

EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada ICES-003

Electromagnetic compatibility - Unintentional radiators

Report Reference No. : G0M-1512-5282-EF01-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 : 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	flowIQ 2100
Model No.	flowIQ 2100
Additional Models	None
Hardware version	5535 1364 C2 (pcb revision) part of 55501453 A1 (bom rf) / 55501367 A1 (bom flow)/ 5550 1350 A6
Firmware / Software version	50981224 C1(fw) / 55141168 A1(eeprom)
	FCC-ID: OUY-FLOW2100 IC: N/A

Test result **Passed**

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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 - 2016-01-18

Compiled by: Jens Marquardt

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

Approved by (+ signature): Marcus Klein

Head of Lab

Date of issue.....: 2016-01-29

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	2016-01-29	Initial Release	

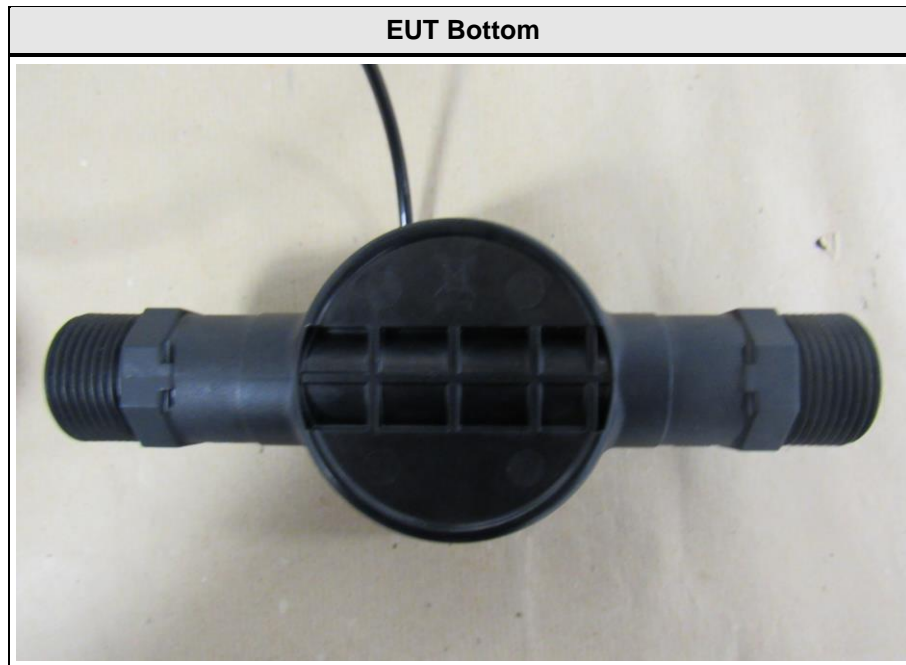
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1 Equipment (Test item) Description

Description	flowIQ 2100
Model	flowIQ 2100
Additional Models	None
Serial number	None
Hardware version	5535 1364 C2 (pcb revision) part of 55501453 A1 (bom rf) / 55501367 A1 (bom flow)/ 5550 1350 A6
Software / Firmware version	50981224 C1(fw) / 55141168 A1(eeprom)
FCC-ID	OUY-FLOW2100
Contains IC	N/A
Power supply	3.6 VDC Battery
Manufacturer	Kamstrup A/S Industrivej 28 8660 Skanderborg DENMARK
Highest emission frequency	Fmax [MHz] = 915
Device classification	Class B
Equipment type	Tabletop
Number of tested samples	1

1.1 Photos – Equipment external



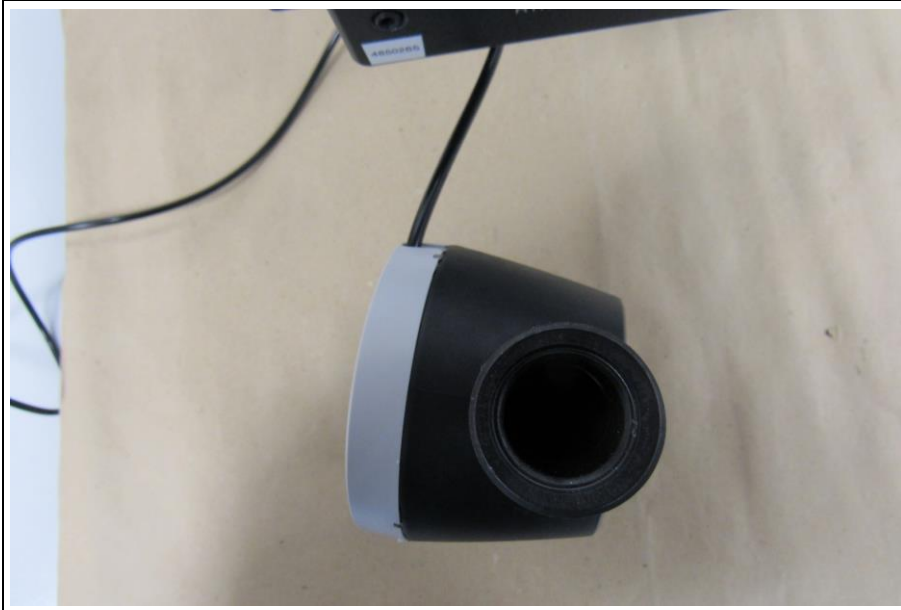
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EUT Side



EUT Side



EUT Side

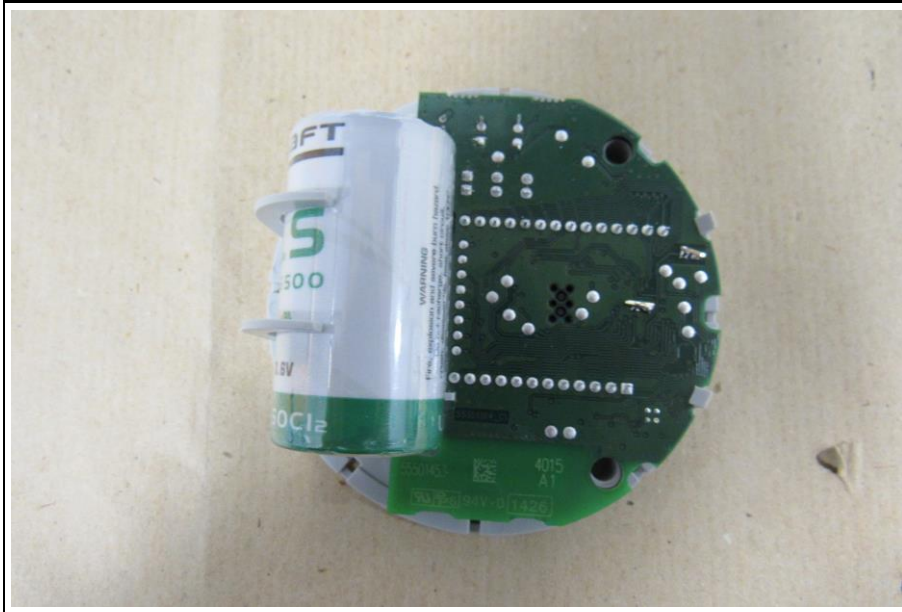


EUT Side

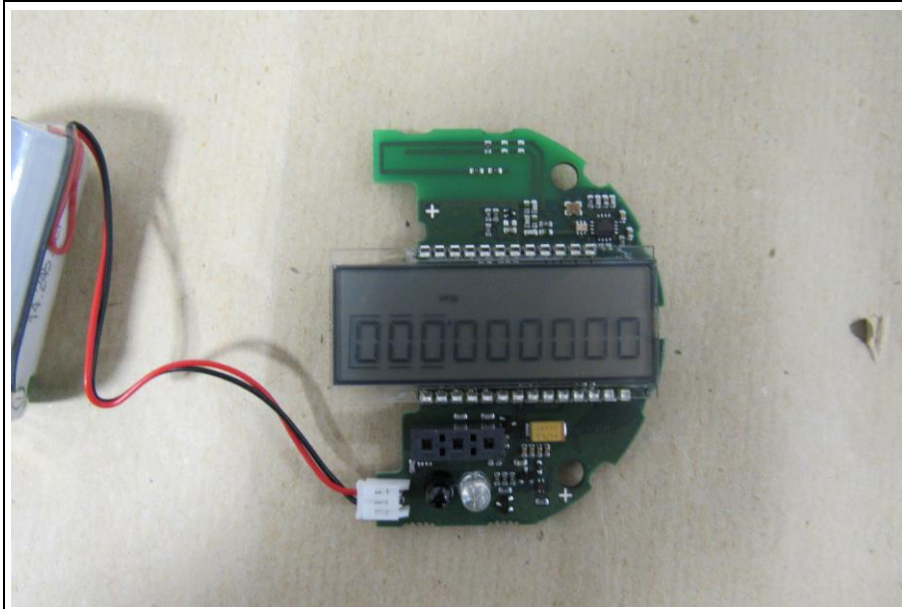


1.2 Photos – Equipment internal

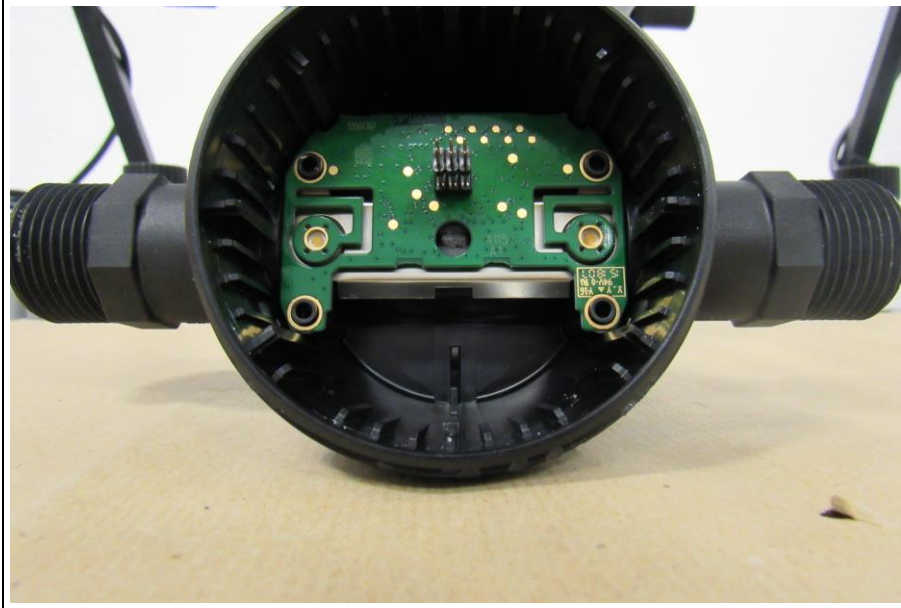
First Battery PCB part bottom



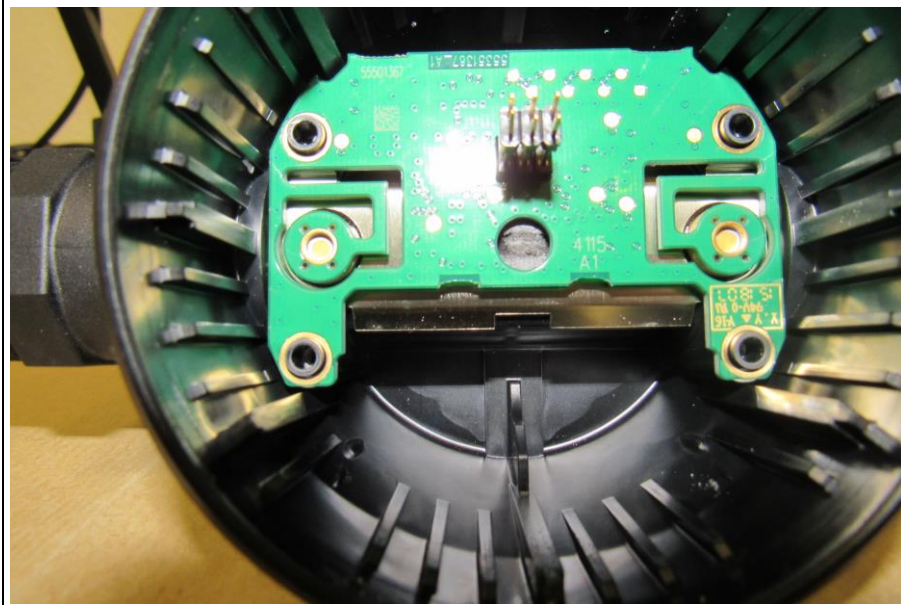
First Battery PCB part top



Second PCB top with case



Second PCB top with case - closer



1.3 Photos – Test setup



1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments (e.g. serial no.)
None				
<p>*Note: Use the following abbreviations:</p> <p>AE : Auxiliary/Associated Equipment, or</p> <p>SIM : Simulator (Not Subjected to Test)</p> <p>CABL : Connecting cables</p>				

1.5 Input / Output Ports

Port #	Name	Type*	Max. Cable Length	Cable Shielded	Comments (e.g. Cat. of Cable)
1	3 wire for Itron communication system	I/O	1.5 m	yes	Service only
<p>*Note: Use the following abbreviations:</p> <p>AC : AC power port</p> <p>DC : DC power port</p> <p>N/E : Non electrical</p> <p>I/O : Signal input or output port</p> <p>TP : Telecommunication port</p>					

1.6 Operating Modes and Configurations

Mode #	Description
1	radio communication on frequency 915 MHz over SRD

Configuration #	EUT Configuration
1	EUT powered up from internal Battery powered

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	2015-01	2016-01
RF Cable			-	System Cal.	System Cal
RF Cable			-	System Cal.	System Cal

Radiated emissions – 10m 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	Keysight	N9038A-526	EF01070	2015-08	2016-08
RF Cable	Huber & Suhner	Sucoflex 106	-	System Cal.	System Cal
RF Cable	Huber & Suhner	Multiflex 141	-	System Cal.	System Cal

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
AMN	Schwarzbeck	NSLK 8128	EF00975	2015-12	2016-12
EMI Test Receiver	R&S	ESR7	EF00943	2015-09	2016-09
EMI Test Receiver	Keysight	N9038A-526	EF01070	2015-08	2016-08
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 dB μ V. 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 dB μ V/m). The FCC limits are given in units of μ V/m. The following formula is used to convert the units of μ V/m to dB μ V/m:

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

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:

$$\begin{array}{rclclcl} \text{Reading} & + & \text{AF} & = & \text{Net Reading} & : & \text{Net reading - FCC limit} & = & \text{Margin} \\ 21.5 \text{ dB}\mu\text{V} & + & 26 \text{ dB} & = & 47.5 \text{ dB}\mu\text{V/m} & : & 47.5 \text{ dB}\mu\text{V/m} - 57.0 \text{ dB}\mu\text{V/m} & = & -9.5 \text{ dB} \end{array}$$

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	N/A	
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		23,94		
Relative Humidity		30 to 60 %		23,25		
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] = 915				
Fully configured sample scanned over the following frequency range		Frequency range				
		30 MHz to 18 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 C63-4:2014 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:

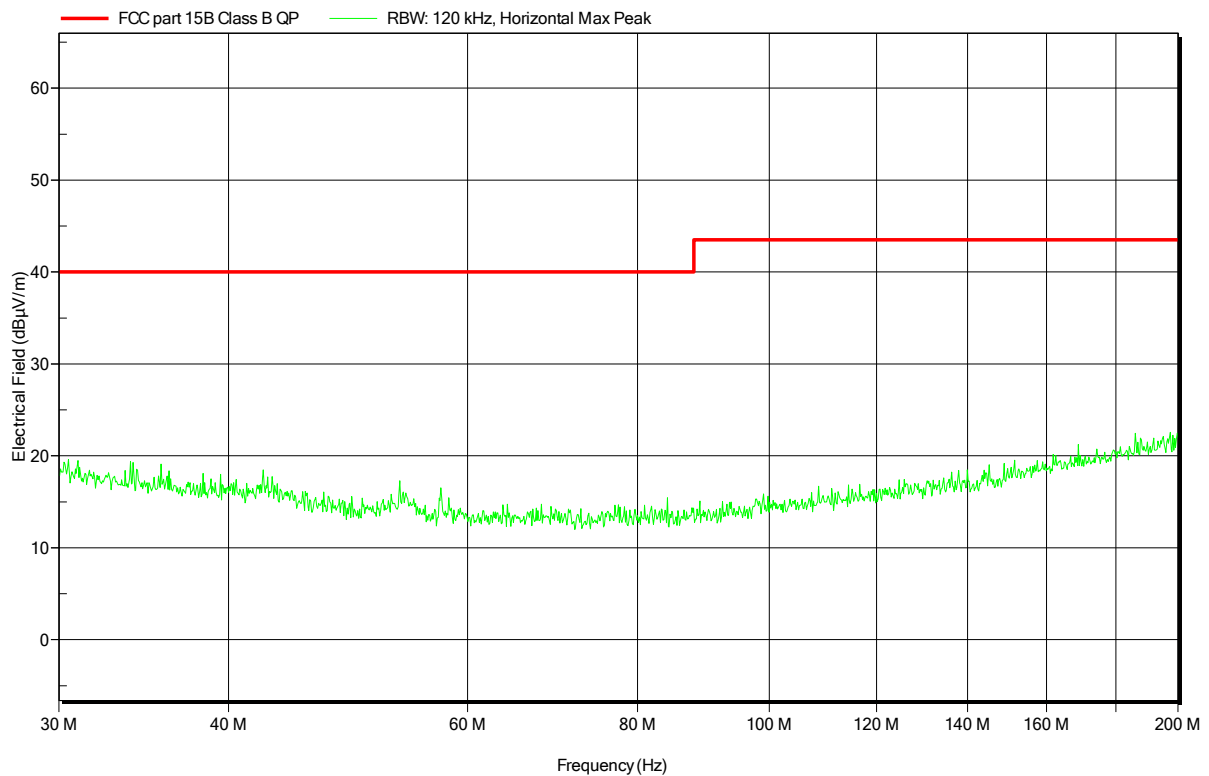
- The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver
- A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 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-1512-5282

Applicant: Kamstrup A/S
 EUT Name: flowIQ 2100
 Model:
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom:
 Antenna: Rohde & Schwarz HK 116, Horizontal
 Measurement distance:
 Mode: tx (sendemodus)
 Test Date: 2016-01-18
 Note:

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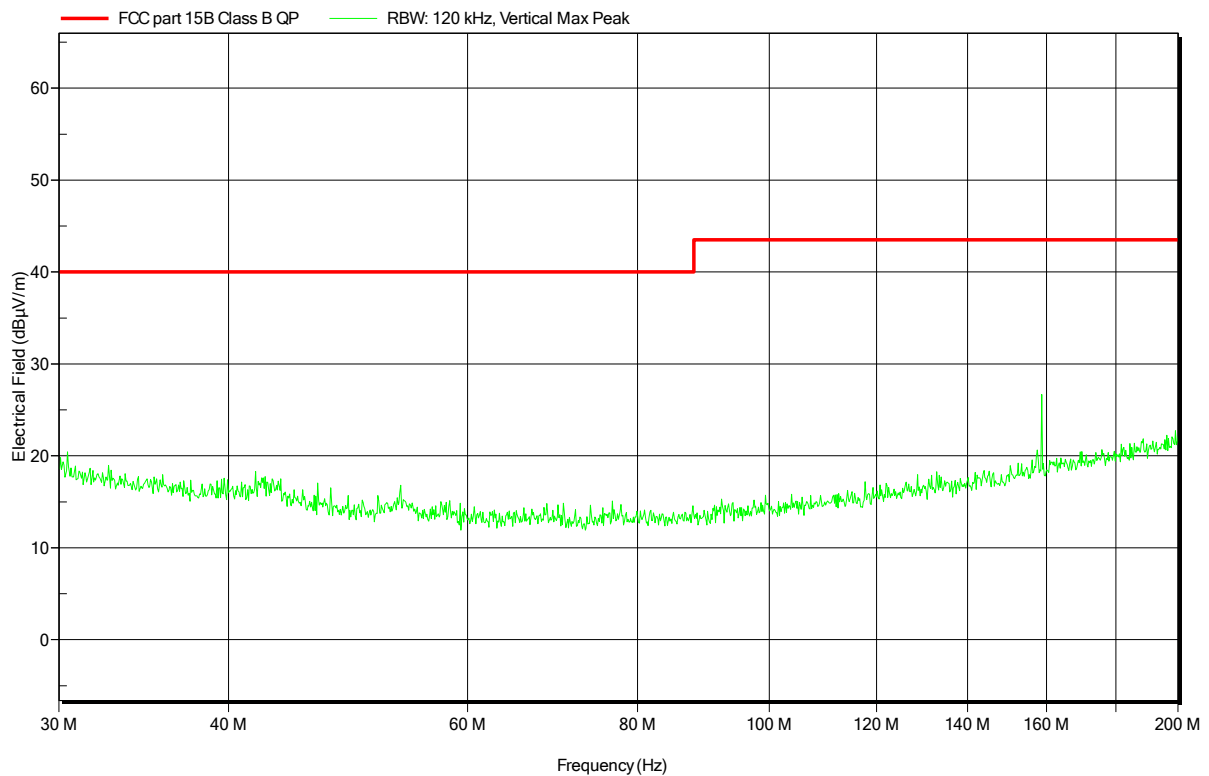
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5282

Applicant: Kamstrup A/S
 EUT Name: flowIQ 2100
 Model:
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom:
 Antenna: Rohde & Schwarz HK 116, Vertical
 Measurement distance:
 Mode: tx (sendemodus)
 Test Date: 2016-01-18
 Note:

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Test Report No.: G0M-1512-5282-EF01-V01

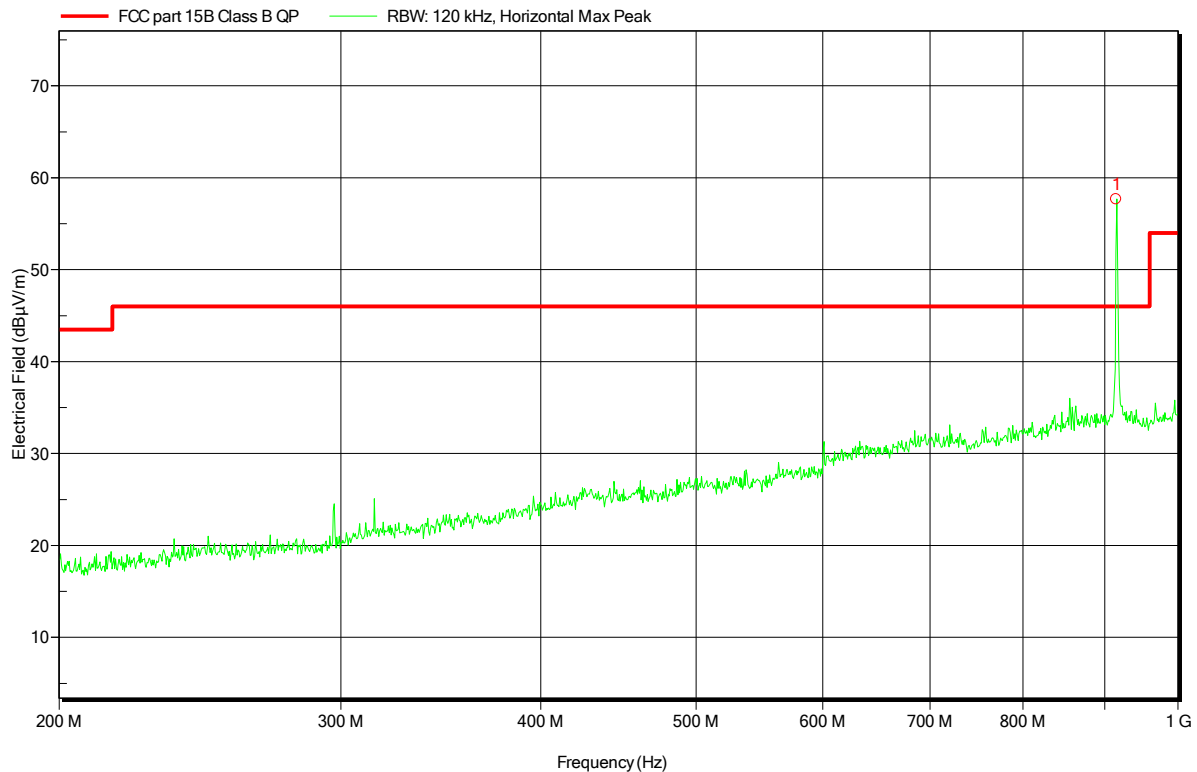
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5282

Applicant: Kamstrup A/S
 EUT Name: flowIQ 2100
 Model:
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom:
 Antenna: Rohde & Schwarz HL 223, Horizontal
 Measurement distance:
 Mode: tx (sendemodus)
 Test Date: 2016-01-18
 Note: 1: Carrier

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Peak Number	Frequency	SRD Carrier
1	914.78 MHz	

Test Report No.: G0M-1512-5282-EF01-V01

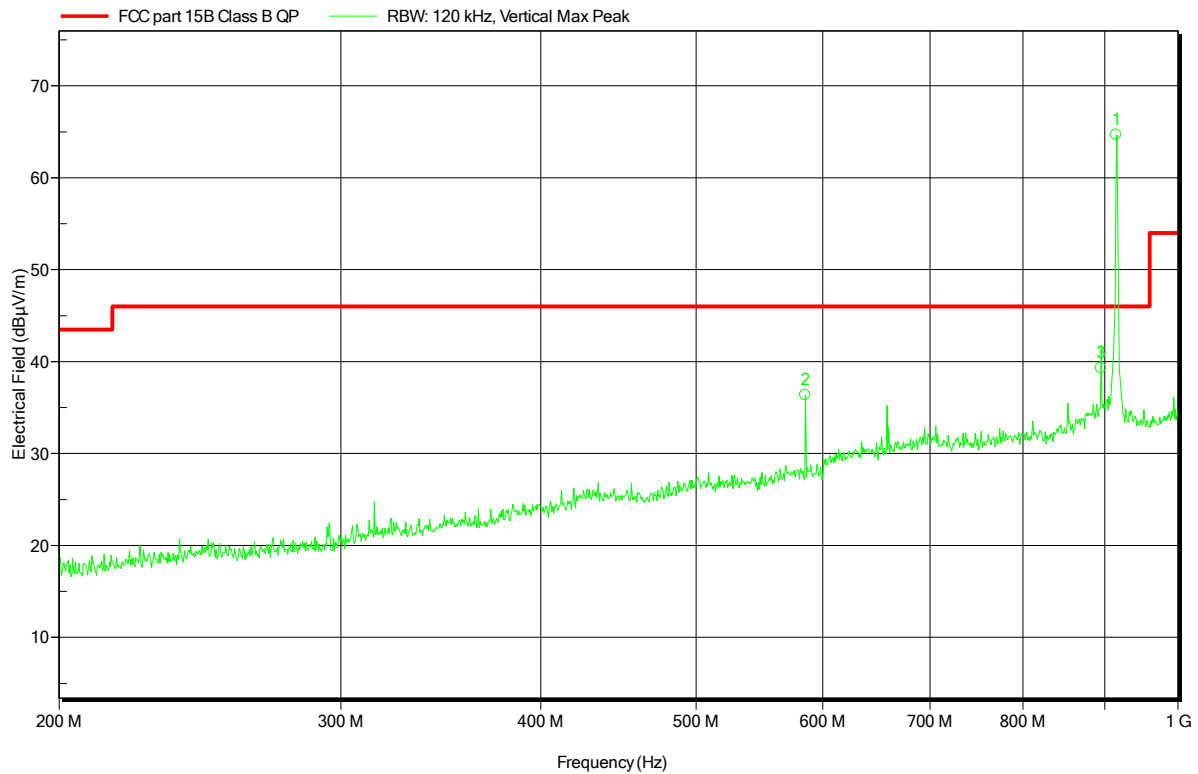
Eurofins Product Service GmbH
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Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5282

Applicant: Kamstrup A/S
 EUT Name: flowIQ 2100
 Model:
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom:
 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement distance:
 Mode: tx (sendemodus)
 Test Date: 2016-01-18
 Note: 1:Carrier

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Peak Number	Frequency	Angle	Height
1	914.78 MHz	SRD Carrier	
2	584.9 MHz	180 Degree	1 m
3	894.98 MHz	1800 Degree	1 m

Test Report No.: G0M-1512-5282-EF01-V01

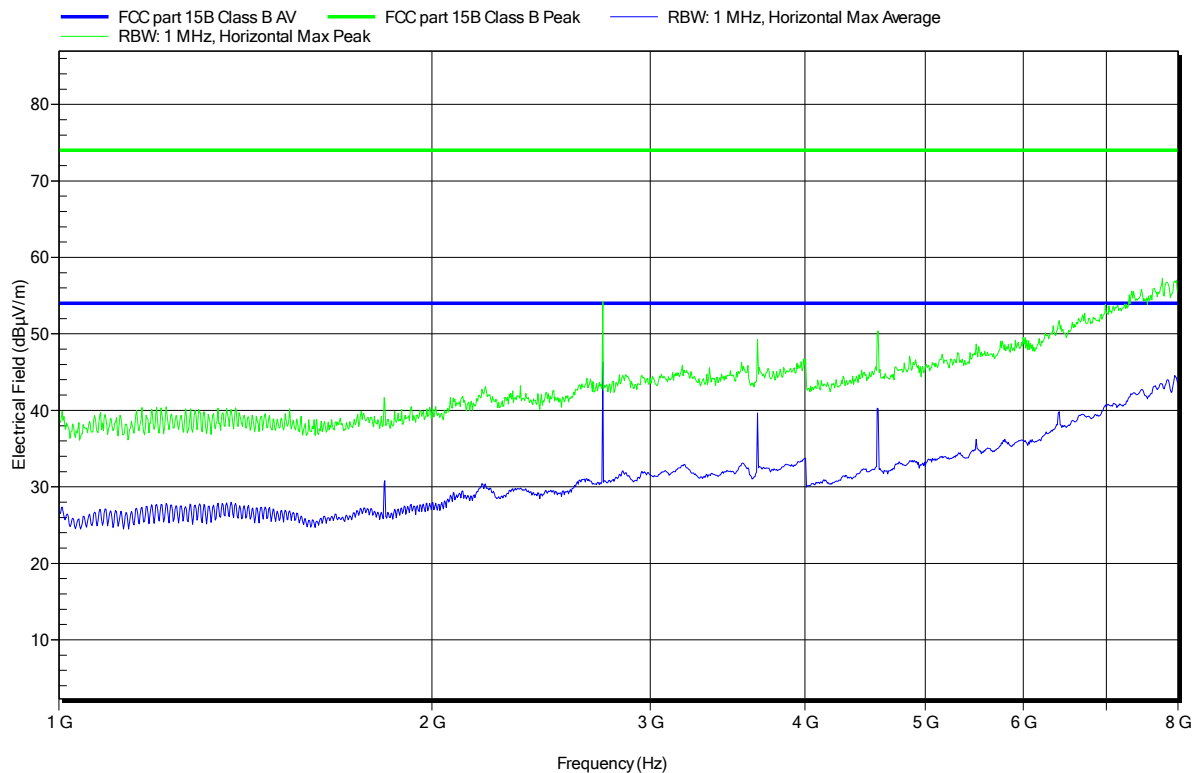
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Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5282

Applicant: Kamstrup A/S
 EUT Name: flowIQ 2100
 Model:
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom:
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance:
 Mode: tx (sendemodus)
 Test Date: 2016-01-18
 Note:

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Test Report No.: G0M-1512-5282-EF01-V01

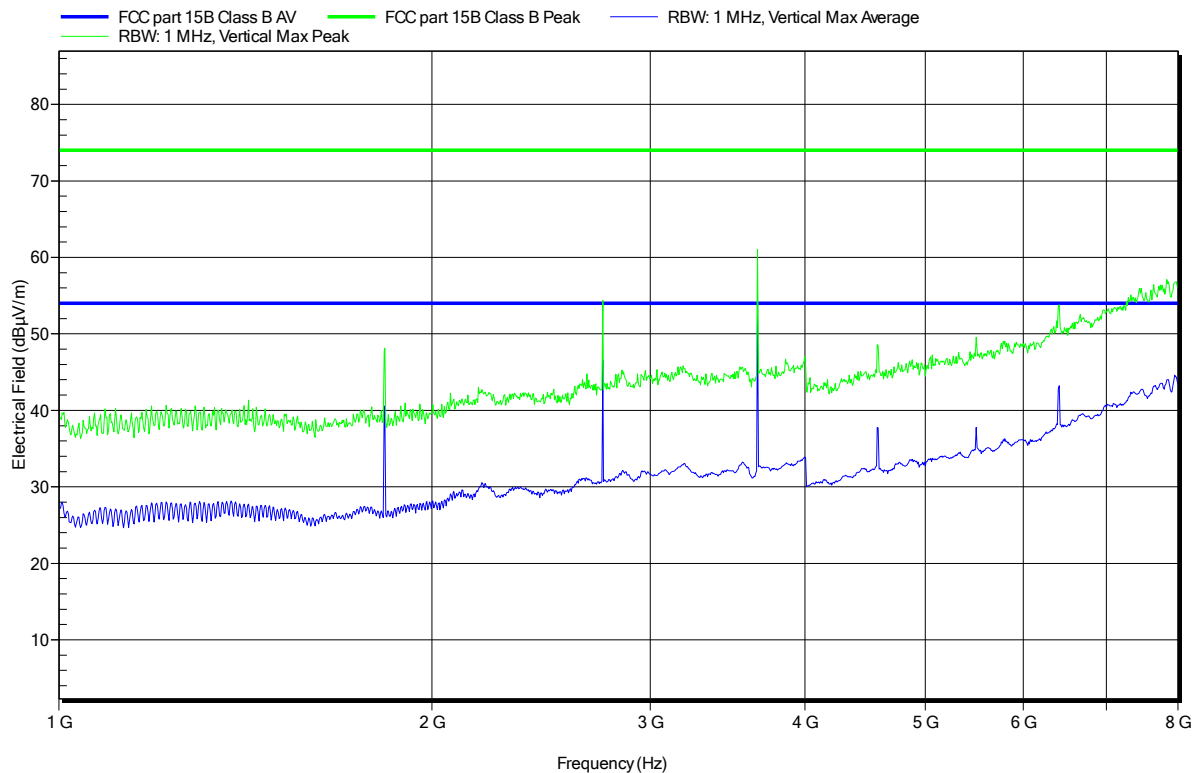
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Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5282

Applicant: Kamstrup A/S
 EUT Name: flowIQ 2100
 Model:
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom:
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance:
 Mode: tx (sendemodus)
 Test Date: 2016-01-18
 Note:

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Test Report No.: G0M-1512-5282-EF01-V01

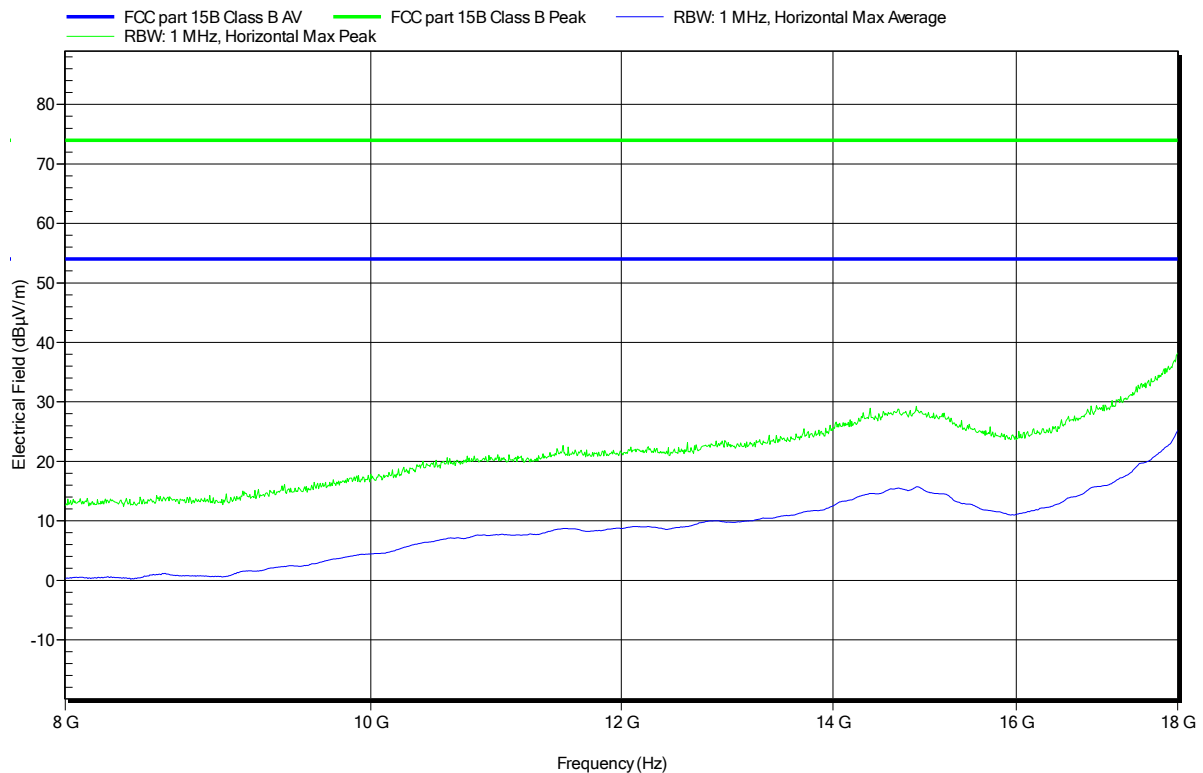
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Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5282

Applicant: Kamstrup A/S
 EUT Name: flowIQ 2100
 Model:
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom:
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance:
 Mode: tx (sendemodus)
 Test Date: 2016-01-18
 Note:

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Spurious emissions under normal conditions according to FCC Part 15 B

Project number: G0M-1512-5282

Applicant: Kamstrup A/S
 EUT Name: flowIQ 2100
 Model:
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Marquardt
 Test Conditions: Tnom: 23°C, Unom:
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance:
 Mode: tx (sendemodus)
 Test Date: 2016-01-18
 Note:

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