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FCC TEST REPORT

FCC 47 CFR Part 15C
Industry Canada RSS-210

Digital transmission systems operating within the 2400 – 2483.5 MHz band

Report Reference No.....:	G0M-1410-4214-TFC247BL-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.....:	Leica Geosystems AG
Address.....:	Heinrich Wild Strasse 9435 Heerbrugg SWITZERLAND
Test specification:	
Standard.....:	47 CFR Part 15C KDB Publication No. 558074 RSS-210, Issue 8, 2010-12 RSS-Gen, Issue 4, 2014-11 ANSI C63.4:2009
Test scope…….....:	complete Radio compliance test
Equipment under test (EUT):	
Product description	Bluetooth, WLAN and BLE Modul
Model No.	TiWi-BLE
Additional Model(s)	None
Brand Name(s)	Leica Geosystems
Hardware version	1.0
Firmware / Software version	4.0
	FCC-ID: RFD-BTWCO IC: 3177A-BTWCO
Test result	**Passed**

Possible test case verdicts:	
- neither assessed nor tested ..... :	N/N
- required by standard but not appl. to test object..... :	N/A
- required by standard but not tested..... :	N/T
- not required by standard for the test object ..... :	N/R
- test object does meet the requirement..... :	P (Pass)
- test object does not meet the requirement..... :	F (Fail)

Testing:		
Test Lab Temperature..... :	20 – 23 °C	
Test Lab Humidity ..... :	32 – 38 %	
Date of receipt of test item ..... :	2015-01-13	
Date (s) of performance of tests ..... :	2015-01-26 – 2015-03-17	
Compiled by ..... :	Wilfried Treffke	
Tested by (+ signature)..... : (Responsible for Test)	Wilfried Treffke	W. Treff .....
Approved by (+ signature) ..... :	Christian Weber	C. Weber .....
Date of issue ..... :	2015-05-12	
Total number of pages ..... :	92	

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
01	2015-05-12	Initial Release	

REPORT INDEX

1 Equipment (Test item) Description

Description	Bluetooth, WLAN and BLE Modul	
Model	TiWi-BLE	
Additional Model(s)	None	
Brand Name(s)	Leica Geosystems	
Serial number	None	
Hardware version	1.0	
Software / Firmware version	4.0	
FCC-ID	RFD-BTWCO	
IC	3177A-BTWCO	
Equipment type	Radio module	
Radio type	Transceiver	
Radio technology	Bluetooth 4.0 Low Energy	
Operating frequency range	2402 - 2480 MHz	
Assigned frequency band	2400 - 2483.5 MHz	
Main test frequencies	F_{LOW}	2402 MHz
	F_{MID}	2440 MHz
	F_{HIGH}	2480 MHz
Spreading	Frequency Hopping	
Modulations	GFSK	
Number of channels	40	
Channel spacing	2MHz	
Number of antennas	1	
Antenna	Type	Inverted - F antenna
	Model	BTFA-2450
	Manufacturer	INWAVE
	Gain	2.0 dBi (customer declaration)
Manufacturer	Leica Geosystems AG Heinrich Wild Strasse 9435 Heerbrugg SWITZERLAND	
Power supply	V_{NOM}	3.6 VDC
AC/DC-Adaptor	Model	MW 3R15GS
	Vendor	Stabi-Net
	Input	100-240 V / 50-60 Hz / 0.35A
	Output	6 VDC

1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	Laptop	Lenovo	T540p	Test mode software

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

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

1.5 Test Modes

Mode #	Description	
Transmit	General conditions:	EUT powered by laboratory power supply.
	Radio conditions:	Mode = standalone transmit Spreading = Hopping stopped (single hopping channel) Modulation = GFSK Data rate = 1 Mbps Bandwidth = 2 MHz Duty cycle = 100 % Power level = 15 (Test mode setting)
Receive	General conditions:	EUT powered by laboratory power supply.
	Radio conditions:	Mode = standalone receive (scan mode) Spreading = On Modulation = GFSK
AC-Powerline	General conditions:	EUT powered by commercial AC/DC-adaptor
	Radio conditions:	Mode = Transmit Spreading = On

1.6 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2014.1.15

Occupied Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

6dB Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Maximum peak conducted power					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Power spectral density					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Band edge compliance					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Conducted spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2014-02	2015-02

Radiated spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 1	EF00062	-	-
Spectrum Analyzer	R&S	FSIQ26	EF00242	2014-03	2015-03
Biconical Antenna	R&S	HK 116	EF00012	2013-02	2016-02
LPD Antenna	R&S	HL 223	EF00187	2014-03	2017-03
LPD Antenna	R&S	HL 025	EF00327	2013-02	2016-02

AC powerline conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2014-11	2016-11
EMI Test Receiver	R&S	ESCS 30	EF00295	2014-10	2015-10

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:

Reading on Analyzer (dBµV) + A.F. (dB) = Net field strength (dBµV/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:

Limit (dBµV/m) = 20*log (µV/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 15C, IC RSS-210				
Product Specific Standard Section	**Requirement – Test**	**Reference Method**	**Result**	**Remarks**
RSS-Gen 6.6	Occupied Bandwidth	RSS-Gen 6.6	N/R	Informational only
FCC § 15.247(a)(2) IC RSS-210 § A8.2	6dB Bandwidth	KDB Publication No. 558074	PASS	
FCC § 15.247(b)(3) IC RSS-210 § A8.4	Maximum peak conducted power	KDB Publication No. 558074	PASS	
FCC § 15.247(e) IC RSS-210 § A8.2	Power spectral density	KDB Publication No. 558074	PASS	
47 CFR 15.207 RSS-Gen 8.8	AC power line conducted emissions	KDB Publication No. 558074 / ANSI C63.4	PASS	
FCC § 15.247(d) IC RSS-210 § A8.5	Band edge compliance	KDB Publication No. 558074	PASS	
FCC § 15.247(d) IC RSS-210 § A8.5	Conducted spurious emissions	KDB Publication No. 558074	PASS	
FCC § 15.247(d) FCC § 15.209 IC RSS-210 A8.5 IC RSS-Gen 4.9 IC RSS-Gen 7.2.5	Transmitter radiated spurious emissions	KDB Publication No. 558074 / ANSI C 63.4	PASS	
IC RSS-Gen 7.1	Receiver radiated spurious emissions	ANSI C 63.4	PASS	
Remarks:				

3 Test Conditions and Results

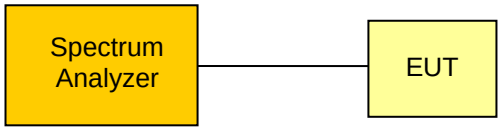
3.1 Test Conditions and Results – Occupied Bandwidth

Occupied Bandwidth acc. to IC RSS-Gen	**Verdict: PASS**
Test according to measurement reference	Reference Method
	RSS-Gen 4.6.1
Test frequency range	Tested frequencies
	F_{LOW} / F_{MID} / F_{HIGH}

Limits

None (Informational only)

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Span set to at least twice the emission spectrum
3. Resolution bandwidth set to 1 % of span
4. Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function

Test results

Channel	Frequency [MHz]	Mode	Occupied Bandwidth [kHz]
F_{LOW}	2402	Transmit	1023
F_{MID}	2440	Transmit	1053
F_{HIGH}	2480	Transmit	1043

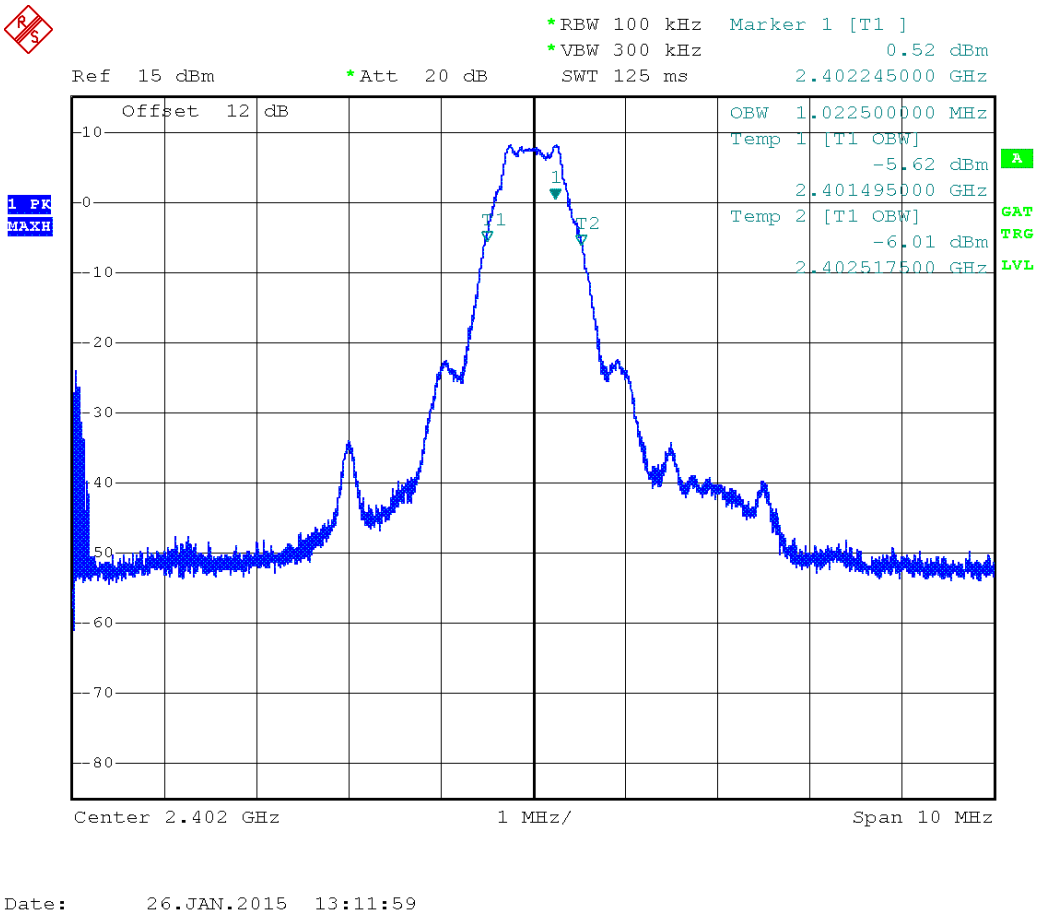
Comments:

Occupied Bandwidth – F_{LOW}

Occupied Bandwidth acc. to RSS-Gen

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BT-LE, 2402 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	A spectrum analyzer with an integrated 99% power bandwidth function is used
Note 2:	conducted measurement

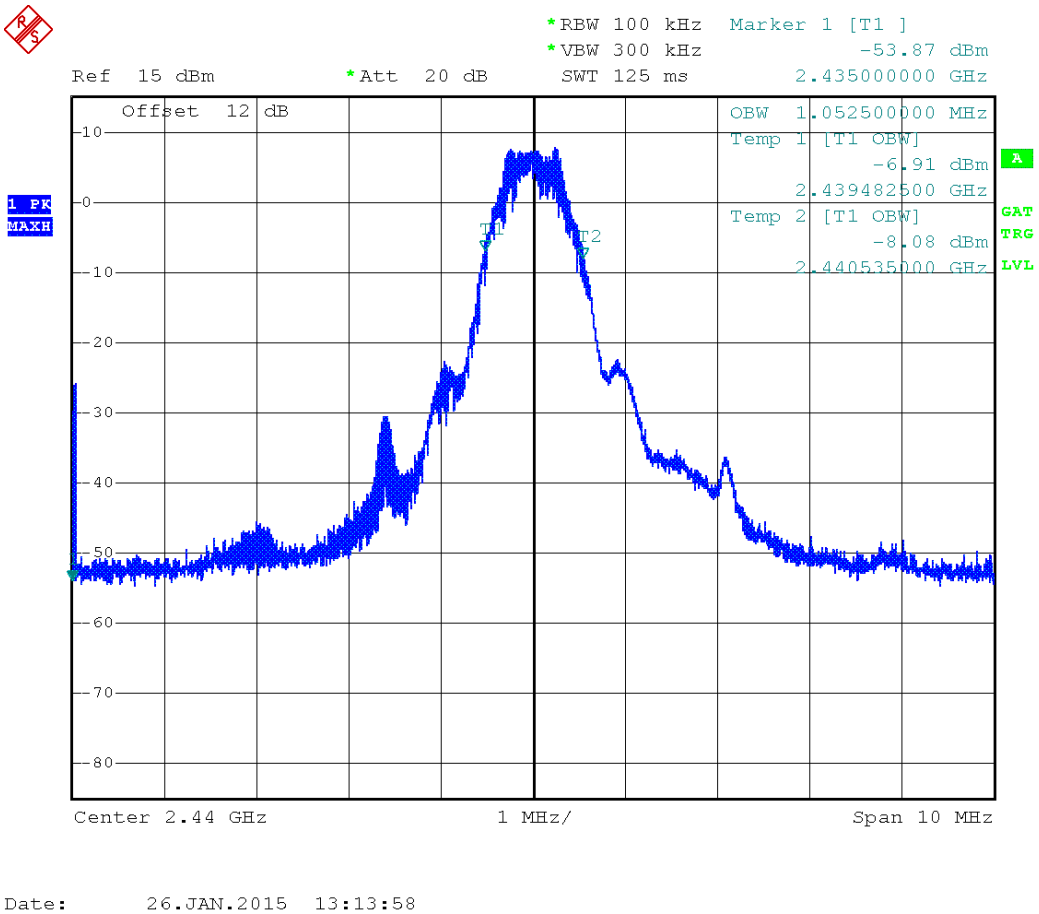


Occupied Bandwidth – F_{MID}

Occupied Bandwidth acc. to RSS-Gen

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BT-LE, 2440 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	A spectrum analyzer with an integrated 99% power bandwidth function is used
Note 2:	conducted measurement

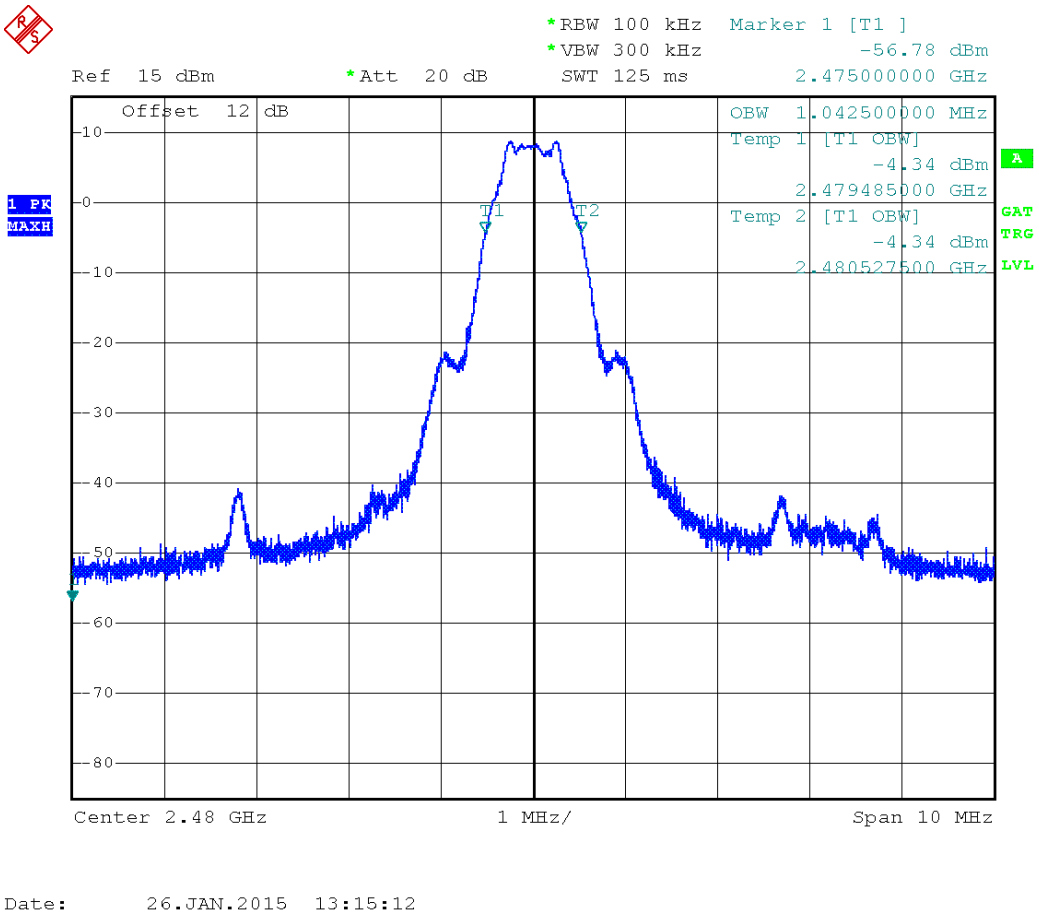


Occupied Bandwidth – F_{HIGH}

Occupied Bandwidth acc. to RSS-Gen

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BT-LE, 2480 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	A spectrum analyzer with an integrated 99% power bandwidth function is used
Note 2:	conducted measurement

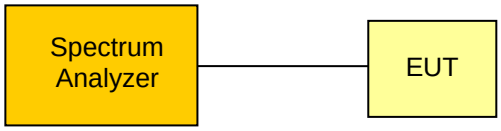


3.2 Test Conditions and Results – 6 dB Bandwidth

6dB Bandwidth acc. to FCC 15.247 / IC RSS-210	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(a)(2) / IC RSS-210 A8.2
Test according to measurement reference	Reference Method
	FCC KDB Publication No. 558074
Test frequency range	Tested frequencies
	F_{LOW} / F_{MID} / F_{HIGH}

Limits
Limit
≥ 500kHz

Test setup



Test procedure

1. EUT set to test mode
2. Span set to at least twice the emission spectrum
3. Detector set to peak and max hold and RBW is set to 100 kHz
4. Envelope peak value of emission spectrum is selected
5. Marker on envelope of spectrum is set to level of -6 dB to the left of the peak
6. Marker on envelope of spectrum is set to level of -6 dB to the right of the peak
7. 6 dB Bandwidth is determined by marker frequency separation

Test results

Channel	Frequency [MHz]	Mode	6 dB Bandwidth [kHz]	Limit [kHz]	Result
F_{LOW}	2402	Transmit	697.2	500	PASS
F_{MID}	2440	Transmit	688.8	500	PASS
F_{HIGH}	2480	Transmit	710.4	500	PASS

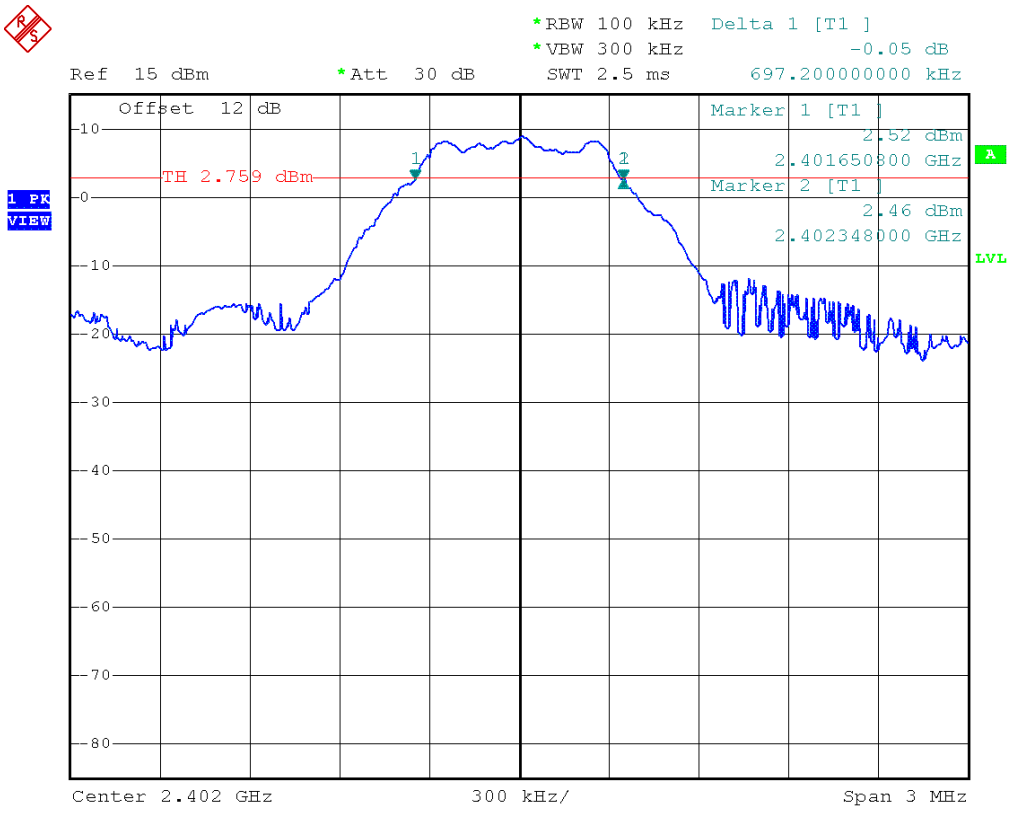
Comments:

6 dB Bandwidth – F_{LOW}

Minimum 6 dB Bandwidth acc. to FCC 15.247

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BTLE, 2402 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	Procedure 8.1 DTS (558074 D01 Meas Guidance)
Note 2:	Minimum 6 dB Bandwidth conducted



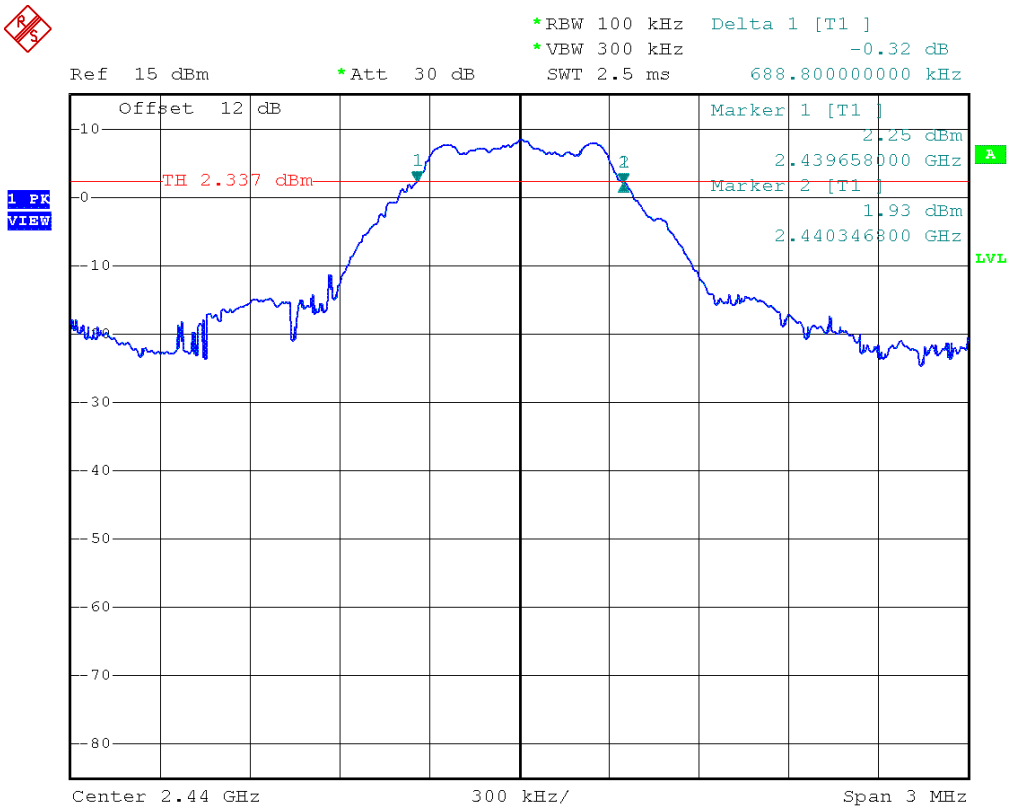
Comment: 6 dB bandwidth: 697.2 KHz > 500 KHz; verdict: PASS
Date: 26.JAN.2015 13:17:30

6 dB Bandwidth – F_{MID}

Minimum 6 dB Bandwidth acc. to FCC 15.247

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BTLE, 2440 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	Procedure 8.1 DTS (558074 D01 Meas Guidance)
Note 2:	Minimum 6 dB Bandwidth conducted



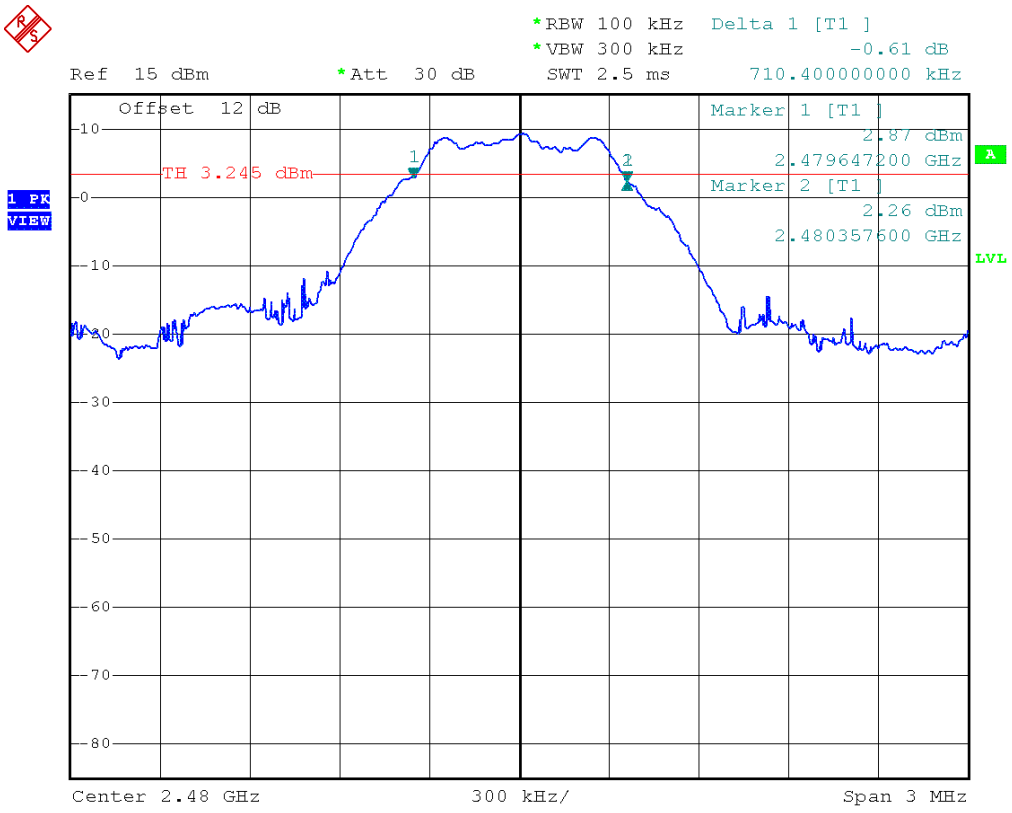
Comment: 6 dB bandwidth: 688.8 KHz > 500 KHz; verdict: PASS
Date: 26.JAN.2015 13:18:41

6 dB Bandwidth – F_{HIGH}

Minimum 6 dB Bandwidth acc. to FCC 15.247

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BTLE, 2480 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	Procedure 8.1 DTS (558074 D01 Meas Guidance)
Note 2:	Minimum 6 dB Bandwidth conducted



Comment: 6 dB bandwidth: 710.4 KHz > 500 KHz; verdict: PASS
Date: 26.JAN.2015 13:19:52

3.3 Test Conditions and Results – Maximum peak conducted power

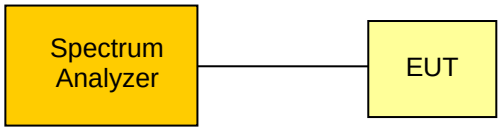
Maximum peak conducted power acc. to FCC 15.247 / IC RSS-210	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(b)(3) / IC RSS-210 A8.4
Test according to measurement reference	Reference Method
	FCC KDB Publication No. 558074
Test frequency range	Tested frequencies
	F_{LOW} / F_{MID} / F_{HIGH}
Measurement mode	Peak
Maximum antenna gain	2.2 dBi ⇒ Limit correction = 0 dB

Limits

1 W (30 dBm)

The conducted output power limit specified above is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in the table, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Center frequency set to test channel center frequency
3. Span set to twice the 20 dB bandwidth and detector to peak and max hold
4. Resolution bandwidth is set to 3 MHz
5. Peak conducted power is determined from peak of spectrum envelope

Test results

Channel	Frequency [MHz]	Voltage	Mode	Peak power [dbm]	Peak power [W]	Limit [dBm]	Margin [dB]
F_{LOW}	2402	V_{nom} = 3.3V	Transmit	9.3	0.01	30	-20.70
F_{MID}	2440	V_{nom} = 3.3V	Transmit	8.7	0.01	30	-21.30
F_{HIGH}	2480	V_{nom} = 3.3V	Transmit	9.5	0.01	30	-20.50

Comment:

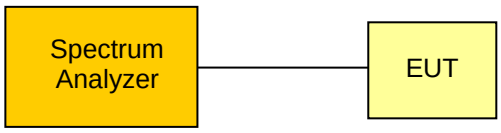
3.4 Test Conditions and Results – Power spectral density

Power spectral density acc. to FCC 15.247 / IC RSS-210	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(e) / IC RSS-210 A8.2
Test according to measurement reference	Reference Method
	FCC KDB Publication No. 558074
Test frequency range	Tested frequencies
	F_{LOW} / F_{MID} / F_{HIGH}
Measurement mode	Peak

Limits

8 dBm / 3 kHz

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Center frequency set to test channel center frequency
3. Span is set large enough to capture maximum emissions in passband, RBW is set to 3kHz
4. Peak power density is determined from peak emission of envelope

Test results

Channel	Frequency [MHz]	Test mode	Peak frequency [MHz]	Peak power density [dBm]	Limit [dBm/3kHz]	Margin [dB]
F_{LOW}	2402	Transmit	2401.97	-0.86	8.0	-08.86
F_{MID}	2442	Transmit	2440.00	-0.93	8.0	-08.93
F_{HIGH}	2480	Transmit	2479.90	-0.55	8.0	-08.55

Comments: Measurement was performed with RBW = 10 kHz

3.5 Test Conditions and Results – AC power line conducted emissions

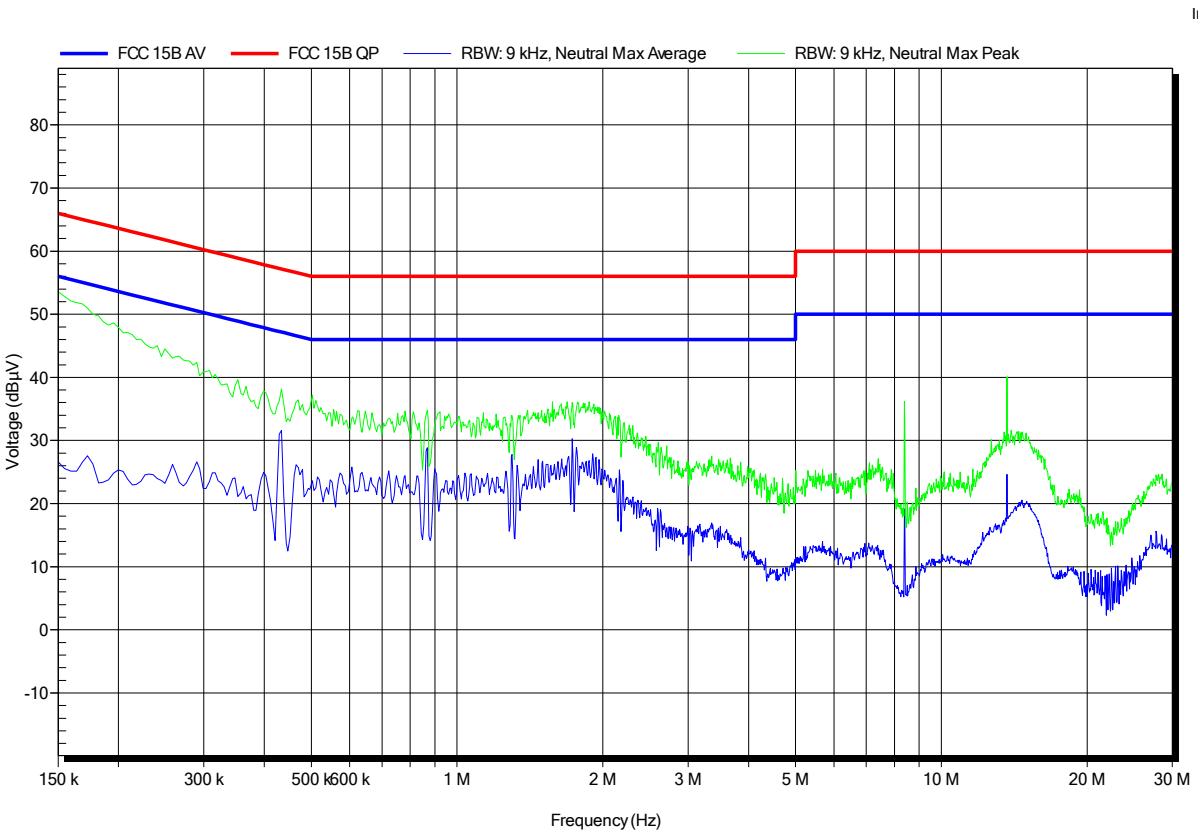
Power line conducted emissions acc. to FCC 47 CFR 15.207 / IC RSS-Gen				**Verdict: PASS**
Test according referenced standards	Reference Method			
	ANSI C63.4			
Fully configured sample scanned over the following frequency range	Frequency range			
	0.15 MHz to 30 MHz			
Points of Application	Application Interface			
AC Mains	LISN			
EUT test mode	AC power line			
Limits and results				
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.				

Conducted Emissions

EMI voltage test in the ac-mains according to FCC 15B

Project number: G0M-1410-4214

Manufacturer:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Klein
Test Conditions:	Tnom: 23°C, Unom: 3.6VDC via AC/DC-adaptor
LISN:	ESH2-Z5 N
Mode:	constant TX
Test Date:	2015-03-17
Note:	

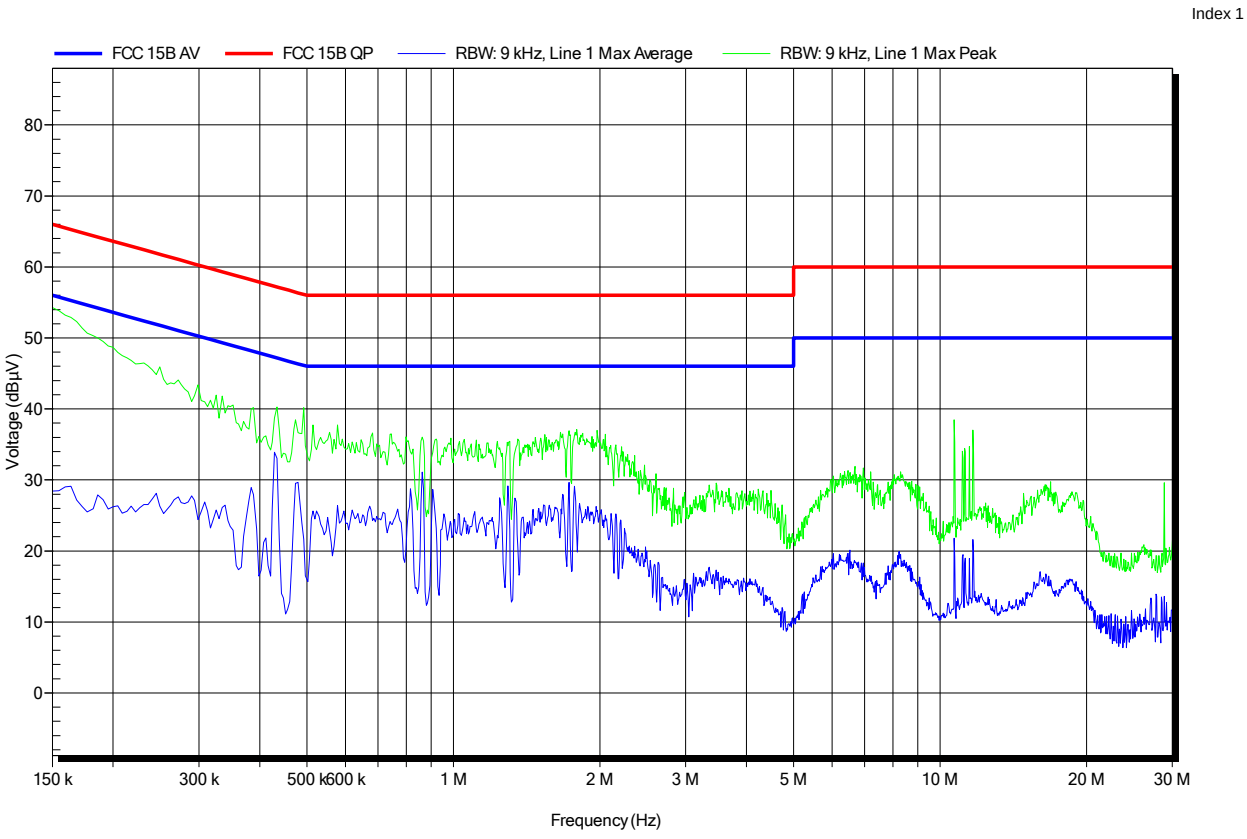


Conducted Emissions

EMI voltage test in the ac-mains according to FCC 15B

Project number: G0M-1410-4214

Manufacturer:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Klein
Test Conditions:	Tnom: 23°C, Unom: 3.6VDC via AC/DC-adaptor
LISN:	ESH2-Z5 L
Mode:	constant TX
Test Date:	2015-03-17
Note:	



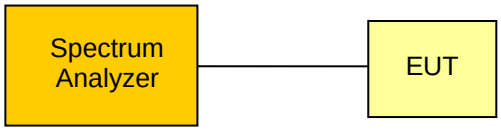
3.6 Test Conditions and Results – Band edge compliance

Band-edge compliance acc. to FCC 15.247 / IC RSS-210	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(d) / IC RSS-210 A8.5
Test according to measurement reference	Reference Method
	FCC KDB Publication No. 558074
Test frequency range	Tested frequencies
	F_{LOW} / F_{HIGH}
Measurement mode	Peak

Limits

Limit	Condition
≤ -20 dB / 100 kHz	Peak power measurement detector = Peak
≤ -30 dB / 100 kHz	Peak power measurement detector = RMS

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Span set around lower band edge and detector is set to peak and max hold
3. Resolution bandwidth is set to 100 kHz
4. Markers are set to peak emission levels within frequency band and outside frequency band
5. Band edge attenuation is determined from level difference

Test results

Channel	Frequency [MHz]	Mode	Level [dBc]	Limit [dBc]	Margin [dB]
F_{LOW}	2402	Transmit	-24.21	-20	-04.21
F_{HIGH}	2480	Transmit	-31.63	-20	-11.63

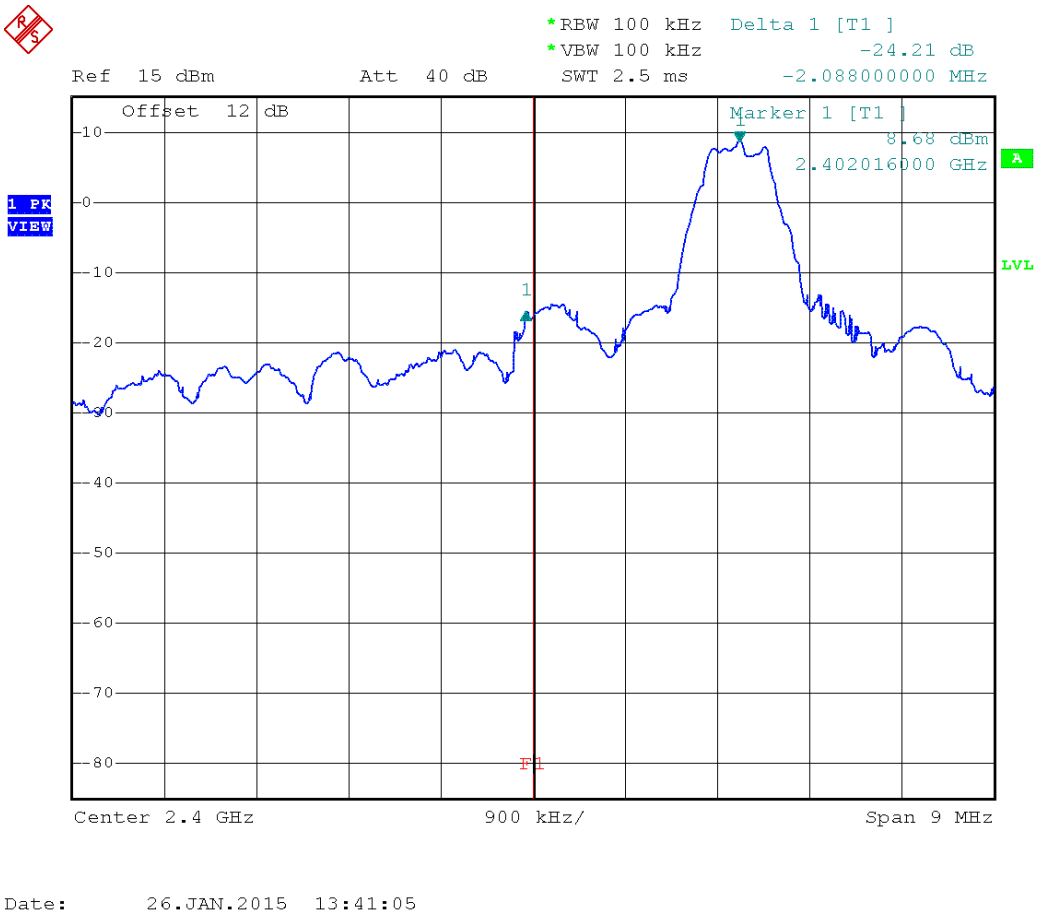
Comments:

Band-edge compliance - F_{LOW}

Band-edge compliance acc. to FCC 15.247

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BTLE, GFSK, 2402 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	20 dB down method (558074 D01 Meas Guidance)
Note 2:	lower Band-edge, conducted measurement

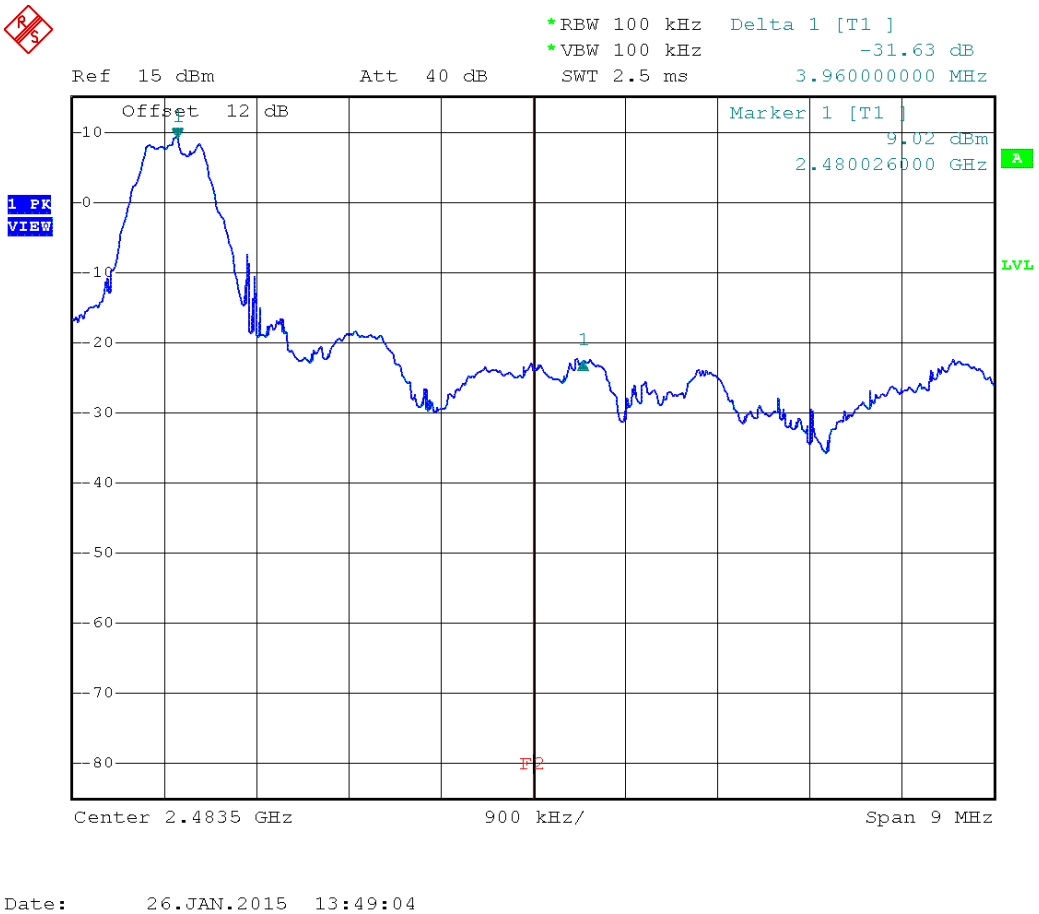


Band-edge compliance – F_{HIGH}

Band-edge compliance acc. to FCC 15.247

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BTLE, GFSK, 2480 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	20 dB down method (558074 D01 Meas Guidance)
Note 2:	upper Band-edge, conducted measurement



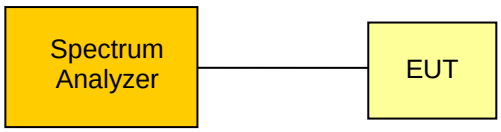
3.7 Test Conditions and Results – Conducted spurious emissions

Conducted spurious emissions acc. to FCC 15.247 / IC RSS-210	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(d) / IC RSS-210 A8.5
Test according to measurement reference	Reference Method
	FCC KDB Publication No. 558074
Test frequency range	Tested frequencies
	10 MHz – 10th Harmonic
Measurement mode	Peak

Limits

Limit	Condition
≤ -20 dB / 100 kHz	Peak power measurement detector = Peak
≤ -30 dB /100 kHz	Peak power measurement detector = RMS

Test setup



Test procedure

1. EUT set to test mode (Communication tester is used if needed)
2. Span it set according to measurement range
3. Resolution bandwidth is set to 100 kHz and detector to peak and max hold
4. Markers are set to peak emission levels within frequency band
5. Emission level is determined by second marker on emission peak
6. Attenuation is determined from level difference

Test results

Channel	Frequency [MHz]	Mode	Emission [MHz]	Emission Level [dbm]	Peak power [dBm]	Limit [dBm]	Margin [dB]
F_{LOW}	2402	Transmit	4805	-36.34	8.0	-12.0	-24.34
F_{MID}	2440	Transmit	4889	-36.91	7.5	-12.5	-24.41
F_{HIGH}	2480	Transmit	4959	-37.21	7.8	-12.2	-25.01

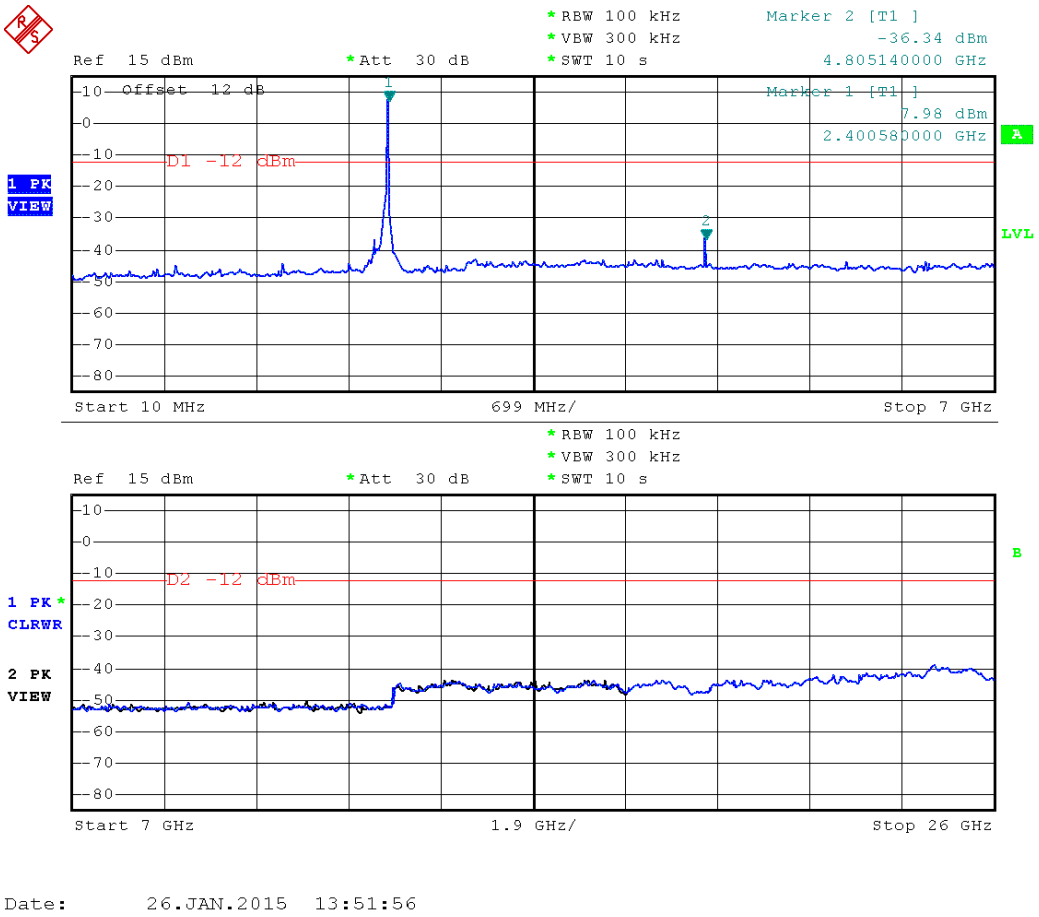
Comments:

Conducted spurious emissions – F_{LOW}

Spurious Emissions acc. to FCC 15.247

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BTLE, 2402 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	Spurious in non-restricted frequency bands (558074 D01 Meas Guidance)
Note 2:	conducted measurement

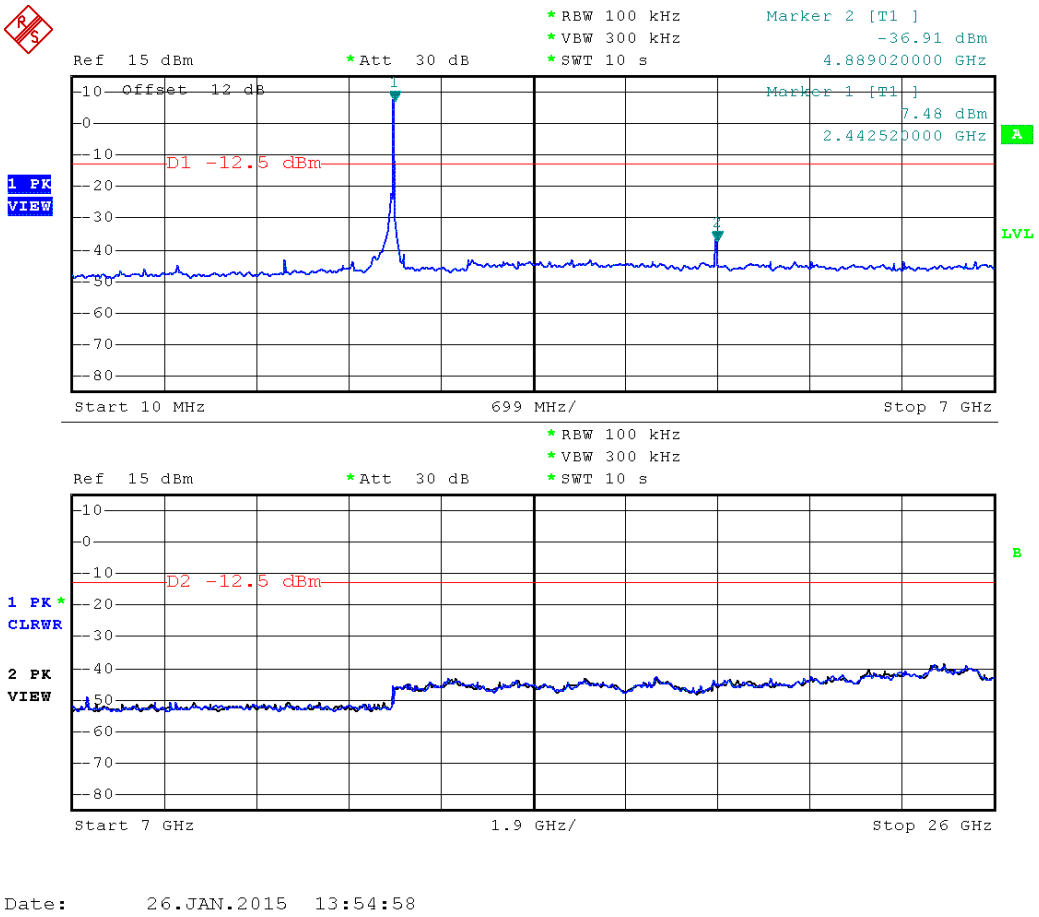


Conducted spurious emissions – F_{MID}

Spurious Emissions acc. to FCC 15.247

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BTLE, 2440 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	Spurious in non-restricted frequency bands (558074 D01 Meas Guidance)
Note 2:	conducted measurement

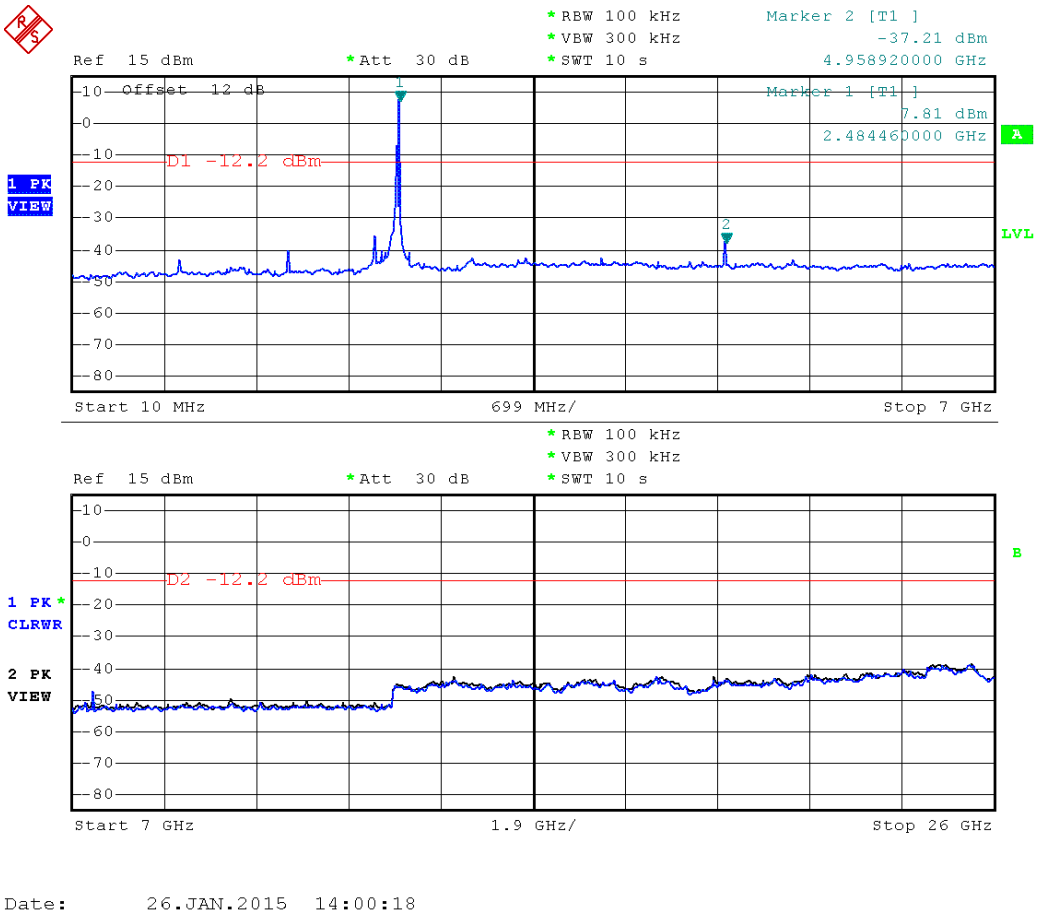


Conducted spurious emissions – F_{HIGH}

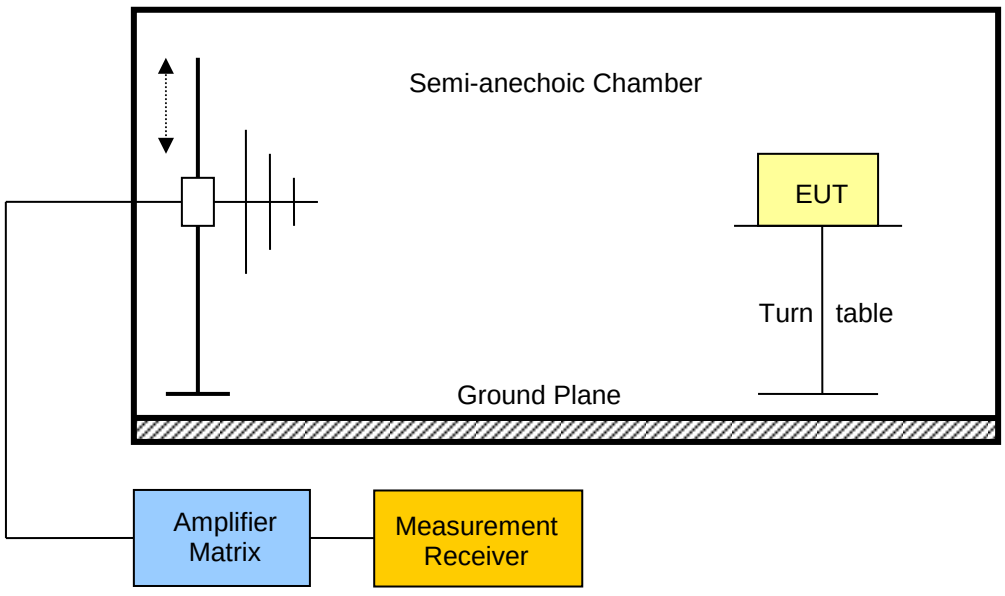
Spurious Emissions acc. to FCC 15.247

Project Number: G0M-1410-4214

Applicant:	Leica Geosystems AG
EUT Name:	Bluetooth, WLAN and BLE Module
Model:	TiWi-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Christian Weber
Test Conditions:	Tnom / Vnom
Mode:	Tx, BTLE, 2480 MHz, modulated
Test Date:	2015-01-26
Verdict:	NONE (INFORMATION ONLY)
Note 1:	Spurious in non-restricted frequency bands (558074 D01 Meas Guidance)
Note 2:	conducted measurement



3.8 Test Conditions and Results – Transmitter radiated emissions

Transmitter radiated emissions acc. to FCC 47 CFR 15.247 / IC RSS-210				**Verdict: PASS**
Test according referenced standards		Reference Method		
		FCC 15.247(d) / IC RSS-210 A8.5		
Test according to measurement reference		Reference Method		
		FCC KDB Publication No. 558074 / ANSI C63.4		
Test frequency range		Tested frequencies		
		30 MHz – 10th Harmonic		
Limits				
Frequency range [MHz]	Detector	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). When average radiated emission measurements are specified, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.				
Test setup				
				

Test procedure
1. EUT set to test mode (Communication tester is used if needed) 2. Span it set according to measurement range 3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz 4. Markers are set to peak emission levels within restricted bands

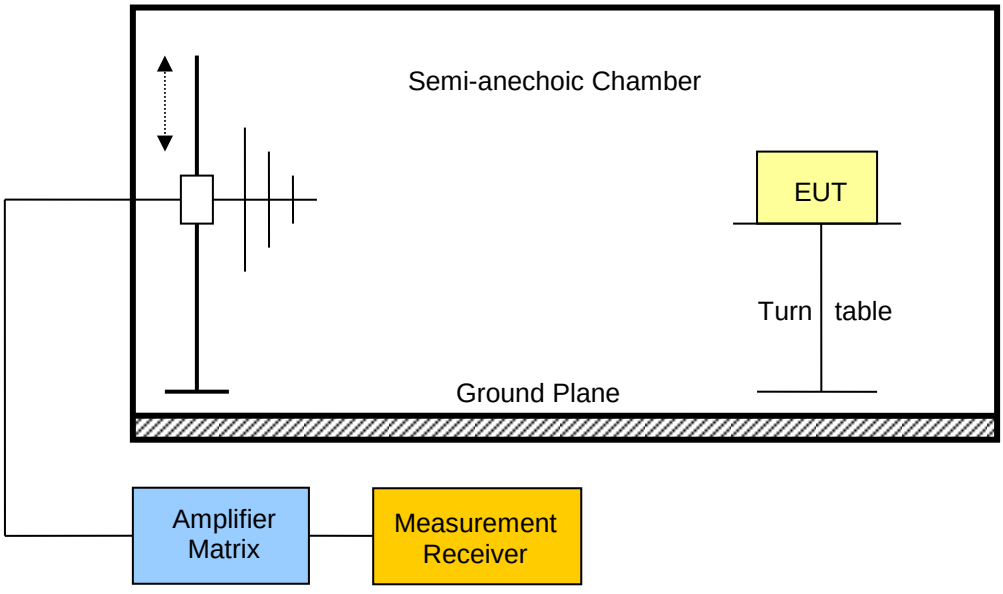
Test results

Channel	Frequency [MHz]	Mode	Emission [MHz]	Level [dbµV/m]	Det.	Pol.	Limit [dbµV/m]	Limit dist. [m]*	Margin [dB]
F_{LOW}	2402	Transmit	2363	47.68	pk	hor	74.00	3	-26.32
F_{LOW}	2402	Transmit	2363	40.28	RMS	hor	54.00	3	-13.72
F_{LOW}	2402	Transmit	2363	46.87	pk	ver	74.00	3	-27.13
F_{LOW}	2402	Transmit	2363	40.02	RMS	ver	54.00	3	-13.98
F_{LOW}	2402	Transmit	2368	67.23	pk	ver	74.00	3	-06.77
F_{LOW}	2402	Transmit	2368	30.80	RMS	ver	54.00	3	-23.20
F_{LOW}	2402	Transmit	2400	80.05	pk	hor	95.00	3	-14.95
F_{LOW}	2402	Transmit	2400	81.02	pk	ver	95.00	3	-13.98
F_{LOW}	2402	Transmit	4000	36.73	pk	hor	74.00	3	-37.27
F_{LOW}	2402	Transmit	4000	36.38	pk	ver	74.00	3	-37.62
F_{LOW}	2402	Transmit	4800	46.74	pk	hor	74.00	3	-27.26
F_{LOW}	2402	Transmit	4800	51.53	pk	ver	74.00	3	-22.47
F_{LOW}	2402	Transmit	17928	47.53	pk	ver	74.00	3	-26.47
F_{LOW}	2402	Transmit	17976	47.68	pk	hor	74.00	3	-26.32
F_{MID}	2440	Transmit	2383	59.12	pk	ver	74.00	3	-14.88
F_{MID}	2440	Transmit	2844.4	41.16	pk	hor	74.00	3	-32.84
F_{MID}	2440	Transmit	3866.5	39.38	pk	hor	74.00	3	-34.62
F_{MID}	2440	Transmit	3878.7	39.62	pk	hor	74.00	3	-34.38
F_{MID}	2440	Transmit	3993.9	39.39	pk	hor	74.00	3	-34.61
F_{MID}	2440	Transmit	4064	38.00	pk	hor	74.00	3	-36.00
F_{MID}	2440	Transmit	4880	49.00	pk	hor	74.00	3	-25.00
F_{MID}	2440	Transmit	4881	53.15	pk	ver	74.00	3	-20.85
F_{MID}	2440	Transmit	4881	51.68	avg	ver	54.00	3	-02.32
F_{MID}	2440	Transmit	17928	47.81	pk	hor	74.00	3	-26.19
F_{MID}	2440	Transmit	17976	47.14	pk	ver	74.00	3	-26.86
F_{MID}	2440	Transmit	22148	43.87	pk	hor	74.00	3	-30.13
F_{MID}	2440	Transmit	23066	43.63	pk	ver	74.00	3	-30.37
F_{HIGH}	2480	Transmit	2484.6	51.58	pk	hor	74.00	3	-22.42
F_{HIGH}	2480	Transmit	2484.6	37.18	RMS	hor	54.00	3	-16.82

F_{HIGH}	2480	Transmit	2487.4	49.76	pk	hor	74.00	3	-24.24
F_{HIGH}	2480	Transmit	2487.4	34.66	RMS	hor	54.00	3	-19.34
F_{HIGH}	2480	Transmit	2490.9	46.96	pk	hor	74.00	3	-27.04
F_{HIGH}	2480	Transmit	2490.9	31.56	RMS	hor	54.00	3	-22.44
F_{HIGH}	2480	Transmit	2494	42.37	pk	hor	74.00	3	-31.63
F_{HIGH}	2480	Transmit	2494	28.21	RMS	hor	54.00	3	-25.79
F_{HIGH}	2480	Transmit	4956	54.81	pk	hor	74.00	3	-19.19
F_{HIGH}	2480	Transmit	4956	53.43	avg	hor	54.00	3	-00.57
F_{HIGH}	2480	Transmit	4956	52.38	pk	ver	74.00	3	-21.62
F_{HIGH}	2480	Transmit	4956	50.30	avg	ver	54.00	3	-03.70
Comments:									

3.9 Test Conditions and Results – Receiver radiated emissions

Receiver radiated emissions acc. to IC RSS-210				**Verdict: PASS**
Test according referenced standards	Reference Method			
	IC RSS-210 A8.5			
Test according to measurement reference	Reference Method			
	ANSI C63.4			
Test frequency range	Tested frequencies			
	30 MHz – 3th Harmonic			
EUT test mode	Receive			
Limits				
Frequency range [MHz]	Detector	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
Test setup				



Test procedure
1. EUT set to receive mode (Communication tester is used if needed) 2. Span it set according to measurement range 3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz 4. Markers are set to peak emission levels

Test results

Channel	Frequency [MHz]	Emission [MHz]	Emission Level [dBµV/m]	Pol.	Det.	Limit [dBµV/m]	Margin [dBµV/m]
F_{MID}	2440	1588	42.88	ver	pk	53.98	-11.1 dB
F_{MID}	2440	1594	46.55	ver	pk	53.98	-7.43 dB
F_{MID}	2440	1786	43.65	ver	pk	53.98	-10.33 dB
F_{MID}	2440	1990	45.52	ver	pk	53.98	-8.46 dB
F_{MID}	2440	2392	44.11	ver	pk	53.98	-9.87 dB

Comments:

ANNEX A Transmitter radiated spurious emissions

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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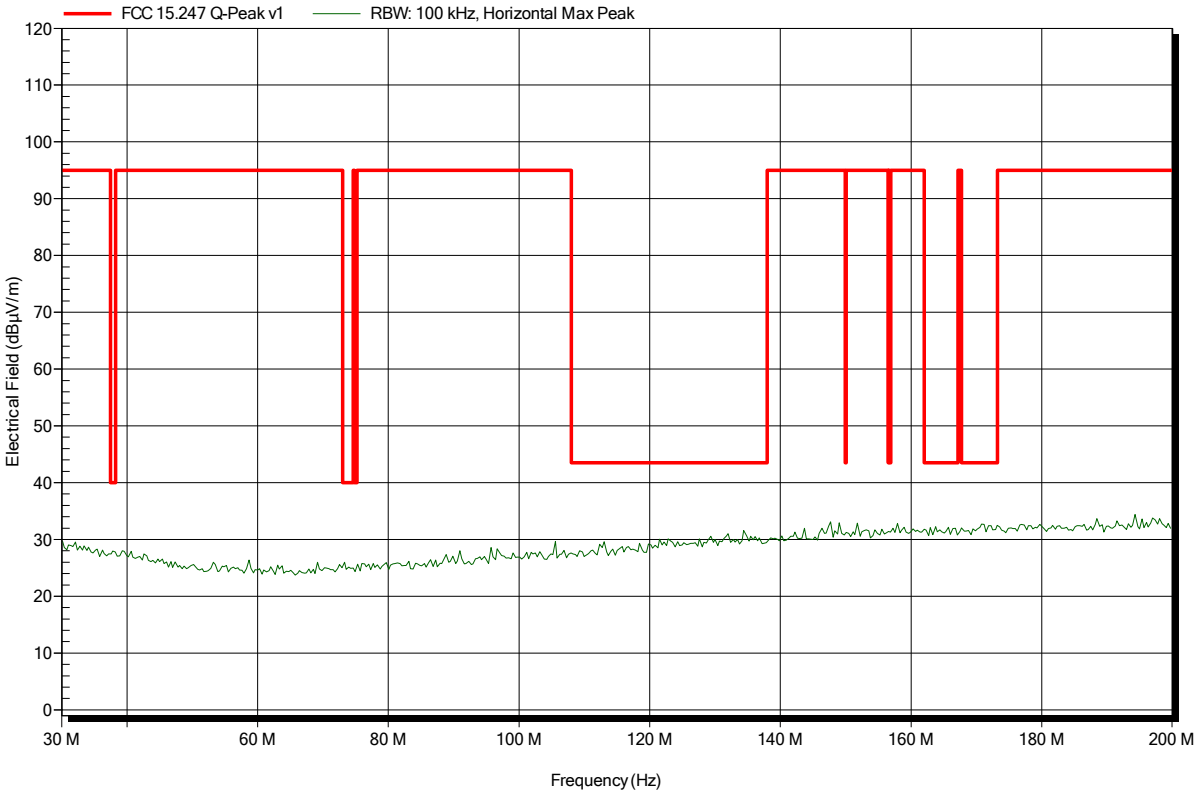

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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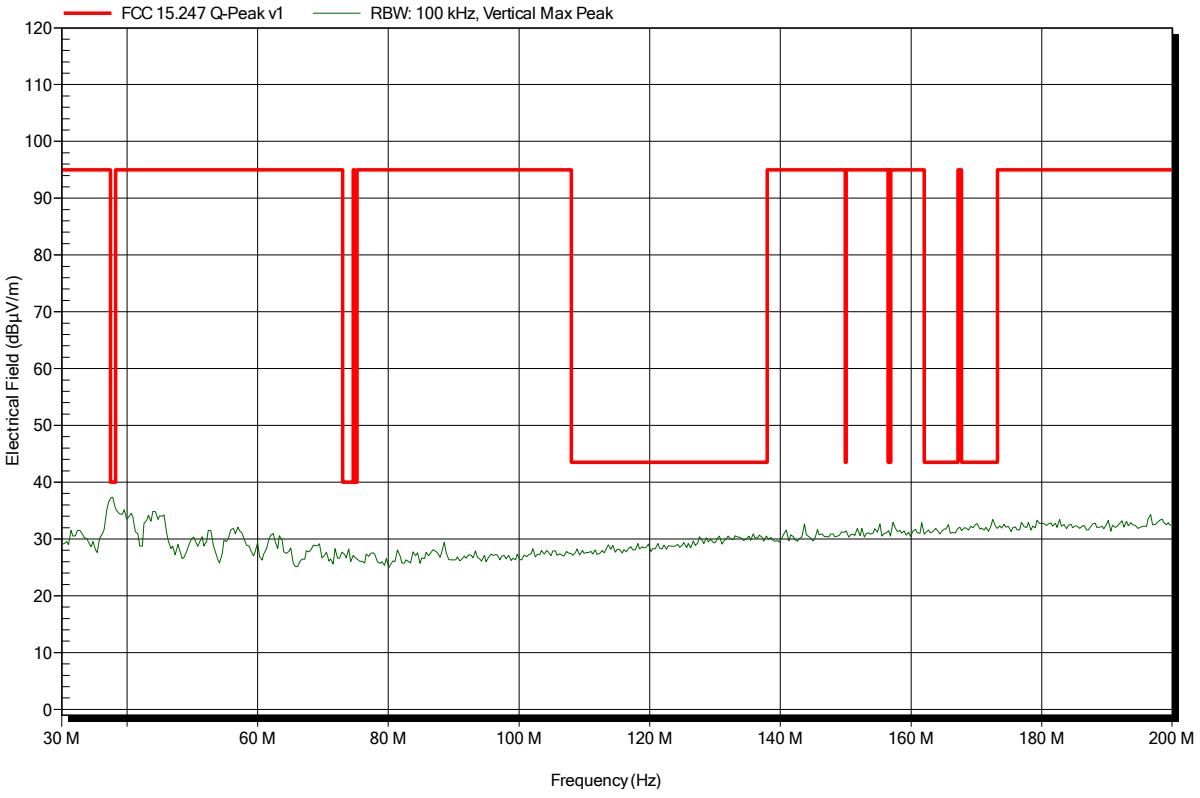

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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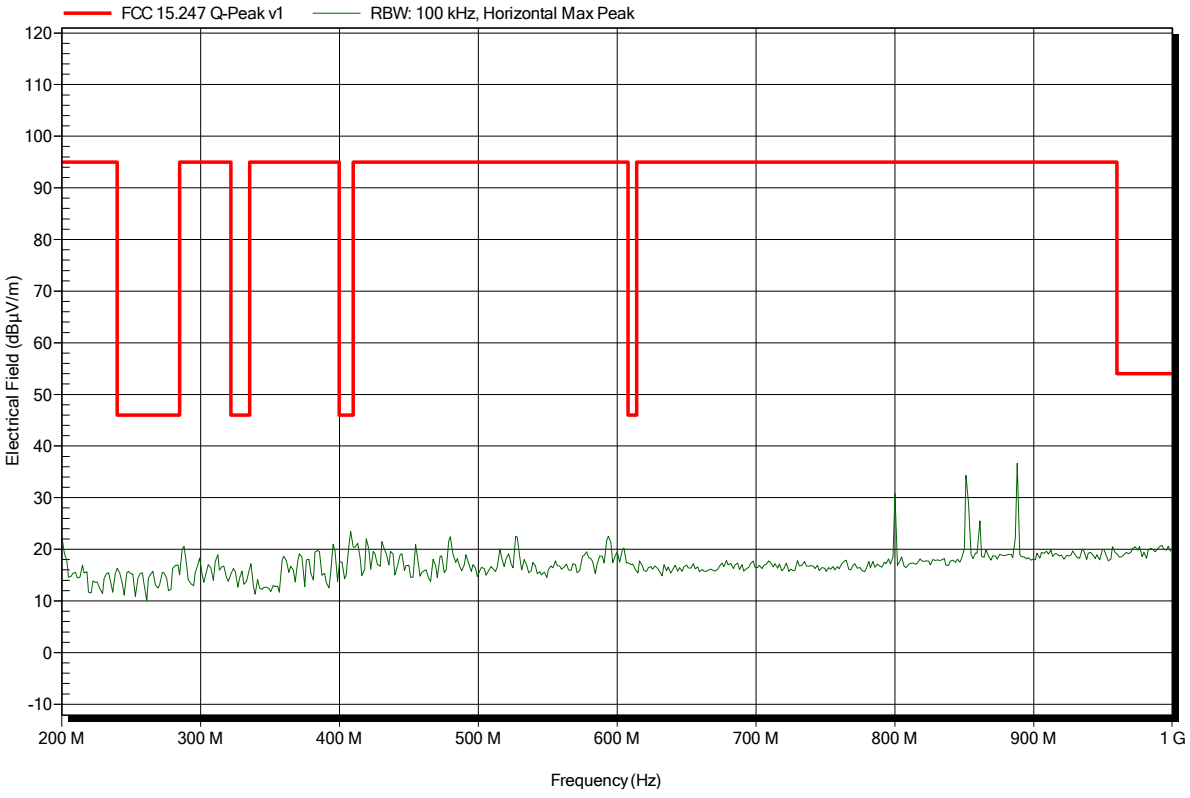

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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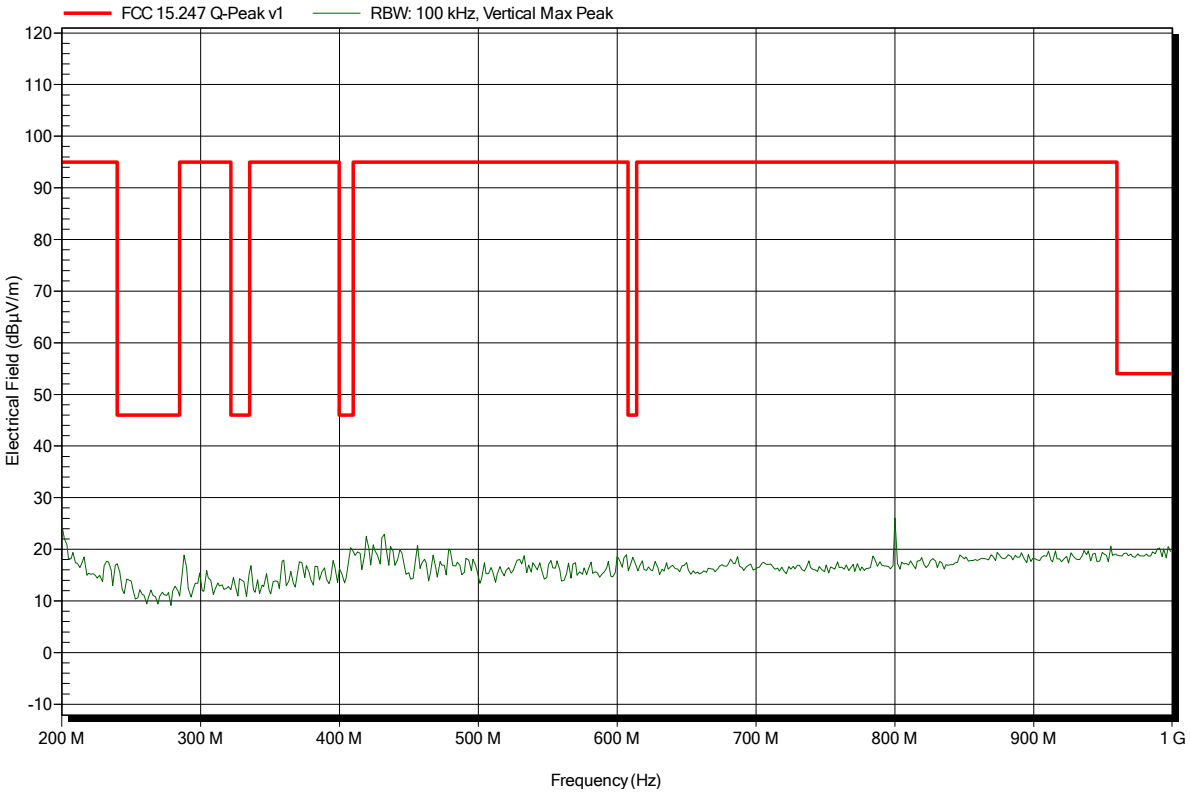

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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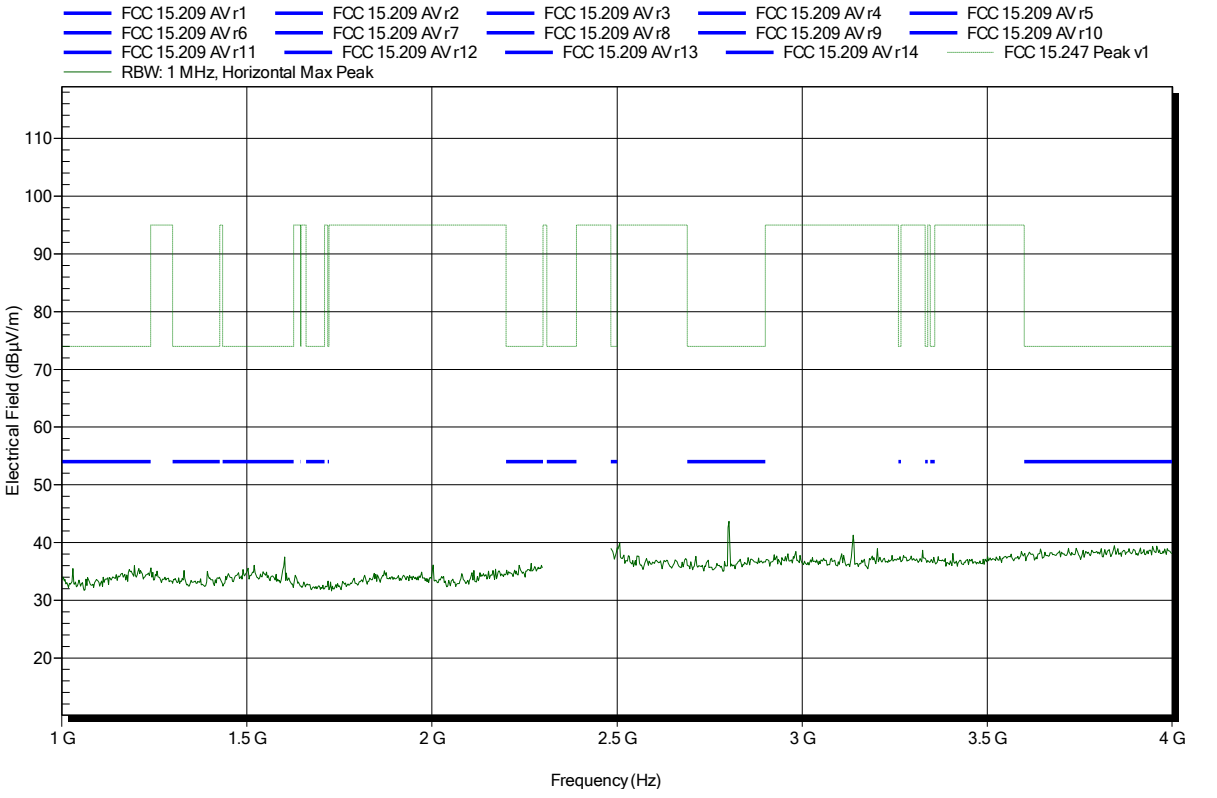

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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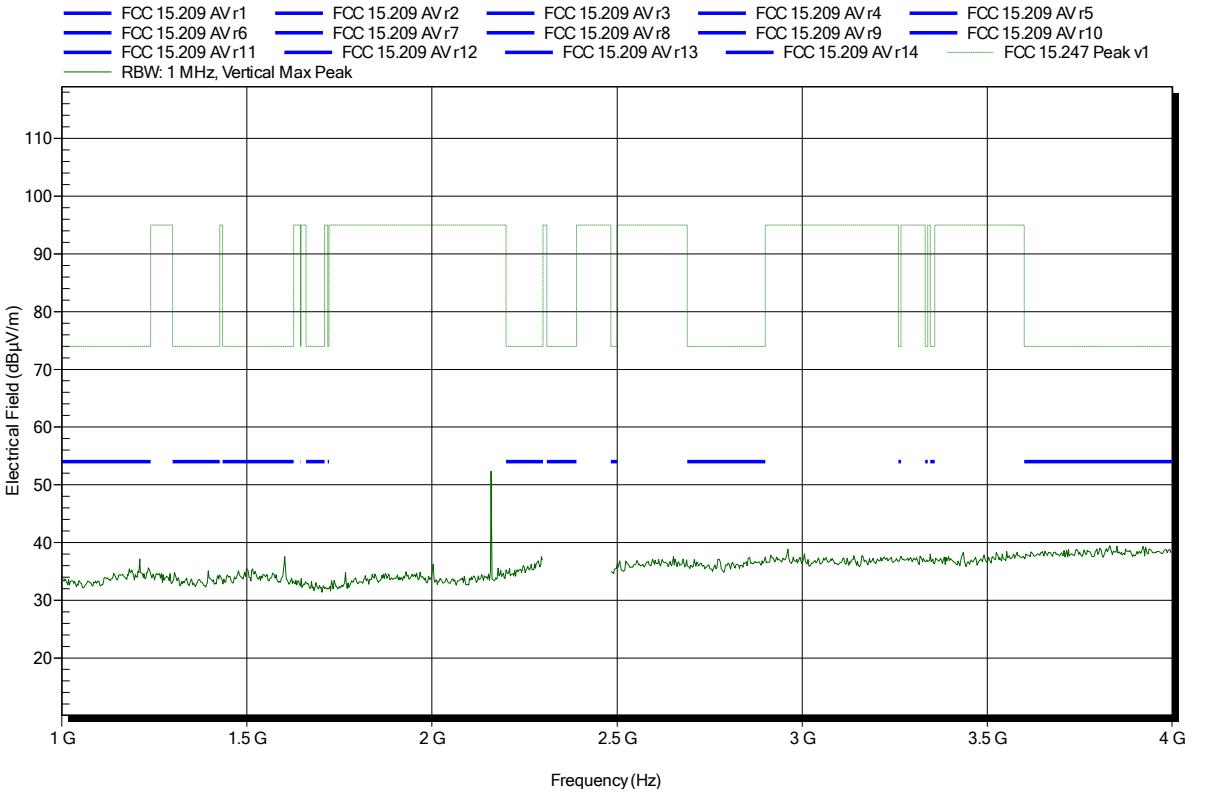

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	lower bandedge

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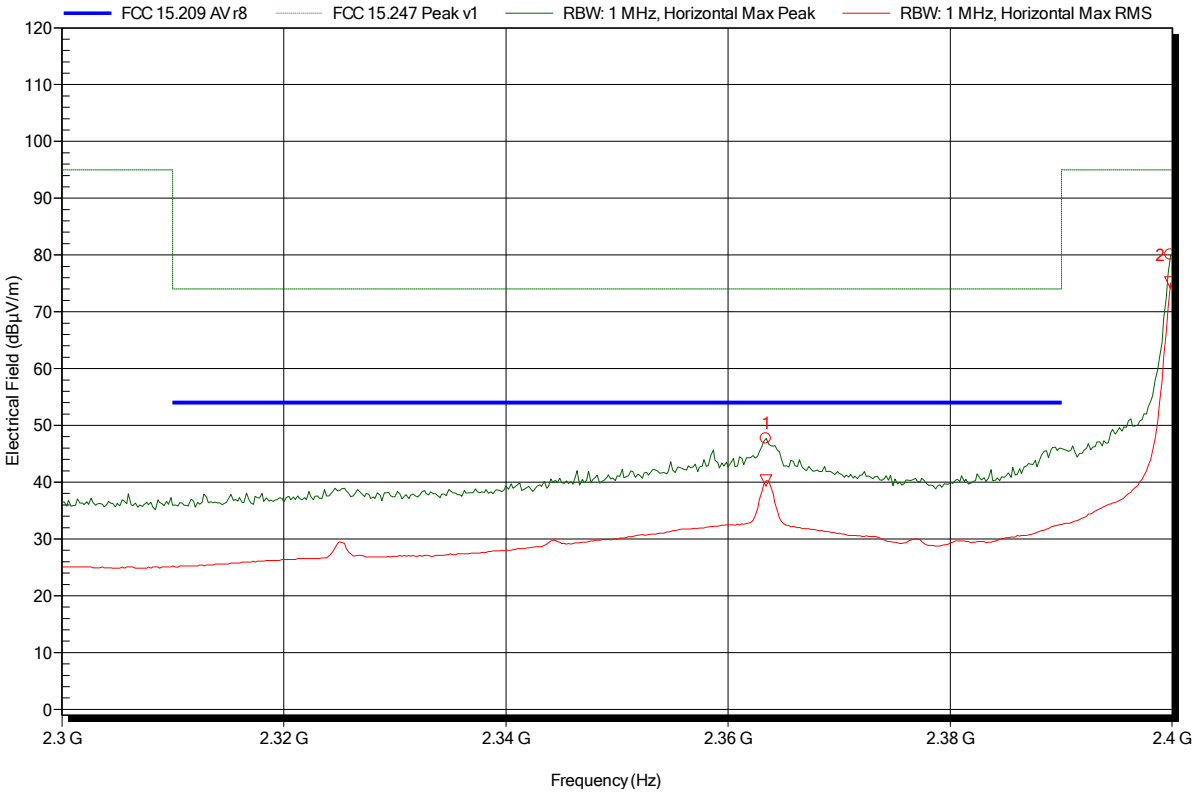

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.363 GHz	47.68 dBµV/m	74 dBµV/m	-26.32 dB	Pass
2.4 GHz	80.05 dBµV/m	95 dBµV/m	-14.95 dB	Pass

Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.363 GHz	40.28 dBµV/m	54 dBµV/m	-13.72 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	lower bandedge

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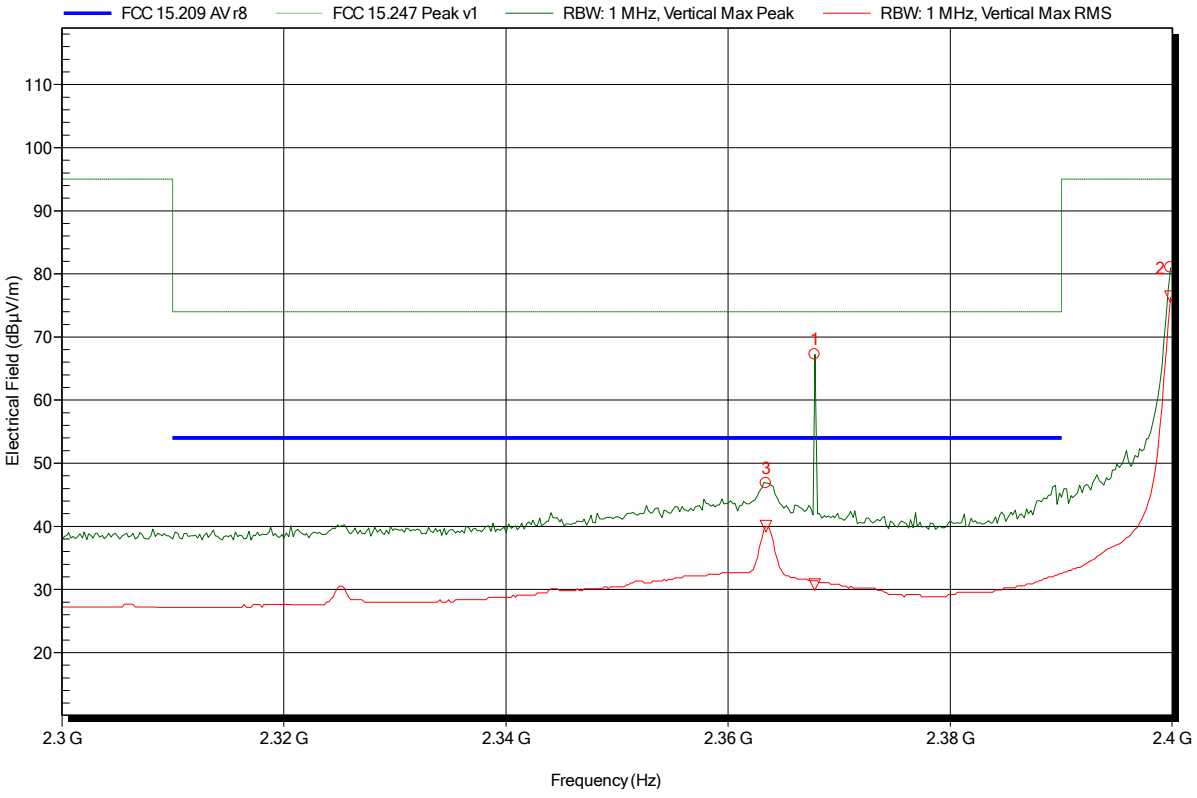

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.363 GHz	46.87 dBµV/m	74 dBµV/m	-27.13 dB	Pass
2.368 GHz	67.23 dBµV/m	74 dBµV/m	-6.77 dB	Pass
2.4 GHz	81.02 dBµV/m	95 dBµV/m	-13.98 dB	Pass

Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.363 GHz	40.02 dBµV/m	54 dBµV/m	-13.98 dB	Pass
2.368 GHz	30.8 dBµV/m	54 dBµV/m	-23.2 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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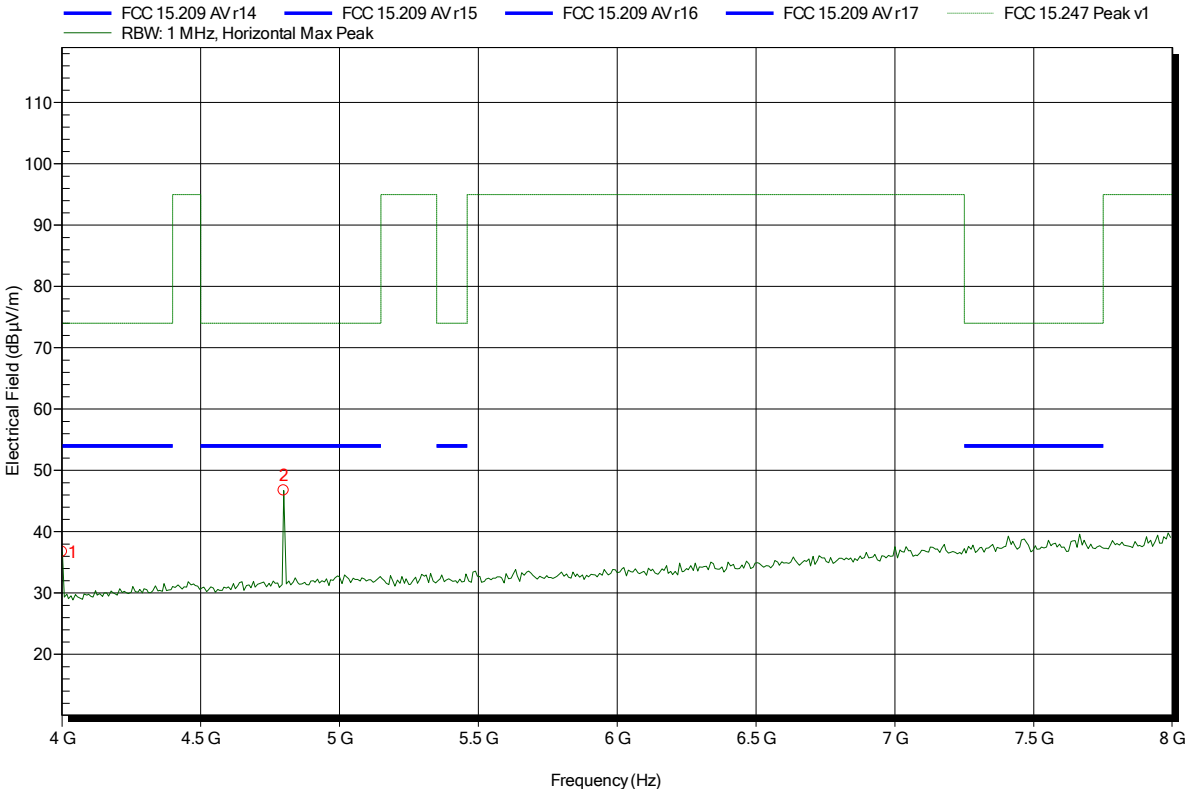

Frequency	Peak	Peak Limit	Peak Difference	Status
4 GHz	36.73 dBµV/m	74 dBµV/m	-37.27 dB	Pass
4.8 GHz	46.74 dBµV/m	74 dBµV/m	-27.26 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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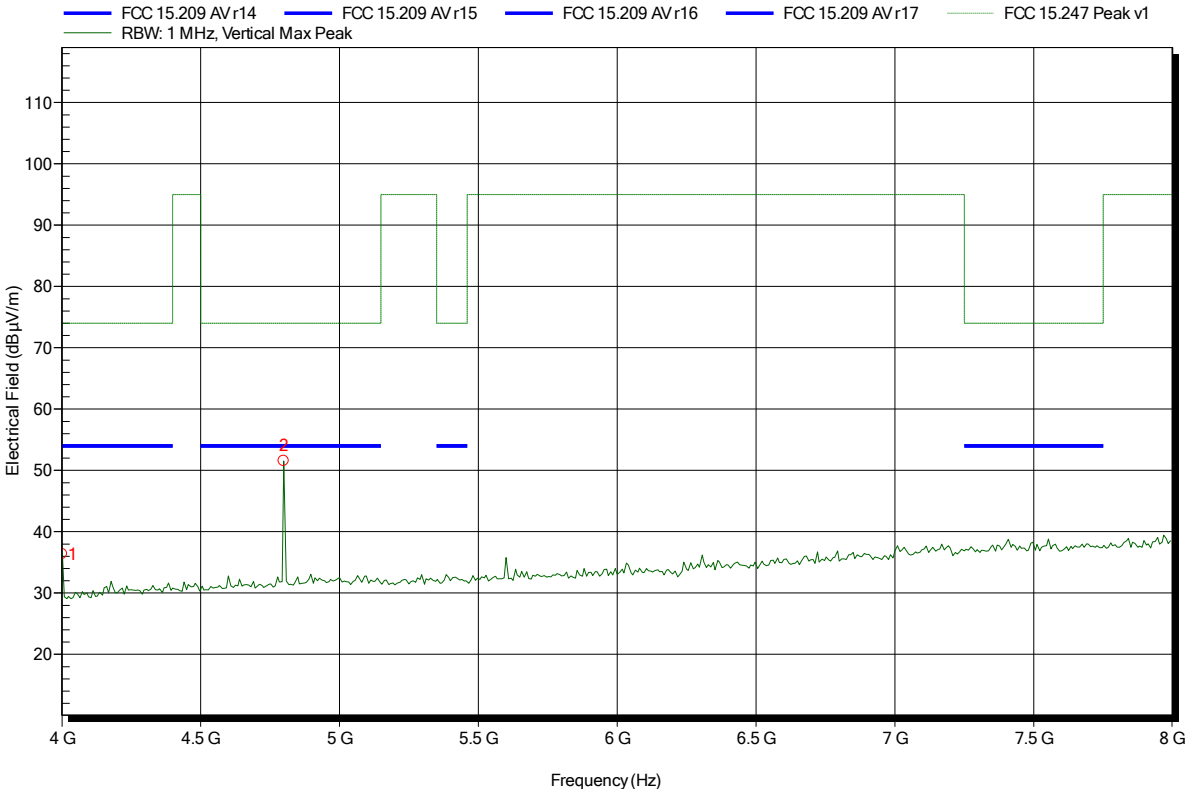

Frequency	Peak	Peak Limit	Peak Difference	Status
4 GHz	36.38 dBµV/m	74 dBµV/m	-37.62 dB	Pass
4.8 GHz	51.53 dBµV/m	74 dBµV/m	-22.47 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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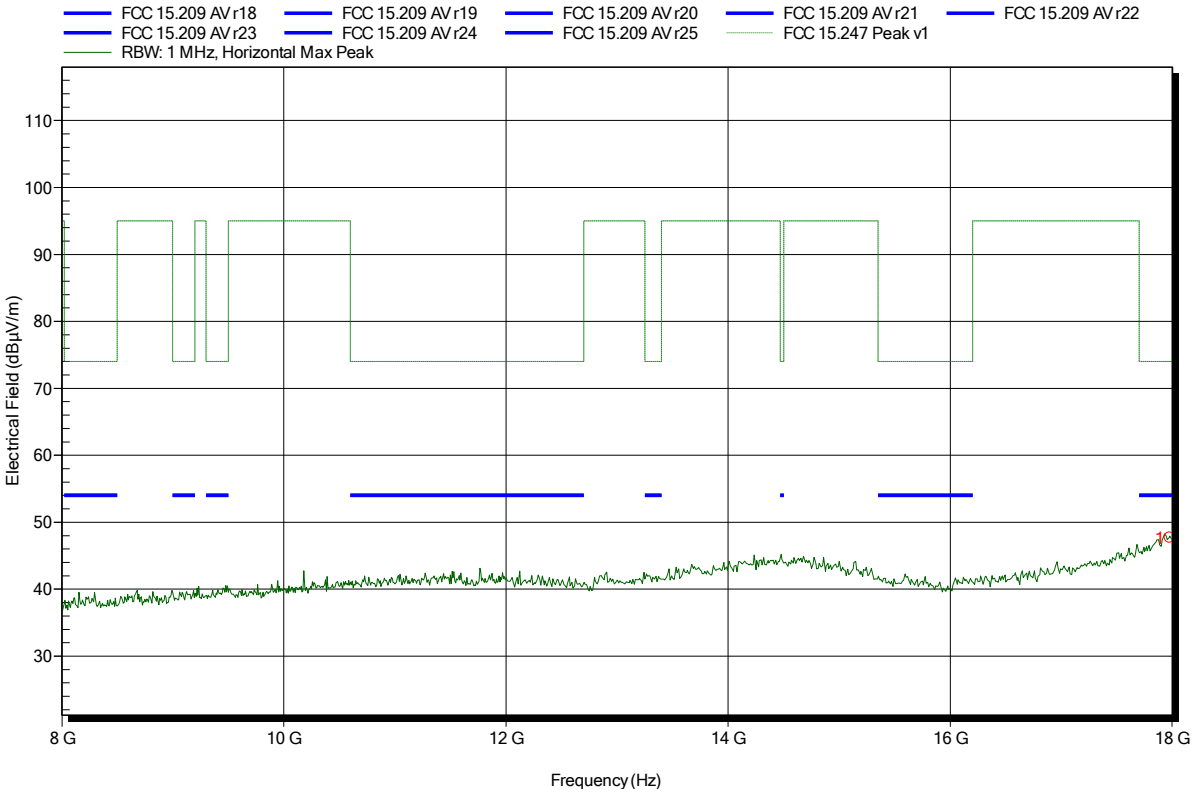

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
17.976 GHz	47.68 dBµV/m	74 dBµV/m	-26.32 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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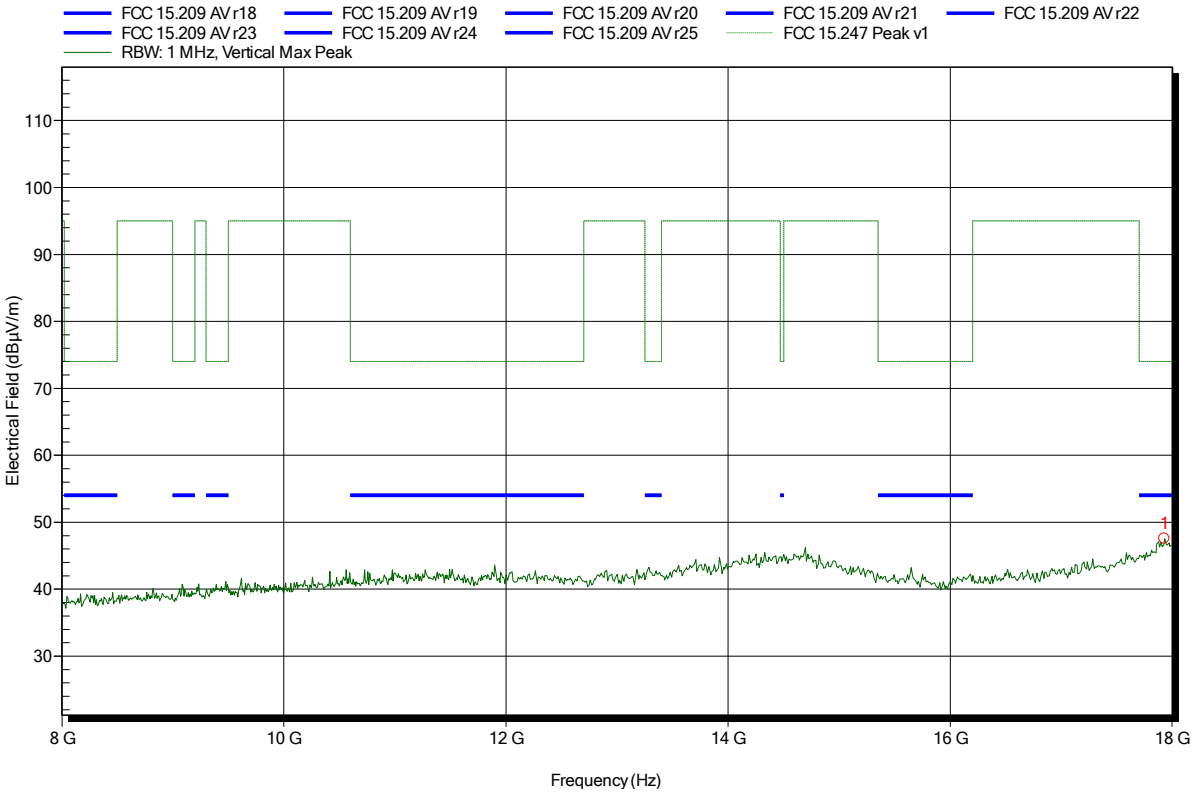

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
17.928 GHz	47.53 dBµV/m	74 dBµV/m	-26.47 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 025, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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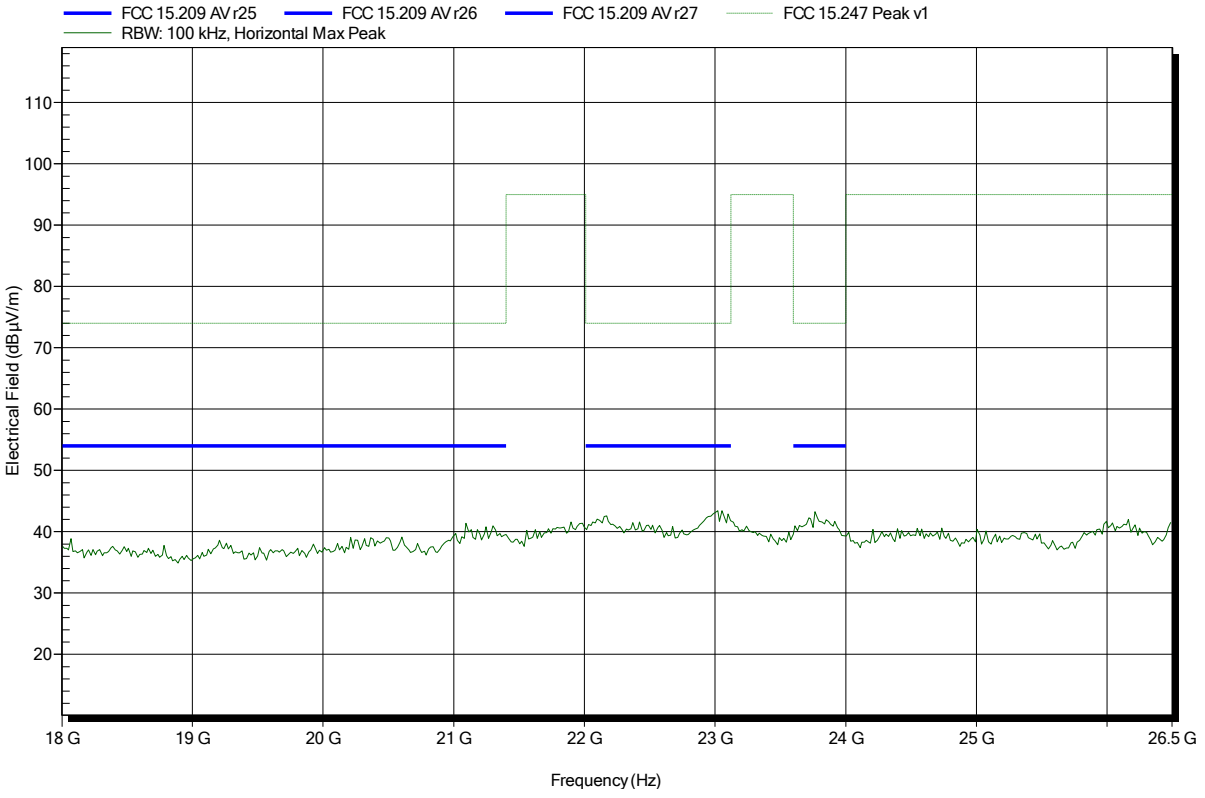

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 025, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; 2402
Test Date:	2015-03-06
Note:	

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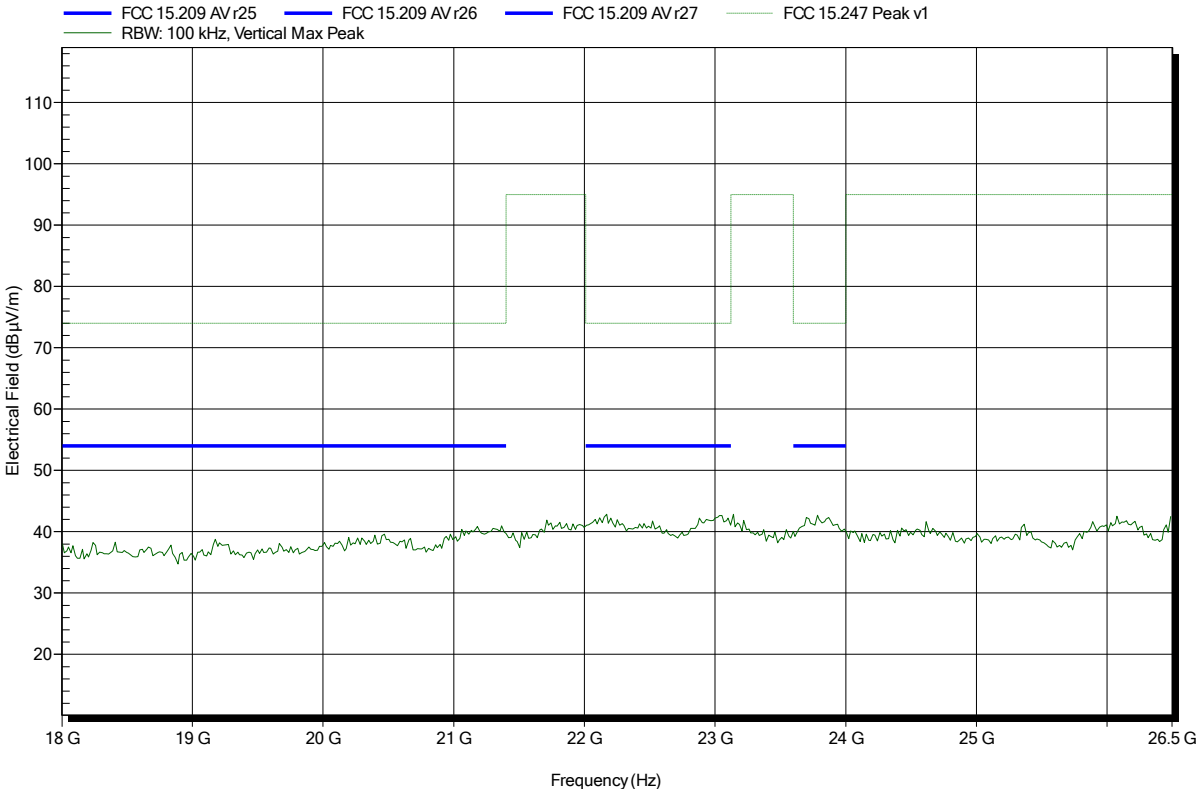

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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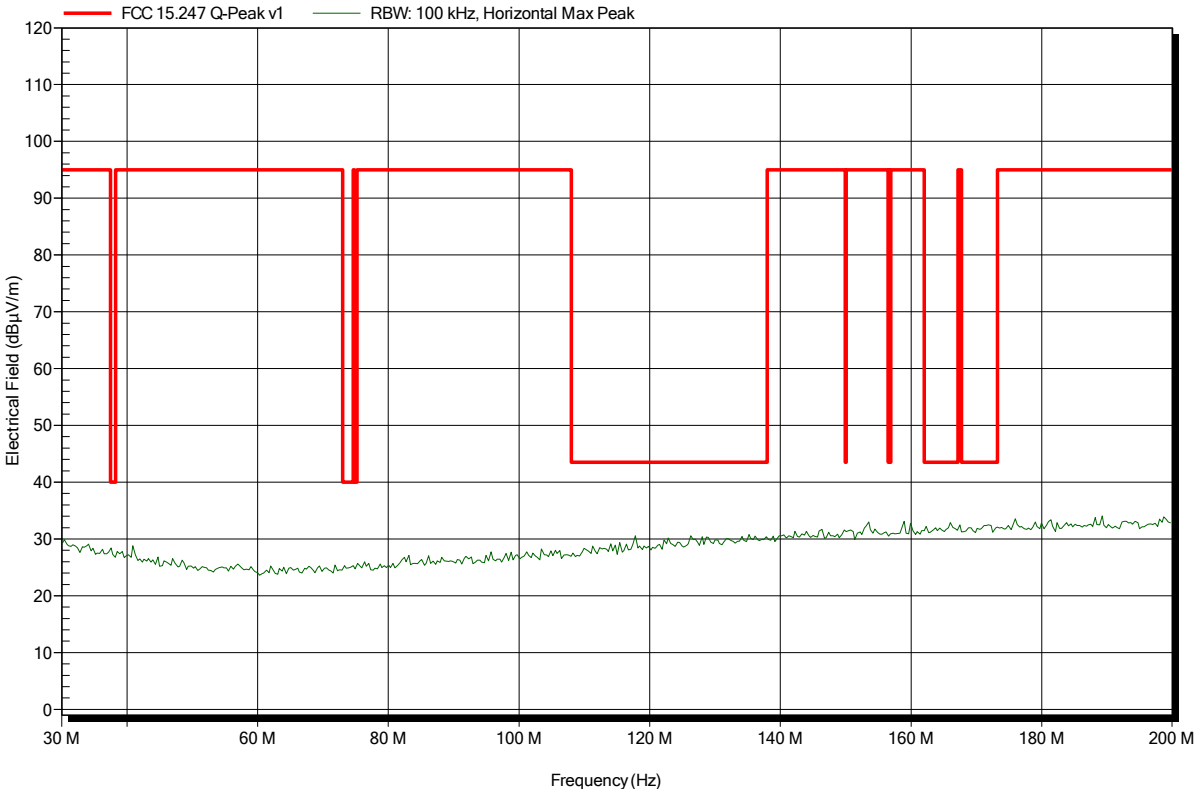

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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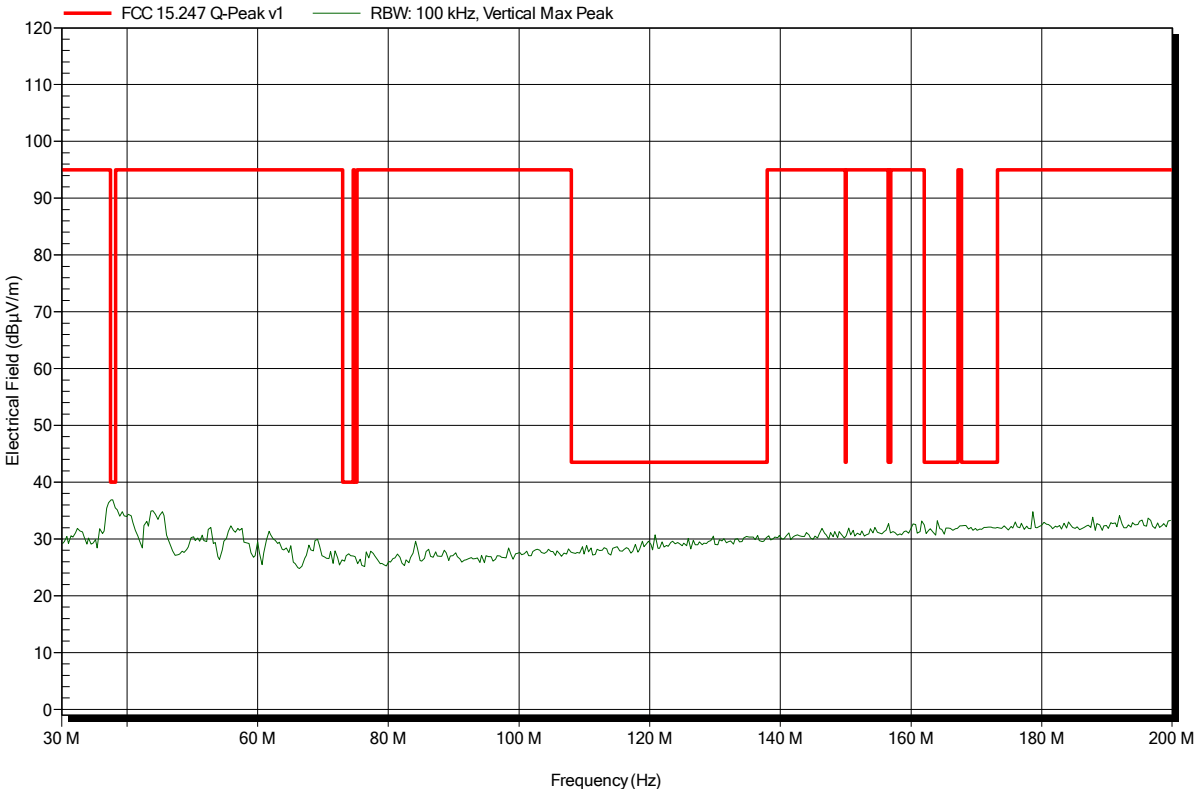

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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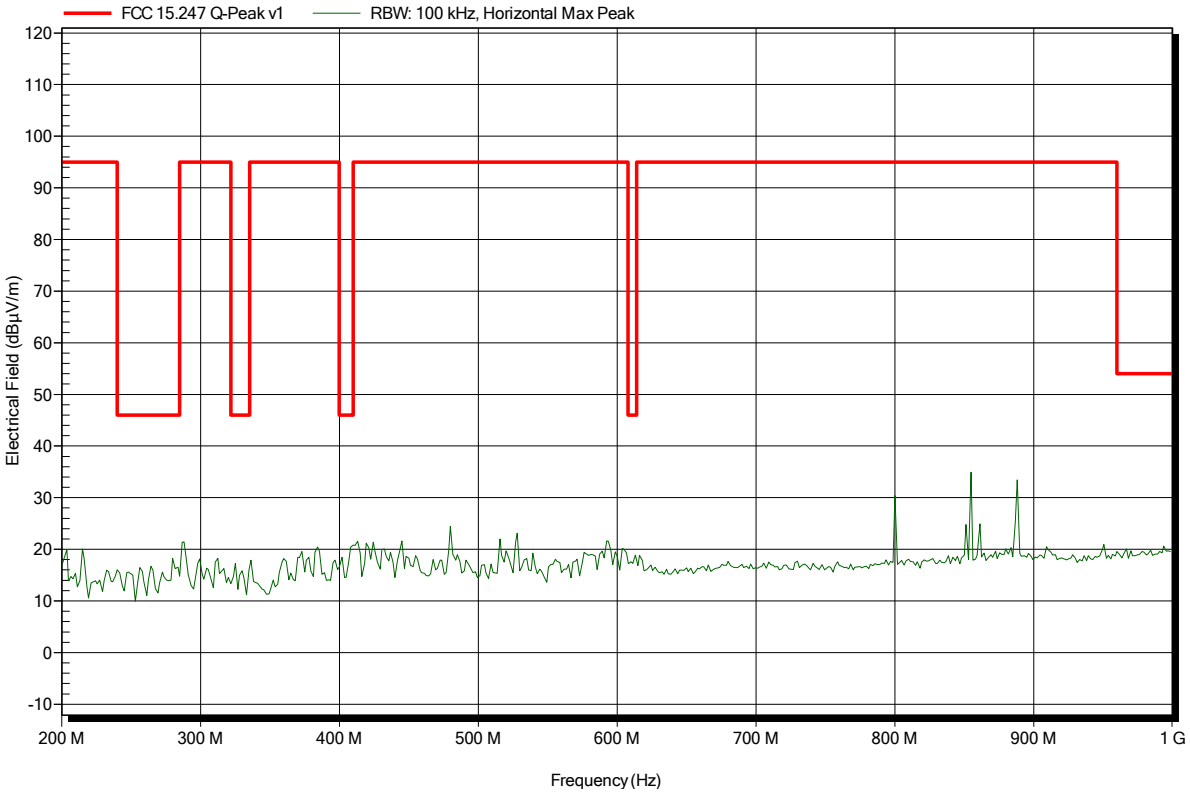

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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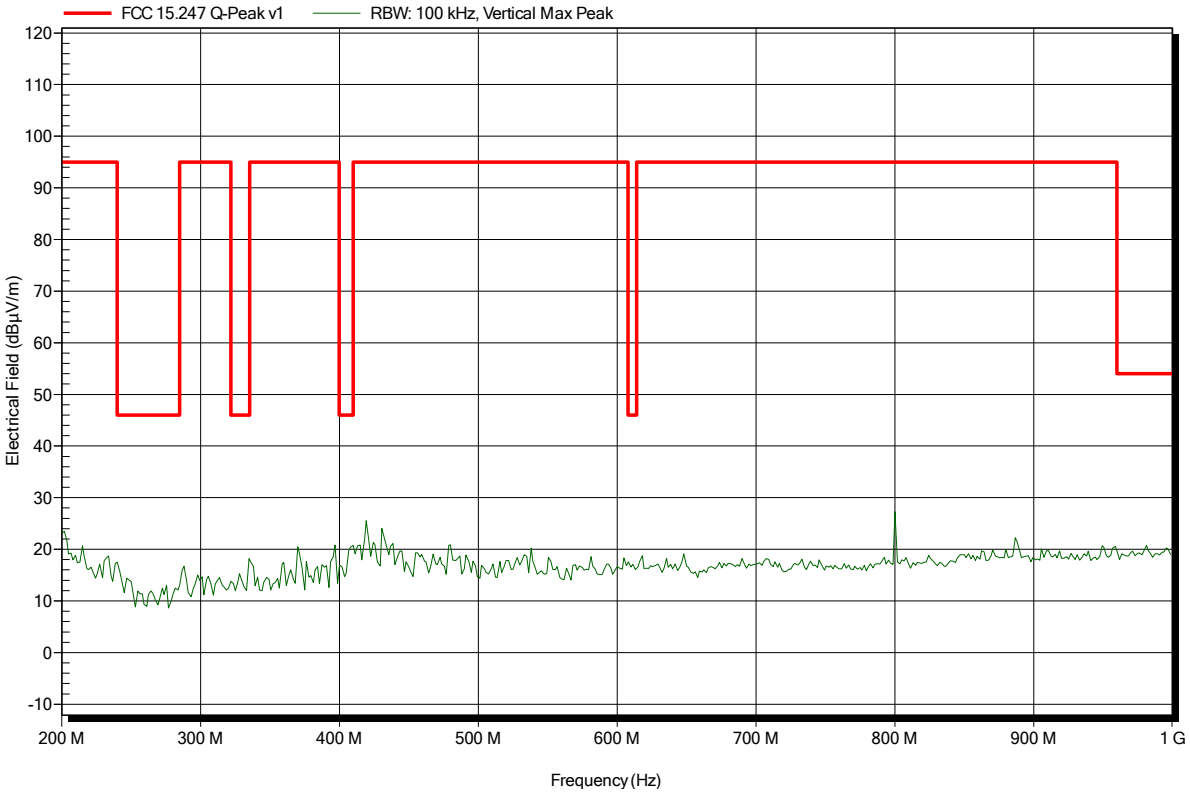

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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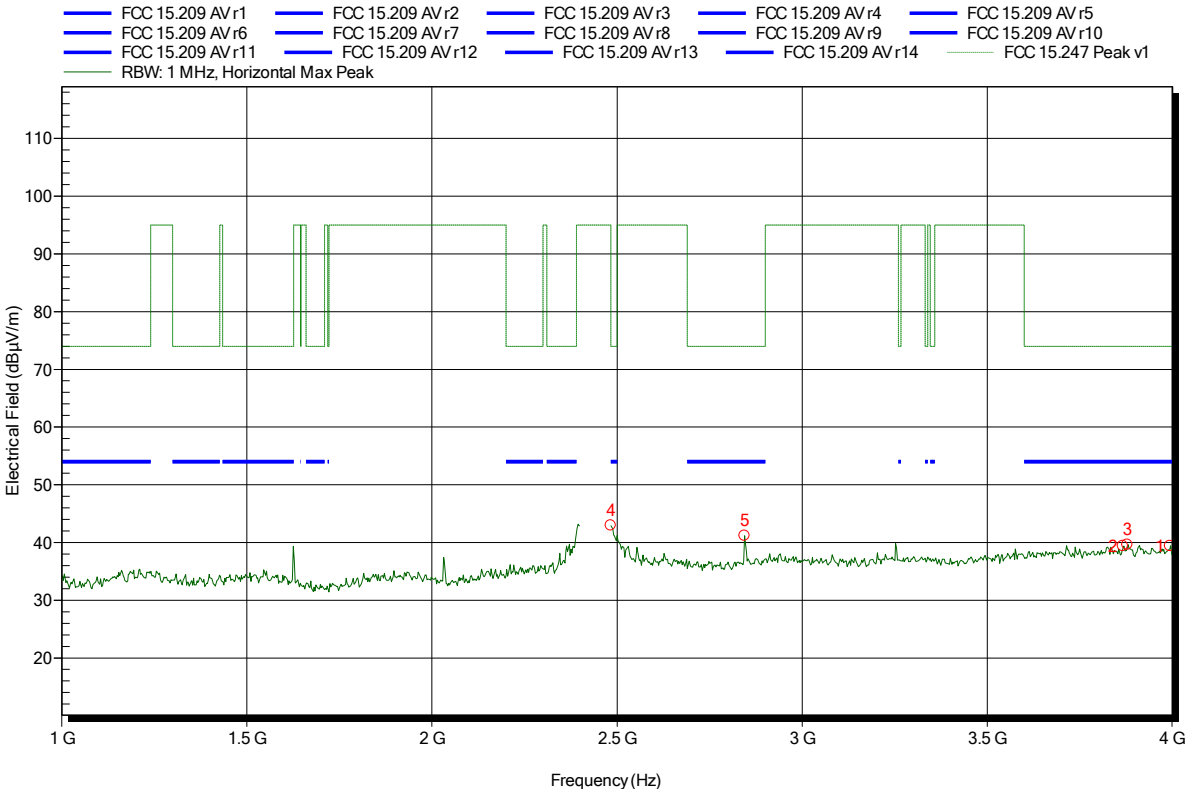

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4835 GHz	42.95 dBµV/m	74 dBµV/m	-31.05 dB	Pass
2.8444 GHz	41.16 dBµV/m	74 dBµV/m	-32.84 dB	Pass
3.8665 GHz	39.38 dBµV/m	74 dBµV/m	-34.62 dB	Pass
3.8787 GHz	39.62 dBµV/m	74 dBµV/m	-34.38 dB	Pass
3.9939 GHz	39.39 dBµV/m	74 dBµV/m	-34.61 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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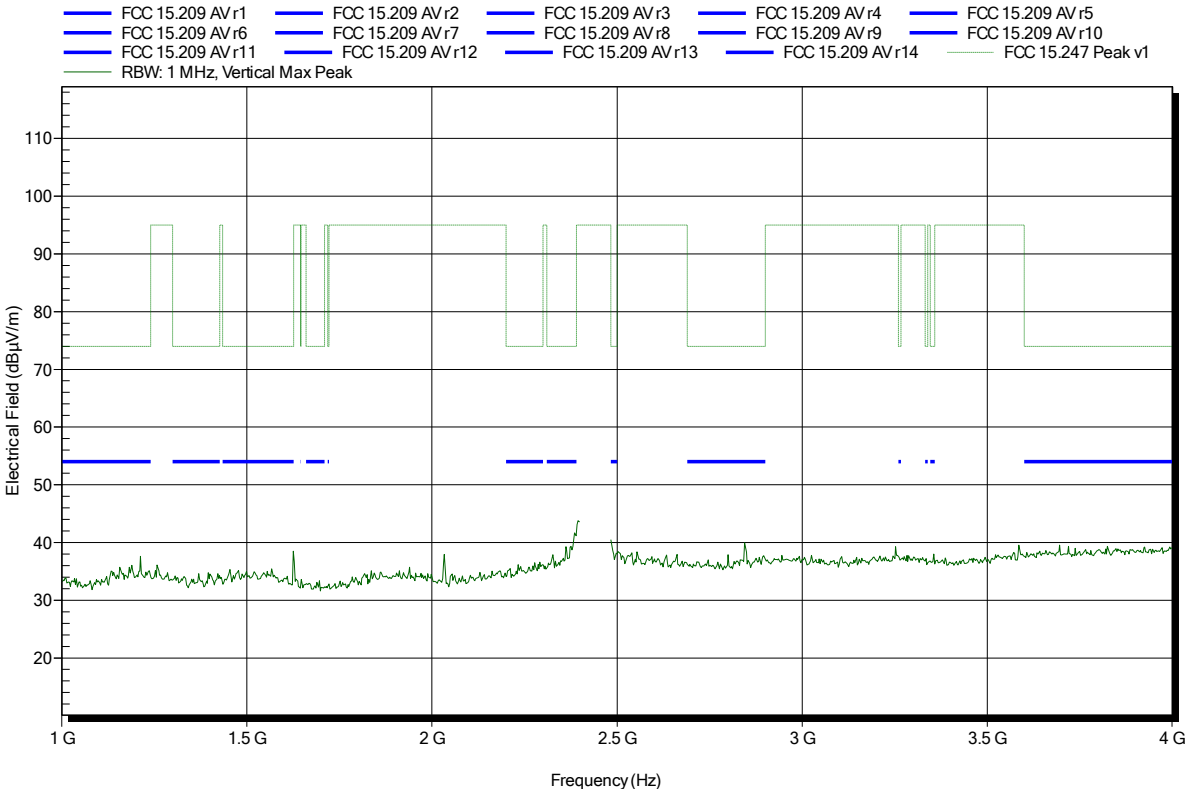

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; Ch.: 19
Test Date:	2015-03-06
Note:	lower bandedge

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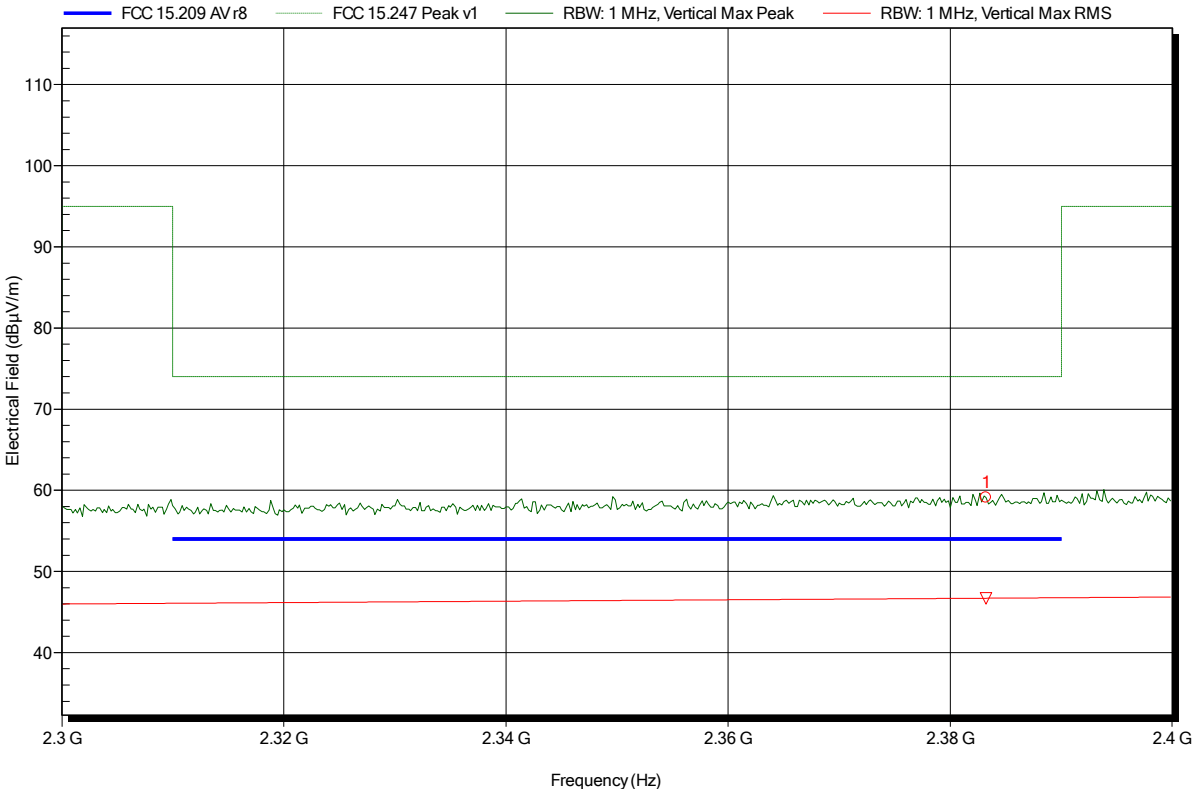

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.383 GHz	59.12 dBµV/m	74 dBµV/m	-14.88 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m converted to 3m
Mode:	TX; Ch.: 19
Test Date:	2015-03-06
Note:	upper bandedge

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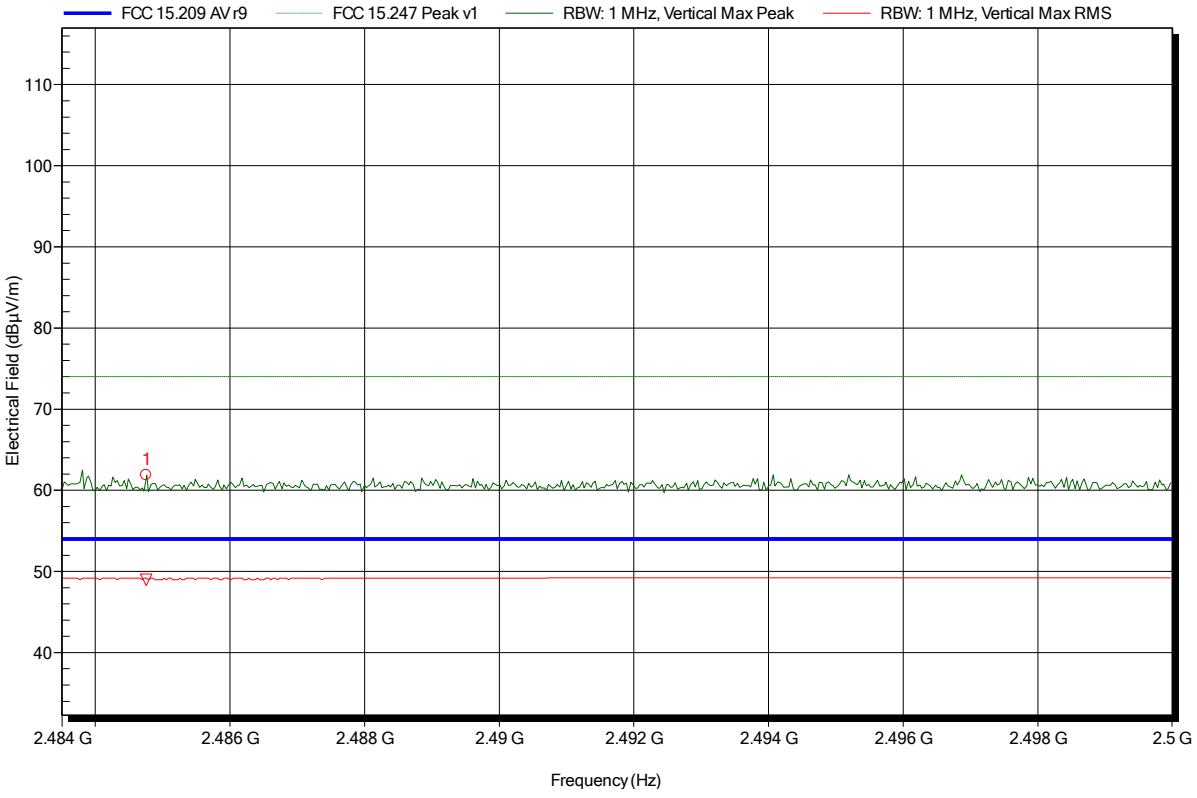

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4848 GHz	61.87 dBµV/m	74 dBµV/m	-12.13 dB	Pass

Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.4848 GHz	48.97 dBµV/m	54 dBµV/m	-5.03 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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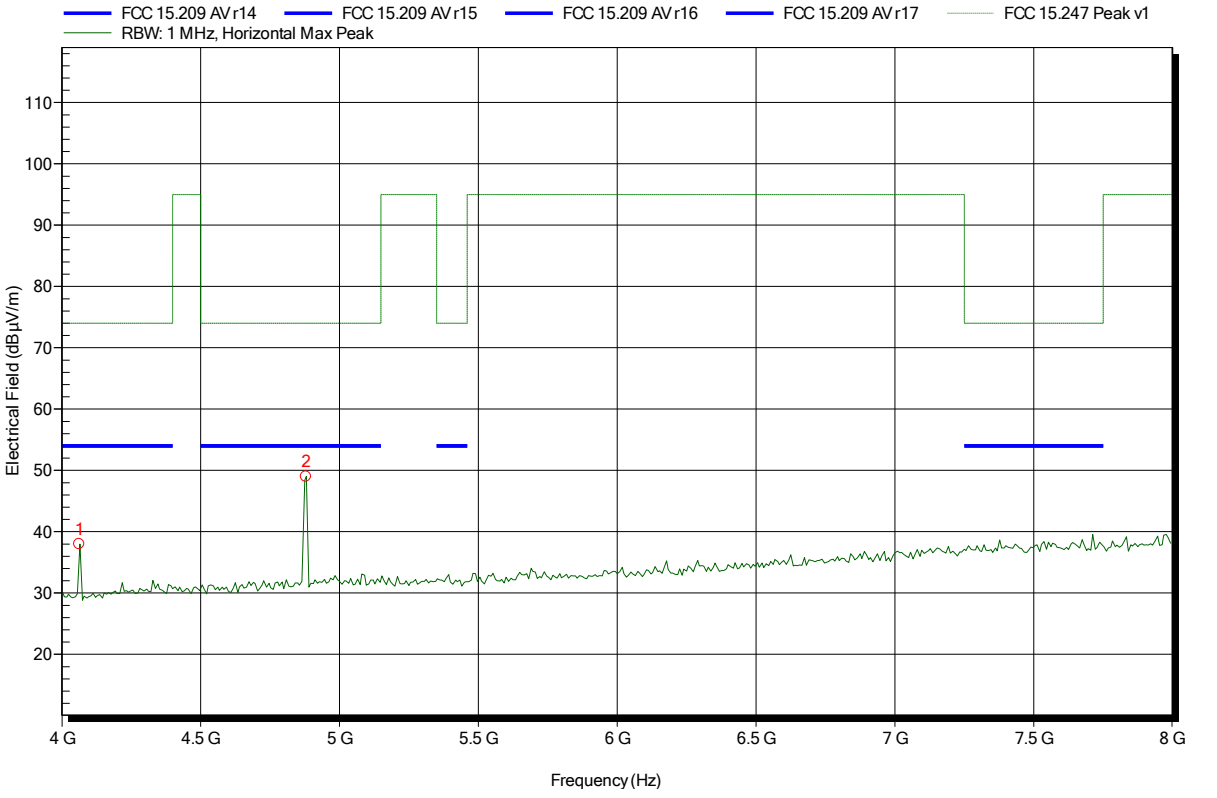

Frequency	Peak	Peak Limit	Peak Difference	Status
4.064 GHz	38 dBµV/m	74 dBµV/m	-36 dB	Pass
4.88 GHz	49 dBµV/m	74 dBµV/m	-25 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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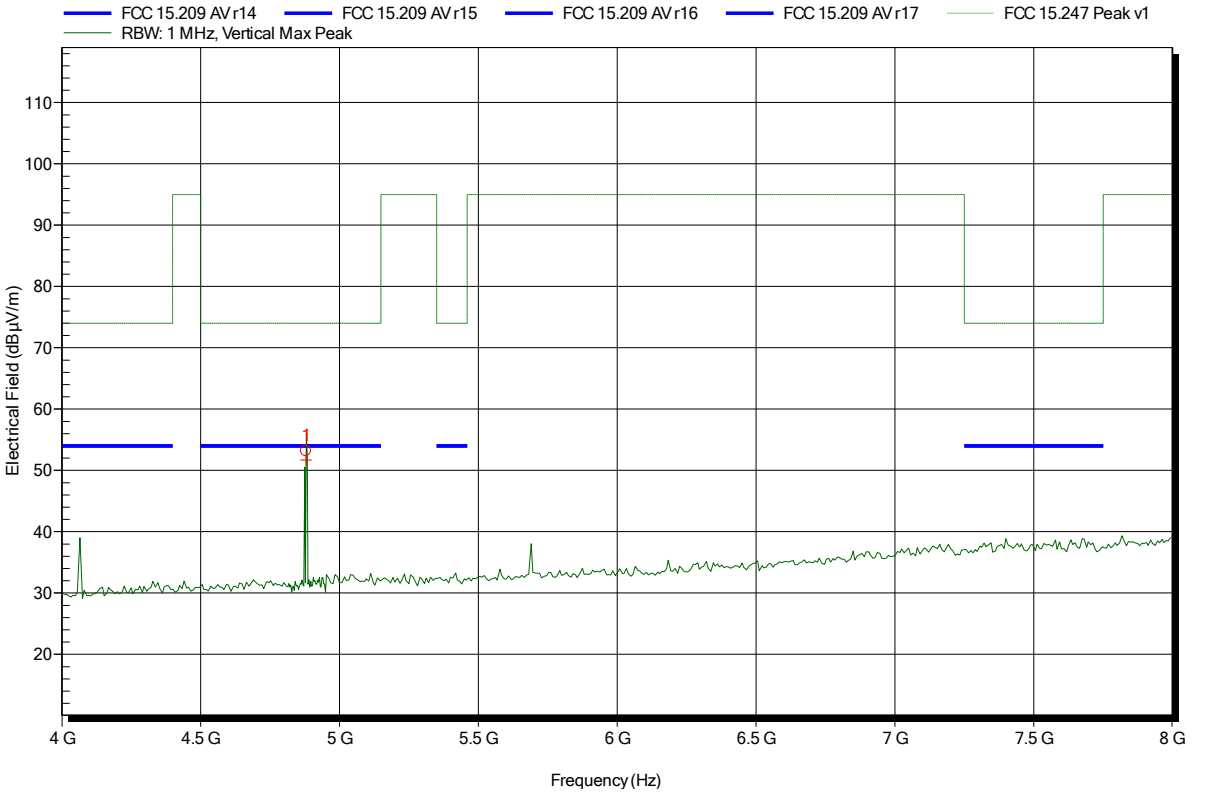

Frequency	Peak	Peak Limit	Peak Difference	Status
4.881 GHz	53.15 dBµV/m	74 dBµV/m	-20.85 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
4.881 GHz	51.68 dBµV/m	54 dBµV/m	-2.32 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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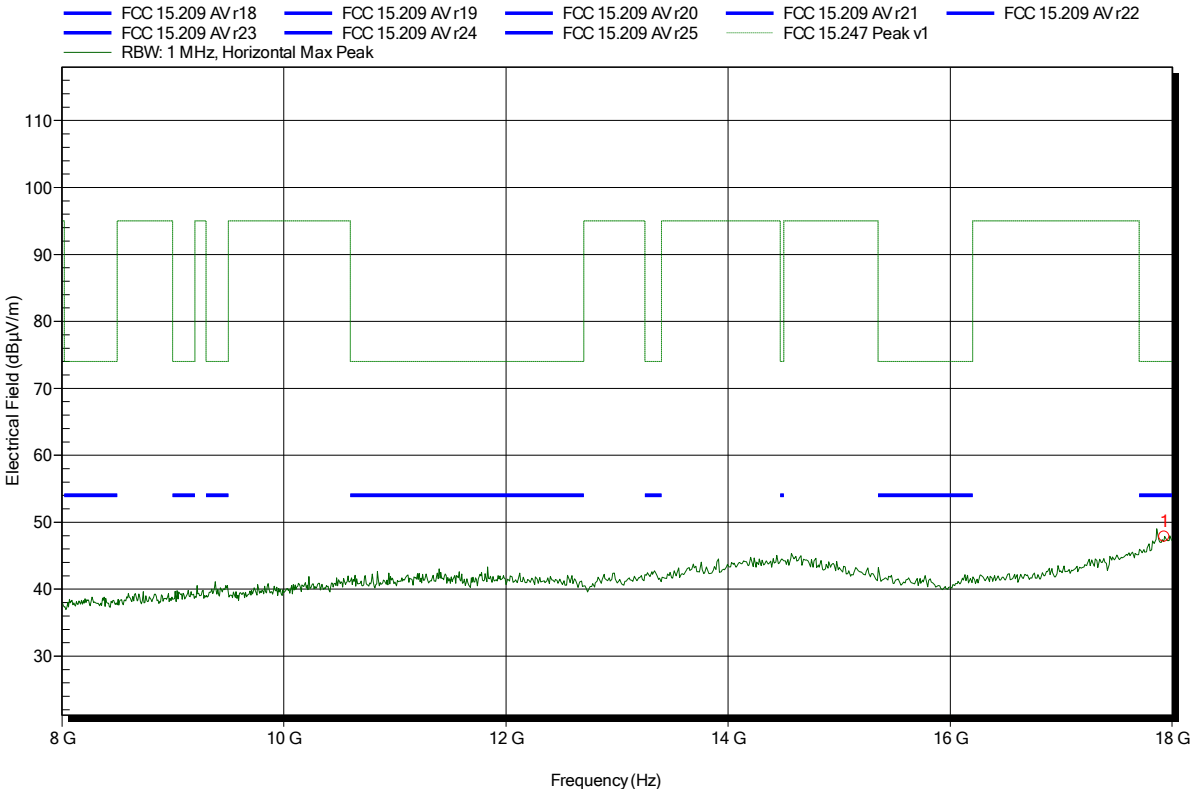

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
17.928 GHz	47.81 dBµV/m	74 dBµV/m	-26.19 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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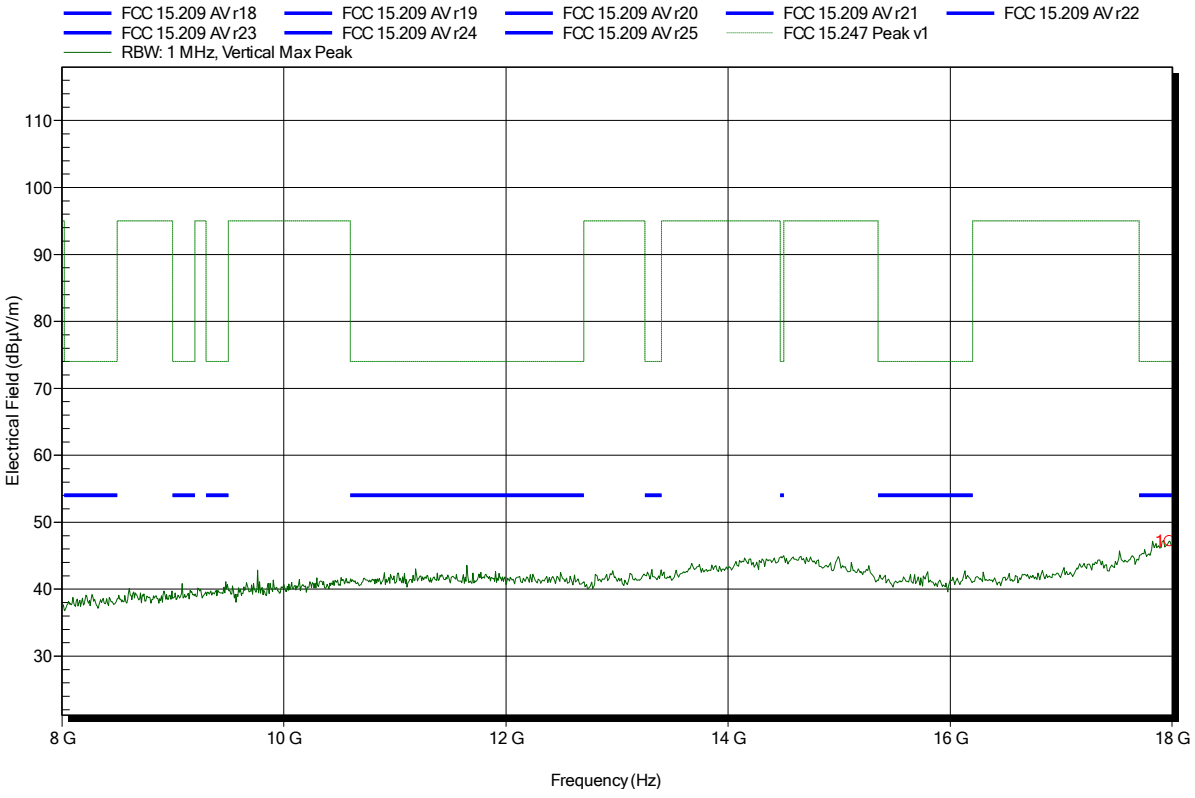

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
17.976 GHz	47.14 dBµV/m	74 dBµV/m	-26.86 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 025, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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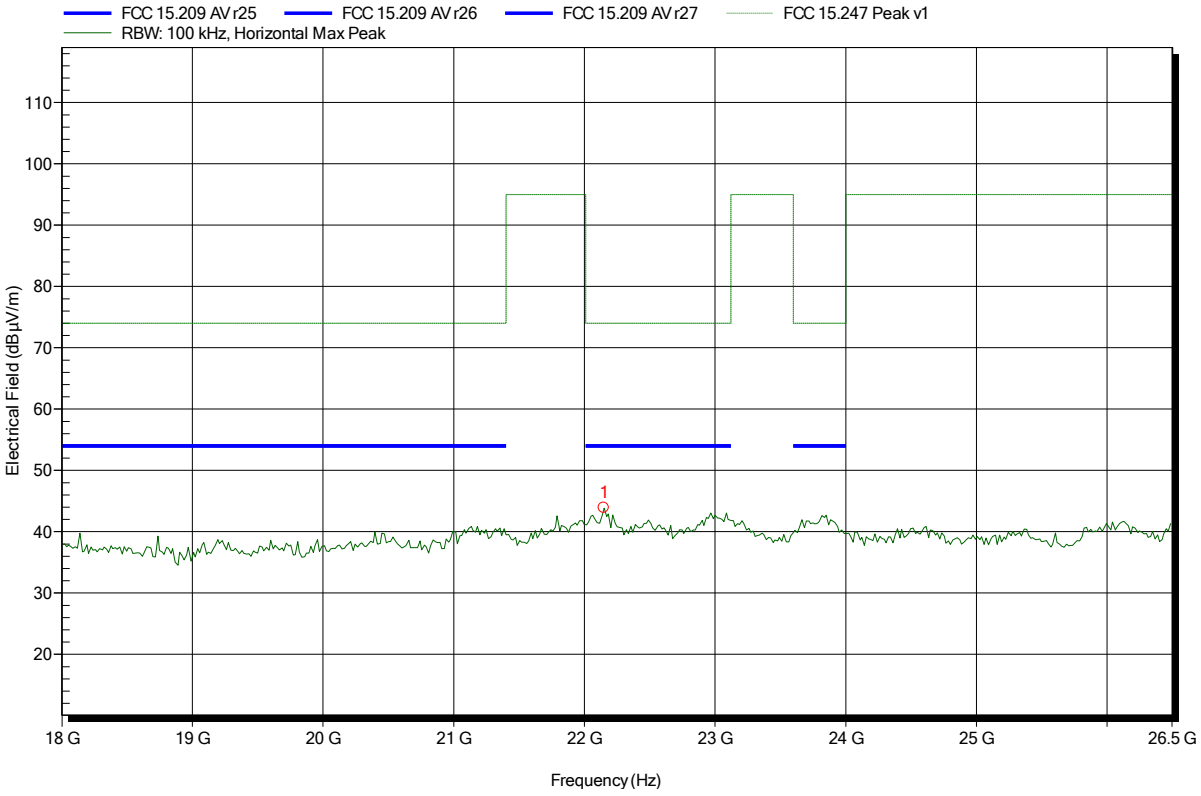

Frequency	Peak	Peak Limit	Peak Difference	Status
22.148 GHz	43.87 dBµV/m	74 dBµV/m	-30.13 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 025, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; 2440
Test Date:	2015-03-06
Note:	

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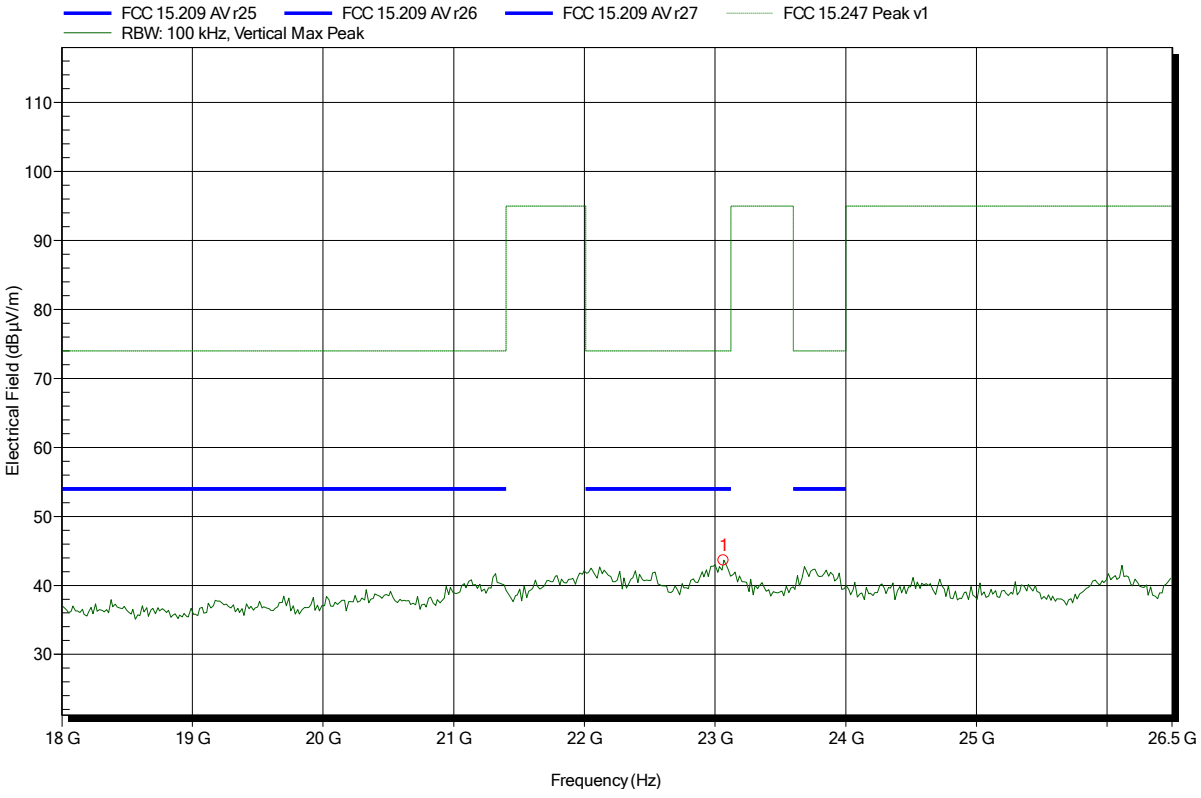

Frequency	Peak	Peak Limit	Peak Difference	Status
23.066 GHz	43.63 dBµV/m	74 dBµV/m	-30.37 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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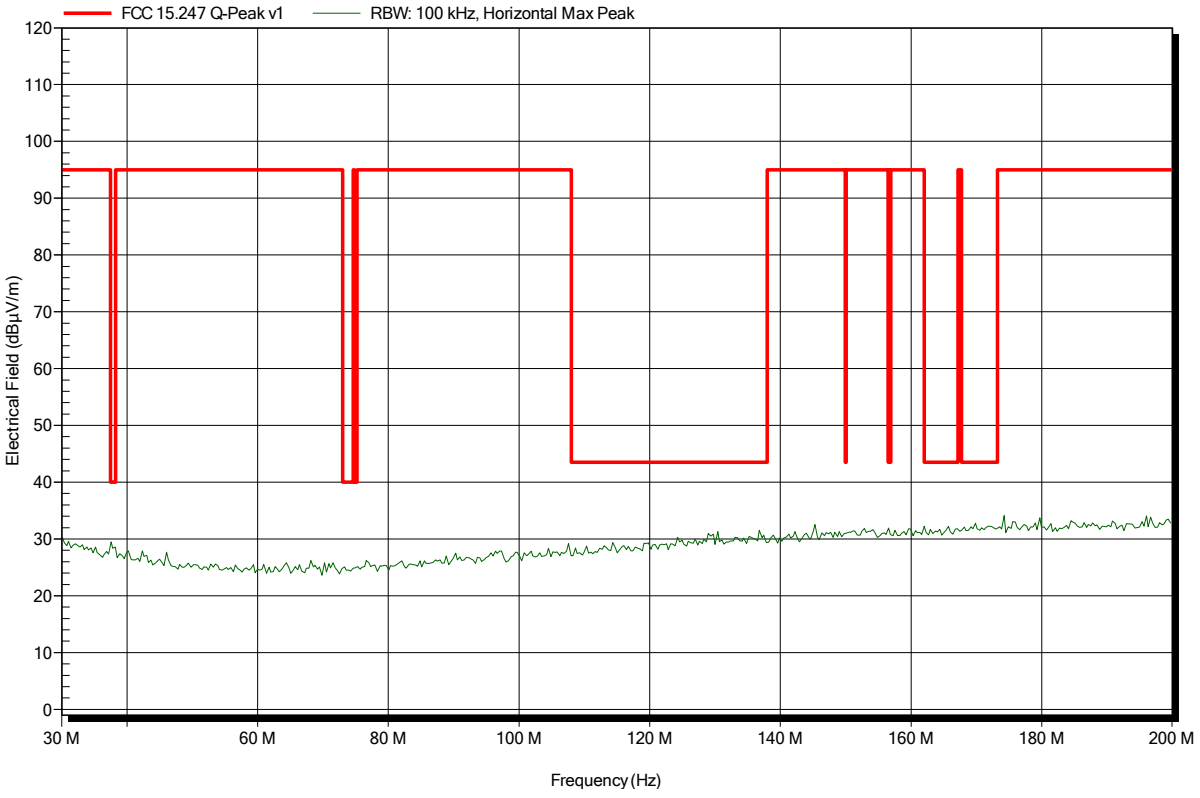

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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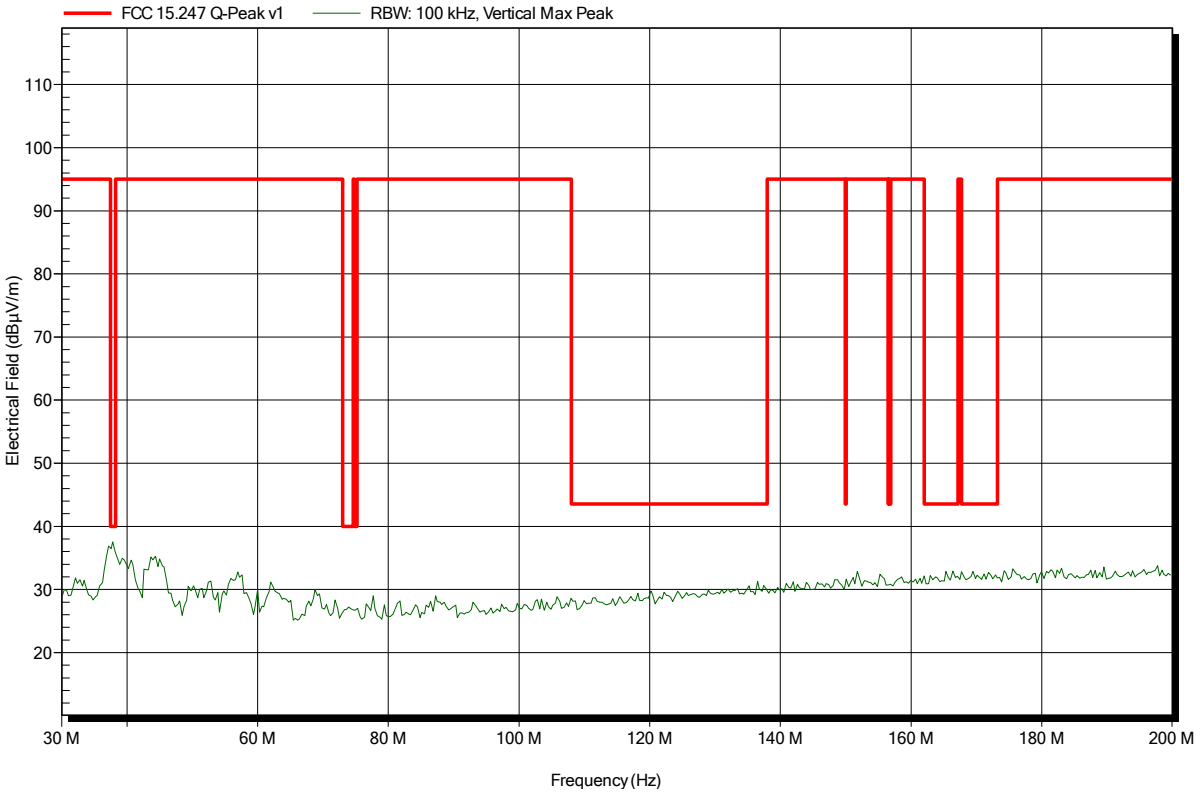

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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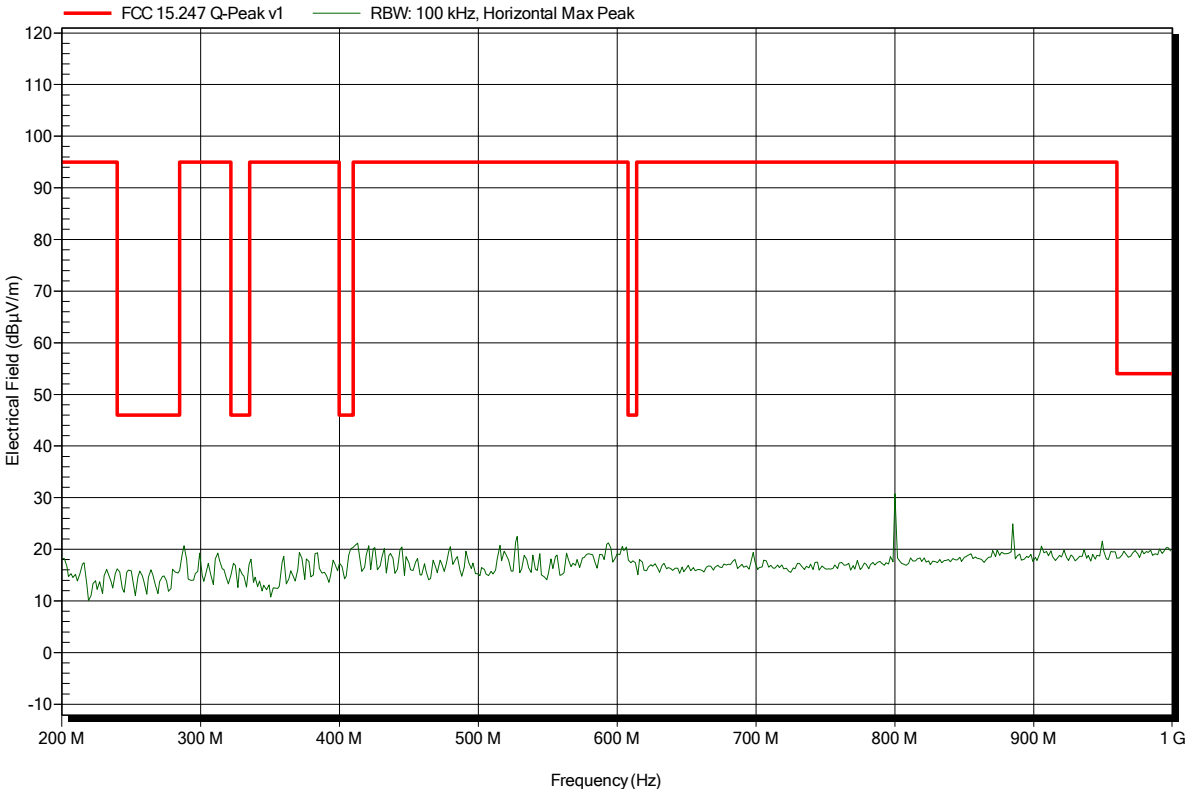

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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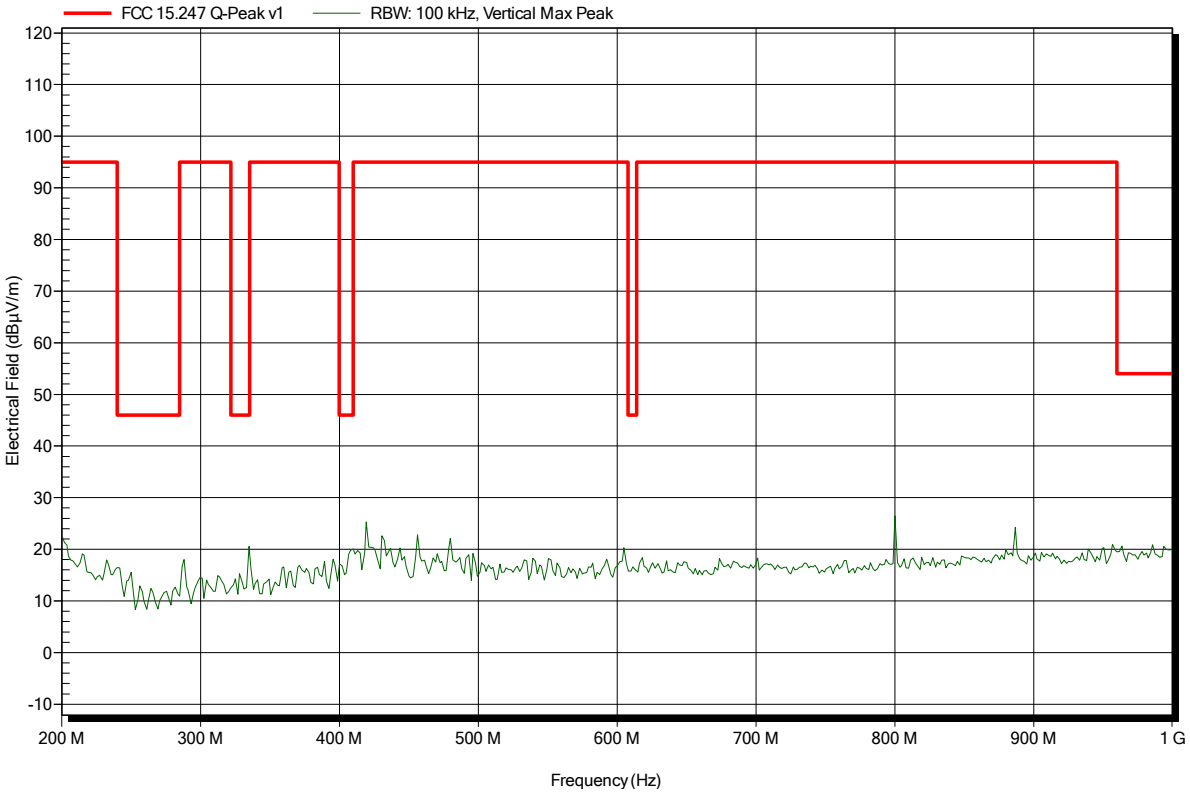

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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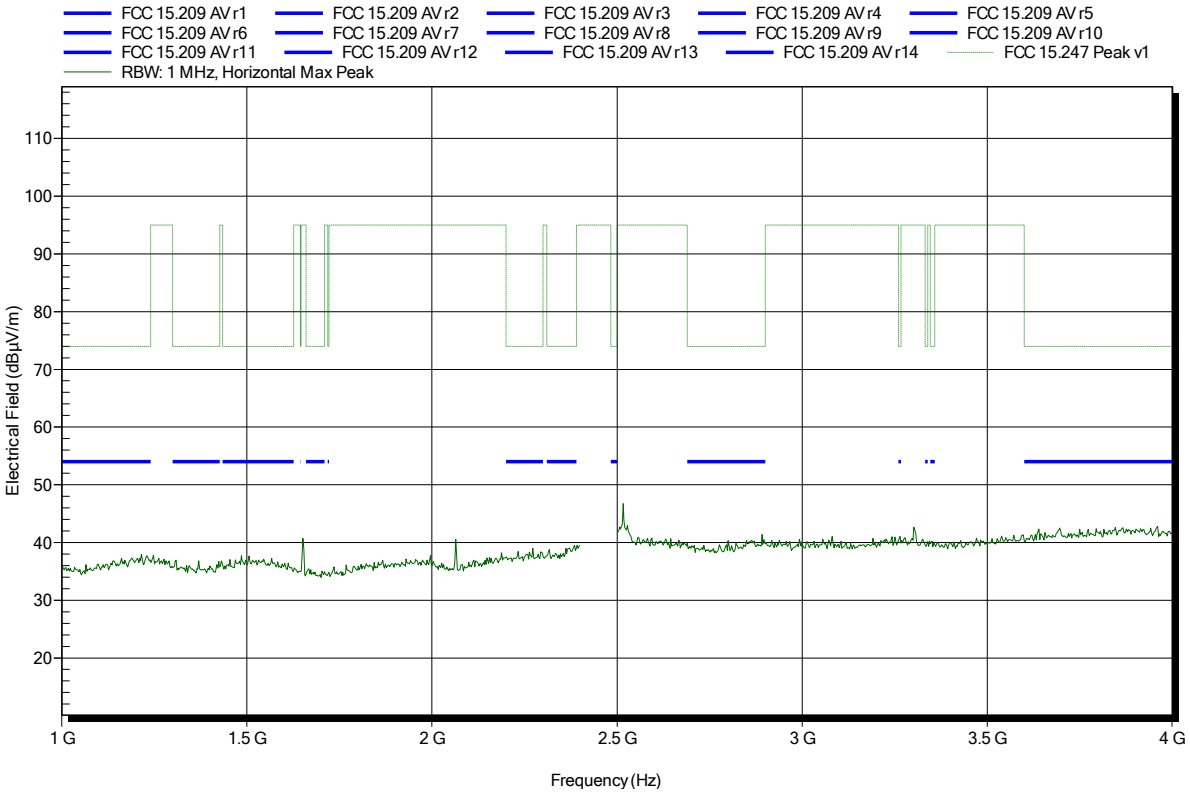

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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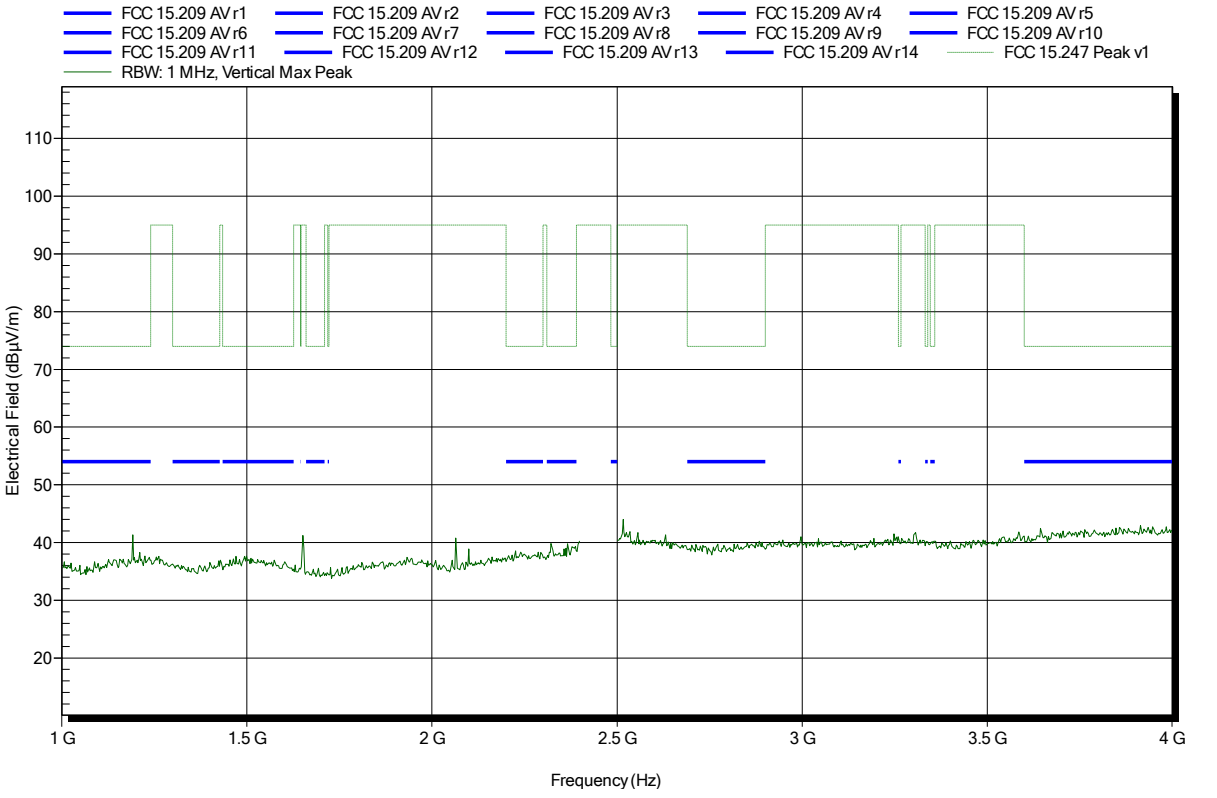

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	upper bandedge

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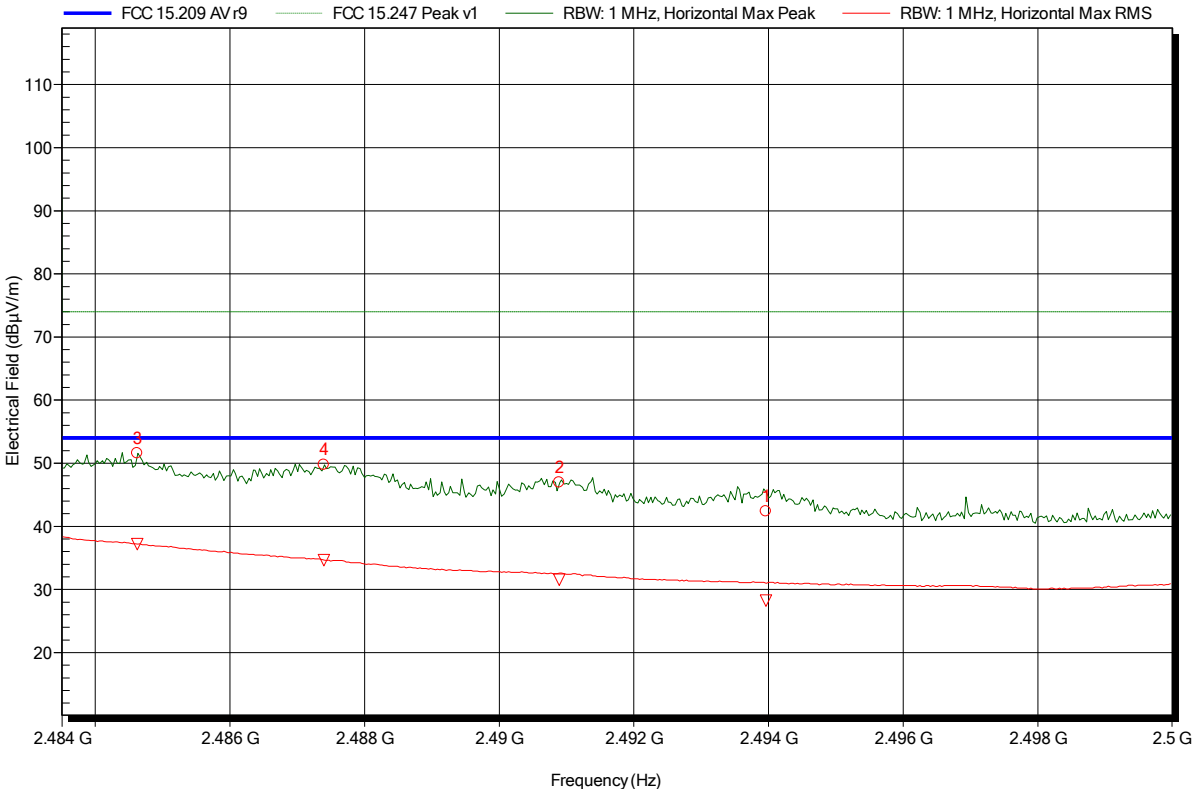

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4846 GHz	51.58 dBµV/m	74 dBµV/m	-22.42 dB	Pass
2.4874 GHz	49.76 dBµV/m	74 dBµV/m	-24.24 dB	Pass
2.4909 GHz	46.96 dBµV/m	74 dBµV/m	-27.04 dB	Pass
2.494 GHz	42.37 dBµV/m	74 dBµV/m	-31.63 dB	Pass

Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.4846 GHz	37.18 dBµV/m	54 dBµV/m	-16.82 dB	Pass
2.4874 GHz	34.66 dBµV/m	54 dBµV/m	-19.34 dB	Pass
2.4909 GHz	31.56 dBµV/m	54 dBµV/m	-22.44 dB	Pass
2.494 GHz	28.21 dBµV/m	54 dBµV/m	-25.79 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	upper bandedge

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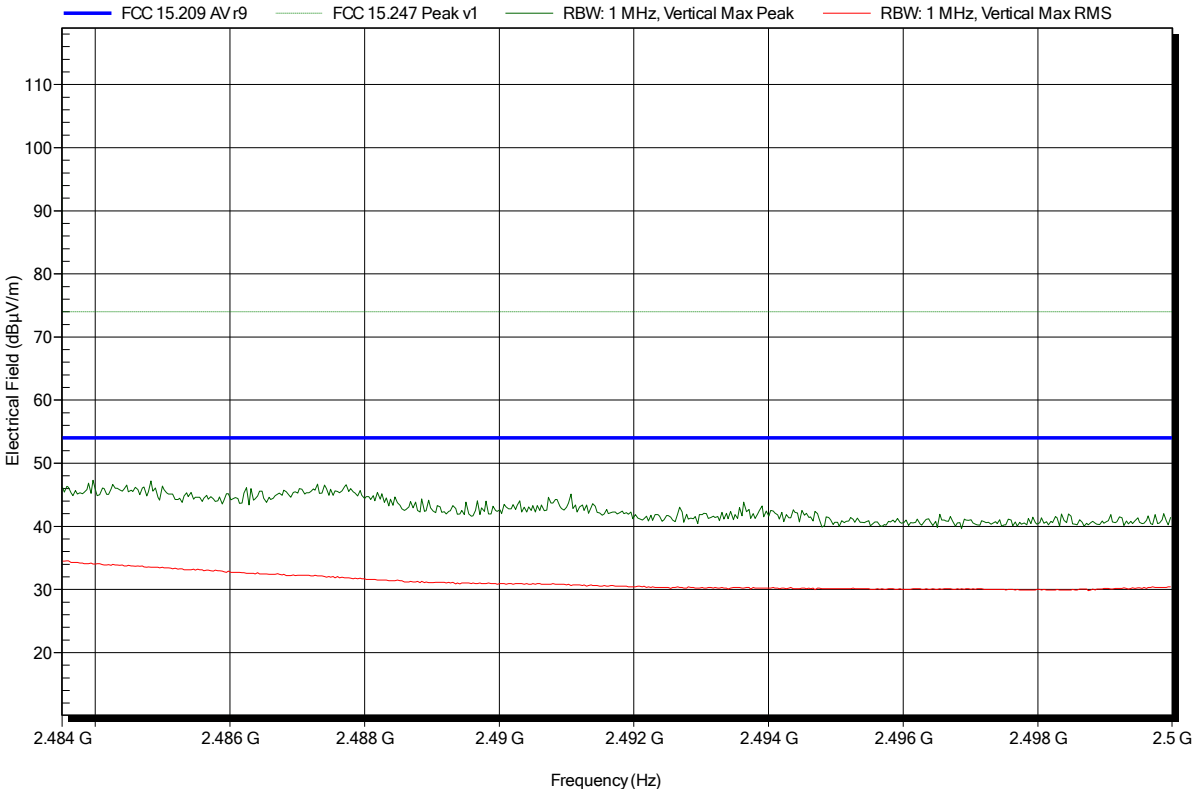

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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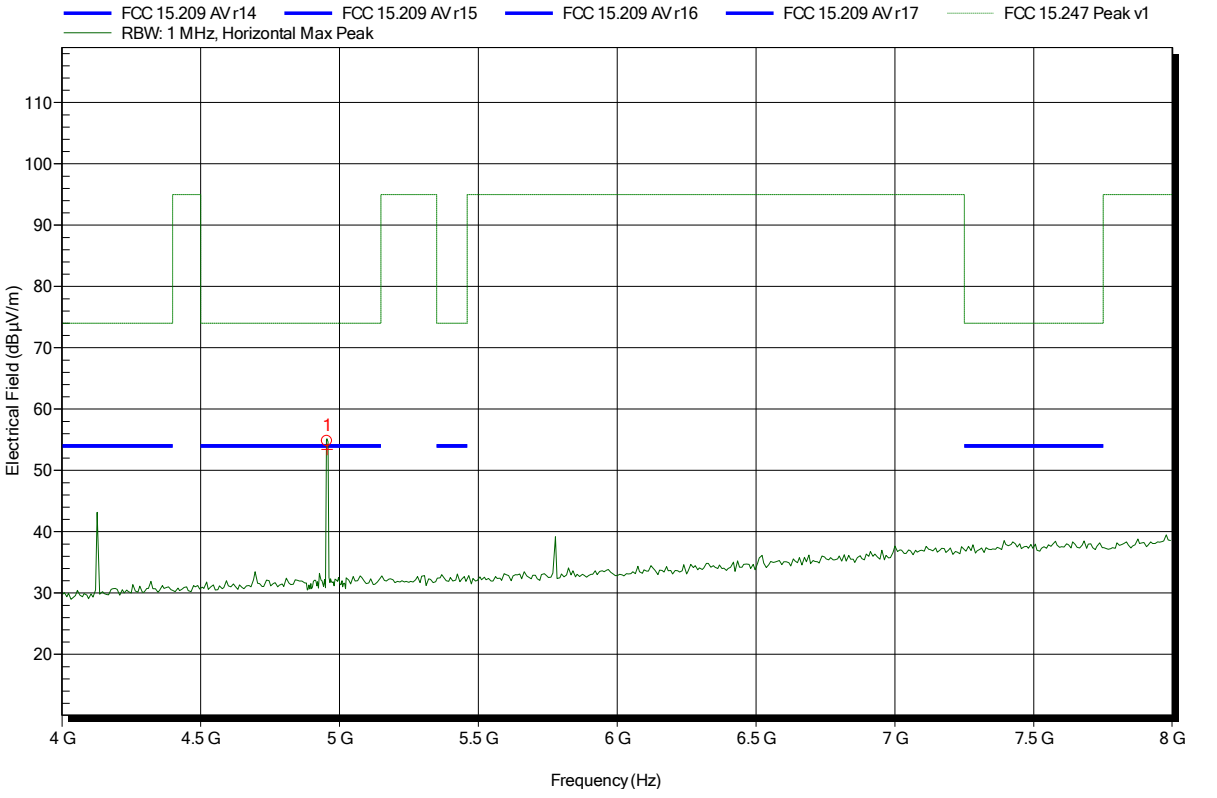

Frequency	Peak	Peak Limit	Peak Difference	Status
4.956 GHz	54.81 dBµV/m	74 dBµV/m	-19.19 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
4.956 GHz	53.43 dBµV/m	54 dBµV/m	-0.57 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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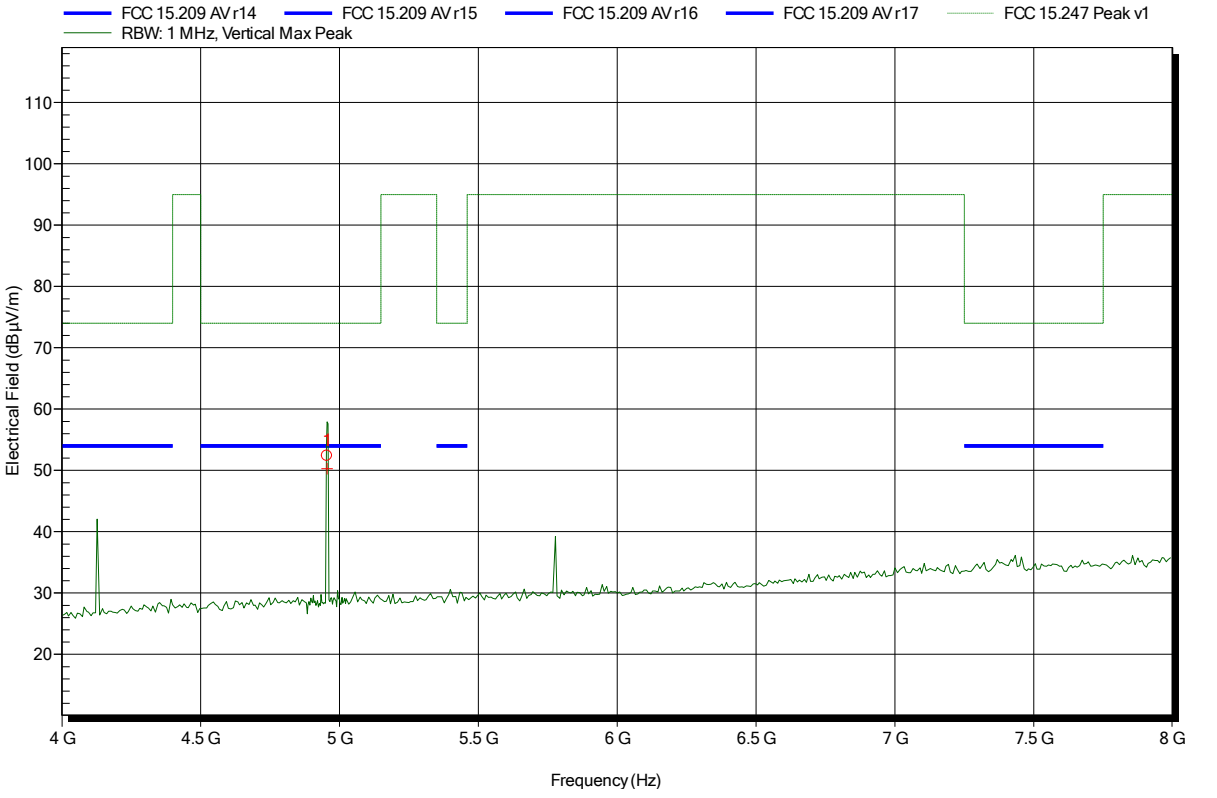

Frequency	Peak	Peak Limit	Peak Difference	Status
4.956 GHz	52.38 dBµV/m	74 dBµV/m	-21.62 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
4.956 GHz	50.3 dBµV/m	54 dBµV/m	-3.7 dB	Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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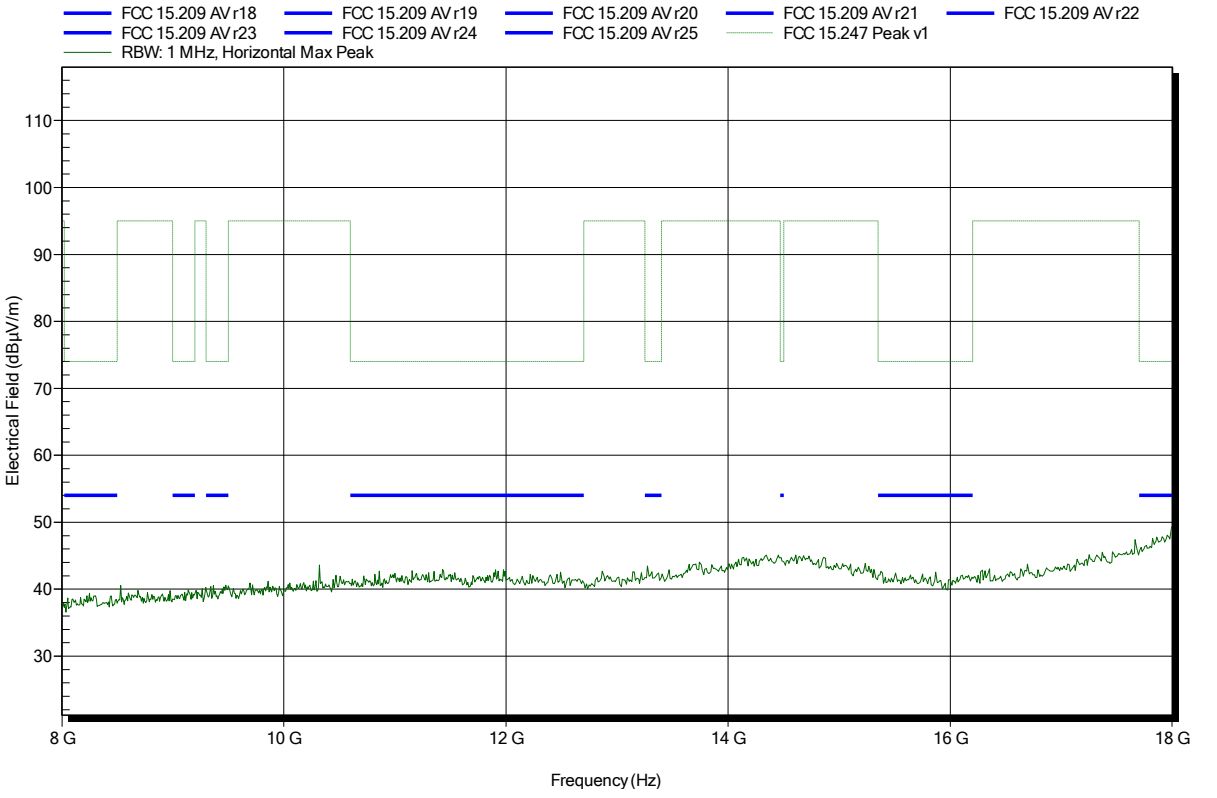

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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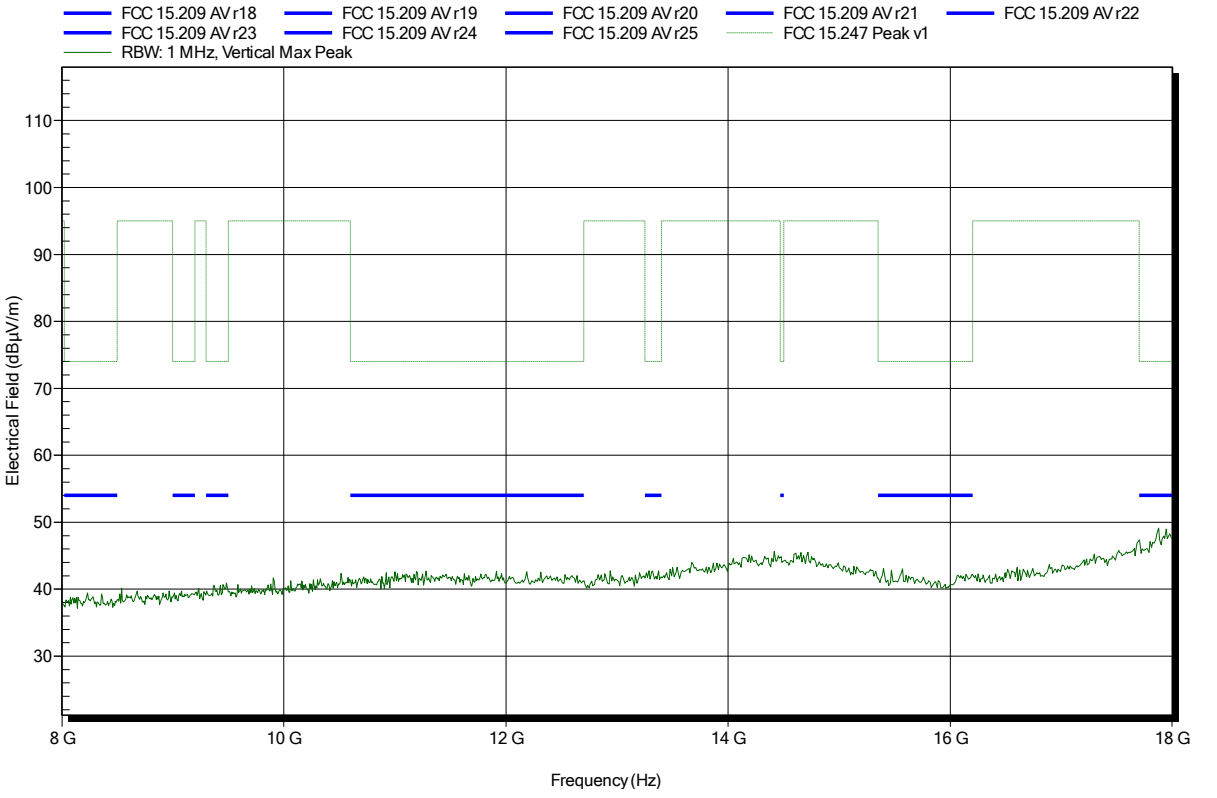

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 025, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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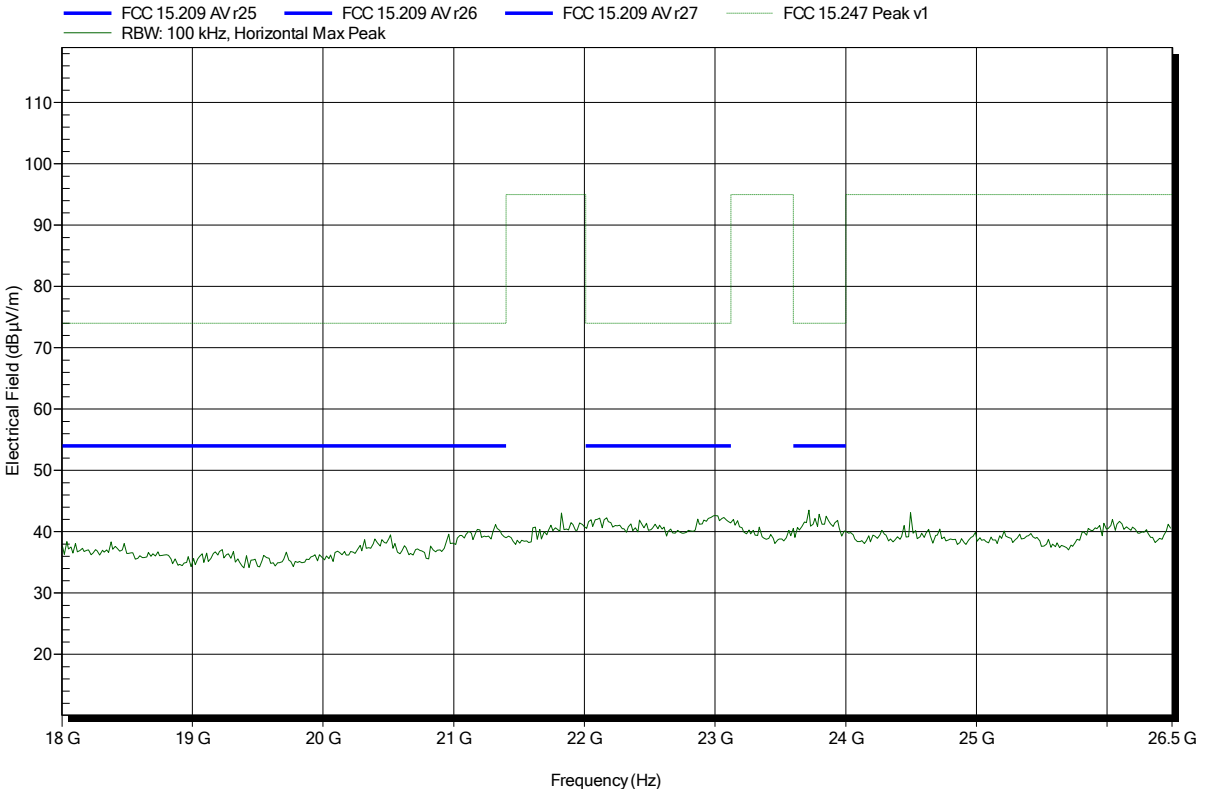

Spurious emissions according to FCC 15.247

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 025, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; 2480
Test Date:	2015-03-06
Note:	

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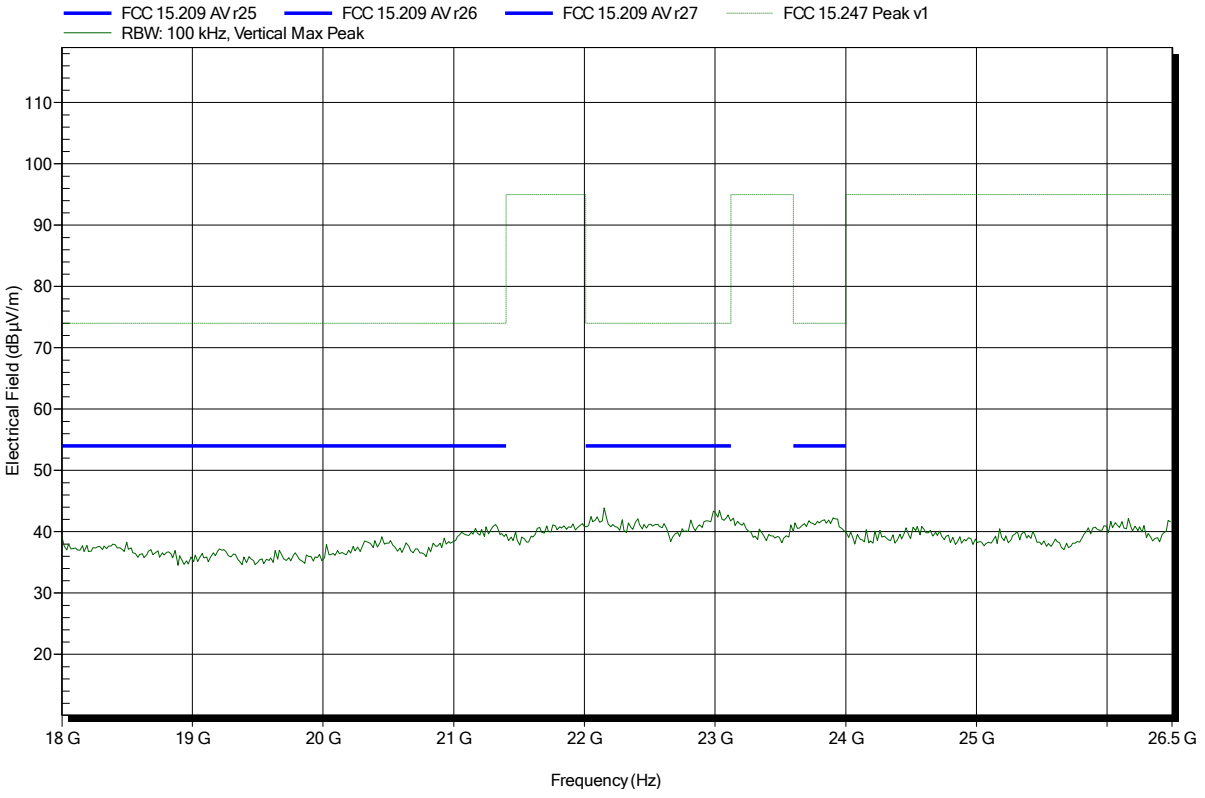

ANNEX B Receiver radiated spurious emissions

Spurious emissions according to RSS-GEN

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	RX; scan mode
Test Date:	2015-03-06
Note:	

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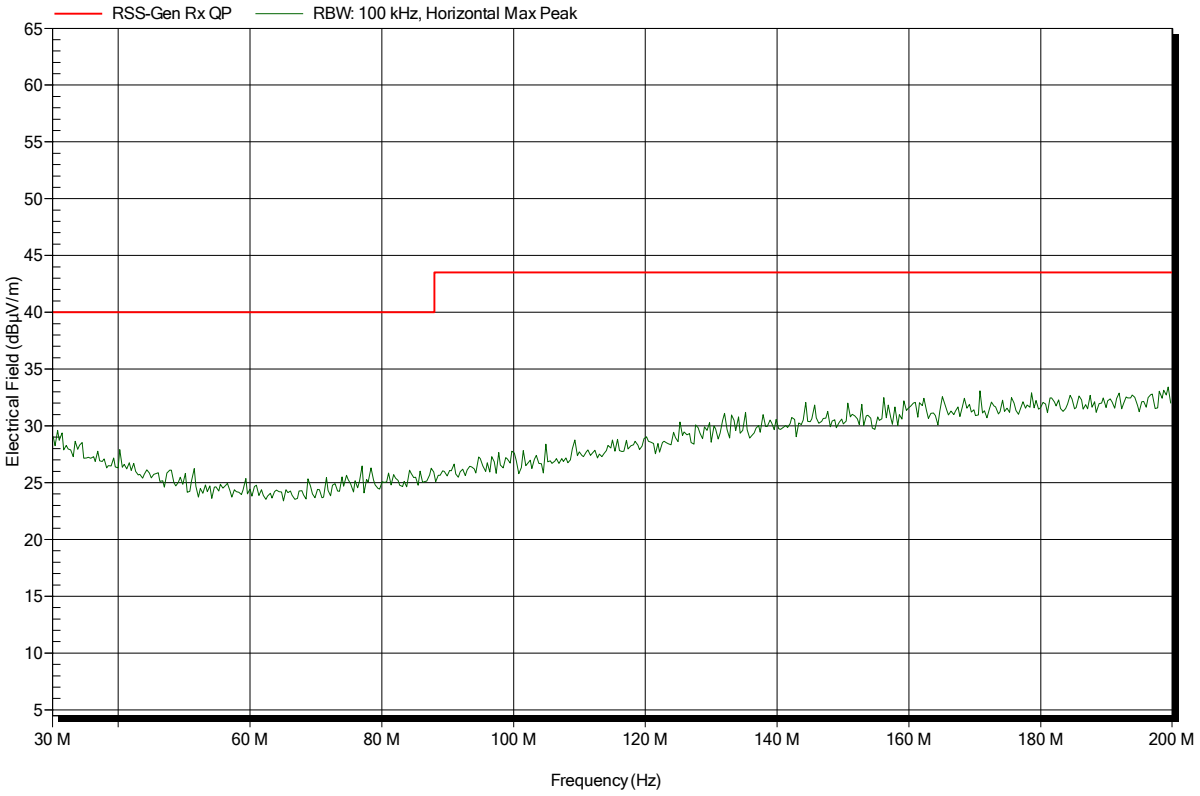

Spurious emissions according to RSS-GEN

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	RX; scan mode
Test Date:	2015-03-06
Note:	

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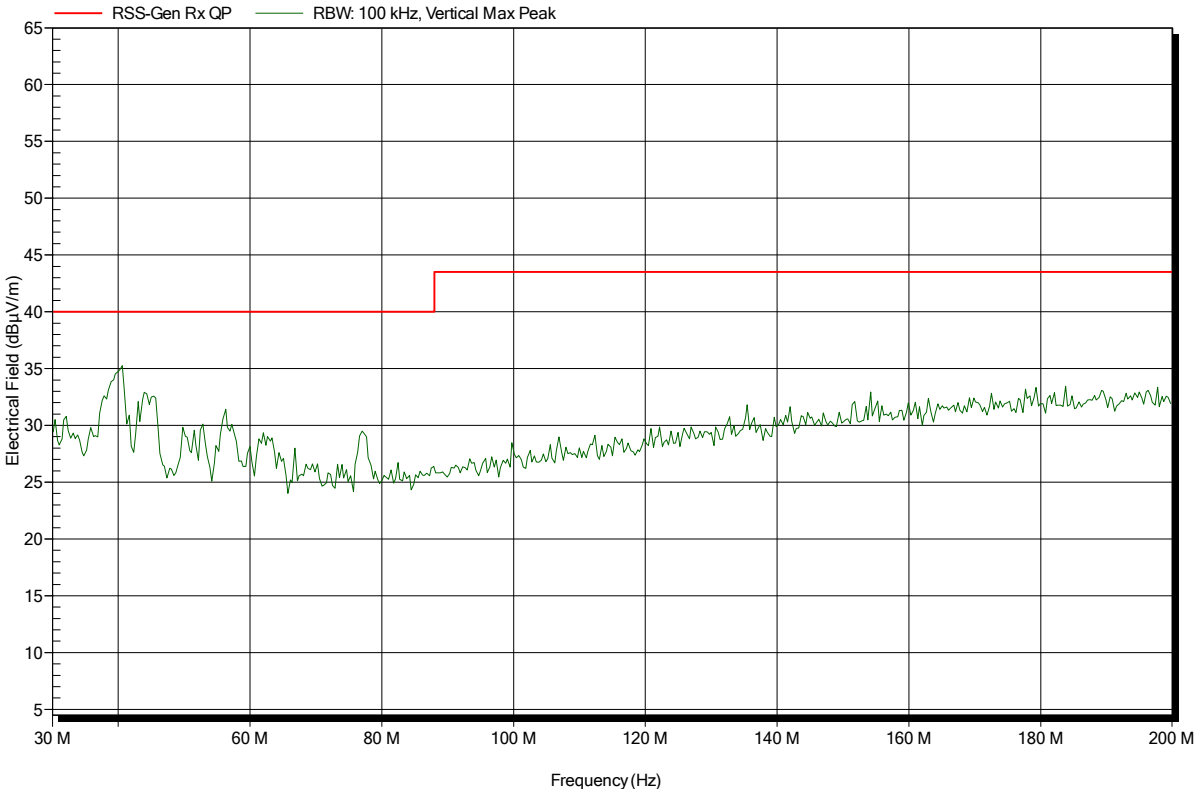

Spurious emissions according to RSS-GEN

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	RX; scan mode
Test Date:	2015-03-06
Note:	

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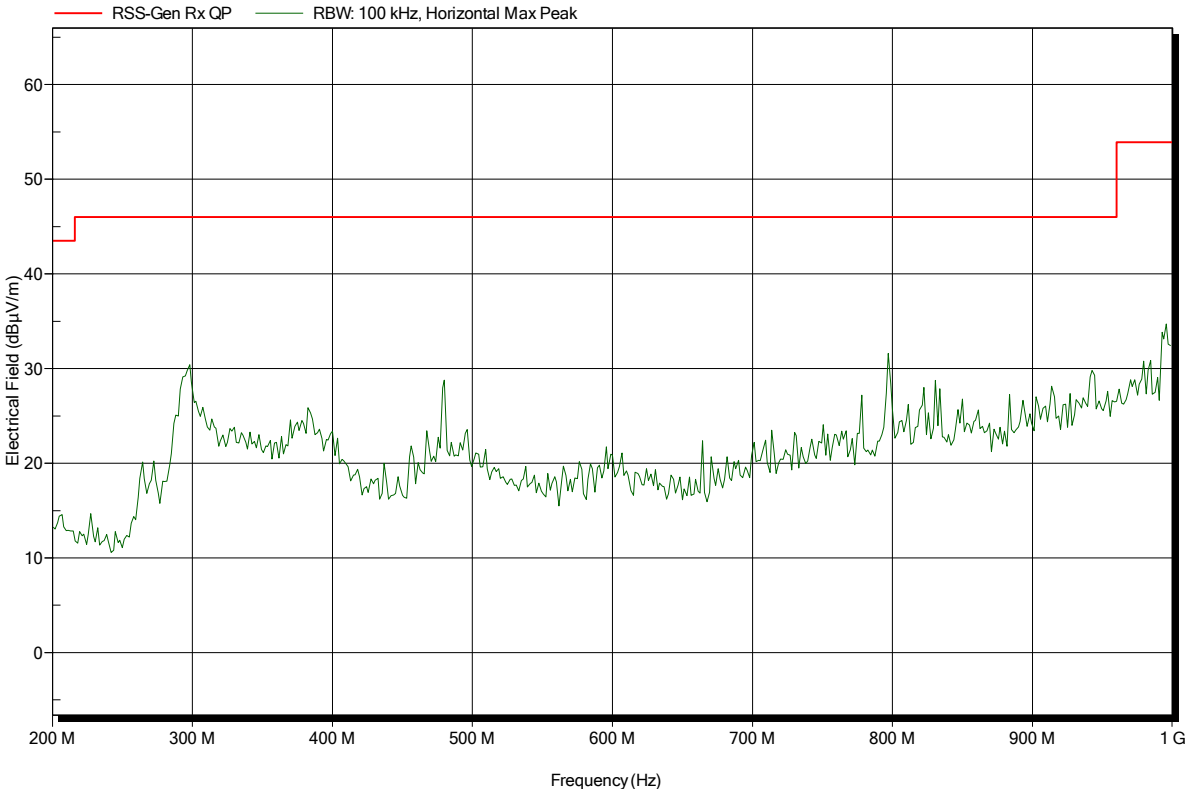

Spurious emissions according to RSS-GEN

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	RX; scan mode
Test Date:	2015-03-06
Note:	

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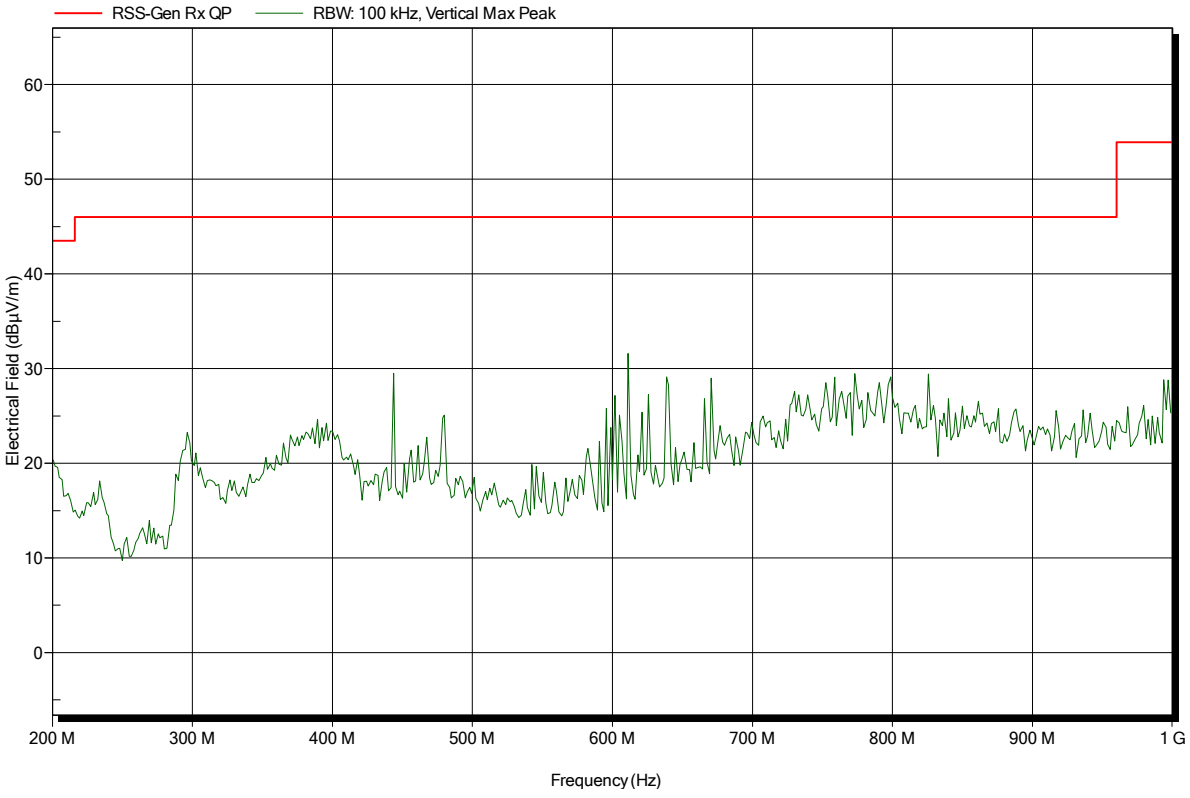

Spurious emissions according to RSS-GEN

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	RX; scan mode
Test Date:	2015-03-06
Note:	

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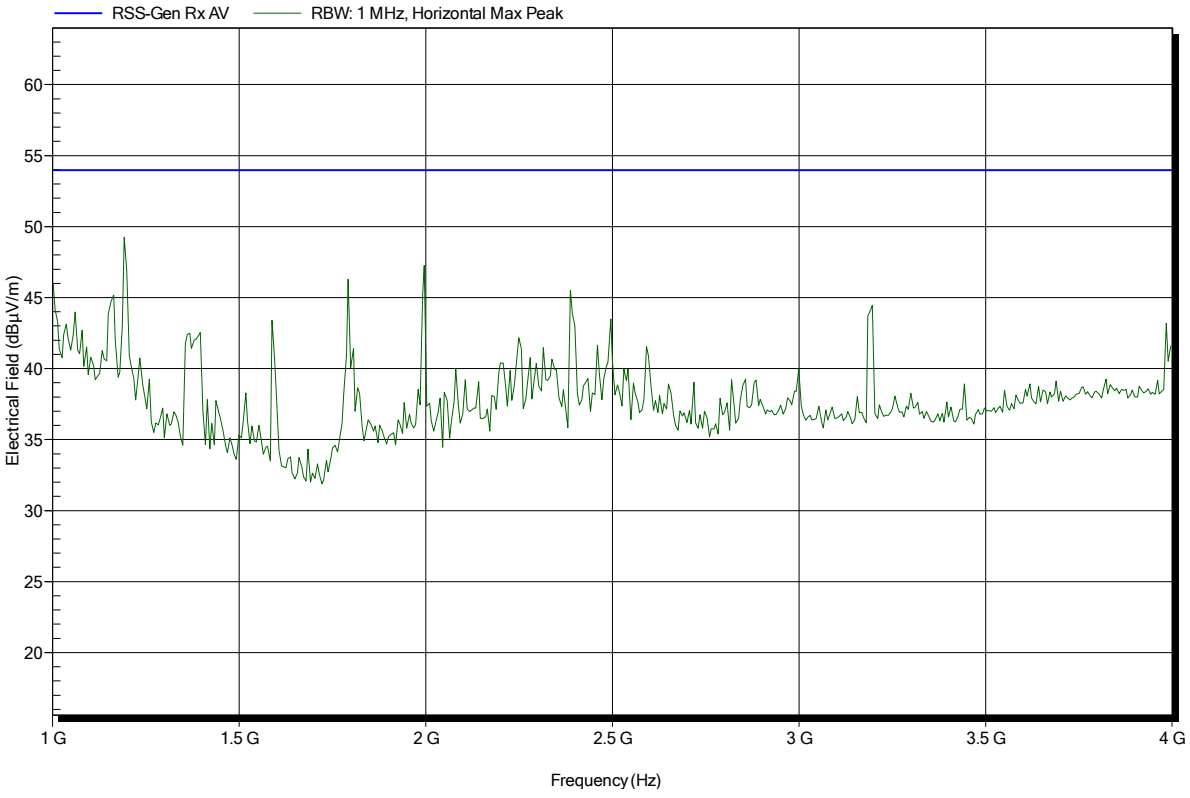

Spurious emissions according to RSS-GEN

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	RX; scan mode
Test Date:	2015-03-06
Note:	

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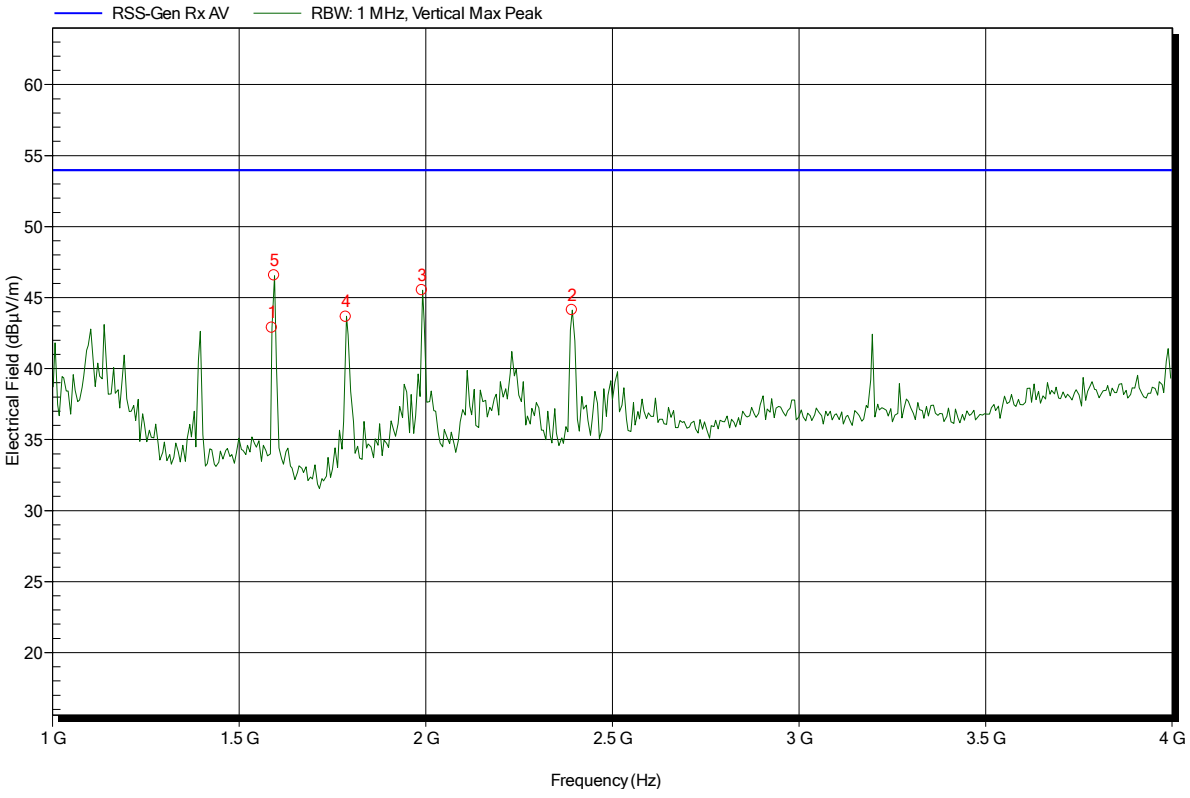

Frequency	Peak	Peak Limit	Peak Difference	Status
1.588 GHz	42.88 dBµV/m	53.98 dBµV/m	-11.1 dB	Pass
1.594 GHz	46.55 dBµV/m	53.98 dBµV/m	-7.43 dB	Pass
1.786 GHz	43.65 dBµV/m	53.98 dBµV/m	-10.33 dB	Pass
1.99 GHz	45.52 dBµV/m	53.98 dBµV/m	-8.46 dB	Pass
2.392 GHz	44.11 dBµV/m	53.98 dBµV/m	-9.87 dB	Pass

Spurious emissions according to RSS-GEN

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	RX; scan mode
Test Date:	2015-03-06
Note:	

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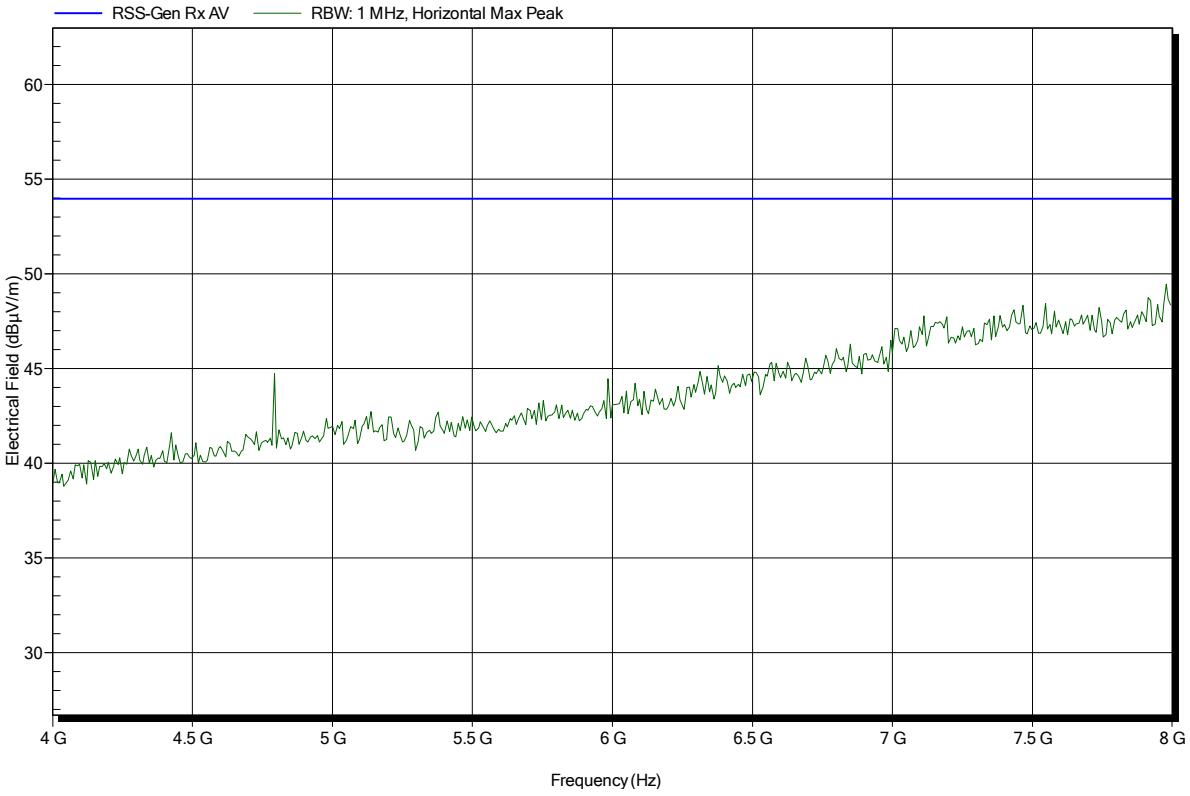

Spurious emissions according to RSS-GEN

Project number: G0M-1410-4214

Applicant:	Leica Geosystems GmbH
EUT Name:	Bluetooth, WLAN and BLE Modul
Model:	TiWi-BLE (Inwave BTFA-2450)
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 22°C, Vnom: 120V AC (AC/DC adaptor)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	RX; scan mode
Test Date:	2015-03-06
Note:	

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