China

FCC - TEST REPORT

Report Number	:	**60.790.16.113.01R01**	Date of Issue	:	May 10, 2017
Model	:	**MRL171**			
Product Type	:	**Marlin**			
Applicant	:	Platysens Limited			
Address	:	206, 2/F Enterprise Place, 5 Science Park Ave West, Shatin, Hong Kong			
Production Facility	:	Telefield Limited			
Address	:	Flat D, 2/F, Valiant Industrial Centre, 2-12 Au Pui Wan Street, Fo Tan, N.T. Hong Kong			
Test Result	:	■**Positive**	☐**Negative**		
Total pages including Appendices	:	45			

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2 Description of Equipment Under Test

Description of the Equipment Under Test

Product:	Marlin
Model no.:	MRL171
FCC ID:	2AKDH-MRL171
Rating:	1) 3.7VDC (1 x 3.7VDC rechargeable battery) 2) 5.0VDC (USB port)
Frequency:	2402MHz-2480MHz
Antenna gain:	0 dBi
Number of operated channel:	40
Modulation:	GFSK

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3 Summary of Test Standards

Test Standards
FCC Part 15 Subpart C 10-1-16 Edition Federal Communications Commission, PART 15 — Radio Frequency Devices, Subpart C — Unintentional Radiators

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4 Details about the Test Laboratory

Site 1

Company name: TÜV SÜD Hong Kong Ltd.
3/F, West Wing, Lakeside 2,
10 Science Park West Avenue,
Science Park, Shatin, Hong Kong

Site 2

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 2
FCC Title 47 Part 15.207 Conduct Emission	NIL
FCC Title 47 Part 15.247(a)(1) 6dB & 99% Bandwidth	Site 2
FCC Title 47 Part 15.247(b) Peak Output Power	Site 2
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	Site 2
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	Site 2
FCC Title 47 Part 15.247(e) Power Spectral Density	Site 2
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	Site 2

4.1 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	15-July-17
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	15-July-17
Horn Antenna	Rohde & Schwarz	HF907	102294	15-July-17
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	15-July-17
3m Semi-anechoic chamber	TDK	9X6X6	----	29-May-19

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	15-July-17
Signal Analyzer	Rohde & Schwarz	FSV40	101030	15-July-17
Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	15-July-17
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	15-July-17

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4.2 Measurement System Uncertainty

Measurement System Uncertainty Emissions

System Measurement Uncertainty	
Items	**Extended Uncertainty**
Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz	4.54dB
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

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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	NIL	☐	☐	☒
FCC Title 47 Part 15.247(a)(2) 6dB & 99% Bandwidth	16-18	☒	☐	☐
FCC Title 47 Part 15.247(b) Peak Output Power	19-21	☒	☐	☐
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	22-24	☒	☐	☐
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	25-28	☒	☐	☐
FCC Title 47 Part 15.247(e) Power Spectral Density	29-31	☒	☐	☐
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	32	☒	☐	☐

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6 General Remarks

Remarks

NIL

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: December 5, 2016

Testing Start Date: December 6, 2016

Testing End Date: May 8, 2017

- TÜV SÜD HONG KONG LTD. -

Reviewed by: Prepared by:

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EMC Project Engineer

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EMC Project Engineer

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7 Emission Test Results

7.1 Spurious Radiated Emission

EUT: MRL171
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	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
45.412	18.92	40	-21.08	Quasi Peak
58.507	16.31	40	-23.69	Quasi Peak
308.174	18.27	46	-27.73	Quasi Peak
889.312	28.22	46	-17.78	Quasi Peak
1270.187	30.15	74	-43.85	Peak
1270.187	20.68	54	-33.32	Average
2299.937	42.28	74	-31.72	Peak
2299.937	30.85	54	-23.15	Average
4804.000	48.05	74	-25.95	Peak
4804.000	39.15	54	-14.85	Average
7206.000	38.26	74	-35.74	Peak
7206.000	25.71	54	-28.29	Average
12010.000	41.35	74	-32.65	Peak
12010.000	30.69	54	-23.31	Average

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Spurious Radiated Emission

EUT: MRL171
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	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
45.412	19.63	40	-20.37	Quasi Peak
58.507	20.88	40	-19.12	Quasi Peak
308.174	25.12	46	-20.88	Quasi Peak
889.312	28.53	46	-17.47	Quasi Peak
1270.187	35.01	74	-38.99	Peak
1270.187	26.81	54	-27.19	Average
2183.312	34.42	74	-39.58	Peak
2183.312	23.68	54	-30.32	Average
4804.687	48.93	74	-25.07	Peak
4804.687	39.95	54	-14.05	Average
8763.755	41.04	74	-32.96	Peak
8763.755	32.53	54	-21.47	Average
11801.250	42.34	74	-31.66	Peak
11801.250	33.66	54	-20.34	Average

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Spurious Radiated Emission

EUT: MRL171
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	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
59.660	21.09	40	-18.91	Quasi Peak
175.482	22.54	43.5	-20.96	Quasi Peak
230.155	25.23	46	-20.77	Quasi Peak
528.795	28.61	46	-17.39	Quasi Peak
1779.625	28.89	74	-45.11	Peak
1779.625	20.91	54	-33.09	Average
2085.210	30.64	74	-43.36	Peak
2085.210	21.28	54	-32.72	Average
4880.156	45.26	74	-28.74	Peak
4880.025	36.89	54	-17.11	Average
11298.750	41.80	74	-32.20	Peak
11298.750	32.68	54	-21.32	Average
12794.531	43.43	74	-30.57	Peak
12794.531	35.08	54	-18.92	Average

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Spurious Radiated Emission

EUT: MRL171
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	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
4879.218	49.21	74	-24.79	Peak
4879.218	40.07	54	-13.93	Average
6834.375	37.35	74	-36.65	Peak
6834.375	28.82	54	-25.18	Average
11103.281	41.54	74	-32.46	Peak
11103.281	32.65	54	-21.35	Average

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Spurious Radiated Emission

EUT: MRL171
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	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
60.055	22.92	40	-17.08	Quasi Peak
175.550	26.78	43.5	-16.72	Quasi Peak
231.075	29.61	46	-16.39	Quasi Peak
530.005	30.39	46	-15.61	Quasi Peak
1202.005	31.28	74	-42.72	Peak
1202.005	22.07	54	-31.93	Average
1599.250	32.02	74	-41.98	Peak
1599.250	23.16	54	-30.84	Average
4959.375	45.22	74	-28.78	Peak
4959.375	36.48	54	-17.52	Average
8761.406	40.51	74	-33.49	Peak
8761.406	31.29	54	-22.71	Average
11105.625	42.39	74	-31.61	Peak
11105.625	31.84	54	-22.16	Average

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Spurious Radiated Emission

EUT: MRL171
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	Result	Limit	Margin	Detector
MHz	dBµV/m	dBµV/m	dB	
60.055	20.85	40	-19.15	Quasi Peak
175.550	22.45	43.5	-21.05	Quasi Peak
231.075	25.67	46	-20.33	Quasi Peak
530.005	28.94	46	-17.06	Quasi Peak
1085.500	35.44	74	-38.56	Peak
1085.500	26.12	54	-27.88	Average
2287.812	35.85	74	-38.15	Peak
2287.812	34.92	54	-19.08	Average
4959.375	46.05	74	-27.95	Peak
4959.375	38.12	54	-15.88	Average
11146.875	42.05	74	-31.95	Peak
11146.875	33.44	54	-20.56	Average
13090.312	42.73	74	-31.27	Peak
13090.312	34.68	54	-19.32	Average

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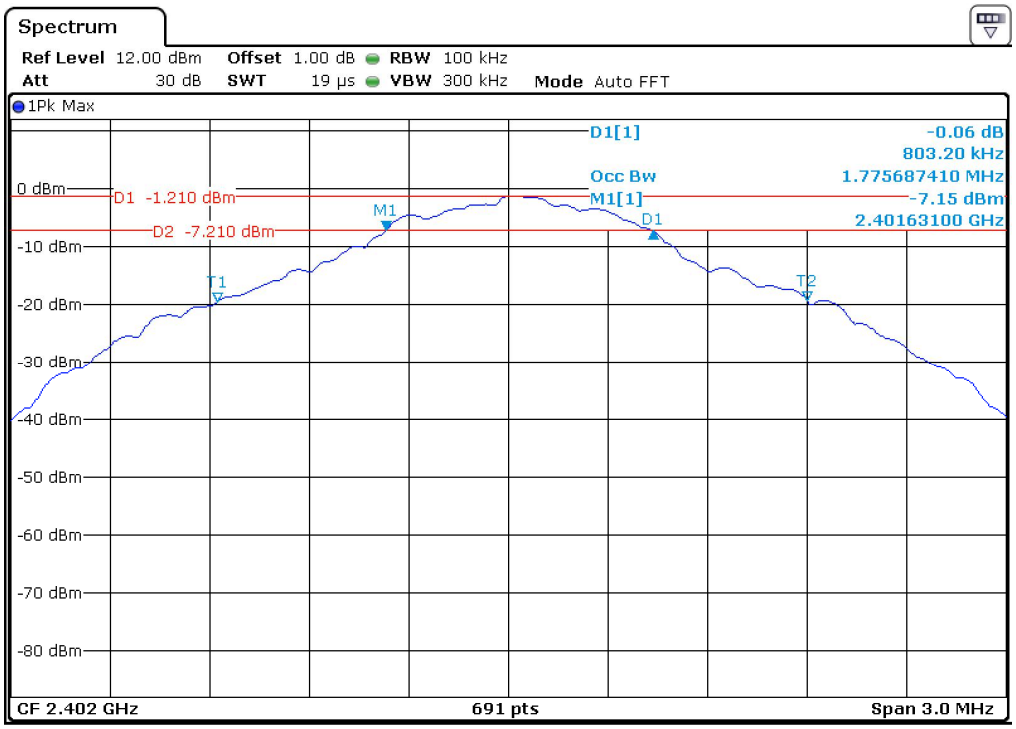
7.2 6dB & 99% Bandwidth

EUT:	MRL171
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	Limit
803.200 kHz	>500 kHz

99% bandwidth
1775.687 kHz

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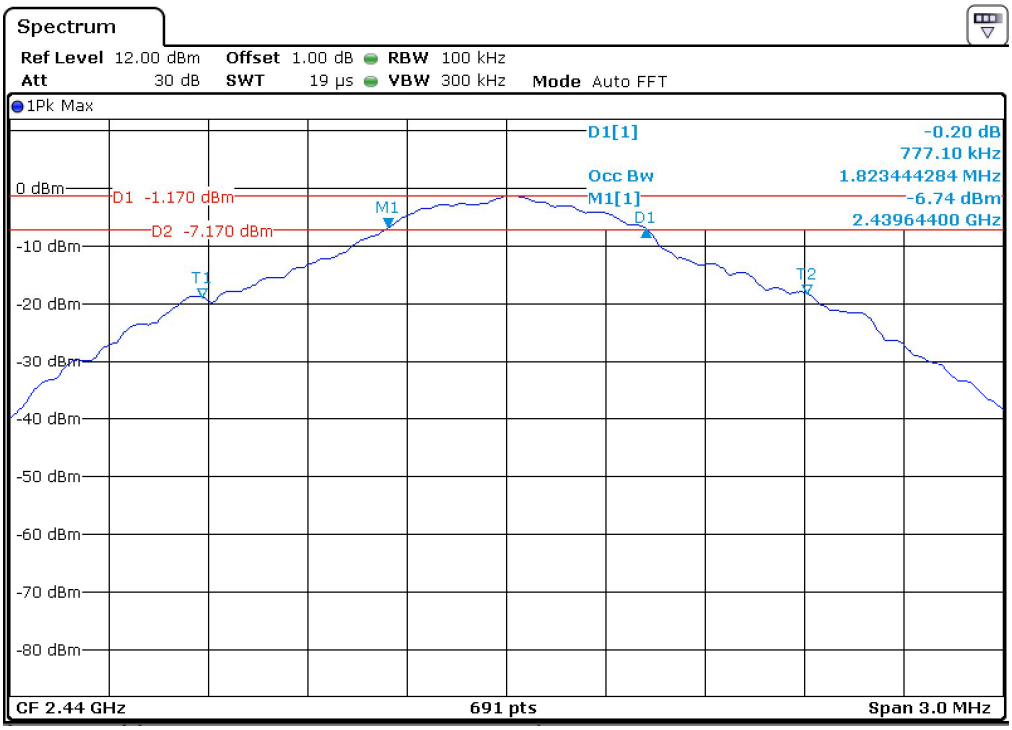
6dB & 99% Bandwidth

EUT:	MRL171
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	Limit
777.100 kHz	>500 kHz

99% bandwidth
1823.444 kHz

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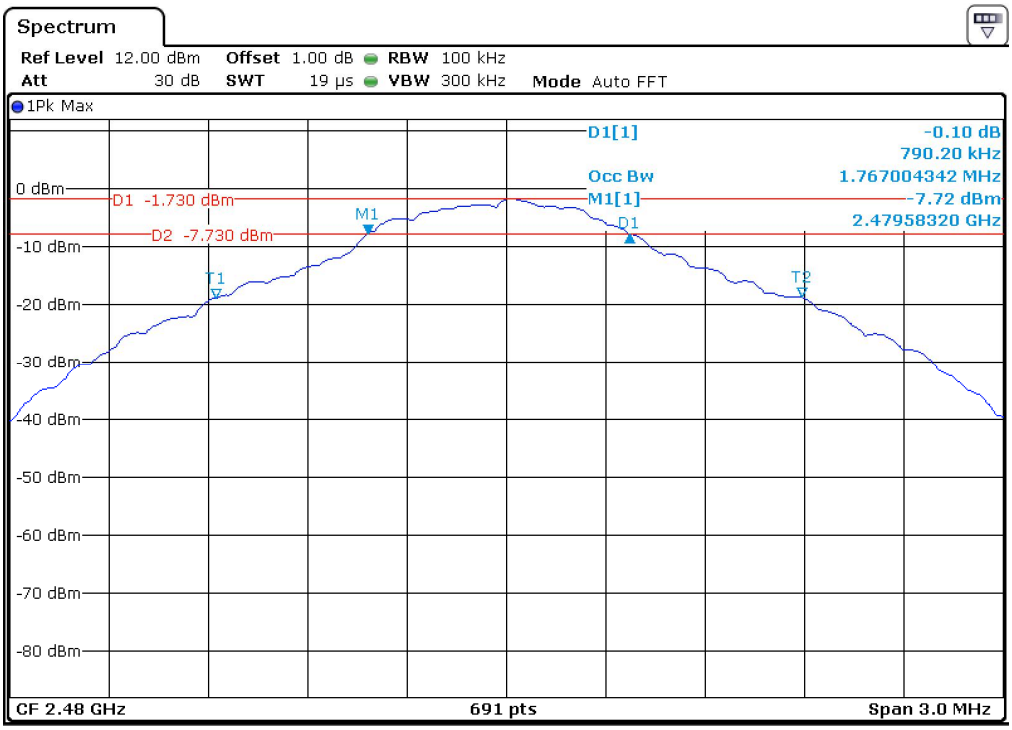
6dB & 99% Bandwidth

EUT:	MRL171
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	Limit
790.200 kHz	>500 kHz

99% bandwidth
1767.004 kHz

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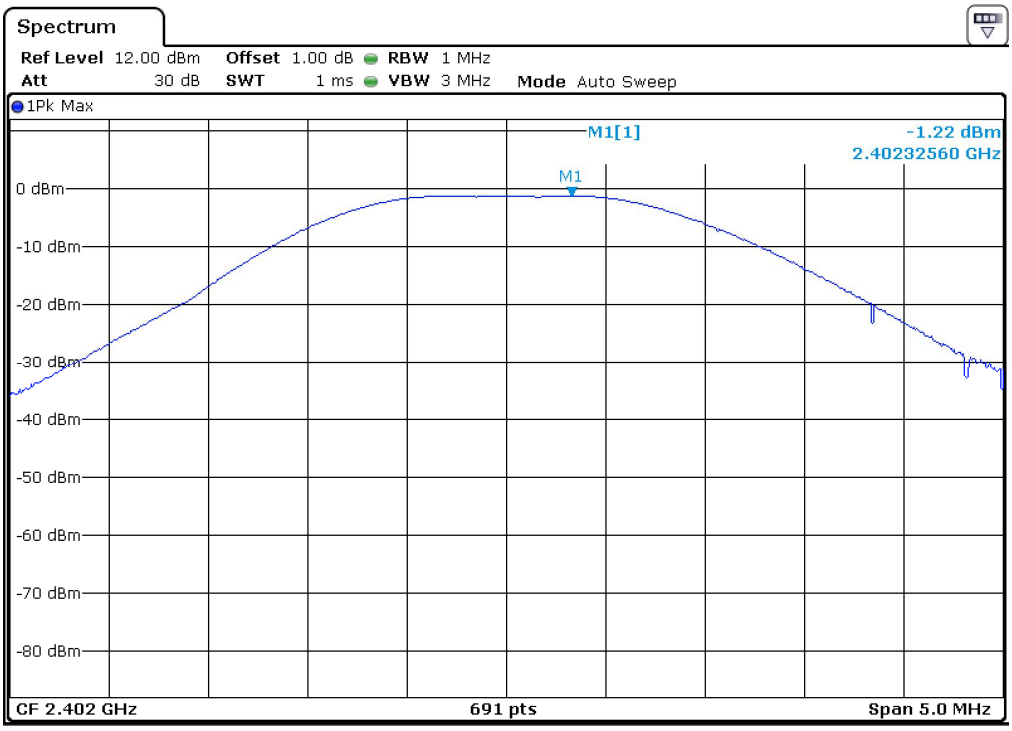
7.3 Peak Output Power

EUT:	MRL171
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(b)
Comment:	3.7VDC, Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed



Conducted Output Power	Limit
-1.22dBm	30dBm

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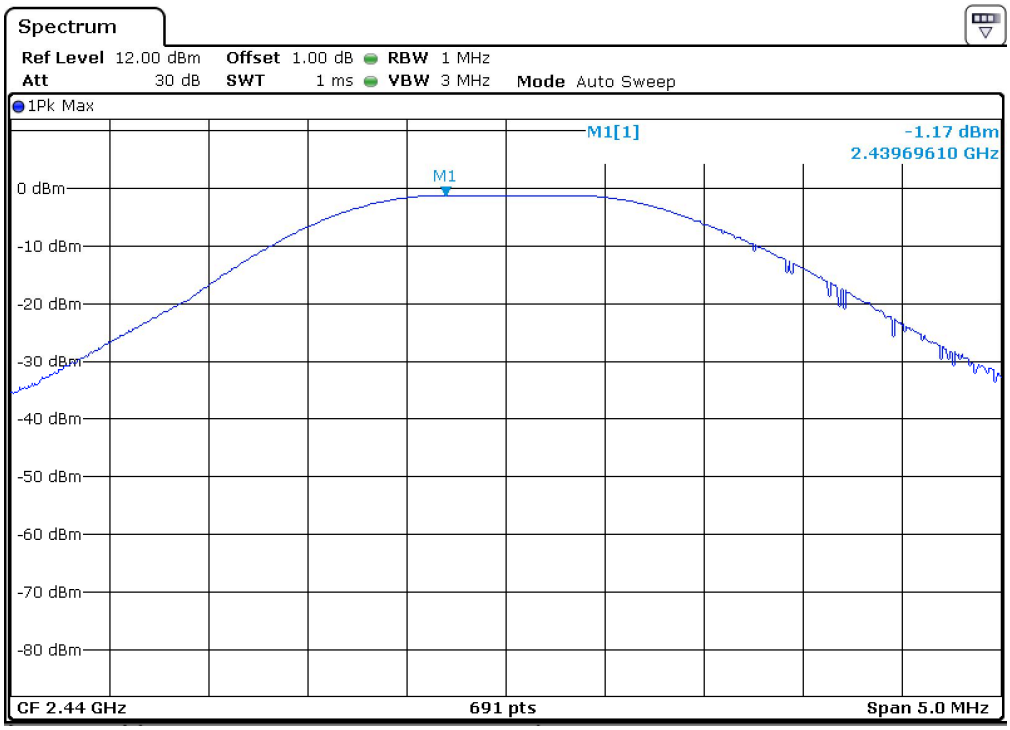
Peak Output Power

EUT:	MRL171
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(b)
Comment:	3.7VDC, Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed



Conducted Output Power	Limit
-1.17dBm	30dBm

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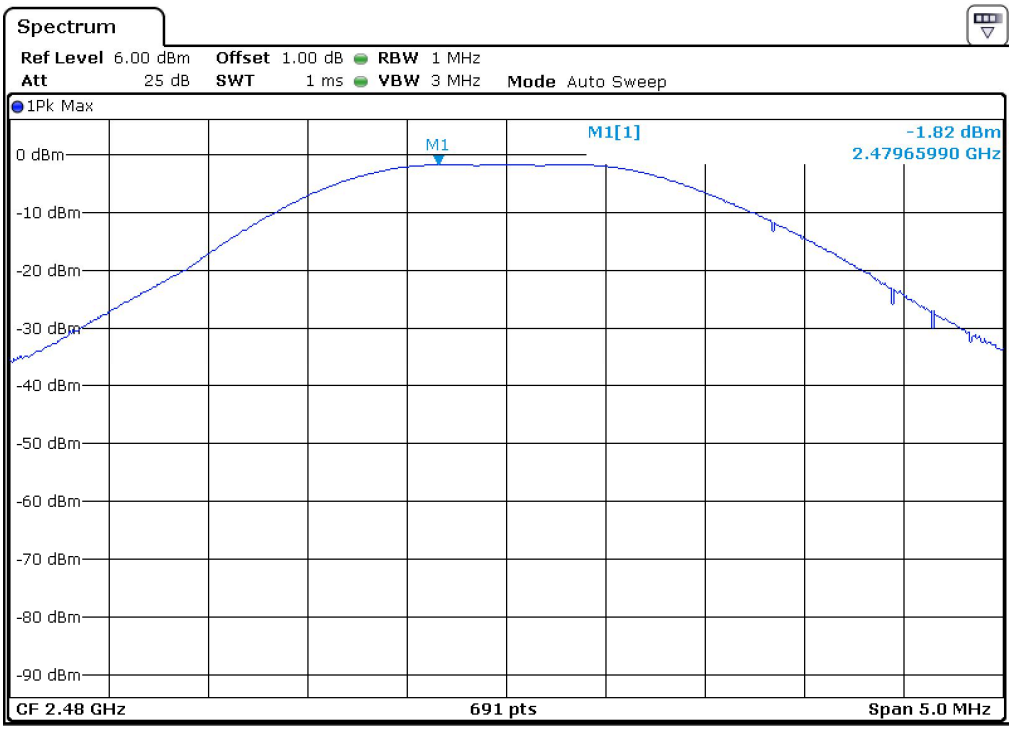
Peak Output Power

EUT:	MRL171
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(b)
Comment:	3.7VDC, Antenna gain: 0 dBi, Cable Loss: 1.0dB

Test Result
☒ Passed
☐ Not Passed



Conducted Output Power	Limit
-1.82dBm	30dBm

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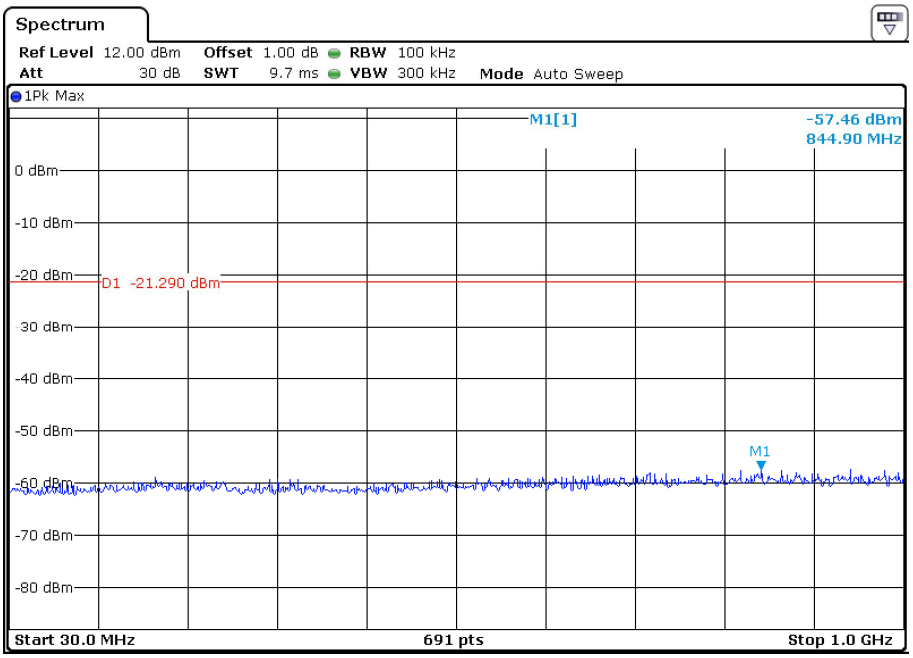
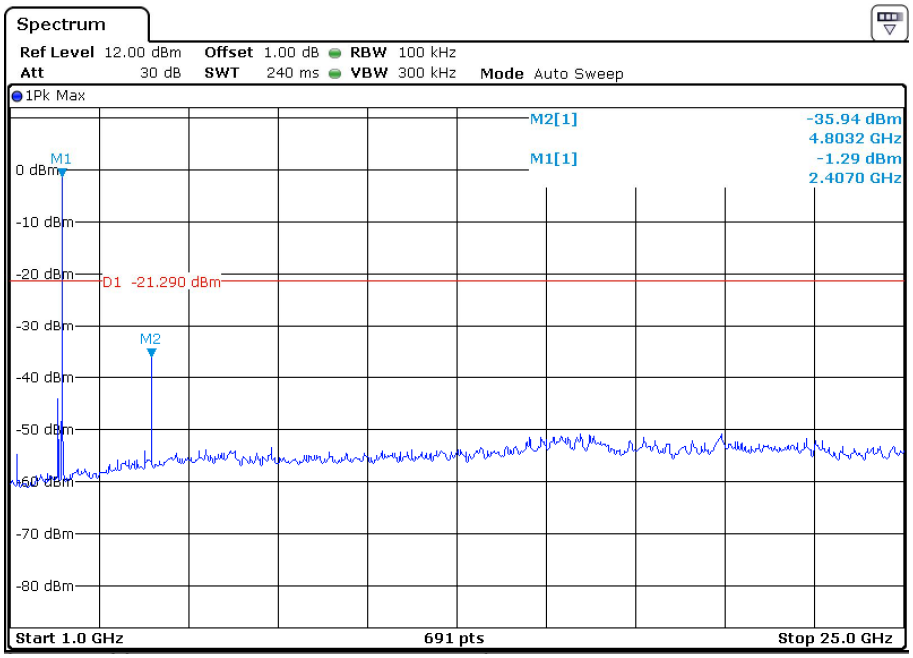
7.4 Spurious Emissions at Antenna Terminals

EUT:	MRL171
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC2.1051 & 15.247(d)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed





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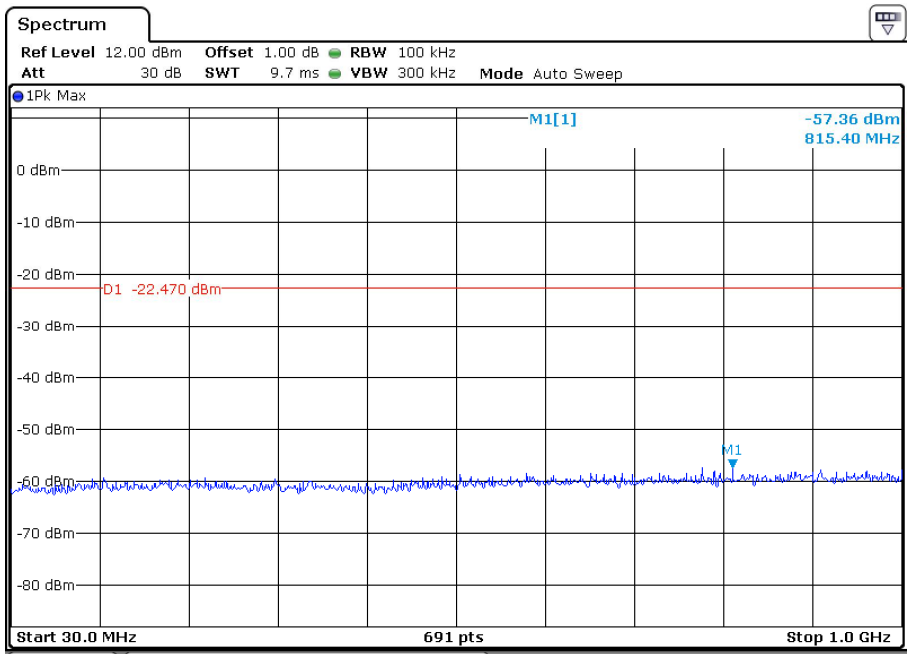
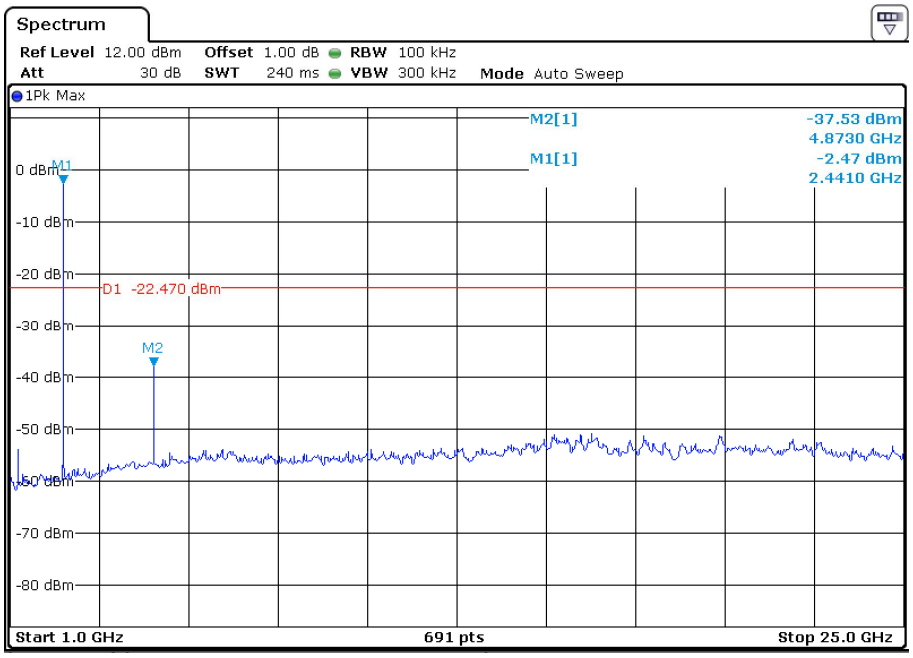
Spurious Emissions at Antenna Terminals

EUT:	MRL171
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC2.1051 & 15.247(d)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed





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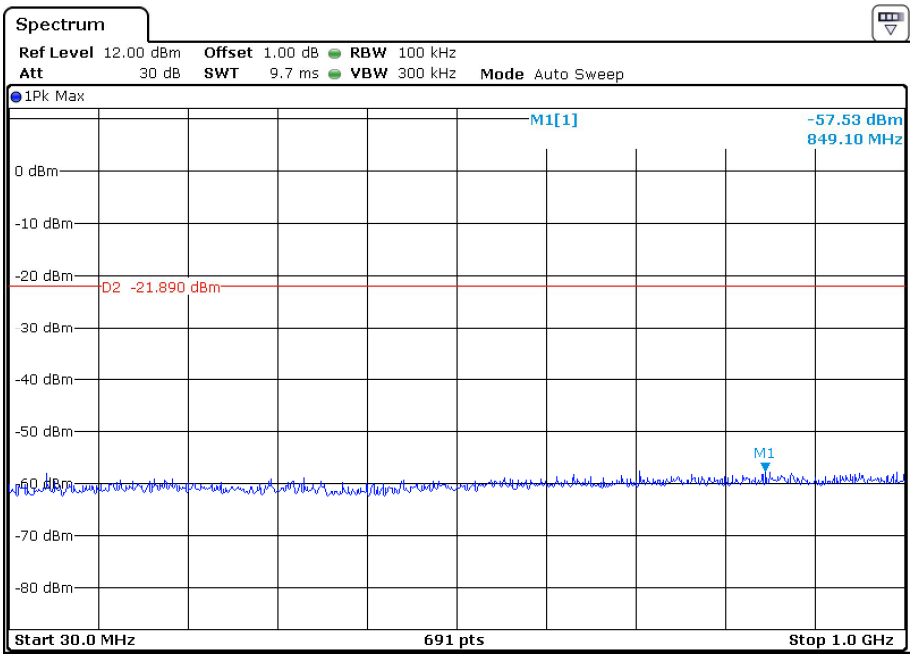
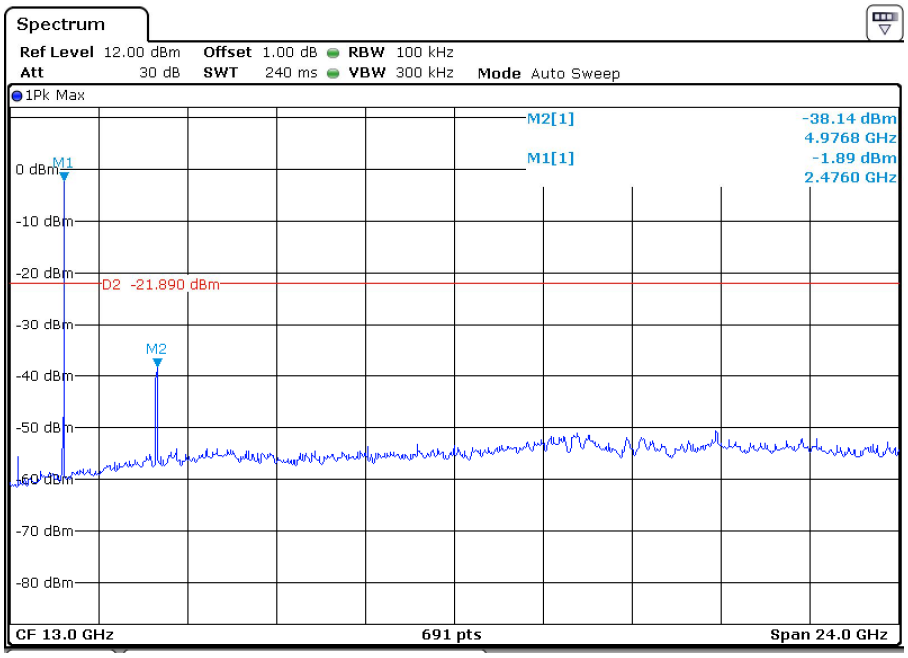
Spurious Emissions at Antenna Terminals

EUT:	MRL171
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC2.1051 & 15.247(d)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed





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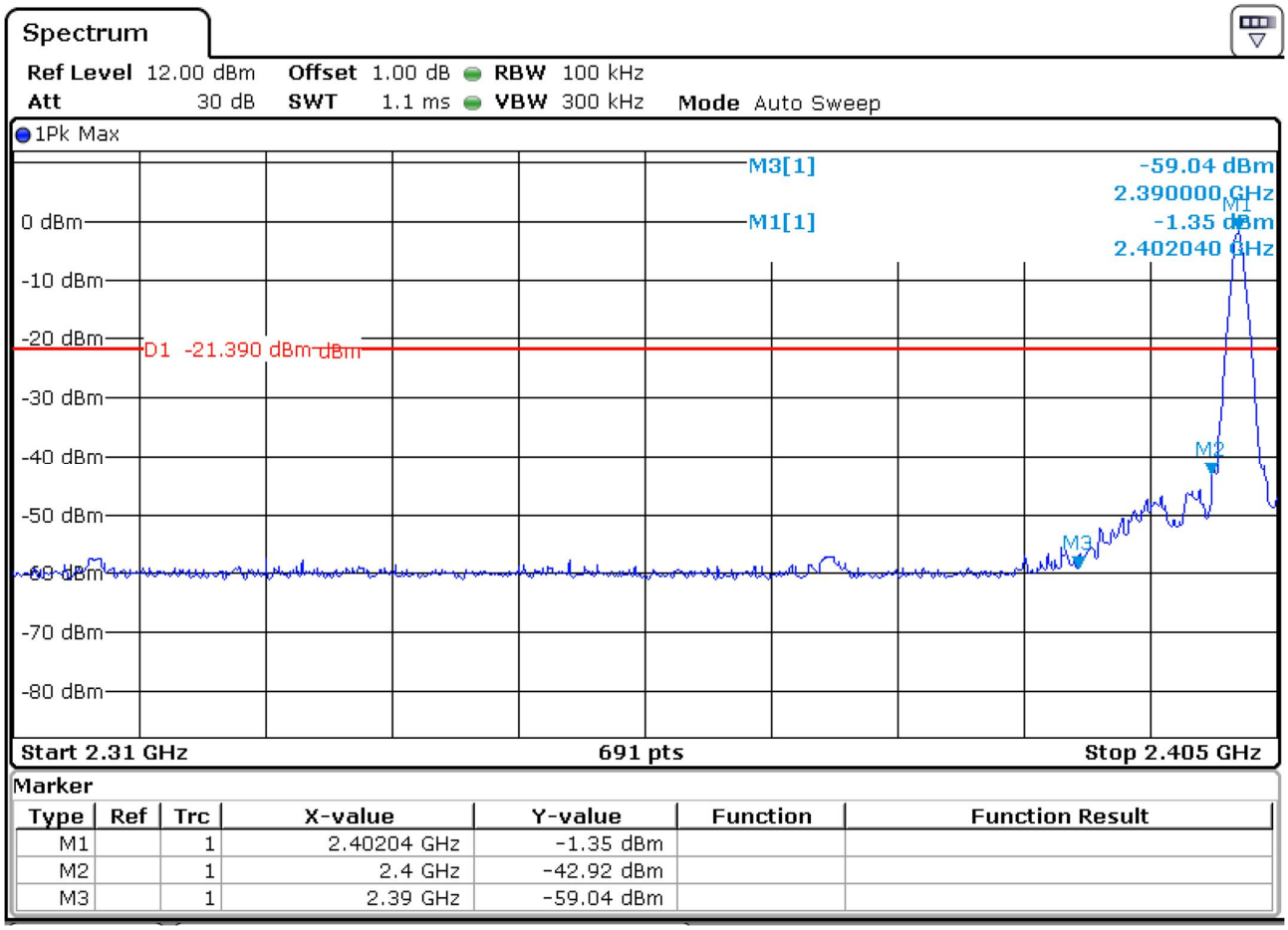
7.5 100kHz Bandwidth of band edges

EUT:	MRL171
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(d), Conducted
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed



Band edges	Limit
41.57 dB	> 20dB

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100kHz Bandwidth of band edges

EUT: MRL171
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(d), Radiated
Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
2390.000	36.19	74	-47.81	Peak
2390.000	27.62	54	-26.38	Average

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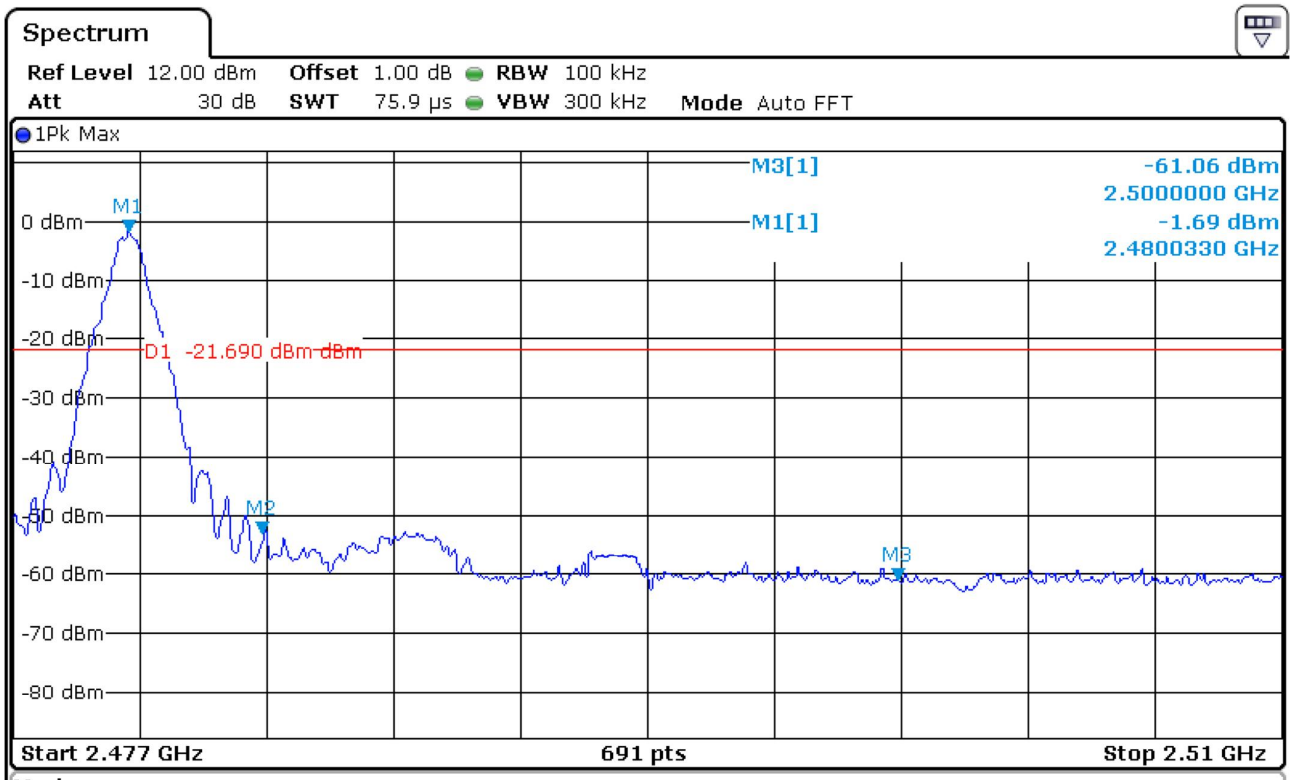
100kHz Bandwidth of band edges

EUT:	MRL171
Op Condition:	Operated, TX Mode (2480MHz)
Test Specification:	FCC15.247(d), Conducted
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.480033 GHz	-1.69 dBm		
M2		1	2.4835 GHz	-53.08 dBm		
M3		1	2.5 GHz	-61.06 dBm		

Band edges	Limit
51.39 dB	> 20dB

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100kHz Bandwidth of band edges

EUT: MRL171
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(d), Radiated
Comment: 3.7VDC

Test Result
☒ Passed
☐ Not Passed

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector
2483.500	42.15	74	-31.85	Peak
2483.500	34.07	54	-19.93	Average

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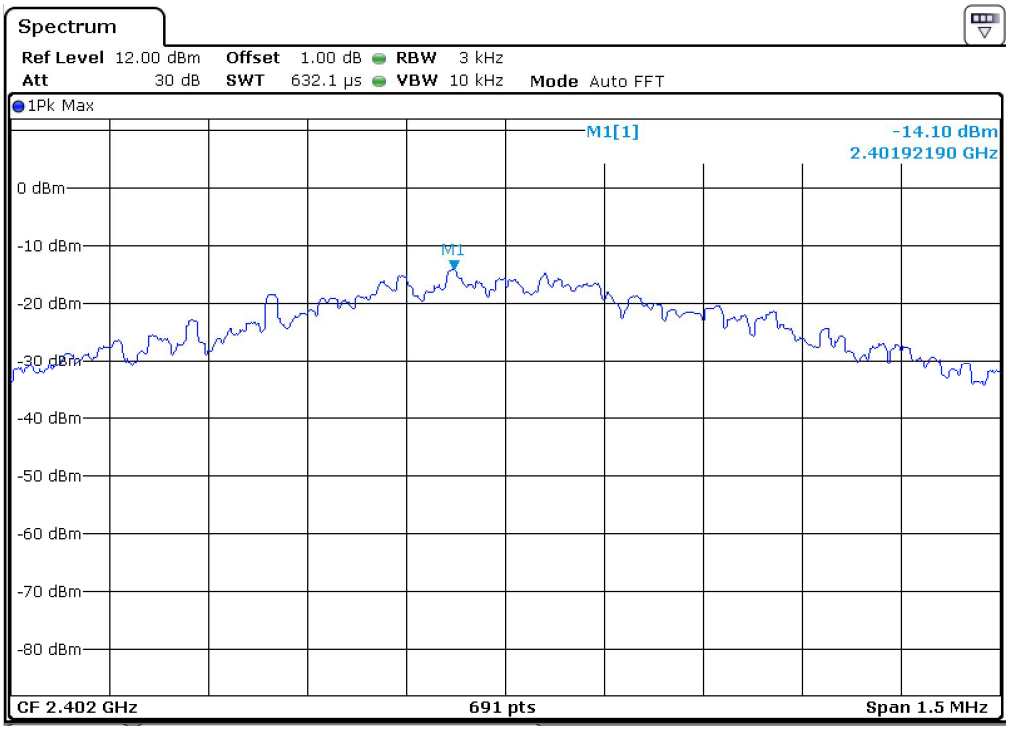
7.6 Power Special Density

EUT:	MRL171
Op Condition:	Operated, TX Mode (2402MHz)
Test Specification:	FCC15.247(e)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed



PSD	Limit
-14.10 dBm	< 8 dBm

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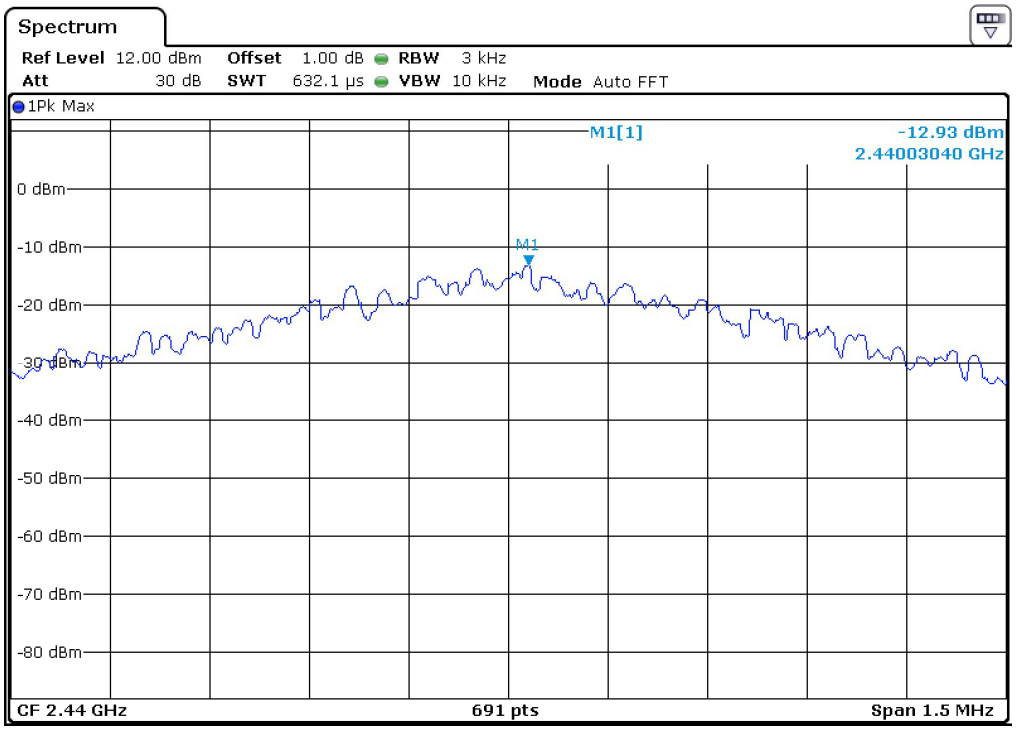
Power Special Density

EUT:	MRL171
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(e)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed



PSD	Limit
-12.93 dBm	< 8 dBm

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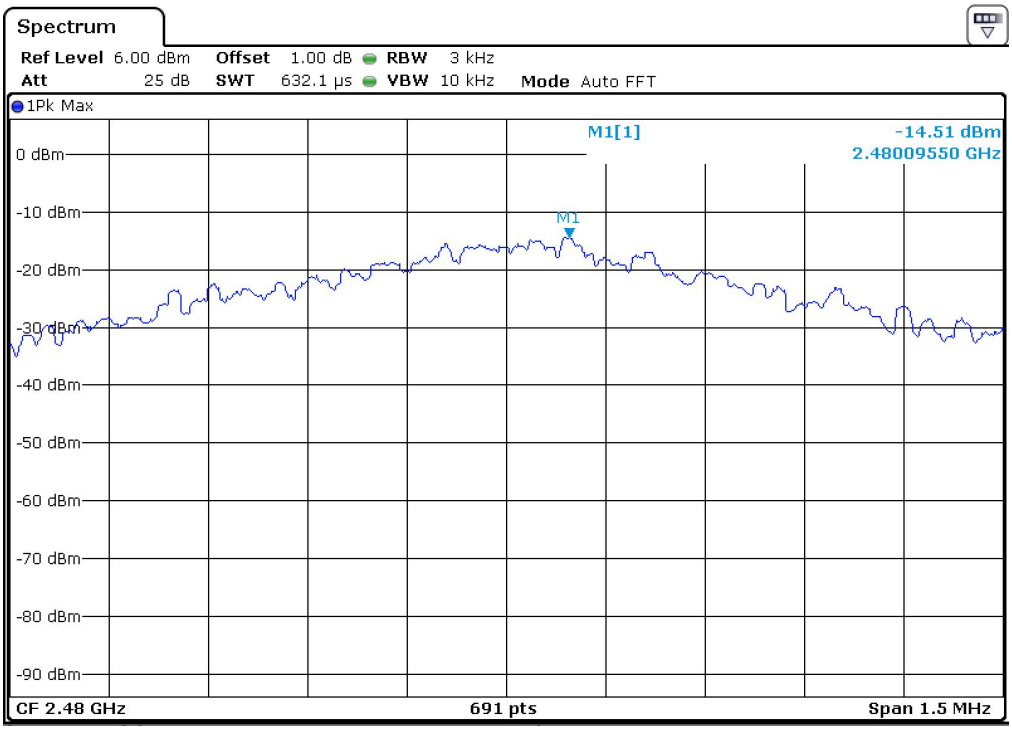
Power Special Density

EUT:	MRL171
Op Condition:	Operated, TX Mode (2440MHz)
Test Specification:	FCC15.247(e)
Comment:	3.7VDC

Test Result
☒ Passed
☐ Not Passed



PSD	Limit
-14.51 dBm	< 8 dBm

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7.7 Antenna Requirement

EUT:	MRL171	Test Result
Op Condition:	Operated, TX Mode	☒ Passed
Test Specification:	FCC15.203 & 15.247(b)	☐ Not Passed
Comment:	3.7VDC	

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.

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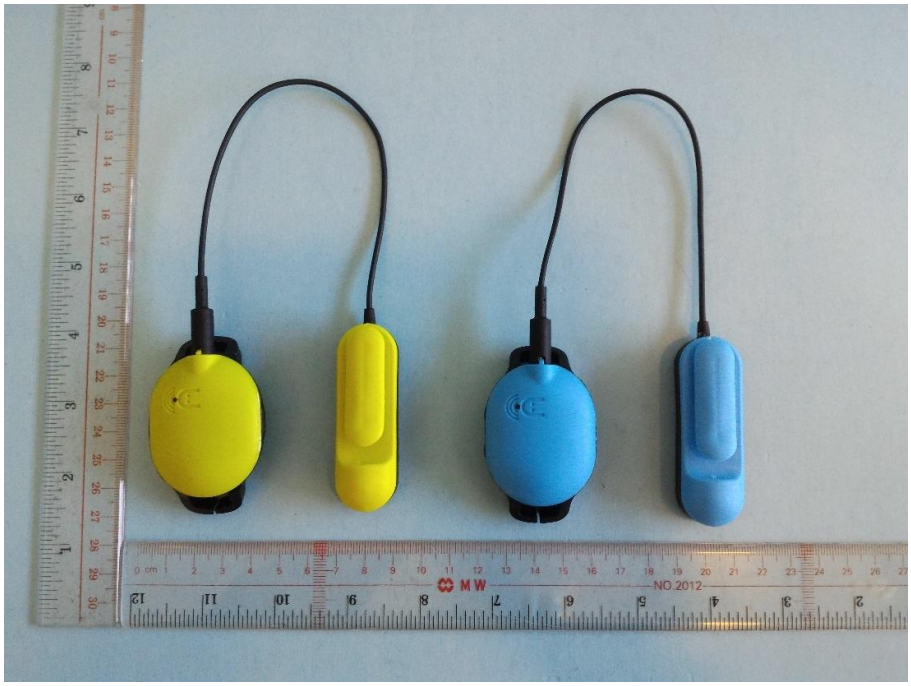
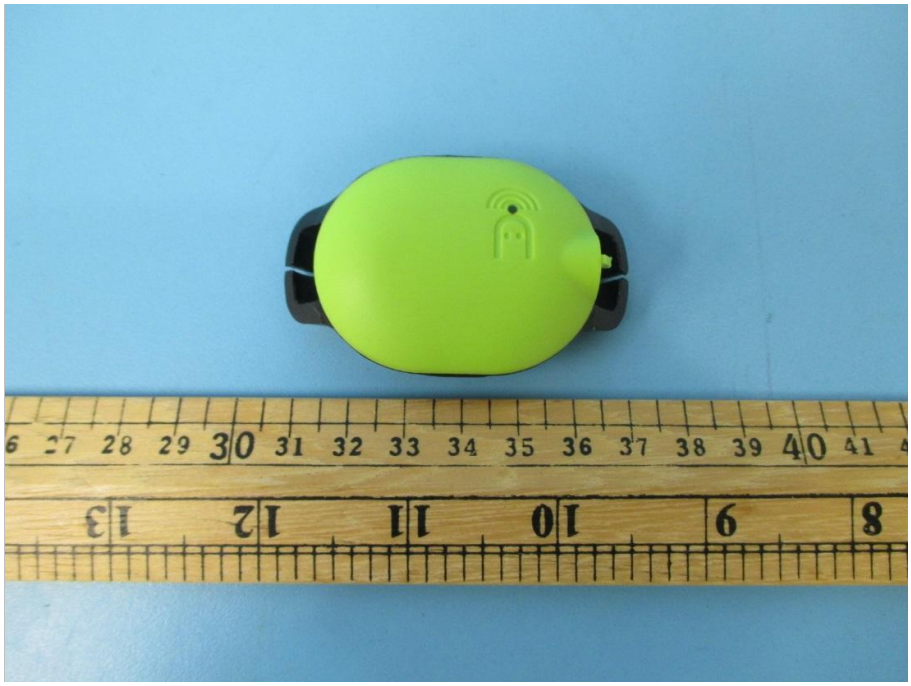
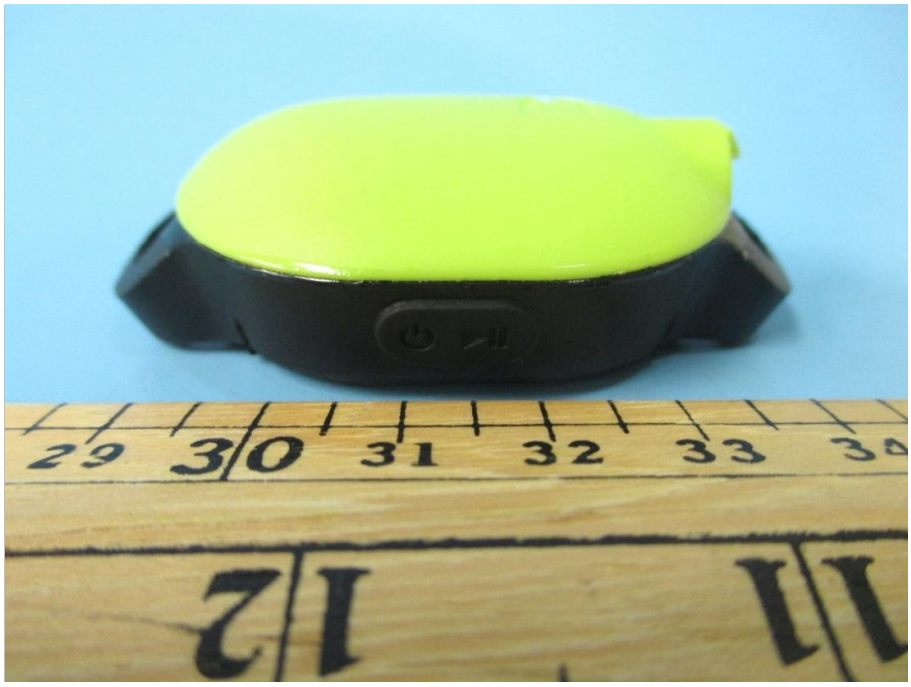
8 Appendix A - Photographs of EUT



Appendix A



Appendix A



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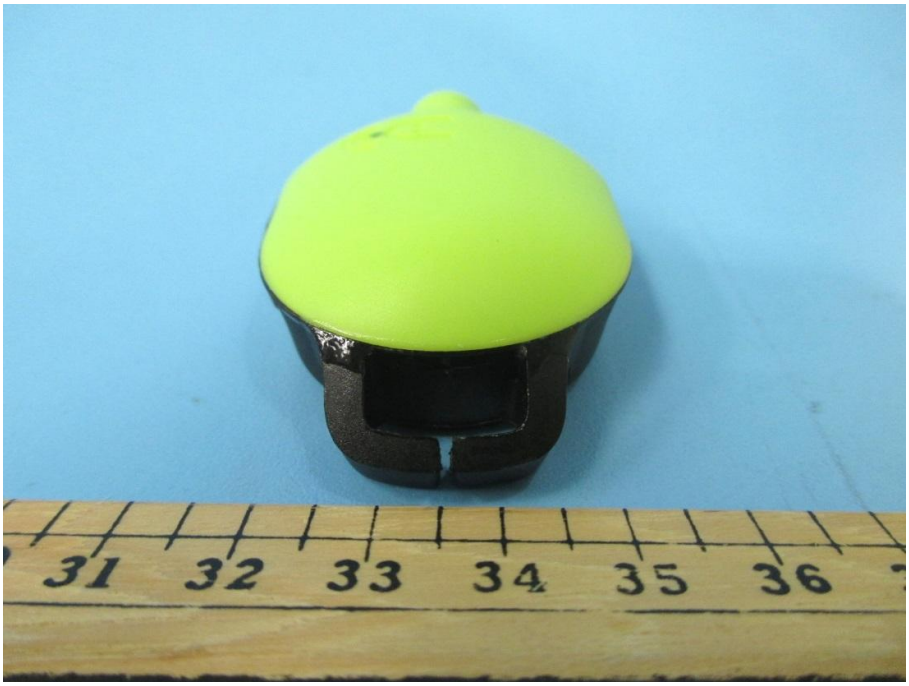
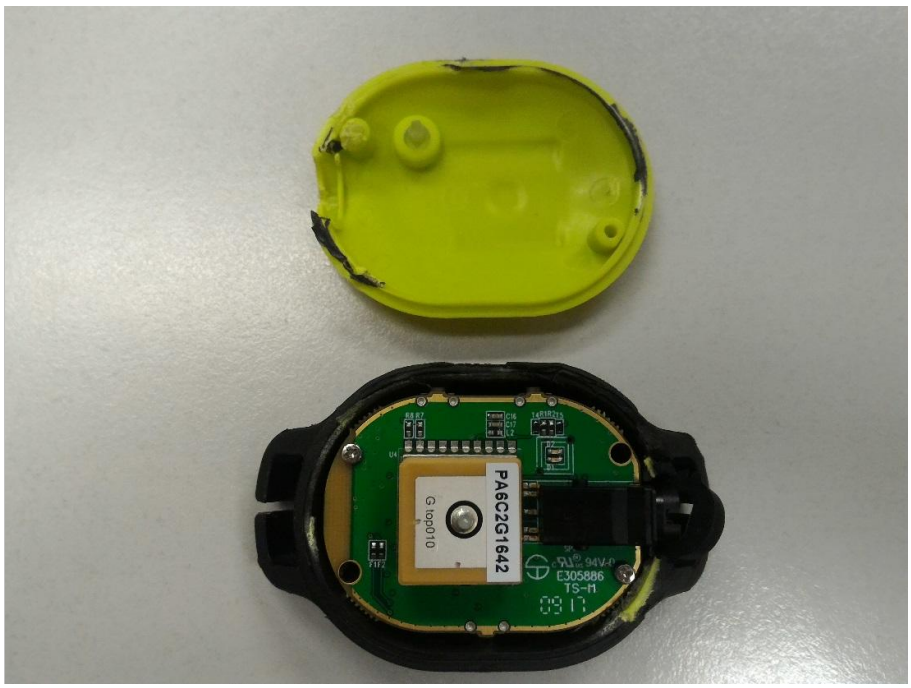
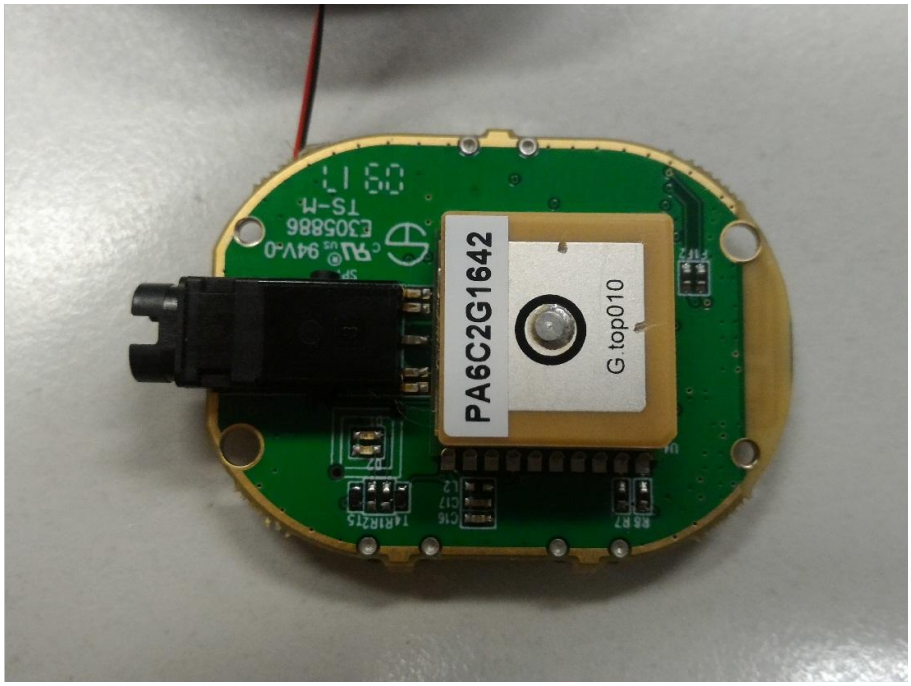
Appendix A



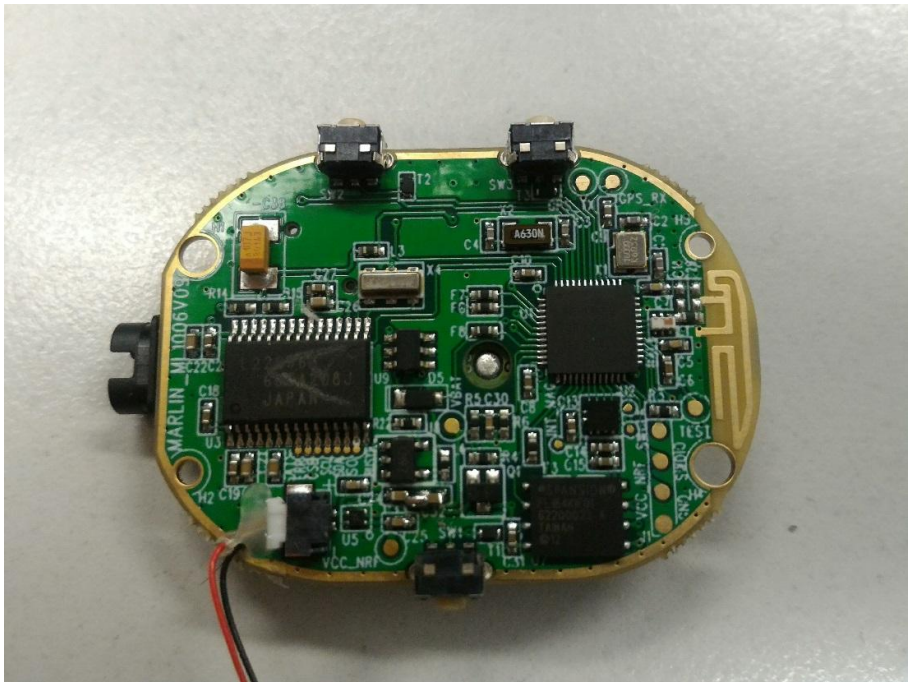
Appendix A



Appendix A



Appendix A



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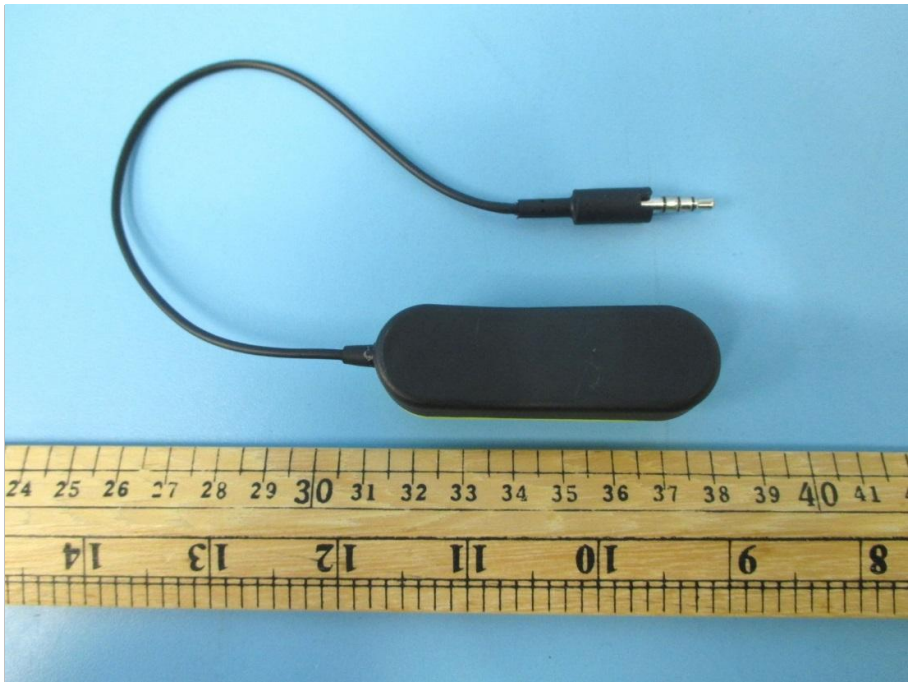
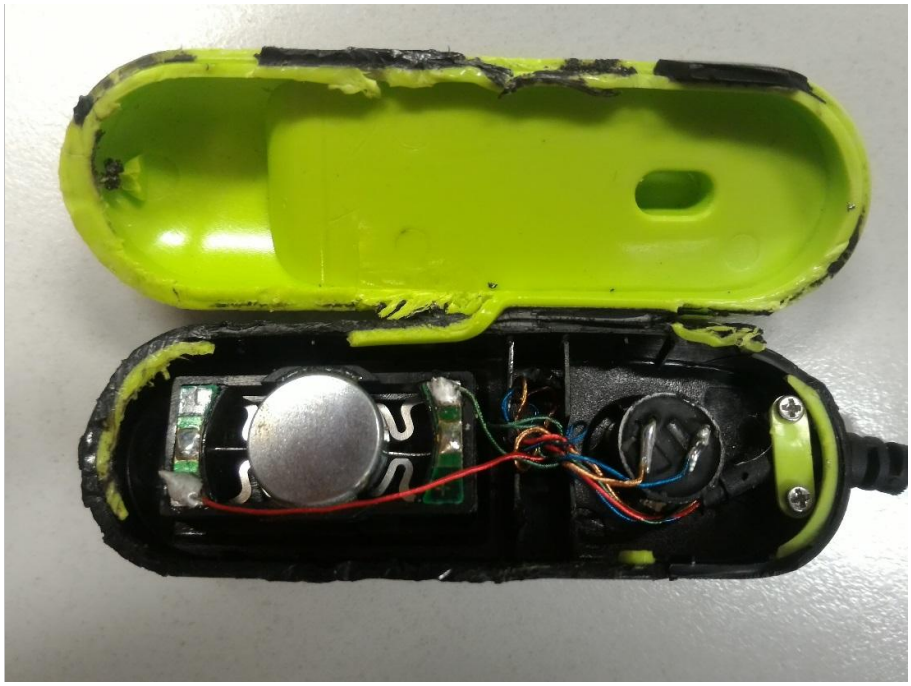
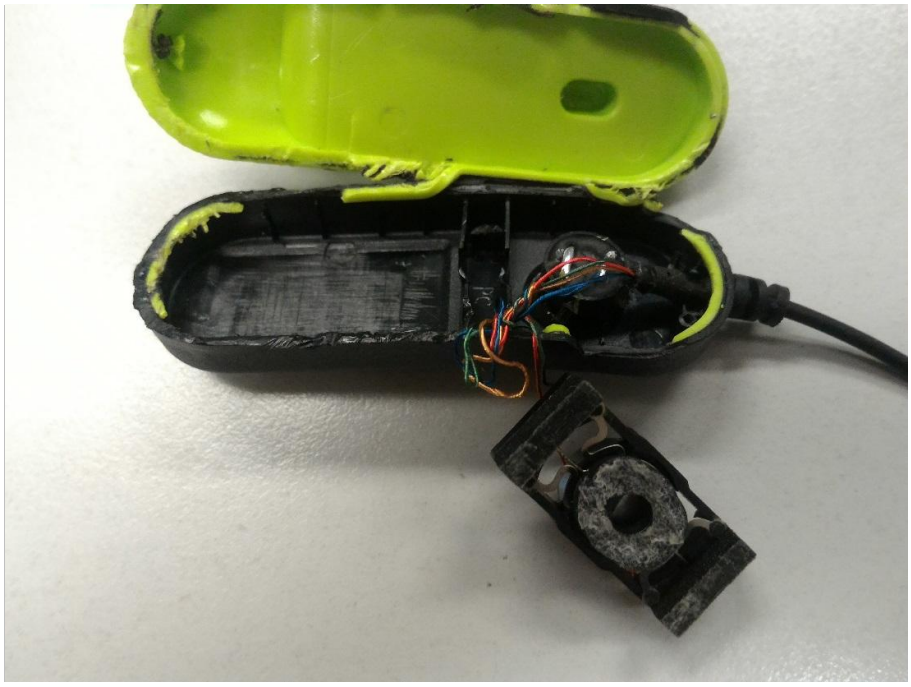
Appendix A

Appendix A





Appendix A



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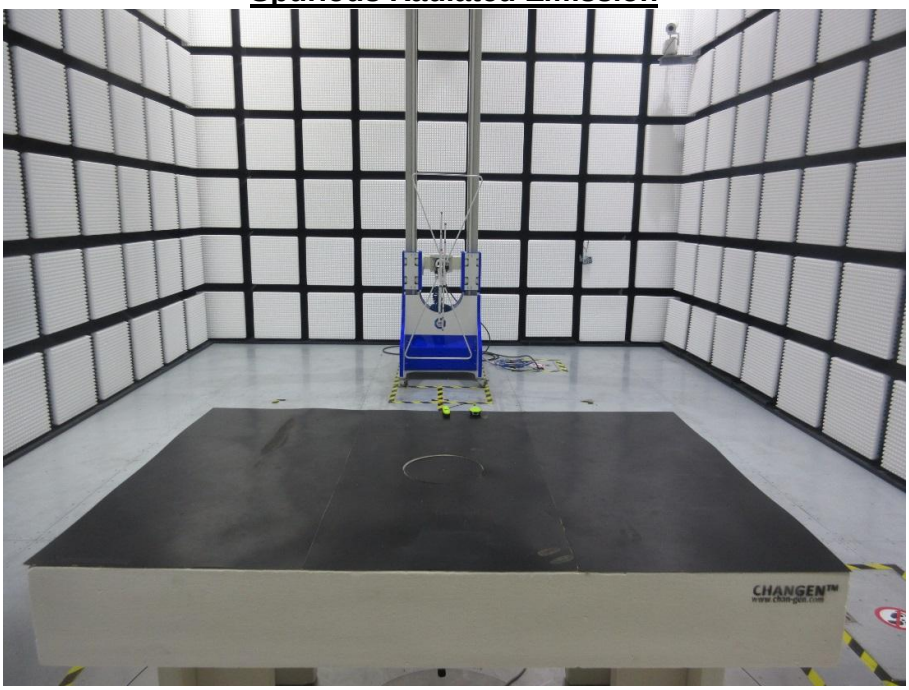
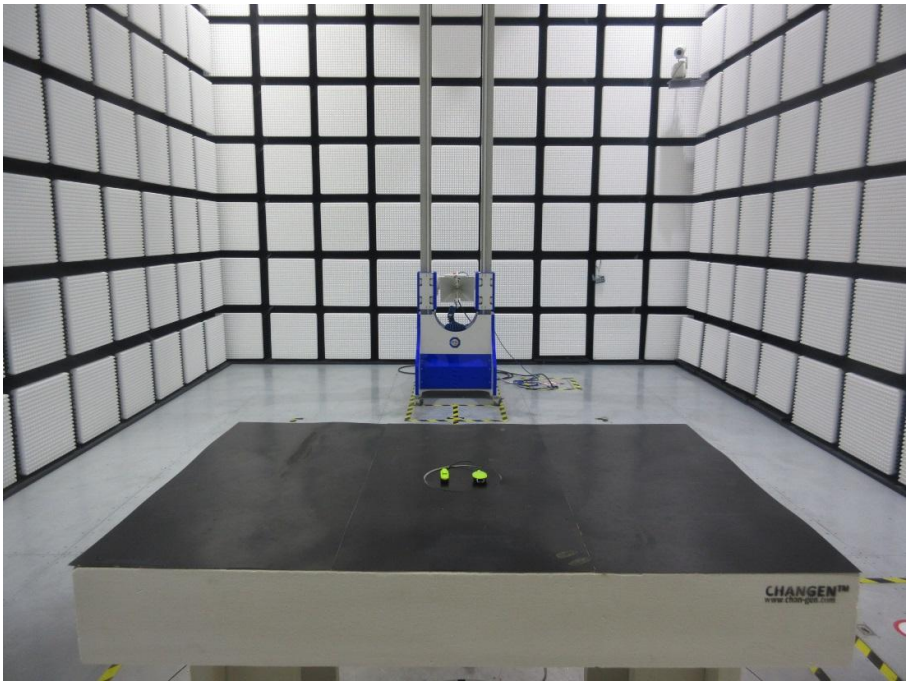
9 Appendix B - Setup Photographs of EUT

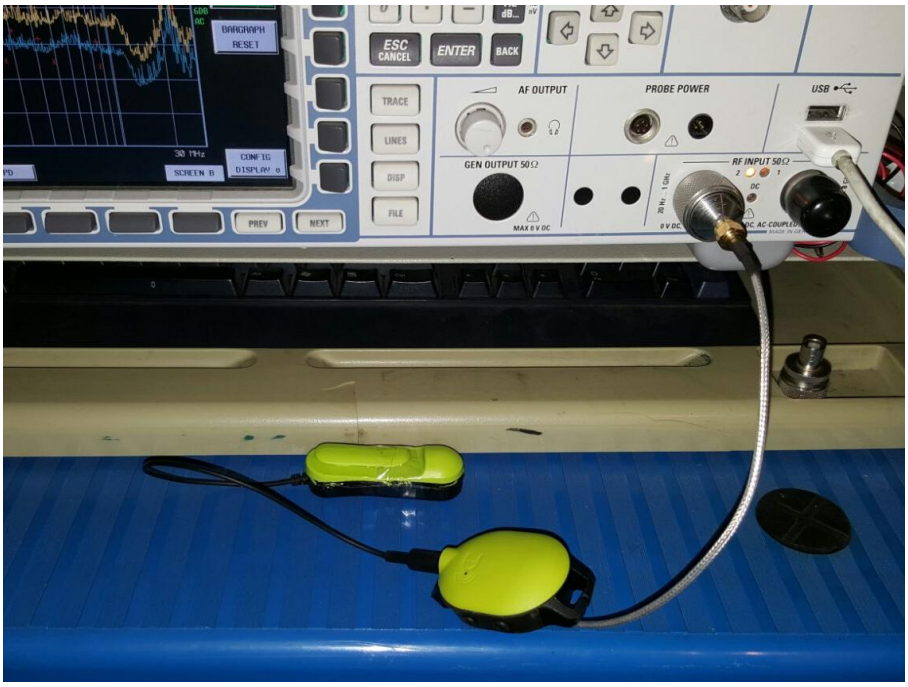
Spurious Radiated Emission





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



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

>> The power of EUT measured (2402MHz) is: -1.22dBm = 0.755mW
The power of EUT measured (2440MHz) is: -1.77dBm = 0.665mW
The power of EUT measured (2480MHz) is: -1.82dBm = 0.658mW
Which is smaller than the Numeric threshold.
Therefore, the device is exempt from stand-alone SAR test requirements.

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