EMC TEST REPORT

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

Report Reference No	G0M-1909-8466-EF0115B-V01
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	Motogadget GmbH
Address	Köpenicker Str. 145 10997 Berlin GERMANY
Test Specification	
Standard	47 CFR Part 15 Subpart B ISED ICES-003 Issue 6 ANSI C63.4:2014
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	vehicle data gateway - motogadget instrument
Model(s)	4005000
Additional Model(s)	None
Brand Name(s)	mo.hub
Hardware Version(s)	rev2
Software Version(s)	650
FCC-ID	2AIF8-4005000
IC	21495-4005000
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	2019-10-29	
Report:		
Compiled by	Matthias Handrik	
Tested by (+ signature) (Responsible for Test)	Matthias Handrik	.....
Approved by (+ signature) (Deputy Head of Lab)	Jens Marquardt	.....
Date of Issue	2019-11-25	
Total number of pages	27	
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:		

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	2019-11-25	Initial Release	

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1 Equipment (Test Item) Under Test

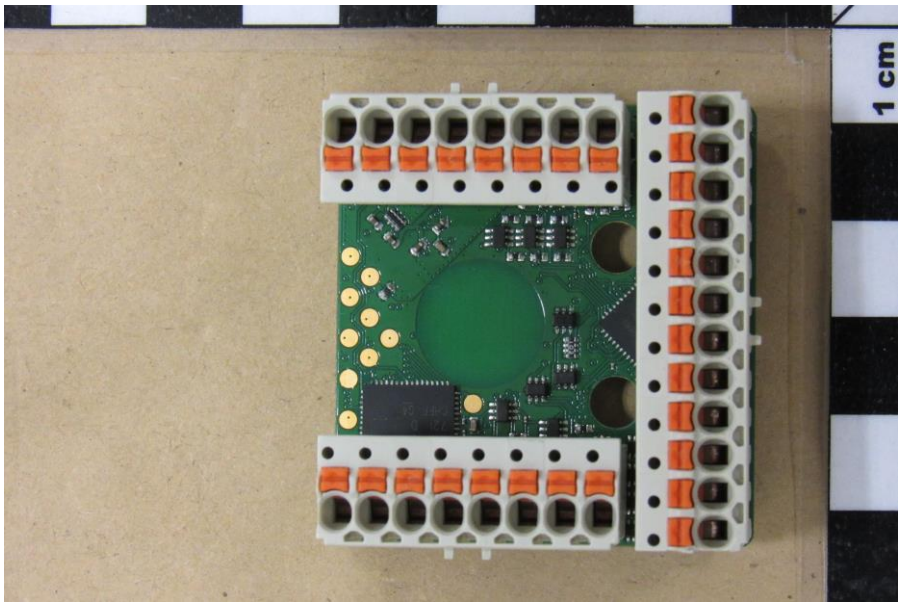
Description	vehicle data gateway - motogadget instrument	
Model	4005000	
Additional Model(s)	None	
Brand Name(s)	mo.hub	
Serial Number(s)	101822	
Hardware Version(s)	rev2	
Software Version(s)	650	
FCC-ID	2AIF8-4005000	
IC	21495-4005000	
Class	Class B	
Equipment type	Table top	
Highest internal frequency [MHz]	2480	
Radio Module	Type	Bluetooth Low Energy module
	Model	CC2564
	Manufacturer	TI
	FCC-ID	Unspecified
	IC	Unspecified
Supply Voltage	V_{NOM}	12 VDC
AC/DC-Adaptor	None	
Manufacturer	Motogadget GmbH Köpenicker Str. 145 10997 Berlin GERMANY	

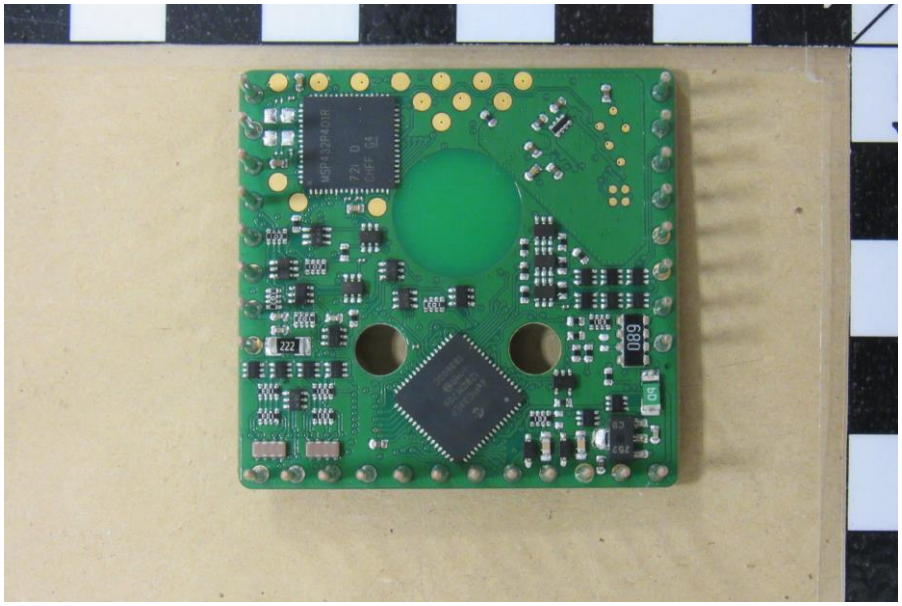
1.1 Equipment Ports

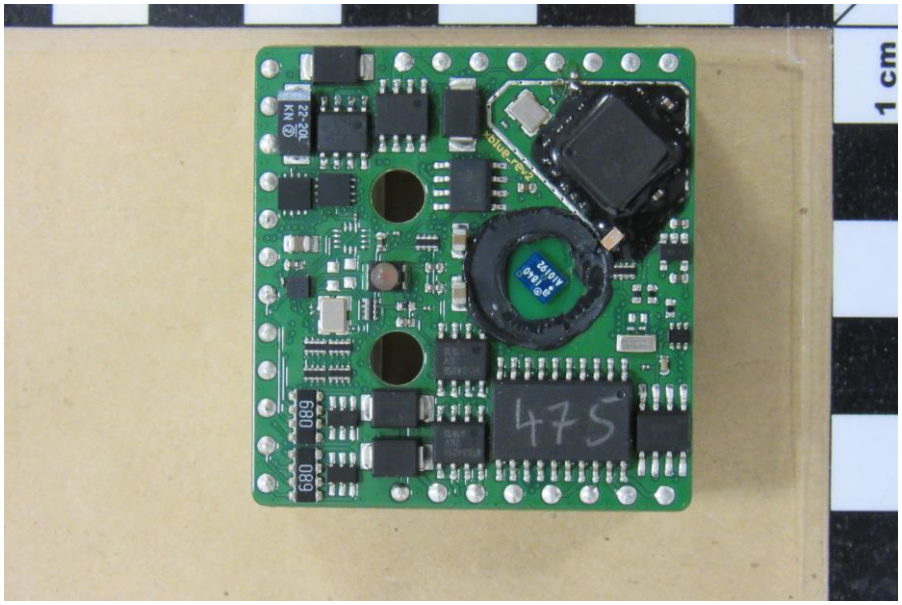
Name	Type	Attributes	Comment
Harness	DC; IO	Count: 1 Direction: In Service only: No	

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

EUT top


EUT PCB top


EUT PCB bottom


1.3 Equipment Photos - External

EUT TOP

EUT BOTTOM

EUT LEFT

EUT RIGHT

1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Smartphone	LGE	Nexus 5X	OPM7.181205.001
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
MON	Monitoring Equipment			
CBL	Connecting Cable			
Comment:				

1.5 Operational Modes

Mode #	Description
1	Device is supplyed with 12V. Ignition and turn signal inputs are high (12V). Output of turn light controlled is blinking (connected LED). Bluetooth Low Energy connection to Smartphone (BLE Scanner App NORDIC Semiconducter)
Comment:	

1.6 EUT Configuration

Configuration #	Description
1	EUT powered via laboratory power supply.
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, 8, 6.1	Radiated emissions	ANSI C63.4:2014	PASS	
FCC 15.107 ICES-003, 8, 6.2	AC power line conducted emissions	ANSI C63.4:2014	N/R	
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

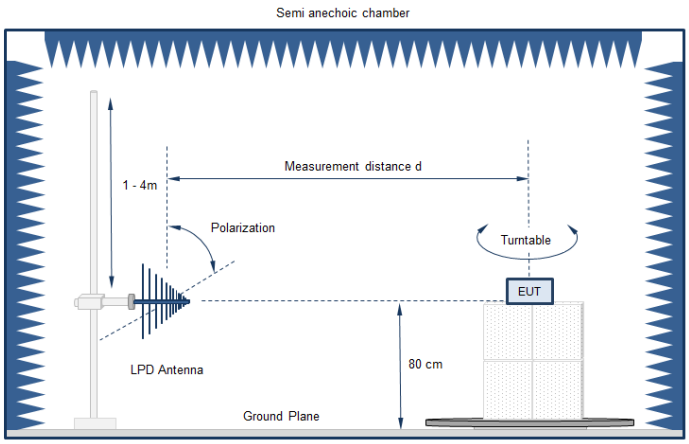
2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

2.1.1 Information

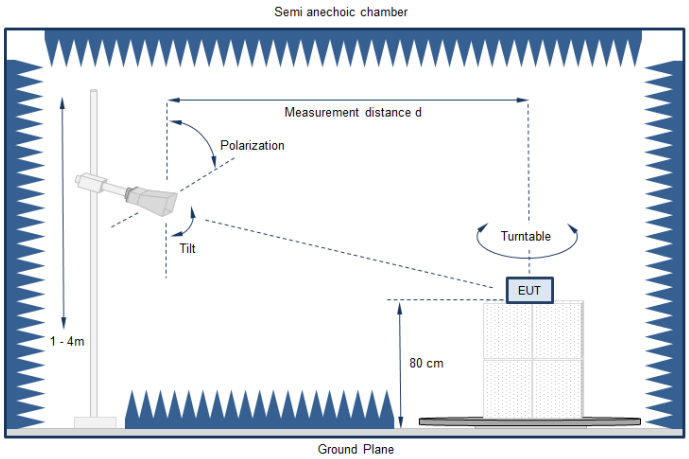
Test Information	
Reference	FCC 15.109, ICES-003, 8, 6.1
Reference method	ANSI C63.4:2014 Section 8
Equipment class	Class B
Equipment type	Table top
Highest internal frequency [MHz]	2480
Measurement range	30 MHz to 12400 MHz
Temperature [°C]	23
Humidity [%]	38
Operator	Matthias Handrik
Date	2019-11-05

2.1.2 Setup

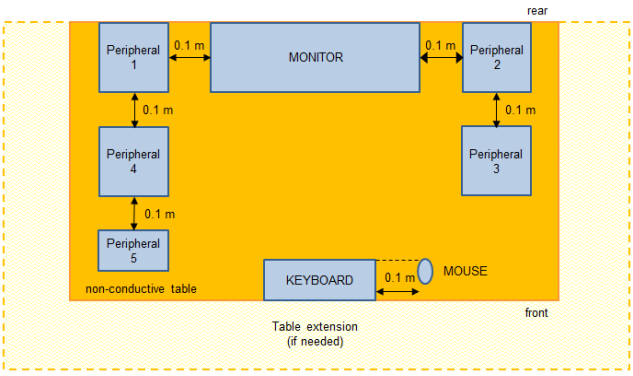
Measurement up to 1 GHz



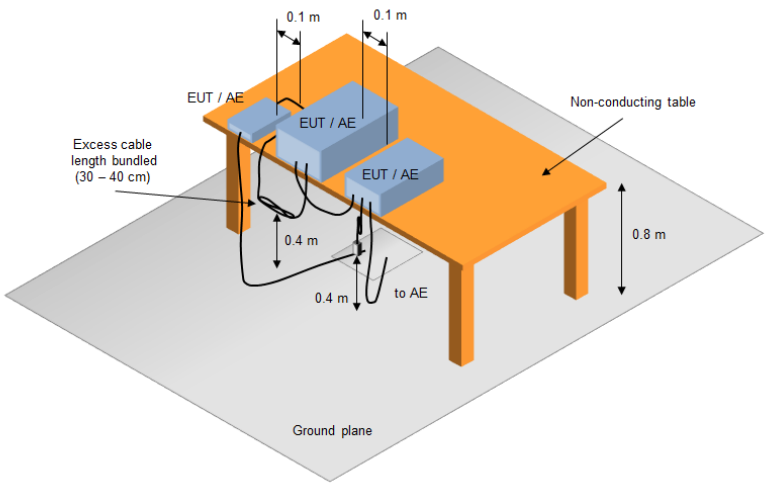
Measurement above 1 GHz



Equipment placement - Table top



Test Setup



2.1.3 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	Radimation	2016.1.10

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	2019-09	2020-09
Biconical Antenna	R&S	HK 116	EF00030	2019-04	2022-04
LPD Antenna	R&S	HL 223	EF00187	2019-05	2022-05
Horn Antenna	ETS-Lindgren	3117	EF01256	2019-09	2022-09
Climatic Sensor	Embedded Data Systems, LLC.	280010000025417E	EF01054	2019-05	2020-05

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

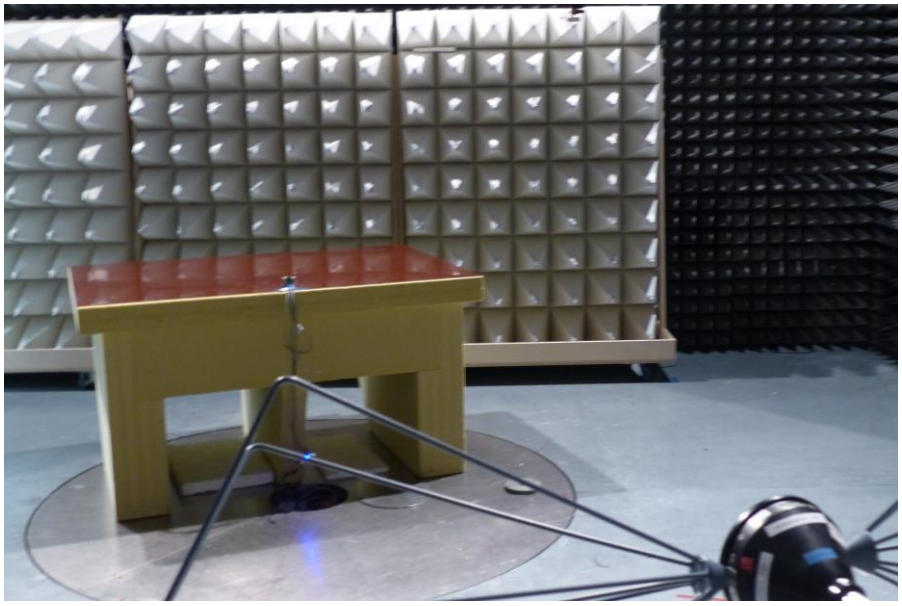
Class B @ 3 m		
Frequency [MHz]	Detector	Limit [dBµV/m]
30 - 88	Quasi-peak	40
88 - 216	Quasi-peak	43.5
216 - 960	Quasi-peak	46
960 - 1000	Quasi-peak	54
> 1000	Peak Average	74 54

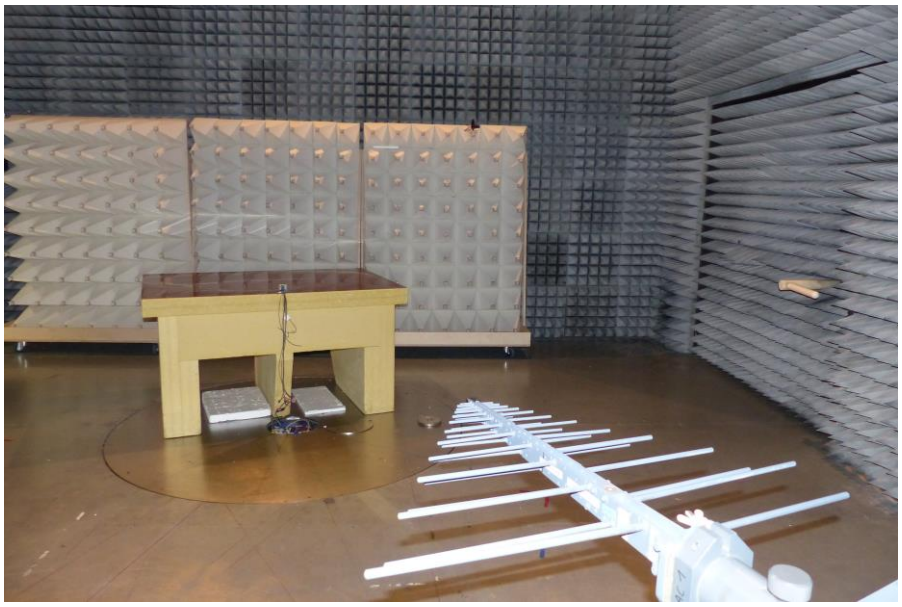
Class A @ 10 m		
Frequency [MHz]	Detector	Limit [dBµV/m]
30 - 88	Quasi-peak	39
88 - 216	Quasi-peak	43.5
216 - 960	Quasi-peak	46.5
960 - 1000	Quasi-peak	49.5
> 1000	Peak Average	69.5 49.5

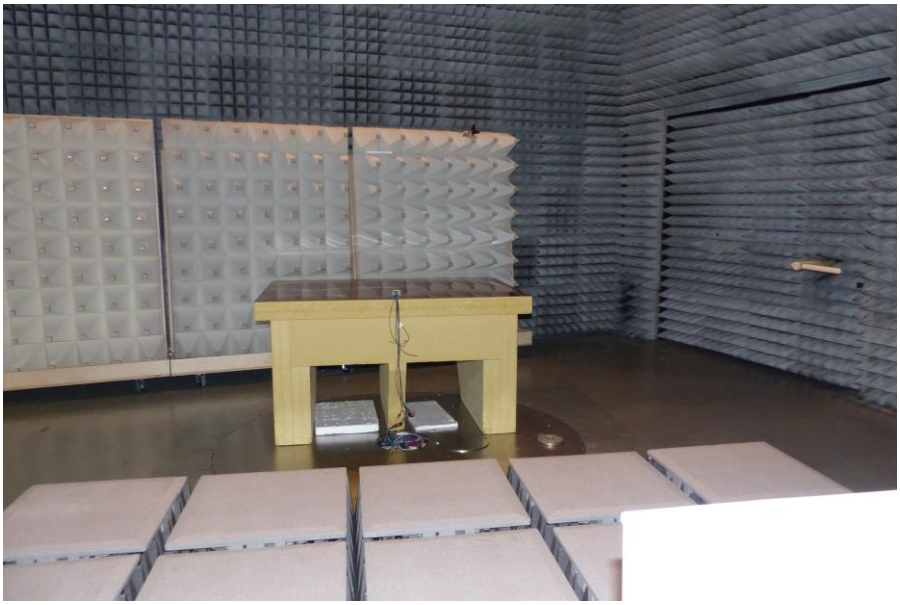
2.1.6 Results

Test Results			
Operational mode	EUT Configuration	Verdict	Remark
1	1	PASS	

2.1.7 Setup Photos

Test setup 30-200 MHz


Test setup 200-1000 MHz


Test setup 1-13 GHz


2.1.8 Records

Radiated emissions according to FCC Part 15b

Project number: G0M-1909-8466

Applicant:	Motogadget GmbH
EUT Name:	vehicle data gateway - motogadget instrument
Model:	4005000
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Unom: 12V DC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	mode#1
Test Date:	2019-11-05
Note:	

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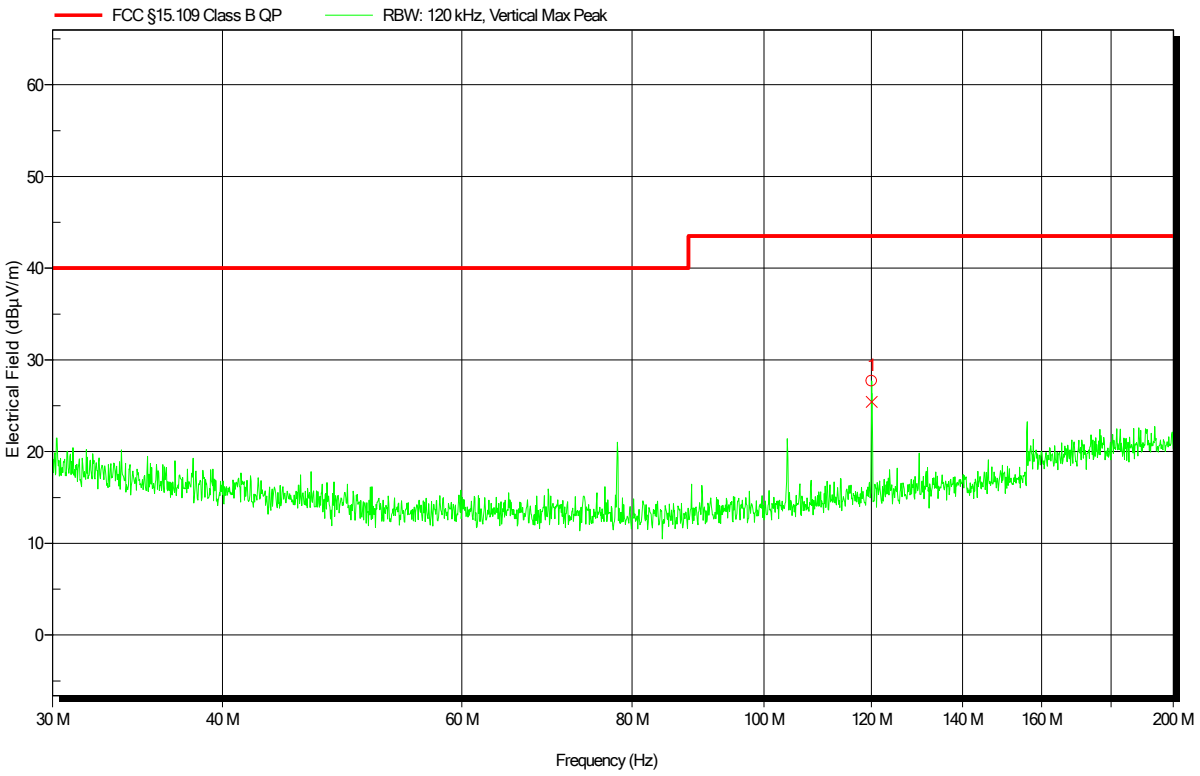

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	120.008 MHz	25.44 dBµV/m	43.52 dBµV/m	-18.08 dB	Pass	18 Degree	1 m

Radiated emissions according to FCC Part 15b

Project number: G0M-1909-8466

Applicant:	Motogadget GmbH
EUT Name:	vehicle data gateway - motogadget instrument
Model:	4005000
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Unom: 12V DC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	mode#1
Test Date:	2019-11-05
Note:	

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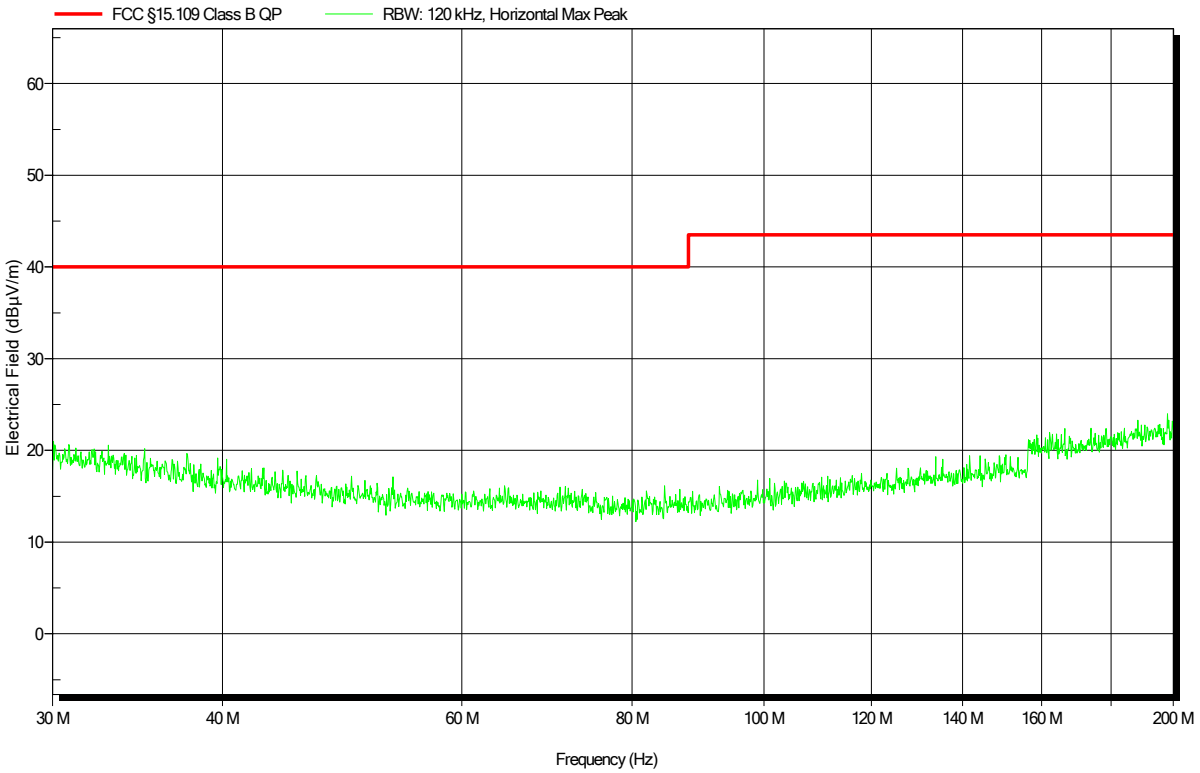

Radiated emissions according to FCC Part 15b

Project number: G0M-1909-8466

Applicant:	Motogadget GmbH
EUT Name:	vehicle data gateway - motogadget instrument
Model:	4005000
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Unom: 12V DC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3m
Mode:	mode#1
Test Date:	2019-11-05
Note:	

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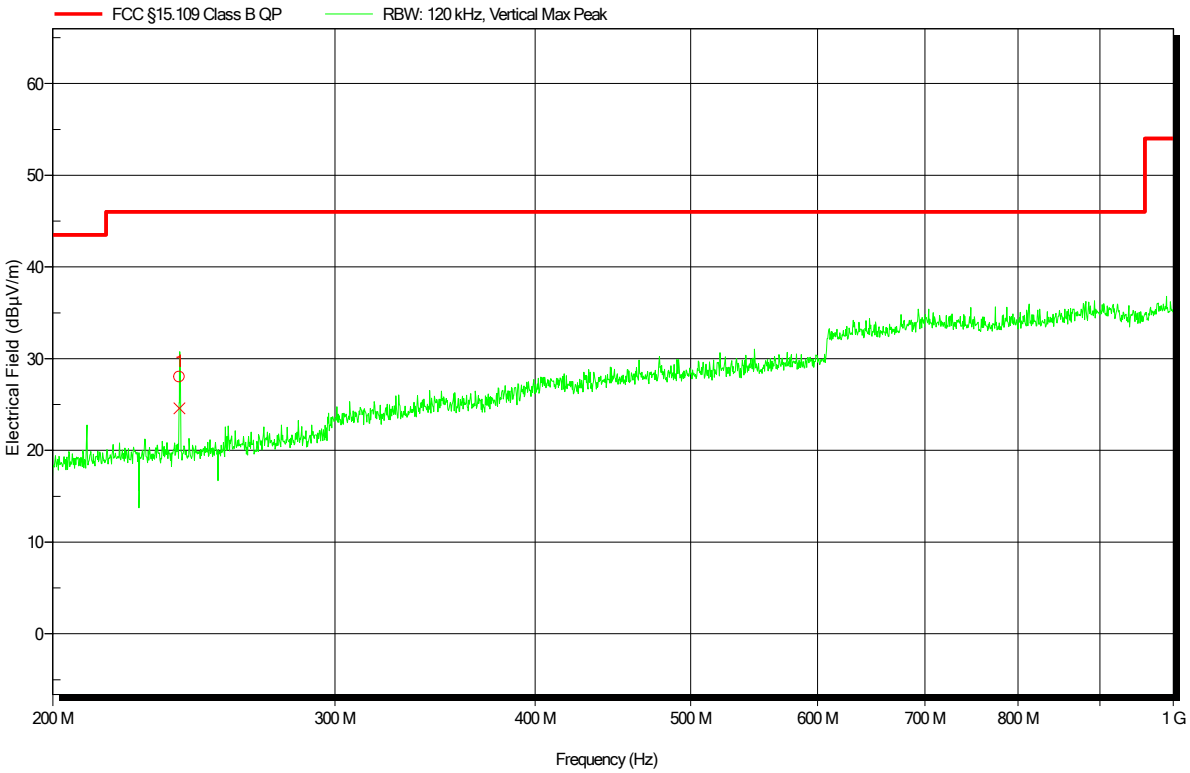

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	240.031 MHz	24.58 dBµV/m	46.02 dBµV/m	-21.44 dB	Pass	-126 Degree	1 m

Radiated emissions according to FCC Part 15b

Project number: G0M-1909-8466

Applicant:	Motogadget GmbH
EUT Name:	vehicle data gateway - motogadget instrument
Model:	4005000
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Unom: 12V DC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	mode#1
Test Date:	2019-11-05
Note:	

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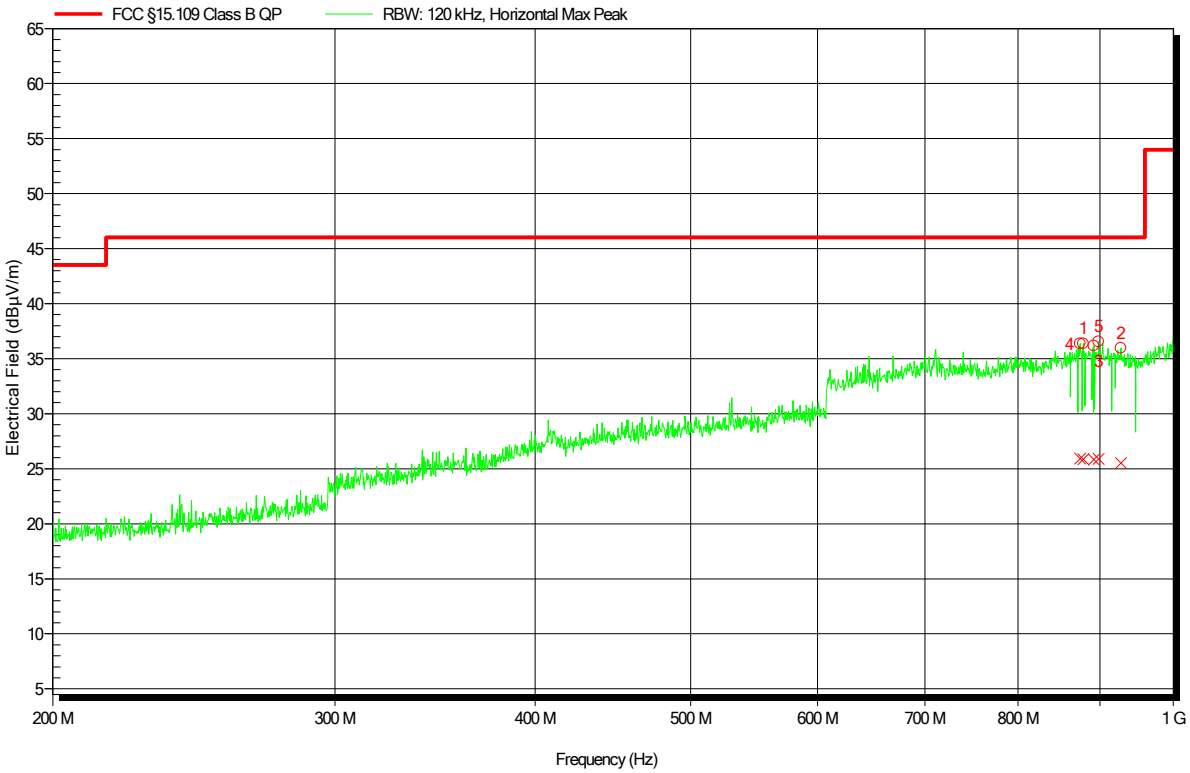

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	878.616 MHz	25.87 dBµV/m	46.02 dBµV/m	-20.15 dB	Pass	-153 Degree	1.1 m
2	927.323 MHz	25.5 dBµV/m	46.02 dBµV/m	-20.52 dB	Pass	-90 Degree	1.1 m
3	891.93 MHz	25.85 dBµV/m	46.02 dBµV/m	-20.17 dB	Pass	-27 Degree	1.1 m
4	874.723 MHz	25.92 dBµV/m	46.02 dBµV/m	-20.1 dB	Pass	63 Degree	2.25 m
5	898.284 MHz	25.89 dBµV/m	46.02 dBµV/m	-20.13 dB	Pass	90 Degree	2.1 m

Radiated emissions according to FCC Part 15b

Project number: G0M-1909-8466

Applicant:	Motogadget GmbH
EUT Name:	vehicle data gateway - motogadget instrument
Model:	4005000
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Unom: 12V DC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	mode#1
Test Date:	2019-11-05
Note:	

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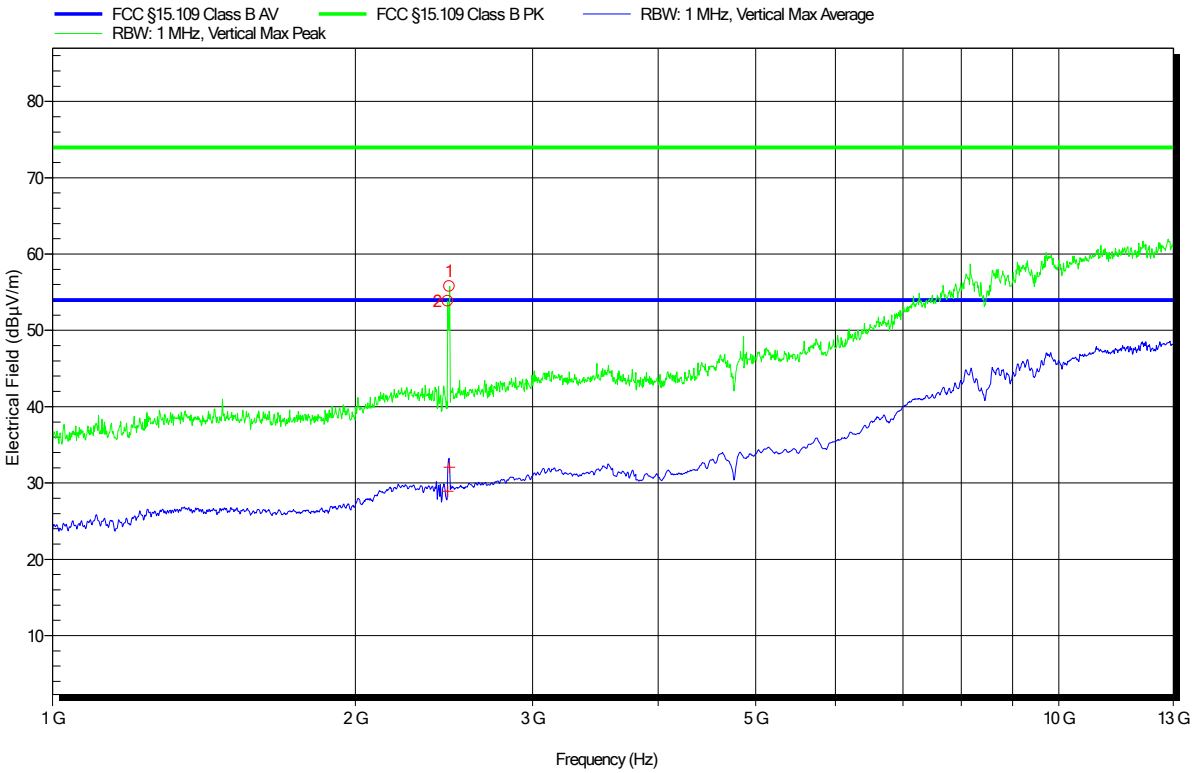

Peak Number	Frequency	Peak	Angle	Height
1	2.48 GHz	Bluetooth carrier		
2	2.471 GHz			

Radiated emissions according to FCC Part 15b

Project number: G0M-1909-8466

Applicant:	Motogadget GmbH
EUT Name:	vehicle data gateway - motogadget instrument
Model:	4005000
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Unom: 12V DC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3m
Mode:	mode#1
Test Date:	2019-11-05
Note:	

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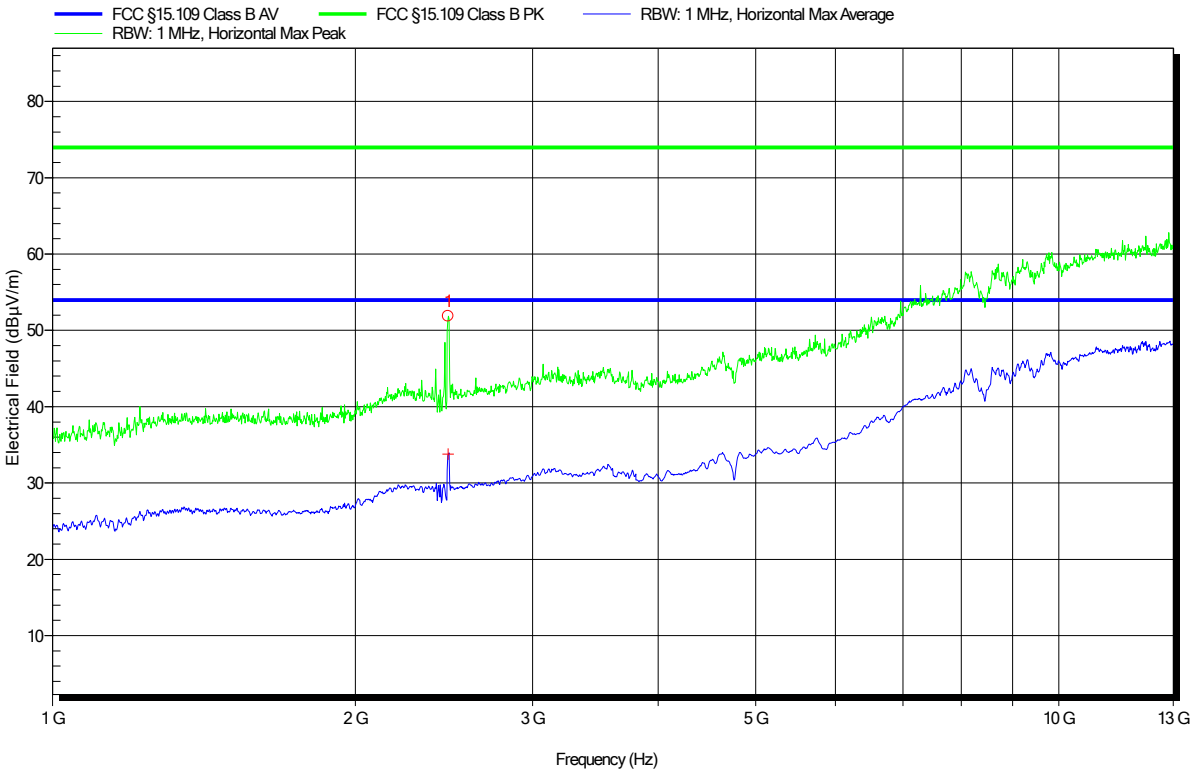

Peak Number	Frequency	Peak	Angle	Height
1	2.473 GHz	Bluetooth carrier		