

EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada RSS-Gen

Electromagnetic compatibility - Unintentional radiators

Report Reference No. : G0M-1406-3919-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 : Leica Geosystems AG

Address : Heinrich Wild Strasse
9435 Heerbrugg
SWITZERLAND

Test specification:

Standard..... : 47 CFR Part 15 Subpart B
RSS-Gen, Issue 3, 2010-12
ANSI C63.4:2009

Equipment under test (EUT):

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
Test result	Passed	

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

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

REPORT INDEX

1	EQUIPMENT (TEST ITEM) DESCRIPTION	5
1.1	Photos – Equipment external	6
1.2	Photos – Equipment internal	8
1.3	Photos – Test setup	10
1.4	Supporting Equipment Used During Testing	11
1.5	Operating Modes	12
1.6	Test Equipment Used During Testing	13
1.7	Sample emission level calculation	14
2	RESULT SUMMARY	15
3	TEST CONDITIONS AND RESULTS	16
3.1	Test Conditions and Results – Radiated emissions	16
3.2	Test Conditions and Results – AC power line conducted emissions	29

1 Equipment (Test item) Description

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

Radiated emissions					
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

Conducted emissions					
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 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 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	-
Remarks:				

3 Test Conditions and Results

3.1 Test Conditions and Results – Radiated emissions

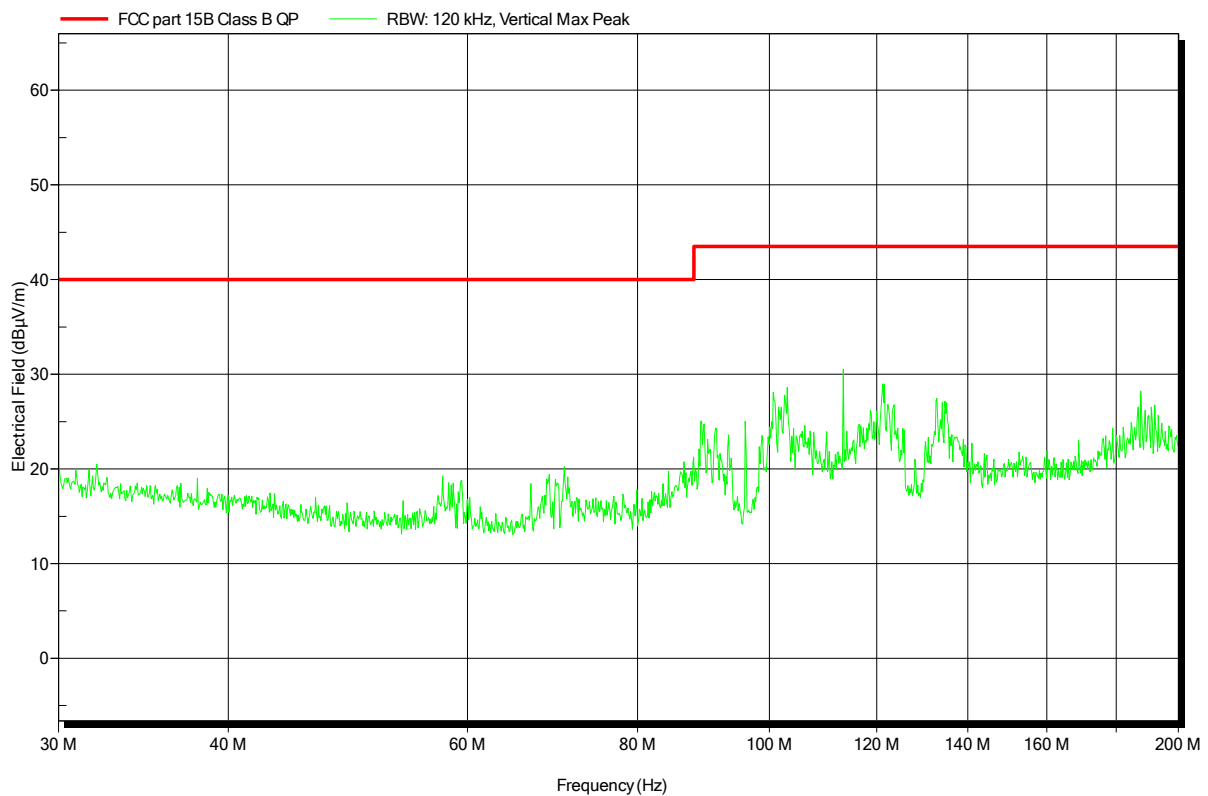
Radiated emissions acc. FCC 47 CFR 15.109 / IC RSS-Gen				Verdict: PASS		
Laboratory Parameters:		Required prior to the test		During the test		
Ambient Temperature		15 to 35 °C		25°C		
Relative Humidity		30 to 60 %		46%		
Test according referenced standards		Reference Method				
		ANSI C63.4				
Sample 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				
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: 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

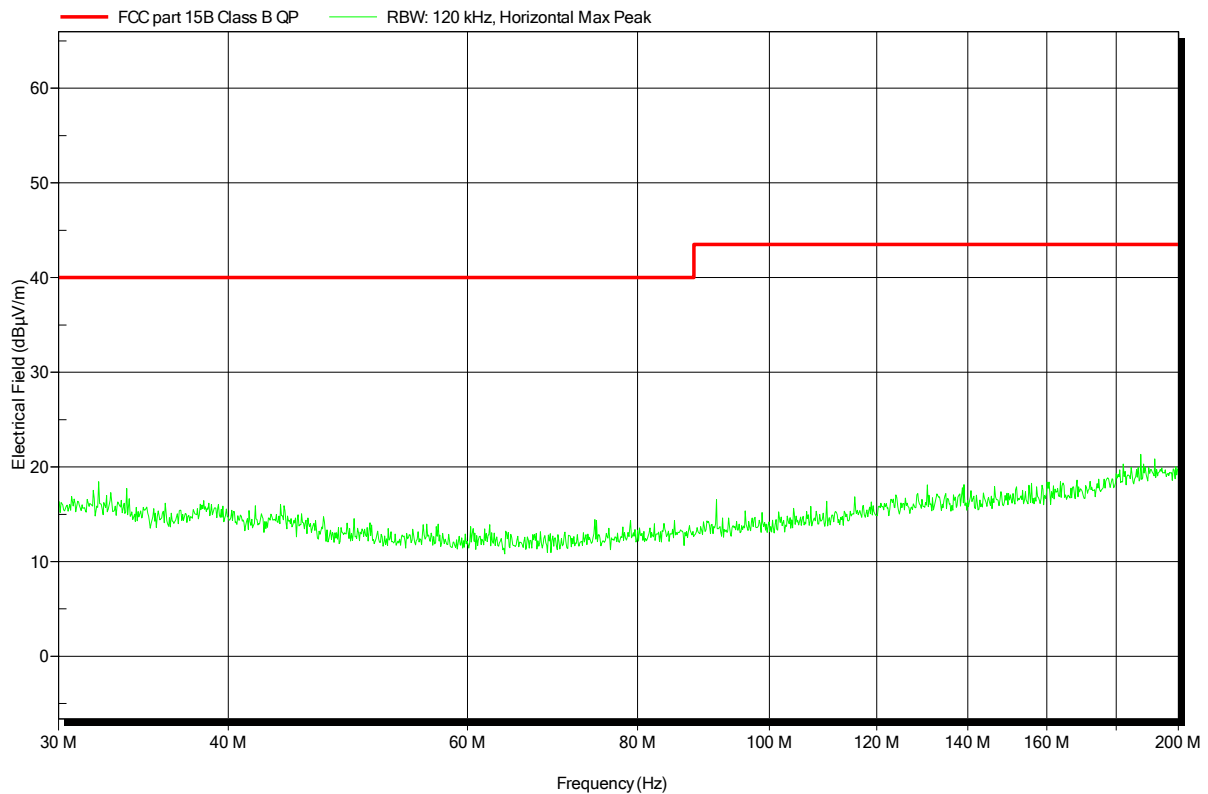


Spurious emissions under normal conditions according to FCC Part 15b

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

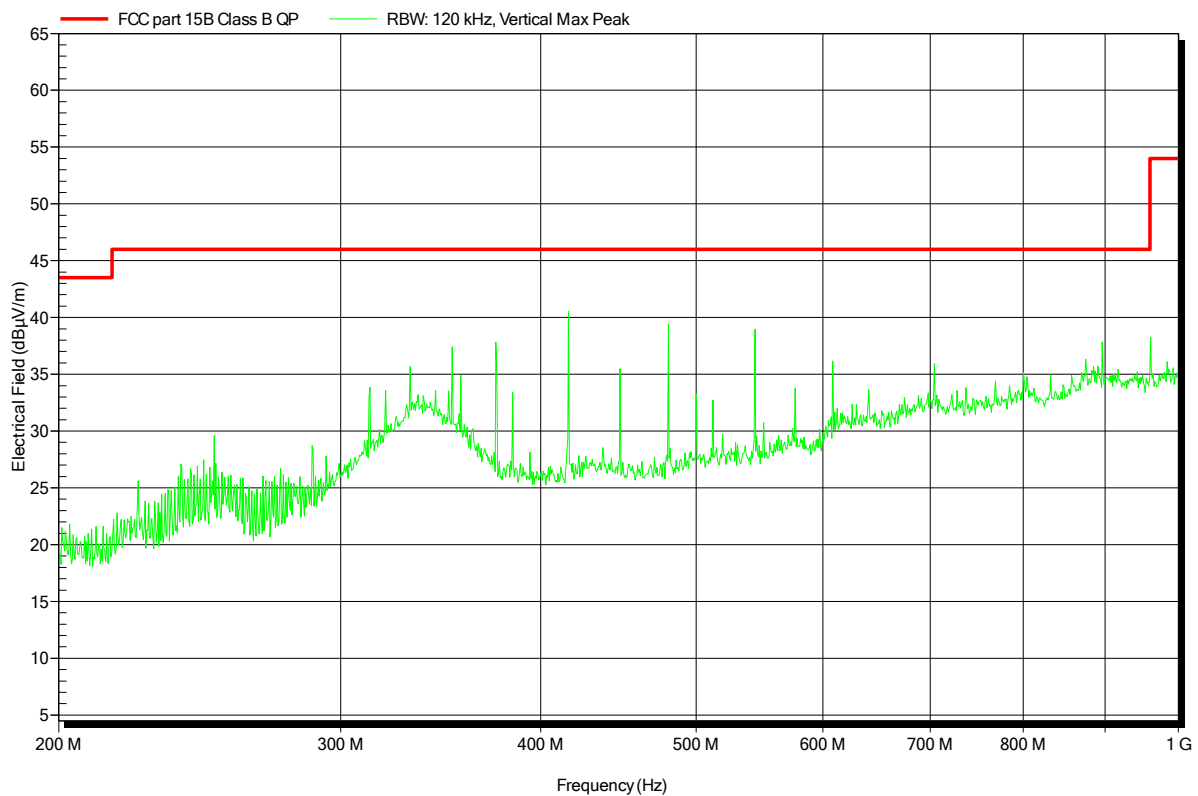


Spurious emissions under normal conditions according to FCC Part 15b

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:	

Index 4



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

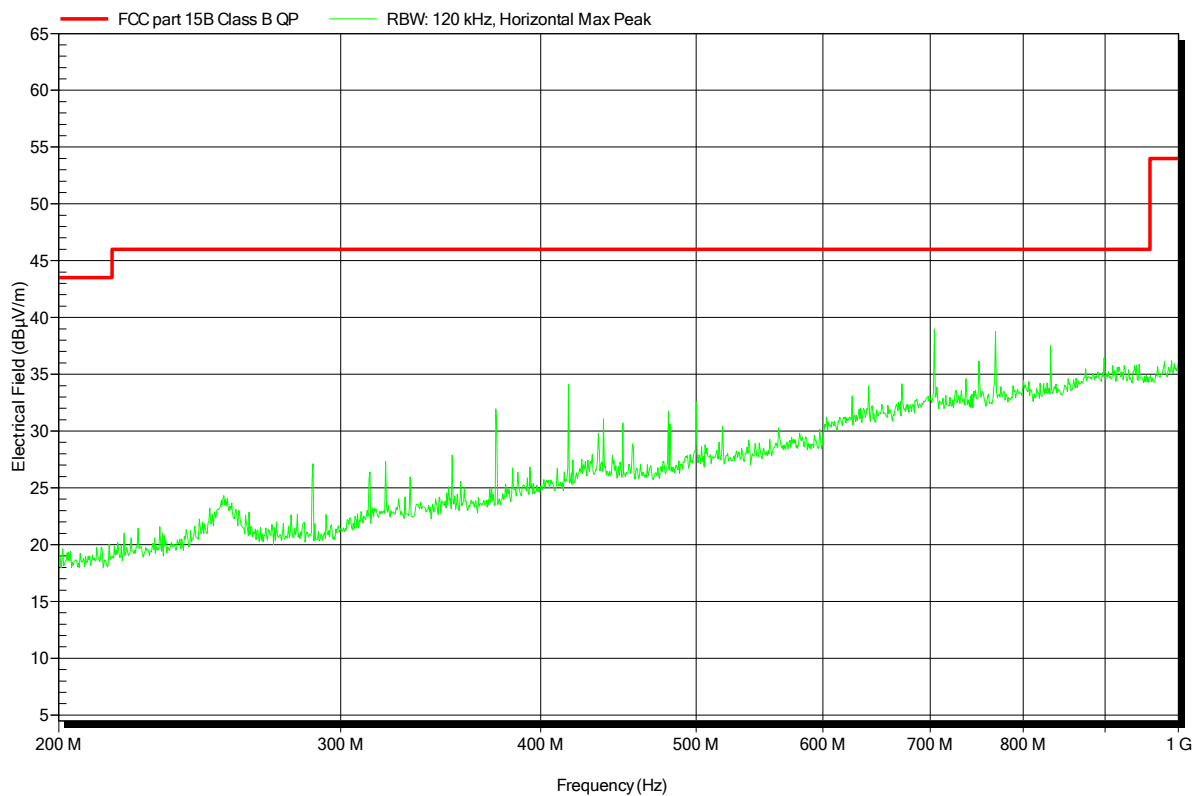
Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

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

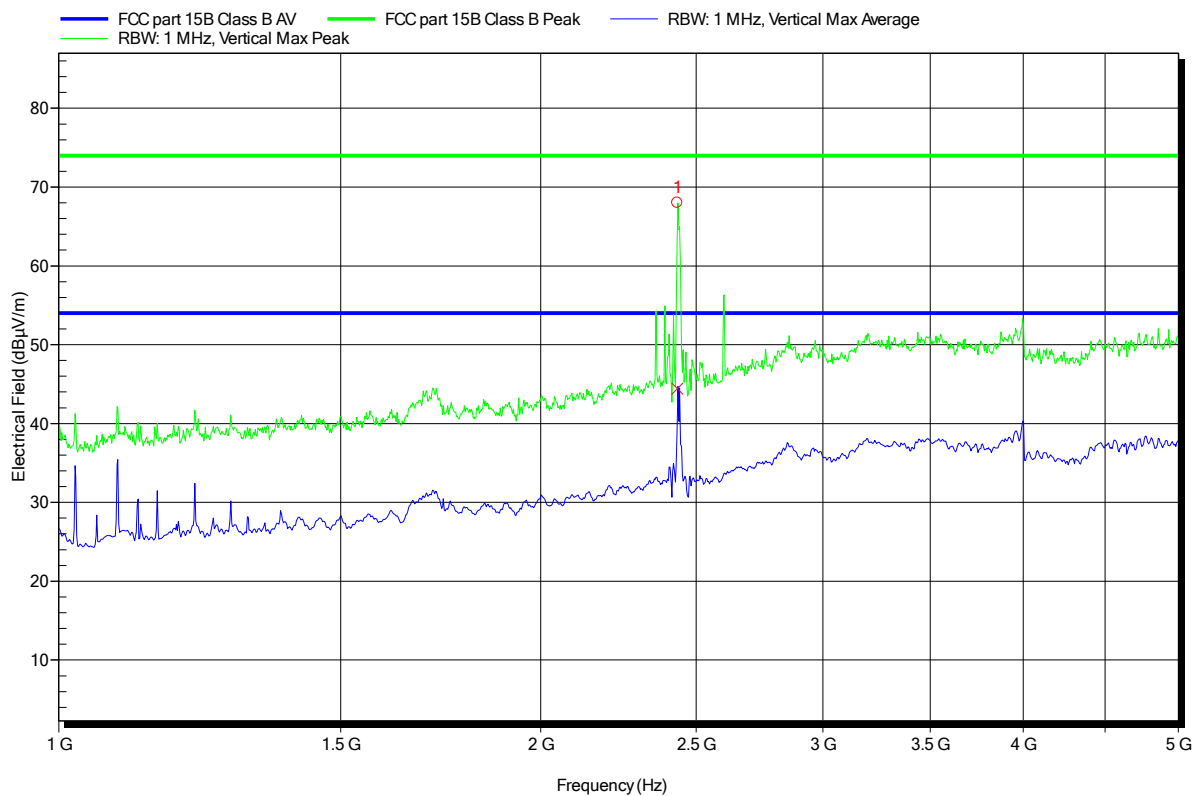


Spurious emissions under normal conditions according to FCC Part 15b

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

Index 5



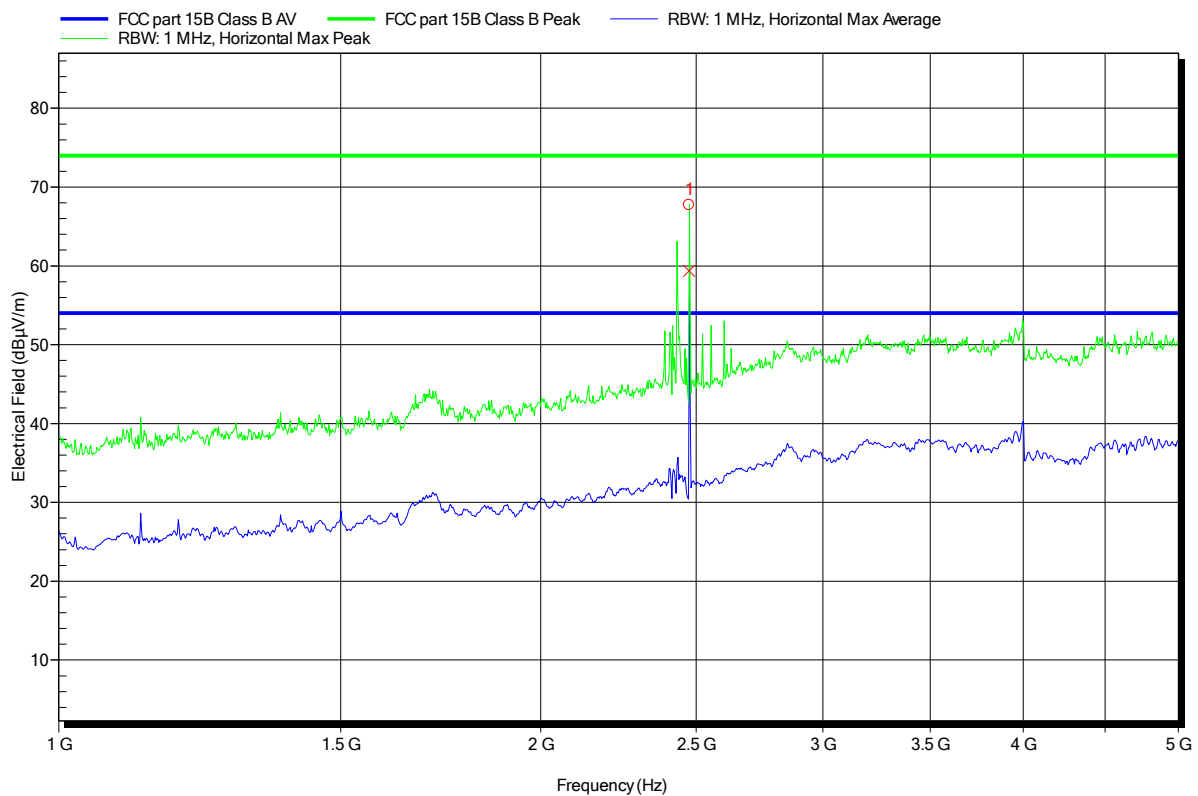
Frequency
 2.434 GHz WLAN carrier

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

Index 6



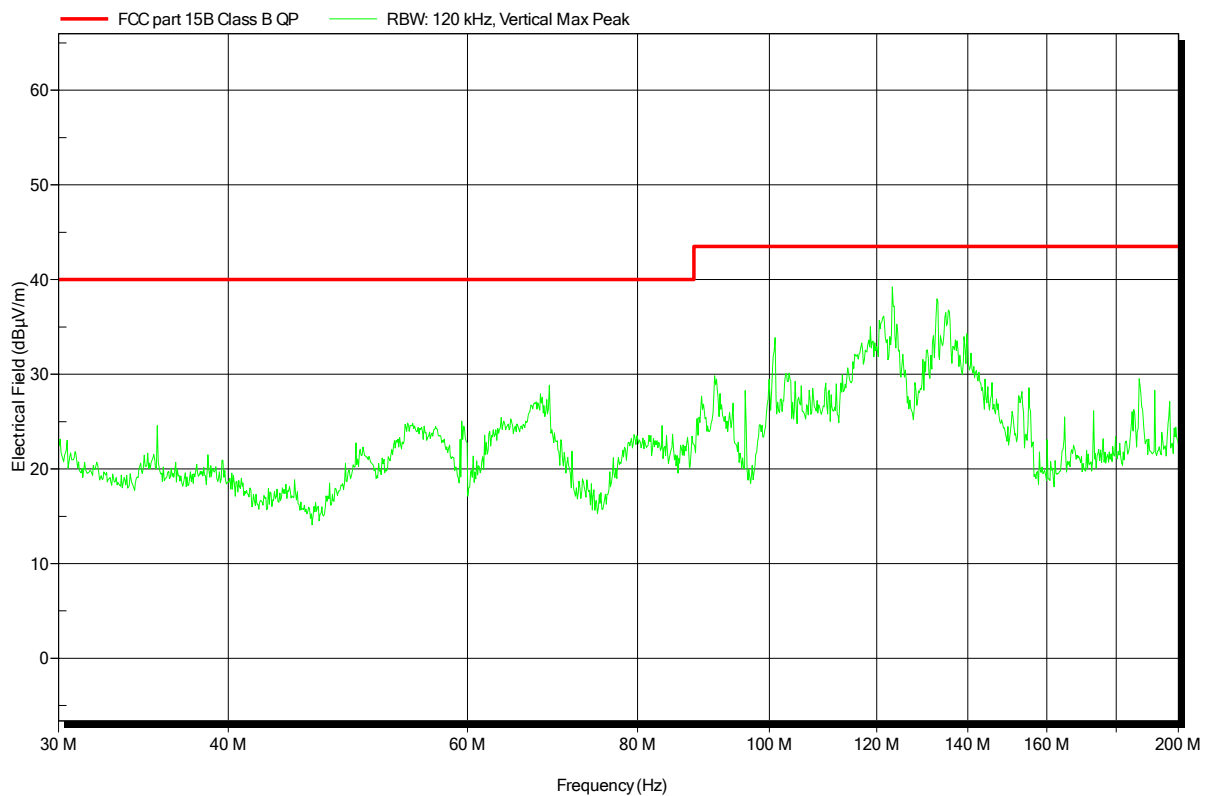
Frequency
 2.475 GHz WLAN carrier

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:	

Index 7



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

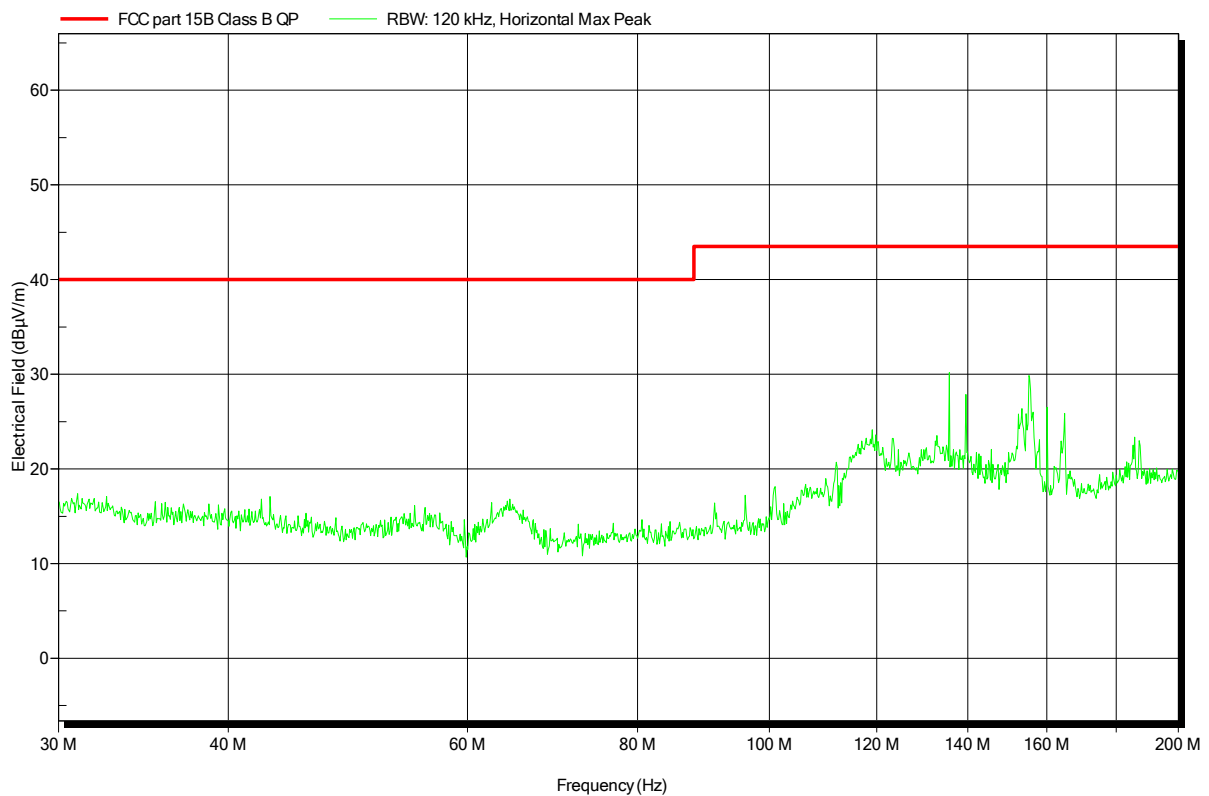
Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

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:	

Index 8



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

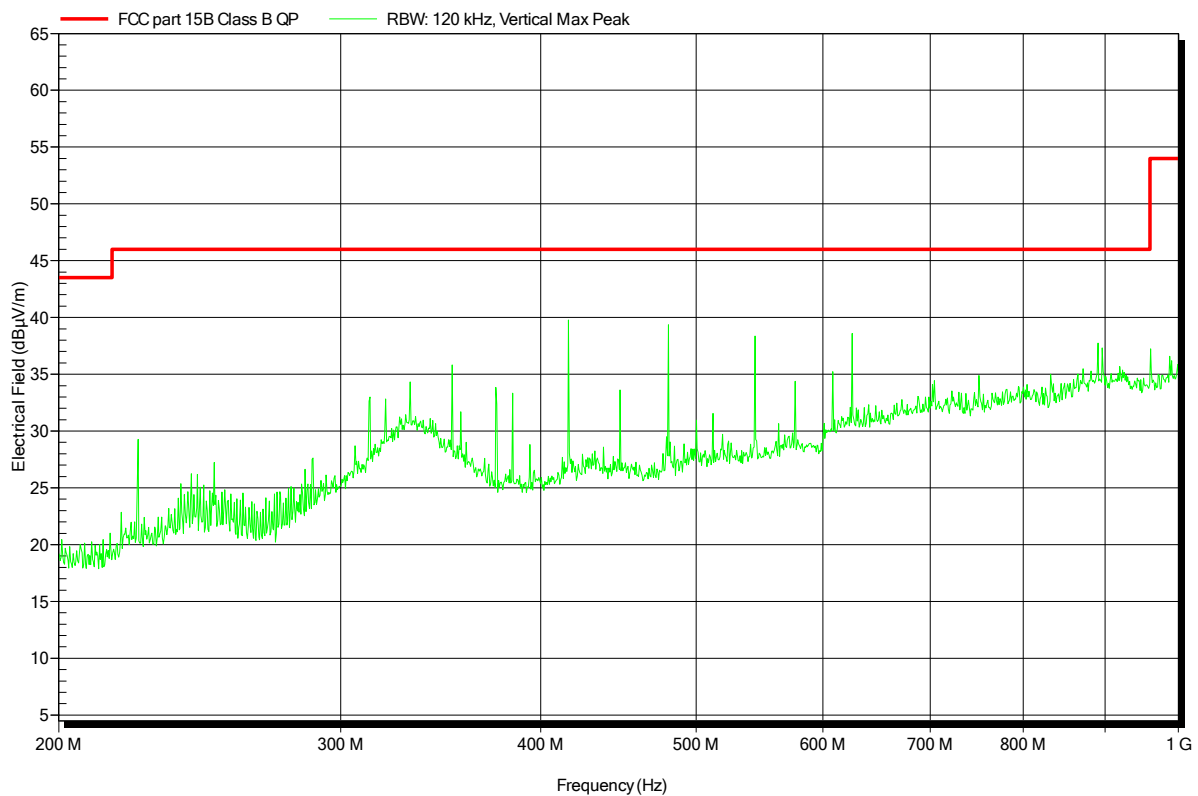
Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

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:

Index 10

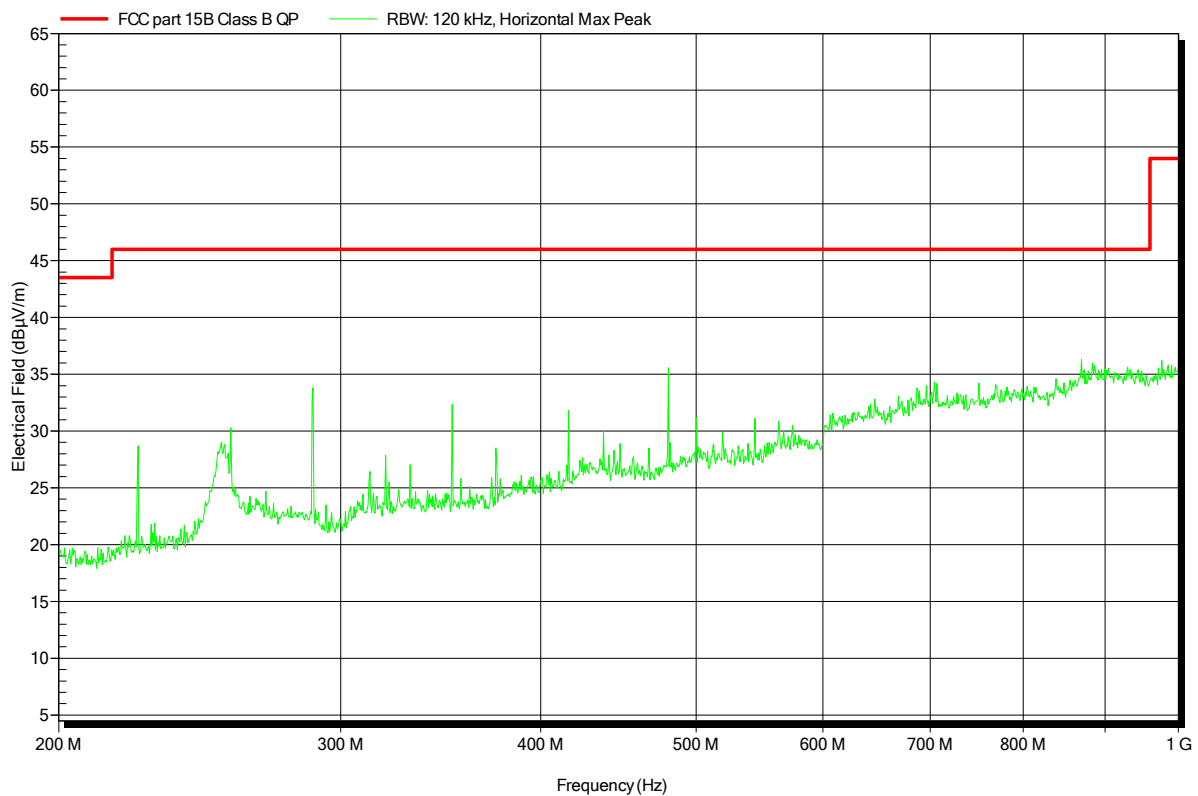


Spurious emissions under normal conditions according to FCC Part 15b

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:	

Index 9

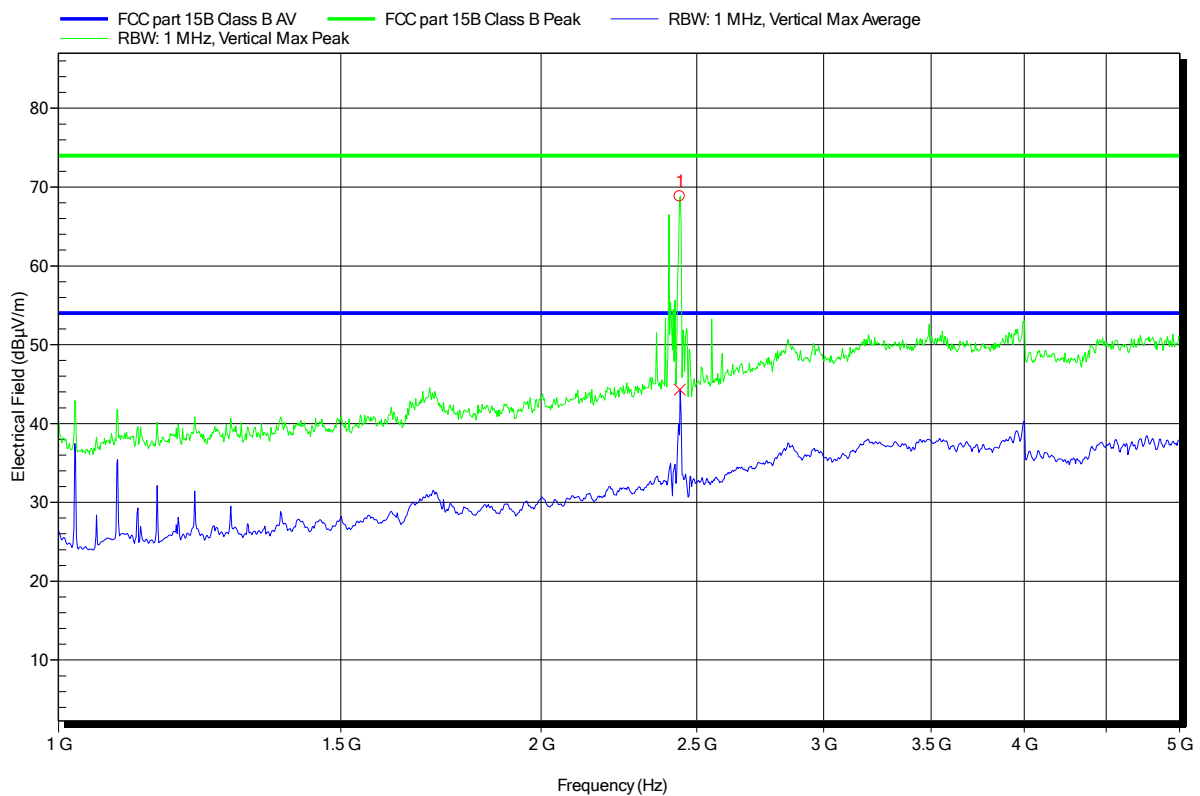


Spurious emissions under normal conditions according to FCC Part 15b

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:

Index 11



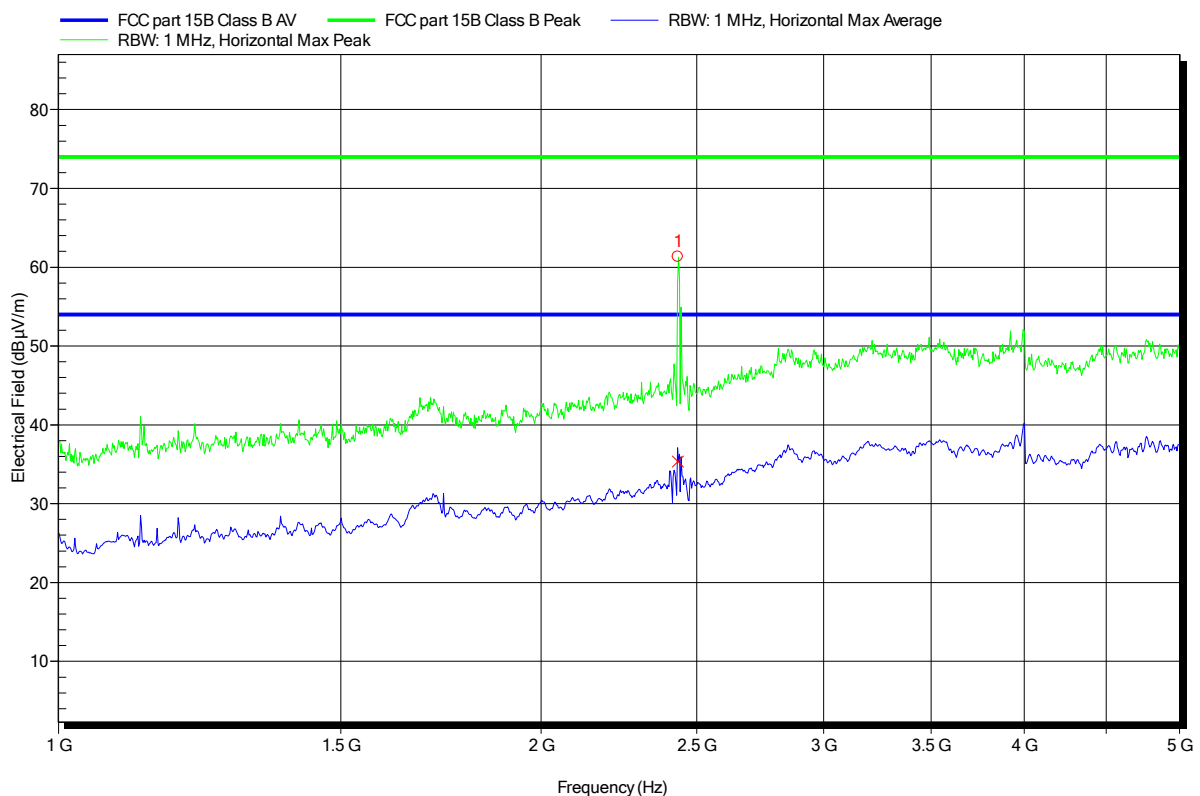
Frequency
 2.44 GHz WLAN carrier

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:

Index 12



Frequency
 2.434 GHz WLAN carrier

3.2 Test Conditions and Results – AC power line conducted emissions

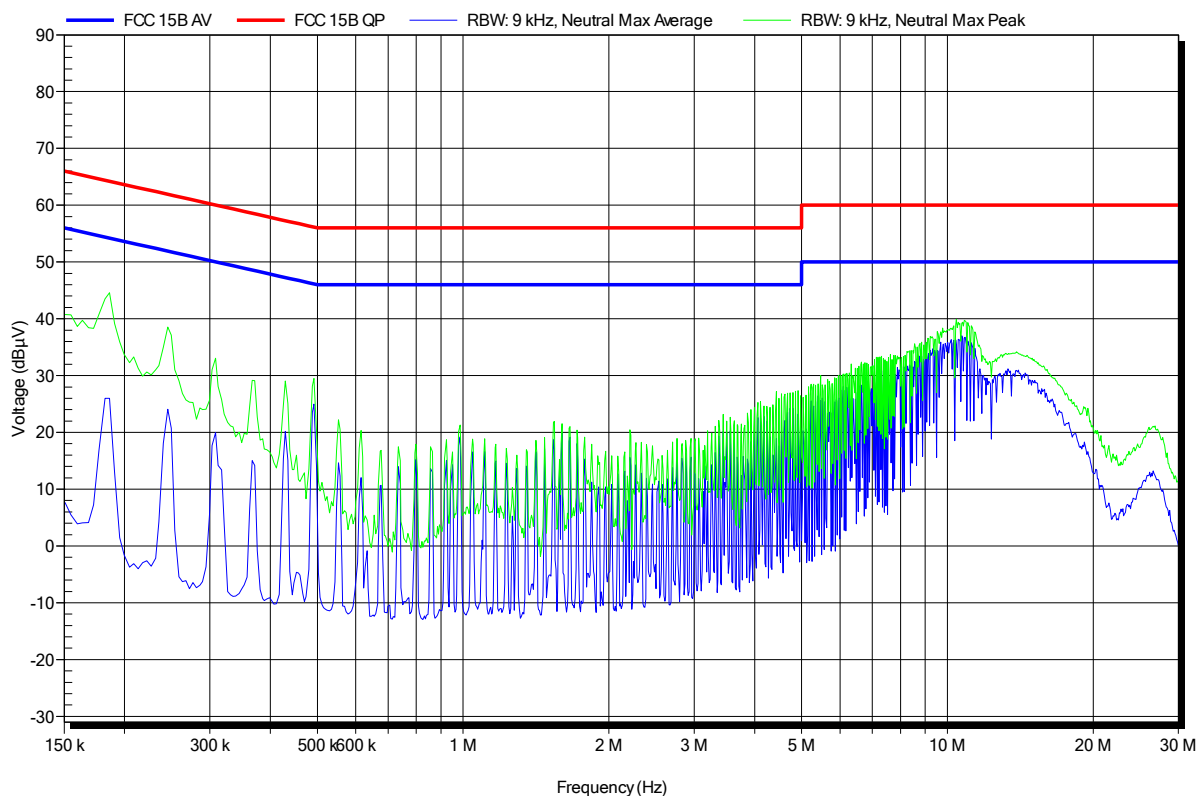
Conducted emissions acc. FCC 47 CFR 15.107 / IC RSS-Gen				Verdict: PASS	
Laboratory Parameters:		Required prior to the test		During the test	
Ambient Temperature		15 to 35 °C		25°C	
Relative Humidity		30 to 60 %		46%	
Test according referenced standards		Reference Method			
		ANSI C63.4			
Fully configured 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			
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.					

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:	

Index 13



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:

Index 14

