China

FCC - TEST REPORT

Report Number	:	60.790.18.021.01R01	Date of Issue	:	June 15, 2018
Model	:	PX102			
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	:	37			

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1 Table of Contents

2 Description of Equipment Under Test

Description of the Equipment Under Test

Product:	Bicycle crank arm power sensor
Model no.:	PX102
FCC ID:	ZZNPX102
Rating:	1. 3.7VDC (1 x 3.7VDC internal rechargeable battery) 2. 5.0VDC (USB cable provided by client)
Frequency:	2457MHz, 2402MHz-2480MHz
Antenna gain:	0 dBi
Number of operated channel:	40
Modulation:	GFSK

Auxiliary Equipment and Software Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Adapter	Apple	A1357	/
Smart Phone	Samsung	GT-N7108	RV1D31RD6EK

Auxiliary Software Used during Test:

DESCRIPTION	MANUFACTURER	NAME	S/N
Android App	4iii	fouriiii-podcwtest	/

Note: 1. Adapter is used as a supporting device for Conducted Emission test.
2. Manufacture developed an Android App called “fouriiii-podcwtest”, which was installed to the Samsung smart phone. Using this app, tester can search EUT’s Bluetooth, and set the wanted test channel.

3 Summary of Test Standards

Test Standards
FCC Part 15 Subpart C 10-1-17 Edition Federal Communications Commission, PART 15 — Radio Frequency Devices, Subpart C — Unintentional Radiators

4 Details about the Test Laboratory

Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13 Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2,
Shenzhen 518052, P.R.China
FCC Registration Number: 502708

Emission Tests	
Test Item	Test Site
FCC Part 15 Subpart C	
FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission	Site 1
FCC Title 47 Part 15.207 Conduct Emission	Site 1
FCC Title 47 Part 15.247 Bandedge Emission	Site 1
FCC Title 47 Part 15.247(a)(1) 6dB & 99% Bandwidth	Site 1
FCC Title 47 Part 15.247(b) Peak Output Power	Site 1
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	Site 1
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	Site 1
FCC Title 47 Part 15.247(e) Power Spectral Density	Site 1
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	Site 1

4.1 Test Equipment Site List

Radiated emission Test – Site 1

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2019-7-6
Signal Analyzer	Rohde & Schwarz	FSV40	101031	2019-7-6
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100398	2019-7-6
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2019-6-28
Horn Antenna	Rohde & Schwarz	HF907	102294	2019-6-28
Wideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	12827	2019-7-12
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2019-7-6
Pre-amplifier	Rohde & Schwarz	SCU 40A	100432	2019-7-6
Signal Generator	Rohde & Schwarz	SMY01	839369/005	2019-7-6
Attenuator	Agilent	8491A	MY39264334	2019-7-6
3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

Conducted Emission Test – Site 1

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2019-7-6
LISN	Rohde & Schwarz	ENV4200	100249	2019-7-6
LISN	Rohde & Schwarz	ENV432	101318	2019-7-6
LISN	Rohde & Schwarz	ENV216	100326	2019-7-6
ISN	Rohde & Schwarz	ENY81	100177	2019-7-6
ISN	Rohde & Schwarz	ENY81-CA6	101664	2019-7-6
High Voltage Probe	Rohde & Schwarz	TK9420(VT9420)	9420-584	2019-6-30
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2019-6-30
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2019-7-6
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A

20dB & 99% Bandwidth, Peak Output Power, Spurious Emissions at Antenna Terminals, 100kHz Bandwidth of band edges, Power Spectral Density – Site 1

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Generator	Rohde & Schwarz	SMB100A	108272	2019-7-6
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2019-7-6
Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2019-7-6
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2019-7-6

4.2 Measurement System Uncertainty

Measurement System Uncertainty Emissions

System Measurement Uncertainty	
Items	**Extended Uncertainty**
Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz	4.46dB
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.91dB; Vertical: 4.89dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-25000MHz	Horizontal: 4.80dB; Vertical: 4.79dB;
Uncertainty for Conducted Emission at AC Power Line 150kHz-30MHz	3.21dB
Uncertainty for frequency test	0.6×10-7

5 Summary of Test Results

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	10-15	☒	☐	☐
FCC Title 47 Part 15.207 Conduct Emission	16-17	☒	☐	☐
FCC Title 47 Part 15.247Bandedge Emission	18-19	☒	☐	☐
FCC Title 47 Part 15.247(a)(2) 6dB & 99% Bandwidth	20-22	☒	☐	☐
FCC Title 47 Part 15.247(b) Peak Output Power	23-25	☒	☐	☐
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	26-28	☒	☐	☐
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	29-30	☒	☐	☐
FCC Title 47 Part 15.247(e) Power Spectral Density	31-33	☒	☐	☐
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	34	☒	☐	☐

6 General Remarks

Remarks

All mode has been tested, only worst case has shown.

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:	April 10, 2018
Testing Start Date:	April 11, 2018
Testing End Date:	May 18, 2018

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Reviewed by:

Hosea CHAN
EMC Project Engineer

Prepared by:

Eric LI
EMC Senior Project Engineer

7 Emission Test Results

7.1 Spurious Radiated Emission

EUT: PX102
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
Comment: 3.7VDC
Remark: 9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
100.163	21.28	43.50	-22.22	Quasi Peak
193.283	28.04	43.50	-15.46	Quasi Peak
440.256	22.73	46.00	-23.27	Quasi Peak
845.392	30.89	46.00	-15.11	Quasi Peak
3581.718	32.54*	54.00	-21.46	Peak
5321.250	36.50*	54.00	-17.50	Peak
8150.150	40.53*	54.00	-13.47	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT:	PX102
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
Comment:	3.7VDC
Remark:	9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
87.661	24.24	40.00	-15.76	Quasi Peak
193.283	28.18	43.50	-15.32	Quasi Peak
223.353	24.85	46.00	-21.15	Quasi Peak
879.127	25.22	46.00	-20.78	Quasi Peak
3496.875	33.66*	54.00	-20.34	Peak
5153.906	35.47*	54.00	-18.53	Peak
7351.406	37.75*	54.00	-16.25	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT:	PX102
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
Comment:	3.7VDC
Remark:	9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
100.125	21.13	43.50	-22.37	Quasi Peak
193.216	28.45	43.50	-15.05	Quasi Peak
440.285	22.87	46.00	-23.13	Quasi Peak
845.314	30.12	46.00	-15.88	Quasi Peak
4004.531	35.24*	54.00	-18.76	Peak
4837.968	34.68*	54.00	-19.32	Peak
8188.593	39.50*	54.00	-14.5	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT:	PX102
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
Comment:	3.7VDC
Remark:	9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
87.625	24.05	40.00	-15.95	Quasi Peak
193.219	28.43	43.50	-15.07	Quasi Peak
223.248	24.75	46.00	-21.25	Quasi Peak
879.184	25.13	46.00	-20.87	Quasi Peak
4913.906	41.60*	54.00	-12.40	Peak
6423.281	37.96*	54.00	-16.04	Peak
7498.593	41.46*	54.00	-12.54	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT:	PX102
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
Comment:	3.7VDC
Remark:	9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
100.125	21.25	43.50	-22.25	Quasi Peak
193.216	28.16	43.50	-15.34	Quasi Peak
440.285	22.84	46.00	-23.16	Quasi Peak
845.314	30.31	46.00	-15.69	Quasi Peak
3886.875	35.55*	54.00	-18.45	Peak
4959.843	44.51*	54.00	-9.49	Peak
7005.468	38.67*	54.00	-15.33	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT:	PX102
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
Comment:	3.7VDC
Remark:	9kHz to 25GHz

Test Result
☒ Passed
☐ Not Passed

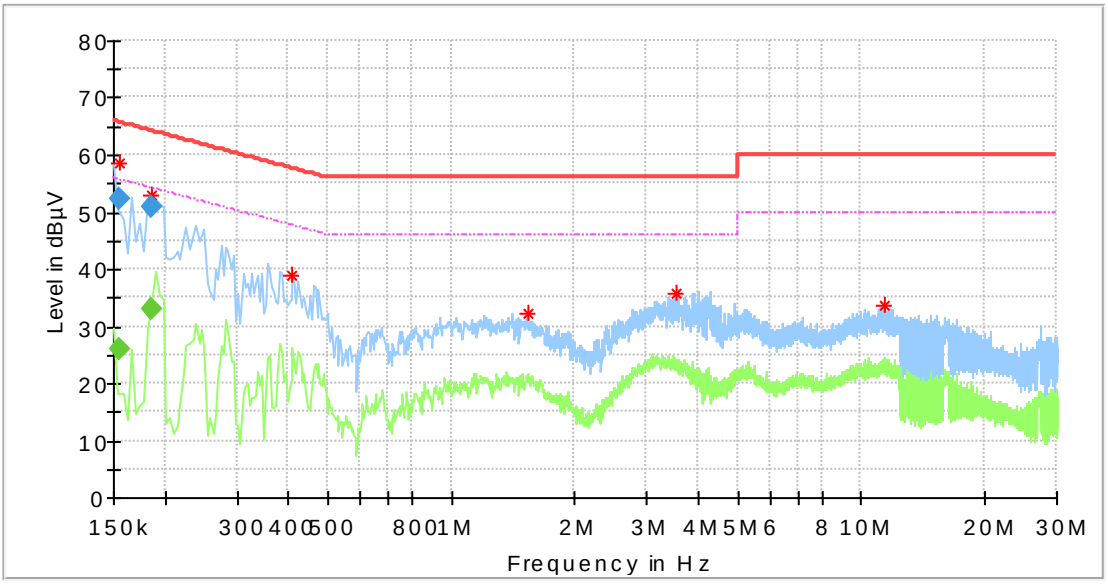
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
87.154	24.61	40.00	-15.39	Quasi Peak
193.612	28.84	43.50	-14.66	Quasi Peak
223.158	24.51	46.00	-21.49	Quasi Peak
879.432	25.13	46.00	-20.87	Quasi Peak
3984.843	33.79*	54.00	-20.21	Peak
5171.718	37.45*	54.00	-16.55	Peak
7017.187	39.46*	54.00	-14.54	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

7.2 Conducted Emission

EUT:	PX102
Op Condition:	Operated, TX Mode
Test Specification:	FCC15.207, L Line
Comment:	120 VAC

Test Result
☒ Passed
☐ Not Passed



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)
0.154500	58.42	---	66.00	-7.58
0.185500	52.82	---	64.21	-11.39
0.410000	38.98	---	57.65	-18.67
1.534000	32.37	---	56.00	-23.63
3.546000	35.95	---	56.00	-20.05
11.398000	33.59	---	60.00	-26.41

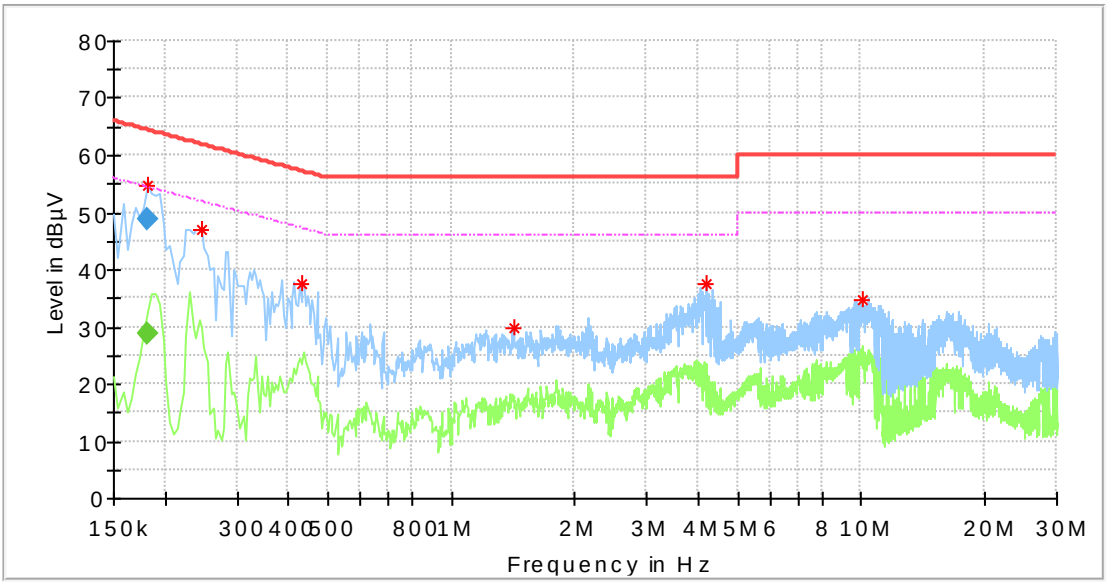
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)
0.154500	---	26.06	55.75	-29.69
0.154500	52.39	---	65.75	-13.36
0.185500	---	33.08	54.24	-21.16
0.185500	50.91	---	64.24	-13.33

Conducted Emission

EUT: PX102
Op Condition: Operated, TX Mode
Test Specification: FCC15.207, N Line
Comment: 120VAC

Test Result
☒ Passed
☐ Not Passed



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)
0.181500	54.75	---	64.39	-9.65
0.246000	46.98	---	61.89	-14.91
0.434000	37.71	---	57.18	-19.47
1.418000	29.96	---	56.00	-26.04
4.174000	37.39	---	56.00	-18.61
10.126000	34.80	---	60.00	-25.20

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)
0.181500	---	28.81	54.42	-25.61
0.181500	48.84	---	64.42	-15.58

7.3 Bandedge Emission

EUT: PX102
Op Condition: Operated, TX Mode
Test Specification: FCC15.247, Antenna: Horizontal
Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed

Band	Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
Low	2390.000	30.23	74	-43.77	Peak
Low	2390.000	25.46	54	-28.54	Average
High	2483.500	30.25	74	-43.75	Peak
High	2483.500	24.15	54	-29.85	Average

Bandedge Emission

EUT: PX102
Op Condition: Operated, TX Mode
Test Specification: FCC15.247, Antenna: Vertical
Comment: 3.7VDC

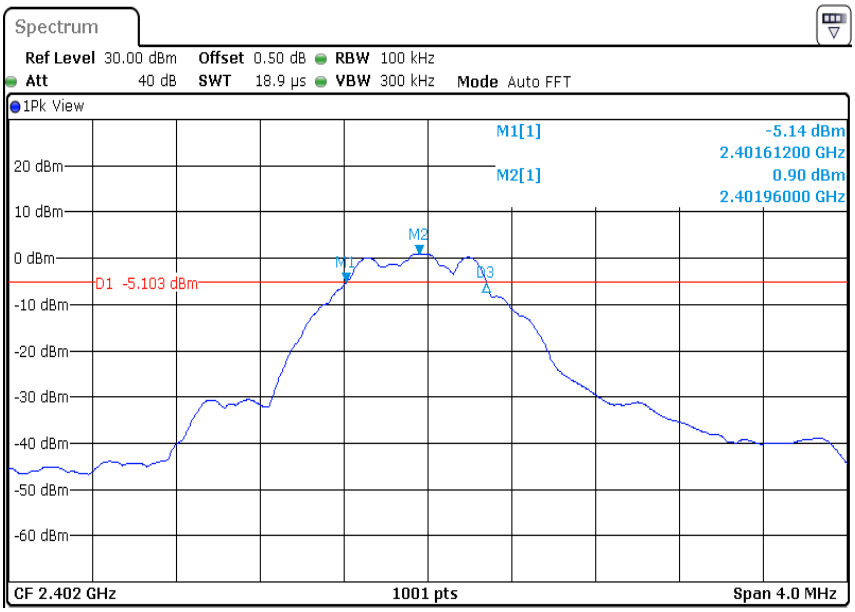
Test Result
☒ Passed
☐ Not Passed

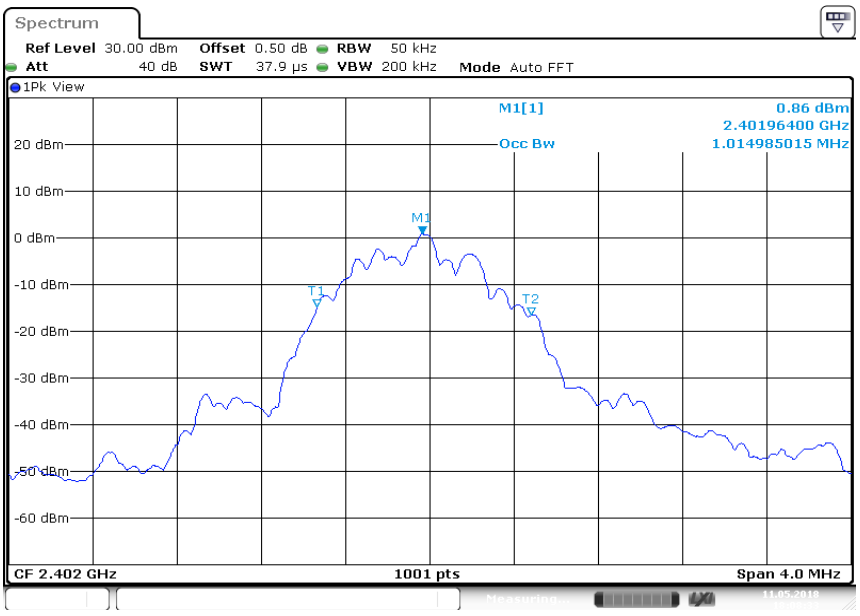
Band	Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
Low	2398.350	30.21	74	-43.79	Peak
Low	2398.350	26.43	54	-27.57	Average
High	2494.000	30.46	74	-43.54	Peak
High	2494.000	25.12	54	-28.88	Average

7.4 6dB & 99% Bandwidth

EUT:	PX102
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed



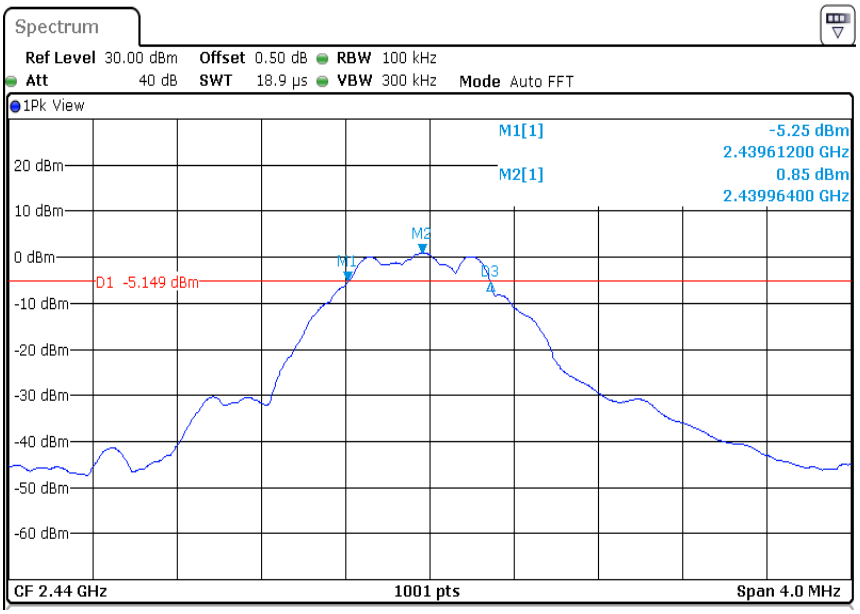


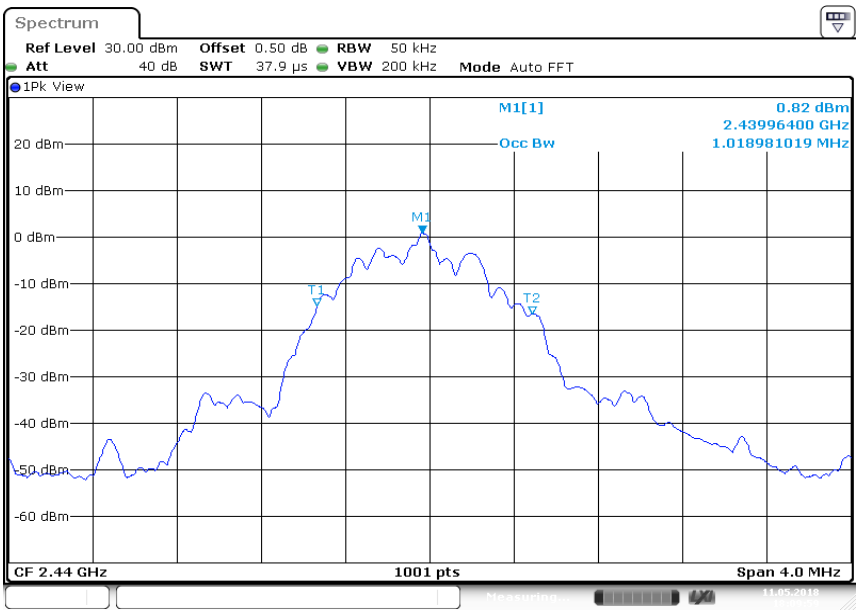
6dB bandwidth	6dB BW Limit	99% bandwidth
668.000 kHz	> 500 kHz	1014.985 kHz

6dB & 99% Bandwidth

EUT:	PX102
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed



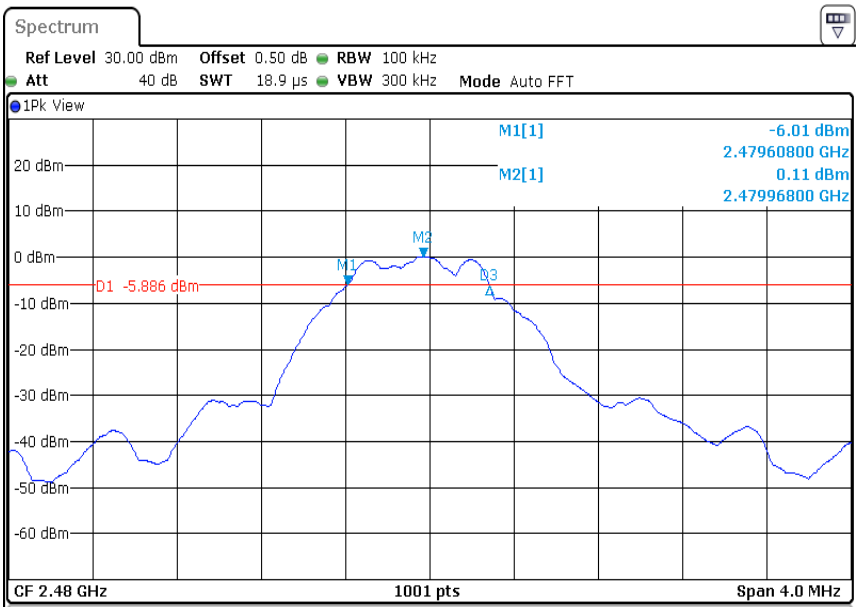


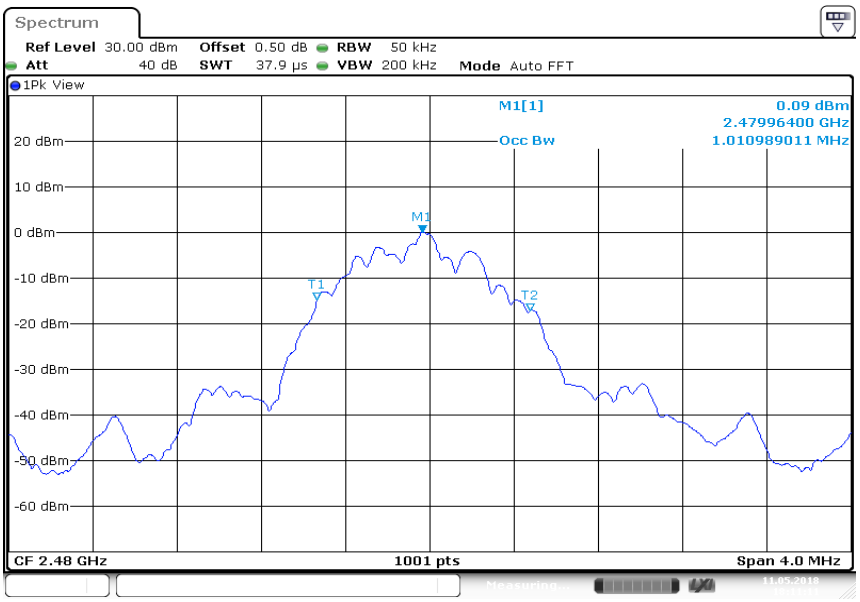
6dB bandwidth	6dB BW Limit	99% bandwidth
676.000 kHz	> 500 kHz	1018.981 kHz

6dB & 99% Bandwidth

EUT:	PX102
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed



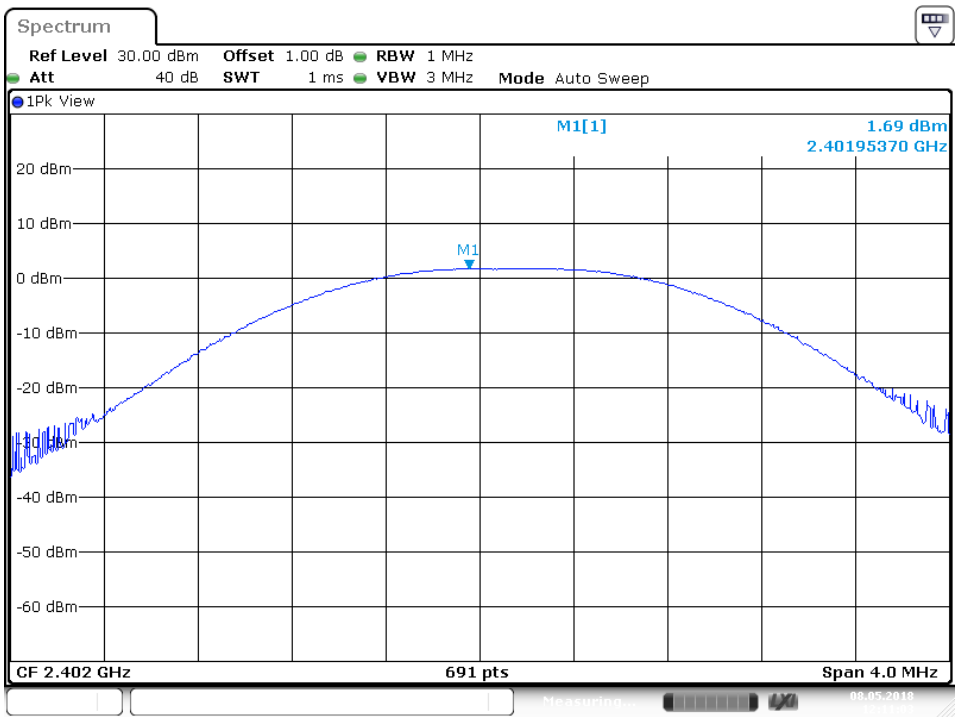


6dB bandwidth	6dB BW Limit	99% bandwidth
676.000 kHz	> 500 kHz	1018.981 kHz

7.5 Peak Output Power

EUT:	PX102
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(b)
Comment:	3.7VDC, Antenna gain: 0 dBi, Cable Loss: 0.5 dB

Test Result
☒ Passed
☐ Not Passed

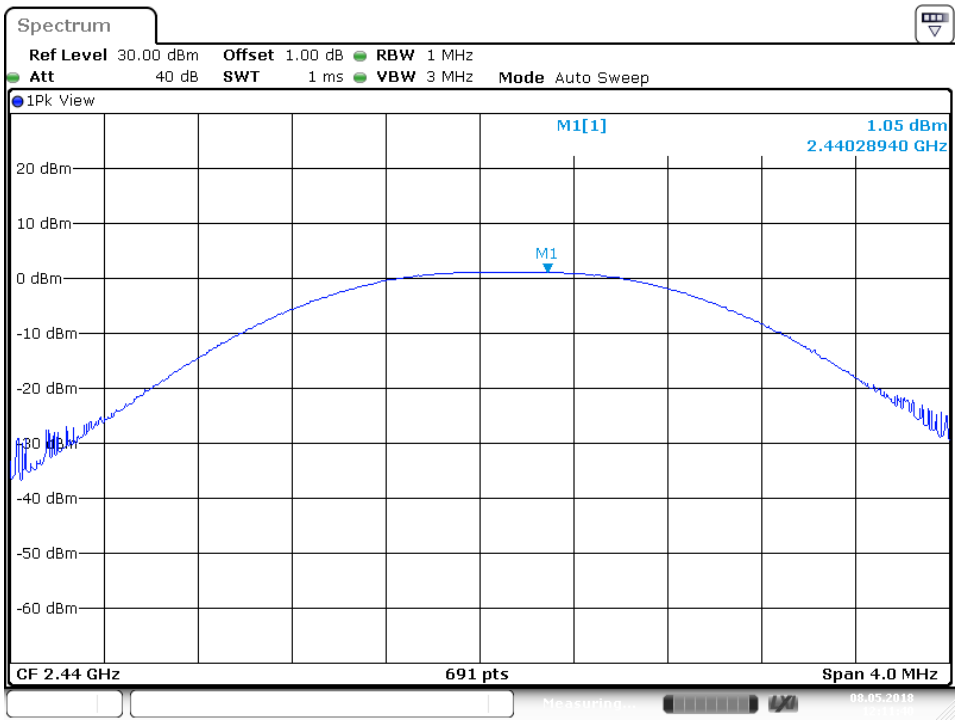


Conducted Output Power	Limit
1.69dBm	< 30dBm

Peak Output Power

EUT:	PX102
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(b)
Comment:	3.7VDC, Antenna gain: 0 dBi, Cable Loss: 0.5 dB

Test Result
☒ Passed
☐ Not Passed

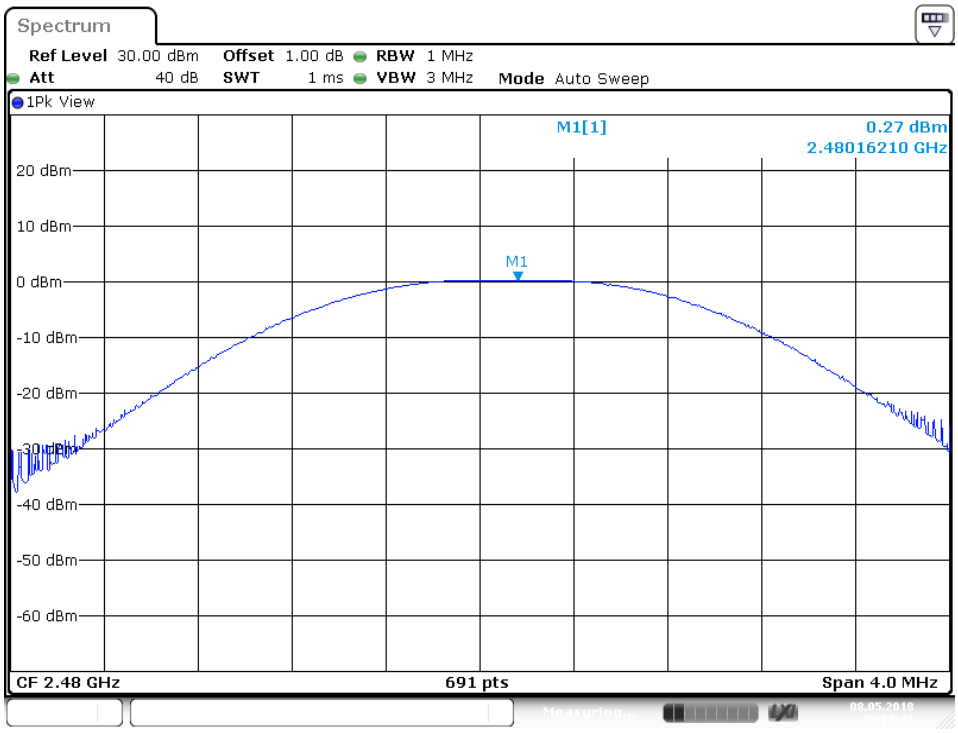


Conducted Output Power	Limit
1.05 dBm	< 30dBm

Peak Output Power

EUT:	PX102
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(b)
Comment:	3.7VDC, Antenna gain: 0 dBi, Cable Loss: 0.5 dB

Test Result
☒ Passed
☐ Not Passed

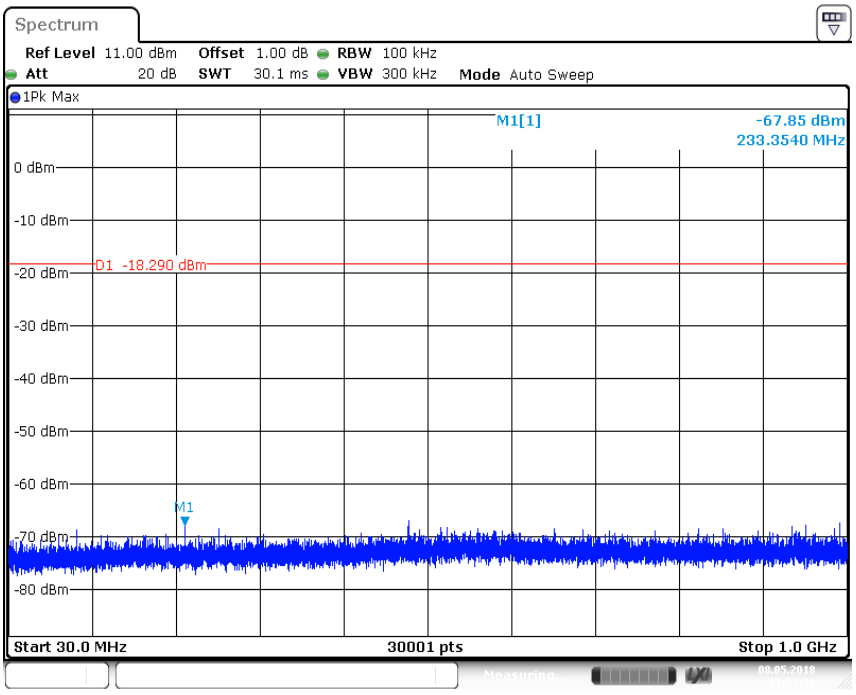


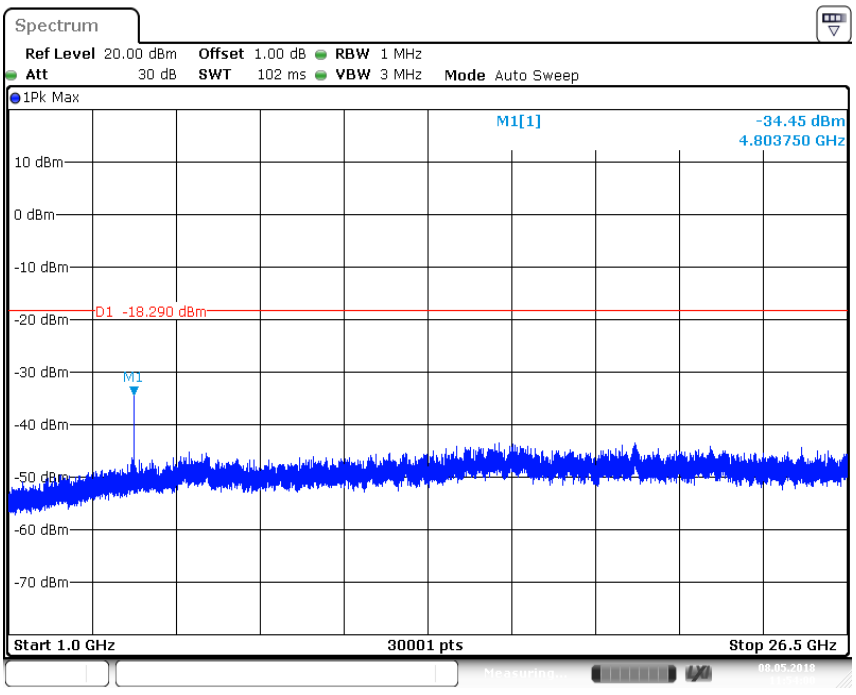
Conducted Output Power	Limit
0.27 dBm	< 30dBm

7.6 Spurious Emissions at Antenna Terminals

EUT:	PX102
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC2.1051 & 15.247(d)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed

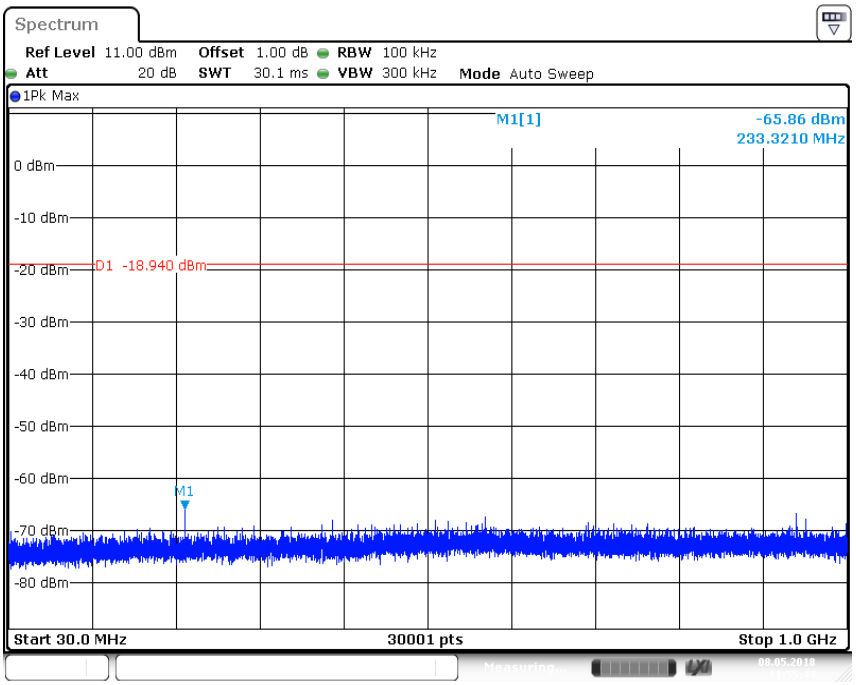


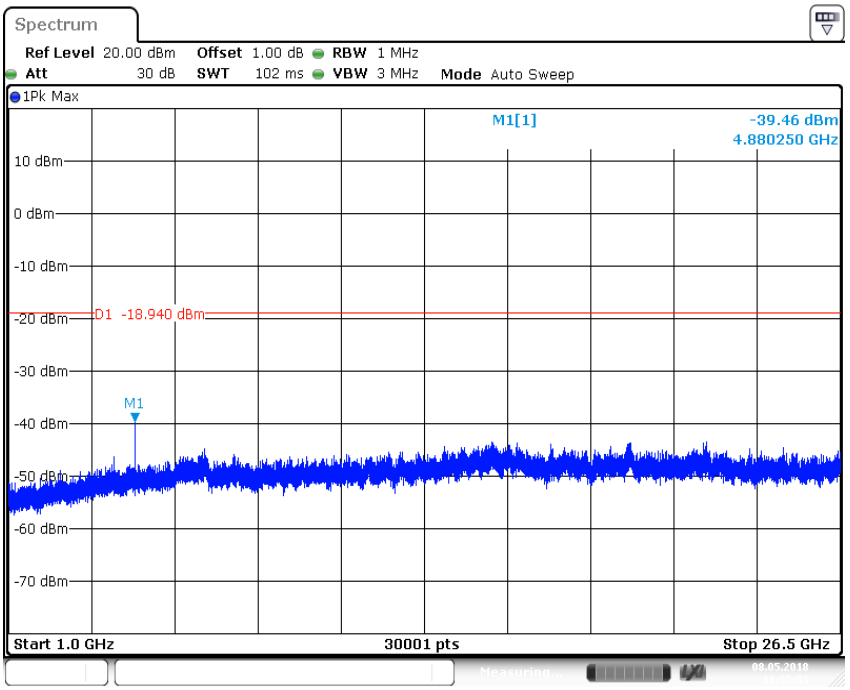


Spurious Emissions at Antenna Terminals

EUT:	PX102
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC2.1051 & 15.247(d)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed

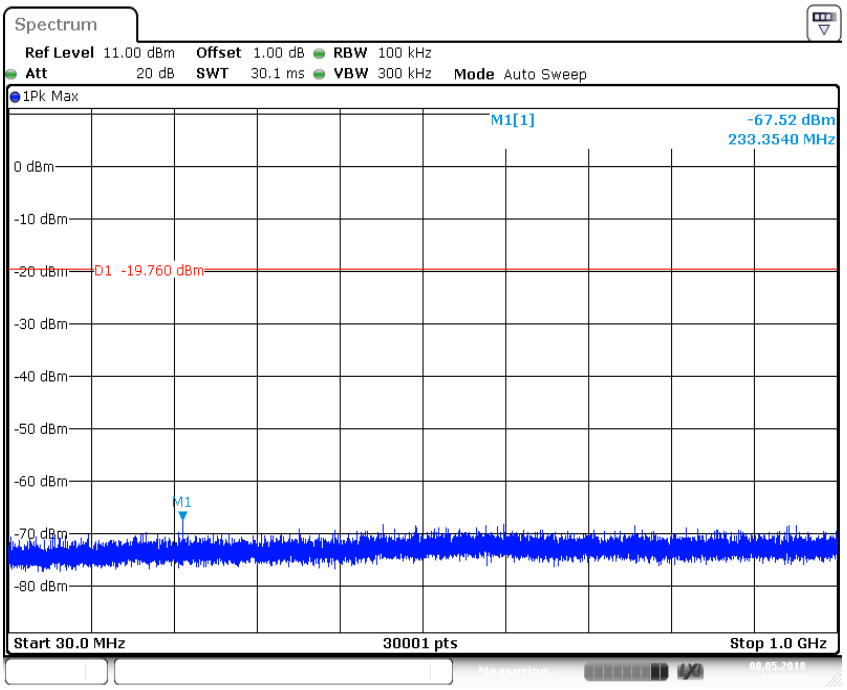


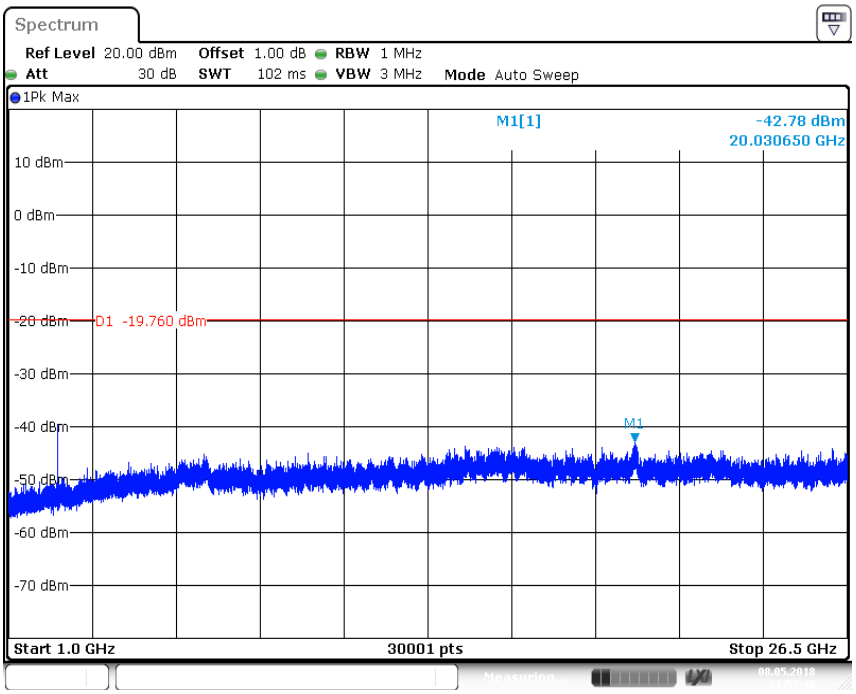


Spurious Emissions at Antenna Terminals

EUT:	PX102
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC2.1051 & 15.247(d)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed

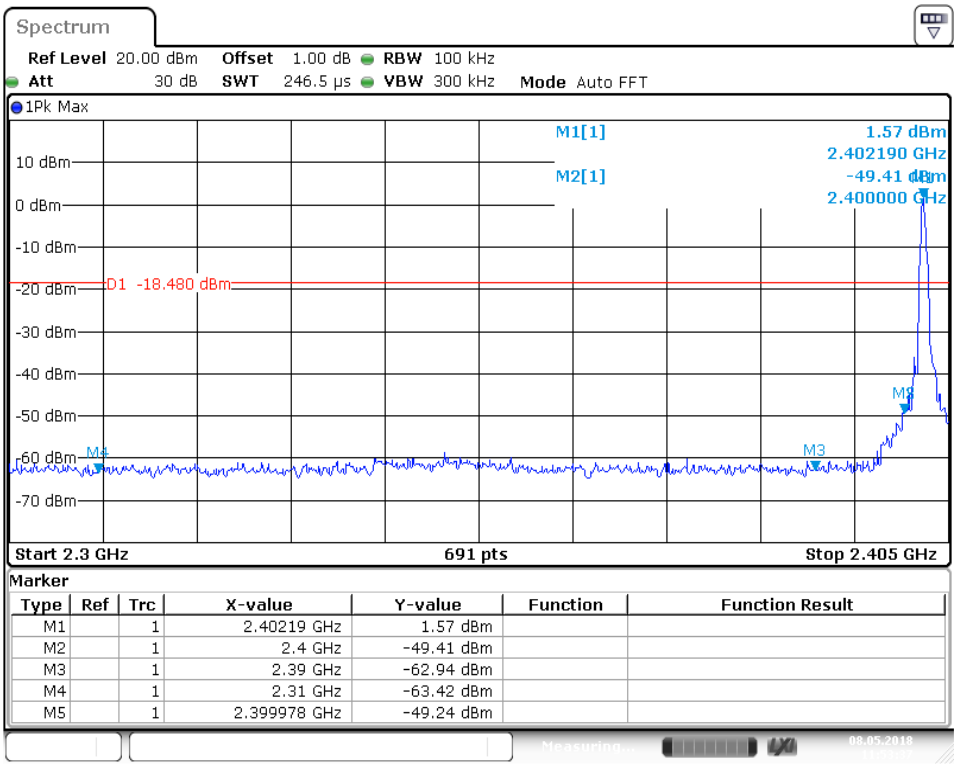




7.7 100kHz Bandwidth of band edges

EUT: PX102
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(d), Conducted
Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed

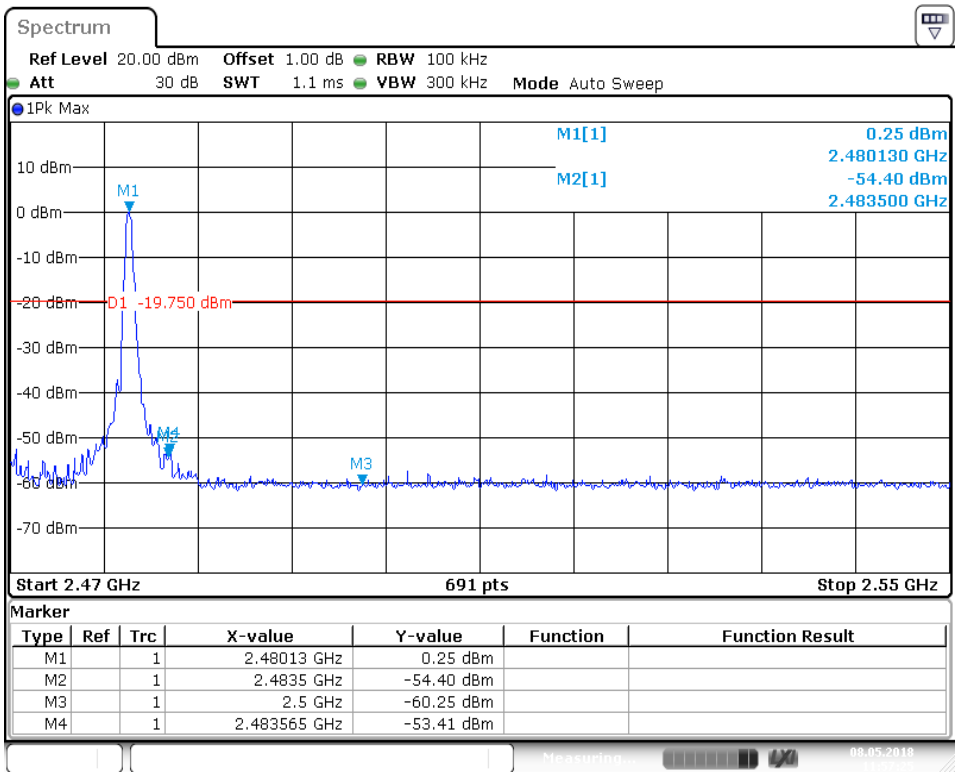


Band edges	Limit
51.38 dB	> 20dB

100kHz Bandwidth of band edges

EUT: PX102
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(d), Conducted
Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed

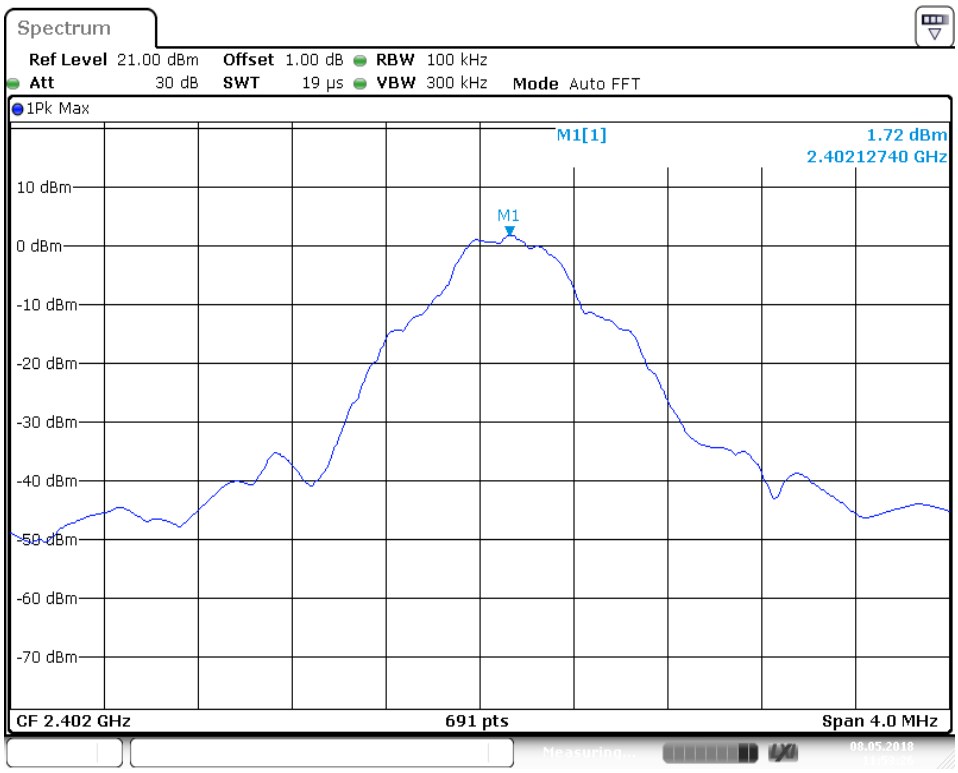


Band edges	Limit
54.65 dB	> 20dB

7.8 Power Spectral Density

EUT:	PX102
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(e)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed

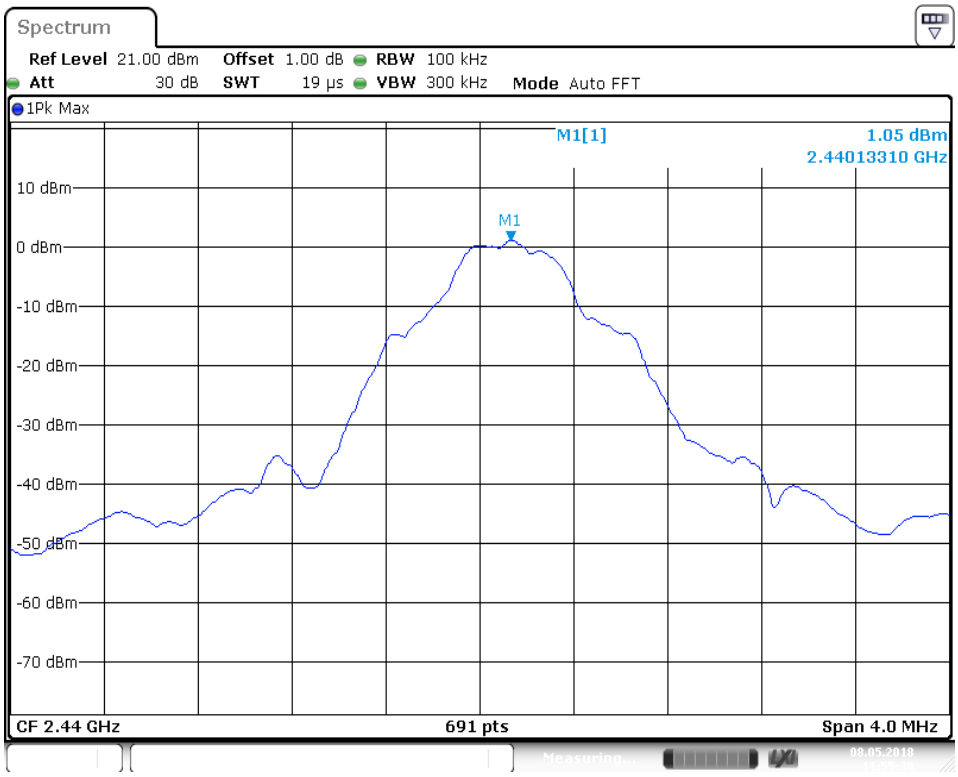


PSD	Limit
1.72 dBm	< 8 dBm

Power Spectral Density

EUT: PX102
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC15.247(e)
Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed

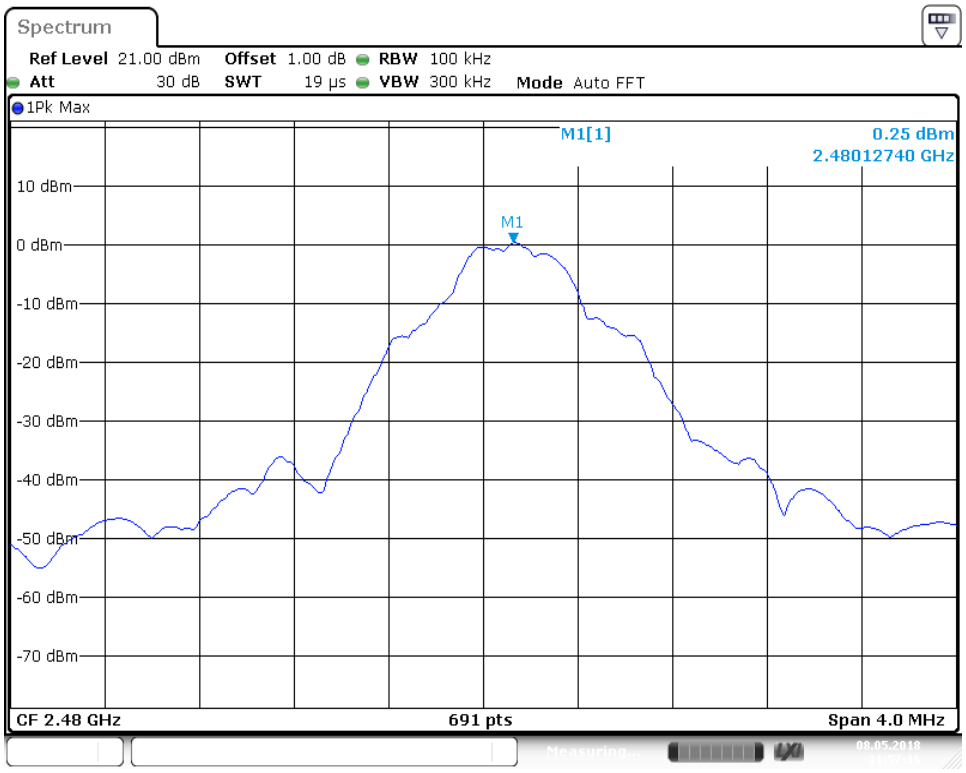


PSD	Limit
1.05 dBm	< 8 dBm

Power Spectral Density

EUT: PX102
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(e)
Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed



PSD	Limit
0.25 dBm	< 8 dBm

7.9 Antenna Requirement

EUT:	PX102
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.

8 Appendix A - 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 (2480MHz), mW / 20mm * √2.480GHz ≤ 3.0
Numeric threshold (2480MHz) ≤ 38.100mW

>> The power of EUT measured (2402MHz) is: 1.69dBm = 1.476mW
The power of EUT measured (2440MHz) is: 1.05dBm = 1.273mW
The power of EUT measured (2480MHz) is: 0.27dBm = 1.064mW

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