

EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada ICES-003

Electromagnetic compatibility - Unintentional radiators

Report Reference No. : G0M-1702-6295-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: eResearchTechnology GmbH

Address : Sieboldstrasse 3
97230 Estenfeld
GERMANY

Test specification:

Standard..... : 47 CFR Part 15 Subpart B
ICES-003, Issue 6:2016
ANSI C63.4:2014

Equipment under test (EUT):

Product description	Spirometer	
Model No.	SpiroSphere - Main Unit	
Additional Models	None	
Hardware version	04.04.03	
Firmware / Software version	Jet_Lib + Test_APP 0.14.0 ERT App: sd_SpiroSpherePackage-v1.1.19tgz	
	FCC-ID: 2AAUFSPS001	IC: 11335A-SPS001

Test result **Passed**

Test Report No.: G0M-1702-6295-EF0215B-V01

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	2017-04-19
Date (s) of performance of tests	2017-04-19 - 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	2017-05-12
Total number of pages	42
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	2017-05-12	Initial Release	

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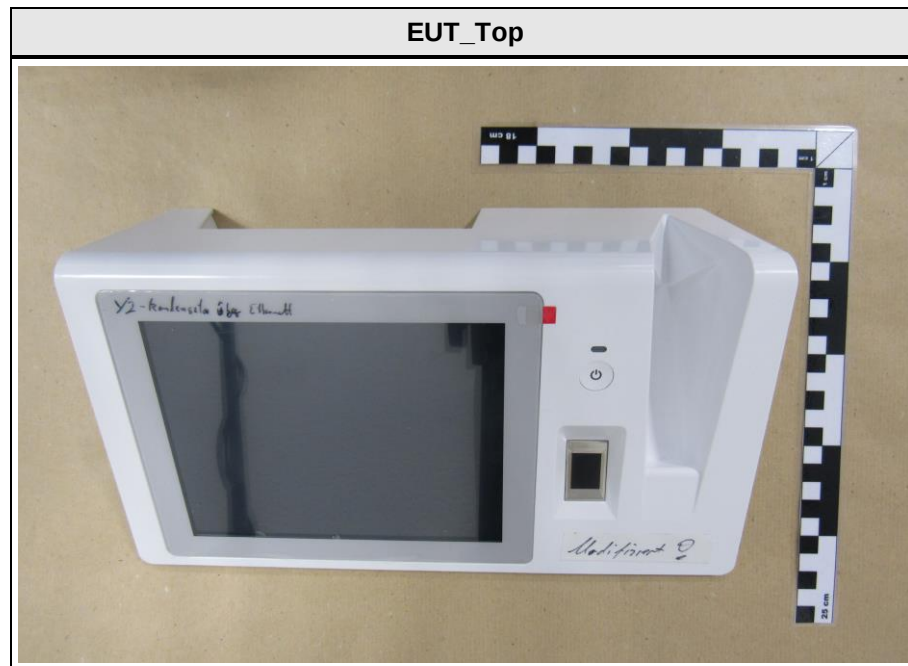
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1 Equipment (Test item) Description

Description	Spirometer	
Model	SpiroSphere	
Additional Models	None	
Serial number	00000053	
Hardware version	04.04.03	
Software / Firmware version	Jet_Lib + Test_APP 0.14.0 ERT App: sd_SpiroSpherePackage-v1.1.19tgz	
FCC-ID	2AAUFSPS001	
IC	11335A-SPS001	
Power supply	5 VDC via AC/DC Adapter	
AC/DC-Adaptor	Model : GTM91099-3009-4.0-T2 2MOPP Manufacturer : GlobTeck®, Inc. Input : 100-240VAC / 50-60Hz Output : 5 VDC / 6A	
Radio module	Type	MoCo
	Model	HL8548
	Manufacturer	Sierra Wireless
	HW Version	Not specified
	SW Version	5.5.14.0 or higher
	SN	HD646601781710
	FCC-ID	N7NHL8548
	IC	2417C-HL8548
	IMEI	359515058390430
Radio module	Type	Wifi/BT
	Model	WL18 MODGB
	Manufacturer	Texas Instruments
	HW Version	n/a
	SW Version	n/a
	SN	n/a
	FCC-ID	Z64-WL18SBMOD
	IC	451I-WL18SBMOD
	IMEI	n/a

Manufacturer	eResearchTechnology GmbH Sieboldstrasse 3 97230 Estenfeld GERMANY
Highest emission frequency	Fmax [MHz] = 2400
Device classification	Class B
Equipment type	Tabletop
Number of tested samples	1

1.1 Photos – Equipment external



EUT_Ports



EUT_Port-Side



EUT_Label



EUT_AC/DC Adapter



EUT_AC/DC Adapter Plugin Interface



EUT_AC/DC Adapter Label

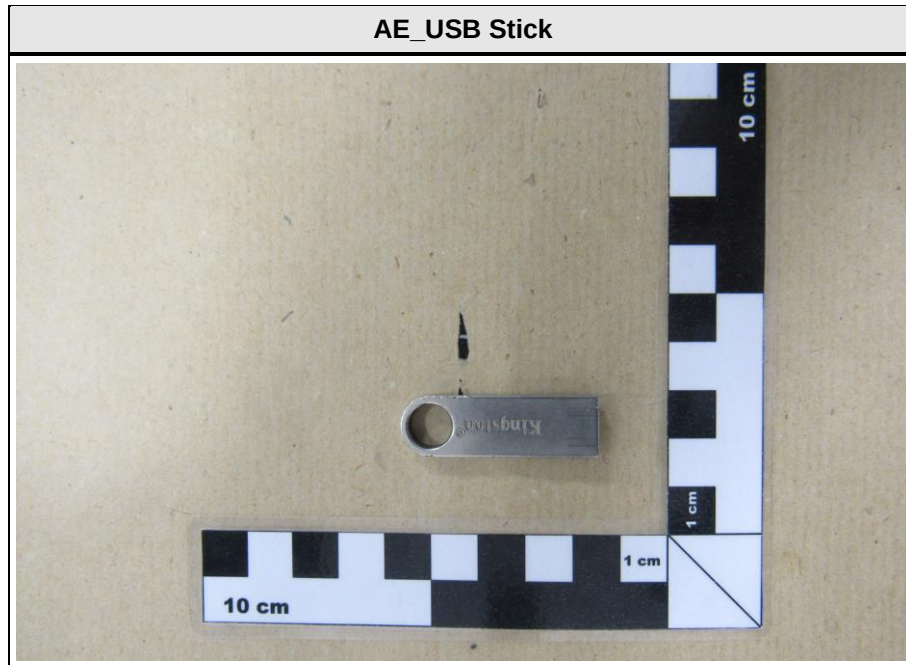


AE_WLAN Router

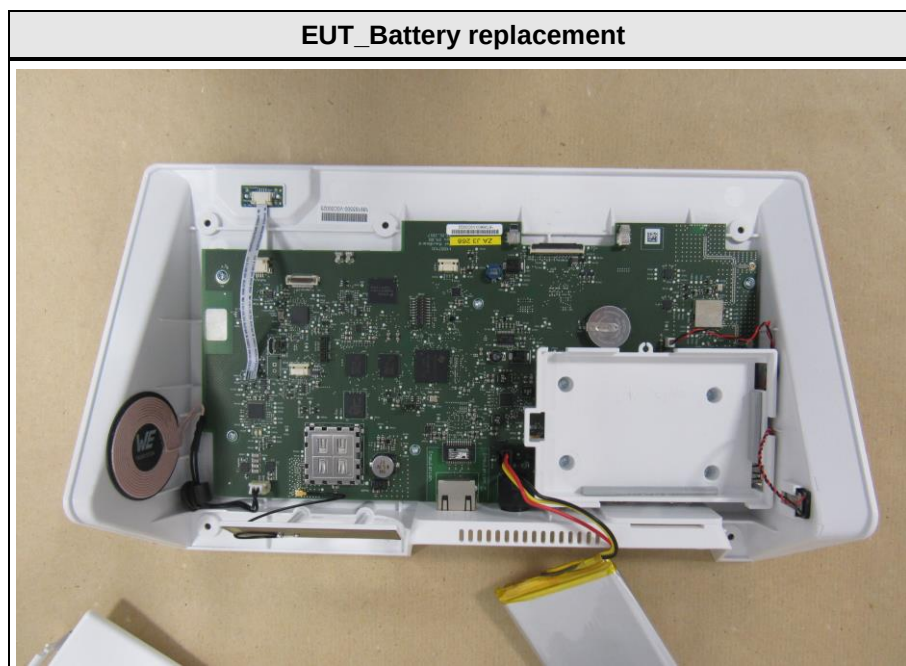
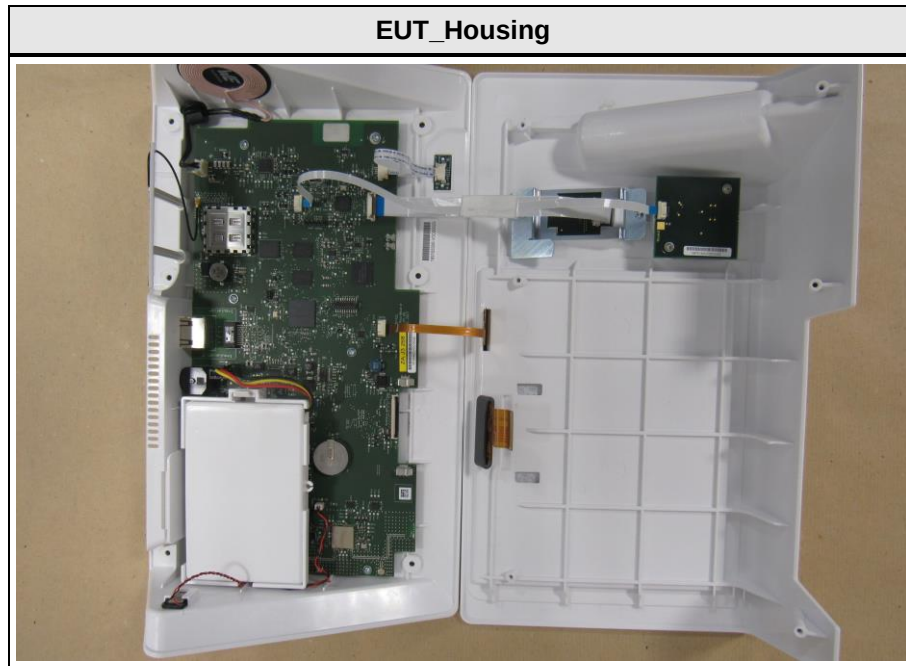


AE_WLAN Router Label

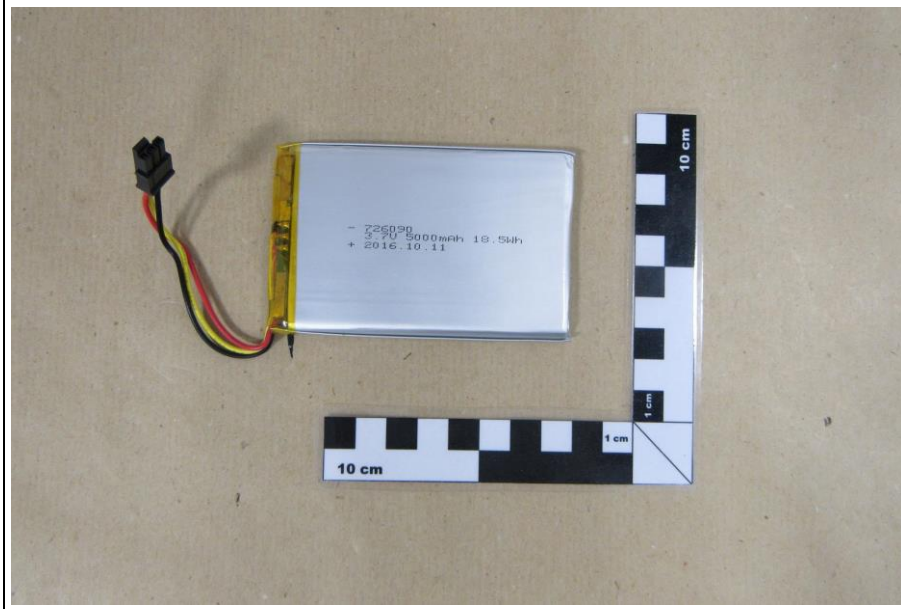




1.2 Photos – Equipment internal



EUT_Battery Main Unit



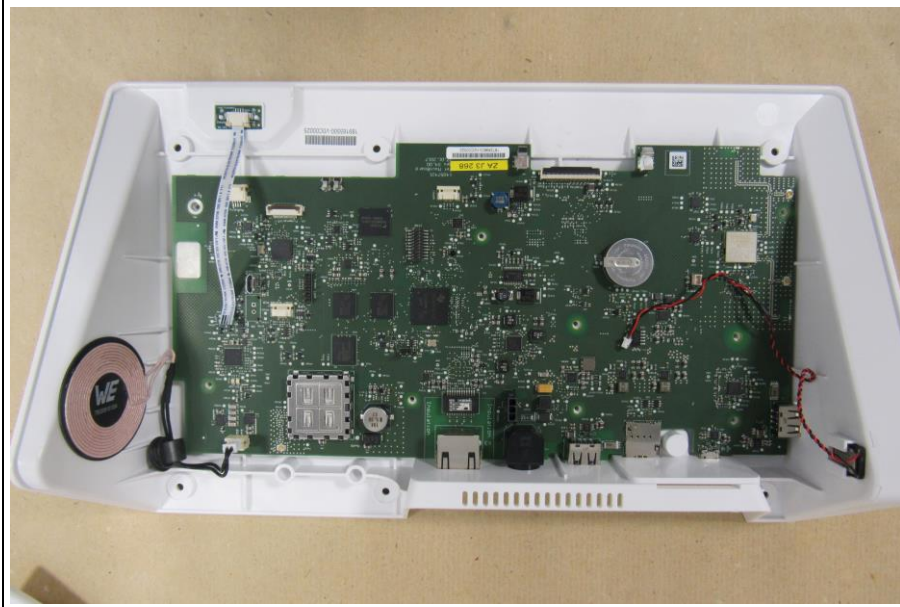
EUT_Cellular Antenna



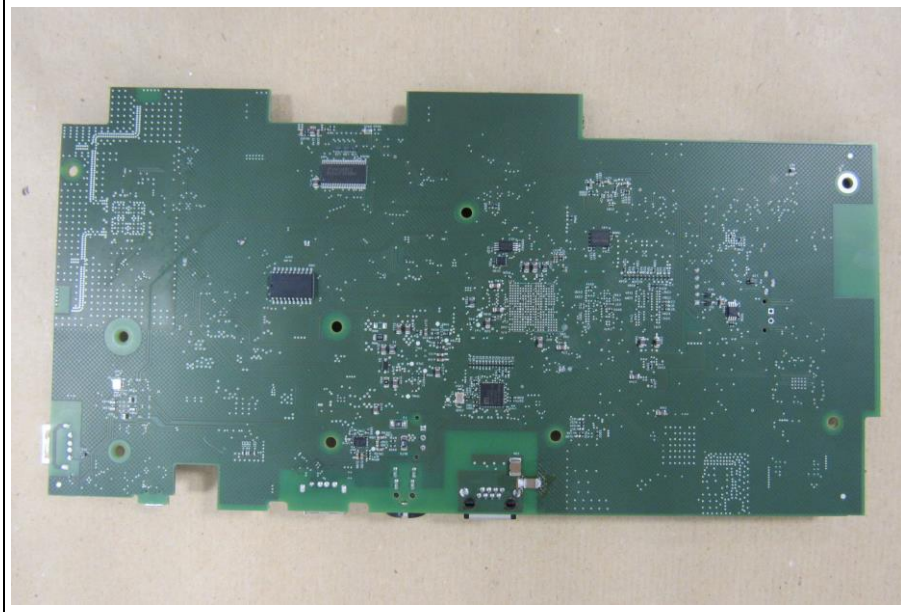
EUT_Qi Wireless Charger



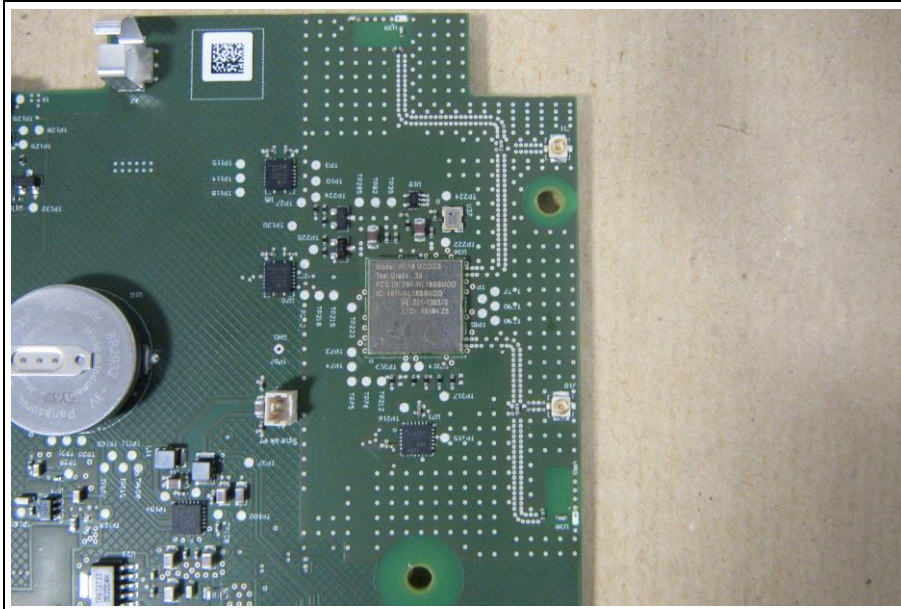
EUT_PCB Top

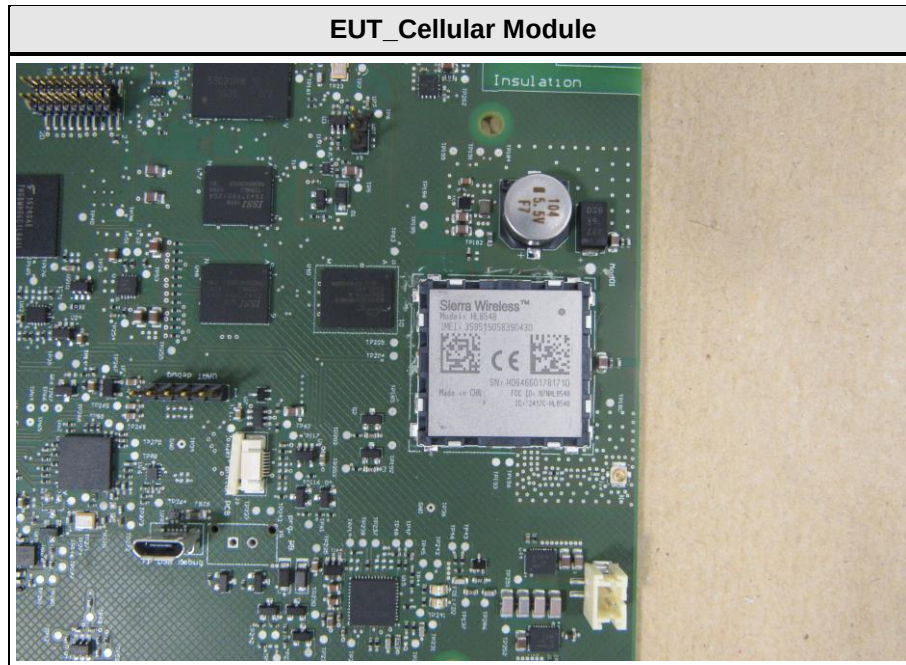


EUT_PCB Bottom

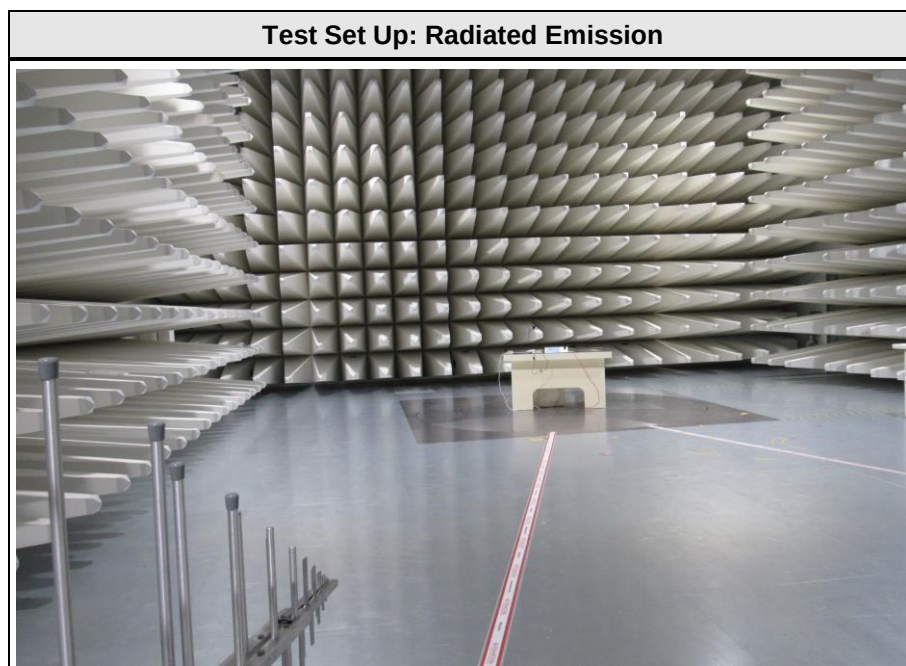
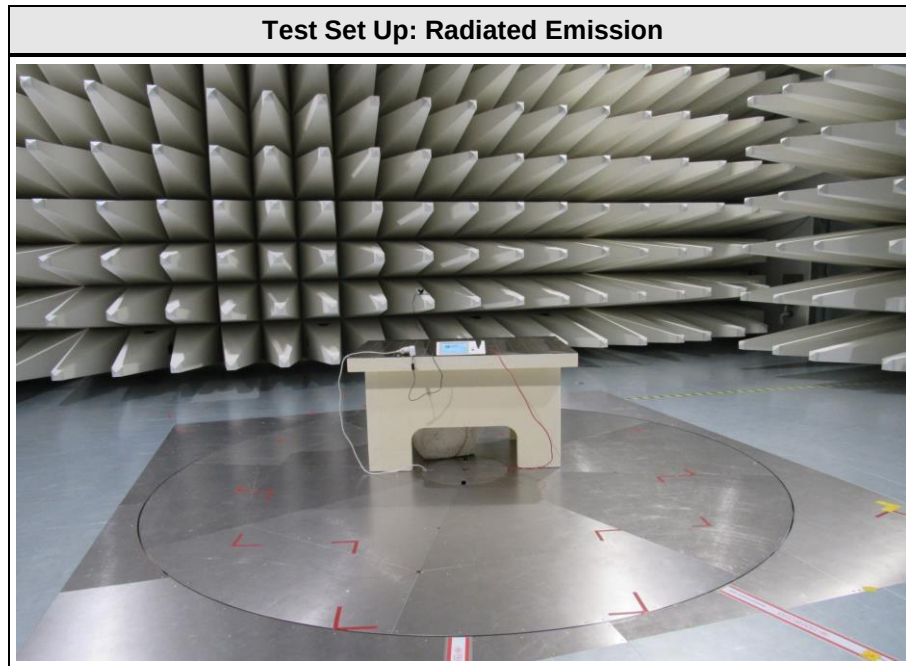


EUT_BT/Wifi Module

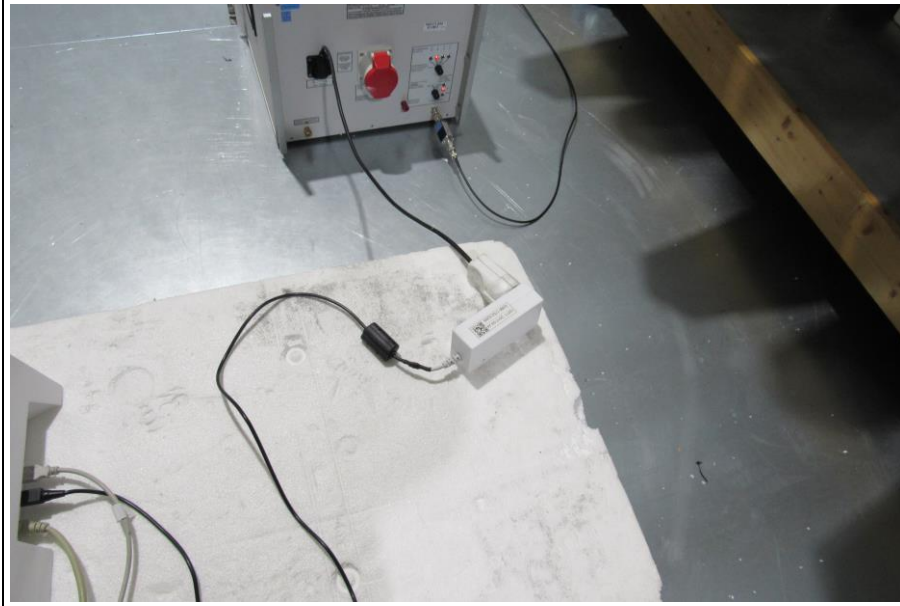




1.3 Photos – Test setup



Test Set Up: Conducted Emission



1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments (e.g. serial no.)
AE	GSM-Tester	Rohde & Schwarz	CMU200	EF00304
AE	Sensor Unit	eResearch	SpiroSphere	00000022
AE	Antenna	Huber + Suhner AG	13.09.17.0008	
AE	Notebook	Lenovo	SL510	Inv: Mexx0173
AE	WLAN Router	TP-Link	TL-WR802W	FCC: TE7WR802NV2

***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	Power	AC	> 3m	No	
2	USB	I/O	< 3 m	Yes	#of ports 2
3	Sim Card Interface	I/O	n/a	n/a	Service only
4	USB	I/O	< 3 m	Yes	Service only
5	Ethernet	TP	> 3 m	Yes	CAT 5e

***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	WLAN, BT, GSM 850 (BCCH 162, MSG 3) active; cont. ping; MainUnit charging;
2	WLAN, BT, GSM 850 (BCCH 162, MSG 3) active; cont. ping; MainUnit charging + SensorUnit charging;

Configuration #	EUT Configuration
1	MainUnit was controlled via PUTTY; TestApp, JetApp was running on MainUnit; Sensor Unit was connected via Bluetooth; continuous measurement active; measured values were observed via WLAN connection to Notebook; cont. ping on Ethernet; GSM-Link to GSM-Tester.

1.7 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2016.1.10

Conducted emissions SR1					
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.

Radiated emissions AC1					
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.

Conducted emissions AC6					
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.

Radiated emissions AC6					
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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Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

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:

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

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		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				
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:

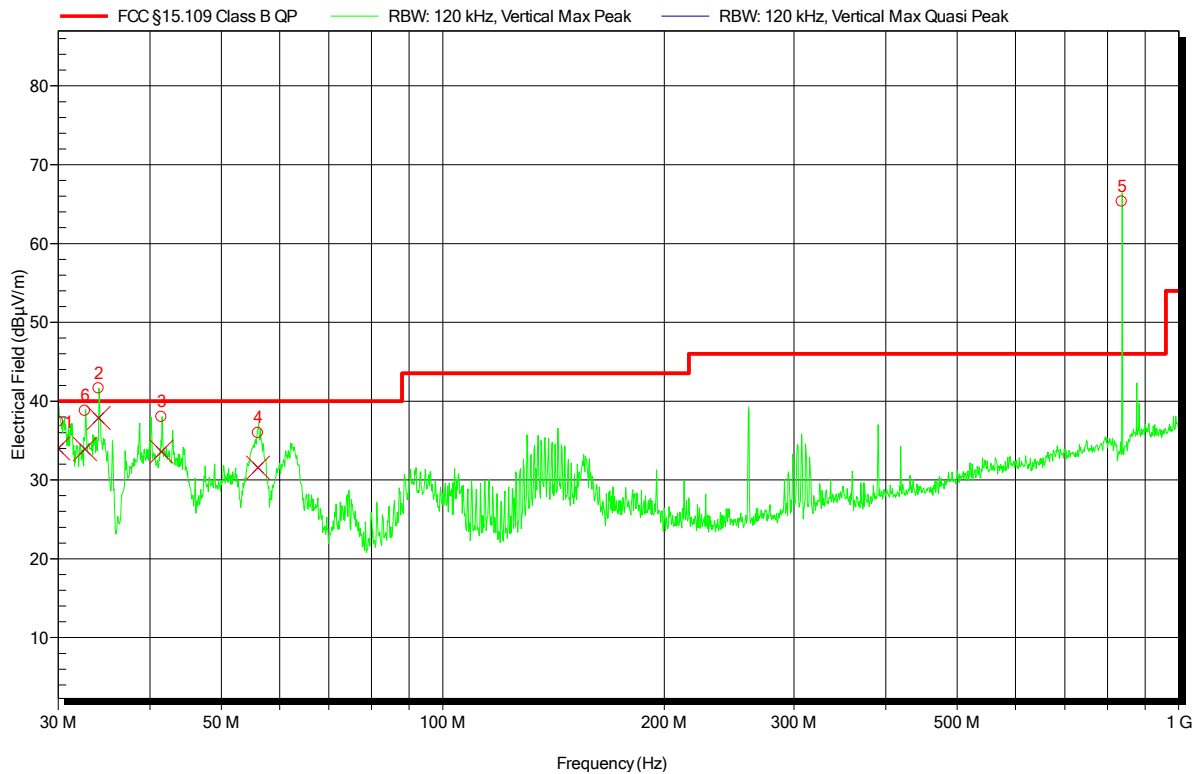
- The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver
- A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 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 - Main 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: 10 m
Mode: 1
Test Date: 2017-04-19
Note:

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Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	30 MHz	34 dBμV/m	40 dBμV/m	-6.0 dB	Pass	60 Degree	1 m
2	34.08 MHz	37.9 dBμV/m	40 dBμV/m	-2.1 dB	Pass	60 Degree	1 m
3	41.466 MHz	33.6 dBμV/m	40 dBμV/m	-6.4 dB	Pass	60 Degree	1 m
4	56.1 MHz	31.6 dBμV/m	40 dBμV/m	-8.4 dB	Pass	60 Degree	1 m
5	837 MHz	GSM Link					
6	32.652 MHz	33.9 dBμV/m	40 dBμV/m	-6.1 dB	Pass	60 Degree	1 m

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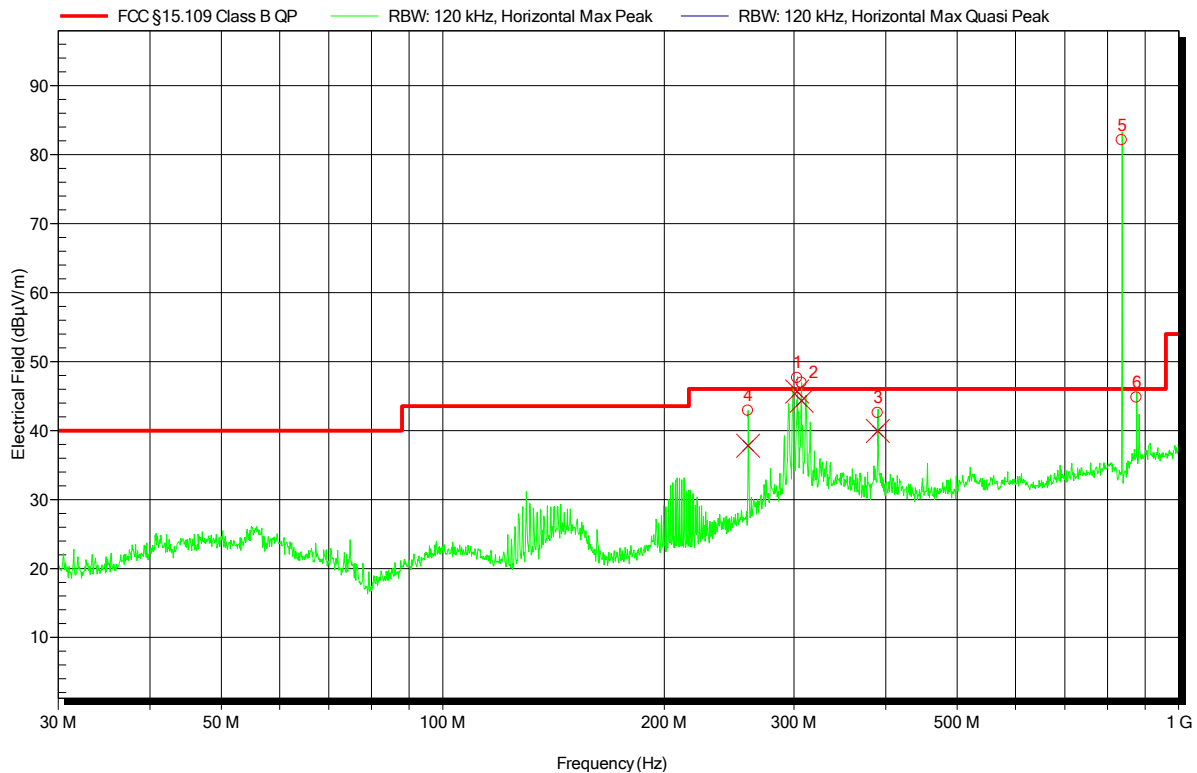
Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

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 Operator: Mr. Belz
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 Antenna: Schwarzbeck VULB 9162, Horizontal
 Measurement distance: 10 m
 Mode: 1
 Test Date: 2017-04-19
 Note:

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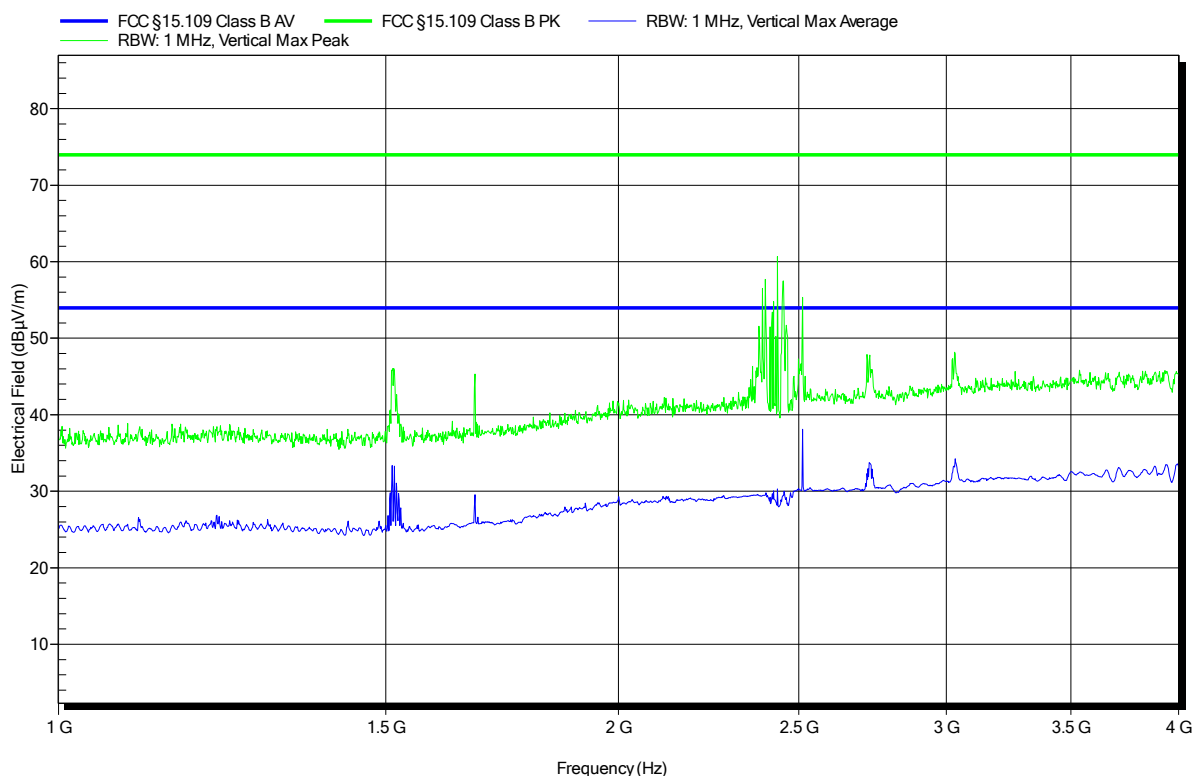
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	303.114 MHz	45.7 dBμV/m	46 dBμV/m	-0.4 dB	Pass	0 Degree	2.6 m
2	307.236 MHz	44.3 dBμV/m	46 dBμV/m	-1.7 dB	Pass	0 Degree	2.6 m
3	390.054 MHz	40 dBμV/m	46 dBμV/m	-6.1 dB	Pass	0 Degree	2.6 m
4	259.98 MHz	37.8 dBμV/m	46 dBμV/m	-8.2 dB	Pass	50 Degree	2.6 m
5	837 MHz	GSM Uplink					
6	876 MHz	GSM Downlink					

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 Model: SpiroSphere - Main 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: 2017-04-19
 Note:

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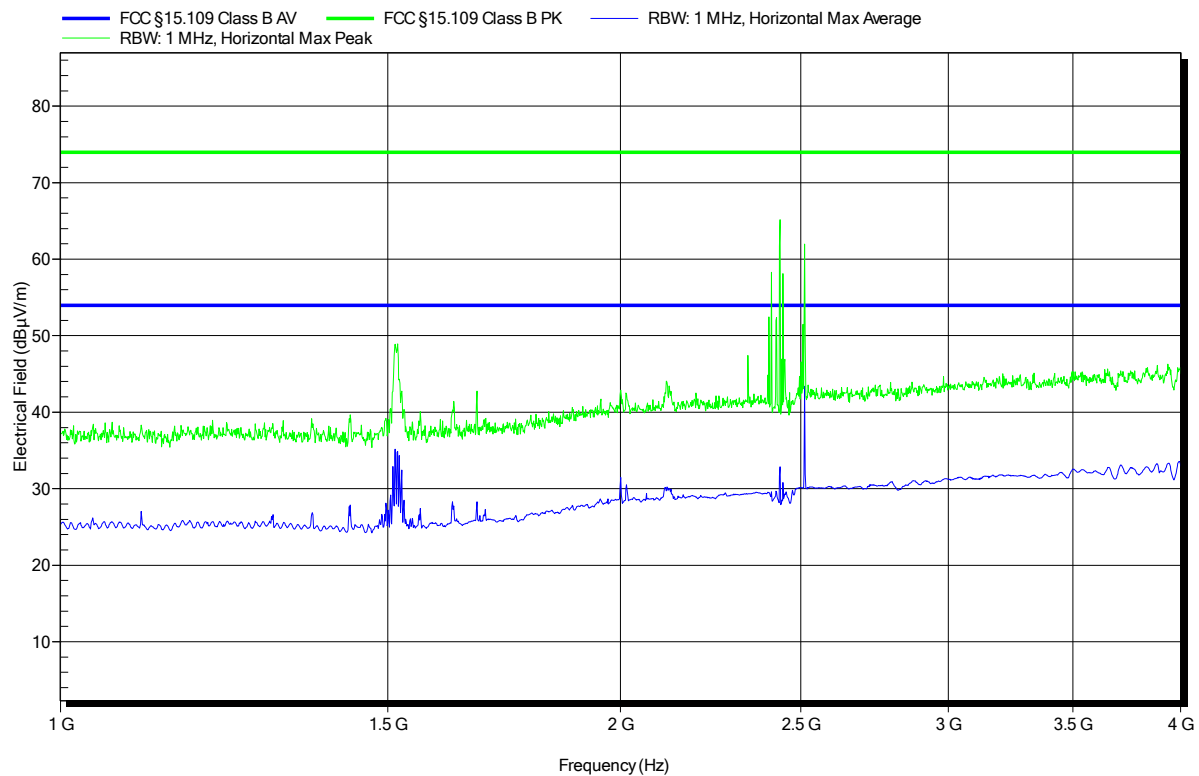


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 Measurement distance: 3 m
 Mode: 1
 Test Date: 2017-04-19
 Note:

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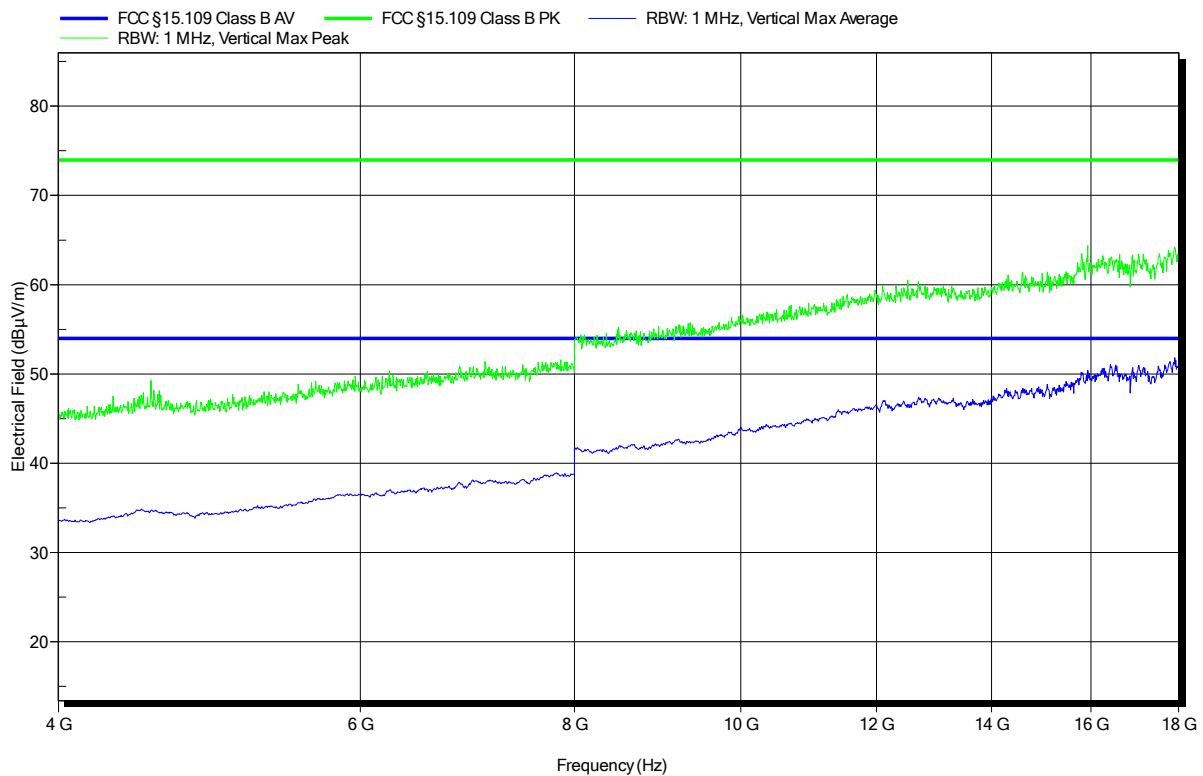


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 Mode: 1
 Test Date: 2017-04-19
 Note:

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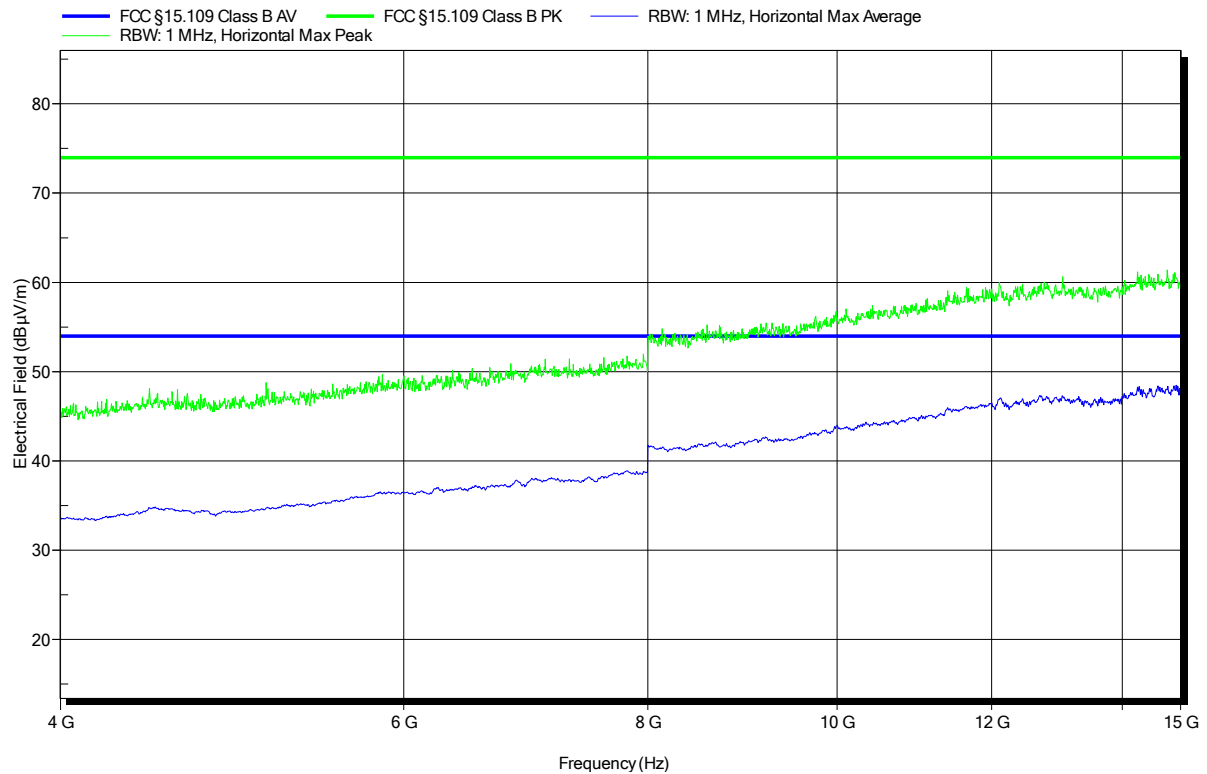


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 Measurement distance: 3 m
 Mode: 1
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 Note:

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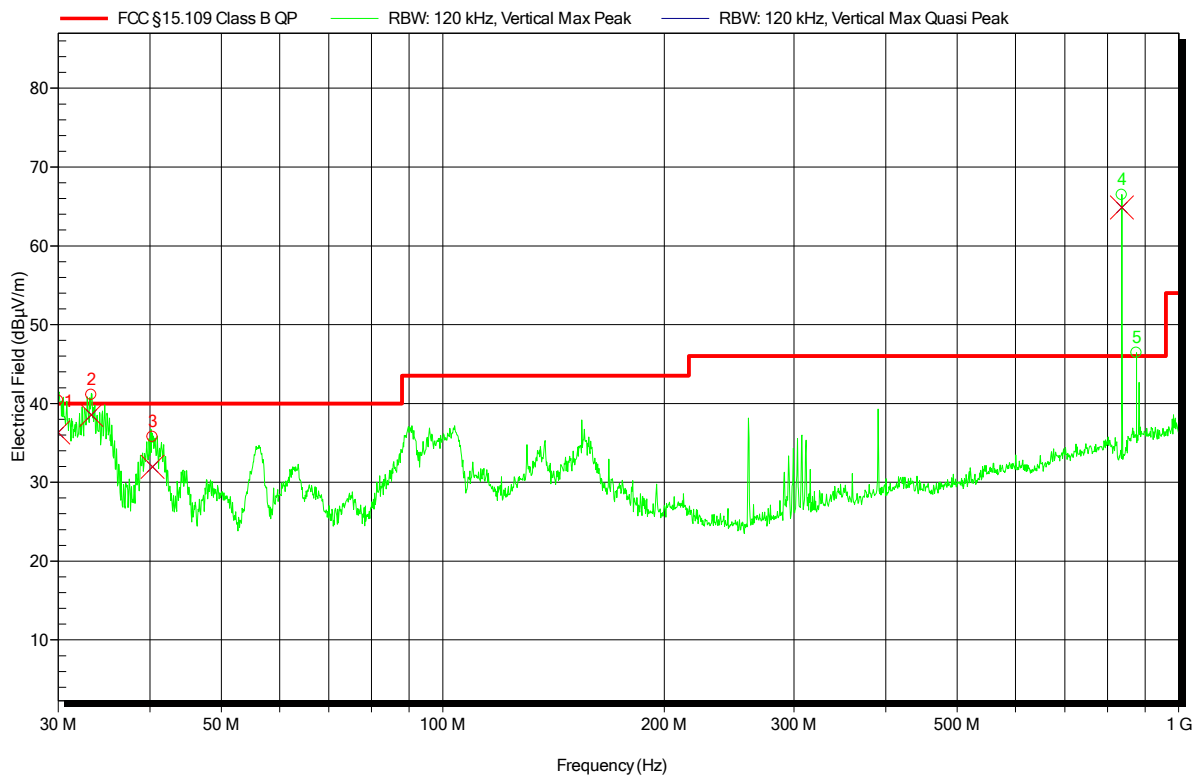


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Test Conditions: Tnom: 22°C, Unom: 120 VAC 60 Hz
Antenna: Schwarzbeck VULB 9162, Vertical
Measurement distance: 10 m
Mode: 2
Test Date: 2017-04-19
Note:

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Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	30 MHz	36.3 dBμV/m	40 dBμV/m	-3.7 dB	Pass	60 Degree	1 m
2	33.282 MHz	38.6 dBμV/m	40 dBμV/m	-1.4 dB	Pass	60 Degree	1 m
3	40.32 MHz	32 dBμV/m	40 dBμV/m	-8.0 dB	Pass	60 Degree	1 m
4	837.066 MHz	GSM Uplink					
5	875.94 MHz	GSM Downlink					

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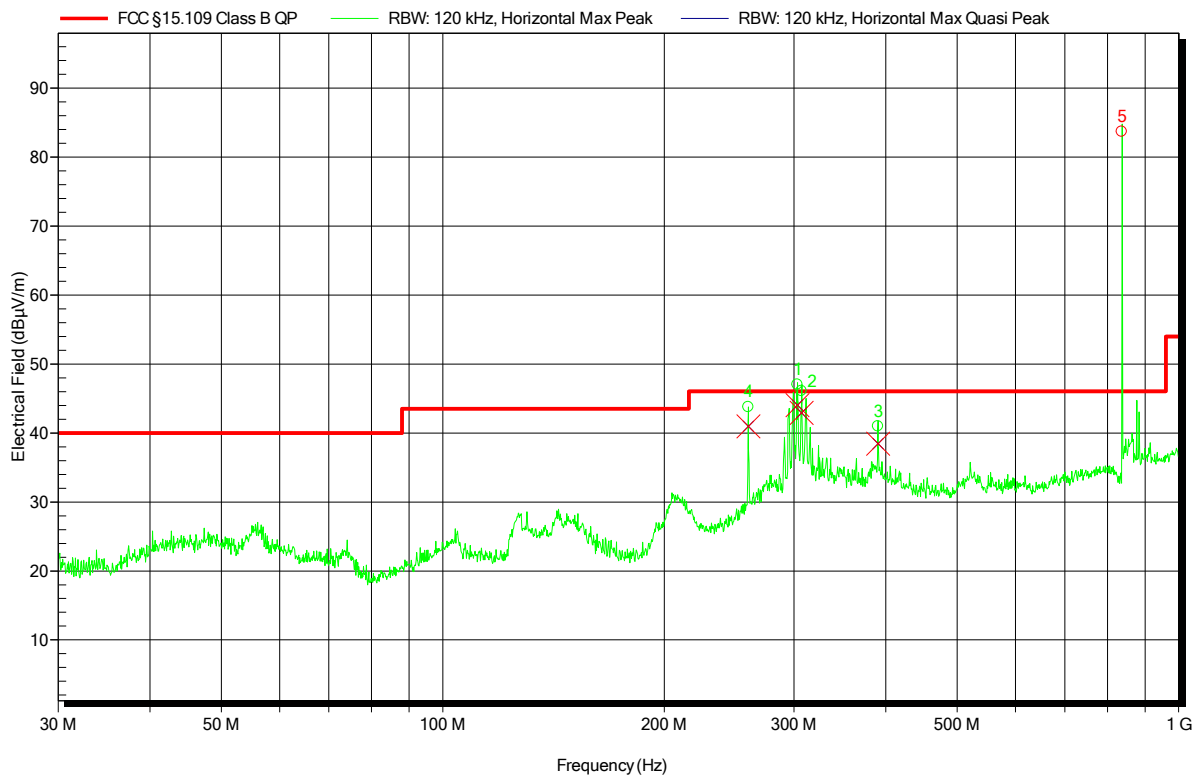
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 Measurement distance: 10 m
 Mode: 2
 Test Date: 2017-04-19
 Note:

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Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	303.312 MHz	44.1 dBµV/m	46 dBµV/m	-2.0 dB	Pass	30 Degree	2.6 m
2	307.38 MHz	42.9 dBµV/m	46 dBµV/m	-3.1 dB	Pass	30 Degree	2.6 m
3	390.174 MHz	38.4 dBµV/m	46 dBµV/m	-7.6 dB	Pass	30 Degree	2.6 m
4	260.04 MHz	41 dBµV/m	46 dBµV/m	-5.1 dB	Pass	50 Degree	2.6 m
5	837 MHz	GSM Uplink					

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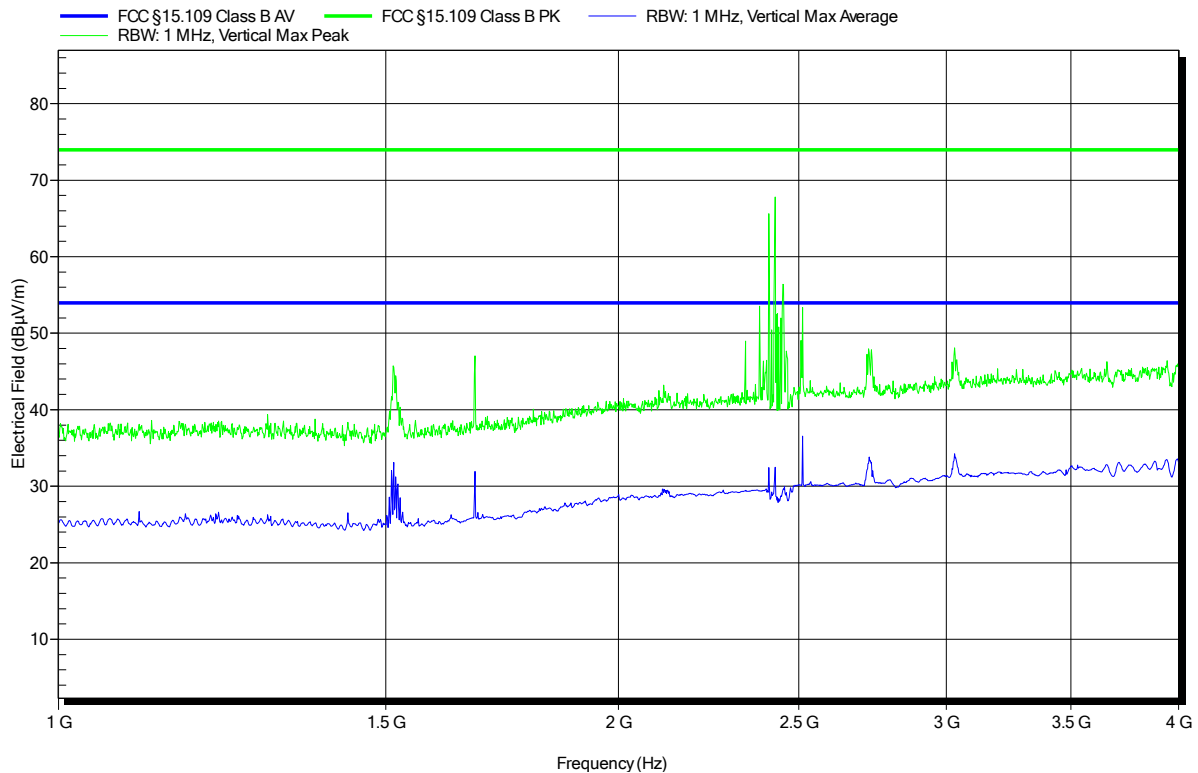
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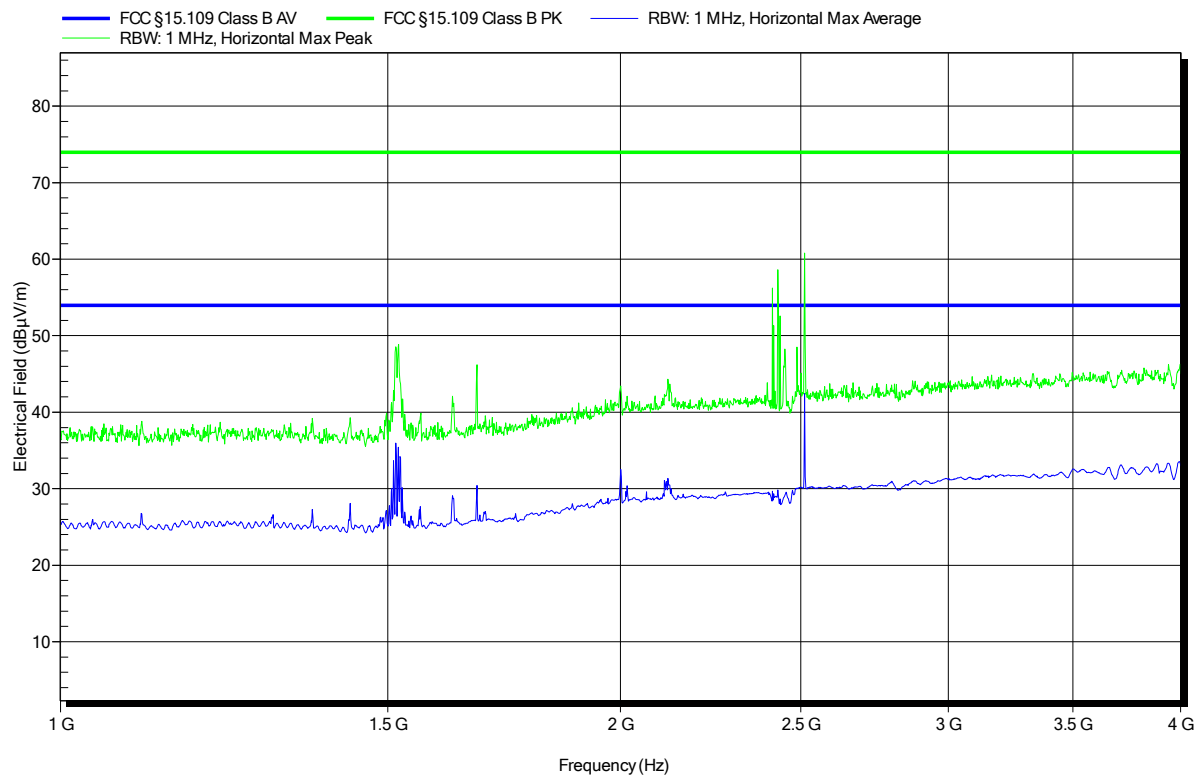


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 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Belz
 Test Conditions: Tnom: 22°C, Unom: 120 VAC 60 Hz
 Antenna: ETS-Lindgren 3117, Horizontal
 Measurement distance: 3 m
 Mode: 2
 Test Date: 2017-04-19
 Note:

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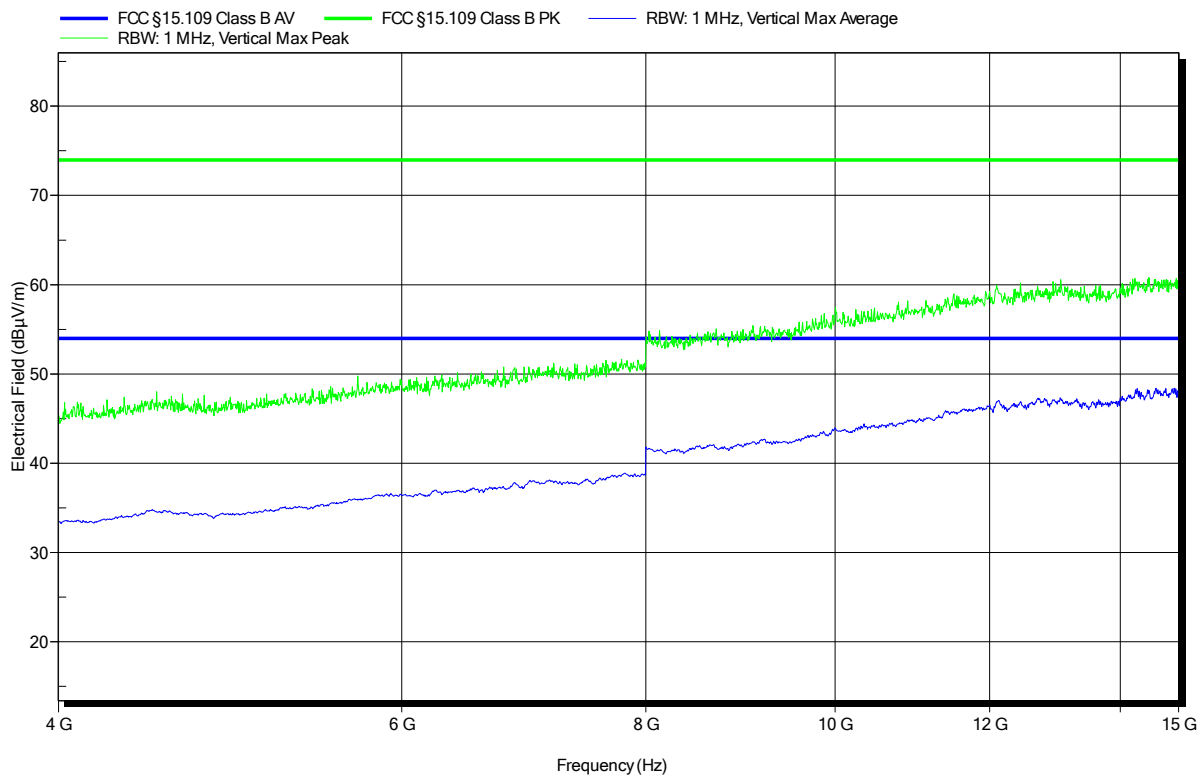


Radiated emissions according to FCC 15B

Project number: G0M-1702-6295

Applicant: eResearchTechnology GmbH
 EUT Name: Spirometer
 Model: SpiroSphere - Main 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: 2
 Test Date: 2017-04-19
 Note:

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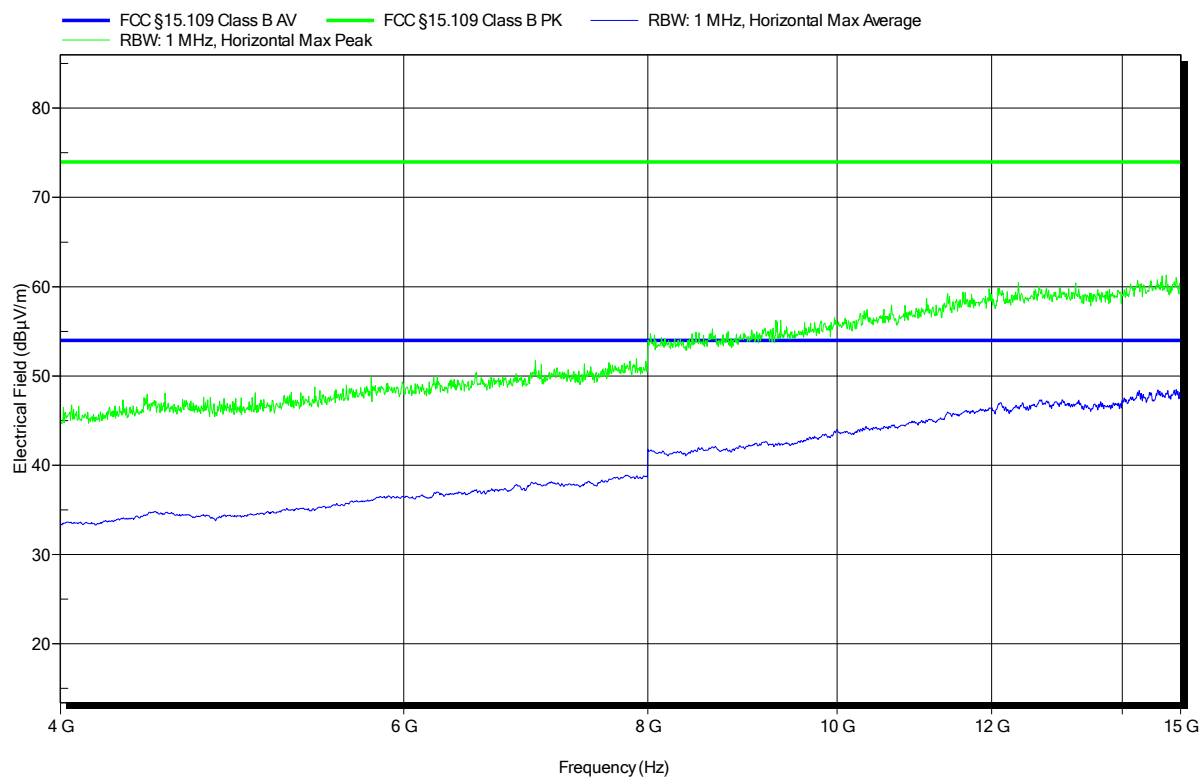


Radiated emissions according to FCC 15B

Project number: G0M-1702-6295

Applicant: eResearchTechnology GmbH
 EUT Name: Spirometer
 Model: SpiroSphere - Main 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: 2
 Test Date: 2017-04-19
 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		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		1		
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:

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:**

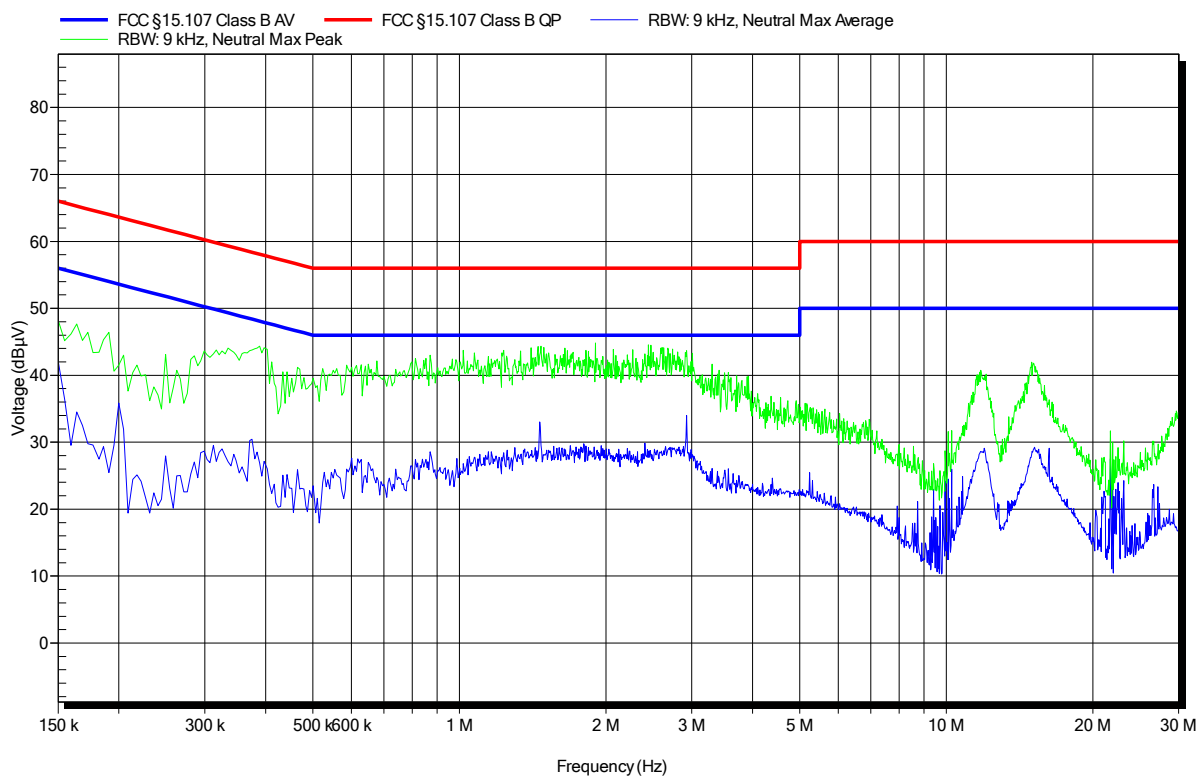
- The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
- The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- The distance between the outer 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: G0M-1702-6295

Applicant: eResearchTechnology GmbH
 EUT Name: Spirometer
 Model: SpiroSphere - Main 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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Test Report No.: G0M-1702-6295-EF0215B-V01

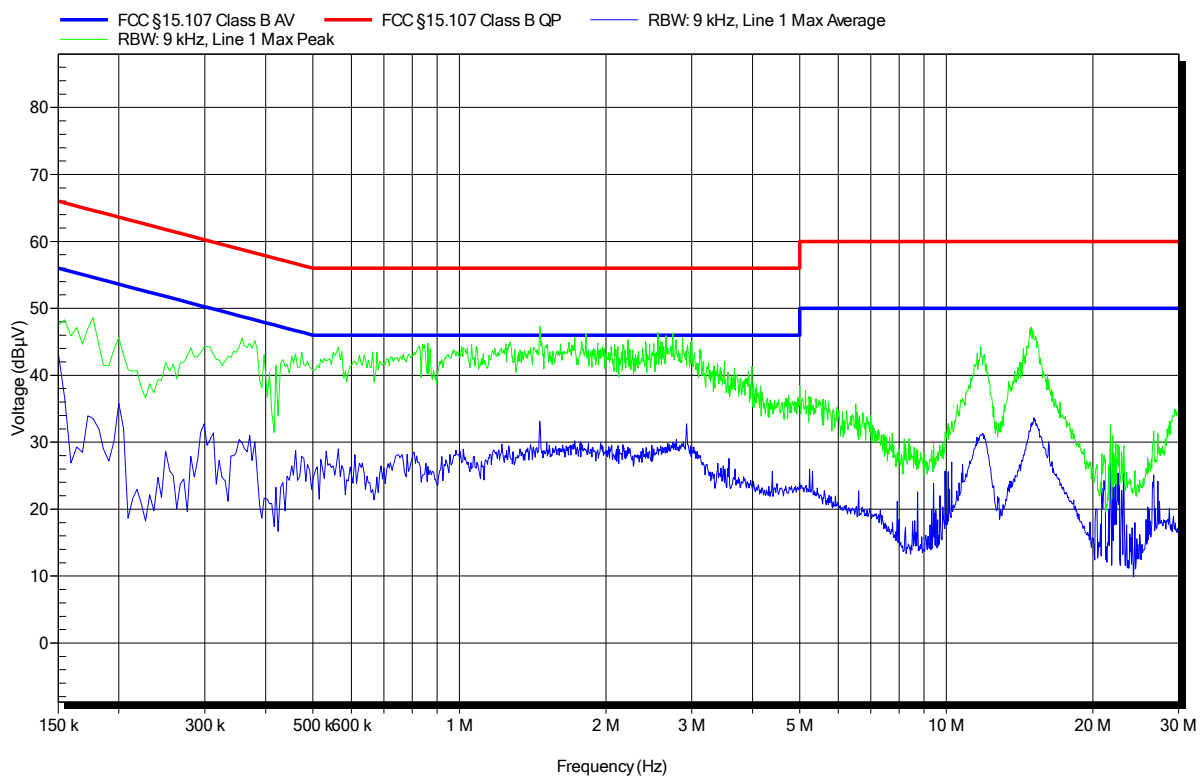
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Conducted emissions according to FCC 15B

Project number: G0M-1702-6295

Applicant: eResearchTechnology GmbH
 EUT Name: Spirometer
 Model: SpiroSphere - Main 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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Test Report No.: G0M-1702-6295-EF0215B-V01

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