




시험 성적서 TEST REPORT

페이지(page) : (1) / (총(Total) 33)

성적서 번호 Report No.		ICRT-TR-E191944-0A	
신청자 Client	기관명 Name	Tau Co. Ltd	
	주소 Address	A-Ram B/D the third floor, Donggwangno 89, jejudi, Jeju Special Self-Governing Province	
시험대상품목 Sample description		T Dongle BLE	
모델명 Type designation		TDNG-V10	
정격 Ratings		DC 5 V	
시험기간 Date of test		21. Oct, 2019 ~ 23. Oct, 2019	
시험방법/항목 Test Method/Item		FCC Part 15 Subpart C §15.247	
시험결과 Test Results		Refer to 3. Test Summary	
확인 Affirmation	작성자 Tested by	기술책임자 Technical Manager	
	성명 Name	Hong-Kyu, Lee (Signature)	성명 Name
			Jun-Hui, Lee (Signature)
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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
ICRT-TR-E191944-0A	24-Oct-2019	Initial Issue	All



1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant information

Applicant	Tau Co. Ltd
Address	A-Ram B/D the third floor, Donggwangno 89, jejudi, Jeju Special Self-Governing Province
Contact Person	Jong Heon Lee
Telephone No.	+82-64-722-2995
Fax No.	+82-64-722-2997
E-mail	vagrant1@empas.com

1.2 Manufacturer Information

Manufacturer	Tau Co. Ltd
Address	A-Ram B/D the third floor, Donggwangno 89, jejudi, Jeju Special Self-Governing Province

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, 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	T Dongle BLE
Brand Name	-
Model Name	TDNG-V10
Additional Model Name	-
FCC ID	2ARRYTDONGLEBLE
Hardware Version	-
Software Version	-
Power Supply	DC 5 V

2.2 Additional Information

Equipment Class	DTS-Digital Transmission System
Device Type	Stand-alone
Operating Frequency	2 402 MHz ~ 2 480 MHz
RF Output Power	2.40 dBm
Number of Channel	40
Modulation Type	GFSK
Antenna Type	Chip Antenna
Antenna Gain	0.5 dBi
Antenna Operating Mode	Single Antenna Equipment with only one antenna
List of Each Oscillator or Crystal Frequency	32 MHz

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.

2.4 Modifications of EUT

- None



3. Test Summary

3.1 Test standards and results

FCC Part 15 Subpart C			
Clause	Test items	Applied	Results
§15.247 (a) (1)	6 dB Bandwidth	<input checked="" type="checkbox"/>	PASS
§15.247 (b) (3)	Maximum Conducted Output Power	<input checked="" type="checkbox"/>	PASS
§15.247 (e)	Power Spectral Density	<input checked="" type="checkbox"/>	PASS
§15.247 (d)	Conducted Spurious Emission	<input checked="" type="checkbox"/>	PASS
§15.247 (d) & §15.209 & §15.205	Radiated Spurious Emission	<input checked="" type="checkbox"/>	PASS
§15.207	Power Line Conducted Emission	<input checked="" type="checkbox"/>	PASS
§15.203	Antenna Requirement	<input checked="" type="checkbox"/>	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 and IC RSS-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 powerline conducted emission test

The EUT was connected to LISN. All supporting equipments 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 transmitter has a **Chip antenna**. The directional gain of the antenna is **0.5** dBi.



4. Used equipment on test

	Description	Model Name	Serial Number	Manufacturer	Last Cal. (cycle)
<input checked="" type="checkbox"/>	Spectrum analyzer	FSW85	100864	Rohde & Schwarz	2019. 03. 04 (1Y)
<input type="checkbox"/>	Spectrum analyzer	FSV40	101455	Rohde & Schwarz	2019 .06. 27 (1Y)
<input checked="" type="checkbox"/>	Signal Generator	SMB100A	180607	Rohde & Schwarz	2019. 03. 04 (1Y)
<input type="checkbox"/>	Wideband Power Sensor	NRP-Z81	103673	Rohde & Schwarz	2019. 03. 05 (1Y)
<input type="checkbox"/>	Open Switch and Control Platform	OSP150	101000	Rohde & Schwarz	2019. 03. 05 (1Y)
<input type="checkbox"/>	Environmental Test Chamber	MHK-408NKDA	1060908	TERCHY	2019. 03. 04 (1Y)
<input type="checkbox"/>	DC Power Supply	XDL 35-5P	J00385373	Sorensen	2019. 03. 05 (1Y)
<input type="checkbox"/>	DC Power Supply	6603D	672483	Topward	2019. 03. 05 (1Y)
<input checked="" type="checkbox"/>	Loop Antenna	HFH2-Z2	100506	Rohde & Schwarz	2019. 06. 27 (2Y)
<input checked="" type="checkbox"/>	TRILOG BROADBAND ANTENNA	VULB9162	120	SCHWARZBECK	2018. 11. 23 (2Y)
<input checked="" type="checkbox"/>	RF Pre Amplifier	SCU08	100747	Rohde & Schwarz	2019. 04. 17 (1Y)
<input checked="" type="checkbox"/>	DOUBLE-RIDGE WAVEGUIDE HORN ANTENNA	HF907	102556	Rohde & Schwarz	2019. 08. 19 (2Y)
<input checked="" type="checkbox"/>	RF Pre Amplifier	SCU18	102342	Rohde & Schwarz	2019. 04. 17 (1Y)
<input checked="" type="checkbox"/>	Horn Antenna	LB-42-10-C-KF	J202024625	AINFO Inc.	2018. 04. 23 (2Y)
<input checked="" type="checkbox"/>	RF Pre Amplifier	AMF-4F-18265-35-8P-1	771846	MITEQ	2019. 03. 04 (1Y)
<input checked="" type="checkbox"/>	Horn Antenna	LB-28-10-C-KF	J202024627	AINFO Inc.	2018. 04. 23 (2Y)
<input type="checkbox"/>	RF Pre Amplifier	AMF-4D-260400-45-6P	779919	MITEQ	2019. 03. 04 (1Y)
<input checked="" type="checkbox"/>	EMI Test Receiver	ESR26	101461	Rohde & Schwarz	2019. 04. 17 (1Y)
<input checked="" type="checkbox"/>	EMI Test Receiver	ESR26	101461	Rohde & Schwarz	2019. 04. 17 (1Y)
<input checked="" type="checkbox"/>	LISN	ENV216	102194	Rohde & Schwarz	2019. 04. 16 (1Y)
<input type="checkbox"/>	ATTENUATOR	WA76-20-1313	1633	WEINSCHHEL	2019. 03. 04 (1Y)
<input checked="" type="checkbox"/>	RF Cable	MULTIFLEX_86	-	HUBER & SUHNER	-
<input checked="" type="checkbox"/>	Chamber Cable	mwx221	-	Junkosha	-

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



5. 6 dB Bandwidth

5.1 Operating environment

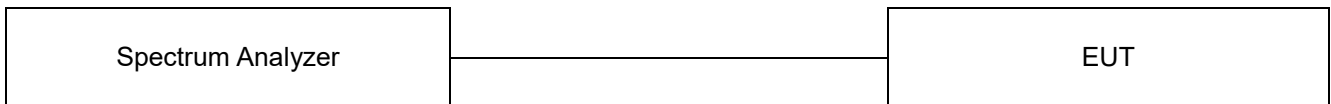
Temperature : 22 °C
Relative humidity : 43 %

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 kHz, 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.





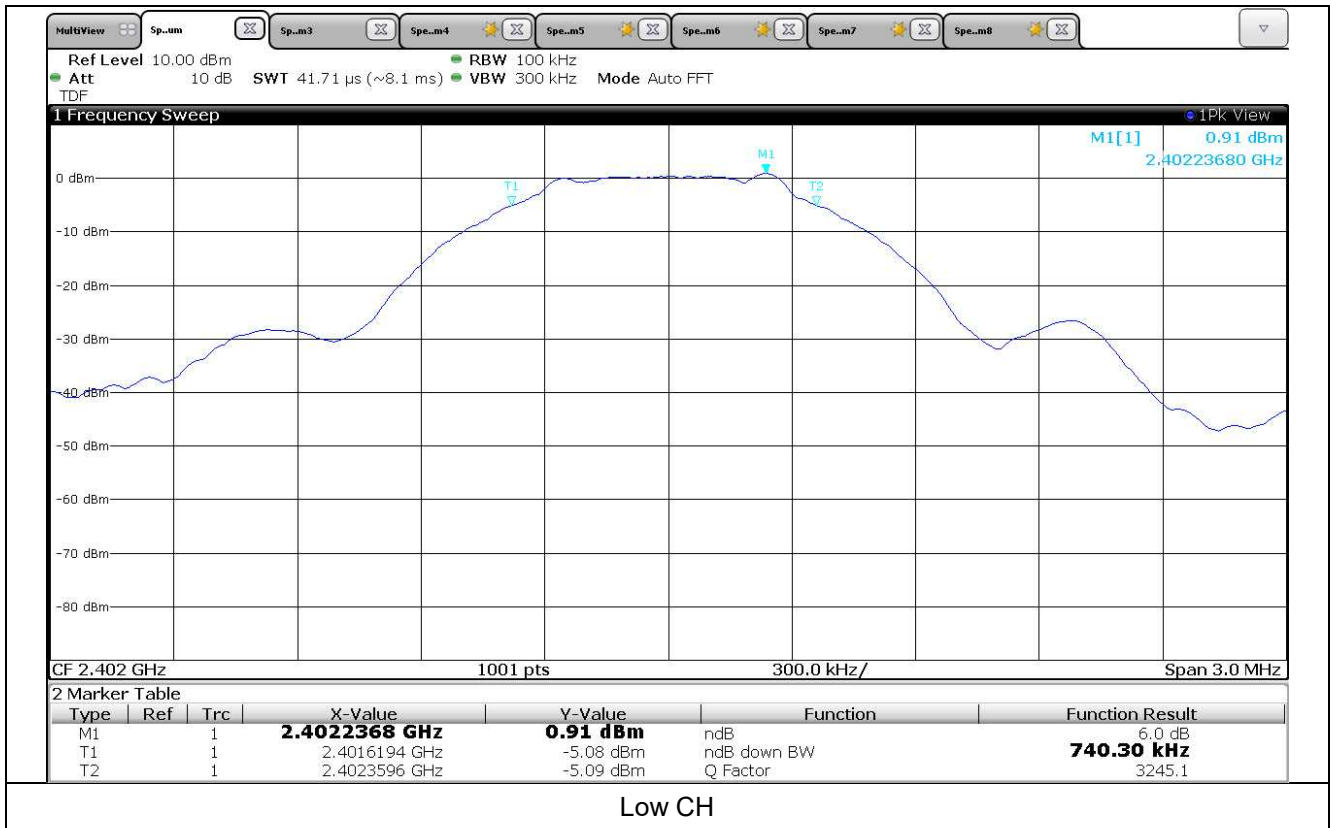
5.4 Test data

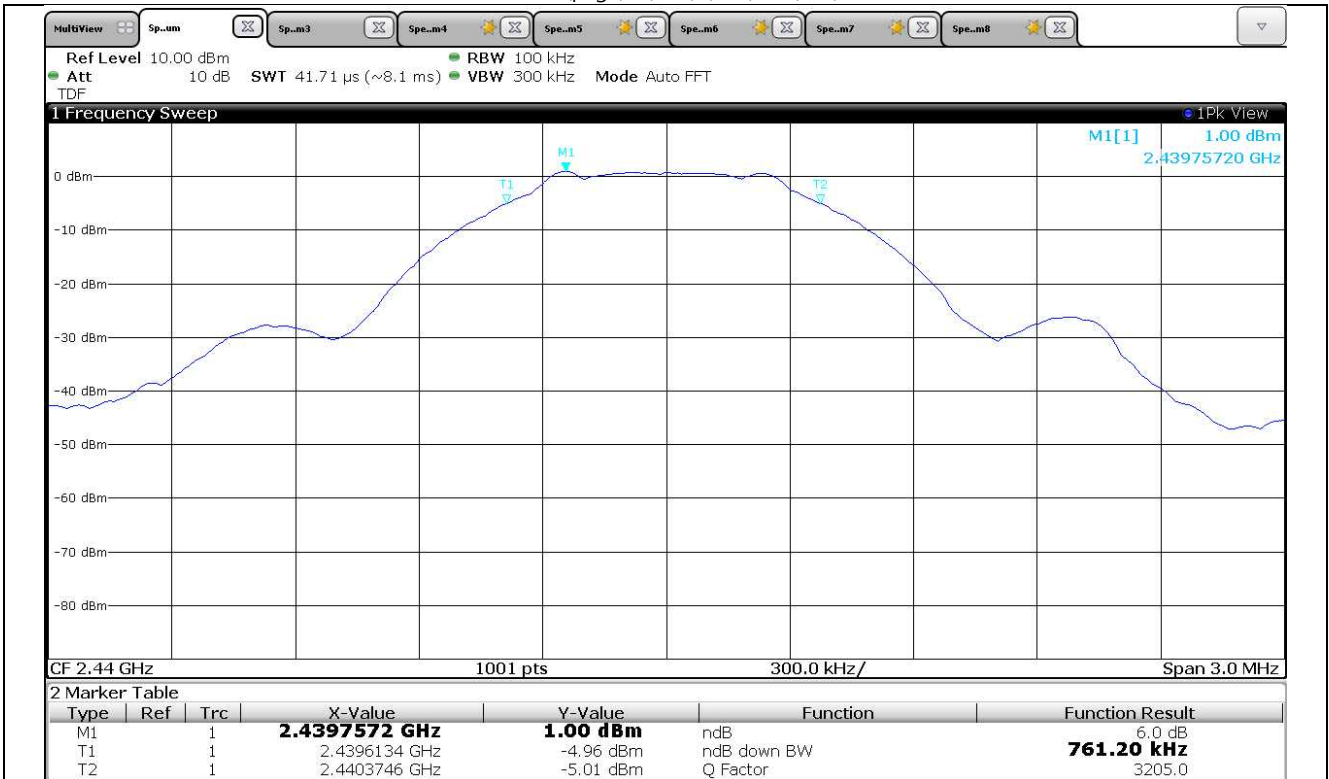
Test date : 23. Oct. 2019
 Operating mode : Transmit mode
 Test Result : Pass

5.4.1 Measured Results

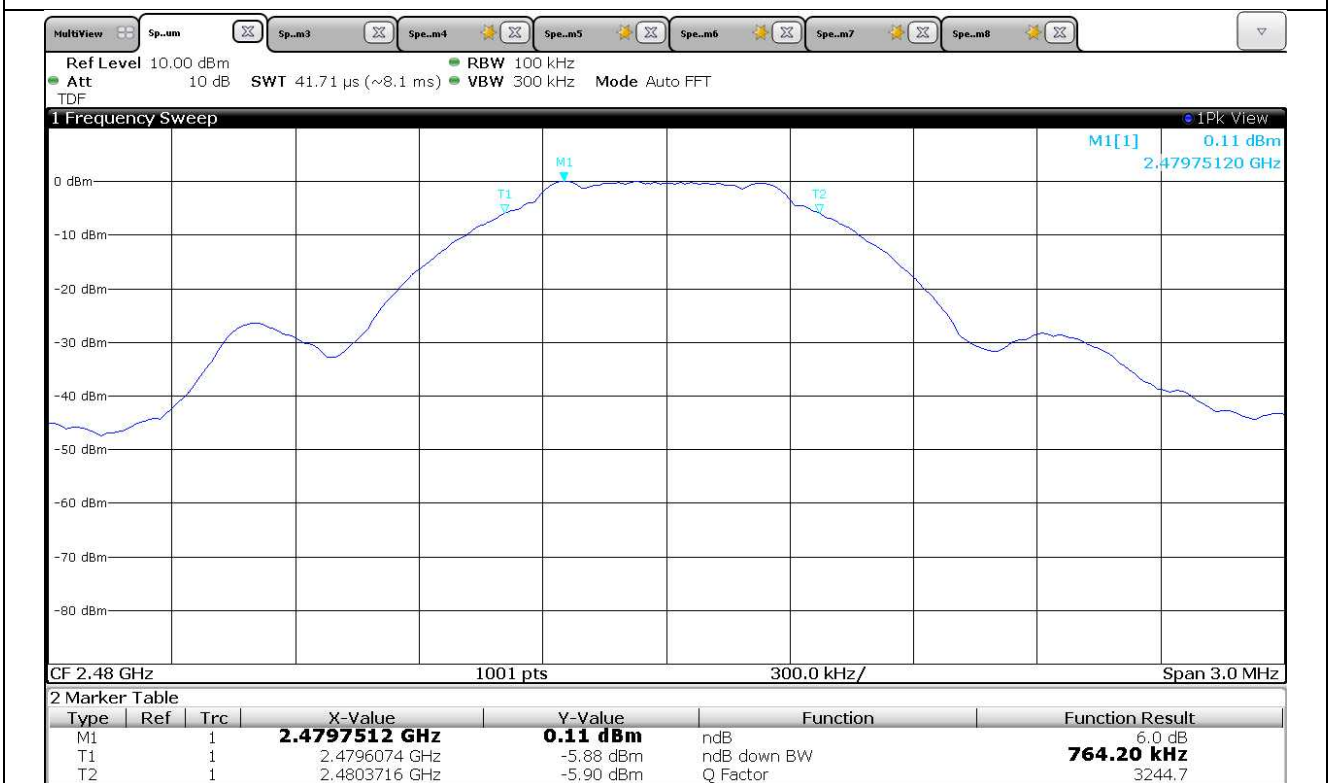
Modulation Type	Channel (Frequency)	Measured Value (kHz)	Limit (kHz)
Bluetooth LE	0 (2 402 MHz)	740.3	at least 500
	19 (2 440 MHz)	761.2	
	39 (2 480 MHz)	764.2	

5.4.2 Measured Graph





Mid CH



High CH



6. Maximum Conducted Output Power

6.1 Operating environment

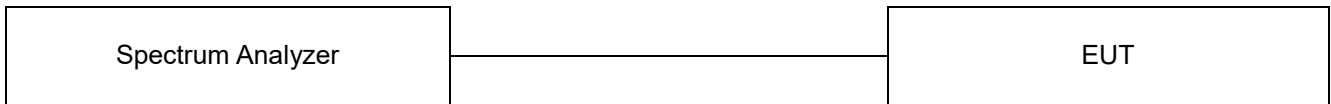
Temperature : 22 °C
Relative humidity : 43 %

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.





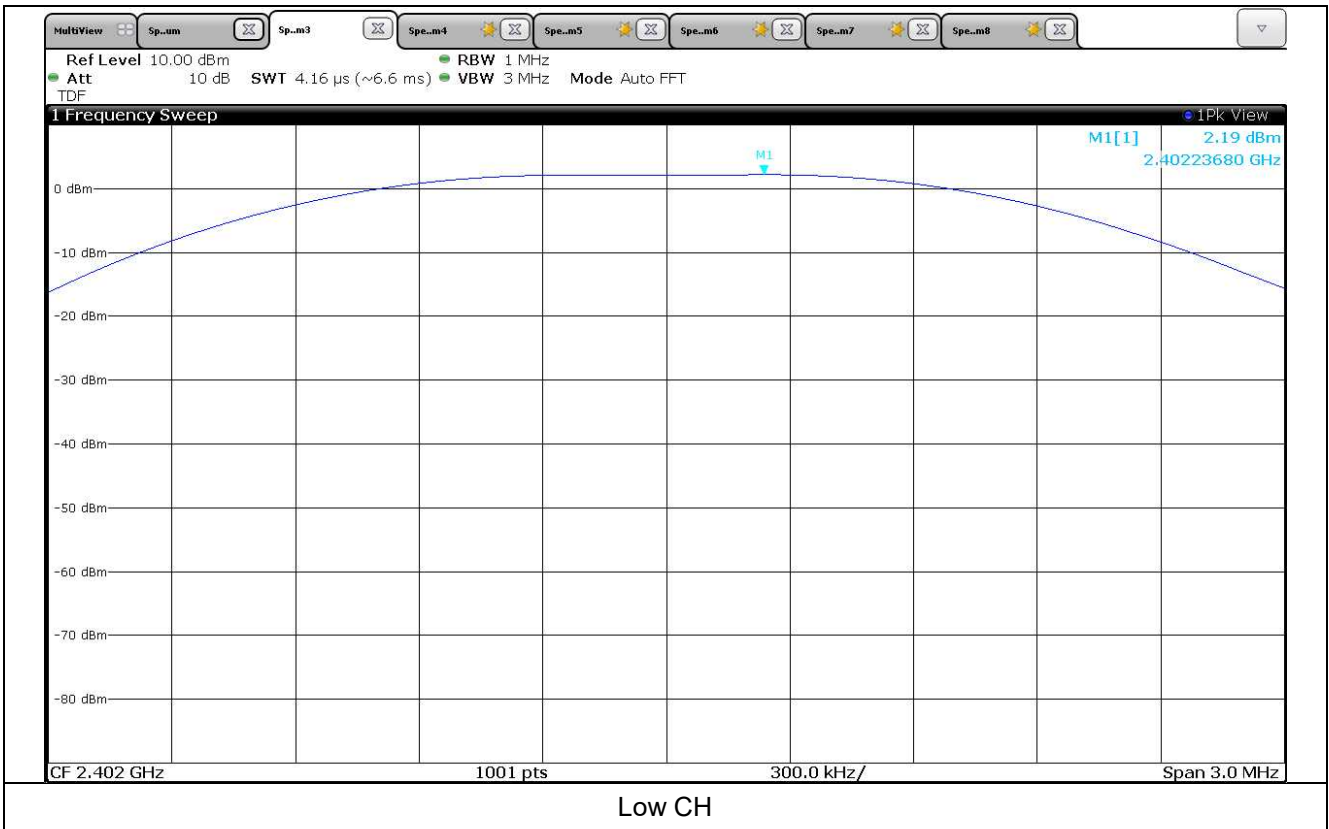
6.4 Test data

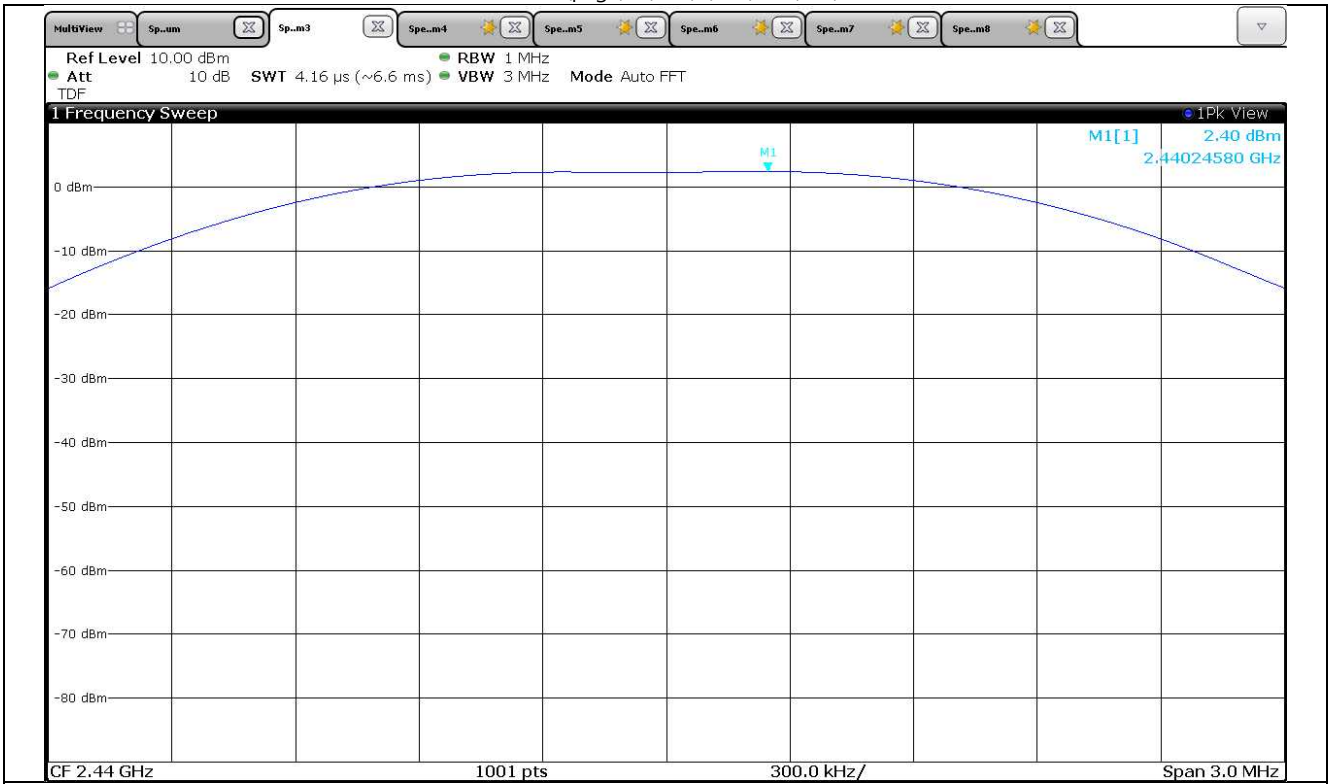
Test date : 23. Oct. 2019
 Operating mode : Transmit mode
 Test Result : Pass

6.4.1 Measured Results

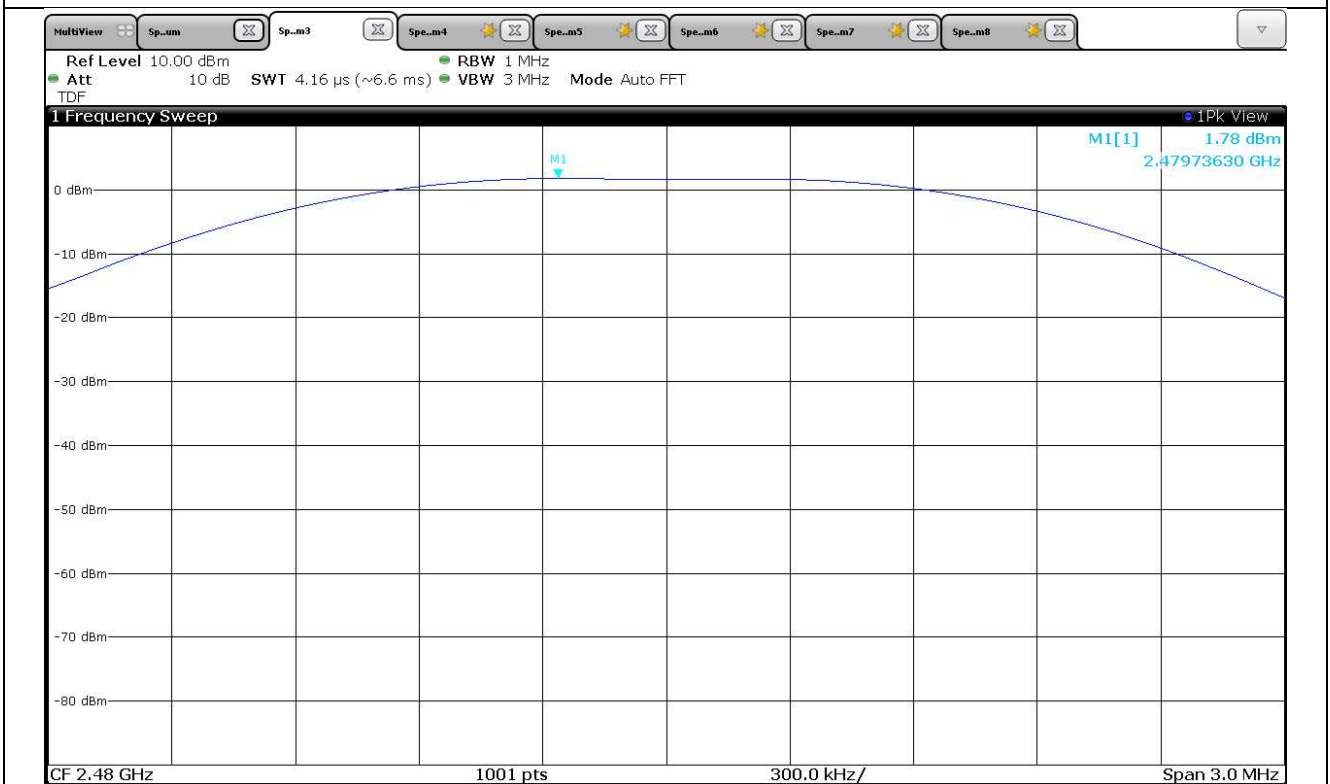
Modulation Type	Channel (Frequency)	Highest signal level (dBm)	Limit (dBm)
Bluetooth LE	0 (2 402 MHz)	2.19	30 (1 Watt)
	19 (2 440 MHz)	2.40	
	39 (2 480 MHz)	1.78	

6.4.2 Measured Graph





Mid CH



High CH



7. Power Spectral Density

7.1 Operating environment

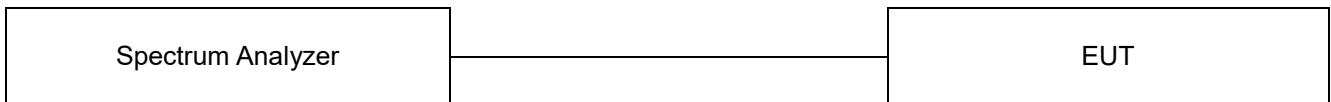
Temperature : 22 °C
Relative humidity : 43 %

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 kHz, the video bandwidth is set to 3 times the resolution bandwidth.





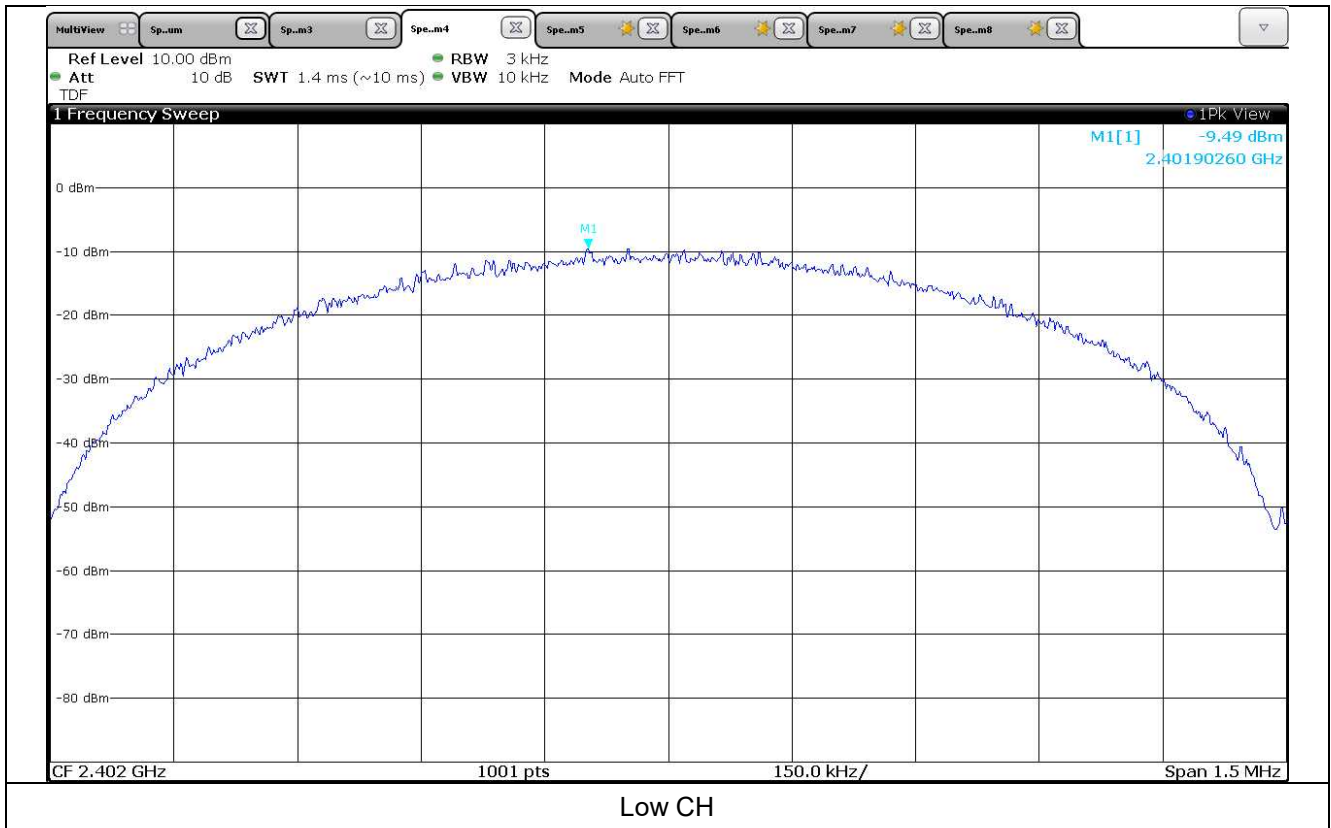
7.4 Test data

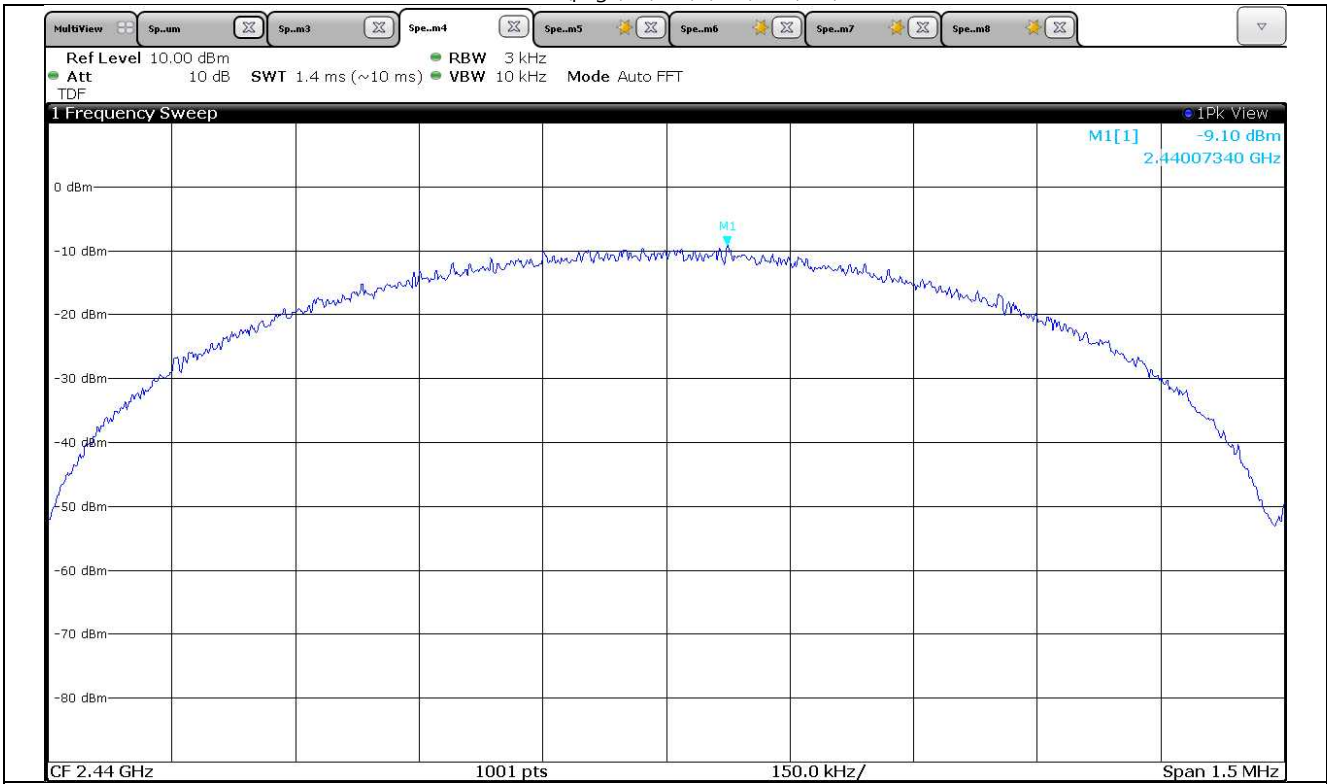
Test date : 23. Oct. 2019
 Operating mode : Transmit mode
 Test Result : Pass

7.4.1 Measured Results

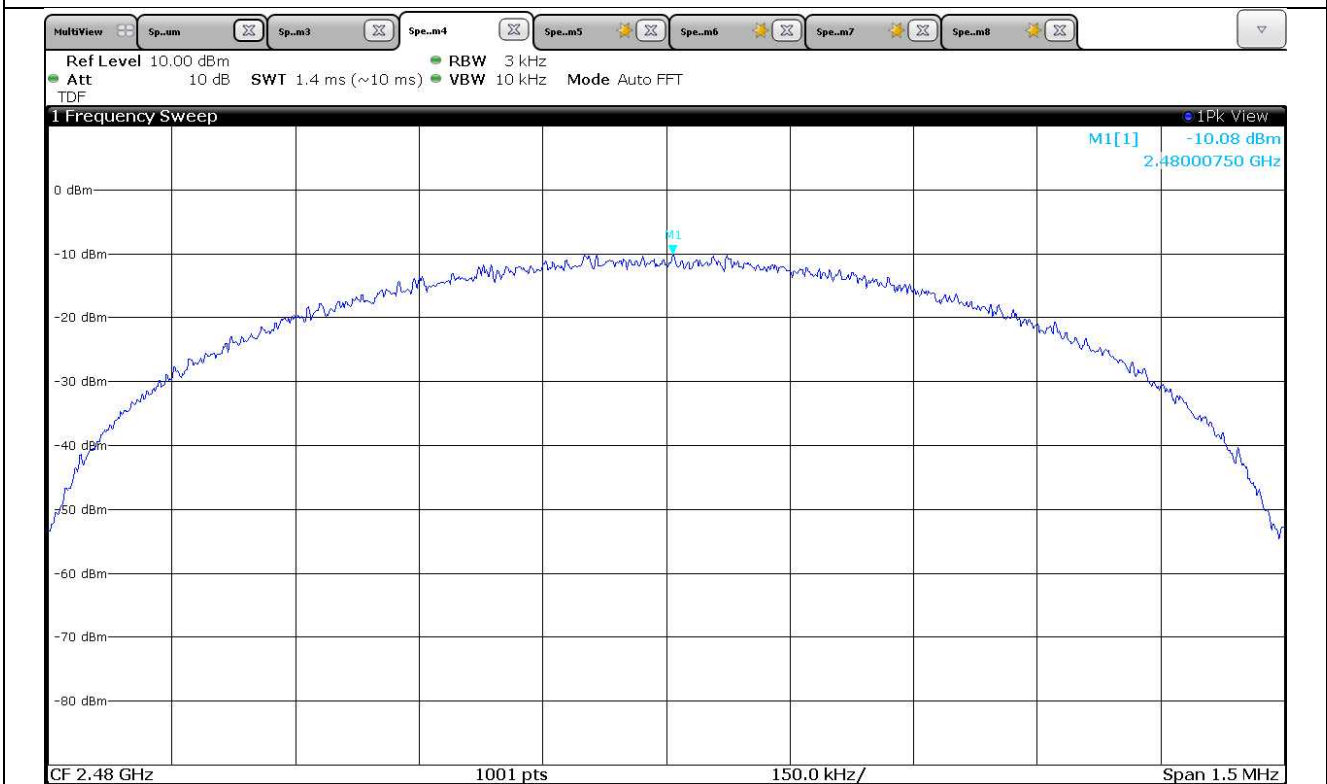
Modulation Type	Channel (Frequency)	Highest signal level (dBm)	Limit (dBm/3kHz)
Bluetooth LE	0 (2 402 MHz)	-9.49	8
	19 (2 440 MHz)	-9.10	
	39 (2 480 MHz)	-10.08	

7.4.2 Measured Graph





Mid CH



High CH



8. Conducted Spurious Emission

8.1 Operating environment

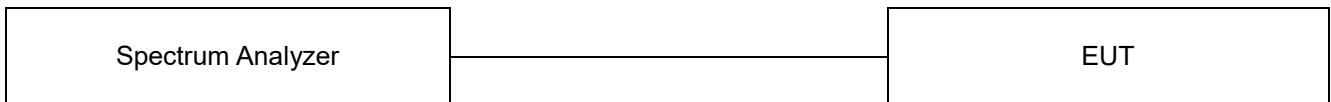
Temperature : 22 °C
Relative humidity : 43 %

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 kHz, and peak detection was used.



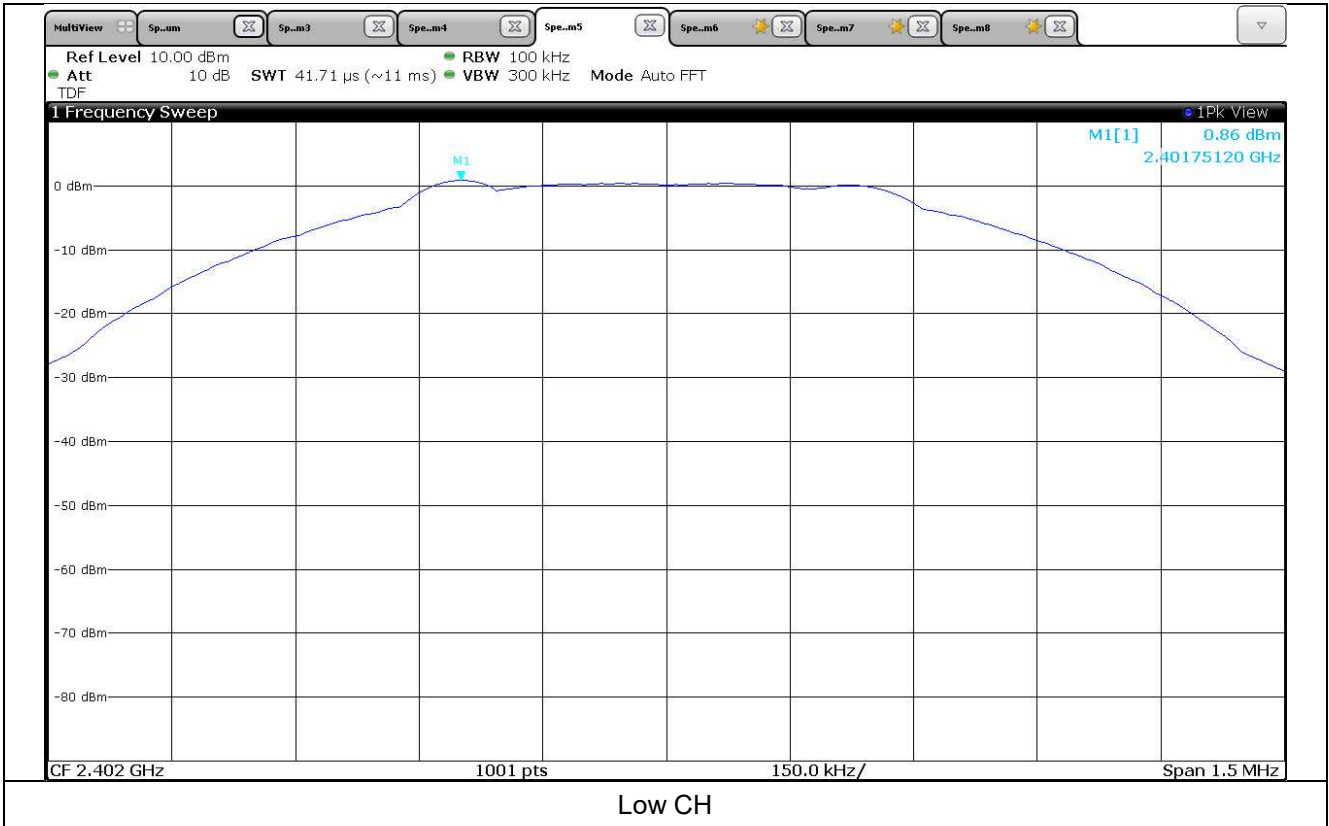


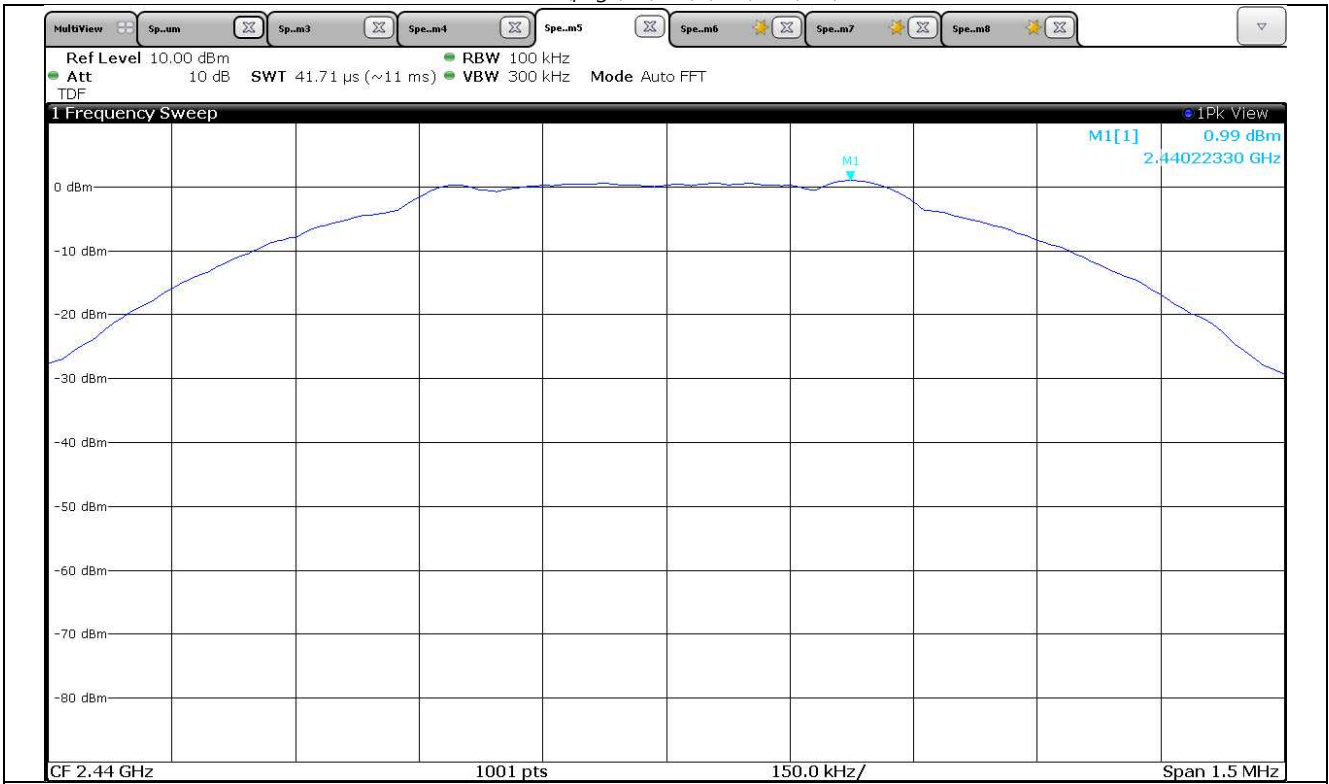
8.4 Test data

Test date : 23. Oct. 2019
Operating mode : Transmit mode
Test Result : Pass

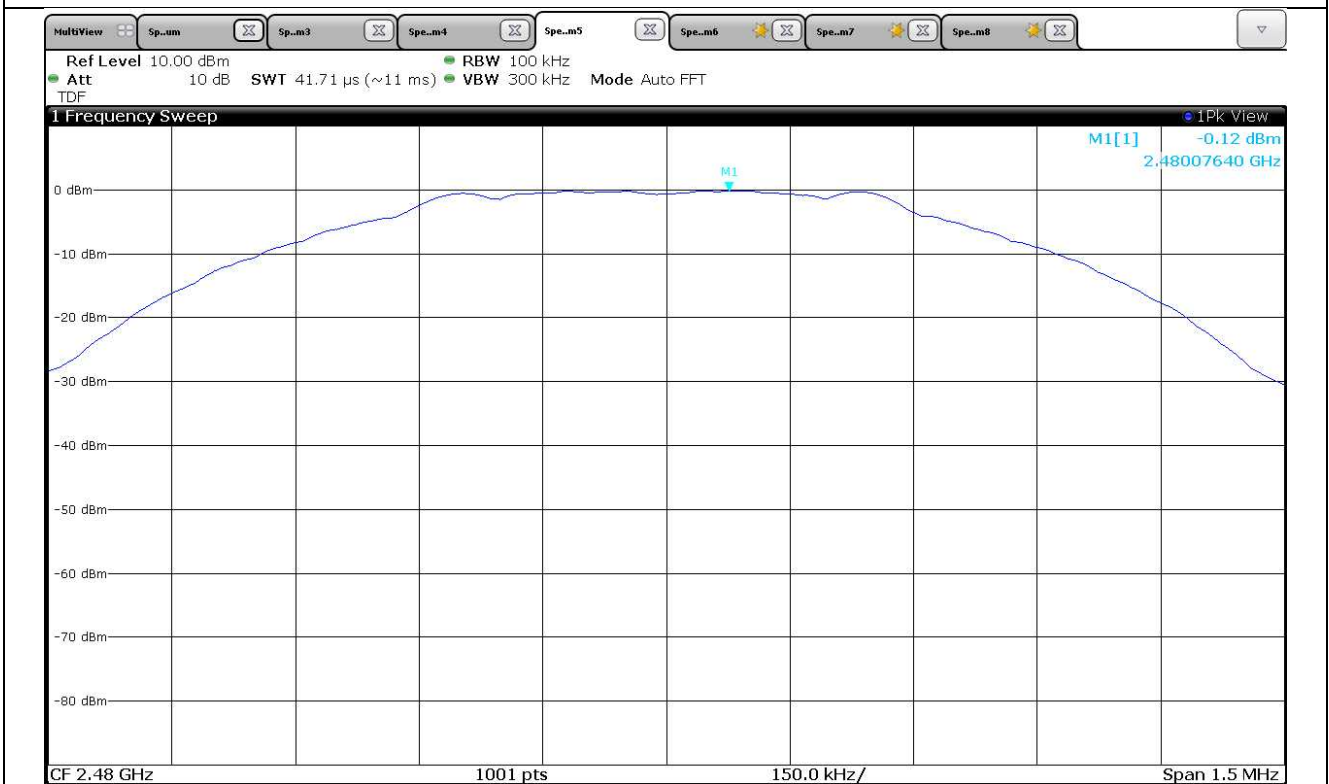
8.4.1 Measured Results

8.4.1.1 Signal level (dB m)





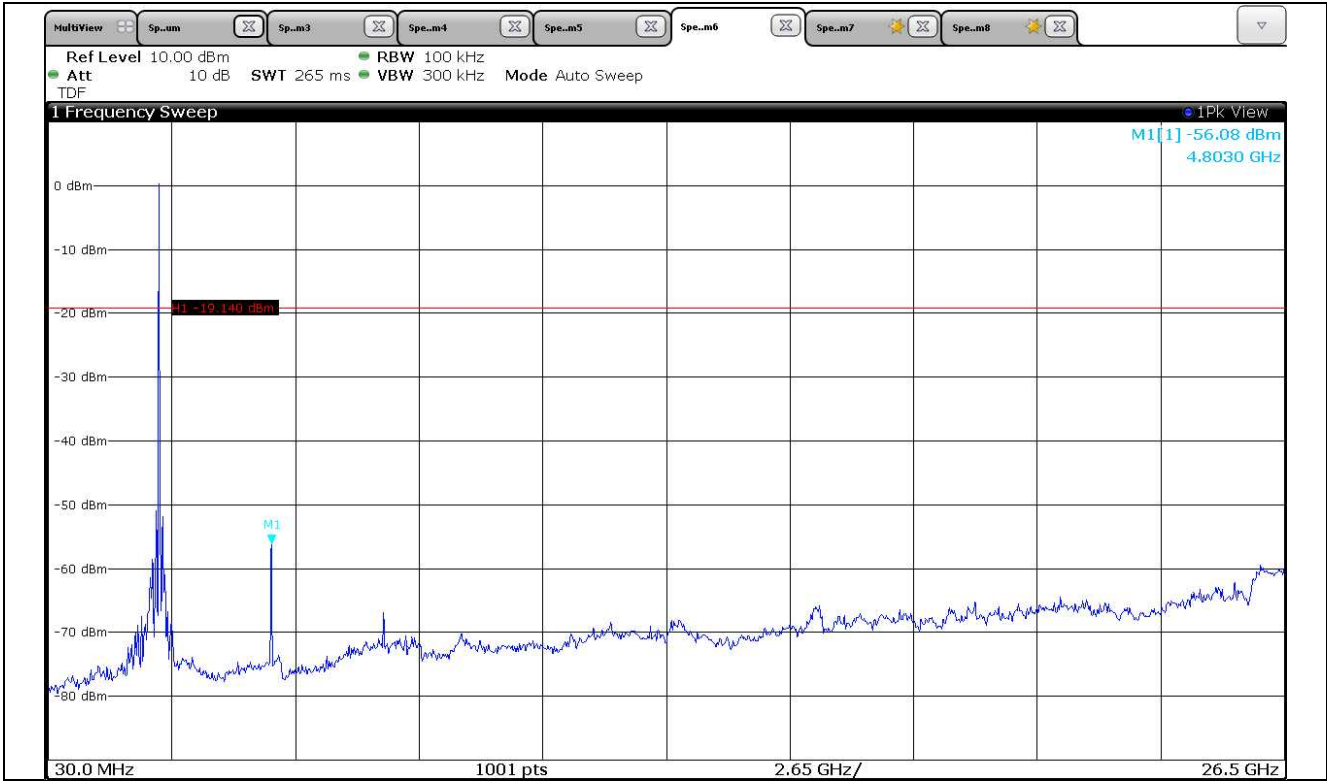
Mid CH



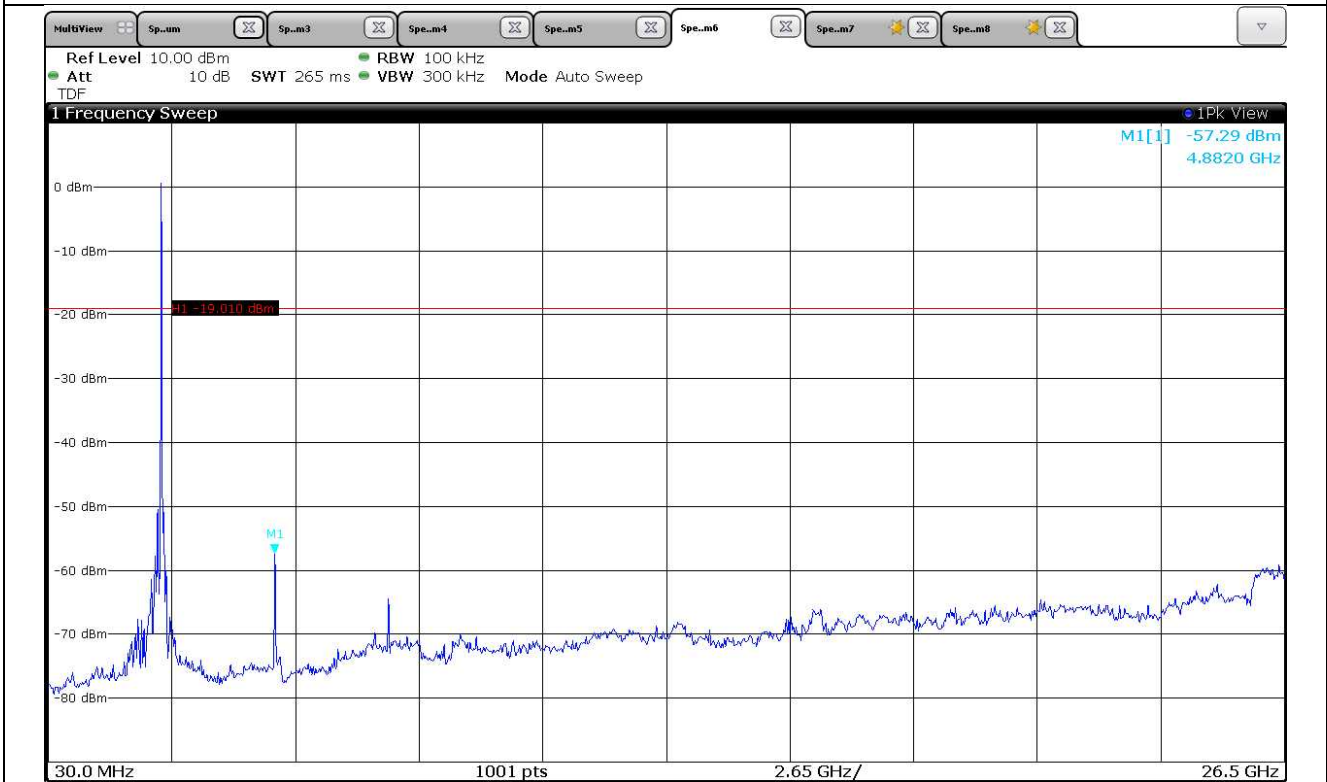
High CH



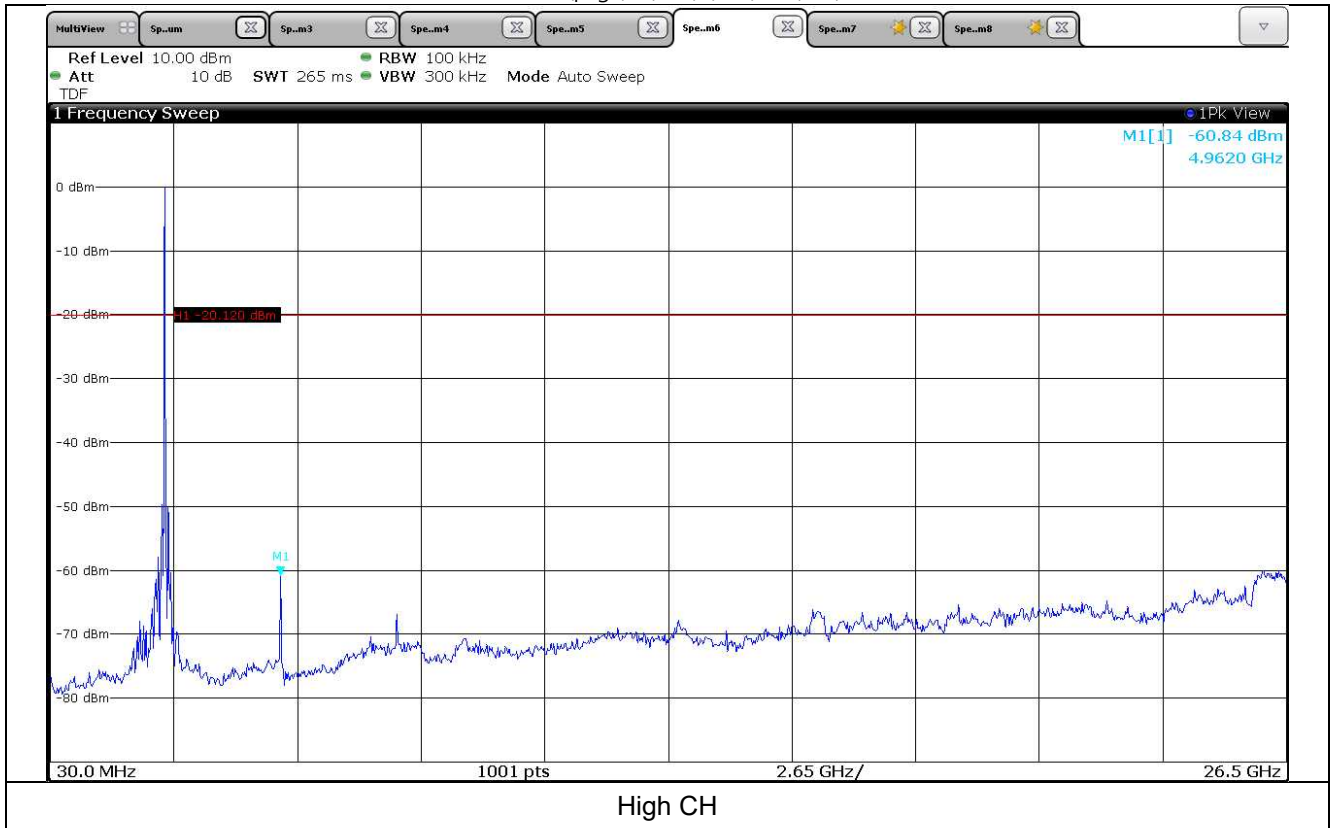
8.4.1.2 Unwanted Emissions In Non-Restricted Frequency Bands



Low CH

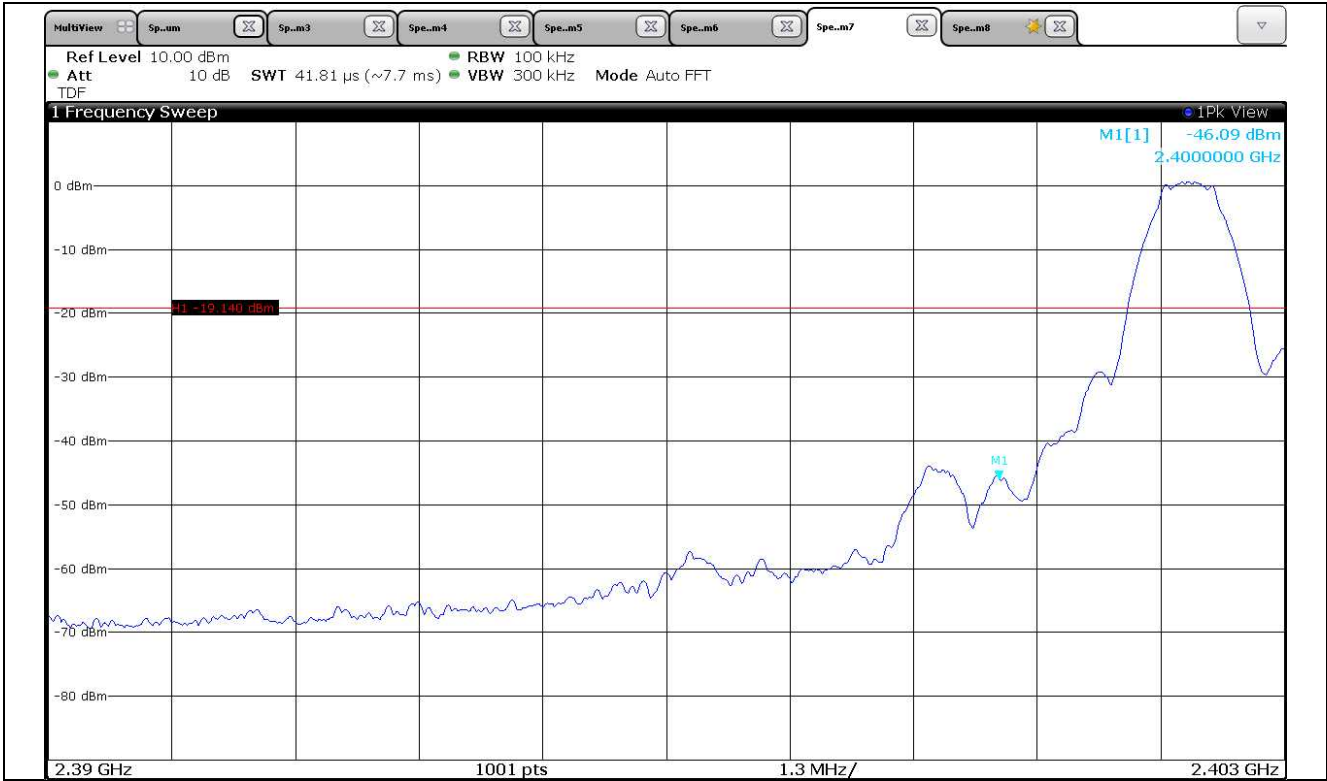


Mid CH

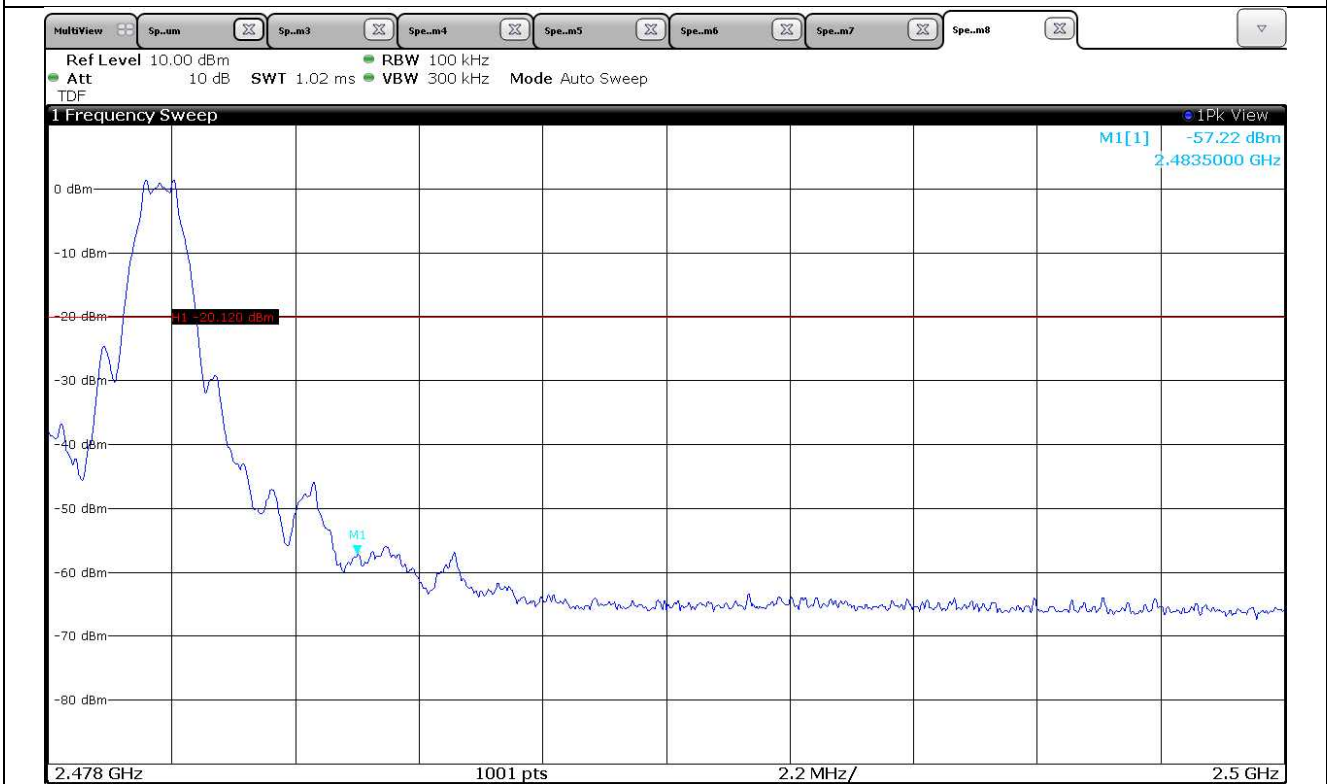




8.4.1.3 Band Edge



Low CH



High CH

9. Radiated Spurious Emission

9.1 Operating environment

Temperature : 23 °C
Relative humidity : 43 %

9.2 Measurement method

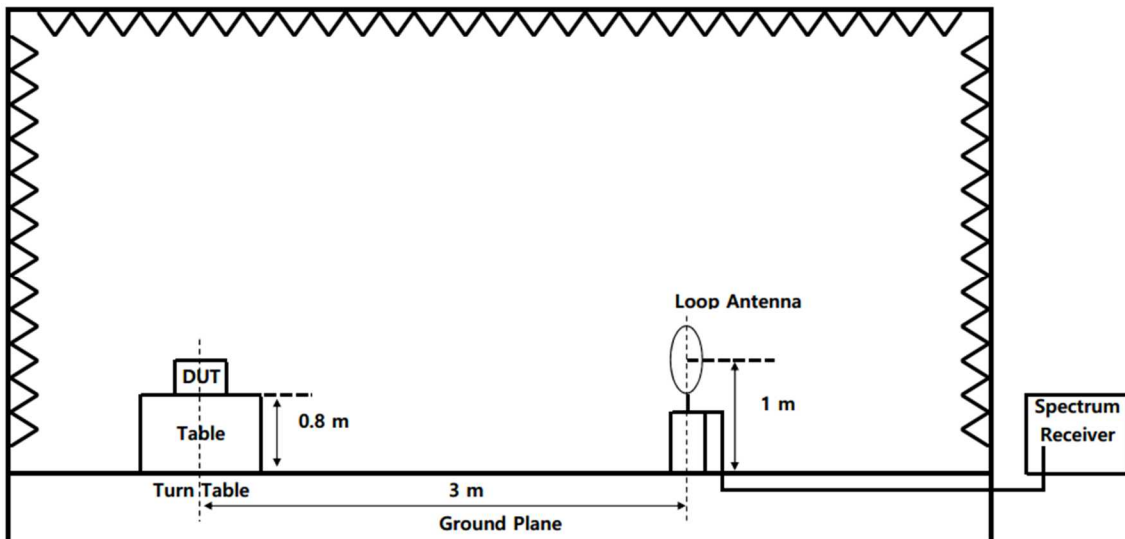
Standard : §15.247 (d), §15.209, §15.205

9.3 Test setup

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

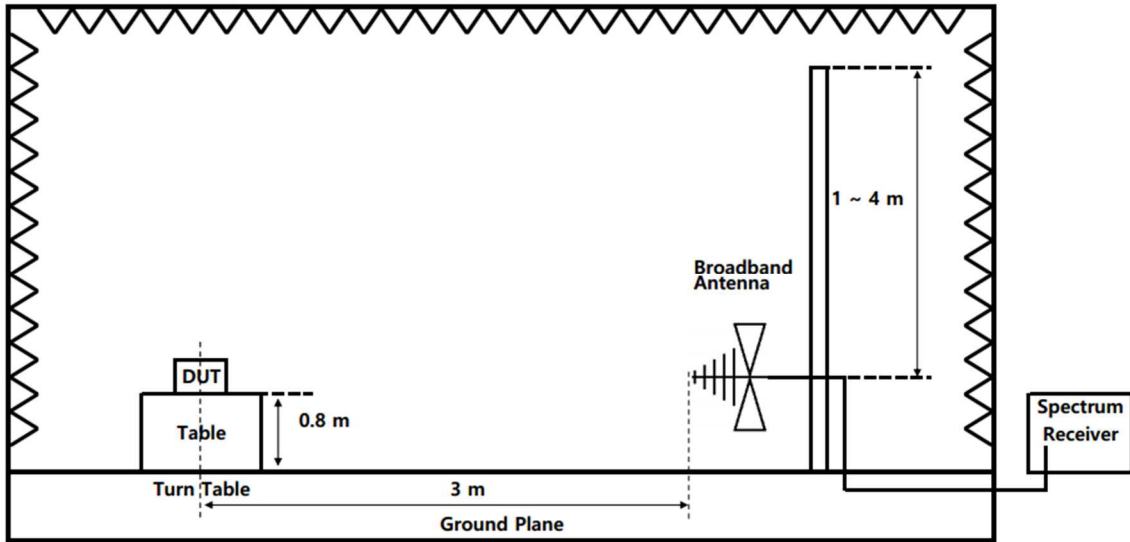
The frequency spectrum from 9 kHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal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

9.3.1 Below 30 MHz

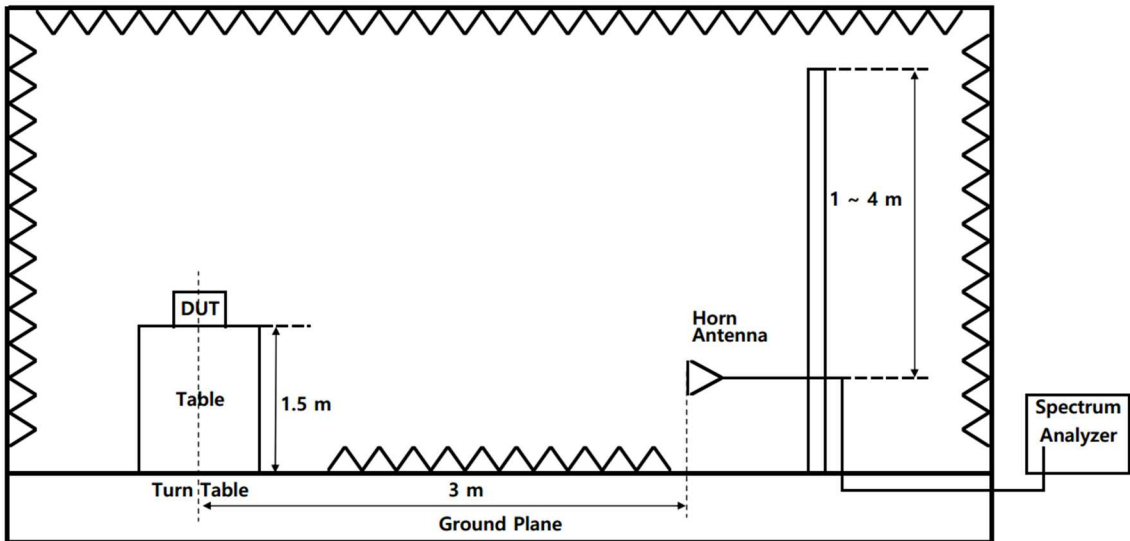




9.3.2 30 MHz to 1 GHz



9.3.3 Above 1 GHz





9.4 Test data

Test date : 21. Oct. 2019
 Operating mode : Transmit mode
 Test Result : Pass

9.4.1 Test data for Restricted band

Frequency (MHz)	Reading (dB μ V)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Low CH							
2 337.96	52.67	Peak	H	-11.00	41.67	73.98	-32.31
	46.35	Average	H		35.35	53.98	-18.63
High CH							
2 483.50	56.99	Peak	H	-9.50	47.49	73.98	-26.49
	43.38	Average	H		33.88	53.98	-20.10

- ※ Ant. Pol. : Antenna Polarization
- ※ Corr. Factor. : Antenna Factor + Cable Loss - Amplifier Gain
- ※ Result = Reading + Corr. Factor
- ※ Margin = Result - Limit

9.4.2 Test data for Spurious & Harmonic

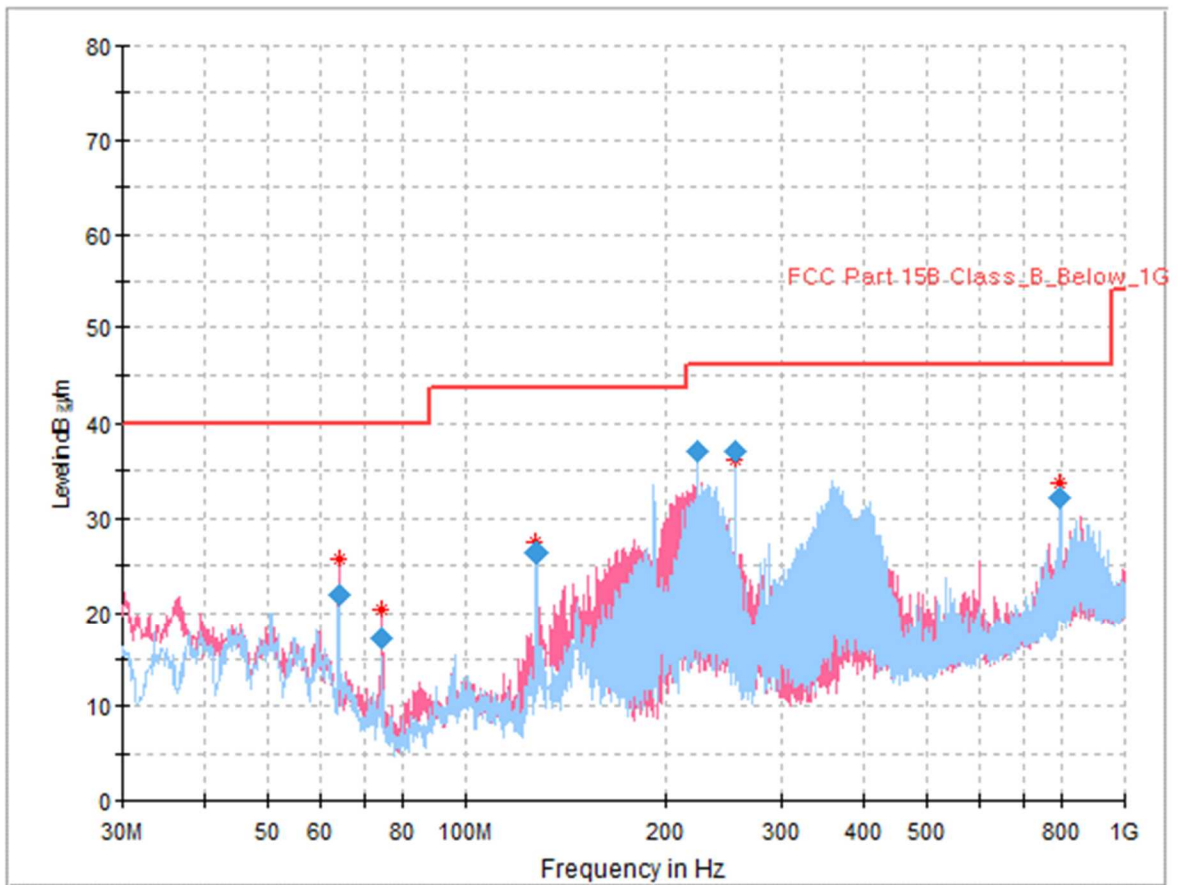
9.4.2.1 Measurement Results for below 30 MHz

Frequency (MHz)	Reading (dB μ V)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dB μ V/m)	Limit (dB μ V/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 = Result - Limit



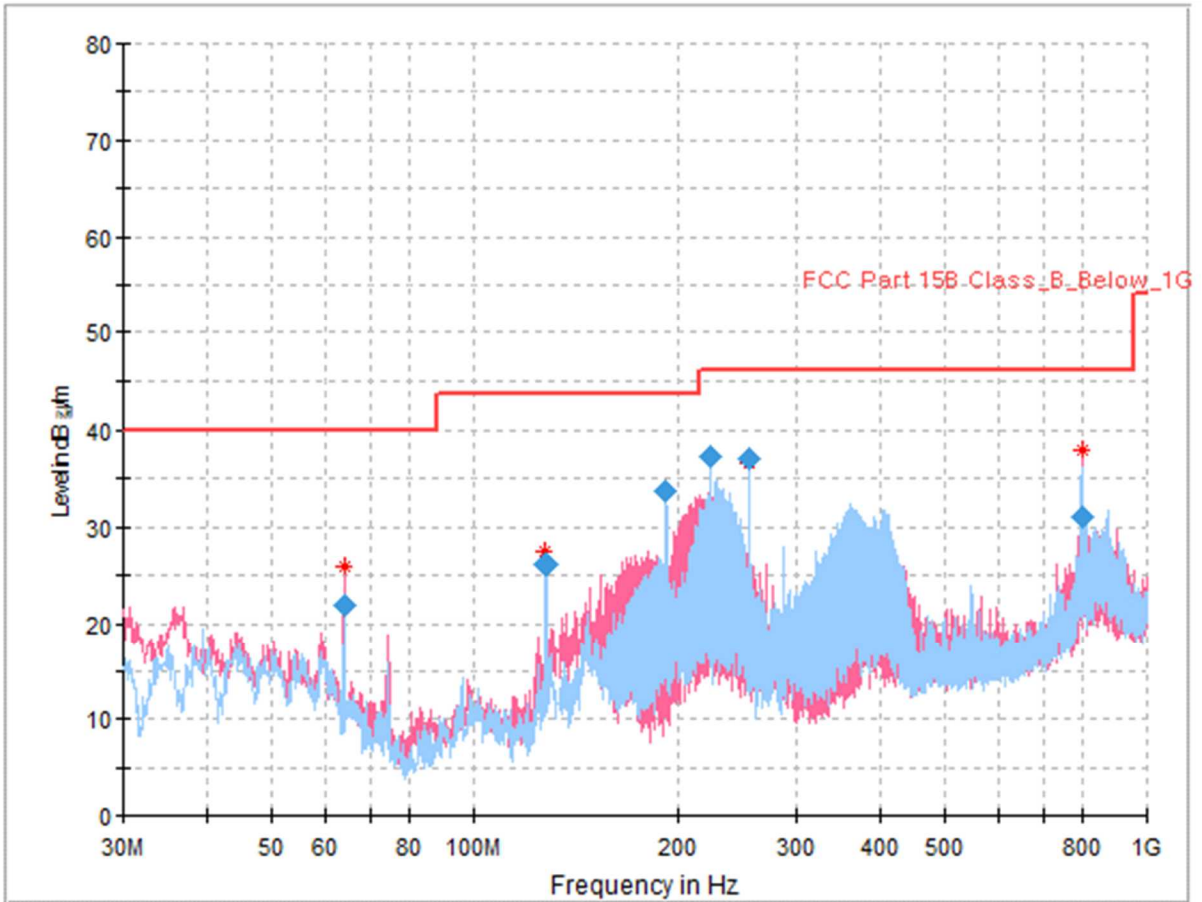
9.4.2.2 Measurement Results for below 1 GHz



Final Result

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
63.950000	21.88	40.00	18.12	1000.0	120.000	99.9	V	302.0	-21.7
74.523000	17.21	40.00	22.79	1000.0	120.000	99.9	V	69.0	-25.5
127.970000	26.39	43.50	17.11	1000.0	120.000	200.0	H	4.0	-24.1
224.000000	37.18	46.00	8.82	1000.0	120.000	100.0	H	190.0	-21.2
256.010000	37.01	46.00	8.99	1000.0	120.000	100.0	H	212.0	-19.0
796.591000	32.13	46.00	13.87	1000.0	120.000	200.1	V	52.0	-8.8

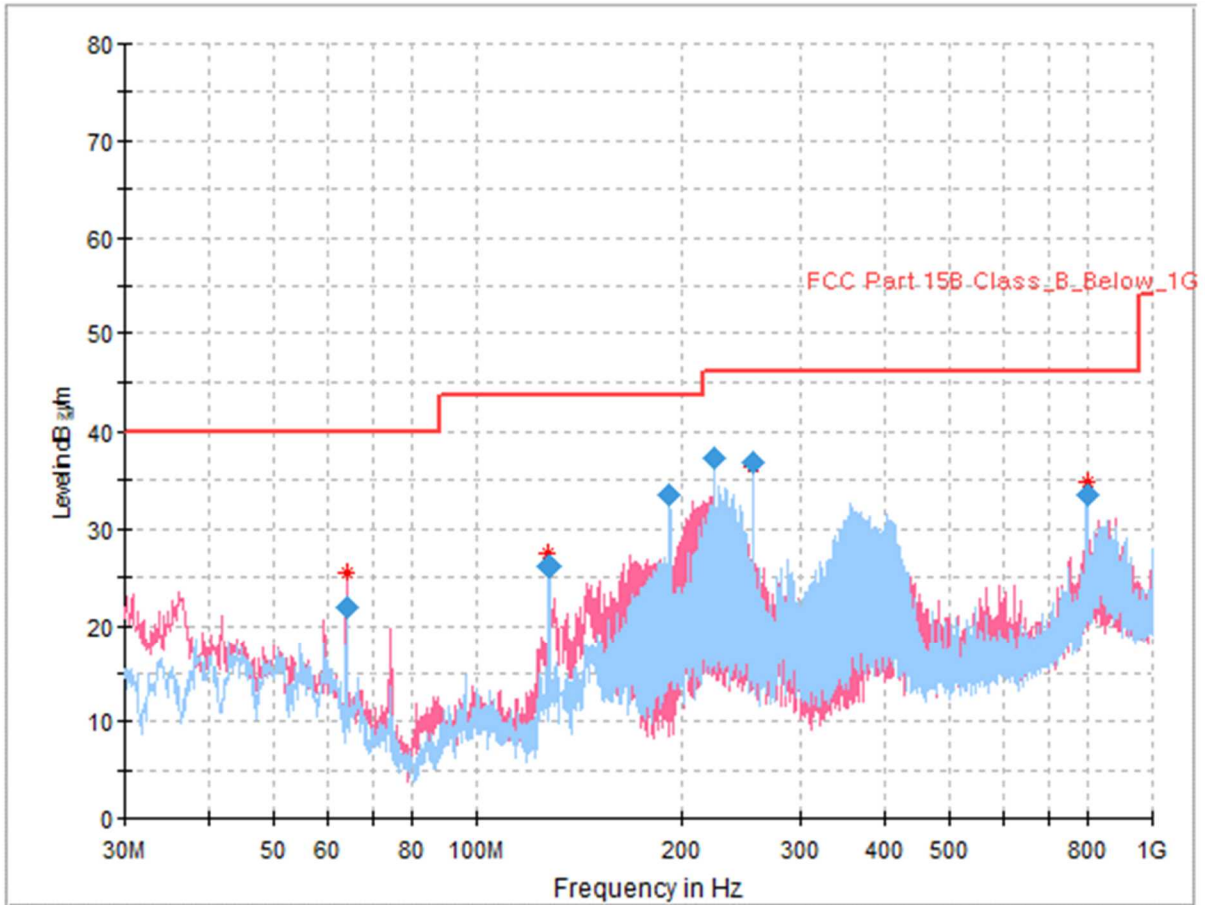
Low CH



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
63.950000	21.86	40.00	18.14	1000.0	120.000	100.1	V	299.0	-21.7
127.970000	26.23	43.50	17.27	1000.0	120.000	200.0	H	0.0	-24.1
191.990000	33.69	43.50	9.81	1000.0	120.000	100.1	H	5.0	-21.9
224.000000	37.28	46.00	8.72	1000.0	120.000	100.1	H	0.0	-21.2
256.010000	37.03	46.00	8.97	1000.0	120.000	100.1	H	0.0	-19.0
799.598000	31.16	46.00	14.84	1000.0	120.000	200.0	V	42.0	-8.8

Mid CH



Final Result

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
63.950000	21.80	40.00	18.20	1000.0	120.000	100.1	V	261.0	-21.7
127.970000	26.17	43.50	17.33	1000.0	120.000	199.9	H	179.0	-24.1
191.990000	33.56	43.50	9.94	1000.0	120.000	100.1	H	190.0	-21.9
224.000000	37.25	46.00	8.75	1000.0	120.000	100.1	H	0.0	-21.2
256.010000	36.89	46.00	9.12	1000.0	120.000	100.1	H	212.0	-19.0
798.628000	33.44	46.00	12.56	1000.0	120.000	199.9	V	16.0	-8.8

High CH



9.4.2.3 Measurement Results for Above 1 GHz

Frequency (MHz)	Reading (dB μ V)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Low CH							
4 805.95	56.91	Peak	H	-1.00	55.91	73.98	-18.07
	36.25	Average	H		35.25	53.98	-18.73
7 205.45	54.50	Peak	H	6.90	61.40	73.98	-12.58
	36.74	Average	H		43.64	53.98	-10.34
9 606.98	53.19	Peak	V	11.80	64.99	73.98	-8.99
	36.14	Average	V		47.94	53.98	-6.04
Mid CH							
4 881.95	57.88	Peak	V	-1.40	56.48	73.98	-17.50
	36.44	Average	V		35.04	53.98	-18.94
7 319.45	55.77	Peak	H	7.60	63.37	73.98	-10.61
	36.48	Average	H		44.08	53.98	-9.90
9 758.95	54.14	Peak	V	13.00	67.14	73.98	-6.84
	36.52	Average	V		49.52	53.98	-4.46
High CH							
4 960.02	57.42	Peak	H	-2.10	55.32	73.98	-18.66
	36.41	Average	H		34.31	53.98	-19.67
7 440.45	55.14	Peak	H	7.20	62.34	73.98	-11.64
	36.84	Average	H		44.04	53.98	-9.94
9 920.15	53.17	Peak	V	13.30	66.47	73.98	-7.51
	36.24	Average	V		49.54	53.98	-4.44

- ※ Ant. Pol. : Antenna Polarization
- ※ Corr. Factor. : Antenna Factor + Cable Loss - Amplifier Gain
- ※ Result = Reading + Corr. Factor
- ※ Margin = Result - Limit



10. Power Line Conducted Emission

10.1 Operating environment

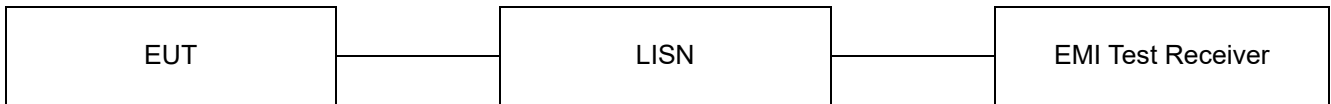
Temperature : 22 °C
Relative humidity : 41 %

10.2 Measurement method

Standard : §15.207

10.3 Test setup

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50Ω / $50 \mu\text{H}$ + 5Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

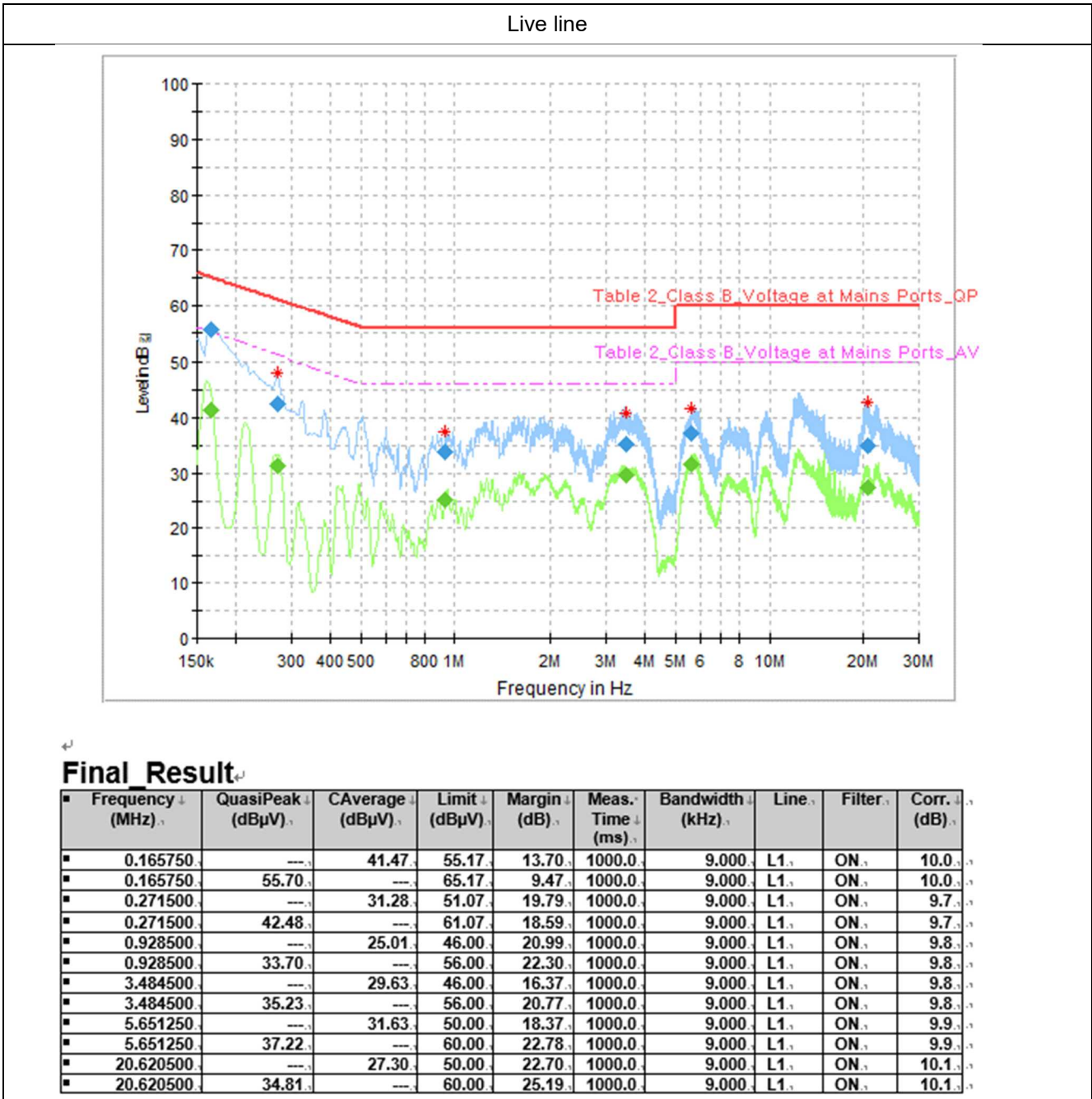




10.4 Test data

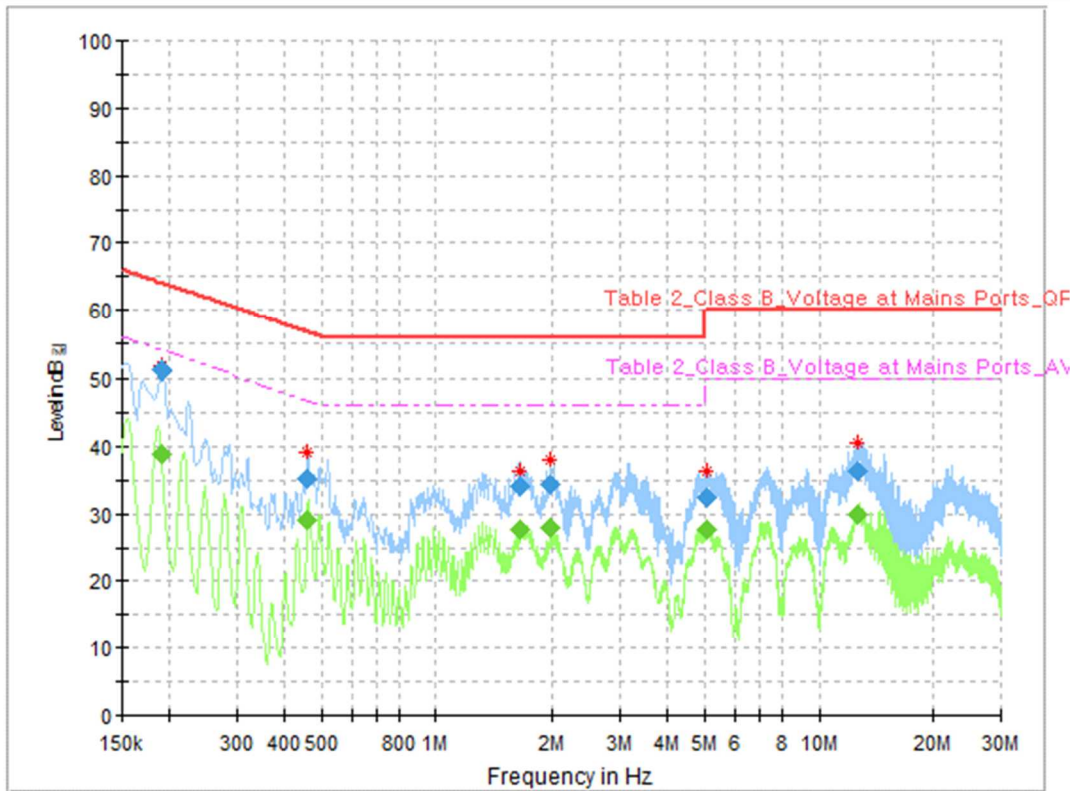
Test date : 21. Oct. 2019
 Operating mode : Transmit mode
 Test Result : Pass

10.4.1 Measured Results & Graph





Neutral line



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.190500	---	38.85	54.02	15.17	1000.0	9.000	N	ON	9.9
0.190500	51.01	---	64.02	13.00	1000.0	9.000	N	ON	9.9
0.460500	---	29.00	46.68	17.69	1000.0	9.000	N	ON	9.9
0.460500	35.27	---	56.68	21.41	1000.0	9.000	N	ON	9.9
1.635000	---	27.74	46.00	18.26	1000.0	9.000	N	ON	9.8
1.635000	33.97	---	56.00	22.03	1000.0	9.000	N	ON	9.8
1.968000	---	28.01	46.00	17.99	1000.0	9.000	N	ON	9.8
1.968000	34.24	---	56.00	21.76	1000.0	9.000	N	ON	9.8
5.052750	---	27.61	50.00	22.39	1000.0	9.000	N	ON	9.9
5.052750	32.54	---	60.00	27.46	1000.0	9.000	N	ON	9.9
12.682500	---	29.88	50.00	20.12	1000.0	9.000	N	ON	10.1
12.682500	36.39	---	60.00	23.61	1000.0	9.000	N	ON	10.1