시 험 성 적 서
TEST REPORT

성적서 번호 Report No.		ICRT-TR-E191912-0A
신청자 Client	기관명 Name	SENA TECHNOLOGIES.Inc
	주 소 Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea
시험대상품목 Sample description		50R
모델명 Type designation		SP76
정 격 Ratings		DC 3.7 V
시험기간 Date of test		08. Oct. 2019 ~ 21. Oct. 2019
시험방법/항목 Test Method/Item		FCC Part 15 Subpart C §15.247 / IC RSS-247
시험결과 Test Results		Refer to 3. Test Summary
확 인 Affirmation	작성자 Tested by 성 명 Name Yeong-Hwan, Hong (Signature)	기술책임자 Technical Manager 성 명 Name Jun-Hui, Lee (Signature)

2019. 10. 22

주식회사 아이씨알 대표이사

The head of INTERNATIONAL CERTIFICATION REGISTRAR

Contents

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
ICRT-TR-E191912-0A	22-Oct-2019	Initial Issue	All

1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant information

Applicant	SENA TECHNOLOGIES.Inc
Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea
Contact Person	Seunghyun Kim
Telephone No.	+82-2-573-7772
Fax No.	+82-2-573-7710
E-mail	shkim77@sena.com

1.2 Manufacturer Information

Manufacturer	SENA TECHNOLOGIES.Inc
Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, 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, 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	50R	
Brand Name	-	
Model Name	SP76	
Additional Model Name	-	
FCC ID / ISED number	S7A-SP76 / 8154A-SP76	
Hardware Version	1.0	
Software Version	Bluetooth LE	2.6.0(CSR Bluetest3)
	Mesh	EUT manual test
Power Supply	DC 3.7 V	
EUT Firmware Version	Bluetooth LE	1.0
	Mesh	1.0
Target Power	Bluetooth LE	4.0
	Mesh	15.0
EUT Serial Number	Test 2	

2.2 Additional Information

Equipment Class	DTS-Digital Transmission System	
Device Type	Stand-alone	
Operating Frequency	Bluetooth LE	2 402 ㎒ ~ 2 480 ㎒
	Mesh	2 405 ㎒ ~ 2 475 ㎒
RF Output Power	Bluetooth LE	10.13 ㏈m
	Mesh	17.81 ㏈m
Number of Channel	Bluetooth LE	40
	Mesh	16
Modulation Type	GFSK	
Antenna Type	Bluetooth LE	Chip Antenna
	Mesh	PCB Pattern Antenna
Antenna Gain	Bluetooth LE	0.93 ㏈i
	Mesh	0.46 ㏈i
Antenna Operating Mode	Dual antenna equipment with each 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

3. Test Summary

3.1 Test standards and results

FCC Part 15 Subpart C & RSS-247 Issue 2 & RSS-GEN Issue 5				
Clause		Test items	Applied	Results
§15.247 (a) (2)	RSS-247 5.2(a) RSS-GEN 6.7	6 dB Bandwidth & 99 % Bandwidth	☒	PASS
§15.247 (b) (3)	RSS-247 5.4(d)	Maximum Conducted Output Power & e.i.r.p.	☒	PASS
§15.247 (e)	RSS-247 5.2(b)	Power Spectral Density	☒	PASS
§15.247 (d)	RSS-247 5.5	Conducted Spurious Emission	☒	PASS
§15.247 (d) §15.209 §15.205	RSS-247 5.5 RSS-GEN 8.9 RSS-GEN 8.10	Radiated Spurious Emission	☒	PASS
§15.207	RSS-GEN 8.8	Power Line Conducted Emission	☒	PASS
§15.203	-	Antenna Requirement	☒	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 of Bluetooth LE*** and ***PCB Pattern Antenna of Mesh***.

The directional gain of the Chip antenna is ***0.93 dBi*** and PCB Pattern antenna is ***0.46 dBi***

4. Used equipment on test

	Description	Model Name	Serial Number	Manufacturer	Last Cal. (cycle)
☒	Spectrum analyzer	FSW85	100864	Rohde & Schwarz	2019. 03. 04 (1Y)
☐	Spectrum analyzer	FSV40	101455	Rohde & Schwarz	2019 .06. 27 (1Y)
☒	Signal Generator	SMB100A	180607	Rohde & Schwarz	2019. 03. 04 (1Y)
☒	Wideband Power Sensor	NRP-Z81	103673	Rohde & Schwarz	2019. 03. 05 (1Y)
☐	Open Switch and Control Platform	OSP150	101000	Rohde & Schwarz	2019. 03. 05 (1Y)
☐	Environmental Test Chamber	MHK-408NKDA	1060908	TERCHY	2019. 03. 04 (1Y)
☒	DC Power Supply	XDL 35-5P	J00385373	Sorensen	2019. 03. 05 (1Y)
☐	DC Power Supply	6603D	672483	Topward	2019. 03. 05 (1Y)
☒	Loop Antenna	HFH2-Z2	100506	Rohde & Schwarz	2019. 06. 27 (2Y)
☒	TRILOG BROADBAND ANTENNA	VULB9162	120	SCHWARZBECK	2018. 11. 23 (2Y)
☒	RF Pre Amplifier	SCU08	100747	Rohde & Schwarz	2019. 04. 17 (1Y)
☒	DOUBLE-RIDGE WAVEGUIDE HORN ANTENNA	HF907	102556	Rohde & Schwarz	2019. 08. 19 (2Y)
☒	RF Pre Amplifier	SCU18	102342	Rohde & Schwarz	2019. 04. 17 (1Y)
☒	Horn Antenna	LB-42-10-C-KF	J202024625	AINFO Inc.	2018. 04. 23 (2Y)
☒	RF Pre Amplifier	AMF-4F-18265-35-8P-1	771846	MITEQ	2019. 03. 04 (1Y)
☐	Horn Antenna	LB-28-10-C-KF	J202024627	AINFO Inc.	2018. 04. 23 (2Y)
☐	RF Pre Amplifier	AMF-4D-260400-45-6P	779919	MITEQ	2019. 03. 04 (1Y)
☒	EMI Test Receiver	ESR26	101461	Rohde & Schwarz	2019. 04. 17 (1Y)
☒	EMI Test Receiver	ESR26	101461	Rohde & Schwarz	2019. 04. 17 (1Y)
☒	LISN	ENV216	102194	Rohde & Schwarz	2020. 04. 16 (1Y)
☒	EMI Test Receiver	ESR3	102119	Rohde & Schwarz	2020. 04. 16(1Y)
☒	ATTENUTOR	WA76-20-1313	1633	WEINSCHEL	2019. 03. 04 (1Y)
☒	RF Cable	MULTIFLEX_86	-	HUBER & SUHNER	-
☒	Chamber Cable	mwx221	-	Junkosha	-

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

5. 6 dB Bandwidth & 99 % Bandwidth

5.1 Operating environment

Temperature : 22 ℃

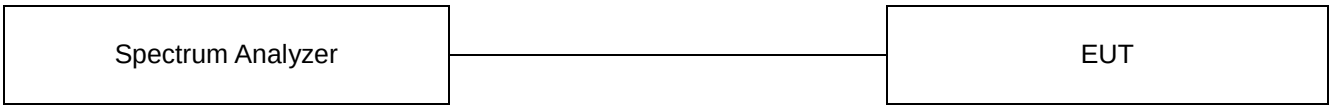
Relative humidity : 46 %

5.2 Measurement method

Standard : §15.247 (a) (2) / RSS-247 (5.2 a) & RSS-Gen (6.7)

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

Test date : 08. Oct. 2019

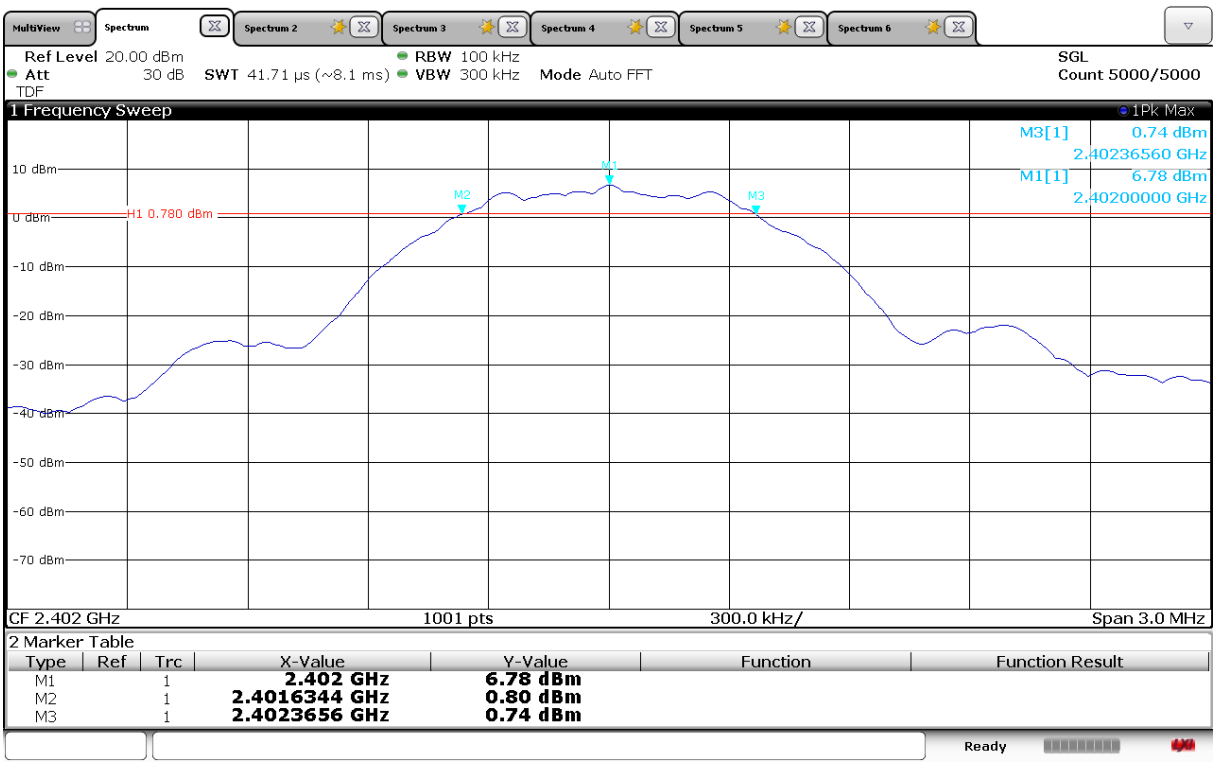
Operating mode : Transmit mode

Test Result : Pass

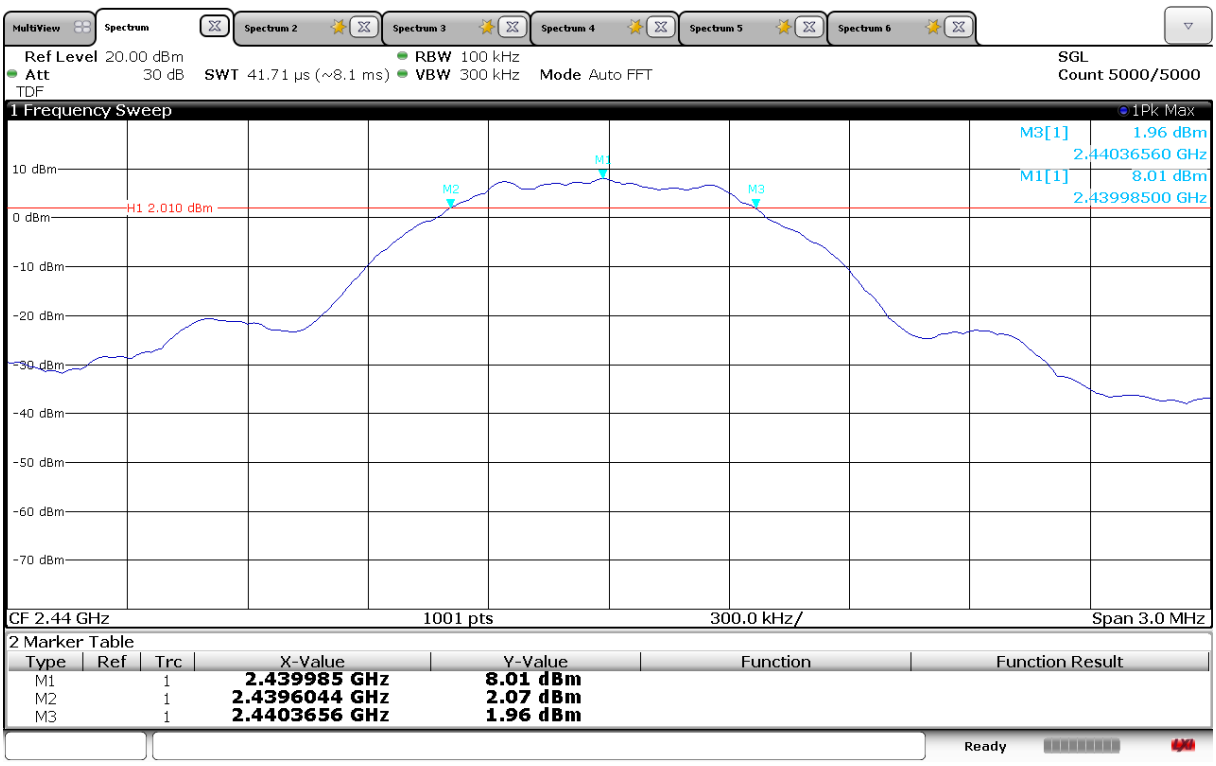
5.4.1 Measured Results

Modulation Type	Channel (Frequency)	6 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)	Limit (kHz)
Bluetooth LE	0 (2 402 MHz)	731.2	1032.9	at least 500
	19 (2 440 MHz)	761.2	1031.6	
	39 (2 480 MHz)	761.2	1036.4	
Mesh	12 (2 405 MHz)	1218.0	2410.9	
	19 (2 445 MHz)	1188.0	2455.9	
	25 (2 475 MHz)	1199.0	2507.8	

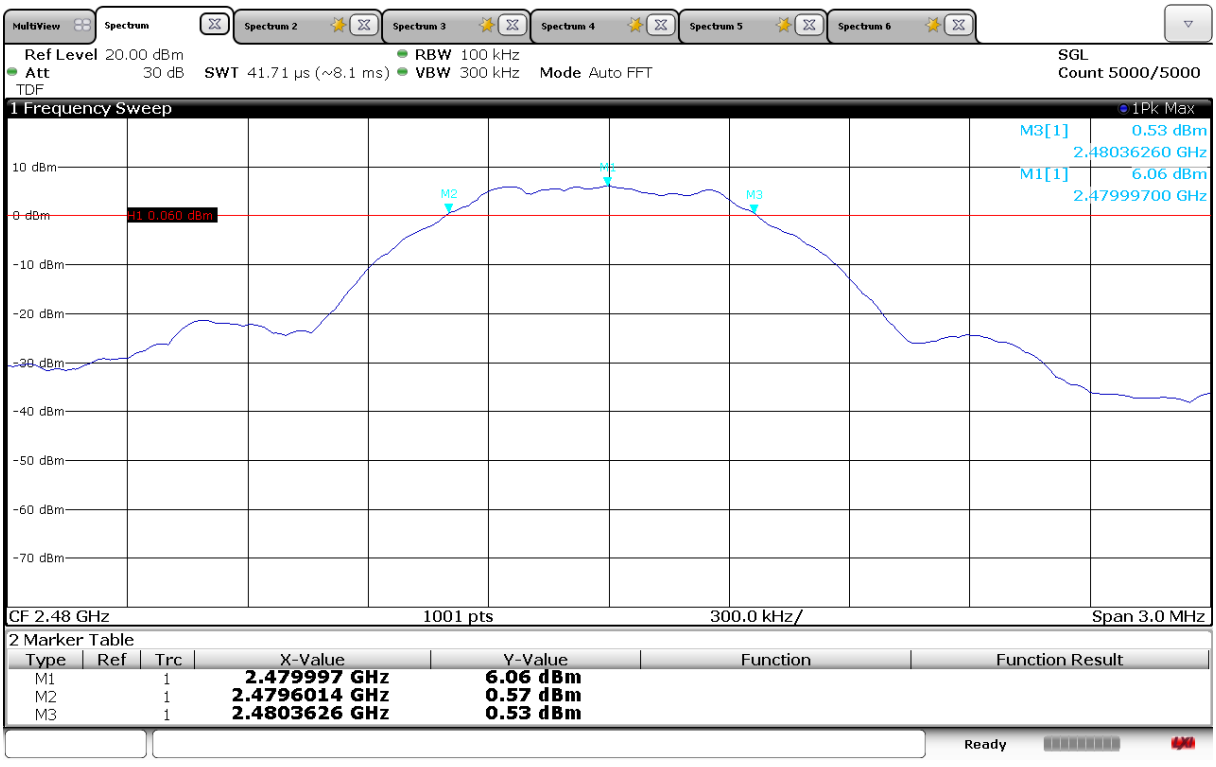
5.4.2 Measured Graph (6 dB Bandwidth)



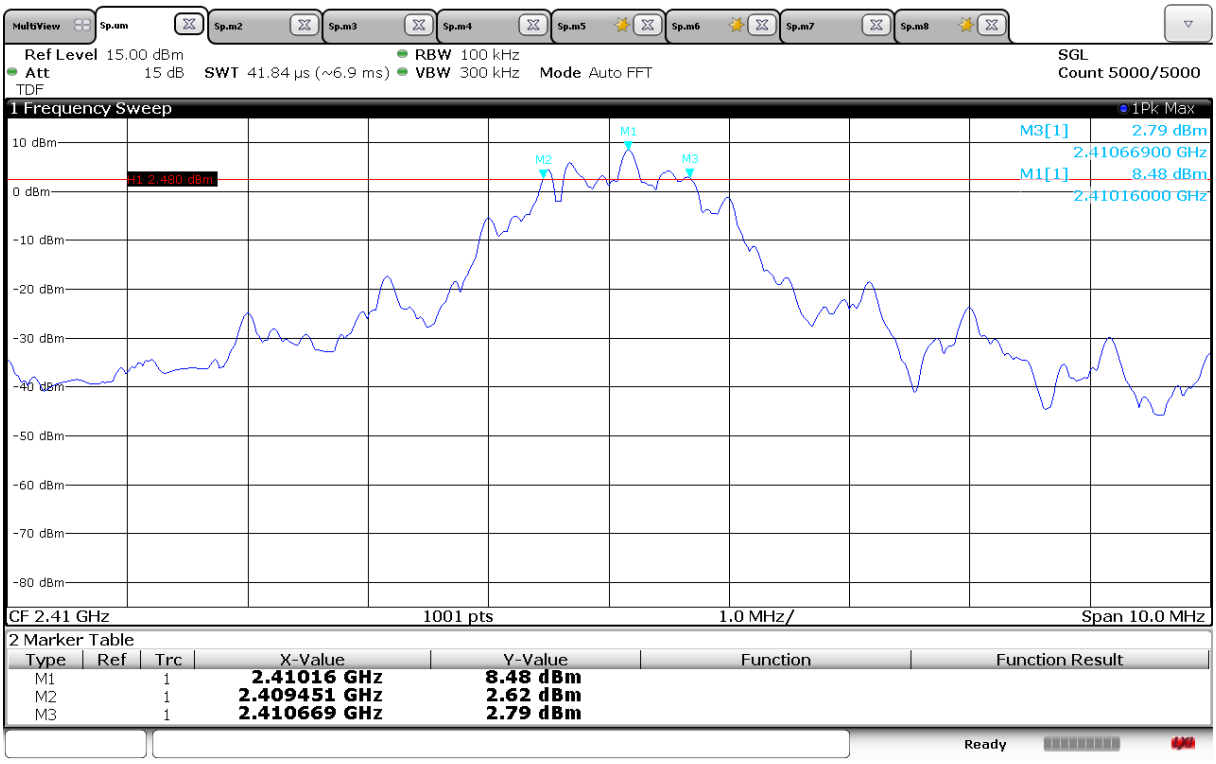
Bluetooth LE_Low CH



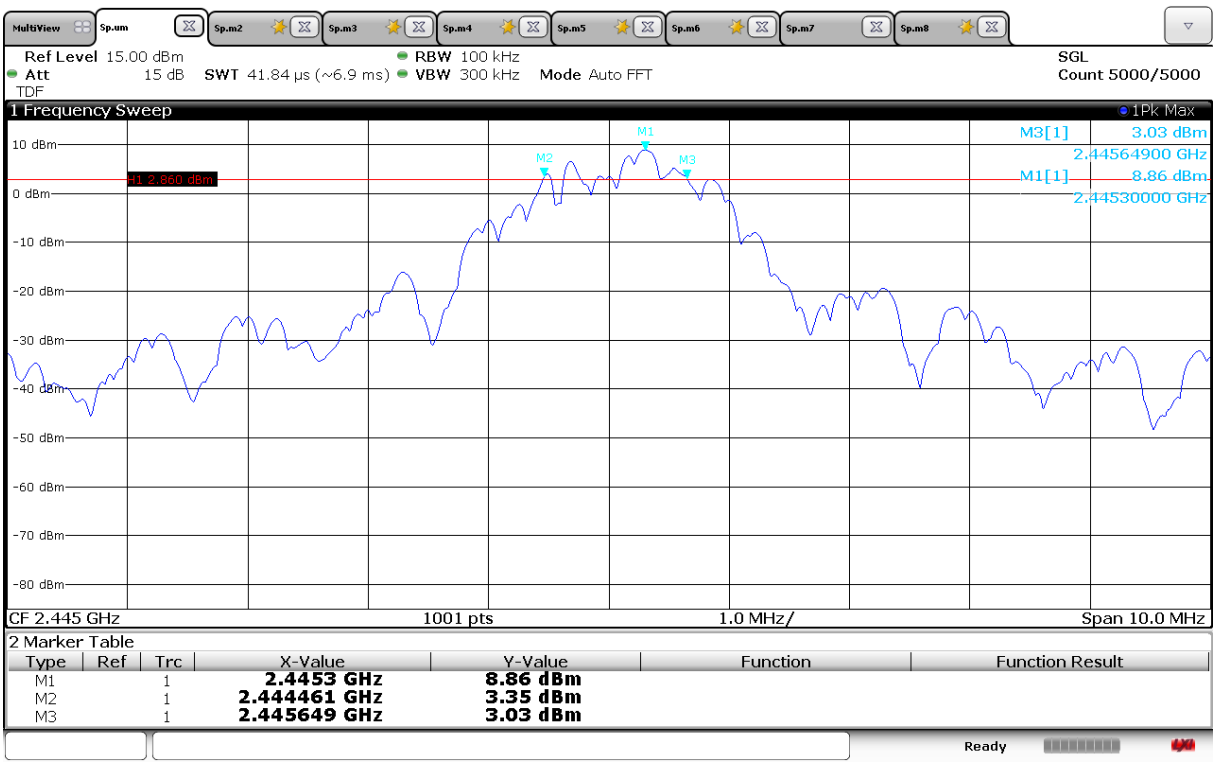
Bluetooth LE_Mid CH



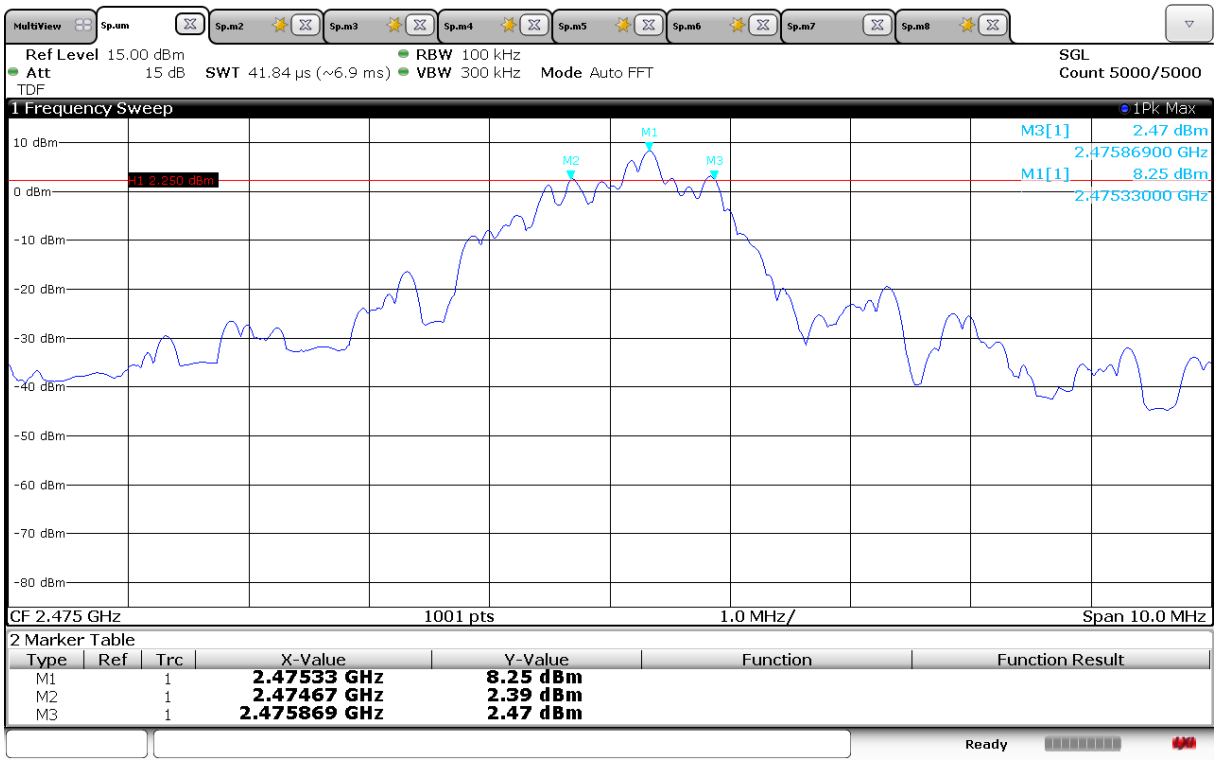
Bluetooth LE_High CH


MultiView
Sp.um
Sp.m2
Sp.m3
Sp.m4
Sp.m5
Sp.m6
Sp.m7
Sp.m8
Ref Level 15.00 dBm
RBW 100 kHz
SGL
Att 15 dB SWT 41.84 µs (~6.9 ms) VBW 300 kHz Mode Auto FFT
Count 5000/5000
TDF
1 Frequency Sweep
1Pk Max
M3[1] 2.79 dBm
2.41066900 GHz
M1[1] 8.48 dBm
2.41016000 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
M2
M3
CF 2.41 GHz
1001 pts
1.0 MHz/
Span 10.0 MHz
2 Marker Table
Type Ref Trc X-Value Y-Value Function Function Result
M1 1 2.41016 GHz 8.48 dBm
M2 1 2.409451 GHz 2.62 dBm
M3 1 2.410669 GHz 2.79 dBm
Ready

Mesh_Low CH

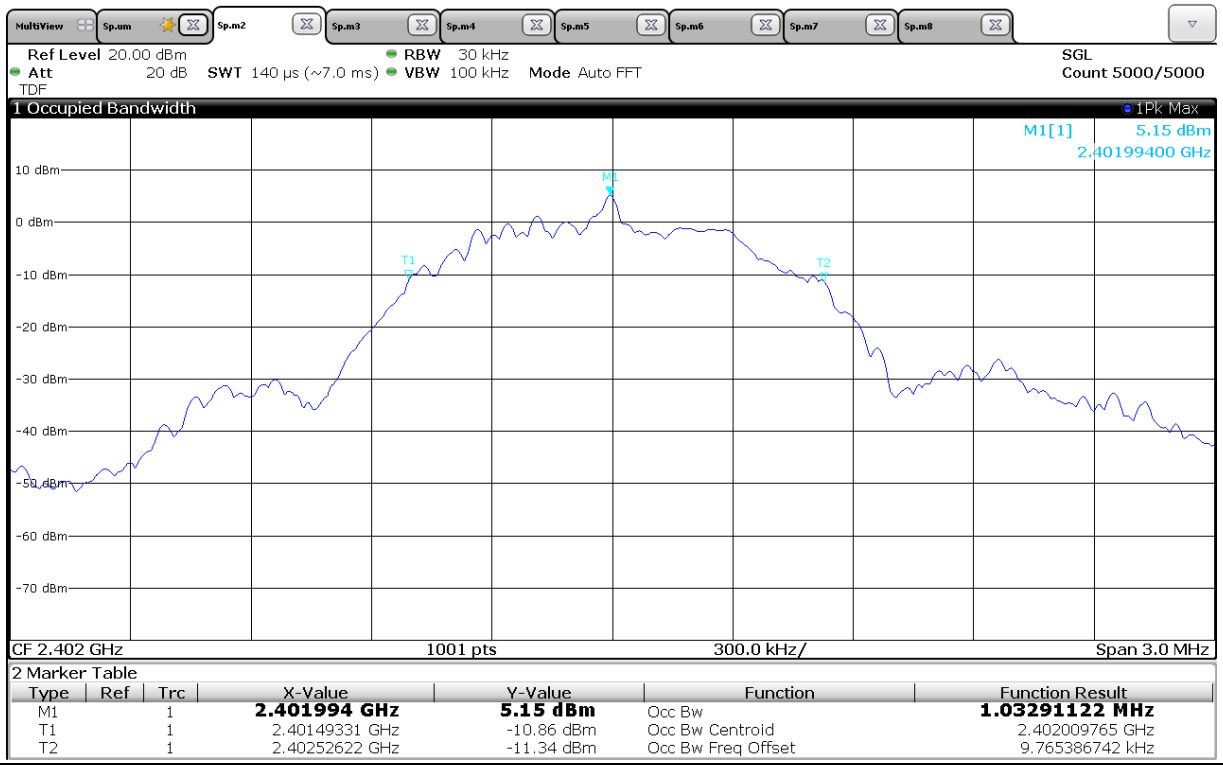


Mesh_Mid CH

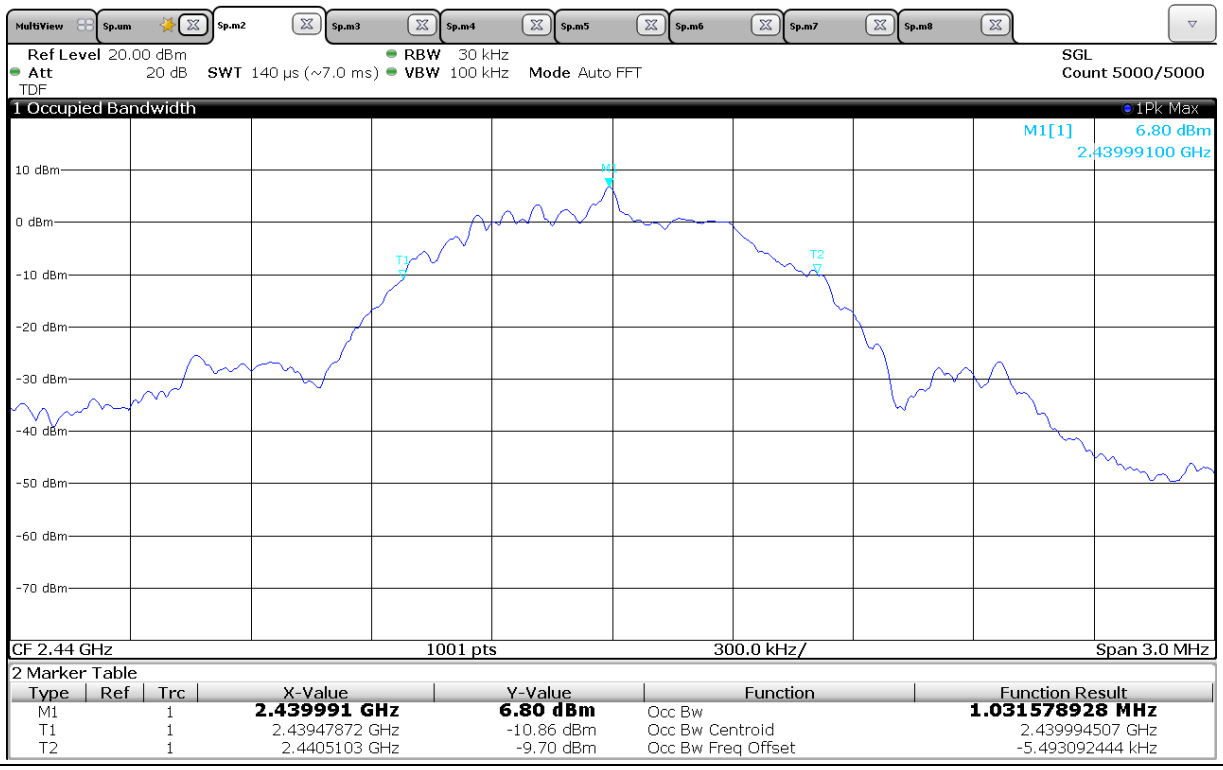


Mesh_High CH

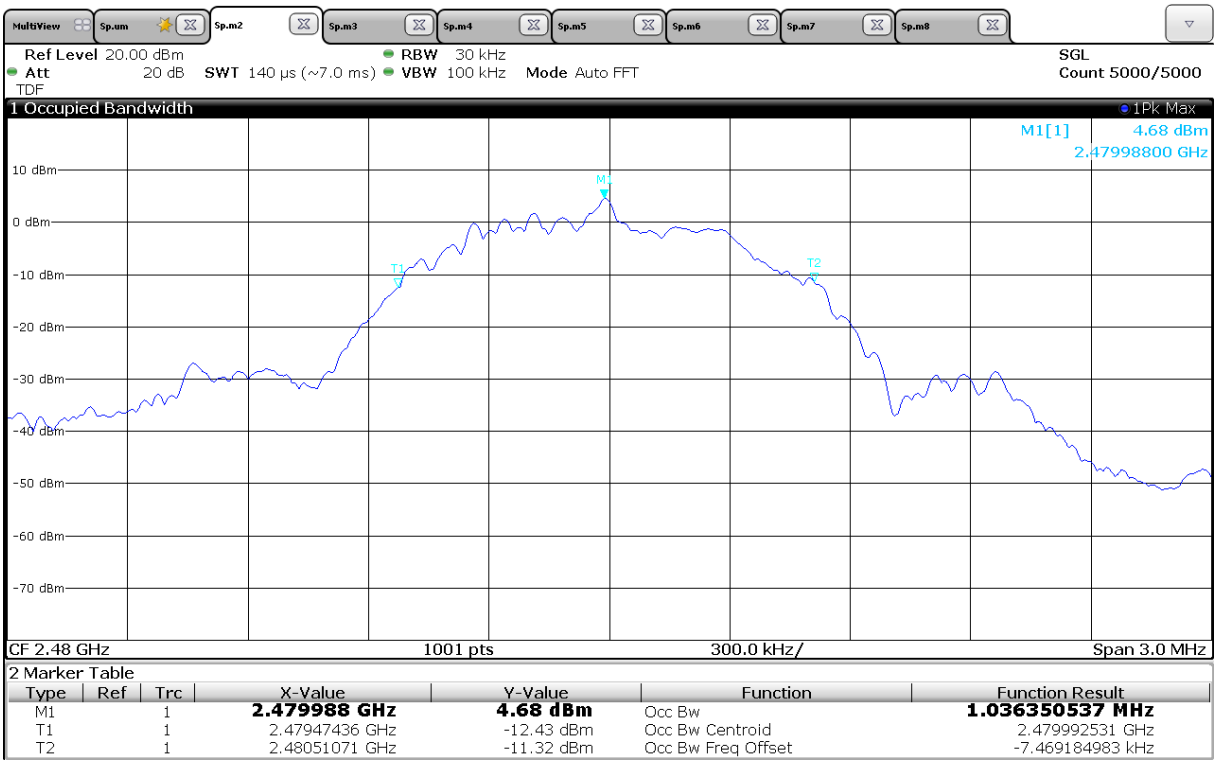
5.4.3 Measured Graph (99 % Bandwidth)



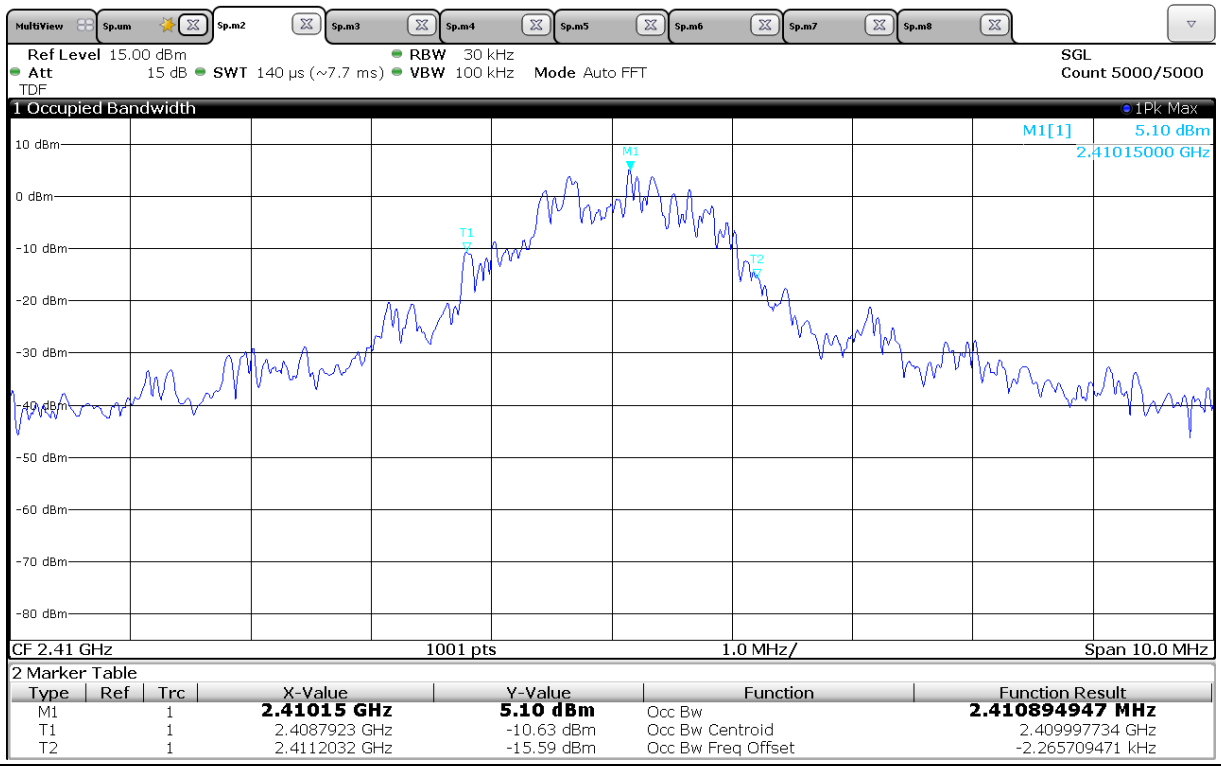
Bluetooth LE_Low CH



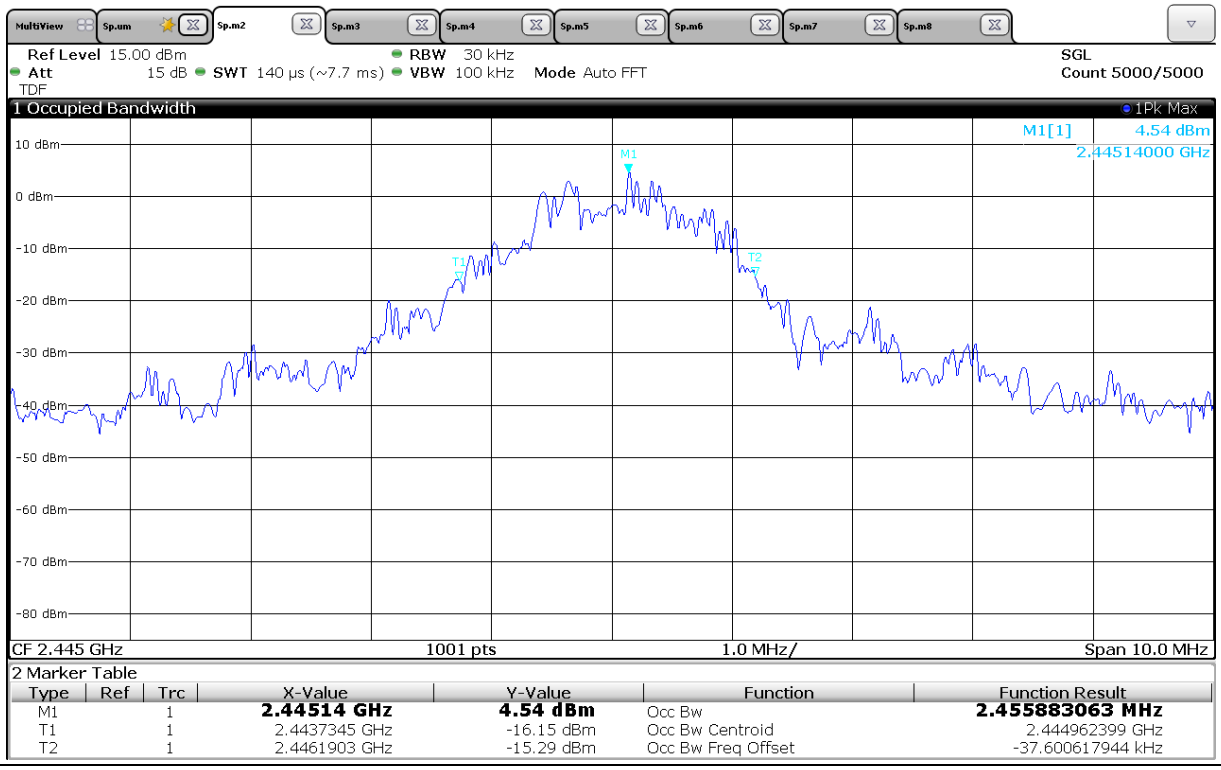
Bluetooth LE_Mid CH



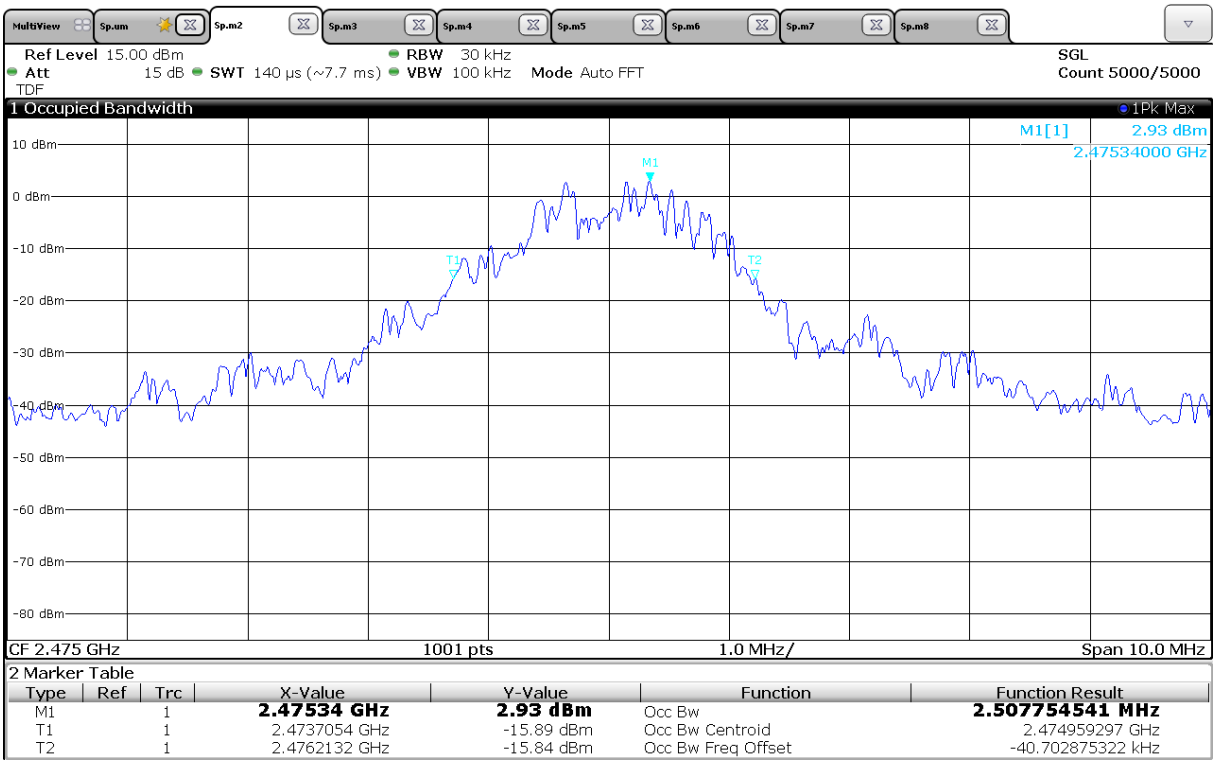
Bluetooth LE_High CH


MultiView
Sp.um
Sp.m2
Sp.m3
Sp.m4
Sp.m5
Sp.m6
Sp.m7
Sp.m8
Ref Level 15.00 dBm
RBW 30 kHz
SGL
Att 15 dB SWT 140 µs (~7.7 ms) VBW 100 kHz Mode Auto FFT
Count 5000/5000
TDF
1 Occupied Bandwidth
1Pk Max
M1[1] 5.10 dBm
2.41015000 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
T1
T2
CF 2.41 GHz
1001 pts
1.0 MHz/
Span 10.0 MHz
2 Marker Table
Type Ref Trc X-Value Y-Value Function Function Result
M1 1 2.41015 GHz 5.10 dBm Occ Bw 2.410894947 MHz
T1 1 2.4087923 GHz -10.63 dBm Occ Bw Centroid 2.409997734 GHz
T2 1 2.4112032 GHz -15.59 dBm Occ Bw Freq Offset -2.265709471 kHz

Mesh_Low CH



Mesh_Mid CH



Mesh_High CH

6. Maximum Conducted Output Power & e.i.r.p.

6.1 Operating environment

Temperature : 24 ℃

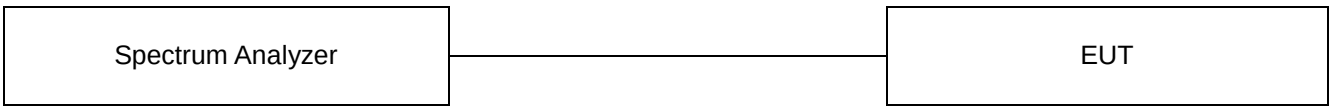
Relative humidity : 45 %

6.2 Measurement method

Standard : §15.247 (b) (3) / RSS-247 (5.4 d)

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 : 08. Oct. 2019

Operating mode : Transmit mode

Test Result : Pass

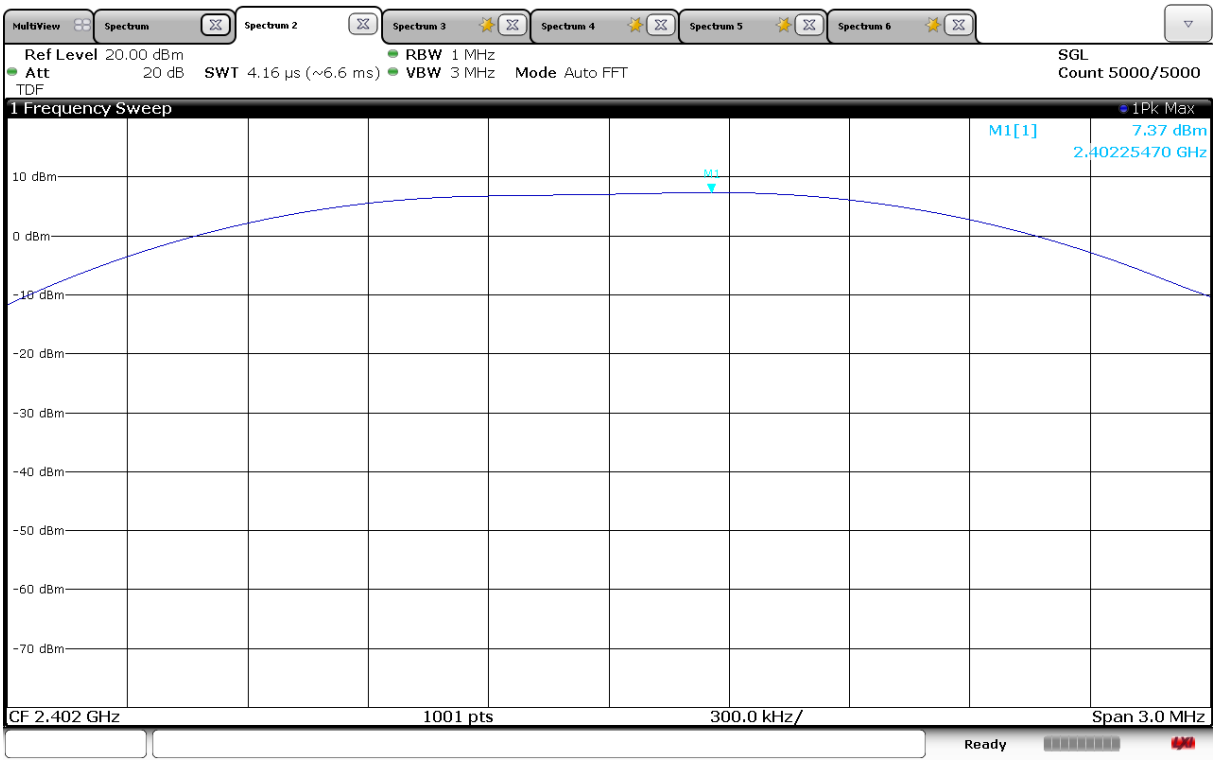
6.4.1 Measured Results

Modulation Type	Channel (Frequency)	Maximum Conducted Output Power			e.i.r.p.	
		Measured value (dBm)	Avaerage Power(dBm)	Limit	Measured value (dBm)	Limit
Bluetooth LE	0 (2 402 ㎒)	7.37	5.73	30 dBm (1 Watt)	8.30	36 dBm (4 Watt)
	19 (2 440 ㎒)	***9.20***	***7.58***		***10.13***	
	39 (2 480 ㎒)	7.77	6.14		8.70	
Mesh	0 (2 402 ㎒)	***17.35***	***8.89***		***17.81***	
	19 (2 440 ㎒)	16.37	8.45		16.83	
	39 (2 480 ㎒)	14.84	7.36		15.30	

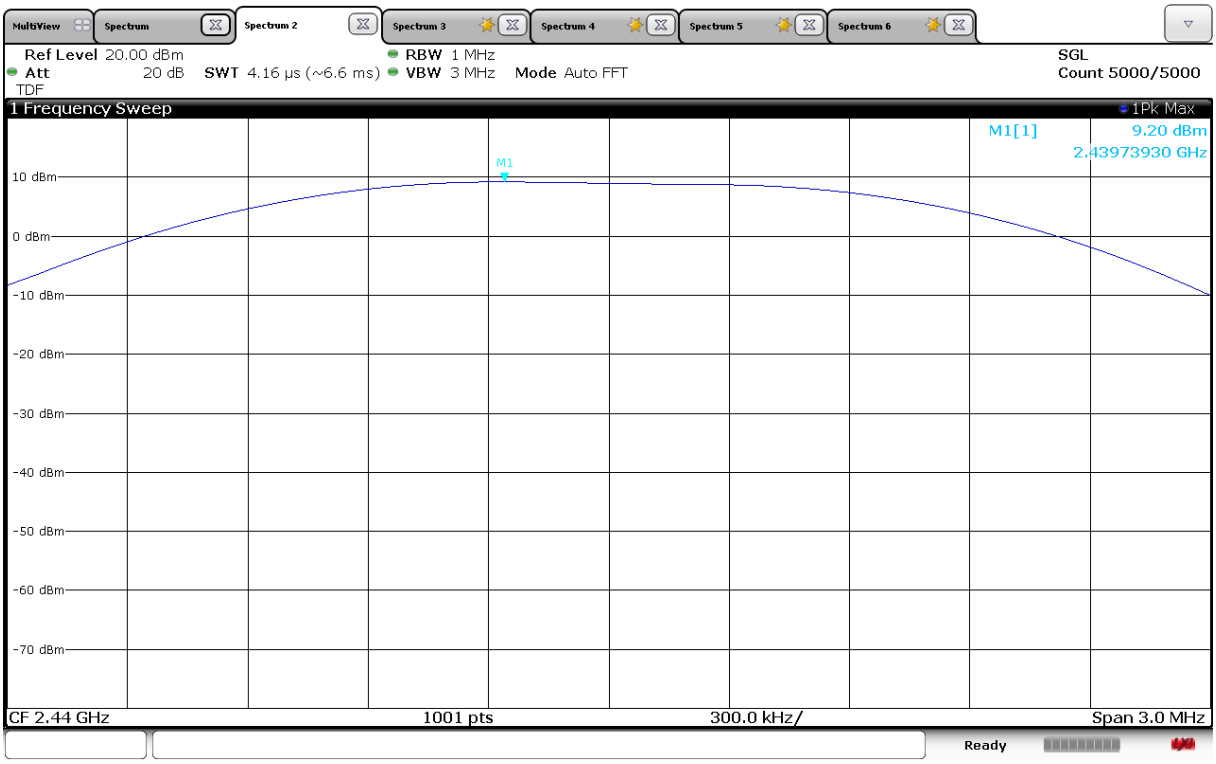
※Bluetooth LE Antenna Gain : 0.93 dBi

※Mesh Antenna Gain : 0.46 dBi

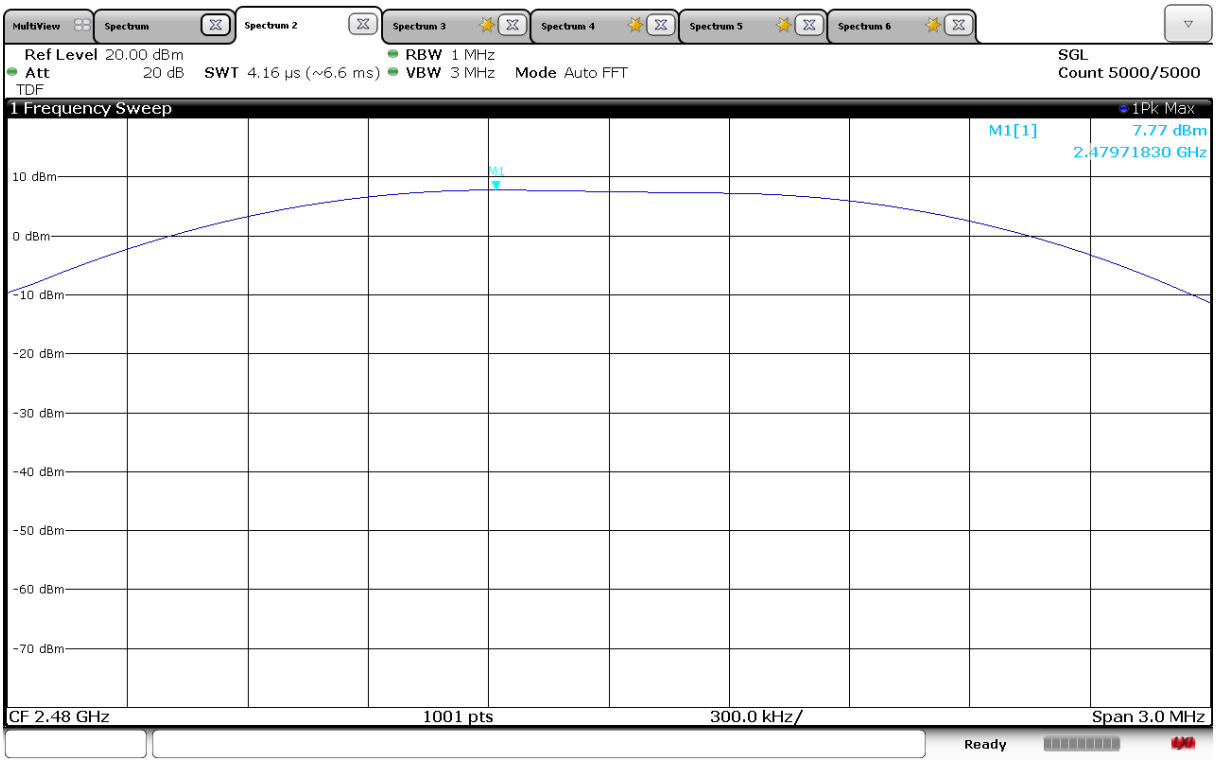
6.4.2 Measured Graph



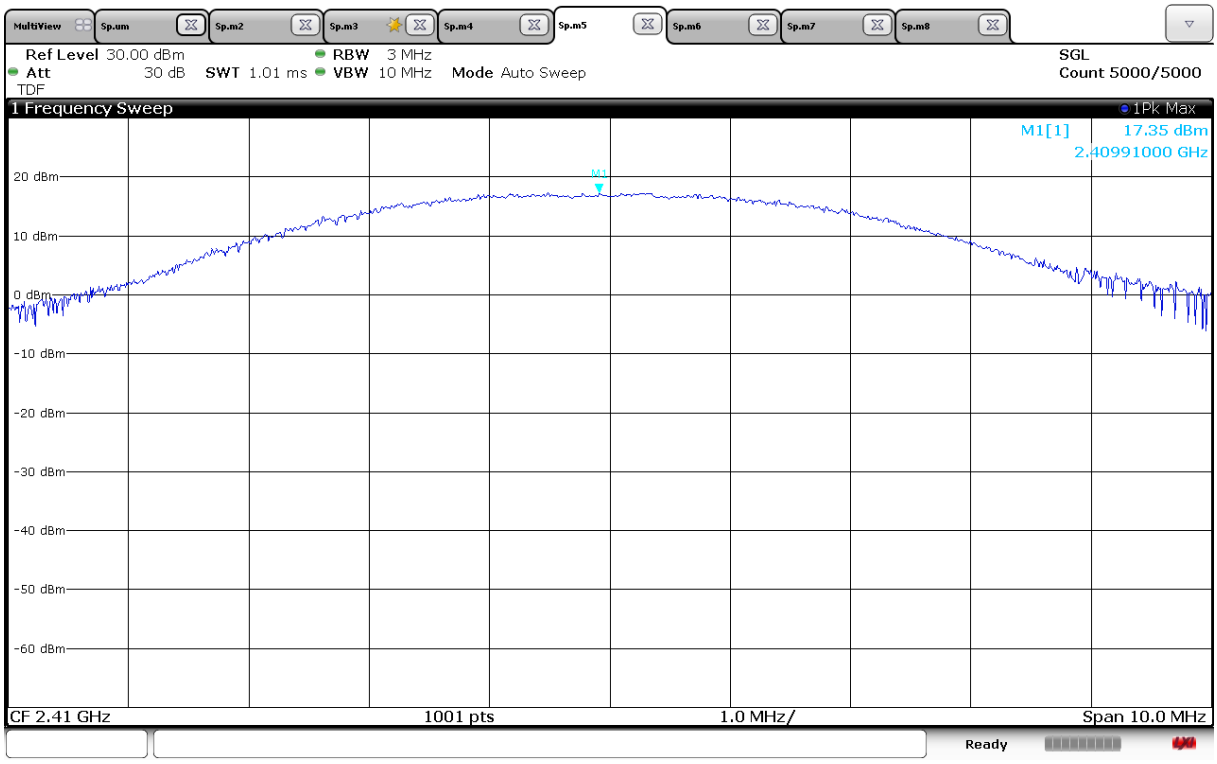
Bluetooth LE_Low CH



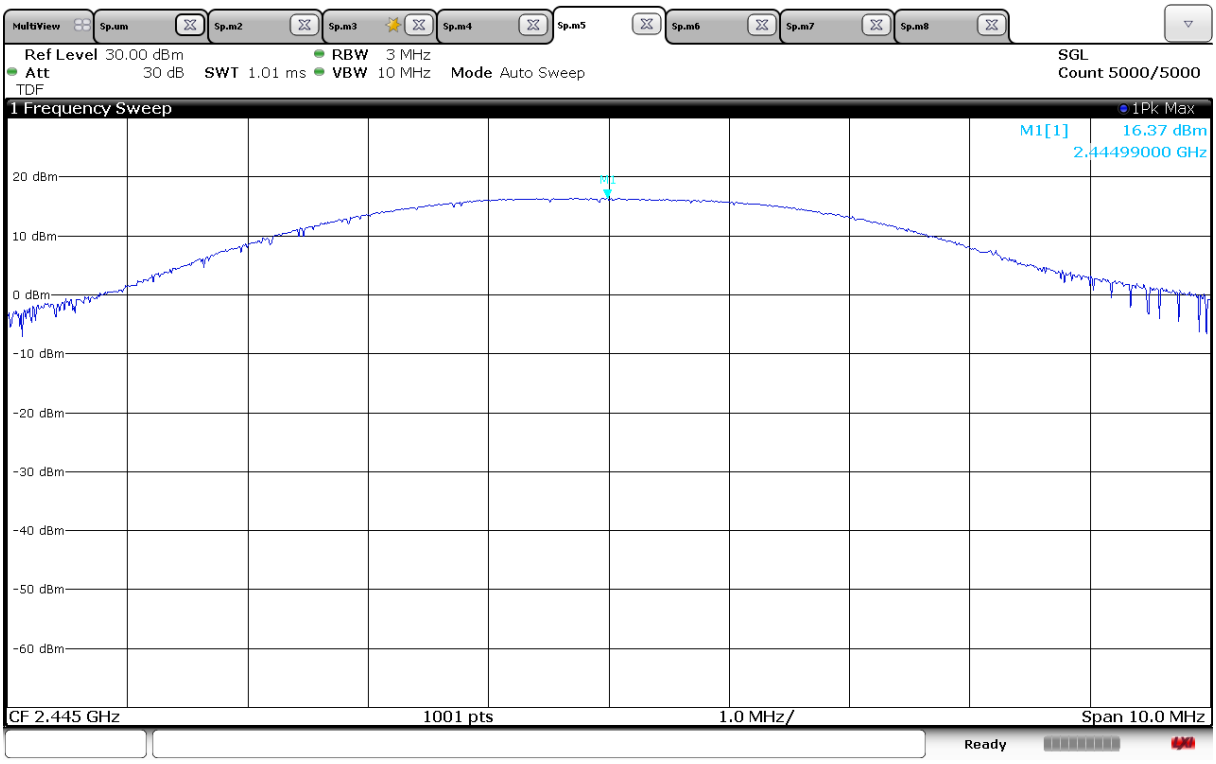
Bluetooth LE_Mid CH



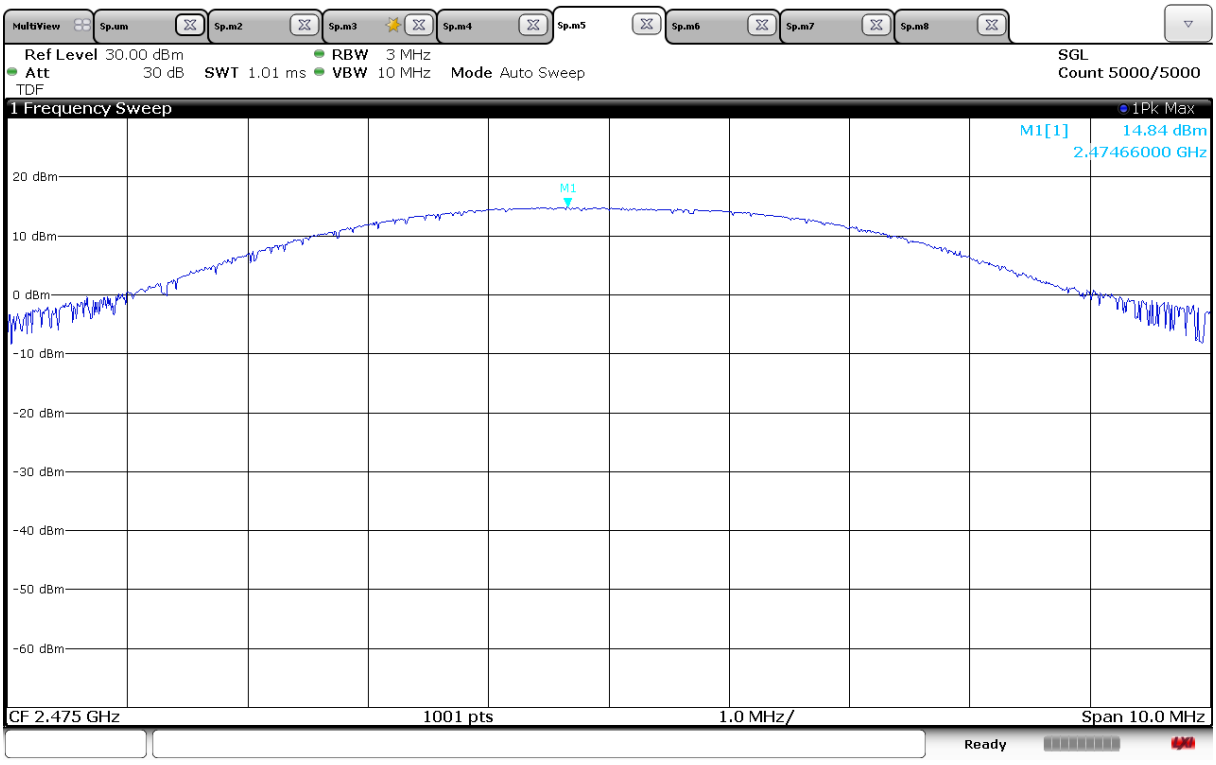
Bluetooth LE_High CH


MultiView
Sp.um
Sp.m2
Sp.m3
Sp.m4
Sp.m5
Sp.m6
Sp.m7
Sp.m8
Ref Level 30.00 dBm
RBW 3 MHz
SGL
Att 30 dB
SWT 1.01 ms
VBW 10 MHz
Mode Auto Sweep
Count 5000/5000
TDF
1 Frequency Sweep
1Pk Max
M1[1] 17.35 dBm
2.40991000 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.41 GHz
1001 pts
1.0 MHz/
Span 10.0 MHz
Ready

Mesh_Low CH



Mesh_Mid CH



Mesh_High CH

7. Power Spectral Density

7.1 Operating environment

Temperature : 22 ℃

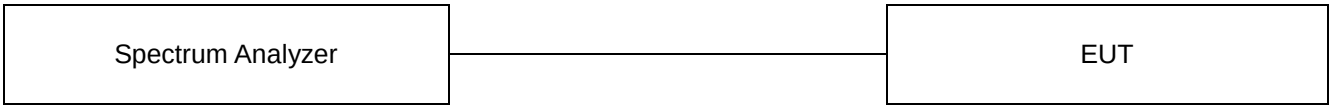
Relative humidity : 46 %

7.2 Measurement method

Standard : §15.247 (e) / RSS-247 (5.2 b)

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

Test date : 08. Oct. 2019

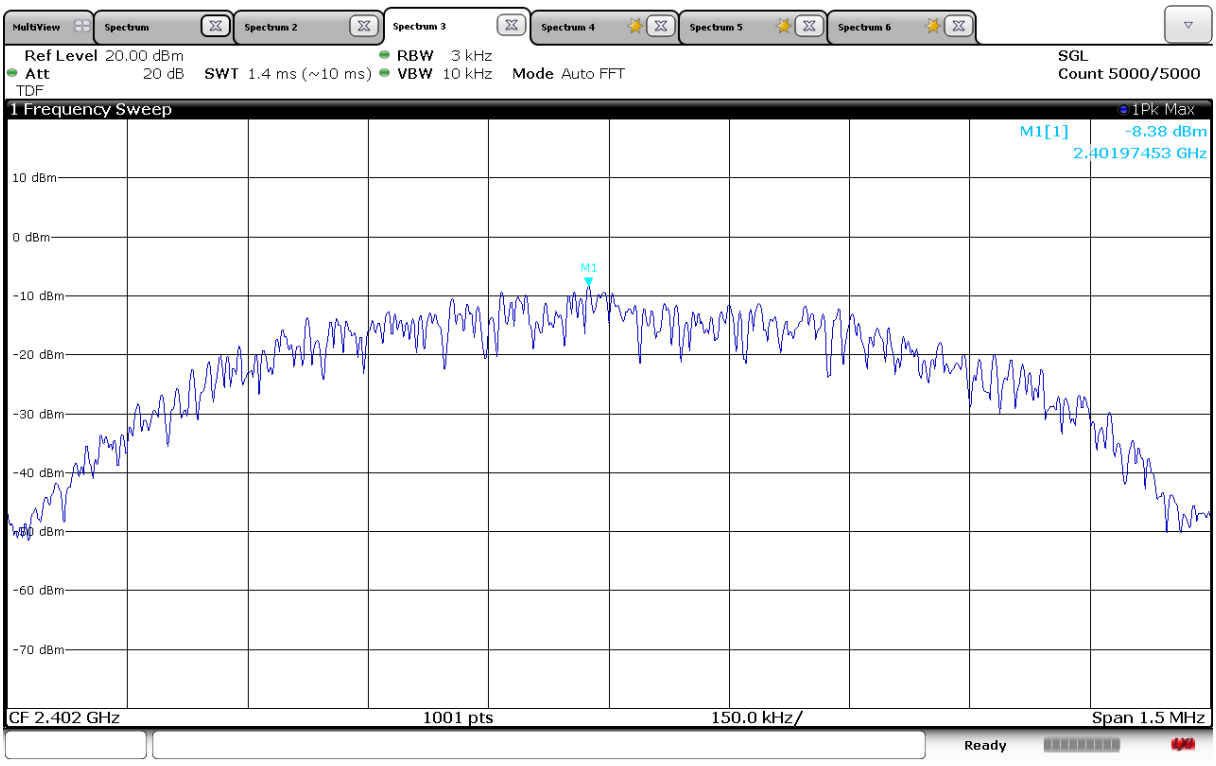
Operating mode : Transmit mode

Test Result : Pass

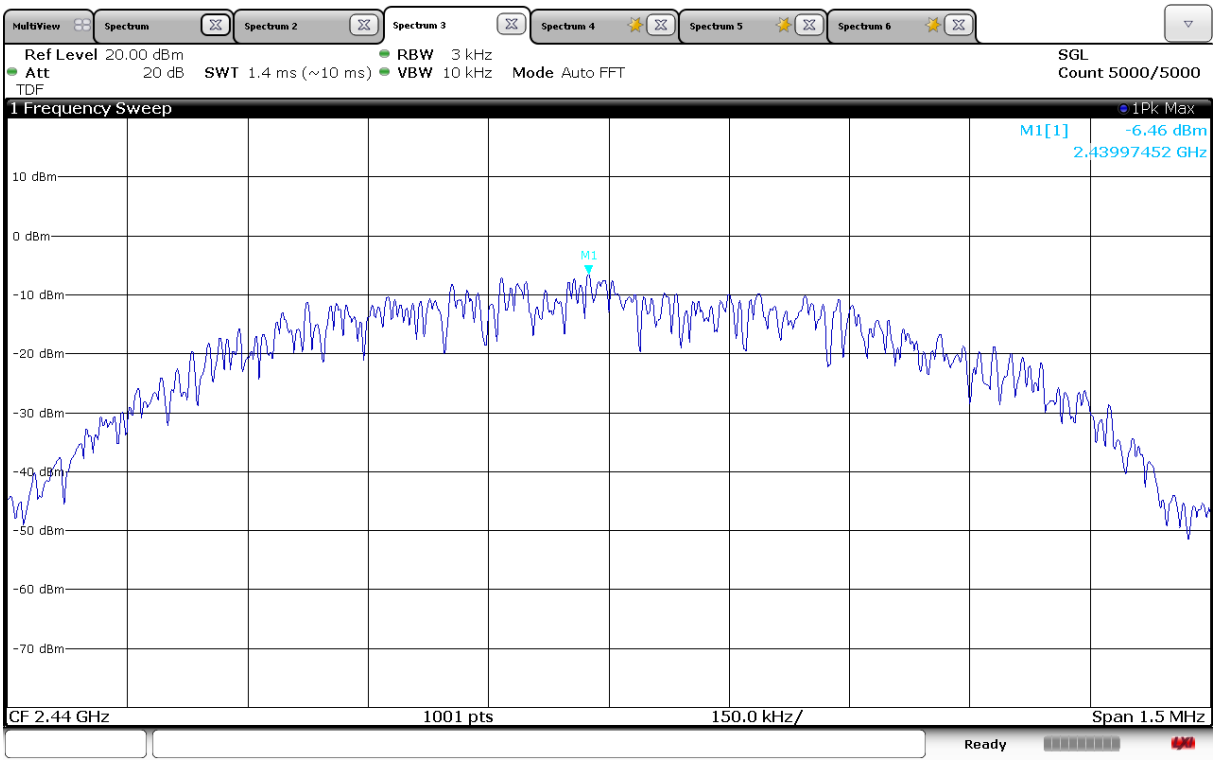
7.4.1 Measured Results

Modulation Type	Channel (Frequency)	Highest signal level (dBm)	Limit (dBm/3㎑)
Bluetooth LE	0 (2 402 ㎒)	-8.38	8
	19 (2 440 ㎒)	-6.46	
	39 (2 480 ㎒)	-7.75	
Mesh	0 (2 405 ㎒)	-4.62	
	19 (2 445 ㎒)	-5.02	
	25 (2 475 ㎒)	-6.70	

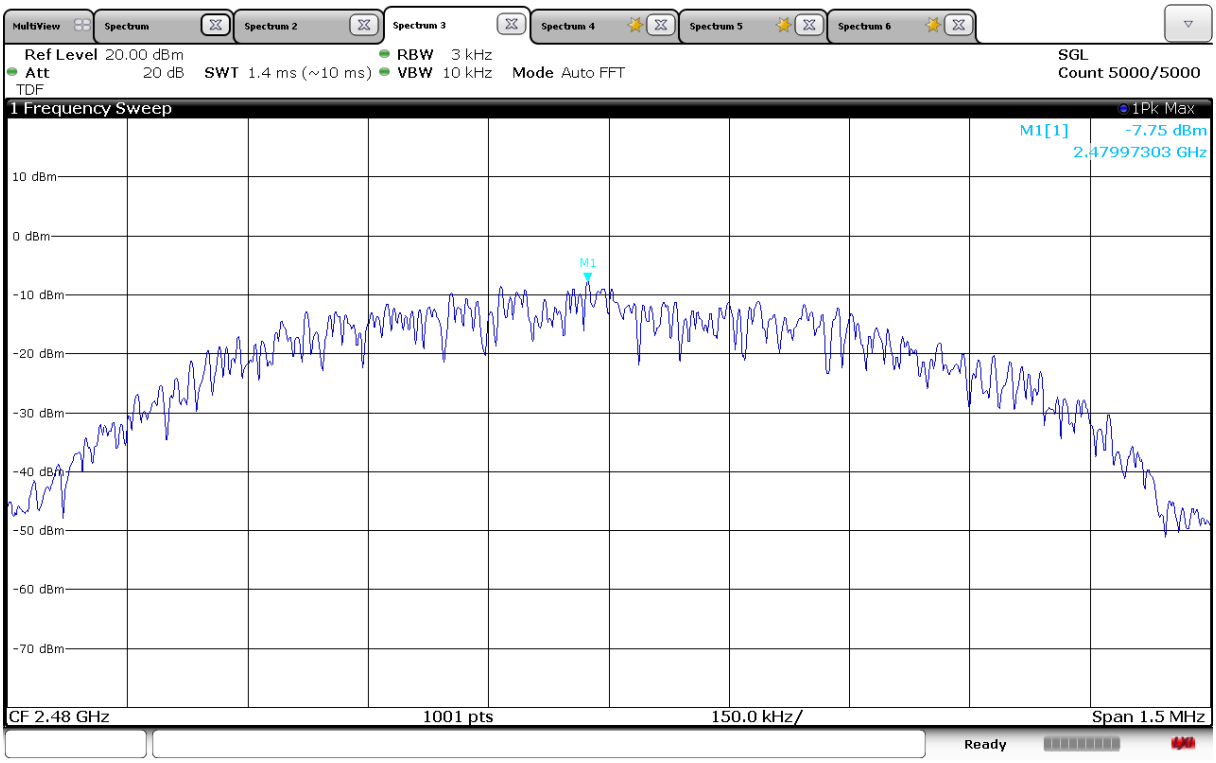
7.4.2 Measured Graph



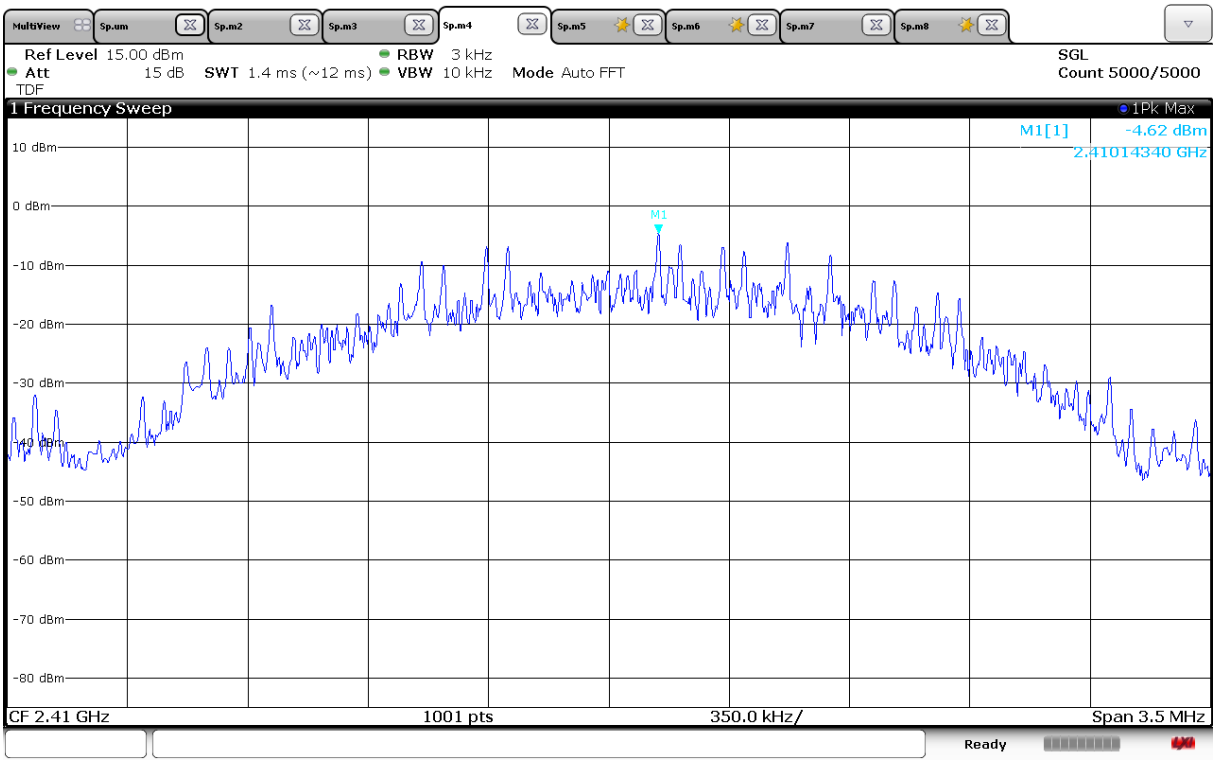
Bluetooth LE_Low CH



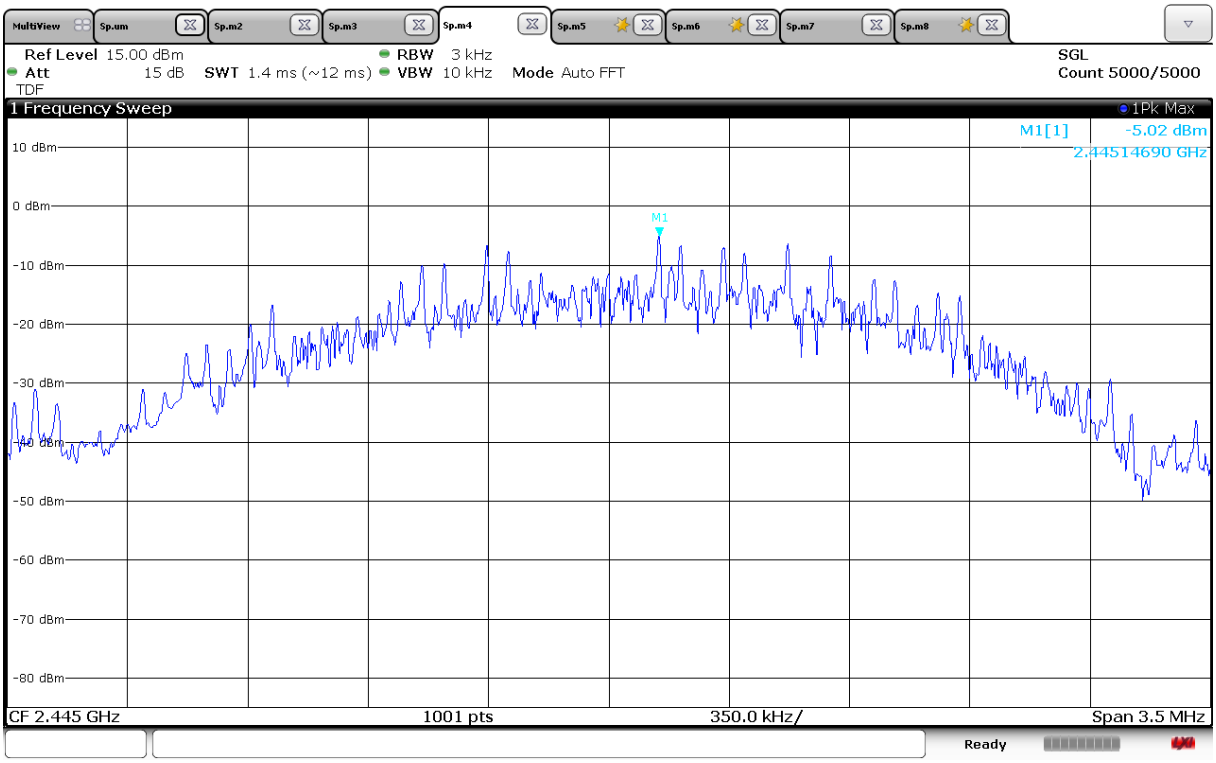
Bluetooth LE_Mid CH



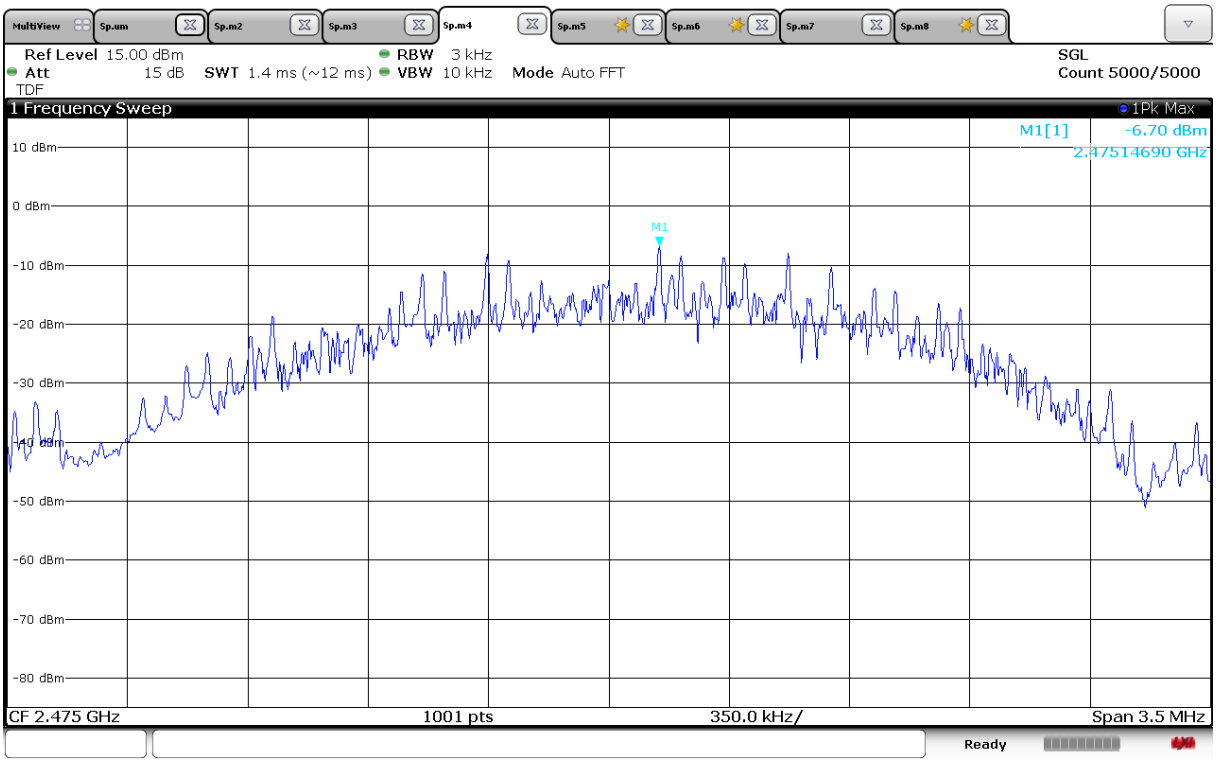
Bluetooth LE_High CH


MultiView
Sp.um
Sp.m2
Sp.m3
Sp.m4
Sp.m5
Sp.m6
Sp.m7
Sp.m8
Ref Level 15.00 dBm
RBW 3 kHz
SGL
Att 15 dB SWT 1.4 ms (~12 ms) VBW 10 kHz Mode Auto FFT
Count 5000/5000
TDF
1 Frequency Sweep
1Pk Max
M1[1] -4.62 dBm
2.41014340 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
CF 2.41 GHz
1001 pts
350.0 kHz/
Span 3.5 MHz
Ready

Mesh_Low CH



Mesh_Mid CH



Mesh_High CH

8. Conducted Spurious Emission

8.1 Operating environment

Temperature : 22 ℃

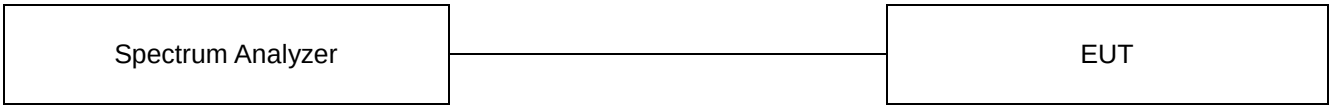
Relative humidity : 46 %

8.2 Measurement method

Standard : §15.247 (d) / RSS-247 (5.5)

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

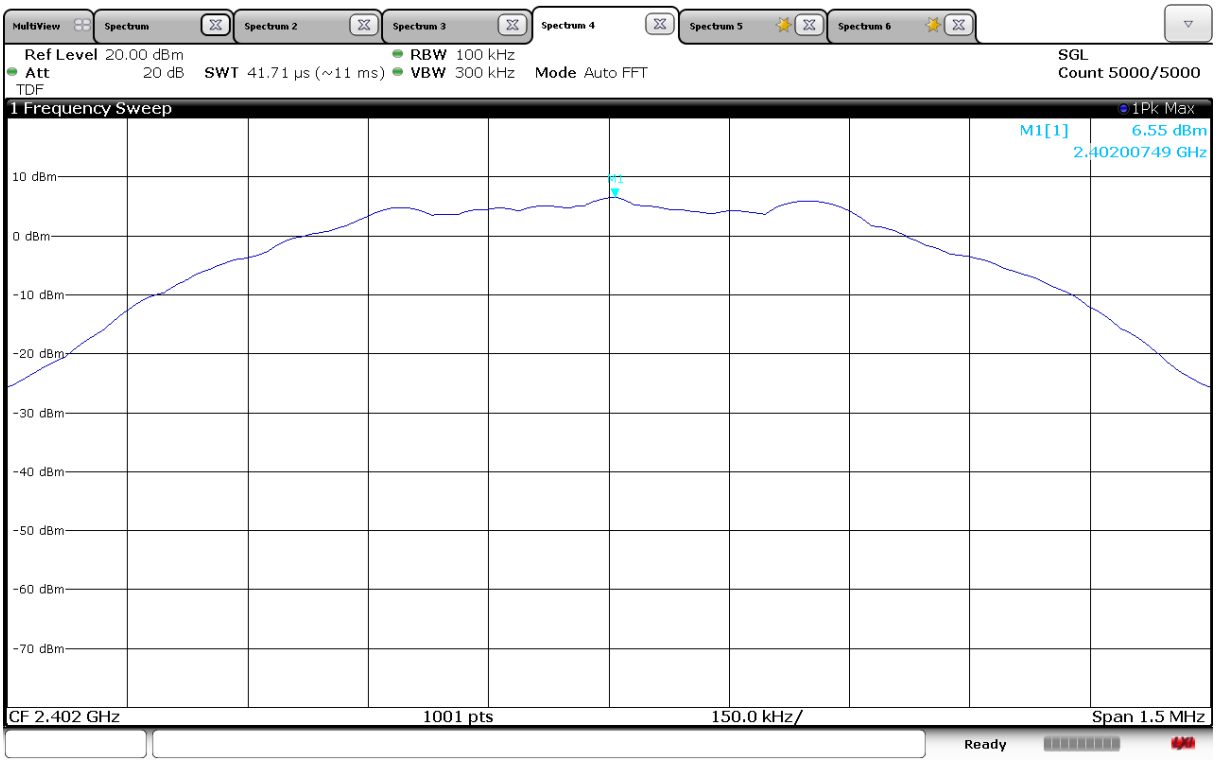
Test date : 08. Oct. 2019

Operating mode : Transmit mode

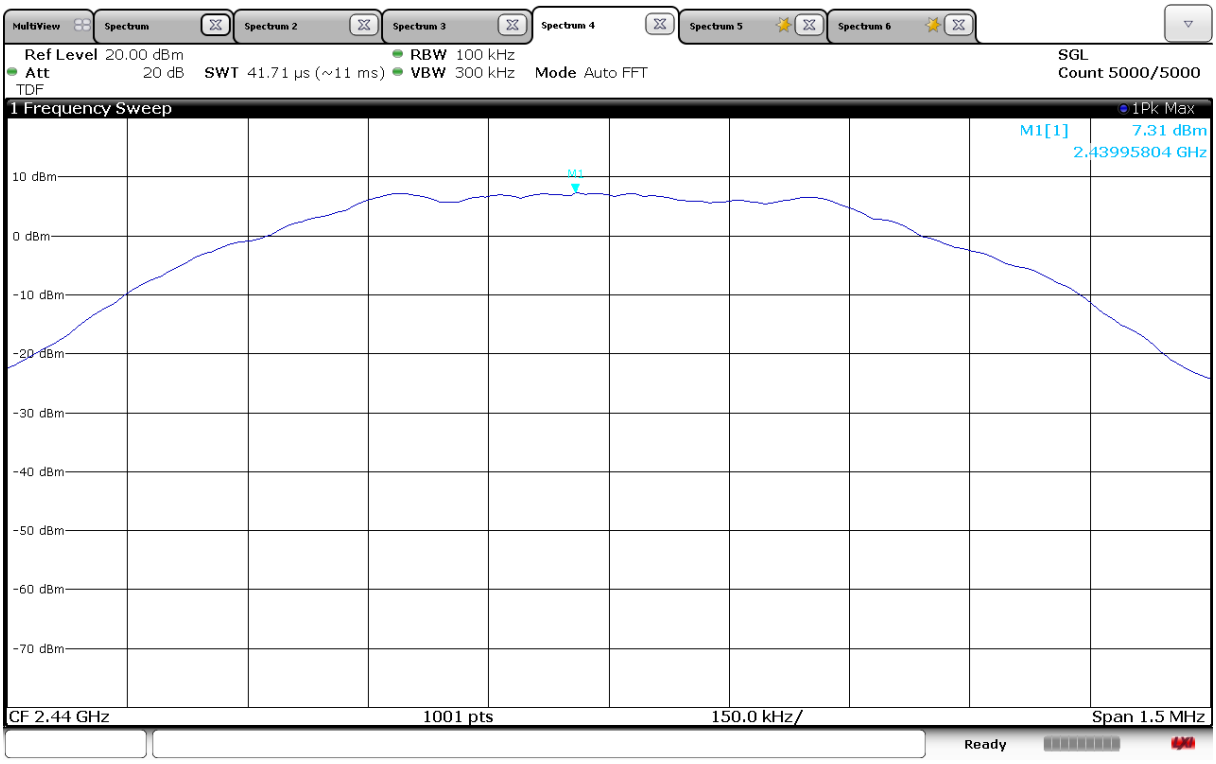
Test Result : Pass

8.4.1 Measured Results

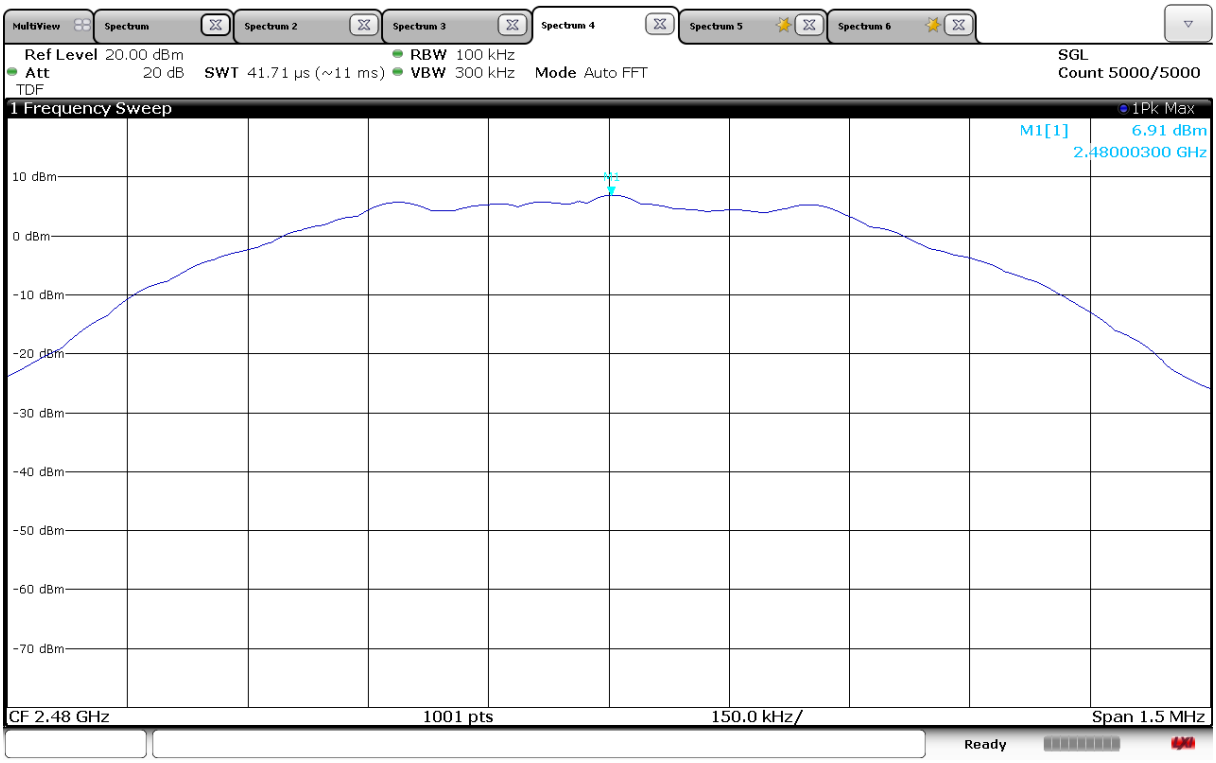
8.4.1.1 Signal level (dB m)



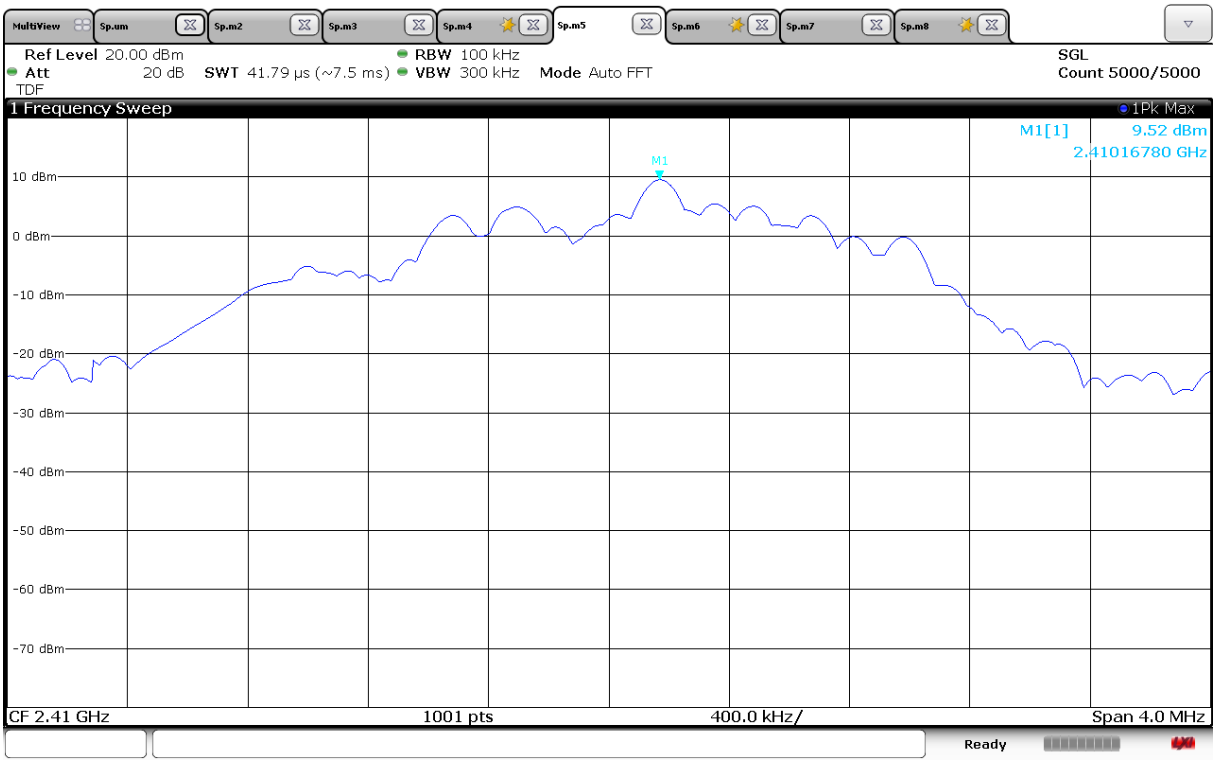
Bluetooth LE_Low CH



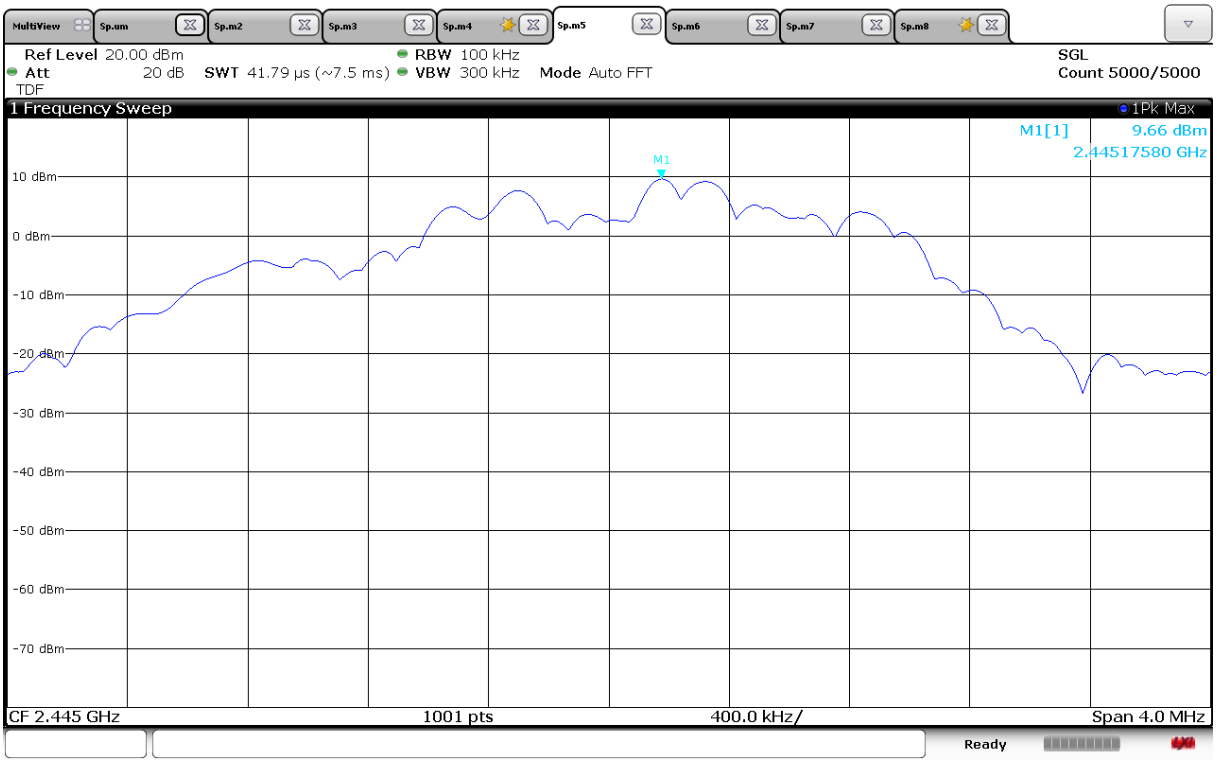
Bluetooth LE_Mid CH



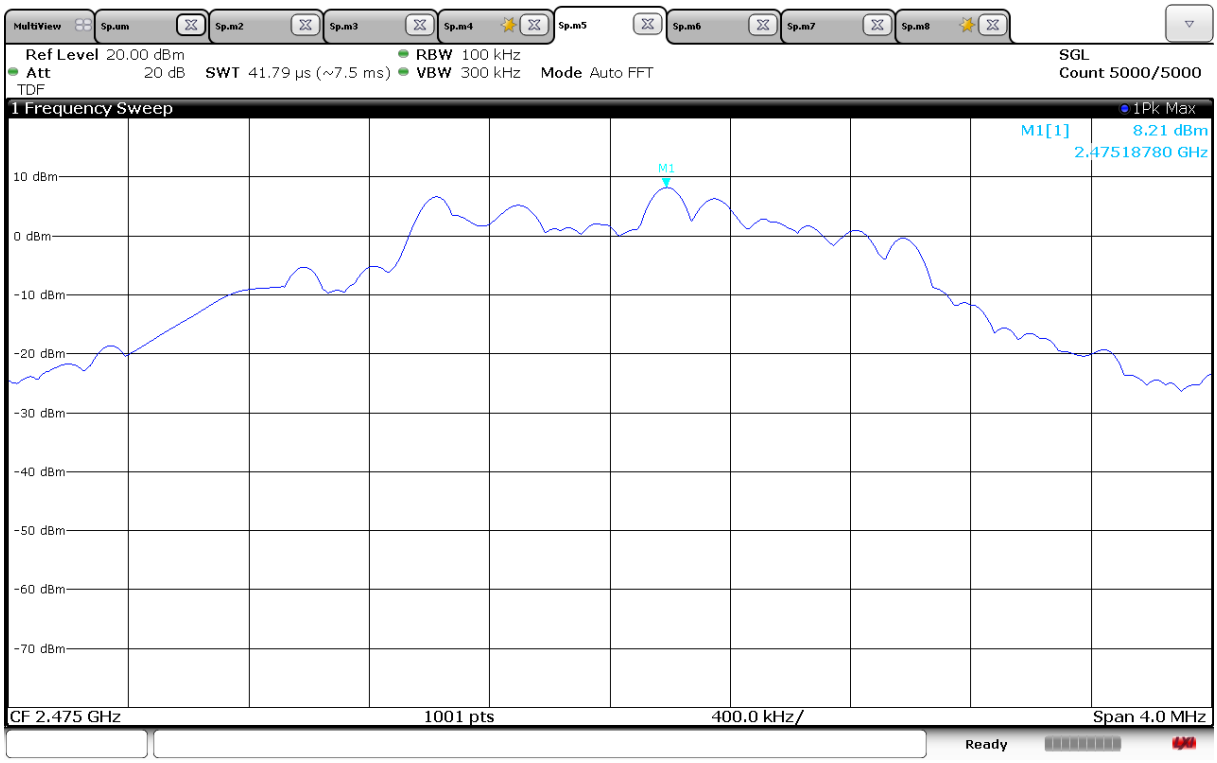
Bluetooth LE_High CH


MultiView
Sp.um
Sp.m2
Sp.m3
Sp.m4
Sp.m5
Sp.m6
Sp.m7
Sp.m8
Ref Level 20.00 dBm
RBW 100 kHz
SGL
Att 20 dB SWT 41.79 µs (~7.5 ms) VBW 300 kHz Mode Auto FFT
Count 5000/5000
TDF
1 Frequency Sweep
1Pk Max
M1[1] 9.52 dBm
2.41016780 GHz
M1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.41 GHz
1001 pts
400.0 kHz/
Span 4.0 MHz
Ready

Mesh_Low CH

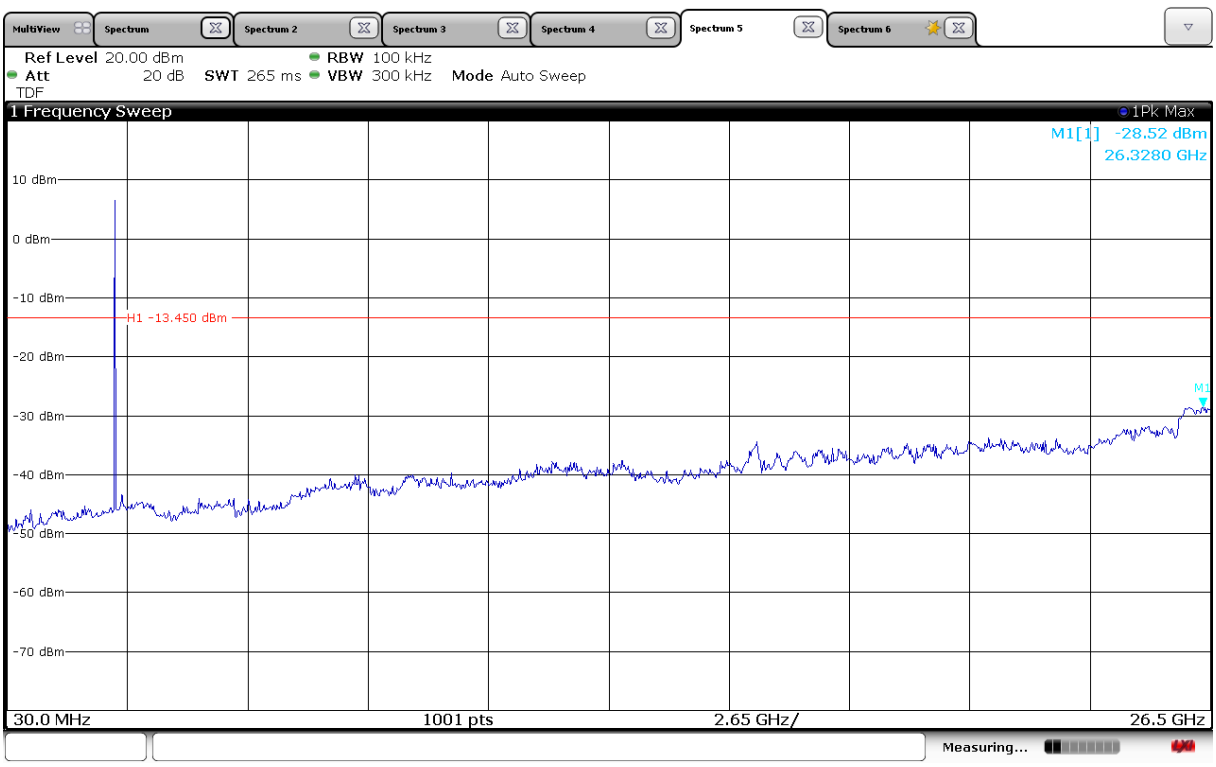


Mesh_Mid CH

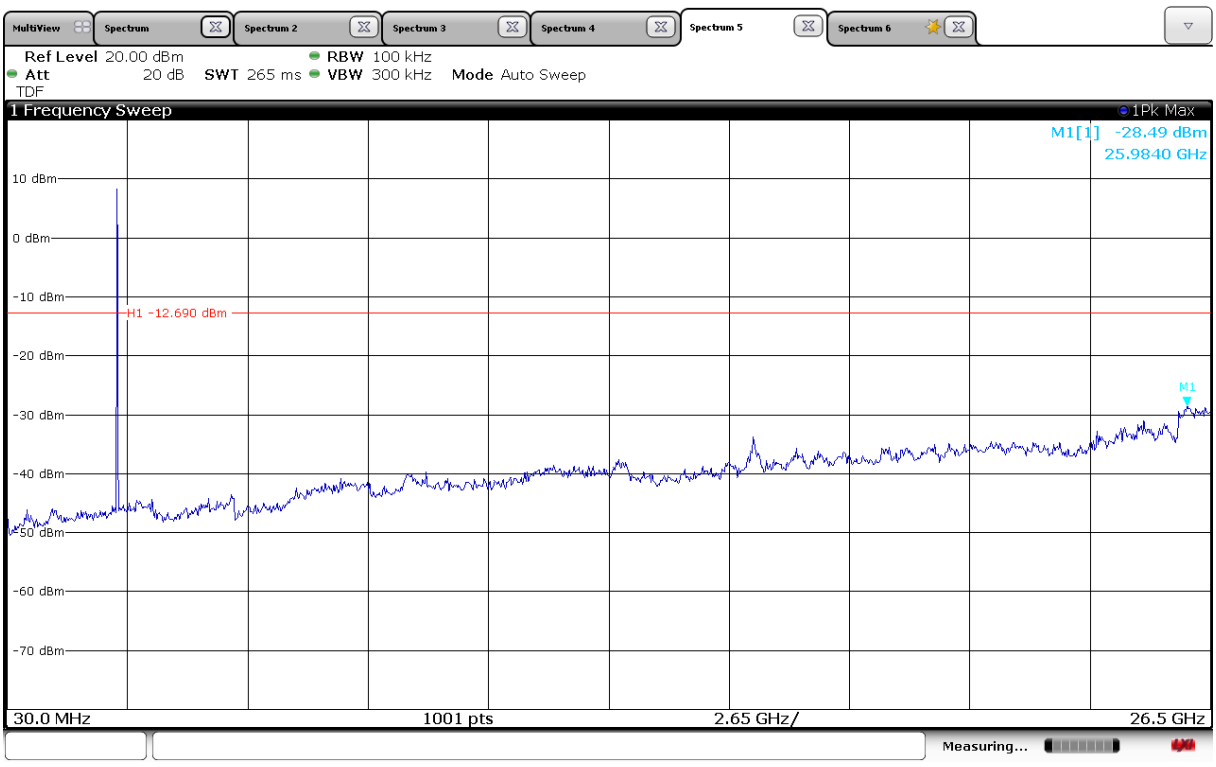


Mesh_High CH

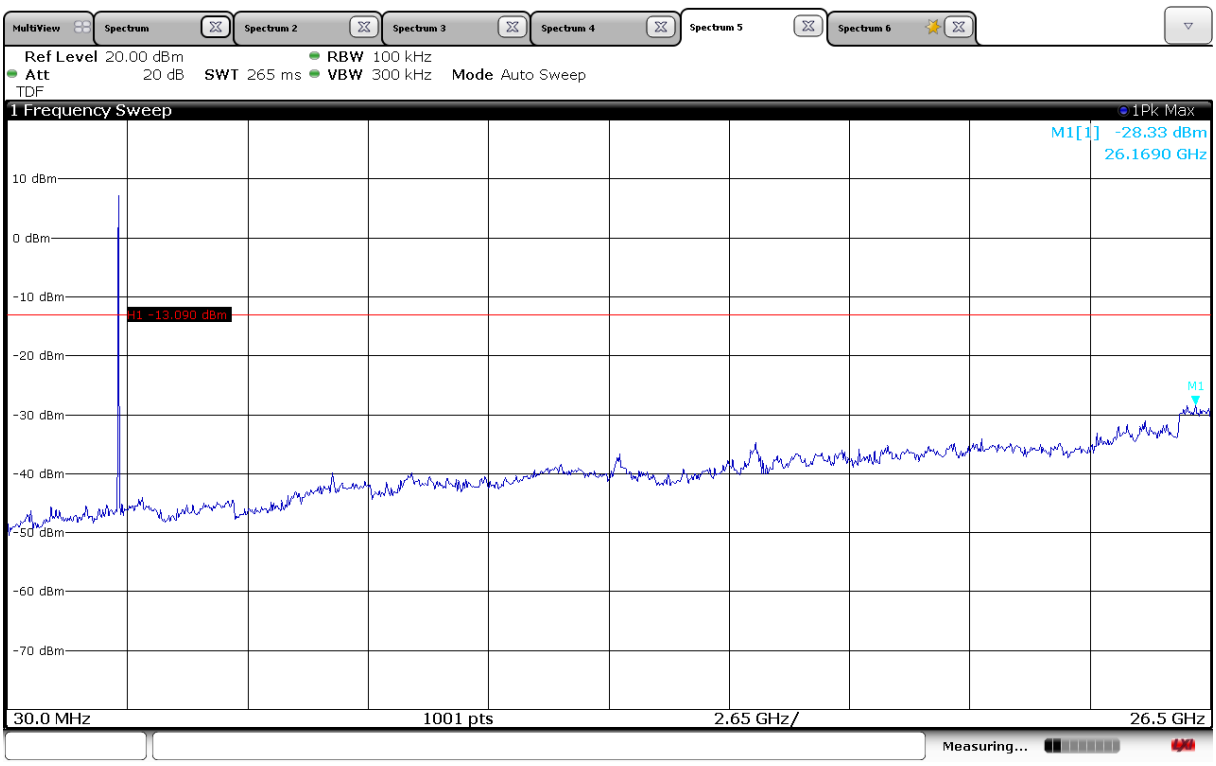
8.4.1.2 Unwanted Emissions In Non-Restricted Frequency Bands



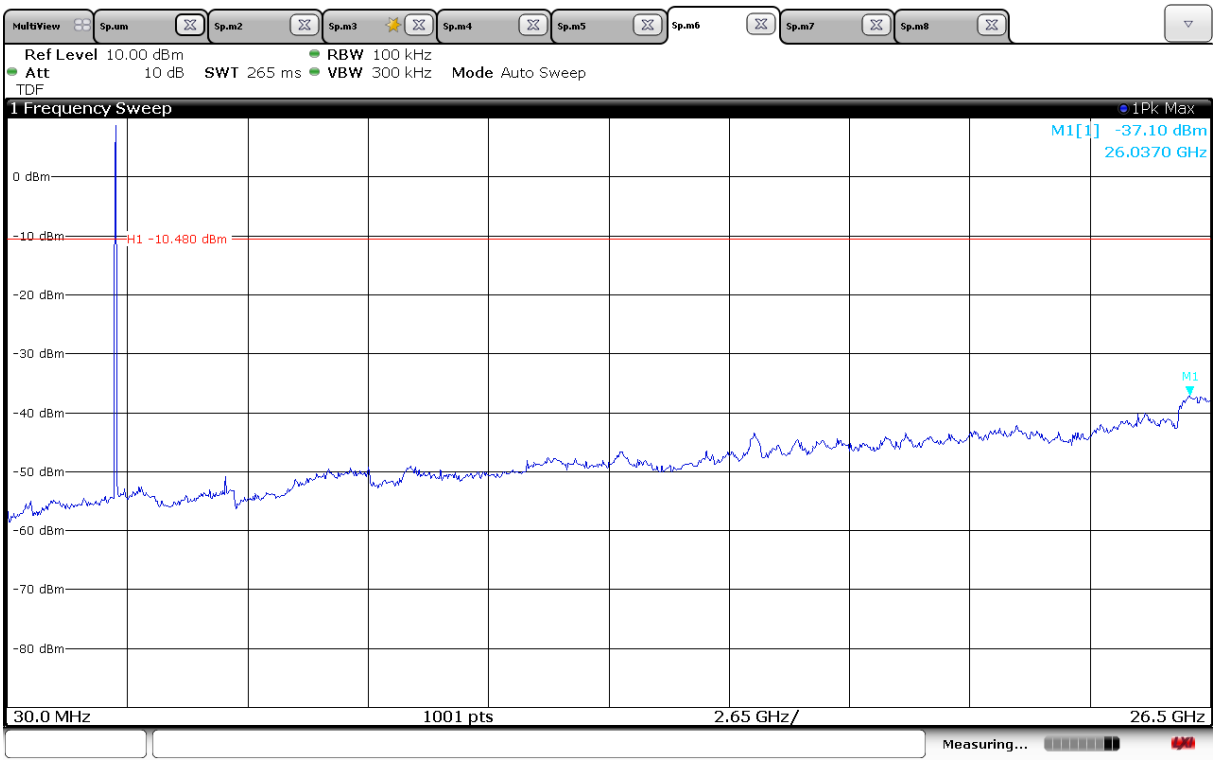
Bluetooth LE_Low CH



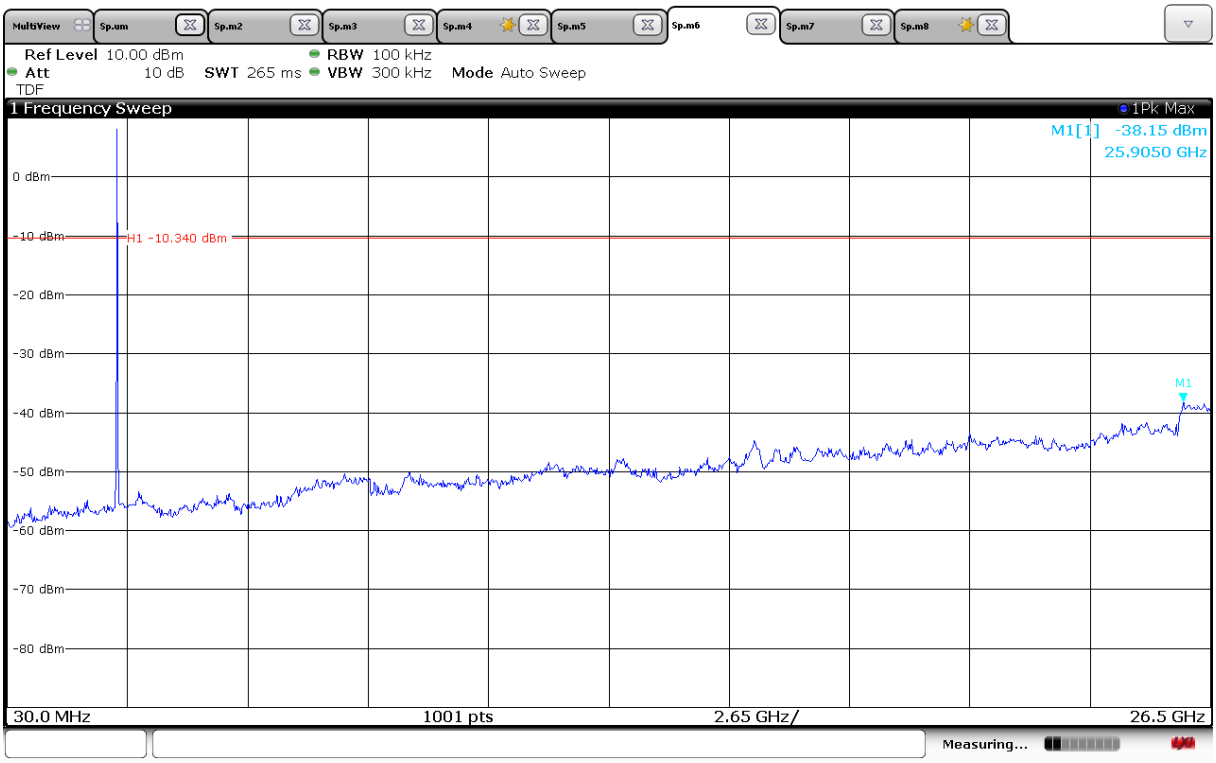
Bluetooth LE_Mid CH



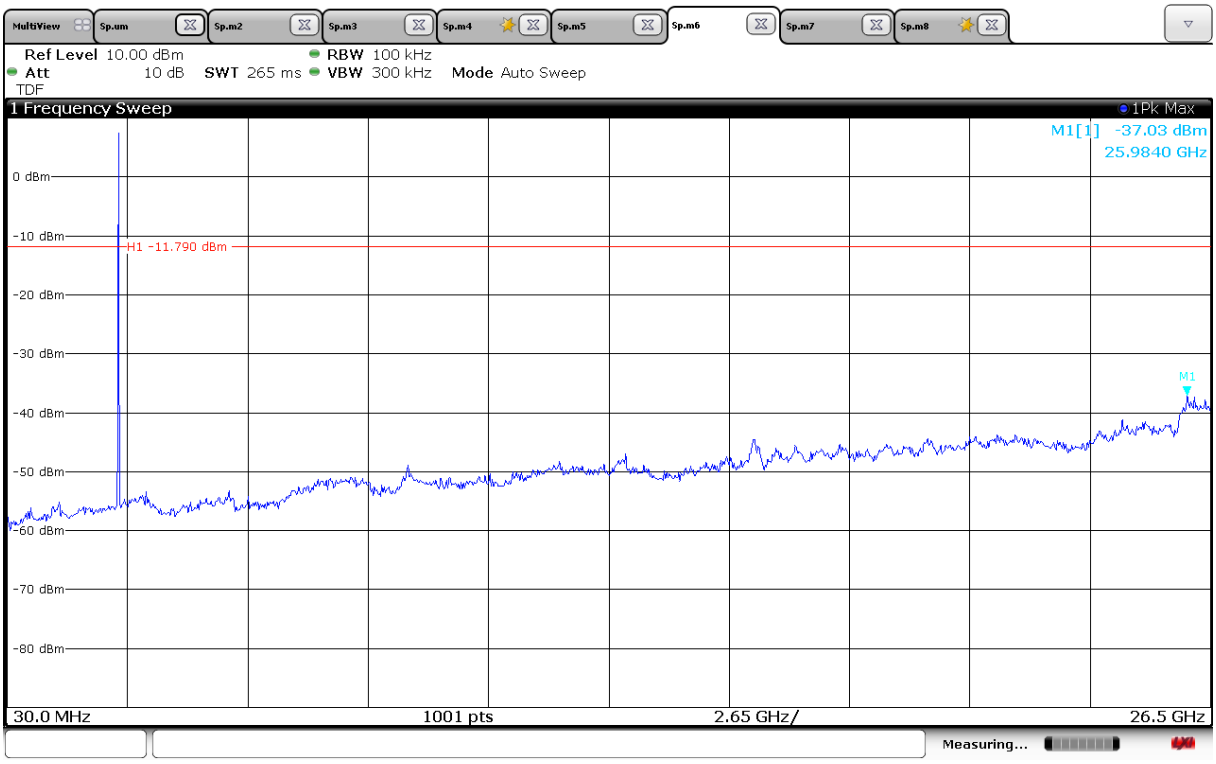
Bluetooth LE_High CH



Mesh_Low CH

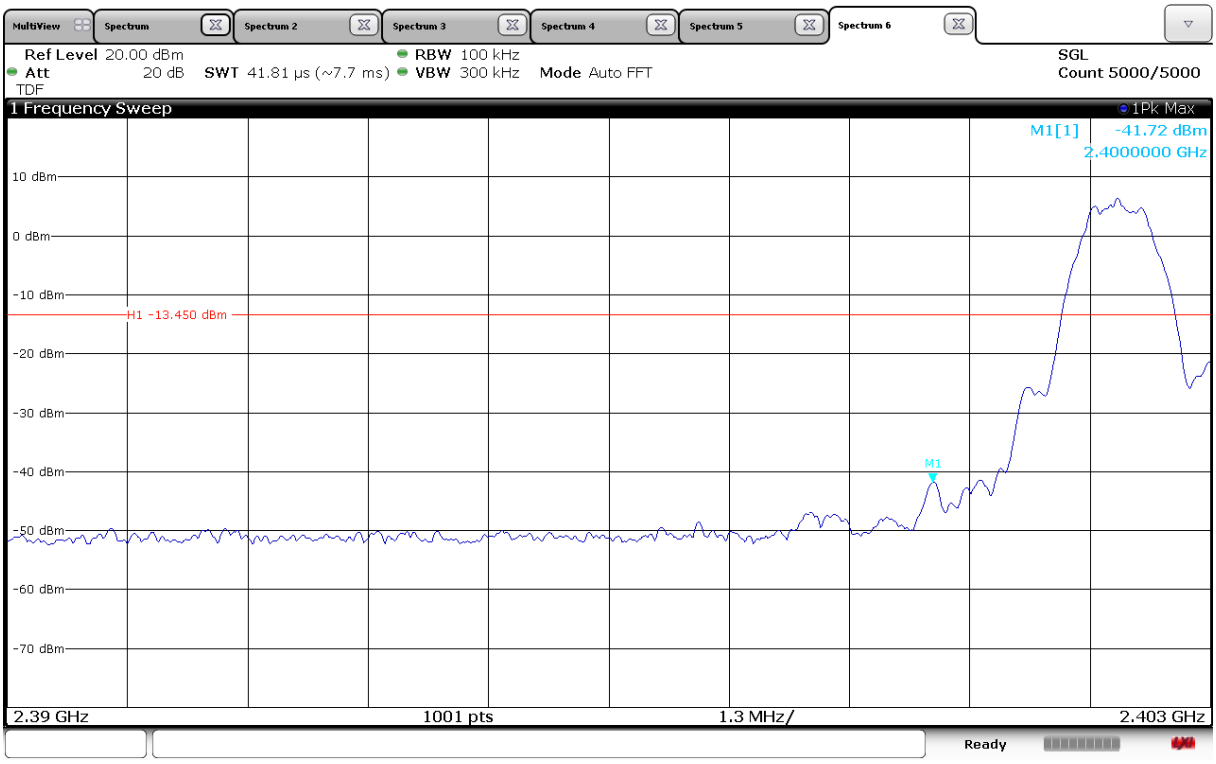


Mesh_Mid CH

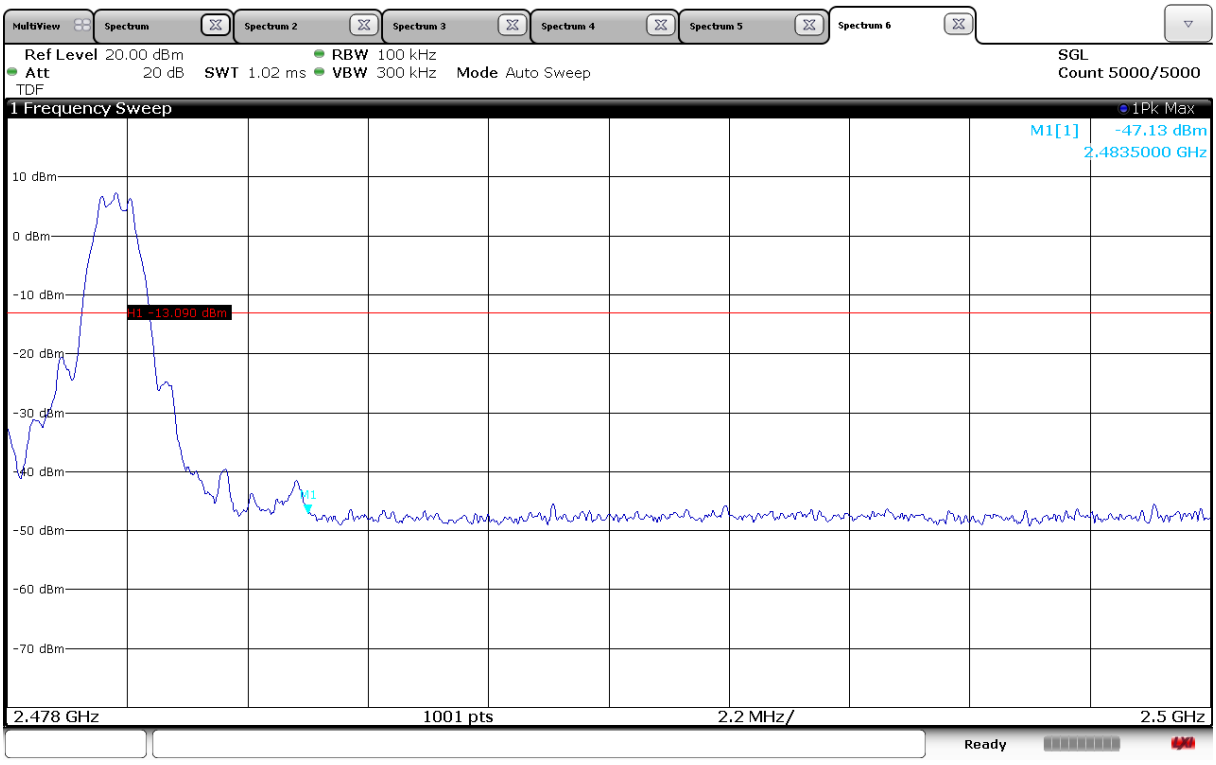

MultiView
Sp.um
Sp.m2
Sp.m3
Sp.m4
Sp.m5
Sp.m6
Sp.m7
Sp.m8
Ref Level 10.00 dBm
RBW 100 kHz
Att 10 dB SWT 265 ms VBW 300 kHz Mode Auto Sweep
TDF
1 Frequency Sweep
1Pk Max
M1[1] -37.03 dBm
25.9840 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
H1 -11.790 dBm
M1
30.0 MHz
1001 pts
2.65 GHz/
26.5 GHz
Measuring...

Mesh_High CH

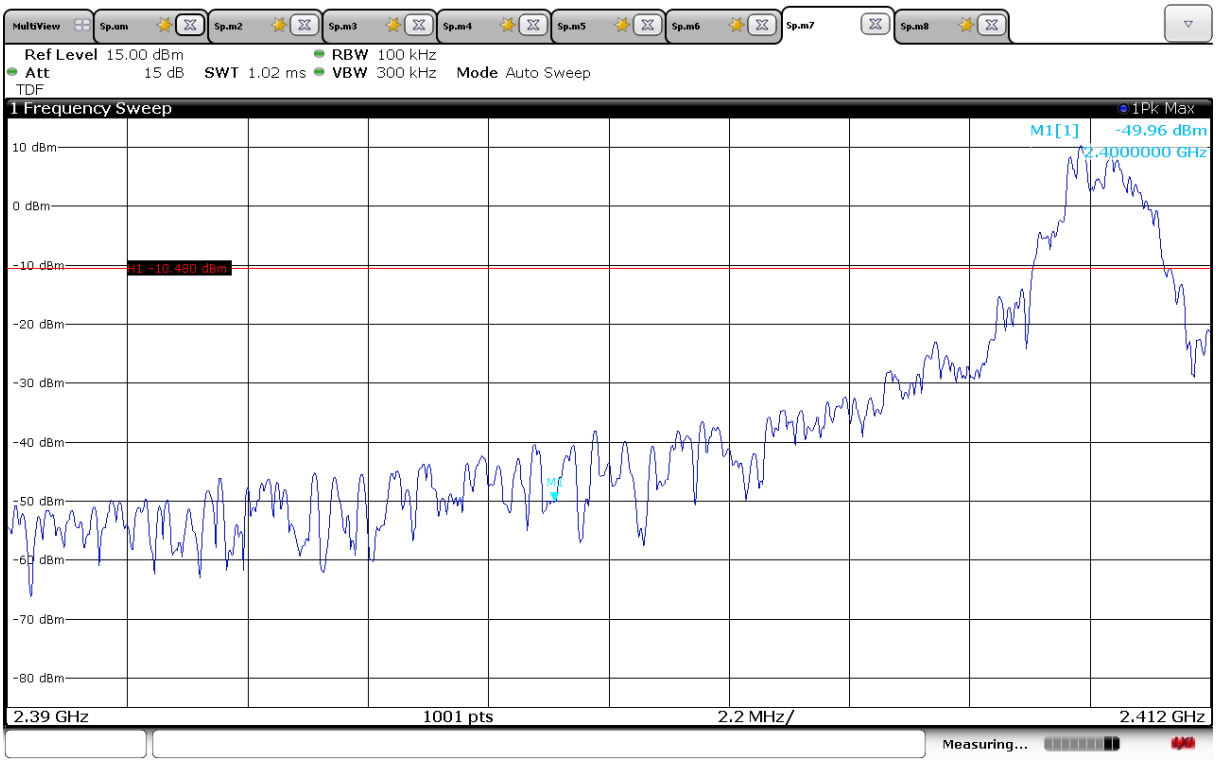
8.4.1.3 Band Edge



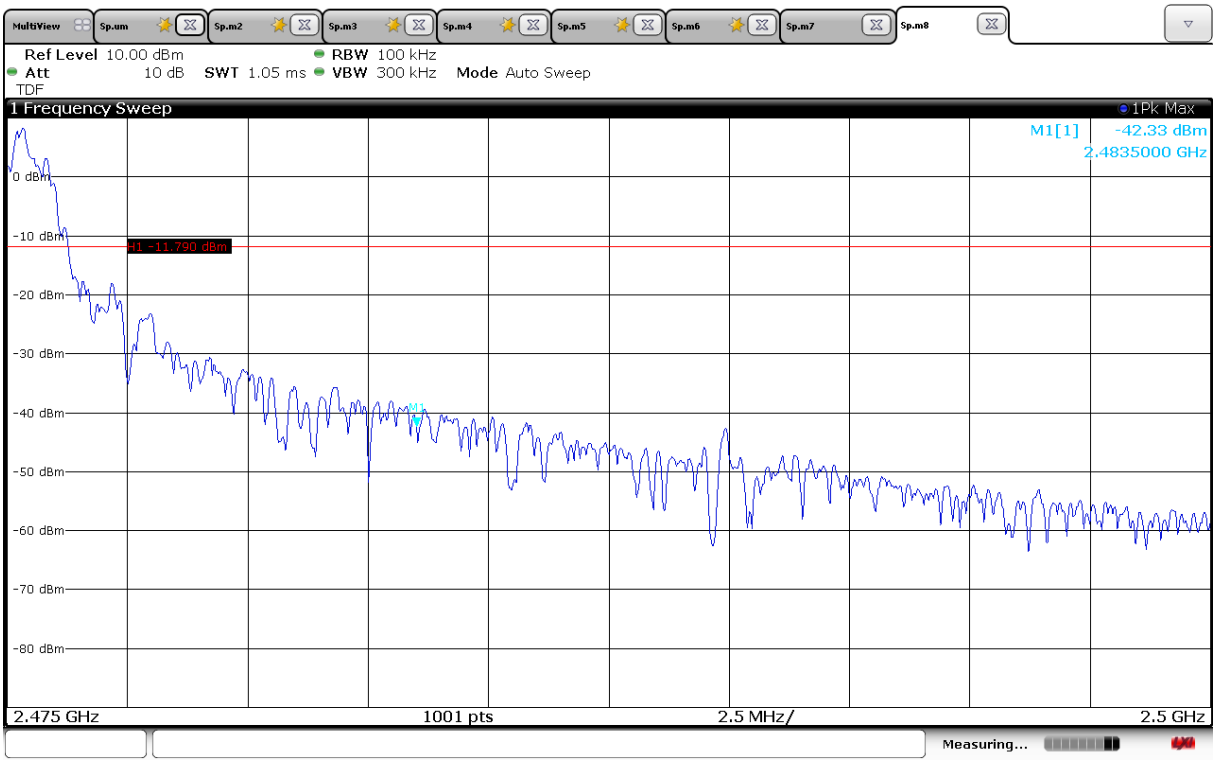
Bluetooth LE_Low CH



Bluetooth LE_High CH



Mesh_Low CH



Mesh_High CH

9. Radiated Spurious Emission

9.1 Operating environment

Temperature : (22 ~ 24) ℃

Relative humidity : (47 ~ 49) %

9.2 Measurement method

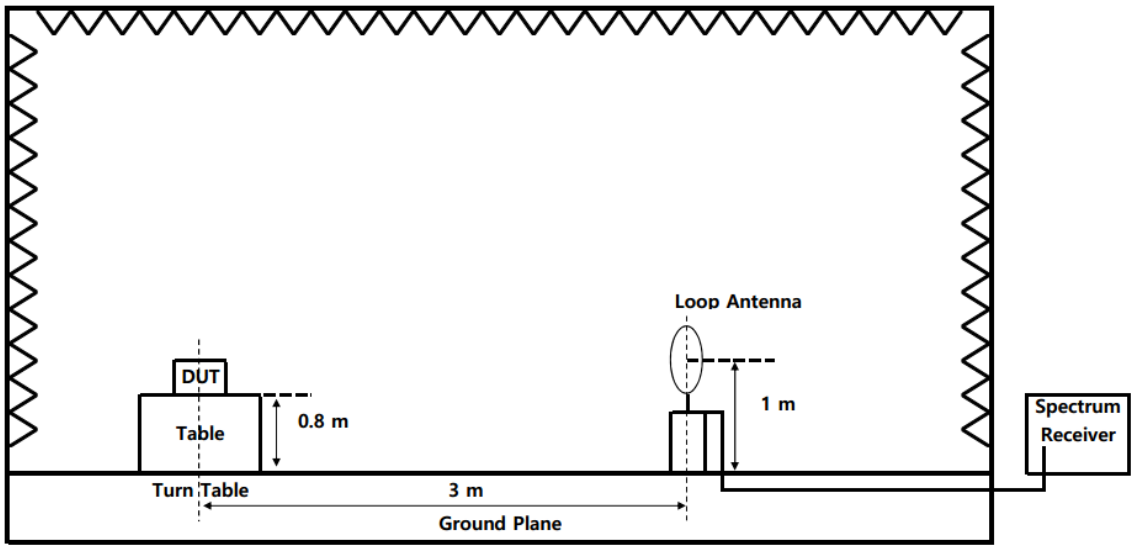
Standard : §15.247 (d), §15.209, §15.205
RSS-247 (5.5), RSS-GEN (5.5), RSS-GEN (8.10)

9.3 Test setup

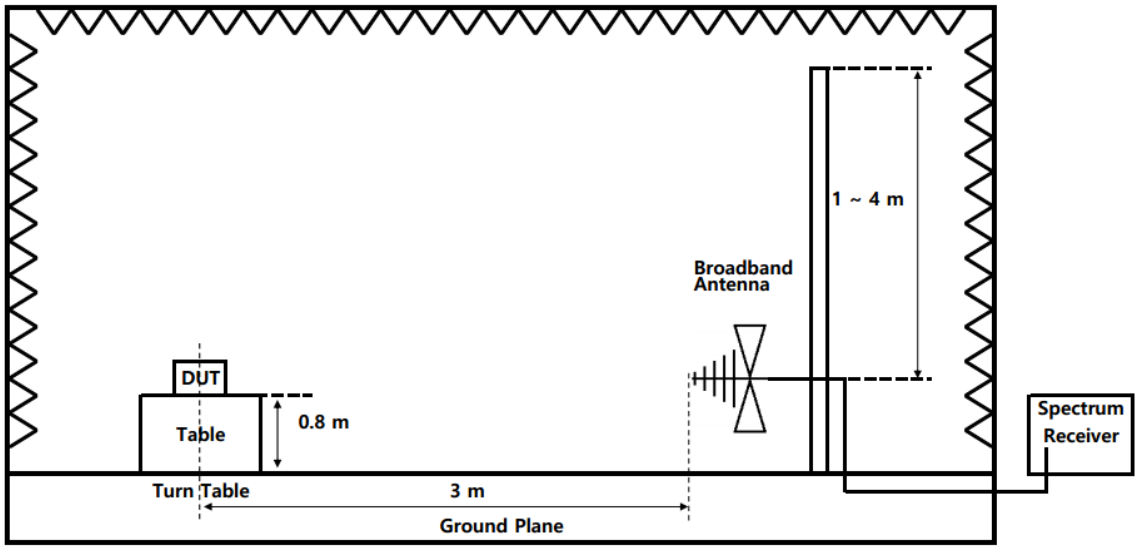
The radiated emissions measurements were performed on the 3 m,Semi-Anechoic Camber. The EUT was placed on a non-conductive turntable above the ground plane.

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.

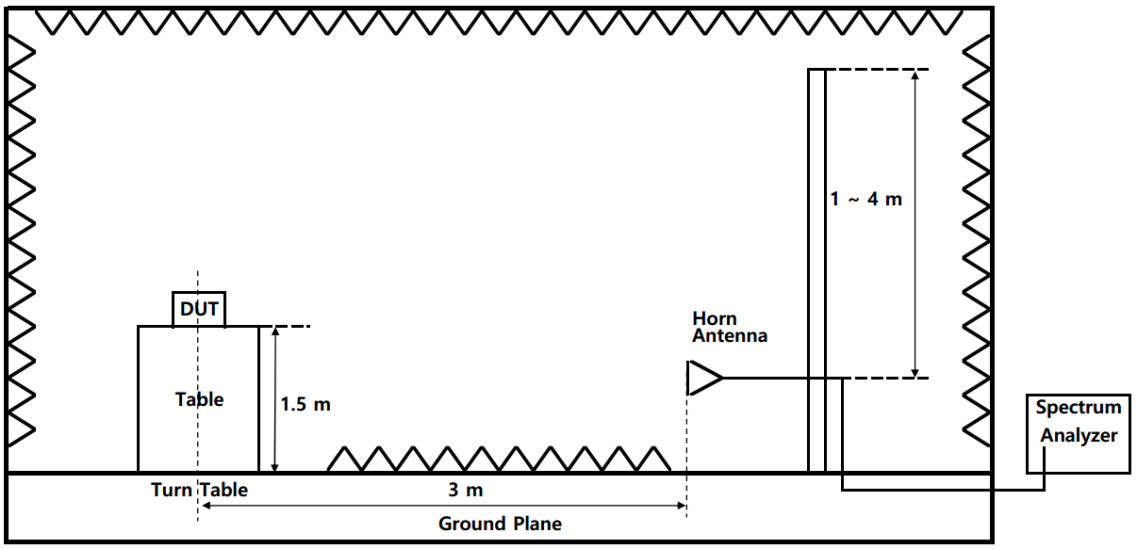
9.3.1 Below 30 ㎒



9.3.2 30 MHz to 1 GHz



9.3.3 Above 1 GHz



9.4 Test data

Test date : 18. Oct. 2019 ~ 21. Oct. 2019

Operating mode : Transmit mode

Test Result : Pass

9.4.1 Test data for Restricted band

9.4.1.1.1 Bluetooth LE

Frequency (㎒)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
2 376.45	50.69	Peak	H	-11.00	39.69	73.98	34.29
	37.96	Average	H		26.96	53.98	27.02
High CH							
2 483.50	61.94	Peak	V	-9.50	52.44	73.98	21.54
	42.01	Average	V		32.51	53.98	21.47

※ Ant. Pol. : Antenna Polarization

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

※ Result = Reading + Corr. Factor

※ Margin = Result – Limit

9.4.1.1.2 Mesh

Frequency (㎒)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
2 376.45	62.00	Peak	H	-11.00	51.00	73.98	22.98
	32.75	Average	H		21.75	53.98	32.23
High CH							
2 483.50	67.88	Peak	H	-9.50	58.38	73.98	15.60
	32.8	Average	H		23.30	53.98	30.68

※ Ant. Pol. : Antenna Polarization

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

※ DCCF(Duty Cycle Correction Factor): 20 * Log(worst case dwell time / 100 ㎳) dB

※ Result = Reading + Corr Factor+ DCCF

※ Margin = Result - Limit

9.4.2 Test data for Spurious & Harmonic

9.4.2.1 Measurement Results for below 30 ㎒

9.4.2.1.1 Bluetooth LE

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.							

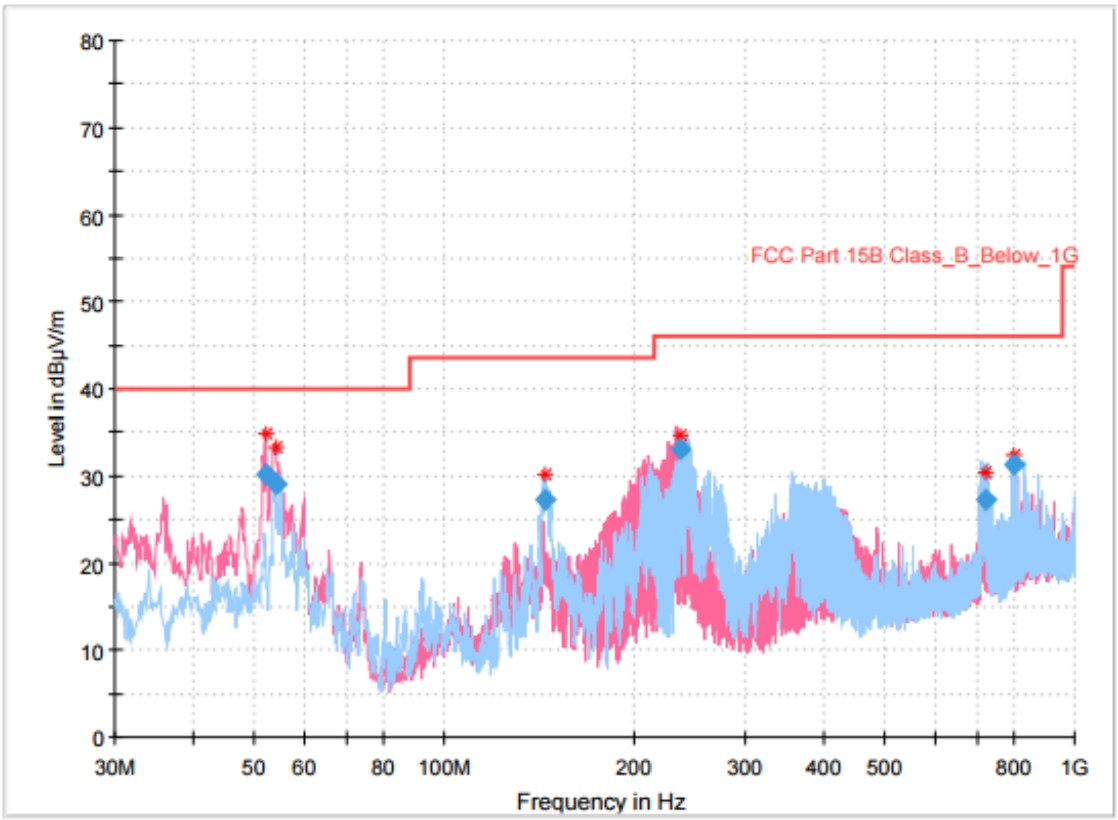
※ Ant. Pol. : Antenna Polarization
※ Corr. Factor. : Antenna Factor + Cable Loss - Amplifier Gain
※ Result = Reading + Corr. Factor
※ Margin = Result - Limit

9.4.2.1.2 Mesh

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 = Result - Limit

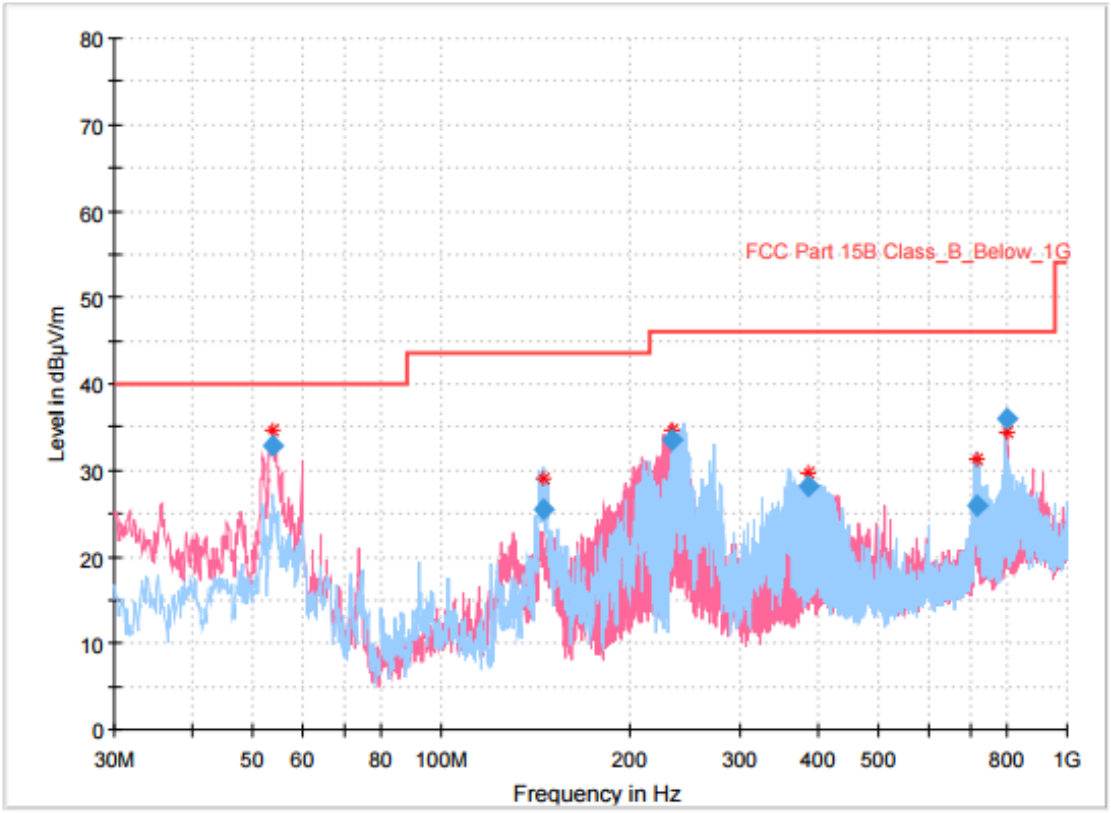
9.4.2.2 Measurement Results for below 1 ㎓



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
52.019000	30.10	40.00	9.90	1000.0	120.000	100.0	V	0.0	-18.9
53.959000	29.07	40.00	10.93	1000.0	120.000	200.1	V	1.0	-19.5
144.945000	27.28	43.50	16.22	1000.0	120.000	200.1	H	237.0	-24.8
236.998000	33.13	46.00	12.87	1000.0	120.000	100.0	H	34.0	-20.2
722.192000	27.33	46.00	18.67	1000.0	120.000	100.0	H	103.0	-9.8
799.792000	31.37	46.00	14.63	1000.0	120.000	100.0	H	279.0	-8.8

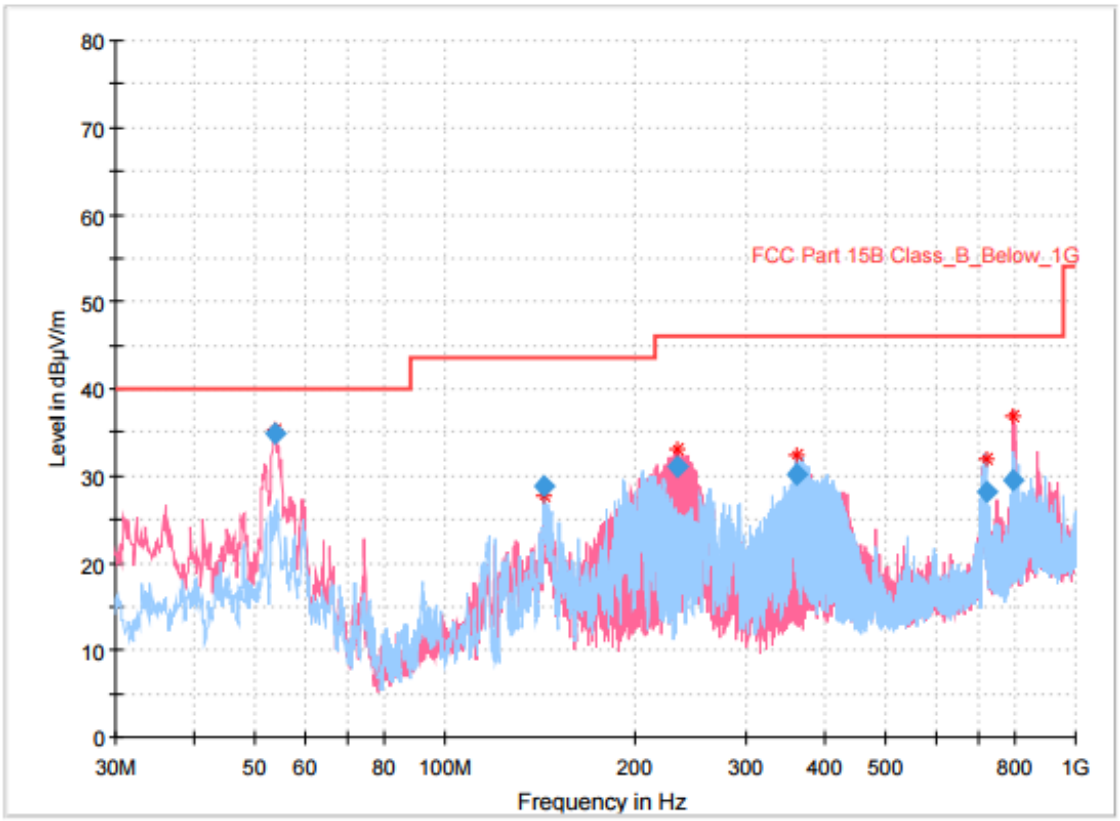
Bluetooth LE_Low CH



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
53.765000	32.80	40.00	7.20	1000.0	120.000	99.9	V	167.0	-19.5
145.333000	25.37	43.50	18.13	1000.0	120.000	99.9	H	237.0	-24.8
233.021000	33.45	46.00	12.55	1000.0	120.000	200.1	V	134.0	-20.1
386.863000	28.11	46.00	17.89	1000.0	120.000	200.1	H	140.0	-15.8
718.409000	25.92	46.00	20.08	1000.0	120.000	200.1	H	63.0	-10.0
799.792000	35.97	46.00	10.03	1000.0	120.000	99.9	V	133.0	-8.8

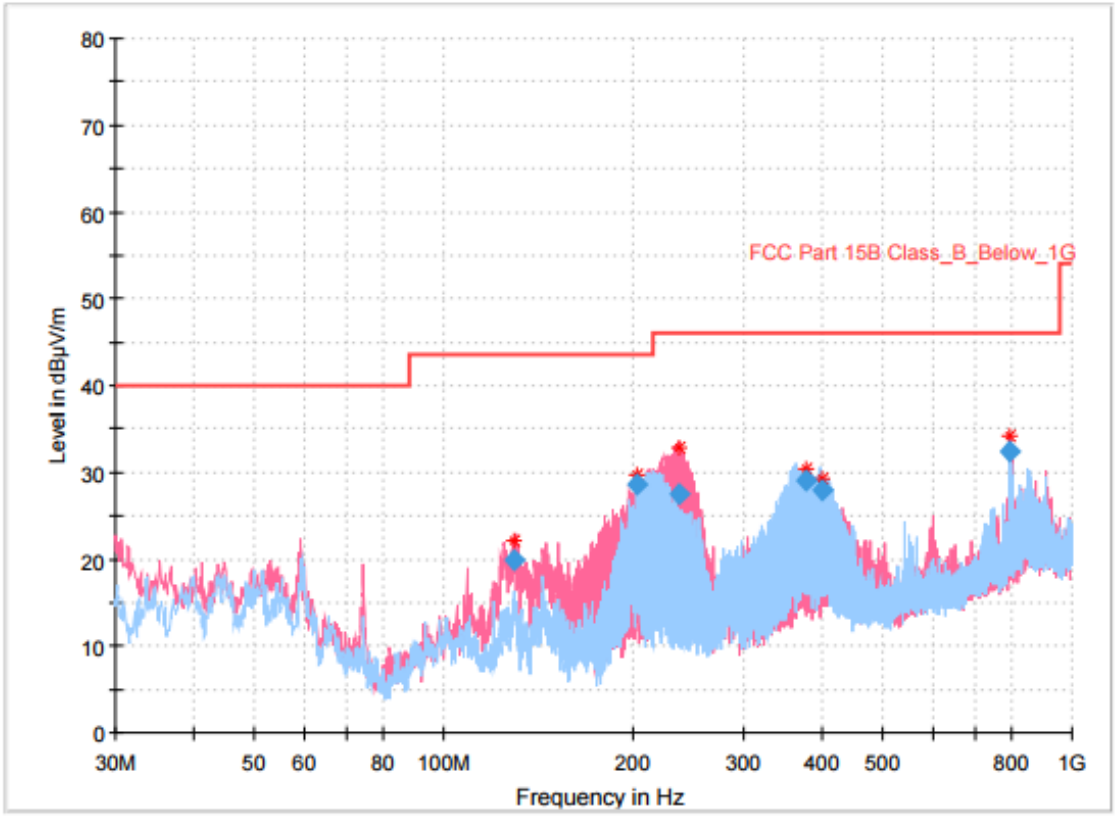
Bluetooth LE_Mid CH



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
53.668000	34.91	40.00	5.09	1000.0	120.000	100.1	V	46.0	-19.5
143.393000	28.79	43.50	14.71	1000.0	120.000	200.0	H	113.0	-24.7
233.215000	31.14	46.00	14.86	1000.0	120.000	200.0	V	165.0	-20.1
362.128000	30.22	46.00	15.78	1000.0	120.000	100.1	H	139.0	-16.5
720.058000	28.22	46.00	17.78	1000.0	120.000	200.0	H	81.0	-9.9
798.046000	29.40	46.00	16.60	1000.0	120.000	100.1	V	144.0	-8.8

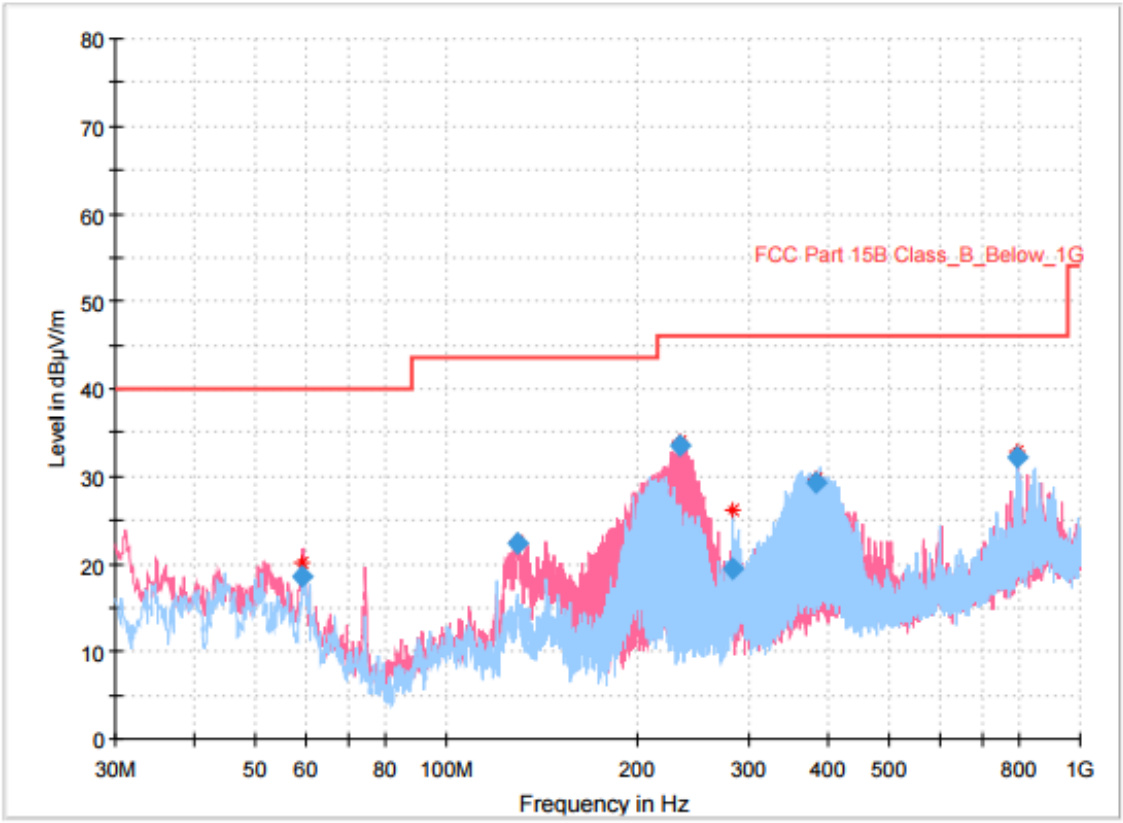
Bluetooth LE_High CH



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
128.940000	19.99	43.50	23.51	1000.0	120.000	100.0	V	87.0	-24.1
203.533000	28.67	43.50	14.83	1000.0	120.000	199.9	V	52.0	-21.6
237.774000	27.57	46.00	18.43	1000.0	120.000	199.9	V	195.0	-20.2
377.357000	29.00	46.00	17.00	1000.0	120.000	199.9	H	129.0	-15.9
401.219000	27.91	46.00	18.09	1000.0	120.000	199.9	H	140.0	-15.6
796.882000	32.37	46.00	13.63	1000.0	120.000	199.9	V	206.0	-8.8

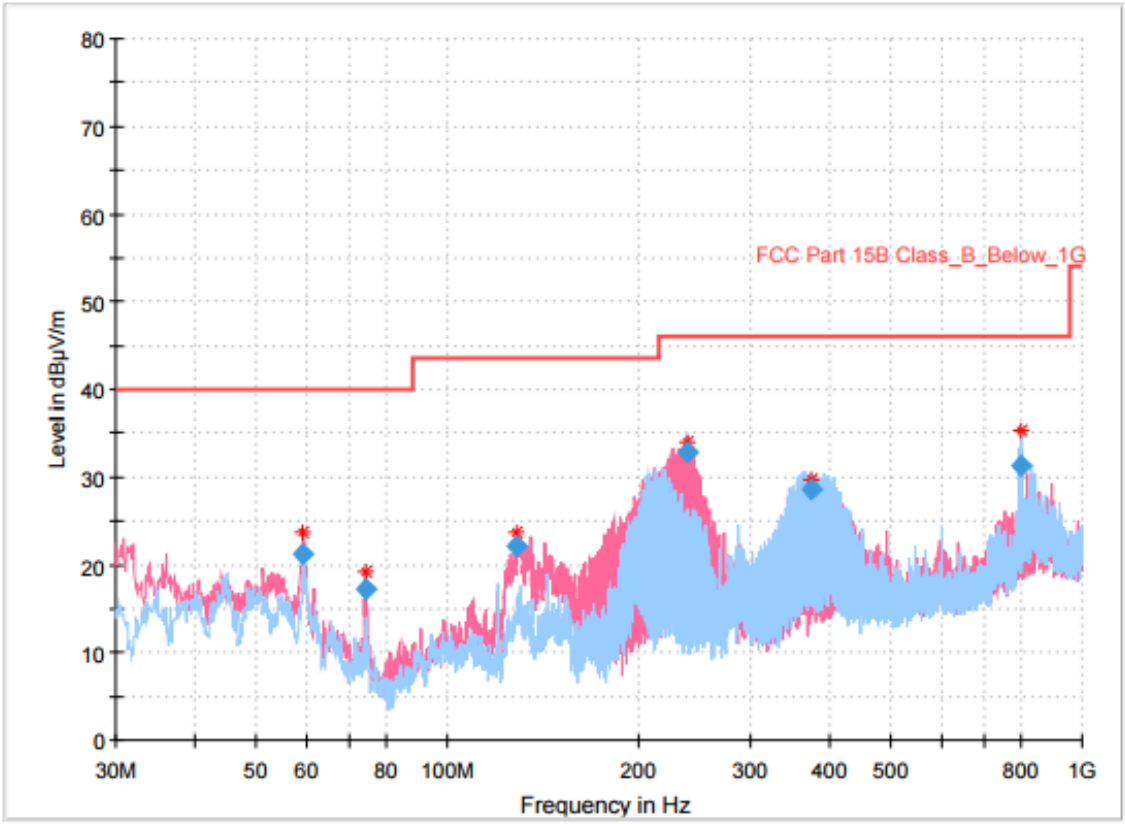
Mesh_Low CH



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
59.294000	18.45	40.00	21.55	1000.0	120.000	200.1	H	234.0	-20.2
129.716000	22.32	43.50	21.18	1000.0	120.000	100.0	V	42.0	-24.1
233.118000	33.54	46.00	12.46	1000.0	120.000	200.1	V	122.0	-20.1
282.685000	19.38	46.00	26.62	1000.0	120.000	100.0	H	130.0	-18.7
382.207000	29.29	46.00	16.71	1000.0	120.000	200.1	H	158.0	-15.9
796.591000	32.24	46.00	13.76	1000.0	120.000	200.1	H	94.0	-8.8

Mesh_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)
59.294000	21.34	40.00	18.66	1000.0	120.000	99.9	V	198.0	-20.2
74.523000	17.13	40.00	22.87	1000.0	120.000	99.9	V	210.0	-25.5
128.746000	22.14	43.50	21.36	1000.0	120.000	99.9	V	47.0	-24.1
238.938000	32.85	46.00	13.15	1000.0	120.000	200.1	V	210.0	-19.9
375.514000	28.70	46.00	17.30	1000.0	120.000	99.9	H	170.0	-15.9
799.889000	31.22	46.00	14.78	1000.0	120.000	99.9	H	126.0	-8.8

Mesh_High CH

9.4.2.3 Measurement Results for Above 1 ㎓

9.4.2.3.1 Bluetooth LE

Frequency (㎒)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
4 804.00	45.81	Peak	V	-1.00	44.81	73.98	29.17
	33.42	Average	V		32.42	53.98	21.56
Mid CH							
4 880.00	46.44	Peak	V	-1.60	44.84	73.98	29.14
	34.16	Average	V		32.56	53.98	21.42
High CH							
4 960.00	45.93	Peak	V	-2.10	43.83	73.98	30.15
	33.49	Average	V		31.39	53.98	22.59

※ Ant. Pol. : Antenna Polarization

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

※ Result = Reading + Corr. Factor

※ Margin = Result - Limit

9.4.2.3.2 Mesh

Frequency (㎒)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
4 820.00	72.78	Peak	H	-1.20	71.58	73.98	2.40
	28.52	Average	H		27.32	53.98	26.66
Mid CH							
4 890.00	66.47	Peak	H	-1.50	64.97	73.98	9.01
	28.19	Average	H		26.69	53.98	27.29
High CH							
4 950.00	56.74	Peak	H	-2.10	54.64	73.98	19.34
	28.34	Average	H		26.24	53.98	27.74

※ 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 ℃

Relative humidity : 44 %

10.2 Measurement method

Standard : §15.207 / RSS-GEN 8.8

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 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

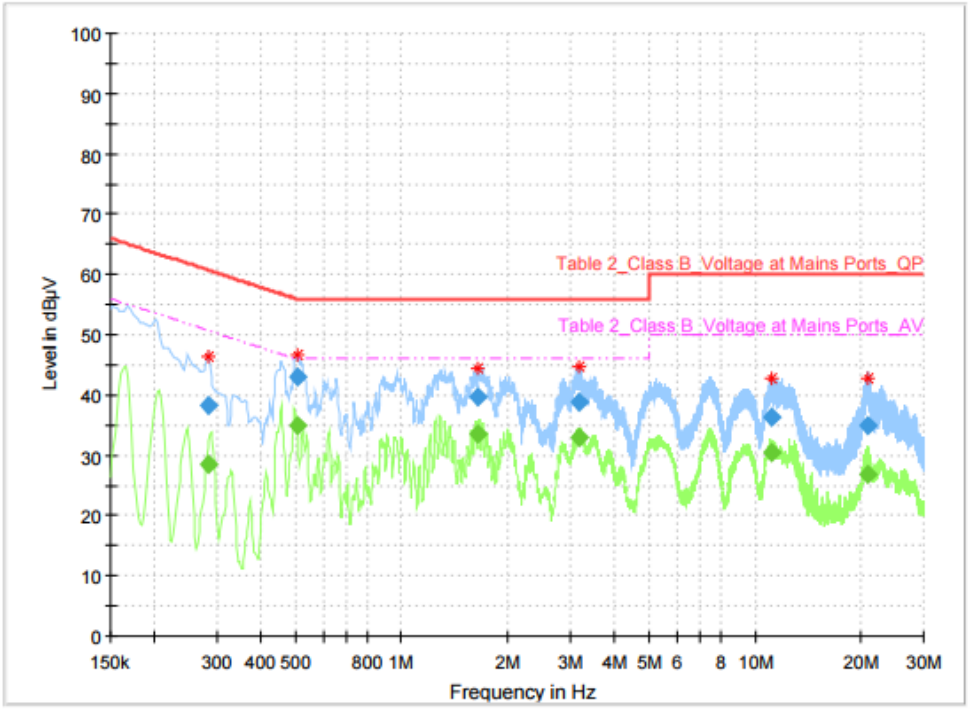
10.4 Test data

Test date : 21. Oct. 2019

Operating mode : Transmit mode

Test Result : Pass

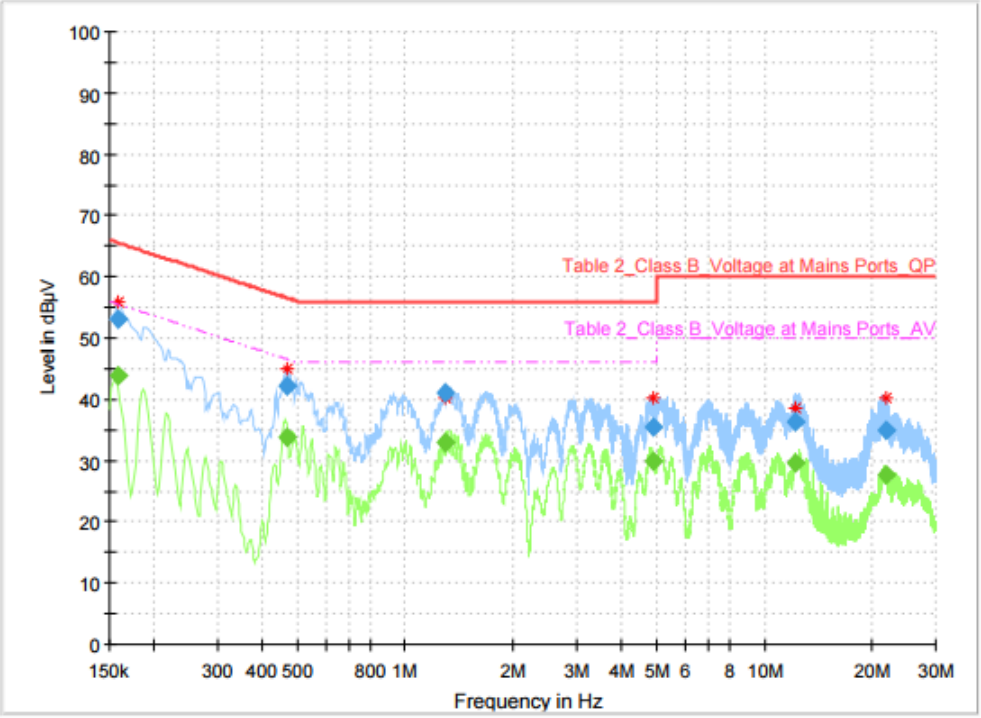
10.4.1 Measured Results & Graph



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.285000	---	28.46	50.67	22.21	1000.0	9.000	L1	ON	9.7
0.285000	38.14	---	60.67	22.53	1000.0	9.000	L1	ON	9.7
0.507750	---	34.81	46.00	11.19	1000.0	9.000	L1	ON	9.9
0.507750	43.11	---	56.00	12.89	1000.0	9.000	L1	ON	9.9
1.650750	---	33.41	46.00	12.59	1000.0	9.000	L1	ON	9.7
1.650750	39.69	---	56.00	16.31	1000.0	9.000	L1	ON	9.7
3.183000	---	32.93	46.00	13.07	1000.0	9.000	L1	ON	9.8
3.183000	38.92	---	56.00	17.08	1000.0	9.000	L1	ON	9.8
11.089500	---	30.57	50.00	19.43	1000.0	9.000	L1	ON	10.0
11.089500	36.33	---	60.00	23.67	1000.0	9.000	L1	ON	10.0
20.744250	---	26.85	50.00	23.15	1000.0	9.000	L1	ON	10.1
20.744250	34.94	---	60.00	25.06	1000.0	9.000	L1	ON	10.1

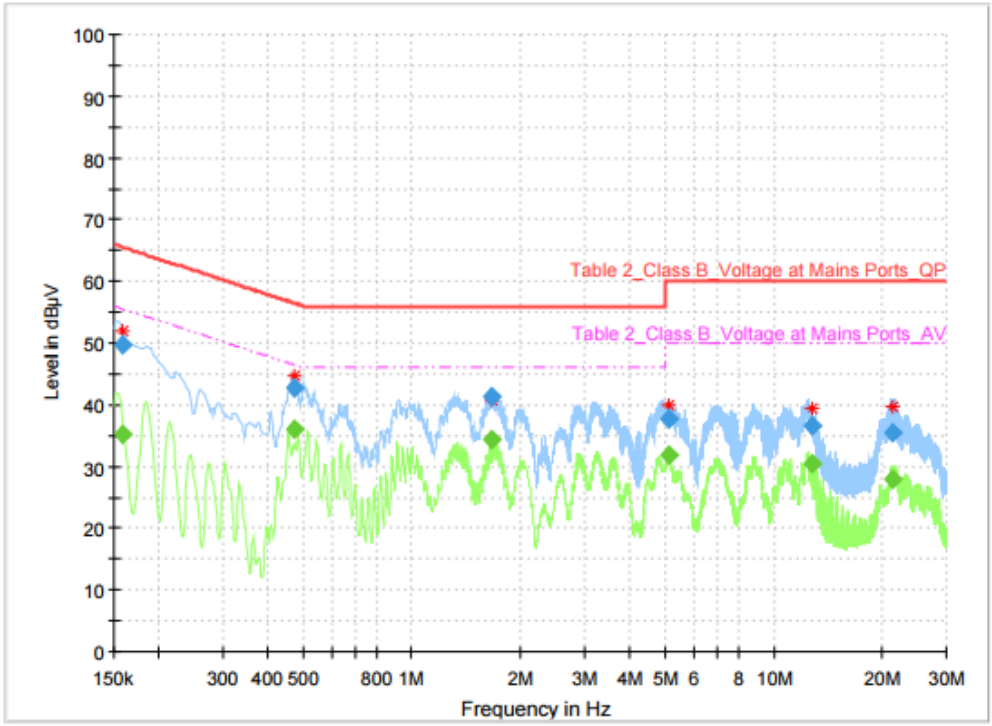
Bluetooth LE_Live line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.159000	---	43.88	55.52	11.64	1000.0	9.000	N	ON	9.9
0.159000	53.05	---	65.52	12.46	1000.0	9.000	N	ON	9.9
0.469500	---	33.90	46.52	12.62	1000.0	9.000	N	ON	9.9
0.469500	42.17	---	56.52	14.36	1000.0	9.000	N	ON	9.9
1.293000	---	33.02	46.00	12.98	1000.0	9.000	N	ON	9.8
1.293000	41.07	---	56.00	14.93	1000.0	9.000	N	ON	9.8
4.881750	---	29.92	46.00	16.08	1000.0	9.000	N	ON	9.9
4.881750	35.57	---	56.00	20.43	1000.0	9.000	N	ON	9.9
12.221250	---	29.54	50.00	20.46	1000.0	9.000	N	ON	10.1
12.221250	36.30	---	60.00	23.70	1000.0	9.000	N	ON	10.1
21.689250	---	27.73	50.00	22.27	1000.0	9.000	N	ON	10.1
21.689250	34.91	---	60.00	25.09	1000.0	9.000	N	ON	10.1

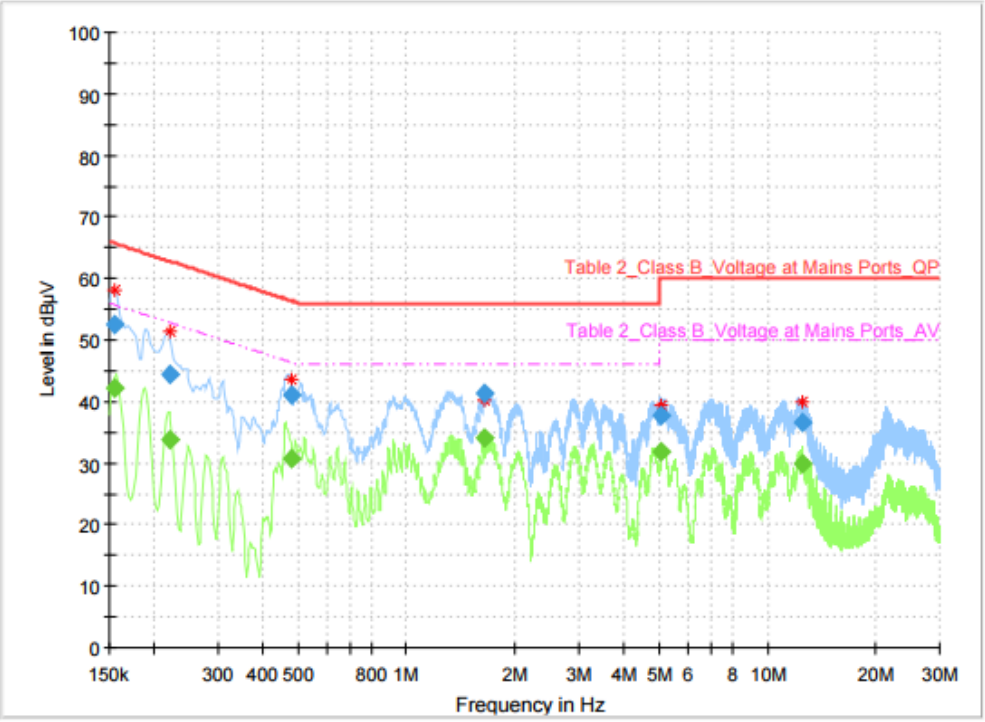
Bluetooth LE_Neutral line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.159000	---	35.18	55.52	20.34	1000.0	9.000	L1	ON	9.9
0.159000	49.70	---	65.52	15.82	1000.0	9.000	L1	ON	9.9
0.474000	---	35.91	46.44	10.53	1000.0	9.000	L1	ON	9.9
0.474000	42.71	---	56.44	13.73	1000.0	9.000	L1	ON	9.9
1.655250	---	34.33	46.00	11.67	1000.0	9.000	L1	ON	9.7
1.655250	41.27	---	56.00	14.73	1000.0	9.000	L1	ON	9.7
5.140500	---	31.77	50.00	18.23	1000.0	9.000	L1	ON	9.9
5.140500	37.61	---	60.00	22.39	1000.0	9.000	L1	ON	9.9
12.738750	---	30.46	50.00	19.54	1000.0	9.000	L1	ON	10.0
12.738750	36.51	---	60.00	23.49	1000.0	9.000	L1	ON	10.0
21.257250	---	27.97	50.00	22.03	1000.0	9.000	L1	ON	10.1
21.257250	35.46	---	60.00	24.54	1000.0	9.000	L1	ON	10.1

Mesh_Live line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.154500	---	42.17	55.75	13.58	1000.0	9.000	N	ON	9.8
0.154500	52.39	---	65.75	13.36	1000.0	9.000	N	ON	9.8
0.219750	---	33.83	52.83	19.00	1000.0	9.000	N	ON	9.8
0.219750	44.52	---	62.83	18.31	1000.0	9.000	N	ON	9.8
0.478500	---	30.76	46.37	15.61	1000.0	9.000	N	ON	9.9
0.478500	41.07	---	56.37	15.29	1000.0	9.000	N	ON	9.9
1.644000	---	34.06	46.00	11.94	1000.0	9.000	N	ON	9.8
1.644000	41.39	---	56.00	14.61	1000.0	9.000	N	ON	9.8
5.097750	---	31.83	50.00	18.17	1000.0	9.000	N	ON	9.9
5.097750	37.83	---	60.00	22.17	1000.0	9.000	N	ON	9.9
12.430500	---	29.97	50.00	20.03	1000.0	9.000	N	ON	10.1
12.430500	36.46	---	60.00	23.54	1000.0	9.000	N	ON	10.1

Mesh_Neutral line

- END OF REPORT.