

FCC - TEST REPORT

Report Number : **60.790.16.111.02R01** Date of Issue : September 21, 2017

Model : Wae Outdoor 04Plus FM

Product Type : Bluetooth Speaker

Applicant : Guillemot Corporation S.A.

Address : Place du Granier BP 97143, 35571 Chantepie, FRANCE

Production Facility : Guillemot Corporation S.A.

Address : Place du Granier BP 97143, 35571 Chantepie, FRANCE

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

Total pages including Appendices : 84

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2. Details about the Test Laboratory

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
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Telephone: 86 755 8828 6998
Fax: 86 755 828 5299

FCC Registration No.: 514049

3. Description of Equipment Under Test

Description of the Equipment Under Test

Product:	Bluetooth Speaker
Model no.:	Wae Outdoor 04Plus FM
FCC ID:	NAM5063275
Rating:	1) 3.7VDC (1 x 3.7VDC Rechargeable battery) 2) 5.0VDC (USB port)
Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Antenna Type:	Integrated antenna
Antenna gain:	0 dBi
Number of operated channel:	79
Modulation:	GFSK

4. Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2016 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods for BDR+ERD were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000 and ANSI C63.10-2013.

All the test methods for BLE were according to 558074 D01 DTS Meas Guidance v04 DTS Measurement Guidance and ANSI C63.10 (2013).

5. Summary of Test Results

5.1. FCC Part 15 Subpart C BDR+EDR

Technical Requirements			
Test Condition		Pages	Test Result
§15.207	Conducted emission AC power port	27-28	Pass
§15.247(b)(1)	Conducted peak output power	38-40	Pass
§15.247(a)(1)	20dB bandwidth and 99% Occupied Bandwidth	30-32	Pass
§15.247(a)(1)	Min. of Hopping Channel Carrier Frequency Separation	63	Pass
§15.247(a)(1)(iii)	Min number of hopping frequencies	61	Pass
§15.247(a)(1)(iii)	Dwell Time - Average Time of Occupancy	65	Pass
§15.205, 15.209 & 15.247(d)	Spurious RF conducted emissions at antenna terminal	45-47	Pass
§15.247(d)	100kHz Bandwidth of band edges	52-55	Pass
§15.247(d) & §15.209 & 15.247(d)	Spurious radiated emissions for transmitter and receiver	12-18	Pass
§15.203 & 15.247(b)	Antenna requirement	70	Pass

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a Integrated antenna, which gain is 0.0dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

5.2. FCC Part 15 Subpart C - BLE

Technical Requirements					
Test Condition		Pages	Test Result		
			Pass	Fail	N/A
§15.207	Conducted emission AC power port	27-28	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247 (b) (1)	Conducted peak output power	41-43	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(a)(2)	6dB bandwidth and 99% Occupied Bandwidth	34-36	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(e)	Power spectral density	67-69	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d)	Spurious RF conducted emissions at antenna terminal	48-50	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d)	100kHz Bandwidth of band edges	56-59	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d) & §15.209	Spurious radiated emissions for transmitter	19-25	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.203 & 15.247(b)	Antenna requirement	70	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a Integrated antenna, which gain is 0.0dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

6. General Remarks

Remarks

This submittal(s) (test report) is intended for

FCC ID: NAM5063275 complies with :

Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules for the or DSS grant and

Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules for the DTS grant

Wae Outdoor 04Plus FM is a Bluetooth Speaker with Bluetooth 4.1+EDR. The TX and RX range is 2402MHz-2480MHz

Note: The report is for BDR+EDR and for BLE for DSS and DTS grants respectively

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.

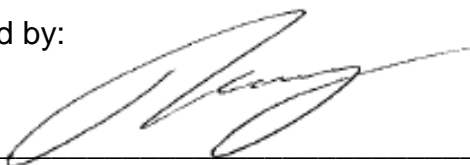
Sample Received Date: July 3, 2017

Testing Start Date: July 4, 2017

Testing End Date: August 11, 2017

- TÜV SÜD HONG KONG LTD. -

Reviewed by:



TSENG Chi Kit
EMC Project Engineer



Prepared by:

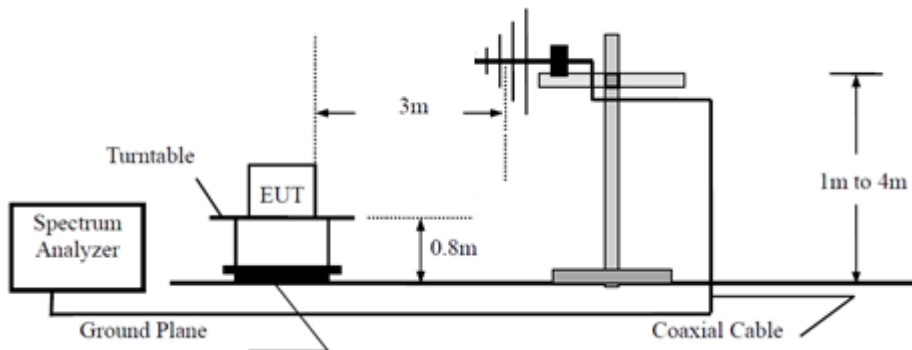


CHAN Kwan Ho Alex
EMC Project Engineer

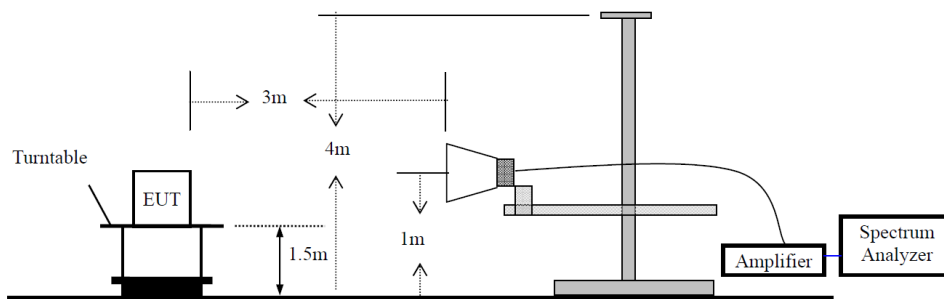
7. Test Setups

7.1. Radiated test setups

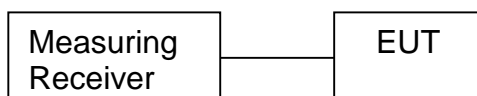
Below 1GHz



7.2. Above 1GHz



7.3. Conducted RF test setups



8. Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Notebook	lenovo	X220	---
Adapter	---	---	

Test software: CRS test tool, which used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status) EDR mode

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

9. Emission Test Results

9.1. Spurious Radiated Emission for Transmitter

Test Method

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

For 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 and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

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, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

- 1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
- 3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ($20\log(1/\text{duty cycle})$).
- 4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2402-2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Antenna: Horizontal / Vertical
 Comment: 3.7VDC
 Remark: 9kHz to 1GHz

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Antenna: Horizontal

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
59.100	20.94	40.0	-19.06	Quasi Peak
149.633	25.86	43.5	-17.64	Quasi Peak
175.716	27.47	43.5	-16.03	Quasi Peak
428.778	37.66	46.0	-8.34	Quasi Peak
853.425	26.73	46.0	-19.27	Quasi Peak

Antenna: Vertical

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
63.249	17.36	40.0	-22.64	Quasi Peak
153.244	20.36	43.5	-23.14	Quasi Peak
274.386	19.59	46.0	-26.41	Quasi Peak
426.299	32.69	46.0	-13.31	Quasi Peak
572.284	23.18	46.0	-22.82	Quasi Peak

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2402MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2282.062	39.64	74.0	-34.36	Peak
2282.062	26.73	54.0	-27.27	Average
2362.125	49.47	74.0	-24.53	Peak
2362.125	39.07	54.0	-14.93	Average
4804.218	51.47	74.0	-22.53	Peak
4804.218	42.63	54.0	-11.37	Average
6405.468	45.83	74.0	-28.17	Peak
6405.468	37.64	54.0	-16.36	Average
7206.562	52.52	74.0	-21.48	Peak
7206.562	42.68	54.0	-11.32	Average
14980.312	46.97	74.0	-27.03	Peak
14980.312	35.89	54.0	-18.11	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2402MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2282.062	38.26	74.0	-35.74	Peak
2282.062	29.72	54.0	-24.28	Average
2362.125	49.96	74.0	-24.04	Peak
2362.125	38.12	54.0	-15.88	Average
4803.750	48.97	74.0	-25.03	Peak
4804.218	41.09	54.0	-12.91	Average
6405.468	47.38	74.0	-26.62	Peak
6405.468	38.91	54.0	-15.09	Average
7206.625	49.62	74.0	-24.38	Peak
7206.562	40.15	54.0	-13.85	Average
17768.906	51.30	74.0	-22.70	Peak
17768.906	42.28	54.0	-11.72	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2441MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2320.937	43.05	74.0	-30.95	Peak
2320.937	32.84	54.0	-21.16	Average
2360.938	48.91	74.0	-25.09	Peak
2360.938	40.05	54.0	-13.95	Average
2521.125	45.74	74.0	-28.26	Peak
2521.125	35.62	54.0	-18.38	Average
4881.562	49.85	74.0	-24.15	Peak
4881.562	39.76	54.0	-14.24	Average
6509.062	45.47	74.0	-28.53	Peak
6509.062	36.18	54.0	-17.82	Average
7322.343	49.65	74.0	-24.35	Peak
7322.343	38.92	54.0	-15.08	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2441MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
2361.062	46.83	74.0	-27.17	Peak
2361.062	37.62	54.0	-16.38	Average
2560.875	42.63	74.0	-31.37	Peak
2560.875	32.38	54.0	-21.62	Average
4882.031	45.47	74.0	-28.53	Peak
4882.031	35.33	54.0	-18.67	Average
6509.531	47.97	74.0	-26.03	Peak
6509.531	38.07	54.0	-15.93	Average
7322.343	49.19	74.0	-24.81	Peak
7322.343	38.76	54.0	-15.24	Average
10019.062	40.54	74.0	-33.46	Peak
10019.062	31.74	54.0	-22.26	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2360.000	44.18	74.0	-29.82	Peak
2360.000	33.86	54.0	-20.14	Average
2560.062	46.74	74.0	-27.26	Peak
2560.062	35.61	54.0	-18.39	Average
4959.375	41.13	74.0	-32.87	Peak
4959.375	30.92	54.0	-23.08	Average
6613.125	46.59	74.0	-27.41	Peak
6613.125	37.77	54.0	-16.23	Average
7440.468	42.47	74.0	-31.53	Peak
7440.468	33.12	54.0	-20.88	Average
12432.187	44.09	74.0	-29.91	Peak
12432.187	33.84	54.0	-20.16	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2359.875	44.60	74.0	-29.40	Peak
2359.875	33.71	54.0	-20.29	Average
2560.000	48.12	74.0	-25.88	Peak
2560.000	37.97	54.0	-16.03	Average
4959.843	40.53	74.0	-33.47	Peak
4959.843	30.28	54.0	-23.72	Average
6613.125	48.64	74.0	-25.36	Peak
6613.120	38.22	54.0	-15.78	Average
7440.468	40.04	74.0	-33.96	Peak
7440.468	29.83	54.0	-24.17	Average
11043.750	41.93	74.0	-32.07	Peak
11043.750	32.07	54.0	-21.93	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2402MHz-2480)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Antenna: Horizontal / Vertical
 Comment: 3.7VDC
 Remark: 9kHz to 30MHz

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Antenna: Horizontal

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
59.100	22.25	40.0	-17.75	Quasi Peak
149.635	24.63	43.5	-18.87	Quasi Peak
175.752	27.08	43.5	-16.42	Quasi Peak
428.425	35.87	46.0	-10.13	Quasi Peak
853.807	27.21	46.0	-18.79	Quasi Peak

Antenna: Vertical

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
63.332	18.09	40.0	-21.91	Quasi Peak
153.147	21.22	43.5	-22.28	Quasi Peak
274.251	20.63	46.0	-25.37	Quasi Peak
426.394	31.81	46.0	-14.19	Quasi Peak
571.885	22.77	46.0	-23.23	Quasi Peak

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2402MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2322.062	44.60	74.0	-29.40	Peak
2322.062	34.11	54.0	-19.89	Average
2361.875	48.72	74.0	-25.28	Peak
2361.875	37.35	54.0	-16.65	Average
2562.062	41.73	74.0	-32.27	Peak
2562.062	32.07	54.0	-21.93	Average
4803.750	54.24	74.0	-19.76	Peak
4803.750	44.70	54.0	-9.30	Average
6405.468	48.45	74.0	-25.55	Peak
6405.468	39.71	54.0	-14.29	Average
7205.156	53.23	74.0	-20.77	Peak
7205.156	43.69	54.0	-10.31	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2402MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2322.000	38.26	74.0	-35.74	Peak
2322.000	29.19	54.0	-24.81	Average
2362.062	47.90	74.0	-26.10	Peak
2362.062	36.48	54.0	-17.52	Average
2601.750	35.28	74.0	-38.72	Peak
2601.750	26.22	54.0	-27.78	Average
4803.281	51.19	74.0	-22.81	Peak
4803.281	40.10	54.0	-13.90	Average
6405.468	49.15	74.0	-24.85	Peak
6405.468	38.22	54.0	-15.78	Average
7206.093	53.56	74.0	-20.44	Peak
7206.093	44.81	54.0	-9.19	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2440MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2359.875	43.49	74.0	-30.51	Peak
2359.875	32.74	54.0	-21.26	Average
2519.812	50.79	74.0	-23.21	Peak
2519.812	40.11	54.0	-13.89	Average
4879.218	48.31	74.0	-25.69	Peak
4879.218	37.88	54.0	-16.12	Average
6506.718	48.50	74.0	-25.50	Peak
6506.718	37.82	54.0	-16.18	Average
7319.531	47.29	74.0	-26.71	Peak
7319.531	37.56	54.0	-16.44	Average
17645.156	50.43	74.0	-23.57	Peak
17645.156	41.14	54.0	-12.86	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2440MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
2359.812	41.45	74.0	-32.55	Peak
2359.812	31.96	54.0	-22.04	Average
2520.000	42.86	74.0	-31.14	Peak
2520.000	33.10	54.0	-20.90	Average
4879.687	47.78	74.0	-26.22	Peak
4879.687	38.63	54.0	-15.37	Average
6506.718	51.09	74.0	-22.91	Peak
6506.718	40.85	54.0	-13.15	Average
7319.062	52.31	74.0	-21.69	Peak
7319.062	43.27	54.0	-10.73	Average
12461.718	42.02	74.0	-31.98	Peak
12461.718	31.73	54.0	-22.27	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2360.062	43.88	74.0	-30.12	Peak
2360.062	32.91	54.0	-21.09	Average
2559.812	49.81	74.0	-24.19	Peak
2559.812	40.07	54.0	-13.93	Average
4959.843	47.59	74.0	-26.41	Peak
4959.843	37.83	54.0	-16.17	Average
6613.125	48.26	74.0	-25.74	Peak
6613.125	38.61	54.0	-15.39	Average
7440.000	45.26	74.0	-28.74	Peak
7440.000	36.15	54.0	-17.85	Average
9385.312	40.43	74.0	-33.57	Peak
9385.312	30.25	54.0	-23.75	Average

Spurious Radiated Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 3.7VDC
 Remark: 1GHz to 25GHz

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
2359.750	40.08	74.0	-33.92	Peak
2359.750	31.26	54.0	-22.74	Average
2559.812	42.94	74.0	-31.06	Peak
2559.812	31.67	54.0	-22.33	Average
4959.843	41.38	74.0	-32.62	Peak
4959.843	30.83	54.0	-23.17	Average
6613.125	50.27	74.0	-23.73	Peak
6613.125	40.11	54.0	-13.89	Average
8772.187	42.52	74.0	-31.48	Peak
8772.187	32.10	54.0	-21.90	Average
11230.781	40.28	74.0	-33.72	Peak
11230.781	30.61	54.0	-23.39	Average

9.2. Conducted Emission

Test Method

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

Limit

According to §15.107, conducted emissions limit as below:

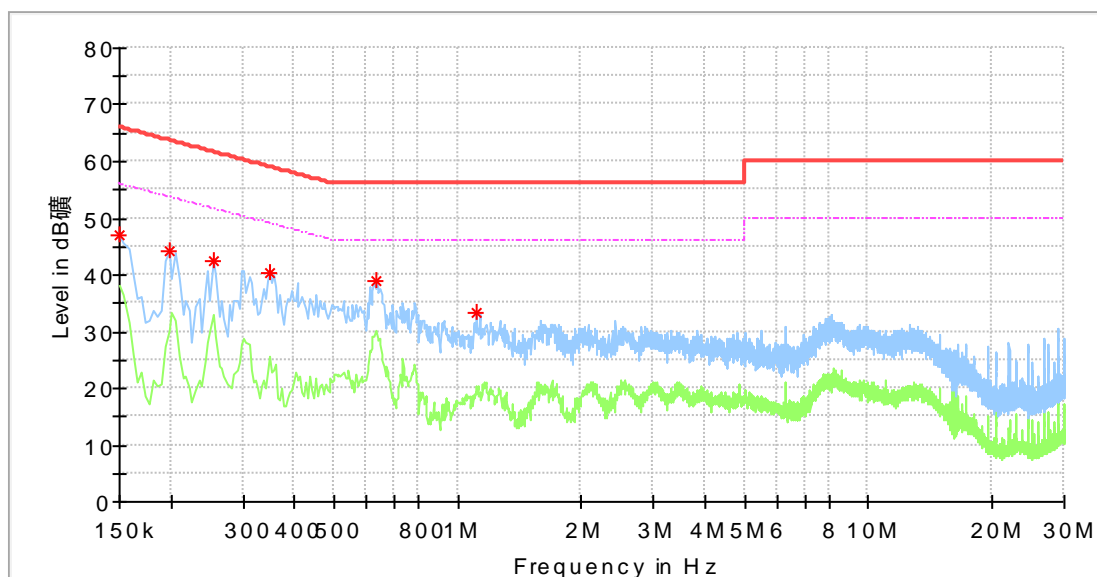
Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

*Decreasing linearly with logarithm of the frequency

Conducted Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, Normal Link
 Test Specification: FCC 15.207 Conduct Emission, L Line
 Comment: 120VAC, 60Hz (For external adaptor)

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

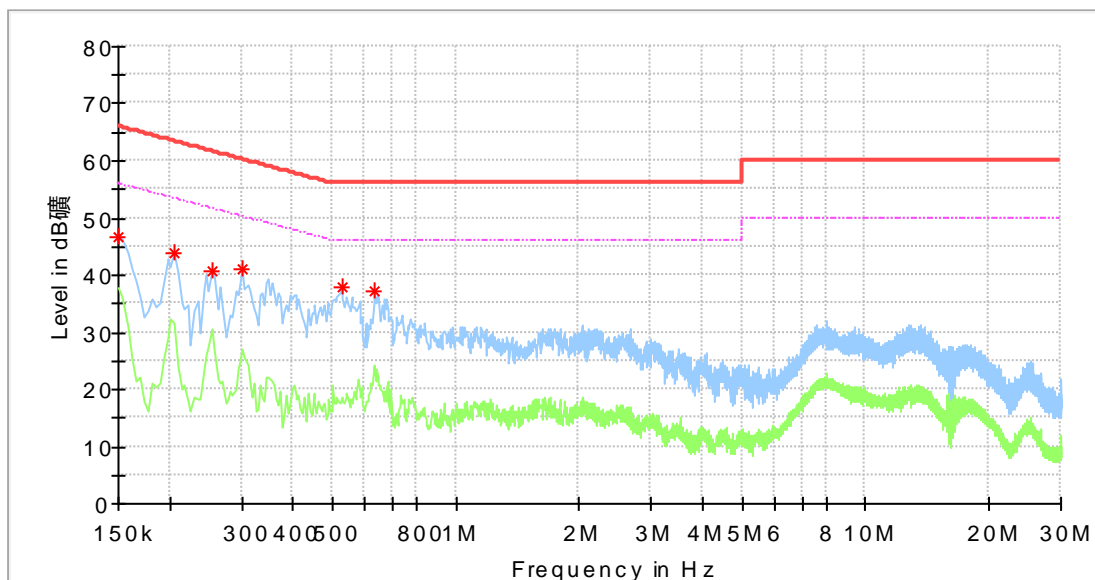


Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)
0.150000	47.13	---	66.00	18.87
0.198000	44.10	---	63.69	19.59
0.254000	42.36	---	61.63	19.27
0.350000	40.26	---	58.96	18.70
0.634000	39.06	---	56.00	16.94
1.110000	33.31	---	56.00	22.69

Conducted Emission

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, Normal Link
 Test Specification: FCC 15.207 Conduct Emission, N Line
 Comment: 120VAC, 60Hz (For external adaptor)

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed



Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)
0.150000	46.69	---	66.00	19.31
0.206000	43.88	---	63.37	19.48
0.254000	40.73	---	61.63	20.89
0.302000	41.09	---	60.19	19.10
0.526000	37.73	---	56.00	18.27
0.634000	37.29	---	56.00	18.71

9.3. 20dB & 99% Bandwidth

Test Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Limit

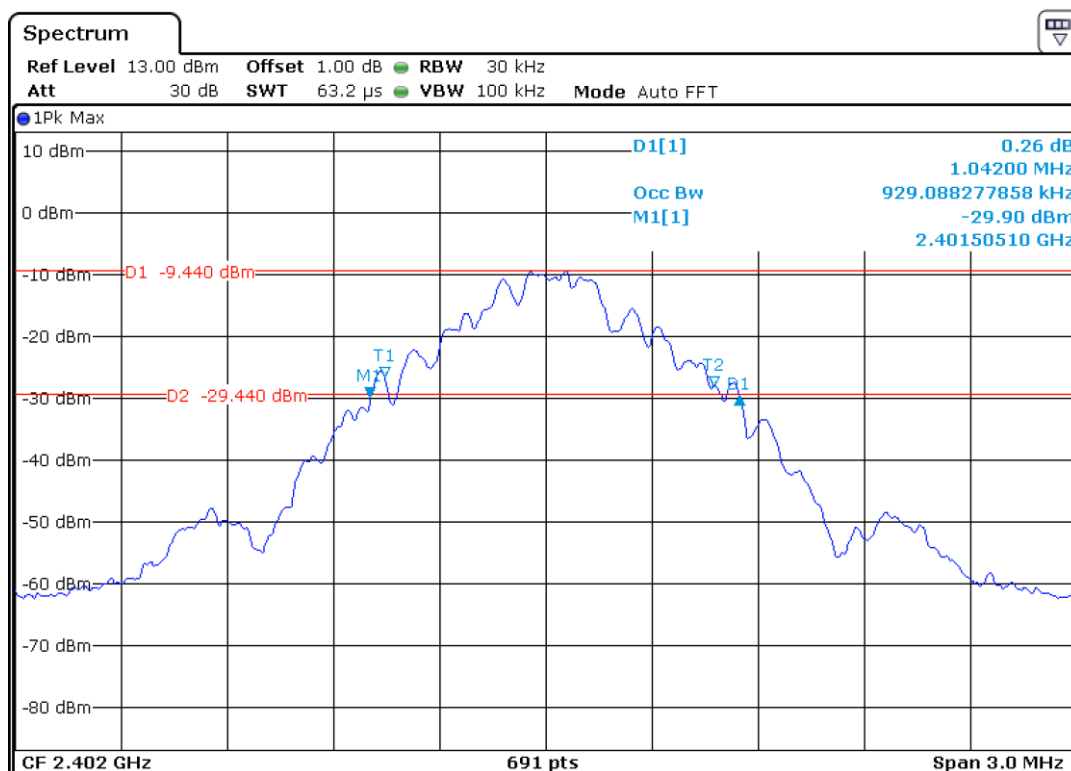
Limit [kHz]

N/A

20dB & 99% Bandwidth

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2402MHz)
 Test Specification: FCC15.247(a)(2), 20dB Bandwidth & 99% Bandwidth
 Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed

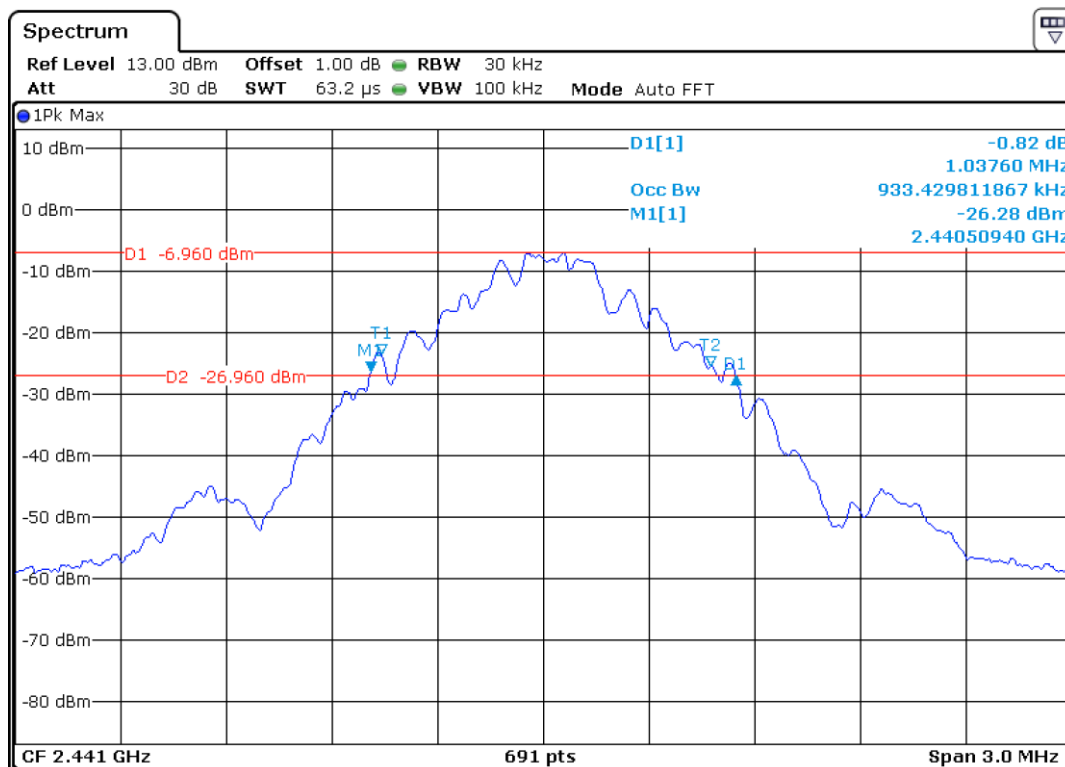


20dB bandwidth	99% bandwidth
1042.000 kHz	929.088 kHz

20dB & 99% Bandwidth

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2441MHz)
 Test Specification: FCC15.247(a)(2), 20dB Bandwidth & 99% Bandwidth
 Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed



20dB bandwidth	99% bandwidth
1037.600 kHz	933.429 kHz

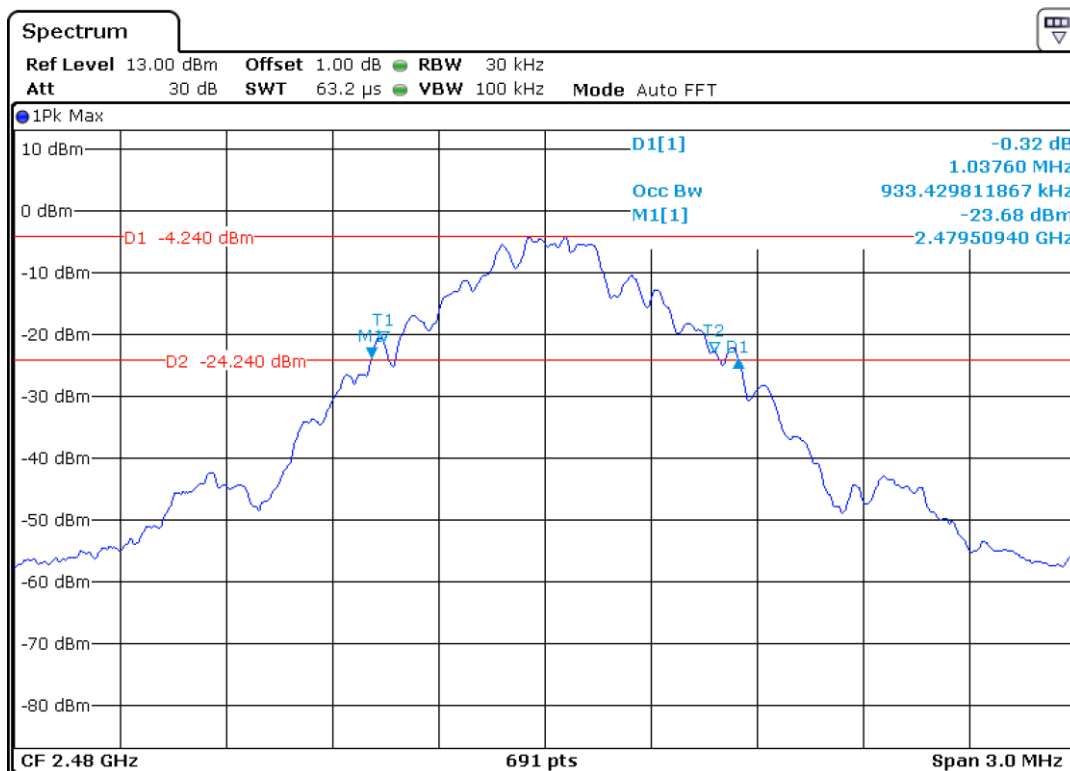
20dB & 99% Bandwidth

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2480MHz)
 Test Specification: FCC15.247(a)(2), 20dB Bandwidth & 99% Bandwidth
 Comment: 3.7VDC

Test Result

☒ Passed

☐ Not Passed



20dB bandwidth	99% bandwidth
1037.600 kHz	933.429 kHz

9.4. 6dB & 99% Bandwidth

Test Method

1. Use the following spectrum analyzer settings:
RBW=100K, VBW \geq 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 \geq 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]

≥ 500

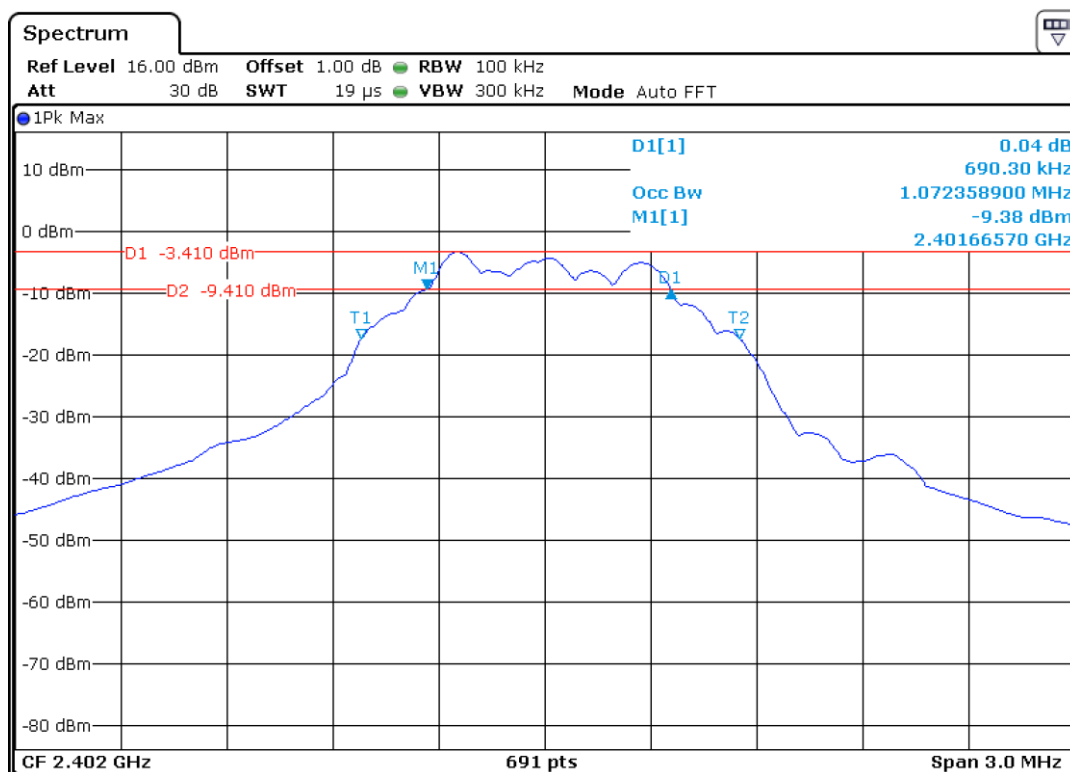
6dB & 99% Bandwidth

Test result

Frequency MHz	6dB bandwidth kHz	99 bandwidth kHz	Result
Bottom channel 2402MHz	703.3	1050.7	Pass
Middle channel 2440MHz	703.3	1046.3	Pass
Top channel 2480MHz	703.3	1046.3	Pass

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2402MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed



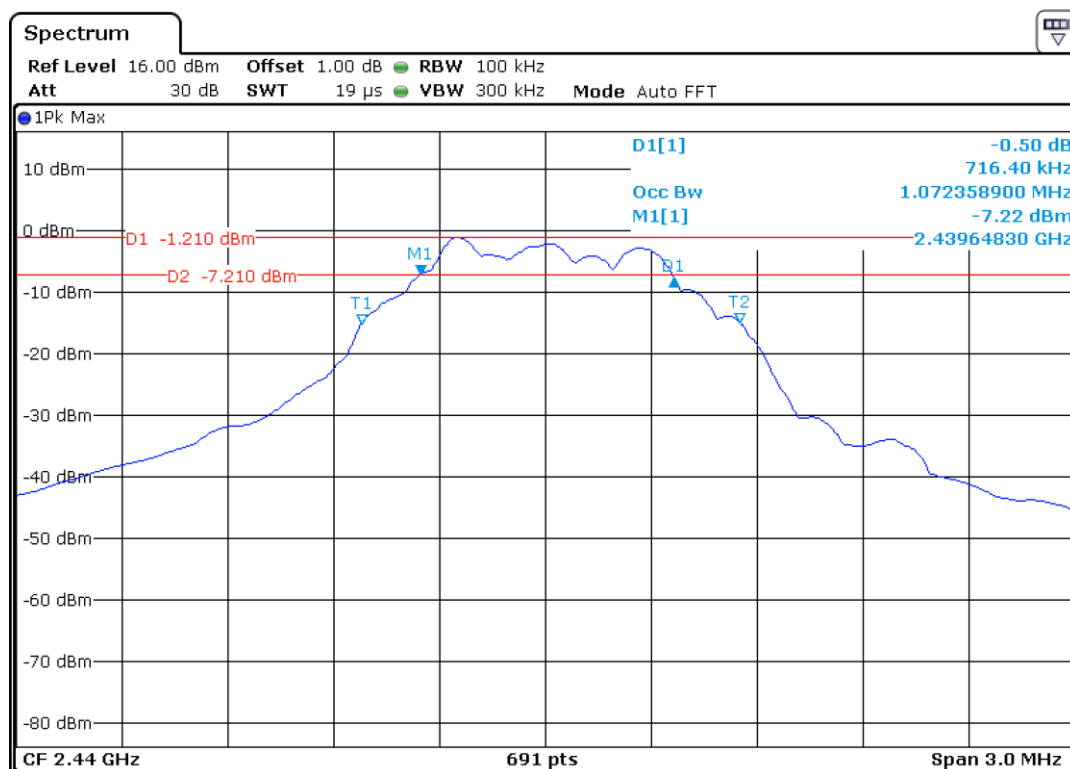
6dB bandwidth	Limit
690.300 kHz	>500 kHz

99% bandwidth
1072.358 kHz

6dB & 99% Bandwidth

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2440MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed



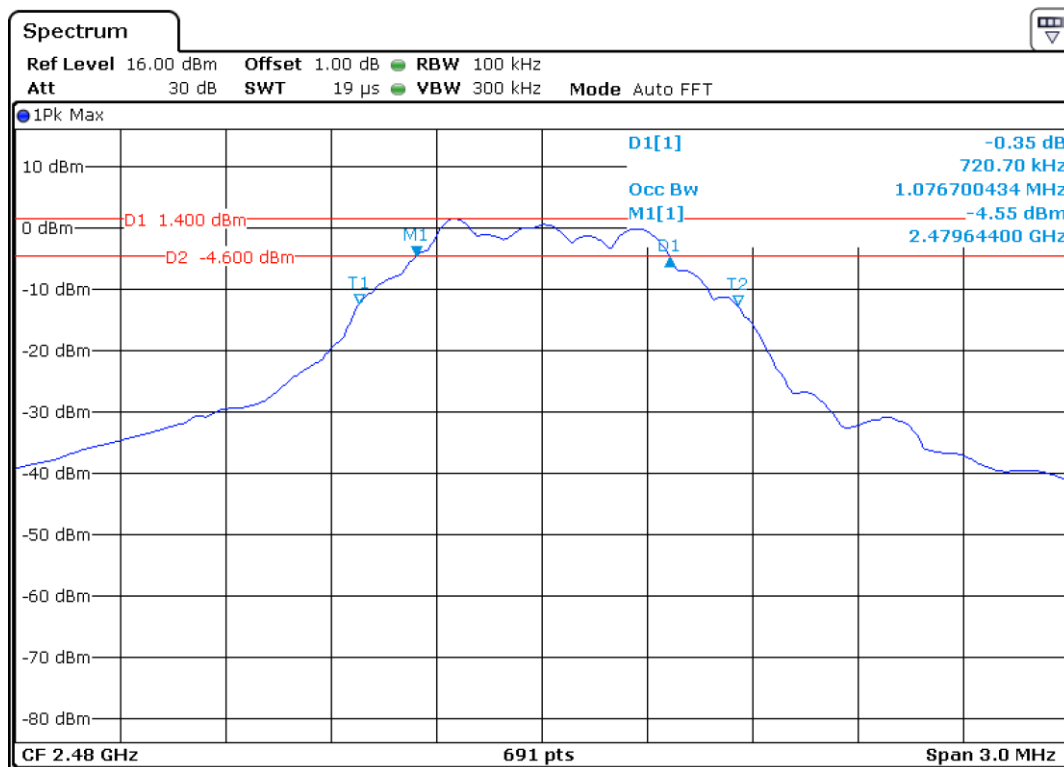
6dB bandwidth	Limit
716.400 kHz	>500 kHz

99% bandwidth
1072.358 kHz

6dB & 99% Bandwidth

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2480MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed



6dB bandwidth	Limit
720.700 kHz	>500 kHz

99% bandwidth
1076.700 kHz

9.5. 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

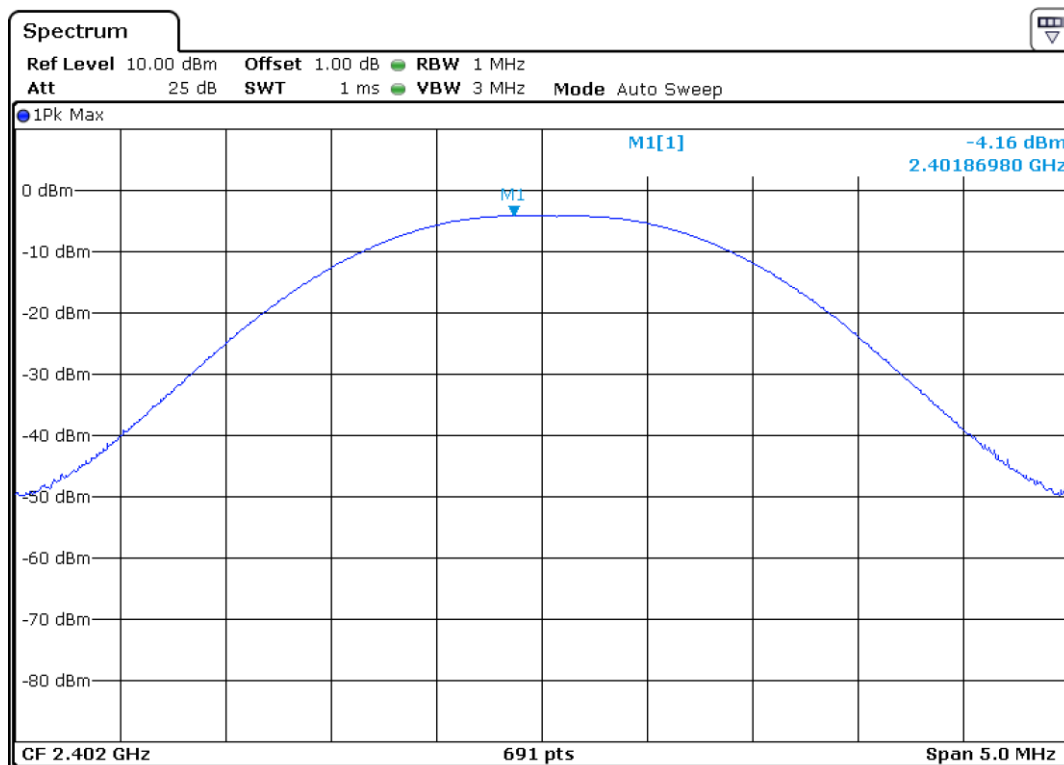
Limits

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

Conducted Peak Output Power

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2402MHz)
 Test Specification: FCC15.247(b)
 Comment: 3.7VDC, Antenna gain: 0 dBi, Cable Loss: 0.5dB

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

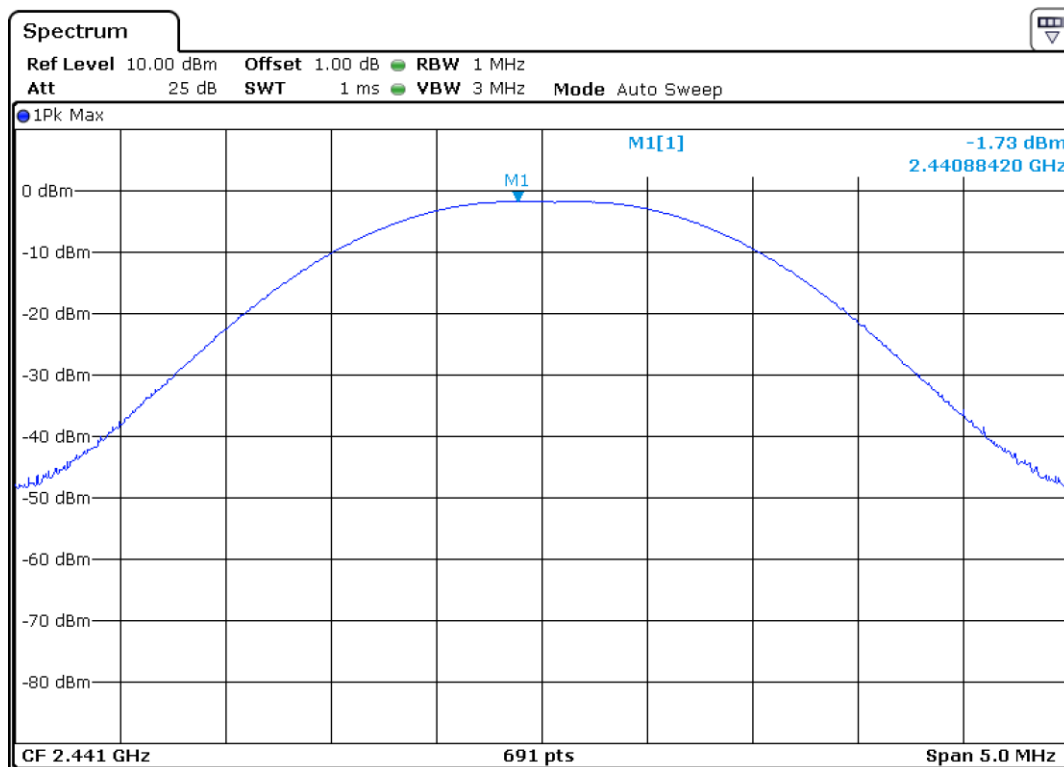


Conducted Output Power (dBm)	Conducted Output Power (mW)	Limit (mW)
-4.16	0.383	< 125.0

Conducted Peak Output Power

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2441MHz)
 Test Specification: FCC15.247(b)
 Comment: 3.7VDC, Antenna gain: 0 dBi, Cable Loss: 0.5dB

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

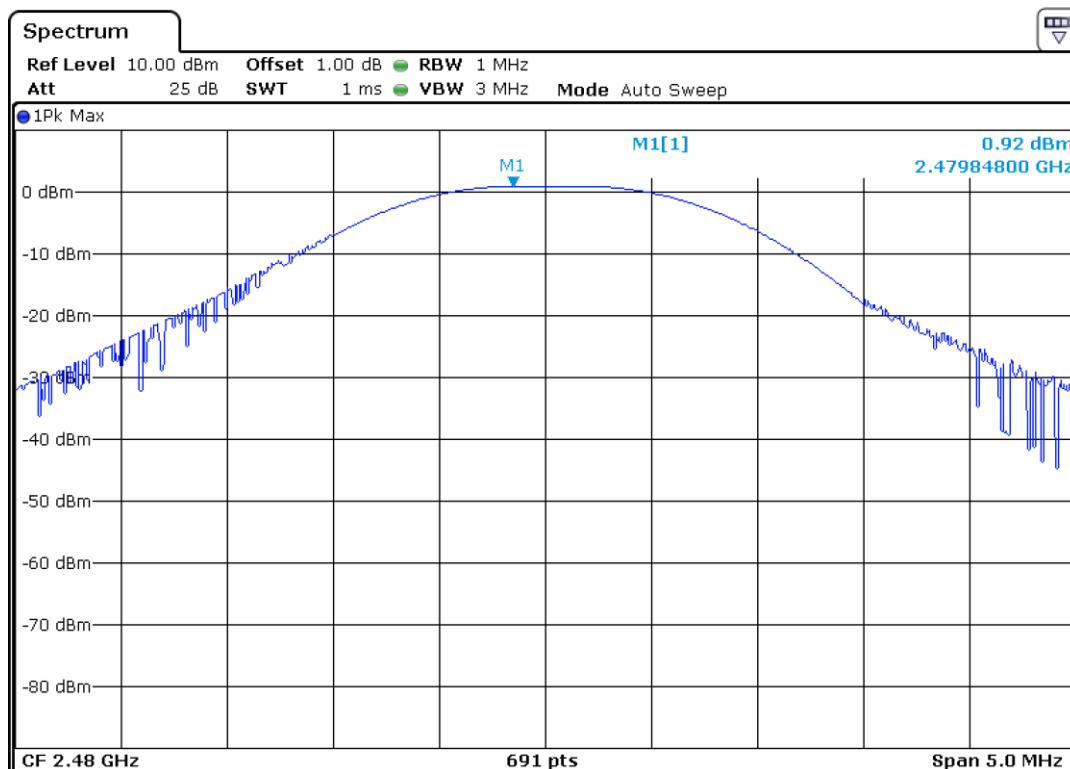


Conducted Output Power (dBm)	Conducted Output Power (mW)	Limit (mW)
-1.73	0.671	< 125.0

Conducted Peak Output Power

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2480MHz)
 Test Specification: FCC15.247(b)
 Comment: 3.7VDC, Antenna gain: 0 dBi, Cable Loss: 0.5dB

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

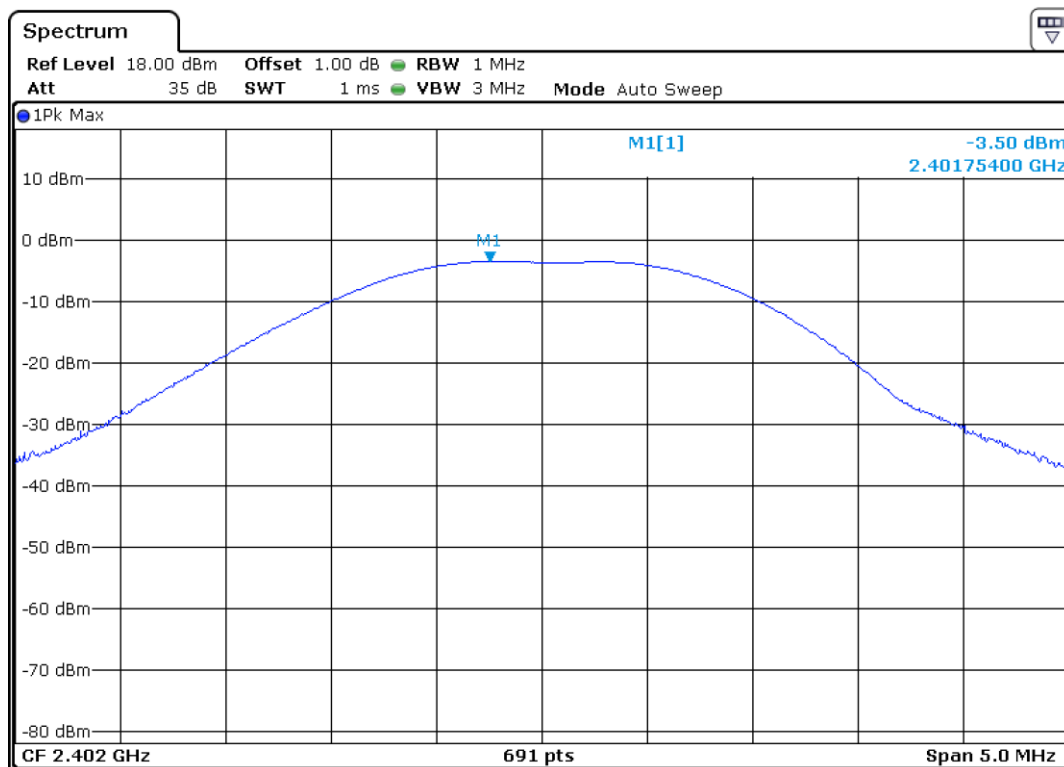


Conducted Output Power (dBm)	Conducted Output Power (mW)	Limit (mW)
0.92	1.236	< 125.0

Conducted Peak Output Power

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2402MHz)
 Test Specification: FCC15.247(b)
 Comment: 3.7VDC, Antenna gain: 0 dBi, Cable Loss: 0.5dB

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

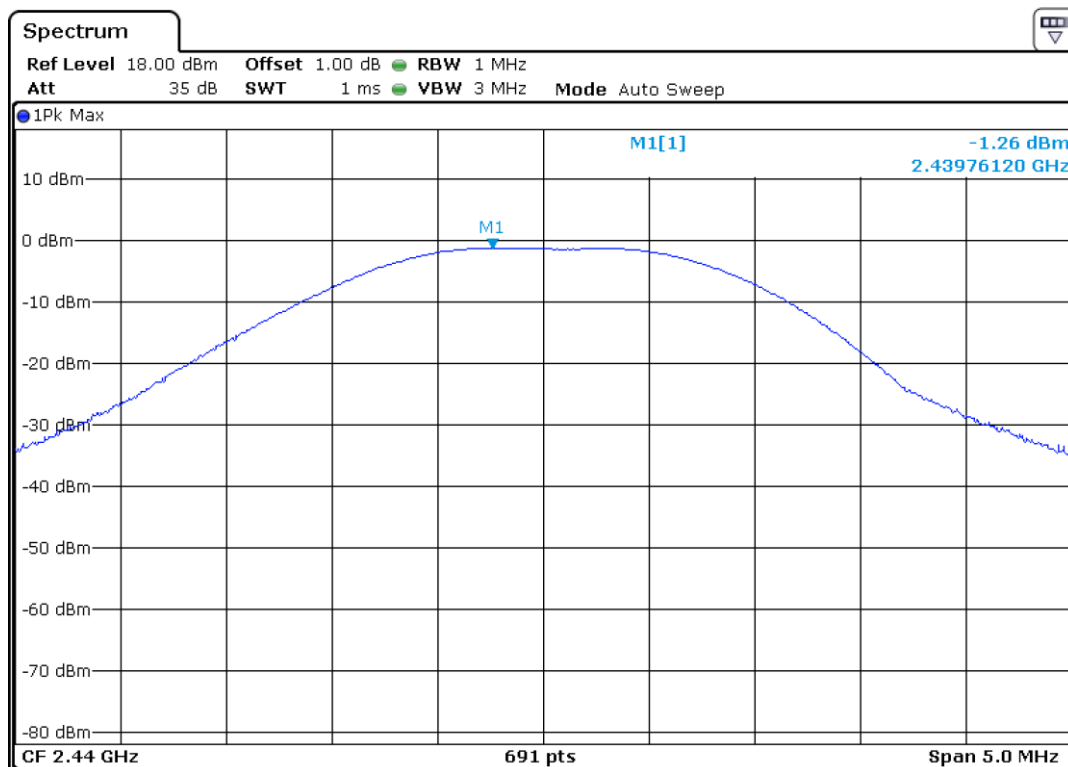


Conducted Output Power (dBm)	Limit (dBm)
-3.50	< 30

Conducted Peak Output Power

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2440MHz)
 Test Specification: FCC15.247(b)
 Comment: 3.7VDC, Antenna gain: 0 dBi, Cable Loss: 0.5dB

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

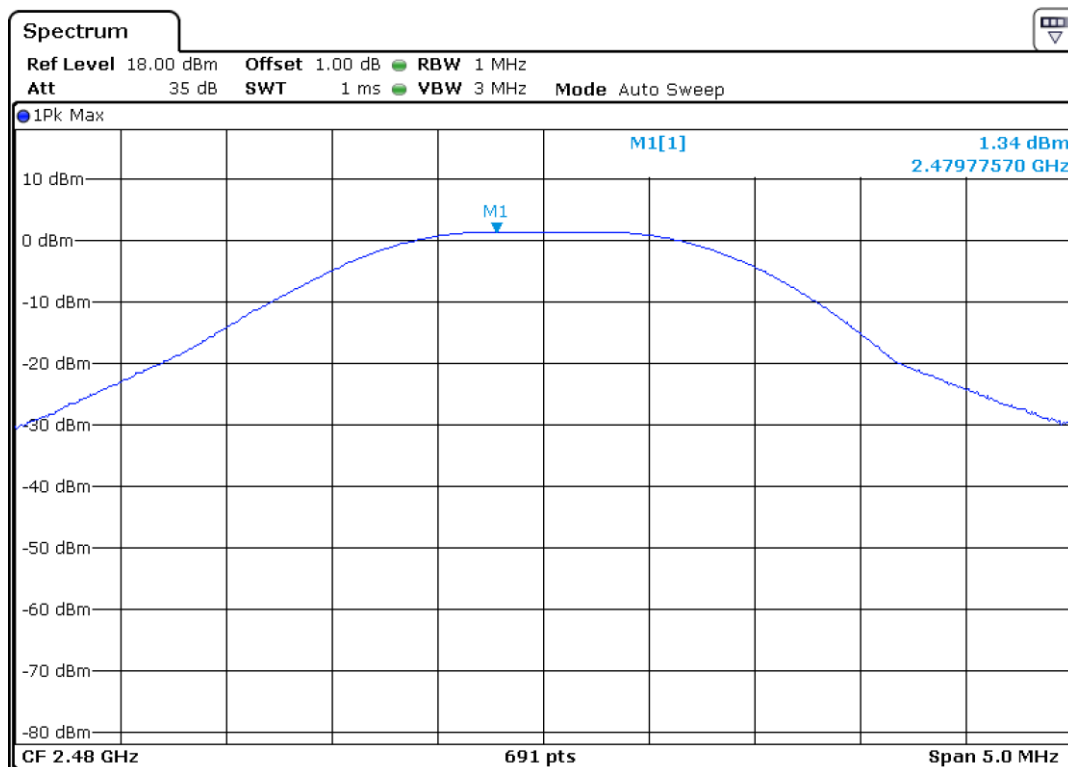


Conducted Output Power (dBm)	Limit (dBm)
-1.26	< 30

Conducted Peak Output Power

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE (2480MHz)
 Test Specification: FCC15.247(b)
 Comment: 3.7VDC, Antenna gain: 0 dBi, Cable Loss: 0.5dB

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed



Conducted Output Power (dBm)	Limit (dBm)
1.34	< 30

9.6. Spurious Emissions at Antenna Terminals

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.

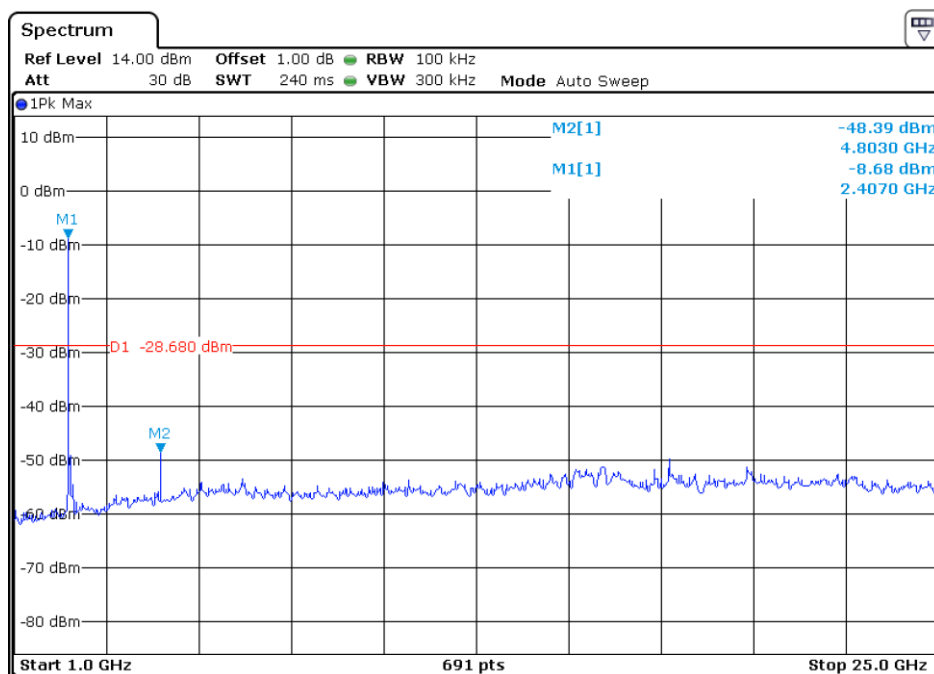
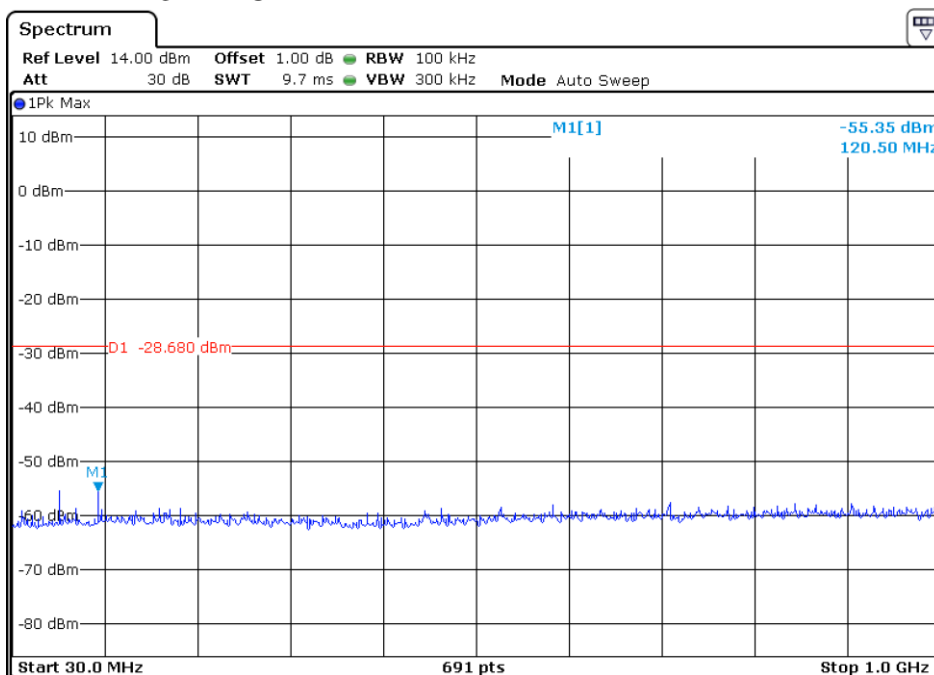
Limit

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

Spurious Emissions at Antenna Terminals

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2402MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed

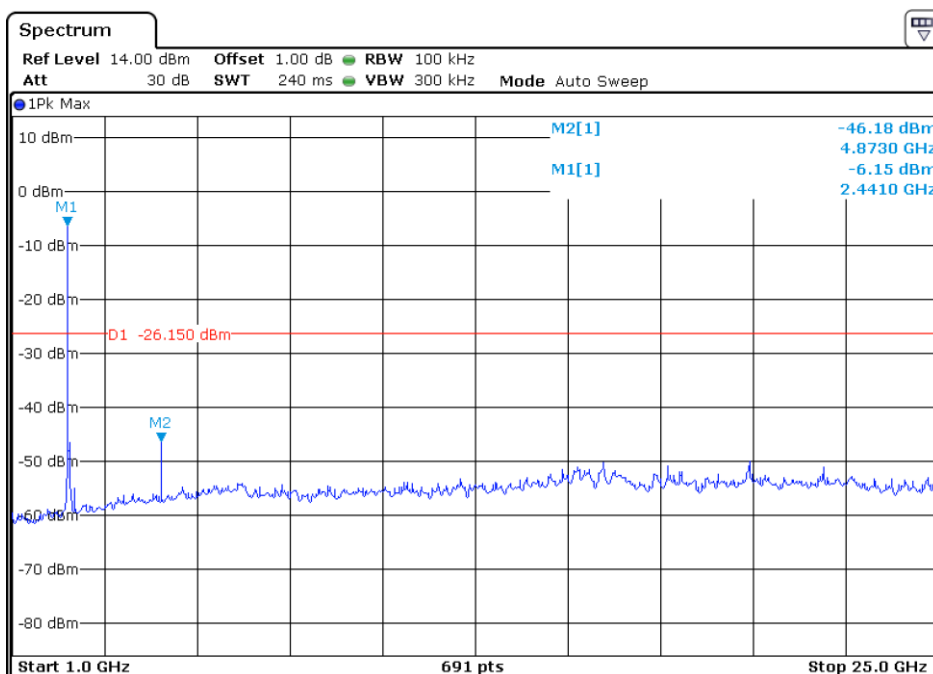
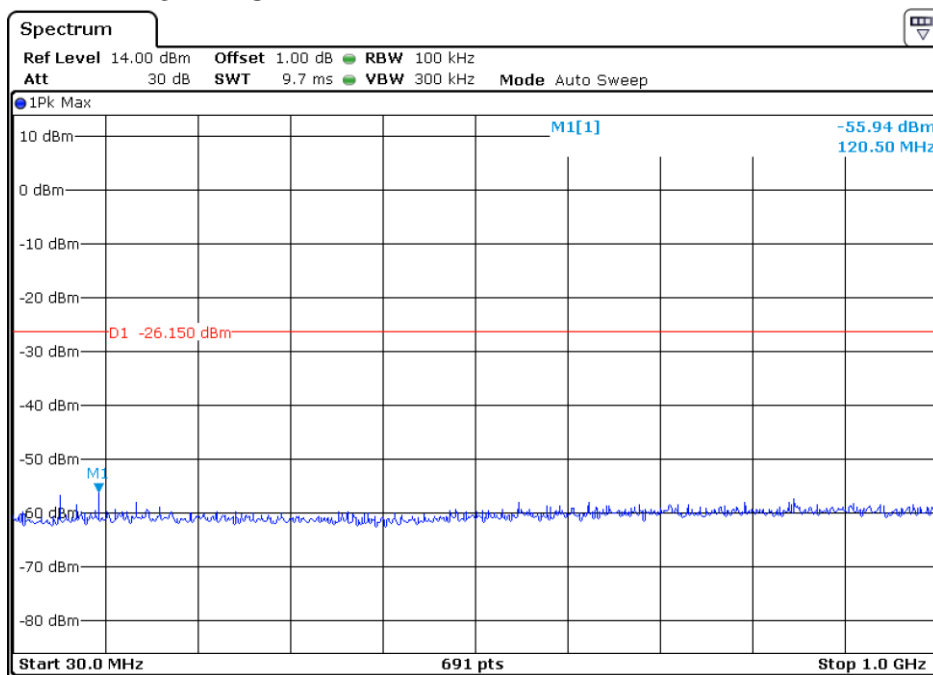


Limit: 20dB below the highest level of the desired power in the passband

Spurious Emissions at Antenna Terminals

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS (2441MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

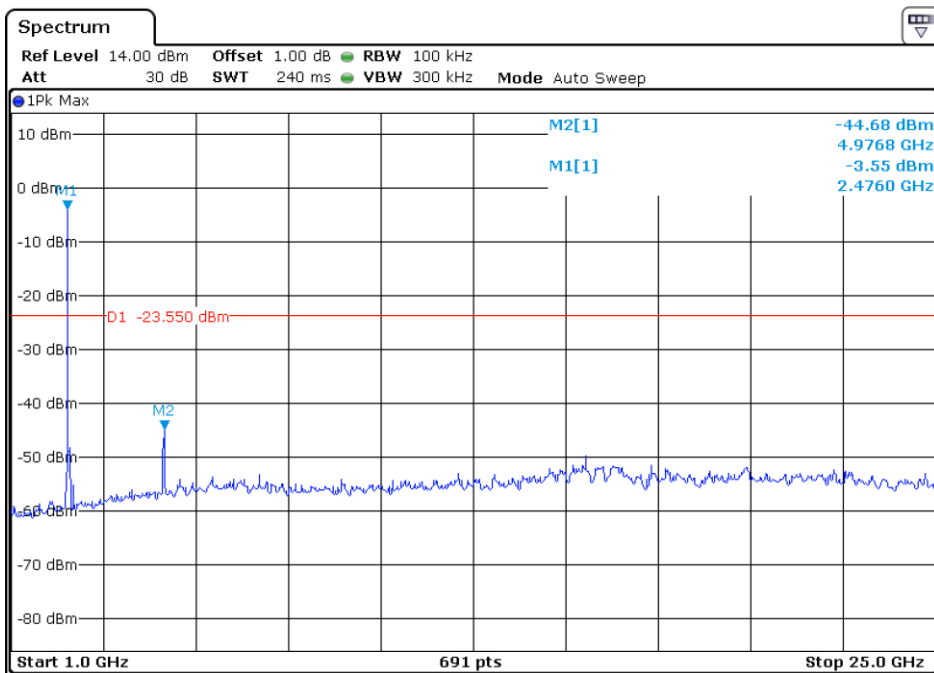
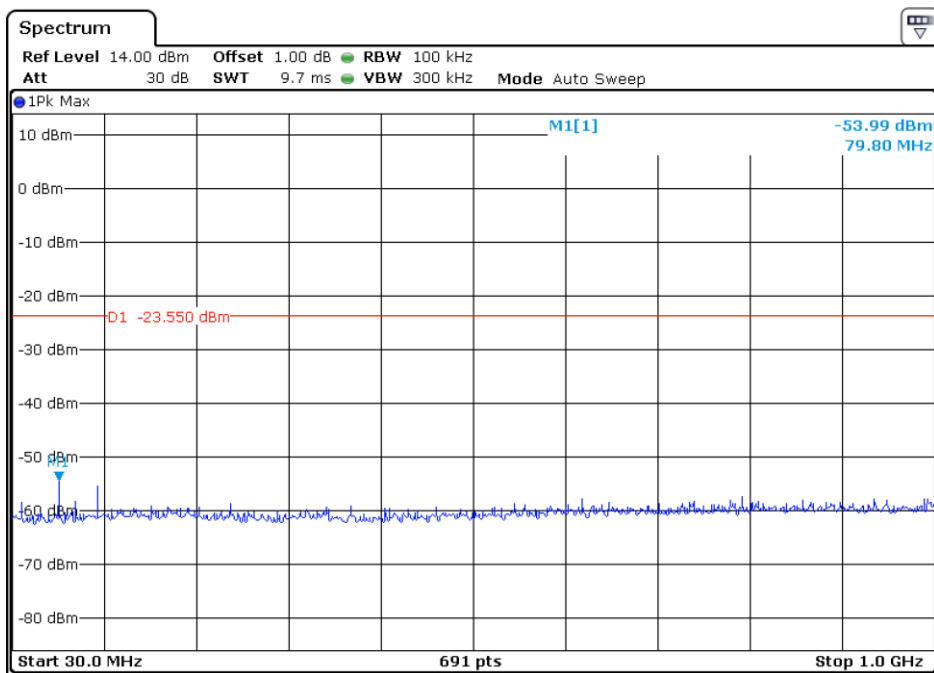


Limit: 20dB below the highest level of the desired power in the passband

Spurious Emissions at Antenna Terminals

EUT: Wae Outdoor 04Plus FM
Op Condition: Operated, TX Mode, FHSS (2480MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 3.7VDC

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

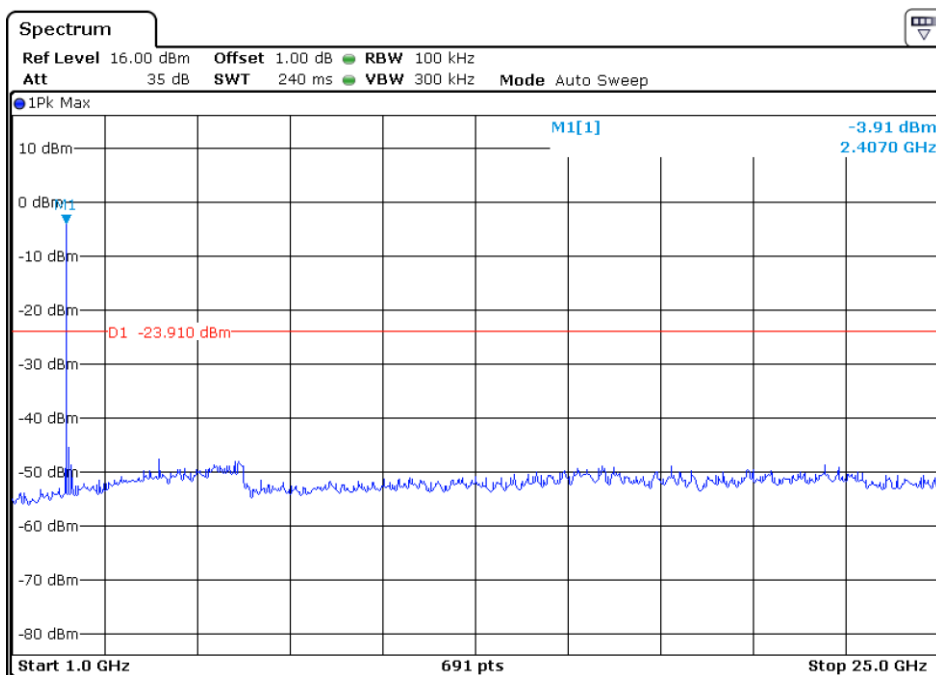
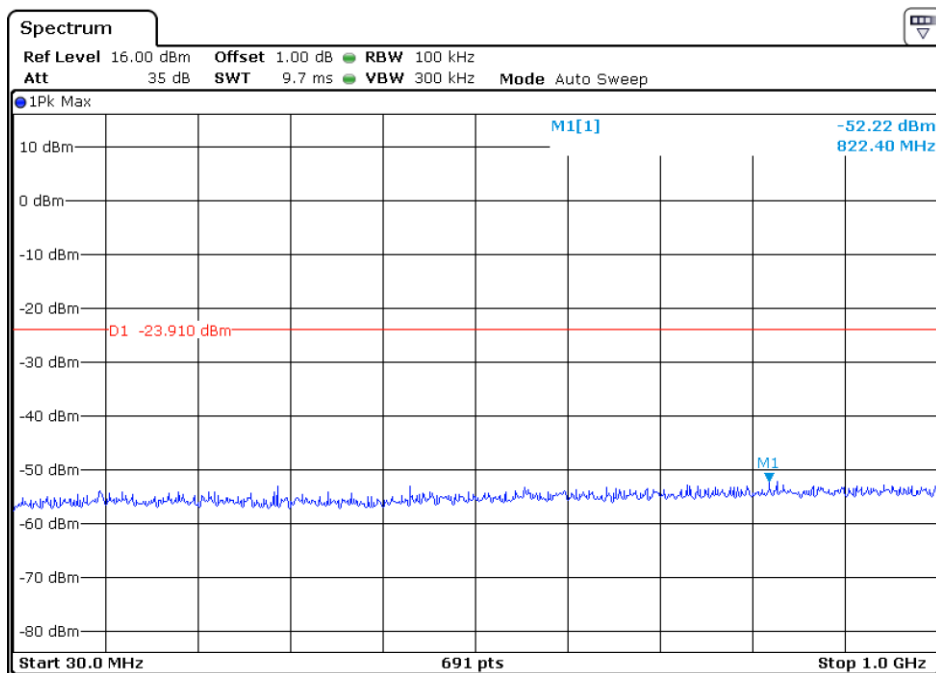


Limit: 20dB below the highest level of the desired power in the passband

Spurious Emissions at Antenna Terminals

EUT: Wae Outdoor 04Plus FM
Op Condition: Operated, TX Mode, BLE (2402MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 3.7VDC

Test Result

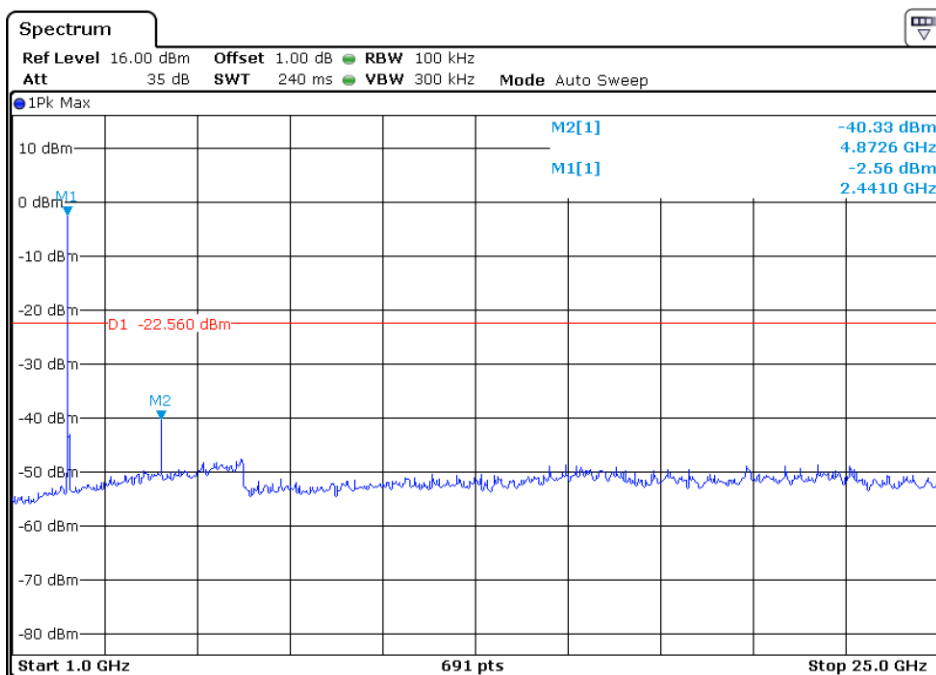
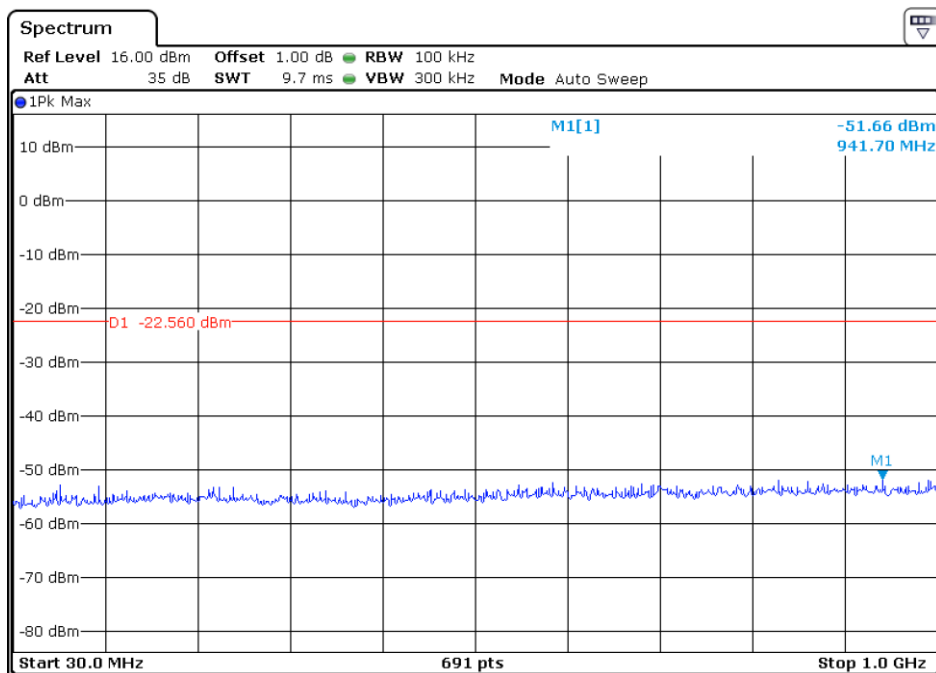
☒ Passed☐ Not Passed

Limit: 20dB below the highest level of the desired power in the passband

Spurious Emissions at Antenna Terminals

EUT: Wae Outdoor 04Plus FM
Op Condition: Operated, TX Mode, BLE (2440MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

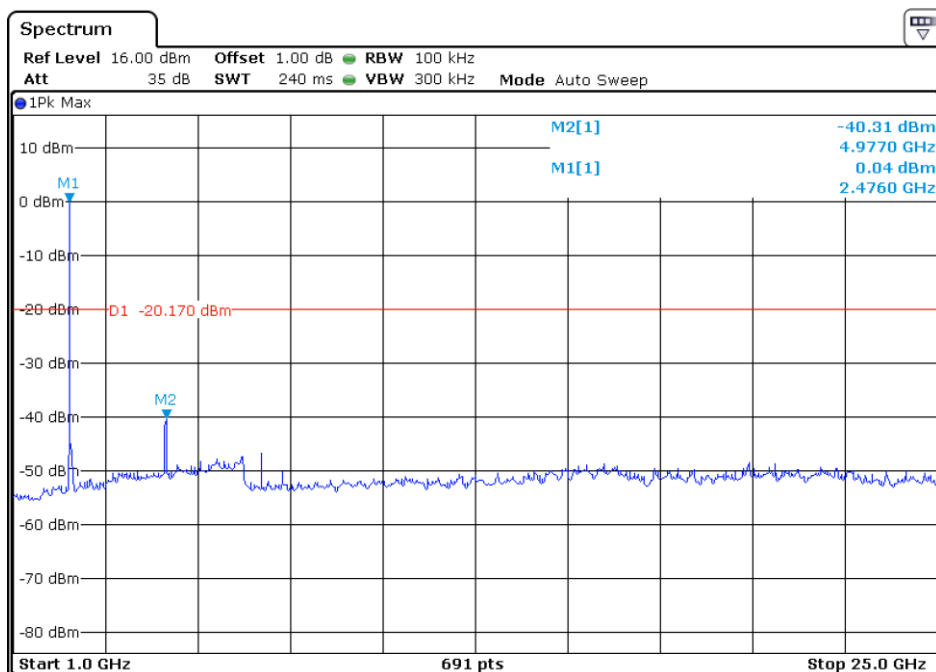
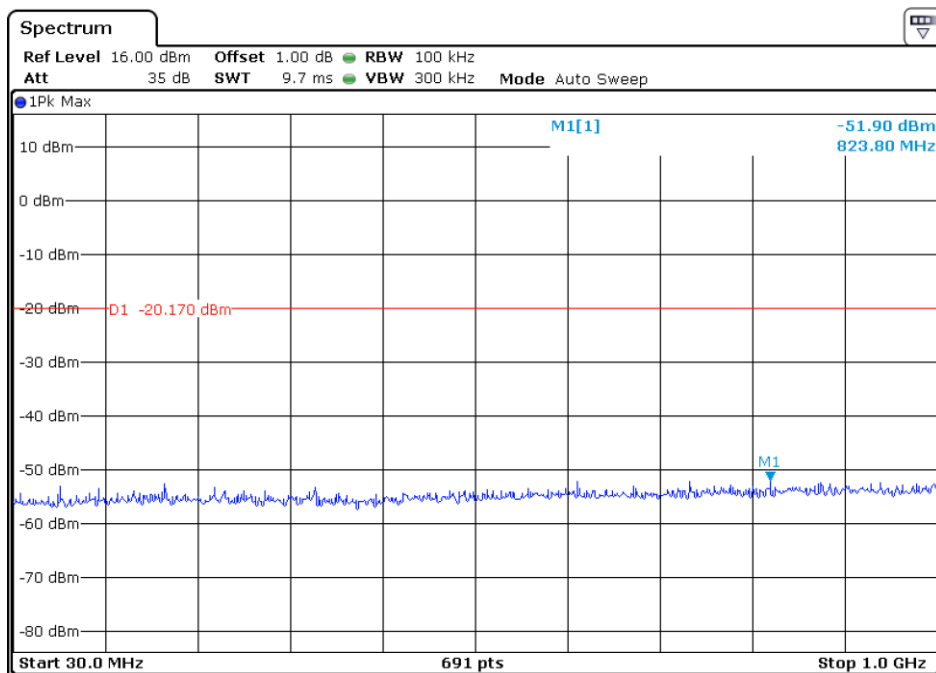


Limit: 20dB below the highest level of the desired power in the passband

Spurious Emissions at Antenna Terminals

EUT: Wae Outdoor 04Plus FM
Op Condition: Operated, TX Mode, BLE (2480MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 3.7VDC

Test Result

☒ Passed☐ Not Passed

Limit: 20dB below the highest level of the desired power in the passband

9.7. 100kHz Bandwidth of band edges

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 \geq 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.

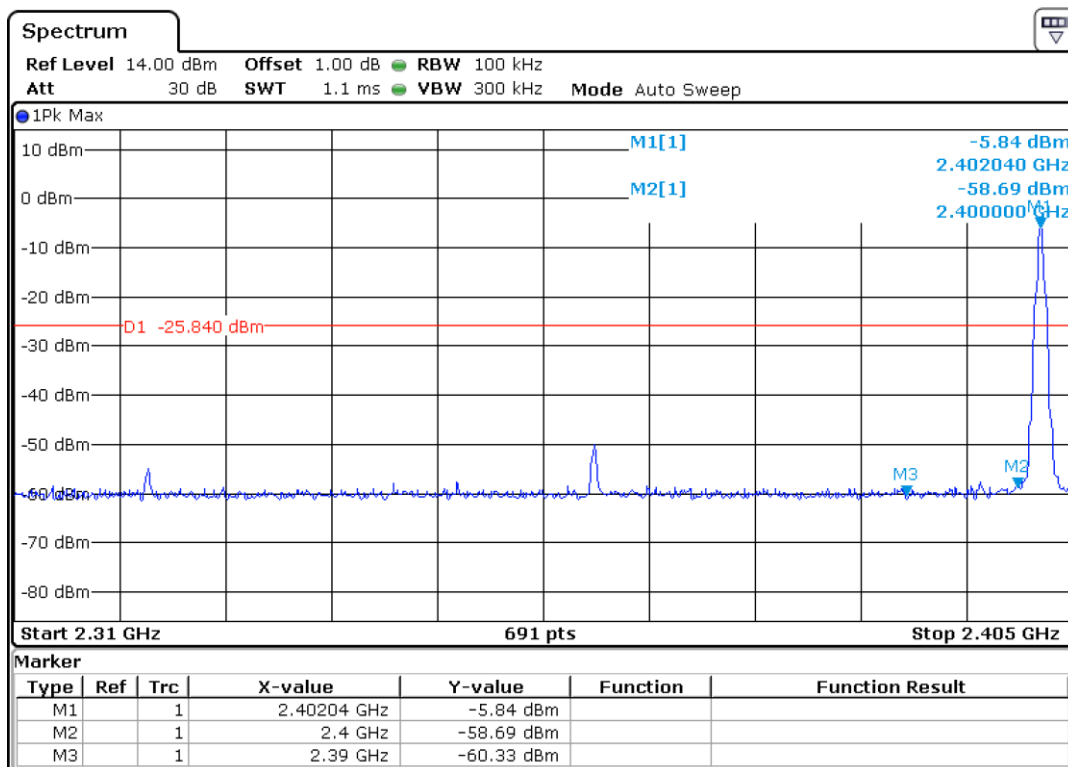
Limit:

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.

100kHz Bandwidth of band edges

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS, (2402MHz)
 Test Specification: FCC15.247(d), Conducted
 Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed



Band edges	Limit
52.85 dB	> 20dB

100kHz Bandwidth of band edges

EUT: Wae Outdoor 04Plus FM
Op Condition: Operated, TX Mode, FHSS, (2402MHz)
Test Specification: FCC15.247(d), Radiated
Comment: 3.7VDC

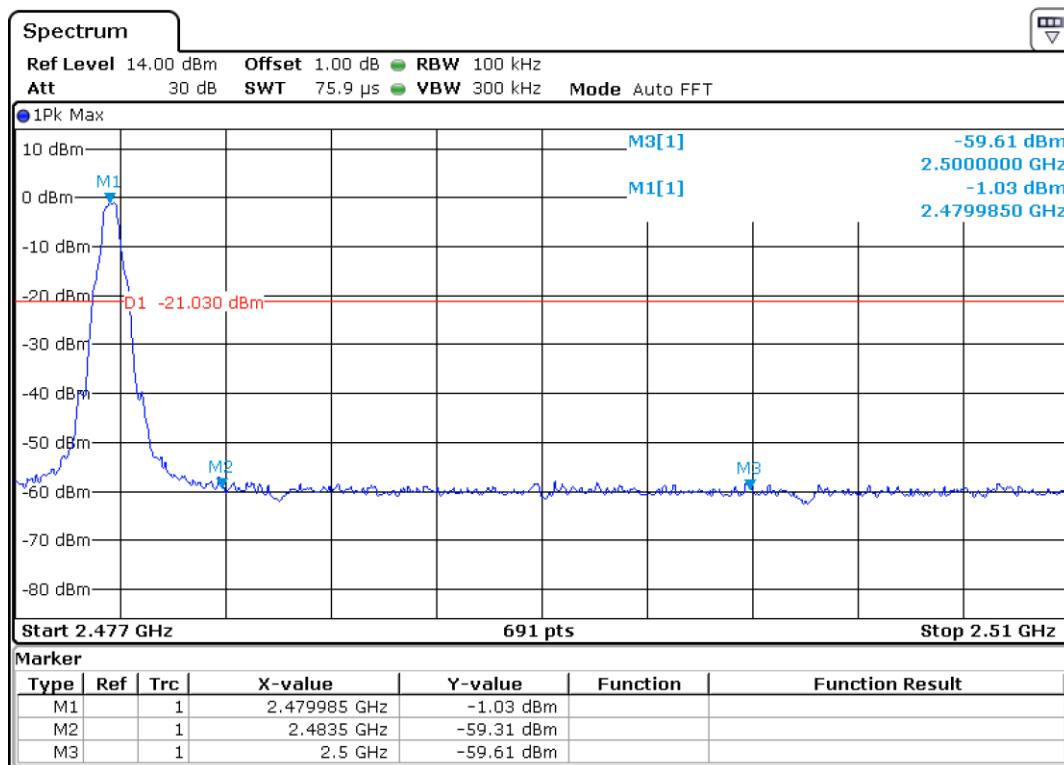
Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
2390.000	34.91	74	-39.09	Peak
2390.000	29.07	54	-24.93	Average

100kHz Bandwidth of band edges

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS, (2480MHz)
 Test Specification: FCC15.247(d), Conducted
 Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed



Band edges	Limit
58.28 dB	> 20dB

100kHz Bandwidth of band edges

EUT: Wae Outdoor 04Plus FM
Op Condition: Operated, TX Mode, FHSS, (2480MHz)
Test Specification: FCC15.247(d), Radiated
Comment: 3.7VDC

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
2483.500	35.92	74	-38.08	Peak
2483.500	29.77	54	-24.23	Average

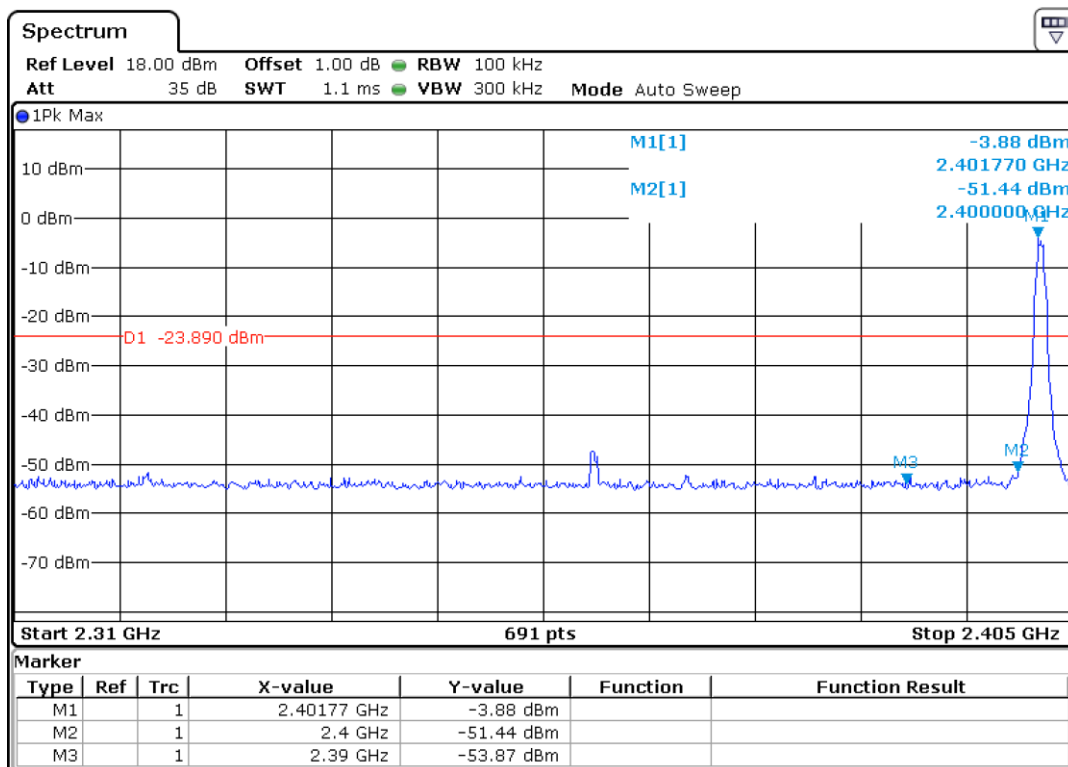
100kHz Bandwidth of band edges

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE, (2402MHz)
 Test Specification: FCC15.247(d), Radiated
 Comment: 3.7VDC

Test Result

☒ Passed

☐ Not Passed



Band edges	Limit
47.56 dB	> 20dB

100kHz Bandwidth of band edges

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE, (2402MHz)
 Test Specification: FCC15.247(d), Radiated
 Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
2390.000	41.36	74	-32.64	Peak
2390.000	35.46	54	-18.54	Average

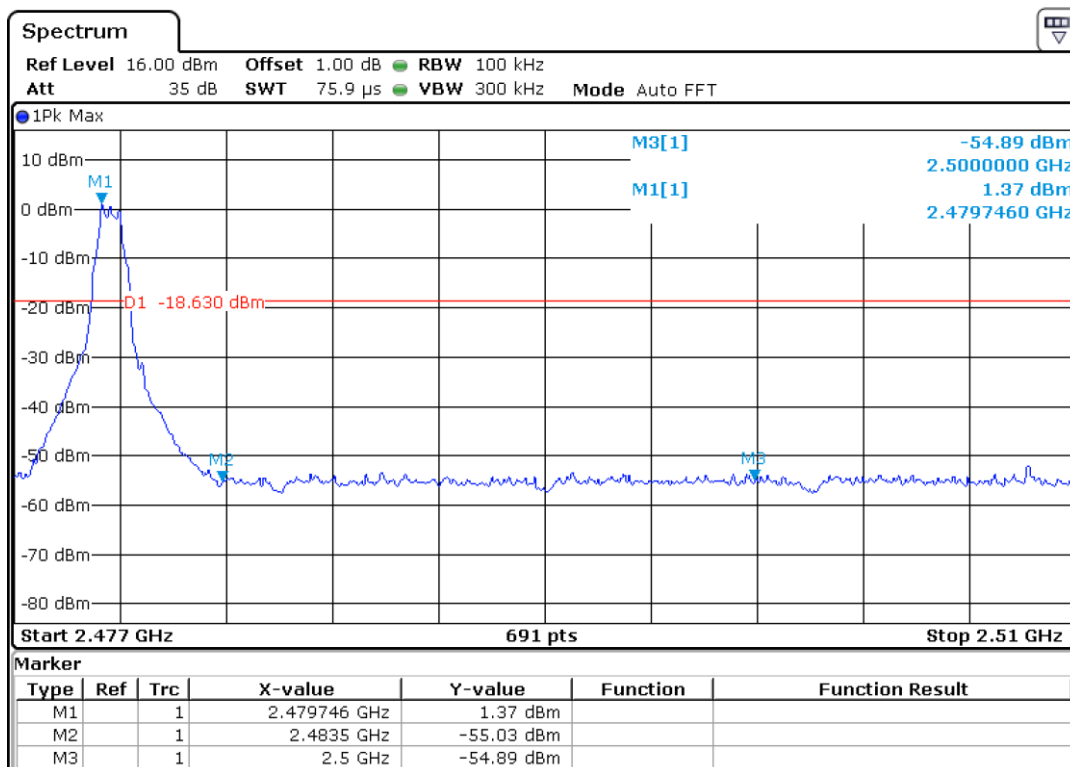
100kHz Bandwidth of band edges

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE, (2480MHz)
 Test Specification: FCC15.247(d), Radiated
 Comment: 3.7VDC

Test Result

☒ Passed

☐ Not Passed



Band edges	Limit
56.26 dB	> 20dB

100kHz Bandwidth of band edges

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE, (2480MHz)
 Test Specification: FCC15.247(d), Radiated
 Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
2483.500	40.34	74	-33.66	Peak
2483.500	35.68	54	-18.32	Average

9.8. Minimum. Number of Hopping Frequencies

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels, $RBW \geq 1\%$ of the span, $VBW \geq RBW$, Sweep = auto, Detector function = peak
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
3. Record all the signals from each channel until each one has been recorded.
4. Repeat above procedures until all frequencies measured were complete.

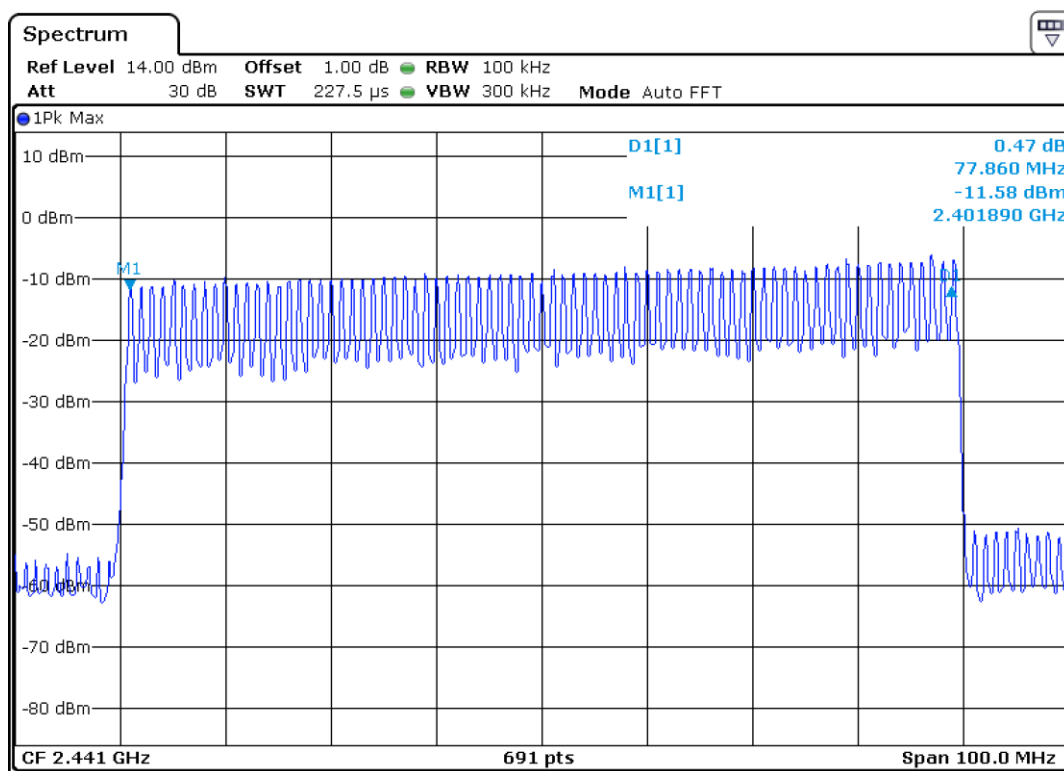
Limit

Limit
number

≥ 15

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS, (2402-2480MHz)
 Test Specification: FCC15.247(a)(1)
 Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed



Hopping Channels	Limit
79	≥ 15

9.9. Minimum Hopping Channel Carrier Frequency Separation

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels, $RBW \geq 1\%$ of the span, $VBW \geq RBW$, Sweep = auto, Detector function = peak
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
4. Repeat above procedures until all frequencies measured were complete.

Limit

**Limit
kHz**

$\geq 25\text{kHz}$ or $2/3$ of the 20 dB bandwidth which is greater

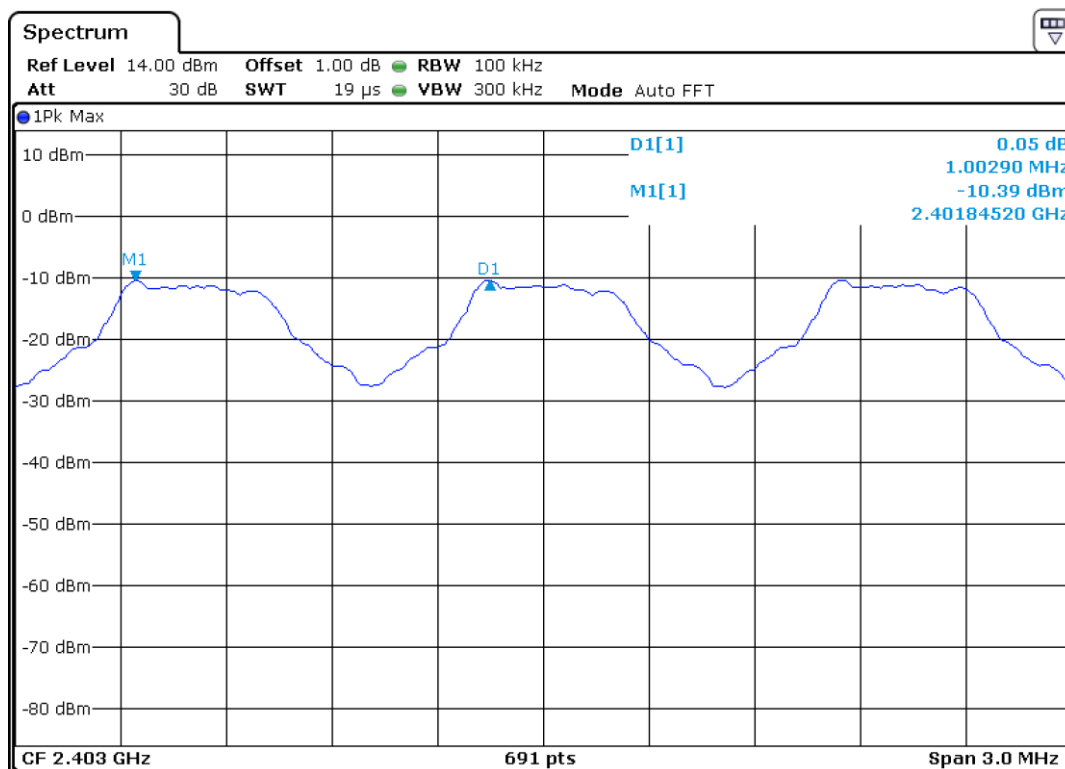
GFSK Modulation Limit

Frequency MHz	2/3 of 20 dB Bandwidth kHz
2402	631
2441	633.9
2480	633.9

Channel Carrier Frequency Separation

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, FHSS, (2402-2480MHz)
 Test Specification: FCC15.247(a)(1)
 Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed



Chanel Separation	Limit
1002.90 kHz	> 694.667 kHz

Limit: 2/3 of 20dB bandwidth of hopping channel

9.10. Average Channel Occupancy Time

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
4. Measure the Dwell Time by spectrum analyzer Marker function.
5. Repeat above procedures until all frequencies measured were complete.

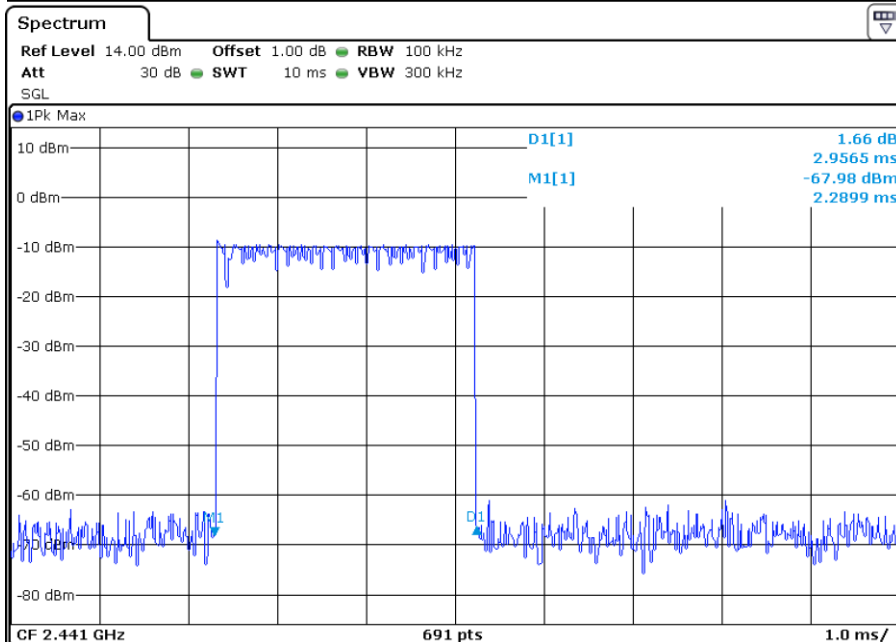
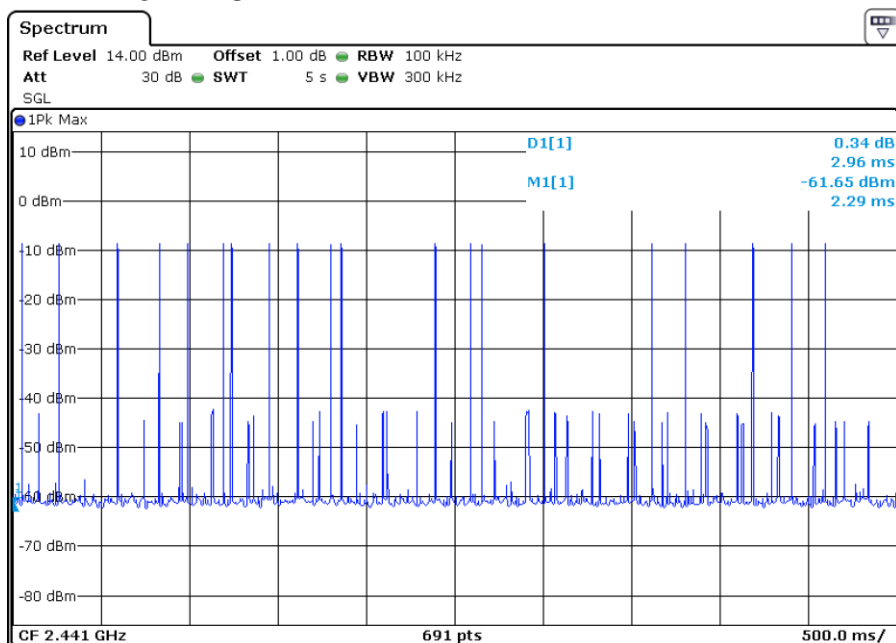
Limit

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Average Occupancy time = Dwell Time

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.247(a)(1)
 Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed



Average time of occupancy	Limit
Number of hops in 5 sec.: 20 Period: 0.4 x 79 Ch. = 31.6 sec. Total number of hops in 31.6 sec.: (20/5)*31.6=126.4 Time of single pulse: 2.9565 ms Average time of occupancy: 2.9565 ms x 126.4 = 0.3736 sec.	0.4 Seconds

9.11. Power Special 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 \geq 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

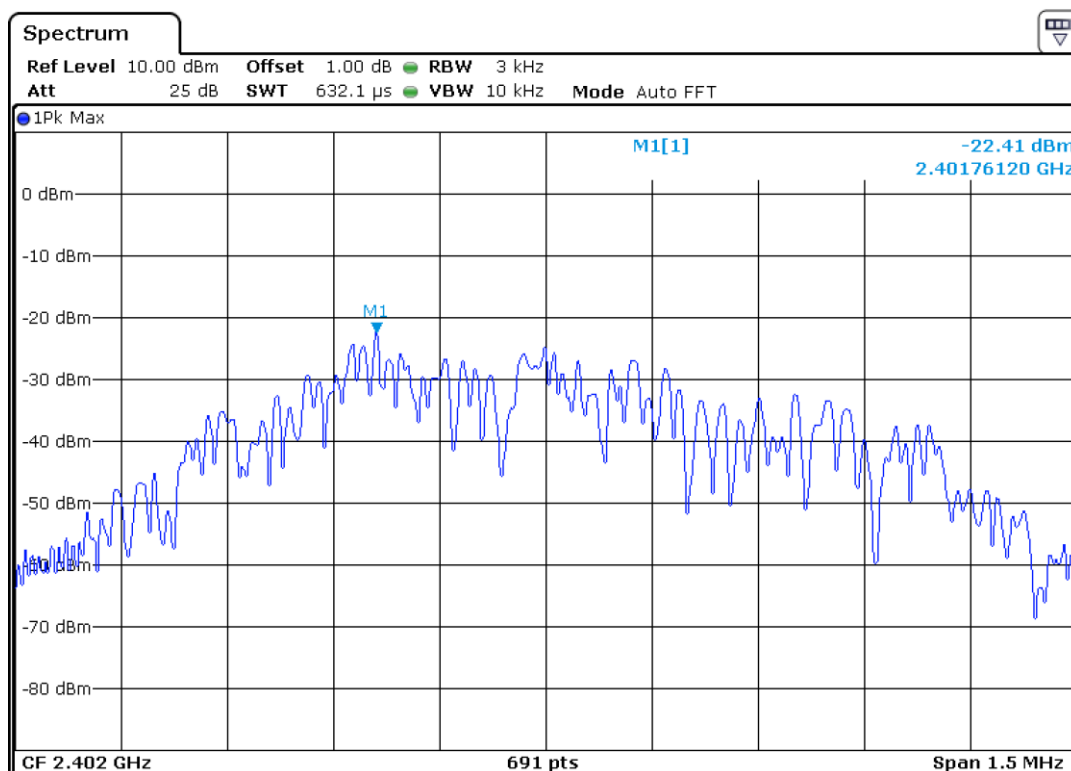
Test result

Frequency MHz	Power spectral density dBm	Result
Top channel 2402MHz	-9.04	Pass
Middle channel 2440MHz	-7.41	Pass
Bottom channel 2480MHz	-7.32	Pass

Power Special Density

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE, (2402MHz)
 Test Specification: FCC15.247(e)
 Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed

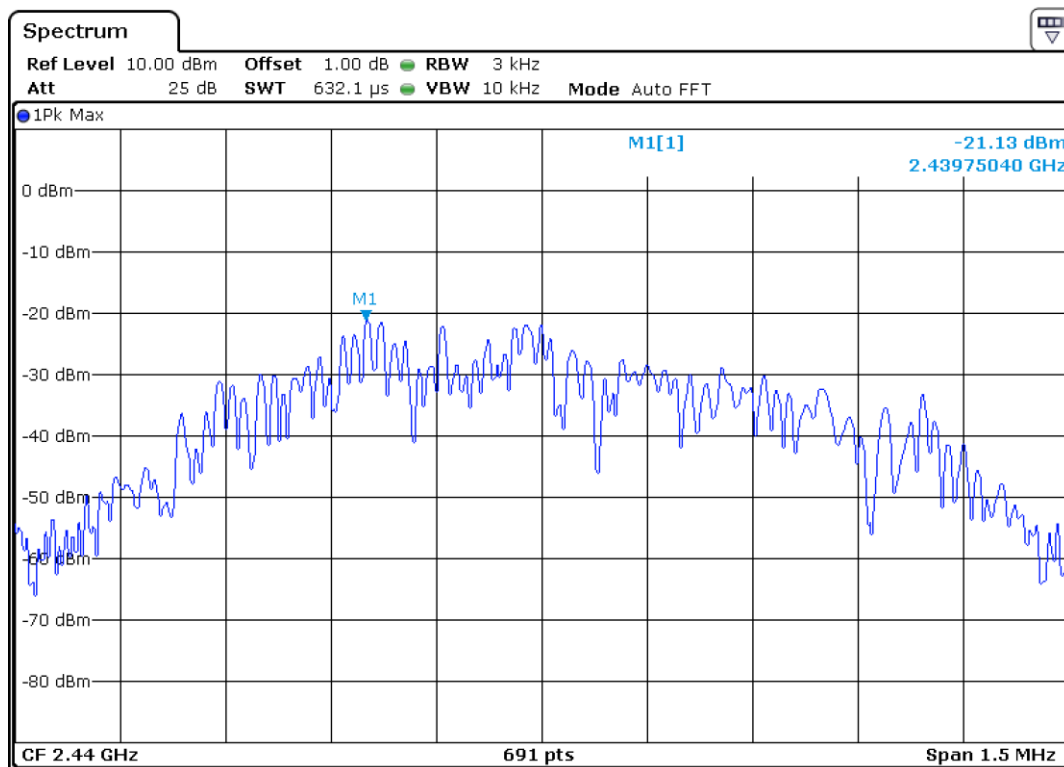


PSD	Limit
-22.41 dBm	< 8 dBm

Power Special Density

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE, (2440MHz)
 Test Specification: FCC15.247(e)
 Comment: 3.7VDC

Test Result
<input checked="" type="checkbox"/> Passed
<input type="checkbox"/> Not Passed

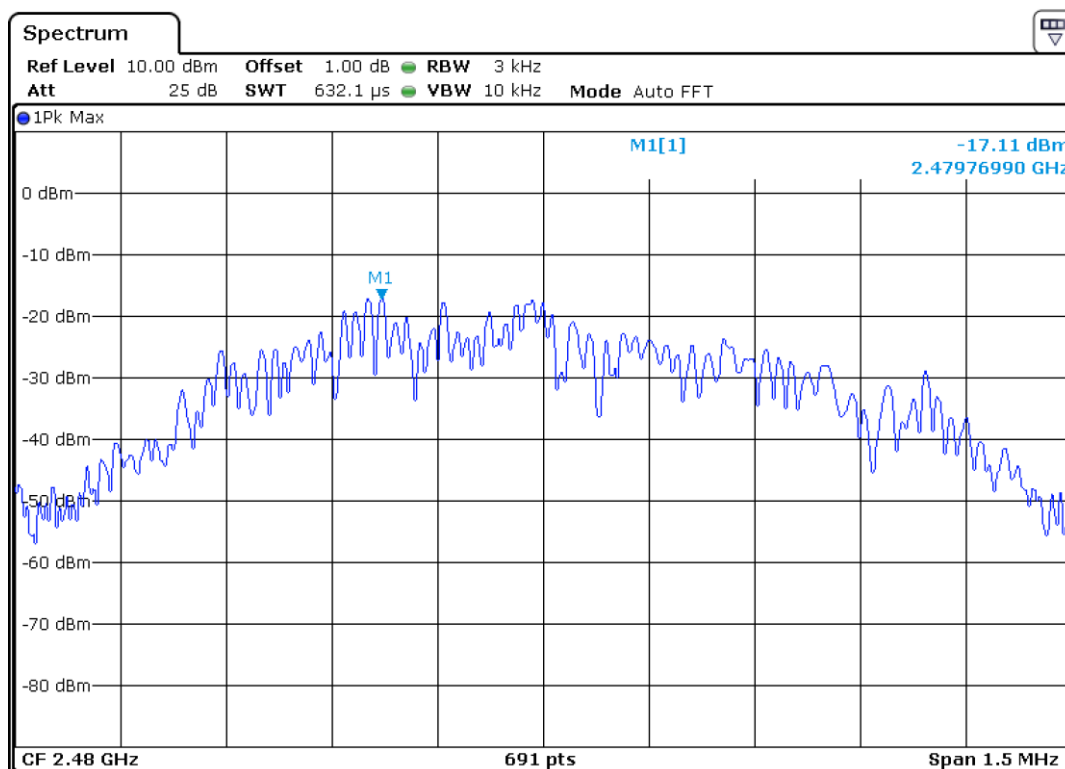


PSD	Limit
-21.13 dBm	< 8 dBm

Power Special Density

EUT: Wae Outdoor 04Plus FM
 Op Condition: Operated, TX Mode, BLE, (2480MHz)
 Test Specification: FCC15.247(e)
 Comment: 3.7VDC

Test Result	
<input checked="" type="checkbox"/>	Passed
<input type="checkbox"/>	Not Passed



PSD	Limit
-17.11 dBm	< 8 dBm

9.12. Antenna Requirement

EUT: Wae Outdoor 04Plus FM
Op Condition: Operated, TX Mode
Test Specification: FCC15.203 & 15.247(b)
Comment: 3.7VDC

Test Result

☒ Passed

☐ Not Passed

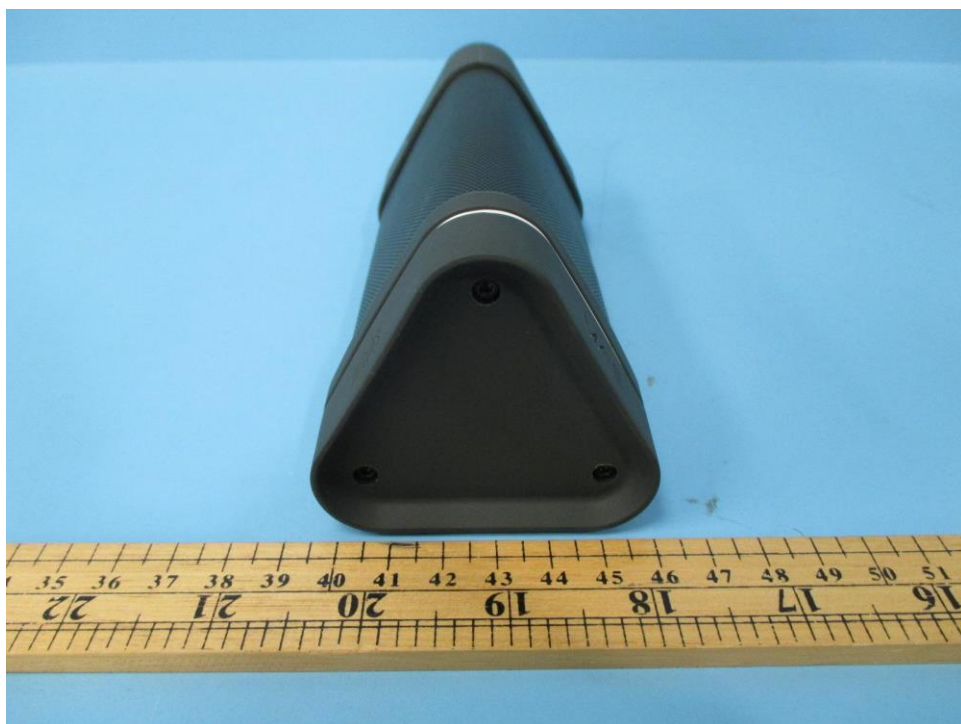
Limit

For intentional device, according to FCC Title 47 Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC Title 47 Part 15.247(b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The antenna used in this product is PCB antenna, and the maximum gain of this antenna is 0.0 dBi.

10. Appendix A - Photographs of EUT



Appendix A



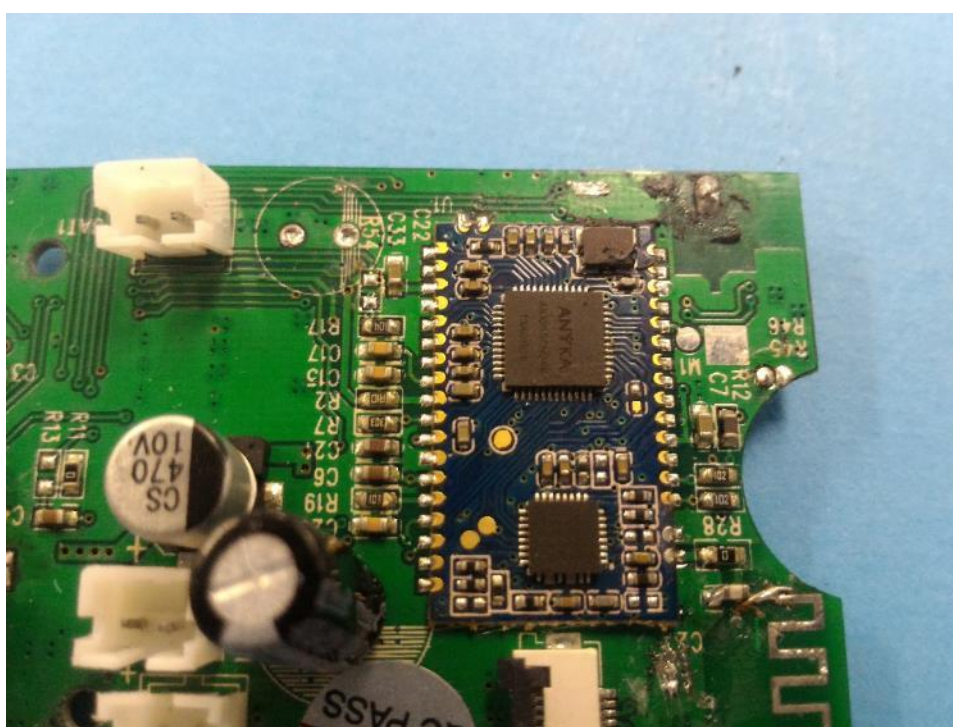
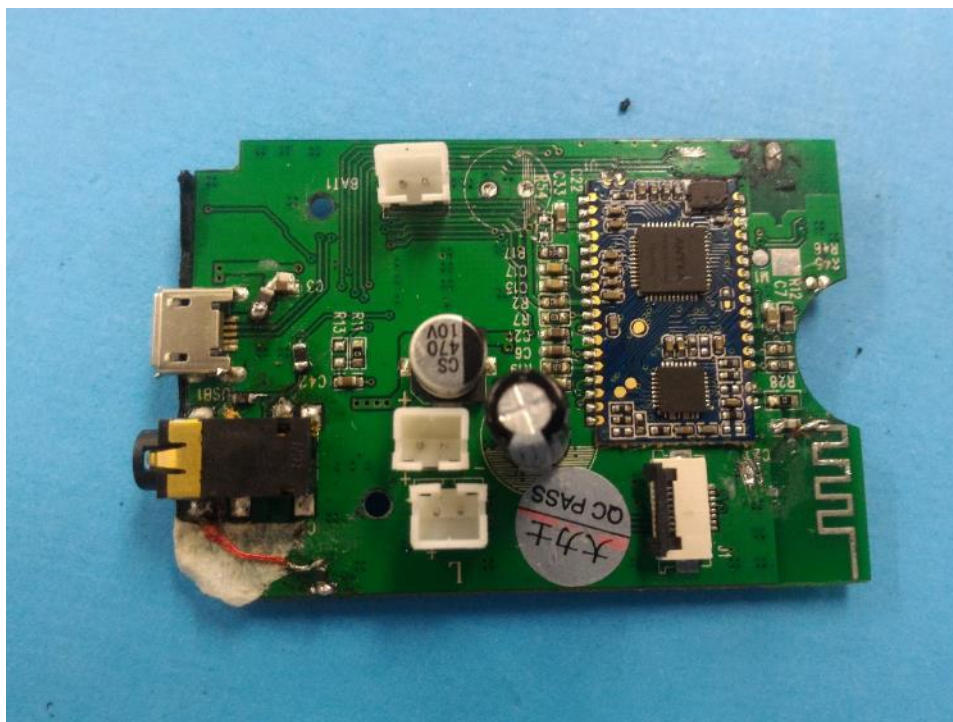
Appendix A



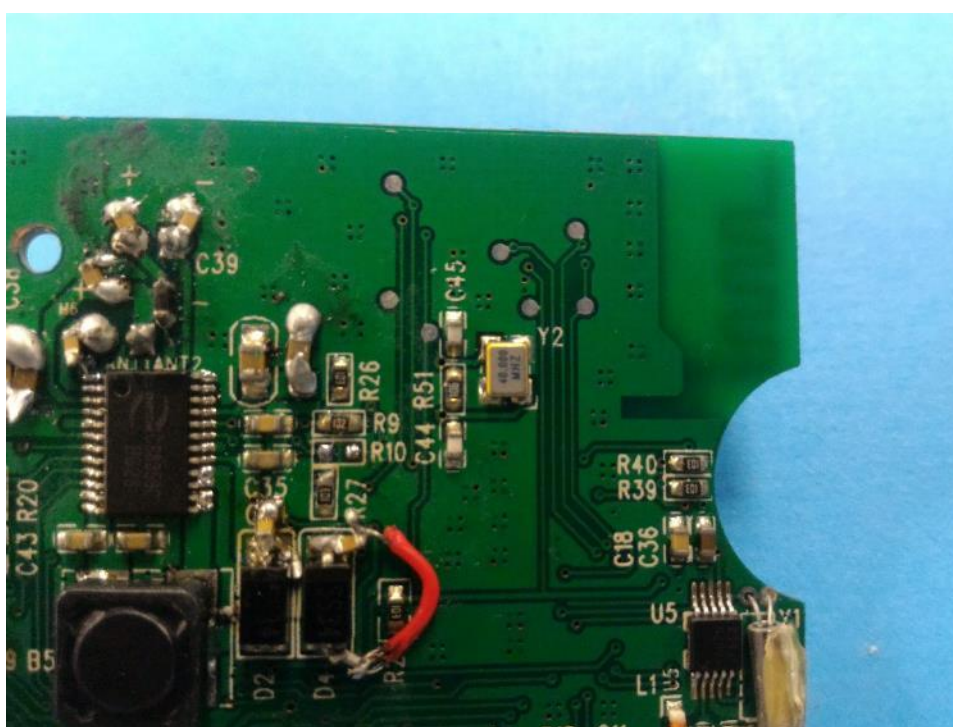
Appendix A



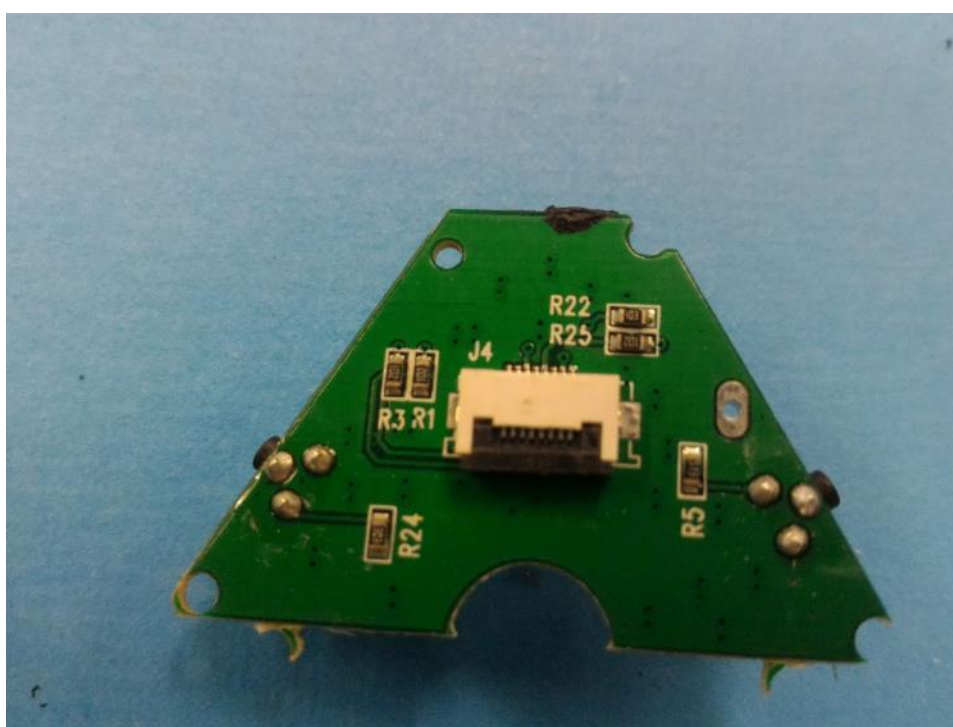
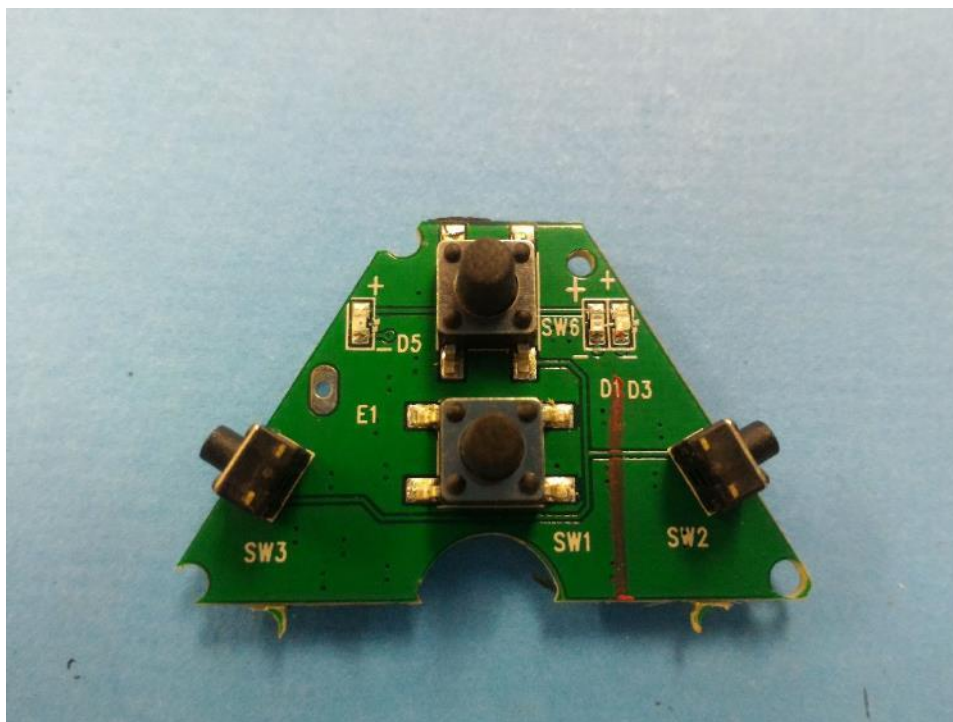
Appendix A



Appendix A



Appendix A



Appendix A



Appendix A



11. Appendix B - Setup Photographs of EUT

Spurious Radiated Emission



Conducted Emission



Appendix B

20dB & 99% Bandwidth, Conducted Peak Output Power,
Spurious Emissions at Antenna Terminals,
100kHz Bandwidth of band edges, Min. No. of Hopping Frequencies,
Min. Hopping Channel Carrier Frequency Separation, Average Time of Occupancy



12. Appendix C - General Product Information

Radiofrequency radiation exposure evaluation

According to KDB 447498 D01v06 section 4.3.1, For frequencies between 100 MHz to 6GHz and test separation distances ≤ 50 mm, the Numeric threshold is determined as

Step a)

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR

>> The fundamental frequency of the EUT is 2402-2480MHz,
the test separation distance is ≤ 50 mm.
(Manufacturer specified the separation distance is: 5mm)

Step a)

>> Numeric threshold (2402MHz), $\text{mW} / 5\text{mm} \cdot \sqrt{2.402\text{GHz}} \leq 3.0$
Numeric threshold (2402MHz) $\leq 9.678\text{mW}$

>> Numeric threshold (2440MHz), $\text{mW} / 5\text{mm} \cdot \sqrt{2.441\text{GHz}} \leq 3.0$
Numeric threshold (2440MHz) $\leq 9.601\text{mW}$

>> Numeric threshold (2480MHz), $\text{mW} / 5\text{mm} \cdot \sqrt{2.480\text{GHz}} \leq 3.0$
Numeric threshold (2480MHz) $\leq 9.525\text{mW}$

FHSS:

>> The power of EUT measured (2402MHz) is: $-4.16\text{dBm} = 0.383\text{mW}$
The power of EUT measured (2441MHz) is: $-1.73\text{dBm} = 0.671\text{mW}$
The power of EUT measured (2480MHz) is: $0.92\text{dBm} = 1.236\text{mW}$

BLE:

>> The power of EUT measured (2402MHz) is: $-3.50\text{dBm} = 0.447\text{mW}$
The power of EUT measured (2440MHz) is: $-1.26\text{dBm} = 0.748\text{mW}$
The power of EUT measured (2480MHz) is: $1.34\text{dBm} = 1.361\text{mW}$

Which is smaller than the Numeric threshold.

Therefore, the device is exempt from stand-alone SAR test requirements.

13. Test Equipment Site List

Radiated emission Test – Site 2

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2018-7-14
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2018-7-14
Horn Antenna	Rohde & Schwarz	HF907	102294	2018-7-14
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100398	2018-7-14
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2018-7-14
Signal Generator	Rohde & Schwarz	SMY01	839369/005	2018-7-7
Attenuator	Agilent	8491A	MY39264334	2018-7-7
3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

20dB & 99% Bandwidth, Conducted Peak Output Power, Spurious Emissions at Antenna Terminals, 100kHz Bandwidth of band edges, Min. No. of Hopping Frequencies, Power Spectral Density
Min. Hopping Channel Carrier Frequency Separation and Average Time of Occupancy – Site 2

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Generator	Rohde & Schwarz	SMB100A	108272	2018-7-7
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2018-7-7
Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2018-7-7
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2018-7-7

Conducted Emission Test – Site 2

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2018-7-14
LISN	Rohde & Schwarz	ENV4200	100249	2018-7-14
LISN	Rohde & Schwarz	ENV432	101318	2018-7-14
LISN	Rohde & Schwarz	ENV216	100326	2018-7-14
ISN	Rohde & Schwarz	ENY81	100177	2018-7-14
ISN	Rohde & Schwarz	ENY81-CA6	101664	2018-7-14
High Voltage Probe	Rohde & Schwarz	TK9420(VT9420)	9420-584	2018-7-14
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2018-7-14
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2018-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

14. Measurement System Uncertainty

Measurement System Uncertainty Emissions

System Measurement Uncertainty	
Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz	4.54dB
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.83dB; Vertical: 4.91dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-25000MHz	Horizontal: 4.89dB; Vertical: 4.88dB;
Uncertainty for Conducted RF test	2.04dB