시 험 성 적 서
TEST REPORT

성적서 번호 Report No.		ICRT-TR-E230749-0A
신청자 Client	기관명 Name	KLT Co., Ltd.
	주 소 Address	34-12, Bangchon-ro 955beon-gil, Tanhyeon-myeon, Paju-si, Gyeonggi-do, Republic of Korea
시험대상품목 Sample description		Pulsarlube LINK
모델명 Type designation		LK-B100
정 격 Ratings		DC 5 V
시험장소 Place of test		■ 고정시험(Inside test) □ 현장시험(Field test) 주소지(Address): 112, Hwanggeum 3-ro 7beon-gil, Hagun-ri, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea
시험기간 Date of test		20. Mar. 2023 ~ 31. Mar. 2023
시험방법/항목 Test Method/Item		FCC Part 15 Subpart C §15.247
시험결과 Test Results		Refer to 3. Test Summary
확 인 Affirmation	작성자 Tested by 성 명 (서명) Name Seong-Hun, Jeong (Signature)	기술책임자 Technical Manager 성 명 (서명) Name Tae-Yang, Yoon (Signature)

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The above test report is certified that the above mentioned products have been tested for the sample.

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The above test report is not related to accreditation by KS Q ISO/IEC 17025 and Korea Laboratory Accreditation scheme.

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2023. 04. 06

주식회사 아이씨알 대표이사

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경기도 김포시 양촌읍 황금3로7번길 112 / Tel: 02-6351-9001 ~ 6
112, Hwanggeum3-ro 7beon-gil, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea / Tel: 02-6351-9001 ~ 6

Contents

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
ICRT-TR-E230749-0A	2023. 04. 06	Initial Issue	All

1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant information

Applicant	KLT Co., Ltd.
Address	34-12, Bangchon-ro 955beon-gil, Tanhyeon-myeon, Paju-si, Gyeonggi-do, Republic of Korea
Contact Person	YoHan Kim
Telephone No.	82-10-3402-5692
Fax No.	-
E-mail	yhkim@pulsarlube.com

1.2 Manufacturer Information

Manufacturer	KLT Co., Ltd.
Address	34-12, Bangchon-ro 955beon-gil, Tanhyeon-myeon, Paju-si, Gyeonggi-do, Republic of Korea

1.3 Test Laboratory Information

Conducted tests were performed at	
Laboratory	ICR Co., Ltd.
Address	112, Hwanggeum 3-ro 7beon-gil, Hagun-ri, Yangchon-eup, Gimpo-si, Gyeonggi-do, Republic of Korea
Telephone No.	+82-2-6351-9002
Fax No.	+82-2-6351-9007
RRA No.	KR0165
KOLAS No.	KT652

2. Equipment under Test(EUT) Information

2.1 General Information

Product Name	Pulsarlube LINK
Brand Name	-
Model Name	LK-B100
Additional Model Name	LK-B101
FCC ID	2APJH-LK-B100
Power Supply	DC 5 V

2.2 Additional Information

Equipment Class	DTS-Digital Transmission System	
Device Type	Stand-alone	
Operating Frequency	2 402 ㎒ ~ 2 480 ㎒	
RF Output Power	Bluetooth LE 1Mbps	7.39 ㏈m
Number of Channel	40	
Modulation Type	GFSK	
Antenna Type	Dipole Antenna	
Antenna Gain	2.296 ㏈i	
Antenna Operating Mode	Equipment with only one antenna	

2.3 Mode of operation during the test

- The EUT is continuous transmission mode during the test with set at Low Channel, Middle Channel, and High Channel. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, YZ, XZ planes.

2.4 Modifications of EUT

- None

2.5 Reasons of Additional Model

- It is a simple external change, and there is no difference in internal parts.

3. Test Summary

3.1 Test standards and results

FCC Part 15 Subpart C			
Clause	Test items	Applied	Results
§15.247 (a) (2)	6 dB Bandwidth	☒	PASS
§15.247 (b) (3)	Maximum Conducted Output Power	☒	PASS
§15.247 (e)	Power Spectral Density	☒	PASS
§15.247 (d)	Conducted Spurious Emission	☒	PASS
§15.247 (d) & §15.209 & §15.205	Radiated Spurious Emission	☒	PASS
§15.203	Antenna Requirement	☒	PASS
§15.207	Power Line Conducted Emission	☒	PASS

3.2 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the standards stated in FCC Part 15 Subpart C Section 15.247.

3.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

3.4 Configuration of Test System

3.4.1 Radiated emission test

Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

3.4.2 AC power line conducted emission test

The EUT was connected to LISN. All supporting equipment were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions

3.5 Antenna requirement

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.

3.5.1 Result: Pass

The dipole antenna of this product uses a standard SMA connector, but the antenna is fixed to the board with an adhesive made of synthetic rubber during the process and cannot be removed by the user, so it satisfies the antenna requirement. The directional gain of the antenna is ***2.296dBi.***

4. Used equipment on test

	Description	Model Name	Manufacturer	Serial Number	Next Cal. (cycle)
☒	SIGNAL & SPECTRUM ANALYZER	FSW85	ROHDE & SCHWARZ	101306	2024-03-02 (1Y)
☒	LOOP ANTENNA	HFH2-Z2	ROHDE & SCHWARZ	100271	2025-03-08 (2Y)
☒	TRILOG BROADBAND ANTENNA	VULB9162	SCHWARZBECK	143	2024-12-14 (1Y)
☒	RF Pre Amplifier	SCU08	ROHDE & SCHWARZ	100747	2023-04-13 (1Y)
☒	EMI Test Receiver	ESR7	ROHDE & SCHWARZ	102034	2023-04-13 (1Y)
☒	HORN ANTENNA	HF907	ROHDE & SCHWARZ	102556	2023-08-18 (1Y)
☒	RF Pre Amplifier	SCU18	ROHDE & SCHWARZ	102342	2023-04-13 (1Y)
☒	EMI Test Receiver	ESR26	ROHDE & SCHWARZ	101462	2023-04-13 (1Y)
☒	HORN ANTENNA	LB-42-10-C-KF	A-INFOMW	J202024625	2024-03-07 (1Y)
☒	PREAMPLIFIER	AMF-4F-18265-35-8P-1	MITEQ	771846	2024-03-07 (1Y)
☒	LISN	ENV216	ROHDE & SCHWARZ	102193	2023-05-20 (1Y)

※ All test equipment used is calibration on a regular basis.

5. 6 dB Bandwidth

5.1 Operating environment

Temperature : 23 ℃

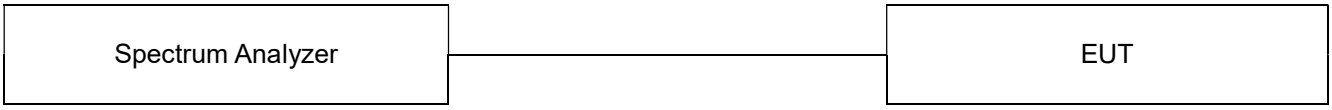
Relative humidity : 47 %

5.2 Measurement method

Standard : §15.247 (a) (2)

5.3 Test setup

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 ㎑, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



5.4 Test data

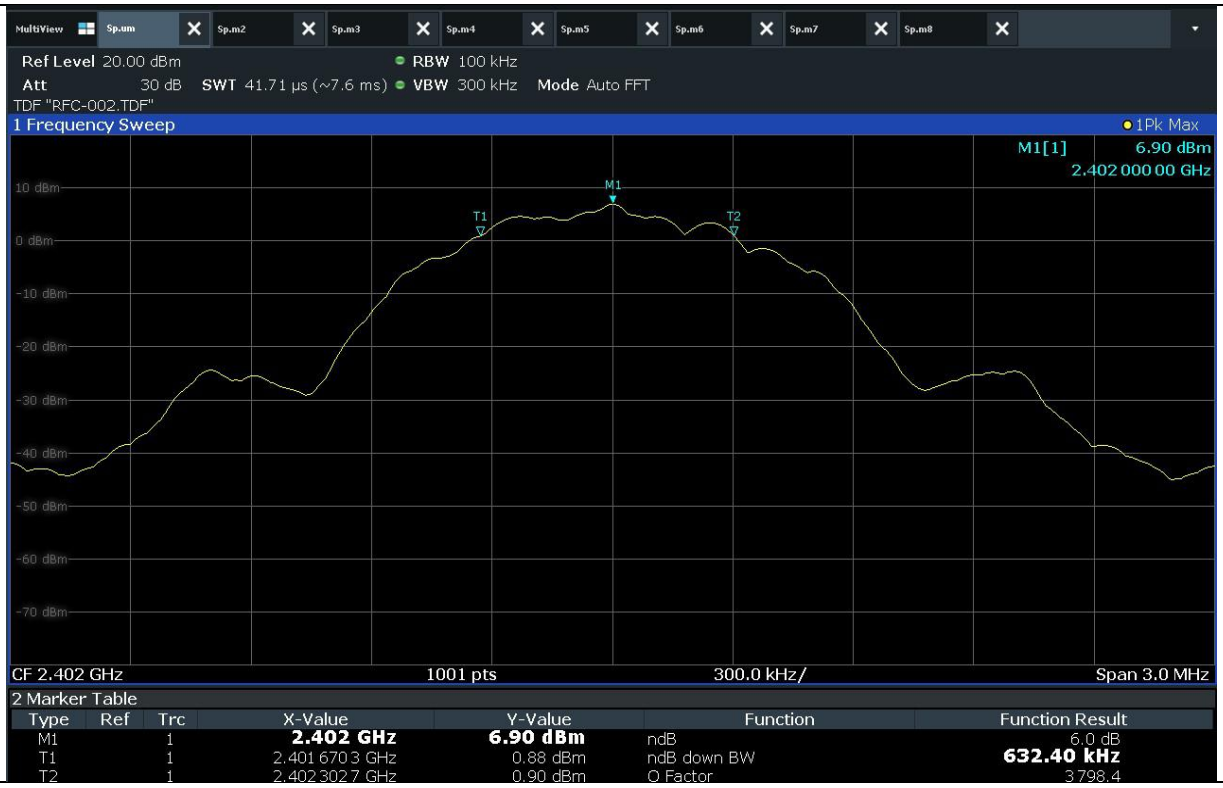
Operating mode : Transmit mode

Test Result : Pass

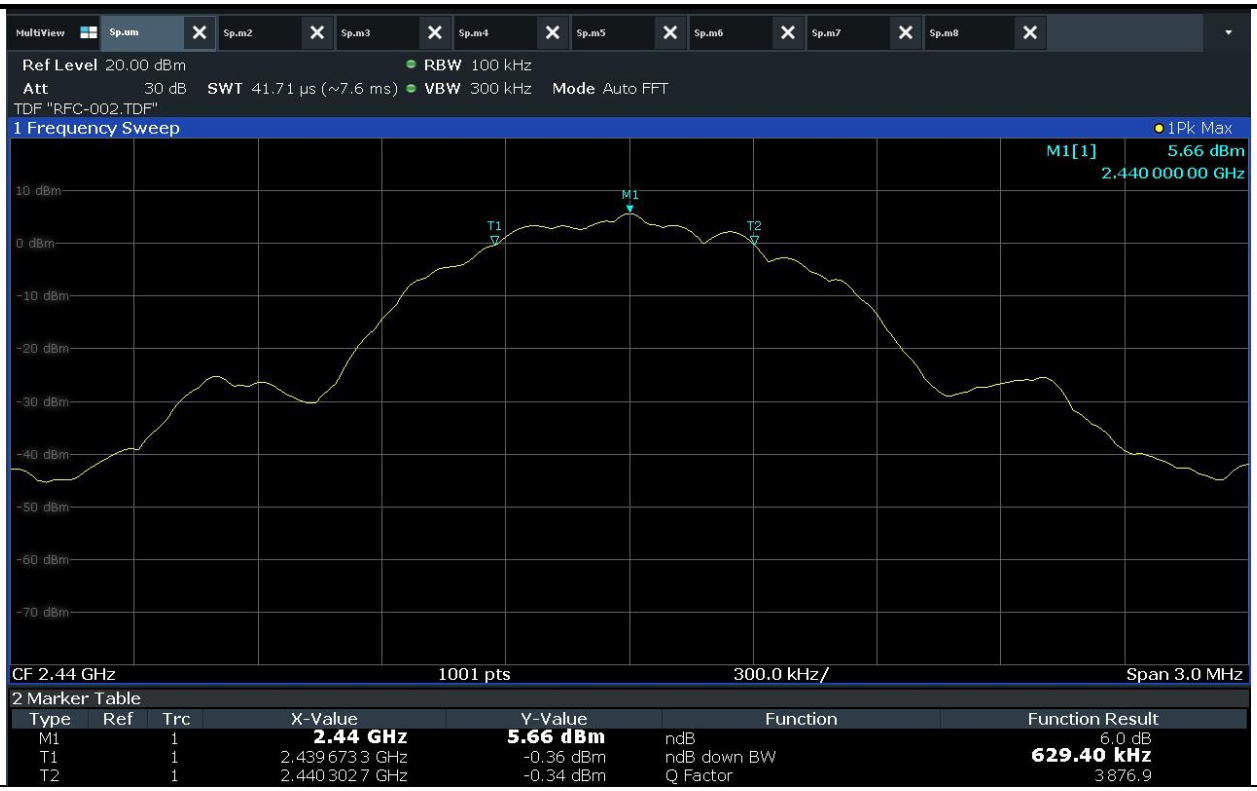
5.4.1 Measured Results

Modulation Type	Channel (Frequency)	Measured Value (㎑)	Limit (㎑)
Bluetooth LE 1M	0 (2 402 ㎒)	632.4	at least 500
	19 (2 440 ㎒)	629.4	
	39 (2 480 ㎒)	629.4	

5.4.2 Measured Graph (6 dB Bandwidth) for LE 1M



Low CH



Mid CH

High CH

6. Maximum Conducted Output Power

6.1 Operating environment

Temperature : 23 ℃

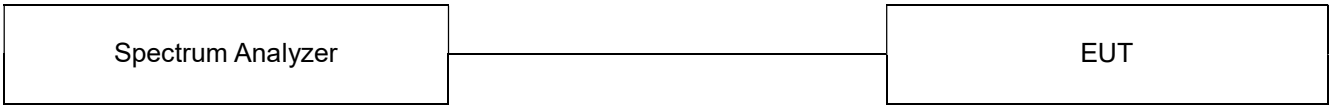
Relative humidity : 47 %

6.2 Measurement method

Standard : §15.247 (b) (3)

6.3 Test setup

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99 % bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.
And e.i.r.p. is added antenna maximum gain with the Maximum Conducted Output Power.



6.4 Test data

Operating mode : Transmit mode

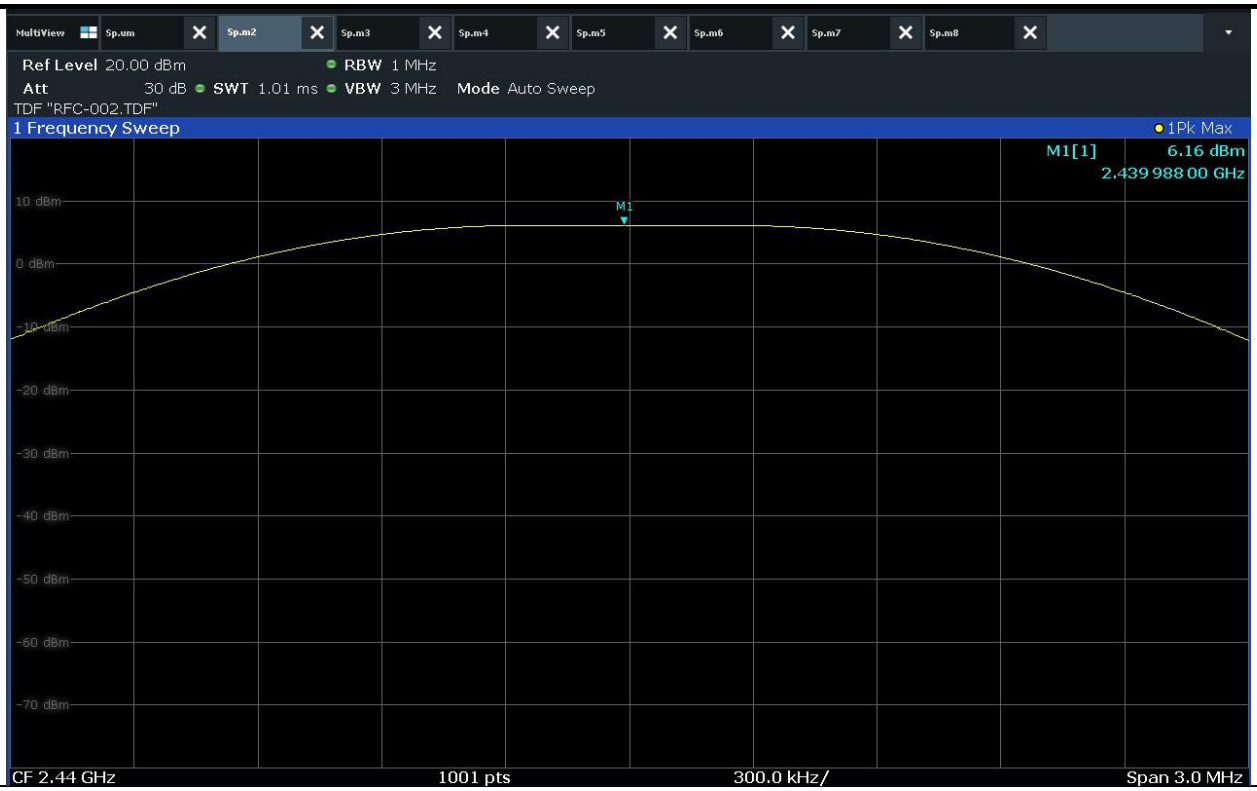
Test Result : Pass

6.4.1 Measured Results

Modulation Type	Channel (Frequency)	Highest signal level (dBm)	Limit (dBm)
Bluetooth LE 1M	0 (2 402 ㎒)	***7.39***	30 (1 Watt)
	19 (2 440 ㎒)	6.16	
	39 (2 480 ㎒)	4.74	

6.4.2 Measured Graph for LE 1M

Low CH



Mid CH

High CH

7. Power Spectral Density

7.1 Operating environment

Temperature : 23 ℃

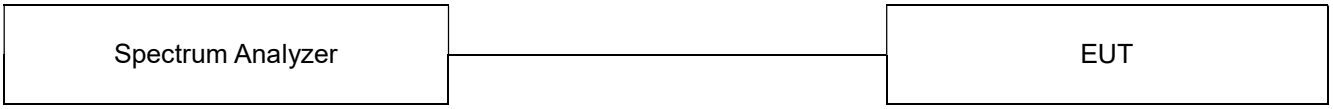
Relative humidity : 47 %

7.2 Measurement method

Standard : §15.247 (e)

7.3 Test setup

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 3 ㎑, the video bandwidth is set to 3 times the resolution bandwidth.



7.4 Test data

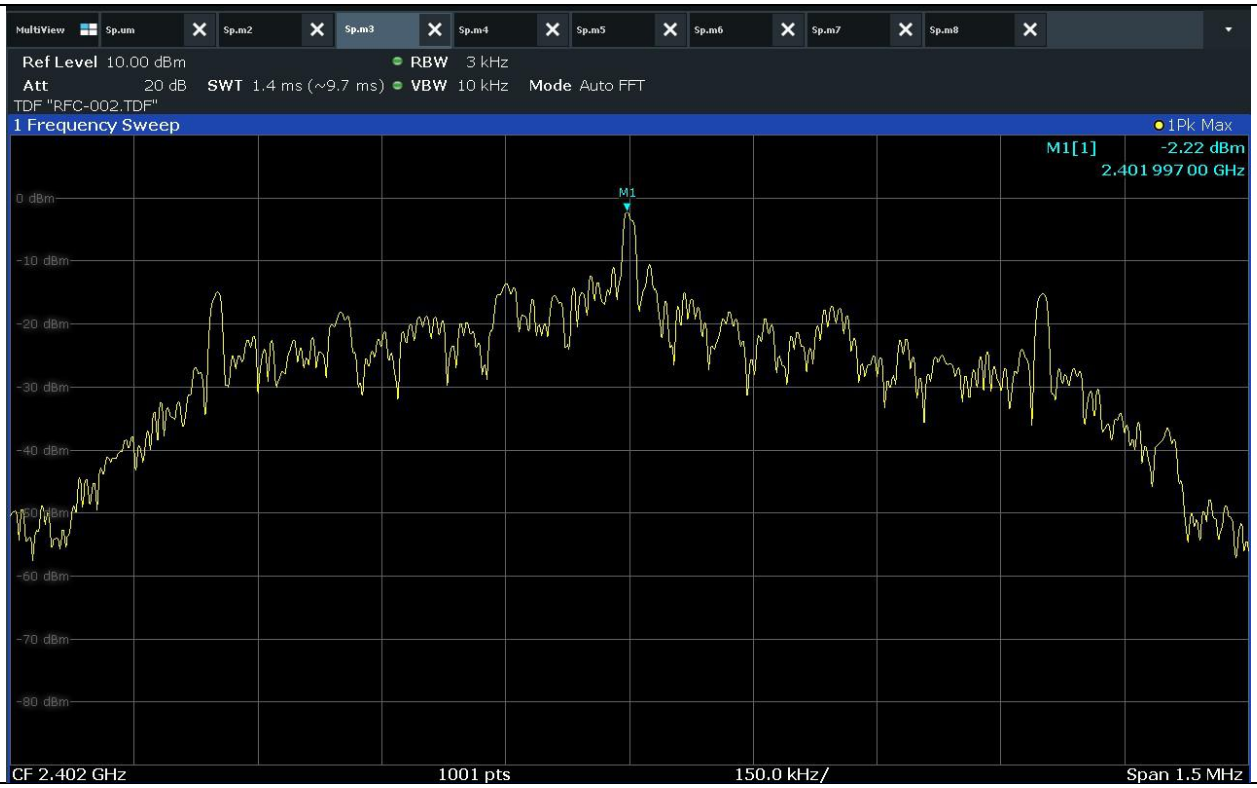
Operating mode : Transmit mode

Test Result : Pass

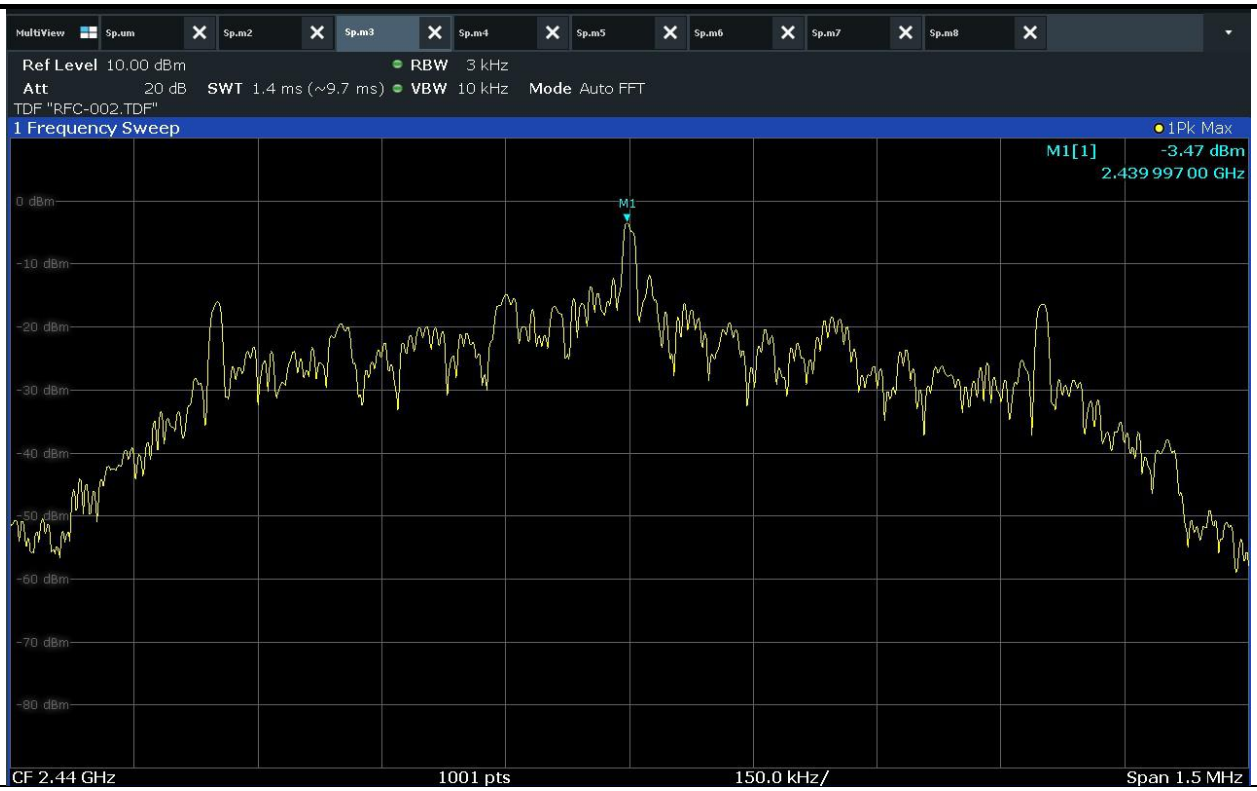
7.4.1 Measured Results

Modulation Type	Channel (Frequency)	Highest signal level (dBm)	Limit (dBm/3㎑)
Bluetooth LE 1M	0 (2 402 ㎒)	-2.22	8
	19 (2 440 ㎒)	-3.47	
	39 (2 480 ㎒)	-4.80	

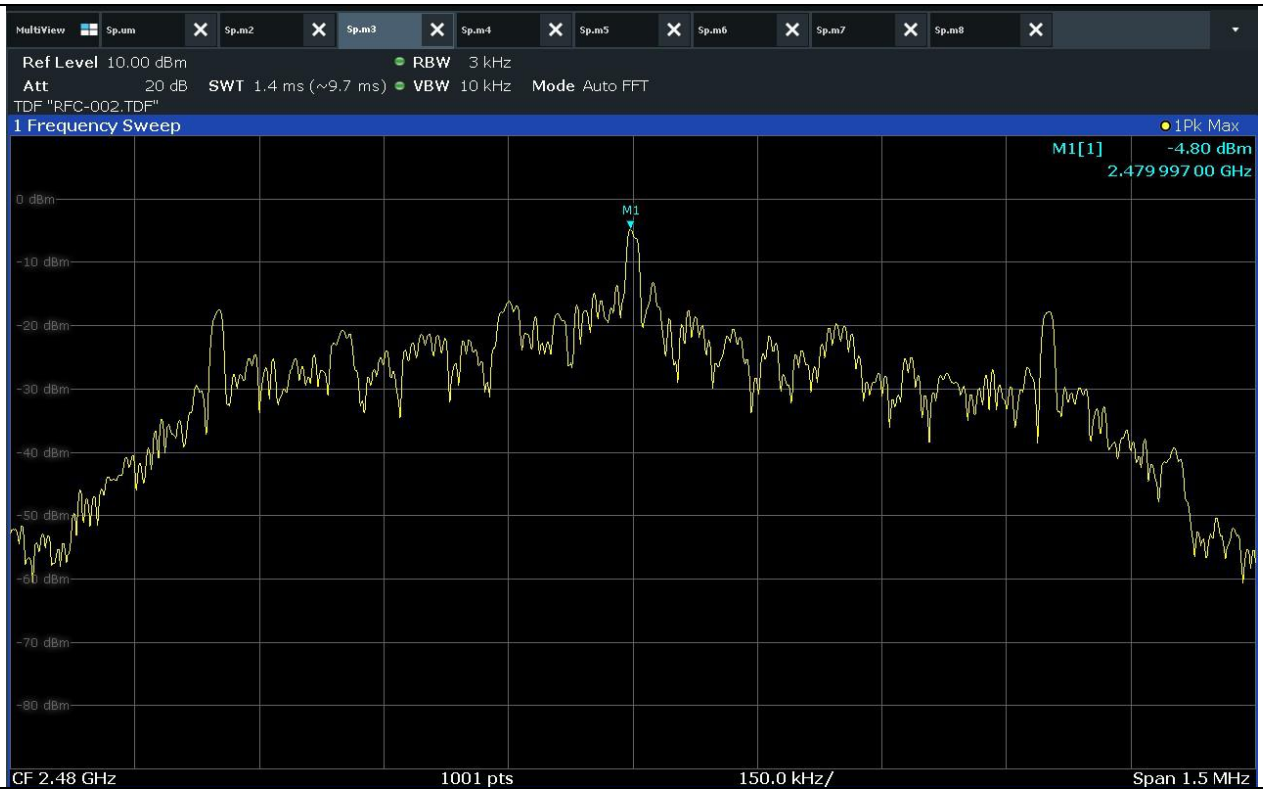
7.4.2 Measured Graph for LE 1M



Low CH



Mid CH



High CH

8. Conducted Spurious Emission

8.1 Operating environment

Temperature : 23 ℃

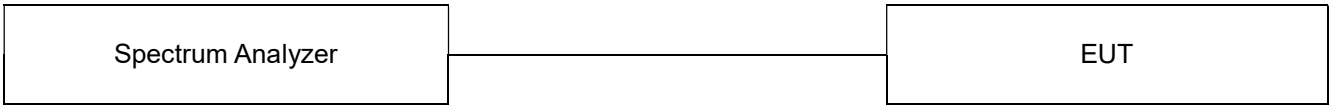
Relative humidity : 47 %

8.2 Measurement method

Standard : §15.247 (d)

8.3 Test setup

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 ㎑, and peak detection was used.



8.4 Test data

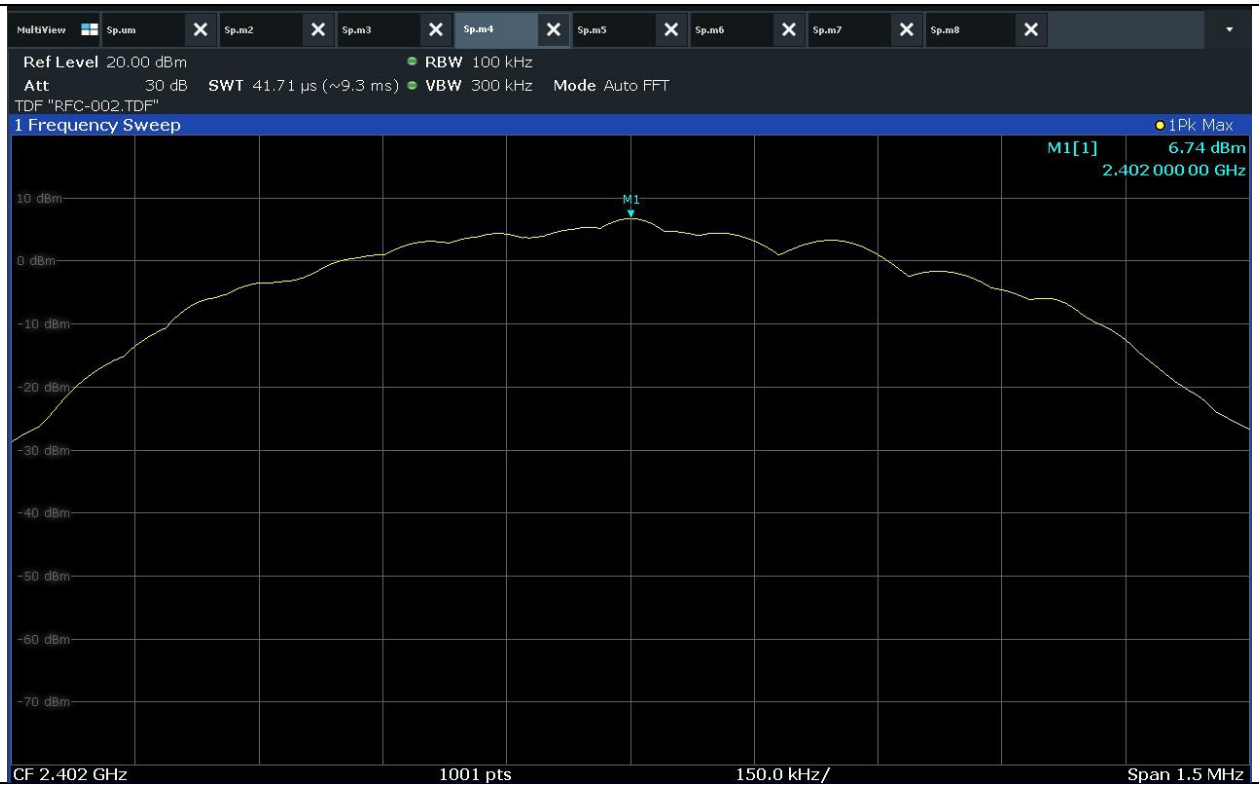
Operating mode : Transmit mode

Test Result : Pass

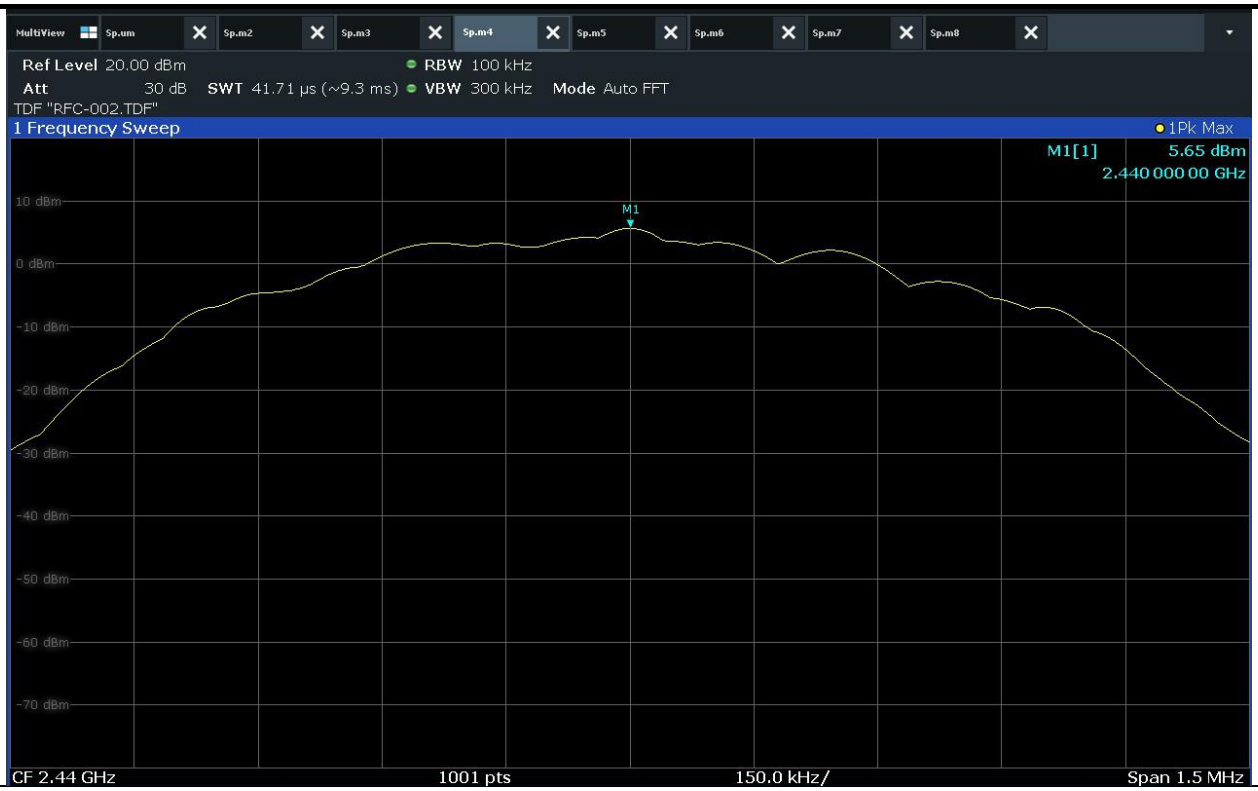
8.4.1 Measured Results

Modulation Type	Channel (Frequency)	Measurement band	Result
Bluetooth LE 1M	0 (2 402 ㎒)	Band Edge	Pass
		30 ㎒ to 1 ㎓	Pass
		1 ㎓ to 26 ㎓	Pass
	19 (2 440 ㎒)	30 ㎒ to 1 ㎓	Pass
		1 ㎓ to 26 ㎓	Pass
	39 (2 480 ㎒)	Band Edge	Pass
		30 ㎒ to 1 ㎓	Pass
		1 ㎓ to 26 ㎓	Pass

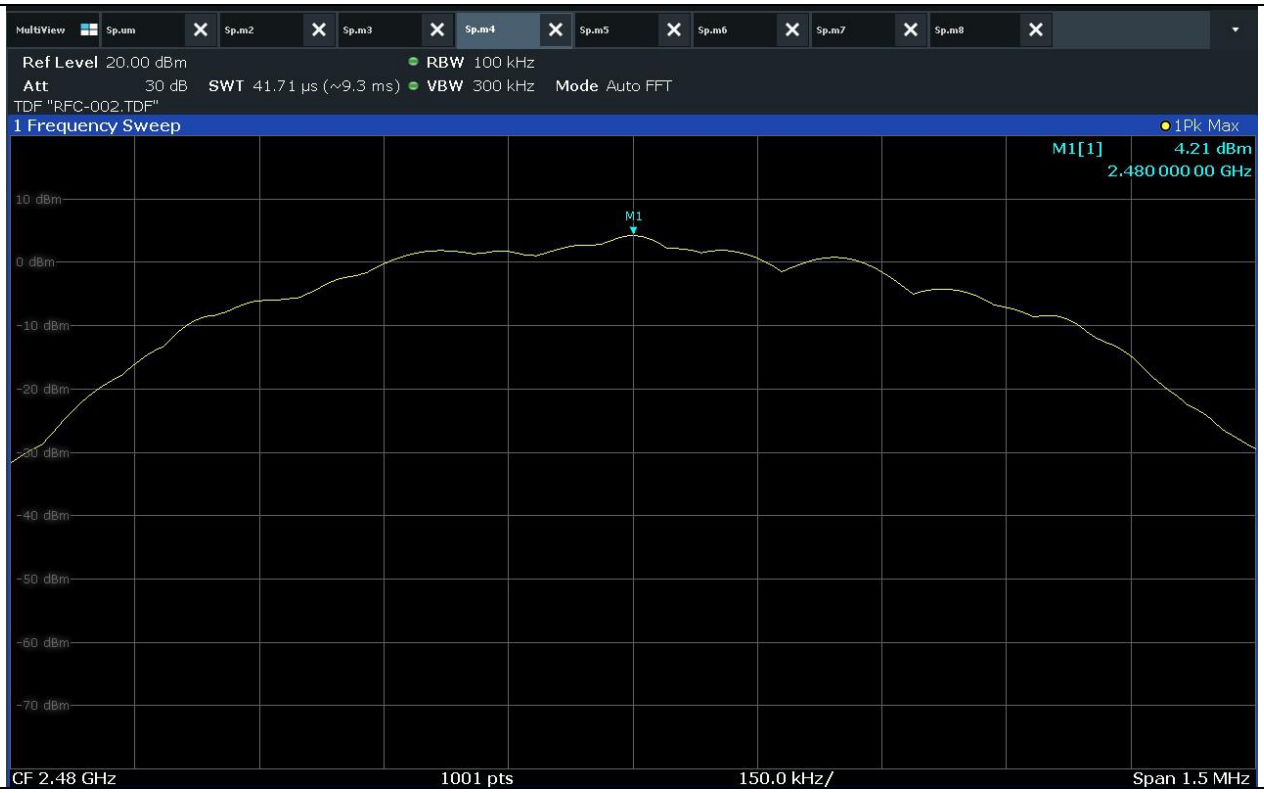
8.4.1.1 Signal level (dB m) for LE 1M



Low CH

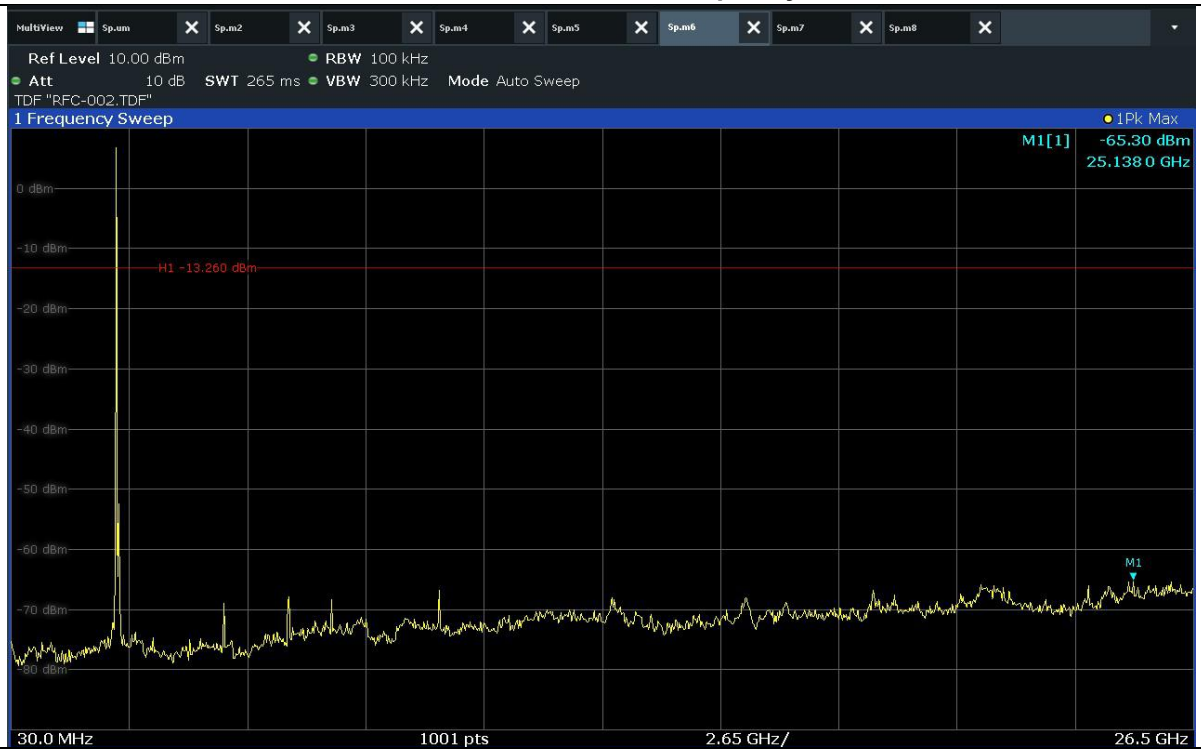


Mid CH

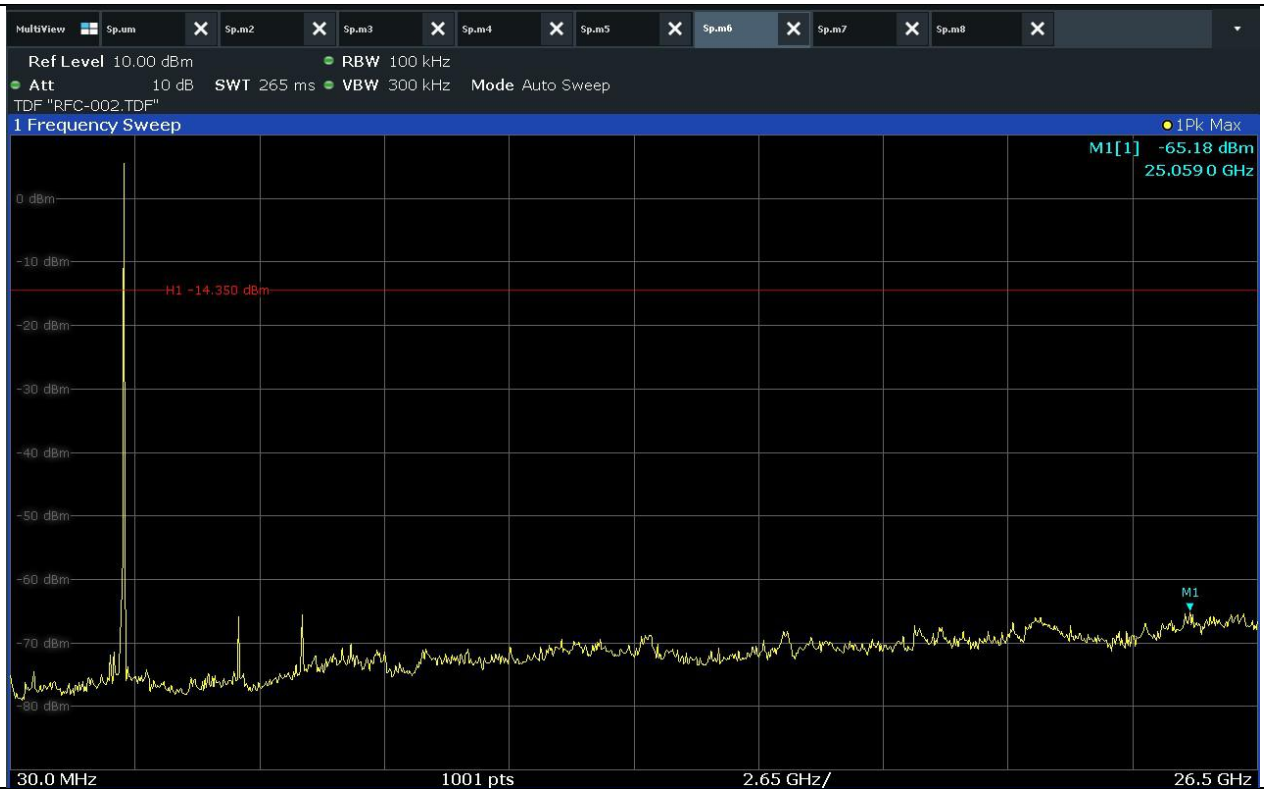


High CH

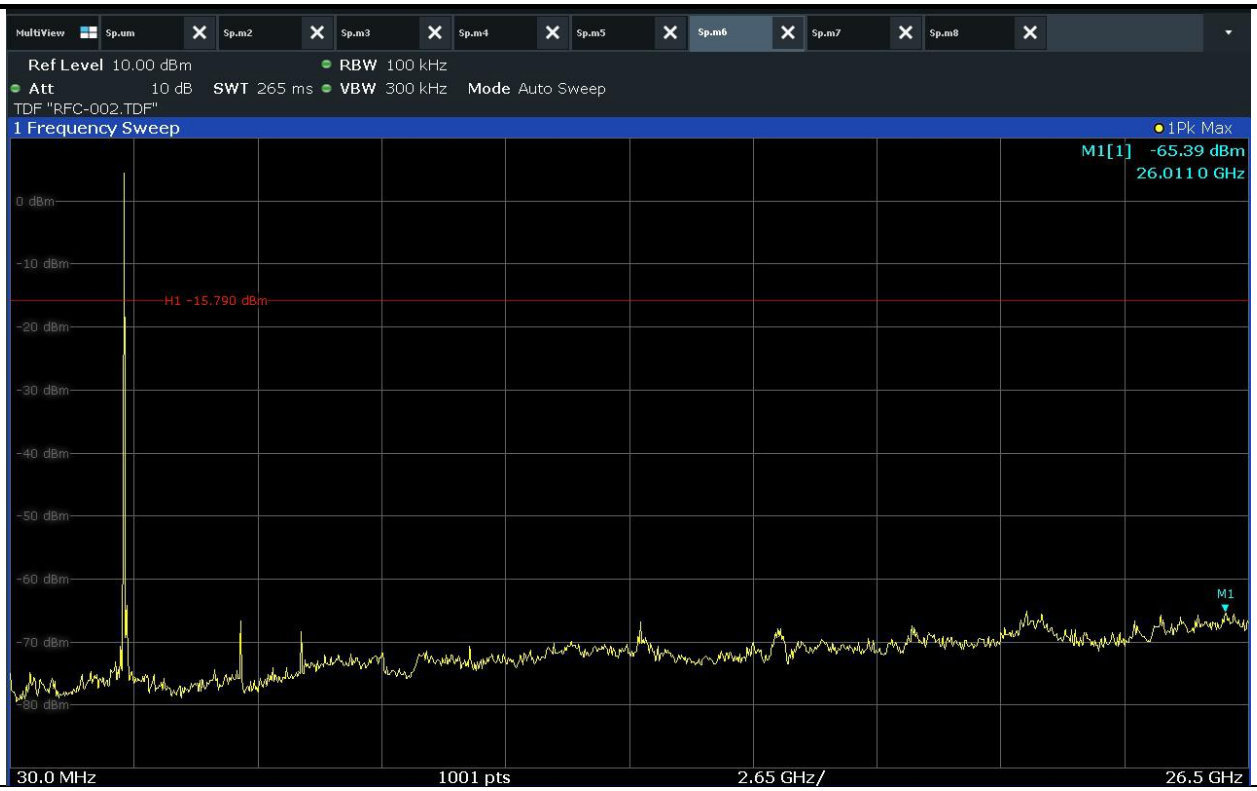
8.4.1.2 Unwanted Emissions In Non-Restricted Frequency Bands for LE 1M



Low CH

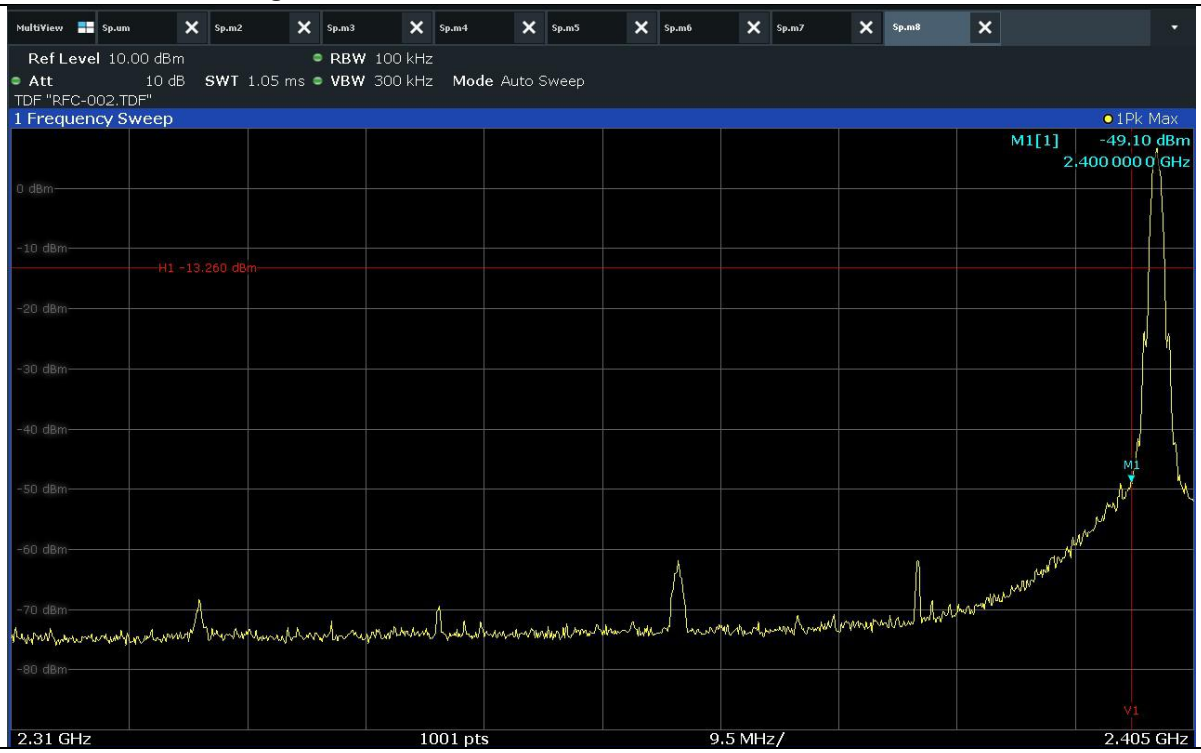


Mid CH

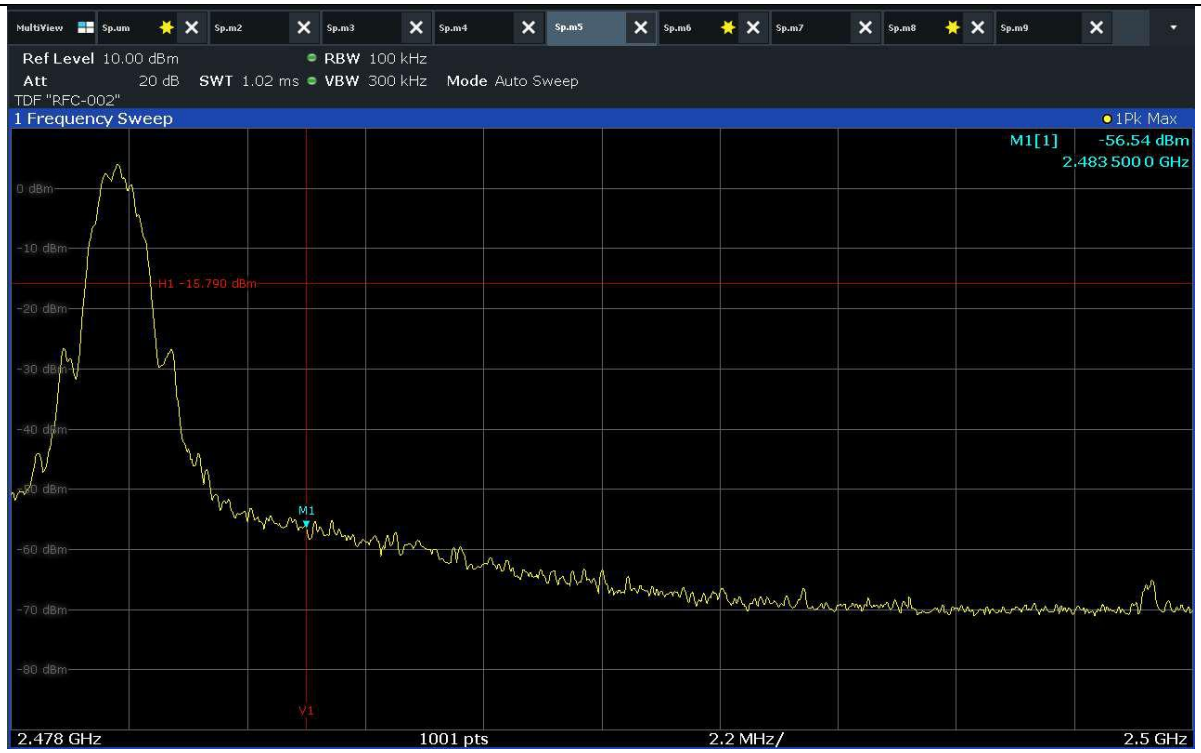

MultiView
Sp.um
Sp.m2
Sp.m3
Sp.m4
Sp.m5
Sp.m6
Sp.m7
Sp.m8
Ref Level 10.00 dBm
RBW 100 kHz
Att 10 dB
SWT 265 ms
VBW 300 kHz
Mode Auto Sweep
TDF "RFC-002.TDF"
1 Frequency Sweep
1Pk Max
M1[1] -65.39 dBm
26.0110 GHz
0 dBm
-10 dBm
H1 -15.790 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
30.0 MHz
1001 pts
2.65 GHz/
26.5 GHz

High CH

8.4.1.3 Band Edge for LE 1M



Low CH



High CH

9. Radiated Spurious Emission

9.1 Operating environment

Temperature : 24 ℃

Relative humidity : 48 %

9.2 Measurement method

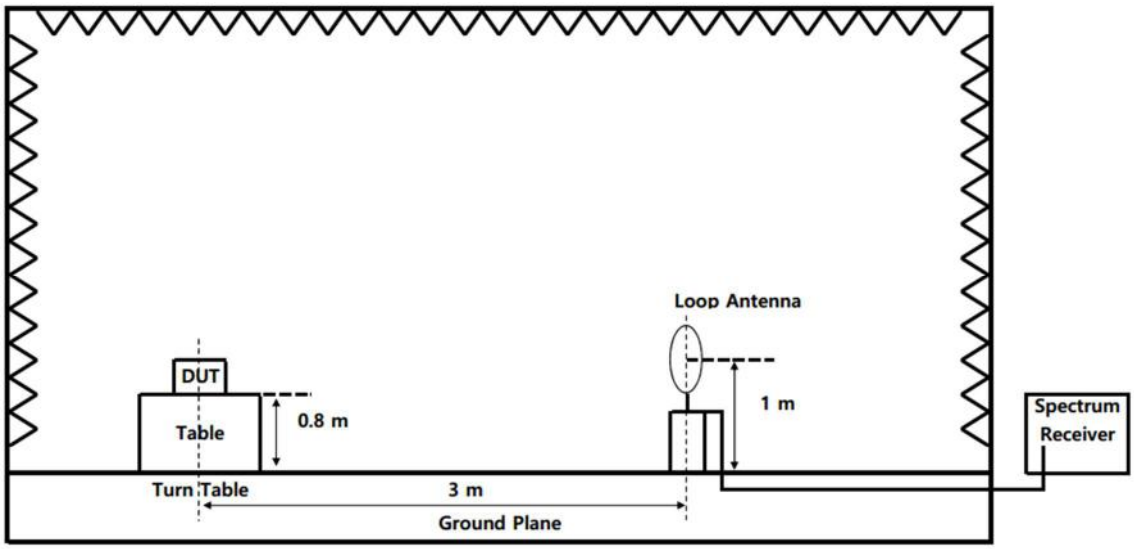
Standard : §15.247 (d), §15.209, §15.205

9.3 Test setup

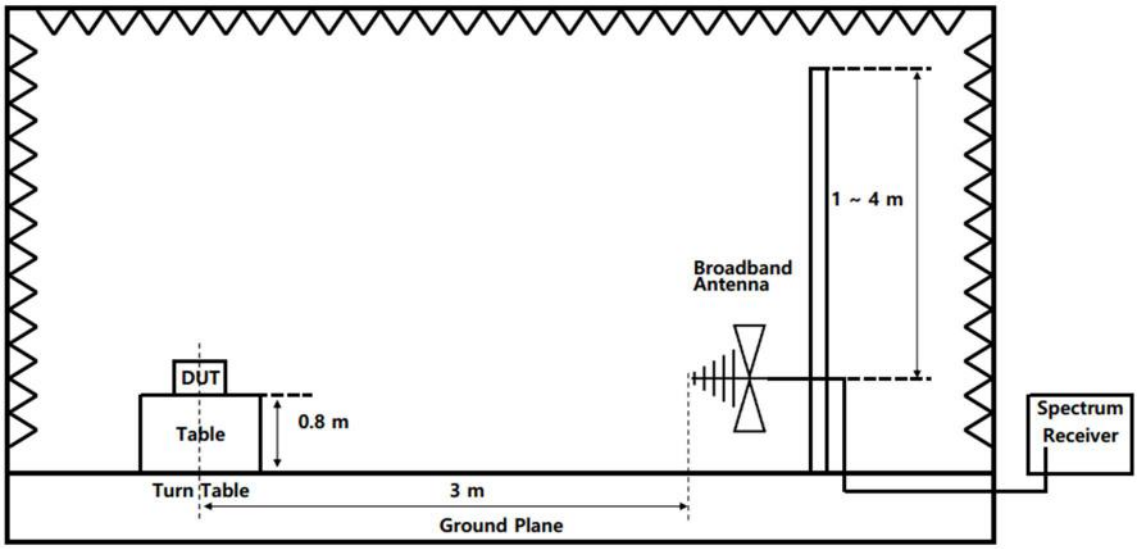
The radiated emissions measurements were performed on the 3 m, Semi-Anechoic Camber. The EUT was placed on a non-conductive turntable above the ground plane.

The frequency spectrum from 9 ㎑ to 26.5 ㎓ was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

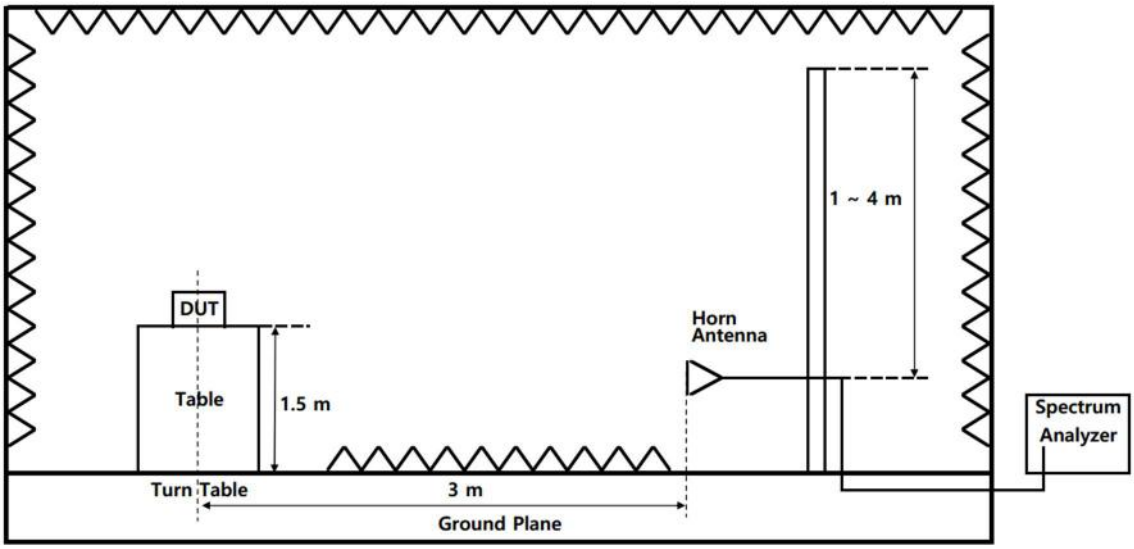
9.3.1 Below 30 ㎒



9.3.2 30 MHz to 1 GHz



9.3.3 Above 1 GHz



9.4 Test data

Operating mode : Transmit mode

Test Result : Pass

9.4.1 Test data for Restricted band for LE 1M

Frequency (㎒)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
2 389.44	55.45	Peak	V	-14.50	40.95	74.00	33.05
	37.98	Average	V		23.48	54.00	30.52
High CH							
2488.344	63.70	Peak	H	-14.10	49.60	74.00	24.40
	33.55	Average	H		19.45	54.00	34.55

※ Ant. Pol. : Antenna Polarization

※ Corr. Factor. : Antenna Factor + Cable Loss - Amplifier Gain

※ Result = Reading + Corr. Factor

※ Margin = Limit - Result

9.4 Test data for Spurious & Harmonic

9.4.4.1 Measurement Results for below 30 ㎒ for LE 1M

Frequency (㎒)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
It was not found any emissions peaks found from the EUT.							
Mid CH							
It was not found any emissions peaks found from the EUT.							
High CH							
It was not found any emissions peaks found from the EUT.							

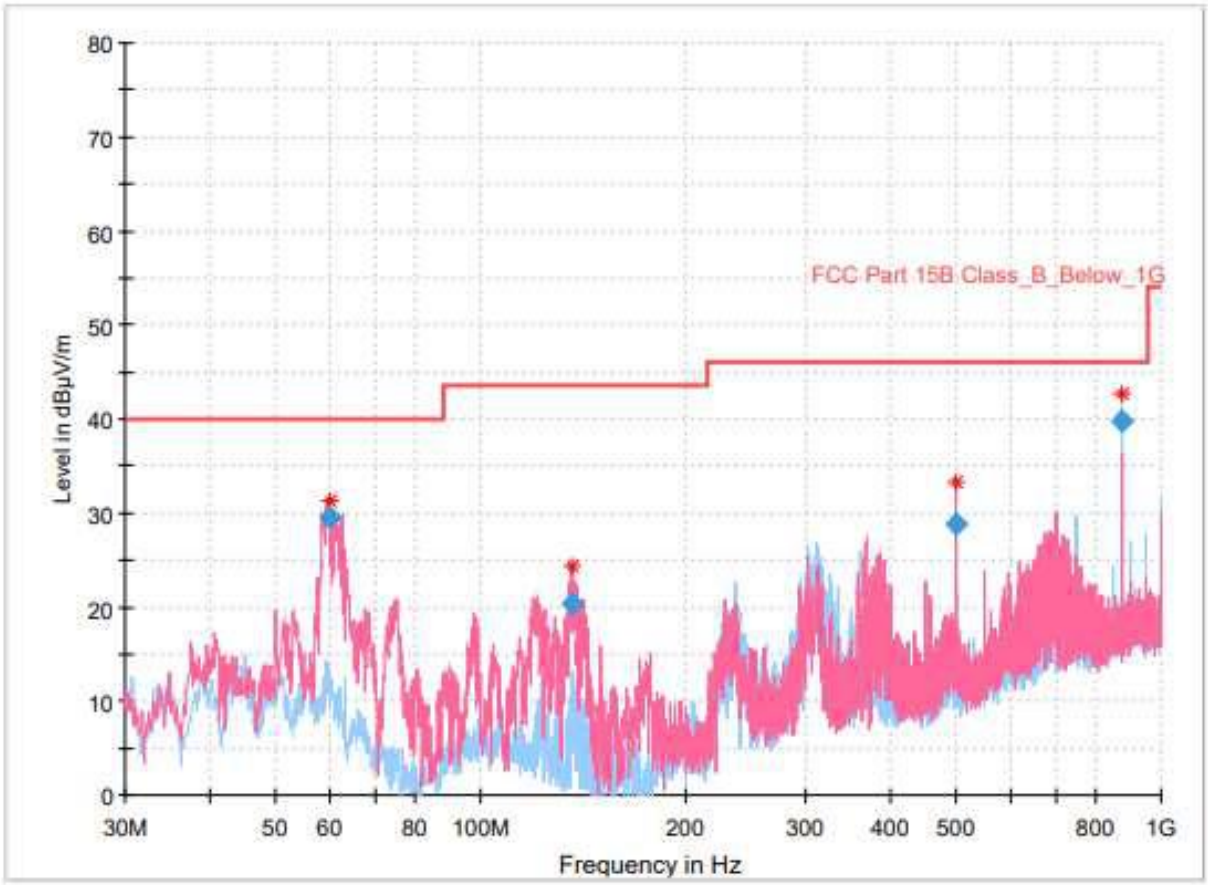
※ Ant. Pol. : Antenna Polarization

※ Corr. Factor. : Antenna Factor + Cable Loss - Amplifier Gain

※ Result = Reading + Corr. Factor

※ Margin = Limit – Result

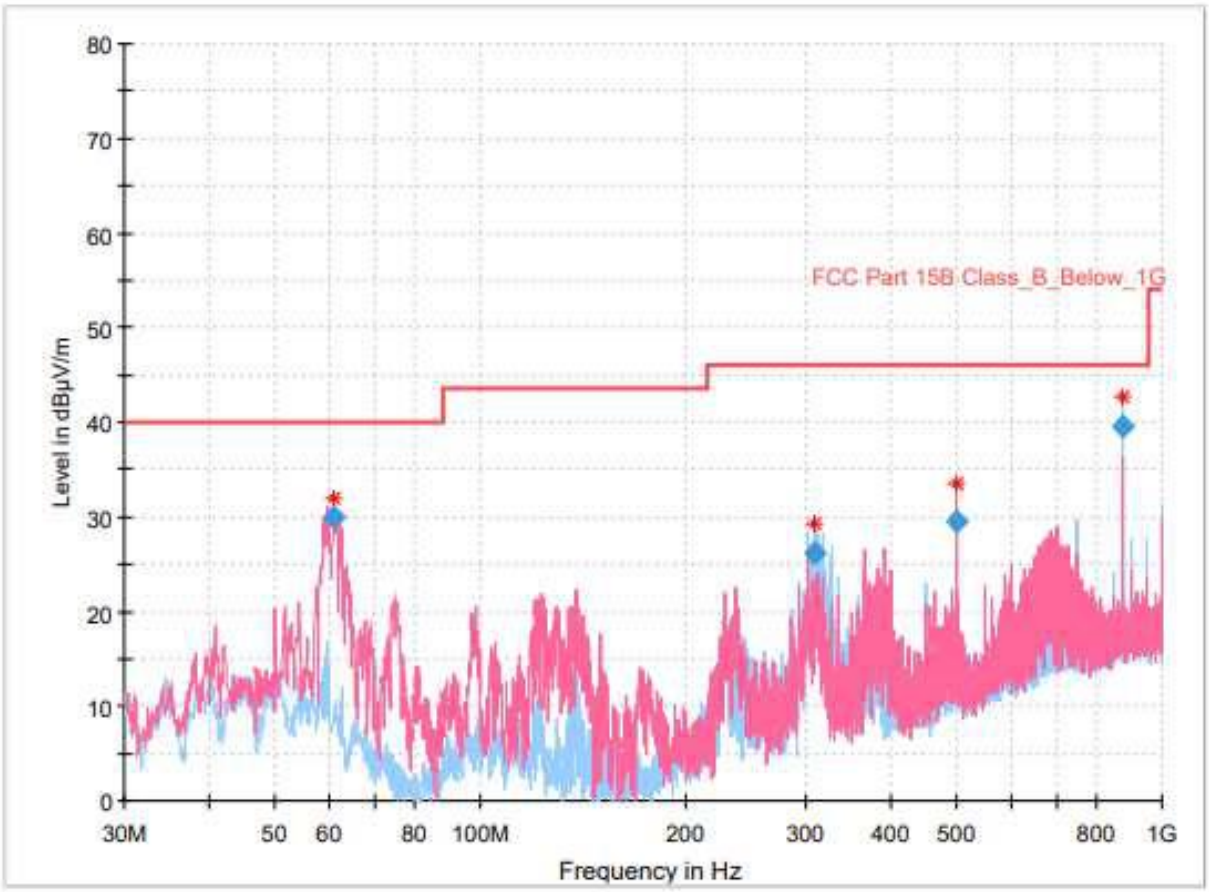
9.4.4.2 Measurement Results for below 1 ㎓ for LE 1M



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
60.070000	29.45	40.00	10.55	1000.0	120.000	99.9	V	289.0	-23.9
135.924000	20.45	43.50	23.05	1000.0	120.000	99.9	V	97.0	-27.6
500.062000	28.91	46.00	17.09	1000.0	120.000	99.9	V	42.0	-15.6
875.064000	39.87	46.00	6.13	1000.0	120.000	99.9	H	208.0	-9.4

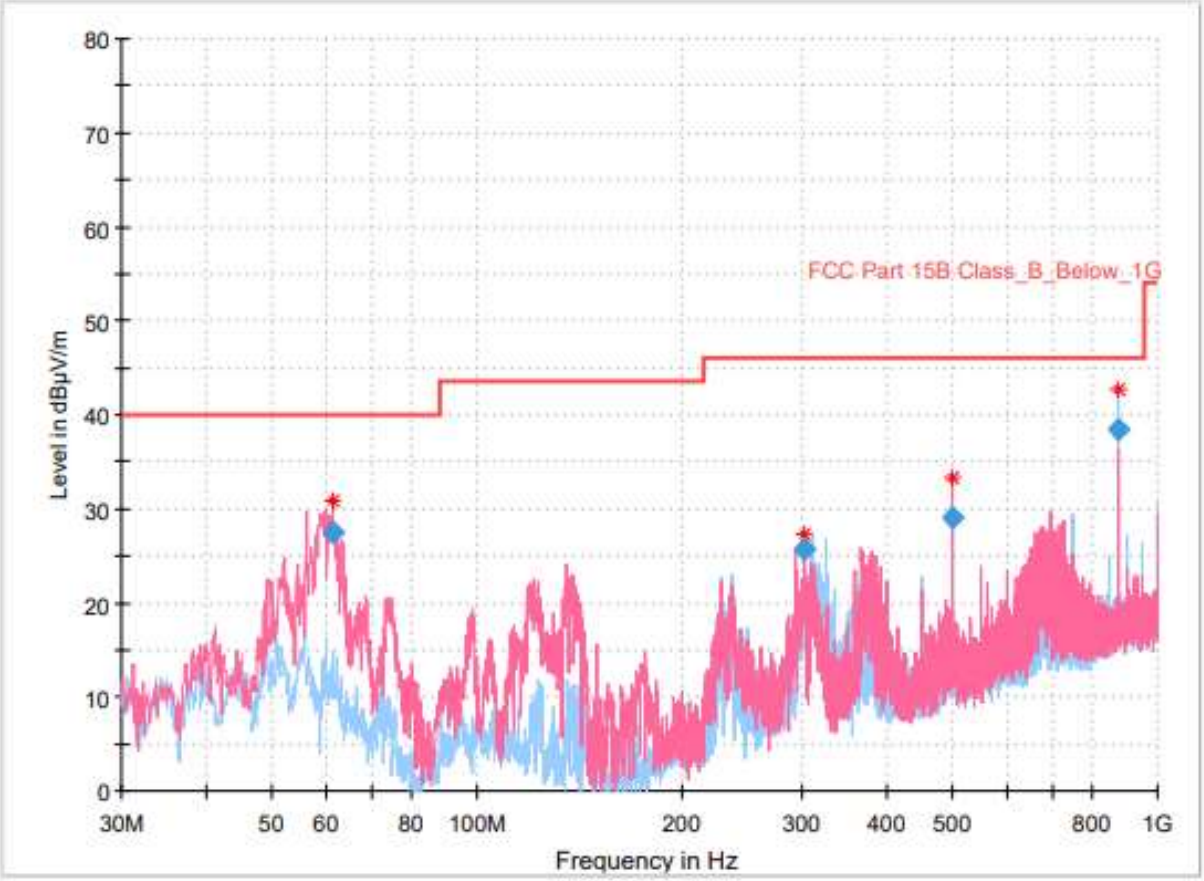
Low CH



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
60.846000	29.97	40.00	10.03	1000.0	120.000	99.9	V	330.0	-23.9
310.136000	26.09	46.00	19.91	1000.0	120.000	99.9	H	57.0	-20.7
500.062000	29.43	46.00	16.57	1000.0	120.000	99.9	V	68.0	-15.6
875.064000	39.60	46.00	6.40	1000.0	120.000	99.9	H	209.0	-9.4

Mid CH



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
61.331000	27.55	40.00	12.45	1000.0	120.000	99.9	V	200.0	-24.1
302.764000	25.64	46.00	20.36	1000.0	120.000	99.9	H	103.0	-20.9
500.062000	29.08	46.00	16.92	1000.0	120.000	99.9	V	48.0	-15.6
875.064000	38.49	46.00	7.51	1000.0	120.000	99.9	H	264.0	-9.4

High CH

9.4.4.3 Measurement Results for Above 1 ㎓ for LE 1M

Frequency (㎒)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
4 806.30	39.77	Peak	V	-3.90	35.87	74	38.13
	26.31	Average	V		22.41	54	31.59
7 206.700	40.34	Peak	V	0.70	37.65	74	32.96
	26.79	Average	V		24.27	54	26.51
9 608.80	40.34	Peak	V	3.60	39.70	74	32.96
	26.79	Average	V		26.52	54	26.51
Mid CH							
4 877.70	40.11	Peak	V	-3.40	36.71	74	37.29
	26.08	Average	V		22.68	54	31.32
7 322.30	38.00	Peak	V	0.70	38.70	74	35.30
	23.90	Average	V		24.60	54	29.40
9 755.0	36.47	Peak	V	3.90	40.37	74	33.63
	22.71	Average	V		26.61	54	27.39
High CH							
4 962.70	39.28	Peak	V	-3.20	36.08	74	37.92
	25.59	Average	V		22.39	54	31.61
7 448.10	38.03	Peak	H	1.00	39.03	74	34.97
	24.51	Average	H		25.51	54	28.49
9 921.60	35.98	Peak	V	4.20	40.18	74	33.82
	22.04	Average	V		26.24	54	27.76

※ Ant. Pol. : Antenna Polarization

※ Corr. Factor. : Antenna Factor + Cable Loss - Amplifier Gain

※ Result = Reading + Corr. Factor

※ Margin = Limit – Result

10. Power Line Conducted Emission

10.1 Operating environment

Temperature : 24 ℃

Relative humidity : 48 %

10.2 Measurement method

Standard : §15.207

10.3 Limit

Standard : §15.207

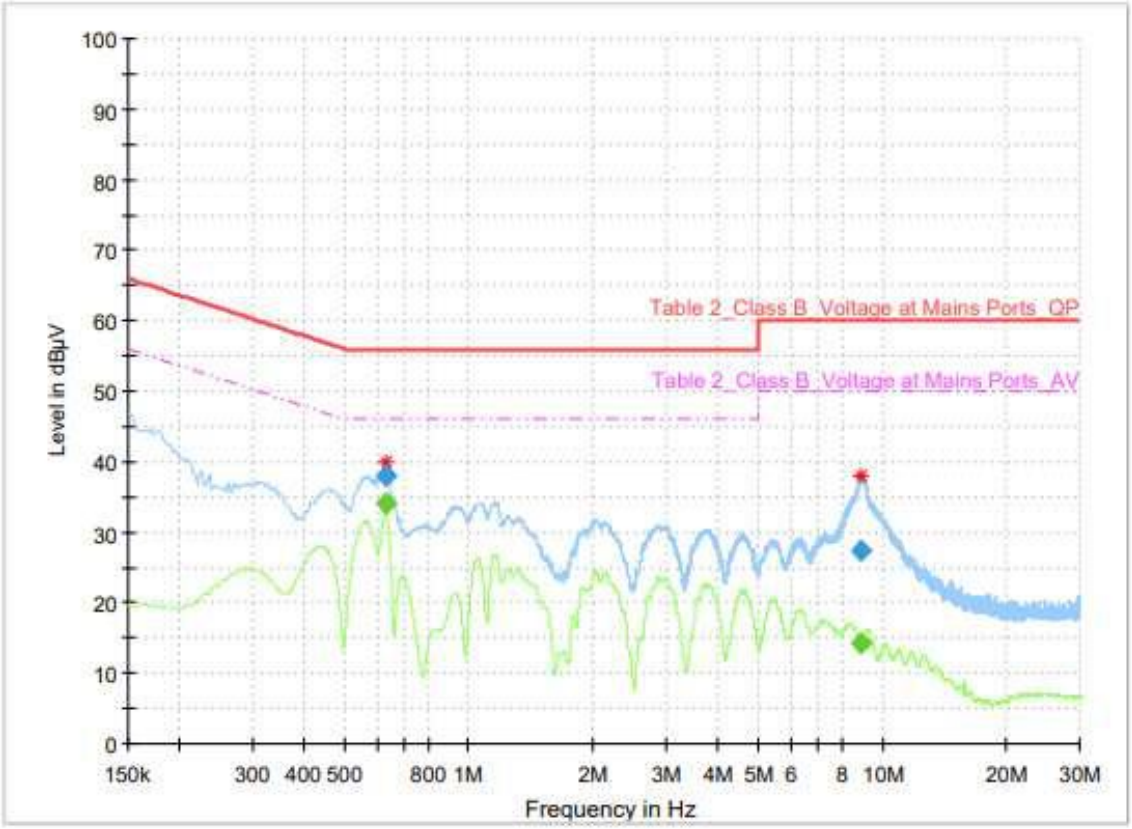
10.4 Test data

Operating mode : Transmit mode

Test Result : Pass

Measured Results & Graph

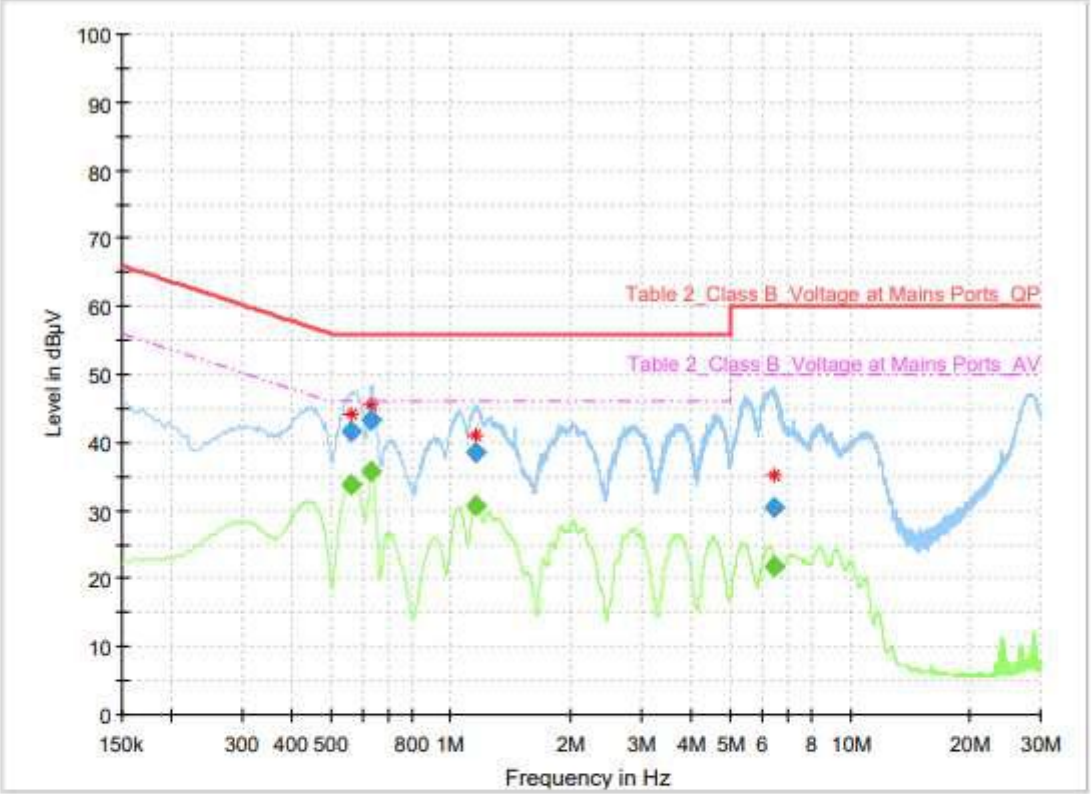
Live line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.631500	---	33.99	46.00	12.01	5000.0	9.000	L1	9.9
0.631500	37.93	---	56.00	18.07	5000.0	9.000	L1	9.9
8.891250	---	14.21	50.00	35.80	5000.0	9.000	L1	10.1
8.891250	27.46	---	60.00	32.54	5000.0	9.000	L1	10.1

Neutral line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.564000	---	33.88	46.00	12.12	5000.0	9.000	N	10.0
0.564000	41.64	---	56.00	14.36	5000.0	9.000	N	10.0
0.631500	---	35.79	46.00	10.21	5000.0	9.000	N	10.0
0.631500	43.29	---	56.00	12.71	5000.0	9.000	N	10.0
1.158000	---	30.63	46.00	15.37	5000.0	9.000	N	9.9
1.158000	38.55	---	56.00	17.45	5000.0	9.000	N	9.9
6.427500	---	21.90	50.00	28.10	5000.0	9.000	N	9.9
6.427500	30.45	---	60.00	29.55	5000.0	9.000	N	9.9

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