FCC TEST REPORT Co-Location	
Report Reference No	G0M-2012-9520-TFCCOLOC-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	DAkkS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	Tharsus Limited
Address	Birmayne House Cowley Road NE24 5TF Blyth United Kingdom
Test Specification	47 CFR Part 15F 47 CFR Part 15C
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	RF Proximity Module
Model(s)	BUMP-718-F
Additional Model(s)	None
Brand Name(s)	Tharsus
Hardware Version(s)	718-F
Software Version(s)	3
FCC ID	2AYMM-BUMP-718-F
Test Result	**PASSED**

Possible test case verdicts:		
Required by standard but not tested	N/T	
Not required by standard	N/R	
Not applicable to EUT	N/A	
Test object does meet the requirement	P(PASS)	
Test object does not meet the requirement	F(FAIL)	
Testing:		
Test Lab Temperature	20 °C - 30 °C	
Test Lab Humidity	25 % - 55 %	
Date of receipt of test item	2021-01-04	
Report:		
Compiled by	Florian Voigt	
Tested by (+ signature) (Responsible for Test)	Florian Voigt	F. Voigt .....
Approved by (+ signature) (Deputy Head of Lab)	Toralf Jahn	T. J .....
Date of Issue	2021-03-25	
Total number of pages	40	
General Remarks:		
The test results presented in this report relate only to the object tested. **The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.** This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.		
Additional Comments:		
Transmitters will be disabled in charging mode		

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2021-03-25	Initial Release	

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
RBW	Resolution bandwidth
RMS	Root mean square
VBW	Video bandwidth
V_{NOM}	Nominal supply voltage

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1.3 Photos – Test Setup 12
1.4 Support Equipment 16
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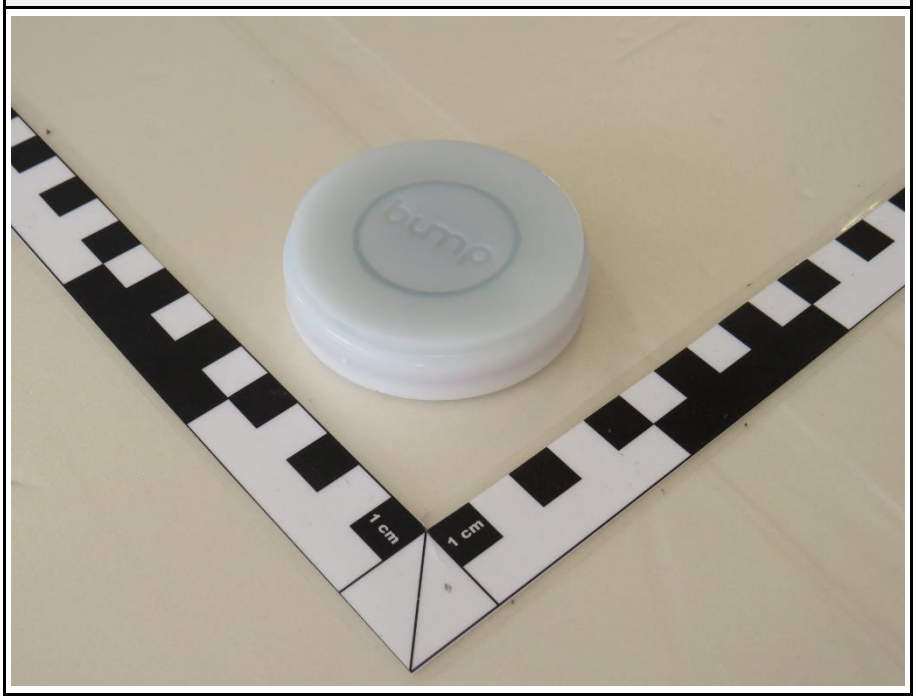
1 Equipment (Test Item) Under Test

Description	RF Proximity Module	
Model	BUMP-718-F	
Additional Model(s)	None	
Brand Name(s)	Tharsus	
Serial Number(s)	None	
Hardware Version(s)	718-F	
Software Version(s)	3	
FCC ID	2AYMM-BUMP-718-F	
Equipment type	End Product	
Radio type	Transceiver	
Assigned frequency bands	2400MHz - 2483.5MHz, 6240MHz - 6740MHz	
Radio technologies	Bluetooth Low Energy, UWB	
Operating modes	UWB: Continuous transmit, Bluetooth Low Energy: Hopping on advertisement channels	
Modulation	2-GFSK, BPM	
Number of modules	None	
UWB Antenna	Type	Integrated
	Model	AH086M555003-T
	Manufacturer	Taiyo-Yuden
	Gain	2.6 dBi
Bluetooth LE Antenna	Type	Integrated antenna
	Model	2450AT18D0100
	Manufacturer	Johanson Technology
	Gain	1.5 dBi
Battery Supply Voltage	V_{NOM}	3.7 VDC
USB Supply Voltage (Charging)	V_{NOM}	5.0 VDC
AC/DC-Adaptor	None	
Manufacturer	Tharsus Limited Birmayne House Cowley Road NE24 5TF Blyth United Kingdom	

1.1 Photos – Equipment External

BUMP IN PERSPECTIVE I



BUMP IN PERSPECTIVE II

Note: EUT is placed with the flat side towards the ground. This represents horizontal EUT positioning

BUMP TOP SIDE

BUMP BOTTOM SIDE

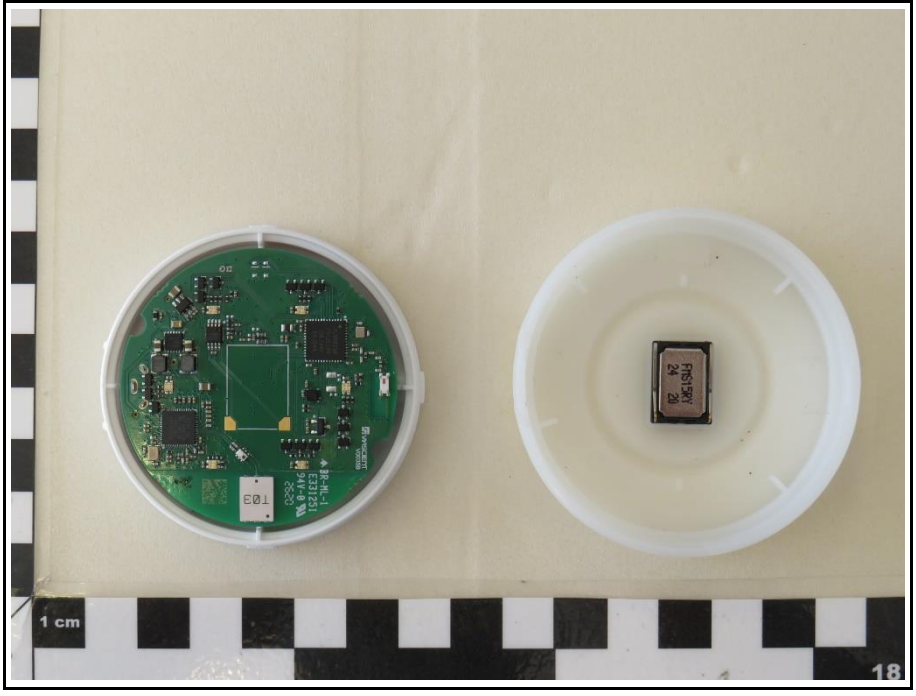
BUMP SIDE

Note: EUT is placed with the short side towards the ground. This represents vertical EUT positioning

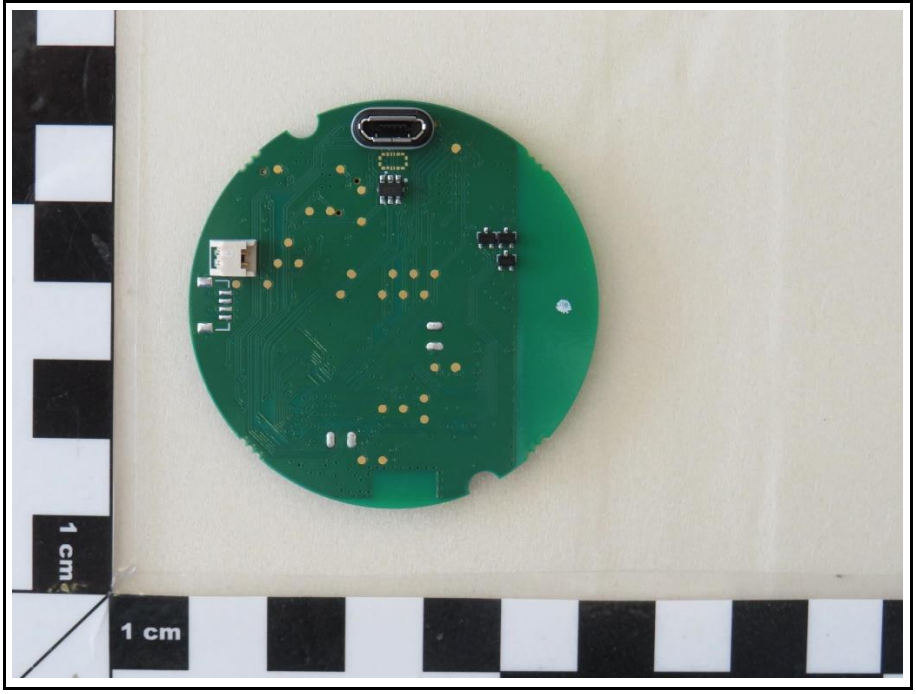
1.2 Photos – Equipment Internal

BUMP BOTTOM COVER

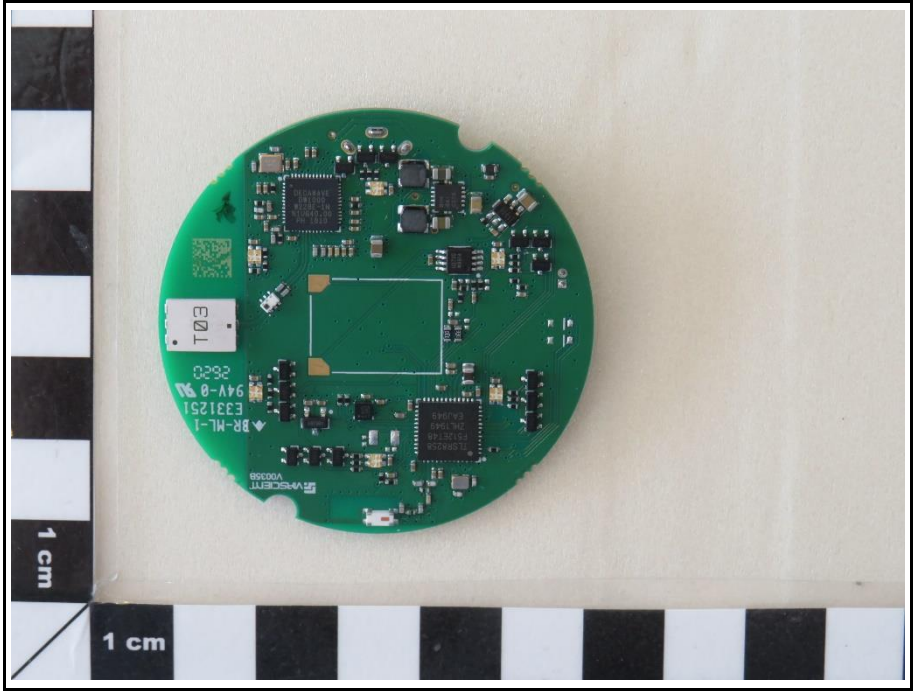
OPEN BUMP WITH TOP AND BOTTOM COVER



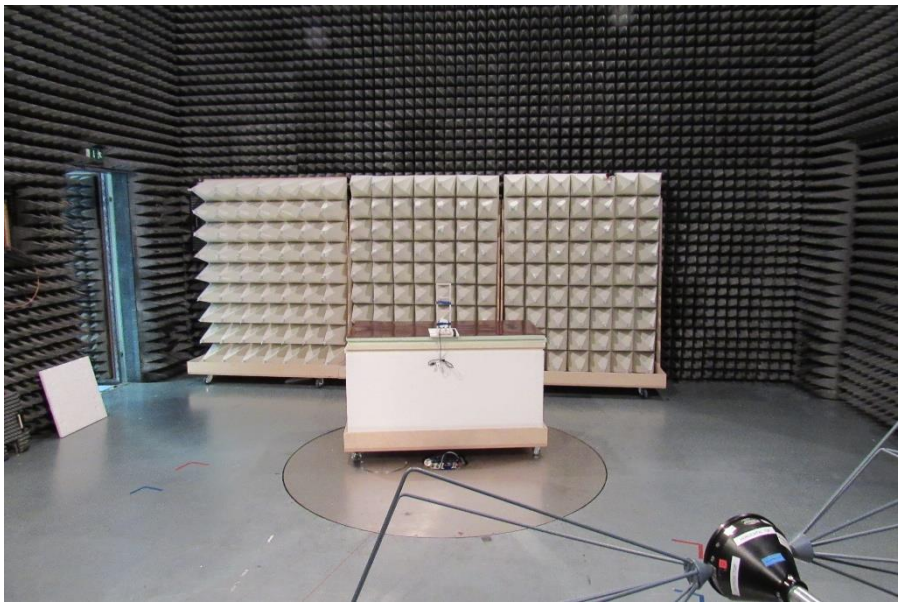
PCB BOTTOM SIDE

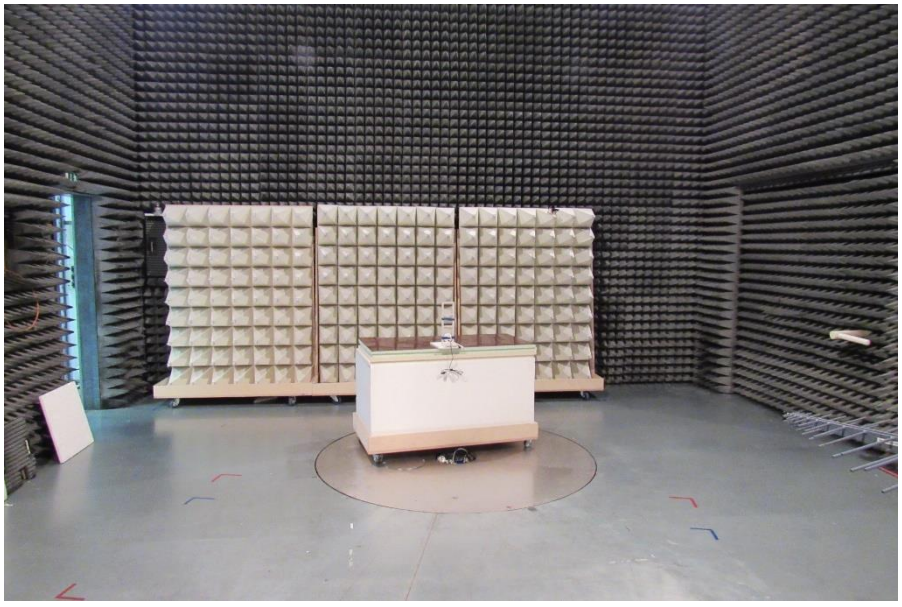


PCB TOP SIDE

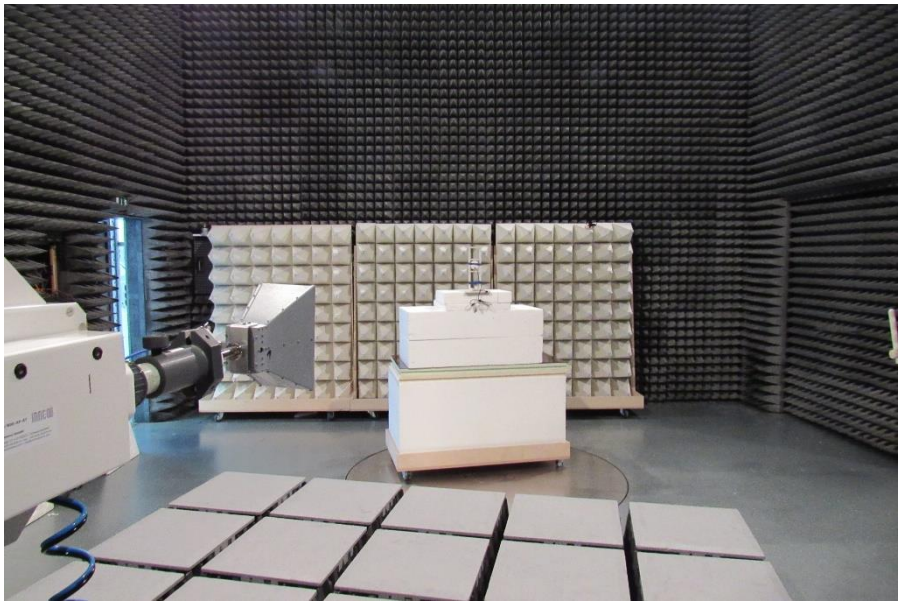


1.3 Photos – Test Setup

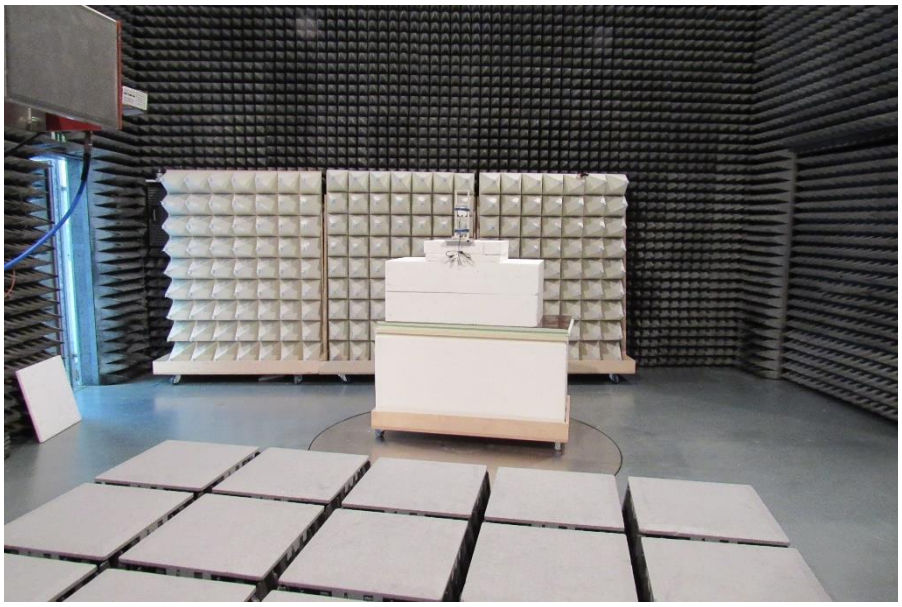
Test setup radiated emission below 200MHz


Test setup radiated emission 200 to 1000MHz


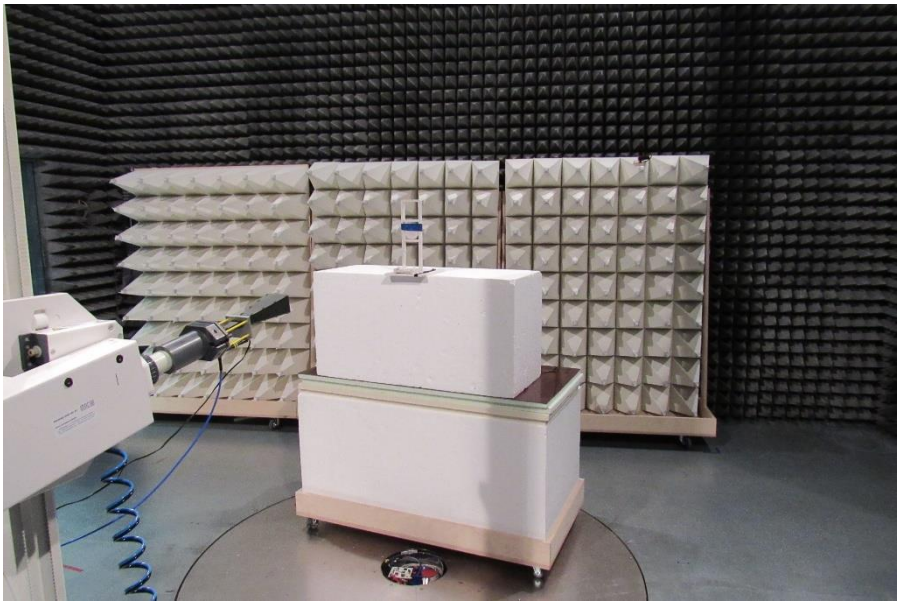
Test setup radiated emission 1 to 17GHz



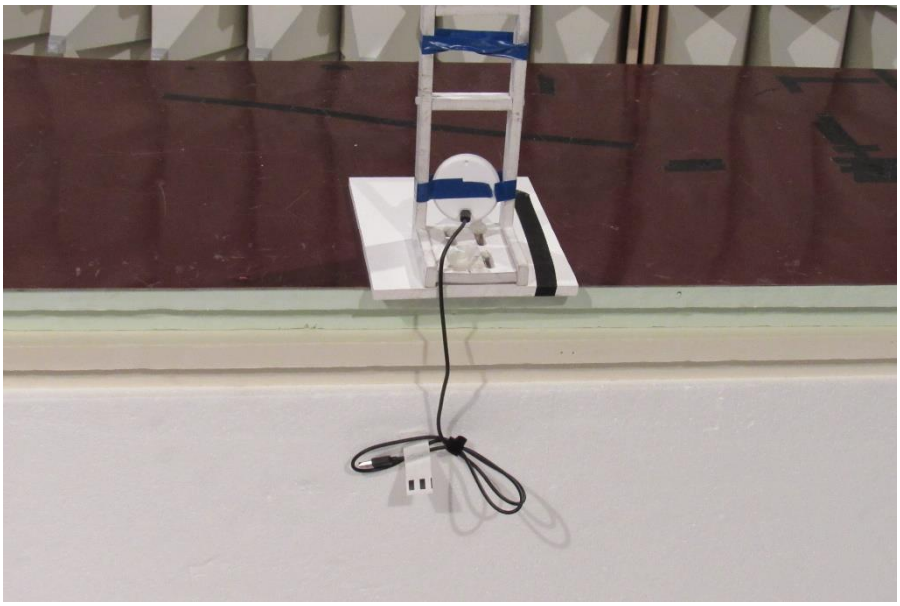
Test setup radiated emission 17 to 26.5GHz

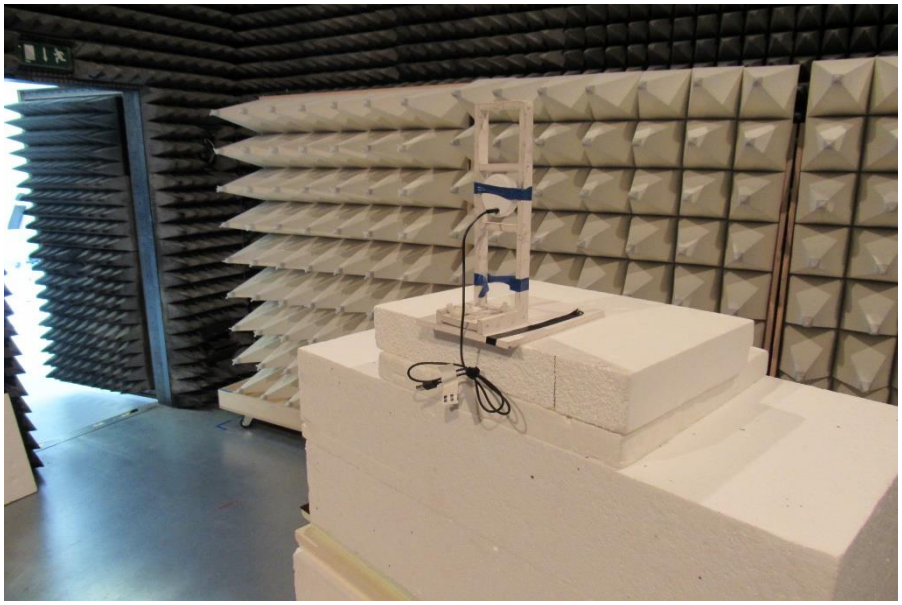


Test setup radiated emission above 26.5GHz



Test setup radiated emission EUT view 0.8m



Test setup radiated emission EUT view 1.5m


1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
None				
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
SFT	Software			
Comment:				

1.5 Test Modes

Mode	Description
Bluetooth LE	Mode = Transmit Modulation = GFSK Spreading = None Powersetting = not specified Duty cycle = 2.5% per advertisement channel
UWB	Mode = Transmit Modulation = BPM Duty cycle = 100%
Comment: Both modes are concurrently active	

1.6 Test Frequencies

Designator	Mode	Channel	Frequency [MHz]
F1	Bluetooth LE	0	2402
F2	Bluetooth LE	12	2426
F3	Bluetooth LE	39	2480
F4	UWB	5	6489.6
Comment: Test firmware was configured to hop between channels 0, 12 and 39			

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBµV. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyzer (dBµV) + A.F. (dB/m) = Net field strength (dBµV/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

Limit (dBµV/m) = 20*log (µV/m)

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF	= Net Reading	:	Net reading - FCC limit	= Margin
+21.5 dBµV + 26 dB/m	= 47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 15C, 15F				
Product Standard Reference	**Requirement**	**Reference Method**	**Result**	**Remarks**
47 CFR 15.207	AC power line conducted emissions	ANSI C63.4-2014	N/R	EUT does not transmit in charging mode
FCC § 15.247(d) FCC § 15.209	Transmitter radiated spurious emissions Radiated out-of-band emissions	ANSI C63.10-2013	PASS	
Comment: Measurements conducted according to FCC § 15.247 specification (Bluetooth LE) because these limits are higher than what allows FCC § 15.519 specification (Ultra wide band).				

Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

3 Test Conditions and Results

3.1 Test Conditions and Results - Transmitter radiated emissions

3.1.1 Information

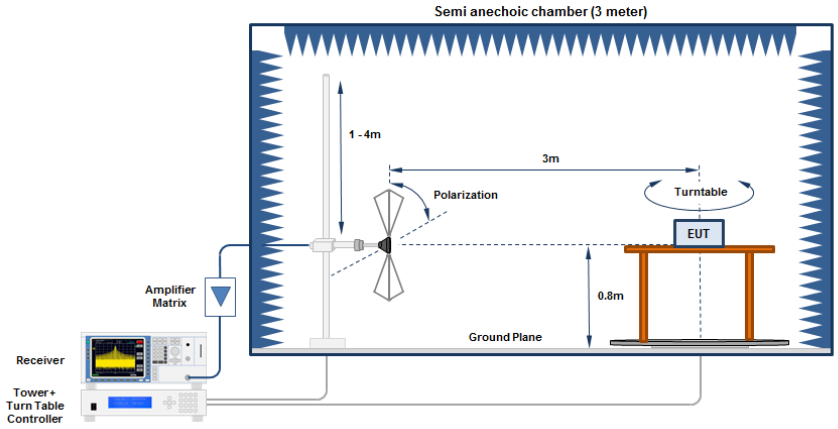
Test Information	
Operator	Florian Voigt
Date	2021-03-10 + 2021-03-11
Reference	FCC § 15.247(d); FCC § 15.209
Measurement Uncertainty	± 5.95 dB
Measurement Method	ANSI C63.10 6.4, 6.5, 6.6, 11.12

3.1.2 Limits

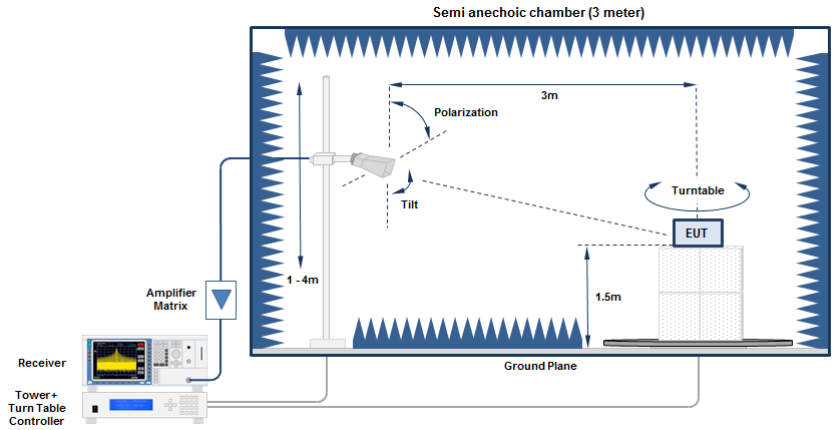
Limits			
Frequency range [MHz]	Detector	Field strength [µV/m]	Measurement distance [m]
0.009 - 0.09	Average	2400/F[kHz]	300
0.09 - 0.110	Quasi-Peak	2400/F[kHz]	300
0.110 - 0.490	Average	2400/F[kHz]	300
0.490 - 1.705	Quasi-Peak	24000/F[kHz]	30
1.705 - 30.0	Quasi-Peak	30	30
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.1.3 Setup

Test Setup 30 - 1000 MHz



Test Setup > 1 GHz



3.1.4 Equipment

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2018-07	2021-07
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2020-06	2021-06
Antenna	R&S	HK 116	EF00030	2019-04	2022-04
Antenna	R&S	HL 223	EF00187	2019-05	2022-05

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2018-07	2021-07
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2020-06	2021-06
Antenna	Schwarzbeck	BBHA 9120D	EF00018	2019-10	2022-10
Antenna	Amplifier Research	AT4560	EF00302	2019-05	2021-05
Antenna	Flann Microwave Ltd	22240-25 Amp. CBL26402075	EF00301	2019-12	2022-12

3.1.5 Procedure

Test Procedure 30 - 1000 MHz
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

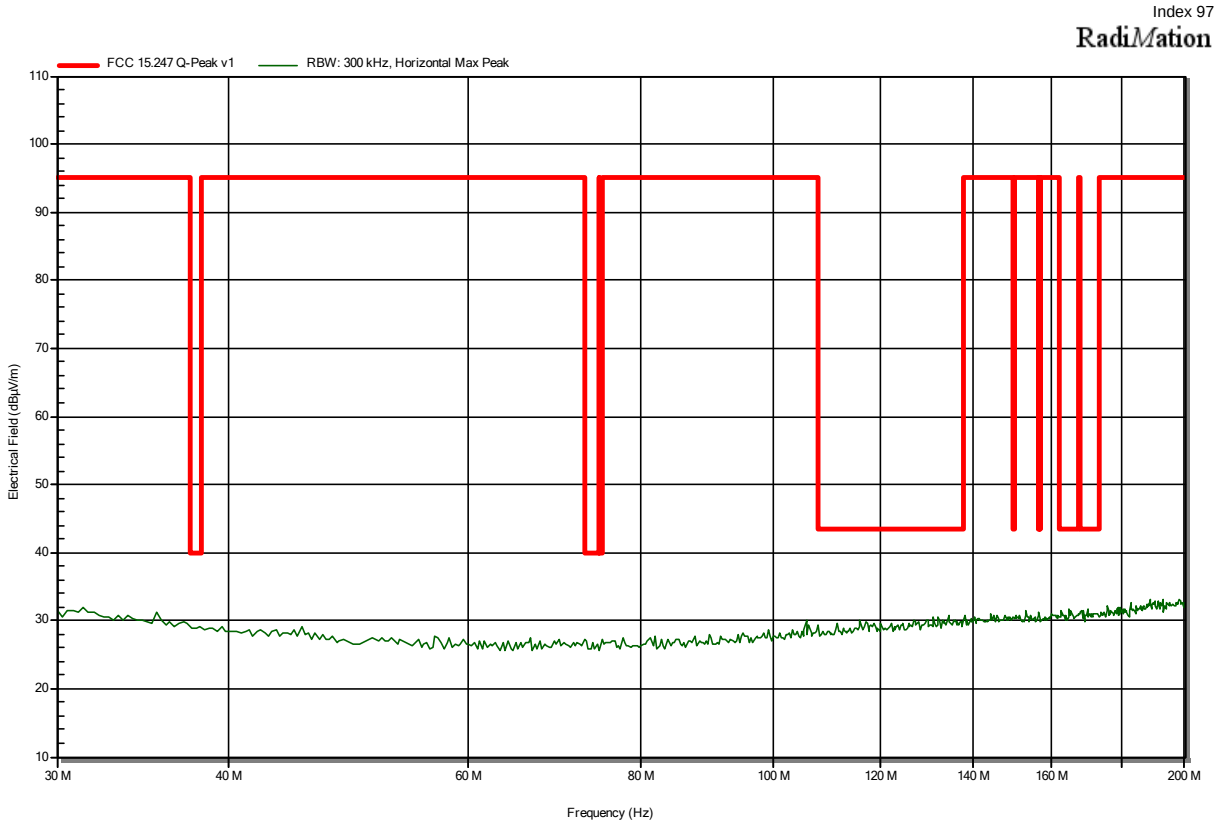
Test Procedure > 1 GHz
1. EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

3.1.6 Results

Test Results					
Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
2389.7	58.50	pk	ver	74.00	-15.50
2389.7	44.92	avg	ver	54.00	-09.08
2483.5	62.89	pk	hor	74.00	-11.11
2483.5	45.26	avg	hor	54.00	-08.74
4801.3	43.89	pk	ver	74.00	-30.11
7442.3	48.84	pk	ver	74.00	-25.16
12011	53.33	pk	ver	74.00	-20.67
12011	43.82	avg	ver	54.00	-10.18
12129	52.24	pk	ver	74.00	-21.76
12129	43.24	avg	ver	54.00	-10.76
12399	49.04	pk	ver	74.00	-24.96
12399	38.67	avg	ver	54.00	-15.33

Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

Project Number:	G0M-2012-9520
Applicant:	Tharsus Limited
Model Description:	RF Proximity Module
Model:	BUMP-718-F
Test Sample ID:	32620
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	



Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

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Antenna:	Rohde & Schwarz HK 116, Vertical
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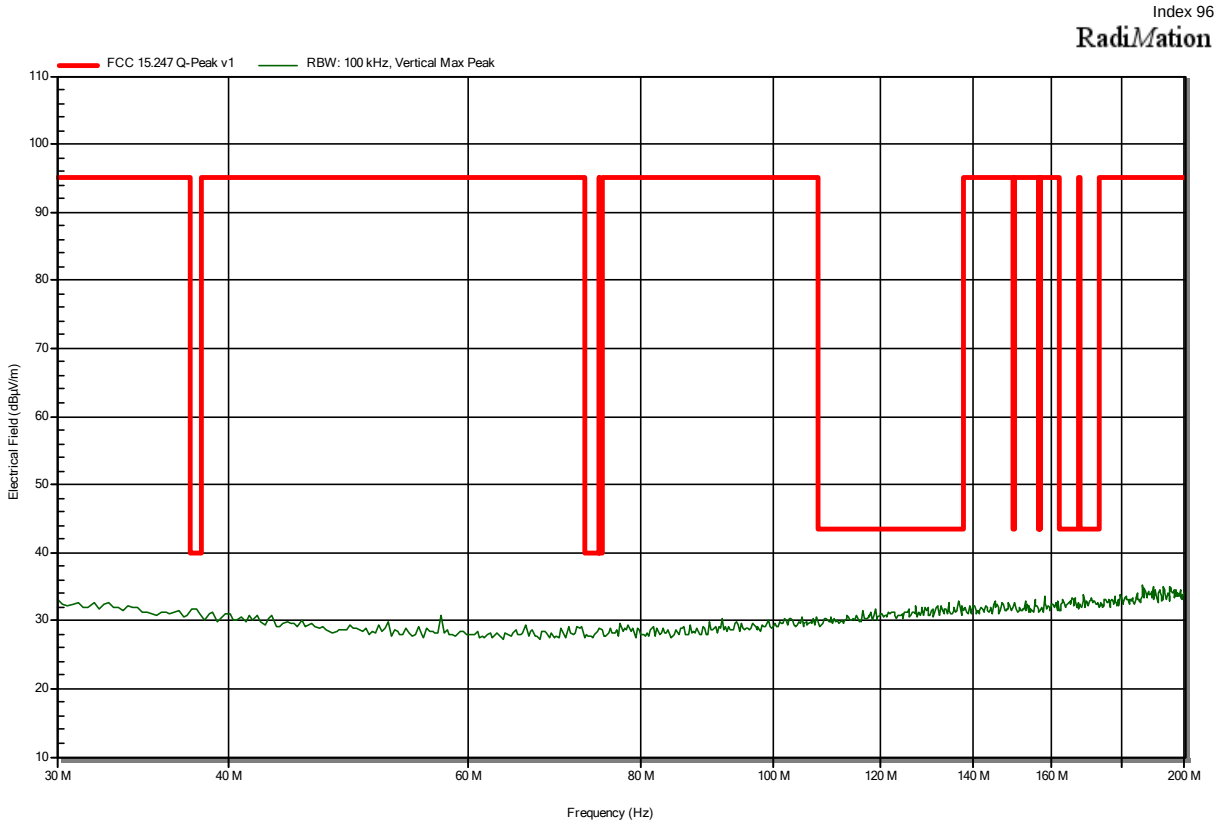
Test Date:	2021-03-11
Note:	



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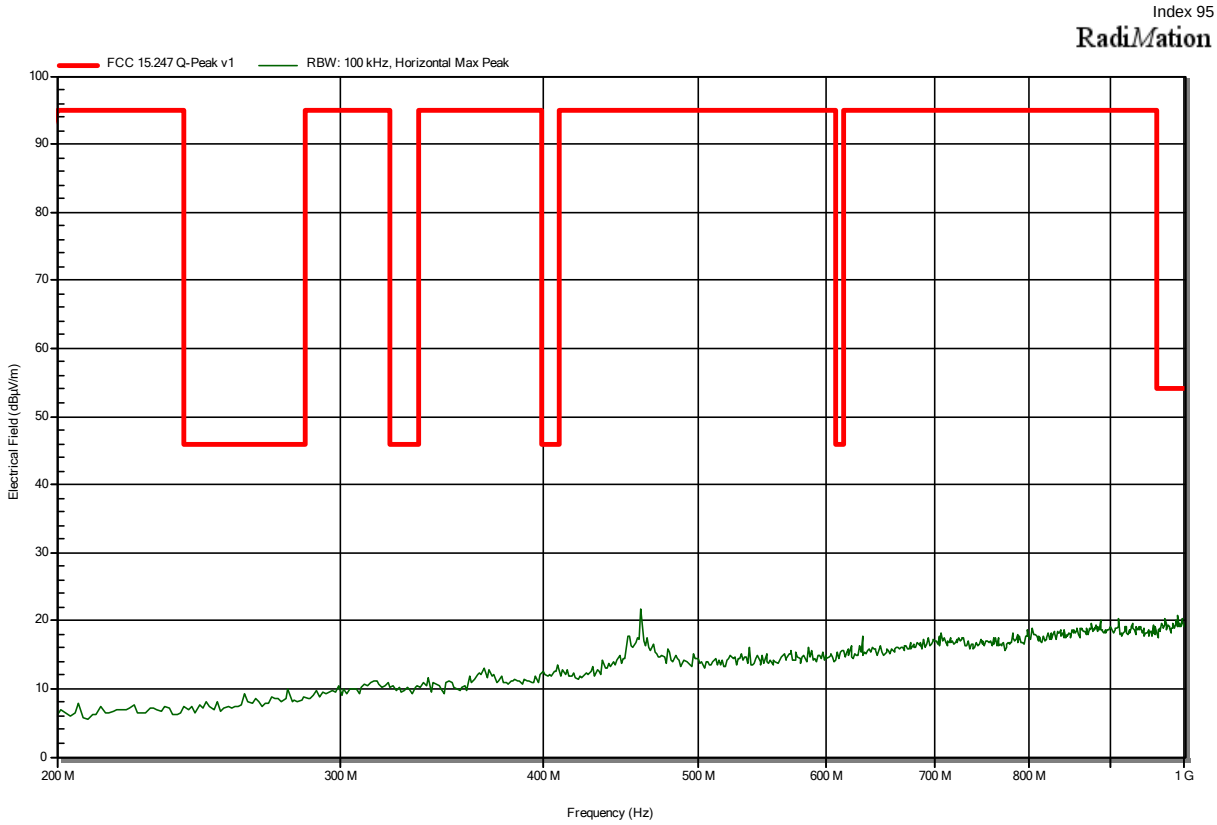
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	



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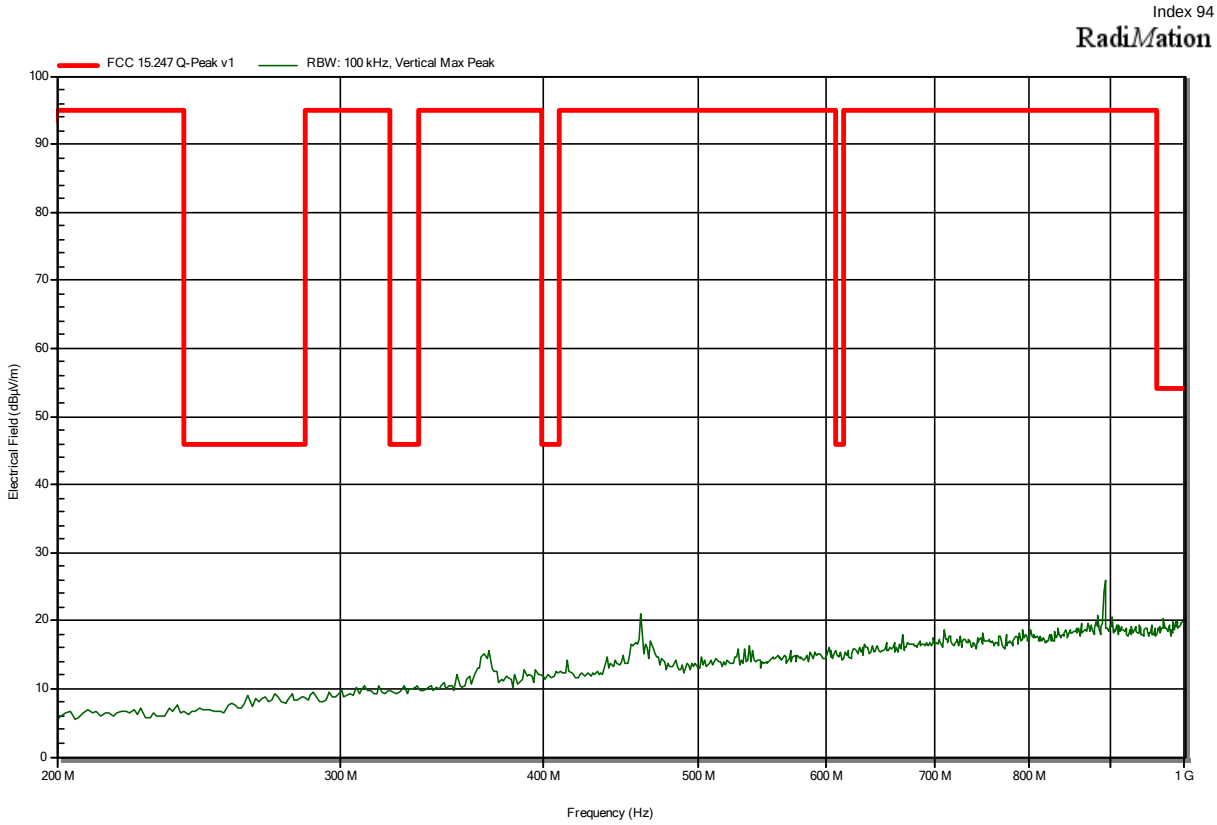
Note:	



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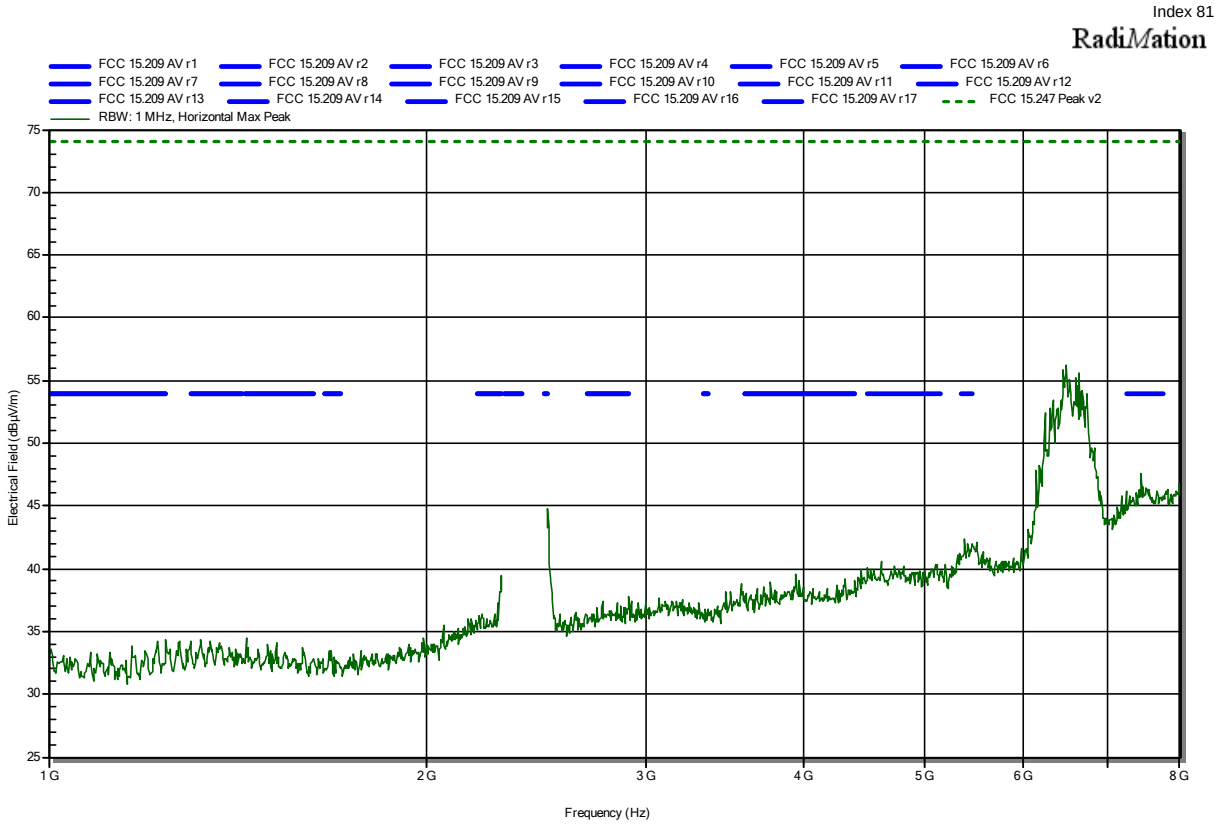
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Rohde & Schwarz BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-10
Note:	



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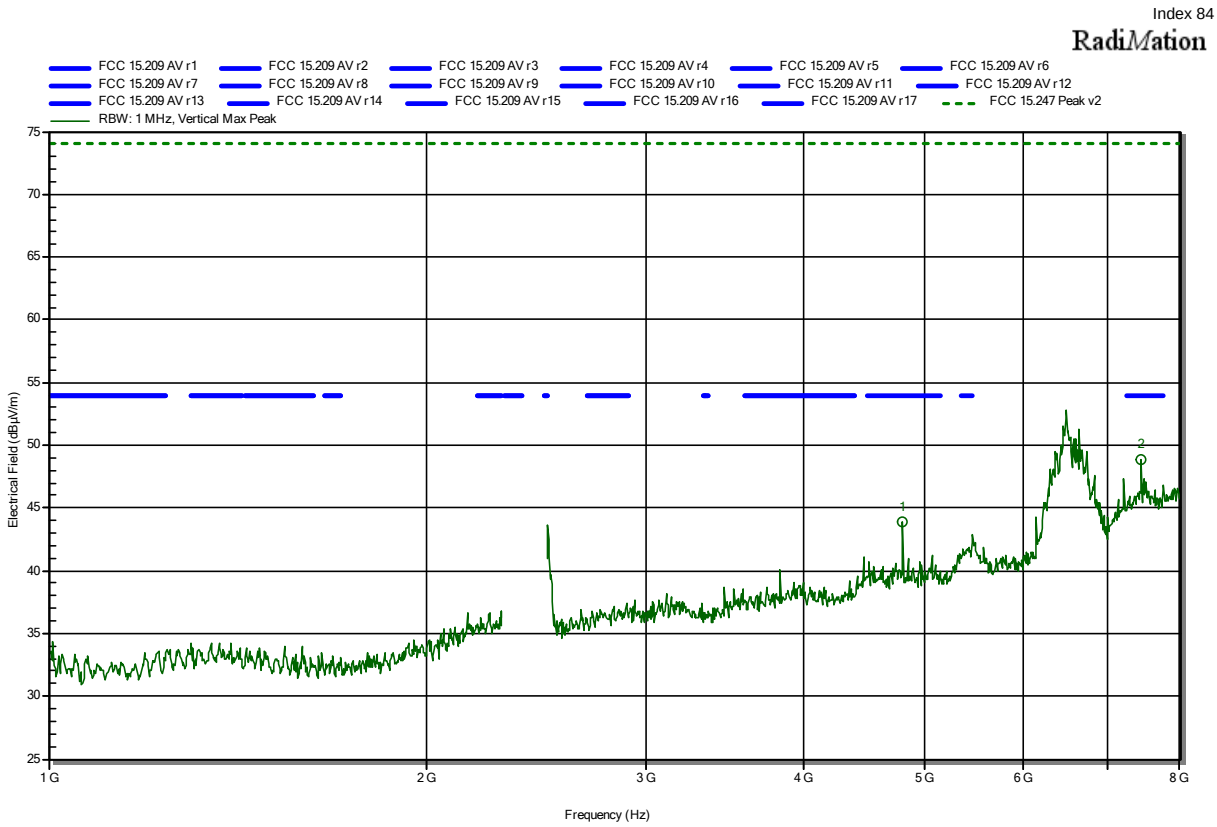
Test Date:	2021-03-11
Note:	



Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.8013 GHz	43.89 dBµV/m	74 dBµV/m	-30.11 dB	Pass
7.4423 GHz	48.84 dBµV/m	74 dBµV/m	-25.16 dB	Pass

Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

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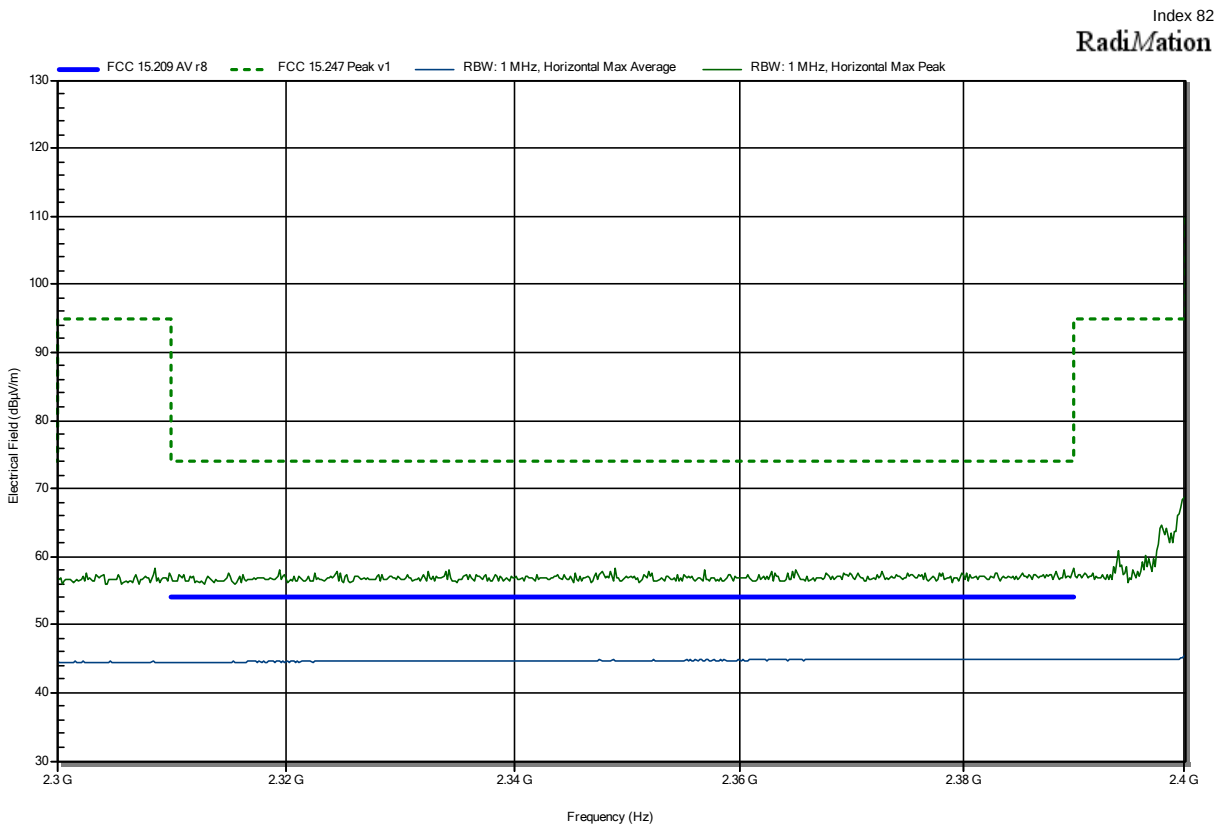
Antenna:	Rohde & Schwarz BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-10
Note:	lower bandedge



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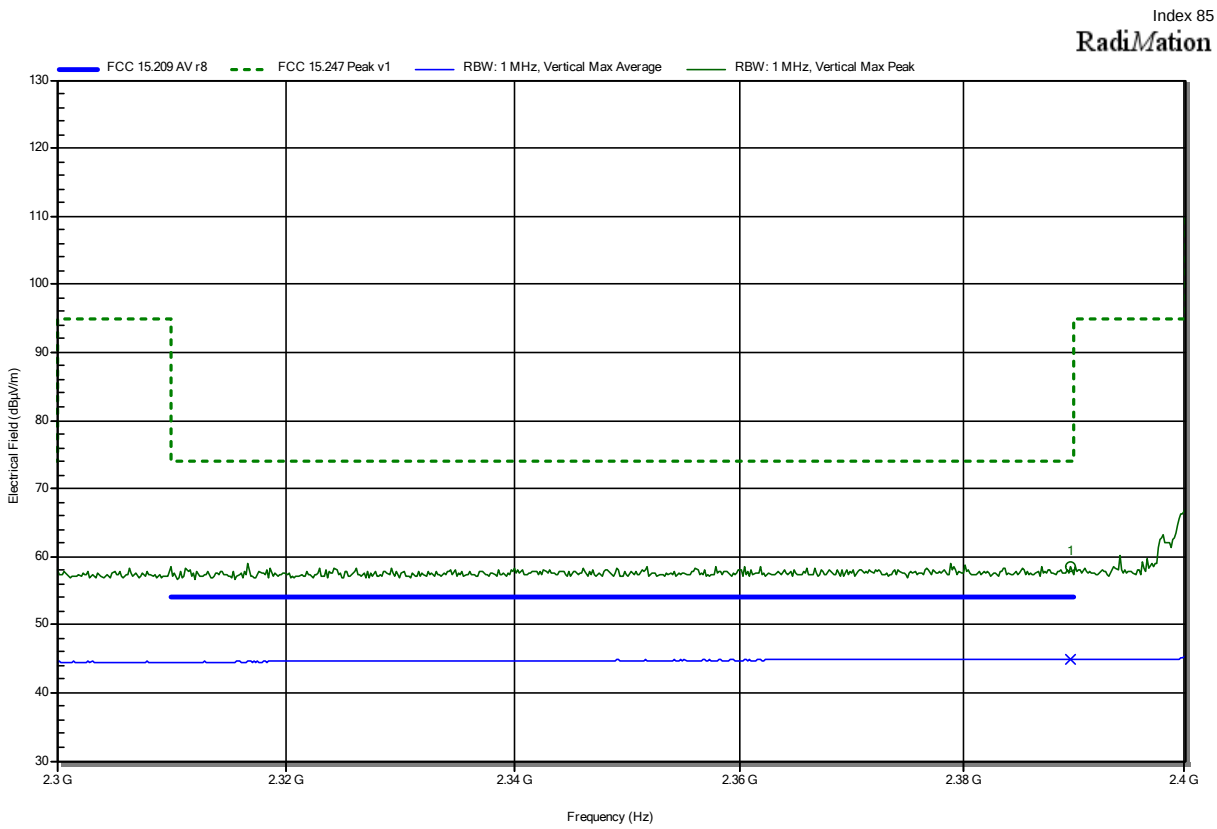
Antenna:	Rohde & Schwarz BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	lower bandedge

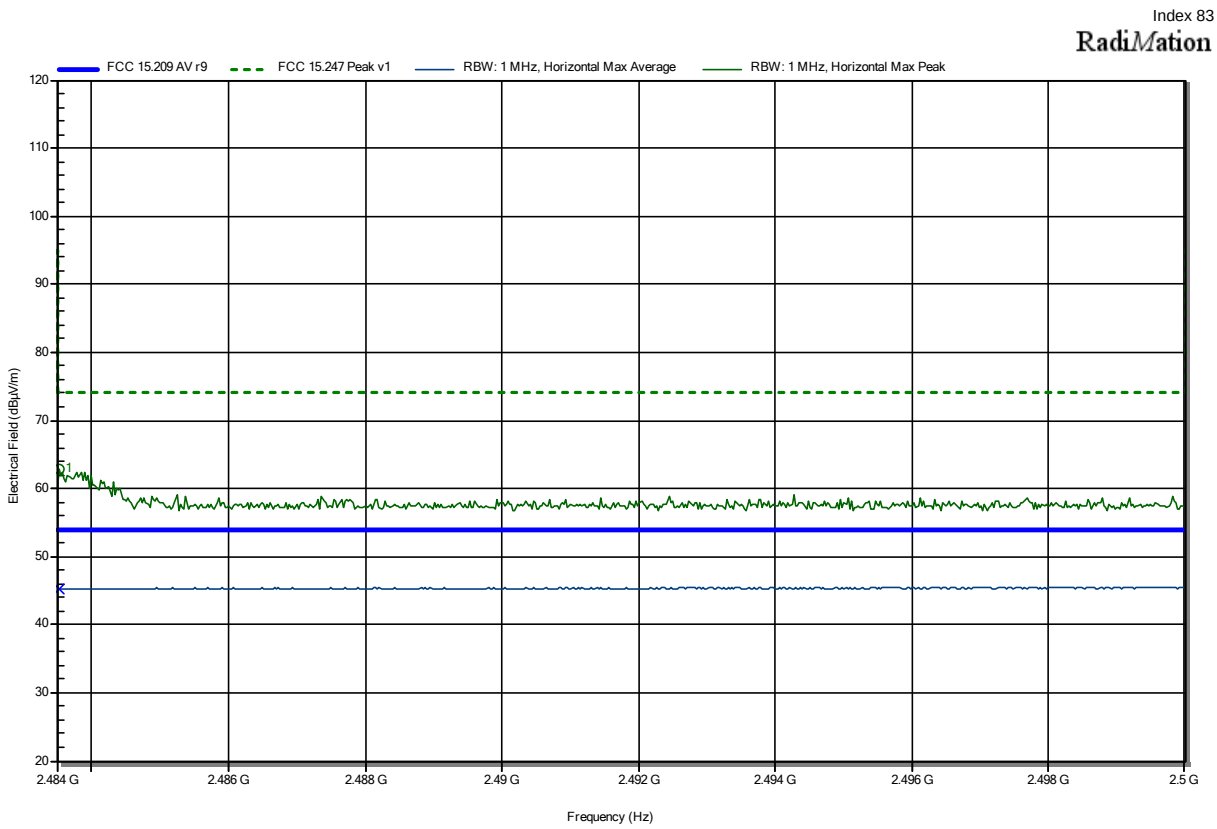


Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.3897 GHz	58.5 dBµV/m	74 dBµV/m	-15.5 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
2.3897 GHz	44.92 dBµV/m	54 dBµV/m	-9.08 dB	Pass

Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

Project Number:	G0M-2012-9520
Applicant:	Tharsus Limited
Model Description:	RF Proximity Module
Model:	BUMP-718-F
Test Sample ID:	32620
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Rohde & Schwarz BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	upper bandedge

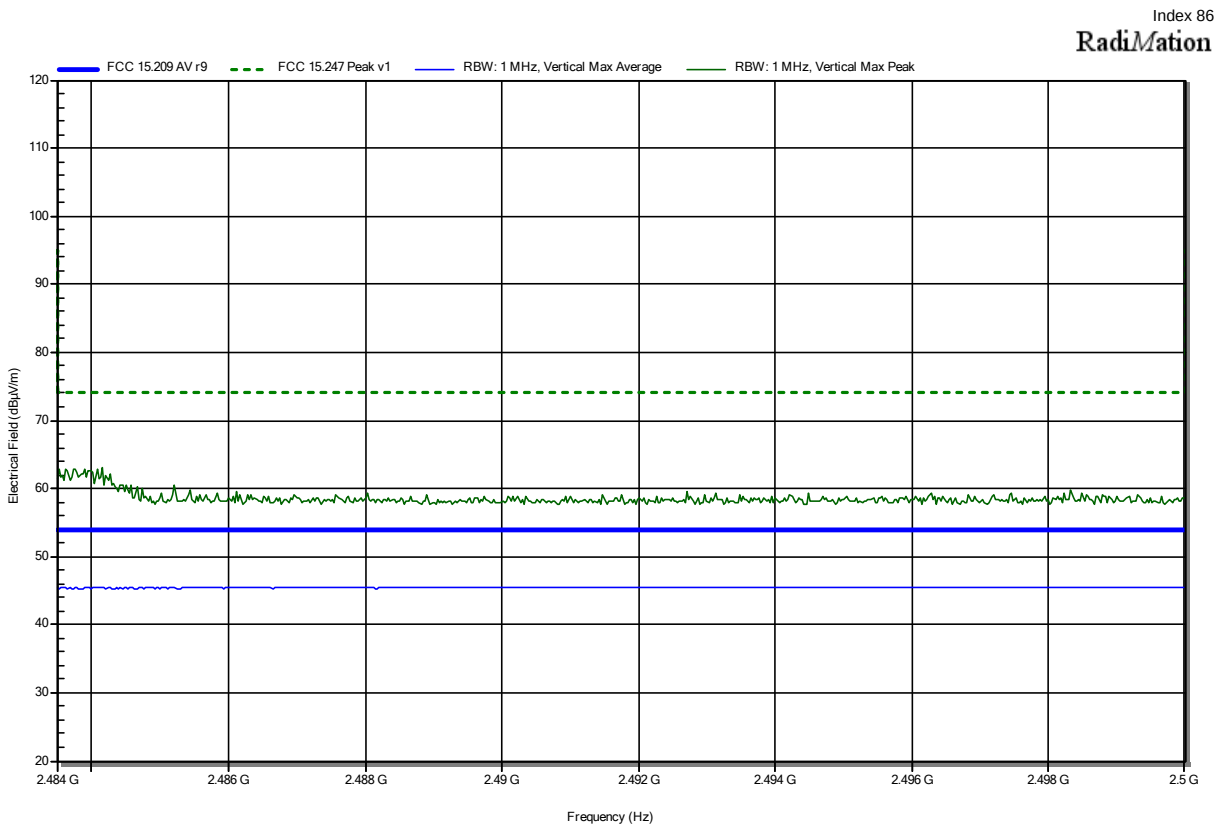


Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4835 GHz	62.89 dBµV/m	74 dBµV/m	-11.11 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
2.4835 GHz	45.26 dBµV/m	54 dBµV/m	-8.74 dB	Pass

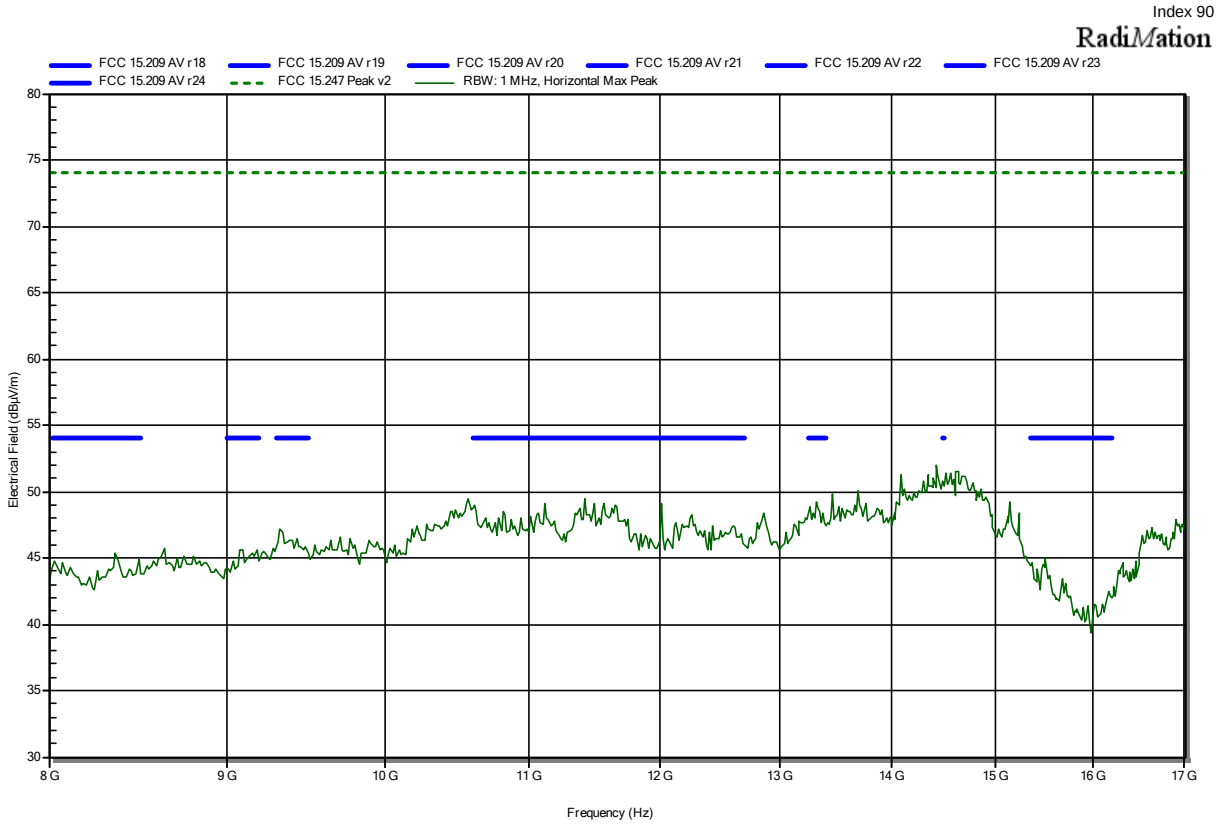
Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

Project Number:	G0M-2012-9520
Applicant:	Tharsus Limited
Model Description:	RF Proximity Module
Model:	BUMP-718-F
Test Sample ID:	32620
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Rohde & Schwarz BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	upper bandedge



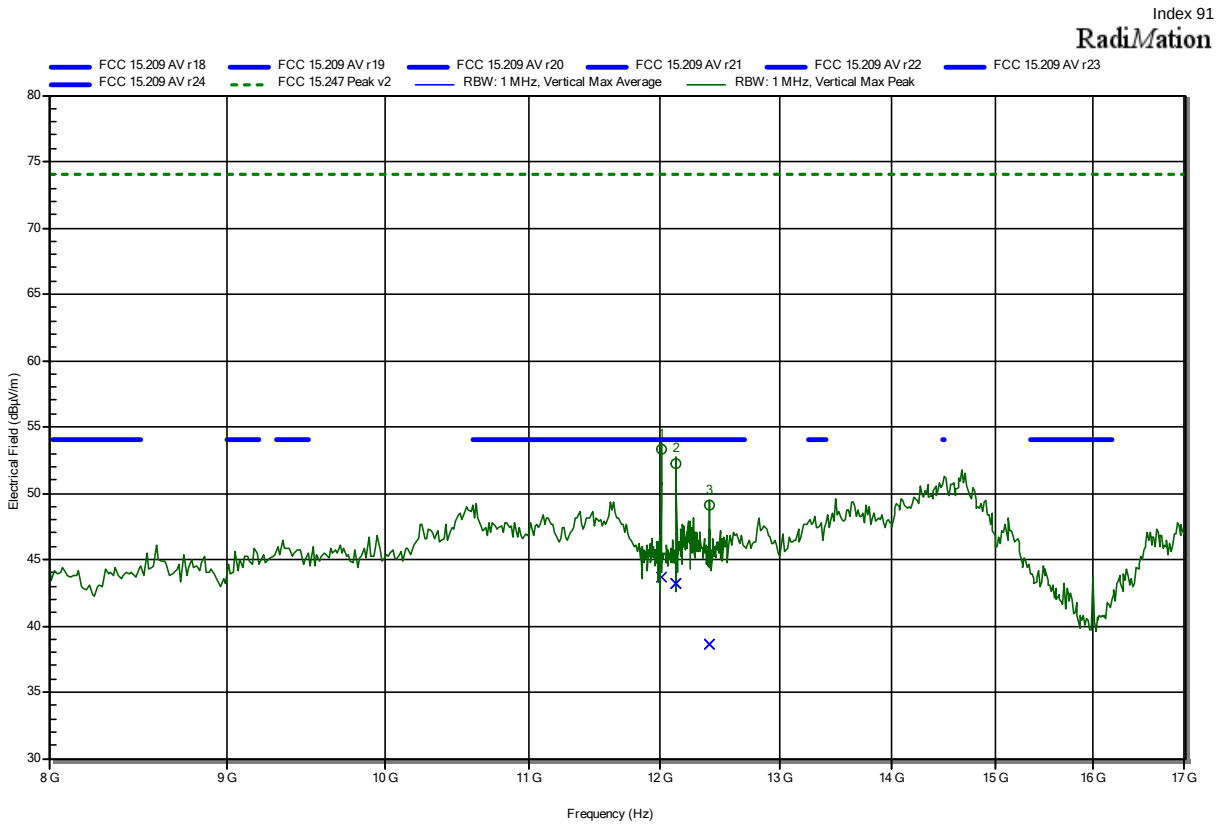
Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

Project Number:	G0M-2012-9520
Applicant:	Tharsus Limited
Model Description:	RF Proximity Module
Model:	BUMP-718-F
Test Sample ID:	32620
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Rohde & Schwarz BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	



Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

Project Number:	G0M-2012-9520
Applicant:	Tharsus Limited
Model Description:	RF Proximity Module
Model:	BUMP-718-F
Test Sample ID:	32620
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Rohde & Schwarz BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	

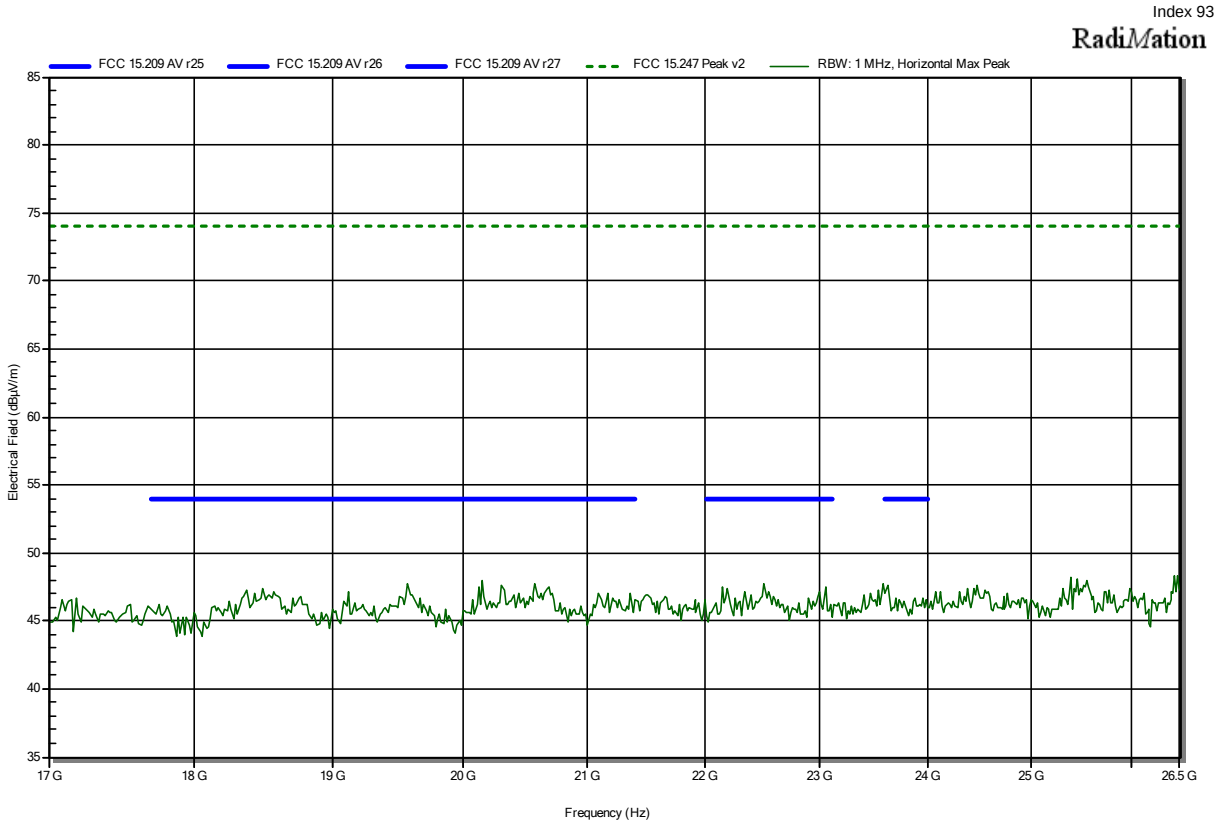


Frequency	Peak	Peak Limit	Peak Difference	Peak Status
12.011 GHz	53.33 dBµV/m	74 dBµV/m	-20.67 dB	Pass
12.129 GHz	52.24 dBµV/m	74 dBµV/m	-21.76 dB	Pass
12.399 GHz	49.04 dBµV/m	74 dBµV/m	-24.96 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
12.011 GHz	43.82 dBµV/m	54 dBµV/m	-10.18 dB	Pass
12.129 GHz	43.24 dBµV/m	54 dBµV/m	-10.76 dB	Pass
12.399 GHz	38.67 dBµV/m	54 dBµV/m	-15.33 dB	Pass

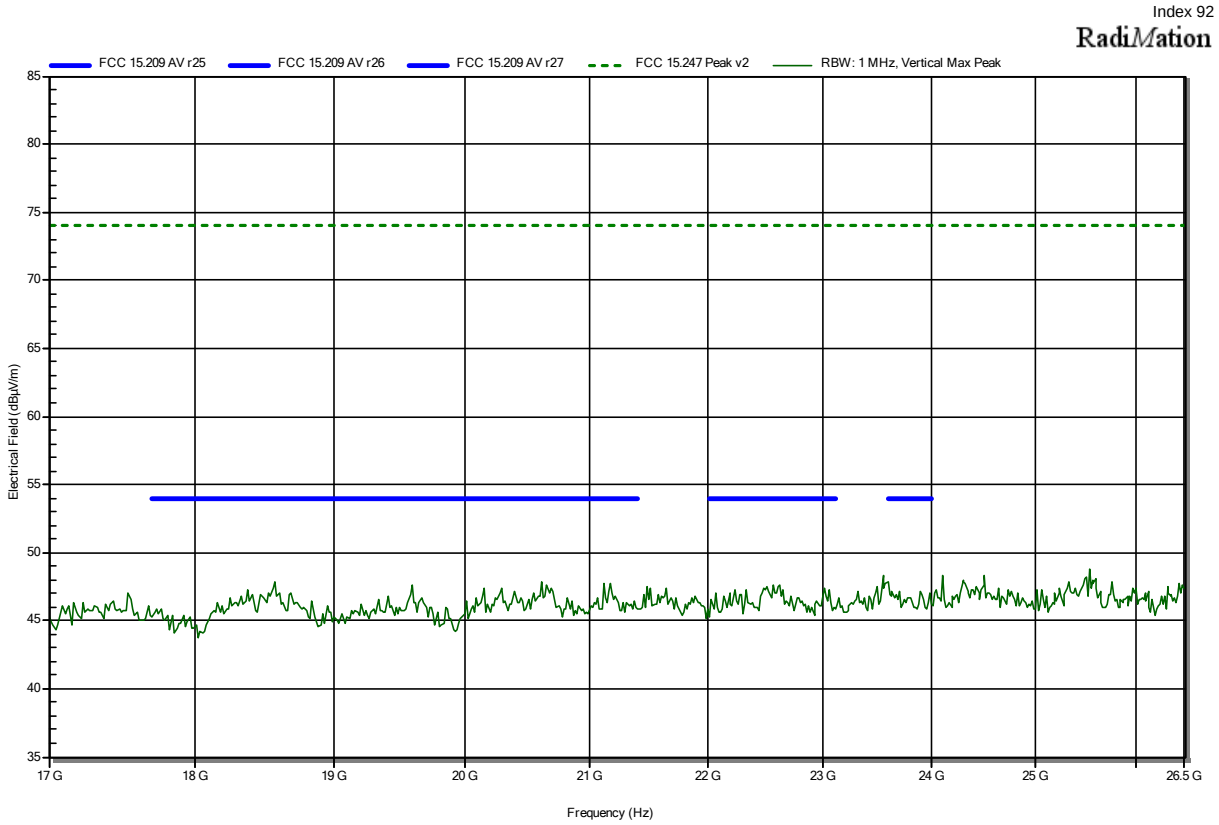
Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

Project Number:	G0M-2012-9520
Applicant:	Tharsus Limited
Model Description:	RF Proximity Module
Model:	BUMP-718-F
Test Sample ID:	32620
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Amplifier Research AT4560, Horizontal
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	



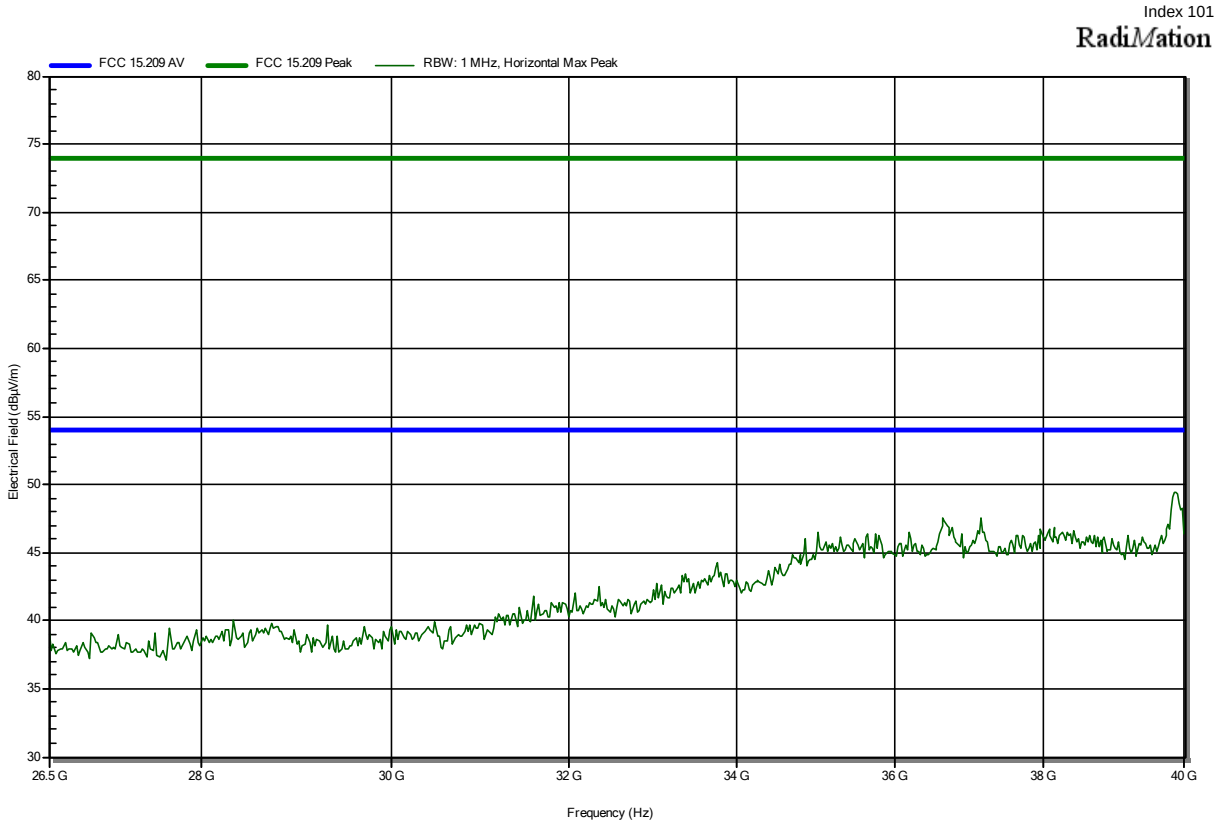
Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

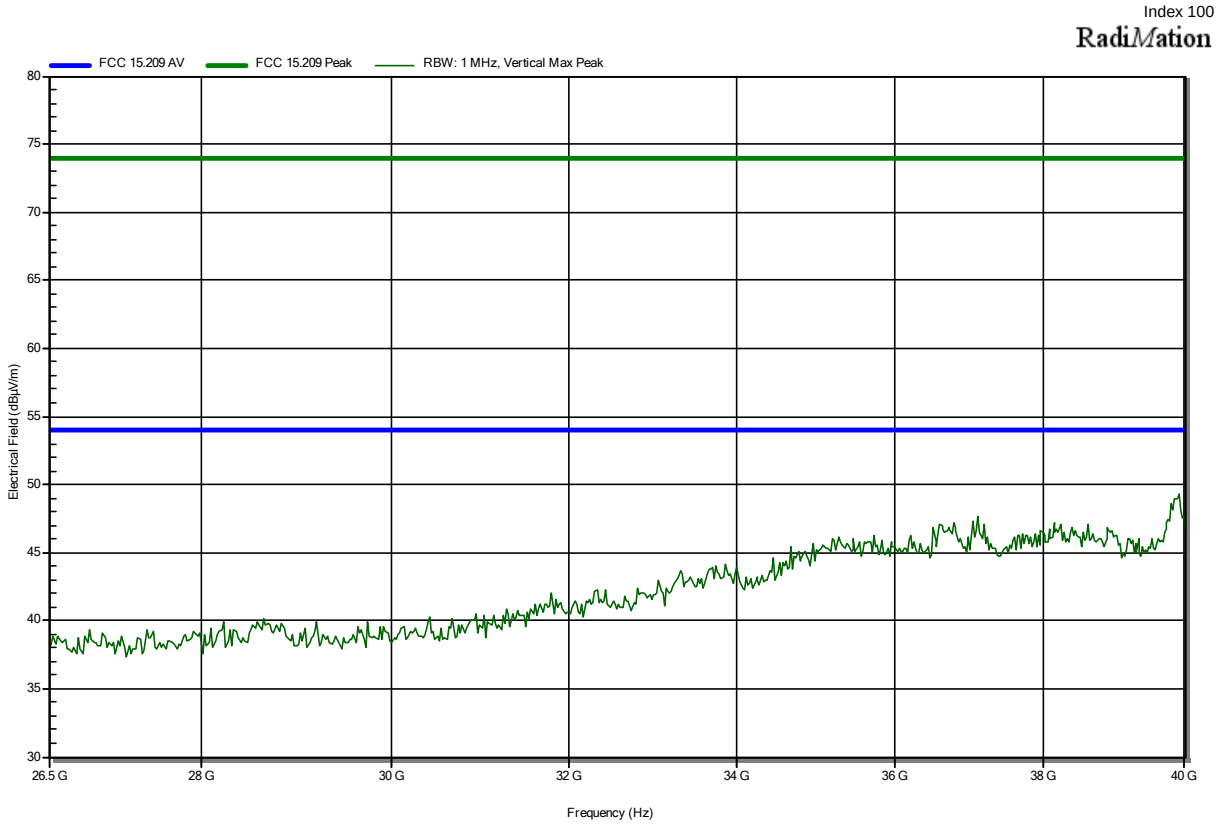
Project Number:	G0M-2012-9520
Applicant:	Tharsus Limited
Model Description:	RF Proximity Module
Model:	BUMP-718-F
Test Sample ID:	32620
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Amplifier Research AT4560, Vertical
Measurement distance:	3 m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	



Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

Project Number:	G0M-2012-9520
Applicant:	Tharsus Limited
Model Description:	RF Proximity Module
Model:	BUMP-718-F
Test Sample ID:	32620
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Flann 22240-25, Horizontal
Measurement distance:	1m converted to 3m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note:	



Radiated Spurious Emissions according to 47 CFR Part 15.519, 47 CFR Part 15.247

Project Number:	G0M-2012-9520
Applicant:	Tharsus Limited
Model Description:	RF Proximity Module
Model:	BUMP-718-F
Test Sample ID:	32620
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Voigt
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 24 °Celsius, Vnom: 3.7 VDC
Antenna:	Flann 22240-25, Vertical
Measurement distance:	1m converted to 3m
Mode:	Tx; UWB, 6489.6 MHz + LE, 2402, 2426, 2480MHz hopping, 3 dBm, 1 Mbps, EUT ver
Test Date:	2021-03-11
Note: