FCC - TEST REPORT

Report Number	:	**68.910.22.0019.02**	Date of Issue:	2024-02-20
Model	:	**AP-001**		
Product Type	:	bubl. Air Purifier		
Applicant	:	Bubl. AB		
Address	:	Gert Fredrikssons Väg 3, 611 35 Nyköping, SWEDEN		
Manufacturer	:	Bubl. AB		
Address	:	Gert Fredrikssons Väg 3, 611 35 Nyköping, SWEDEN		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	**49**		

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1 Table of Contents

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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, Guankou Erlu, Nantou, Nanshan District, Shenzhen, 518052 China
FCC Designation Number:	CN5009
FCC Registration No.:	514049
Telephone:	86 755 8828 6998
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3 Description of the Equipment under Test

Product:	bubl. Air Purifier
Model no.:	AP-001
FCC ID:	2A8E8AP-001
Rating:	5V⎓1A
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	40
Modulation:	GFSK
Antenna Type:	PCB antenna
Antenna Gain:	2.0dBi
Description of the EUT:	The Equipment Under Test (EUT) is a bubl. Air Purifier with 2.4GHz Bluetooth LE functions which supports 1M PHY and 2M PHY.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2021 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 Measurement Guidance and ANSI C63.10-2020.

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5 Summary of Test Results

Technical Requirements			
FCC Part 15 Subpart C			
Test Condition		Test Result	Test Site
§15.207	Conducted emission AC power port	Pass	Site 1
§15.247 (b) (3)	Conducted output power	Pass	Site 1
§15.247(e)	Power spectral density	Pass	Site 1
§15.247(a)(2)	6dB bandwidth	Pass	Site 1
§15.247(a)(1)	20dB Occupied bandwidth	N/A	--
§15.247(a)(1)	Carrier frequency separation	N/A	--
§15.247(a)(1)(iii)	Number of hopping frequencies	N/A	--
§15.247(a)(1)(iii)	Dwell Time	N/A	--
§15.247(d)	Spurious RF conducted emissions	Pass	Site 1
§15.247(d)	Band edge	Pass	Site 1
§15.247(d) & §15.209 & §15.205	Spurious radiated emissions for transmitter	Pass	Site 1
§15.203	Antenna requirement	Pass See note 1	--

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses a PCB antenna, which gain is 2.0dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2A8E8AP-001, complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C.

This report is based on the previous report (68.910.22.0019.01) for following change:
- Adding a new standalone control construction, which is used for power supply, activate Bluetooth pairing and motor speed control.
New Test report 68.910.22.0019.02 was provided in this application and the test data of conducted emission and radiated spurious emissions (30-1000MHz) are new test data to verify the compliance of these changes, other test data were referred from 68.910.22.0019.01 of original application and these test data are still effective and representative of the compliance of this change of the product.

SUMMARY:

All tests according to the regulations cited on page 6 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

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

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

Sample Received Date:	2022-04-26	2023-05-31
Testing Start Date:	2022-07-14	2023-06-02
Testing End Date:	2022-08-12	2023-06-08

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

Reviewed by:	Prepared by:	Tested by:
Jessie He	Myron Yu	Carry Cai
Project Manager	Project Engineer	Test Engineer

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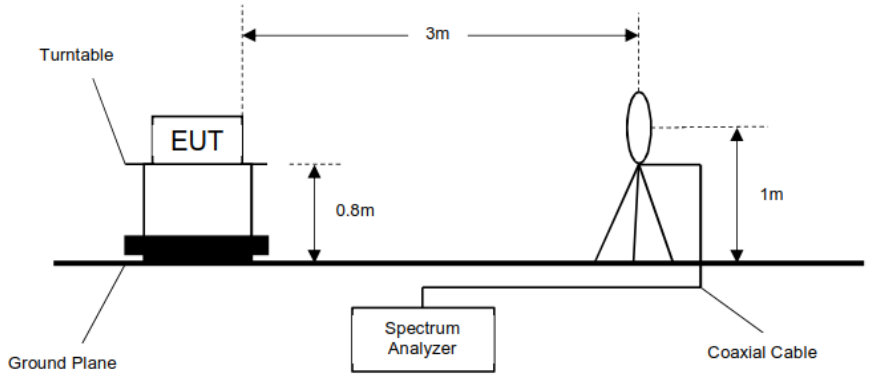
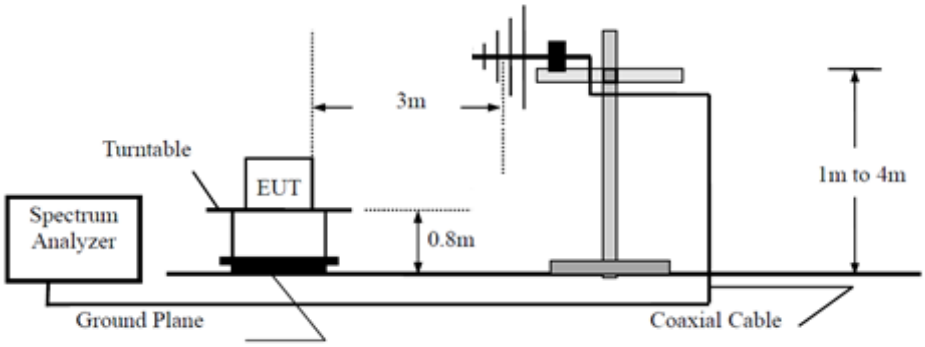
7 Test Setups

7.1 Radiated test setups

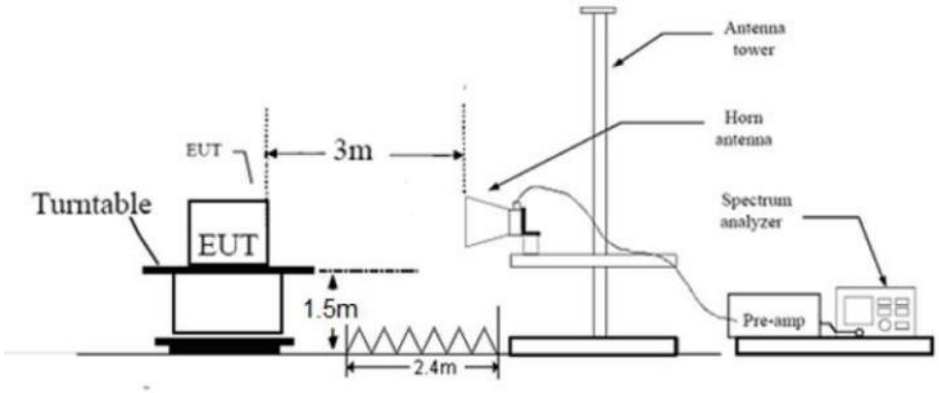
9KHz - 30MHz



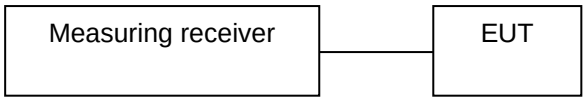
30MHz - 1GHz



Above 1GHz



7.2 Conducted RF test setups



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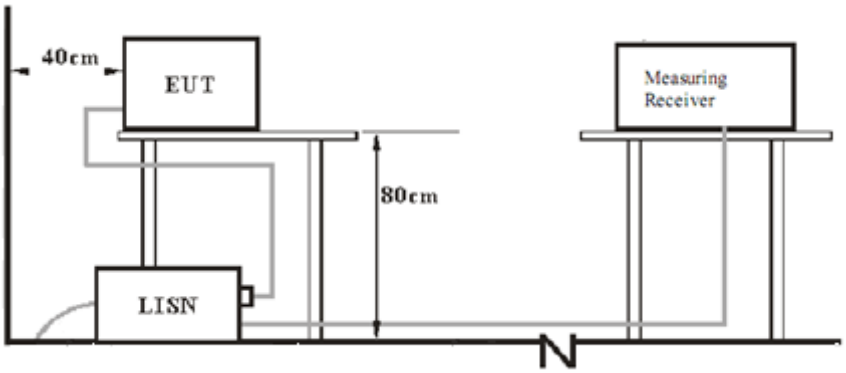
7.3 AC Power Line Conducted Emission test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
LAPTOP	THINKPAD	X220	429044C

The system was configured to channel 0, 19, and 39 for the test.

Test Software Information:

Test Software Version	nRF_DTM (Version 0.9.0)	
Modulation	Setting TX Power	Packet Type
GFSK	Tx Power 4	/

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

Limit

According to §15.207, conducted emissions limit as below:

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

*Decreasing linearly with logarithm of the frequency

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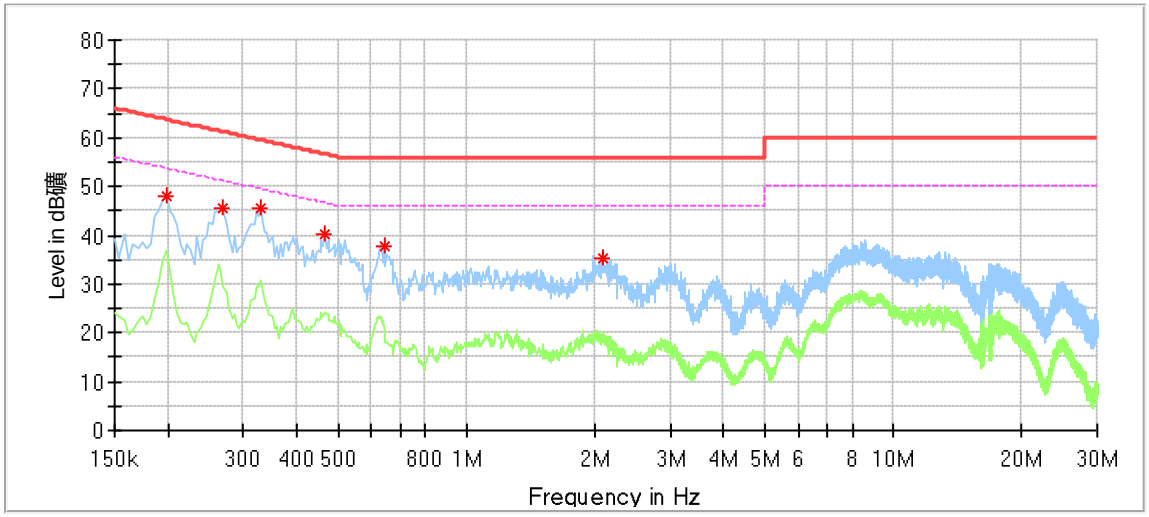
Conducted Emission

Product Type : bubl. Air Purifier
M/N : AP-001
Operating Condition : Charging + Transmitting
Test Specification : Power Line, Live
Comment : AC 120V/60Hz (External adapter)



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.198000	47.80	---	63.69	15.90	L1	9.24
0.270000	45.59	---	61.12	15.52	L1	9.22
0.330000	45.50	---	59.45	13.95	L1	9.21
0.466000	40.14	---	56.59	16.44	L1	9.20
0.642000	37.64	---	56.00	18.36	L1	9.20
2.078000	35.11	---	56.00	20.89	L1	9.23

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)

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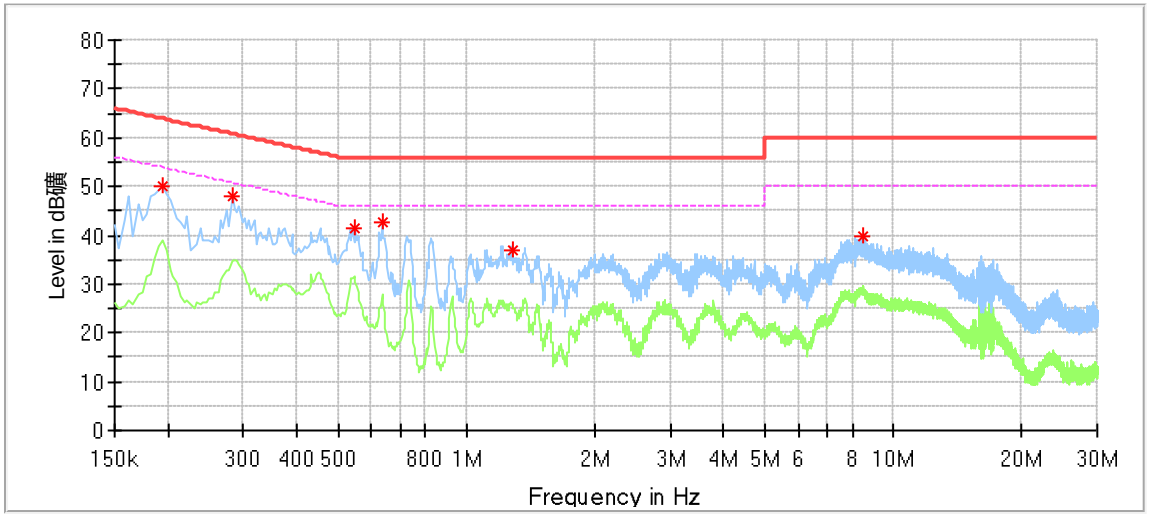
Conducted Emission

Product Type	:	bubl. Air Purifier
M/N	:	AP-001
Operating Condition	:	Charging + Transmitting
Test Specification	:	Power Line, Neutral
Comment	:	AC 120V/60Hz (External adapter)



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.194000	49.92	---	63.86	13.95	N	9.40
0.282000	48.15	---	60.76	12.60	N	9.39
0.550000	41.53	---	56.00	14.47	N	9.39
0.634000	42.48	---	56.00	13.52	N	9.39
1.278000	36.79	---	56.00	19.21	N	9.40
8.478000	39.86	---	60.00	20.14	N	9.59

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)

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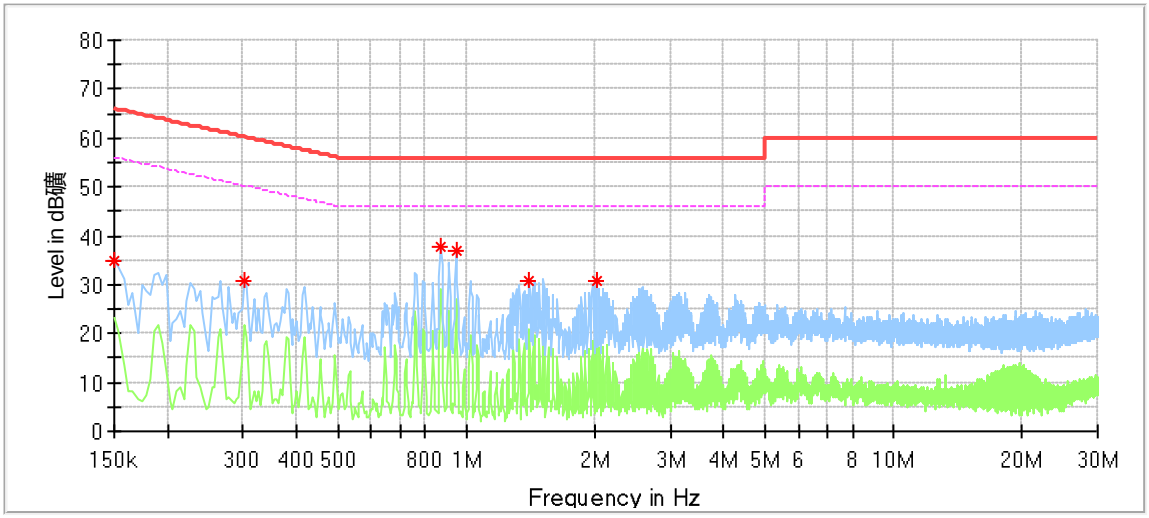
Conducted Emission

Product Type	:	bubl. Air Purifier
M/N	:	AP-001 with alternative controller
Operating Condition	:	Charging + Transmitting
Test Voltage	:	120VAC, 60Hz (for auxiliary adapter)
Comment	:	Power Line, Live



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.150000	34.82	---	66.00	31.18	L1	9.57
0.302000	30.62	---	60.19	29.57	L1	9.61
0.874000	37.83	---	56.00	18.17	L1	9.64
0.946000	36.98	---	56.00	19.02	L1	9.64
1.406000	30.92	---	56.00	25.08	L1	9.65
2.010000	30.70	---	56.00	25.30	L1	9.66

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)

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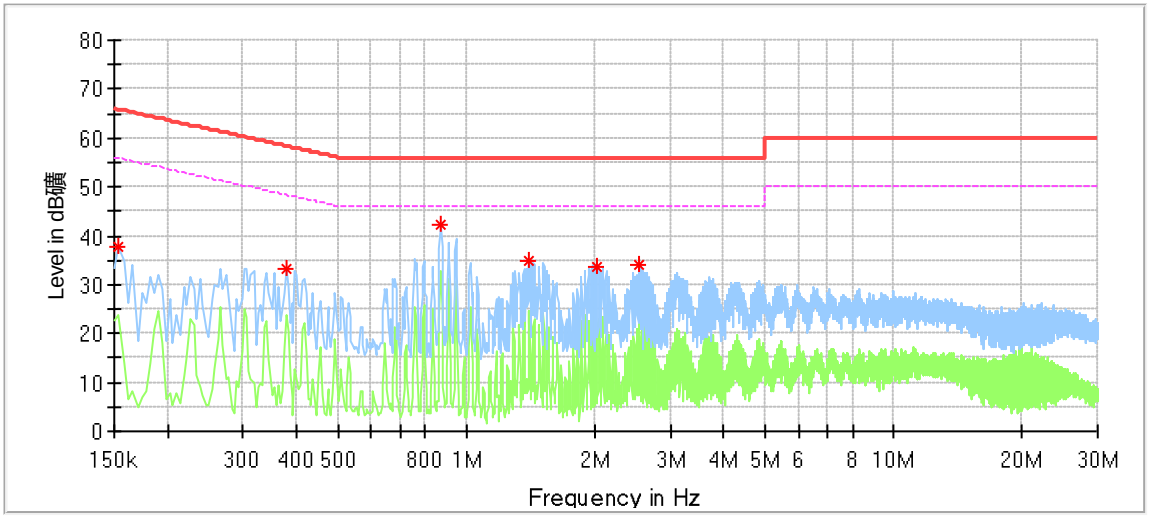
Conducted Emission

Product Type	:	bubl. Air Purifier
M/N	:	AP-001 with alternative controller
Operating Condition	:	Charging + Transmitting
Test Voltage	:	120VAC, 60Hz (for auxiliary adapter)
Comment	:	Power Line, Neutral



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.154000	37.54	---	65.78	28.24	N	9.56
0.378000	33.14	---	58.32	25.19	N	9.62
0.874000	42.19	---	56.00	13.81	N	9.64
1.402000	35.07	---	56.00	20.93	N	9.65
2.014000	33.84	---	56.00	22.16	N	9.66
2.542000	33.91	---	56.00	22.09	N	9.68

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)

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9.2 Conducted output power

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. Use the following test receiver settings:
   Span = approximately 5 times the 6dB bandwidth, centered on a channel need to test,
   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

According to §15.247 (b) (3), conducted output power limit as below:

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

Test result as below table

Test Mode	Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
BLE 1M	2402	0.84	2.0	2.84	Pass
	2440	0.49	2.0	2.49	Pass
	2480	-0.01	2.0	1.99	Pass
BLE 2M	2402	0.85	2.0	2.85	Pass
	2440	0.53	2.0	2.53	Pass
	2480	0.00	2.0	2.00	Pass

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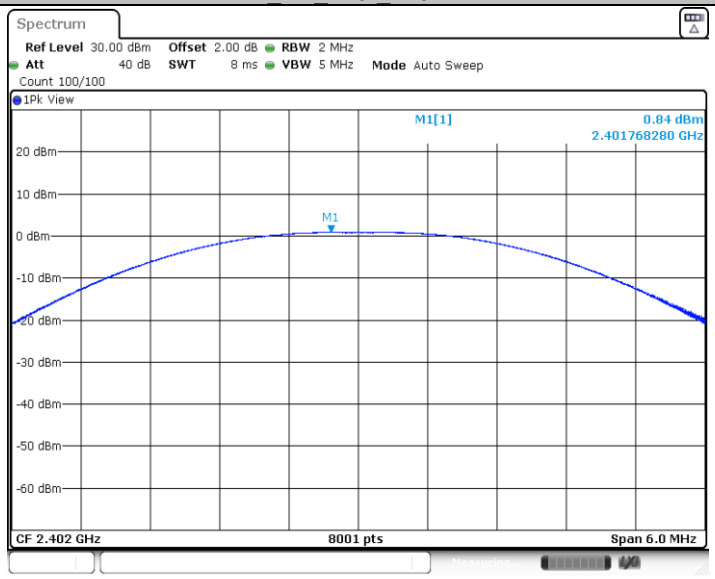
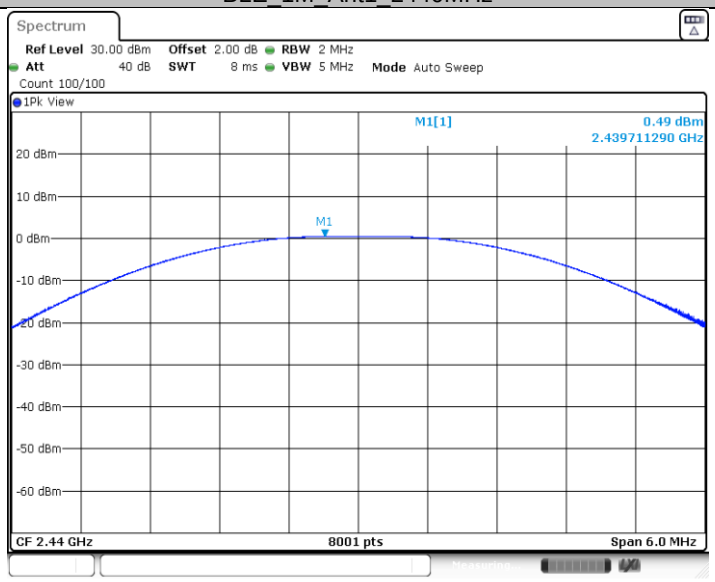
Test Graphs

BLE_1M_Ant1_2402MHz



Date: 15.AUG.2022 15:03:12

BLE_1M_Ant1_2440MHz



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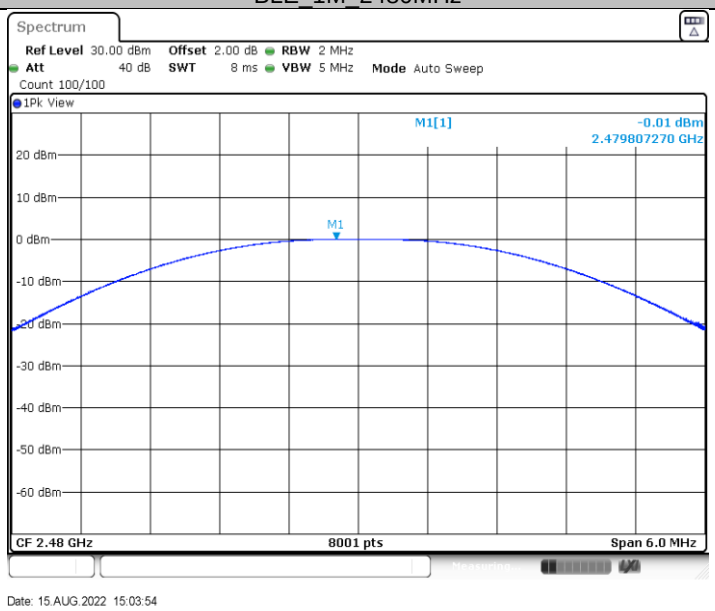
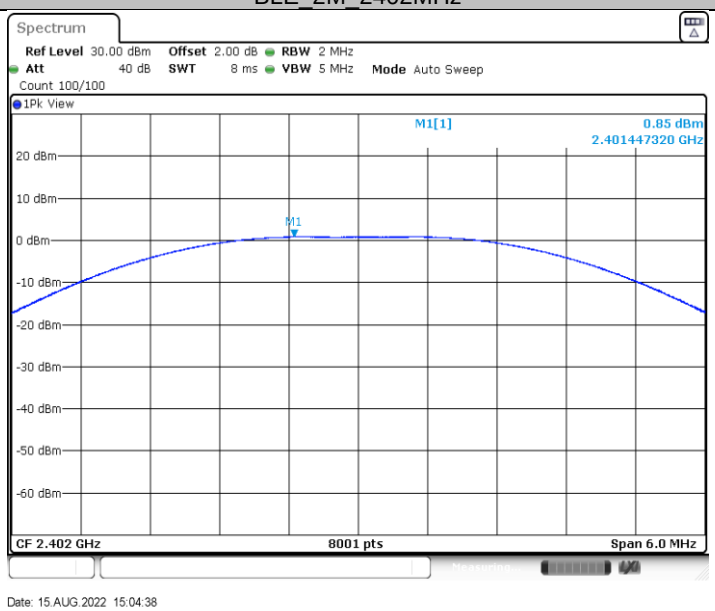
BLE_1M_2480MHz



BLE_2M_2402MHz



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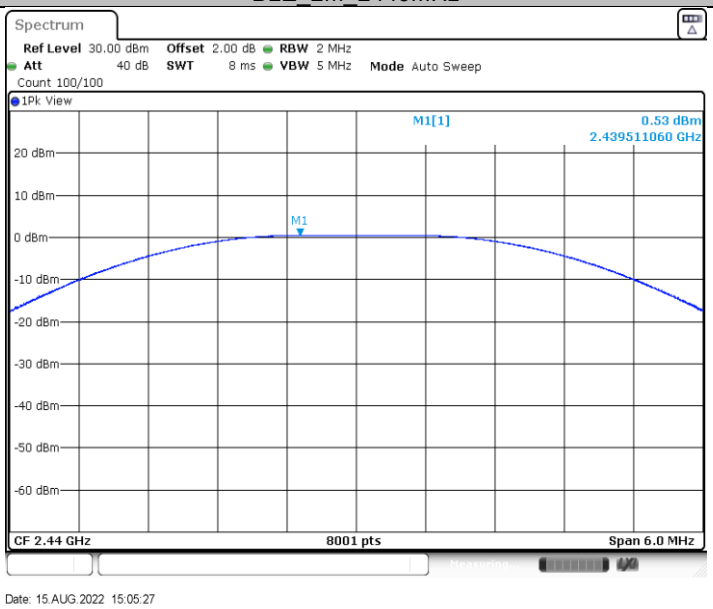
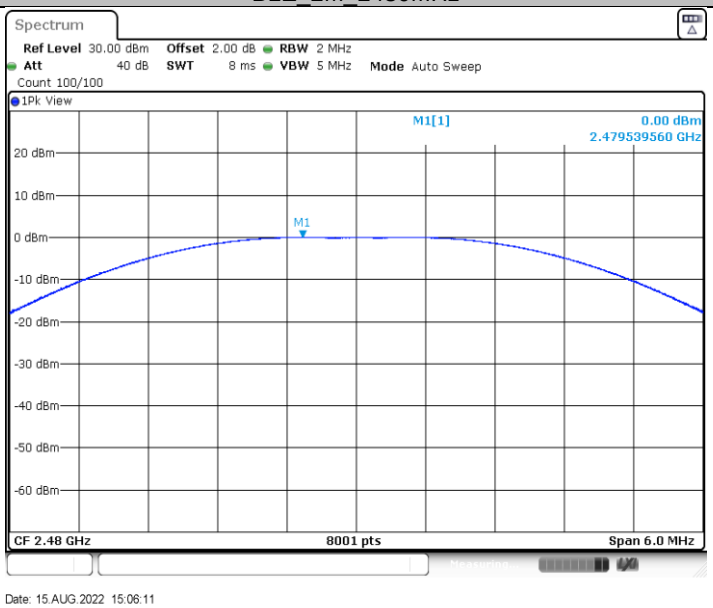
BLE_2M_2440MHz



BLE_2M_2480MHz



9.3 6dB bandwidth

Test Method

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set center frequency to the nominal EUT channel center frequency
3. Set RBW = 1 % to 5 % of the emission bandwidth, VBW)≥ 3 × RBW Detector = Peak. Trace mode = max hold. Sweep = auto Trace = max hold
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
5. Record the results in the test report.

Limit

Limit [kHz]
≥500

Test result

Test Mode	Channel (MHz)	Result (MHz)	Limit (kHz)	Verdict
BLE 1M	2402	0.728	≥500	PASS
	2440	0.724	≥500	PASS
	2480	0.724	≥500	PASS
BLE 2M	2402	1.152	≥500	PASS
	2440	1.144	≥500	PASS
	2480	1.152	≥500	PASS

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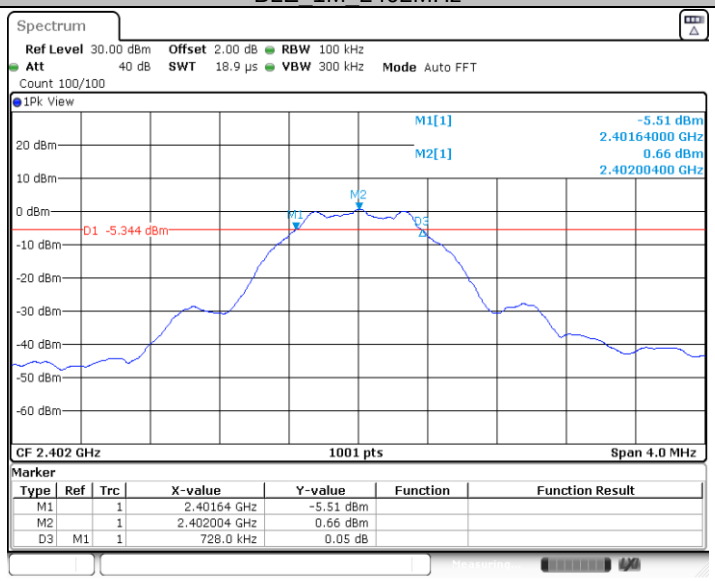
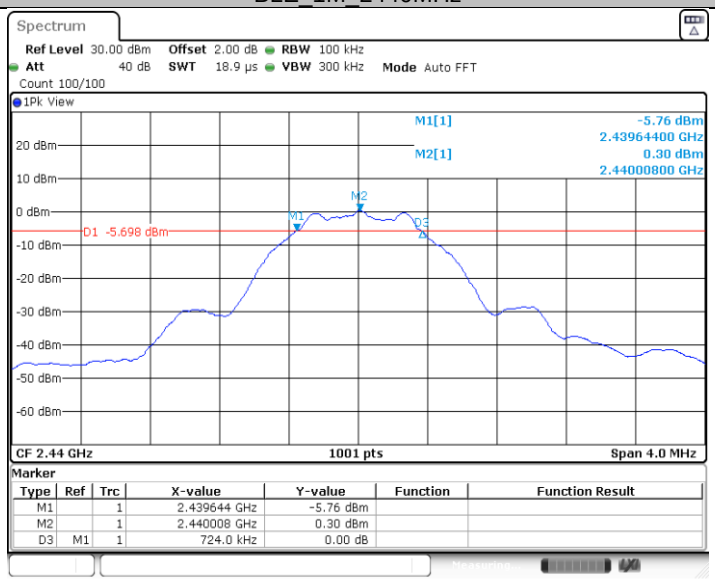
Test Graphs

BLE_1M_2402MHz



Date: 15.AUG.2022 15:03:05

BLE_1M_2440MHz



Date: 15.AUG.2022 15:02:05

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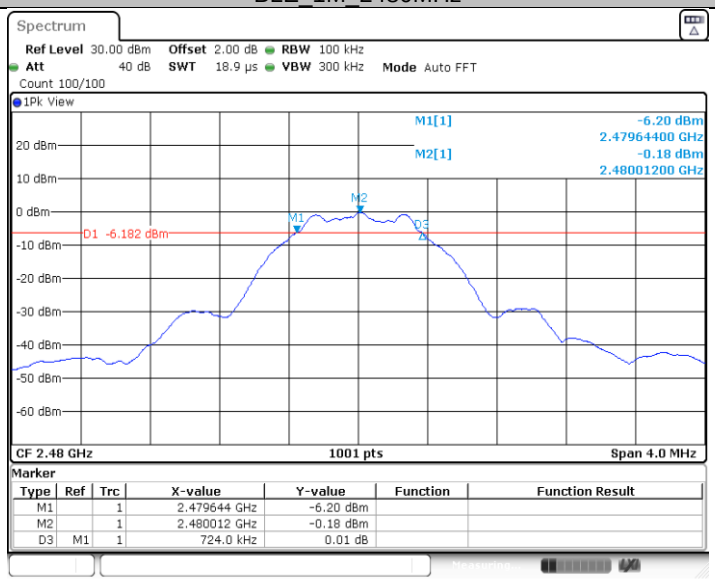
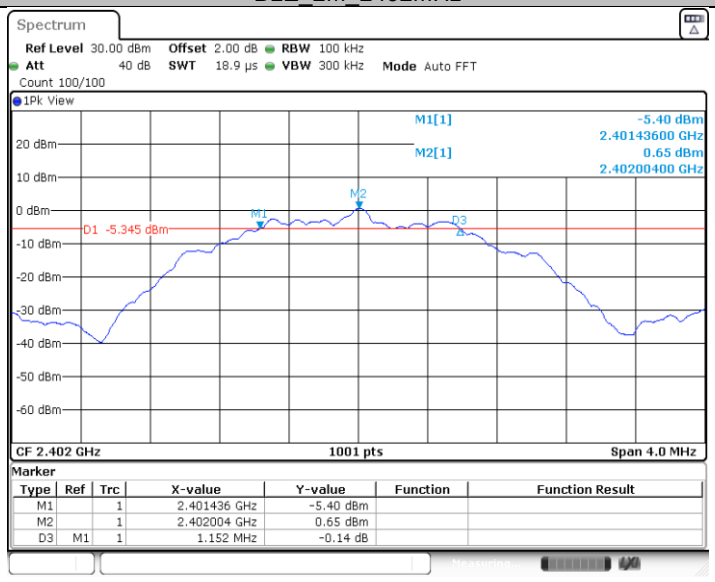
BLE_1M_2480MHz



Date: 15.AUG.2022 15:03:48

BLE_2M_2402MHz



Date: 15.AUG.2022 15:04:31

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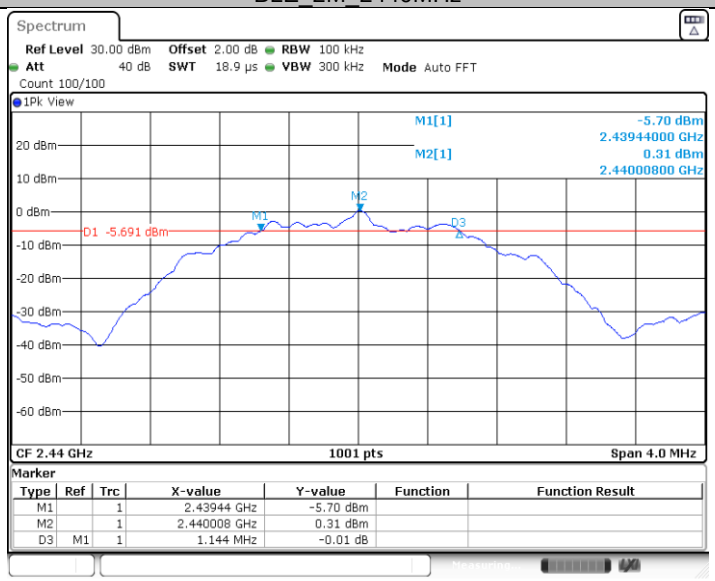
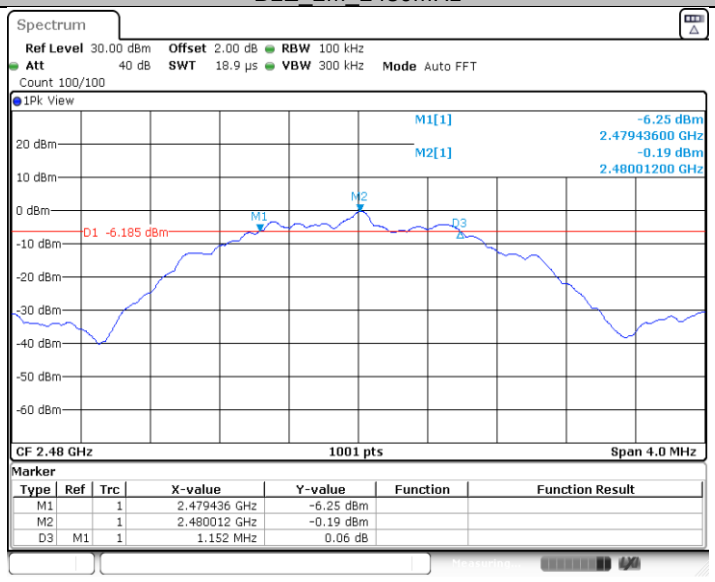
BLE_2M_2440MHz



Date: 15.AUG.2022 15:05:21

BLE_2M_2480MHz



Date: 15.AUG.2022 15:06:05

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9.4 Power spectral density

Test Method

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
4. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
5. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
6. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3kHz]
≤8

Test result

Test Mode	Channel (MHz)	Result (dBm/3KHz)	Limit(dBm/3kHz)	Verdict
BLE 1M	2402	-14.67	8	PASS
	2440	-15.34	8	PASS
	2480	-15.67	8	PASS
BLE 2M	2402	-17.34	8	PASS
	2440	-17.79	8	PASS
	2480	-18.31	8	PASS

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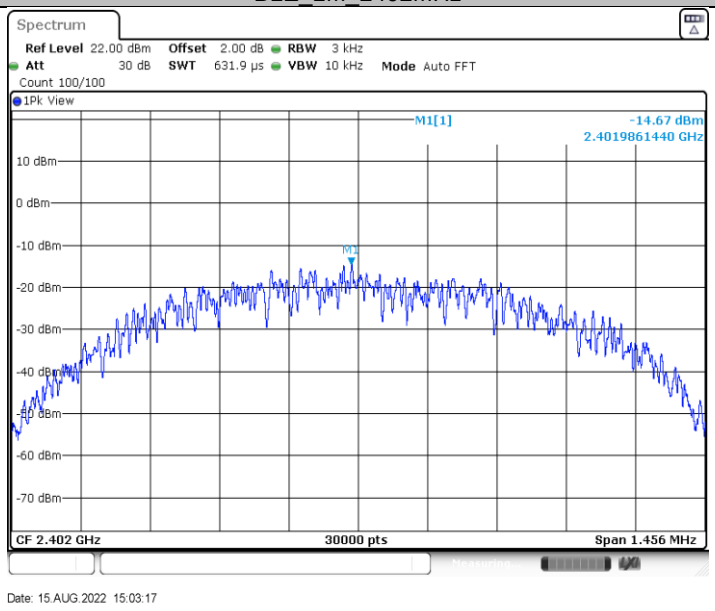
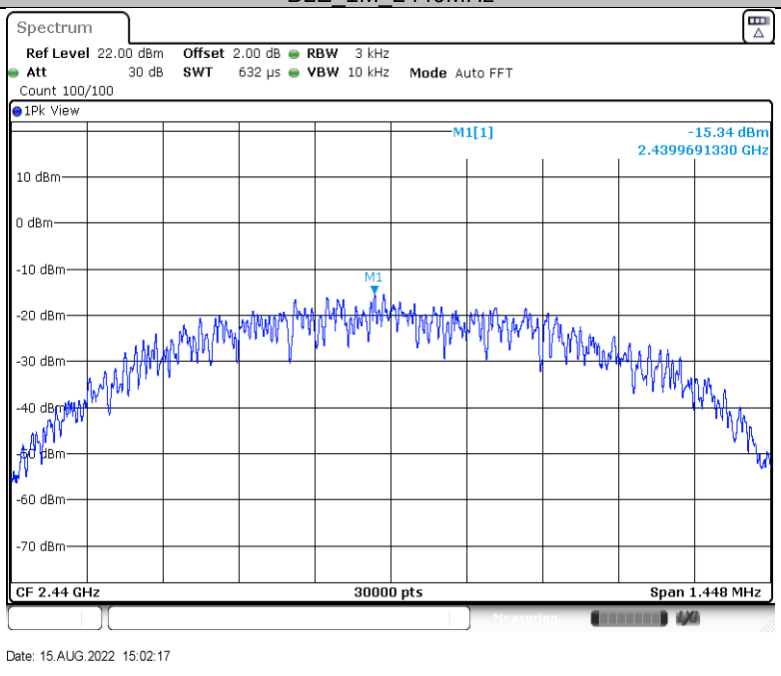
Test Graphs

BLE_1M_2402MHz



BLE_1M_2440MHz



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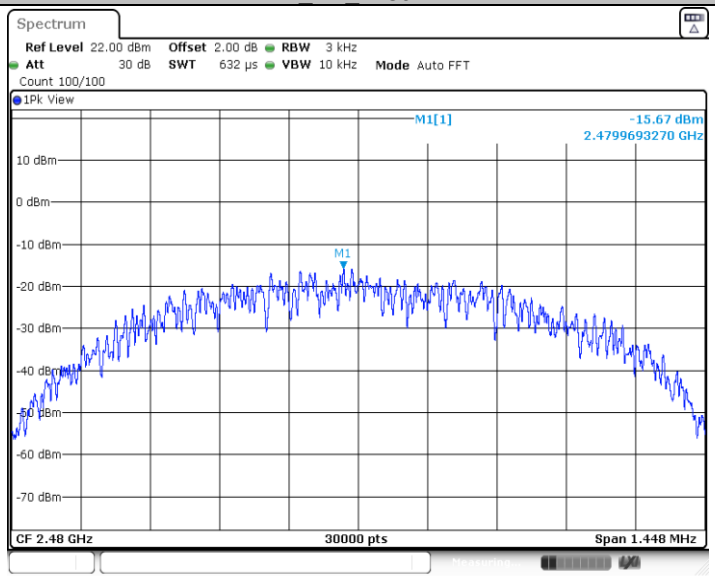
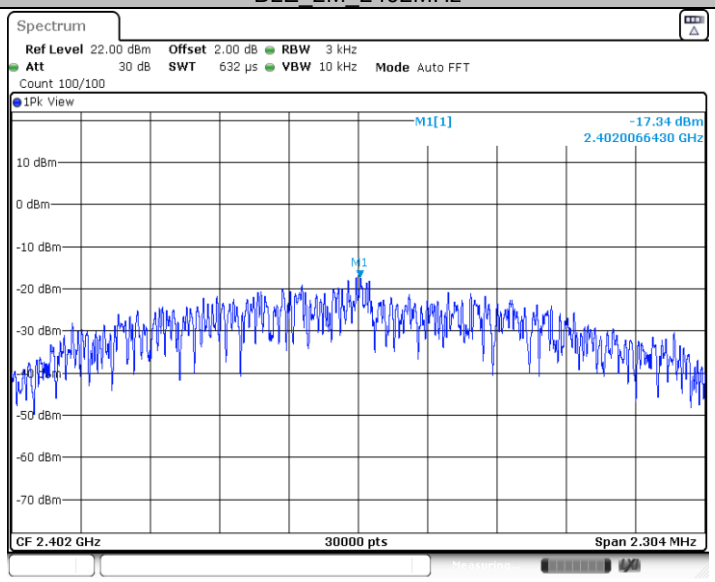
BLE_1M_2480MHz



BLE_2M_2402MHz



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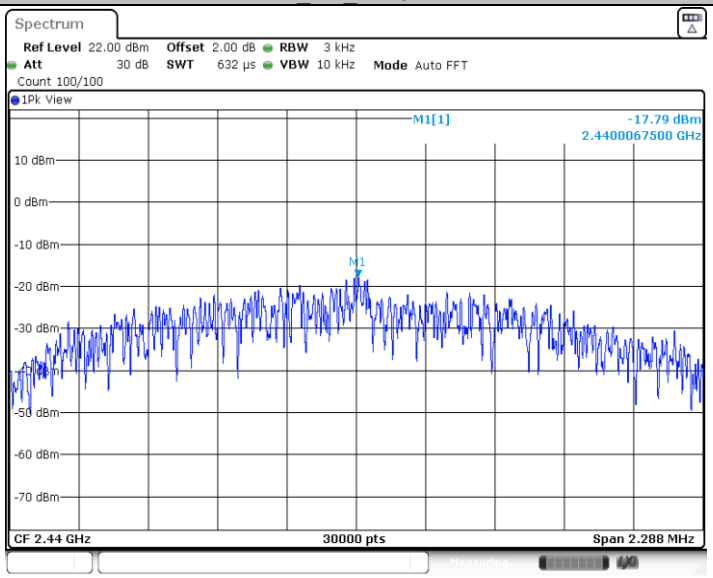
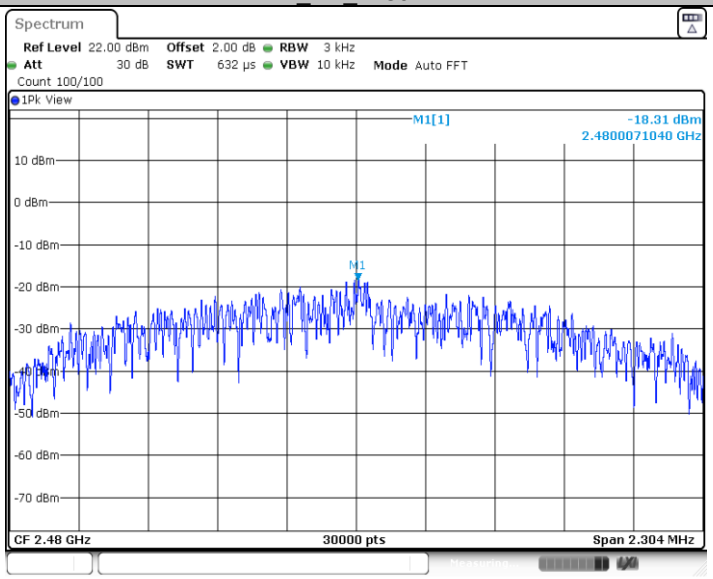
BLE_2M_2440MHz



BLE_2M_2480MHz



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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, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

Limit

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

Test Result

Remark: The emissions exceed limit is fundamental signal.

Test Mode	Channel (MHz)	Freq Range (MHz)	Ref Level (dBm)	Result (dBm)	Limit (dBm)	Verdict
BLE 1M	2402	Reference	2.65	2.65	---	PASS
		30~1000	---	-67.92	<=-17.35	PASS
		1000~26500	---	-49.36	<=-17.35	PASS
	2440	Reference	2.45	2.45	---	PASS
		30~1000	---	-67.87	<=-17.55	PASS
		1000~26500	---	-52.71	<=-17.55	PASS
	2480	Reference	2.40	2.40	---	PASS
		30~1000	---	-68.08	<=-17.6	PASS
		1000~26500	---	-51.01	<=-17.6	PASS
BLE 2M	2402	Reference	2.64	2.64	---	PASS
		30~1000	---	-68.16	<=-17.36	PASS
		1000~26500	---	-35	<=-17.36	PASS
	2440	Reference	2.46	2.46	---	PASS
		30~1000	---	-68.32	<=-17.54	PASS
		1000~26500	---	-50.93	<=-17.54	PASS
	2480	Reference	2.41	2.41	---	PASS
		30~1000	---	-68.53	<=-17.59	PASS
		1000~26500	---	-52.25	<=-17.59	PASS

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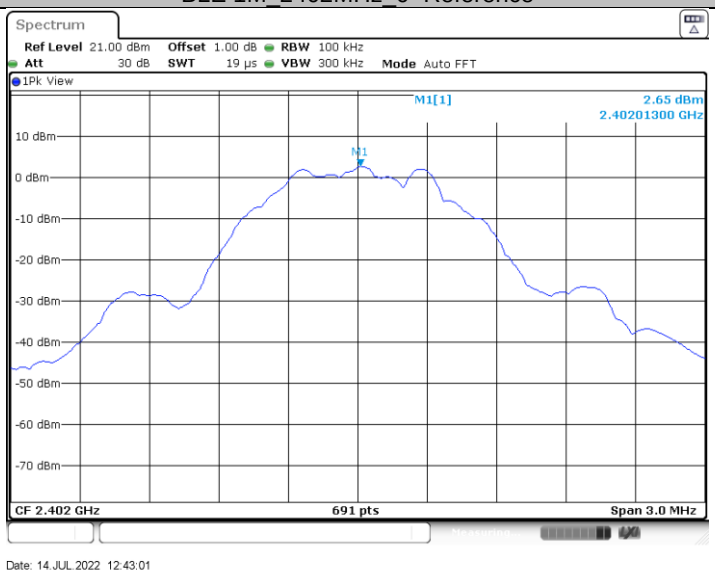
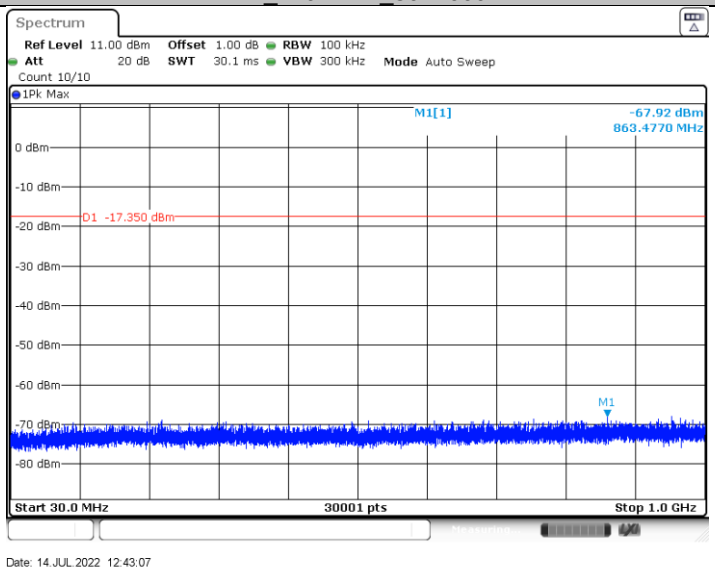
Test Graphs

BLE 1M_2402MHz_0~Reference



BLE 1M_2402MHz_30~1000MHz



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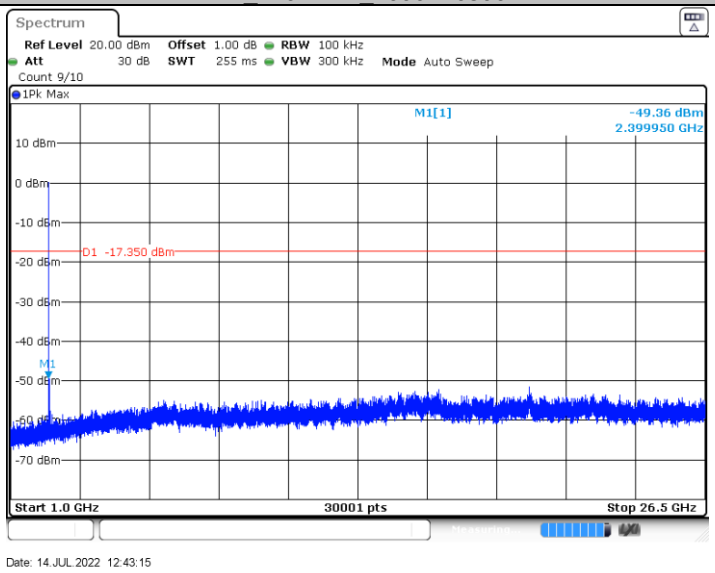
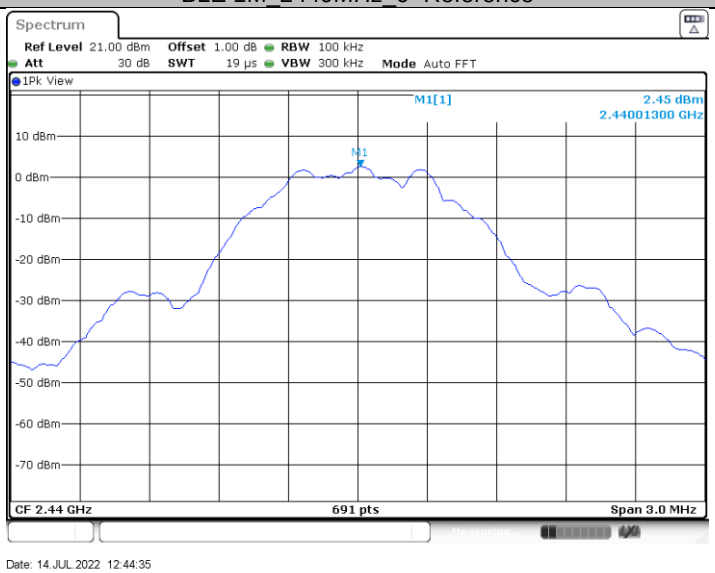
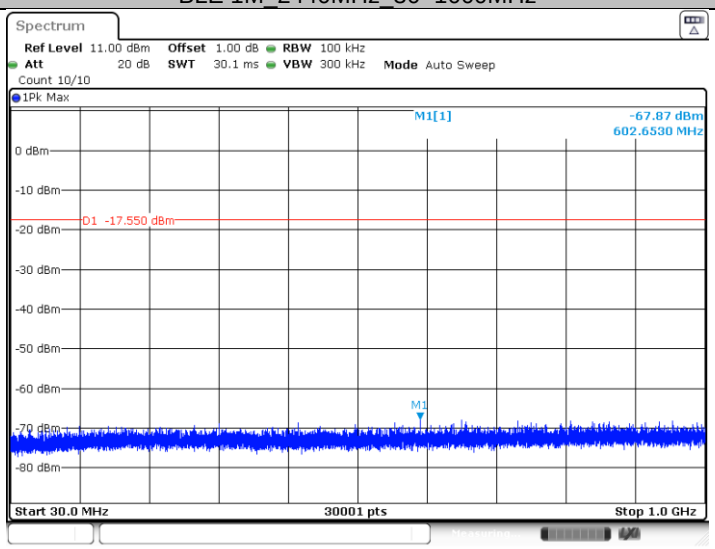
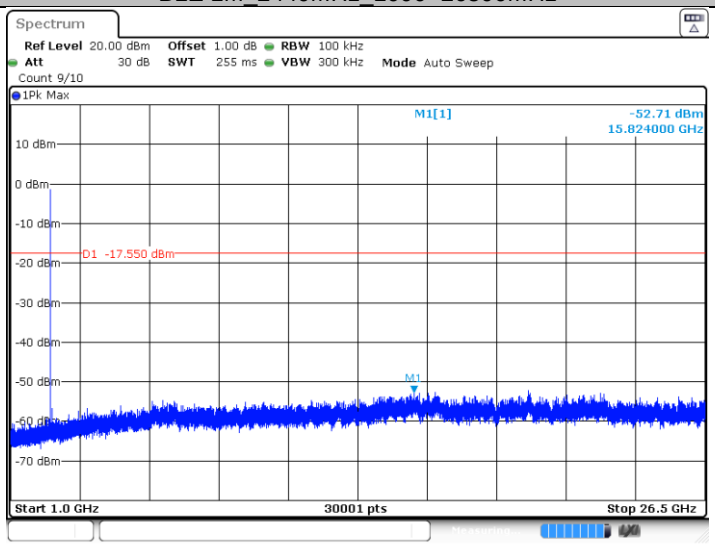
BLE 1M_2402MHz_1000~26500MHz

BLE 1M_2440MHz_0~Reference


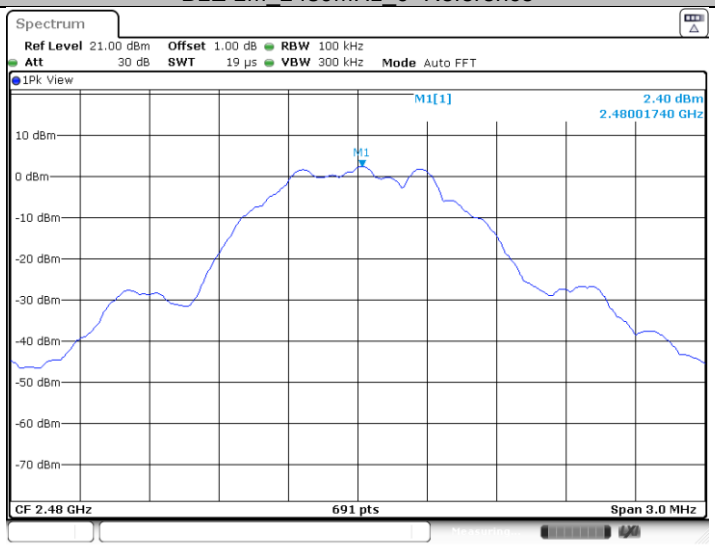
BLE 1M_2440MHz_30~1000MHz



BLE 1M_2440MHz_1000~26500MHz



BLE 1M_2480MHz_0~Reference



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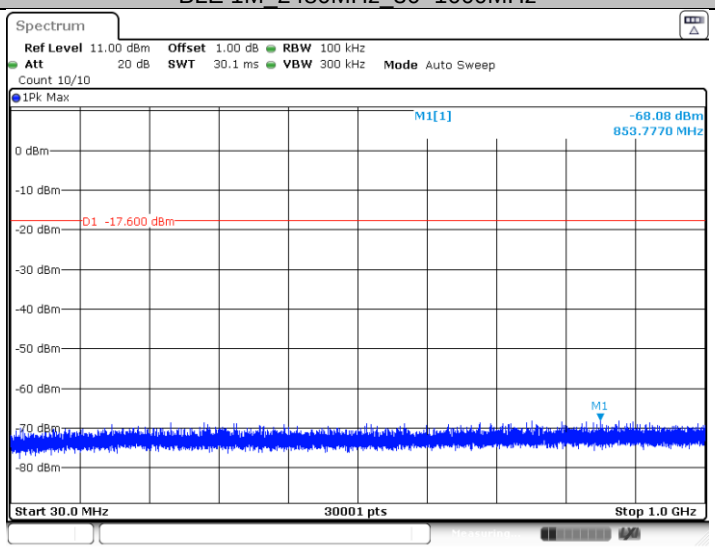
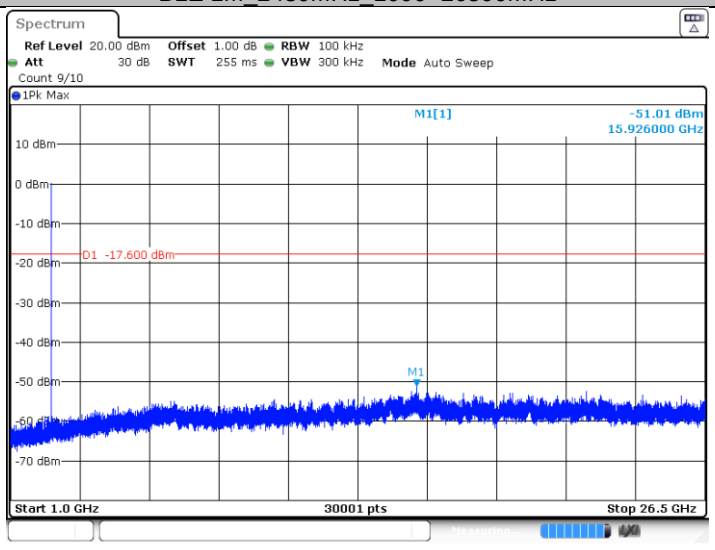
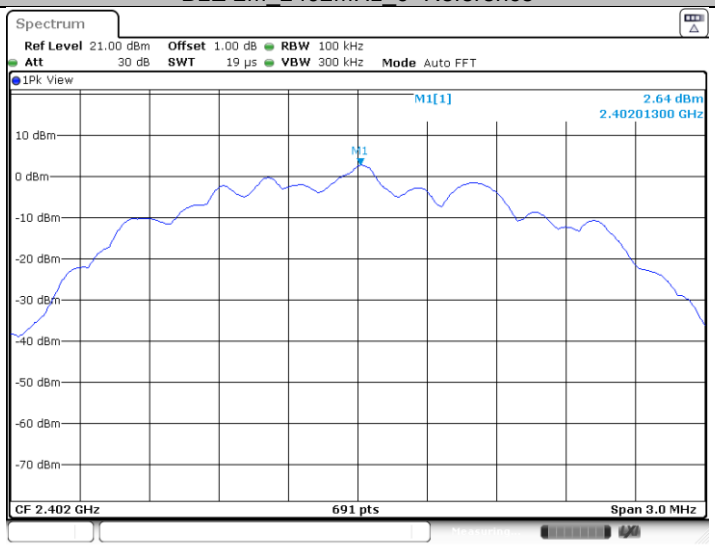
BLE 1M_2480MHz_30~1000MHz



BLE 1M_2480MHz_1000~26500MHz



BLE 2M_2402MHz_0~Reference



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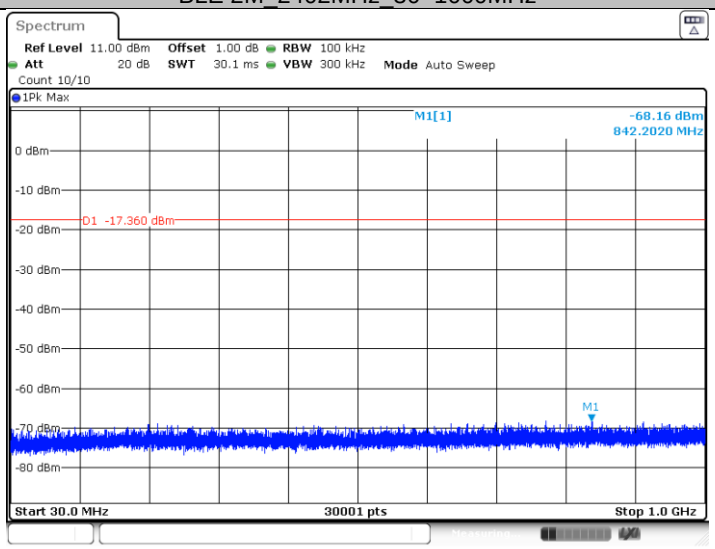
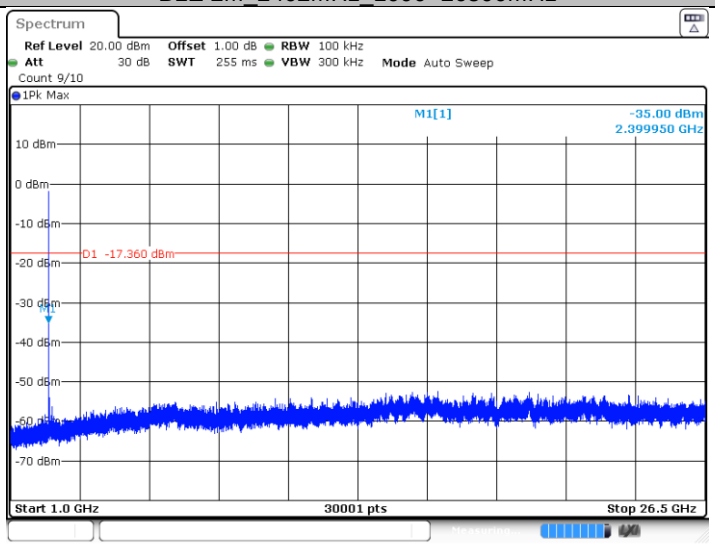
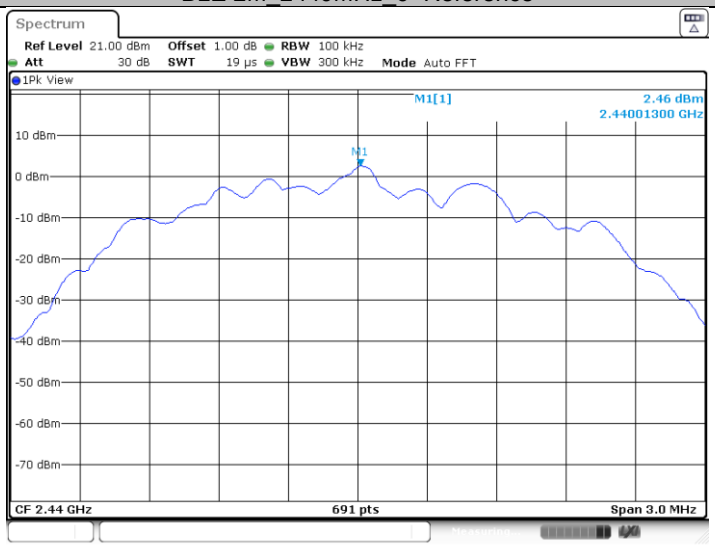
BLE 2M_2402MHz_30~1000MHz



BLE 2M_2402MHz_1000~26500MHz



BLE 2M_2440MHz_0~Reference



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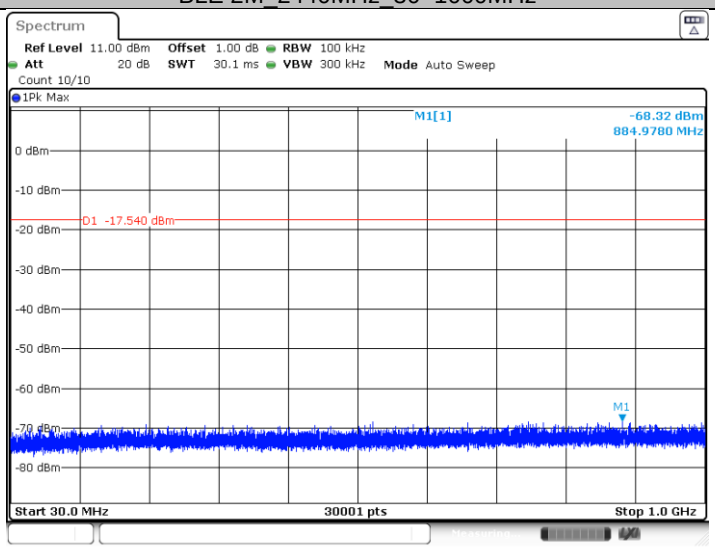
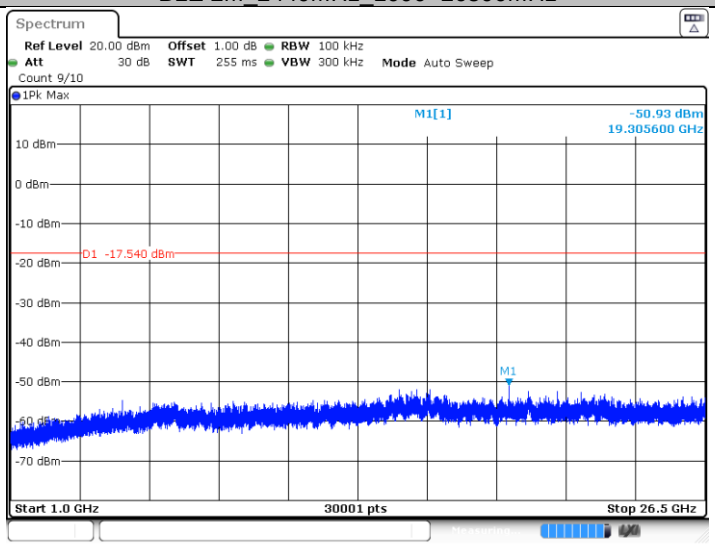
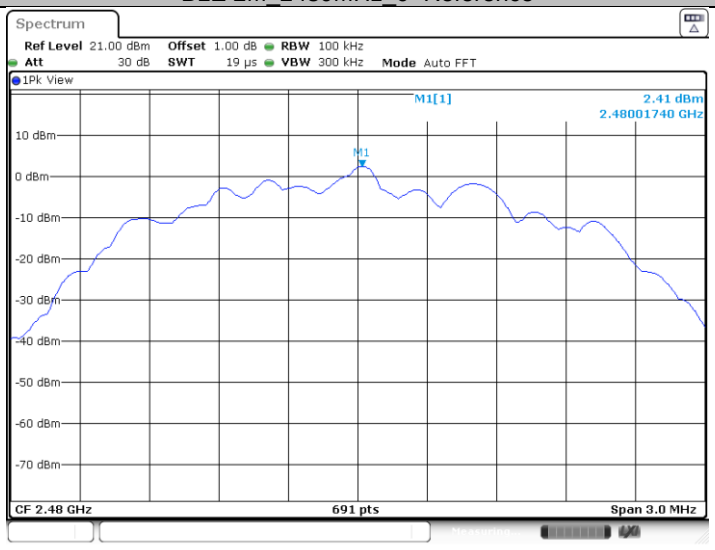
BLE 2M_2440MHz_30~1000MHz



BLE 2M_2440MHz_1000~26500MHz



BLE 2M_2480MHz_0~Reference



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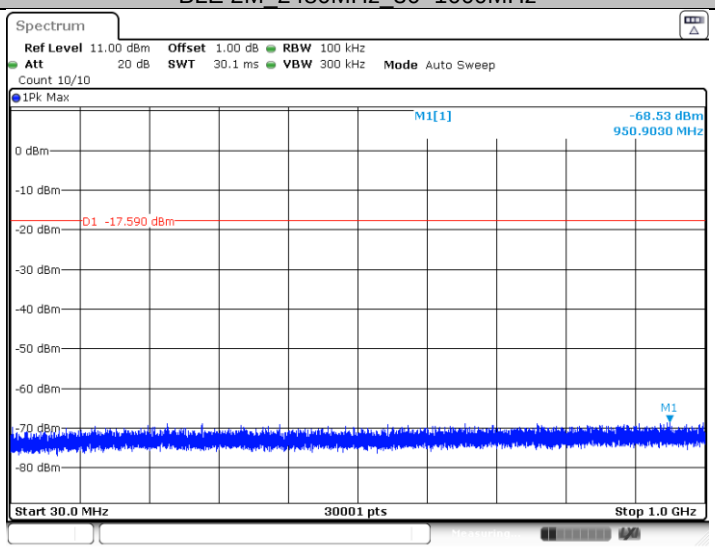
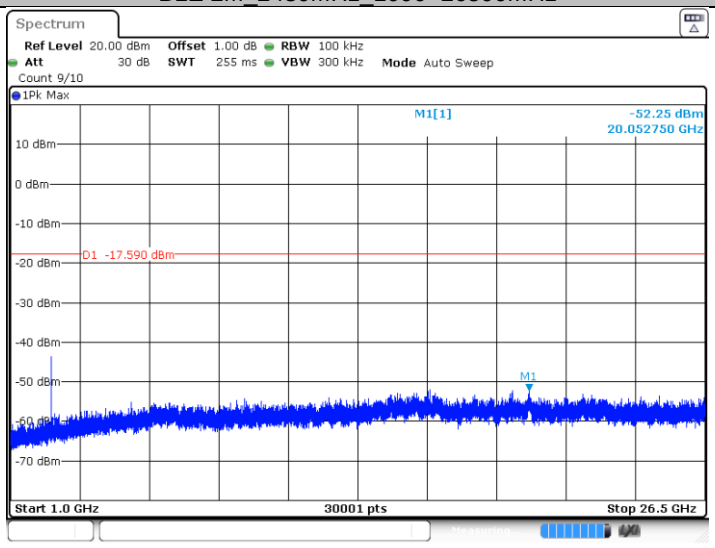
BLE 2M_2480MHz_30~1000MHz



BLE 2M_2480MHz_1000~26500MHz



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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, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under § 15.247(b)(3), the attenuation required shall be 30 dB instead of 20 dB.

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

Test result

Test Mode	Channel (MHz)	Ref Level (dBm)	Result (dBm)	Limit (dBm)	Verdict
BLE 1M	2402	2.63	-50.75	<=-17.37	PASS
	2480	2.25	-50.76	<=-17.75	PASS
BLE 2M	2402	2.64	-29.92	<=-17.36	PASS
	2480	2.28	-50.83	<=-17.72	PASS

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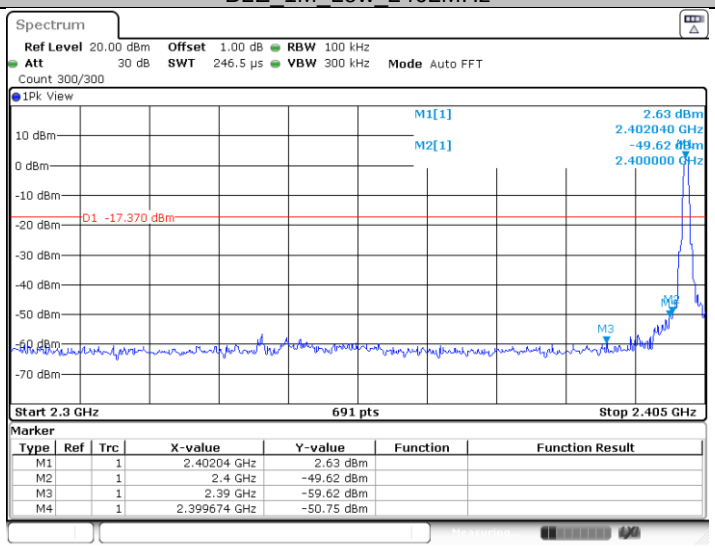
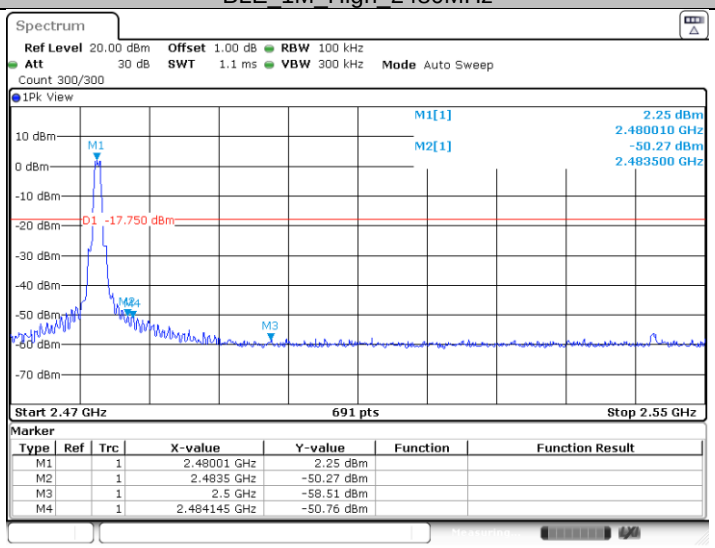
Test Graphs

BLE_1M_Low_2402MHz



Date: 14.JUL.2022 12:42:56

BLE_1M_High_2480MHz



Date: 14.JUL.2022 12:46:03

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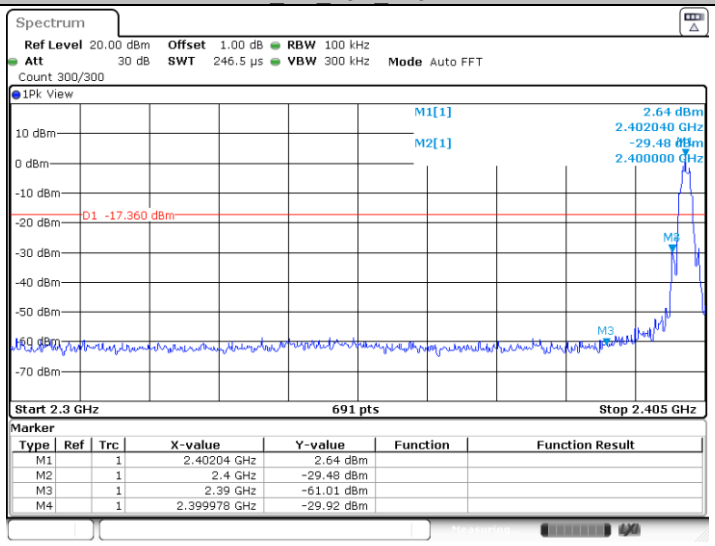
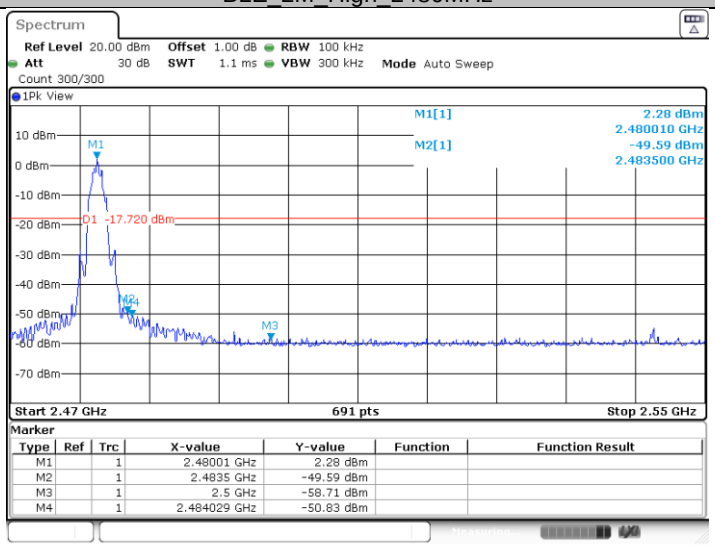
BLE_2M_Low_2402MHz



Date: 14.JUL.2022 12:48:12

BLE_2M_High_2480MHz



Date: 14.JUL.2022 12:52:11

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9.7 Spurious radiated emissions for transmitter

Test Method

1. The EUT was place 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 = 1MHz.

b) VBW \ [3 × RBW].

c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ 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

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under § 15.247(b)(3), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in§ 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

Frequency MHz	Field Strength µV/m	Field Strength dBµV/m	Detector	Measurement distance meters
0.009-0.490	2400/F(kHz)	48.5-13.8	AV	300
0.490-1.705	24000/F(kHz)	33.8-23.0	QP	30
1.705-30	30	29.5	QP	30
30-88	100	40	QP	3
88-216	150	43.5	QP	3
216-960	200	46	QP	3
960-1000	500	54	QP	3
Above 1000	500	54	AV	3
Above 1000	5000	74	PK	3

Note 1: Limit 3m(dBµV/m)=Limit 300m(dBµV/m)+40Log(300m/3m) (Below 30MHz)
Note 2: Limit 3m(dBµV/m)=Limit 30m(dBµV/m)+40Log(30m/3m) (Below 30MHz)

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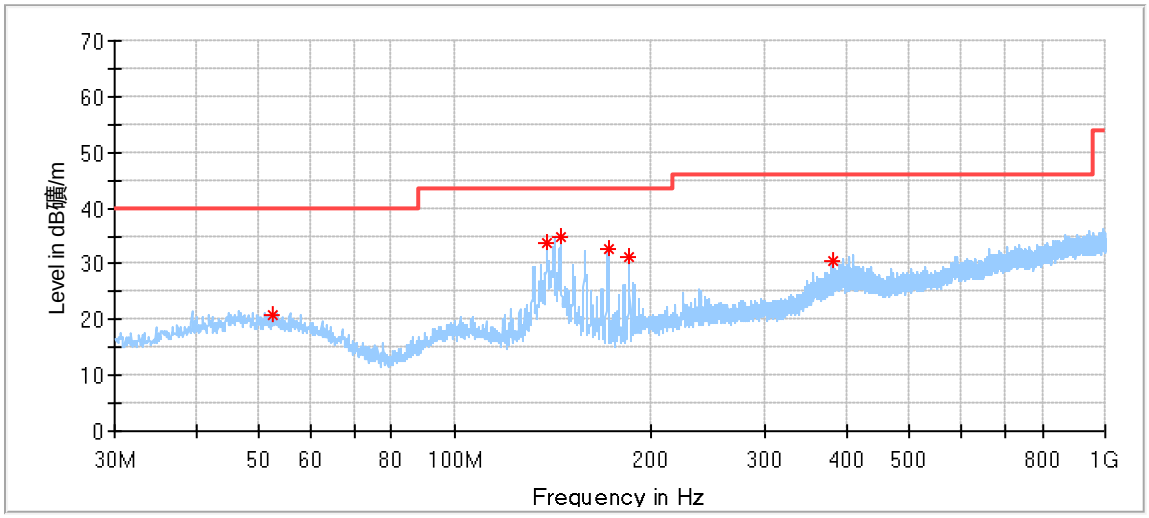
Spurious radiated emissions for transmitter

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.
The only worse case (BLE 1M) test result is listed in the report.

Transmitting spurious emission test result as below:

Below 1G:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
52.417778	20.69	40.00	19.31	200.0	H	222.0	20.75
138.693889	33.90	43.50	9.60	200.0	H	18.0	15.05
145.483889	34.65	43.50	8.85	200.0	H	185.0	15.05
171.997222*	32.62	43.50	10.88	200.0	H	194.0	15.97
185.523333	31.23	43.50	12.27	100.0	H	19.0	17.28
381.571111	30.65	46.00	15.35	100.0	H	258.0	23.14

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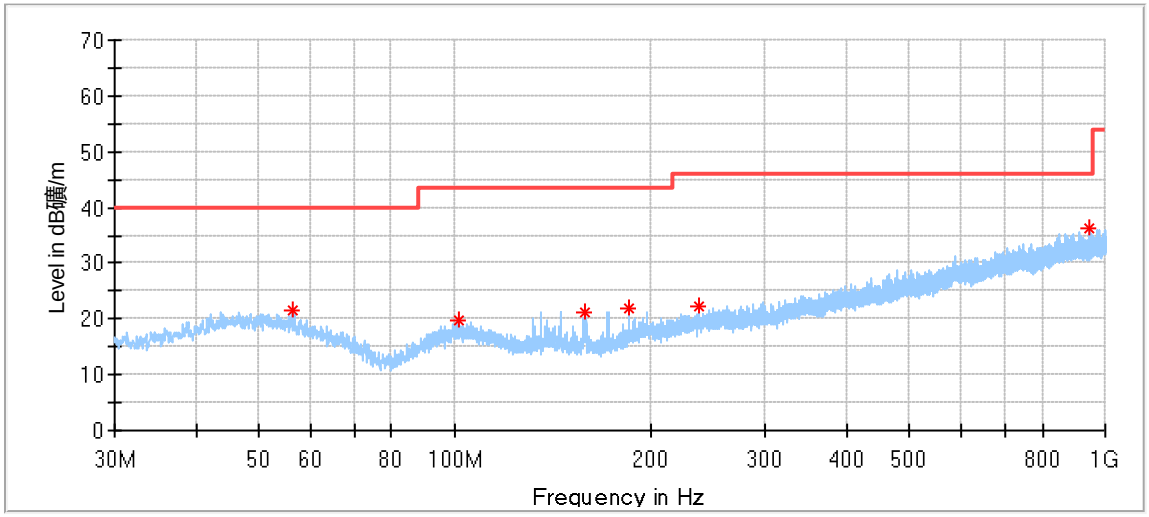

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
56.243889	21.61	40.00	18.39	100.0	V	359.0	20.23
101.133333	19.84	43.50	23.66	100.0	V	111.0	18.55
158.632778	21.35	43.50	22.15	100.0	V	138.0	15.68
185.738889	21.88	43.50	21.62	100.0	V	83.0	17.30
237.903333	22.41	46.00	23.59	100.0	V	175.0	19.49
948.212778	36.13	46.00	9.87	100.0	V	129.0	31.84

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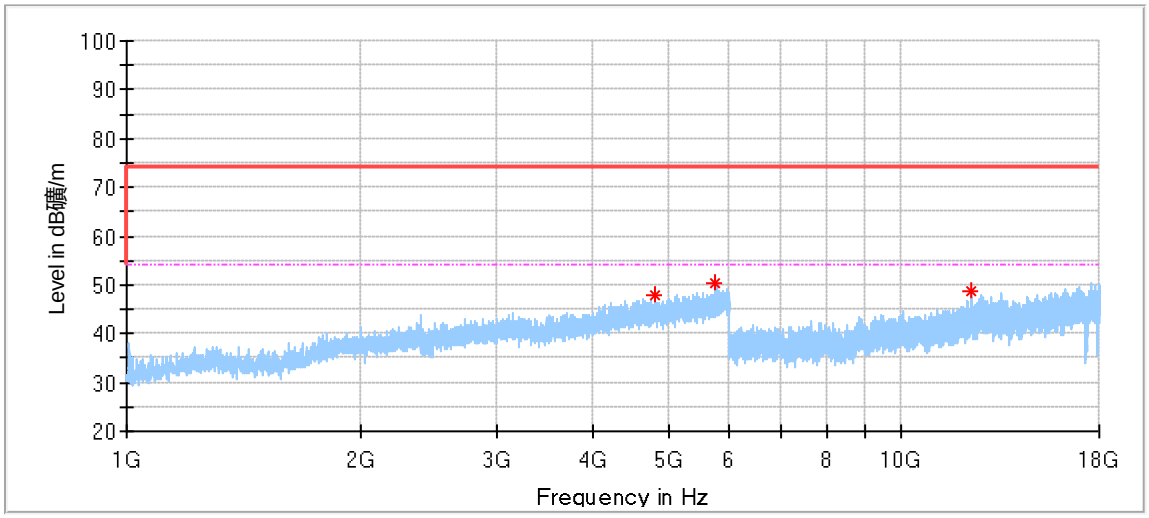
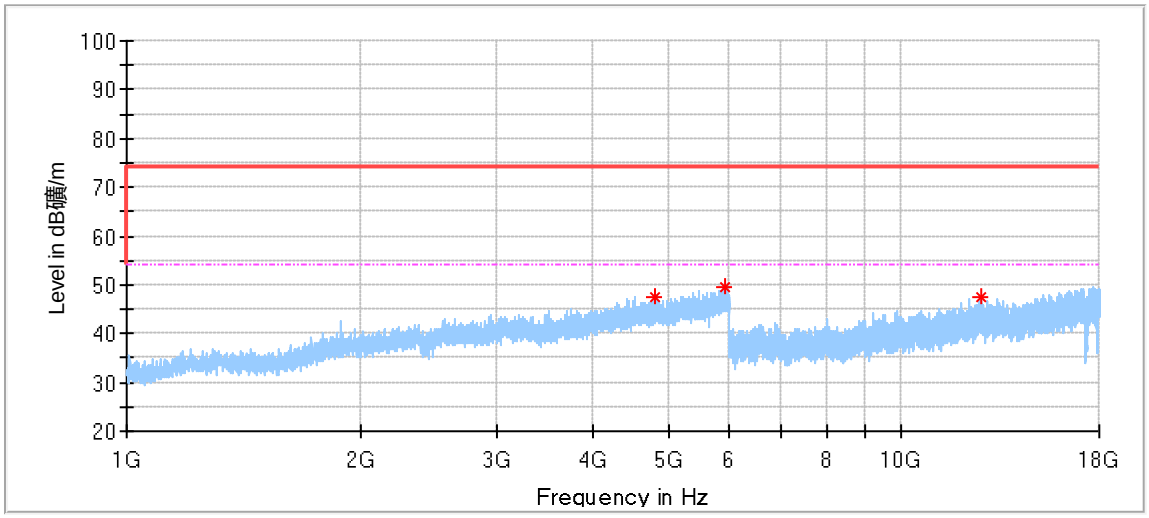
Low channel 2402MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4804.000000*	47.72	74.00	26.28	150.0	H	130.0	3.86
5756.500000	50.46	74.00	23.54	150.0	H	273.0	5.98
12282.000000*	48.65	74.00	25.35	150.0	H	188.0	15.10



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4804.500000*	47.54	74.00	26.46	150.0	V	85.0	3.86
5906.000000	49.74	74.00	24.26	150.0	V	355.0	6.51
12689.500000*	47.33	74.00	26.67	150.0	V	300.0	16.20

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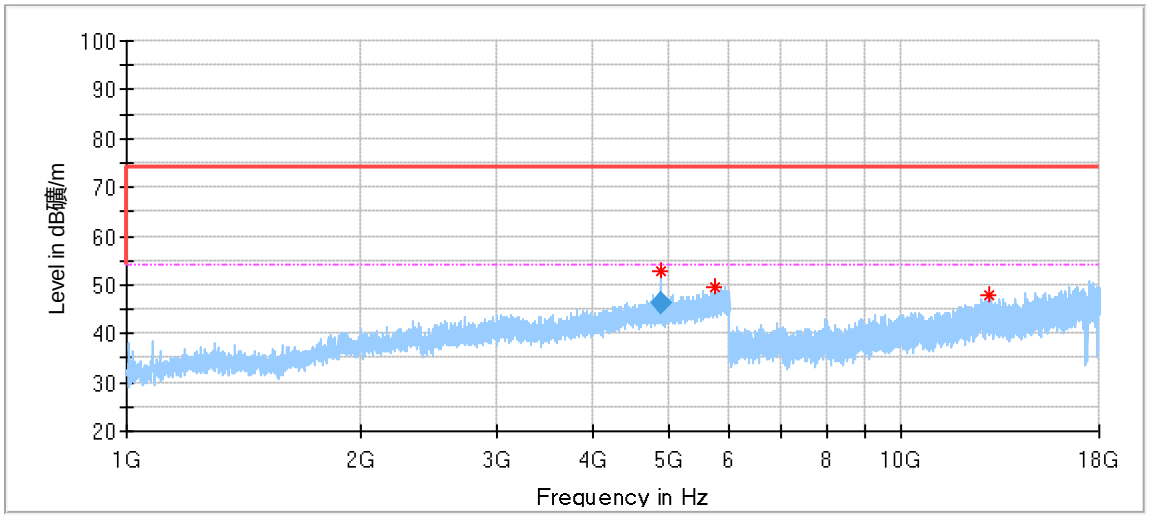
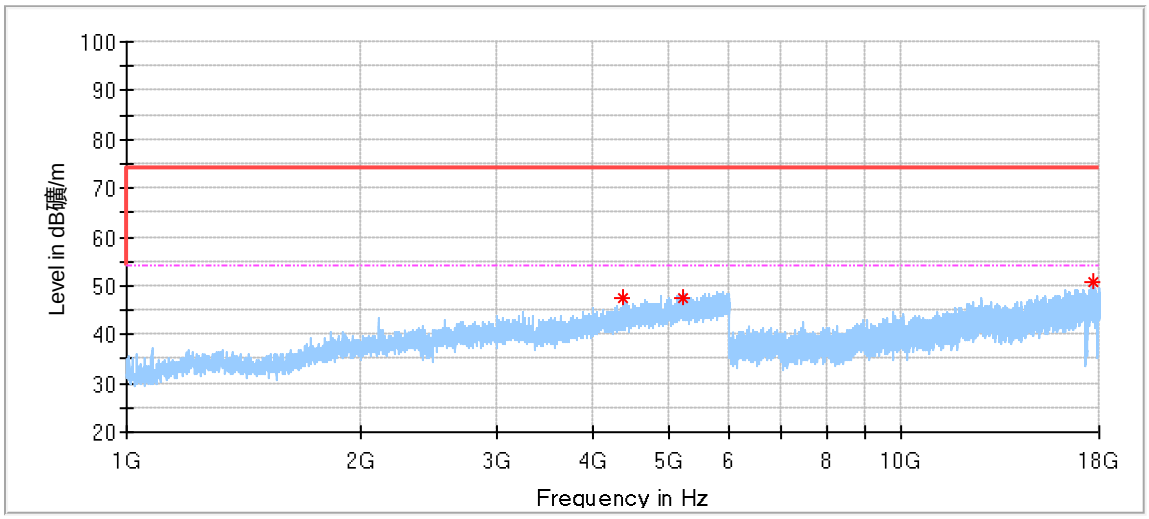
Middle channel 2440MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4880.000000*	52.77	74.00	21.23	150.0	H	4.0	3.96
5746.000000	49.34	74.00	24.66	150.0	H	204.0	5.92
13011.500000	48.03	74.00	25.97	150.0	H	134.0	16.20

Final_Result

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4880.000000*	46.39	54.00	7.61	150.0	H	4.0	3.96



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4368.000000*	47.43	74.00	26.57	150.0	V	257.0	2.67
5236.500000	47.30	74.00	26.70	150.0	V	123.0	5.07
17677.500000	50.74	74.00	23.26	150.0	V	203.0	22.10

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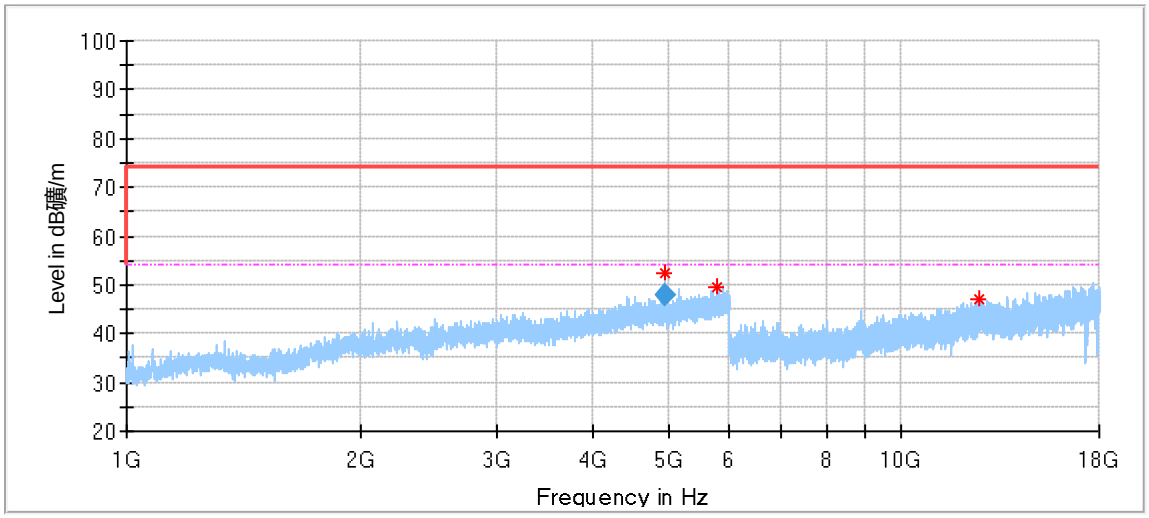
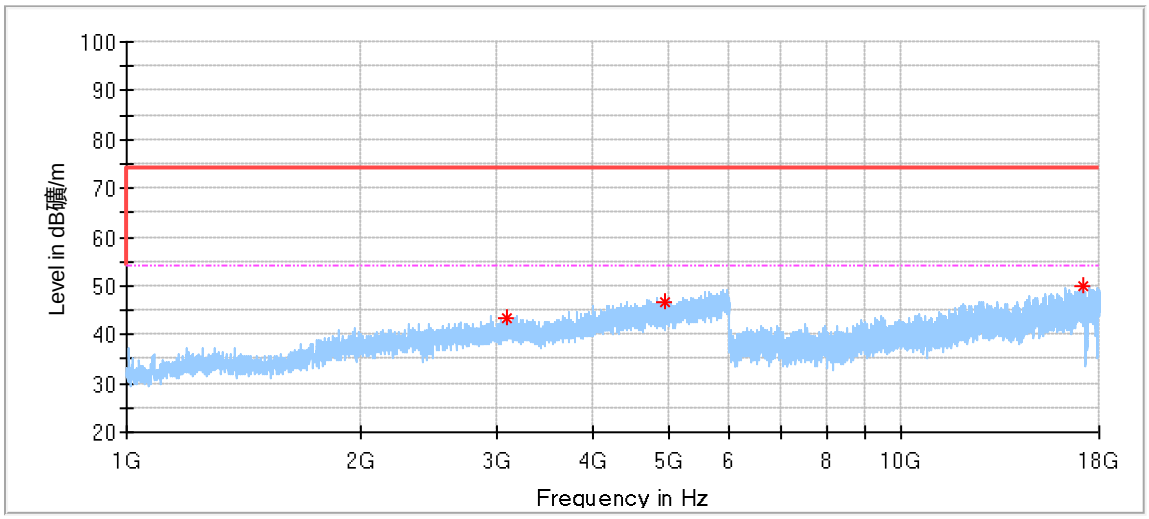
High channel 2480MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4960.500000*	52.56	74.00	21.44	150.0	H	0.0	3.99
5782.500000	49.72	74.00	24.28	150.0	H	301.0	6.07
12572.500000*	47.28	74.00	26.72	150.0	H	333.0	15.92

Final_Result

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4960.500000*	47.79	54.00	6.21	150.0	H	0.0	3.99



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3098.000000	43.39	74.00	30.61	150.0	V	351.0	-0.44
4962.000000*	46.47	74.00	27.53	150.0	V	356.0	3.99
17128.500000	50.14	74.00	23.86	150.0	V	144.0	22.20

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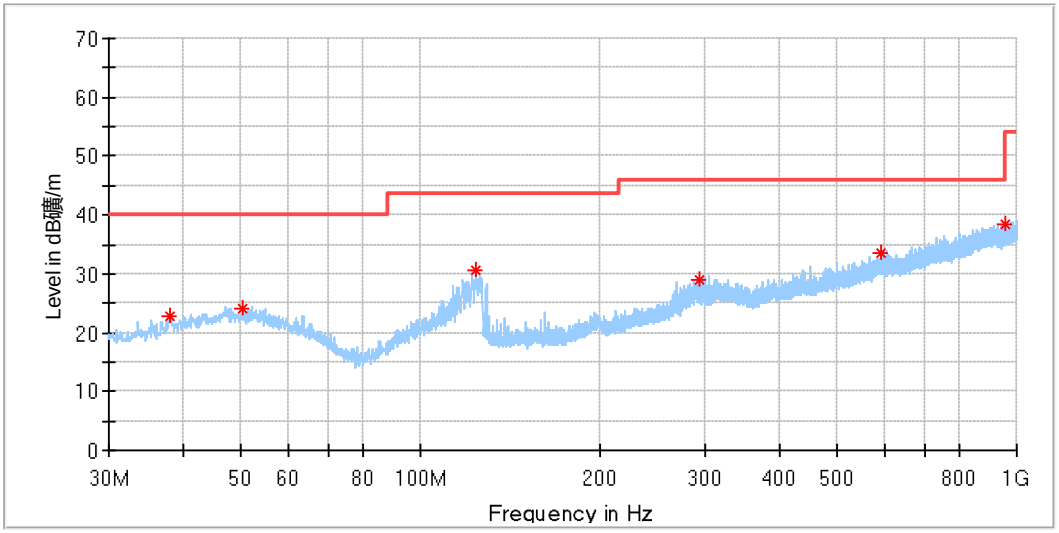
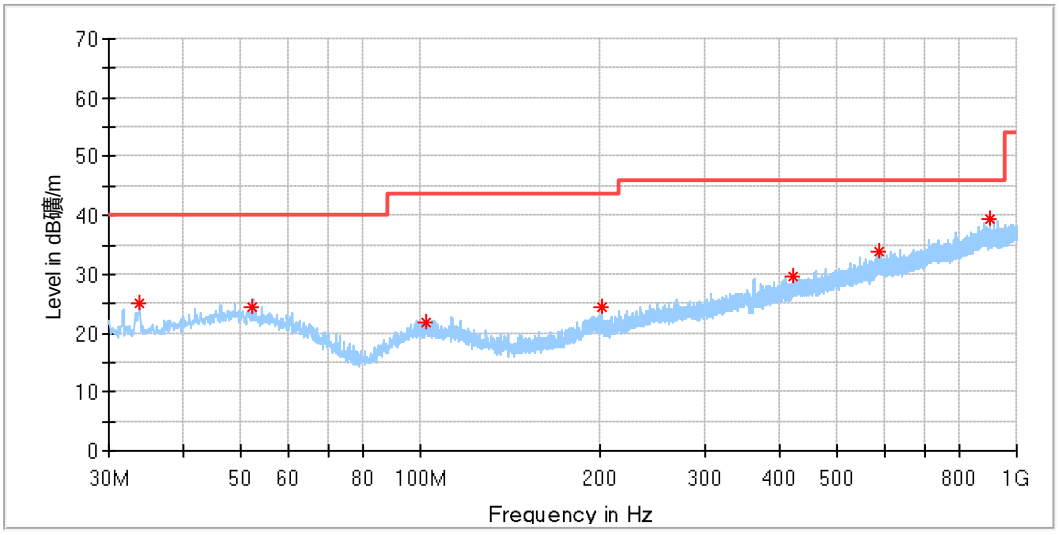
AP-001 with alternative controller
Below 1G:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
37.941875*	22.81	40.00	17.19	200.0	H	196.0	18.96
50.370000	24.12	40.00	15.88	100.0	H	0.0	21.02
123.847500*	30.62	43.50	12.88	100.0	H	0.0	16.43
292.870000	28.82	46.00	17.18	100.0	H	1.0	21.03
591.690625	33.61	46.00	12.39	100.0	H	86.0	27.77
955.258750	38.30	46.00	7.70	200.0	H	307.0	32.48



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
33.819375	25.04	40.00	14.96	100.0	V	1.0	17.27
52.188750	24.35	40.00	15.65	200.0	V	340.0	20.98
102.446875	21.84	43.50	21.66	200.0	V	0.0	18.70
201.023125	24.48	43.50	19.02	100.0	V	0.0	18.63
421.516250	29.59	46.00	16.41	100.0	V	99.0	24.40
587.992500	33.80	46.00	12.20	100.0	V	0.0	27.62
900.696250	39.27	46.00	6.73	200.0	V	221.0	32.19

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Remark:
(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(2) Data of measurement within frequency range 9kHz-30MHz,18-26GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.
(3) 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)

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10 Test Equipment List

Conducted Emission Test

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 3	68-4-74-19-002	102590	1	2024-5-19
LISN	Rohde & Schwarz	ENV216	68-4-87-19-001	102472	1	2024-5-20
Attenuator	Shanghai Huaxiang	TS2-26-3	68-4-81-16-003	080928189	1	2024-5-19
Test software	Rohde & Schwarz	EMC32	68-4-90-19-005-A01	Version 10.35.02	N/A	N/A
Shielding Room	TDK	CSR #2	68-4-90-19-005	----	3	2025-10-15

Radiated Emission Test, SAC-3 #1

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 7	68-4-74-19-001	102176	1	2024-5-20
Loop Antenna	Rohde & Schwarz	HFH2-Z2	68-4-80-14-006	100398	1	2024-8-7
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	1	2024-5-19
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-001	15542	1	2024-5-19
3m Semi-anechoic chamber	TDK	SAC-3 #1	68-4-90-14-001	----	3	2024-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-14-001-A10	Version10.35.02	N/A	N/A

Radiated Emission Test, SAC-3 #2

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2024-5-20
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9162	68-4-80-19-003	284	1	2024-3-5
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	1	2024-4-26
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2024-5-19
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	1	2024-5-19
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2024-7-11
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2024-8-1
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	1	2024-5-19
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2024-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.35.02	N/A	N/A

RF Conducted Test

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	1	2024-5-19
Test software	Tonscend	System for BT/WIFI	68-4-74-14-006-A13	Version 2.6.77.0518	N/A	N/A

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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 Conducted Emission in new shielding room (68-4-90-19-005) 150kHz-30MHz (for test using AMN ENV216)	3.33dB
Uncertainty for Radiated Emission in 3m chamber (68-4-90-14-001) 9kHz-30MHz	4.70dB
Uncertainty for Radiated Emission in 3m chamber (68-4-90-14-001) 30MHz-1000MHz	Horizontal: 4.64dB; Vertical: 4.79dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 30MHz-1000MHz	Horizontal: 4.59dB; Vertical: 4.75dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 1000MHz-18000MHz	Horizontal: 5.08dB; Vertical: 5.09dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) above 18000MHz	Horizontal: 3.14dB; Vertical: 3.12dB
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.31dB Frequency test involved: 0.6×10^{-8} or 1%

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2021, clause 4.4.3 and 4.5.1.

---THE END OF REPORT---

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