



<b>EMC TEST REPORT</b> <b>FCC 47 CFR Part 15B</b> <b>Industry Canada ICES-003</b> <b>Electromagnetic compatibility - Unintentional radiators</b>	
<b>Report Reference No.</b> .....	G0M-1702-6295-EF0115B-SU-V01
<b>Testing Laboratory</b> .....	Eurofins Product Service GmbH
Address .....	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation .....	<div style="text-align: center;">   </div> <p>A2LA Accredited Testing Laboratory, Certificate No.: 1983.01                      FCC Filed Test Laboratory, Reg.-No.: 96970                      IC OATS Filing assigned code: 3470A</p>
<b>Applicant's name</b> .....	eResearchTechnology GmbH
Address .....	Sieboldstrasse 3 97230 Estenfeld GERMANY
<b>Test specification:</b>	
Standard.....	47 CFR Part 15 Subpart B ICES-003, Issue 6:2016 ANSI C63.4:2014
<b>Equipment under test (EUT):</b>	
Product description	Spirometer
Model No.	SpiroSphere - Sensor Unit
Additional Models	None
Hardware version	06.06.00
Firmware / Software version	Firmware µC: 00.12.00 / Bootloader µC: 01.00.00 / BT-Script: 8
	FCC-ID: 2AAUFSPS002                      IC: 11335A-SPS002
<b>Test result</b>	<b>Passed</b>

**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 .....: 2017-03-24

Date (s) of performance of tests .....: 2017-04-07 – 2017-04-21

Compiled by ..... : Marco Belz

Tested by (+ signature)..... : Andreas Pflug/Marco Belz

Approved by (+ signature) ..... : Jens Marquardt  
Deputy Head of Lab

Date of issue ..... : 2017-05-19

Total number of pages..... : 28


**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:**

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## Version History

Version	Issue Date	Remarks	Revised by
V01	2017-05-12	Initial Release	

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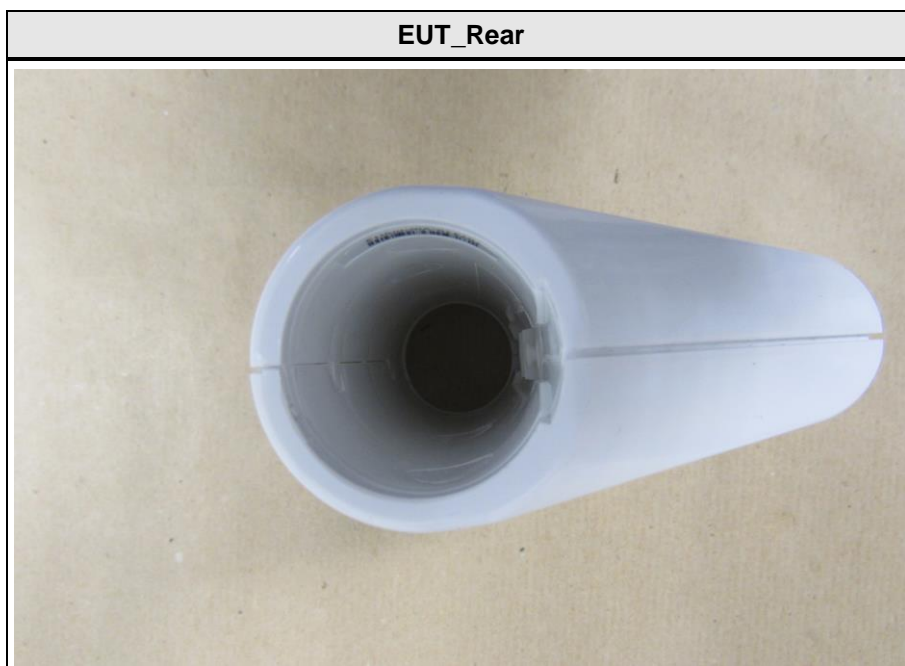
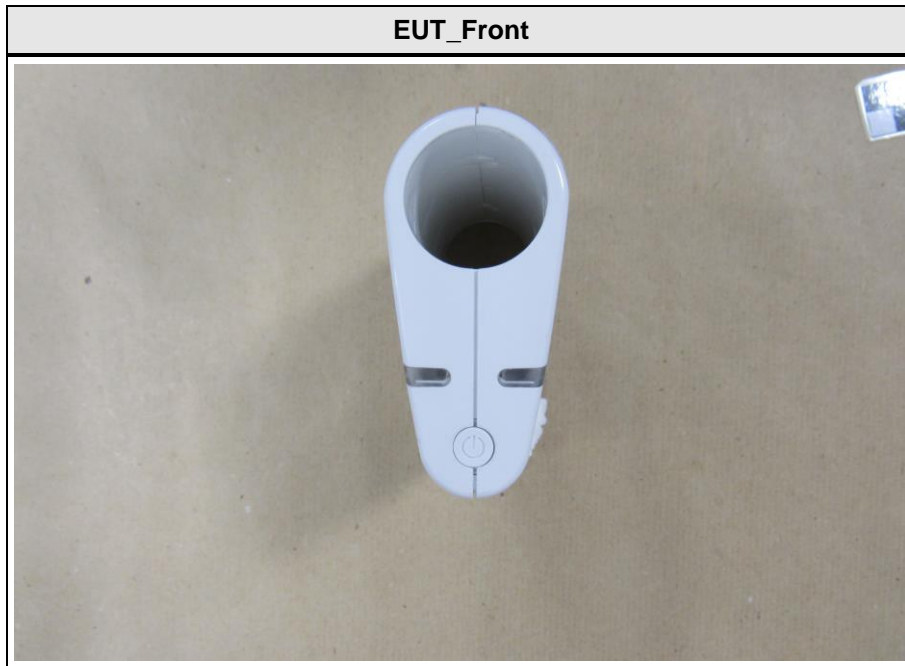
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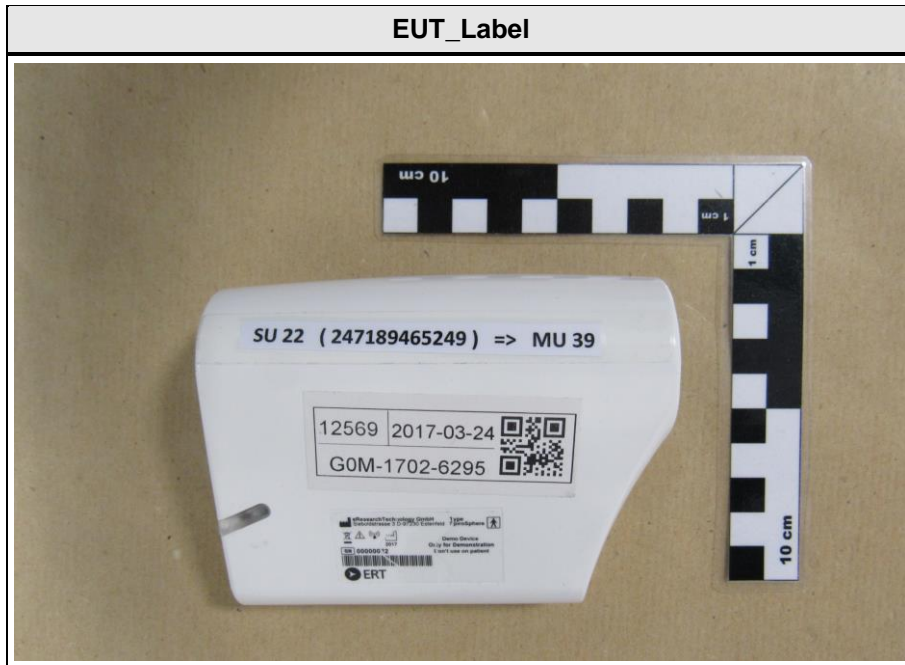
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## 1 Equipment (Test item) Description

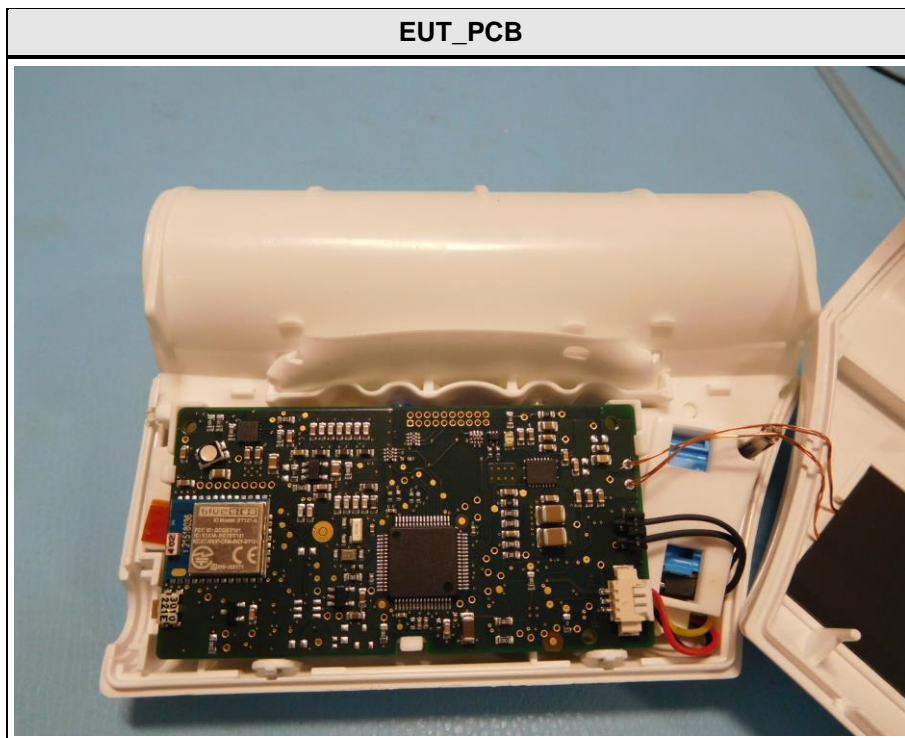
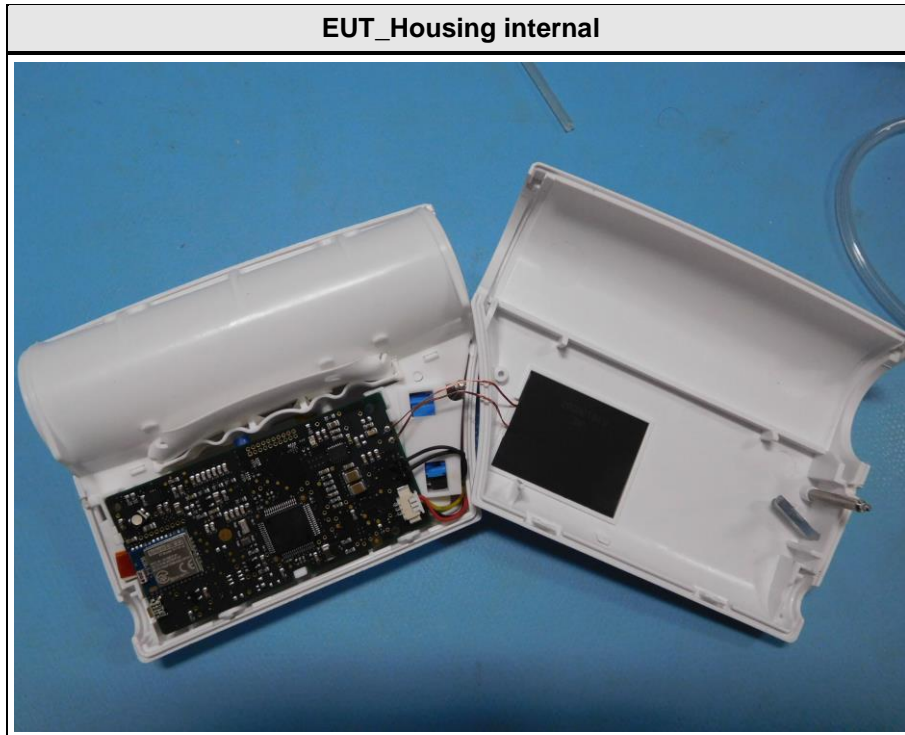
<b>Description</b>	Spirometer
<b>Model</b>	SpiroSphere - Sensor Unit
<b>Additional Models</b>	None
<b>Serial number</b>	00000022
<b>Hardware version</b>	06.06.00
<b>Software / Firmware version</b>	Firmware $\mu$ C: 00.12.00 / Bootloader $\mu$ C: 01.00.00 / BT-Script: 8
<b>FCC-ID</b>	2AAUFSPS002
<b>IC</b>	11335A-SPS002
<b>Power supply</b>	3.7 VDC via internal Battery
<b>Manufacturer</b>	eResearchTechnology GmbH Sieboldstrasse 3 97230 Estenfeld GERMANY
<b>Highest emission frequency</b>	$f_{max}$ [MHz] = 2400
<b>Device classification</b>	Class B
<b>Equipment type</b>	Tabletop
<b>Number of tested samples</b>	1

1.1 Photos – Equipment external





1.2 Photos – Equipment internal





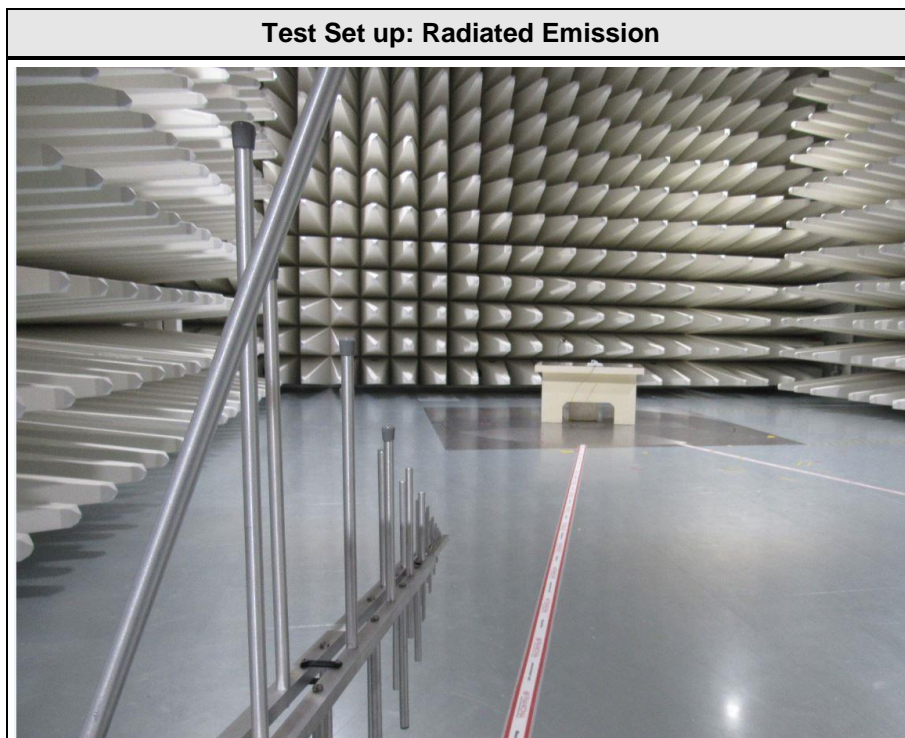
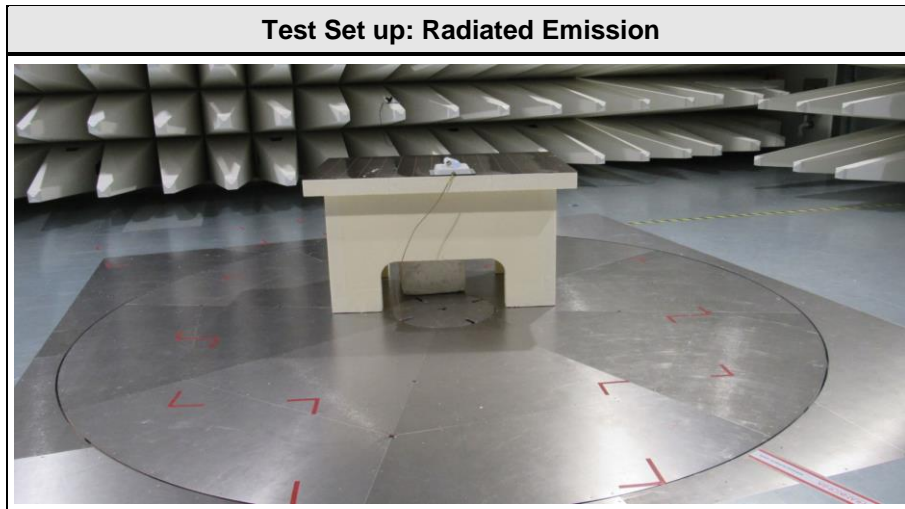
EUT\_Radio Module



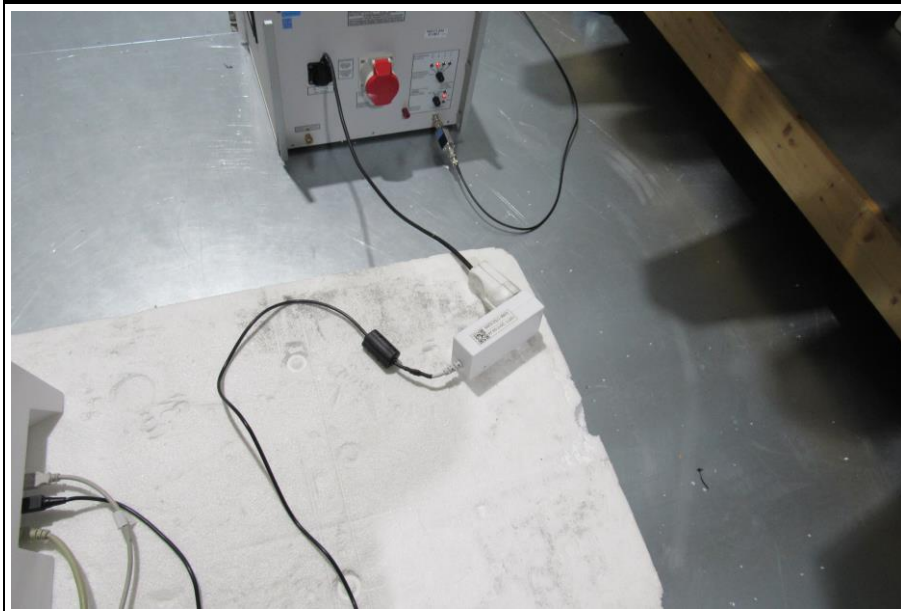
EUT\_Battery



1.3 Photos – Test setup



**Test Set up: Conducted Emission**



#### 1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments (e.g. serial no.)
AE	MainUnit	eResearch	SpiroSphere	00000053
AE	AC/DC Adapter	Globtek	GTM91099-3009-4.0-T2	RoHS 186826134/16
AE	Notebook	Lenovo	SL510	Inv. MEXX0173

**\*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)
-	-	-	-	-	-

**\*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	Bluetooth-Connection active; continuous measurement;
2	Charging

Configuration #	EUT Configuration
1	SensorUnit was paired with MainUnit via Bluetooth
2	SensorUnit was placed in MainUnit for charging

**1.7 Test Equipment Used During Testing**

<b>Measurement Software</b>			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2016.1.10

<b>Conducted emissions SR1</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182		
AMN	R&S	ESH3-Z5	EF00036		
EMI Test Receiver	R&S	ESR7	EF00943		
Cable	-	RG223/U	-	System Cal.	System Cal.

<b>Radiated emissions AC1</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Biconical Antenna	R&S	HK 116	EF00030		
LPD Antenna	R&S	HL 223	EF00187		
Horn antenna	Schwarzbeck	BBHA 9120D	EF00018		
MXE EMI Receiver	Keysight Technologies	N9038A-526/WXP	EF01070		
RF Cable			-	System Cal.	System Cal
RF Cable			-	System Cal.	System Cal

<b>Conducted emissions AC6</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
LISN	Schwarzbeck	NSLK 8128	EF00975		
EMI Test Receiver	Rohde & Schwarz Vertriebs GmbH	ESU26	EF00887		
Pulse Limiter	R&S	ESH3-Z2	EF01063		
Cable	-	RG223/U	-	System Cal.	System Cal.

<b>Radiated emissions AC6</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
TRILOG Broadband Antenna	Schwarzbeck	VULB 9162	EF00978		
Double-Ridged Guide Antenna	ETS-Lindgren	3117	EF00976		
EMI Test Receiver	R&S	ESU26	EF00887		
RF Cable	Huber & Suhner	Sucoflex 106	-	System Cal.	System Cal
RF Cable	Huber & Suhner	Multiflex 141	-	System Cal.	System Cal

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Test Report No.: G0M-1702-6295-EF0115B-SU-V01

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## 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 $\mu$ 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 $\mu$ V/m). The FCC limits are given in units of  $\mu$ V/m. The following formula is used to convert the units of  $\mu$ V/m to dB $\mu$ 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:

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

## 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	PASS	
<b>Remarks:</b>				



### 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		22 °C +/- 2 K		
Relative Humidity		30 to 60 %		34 % +/- 3 %		
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 15 GHz				
Operating mode		1 / 2				
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:

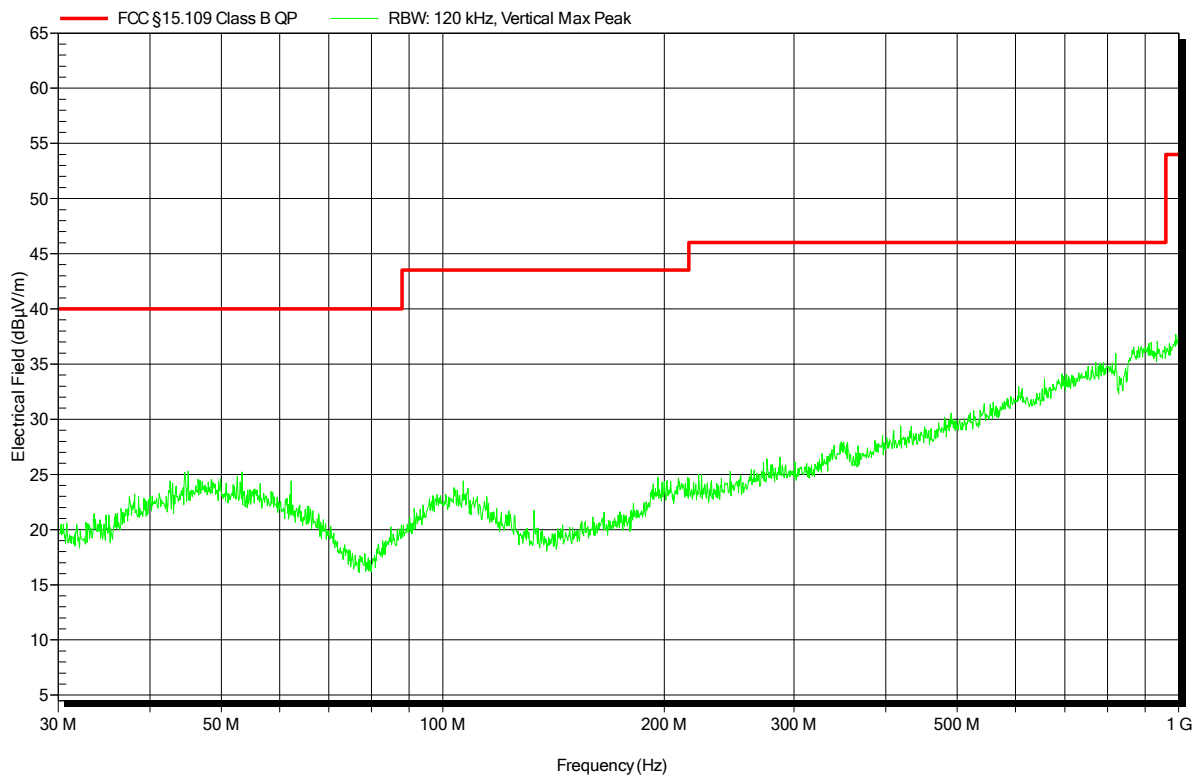
- The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver
- A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200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

**Radiated emissions according to FCC 15B**

Project number: G0M-1702-6295

Applicant:	eResearchTechnology GmbH
EUT Name:	Spirometer
Model:	SpiroSphere - Sensor Unit
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Belz
Test Conditions:	Tnom: 22°C, Unom: 120 VAC 60 Hz
Antenna:	Schwarzbeck VULB 9162, Vertical
Measurement distance:	3 m
Mode:	1
Test Date:	2017-04-18
Note:	

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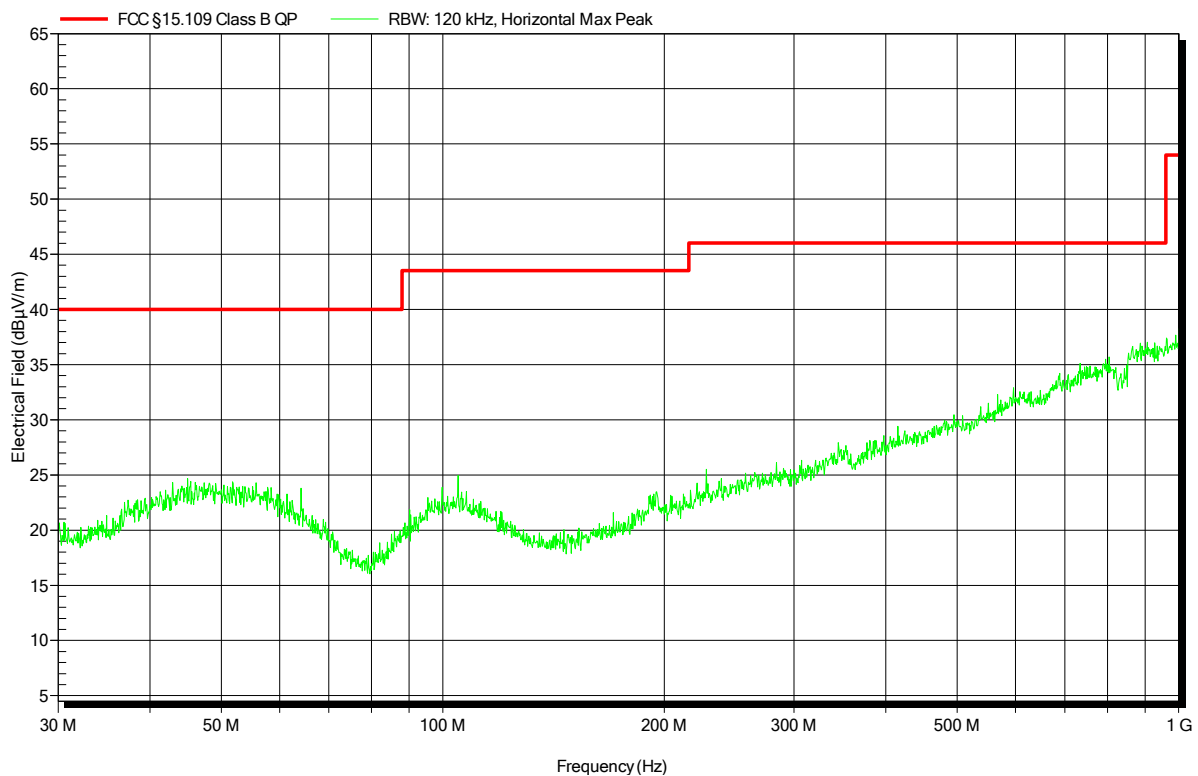


**Radiated emissions according to FCC 15B**

Project number: G0M-1702-6295

Applicant:	eResearchTechnology GmbH
EUT Name:	Spirometer
Model:	SpiroSphere - Sensor Unit
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Belz
Test Conditions:	Tnom: 22°C, Unom: 120 VAC 60 Hz
Antenna:	Schwarzbeck VULB 9162, Horizontal
Measurement distance:	3 m
Mode:	1
Test Date:	2017-04-18
Note:	

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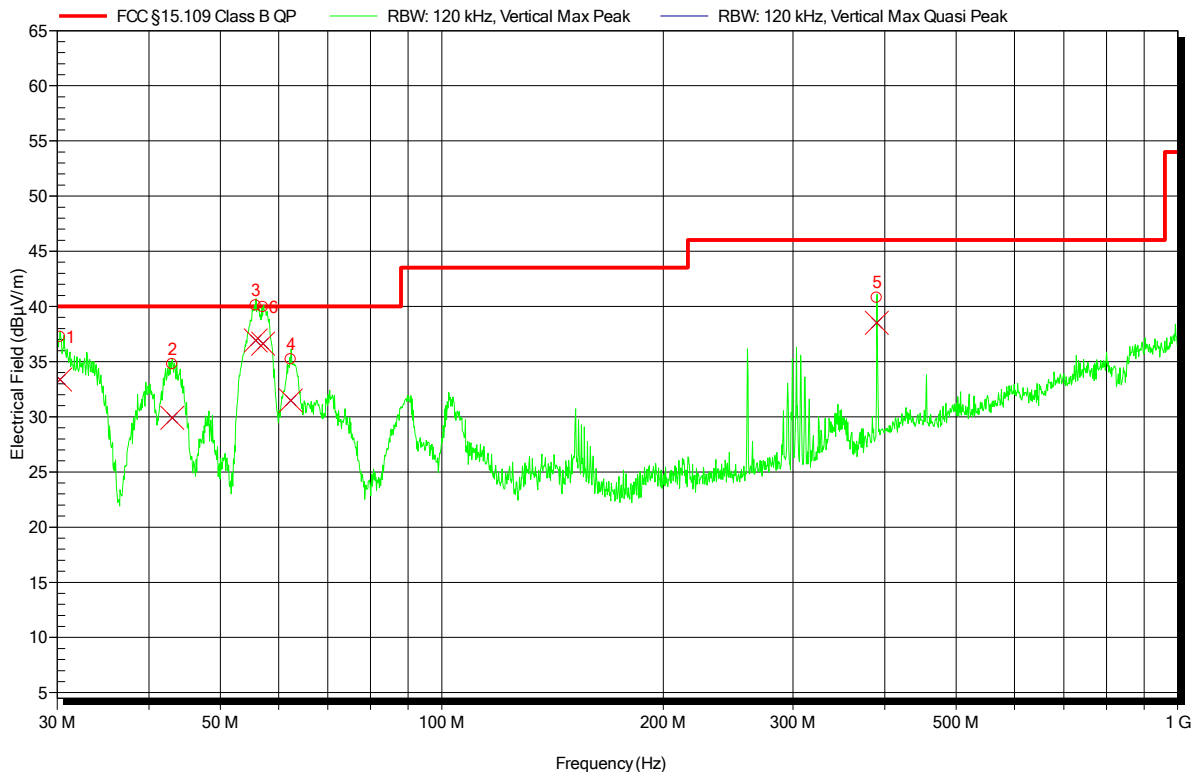


**Radiated emissions according to FCC 15B**

Project number: G0M-1702-6295

Applicant: eResearchTechnology GmbH  
 EUT Name: Spirometer  
 Model: SpiroSphere - Sensor Unit  
 Test Site: Eurofins Product Service GmbH  
 Operator: Mr. Belz  
 Test Conditions: Tnom: 22°C, Unom: 120 VAC 60 Hz  
 Antenna: Schwarzbeck VULB 9162, Vertical  
 Measurement distance: 3 m  
 Mode: 2  
 Test Date: 2017-04-18  
 Note:

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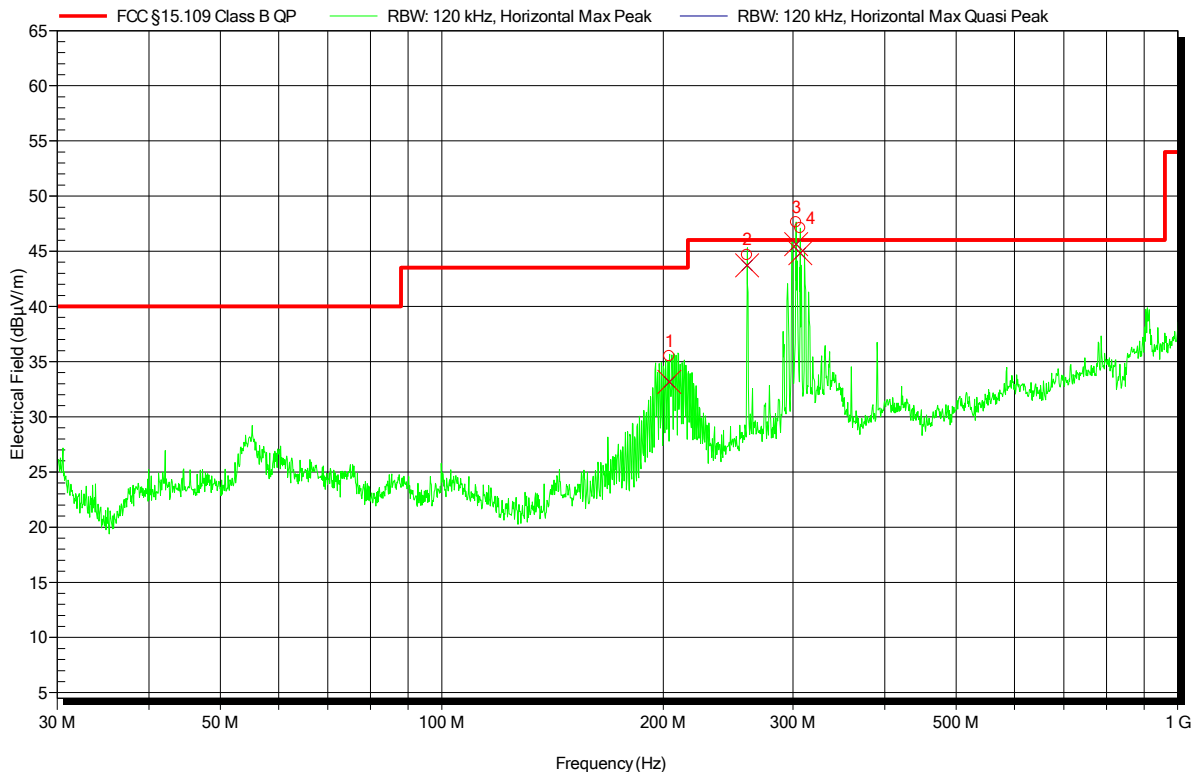
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	30.3 MHz	33.4 dBµV/m	40 dBµV/m	-6.6 dB	Pass	0 Degree	1 m
2	43.02 MHz	29.9 dBµV/m	40 dBµV/m	-10.1 dB	Pass	0 Degree	1 m
3	55.86 MHz	36.9 dBµV/m	40 dBµV/m	-3.1 dB	Pass	0 Degree	1 m
4	62.34 MHz	31.5 dBµV/m	40 dBµV/m	-8.5 dB	Pass	0 Degree	1 m
5	389.982 MHz	38.5 dBµV/m	46 dBµV/m	-7.5 dB	Pass	0 Degree	1 m
6	57.18 MHz	36.6 dBµV/m	40 dBµV/m	-3.4 dB	Pass	0 Degree	1 m

**Radiated emissions according to FCC 15B**

Project number: G0M-1702-6295

Applicant: eResearchTechnology GmbH  
 EUT Name: Spirometer  
 Model: SpiroSphere - Sensor Unit  
 Test Site: Eurofins Product Service GmbH  
 Operator: Mr. Belz  
 Test Conditions: Tnom: 22°C, Unom: 120 VAC 60 Hz  
 Antenna: Schwarzbeck VULB 9162, Horizontal  
 Measurement distance: 3 m  
 Mode: 1  
 Test Date: 2017-04-18  
 Note:

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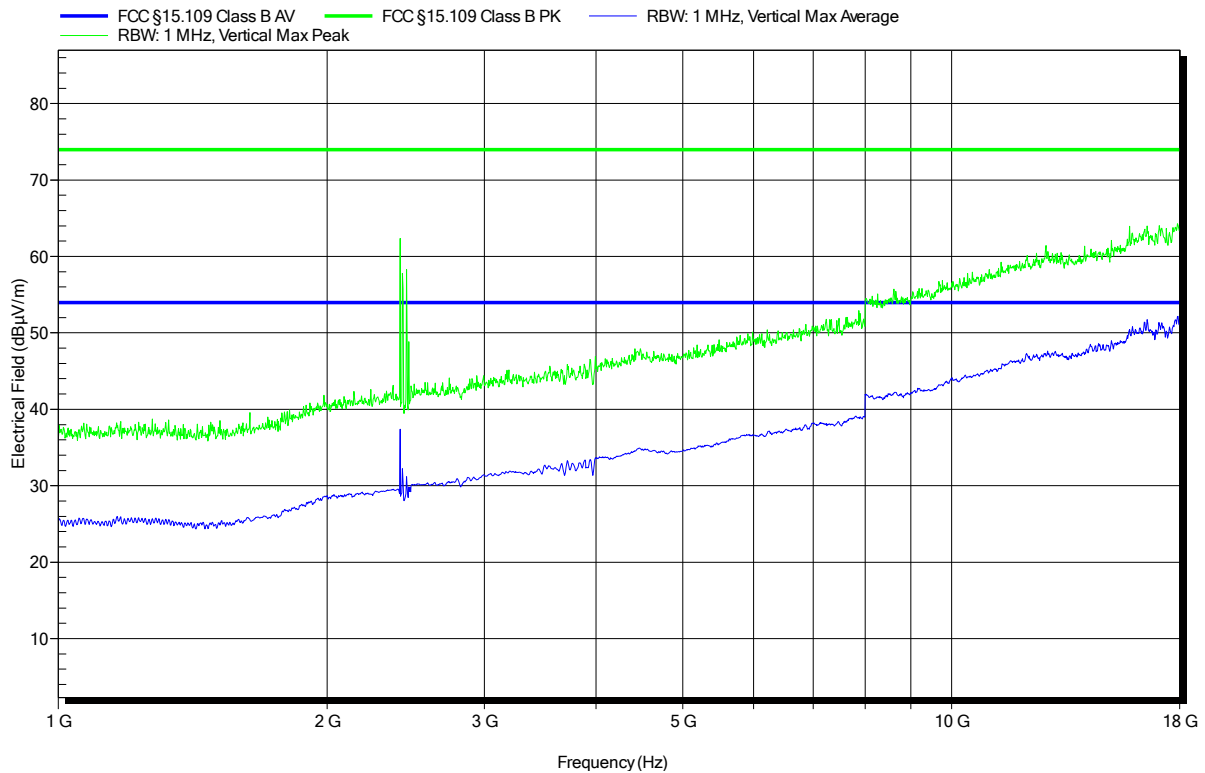
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	203.832 MHz	33.2 dBµV/m	43.5 dBµV/m	-10.3 dB	Pass	0 Degree	3.7 m
2	259.974 MHz	43.7 dBµV/m	46 dBµV/m	-2.3 dB	Pass	0 Degree	3.7 m
3	302.874 MHz	45.7 dBµV/m	46 dBµV/m	-0.4 dB	Pass	0 Degree	3.7 m
4	306.96 MHz	44.8 dBµV/m	46 dBµV/m	-1.2 dB	Pass	0 Degree	3.7 m

**Radiated emissions according to FCC 15B**

Project number: GOM-1702-6295

Applicant:	eResearchTechnology GmbH
EUT Name:	Spirometer
Model:	SpiroSphere - Sensor Unit
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Belz
Test Conditions:	Tnom: 22°C, Unom: 120 VAC 60 Hz
Antenna:	ETS-Lindgren 3117, Vertical
Measurement distance:	3 m
Mode:	1
Test Date:	2017-04-21
Note:	

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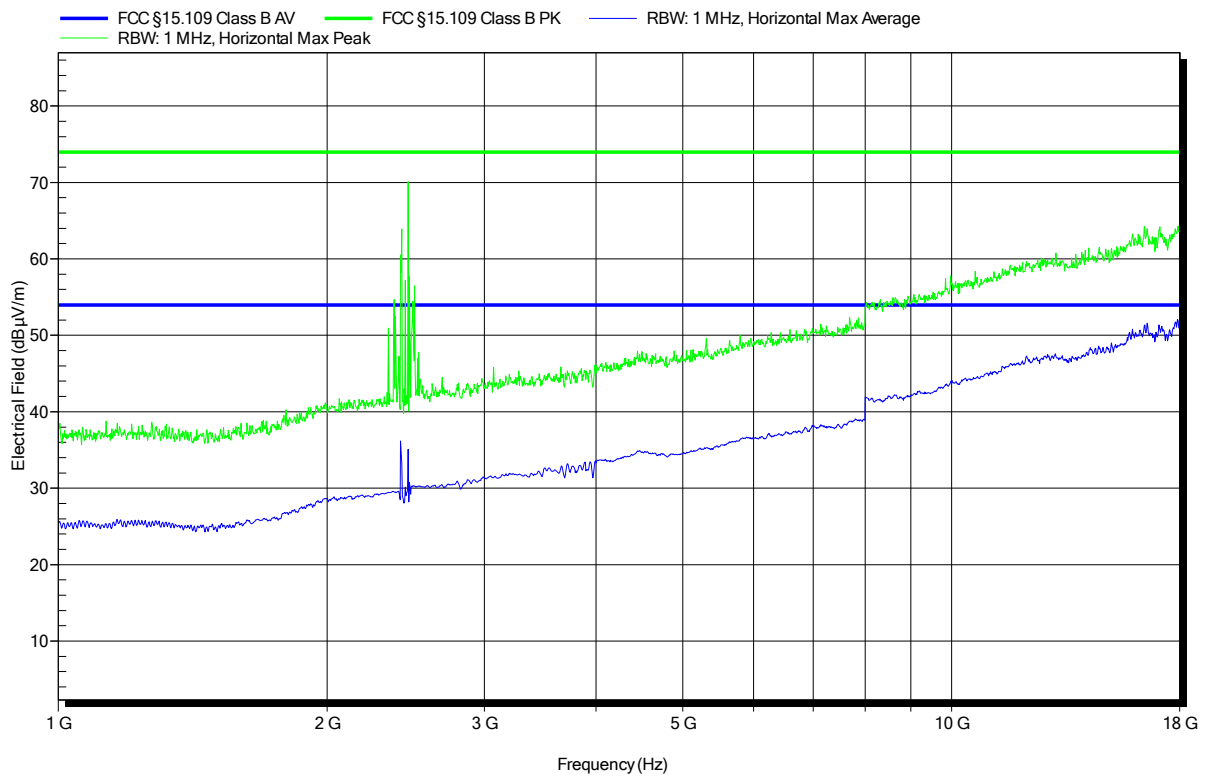


**Radiated emissions according to FCC 15B**

Project number: G0M-1702-6295

Applicant: eResearchTechnology GmbH  
 EUT Name: Spirometer  
 Model: SpiroSphere - Sensor Unit  
 Test Site: Eurofins Product Service GmbH  
 Operator: Mr. Belz  
 Test Conditions: Tnom: 22°C, Unom: 120 VAC 60 Hz  
 Antenna: ETS-Lindgren 3117, Horizontal  
 Measurement distance: 3 m  
 Mode: 1  
 Test Date: 2017-04-21  
 Note:

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**3.2 Test Conditions and Results – AC power line conducted emissions**

<b>Conducted emissions acc. FCC 47 CFR 15.107 / ICES-003</b>			<b>Verdict: PASS</b>	
Laboratory Parameters:	Required prior to the test		During the test	
Ambient Temperature	15 to 35 °C		22 °C +/- 2 K	
Relative Humidity	30 to 60 %		34 % +/- 3 %	
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	2			
Configuration	2			
<b>Limits and results Class B</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:**

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: 2014 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:

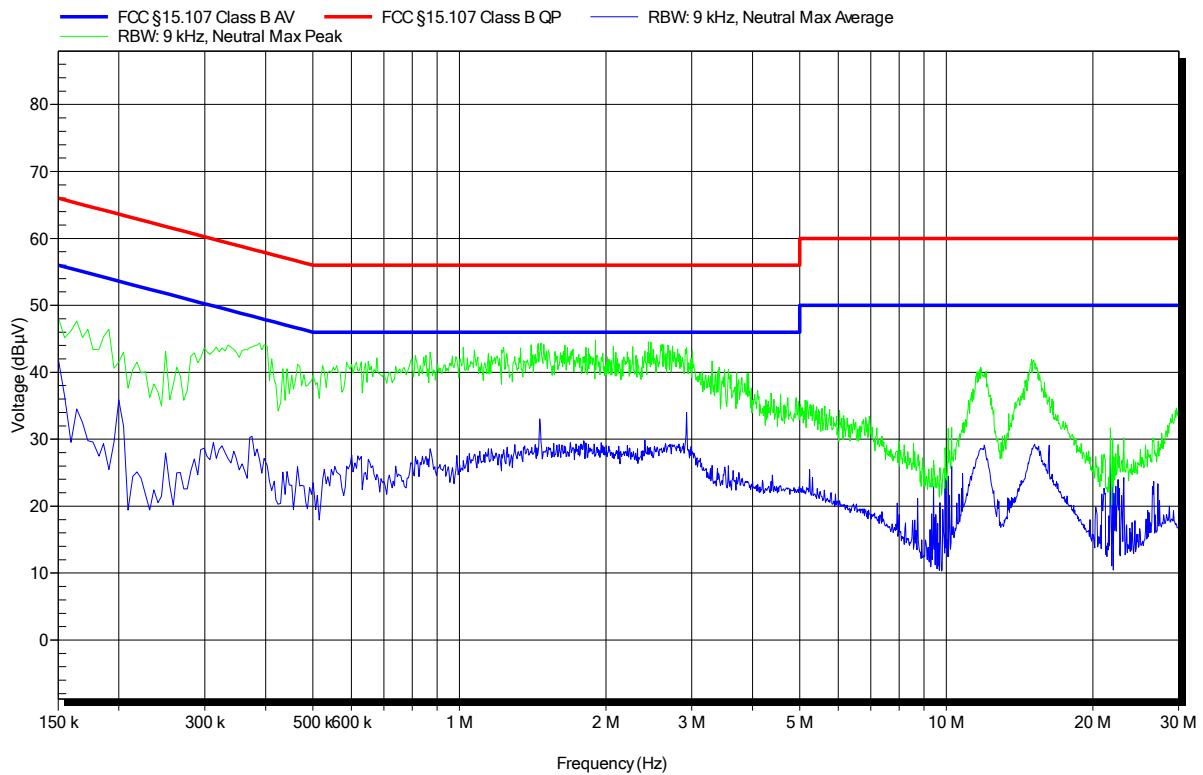
- The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
- The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- The distance between the outer 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.

**Conducted emissions according to FCC 15b**

Project number: GOM-1702-6295

Applicant:	eResearchTechnology GmbH
EUT Name:	Spirometer
Model:	SpiroSphere - Sensor Unit
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Belz
Test Conditions:	Tnom: 22°C, Unom: 120 VAC
LISN:	Schwarzbeck NSLK 8128 (N)
Mode:	2
Test Date:	2017-04-20
Note:	

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**Conducted emissions according to FCC 15b**

Project number: G0M-1702-6295

Applicant:	eResearchTechnology GmbH
EUT Name:	Spirometer
Model:	SpiroSphere - Sensor Unit
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Belz
Test Conditions:	Tnom: 22°C, Unom: 120 VAC
LISN:	Schwarzbeck NSLK 8128 (L)
Mode:	2
Test Date:	2017-04-20
Note:	

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