FCC - TEST REPORT

Report Number	:	**68.710.19.0474.01**	Date of Issue:	December 12, 2019
Model	:	**DT2018338**		
Product Type	:	APP Mouse		
Applicant	:	HangzhouTianyuan Pet Products Co.,Ltd		
Address	:	No.10-1 Xingling Rd., XingQiao Town, Linping, Yuhang, 311100 Hangzhou, PEOPLE'S REPUBLIC OF CHINA		
Production Facility	:	HangzhouTianyuan Pet Products Co.,Ltd		
Address	:	No.10-1 Xingling Rd., XingQiao Town, Linping, Yuhang, 311100 Hangzhou, PEOPLE'S REPUBLIC OF CHINA		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	29		

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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, Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052, P. R. China
FCC Registration Number:	514049
ISED#:	10320A
CAB identifier:	CN0077
Telephone: Fax:	86 755 8828 6998 86 755 8828 5299

3 Description of the Equipment under Test

Product/PMN:	APP Mouse
Model no./HVIN:	DT2018338
FCC ID:	2AL5X-DT2018338
Ratings:	DC 3.7V, 0.37mW (for inner battery) DC 5V, 1A (for charging input)
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	40
Modulation:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain:	2dBi
Description of the EUT:	The Equipment Under Test (EUT) is a APP Mouse supports 2.4GHz BLE function.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2018 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10 (2013).

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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	16	Site 1	☒	☐	☐
§15.247(e)	Power spectral density	19	Site 1	☒	☐	☐
§15.247(d)	Spurious RF conducted emissions	22	Site 1	☒	☐	☐
§15.247(d)	Band edge	28	Site 1	☒	☐	☐
§15.247(d) & §15.209	Spurious radiated emissions for transmitter	30	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Note 1: N/A=Not Applicable.
Note 2: The EUT uses a PCB antenna, which gain is 2dBi. 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: 2AL5X-DT2018338 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

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:	November 19, 2019
Testing Start Date:	December 04, 2019
Testing End Date:	December 06, 2019

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

Reviewed by:	Prepared by:	Tested by:
Jessie He	Henry Chen	Louise Liu
EMC Project Manager	EMC Project Engineer	EMC Test Engineer

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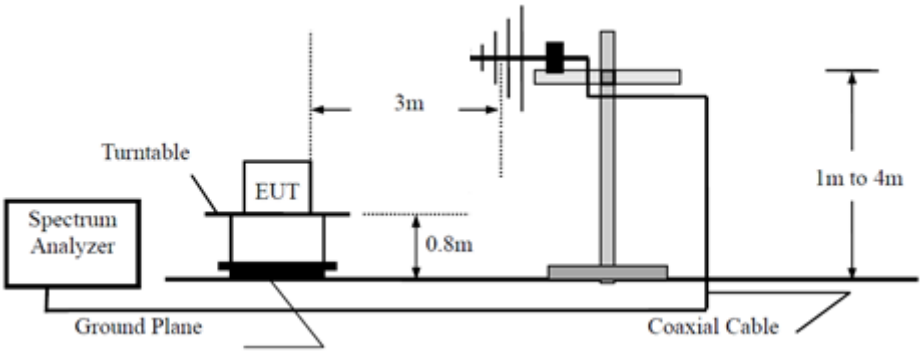
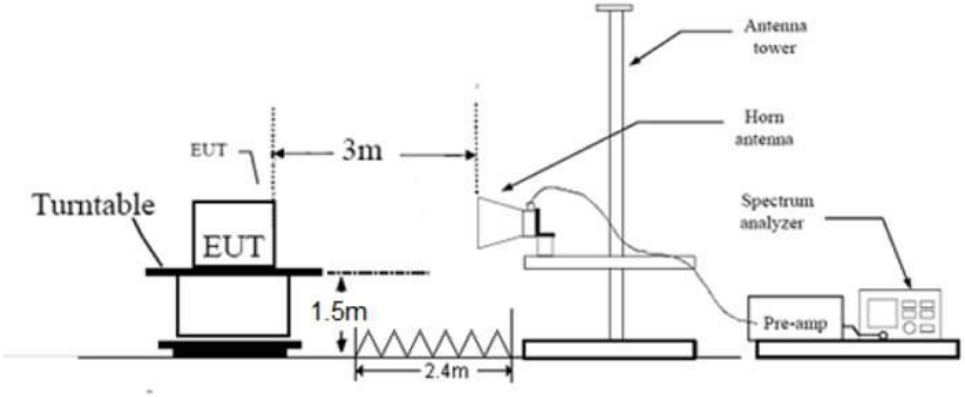
7 Test Setups

7.1 Radiated test setups

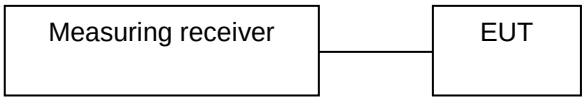
Below 1GHz



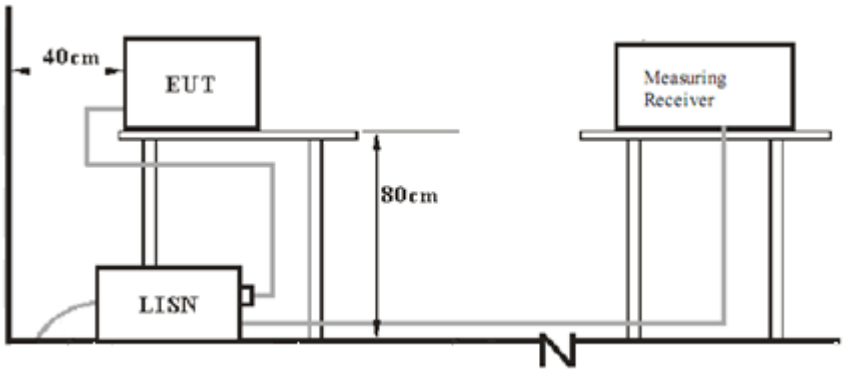
Above 1GHz



7.2 Conducted RF test setups



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
---	---	---	---

Test software information:

Test Software Version		
Modulation	Setting TX Power	Packet Type
GFSK	-2dBm	/

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

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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

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

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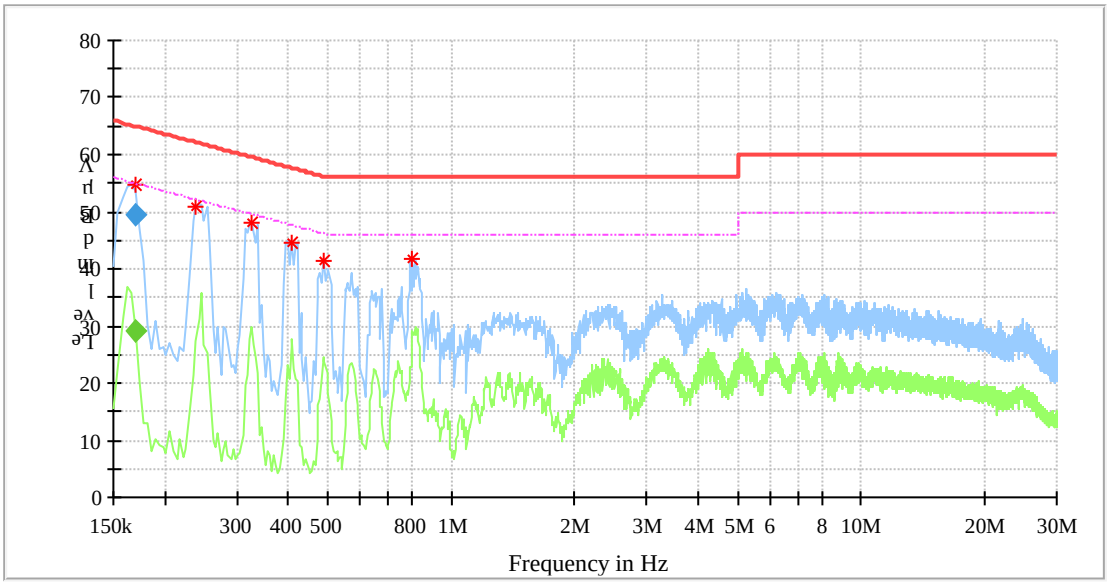
Conducted Emission

Product Type	:	APP Mouse
M/N	:	DT2018338
Operating Condition	:	Charging
Test Specification	:	Power Line, Live
Comment	:	AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.169500	54.59	---	65.16	10.57	L1	10.3
0.238000	51.02	---	62.17	11.15	L1	10.3
0.326000	48.00	---	59.55	11.56	L1	10.3
0.410000	44.43	---	57.65	13.22	L1	10.3
0.490000	41.49	---	56.17	14.68	L1	10.3
0.806000	41.93	---	56.00	14.07	L1	10.3

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.169500	---	29.15	54.98	25.83	L1	10.3
0.169500	49.60	---	64.98	15.38	L1	10.3

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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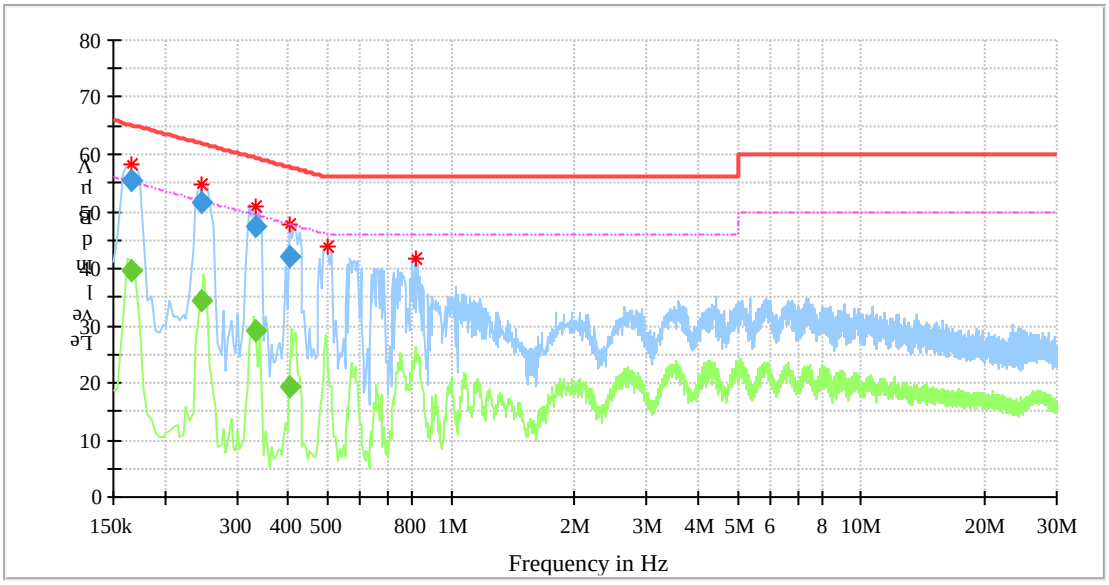
Conducted Emission

Product Type	:	APP Mouse
M/N	:	DT2018338
Operating Condition	:	Charging
Test Specification	:	Power Line, Neutral
Comment	:	AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.165500	58.33	---	64.96	6.63	N	10.3
0.245500	54.63	---	61.76	7.13	N	10.3
0.333500	50.99	---	59.35	8.36	N	10.3
0.401500	47.76	---	57.81	10.05	N	10.3
0.498000	43.70	---	56.03	12.33	N	10.3
0.818000	41.76	---	56.00	14.24	N	10.3

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.165500	---	39.77	55.18	15.41	N	10.3
0.165500	55.61	---	65.18	9.57	N	10.3
0.245500	---	34.39	51.91	17.52	N	10.3
0.245500	51.53	---	61.91	10.38	N	10.3
0.333500	---	29.17	49.36	20.19	N	10.3
0.333500	47.25	---	59.36	12.11	N	10.3
0.401500	---	19.30	47.82	28.52	N	10.3
0.401500	42.11	---	57.82	15.71	N	10.3

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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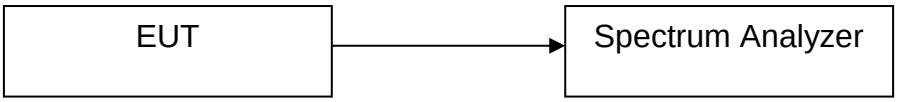
9.2 Conducted Peak output power

Test Method

1. The EUT was placed on 0.8m height table, 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. Setting the highest output power level of the EUT
3. Use the following spectrum analyzer settings:
   RBW≥DTS bandwidth, VBW≥3RBW, Sweep = auto, Detector function = peak,
   Trace = max hold, allow trace to fully stabilize.
4. Record the peak power value.

Test Setup



Limits

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

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

Test result as below table

For BLE

Frequency MHz	Conducted peak Output Power dBm	Result
Top channel 2402MHz	-5.72	Pass
Middle channel 2440MHz	-6.43	Pass
Bottom channel 2480MHz	-6.61	Pass

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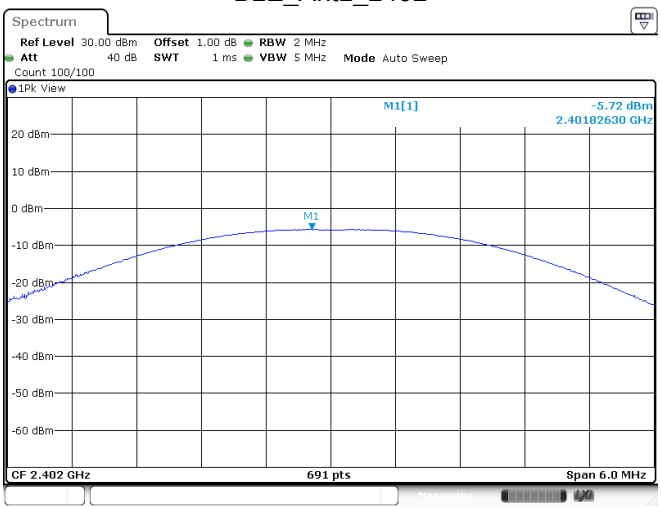
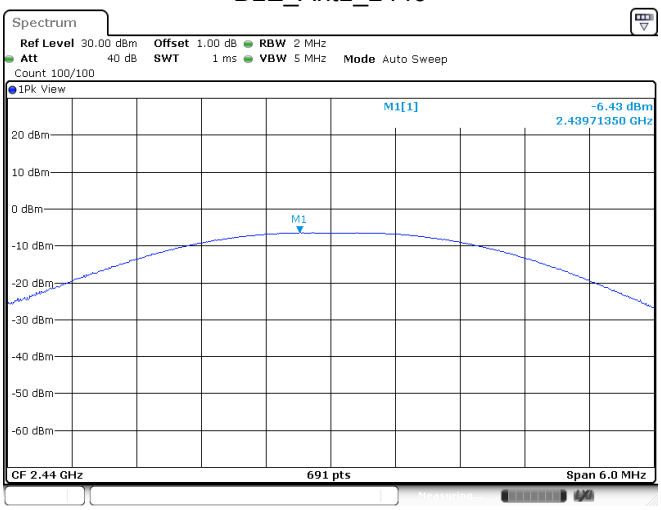
Test Graphs

For BLE

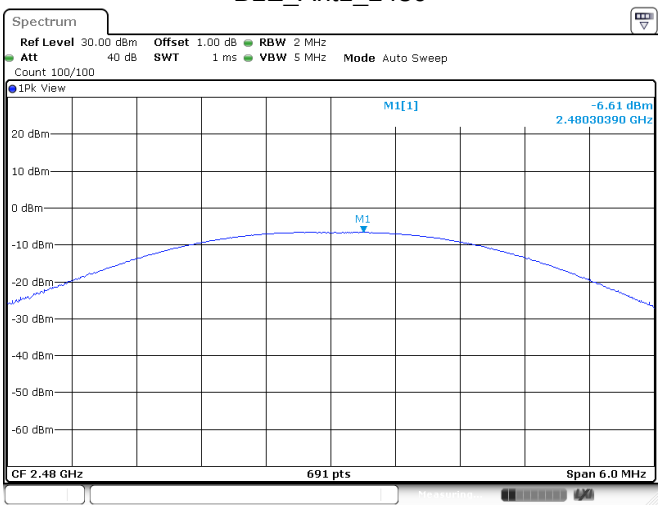
BLE_Ant1_2402



BLE_Ant1_2440



BLE_Ant1_2480



9.3 6dB bandwidth

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Use the following spectrum analyzer settings:
   Set RBW ≥ 1% of the 99% bandwidth, VBW ≥ RBW.
   Sweep = auto, Detector function = peak, Trace = max hold
3. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
4. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]
≥500

Test result

For BLE

Test Mode	Channel (MHz)	6dB bandwidth (MHz)	Limit (KHz)	Verdict
BLE	2402	0.716	≥500	PASS
BLE	2440	0.716	≥500	PASS
BLE	2480	0.716	≥500	PASS

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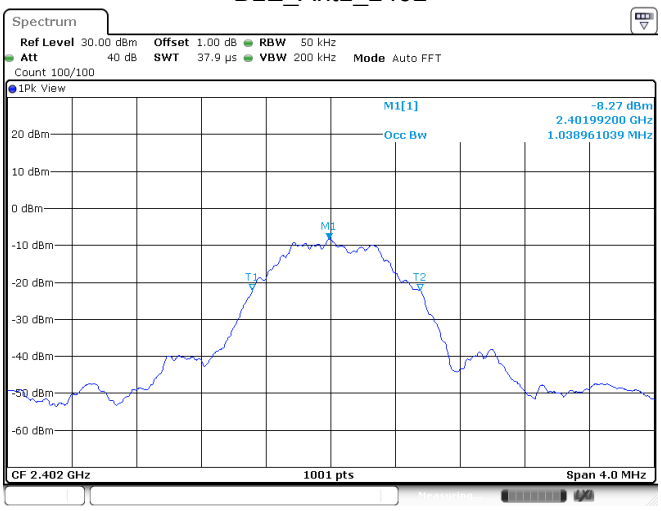
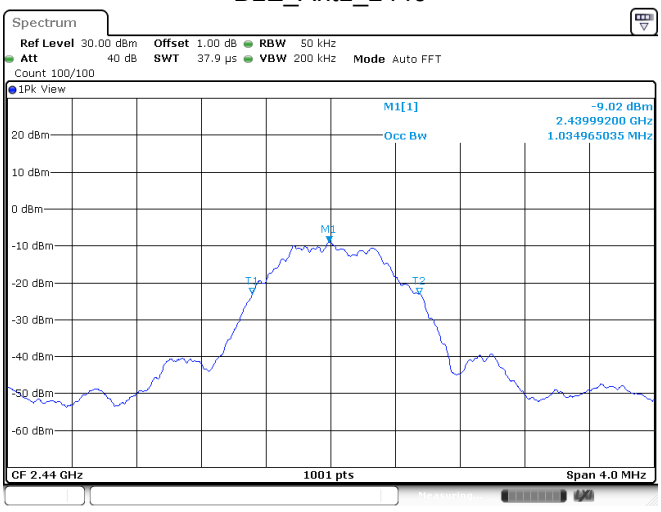
Test Graphs

For BLE

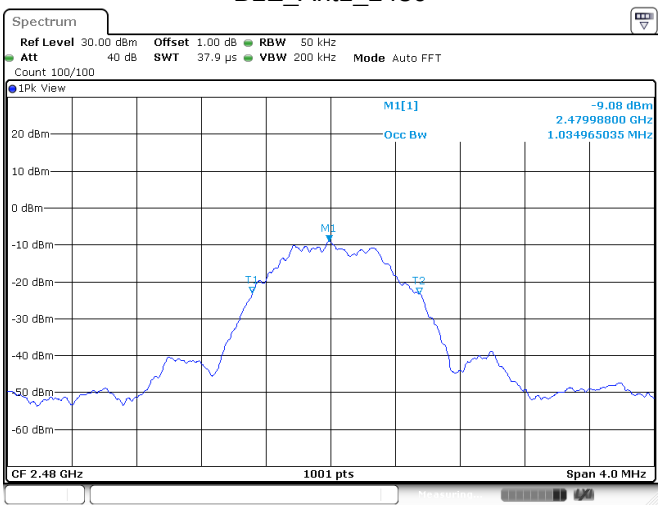
BLE_Ant1_2402



BLE_Ant1_2440



BLE_Ant1_2480



9.4 Power spectral density

Test Method

1. Connect EUT test port to spectrum analyzer.
2. 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.
3. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
4. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3KHz]
≤8

Test result

For BLE

Test Mode	Channel (MHz)	Result (dBm/3KHz)	Limit(dBm/3KHz)	Verdict
BLE	2402	-15.86	8	PASS
BLE	2440	-16.84	8	PASS
BLE	2480	-16.69	8	PASS

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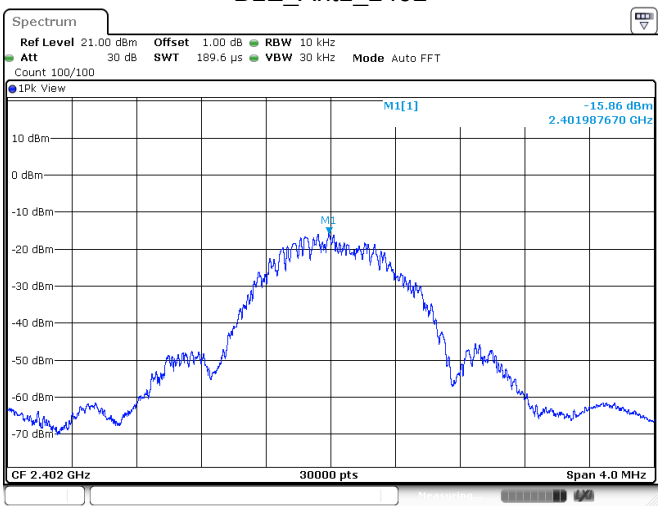
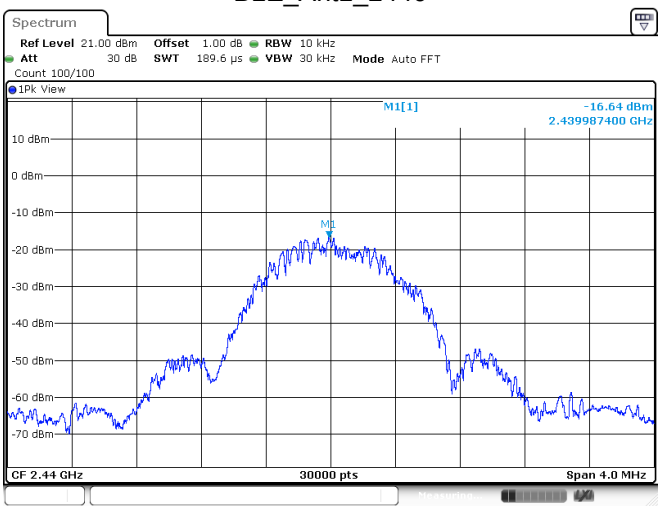
Test Graphs

For BLE

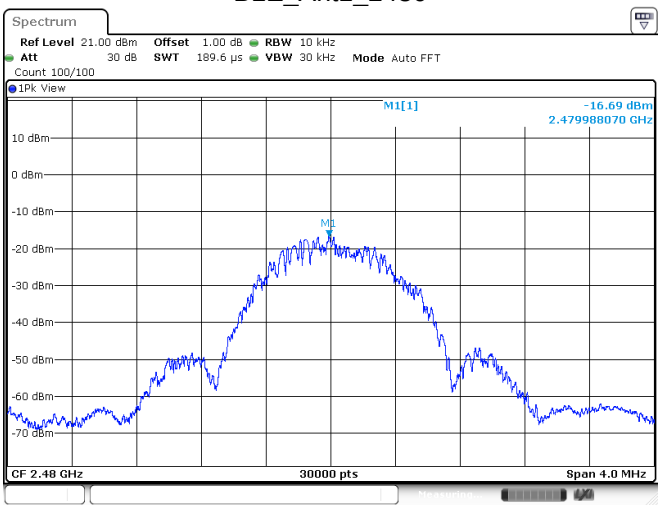
BLE_Ant1_2402



BLE_Ant1_2440



BLE_Ant1_2480



9.5 Spurious RF conducted emissions

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Establish a reference level by using the following procedure:
   a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
   b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
3. Use the maximum PSD level to establish the reference level.
   a. Set the center frequency and span to encompass frequency range to be measured.
   b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
4. Repeat above procedures until other frequencies measured were completed.

Limit

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

Test Result

For BLE

TestMode	Antenna	Channel (MHz)	FreqRange (MHz)	RefLevel (dBm)	Result (dBm)	Limit (dBm)	Verdict
BLE	Ant1	2402	30~1000	-6.47	-68.04	<=-26.47	PASS
		2402	1000~26500	-6.47	-48.37	<=-26.47	PASS
		2440	30~1000	-7.42	-66.59	<=-27.42	PASS
		2440	1000~26500	-7.42	-48.78	<=-27.42	PASS
		2480	30~1000	-7.38	-66.26	<=-27.38	PASS
		2480	1000~26500	-7.38	-47.8	<=-27.38	PASS

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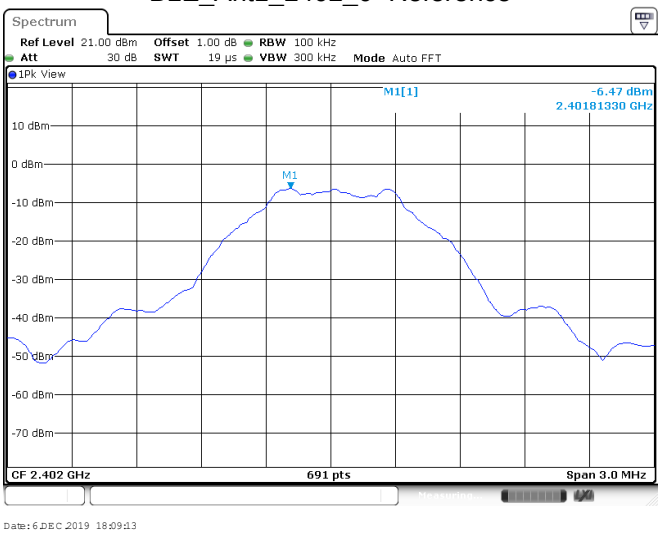
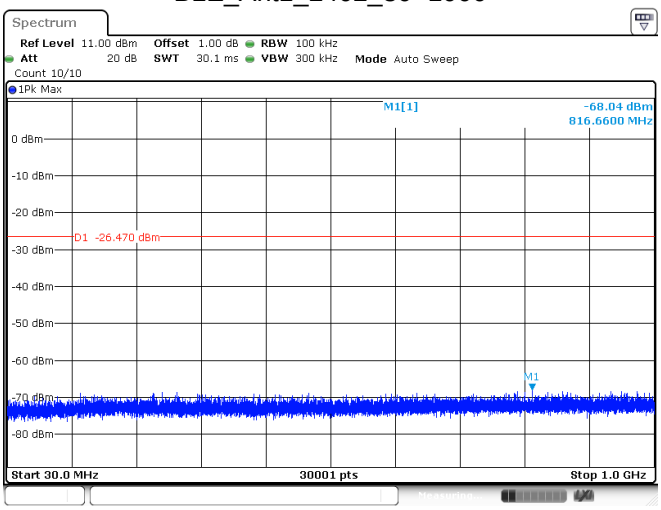
Test Graphs

For BLE

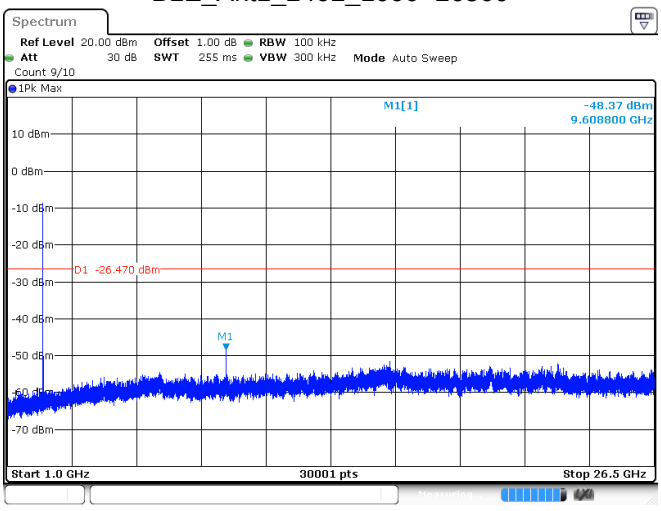
BLE_Ant1_2402_0~Reference



BLE_Ant1_2402_30~1000



BLE_Ant1_2402_1000~26500



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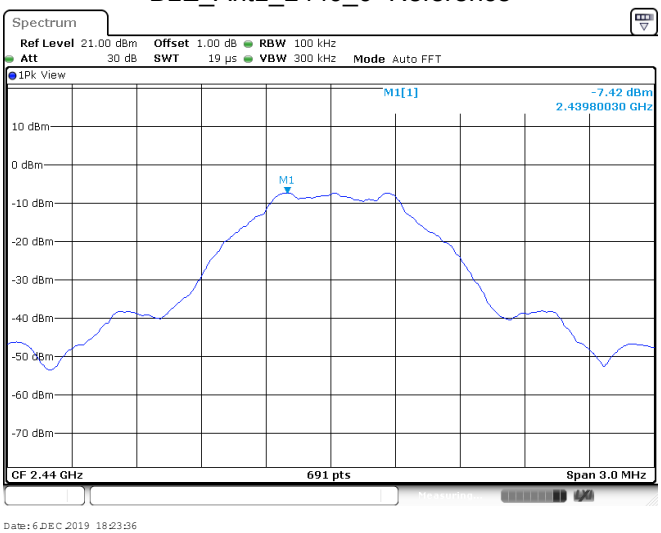
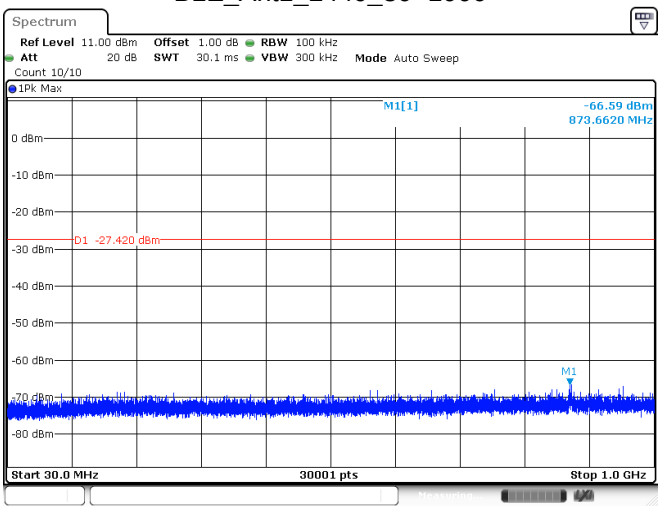
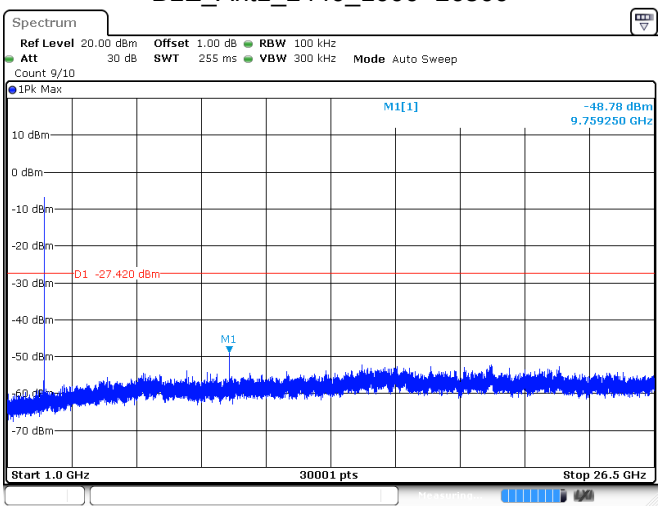
BLE_Ant1_2440_0~Reference



BLE_Ant1_2440_30~1000



BLE_Ant1_2440_1000~26500



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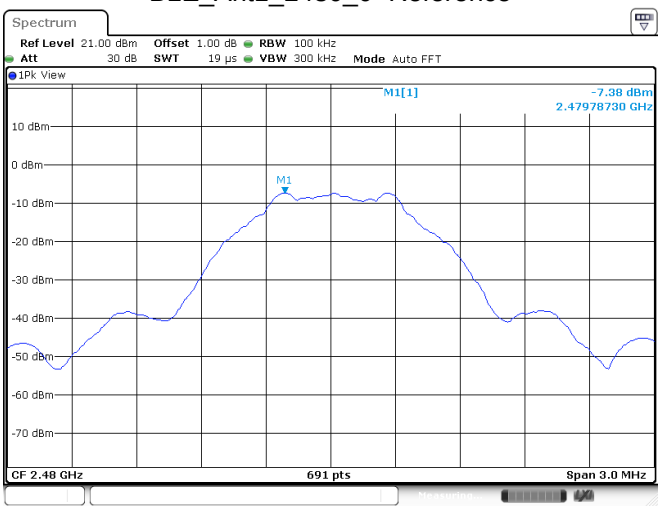
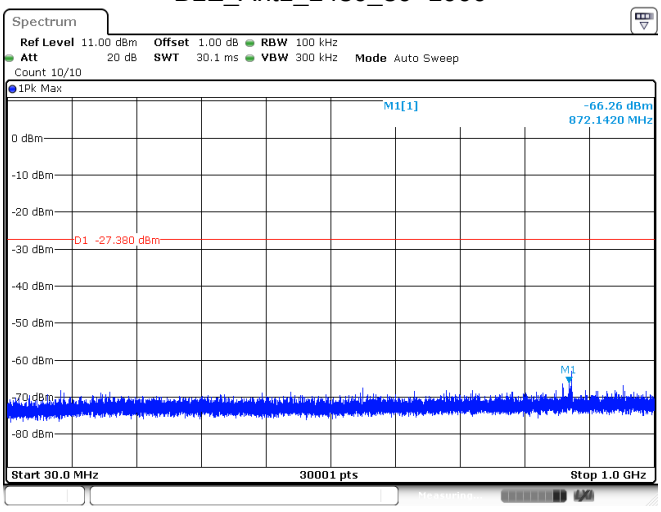
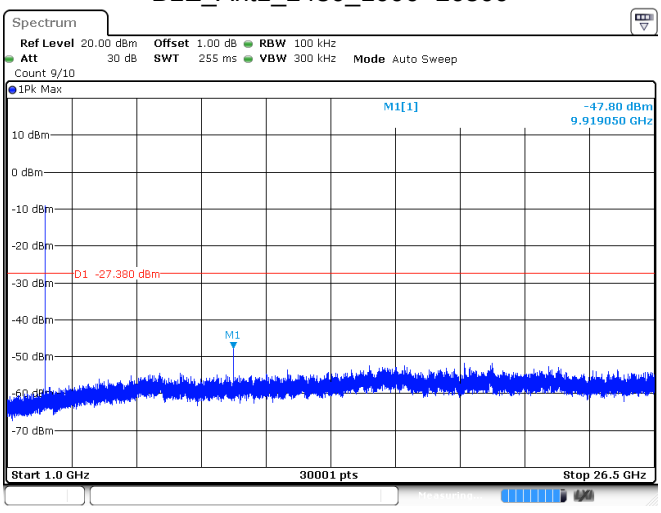
BLE_Ant1_2480_0~Reference



BLE_Ant1_2480_30~1000



BLE_Ant1_2480_1000~26500



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9.6 Band edge

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Set spectrum analyzer setting as below:
   Set RBW ≥ 1% of the span, VBW ≥ RBW.
   Set Sweep = auto. Set Detector function = peak. Allow the trace to stabilize.
   Set Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
3. Repeat above procedures until all frequencies measured were complete.

Limit

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

Test result

For BLE

TestMode	Antenna	ChName	Channel (MHz)	RefLevel (dBm)	Result (dBm)	Limit (dBm)	Verdict
BLE	Ant1	Low	2402	-6.59	-44.98	<=-26.59	PASS
		High	2480	-7.34	-50.9	<=-27.34	PASS

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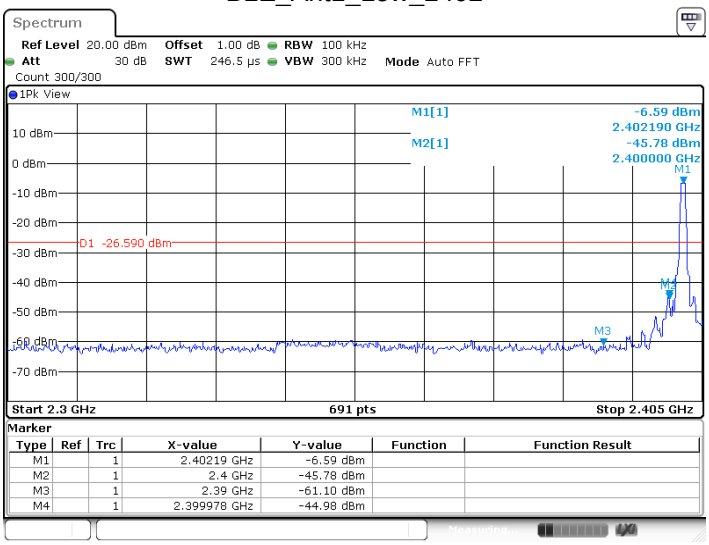
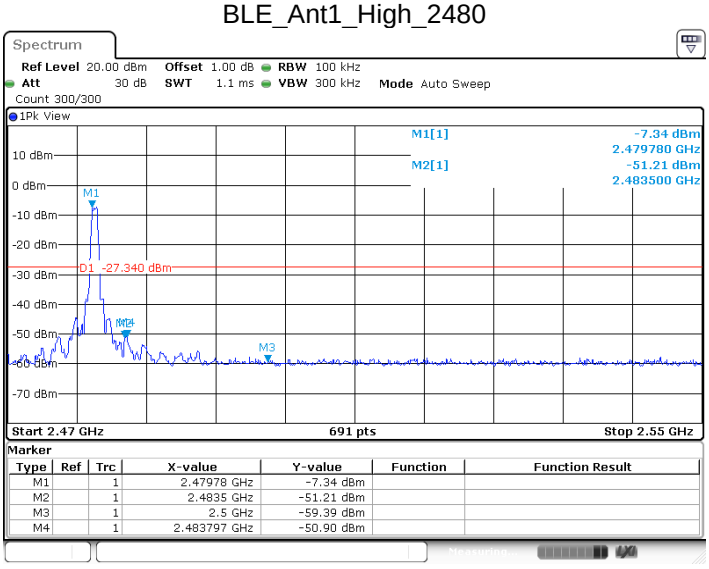
Test Graphs

For BLE-1M

BLE_Ant1_Low_2402



BLE_Ant1_High_2480



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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 = 1 MHz.
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.

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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 section15.205, 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

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.

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Spurious radiated emissions for transmitter

Transmitting spurious emission test result as below:

For BLE

(30MHz – 1GHz)

Invested Frequency Range (MHz)	Frequency (MHz)	Maximum Emission Observed(dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization	Detector	Factor (dB/m)
30-1000	891.47	32.93	46	13.07	Horizontal	Peak	-15.7
30-1000	943.26	35.66	46	10.34	Vertical	Peak	-14.6

2402MHz (Above 1GHz)

Invested Frequency Range (MHz)	Frequency (MHz)	Maximum Emission Observed(dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization	Detector	Factor (dB/m)
30-1000	15926.25	49.17	74	24.83	Horizontal	Peak	20.5
30-1000	15928.59	48.67	74	25.33	Vertical	Peak	20.6

2440MHz (Above 1GHz)

Invested Frequency Range (MHz)	Frequency (MHz)	Maximum Emission Observed(dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization	Detector	Factor (dB/m)
30-1000	15950.16	48.19	74	25.81	Horizontal	Peak	20.8
30-1000	15951.56	48.25	74	25.75	Vertical	Peak	20.7

2480MHz (Above 1GHz)

Invested Frequency Range (MHz)	Frequency (MHz)	Maximum Emission Observed(dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization	Detector	Factor (dB/m)
30-1000	15881.25	46.85	74	27.15	Horizontal	Peak	19
30-1000	15926.72	48.34	74	25.66	Vertical	Peak	20.5

Remark:

(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 10dB below the permissible limits or the field strength is too small to be measured.
(3) Level=Reading Level + Correction 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

Site 1:

Conducted Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	68-4-74-14-001	101782	2020-6-28
LISN	Rohde & Schwarz	ENV432	68-4-87-16-001	101318	2020-7-19
Attenuator	Shanghai Huaxiang	TS2-26-3	68-4-81-16-003	080928189	2020-6-28
Test software	Rohde & Schwarz	EMC32	68-4-90-14-003-A10	Version9.15.00	N/A

TS8997 Test System

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	2020-6-28
Test software	Tonscend	System for BT/WIFI	68-4-74-14-006-A13	Version 2.5.77.0418	N/A

Radiated Spurious Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-003	101031	2020-6-28
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	68-4-80-14-003	708	2020-7-5
Horn Antenna	Rohde & Schwarz	HF907	68-4-80-14-004	102295	2020-7-5
Wideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	2020-7-5
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	2020-6-28
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	2020-7-16
Fully Anechoic Chamber	TDK	8X4X4	68-4-90-14-002	--	2020-7-7
Test software	Rohde & Schwarz	EMC32	68-4-90-14-002-A10	Version 9.15.00	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:

Site 1:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz	3.21dB
Uncertainty for Radiated Spurious Emission 30MHz-1000MHz	Horizontal: 5.12dB; Vertical: 5.10dB;
Uncertainty for Radiated Spurious Emission 1000MHz-18000MHz	Horizontal: 5.01dB; Vertical: 5.00dB
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10-7 or 1%

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