






# TEST REPORT

<b>KCTL Inc.</b> 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 <a href="http://www.kctl.co.kr">www.kctl.co.kr</a>		Report No.: <b>KR18-SRF0117-A</b> Page (1) of (46)		
<b>1. Client</b> ◦ Name : Samsung Electronics Co., Ltd. ◦ Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep.of Korea ◦ Date of Receipt : 2018-09-27				
<b>2. Use of Report</b> : -				
<b>3. Name of Product and Model</b> : ARTIK-0710 / SIP007AFS00				
<b>4. Manufacturer and Country of Origin</b> : Samsung Electronics Co., Ltd. / Korea				
<b>5. FCC ID</b> : A3LSIP007AFS00				
<b>6. IC ID</b> : 649E-SIP007AFS00				
<b>7. Date of Test</b> : 2018-10-15 to 2018-10-19				
<b>8. Test Standards</b> : FCC Part 15 Subpart C, 15.247 RSS-247 Issue 2, RSS-GEN Issue 5				
<b>9. Test Results</b> : Refer to the test result in the test report				
Affirmation	Tested by  Name : Euijung Kim (Signature)		Technical Manager  Name : Bongok Ko (Signature)	
	2018-11-06			
<h2>KCTL Inc.</h2>				
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.				

**REPORT REVISION HISTORY**

Date	Revision	Page No
2018-10-23	Originally issued	-
2018-11-06	Revised notes	16, 20

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## 1. Client information

**Applicant:** Samsung Electronics Co., Ltd.  
**Address:** 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,  
16677, Rep.of Korea  
**Telephone number:** +82 10 7260 5096  
**Contact person:** Sungjin Kim / sj999.kim@samsung.com

**Manufacturer:** Samsung Electronics Co., Ltd.  
**Address:** 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,  
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# KCTL

## 2. Laboratory information

### Address

#### **KCTL Inc.**

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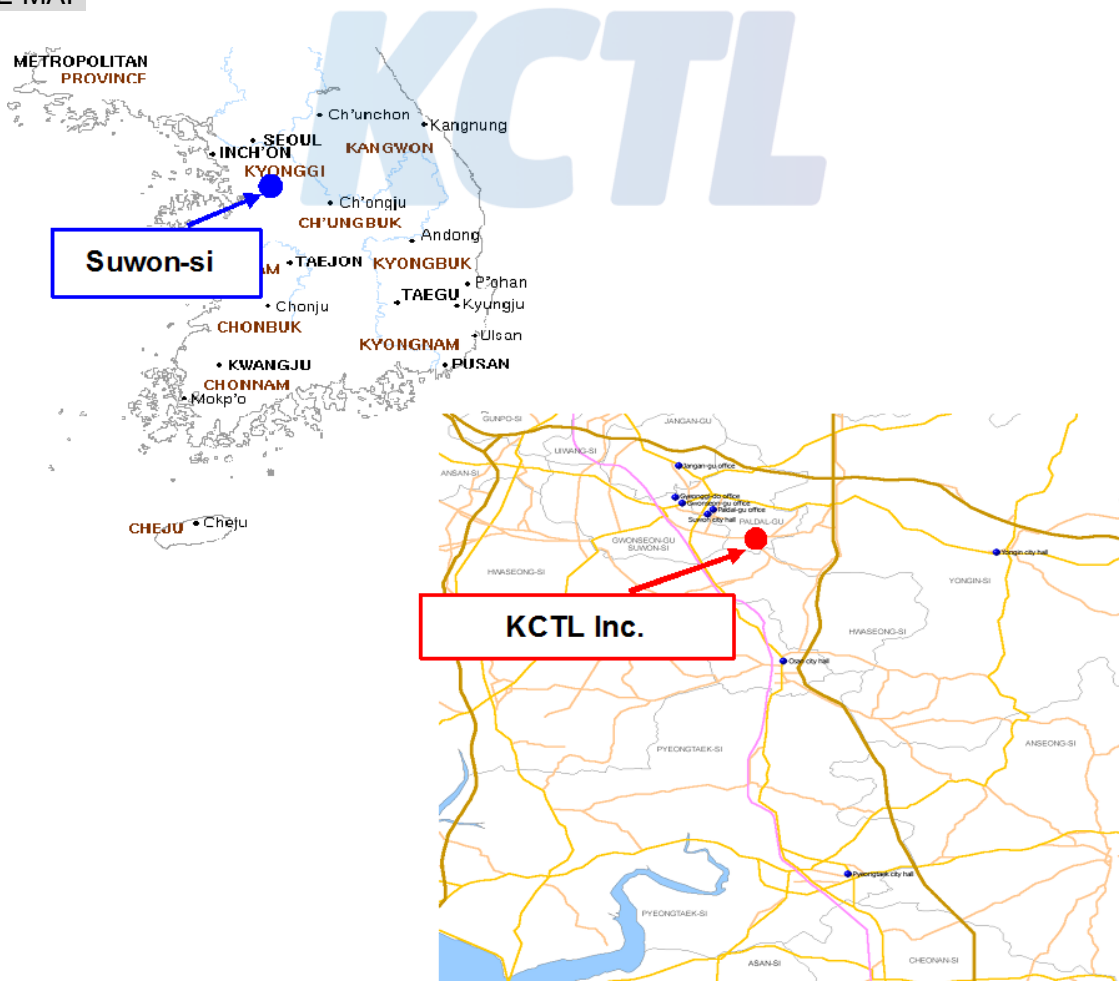
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

VCCI Registration No. : R-3327, G-198, C-3706, T-1849

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

### **SITE MAP**



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### 3. Description of E.U.T.

#### 3.1 Basic description

Applicant	Samsung Electronics Co., Ltd.
Address of Applicant	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep.of Korea
Manufacturer	Samsung Electronics Co., Ltd.
Address of Manufacturer	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep.of Korea
Type of equipment	ARTIK-0710
Basic Model	SIP007AFS00
Serial number	N/A

#### 3.2 General description

Frequency Range	2 402 MHz ~ 2 480 MHz (Bluetooth, Bluetooth Low Energy) 2 402 MHz ~ 2 475 MHz (Zigbee) 2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20) 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20) 5 190 MHz ~ 5 230 MHz (802.11n_HT40) 5 210 MHz (802.11ac_VHT80) 5 260 MHz ~ 5 320 MHz (802.11a/n_HT20) 5 270 MHz ~ 5 310 MHz (802.11n_HT40) 5 290 MHz (802.11ac_VHT80) 5 500 MHz ~ 5 720 MHz (802.11a/n_HT20) 5 510 MHz ~ 5 710 MHz (802.11n_HT40) 5 530 MHz ~ 5 690 MHz (802.11ac_VHT80) 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20) 5 755 MHz ~ 5 795 MHz (802.11n_HT40) 5 775 MHz (802.11ac_VHT80)
Type of Modulation	Bluetooth: GFSK, $\pi/4$ DQPSK, 8DPSK Bluetooth Low Energy: GFSK Zigbee: DSSS WiFi: DSSS, OFDM

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The number of channels	<p><b>2.4 GHz:</b> 79 ch (Bluetooth) 40 ch (Bluetooth Low Energy) 11 ch (802.11b/g/n_HT20) 15 ch (Zigbee)</p> <p><b>5.0 GHz:</b> U-NII-1: 4 ch (802.11a/n_HT20) 2 ch (802.11n_HT40) 1 ch (802.11ac_VHT80) U-NII-2A: 4 ch (802.11a/n_HT20) 2 ch (802.11n_HT40) 1 ch (802.11ac_VHT80) U-NII-2C: 12 ch (802.11a/n_HT20) 6 ch (802.11n_HT40) 3 ch (802.11ac_VHT80) U-NII-3: 5 ch (802.11a/n_HT20) 2 ch (802.11n_HT40) 1 ch (802.11ac_VHT80)</p>
Type of Antenna	Dipole Antenna, Balance Flex Antenna
Antenna Gain	<p><b>Dipole Antenna</b> 2.4 GHz: 3.8 dBi 5 GHz: 5.5 dBi</p> <p><b>Balance Flex Antenna</b> 2.4 GHz: 3.0 dBi 5 GHz: 4.0 dBi</p>
Power supply	DC 4.2 V
Test SW Version	0710GC0F-41F-01Q0
RF power setting in TEST SW	Referred the measuring instrument from manufacturer

Note : The above EUT information was declared by the manufacturer.

### 3.3 Peak output power

#### PKPM1 Peak-reading power meter method

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the *DTS bandwidth* and shall utilize a fast-responding diode detector.

#### -Peak output power

Mode	Channel	Frequency [MHz]	Peak output power [dBm]
GFSK	Lowest	2 402	5.65
	Middle	2 441	7.45
	Highest	2 480	6.75
8DPSK	Lowest	2 402	5.55
	Middle	2 441	5.35
	Highest	2 480	4.95

Note<sub>1</sub>) : The above peak output power were retested results.

Note<sub>2</sub>) : The GFSK and 8DPSK power are the worst case.



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### 3.4 Test frequency

	Bluetooth
Lowest frequency	2 402 MHz
Middle frequency	2 441 MHz
Highest frequency	2 480 MHz

### 3.5 Normal and extreme test conditions

#### - Ambient Conditions

	Temperature [°C]	Relative humidity [%]
Requirement for tests	15 to 35	20 to 75
Ambient Conditions	23	51

#### - Test Conditions

Test Condition	Temperature [°C]	Voltage [V]
NTNV	23	DC 4.20

Note<sub>1)</sub> : N:Normal T:Temperature V:Voltage

## 4. Summary of test results

### 4.1 Standards & results

FCC Rule Reference	IC Rule Reference	Parameter	Report Section	Test Result
15.203, 15.247(b)(4)	-	Antenna Requirement	5.1	C
15.247(d), 15.205 (a), 15.209(a)	RSS-247 Issue 2 5.5 RSS-Gen Issue 5 8.9	Spurious Emission, Band Edge and Restricted bands	5.2	C
Note <sub>1)</sub> : C = Complies, NC = Not complies, NT = Not tested, NA = Not applicable				

Note: Measurement methods used to test this device are ANSI C63.10:2013 and KDB558074 D01 v04

### 4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = kU_c (k = 2)$	
	Radiated Spurious Emissions	9 kHz ~ 30 MHz:
30 MHz ~ 300 MHz:		+4.94 dB, -5.06 dB
		+4.93 dB, -5.05 dB
300 MHz ~ 1 000 MHz:		+4.97 dB, -5.08 dB
		+4.84 dB, -4.96 dB
1 GHz ~ 25 GHz:	+6.03 dB, -6.05 dB	

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## 5. Test results

### 5.1 Antenna Requirement

#### 5.1.1 Regulation

According to §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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And 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.

#### 5.1.2 Result

- Complied

The transmitter uses a unique coupling to the intentional radiator (two types of external antenna, Dipole antenna or Balance Flex antenna).

## 5.2 Spurious Emission, Band Edge, and Restricted bands

### 5.2.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

According to §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 ( $\mu\text{V}/\text{m}$ )	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., §15.231 and 15.241.

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According to § 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	167.72 - 173.2	3 345.8 - 3 358	36.43 - 36.5
25	240 - 285	3 600 - 4 400	Above 38.6
12.576 75 - 12.577	322 - 335.4		
25			
13.36 - 13.41			

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

## 5.2.2 Measurement Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

### Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an semi-anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1 000 MHz using the Bi-Log antenna, and from 1 000 MHz to 26 500 MHz using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter in an semi-anechoic chamber. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The 0.8m height is for below 1 G testing, and 1.5m is for above 1G testing.

#### **- Procedure for unwanted emissions measurements below 1 000 MHz**

The procedure for unwanted emissions measurements below 1 000 MHz is as follows:

- a) Follow the requirements in 12.7.4.
- b) Compliance shall be determined using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection

#### **- Procedure for peak unwanted emissions measurements above 1 000 MHz**

The procedure for peak unwanted emissions measurements above 1 000 MHz is as follows:

- a) Follow the requirements in 12.7.4.
- b) Peak emission levels are measured by setting the instrument as follows:
  - 1) RBW = 1 MHz./ VBW ≥ [3 MHz RBW].
  - 2) Detector = peak.
  - 3) Sweep time = auto.
  - 4) Trace mode = max hold.
  - 5) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, then the time required for the trace to stabilize will increase by a factor of approximately 1 / D, where D is the duty cycle. For example, at 50 % duty cycle, the measurement time will increase by a factor of two, relative to measurement time for continuous transmission.

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**- Procedures for average unwanted emissions measurements above 1 000 MHz**

Method VB-A is averaging using reduced video bandwidth. The procedure for this method is as follows:

a) RBW = 1 MHz.

b) Video bandwidth:

1) If the EUT is configured to transmit with  $D \geq 98\%$ , then set  $VBW \leq RBW / 100$  (i.e., 10 kHz), but not less than 10 Hz.

2) If the EUT  $D$  is  $< 98\%$ , then set  $VBW \geq 1 / T$ , where  $T$  is defined in item a1) of 12.2.

c) Video bandwidth mode or display mode:

1) The instrument shall be set with video filtering applied in the power domain. Typically, this requires setting the detector mode to RMS (power averaging) and setting the average-VBW type to power (rms).

2) As an alternative, the instrument may be set to linear detector mode. Video filtering shall be applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode to accomplish this. Others have a setting for average-VBW type, which can be set to "voltage" regardless of the display mode.

d) Detector = peak.

e) Sweep time = auto.

f) Trace mode = max hold.

g) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98% duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of  $1/x$ , where  $D$  is the duty cycle. For example, use at least 200 traces if the duty cycle is 25%. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 50 traces should be averaged.)

**RADIATED EMISSION TEST SITES FOR MEASUREMENTS FROM 9 kHz TO 30 MHz**

According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test 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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### 5.2.3.1 Test Result (Dipole Antenna)

**Test Condition:** Refer to the clause 3.6 Normal and extreme test conditions

- Complied

1. Measured value of the Field strength of spurious Emissions (Radiated).
2. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.
3. The worst case of this product is the y-axis.

- Below 1 GHz data (worst-case)

#### Bluetooth 8DPSK Lowest Channel (2 402 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Quasi-Peak DATA. Emissions below 30 MHz</b>										
10.98	9	V	35.50	3.03	-32.67	18.64	-11.00	24.50	69.50	45.00
25.73	9	V	34.20	4.61	-32.68	18.27	-9.80	24.40	69.50	45.10
<b>Quasi-Peak DATA. Emissions below 1 GHz</b>										
136.09	120	H	33.50	2.52	-25.29	12.37	-10.40	23.10	43.50	20.40
269.11	120	H	35.30	3.65	-24.90	12.45	-8.80	26.50	46.00	19.50
405.51	120	H	42.30	4.60	-24.72	15.82	-4.30	38.00	46.00	8.00
479.23	120	H	37.20	5.02	-24.66	17.44	-2.20	35.00	46.00	11.00

Note1. Factor = Cable loss + Amp gain + Antenna factor  
Result = Reading + Factor



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**- Above 1 GHz data**

**- Bluetooth GFSK**

**Lowest Channel (2 402 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
2 364.35 <sup>1)</sup>	1 000	V	45.44	3.69	-29.98	28.49	2.20	47.64	74.00	26.36
3 065.00	1 000	H	64.92	4.18	-59.90	29.88	-25.84	39.08	74.00	34.92
4 804.06 <sup>2)</sup>	1 000	V	72.90	5.34	-60.69	32.80	-22.55	50.35	74.00	23.65
17 075.17	1 000	H	58.49	10.45	-58.57	40.75	-7.37	51.12	74.00	22.88
21 561.77	1 000	V	47.05	12.00	-49.14	45.00	7.86	54.91	74.00	19.09
24 115.22	1 000	V	47.32	12.80	-42.84	45.10	15.06	62.39	74.00	11.61
<b>Average DATA. Emissions above 1 GHz</b>										
2 364.35 <sup>1)</sup>	1 000	V	33.84	3.69	-29.98	28.49	2.20	36.04	54.00	17.96
4 804.06 <sup>2)</sup>	1 000	V	70.69	5.34	-60.69	32.80	-22.55	48.14	54.00	5.86

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

**Middle Channel (2 441 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
1 849.30	1 000	H	67.45	3.28	-60.05	27.20	-29.57	37.88	74.00	36.12
3 063.83	1 000	H	65.51	4.18	-59.89	29.87	-25.84	39.67	74.00	34.33
4 882.03 <sup>2)</sup>	1 000	V	74.49	5.39	-60.94	32.84	-22.71	51.78	74.00	22.22
17 079.70	1 000	V	58.65	10.46	-58.61	40.78	-7.37	51.28	74.00	22.72
21 598.69	1 000	V	49.12	12.00	-49.16	45.00	7.84	56.95	74.00	17.05
24 124.78	1 000	V	45.56	12.80	-42.85	45.10	15.05	60.60	74.00	13.40
<b>Average DATA. Emissions above 1 GHz</b>										
4 882.03 <sup>2)</sup>	1 000	V	73.50	5.39	-60.94	32.84	-22.71	50.79	54.00	3.21

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

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**Highest Channel (2 480 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
2 483.52 <sup>1)</sup>	1 000	V	48.89	3.77	-30.10	28.72	2.39	51.27	74.00	22.73
3 243.52	1 000	H	66.12	4.29	-60.42	30.36	-25.77	40.35	74.00	33.65
4 959.95 <sup>2)</sup>	1 000	V	74.71	5.44	-60.61	32.88	-22.29	52.42	74.00	21.58
17 253.25	1 000	V	57.85	10.54	-59.75	41.82	-7.39	50.46	74.00	23.54
21 466.67	1 000	H	48.34	11.90	-48.88	44.90	7.92	56.27	74.00	17.73
24 286.55	1 000	H	47.24	12.80	-43.12	45.10	14.78	62.02	74.00	11.98
<b>Average DATA. Emissions above 1 GHz</b>										
2 483.52 <sup>1)</sup>	1 000	V	36.01	3.77	-30.10	28.72	2.39	38.40	54.00	15.60
4 959.95 <sup>2)</sup>	1 000	V	71.28	5.44	-60.61	32.88	-22.29	48.99	54.00	5.01

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

**- Bluetooth 8DPSK****Lowest Channel (2 402 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
2 364.71 <sup>1)</sup>	1 000	V	45.44	3.69	-29.98	28.49	2.20	47.64	74.00	26.36
3 065.00	1 000	H	64.88	4.18	-59.86	29.88	-25.80	39.08	74.00	34.92
4 803.97 <sup>2)</sup>	1 000	V	71.12	5.34	-60.69	32.80	-22.55	48.57	74.00	25.43
17 095.11	1 000	V	58.31	10.46	-58.70	40.87	-7.37	50.94	74.00	23.06
21 584.08	1 000	H	48.34	12.00	-49.15	45.00	7.85	56.19	74.00	17.81
24 039.52	1 000	H	46.17	12.80	-42.61	45.00	15.19	61.36	74.00	12.64
<b>Average DATA. Emissions above 1 GHz</b>										
2 364.71 <sup>1)</sup>	1 000	V	33.37	3.69	-29.98	28.49	2.20	35.57	54.00	18.43
4 803.97 <sup>2)</sup>	1 000	V	63.95	5.34	-60.69	32.80	-22.55	41.40	54.00	12.60

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

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**Middle Channel (2 441 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
1 874.92	1 000	V	67.48	3.31	-59.95	27.30	-29.34	38.13	74.00	35.87
2 532.66	1 000	H	70.65	3.81	-59.40	28.81	-26.78	43.87	74.00	30.13
4 882.03 <sup>2)</sup>	1 000	V	69.29	5.39	-60.94	32.84	-22.71	46.58	74.00	27.42
17 121.39	1 000	V	57.67	10.48	-58.88	41.03	-7.37	50.30	74.00	23.70
21 523.25	1 000	V	47.45	12.00	-49.11	45.00	7.89	55.34	74.00	18.66
24 094.77	1 000	H	45.71	12.80	-42.80	45.10	15.10	60.81	74.00	13.19
<b>Average DATA. Emissions above 1 GHz</b>										
4 882.03 <sup>2)</sup>	1 000	V	64.25	5.39	-60.94	32.84	-22.71	41.54	54.00	12.46

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

**Highest Channel (2 480 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
2 483.50 <sup>1)</sup>	1 000	V	46.43	3.77	-30.10	28.72	2.39	48.82	74.00	25.18
3 123.83	1 000	H	66.08	4.22	-60.13	30.03	-25.88	40.20	74.00	33.80
4 959.98 <sup>2)</sup>	1 000	V	68.15	5.44	-60.61	32.88	-22.29	45.86	74.00	28.14
17 116.41	1 000	H	58.34	10.47	-58.84	41.00	-7.37	50.96	74.00	23.04
21 400.27	1 000	V	48.85	11.90	-48.84	44.90	7.96	56.81	74.00	17.19
24 027.03	1 000	V	47.71	12.80	-42.59	45.00	15.21	62.92	74.00	11.08
<b>Average DATA. Emissions above 1 GHz</b>										
2 483.50 <sup>1)</sup>	1 000	V	34.32	3.77	-30.10	28.72	2.39	36.71	54.00	17.29
4 959.98 <sup>2)</sup>	1 000	V	64.13	5.44	-60.61	32.88	-22.29	41.84	54.00	12.16

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

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### 5.2.3.2 Test Result (Balance Flex Antenna)

**Test Condition:** Refer to the clause 3.6 Normal and extreme test conditions

- Complied

4. Measured value of the Field strength of spurious Emissions (Radiated).
5. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.
6. The worst case of this product is the y-axis.

#### - Below 1 GHz data (worst-case)

##### Bluetooth 8DPSK Lowest Channel (2 402 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Quasi-Peak DATA. Emissions below 30 MHz</b>										
2.08	9	V	40.30	1.28	-32.71	19.63	-11.80	28.50	69.50	41.00
17.78	9	V	34.40	3.88	-32.68	18.40	-10.40	24.00	69.50	45.50
<b>Quasi-Peak DATA. Emissions below 1 GHz</b>										
137.43	120	H	39.90	2.54	-25.32	12.48	-10.30	29.60	43.50	13.90
268.01	120	H	37.70	3.64	-24.95	12.41	-8.90	28.80	46.00	17.20
302.33	120	H	33.10	3.90	-25.05	13.55	-7.60	25.50	46.00	20.50
425.03	120	H	32.70	4.71	-24.56	16.25	-3.60	29.10	46.00	16.90

Note1. Factor = Cable loss + Amp gain + Antenna factor  
Result = Reading + Factor

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**- Above 1 GHz data**

**- Bluetooth GFSK**

**Lowest Channel (2 402 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
2 327.11 <sup>1)</sup>	1 000	V	47.40	3.66	-30.03	28.43	2.06	49.46	74.00	24.54
3 074.84	1 000	V	65.58	4.19	-59.96	29.90	-25.87	39.71	74.00	34.29
3 843.16 <sup>1)</sup>	1 000	V	69.96	4.68	-60.79	31.98	-24.13	45.83	74.00	28.17
4 803.92 <sup>2)</sup>	1 000	H	77.74	5.34	-60.69	32.80	-22.55	55.19	74.00	18.81
17 637.95	1 000	H	57.86	10.68	-58.63	40.69	-7.26	50.60	74.00	23.40
21 512.36	1 000	V	48.01	11.90	-49.01	45.00	7.89	55.90	74.00	18.10
24 025.17	1 000	H	45.45	12.80	-42.59	45.00	15.21	60.66	74.00	13.34
<b>Average DATA. Emissions above 1 GHz</b>										
2 327.11 <sup>1)</sup>	1 000	V	33.55	3.66	-30.03	28.43	2.06	35.61	54.00	18.39
3 843.16 <sup>1)</sup>	1 000	V	67.16	4.68	-60.79	31.98	-24.13	43.03	54.00	10.97
4 803.92 <sup>2)</sup>	1 000	H	71.82	5.34	-60.69	32.80	-22.55	49.27	54.00	4.73

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

**Middle Channel (2 441 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
1 842.19	1 000	V	66.73	3.27	-60.07	27.17	-29.63	37.10	74.00	36.90
3 144.77	1 000	H	65.67	4.23	-60.14	30.09	-25.82	39.85	74.00	34.15
3 905.55 <sup>1)</sup>	1 000	V	68.76	4.72	-60.81	32.14	-23.95	44.82	74.00	29.18
4 881.94 <sup>2)</sup>	1 000	H	78.01	5.39	-60.94	32.84	-22.71	55.30	74.00	18.70
17 066.56	1 000	V	57.98	10.45	-58.16	40.34	-7.37	50.61	74.00	23.39
21 506.25	1 000	V	48.07	11.90	-49.00	45.00	7.90	55.97	74.00	18.03
24 044.03	1 000	V	45.49	12.80	-42.62	45.00	15.18	60.67	74.00	13.33
<b>Average DATA. Emissions above 1 GHz</b>										
3 905.55 <sup>1)</sup>	1 000	V	66.05	4.72	-60.81	32.14	-23.95	42.10	54.00	11.90
4 881.94 <sup>2)</sup>	1 000	H	72.85	5.39	-60.94	32.84	-22.71	50.14	54.00	3.86

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

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**KCTL****Highest Channel (2 480 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
2 483.50 <sup>1)</sup>	1 000	H	48.38	3.77	-30.10	28.72	2.39	50.77	74.00	23.23
3 145.47	1 000	V	66.60	4.23	-60.14	30.09	-25.82	40.78	74.00	33.22
4 959.99 <sup>2)</sup>	1 000	H	73.60	5.44	-60.61	32.88	-22.29	51.31	74.00	22.69
17 561.38	1 000	V	59.01	10.68	-61.71	43.67	-7.36	51.65	74.00	22.35
21 526.17	1 000	H	48.18	12.00	-49.12	45.00	7.88	56.06	74.00	17.94
24 000.20	1 000	V	46.26	12.80	-42.55	45.00	15.25	61.51	74.00	12.49
<b>Average DATA. Emissions above 1 GHz</b>										
2 483.50 <sup>1)</sup>	1 000	H	35.58	3.77	-30.10	28.72	2.39	37.97	54.00	16.03
4 959.99 <sup>2)</sup>	1 000	H	72.97	5.44	-60.61	32.88	-22.29	50.68	54.00	3.32

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

**- Bluetooth 8DPSK****Lowest Channel (2 402 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
2 317.45 <sup>1)</sup>	1 000	H	46.56	3.66	-30.04	28.42	2.04	48.60	74.00	25.40
3 096.25	1 000	V	67.15	4.20	-60.09	29.96	-25.93	41.22	74.00	32.78
4 803.96 <sup>2)</sup>	1 000	H	70.31	5.34	-60.69	32.80	-22.55	47.76	74.00	26.24
17 610.31	1 000	H	57.91	10.70	-61.95	43.96	-7.29	50.61	74.00	23.39
21 464.02	1 000	V	46.87	11.90	-48.88	44.90	7.92	54.79	74.00	19.21
24 068.47	1 000	H	46.23	12.80	-42.66	45.00	15.14	61.37	74.00	12.63
<b>Average DATA. Emissions above 1 GHz</b>										
2 317.45 <sup>1)</sup>	1 000	H	33.32	3.66	-30.04	28.42	2.04	35.36	54.00	18.64
4 803.96 <sup>2)</sup>	1 000	H	58.92	5.34	-60.69	32.80	-22.55	36.37	54.00	17.63

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

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**KCTL****Middle Channel (2 441 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
1 842.81	1 000	V	67.06	3.28	-60.08	27.17	-29.63	37.43	74.00	36.57
3 146.48	1 000	V	67.11	4.23	-60.15	30.10	-25.82	41.29	74.00	32.71
4 881.95 <sup>2)</sup>	1 000	H	71.69	5.39	-60.94	32.84	-22.71	48.97	74.00	25.03
17 623.45	1 000	H	58.37	10.71	-62.03	44.04	-7.28	51.09	74.00	22.91
21 476.23	1 000	H	47.87	11.90	-48.98	45.00	7.92	55.78	74.00	18.22
24 410.33	1 000	H	46.70	12.80	-43.32	45.10	14.58	61.28	74.00	12.72
<b>Average DATA. Emissions above 1 GHz</b>										
4 881.95 <sup>2)</sup>	1 000	H	62.01	5.39	-60.94	32.84	-22.71	39.30	54.00	14.70

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

**Highest Channel (2 480 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
<b>Peak DATA. Emissions above 1 GHz</b>										
2 483.62 <sup>1)</sup>	1 000	H	47.88	3.77	-30.10	28.72	2.39	50.27	74.00	23.73
3 068.20	1 000	V	66.94	4.18	-59.91	29.88	-25.85	41.09	74.00	32.91
4 959.95 <sup>2)</sup>	1 000	H	71.58	5.44	-60.61	32.88	-22.29	49.30	74.00	24.70
17 502.02	1 000	H	58.17	10.65	-61.39	43.31	-7.43	50.74	74.00	23.26
21 696.97	1 000	H	47.17	12.00	-49.23	45.00	7.77	54.94	74.00	19.06
24 012.42	1 000	H	46.94	12.80	-42.57	45.00	15.23	62.17	74.00	11.83
<b>Average DATA. Emissions above 1 GHz</b>										
2 483.62 <sup>1)</sup>	1 000	H	34.38	3.77	-30.10	28.72	2.39	36.77	54.00	17.23
4 959.95 <sup>2)</sup>	1 000	H	61.77	5.44	-60.61	32.88	-22.29	39.48	54.00	14.52

Note. Factor = Cable loss + Amp. Gain + Antenna factor

Result = Reading + Factor

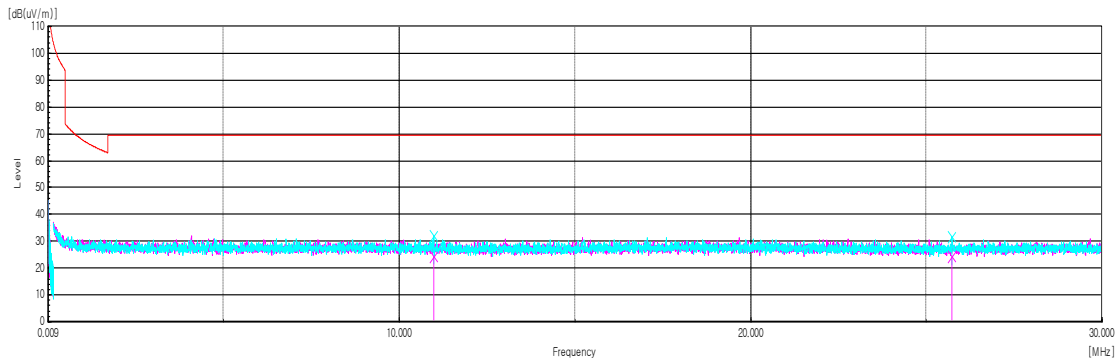
<sup>1)</sup> Restricted band

<sup>2)</sup> Harmonic

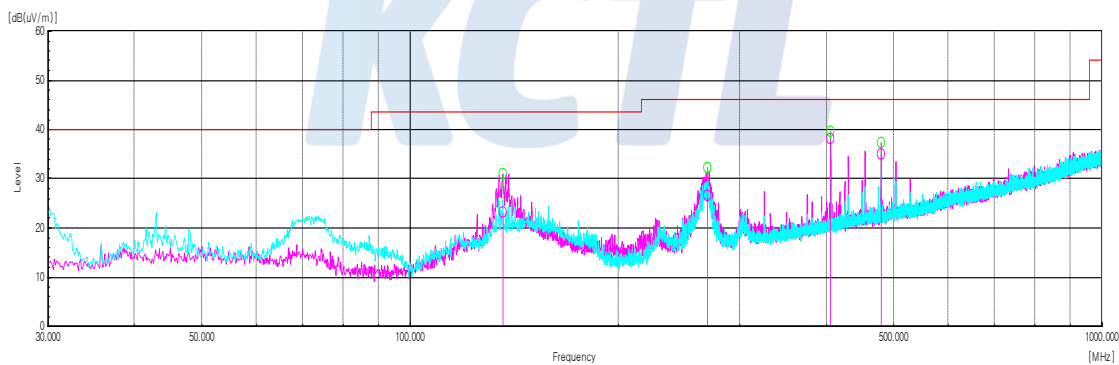
### 5.2.4.1 Test Plot (Dipole Antenna)

Figure 1. Plot of the Spurious Emissions (Radiated)

**- 9 kHz ~ 30 MHz data**



**- 30 MHz ~ 1 GHz data**

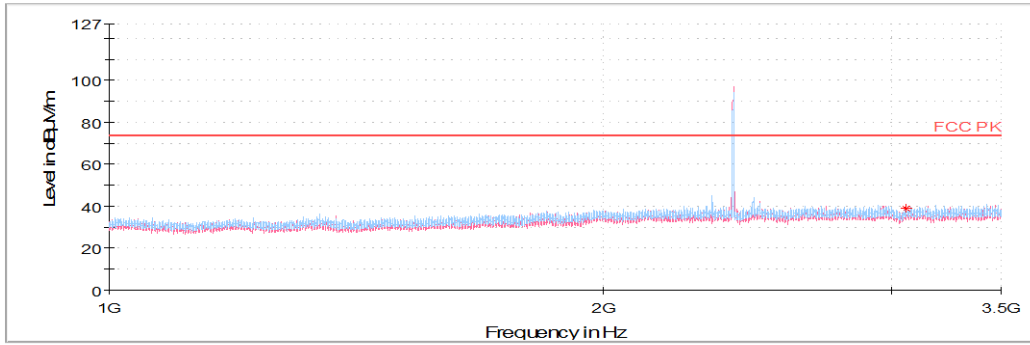




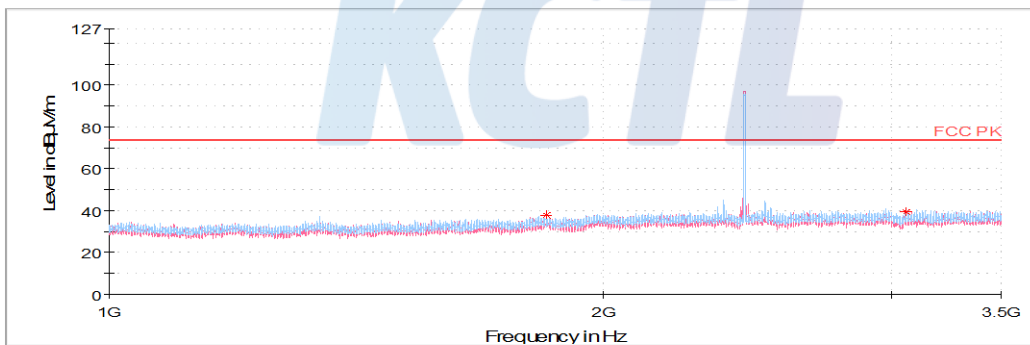
**- 1 GHz ~ 3.5 GHz data**

**- Bluetooth GFSK**

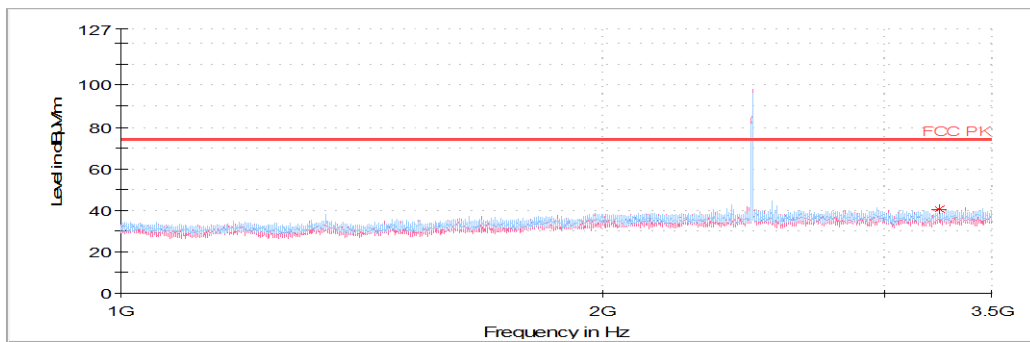
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)

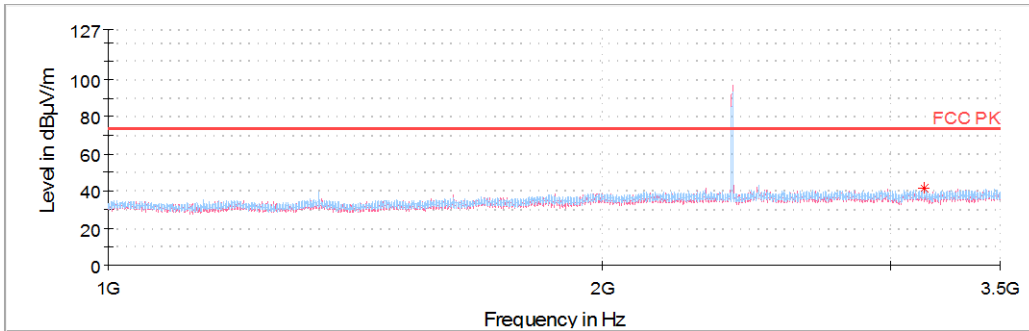


Highest Channel (2 480 MHz)

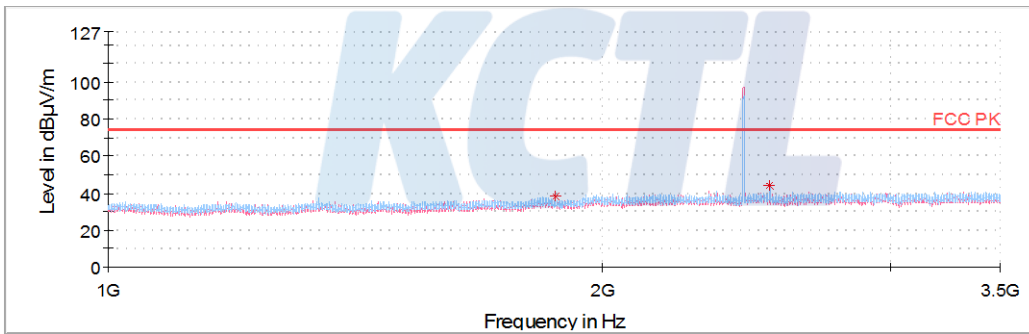


**- Bluetooth 8DPSK**

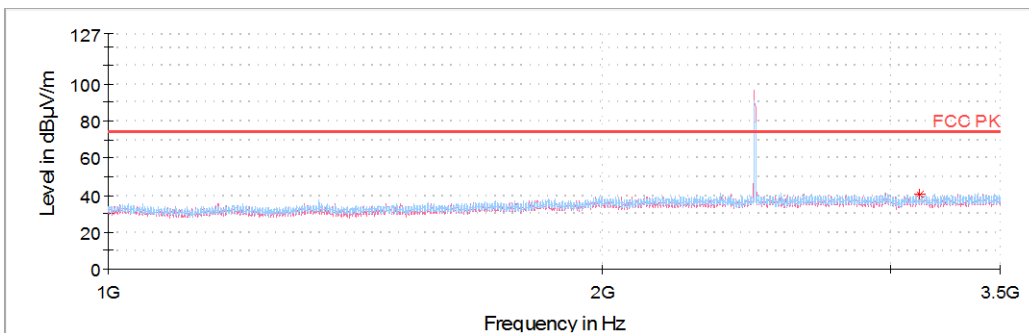
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)



Highest Channel (2 480 MHz)



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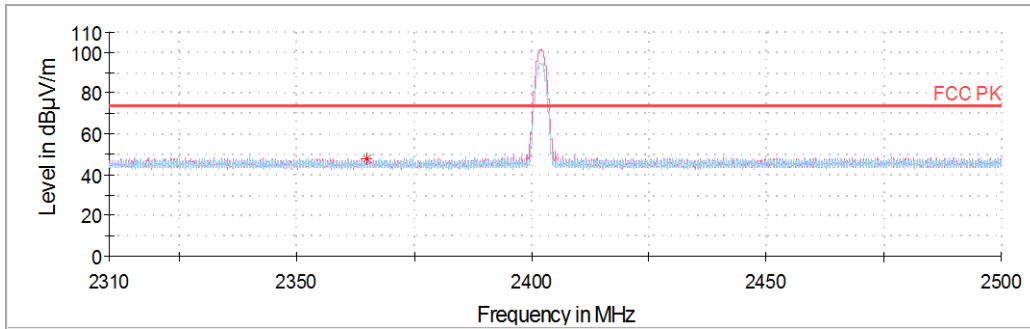
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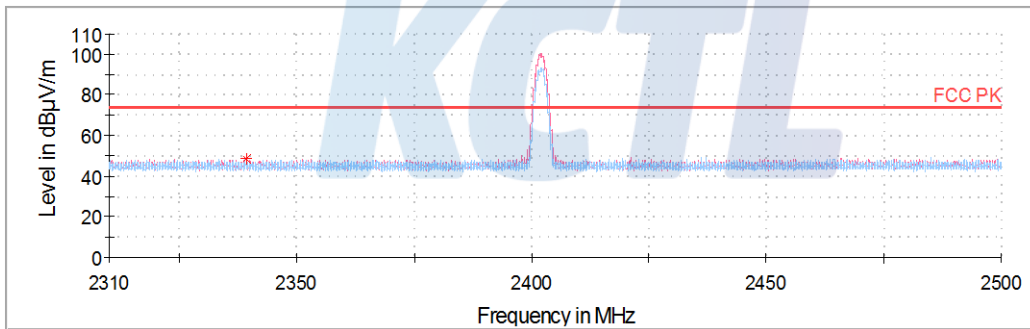


**- Restricted Bandedge data(Lowest Channel)**

**- Bluetooth GFSK**



**- Bluetooth 8DPSK**



**KCTL Inc.**

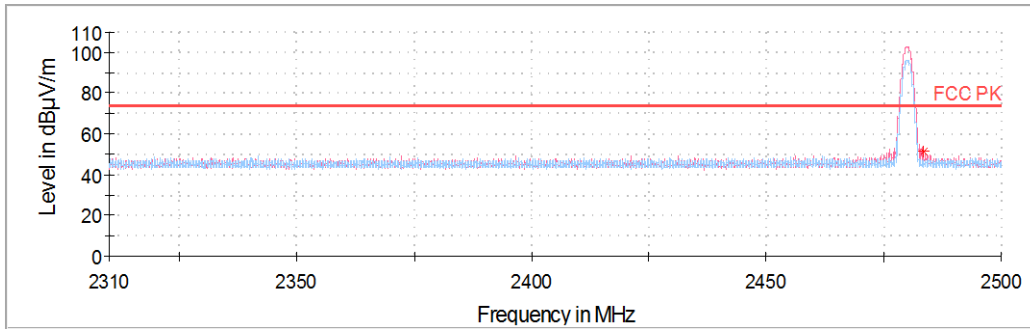
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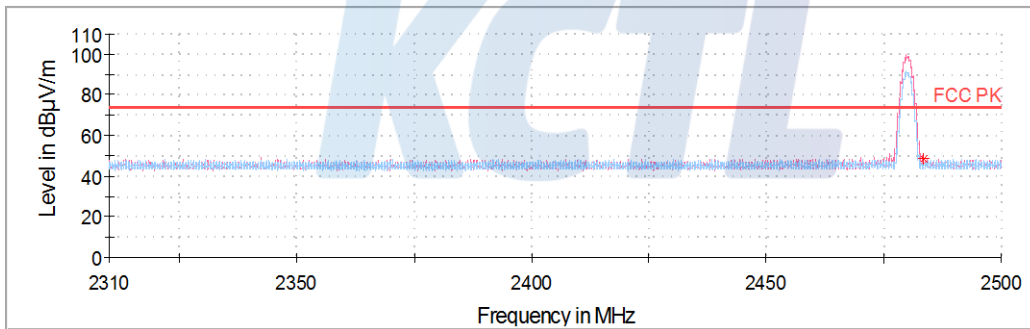


**- Restricted Bandedge data(Highest Channel)**

**- Bluetooth GFSK**



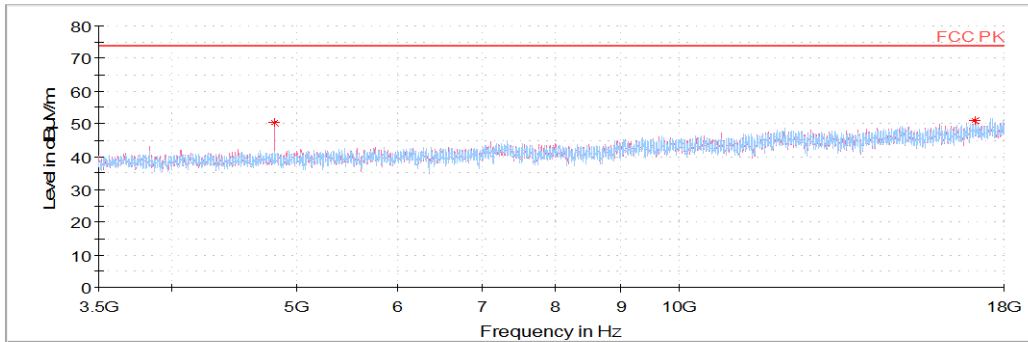
**- Bluetooth 8DPSK**



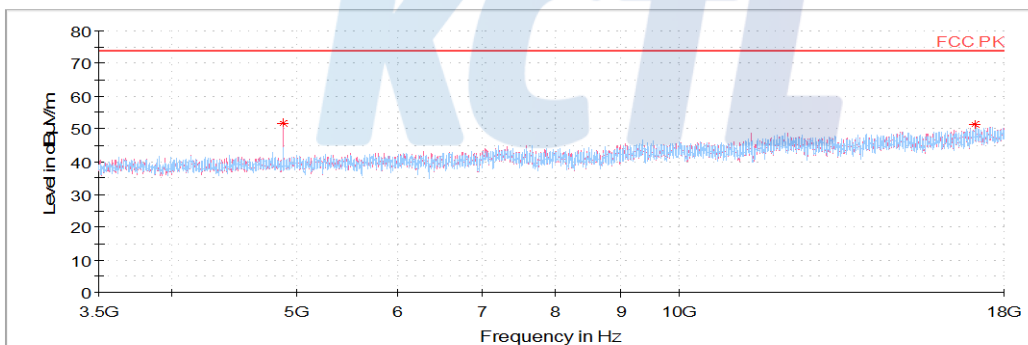
**- 3.5 GHz ~ 18 GHz data**

**- Bluetooth GFSK**

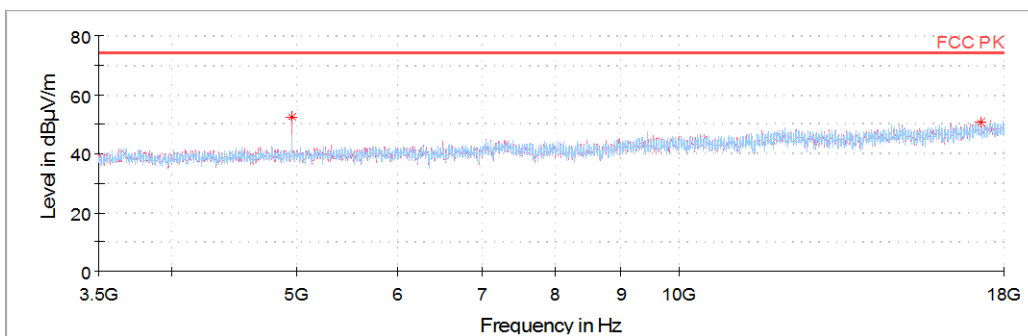
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)

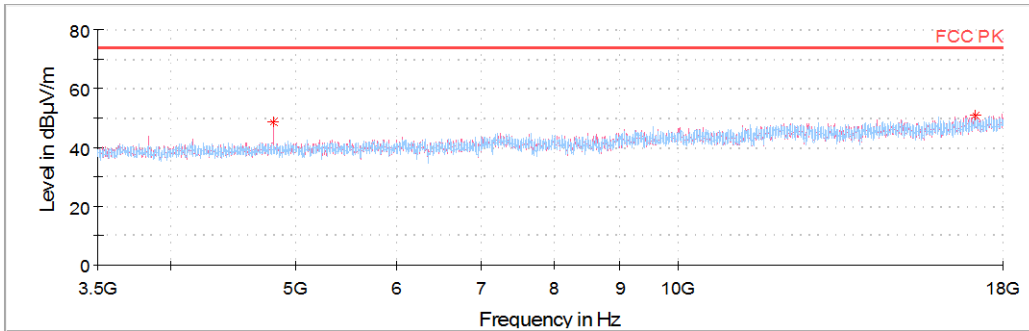


Highest Channel (2 480 MHz)

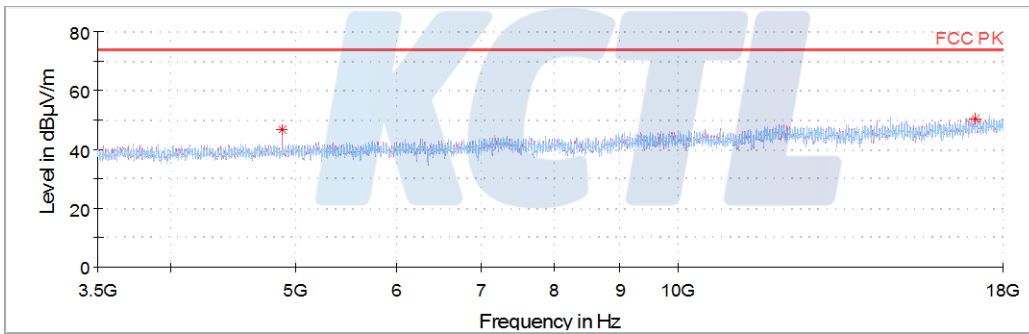


**- Bluetooth 8DPSK**

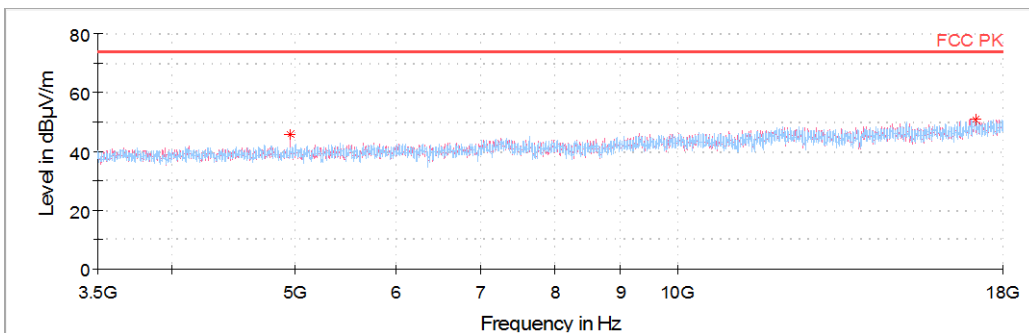
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)



Highest Channel (2 480 MHz)



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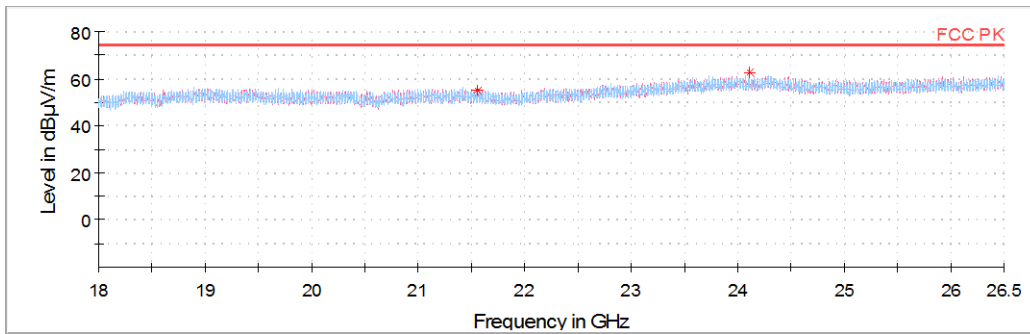
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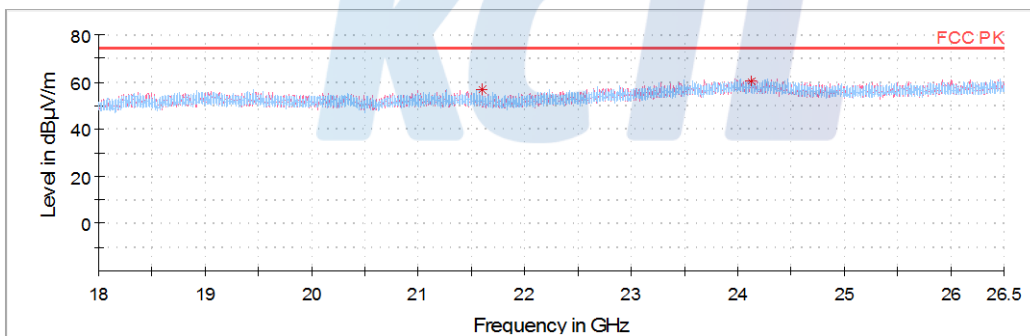
**- 18 GHz ~ 26.5 GHz data**

**- Bluetooth GFSK**

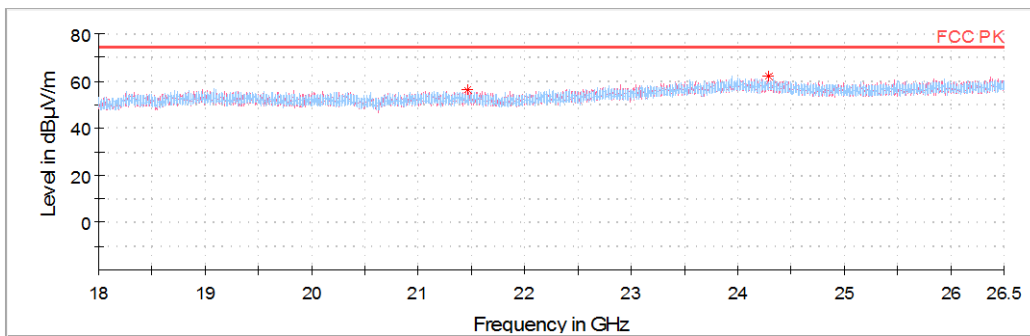
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)

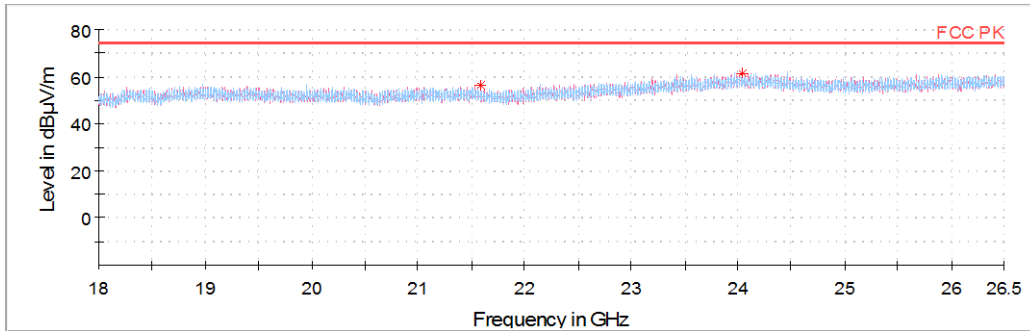


Highest Channel (2 480 MHz)

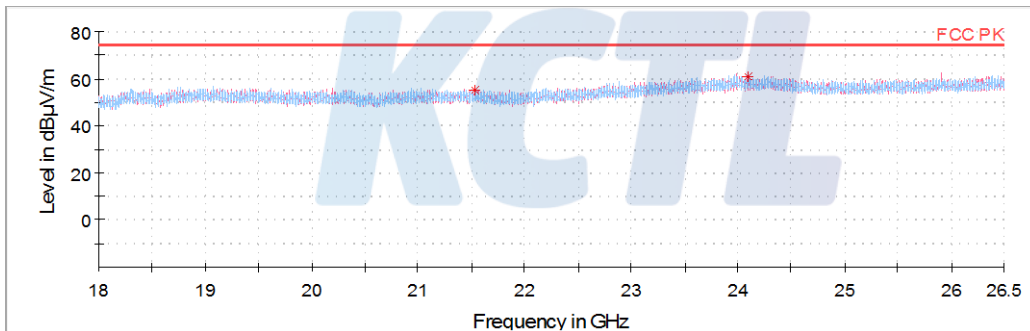


**- Bluetooth 8DPSK**

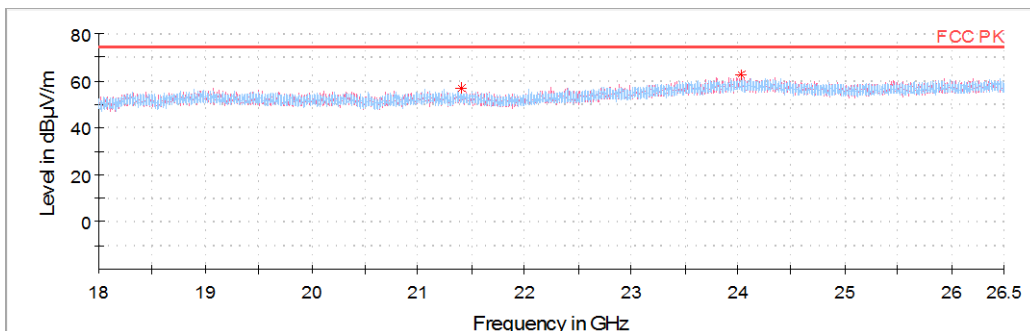
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)



Highest Channel (2 480 MHz)





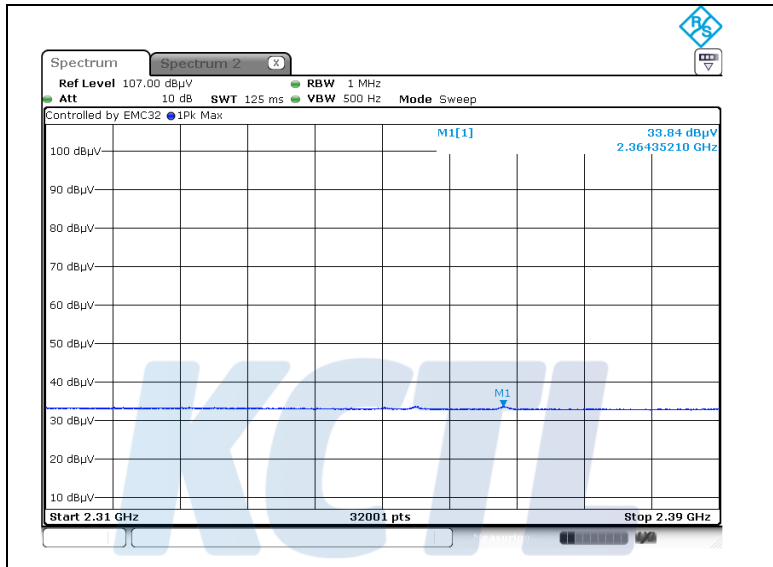
### 5.2.4.2 Test Plot (Dipole Antenna)

Figure 2. Plot of the average data emissions

#### - Restricted Bandedge data(Lowest Channel)

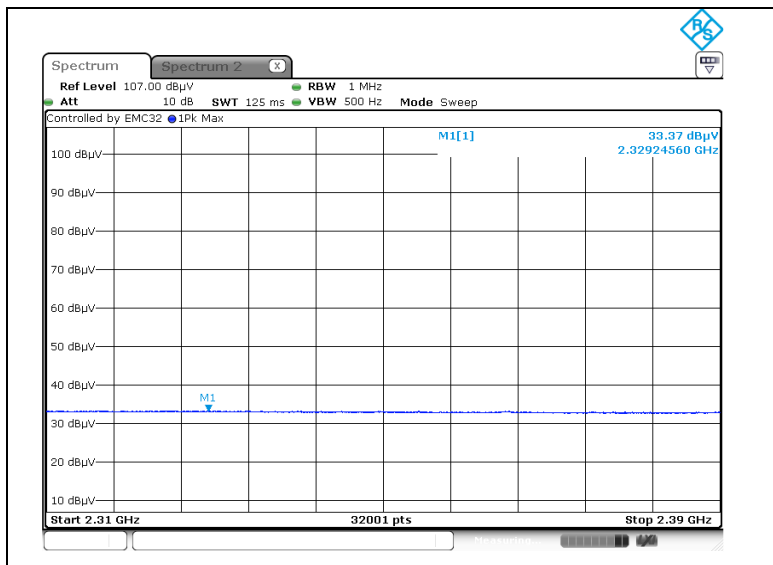
#### - Bluetooth GFSK

Worst Antenna polarization : V



#### - Bluetooth 8DPSK

Worst Antenna polarization : V



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## - Restricted Bandedge data(Highest Channel)

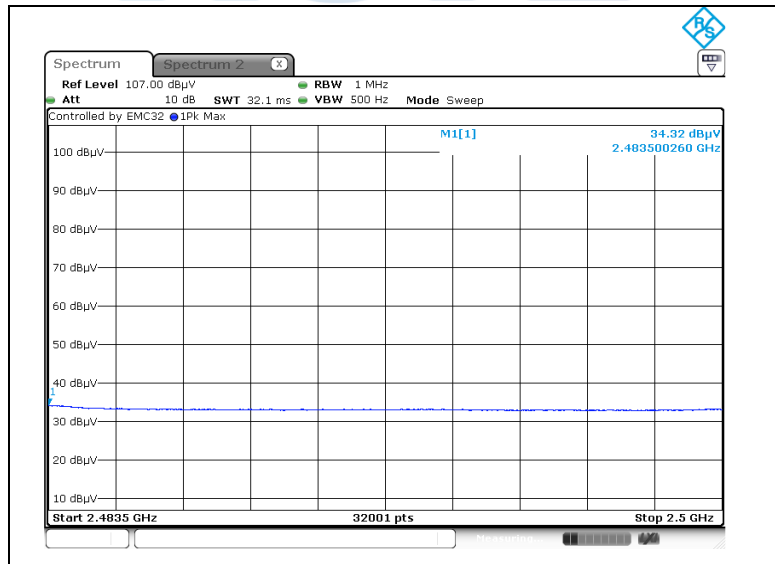
### - Bluetooth GFSK

Worst Antenna polarization : V



### - Bluetooth 8DPSK

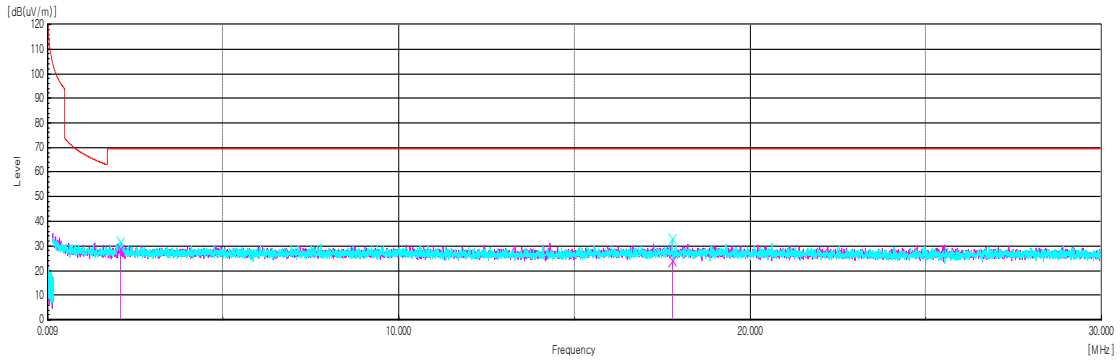
Worst Antenna polarization : V



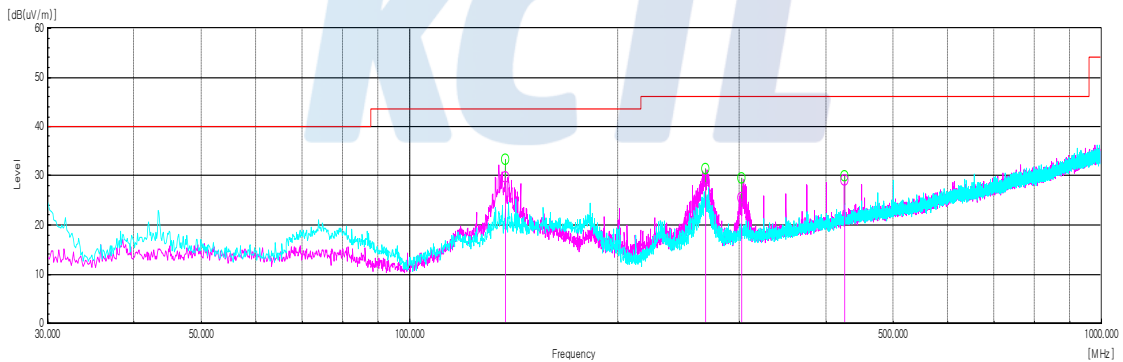
### 5.2.4.3 Test Plot (Balance Flex Antenna)

Figure 1. Plot of the Spurious Emissions (Radiated)

**- 9 kHz ~ 30 MHz data**



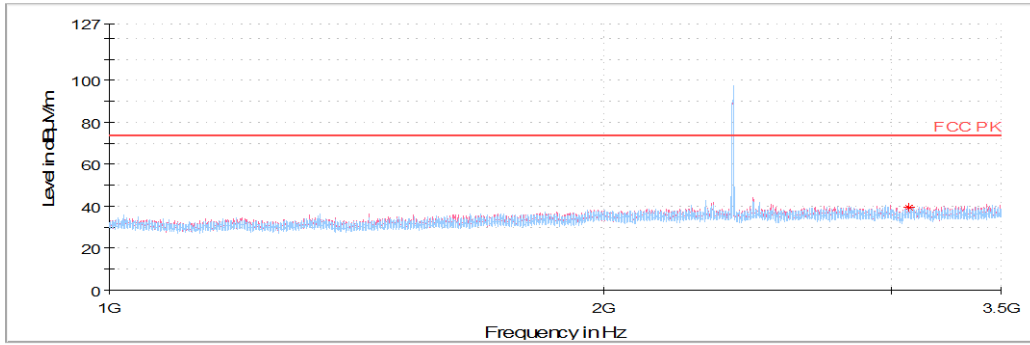
**- 30 MHz ~ 1 GHz data**



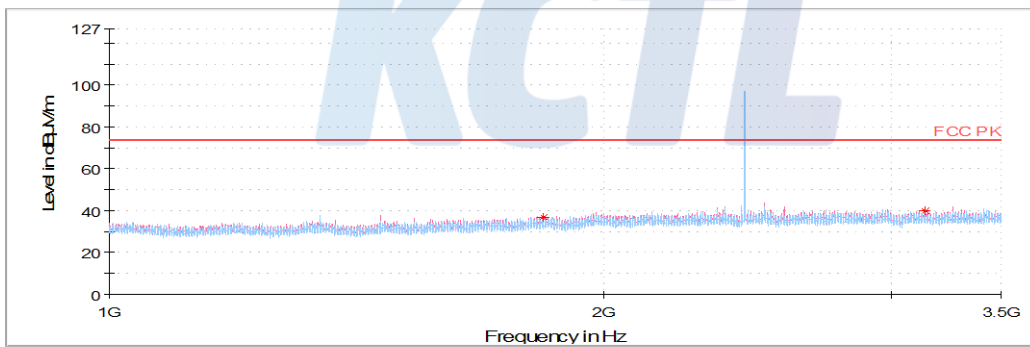
**- 1 GHz ~ 3.5 GHz data**

**- Bluetooth GFSK**

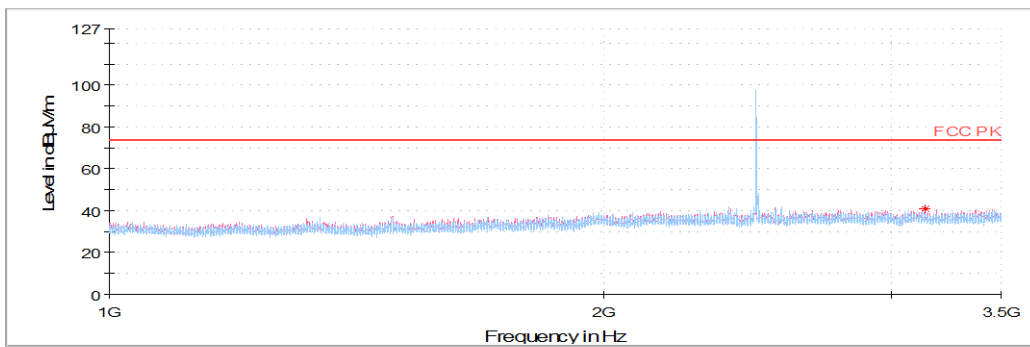
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)

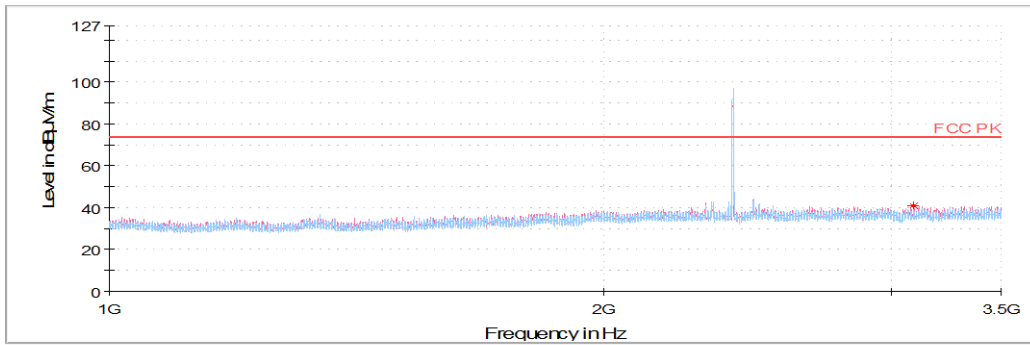


Highest Channel (2 480 MHz)

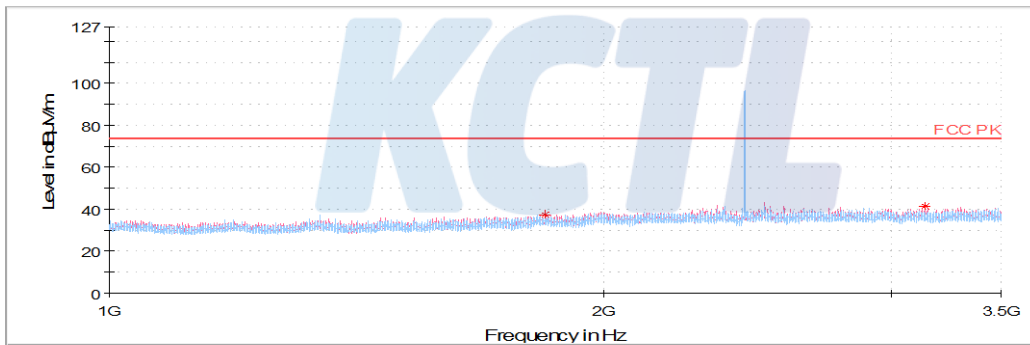


**- Bluetooth 8DPSK**

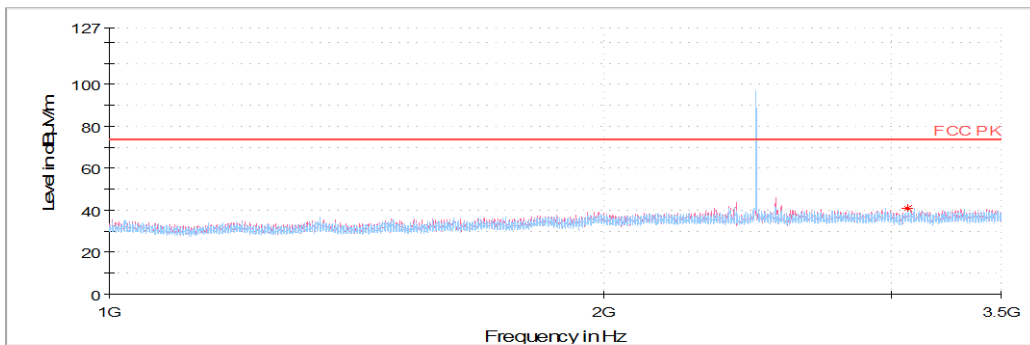
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)



Highest Channel (2 480 MHz)



**KCTL Inc.**

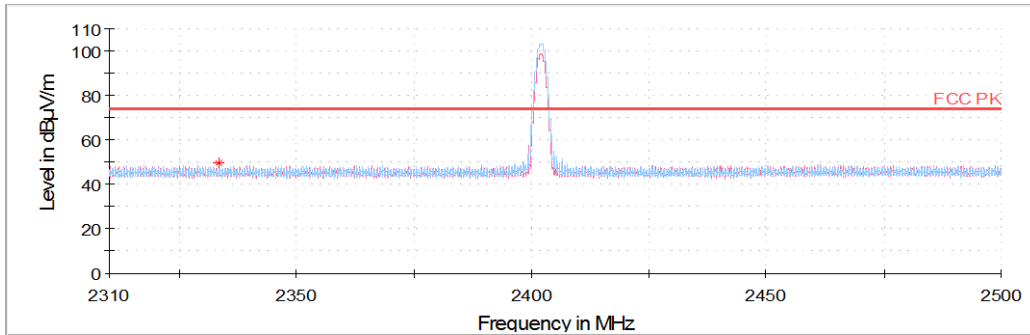
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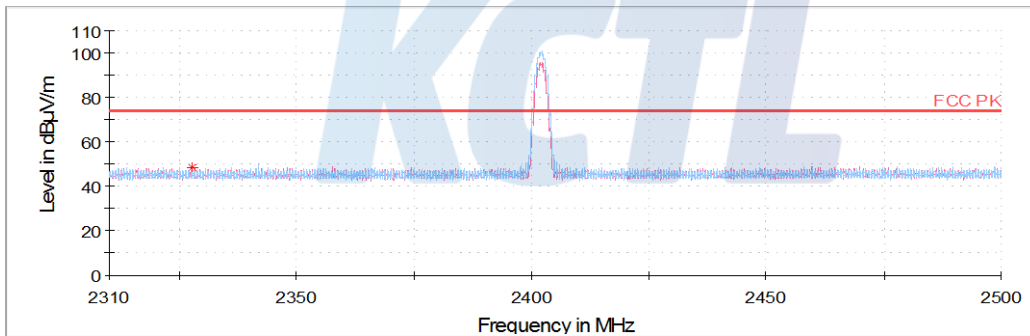


**- Restricted Bandedge data(Lowest Channel)**

**- Bluetooth GFSK**



**- Bluetooth 8DPSK**



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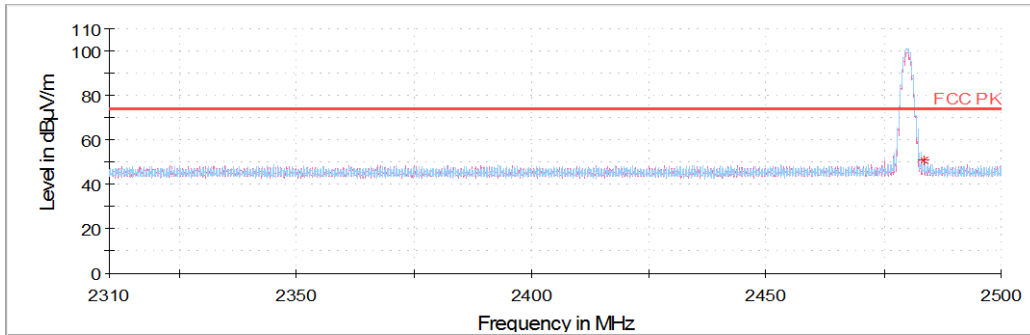
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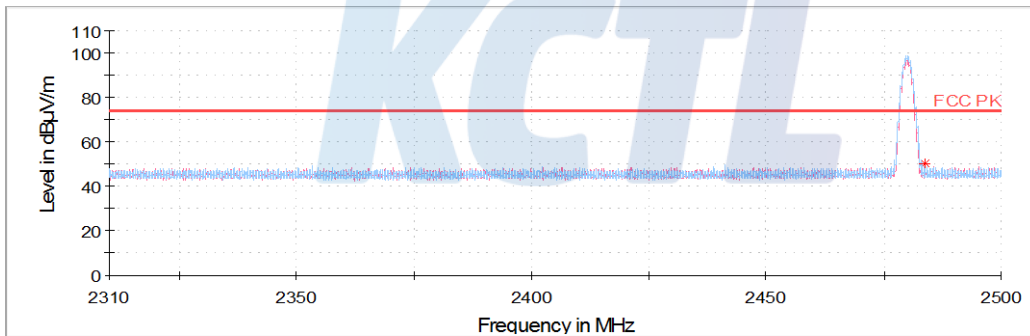


**- Restricted Bandedge data(Highest Channel)**

**- Bluetooth GFSK**



**- Bluetooth 8DPSK**



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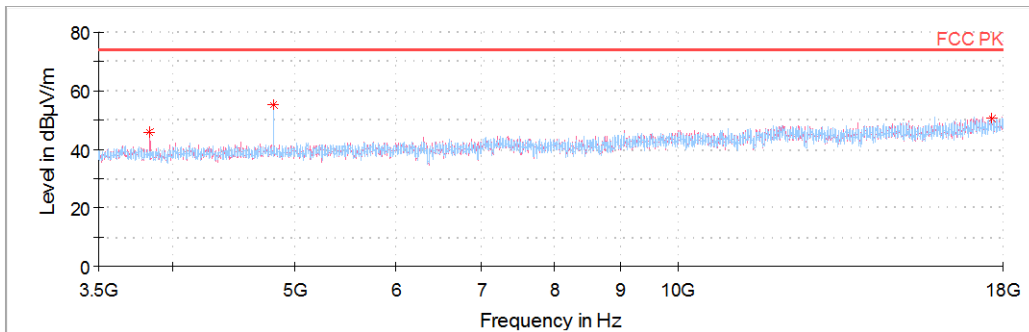
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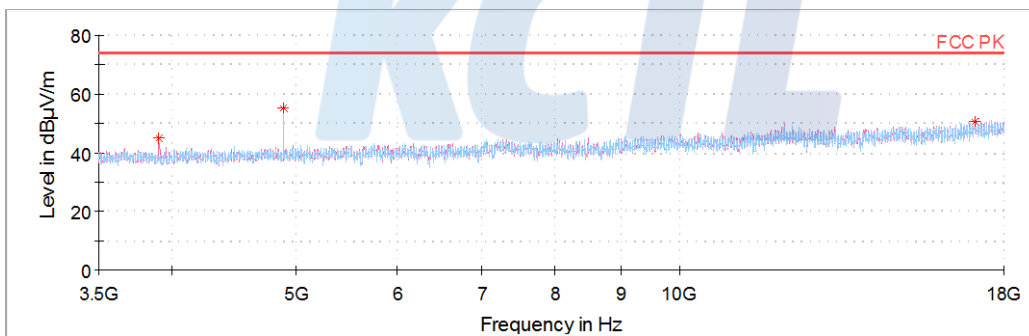
## - 3.5 GHz ~ 18 GHz data

### - Bluetooth GFSK

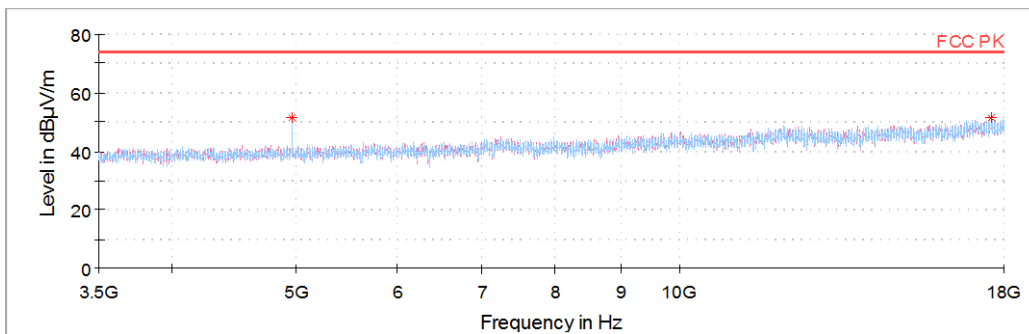
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)



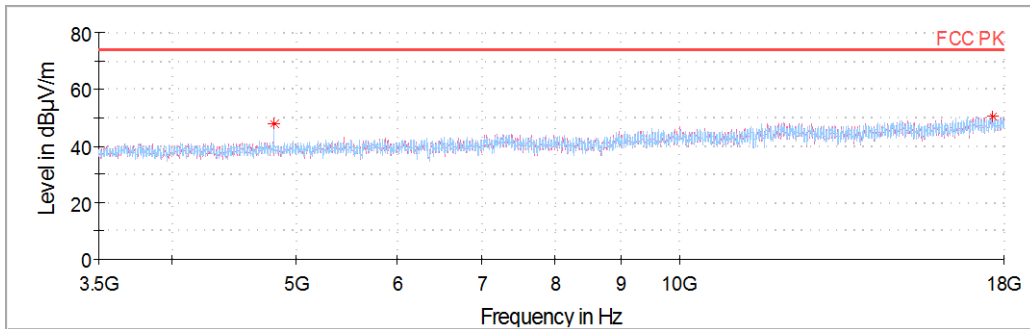
Highest Channel (2 480 MHz)



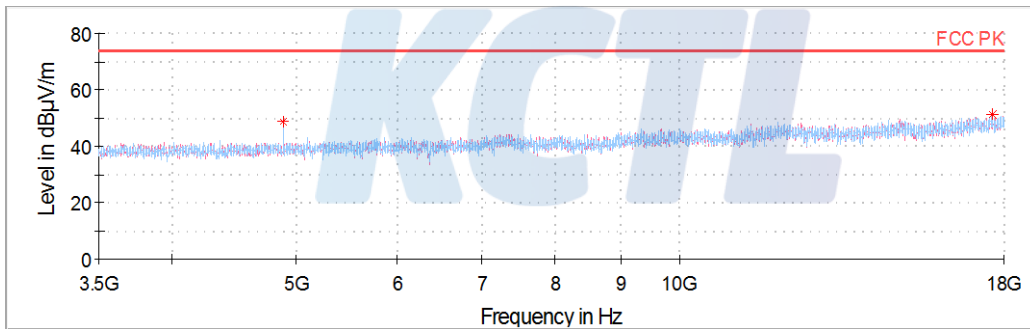


**- Bluetooth 8DPSK**

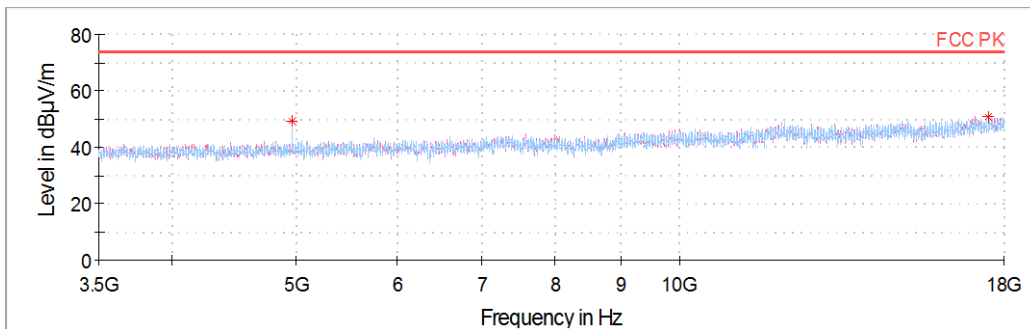
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)



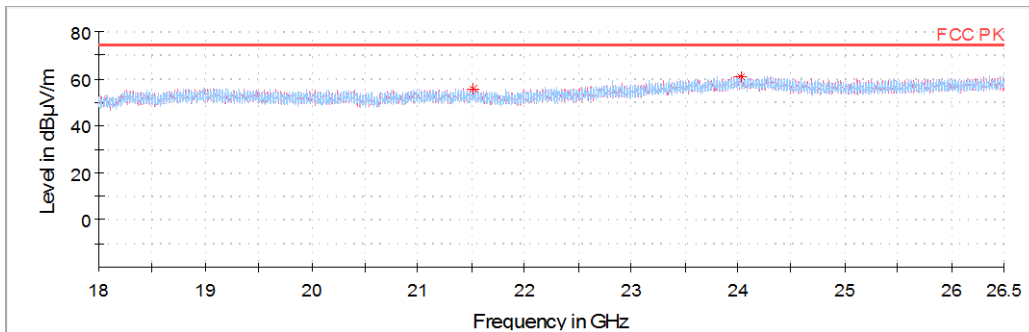
Highest Channel (2 480 MHz)



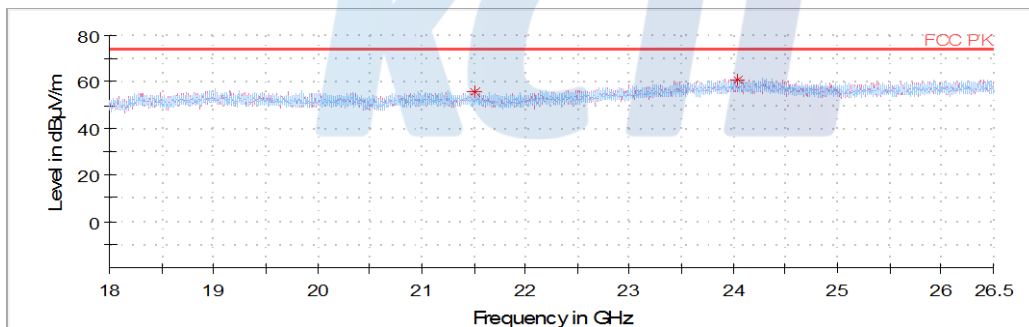
**- 18 GHz ~ 26.5 GHz data**

**- Bluetooth GFSK**

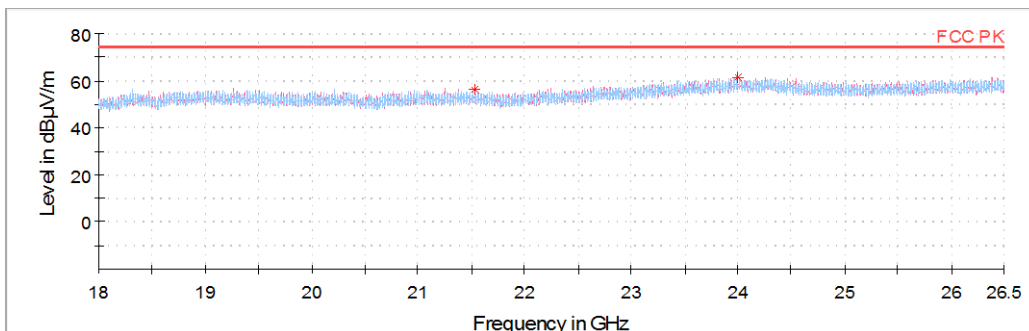
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)

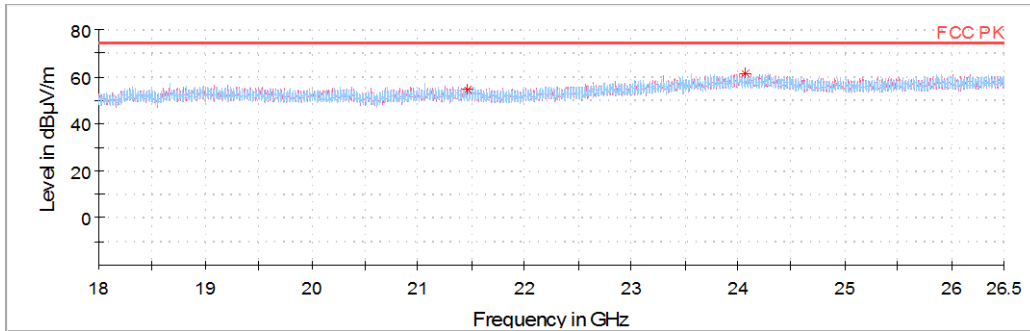


Highest Channel (2 480 MHz)

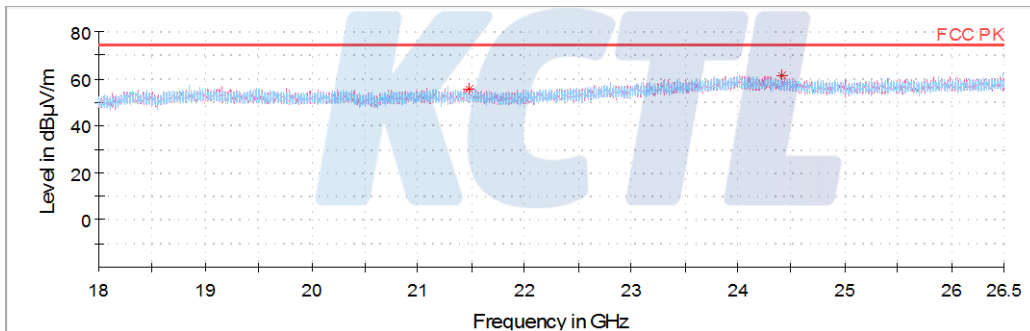


**- Bluetooth 8DPSK**

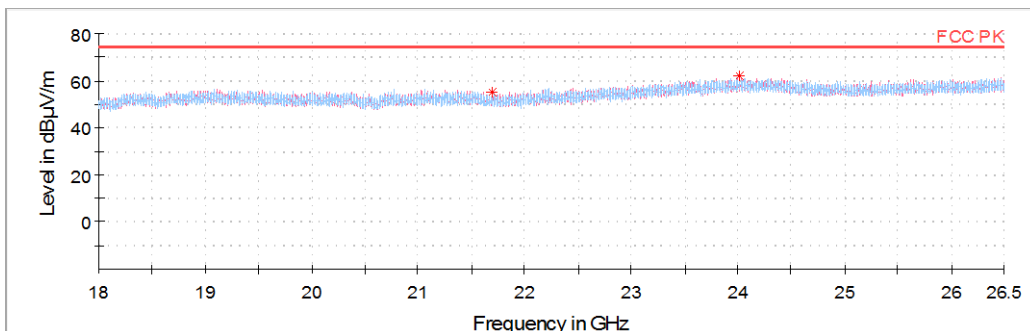
Lowest Channel (2 402 MHz)



Middle Channel (2 441 MHz)



Highest Channel (2 480 MHz)



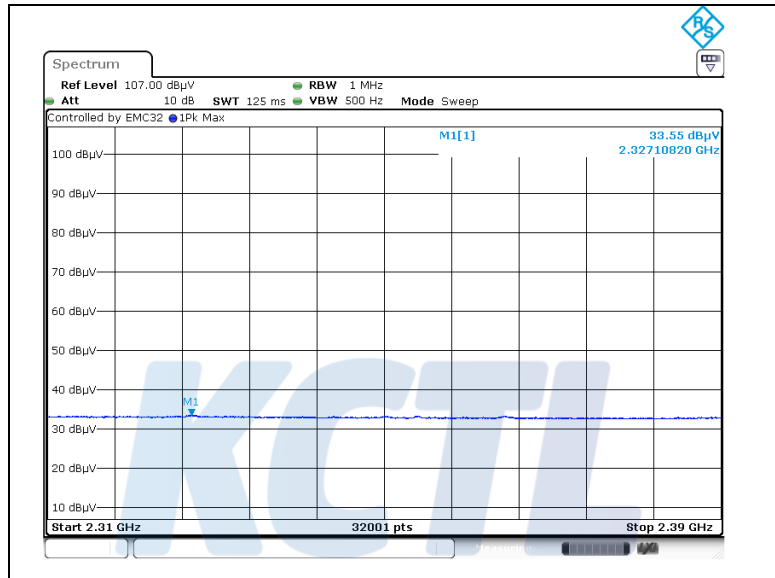
### 5.2.4.4 Test Plot (Balance Flex Antenna)

Figure 2. Plot of the average data emissions

#### - Restricted Bandedge data(Lowest Channel)

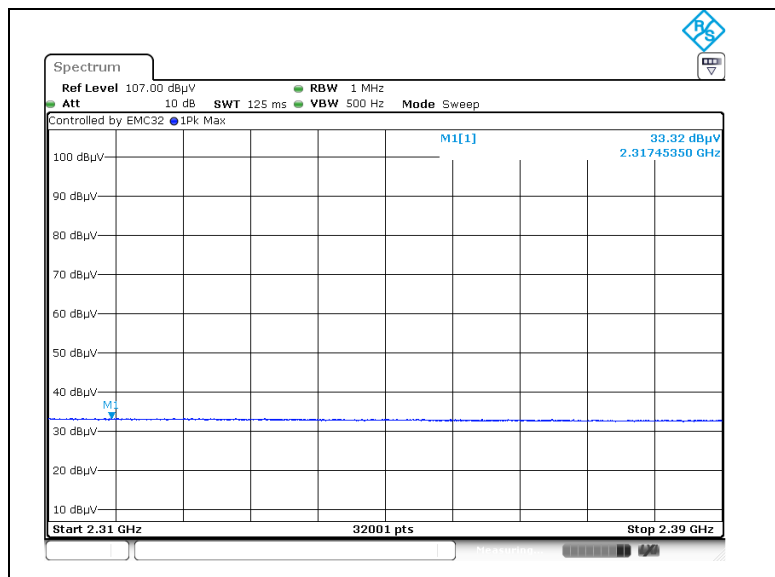
#### - Bluetooth GFSK

Worst Antenna polarization : V



#### - Bluetooth 8DPSK

Worst Antenna polarization : H



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## - Restricted Bandedge data(Highest Channel)

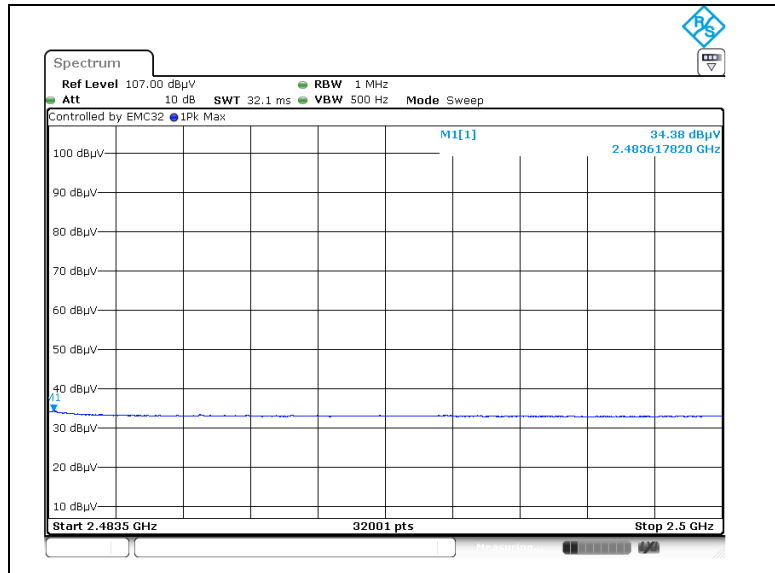
### - Bluetooth GFSK

Worst Antenna polarization : H



### - Bluetooth 8DPSK

Worst Antenna polarization : H



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## 6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	Spectrum Analyzer	R&S	FSV40	100988	19.01.05
■	Wideband Power Sensor	R&S	NRP-Z81	102398	19.01.31
■	Bilog Antenna	SCHWARZBECK	VULB9168	583	20.04.13
■	COAXIAL FIXED ATTENUATOR	Agilent	8491B-003	2708A18758	20.04.13
■	Loop Antenna	R&S	HFH2-Z2	100355	20.08.24
■	EMI TEST RECEIVER	R&S	ESC17	100732	19.08.23
■	AMPLIFIER	SONOMA	310N	284608	19.08.23
■	HORN ANTENNA	ETS-LINDGREN	3117	00155787	18.10.20
■	HORN ANTENNA	ETS-LINDGREN	3116	00086632	19.04.20
■	AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800-22-10P	2031196	19.05.15
■	Broadband PreAmplifier	SCHWARZBECK	BBV9718	216	19.08.01
■	AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000997	19.08.02
■	High Pass Filter	WT	WT-A1698-HS	WT160411001	19.05.14
■	Antenna Mast	MATURO	AM4.0	079/3440509	-
■	Turn Table	MATURO	CO2000-SOFT	-	-
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000	79	-
■	TWO-LINE V - NETWORK	R&S	ENV216	101358	19.04.05
■	Signal Generator	R&S	SMR40	100007	19.05.15
■	Vector Signal Generator	R&S	SMBV100A	257566	19.01.05
■	Cable Assembly	RadiAll	2301761768000 PJ	17.30.38	-
■	Cable Assembly	gigalane	RG-400	-	-
■	Cable Assembly	HUER+SUHNER	SUCOFLEX 104	MY4342/4	-