




# 시험 성적서 TEST REPORT

페이지(page) : ( 1 ) / ( 총(Total) 30 )

성적서 번호 Report No.		ICRT-TR-E220445-0A	
신청자 Client	기관명 Name	Monimoto UAB	
	주소 Address	Sauletekio al. 15, Vilnius LT-10224 Lithuania	
시험대상품목 Sample description		Bluetooth Transceiver	
모델명 Type designation		KEY4	
정격 Ratings		DC 3.0 V	
시험장소 Place of test		<input checked="" type="checkbox"/> 고정시험(Inside test) <input type="checkbox"/> 현장시험(Field test) 주소지(Address): 112, Hwanggeum 3-ro 7beon-gil, Hagun-ri, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea	
시험기간 Date of test		21. Jan. 2022 ~ 28. Feb. 2022	
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	성명 Name	성명 Name
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2022. 03. 02			
주식회사 아이씨알 대표이사		The head of INTERNATIONAL CERTIFICATION REGISTRAR	

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The authenticity of the test report can be checked on the G4B or ICR website.

경기도 김포시 양촌읍 황금3로7번길 112 / Tel: 02-6351-9001 ~ 6



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### Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
ICRT-TR-E220445-0A	02-Mar-2022	Initial Issue	All



# **1. Applicant & Manufacturer & Test Laboratory Information**

## **1.1 Applicant information**

Applicant	Monimoto UAB
Address	Sauletekio al. 15, Vilnius LT-10224 Lithuania
Contact Person	Gintaras Meliūnas
Telephone No.	37062226000
Fax No.	-
E-mail	gintaras@monimoto.com

## **1.2 Manufacturer Information**

Manufacturer	Monimoto UAB
Address	Sauletekio al. 15, Vilnius LT-10224 Lithuania

## **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
Test Firm Registration Number	490614



## 2. Equipment under Test(EUT) Information

### 2.1 General Information

Product Name	Bluetooth Transceiver
Brand Name	-
Model Name	KEY4
Additional Model Name	-
FCC ID	2AU3KKEY4
Hardware Version	1.0
Software Version	1.0
Power Supply	DC 3.0 V (Used Battery)

### 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	4.64 dBm
Number of Channel	40
Modulation Type	GFSK
Antenna Type	PCB Antenna
Antenna Gain	-0.6 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, the EUT was moved throughout the XY, YZ, XZ planes.

### 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) (2)	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 type="checkbox"/>	N/A
§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.

#### 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.



### 3.5 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 **PCB Antenna**. The directional gain of the antenna is **-0.6 dBi**.



#### 4. Used equipment on test

	Description	Model Name	Manufacturer	Serial Number	Next Cal. (cycle)
<input checked="" type="checkbox"/>	Spectrum analyzer	FSV40	Rohde & Schwarz	101455	2022 .06. 16 (1Y)
<input checked="" type="checkbox"/>	Signal Generator	SMB100A	Rohde & Schwarz	180607	2022. 03. 03 (1Y)
<input checked="" type="checkbox"/>	DC Power Supply	XDL 35-5P	Sorensen	J00385373	2022. 03. 03 (1Y)
<input checked="" type="checkbox"/>	Loop Antenna	HFH2-Z2	Rohde & Schwarz	100506	2023. 07. 05 (2Y)
<input checked="" type="checkbox"/>	TRILOG BROADBAND ANTENNA	VULB9162	SCHWARZBECK	120	2022. 12. 15 (2Y)
<input checked="" type="checkbox"/>	RF Pre Amplifier	SCU08	Rohde & Schwarz	100747	2022. 04. 14 (1Y)
<input checked="" type="checkbox"/>	DOUBLE-RIDGE WAVEGUIDE HORN ANTENNA	HF907	Rohde & Schwarz	102556	2022. 08. 21 (2Y)
<input checked="" type="checkbox"/>	RF Pre Amplifier	SCU18	Rohde & Schwarz	102342	2022. 04. 14 (1Y)
<input checked="" type="checkbox"/>	Horn Antenna	LB-42-10-C-KF	AINFO Inc.	J202024625	2022. 03. 04 (2Y)
<input checked="" type="checkbox"/>	RF Pre Amplifier	AMF-4F-18265-35-8P-1	MITEQ	771846	2022. 03. 04 (1Y)
<input checked="" type="checkbox"/>	Horn Antenna	LB-28-10-C-KF	AINFO Inc.	J202024627	2022. 03. 04 (2Y)
<input checked="" type="checkbox"/>	RF Pre Amplifier	AMF-4D-260400-45-6P	MITEQ	779919	2022. 03. 04 (1Y)
<input checked="" type="checkbox"/>	EMI Test Receiver	ESR26	Rohde & Schwarz	101461	2022. 04. 14 (1Y)
<input checked="" type="checkbox"/>	EMI Test Receiver	ESR26	Rohde & Schwarz	101462	2022. 04. 14 (1Y)

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





## 5. 6 dB Bandwidth

### 5.1 Operating environment

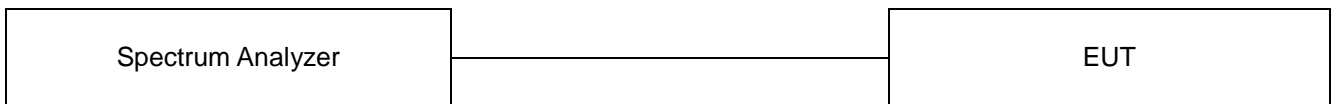
Temperature : 23 °C  
Relative humidity : 47 %

### 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 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.





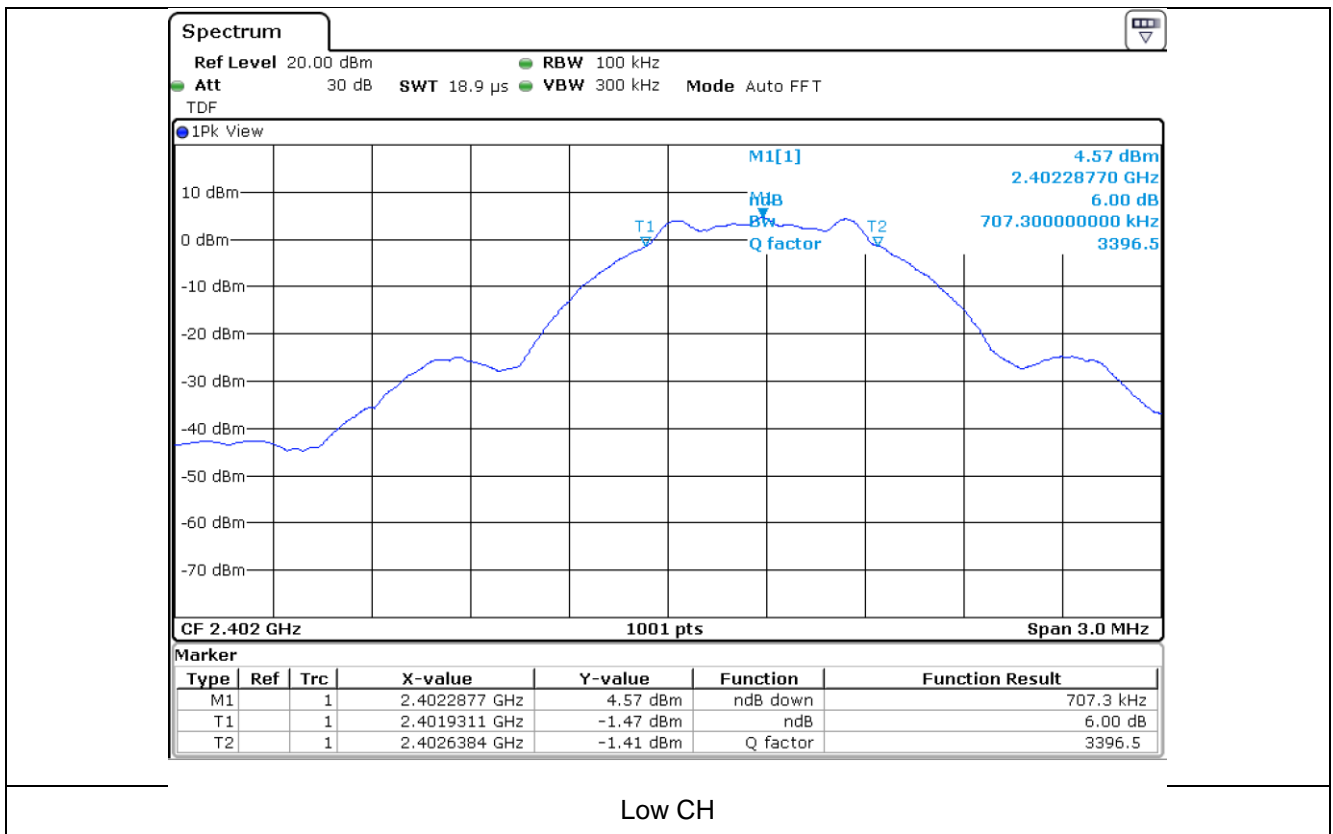
### 5.4 Test data

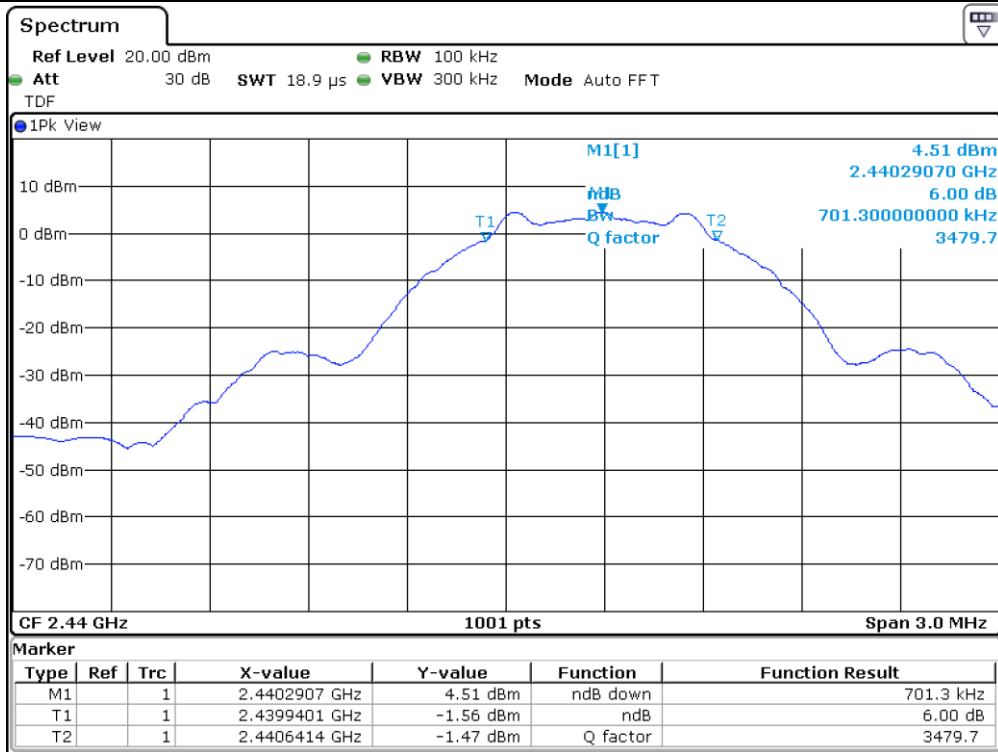
Test date : 21. Jan. 2022  
 Operating mode : Transmit mode  
 Test Result : Pass

#### 5.4.1 Measured Results

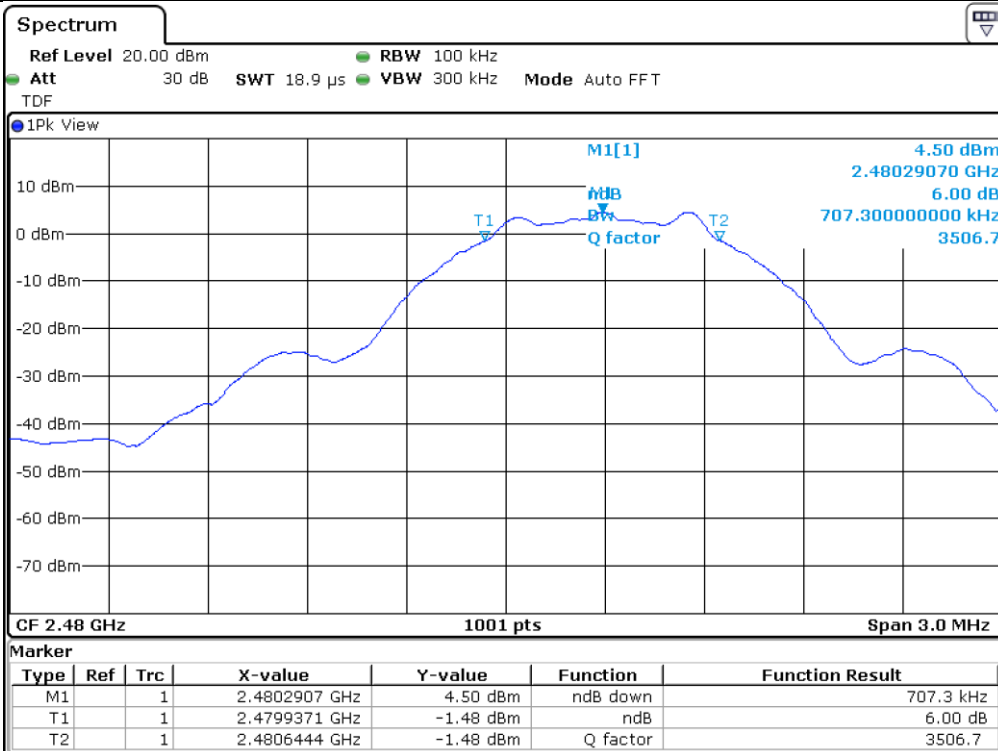
Modulation Type	Channel (Frequency)	Measured Value (kHz)	Limit (kHz)
Bluetooth LE	0 (2 402 MHz)	707.3	at least 500
	19 (2 440 MHz)	701.3	
	39 (2 480 MHz)	707.3	

#### 5.4.2 Measured Graph (6 dB Bandwidth)





Mid CH



High CH



## 6. Maximum Conducted Output Power

### 6.1 Operating environment

Temperature : 23 °C

Relative humidity : 47 %

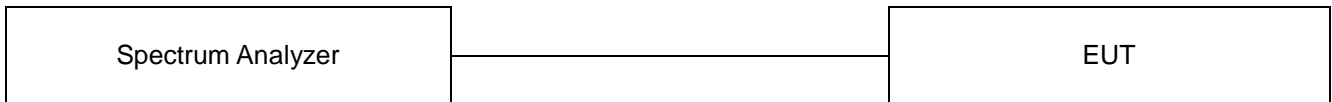
### 6.2 Measurement method

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.





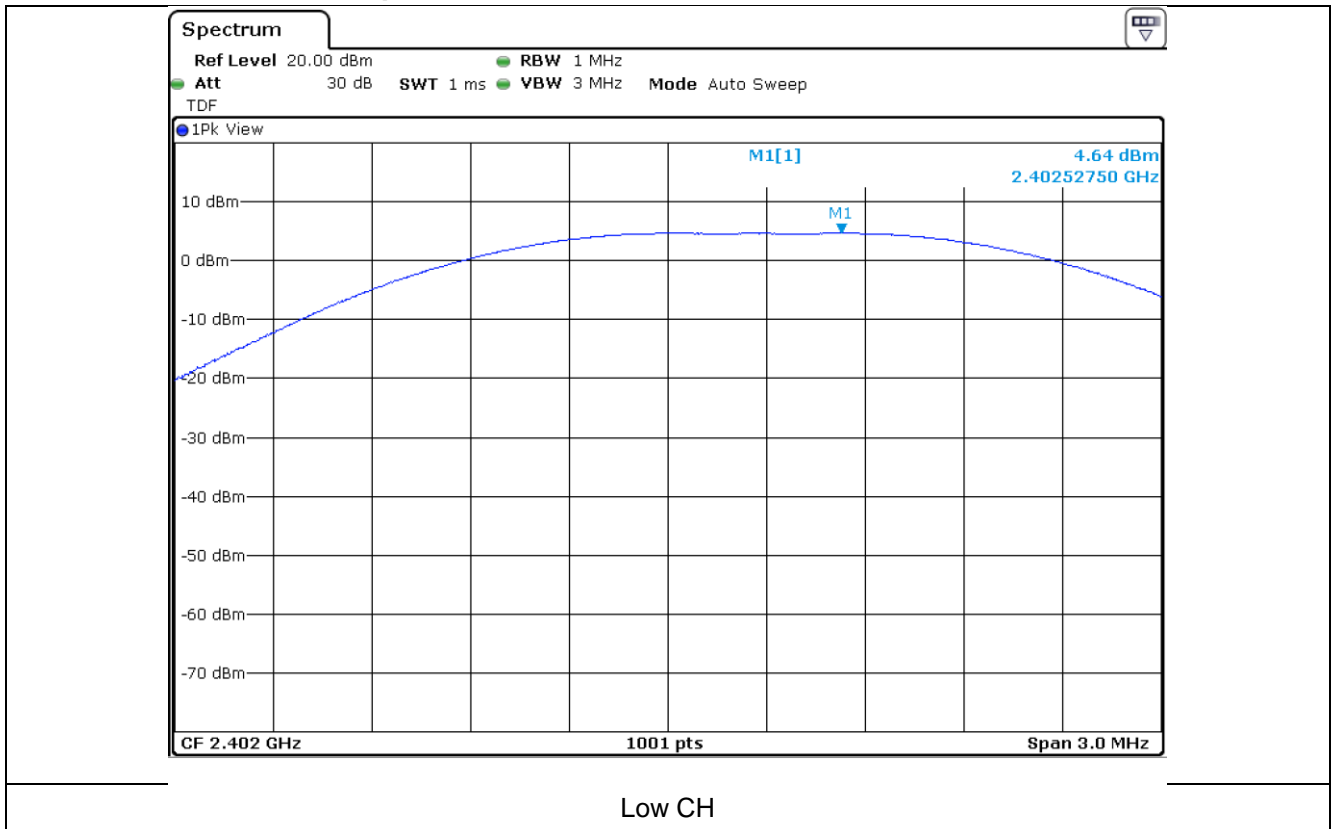
## 6.4 Test data

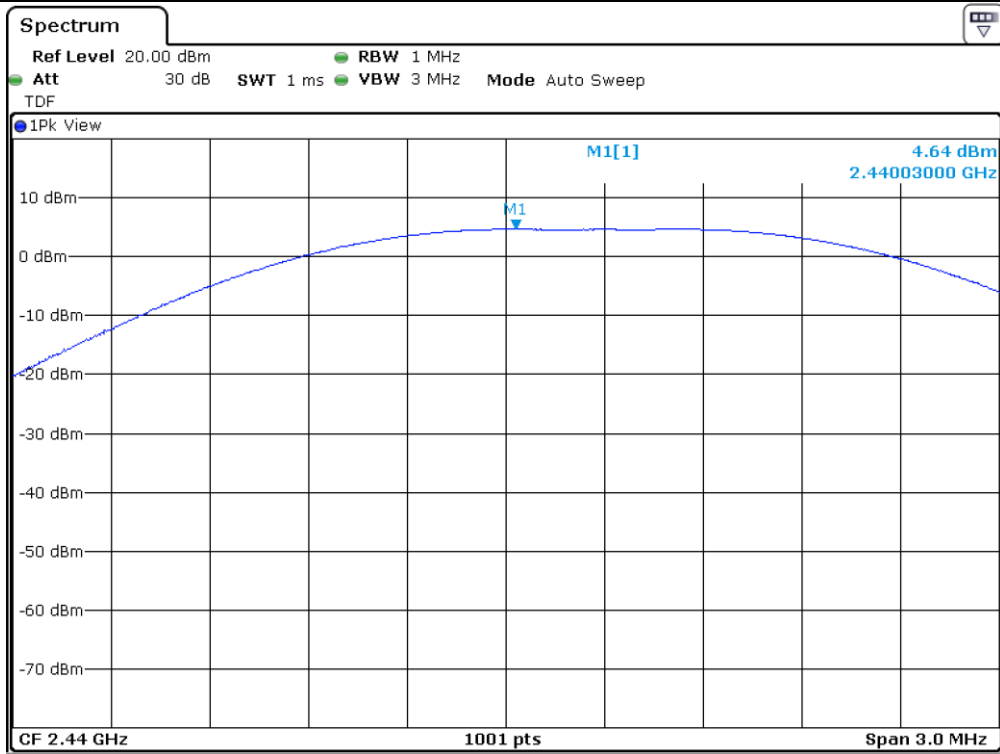
Test date : 21. Jan. 2022  
 Operating mode : Transmit mode  
 Test Result : Pass

### 6.4.1 Measured Results

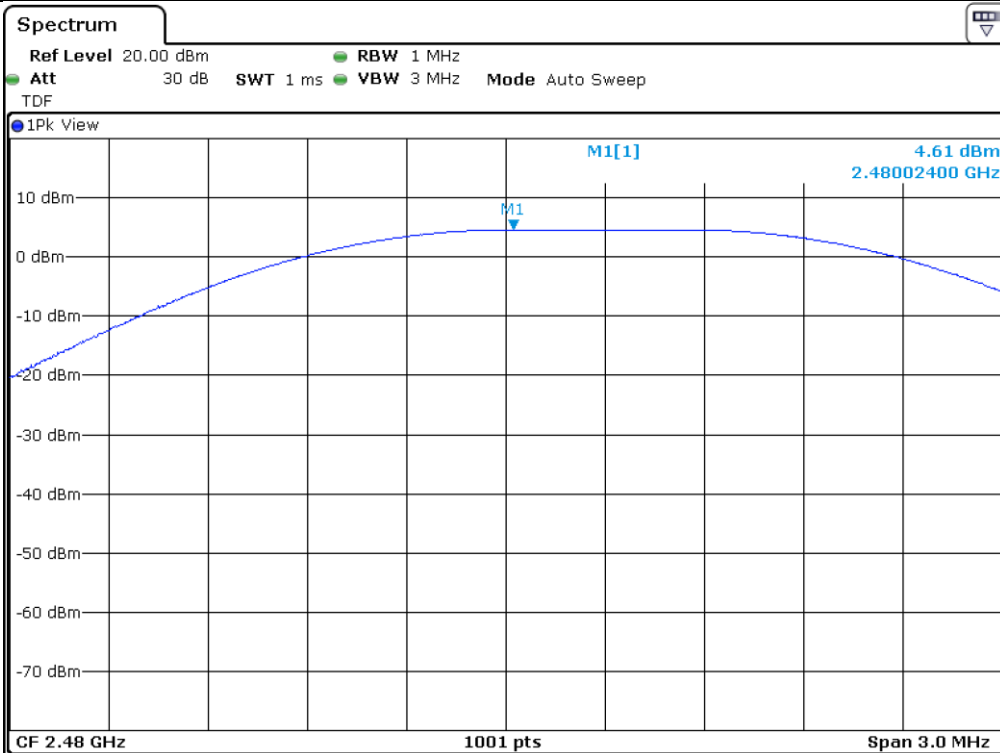
Modulation Type	Channel (Frequency)	Highest signal level (dBm)	Limit (dBm)
Bluetooth LE	0 (2 402 MHz)	4.64	30 (1 Watt)
	19 (2 440 MHz)	<b>4.64</b>	
	39 (2 480 MHz)	4.61	

### 6.4.2 Measured Graph





Mid CH



High CH



## 7. Power Spectral Density

### 7.1 Operating environment

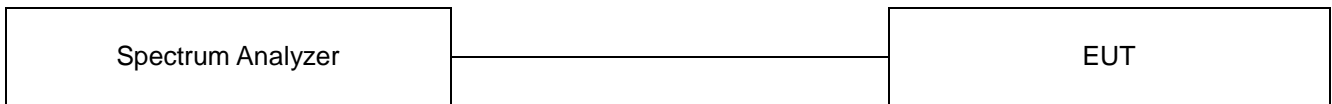
Temperature : 23 °C  
Relative humidity : 47 %

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





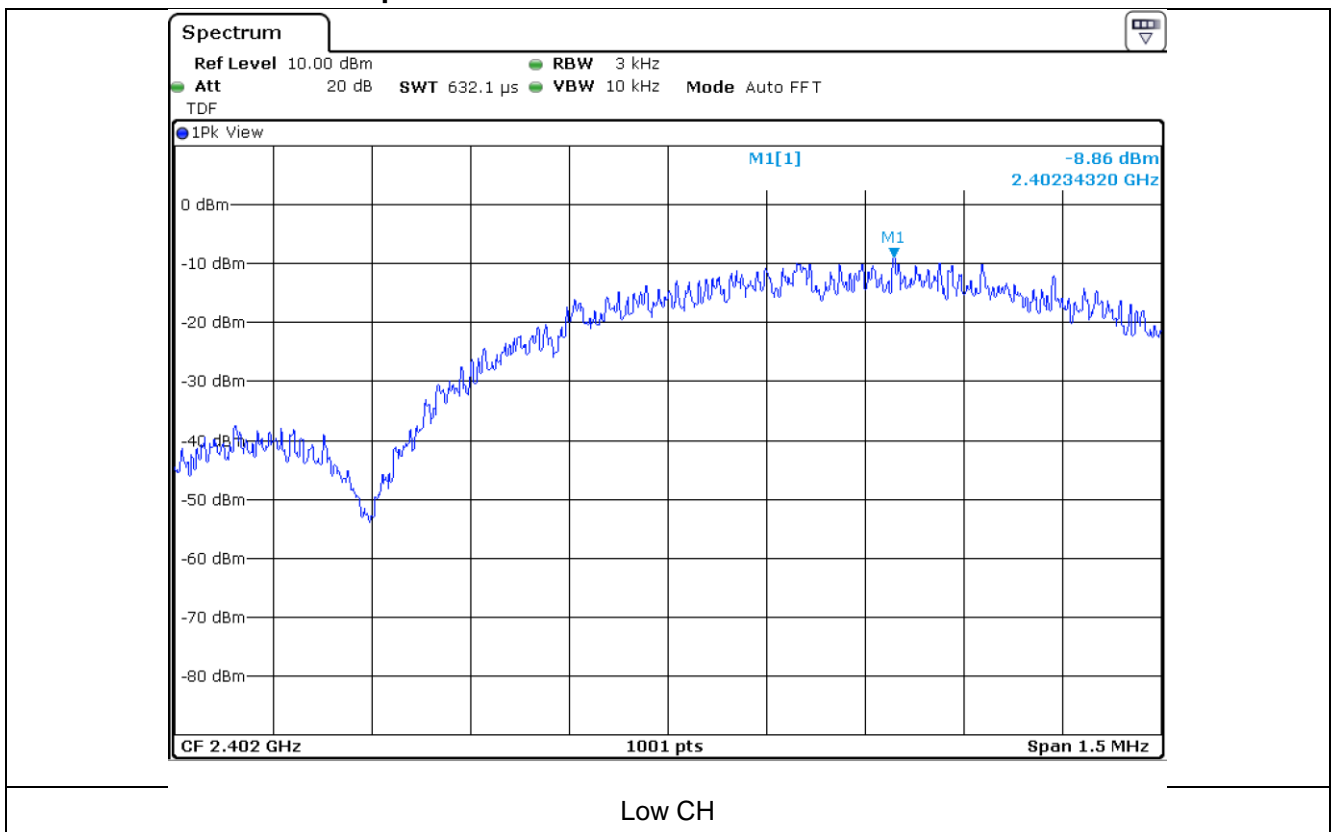
### 7.4 Test data

Test date : 21. Jan. 2022  
 Operating mode : Transmit mode  
 Test Result : Pass

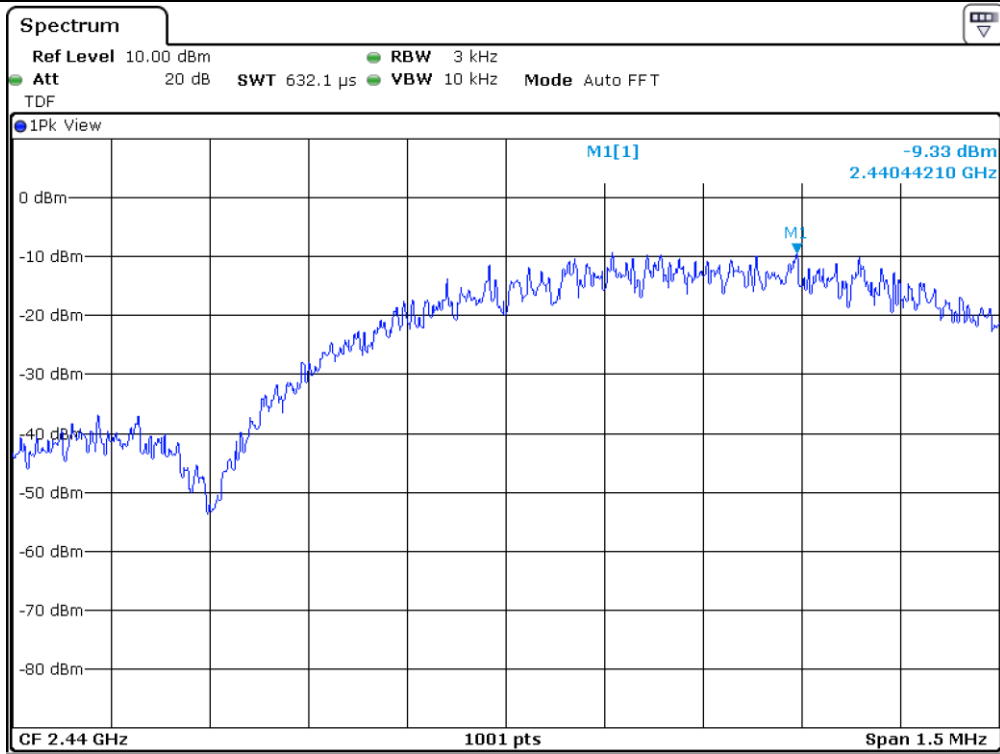
#### 7.4.1 Measured Results

Modulation Type	Channel (Frequency)	Highest signal level (dBm)	Limit (dBm/3kHz)
Bluetooth LE	0 (2 402 MHz)	-8.86	8
	19 (2 440 MHz)	-9.33	
	39 (2 480 MHz)	-8.54	

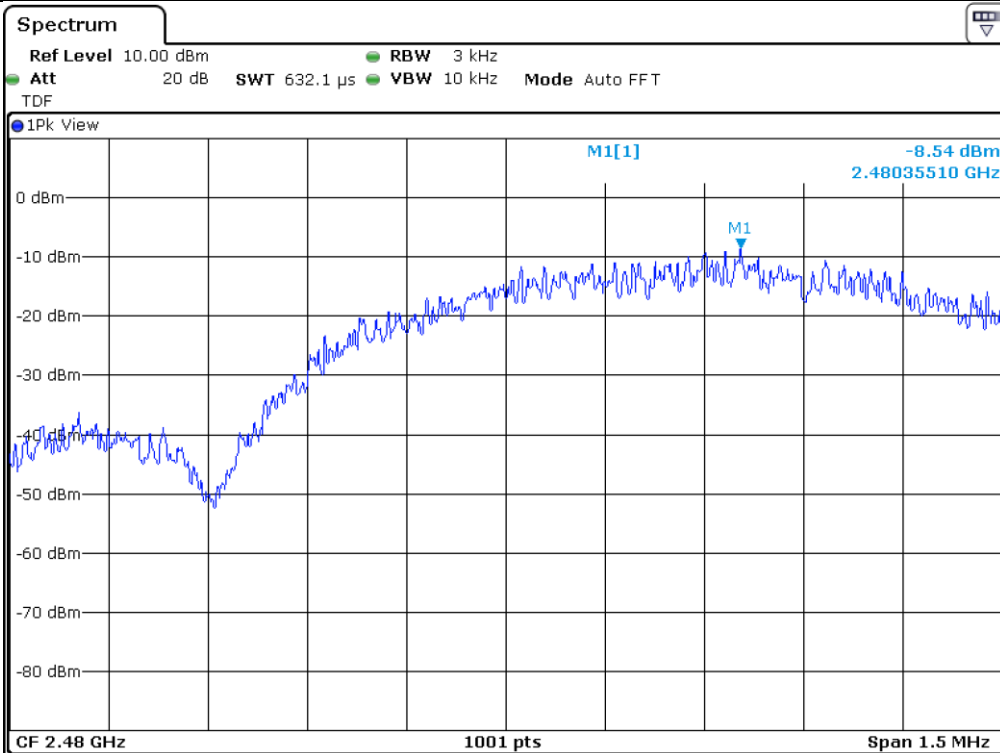
#### 7.4.2 Measured Graph







Mid CH



High CH



## 8. Conducted Spurious Emission

### 8.1 Operating environment

Temperature : 23 °C

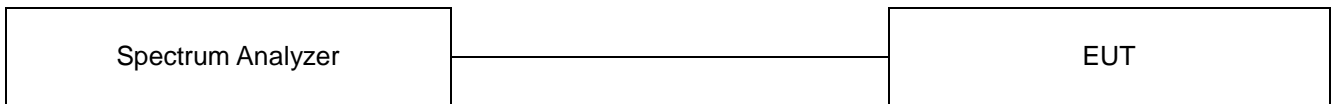
Relative humidity : 47 %

### 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 kHz, and peak detection was used.



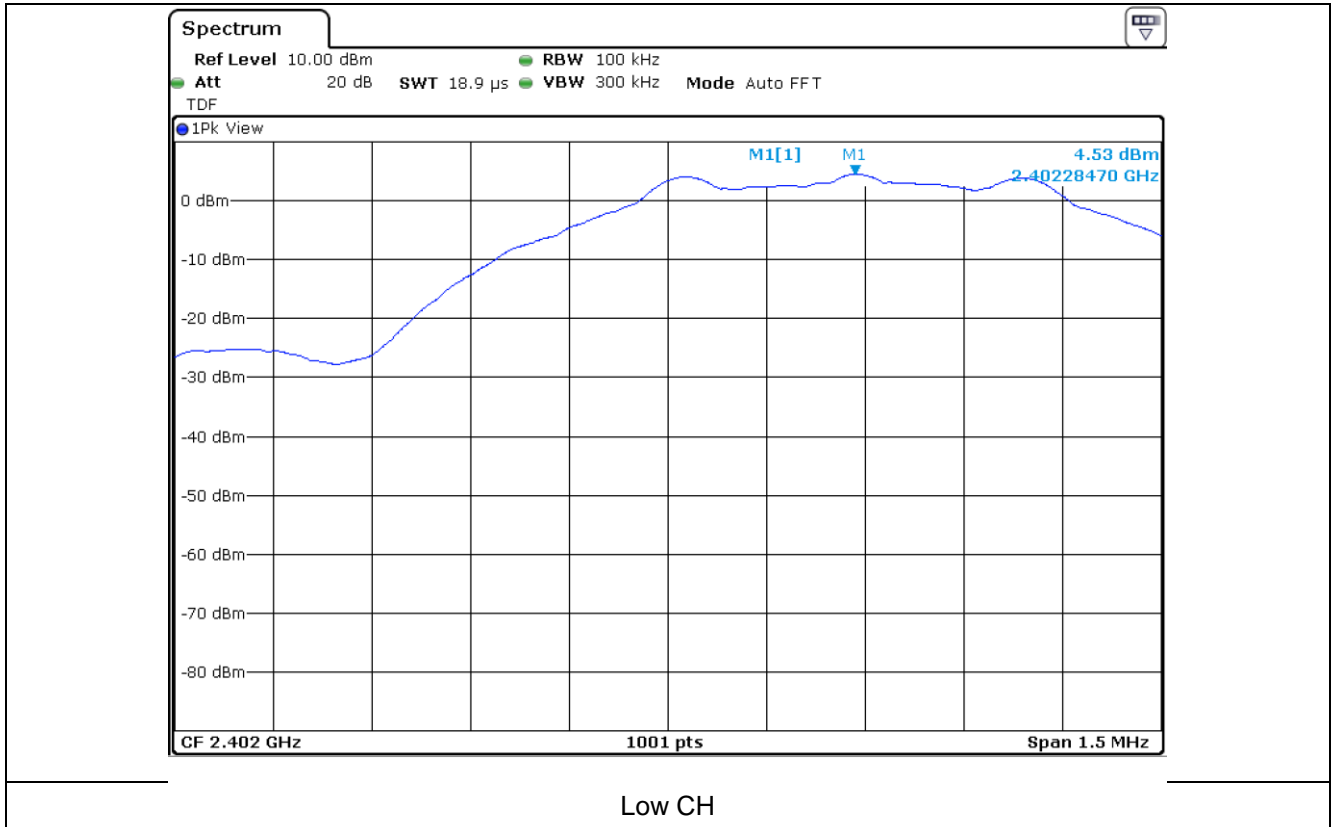


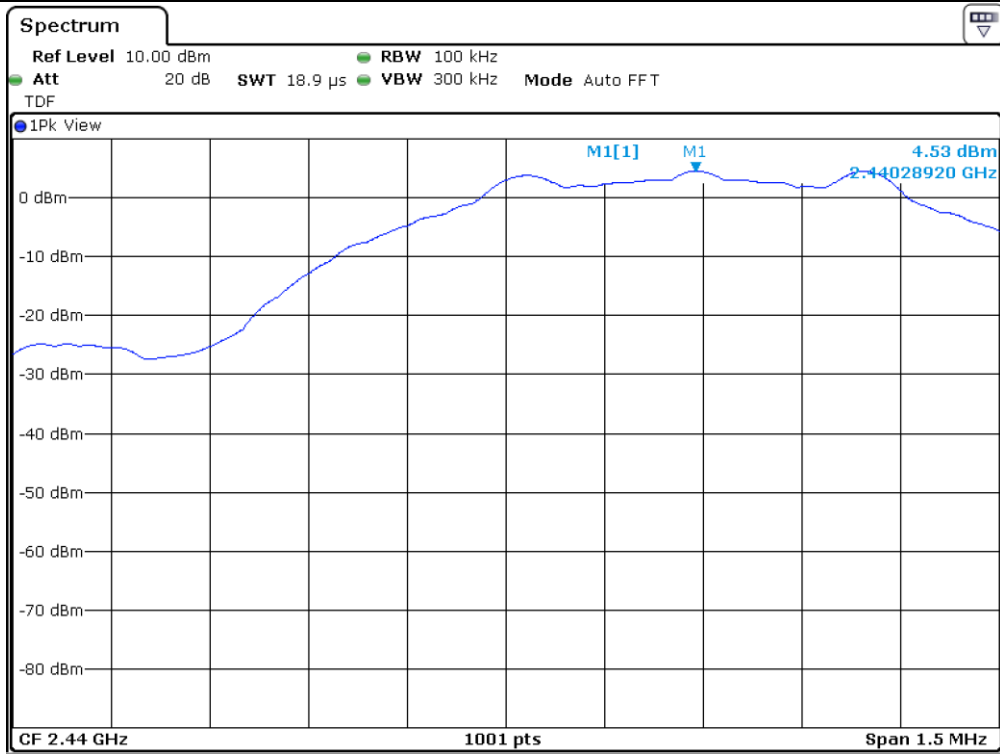
## 8.4 Test data

Test date : 21. Jan. 2022  
Operating mode : Transmit mode  
Test Result : Pass

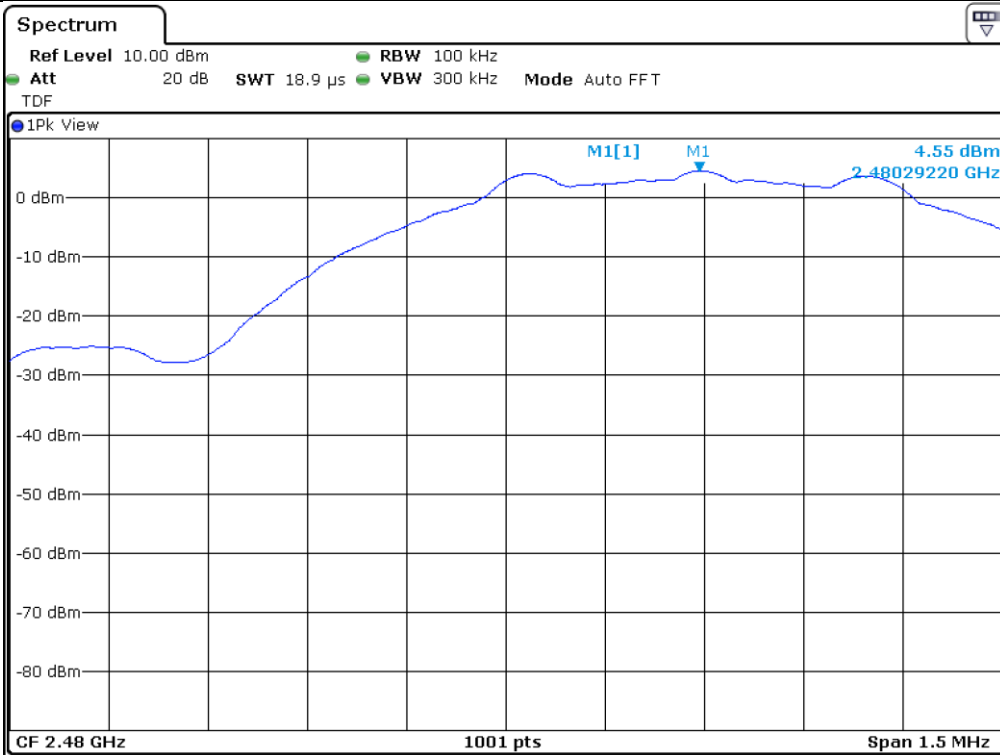
### 8.4.1 Measured Results

#### 8.4.1.1 Signal level (dB m)





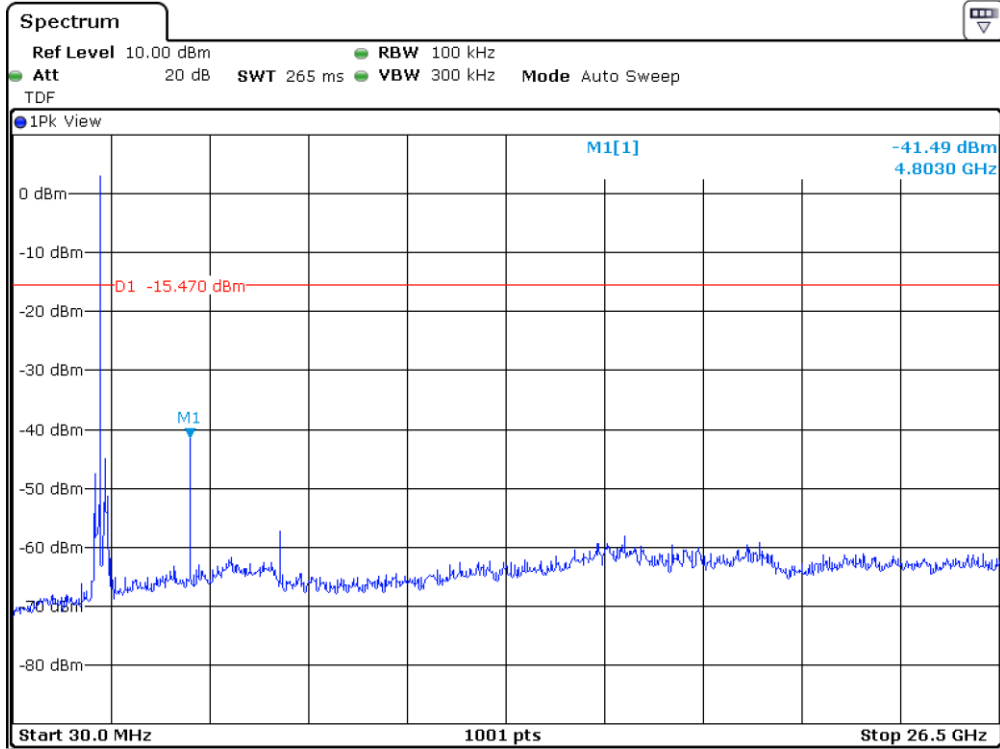
Mid CH



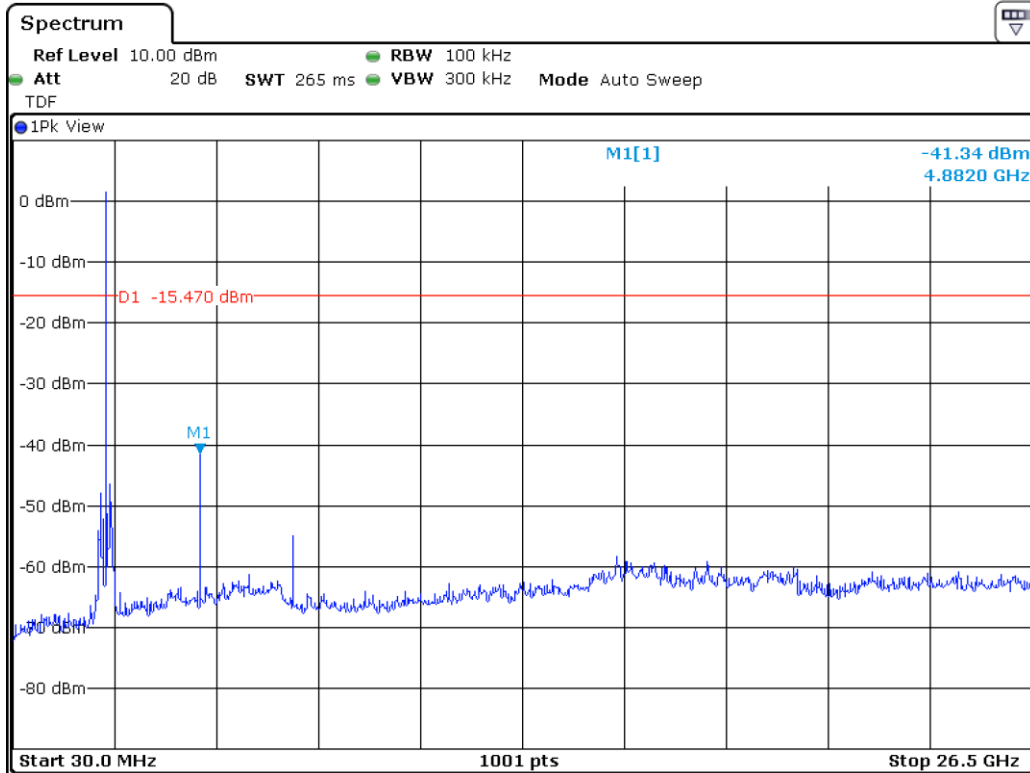
High CH



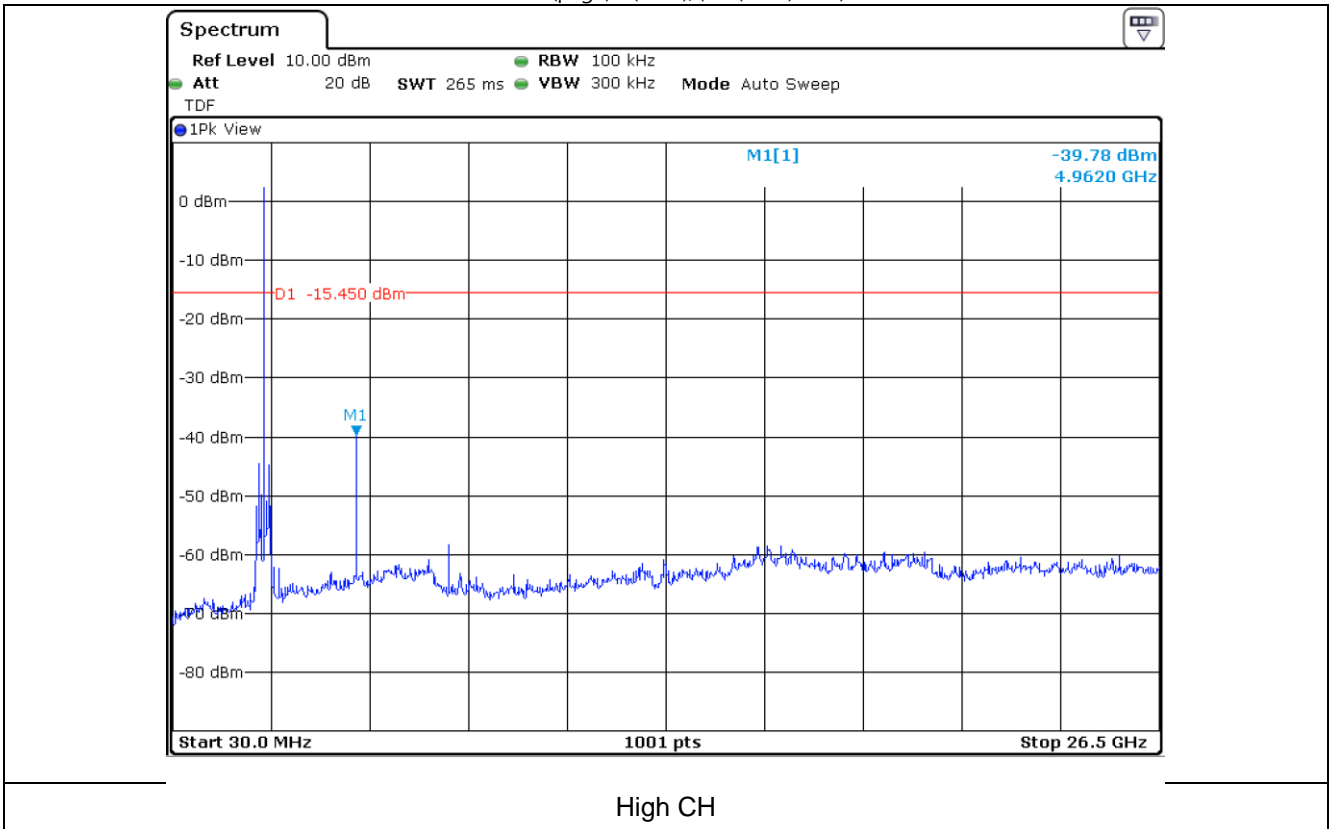
### 8.4.1.2 Unwanted Emissions In Non-Restricted Frequency Bands



Low CH

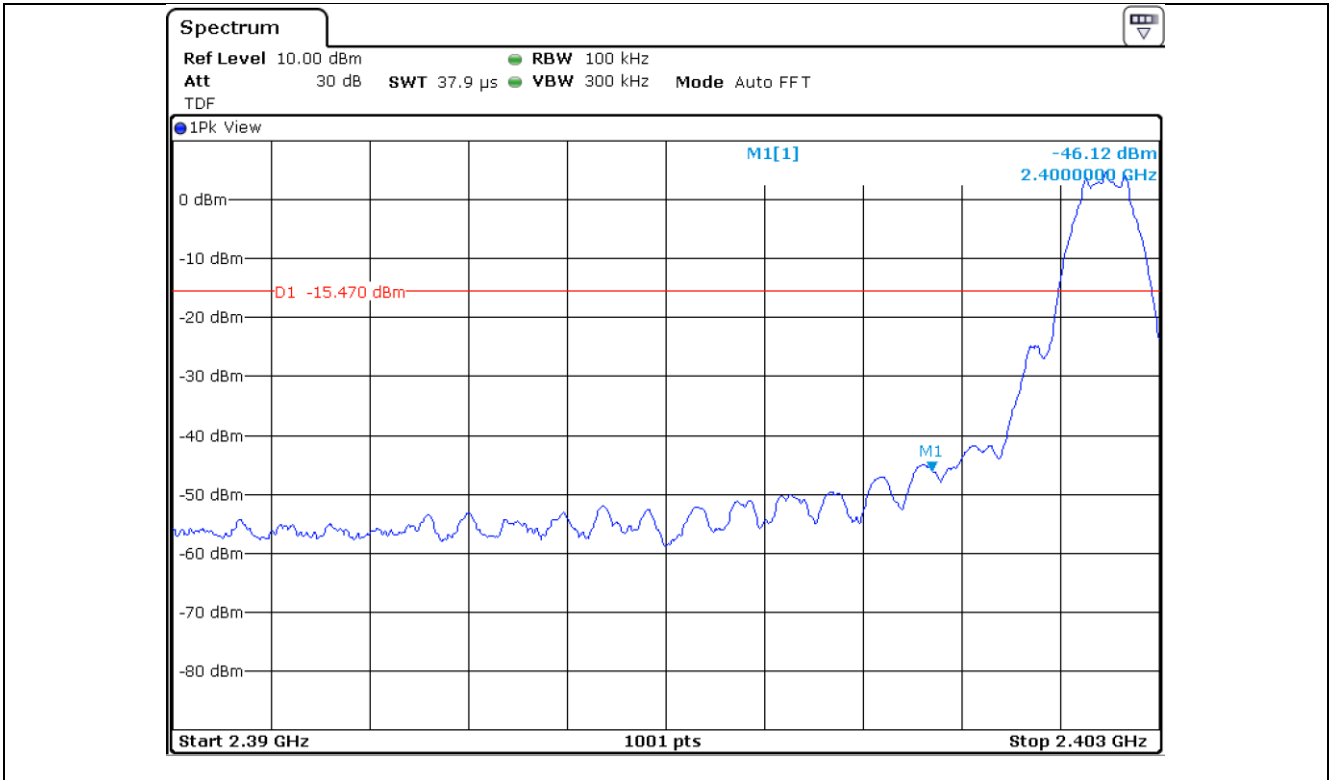


Mid CH

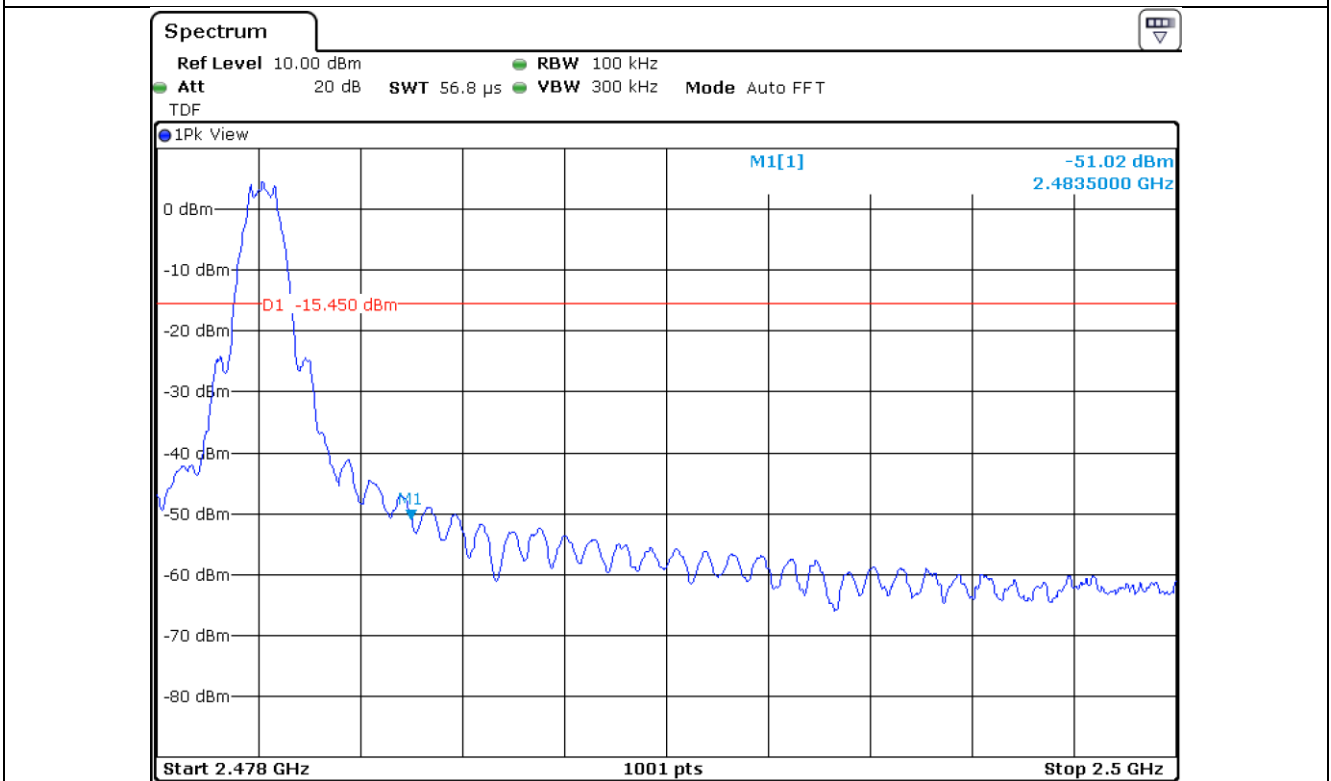




### 8.4.1.3 Band Edge



Low CH



High CH

## 9. Radiated Spurious Emission

### 9.1 Operating environment

Temperature : 24 °C  
Relative humidity : 48 %

### 9.2 Measurement method

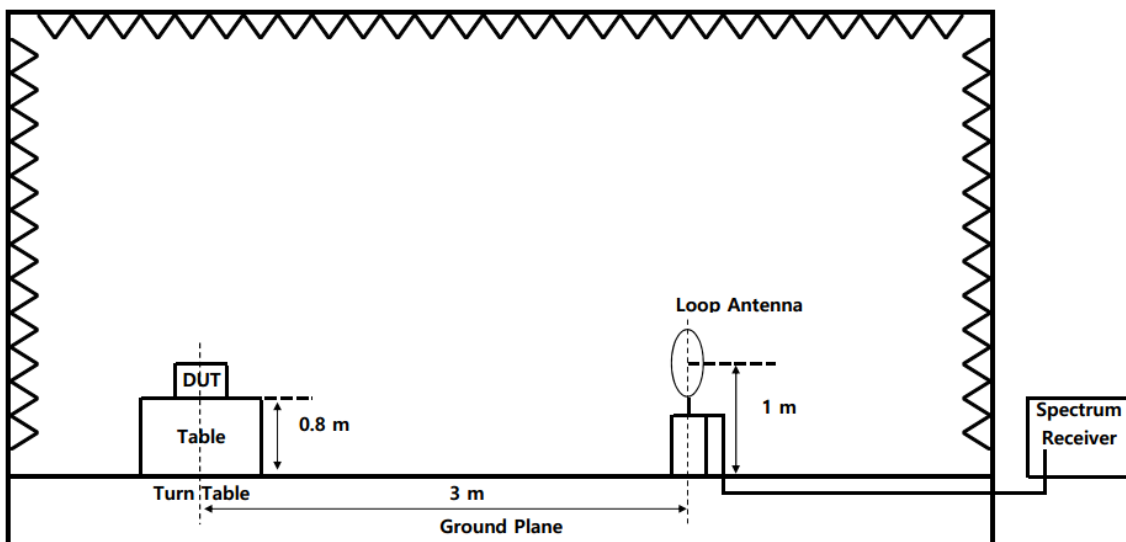
Standard : §15.247 (d), §15.209, §15.205

### 9.3 Test setup

The radiated emissions measurements were performed on the 3 m, Semi-Anechoic 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.

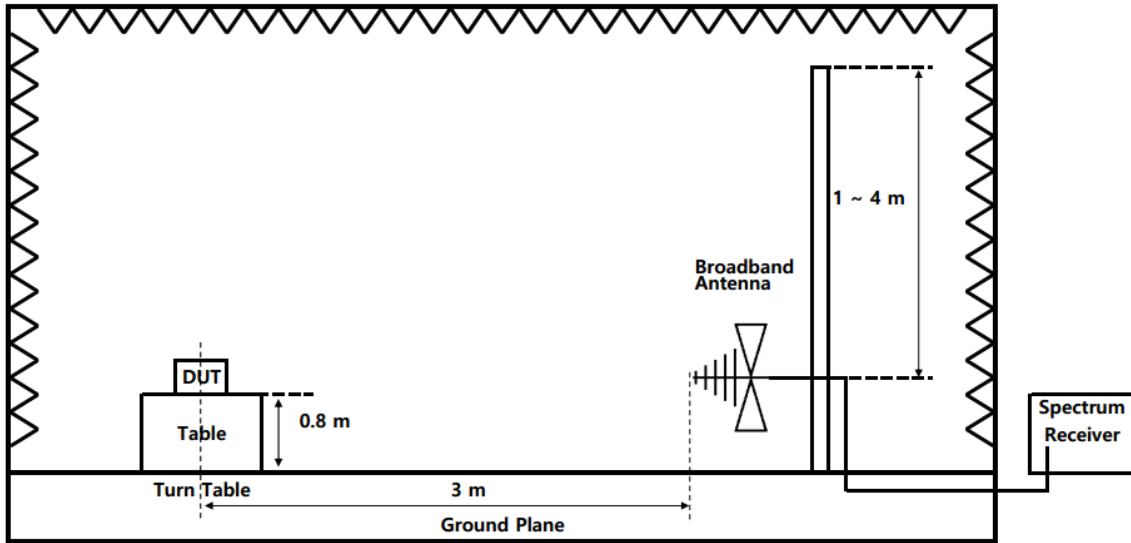
#### 9.3.1 Below 30 MHz



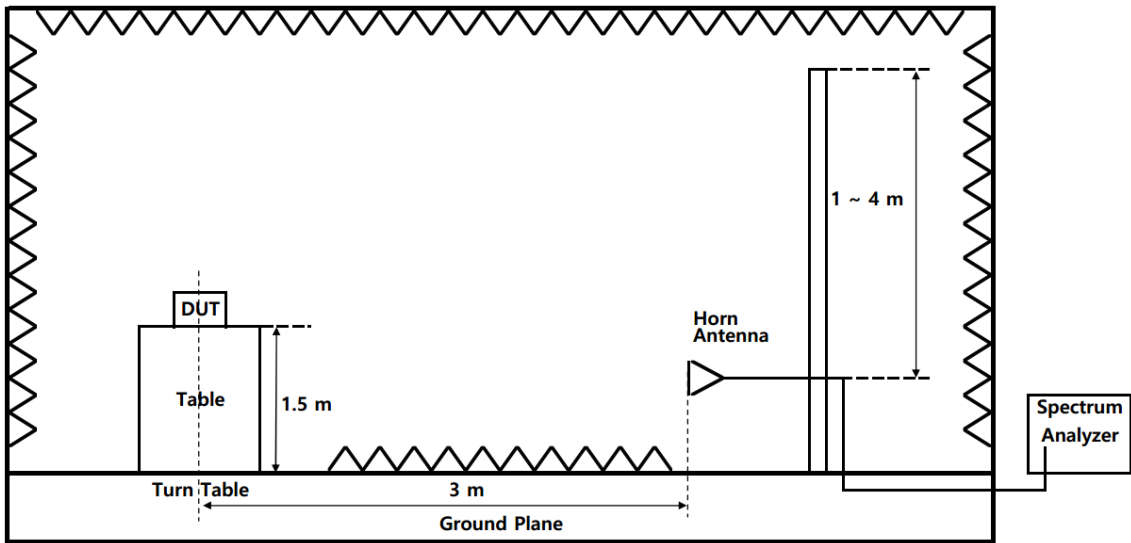




### 9.3.2 30 MHz to 1 GHz



### 9.3.3 Above 1 GHz





## 9.4 Test data

Test date : 24. Jan. 2022  
 Operating mode : Transmit mode  
 Test Result : Pass

### 9.4.1 Test data for Restricted band

Frequency (MHz)	Reading (dB $\mu$ V)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
Low CH							
2 351.80	47.49	Peak	H	-13.20	34.29	73.98	39.69
	34.34	Average	H		21.14	53.98	32.84
High CH							
2 485.48	74.05	Peak	H	-12.80	61.25	73.98	12.73
	41.90	Average	H		29.1	53.98	24.88

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

### 9.4.2 Test data for Spurious & Harmonic

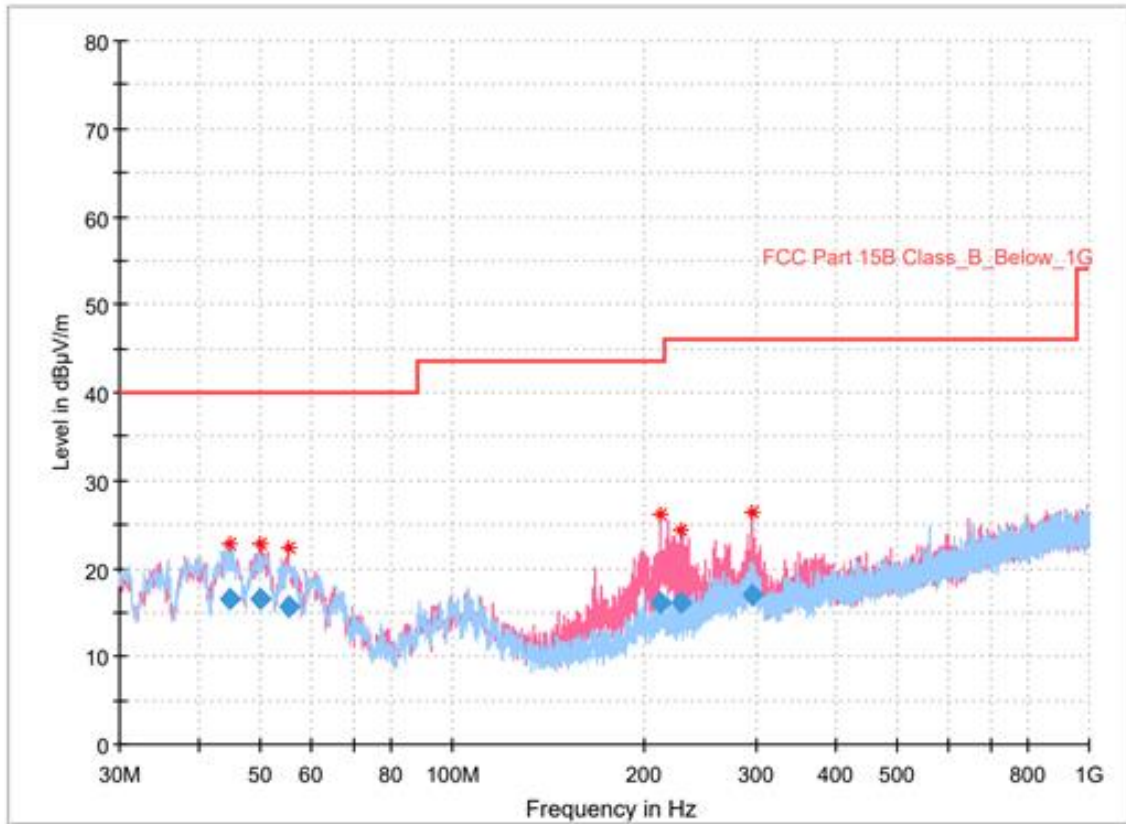
#### 9.4.2.1 Measurement Results for below 30 MHz

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



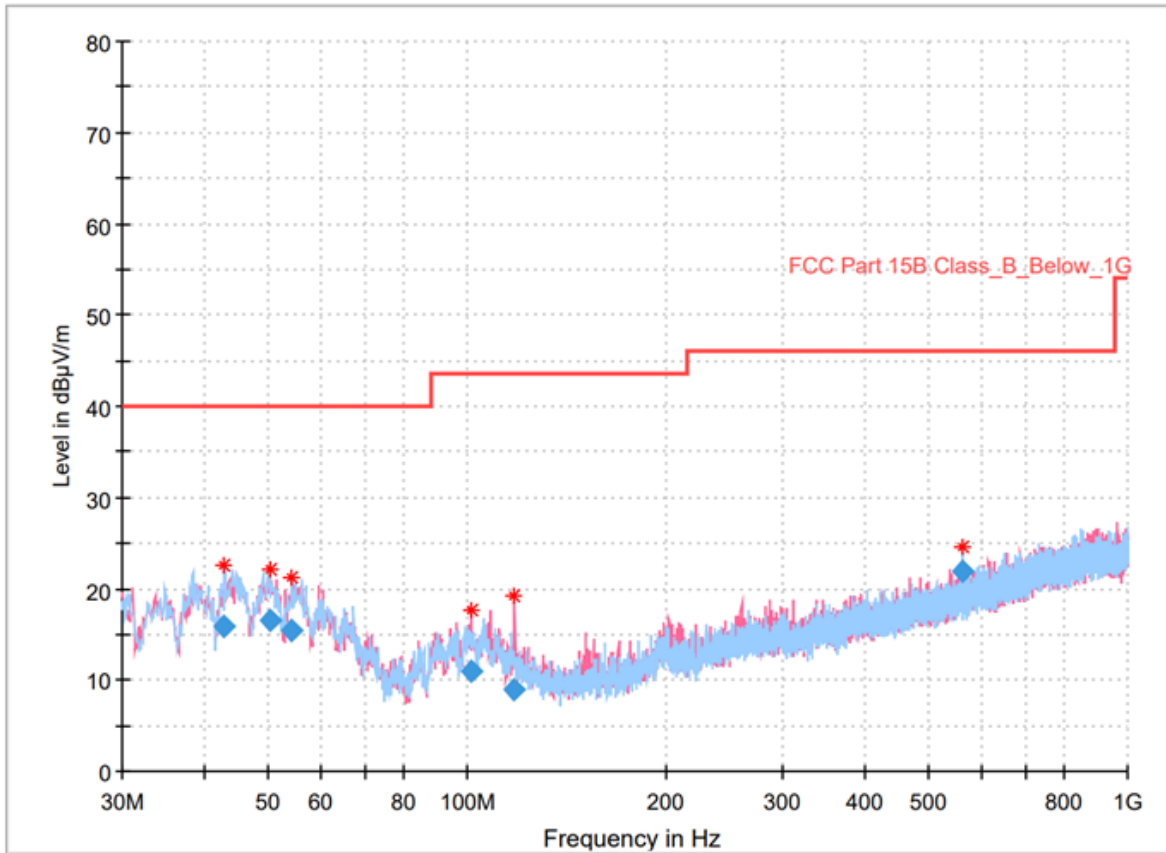
9.4.2.2 Measurement Results for below 1 GHz



**Final Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.841000	16.57	40.00	23.43	1000.0	120.000	199.9	H	276.0	-19.2
49.788000	16.44	40.00	23.56	1000.0	120.000	300.0	V	10.0	-18.9
55.317000	15.72	40.00	24.28	1000.0	120.000	400.0	V	0.0	-19.3
211.681000	16.12	43.50	27.38	1000.0	120.000	99.8	V	205.0	-21.5
228.462000	16.10	46.00	29.90	1000.0	120.000	99.8	V	259.0	-20.4
296.750000	16.97	46.00	29.03	1000.0	120.000	99.8	V	301.0	-17.9

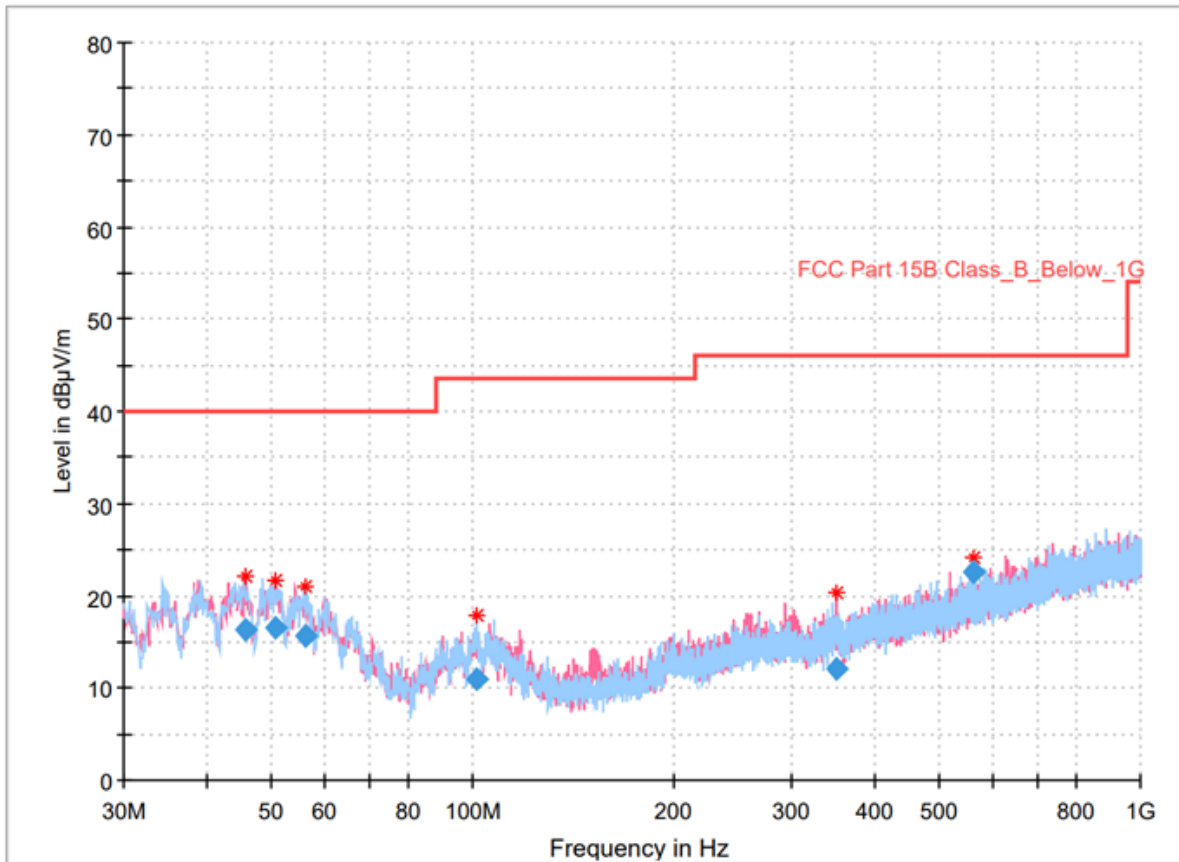
Low CH



### Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
42.901000	15.94	40.00	24.06	1000.0	120.000	100.0	H	168.0	-19.4
50.273000	16.51	40.00	23.49	1000.0	120.000	200.0	H	210.0	-18.8
54.250000	15.37	40.00	24.63	1000.0	120.000	100.0	V	116.0	-19.4
101.586000	10.89	43.50	32.61	1000.0	120.000	100.0	V	339.0	-20.7
117.979000	8.90	43.50	34.60	1000.0	120.000	100.0	V	45.0	-22.9
562.530000	21.99	46.00	24.01	1000.0	120.000	200.0	H	0.0	-12.1

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)
45.811000	16.23	40.00	23.77	1000.0	120.000	199.9	V	122.0	-19.1
50.855000	16.45	40.00	23.55	1000.0	120.000	199.9	V	285.0	-18.7
55.996000	15.66	40.00	24.34	1000.0	120.000	199.9	H	5.0	-19.3
101.489000	10.91	43.50	32.59	1000.0	120.000	199.9	H	124.0	-20.7
350.003000	12.15	46.00	33.85	1000.0	120.000	99.9	V	110.0	-16.3
562.530000	22.50	46.00	23.50	1000.0	120.000	199.9	H	259.0	-12.1

High CH



**9.4.2.3 Measurement Results for Above 1 GHz**

Frequency (MHz)	Reading (dB $\mu$ V)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
Low CH							
4 803.38	63.16	Peak	V	-5.00	58.16	73.98	15.82
	50.61	Average	V		45.61	53.98	8.37
5 979.90	51.14	Peak	V	-2.60	48.54	73.98	25.44
	30.09	Average	V		27.49	53.98	26.49
7 206.41	53.59	Peak	V	-2.00	51.59	73.98	22.39
	40.55	Average	V		38.55	53.98	15.43
Mid CH							
4 880.56	63.48	Peak	V	-4.60	58.88	73.98	15.10
	51.00	Average	V		46.40	53.98	7.58
7 319.17	58.21	Peak	H	-1.70	56.51	73.98	17.47
	44.67	Average	H		42.97	53.98	11.01
High CH							
4 959.95	60.45	Peak	V	-4.50	55.95	73.98	18.03
	49.51	Average	V		45.01	53.98	8.97
7 439.65	57.36	Peak	H	-1.40	55.96	73.98	18.02
	44.93	Average	H		43.53	53.98	10.45

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

**- END OF REPORT.**