eurofins | Product Service

# EMC TEST REPORT

**FCC 47 CFR Part 15B**
**Electromagnetic compatibility - Unintentional radiators**

| | |
|---|---|
| **Report Reference No**. ..... : | G0M-1312-3474-FCC15B-01-V02 |
| **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** ..... : | Atmel Automotive GmbH |
| Address ..... : | Koenigsbruecker Str. 61<br>01099 Dresden<br>GERMANY |
| **Test specification:** | |
| Standard..... : | 47 CFR Part 15 Subpart B<br>ANSI C63.4:2009 |
| **Equipment under test (EUT):** | |
| Product description | REB233SMAD Evaluation Kit |
| Model No. | ATREB233SMAD-EK |
| Additional Models | None |
| Hardware version | v1.8.0 |
| Firmware / Software version | v0.6 |
| Contains | FCC-ID: VNR-E33SD-X5B-00 IC: N/A |
| **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 ..... : | 2014-01-06 |
| Date (s) of performance of tests ..... : | 2014-01-13; 2014-02-11 |
| Compiled by..... : | Antje Bartusch |
| Tested by (+ signature)..... : | Andreas Pflug |
| Approved by (+ signature) ..... : | Marcus Klein |
| Date of issue..... : | 2014-02-12 |
| 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.**



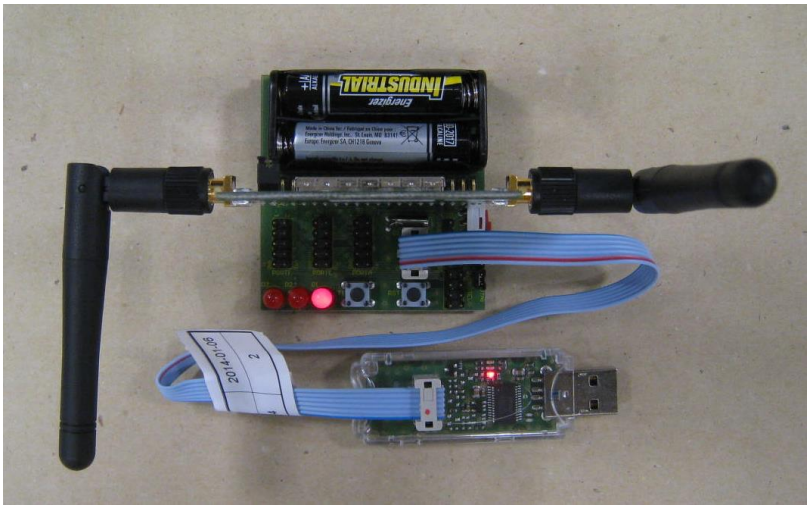
**Additional comments:**

## REPORT INDEX

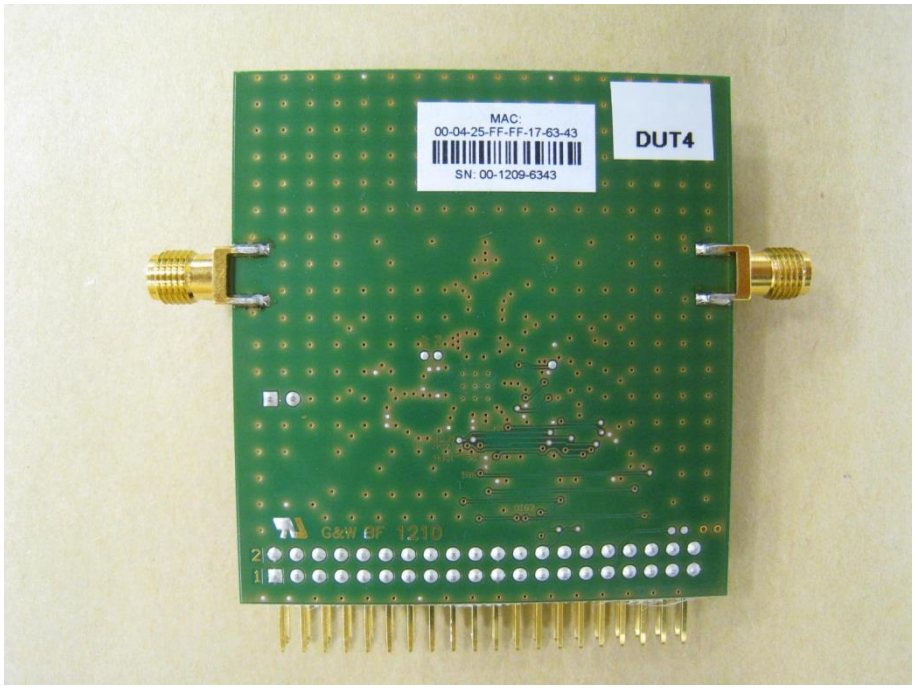
# 1 Equipment (Test item) Description

| | |
|---|---|
| **Description** | REB233SMAD Evaluation Kit |
| **Model** | ATREB233SMAD-EK |
| **Additional Models** | None |
| **Serial number** | None |
| **Hardware version** | v1.8.0 |
| **Software / Firmware version** | v0.6 |
| **Contains FCC-ID** | VNR-E33SD-X5B-00 |
| **Contains IC** | N/A |
| **Power supply** | 3 VDC (battery) |
| **Manufacturer** | dresden elektronik ingenieurtechnik gmbh<br>Enno-Heidebroek-Straße 12<br>01237 Dresden<br>GERMANY |
| **Highest emission frequency** | Fmax [MHz] = 32 |
| **Device classification** | Class B |
| **Equipment type** | Tabletop |
| **Number of tested samples** | 1 |

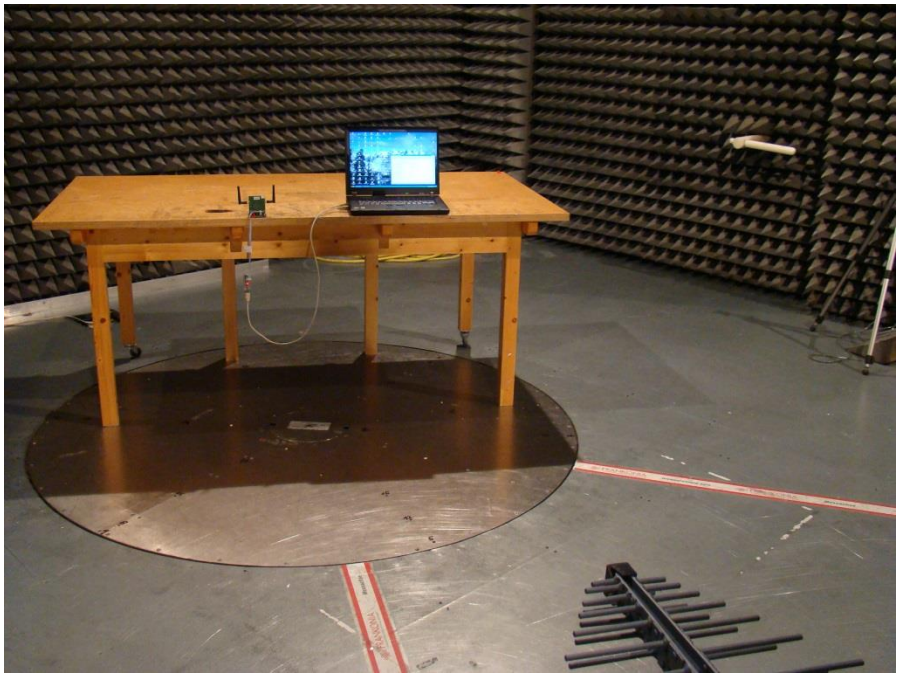
## 1.1 Photos – Equipment external




## 1.2 Photos – Equipment internal

## 1.3 Photos – Test setup

| Test Setup : Radiated Emissions |
| --- |
|  |

### 1.4 Supporting Equipment Used During Testing

| Product Type* | Device | Manufacturer | Model No. | Comments |
|---|---|---|---|---|
| AE | USB level shifter | dresden elektronik | BN-031648 | |

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

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

### 1.5 Operating Modes

| Mode # | Description |
|---|---|
| 1 | Modulation: DCSS |
| 2 | Modulation: OQPSK |

### 1.6 Test Equipment Used During Testing

| Radiated emissions | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal. Date | Cal. Due |
| Biconical Antenna | R&S | HK 116 | EF00012 | 2013-02 | 2016-02 |
| LPD-Antenne | R&S | HL 223 | EF00187 | 2011-02 | 2014-02 |
| LPD-Antenna | R&S | HL 025 | EF00327 | 2013-02 | 2016-02 |
| EMI Test Receiver | R&S | ESU8 | EF00379 | 2013-03 | 2014-03 |
| EMI Test Receiver | R&S | ESCS30 | EF00295 | 2013-10 | 2014-10 |

### 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) = 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 RSS-Gen | | | | |
|---|---|---|---|---|
| **Product Specific Standard** | **Requirement – Test** | **Reference Method** | **Result** | **Remarks** |
| 47 CFR 15.109<br>RSS-Gen 4.9 & 4.10 | Radiated emissions | ANSI C 63.4 | PASS | |
| 47 CFR 15.107<br>RSS-Gen 7.2.4 | AC power line conducted emissions | ANSI C63.4 | PASS | |
| **Remarks:** | | | | |

# 3 Test Conditions and Results

## 3.1 Test Conditions and Results – Radiated emissions

| **Radiated emissions acc. FCC 47 CFR 15.109 / IC RSS-Gen** | | **Verdict: PASS** |
|---|---|---|
| Laboratory Parameters: | Required prior to the test | During the test |
| Ambient Temperature | 15 to 35 °C | 23°C |
| Relative Humidity | 30 to 60 % | 30% |
| 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 | |
| | Fmax [MHz] = 32 | |
| Fully configured sample scanned over the following frequency range | Frequency range | |
| | 30 MHz to 1 GHz | |
| Operating mode | 1 + 2 | |

**Limits and results Class B**

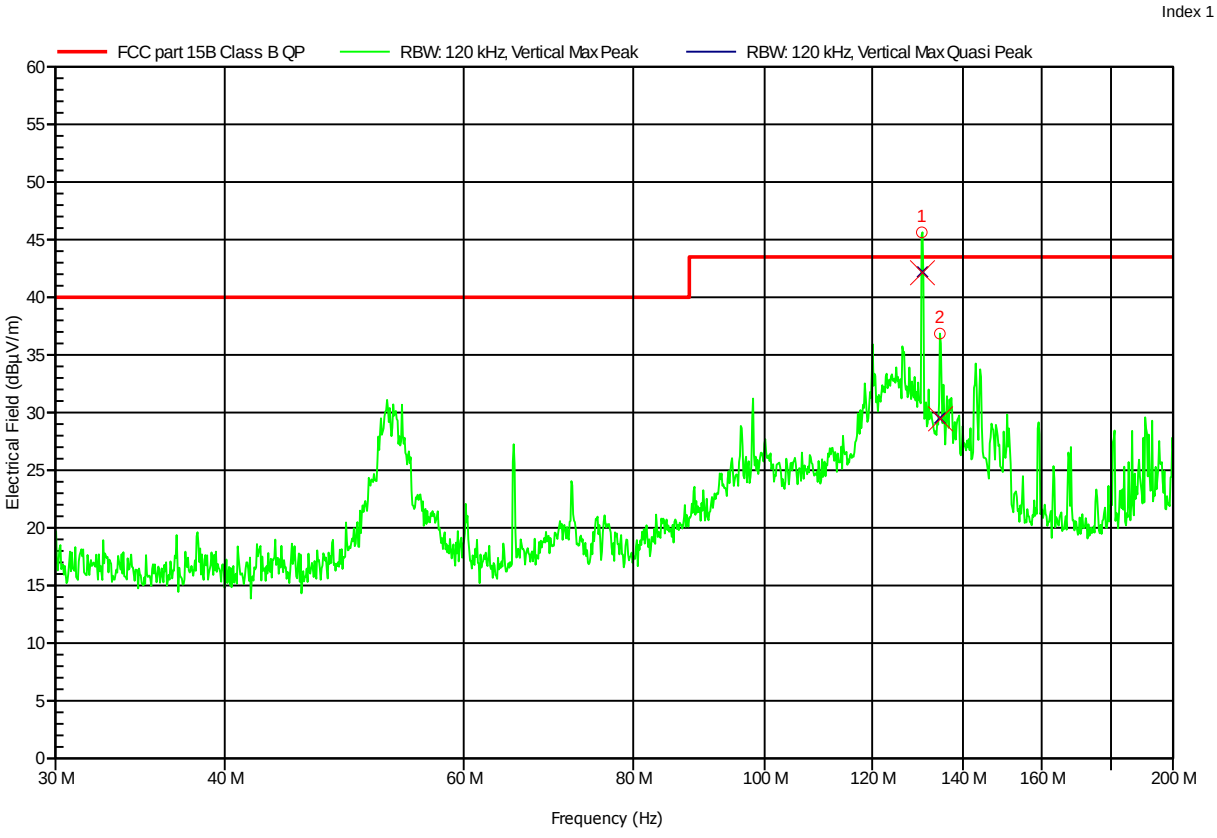
| Frequency [MHz] | Quasi-Peak [dBµV/m] | Result | Average [dBµV/m] | Result | Peak [dBµV/m] | Result |
|---|---|---|---|---|---|---|
| 30 – 88 | 40 | PASS | - | | - | - |
| 88 – 216 | 43.5 | PASS | - | | - | - |
| 216 – 960 | 46 | PASS | - | | - | - |
| 960 – 1000 | 54 | PASS | - | | - | - |
| > 1000 | - | - | 54 | PASS | 74 | PASS |

Comments:

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HK 116, Vertical |
| Measurement distance: | 3m |
| Mode: | DCSS, max.power |
| Test Date: | 2014-01-13 |
| Note: | |

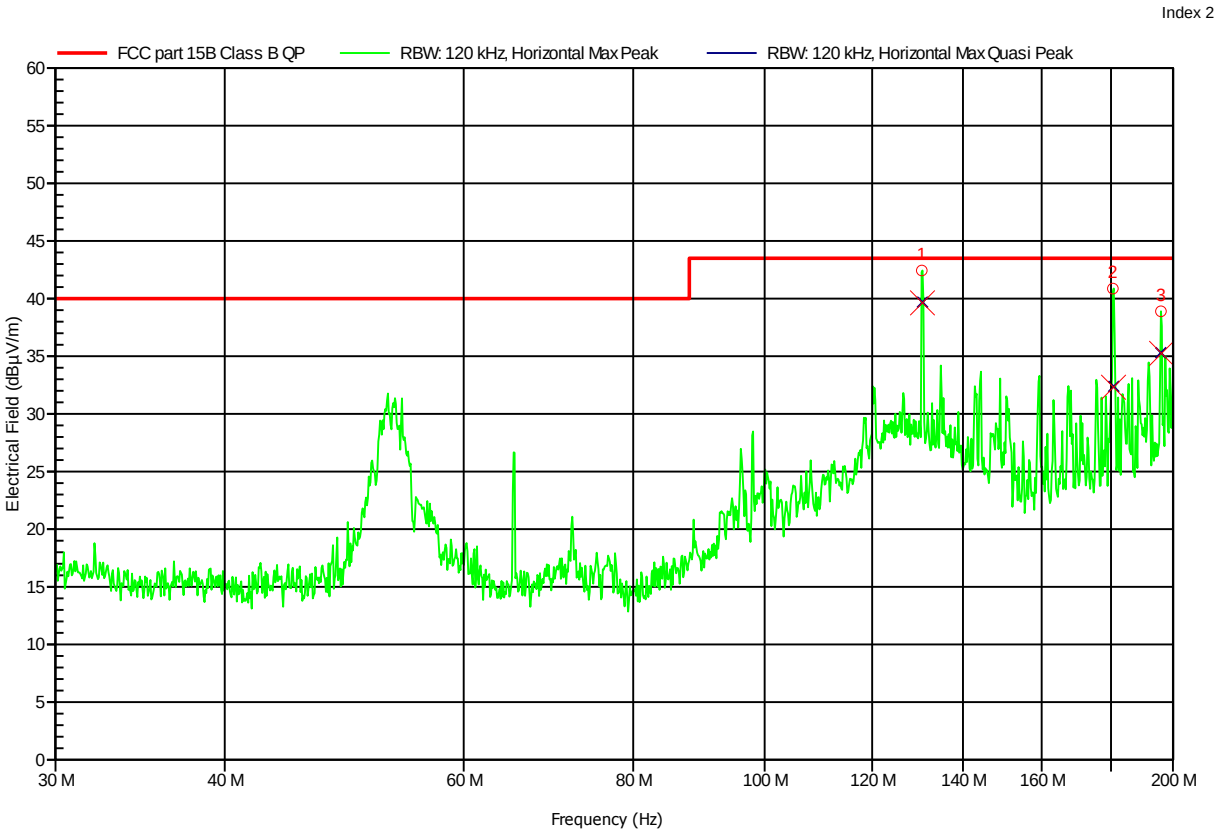



| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 130,554 MHz | 42,18 dBµV/m | 43,5 dBµV/m | -1,32 dB | Pass |
| 2 | 134,622 MHz | 29,51 dBµV/m | 43,5 dBµV/m | -13,99 dB | Pass |

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HK 116, Horizontal |
| Measurement distance: | 3m |
| Mode: | DCSS, max.power |
| Test Date: | 2014-01-13 |
| Note: | |




| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 130,56 MHz | 39,68 dBµV/m | 43,5 dBµV/m | -3,82 dB | Pass |
| 2 | 180,564 MHz | 32,37 dBµV/m | 43,5 dBµV/m | -11,13 dB | Pass |
| 3 | 195,888 MHz | 35,3 dBµV/m | 43,5 dBµV/m | -8,2 dB | Pass |

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HK 116, Horizontal |
| Measurement distance: | 3m |
| Mode: | OQPSK, max.power |
| Test Date: | 2014-01-13 |
| Note: | |

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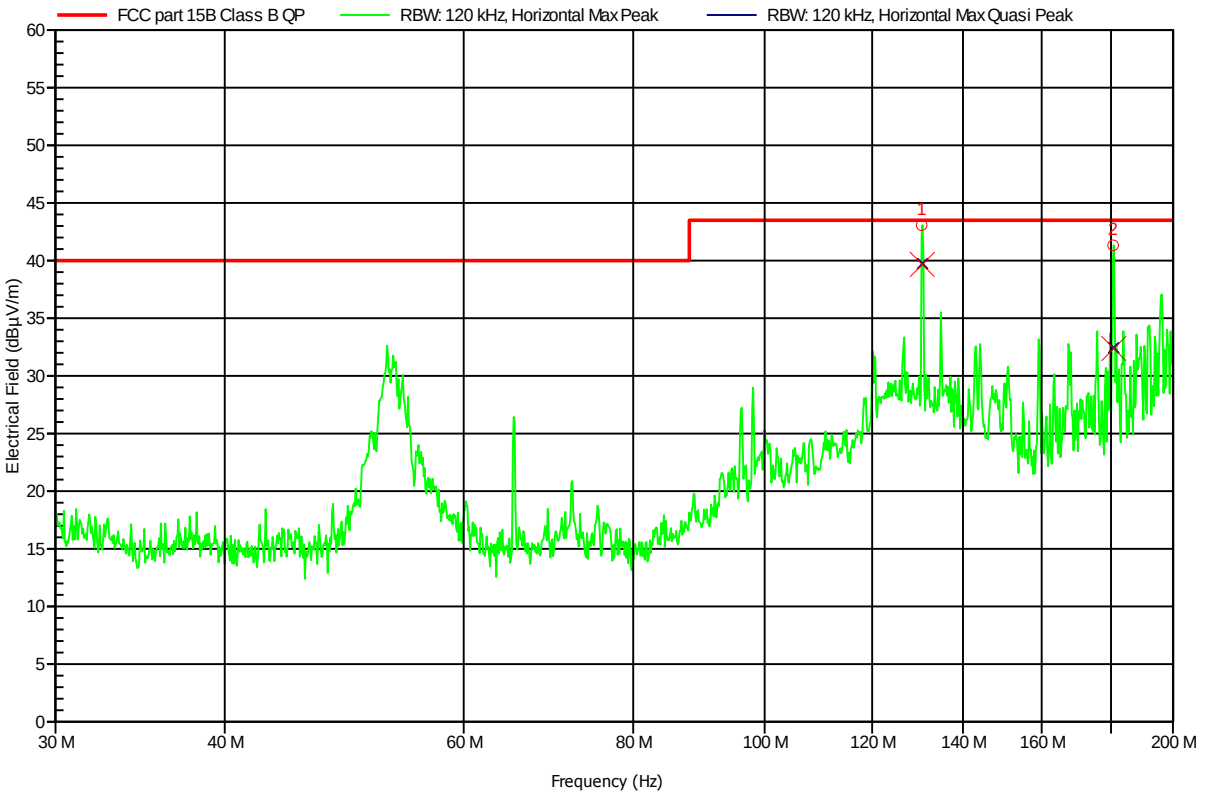


| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 130,518 MHz | 39,72 dBµV/m | 43,5 dBµV/m | -3,78 dB | Pass |
| 2 | 180,642 MHz | 32,43 dBµV/m | 43,5 dBµV/m | -11,07 dB | Pass |

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HK 116, Vertical |
| Measurement distance: | 3m |
| Mode: | OQPSK, max.power |
| Test Date: | 2014-01-13 |
| Note: | |

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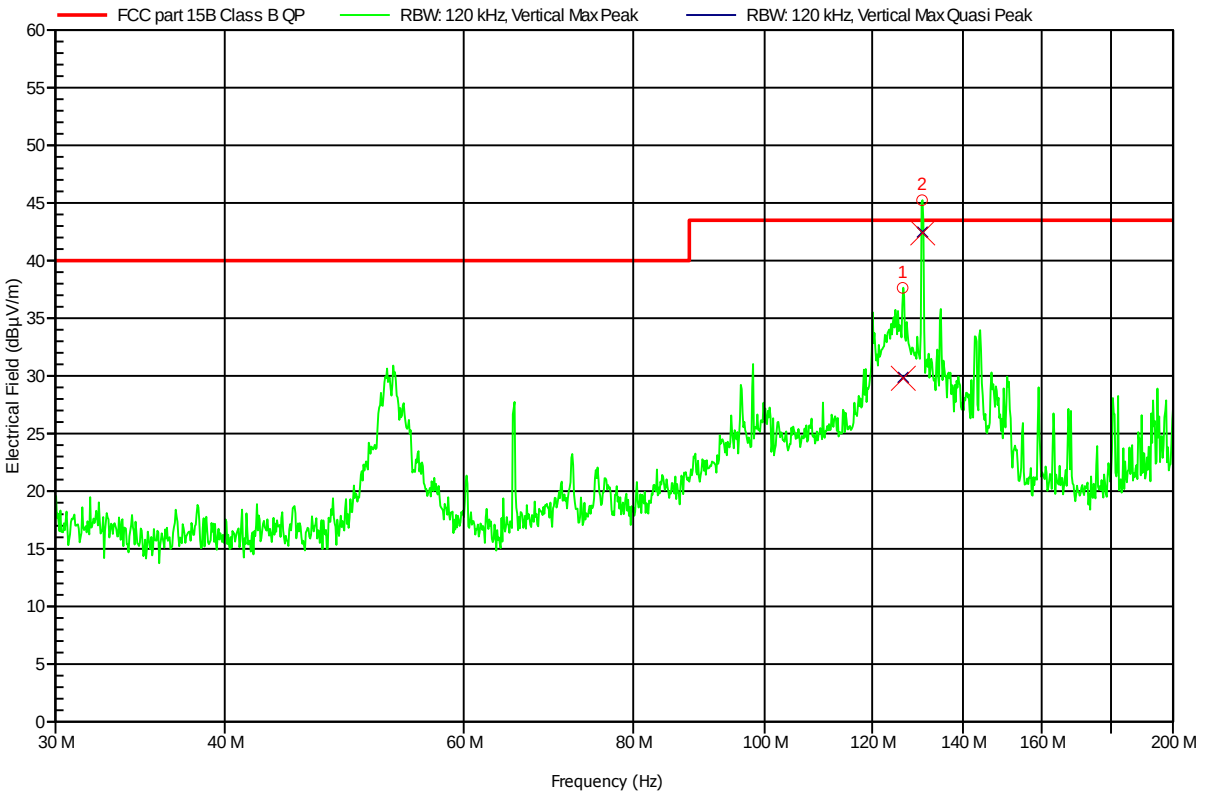


| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 126,378 MHz | 29,85 dBµV/m | 43,5 dBµV/m | -13,65 dB | Pass |
| 2 | 130,62 MHz | 42,46 dBµV/m | 43,5 dBµV/m | -1,04 dB | Pass |

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HK 116, Vertical |
| Measurement distance: | 3m |
| Mode: | DCSS |
| Test Date: | 2014-01-13 |
| Note: | RX |

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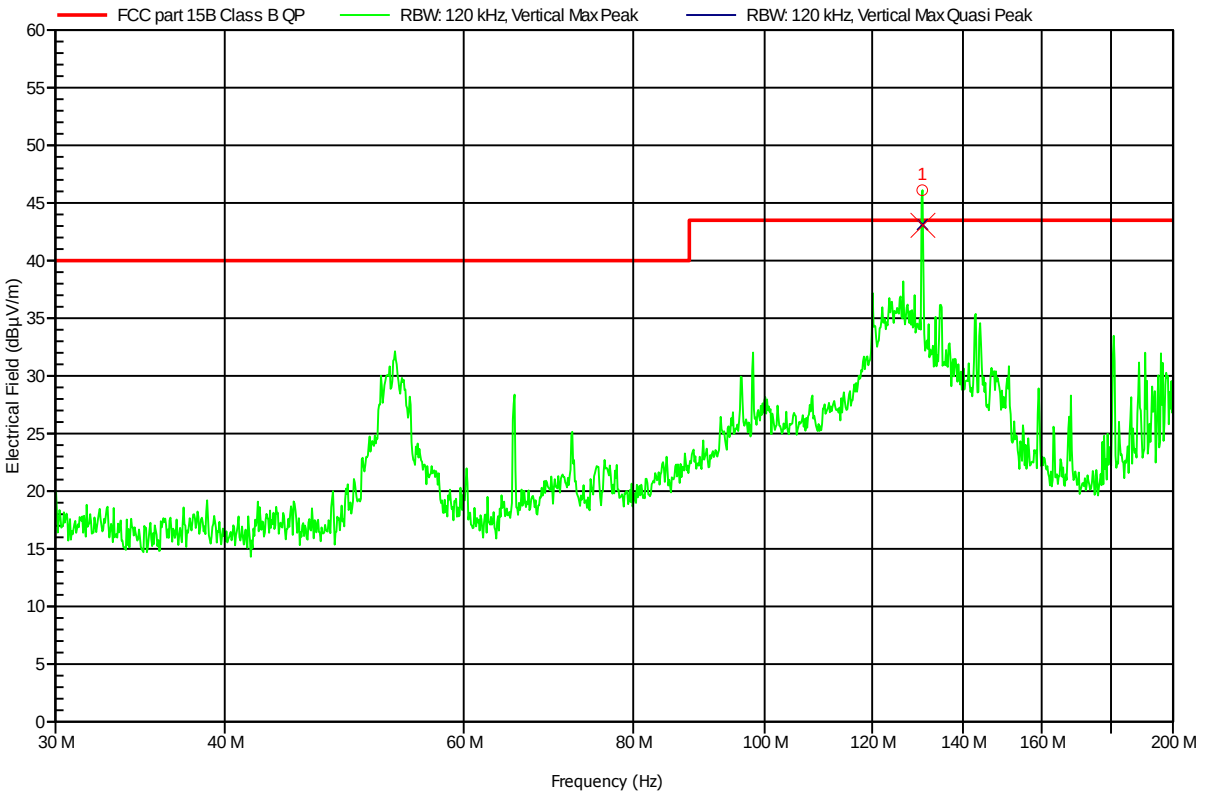


| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 130,656 MHz | 43,12 dBµV/m | 43,5 dBµV/m | -0,38 dB | Pass |

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HK 116, Horizontal |
| Measurement distance: | 3m |
| Mode: | DCSS |
| Test Date: | 2014-01-13 |
| Note: | RX |

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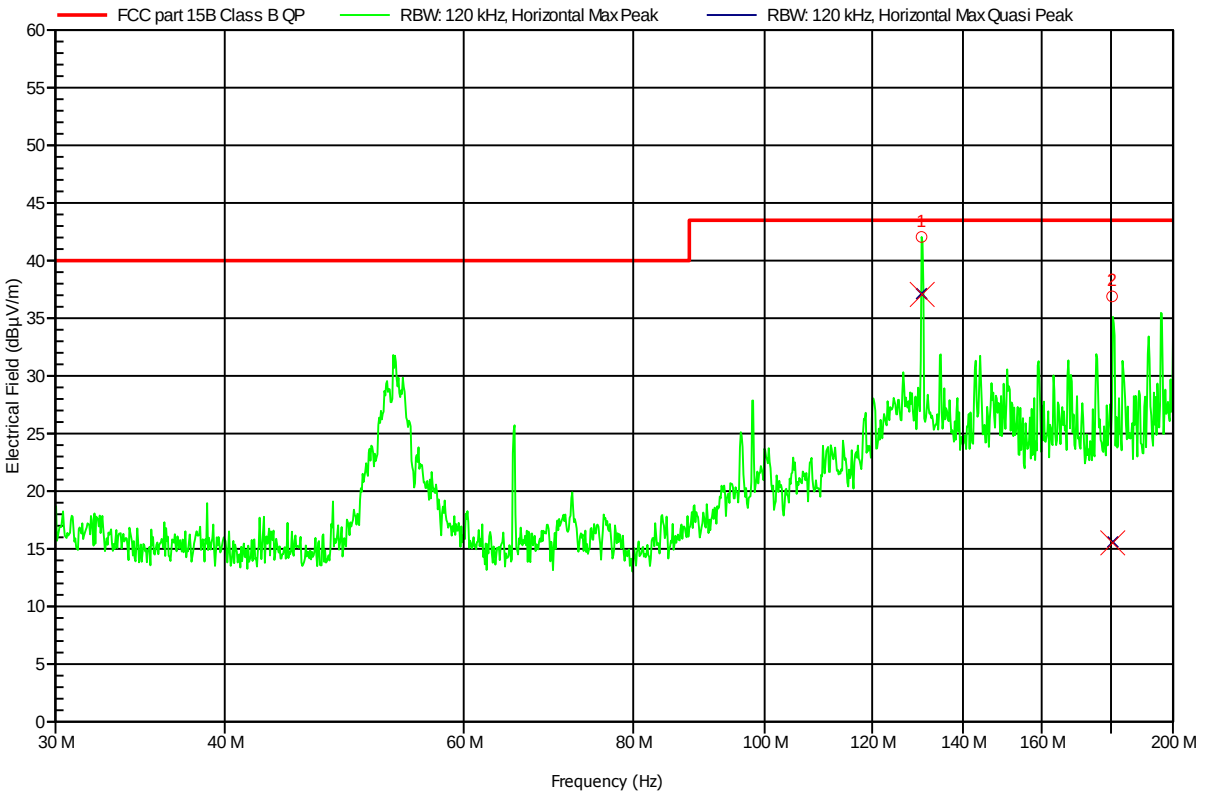


| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 130,494 MHz | 37,12 dBµV/m | 43,5 dBµV/m | -6,38 dB | Pass |
| 2 | 180,3 MHz | 15,57 dBµV/m | 43,5 dBµV/m | -27,93 dB | Pass |

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HL 223, Horizontal |
| Measurement distance: | 3m |
| Mode: | DCSS, max.power |
| Test Date: | 2014-01-13 |
| Note: | |

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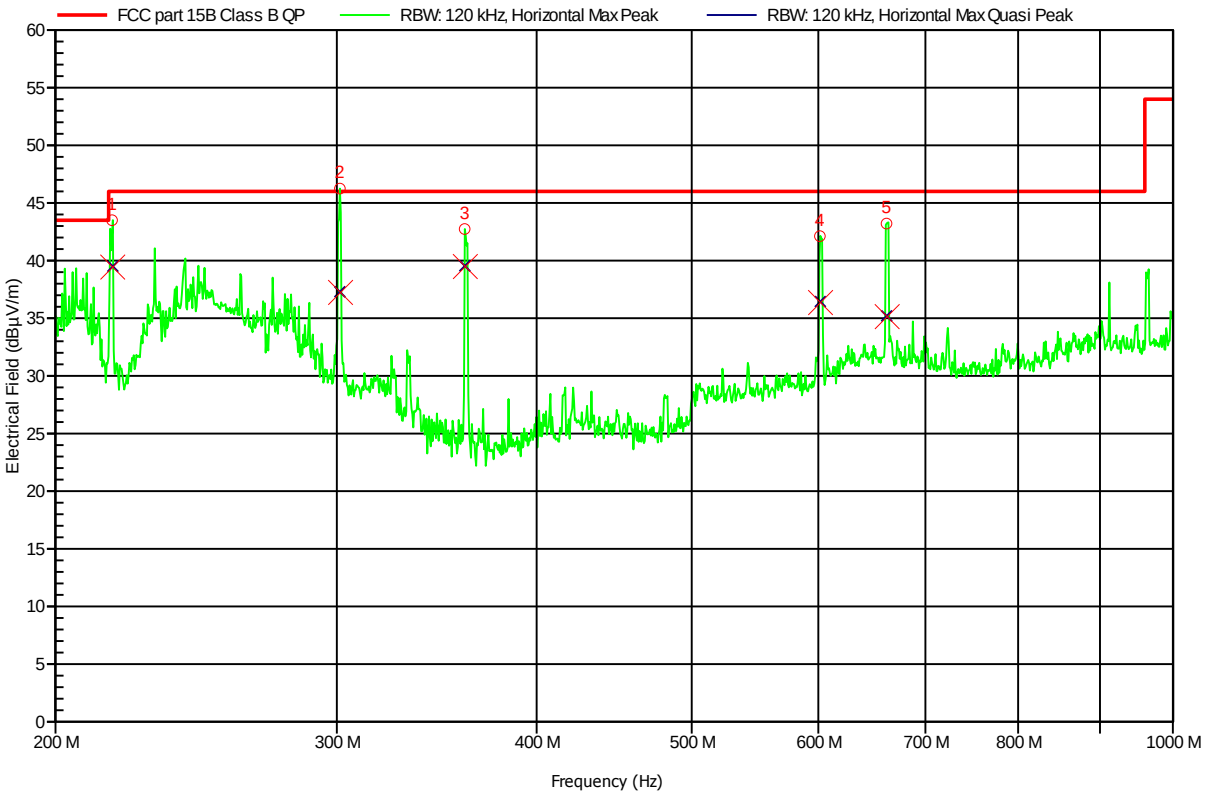


| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 217,076 MHz | 39,49 dBµV/m | 46 dBµV/m | -6,51 dB | Pass |
| 2 | 301,31 MHz | 37,29 dBµV/m | 46 dBµV/m | -8,71 dB | Pass |
| 3 | 360,626 MHz | 39,54 dBµV/m | 46 dBµV/m | -6,46 dB | Pass |
| 4 | 601,334 MHz | 36,42 dBµV/m | 46 dBµV/m | -9,58 dB | Pass |
| 5 | 661,892 MHz | 35,2 dBµV/m | 46 dBµV/m | -10,8 dB | Pass |

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HL 223, Horizontal |
| Measurement distance: | 3m |
| Mode: | OQPSK, max.power |
| Test Date: | 2014-01-13 |
| Note: | |

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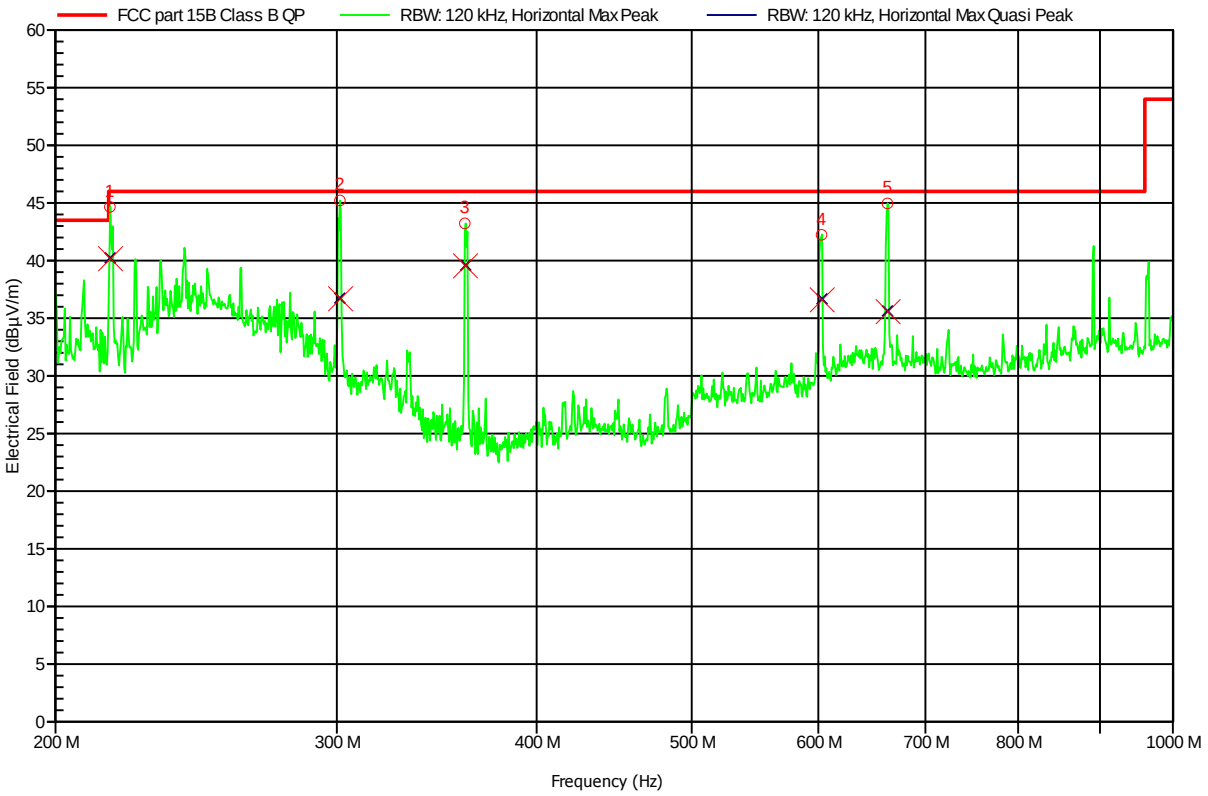


| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 216,368 MHz | 40,22 dBµV/m | 46 dBµV/m | -5,78 dB | Pass |
| 2 | 301,304 MHz | 36,74 dBµV/m | 46 dBµV/m | -9,26 dB | Pass |
| 3 | 360,722 MHz | 39,6 dBµV/m | 46 dBµV/m | -6,4 dB | Pass |
| 4 | 602,834 MHz | 36,65 dBµV/m | 46 dBµV/m | -9,35 dB | Pass |
| 5 | 662,804 MHz | 35,63 dBµV/m | 46 dBµV/m | -10,37 dB | Pass |

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HL 223, Vertical |
| Measurement distance: | 3m |
| Mode: | DCSS, max.power |
| Test Date: | 2014-01-13 |
| Note: | |

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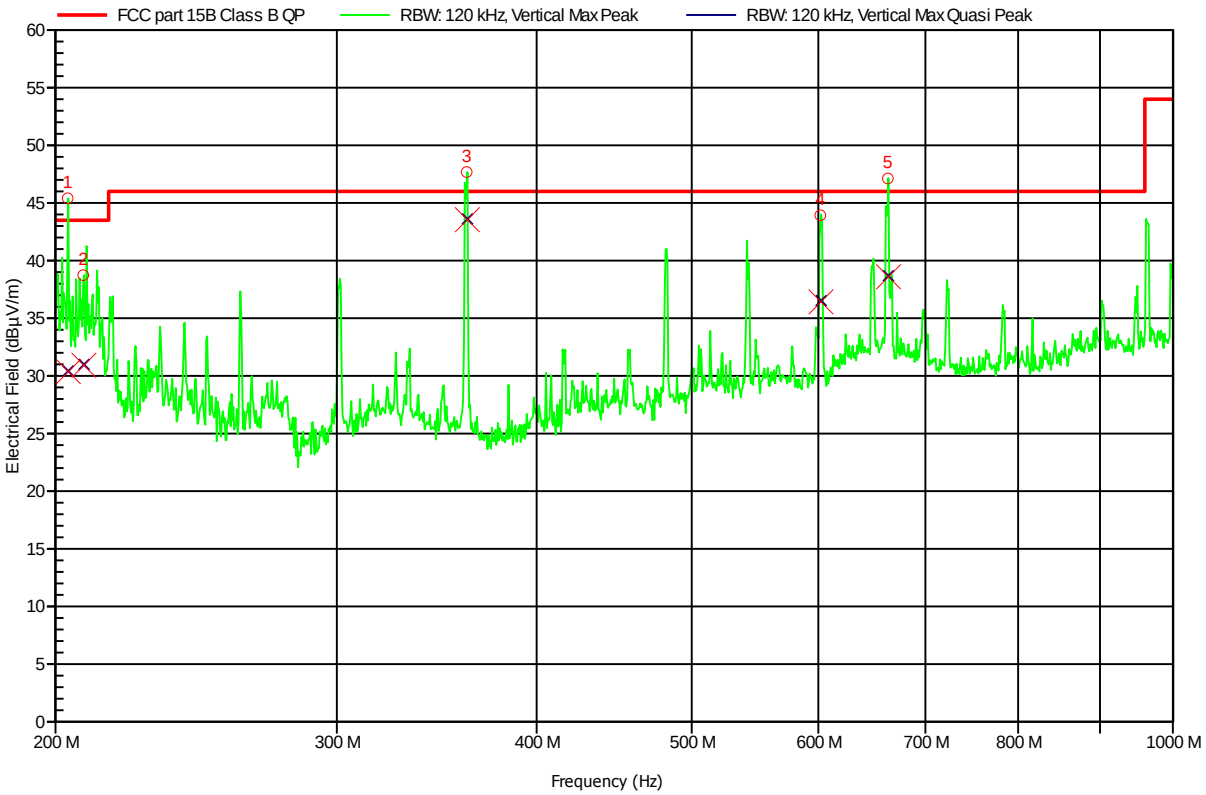


| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 203,654 MHz | 30,43 dBµV/m | 43,5 dBµV/m | -13,07 dB | Pass |
| 2 | 208,244 MHz | 30,98 dBµV/m | 43,5 dBµV/m | -12,52 dB | Pass |
| 3 | 361,67 MHz | 43,61 dBµV/m | 46 dBµV/m | -2,39 dB | Pass |
| 4 | 601,736 MHz | 36,48 dBµV/m | 46 dBµV/m | -9,52 dB | Pass |
| 5 | 663,14 MHz | 38,65 dBµV/m | 46 dBµV/m | -7,35 dB | Pass |

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Pflug |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AAA |
| Antenna: | Rohde & Schwarz HL 223, Vertical |
| Measurement distance: | 3m |
| Mode: | OQPSK, max.power |
| Test Date: | 2014-01-13 |
| Note: | |

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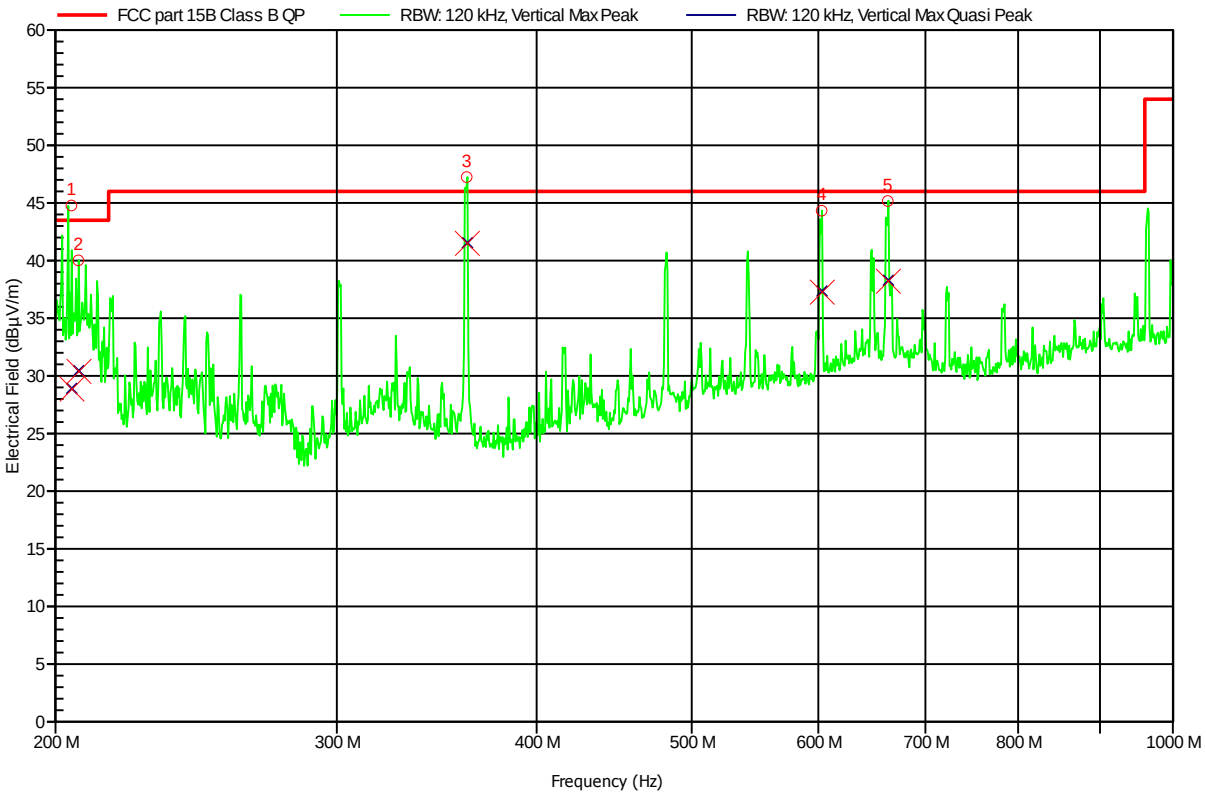


| Nr | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 204,74 MHz | 28,91 dBµV/m | 43,5 dBµV/m | -14,59 dB | Pass |
| 2 | 206,786 MHz | 30,44 dBµV/m | 43,5 dBµV/m | -13,06 dB | Pass |
| 3 | 361,664 MHz | 41,55 dBµV/m | 46 dBµV/m | -4,45 dB | Pass |
| 4 | 602,846 MHz | 37,32 dBµV/m | 46 dBµV/m | -8,68 dB | Pass |
| 5 | 663,116 MHz | 38,26 dBµV/m | 46 dBµV/m | -7,74 dB | Pass |

### 3.2 Test Conditions and Results – AC power line conducted emissions

| **Conducted emissions acc. FCC 47 CFR 15.107 / IC RSS-Gen** | | | | **Verdict: PASS** |
|---|---|---|---|---|
| Laboratory Parameters: | Required prior to the test | | During the test | |
| Ambient Temperature | 15 to 35 °C | | 23°C | |
| Relative Humidity | 30 to 60 % | | 30% | |
| Test according referenced standards | Reference Method | | | |
| | ANSI C63.4 | | | |
| Fully configured sample scanned over the following frequency range | Frequency range | | | |
| | 0.15 MHz to 30 MHz | | | |
| Sample is tested with respect to the requirements of the equipment class | Equipment class | | | |
| | Class B | | | |
| Points of Application | Application Interface | | | |
| AC Mains | LISN | | | |
| Operating mode | 1+2 | | | |
| **Limits and results Class B** | | | | |
| Frequency [MHz] | Quasi-Peak [dBµV] | Result | Average [dBµV] | Result |
| 0.15 to 5 | 66 to 56* | PASS | 56 to 46* | PASS |
| 0.5 to 5 | 56 | PASS | 46 | PASS |
| 5 to 30 | 60 | PASS | 50 | PASS |
| Comments:<br>* Limit decreases linearly with the logarithm of the frequency. | | | | |

**EMI voltage test in the ac-mains according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Zunke |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AA |
| LISN: | ESH2-Z5 N |
| Mode: | DCSS, max.power<br>OQPSK |
| Test Date: | 2014-02-11 |
| Note: | |

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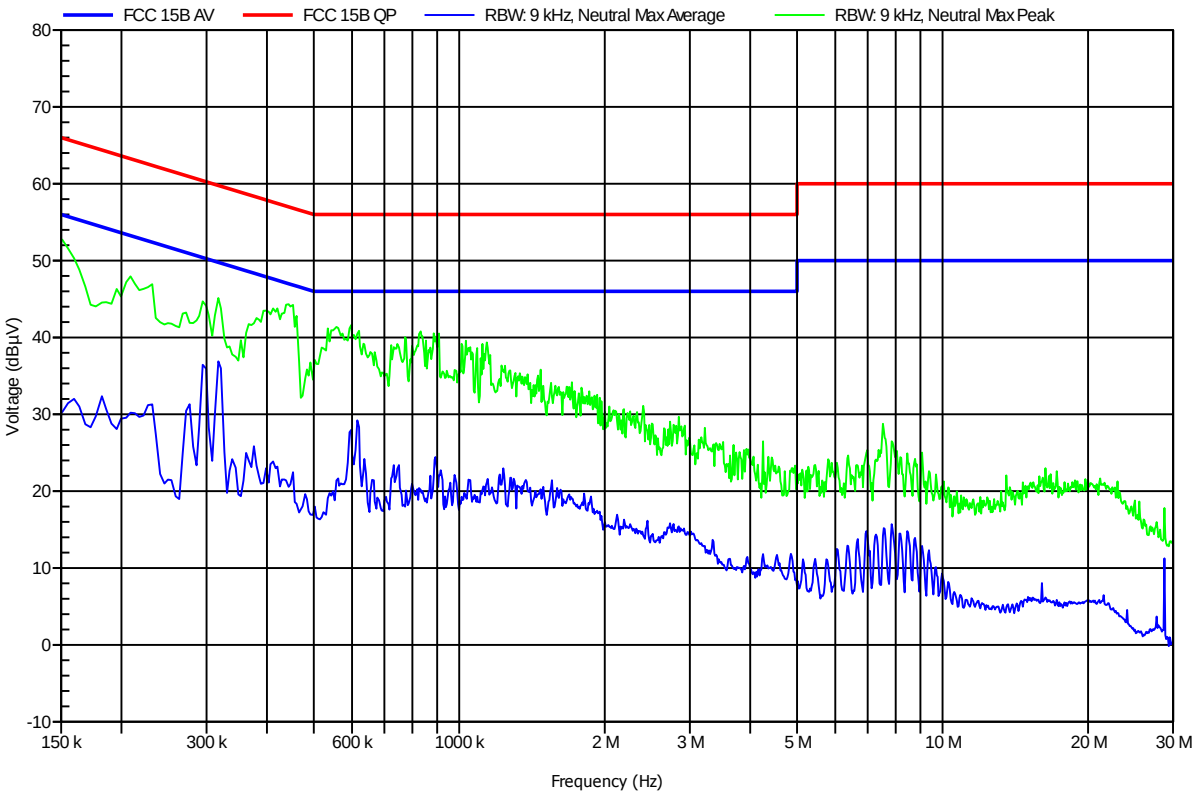

**EMI voltage test in the ac-mains according to FCC Part 15b**

Project number: G0M-1312-3474

| | |
|---|---|
| Manufacturer: | Atmel Automotive GmbH |
| EUT Name: | REB233SMAD Evaluation Kit |
| Model: | ATREB233SMAD-EK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Zunke |
| Test Conditions: | Tnom: 23°C, Unom: 2x1.5VDC battery AA |
| LISN: | ESH2-Z5 L |
| Mode: | DCSS, max.power<br>OQPSK |
| Test Date: | 2014-02-11 |
| Note: | |

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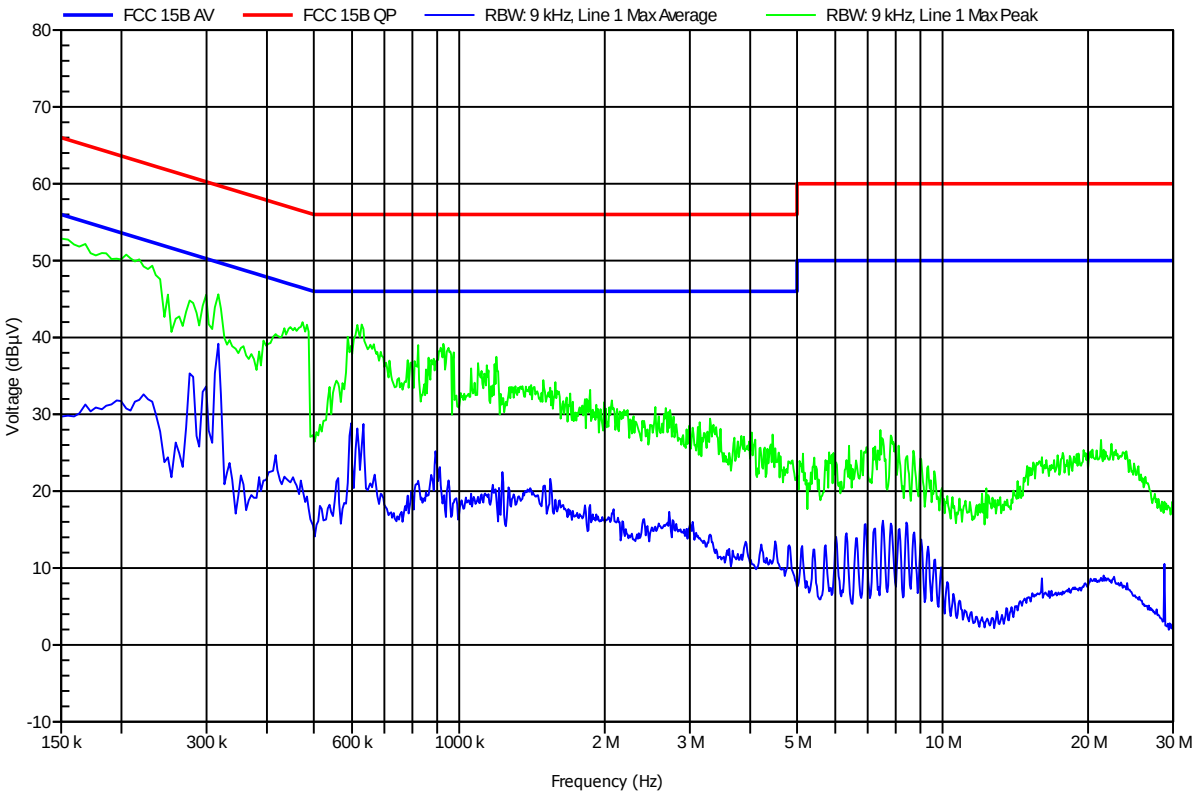

# Revision History

| Revision | Issue Date | Revision | | Revised by |
|---|---|---|---|---|
| 01 | 12.02.2014 | Replaced document:<br>Replaced by:<br><br>Reason:<br><br>• Page 24-26: The conducted spurious emissions were added. | G0M-1312-3474-FCC15B-01-V01<br>G0M-1312-3474-FCC15B-01-V02 | A. Bartusch |