

FCC TEST REPORT FCC 47 CFR Part 15C Industry Canada RSS-210 Digital transmission systems operating within the 902 – 928 MHz band	
Report Reference No.	G0M-1211-2398-TFC247D-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	Zentrum Mikroelektronik Dresden AG
Address	Grenzstr. 28 01109 Dresden GERMANY
Test specification:	
Standard	47 CFR Part 15C KDB Publication No. 558074 RSS-210, Issue 8, 2010-12 RSS-Gen, Issue 3, 2010-12 ANSI C63.4:2009
Equipment under test (EUT):	
Product description	SubGHz 6LoWPAN Radio Module
Model No.	ZWIR4512AC2
Hardware version	1.0
Firmware / Software version	1.6.1180
	FCC-ID: COR-ZWIR4512AC1 IC: N/A
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:

Date of receipt of test item: 2012-12-03

Date (s) of performance of tests: 2012-12-03 - 2012-12-04

Compiled by: Christian Weber

Tested by (+ signature).....: Wilfried Treffke 

(Testing Manager)

Approved by (+ signature): Jens Zimmermann 

(Test Lab Manager)

Date of issue: 2012-12-18

Total number of pages: 59

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:

Testing is performed for a class II permissive change. Test case selection is based on the modifications given in the permissive change letter in order to verify all affected radio characteristics. All other test case are considered unaffected by the modifications.

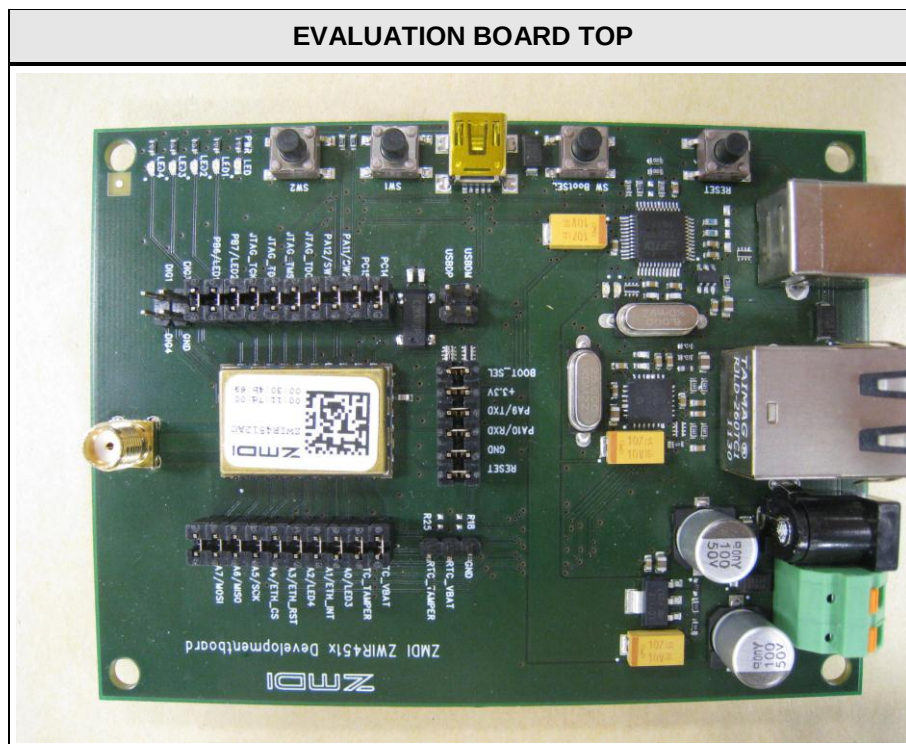
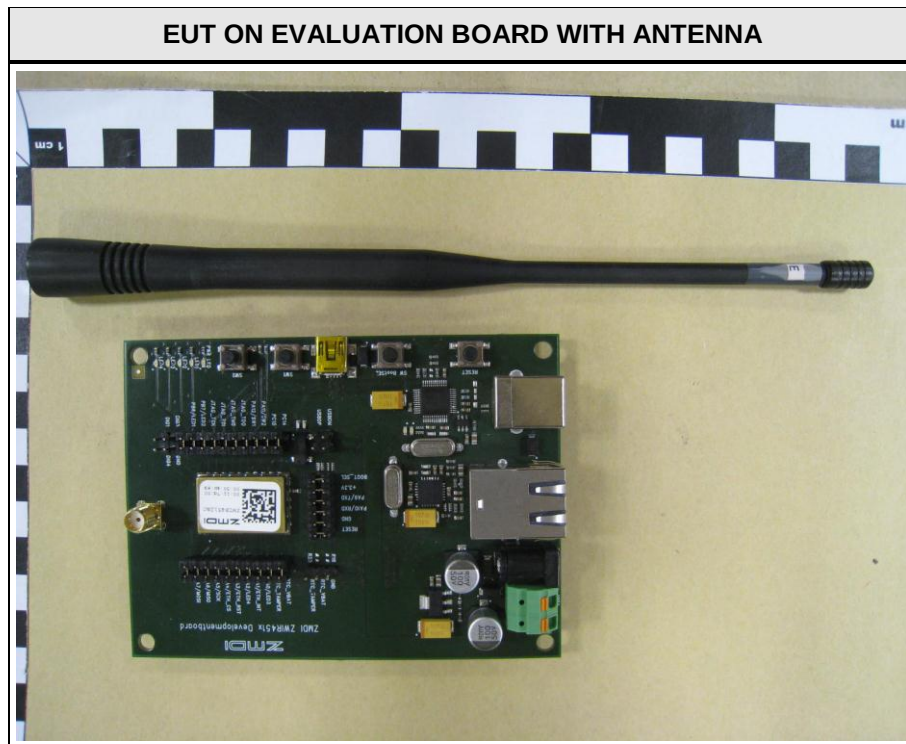
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1 Equipment (Test item) Description

Description	SubGHz 6LoWPAN Radio Module	
Model	ZWIR4512AC2	
Serial number	None	
Hardware version	1.0	
Software / Firmware version	1.6.1180	
FCC-ID	COR-ZWIR4512AC1	
IC	N/A	
Equipment type	Radio module	
Radio type	Transceiver	
Radio technology	IEEE 802.15.4	
Operating frequency range	906 - 924 MHz	
Assigned frequency band	902 - 928 MHz	
Tested Frequencies	F _{LOW}	906 MHz
	F _{MID}	916 MHz
	F _{HIGH}	926 MHz
Spreading	DSSS	
Modulations	BPSK, O-QPSK	
Number of channels	10 Channel	
Channel spacing	2 MHz	
Number of antennas	1	
Antenna	Type	external dedicated
	Model	portable rubber duck antenna MEXE902RPSM
	Manufacturer	PCTEL, Inc.
	Gain	2.0 dBi
Manufacturer	Zentrum Mikroelektronik Dresden AG Grenzstr. 28 01109 Dresden GERMANY	
Power supply	V _{NOM}	3.3 VDC
AC/DC-Adaptor	Model	N/A
	Vendor	N/A
	Input	N/A
	Output	N/A

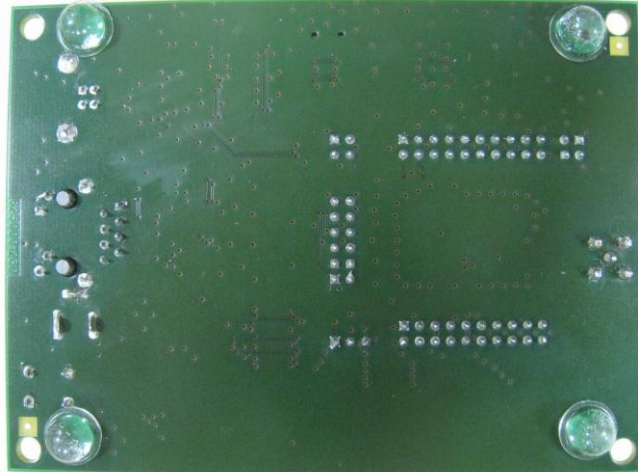
1.1 Photos – Equipment External



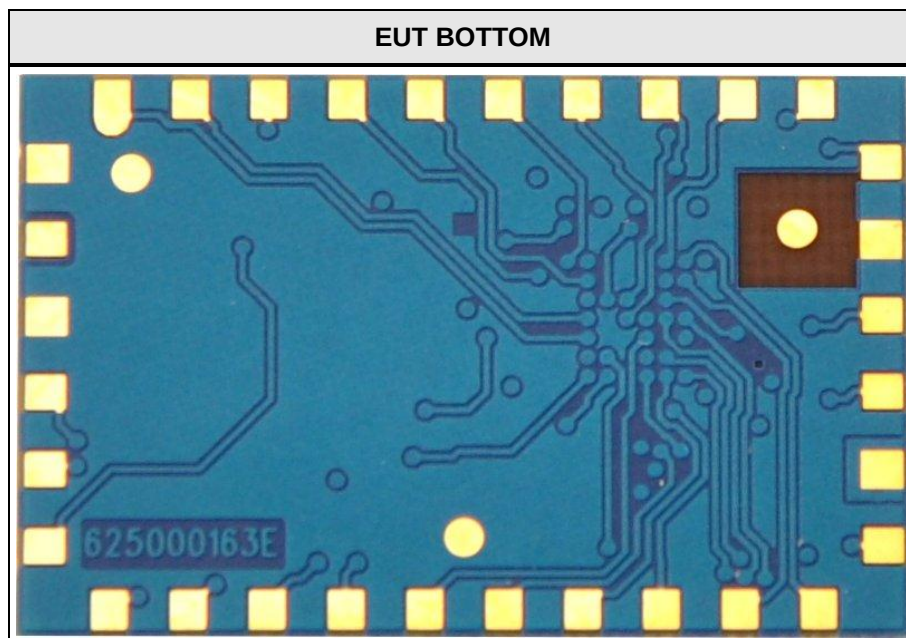
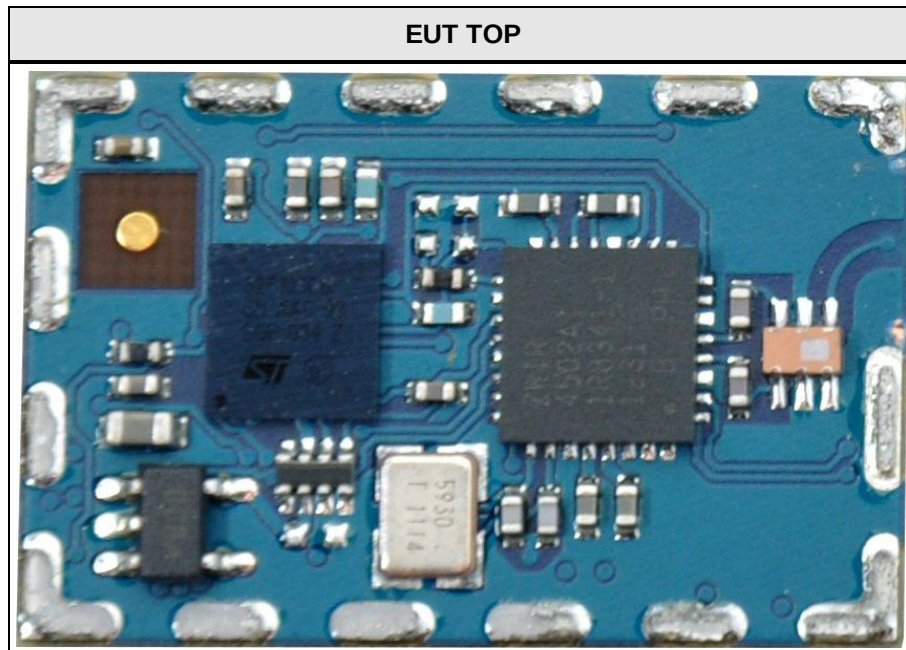
Test Report No.: G0M-1211-2398-TFC247D-V01

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

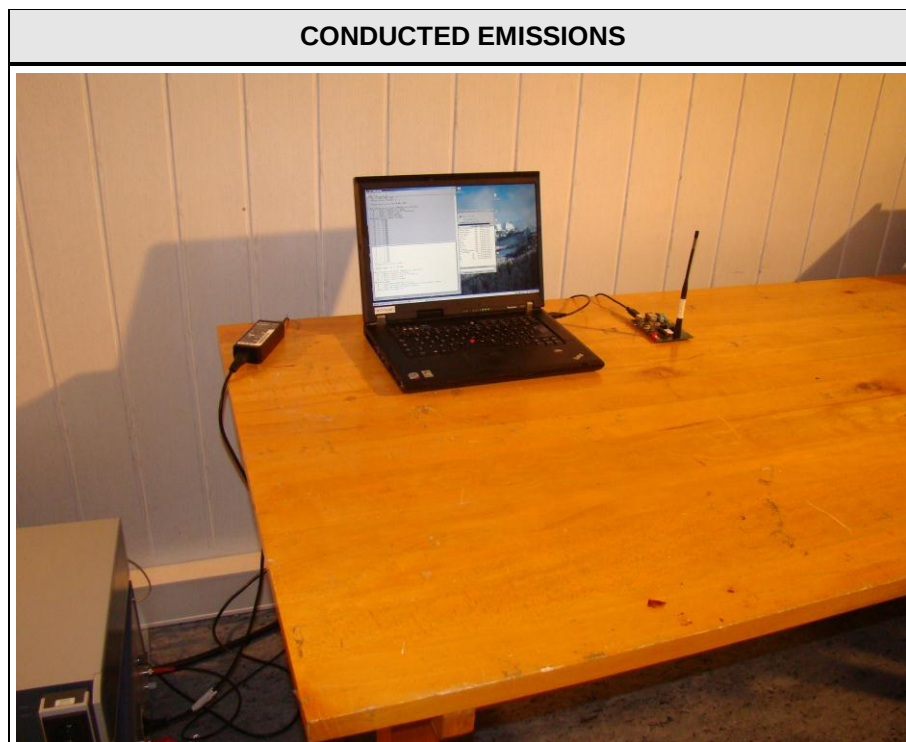
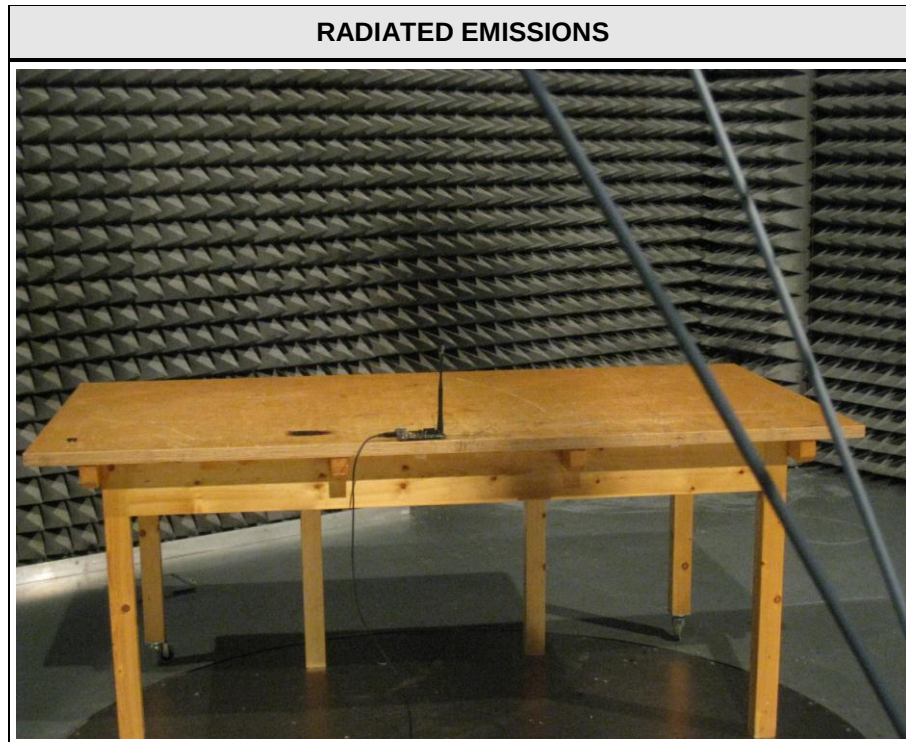
EVALUATION BOARD BOTTOM



1.2 Photos – Equipment internal



1.3 Photos – Test setup



1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
None				
*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	
BPSK	General conditions:	EUT powered by laboratory power supply via evaluation board.
	Radio conditions:	Mode = standalone transmit Spreading = DSSS Modulation = BPSK Duty cycle = 100 % Power level = Maximum
O-QPSK	General conditions:	EUT powered by laboratory power supply via evaluation board.
	Radio conditions:	Mode = standalone transmit Spreading = DSSS Modulation = O-QPSK Duty cycle = 100 % Power level = Maximum
Receive	General conditions:	EUT powered by laboratory power supply via evaluation board.
	Radio conditions:	Mode = standalone receive Spreading = DSSS Modulation = BPSK & O-QPSK
AC-Powerline	General conditions:	EUT powered by laboratory power supply via evaluation board.
	Radio conditions:	Mode = standalone transmit Spreading = DSSS Modulation = BPSK Duty cycle = 100 % Power level = Maximum

1.6 Test Equipment Used During Testing

Maximum peak conducted power					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2011-12	2012-12

Radiated spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 5	EF00395	-	-
Spectrum Analyzer	R&S	FSIQ26	EF00242	2012-05	2013-05
Biconical Antenna	R&S	HK 116	EF00012	2010-01	2013-01
LPD Antenna	R&S	HL 223	EF00187	2011-02	2014-02
LPD Antenna	R&S	HL 025	EF00327	2010-02	2013-02

AC powerline conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2012-10	2014-10
EMI Test Receiver	R&S	ESCS 30	EF00295	2012-08	2013-08

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:

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

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 15C, IC RSS-210				
Product Specific Standard Section	Requirement – Test	Reference Method	Result	Remarks
RSS-Gen 4.6.1	Occupied Bandwidth	RSS-Gen 4.6.1	N/R	No IC
FCC § 15.247(a)(2) IC RSS-210 § A8.2	6 dB Bandwidth	KDB Publication No. 558074	N/T	Results are considered unaffected by modification
FCC § 15.247(b)(3) IC RSS-210 § A8.4	Maximum peak conducted power	KDB Publication No. 558074	PASS	power verification only
FCC § 15.247(e) IC RSS-210 § A8.2	Power spectral density	KDB Publication No. 558074	N/T	Results are considered unaffected by modification
47 CFR 15.207 RSS-Gen 7.2.4	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	N/T	Results are considered unaffected by modification
FCC § 15.247(d) IC RSS-210 § A8.5	Conducted spurious emissions	KDB Publication No. 558074	N/T	Results are considered unaffected by modification
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 4.10 IC RSS-Gen 6.1	Receiver radiated spurious emissions	ANSI C 63.4	N/R	No IC
Remarks:				

3 Test Conditions and Results

3.1 Test Conditions and Results – Maximum peak conducted power

Maximum peak conducted power acc. 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 _{MID}						
EUT test mode	BPSK / O-QPSK						
Measurement mode	Peak						
Maximum antenna gain	2 dBi ⇒ Limit correction = 0 dB						
Limits							
1W (30dBm)							
The conducted output power limit specified above is based on the use of antennas with directional gains that do not exceed 6dBi. If transmitting antennas of directional gain greater than 6dBi 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 6dBi.							
Test setup							
Spectrum Analyzer EUT							
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 to be larger than the 6 dB bandwidth and RBW is set to be at least the 6 dB bandwidth 4. Peak output power is determined from the maximum of the emission envelope							
Test results							
Channel	Frequency [MHz]	Voltage	Peak power [dbm]	Peak power [W]	Limit [dBm]	Margin [dB]	Result
F _{LOW} / BPSK	906	3.3 VDC	8.6	0.0044	30	-21.40	PASS
F _{HIGH} / O-QPSK	926	3.3 VDC	8.5	0.0043	30	-21.50	PASS
Comments: The measurement results represent the worst case conducted power values							

3.3 Test Conditions and Results – AC power line conducted emissions

Power line conducted emissions acc. 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-Powerline			
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.					

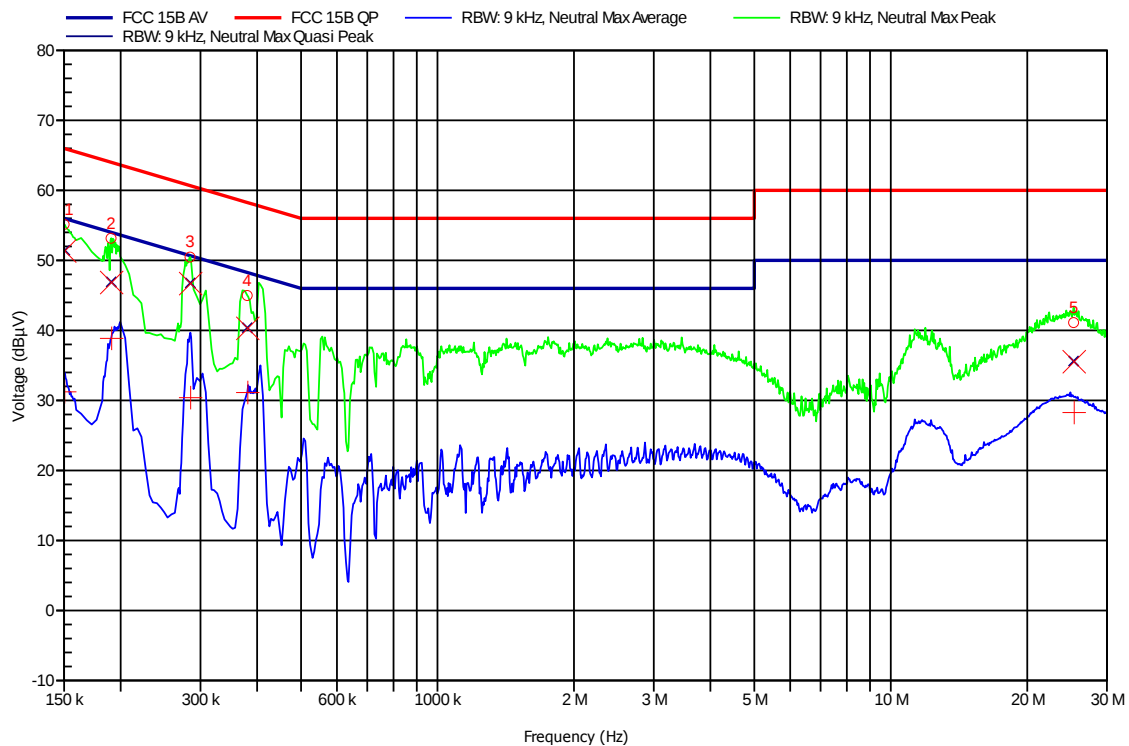
Conducted Emissions

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

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz 6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Handrik
 Test Conditions: Tnom: 22°C, Unom: 5 V DC (USB)
 LISN: ESH2-Z5 N
 Mode: 916 MHz, BPSK
 Test Date: 2012-12-06
 Note:

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Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
150 kHz	51.43 dBµV	66 dBµV	-14.57 dB	Pass
190.5 kHz	46.93 dBµV	64.01 dBµV	-17.09 dB	Pass
284.55 kHz	46.77 dBµV	60.68 dBµV	-13.91 dB	Pass
380.4 kHz	40.38 dBµV	58.27 dBµV	-17.89 dB	Pass
25.308 MHz	35.61 dBµV	60 dBµV	-24.39 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
150 kHz	31.32 dBµV	56 dBµV	-24.68 dB	Pass
190.5 kHz	38.96 dBµV	54.01 dBµV	-15.06 dB	Pass
284.55 kHz	30.48 dBµV	50.68 dBµV	-20.2 dB	Pass
380.4 kHz	31.22 dBµV	48.27 dBµV	-17.05 dB	Pass
25.308 MHz	28.36 dBµV	50 dBµV	-21.64 dB	Pass

Test Report No.: G0M-1211-2398-TFC247D-V01

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

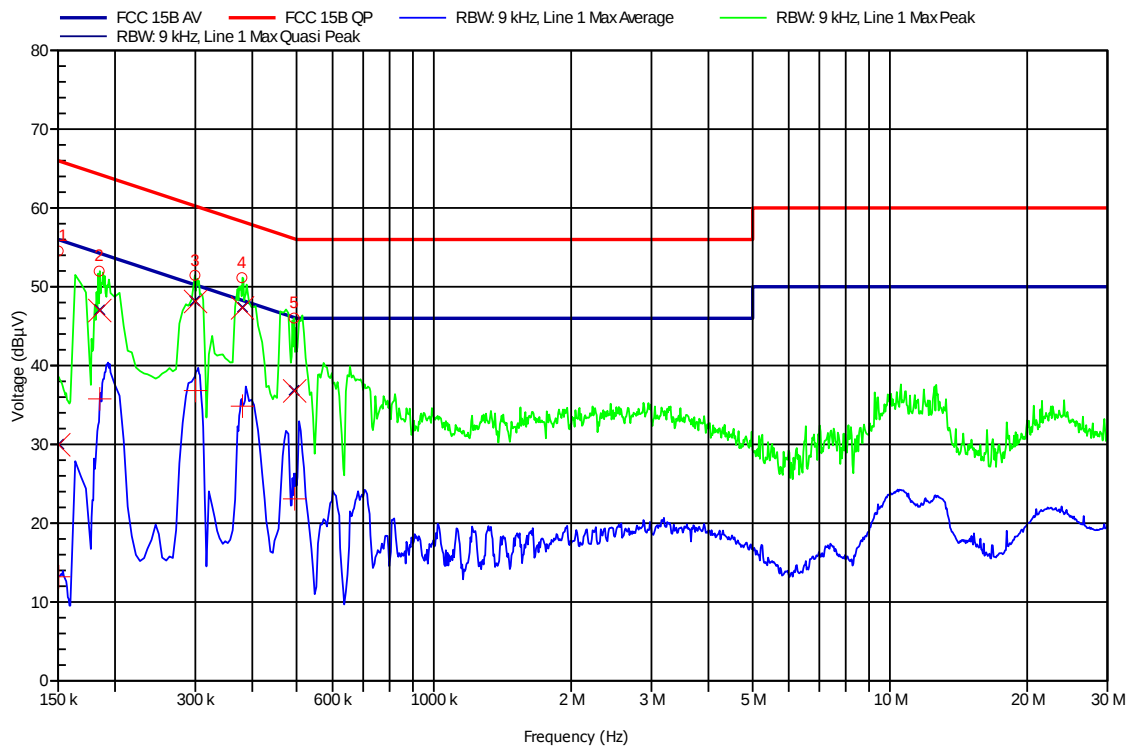
Conducted Emissions

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

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
EUT Name: SubGHz 6LoWPAN Radio Module
Model: ZWIR4512AC2
Test Site: Eurofins Product Service GmbH
Operator: Mr. Handrik
Test Conditions: Tnom: 22°C, Unom: 5 V DC (USB)
LISN: ESH2-Z5 L
Mode: 916 MHz, BPSK
Test Date: 2012-12-06
Note:

Index 2



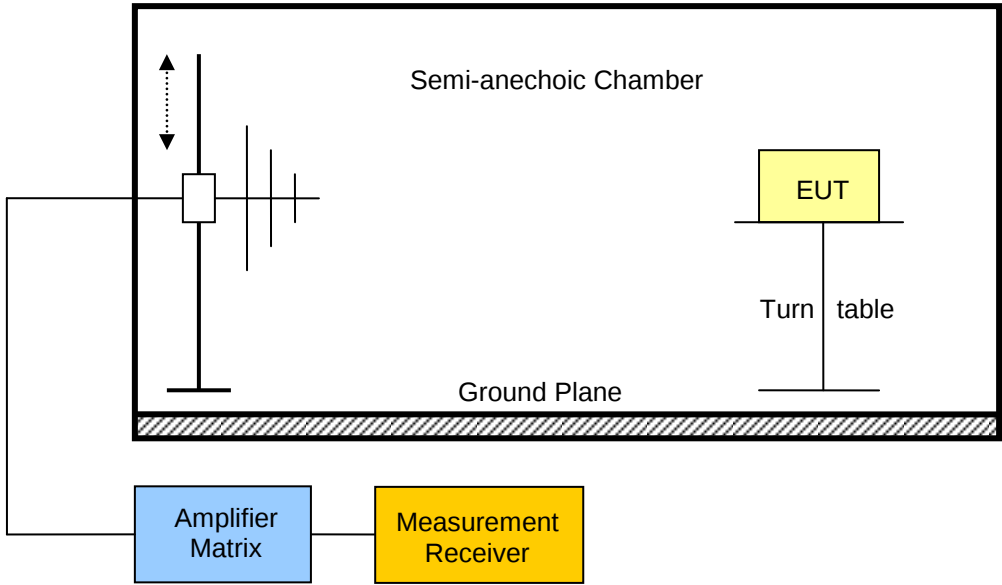
Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
150 kHz	30.02 dBμV	66 dBμV	-35.98 dB	Pass
184.65 kHz	47.05 dBμV	64.27 dBμV	-17.22 dB	Pass
299.4 kHz	48.21 dBμV	60.26 dBμV	-12.05 dB	Pass
379.5 kHz	47.39 dBμV	58.29 dBμV	-10.9 dB	Pass
493.8 kHz	36.85 dBμV	56.1 dBμV	-19.25 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
150 kHz	13.27 dBμV	56 dBμV	-42.73 dB	Pass
184.65 kHz	35.85 dBμV	54.27 dBμV	-18.42 dB	Pass
299.4 kHz	36.91 dBμV	50.26 dBμV	-13.35 dB	Pass
379.5 kHz	34.93 dBμV	48.29 dBμV	-13.36 dB	Pass
493.8 kHz	23.16 dBμV	46.1 dBμV	-22.94 dB	Pass

Test Report No.: G0M-1211-2398-TFC247D-V01

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

3.4 Test Conditions and Results – Transmitter radiated emissions

Transmitter radiated emissions acc. 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 – 10 th Harmonic			
EUT test mode	BPSK / O-QPSK			
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				
				

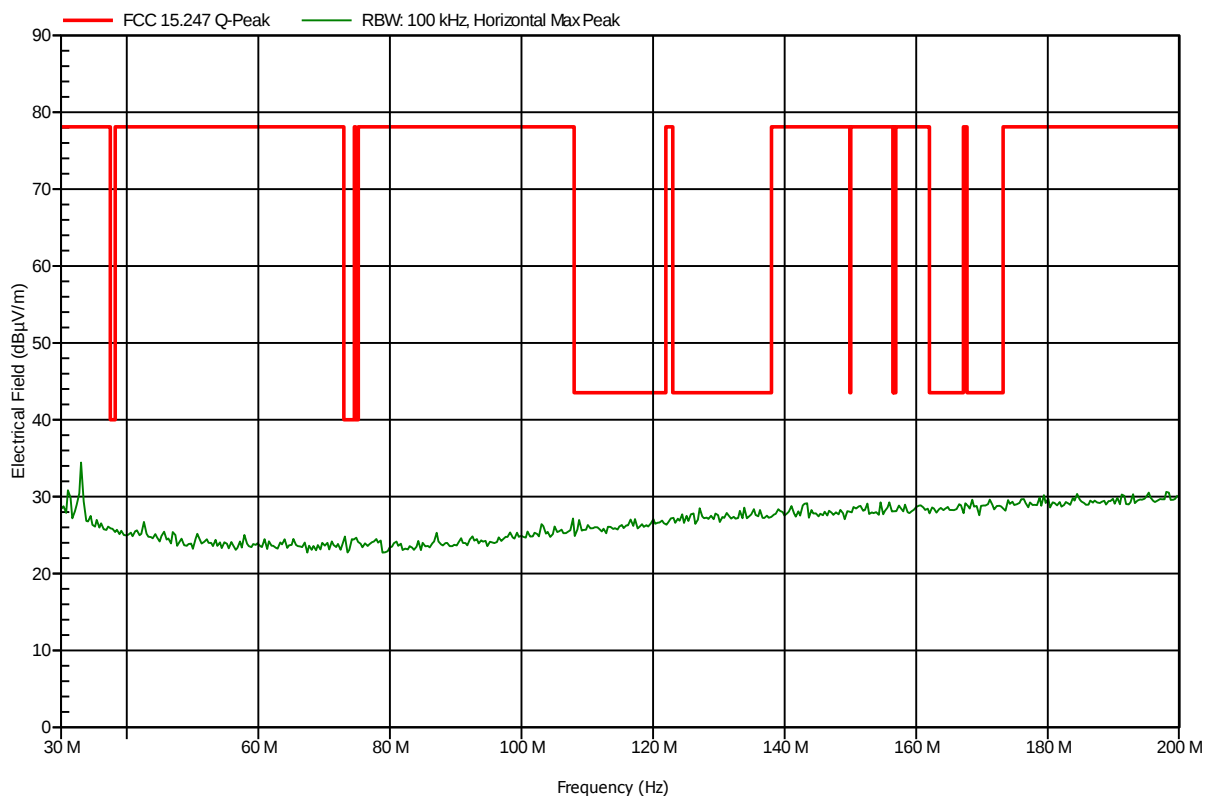
Test procedure								
1. EUT set to test mode (Communication tester is used if needed)								
2. Span it set according to measurement range								
3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz								
4. Markers are set to peak emission levels within restricted bands								
Test results – BPSK								
Channel	Frequency [MHz]	Emission [MHz]	Level [dBμV/m]	Detector	Pol.	Limit [dBμV/m]	Limit distance [m]*	Margin [dB]
F _{LOW}	906	4530	56.12	pk	ver	74.00	3	-17.88
F _{LOW}	906	4530	50.73	avg	ver	54.00	3	-03.27
F _{MID}	916	No significant spurious emissions						
F _{HIGH}	926	No significant spurious emissions						
Test results – O-QPSK								
Channel	Frequency [MHz]	Emission [MHz]	Level [dBμV/m]	Detector	Pol.	Limit [dBμV/m]	Limit distance [m]*	Margin [dB]
F _{LOW}	906	900.599	54.70	pk	ver	78.10	3	-23.40
F _{LOW}	906	4529	53.53	pk	ver	74.00	3	-20.47
F _{LOW}	906	4529	45.12	avg	ver	54.00	3	-08.88
F _{MID}	916	No significant spurious emissions						
F _{HIGH}	926	931.593	56.32	pk	ver	78.10	3	-21.78
Comments: * Physical distance between EUT and measurement antenna.								

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer:	Zentrum Mikroelektronik Dresden AG
EUT Name:	SubGHz6LoWPAN Radio Module
Model:	ZWIR4512AC2
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 5.0V DC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; O-QPSK; 924 MHz; power:u=10dBm
Test Date:	2012-12-03
Note:	worst case

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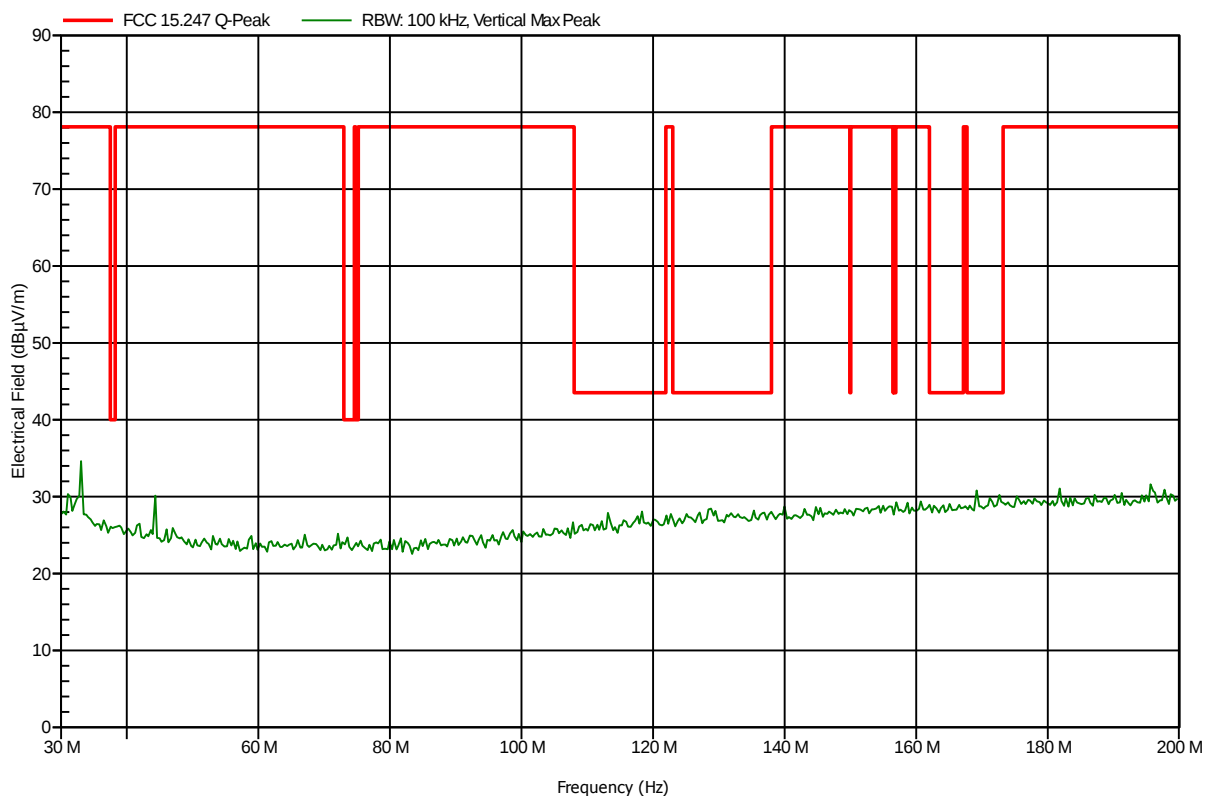


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 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HK 116, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note: worst case

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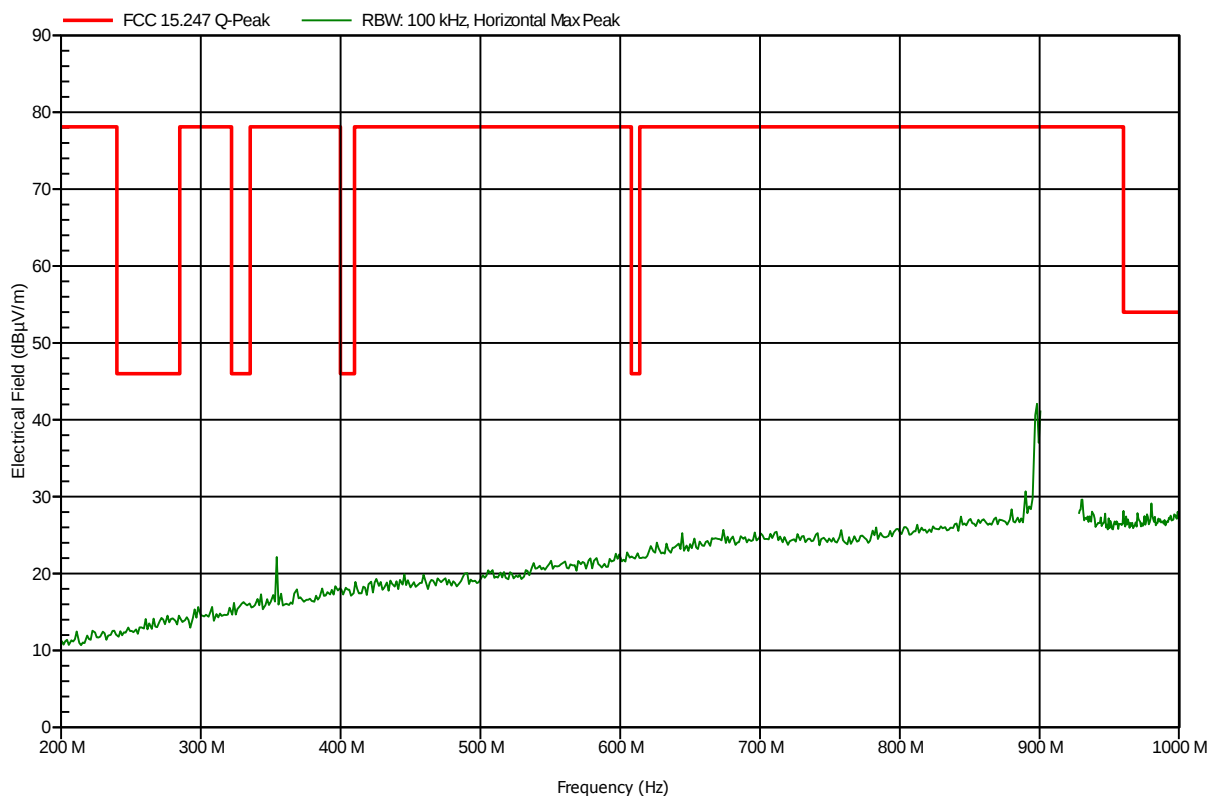
Eurofins Product Service GmbH
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 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HL 223, Horizontal
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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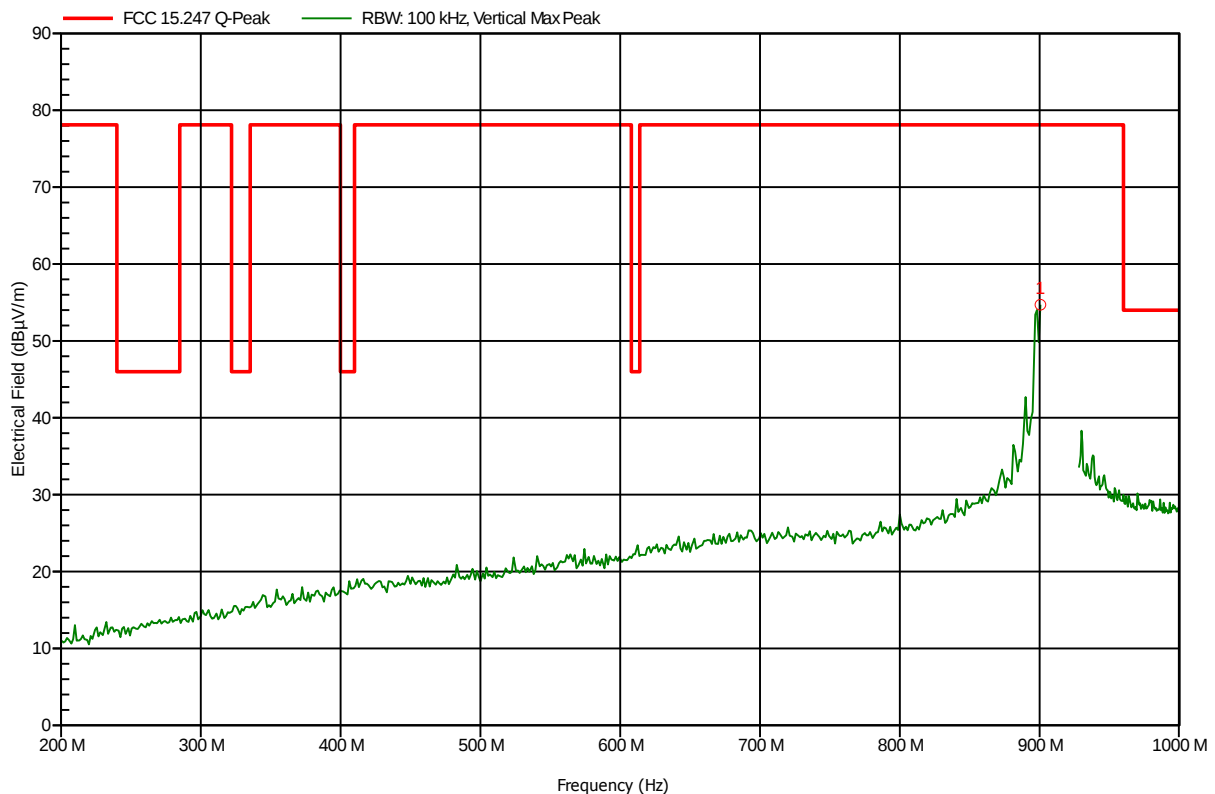


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 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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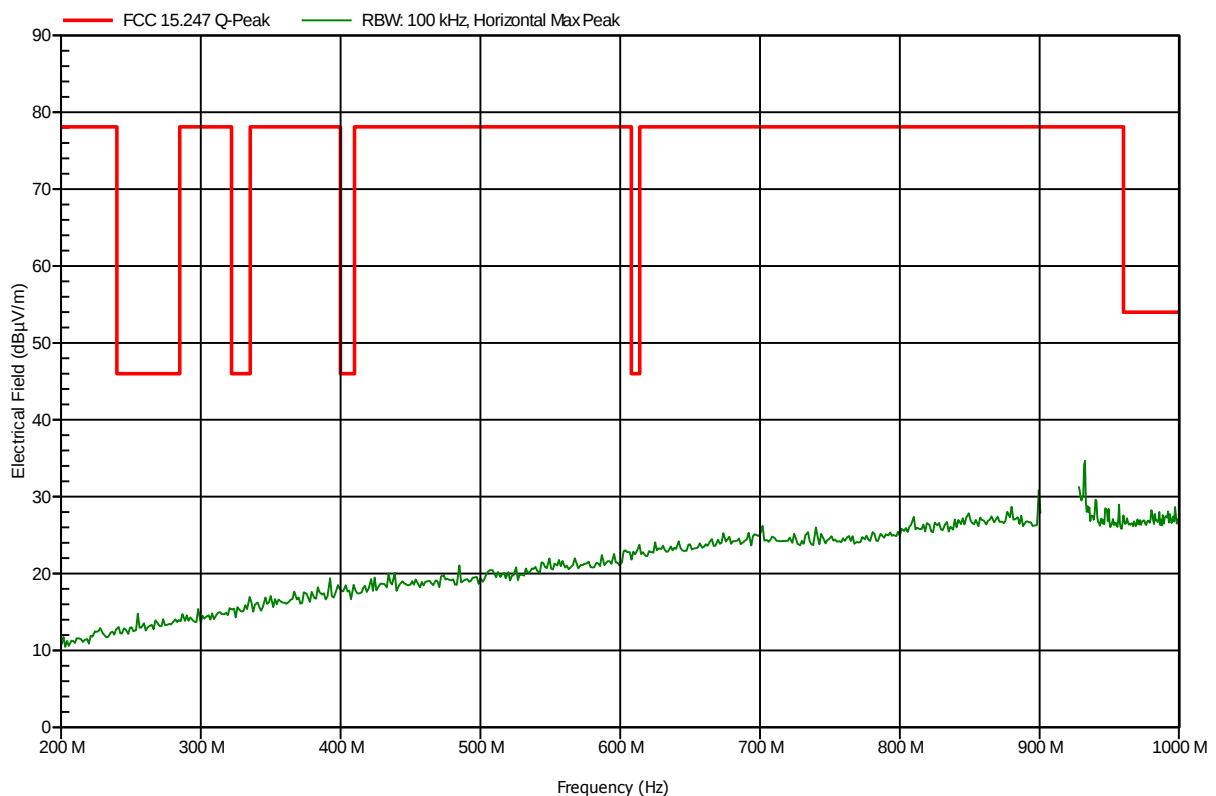
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
900.599 MHz	54.7 dBµV/m	78.1 dBµV/m	-23.4 dB	Pass

Spurious emissions according to FCC 15.247

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 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HL 223, Horizontal
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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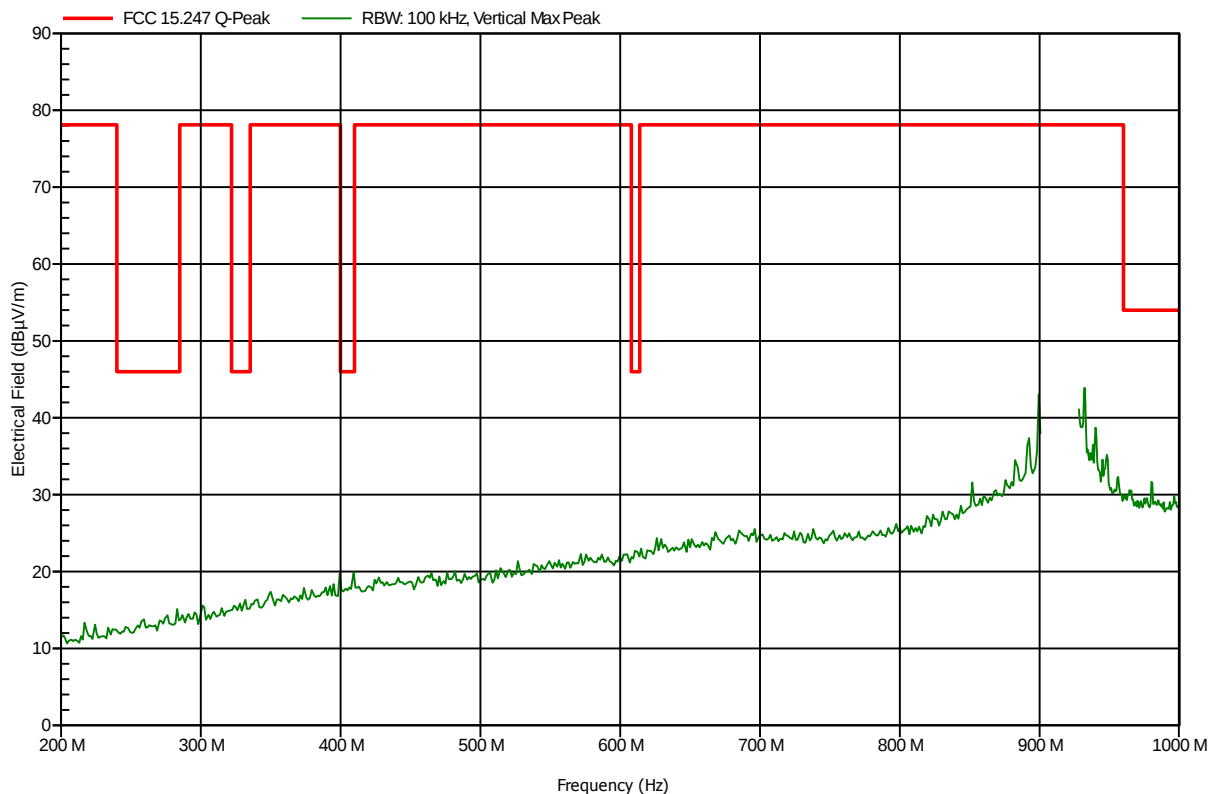


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 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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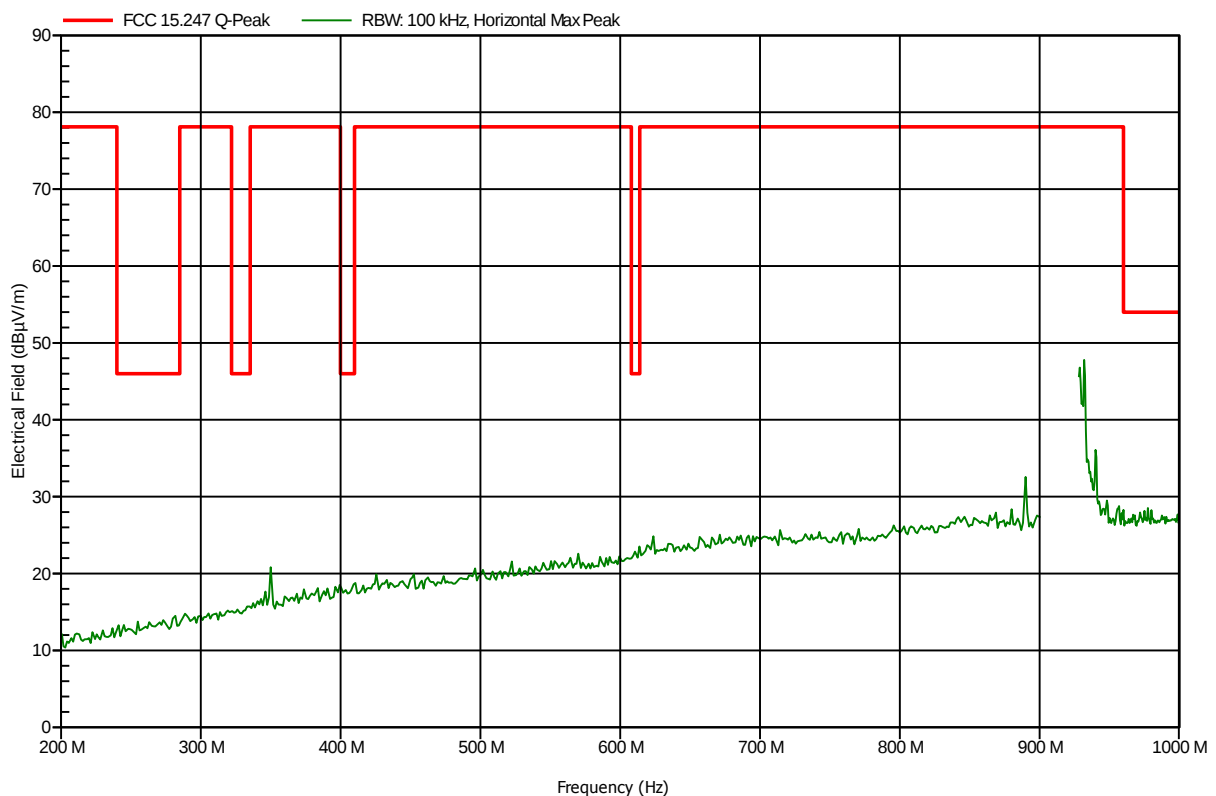


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Test Conditions:	Tnom: 24°C, Vnom: 5.0V DC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; O-QPSK; 924 MHz; power:u=10dBm
Test Date:	2012-12-03
Note:	

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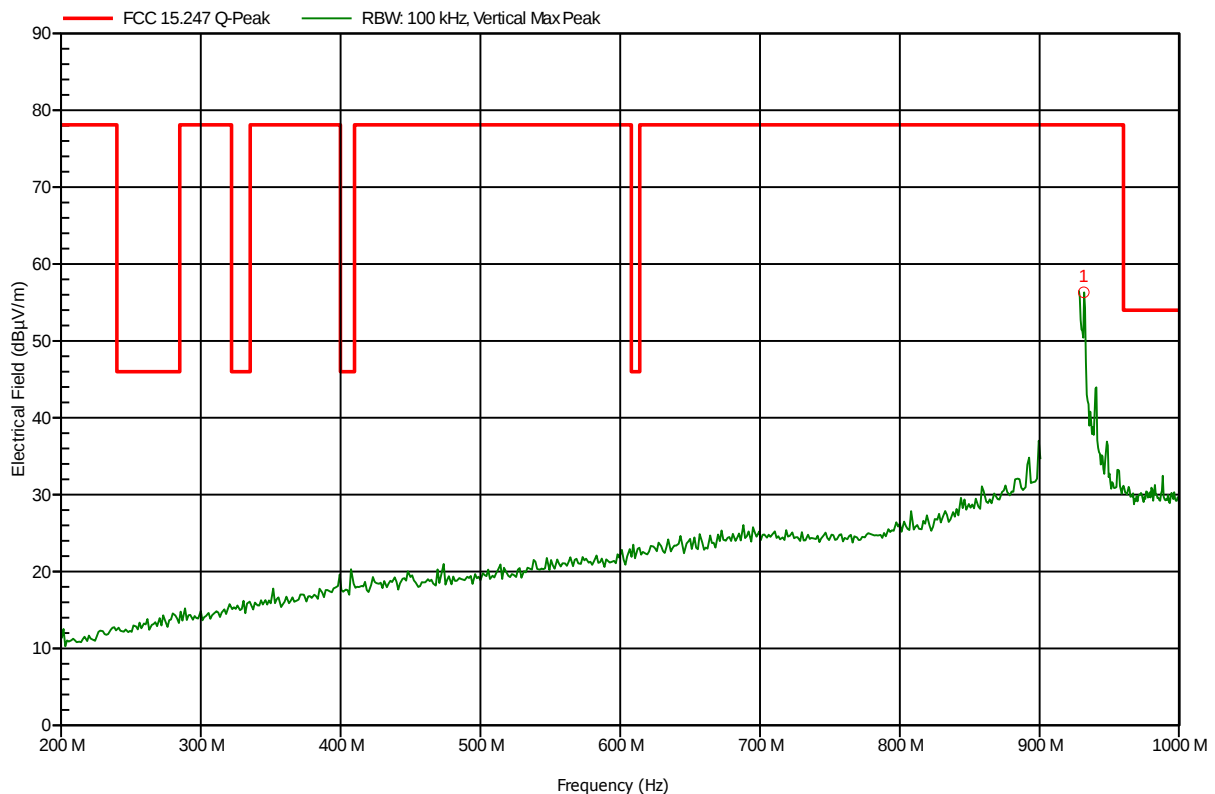


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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Frequency	Peak	Peak Limit	Peak Difference	Peak Status
931.593 MHz	56.32 dBμV/m	78.1 dBμV/m	-21.78 dB	Pass

Test Report No.: G0M-1211-2398-TFC247D-V01

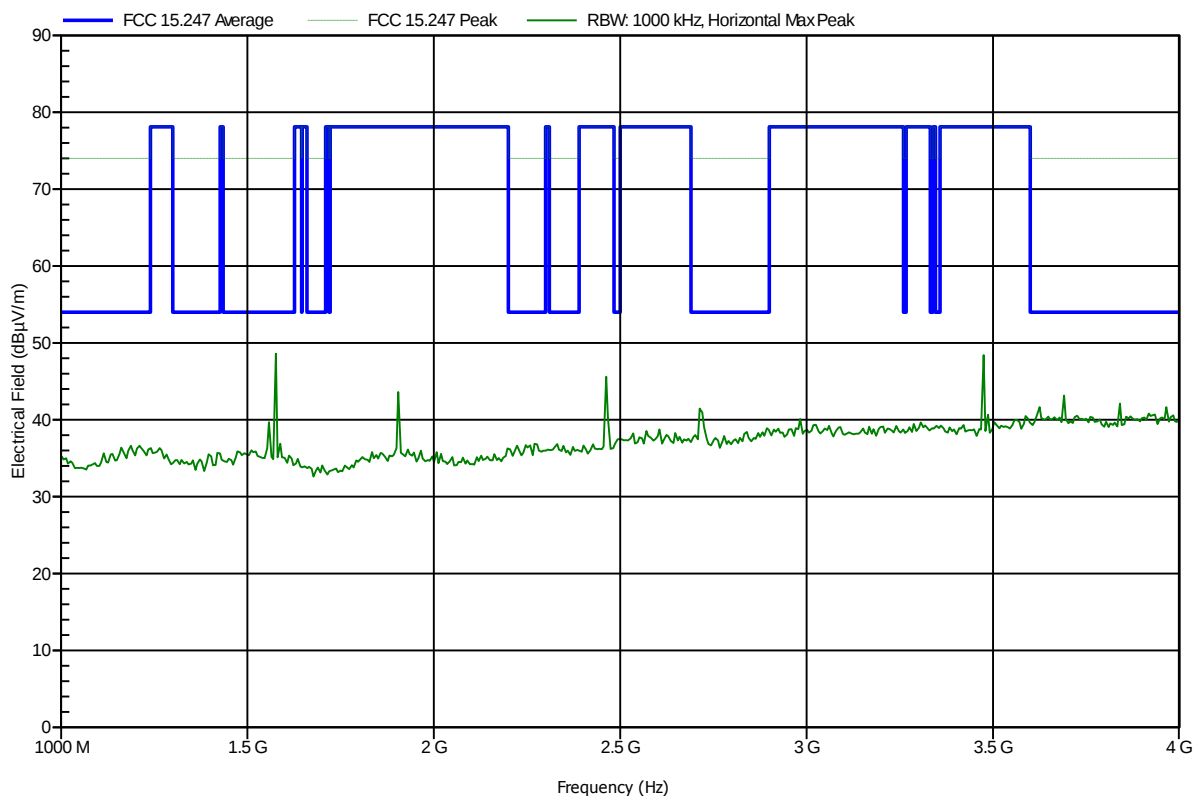
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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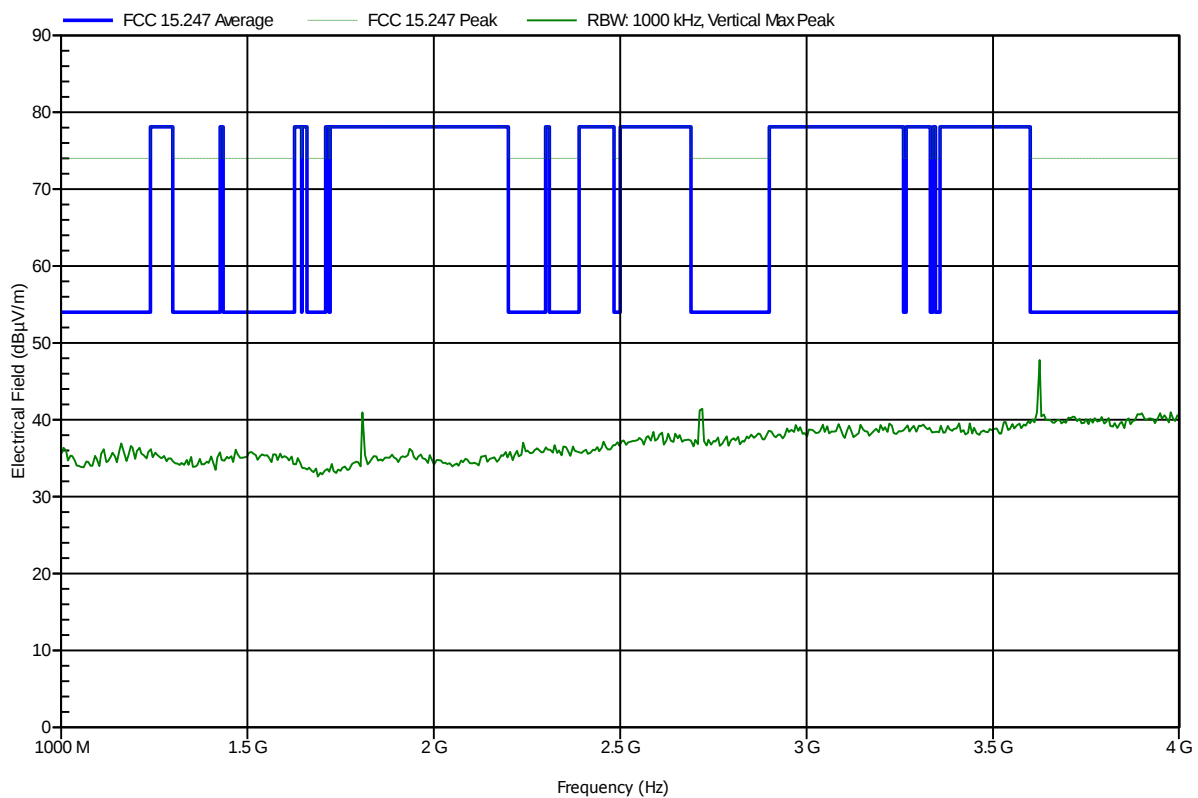


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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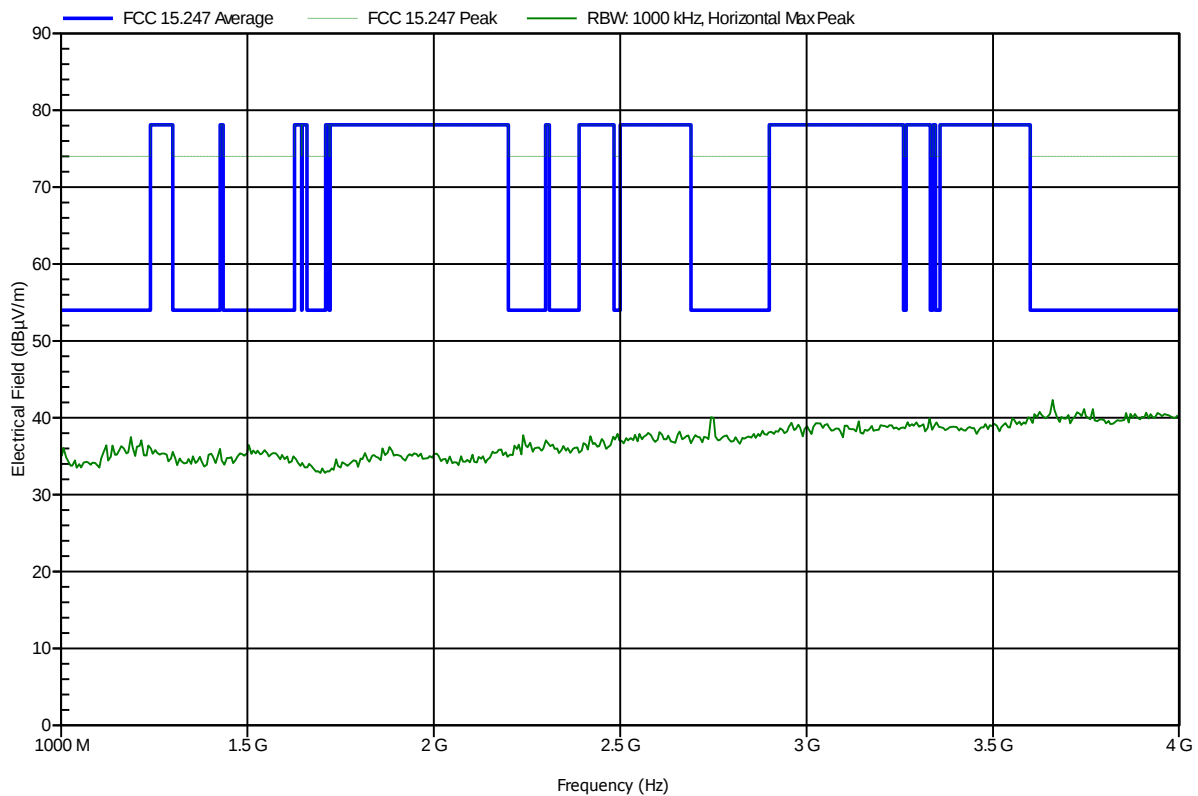


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

Index 28

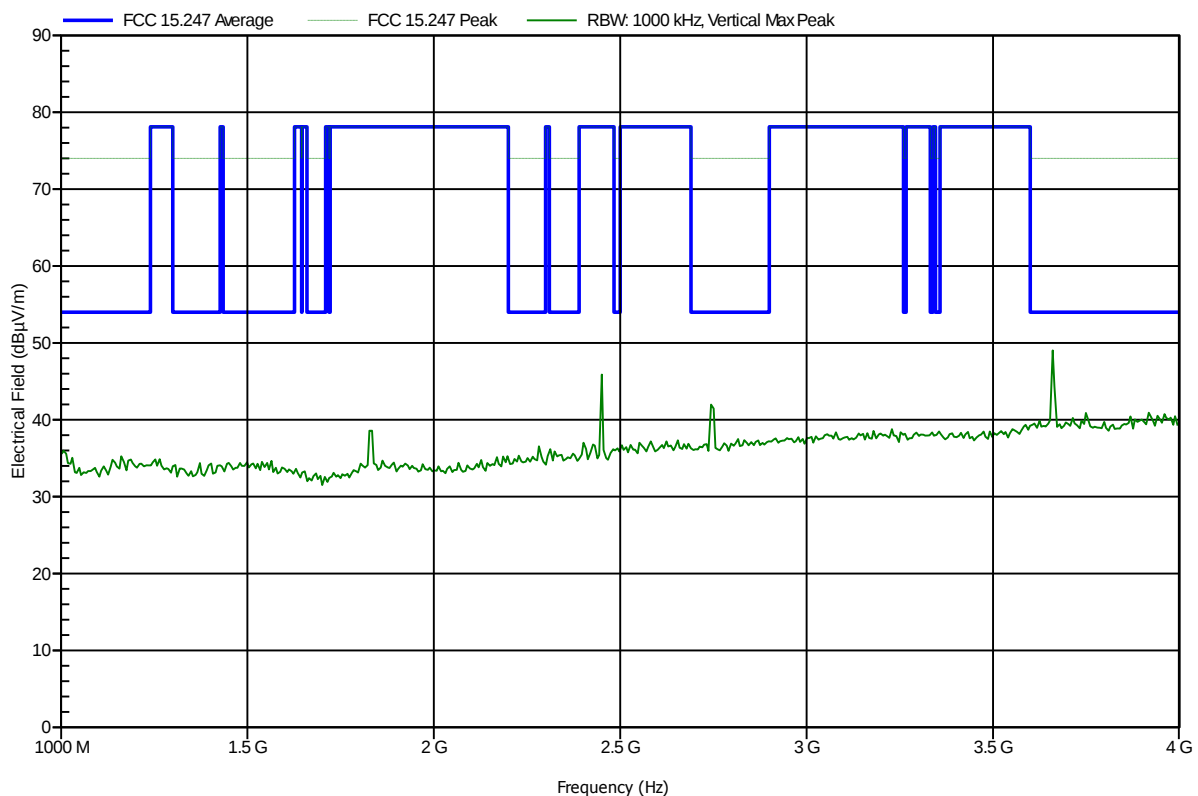


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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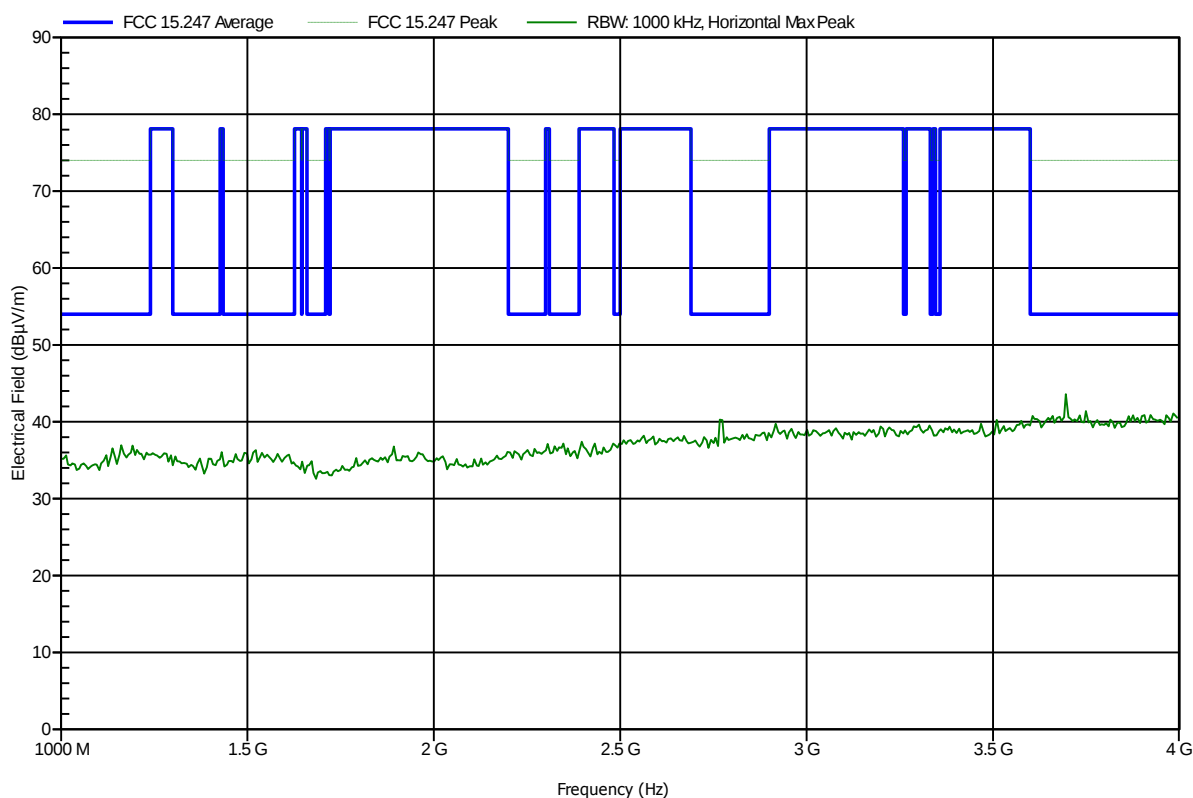


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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Test Report No.: G0M-1211-2398-TFC247D-V01

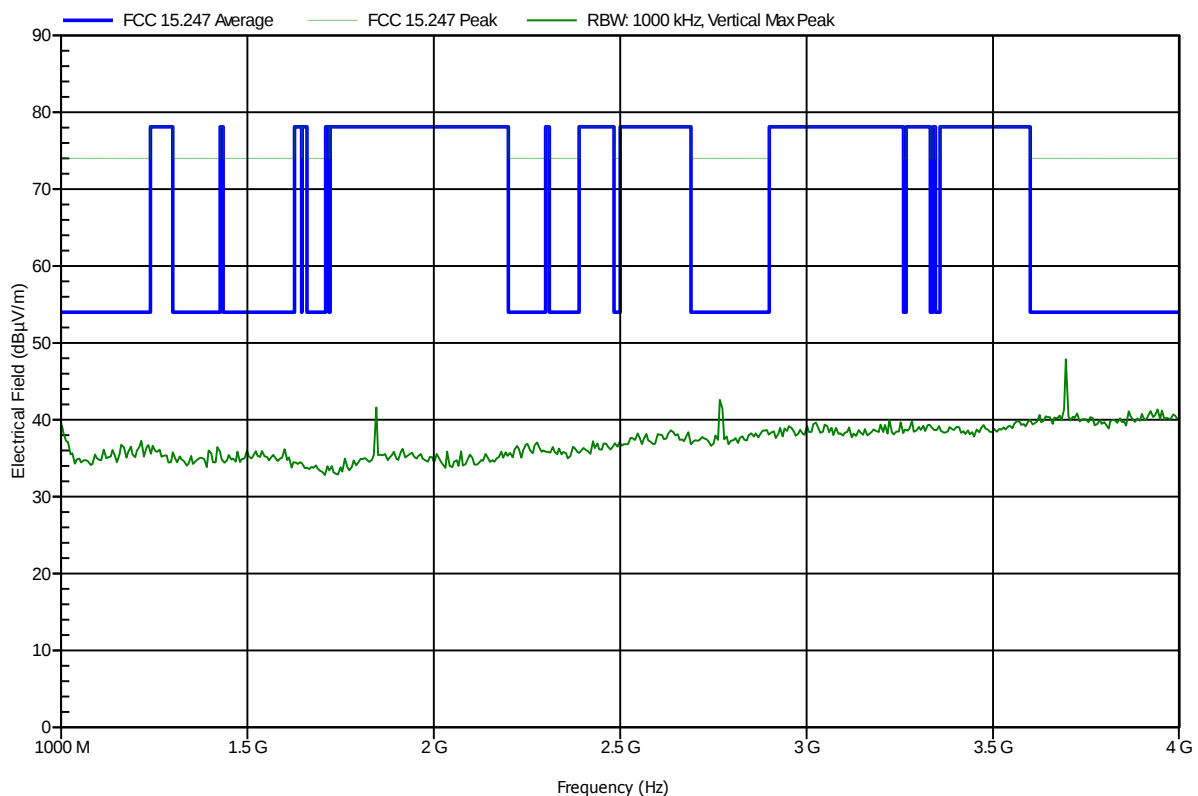
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

Index 24

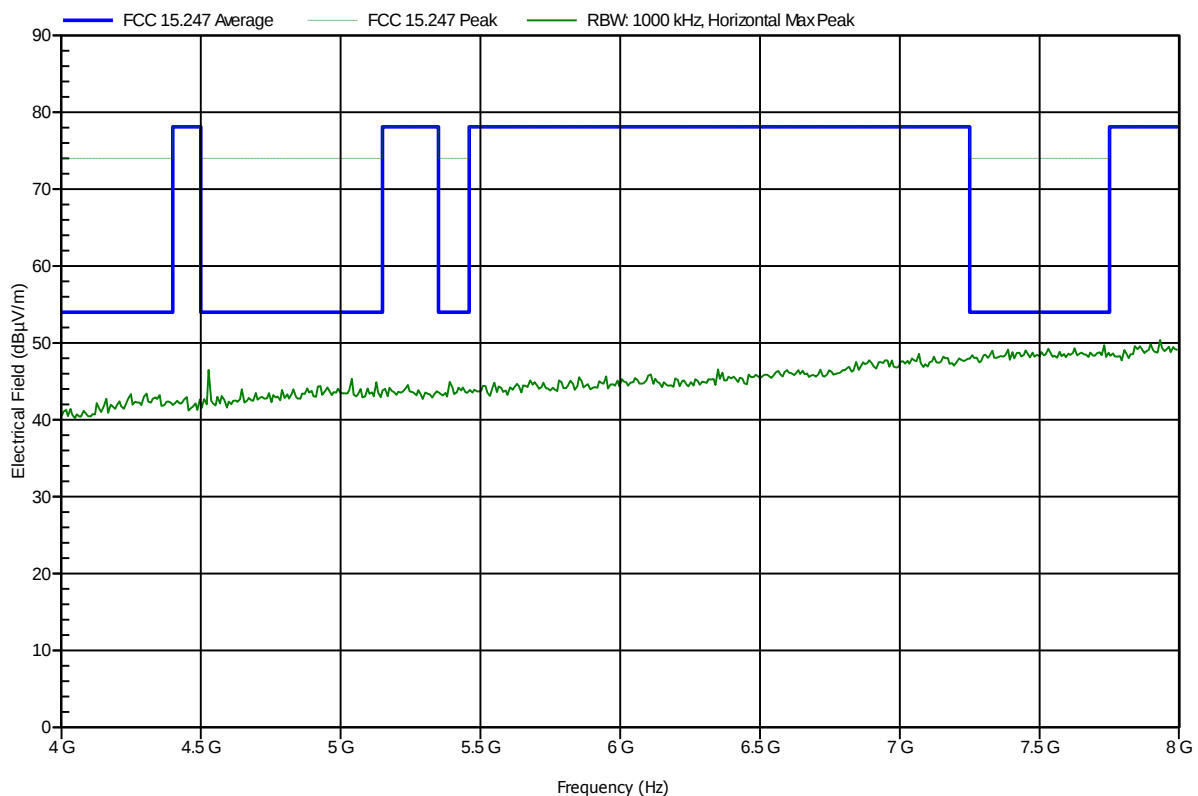


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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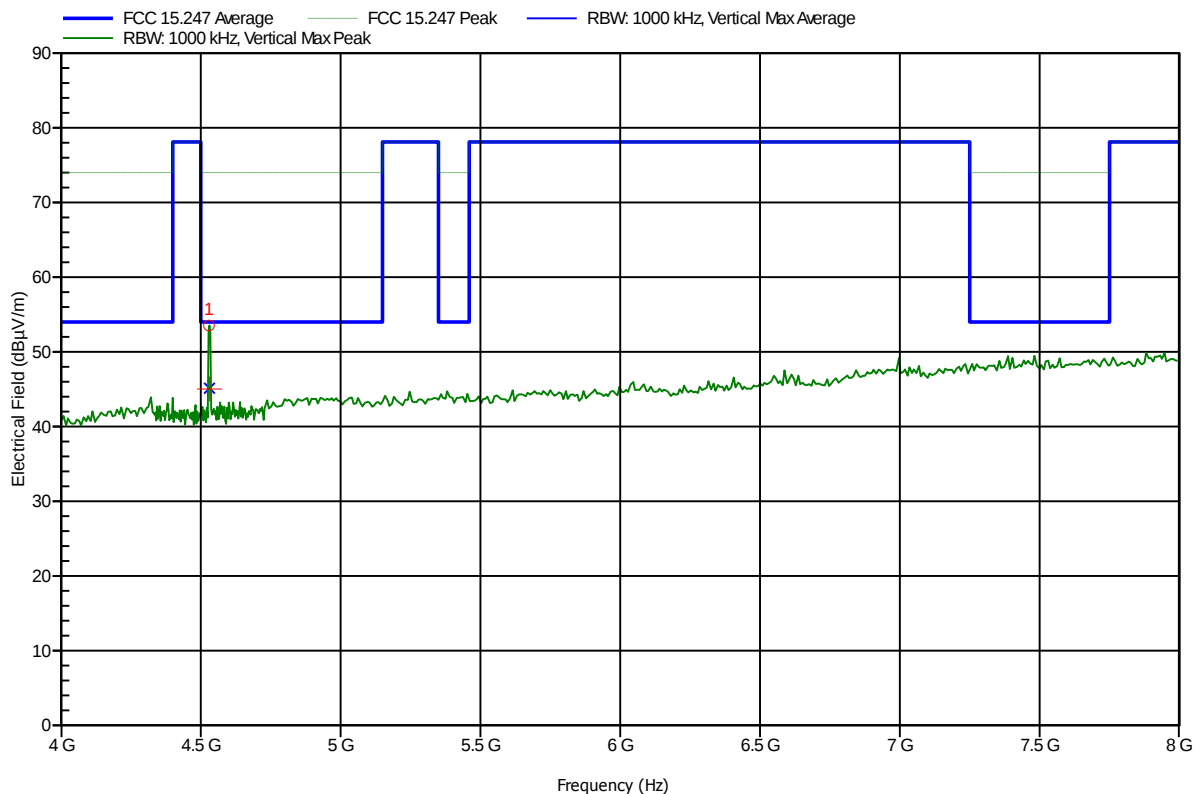


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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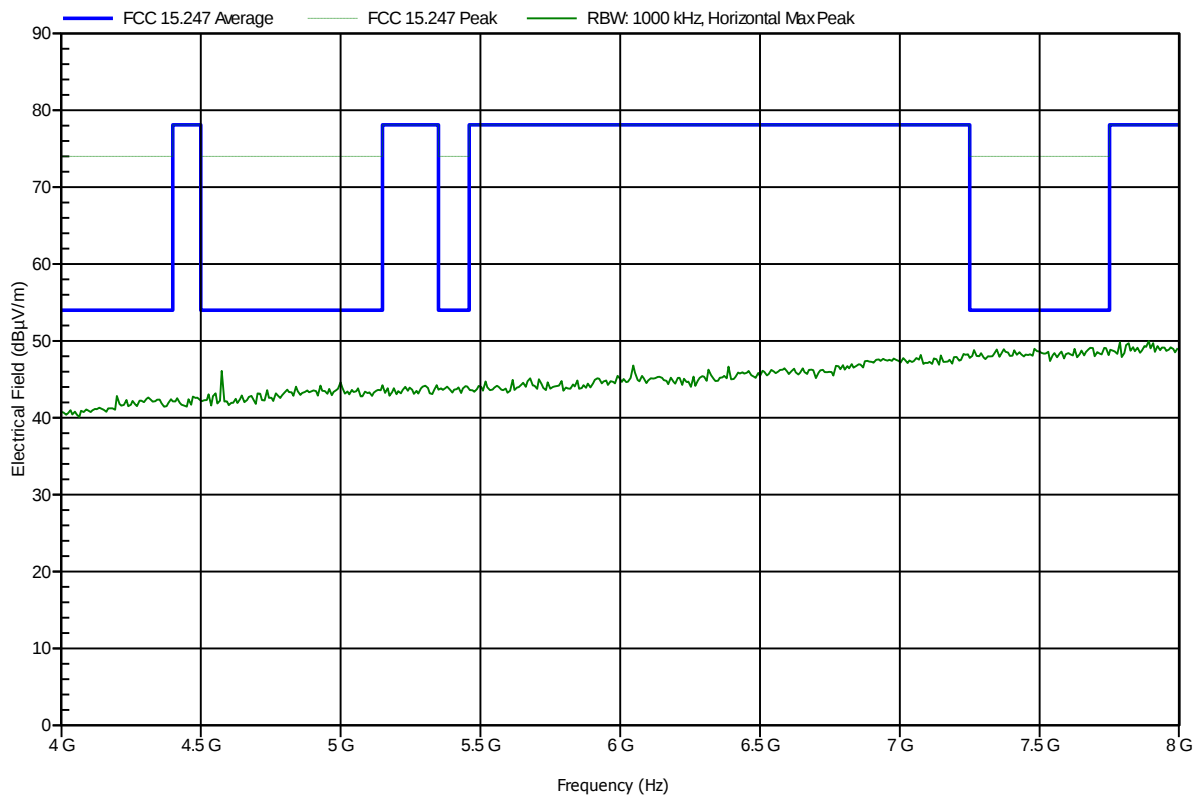
Frequency 4.529 GHz	Peak 53.53 dBµV/m	Peak Limit 74 dBµV/m	Peak Difference -20.47 dB	Peak Status Pass
Frequency 4.529 GHz	Average 45.12 dBµV/m	Average Limit 54 dBµV/m	Average Difference -8.88 dB	Average Status Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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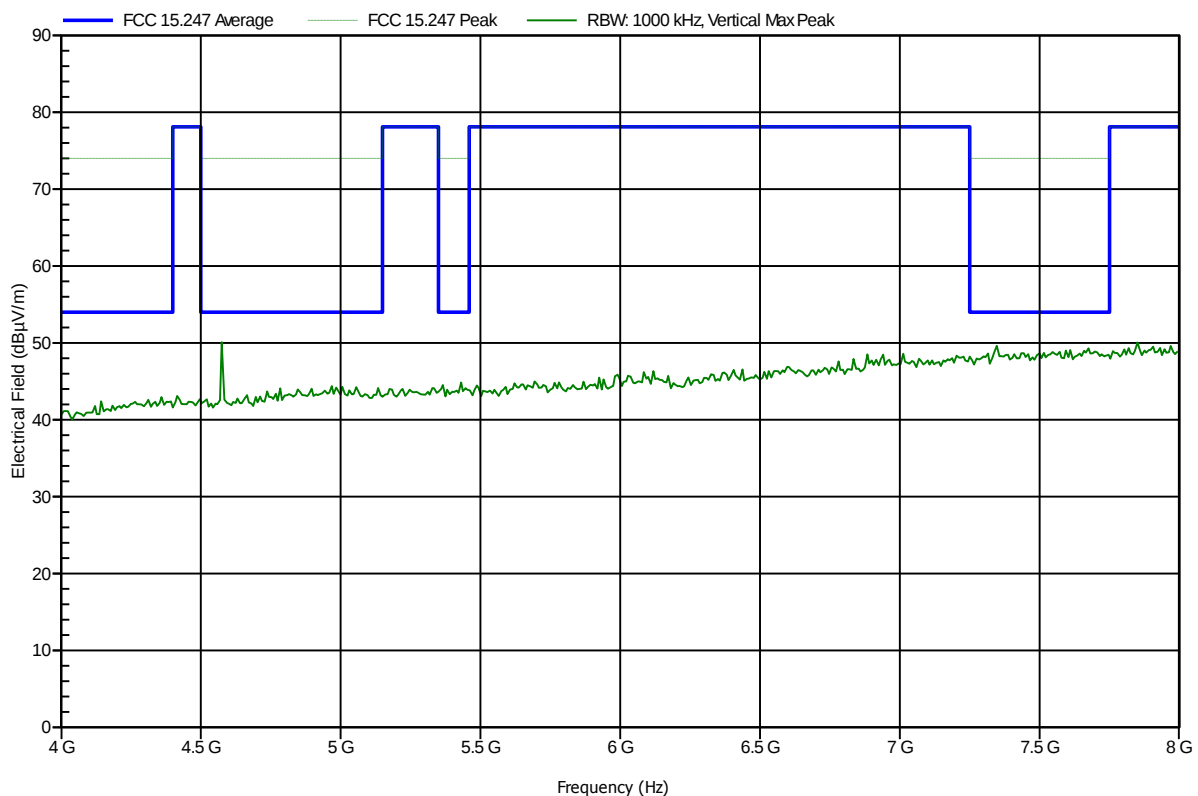


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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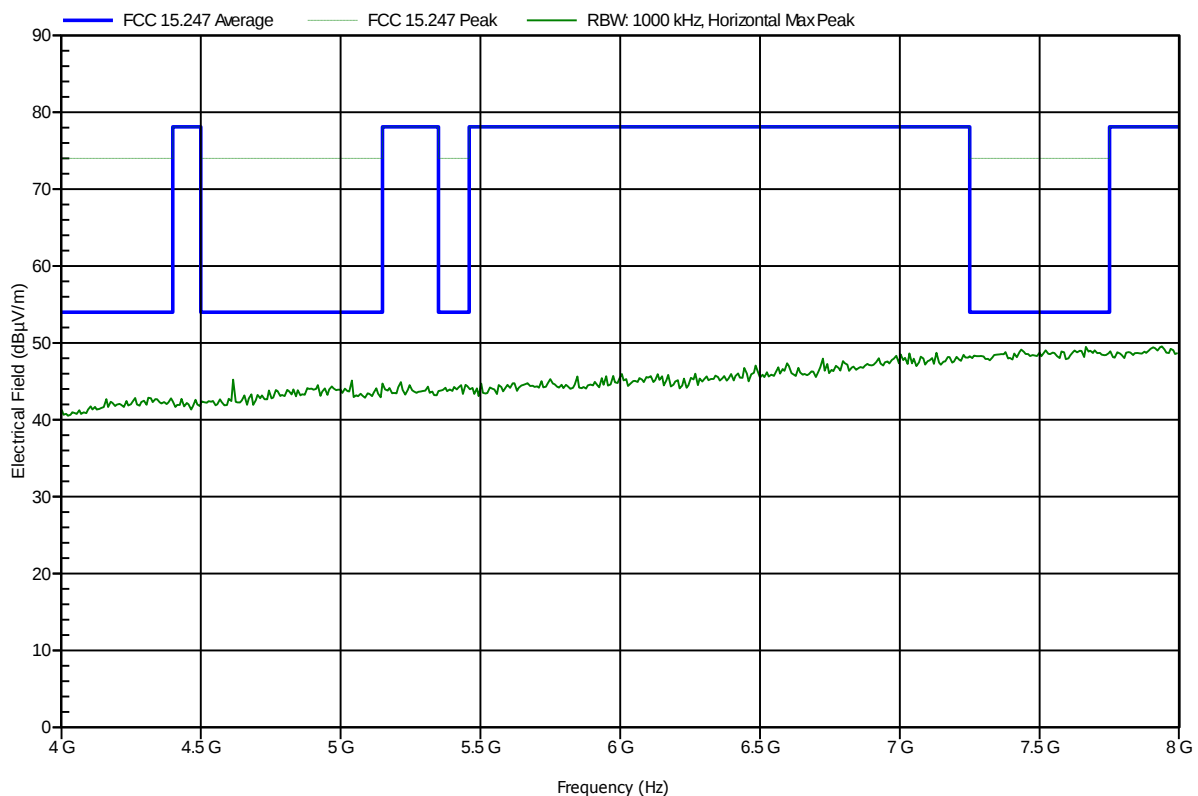


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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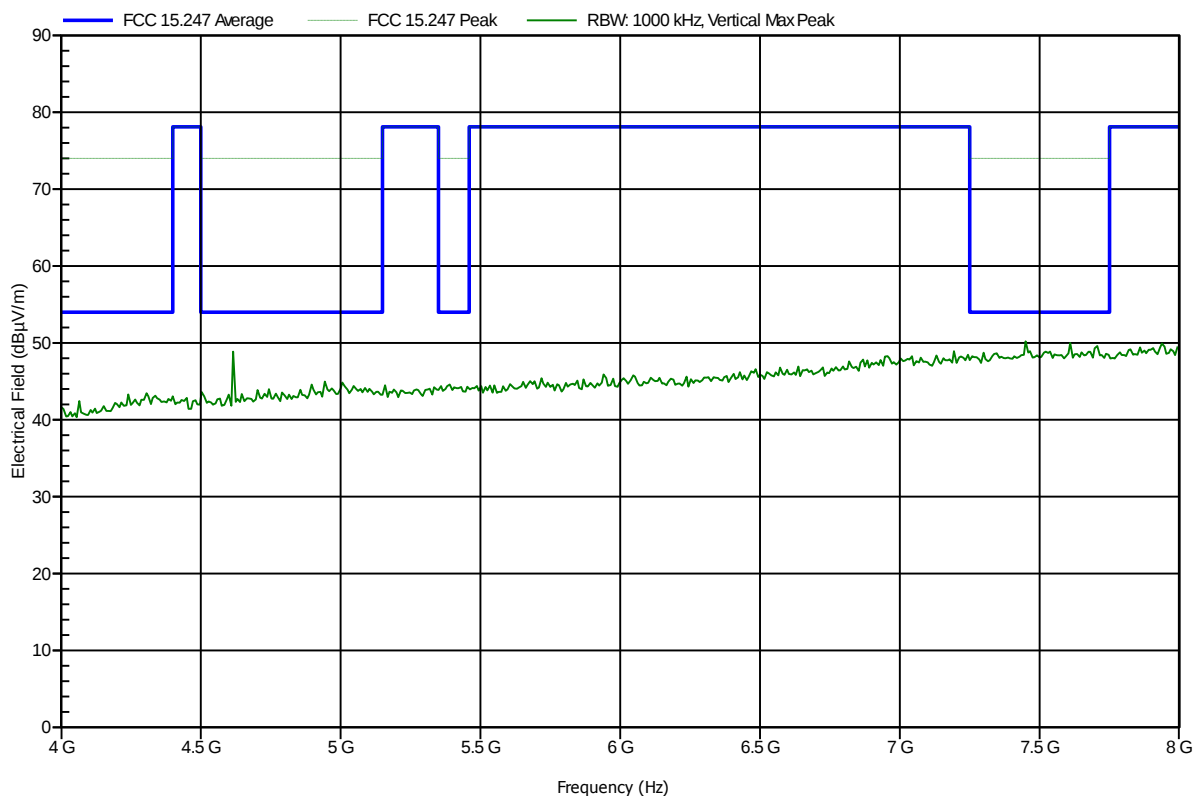


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; O-QPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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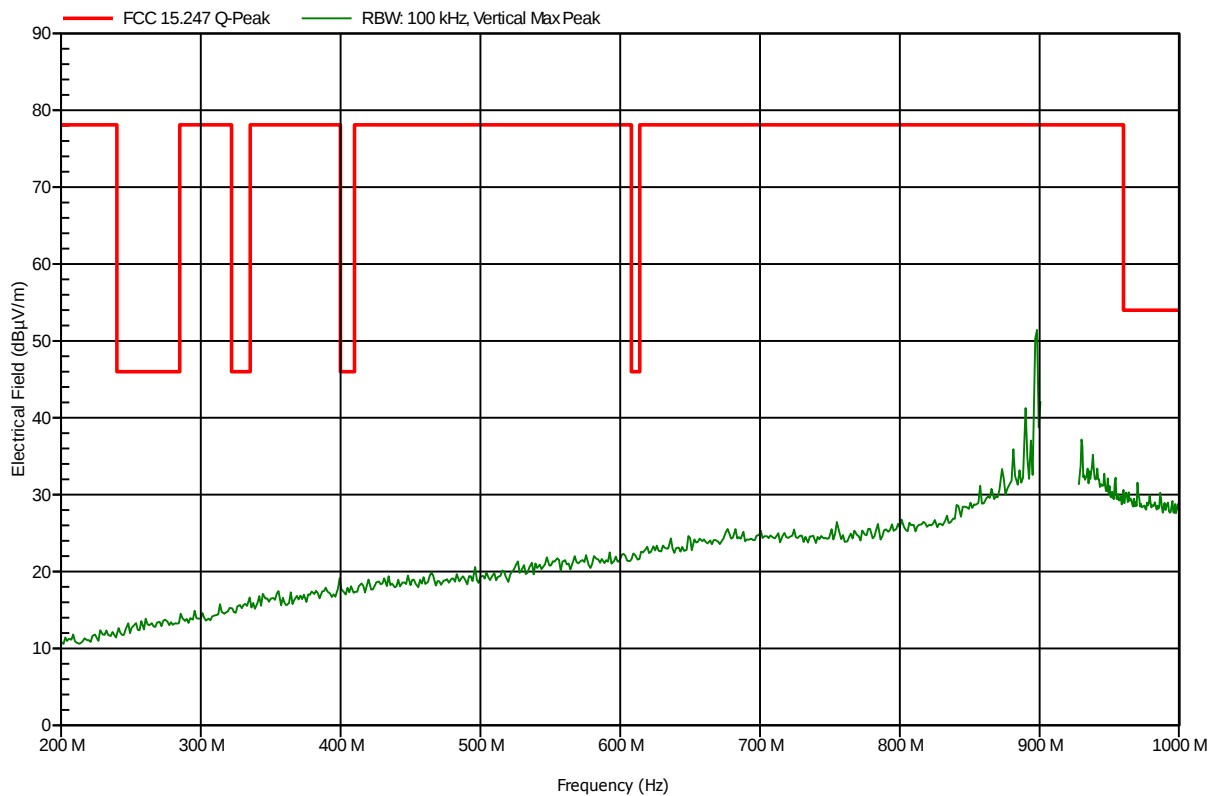


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement distance: 3 m
 Mode: TX; BPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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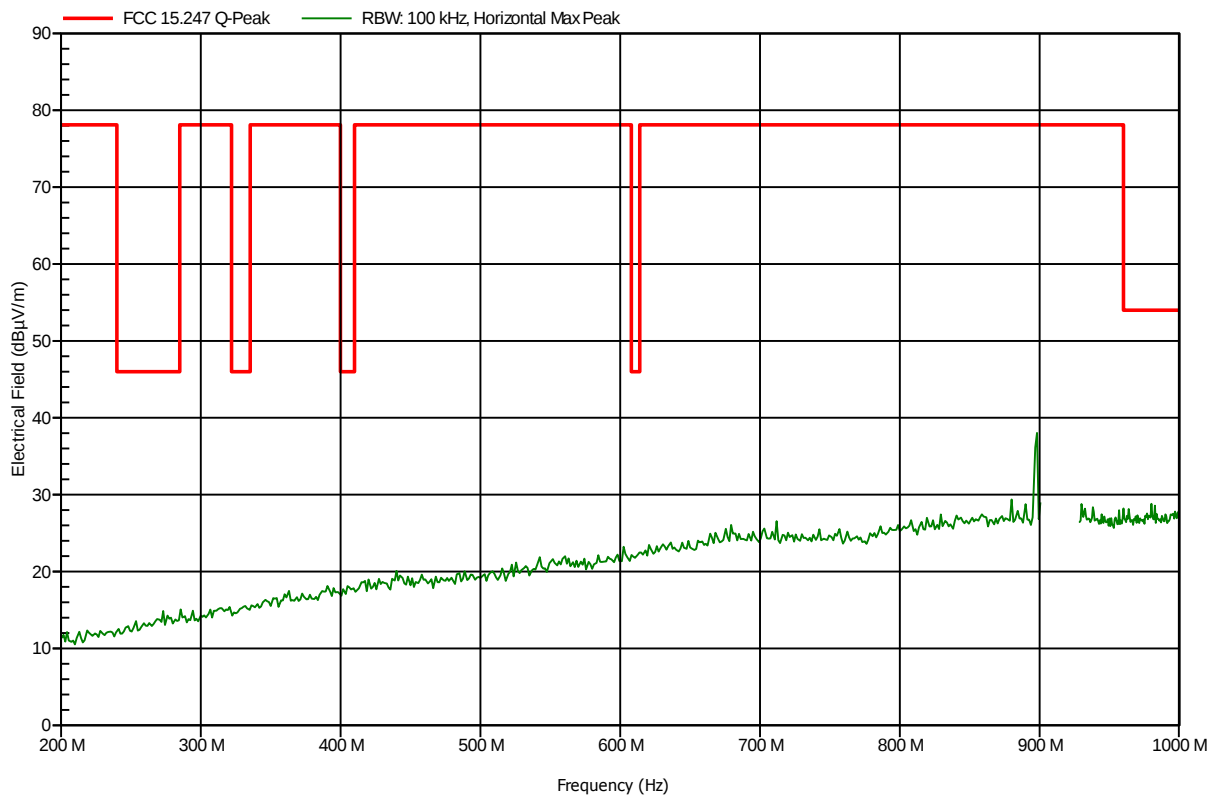


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HL 223, Horizontal
 Measurement distance: 3 m
 Mode: TX; BPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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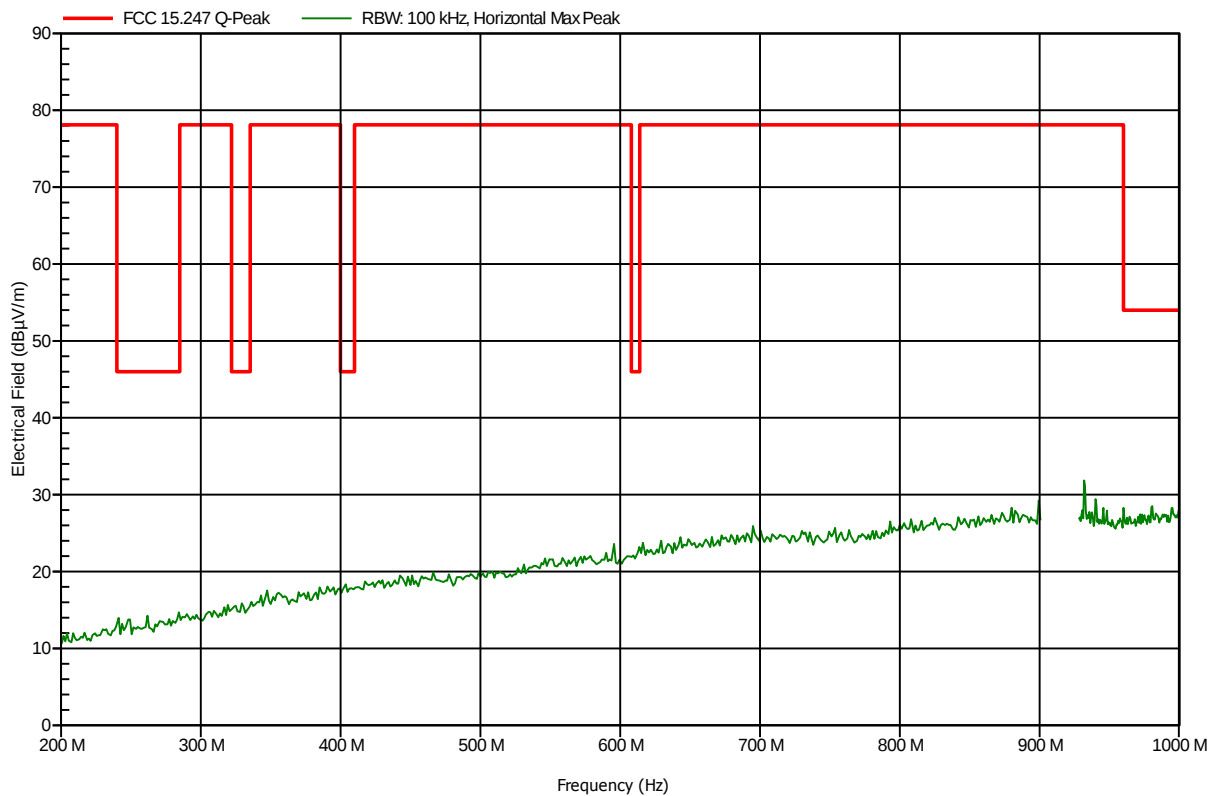


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HL 223, Horizontal
 Measurement distance: 3 m
 Mode: TX; BPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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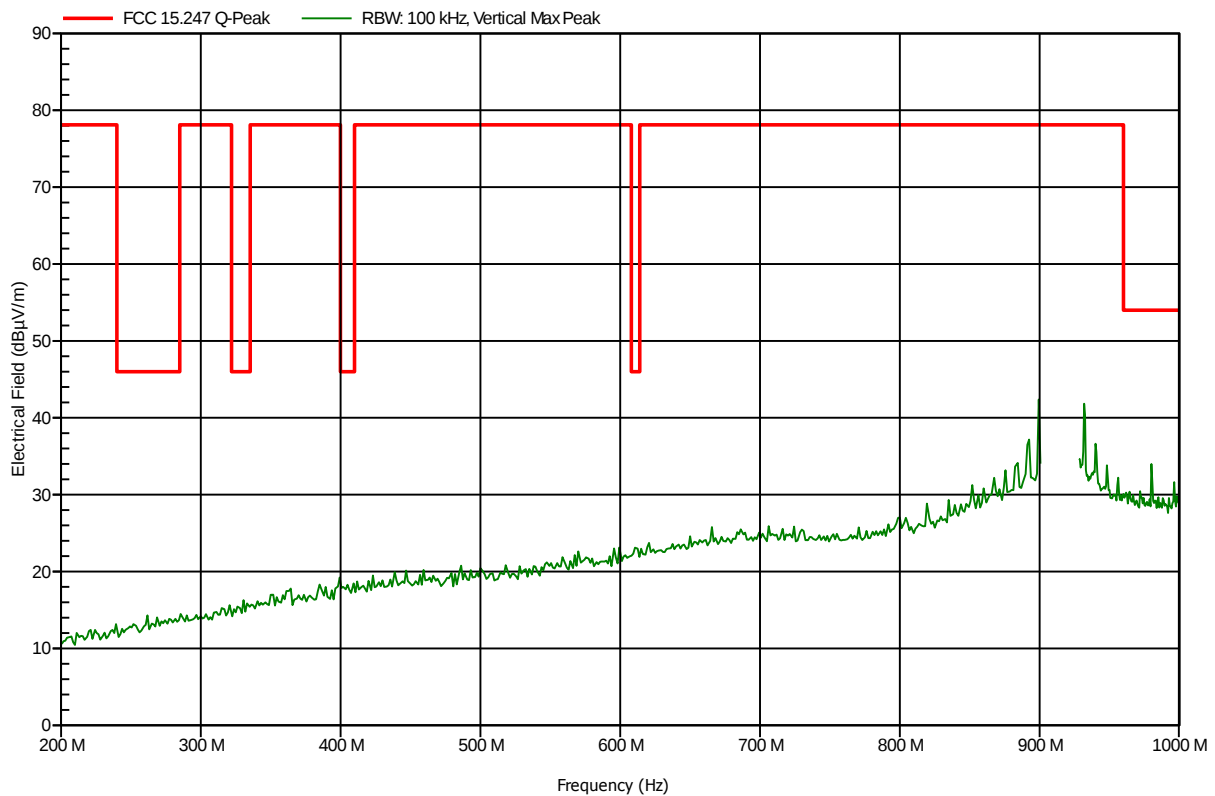


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement distance: 3 m
 Mode: TX; BPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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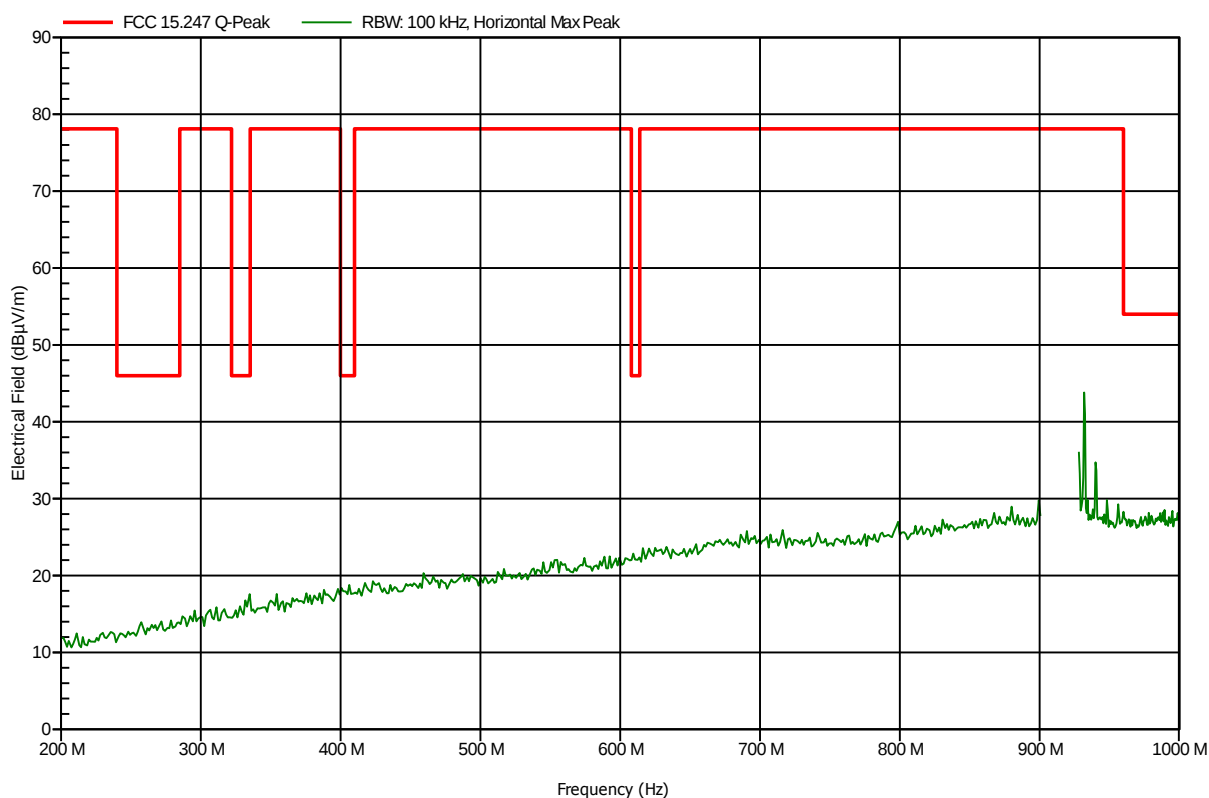


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
EUT Name: SubGHz6LoWPAN Radio Module
Model: ZWIR4512AC2
Test Site: Eurofins Product Service GmbH
Operator: Mr. Treffke
Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
Antenna: Rohde & Schwarz HL 223, Horizontal
Measurement distance: 3 m
Mode: TX; BPSK; 924 MHz; power:u=10dBm
Test Date: 2012-12-03
Note:

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Test Report No.: G0M-1211-2398-TFC247D-V01

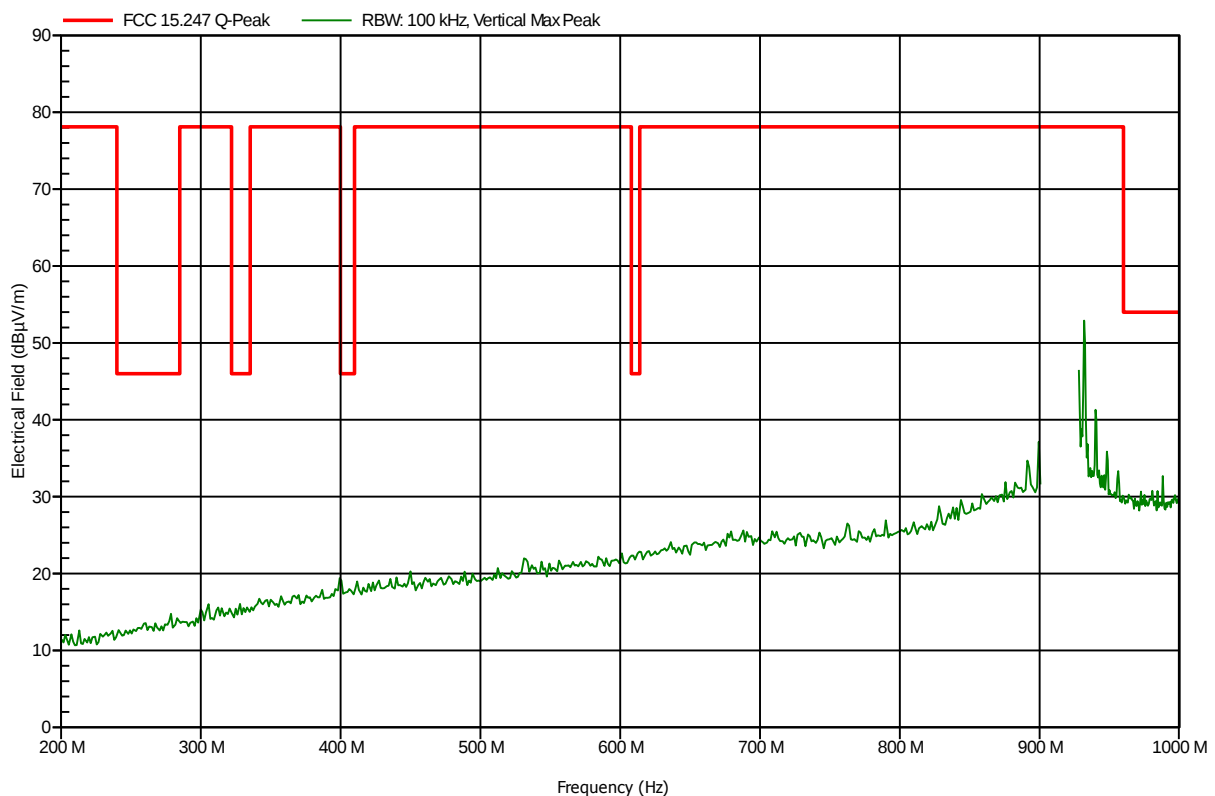
Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement distance: 3 m
 Mode: TX; BPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-03
 Note:

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Test Report No.: G0M-1211-2398-TFC247D-V01

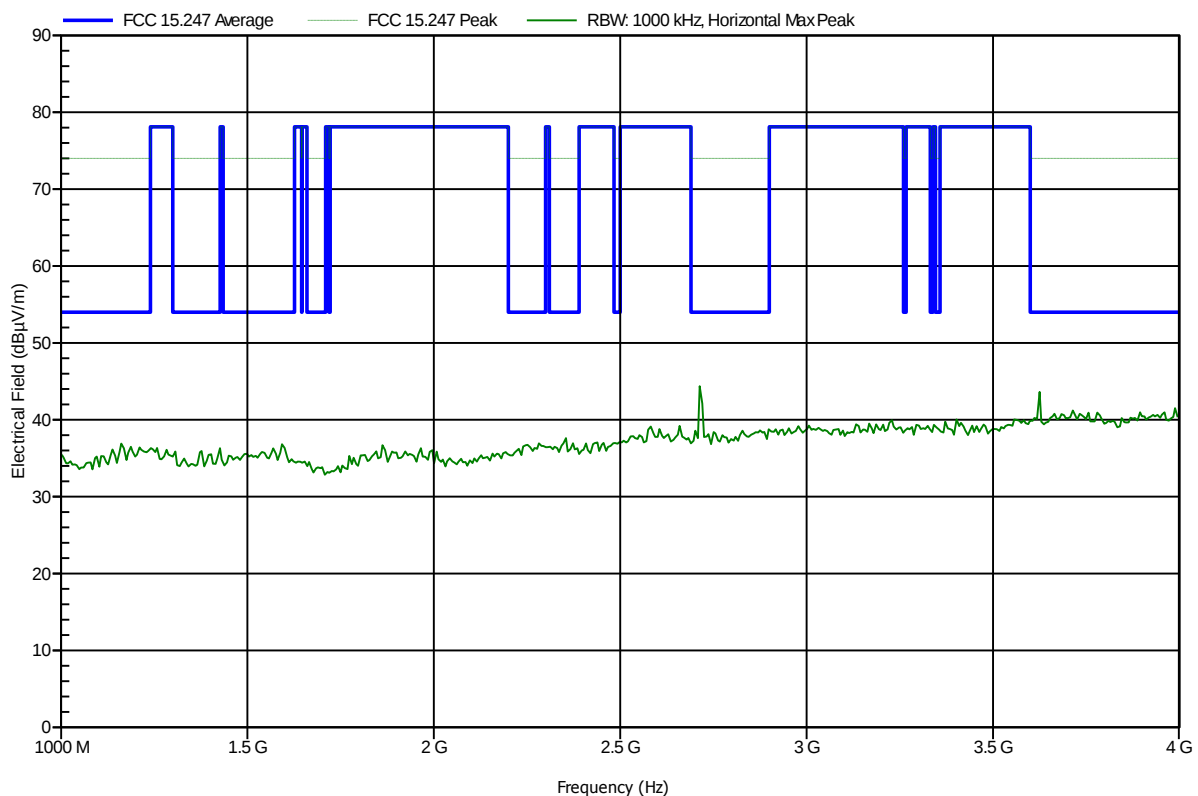
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; BPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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Test Report No.: G0M-1211-2398-TFC247D-V01

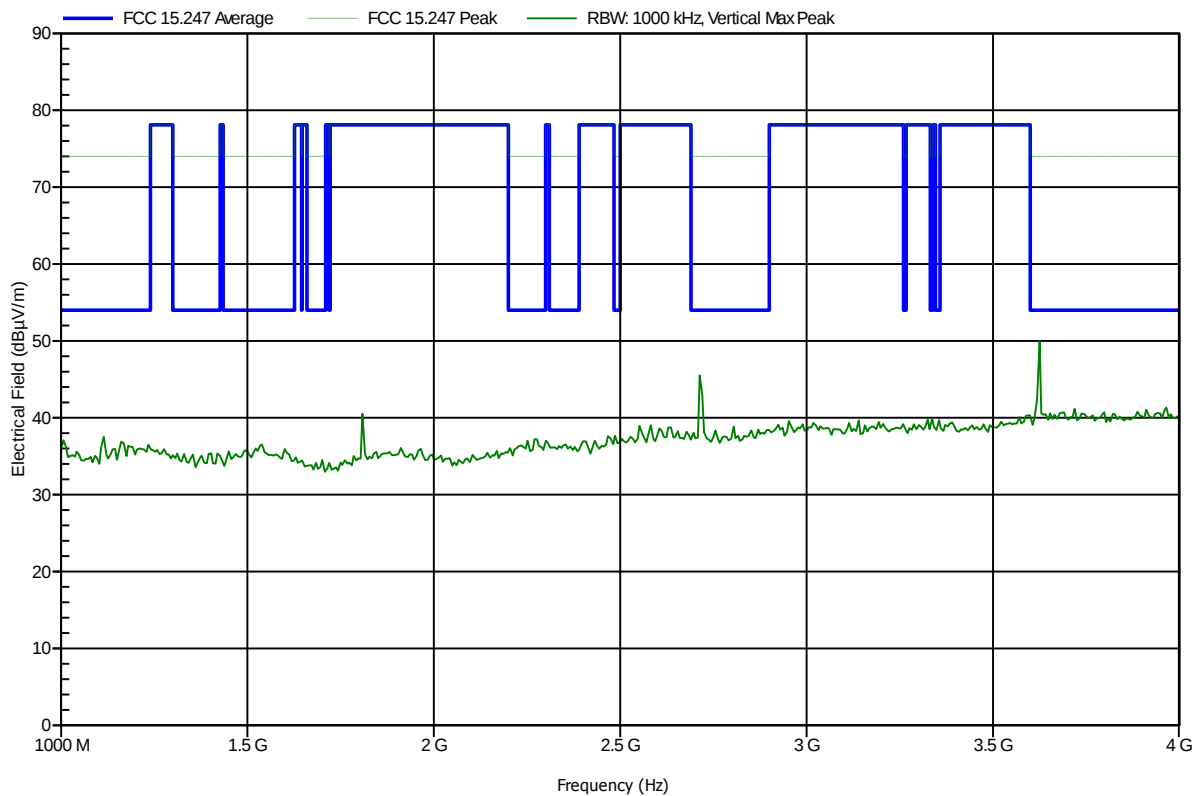
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; BPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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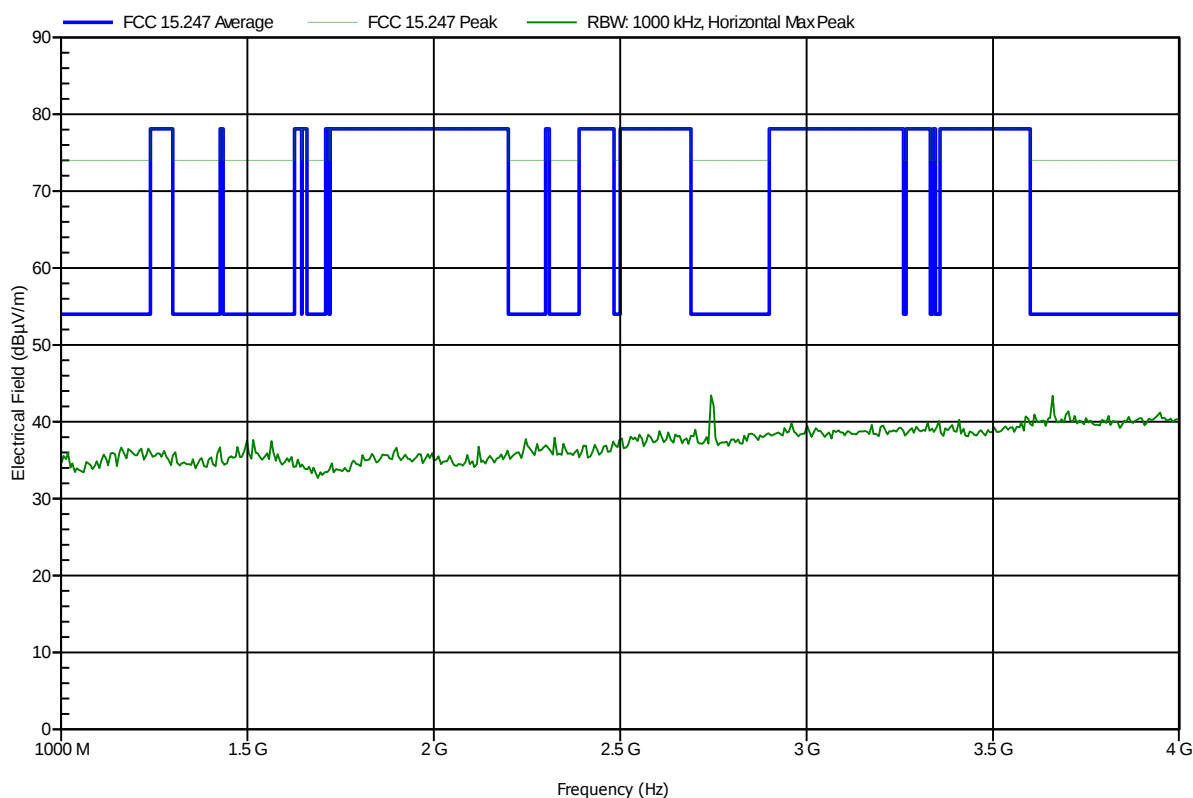


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; BPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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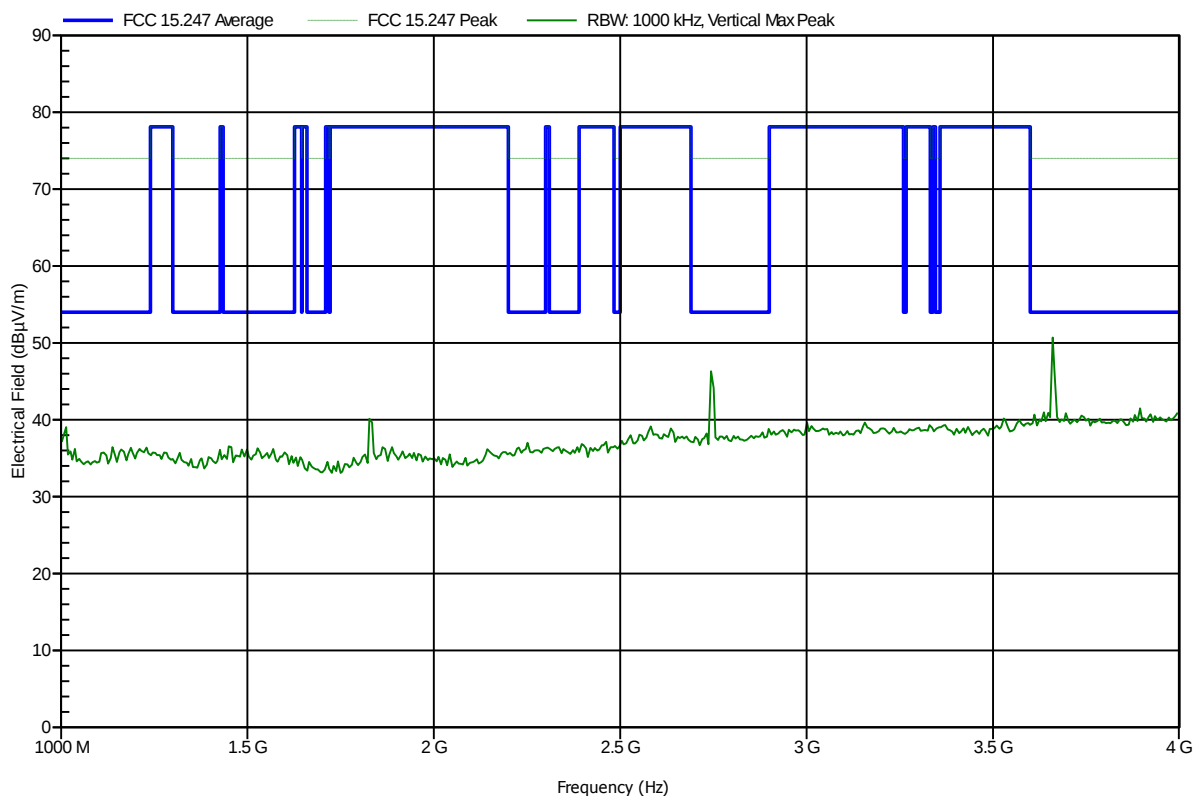


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; BPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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Test Report No.: G0M-1211-2398-TFC247D-V01

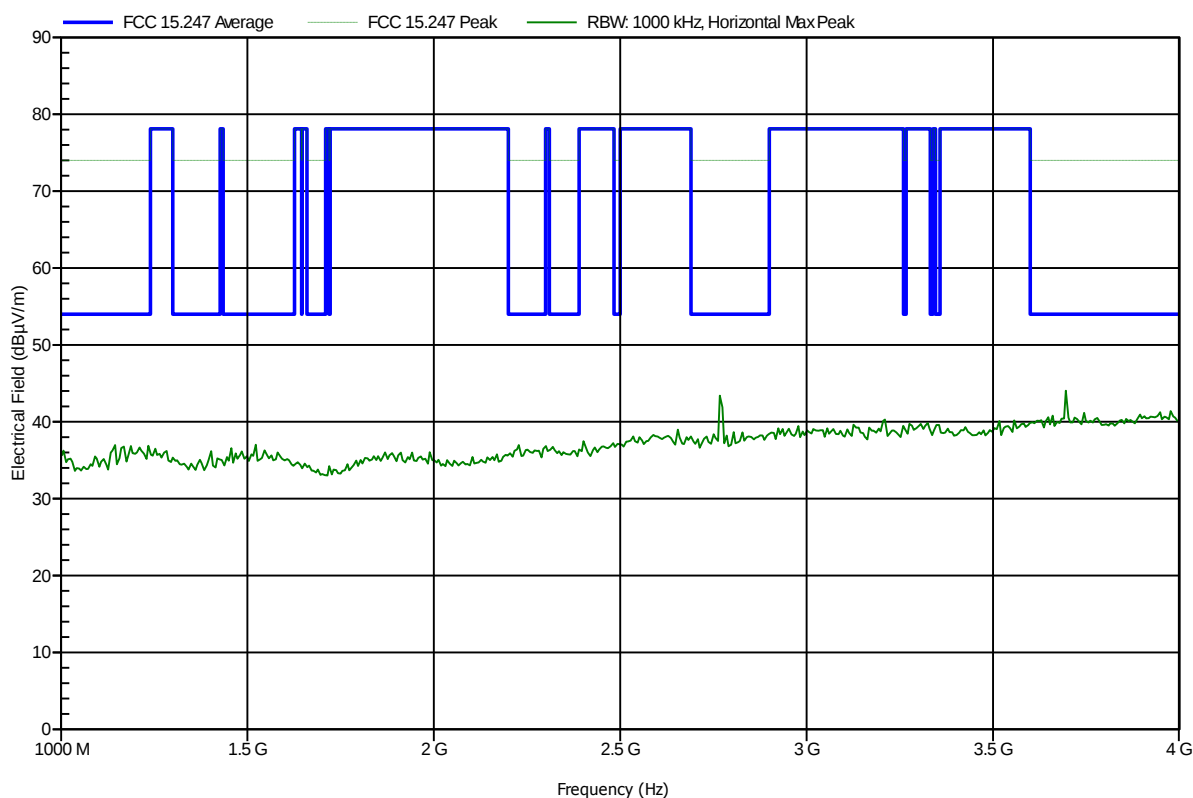
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; BPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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Test Report No.: G0M-1211-2398-TFC247D-V01

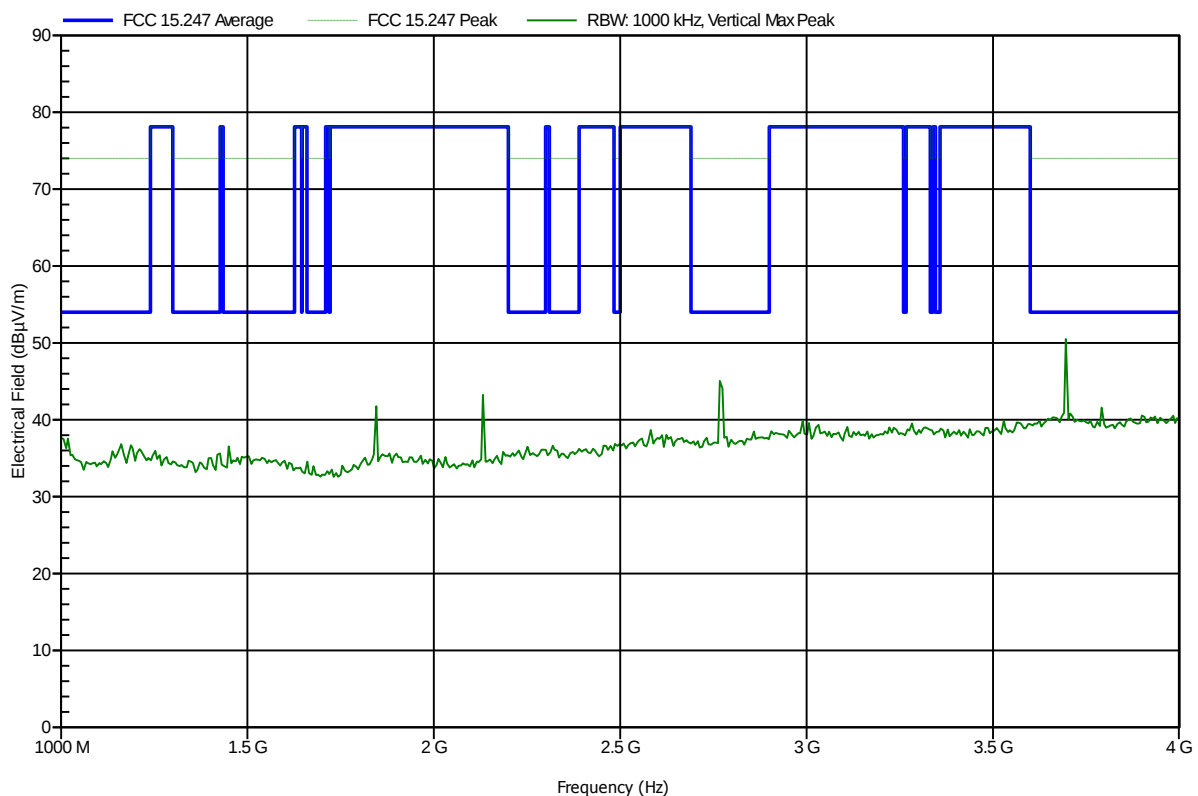
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; BPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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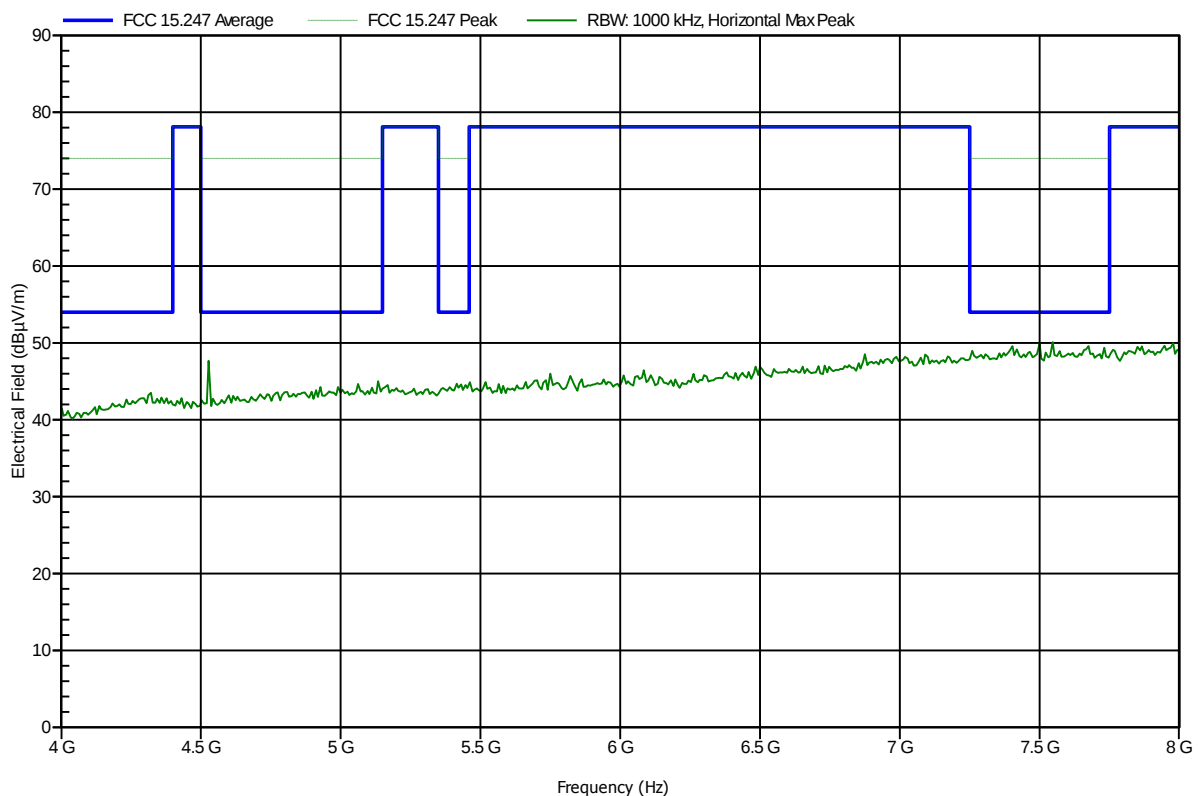


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; BPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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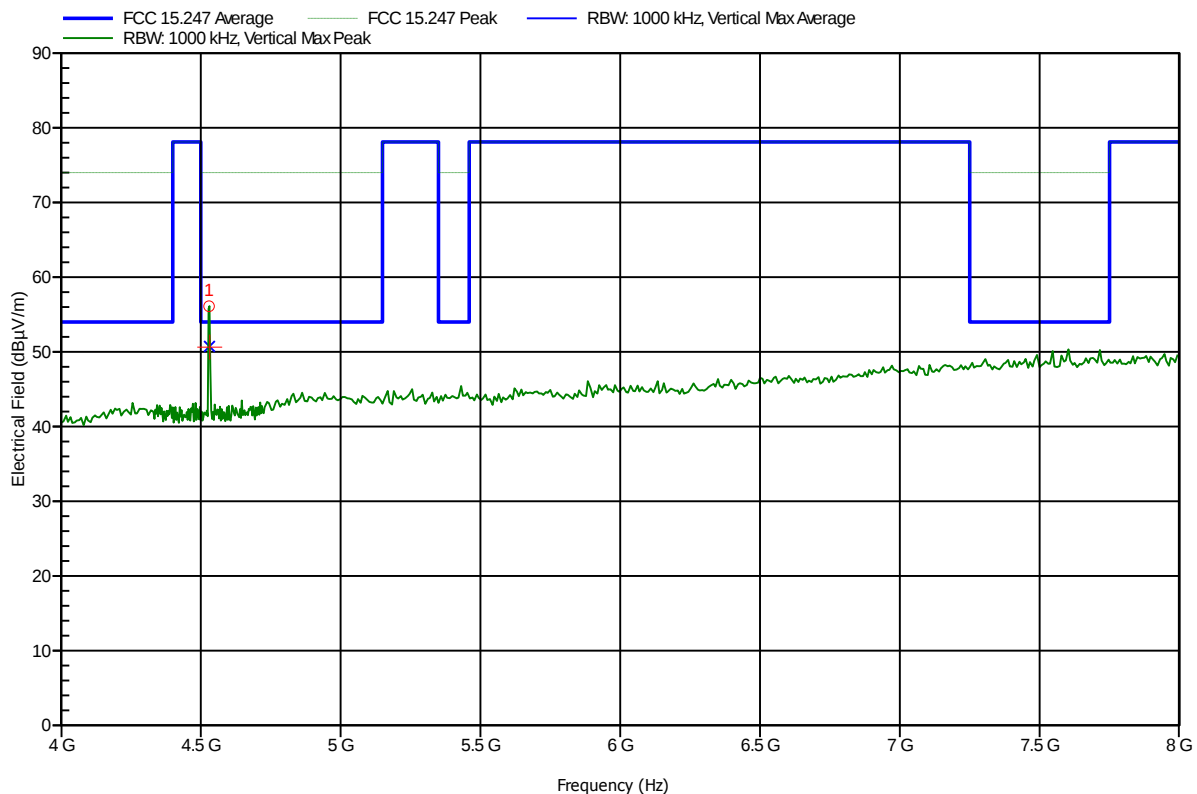


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; BPSK; 906 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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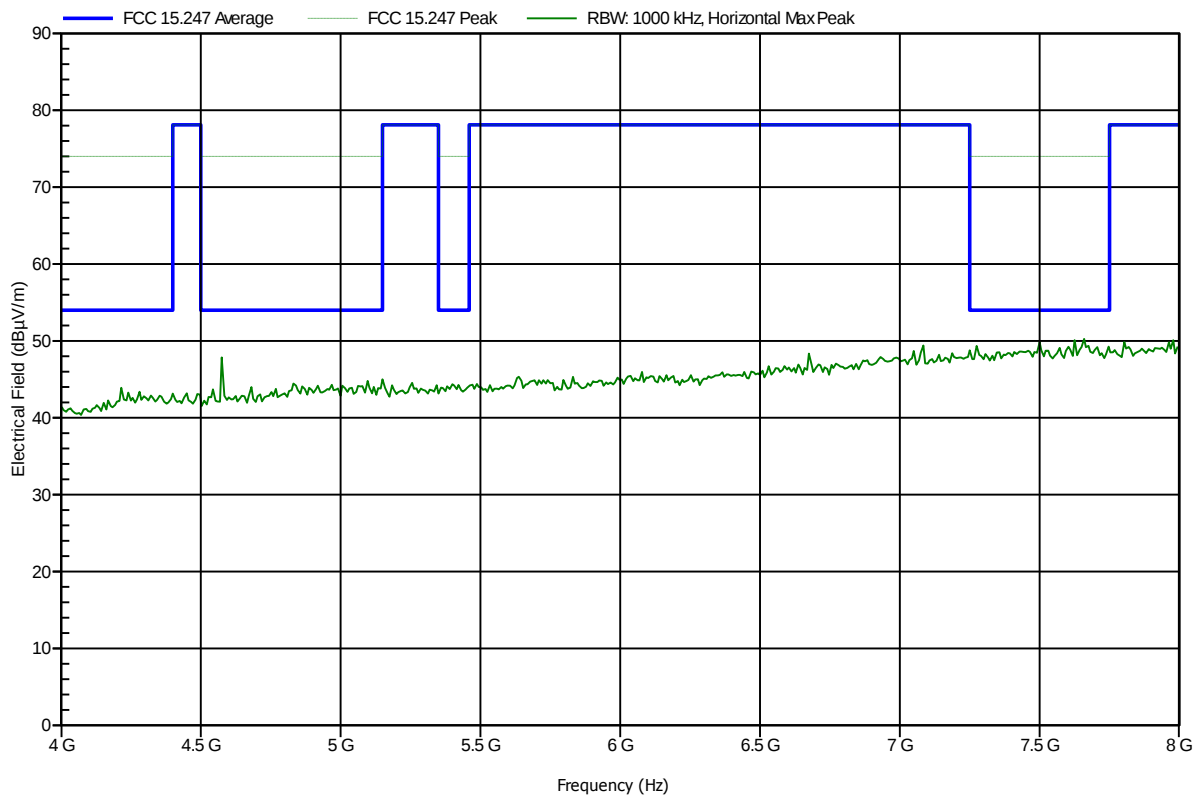
Frequency 4.53 GHz	Peak 56.12 dBµV/m	Peak Limit 74 dBµV/m	Peak Difference 22.12 dB	Peak Status Pass
Frequency 4.53 GHz	Average 50.73 dBµV/m	Average Limit 54 dBµV/m	Average Difference -3.27 dB	Average Status Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; BPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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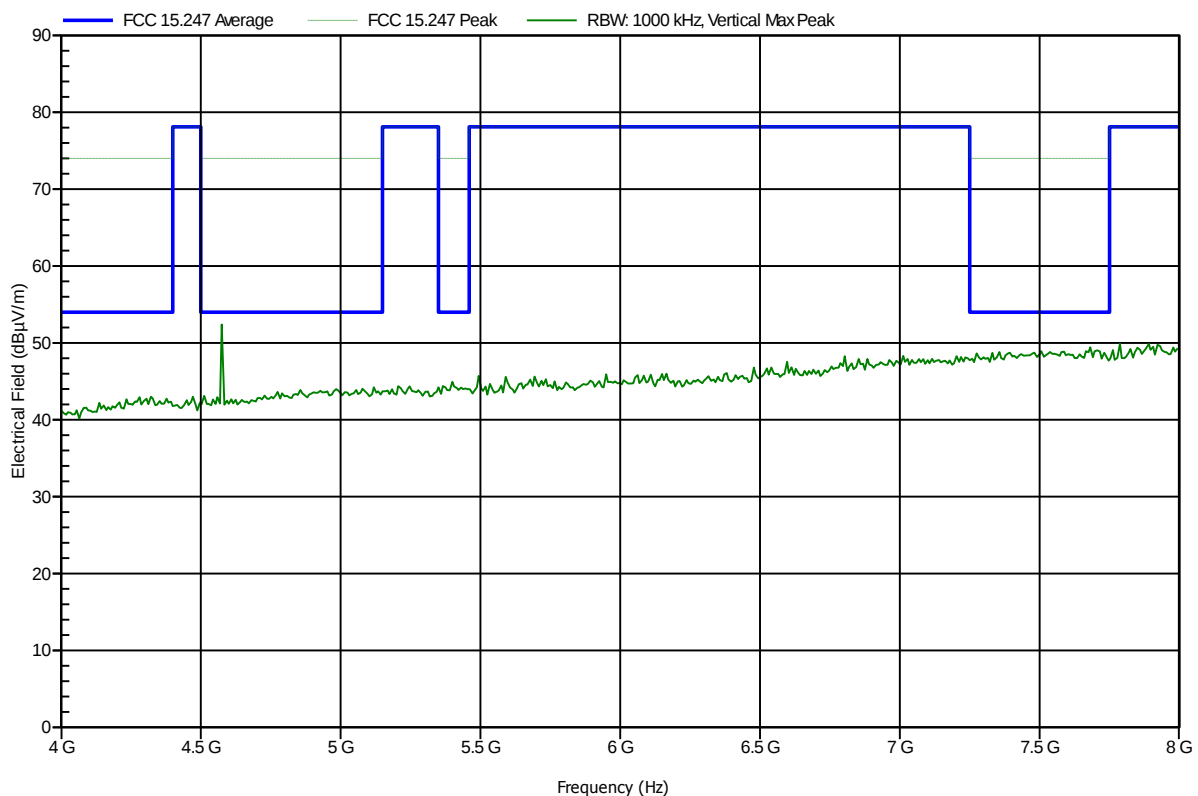


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; BPSK; 916 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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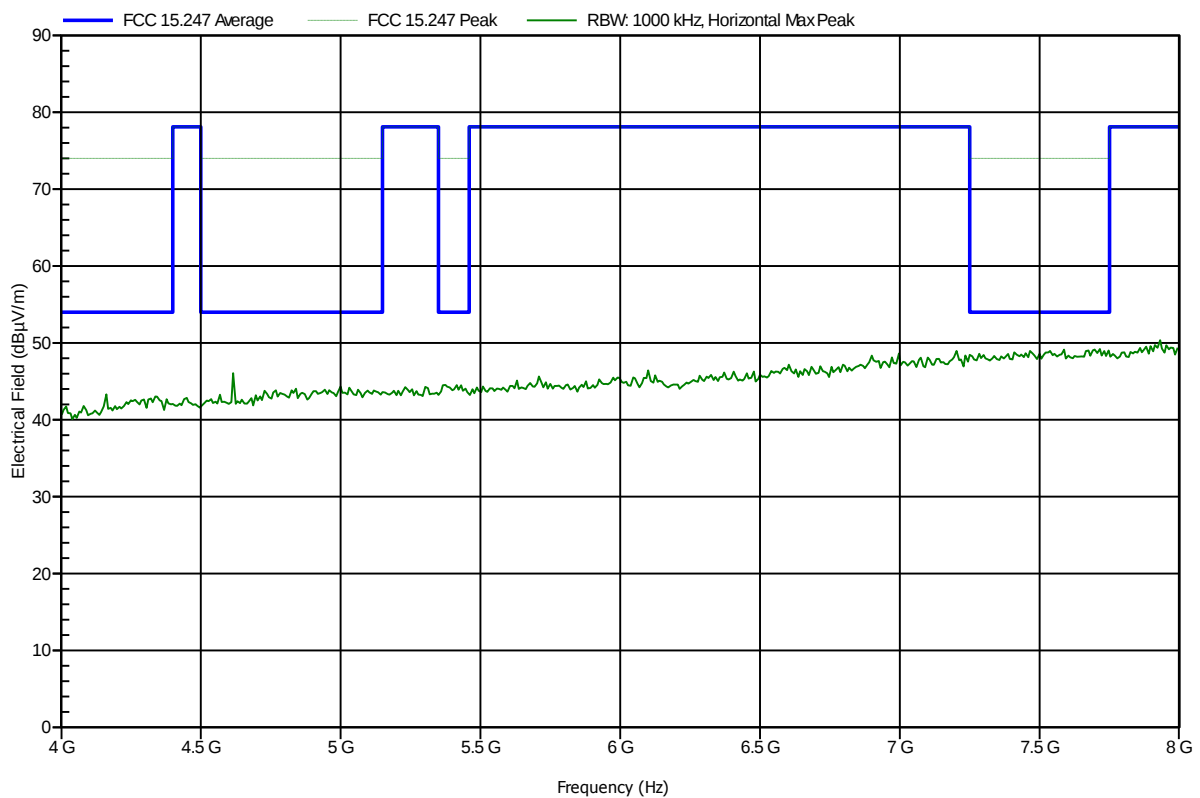


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; BPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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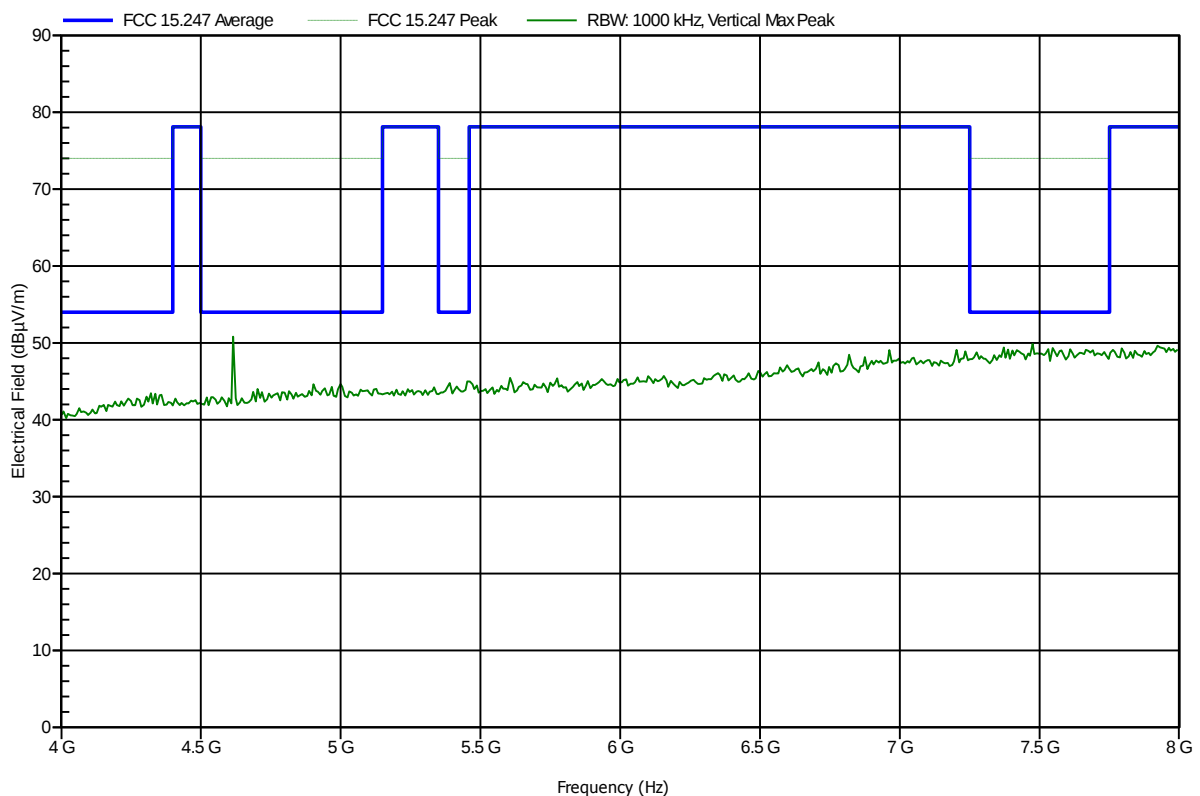


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; BPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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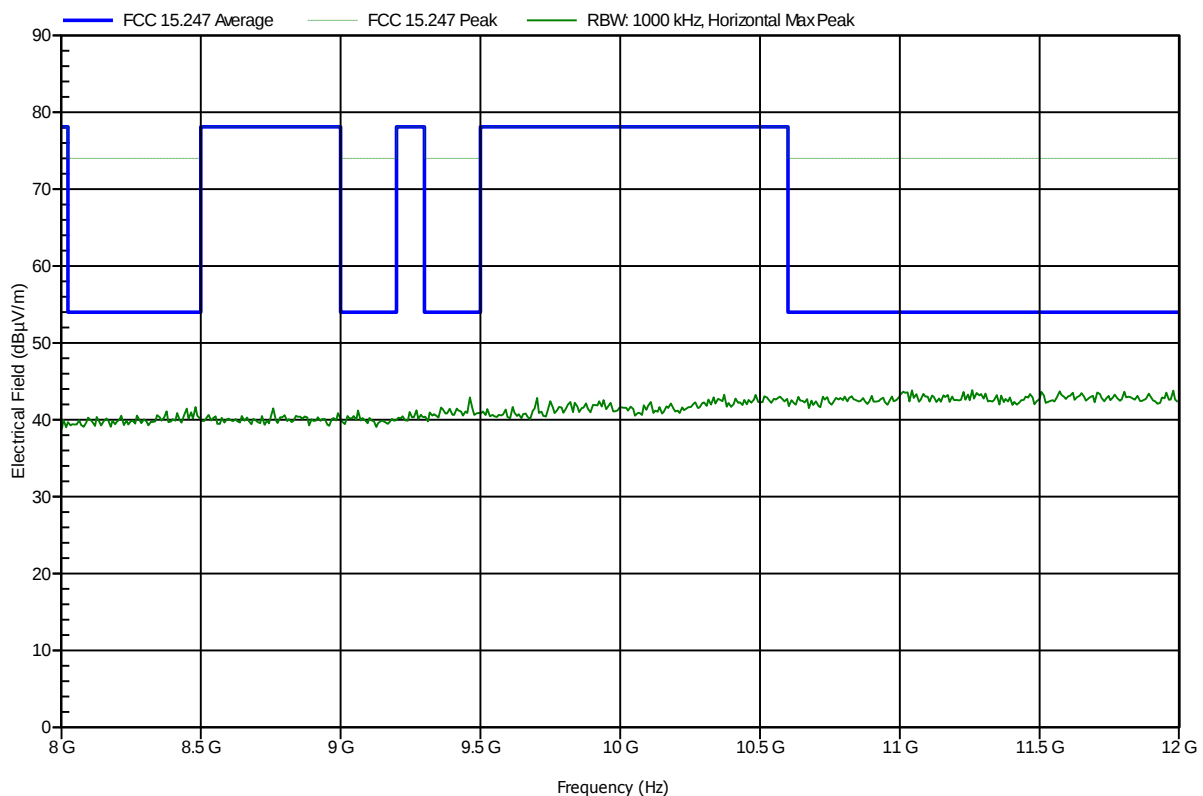


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 100 cm converted to 3m
 Mode: TX; BPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note:

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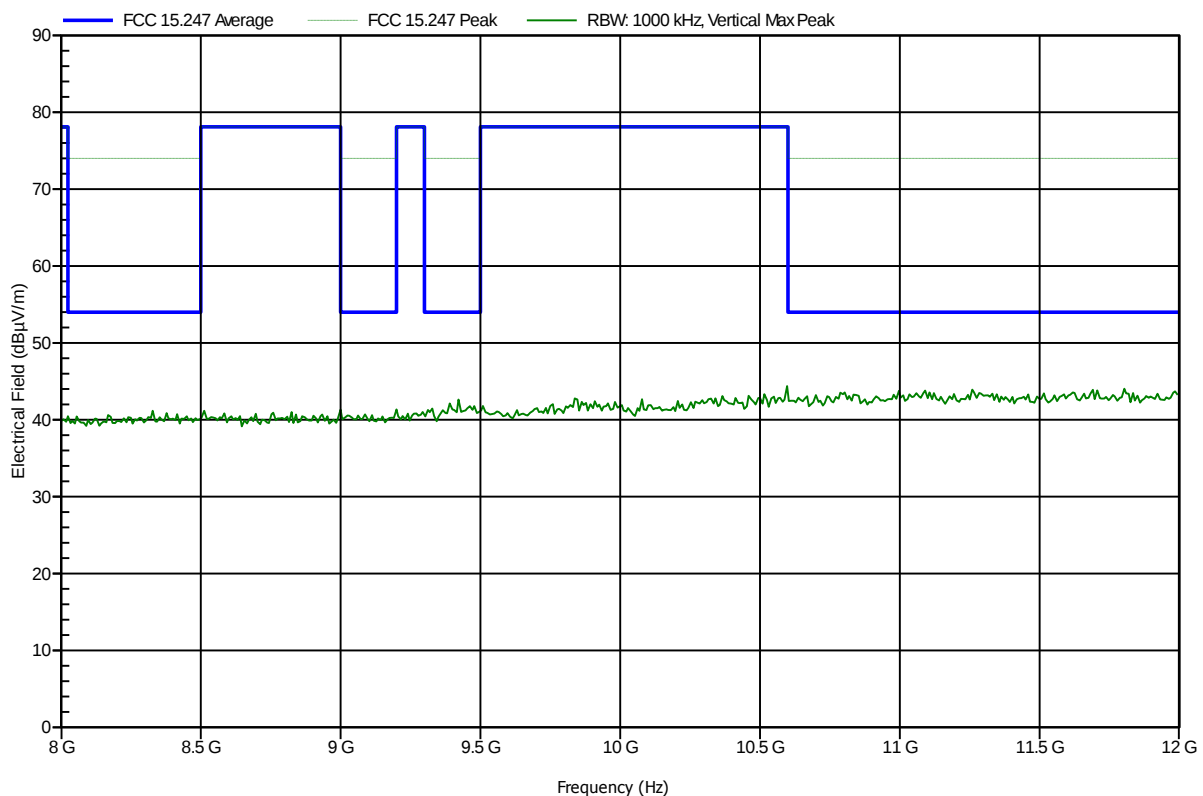


Spurious emissions according to FCC 15.247

Project number: G0M-1211-2398

Manufacturer: Zentrum Mikroelektronik Dresden AG
 EUT Name: SubGHz6LoWPAN Radio Module
 Model: ZWIR4512AC2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Treffke
 Test Conditions: Tnom: 24°C, Vnom: 5.0V DC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 100 cm
 Mode: TX; BPSK; 924 MHz; power:u=10dBm
 Test Date: 2012-12-04
 Note: worst case

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Test Report No.: G0M-1211-2398-TFC247D-V01

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