FCC/IC - TEST REPORT

Report Number	:	**68.940.15.016.01**	Date of Issue:	November 23, 2015
Model	:	**BTL301W**		
Product Type	:	MIPOW PLAYBULB SPHERE		
Applicant	:	Shenzhen Baojia Battery Technology Co.,Ltd		
Address	:	Block A, Yonghe Road, Tongfuyu Industrial Zone, Heping, Fuyong, Baoan, Shenzhen,China		
Production Facility	:	Shenzhen Baojia Battery Technology Co.,Ltd		
Address	:	Block A, Yonghe Road, Tongfuyu Industrial Zone, Heping, Fuyong, Baoan, Shenzhen,China		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages	:	25		

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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:	502708
IC Registration Number:	10320A
Telephone:	86 755 8828 6998
Fax:	86 755 8828 5299

Test Site 2:

Company name:	Dongguan Precise Testing Service Co., Ltd. Building D, Baoding Technology Park,Guangming Road2, Dongcheng District, Dongguan, Guangdong, China.
FCC Registration Number:	371540

Remark: All test items were performed at Site 2.

3 Description of the Equipment Under Test

Product:	MIPOW PLAYBULB SPHERE
Model no.:	BTL301W
FCC ID:	SL7BTL301W
Brand Name:	MIPOW
Rating Voltage:	DC 3.7V by Li-ion Battery
RF Transmission Frequency:	2402-2480MHz
No. of Operated Channel:	40
Modulation:	GFSK(BLE)
Antenna Type:	PCB
Antenna Gain:	3.0dBi
Description of the EUT:	The Equipment Under Test (EUT) is a lamp with Bluetooth function which operated at 2.4GHz.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2014 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 D01 DTS Meas Guidance v03r02 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
§15.207	Conducted emission AC power port	---	---	N/A
§15.247(b)(1)	Conducted peak output power	10	Site 2	Pass
§15.247(a)(2)	6dB bandwidth	11	Site 2	Pass
§15.247(a)(1)	20dB bandwidth and 99% 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(e)	Power spectral density*	13	Site 2	Pass
§15.247(d)	Spurious RF conducted emissions	14	Site 2	Pass
§15.247(d)	Band edge	20	Site 2	Pass
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter and receiver	22	Site 2	Pass
§15.203	Antenna requirement	See note 2		Pass

Note 1: N/A=Not Applicable.
Note 2: The EUT uses an Integral antenna, which gain is 3.0dBi. 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: SL7BTL301W 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 11, 2015

Testing Start Date: November 11, 2015

Testing End Date: November 20, 2015

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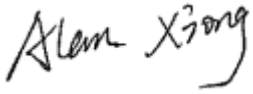
Reviewed by:

John Zhi
EMC Project Manager

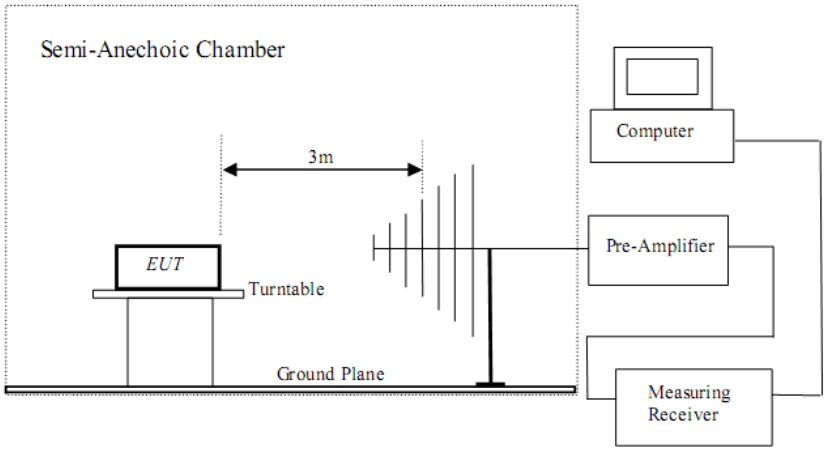
Prepared by:



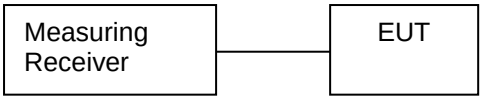
Alan Xiong
EMC Project Engineer

7 Test Setups

7.1 Radiated test setups



7.2 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

Name	Model No	S/N	Manufacturer	FCC
Notebook	Inspiron 14-3437	---	DELL	---

The system was configured to non-hopping mode.

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power

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9 Technical Requirement

9.1 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW > the 20 dB bandwidth of the emission being measured, VBW≥RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
2. Add a correction factor to the display.
3. 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

Limits

According to §15.247 (b) (1), conducted peak output power limit as below:

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

Bluetooth Mode BLE modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	-3.359	Pass
Middle channel 2442MHz	-1.758	Pass
High channel 2480MHz	-1.162	Pass

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9.2 6dB bandwidth

Test Method

1. Use the following spectrum analyzer settings:
   RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. 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.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

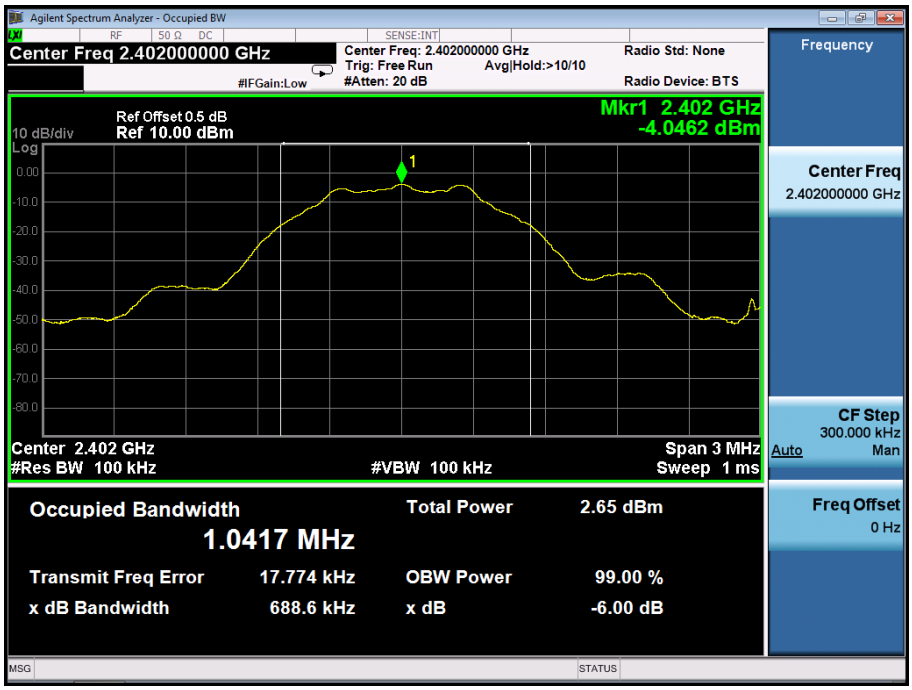
Limit

Limit [kHz]
≥500

Test result

Frequency MHz	6dB bandwidth kHz	Result
Top channel 2402MHz	688.6	Pass
Middle channel 2442MHz	690.5	Pass
Bottom channel 2480MHz	687.6	Pass

2402MHz



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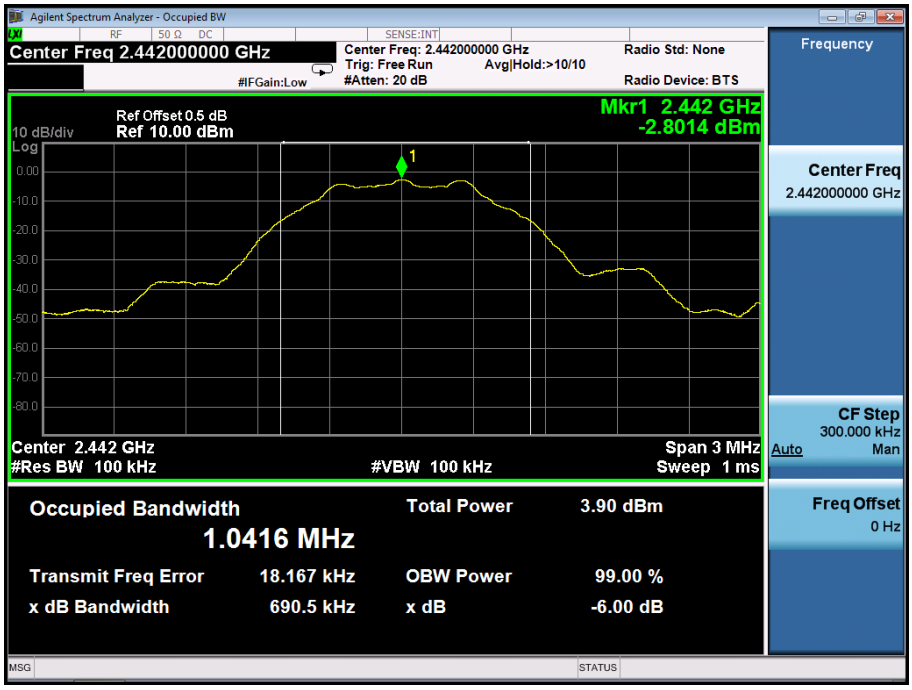
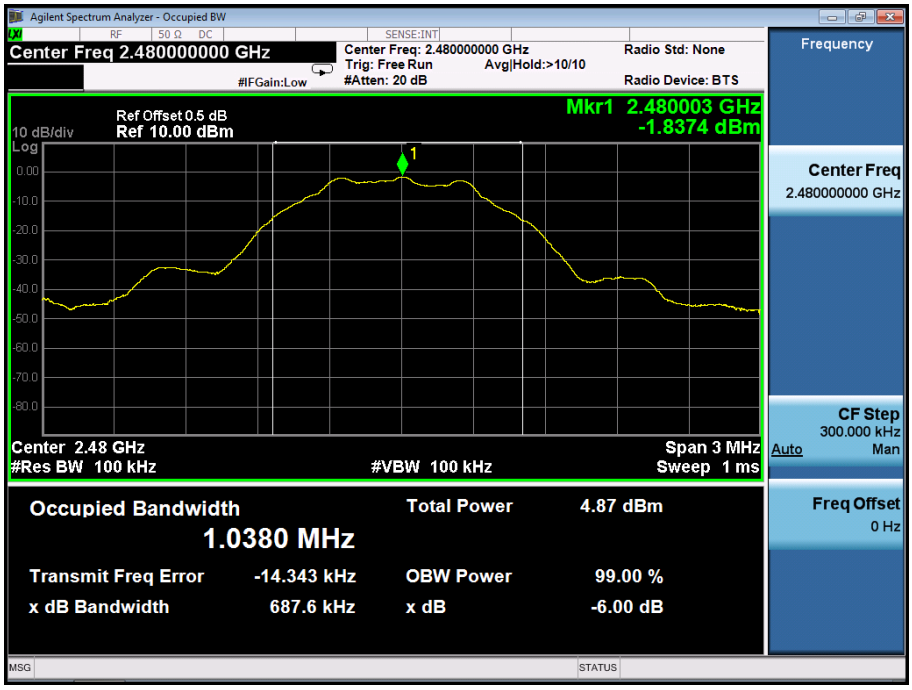
2442MHz



2480MHz



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9.3 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

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

Limit

Limit [dBm]
≤8

Test result

Frequency	Power spectral density	Result
MHz	**dBm**	
Low channel 2402MHz	-19.089	Pass
Middle channel 2442MHz	-18.358	Pass
High channel 2480MHz	-16.852	Pass

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9.4 Spurious RF conducted emissions

Test Method

1. 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≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

Limit

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

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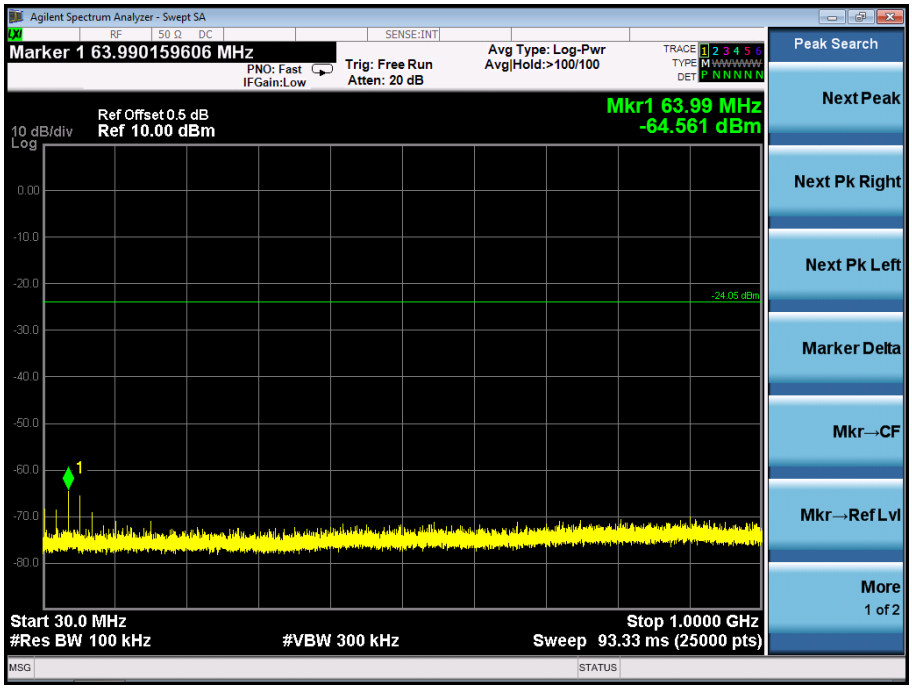
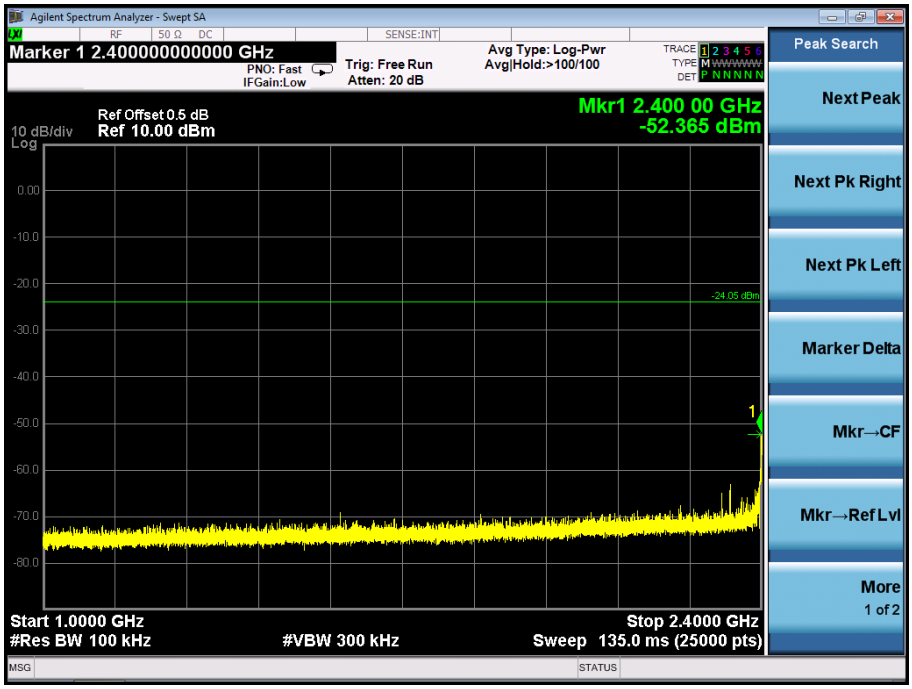
Spurious RF conducted emissions

2402MHz





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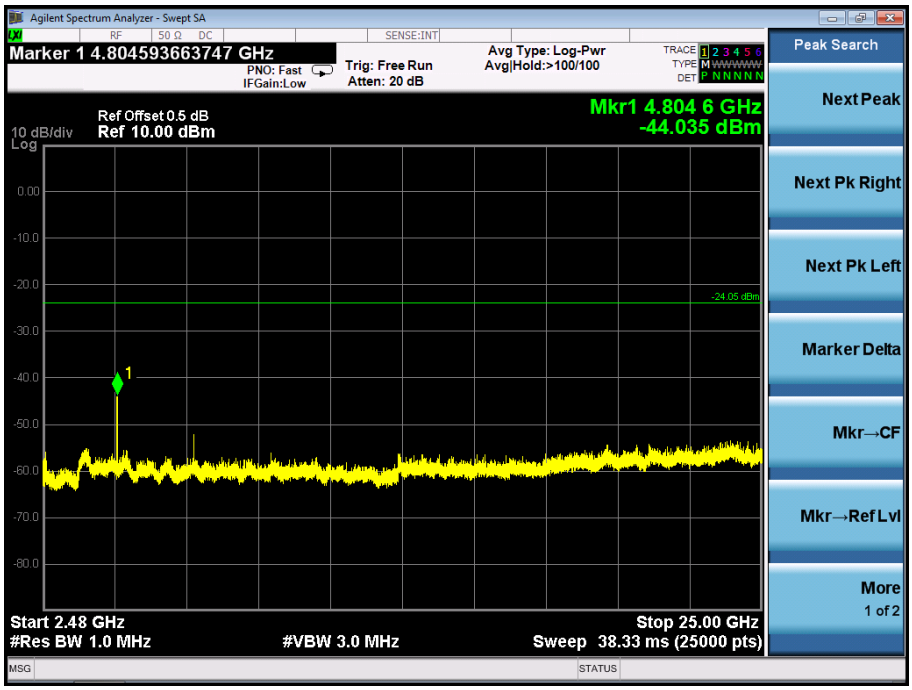
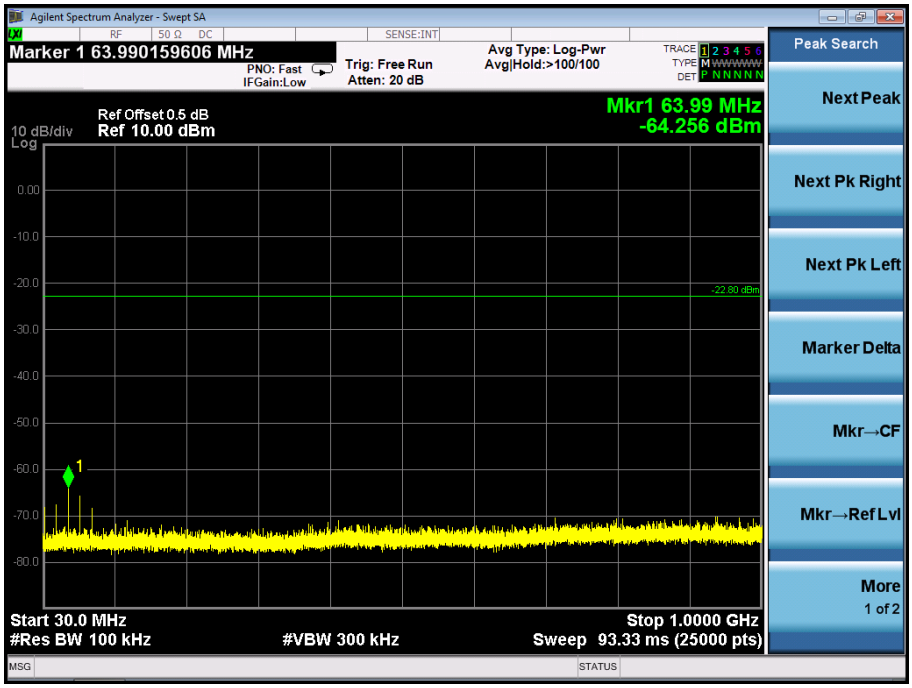
Spurious RF conducted emissions



2442MHz



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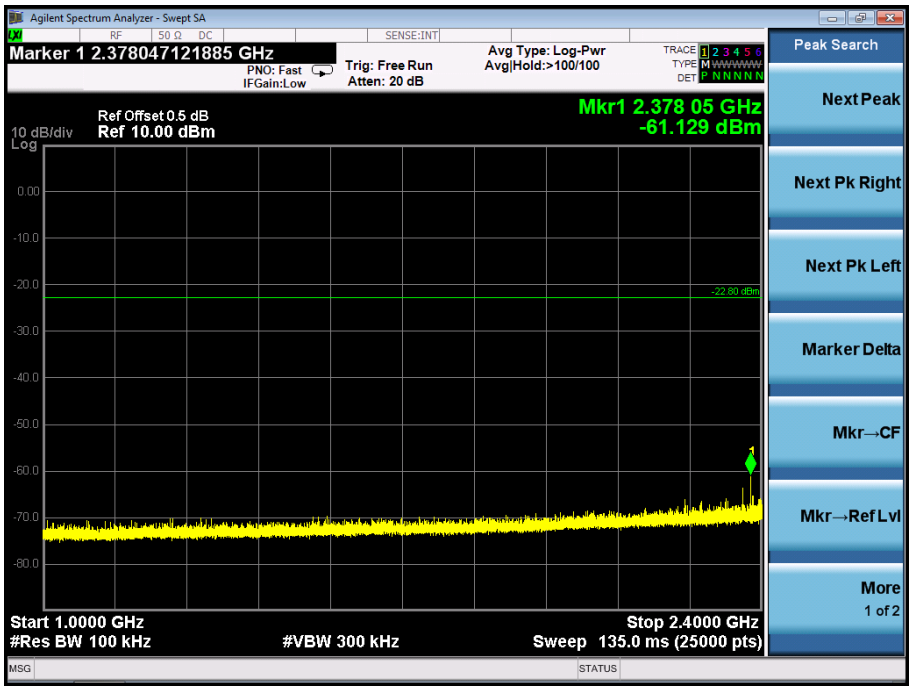
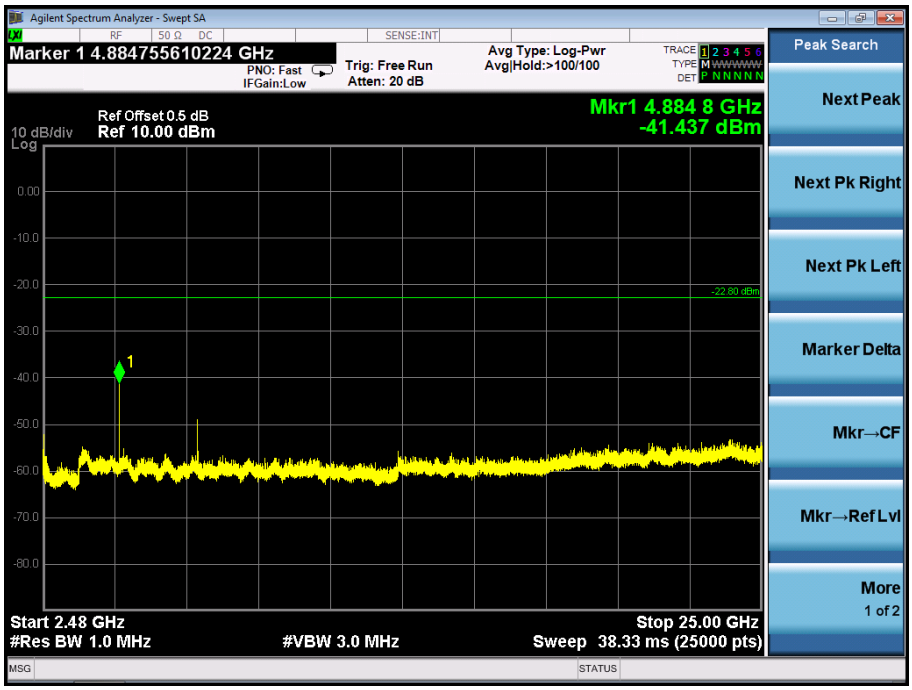
Spurious RF conducted emissions





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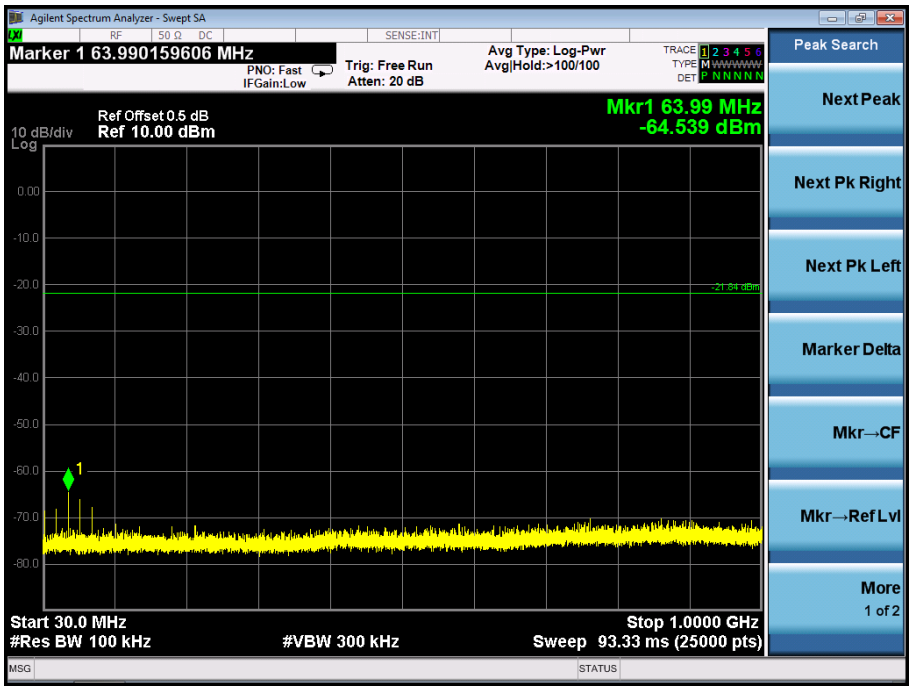
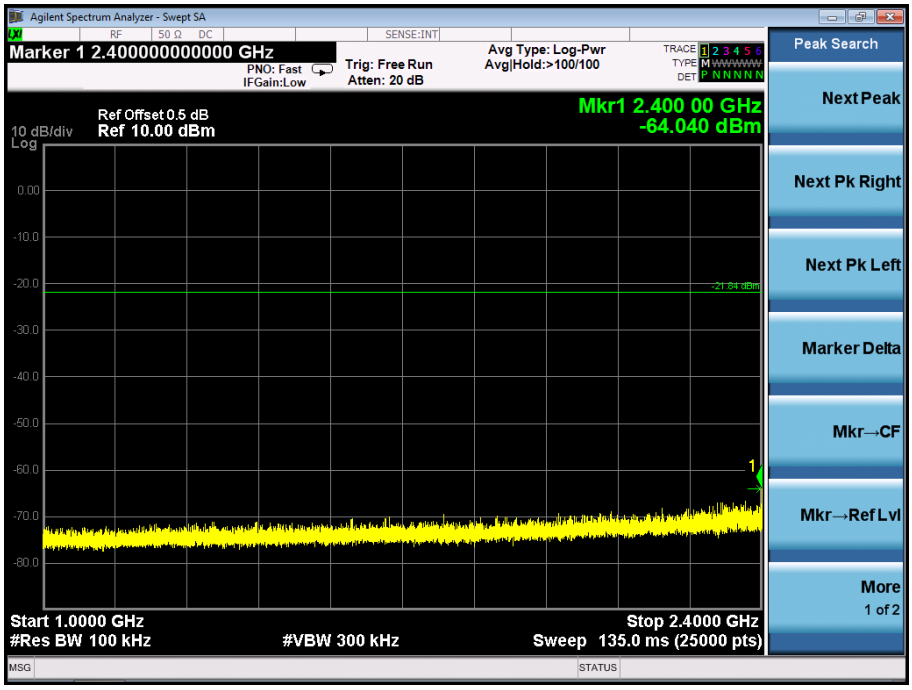
Spurious RF conducted emissions

2480MHz





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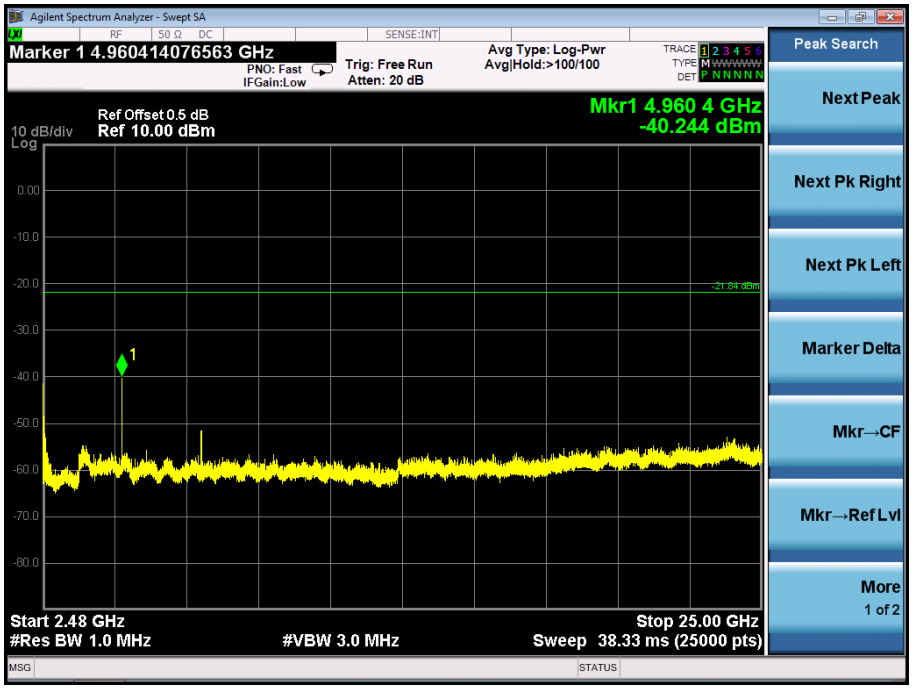
Spurious RF conducted emissions



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9.5 Band edge testing

Test Method

1 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, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
3 The level displayed must comply with the limit specified in this Section. .
4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

Limit:

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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) (see Section 15.205(c))

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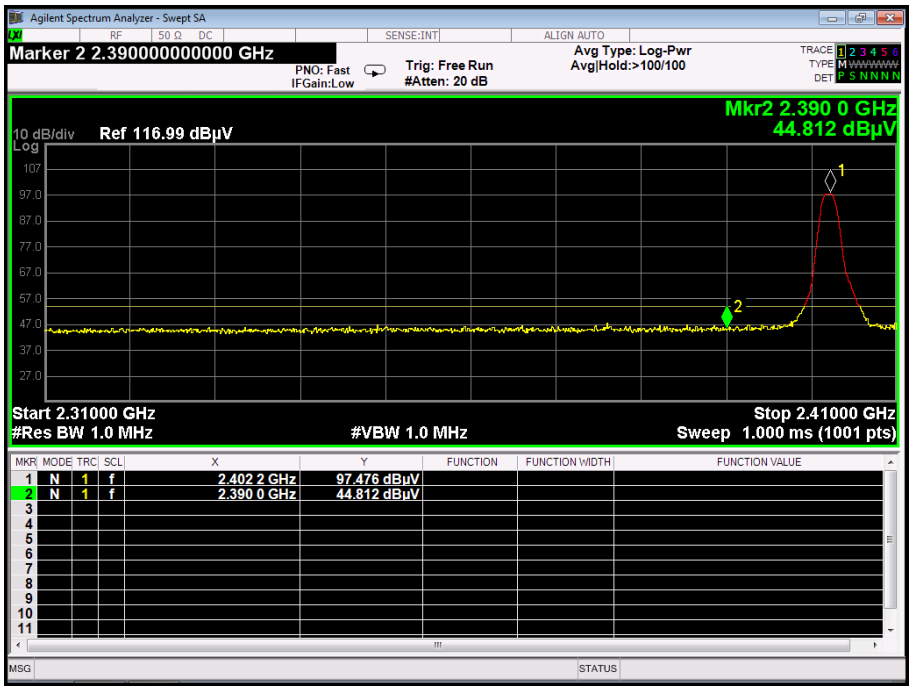
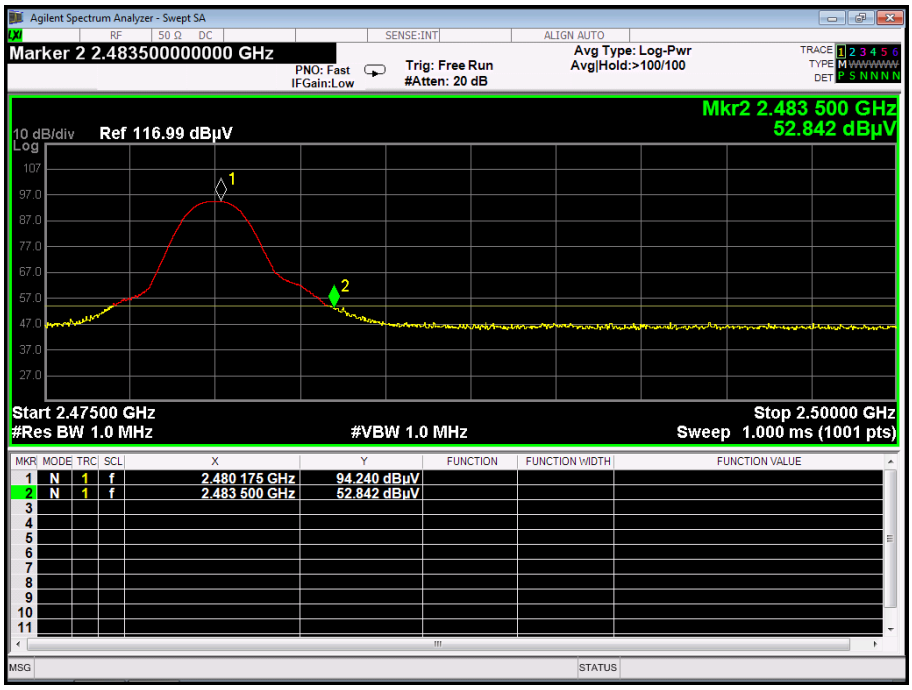
Band edge testing

BLE Modulation Test Result:





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9.6 Spurious radiated emissions for transmitter

Test Method

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
3. Use the following spectrum analyzer settings:
   Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Follow the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc.
   The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength,submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(duty cycle/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Limit

According to part 15.247(d), 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

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Spurious radiated emissions for transmitter and receiver

Transmitting spurious emission test result as below:

Low Channel-H

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Value Type
2402.013	106.85	-9.37	97.48	--	--	peak
2402.013	93.86	-9.37	84.49	--	--	AVG
4804.026	50.75	3.74	54.49	74	-19.51	peak
4804.026	41.67	3.74	45.41	54	-8.59	AVG
7206.039	39.52	8.14	47.66	74	-26.34	peak
7206.039	30.28	8.14	38.42	54	-15.58	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Low Channel-V

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Value Type
2402.013	104.21	-9.37	94.84	--	--	peak
2402.013	91.24	-9.37	81.87	--	--	AVG
4804.026	47.85	3.74	51.59	74	-22.41	peak
4804.026	39.25	3.74	42.99	54	-11.01	AVG
7206.039	40.12	8.14	48.26	74	-25.74	peak
7206.039	31.28	8.14	39.42	54	-14.58	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Middle Channel-H

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Value Type
2441.016	106.25	-9.63	96.62	--	--	peak
2441.016	92.86	-9.63	83.23	--	--	AVG
4882.032	50.12	3.76	53.88	74	-20.12	peak
4882.032	41.34	3.76	45.1	54	-8.9	AVG
7323.048	43.86	8.17	52.03	74	-21.97	peak
7323.048	33.16	8.17	41.33	54	-12.67	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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10 Test Equipment List

List of Test Instruments

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
C	EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 3, 2016
RE	EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 3, 2016
	Trilog Broadband Antenna (25M-1GHz)	SCHWARZBECK	VULB9160	9160-3355	July 3, 2016
	Signal Amplifier	SCHWARZBECK	BBV 9475	9745-0013	July 3, 2016
	RF Cable	SCHWARZBECK	AK9515E	96221	July 3, 2016
	3m Anechoic Chamber	CHENGYU	966	PTS-001	June 5, 2016
	MULTI-DEVICE Positioning Controller	Max-Full	MF-7802	MF780208339	N/A
	Active loop antenna (9K-30MHz)	Schwarzbeck	FMZB1519	1519-038	June 5, 2016
	Spectrum analyzer	Agilent	E4407B	MY46185649	June 5, 2016
	Horn Antenna (1G-18GHz)	SCHWARZBECK	BBHA9120D	9120D-1246	June 5, 2016
	Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170	9170-181	June 5, 2016

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth and 99% bandwidth
- Power spectral density
- Spurious RF conducted emissions
- Band edge

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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	
Items	**Extended Uncertainty**
Radiated Emissions Electric field 3 m distance	±3.80 dB
Conducted RF test	Power level test involved: 2.04dB Frequency test involved:1.1×10^{-7}

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