

FCC - TEST REPORT

Report Number : **68.950.21.0115.01** Date of Issue: **2021-04-30**

Model : **CS63038**

Product Type : **BT Module_BT5.0**

Applicant : **CoreStar Co., Ltd.**

Address : **No. 16-3, Shunping 1st St., Xitun Dist., Taichung City TAIWAN**

Manufacturer : **CoreStar Co., Ltd.**

Address : **No. 16-3, Shunping 1st St., Xitun Dist., Taichung City TAIWAN**

Test Result : ☒ **Positive** ☐ **Negative**

Total pages including Appendices : **52**

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1 Table of Contents

1	Table of Contents.....	2
2	Details about the Test Laboratory.....	3
3	Description of the Equipment Under Test.....	4
4	Summary of Test Standards.....	5
5	Summary of Test Results.....	6
6	General Remarks	7
7	Test Setups	8
8	Systems test configuration.....	9
9	Technical Requirement	10
9.1	Conducted Emission	10
9.2	Conducted peak output power.....	13
9.3	Power spectral density.....	16
9.4	6 dB Bandwidth and 99% Occupied Bandwidth	19
9.5	Spurious RF conducted emissions	24
9.6	Band edge	32
9.7	Spurious radiated emissions for transmitter	35
10	Test Equipment List.....	51
11	System Measurement Uncertainty	52

2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint
Road 2, Nanshan District
Shenzhen 518052
P.R. China

Telephone: 86 755 8828 6998

Fax: 86 755 8828 5299

FCC Registration No.: 514049

FCC Designation Number: CA5009

IC Registration No.: 10320A

3 Description of the Equipment Under Test

Product: BT Module_BT5.0

Model no.: CS63038

FCC ID: 2ANCG-CS63038

Options and accessories: N/A

Rating: 5Vdc

RF Transmission Frequency: 2402MHz-2480MHz

No. of Operated Channel: 40

Modulation: GFSK

Antenna Type: PCB antenna

Antenna Gain: 0dBi

Description of the EUT: The Equipment Under Test (EUT) is a BT Module_BT5.0 which support Bluetooth function and the Occupied Bandwidth with 1MHz/2MHz. Only Bluetooth Low Energy included in this report.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2020 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10 (2013).

5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207	Conducted emission AC power port	10	Site 1	☒	☐	☐
§15.247 (b) (1)	Conducted peak output power	13	Site 1	☒	☐	☐
§15.247(a)(1)	20dB bandwidth	---	---	☐	☐	☒
§15.247(a)(1)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Dwell Time	---	---	☐	☐	☒
§15.247(a)(2)	6dB bandwidth and 99% Occupied Bandwidth	19	Site 1	☒	☐	☐
§15.247(e)	Power spectral density	16	Site 1	☒	☐	☐
§15.247(d)	Spurious RF conducted emissions	24	Site 1	☒	☐	☐
§15.247(d)	Band edge	32	Site 1	☒	☐	☐
§15.247(d)	Spurious radiated emissions for transmitter	35	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 2		☒	☐	☐

Note 1: N/A=Not Applicable.

Note 2: The EUT uses an Integrated antenna, which gain is 0dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2ANCG-CS63038 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

This report is for Bluetooth Low Energy only.

SUMMARY:

All tests according to the regulations cited on page 5 were.

■ - Performed

□ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

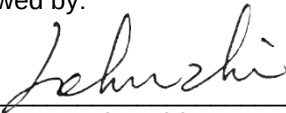
Sample Received Date: 2020-11-17

Testing Start Date: 2020-11-18

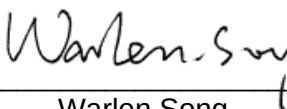
Testing End Date: 2021-03-18

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

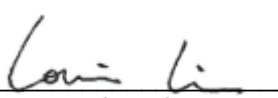
Reviewed by:


John Zhi
Project Manager

Prepared by:


Warlen Song
Project Engineer

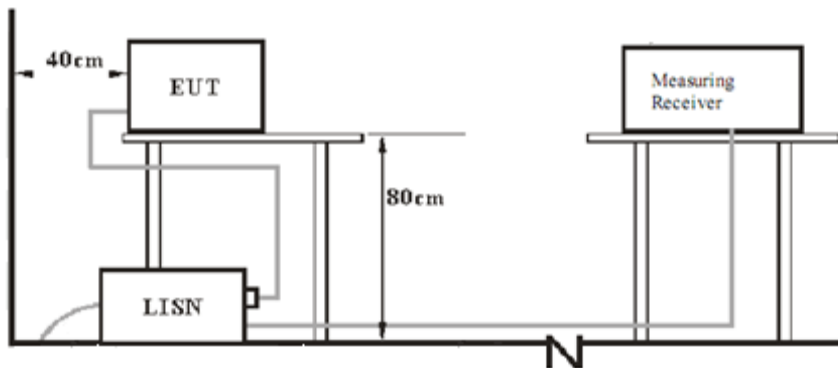
Tested by:


Louise Liu
Test Engineer

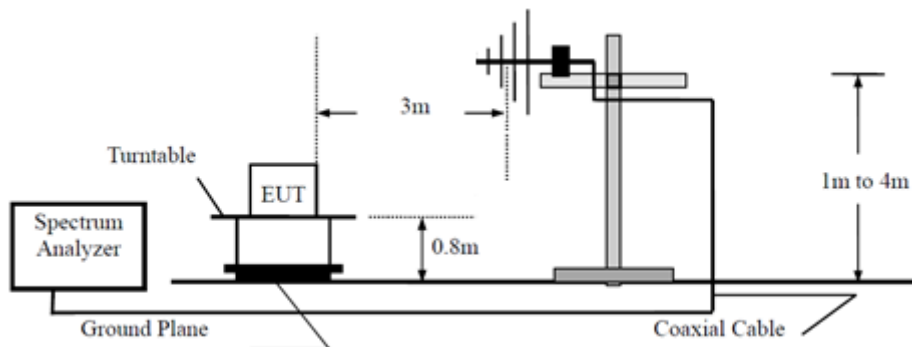


7 Test Setups

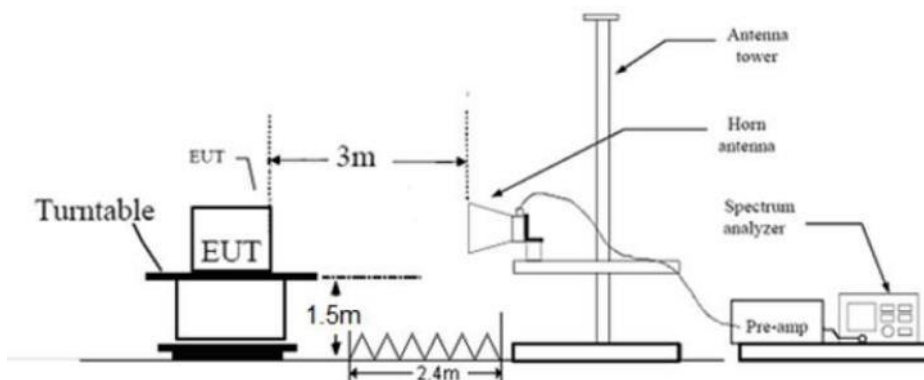
7.1 AC Power Line Conducted Emission test setups



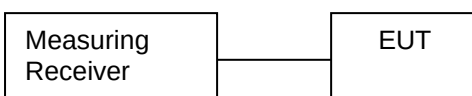
7.2 Radiated test setups Below 1GHz



Above 1GHz



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Notebook	Lenovo	X240	---

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

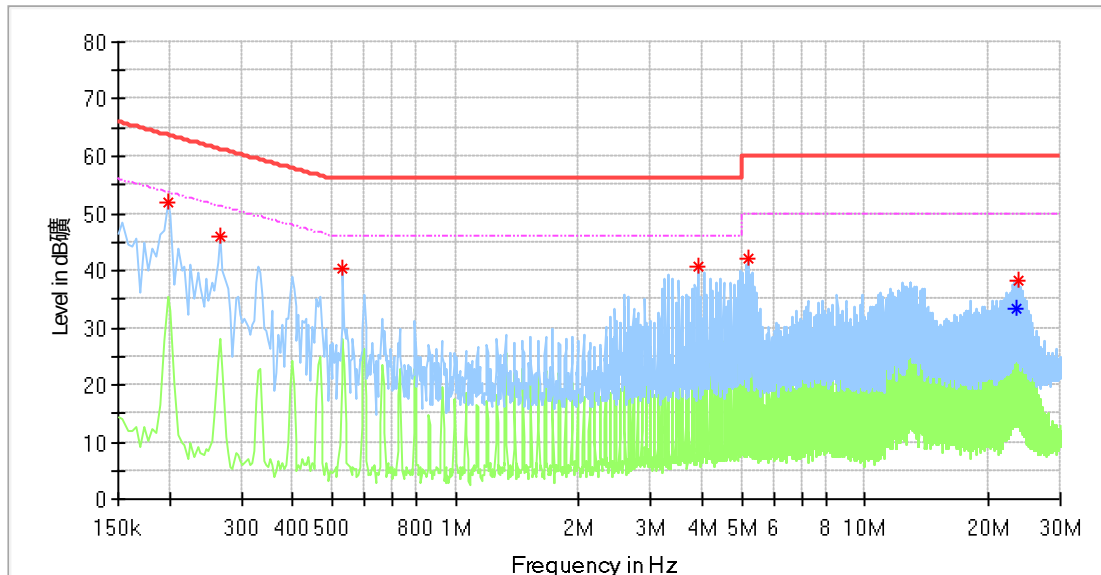
According to §15.207, conducted emissions limit as below:

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Remark: “*” Decreasing linearly with logarithm of the frequency

Conducted Emission

Product Type : BT Module_BT5.0
 M/N : CS63038
 Operating Condition : Transmit
 Test Specification : Power Line, Live
 Comment : AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)
0.198000	51.87	---	63.69	11.82	L1	10.32
0.266000	45.82	---	61.24	15.42	L1	10.32
0.530000	40.42	---	56.00	15.58	L1	10.33
3.914000	40.68	---	56.00	15.32	L1	10.47
5.174000	41.94	---	60.00	18.06	L1	10.53
23.362000	---	33.42	50.00	16.58	L1	11.42
23.558000	38.10	---	60.00	21.90	L1	11.44

Remark :

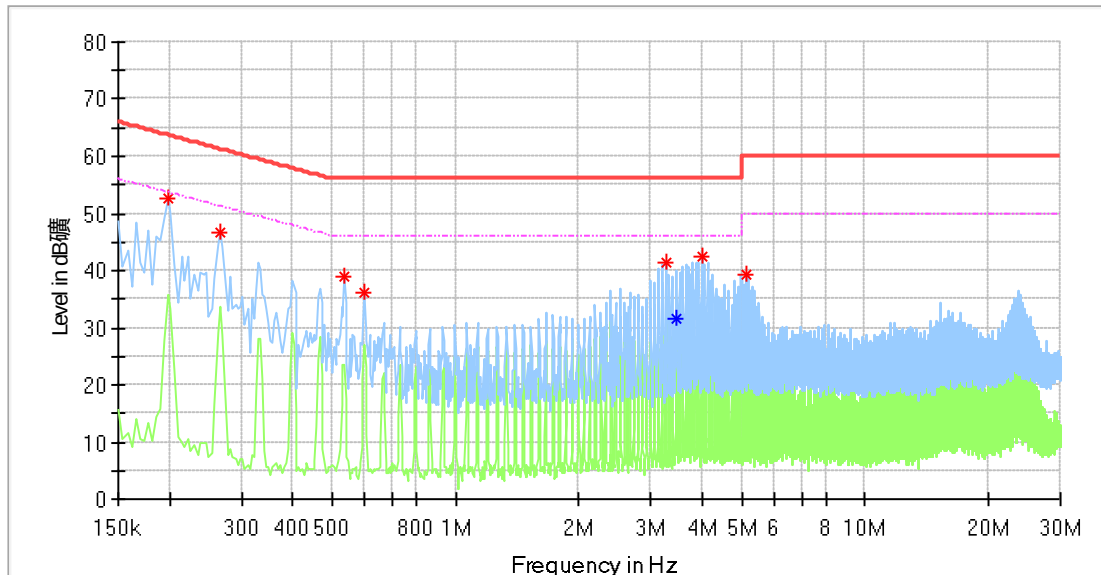
Level=Reading Level + Correction Factor

Correction Factor=Cable Loss + LISN Factor

(The Reading Level is recorded by software which is not shown in the sheet)

Conducted Emission

Product Type : BT Module_BT5.0
 M/N : CS63038
 Operating Condition : Transmit
 Test Specification : Power Line, Neutral
 Comment : AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)
0.198000	52.62	---	63.69	11.08	N	10.33
0.266000	46.84	---	61.24	14.41	N	10.33
0.534000	38.99	---	56.00	17.01	N	10.33
0.598000	35.98	---	56.00	20.02	N	10.33
3.254000	41.40	---	56.00	14.60	N	10.46
3.458000	---	31.66	46.00	14.34	N	10.46
3.990000	42.30	---	56.00	13.70	N	10.49
5.122000	39.23	---	60.00	20.77	N	10.56

Remark :

Level=Reading Level + Correction Factor

Correction Factor=Cable Loss + LISN Factor

(The Reading Level is recorded by software which is not shown in the sheet)

9.2 Conducted peak output power

Test Method

1. The RF output of EUT was connected to the power meter by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following test receiver settings:
Span = approximately 5 times the 6dB bandwidth, centered on a hopping channel
RBW > the 6dB bandwidth of the emission being measured, VBW ≥ 3RBW,
Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power and record the results in the test report.
5. Repeat above procedures until all frequencies measured were complete.

Limits

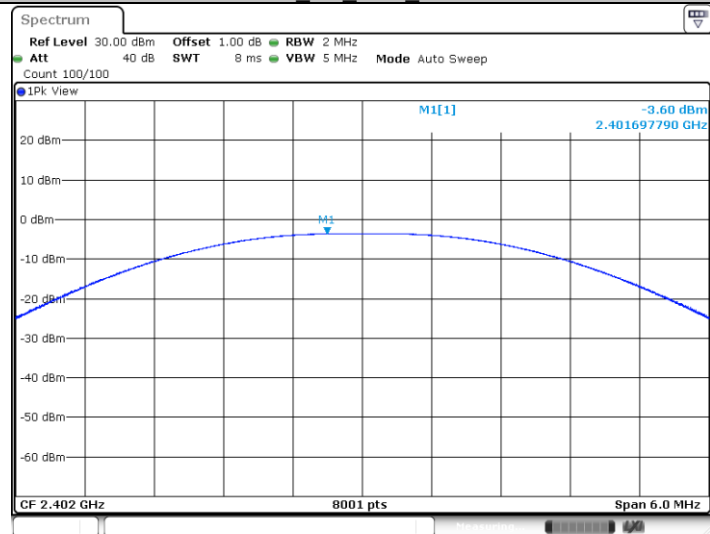
Conducted peak output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

Test result as below table

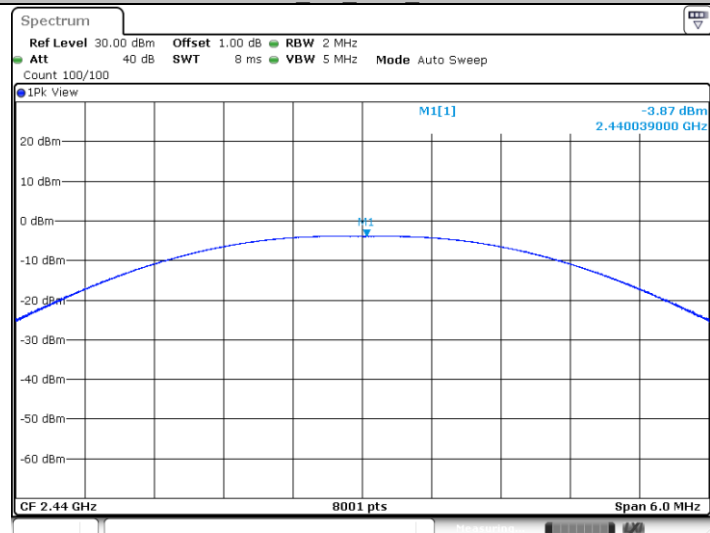
Frequency MHz	Data Rate bps	Conducted Peak Output Power dBm	Limit dBm	Result
Bottom channel 2402MHz	LE 1M	-3.60	≤30	Pass
Middle channel 2440MHz	LE 1M	-3.87	≤30	Pass
Top channel 2480MHz	LE 1M	-4.62	≤30	Pass
Bottom channel 2402MHz	LE 2M	-3.56	≤30	Pass
Middle channel 2440MHz	LE 2M	-3.84	≤30	Pass
Top channel 2480MHz	LE 2M	-4.60	≤30	Pass

BLE_1M_Ant1_2402



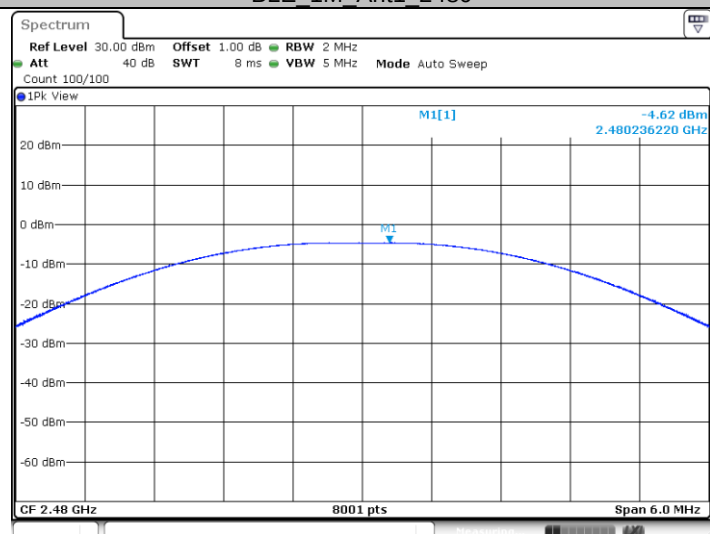
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BLE_1M_Ant1_2440



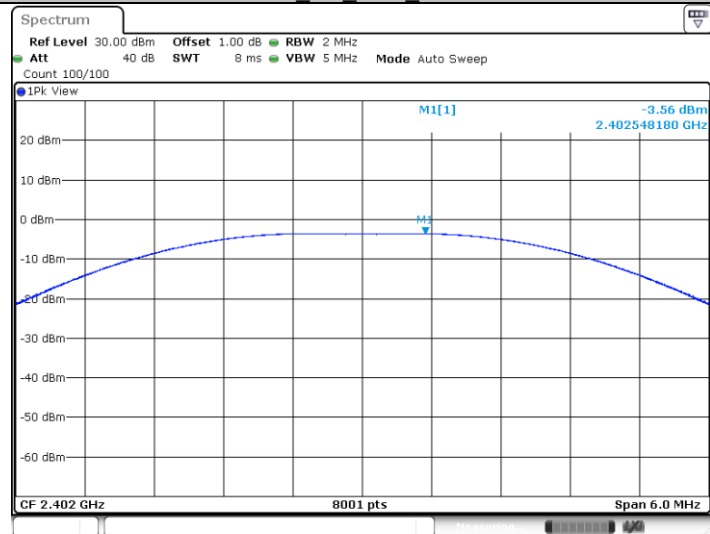
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BLE_1M_Ant1_2480



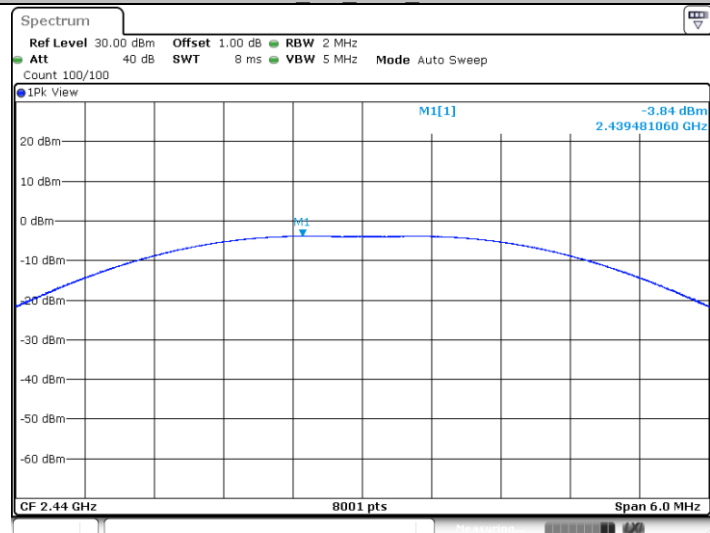
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BLE_2M_Ant1_2402



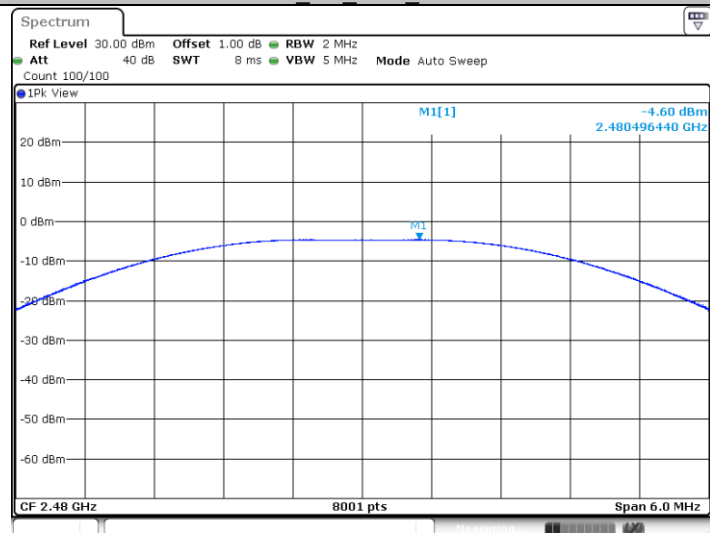
Date: 17.MAR.2021 21:29:22

BLE_2M_Ant1_2440



Date: 17.MAR.2021 21:32:28

BLE_2M_Ant1_2480



Date: 17.MAR.2021 21:34:32

9.3 Power spectral density

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW $\geq$ 3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power and record the results in the test report.
5. Repeat above procedures until other frequencies measured were completed.

Limit

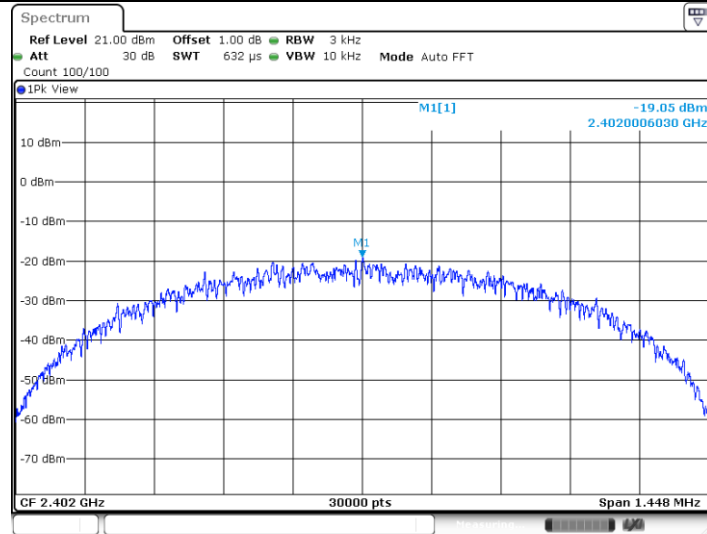
Limit [dBm/3KHz]

≤ 8

Test result

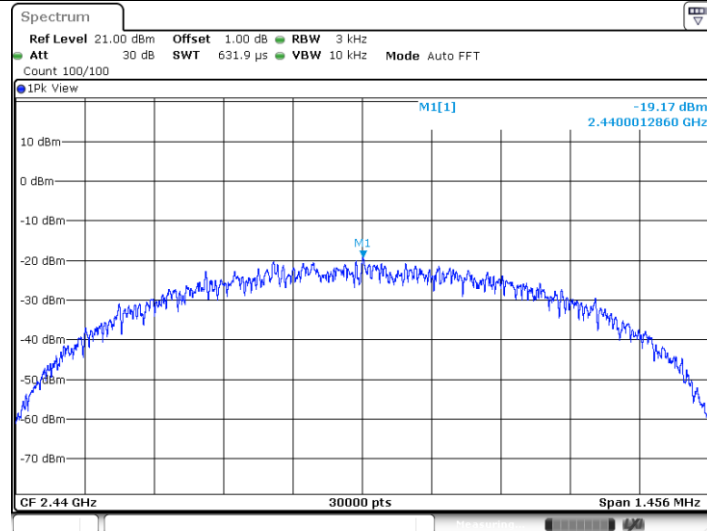
Frequency MHz	Data Rate bps	Power spectral density dBm/3KHz	Result
Bottom channel 2402MHz	LE 1M	-19.05	Pass
Middle channel 2440MHz	LE 1M	-19.17	Pass
Top channel 2480MHz	LE 1M	-20.15	Pass
Bottom channel 2402MHz	LE 2M	-21.81	Pass
Middle channel 2440MHz	LE 2M	-22.07	Pass
Top channel 2480MHz	LE 2M	-23.03	Pass

BLE_1M_2402



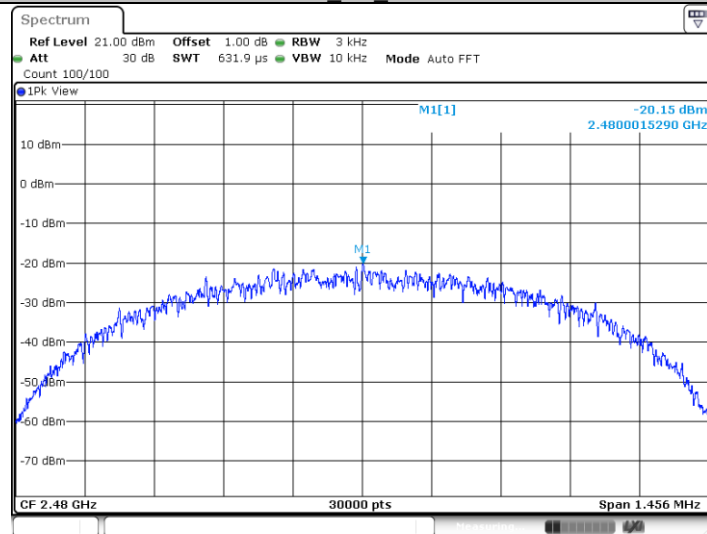
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BLE_1M_2440



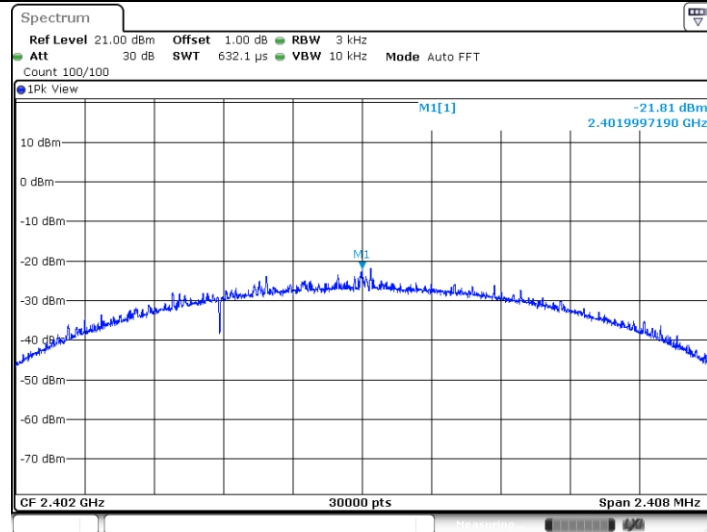
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BLE_1M_2480



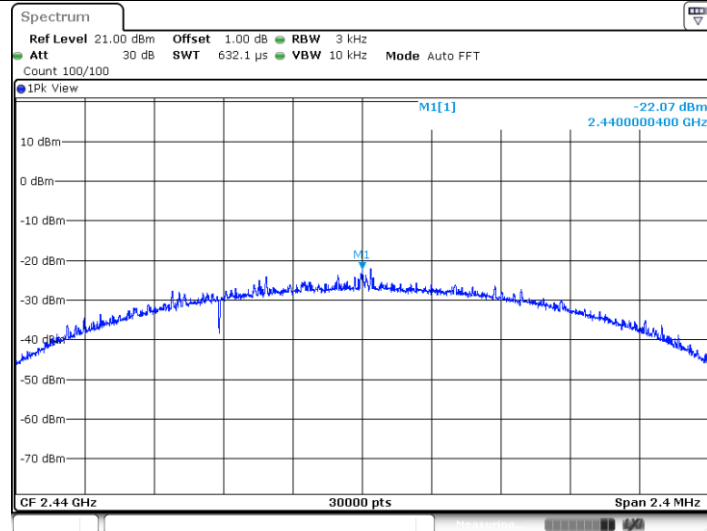
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BLE_2M_2402



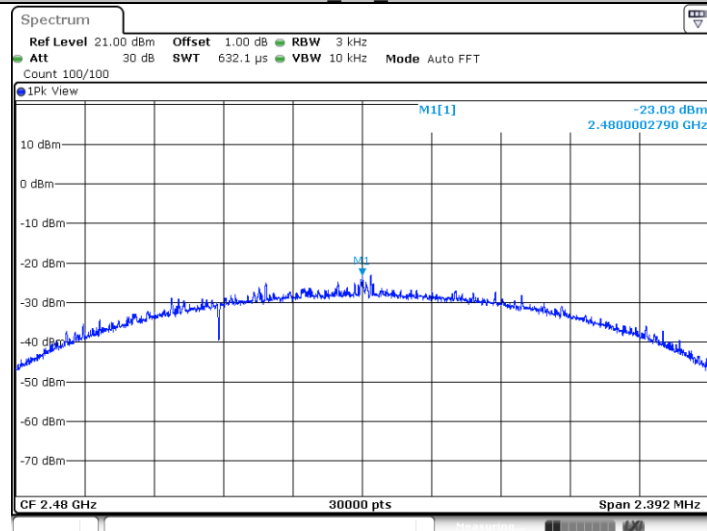
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BLE_2M_2440



Date: 17.MAR.2021 21:32:34

BLE_2M_2480



Date: 17.MAR.2021 21:34:38

9.4 6 dB Bandwidth and 99% Occupied Bandwidth

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following test receiver settings:
Span = approximately 5 times the 6dB bandwidth, centered on a hopping channel
RBW =100KHz, VBW $\geq$ 3RBW,
Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth. Record the results.
5. Repeat above procedures until all frequencies measured were complete.

Limit

Limit [kHz]

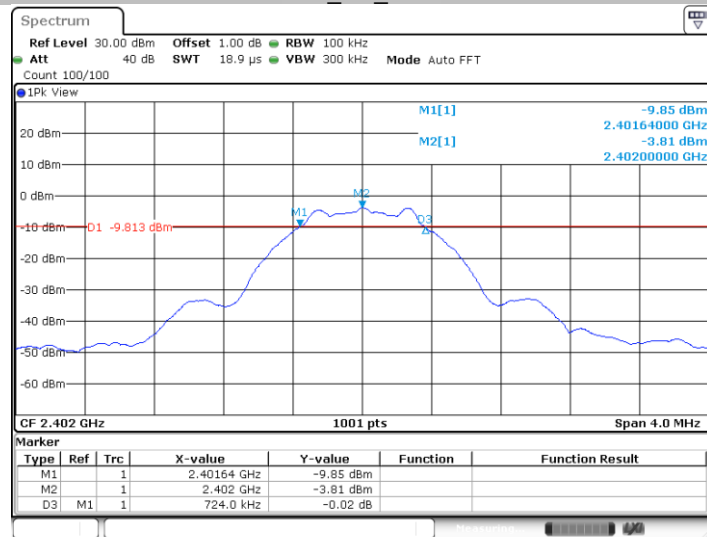
≥ 500

Test result

Frequency MHz	Data Rate bps	6dB bandwidth MHz	99% bandwidth MHz	Result
Bottom channel 2402MHz	LE 1M	0.724	1.051	Pass
Middle channel 2440MHz	LE 1M	0.728	1.055	Pass
Top channel 2480MHz	LE 1M	0.728	1.059	Pass
Bottom channel 2402MHz	LE 2M	1.204	2.058	Pass
Middle channel 2440MHz	LE 2M	1.200	2.066	Pass
Top channel 2480MHz	LE 2M	1.196	2.066	Pass

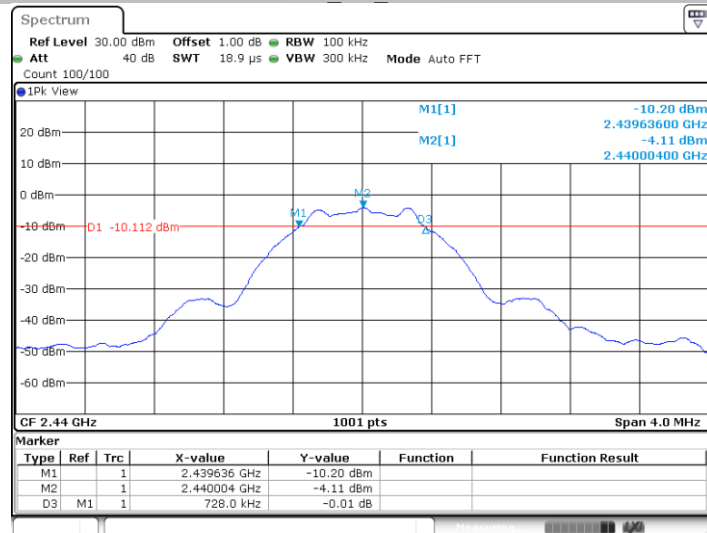
6 dB Bandwidth

BLE_1M_2402



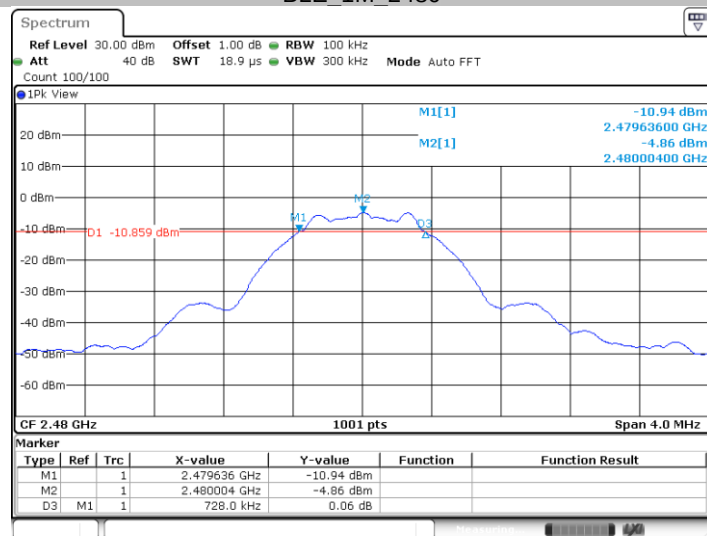
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BLE_1M_2440



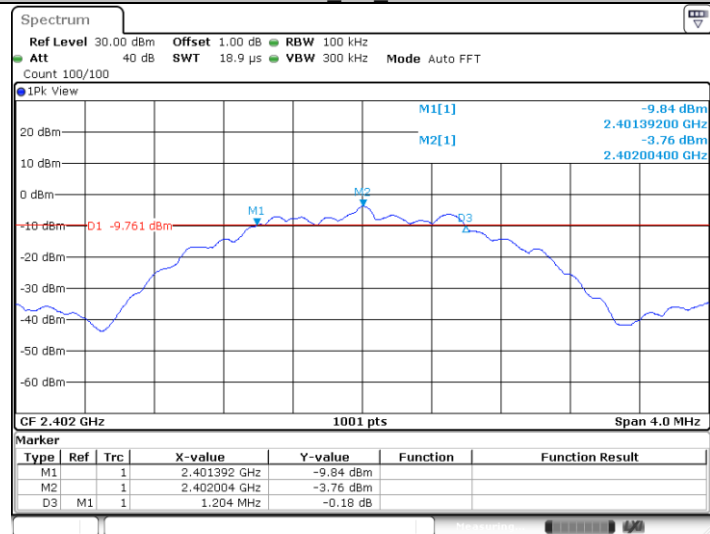
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BLE_1M_2480



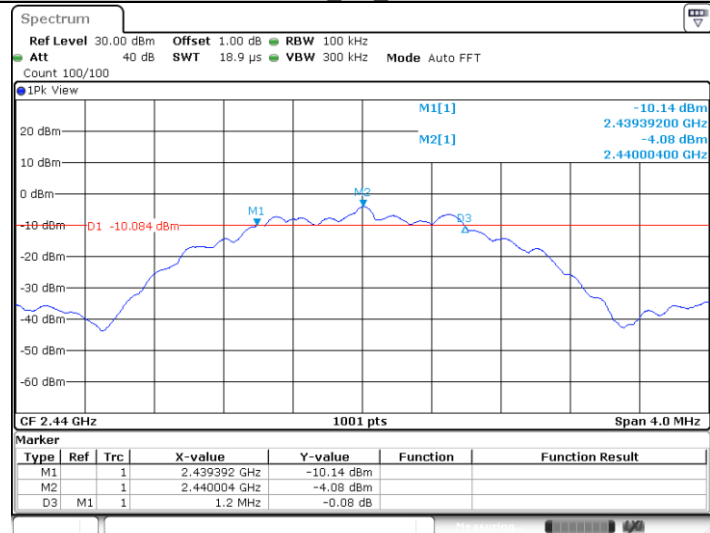
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BLE_2M_2402



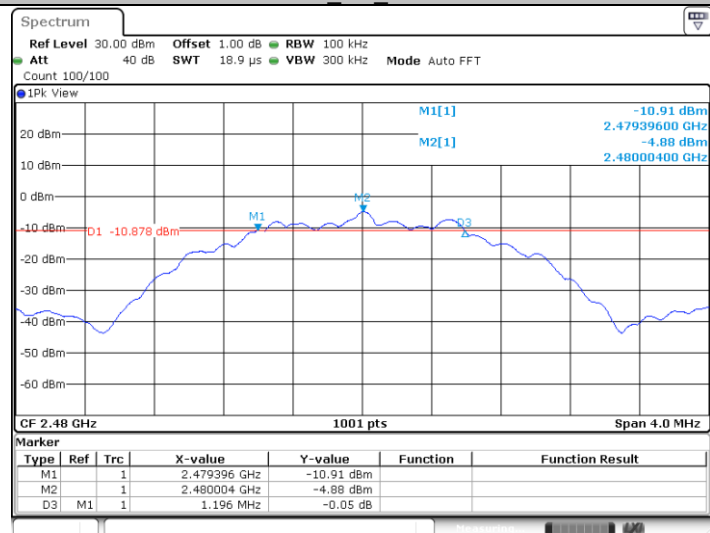
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BLE_2M_2440



Date: 17.MAR.2021 21:32:11

BLE_2M_2480



Date: 17.MAR.2021 21:34:15

BLE 1M 2402



BLE_1M_2440



BLE_1M_2480

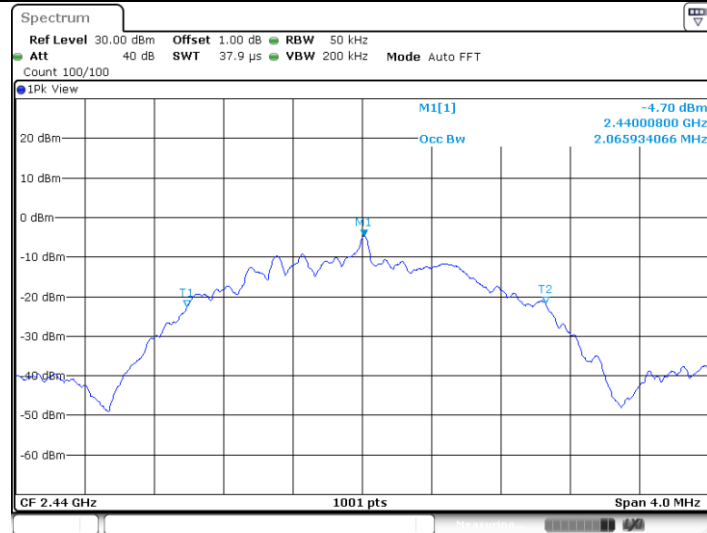


BLE 2M 2402



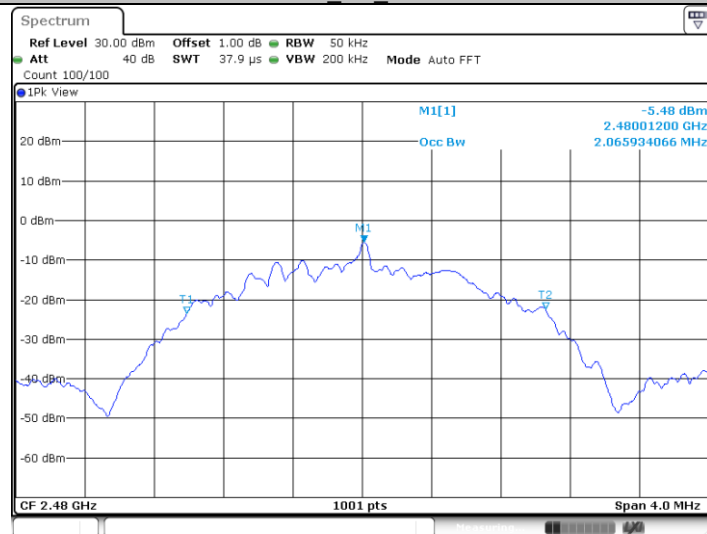
Date: 17.MAR.2021 21:29:15

BLE 2M 2440



Date: 17.MAR.2021 21:32:22

BLE 2M 2480



Date: 17.MAR.2021 21:34:26

9.5 Spurious RF conducted emissions

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency

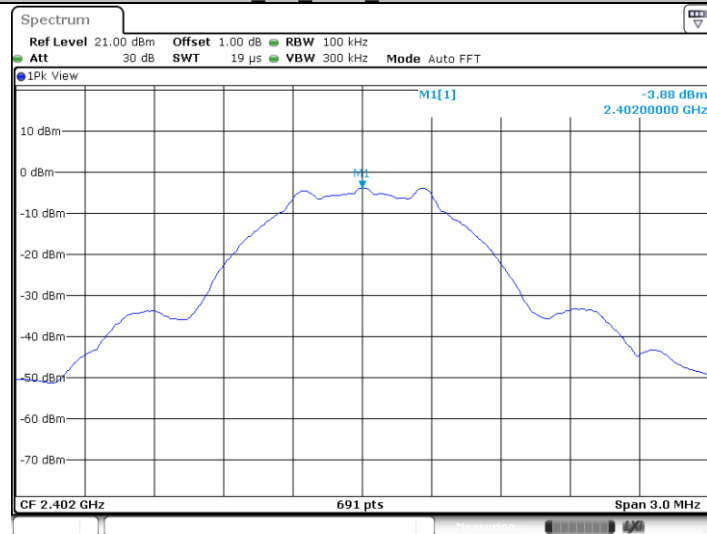
Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

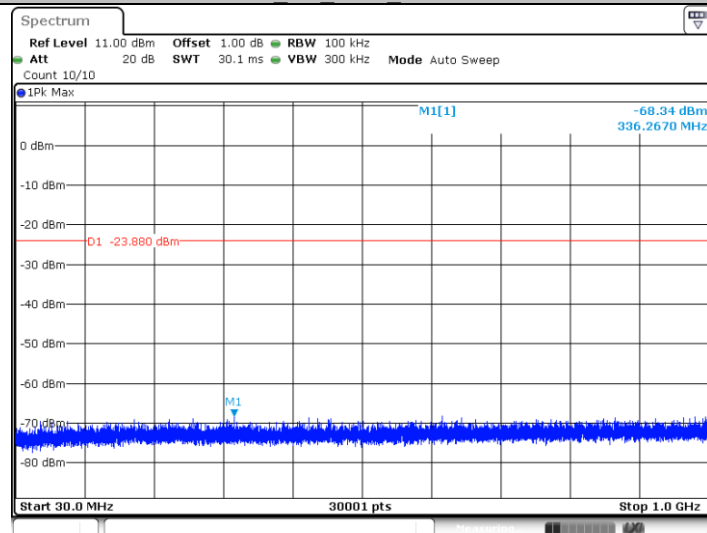
TestMode	Antenna	Channel (MHz)	FreqRange (MHz)	RefLevel	Result (dBm)	Limit (dBm)	Verdict
BLE_1M	Ant1	2402	Reference	-3.88 dBm	-3.88	---	PASS
		2402	30~1000	30~1000 MHz	-68.34	<=-23.88	PASS
		2402	1000~26500	1000~26500 MHz	-52.63	<=-23.88	PASS
		2440	Reference	-4.02 dBm	-4.02	---	PASS
		2440	30~1000	30~1000	-67.91	<=-24.02	PASS
		2440	1000~26500	1000~26500 MHz	-52.3	<=-24.02	PASS
		2480	Reference	-4.98 dBm	-4.98	---	PASS
		2480	30~1000	30~1000 MHz	-67.77	<=-24.98	PASS
		2480	1000~26500	1000~26500 MHz	-52.46	<=-24.98	PASS
BLE_2M	Ant1	2402	Reference	-3.86 dBm	-3.86	---	PASS
		2402	30~1000	30~1000 MHz	-67.48	<=-23.86	PASS
		2402	1000~26500	1000~26500 MHz	-32.94	<=-23.86	PASS
		2440	Reference	-4.01 dBm	-4.01	---	PASS
		2440	30~1000	30~1000 MHz	-67.75	<=-24.01	PASS
		2440	1000~26500	1000~26500 MHz	-52.12	<=-24.01	PASS
		2480	Reference	-4.95 dBm	-4.95	---	PASS
		2480	30~1000	30~1000 MHz	-66.66	<=-24.95	PASS
		2480	1000~26500	1000~26500 MHz	-52.24	<=-24.95	PASS

BLE_1M_2402_0~Reference



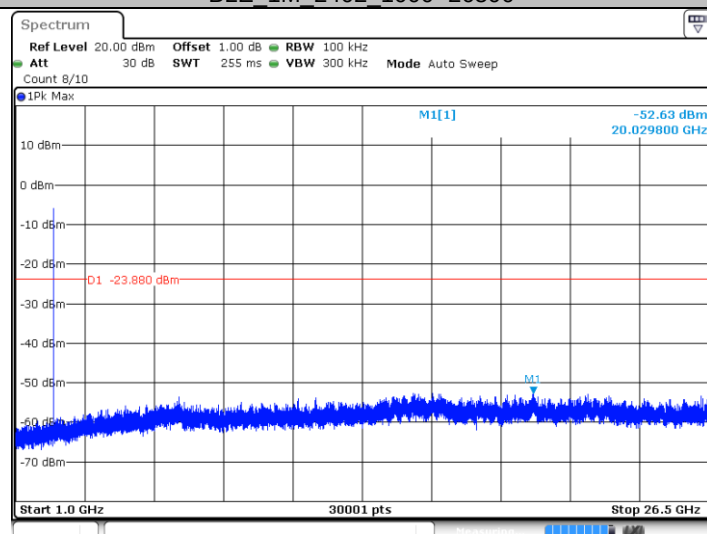
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BLE_1M_2402_30~1000



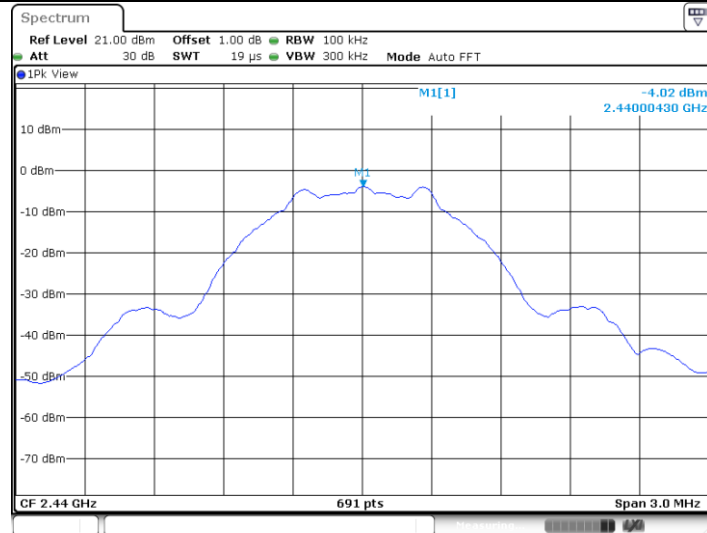
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BLE_1M_2402_1000~26500



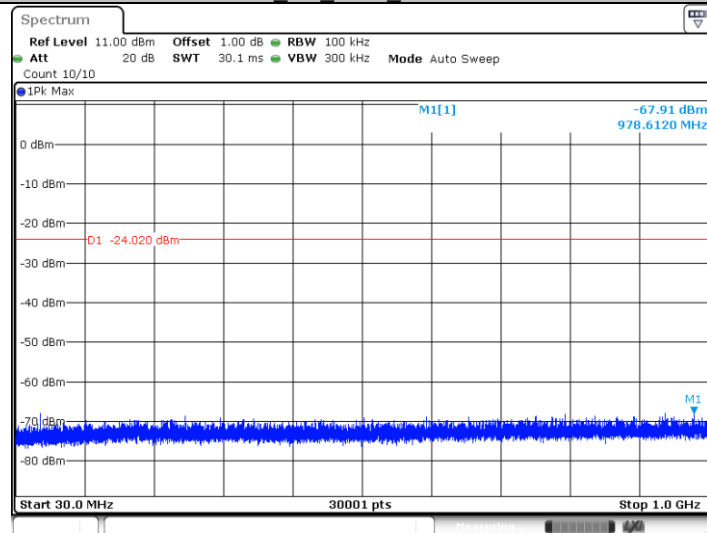
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BLE_1M_2440_0~Reference



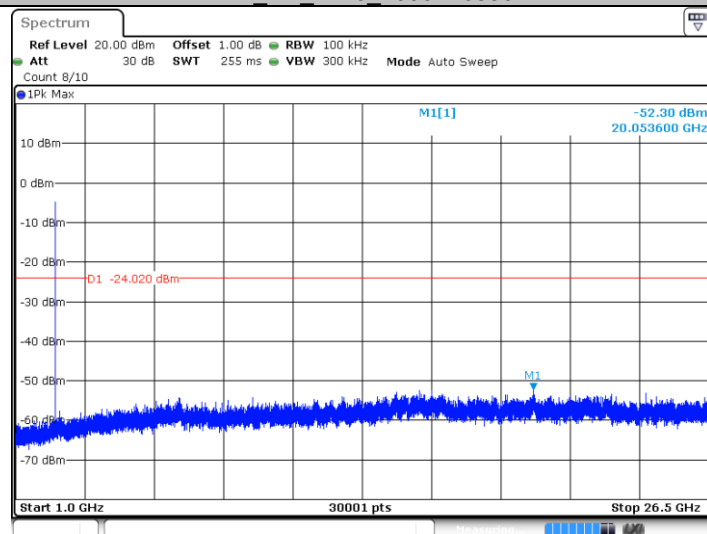
Date: 17.MAR.2021 21:21:10

BLE_1M_2440_30~1000



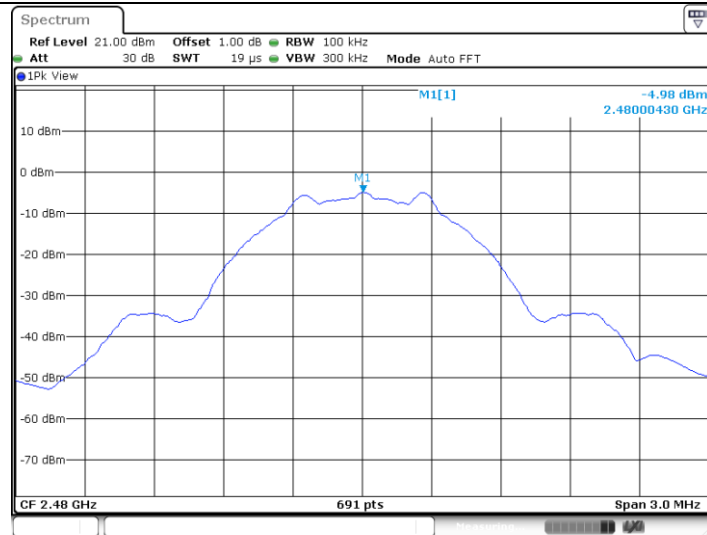
Date: 17.MAR.2021 21:21:16

BLE_1M_2440_1000~26500



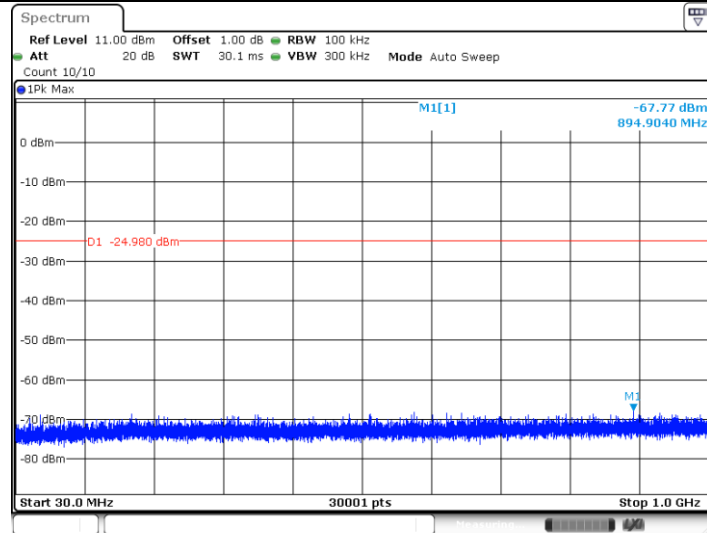
Date: 17.MAR.2021 21:21:24

BLE_1M_2480_0~Reference



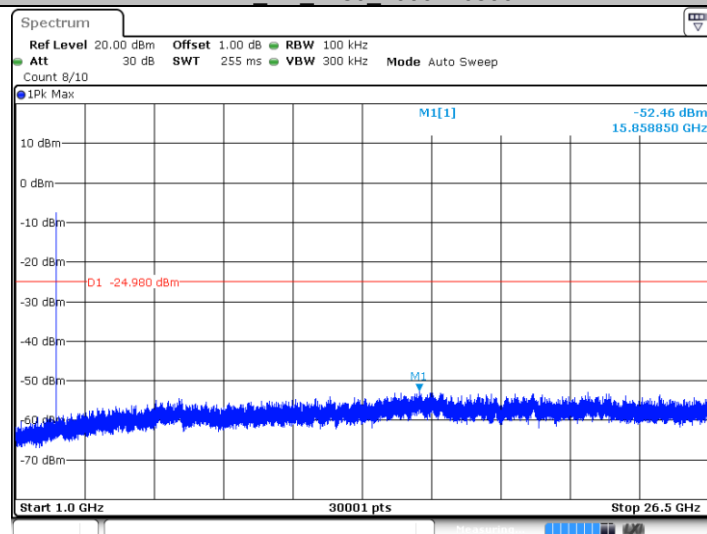
Date: 17.MAR 2021 21:24:37

BLE 1M 2480 30~1000



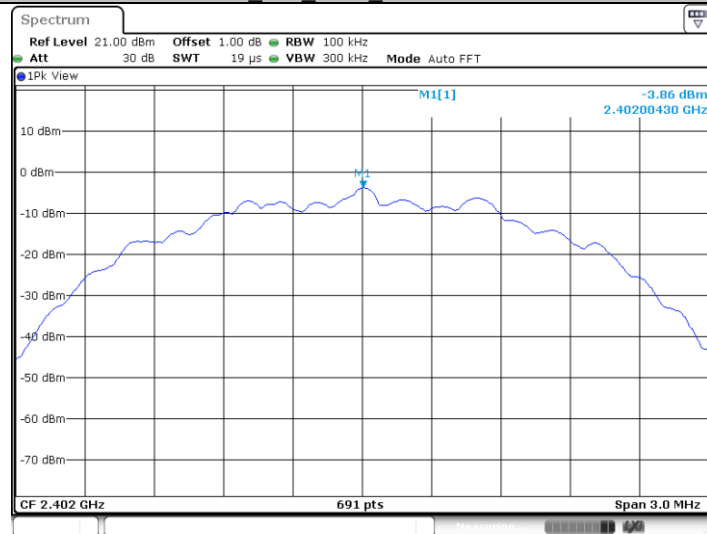
Date: 17.MAR 2021 21:24:43

BLE 1M 2480 1000~26500



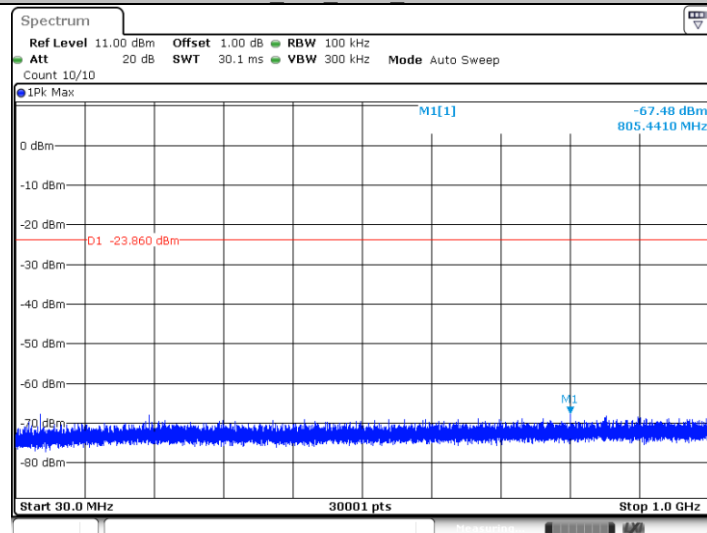
Date: 17.MAR 2021 21:24:51

BLE_2M_2402_0~Reference



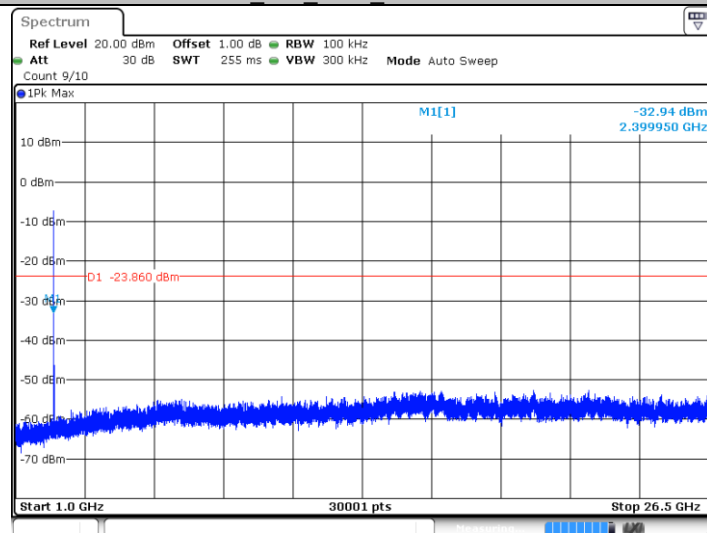
Date: 17.MAR.2021 21:30:34

BLE_2M_2402_30~1000



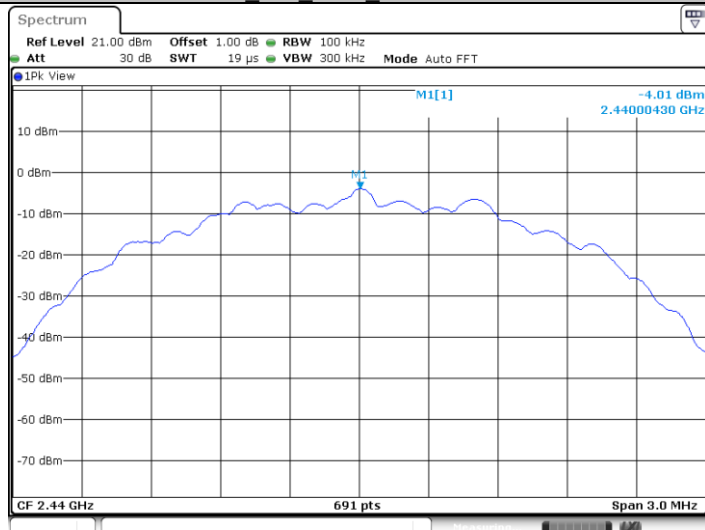
Date: 17.MAR.2021 21:30:40

BLE_2M_2402_1000~26500



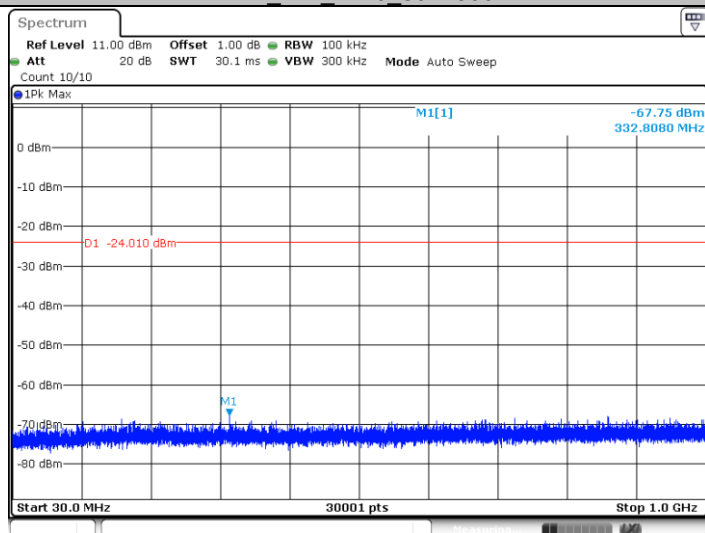
Date: 17.MAR.2021 21:30:48

BLE 2M_2440_0~Reference



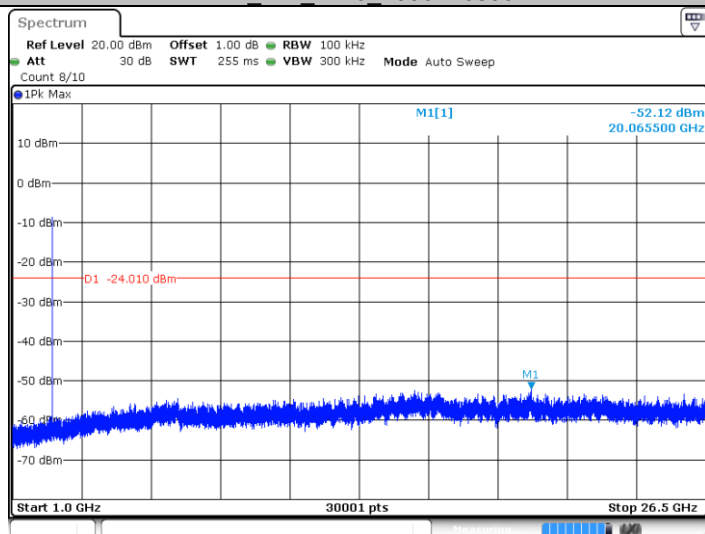
Date: 17.MAR 2021 21:32:40

BLE 2M_2440_30~1000



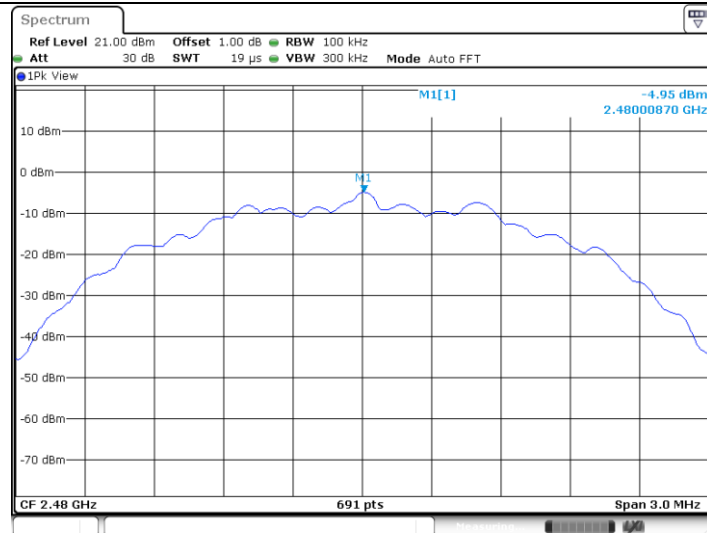
Date: 17.MAR 2021 21:32:46

BLE 2M_2440_1000~26500



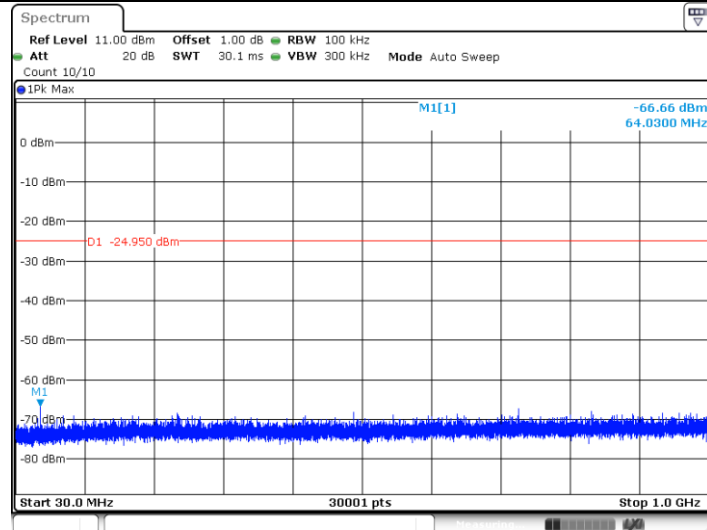
Date: 17.MAR 2021 21:32:54

BLE 2M_2480_0~Reference



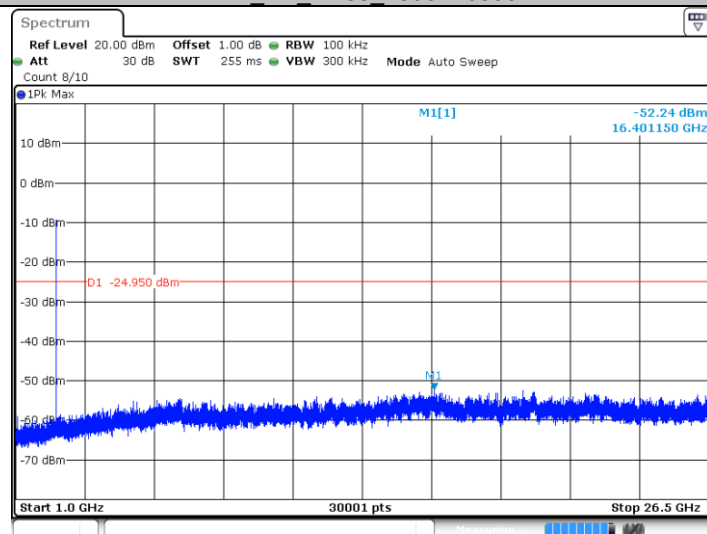
Date: 17.MAR.2021 21:35:45

BLE 2M 2480 30~1000



Date: 17.MAR.2021 21:35:51

BLE 2M 2480 1000~26500



Date: 17.MAR.2021 21:35:59

9.6 Band edge

Test Method

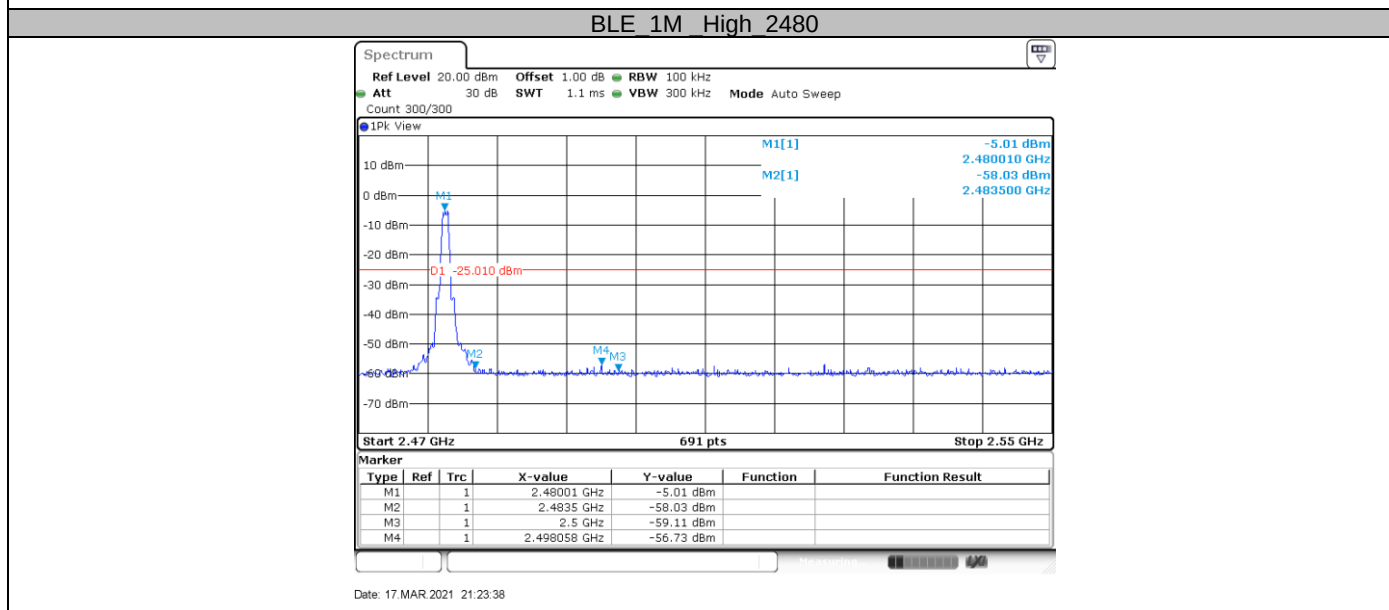
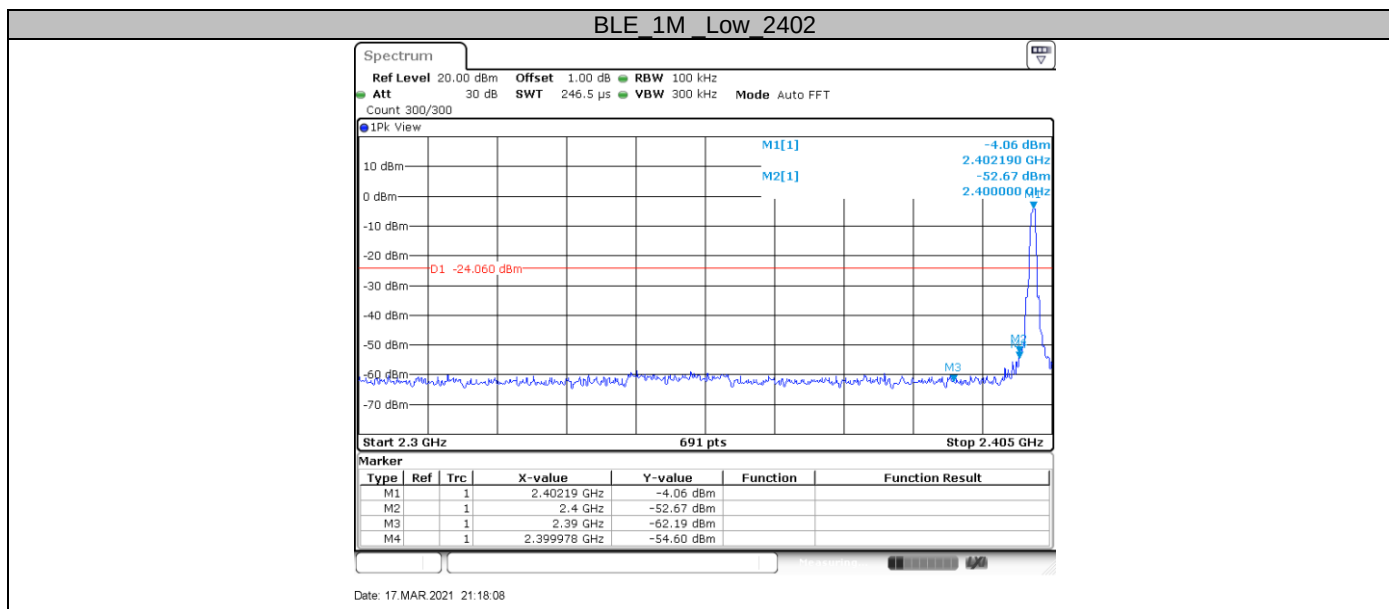
1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency
6. Set to the maximum power setting and enable the EUT hopping mode, repeat the test.

Limit

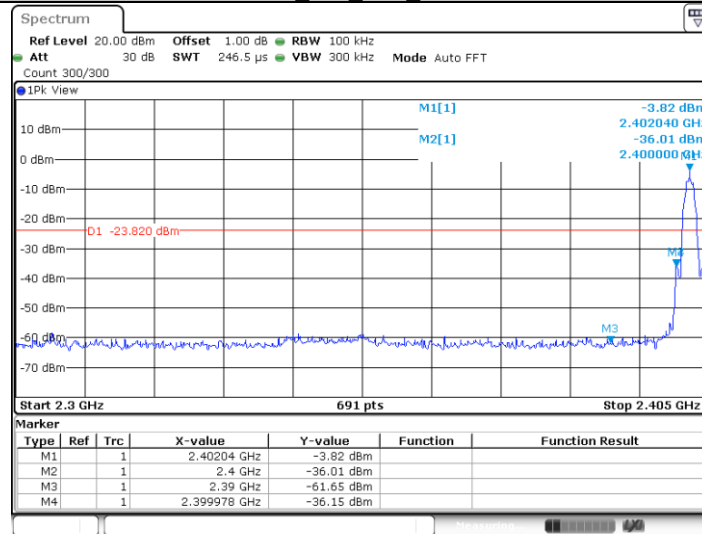
Frequency Range	Limit (dBm)
MHz	
30-25000	-20

Band edge testing

Test Mode bps	Antenna	ChName	Channel (MHz)	RefLevel (dBm)	Result (dBm)	Limit (dBm)	Verdict
BLE_1M	Ant1	Low	2402	-4.06	-54.6	<=-14.93	PASS
		High	2480	-5.01	-56.73	<=-15.3	PASS
BLE_2M	Ant1	Low	2402	-3.82	-36.15	<=-23.82	PASS
		High	2480	-5.08	-56.43	<=-25.08	PASS

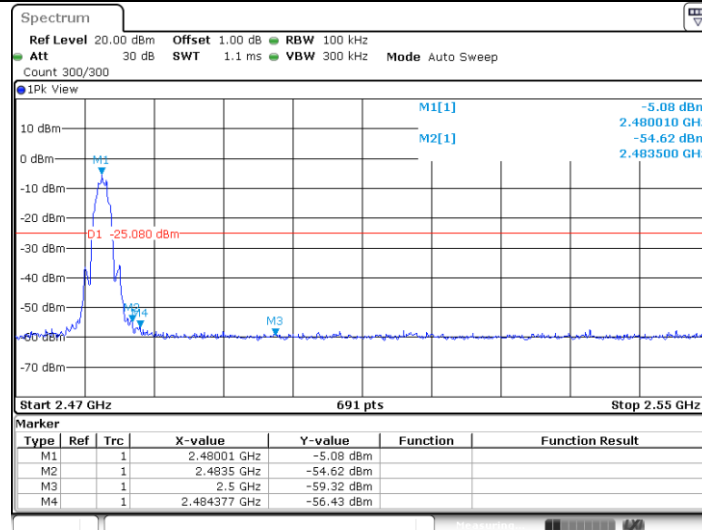


BLE 2M Low 2402



Date: 17.MAR.2021 21:29:37

BLE 2M High 2480



Date: 17.MAR.2021 21:34:47

9.7 Spurious radiated emissions for transmitter

Test Method

- 1: The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5: Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 100 KHz to 120KHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 1MHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

- a) RBW = 1 MHz.
- b) $VBW \geq [3 \times RBW]$.
- c) Detector = RMS (power averaging), if $[\text{span} / (\# \text{ of points in sweep})] \leq RBW / 2$.
 Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
- e) Sweep time = auto.
- f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of $1 / D$, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
- g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is $[10 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty

cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

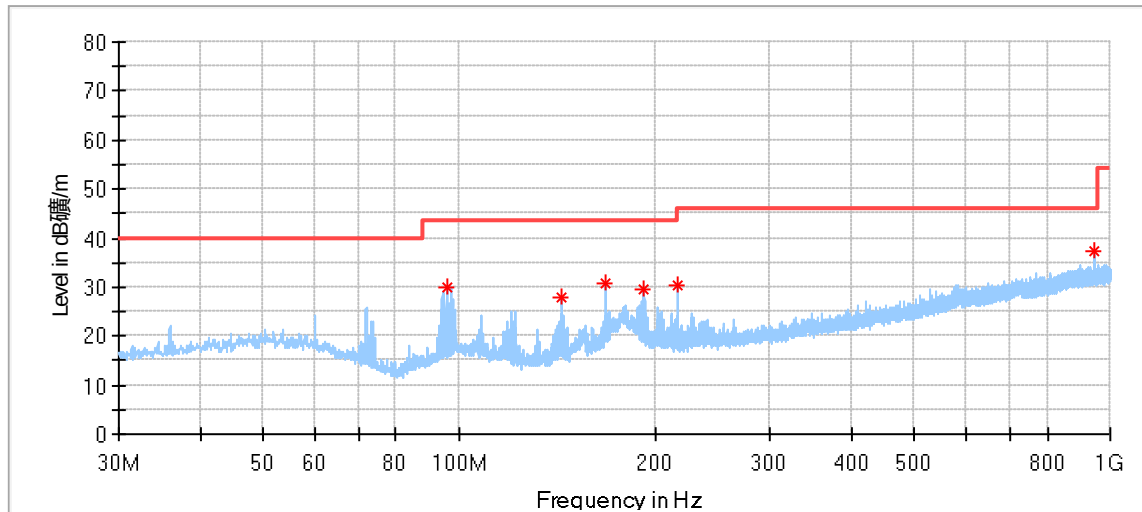
Frequency MHz	Field Strength uV/m	Field Strength dBμV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

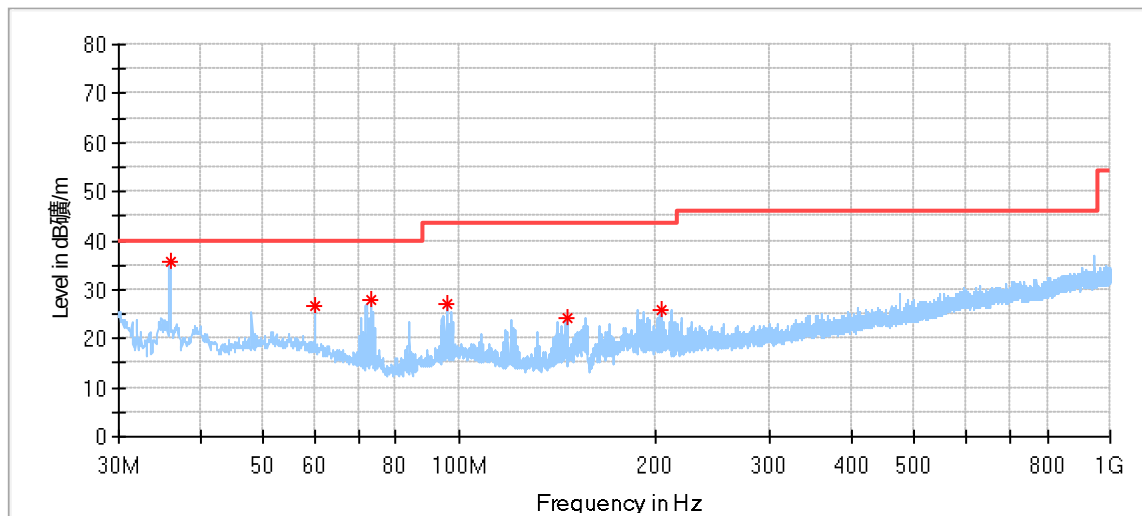
According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Transmitting spurious emission test result as below:

30MHz-1000MHz:

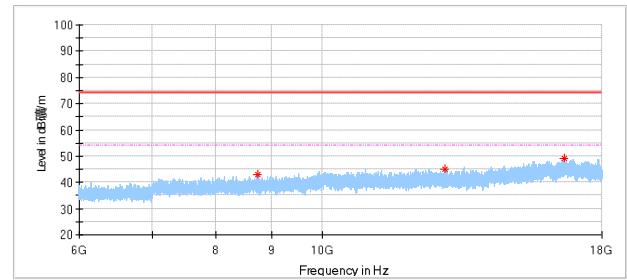
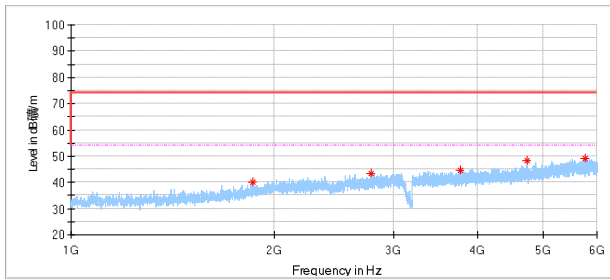


Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
95.960000	30.14	43.50	13.36	200.0	H	42.0	12.02
143.975000	27.97	43.50	15.53	100.0	H	124.0	9.28
167.955556	30.79	43.50	12.71	100.0	H	144.0	10.13
191.936111	29.46	43.50	14.04	100.0	H	117.0	11.95
215.970556	30.45	43.50	13.05	100.0	H	117.0	12.64
945.680000	37.31	46.00	8.69	100.0	H	15.0	25.51



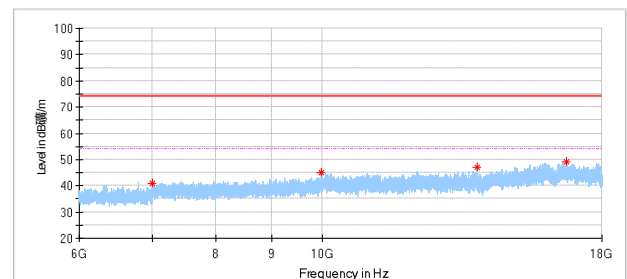
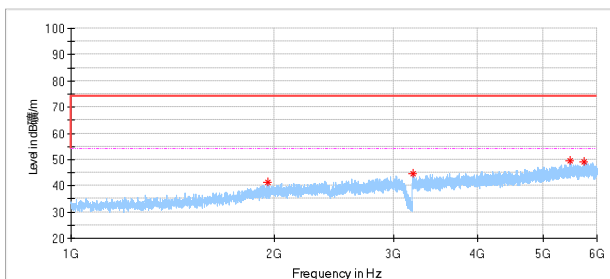
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
35.981667	35.50	40.00	4.50	100.0	V	78.0	12.59
59.962222	26.67	40.00	13.33	100.0	V	222.0	14.03
73.111111	27.71	40.00	12.29	100.0	V	161.0	10.02
95.960000	27.22	43.50	16.28	100.0	V	214.0	12.02
146.292222	24.35	43.50	19.15	200.0	V	298.0	9.35
204.546111	25.73	43.50	17.77	100.0	V	188.0	12.72

1GHz -18GHz:
1MHz_BLE-2402MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1860.500000	40.22	74.00	33.78	150.0	H	239.0	-5.29
2781.000000	43.47	74.00	30.53	150.0	H	266.0	-2.11
3762.500000	44.68	74.00	29.32	150.0	H	31.0	0.56
4728.500000	48.19	74.00	25.81	150.0	H	284.0	2.62
5759.500000	49.02	74.00	24.98	150.0	H	310.0	5.17
8734.000000	43.16	74.00	30.84	150.0	H	150.0	6.44
12928.000000	45.05	74.00	28.95	150.0	H	0.0	9.20
16617.000000	49.01	74.00	24.99	150.0	H	282.0	15.79

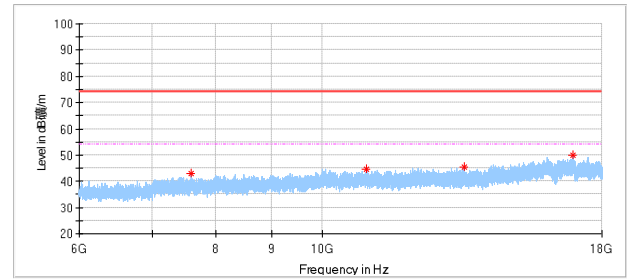
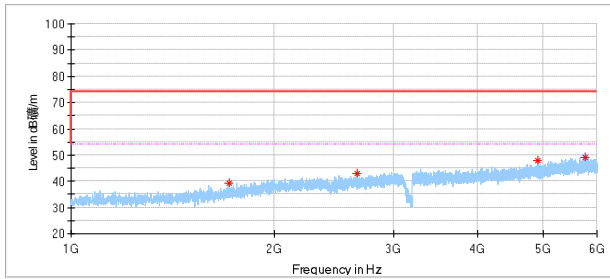
Vertical



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1952.000000	41.48	74.00	32.52	150.0	V	50.0	-4.59
3210.500000	44.79	74.00	29.21	150.0	V	308.0	-0.87
5483.500000	49.49	74.00	24.51	150.0	V	282.0	4.42
5736.000000	49.28	74.00	24.72	150.0	V	183.0	5.01
7001.500000	41.07	74.00	32.93	150.0	V	4.0	4.93
9972.000000	44.96	74.00	29.04	150.0	V	52.0	8.33
13861.500000	47.19	74.00	26.81	150.0	V	358.0	9.66
16705.500000	48.99	74.00	25.01	150.0	V	266.0	15.92

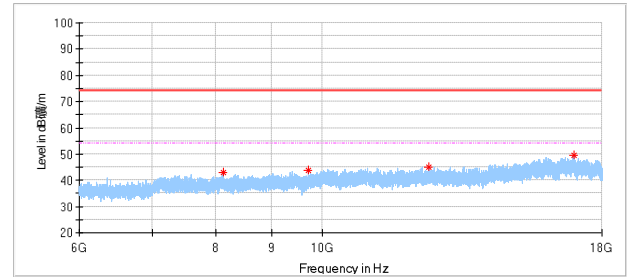
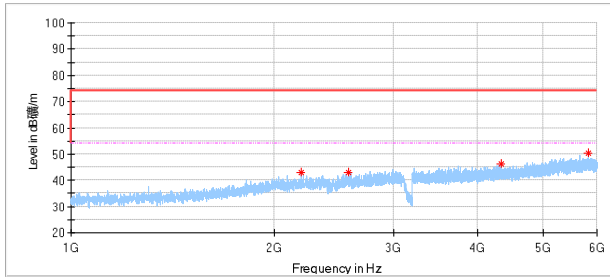
1MHz_BLE-2440MHz:

Horizontal:



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1713.000000	39.35	74.00	34.65	150.0	H	273.0	-6.38
2653.500000	43.09	74.00	30.91	150.0	H	166.0	-2.46
4907.500000	47.99	74.00	26.01	150.0	H	85.0	2.90
5755.000000	49.11	74.00	24.89	150.0	H	201.0	5.14
7598.000000	42.92	74.00	31.08	150.0	H	42.0	5.48
10976.500000	44.42	74.00	29.58	150.0	H	308.0	8.45
13463.500000	45.64	74.00	28.36	150.0	H	356.0	9.71
16926.500000	49.93	74.00	24.07	150.0	H	147.0	16.49

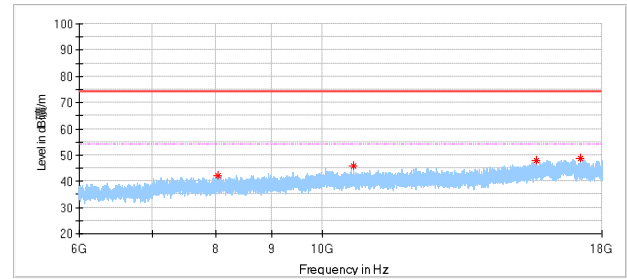
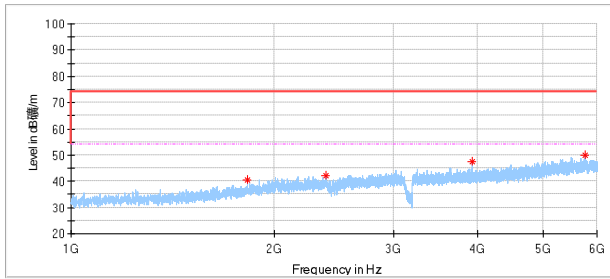
Vertical



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2193.500000	43.15	74.00	30.85	150.0	V	212.0	-3.70
2574.500000	43.10	74.00	30.90	150.0	V	59.0	-2.70
4329.000000	46.12	74.00	27.88	150.0	V	184.0	2.04
5826.000000	50.43	74.00	23.57	150.0	V	41.0	5.21
8118.000000	42.91	74.00	31.09	150.0	V	4.0	6.39
9705.500000	43.77	74.00	30.23	150.0	V	81.0	7.71
12513.000000	45.12	74.00	28.88	150.0	V	0.0	9.21
16968.500000	49.66	74.00	24.34	150.0	V	344.0	16.44

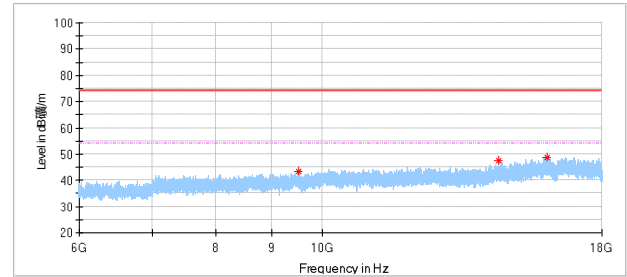
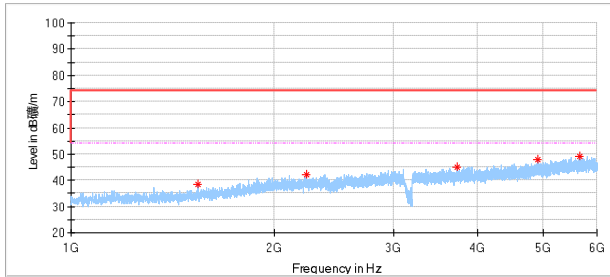
1MHz_BLE-2480MHz

Horizontal:



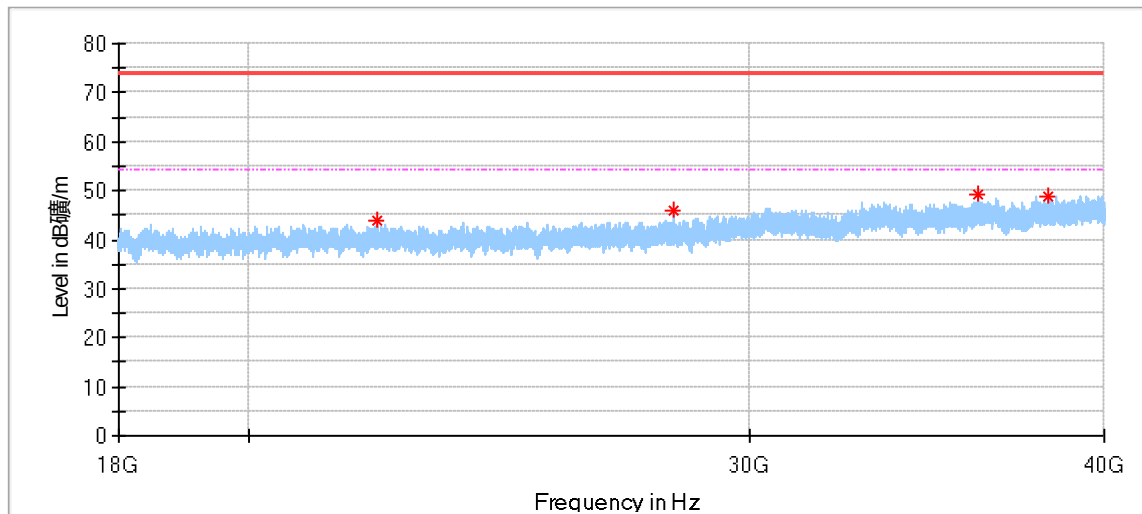
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1825.500000	40.62	74.00	33.38	150.0	H	284.0	-5.57
2386.500000	42.13	74.00	31.87	150.0	H	275.0	-3.17
3922.000000	47.30	74.00	26.70	150.0	H	2.0	1.12
5753.000000	50.10	74.00	23.90	150.0	H	203.0	5.13
8025.000000	42.24	74.00	31.76	150.0	H	292.0	6.42
10667.000000	45.73	74.00	28.27	150.0	H	0.0	8.31
15695.500000	47.82	74.00	26.18	150.0	H	78.0	13.62
17195.000000	48.72	74.00	25.28	150.0	H	78.0	15.83

Vertical



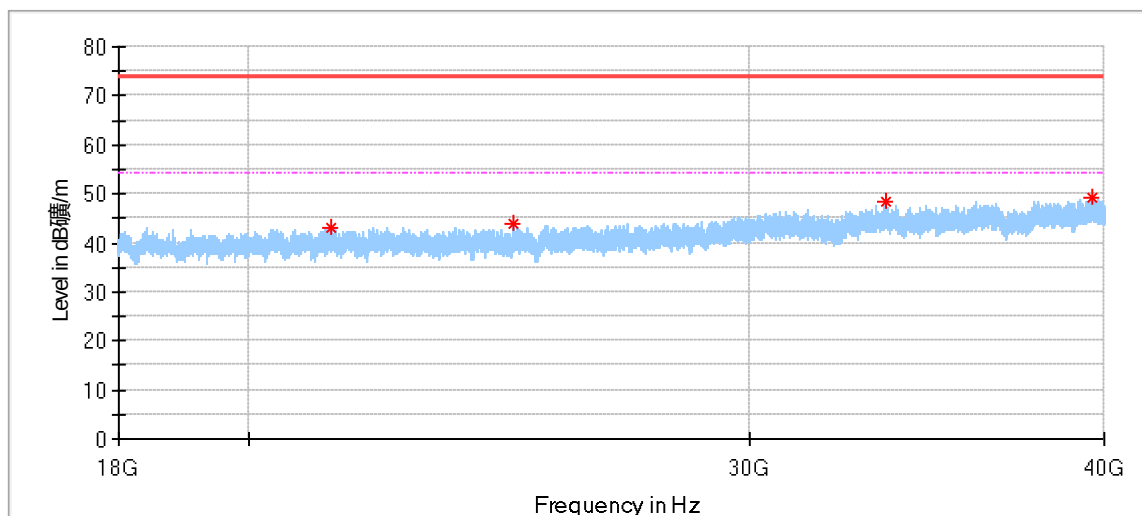
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1539.500000	38.42	74.00	35.58	150.0	V	0.0	-7.92
2227.500000	41.99	74.00	32.01	150.0	V	15.0	-3.63
3729.500000	45.10	74.00	28.90	150.0	V	59.0	0.47
4906.500000	47.84	74.00	26.16	150.0	V	130.0	2.90
5661.000000	49.25	74.00	24.75	150.0	V	228.0	4.66
9505.500000	43.44	74.00	30.56	150.0	V	42.0	7.59
14473.500000	47.57	74.00	26.43	150.0	V	0.0	11.07
16029.500000	48.87	74.00	25.13	150.0	V	226.0	14.67

18GHz- 40GHz:
1MHz_BLE_2402MHz:
Horizontal:



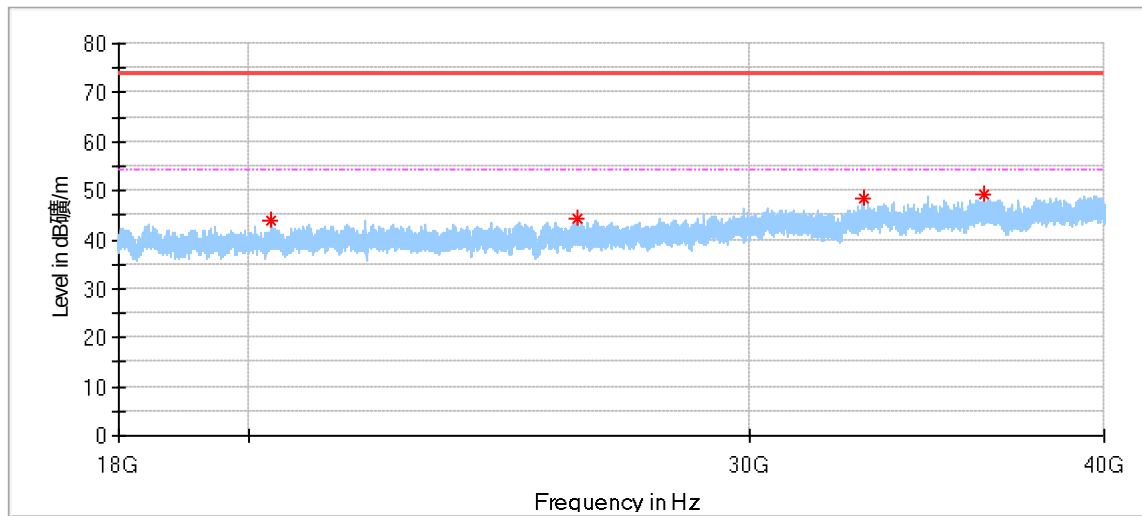
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22177.937500	43.91	74.00	30.09	150.0	H	300.0	0.79
28199.750000	45.75	74.00	28.25	150.0	H	44.0	2.02
36133.500000	49.11	74.00	24.89	150.0	H	274.0	5.94
38215.937500	48.95	74.00	25.05	150.0	H	0.0	7.08

Vertical:



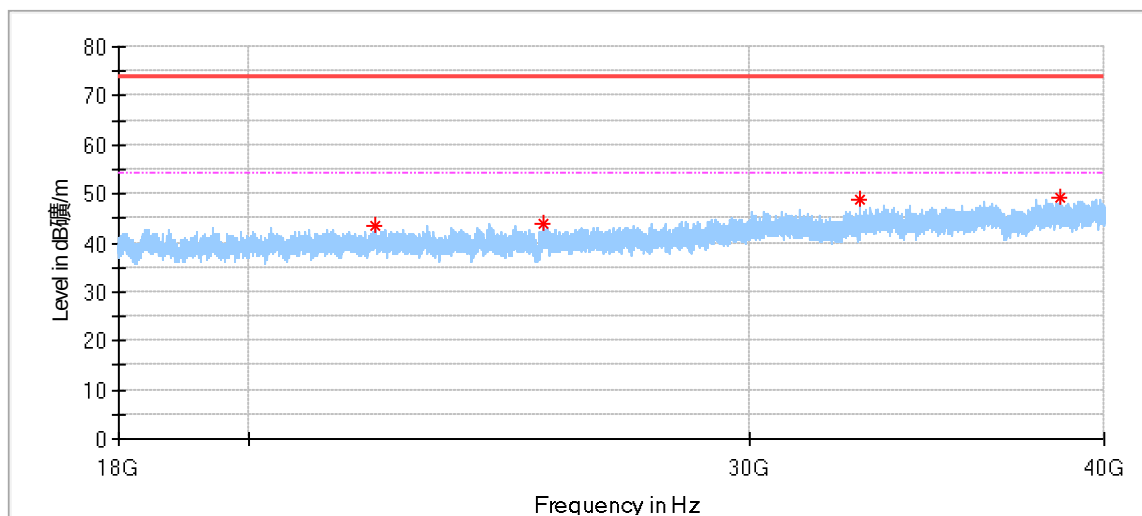
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
21395.562500	42.98	74.00	31.02	150.0	V	194.0	0.27
24793.187500	43.85	74.00	30.15	150.0	V	344.0	1.34
33540.250000	48.43	74.00	25.57	150.0	V	0.0	4.54
39637.687500	49.43	74.00	24.57	150.0	V	261.0	9.13

1MHz_BLE_2440MHz:
Horizontal:



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20379.437500	43.89	74.00	30.11	150.0	H	289.0	-0.71
26092.562500	44.15	74.00	29.85	150.0	H	222.0	2.00
32894.687500	48.34	74.00	25.66	150.0	H	0.0	4.15
36288.187500	49.08	74.00	24.92	150.0	H	263.0	6.08

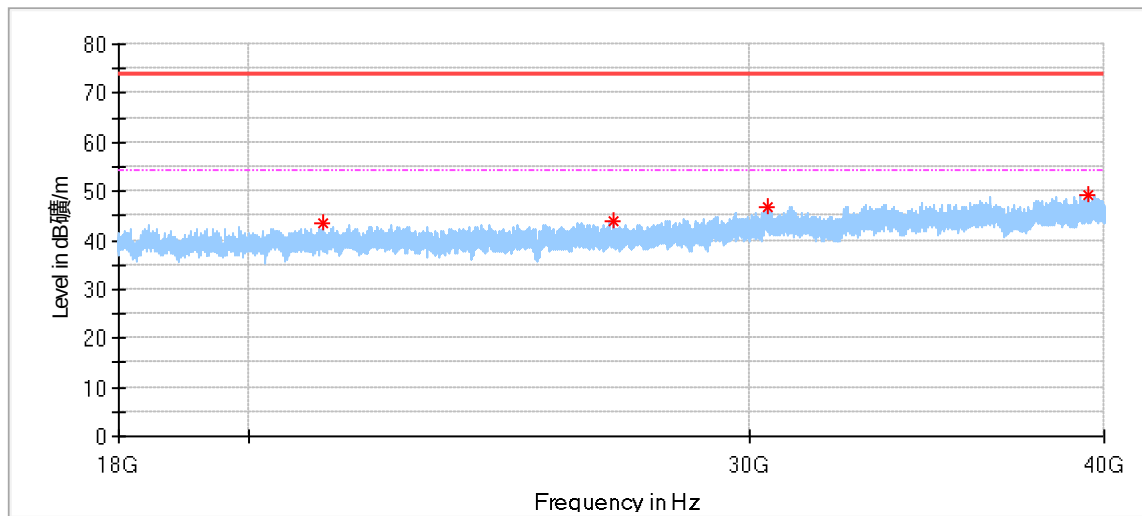
Vertical:



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22147.000000	43.33	74.00	30.67	150.0	V	149.0	0.74
25392.000000	43.99	74.00	30.01	150.0	V	315.0	1.79
32837.625000	48.76	74.00	25.24	150.0	V	345.0	4.03
38578.250000	49.32	74.00	24.68	150.0	V	0.0	7.02

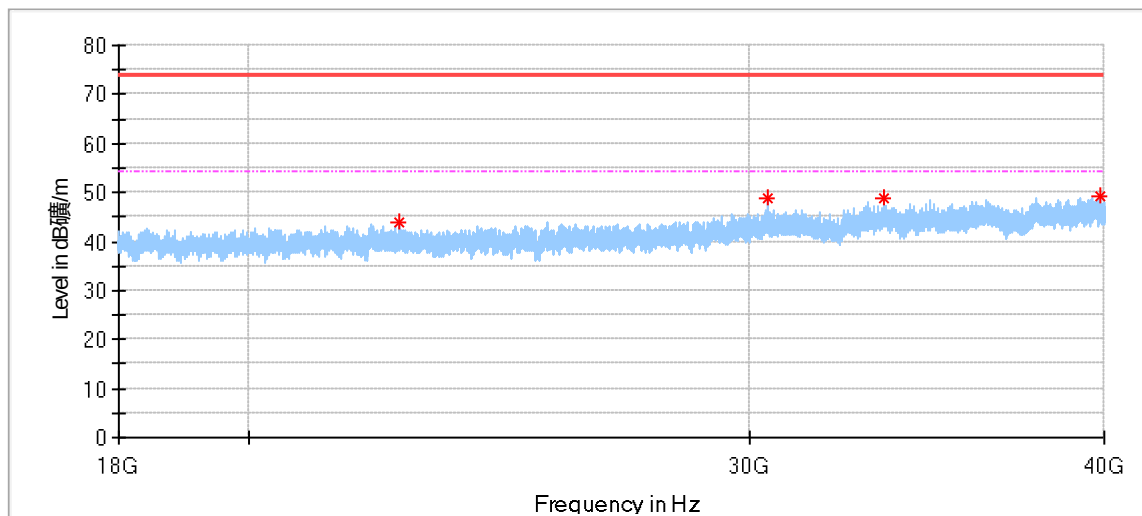
1MHz_BLE_2480MHz:

Horizontal:



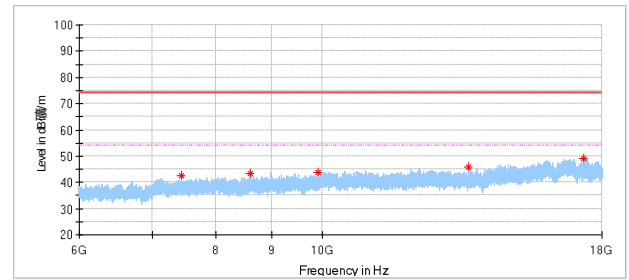
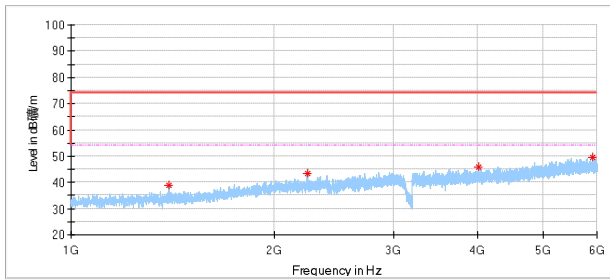
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
21248.437500	43.50	74.00	30.50	150.0	H	287.0	0.27
26870.812500	44.09	74.00	29.91	150.0	H	315.0	2.26
30432.062500	46.71	74.00	27.29	150.0	H	206.0	3.08
39456.875000	49.18	74.00	24.82	150.0	H	1.0	8.59

Vertical:



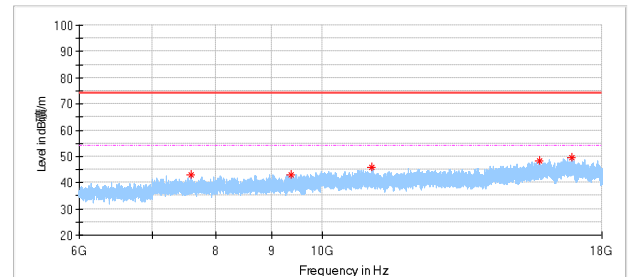
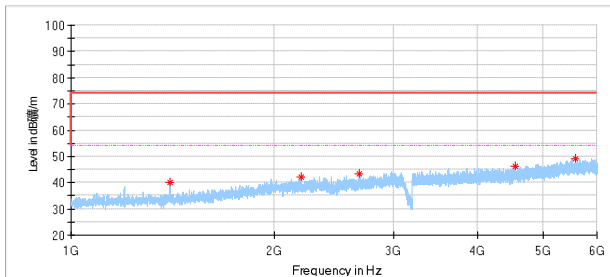
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22604.187500	43.79	74.00	30.21	150.0	V	113.0	0.92
30442.375000	48.64	74.00	25.36	150.0	V	273.0	3.09
33481.125000	48.80	74.00	25.20	150.0	V	193.0	4.52
39883.125000	49.34	74.00	24.66	150.0	V	246.0	9.82

1GHz -18GHz:
2MHz_BLE-2402MHz
Horizontal:



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1397.000000	39.02	74.00	34.98	150.0	H	255.0	-8.62
2238.000000	43.57	74.00	30.43	150.0	H	15.0	-3.58
4014.500000	45.70	74.00	28.30	150.0	H	338.0	1.36
5911.500000	49.56	74.00	24.44	150.0	H	175.0	5.50
7437.000000	42.76	74.00	31.24	150.0	H	0.0	5.49
8589.500000	43.42	74.00	30.58	150.0	H	19.0	6.42
9915.000000	43.82	74.00	30.18	150.0	H	356.0	8.06
13608.000000	45.79	74.00	28.21	150.0	H	203.0	9.52
17315.000000	49.02	74.00	24.98	150.0	H	124.0	16.15

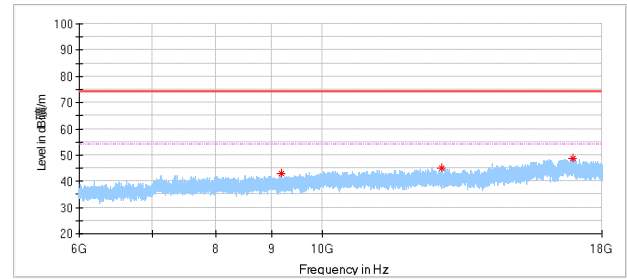
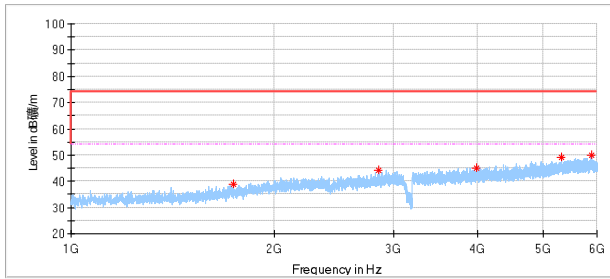
Vertical



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1400.000000	39.90	74.00	34.10	150.0	V	120.0	-8.61
2187.000000	41.98	74.00	32.02	150.0	V	0.0	-3.73
2673.500000	43.53	74.00	30.47	150.0	V	164.0	-2.39
4546.000000	46.16	74.00	27.84	150.0	V	351.0	2.47
5576.500000	49.31	74.00	24.69	150.0	V	236.0	4.42
7585.000000	42.99	74.00	31.01	150.0	V	108.0	5.49
9361.000000	42.94	74.00	31.06	150.0	V	55.0	7.02
11086.500000	45.84	74.00	28.16	150.0	V	0.0	8.25
15771.000000	48.26	74.00	25.74	150.0	V	318.0	13.75
16914.500000	49.46	74.00	24.54	150.0	V	27.0	16.51

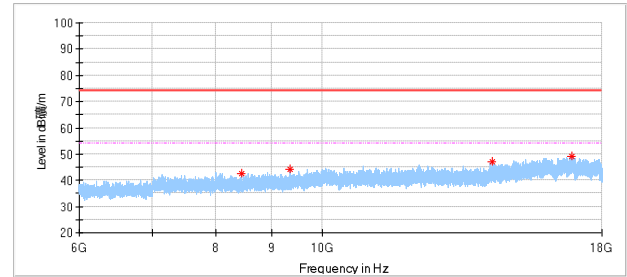
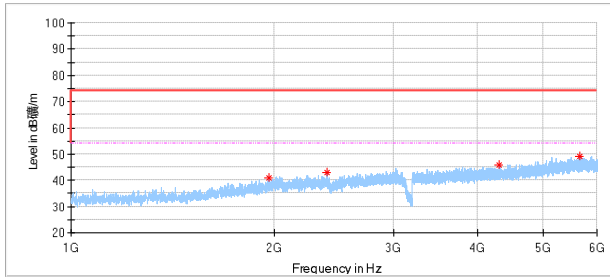
2MHz_BLE-2440MHz:

Horizontal:



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1737.000000	39.01	74.00	34.99	150.0	H	0.0	-6.14
2854.500000	44.39	74.00	29.61	150.0	H	34.0	-1.86
3982.500000	45.01	74.00	28.99	150.0	H	25.0	1.36
5312.500000	49.31	74.00	24.69	150.0	H	5.0	3.79
5887.500000	49.81	74.00	24.19	150.0	H	114.0	5.56
9167.500000	42.96	74.00	31.04	150.0	H	263.0	6.72
12852.500000	45.04	74.00	28.96	150.0	H	24.0	9.21
16950.000000	48.88	74.00	25.12	150.0	H	341.0	16.46

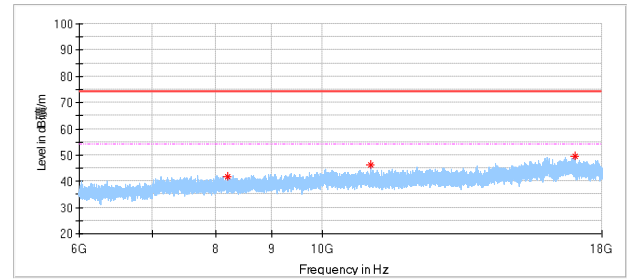
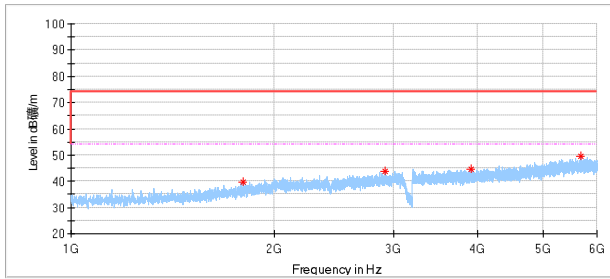
Vertical



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1964.000000	41.05	74.00	32.95	150.0	V	282.0	-4.51
2390.500000	43.05	74.00	30.95	150.0	V	246.0	-3.16
4299.000000	46.01	74.00	27.99	150.0	V	291.0	1.99
5653.000000	49.03	74.00	24.97	150.0	V	237.0	4.63
8435.500000	42.45	74.00	31.55	150.0	V	97.0	5.95
9350.500000	44.09	74.00	29.91	150.0	V	255.0	7.02
14303.000000	47.12	74.00	26.88	150.0	V	2.0	10.79
16914.000000	49.16	74.00	24.84	150.0	V	0.0	16.51

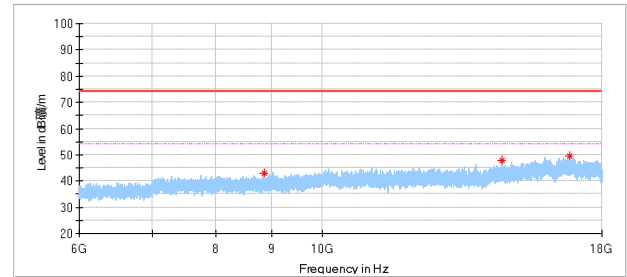
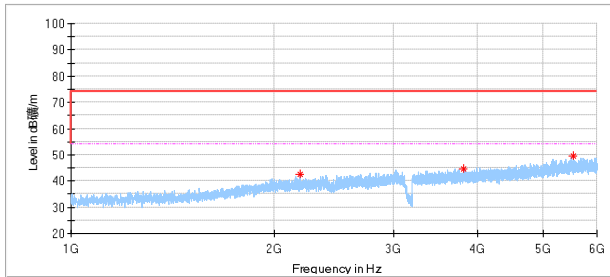
2MHz_BLE-2480MHz

Horizontal:



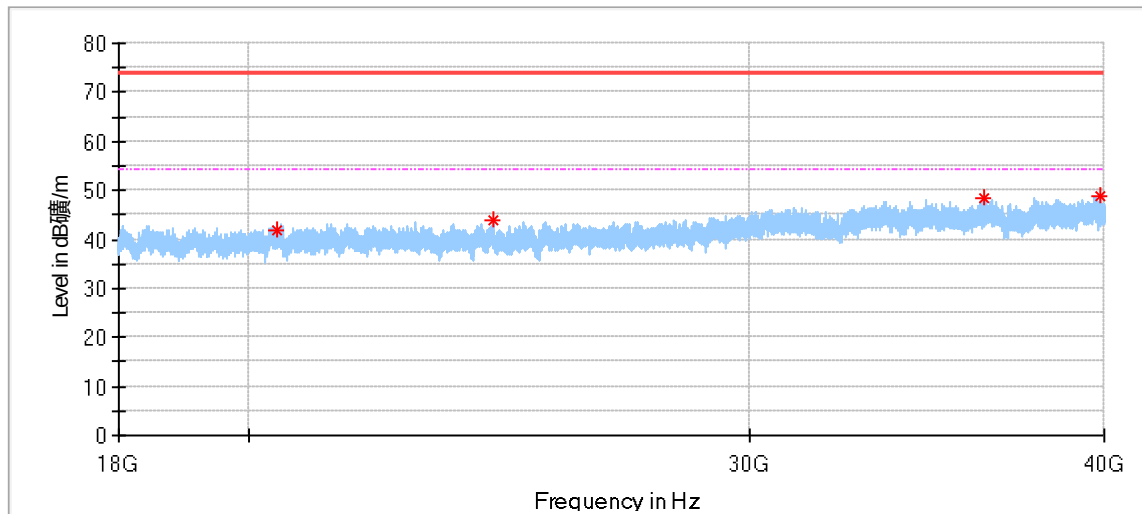
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1799.500000	39.88	74.00	34.12	150.0	H	50.0	-5.79
2919.000000	43.93	74.00	30.07	150.0	H	187.0	-1.75
3904.000000	44.70	74.00	29.30	150.0	H	178.0	1.04
5680.000000	49.59	74.00	24.41	150.0	H	249.0	4.72
8205.000000	41.92	74.00	32.08	150.0	H	0.0	6.12
11081.500000	46.19	74.00	27.81	150.0	H	255.0	8.26
16992.000000	49.36	74.00	24.64	150.0	H	150.0	16.40

Vertical



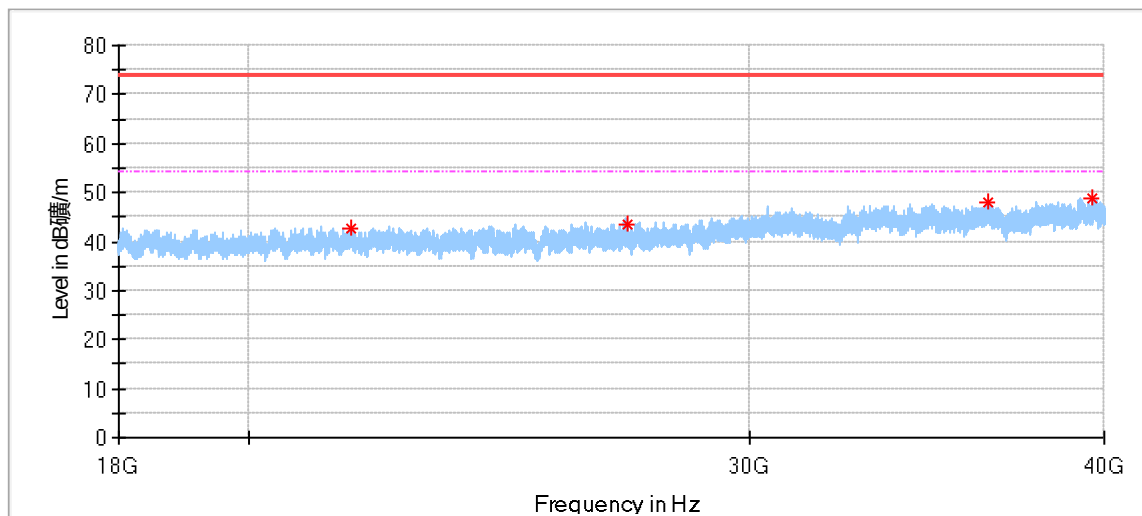
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2179.500000	42.50	74.00	31.50	150.0	V	221.0	-3.76
3810.500000	44.75	74.00	29.25	150.0	V	284.0	0.69
5526.500000	49.42	74.00	24.58	150.0	V	351.0	4.41
8845.500000	43.14	74.00	30.86	150.0	V	105.0	6.45
14583.500000	47.94	74.00	26.06	150.0	V	0.0	11.13
16820.500000	49.39	74.00	24.61	150.0	V	136.0	16.35

18GHz- 40GHz:
2MHz_BLE_2402MHz:
Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20464.000000	42.02	74.00	31.98	150.0	H	1.0	-0.55
24366.937500	44.02	74.00	29.98	150.0	H	218.0	1.19
36288.187500	48.52	74.00	25.48	150.0	H	124.0	6.08
39893.437500	48.62	74.00	25.38	150.0	H	191.0	9.85

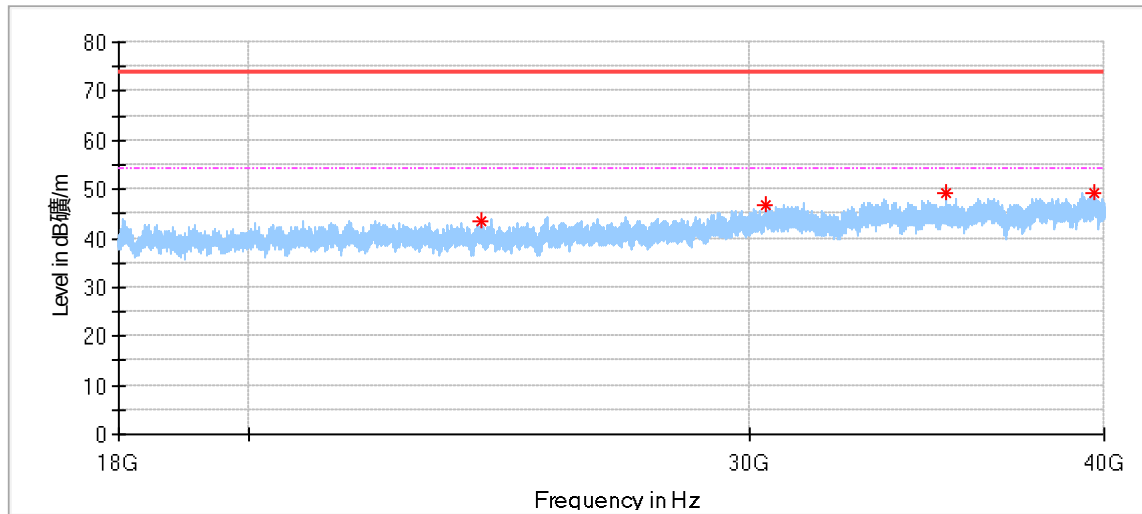
Vertical:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
21743.437500	42.74	74.00	31.26	150.0	V	319.0	0.48
27178.125000	43.66	74.00	30.34	150.0	V	188.0	2.23
36402.312500	48.16	74.00	25.84	150.0	V	203.0	6.19
39603.312500	48.87	74.00	25.13	150.0	V	127.0	9.03

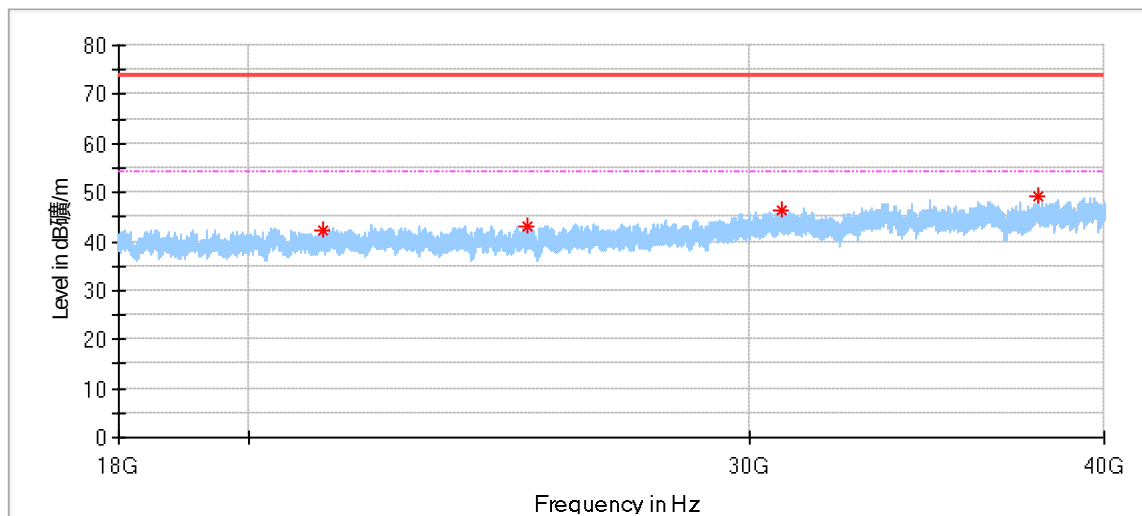
2MHz_BLE_2440MHz:

Horizontal:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
24143.500000	43.57	74.00	30.43	150.0	H	31.0	1.11
30415.562500	46.66	74.00	27.34	150.0	H	355.0	3.06
35162.750000	49.31	74.00	24.69	150.0	H	48.0	5.49
39674.812500	49.32	74.00	24.68	150.0	H	233.0	9.23

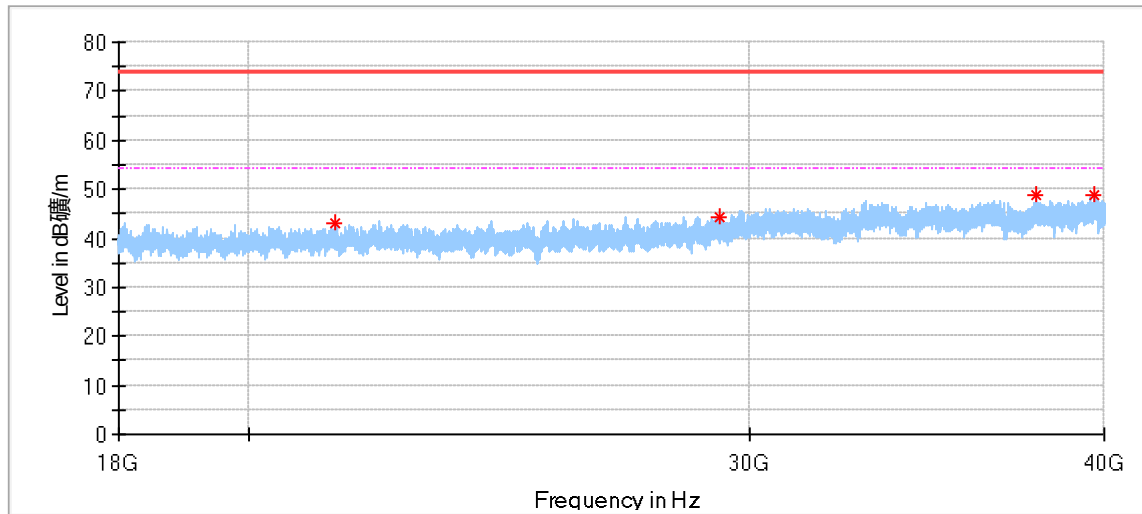
Vertical:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
21244.312500	42.19	74.00	31.81	150.0	V	183.0	0.27
25055.812500	43.00	74.00	31.00	150.0	V	199.0	1.76
30777.875000	46.31	74.00	27.69	150.0	V	305.0	2.95
37922.375000	49.18	74.00	24.82	150.0	V	67.0	6.89

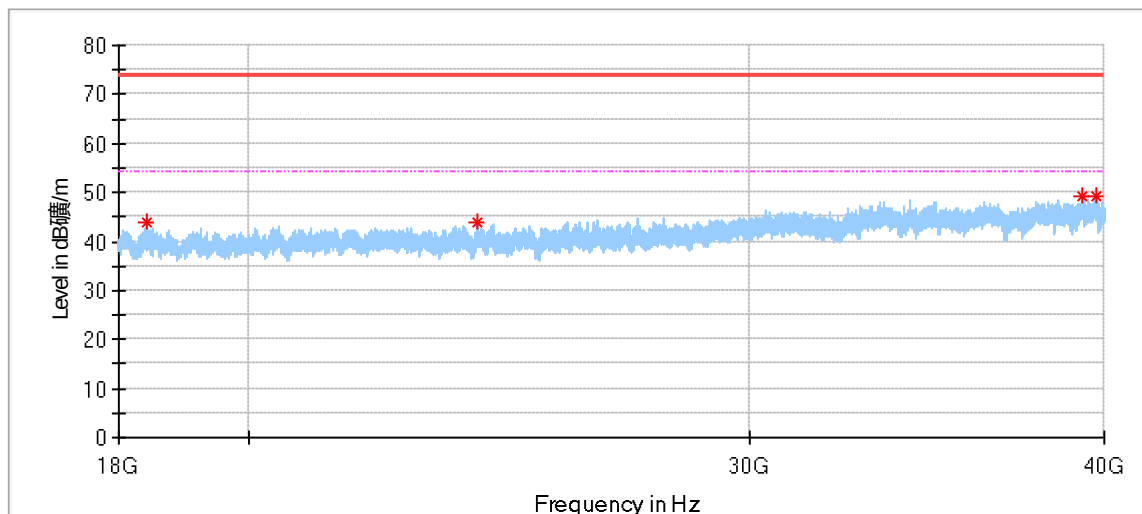
2MHz_BLE_2480MHz:

Horizontal:



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
21458.812500	42.88	74.00	31.12	150.0	H	354.0	0.30
29273.625000	44.36	74.00	29.64	150.0	H	354.0	2.24
37860.500000	48.95	74.00	25.05	150.0	H	31.0	6.73
39692.687500	48.72	74.00	25.28	150.0	H	1.0	9.28

Vertical:



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18417.312500	44.00	74.00	30.00	150.0	V	185.0	-1.91
24059.625000	43.84	74.00	30.16	150.0	V	345.0	1.14
39323.500000	49.29	74.00	24.71	150.0	V	284.0	8.15
39757.312500	49.29	74.00	24.71	150.0	V	299.0	9.47

Remark:

- Corrected Amplitude = Read level + Corrector factor
 Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
 Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
 (The Reading Level is recorded by software which is not shown in the sheet)

10 Test Equipment List

List of Test Instruments

Radiated Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2021-6-29
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2021-8-4
Horn Antenna	Rohde & Schwarz	HF907	102294	2021-7-14
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2021-6-21
Signal Generator	Rohde & Schwarz	SMY01	839369/005	2021-6-21
Attenuator	Agilent	8491A	MY39264334	2022-10-28
3m Semi-anechoic chamber	TDK	9X6X6	----	N/A

Conducted RF Test System

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2021-6-21
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2021-6-21
Power Splitter	Weinschel	1580	SC319	2021-7-16
Test software	Tonscend	System for BT/WIFI	Version 2.5.77.0418	N/A

Conducted Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2021-6-29
LISN	Rohde & Schwarz	ENV4200	100249	2021-6-12
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2021-6-21
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 30MHz-1000MHz	Horizontal: 4.70dB; Vertical: 4.67dB;
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 1000MHz-18000MHz	Horizontal: 4.65dB; Vertical: 4.63dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 4.89dB; Vertical: 4.87dB;
Uncertainty for Conducted Emission in shielding room (68-4-90-19-004) 150kHz-30MHz (for test using AMN ENV432 or ENV4200)	3.21dB
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10^{-7} or 1%