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EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada RSS-Gen

Electromagnetic compatibility - Unintentional radiators

Report Reference No. ..... :	G0M-1505-4775-EF0215B-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 15 Subpart B ICES-003, Issue 5:2012 ANSI C63.4:2014
Equipment under test (EUT):	
Product description	ATSAMR21 ZLL Module
Model No.	ATSAMR21B18-MZ210PA
Additional Models	None
Hardware version	Rev 2.3
Firmware / Software version	None
FCC/IC IDs	FCC-ID: VNR-ATSAMZ210PA-0 IC: 20266-ATSMZ210PA0
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 .....: 2015-10-30

Date (s) of performance of tests .....: 2015-11-25

Compiled by ..... : Steffen Zunke

Tested by (+ signature)..... : Andreas Pflug .....

Approved by (+ signature) ..... : Marcus Klein .....
Head of Lab

Date of issue ..... : 2015-12-01

Total number of pages ..... : 26

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:

Version History

Version	Issue Date	Remarks	Revised by
V01	2015-12-01	Initial Release	

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

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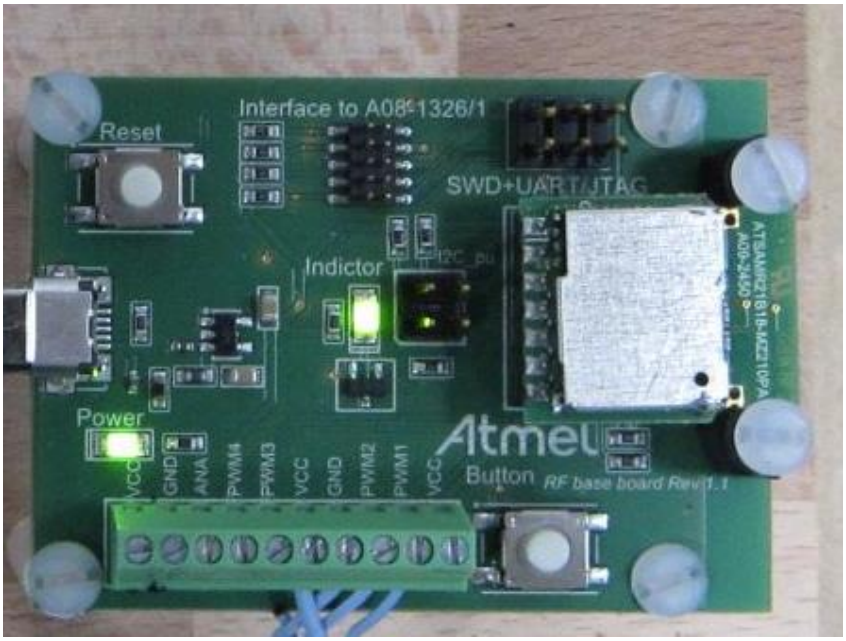
1 Equipment (Test item) Description

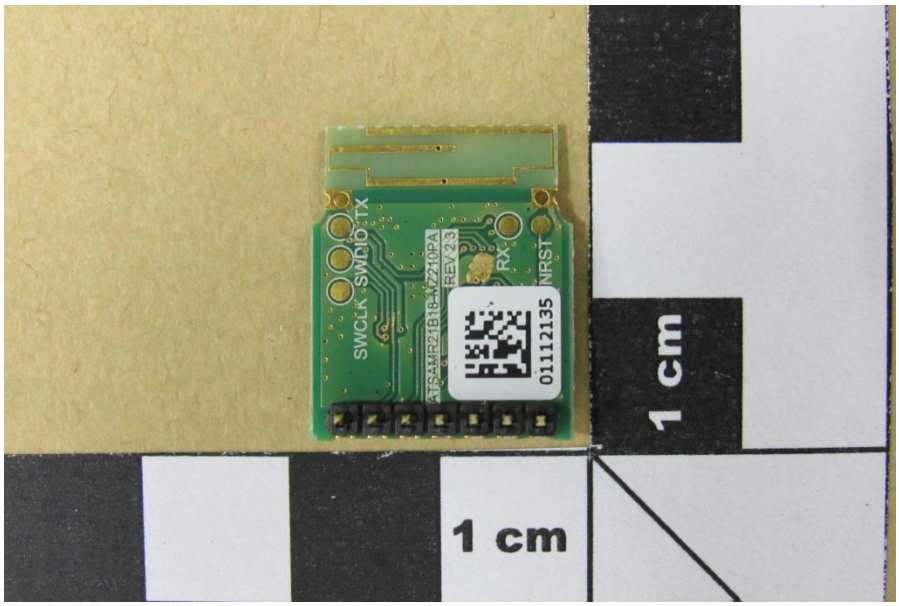
Description	ATSAMR21 ZLL Module
Model	ATSAMR21B18-MZ210PA
Additional Models	None
Serial number	None
Hardware version	Rev 2.3
Software / Firmware version	None
FCC-ID	VNR-ATSAMZ210PA-0
IC-ID	20266-ATSMZ210PA0
Power supply	5 VDC via Battery pack or via AC/DC Adapter
AC/DC-Adaptor	Model : HNP10i MicroUSB Manufacturer : hn electronic Input : 100-240VAC / 50-60Hz Output : 5VDC / 2.0A
Manufacturer	Atmel Automotive GmbH Koenigsbruecker Str. 61 01099 Dresden GERMANY
Highest emission frequency	Fmax [MHz] = 2400
Device classification	Class B
Equipment type	Tabletop
Number of tested samples	1

1.1 Photos – Equipment

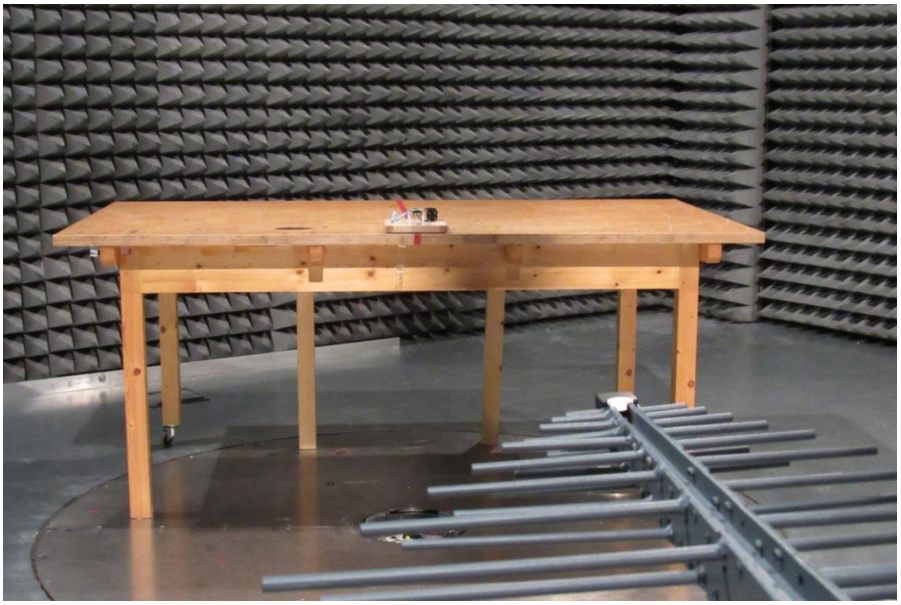
EUT Top on Evaluation Board



EUT Bottom



1.2 Photos – Test setup

Test Setup : Radiated Emissions


Test Setup : Conducted Emissions

1.3 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	breakout/Interface board	ATMEL	Baseboard R21E ZLL	-
AE	USB Levelshifter	dresden elektronik	USB levelshifter basic	-
AE	USB memory stick	dresden elektronik	N/A	-
AE	USB cord	Molex	USB A/m <-> A/f	-
AE	4xAA Battery pack	custom	N/A	-
AE	Mains adapter	hn electronic	HNP10i MicroUSB	-
AE	Notebook	DELL	Latitude 620	-

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

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

1.4 Input / Output Ports

Port #	Name	Type*	Max. Cable Length	Cable Shielded	Comments
1	USB	I/O / DC	1 m	Yes	Interface on the Supporting Equipment
2	SMA	I/O	-	Yes	Interface on the Supporting Equipment

***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

1.5 Operating Modes and Configurations

Mode #	Description
1	TX-RX (packet error rate test, continuously record)

Configuration #	EUT Configuration
1	EUT fully assembled, powered via battery pack
2	EUT fully assembled, powered via AC/DC adapter

1.6 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2014.1.15

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	2014-03	2017-03
Horn antenna	Schwarzbeck	BBHA 9120D	EF00018	2013-09	2016-09
EMI Test Receiver	R&S	ESU26	EF00887	2015-01	2016-01

Conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2014-11	2016-11
AMN	R&S	ESH3-Z5	EF00036	2014-12	2016-12
EMI Test Receiver	R&S	ESCS 30	EF00295	2014-10	2015-10

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 RSS-Gen 6.13	Radiated emissions	ANSI C 63.4	PASS	-
47 CFR 15.107 RSS-Gen 8.8	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	24°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	
	Fmax [MHz] = 2400	
Fully configured sample scanned over the following frequency range	Frequency range	
	30 MHz to 14 GHz	
Operating mode	1	
Configuration	1	

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 C63-4:2009 requirements and is listed by FCC.
The measurement procedure is as follows:

1) The EUT was placed on a 0.8 m non conductive table at a 3 m distance from the receive antenna (ANSI C63.4: 2009 item 6.2)
2) The antenna output was connected to the measurement receiver
3) 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
4) Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.

Spurious emissions under normal conditions according to FCC part 15B

Project number: G0M-1505-4775

Applicant:	dresden elektronik ingenieurtechnik gmbh
EUT Name:	2.4GHz IEEE802.15.4 radio module (shielded)
Model:	ATSAMR21
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: +6VDC(4x1.5V,battery AA)
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note:	

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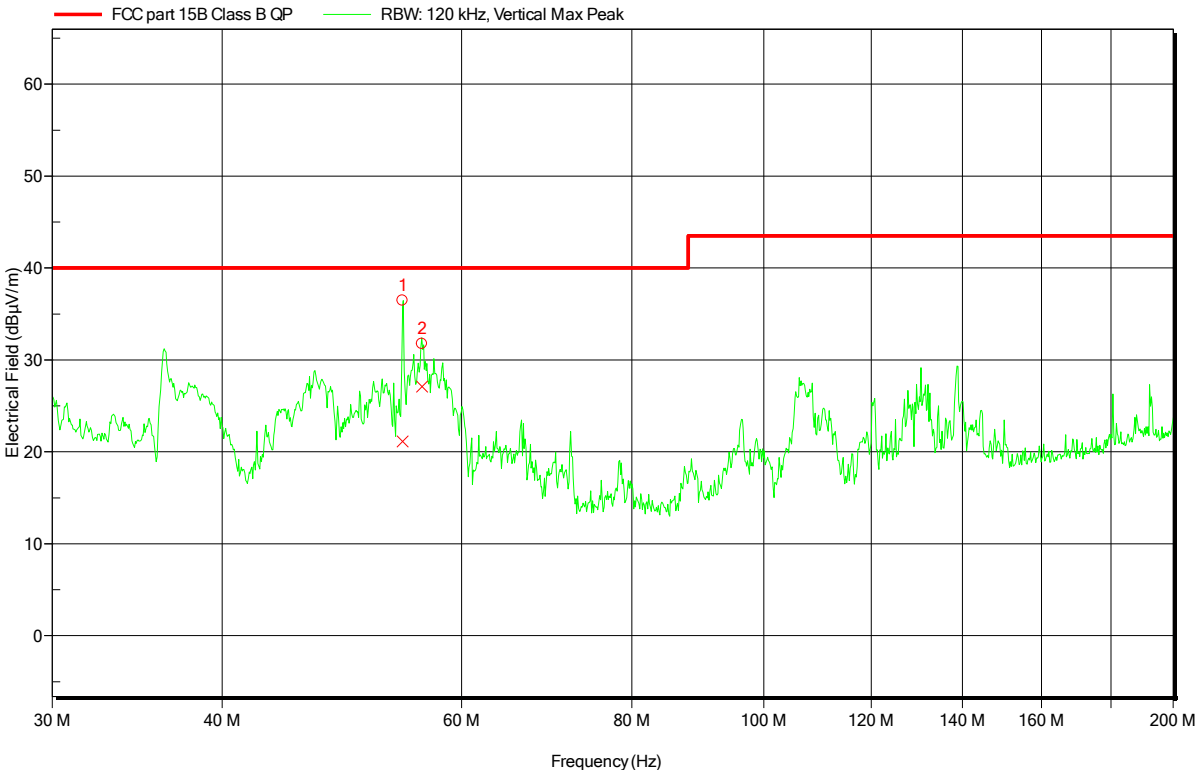

Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
54.288 MHz	21.12 dBµV/m	40 dBµV/m	-18.88 dB	Pass
56.1 MHz	27.11 dBµV/m	40 dBµV/m	-12.89 dB	Pass

Spurious emissions under normal conditions according to FCC part 15B

Project number: G0M-1505-4775

Applicant:	dresden elektronik ingenieurtechnik gmbh
EUT Name:	2.4GHz IEEE802.15.4 radio module (shielded)
Model:	ATSAMR21
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: +6VDC(4x1.5V,battery AA)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note:	

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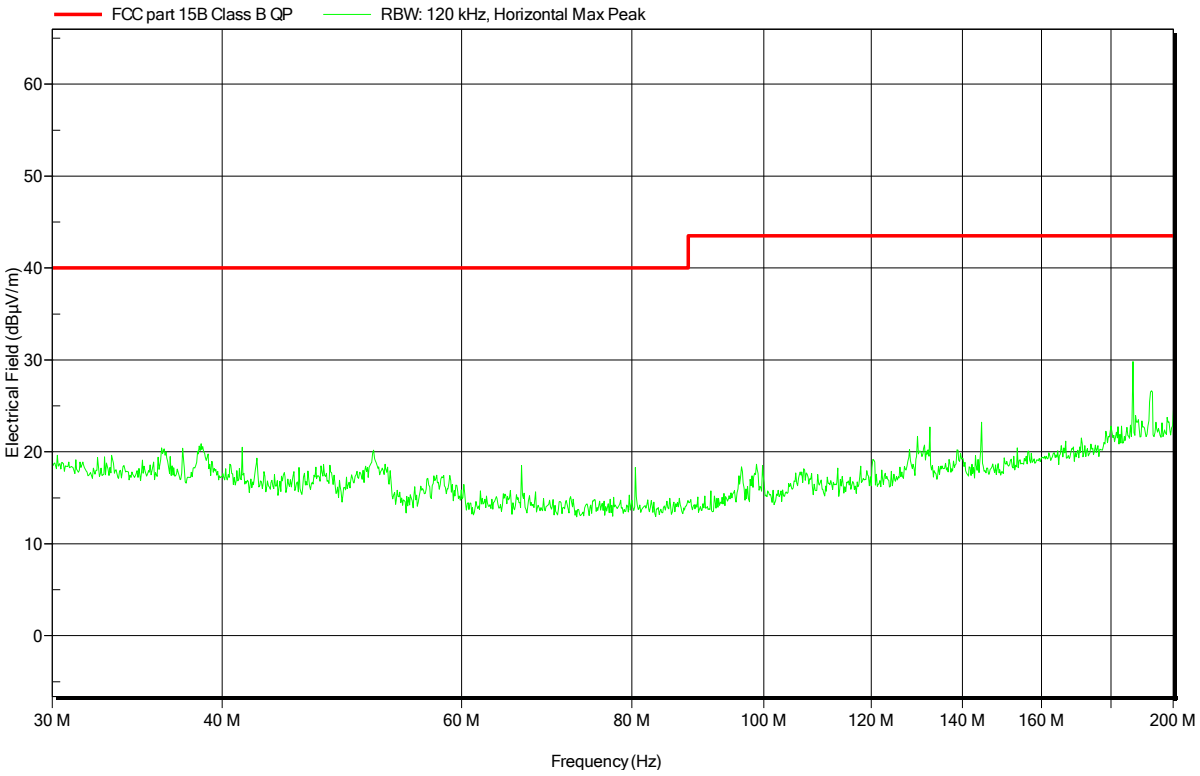

Spurious emissions under normal conditions according to FCC part 15B

Project number: G0M-1505-4775

Applicant:	dresden elektronik ingenieurtechnik gmbh
EUT Name:	2.4GHz IEEE802.15.4 radio module (shielded)
Model:	ATSAMR21
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: +6VDC(4x1.5V,battery AA)
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3m
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note:	

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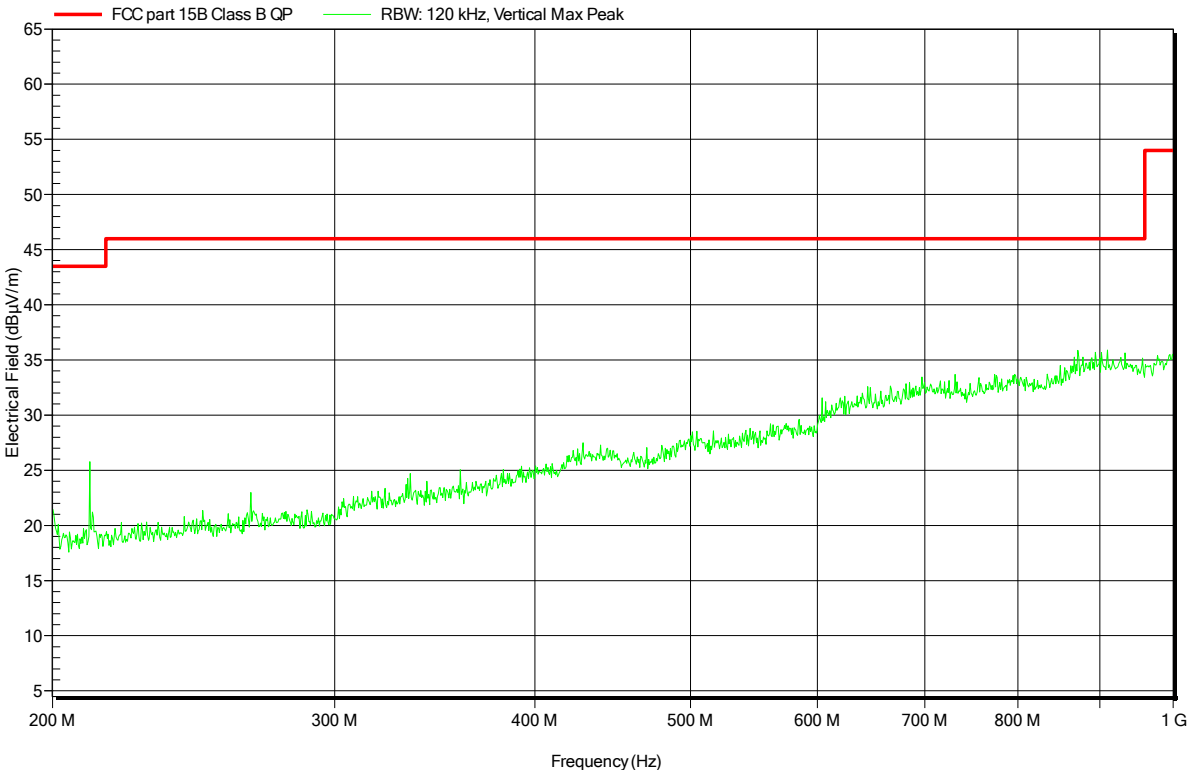

Spurious emissions under normal conditions according to FCC part 15B

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Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: +6VDC(4x1.5V,battery AA)
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note:	

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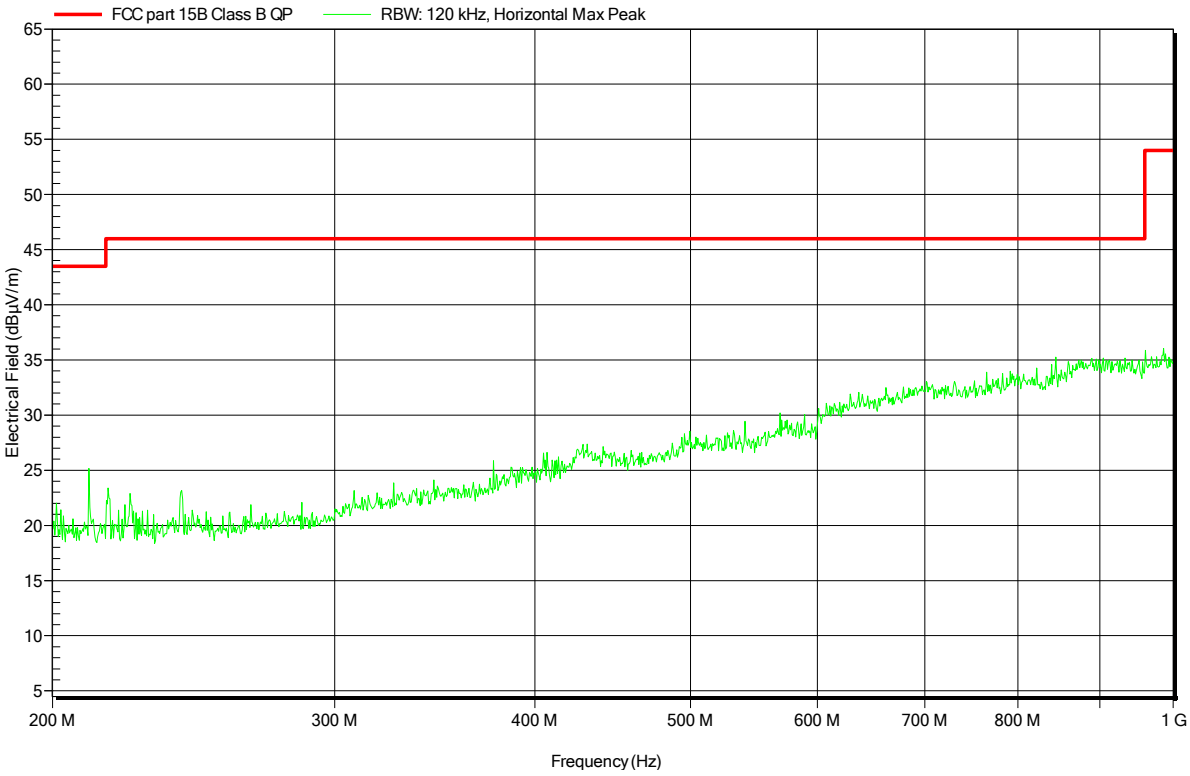

Spurious emissions under normal conditions according to FCC part 15B

Project number: G0M-1505-4775

Applicant:	dresden elektronik ingenieurtechnik gmbh
EUT Name:	2.4GHz IEEE802.15.4 radio module (shielded)
Model:	ATSAMR21
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: +6VDC(4x1.5V,battery AA)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note:	

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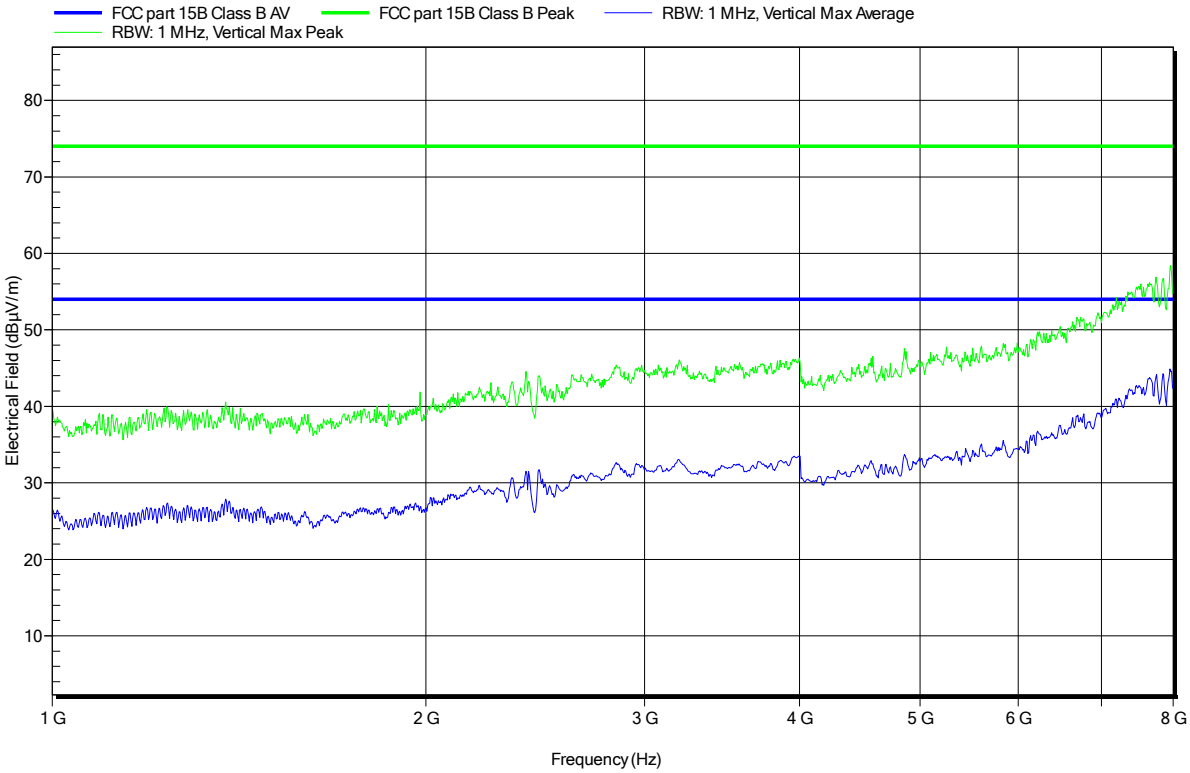

Spurious emissions under normal conditions according to FCC part 15B

Project number: G0M-1505-4775

Applicant:	dresden elektronik ingenieurtechnik gmbh
EUT Name:	2.4GHz IEEE802.15.4 radio module (shielded)
Model:	ATSAMR21
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: +6VDC(4x1.5V,battery AA)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3m
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note:	

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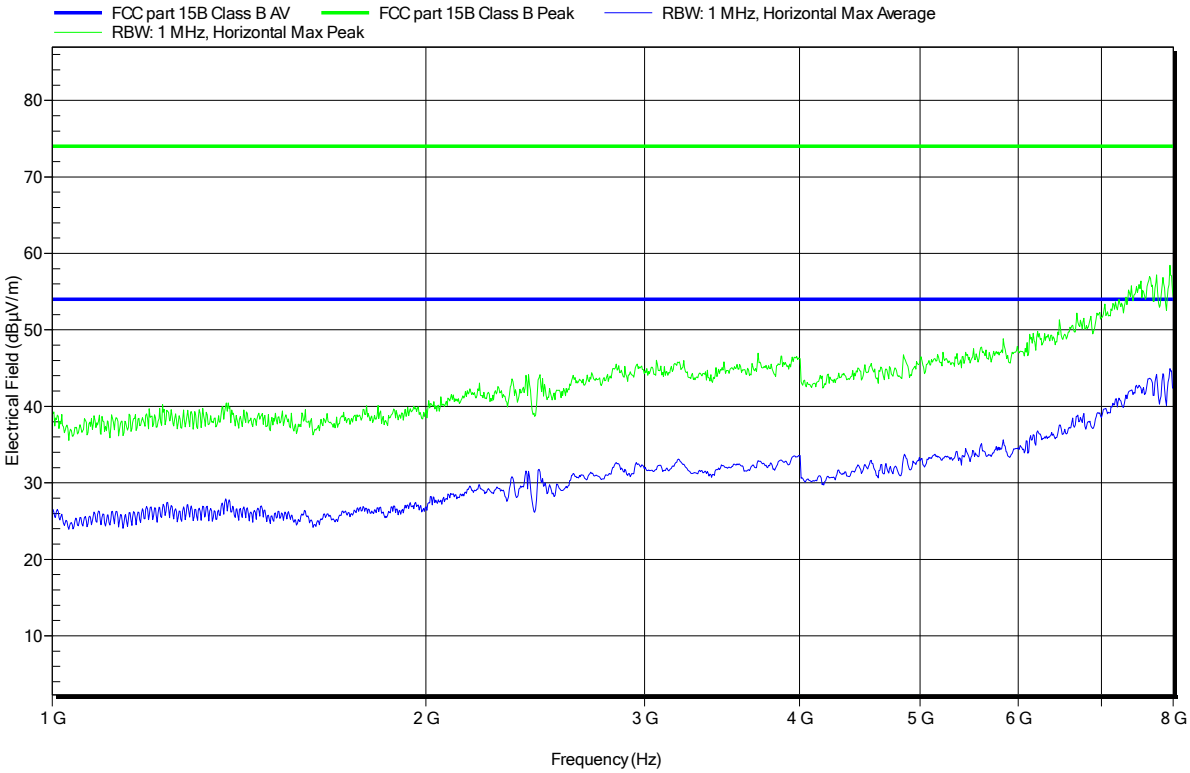

Spurious emissions under normal conditions according to FCC part 15B

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EUT Name:	2.4GHz IEEE802.15.4 radio module (shielded)
Model:	ATSAMR21
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: +6VDC(4x1.5V,battery AA)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note:	

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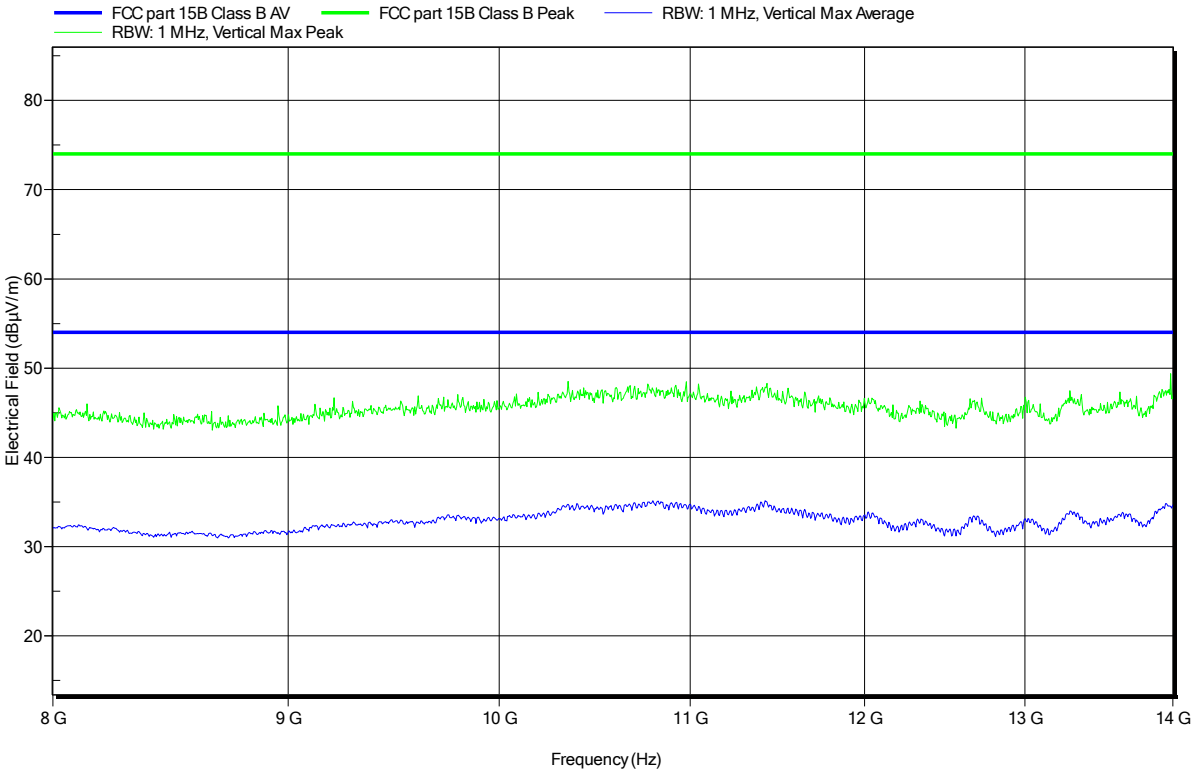

Spurious emissions under normal conditions according to FCC part 15B

Project number: G0M-1505-4775

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EUT Name:	2.4GHz IEEE802.15.4 radio module (shielded)
Model:	ATSAMR21
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: +6VDC(4x1.5V,battery AA)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3m
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note:	

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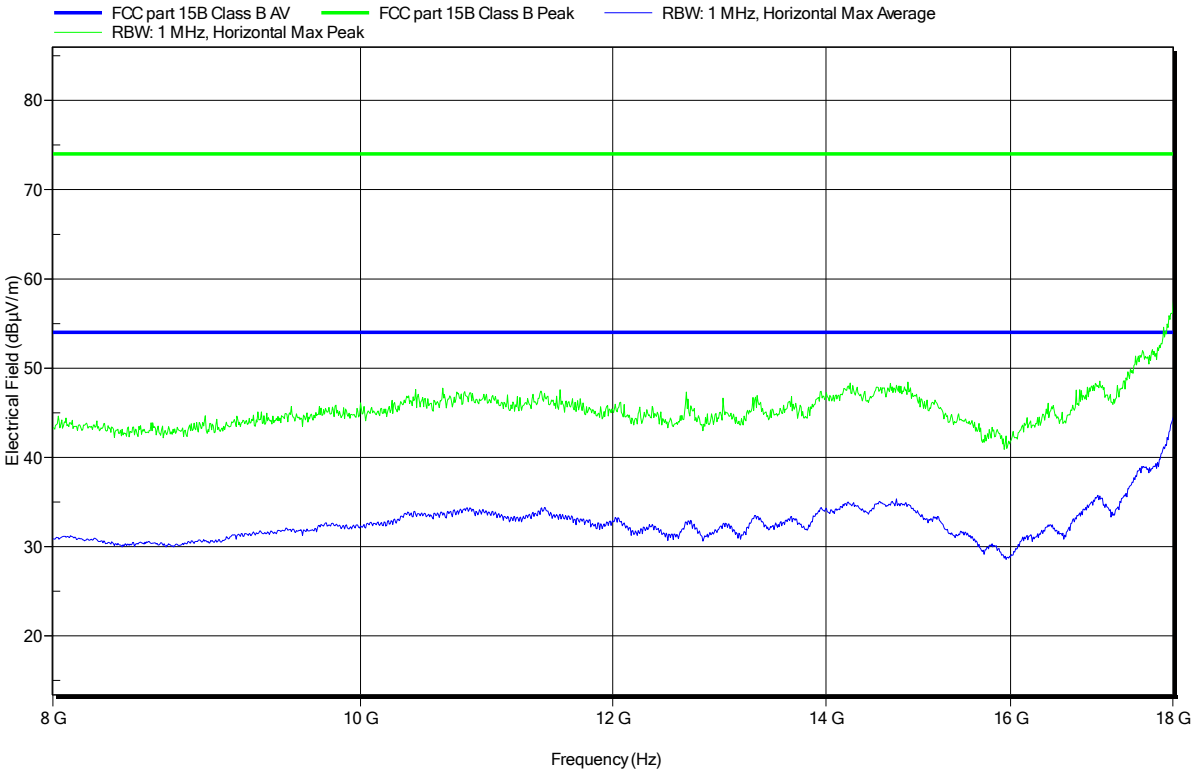


3.2 Test Conditions and Results – AC power line conducted emissions

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	24°C
Relative Humidity	30 to 60 %	40%
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	
Configuration	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:
* Limit decreases linearly with the logarithm of the frequency.

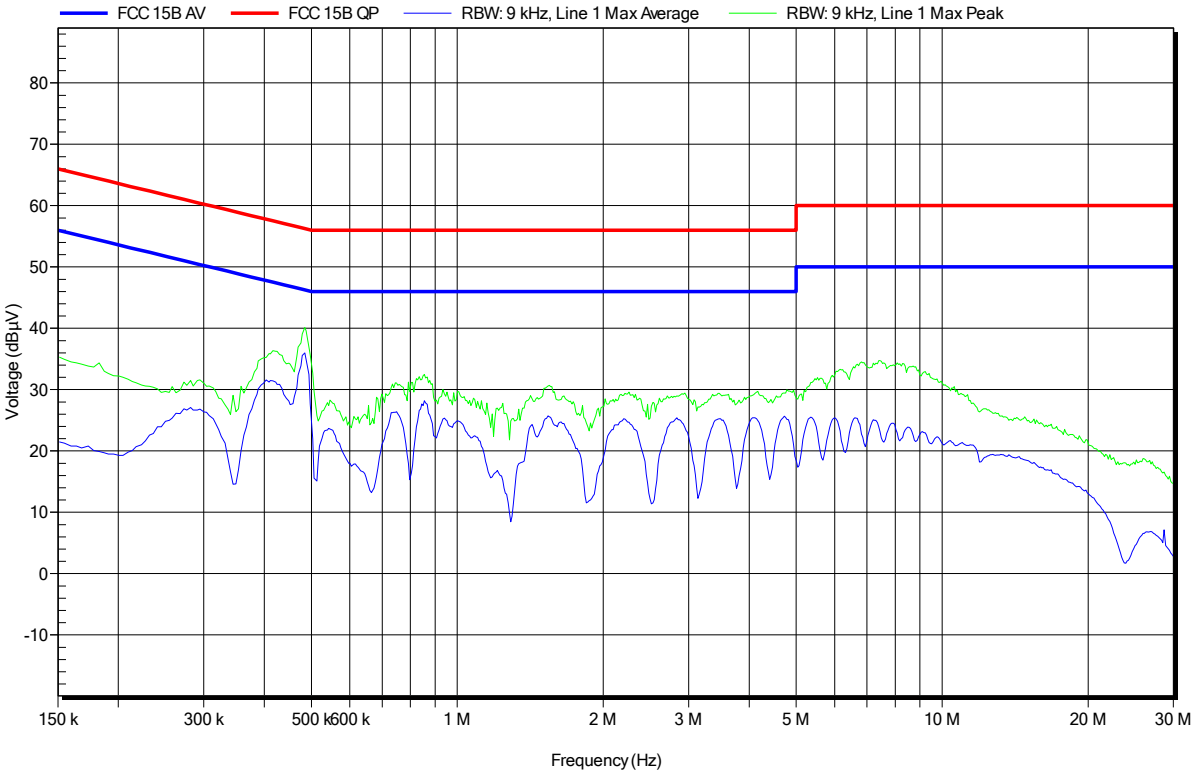
Test Procedure:

1) The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2009 item 7.3.1)
2) The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
3) The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
4) The LISN measurement port was connected to a measurement receiver
5) I/O cables were bundled not longer than 0.4 m
6) Measurement was performed in the frequency range 0.15 – 30MHz on each current-carrying conductor

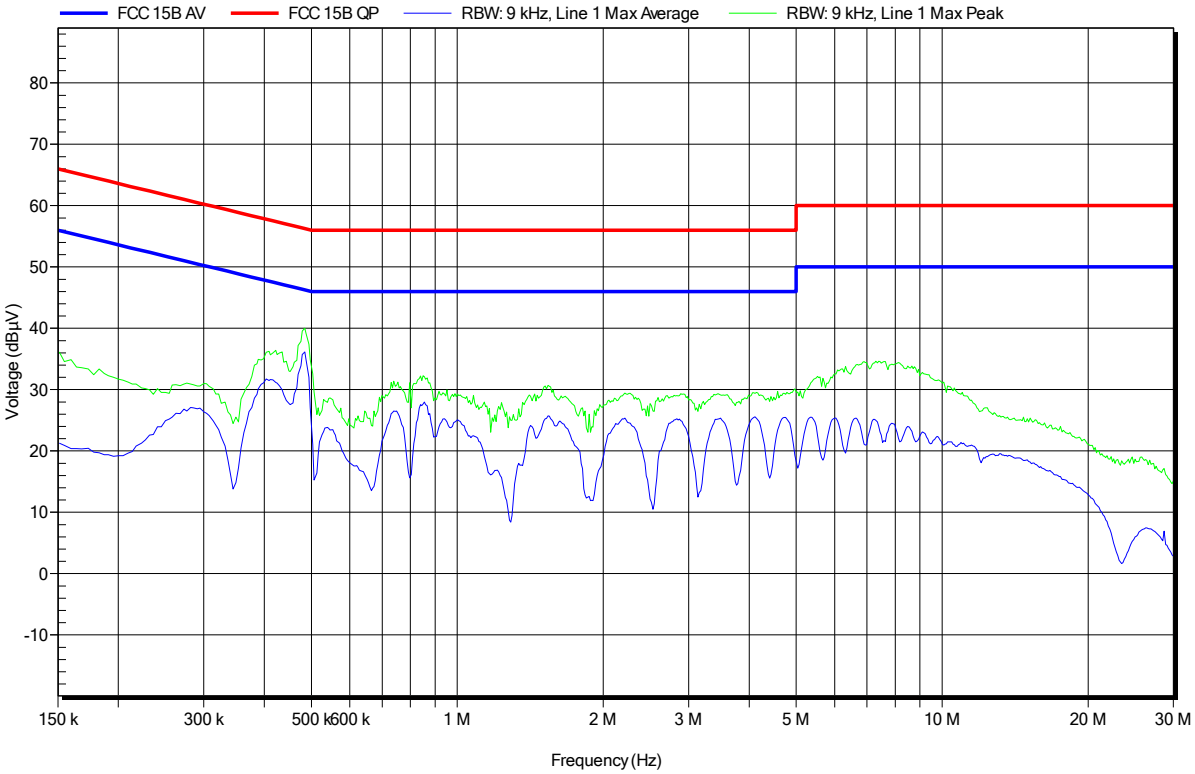
EMI voltage test in the ac-mains according to FCC part 51B

Project number: G0M-1505-4775

Applicant:	dresden elektronik ingenieurtechnik gmbh
EUT Name:	2.4GHz IEEE802.15.4 radio module (shielded)
Model:	ATSAMR21
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C,Unom: 120VAC,AC/DC-adapter mod:HNP10I- Micro USB
LISN:	ESH2-Z5 N
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note:	



EMI voltage test in the ac-mains according to FCC part 51B

Project number: G0M-1505-4775

Applicant:	dresden elektronik ingenieurtechnik gmbh
EUT Name:	2.4GHz IEEE802.15.4 radio module (shielded)
Model:	ATSAMR21
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: 120VAC,AC/DC-adapter mod:HNP10I- Micro USB
LISN:	ESH2-Z5 L
Mode:	TX-RX(packet error rate test, continuously record)
Test Date:	2015-11-25
Note: