

EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada ICES-003

Electromagnetic compatibility - Unintentional radiators

Report Reference No. : G0M-1511-5232-EF0115B-V02

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 : Kamstrup A/S

Address : Industrivej 28
8660 Skanderborg
DENMARK

Test specification:

Standard..... : 47 CFR Part 15 Subpart B
ICES-003, Issue 5:2012
ANSI C63.4:2014

Equipment under test (EUT):

Product description	READy Converter for Australia	
Model No.	READy Converter	
Additional Models	None	
Hardware version	5550 1413 A3	
Firmware / Software version	50981118 D1 / 5514 1447 A1	
Contains	FCC-ID: OUY-READYAMR2	IC: N/A
Test result	Passed	

Test Report No.: G0M-1511-5232-EF0115B-V02

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

Possible test case verdicts:

- not applicable to test object: N/A
- test object does meet the requirement.....: P (Pass)
- test object does not meet the requirement.....: F (Fail)

Testing:

Date of receipt of test item: 2016-01-18

Date (s) of performance of tests: 2016-01-18 - 2016-01-19

Compiled by: Jens Marquardt

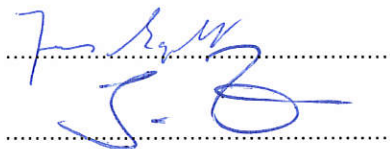
Tested by (+ signature).....: Jens Marquardt

Approved by (+ signature): Jens Zimmermann

Deputy Head of Lab

Date of issue: 2016-02-23

Total number of pages: 43


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	2016-02-17	Initial Release	
V02	2016-02-23	Diagrams were corrected.	J. Marquardt

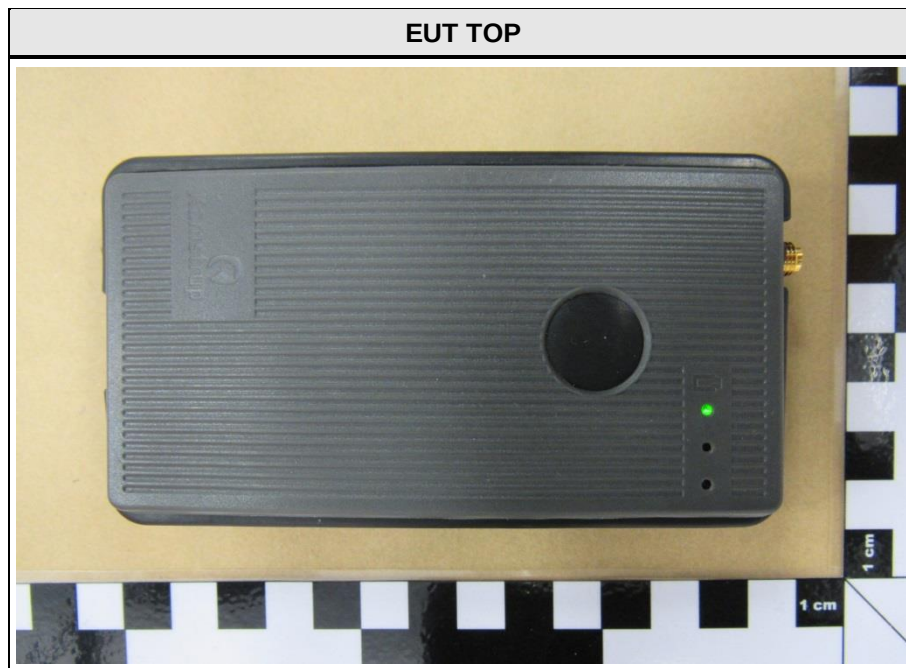
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1 Equipment (Test item) Description

Description	READy Converter for Australia
Model	READy Converter
Additional Models	None
Serial number	None
Hardware version	5550 1413 A3
Software / Firmware version	50981118 D1 / 5514 1447 A1
Contains FCC-ID	OUY-READYAMR2
Contains IC	N/A
Power supply	24 VDC
AC/DC-Adaptor	None
Manufacturer	Kamstrup A/S Industrivej 28 8660 Skanderborg DENMARK
Highest emission frequency	Fmax[MHz]=925
Device classification	Class B
Equipment type	Tabletop
Number of tested samples	1

1.1 Photos – Equipment external



EUT ANTENNA CONNECTOR



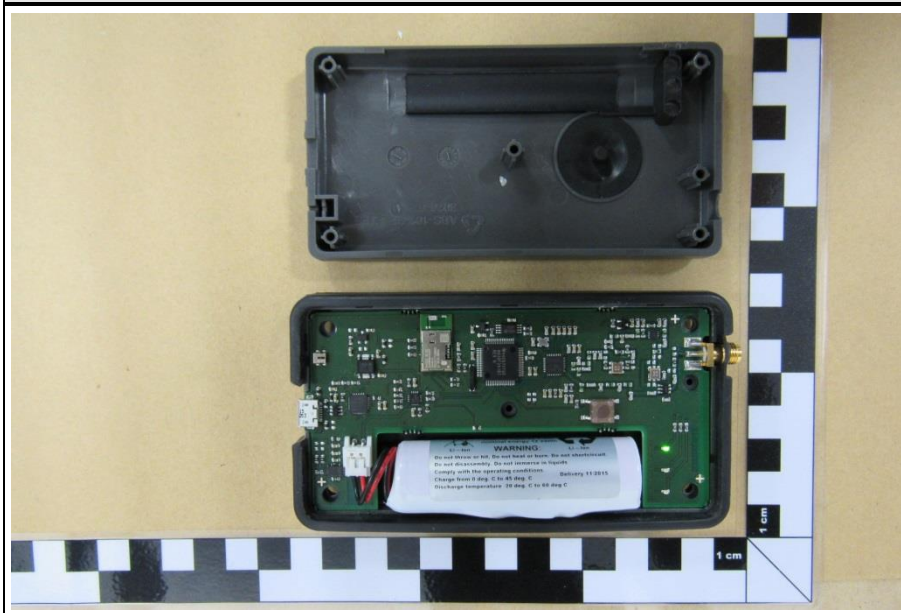
EUT USB CONNECTOR



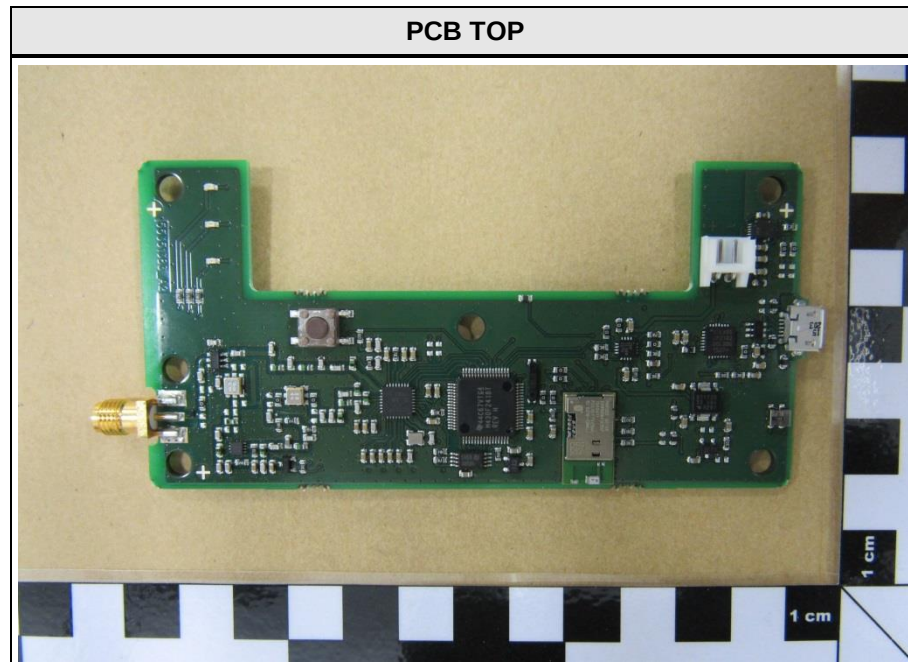
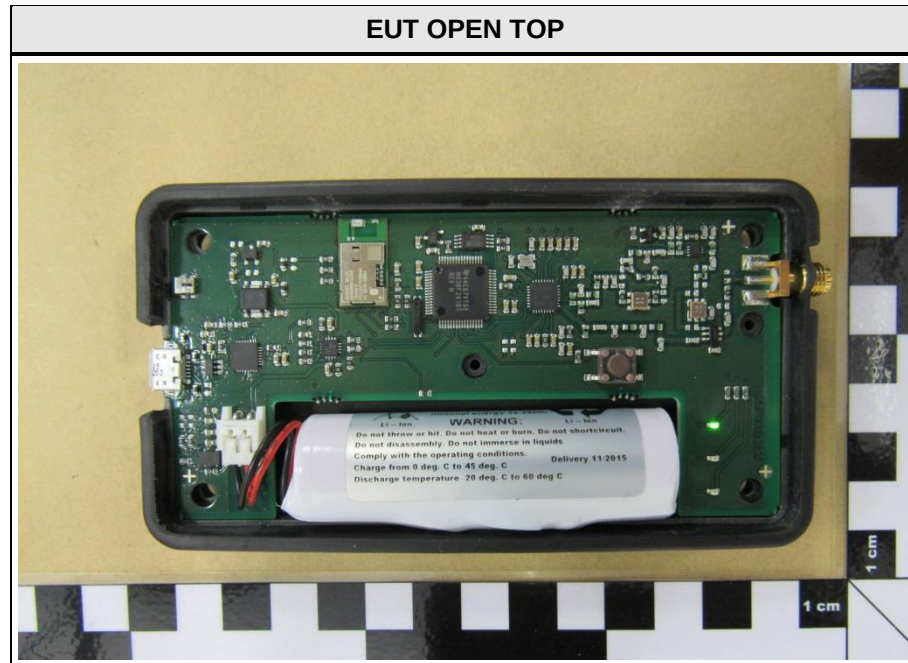
EUT SIDE



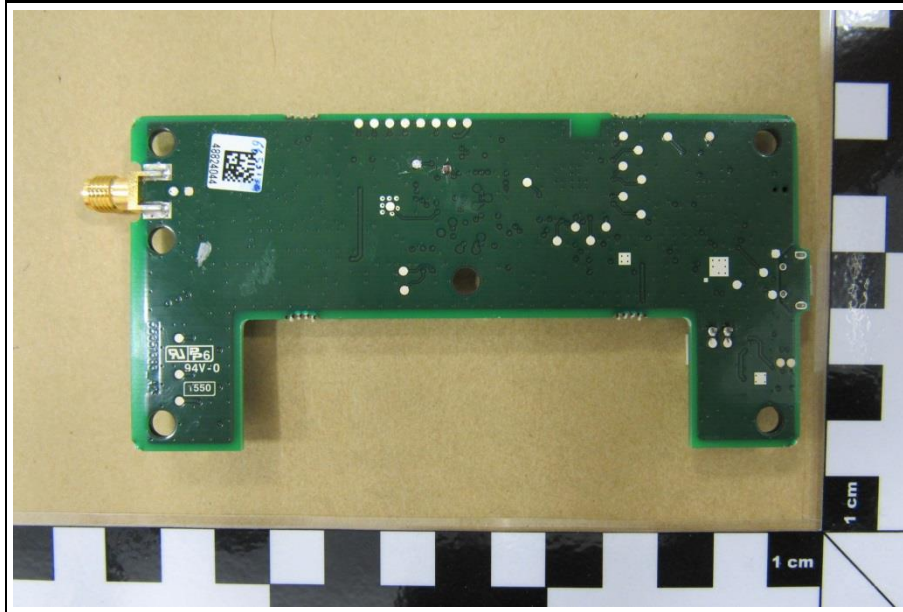
EUT OPEN



1.2 Photos – Equipment internal



PCB BOTTOM



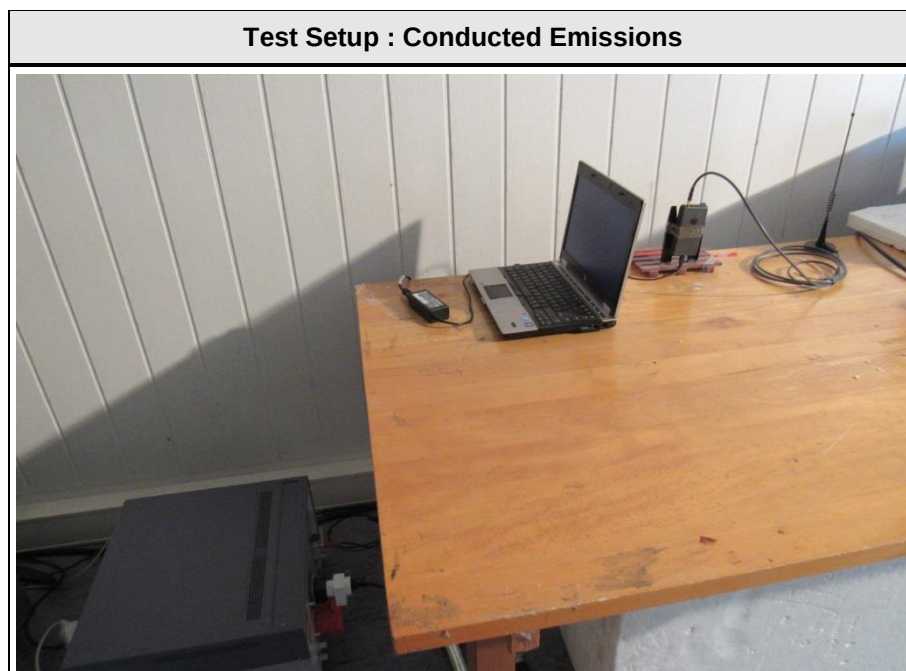
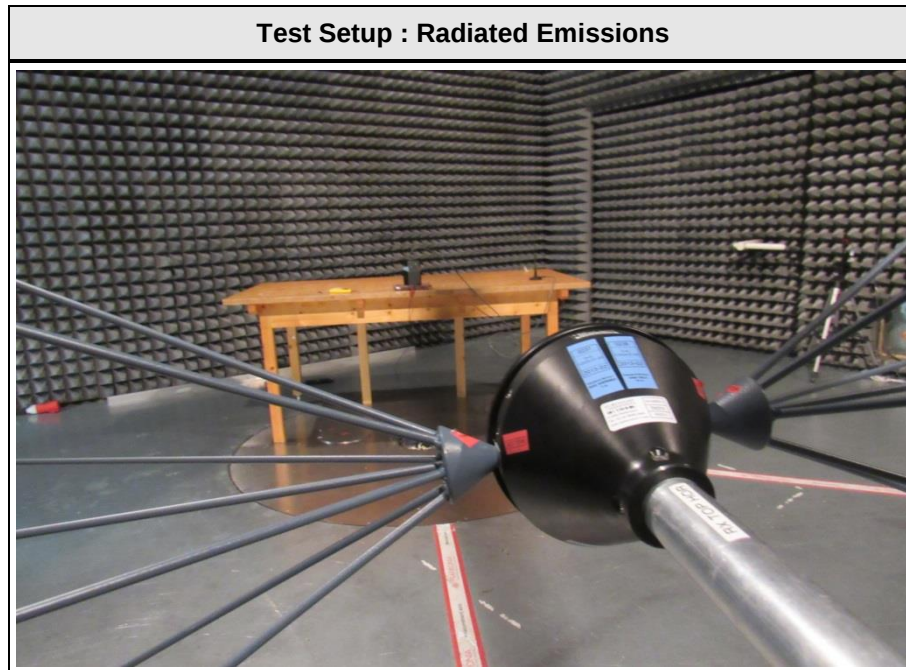
ANTENNA VARIANT 1



ANTENNA VARIANT 2



1.3 Photos – Test setup



1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments (e.g. serial no.)
AE	Notebook	HP	Elitebook 8440p	Serial: CZC0506398
AE	Smartphone	Sony	Xperia	IMEI: 351710058229179
EUT	READY Converter AUS	Kamstrup	5550 1413 A3	Short range device to BT data bridge
EUT	External antenna 1	Laird technology / Nearson	S161AM-915	whip antenna RP SMA
EUT	External antenna 2	smarteq	6699467+ 6699466 with low loss cable	roof top antenna
None				
*Note: Use the following abbreviations: AE : Auxiliary/Associated Equipment, or SIM : Simulator (Not Subjected to Test) CABL : Connecting cables				

1.5 Input / Output Ports

Port #	Name	Type*	Max. Cable Length	Cable Shielded	Comments (e.g. Cat. of Cable)
1	USB-Cable	I/O	<3m	Yes	For charging
*Note: Use the following abbreviations: AC : AC power port DC : DC power port N/E : Non electrical I/O : Signal input or output port TP : Telecommunication port					

1.6 Operating Modes and Configurations

Mode #	Description
1	USB Cable connected for charging. Bluetooth connection to Smartphone

Configuration #	EUT Configuration
1	Charging with USB, SRD, roof top antenna Bluetooth connection (<u>inactive</u>) to Smartphone
2	Charging with USB, SRD, Walk by antenna Bluetooth connection (<u>active</u>) to Smartphone

1.7 Test Equipment Used During Testing

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

Radiated emissions – 3m Chamber					
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	2016-01	2017-01
RF Cable			-	System Cal.	System Cal
RF Cable			-	System Cal.	System Cal

Conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2014-11	2016-11
EMI Test Receiver	R&S	ESR7	EF00943	2015-09	2016-09
Cable	-	RG58/U	-	System Cal.	System Cal.

1.8 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBμV. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

$$\text{Reading on Analyzer (dB}\mu\text{V)} + \text{A.F. (dB)} = \text{Net field strength (dB}\mu\text{V/m)}$$

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:

$$\text{Limit (dB}\mu\text{V/m)} = 20 \cdot \log(\mu\text{V/m})$$

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

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

2 Result Summary

FCC 47 CFR Part 15B, Industry Canada ICES-003				
Product Specific Standard	Requirement – Test	Reference Method	Result	Remarks
47 CFR 15.109 ICES-003 Item 6.2	Radiated emissions	ANSI C 63.4	PASS	
47 CFR 15.107 ICES-003 Item 6.1	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 / ICES-003				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 %		41%		
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				
		925 MHz				
Fully configured sample scanned over the following frequency range		Frequency range				
		30 MHz to 18 GHz				
Operating mode		1				
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:						

Test Procedure:

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

Exploratory measurement:

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

Final measurement:

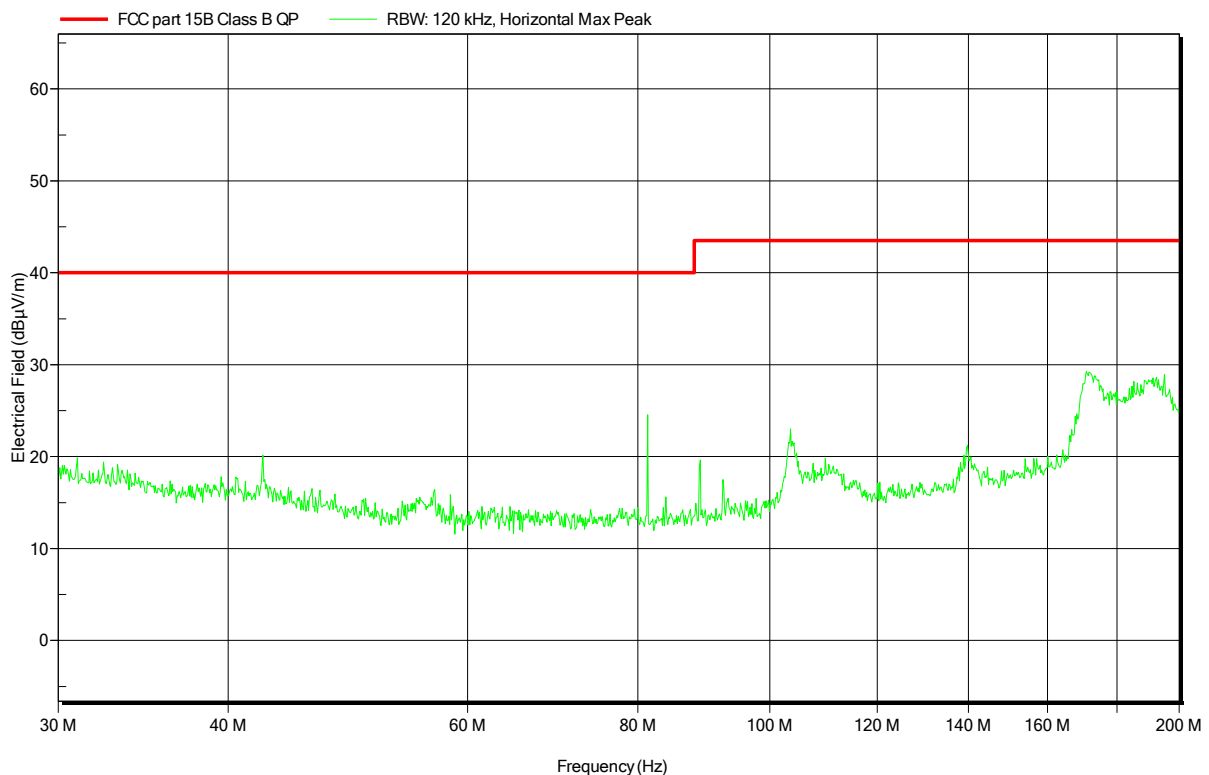
- The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver
- A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 1000 MHz. Above one 1 GHz a Double Ridged Broadband Horn antenna was used. The antenna was placed on an adjustable height antenna mast
- The EUT and cable arrangement were based on the exploratory measurement results
- Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.
- The test data of the worst-case conditions were recorded and shown on the next pages.

Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5232

Applicant:	Kamstrup A/S
EUT Name:	READY Converter for Australia
Model:	READY Converter
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Marquardt
Test Conditions:	Tnom: 23°C, Unom: 5 VDC (via USB)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	1
Test Date:	2016-01-19
Note:	

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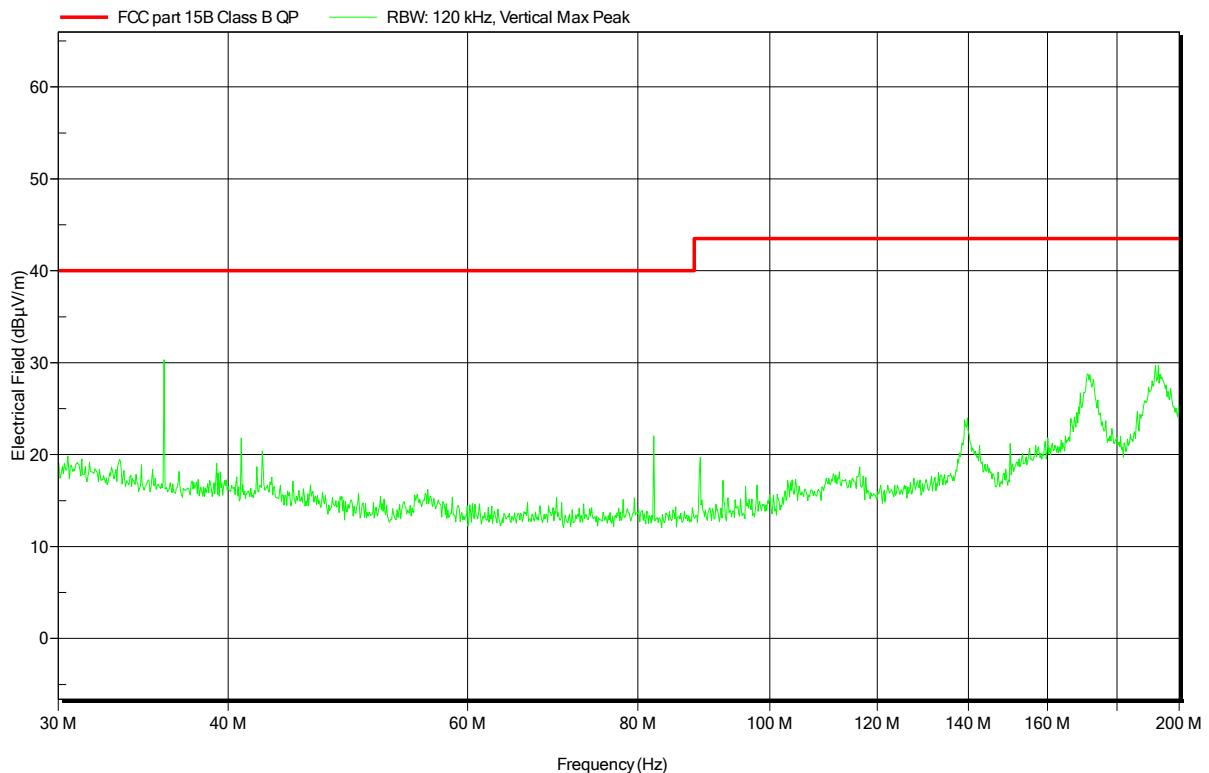


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Operator:	Mr. Marquardt
Test Conditions:	Tnom: 23°C, Unom: 5 VDC (via USB)
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	1
Test Date:	2016-01-19
Note:	

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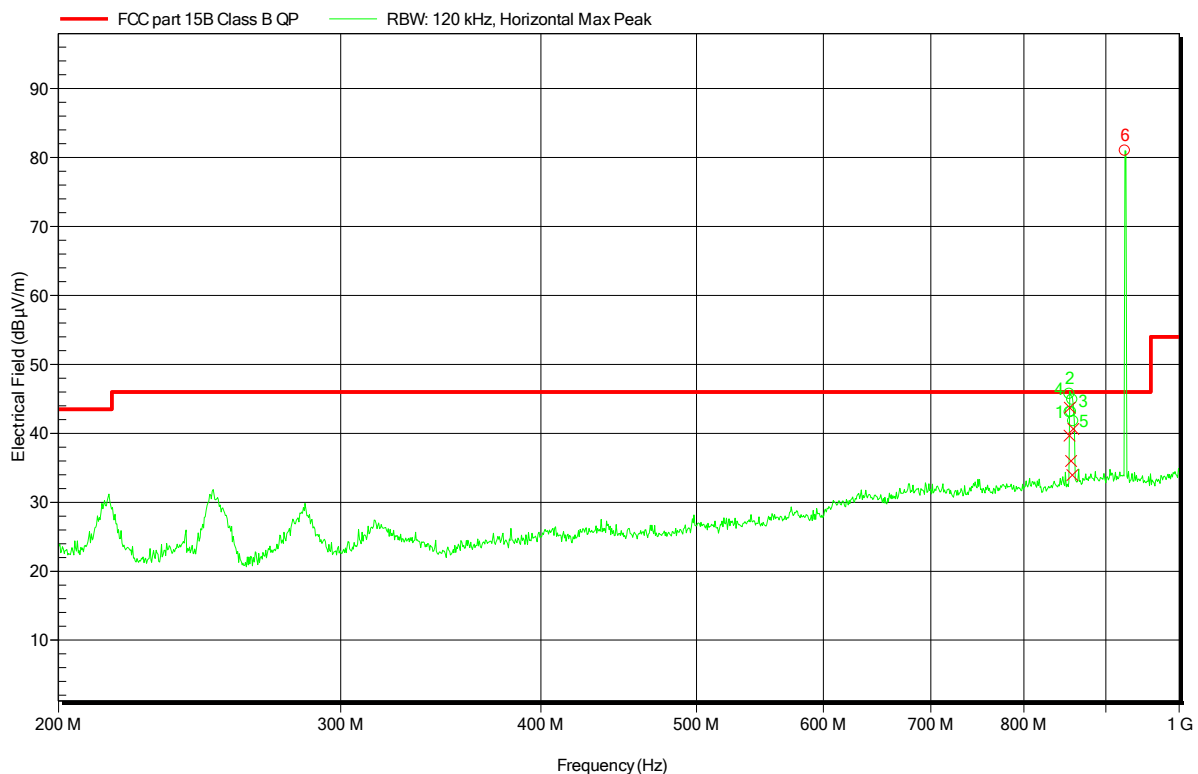


Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5232

Applicant: Kamstrup A/S
 EUT Name: READy Converter for Australia
 Model: READy Converter
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Rohde & Schwarz HL 223, Horizontal
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-01-19
 Note: Peak 6: SRD Carrier

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Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	854.642 MHz	43.7 dBµV/m	46 dBµV/m	-2.3 dB	Pass	0 Degree	1 m
2	854.036 MHz	39.68 dBµV/m	46 dBµV/m	-6.32 dB	Pass	0 Degree	1 m
3	855.944 MHz	35.97 dBµV/m	46 dBµV/m	-10.03 dB	Pass	0 Degree	1 m
4	857.564 MHz	33.95 dBµV/m	46 dBµV/m	-12.05 dB	Pass	0 Degree	1 m
5	858.68 MHz	40.65 dBµV/m	46 dBµV/m	-5.35 dB	Pass	0 Degree	1 m
6	924.8 MHz					0 Degree	1 m

Test Report No.: G0M-1511-5232-EF0115B-V02

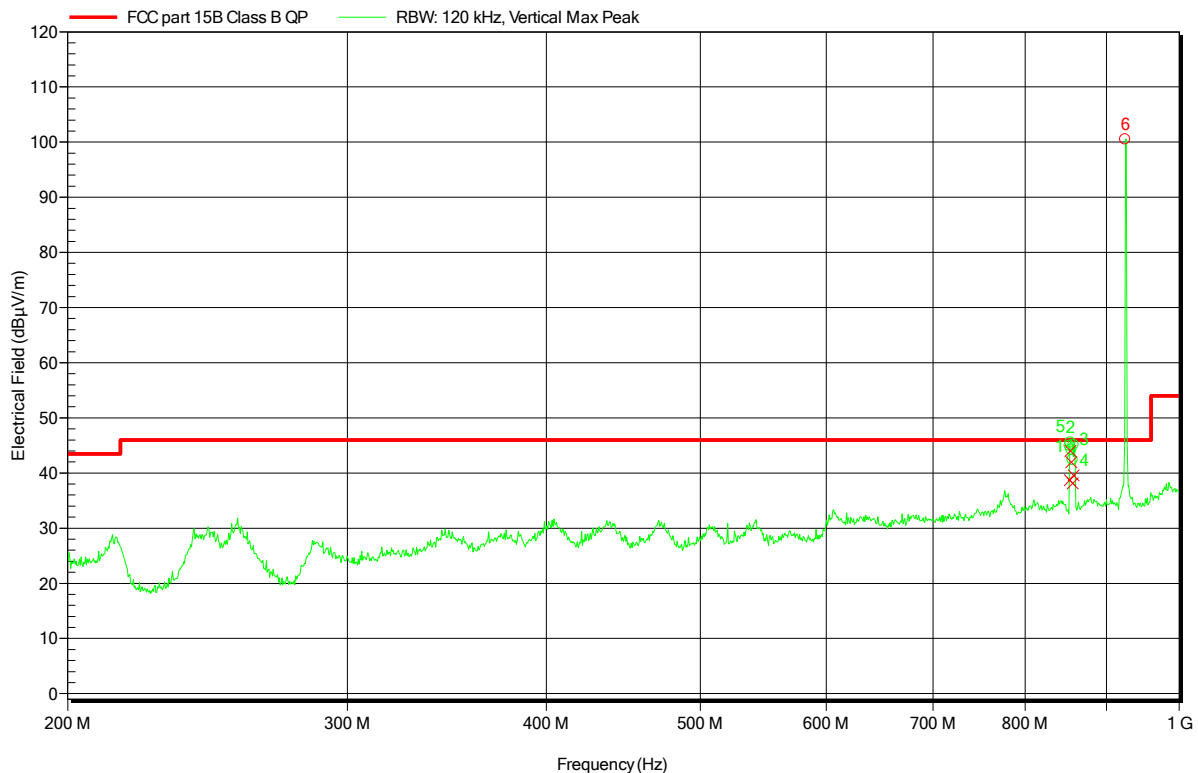
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5232

Applicant: Kamstrup A/S
 EUT Name: REAdy Converter for Australia
 Model: REAdy Converter
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-01-19
 Note: Peak 6: SRD Carrier

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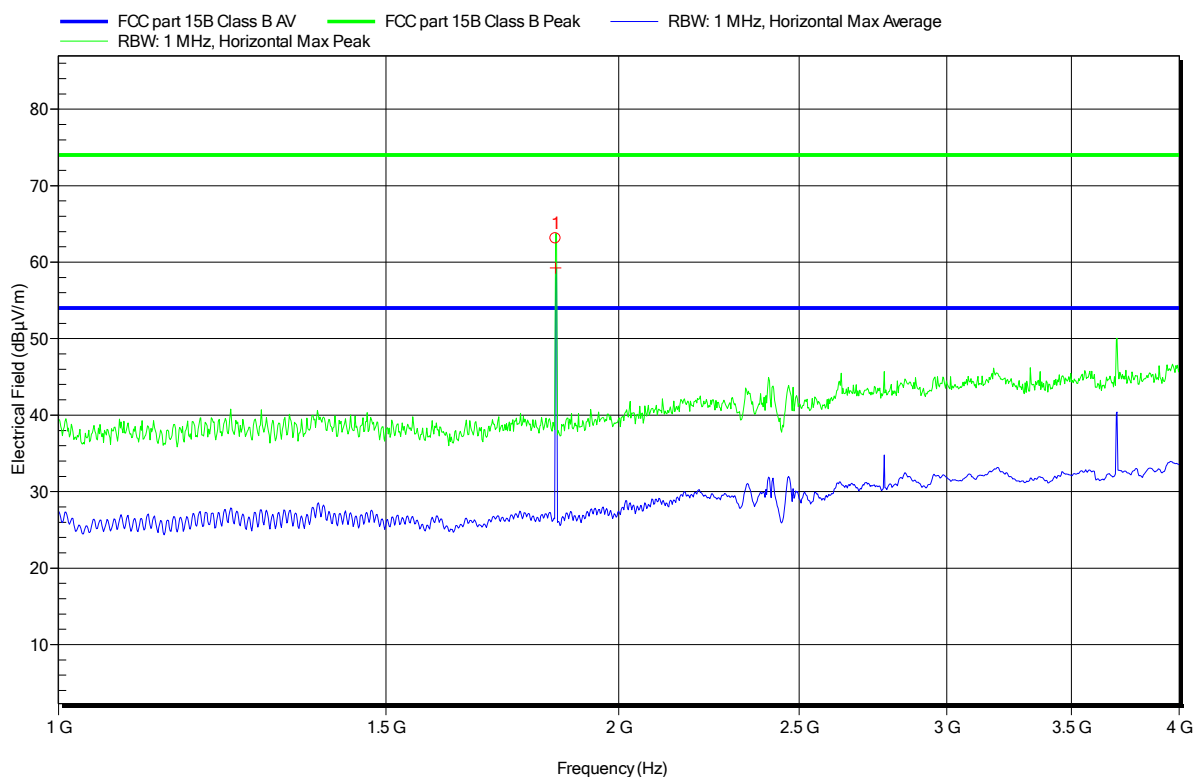
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	853.304 MHz	38.7 dBµV/m	46 dBµV/m	-7.3 dB	Pass	0 Degree	1 m
2	854.318 MHz	43.99 dBµV/m	46 dBµV/m	-2.01 dB	Pass	0 Degree	1 m
3	855.584 MHz	41.95 dBµV/m	46 dBµV/m	-4.05 dB	Pass	0 Degree	1 m
4	856.994 MHz	38.11 dBµV/m	46 dBµV/m	-7.89 dB	Pass	0 Degree	1 m
5	858.356 MHz	39.57 dBµV/m	46 dBµV/m	-6.43 dB	Pass	0 Degree	1 m
6	924.8 MHz					0 Degree	1 m

Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5232

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 EUT Name: REAdy Converter for Australia
 Model: REAdy Converter
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-01-19
 Note: Peak 1: SRD 2nd Harmonic

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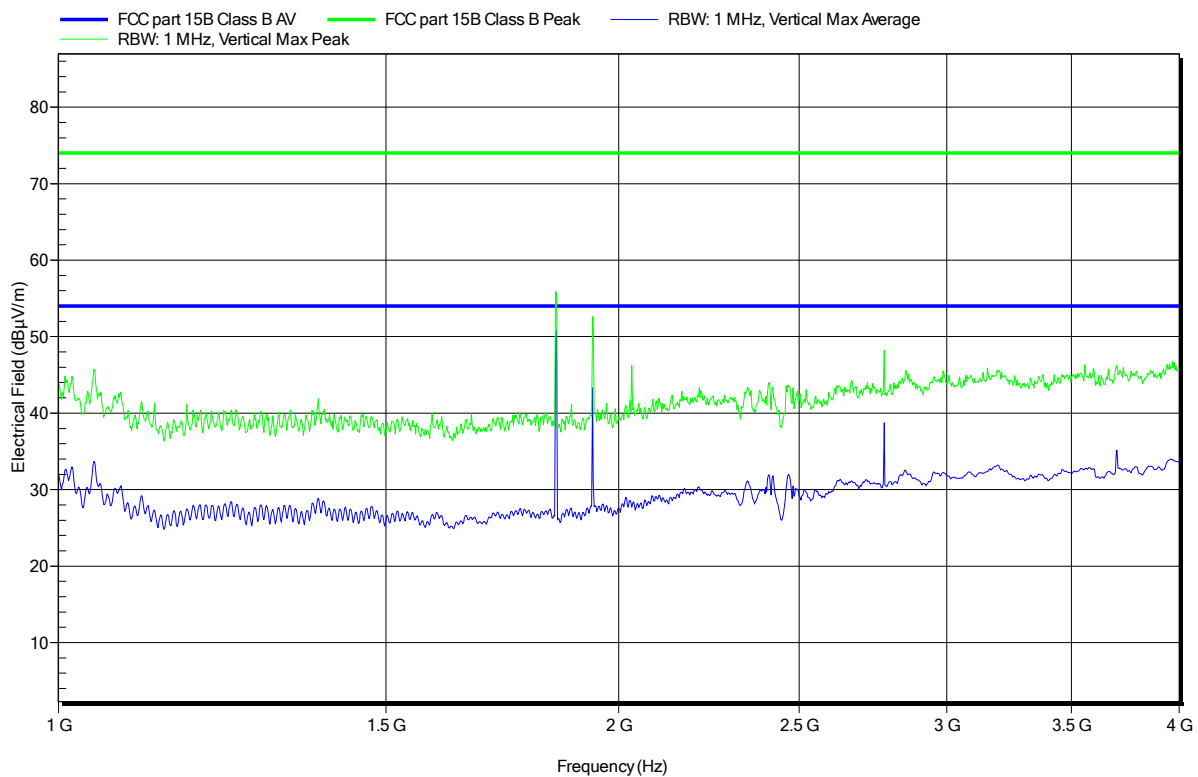
Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	1.85 GHz	59.24 dBµV/m	54 dBµV/m	5.24 dB	Fail	0 Degree	1 m

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 EUT Name: READy Converter for Australia
 Model: READy Converter
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-01-19
 Note:

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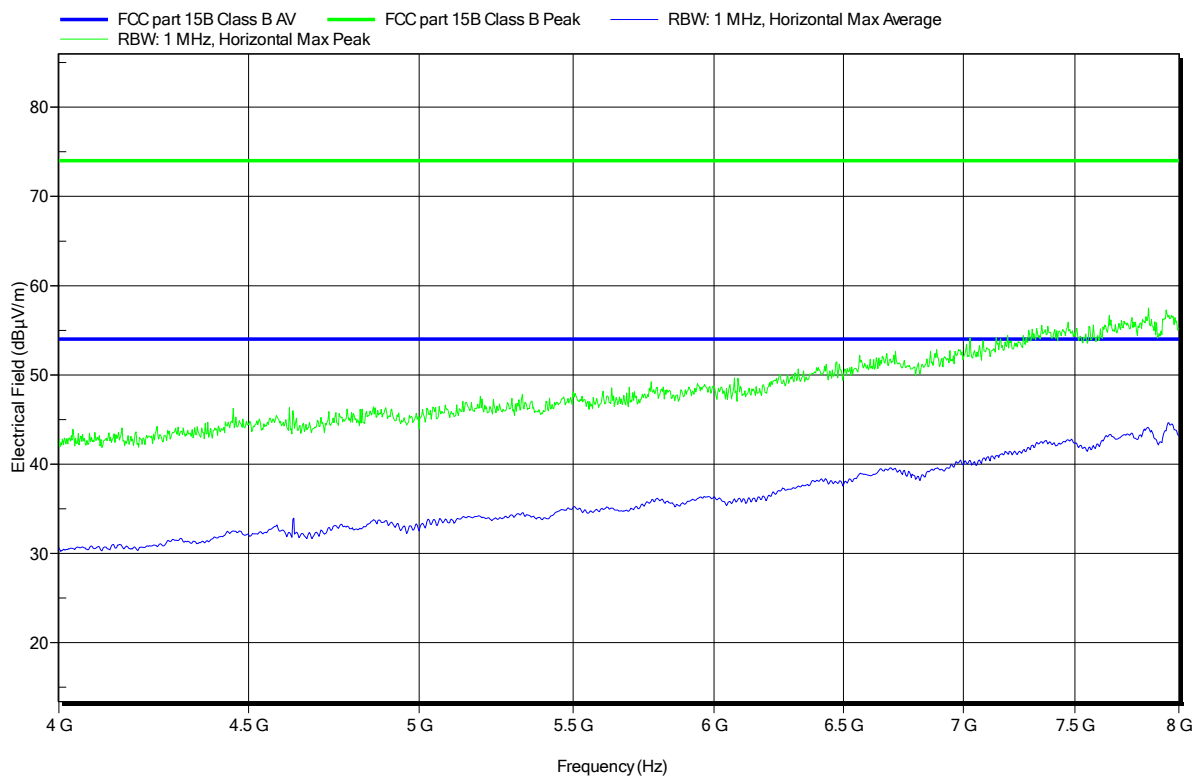


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 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-01-19
 Note:

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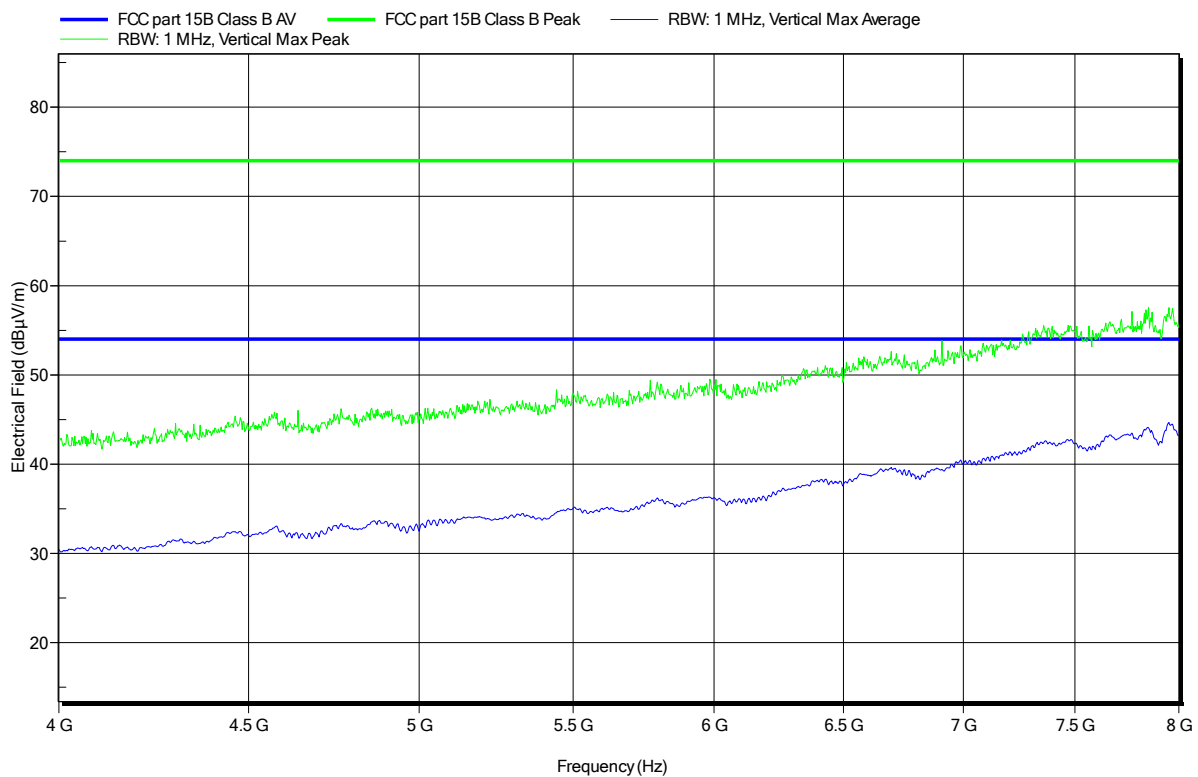


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 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-01-19
 Note:

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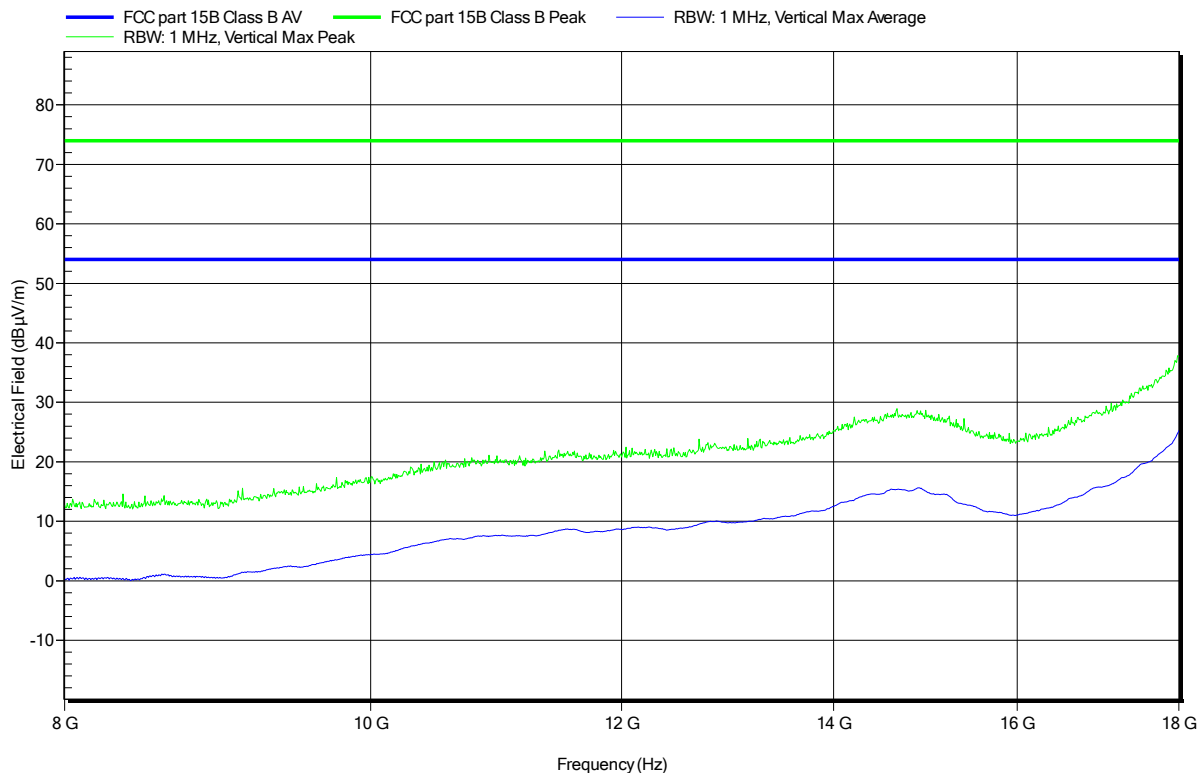


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Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	1
Test Date:	2016-01-19
Note:	

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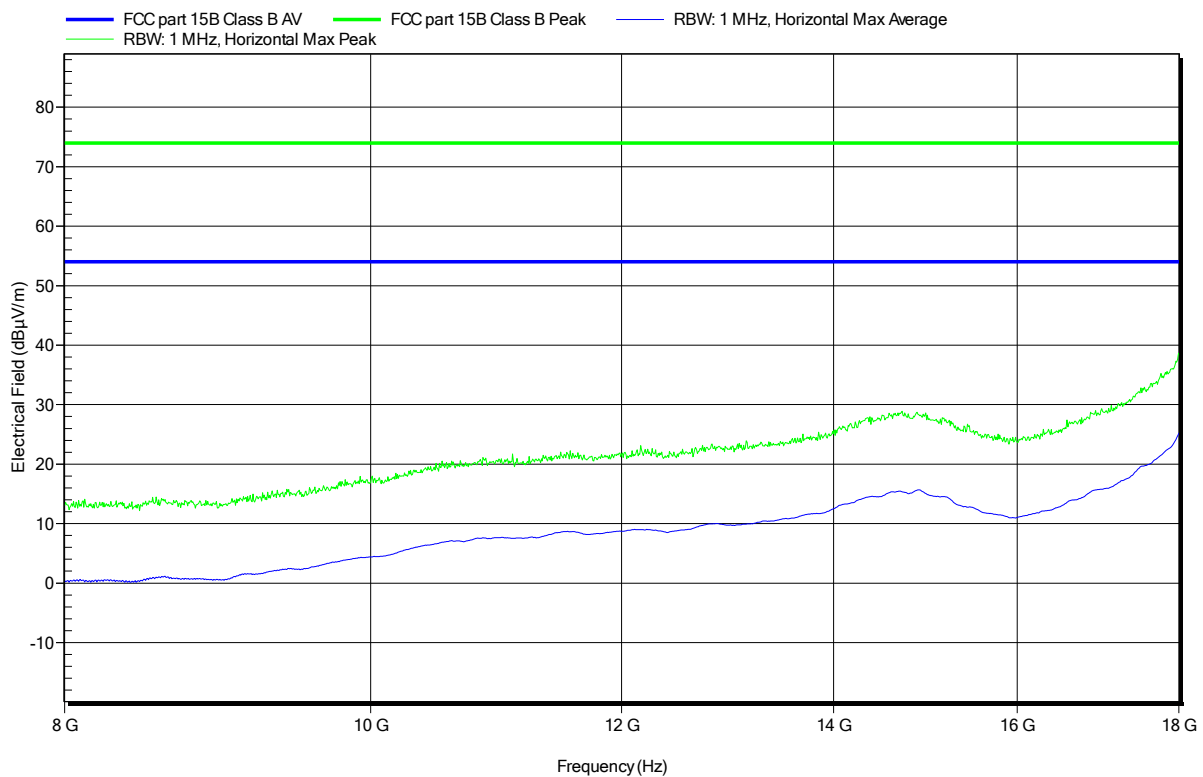


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 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3m
 Mode: 1
 Test Date: 2016-01-19
 Note:

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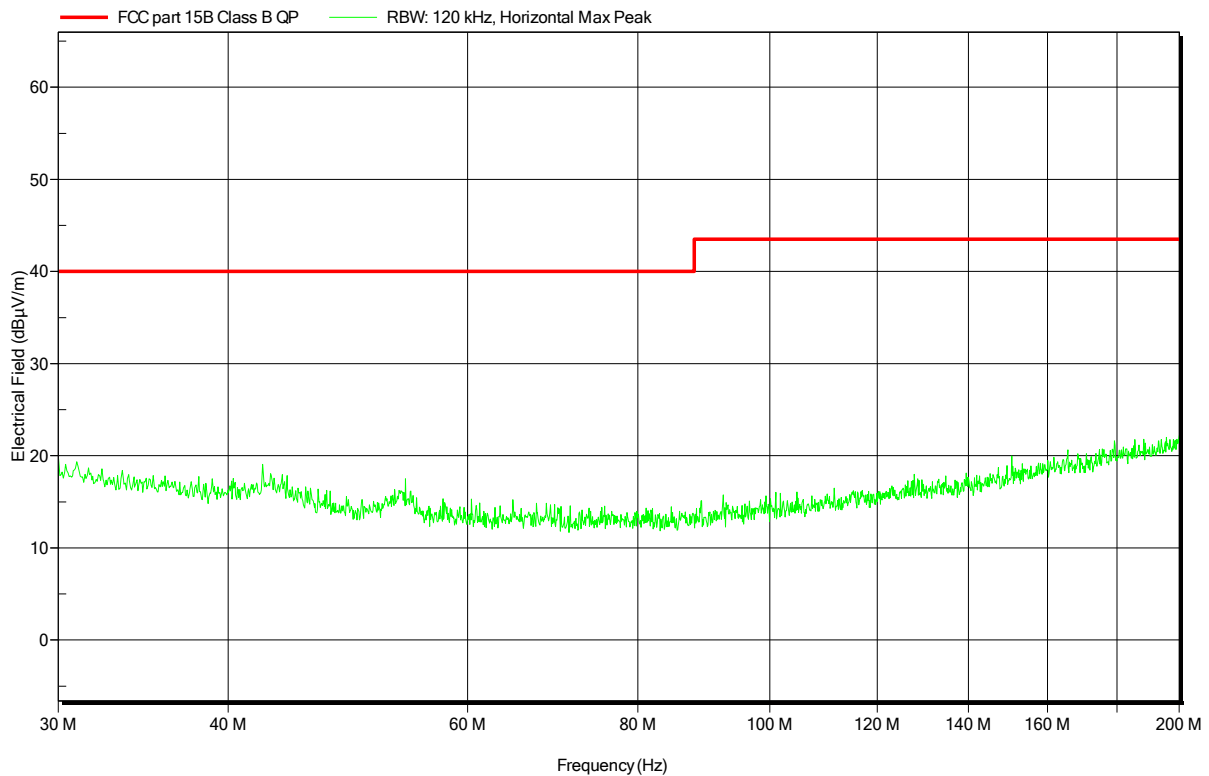


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Operator:	Mr. Marquardt
Test Conditions:	Tnom: 23°C, Unom: 5 VDC (via USB)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	2
Test Date:	2016-01-18
Note:	

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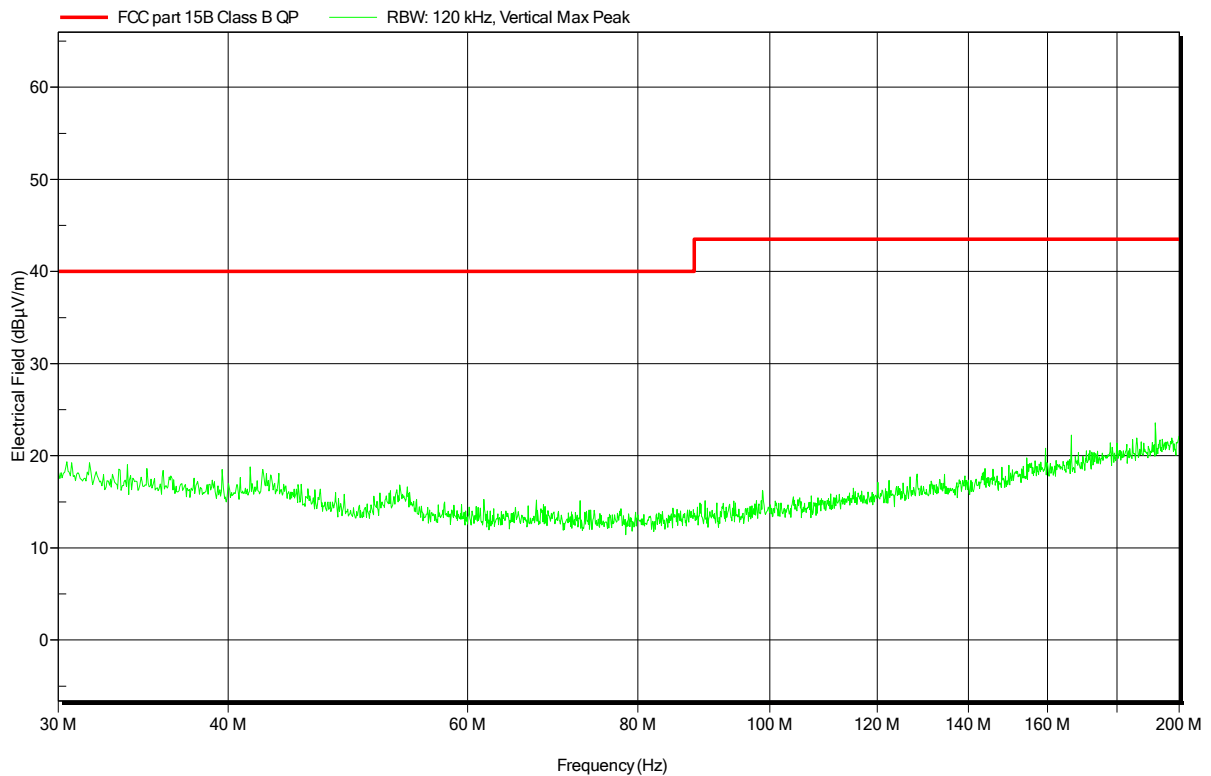


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Measurement distance:	3m
Mode:	2
Test Date:	2016-01-18
Note:	

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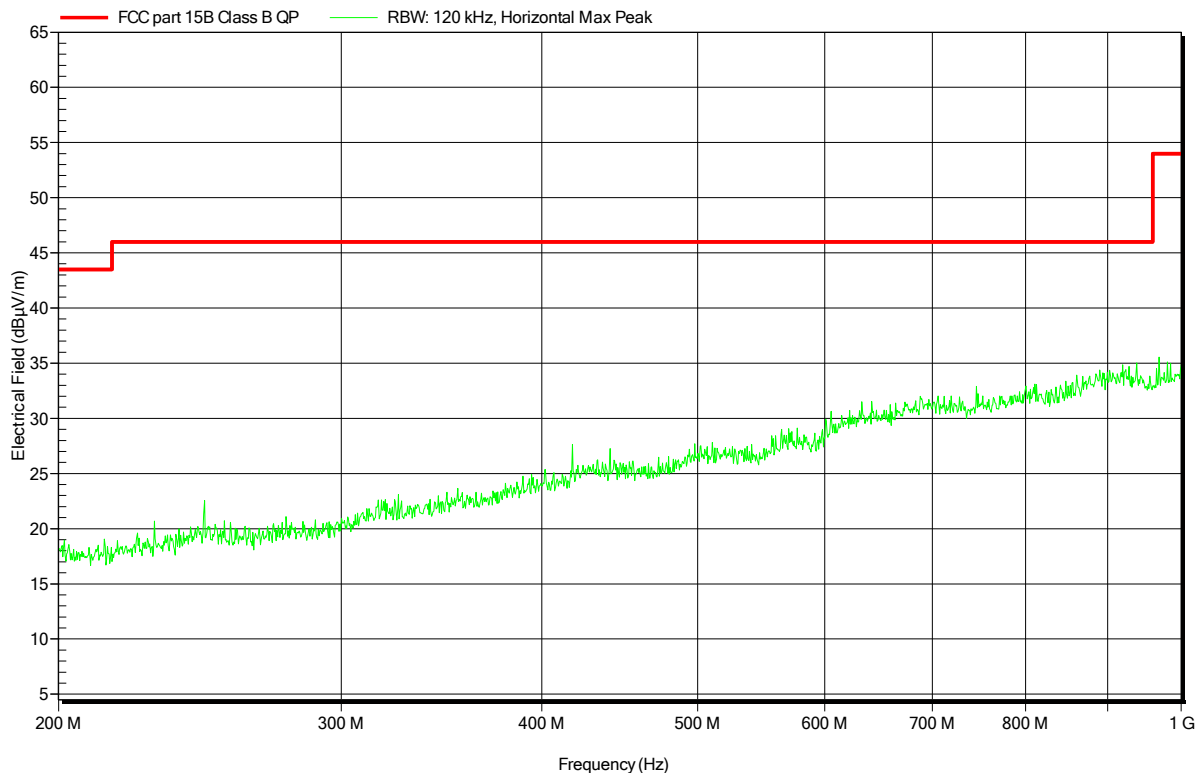


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Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	2
Test Date:	2016-01-18
Note:	

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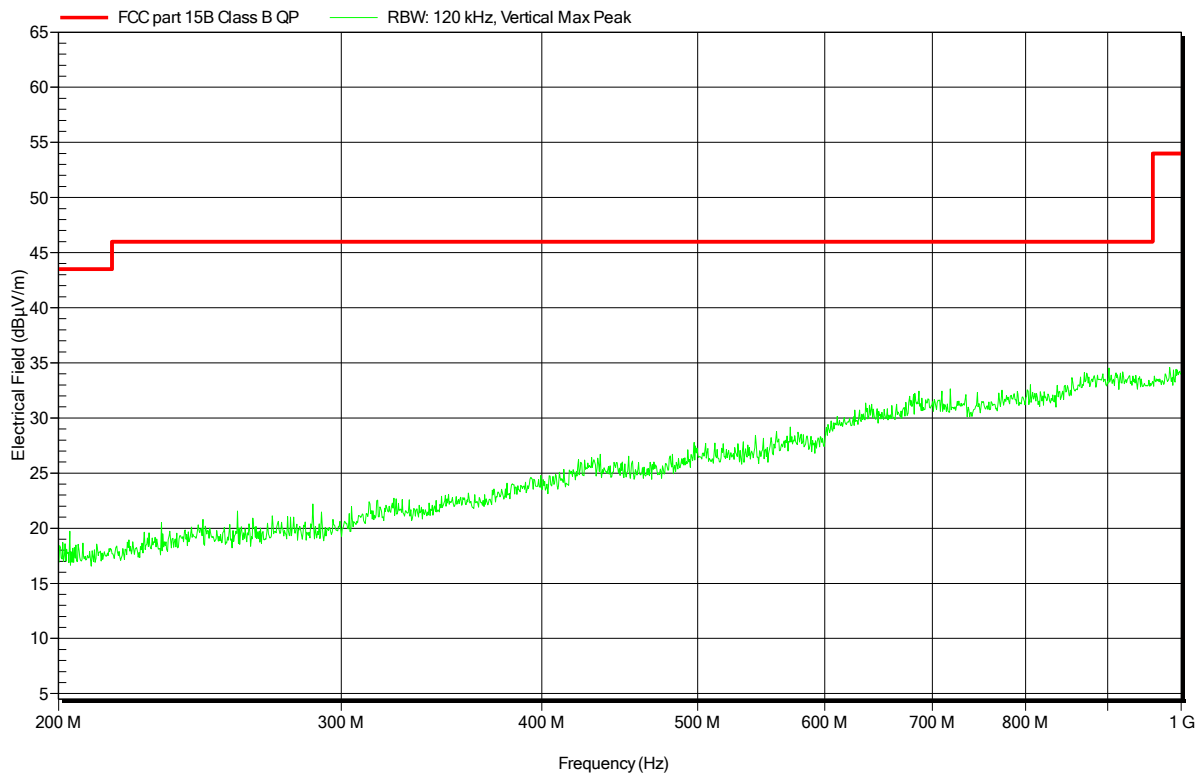


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Mode:	2
Test Date:	2016-01-18
Note:	

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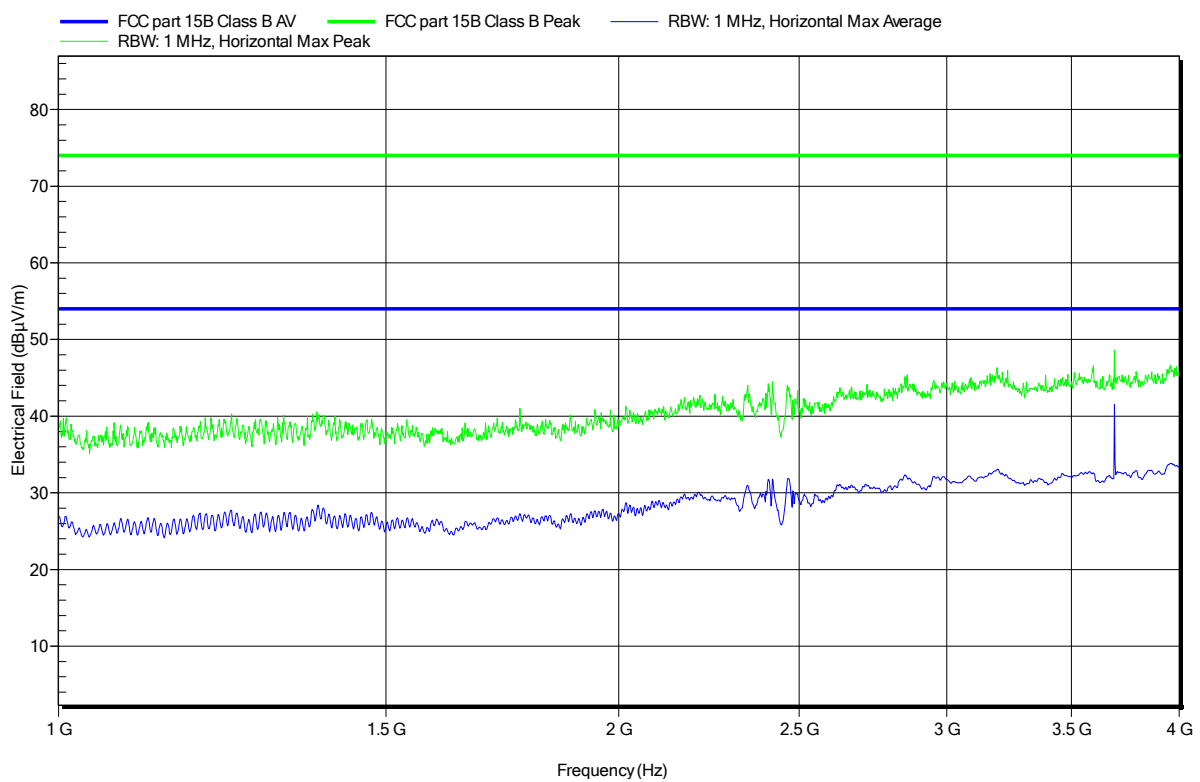


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 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3m
 Mode: 2
 Test Date: 2016-01-18
 Note:

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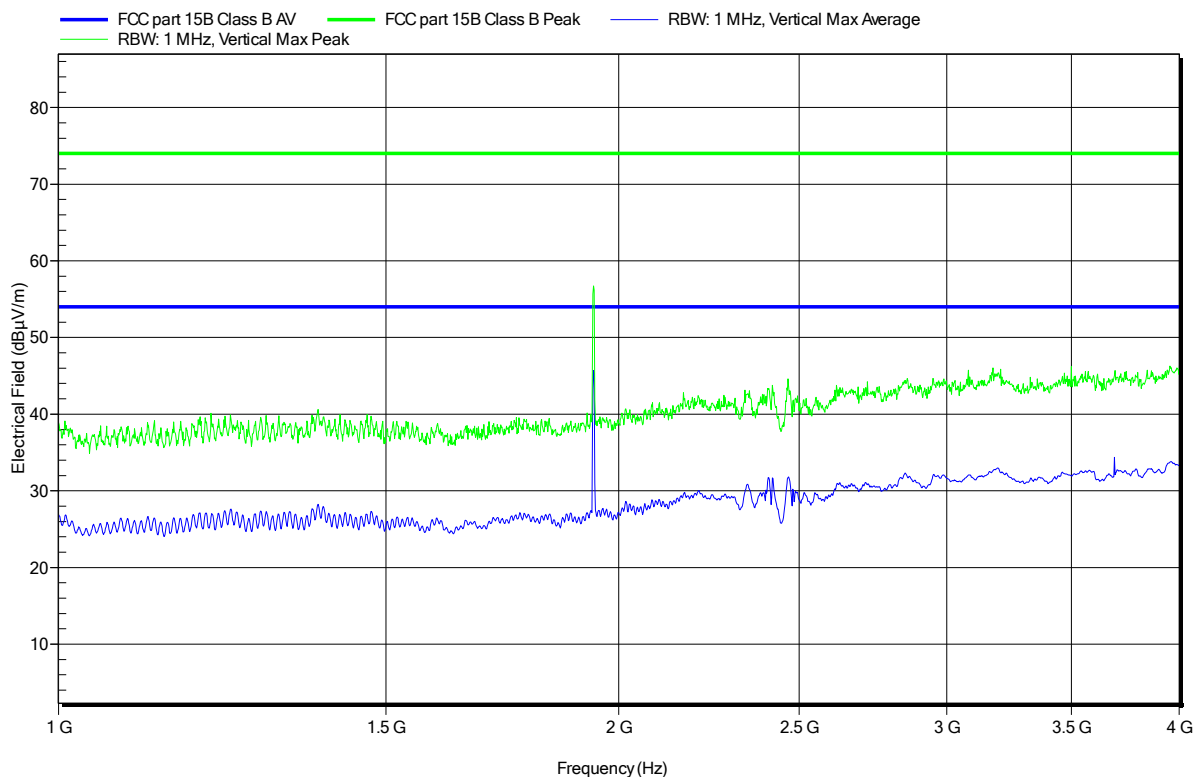


Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5232

Applicant: Kamstrup A/S
 EUT Name: READy Converter for Australia
 Model: READy Converter
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3m
 Mode: 2
 Test Date: 2016-01-18
 Note:

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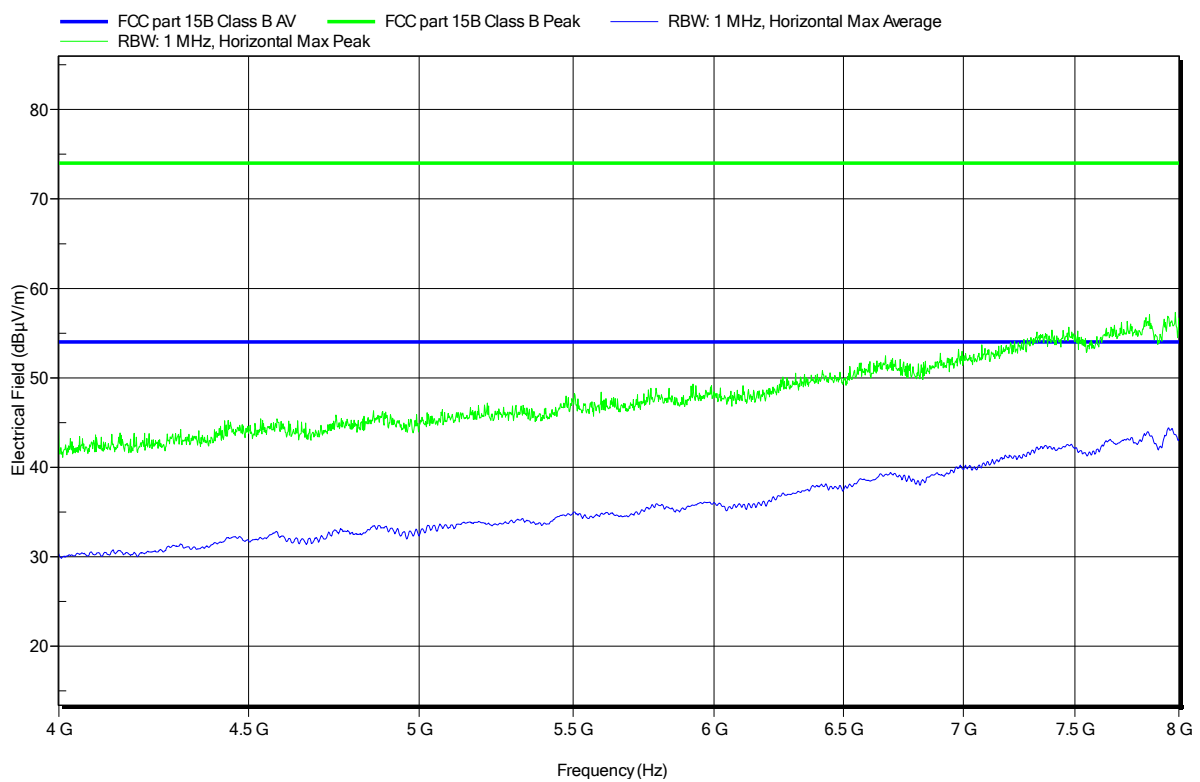


Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5232

Applicant: Kamstrup A/S
 EUT Name: REAdy Converter for Australia
 Model: REAdy Converter
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3m
 Mode: 2
 Test Date: 2016-01-18
 Note:

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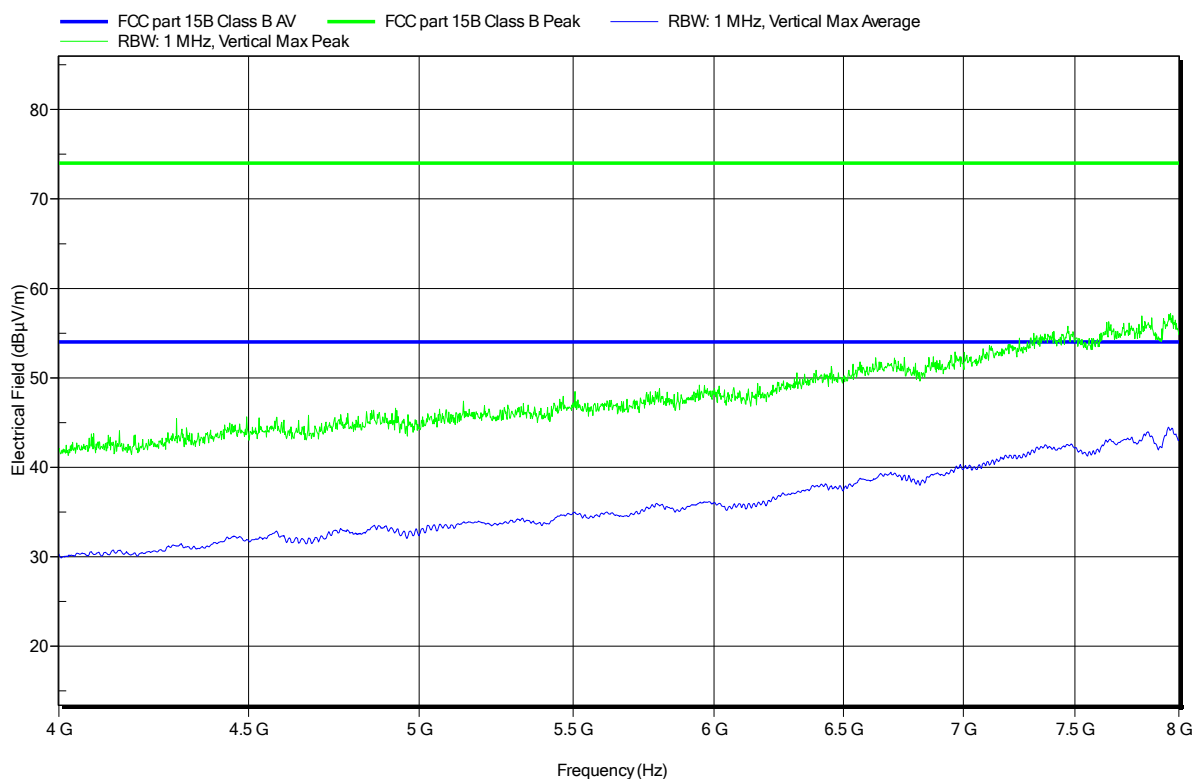


Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5232

Applicant: Kamstrup A/S
 EUT Name: REAdy Converter for Australia
 Model: REAdy Converter
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3m
 Mode: 2
 Test Date: 2016-01-18
 Note:

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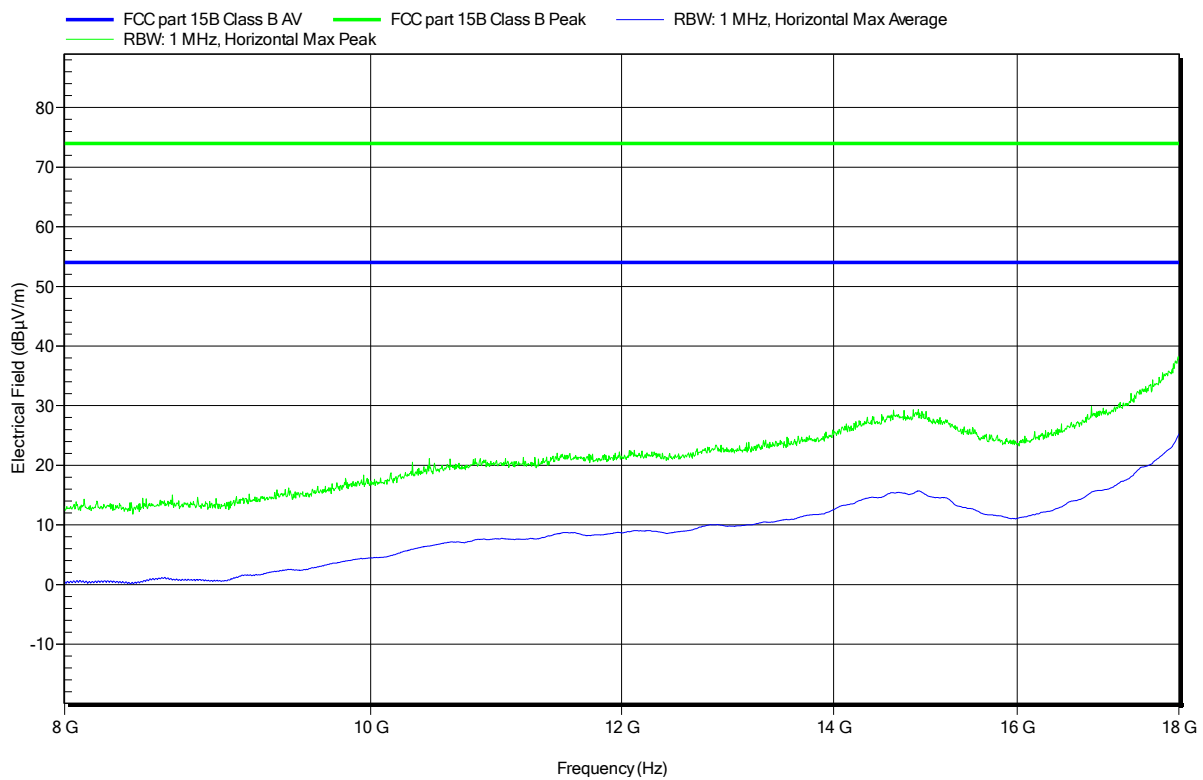


Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5232

Applicant: Kamstrup A/S
 EUT Name: READy Converter for Australia
 Model: READy Converter
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3m
 Mode: 2
 Test Date: 2016-01-18
 Note:

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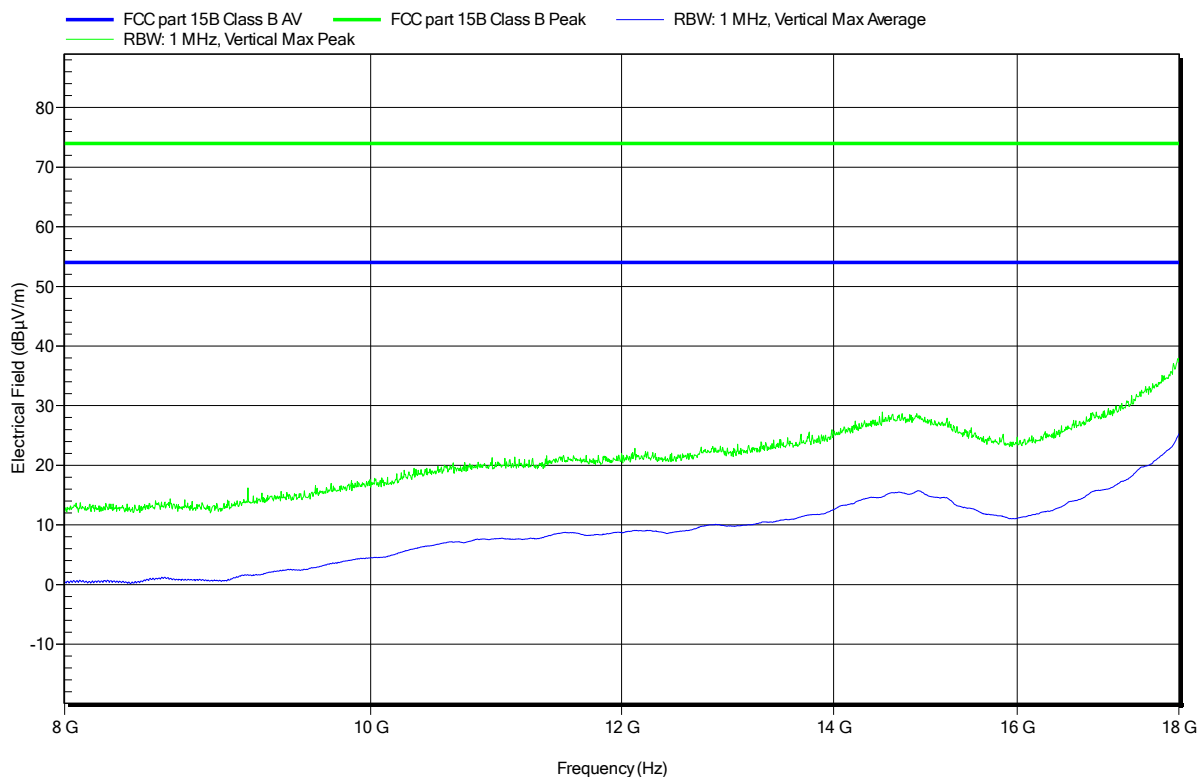


Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5232

Applicant: Kamstrup A/S
 EUT Name: READy Converter for Australia
 Model: READy Converter
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom: 5 VDC (via USB)
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3m
 Mode: 2
 Test Date: 2016-01-18
 Note:

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3.2 Test Conditions and Results – AC power line conducted emissions

Conducted emissions acc. FCC 47 CFR 15.107 / ICES-003				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 %		41%
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
Limits and results Class A				
Frequency [MHz]	Quasi-Peak [dBµV]	Result	Average [dBµV]	Result
0.15 to 5	79	PASS	66	PASS
5 to 30	73	PASS	60	PASS
Comments:				
* Limit decreases linearly with the logarithm of the frequency.				

Test Procedure:

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

Exploratory measurement:

- The EUT was placed on a non conductive table 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)
- The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- 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).
- The LISN measurement port was connected to a measurement receiver
- I/O cables were bundled not longer than 0.4 m
- Measurement was performed in the frequency range 0.15 – 30MHz on each current-carrying conductor
- To maximize the emissions the cable positions were manipulated
- The worst configuration of EUT and cables is shown on a test setup picture at item 1.3

Test Procedure:

Final measurement:

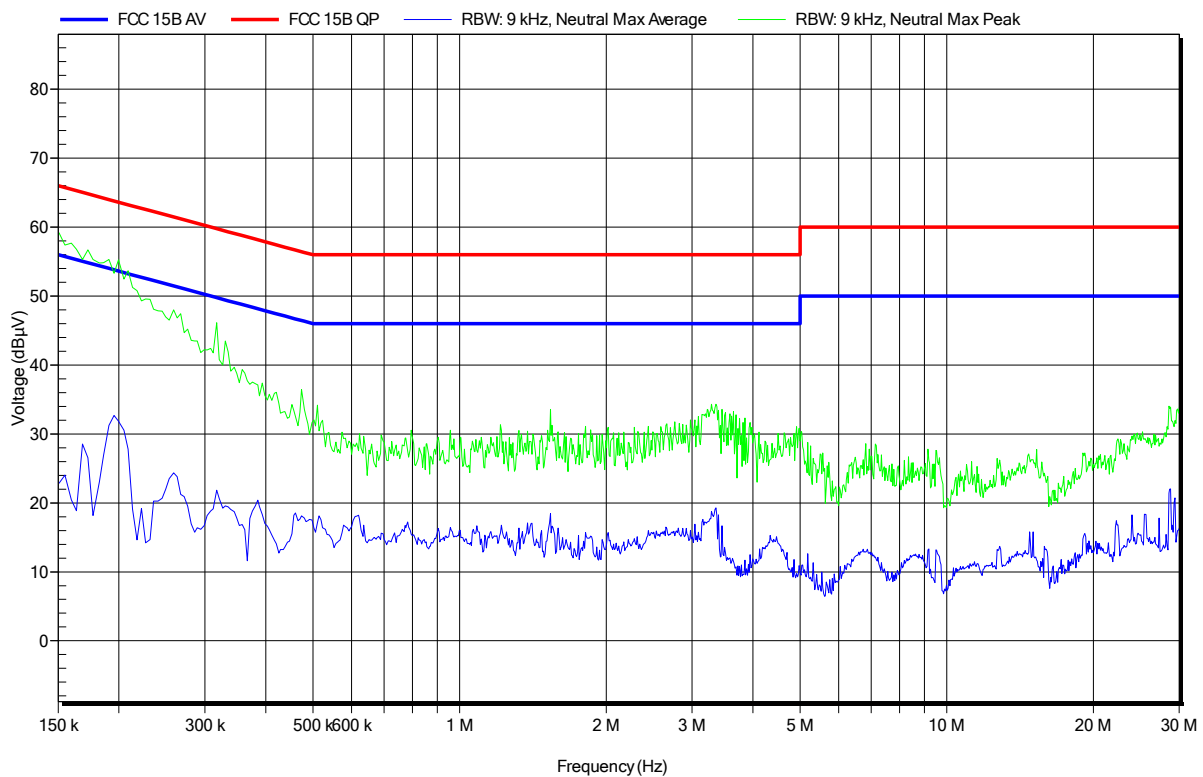
- The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2009 item 7.3.1)
- The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- The distance between the outer 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).
- The LISN measurement port was connected to a measurement receiver
- The EUT and cable arrangement were based on the exploratory measurement results
- The test data of the worst-case conditions were recorded and shown on the next pages.

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

Project number: G0M-1512-5232

Applicant:	Kamstrup A/S
EUT Name:	READY Converter for Australia
Model:	READY Converter
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Marquardt
Test Conditions:	Tnom: 23°C, Unom: 120VAC / 5 VDC (via USB)
LISN:	ESH2-Z5 N
Mode:	1
Test Date:	2016-01-19
Note:	

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

Project number: G0M-1512-5232

Applicant:	Kamstrup A/S
EUT Name:	READY Converter for Australia
Model:	READY Converter
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Marquardt
Test Conditions:	Tnom: 23°C, Unom: 120 VAC / 5 VDC (via USB)
LISN:	ESH2-Z5 L
Mode:	1
Test Date:	2016-01-19
Note:	

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