


<b>EMC TEST REPORT</b> <b>FCC 47 CFR Part 15B</b> <b>Industry Canada RSS-Gen</b> <b>Electromagnetic compatibility - Unintentional radiators</b>		
<b>Report Reference No.</b> .....	G0M-1406-3919-EF0115B-V02	
<b>Testing Laboratory</b> .....	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	
<b>Applicant's name</b> .....	Leica Geosystems AG	
Address .....	Heinrich Wild Strasse 9435 Heerbrugg SWITZERLAND	
<b>Test specification:</b>		
Standard.....	47 CFR Part 15 Subpart B RSS-Gen, Issue 3, 2010-12 ANSI C63.4:2009	
<b>Equipment under test (EUT):</b>		
Product description	Field Controller Win EC7	
Model No.	CS20 Art. Nr. 808008	
Additional Models	None	
Hardware version	V5.0	
Firmware / Software version	None	
FCC / IC-ID	FCC-ID: RFD-CSNGB	IC: 3177A-CSNGB
<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 .....: 2014-07-14

Date (s) of performance of tests .....: 2014-08-04 – 2014-08-06

Compiled by .....: Steffen Zunke

Tested by (+ signature).....: Steffen Zunke 

Approved by (+ signature) .....: Marcus Klein 

Date of issue.....: 2014-09-30

Total number of pages.....: 31

**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	2014-09-29	Initial Release	
V02	2014-09-30	FCC-ID and IC-ID changed	Steffen Zunke

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## 1 Equipment (Test item) Description

<b>Description</b>	Field Controller Win EC7	
<b>Model</b>	CS20 Art. Nr. 808008	
<b>Additional Models</b>	None	
<b>Serial number</b>	None	
<b>Hardware version</b>	V5.0	
<b>Software / Firmware version</b>	None	
<b>FCC-ID</b>	RFD-CSNGB	
<b>IC-ID</b>	3177A-CSNGB	
<b>Power supply</b>	10.8VDC via rechargeable battery or via AC/DC adapter	
<b>AC/DC-Adaptor</b>	Model : AEL40US15 Manufacturer : XP Power Input : 100-240VAC / 50-60Hz Output : 15VDC / 2.66A	
<b>Radio module</b>	Type	Bluetooth / WLAN Module
	Model	TIWI-BLE
	Manufacturer	LS Research
	HW Version	None
	SW Version	None
	FCC-ID	TFB-TIWI1-01
	IC	5969A-TIWI101
<b>Manufacturer</b>	Leica Geosystems AG Heinrich Wild Strasse 9435 Heerbrugg SWITZERLAND	
<b>Highest emission frequency</b>	> 1000 MHz (up to 5th Harm)	
<b>Device classification</b>	Class B	
<b>Equipment type</b>	Tabletop	
<b>Number of tested samples</b>	1	

#### 1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
SIM	Communication tester	Rohde & Schwarz	CMU 200	-
AE	Total Station	Leica	TS15	-
AE	WLAN Access Point	Siemens	-	-
AE	Laptop	DELL	E6400	-
AE	AC/DC Adapter	XP Power	AEL40US15	-

**\*Note:** Use the following abbreviations:

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

## 1.5 Operating Modes

Mode #	Description
1	Battery powered, Bluetooth link to GPS antenna, WLAN link to WLAN Access Point
2	charging via AC/DC adapter, Bluetooth link to GPS antenna, WLAN link to WLAN Access Point

**1.6 Test Equipment Used During Testing**

<b>Radiated emissions</b>					
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
LPD-Antenna	R&S	HL 025	EF00327	2013-02	2016-02
EMI Test Receiver	R&S	ESU8	EF00379	2014-03	2015-03
EMI Test Receiver	R&S	ESCS30	EF00295	2013-10	2014-10

<b>Conducted emissions</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2012-10	2014-10
AMN	R&S	ESH3-Z5	EF00036	2012-11	2014-11
EMI Test Receiver	R&S	ESCS 30	EF00295	2013-10	2014-10



## 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 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 RSS-Gen				
Product Specific Standard	Requirement – Test	Reference Method	Result	Remarks
47 CFR 15.109 RSS-Gen 4.9 & 4.10	Radiated emissions	ANSI C 63.4	PASS	-
47 CFR 15.107 RSS-Gen 7.2.4	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

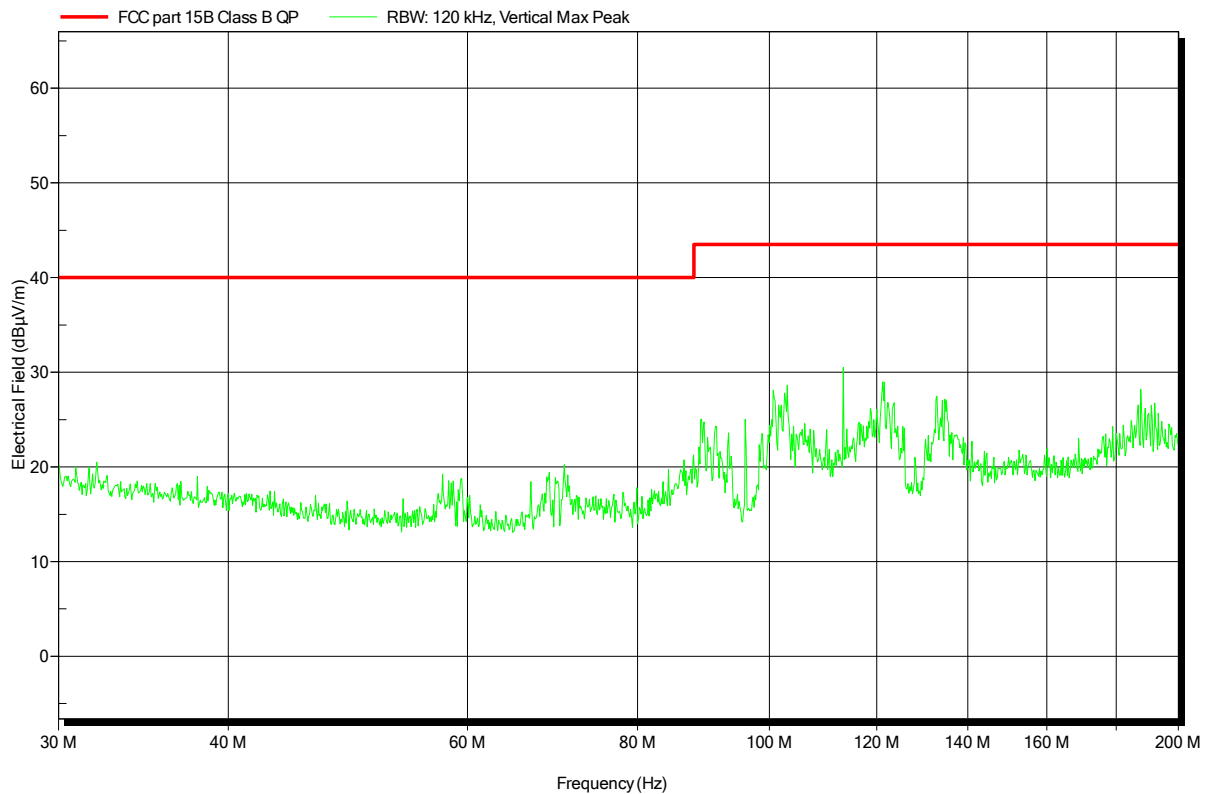
Radiated emissions acc. FCC 47 CFR 15.109 / IC RSS-Gen		Verdict: PASS				
Laboratory Parameters:	Required prior to the test	During the test				
Ambient Temperature	15 to 35 °C	25°C				
Relative Humidity	30 to 60 %	46%				
Test according referenced standards	Reference Method					
	ANSI C63.4					
Sample 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					
	> 1000 MHz (up to 5th Harm)					
Fully configured sample scanned over the following frequency range	Frequency range					
	30 MHz to 5 GHz					
Operating mode	1 / 2					
<b>Limits and results Class B</b>						
Frequency [MHz]	Quasi-Peak [dB $\mu$ V/m]	Result	Average [dB $\mu$ V/m]	Result	Peak [dB $\mu$ V/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: Measurements were performed up to 5GHz, Above 5 GHz no relevant emission were determined.						

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 23°C, Unom: 10.8VDC via Battery
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	Basic, battery powered, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-04
Note:	

Index 1

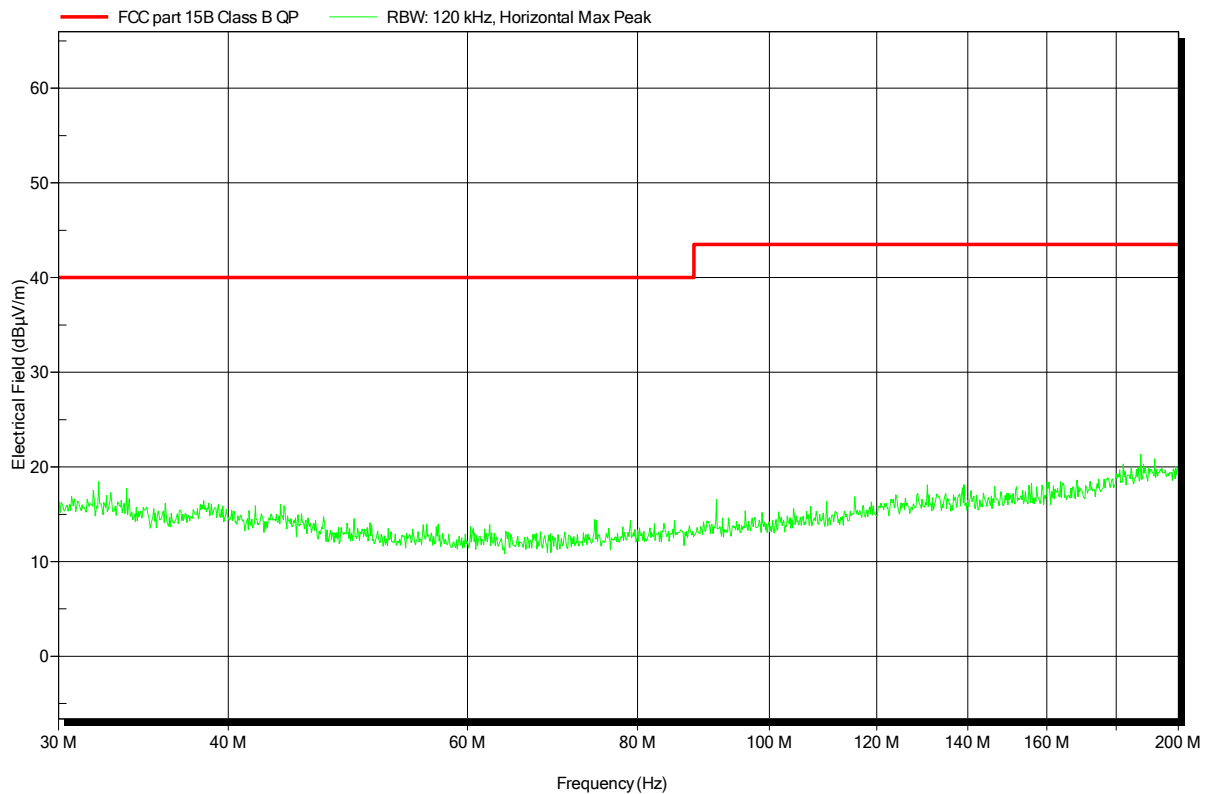


**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 23°C, Unom: 10.8VDC via Battery
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	Basic, battery powered, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-04
Note:	

Index 2

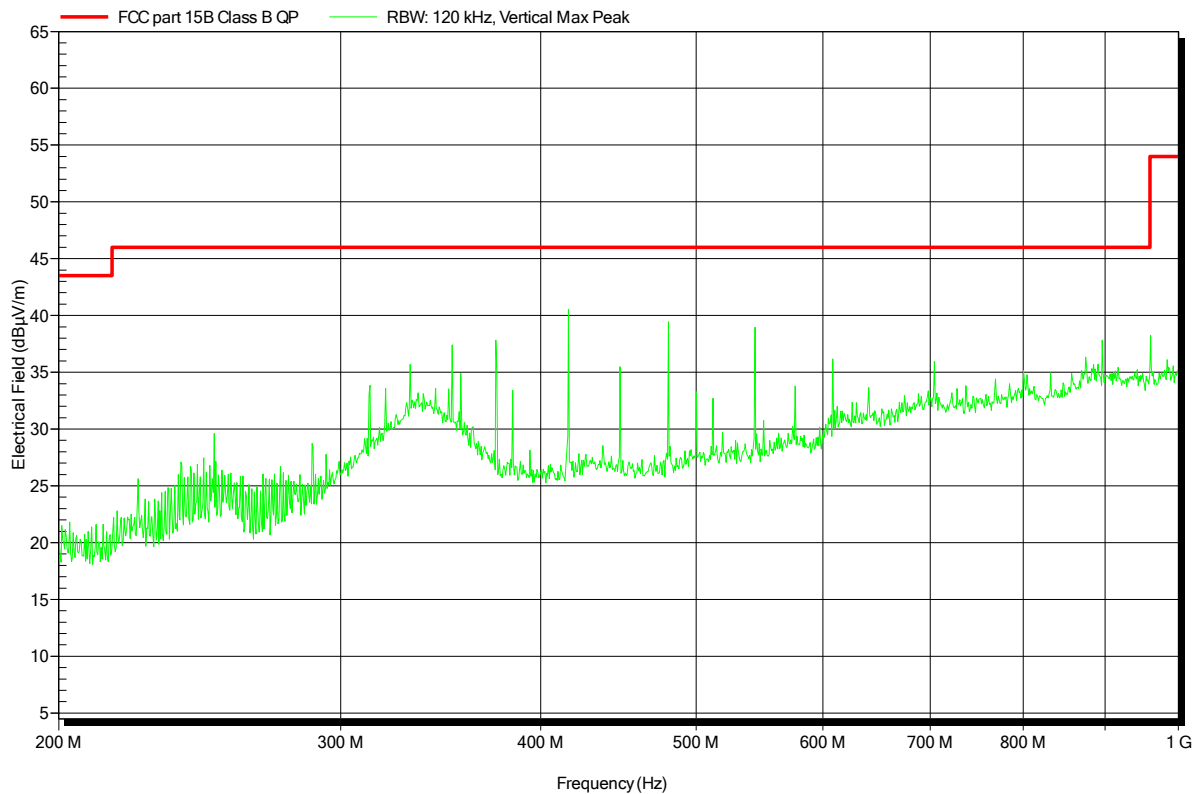


**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 23°C, Unom: 10.8VDC via Battery
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3m
Mode:	Basic, battery powered, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-04
Note:	

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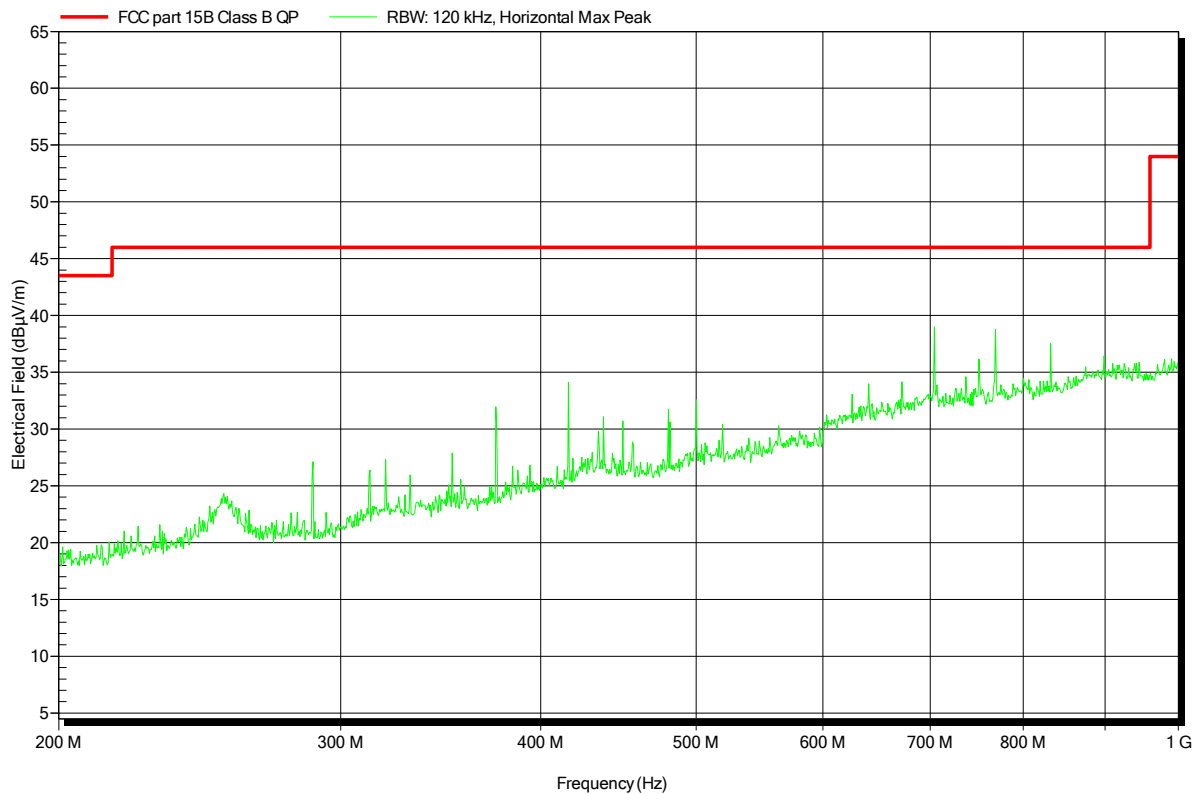


**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 23°C, Unom: 10.8VDC via Battery
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	Basic, battery powered, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-04
Note:	

Index 3

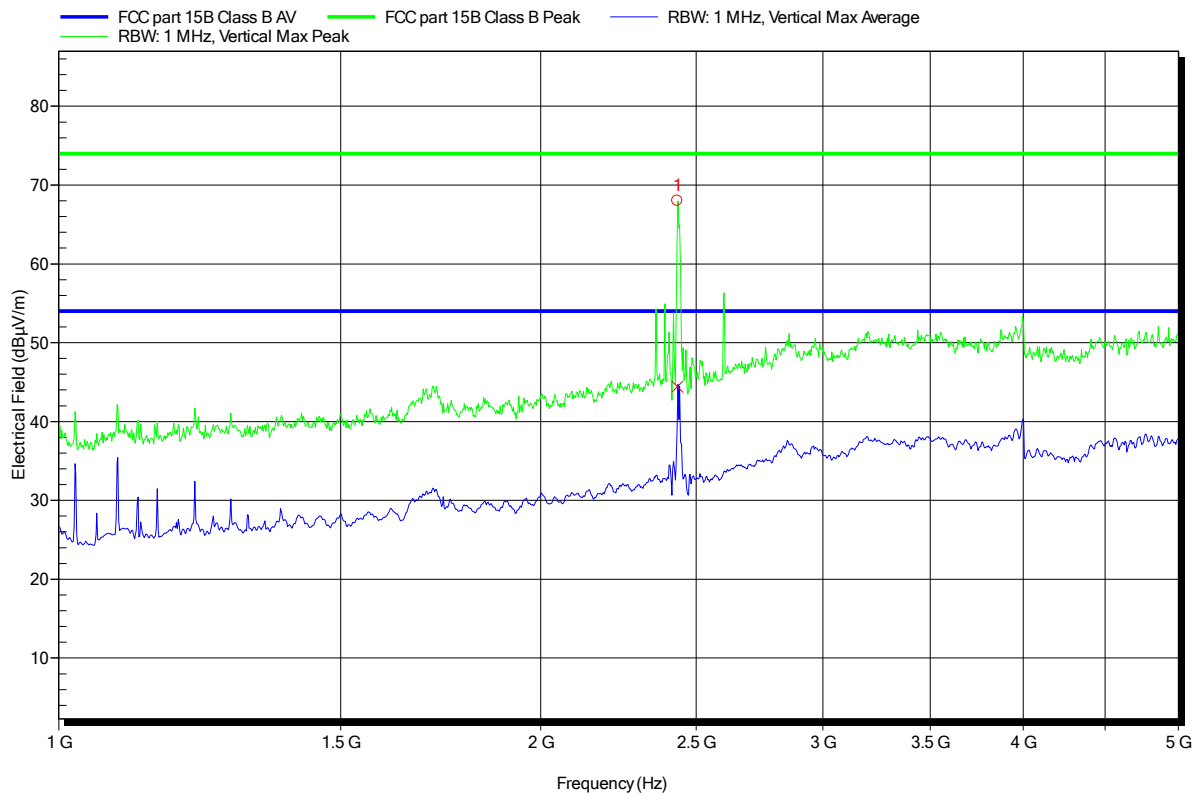


**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 23°C, Unom: 10.8VDC via Battery
Antenna:	Rohde & Schwarz HL 025, Vertical
Measurement distance:	3m
Mode:	Basic, battery powered, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-04
Note:	Peak 1: Carrier Frequency BT/WLAN

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Frequency  
2.434 GHz WLAN carrier

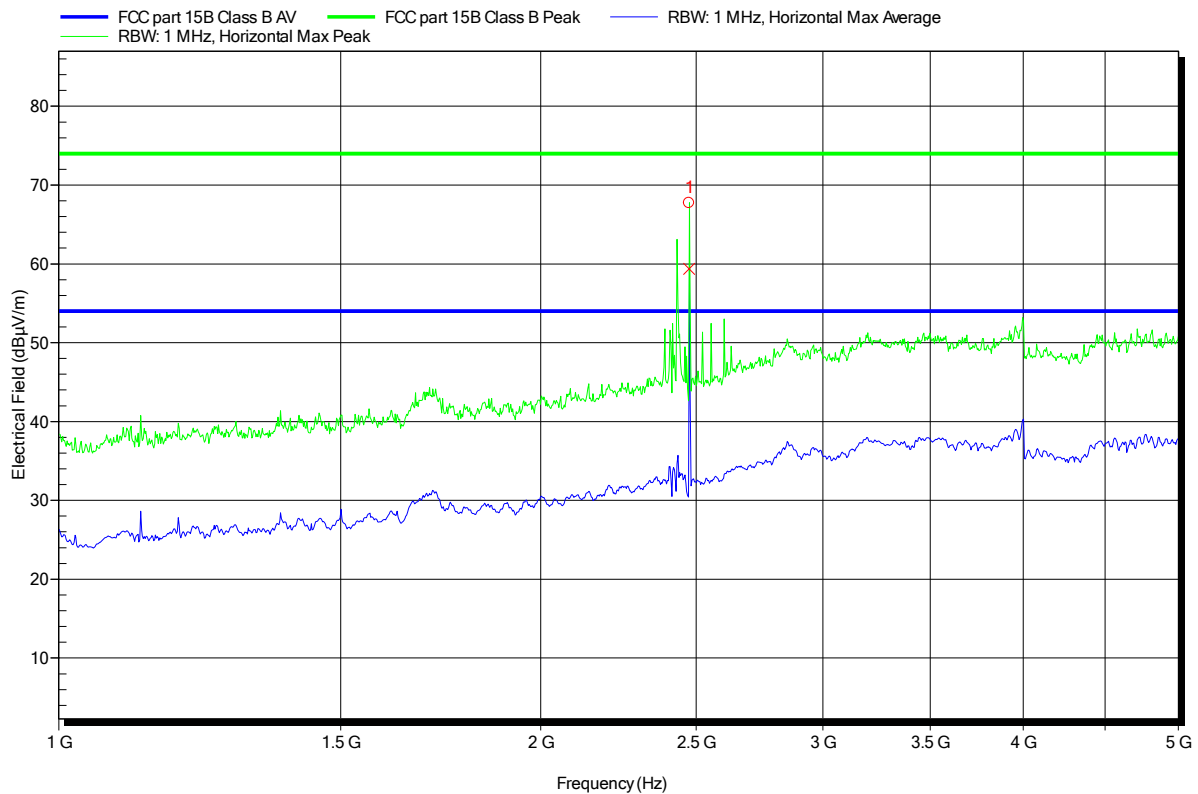


**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 23°C, Unom: 10.8VDC via Battery
Antenna:	Rohde & Schwarz HL 025, Horizontal
Measurement distance:	3m
Mode:	Basic, battery powered, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-04
Note:	Peak 1: Carrier Frequency BT/WLAN

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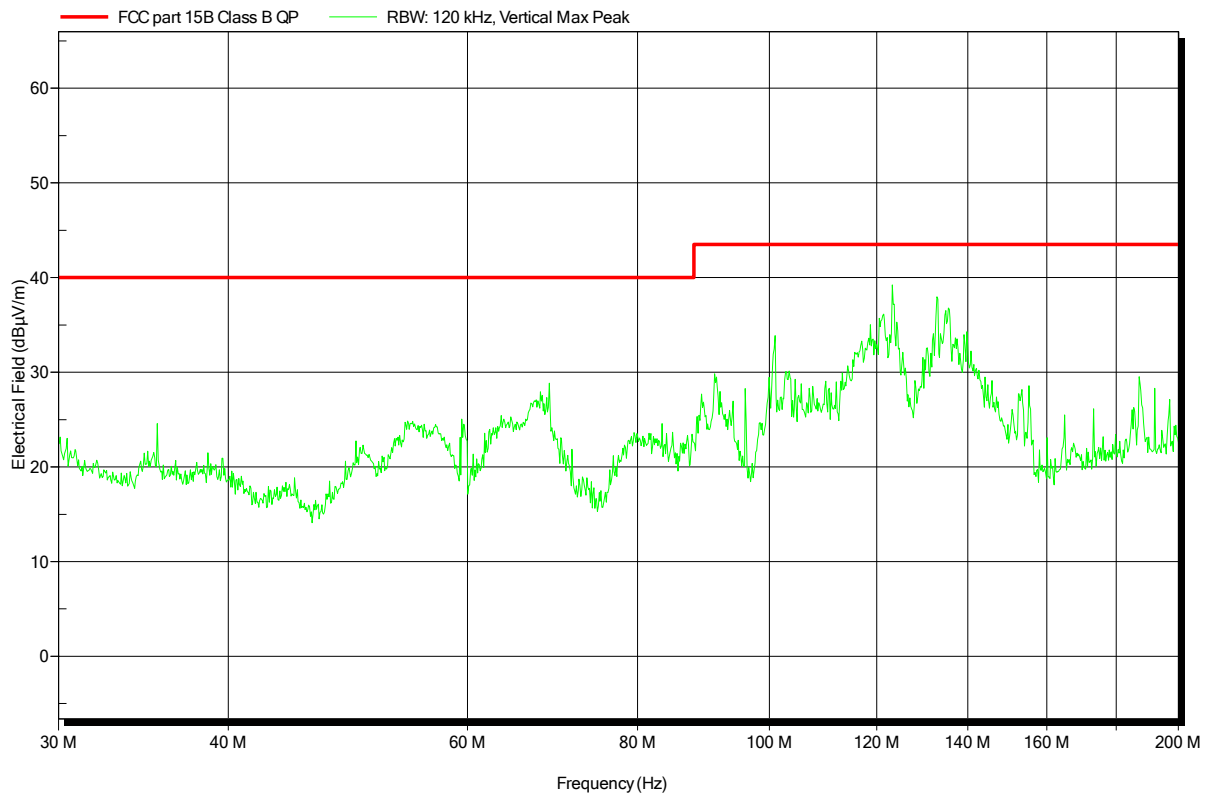
Frequency  
2.475 GHz WLAN carrier

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 25°C, Unom: 10.8VDC via AC/DC Adapter
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	Basic, charging, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-05
Note:	

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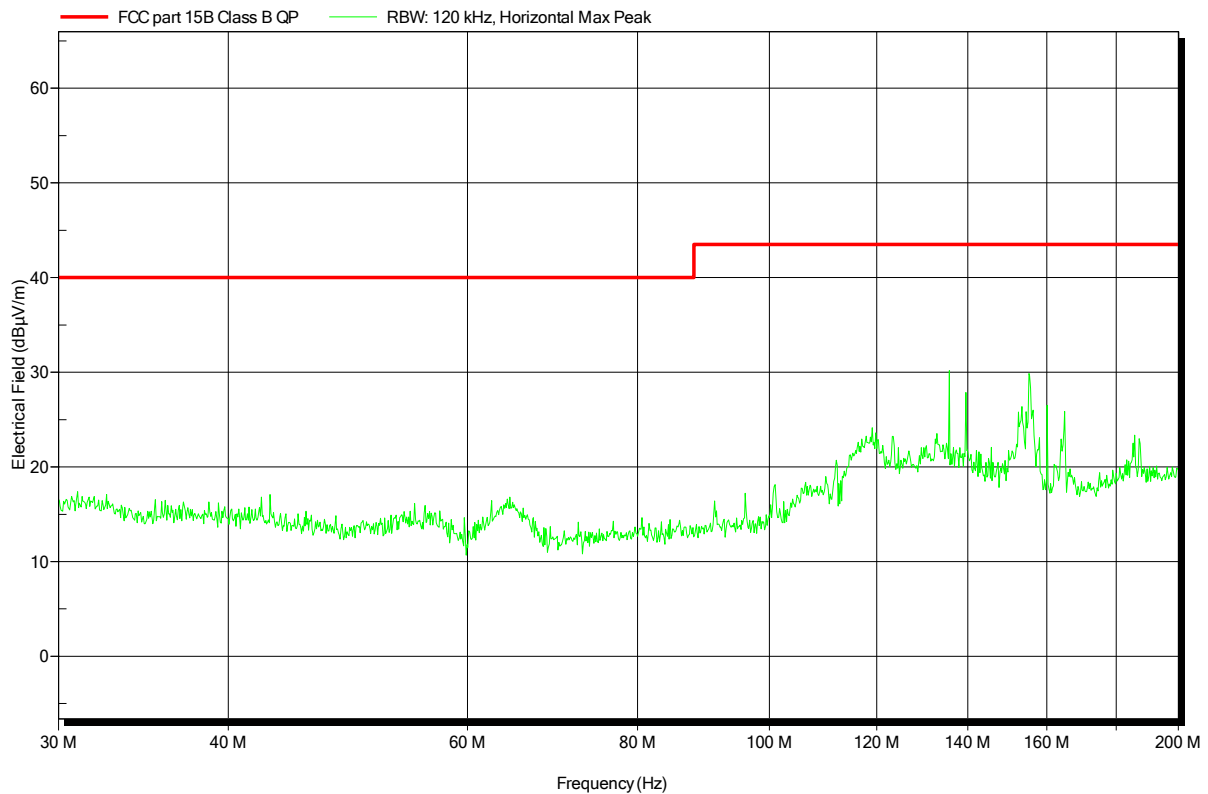


**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 25°C, Unom: 10.8VDC via AC/DC Adapter
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	Basic, charging, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-05
Note:	

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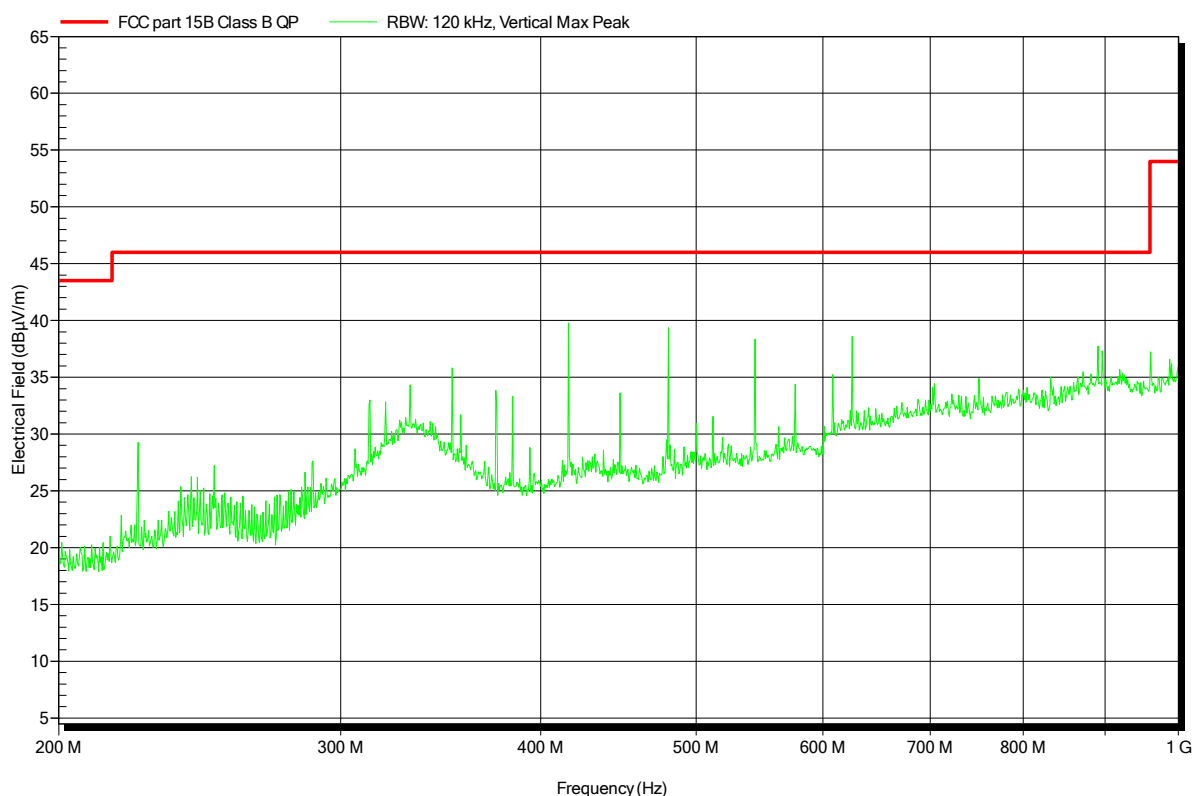


**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 25°C, Unom: 10.8VDC via AC/DC Adapter
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3m
Mode:	Basic, charging, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-05
Note:	

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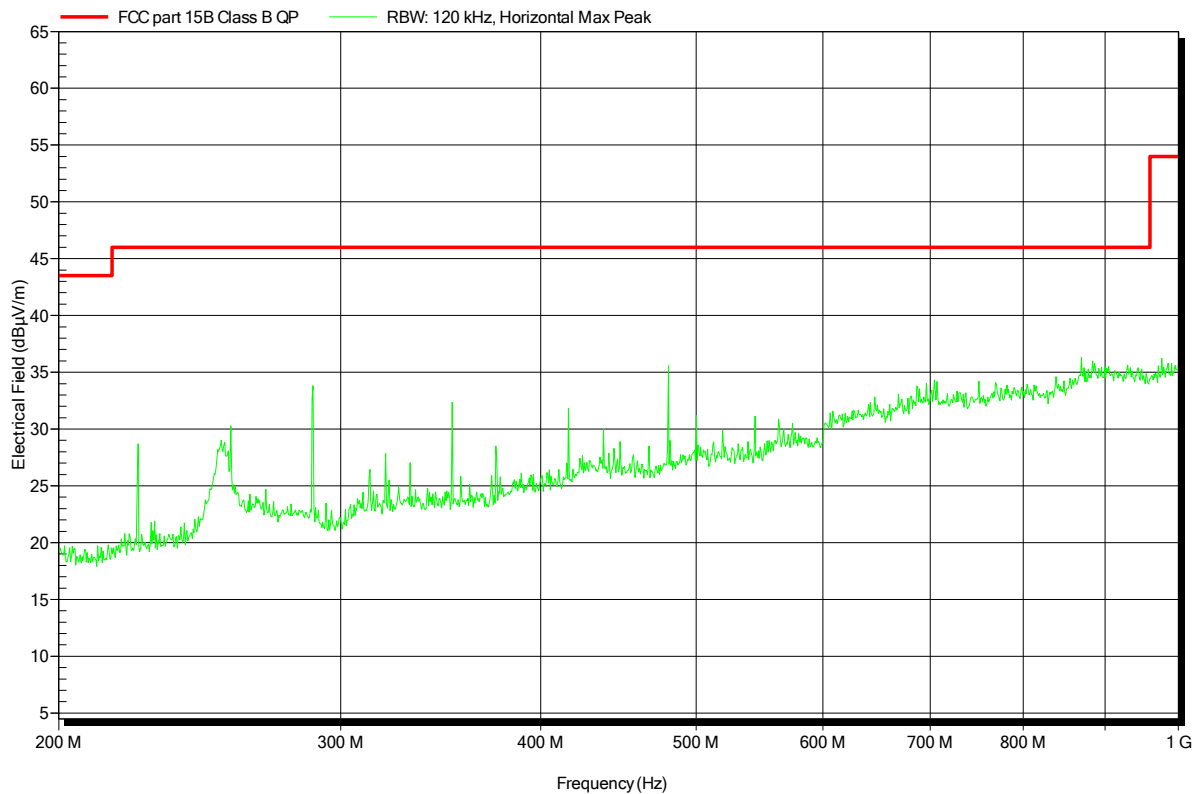


**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 25°C, Unom: 10.8VDC via AC/DC Adapter
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	Basic, charging, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-05
Note:	

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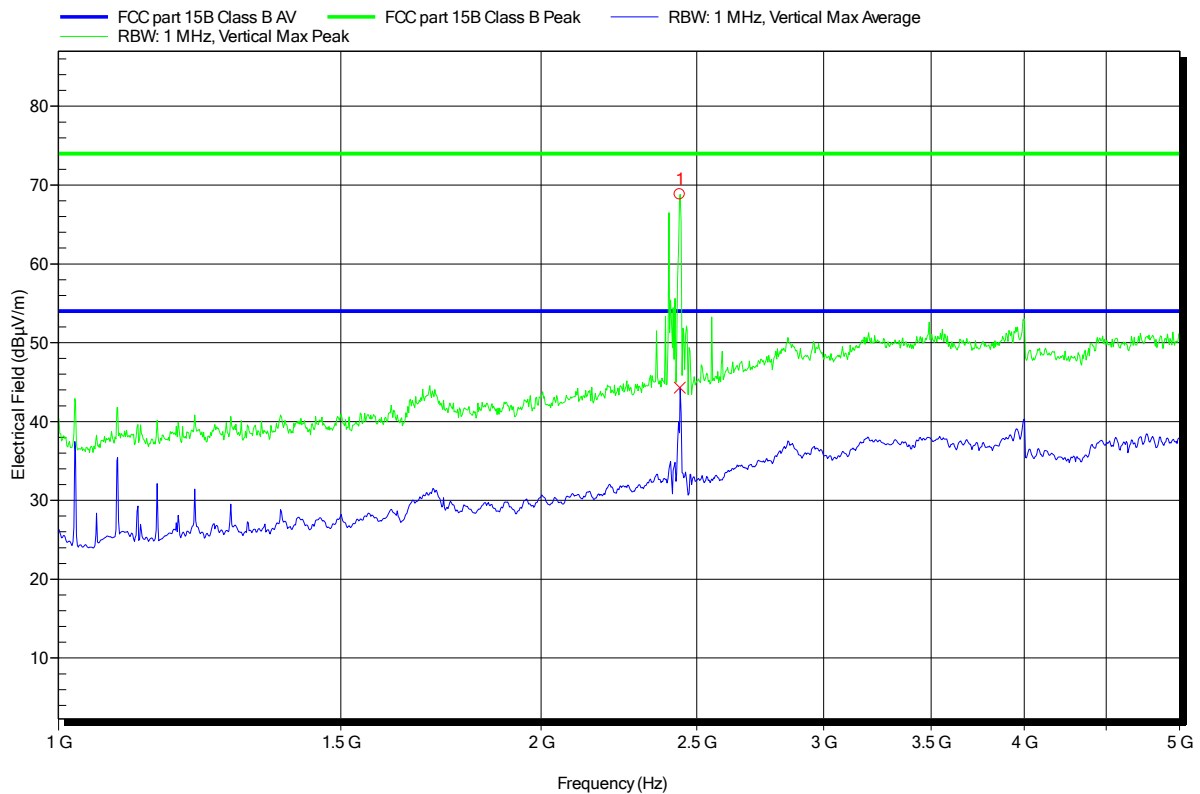


**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 25°C, Unom: 10.8VDC via AC/DC Adapter
Antenna:	Rohde & Schwarz HL 025, Vertical
Measurement distance:	3m
Mode:	Basic, charging, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-05
Note:	

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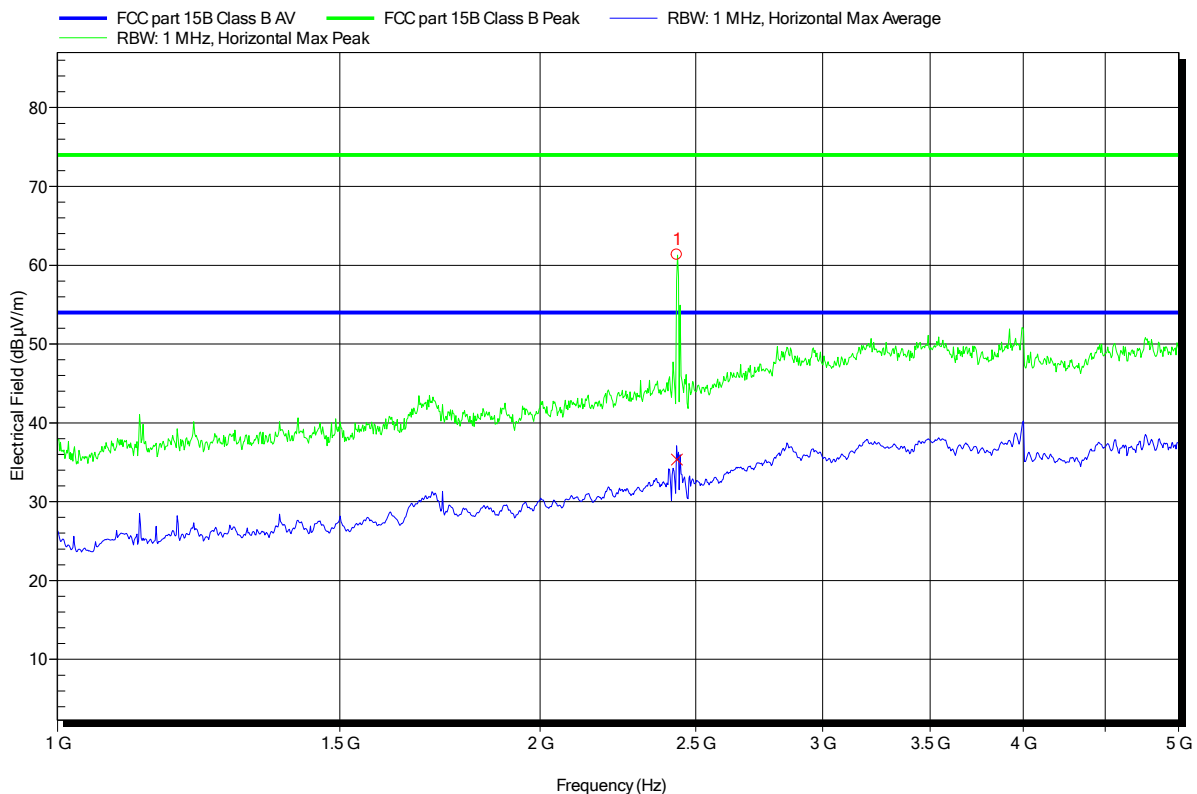
Frequency  
 2.44 GHz WLAN carrier

**Spurious emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer: Leica Geosystems AG  
 EUT Name: Feld- Controller  
 Model: Belatrix - Basic  
 Test Site: Eurofins Product Service GmbH  
 Operator: Mr. Zunke  
 Test Conditions: Tnom: 25°C, Unom: 10.8VDC via AC/DC Adapter  
 Antenna: Rohde & Schwarz HL 025, Horizontal  
 Measurement distance: 3m  
 Mode: Basic, charging, WLAN link to AP, BT link to GPS Antenna  
 Test Date: 2014-08-05  
 Note:

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Frequency  
 2.434 GHz WLAN carrier

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

<b>Conducted emissions acc. FCC 47 CFR 15.107 / IC RSS-Gen</b>		<b>Verdict: PASS</b>		
Laboratory Parameters:	Required prior to the test	During the test		
Ambient Temperature	15 to 35 °C	25°C		
Relative Humidity	30 to 60 %	46%		
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			
<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.				

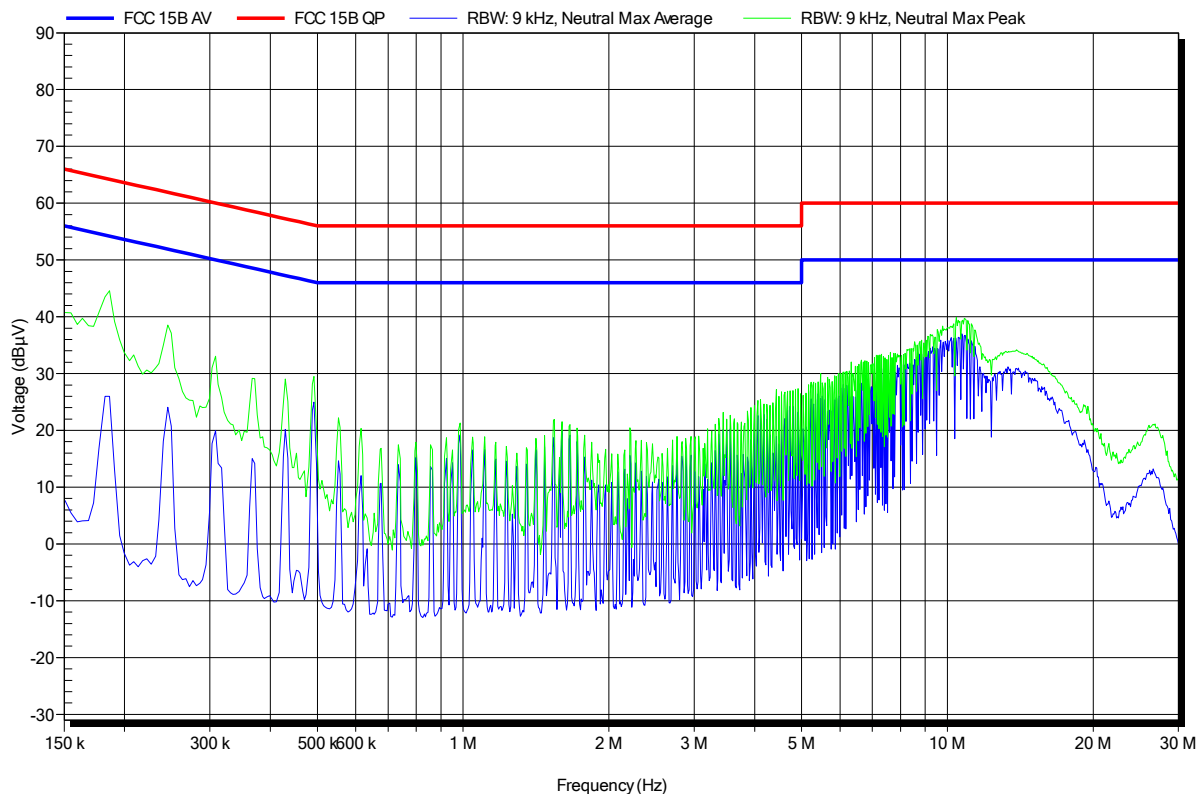


**EMI voltage test in the ac-mains according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 25°C, Unom: 10.8VDC via AC/DC Adapter
LISN:	ESH2-Z5 N
Mode:	Basic, charging, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-06
Note:	

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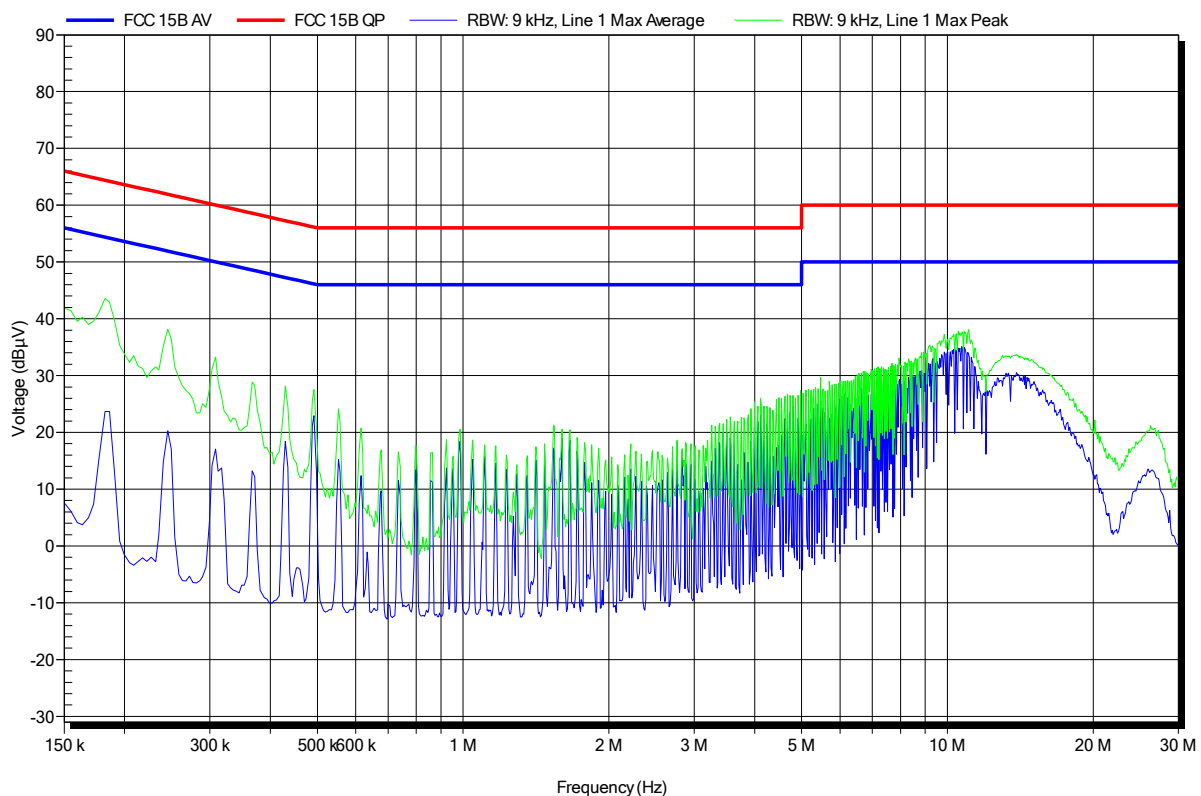


**EMI voltage test in the ac-mains according to FCC Part 15b**

Project number: G0M-1406-3919

Manufacturer:	Leica Geosystems AG
EUT Name:	Feld- Controller
Model:	Belatrix - Basic
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Zunke
Test Conditions:	Tnom: 25°C, Unom: 10.8VDC via AC/DC Adapter
LISN:	ESH2-Z5 L
Mode:	Basic, charging, WLAN link to AP, BT link to GPS Antenna
Test Date:	2014-08-06
Note:	

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Test Report No.: G0M-1406-3919-EF0115B-V02

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