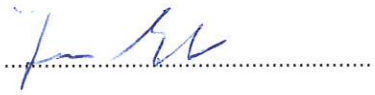
EMC TEST REPORT

FCC 47 CFR Part 15B, ISED ICES-003 Issue 6

Report Reference No	G0M-2012-9520-EF0115B-V02
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	DAkkS - Registration number : D-PL-12092-01-03 (ISED) ISED Testing Laboratory site: 3470A-2 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 Standard(s)	47 CFR Part 15 Subpart B ISED ICES-003 Issue 6 ANSI C63.4:2014+A1:2017
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
IC	N/A
Test Result	**PASSED**

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
required by standard but not appl. to test object	N/A	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Date of receipt of test item	2021-01-04	
Report:		
Compiled by	Stephan Liebich	
Tested by (+ signature) (Responsible for Test)	Stephan Liebich	
Approved by (+ signature) (Deputy Head of Lab)	Jens Marquardt	
Date of Issue	2021-03-19	
Total number of pages	55	
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:		
None		

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
T_{NOM}	Nominal operating temperature
V_{NOM}	Nominal supply voltage

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2021-03-11	Initial Release	-
02	2021-03-19	Replaced document: G0M-2012-9520-EF0115B-V01 Replaced by: G0M-2012-9520-EF0115B-V02 Changes: Page 1 & 6: • Designation changes of Model Name and Hardware Version	St. Liebich

REPORT INDEX

1 Equipment (Test Item) Under Test

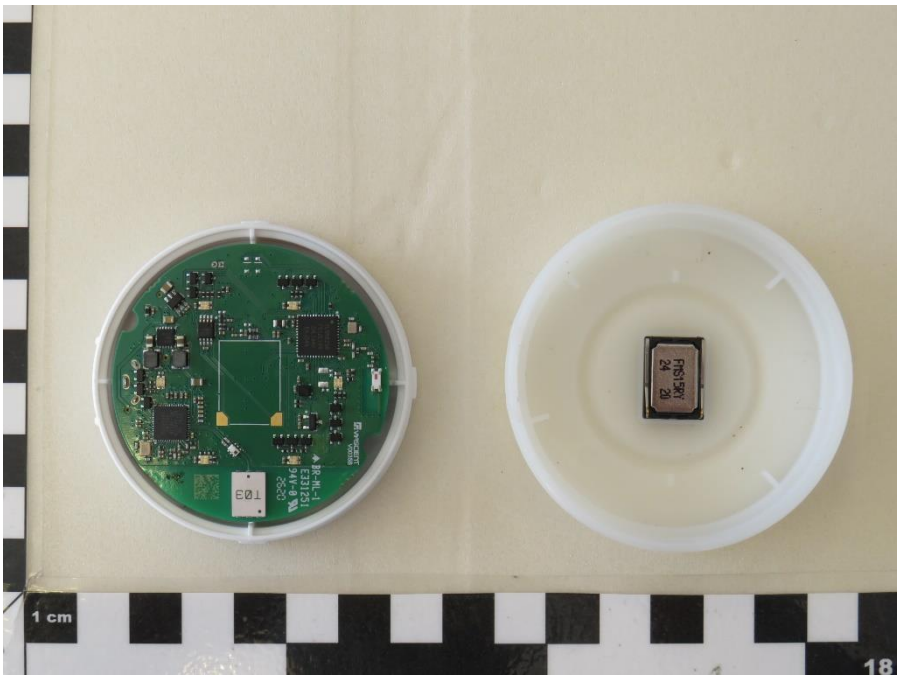
Description	RF Proximity Module	
Model	BUMP-718-F	
Additional Model(s)	None	
Brand Name(s)	Tharsus	
Serial Number(s)	Unspecified	
Sample ID	32623	
Hardware Version(s)	718-F	
Software Version(s)	3	
FCC-ID	2AYMM-BUMP-718-F	
IC	N/A	
Class	Class B	
Equipment type	Table top	
Highest internal frequency [MHz]	6739.2	
Radio Module	None	
Supply Voltage	V_{NOM}	5 V DC via USB 3.7 V DC by internal Lithium battery
AC/DC-Adaptor	None	
Manufacturer	Tharsus Limited Birmayne House Cowley Road NE24 5TF Blyth United Kingdom	

1.1 Equipment Ports

Name	Type	Attributes	Comment
AC Mains	AC	Count: 1 Direction: In Service only: No	AC/DC-Adaptor port (not dedicated to EUT)
USB	IO	Count: 1 Direction: IO Service only: No	EUT port

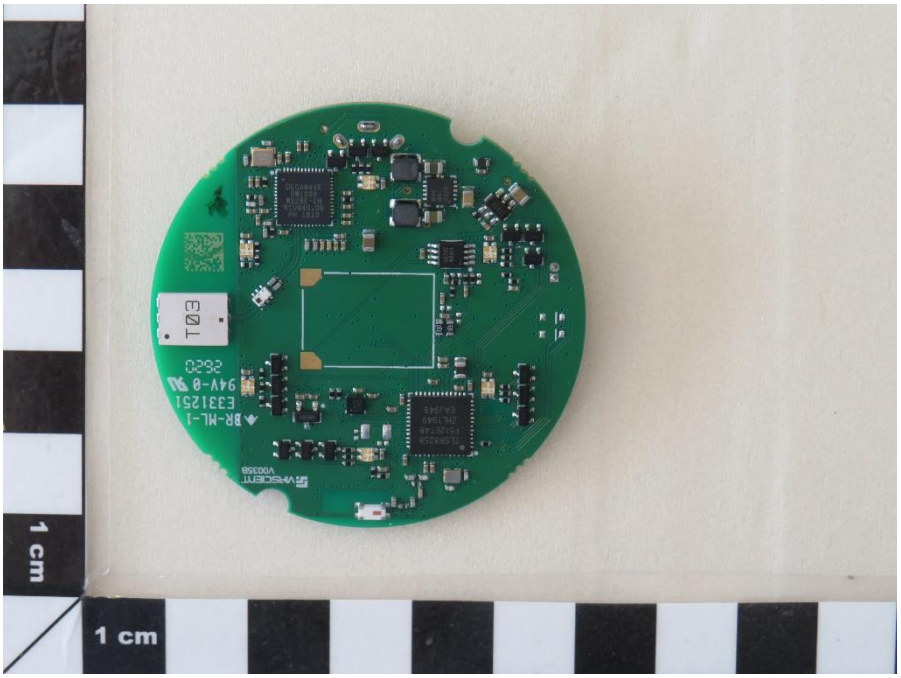
Description:	
AC	AC mains power input/output port
DC	DC power input/output port
BAT	DC power input port connected to external battery
IO	Input/Output port
TP	Telecommunication port
NE	Non-electrical port

1.2 Equipment Photos - Internal

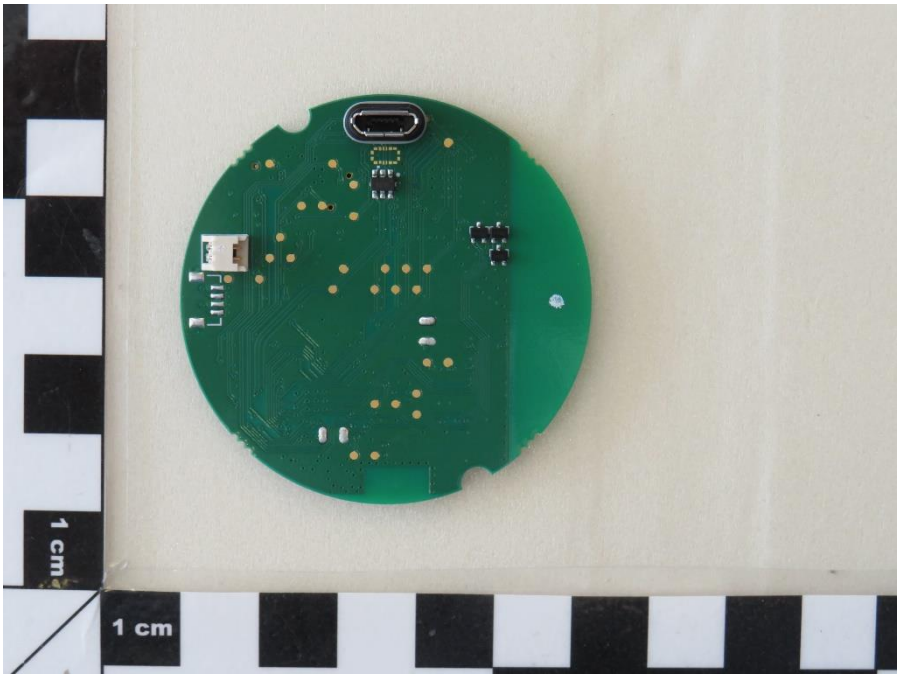
OPEN BUMP WITH TOP AND BOTTOM COVER


BUMP BOTTOM COVER


BUMP PCB TOP SIDE



BUMP PCB BOTTOM SIDE



1.3 Equipment Photos - External

BUMP WITH AC/DC-ADAPTOR I IN PERSPECTIVE

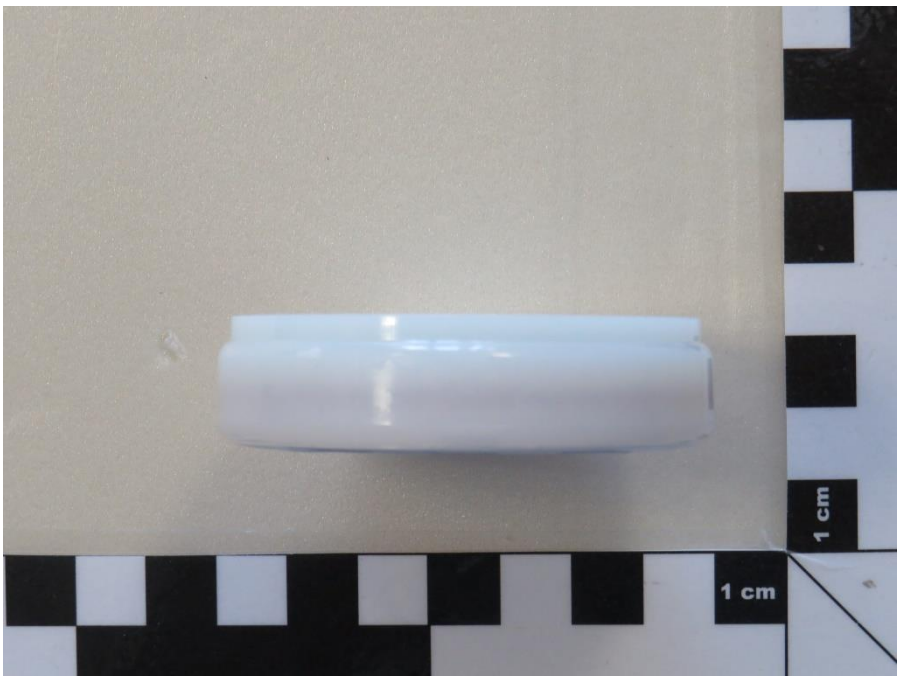

BUMP WITH AC/DC-ADAPTOR II IN PERSPECTIVE


BUMP IN PERSPECTIVE I

BUMP IN PERSPECTIVE II

BUMP TOP SIDE

BUMP BOTTOM SIDE

BUMP SIDE


AC/DC-ADAPTOR I


AC/DC-ADAPTOR II


1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	AC/DC-Adaptor I	Q2power	QDAPTER USB	For radiated emission test
AE	AC/DC-Adaptor II	unspecified	unspecified	For conducted emission test (from Eurofins)
AE	RF Proximity Module	Tharsus Limited	Bump	Companion Device
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
MON	Monitoring Equipment			
CBL	Connecting Cable			
Comment:				

1.5 Operational Modes

Mode #	Description
1	Charging (EUT's internal battery is charging, radio technologies are off)
2	UWB Channel 5 TX/RX+ Bluetooth LE TX/RX (EUT sends/receives data via UWB Channel 5 and Bluetooth LE connection to/from Companion Device.)
Comment: --	

1.6 EUT Configuration

Configuration #	Description
1	EUT is powered by AC/DC-adapter via USB connection. AC/DC-adapter is powered by external laboratory power supply unit.
2	EUT is powered by internal Lithium battery.
Comment: --	

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 analyser in dBµV. Any external preamplifiers used are taken into account through internal analyser 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 analyser. 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 Analyser (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 15B, ISED ICES-003 Issue 6				
Reference	**Requirement**	**Reference Method**	**Result**	**Remarks**
Emission				
FCC 15.109 ICES-003, 6.2	Radiated emissions	ANSI C63.4:2014 +A1:2017	PASS	--
FCC 15.107 ICES-003, 6.1	AC power line conducted emissions	ANSI C63.4:2014 +A1:2017	PASS	--
Comment:				

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

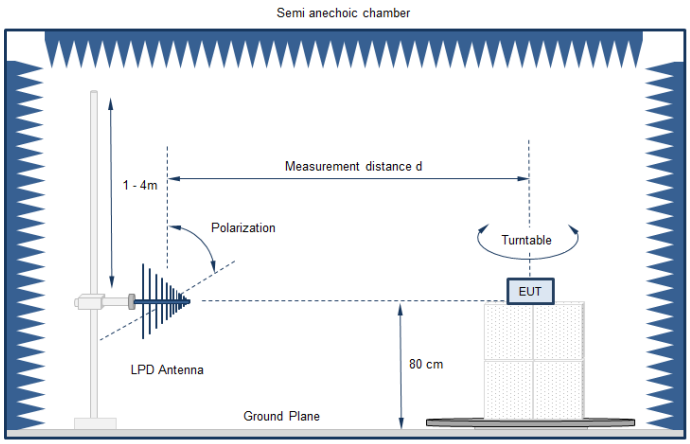
2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

2.1.1 Information

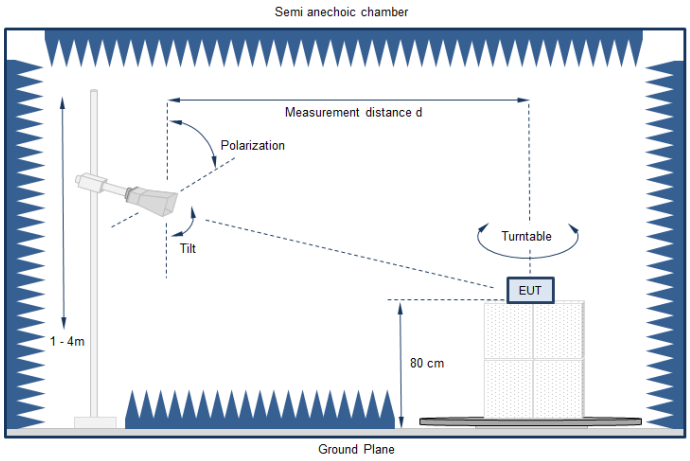
Test Information	
Reference	FCC 15.109, ICES-003, 6.2
Reference method	ANSI C63.4:2014+A1:2017 Section 8
Equipment class	Class B
Equipment type	Table top
Highest internal frequency [MHz]	6739.2
Measurement range	30 MHz to 40000 MHz
Temperature [°C]	20 – 24
Humidity [%]	27 – 32
Operator	Stephan Liebich
Date	2021-02-19

2.1.2 Setup

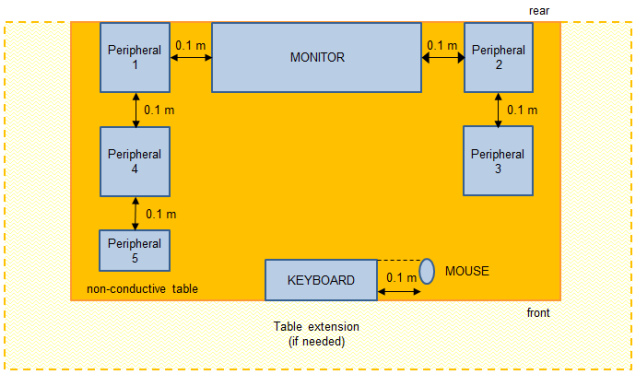
Measurement up to 1 GHz



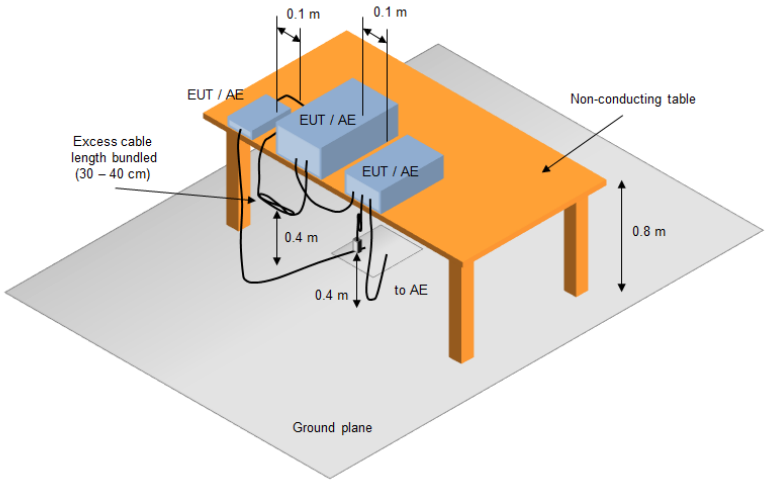
Measurement above 1 GHz



Equipment placement - Table top



Test Setup



2.1.3 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	Radimation	2020.1.8

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic chamber	Frankonia	AC1	EF00062	2018-07	2021-07
EMI Test Receiver	Keysight	N9038A-526/WXP	EF01070	2020-06	2021-06
Spectrum analyzer	Rohde & Schwarz GmbH & Co. KG	FSU43	EF01631	2020-07	2021-07
Biconical Antenna	R&S	HK 116	EF00030	2019-04	2022-04
LPD Antenna	R&S	HL 223	EF00187	2019-05	2022-05
Horn Antenna	Schwarzbeck	BBHA9120D	EF00018	2019-10	2022-10
40GHz High Gain Antenna	Amplifier Research	AT4560	EF00302	2019-05	2021-05
Horn antenna	Amplifier Research	ATH18G40 (18-40GHz)	EF01152	2020-11	2022-11
Climatic Sensor	Embedded Data Systems, LLC.	280010000025417E	EF01054	2020-03	2021-03

2.1.4 Procedure

Exploratory measurement
1. The EUT was placed on a non-conductive table at a height of 0.8m. 2. The EUT and support equipment, if needed, were set up to simulate typical usage. 3. Cables, of type and length specified by the manufacturer, were connected to at least one port of each type and were terminated by a device or simulating load of actual usage. 4. The antenna was placed at a distance of 3 or 10 m. 5. The received signal was monitored at the measurement receiver. 6. This procedure has to be performed in both antenna polarizations, horizontal and vertical. 7. The arrangement of the equipment with the maximum emission level is shown on the setup picture at item 1.3

Final measurement
1. The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver. 2. A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 1000 MHz. Above one 1 GHz a Double Ridged Broadband Horn antenna was used. The antenna was placed on an adjustable height antenna mast. 3. The EUT and cable arrangement were based on the exploratory measurement results. 4. Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded. 5. The test data of the worst-case conditions were recorded and shown on the next pages.

2.1.5 Limits

Class B @ 3 m		
Frequency [MHz]	Detector	Limit [dBµV/m]
30 - 88	Quasi-peak	40
88 - 216	Quasi-peak	43.5
216 - 960	Quasi-peak	46
960 - 1000	Quasi-peak	54
> 1000	Peak Average	74 54

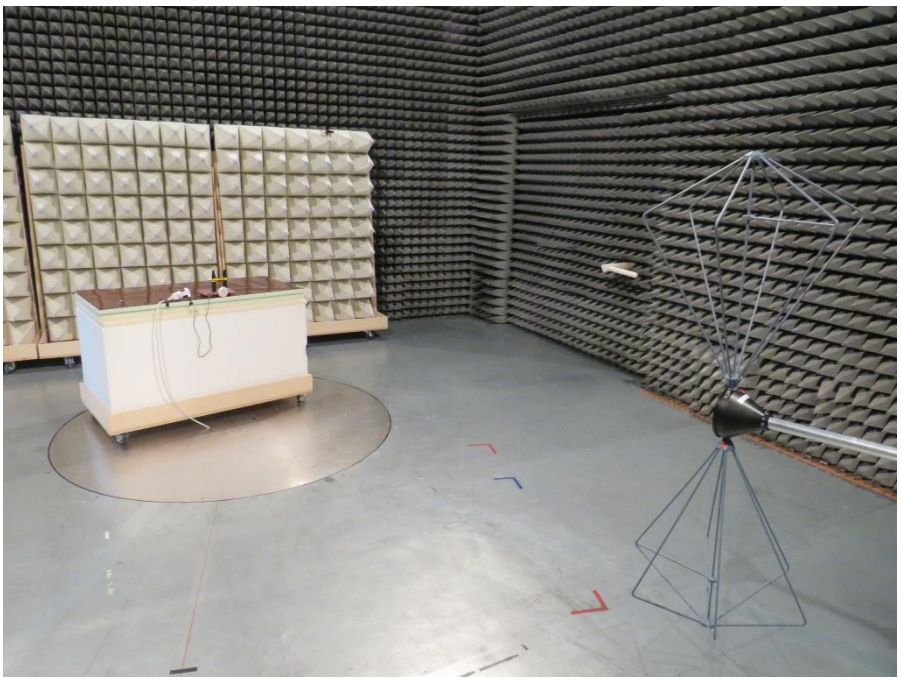
Class A @ 10 m		
Frequency [MHz]	Detector	Limit [dBµV/m]
30 - 88	Quasi-peak	39
88 - 216	Quasi-peak	43.5
216 - 960	Quasi-peak	46.5
960 - 1000	Quasi-peak	49.5
> 1000	Peak Average	69.5 49.5

2.1.6 Results

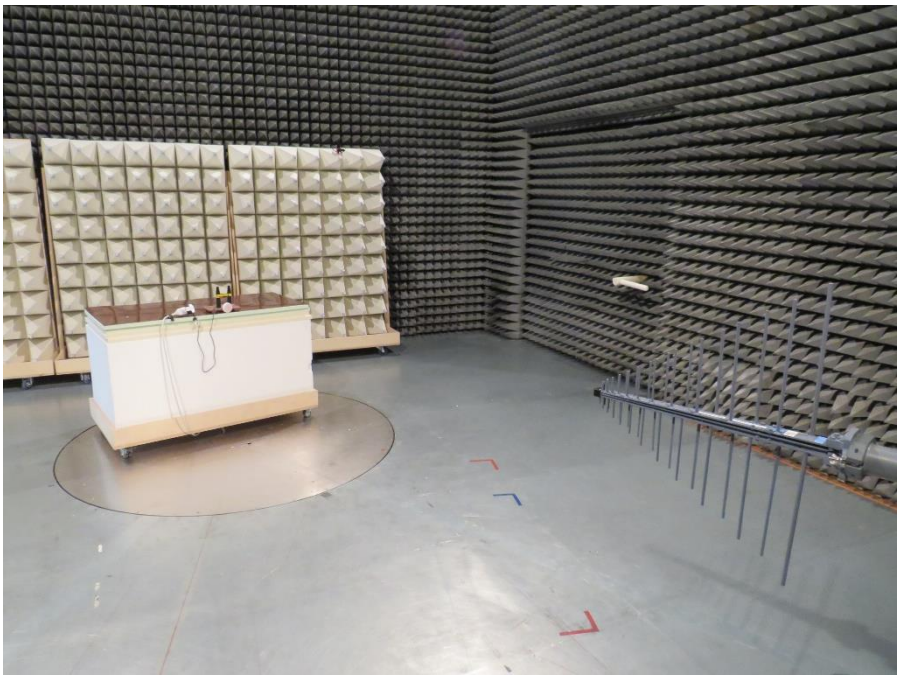
Test Results			
Operational mode	EUT Configuration	Verdict	Remark
1	1	PASS	--
2	2	PASS	--

2.1.7 Setup Photos

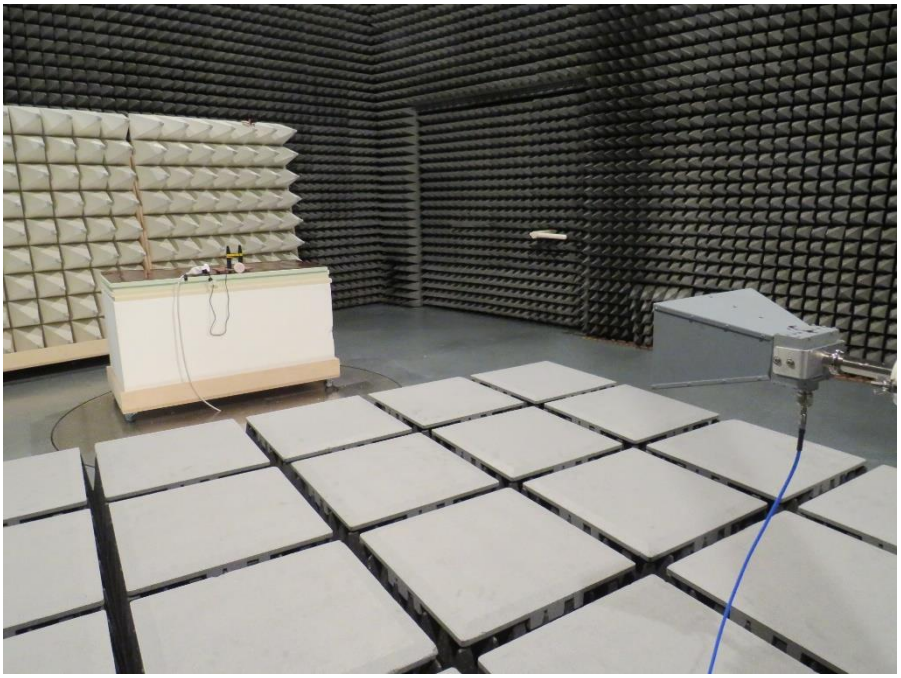
RADIATED EMISSION - CONFIGURATION I - 30 MHz to 200 MHz



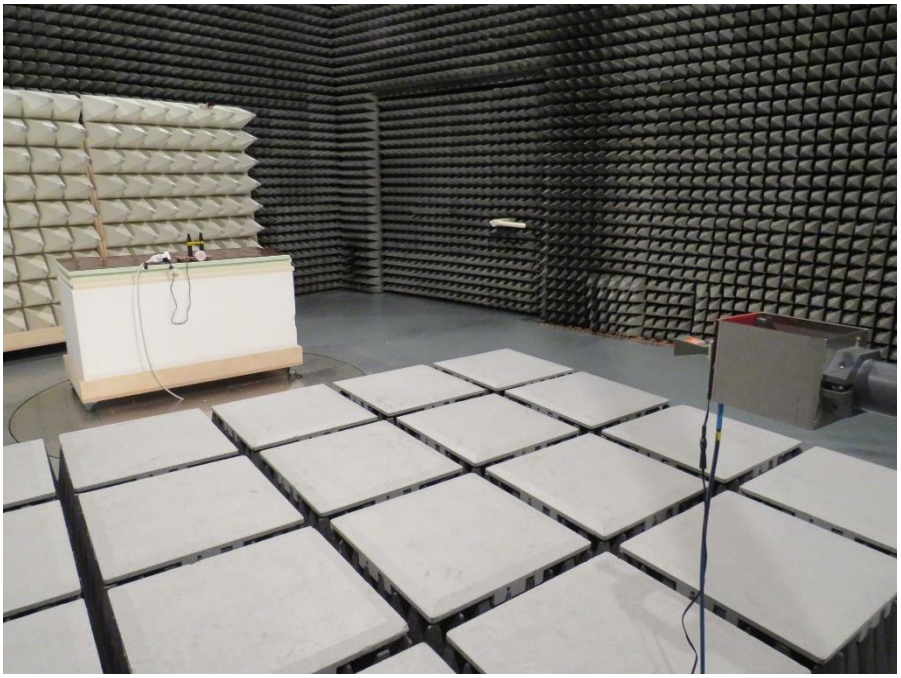
RADIATED EMISSION - CONFIGURATION I - 200 MHz to 1 GHz



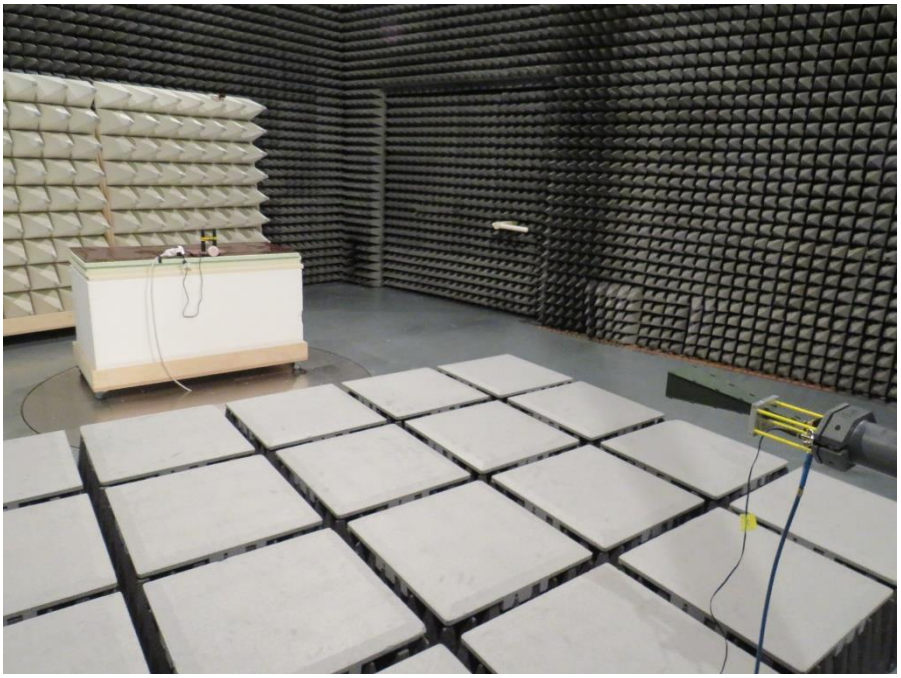
RADIATED EMISSION - CONFIGURATION I - 1 GHz to 17 GHz



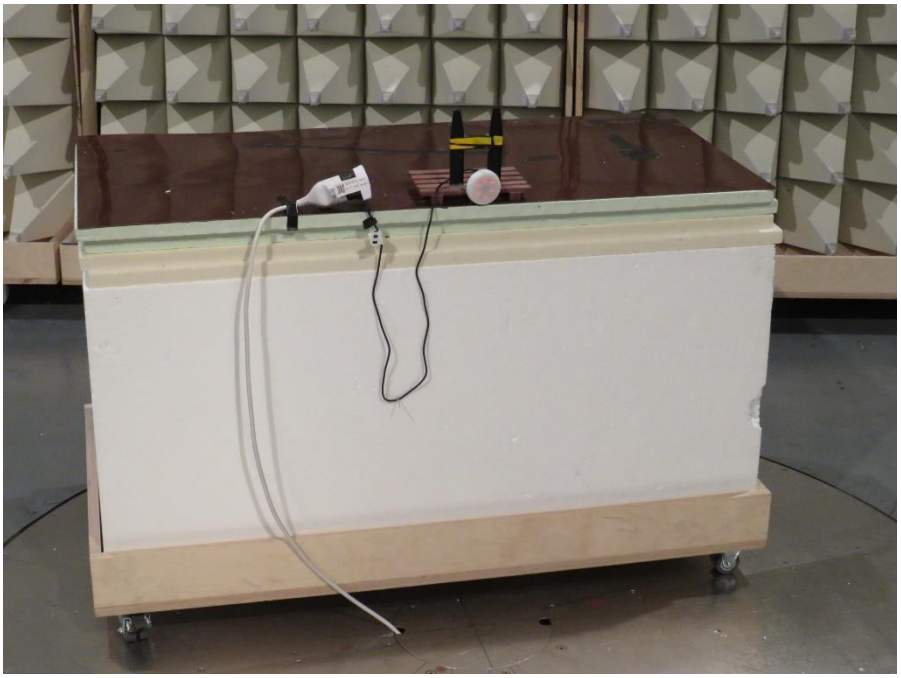
RADIATED EMISSION - CONFIGURATION I - 17 GHz to 26.5 GHz



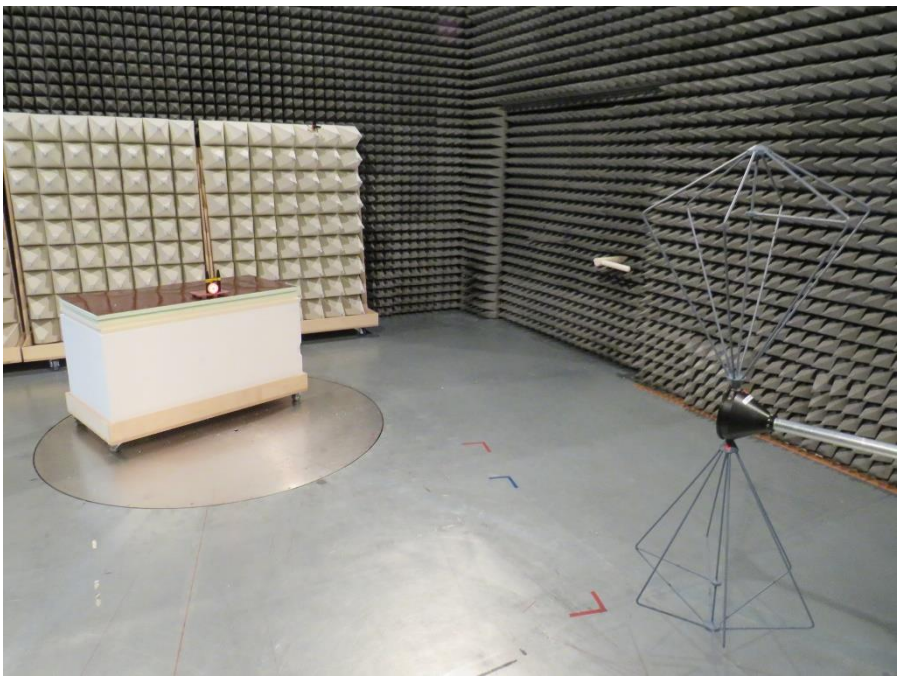
RADIATED EMISSION - CONFIGURATION I - 26.5 GHz to 40 GHz



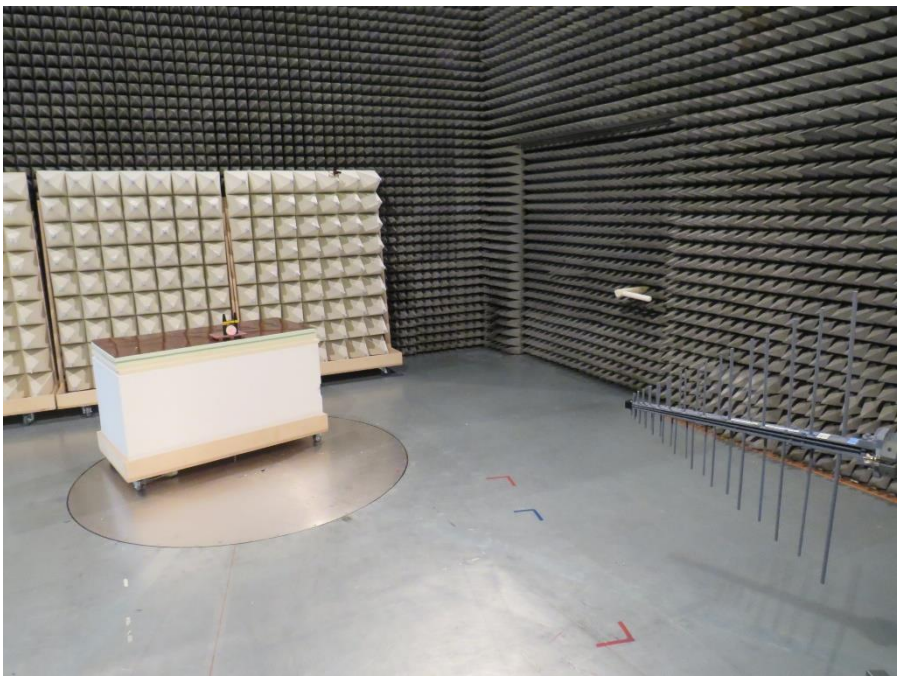
RADIATED EMISSION - CONFIGURATION I - FOCUS



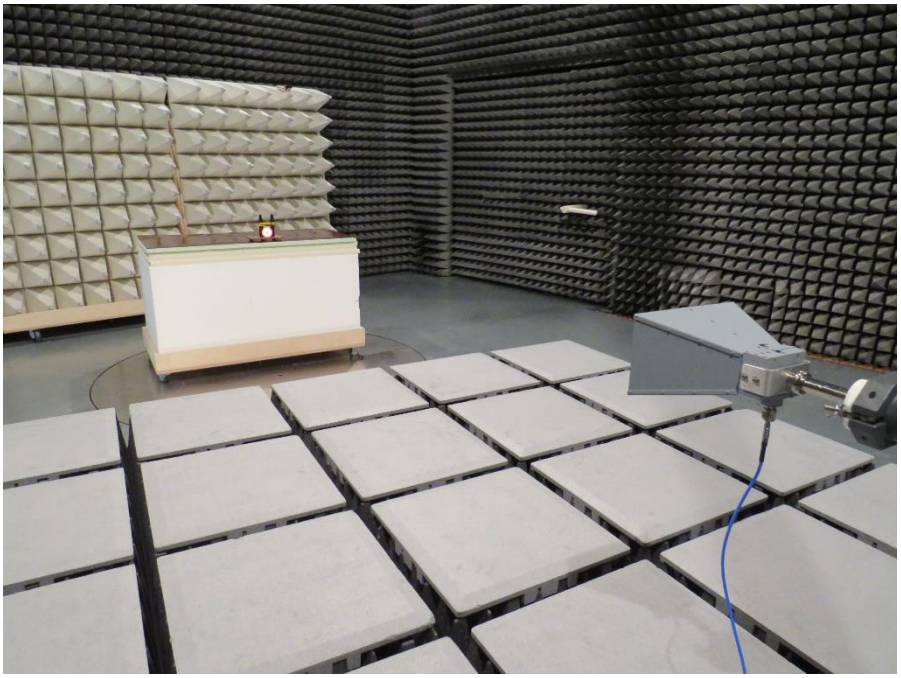
RADIATED EMISSION - CONFIGURATION II - 30 MHz to 200 MHz



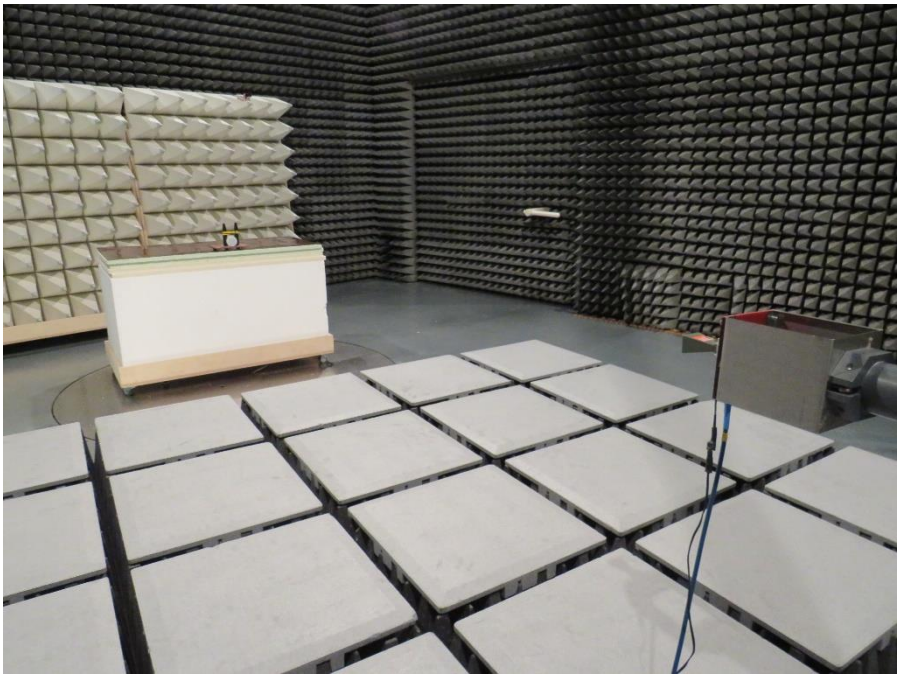
RADIATED EMISSION - CONFIGURATION II - 200 MHz to 1 GHz



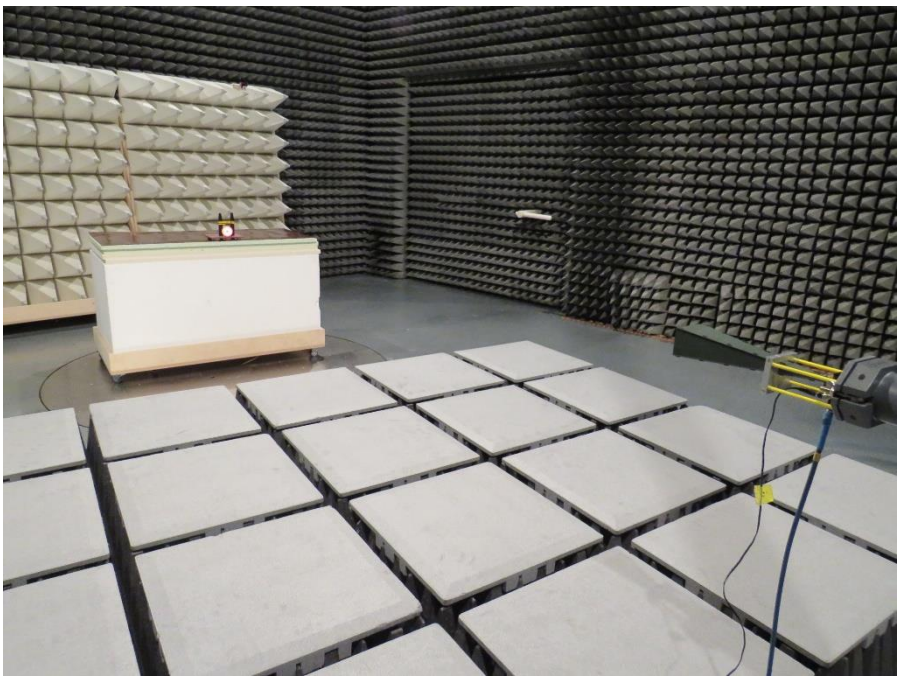
RADIATED EMISSION - CONFIGURATION II - 1 GHz to 17 GHz



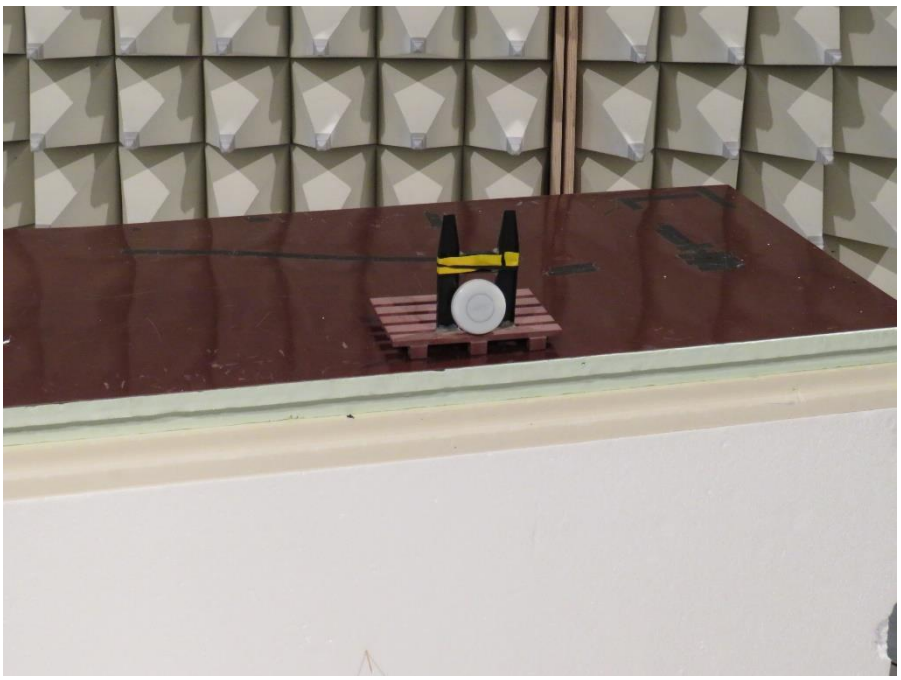
RADIATED EMISSION - CONFIGURATION II - 17 GHz to 26.5 GHz



RADIATED EMISSION - CONFIGURATION II - 26.5 GHz to 40 GHz



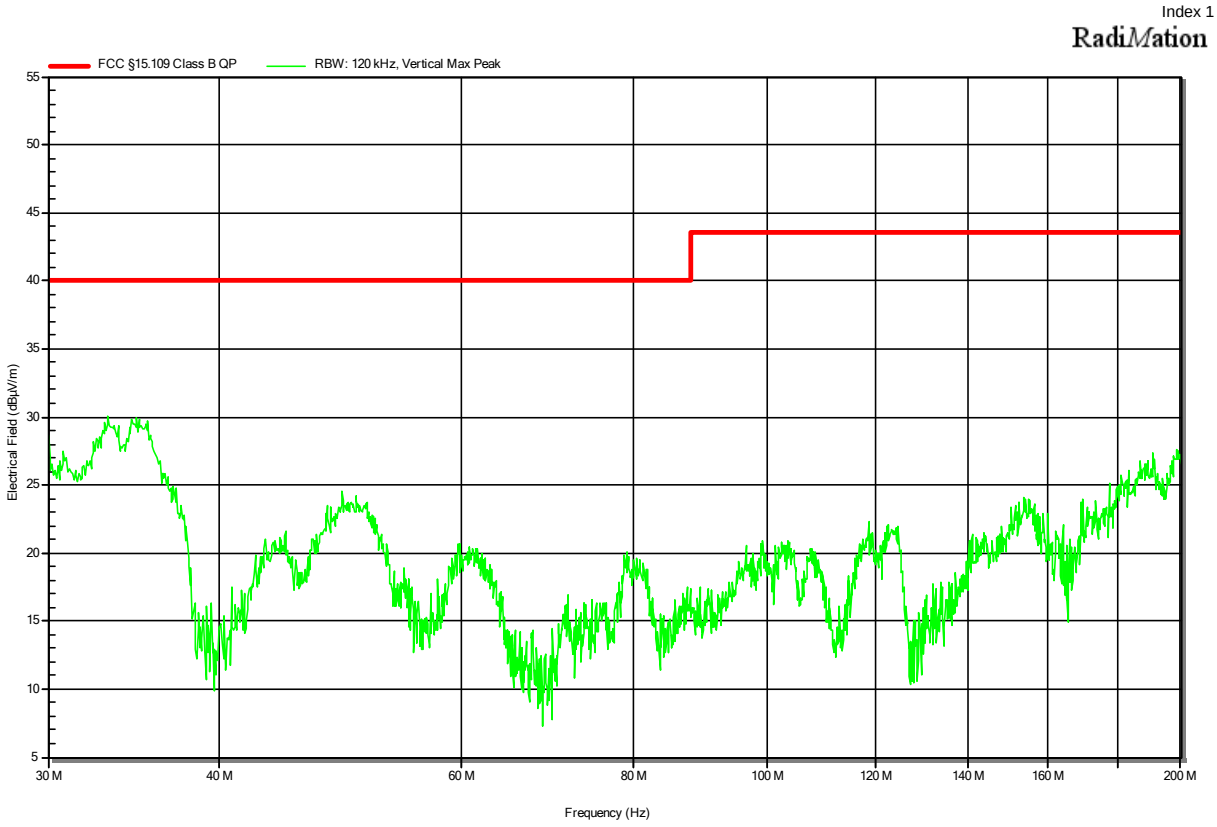
RADIATED EMISSION - CONFIGURATION II - FOCUS



2.1.8 Records

Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	



Radiated emissions
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Measurement Distance:	3m
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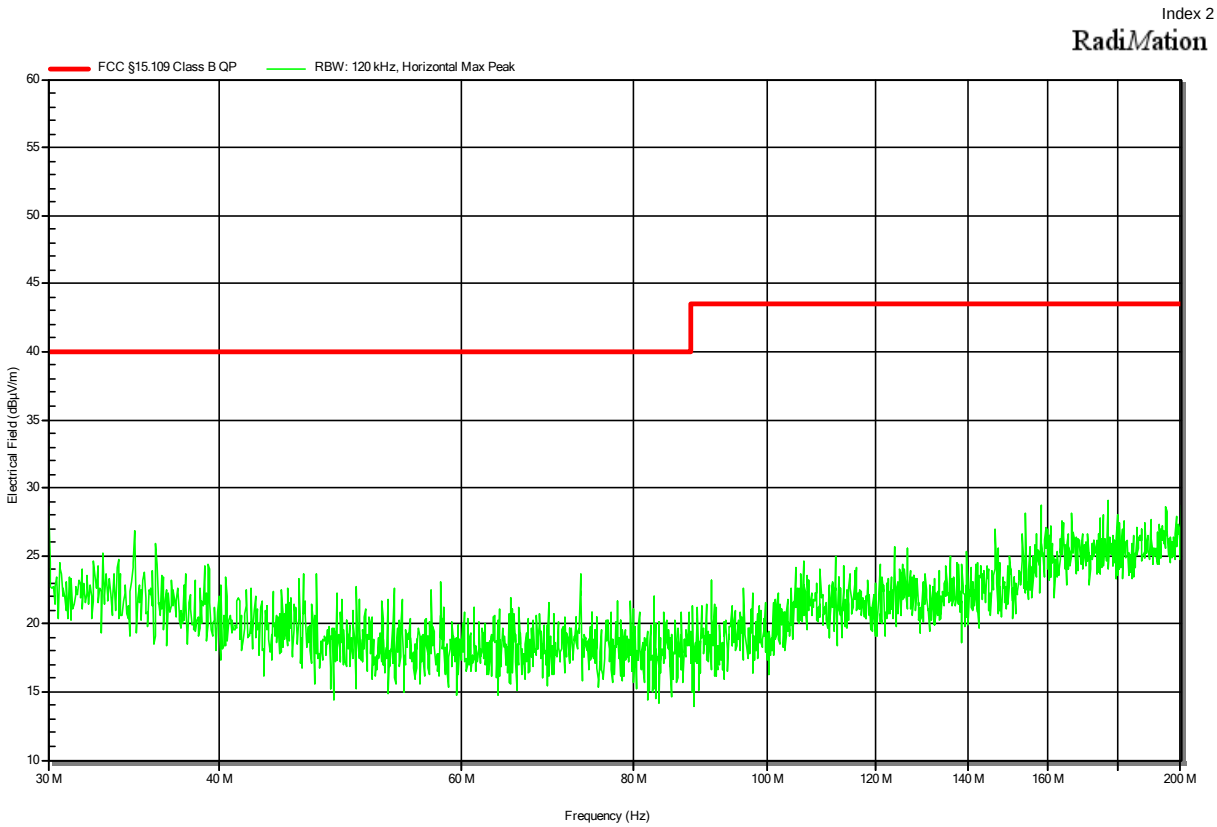

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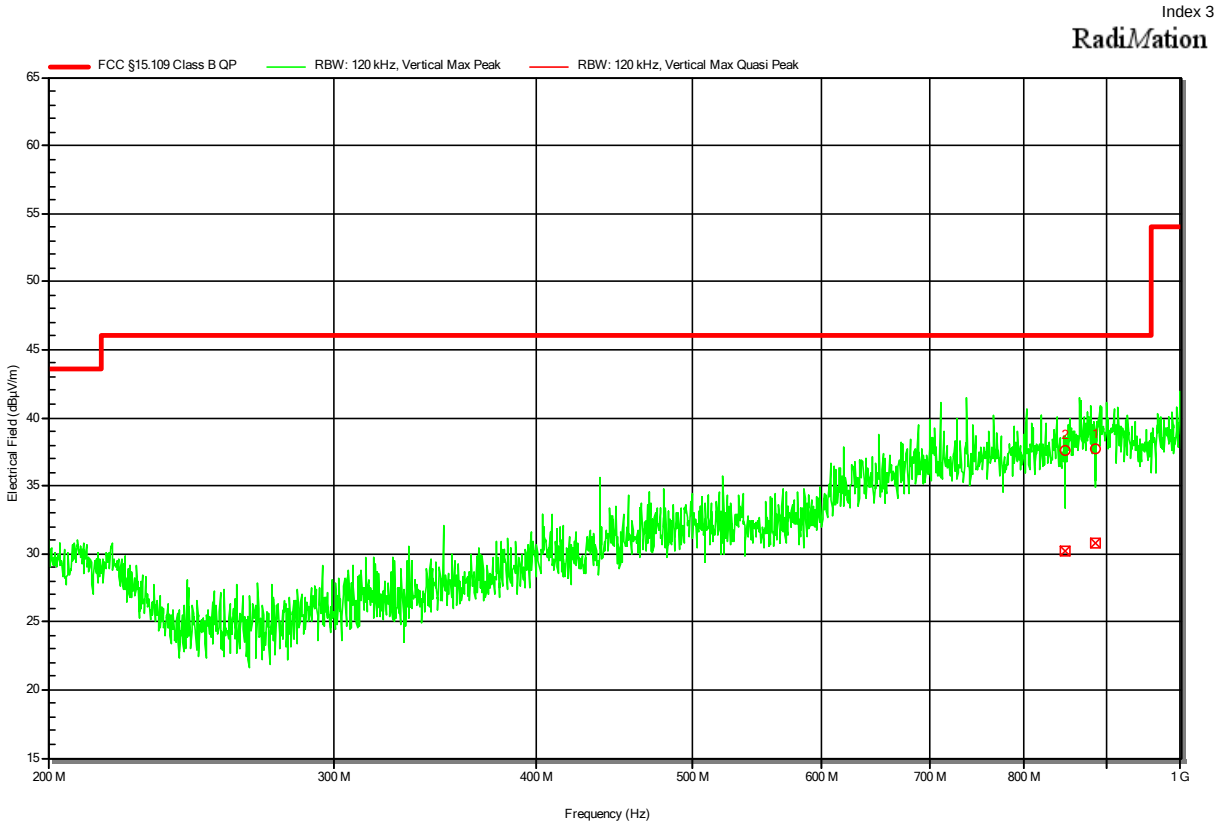
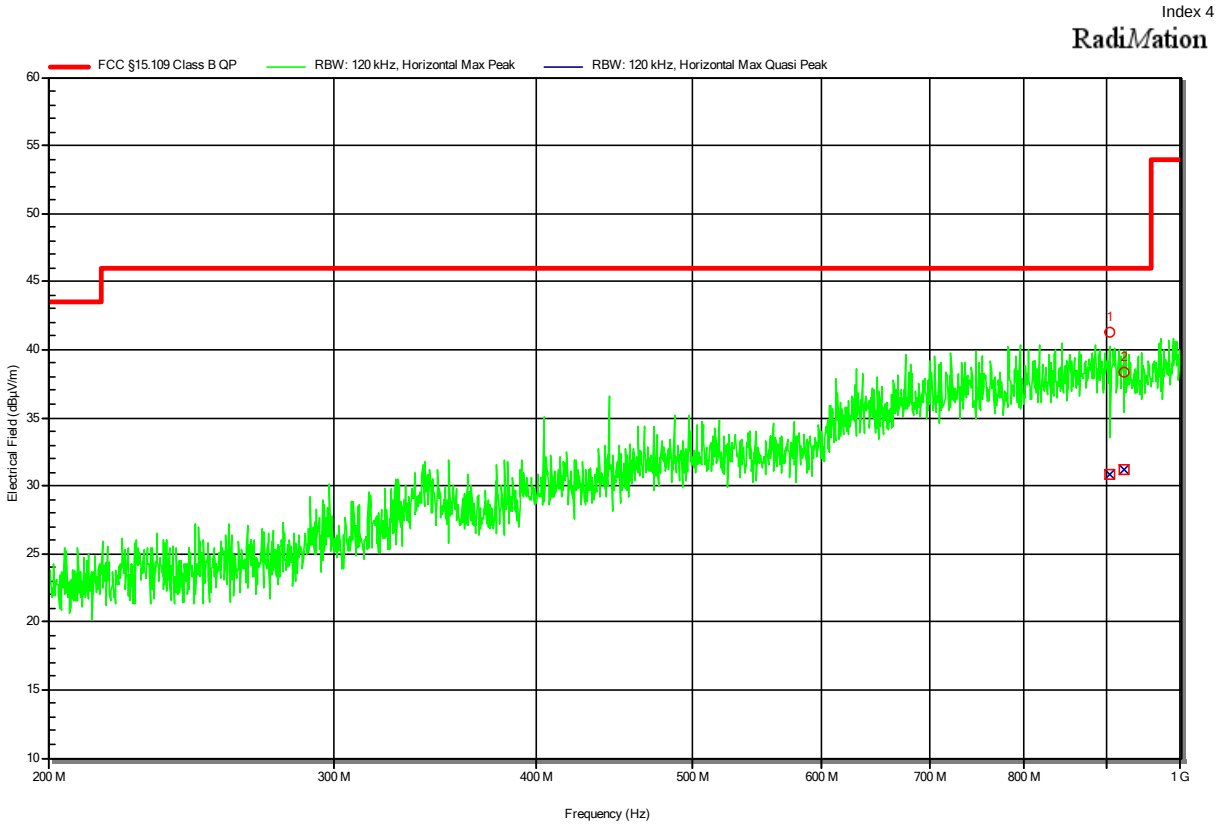
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	885.272 MHz	30.8 dBµV/m	46.02 dBµV/m	-15.22 dB	Pass	0 degrees	1 m
2	848.28 MHz	30.21 dBµV/m	46.02 dBµV/m	-15.81 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B

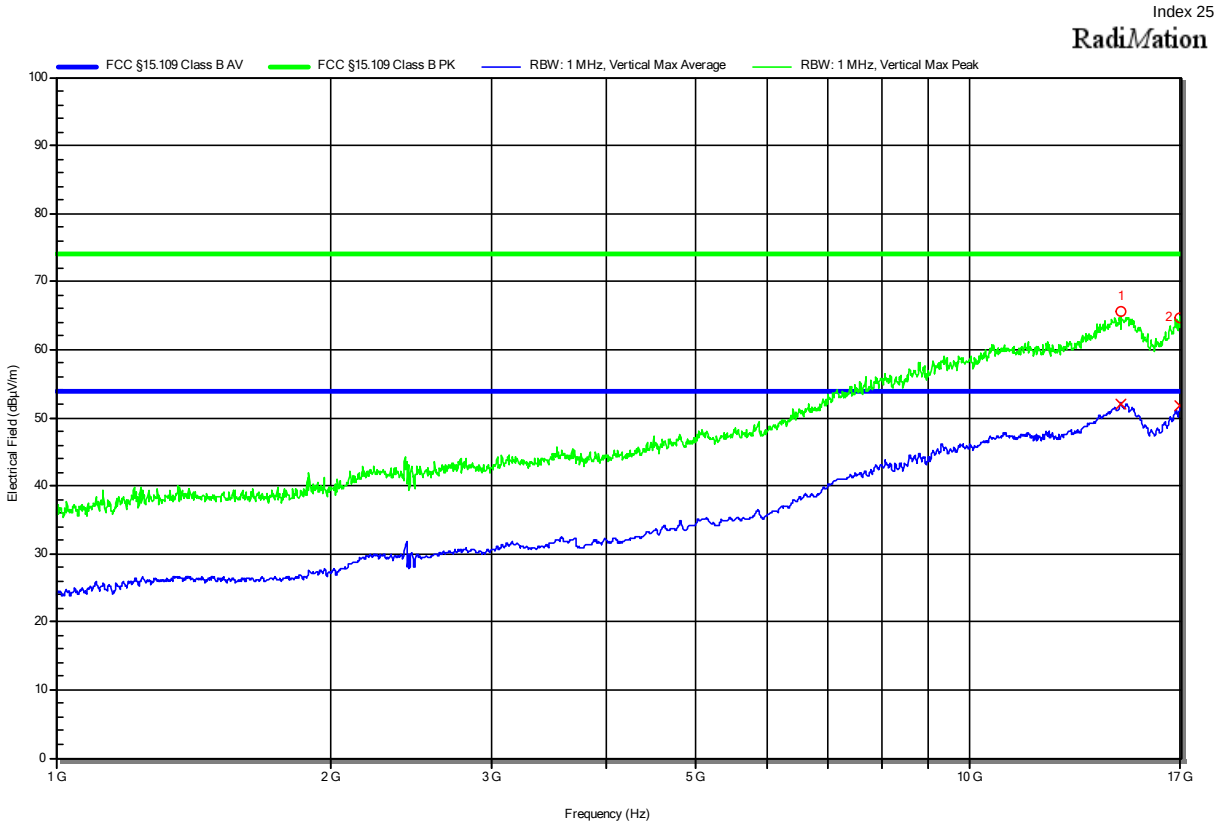
Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	905.014 MHz	30.81 dBµV/m	46.02 dBµV/m	-15.21 dB	Pass	0 degrees	1 m
2	922.005 MHz	31.16 dBµV/m	46.02 dBµV/m	-14.86 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	

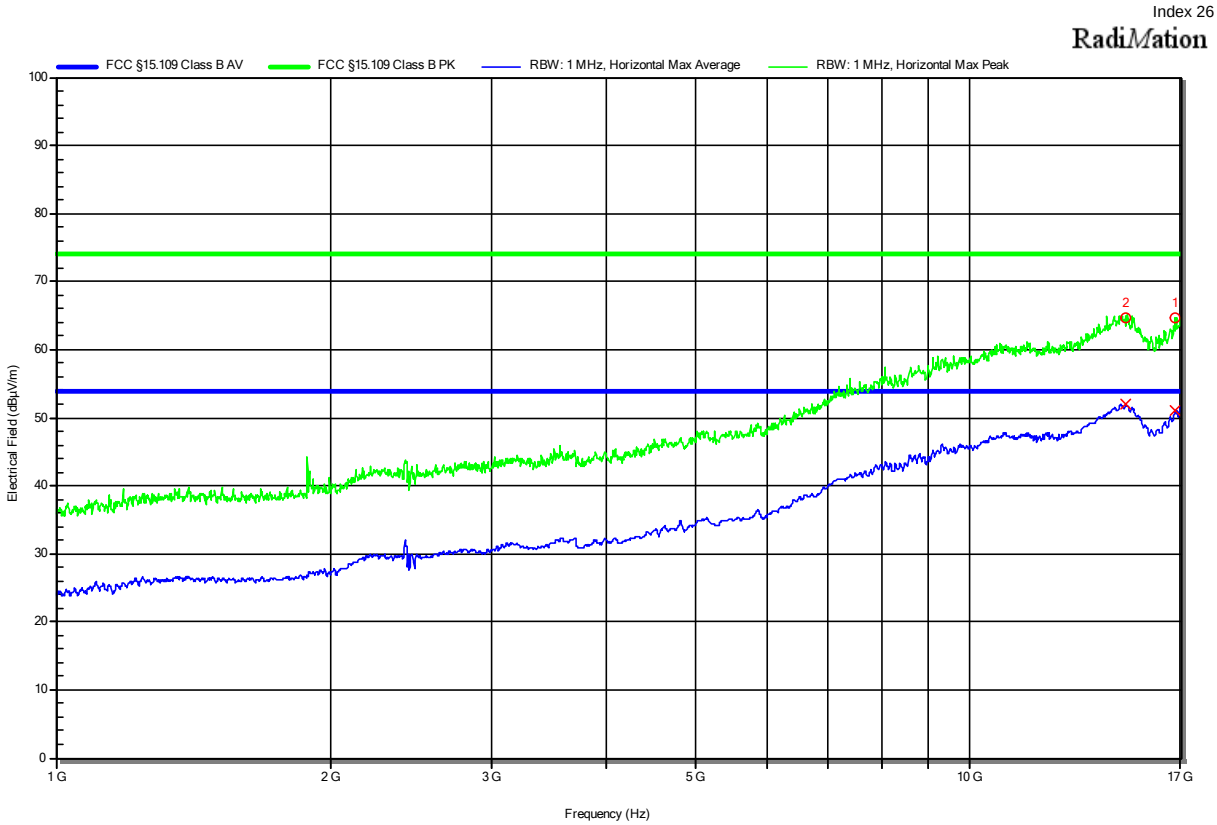


Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	14.621 GHz	65.62 dBµV/m	73.98 dBµV/m	-8.36 dB	Pass	0 degrees	1 m
2	16.995 GHz	64.63 dBµV/m	73.98 dBµV/m	-9.35 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	14.621 GHz	51.88 dBµV/m	53.98 dBµV/m	-2.1 dB	Pass	0 degrees	1 m
2	16.995 GHz	51.69 dBµV/m	53.98 dBµV/m	-2.29 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	16.781 GHz	64.62 dBµV/m	73.98 dBµV/m	-9.36 dB	Pass	0 degrees	1 m
2	14.821 GHz	64.73 dBµV/m	73.98 dBµV/m	-9.25 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	16.781 GHz	50.95 dBµV/m	53.98 dBµV/m	-3.03 dB	Pass	0 degrees	1 m
2	14.821 GHz	51.88 dBµV/m	53.98 dBµV/m	-2.1 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	AT4560, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	

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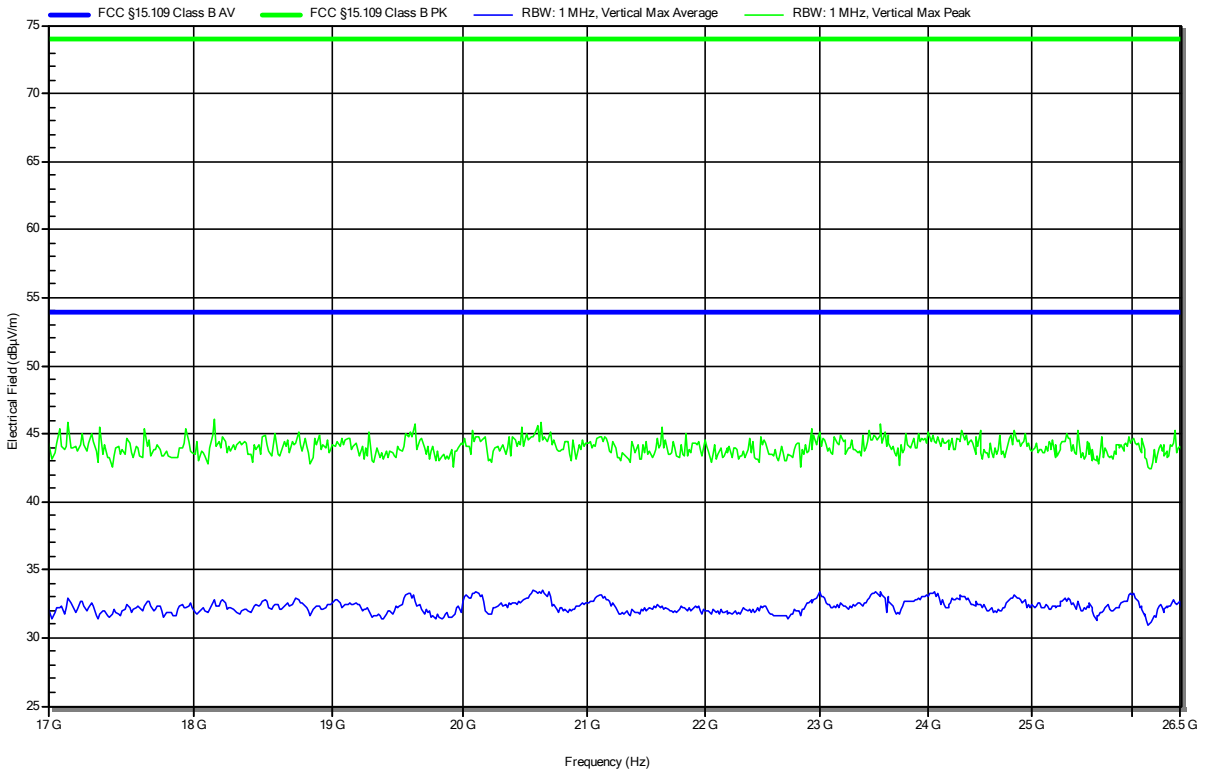
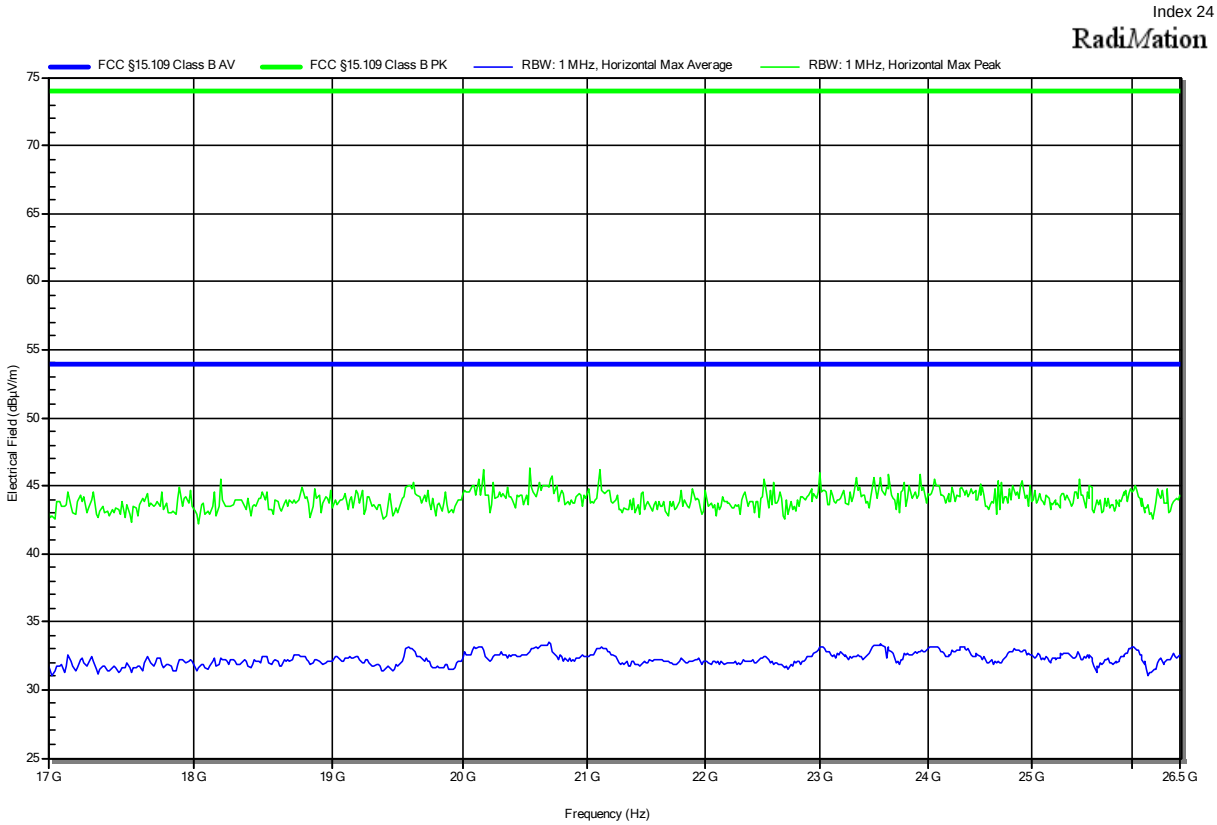
RadiMation



Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	AT4560, Horizontal
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	



Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	ATH18G40, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	

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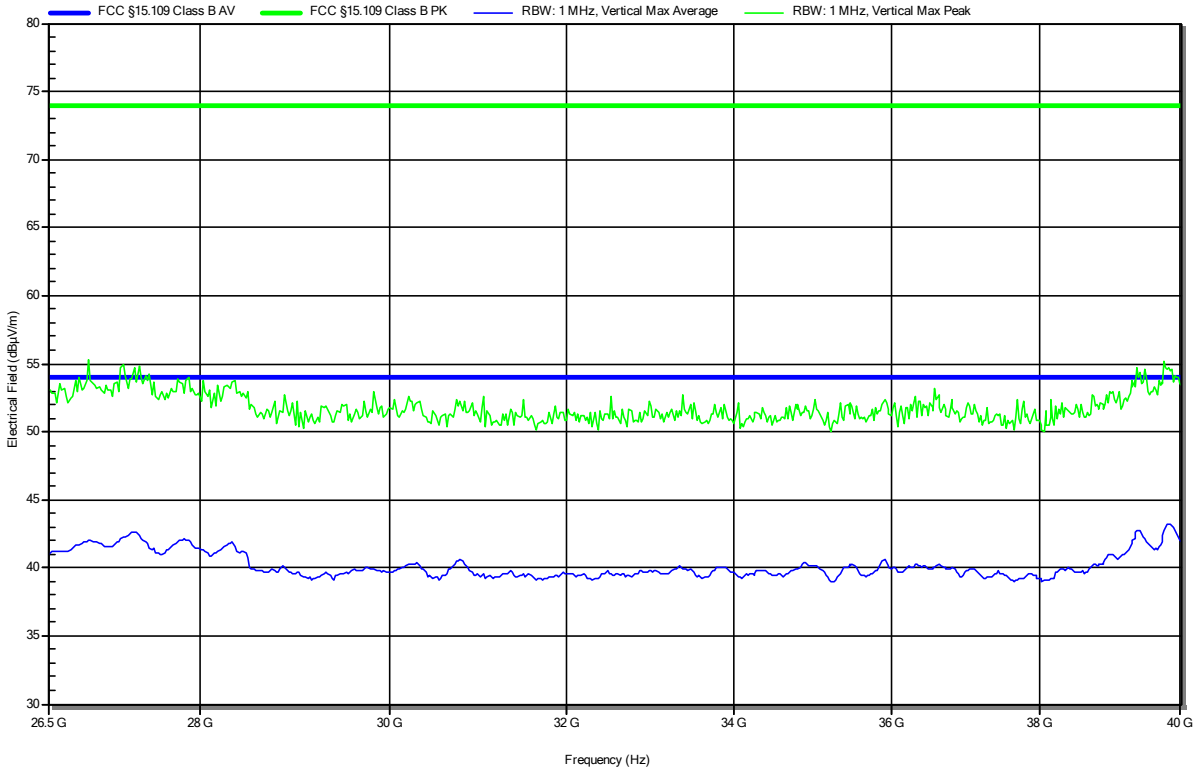
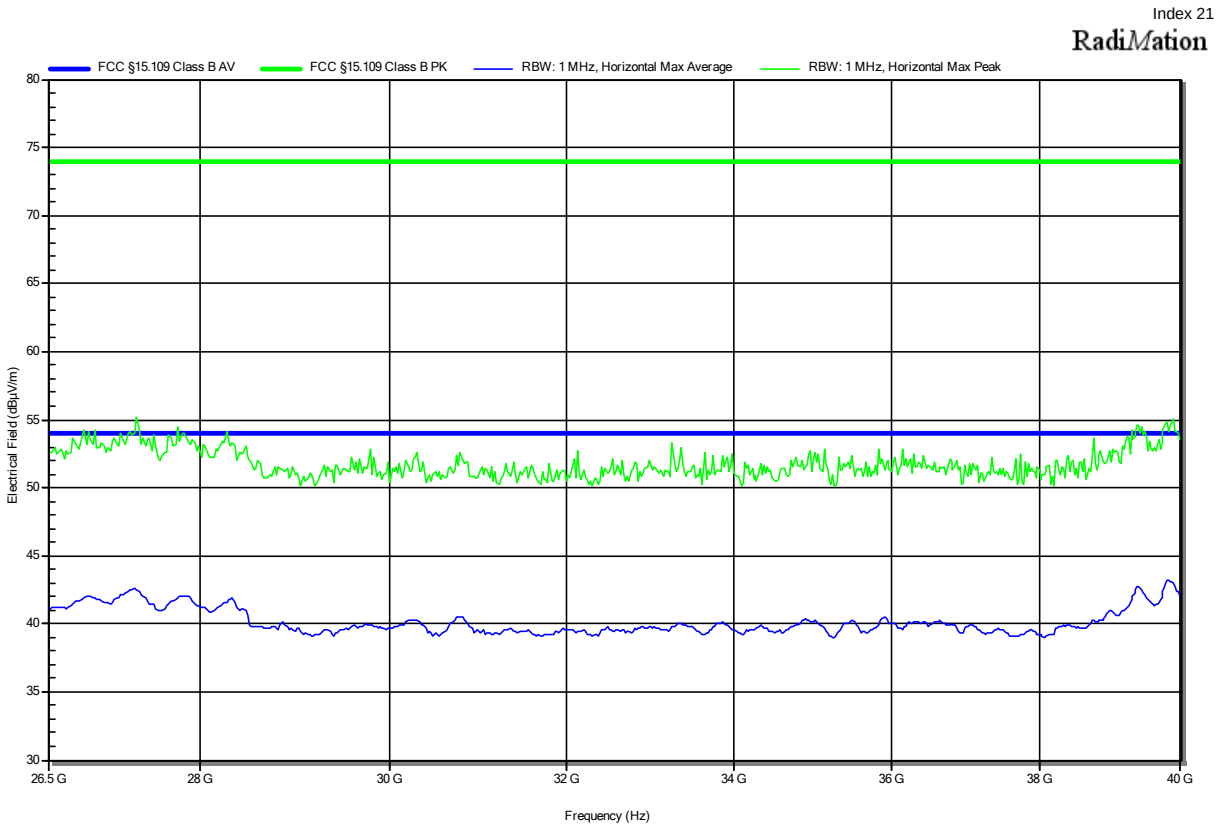
RadiMation



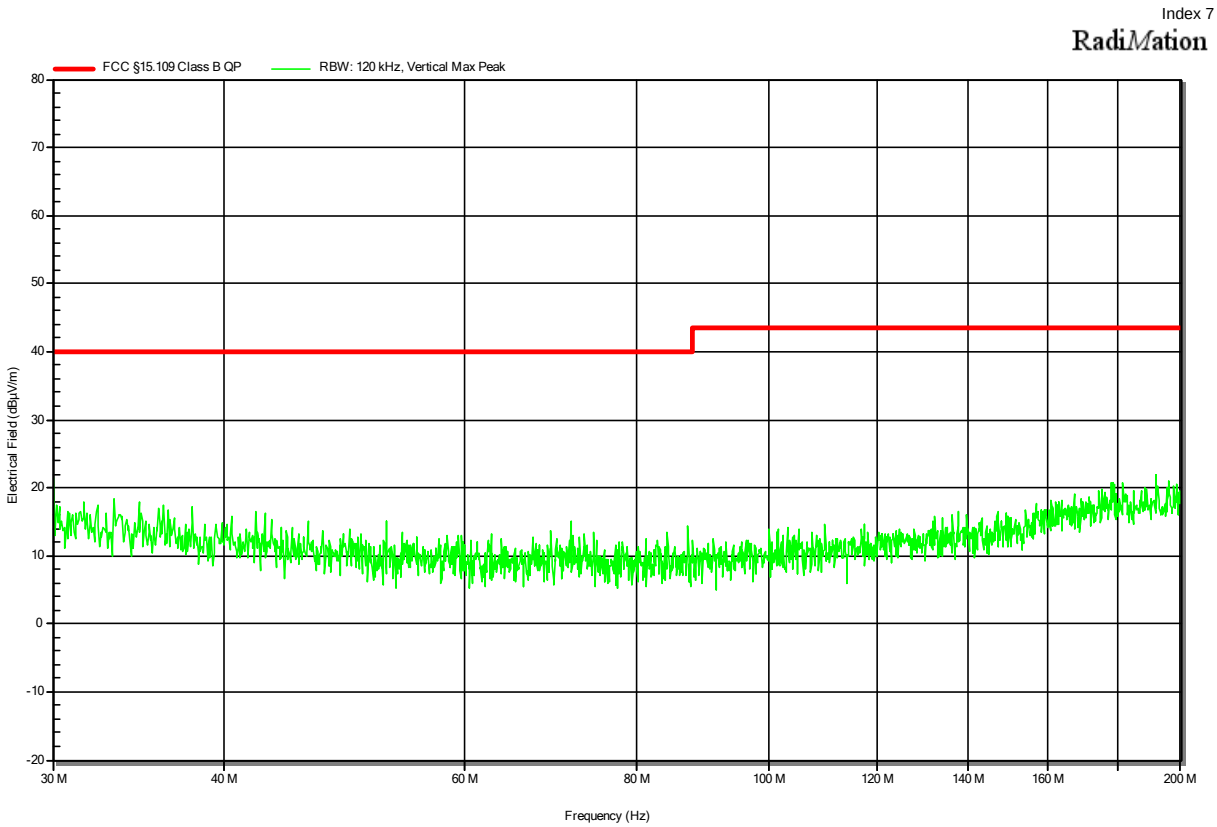
Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	ATH18G40, Horizontal
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	



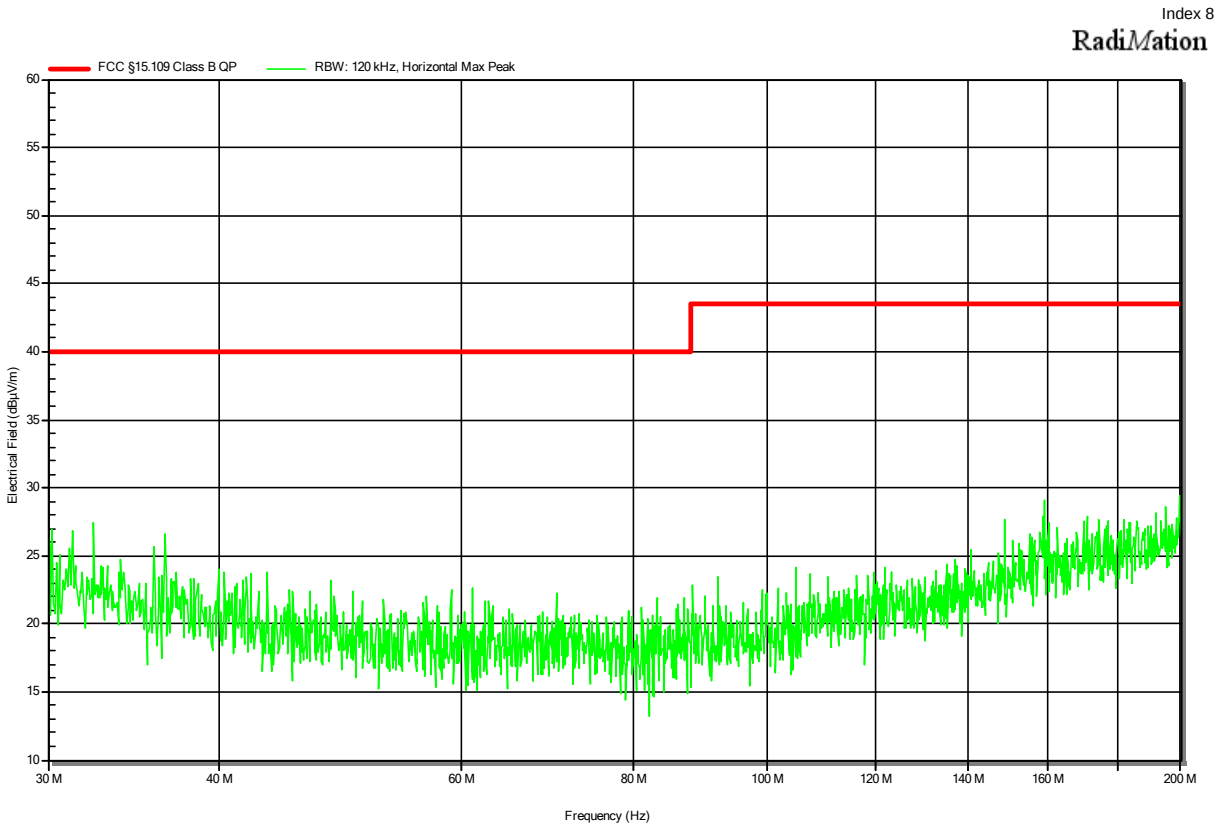
Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	



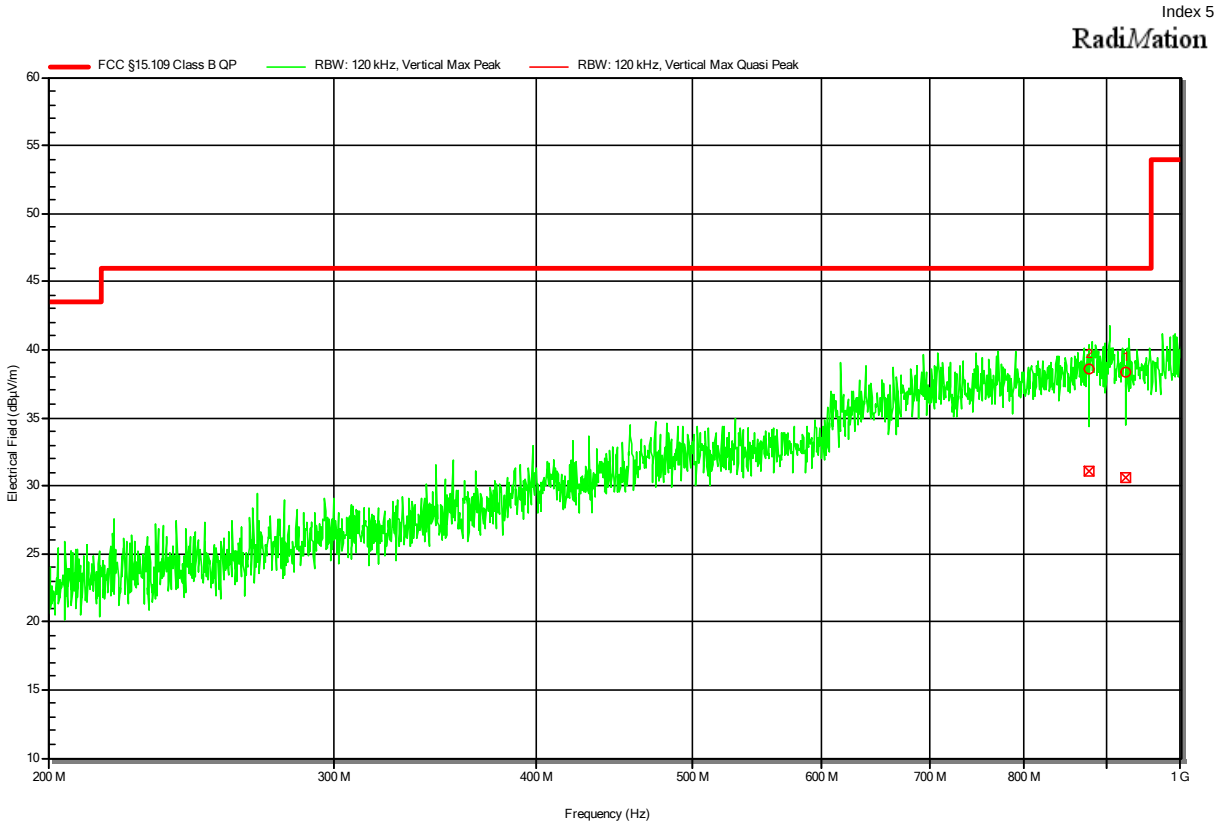
Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	



Radiated emissions
according to FCC part 15B

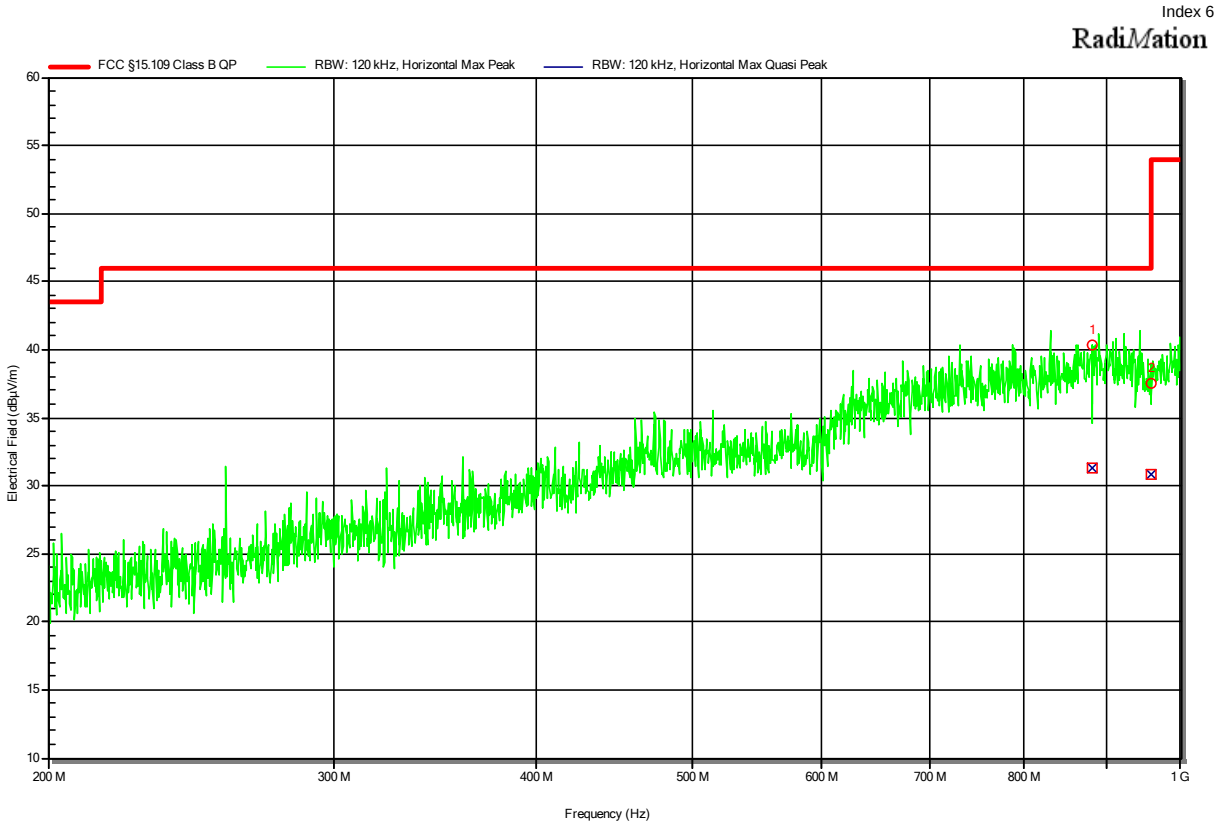
Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	925.758 MHz	30.57 dBµV/m	46.02 dBµV/m	-15.46 dB	Pass	0 degrees	1 m
2	877.953 MHz	31.02 dBµV/m	46.02 dBµV/m	-15 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B

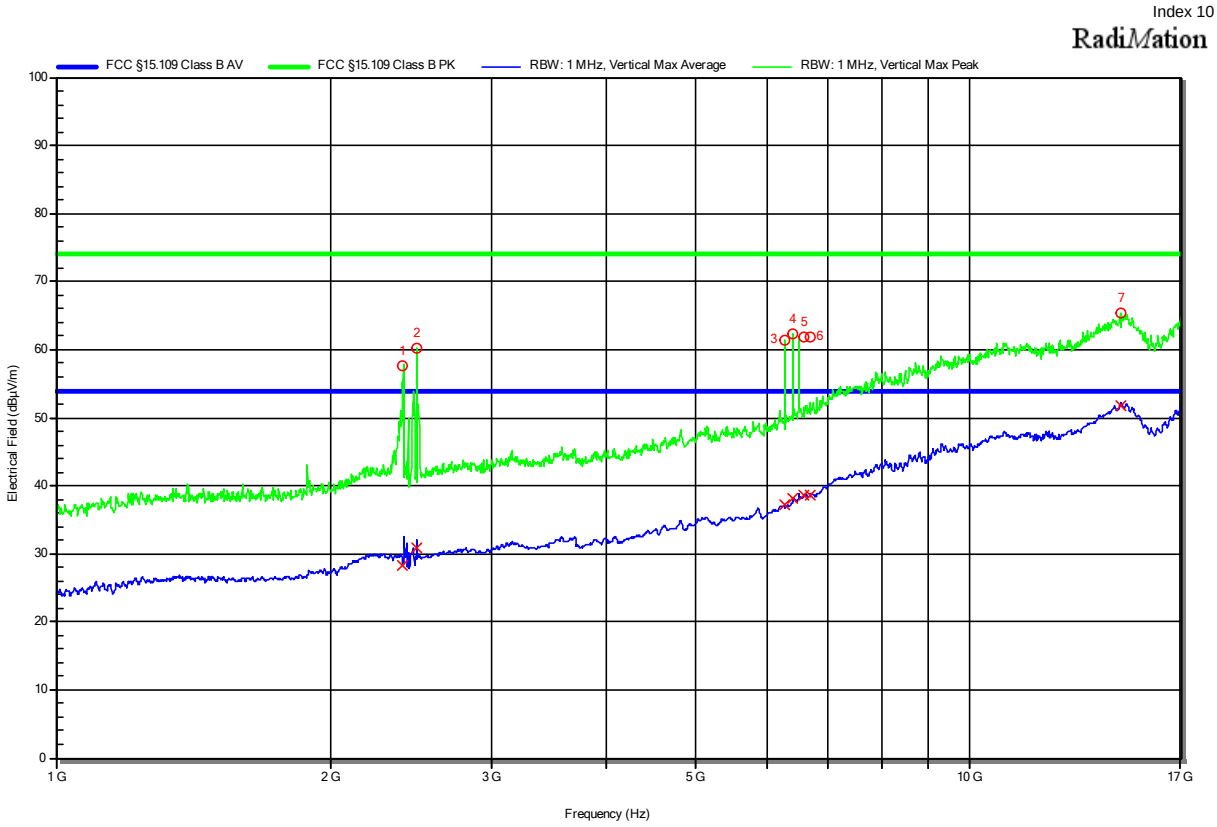
Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	882.059 MHz	31.29 dBµV/m	46.02 dBµV/m	-14.74 dB	Pass	0 degrees	1 m
2	958.697 MHz	30.88 dBµV/m	46.02 dBµV/m	-15.14 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	

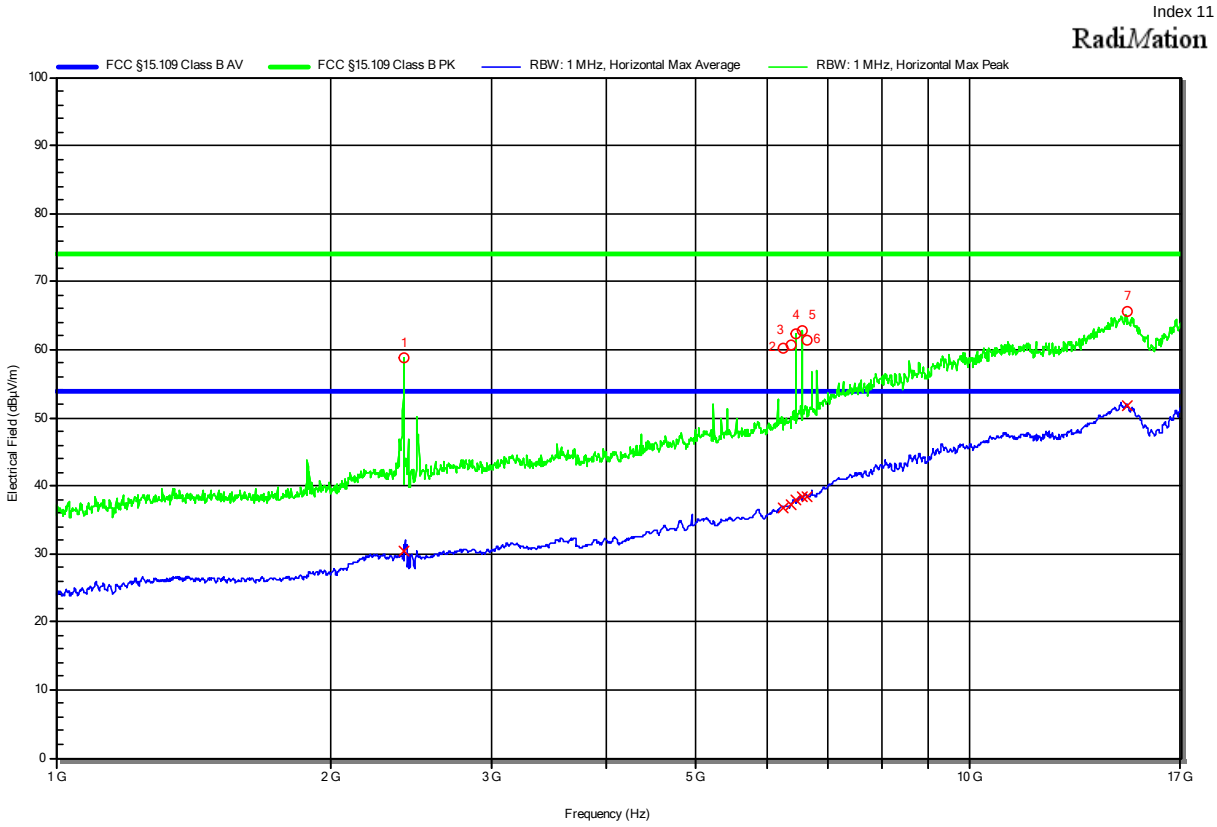


Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	2.398 GHz	BLE-Carrier			Pass	0 degrees	1 m
2	2.48 GHz				Pass	0 degrees	1 m
3	6.276 GHz				Pass	0 degrees	1 m
4	6.397 GHz	UWB Channel 5 Carrier			Pass	0 degrees	1 m
5	6.583 GHz				Pass	0 degrees	1 m
6	6.696 GHz				Pass	0 degrees	1 m
7	14.602 GHz	65.36 dBµV/m	73.98 dBµV/m	-8.62 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	2.398 GHz	BLE-Carrier			Pass	0 degrees	1 m
2	2.48 GHz				Pass	0 degrees	1 m
3	6.276 GHz				Pass	0 degrees	1 m
4	6.397 GHz	UWB Channel 5 Carrier			Pass	0 degrees	1 m
5	6.583 GHz				Pass	0 degrees	1 m
6	6.696 GHz				Pass	0 degrees	1 m
7	14.602 GHz	51.8 dBµV/m	53.98 dBµV/m	-2.18 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	

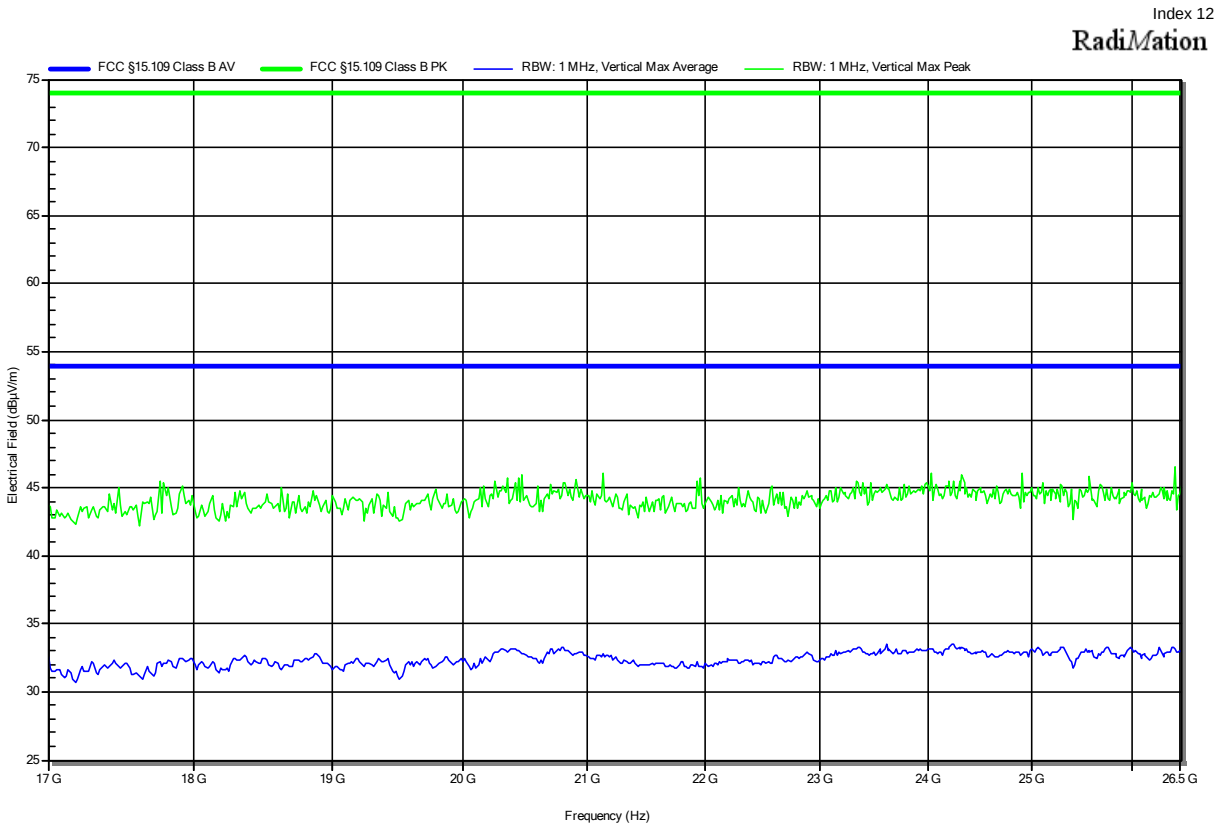


Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	2.402 GHz	BLE-Carrier			Pass	0 degrees	1 m
2	6.253 GHz				Pass	0 degrees	1 m
3	6.368 GHz				Pass	0 degrees	1 m
4	6.453 GHz	UWB Channel 5 Carrier			Pass	0 degrees	1 m
5	6.544 GHz				Pass	0 degrees	1 m
6	6.632 GHz				Pass	0 degrees	1 m
7	14.879 GHz	65.51 dBµV/m	73.98 dBµV/m	-8.47 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	2.402 GHz	BLE-Carrier			Pass	0 degrees	1 m
2	6.253 GHz				Pass	0 degrees	1 m
3	6.368 GHz				Pass	0 degrees	1 m
4	6.453 GHz	UWB Channel 5 Carrier			Pass	0 degrees	1 m
5	6.544 GHz				Pass	0 degrees	1 m
6	6.632 GHz				Pass	0 degrees	1 m
7	14.879 GHz	51.69 dBµV/m	53.98 dBµV/m	-2.29 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	AT4560, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	



Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	AT4560, Horizontal
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	

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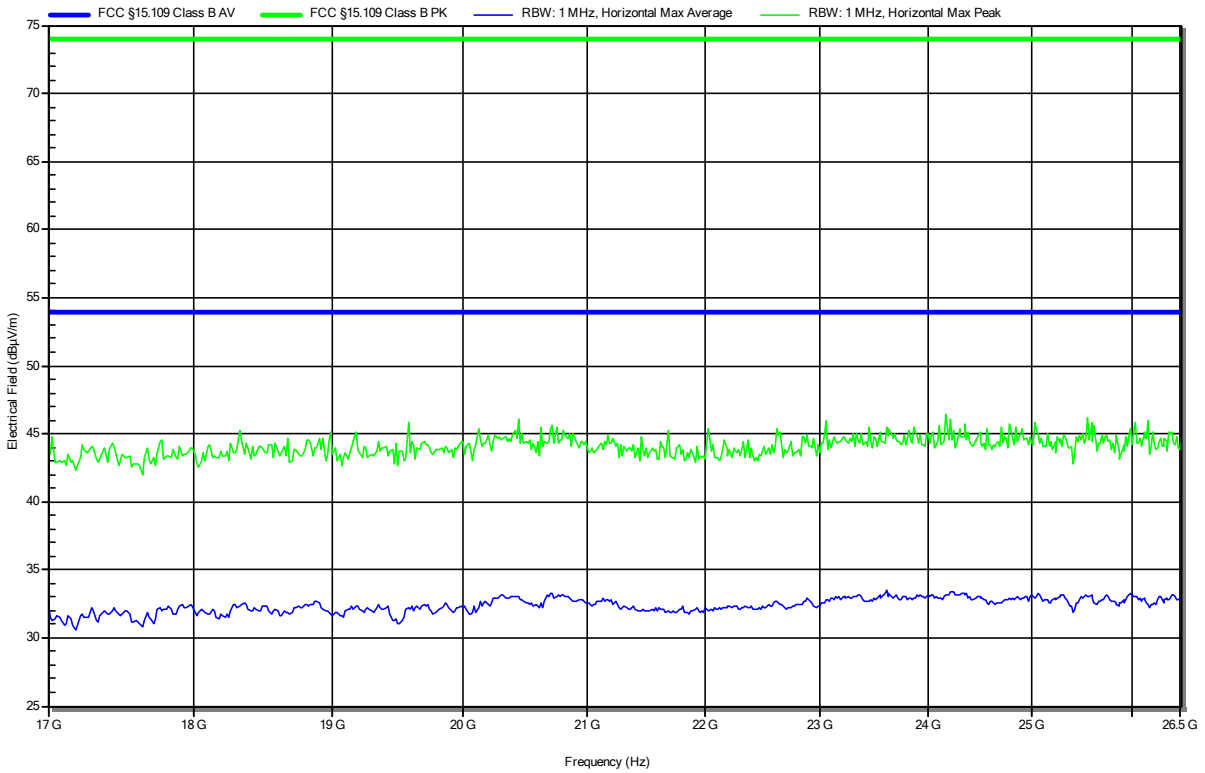
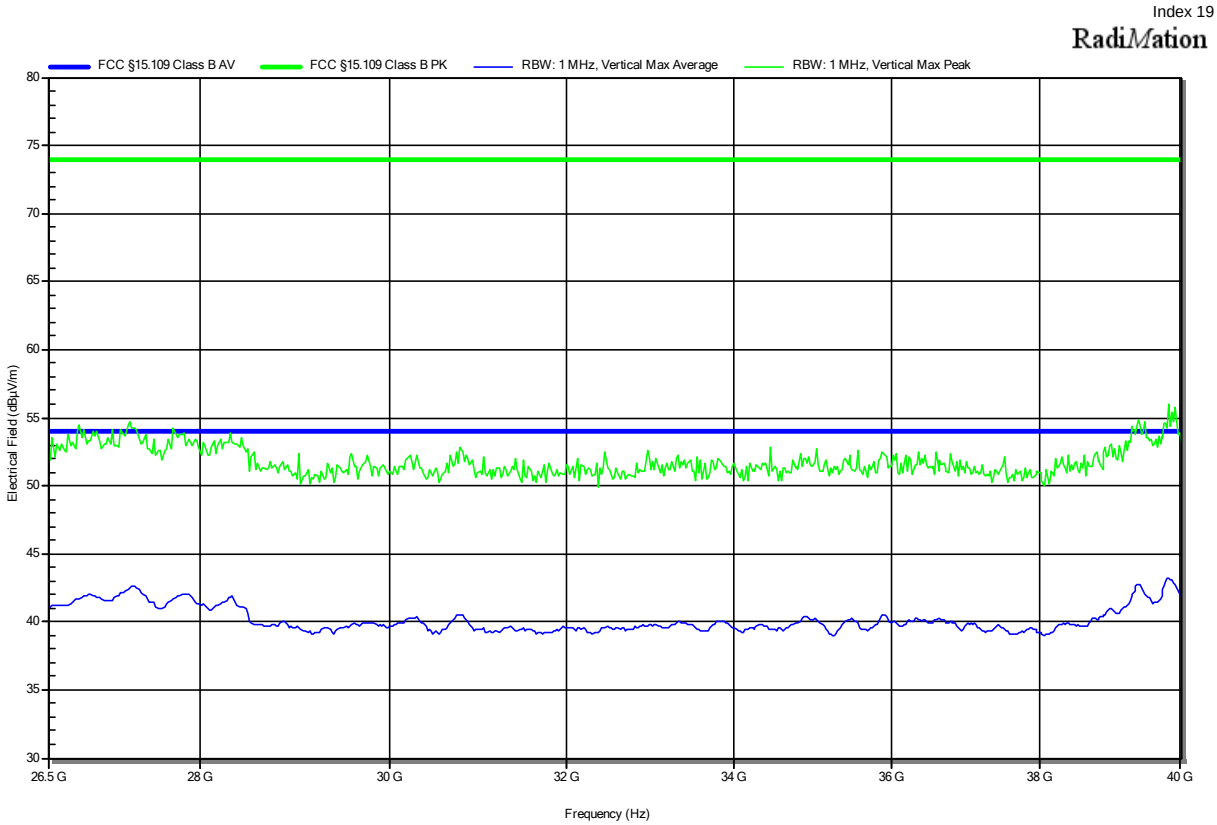


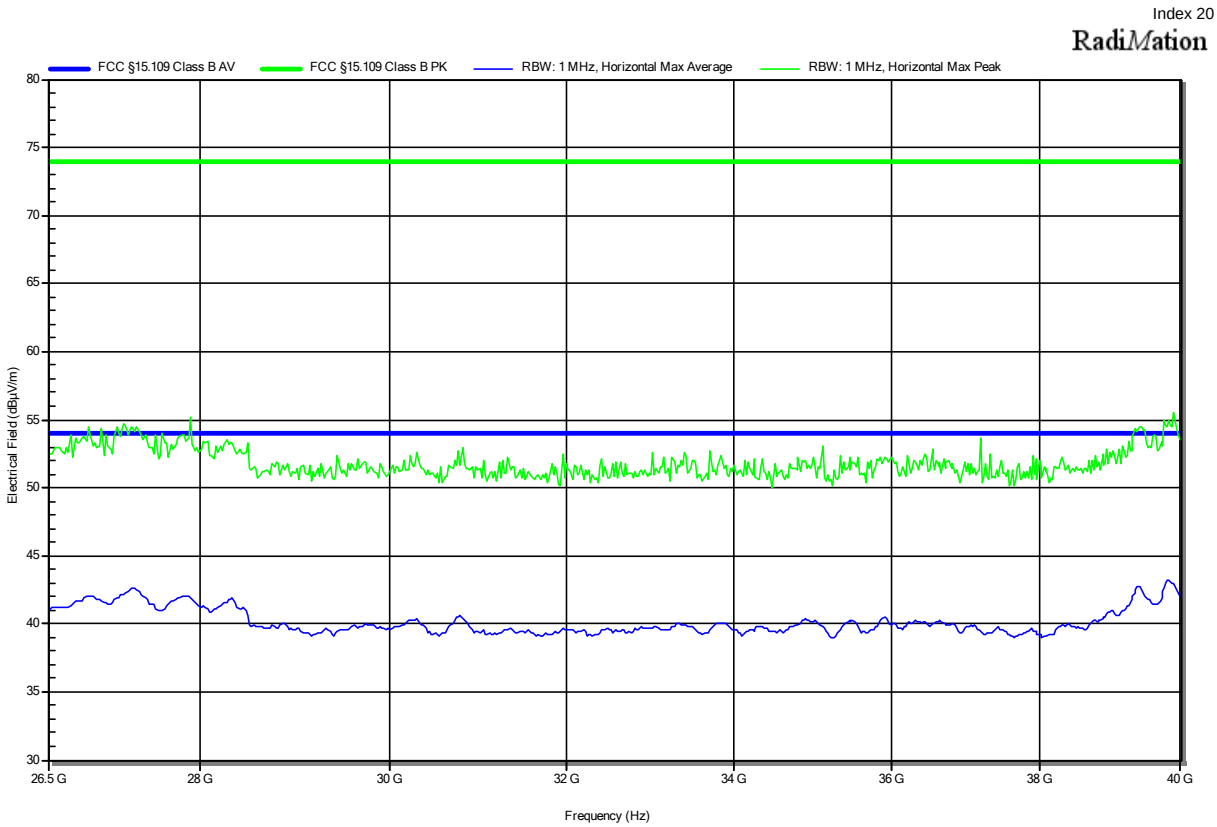
Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	ATH18G40, Vertical
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	



Radiated emissions
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-19
Operating Conditions:	ambient temperature: 23 °Celsius power input: 115 V / 60 Hz
Antenna:	ATH18G40, Horizontal
Measurement Distance:	3m
Operational Mode & EUT Configuration:	Mode 2 Configuration 2
Note 1:	



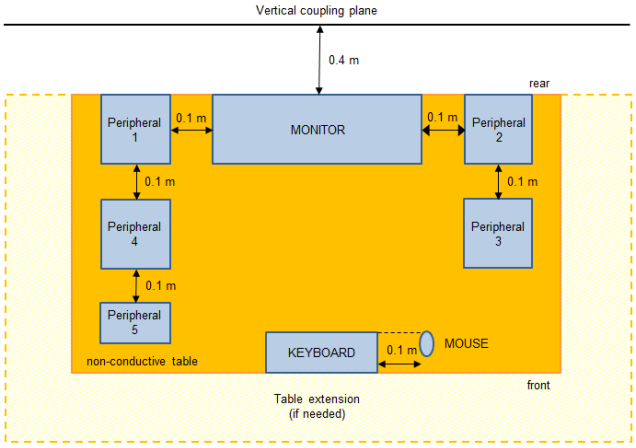
2.2 Test Conditions and Results - Conducted emissions acc. to ANSI C63.4

2.2.1 Information

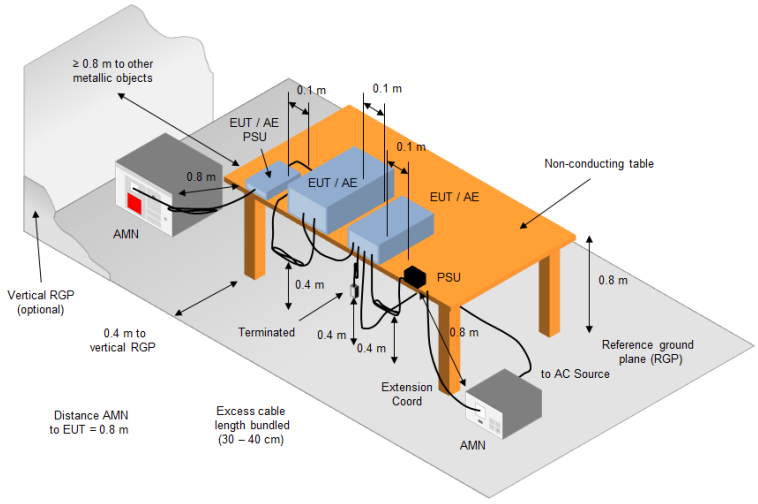
Test Information	
Reference	FCC 15.107, ICES-003, 6.1
Reference method	ANSI C63.4:2014+A1:2017 Section 12
Measurement range	150 kHz to 30 MHz
Equipment class	Class B
Equipment type	Table top
Temperature [°C]	20 – 24
Humidity [%]	30 – 34
Operator	Stephan Liebich
Date	2021-02-22

2.2.2 Setup

Equipment placement



Test Setup



2.2.3 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	Radimation	2020.1.8

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	Schwarzbeck	NSLK 8127	EF01592	2020-07	2021-07
Pulse Limiter	R&S	ESH3-Z2	EF01063	2020-07	2021-07
EMI Test Receiver	R&S	ESR 7	EF00943	2020-07	2021-07
Climatic Sensor	Embedded Data Systems, LLC.	2800100000254 17E	EF01054	2020-03	2021-03

2.2.4 Procedure

Exploratory measurement
1. The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
2. The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
3. The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
4. The LISN measurement port was connected to a measurement receiver
5. I/O cables were bundled not longer than 0.4 m
6. Measurement was performed in the frequency range 0.15 – 30MHz on each current-carrying conductor
7. To maximize the emissions the cable positions were manipulated
8. The worst configuration of EUT and cables is shown on a test setup picture at item 1.3

Final measurement
1. The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
2. The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
3. The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
4. The LISN measurement port was connected to a measurement receiver
5. The EUT and cable arrangement were based on the exploratory measurement results
6. The test data of the worst-case conditions were recorded and shown on the next pages

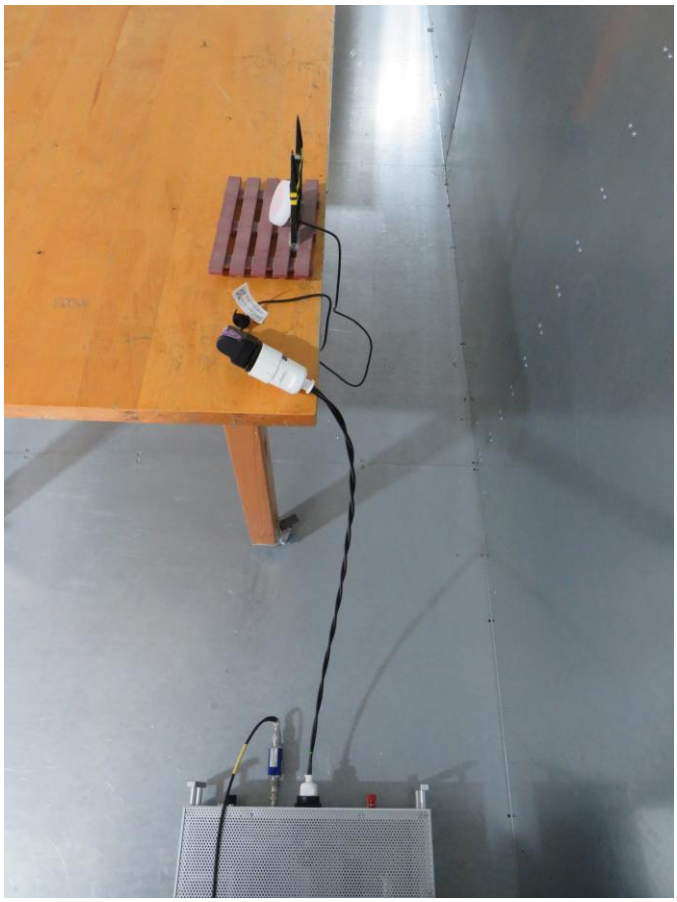
2.2.5 Limits

Class B		
Frequency [MHz]	Quasi-peak Limit [dBµV]	Average Limit [dBµV]
0.15 - 0.5	66 - 56 *	56 - 46 *
0.5 - 5	56	46
5 - 30	60	50
* Decreases with the logarithm of the frequency		

2.2.6 Results

AC power line conducted emissions					
Port	Coupling	Operational mode	EUT Configuration	Verdict	Remark
AC Mains	AMN	1	1	PASS	--

2.2.7 Setup Photos

CONDUCTED EMISSION ON PORT AC MAINS


2.2.8 Records

Conducted emissions at the mains power port
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-22
Operating Conditions:	ambient temperature: 22 °Celsius power input: 115 V / 60 Hz
LISN:	Schwarzbeck NSLK 8127 RC N
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Applied to Port:	AC Mains
Note 1:	

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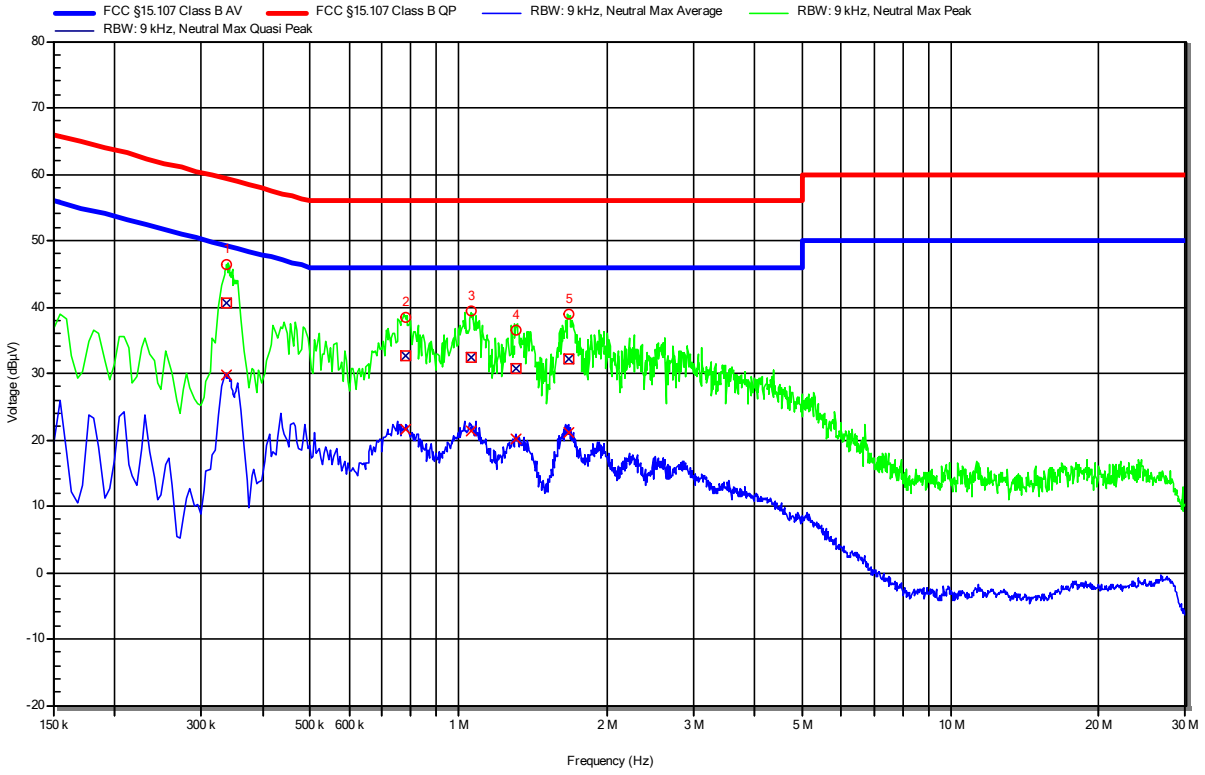
RadiMation



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	LISN
1	337.65 kHz	40.59 dBµV	59.26 dBµV	-18.67 dB	Pass	Neutral
2	780 kHz	32.54 dBµV	56 dBµV	-23.46 dB	Pass	Neutral
3	1.063 MHz	32.52 dBµV	56 dBµV	-23.48 dB	Pass	Neutral
4	1.311 MHz	30.74 dBµV	56 dBµV	-25.26 dB	Pass	Neutral
5	1.675 MHz	32.26 dBµV	56 dBµV	-23.74 dB	Pass	Neutral

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	LISN
1	337.65 kHz	29.66 dBµV	49.26 dBµV	-19.6 dB	Pass	Neutral
2	780 kHz	21.49 dBµV	46 dBµV	-24.51 dB	Pass	Neutral
3	1.063 MHz	21.34 dBµV	46 dBµV	-24.66 dB	Pass	Neutral
4	1.311 MHz	20.15 dBµV	46 dBµV	-25.85 dB	Pass	Neutral
5	1.675 MHz	21.15 dBµV	46 dBµV	-24.85 dB	Pass	Neutral

Conducted emissions at the mains power port
according to FCC part 15B

Project Number:	G0M-2012-9520
Applicant:	Tharsus Group Ltd
Model Description:	RF Proximity Module
Model:	Bump
Test Sample ID:	32623
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Liebich
Test Date:	2021-02-22
Operating Conditions:	ambient temperature: 22 °Celsius power input: 115 V / 60 Hz
LISN:	Schwarzbeck NSLK 8127 RC L
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Applied to Port:	AC Mains
Note 1:	

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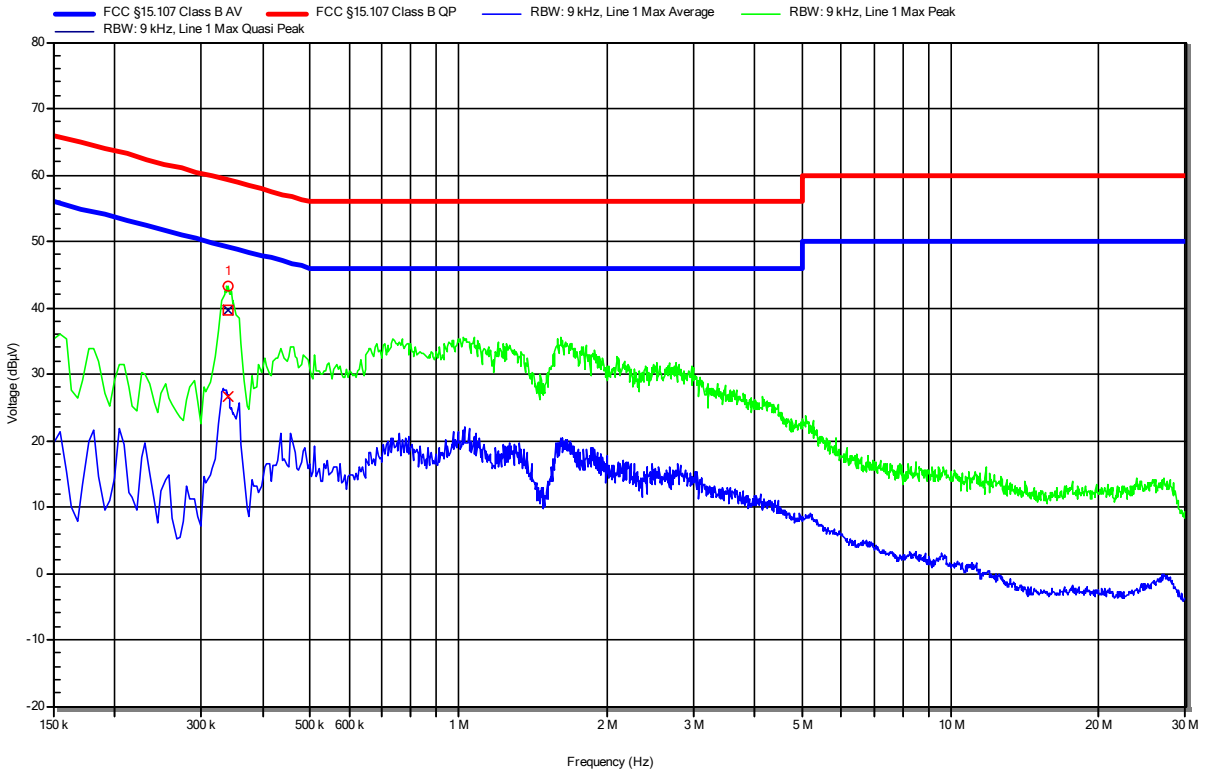
RadiMation



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	LISN
1	340.35 kHz	39.67 dBµV	59.19 dBµV	-19.53 dB	Pass	Line 1

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	LISN
1	340.35 kHz	26.62 dBµV	49.19 dBµV	-22.58 dB	Pass	Line 1