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TEST REPORT

KCTL Inc.
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Suwon-si, Gyeonggi-do, 16677, Korea
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KCTL

1. Client

- 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

2. Use of Report : -

3. Name of Product and Model : ARTIK-0710 / SIP007AFS00

4. Manufacturer and Country of Origin : Samsung Electronics Co., Ltd. / Korea

5. FCC ID : A3LSIP007AFS00

6. IC ID : 649E-SIP007AFS00

7. Date of Test : 2018-10-15 to 2018-10-19

8. Test Standards : FCC Part 15 Subpart C, 15.247
RSS-247 Issue 2, RSS-GEN Issue 5

9. Test Results : 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

KCTL Inc.

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	18, 21

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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, 16677, Rep.of Korea

KCTL

2. Laboratory information

Address

KCTL Inc.

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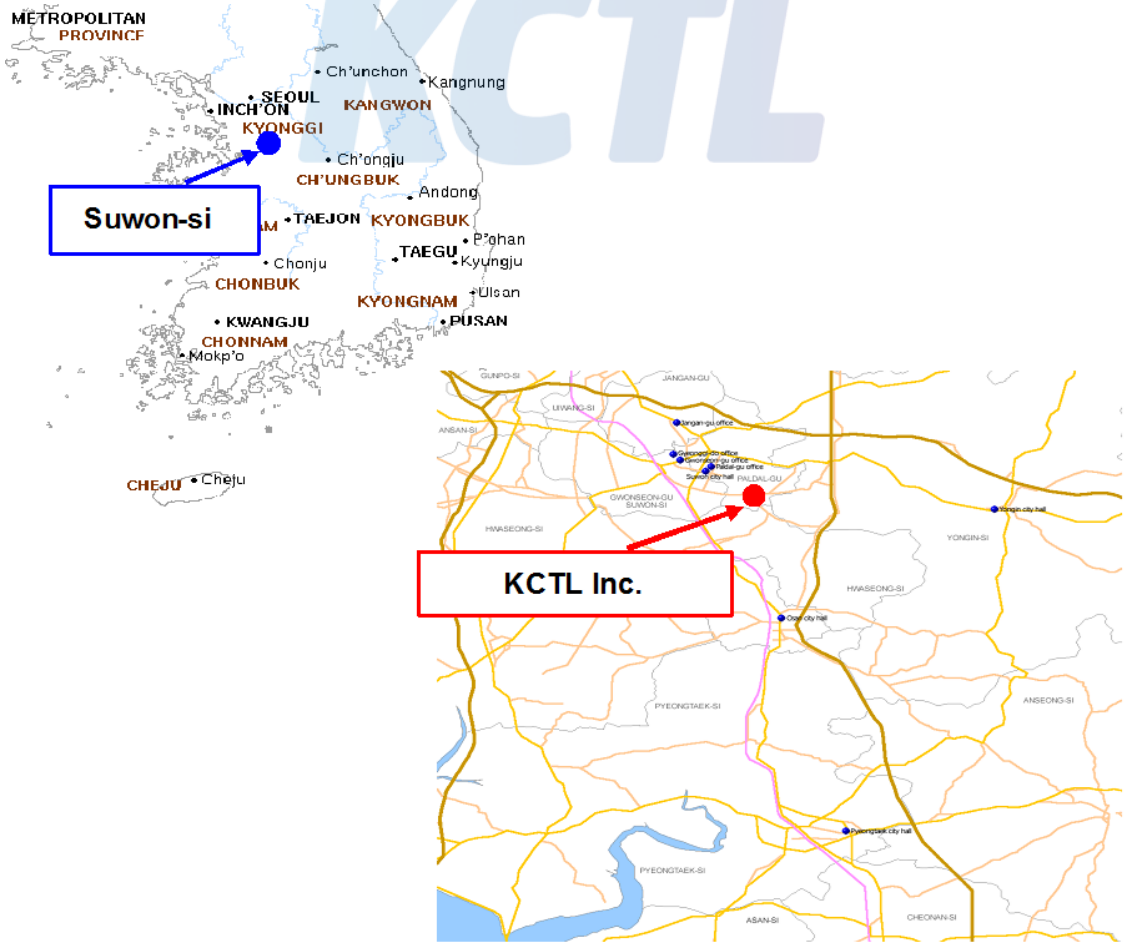
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

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

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

SITE MAP



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

The number of channels	2.4 ㎓:79 ch (Bluetooth) 40 ch (Bluetooth Low Energy) 11 ch (802.11b/g/n_HT20) 15 ch (Zigbee) 5.0 ㎓: 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)
Type of Antenna	Diploe Antenna, Balance Flex Antenna
Antenna Gain	Dipole Antenna 2.4 ㎓: 3.8 ㏈i 5 ㎓: 5.5 ㏈i Balance Flex Antenna 2.4 ㎓: 3.0 ㏈i 5 ㎓: 4.0 ㏈i
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 [㎒]	Peak output power [dBm]
Bluetooth Low Energy (GFSK)	Lowest	2 402	3.25
	Middle	2 440	2.74
	Highest	2 480	1.54

Note1) : The above peak output power were retested results.

3.4 Test frequency

	Bluetooth Low Energy
Lowest frequency	2 402 ㎒
Middle frequency	2 440 ㎒
Highest frequency	2 480 ㎒

3.5 Normal and extreme test conditions

- Ambient Conditions

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

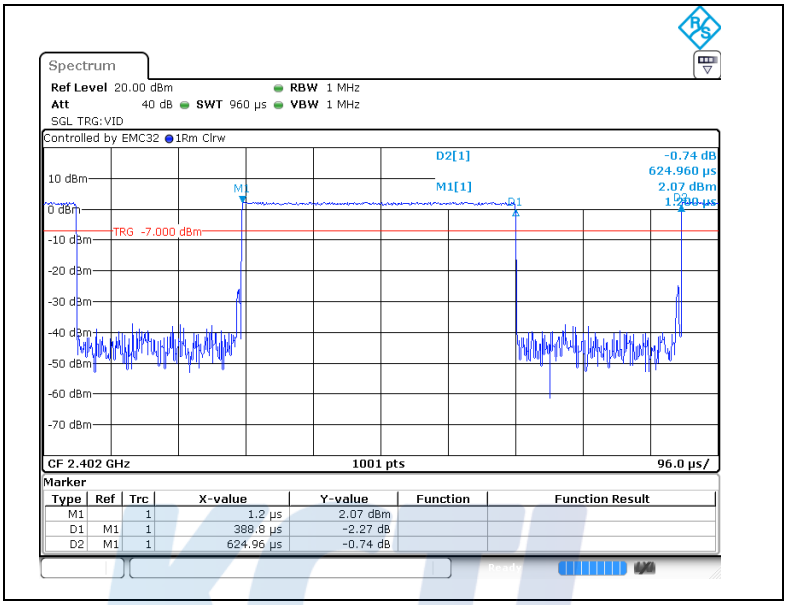
-Test Conditions

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

Note1) : N:Normal T:Temperature V:Voltage

3.6 Duty Cycle Correction Factor

- Bluetooth Low Energy (GFSK)



Note1) : Period : 0.62 ms, On time : 0.39 ms
Note2) : Duty Cycle : 62.21 %
Note3) : It is a non-continuous transmission (duty cycle < 98 %)
Note4) : Duty Cycle Correction Factor : 10 log(1 / x) = 10 log(1 / (0.39 / 0.62)) = 2.06 dB

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
Note1) : 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 Measurement Uncertainty

Measurement Item	Expanded Uncertainty U = *k*Uc (*k* = 2)	
Radiated Spurious Emissions	9 ㎑ ~ 30 ㎒:	+2.42 ㏈, -2.42 ㏈
	30 ㎒ ~ 300 ㎒:	+4.94 ㏈, -5.06 ㏈
		+4.93 ㏈, -5.05 ㏈
	300 ㎒ ~ 1 000 ㎒:	+4.97 ㏈, -5.08 ㏈
		+4.84 ㏈, -4.96 ㏈
	1 ㎓ ~ 25 ㎓:	+6.03 ㏈, -6.05 ㏈

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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 ㎑ 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 ㏈ below that in the 100 ㎑ 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 ㏈ instead of 20 ㏈. 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 notexceed the field strength levels specified in the following table:

Frequency (㎒)	Field strength (㎛/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	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 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permItted under other sections of this part, e.g., §15.231 and 15.241.

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

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

5.2.2.1 Band-edge Compliance of RF Conducted Emissions

5.2.2.1.1 Reference Level Measurement

Establish a reference level by using the following procedure:

1) Set instrument center frequency to DTS channel center frequency.
2) Set the span to ≥ 1.5 times the DTS bandwidth.
3) Set the RBW = 100 ㎑.
4) Set the VBW ≥ 3 x RBW.
5) Detector = peak.
6) Sweep time = auto couple.
7) Trace mode = max hold.
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum PSD level.

5.2.2.1.2 Emissions Level Measurement

1) Set the center frequency and span to encompass frequency range to be measured.
2) Set the RBW = 100 ㎑.
3) Set the VBW ≥ 3 x RBW.
4) Detector = peak.
5) Ensure that the number of measurement points ≥ span/RBW
6) Sweep time = auto couple.
7) Trace mode = max hold.
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

5.2.2.2 Conducted Spurious Emissions

Set the spectrum analyzer as follows:

1) Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
   Typically, several plots are required to cover this entire span.
2) RBW = 100 ㎑
3) VBW ≥ RBW
4) Sweep = auto
5) Detector function = peak
6) Trace = max hold
7) Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
8) 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 specifiedbandwidth.

5.2.2.3 Radiated Spurious Emissions

1) The preliminary and final rdiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m semi-anechoic chamber. The EUT was tested at a distance 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 ㎑ to 30 ㎒ using the loop antenna, and from 30 to 1 000 ㎒ using the Bi-Log antenna, and from 1 000 ㎒ to 26 500 ㎒ using the horn antenna.
4) 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.
5) The 0.8m height is for below 1 G testing, and 1.5m is for above 1G testing.

Note

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 3 ㎒ for Average detection (AV) at frequency above 1 ㎓. (Detector = RMS, Averaging type = power)
   In case of duty cycle less than 98%, a duty cycle correction factor has to be added to the measurement result.

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 ㎓ data (worst-case)

Bluetooth Low Energy Lowest Channel (2 402 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	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]
Quasi-Peak DATA. Emissions below 30 ㎒										
5.01	9	V	35.70	1.94	-32.69	19.45	-11.30	24.40	69.50	45.10
19.08	9	V	35.00	4.09	-32.68	18.29	-10.30	24.70	69.50	44.80
Quasi-Peak DATA. Emissions below 1 ㎓										
134.40	120	H	33.40	2.51	-25.33	12.22	-10.60	22.80	43.50	20.70
267.17	120	H	35.20	3.64	-25.02	12.38	-9.00	26.20	46.00	19.80
405.51	120	H	43.10	4.60	-24.72	15.82	-4.30	38.80	46.00	7.20
479.23	120	H	37.80	5.02	-24.66	17.44	-2.20	35.60	46.00	10.40

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

- Above 1 ㎓ data

- Bluetooth Low Energy

Lowest Channel (2 402 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB(㎶/m)]	Limit dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
2 334.95 1)	1 000	H	46.11	3.66	-30.03	28.43	2.06	-	48.17	74.00	25.83
3 016.72	1 000	V	65.13	4.15	-59.61	29.75	-25.71	-	39.42	74.00	34.58
4 803.74 2)	1 000	V	68.92	5.34	-60.69	32.80	-22.55	-	46.37	74.00	27.63
17 065.66	1 000	V	58.20	10.45	-58.51	40.69	-7.37	-	50.83	74.00	23.17
21 493.23	1 000	V	48.09	11.90	-49.00	45.00	7.90	-	55.99	74.00	18.01
24 019.59	1 000	V	45.50	12.80	-42.58	45.00	15.22	-	60.72	74.00	13.28
Average DATA. Emissions above 1 ㎓											
2 334.95 1)	1 000	H	35.91	3.66	-30.03	28.43	2.06	2.06	40.03	54.00	13.97
4 803.74 2)	1 000	V	65.68	5.34	-60.69	32.80	-22.55	2.06	45.19	54.00	8.81

Note. Factor = Cable loss + Amp. Gain + Antenna factor
Result = Reading + Factor + DCCF
1) Restricted band
2) Harmonic

Middle Channel (2 440 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB(㎶/m)]	Limit dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
1 343.91 1)	1 000	H	70.75	2.80	-60.43	25.18	-32.45	-	38.30	74.00	35.70
3 238.91	1 000	H	66.56	4.29	-60.40	30.35	-25.76	-	40.80	74.00	33.20
4 879.88 2)	1 000	V	67.47	5.39	-60.94	32.84	-22.71	-	44.76	74.00	29.24
17 595.36	1 000	V	59.57	10.70	-61.88	43.87	-7.31	-	52.25	74.00	21.75
21 554.06	1 000	V	47.68	12.00	-49.13	45.00	7.87	-	55.55	74.00	18.45
24 284.69	1 000	H	46.64	12.80	-43.12	45.10	14.78	-	61.43	74.00	12.57
Average DATA. Emissions above 1 ㎓											
1 343.91 1)	1 000	H	64.39	2.80	-60.43	25.18	-32.45	2.06	34.00	54.00	20.00
4 879.88 2)	1 000	V	62.86	5.39	-60.94	32.84	-22.71	2.06	42.22	54.00	11.78

Note. Factor = Cable loss + Amp. Gain + Antenna factor
Result = Reading + Factor + DCCF
1) Restricted band
2) Harmonic

Highest Channel (2 480 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
2 483.70 1)	1 000	H	46.26	3.77	-30.10	28.72	2.39	-	48.65	74.00	25.35
3 063.67	1 000	H	65.65	4.18	-59.89	29.87	-25.84	-	39.81	74.00	34.19
4 960.21 2)	1 000	V	67.27	5.44	-60.61	32.88	-22.29	-	44.98	74.00	29.02
17 117.31	1 000	V	57.71	10.47	-58.84	41.00	-7.37	-	50.34	74.00	23.66
21 509.44	1 000	V	47.78	11.90	-49.01	45.00	7.89	-	55.68	74.00	18.32
24 111.23	1 000	H	47.17	12.80	-42.83	45.10	15.07	-	62.24	74.00	11.76
Average DATA. Emissions above 1 ㎓											
2 483.70 1)	1 000	H	36.14	3.77	-30.10	28.72	2.39	2.06	40.59	54.00	13.41
4 960.21 2)	1 000	V	61.99	5.44	-60.61	32.88	-22.29	2.06	41.77	54.00	12.23

Note. Factor = Cable loss + Amp. Gain + Antenna factor
Result = Reading + Factor + DCCF
1) Restricted band
2) Harmonic

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 ㎓ data (worst-case)

Bluetooth Low Energy Lowest Channel (2 402 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	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]
Quasi-Peak DATA. Emissions below 30 ㎒										
2.08	9	V	40.60	1.28	-32.71	19.63	-11.80	28.80	69.50	40.70
15.56	9	V	34.50	3.38	-32.67	18.59	-10.70	23.80	69.50	45.70
Quasi-Peak DATA. Emissions below 1 ㎓										
136.09	120	H	39.70	2.52	-25.29	12.37	-10.40	29.30	43.50	14.20
267.53	120	H	37.90	3.64	-25.04	12.40	-9.00	28.90	46.00	17.10
304.27	120	H	32.70	3.91	-25.10	13.59	-7.60	25.10	46.00	20.90
499.97	120	H	28.90	5.13	-24.73	17.90	-1.70	27.20	46.00	18.80

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

- Above 1 ㎓ data

- Bluetooth Low Energy

Lowest Channel (2 402 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB(㎶/m)]	Limit dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
2 337.87 1)	1 000	V	46.59	3.66	-30.04	28.43	2.05	-	48.65	74.00	25.35
3 074.06	1 000	H	66.50	4.19	-59.96	29.90	-25.87	-	40.64	74.00	33.36
4 803.77 2)	1 000	H	66.93	5.34	-60.69	32.80	-22.55	-	44.38	74.00	29.62
17 577.23	1 000	V	58.26	10.69	-61.79	43.76	-7.34	-	50.92	74.00	23.08
21 484.73	1 000	H	47.50	11.90	-48.99	45.00	7.91	-	55.41	74.00	18.59
24 282.83	1 000	H	46.61	12.80	-43.11	45.10	14.79	-	61.40	74.00	12.60
Average DATA. Emissions above 1 ㎓											
2 337.87 1)	1 000	V	35.88	3.66	-30.04	28.43	2.05	2.06	40.00	54.00	14.00
4 803.77 2)	1 000	H	61.65	5.34	-60.69	32.80	-22.55	2.06	41.16	54.00	12.84

Note. Factor = Cable loss + Amp. Gain + Antenna factor
Result = Reading + Factor + DCCF
1) Restricted band
2) Harmonic

Middle Channel (2 440 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result dB(㎶/m)]	Limit dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
1 344.02 1)	1 000	H	70.47	2.80	-60.44	25.18	-32.46	-	38.02	74.00	35.98
3 111.25	1 000	V	66.58	4.21	-60.12	30.00	-25.91	-	40.67	74.00	33.33
4 879.65 2)	1 000	H	68.10	5.39	-60.94	32.84	-22.71	-	45.39	74.00	28.61
17 590.38	1 000	H	58.72	10.69	-61.85	43.84	-7.32	-	51.40	74.00	22.60
21 452.59	1 000	H	48.20	11.90	-48.87	44.90	7.93	-	56.13	74.00	17.87
24 065.28	1 000	H	46.14	12.80	-42.65	45.00	15.15	-	61.28	74.00	12.72
Average DATA. Emissions above 1 ㎓											
1 344.02 1)	1 000	H	64.33	2.80	-60.44	25.18	-32.46	2.06	33.94	54.00	20.06
4 879.65 2)	1 000	H	64.83	5.39	-60.94	32.84	-22.71	2.06	44.19	54.00	9.81

Note. Factor = Cable loss + Amp. Gain + Antenna factor
Result = Reading + Factor + DCCF
1) Restricted band
2) Harmonic

Highest Channel (2 480 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	DCCF [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓											
2 483.74 1)	1 000	V	45.29	3.77	-30.10	28.72	2.39	-	47.68	74.00	26.32
3 081.41	1 000	V	65.53	4.19	-60.00	29.92	-25.89	-	39.64	74.00	34.36
4 960.42 2)	1 000	H	69.73	5.45	-60.61	32.88	-22.28	-	47.45	74.00	26.55
17 580.41	1 000	H	58.14	10.69	-61.80	43.78	-7.33	-	50.81	74.00	23.19
21 417.27	1 000	H	48.77	11.90	-48.85	44.90	7.95	-	56.72	74.00	17.28
24 276.98	1 000	H	46.73	12.80	-43.10	45.10	14.80	-	61.53	74.00	12.47
Average DATA. Emissions above 1 ㎓											
2 483.74 1)	1 000	V	36.22	3.77	-30.10	28.72	2.39	2.06	40.67	54.00	13.33
4 960.42 2)	1 000	H	65.60	5.45	-60.61	32.88	-22.28	2.06	45.38	54.00	8.62

Note. Factor = Cable loss + Amp. Gain + Antenna factor
Result = Reading + Factor + DCCF
1) Restricted band
2) Harmonic

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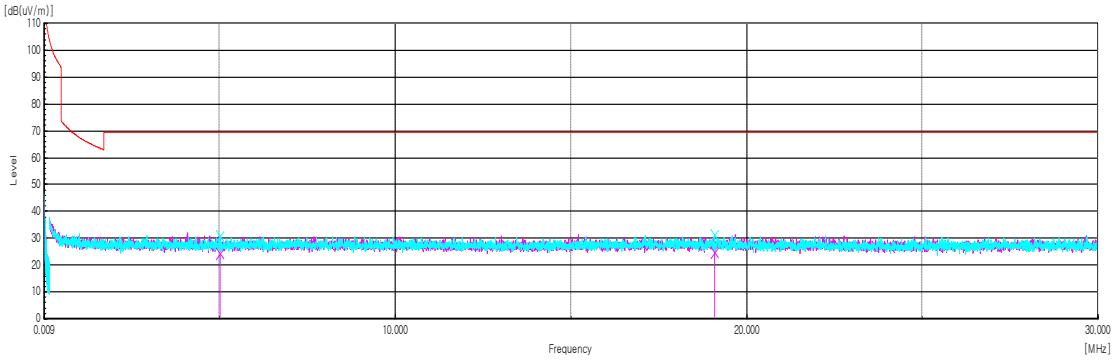
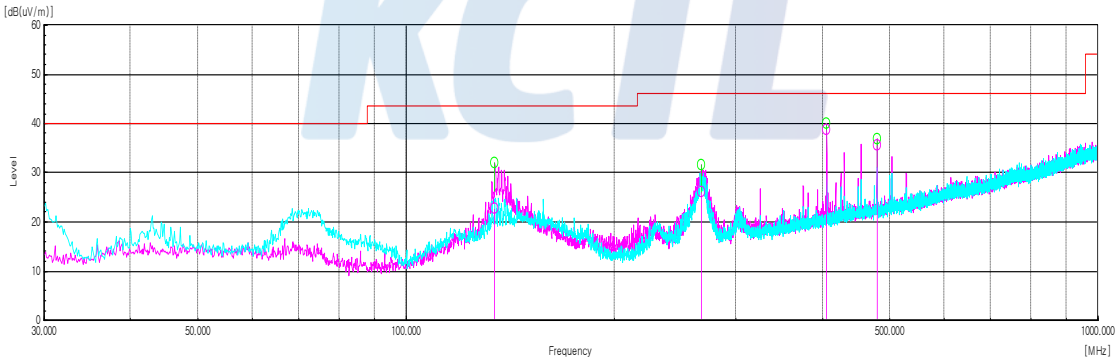
5.2.4.1 Test Plot (Dipole Antenna)

Figure 1. Plot of the Spurious Emissions (Radiated)

- 9 ㎑ ~ 30 ㎒ data



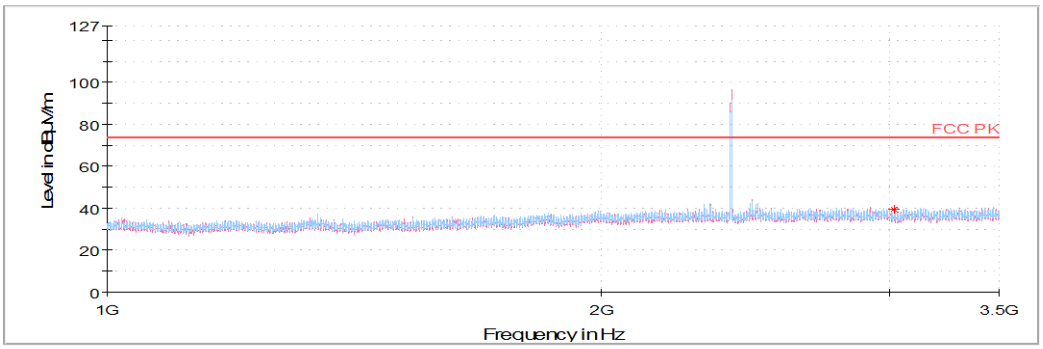
- 30 ㎒ ~ 1 ㎓ data



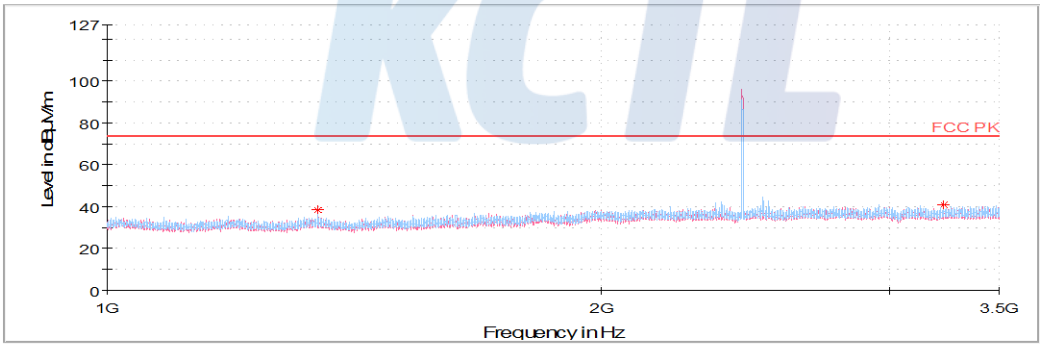
- 1 ㎓ ~ 3.5 ㎓ data

- Bluetooth Low Energy

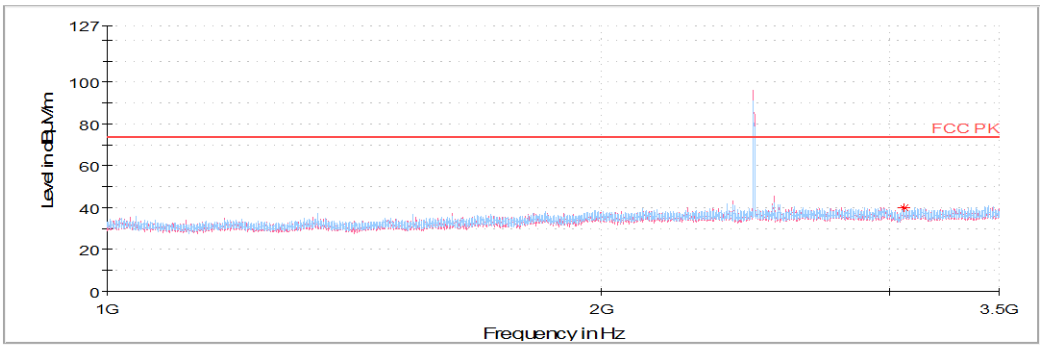
Lowest Channel (2 402 ㎒)



Middle Channel (2 440 ㎒)

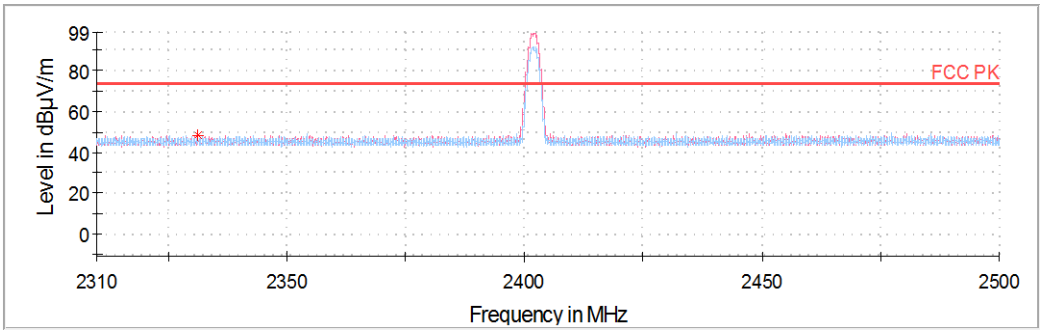


Highest Channel (2 480 ㎒)



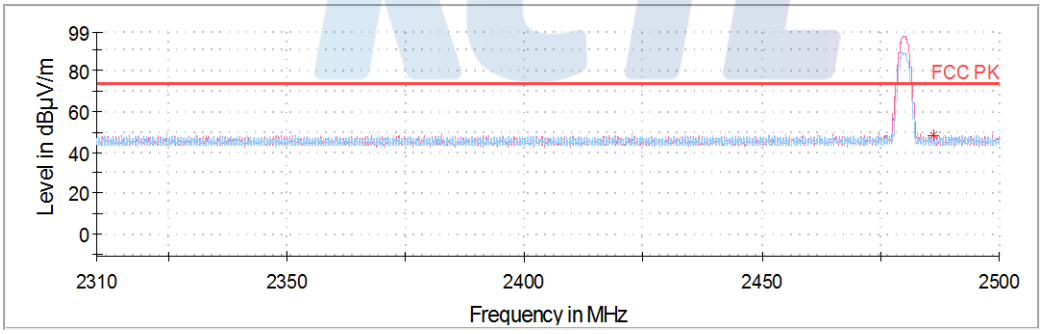
- Restricted Bandedge data(Lowest Channel)

- Bluetooth Low Energy



- Restricted Bandedge data(Highest Channel)

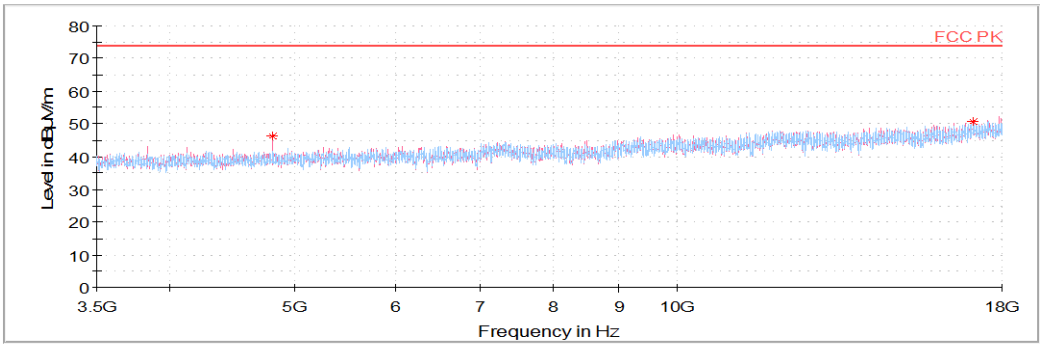
- Bluetooth Low Energy



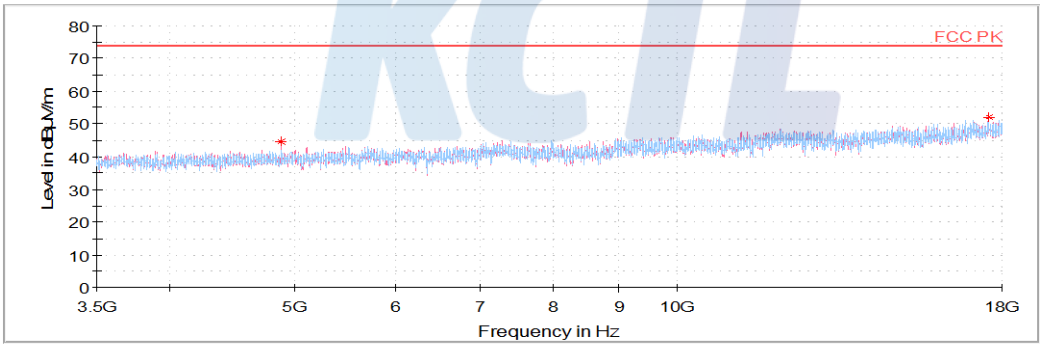
- 3.5 ㎓ ~ 18 ㎓ data

- Bluetooth Low Energy

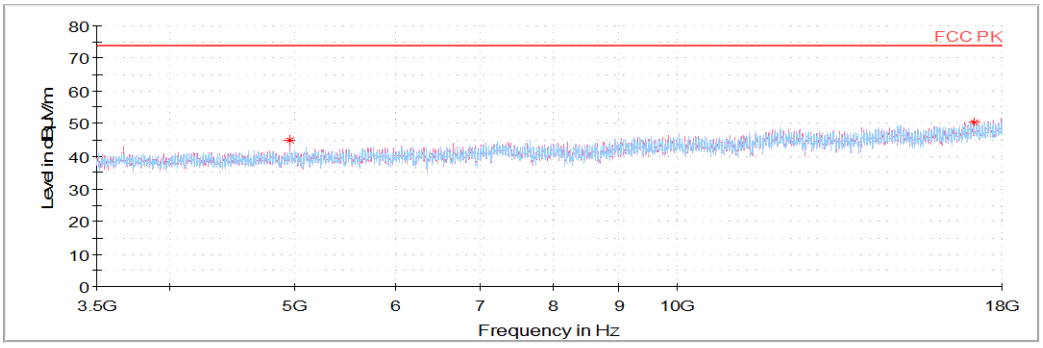
Lowest Channel (2 402 ㎒)



Middle Channel (2 440 ㎒)



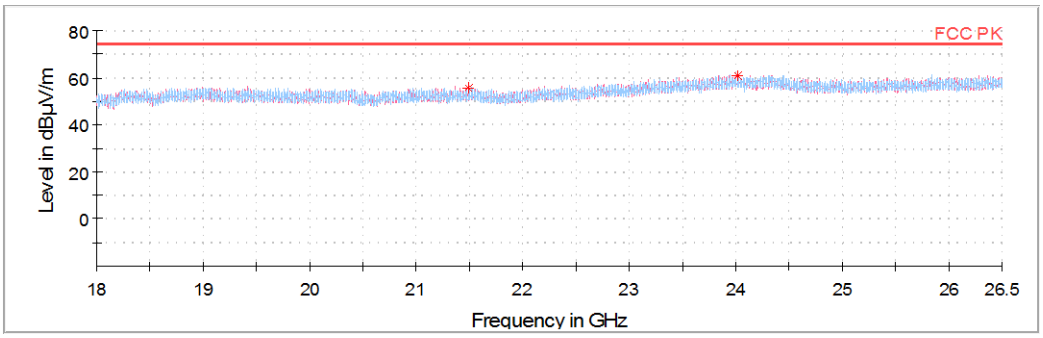
Highest Channel (2 480 ㎒)



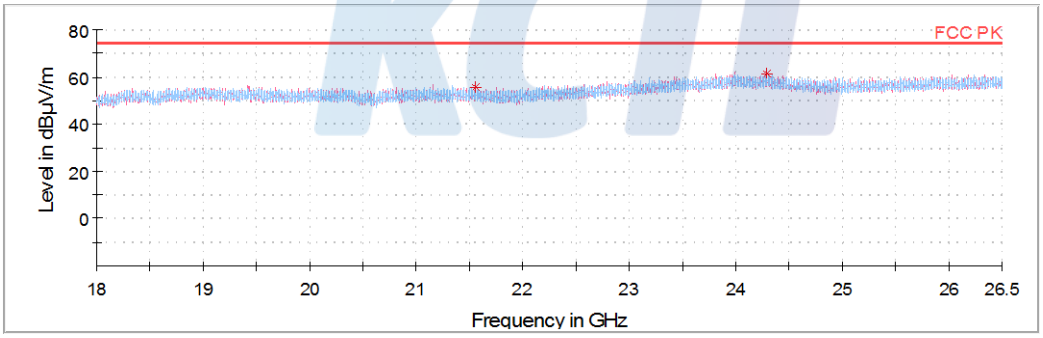
- 18 ㎓ ~ 26.5 ㎓ data

- Bluetooth Low Energy

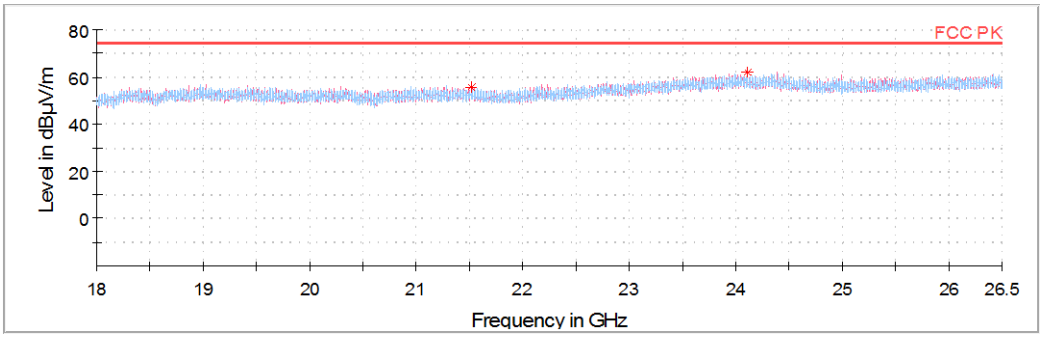
Lowest Channel (2 402 ㎒)



Middle Channel (2 440 ㎒)



Highest Channel (2 480 ㎒)



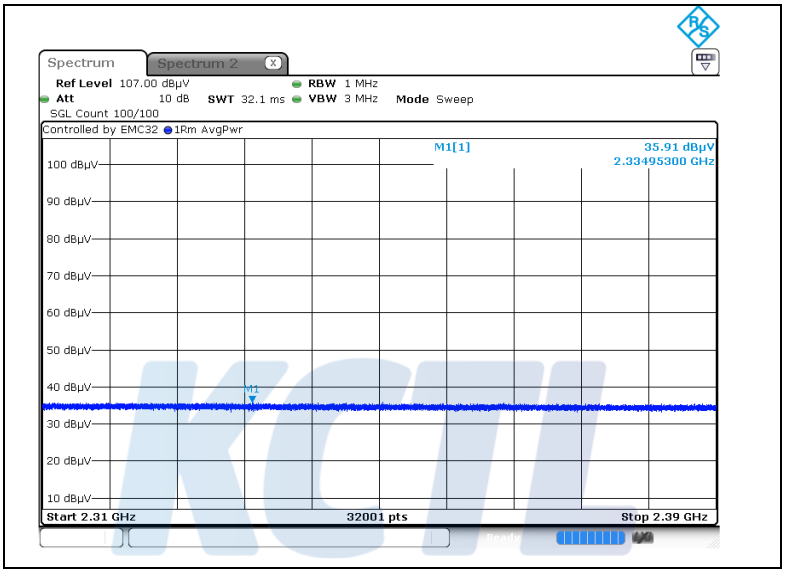
5.2.4.2 Test Plot (Dipole Antenna)

Figure 2. Plot of the average data emissions

- Restricted Bandedge data(Lowest Channel)

- Bluetooth Low Energy

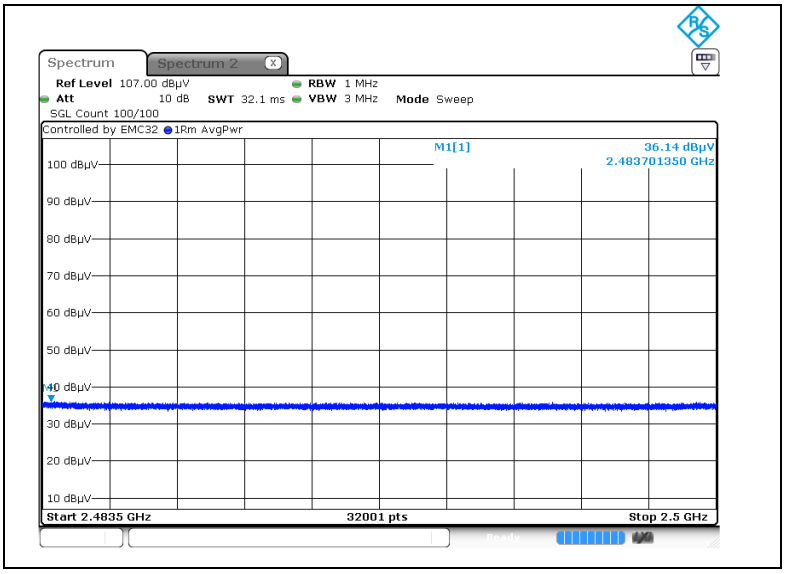
Worst Antenna polarization : H



- Restricted Bandedge data(Highest Channel)

- Bluetooth Low Energy

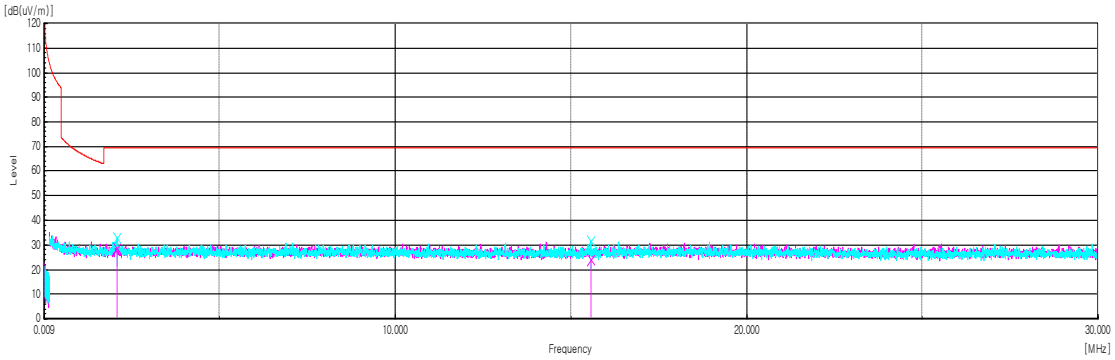
Worst Antenna polarization : H



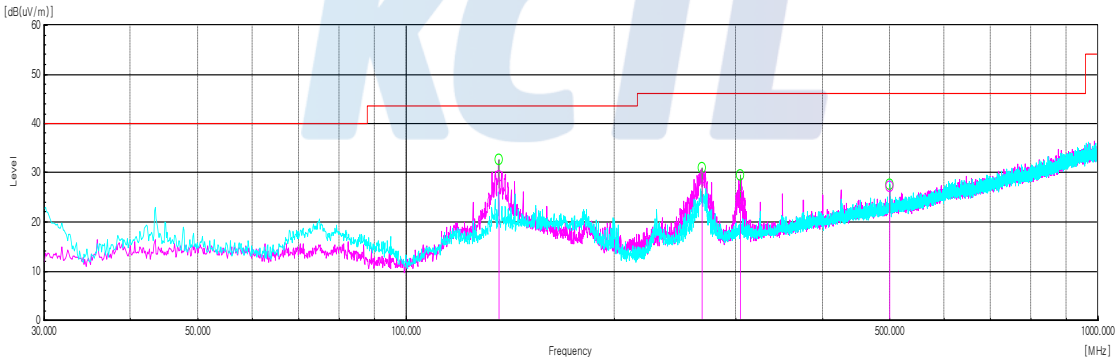
5.2.4.3 Test Plot (Balance Flex Antenna)

Figure 1. Plot of the Spurious Emissions (Radiated)

- 9 ㎑ ~ 30 ㎒ data



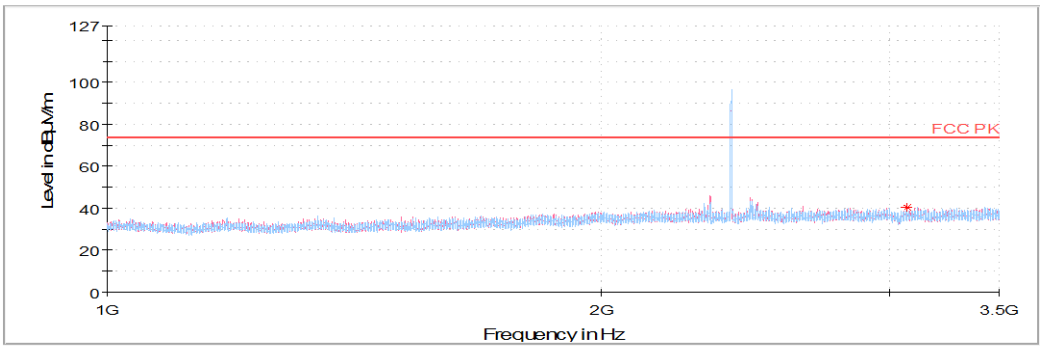
- 30 ㎒ ~ 1 ㎓ data



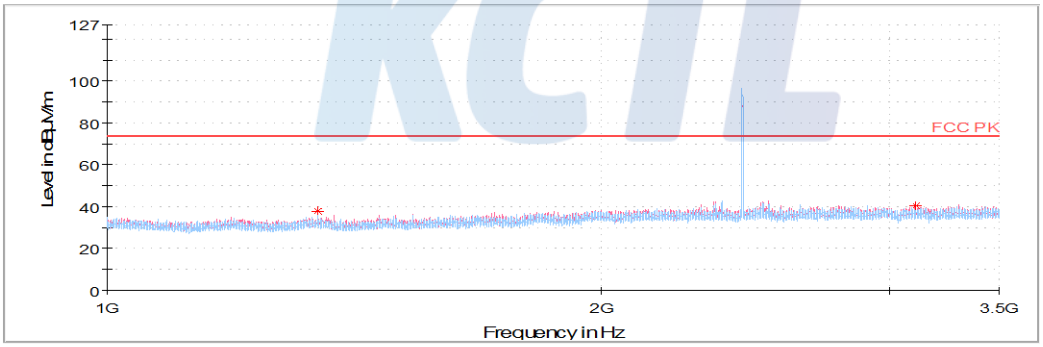
- 1 ㎓ ~ 3.5 ㎓ data

- Bluetooth Low Energy

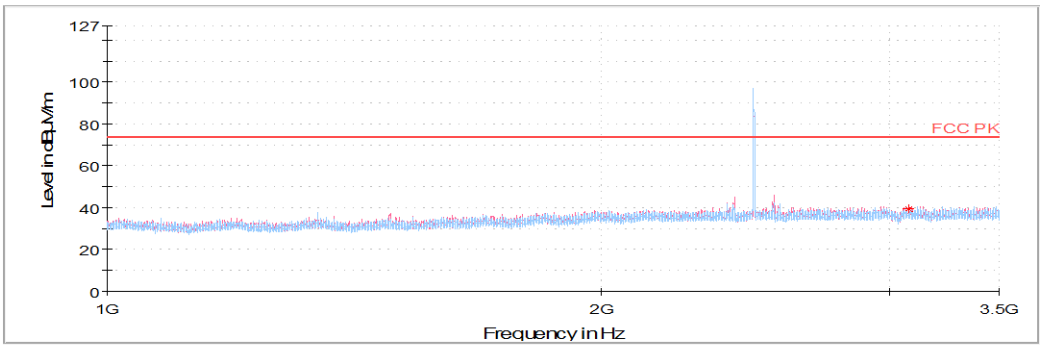
Lowest Channel (2 402 ㎒)



Middle Channel (2 440 ㎒)

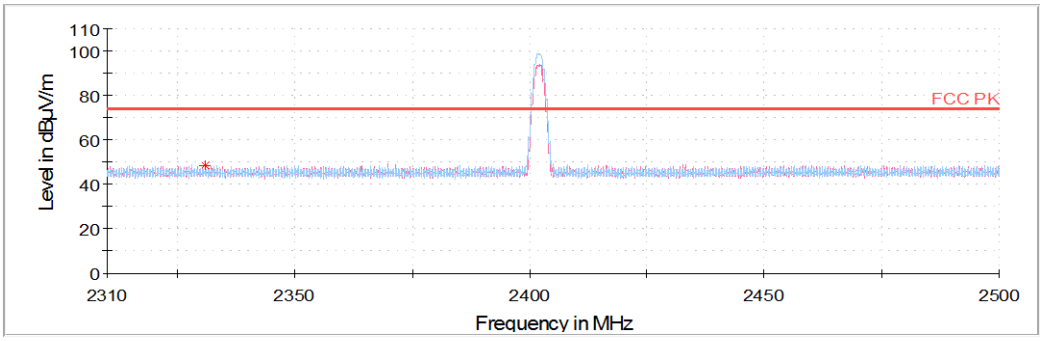


Highest Channel (2 480 ㎒)



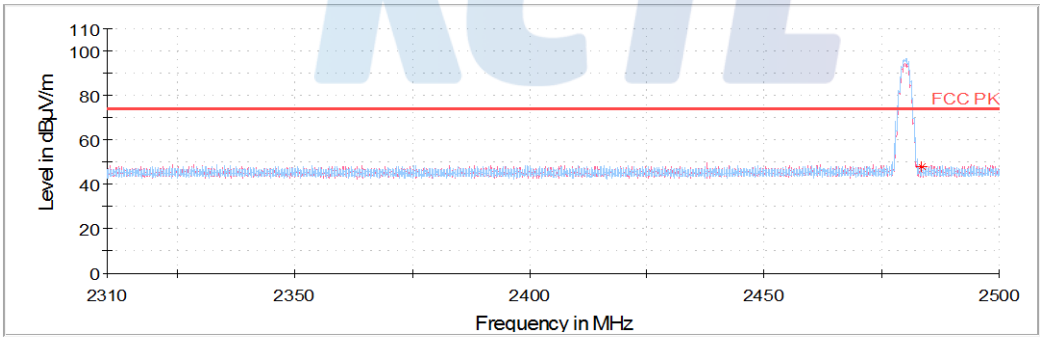
- Restricted Bandedge data(Lowest Channel)

- Bluetooth Low Energy



- Restricted Bandedge data(Highest Channel)

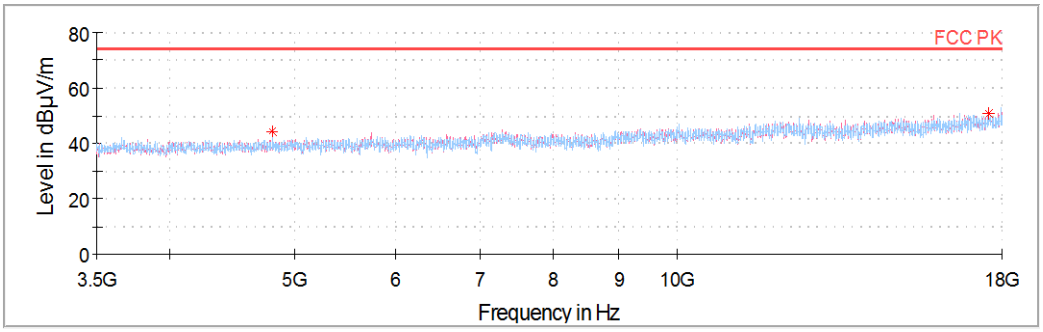
- Bluetooth Low Energy



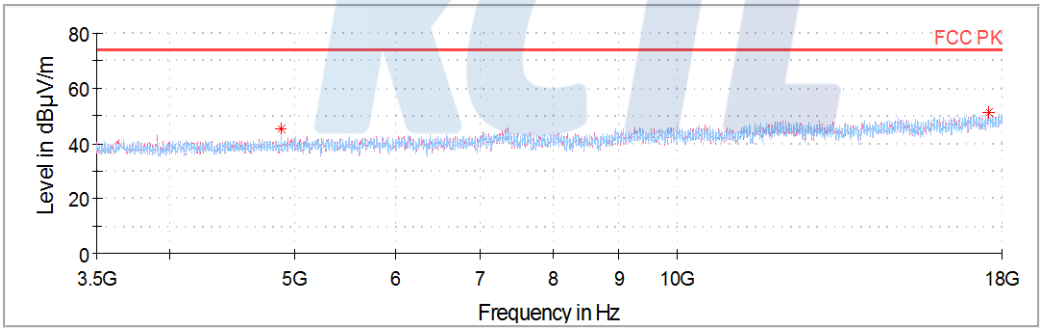
- 3.5 ㎓ ~ 18 ㎓ data

- Bluetooth Low Energy

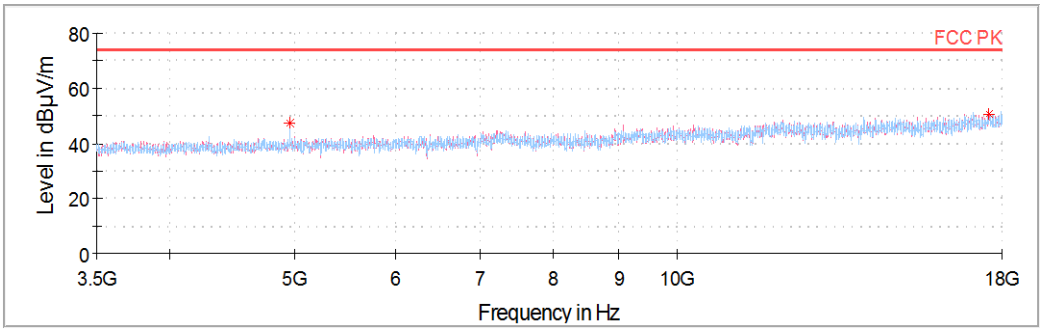
Lowest Channel (2 402 ㎒)



Middle Channel (2 440 ㎒)



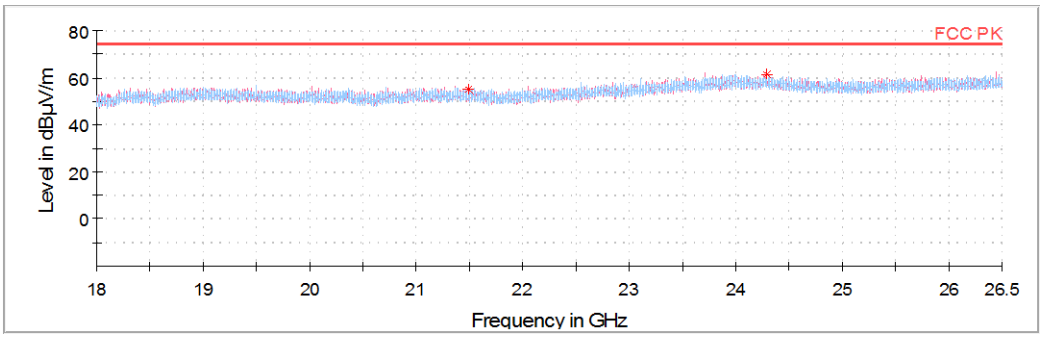
Highest Channel (2 480 ㎒)



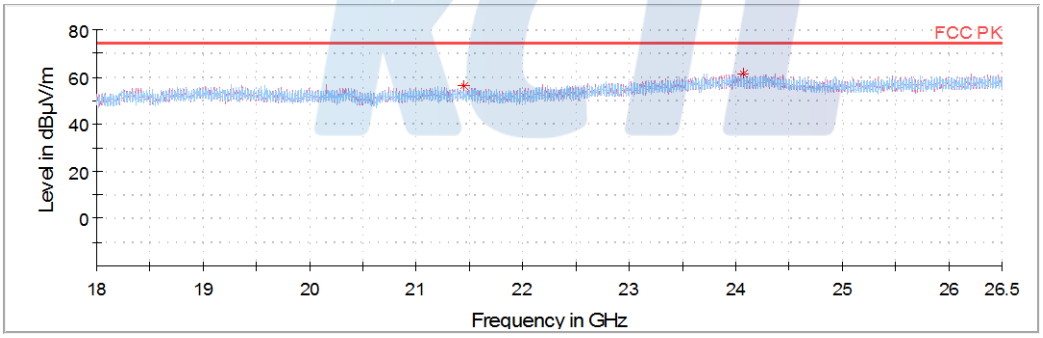
- 18 ㎓ ~ 26.5 ㎓ data

- Bluetooth Low Energy

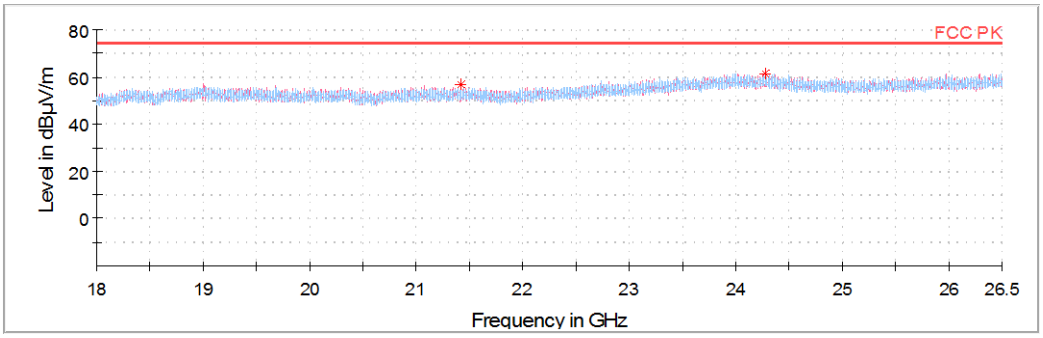
Lowest Channel (2 402 ㎒)



Middle Channel (2 440 ㎒)



Highest Channel (2 480 ㎒)



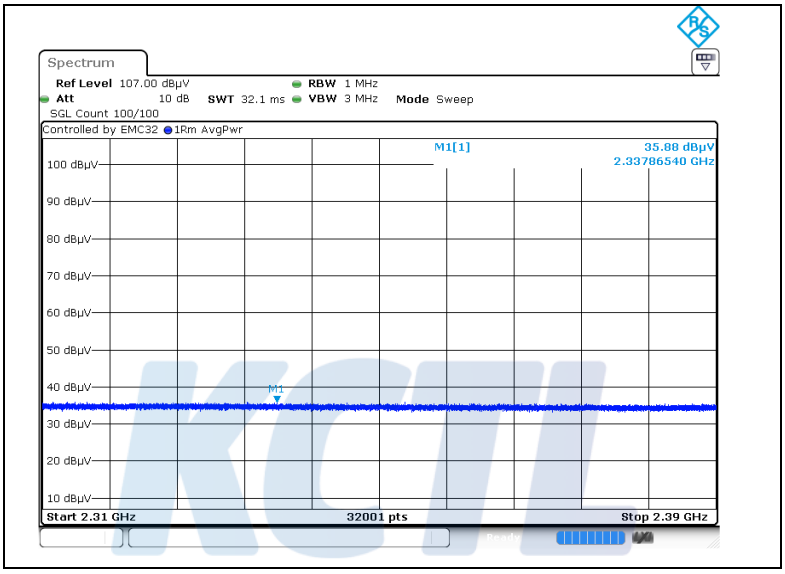
5.2.4.4 Test Plot (Balance Flex Antenna)

Figure 2. Plot of the average data emissions

- Restricted Bandedge data(Lowest Channel)

- Bluetooth Low Energy

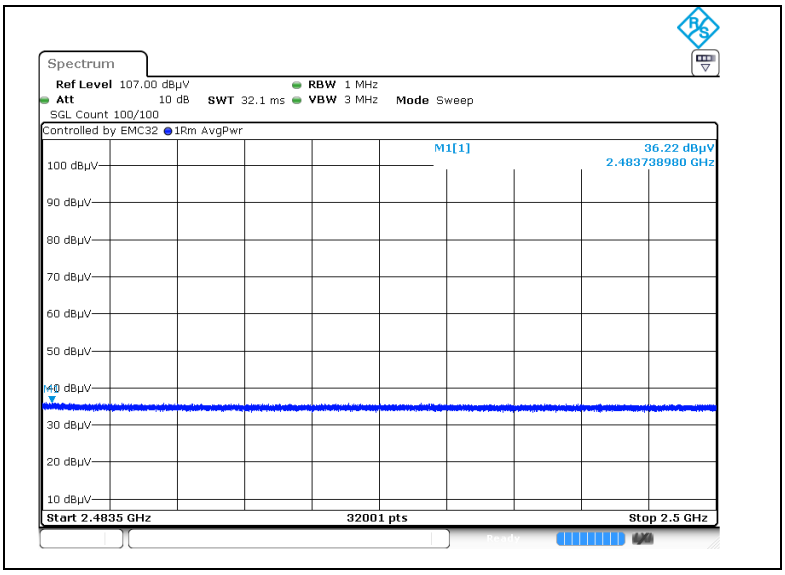
Worst Antenna polarization : V



- Restricted Bandedge data(Highest Channel)

- Bluetooth Low Energy

Worst Antenna polarization : V



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	ESCI7	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	-

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