eurofins | Product Service

FCC TEST REPORT

FCC 47 CFR Part 15C
Industry Canada RSS-210

Digital transmission systems operating within the 2400 – 2483.5 MHz band

Report Reference No. ..... :	G0M-1312-3474-TFC247ZC-V01
Testing Laboratory ..... :	Eurofins Product Service GmbH
Address ..... :	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation ..... :	A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Filed Test Laboratory, Reg.-No.: 96970 IC OATS Filing assigned code: 3470A
Applicant's name ..... :	Atmel Automotive GmbH
Address ..... :	Koenigsbruecker Str. 61 01099 Dresden GERMANY
Test specification:	
Standard..... :	47 CFR Part 15C KDB Publication No. 558074 RSS-210, Issue 8, 2010-12 RSS-Gen, Issue 3, 2010-12 ANSI C63.4:2009
Equipment under test (EUT):	
Product description	REB233SMAD Evaluation Kit
Model No.	ATREB233SMAD-EK
Hardware version	v1.8.0
Firmware / Software version	v0.6
	FCC-ID: VNR-E33SD-X5B-00 IC: N/A
Test result	**Passed**

Possible test case verdicts:	
- neither assessed nor tested ..... :	N/N
- required by standard but not appl. to test object..... :	N/A
- required by standard but not tested..... :	N/T
- not required by standard for the test object ..... :	N/R
- 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 ..... :	2014-01-08 – 2014-01-14	
Compiled by..... :	Antje Bartusch	
Tested by (+ signature)..... : (Responsible for Test)	Wilfried Treffke	W. Treffke
Approved by (+ signature) ..... :	Christian Weber	C. Weber
Date of issue..... :	2014-02-17	
Total number of pages..... :	47	

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
01	2014-02-17	Initial Release	

REPORT INDEX

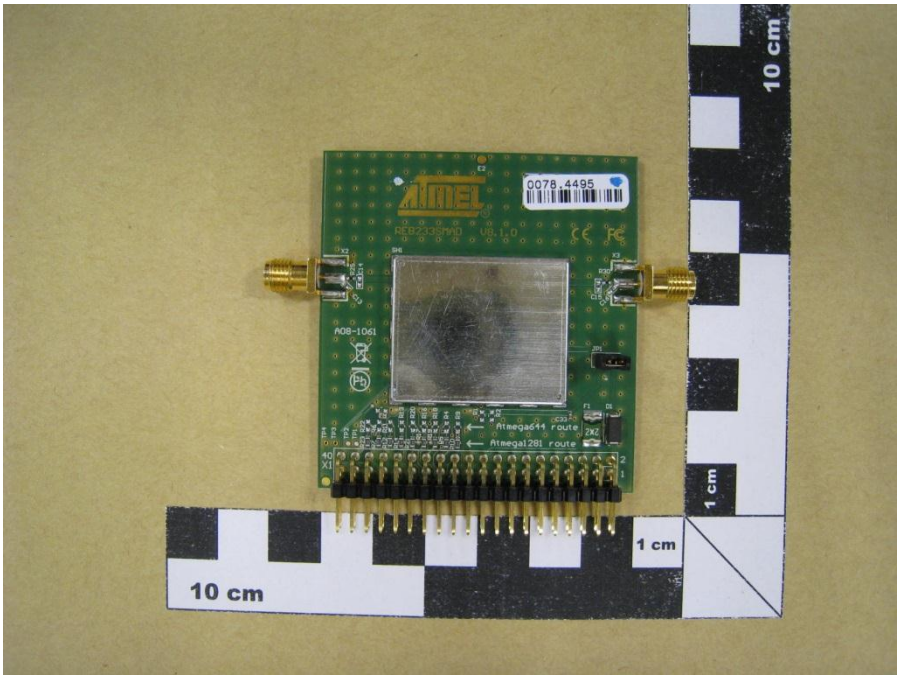
1 Equipment (Test item) Description

Description	REB233SMAD Evaluation Kit	
Model	ATREB233SMAD-EK	
Serial number	None	
Hardware version	v1.8.0	
Software / Firmware version	v0.6	
FCC-ID	VNR-E33SD-X5B-00	
IC	N/A	
Equipment type	Radio module	
Radio type	Transceiver	
Radio technology	IEEE 802.15.4a Chirp Spread Spectrum (CSS)	
Operating frequency range	Initiator 2402-2479 MHz Reflector 2404-2481 MHz	
Assigned frequency band	2400 - 2483.5 MHz	
Spreading	Chirp	
Modulations	DCCS	
Number of antennas	2	
Antenna	Type	2 x external dedicated
	Model	M35-S
	Manufacturer	Tekfun
	Gain	2dBi (declared by customer)
Manufacturer	dresden elektronik ingenieurtechnik gmbh Enno-Heidebroek-Straße 12 01237 Dresden GERMANY	
Power supply	V_{NOM}	3.0 VDC
	V_{MIN}	1.8 VDC
	V_{MAX}	3.6 VDC
AC/DC-Adaptor	Model	N/A
	Vendor	N/A
	Input	N/A
	Output	N/A

1.1 Photos – Equipment External

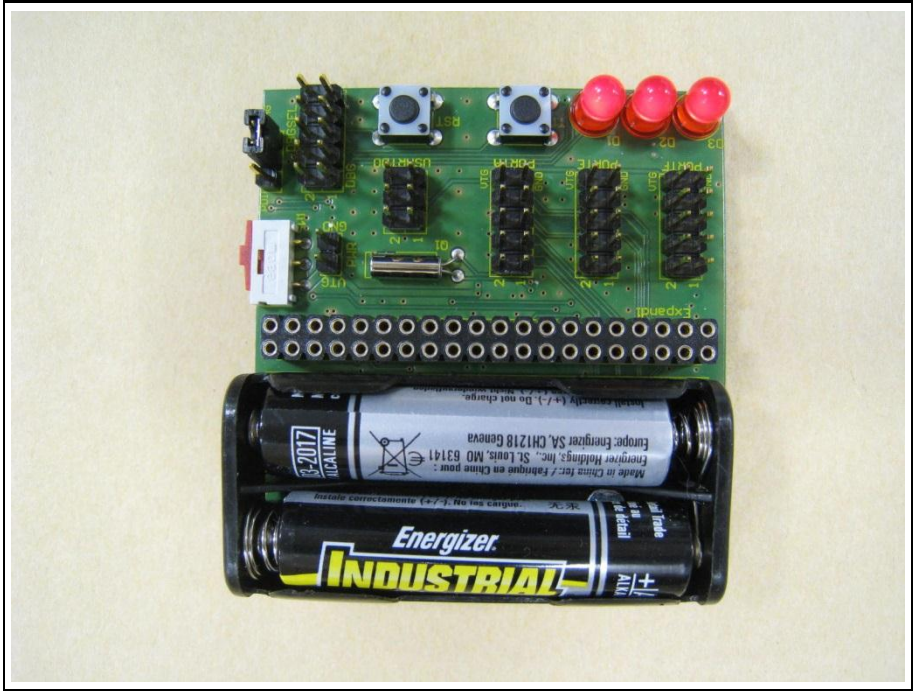
EUT

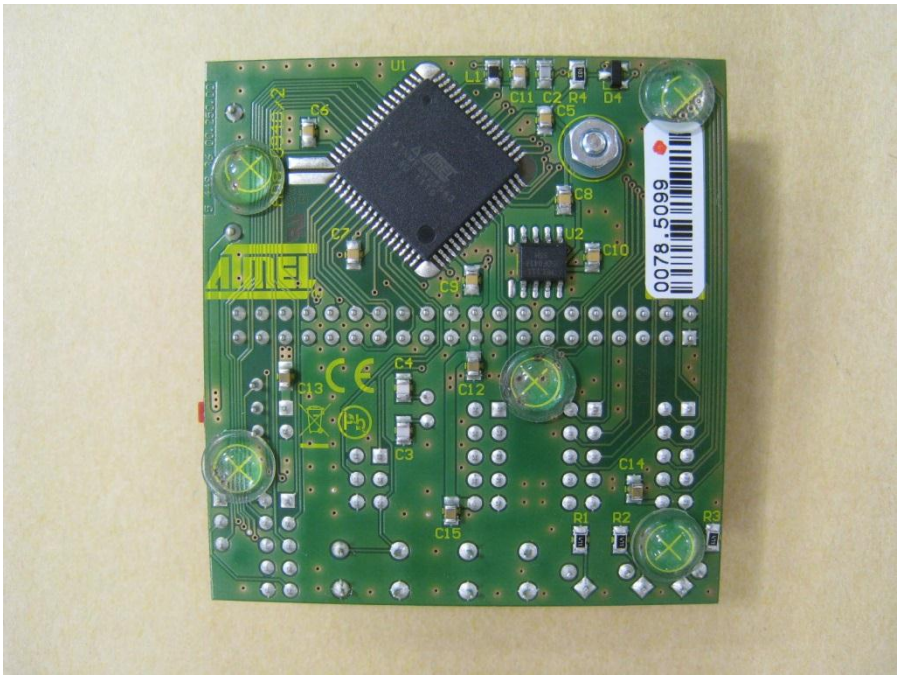

1.2 Photos – Equipment internal

PCB 1 TOP


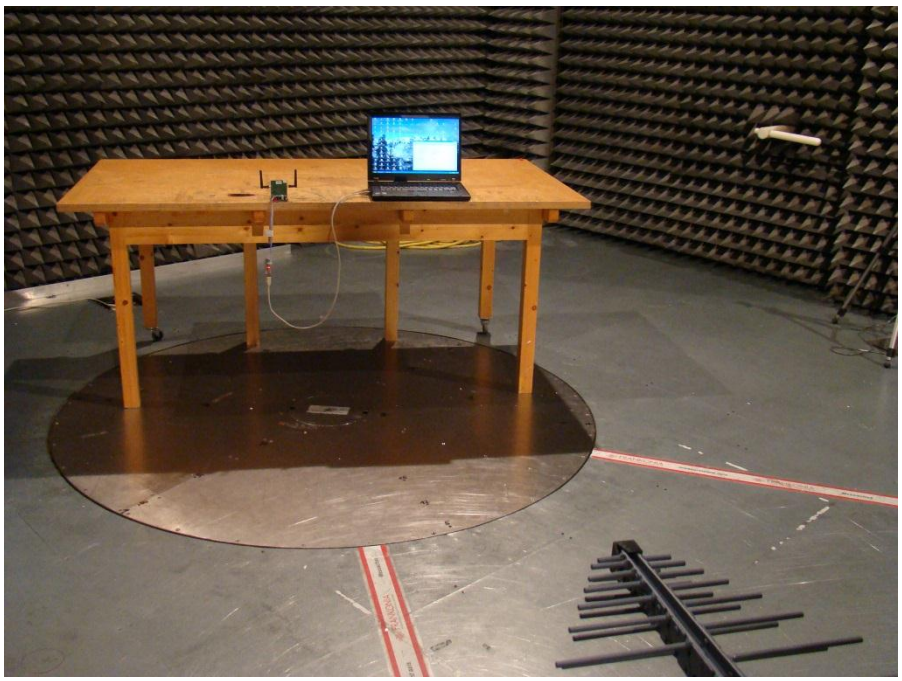
PCB 1 TOP WITHOUT SHIELDING

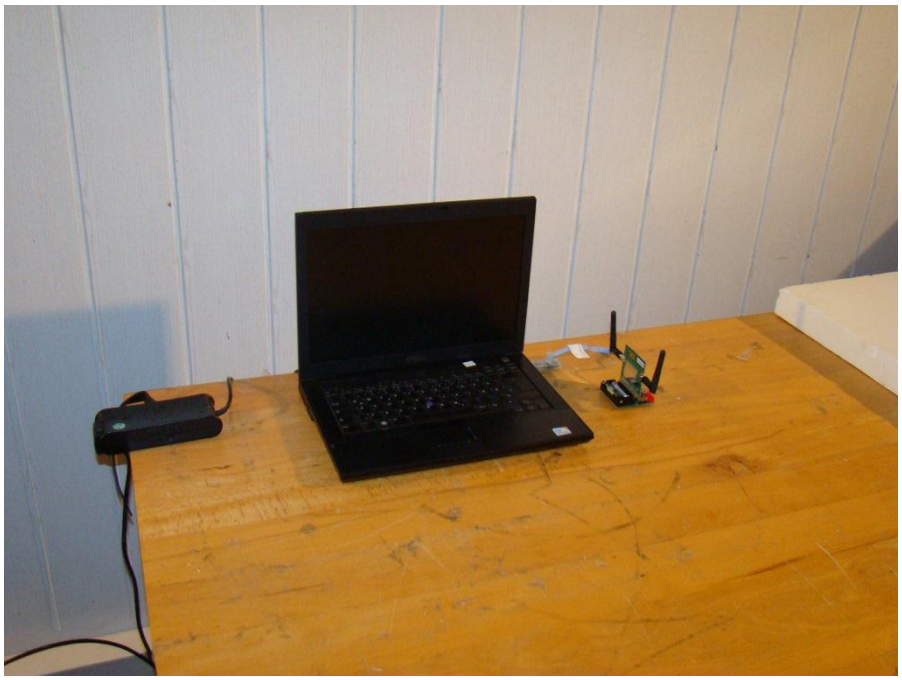

PCB1 BOTTOM


PCB 2 TOP


PCB 2 BOTTOM


1.3 Photos – Test setup

TEST SETUP RADIATED MEASUREMENTS


TEST SETUP CONDUCTED MEASUREMENTS


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 Test Modes

Mode #	Description	
Initiator	General conditions:	EUT powered by battery
	Radio conditions:	Mode = standalone transmit Spreading = Chirp Modulation = DCCS Duty cycle = 100 % Power level = Maximum
Reflector	General conditions:	EUT powered by battery
	Radio conditions:	Mode = standalone transmit Spreading = Chirp Modulation = DCCS Duty cycle = 100 % Power level = Maximum
AC-Powerline	General conditions:	EUT connected to notebook via usb, notebook powered by commercial AC/DC-Adapter
	Radio conditions:	Mode = standalone transmit Spreading = DSSS Power level = Maximum

1.6 Test Equipment Used During Testing

6dB Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Maximum peak conducted power					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Power spectral density					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Band edge compliance					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Conducted spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Radiated spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 5	EF00395	calibration	calibration
Spectrum Analyzer	R&S	FSIQ26	EF00242	2013-06	2014-06
Biconical Antenna	R&S	HK 116	EF00012	2013-02	2016-02
LPD antenna	R&S	HL 223	EF00187	2011-02	2014-02
LPD Antenna	R&S	HL 025	EF00327	2013-02	2016-02

AC powerline conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2012-10	2014-10
AMN	R&S	ESH3-Z5	EF00036	2012-11	2014-11
EMI Test Receiver	R&S	ESCS 30	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:

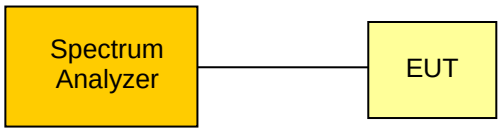
Reading	+	AF	=	Net Reading	:	Net reading - FCC limit	= Margin
21.5 dBµV	+	26 dB	=	47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 15C, IC RSS-210				
Product Specific Standard Section	**Requirement – Test**	**Reference Method**	**Result**	**Remarks**
RSS-Gen 4.6.1	Occupied Bandwidth	RSS-Gen 4.6.1	N/R	
FCC § 15.247(a)(2) IC RSS-210 § A8.2	6dB Bandwidth	KDB Publication No. 558074	PASS	
FCC § 15.247(b)(3) IC RSS-210 § A8.4	Maximum peak conducted power	KDB Publication No. 558074	PASS	
FCC § 15.247(e) IC RSS-210 § A8.2	Power spectral density	KDB Publication No. 558074	PASS	
47 CFR 15.207 RSS-Gen 7.2.4	AC power line conducted emissions	KDB Publication No. 558074 / ANSI C63.4	PASS	
FCC § 15.247(d) IC RSS-210 § A8.5	Band edge compliance	KDB Publication No. 558074	PASS	
FCC § 15.247(d) IC RSS-210 § A8.5	Conducted spurious emissions	KDB Publication No. 558074	PASS	
FCC § 15.247(d) FCC § 15.209 IC RSS-210 A8.5 IC RSS-Gen 4.9 IC RSS-Gen 7.2.5	Transmitter radiated spurious emissions	KDB Publication No. 558074 / ANSI C 63.4	PASS	
IC RSS-Gen 4.10 IC RSS-Gen 6.1	Receiver radiated spurious emissions	ANSI C 63.4	N/A	
Remarks:				

3 Test Conditions and Results

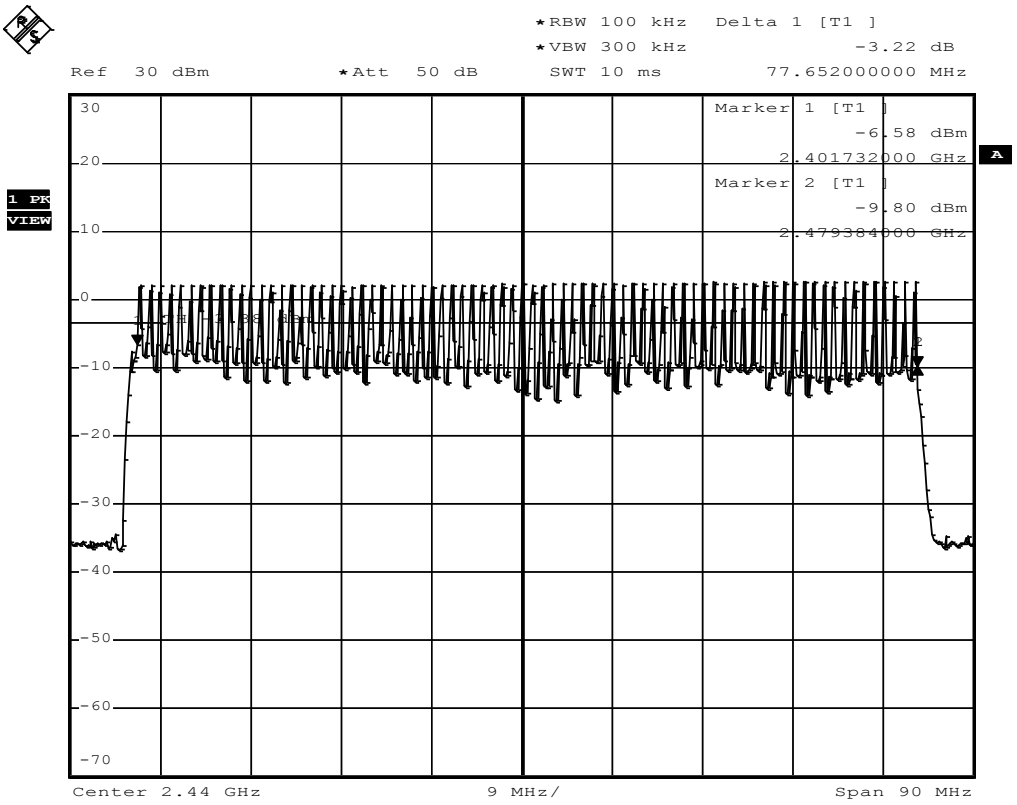
3.1 Test Conditions and Results – 6 dB Bandwidth

6dB Bandwidth acc. FCC 15.247 / IC RSS-210					**Verdict: PASS**
EUT requirement rule parts and clause	Reference				
	FCC 15.247(a)(2) / IC RSS-210 A8.2				
Test according to measurement reference	Reference Method				
	FCC KDB Publication No. 558074				
Test frequency range	Tested frequencies				
	Initiator: 2402 - 2479 MHz Reflector: 2404 – 2481 MHz				
Limits					
≥ 500kHz					
Test setup					
					
Test procedure					
1. EUT set to test mode 2. Span set to at least twice the emission spectrum 3. Detector set to peak and max hold and RBW is set to 100 kHz 4. Envelope peak value of emission spectrum is selected 5. Marker on envelope of spectrum is set to level of -6 dB to the left of the peak 6. Marker on envelope of spectrum is set to level of -6 dB to the right of the peak 7. 6 dB Bandwidth is determined by marker frequency separation					
Test results - Initiator					
Channel	Frequency [MHz]	Mode	6 dB Bandwidth [kHz]	Limit [kHz]	Result
F_{MID}	2402-2479	DCCS	77.652	500	PASS
Test results - Reflector					
Channel	Frequency [MHz]	Mode	6 dB Bandwidth [kHz]	Limit [kHz]	Result
F_{MID}	2404 – 2481	DCCS	78.000	500	PASS
Comments:					

6 dB Bandwidth – Chirp Initiator

FCC part 15.247 (a)2
Minimum 6 dB Bandwidth

EUT	REB233SMAD Evaluation Kit
Model	ATREB233SMAD-EK
Approval Holder	Atmel Automotive GmbH / Ord.: G0M-1312-3474
Temperature / Voltage	Tnom / Vnom
Test Site / Operator	Eurofins Product Service GmbH / Mr. Treffke
Test Specification	FCC part 15.247 (a)2
Comment 1	Minimum 6 dB Bandwidth
Comment 2	Initiator 2402-2479 MHz, DCCS
Comment 3	procedure 8.1 DTS BW (558074 D01 DTS)

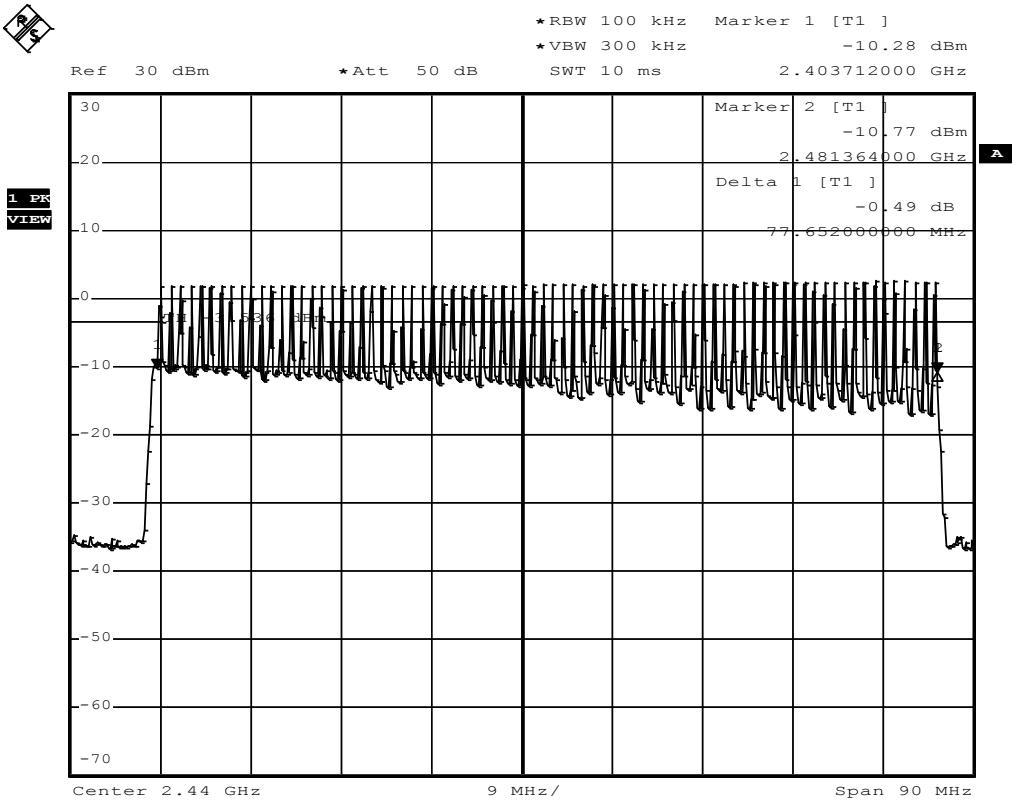


Comment: 6 dB bandwidth: 77652 KHz > 500 KHz; verdict: PASS
Date: 8.JAN.2014 13:35:53

6 dB Bandwidth – Chirp Reflector

FCC part 15.247 (a)2
Minimum 6 dB Bandwidth

EUT	REB233SMAD Evaluation Kit
Model	ATREB233SMAD-EK
Approval Holder	Atmel Automotive GmbH / Ord.: G0M-1312-3474
Temperature / Voltage	Tnom / Vnom
Test Site / Operator	Eurofins Product Service GmbH / Mr. Treffke
Test Specification	FCC part 15.247 (a)2
Comment 1	Minimum 6 dB Bandwidth
Comment 2	Reflector 2404-2481 MHz, DCCS
Comment 3	procedure 8.1 DTS BW (558074 D01 DTS)



Comment: 6 dB bandwidth: 77652 KHz > 500 KHz; verdict: PASS
Date: 8.JAN.2014 13:42:31

3.2 Test Conditions and Results – Maximum peak conducted power

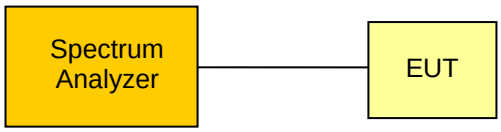
Maximum peak conducted power acc. FCC 15.247 / IC RSS-210	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(b)(3) / IC RSS-210 A8.4
Test according to measurement reference	Reference Method
	FCC KDB Publication No. 558074
Test frequency range	Tested frequencies
	Initiator: 2402 - 2479 MHz Reflector: 2404 – 2481 MHz
Measurement mode	Peak
Maximum antenna gain	2 dBi ⇒ Limit correction = 0 dB

Limits

1 W (30 dBm)

The conducted output power limit specified above is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in the table, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Center frequency set to test channel center frequency
3. Span set to twice the 20 dB bandwidth and detector to peak and max hold
4. Resolution bandwidth is set to 3 MHz
5. Peak conducted power is determined from peak of spectrum envelope

Test results - Initiator

Channel	Frequency [MHz]	Voltage [VDC]	Mode	Peak power [dbm]	Peak power [W]	Limit [dBm]	Margin [dB]
F_{MID}	2402-2479	V_{NOM} = 3.0	DCCS	2.7	0.002	30	-27.30

Test results - Reflector

Channel	Frequency [MHz]	Voltage [VDC]	Mode	Peak power [dbm]	Peak power [W]	Limit [dBm]	Margin [dB]
F_{MID}	2404-2481	V_{NOM} = 3.0	DCCS	2.7	0.002	30	-27.30

Comments:

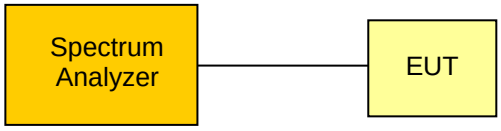
3.3 Test Conditions and Results – Power spectral density

Power spectral density acc. FCC 15.247 / IC RSS-210	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(e) / IC RSS-210 A8.2
Test according to measurement reference	Reference Method
	FCC KDB Publication No. 558074
Test frequency range	Tested frequencies
	Initiator: 2402 - 2479 MHz Reflector: 2404 – 2481 MHz
Measurement mode	Peak

Limits

8 dBm / 3 kHz

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Center frequency set to test channel center frequency
3. Span is set large enough to capture maximum emissions in passband, RBW is set to 3kHz
4. Peak power density is determined from peak emission of envelope

Test results - Initiator

Channel	Frequency [MHz]	Test mode	Peak frequency [MHz]	Peak power density [dBm]	Limit [dBm/3kHz]	Margin [dB]
F_{MID}	2402 - 2479	DCCS	2467.000	2.62	8.0	-05.38

Test results - Reflector

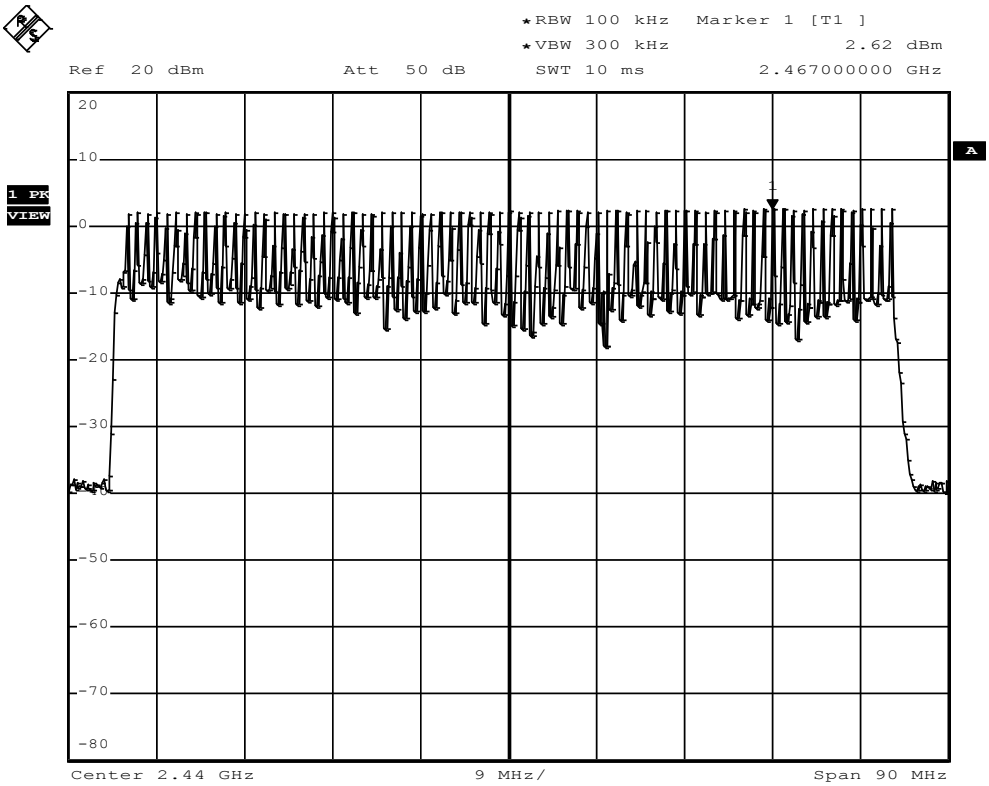
Channel	Frequency [MHz]	Test mode	Peak frequency [MHz]	Peak power density [dBm]	Limit [dBm/3kHz]	Margin [dB]
F_{MID}	2404 - 2481	DCCS	2478.160	2.42	8.0	-05.58

Comments:

Power Spectral Density – Initiator

FCC part 15.247 (d)
Power spectral density (PSD)

EUT	REB233SMAD Evaluation Kit
Model	ATREB233SMAD-EK
Approval Holder	Atmel Automotive GmbH / Ord.: G0M-1312-3474
Temperature / Voltage	Tnom / Vnom
Test Site / Operator	Eurofins Product Service GmbH / Mr. Treffke
Test Specification	FCC part 15.247 (d)
Comment 1	Power spectral density conducted
Comment 2	Initiator 2402-2479 MHz, DCCS
Comment 3	Procedure 10.2 PKPSD (558074 D01 DTS Meas Guidance)

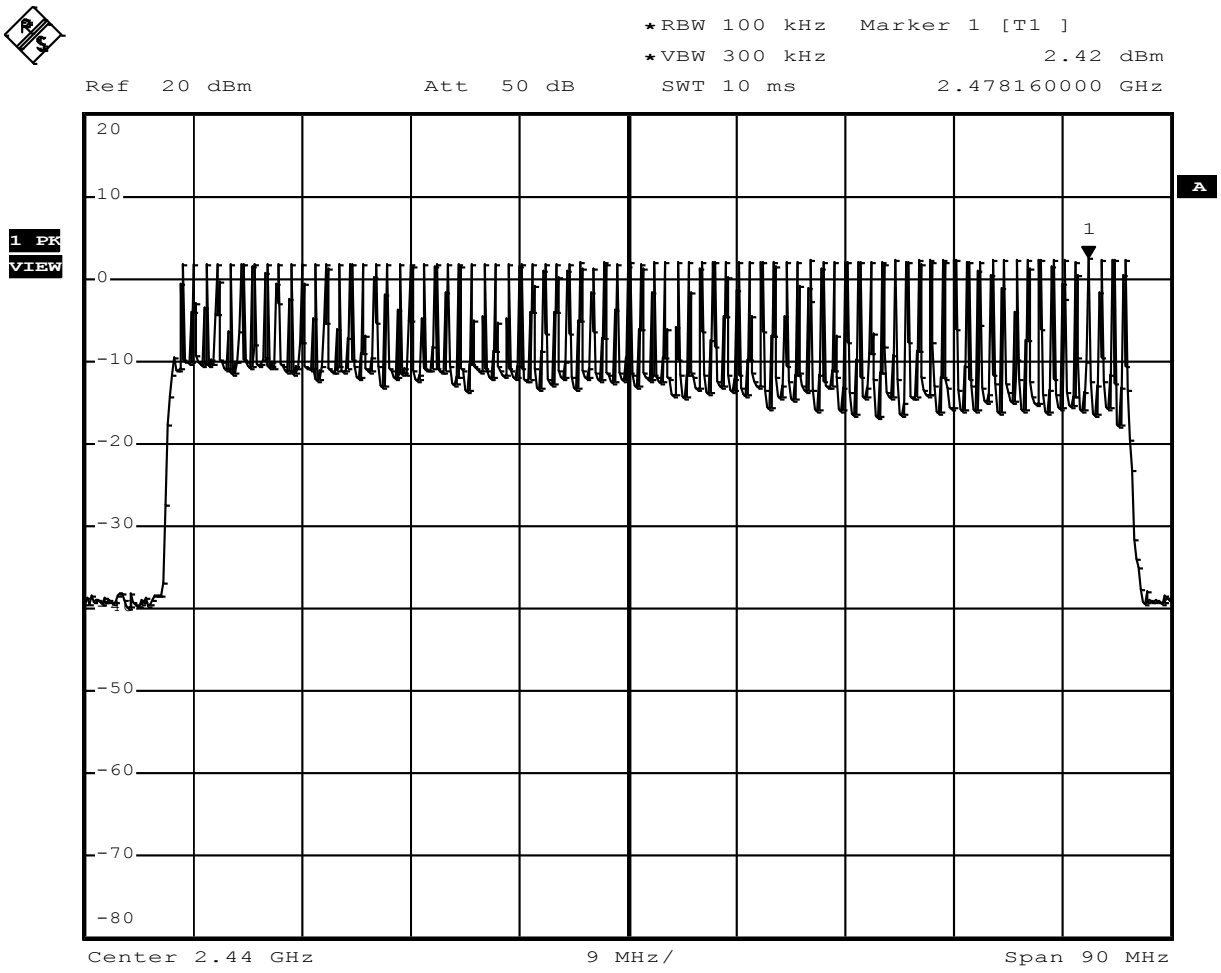


Comment: Maximum Power Spectral Density=2.62dBm
Comment: f=2.467GHz RBW= 100kHz , Limit <8dBm/3kHz
Date: 8.JAN.2014 09:40:08

Power Spectral Density – Reflector

FCC part 15.247 (d)
Power spectral density (PSD)

EUT	REB233SMAD Evaluation Kit
Model	ATREB233SMAD-EK
Approval Holder	Atmel Automotive GmbH / Ord.: G0M-1312-3474
Temperature / Voltage	Tnom / Vnom
Test Site / Operator	Eurofins Product Service GmbH / Mr. Treffke
Test Specification	FCC part 15.247 (d)
Comment 1	Power spectral density conducted
Comment 2	Reflector 2404-2481 MHz, DCCS
Comment 3	Procedure 10.2 PKPSD (558074 D01 DTS Meas Guidance)



Comment: Maximum Power Spectral Density=2.42dBm
Comment: f=2.47816GHz RBW= 100kHz , Limit <8dBm/3kHz
Date: 8.JAN.2014 10:15:06

3.4 Test Conditions and Results – AC power line conducted emissions

Power line conducted emissions acc. FCC 47 CFR 15.207 / IC RSS-Gen				**Verdict: PASS**
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			
Points of Application	Application Interface			
AC Mains	LISN			
EUT test mode	AC-Powerline			
Limits and results				
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: * Limit decreases linearly with the logarithm of the frequency.				

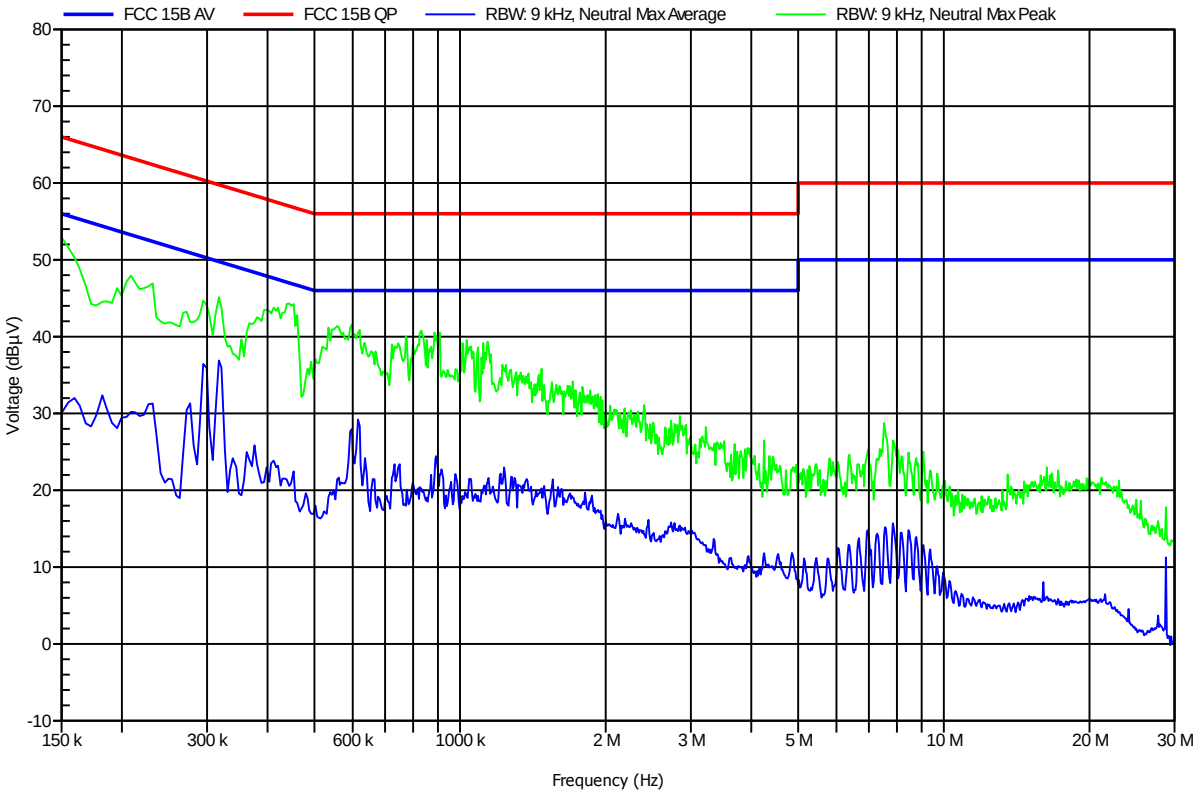
Conducted Emissions

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
OQPSK	
Test Date:	2014-02-11
Note:	

Index 11



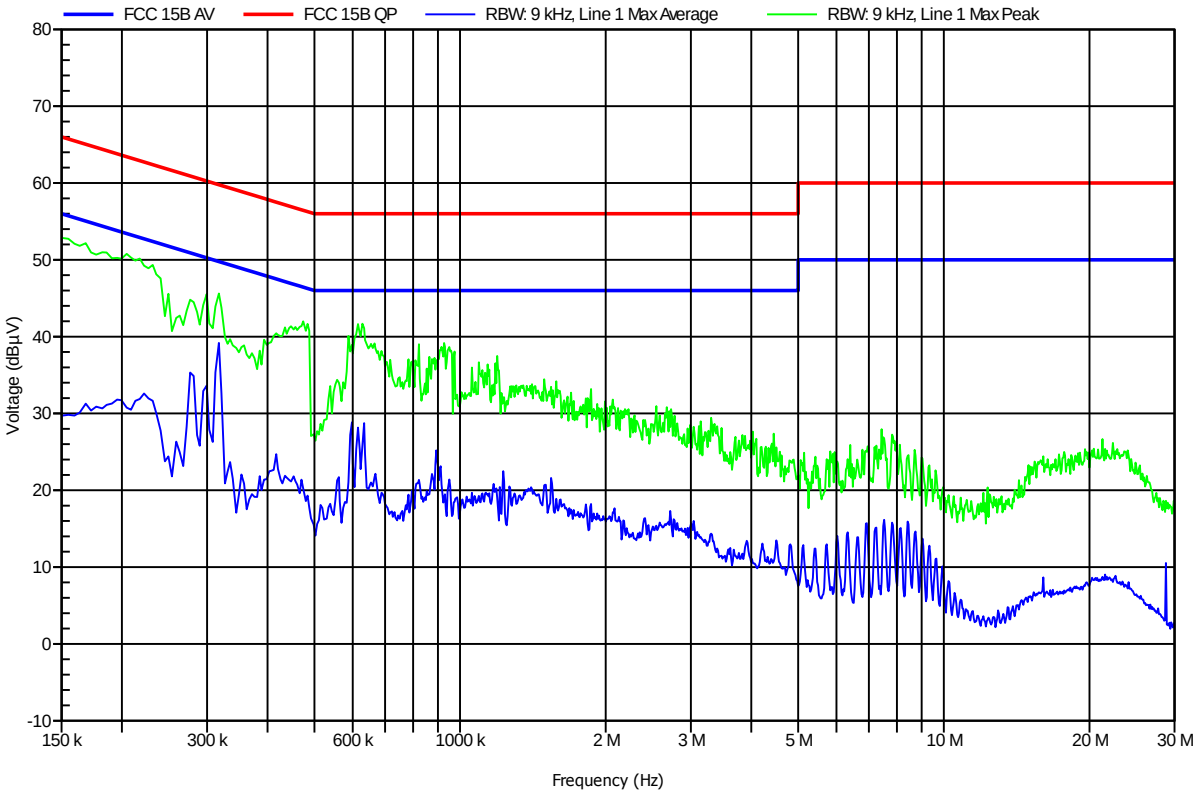
Conducted Emissions

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
OQPSK	
Test Date:	2014-02-11
Note:	

Index 12

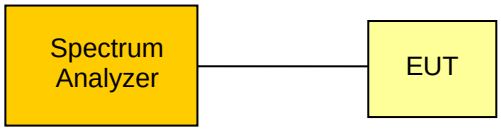


3.5 Test Conditions and Results – Band edge compliance

Band-edge compliance acc. FCC 15.247 / IC RSS-210	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(d) / IC RSS-210 A8.5
Test according to measurement reference	Reference Method
	FCC KDB Publication No. 558074
Test frequency range	Tested frequencies
	Initiator: 2402 - 2479 MHz Reflector: 2404 – 2481 MHz
Measurement mode	Peak

Limits	
Limit	Condition
≤ -20 dB / 100 kHz	Peak power measurement detector = Peak
≤ -30 dB / 100 kHz	Peak power measurement detector = RMS

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Span set around lower band edge and detector is set to peak and max hold
3. Resolution bandwidth is set to 100 kHz
4. Markers are set to peak emission levels within frequency band and outside frequency band
5. Band edge attenuation is determined from level difference

Test results – Initiator F_{LOW}

Channel	Frequency [MHz]	Mode	Level [dBc]	Limit [dBc]	Margin [dB]
F_{LOW}	2402	DCCS	-40.16	-20	-20.16

Test results – Initiator F_{HIGH}

Channel	Frequency [MHz]	Mode	Level [dBc]	Limit [dBc]	Margin [dB]
F_{HIGH}	2481	DCCS	-41.81	-20	-21.81

Comments:

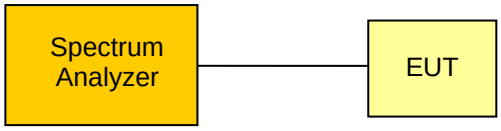
3.6 Test Conditions and Results – Conducted spurious emissions

Conducted spurious emissions acc. FCC 15.247 / IC RSS-210	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(d) / IC RSS-210 A8.5
Test according to measurement reference	Reference Method
	FCC KDB Publication No. 558074
Test frequency range	Tested frequencies
	10 MHz – 10th Harmonic
Measurement mode	Peak

Limits

Limit	Condition
≤ -20 dB / 100 kHz	Peak power measurement detector = Peak
≤ -30 dB /100 kHz	Peak power measurement detector = RMS

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Span it set according to measurement range
3. Resolution bandwidth is set to 100 kHz and detector to peak and max hold
4. Markers are set to peak emission levels within frequency band
5. Emission level is determined by second marker on emission peak
6. Attenuation is determined from level difference

Test results - Initiator

Channel	Frequency [MHz]	Mode	Emission [MHz]	Emission Level [dbm]	Peak power [dBm]	Limit [dBm]	Margin [dB]
F_{MID}	2402 – 2479	DCCS	24765	-37.02	2.6	-17.4	-19.62

Test results - Reflector

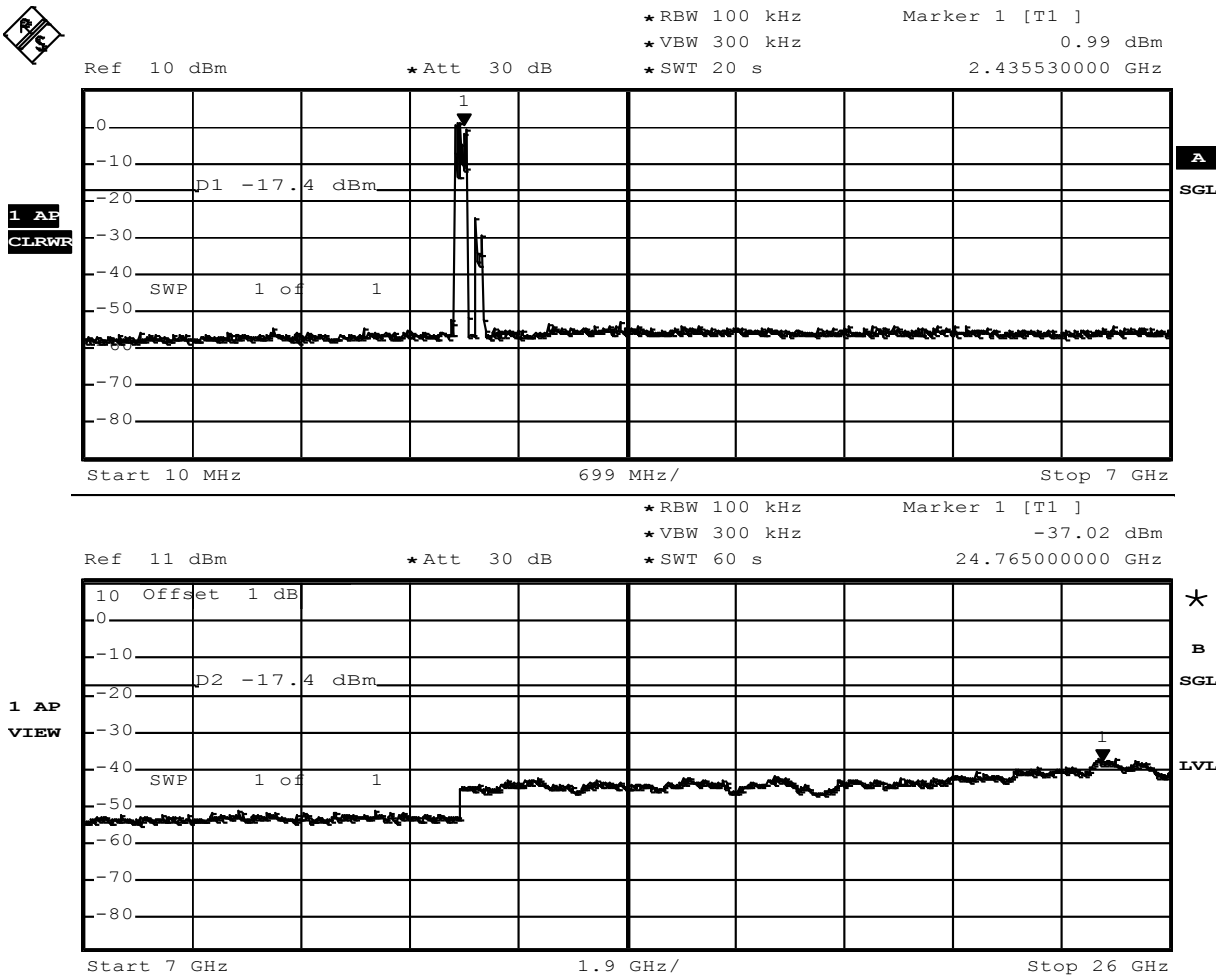
Channel	Frequency [MHz]	Mode	Emission [MHz]	Emission Level [dbm]	Peak power [dBm]	Limit [dBm]	Margin [dB]
F_{MID}	2404 – 2481	DCCS	24803	-37.19	2.4	-17.6	-19.59

Comments:

Conducted spurious emissions – Initiator

FCC part 15.247 (d)
Spurious Emissions

EUT	REB233SMAD Evaluation Kit
Model	ATREB233SMAD-EK
Approval Holder	Atmel Automotive GmbH / Ord.: G0M-1312-3474
Temperature / Voltage	Tnom / Vnom
Test Site / Operator	Eurofins Product Service GmbH / Mr. Treffke
Test Specification	FCC part 15.247 (d)
Comment 1	Spurious Emissions conducted
Comment 2	Initiator 2402-2479 MHz; DCCS
Comment 3	Emissions in non-restricted frequency bands 558074 D01 Meas Guidance

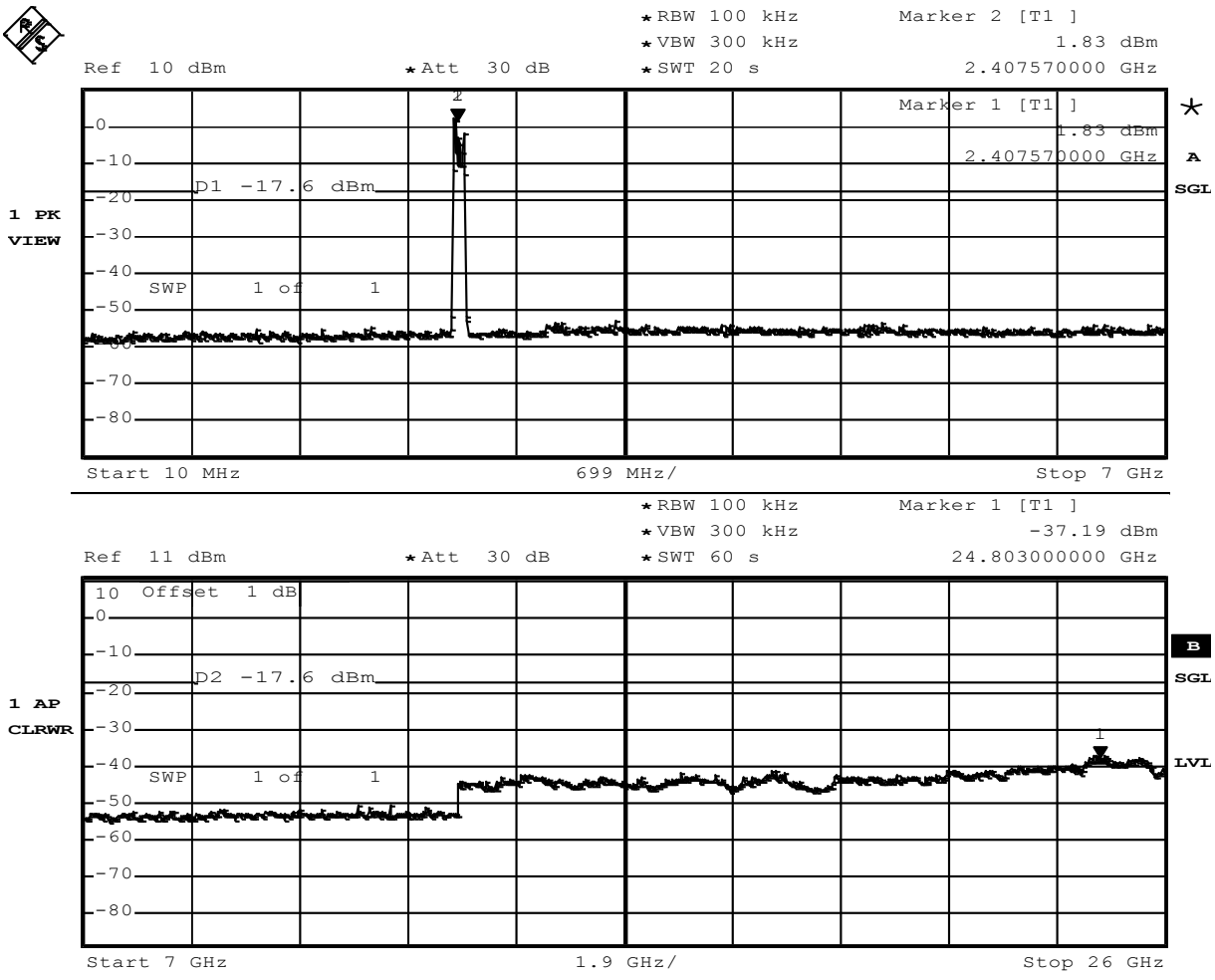


Date: 8.JAN.2014 10:09:29

Conducted spurious emissions – Reflector

FCC part 15.247 (d)
Spurious Emissions

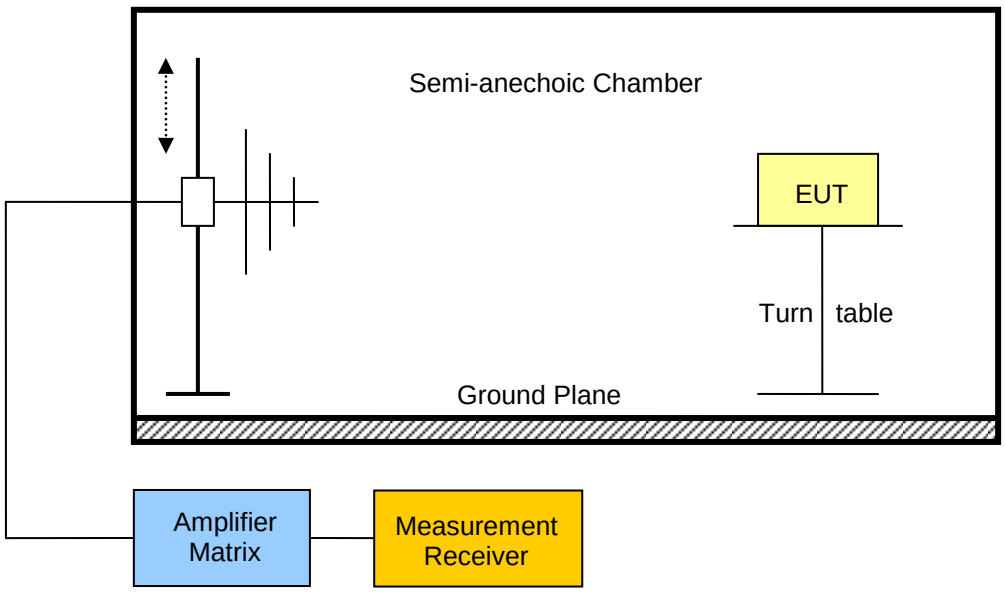
EUT	REB233SMAD Evaluation Kit
Model	ATREB233SMAD-EK
Approval Holder	Atmel Automotive GmbH / Ord.: G0M-1312-3474
Temperature / Voltage	Tnom / Vnom
Test Site / Operator	Eurofins Product Service GmbH / Mr. Treffke
Test Specification	FCC part 15.247 (d)
Comment 1	Spurious Emissions conducted
Comment 2	Reflector 2404-2481, DCCS
Comment 3	Emissions in non-restricted frequency bands 558074 D01 Meas Guidance



Date: 8.JAN.2014 09:56:43

3.7 Test Conditions and Results – Transmitter radiated emissions

Transmitter radiated emissions acc. FCC 47 CFR 15.247 / IC RSS-210				**Verdict: PASS**
Test according referenced standards		Reference Method		
		FCC 15.247(d) / IC RSS-210 A8.5		
Test according to measurement reference		Reference Method		
		FCC KDB Publication No. 558074 / ANSI C63.4		
Test frequency range		Tested frequencies		
		30 MHz – 10th Harmonic		
Limits				
Frequency range [MHz]	Detector	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). When average radiated emission measurements are specified, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.				
Test setup				



Test procedure
1. EUT set to test mode (Communication tester is used if needed) 2. Span it set according to measurement range 3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz 4. Markers are set to peak emission levels within restricted bands

Test results

Channel	Frequency [MHz]	Mode	Emission [MHz]	Level [dbµV/m]	Det.	Pol.	Limit [dbµV/m]	Limit dist. [m]*	Margin [dB]
F_{MID}	2402-2481	DCSS	2390	59.33	pk	ver	74.00	3	-14.67
F_{MID}	2402-2481	DCSS	2390	30.02	RMS	ver	54.00	3	-23.98
F_{MID}	2402-2481	DCSS	2400	81.23	pk	ver	95.00	3	-13.77
F_{MID}	2402-2481	DCSS	2483.5	66.20	pk	hor	74.00	3	-07.80
F_{MID}	2402-2481	DCSS	2483.5	38.91	RMS	hor	54.00	3	-15.09
F_{MID}	2402-2481	DCSS	2483.6	72.46	pk	ver	74.00	3	-01.54
F_{MID}	2402-2481	DCSS	2483.6	45.01	RMS	ver	54.00	3	-08.99
F_{MID}	2402-2481	DCSS	2500	49.23	pk	ver	74.00	3	-24.77
F_{MID}	2402-2481	DCSS	2500	25.69	avg	ver	54.00	3	-28.31
F_{MID}	2402-2481	DCSS	2533	82.39	pk	hor	95.00	3	-12.61
F_{MID}	2402-2481	DCSS	2569	82.71	pk	ver	95.00	3	-12.29

Comments: * Physical distance between EUT and measurement antenna.

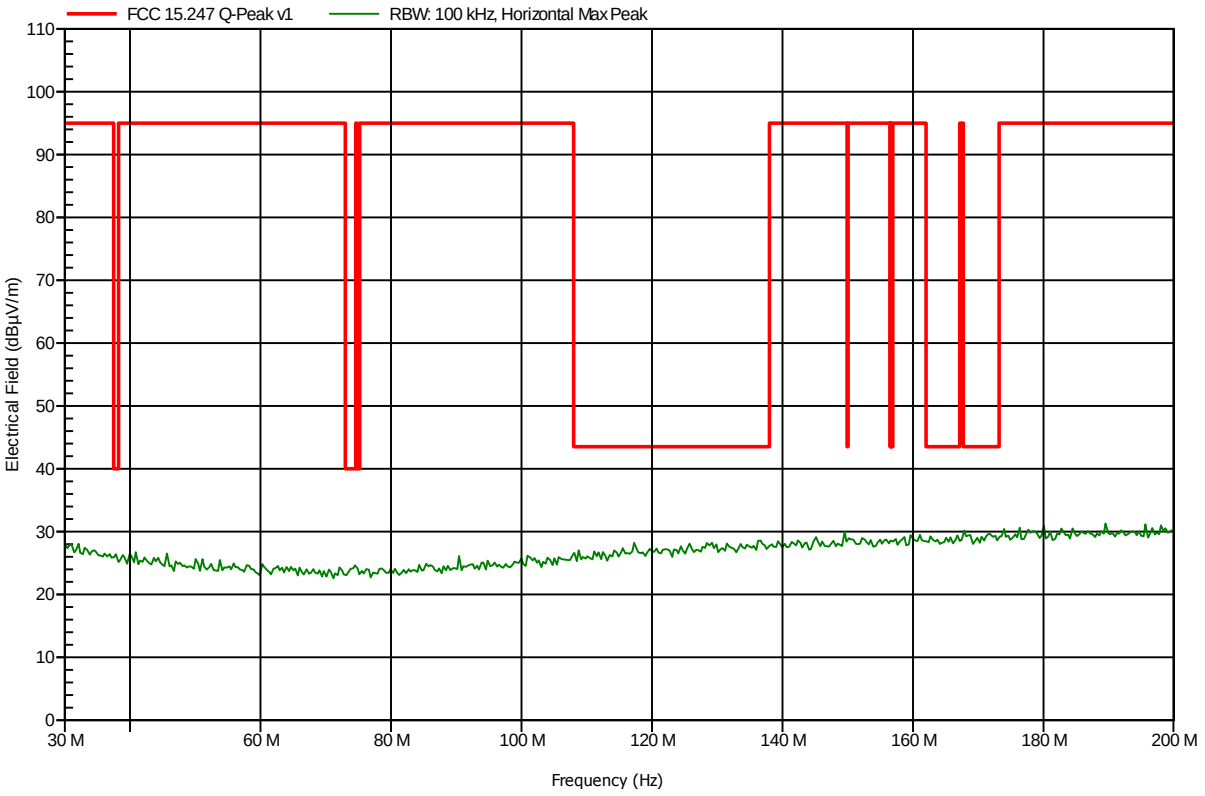
ANNEX A Transmitter radiated spurious emissions

Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 154

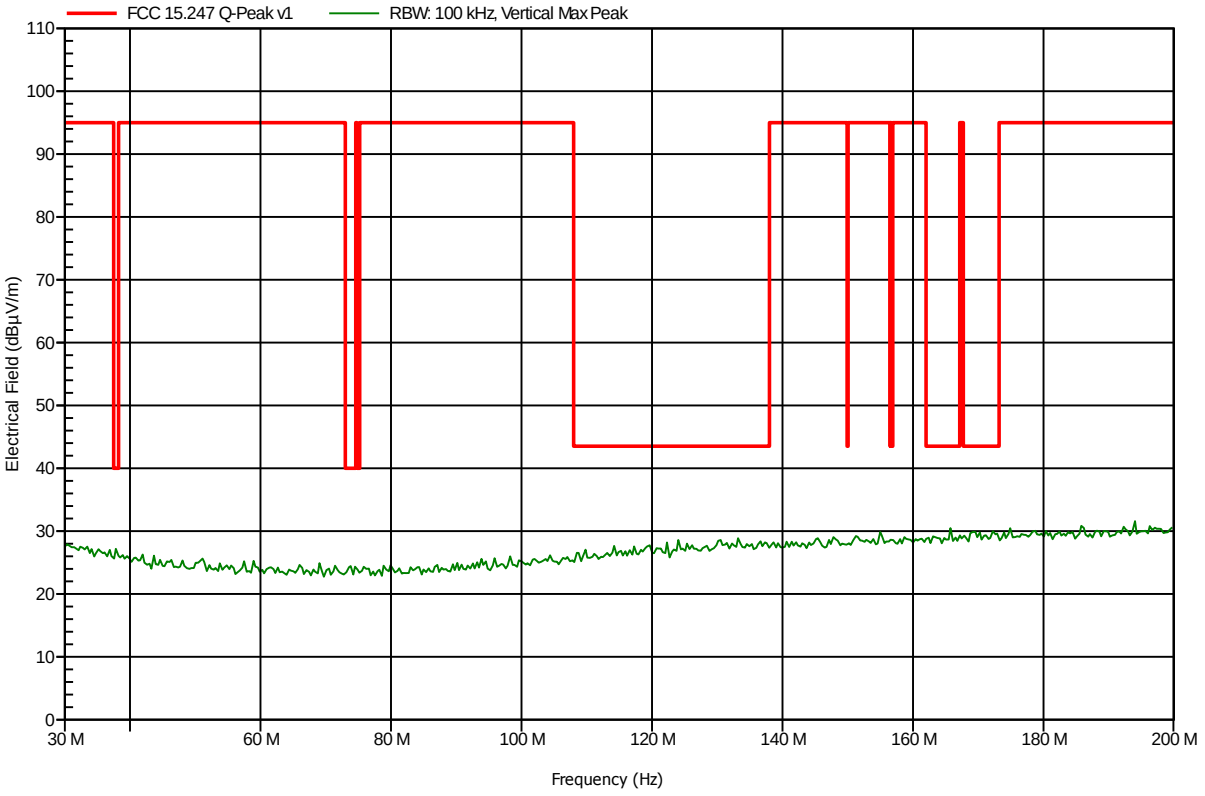


Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 155

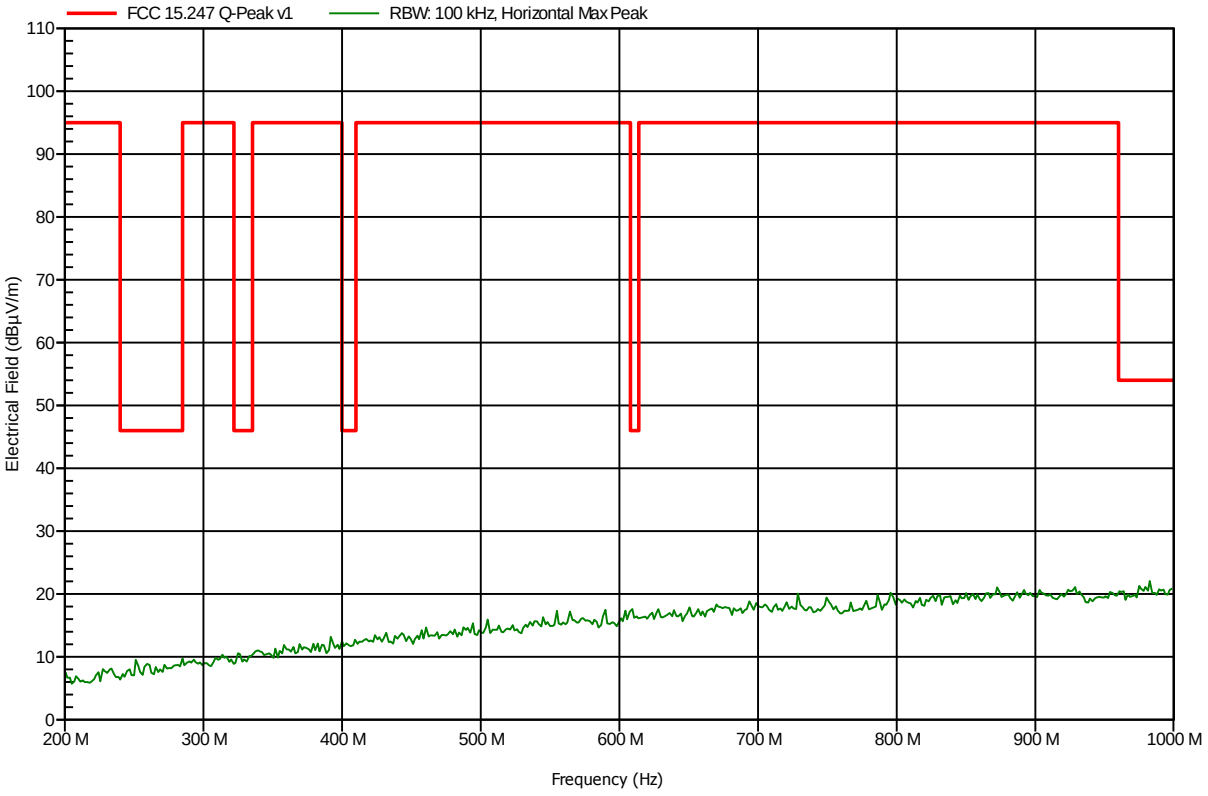


Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 152

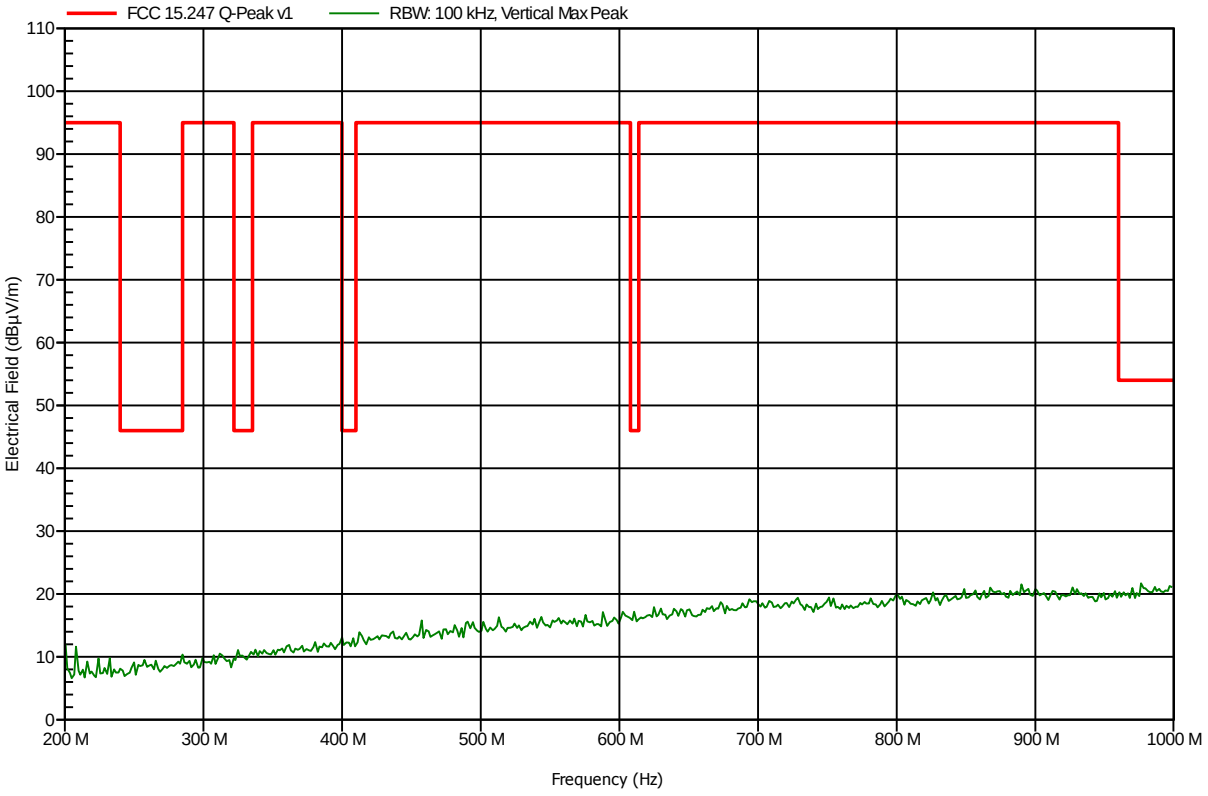


Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 153

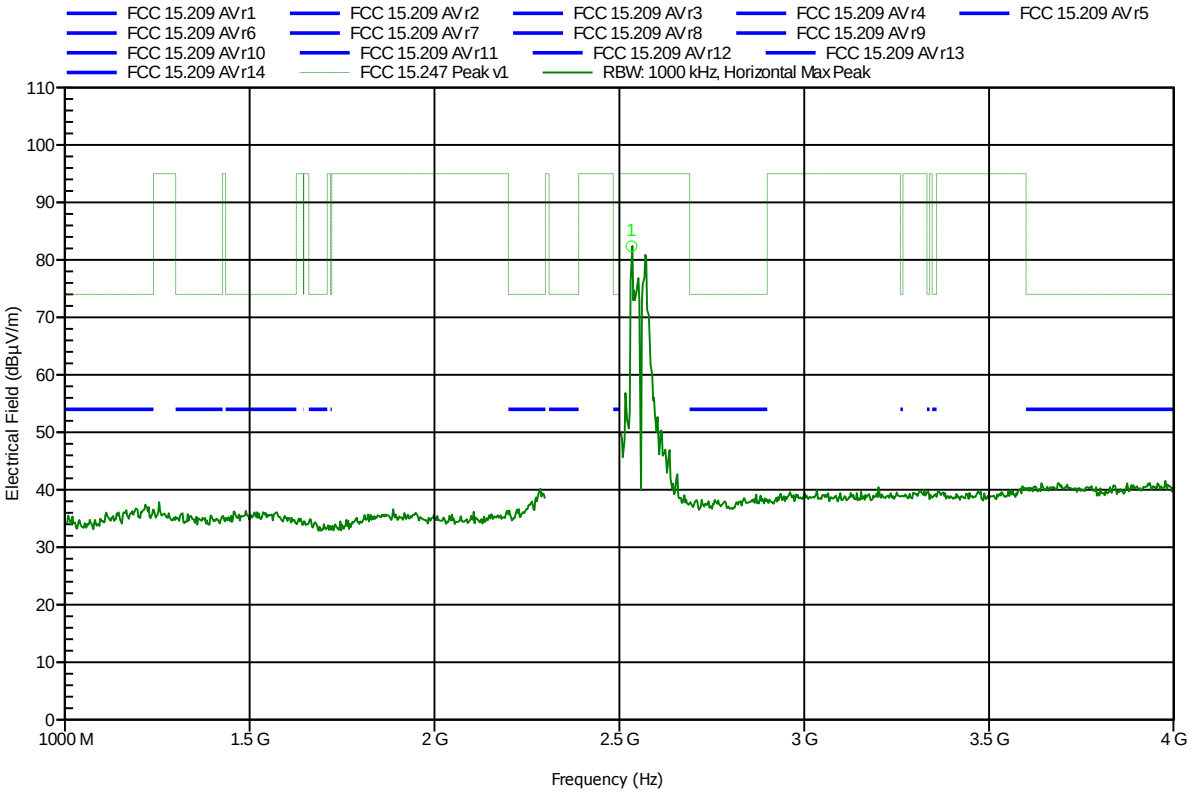


Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 148



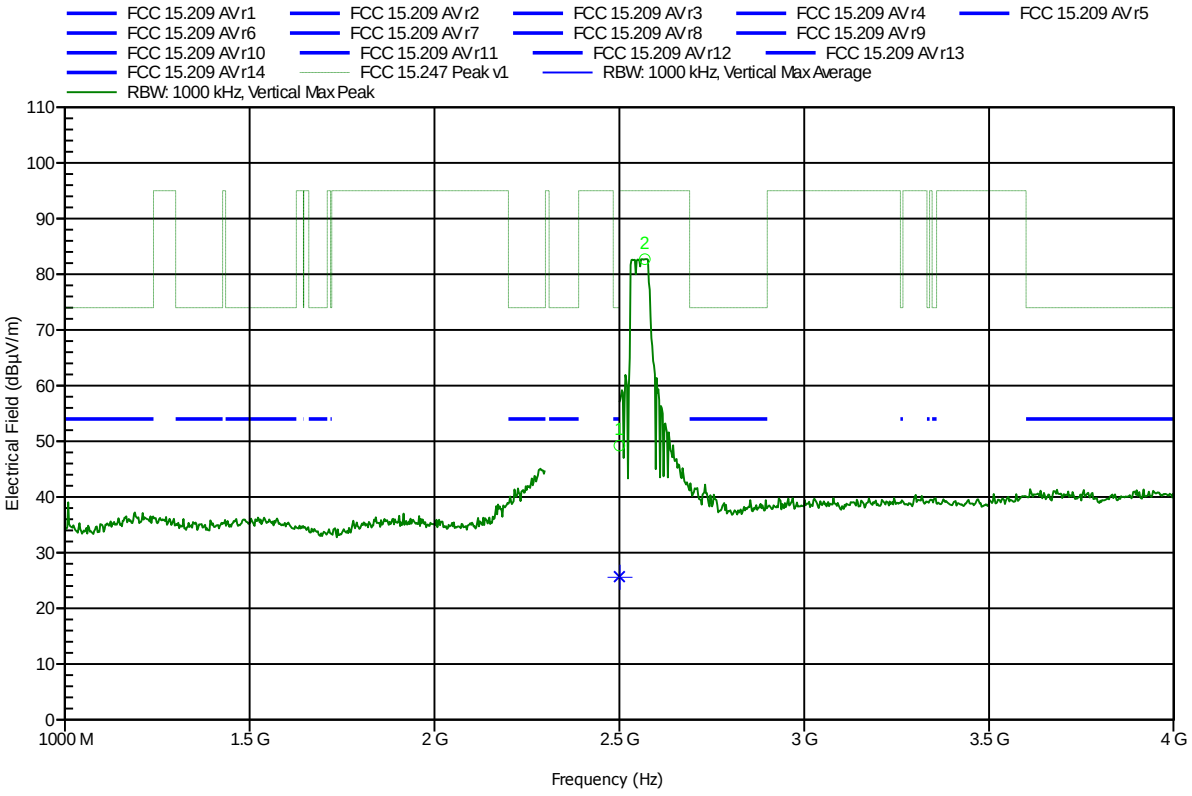
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.533 GHz	82.39 dBµV/m	95 dBµV/m	-12.61 dB	Pass

Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 149



Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.5 GHz	49.23 dBµV/m	74 dBµV/m	-24.77 dB	Pass
2.569 GHz	82.71 dBµV/m	95 dBµV/m	-12.29 dB	Pass

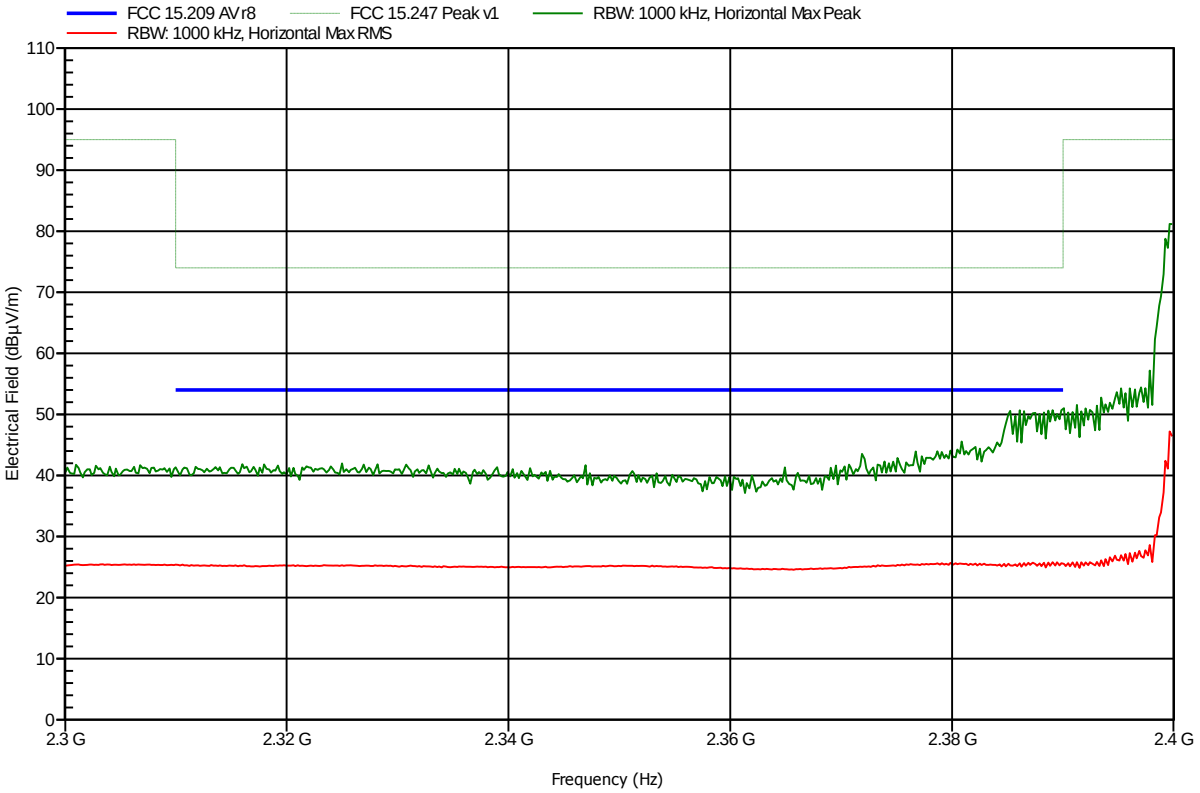
Frequency	Average	Average Limit	Average Difference	Average Status
2.5 GHz	25.69 dBµV/m	54 dBµV/m	-28.31 dB	Pass

Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	lower bandedge; initiator mode

Index 145

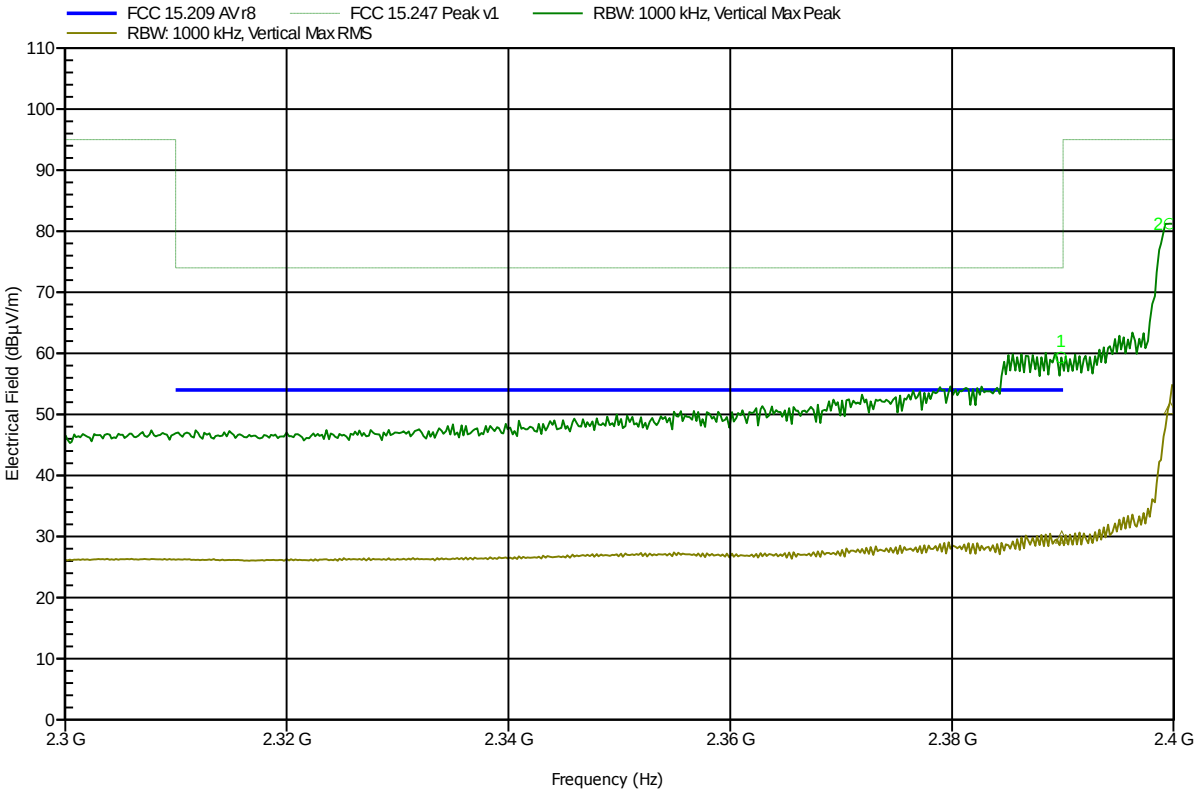


Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	lower bandedge; initiator mode

Index 146



Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.39 GHz	59.33 dBµV/m	74 dBµV/m	-14.67 dB	Pass
2.4 GHz	81.23 dBµV/m	95 dBµV/m	-13.77 dB	Pass

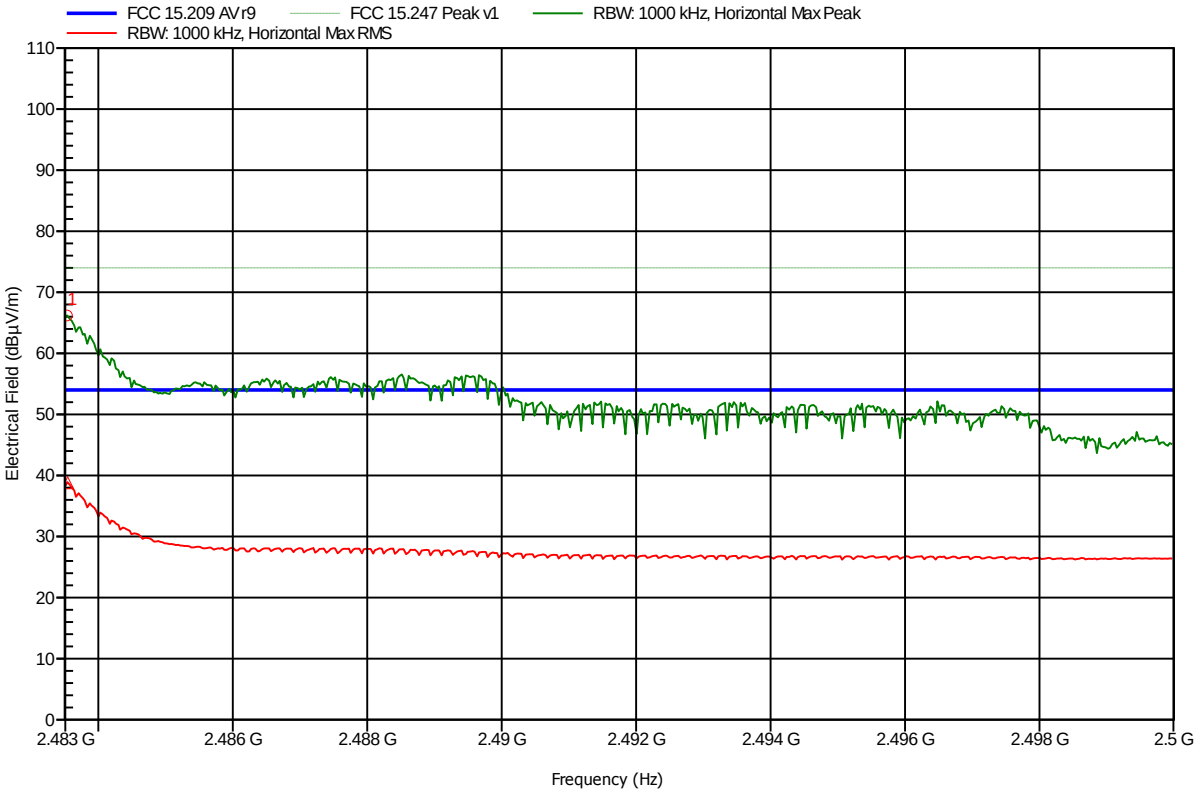
Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.39 GHz	30.02 dBµV/m	54 dBµV/m	-23.98 dB	Pass

Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	upper bandedge; reflector mode

Index 144



Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4835 GHz	66.2 dBµV/m	74 dBµV/m	-7.8 dB	Pass

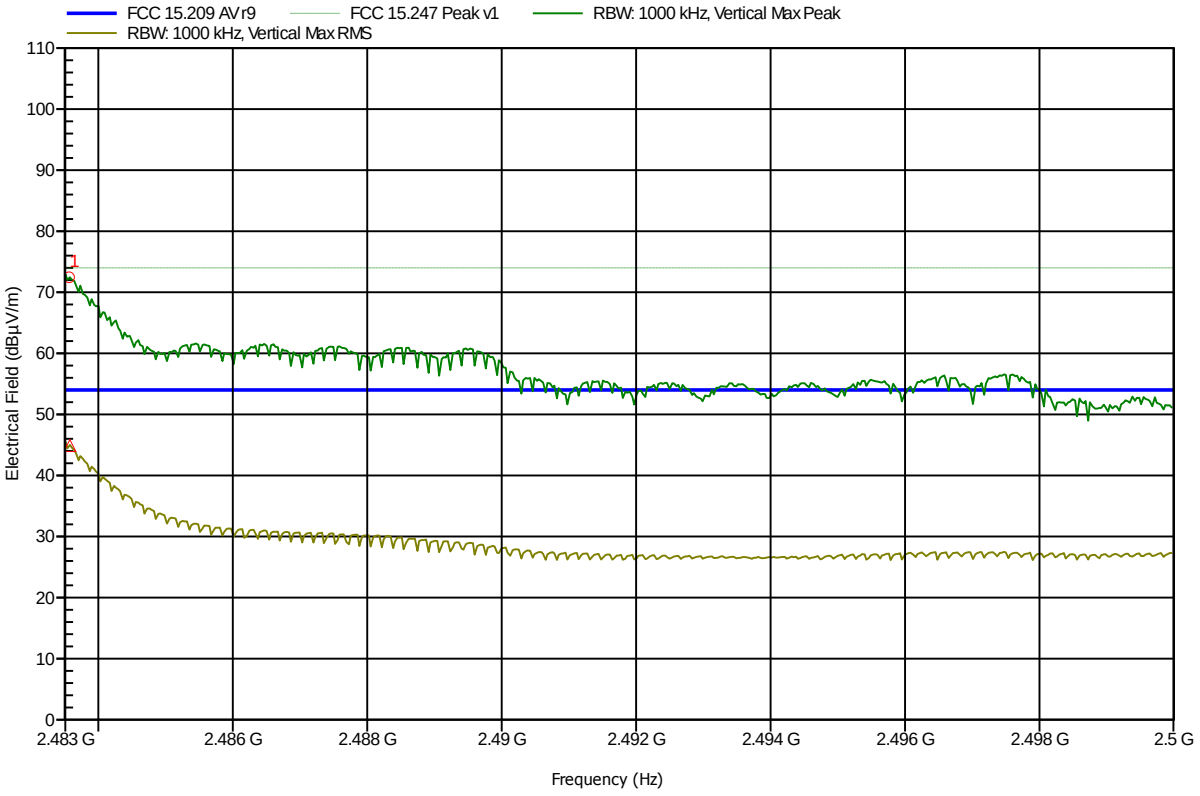
Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.4835 GHz	38.91 dBµV/m	54 dBµV/m	-15.09 dB	Pass

Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	upper bandedge; reflector mode

Index 143



Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4836 GHz	72.46 dBµV/m	74 dBµV/m	-1.54 dB	Pass

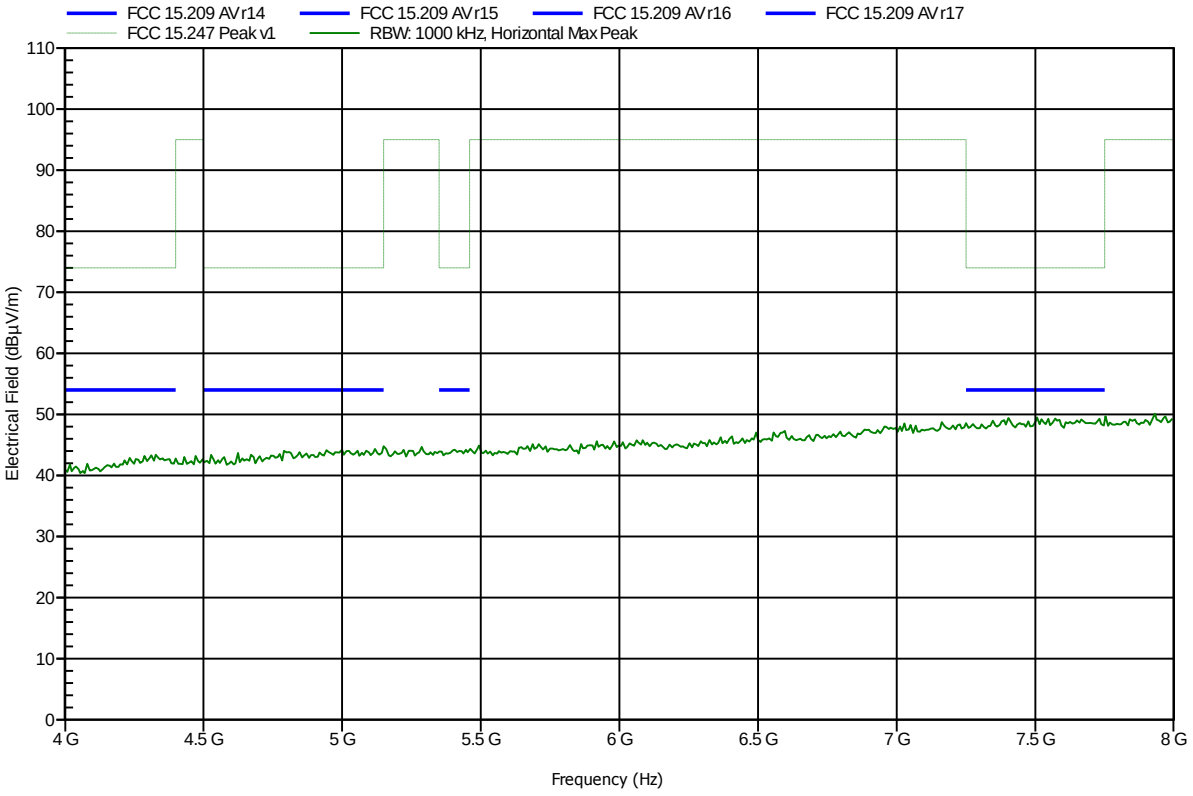
Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.4836 GHz	45.01 dBµV/m	54 dBµV/m	-8.99 dB	Pass

Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 150

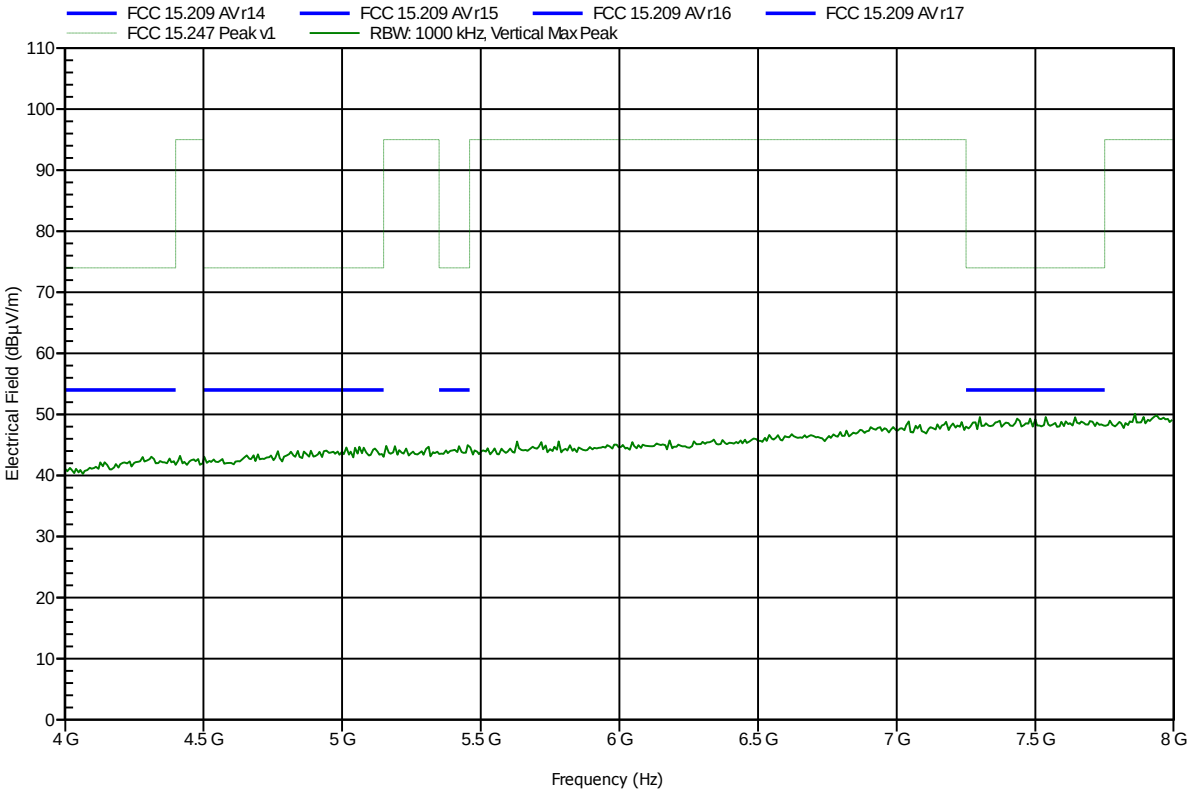


Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 151

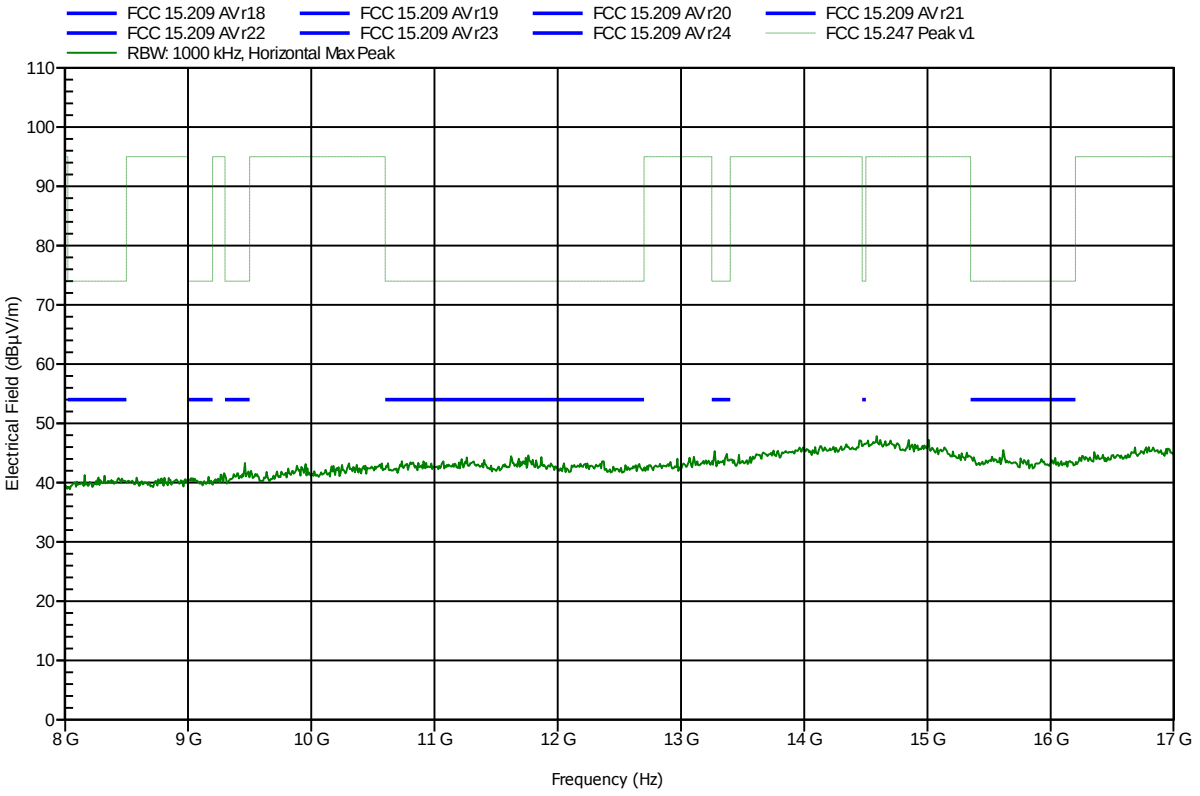


Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	100 cm converted to 3m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 156

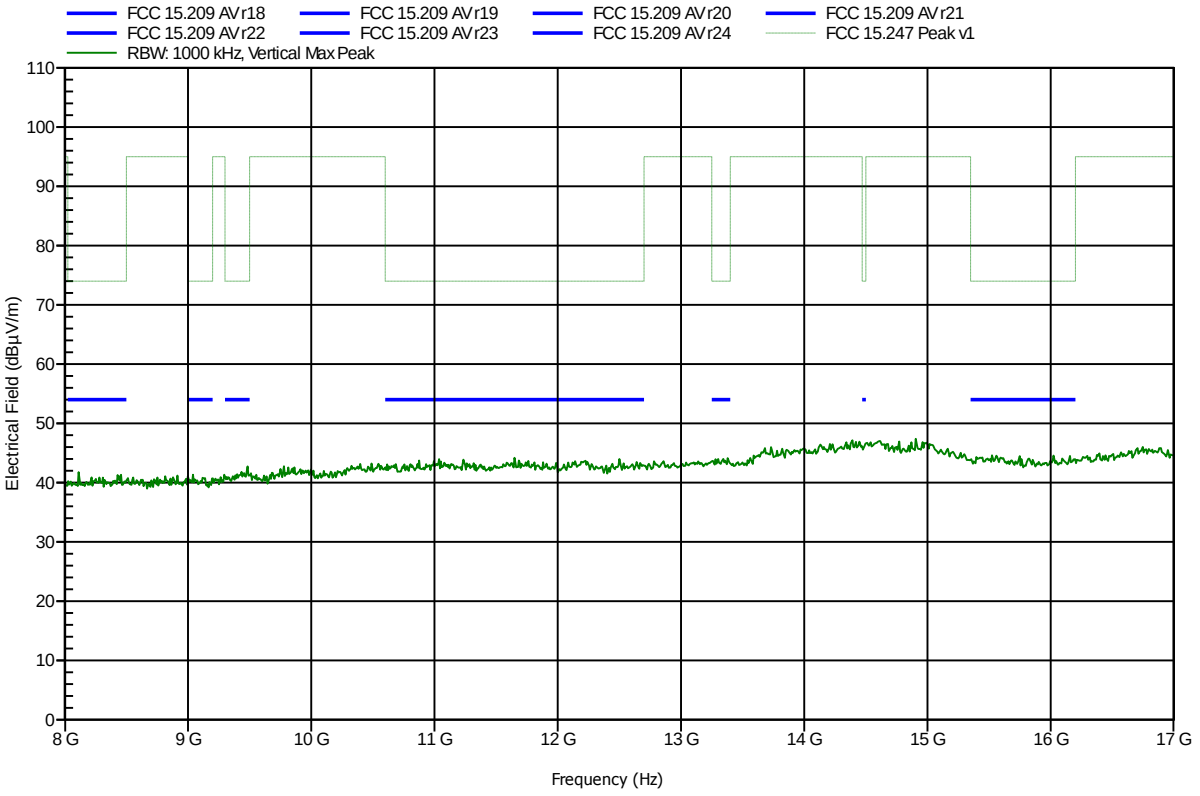


Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	100 cm converted to 3m
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 158

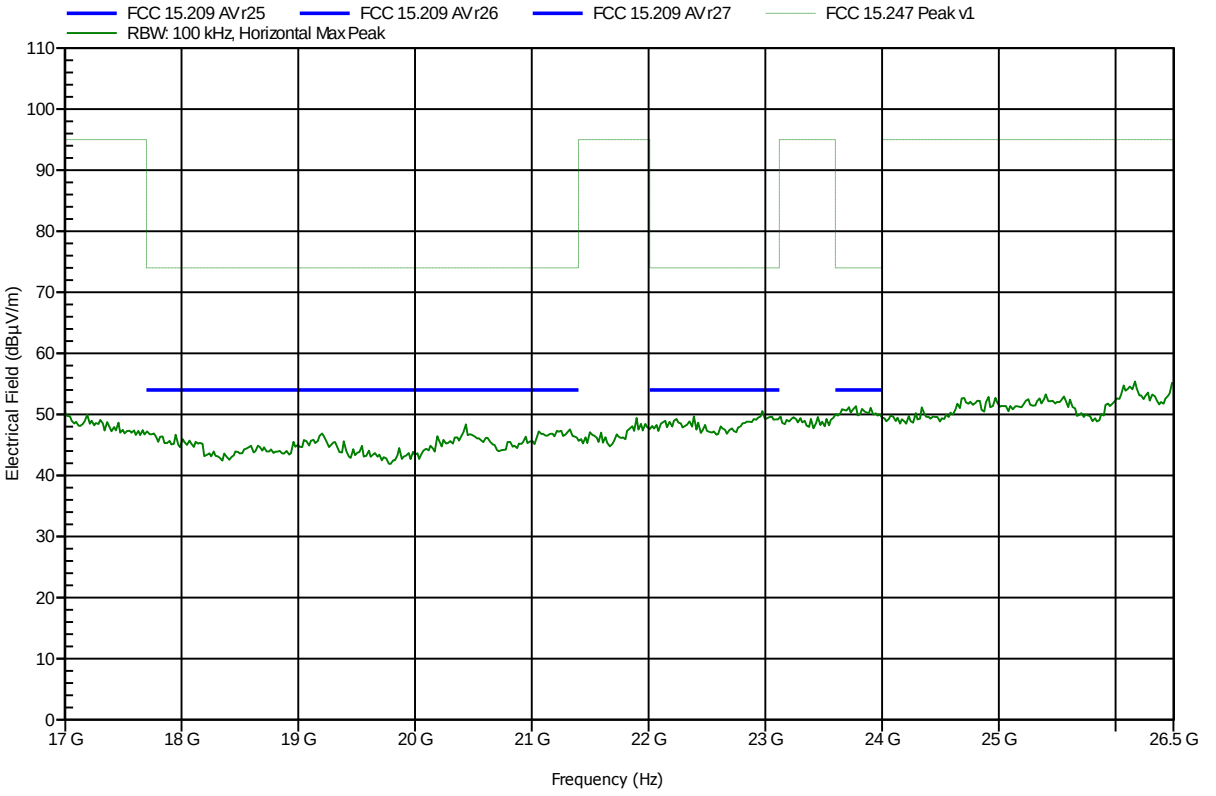


Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Rohde & Schwarz HL 025, Horizontal
Measurement distance:	100 cm
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 157



Spurious emissions according to FCC 15.247

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. Treffke
Test Conditions:	Tnom: 25°C, Vnom: 3V DC (2x1.5 v battery)
Antenna:	Rohde & Schwarz HL 025, Vertical
Measurement distance:	100 cm
Mode:	TX; DCSS; ant.1; Pmax; Chirp
Test Date:	2014-01-14
Note:	

Index 159