eurofins | Product Service

# EMC TEST REPORT

**FCC 47 CFR Part 15B**
**Industry Canada ICES-003**

**Electromagnetic compatibility - Unintentional radiators**

| | |
|---|---|
| **Report Reference No**. ..... : | G0M-1605-5591-EF0115B-V01 |
| **Testing Laboratory** ..... : | Eurofins Product Service GmbH |
| Address ..... : | Storkower Str. 38c<br>15526 Reichenwalde<br>Germany |
| Accreditation ..... : |   <br>A2LA Accredited Testing Laboratory, Certificate No.: 1983.01<br>FCC Filed Test Laboratory, Reg.-No.: 96970<br>IC OATS Filing assigned code: 3470A |
| **Applicant's name** ..... : | Motogadget GmbH |
| Address ..... : | Köpenicker Str. 145<br>10997 Berlin<br>GERMANY |
| **Test specification:** | |
| Standard..... : | 47 CFR Part 15 Subpart B<br>ICES-003, Issue 6:2016<br>ANSI C63.4:2014 |
| **Equipment under test (EUT):** | |
| Product description | vehicle body control module |
| Model No. | m.unit_blue |
| Additional Models | None |
| Hardware version | 1.4 |
| Firmware / Software version | 177 / 130 |
| Contains | FCC-ID: 2AIF8-4002040 IC: 21495-4002040 |
| **Test result** | **Passed** |

| | |
|---|---|
| **Possible test case verdicts:** | |
| - not applicable 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 ..... : | 2016-05-13 |
| Date (s) of performance of tests ..... : | 2016-09-09 |
| Compiled by..... : | Matthias Handrik |
| Tested by (+ signature)..... : | Matthias Handrik |
| Approved by (+ signature) ..... : Deputy Head of Lab | Jens Marquardt |
| Date of issue..... : | 2016-09-12 |
| Total number of pages..... : | 19 |

**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.**



**Additional comments:**

# Version History

| Version | Issue Date | Remarks | Revised by |
|---|---|---|---|
| V01 | 2016-09-12 | Initial Release | |



Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

## REPORT INDEX


| | | |
|---|---|---|
| **1** | **EQUIPMENT (TEST ITEM) DESCRIPTION** | **5** |
| 1.1 | Photos – Equipment external | 6 |
| 1.2 | Photos – Equipment internal | 7 |
| 1.3 | Photos – Test setup | 8 |
| 1.4 | Supporting Equipment Used During Testing | 9 |
| 1.5 | Input / Output Ports | 9 |
| 1.6 | Operating Modes and Configurations | 10 |
| 1.7 | Test Equipment Used During Testing | 11 |
| 1.8 | Sample emission level calculation | 12 |
| **2** | **RESULT SUMMARY** | **13** |
| **3** | **TEST CONDITIONS AND RESULTS** | **14** |
| 3.1 | Test Conditions and Results – Radiated emissions | 14 |

# 1 Equipment (Test item) Description

| | |
|---|---|
| **Description** | vehicle body control module |
| **Model** | m.unit_blue |
| **Additional Models** | None |
| **Serial number** | None |
| **Hardware version** | 1.4 |
| **Software / Firmware version** | 177 / 130 |
| **Contains FCC-ID** | 2AIF8-4002040 |
| **Contains IC** | 21495-4002040 |
| **Power supply** | 12 VDC |
| **AC/DC-Adaptor** | None |
| **Manufacturer** | Motogadget GmbH<br>Köpenicker Str. 145<br>10997 Berlin<br>GERMANY |
| **Highest emission frequency** | > 1000 MHz (up to 5th Harm) |
| **Device classification** | Class B |
| **Equipment type** | Tabletop |
| **Number of tested samples** | 1 |

### 1.4 Supporting Equipment Used During Testing

| Product Type* | Device | Manufacturer | Model No. | Comments (e.g. serial no.) |
|---|---|---|---|---|
| None | | | | |

***Note:** Use the following abbreviations:

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

### 1.5 Input / Output Ports

| Port # | Name | Type* | Max. Cable Length | Cable Shielded | Comments (e.g. Cat. of Cable) |
|---|---|---|---|---|---|
| 1 | Harness | DC / I/O | 1.7m | - | - |

***Note:** Use the following abbreviations:

AC : AC power port

DC : DC power port

N/E : Non electrical

I/O : Signal input or output port

TP : Telecommunication port

### 1.6 Operating Modes and Configurations

| Mode # | Description |
|---|---|
| 1 | Bluetooth Low Energy transmit continuously on lowest channel |

| Configuration # | EUT Configuration |
|---|---|
| Bluetooth Low Energy | EUT is powered up, via Laptop set the EUT in the test mode for Bluetooth Low Energy to transmit continuously on lowest channel. |

### 1.7 Test Equipment Used During Testing

| Measurement Software | | | |
|---|---|---|---|
| Description | Manufacturer | Name | Version |
| EMC Test Software | Dare Instruments | Radimation | 2015.1.12 |

| Radiated emissions – 10m Chamber | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal. Date | Cal. Due |
| Biconical Antenna | R&S | HK 116 | EF00012 | 2016-05 | 2019-05 |
| LPD-Antenne | R&S | HL 223 | EF00187 | 2016-05 | 2019-05 |
| Horn antenna | Schwarzbeck | BBHA 9120D | EF00018 | 2013-09 | 2016-09 |
| EMI Test Receiver | R&S | ESU26 | EF00887 | 2016-01 | 2017-01 |
| RF Cable | Huber & Suhner | Sucoflex 106 | - | System Cal. | System Cal |
| RF Cable | Huber & Suhner | Multiflex 141 | - | System Cal. | System Cal |

### 1.8 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) = 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 | = | 47.5 dBµV/m | : | 47.5 dBµV/m - 57.0 dBµV/m | = -9.5 dB |

## 2 Result Summary

| FCC 47 CFR Part 15B, Industry Canada ICES-003 | | | | |
|---|---|---|---|---|
| **Product Specific Standard** | **Requirement – Test** | **Reference Method** | **Result** | **Remarks** |
| 47 CFR 15.109<br>ICES-003 Item 6.2 | Radiated emissions | ANSI C 63.4 | PASS | |
| 47 CFR 15.107<br>ICES-003 Item 6.1 | AC power line conducted emissions | ANSI C63.4 | N/A | Only DC powered for vehicular use. |
| **Remarks:** | | | | |

# 3 Test Conditions and Results

## 3.1 Test Conditions and Results – Radiated emissions

| **Radiated emissions acc. FCC 47 CFR 15.109 / ICES-003** | | | | | | **Verdict: PASS** |
|---|---|---|---|---|---|---|
| Laboratory Parameters: | Required prior to the test | | During the test | | | |
| Ambient Temperature | 15 to 35 °C | | 22°C | | | |
| Relative Humidity | 30 to 60 % | | 40% | | | |
| Test according referenced standards | Reference Method | | | | | |
| | ANSI C63.4 | | | | | |
| Sample is tested with respect to the requirements of the equipment class | Equipment class | | | | | |
| | Class B | | | | | |
| Test frequency range determined from highest emission frequency | Highest emission frequency | | | | | |
| | > 1000 MHz (up to 5th Harm) | | | | | |
| Fully configured sample scanned over the following frequency range | Frequency range | | | | | |
| | 30 MHz to 12.5 GHz | | | | | |
| Operating mode | 1 | | | | | |
| Configuration | Bluetooth Low Energy | | | | | |
| **Limits and results Class B** | | | | | | |
| Frequency [MHz] | Quasi-Peak [dBµV/m] | Result | Average [dBµV/m] | Result | Peak [dBµV/m] | Result |
| 30 – 88 | 40 | PASS | - | | - | - |
| 88 – 216 | 43.5 | PASS | - | | - | - |
| 216 – 960 | 46 | PASS | - | | - | - |
| 960 – 1000 | 54 | PASS | - | | - | - |
| > 1000 | - | - | 54 | PASS | 74 | PASS |
| Comments: | | | | | | |

**Test Procedure:**

The test site is in accordance with ANSI C63-4:2014 requirements and is listed by FCC.
The measurement procedure is as follows:

Exploratory measurement:

- The EUT was placed on a non-conductive table at a height of 0.8m.
- The EUT and support equipment, if needed, were set up to simulate typical usage.
- 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.
- The antenna was placed at a distance of 3 or 10 m.
- The received signal was monitored at the measurement receiver.
    - Cables not bundled were manipulated within the range of likely arrangements to produce the highest emission amplitude
    - To maximize the suspected emissions the EUT is rotated 360 degrees. If the signal exceeds the previous amplitude, go back to the corresponding azimuth and manipulate the cables again for maximizing the emissions if possible.
    - Move the antenna from 1 to 4m to maximize the suspected highest amplitude signal.
- This procedure has to be performed in both antenna polarizations, horizontal and vertical.
- The arrangement of the equipment with the maximum emission level is shown on the setup picture at item 1.3.

Final measurement:

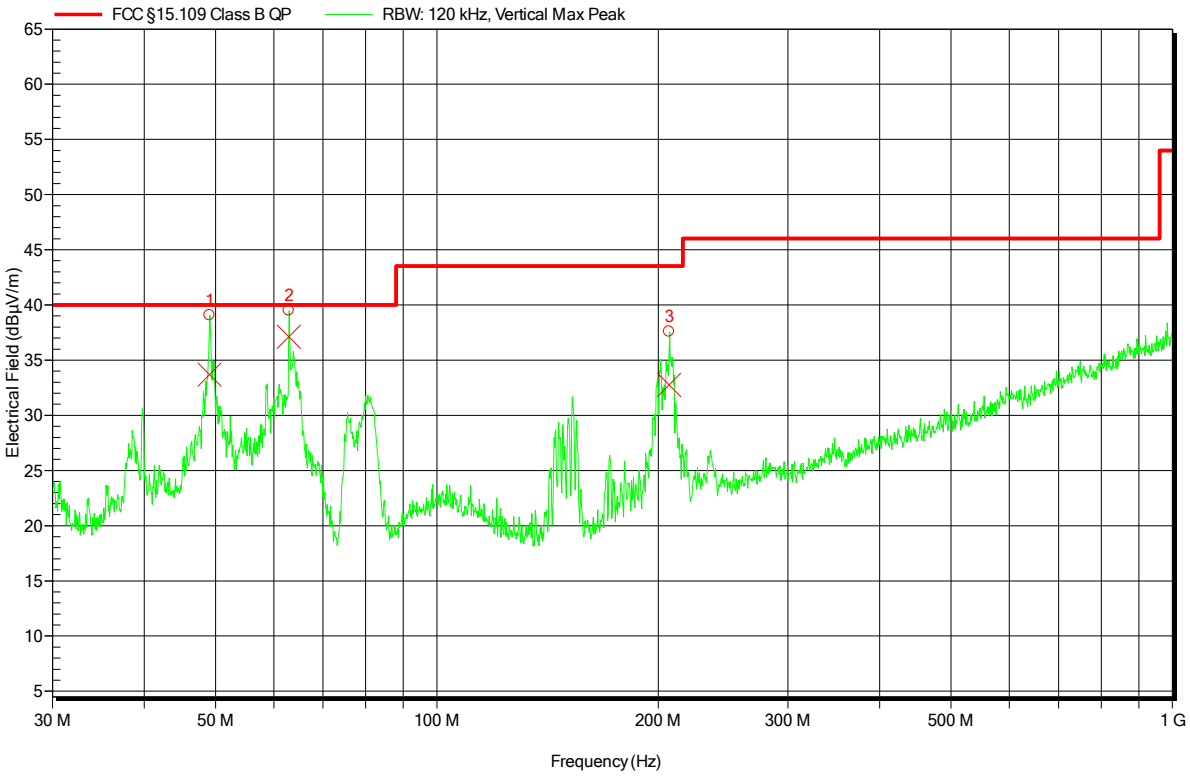
- The EUT was placed on a 0.8 m non-conductive table at a 3 or 10 m distance from the receive antenna. The antenna output was connected to the measurement receiver
- A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 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
- The EUT and cable arrangement were based on the exploratory measurement results
- Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.
- The test data of the worst-case conditions were recorded and shown on the next pages.

**Spurious emissions under normal conditions according to FCC 15B**

Project number: G0M-1605-5591

| | |
|---|---|
| Applicant: | Motogadget GmbH |
| EUT Name: | vehicle body control module |
| Model: | m.unit_blue |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Handrik |
| Test Conditions: | Tnom: 20°C, Unom: 12 VDC |
| Antenna: | Schwarzbeck VULB 9162, Vertical |
| Measurement distance: | 10 m converted to 3m |
| Mode: | Bluetooth Low Energy test mode: continuous TX: 2402 MHz |
| Test Date: | 2016-09-09 |
| Note: | |

Index 1



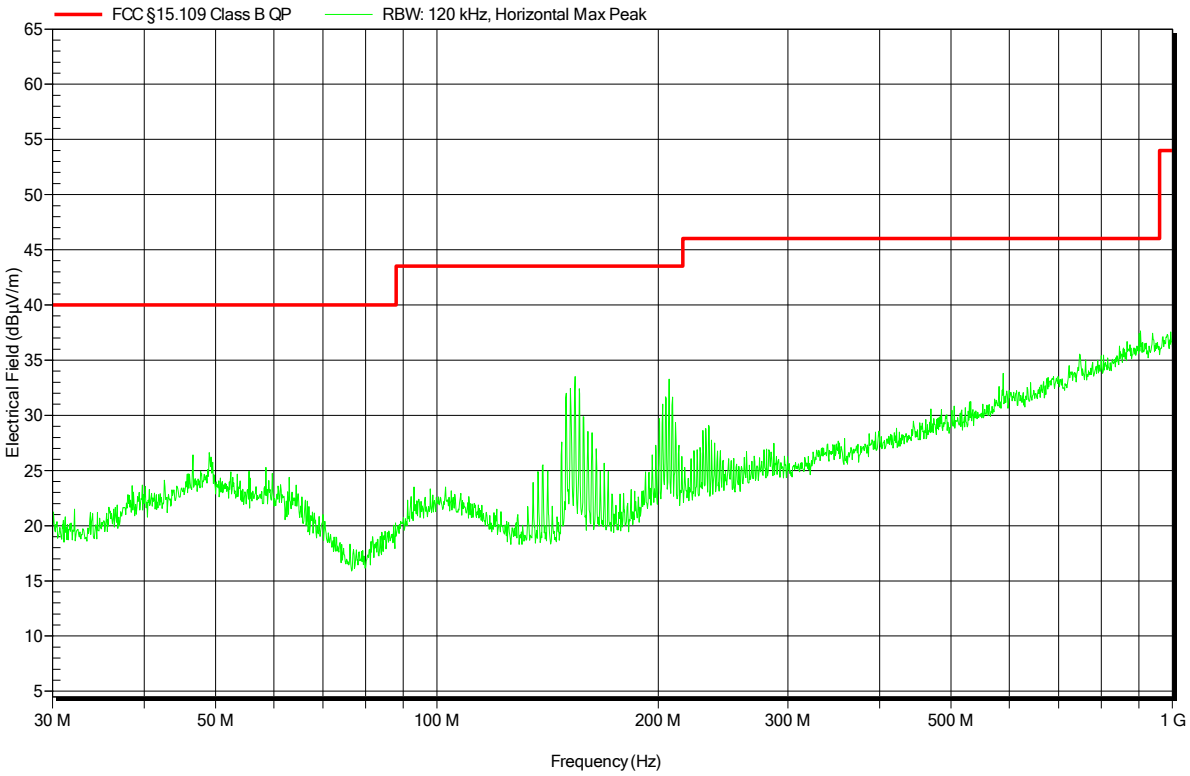

| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|---|---|---|---|---|---|---|---|
| 1 | 49.08 MHz | 33.7 dBµV/m | 40 dBµV/m | -6.3 dB | Pass | 0 Degree | 1 m |
| 2 | 62.916 MHz | 37.1 dBµV/m | 40 dBµV/m | -2.9 dB | Pass | 0 Degree | 1 m |
| 3 | 206.94 MHz | 32.7 dBµV/m | 43.5 dBµV/m | -10.8 dB | Pass | 0 Degree | 1 m |

**Spurious emissions under normal conditions according to FCC 15B**

Project number: G0M-1605-5591

| | |
|---|---|
| Applicant: | Motogadget GmbH |
| EUT Name: | vehicle body control module |
| Model: | m.unit_blue |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Handrik |
| Test Conditions: | Tnom: 20°C, Unom: 12 VDC |
| Antenna: | Schwarzbeck VULB 9162, Horizontal |
| Measurement distance: | 10m converted to 3 m |
| Mode: | Bluetooth Low Energy test mode: continuous TX: 2402 MHz |
| Test Date: | 2016-09-09 |
| Note: | |

Index 3

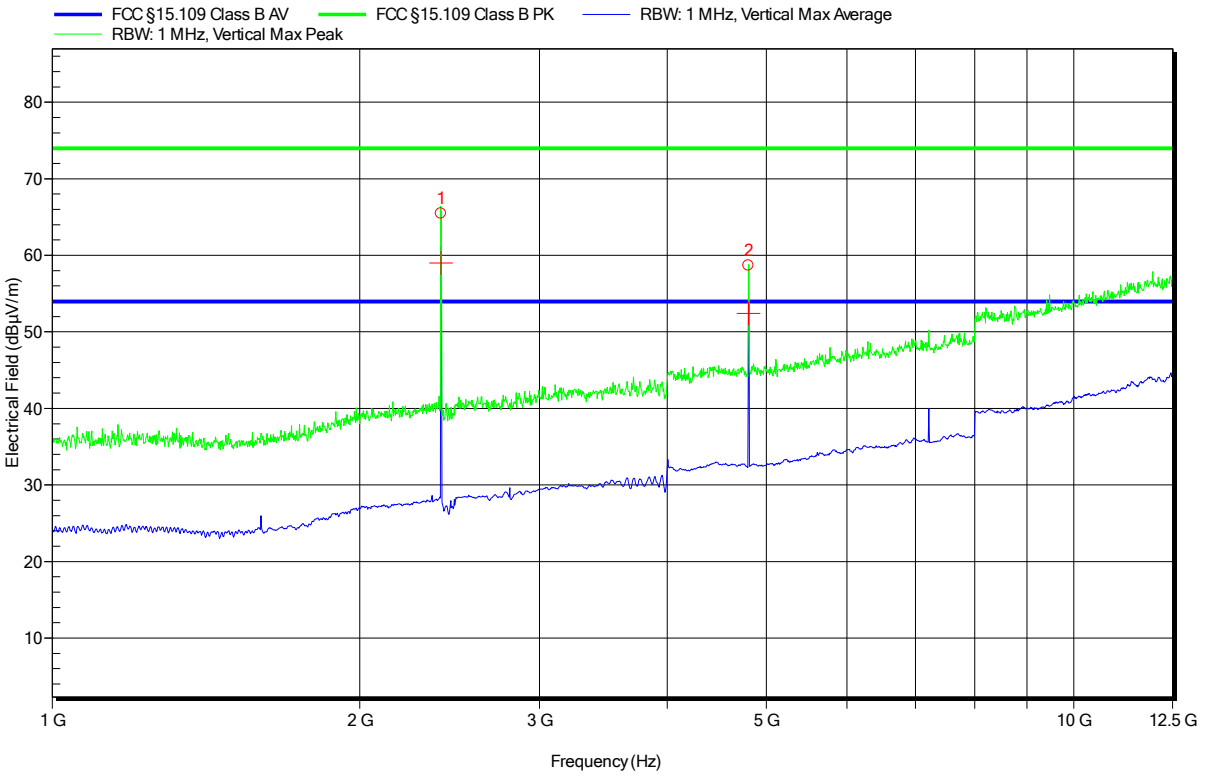


**Spurious emissions under normal conditions according to FCC 15B**

Project number: G0M-1605-5591

| | |
|---|---|
| Applicant: | Motogadget GmbH |
| EUT Name: | vehicle body control module |
| Model: | m.unit_blue |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Handrik |
| Test Conditions: | Tnom: 20°C, Unom: 12 VDC |
| Antenna: | ETS-Lindgren 3117, Vertical |
| Measurement distance: | 3 m |
| Mode: | Bluetooth Low Energy test mode: continuous TX: 2402 MHz |
| Test Date: | 2016-09-09 |
| Note: | |

Index 13



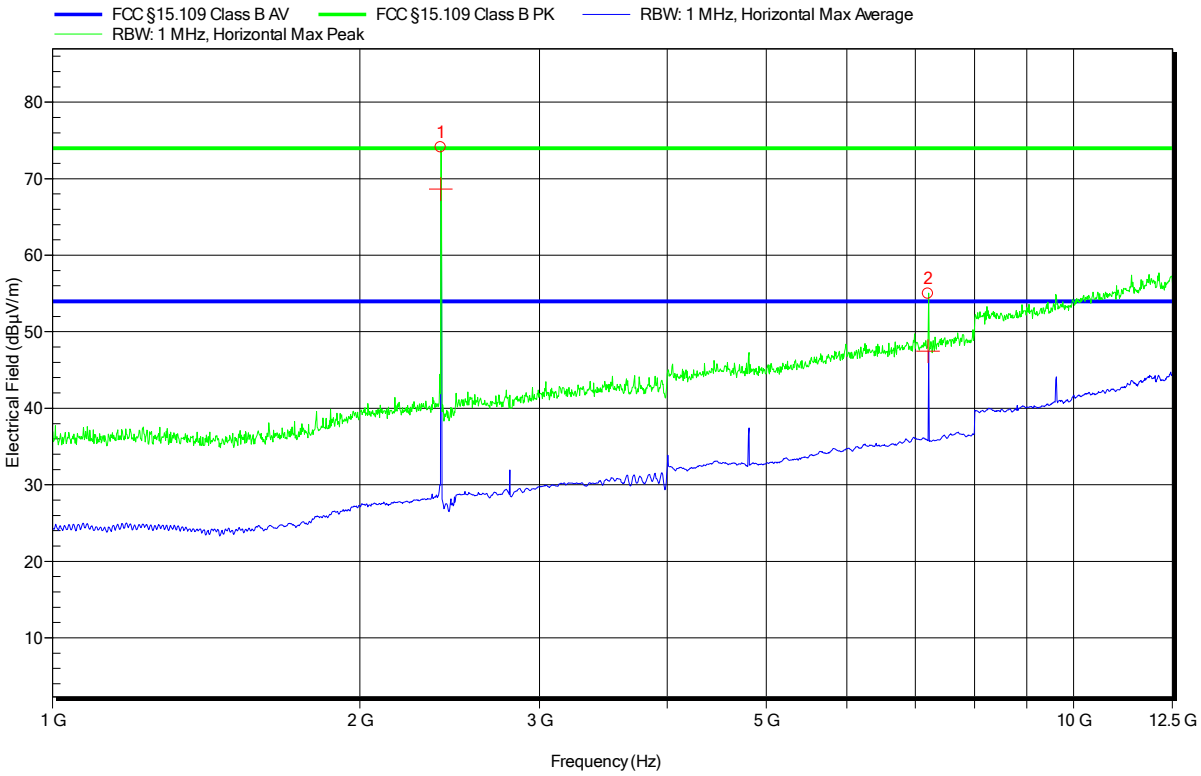

| Peak Number | Frequency | |
|---|---|---|
| 1 | 2.402 GHz | 1th harmonic |
| 2 | 4.805 GHz | 2th harmonic |

**Spurious emissions under normal conditions according to FCC 15B**

Project number: G0M-1605-5591

| | |
|---|---|
| Applicant: | Motogadget GmbH |
| EUT Name: | vehicle body control module |
| Model: | m.unit_blue |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Handrik |
| Test Conditions: | Tnom: 20°C, Unom: 12 VDC |
| Antenna: | ETS-Lindgren 3117, Horizontal |
| Measurement distance: | 3 m |
| Mode: | Bluetooth Low Energy test mode: continuous TX: 2402 MHz |
| Test Date: | 2016-09-09 |
| Note: | |

Index 14




| Peak Number | Frequency | |
|---|---|---|
| 1 | 2.402 GHz | 1th harmonic |
| 2 | 7.206 GHz | 3th harmonic |