FCC - TEST REPORT

Report Number	:	60.960.15.027.02R01	Date of Issue	:	September 8, 2017
Model	:	PML100, 82031, 82032			
Product Type	:	PRECISION POWER METER			
Applicant	:	4iiii Innovations Inc.			
Address	:	141 2nd Ave East, Cochrane Alberta, Canada T4C 2B9			
Production Facility	:	4iiii Innovations Inc.			
Address	:	141 2nd Ave East, Cochrane Alberta, Canada T4C 2B9			
Test Result	:	■Positive ☐Negative			
Total pages including Appendices	:	57			

1. Table of Contents

2. Details about the Test Laboratory

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052 P.R. China
Telephone: Fax:	86 755 8828 6998 86 755 828 5299
FCC Registration No.:	514049

3. Description of Equipment Under Test

Description of the Equipment Under Test

Product:	PRECISION POWER METER
Model no.:	PML100, 82031, 82032
FCC ID:	ZZNPM101
Rating:	3.0VDC (1 x 3.0VDC size “CR2032” cell battery)
Frequency:	2457MHz, 2402MHz-2480MHz
Antenna gain:	0 dBi
Number of operated channel:	40
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 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 - BLE

Emission Tests				
FCC Part 15 Subpart C				
Test Condition	Pages	Test Result		
		Pass	Fail	N/A
FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission	34-36	☒	☐	☐
FCC Title 47 Part 15.207 Conduct Emission	NIL	☐	☐	☒
FCC Title 47 Part 15.247(a)(2) 6dB & 99% Bandwidth	28-29	☒	☐	☐
FCC Title 47 Part 15.247(b) Peak Output Power	32-34	☒	☐	☐
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	36-38	☒	☐	☐
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	40-43	☒	☐	☐
FCC Title 47 Part 15.247(e) Power Spectral Density	45-47	☒	☐	☐
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	48	☒	☐	☐

5.2. FCC Part 15 Subpart C – ANT+

Emission Tests				
FCC Part 15 Subpart C				
Test Condition	Pages	Test Result		
		Pass	Fail	N/A
FCC Title 47 Part 15.249 & 15.209 Radiated Emission	18-19	☒	☐	☐
FCC Title 47 Part 15.207 Conduct Emission	NIL	☐	☐	☒
FCC Title 47 Part 15.215 20dB & 99% Bandwidth	22-23	☒	☐	☐
FCC Title 47 Part 15.249 Bandedge Emission	25-26	☒	☐	☐

6. General Remarks

Remarks

Client informs that the 82031, 82032 have the same technical construction including circuit diagram, PCB Layout, components and component layout, all electrical construction and mechanical construction, with PRECISION POWER METER, PML100. The difference lies only on different color of the different models. (Client's conformation letter shown at appendix A)

EMC Tests were performed on model: PML100.

This submittal(s) (test report) is intended for
FCC ID: ZZNPM101 complies with :
Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules for the DTS grant
and
Section 15.249 of the FCC Part 15, Subpart C rules for the or DXT grant

The TX and RX range is 2402MHz-2480MHz for the BLE and 2475 Mhz for the ANT+
Note: The report is for BLE and ANT+ is for DTS and DXT 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: May 22, 2017

Testing Start Date: May 23, 2017

Testing End Date: July 31, 2017

- TÜV SÜD HONG KONG LTD. -

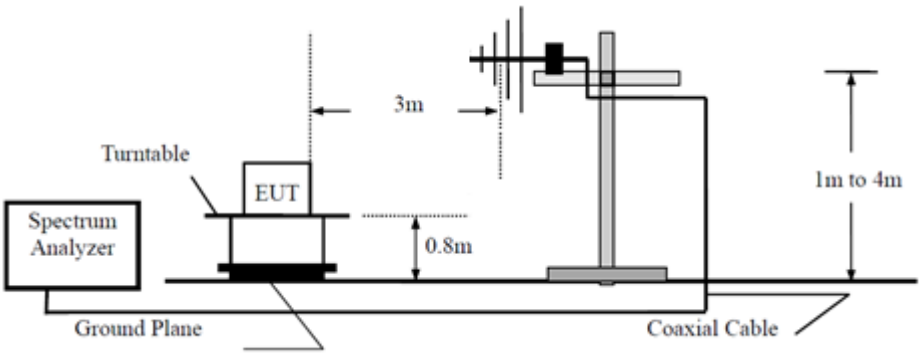
Reviewed by: Prepared by:

CHAN Kwong Ngai
EMC Test Engineer

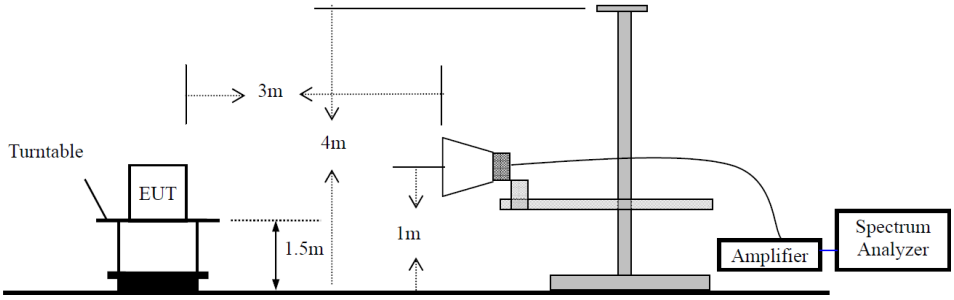
Alex CHAN
EMC Project Engineer

7. Test Setups

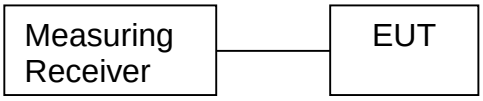
7.1. Radiated test setups Below 1GHz



7.2. Radiated test setups Above 1GHz



7.3. Conducted RF test setups



8. Systems test configuration

Auxiliary Equipment Used during Test:

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

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 BLE

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 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 (20log(1/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 above1GHz

Spurious Radiated Emission BLE

EUT: PML100
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
Comment: 3.0VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
59.423	31.88	40	-8.12	Quasi Peak
176.847	37.65	43.5	-5.85	Quasi Peak
232.783	34.52	46	-11.48	Quasi Peak
528.680	32.69	46	-13.31	Quasi Peak
1004.330	35.22	74	-38.78	Peak
1004.330	20.65	54	-33.35	Average
1597.937	46.14	74	-27.86	Peak
1597.937	32.63	54	-21.37	Average
4804.000	38.55	74	-35.45	Peak
4804.000	28.92	54	-25.08	Average
7206.000	37.88	74	-36.12	Peak
7206.000	26.42	54	-27.58	Average
12010.000	47.87	74	-26.13	Peak
12010.000	37.59	54	-16.41	Average

Spurious Radiated Emission BLE

EUT: PML100
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
Comment: 3.0VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
59.423	31.03	40	-8.97	Quasi Peak
176.847	35.48	43.5	-8.02	Quasi Peak
232.783	33.29	46	-12.71	Quasi Peak
528.680	31.09	46	-14.91	Quasi Peak
1004.330	37.25	74	-36.75	Peak
1004.330	26.44	54	-27.56	Average
1597.937	41.58	74	-32.42	Peak
1597.937	21.72	54	-32.28	Average
4804.000	35.25	74	-38.75	Peak
4804.000	24.97	54	-29.03	Average
7206.000	41.04	74	-32.96	Peak
7206.000	30.85	54	-23.15	Average
12010.000	42.76	74	-31.24	Peak
12010.000	32.33	54	-21.67	Average

Spurious Radiated Emission BLE

EUT: PML100
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
Comment: 3.0VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
59.660	30.03	40	-9.97	Quasi Peak
175.482	32.50	43.5	-11.00	Quasi Peak
230.155	31.55	46	-14.45	Quasi Peak
528.795	30.95	46	-15.05	Quasi Peak
1197.000	41.57	74	-32.43	Peak
1197.000	20.92	54	-33.08	Average
1625.210	39.28	74	-34.72	Peak
1625.210	30.01	54	-23.99	Average
4880.025	34.25	74	-39.75	Peak
4880.025	24.07	54	-29.93	Average
7556.718	39.00	74	-35.00	Peak
7556.718	28.41	54	-25.59	Average
12200.210	46.90	74	-27.10	Peak
12200.210	37.83	54	-16.17	Average

Spurious Radiated Emission BLE

EUT: PML100
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
Comment: 3.0VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
59.660	29.25	40	-10.75	Quasi Peak
175.482	31.92	43.5	-11.58	Quasi Peak
230.155	31.49	46	-14.51	Quasi Peak
528.795	30.81	46	-15.19	Quasi Peak
1197.000	39.54	74	-34.46	Peak
1197.000	29.27	54	-24.73	Average
1593.062	43.11	74	-30.89	Peak
1593.062	32.85	54	-21.15	Average
4880.156	40.46	74	-33.54	Peak
4880.156	29.72	54	-24.28	Average
7319.062	43.23	74	-30.77	Peak
7319.062	32.61	54	-21.39	Average
12200.210	43.33	74	-30.67	Peak
12200.210	32.88	54	-21.12	Average

Spurious Radiated Emission BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
Comment:	3.0VDC
Remark:	9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
60.055	30.15	40	-9.85	Quasi Peak
175.550	32.84	43.5	-10.66	Quasi Peak
231.075	29.77	46	-16.23	Quasi Peak
530.005	31.26	46	-14.74	Quasi Peak
1202.005	40.08	74	-33.92	Peak
1202.005	29.94	54	-24.06	Average
1595.625	43.37	74	-30.63	Peak
1595.625	33.48	54	-20.52	Average
4880.156	45.84	74	-28.16	Peak
4880.156	36.11	54	-17.89	Average
7439.065	42.35	74	-31.65	Peak
7439.065	31.87	54	-22.13	Average
12400.450	46.97	74	-27.03	Peak
12400.450	36.54	54	-17.46	Average

Spurious Radiated Emission BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
Comment:	3.0VDC
Remark:	9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
60.055	29.85	40	-10.15	Quasi Peak
175.550	31.42	43.5	-12.08	Quasi Peak
231.075	28.53	46	-17.47	Quasi Peak
530.005	30.40	46	-15.60	Quasi Peak
1202.005	37.22	74	-36.78	Peak
1202.005	26.40	54	-27.60	Average
1595.625	45.47	74	-28.53	Peak
1595.625	34.92	54	-19.08	Average
4880.156	36.29	74	-37.71	Peak
4880.156	26.33	54	-27.67	Average
7527.185	40.80	74	-33.20	Peak
7527.185	31.51	54	-22.49	Average
12400.450	47.14	74	-26.86	Peak
12400.450	36.93	54	-17.07	Average

9.2. Radiated Emission ANT+

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 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 (20log(1/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 requencyabove1GHz

Radiated Emission – ANT+

EUT:	PML100
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.249 & 15.209, Antenna: Horizontal
Comment:	3.0VDC
Remark:	9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
45.520	16.40	40	-23.60	Quasi Peak
59.463	17.51	40	-22.49	Quasi Peak
108.145	15.92	43.5	-27.58	Quasi Peak
2457.000	90.56	114	-23.44	Peak
2457.000	88.46	94	-5.54	Average
4913.750	51.71	74	-22.29	Peak
4913.750	49.88	54	-4.12	Average
9828.125	45.60	74	-28.40	Peak

Radiated Emission

EUT:	PML100
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.249 & 15.209, Antenna: Vertical
Comment:	3.0VDC
Remark:	9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
41.397	17.13	40	-22.87	Quasi Peak
48.733	16.73	40	-23.27	Quasi Peak
62.798	15.24	40	-24.76	Quasi Peak
2457.000	89.43	114	-24.57	Peak
2457.000	87.16	94	-6.84	Average
4913.750	48.28	74	-25.72	Peak
4913.750	46.54	54	-7.46	Average
9828.125	47.15	74	-26.85	Peak

9.3. 20dB & 99% Bandwidth ANT+

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.

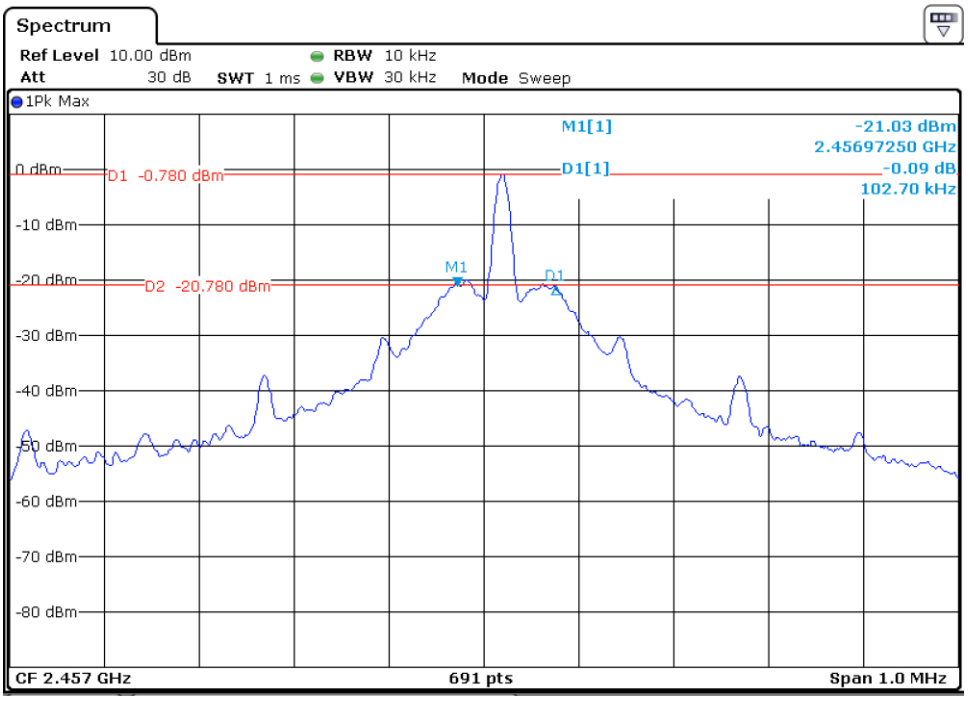
Limit

Limit [kHz]
>150 KHz for DTS

20dB & 99% Bandwidth – ANT+

EUT:	PML100
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.215, 20dB Bandwidth
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed

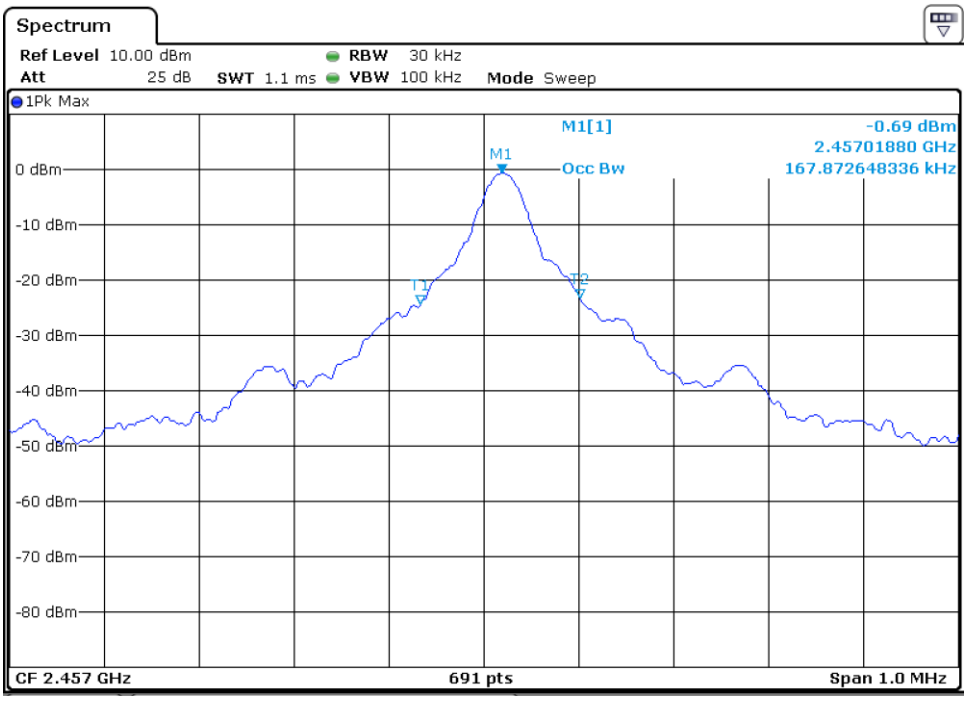


20dB bandwidth
107.700 kHz

20dB & 99% Bandwidth ANT+

EUT:	PML100
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.215, 99% Bandwidth
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed



99% bandwidth
167.872 kHz

9.4. Bandedge Emission ANT+

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 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.

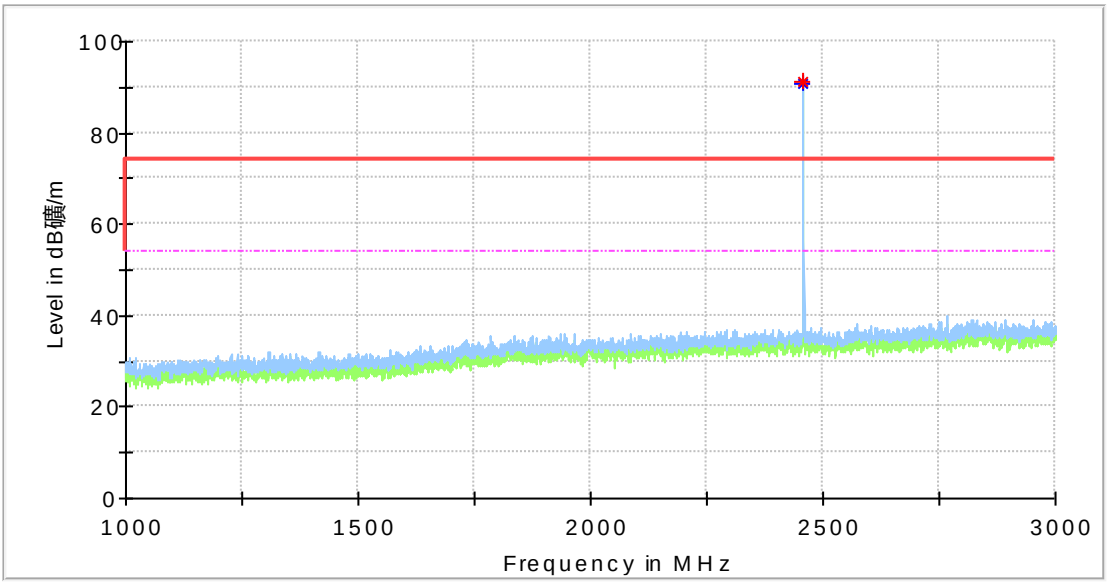
3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle).

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 requencyabove1GHz

Bandedge Emission ANT+

EUT:	PML100
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.247, Antenna: Horizontal
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed

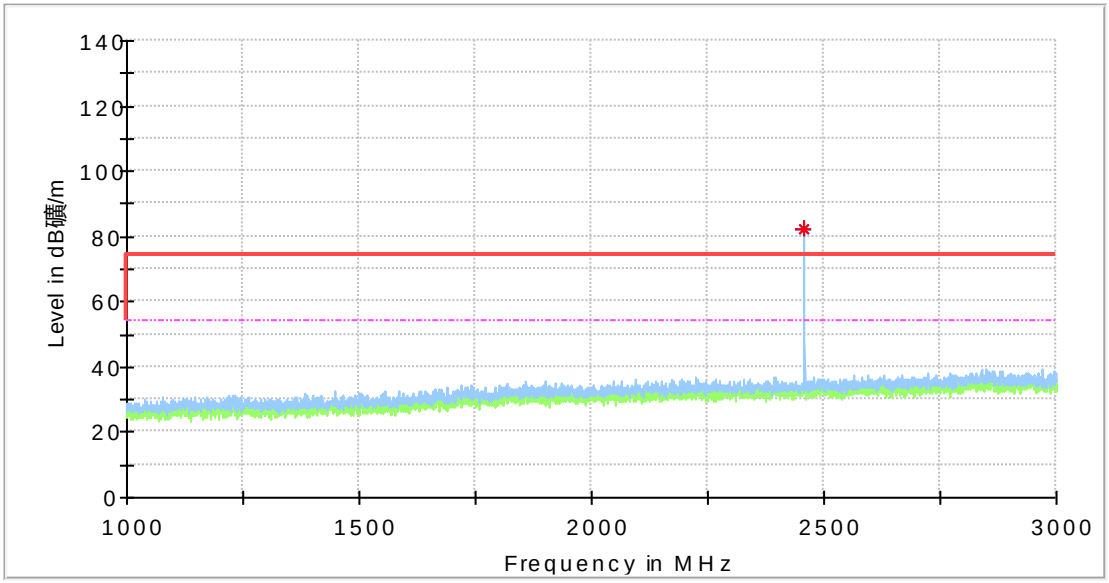


Band	Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
Low	2396.000	34.72	74	-39.28	Peak
Low	2396.000	31.62	54	-22.38	Average
High	2491.000	36.98	74	-37.02	Peak
High	2491.000	32.88	54	-21.12	Average

Bandedge Emission ANT+

EUT:	PML100
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.247, Antenna: Vertical
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed



Band	Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
Low	2396.000	33.58	74	-40.42	Peak
Low	2396.000	30.17	54	-23.83	Average
High	2491.000	35.99	74	-38.01	Peak
High	2491.000	32.82	54	-21.18	Average

9.5. 6dB & 99% Bandwidth BLE

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.

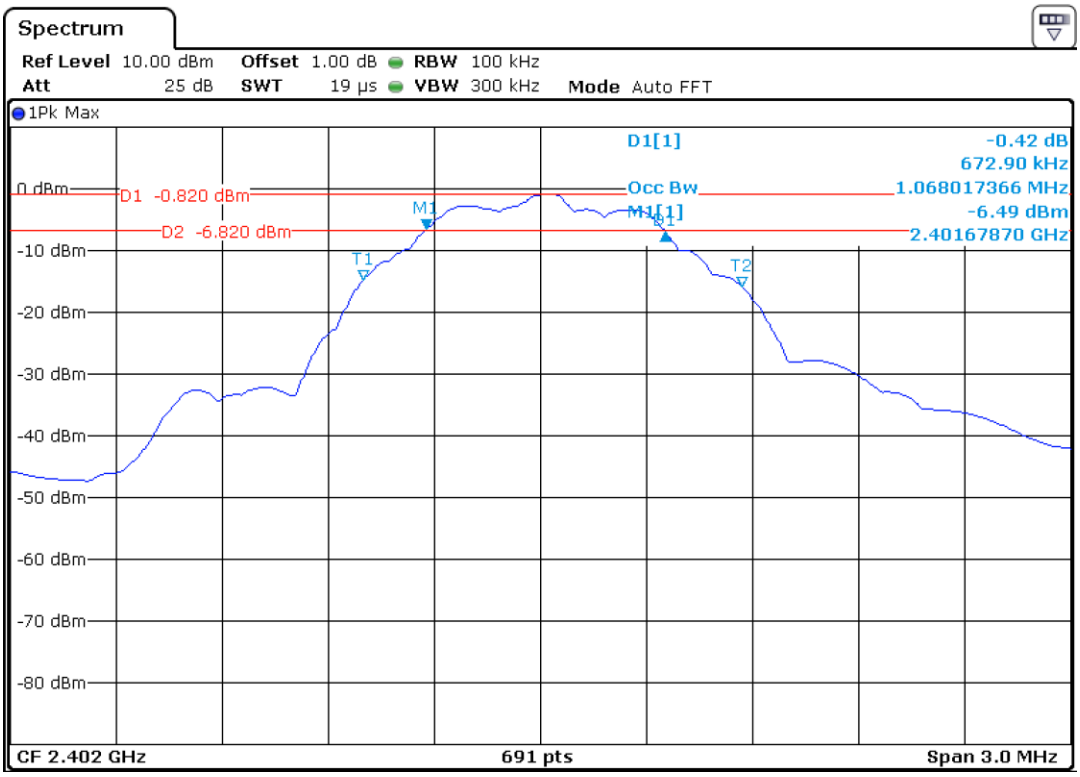
Limit

Limit [kHz]
≥500

6dB & 99% Bandwidth BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed



6dB bandwidth	Limit
672.900 kHz	>500 kHz

99% bandwidth
1068.017 kHz

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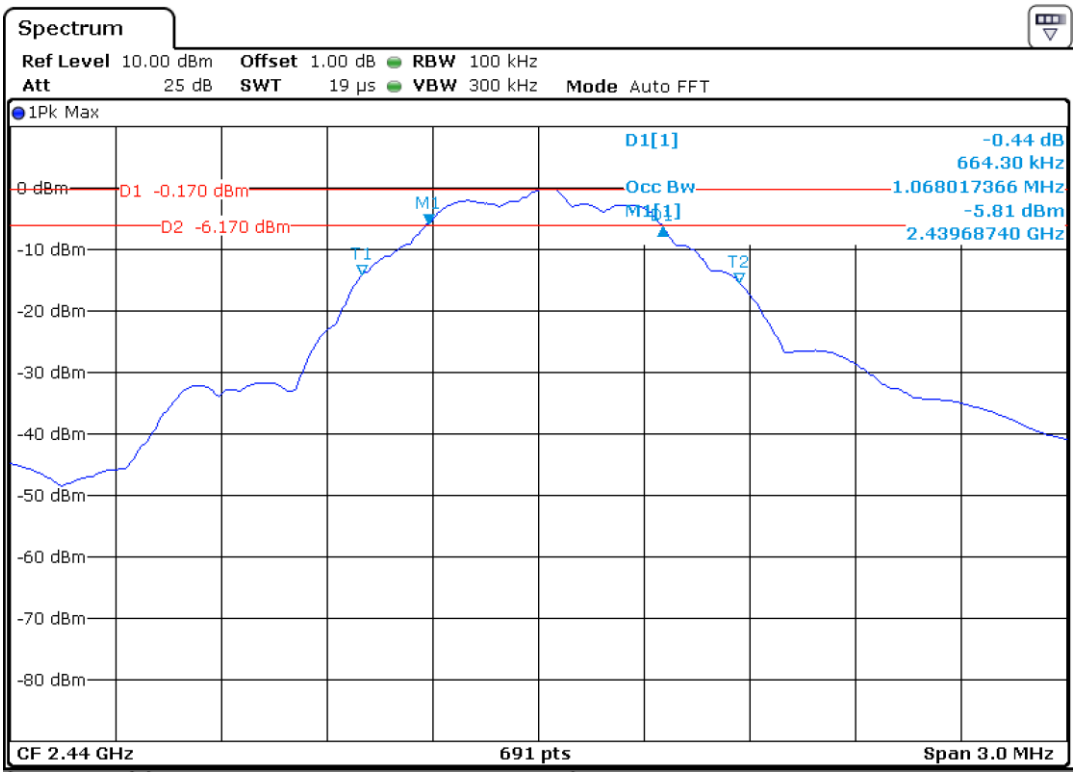
6dB & 99% Bandwidth BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed



6dB bandwidth	Limit
664.300 kHz	>500 kHz

99% bandwidth
1068.017 kHz

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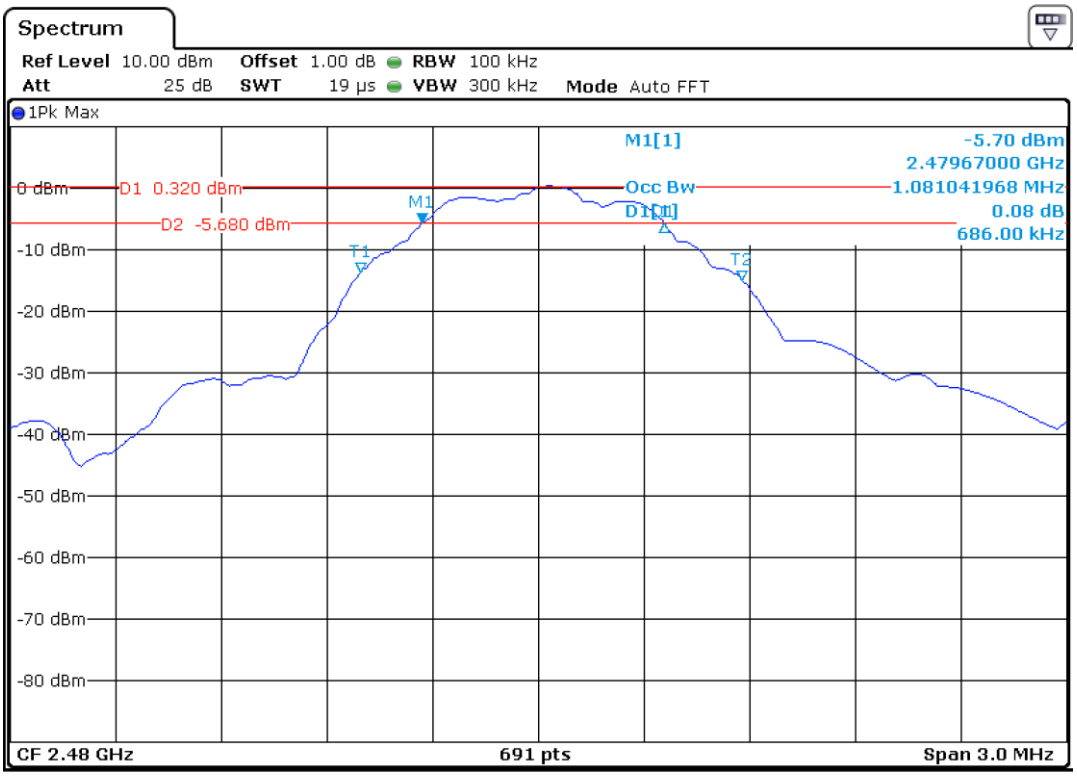
6dB & 99% Bandwidth BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed



6dB bandwidth	Limit
686.000 kHz	>500 kHz

99% bandwidth
1081.041 kHz

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9.6. Conducted Peak Output Power BLE

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

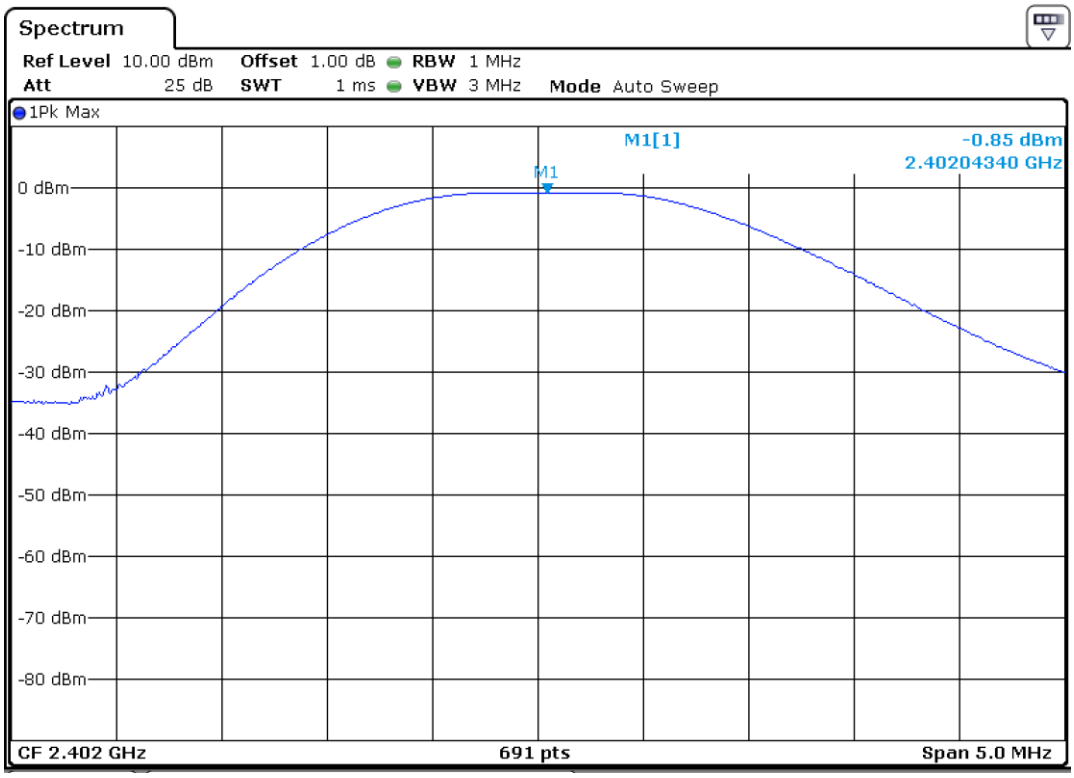
Limits

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

Conducted Peak Output Power BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(b)
Comment:	3.0VDC, Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed

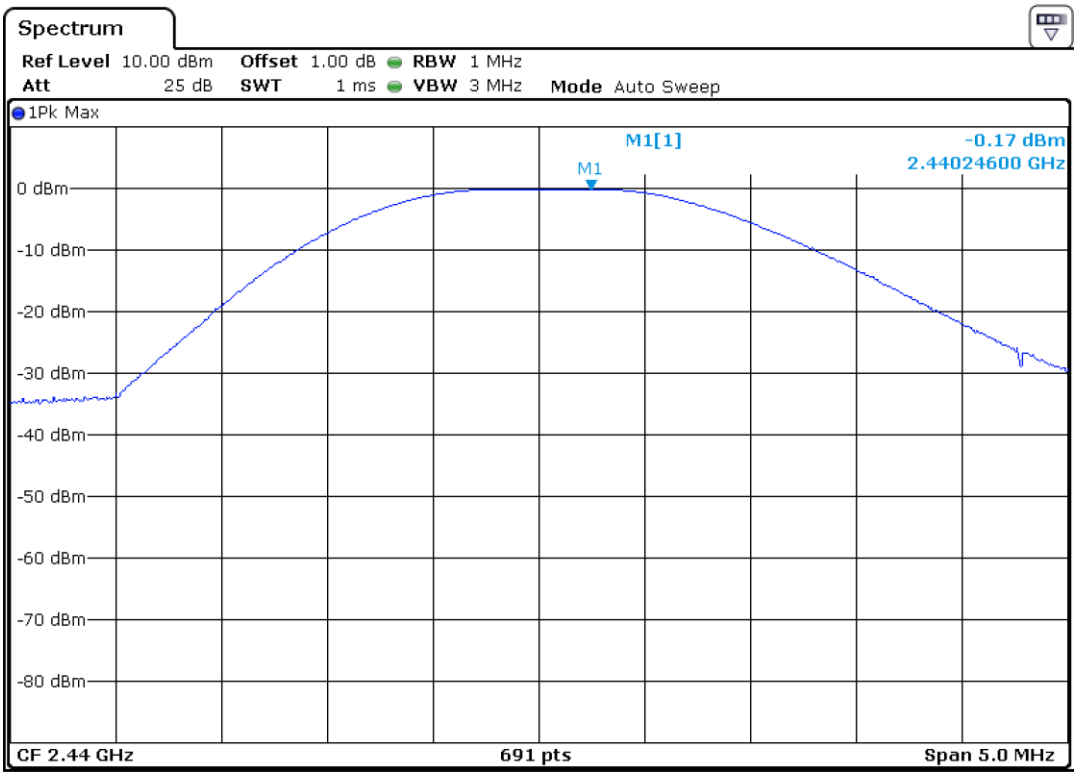


Conducted Output Power	Limit
-0.05dBm	30dBm

Conducted Peak Output Power BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(b)
Comment:	3.0VDC, Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed



Conducted Output Power	Limit
-0.17dBm	30dBm

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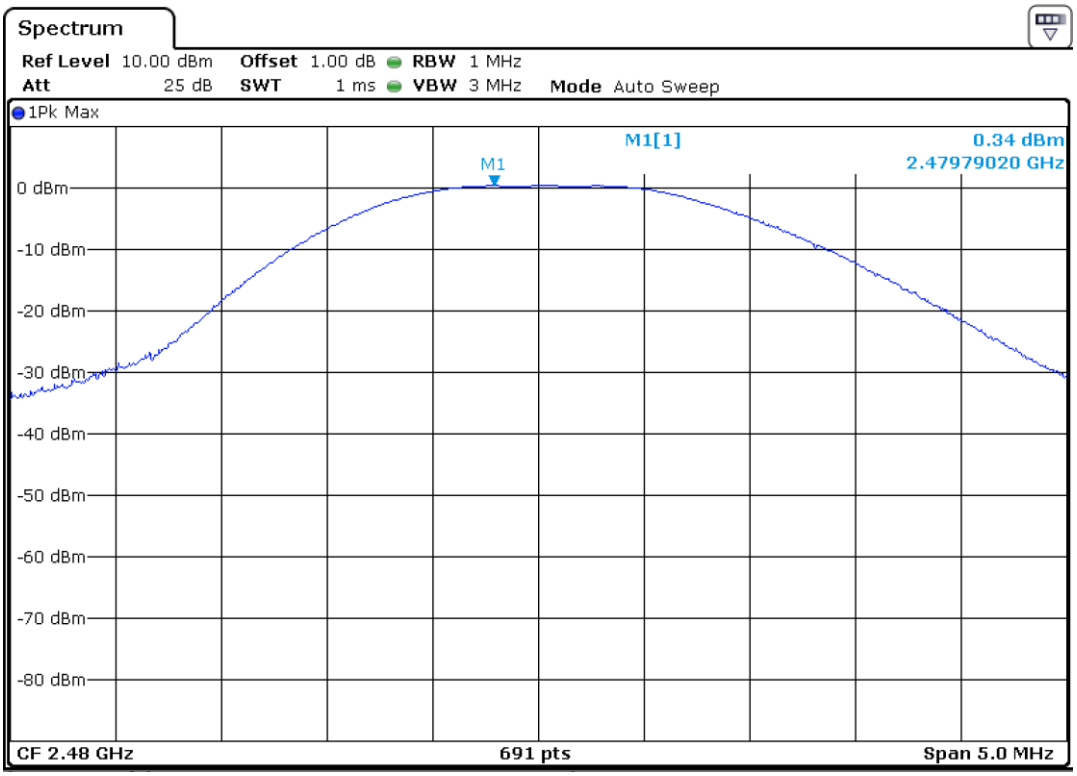
Conducted Peak Output Power BLE

EUT: PML100
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(b)
Comment: 3.0VDC, Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed



Conducted Output Power	Limit
0.34dBm	30dBm

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9.7. Spurious Emissions at Antenna Terminals BLE

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.

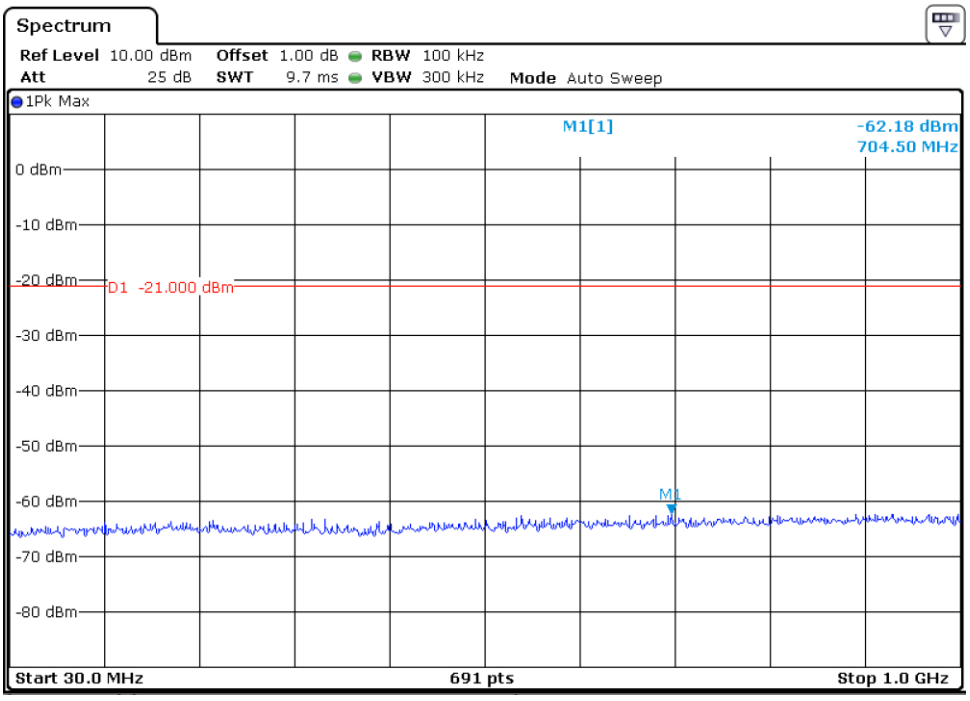
Limit

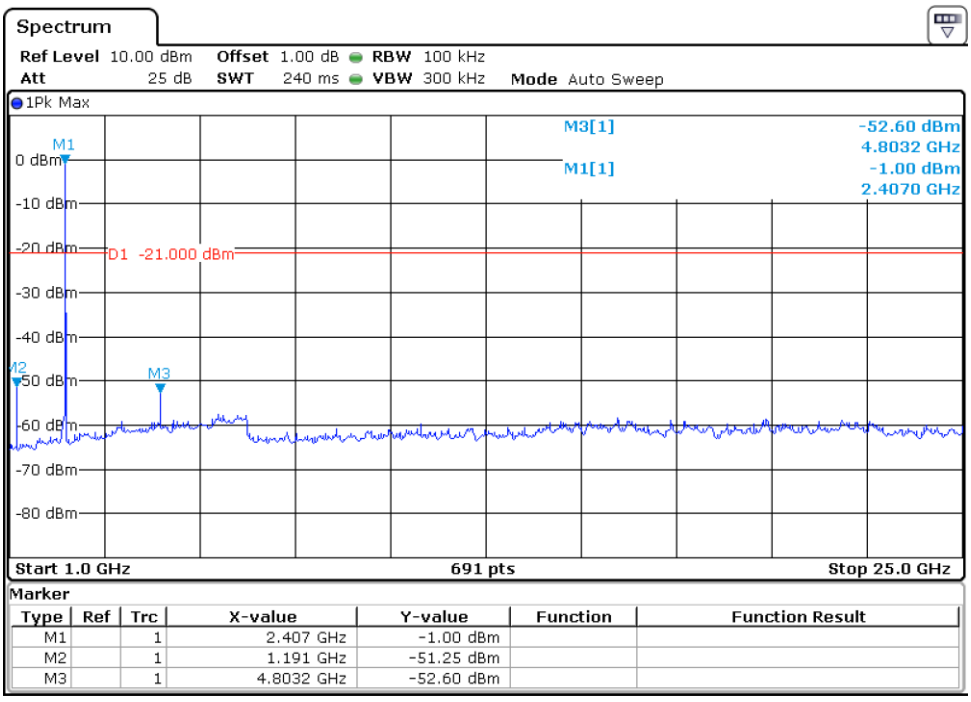
Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious Emissions at Antenna Terminals BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC2.1051 & 15.247(d)
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed





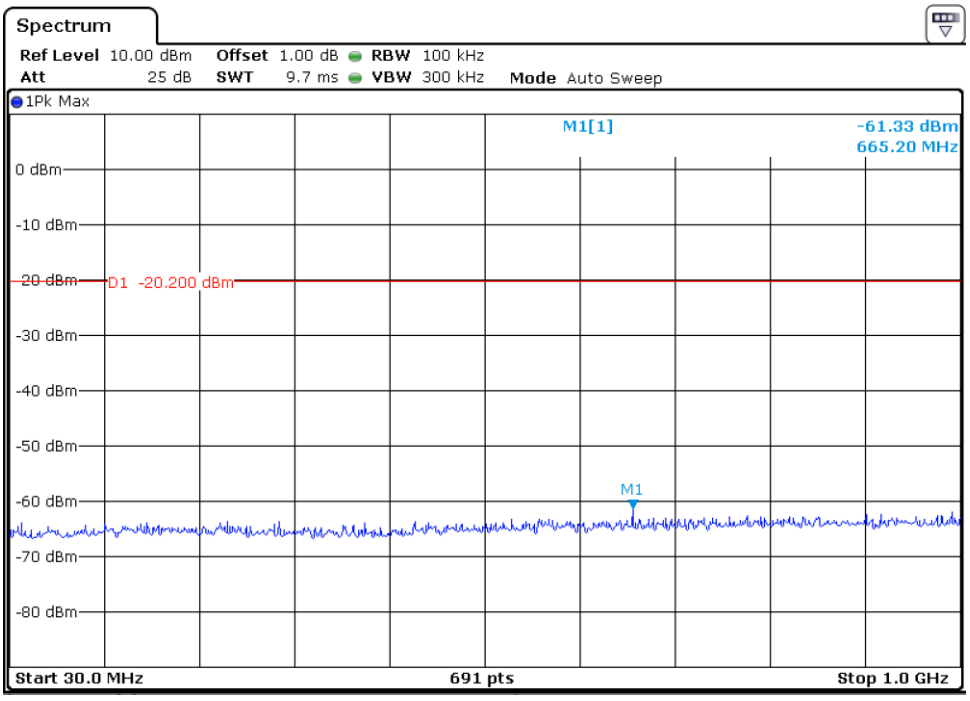
Marker

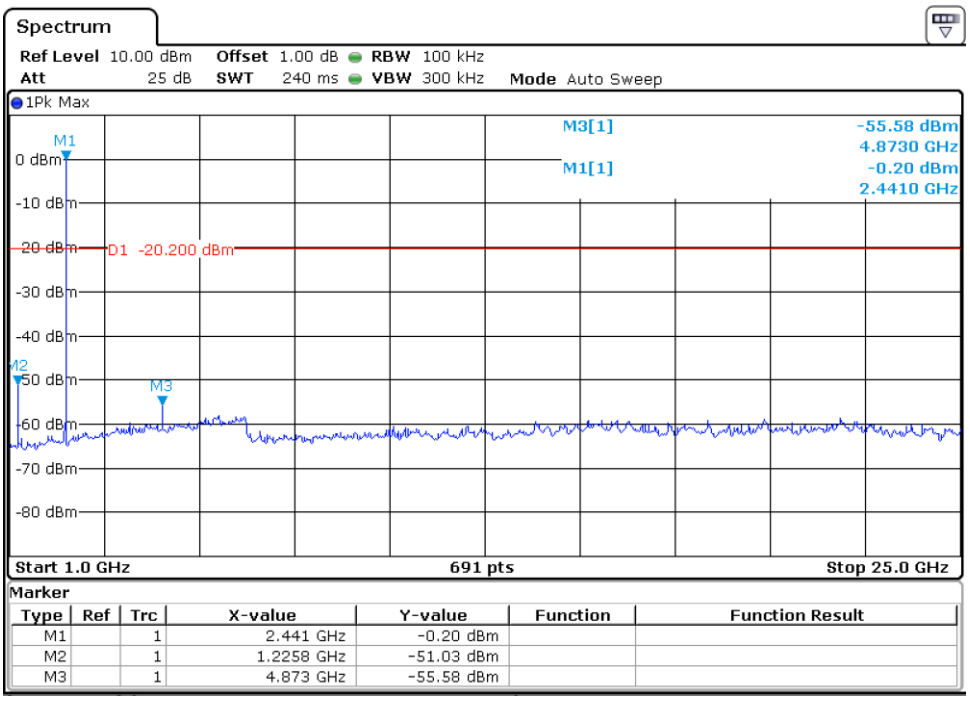
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.407 GHz	-1.00 dBm		
M2		1	1.191 GHz	-51.25 dBm		
M3		1	4.8032 GHz	-52.60 dBm		

Spurious Emissions at Antenna Terminals BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC2.1051 & 15.247(d)
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed





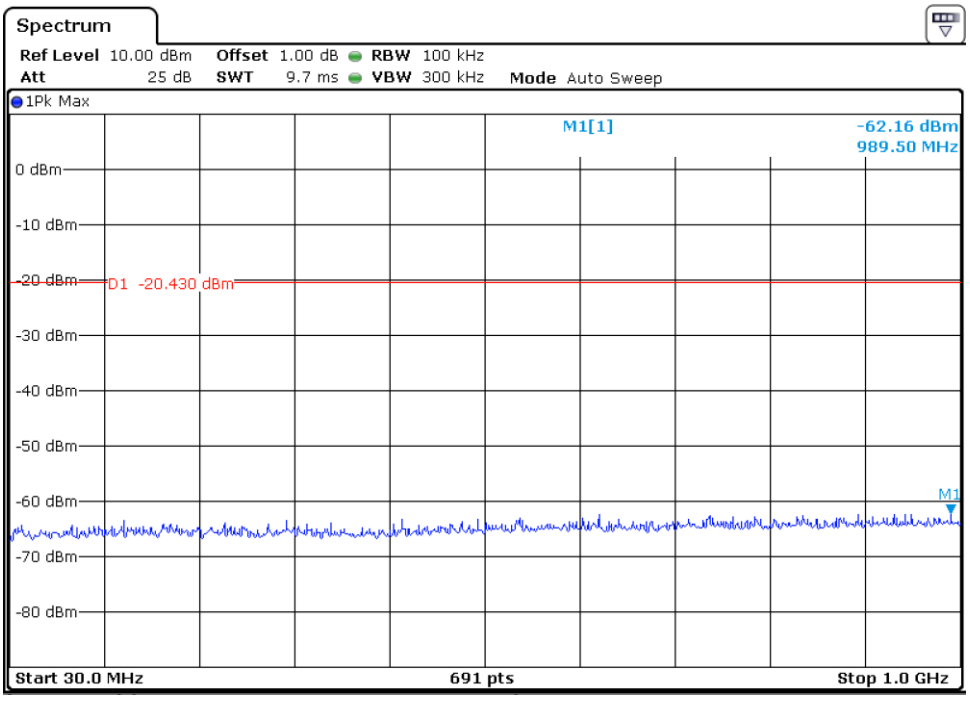
Marker

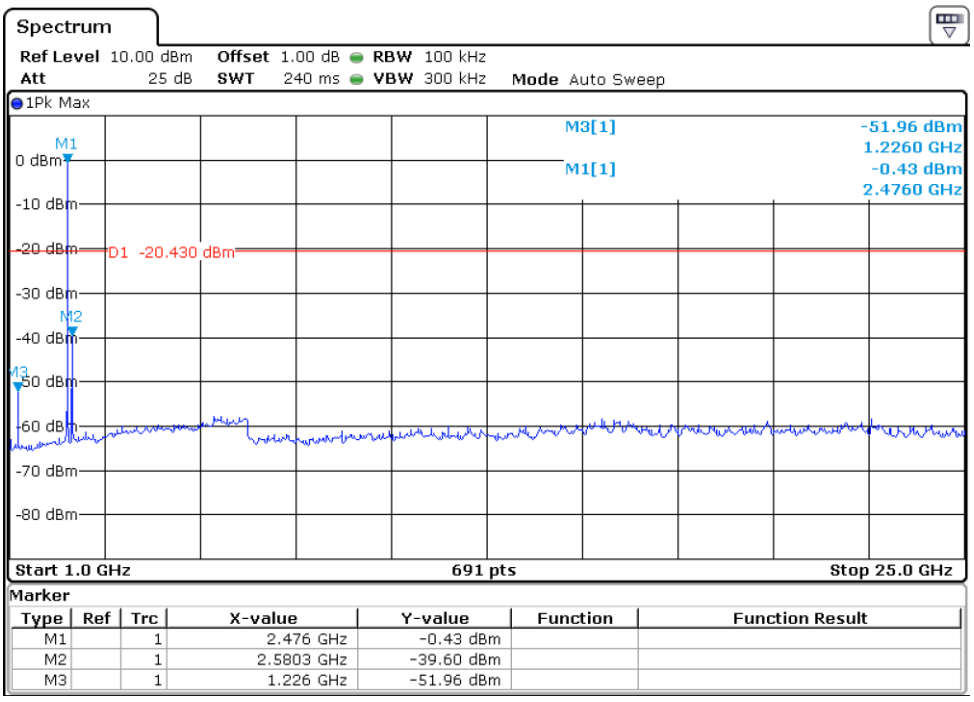
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.441 GHz	-0.20 dBm		
M2		1	1.2258 GHz	-51.03 dBm		
M3		1	4.873 GHz	-55.58 dBm		

Spurious Emissions at Antenna Terminals BLE

EUT: PML100
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 3.0VDC

Test Result
☒ Passed
☐ Not Passed





Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.476 GHz	-0.43 dBm		
M2		1	2.5803 GHz	-39.60 dBm		
M3		1	1.226 GHz	-51.96 dBm		

9.8. 100kHz Bandwidth of band edges BLE

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.

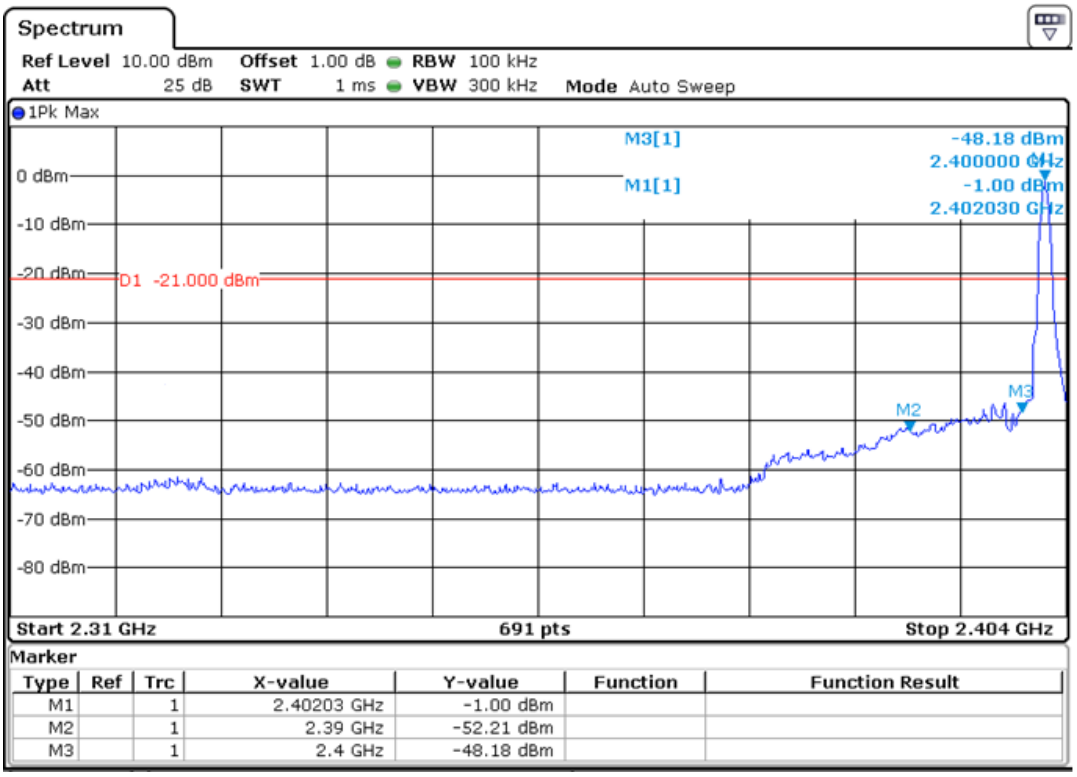
Limit:

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 the100 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 BLE

EUT: PML100
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(d), Conducted
Comment: 3.0VDC

Test Result
☒ Passed
☐ Not Passed



Band edges	Limit
47.18 dB	> 20dB

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100kHz Bandwidth of band edges BLE

EUT: PML100
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(d), Radiated
Comment: 3.0VDC

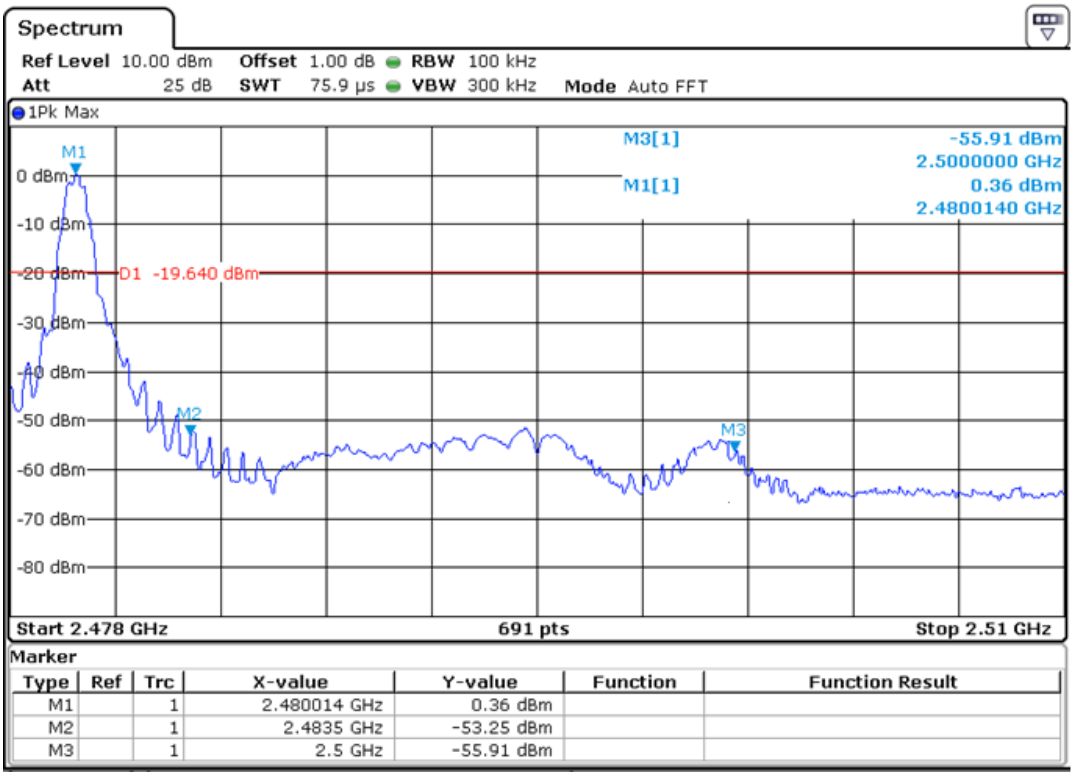
Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
2390.000	43.02	74	-30.98	Peak
2390.000	32.72	54	-21.28	Average

100kHz Bandwidth of band edges BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(d), Conducted
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed



Band edges	Limit
52.89 dB	> 20dB

100kHz Bandwidth of band edges BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(d), Radiated
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
2483.500	41.98	74	-32.02	Peak
2483.500	30.25	54	-23.75	Average

9.9. Power Special Density BLE

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**	
Top channel 2402MHz	-9.04	Pass
Middle channel 2440MHz	-7.41	Pass
Bottom channel 2480MHz	-7.32	Pass

Power Spectral Density BLE

EUT: PML100
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(e)
Comment: 3.0VDC

Test Result
☒ Passed
☐ Not Passed

PSD	Limit
-14.54 dBm	< 8 dBm

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Power Spectral Density BLE

EUT:	PML100
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(e)
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed

PSD	Limit
-13.28 dBm	< 8 dBm

Power Special Density

EUT:	PML100
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(e)
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed

PSD	Limit
-12.60 dBm	< 8 dBm

9.10. Antenna Requirement

EUT:	PML100
Op Condition:	Operated, TX Mode
Test Specification:	FCC15.203 & 15.247(b)
Comment:	3.0VDC

Test Result
☒ Passed
☐ Not Passed

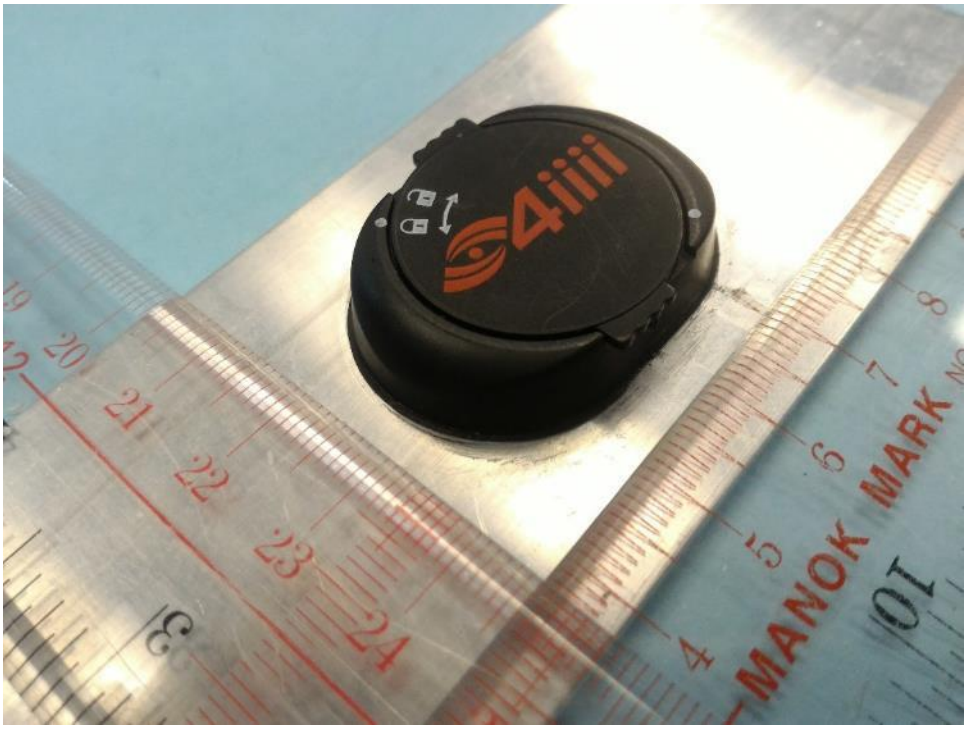
Limit

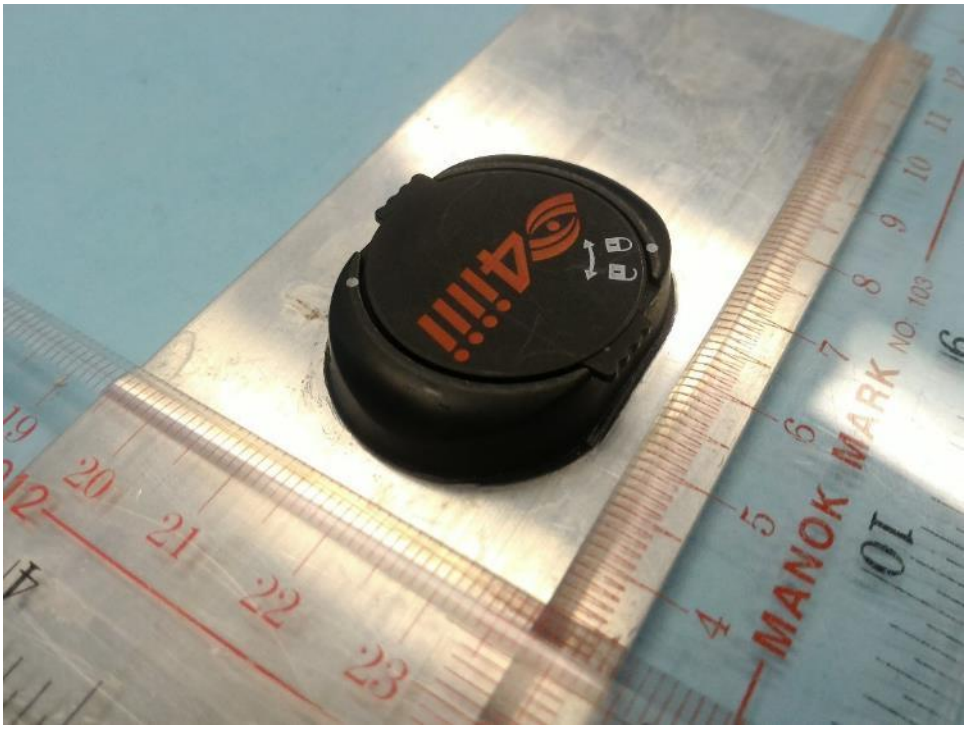
For intentional device, according to FCC Title 47 Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC Title 47 Part 15.247(b), if transmitting antennas of directional gain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

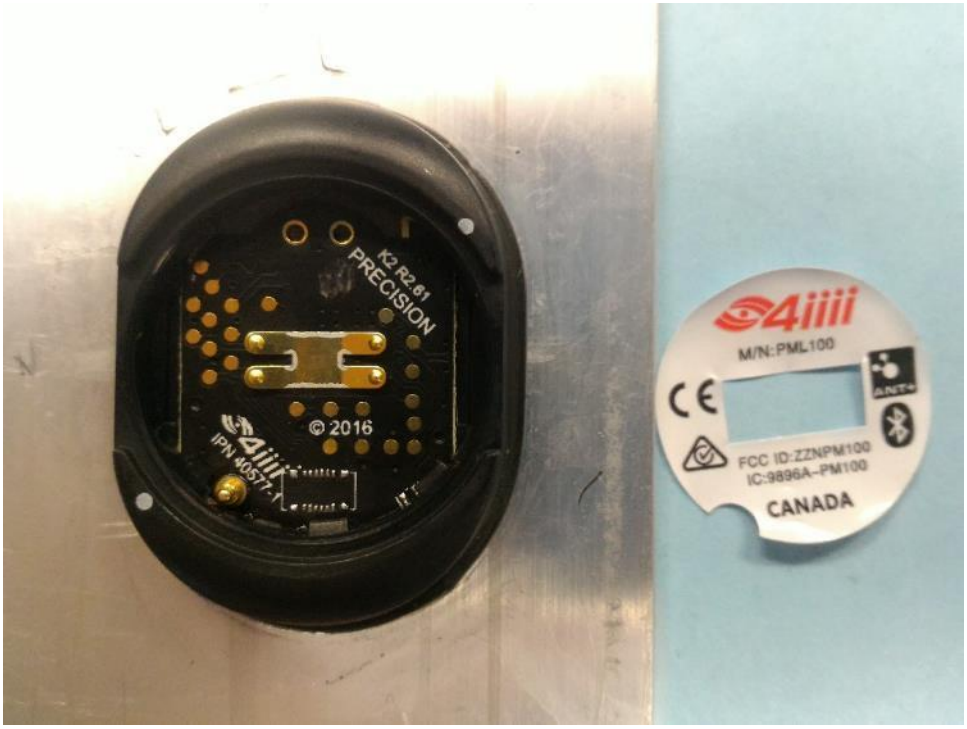
10. Appendix A - Photographs of EUT



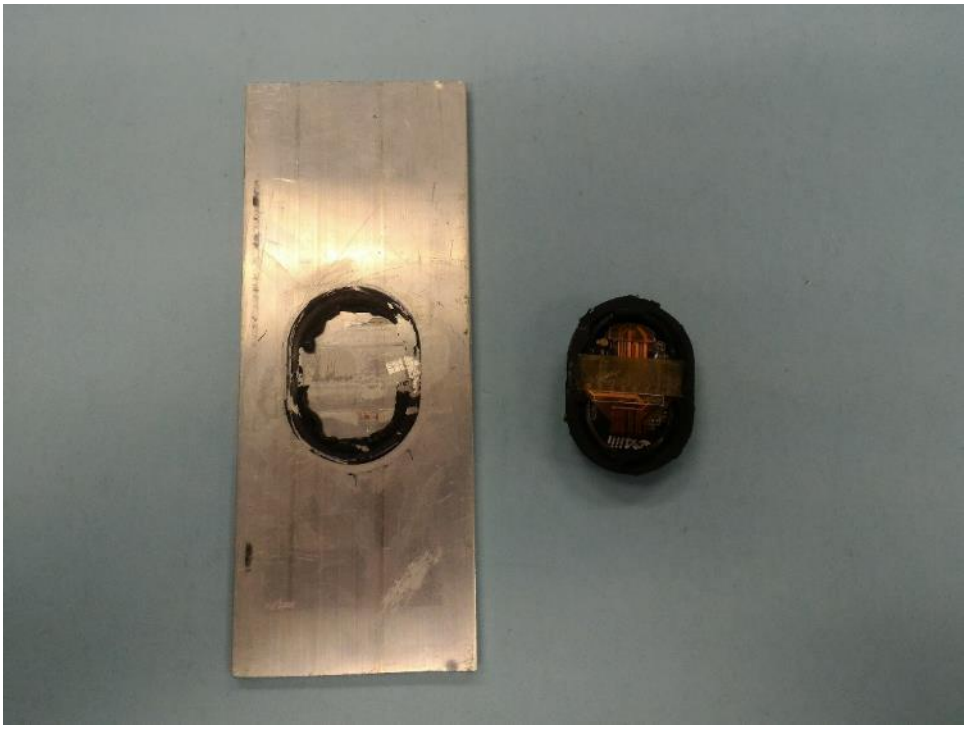


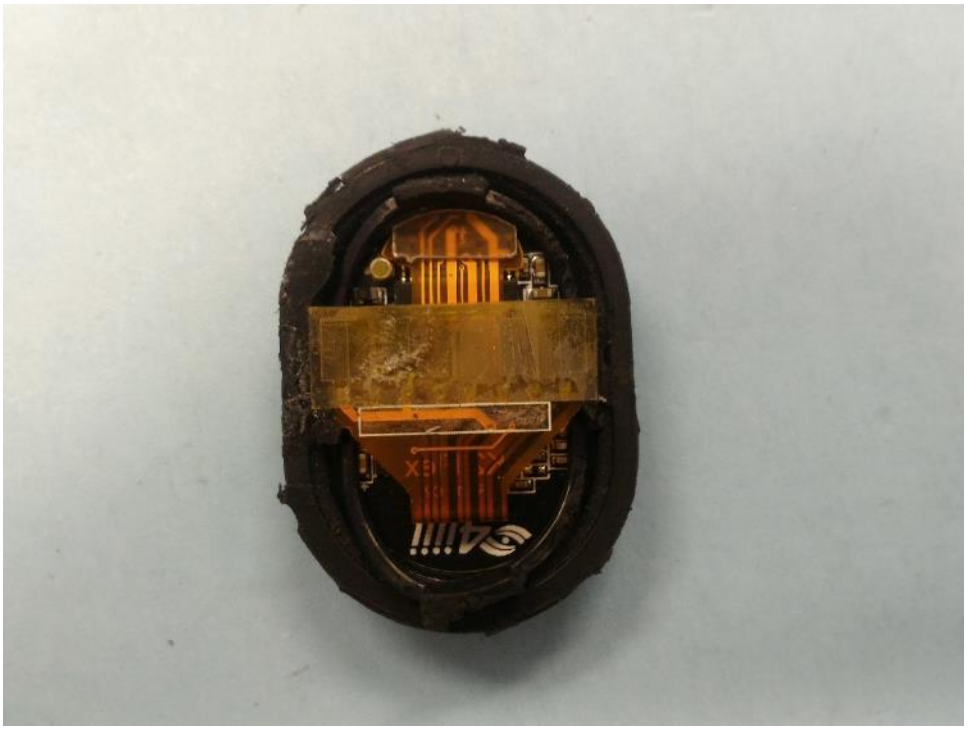
Appendix B


M/N:PML100
FCC ID:ZZNPM100
IC:9896A-PM100
CANADA

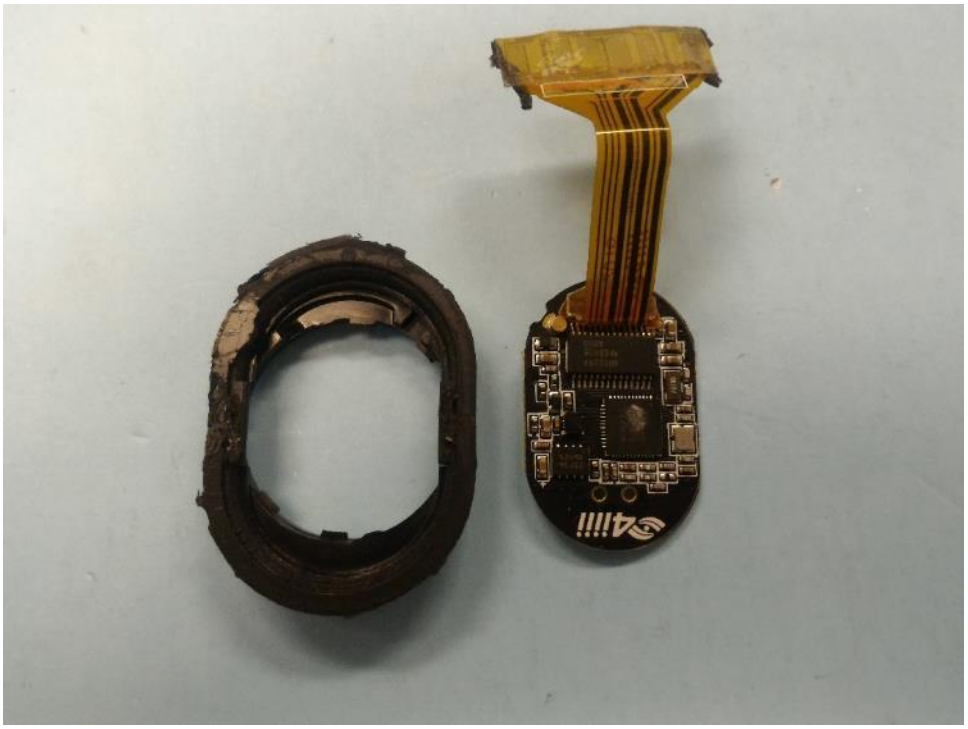

K2 R2.61
PRECISION
© 2016
M/N:PML100
FCC ID:ZZNPM100
IC:9896A-PM100
CANADA

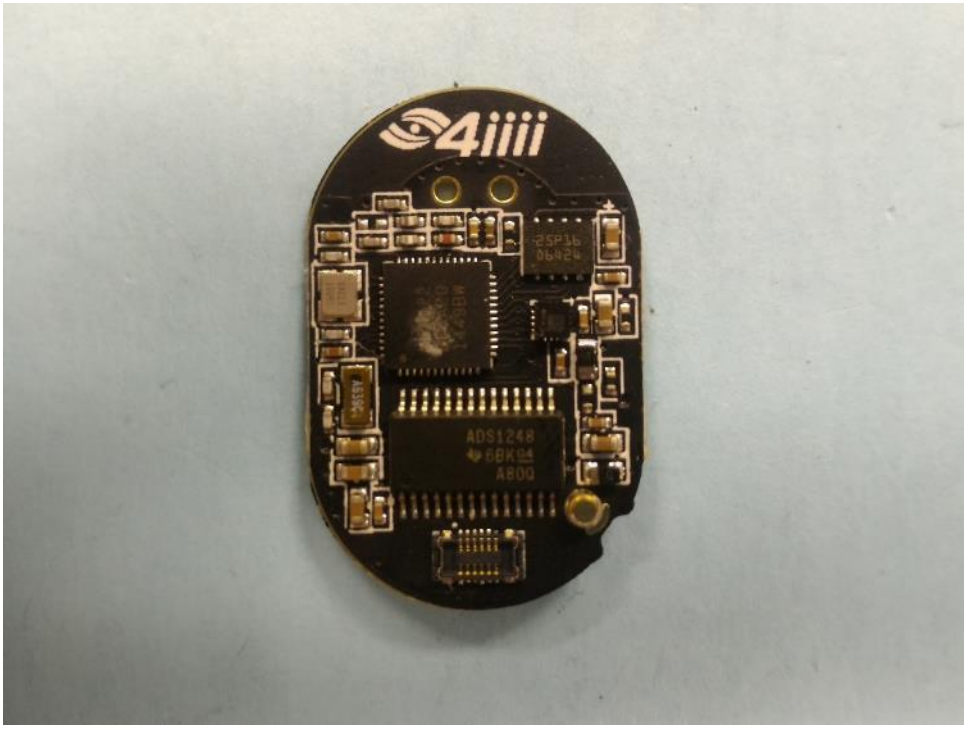
Appendix B



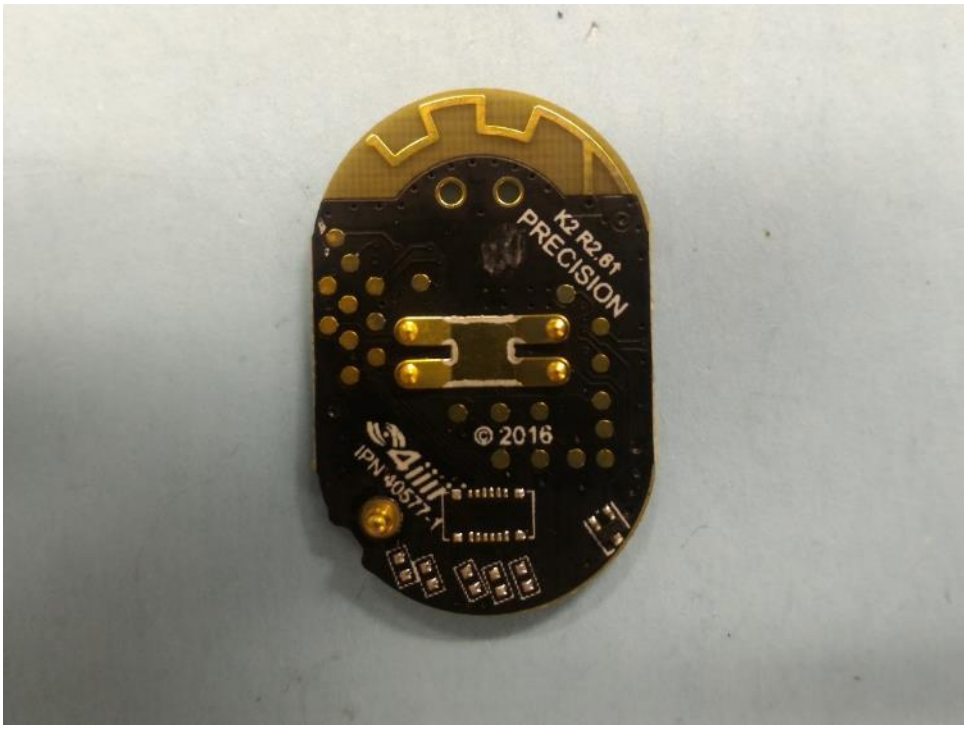


Appendix B



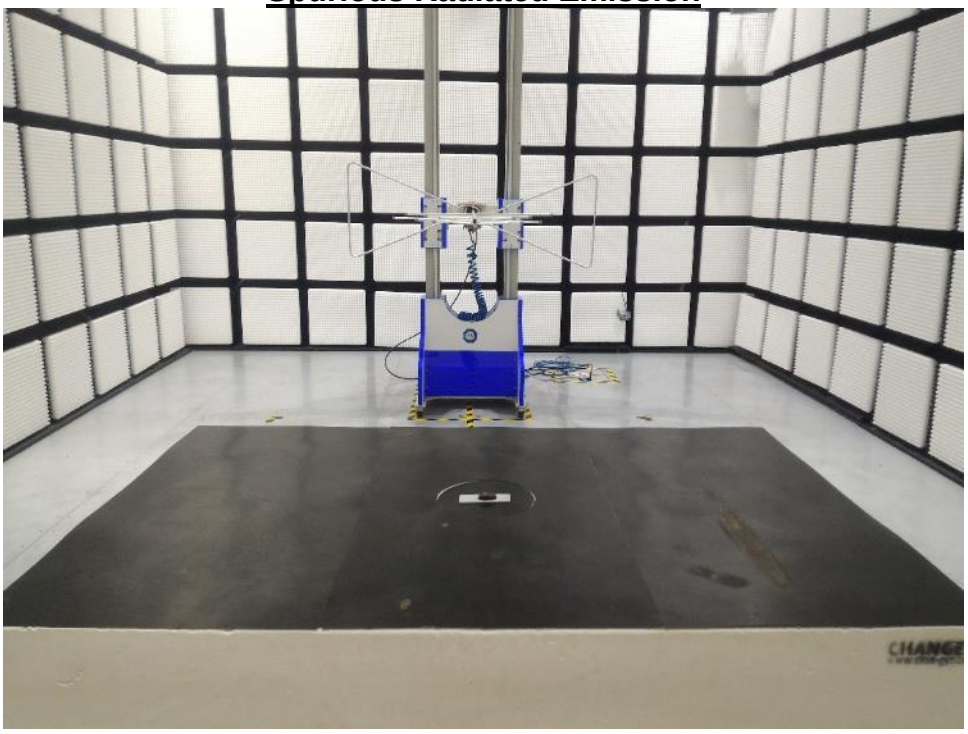


Appendix B



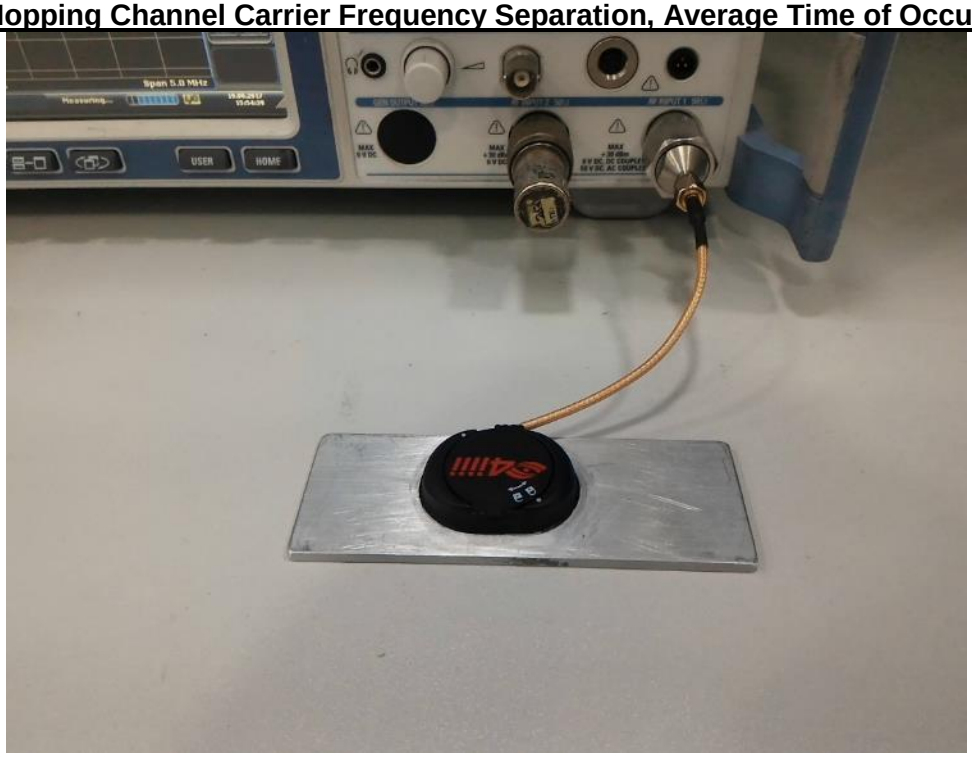
11. Appendix B - Setup Photographs of EUT

Spurious Radiated Emission



Appendix B

20dB & 99% Bandwidth, 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. 10 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)
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR

>> The fundamental frequency of the EUT is 2402-2480MHz,
the test separation distance is ≤ 50mm.
(Manufacturer specified the separation distance is: 20mm)

Step a)
>> Numeric threshold (2402MHz), mW / 20mm * √2.402GHz ≤ 3.0
Numeric threshold (2402MHz) ≤ 38.713mW

>> Numeric threshold (2440MHz), mW / 20mm * √2.440GHz ≤ 3.0
Numeric threshold (2440MHz) ≤ 38.411mW

>> Numeric threshold (2457MHz), mW / 20mm * √2.457GHz ≤ 3.0
Numeric threshold (2457MHz) ≤ 38.278mW

>> Numeric threshold (2480MHz), mW / 20mm * √2.480GHz ≤ 3.0
Numeric threshold (2480MHz) ≤ 38.100mW

>> The power of EUT measured (2402MHz) is: -0.05dBm = 0.989mW
The power of EUT measured (2440MHz) is: -0.17dBm = 0.962mW
The power of EUT measured (2457MHz) is: -0.47dBm = 0.341mW
The power of EUT measured (2480MHz) is: 0.34dBm = 1.081mW

Which is smaller than the Numeric threshold.
Therefore, the device is exempt from stand-alone SAR test requirements.

Appendix C

To: TÜV SÜD HKG Ltd.

Attention: **Mr. Edmond Fung**
From: **Dave McNab**
Fax No:

Date: August 17, 2017
Total Page (Cover Included): 1

Declaration Letter

Subject: Declaration of Model Consistency

We: **4iiii Innovations Inc.**

Officially notify TÜV SÜD HKG Ltd. that the <<Additional Model>> have the same technical construction including circuit diagram, PCB Layout, components and component layout, all electrical construction and mechanical construction, with <<PRODUCT>>, <<Main Test Model>>.
The difference lies only on different color / different outlook of the different models.

<<Additional Model >>: 82031, 82032

<<Main Test Model >>: PML100

<<Product>>: PRECISION POWER METER

Applicant:

August 16, 2017
(Date)

(Applicant's authorized signature and company Chop)

file: declaration letter-template

Page 1 of 1

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
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, Peak Output Power, Spurious Emissions at Antenna Terminals, 100kHz Bandwidth of band edges, Power Spectral Density – 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

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