

FCC TEST REPORT	
FCC 47 CFR Part 15C ISED RSS-247	
Digital transmission systems operating within the 2400 – 2483.5 MHz band	
Report Reference No. :	G0M-1510-5171-T-01-FC247BL-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 ISED OATS Filing assigned code: 3470A
Applicant's name	Grässlin GmbH
Address	Bundesstraße 36 78112 St. Georgen GERMANY
Test specification:	
Standard..... :	47 CFR Part 15C RSS-247, Issue 1, 2015-05
Test scope..... :	complete Radio compliance test
Equipment under test (EUT):	
Product description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model No.	Carrier Board LCD-BLE
Additional Model(s)	None
Brand Name(s)	None
Hardware version	Rev_02
Firmware / Software version	V.1.0
	FCC-ID: 2AHH7-DG 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:

Test Lab Temperature : 20 – 23 °C

Test Lab Humidity : 32 – 38 %

Date of receipt of test item : 2016-01-20

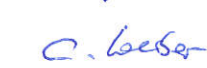
Date (s) of performance of tests : 2016-03-02 – 2016-03-31

Compiled by : Matthias Handrik

Tested by (+ signature) : Matthias Handrik
(Responsible for Test)



Approved by (+ signature) : Christian Weber
(Head of Lab)



Date of issue : 2016-05-26

Total number of pages : 80

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	2016-05-26	Initial Release	

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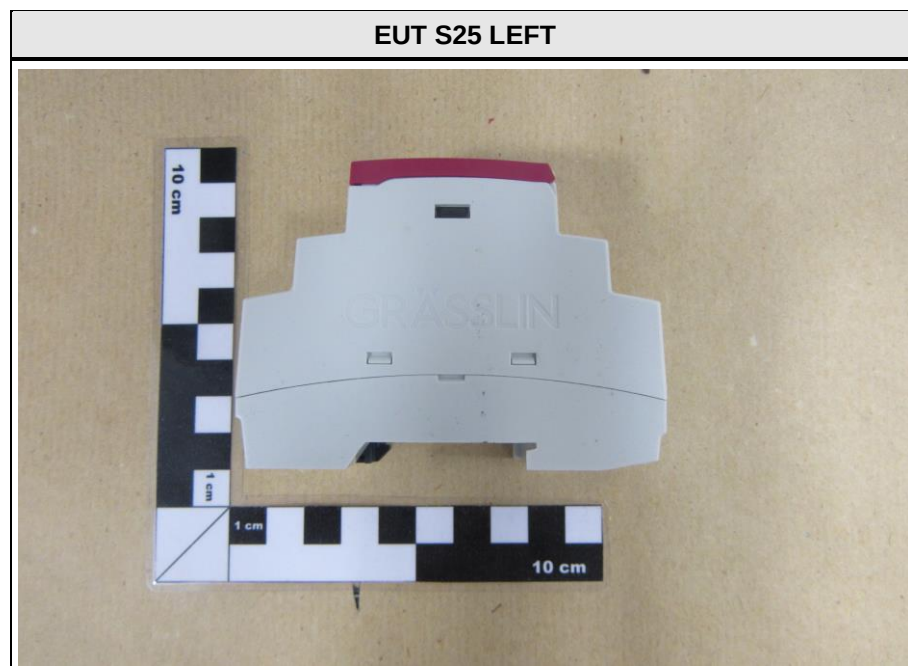
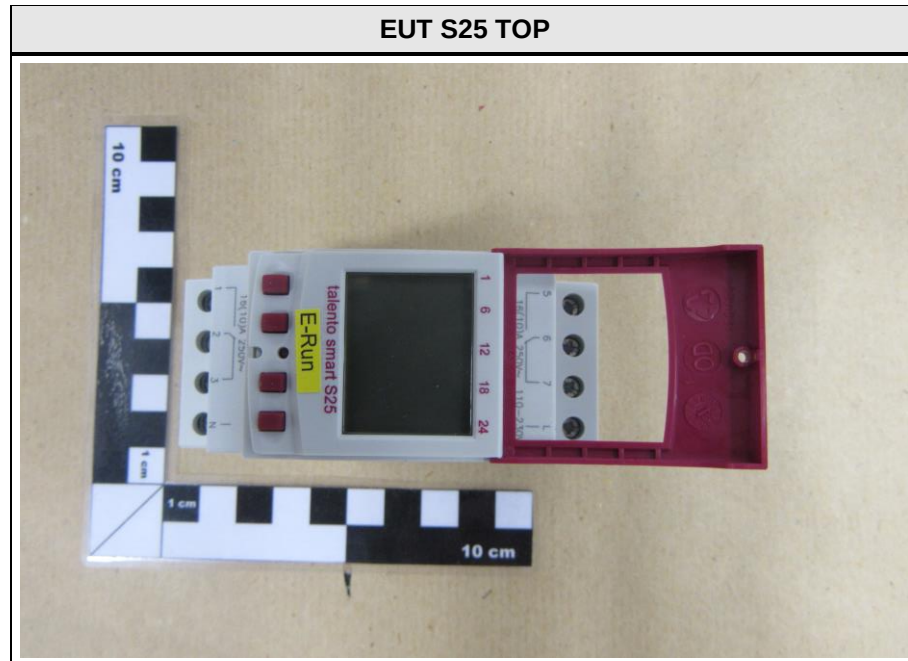
1 Equipment (Test item) Description

Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)	
Model	Carrier Board LCD-BLE	
Additional Model(s)	None	
Brand Name(s)	None	
Serial number	None	
Hardware version	Rev_02	
Software / Firmware version	V.1.0	
PMN	N/A	
HVIN	Carrier Board LCD-BLE	
FVIN	N/A	
HMN	N/A	
FCC ID	2AHH7-DG	
ISED Certification Number	N/A	
Equipment type	Radio module	
Radio type	Transceiver	
Radio technology	Bluetooth 4.2 Low Energy	
Operating frequency range	2402 - 2480 MHz	
Assigned frequency band	2400 - 2483.5 MHz	
Main test frequencies	F _{LOW}	2402 MHz
	F _{MID}	2442 MHz
	F _{HIGH}	2480 MHz
Spreading	Frequency Hopping	
Modulations	GFSK	
Number of channels	40	
Channel spacing	2MHz	
Number of antennas	1	
Antenna	Type	integrated
	Model	PCB Antenna
	Manufacturer	Graesslin
	Gain	+4.0 dBi (manufacturer declaration)
Manufacturer	Grässlin GmbH Bundesstraße 36 78112 St. Georgen GERMANY	
Power supply	V _{NOM}	120VAC
	V _{MIN}	85VAC
	V _{MAX}	253VAC
AC/DC-Adaptor	none	

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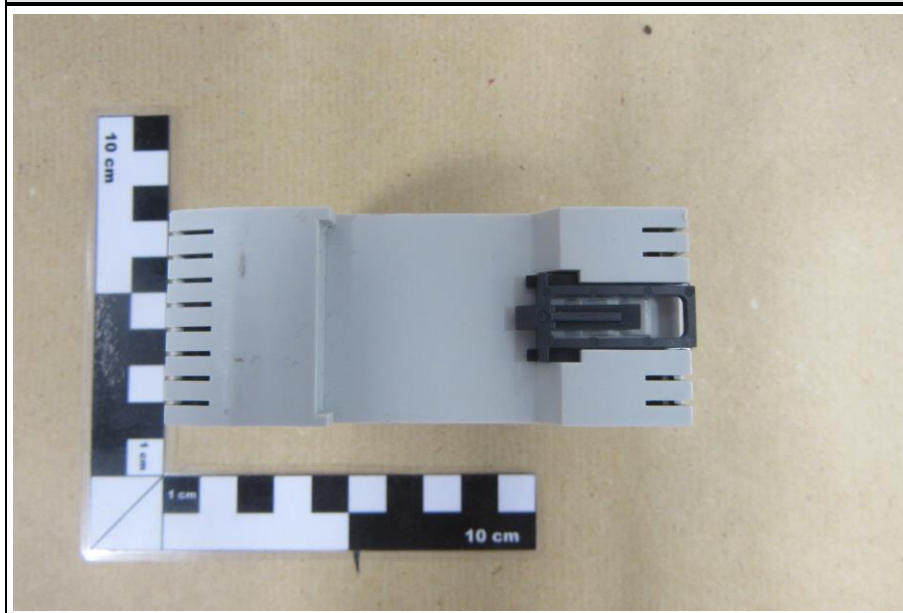
1.1 Photos – Equipment External



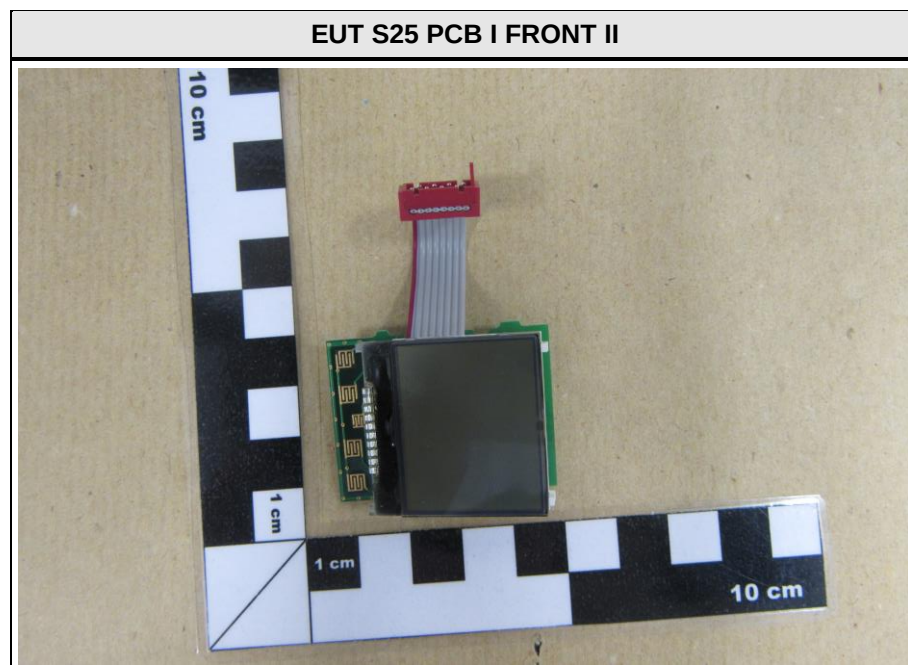
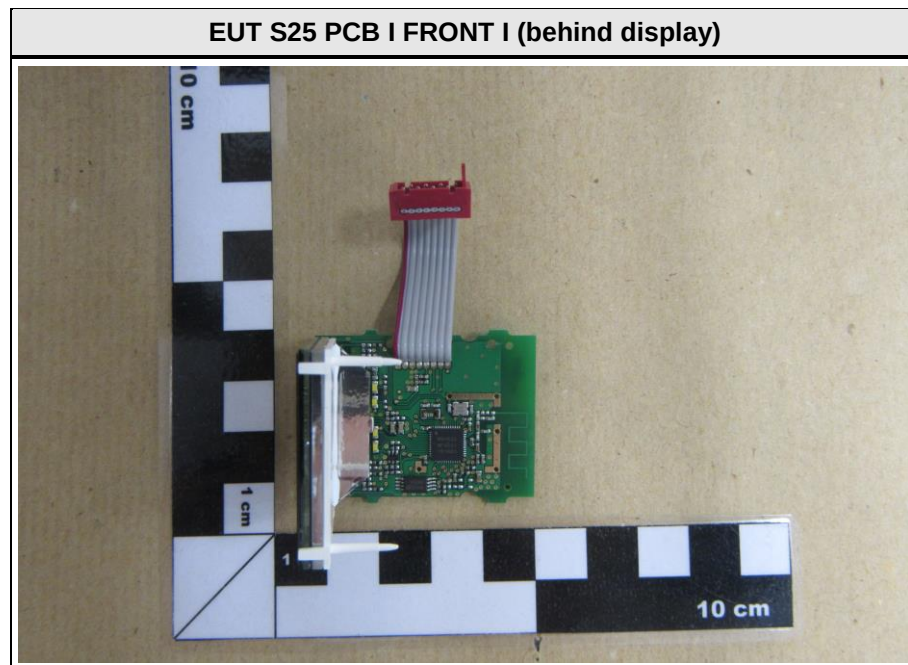
EUT S25 RIGHT



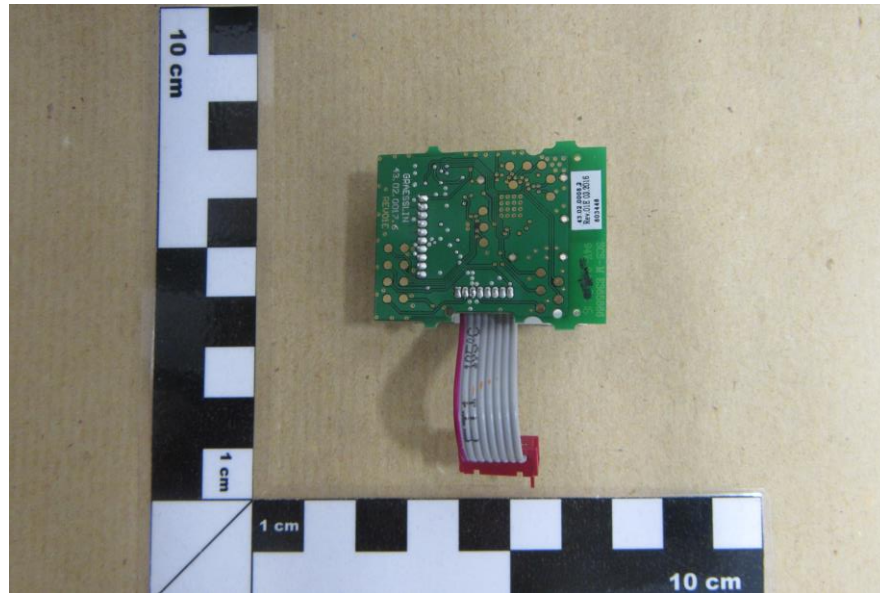
EUT S25 BOTTOM



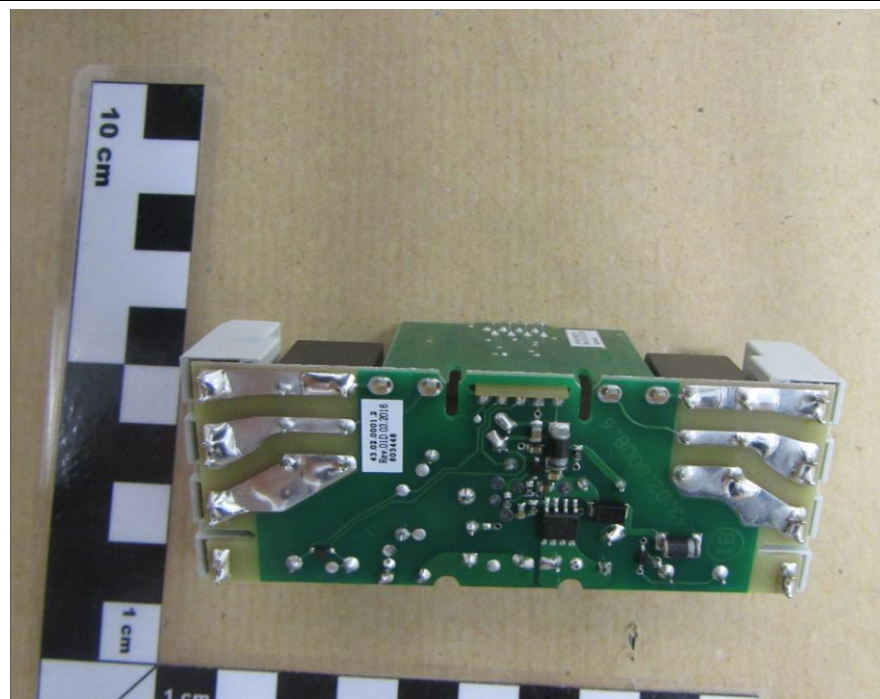
1.2 Photos – Equipment internal

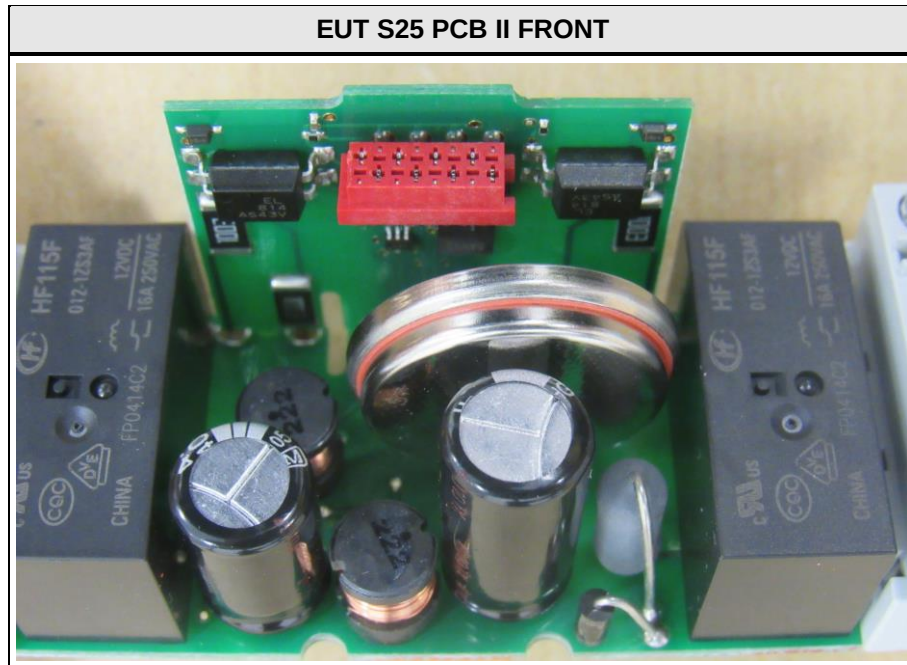


EUT S25 PCB I BACK

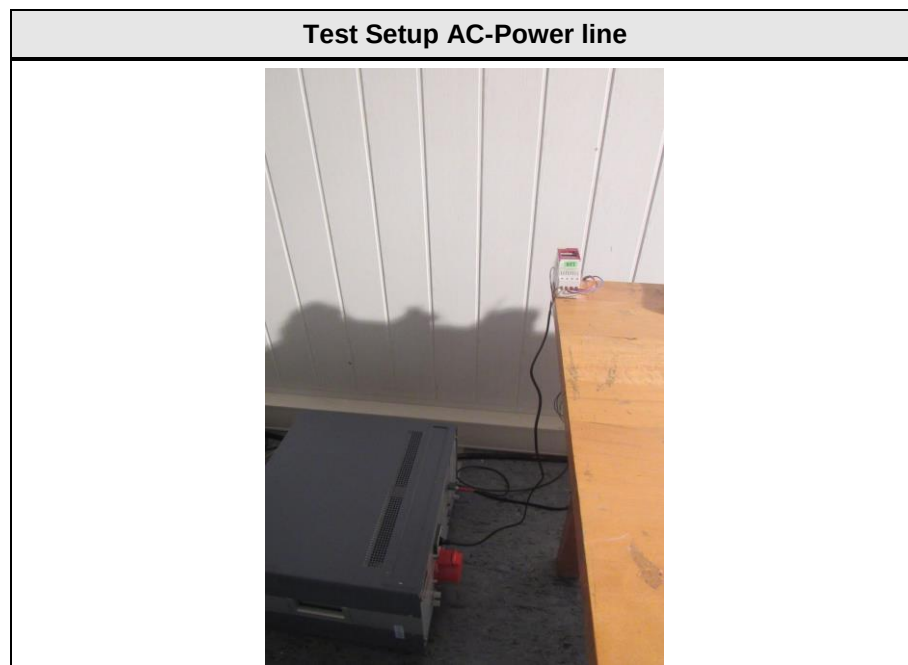
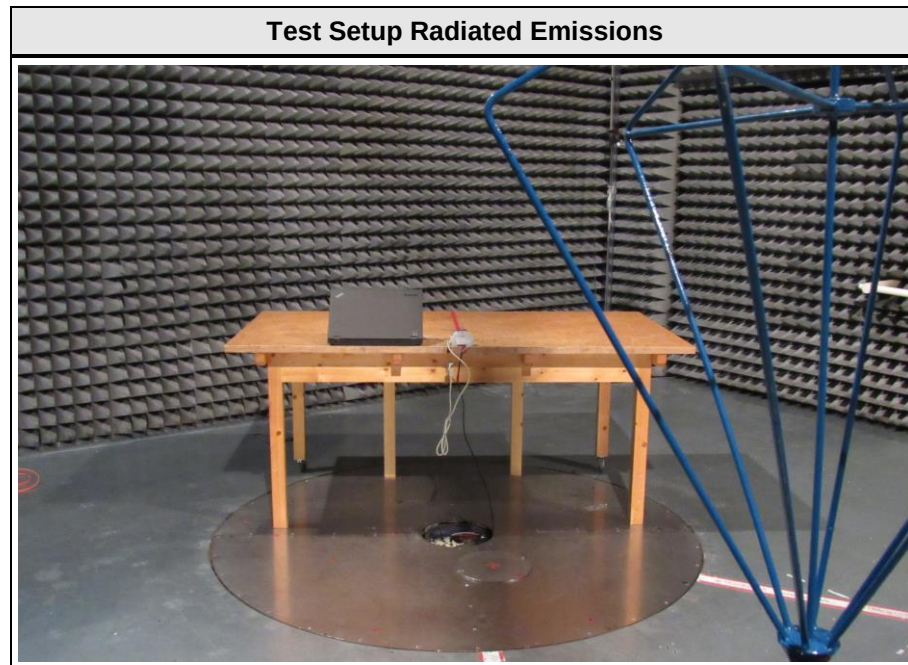


EUT S25 PCB II BACK





1.3 Photos – Test setup



1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	Laptop	Lenovo	ThinkPad T540p	Type 20BF-A07R05 S/N R9-02L0T1 14/06
AE	2-Channels 230VAC Timer Switch	Grässlin GmbH	Talento Smart S25	Host with EUT integrated
*Note: Use the following abbreviations: AE : Auxiliary/Associated Equipment				

1.5 Test Modes

Mode #	Description	
Transmit	General conditions:	EUT powered by AC-mains and controlled by Laptop.
	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 = -4dBm
AC-Powerline	General conditions:	EUT powered by AC-mains
	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	2016-02	2017-02

6dB Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2016-02	2017-02

Maximum peak conducted power					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2016-02	2017-02

Power spectral density					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2016-02	2017-02

Band edge compliance					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2016-02	2017-02

Conducted spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP 30	EF00312	2016-02	2017-02

Radiated spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 1	EF00062	-	-
Spectrum Analyzer	R&S	FSIQ26	EF00242	2015-04	2016-04
Biconical antenna	R&S	HK116	EF00186	2016-02	2018-02
LPD Antenna	R&S	HL 223	EF00187	2014-03	2017-03
LPD Antenna	R&S	HL 025	EF00327	2015-10	2018-10

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Storkower Str. 38c, D-15526 Reichenwalde, Germany

AC powerline conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2014-11	2016-11
AMN	R&S	ESH3-Z5	EF00036	2014-12	2016-12
EMI Test Receiver	R&S	ESCS 30	EF00295	2015-10	2016-10

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBμV. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

$$\text{Reading on Analyzer (dB}\mu\text{V)} + \text{A.F. (dB)} = \text{Net field strength (dB}\mu\text{V/m)}$$

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBμV/m). The FCC limits are given in units of μV/m. The following formula is used to convert the units of μV/m to dBμV/m:

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

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading	+	AF	=	Net Reading	:	Net reading - FCC limit	=	Margin
21.5 dBμV	+	26 dB	=	47.5 dBμV/m	:	47.5 dBμV/m - 57.0 dBμV/m	=	-9.5 dB

2 Result Summary

FCC 47 CFR Part 15C, ISED RSS-247				
Product Specific Standard Section	Requirement – Test	Reference Method	Result	Remarks
RSS-Gen 6.6	Occupied Bandwidth	ANSI C63.10	N/R	Informational only
FCC § 15.247(a)(2) ISED RSS-247 § 5.2	6dB Bandwidth	ANSI C63.10	PASS	
FCC § 15.247(b)(3) ISED RSS-247 § 5.4	Maximum peak conducted power	ANSI C63.10	PASS	
FCC § 15.247(e) ISED RSS-247 § 5.2	Power spectral density	ANSI C63.10	PASS	
47 CFR 15.207 ISED RSS-247 § 3.1	AC power line conducted emissions	ANSI C63.4	PASS	
FCC § 15.247(d) ISED RSS-247 § 5.5	Band edge compliance	ANSI C63.10	PASS	
FCC § 15.247(d) ISED RSS-247 § 5.5	Conducted spurious emissions	ANSI C63.10	PASS	
FCC § 15.247(d) FCC § 15.209 ISED RSS-247 § 5.5	Transmitter radiated spurious emissions	ANSI C63.10	PASS	
ISED RSS-247 § 3.1	Receiver radiated spurious emissions	ANSI C63.10	N/R	
Remarks:				

3 Test Conditions and Results

3.1 Test Conditions and Results – Occupied Bandwidth

Occupied Bandwidth acc. to ISED RSS-Gen			Verdict: PASS
Test according to measurement reference	Reference Method		
	ANSI C63.10		
Test frequency range	Tested frequencies		
	F _{LOW} / F _{MID} / F _{HIGH}		
Limits			
None (Informational only)			
Test setup			
Spectrum Analyzer EUT			
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 [MHz]
F _{LOW}	2402	Transmit	1.025
F _{MID}	2440	Transmit	1.095
F _{HIGH}	2480	Transmit	1.025
Comments:			

Occupied Bandwidth – F_{Low}

Occupied Bandwidth

Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 6.9.3
 Operational Mode: GFSK, Channel: 0, 2402 MHz
 Operating Conditions: T_{nom}/V_{nom}
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-01-21
 Occupied Bandwidth [MHz]: 1.025

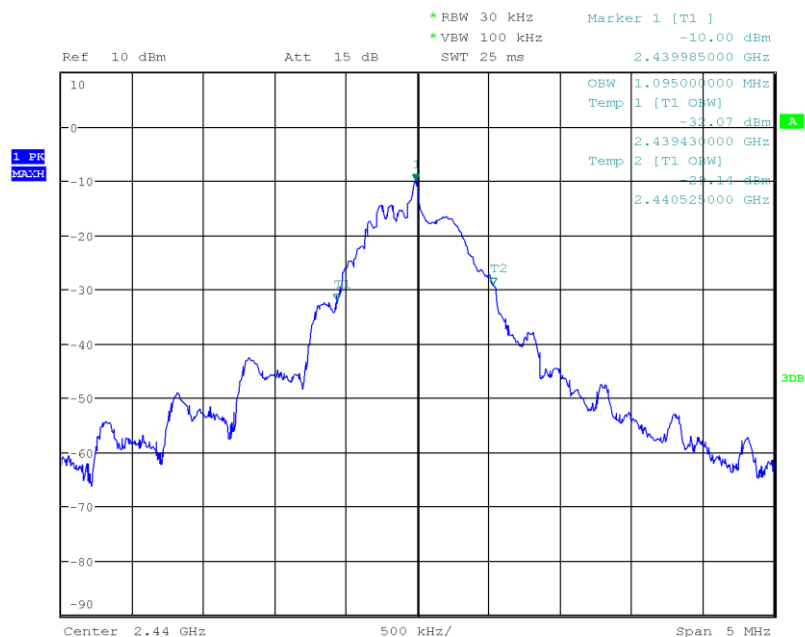


Date: 21.JAN.2016 12:30:35

Occupied Bandwidth – F_{MID}

Occupied Bandwidth

Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 6.9.3
 Operational Mode: GFSK, Channel: 19, 2440 MHz
 Operating Conditions: T_{nom}/V_{nom}
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-01-21
 Occupied Bandwidth [MHz]: 1.095

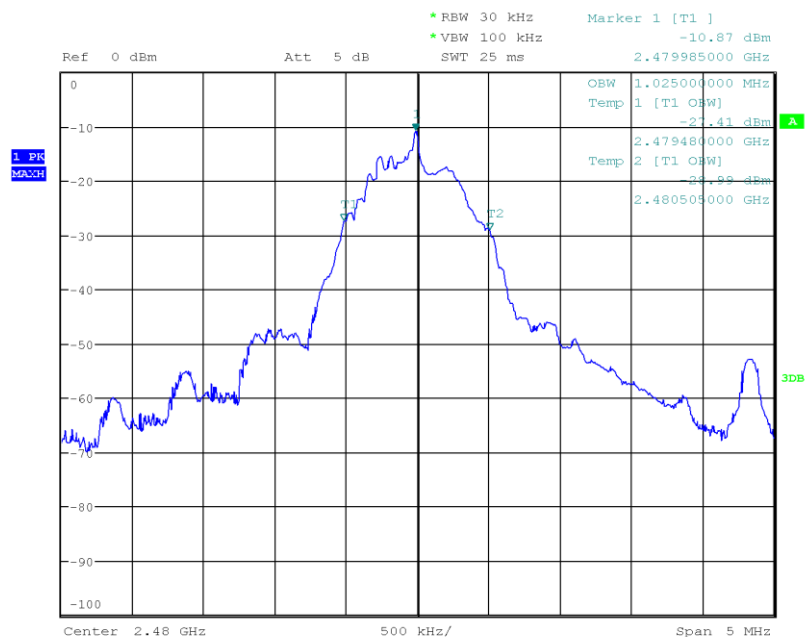


Date: 21.JAN.2016 12:31:41

Occupied Bandwidth – F_{HIGH}

Occupied Bandwidth

Project Number: G0M-1510-5171
Applicant: Grässlin GmbH
Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model: Carrier Board LCD-BLE
Reference Standards: FCC 15.247, RSS-247
Reference Method: ANSI C63.10:2013, Section 6.9.3
Operational Mode: GFSK, Channel: 39, 2480 MHz
Operating Conditions: T_{nom}/V_{nom}
Operator: C. Weber
Test Site: Eurofins Product Service GmbH
Test Date: 2016-01-21
Occupied Bandwidth [MHz]: 1.025



Date: 21.JAN.2016 12:32:43

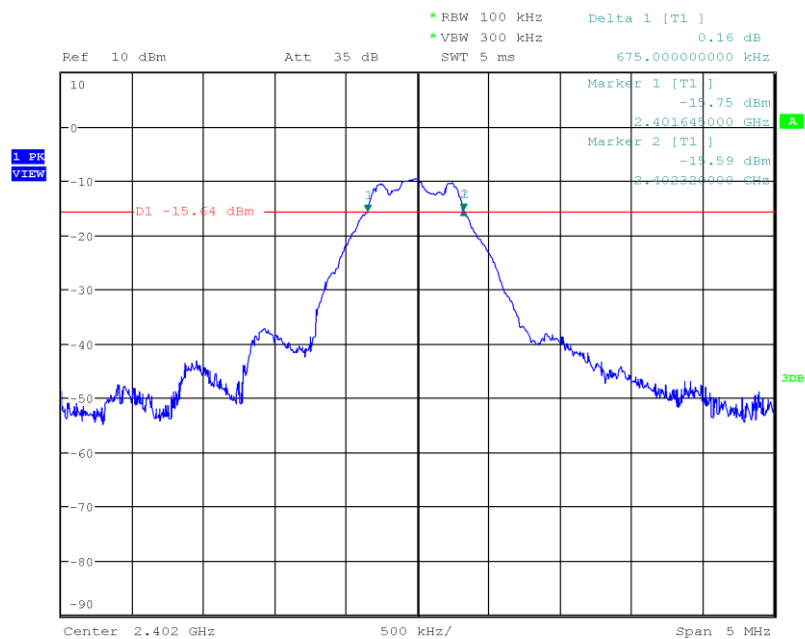
3.2 Test Conditions and Results – 6 dB Bandwidth

6dB Bandwidth acc. to FCC 15.247 / ISED RSS-247				Verdict: PASS	
EUT requirement rule parts and clause		Reference			
		FCC 15.247(a)(2) / ISED RSS-247 5.2			
Test according to measurement reference		Reference Method			
		ANSI C63.10			
Test frequency range		Tested frequencies			
		F _{LOW} / F _{MID} / F _{HIGH}			
Limits					
Limit					
≥ 500kHz					
Test setup					
Spectrum Analyzer EUT					
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	675	500	PASS
F _{MID}	2440	Transmit	685	500	PASS
F _{HIGH}	2480	Transmit	670	500	PASS
Comments:					

6 dB Bandwidth – F_{Low}

DTS (6 dB) Bandwidth

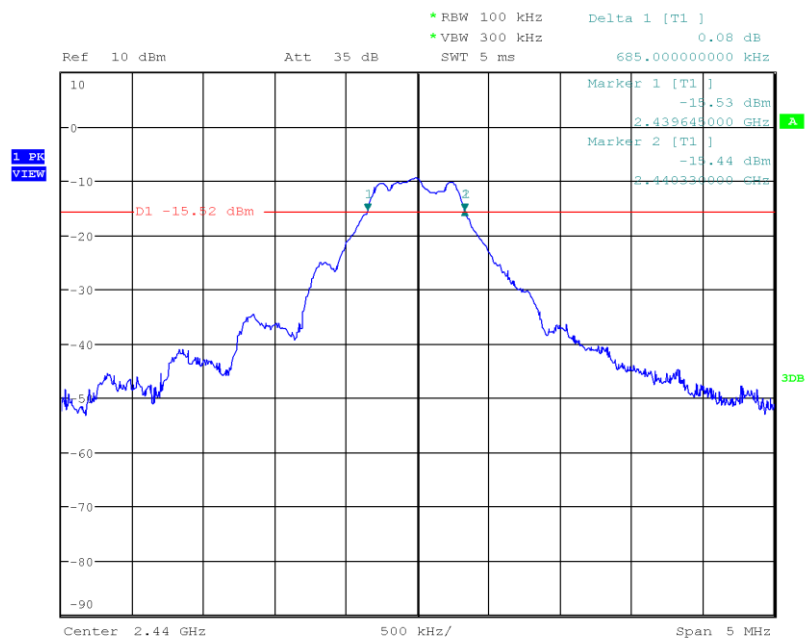
Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 11.8.1 Option 1
 Operational Mode: GFSK, Channel: 0, 2402 MHz
 Operating Conditions: T_{nom}/V_{nom}
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-01-21
 Lower Frequency [MHz]: 2401.645
 Upper Frequency [MHz]: 2402.320
 6 dB Bandwidth [kHz]: 675



6 dB Bandwidth – F_{MD}

DTS (6 dB) Bandwidth

Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 11.8.1 Option 1
 Operational Mode: GFSK, Channel: 19, 2440 MHz
 Operating Conditions: T_{nom}/V_{nom}
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-01-21
 Lower Frequency [MHz]: 2439.645
 Upper Frequency [MHz]: 2440.330
 6 dB Bandwidth [kHz]: 685



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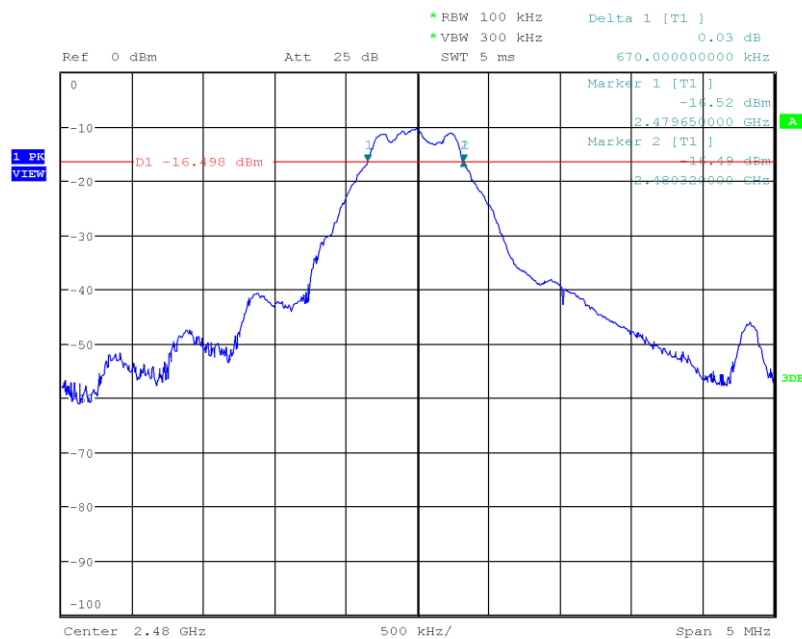
Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

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

6 dB Bandwidth – F_{HIGH}

DTS (6 dB) Bandwidth

Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 11.8.1 Option 1
 Operational Mode: GFSK, Channel: 39, 2480 MHz
 Operating Conditions: T_{nom}/V_{nom}
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-01-21
 Lower Frequency [MHz]: 2479.650
 Upper Frequency [MHz]: 2480.320
 6 dB Bandwidth [kHz]: 670



Date: 21.JAN.2016 12:28:45

Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

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

3.3 Test Conditions and Results – Maximum peak conducted power

Maximum peak conducted power acc. to FCC 15.247 / ISD RSS-247						Verdict: PASS	
EUT requirement rule parts and clause			Reference				
			FCC 15.247(b)(3) / ISD RSS-247 5.4				
Test according to measurement reference			Reference Method				
			ANSI C63.10				
Test frequency range			Tested frequencies				
			F _{LOW} / F _{MID} / F _{HIGH}				
Measurement mode			Peak				
Maximum antenna gain			0.9 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							
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 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} = 120V	Transmit	-9.063	0.0001	30	-39.06
F _{MID}	2440	V _{nom} = 120V	Transmit	-8.367	0.0001	30	-38.37
F _{HIGH}	2480	V _{nom} = 120V	Transmit	-7.019	0.0002	30	-37.02
Comment:							

3.4 Test Conditions and Results – Power spectral density

Power spectral density acc. to FCC 15.247 / ISSED RSS-247					Verdict: PASS	
EUT requirement rule parts and clause		Reference				
		FCC 15.247(e) / ISED RSS-247 5.2				
Test according to measurement reference		Reference Method				
		ANSI C63.10				
Test frequency range		Tested frequencies				
		F _{LOW} / F _{MID} / F _{HIGH}				
Measurement mode		Peak				
Limits						
8 dBm / 3 kHz						
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 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	2401.970	-9.670	8.0	-17.67
F _{MID}	2440	Transmit	2439.997	-9.119	8.0	-17.12
F _{HIGH}	2480	Transmit	2479.994	-7.463	8.0	-15.46
Comments:						

3.5 Test Conditions and Results – AC power line conducted emissions

Power line conducted emissions acc. to FCC 47 CFR 15.207 / ISED 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.					

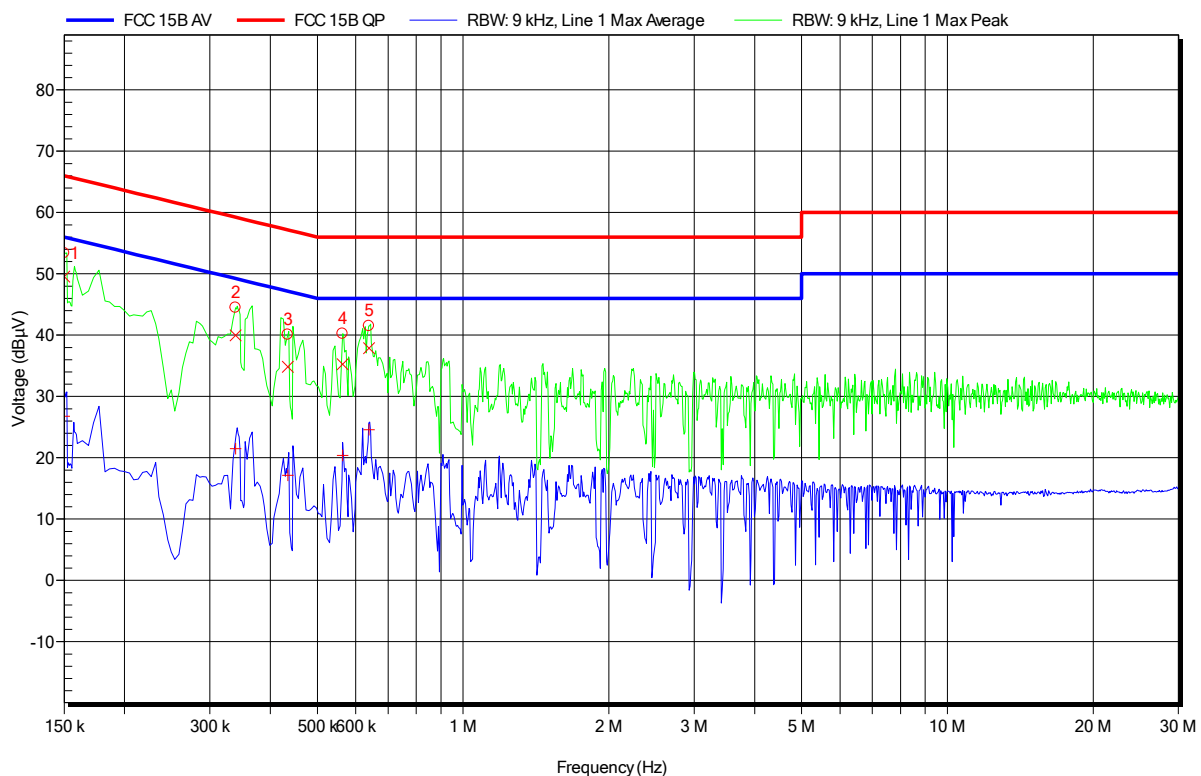
Conducted Emissions S25

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

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model: Carrier Board LCD-BLE
Test Site: Eurofins Product Service GmbH
Operator: Mr. Yu
Test Conditions: Tnom: 23°C, Unom: 120 VAC
LISN: ESH2-Z5 L
Mode: 1
Test Date: 2016-03-11
Note:

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Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
1	150 kHz	49.53 dBμV	66 dBμV	-16.47 dB	Pass
2	339 kHz	39.99 dBμV	59.23 dBμV	-19.24 dB	Pass
3	434.4 kHz	34.86 dBμV	57.17 dBμV	-22.31 dB	Pass
4	564 kHz	35.24 dBμV	56 dBμV	-20.76 dB	Pass
5	639.15 kHz	37.85 dBμV	56 dBμV	-18.15 dB	Pass

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status
1	150 kHz	26.79 dBμV	56 dBμV	-29.21 dB	Pass
2	339 kHz	21.49 dBμV	49.23 dBμV	-27.74 dB	Pass
3	434.4 kHz	17.17 dBμV	47.17 dBμV	-30 dB	Pass
4	564 kHz	20.38 dBμV	46 dBμV	-25.62 dB	Pass
5	639.15 kHz	24.57 dBμV	46 dBμV	-21.43 dB	Pass

Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

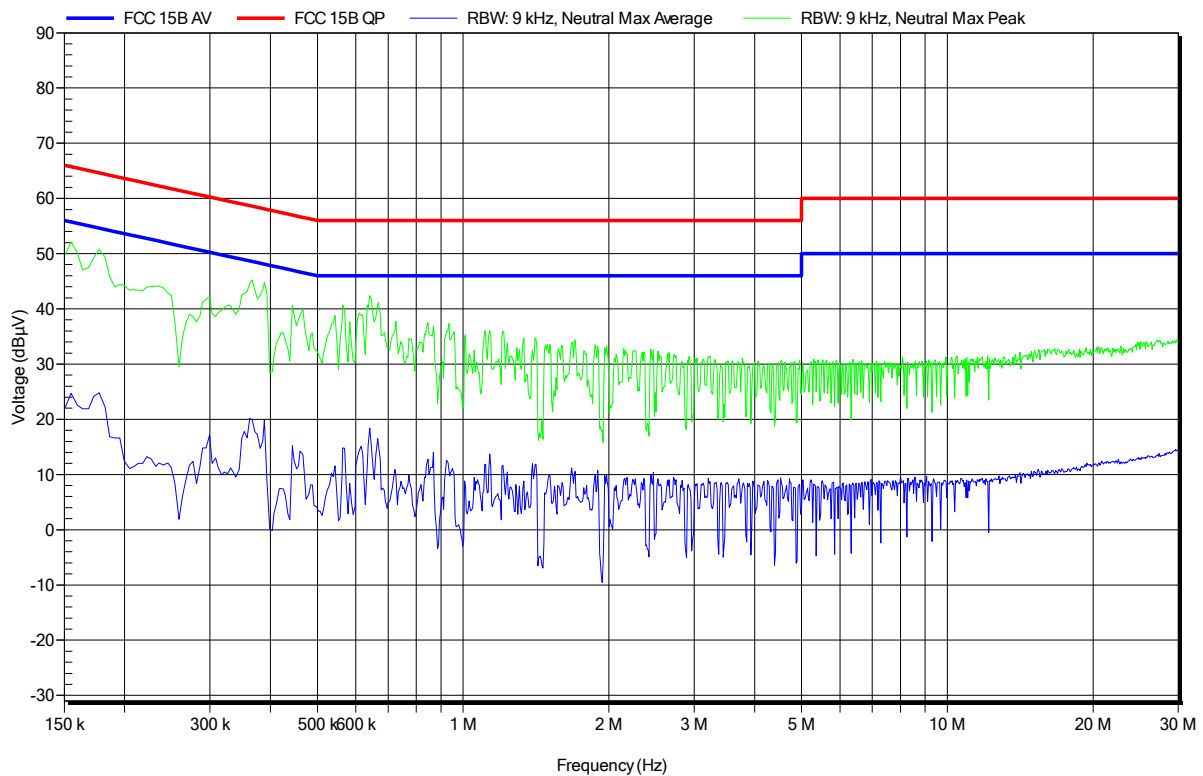
Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

Conducted Emissions S25
EMI voltage test in the ac-mains according to FCC Part 15b

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Yu
 Test Conditions: Tnom: 23°C, Unom: 120VAC
 LISN: ESH2-Z5 N
 Mode: 1
 Test Date: 2016-03-11
 Note:

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Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

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

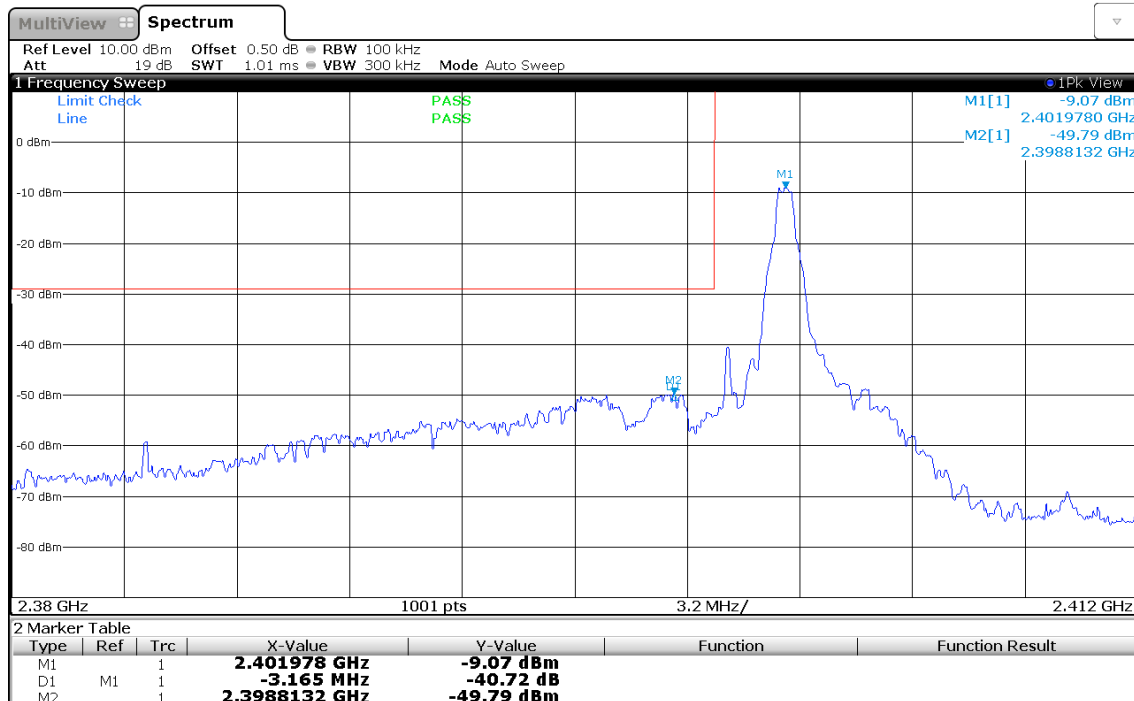
3.6 Test Conditions and Results – Band edge compliance

Band-edge compliance acc. to FCC 15.247 / ISED RSS-247					Verdict: PASS
EUT requirement rule parts and clause		Reference			
		FCC 15.247(d) / ISED RSS-247 5.5			
Test according to measurement reference		Reference Method			
		ANSI C63.10			
Test frequency range		Tested frequencies			
		F _{LOW} / F _{HIGH}			
Measurement mode		Peak			
Limits					
Limit			Condition		
≤ -20 dB / 100 kHz			Power measurement detector = Peak		
≤ -30 dB / 100 kHz			Power measurement detector = RMS		
Test setup					
Spectrum Analyzer EUT					
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	-40.72	-20	-20.72
F _{HIGH}	2480	Transmit	-32.63	-20	-12.63
Comments:					

Band-edge compliance

Band-edge Compliance

Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 11.11
 Operational Mode: GFSK, Channel: 0, 2402 MHz
 Operating Conditions: Tnom/Vnom
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-03-04
 Band-edge: Lower
 In-band Frequency [MHz]: 2401.978
 Max. in-band Level [dBm/100 kHz]: -9.069
 Out-of-band Frequency [MHz]: 2398.813
 Max. out-of-band Level [dBm/100 kHz]: -49.786
 Attenuation [dB]: -40.72



Date: 4 MAR. 2016 15:40:40

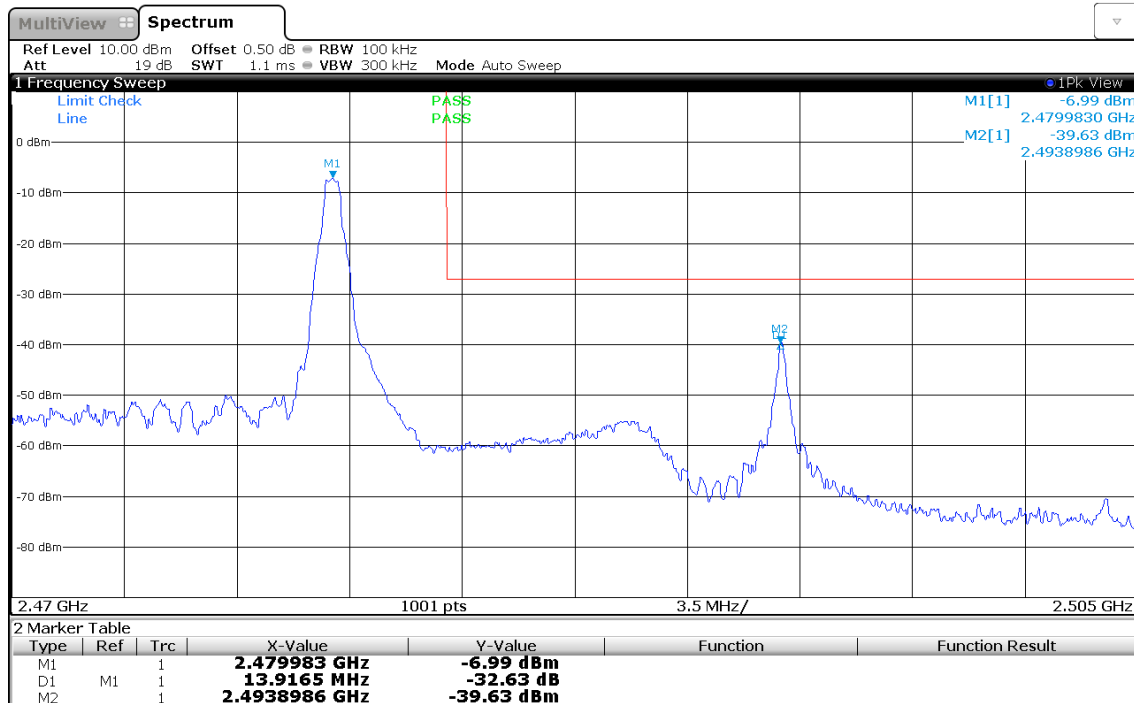
Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

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

Band-edge compliance

Band-edge Compliance

Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 11.11
 Operational Mode: GFSK, Channel: 39, 2480 MHz
 Operating Conditions: Tnom/Vnom
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-03-04
 Band-edge: Upper
 In-band Frequency [MHz]: 2479.983
 Max. in-band Level [dBm/100 kHz]: -6.995
 Out-of-band Frequency [MHz]: 2493.899
 Max. out-of-band Level [dBm/100 kHz]: -39.625
 Attenuation [dB]: -32.63



Date: 4 MAR 2016 15:42:10

Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

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

3.7 Test Conditions and Results – Conducted spurious emissions

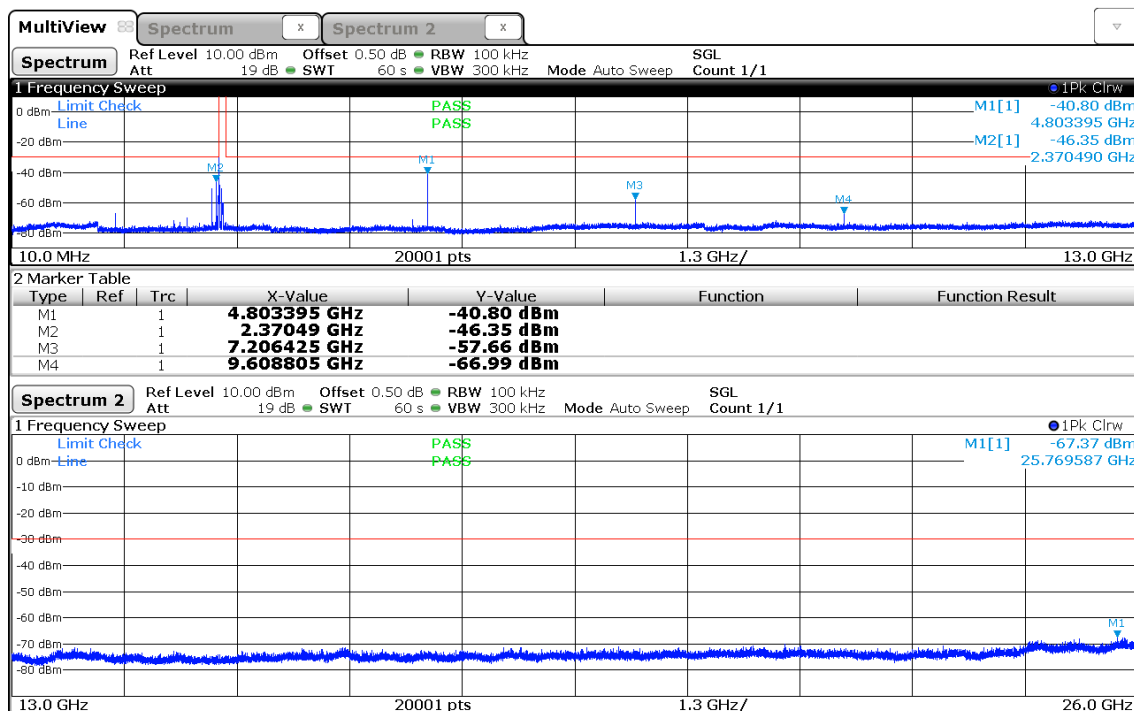
Conducted spurious emissions acc. to FCC 15.247 / ISED RSS-247						Verdict: PASS	
EUT requirement rule parts and clause			Reference				
			FCC 15.247(d) / ISED RSS-247 5.5				
Test according to measurement reference			Reference Method				
			ANSI C63.10				
Test frequency range			Tested frequencies				
			10 MHz – 10 th 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							
Spectrum Analyzer EUT							
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	2370.49	-46.35	-9.8	-29.8	-16.55
F _{LOW}	2402	Transmit	4803.40	-40.80	-9.8	-29.8	-11.00
F _{LOW}	2402	Transmit	7206.43	-57.66	-9.8	-29.8	-27.86
F _{LOW}	2402	Transmit	9608.81	-66.99	-9.8	-29.8	-37.19
F _{MID}	2440	Transmit	1887.29	-58.38	-9.2	-29.2	-29.18
F _{MID}	2440	Transmit	2564.03	-43.64	-9.2	-29.2	-14.44
F _{MID}	2440	Transmit	4879.38	-40.30	-9.2	-29.2	-11.10
F _{MID}	2440	Transmit	7319.43	-57.53	-9.2	-29.2	-28.33

F _{HIGH}	2480	Transmit	1881.44	-54.66	-7.9	-27.9	-26.76
F _{HIGH}	2480	Transmit	2493.89	-43.12	-7.9	-27.9	-15.22
F _{HIGH}	2480	Transmit	4959.92	-42.81	-7.9	-27.9	-14.91
F _{HIGH}	2480	Transmit	7440.23	-58.51	-7.9	-27.9	-30.61
Comments:							

Conducted spurious emissions – F_{Low}

Conducted Spurious Emissions

Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 11.11
 Operational Mode: GFSK, Channel: 0, 2402 MHz
 Operating Conditions: Tnom/Vnom
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-03-04
 Max. in-band Frequency [MHz]: 2402.0
 Max. in-band Level [dBm/100 kHz]: -9.8
 Out-of-band Limit [dBm/100 kHz]: -29.8



Date: 4. MAR. 2016 15:46:49

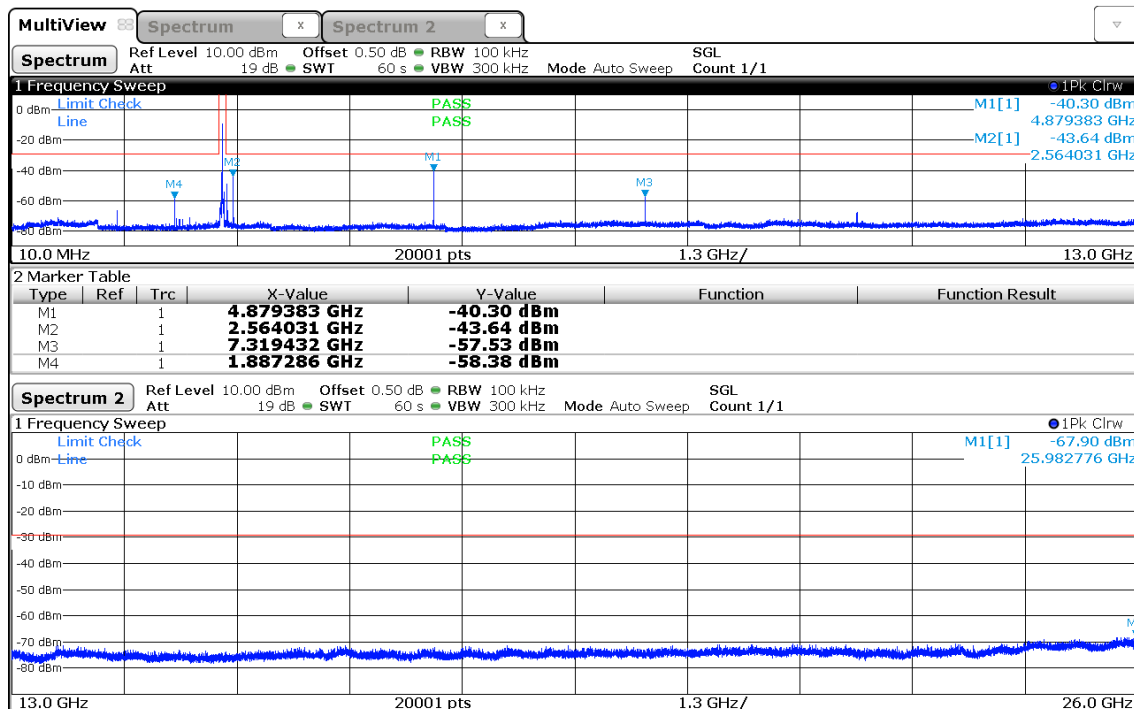
Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

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

Conducted spurious emissions – F_{MID}

Conducted Spurious Emissions

Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 11.11
 Operational Mode: GFSK, Channel: 19, 2440 MHz
 Operating Conditions: Tnom/Vnom
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-03-04
 Max. in-band Frequency [MHz]: 2440.0
 Max. in-band Level [dBm/100 kHz]: -9.2
 Out-of-band Limit [dBm/100 kHz]: -29.2



Date: 4. MAR. 2016 15:51:01

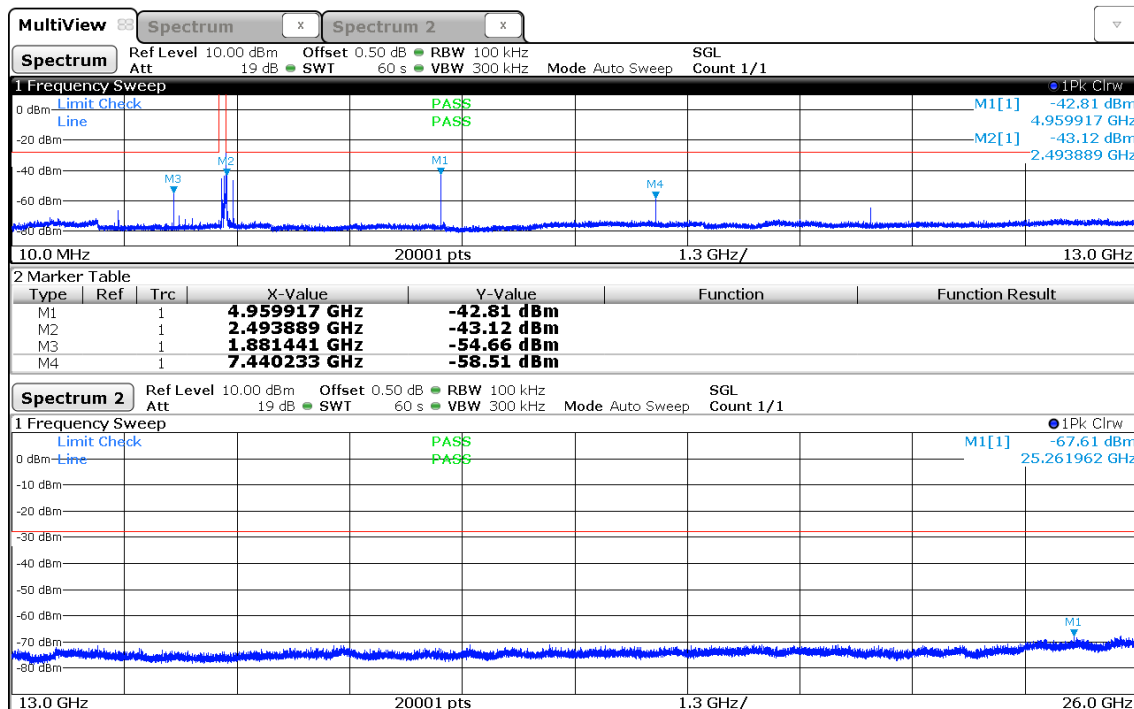
Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

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

Conducted spurious emissions – F_{HIGH}

Conducted Spurious Emissions

Project Number: G0M-1510-5171
 Applicant: Grässlin GmbH
 Model Description: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Reference Standards: FCC 15.247, RSS-247
 Reference Method: ANSI C63.10:2013, Section 11.11
 Operational Mode: GFSK, Channel: 39, 2480 MHz
 Operating Conditions: Tnom/Vnom
 Operator: C. Weber
 Test Site: Eurofins Product Service GmbH
 Test Date: 2016-03-04
 Max. in-band Frequency [MHz]: 2480.0
 Max. in-band Level [dBm/100 kHz]: -7.9
 Out-of-band Limit [dBm/100 kHz]: -27.9

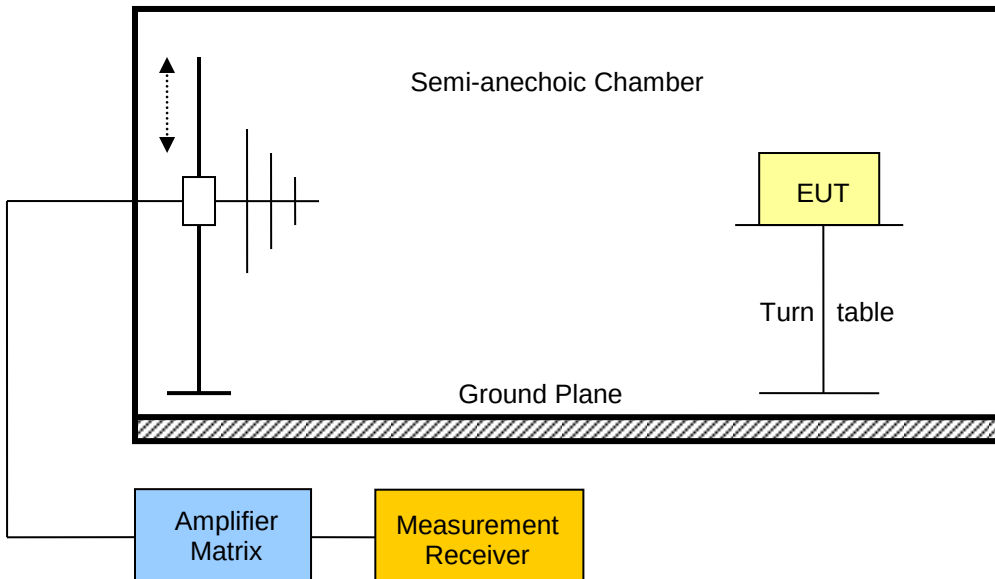


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Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

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

3.8 Test Conditions and Results – Transmitter radiated emissions

Transmitter radiated emissions acc. to FCC 47 CFR 15.247 / ISED RSS-247				Verdict: PASS
Test according referenced standards	Reference Method			
	FCC 15.247(d) / ISED RSS-247 5.5			
Test according to measurement reference	Reference Method			
	ANSI C63.10			
Test frequency range	Tested frequencies			
	30 MHz – 10 th 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 S25									
Channel	Frequency [MHz]	Mode	Emission [MHz]	Level [dB μ V/m]	Det.	Pol.	Limit [dB μ V/m]	Limit dist. [m]*	Margin [dB]
F _{LOW}	2402	Transmit	4804	55.53	pk	hor	74.00	3	-18.47
F _{LOW}	2402	Transmit	4804	53.58	avg	hor	54.00	3	-00.42
F _{LOW}	2402	Transmit	4804	55.28	pk	ver	74.00	3	-18.72
F _{LOW}	2402	Transmit	4804	53.29	avg	ver	54.00	3	-00.71
F _{MID}	2442	Transmit	2486.5	52.58	pk	hor	74.00	3	-21.42
F _{MID}	2442	Transmit	2486.5	50.71	pk	ver	74.00	3	-23.29
F _{MID}	2442	Transmit	4872	52.59	pk	hor	74.00	3	-21.41
F _{MID}	2442	Transmit	4880	55.68	pk	ver	74.00	3	-18.32
F _{MID}	2442	Transmit	4880	53.64	avg	ver	54.00	3	-00.36
F _{HIGH}	2480	Transmit	4952	51.67	pk	hor	74.00	3	-22.33
F _{HIGH}	2480	Transmit	4960	55.13	pk	ver	74.00	3	-18.87
F _{HIGH}	2480	Transmit	4960	53.34	avg	ver	54.00	3	-00.66
Comments: * Physical distance between EUT and measurement antenna.									

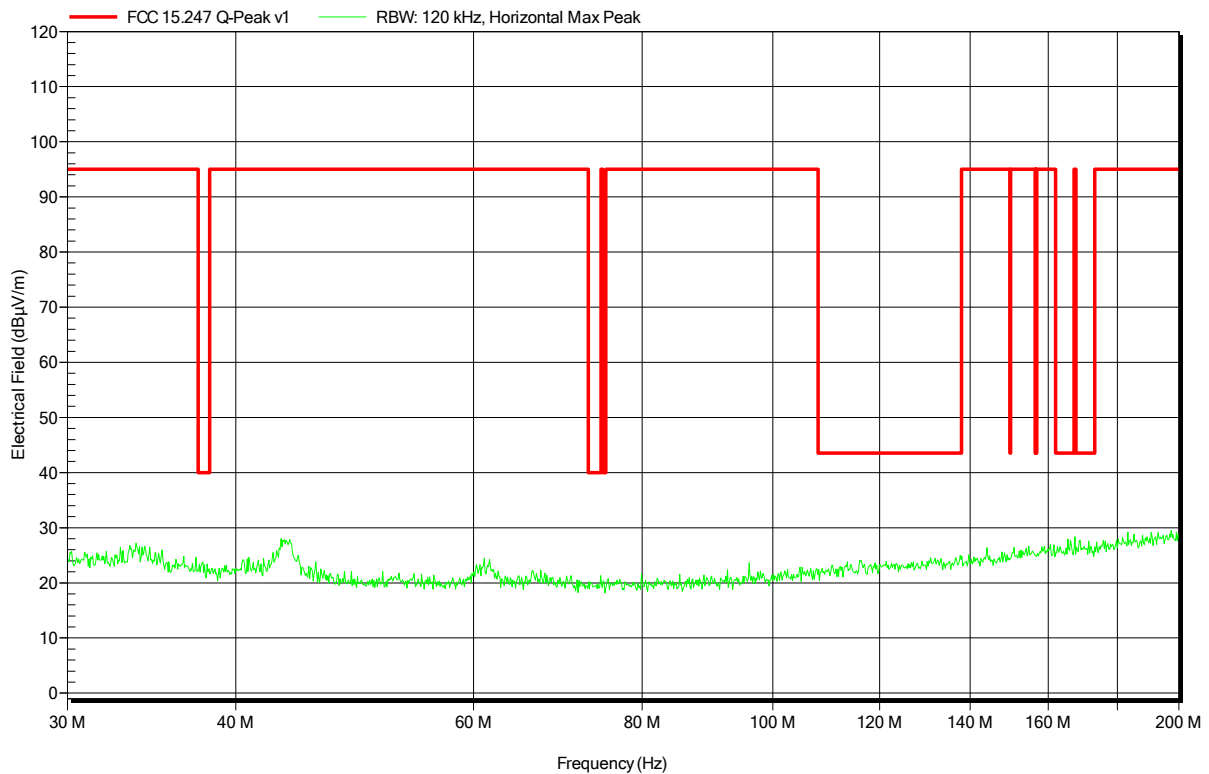
ANNEX A Transmitter radiated spurious emissions

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; BT LE, CH.0, 2402 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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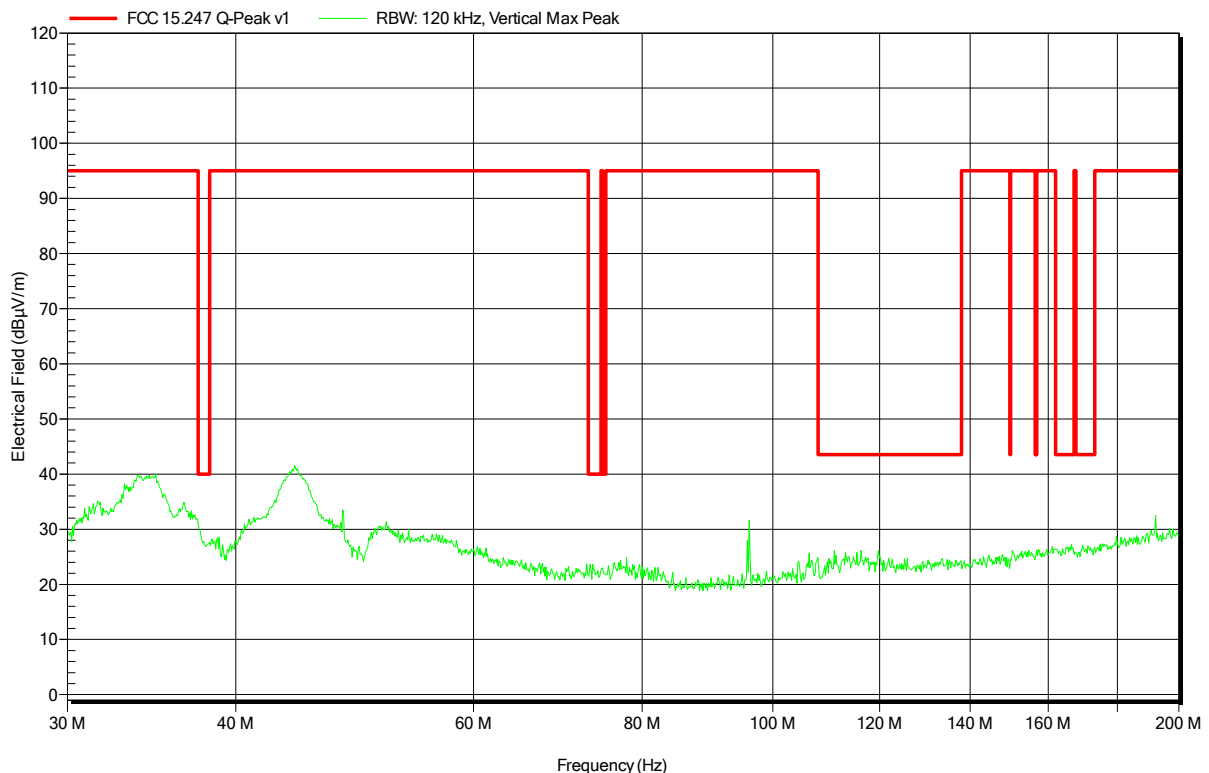


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; BT LE, CH.0, 2402 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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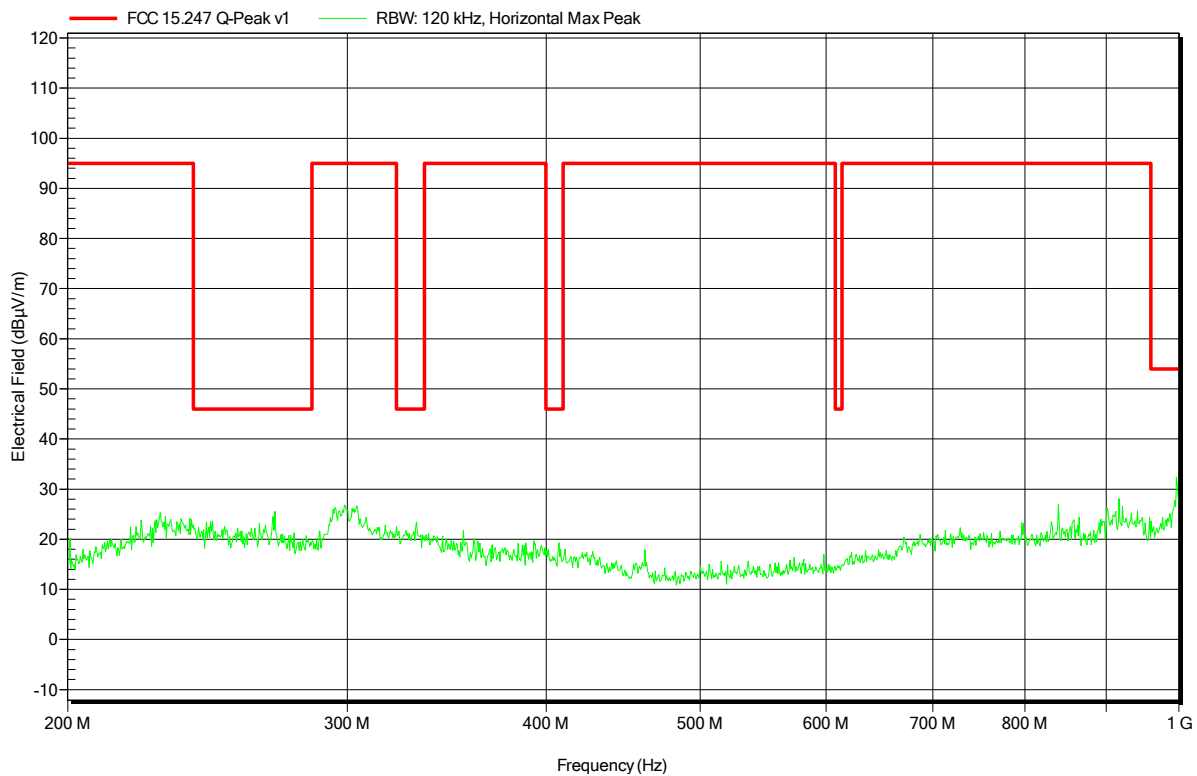


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; BT LE, CH.0, 2402 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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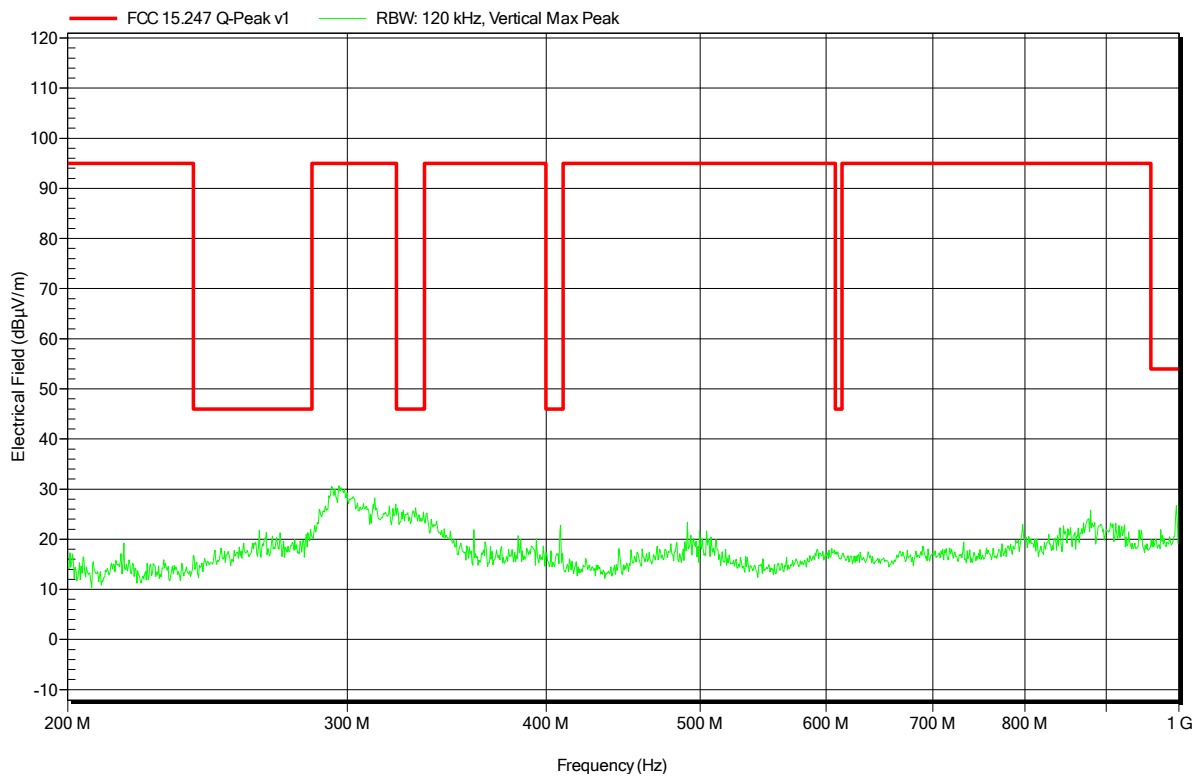


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; BT LE, CH.0, 2402 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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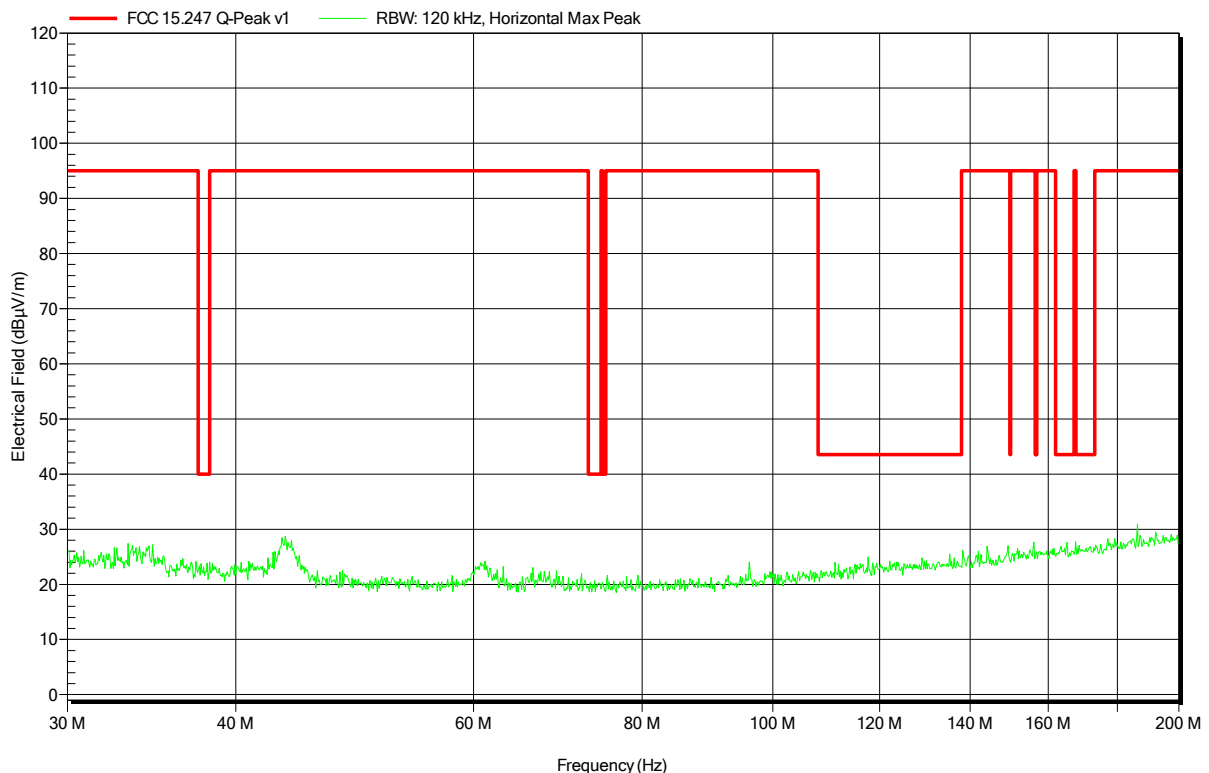


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; BT LE, CH.19, 2440 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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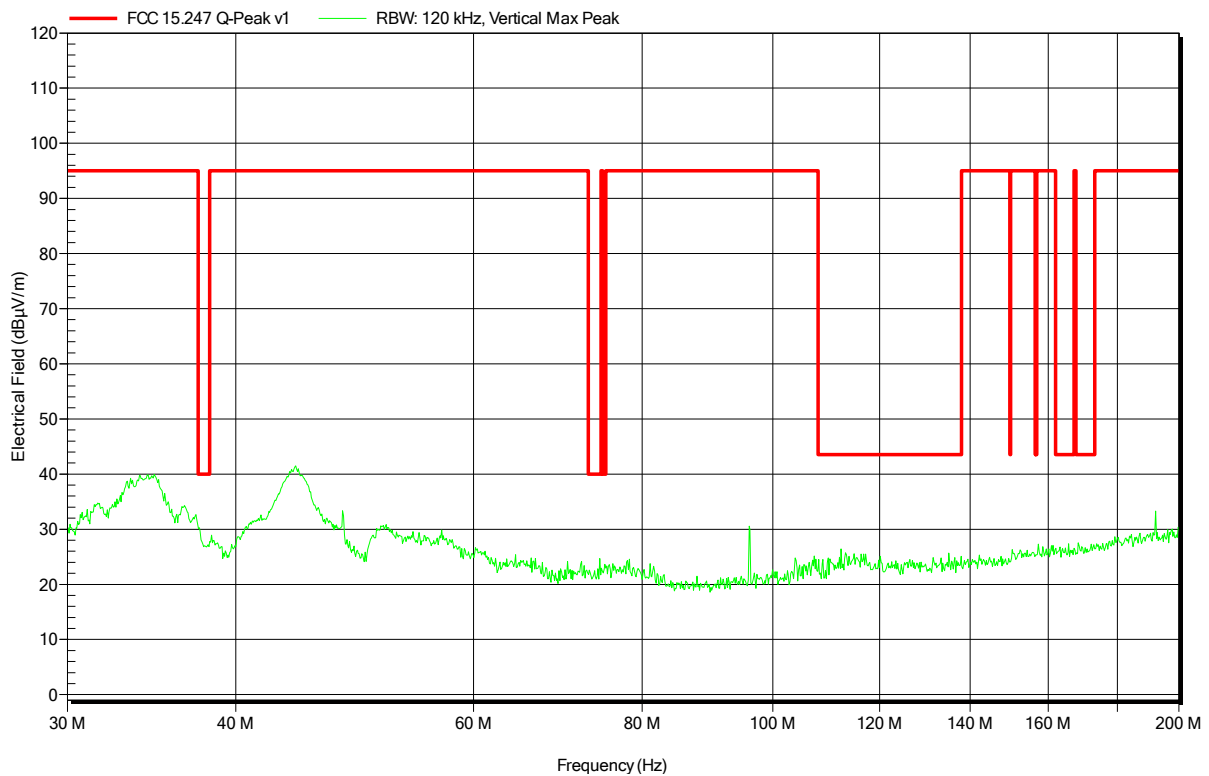


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; BT LE, CH.19, 2440 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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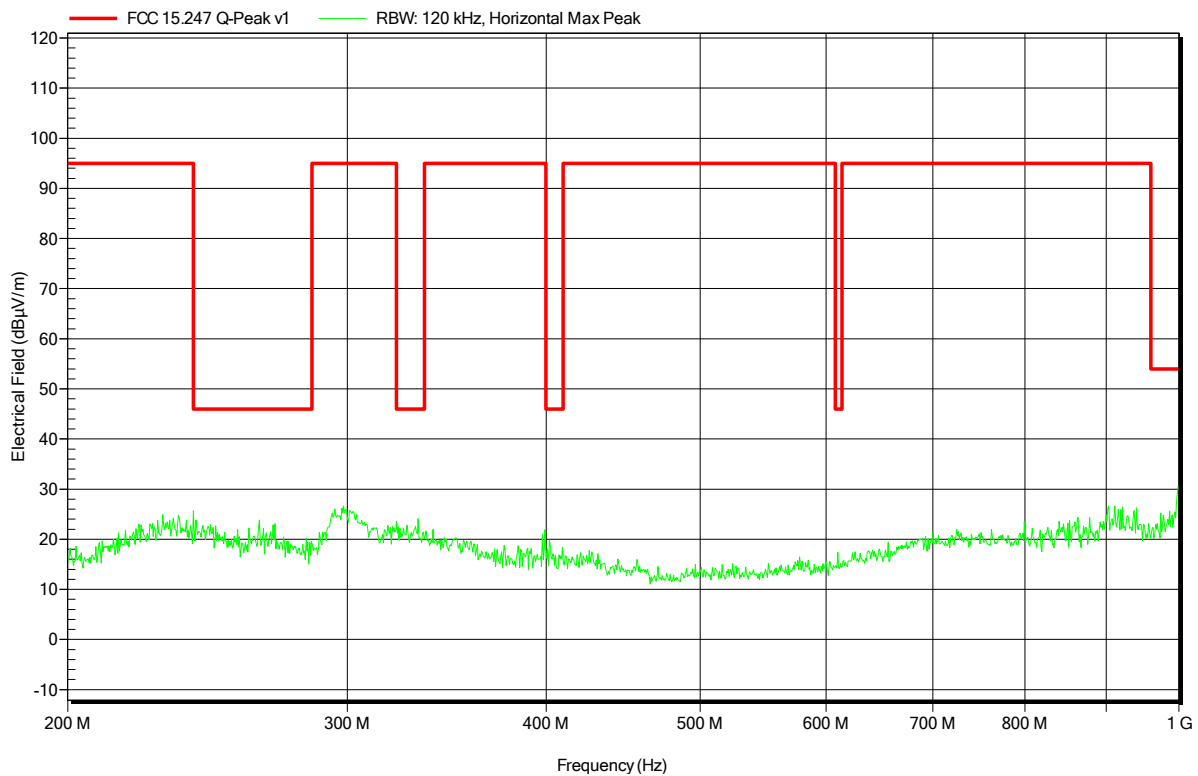


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; BT LE, CH.19, 2440 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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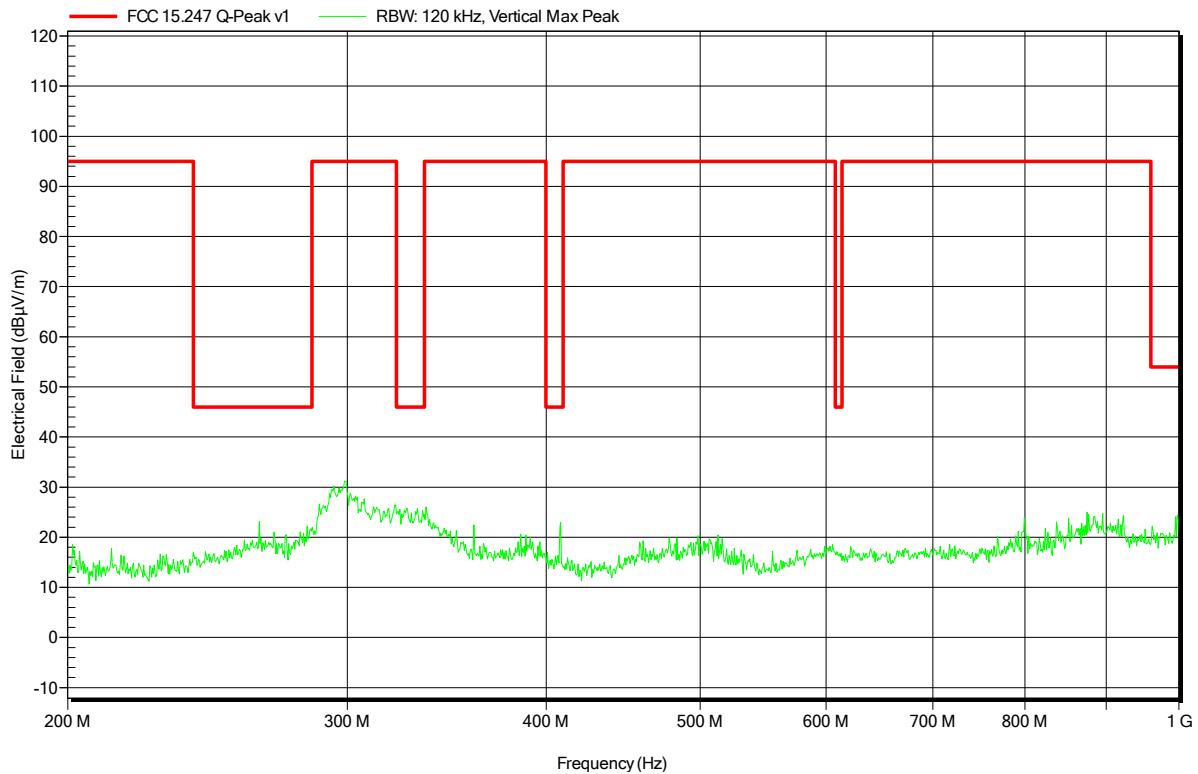


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; BT LE, CH.19, 2440 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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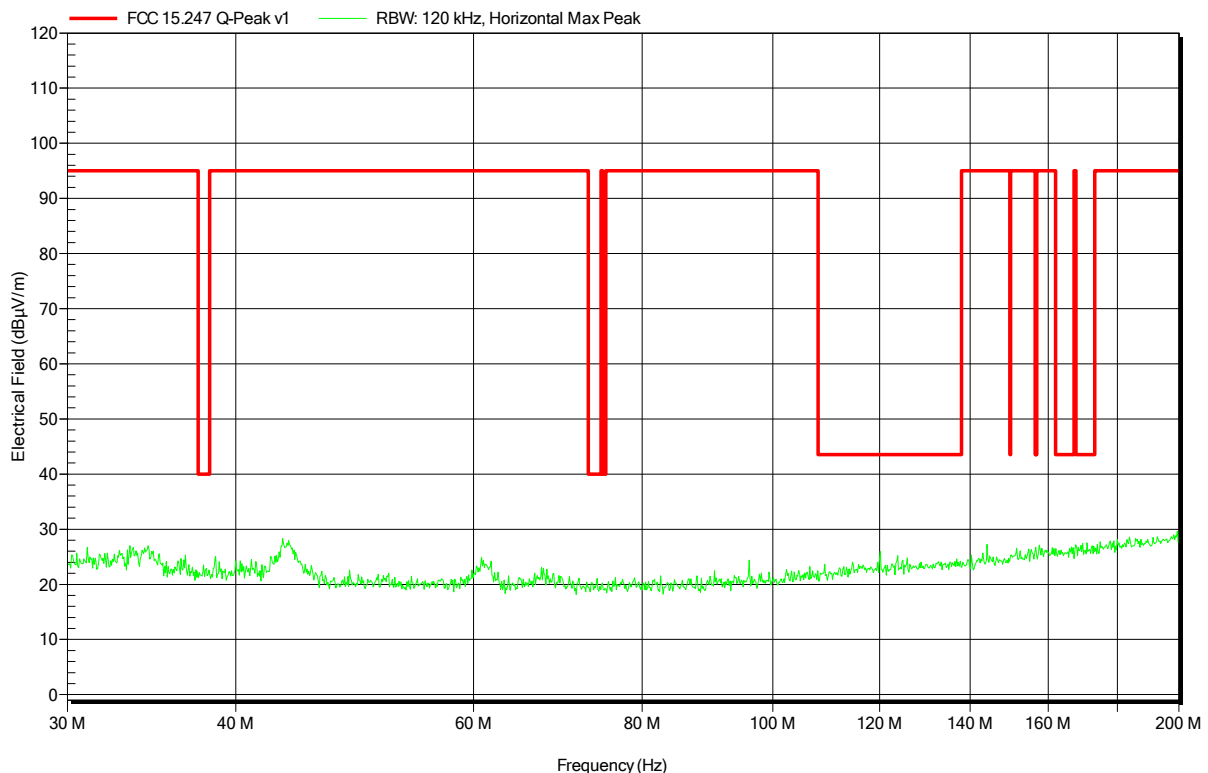


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; BT LE, CH.39, 2480 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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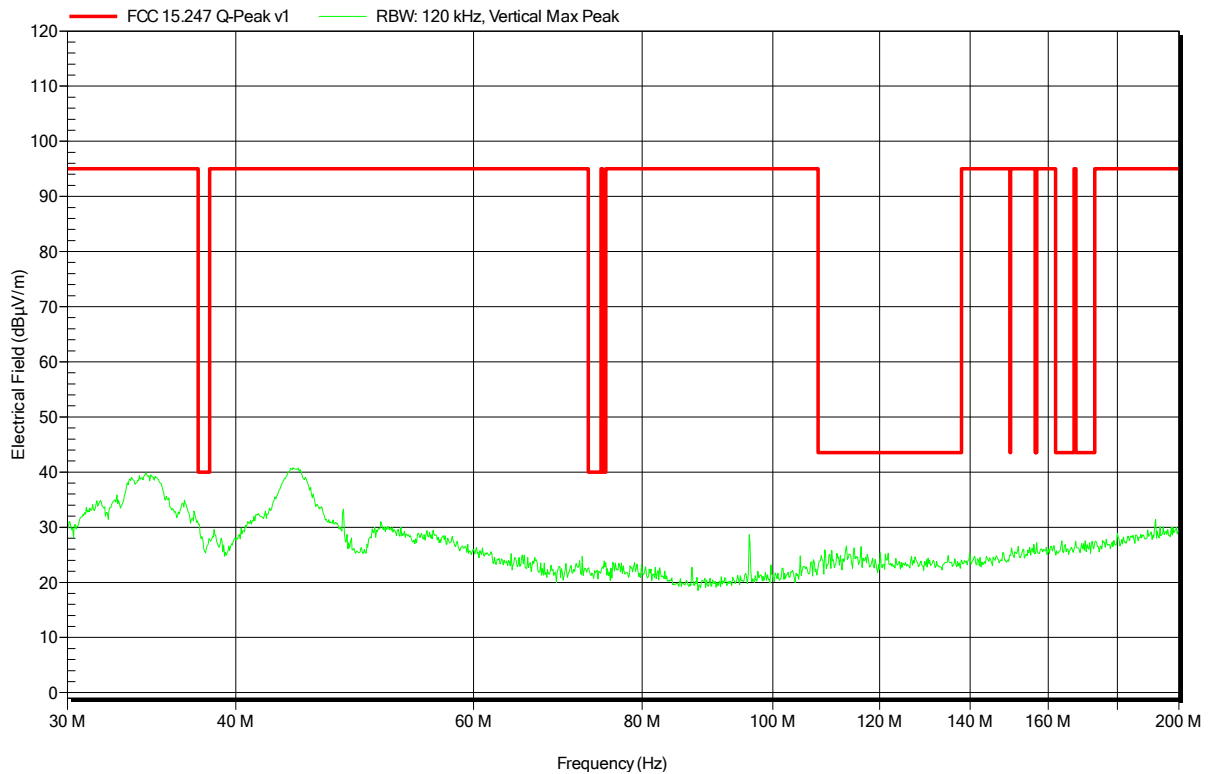


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; BT LE, CH.39, 2480 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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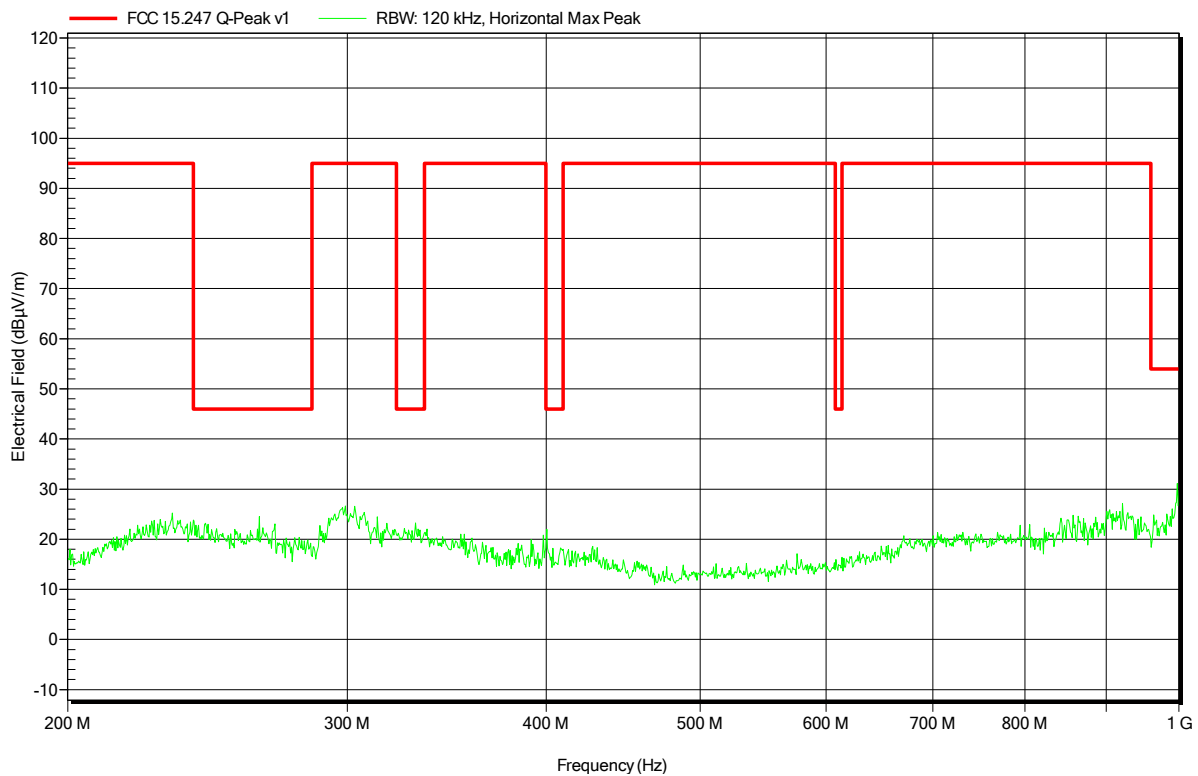


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; BT LE, CH.39, 2480 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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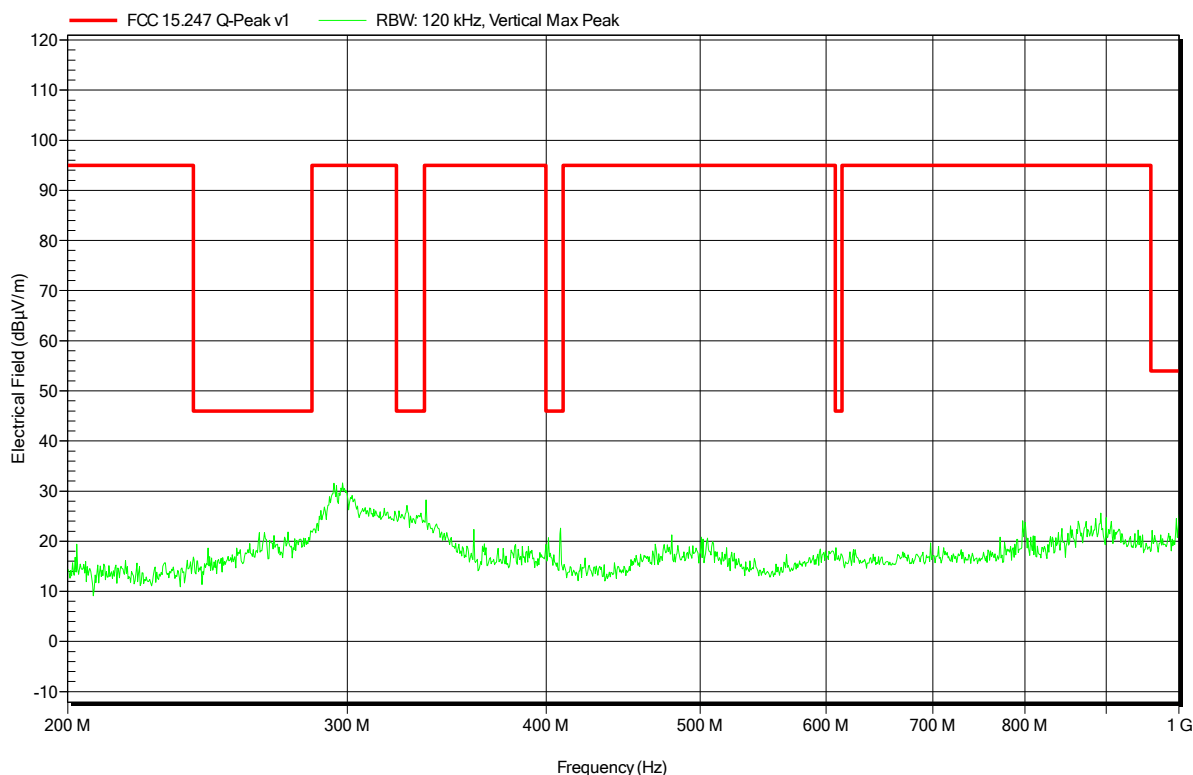


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 22°C, Vnom: 120 VAC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; BT LE, CH.39, 2480 MHz
Test Date:	2016-03-04
Note:	Power Setting = -4 dBm, Modulated

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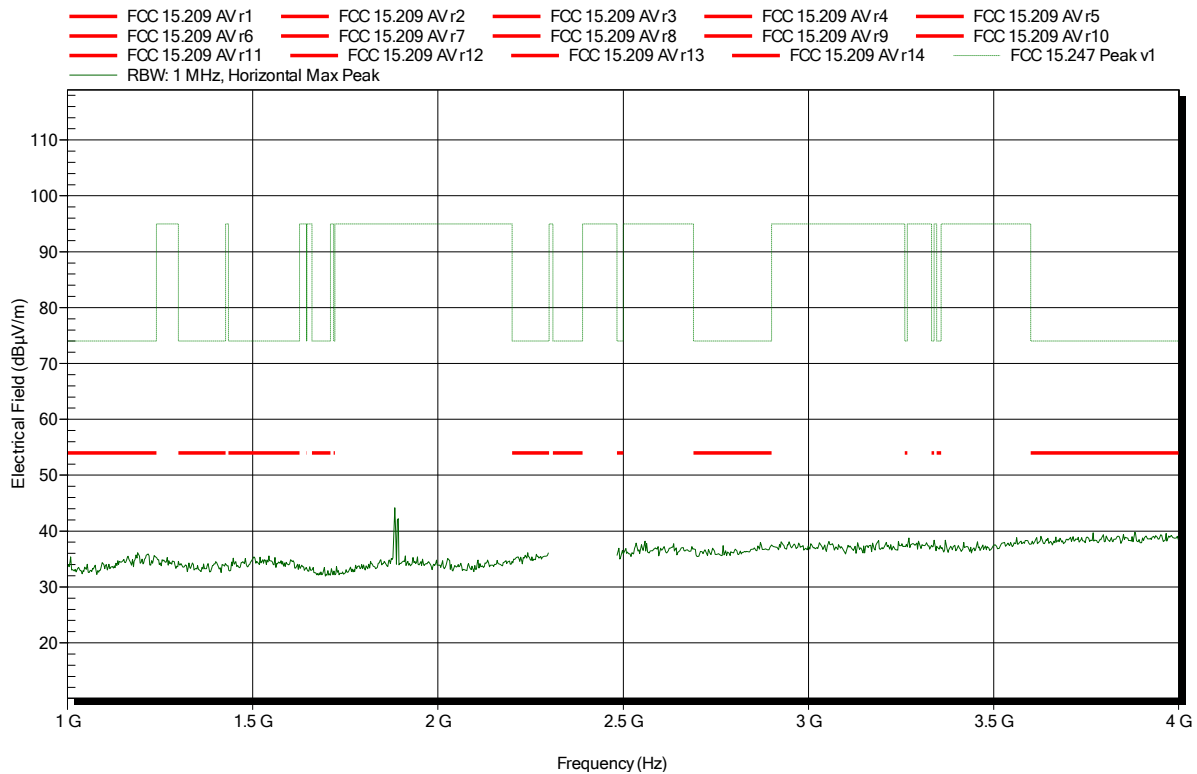


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; BT LE, CH.0, 2402 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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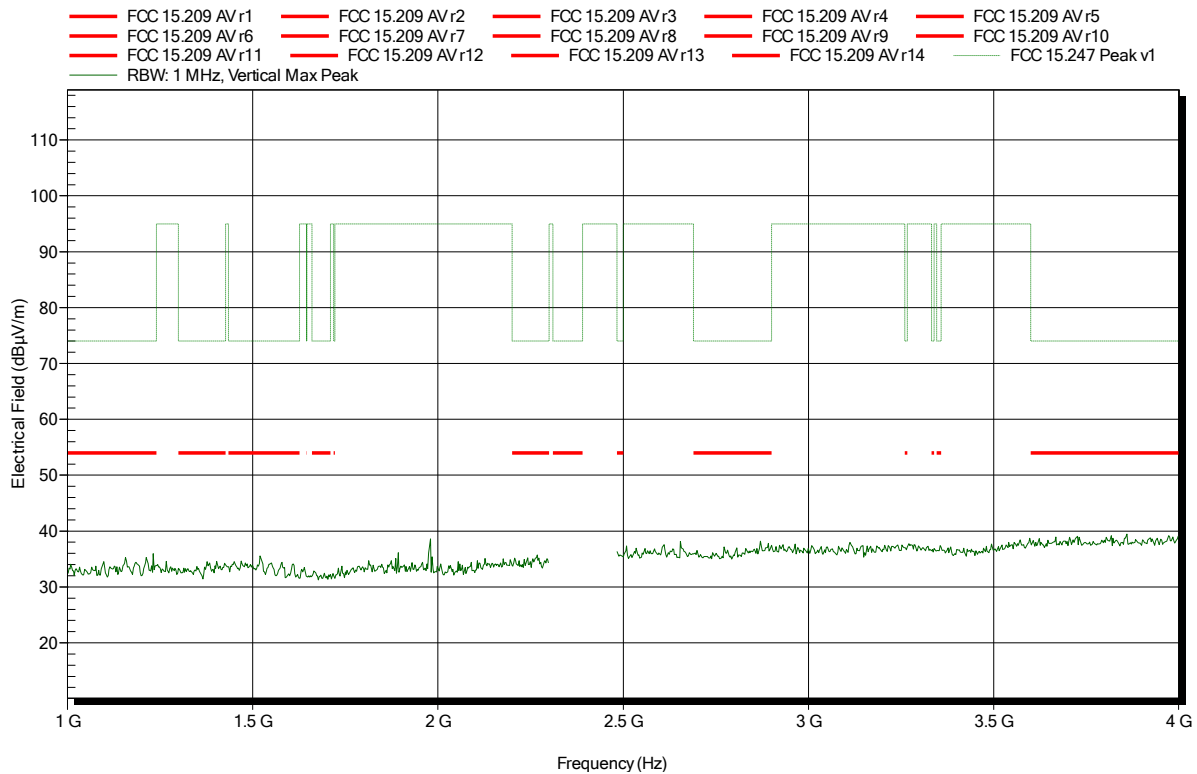


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; BT LE, CH.0, 2402 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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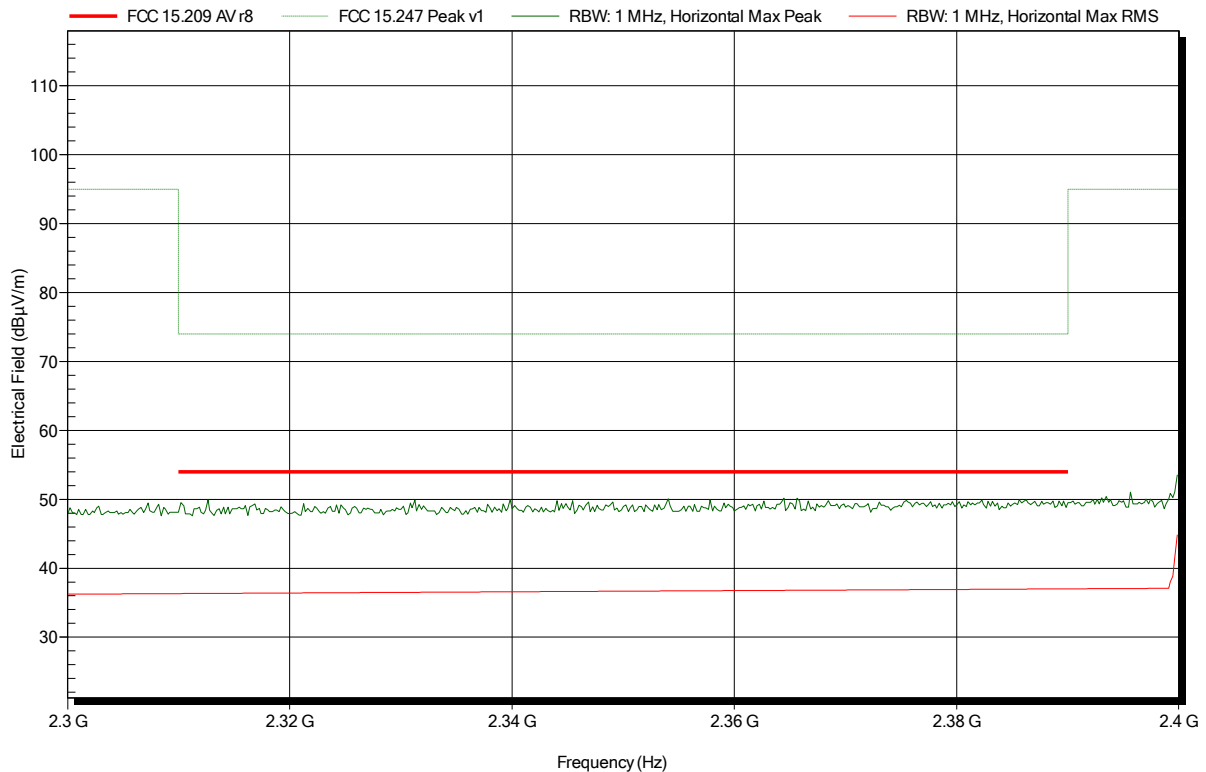


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.0, 2402 MHz
 Test Date: 2016-03-02
 Note: lower bandedge, Power Setting = -4 dBm, Modulated

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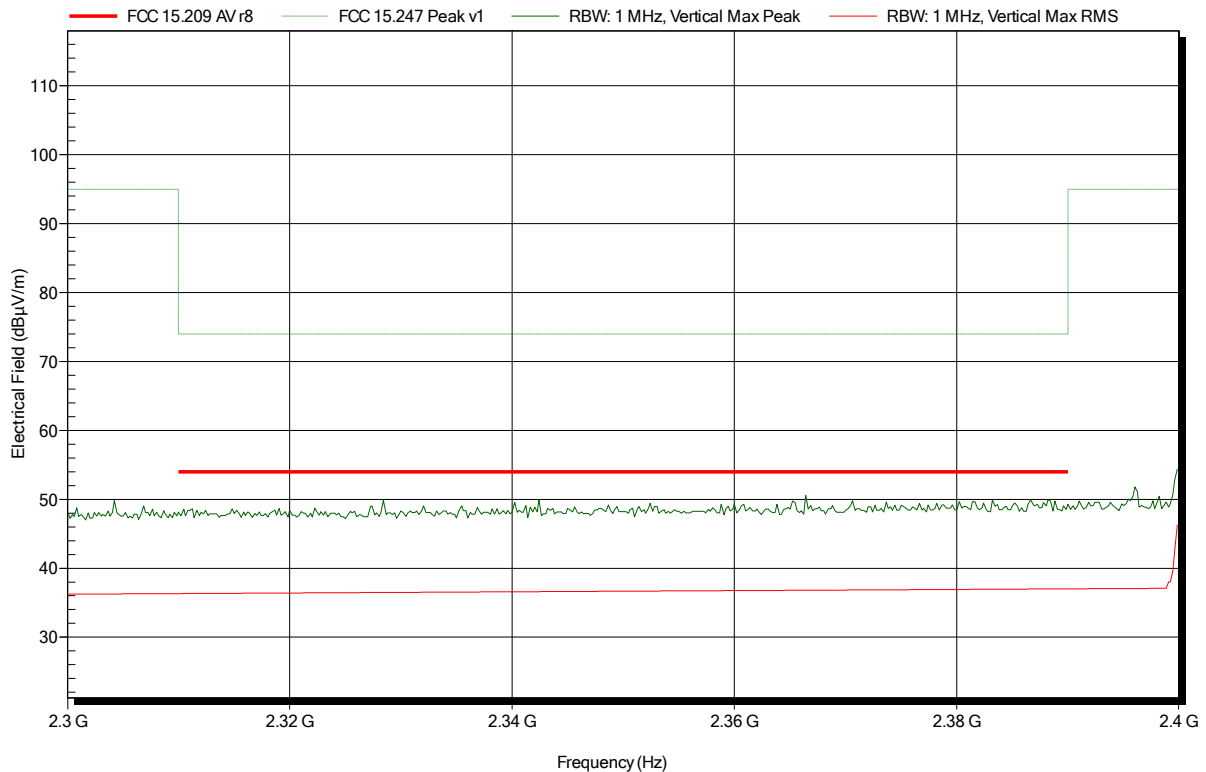


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.0, 2402 MHz
 Test Date: 2016-03-02
 Note: lower bandedge, Power Setting = -4 dBm, Modulated

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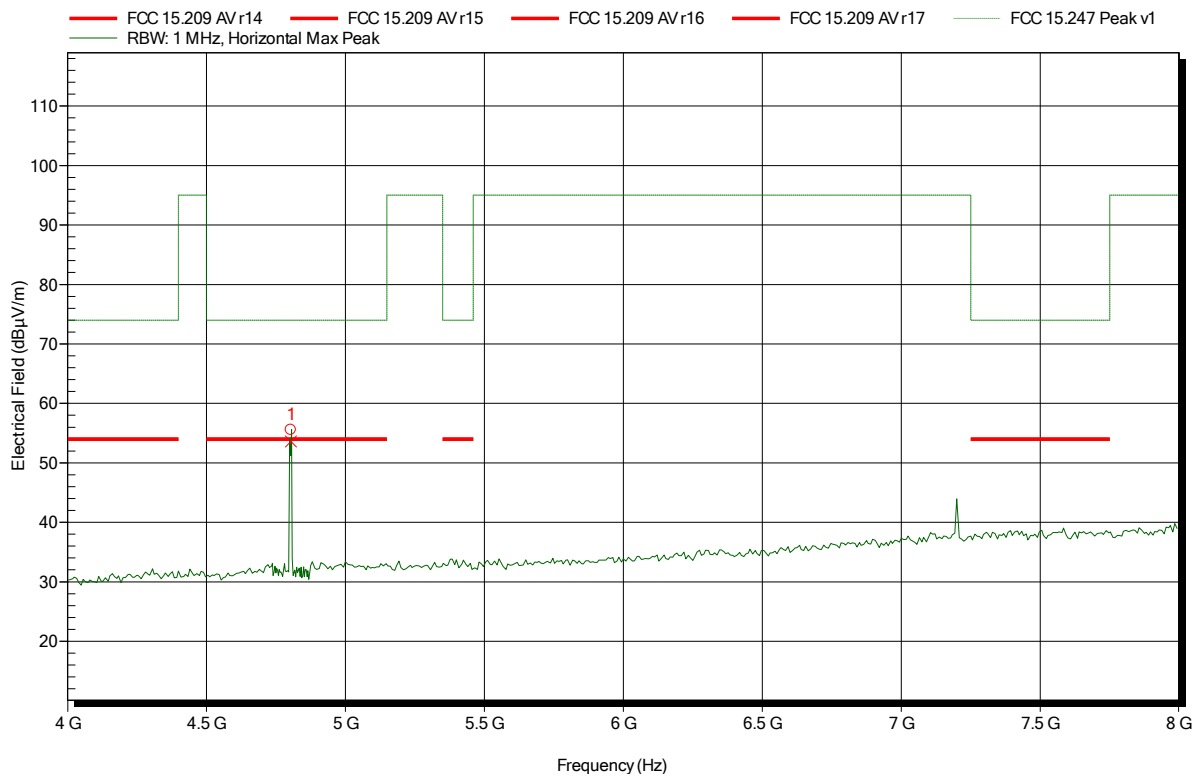


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.0, 2402 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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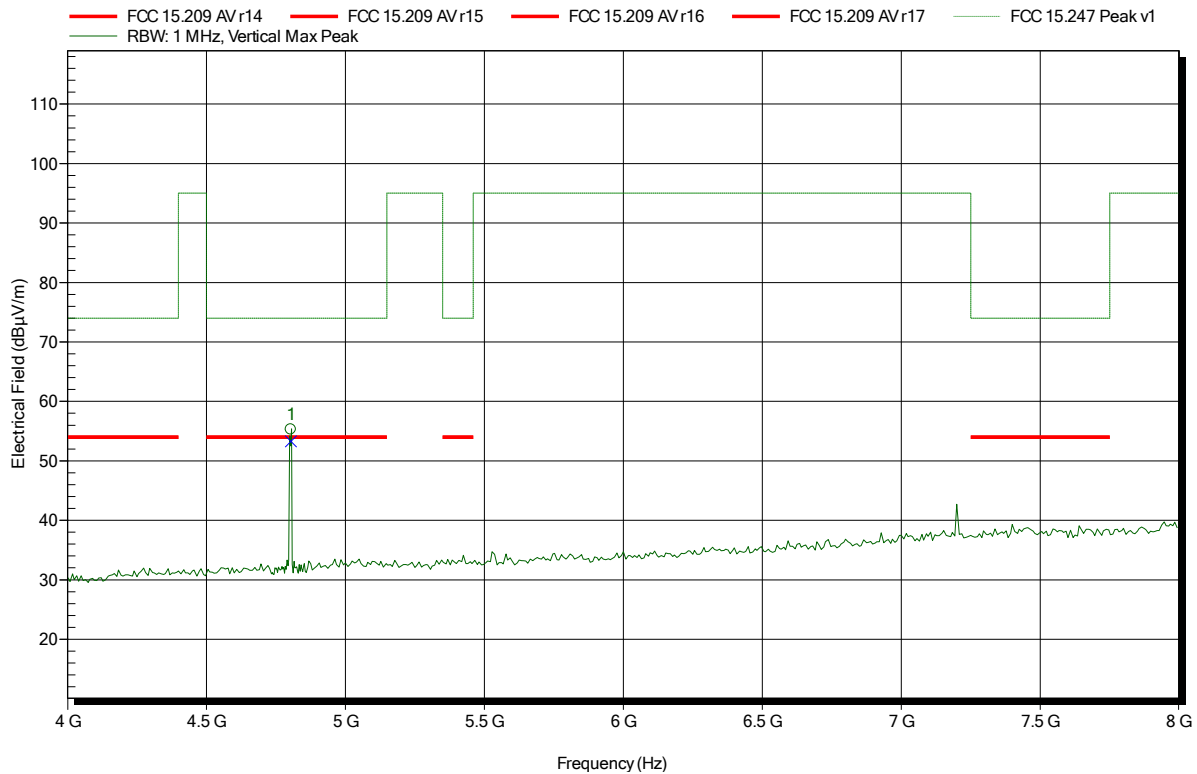
Frequency 4.804 GHz	Peak 55.53 dBµV/m	Peak Limit 74 dBµV/m	Peak Difference -18.47 dB	Status Pass
Frequency 4.804 GHz	Average 53.58 dBµV/m	Average Limit 54 dBµV/m	Average Difference -0.42 dB	Average Status Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.0, 2402 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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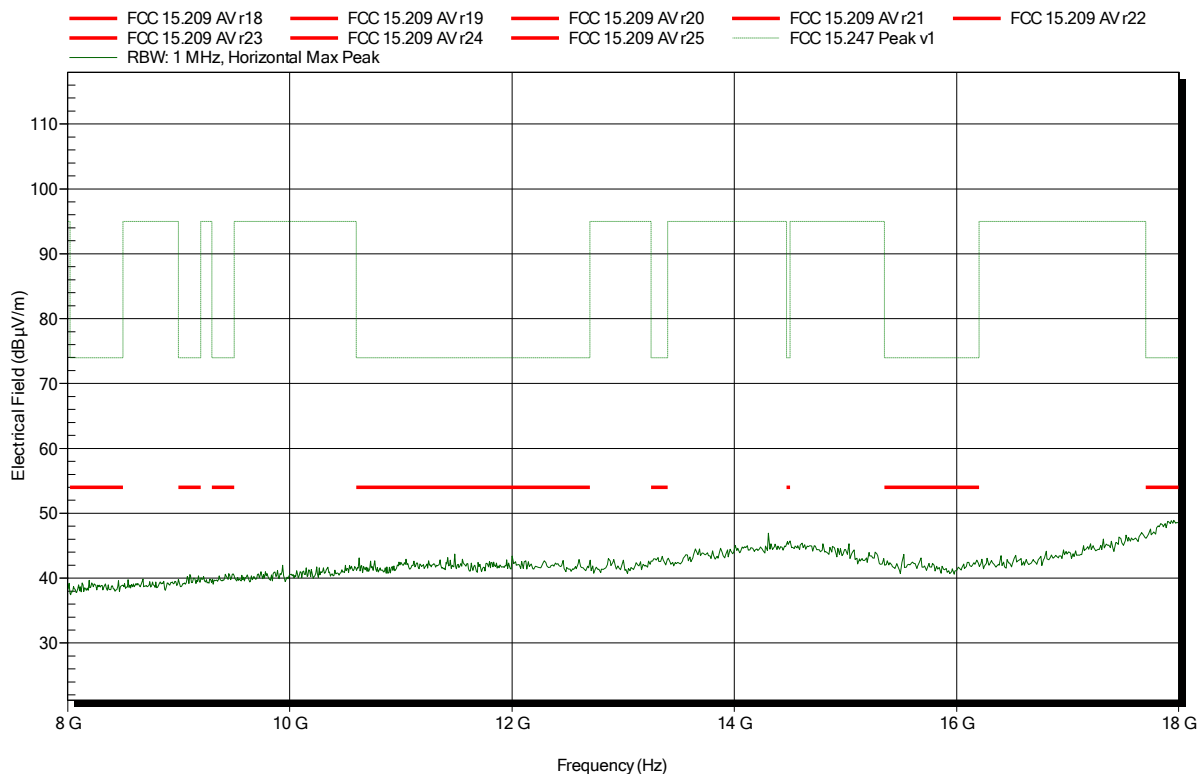
Frequency 4.804 GHz	Peak 55.28 dBμV/m	Peak Limit 74 dBμV/m	Peak Difference -18.72 dB	Status Pass
Frequency 4.804 GHz	Average 53.29 dBμV/m	Average Limit 54 dBμV/m	Average Difference -0.71 dB	Average Status Pass

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.0, 2402 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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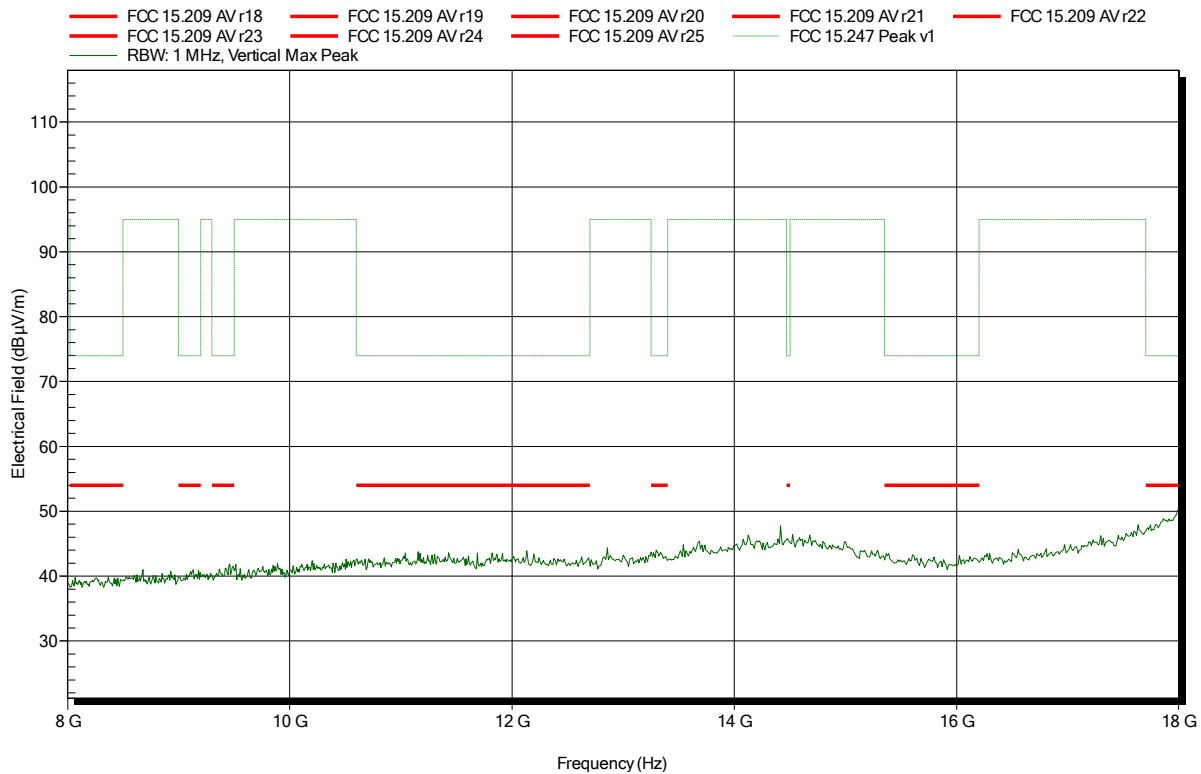


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.0, 2402 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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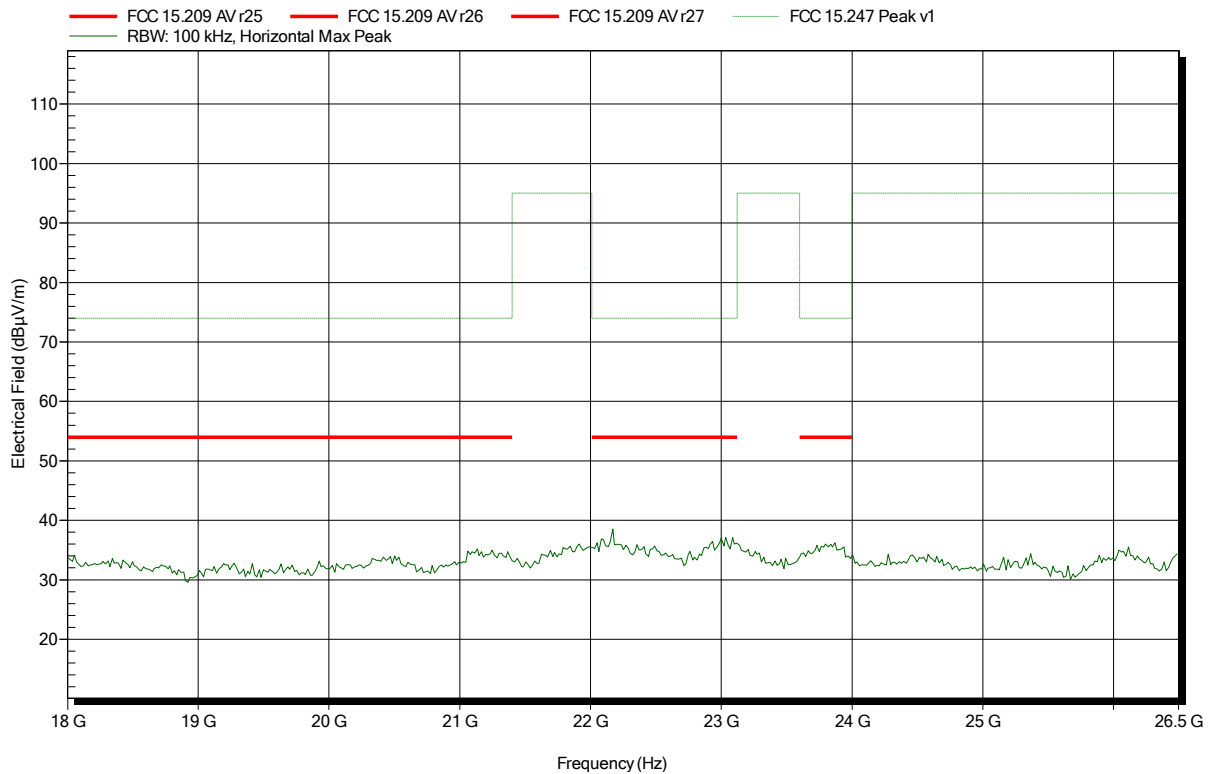


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 21°C, Vnom: 120 VAC
Antenna:	Configurable Antenna, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BT LE, CH.0, 2402 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

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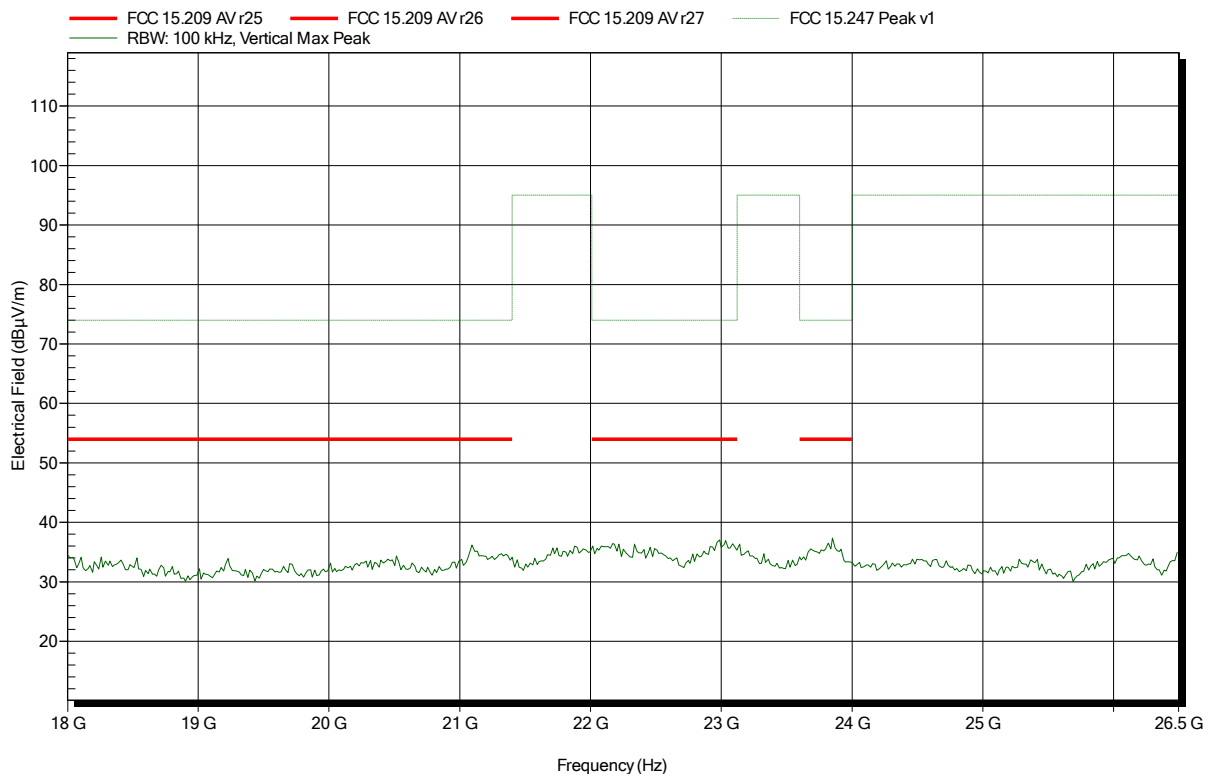


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 21°C, Vnom: 120 VAC
Antenna:	Configurable Antenna, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BT LE, CH.0, 2402 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

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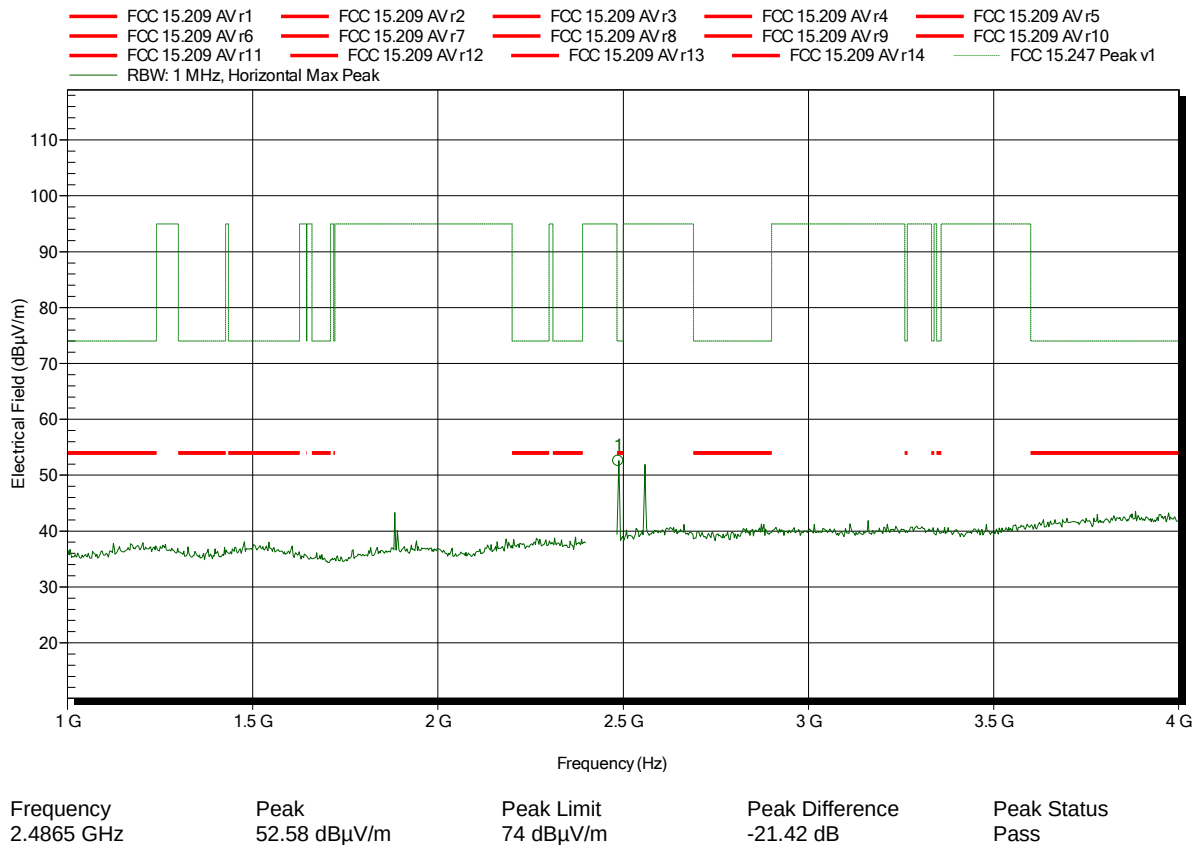


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; BT LE, CH.19, 2440 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

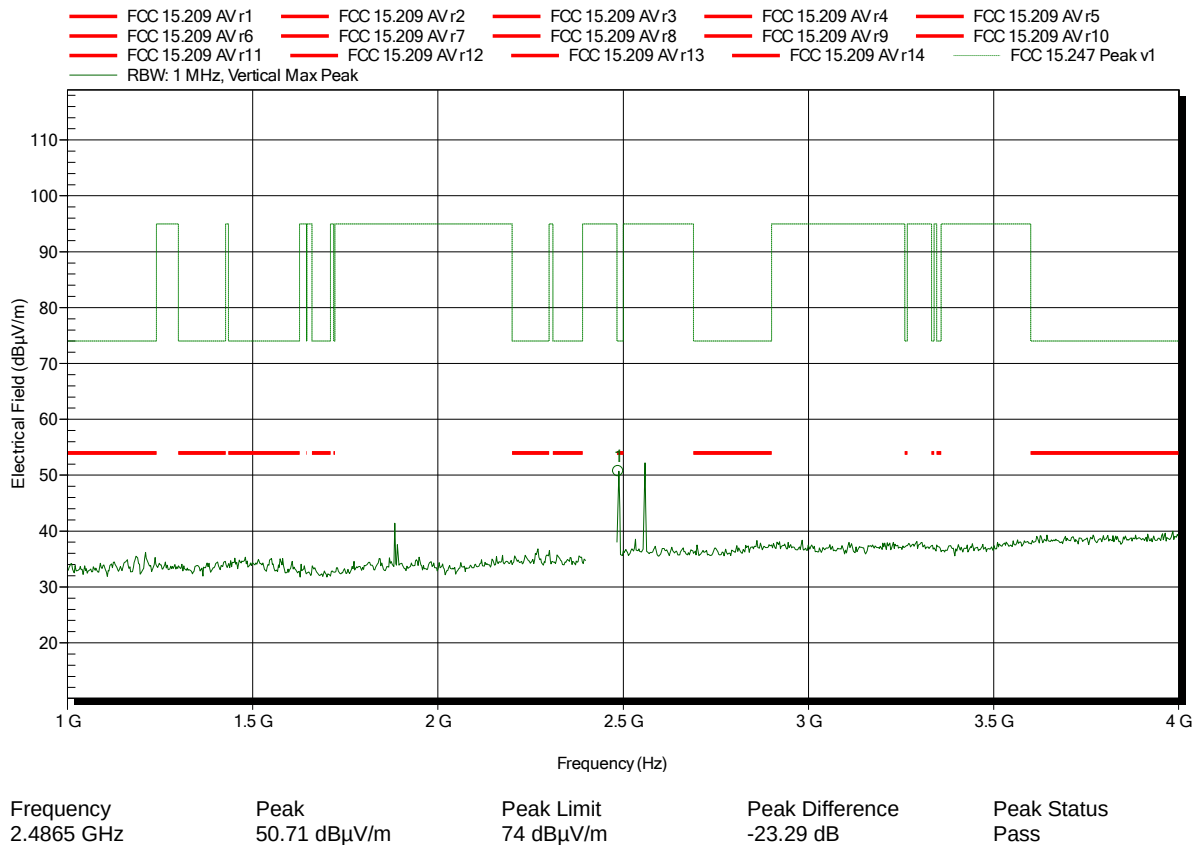
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; BT LE, CH.19, 2440 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

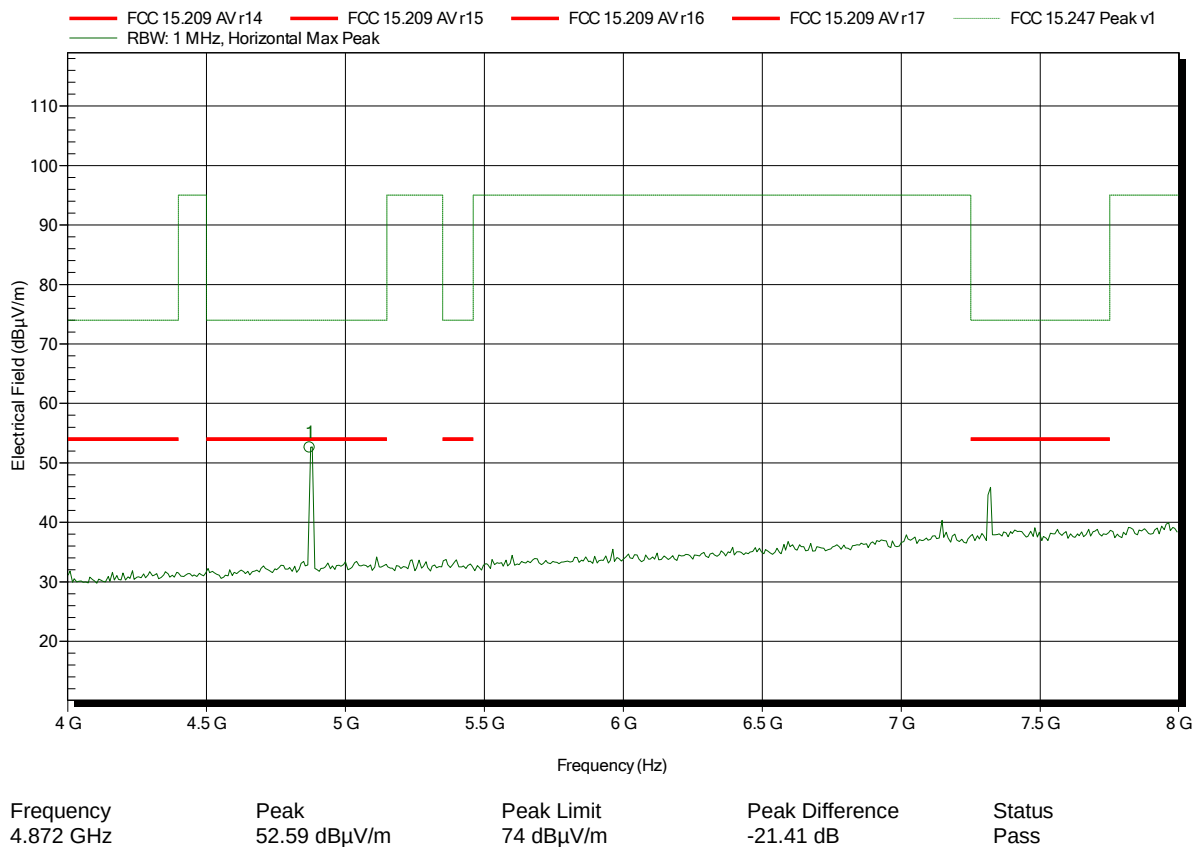
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.19, 2440 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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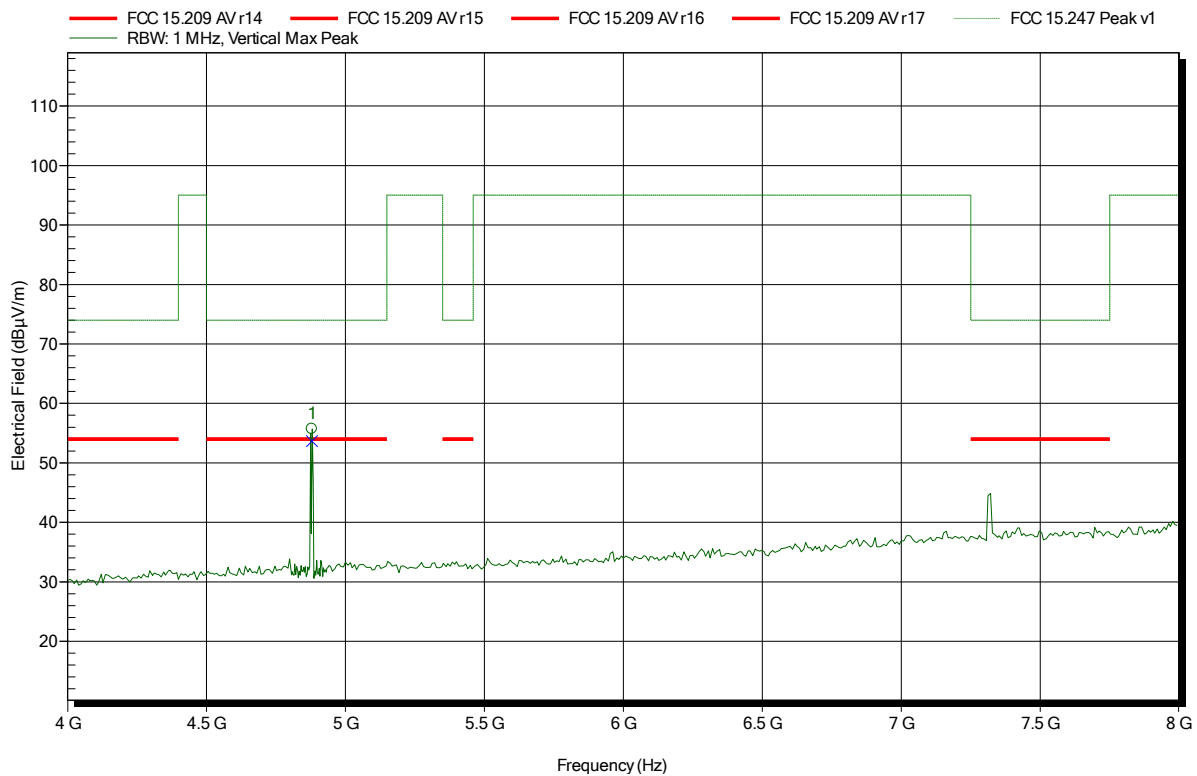


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.19, 2440 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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Frequency 4.88 GHz	Peak 55.68 dBμV/m	Peak Limit 74 dBμV/m	Peak Difference -18.32 dB	Status Pass
Frequency 4.88 GHz	Average 53.64 dBμV/m	Average Limit 54 dBμV/m	Average Difference -0.36 dB	Average Status Pass

Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

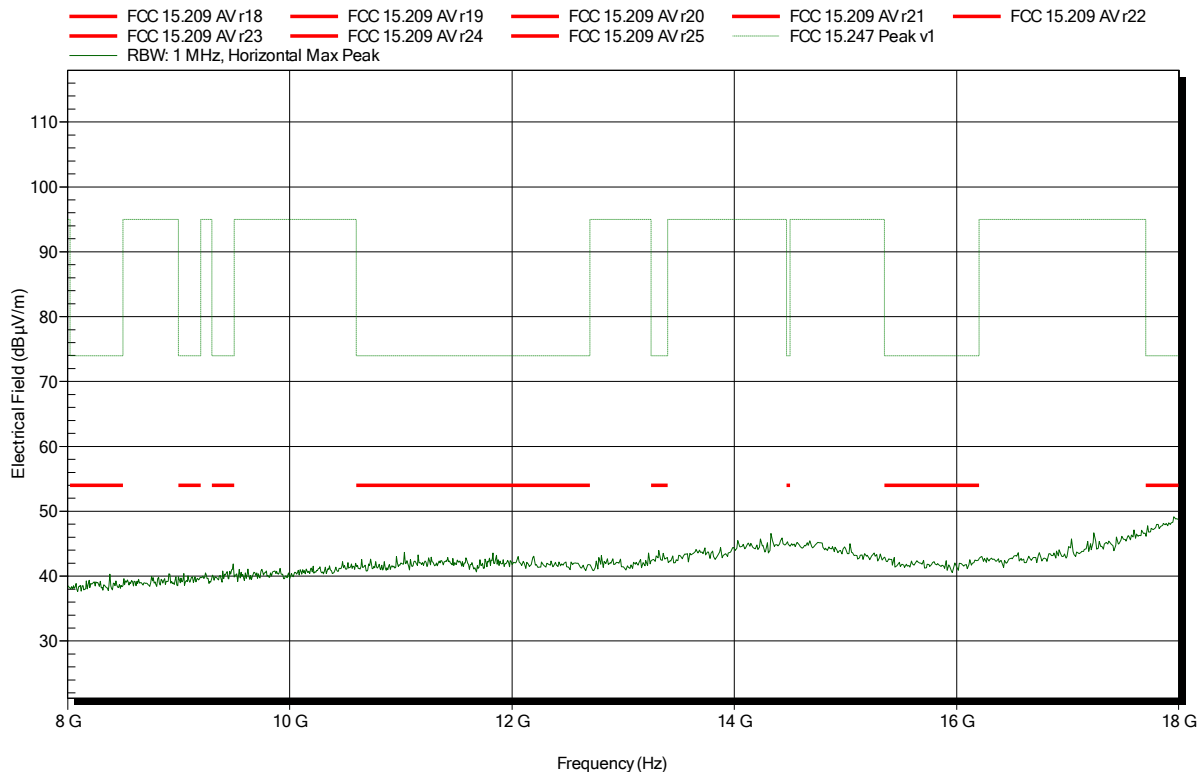
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.19, 2440 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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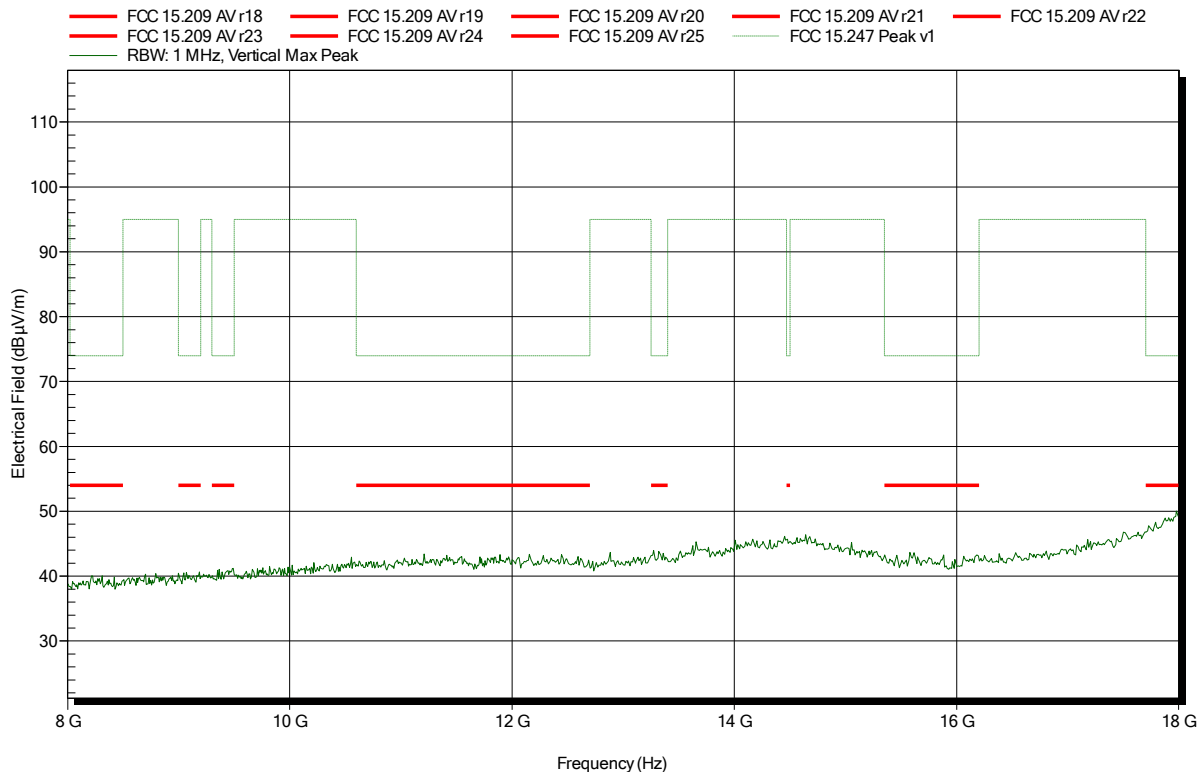


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.19, 2440 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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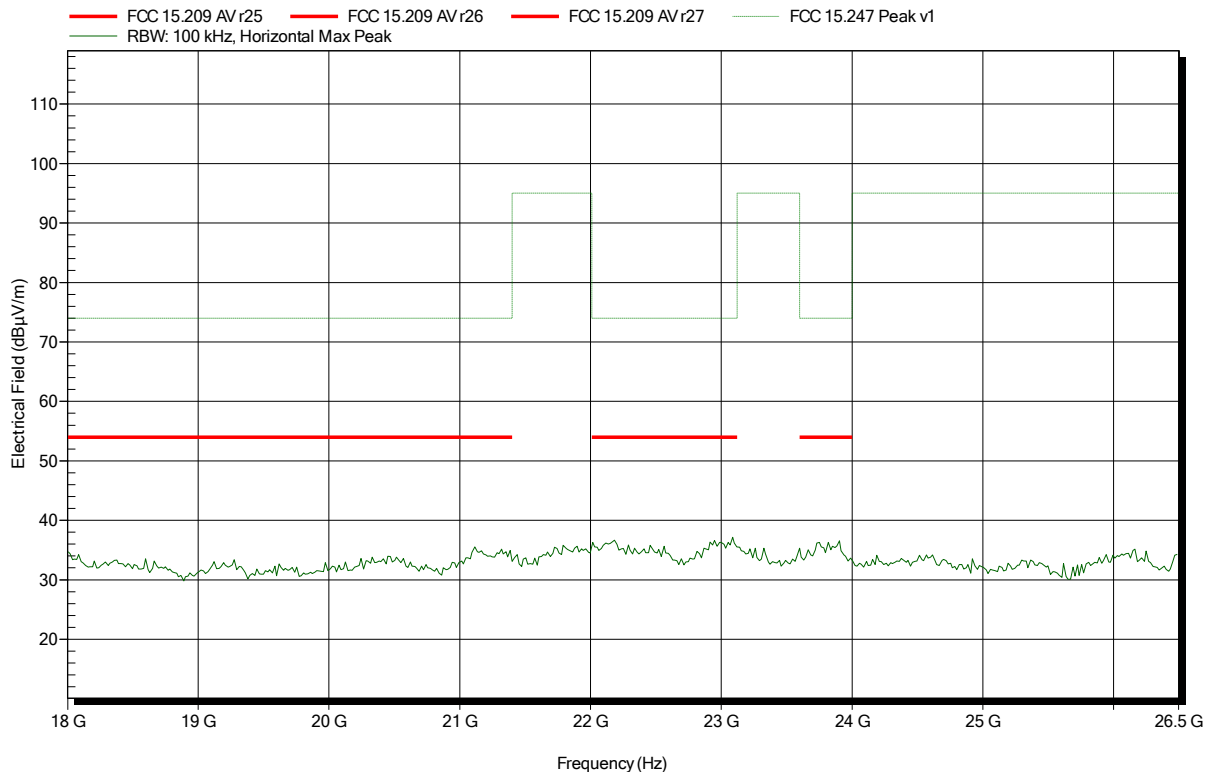


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 21°C, Vnom: 120 VAC
Antenna:	Configurable Antenna, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BT LE, CH.19, 2440 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

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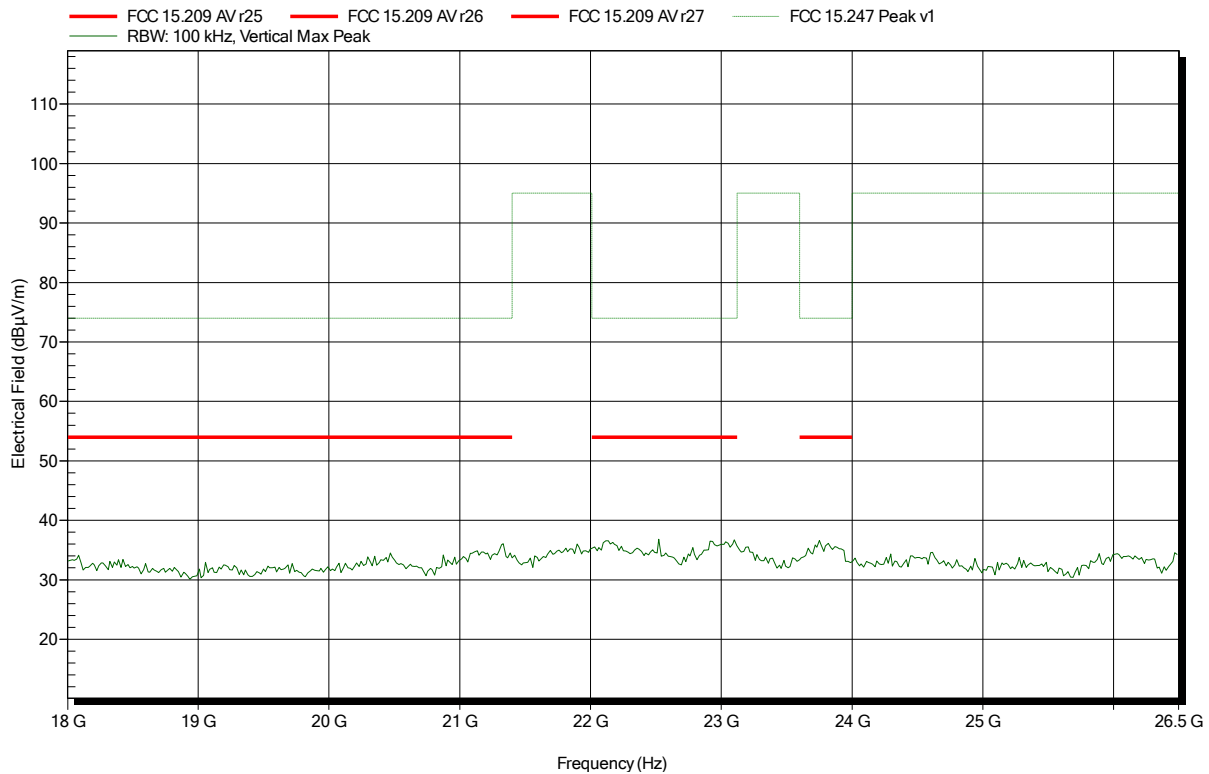


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 21°C, Vnom: 120 VAC
Antenna:	Configurable Antenna, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BT LE, CH.19, 2440 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

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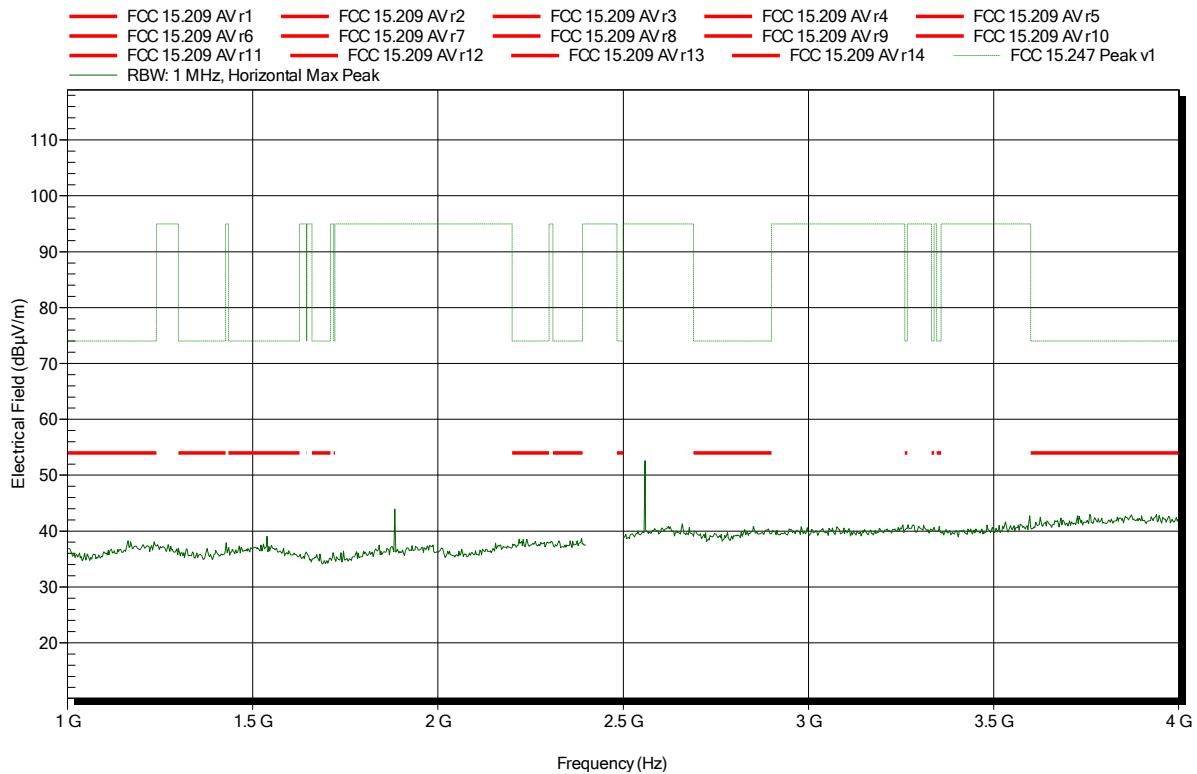


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; BT LE, CH.39, 2480 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

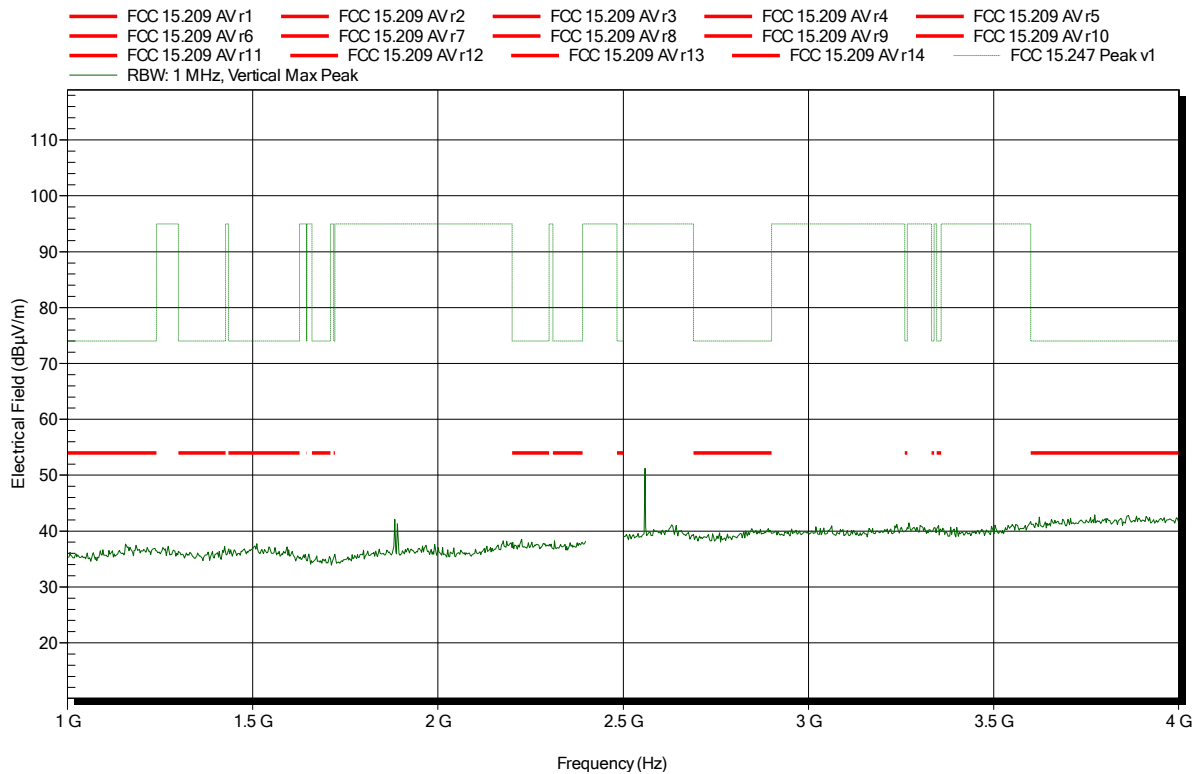
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; BT LE, CH.39, 2480 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

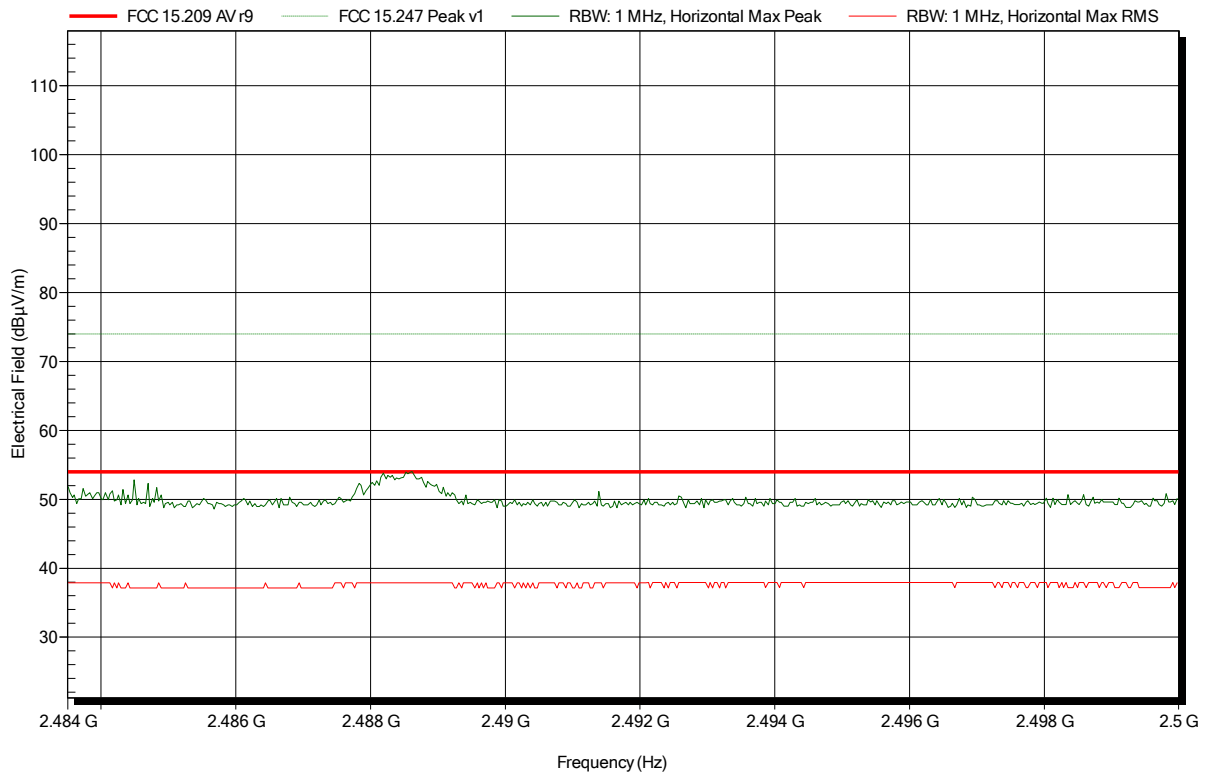
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 21°C, Vnom: 120 VAC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BT LE, CH.39, 2480 MHz
Test Date:	2016-03-02
Note:	upper bandedge, Power Setting = -4 dBm, Modulated

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Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

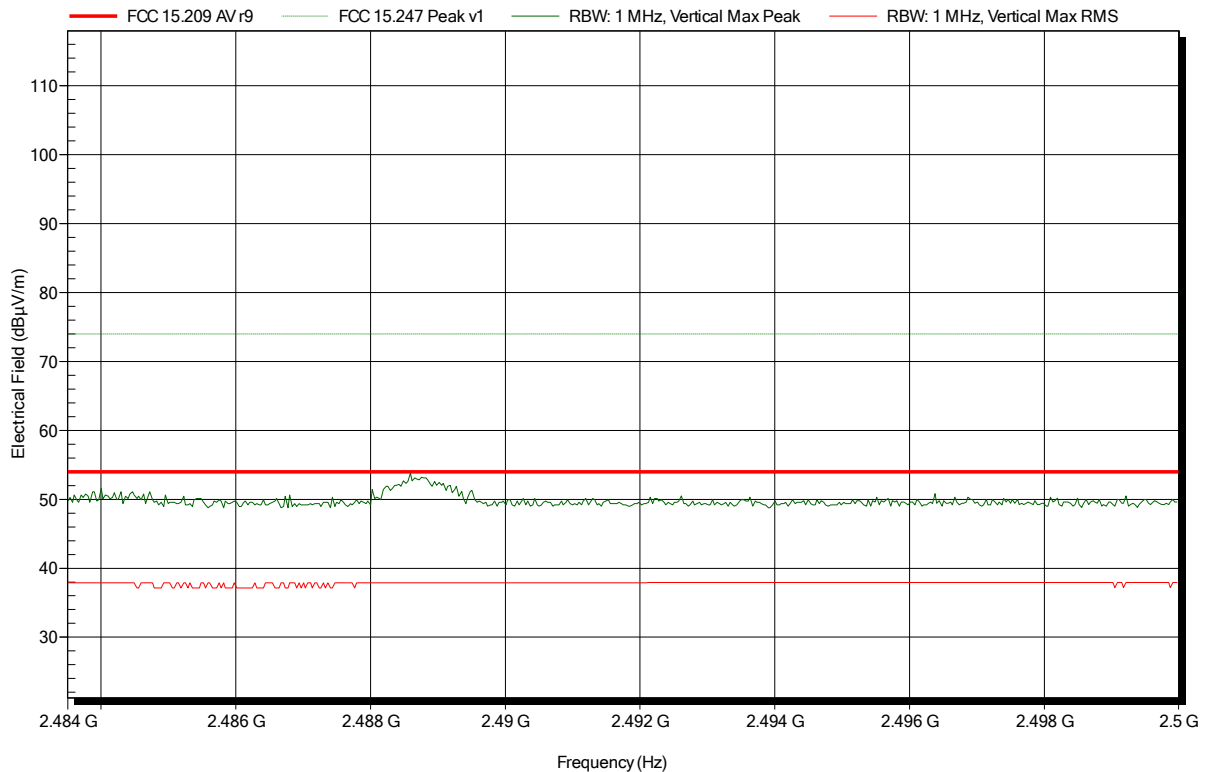
Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 21°C, Vnom: 120 VAC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BT LE, CH.39, 2480 MHz
Test Date:	2016-03-02
Note:	upper bandedge, Power Setting = -4 dBm, Modulated

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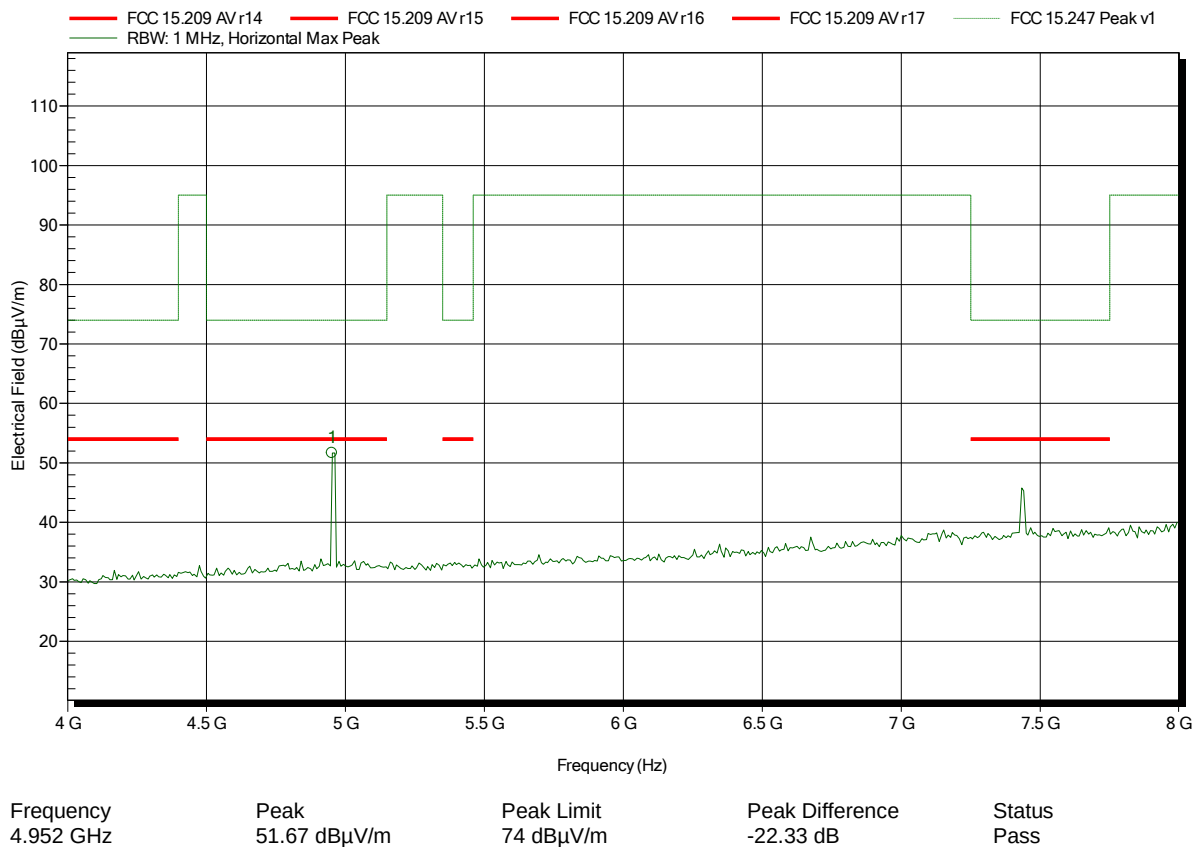


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.39, 2480 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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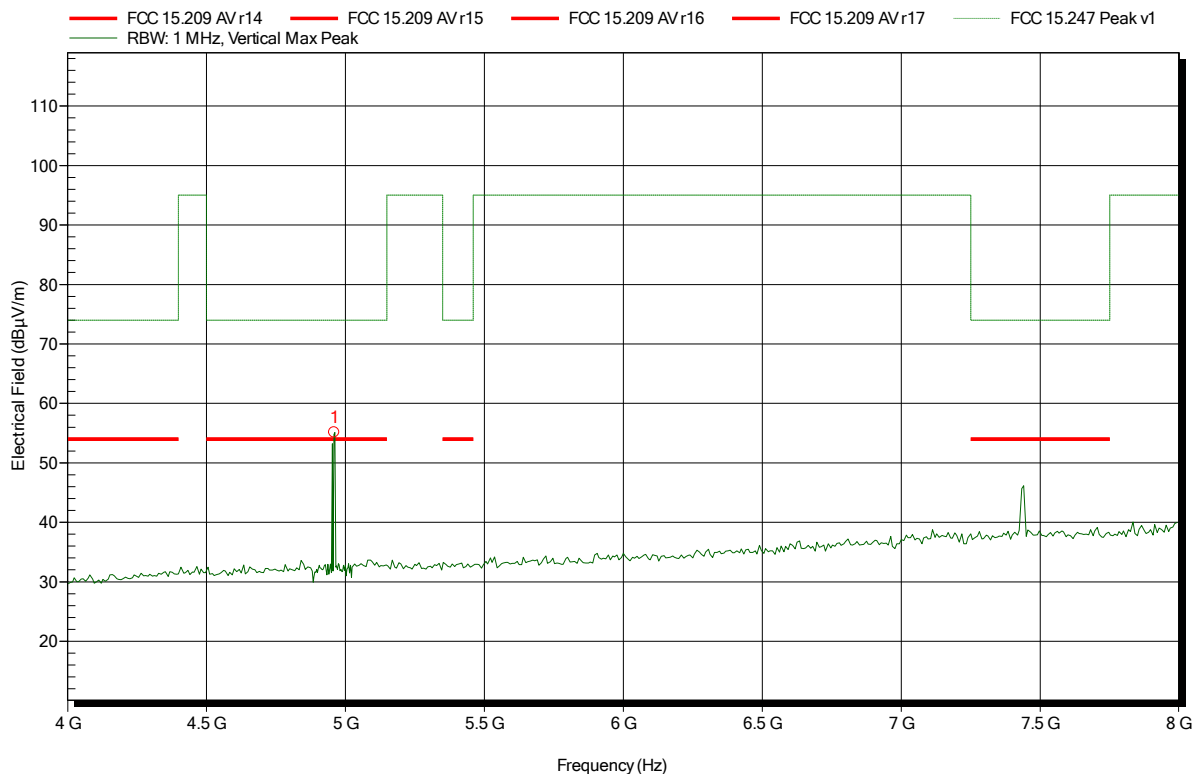


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.39, 2480 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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Frequency 4.96 GHz	Peak 55.13 dBμV/m	Peak Limit 74 dBμV/m	Peak Difference -18.87 dB	Status Pass
Frequency 4.96 GHz	Average 53.34 dBμV/m	Average Limit 54 dBμV/m	Average Difference -0.66 dB	Average Status Pass

Test Report No.: G0M-1510-5171-T-01-FC247BL-V01

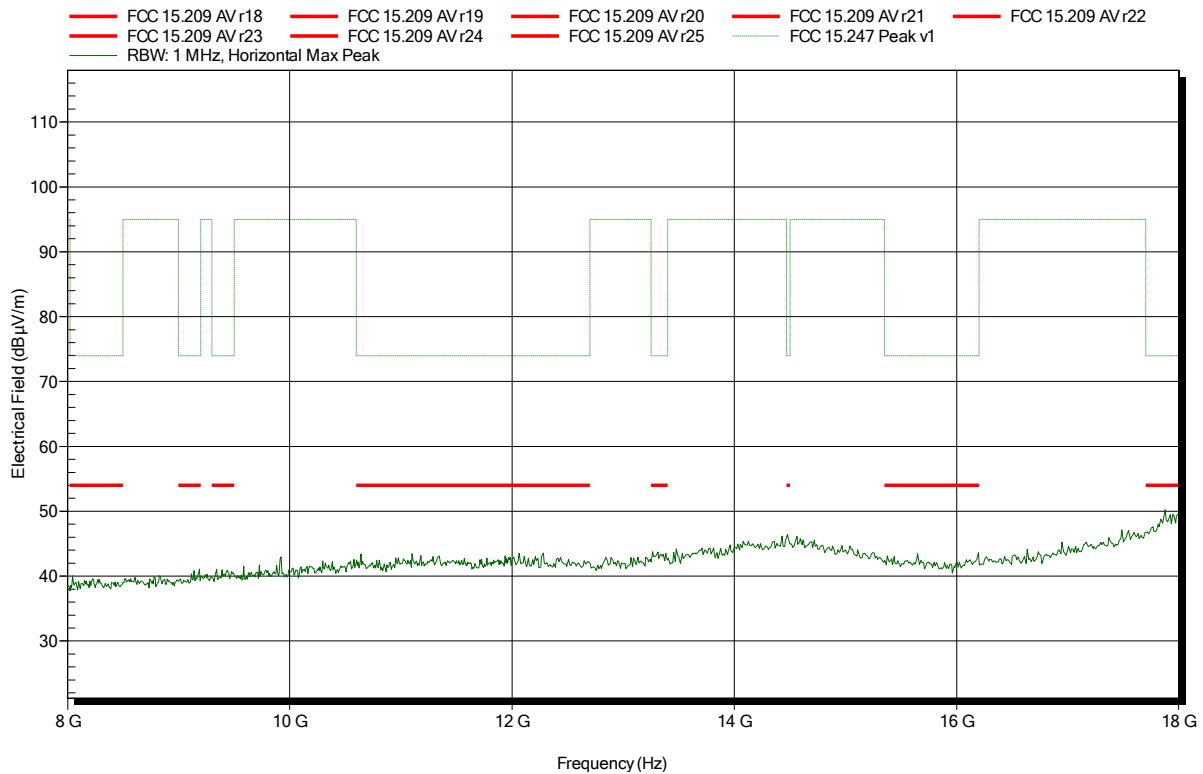
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
 Model: Carrier Board LCD-BLE
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Weber
 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.39, 2480 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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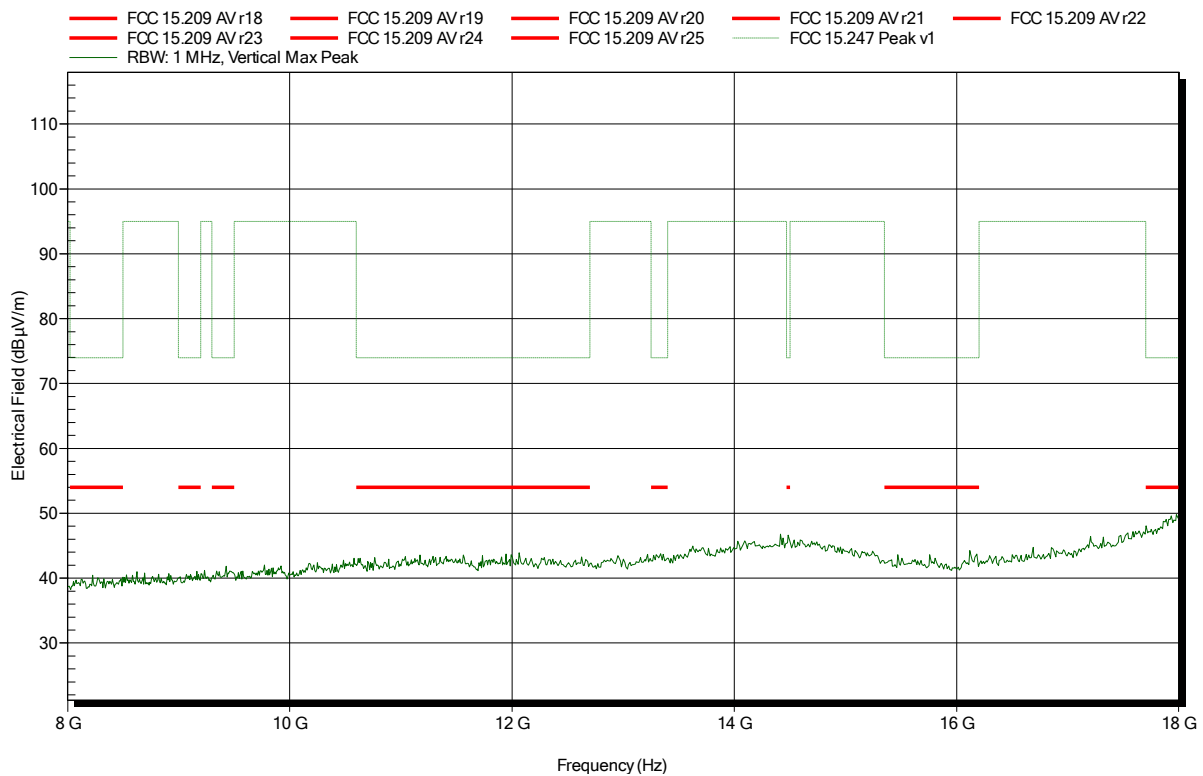


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant: Grässlin GmbH
 EUT Name: 2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
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 Test Conditions: Tnom: 21°C, Vnom: 120 VAC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; BT LE, CH.39, 2480 MHz
 Test Date: 2016-03-02
 Note: Power Setting = -4 dBm, Modulated

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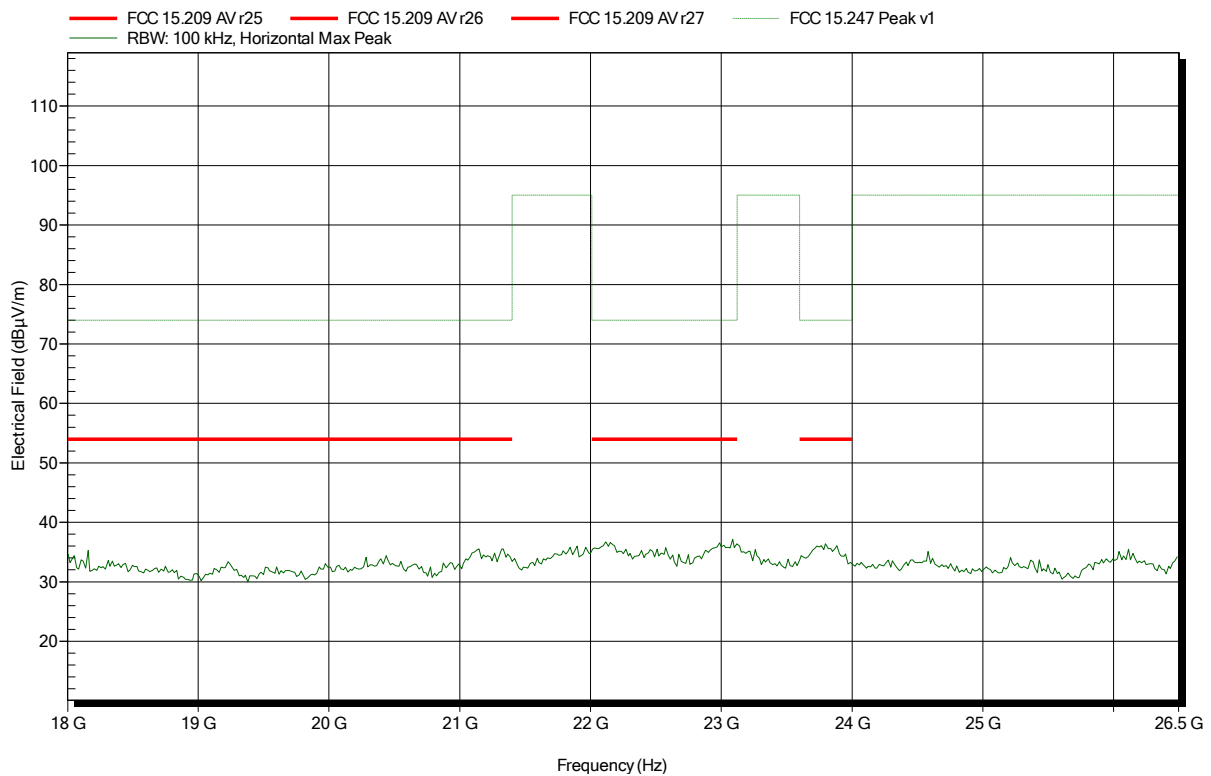


Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 21°C, Vnom: 120 VAC
Antenna:	Configurable Antenna, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BT LE, CH.39, 2480 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

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Spurious emissions according to FCC 15.247

Project number: G0M-1510-5171

Applicant:	Grässlin GmbH
EUT Name:	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Weber
Test Conditions:	Tnom: 21°C, Vnom: 120 VAC
Antenna:	Configurable Antenna, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BT LE, CH.39, 2480 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

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