



Test Report No.:
FCC2022-0042-RF/R2

TEST REPORT

FCC ID : 2AN5D-Y2076
Applicant : Shenzhen Yunding Information
Technology Co.,Ltd.
Product Name : Oclean Smart Sonic Electric Toothbrush
Mode No. : Y2076

CVC Testing Technology Co., Ltd.

Applicant		Name: Shenzhen Yunding Information Technology Co.,Ltd. Address: 28G,Building 3, Dachong Business Center(phase III), No.18 Dachong 1st Road, Dachong Community, Yuehai Street, Nanshan District, Shenzhen, Guangdong, China.	
Manufacturer		Name: Shenzhen Yunding Information Technology Co.,Ltd. Address: 28G,Building 3, Dachong Business Center(phase III), No.18 Dachong 1st Road, Dachong Community, Yuehai Street, Nanshan District, Shenzhen, Guangdong, China.	
Equipment Under Test		Product Name : Oclean Smart Sonic Electric Toothbrush Model No. : Y2076 Trade mark : Oclean Serial no. : Y2076-0001 Sampling : 1-1	
Date of Receipt.	2022.07.23	Date of Testing	2022.08.15
Test Specification		Test Result	
FCC CFR47 Part 15C (2020) Radio Frequency Devices ANSI C63.10 (2013) KDB 558074 D01 DTS Meas Guidance v05 KDB 66911 D01 Multiple Transmitter Output v02r01		PASS	
Evaluation of Test Result		The equipment under test was found to comply with the requirements of the standards applied. Seal of CVC Issue Date: 2022.10.08	
Tested by: Xu Zhenfei <i>Xu Zhenfei</i>		Reviewed by: Liu YongHai <i>Liu Yonghai</i>	Approved by: Chen HuaWen <i>Chen HuaWen</i>
Other Aspects: NONE.			
Abbreviations:OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested			
This test report relates only to the EUT, and shall not be reproduced except in full, without written approval of CVC . After this report is released, it will replace the report numbered FCC2022-0042-RF/R1.			

TABLE OF CONTENTS

- 1. GENERAL PRODUCT INFORMATION..... 4**
 - 1.1 GENERAL INFORMATION 4
- 2. TEST SITES 5**
 - 2.1 TEST FACILITIES 5
 - 2.2 DESCRIPTION OF NON-STANDARD METHOD AND DEVIATIONS..... 5
 - 2.3 LIST OF TEST AND MEASUREMENT INSTRUMENTS 5
- 3. TEST CONFIGURATION 6**
 - 3.1 TEST MODE 6
 - 3.2 DUTY CYCLE 7
- 4. SUMMARY OF MEASUREMENT RESULTS..... 8**
- 5. MEASUREMENT PROCEDURE..... 9**
 - 5.1 CONDUCTED EMISSION 9
 - 5.2 RADIATED EMISSION 13
 - 5.3 MAXIMUM CONDUCTED OUTPUT POWER 29
 - 5.4 MINIMUM 6 DB BANDWIDTH..... 31
 - 5.5 OCCUPIED CHANNEL BANDWIDTH 36
 - 5.6 BAND EDGE MEASUREMENT 40
 - 5.7 MAXIMUM POWER SPECTRAL DENSITY 44
 - 5.8 SPURIOUS RF CONDUCTED EMISSIONS 48
- 6. APPENDIX E 57**

1. General Product Information

1.1 General information

Product Name	Oclean Smart Sonic Electric Toothbrush	
Model No.	Y2076	
Power Supply	DC 3.8V	
Serial Number(SN)	Y2076-0001	
Power Supply	Adapter	—
	Battery	—
Antenna Type	PCB Antenna	
Antenna Connector	A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)	
Antenna Gain	-0.49 dBi (provided by client)	
Beamforming gain	Unsupported	
Frequency Range	Bluetooth(Low Energy): 2402~2480MHz	
Channel Number	Bluetooth(Low Energy):40 Channels	
Type of Modulation	Bluetooth(Low Energy):GFSK	
Max. Conducted Power	Bluetooth(Low Energy): -0.75 dBm	
Operate Temp.Range	+5°C to +40°C	
Note:		
1. The information of the EUT is declared by the manufacturer.		
2. The laboratory is not responsible for the product technical specification provided by the client.		

2. Test Sites

2.1 Test Facilities

The tests and measurements refer to this report were performed by EMC testing Lab. of CVC Testing Technology Co., Ltd.

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Telephone : +86-20-32293888

Fax : +86-20-32293889

FCC(Test firm designation number: CN1282)

IC(Test firm CAB identifier number: CN0103)

2.2 Description of Non-standard Method and Deviations

The testing and measurement methods used in this report are applied by all standard methods. Not any non-standard method or deviation from the used standards was used.

2.3 List of Test and Measurement Instruments

Refer to **Appendix E**.

3. Test Configuration

3.1 Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

Test Mode	Antenna Delivery	Test Channel
Bluetooth(Low Energy)	1TX / 1RX	0,19,39

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

Test Mode	Data Rate		
	Antenna 1	Antenna 2	MIMO
Bluetooth(Low Energy)	1	/	/

3.2 Duty cycle

TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Limit	Verdict
BLE_1M	Ant1	2402	2.17	2.50	86.80	---	PASS
		2440	2.17	2.50	86.80	---	PASS
		2480	2.17	2.50	86.80	---	PASS
BLE_2M	Ant1	2402	1.12	1.88	59.57	---	PASS
		2440	1.12	1.88	59.57	---	PASS
		2480	1.12	1.88	59.57	---	PASS

4. Summary of measurement results

Summary of measurements of results	Clause in FCC rules	Verdict	Note
Conducted Emissions	15.207	PASS	/
Radiated Emissions	15.247(d),15.205,15.209	PASS	/
Maximum conducted output power	15.247(b)(3)	PASS	/
Minimum 6 dB bandwidth	15.247(a)(2)	PASS	/
Occupied Channel Bandwidth	15.247(a)(2)	PASS	/
Band Edge Measurement	15.247(d)	PASS	/
Maximum Power spectral density	15.247(e)	PASS	/
Spurious RF Conducted Emissions	15.247(d)	PASS	/

5. Measurement procedure

5.1 Conducted Emission

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was setup according to ANSI C63.10, 2013 for compliance to FCC 47CFR 15.247 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

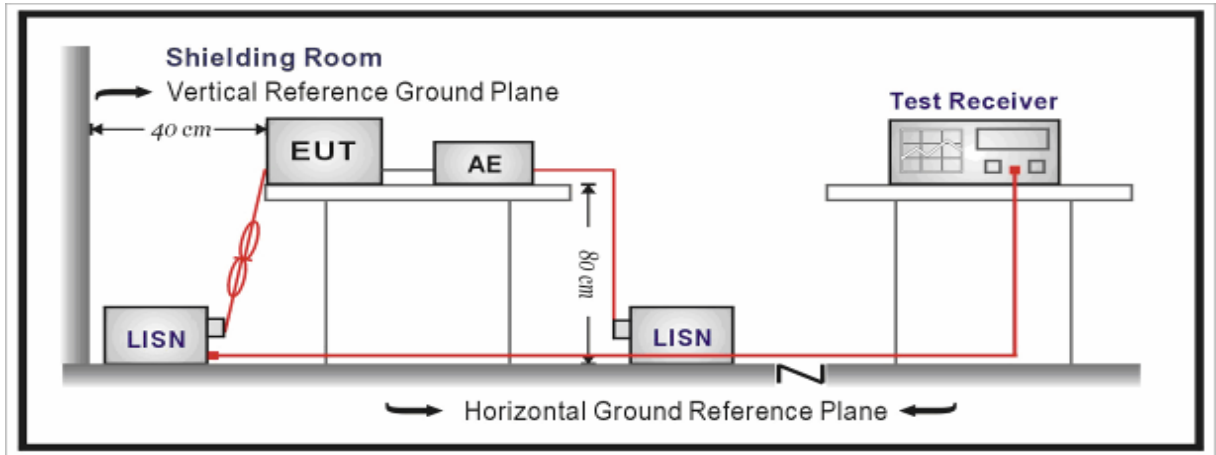
Limits:

Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Test Setup:



Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Level = Reading + Factor.

Measurement Uncertainty:

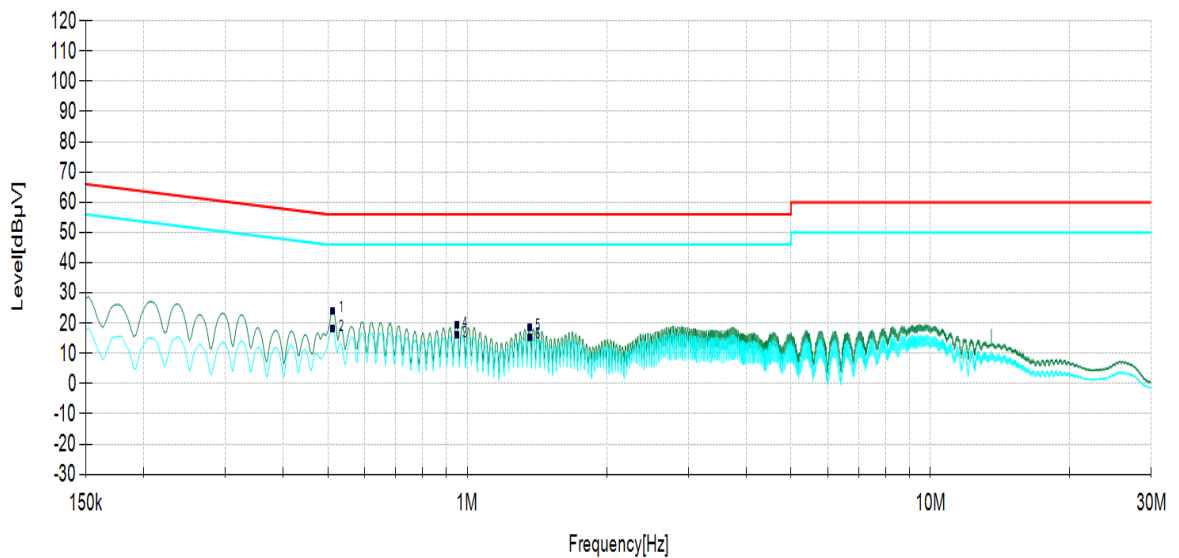
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$. $U = 3.12$ dB.

Test Results:

During the test, the Conducted Emission from 150KHz to 30MHz was performed in all modes with all channels and all antenna. BLE(1Mbps), Channel 1, antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

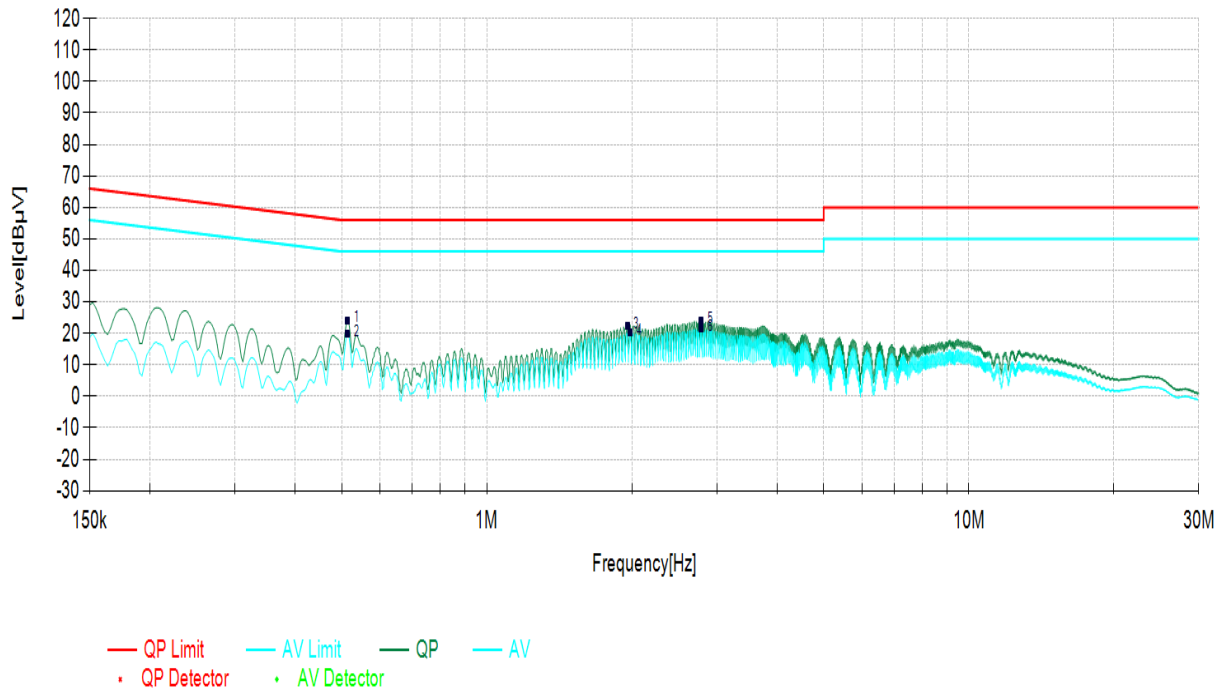
Power Line	L
Test channel	Worst-Case

Suspected List								
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/Fail
1	0.5123	10.48	13.71	24.19	56.00	31.81	QP	PASS
4	0.9488	10.50	8.75	19.25	56.00	36.75	QP	PASS
5	1.3628	10.52	7.97	18.49	56.00	37.51	QP	PASS
2	0.5123	10.48	7.58	18.06	46.00	27.94	AV	PASS
6	1.3628	10.52	4.90	15.42	46.00	30.58	AV	PASS
3	0.9488	10.50	5.57	16.07	46.00	29.93	AV	PASS



Power Line	N
Test channel	Worst-Case

Suspected List								
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/Fail
1	0.5145	10.29	13.79	24.08	56.00	31.92	QP	PASS
3	1.9568	10.36	12.04	22.40	56.00	33.60	QP	PASS
5	2.7870	10.39	13.49	23.88	56.00	32.12	QP	PASS
2	0.5145	10.29	9.52	19.81	46.00	26.19	AV	PASS
4	1.9860	10.36	9.70	20.06	46.00	25.94	AV	PASS
6	2.7870	10.39	10.96	21.35	46.00	24.65	AV	PASS



5.2 Radiated Emission

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was setup and tested according to ANSI C63.10, 2013.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from Antenna to the EUT was 3 meters.

The Antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the Antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn Antenna will be bended down a little (as horn

Antenna has the narrow beamwidth) in order to keeping the Antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

Limits:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

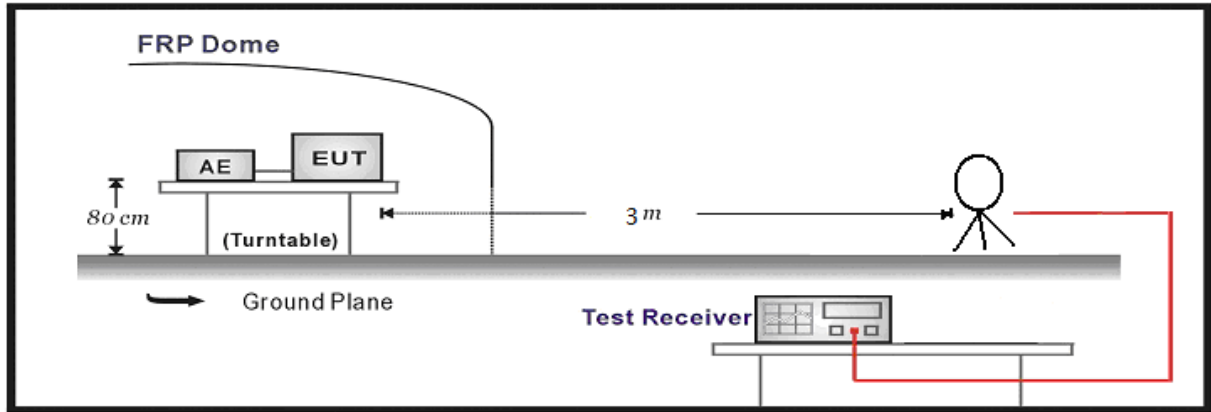
Frequency	Limit (dBµV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Level
88MHz-216MHz	43.5	Quasi-peak Level
216MHz-960MHz	46.0	Quasi-peak Level
960MHz-1GHz	54.0	Quasi-peak Level
Above 1GHz	54.0	Average Level
	74.0	Peak Level

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

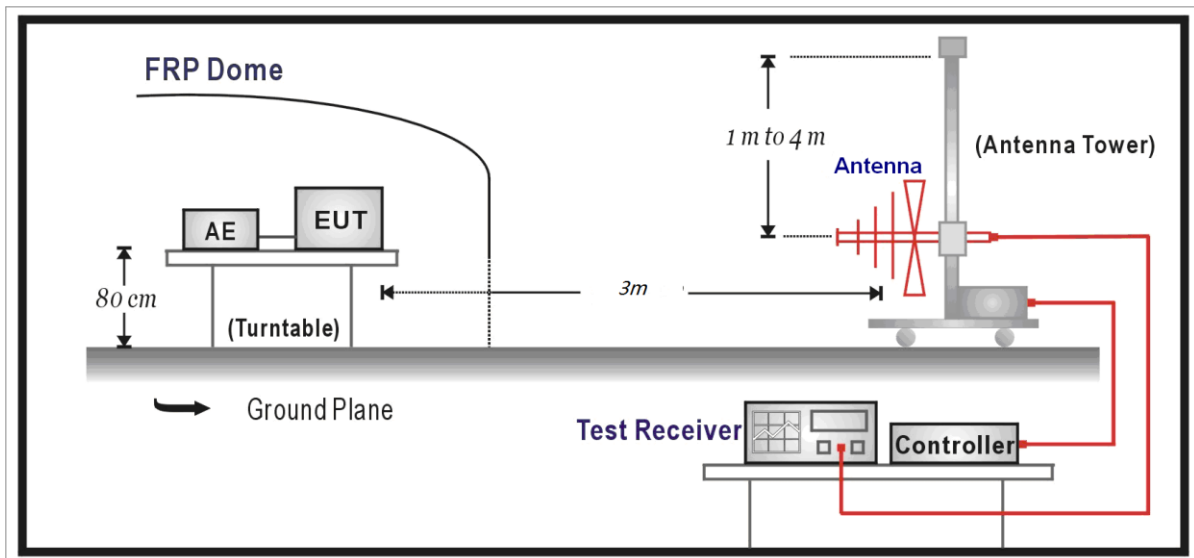
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.
12.57675-12.57725	322-335.4	3600-4400	/
13.36-13.41	/	/	/

Test Setup:

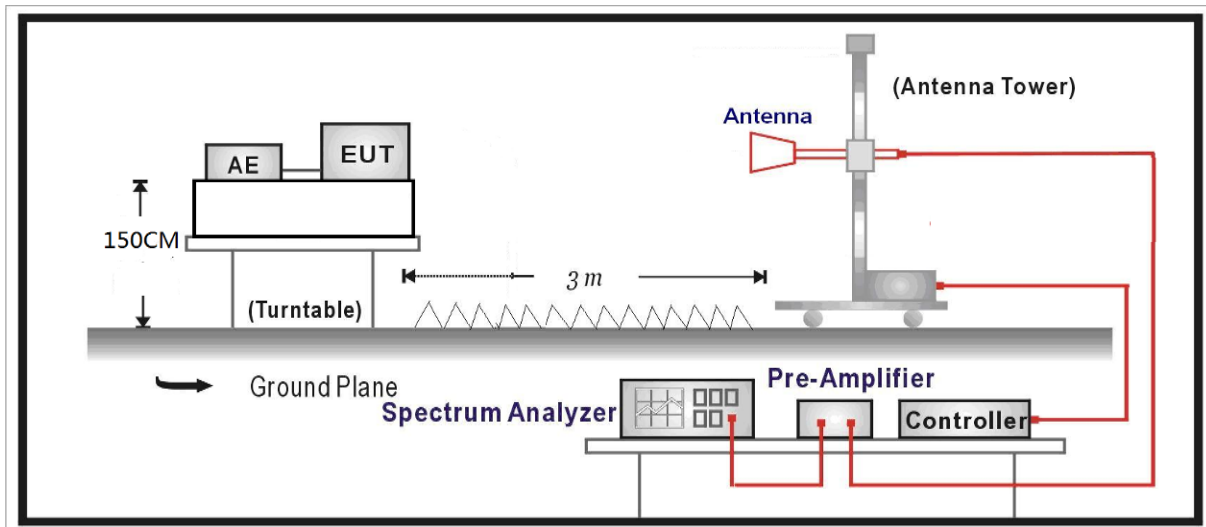
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



Measurement Data:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Level = Reading - Factor

Factor = Preamplifier Factor – Antenna Factor–Cable Loss

Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.19 dB
200MHz-1GHz	3.63 dB
Above 1GHz	3.68 dB

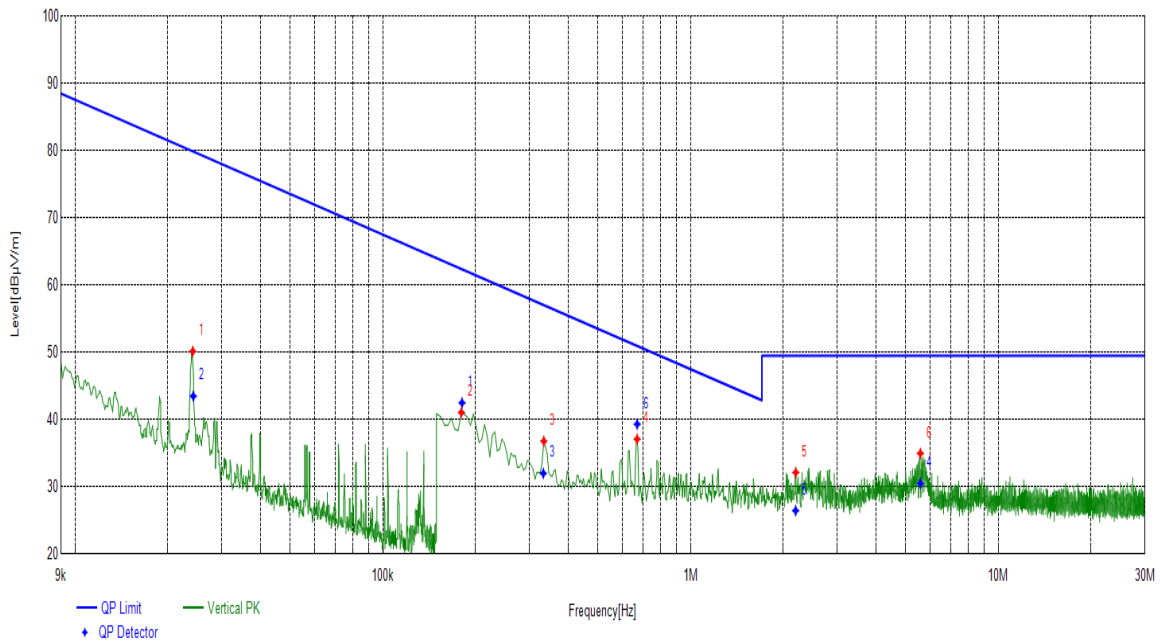
Test Results:

SPURIOUS EMISSIONS:

During the test, the Radiates Emission from 9KHz to 30MHz was performed in all modes with all channels and all antenna. BLE(1Mbps), Channel 39, antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

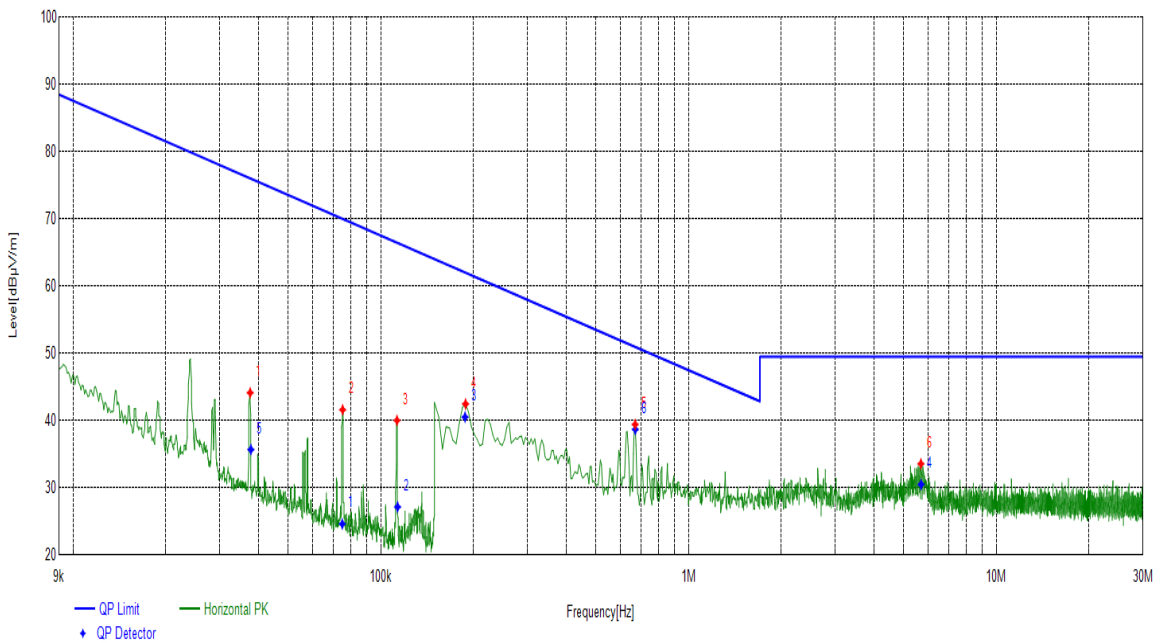
Radiated Emission	9KHz-30MHz
Polarity	X axis
Test channel	Worst-Case

Final Data List								
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail
0.1808	X axis	19.50	42.51	62.38	19.87	220	360	PASS
0.0242	X axis	19.62	43.51	79.88	36.37	120	0	PASS
0.3322	X axis	19.55	32.02	57.08	25.06	120	32	PASS
5.5861	X axis	19.66	30.52	49.50	18.98	120	63	PASS
2.1950	X axis	19.92	26.48	49.50	23.02	150	160	PASS
0.6705	X axis	19.68	39.34	50.98	11.64	250	220	PASS



Radiated Emission	9KHz-30MHz
Polarity	Y axis
Test channel	Worst-Case

Final Data List								
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail
0.0749	Y axis	19.68	24.65	70.05	45.40	280	358	PASS
0.1133	Y axis	19.70	27.18	66.45	39.27	160	270	PASS
0.1877	Y axis	19.48	40.55	62.05	21.50	160	274	PASS
5.6989	Y axis	19.66	30.52	49.50	18.98	180	252	PASS
0.0378	Y axis	19.63	35.71	76.01	40.30	200	88	PASS
0.6712	Y axis	19.68	38.70	50.97	12.27	160	24	PASS

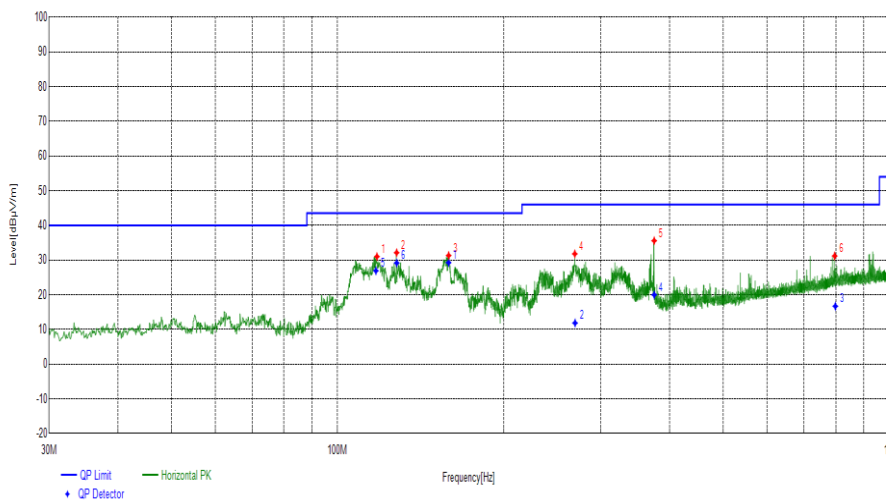


Bluetooth(Low Energy):

During the test, the Radiates Emission from 30MHz to 40GHz was performed in Bluetooth(Low Energy) all modes with all channels and all antenna. BLE(1Mbps), Channel 39, antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Radiates Emission		30M~1G							
Test channel		Worst-Case							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
117.8908	10.56	20.45	31.01	43.52	12.51	PK	100	179	PASS
127.9798	9.84	22.29	32.13	43.52	11.39	PK	100	201	PASS
159.0229	9.95	21.37	31.32	43.52	12.20	PK	100	9	PASS
269.2259	14.71	17.09	31.80	46.02	14.22	PK	100	44	PASS
374.9665	17.29	18.28	35.57	46.02	10.45	PK	100	44	PASS
796.4736	24.53	6.66	31.19	46.02	14.83	PK	100	53	PASS

Final Data List								
Frequency [MHz]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail	
158.9838	9.95	29.27	43.52	14.25	250	14	PASS	
269.4987	14.71	11.86	46.02	34.16	230	49	PASS	
798.6632	24.53	16.70	46.02	29.32	220	58	PASS	
375.0154	17.29	19.99	46.02	26.03	240	49	PASS	
117.3772	10.57	26.92	43.52	16.60	110	184	PASS	
128.0187	9.84	29.17	43.52	14.35	240	206	PASS	



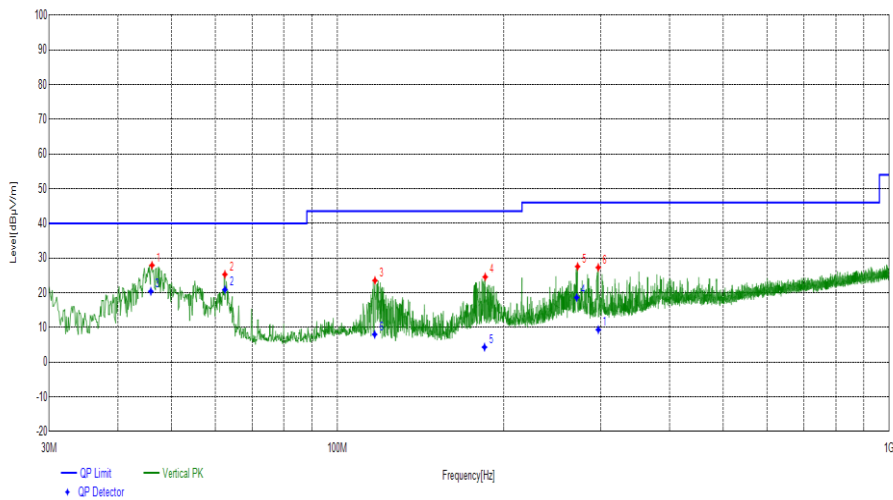
Radiates Emission	30M~1G
Test channel	Worst-Case
polarization	Vertical

Suspected List

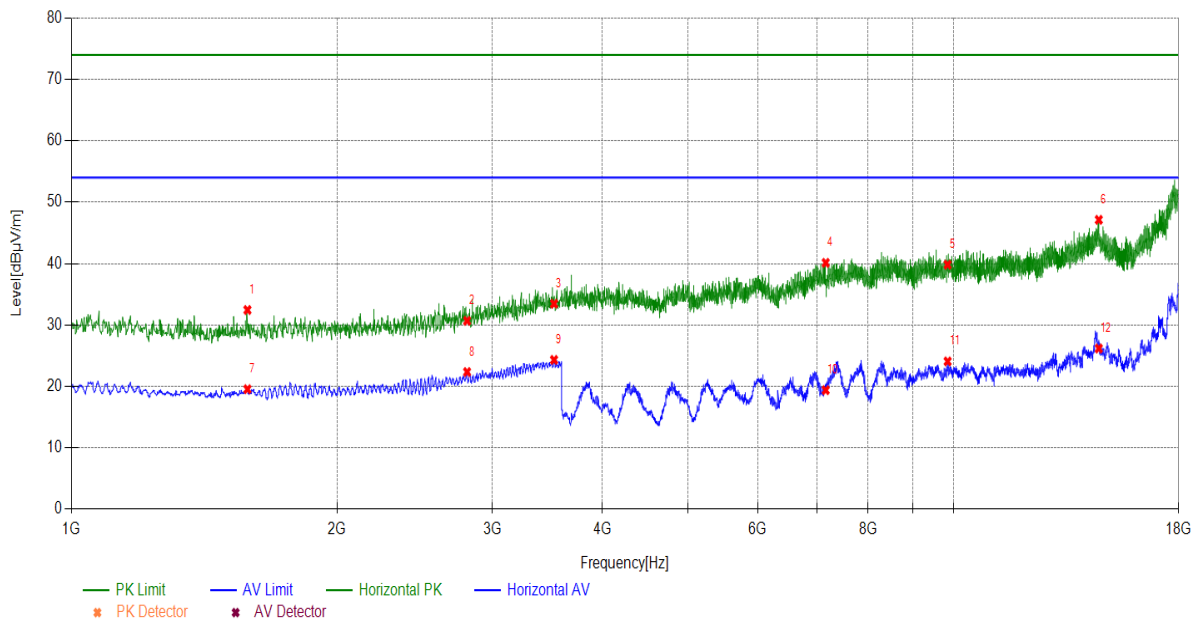
Frequency [MHz]	Factor [dB]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
46.1036	12.72	15.20	27.92	40.00	12.08	PK	100	221	PASS
62.4983	11.53	13.76	25.29	40.00	14.71	PK	100	147	PASS
116.9207	10.69	12.84	23.53	43.52	19.99	PK	100	278	PASS
185.2155	12.29	12.27	24.56	43.52	18.96	PK	100	261	PASS
272.4272	14.79	12.77	27.56	46.02	18.46	PK	100	239	PASS
296.9707	15.43	11.86	27.29	46.02	18.73	PK	100	16	PASS

Final Data List

Frequency [MHz]	Factor [dB]	QP Value [dB μ V/m]	QP Limit [dB μ V/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail
297.0136	15.43	9.35	46.02	36.67	170	21	PASS
62.5128	11.53	20.92	40.00	19.08	230	152	PASS
45.8814	12.72	20.41	40.00	19.59	180	226	PASS
271.3036	14.79	18.64	46.02	27.38	240	244	PASS
184.6740	12.29	4.32	43.52	39.20	130	266	PASS
116.7735	10.69	8.00	43.52	35.52	210	283	PASS

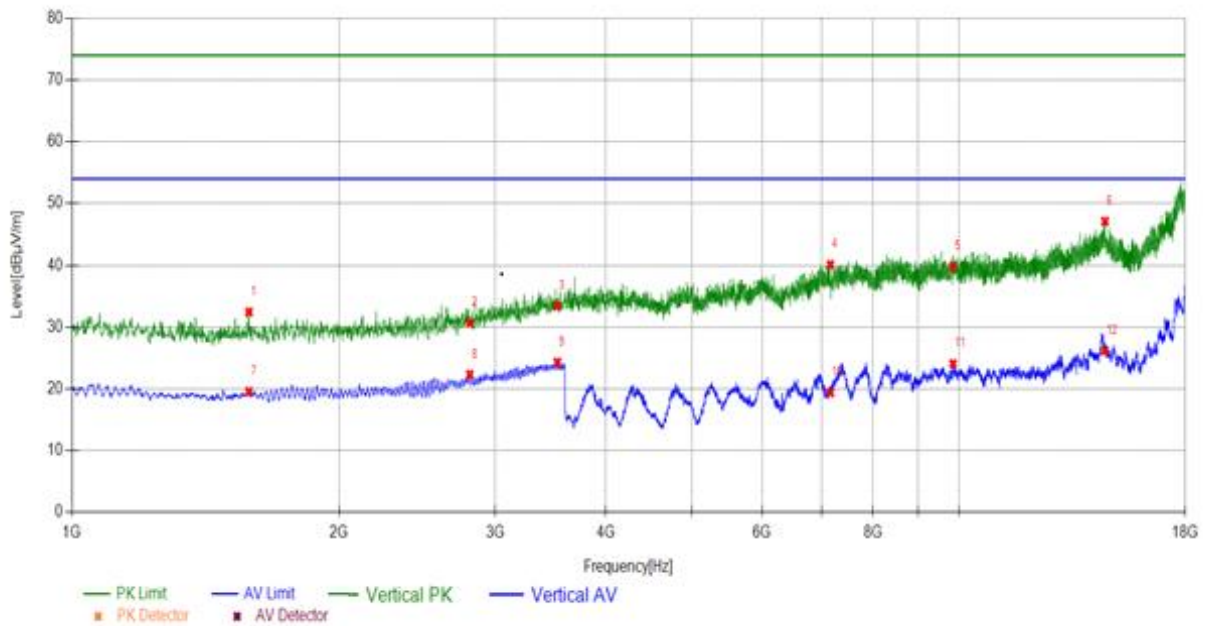


Radiates Emission	1G~18G								
Test channel	Worst-Case								
polarization	Horizontal								
Suspected List									
Frequency[MHz]	Factor [dB]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
1583.1583	-9.15	41.60	32.45	74.00	41.55	PK	150	340	PASS
2808.9809	-5.43	36.12	30.69	74.00	43.31	PK	150	10	PASS
3524.7525	-2.85	36.32	33.47	74.00	40.53	PK	150	280	PASS
7163.1163	4.69	35.44	40.13	74.00	33.87	PK	150	10	PASS
9847.6848	8.54	31.29	39.83	74.00	34.17	PK	150	10	PASS
14611.5612	13.48	33.66	47.14	74.00	26.86	PK	150	280	PASS
1583.1583	-9.15	28.70	19.55	54.00	34.45	AV	150	30	PASS
2808.9809	-5.43	27.78	22.35	54.00	31.65	AV	150	50	PASS
3524.7525	-2.85	27.17	24.32	54.00	29.68	AV	150	50	PASS
7163.1163	4.69	14.70	19.39	54.00	34.61	AV	150	100	PASS
9847.6848	8.54	15.54	24.08	54.00	29.92	AV	150	50	PASS
14611.5612	13.48	12.70	26.18	54.00	27.82	AV	150	360	PASS



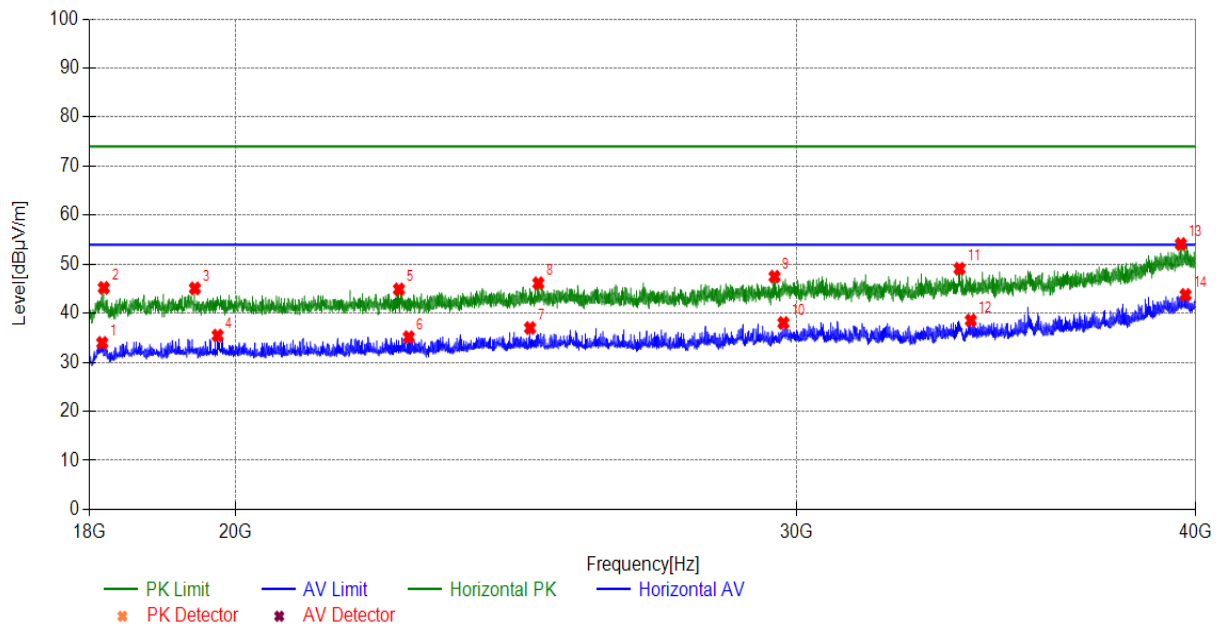
Note: The signal beyond the limit is carrier

Radiates Emission	1G~18G								
Test channel	Worst-Case								
polarization	Vertical								
Suspected List									
Frequency[MHz]	Factor [dB]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
1583.1533	-9.15	41.60	32.45	74.00	41.55	PK	150	340	PASS
2808.9899	-5.43	36.12	30.69	74.00	43.31	PK	150	10	PASS
3524.7425	-2.85	36.32	33.47	74.00	40.53	PK	150	280	PASS
7163.1063	4.69	35.44	40.13	74.00	33.87	PK	150	10	PASS
9847.6888	8.54	31.29	39.83	74.00	34.17	PK	150	10	PASS
14611.5622	13.48	33.66	47.14	74.00	26.86	PK	150	280	PASS
1583.1589	-9.15	28.70	19.55	54.00	34.45	AV	150	30	PASS
2808.9819	-5.43	27.78	22.35	54.00	31.65	AV	150	50	PASS
3524.7515	-2.85	27.17	24.32	54.00	29.68	AV	150	50	PASS
7163.1165	4.69	14.70	19.39	54.00	34.61	AV	150	100	PASS
9847.6845	8.54	15.54	24.08	54.00	29.92	AV	150	50	PASS
14611.5602	13.48	12.70	26.18	54.00	27.82	AV	150	360	PASS

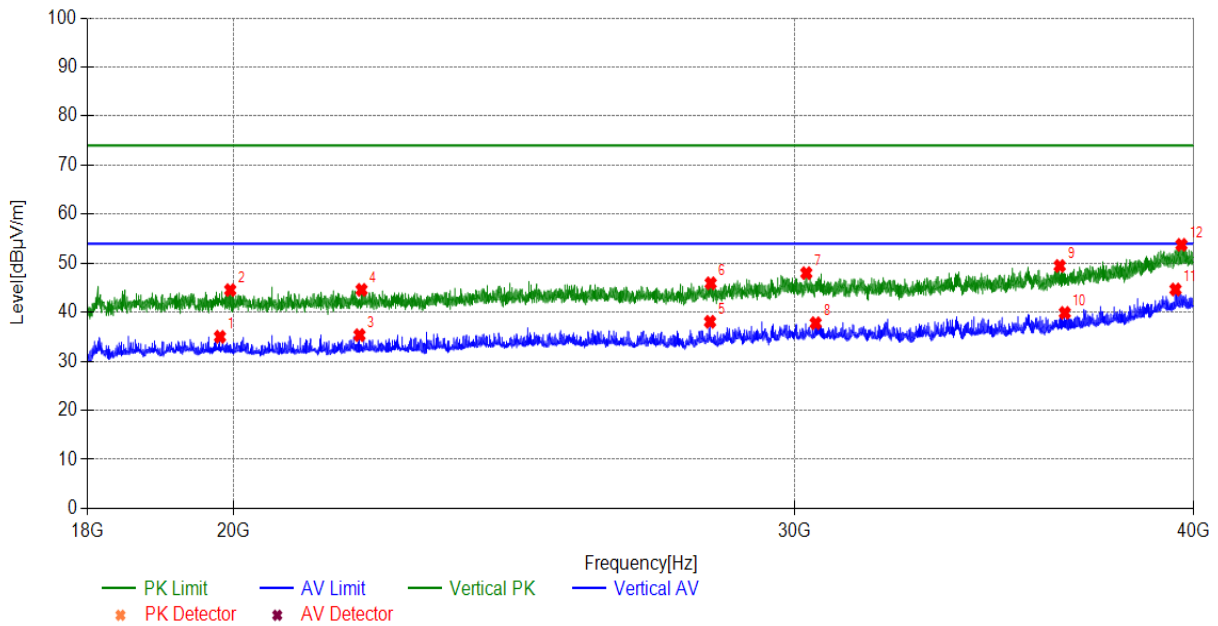


Note: The signal beyond the limit is carrier

Radiates Emission		18G~40G							
Test channel		Worst-Case							
polarization		Horizontal							
Suspected List									
Frequency[MHz]	Factor [dB]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
19423.5424	1.33	43.74	45.07	74.00	28.93	PK	100	100	PASS
24888.8889	4.06	42.06	46.12	74.00	27.88	PK	100	60	PASS
39575.3575	10.78	43.33	54.11	74.00	19.89	PK	100	150	PASS
18187.0187	1.15	44.03	45.18	74.00	28.82	PK	100	60	PASS
33731.5732	6.52	42.56	49.08	74.00	24.92	PK	100	180	PASS
22506.0506	2.41	42.47	44.88	74.00	29.12	PK	100	90	PASS
29515.9516	6.36	41.10	47.46	74.00	26.54	PK	100	170	PASS
19744.7745	1.31	34.14	35.45	54.00	18.55	AV	100	10	PASS
22666.6667	2.57	32.56	35.13	54.00	18.87	AV	100	10	PASS
24739.2739	4.00	32.99	36.99	54.00	17.01	AV	100	10	PASS
39709.5710	10.79	32.95	43.74	54.00	10.26	AV	100	10	PASS
29705.1705	6.49	31.53	38.02	54.00	15.98	AV	100	10	PASS
34008.8009	6.60	31.94	38.54	54.00	15.46	AV	100	10	PASS
18167.2167	1.14	32.82	33.96	54.00	20.04	AV	100	10	PASS



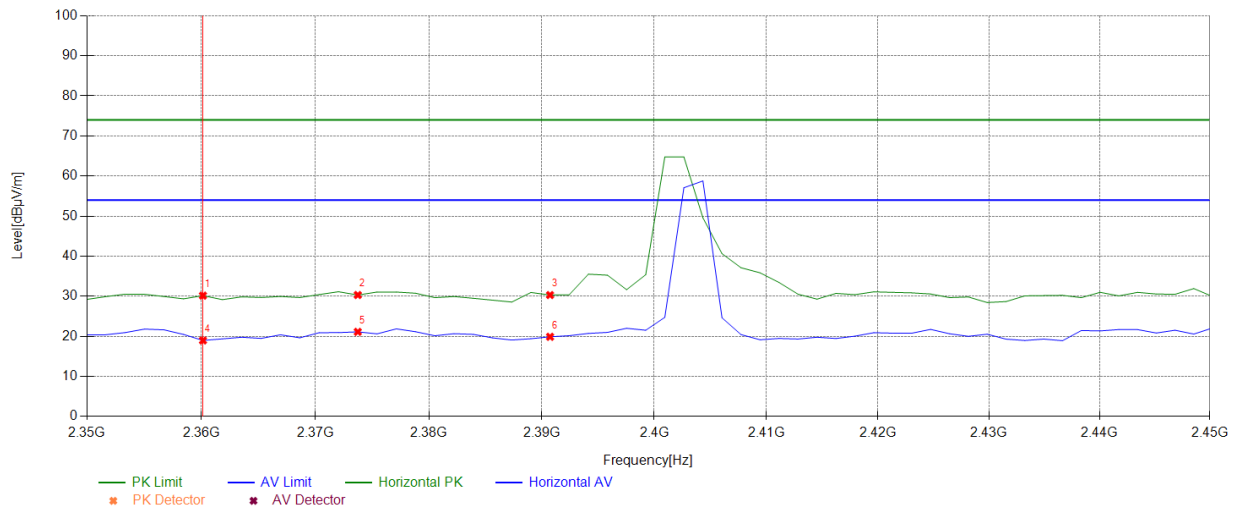
Radiates Emission	18G~40G								
Test channel	Worst-Case								
polarization	Vertical								
Suspected List									
Frequency[MHz]	Factor [dB]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
39650.1650	10.78	42.97	53.75	74.00	20.25	PK	100	230	PASS
19953.7954	1.30	43.22	44.52	74.00	29.48	PK	100	150	PASS
28226.6227	5.54	40.37	45.91	74.00	28.09	PK	100	190	PASS
30244.2244	6.59	41.39	47.98	74.00	26.02	PK	100	200	PASS
36314.6315	7.38	42.06	49.44	74.00	24.56	PK	100	30	PASS
21938.3938	1.88	42.69	44.57	74.00	29.43	PK	100	270	PASS
39480.7481	10.77	33.87	44.64	54.00	9.36	AV	100	10	PASS
28213.4213	5.53	32.52	38.05	54.00	15.95	AV	100	10	PASS
21905.3905	1.88	33.45	35.33	54.00	18.67	AV	100	10	PASS
36448.8449	7.48	32.39	39.87	54.00	14.13	AV	100	10	PASS
30448.8449	6.50	31.27	37.77	54.00	16.23	AV	100	10	PASS
19806.3806	1.31	33.68	34.99	54.00	19.01	AV	100	10	PASS



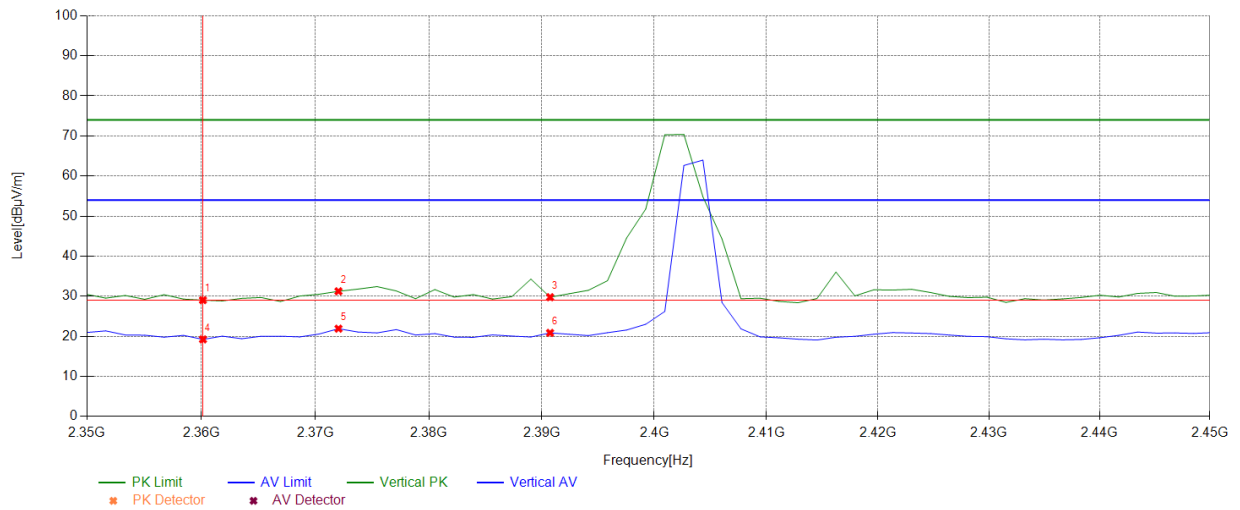
Band Edge:

During the test, the Band Edge was performed in BLE all modes with all channels and all antenna. BLE(1Mbps), Channel 0, Antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

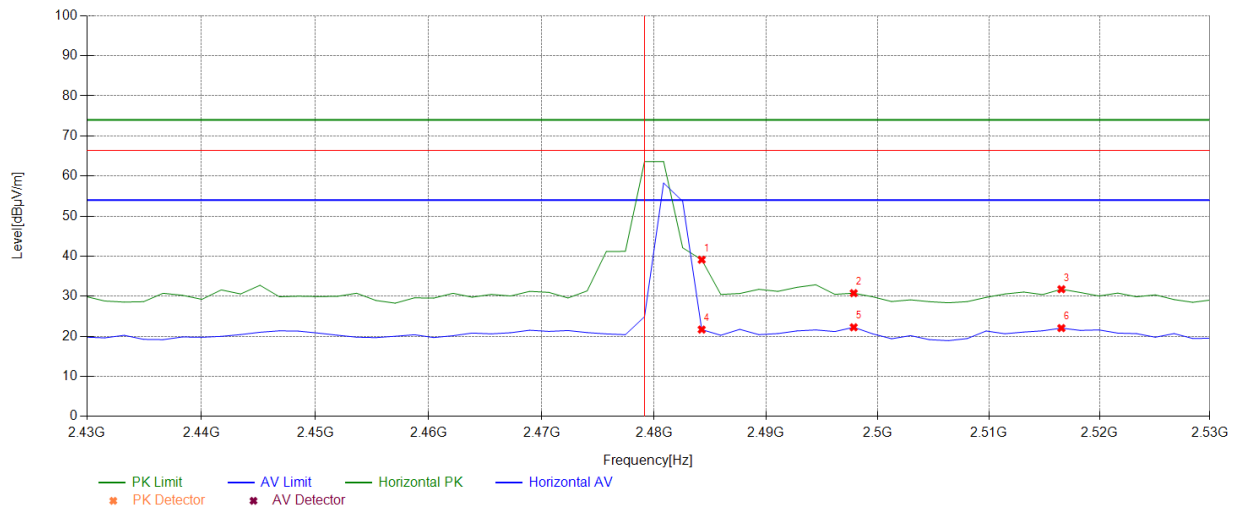
Test mode	BLE(1Mbps)								
Test channel	Lowest channel								
polarization	Horizontal								
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
2360.136	-6.93	37.09	30.16	74.00	43.84	PK	150	240	PASS
2373.7374	-6.89	37.21	30.32	74.00	43.68	PK	150	280	PASS
2390.7391	-6.85	37.16	30.31	74.00	43.69	PK	150	140	PASS
2360.136	-6.93	25.91	18.98	54.00	35.02	AV	150	270	PASS
2373.7374	-6.89	28.02	21.13	54.00	32.87	AV	150	60	PASS
2390.7391	-6.85	26.74	19.89	54.00	34.11	AV	150	60	PASS



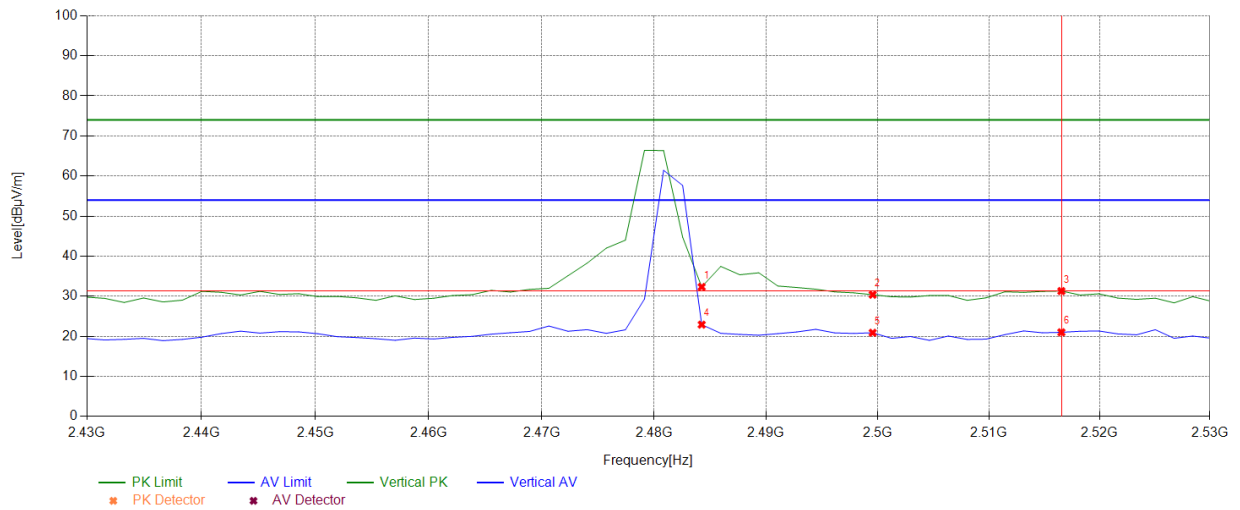
Test mode	BLE(1Mbps)								
Test channel	Lowest channel								
polarization	Vertical								
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
2360.1360	-6.93	35.97	29.04	74.00	44.96	PK	150	210	PASS
2372.0372	-6.90	38.14	31.24	74.00	42.76	PK	150	280	PASS
2390.7391	-6.85	36.62	29.77	74.00	44.23	PK	150	30	PASS
2360.136	-6.93	26.17	19.24	54.00	34.76	AV	150	190	PASS
2372.0372	-6.90	28.81	21.91	54.00	32.09	AV	150	10	PASS
2390.7391	-6.85	27.72	20.87	54.00	33.13	AV	150	50	PASS



Test mode	BLE(1Mbps)								
Test channel	Highest channel								
polarization	Horizontal								
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
2484.2484	-6.62	45.74	39.12	74.00	34.88	PK	150	330	PASS
2497.8498	-6.59	37.37	30.78	74.00	43.22	PK	150	250	PASS
2516.5517	-6.52	38.28	31.76	74.00	42.24	PK	150	330	PASS
2484.2484	-6.62	28.31	21.69	54.00	32.31	AV	150	60	PASS
2497.8498	-6.59	28.85	22.26	54.00	31.74	AV	150	10	PASS
2516.5517	-6.52	28.58	22.06	54.00	31.94	AV	150	10	PASS



Test mode	BLE(1Mbps)								
Test channel	Highest channel								
polarization	Vertical								
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
2484.2484	-6.62	38.95	32.33	74.00	41.67	PK	150	330	PASS
2499.5500	-6.59	36.98	30.39	74.00	43.61	PK	150	330	PASS
2516.5517	-6.52	37.82	31.30	74.00	42.70	PK	150	50	PASS
2484.2484	-6.62	29.54	22.92	54.00	31.08	AV	150	310	PASS
2499.5500	-6.59	27.49	20.90	54.00	33.10	AV	150	20	PASS
2516.5517	-6.52	27.53	21.01	54.00	32.99	AV	150	180	PASS



5.3 Maximum conducted output power

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was tested according to DTS test procedure of ANSI C63.10 for compliance to FCC 47CFR 15.247 requirements. The maximum conducted output power using ANSI C63.10 section 11.9.2.3 AVGPMAverage power meter method.

1. Power meter and sensor’s minimum video bandwidth is 50MHz, larger than 802.11n(40MHz) bandwidth;
2. Fast responding diode sensors respond immediately to changes in power level to reduce total test time.
3. Use average detector to test.

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation. The Average detector is used. We use Maximum Average Conducted Output Power Level Method AVGSA-2 in KDB 558074 D01 /KDB662911 D01 for this test.

The conducted Power is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

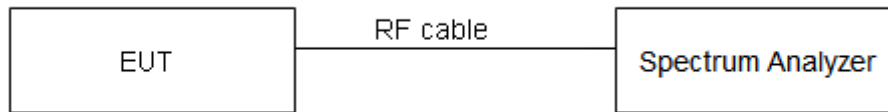
Limits:

Average Output Power	≤ 1W (30dBm)
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Note: the conducted output power limit specified above is based on the use the antennas with directional gains that do not exceed 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated Levels above, as appropriate, by the amount in dB that the directional gain of antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Test Setup:



Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.44$ dB.

Test Results:

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	-0.75	<=30	PASS
		2440	-1.00	<=30	PASS
		2480	-1.46	<=30	PASS
BLE_2M	Ant1	2402	-1.93	<=30	PASS
		2440	-2.27	<=30	PASS
		2480	-2.61	<=30	PASS

5.4 Minimum 6 dB Bandwidth

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 100 kHz; VBW is set to 300 kHz on spectrum analyzer.

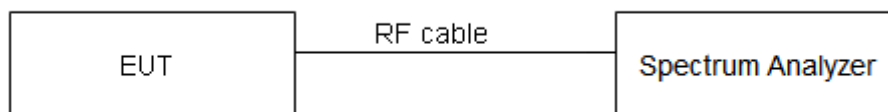
Detector=Peak, Trace mode=Max hold.

Limits:

Rule Part 15.247 (a) (2) specifies that “Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.”

Minimum 6dB Bandwidth	≥ 500 kHz
-----------------------	-----------

Test Setup:



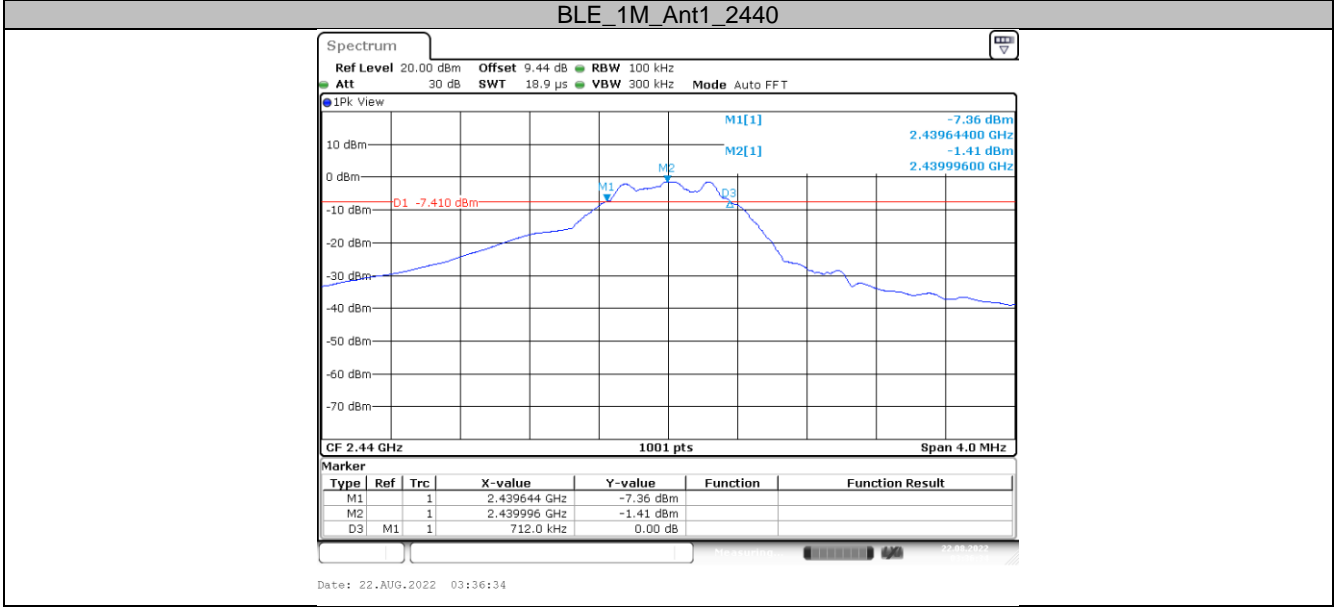
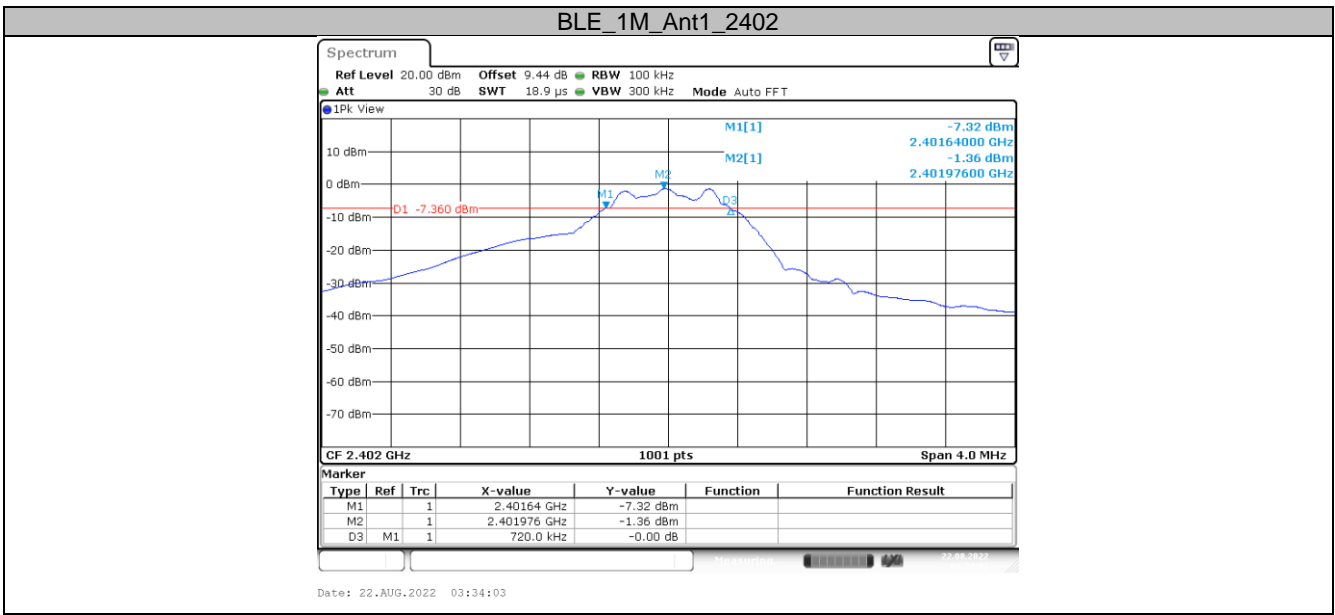
Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.

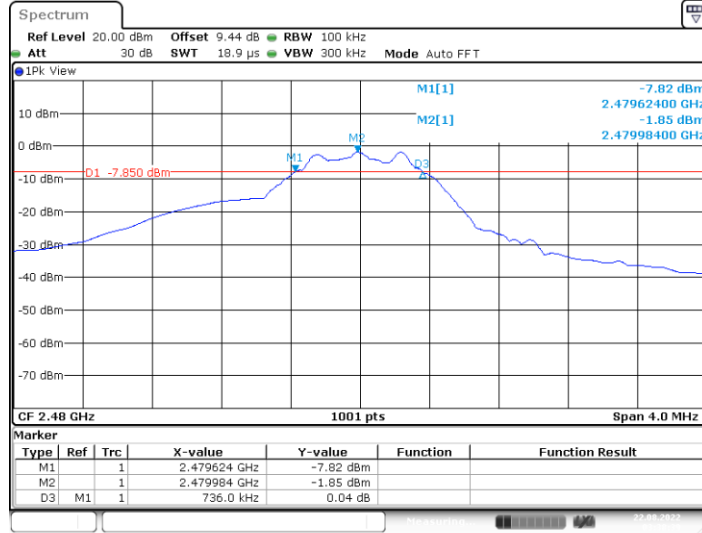
Test Results:

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.72	2401.64	2402.36	0.5	PASS
		2440	0.71	2439.64	2440.36	0.5	PASS
		2480	0.74	2479.62	2480.36	0.5	PASS
BLE_2M	Ant1	2402	1.05	2401.47	2402.52	0.5	PASS
		2440	1.04	2439.47	2440.52	0.5	PASS
		2480	1.05	2479.47	2480.52	0.5	PASS

Test Graphs:

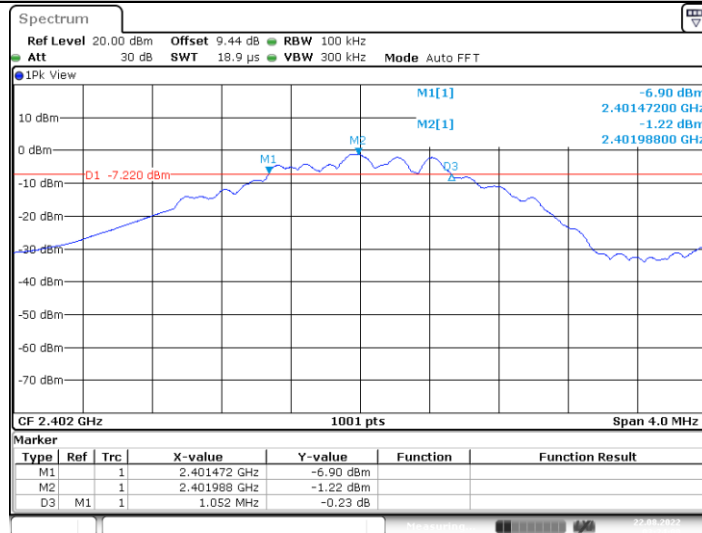


BLE_1M_Ant1_2480



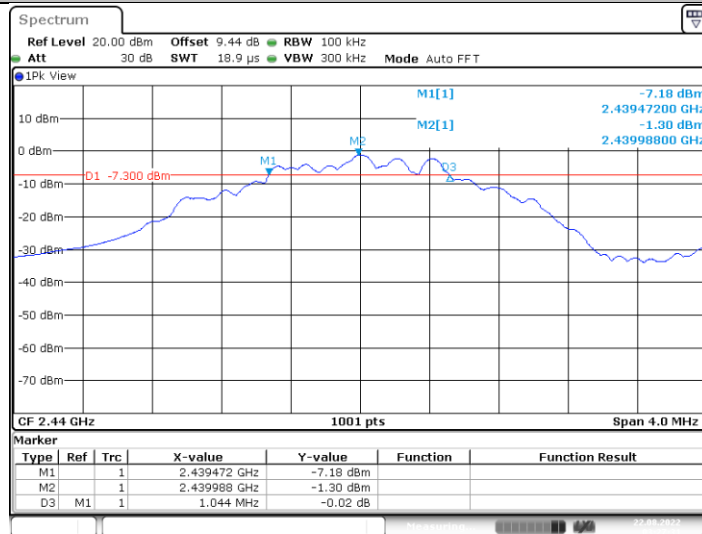
Date: 22.AUG.2022 03:38:39

BLE_2M_Ant1_2402



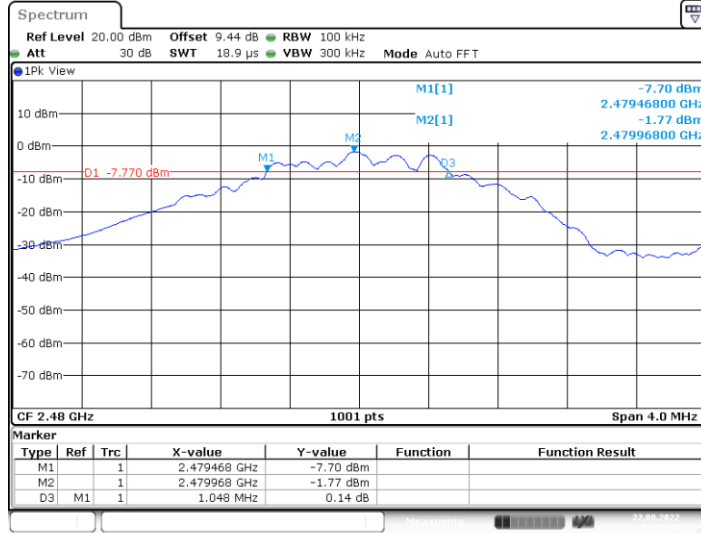
Date: 22.AUG.2022 03:24:00

BLE_2M_Ant1_2440



Date: 22.AUG.2022 03:27:32

BLE_2M_Ant1_2480



5.5 Occupied Channel Bandwidth

Ambient condition:

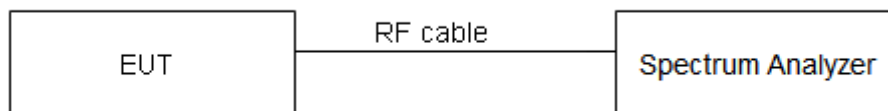
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 50 kHz; VBW is set to 200 kHz on spectrum analyzer.

Detector=Peak, Trace mode=Max hold.

Test Setup:



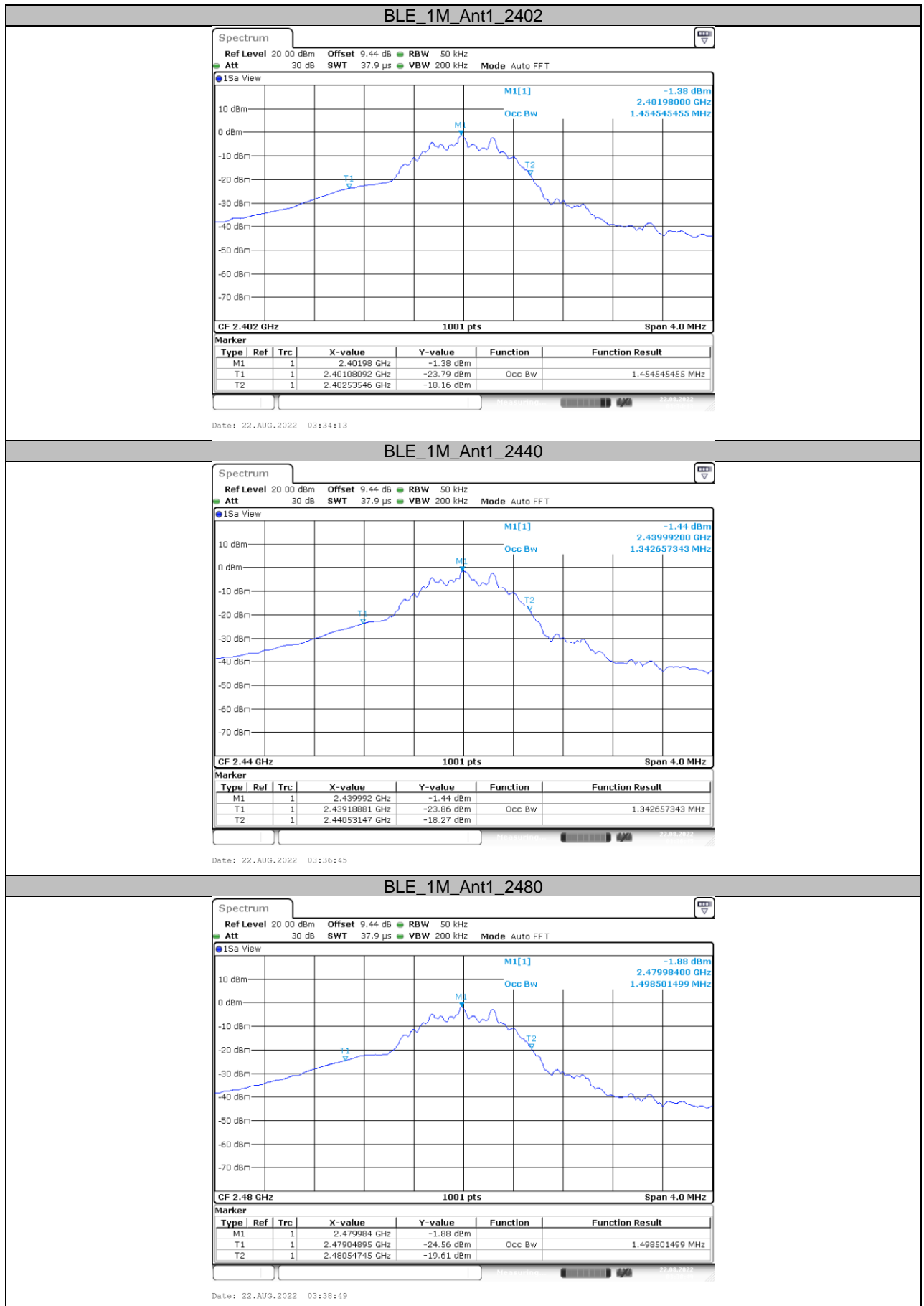
Measurement Uncertainty:

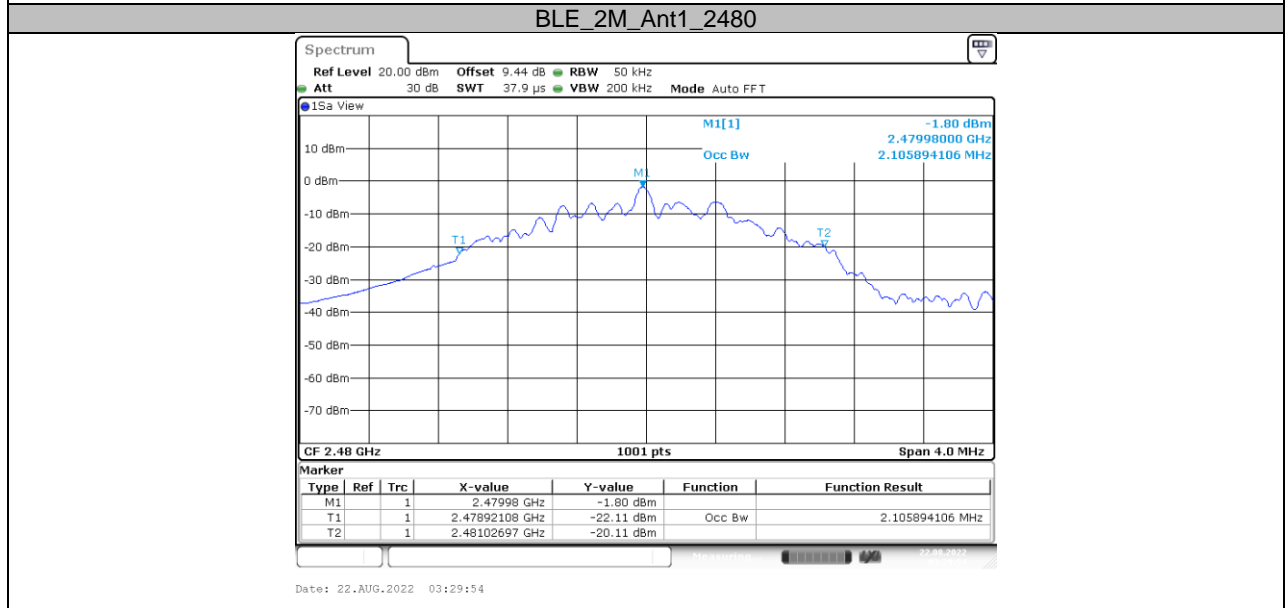
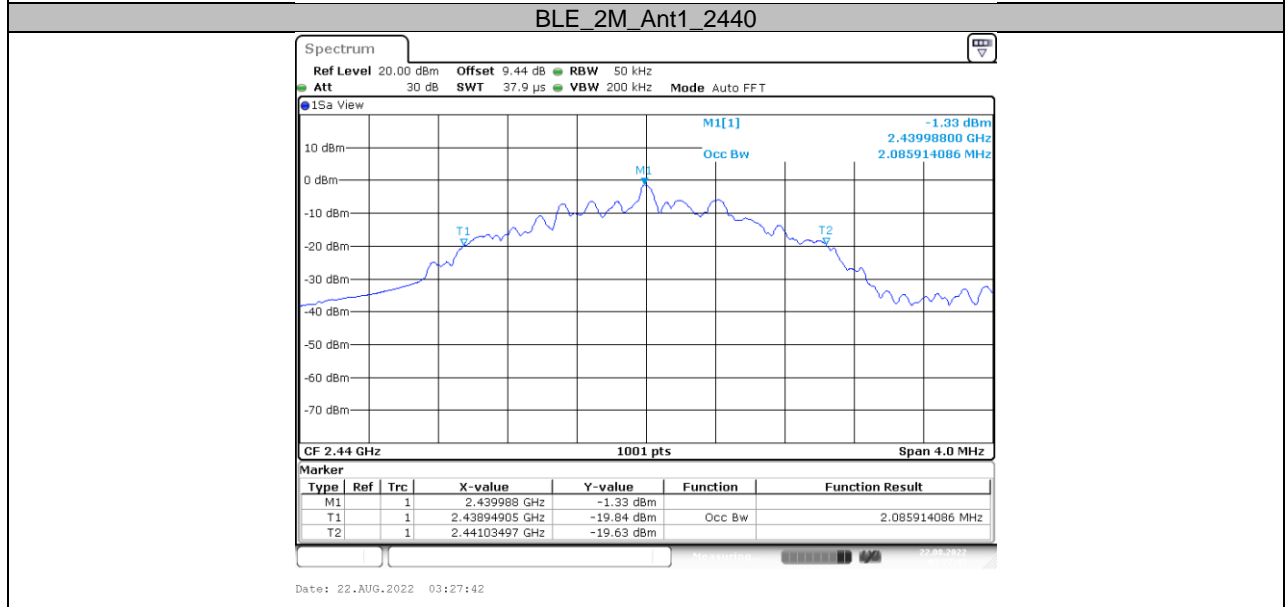
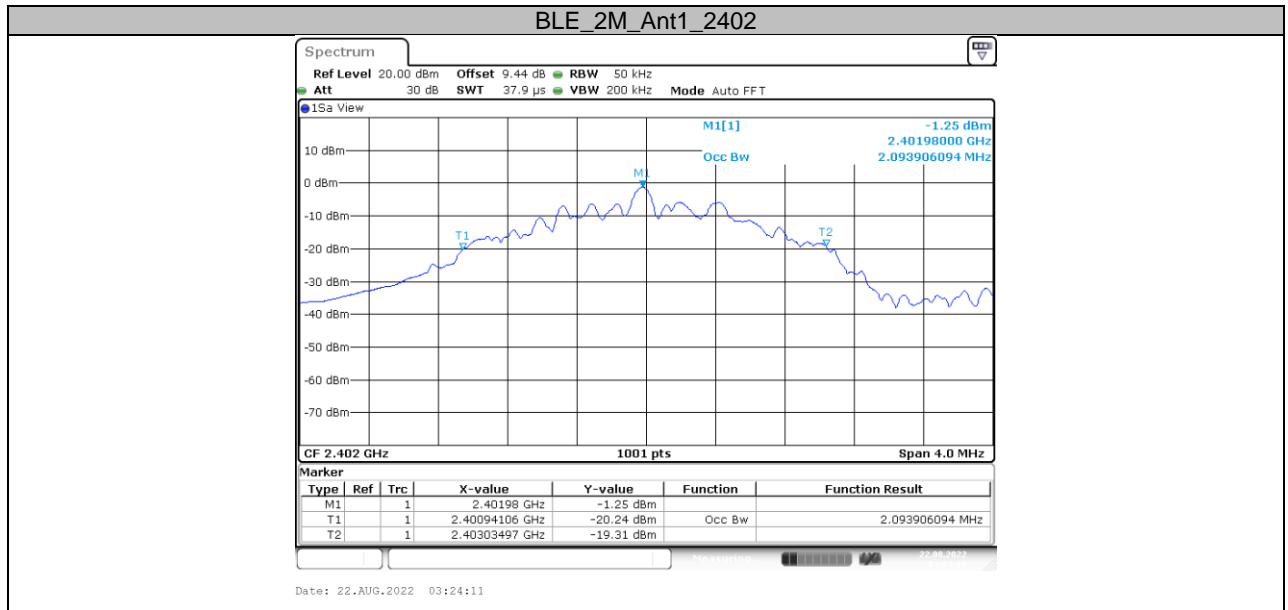
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.

Test Results:

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.455	2401.081	2402.535	---	PASS
		2440	1.343	2439.189	2440.531	---	PASS
		2480	1.499	2479.049	2480.547	---	PASS
BLE_2M	Ant1	2402	2.094	2400.941	2403.035	---	PASS
		2440	2.086	2438.949	2441.035	---	PASS
		2480	2.106	2478.921	2481.027	---	PASS

Test Graphs:





5.6 Band Edge Measurement

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

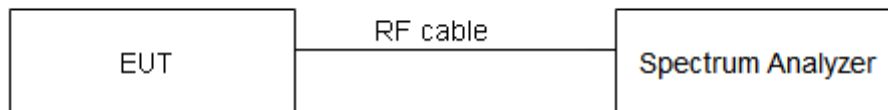
Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer.

Limits:

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Setup:



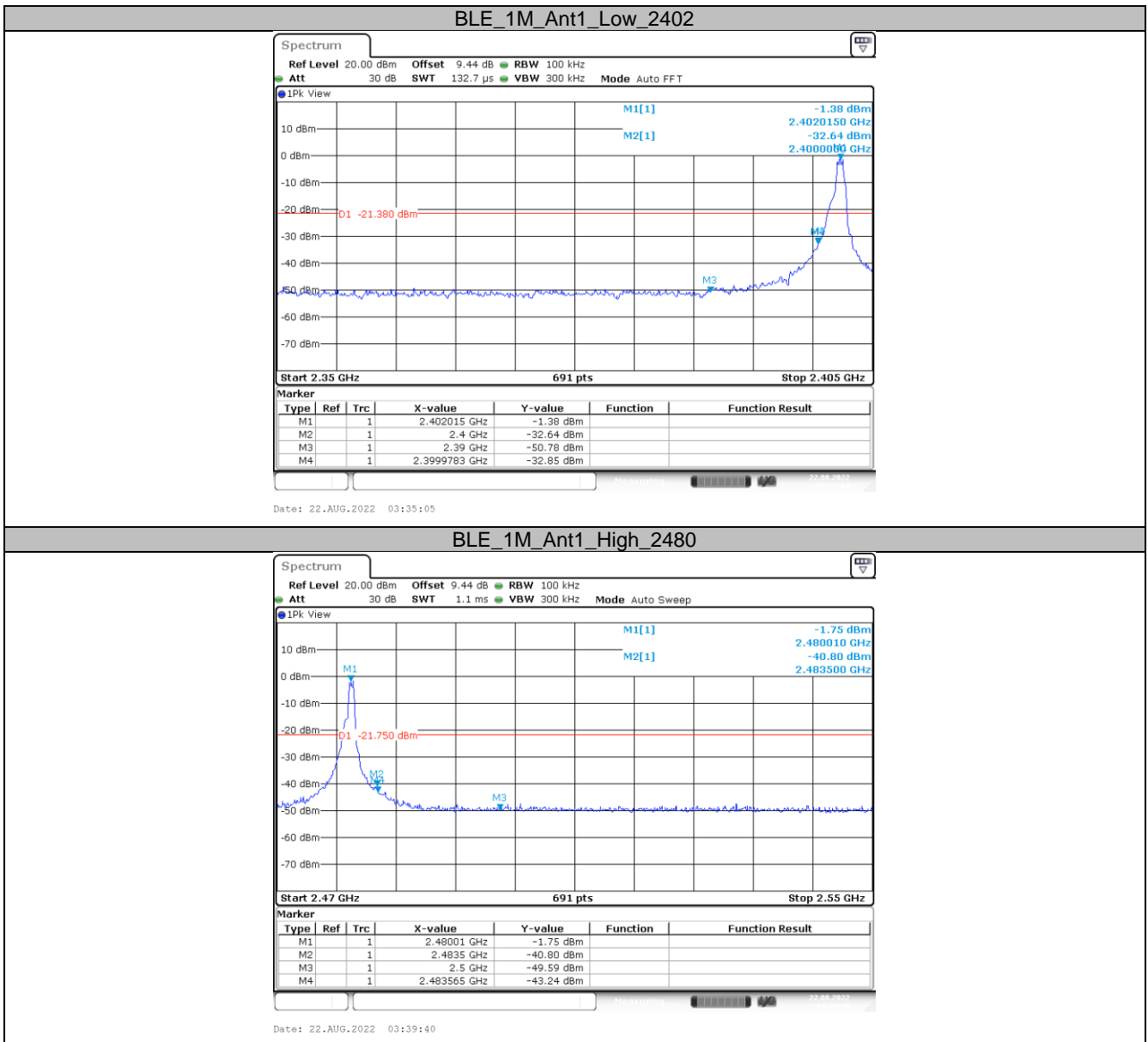
Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U = 936 \text{ Hz}$, $2 \text{ GHz} - 3 \text{ GHz} = 1.407 \text{ dB}$.

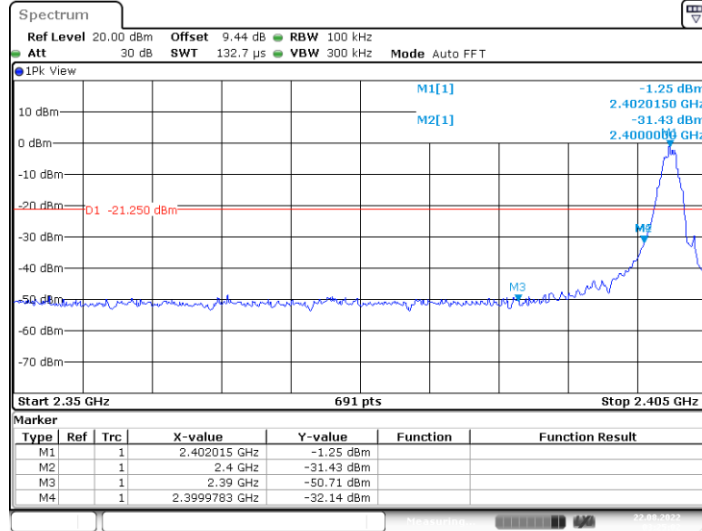
Test Results:

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	-1.38	-32.85	≤-21.38	PASS
		High	2480	-1.75	-43.24	≤-21.75	PASS
BLE_2M	Ant1	Low	2402	-1.25	-32.14	≤-21.25	PASS
		High	2480	-1.68	-42.6	≤-21.68	PASS

Test Graphs:

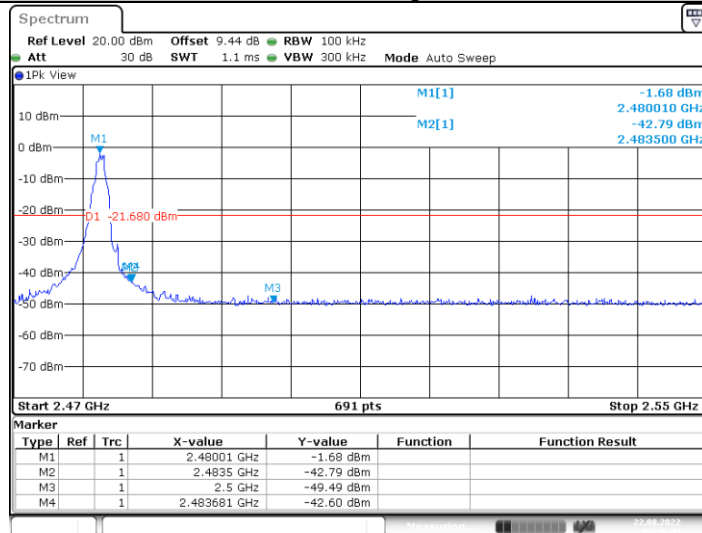


BLE_2M_Ant1_Low_2402



Date: 22.AUG.2022 03:25:02

BLE_2M_Ant1_High_2480



Date: 22.AUG.2022 03:30:45

5.7 Maximum Power Spectral Density

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation. The Average detector is used. We use Method AVGPSD-2 in KDB 558074 D01 for this test.

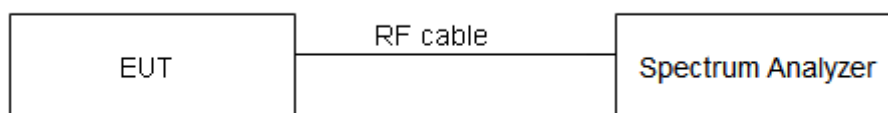
The conducted Power is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Limits:

Rule Part 15.247(e) specifies that” For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Maximum Power Spectral Density	$\leq 8 \text{ dBm} / 3\text{kHz}$
--------------------------------	------------------------------------

Test Setup:



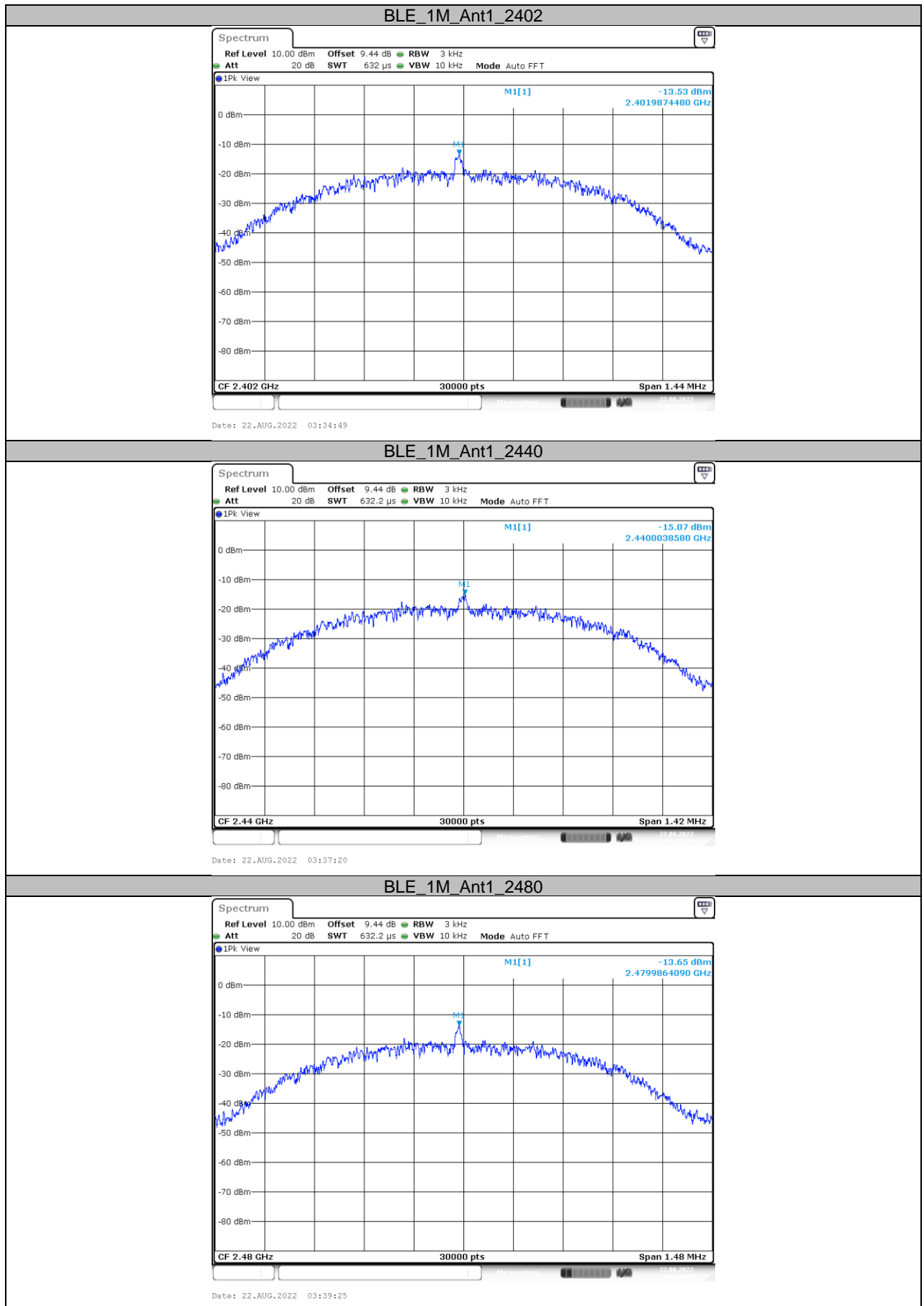
Measurement Uncertainty:

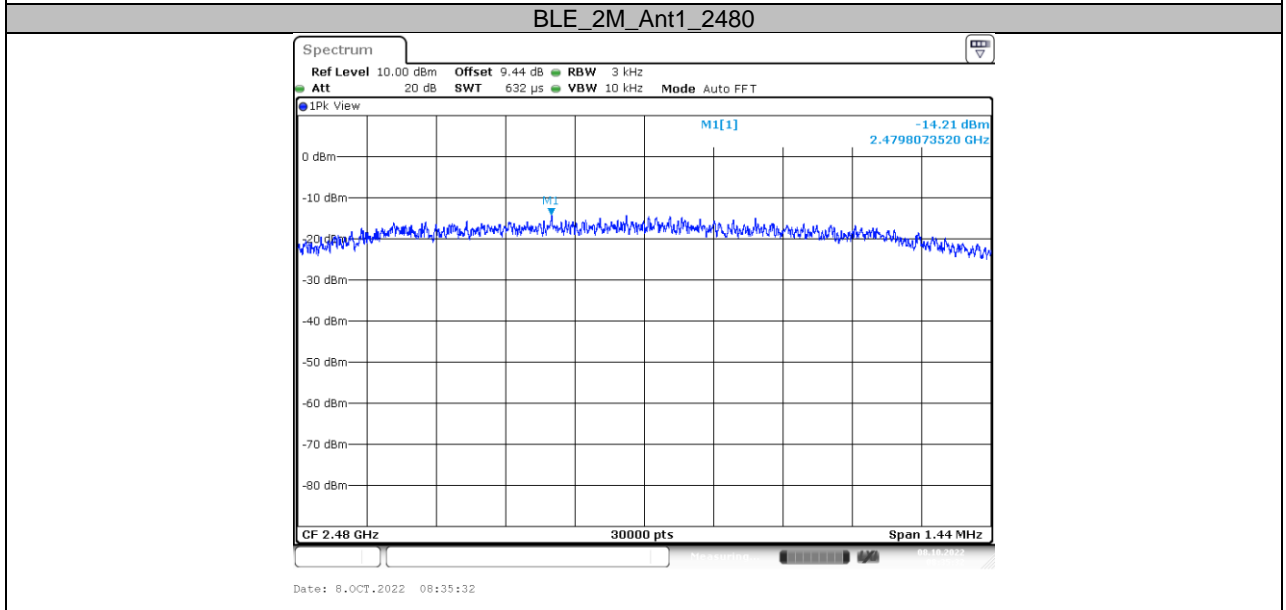
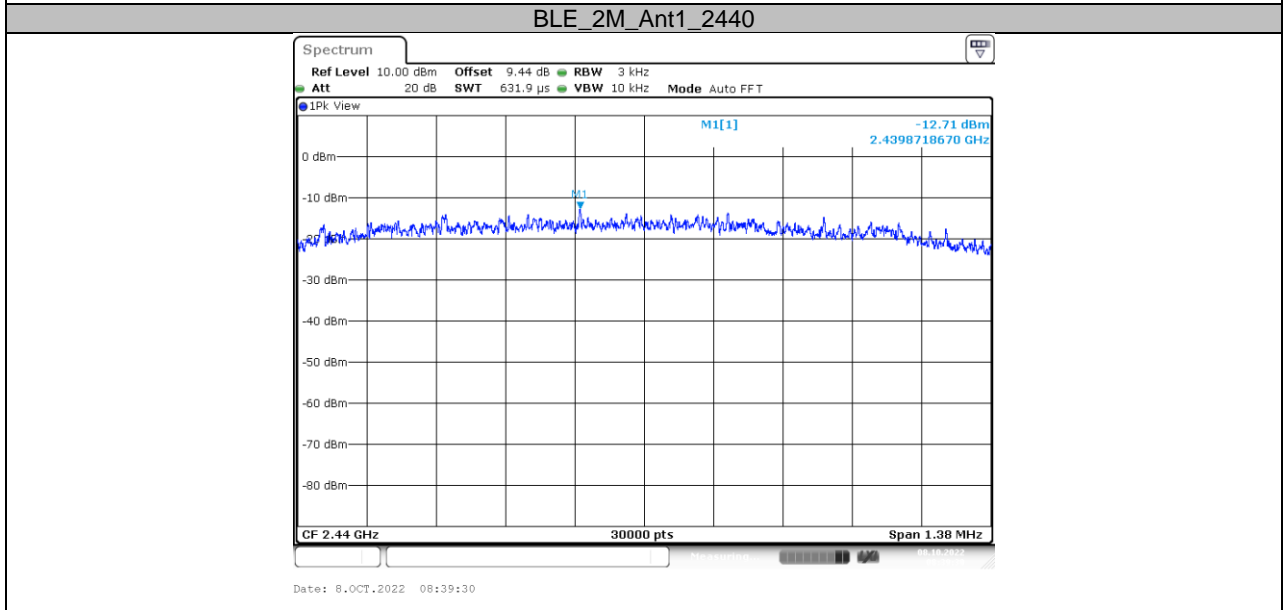
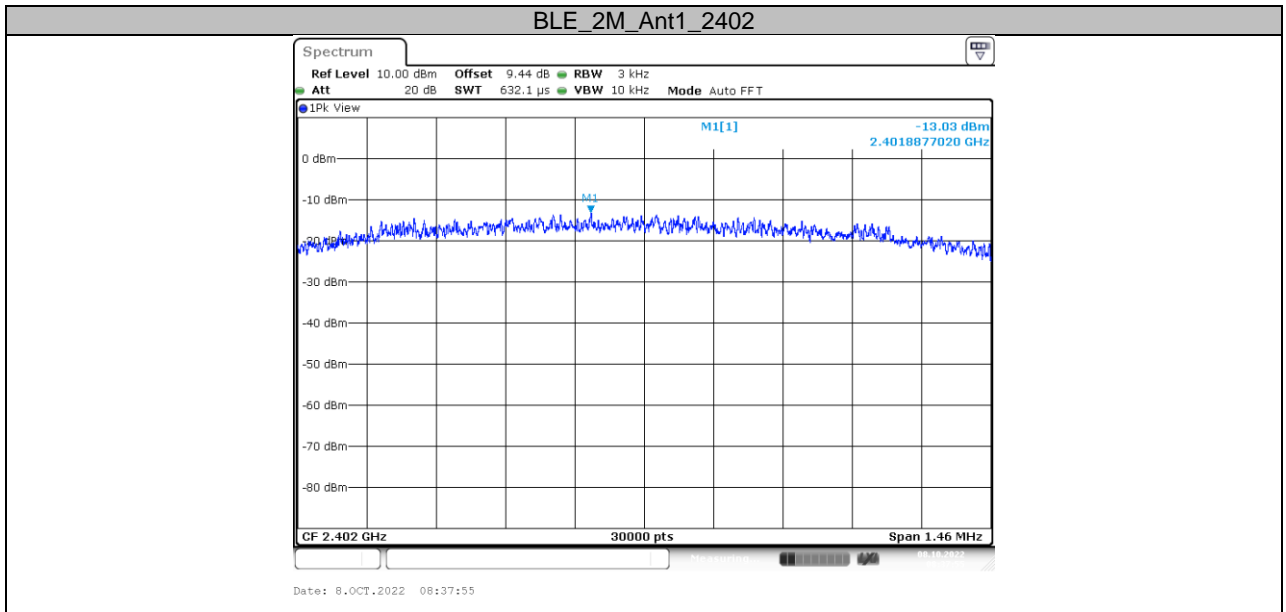
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.75\text{dB}$.

Test Results:

TestMode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-13.53	<=8	PASS
		2440	-15.07	<=8	PASS
		2480	-13.65	<=8	PASS
BLE_2M	Ant1	2402	-13.03	<=8	PASS
		2440	-12.71	<=8	PASS
		2480	-14.21	<=8	PASS

Test Graphs:





5.8 Spurious RF Conducted Emissions

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW to 100kHz and VBW to 300 kHz, Sweep is set to AUTO. The test is in transmitting mode.

Limits:

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

Test Setup:



Measurement Uncertainty:

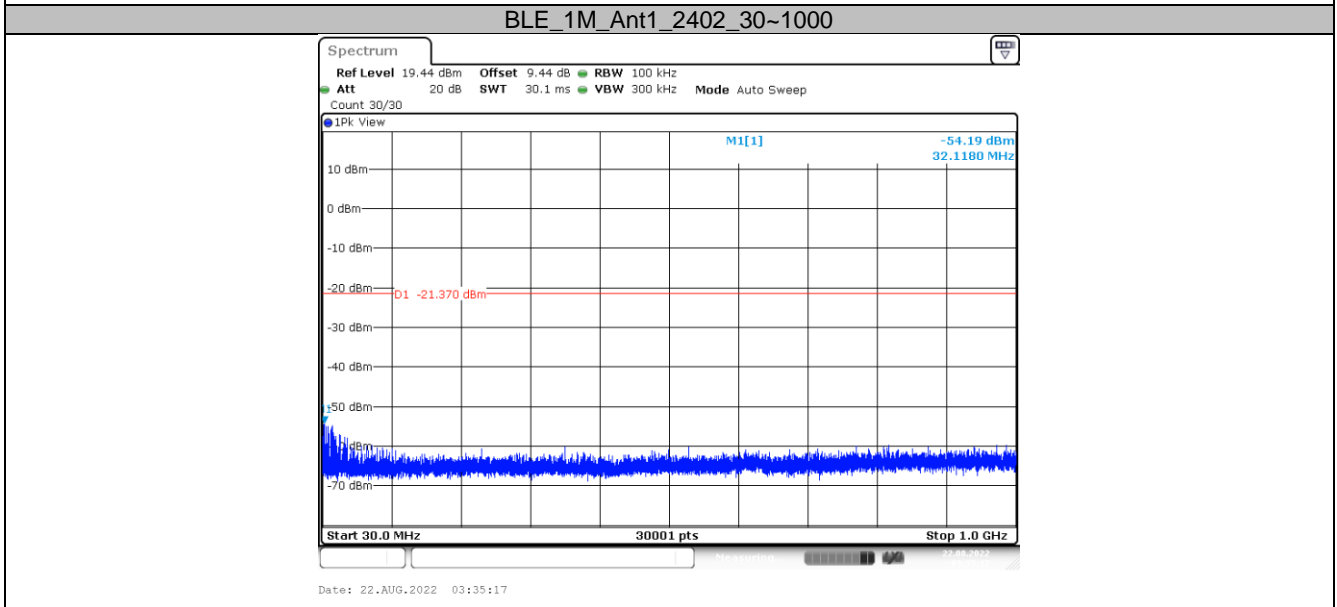
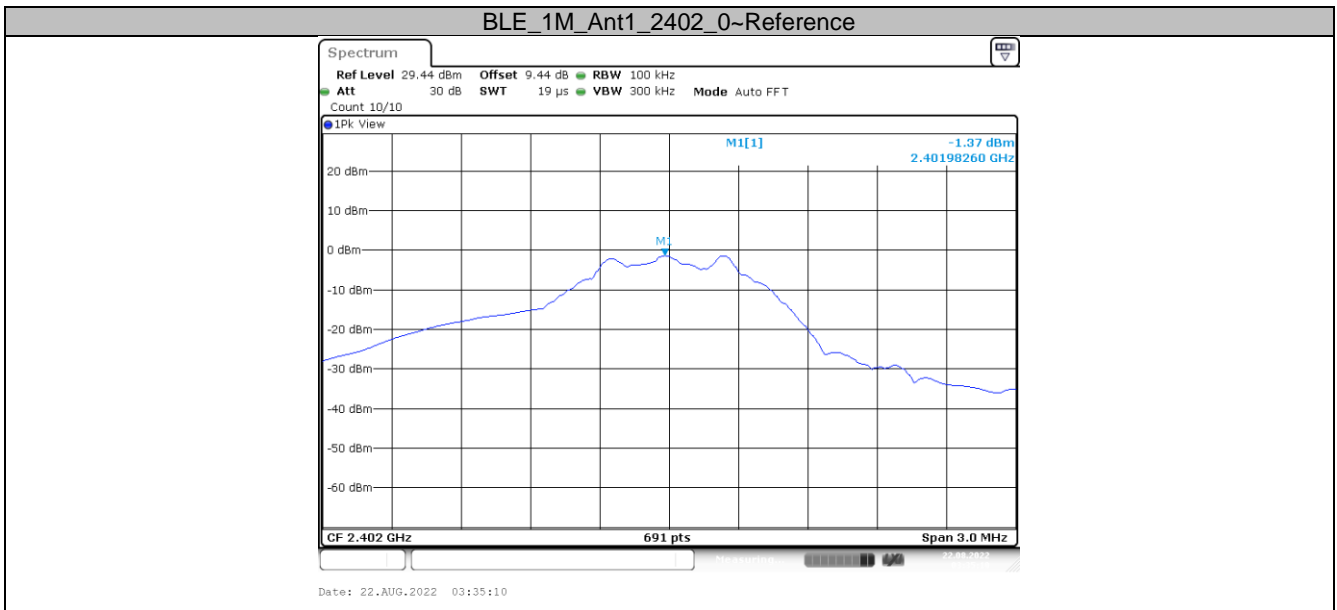
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-26GHz	1.407 dB

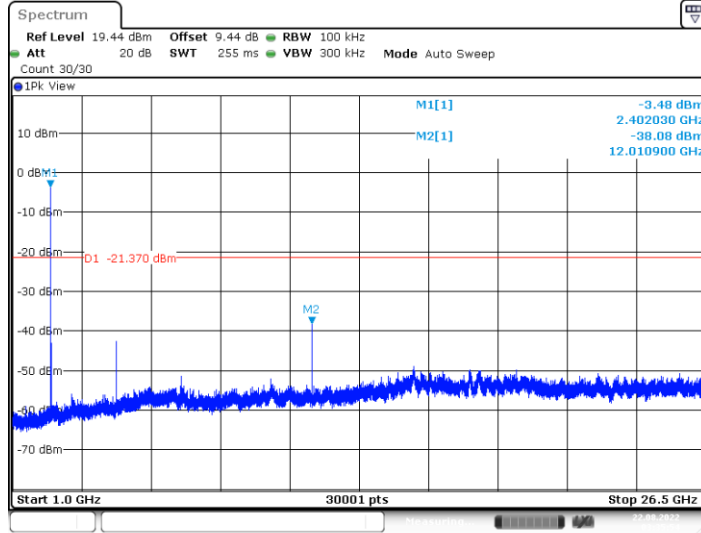
Test Results:

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	-1.37	-1.37	---	PASS
			30~1000	-1.37	-54.19	≤-21.37	PASS
			1000~26500	-1.37	-38.08	≤-21.37	PASS
		2440	Reference	-1.42	-1.42	---	PASS
			30~1000	-1.42	-53.04	≤-21.42	PASS
			1000~26500	-1.42	-40.24	≤-21.42	PASS
		2480	Reference	-1.87	-1.87	---	PASS
			30~1000	-1.87	-54.13	≤-21.87	PASS
			1000~26500	-1.87	-38.43	≤-21.87	PASS
BLE_2M	Ant1	2402	Reference	-1.72	-1.72	---	PASS
			30~1000	-1.72	-59.98	≤-21.72	PASS
			1000~26500	-1.72	-36	≤-21.72	PASS
		2440	Reference	-1.76	-1.76	---	PASS
			30~1000	-1.76	-59.8	≤-21.76	PASS
			1000~26500	-1.76	-39.02	≤-21.76	PASS
		2480	Reference	-1.80	-1.80	---	PASS
			30~1000	-1.80	-53.43	≤-21.8	PASS
			1000~26500	-1.80	-39.71	≤-21.8	PASS

Test Graphs:



BLE_1M_Ant1_2402_1000~26500



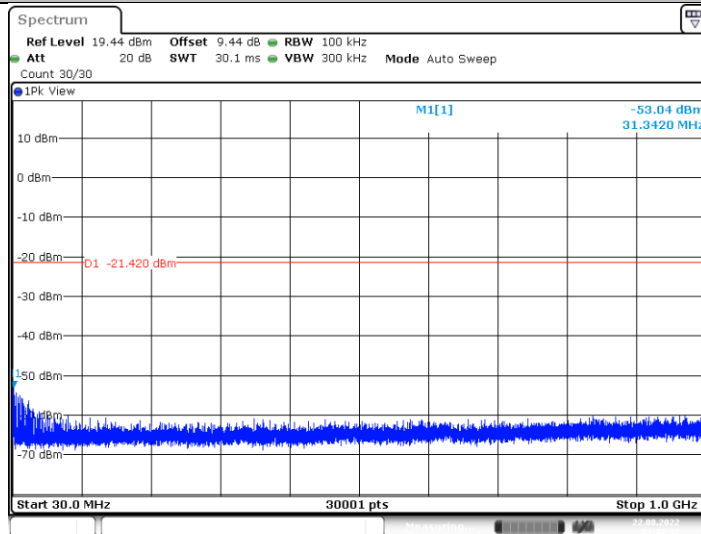
Date: 22.AUG.2022 03:35:54

BLE_1M_Ant1_2440_0~Reference



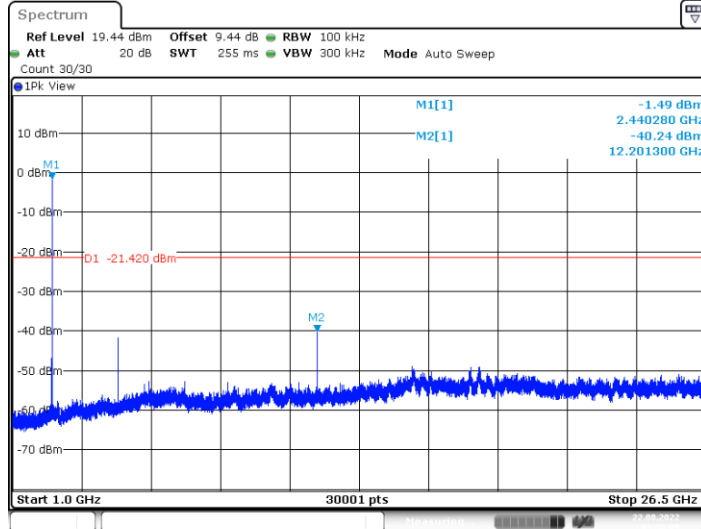
Date: 22.AUG.2022 03:37:26

BLE_1M_Ant1_2440_30~1000

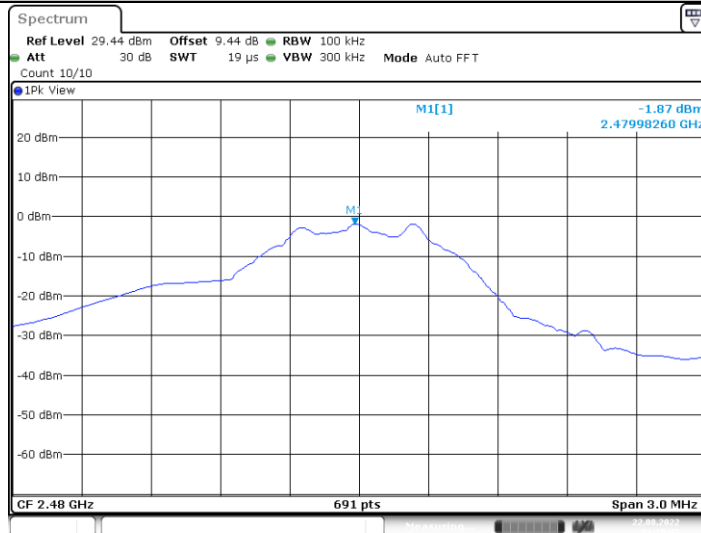


Date: 22.AUG.2022 03:37:32

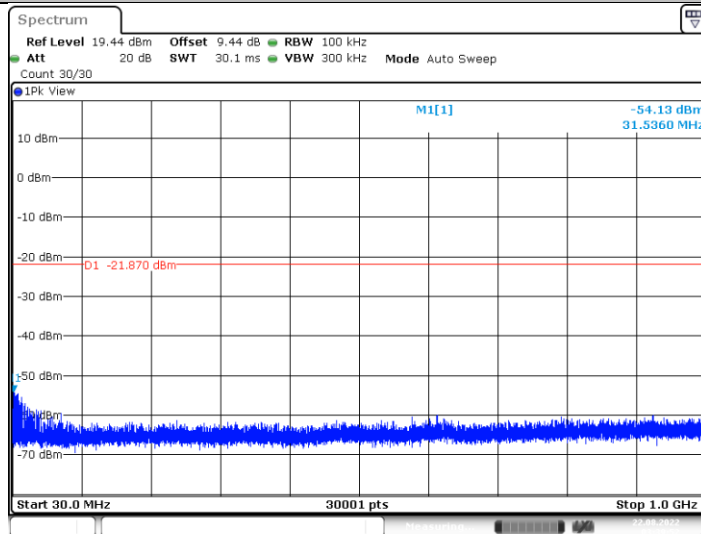
BLE_1M_Ant1_2440_1000~26500



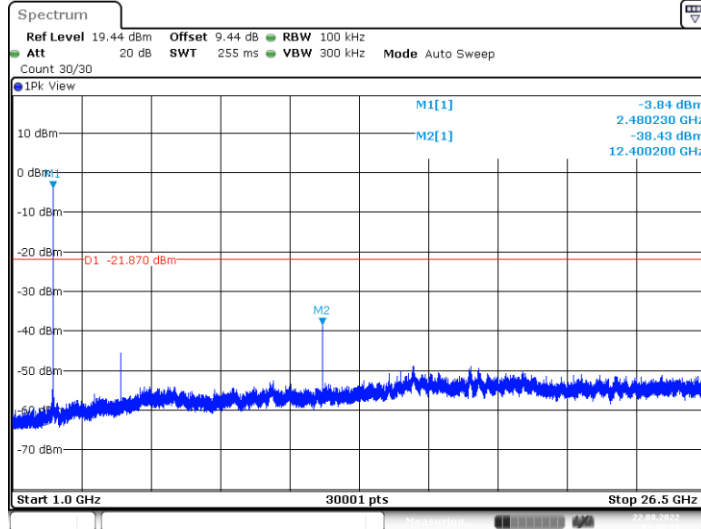
BLE_1M_Ant1_2480_0~Reference



BLE_1M_Ant1_2480_30~1000

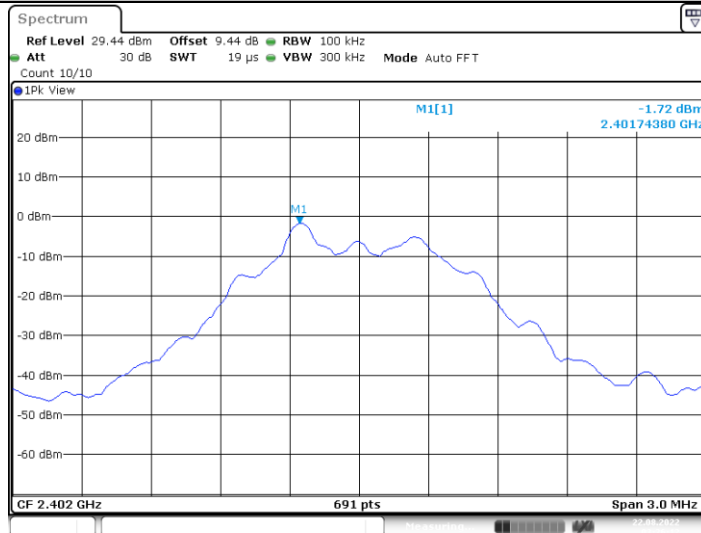


BLE_1M_Ant1_2480_1000~26500



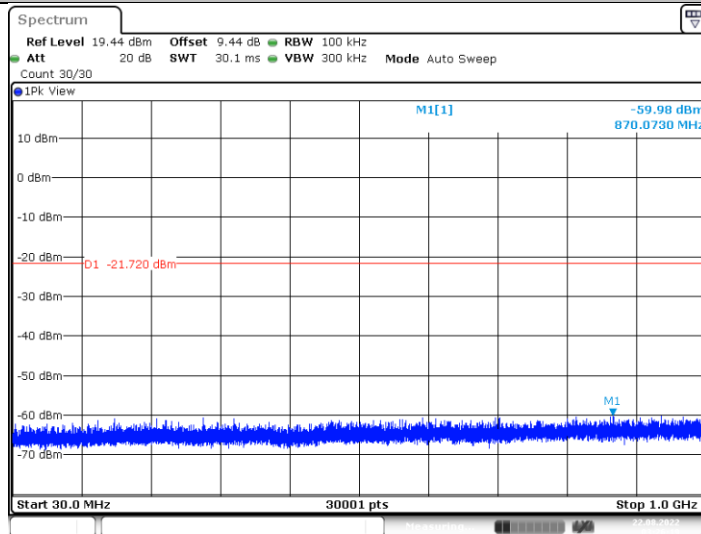
Date: 22.AUG.2022 03:40:29

BLE_2M_Ant1_2402_0~Reference



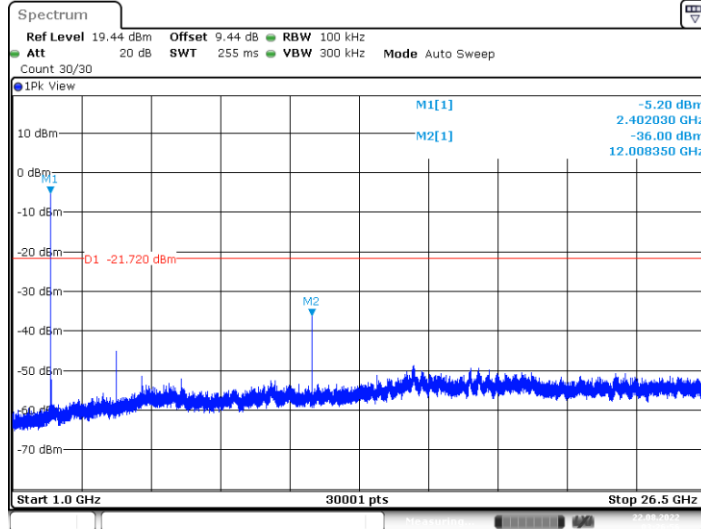
Date: 22.AUG.2022 03:26:13

BLE_2M_Ant1_2402_30~1000



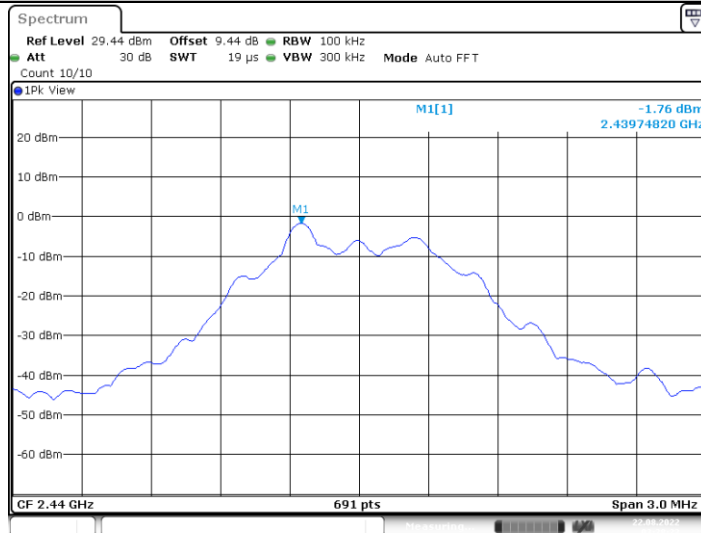
Date: 22.AUG.2022 03:26:19

BLE_2M_Ant1_2402_1000~26500



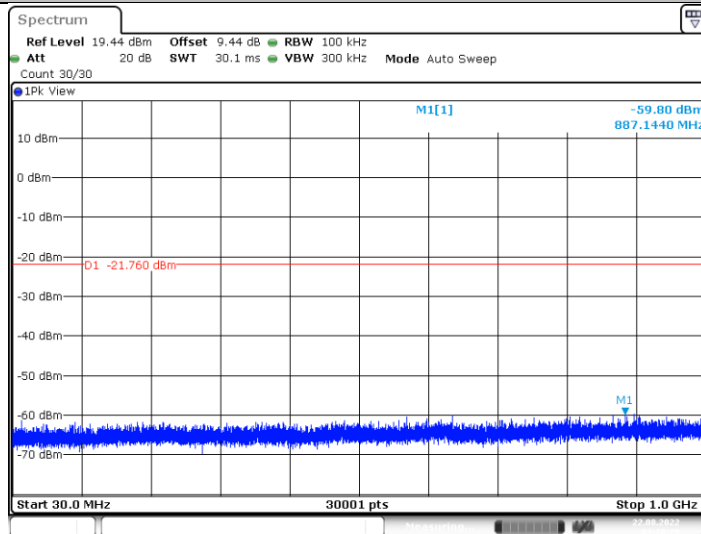
Date: 22.AUG.2022 03:26:56

BLE_2M_Ant1_2440_0~Reference



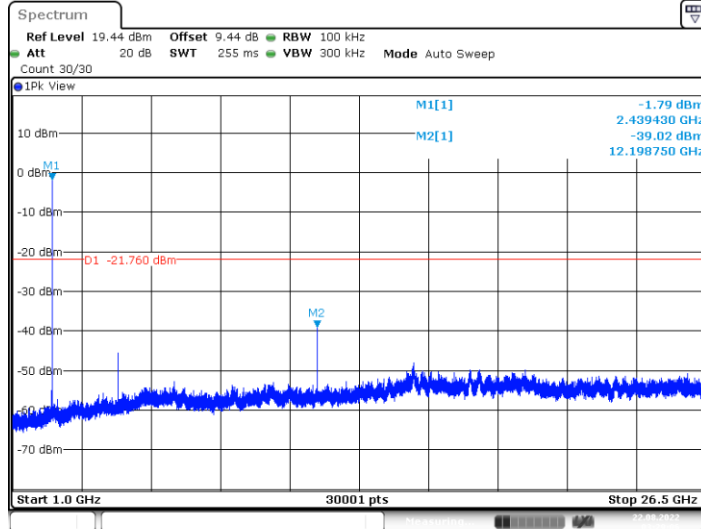
Date: 22.AUG.2022 03:28:23

BLE_2M_Ant1_2440_30~1000



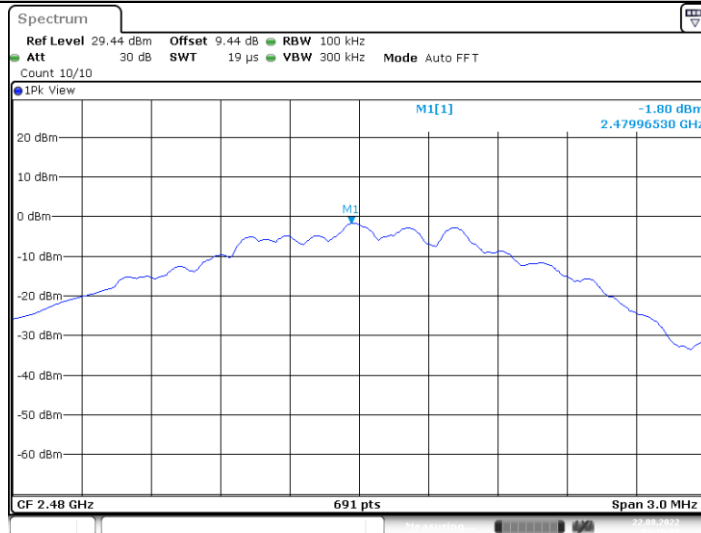
Date: 22.AUG.2022 03:28:29

BLE_2M_Ant1_2440_1000~26500



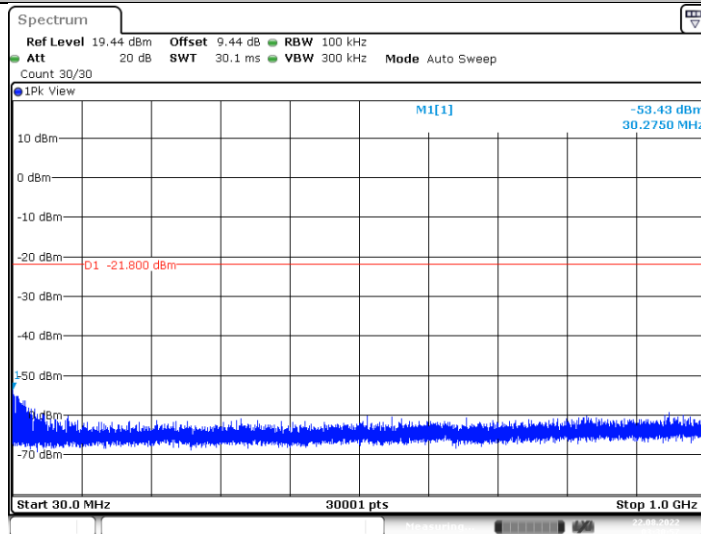
Date: 22.AUG.2022 03:29:06

BLE_2M_Ant1_2480_0~Reference

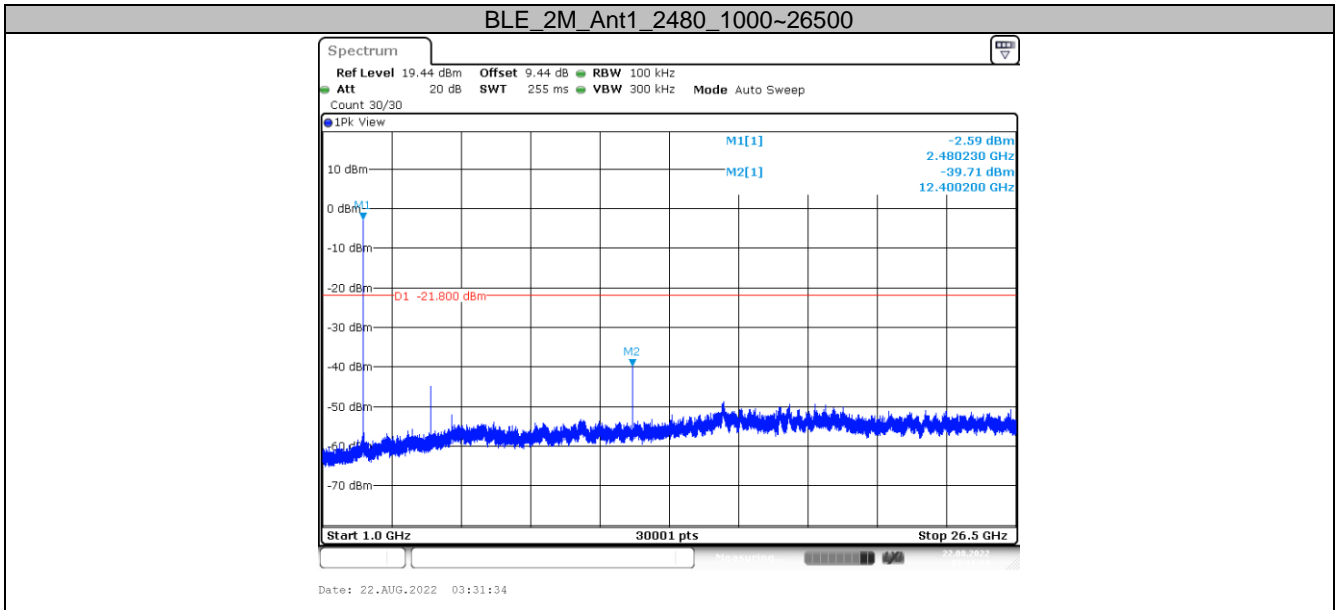


Date: 22.AUG.2022 03:30:50

BLE_2M_Ant1_2480_30~1000



Date: 22.AUG.2022 03:30:57



6. Appendix E

Test Equipment	Type/Mode	SERIAL NO.	Equipment No.	Manufacturer	Cal. Due
Spectrum Analyzer	FSV40	101580	DZ-000238-3	R&S	2023/06/05
Comprehensive Test Instrument	CMW270	100304	DZ-000240-1	R&S	2022/12/09
Analog Signal Generator	SMB100A	181858	DZ-000238-2	R&S	2023/06/05
Vector Signal Generator	SGT100A	111661	DZ-000238-1	R&S	2023/06/05
RF Radio Frequency Switch	JS0806-2	19H9080187	DZ-000241	Tonscend	2023/06/06
Programmable DC Power Supply	E3644A	MY58036222	DZ-000178	KEYSIGHT	2023/04/21
3m Semi-Anechoic Chamber	FACT-4	ST08035	WKNA-0024	ETS	2024/12/12
Spectrum Analyzer	N9010B	MY57470323	DZ-000174	KEYSIGHT	2023/03/02
EMI Test Receiver	N9038A-508	MY532290079	EM-000397	Agilent	2023/03/02
Broadband Antenna	VULB 9163	9163-530	EM-000342	SCHWARZBECK	2023/06/25
Waveguide Horn Antenna	HF906	360306/008	WKNA-0024-8	R&S	2023/03/04
Waveguide Horn Antenna	BBHA9170	00949	EM-000383	SCHWARZBECK	2023/08/26
Bandstop Filters	SW-BSF-2400-100-7-A1	/	EM-000495	/	2023/08/30
5G Bandstop Filters	WRCJV12-4900-5100-5900-6100-50EE	1	DZ-000186	WI	2022/12/20

The End