EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada RSS-Gen

Electromagnetic compatibility - Unintentional radiators

Report Reference No. ..... :	G0M-1505-4730-EF0115B-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 RSS-Gen, Issue 4, 2014-11 ANSI C63.4:2009
Equipment under test (EUT):	
Product description	ATSAMR21 Smart Connect Module with solder mount footprint
Model No.	ATSAMR21G18-MR210UA
Additional Models	None
Hardware version	1.0
Firmware / Software version	Test FW REV2755
FCC/IC ID	FCC-ID: VNR-ATSAMR210UA-0 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 ..... :	2015-05-08
Date (s) of performance of tests ..... :	2015-05-27 - 2015-06-04
Compiled by..... :	Steffen Zunke
Tested by (+ signature)..... :	Yu Yu / Steffen Zunke
Approved by (+ signature) ..... : Deputy Head of Lab	Jens Marquardt
Date of issue..... :	2015-07-30
Total number of pages..... :	35
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	2015-07-30	Initial Release	

REPORT INDEX

1 Equipment (Test item) Description

Description	ATSAMR21 Smart Connect Module with solder mount footprint
Model	ATSAMR21G18-MR210UA
Additional Models	None
Serial number	None
Hardware version	1.0
Software / Firmware version	Test FW REV2755
FCC-ID	VNR-ATSAMR210UA-0
IC	N/A
Power supply	5 VDC via USB
AC/DC-Adaptor from laptop	Model : PA1900-02D Manufacturer : DELL Input : 100-240VAC / 50-60Hz Output : 19.5VDC / 4.62A
Manufacturer	Atmel Automotive GmbH Koenigsbruecker Str. 61 01099 Dresden GERMANY
Highest emission frequency	Fmax [MHz] = 2480
Device classification	Class B
Equipment type	Tabletop
Number of tested samples	1

1.3 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	USB cord	Molex	USB A <-> micro B	-
AE	Interface board	ATMEL	SAM4L xplained pro	-
AE	2x stub antennas	RF Solutions	ANT-24G-S21-P5FL	-
AE	2x swivel antennas	TekFun	M07-FL	-
AE	PC	DELL	Latitude 620	-
AE	Mains adapter	DELL	PA1900-02D	-

***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	DC / I/O	1	Yes	-
2	Antenna port	I/O	-	Yes	2 pieces, antenna direct connected

***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	EUT send a continuously signal on antenna port 1 with the stub antenna to companion device antenna port 1 with the swivel antenna
2	EUT send a continuously signal on antenna port 2 with the stub antenna to companion device antenna port 2 with the swivel antenna
3	EUT send a continuously signal on antenna port 1 with the swivel antenna to companion device antenna port 1 with the stub antenna
4	EUT send a continuously signal on antenna port 2 with the swivel antenna to companion device antenna port 2 with the stub antenna
5	standby

Configuration #	EUT Configuration
1	EUT fully assembled with interface board and stub antennas, connected to the laptop via USB
2	EUT fully assembled with interface board and swivel antennas, connected to the laptop via USB

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		25°C			
Relative Humidity	30 to 60 %		35%			
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] = 2480					
Fully configured sample scanned over the following frequency range	Frequency range					
	30 MHz to 14 GHz					
Operating mode	1 / 2 / 3 / 4 / 5					
Configuration	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: Mode 1 and 2 were detected as worst case. Only the results from mode 1 and 2 were shown.						

Test Procedure:

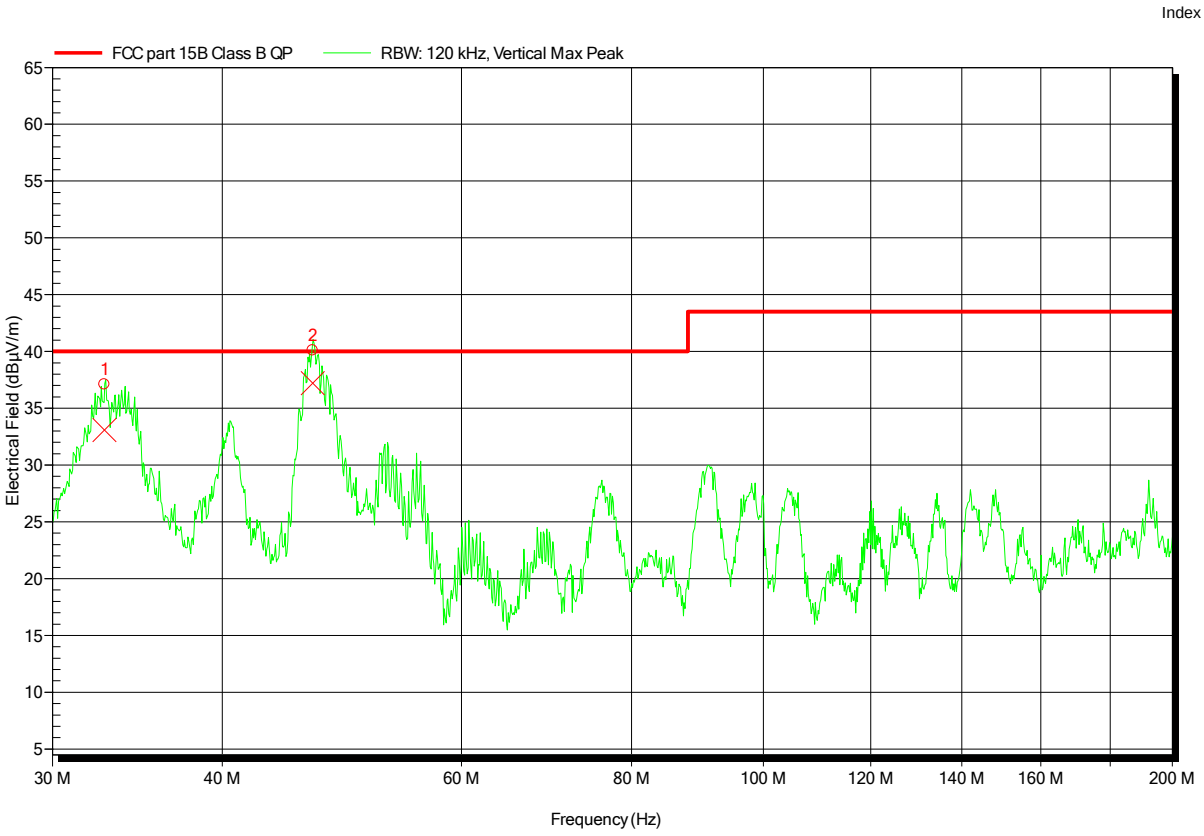
The test site is in accordance with ANSI C63-4:2009 requirements and is listed by FCC.
The measurement procedure is as follows:

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 Part15 B

Project number: G0M-1505-4730

Applicant:	Atmel Automotive GmbH
EUT Name:	ATSAMR21 Smart Connect Module with solder mount footprint
Model:	ATSAMR21G18-MR210UA
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Yu
Test Conditions:	Tnom: 25°C, Unom: 5VDC via notebook
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	mode 1
Test Date:	2015-06-04
Note:	



Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
32.76 MHz	33.08 dBµV/m	40 dBµV/m	-6.92 dB	Pass
46.62 MHz	37.22 dBµV/m	40 dBµV/m	-2.78 dB	Pass

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Test Conditions:	Tnom: 25°C, Unom: 5VDC via notebook
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	mode 1
Test Date:	2015-06-04
Note:	

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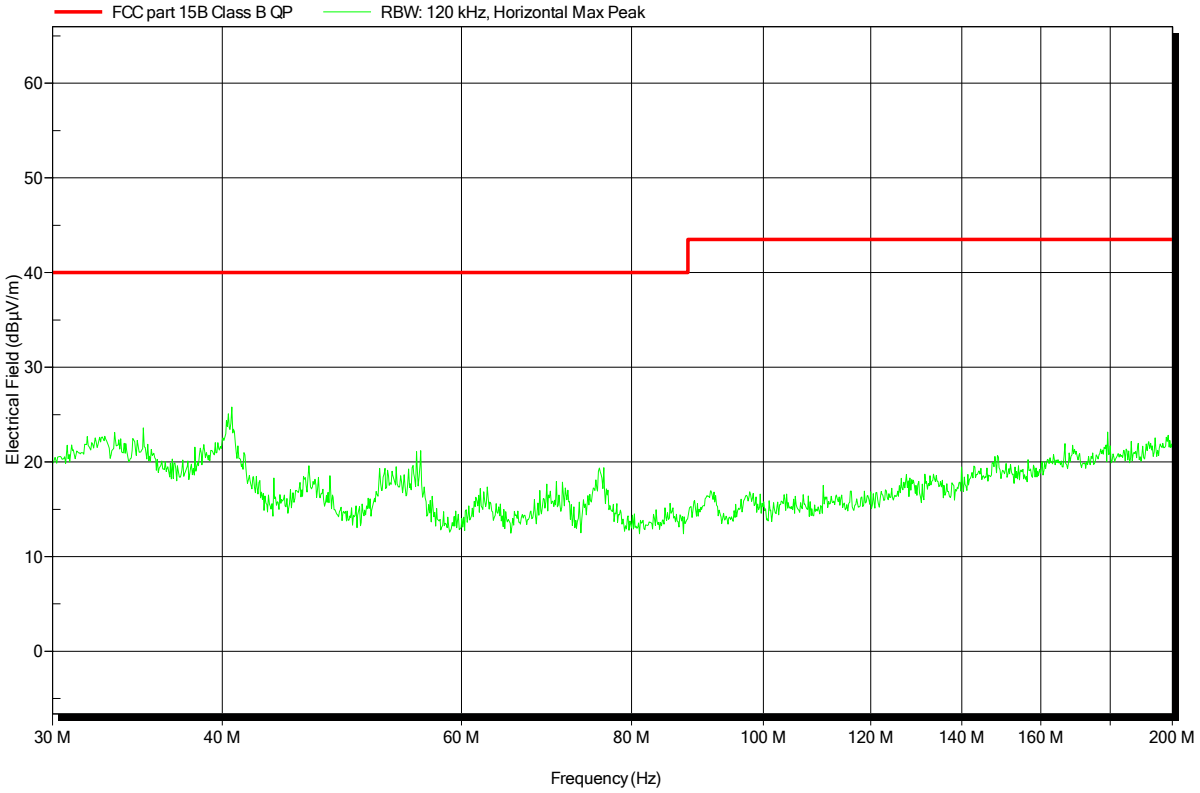

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Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3m
Mode:	mode 1
Test Date:	2015-06-04
Note:	

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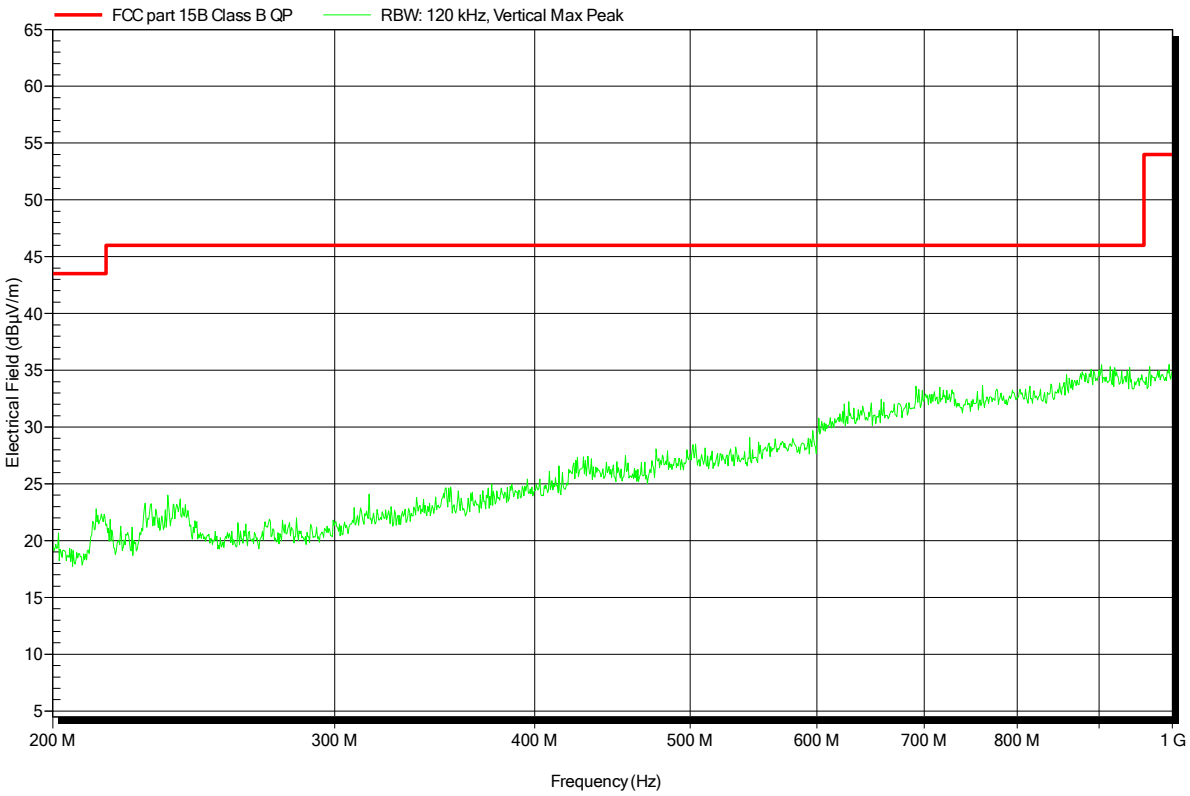

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Measurement distance:	3m
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Note:	

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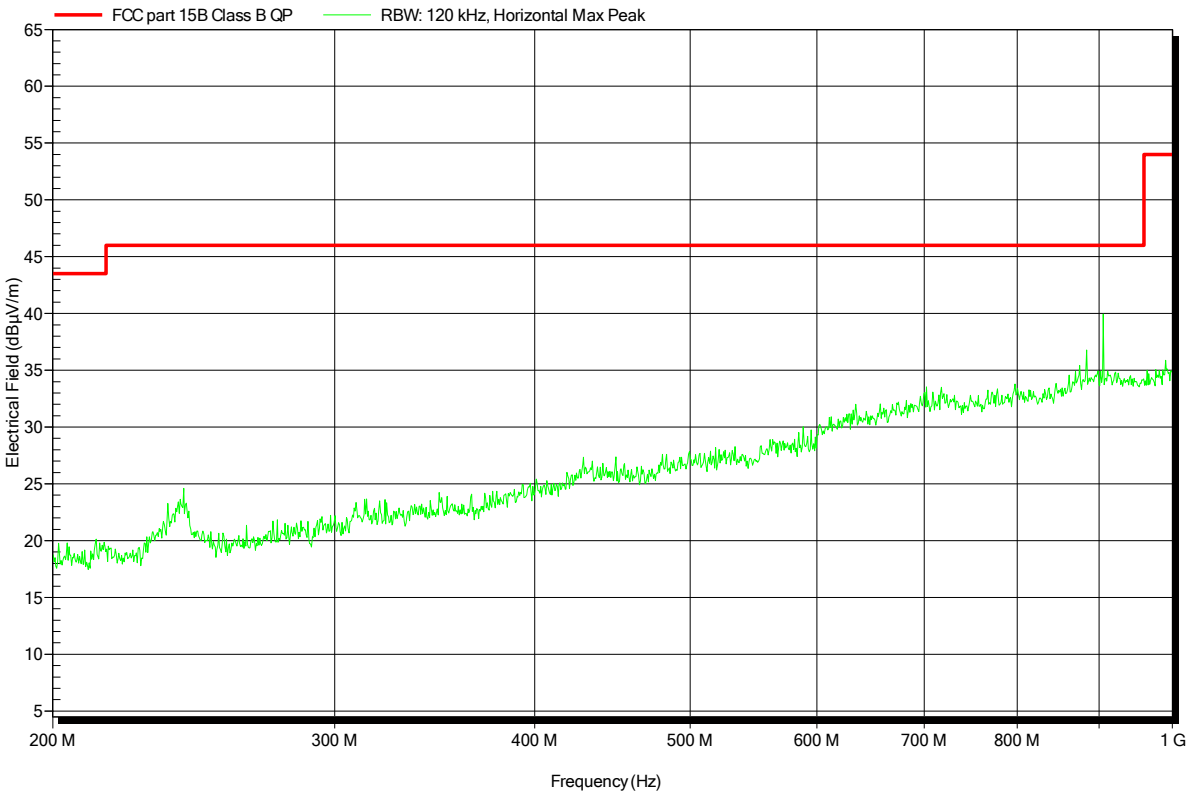

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Operator:	Mr. Yu
Test Conditions:	Tnom: 25°C, Unom: 5VDC via notebook
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	mode 1
Test Date:	2015-06-04
Note:	

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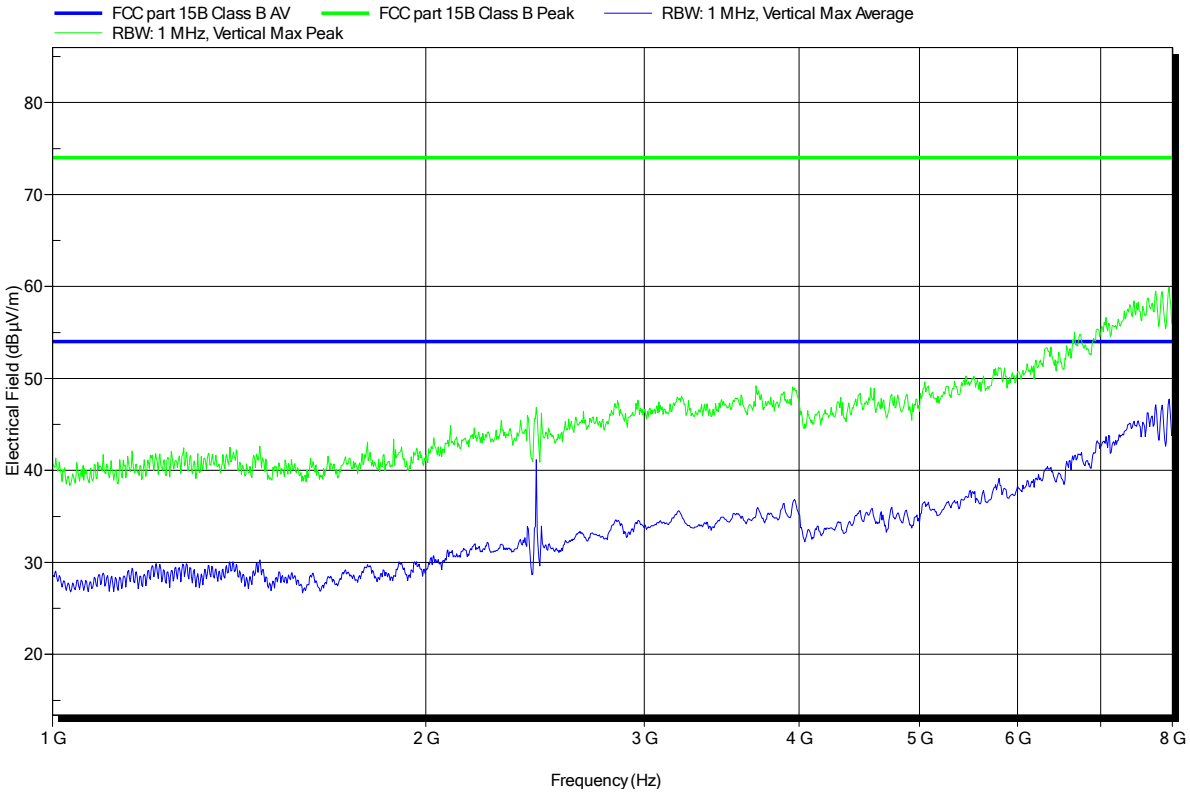

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Measurement distance:	3m
Mode:	mode 1
Test Date:	2015-06-04
Note:	

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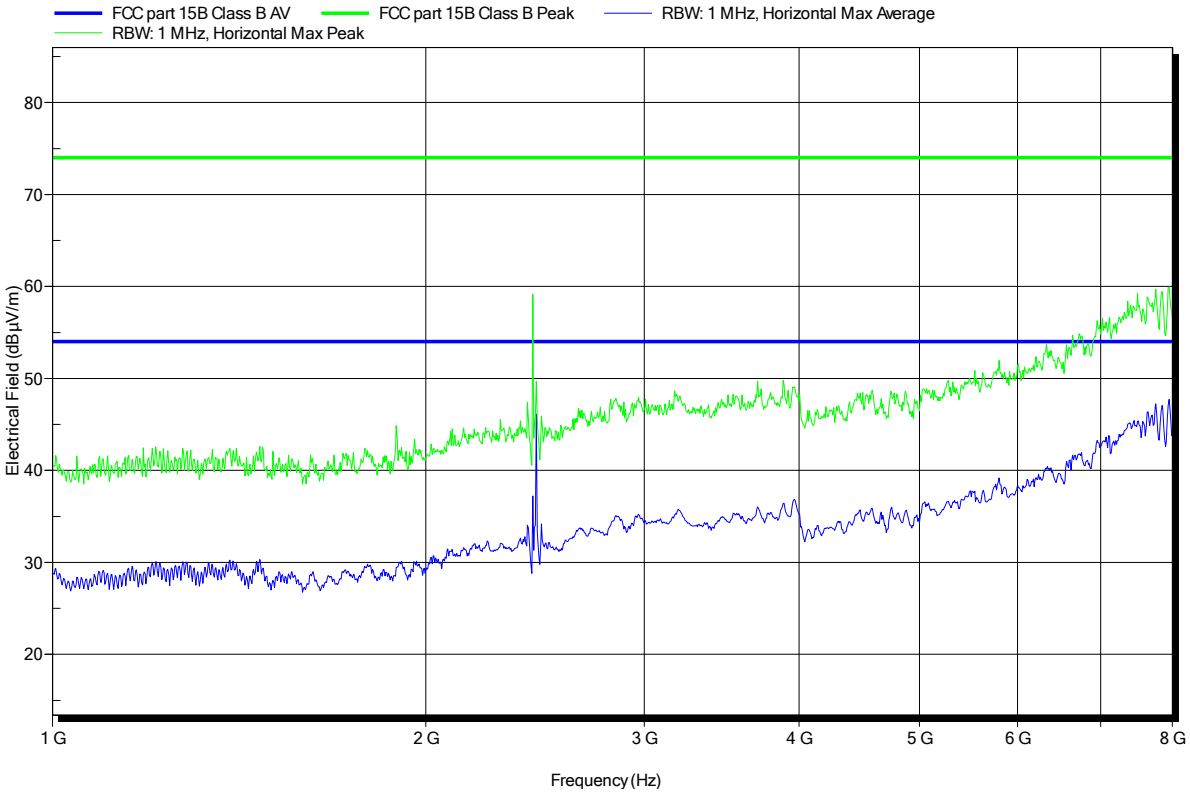

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Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	mode 1
Test Date:	2015-06-04
Note:	

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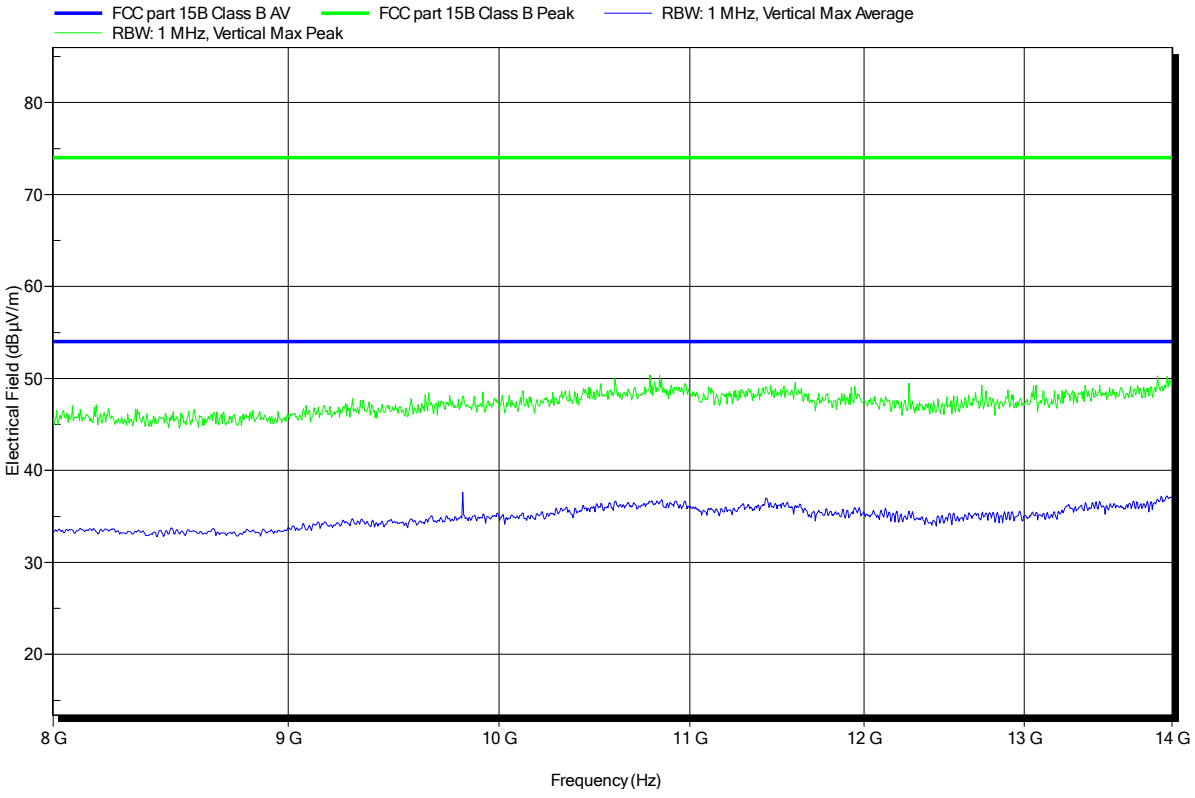

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Measurement distance:	3m
Mode:	mode 1
Test Date:	2015-06-04
Note:	

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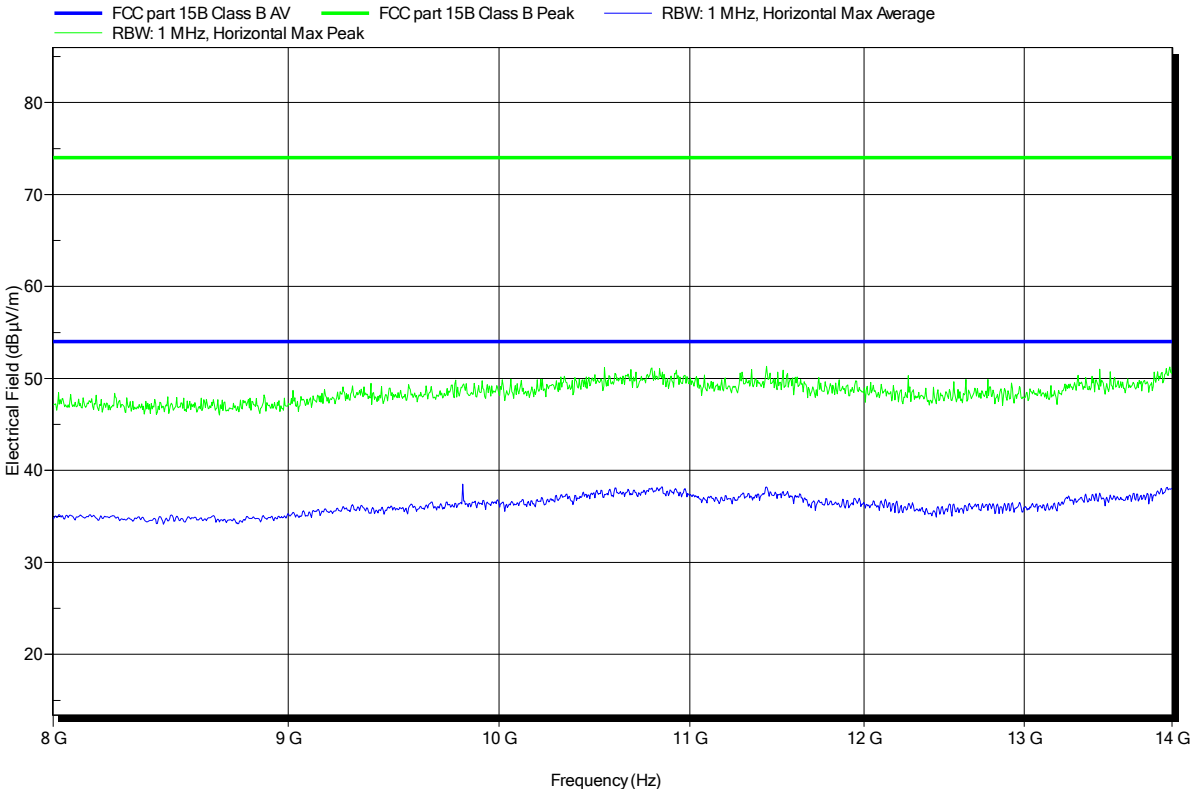

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Test Conditions:	Tnom: 25°C, Unom: 5VDC via notebook
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	mode 2
Test Date:	2015-06-04
Note:	

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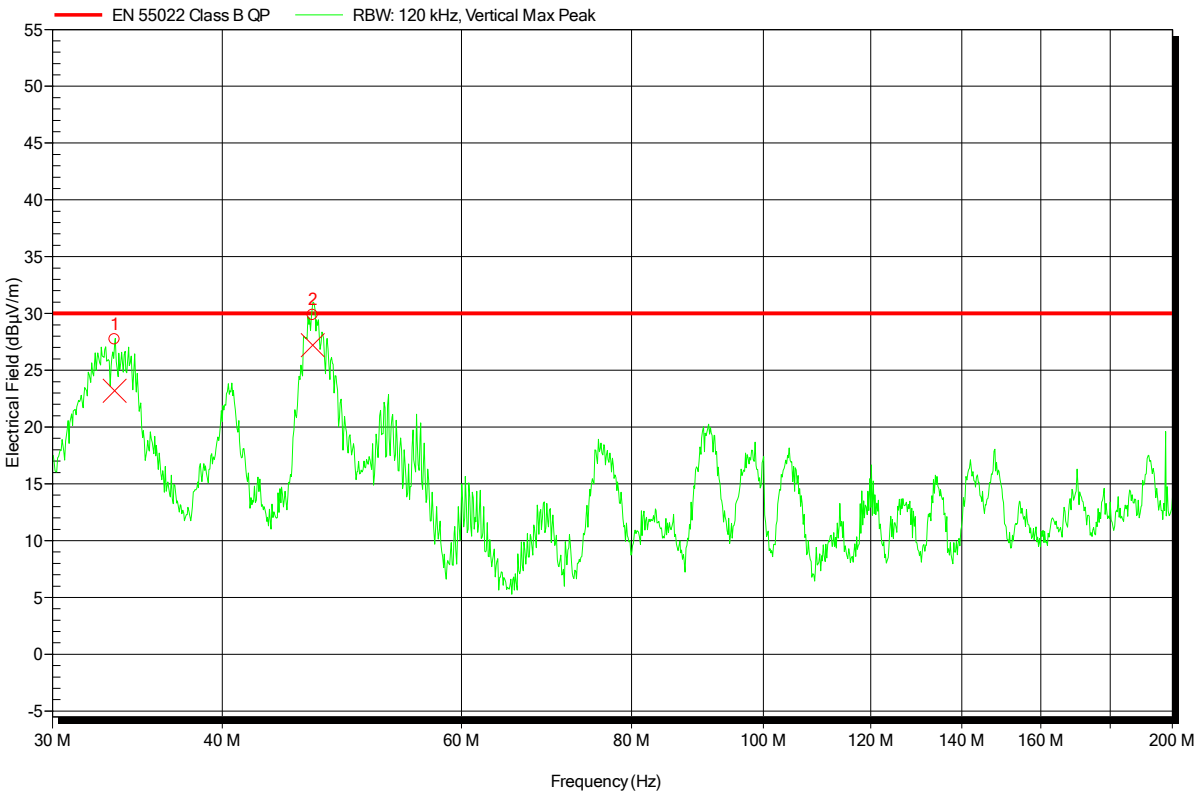

Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
33.33 MHz	23.2 dBµV/m	30 dBµV/m	-6.8 dB	Pass
46.62 MHz	27.21 dBµV/m	30 dBµV/m	-2.79 dB	Pass

Spurious emissions under normal conditions according to FCC Part15B

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Note:	

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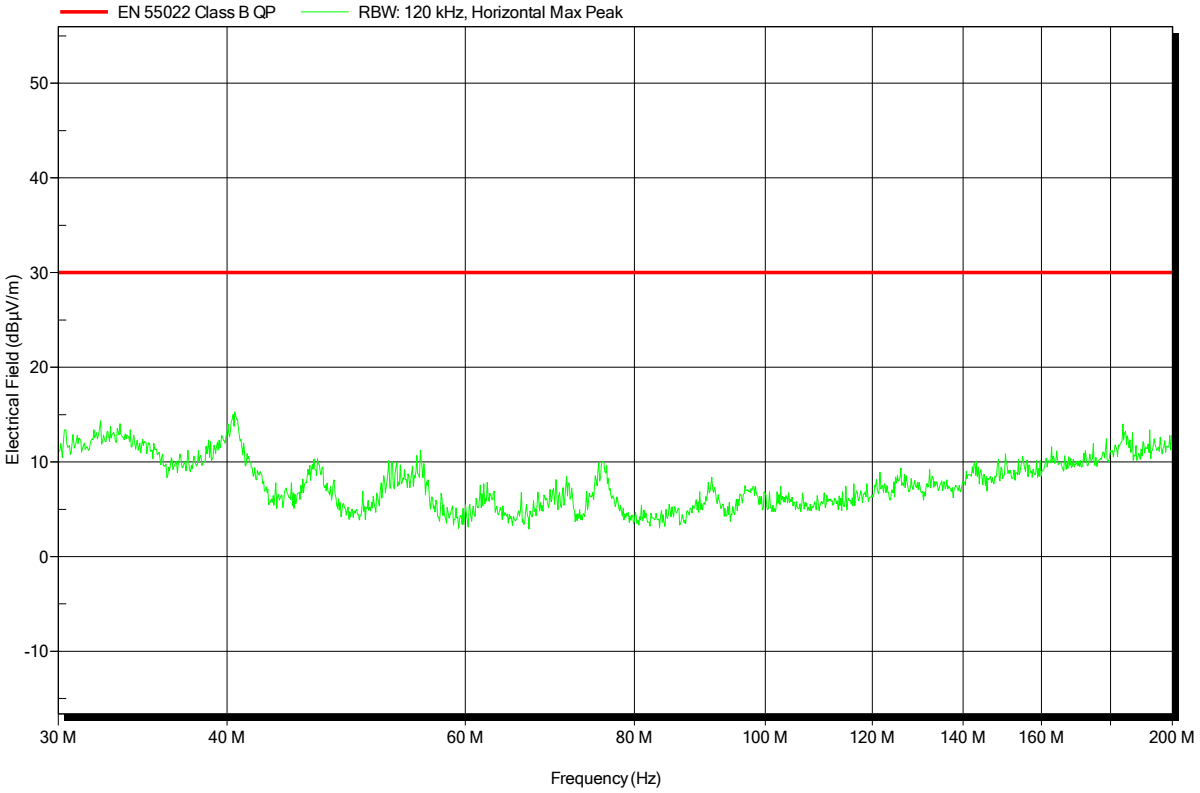

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Note:	

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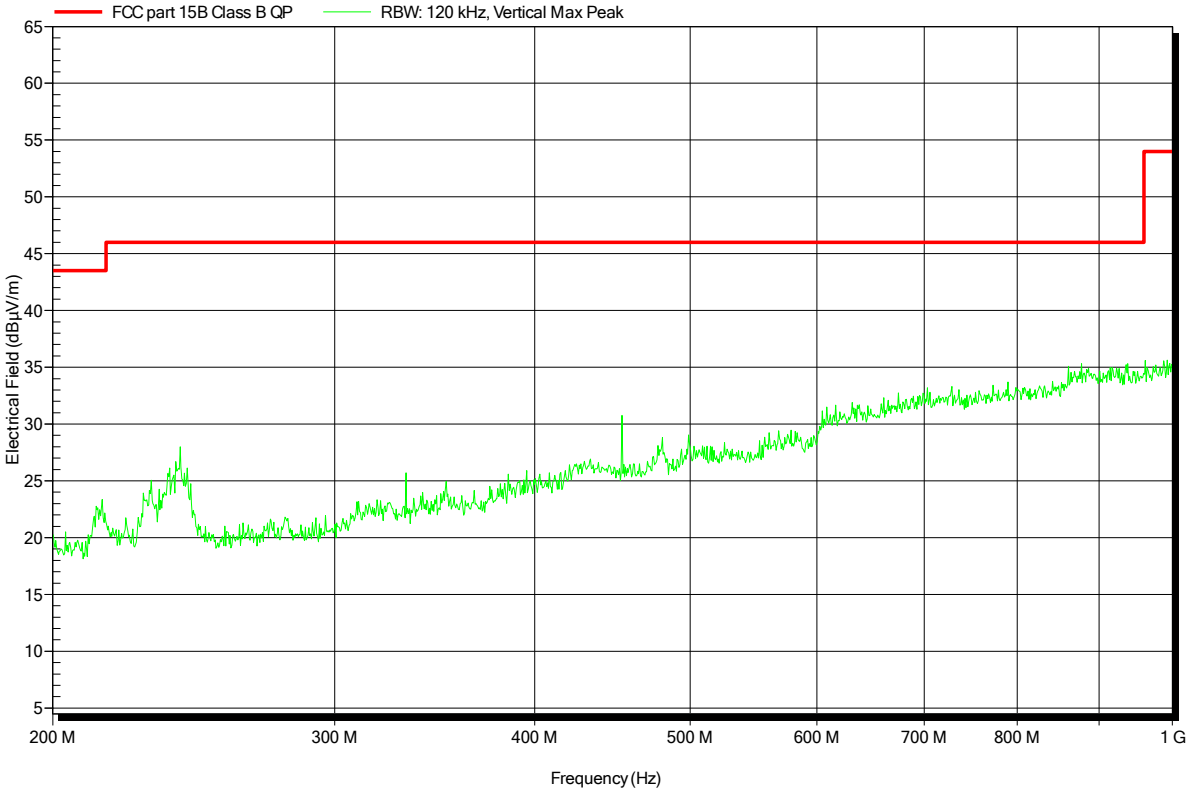

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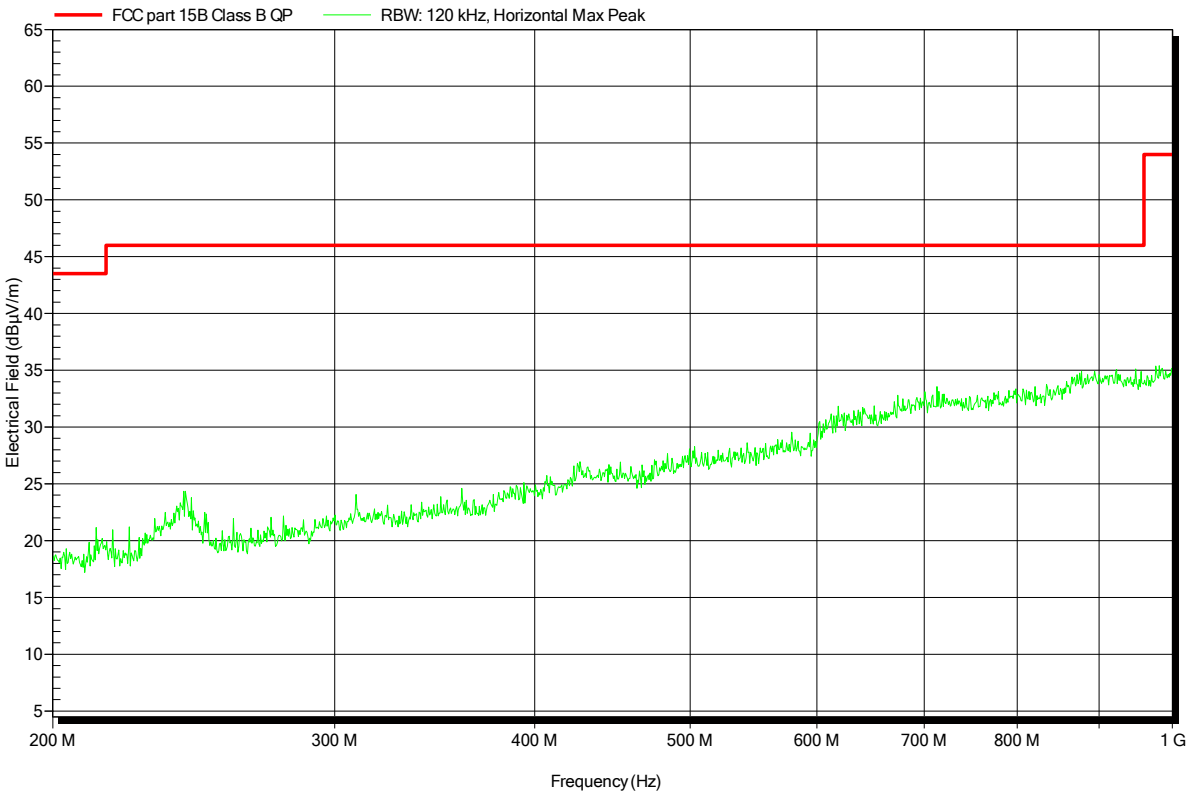

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Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	mode 2
Test Date:	2015-06-04
Note:	

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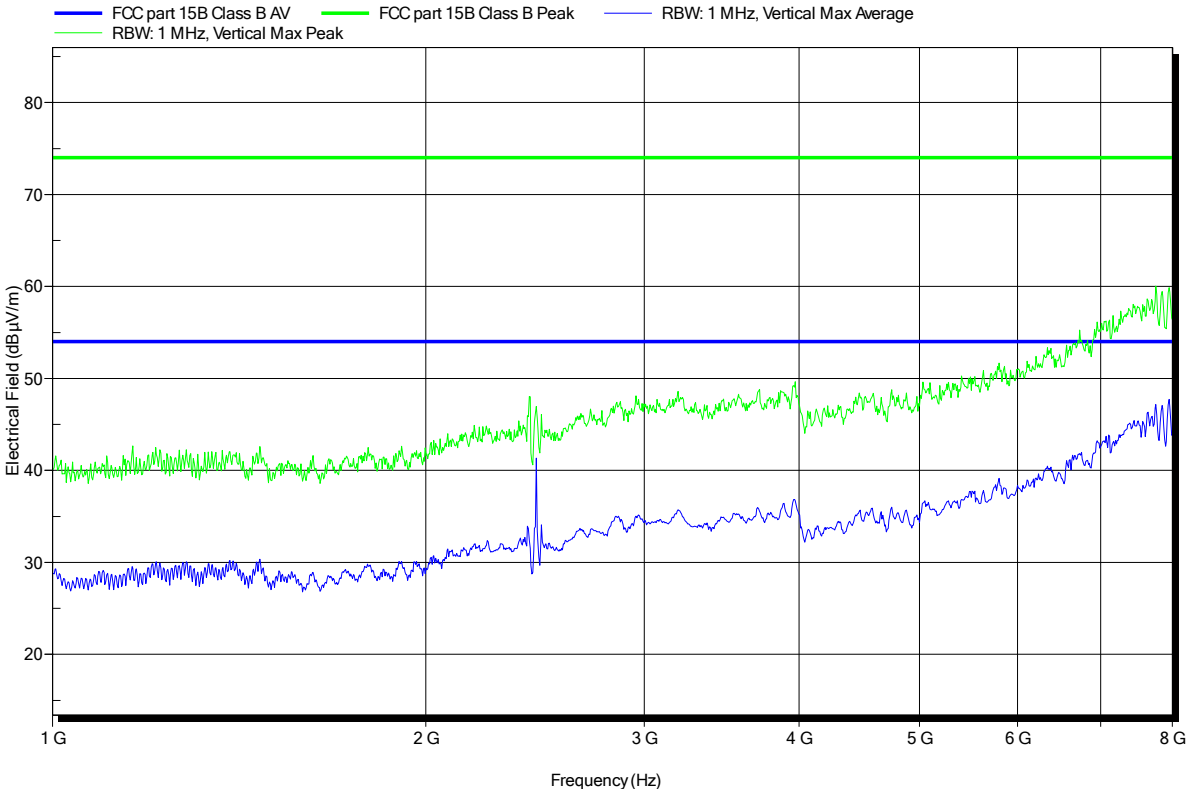

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Note:	

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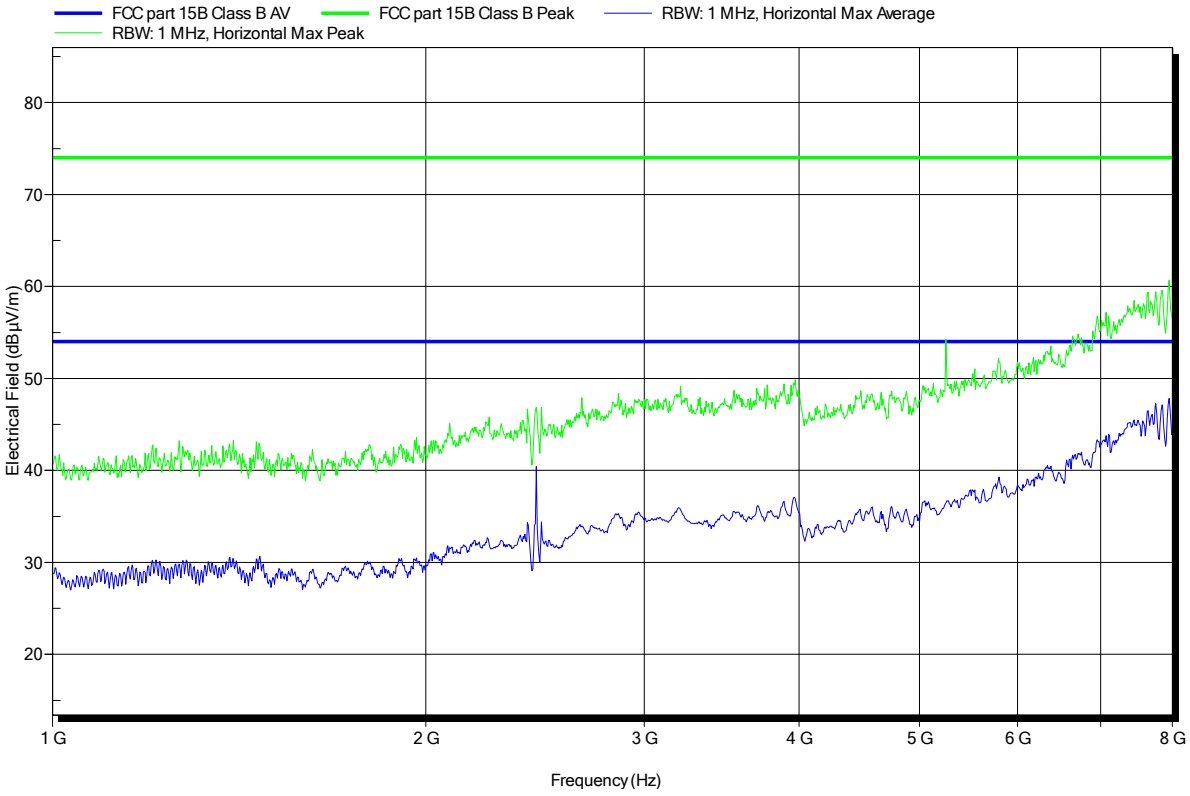

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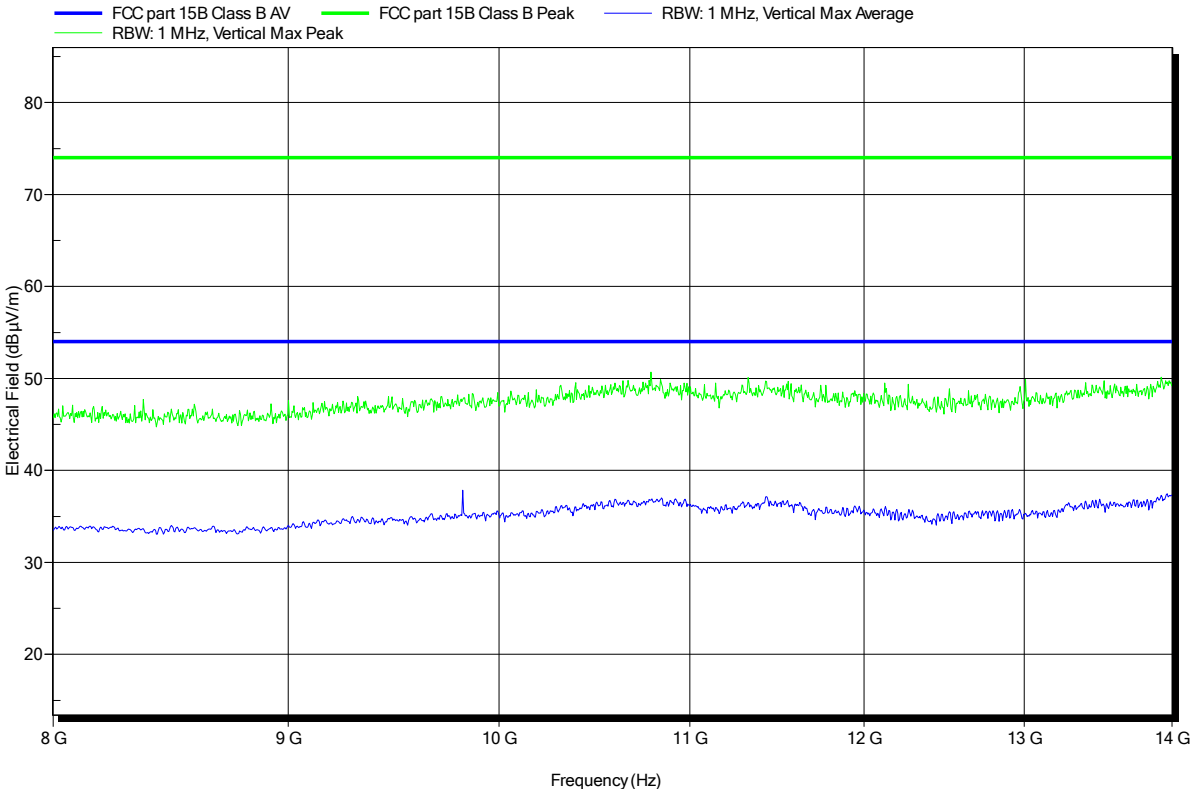

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Note:	

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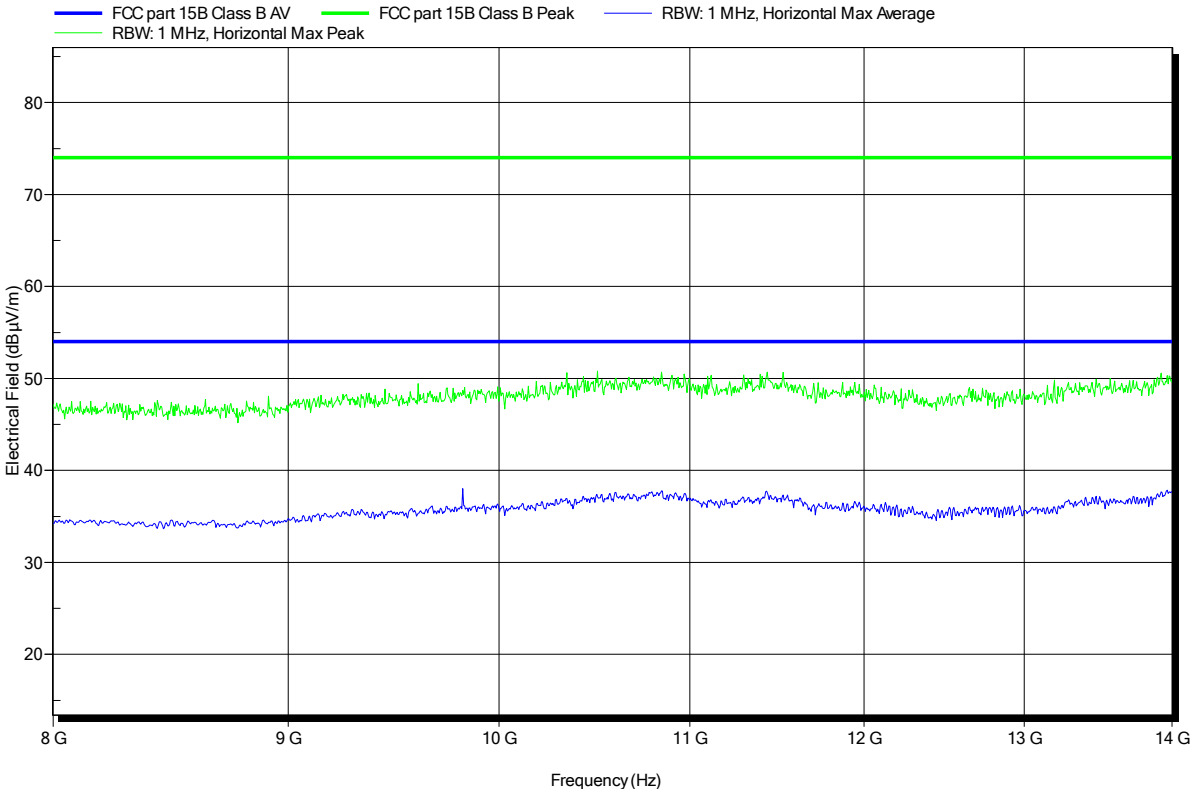

3.2 Test Conditions and Results – AC power line conducted emissions

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	25°C
Relative Humidity	30 to 60 %	35%
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	3	
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 15B

Project number: G0M-1505-4730

Applicant:	Atmel Automotive GmbH
EUT Name:	ATSAMR21 Smart Connect Module with solder mount footprint
Model:	ATSAMR21G18-MR210UA
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Unom: 120 V AC
LISN:	ESH2-Z5 N
Mode:	TX
Test Date:	2015-05-27
Note:	

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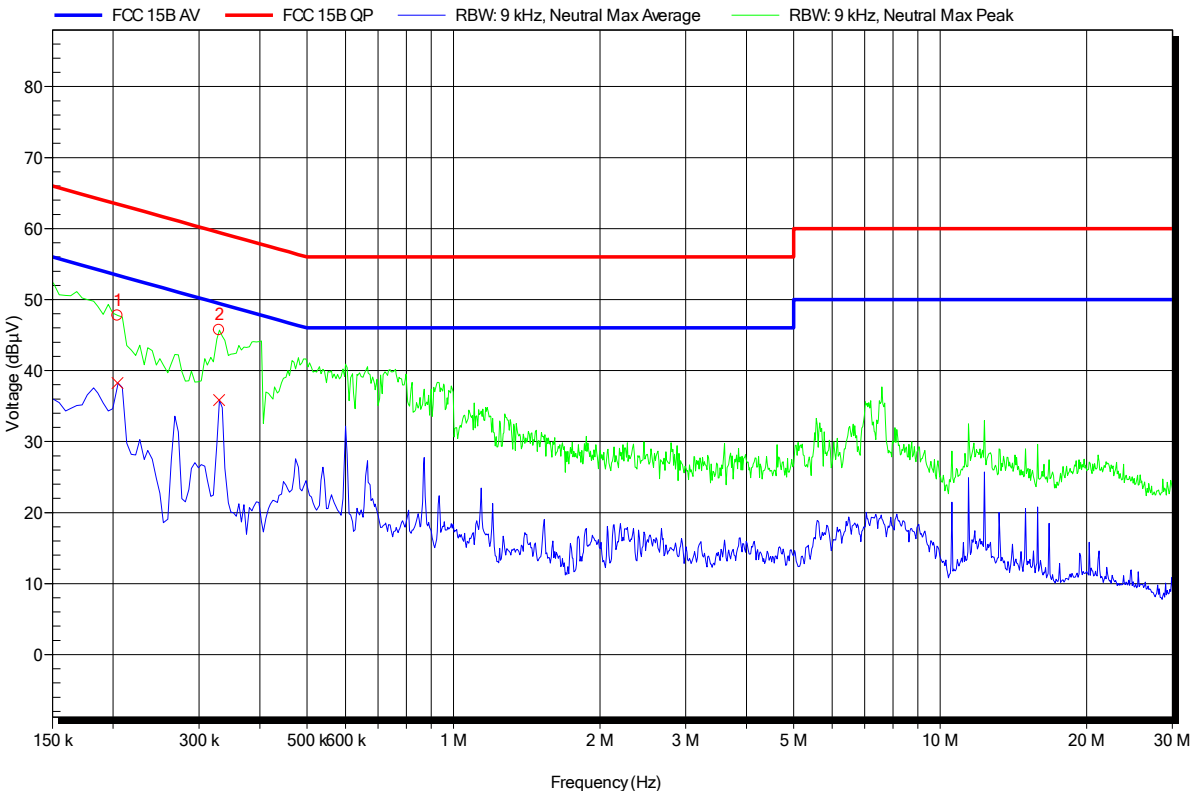

Frequency	Average	Average Limit	Average Difference	Average Status
204 kHz	38.25 dBµV	53.45 dBµV	-15.19 dB	Pass
330 kHz	35.83 dBµV	49.45 dBµV	-13.63 dB	Pass

EMI voltage test in the ac-mains according to FCC 15B

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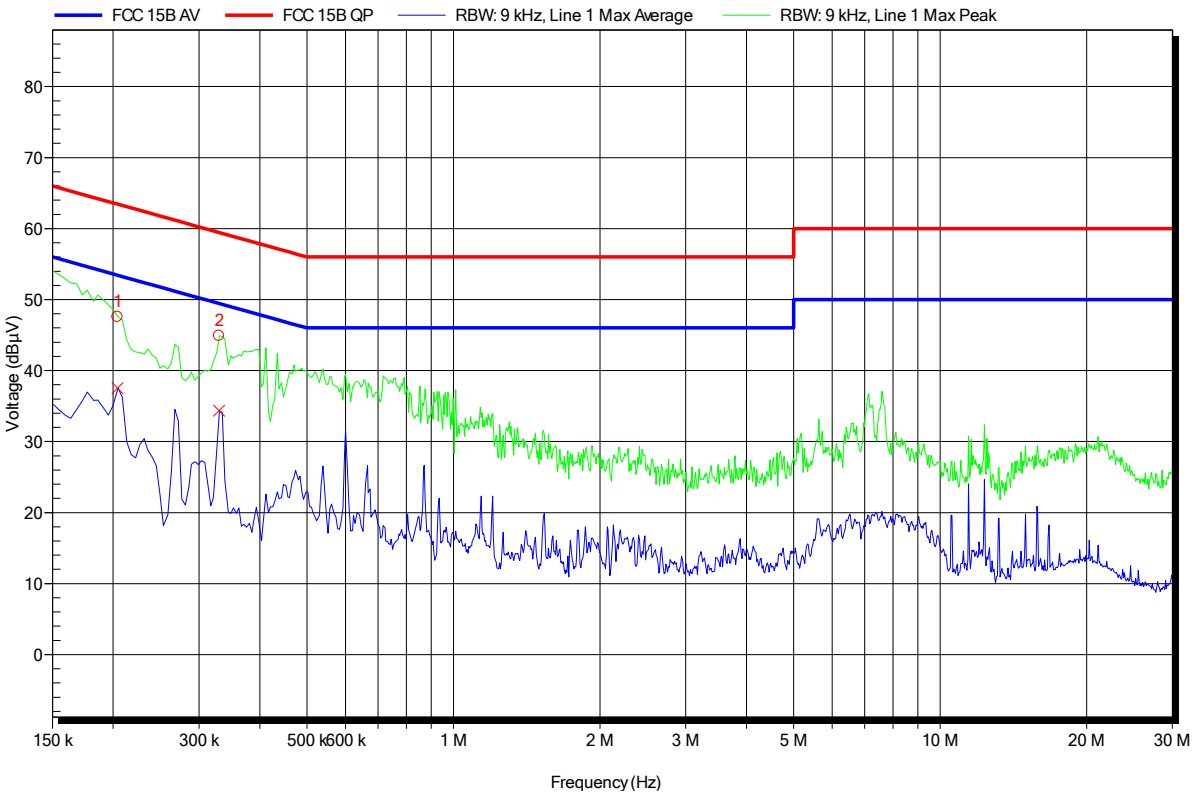

Frequency	Average	Average Limit	Average Difference	Average Status
204 kHz	37.51 dBµV	53.45 dBµV	-15.93 dB	Pass
330 kHz	34.36 dBµV	49.45 dBµV	-15.1 dB	Pass