FCC - TEST REPORT

Report Number	:	**60.790.17.028.02R01**	Date of Issue	: September 8, 2017
Model	:	**PIC102, PIC102-M1B00M, PIC102-R1B00R, PIC102-R2B00R, PIC102-R3B00R, PIC102-Z1B00M, PIC102-Z2B00M, PIC102-N1B00N**		
Product Type	:	**Bicycle Crank Arm Power Sensor**		
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	:	59		

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1. Table of Contents

2. Details about the Test Laboratory

Company name:	TÜV SÜD Cert and Testing (China) Co., Ltd. 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:	Bicycle Crank Arm Power Sensor
Model no.:	PIC102, PIC102-M1B00M, PIC102-R1B00R, PIC102-R2B00R, PIC102-R3B00R, PIC102-Z1B00M, PIC102-Z2B00M, PIC102-N1B00N
FCC ID:	ZZNPM102
Rating:	4.5VDC (3 x 1.5VDC size “AA” batteries)
Frequency:	ANT+: 2457MHz, BT: 2402MHz-2480MHz (BLE only)
Antenna gain:	0 dBi
Number of operated channel:	ANT+:1 BT: 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	9-15	☒	☐	☐
FCC Title 47 Part 15.207 Conduct Emission	NIL	☐	☐	☒
FCC Title 47 Part 15.247(a)(2) 6dB & 99% Bandwidth	25-28	☒	☐	☐
FCC Title 47 Part 15.247(b) Conducted Peak Output Power	29-32	☒	☐	☐
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	33-36	☒	☐	☐
FCC Title 47 Part 15.247(d) Radiated restrict band edges	37-41	☒	☐	☐
FCC Title 47 Part 15.247(e) Power Spectral Density	42-45	☒	☐	☐
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	46	☒	☐	☐

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	16-18	☒	☐	☐
FCC Title 47 Part 15.207 Conduct Emission	NIL	☐	☐	☒
FCC Title 47 Part 15.215 20dB & 99% Bandwidth	19-21	☒	☐	☐
FCC Title 47 Part 15.249 Bandedge Emission	22-24	☒	☐	☐

6. General Remarks

Remarks

Client informs that the PIC102-M1B00M, PIC102-R1B00R, PIC102-R2B00R, PIC102-R3B00R, PIC102-Z1B00M, PIC102-Z2B00M, PIC102-N1B00N have the same technical construction including circuit diagram, PCB Layout, components and component layout, all electrical construction and mechanical construction, with Bicycle Crank Arm Power Sensor, PIC102. 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: PIC102.

This submittal(s) (test report) is intended for
FCC ID: ZZNPM102 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 DXX 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 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: June 29, 2017

Testing Start Date: June 30, 2017

Testing End Date: July 31, 2017

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Reviewed by:

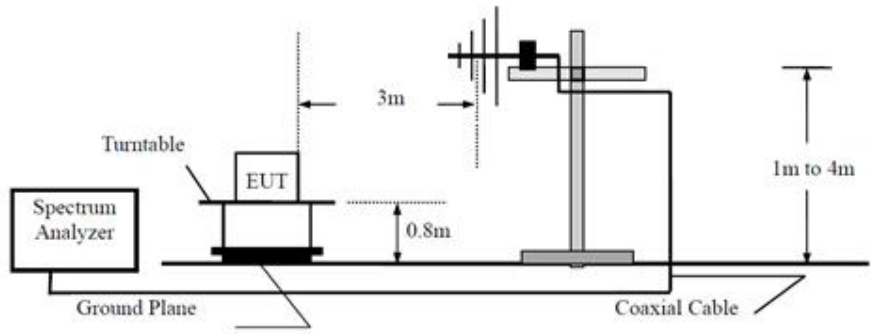
CHAN Kwong Ngai
EMC Test Engineer

Prepared by:

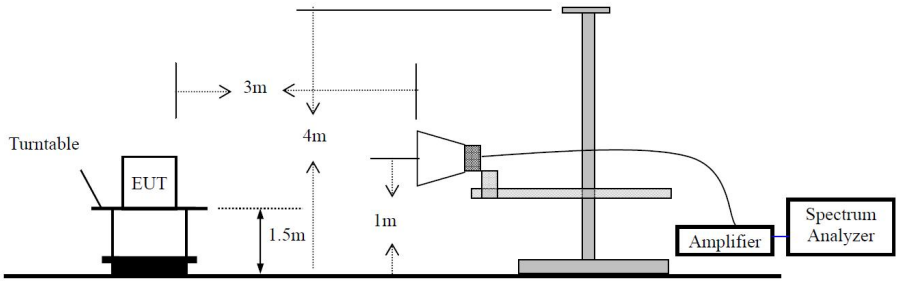
Alex CHAN
EMC Project Engineer

7. Test Setups

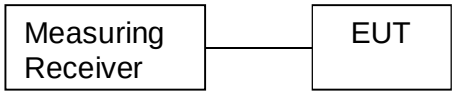
7.1. Radiated test setups Below 1GHz



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 = Quasi 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: PIC102
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
Comment: 4.5VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
58.736	18.05	40	-21.95	Quasi Peak	-16.3
69.527	17.67	40	-22.33	Quasi Peak	-13.9
109.115	14.80	43.5	-28.70	Quasi Peak	-15.8
1167.800	37.44	74	-32.56	Peak	-14.6
2400.000	46.18	54	-3.82	Average	-7.9
2438.400	39.25	74	-30.75	Peak	-7.9
4803.750	65.57	74	-8.43	Peak	0.5
4803.750	39.56	54	-14.44	Average	0.5
7206.250	58.03	74	-15.97	Peak	2.7
7206.250	36.99	54	-17.01	Average	2.7

Remark: Result=Reading Value + Factor
Factor=Antenna Factor+ Cable Loss + Pre-Amplifier Gain

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Spurious Radiated Emission BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
Comment: 4.5VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
88.200	19.93	43.5	-23.57	Quasi Peak	-13.5
119.725	20.82	43.5	-22.68	Quasi Peak	-16.1
136.215	23.74	43.5	-19.76	Quasi Peak	-12.9
151.674	20.62	43.5	-22.88	Quasi Peak	-13.0
1173.600	39.48	74	-34.52	Peak	-14.3
2404.600	45.77	74	-28.23	Peak	-7.8
2404.600	42.91	54	-11.09	Average	-7.8
4803.750	65.54	74	-8.46	Peak	0.5
4803.750	37.76	54	-16.24	Average	0.5
7206.875	54.27	74	-19.73	Peak	2.8
7206.875	36.80	54	-17.20	Average	2.8

Remark: Result=Reading Value + Factor
Factor=Antenna Factor+ Cable Loss + Pre-Amplifier Gain

Spurious Radiated Emission BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
Comment: 4.5VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
58.736	18.05	40	-21.95	Quasi Peak	-16.3
69.527	17.67	40	-22.33	Quasi Peak	-13.9
109.115	14.80	43.5	-28.70	Quasi Peak	-15.8
1605.400	39.47	74	-34.53	Peak	-12.1
2453.200	45.03	74	-28.97	Peak	-7.8
2453.200	44.44	54	-9.56	Average	-7.8
4879.375	65.19	74	-8.81	Peak	0.5
4879.375	42.17	54	-11.83	Average	0.5
7320.000	60.18	74	-13.82	Peak	3.2
7320.000	39.60	54	-14.40	Average	3.2

Remark: Result=Reading Value + Factor
Factor=Antenna Factor+ Cable Loss + Pre-Amplifier Gain

Spurious Radiated Emission BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
Comment: 4.5VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
88.200	19.93	43.5	-23.57	Quasi Peak	-13.5
119.725	20.82	43.5	-22.68	Quasi Peak	-16.1
136.215	23.74	43.5	-19.76	Quasi Peak	-12.9
151.674	20.62	43.5	-22.88	Quasi Peak	-13.0
2145.800	42.32	74	-31.68	Peak	-8.5
2556.200	41.43	54	-12.57	Average	-7.3
4880.625	61.44	74	-12.56	Peak	0.6
4880.625	38.56	54	-15.44	Average	0.6
7319.375	57.45	74	-16.55	Peak	3.3
7319.375	37.25	54	-16.75	Average	3.3

Remark: Result=Reading Value + Factor
Factor=Antenna Factor+ Cable Loss + Pre-Amplifier Gain

Spurious Radiated Emission BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
Comment: 4.5VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
58.736	18.05	40	-21.95	Quasi Peak	-16.3
69.527	17.67	40	-22.33	Quasi Peak	-13.9
109.115	14.80	43.5	-28.70	Quasi Peak	-15.8
1599.800	46.73	74	-27.27	Peak	-12.1
1599.800	45.67	54	-8.33	Average	-12.1
2396.200	45.40	74	-28.60	Peak	-8.0
4960.000	62.22	74	-11.78	Peak	0.6
4960.000	35.94	54	-8.06	Average	0.6
7439.375	58.90	74	-15.10	Peak	3.7
7439.375	35.20	54	-8.80	Average	3.7

Remark: Result=Reading Value + Factor
Factor=Antenna Factor+ Cable Loss + Pre-Amplifier Gain

Spurious Radiated Emission BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
Comment: 4.5VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
88.200	19.93	43.5	-23.57	Quasi Peak	-13.5
119.725	20.82	43.5	-22.68	Quasi Peak	-16.1
136.215	23.74	43.5	-19.76	Quasi Peak	-12.9
151.674	20.62	43.5	-22.88	Quasi Peak	-13.0
1198.200	39.67	74	-34.33	Peak	-14.3
2612.400	39.91	74	-34.09	Peak	-7.0
2612.400	38.07	54	-15.93	Average	-7.0
4960.625	62.23	74	-11.77	Peak	0.7
4960.625	37.11	54	-16.89	Average	0.7
7440.000	59.22	74	-14.78	Peak	3.8
7440.000	35.08	54	-18.92	Average	3.8

Remark: Result=Reading Value + Factor
Factor=Antenna Factor+ Cable Loss + Pre-Amplifier Gain

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: PIC102
Op Condition: Operated, TX Mode (2457MHz)
Test Specification: FCC15.249 & 15.209, Antenna: Horizontal
Comment: 4.5VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
58.736	18.05	40	-21.95	Quasi Peak	-16.3
69.527	17.67	40	-22.33	Quasi Peak	-13.9
109.115	14.80	43.5	-28.70	Quasi Peak	-15.8
2457.000	89.32	114	-24.68	Peak	-6.8
2457.000	87.56	94	-6.44	Average	-6.8
4913.750	58.20	74	-15.80	Peak	0.7
4913.750	50.16	54	-3.84	Average	0.7
7371.250	46.90	74	-27.10	Peak	3.2
7371.250	37.82	54	-16.18	Average	3.2

Remark: Result=Reading Value + Factor
Factor=Antenna Factor+ Cable Loss + Pre-Amplifier Gain

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Nanshan District, Shenzhen 518052, P.R. China

Radiated Emission

EUT: PIC102
Op Condition: Operated, TX Mode (2457MHz)
Test Specification: FCC15.249 & 15.209, Antenna: Vertical
Comment: 4.5VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
88.200	19.93	43.5	-23.57	Quasi Peak	-13.5
119.725	20.82	43.5	-22.68	Quasi Peak	-16.1
136.215	23.74	43.5	-19.76	Quasi Peak	-12.9
151.674	20.62	43.5	-22.88	Quasi Peak	-13.0
2457.000	89.56	114	-24.44	Peak	-6.8
2457.000	88.43	94	-5.57	Average	-6.8
4913.750	60.49	74	-13.51	Peak	0.7
4913.750	50.16	54	-3.84	Average	0.7
7371.250	46.90	74	-27.10	Peak	3.2
7371.250	37.82	54	-16.18	Average	3.2

Remark: Result=Reading Value + Factor
Factor=Antenna Factor+ Cable Loss + Pre-Amplifier Gain

9.3. 20dB & 99% Bandwidth ANT+

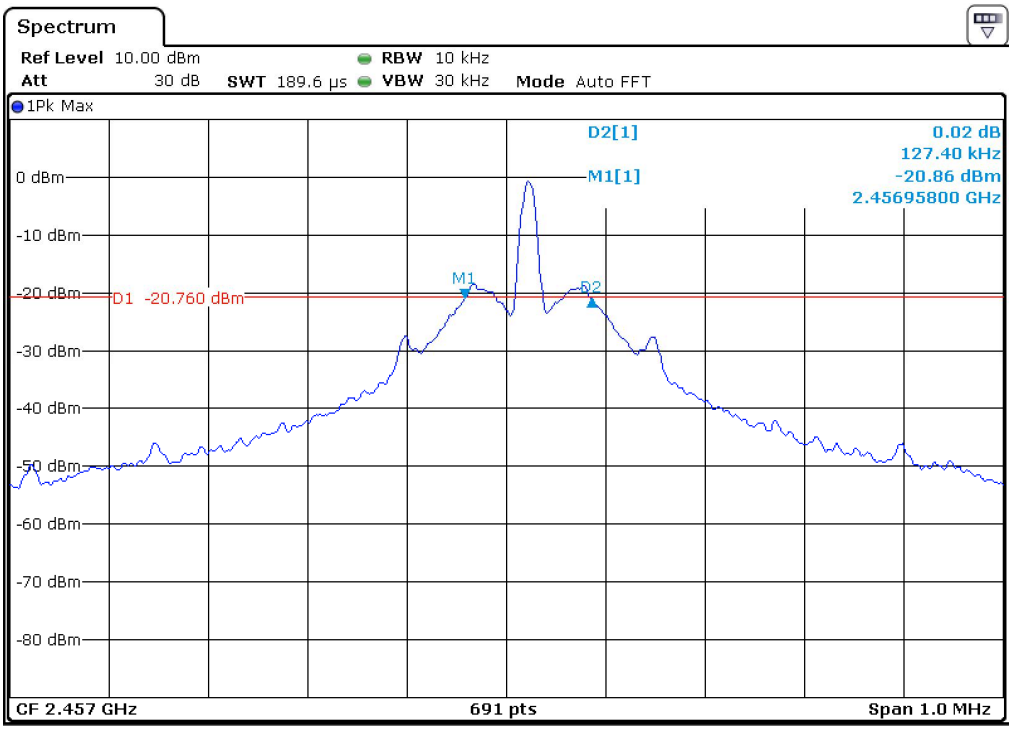
Test Method

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.

20dB & 99% Bandwidth – ANT+

EUT:	PIC102
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.215, 20dB Bandwidth
Comment:	4.5VDC

Test Result
☒ Passed
☐ Not Passed

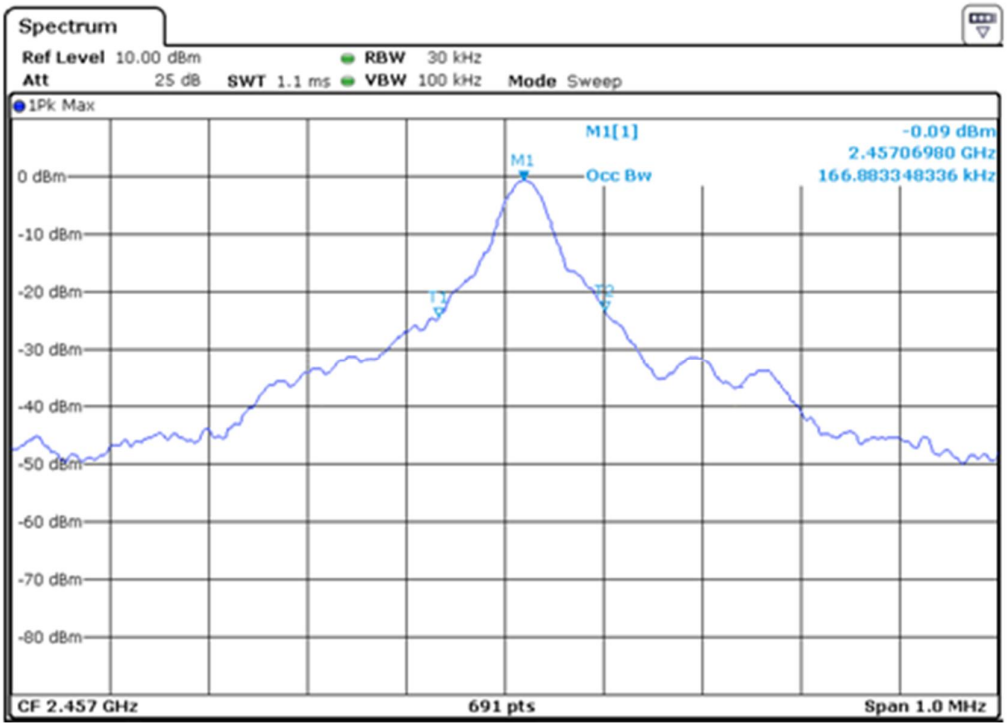


20dB bandwidth
127.400 kHz

20dB & 99% Bandwidth ANT+

EUT:	PIC102
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.215, 99% Bandwidth
Comment:	4.5VDC

Test Result
☒ Passed
☐ Not Passed



99% bandwidth
166.883 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.

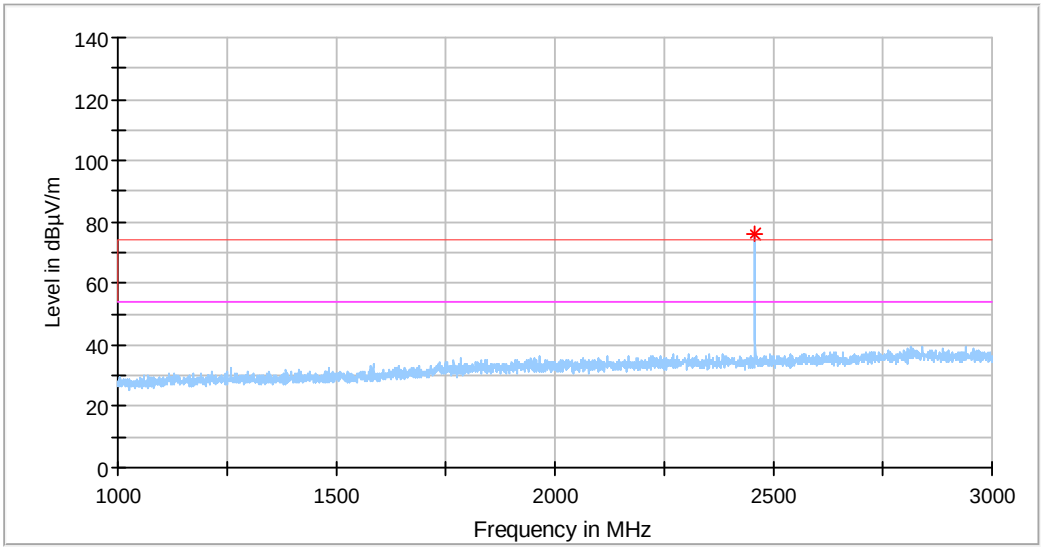
3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle).

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:	PIC102
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.247, Antenna: Horizontal
Comment:	4.5VDC

Test Result
☒ Passed
☐ Not Passed

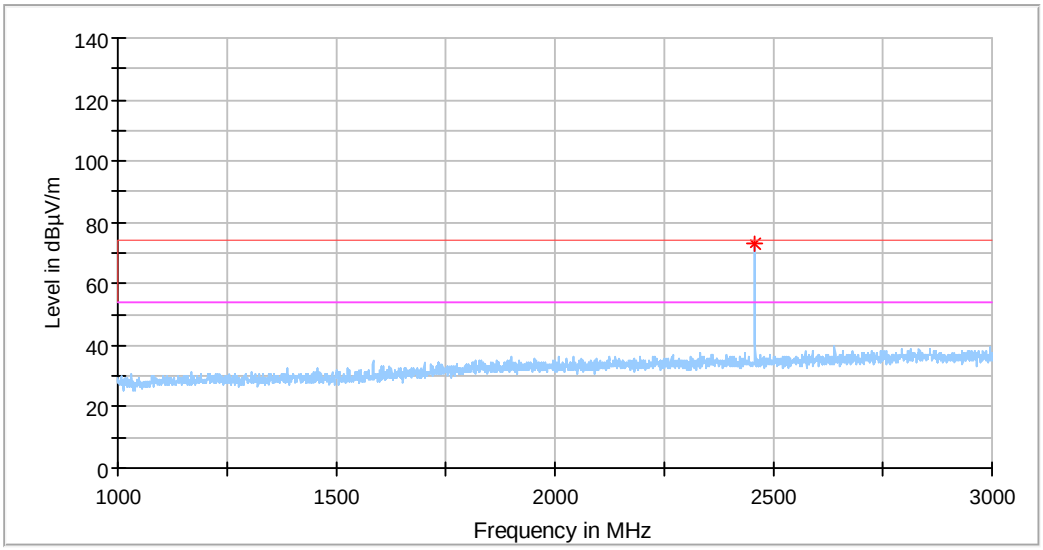


Band	Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
Low	2390.000	34.68	74	-39.32	Peak	-8.1
Low	2390.000	31.32	54	-22.78	Average	-8.1
High	2483.500	36.59	74	-37.02	Peak	-7.9
High	2483.500	32.21	54	-21.79	Average	-7.9

Bandedge Emission ANT+

EUT:	PIC102
Op Condition:	Operated, TX Mode (2457MHz)
Test Specification:	FCC15.247, Antenna: Vertical
Comment:	4.5VDC

Test Result
☒ Passed
☐ Not Passed



Band	Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
Low	2390.000	33.13	74	-40.87	Peak	-7.9
Low	2390.000	30.65	54	-23.35	Average	-7.9
High	2483.500	35.48	74	-38.52	Peak	-7.8
High	2483.500	32.16	54	-21.84	Average	-7.8

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.

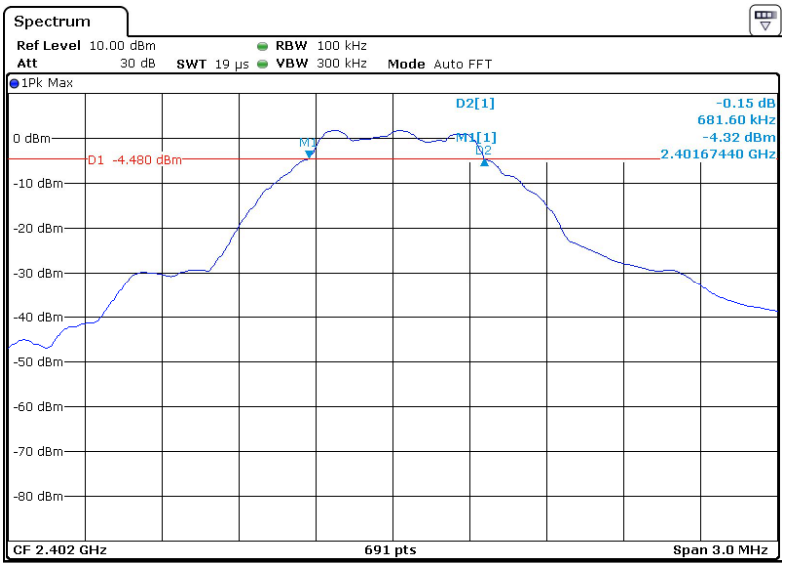
Limit

Limit [kHz]
≥500

6dB & 99% Bandwidth BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment: 4.5VDC

Test Result
☒ Passed
☐ Not Passed



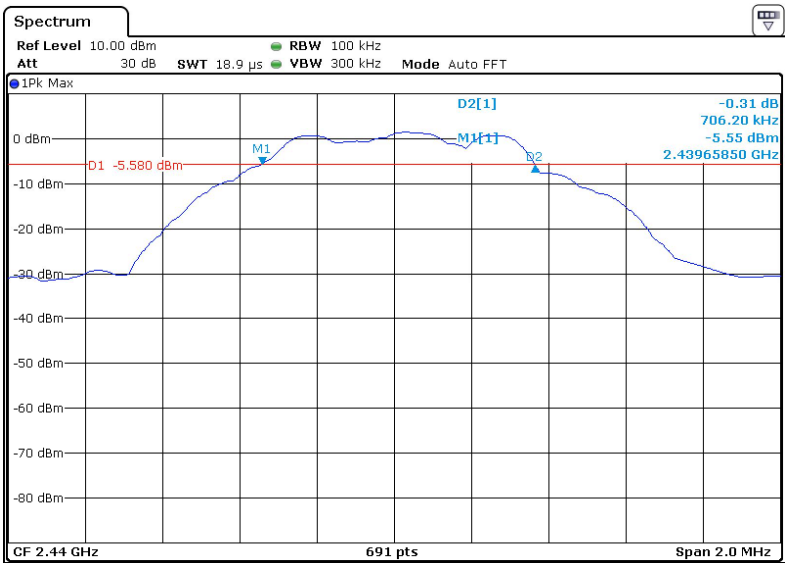
6dB bandwidth	Limit
681.600 kHz	> 500 kHz

99% bandwidth
1030.390 kHz

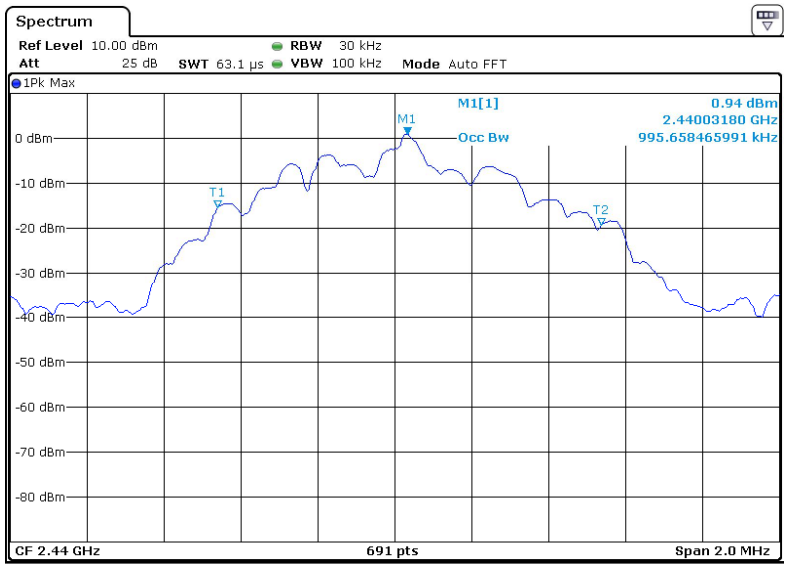
6dB & 99% Bandwidth BLE

EUT:	PIC102
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment:	4.5VDC

Test Result
☒ Passed
☐ Not Passed



6dB bandwidth	Limit
706.200 kHz	> 500 kHz

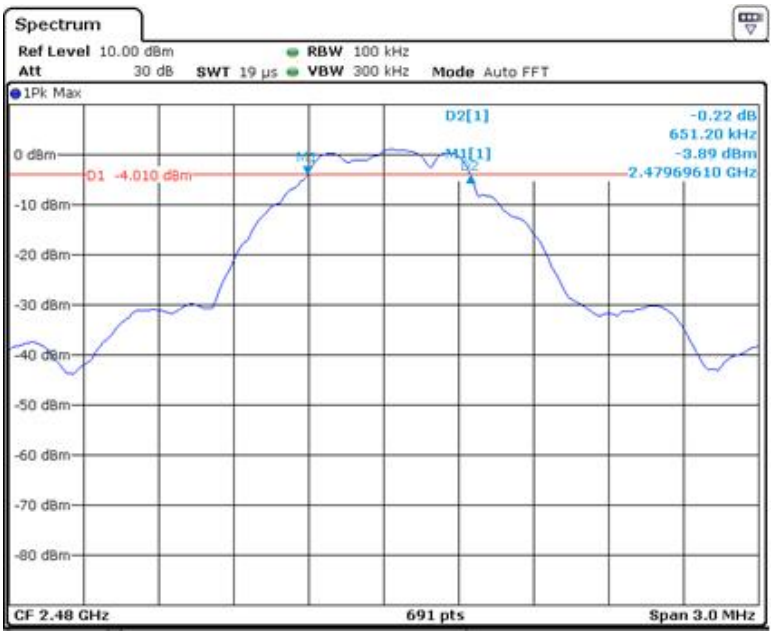


99% bandwidth
995.658 kHz

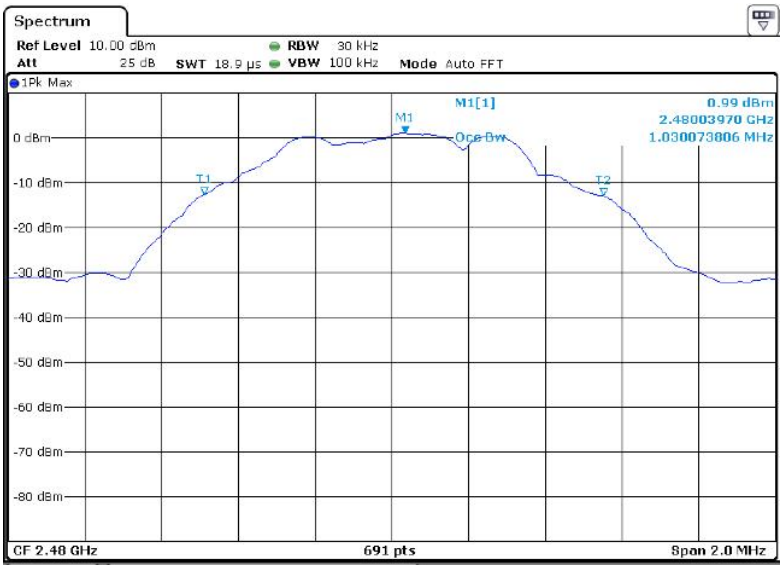
6dB & 99% Bandwidth BLE

EUT:	PIC102
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment:	4.5VDC

Test Result
☒ Passed
☐ Not Passed



6dB bandwidth	Limit
651.200 kHz	>500 kHz



99% bandwidth
1030.073 kHz

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

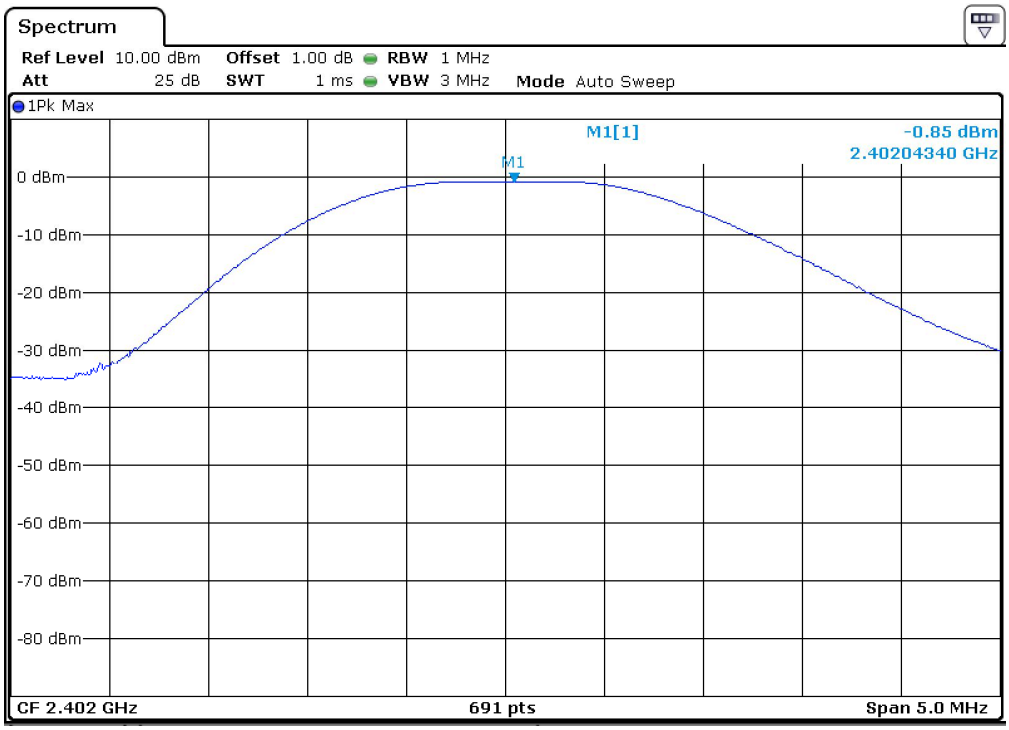
Limits

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

Conducted Peak Output Power BLE

EUT:	PIC102
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(b)
Comment:	4.5VDC, Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed



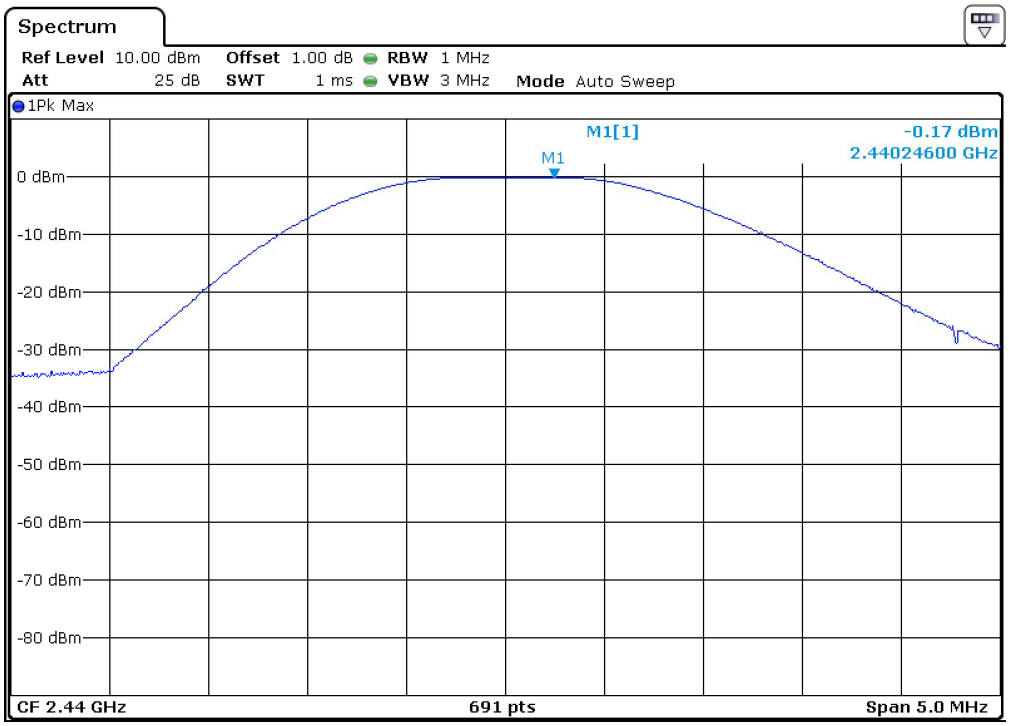
Conducted Output Power	Limit
-0.85 dBm	30dBm

TÜV SÜD Cert and Testing (China) Co., Ltd.
Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2,
Nanshan District, Shenzhen 518052, P.R. China

Conducted Peak Output Power BLE

EUT:	PIC102
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(b)
Comment:	4.5VDC, Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed

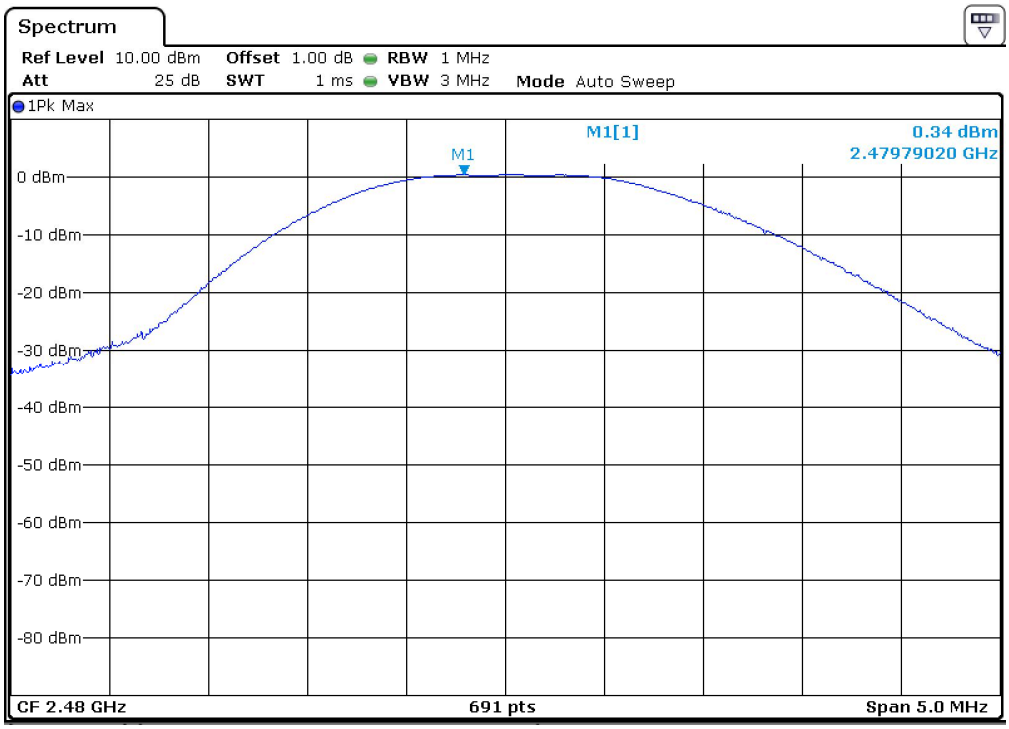


Conducted Output Power	Limit
-0.17 dBm	30dBm

Conducted Peak Output Power BLE

EUT:	PIC102
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(b)
Comment:	4.5VDC, Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed



Conducted Output Power	Limit
0.34 dBm	30dBm

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

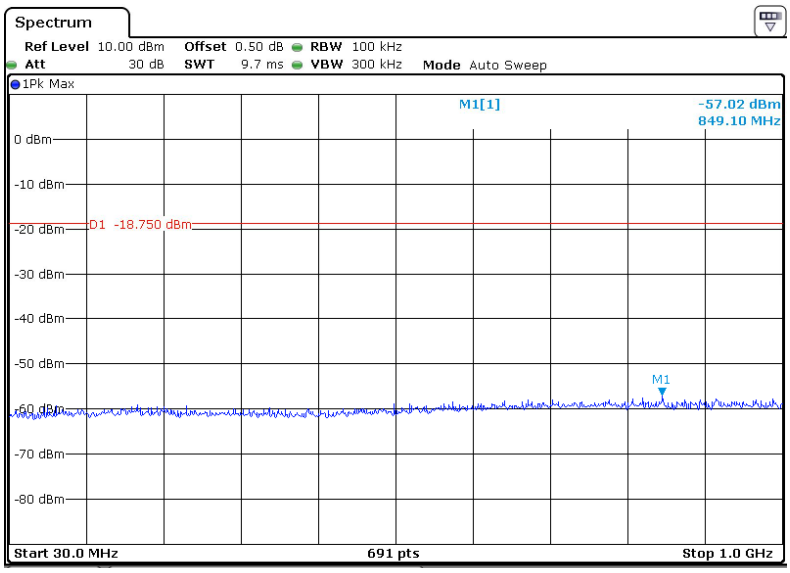
Frequency Range MHz	Limit (dBc)
30-25000	-20

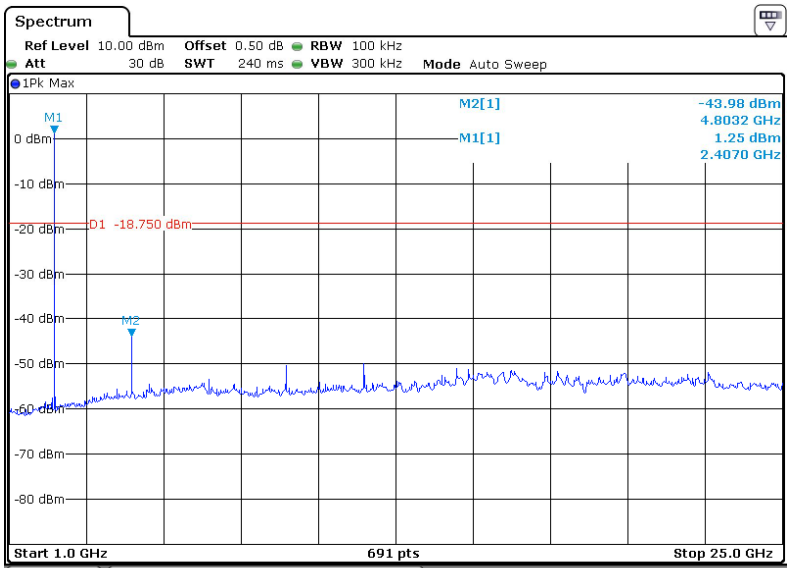
Spurious Emissions at Antenna Terminals BLE

EUT:	PIC102
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC2.1051 & 15.247(d)
Comment:	4.5VDC

Test Result
☒ Passed
☐ Not Passed

Measured Reference Level is 1.25dBm



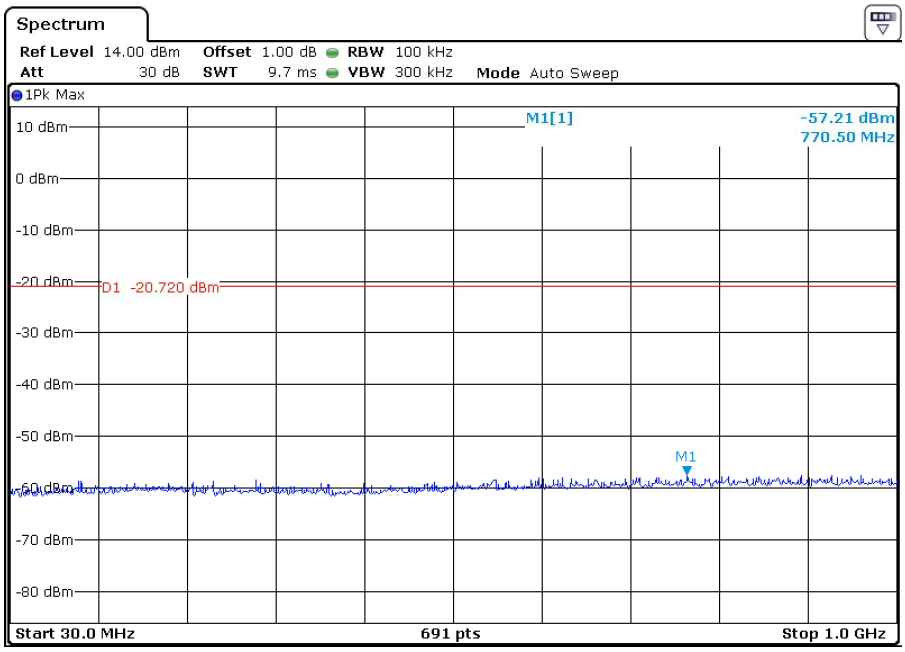


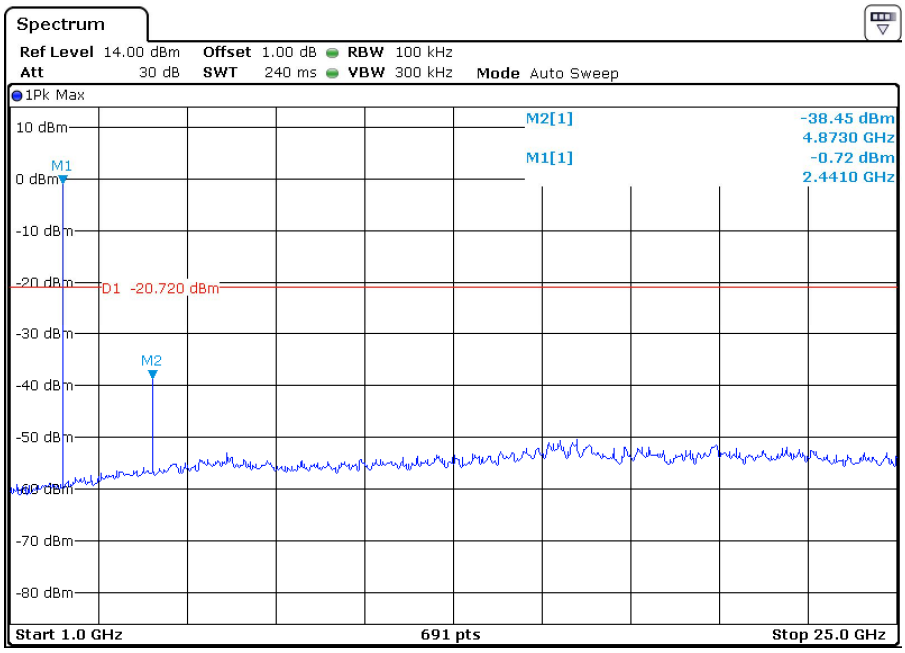
Spurious Emissions at Antenna Terminals BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 4.5VDC

Test Result
☒ Passed
☐ Not Passed

Measured Reference Level is -0.72dBm



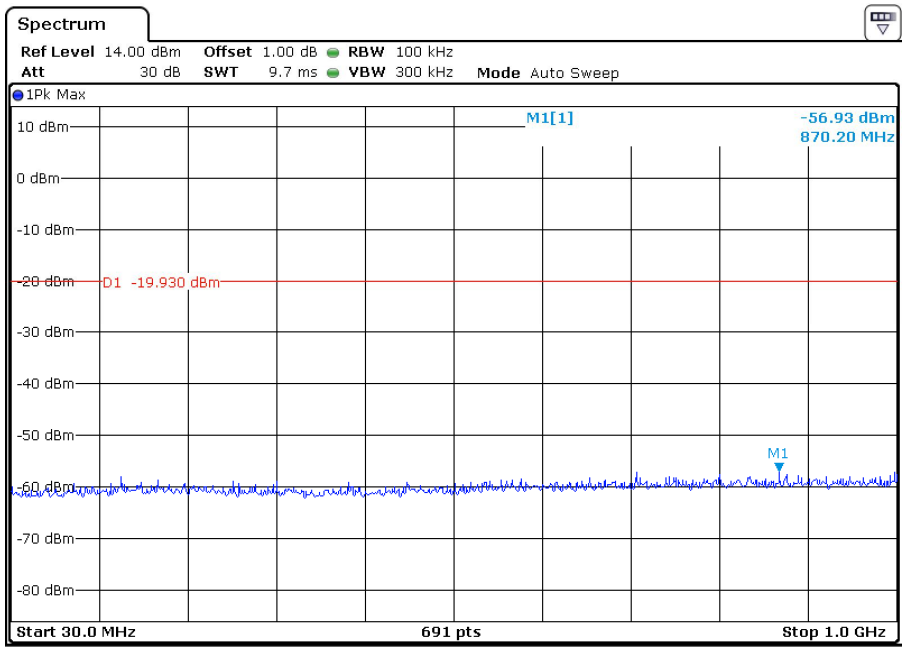


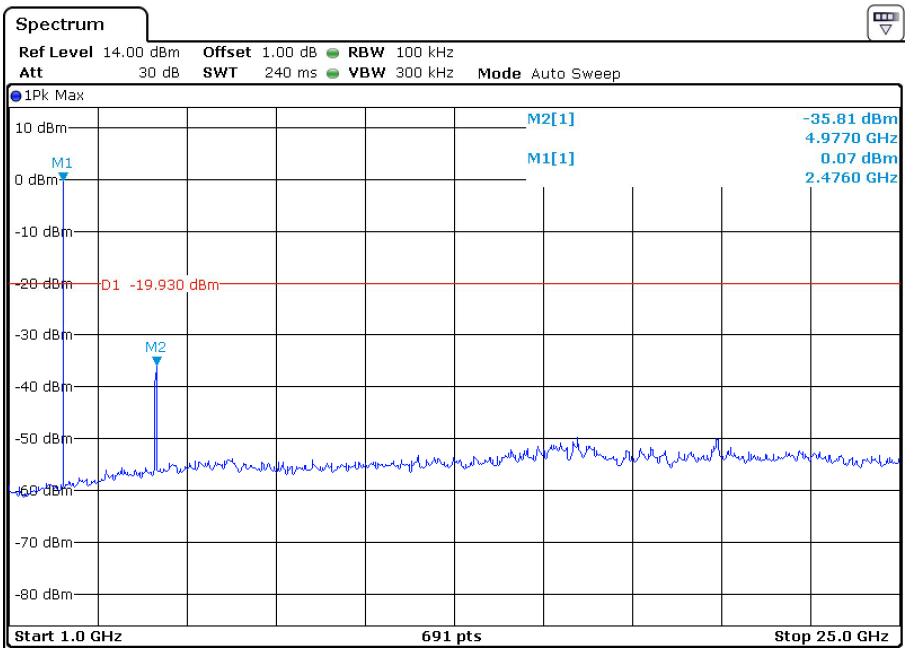
Spurious Emissions at Antenna Terminals BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 4.5VDC

Test Result
☒ Passed
☐ Not Passed

Measured Reference Level is -0.07dBm





9.8. Radiated restrict 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.

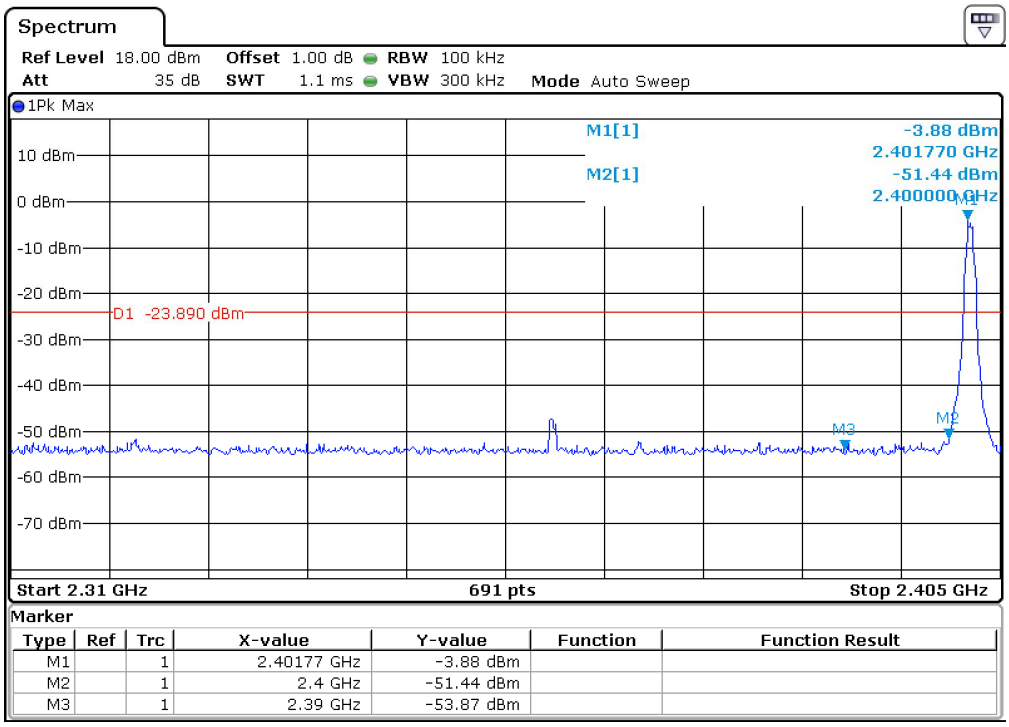
Limit:

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.

Radiated restrict band edges BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(d), Conducted
Comment: 4.5VDC

Test Result
☒ Passed
☐ Not Passed

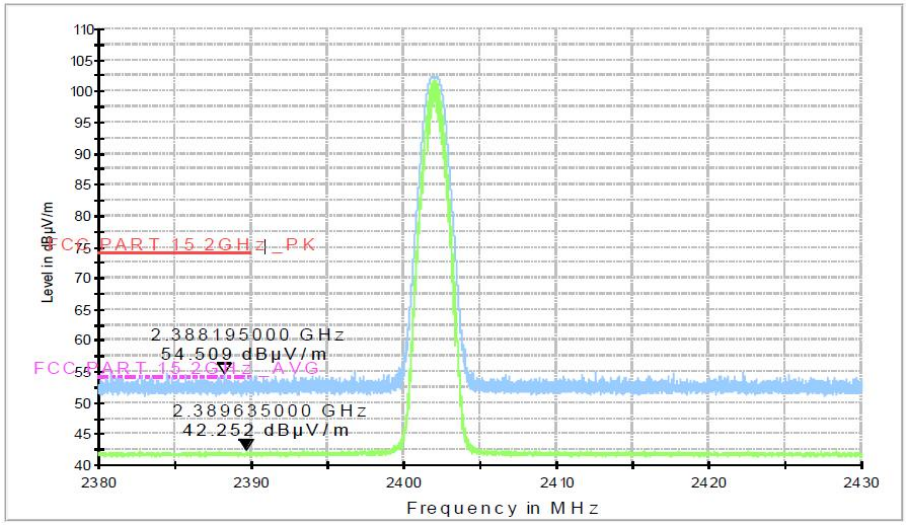


Band edges	Limit
52.85 dBc	> 20dBc

Radiated restrict band edges BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(d), Radiated
Comment: 4.5VDC

Test Result
☒ Passed
☐ Not Passed



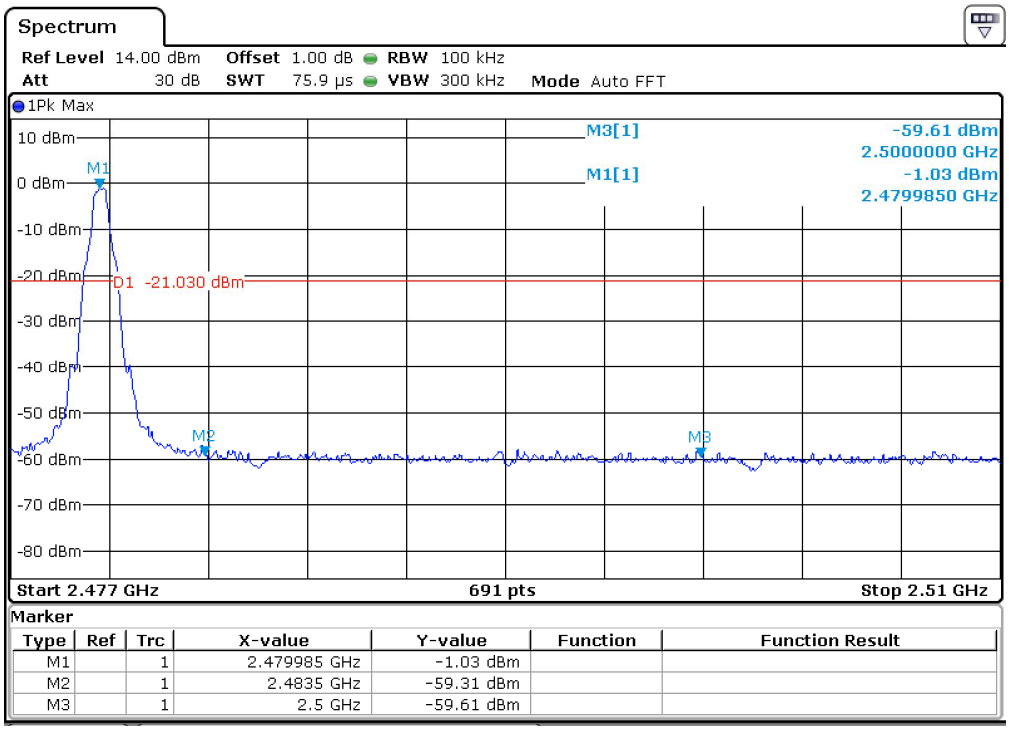
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
2388.195	54.51	74	-19.49	Peak	-8.0
2389.635	42.25	54	-11.75	Average	-8.0

Remark: 1.RBW=1MHz VBW=3MHz
2.Worst case is vertical polarity.

Radiated restrict band edges BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(d), Conducted
Comment: 4.5VDC

Test Result
☒ Passed
☐ Not Passed

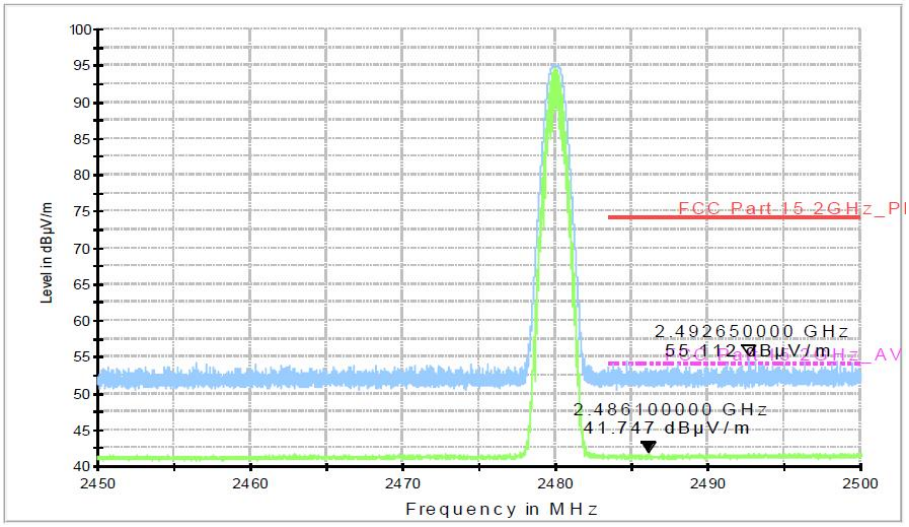


Band edges	Limit
58.28 dBc	> 20dBc

Radiated restrict band edges BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(d), Radiated
Comment: 4.5VDC

Test Result
☒ Passed
☐ Not Passed



Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Factor dB
2492.650	55.11	74	-18.89	Peak	-7.7
2486.100	41.75	54	-13.25	Average	-7.8

Remark: 1.RBW=1MHz VBW=3MHz
2.Worst case is vertical polarity.

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.

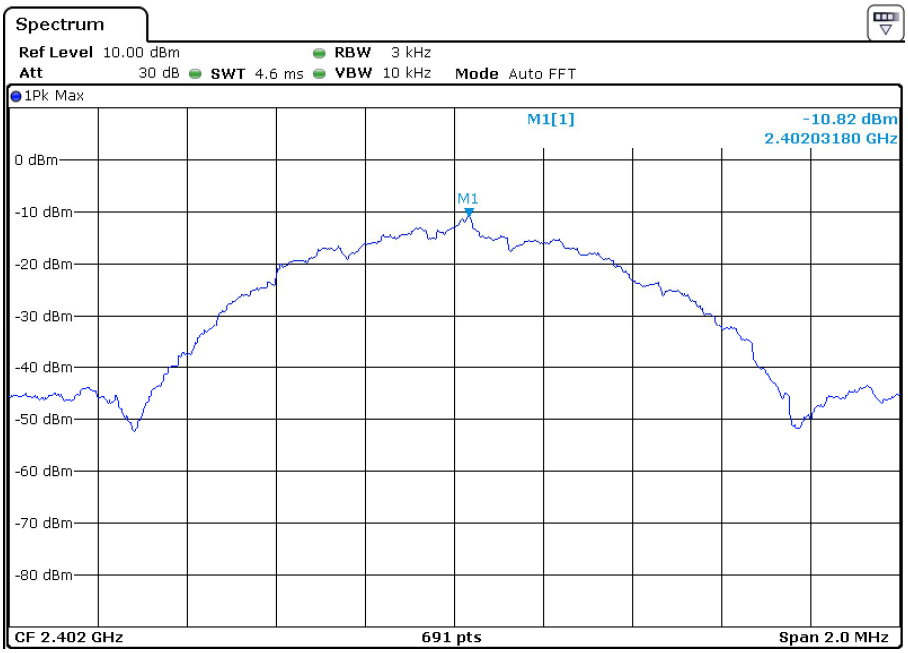
Limit

Limit [dBm]
≤8

Power Spectral Density BLE

EUT:	PIC102
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(e)
Comment:	4.5VDC

Test Result
☒ Passed
☐ Not Passed



PSD	Limit
-10.82 dBm	< 8 dBm

Power Spectral Density BLE

EUT: PIC102
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC15.247(e)
Comment: 4.5VDC

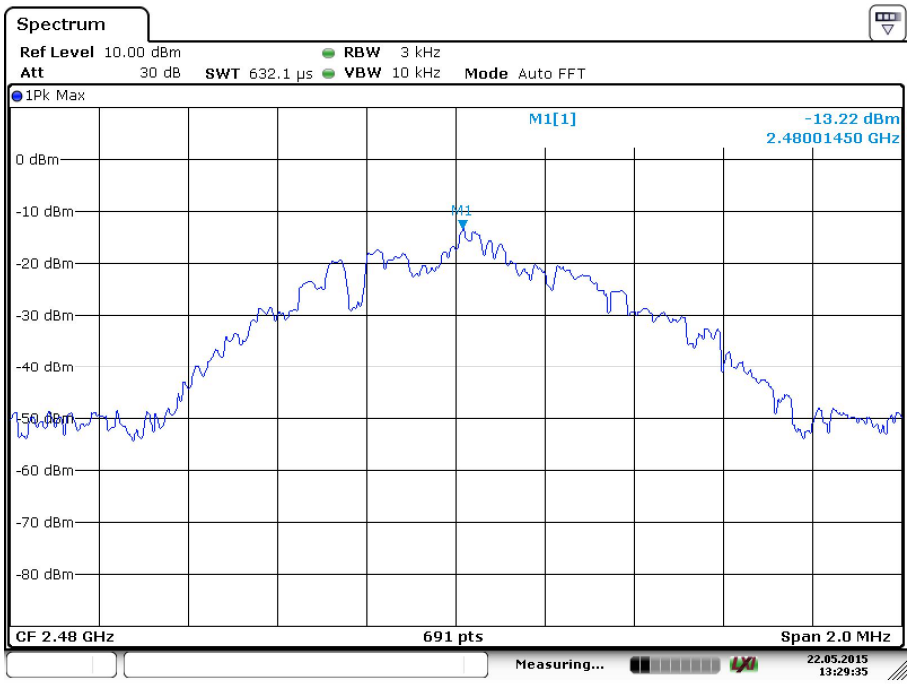
Test Result
☒ Passed
☐ Not Passed

PSD	Limit
-11.45 dBm	< 8 dBm

Power Special Density

EUT: PIC102
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(e)
Comment: 4.5VDC

Test Result
☒ Passed
☐ Not Passed



Date: 22.MAY.2015 13:29:36

PSD	Limit
-13.22 dBm	< 8 dBm

9.10. Antenna Requirement

EUT:	PIC102
Op Condition:	Operated, TX Mode
Test Specification:	FCC15.203 & 15.247(b)
Comment:	4.5VDC

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.

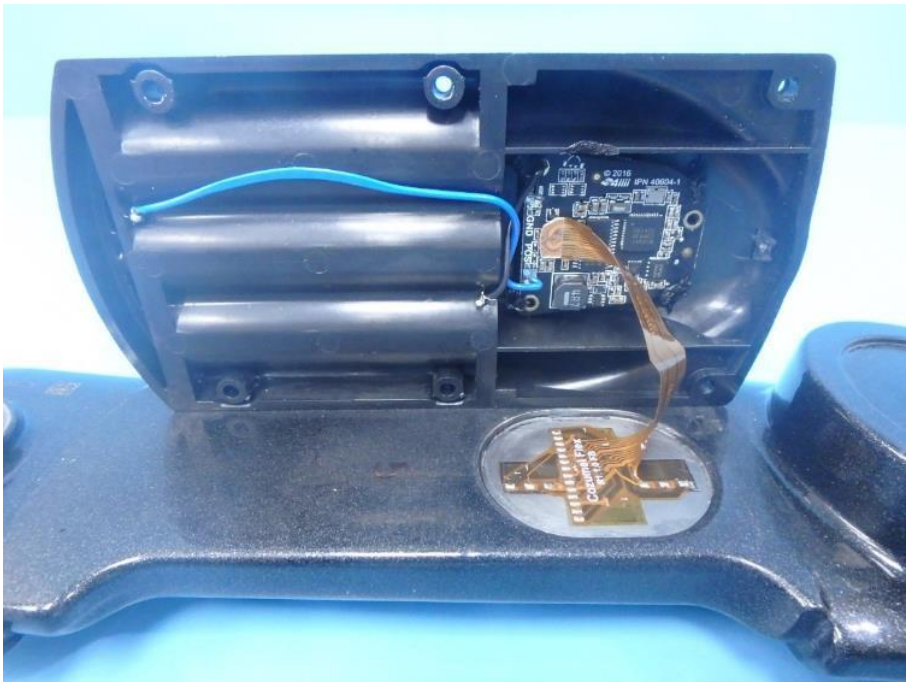
Antenna Connector Construction

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

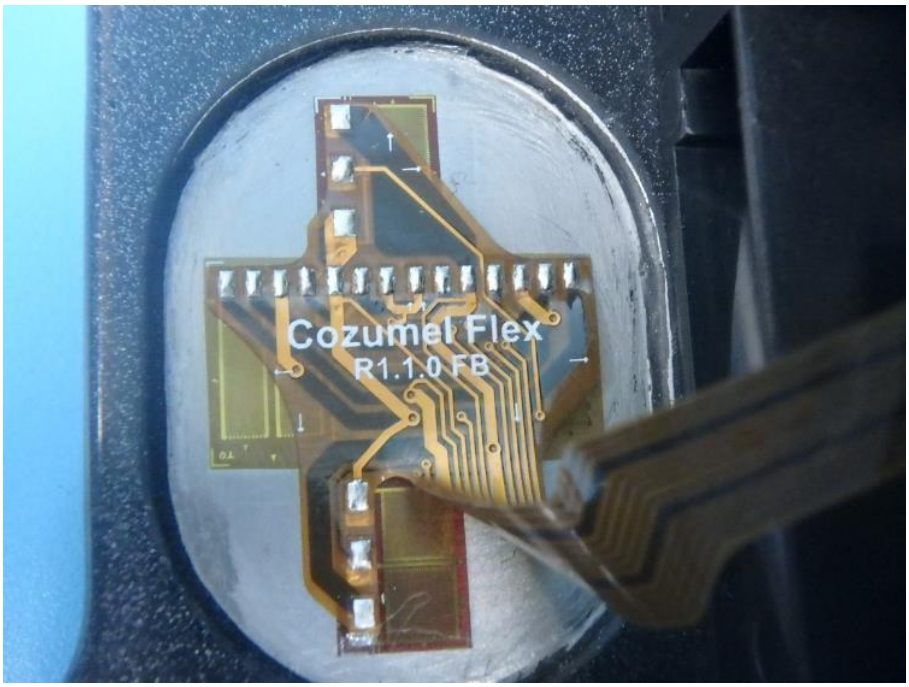
10. Appendix A - Photographs of EUT

Appendix A

Appendix A

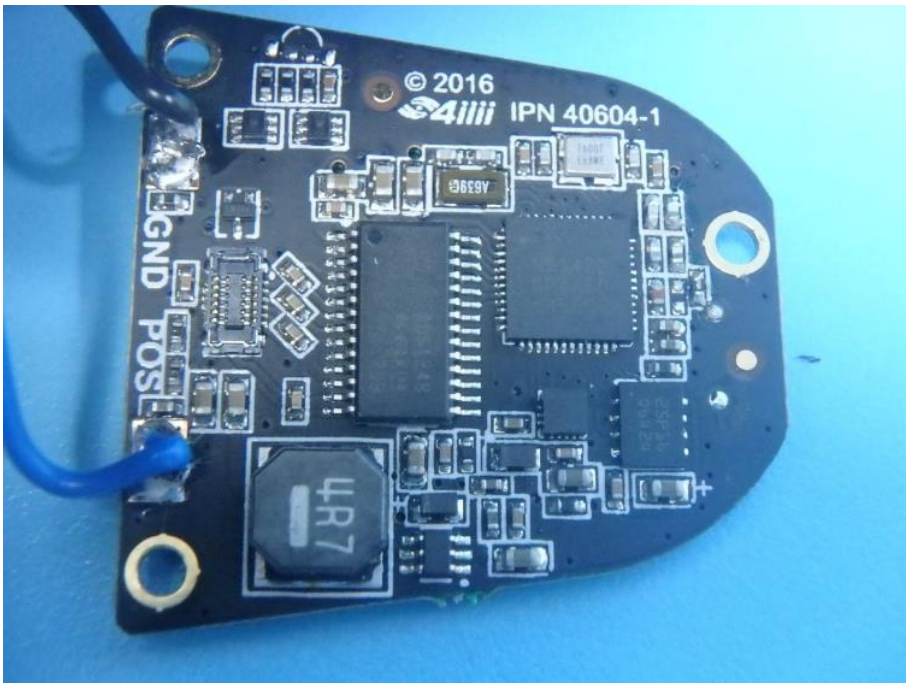


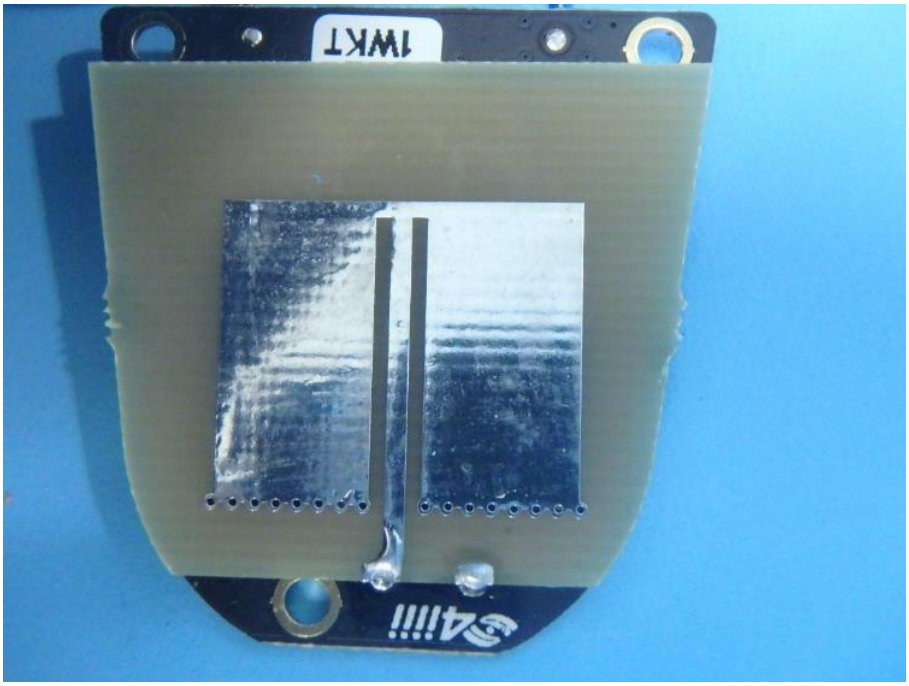
Appendix A


Cozumel Flex
R1.1.0 FB

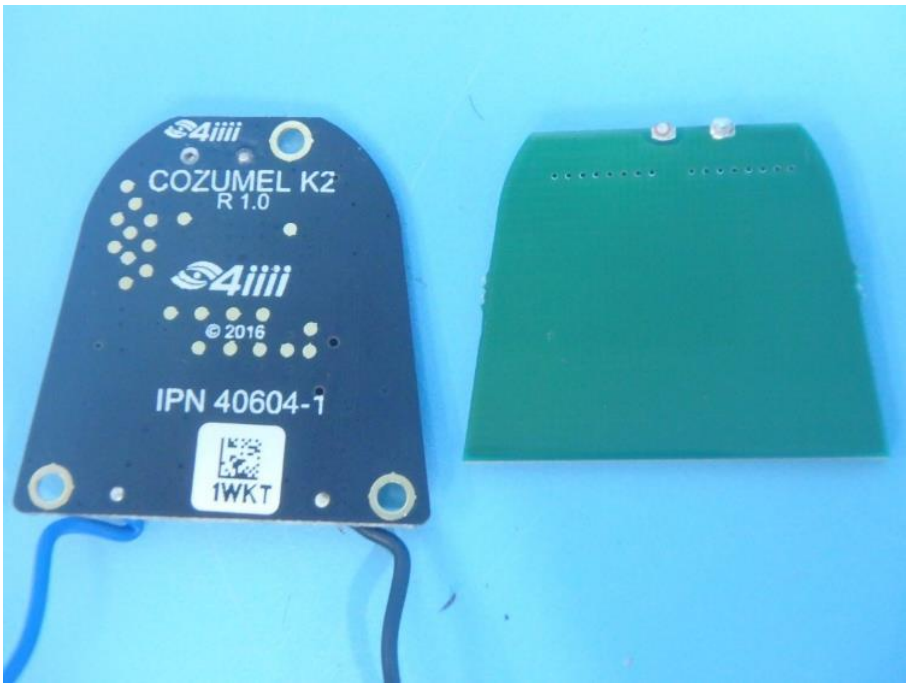

© 2016
4iiii
IPN 40604-1
GND
POS
N51422
QFAAE0
1450CB
ADS1248

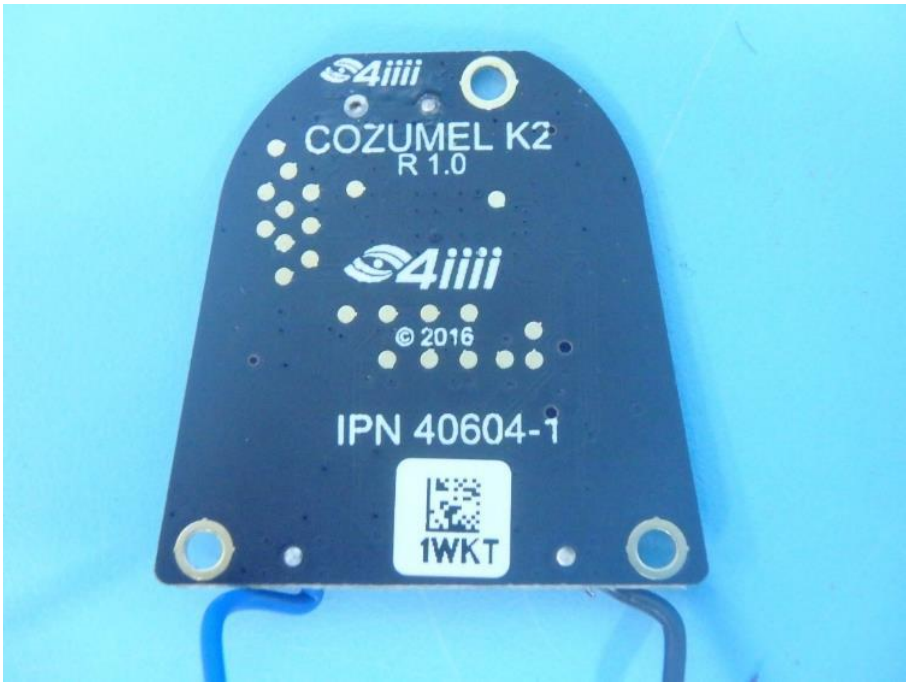
Appendix A





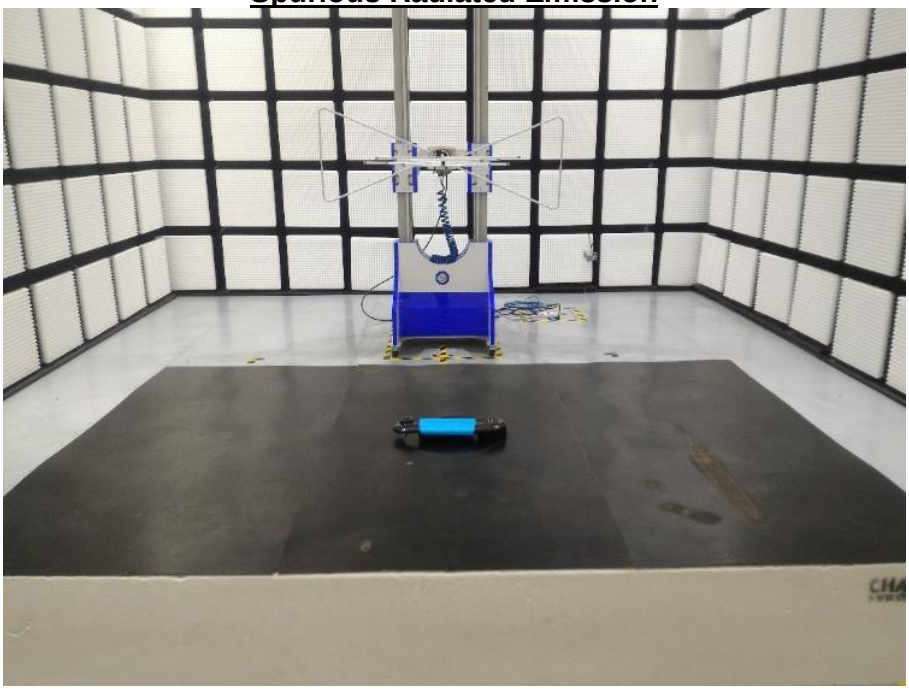
Appendix A

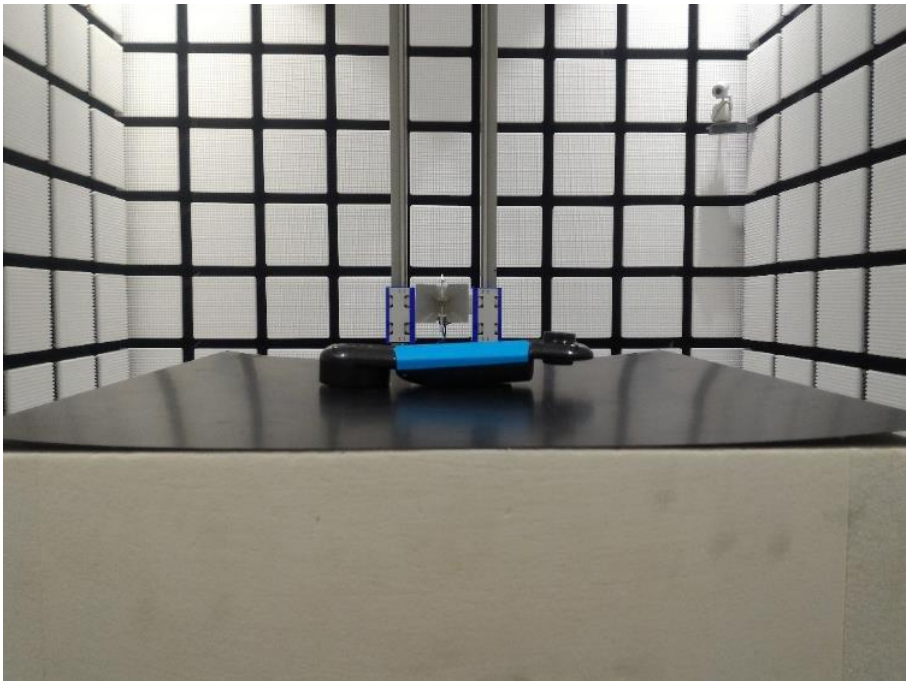

4iiii
COZUMEL K2
R 1.0
4iiii
© 2016
IPN 40604-1
1WKT


4iiii
COZUMEL K2
R 1.0
4iiii
© 2016
IPN 40604-1
1WKT

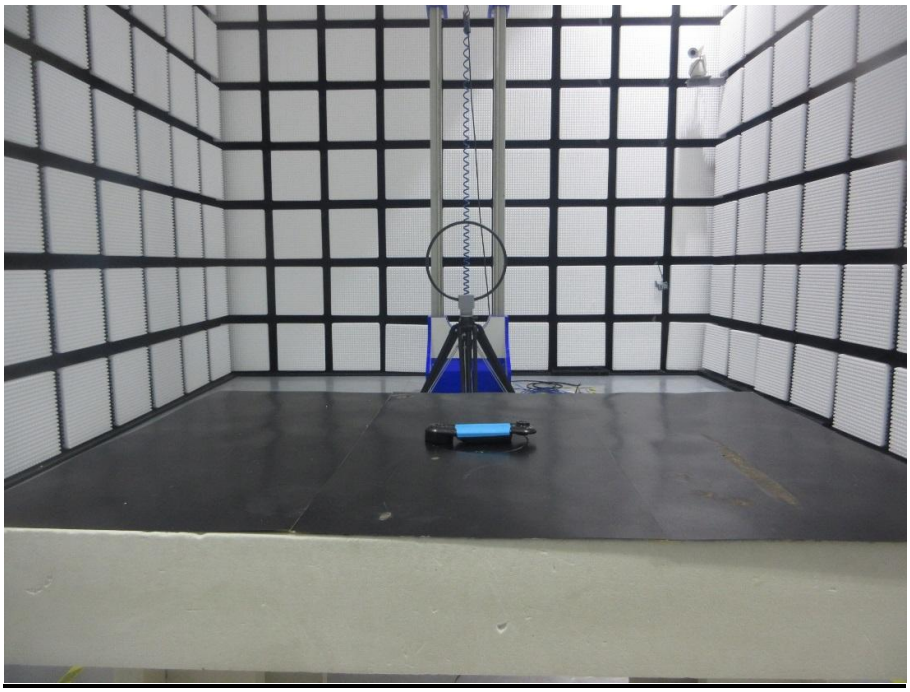
11. Appendix B - Setup Photographs of EUT

Spurious Radiated Emission





Appendix B



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. 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: -0.85dBm = 0.822mW
The power of EUT measured (2440MHz) is: -0.17dBm = 0.961mW
The power of EUT measured (2457MHz) is: -5.67dBm = 0.271mW
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: Kip Fyfe Date: September 8, 2017
Fax No: Total Page (Cover Included): 1

Declaration Letter

Subject:

We:

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 outlook of the different models.

<<Additional Model >>:PIC102-M1B00M, PIC102-R1B00R, PIC102-R2B00R, PIC102-R3B00R, PIC102-Z1B00M, PIC102-Z2B00M, PIC102-N1B00N
<<Main Test Model >>: PIC102

<<Product>>: Bicycle Crank Arm Power Sensor

Applicant:

Sept 11, 2017
(Date)

(Applicant's authorized signature and company Chop)
Name: Kip Fyfe Position: CEO

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13. Test Equipment Site List

Radiated emission Test

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
Wideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	12827	2018-7-5
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
RF cable	Aken	/	C0003	2018-10-23
RF cable	Aken	/	C0005	2018-10-23
RF cable	Aken	/	C0006	2018-10-23
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

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