eurofins | Product Service

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) ..... : (Responsible for Test)	Matthias Handrik	.....
Approved by (+ signature) ..... : (Head of Lab)	Christian Weber	.....
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.

Additional comments:

Version History

Version	Issue Date	Remarks	Revised by
01	2016-05-26	Initial Release	

REPORT INDEX

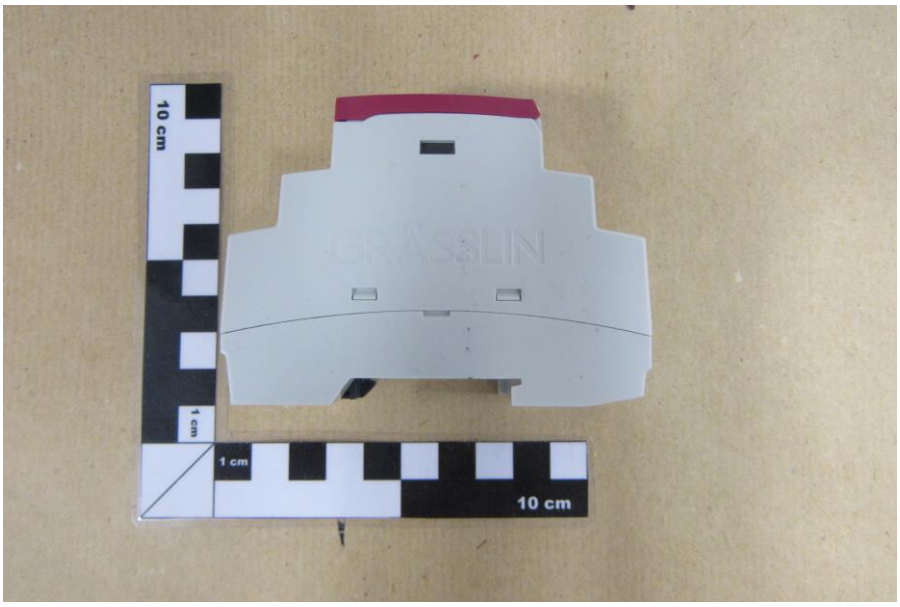
1 Equipment (Test item) Description

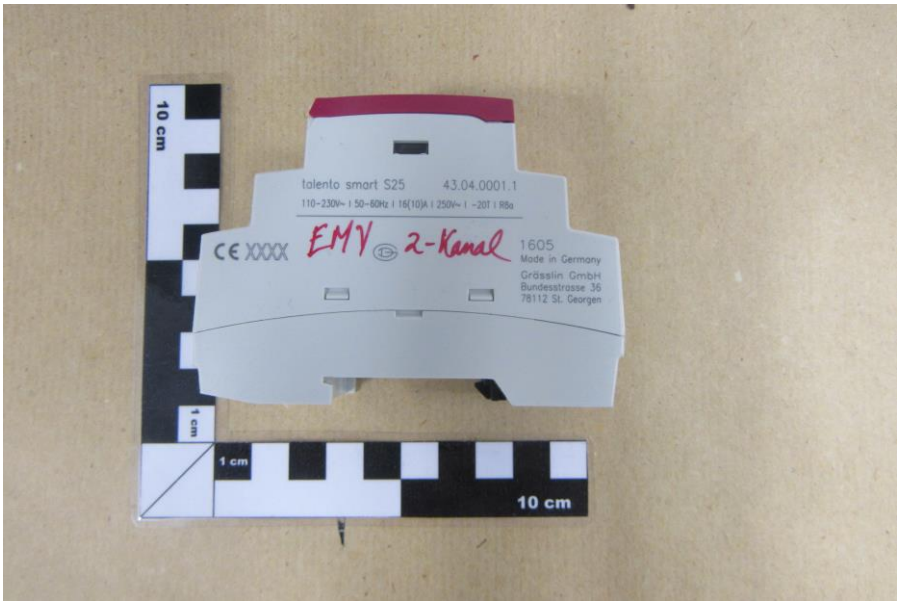
Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)	
Model	Carrier Board LCD-BLE	
Additional Model(s)	None	
Brand Name(s)	None	
Serial number	None	
Hardware version	Rev_02	
Software / Firmware version	V.1.0	
PMN	N/A	
HVIN	Carrier Board LCD-BLE	
FVIN	N/A	
HMN	N/A	
FCC ID	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	

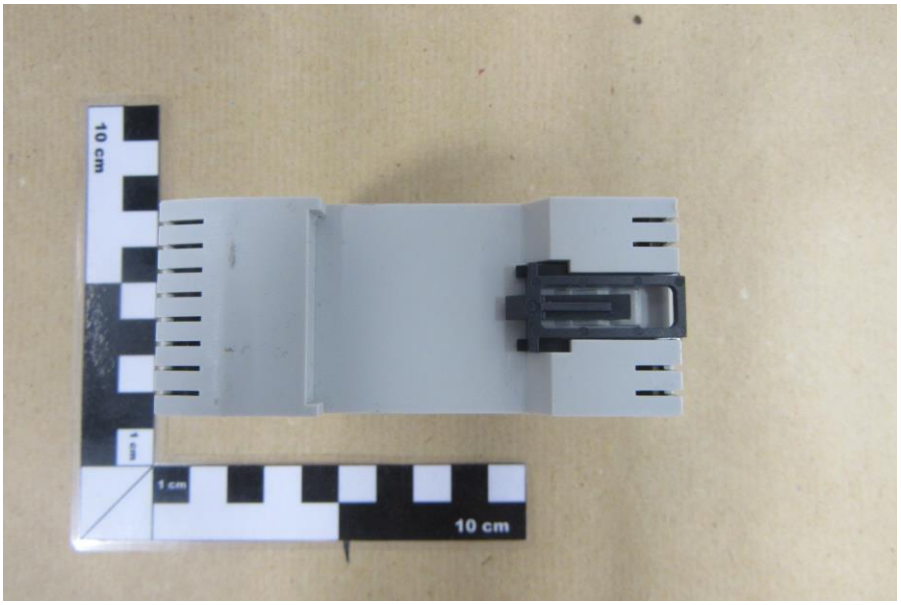
1.1 Photos – Equipment External

EUT S25 TOP

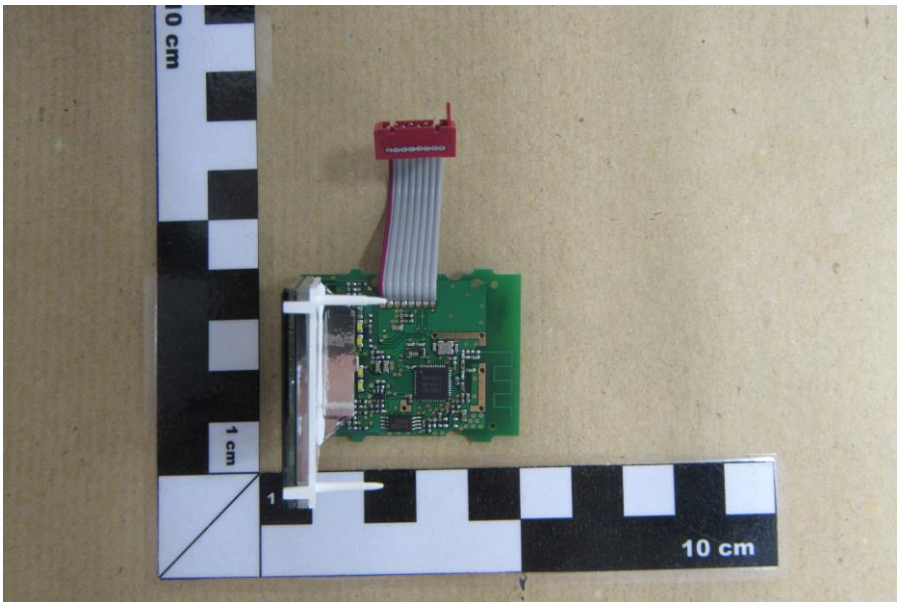
EUT S25 LEFT

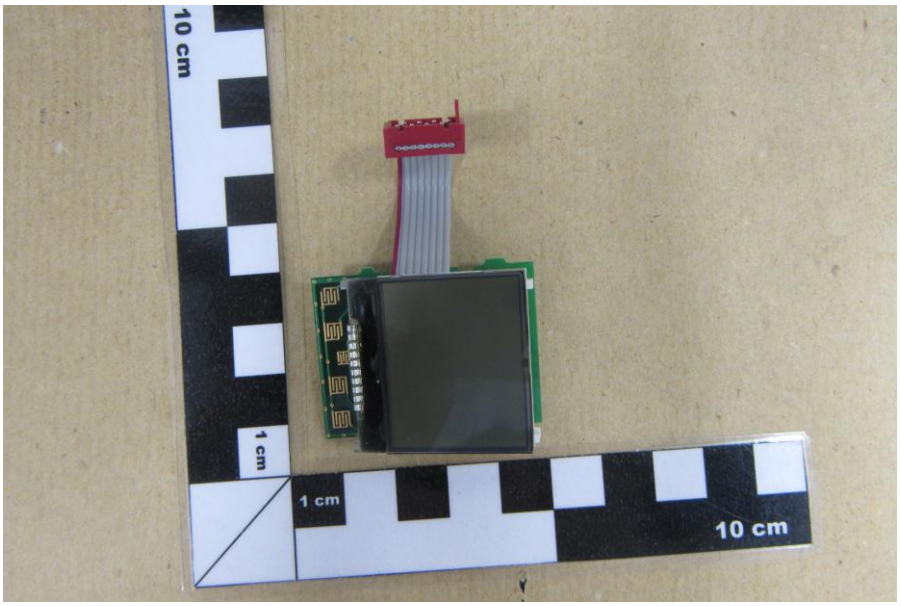


EUT S25 RIGHT


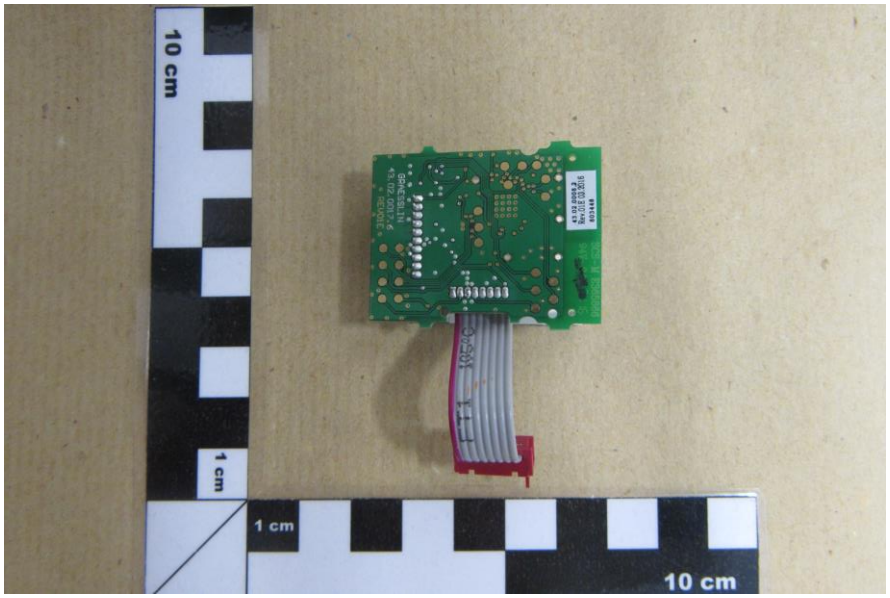
EUT S25 BOTTOM


1.2 Photos – Equipment internal

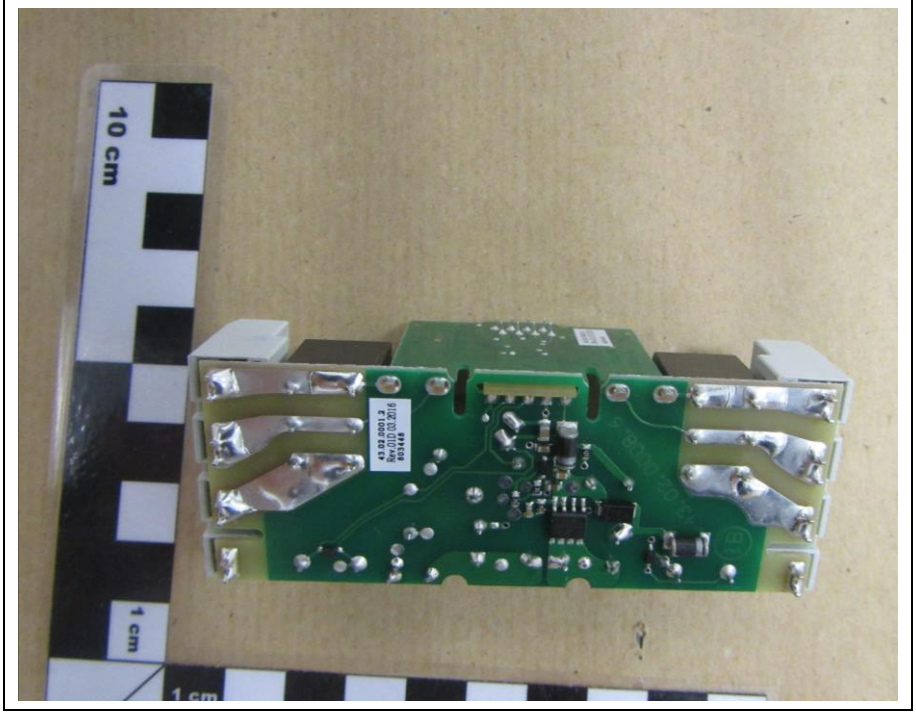
EUT S25 PCB I FRONT I (behind display)


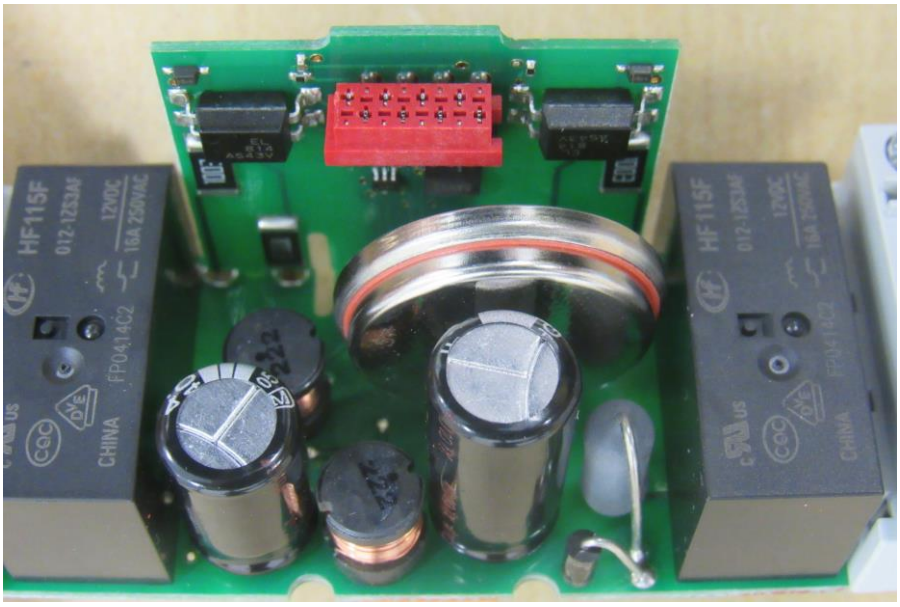
EUT S25 PCB I FRONT II


EUT S25 PCB I BACK

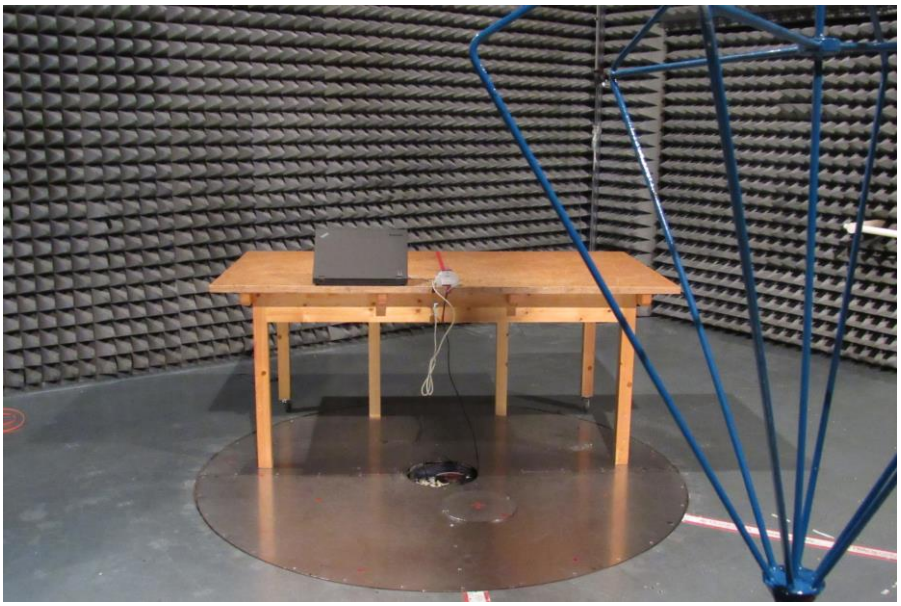


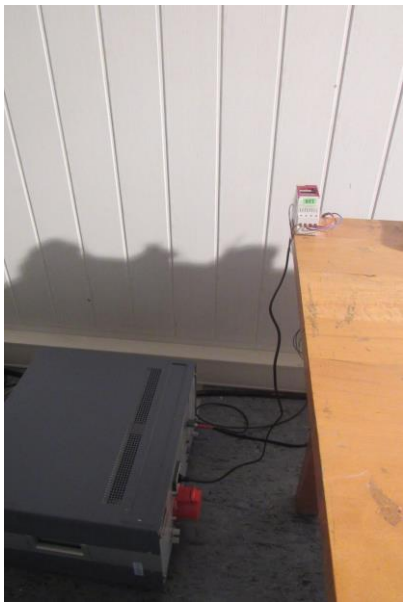
EUT S25 PCB II BACK



EUT S25 PCB II FRONT


1.3 Photos – Test setup

Test Setup Radiated Emissions


Test Setup AC-Power line


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

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:

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

Net:

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

Limit:

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

Limit (dBµV/m) = 20*log (µV/m)

Margin:

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

Example only:

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

2 Result Summary

FCC 47 CFR Part 15C, 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

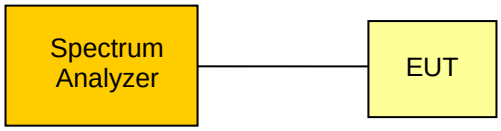
3.1 Test Conditions and Results – Occupied Bandwidth

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



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

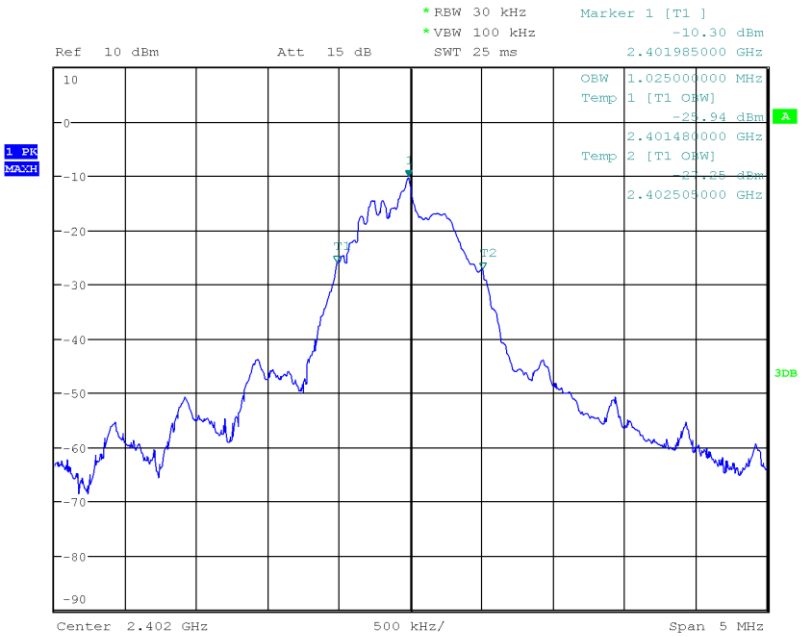
Channel	Frequency [MHz]	Mode	Occupied Bandwidth [MHz]
F_{LOW}	2402	Transmit	1.025
F_{MID}	2440	Transmit	1.095
F_{HIGH}	2480	Transmit	1.025

Comments:

Occupied Bandwidth – F_{LOW}

Occupied Bandwidth

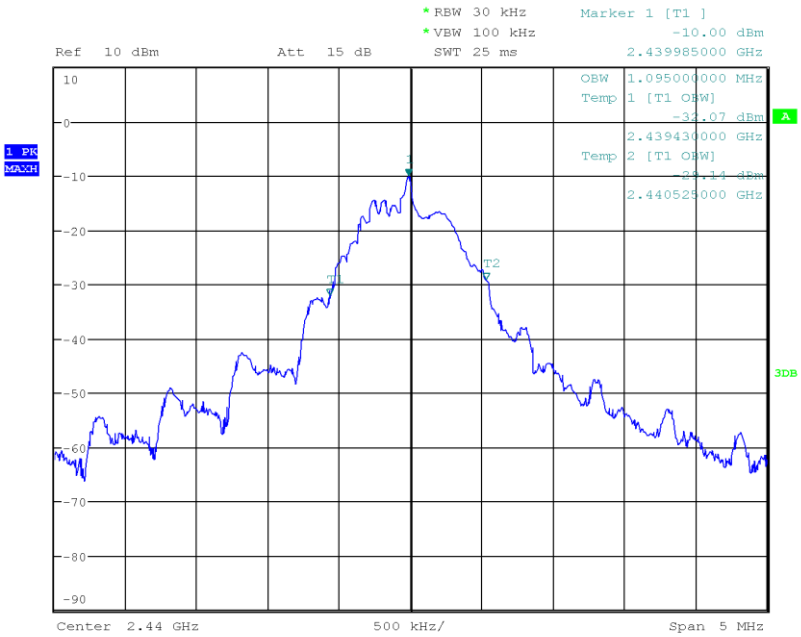
Project Number:	G0M-1510-5171
Applicant	Grässlin GmbH
Model Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 6.9.3
Operational Mode:	GFSK, Channel: 0, 2402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



Occupied Bandwidth – F_{MID}

Occupied Bandwidth

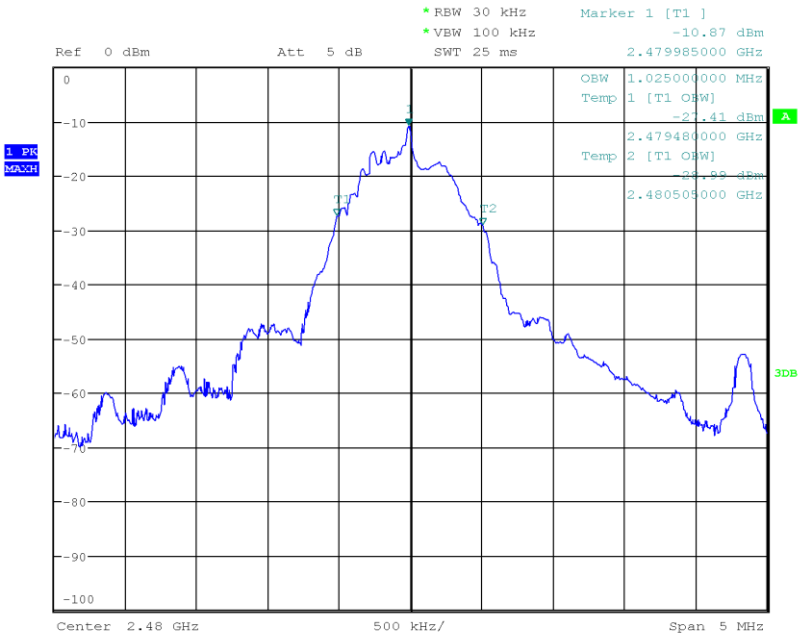
Project Number:	G0M-1510-5171
Applicant	Grässlin GmbH
Model Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 6.9.3
Operational Mode:	GFSK, Channel: 19, 2440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



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:	Tnom/Vnom
Operator:	C. Weber
Test Site:	Eurofins Product Service GmbH
Test Date:	2016-01-21
Occupied Bandwidth [MHz]:	1.025



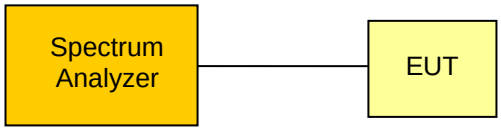
3.2 Test Conditions and Results – 6 dB Bandwidth

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



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

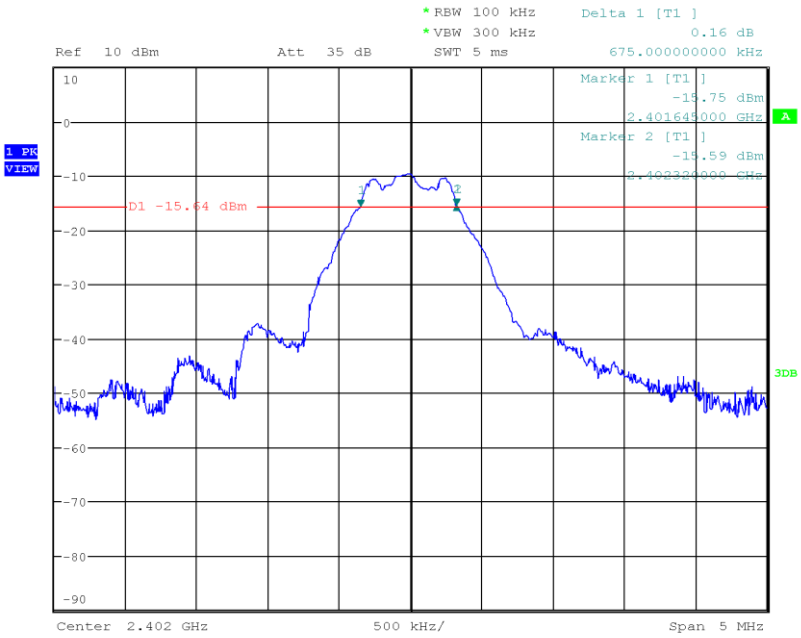
Channel	Frequency [MHz]	Mode	6 dB Bandwidth [kHz]	Limit [kHz]	Result
F_{LOW}	2402	Transmit	675	500	PASS
F_{MID}	2440	Transmit	685	500	PASS
F_{HIGH}	2480	Transmit	670	500	PASS

Comments:

6 dB Bandwidth – F_{LOW}

DTS (6 dB) Bandwidth

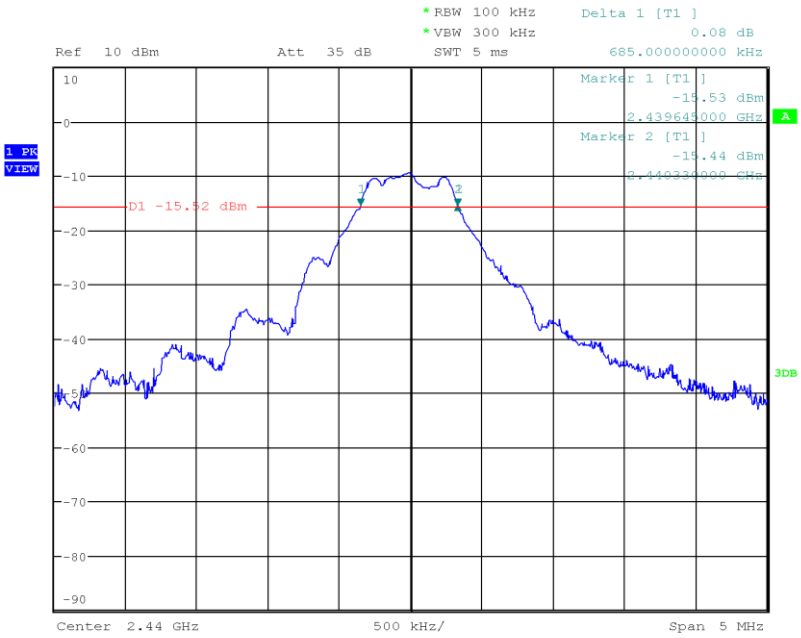
Project Number:	G0M-1510-5171
Applicant	Grässlin GmbH
Model Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.8.1 Option 1
Operational Mode:	GFSK, Channel: 0, 2402 MHz
Operating Conditions:	Tnom/Vnom
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_{MID}

DTS (6 dB) Bandwidth

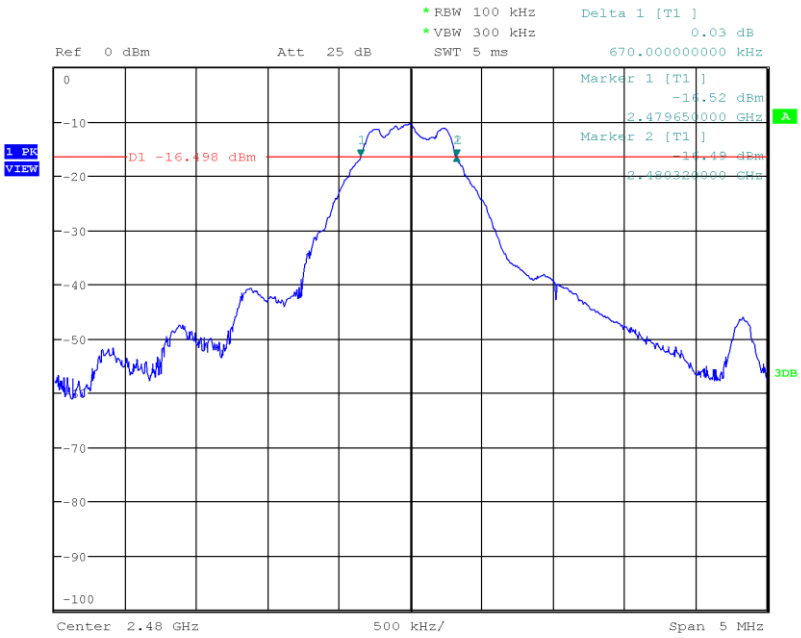
Project Number:	G0M-1510-5171
Applicant	Grässlin GmbH
Model Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.8.1 Option 1
Operational Mode:	GFSK, Channel: 19, 2440 MHz
Operating Conditions:	Tnom/Vnom
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



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:	Tnom/Vnom
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



3.3 Test Conditions and Results – Maximum peak conducted power

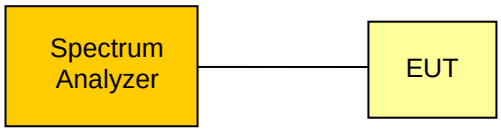
Maximum peak conducted power acc. to FCC 15.247 / ISED RSS-247	**Verdict: PASS**
EUT requirement rule parts and clause	Reference
	FCC 15.247(b)(3) / ISED RSS-247 5.4
Test according to measurement reference	Reference Method
	ANSI C63.10
Test frequency range	Tested frequencies
	F_{LOW} / F_{MID} / F_{HIGH}
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



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:

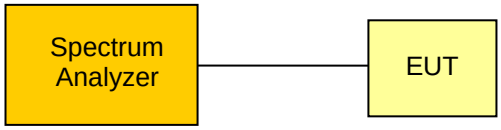
3.4 Test Conditions and Results – Power spectral density

Power spectral density acc. to FCC 15.247 / ISED 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



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.				

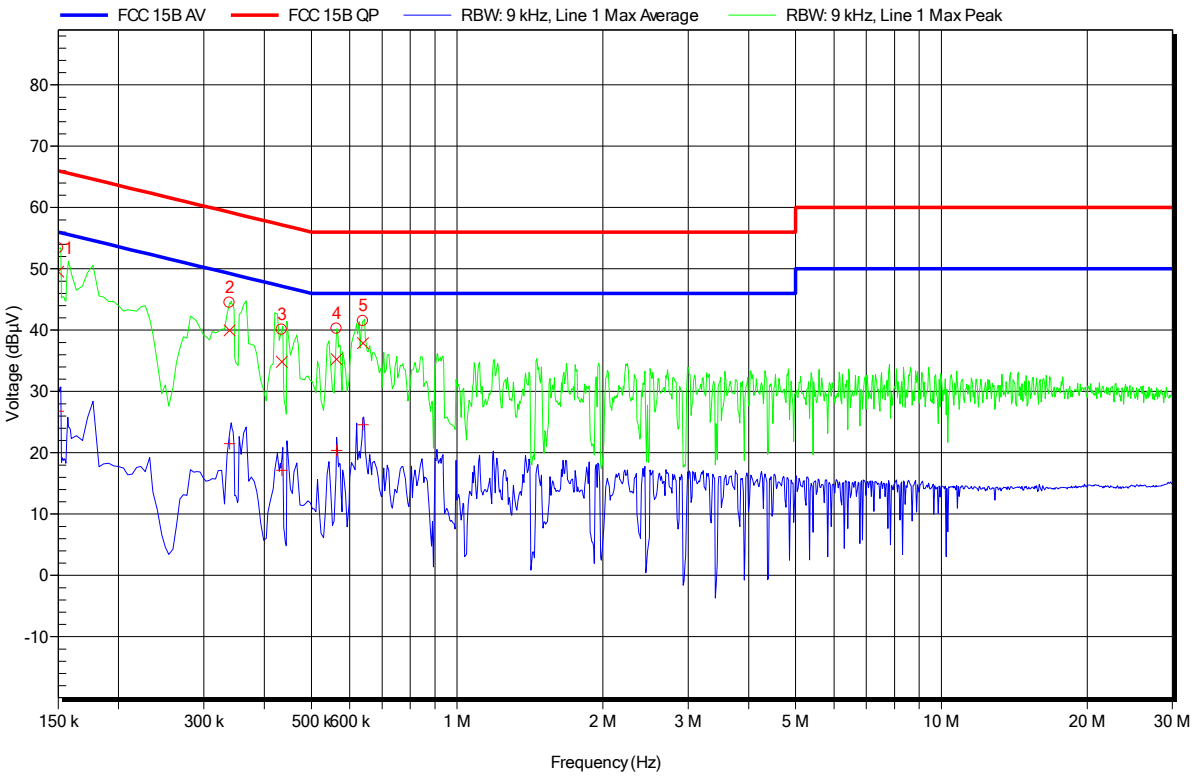
Conducted Emissions S25

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:	

Index 61



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

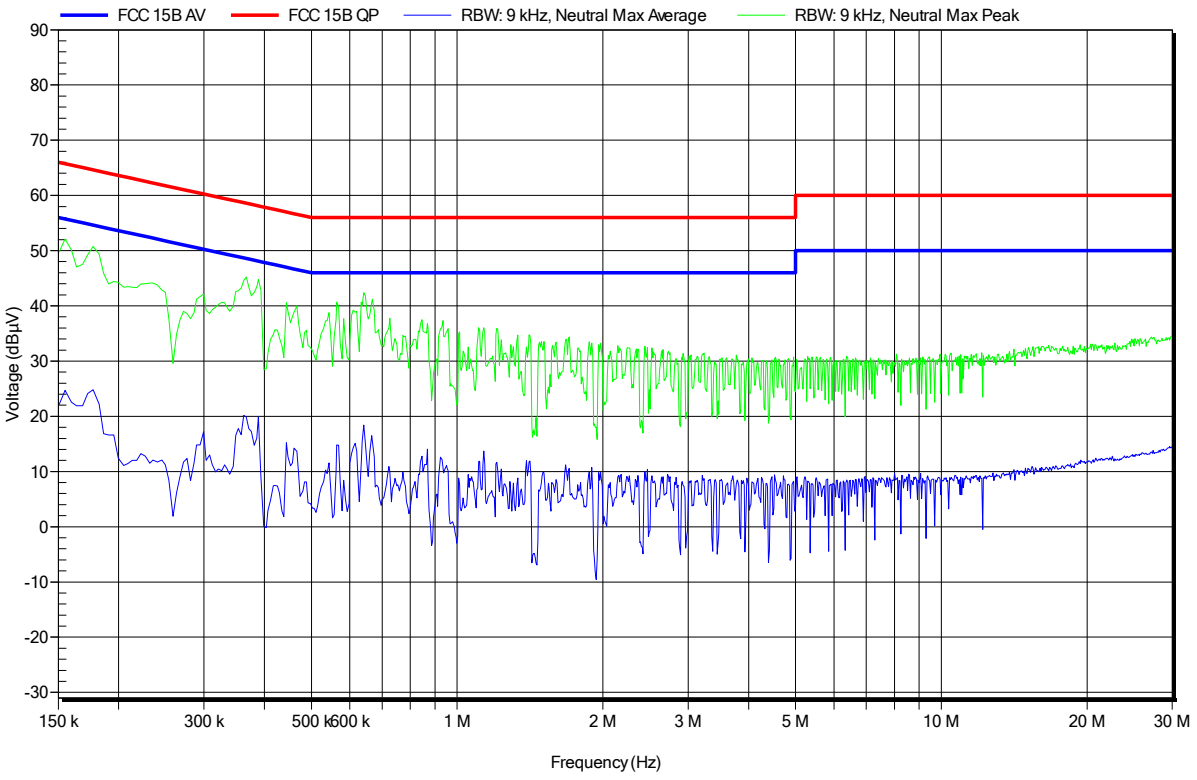
Conducted Emissions S25

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:	

Index 60



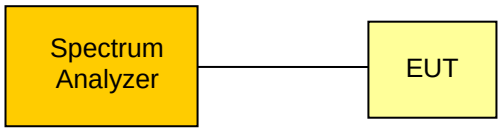
3.6 Test Conditions and Results – Band edge compliance

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



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

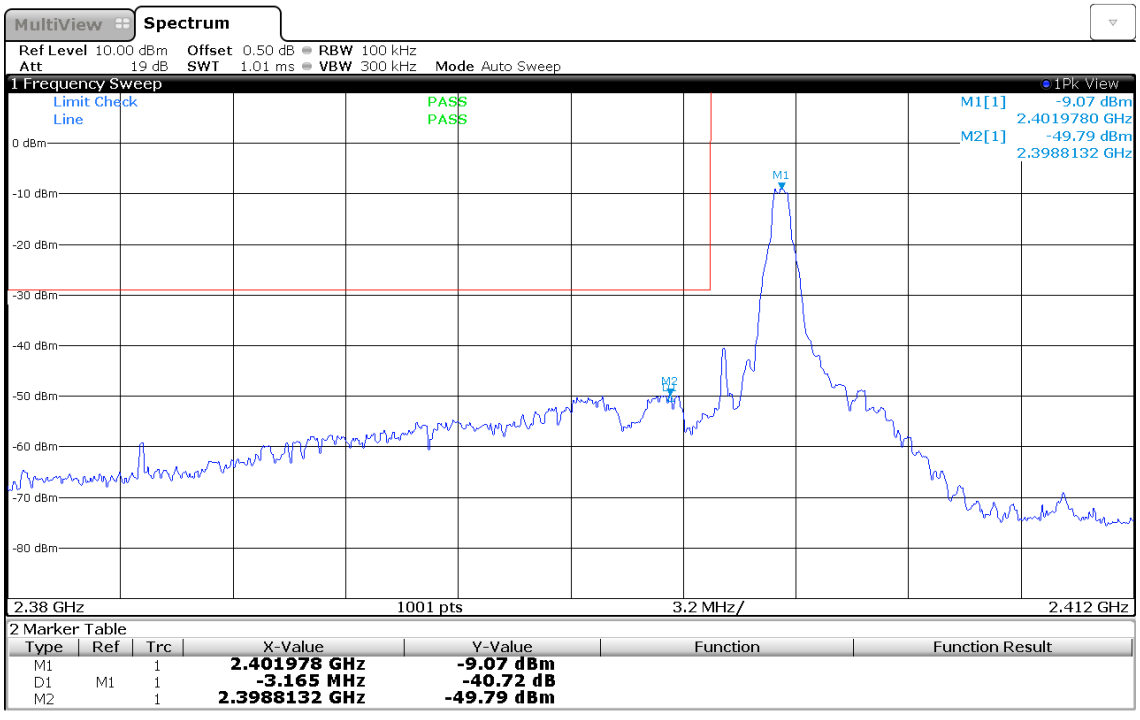
Channel	Frequency [MHz]	Mode	Level [dBc]	Limit [dBc]	Margin [dB]
F_{LOW}	2402	Transmit	-40.72	-20	-20.72
F_{HIGH}	2480	Transmit	-32.63	-20	-12.63

Comments:

Band-edge compliance

Band-edge Compliance

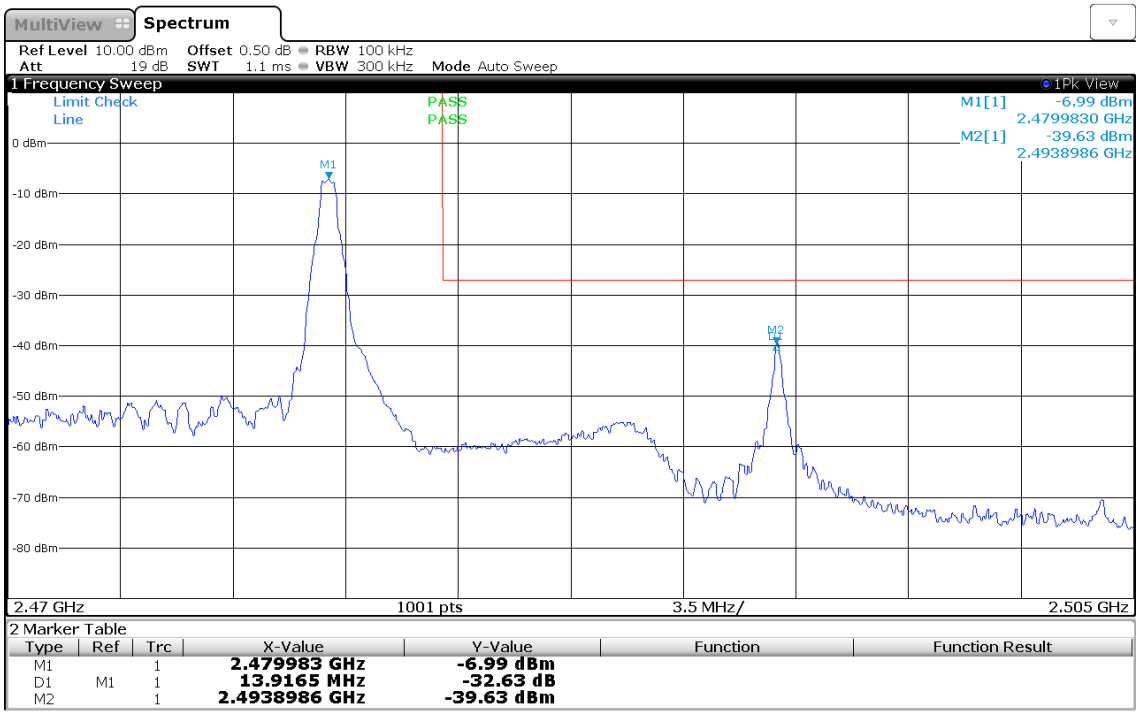
Project Number:	G0M-1510-5171
Applicant	Grässlin GmbH
Model Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	GFSK, Channel: 0, 2402 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



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

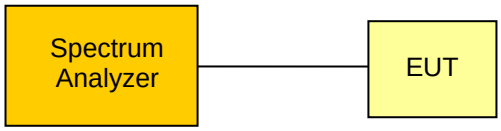
3.7 Test Conditions and Results – Conducted spurious emissions

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 – 10th Harmonic
Measurement mode	Peak

Limits

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

Test setup



Test procedure

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

Test results

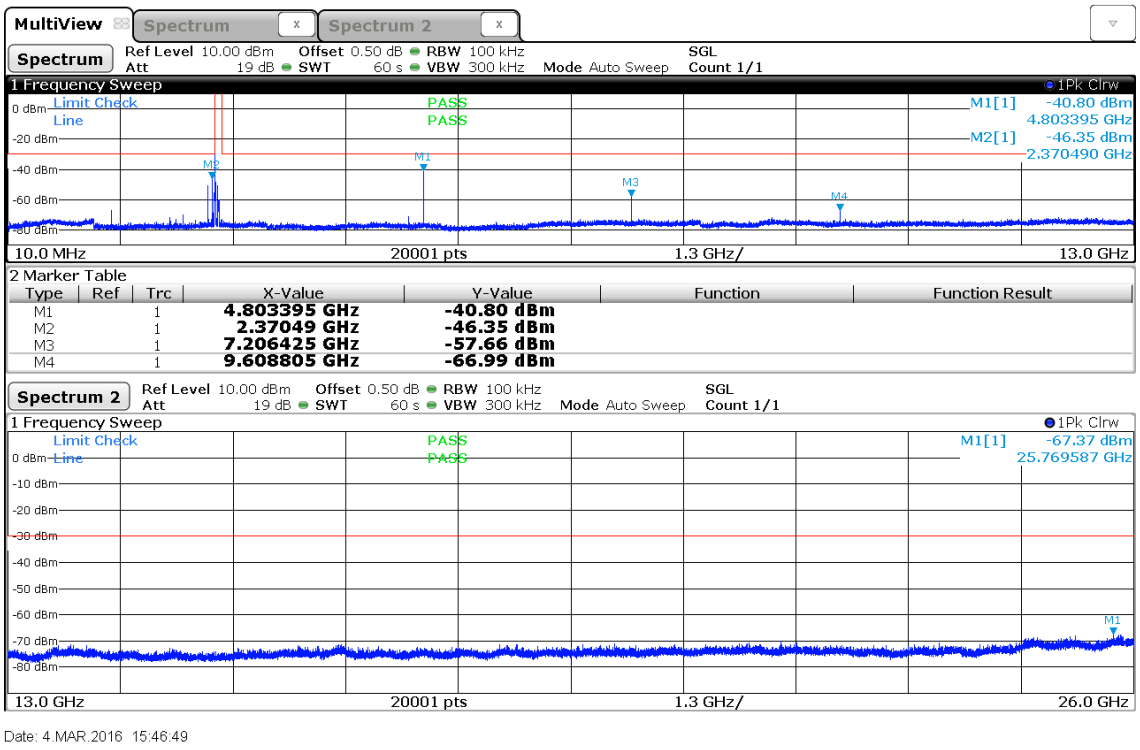
Channel	Frequency [MHz]	Mode	Emission [MHz]	Emission Level [dBm]	Peak power [dBm]	Limit [dBm]	Margin [dB]
F_{LOW}	2402	Transmit	2370.49	-46.35	-9.8	-29.8	-16.55
F_{LOW}	2402	Transmit	4803.40	-40.80	-9.8	-29.8	-11.00
F_{LOW}	2402	Transmit	7206.43	-57.66	-9.8	-29.8	-27.86
F_{LOW}	2402	Transmit	9608.81	-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

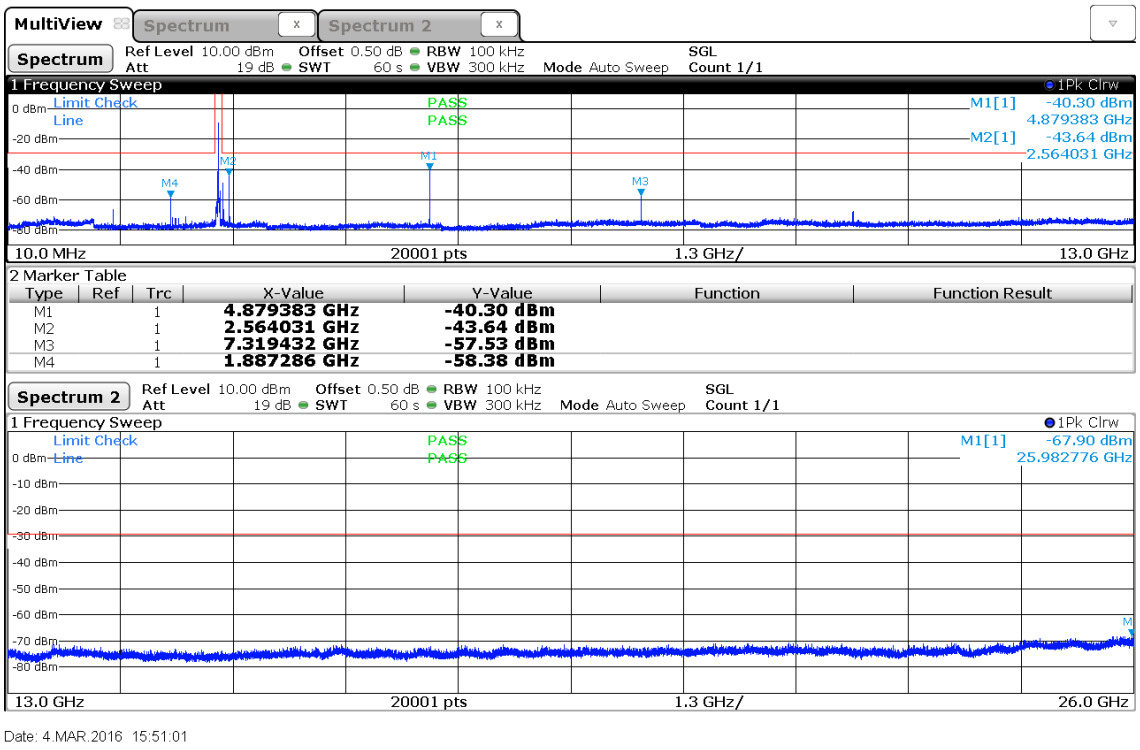
Project Number:	G0M-1510-5171
Applicant	Grässlin GmbH
Model Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	GFSK, Channel: 0, 2402 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



Conducted spurious emissions – F_{MID}

Conducted Spurious Emissions

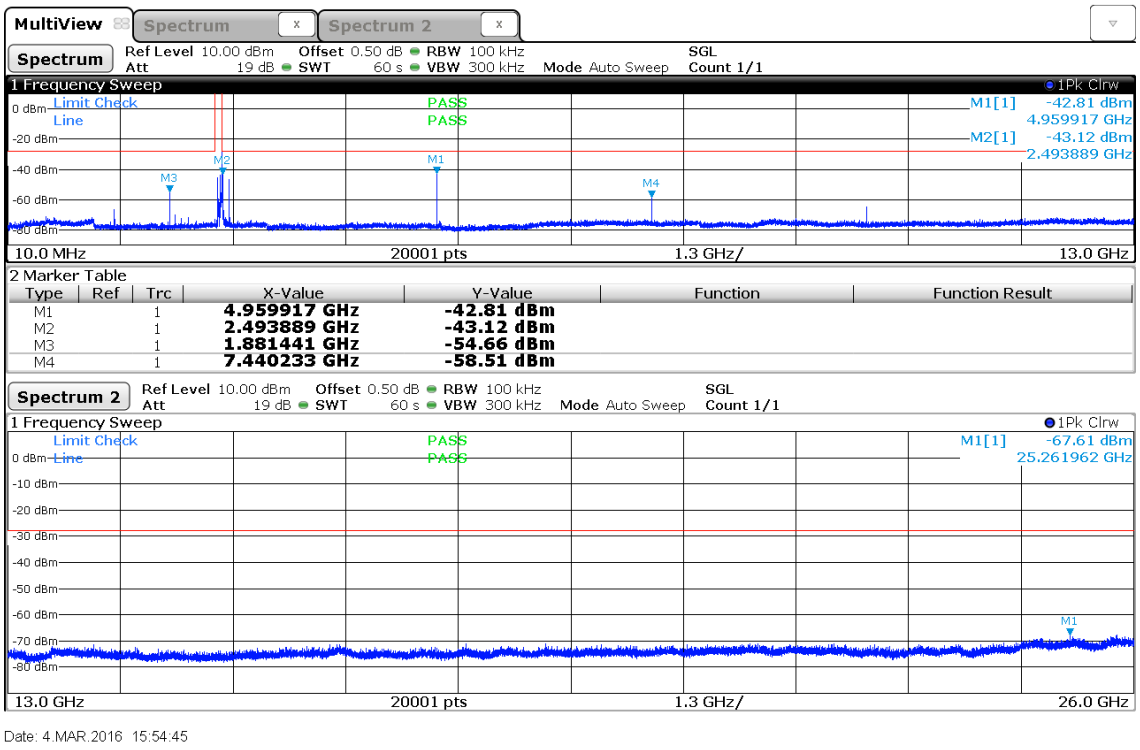
Project Number:	G0M-1510-5171
Applicant	Grässlin GmbH
Model Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	GFSK, Channel: 19, 2440 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



Conducted spurious emissions – F_{HIGH}

Conducted Spurious Emissions

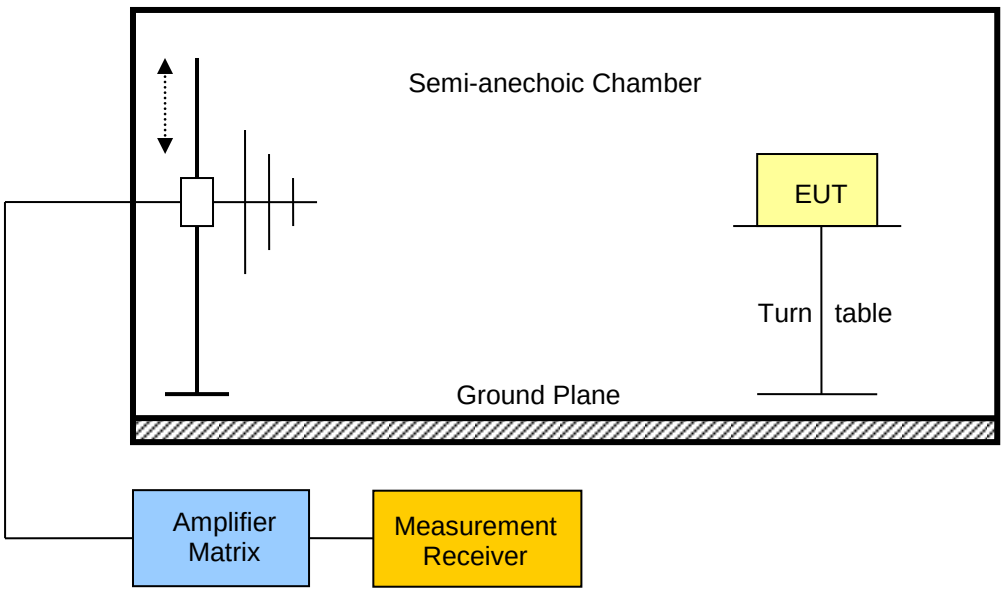
Project Number:	G0M-1510-5171
Applicant	Grässlin GmbH
Model Description	2,4GHz BLE (Bluetooth Low Energy) Module (with LCD, Keypad, LCD Glas)
Model:	Carrier Board LCD-BLE
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	GFSK, Channel: 39, 2480 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



Date: 4.MAR.2016 15:54:45

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 – 10th Harmonic			
Limits				
Frequency range [MHz]	Detector	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). When average radiated emission measurements are specified, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.				
Test setup				



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

Test results S25

Channel	Frequency [MHz]	Mode	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/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.

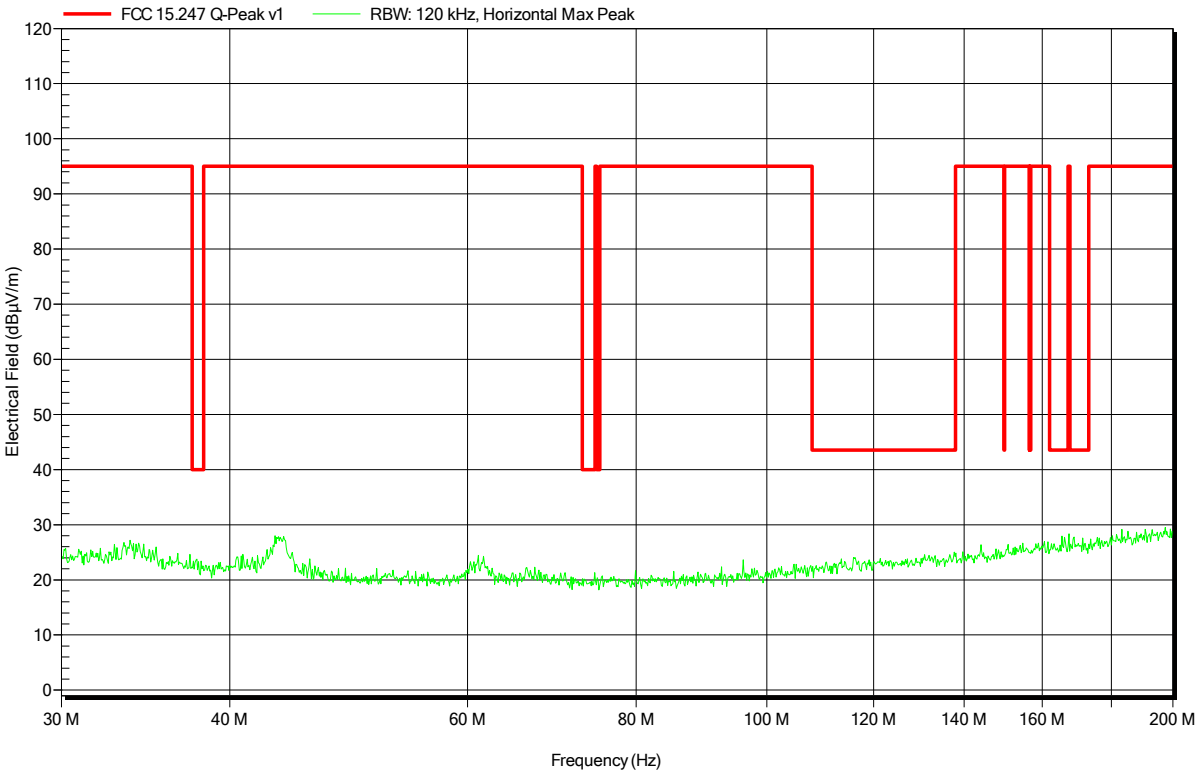
ANNEX A Transmitter radiated spurious emissions

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

Index 46

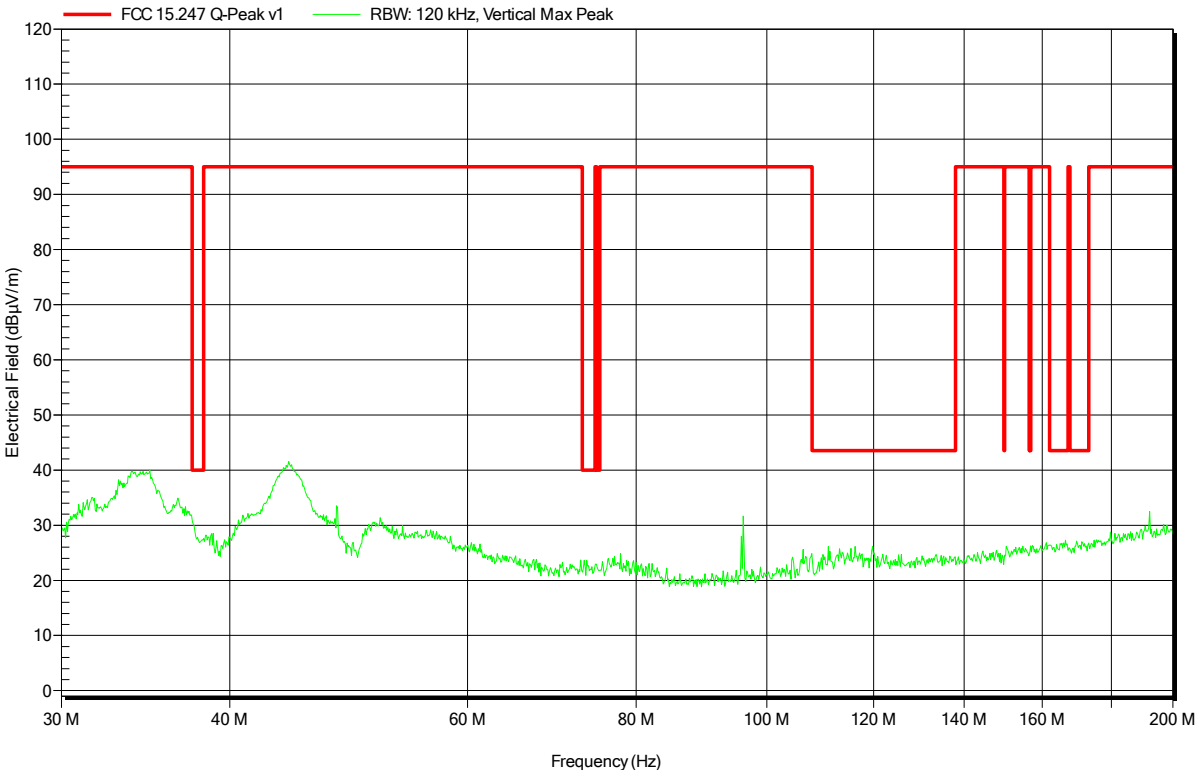


Spurious emissions according to FCC 15.247

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

Index 43

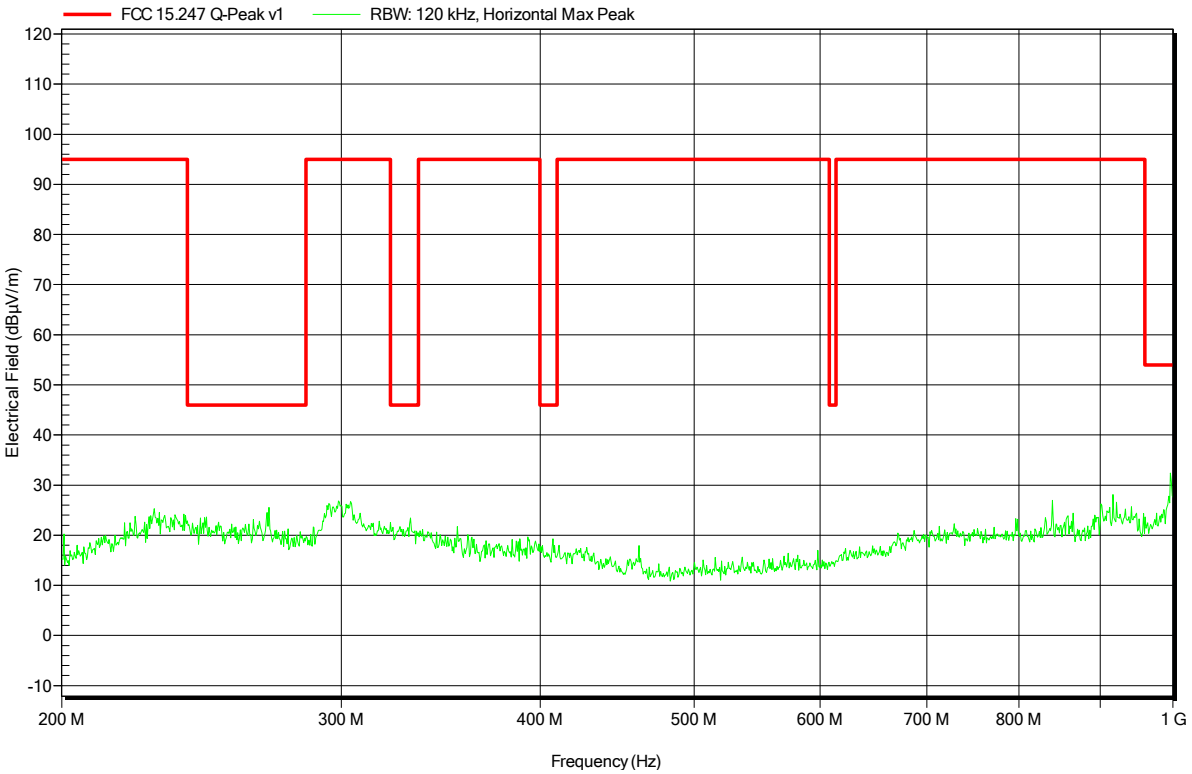


Spurious emissions according to FCC 15.247

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

Index 49

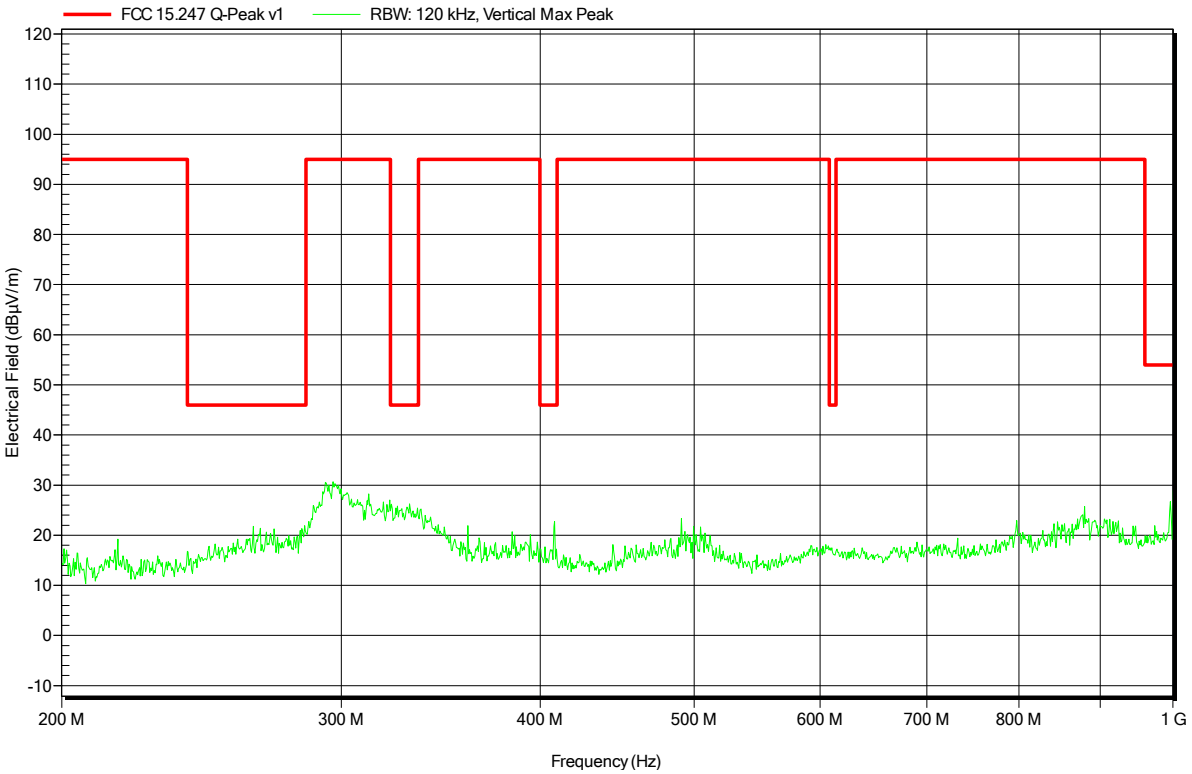


Spurious emissions according to FCC 15.247

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

Index 52

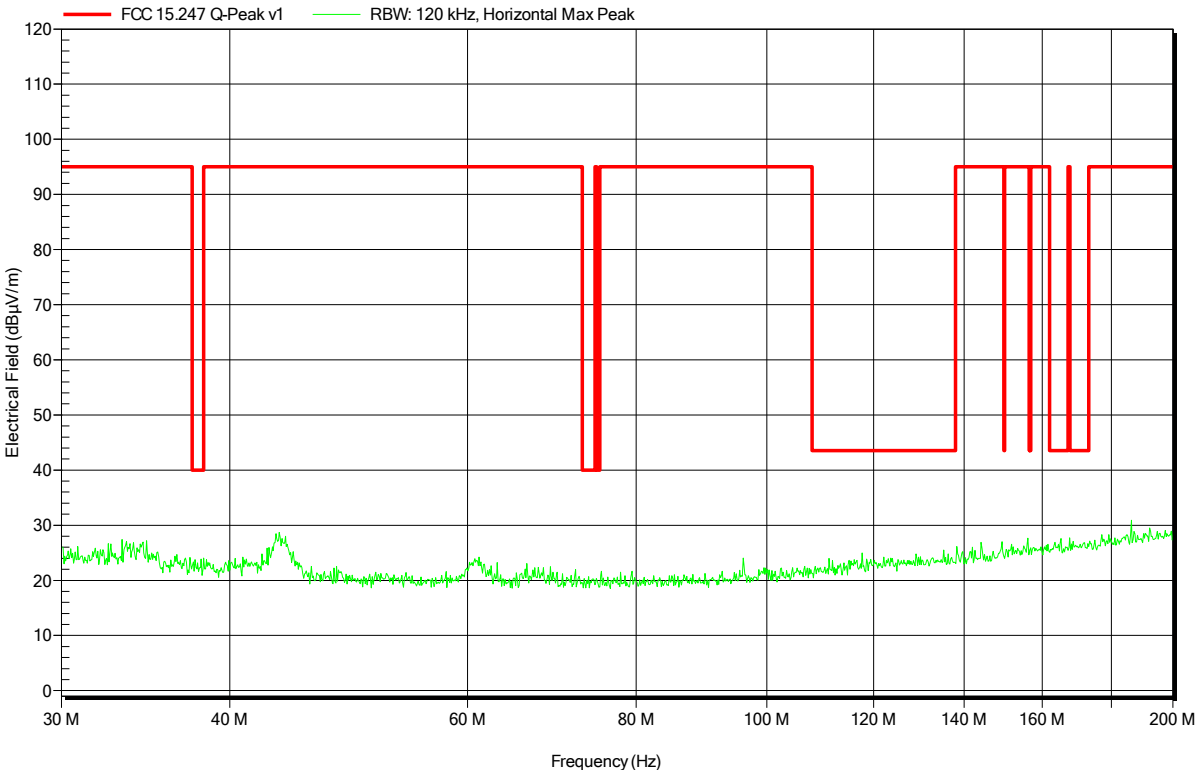


Spurious emissions according to FCC 15.247

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

Index 47

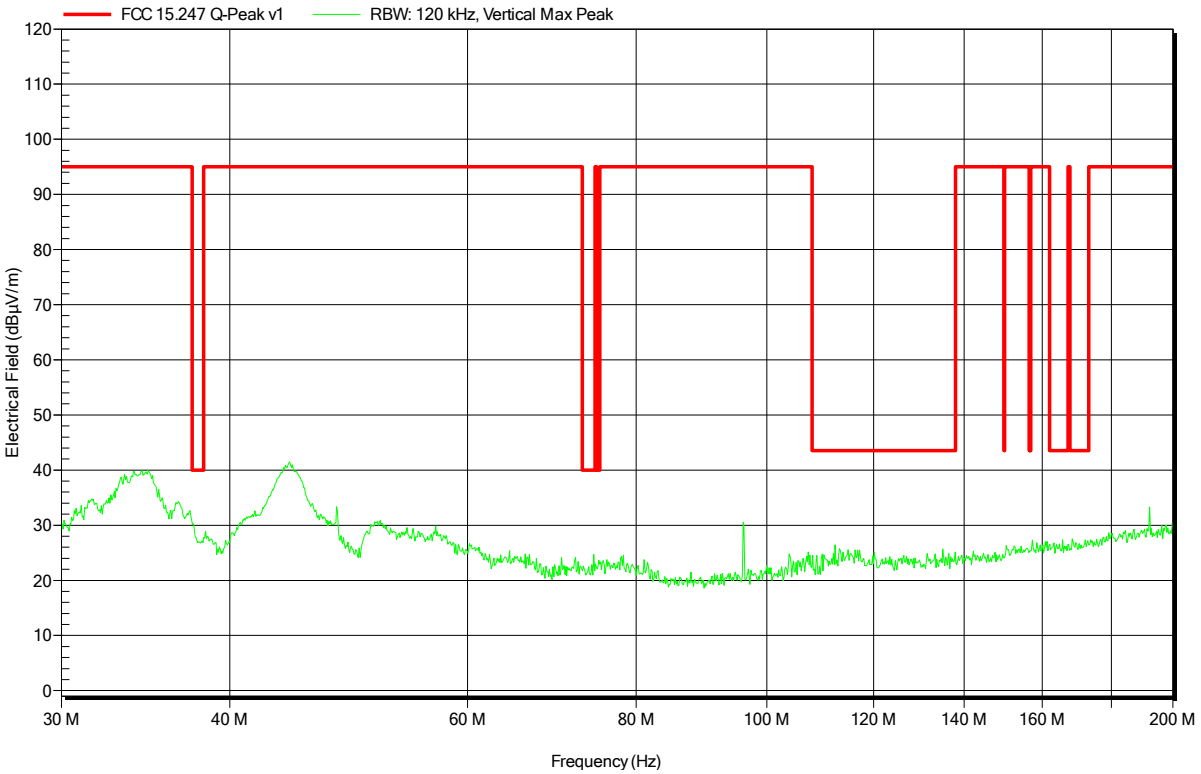


Spurious emissions according to FCC 15.247

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

Index 44

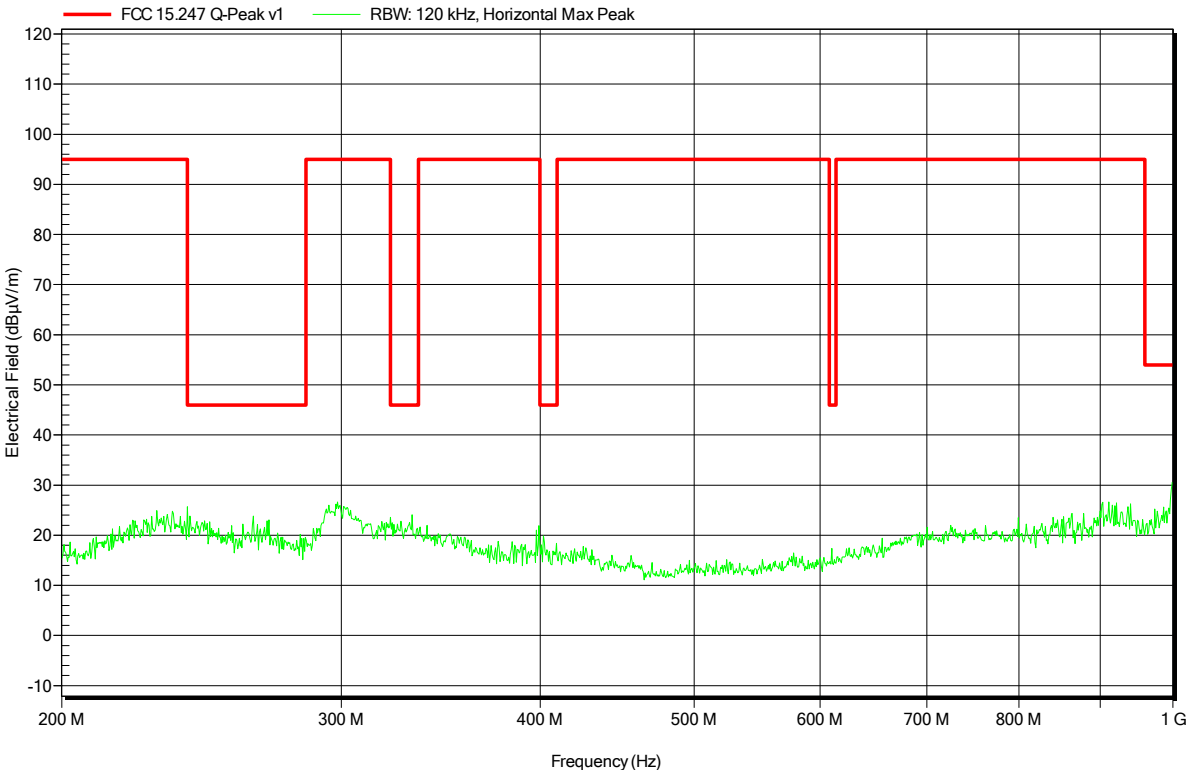


Spurious emissions according to FCC 15.247

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

Index 50

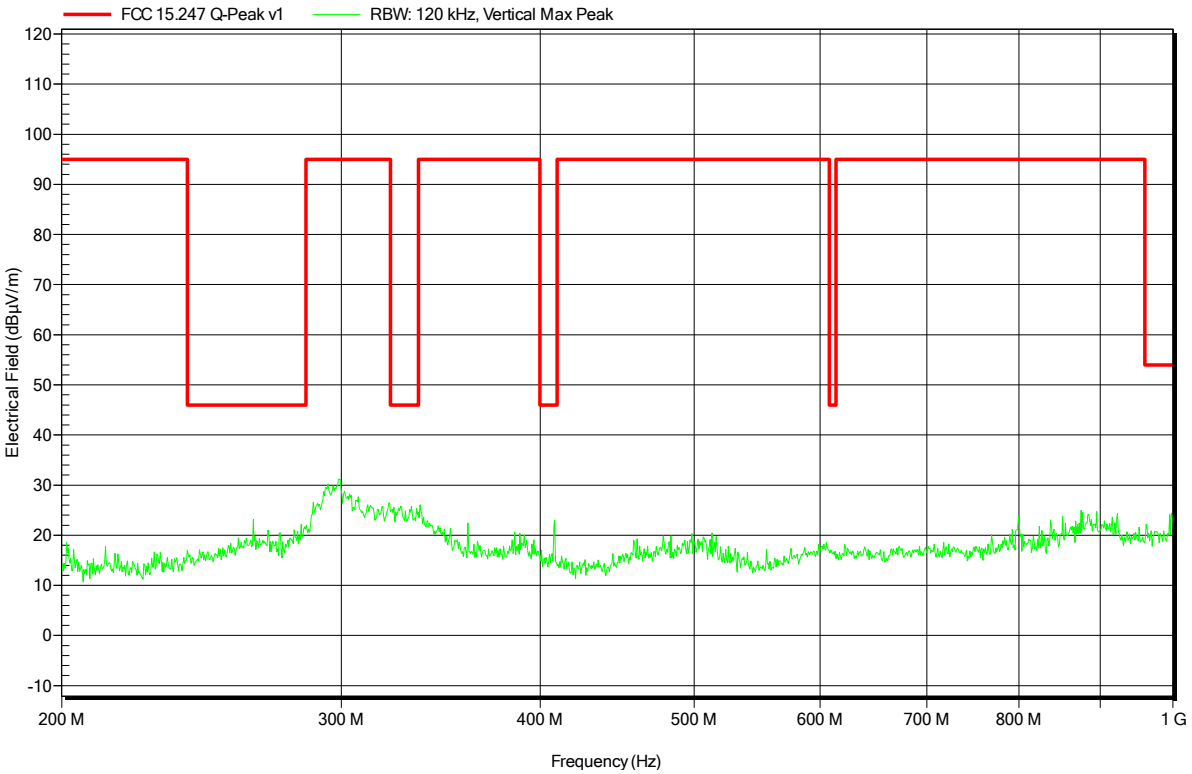


Spurious emissions according to FCC 15.247

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

Index 53

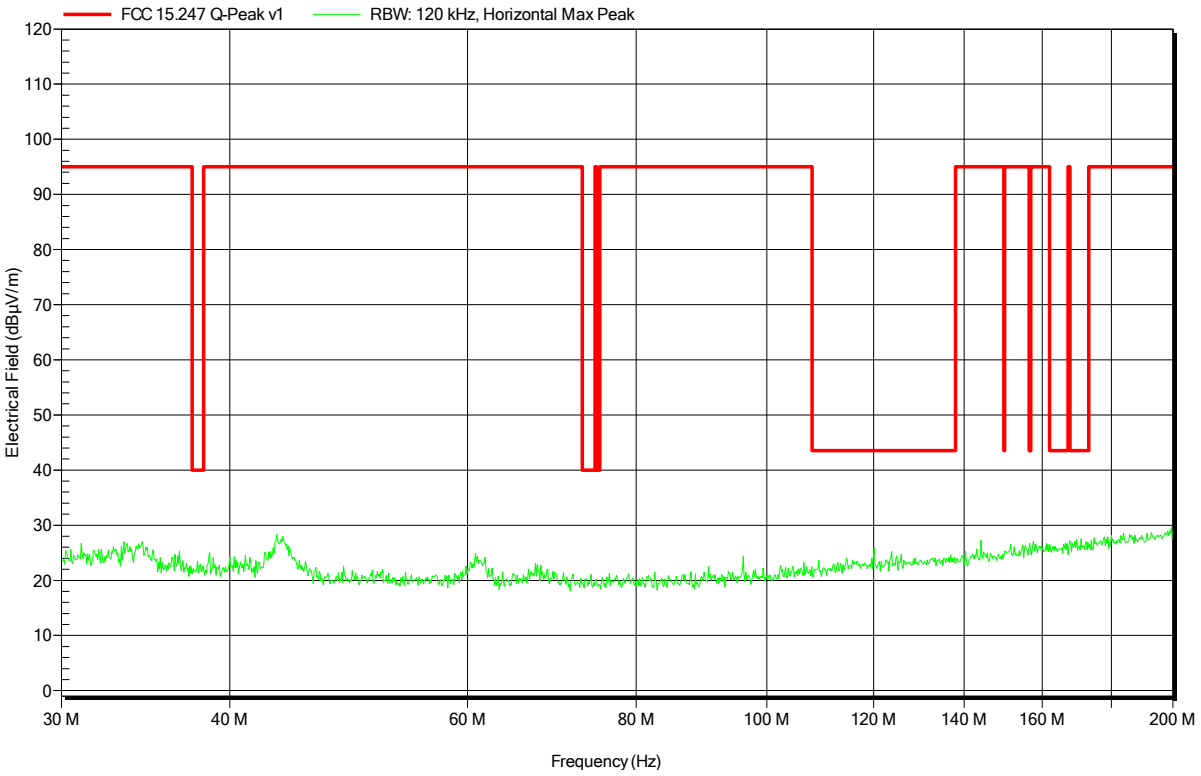


Spurious emissions according to FCC 15.247

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

Index 48

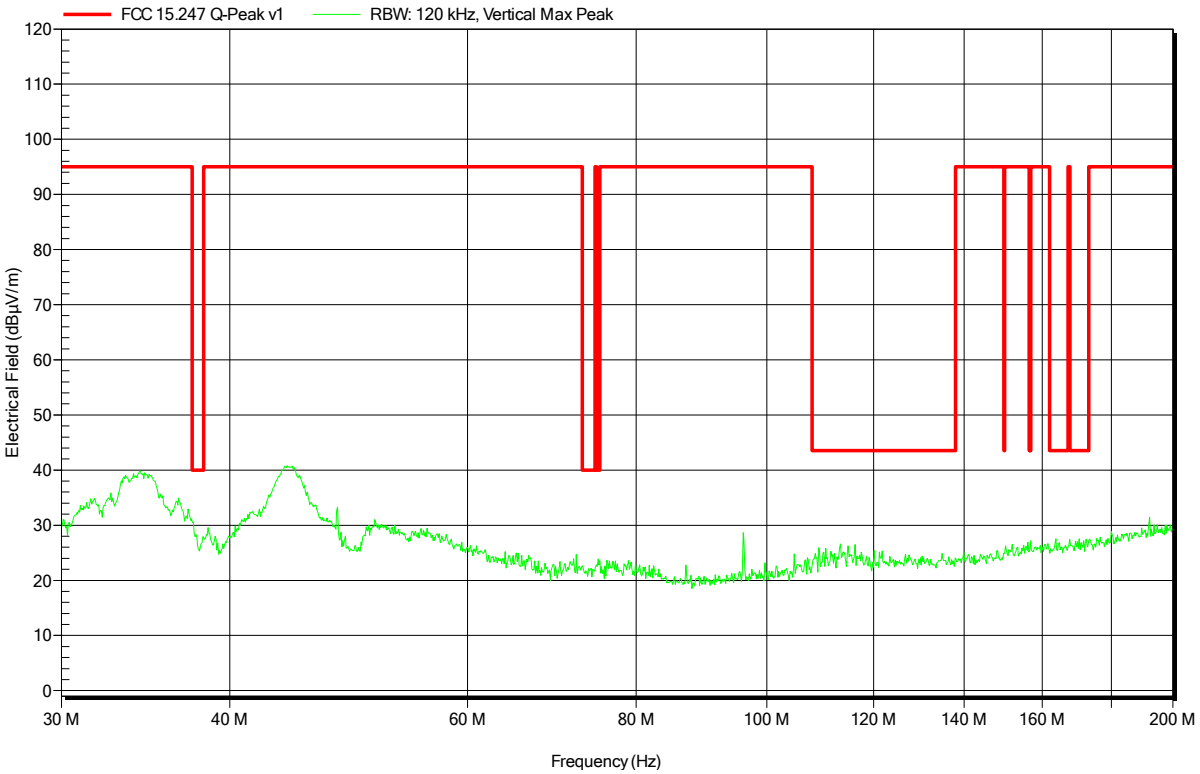


Spurious emissions according to FCC 15.247

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

Index 45

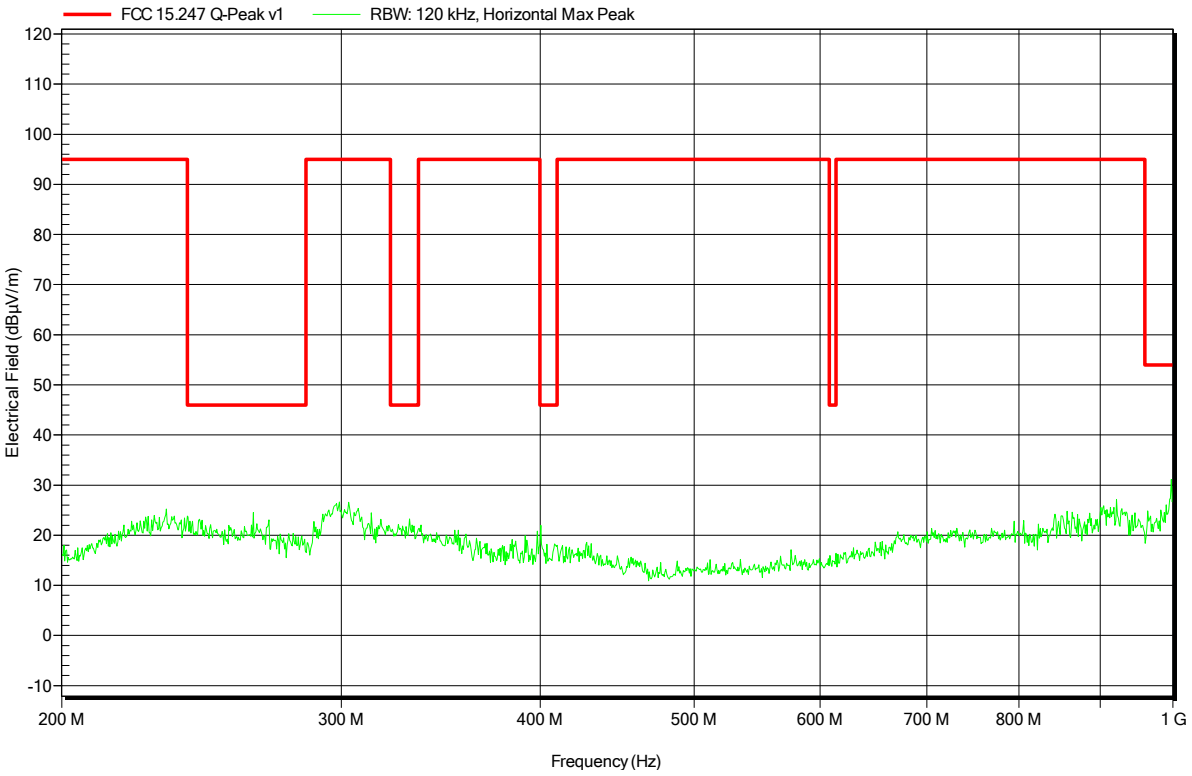


Spurious emissions according to FCC 15.247

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

Index 51

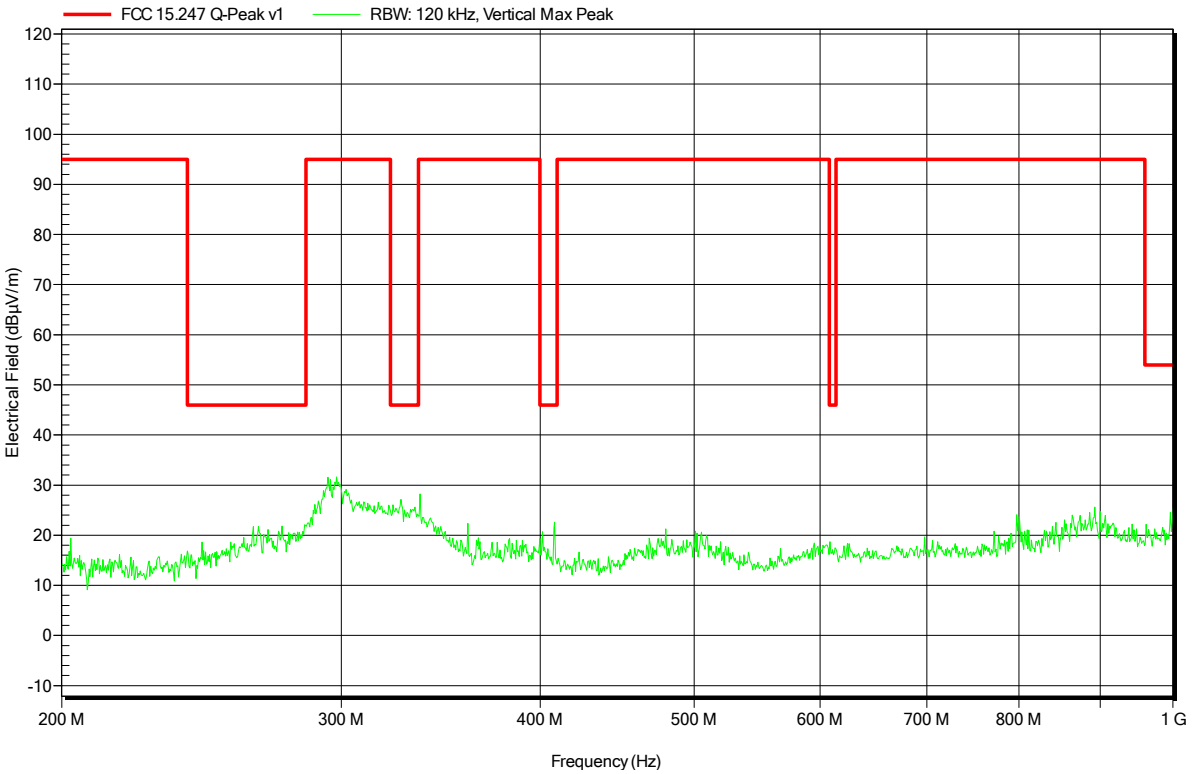


Spurious emissions according to FCC 15.247

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

Index 54

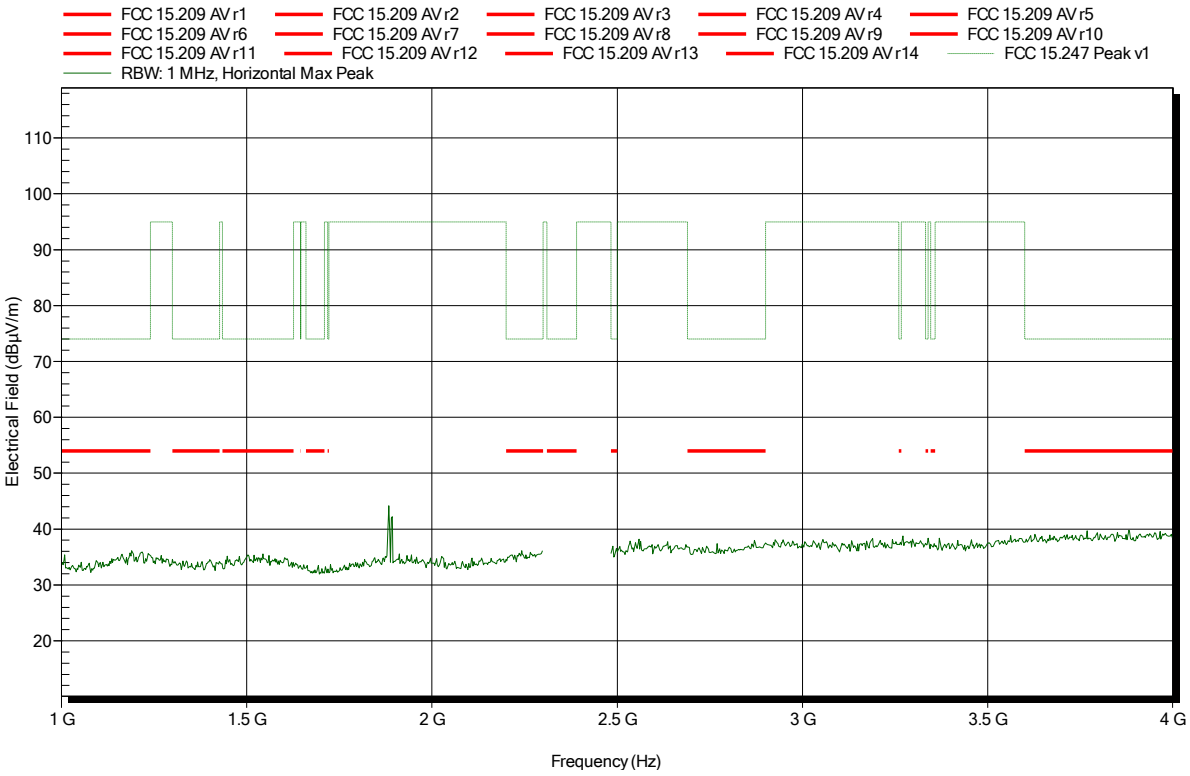


Spurious emissions according to FCC 15.247

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

Index 8

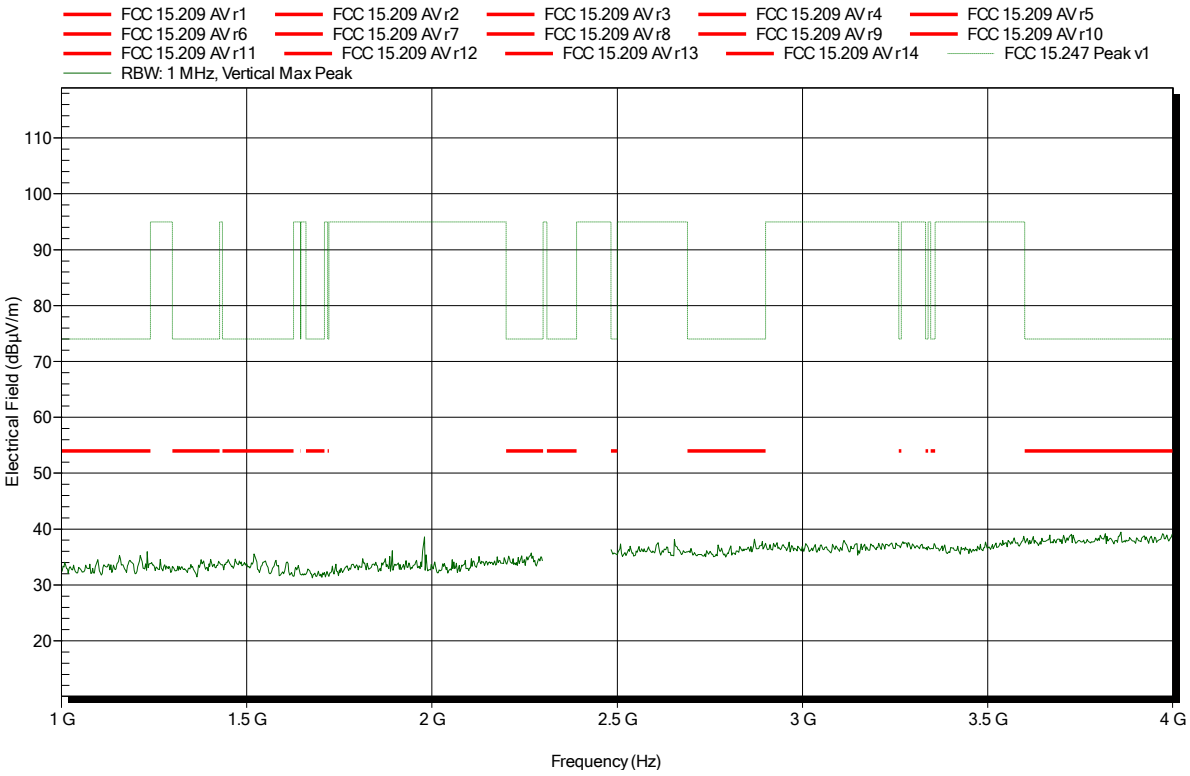


Spurious emissions according to FCC 15.247

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

Index 11

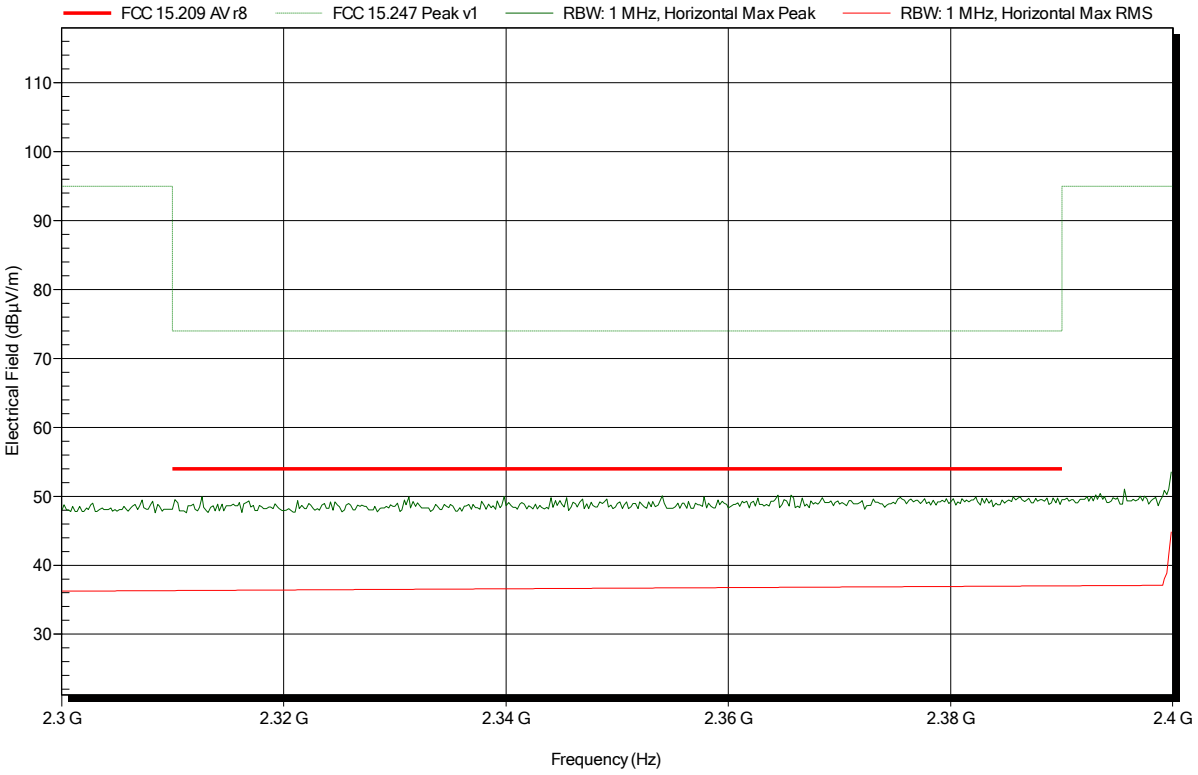


Spurious emissions according to FCC 15.247

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

Index 26

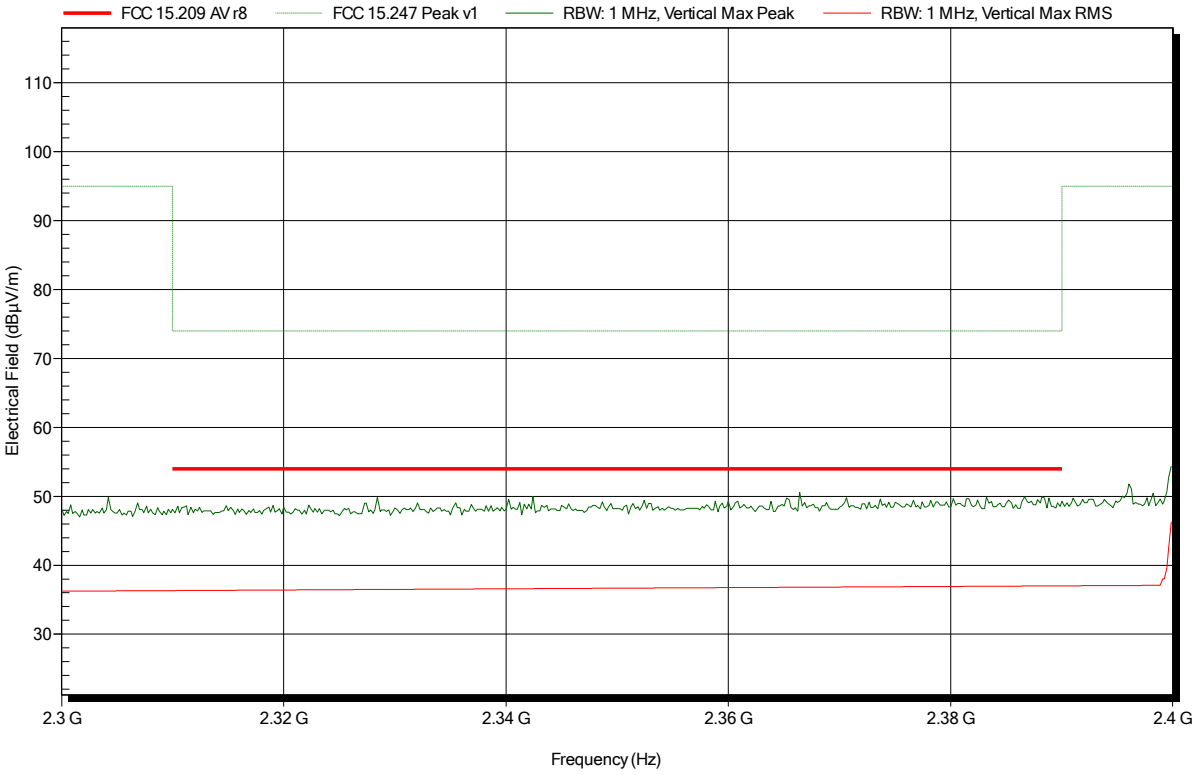


Spurious emissions according to FCC 15.247

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

Index 17

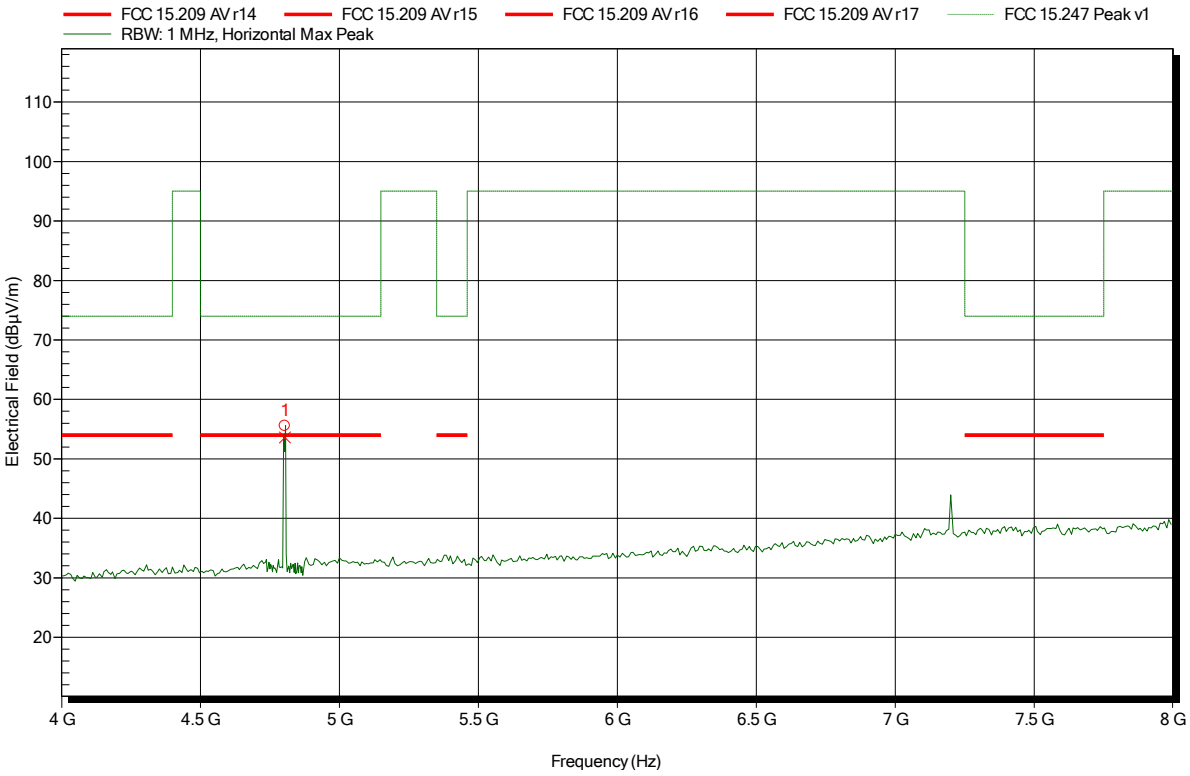


Spurious emissions according to FCC 15.247

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

Index 24



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

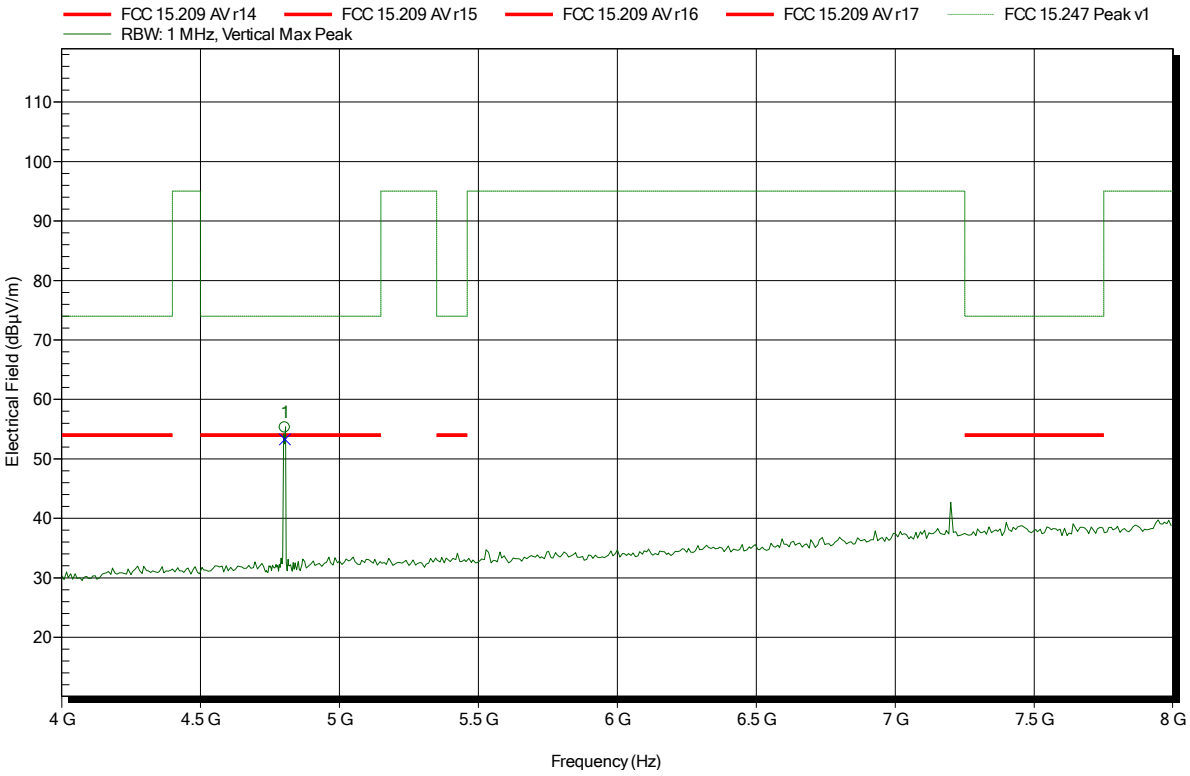
Frequency	Average	Average Limit	Average Difference	Average Status
4.804 GHz	53.58 dBµV/m	54 dBµV/m	-0.42 dB	Pass

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

Index 18



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

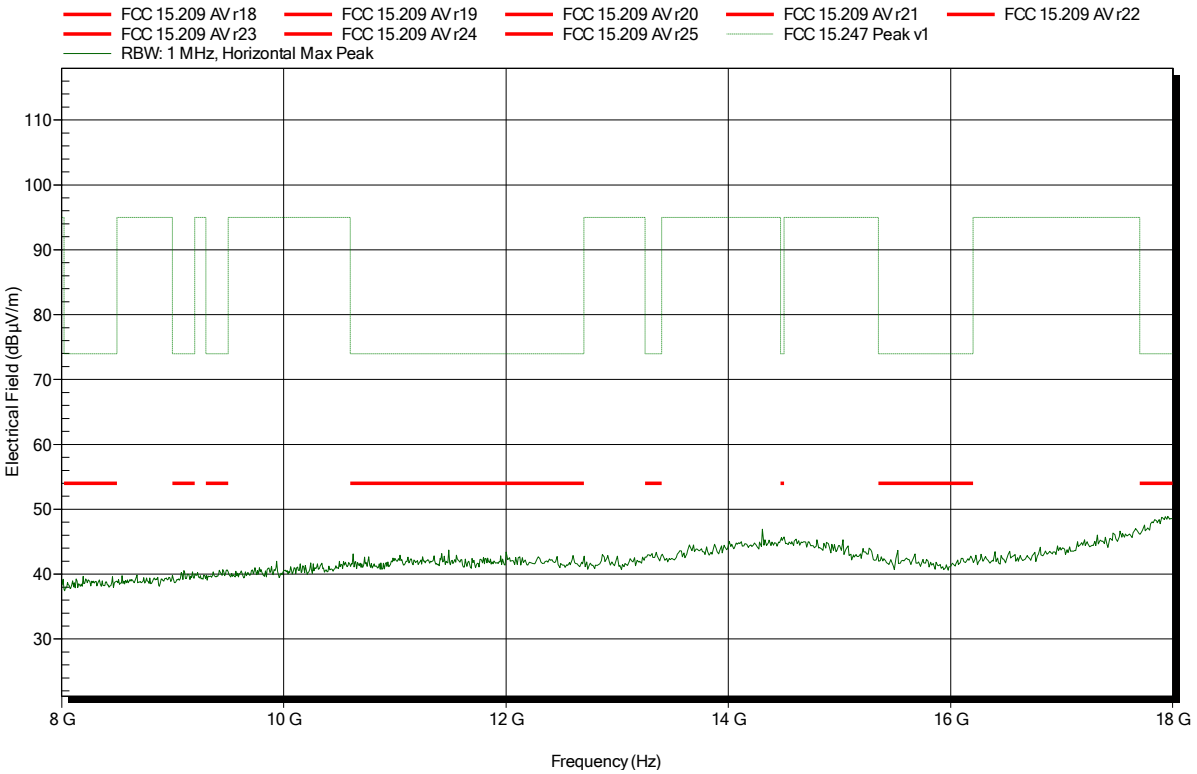
Frequency	Average	Average Limit	Average Difference	Average Status
4.804 GHz	53.29 dBµV/m	54 dBµV/m	-0.71 dB	Pass

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

Index 23

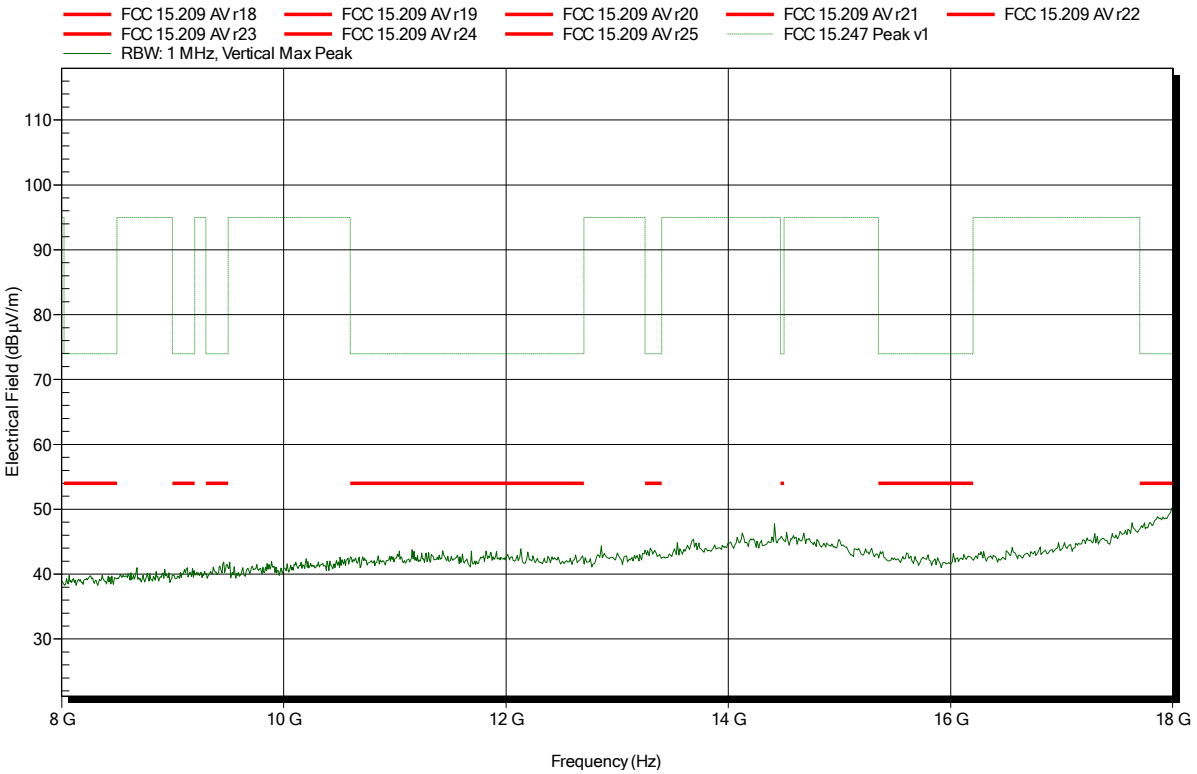


Spurious emissions according to FCC 15.247

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

Index 19

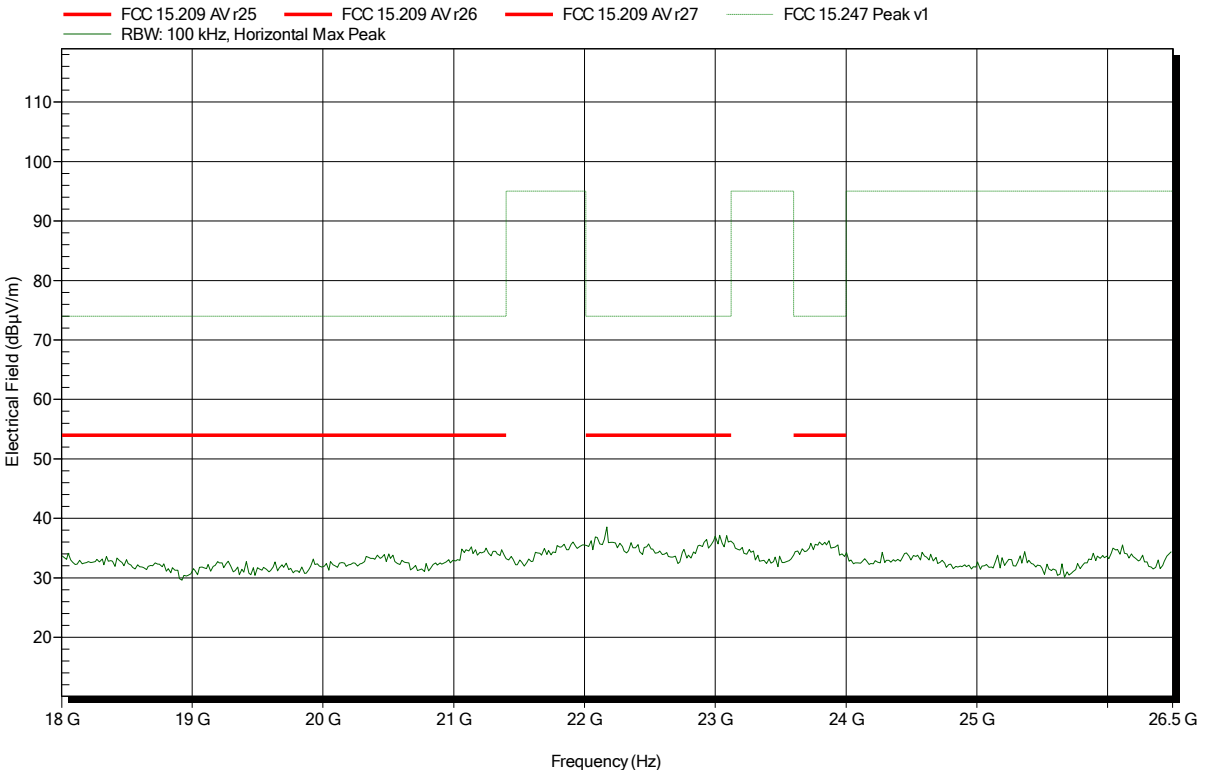


Spurious emissions according to FCC 15.247

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

Index 36

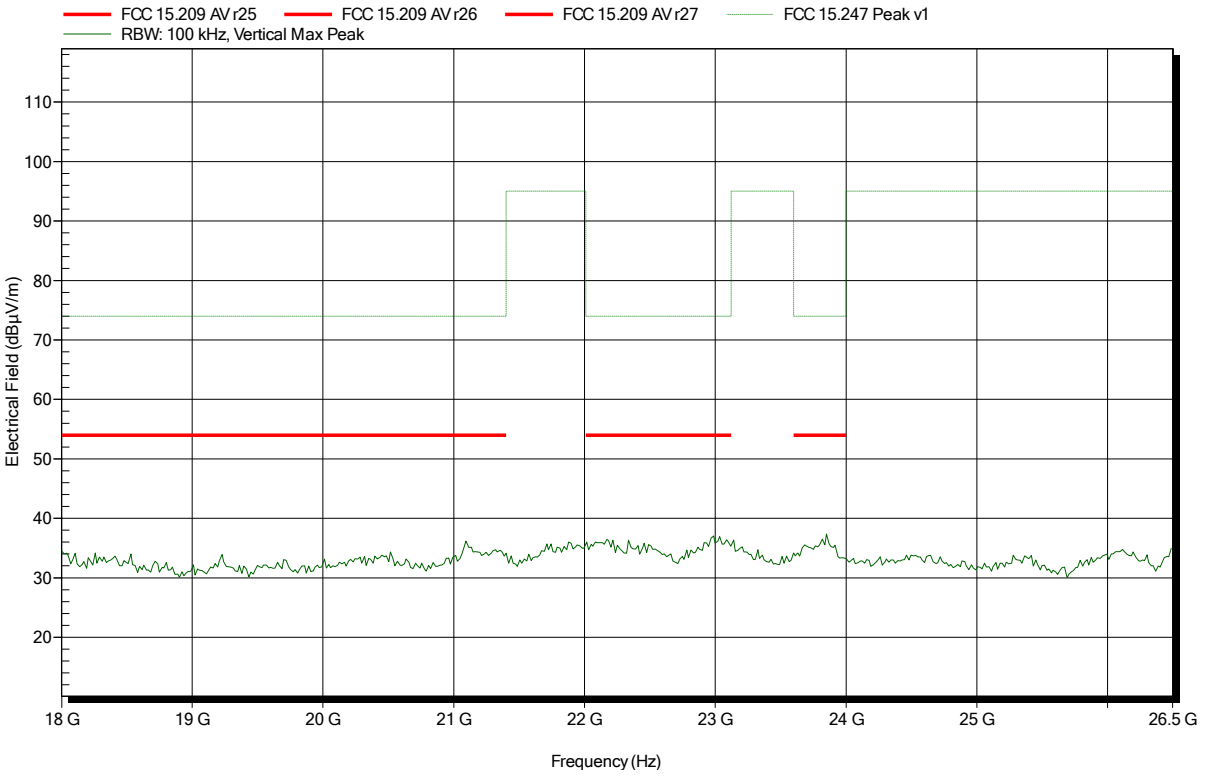


Spurious emissions according to FCC 15.247

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

Index 42

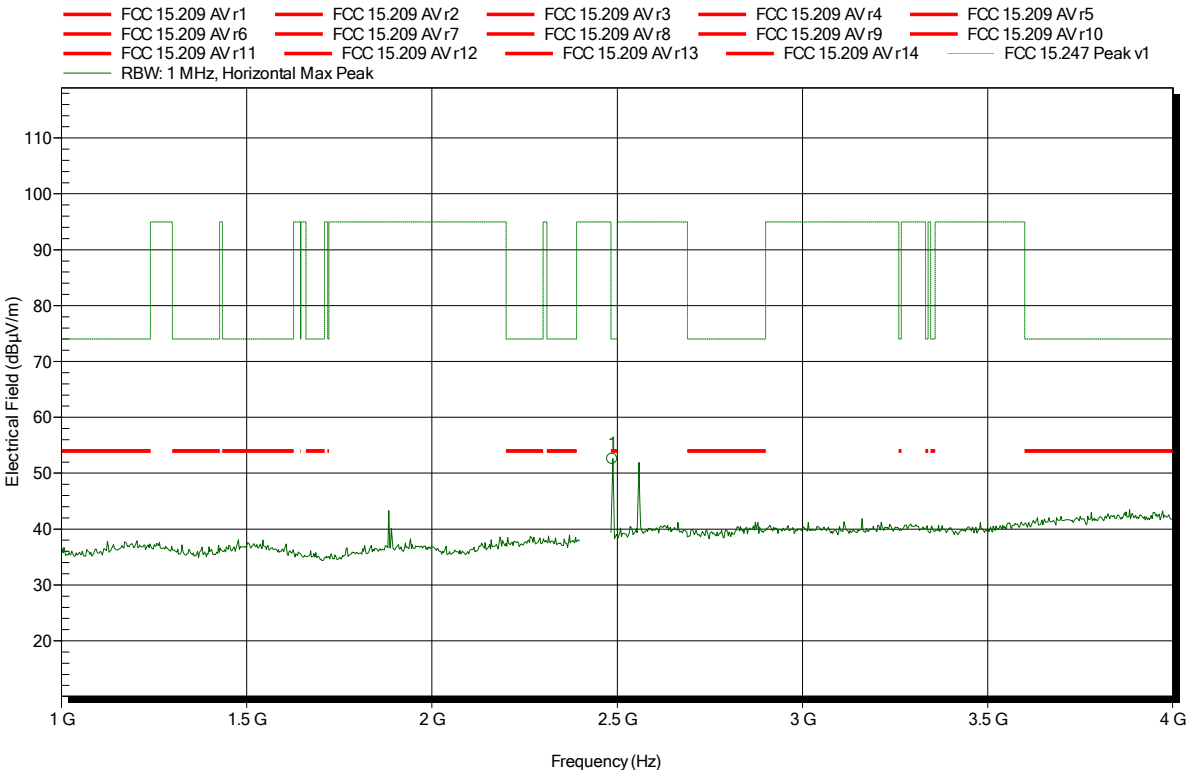


Spurious emissions according to FCC 15.247

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

Index 9



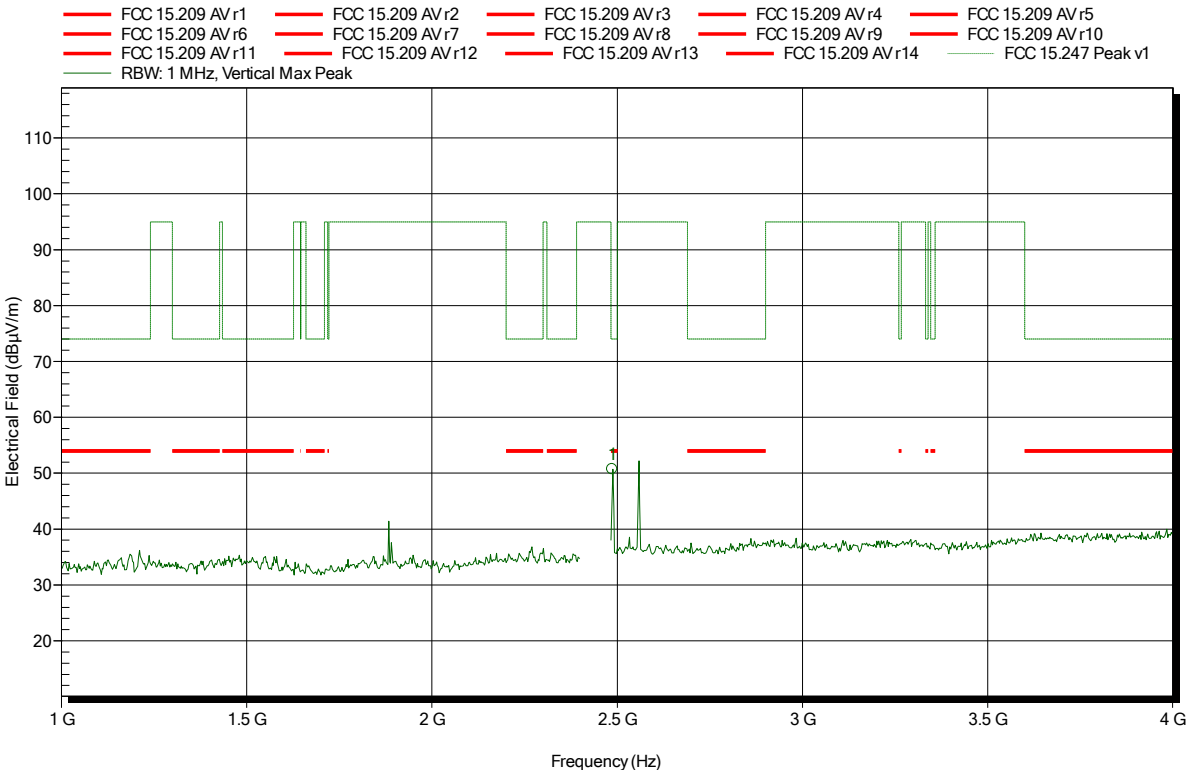
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4865 GHz	52.58 dBµV/m	74 dBµV/m	-21.42 dB	Pass

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:	3 m
Mode:	TX; BT LE, CH.19, 2440 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

Index 12



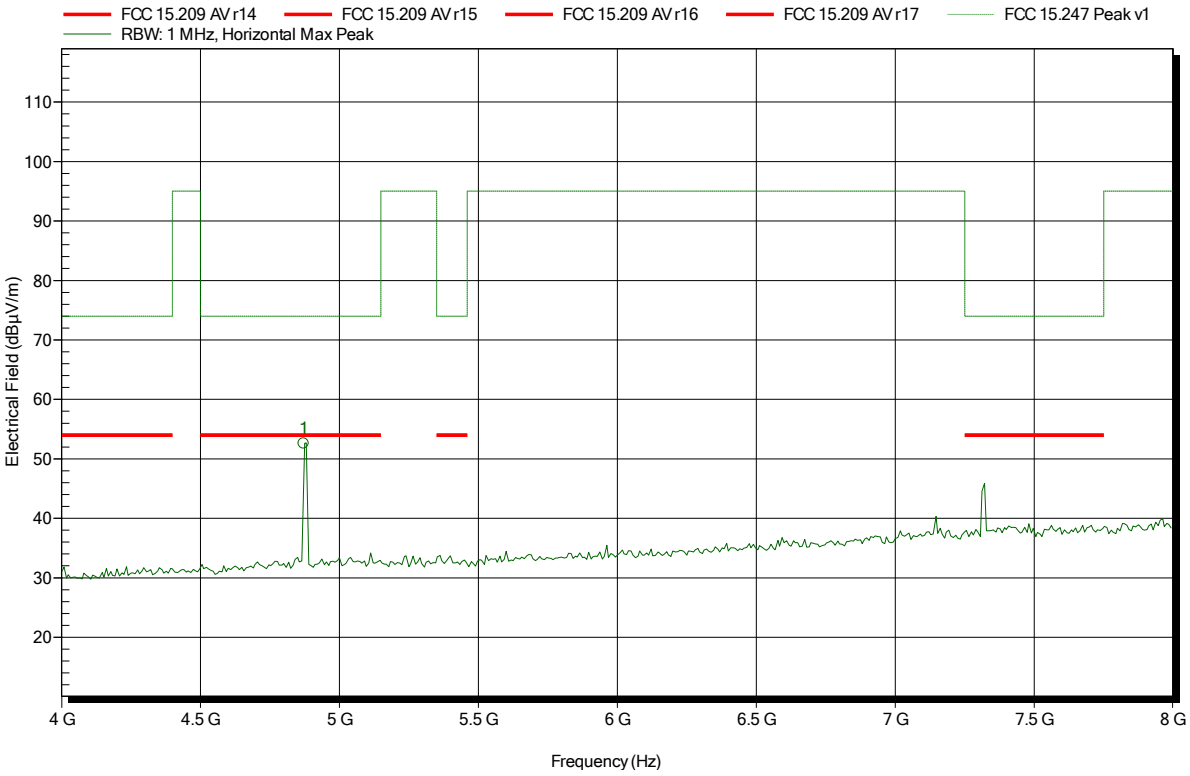
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4865 GHz	50.71 dBµV/m	74 dBµV/m	-23.29 dB	Pass

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.19, 2440 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

Index 31



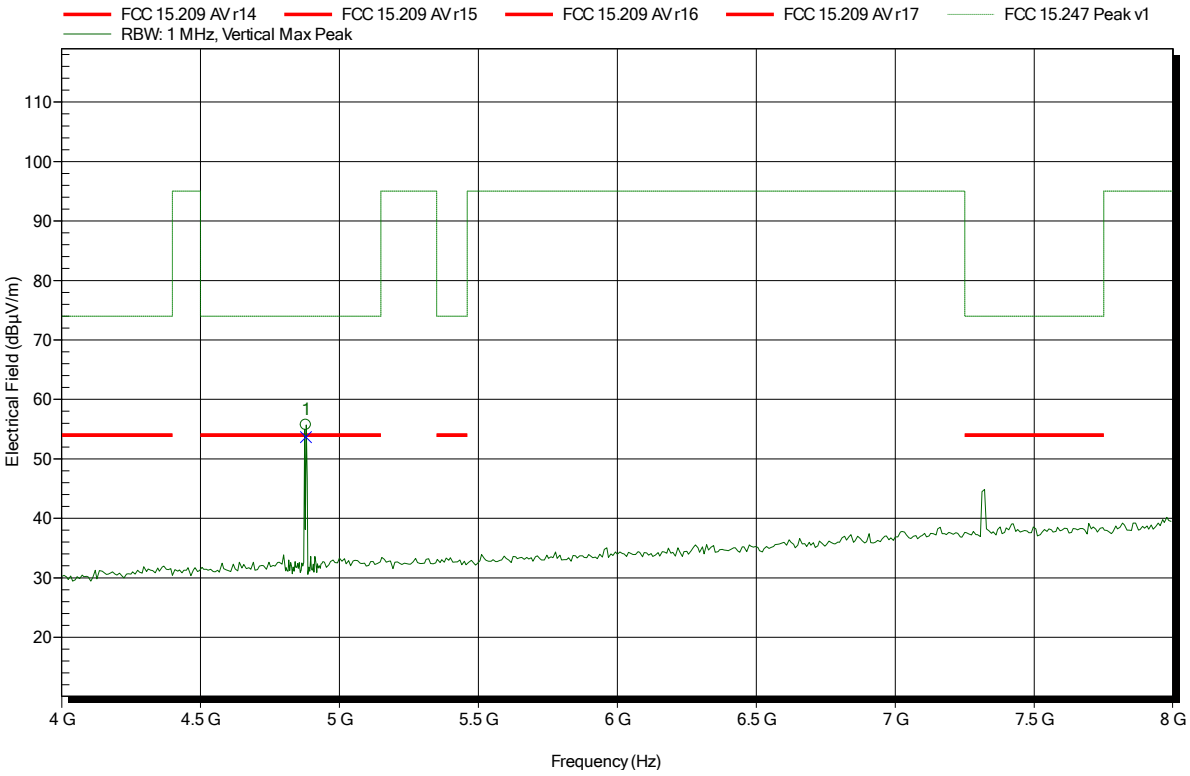
Frequency	Peak	Peak Limit	Peak Difference	Status
4.872 GHz	52.59 dBµV/m	74 dBµV/m	-21.41 dB	Pass

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.19, 2440 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

Index 21



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

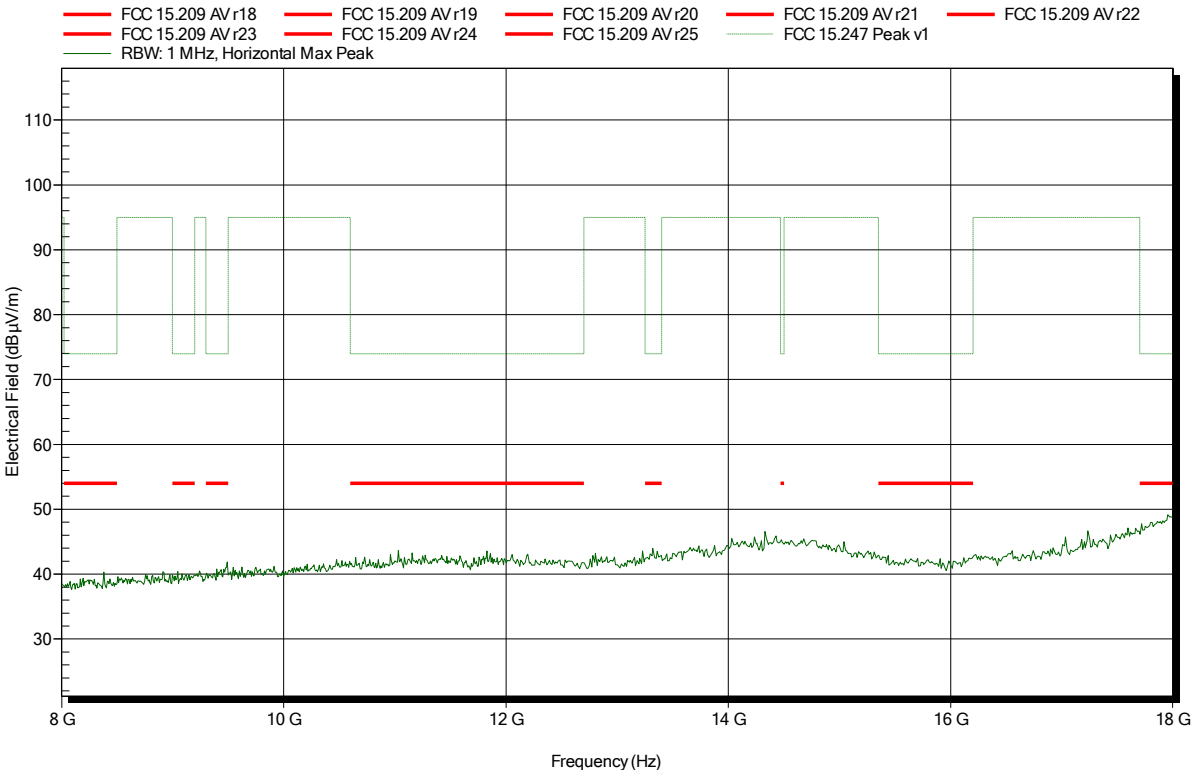
Frequency	Average	Average Limit	Average Difference	Average Status
4.88 GHz	53.64 dBµV/m	54 dBµV/m	-0.36 dB	Pass

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.19, 2440 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

Index 30

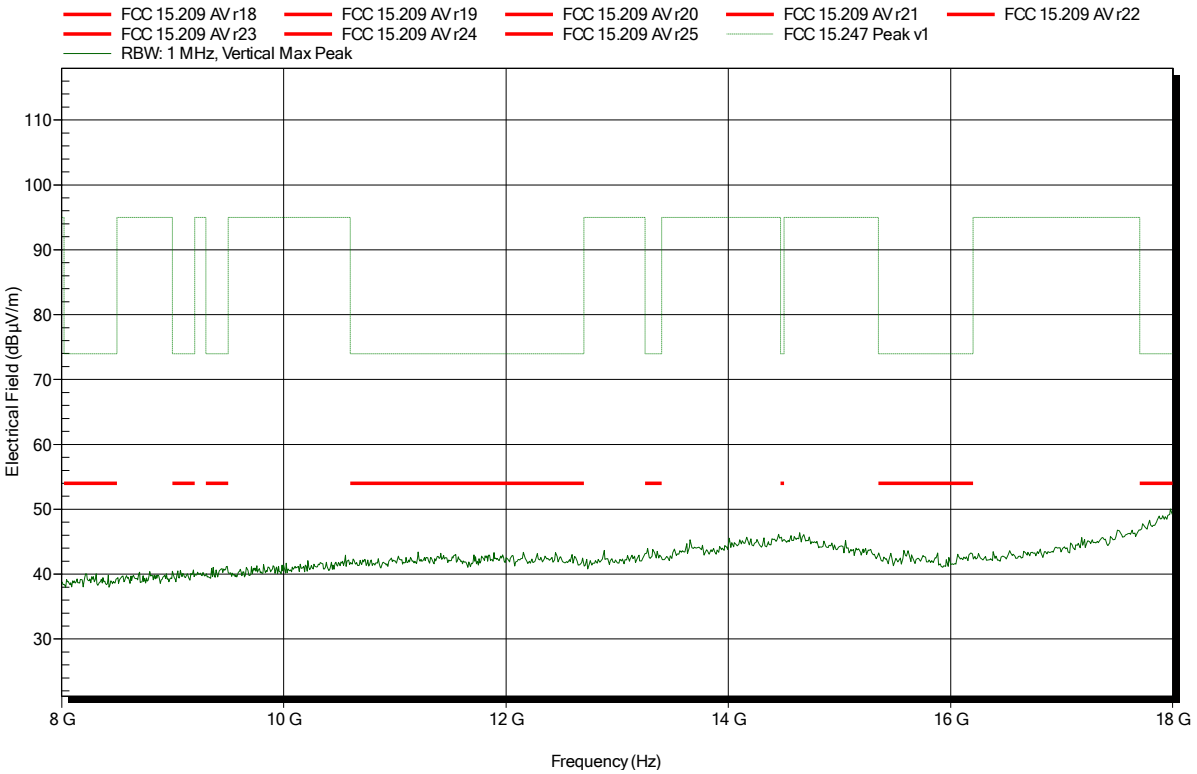


Spurious emissions according to FCC 15.247

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

Index 20

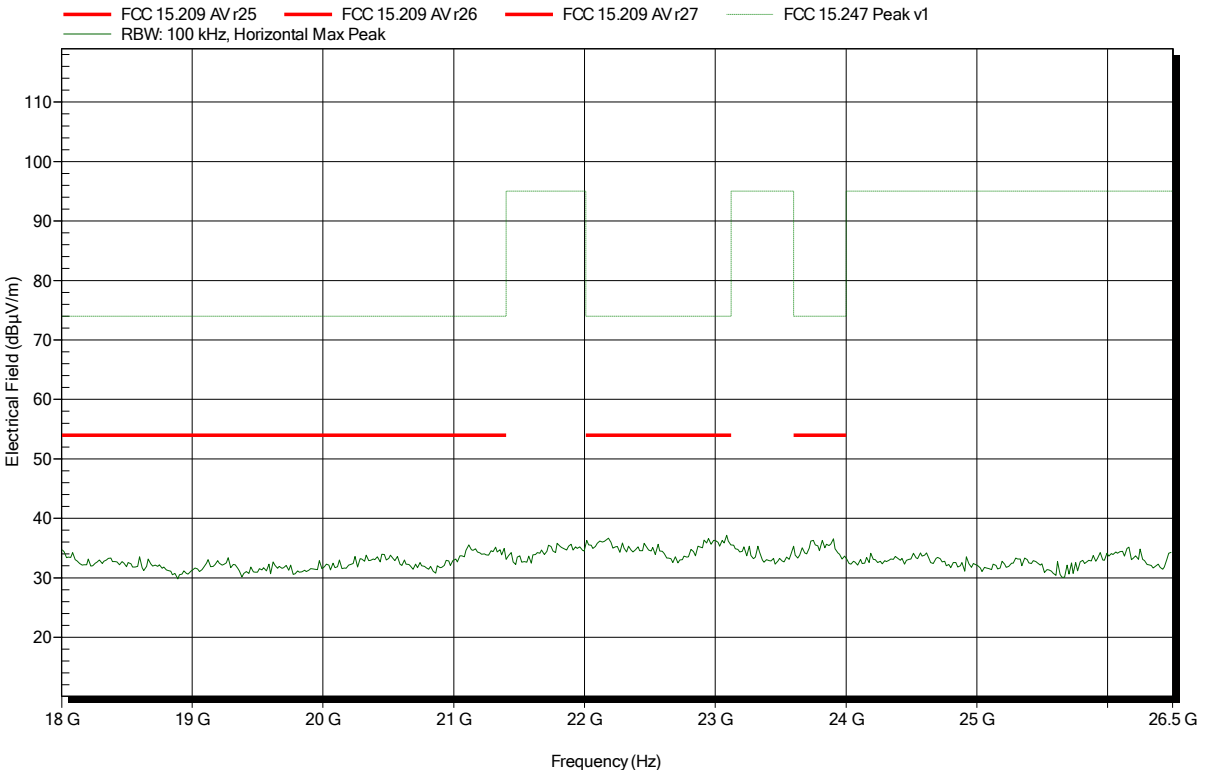


Spurious emissions according to FCC 15.247

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

Index 35



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

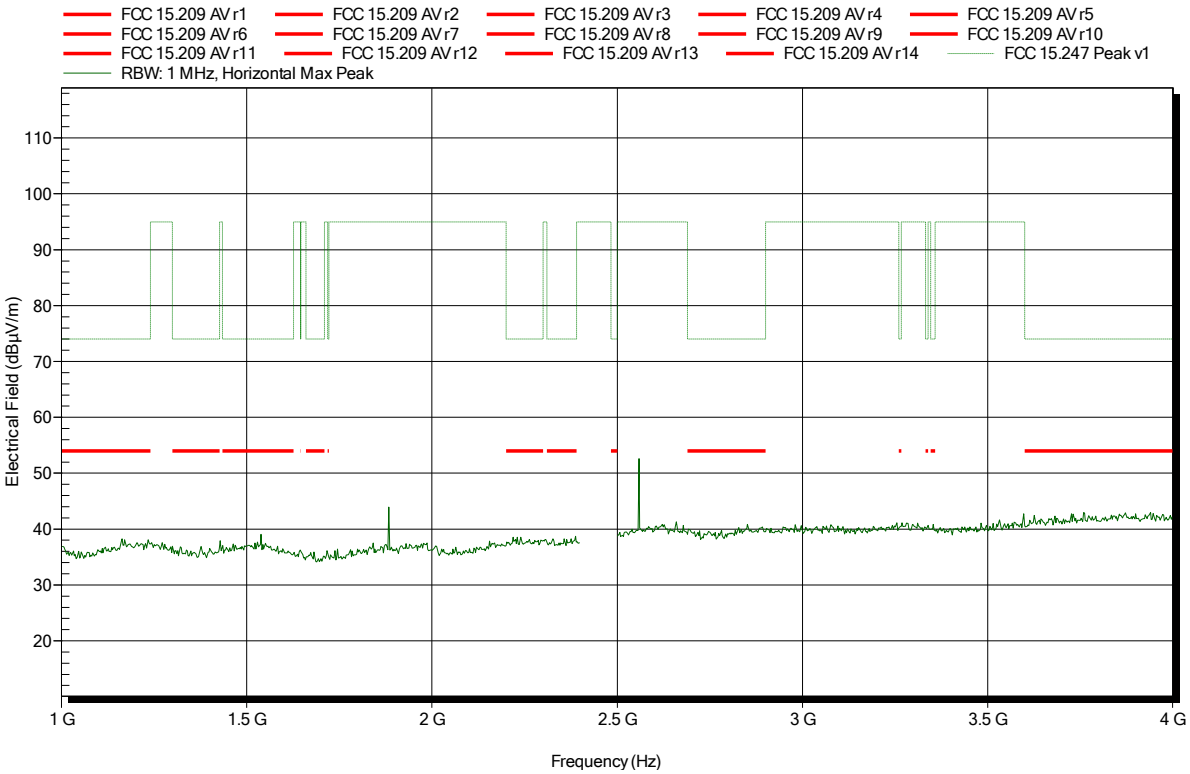
Index 41

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

Index 10

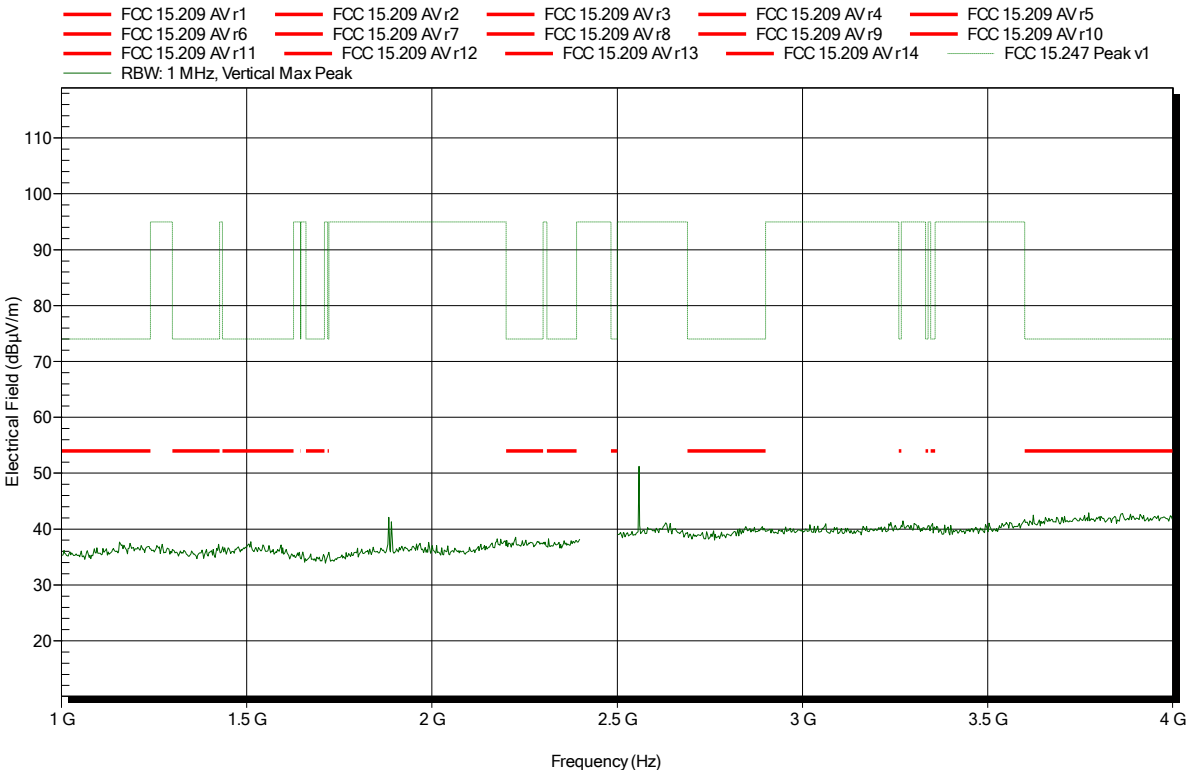


Spurious emissions according to FCC 15.247

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

Index 13

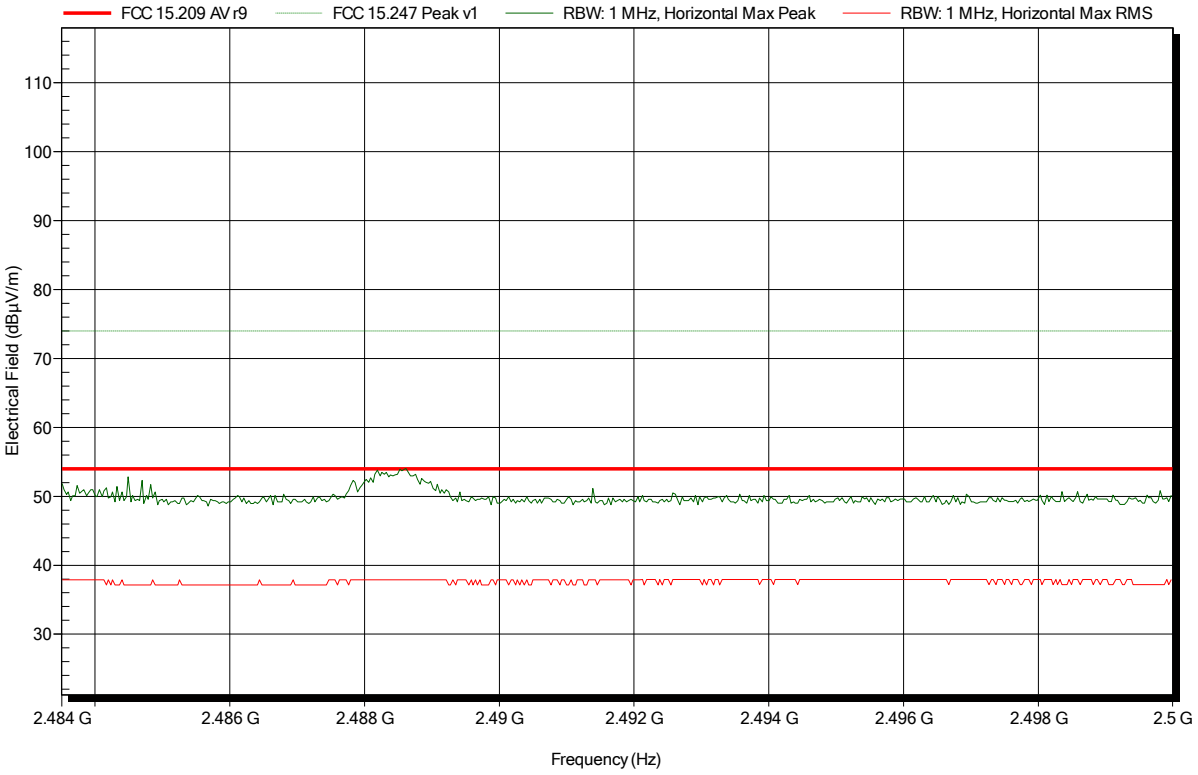


Spurious emissions according to FCC 15.247

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

Index 27

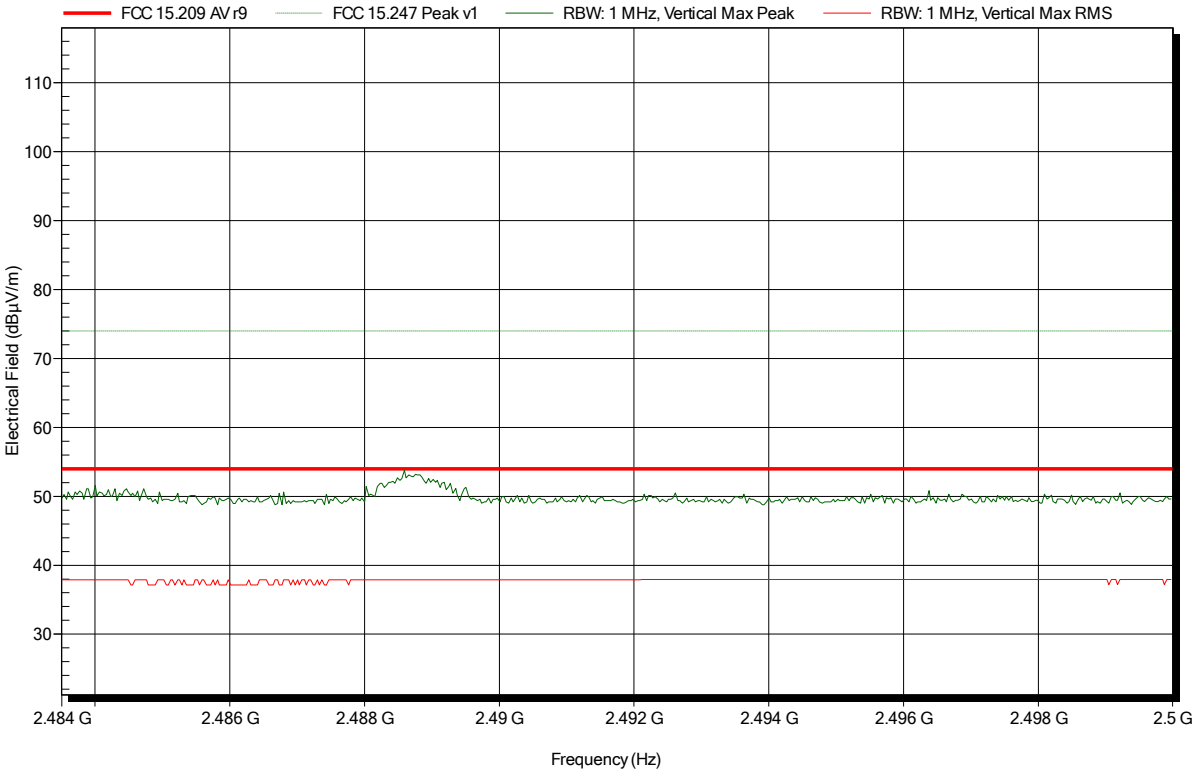


Spurious emissions according to FCC 15.247

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

Index 14

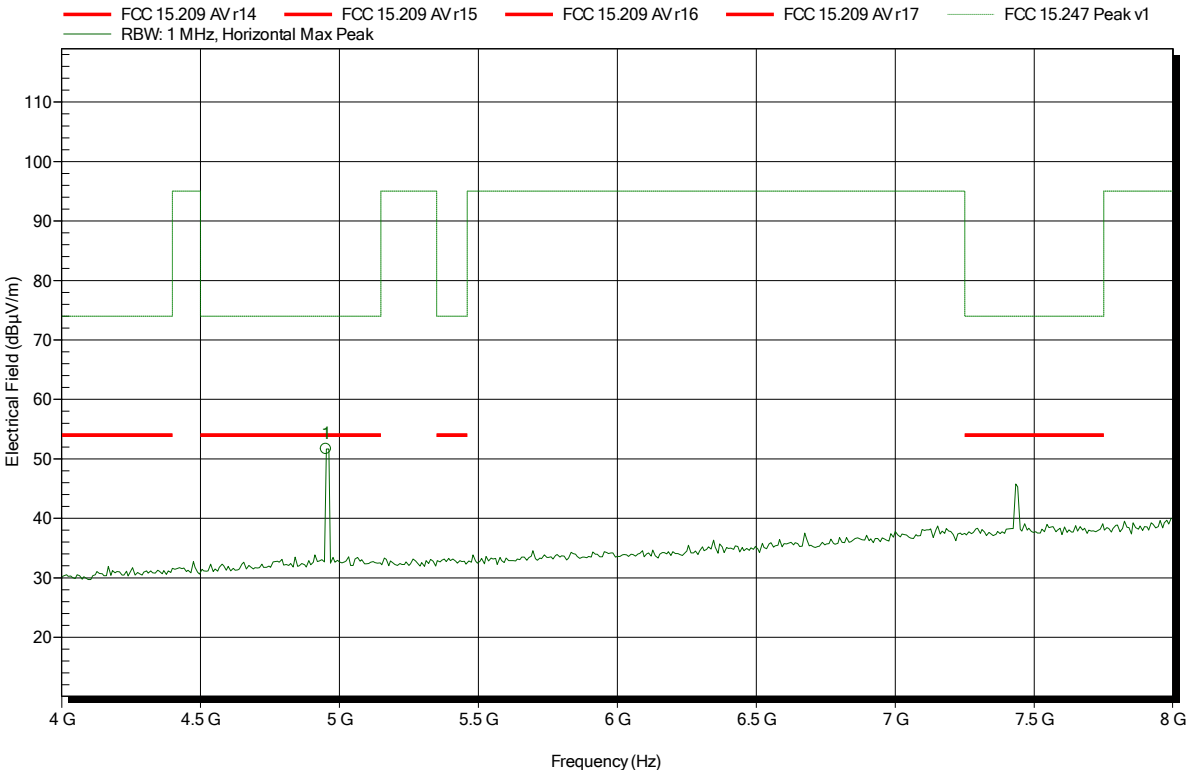


Spurious emissions according to FCC 15.247

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

Index 28



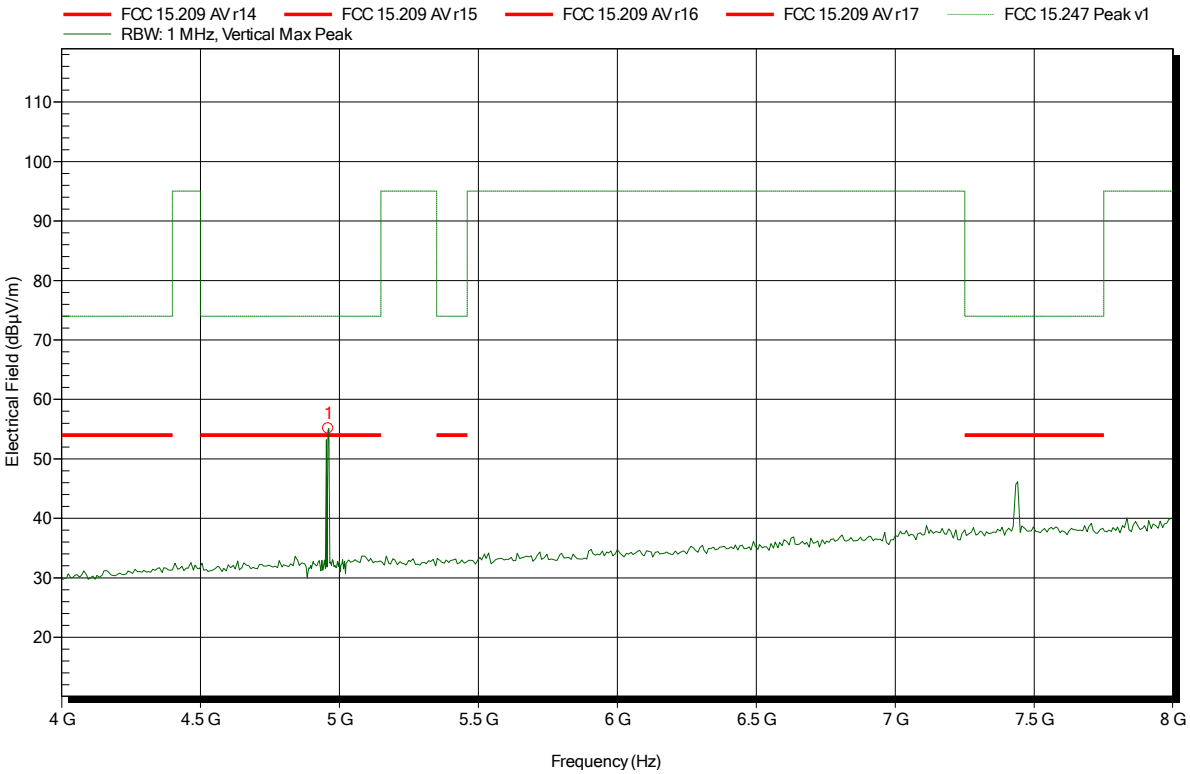
Frequency	Peak	Peak Limit	Peak Difference	Status
4.952 GHz	51.67 dBµV/m	74 dBµV/m	-22.33 dB	Pass

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.39, 2480 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

Index 15



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

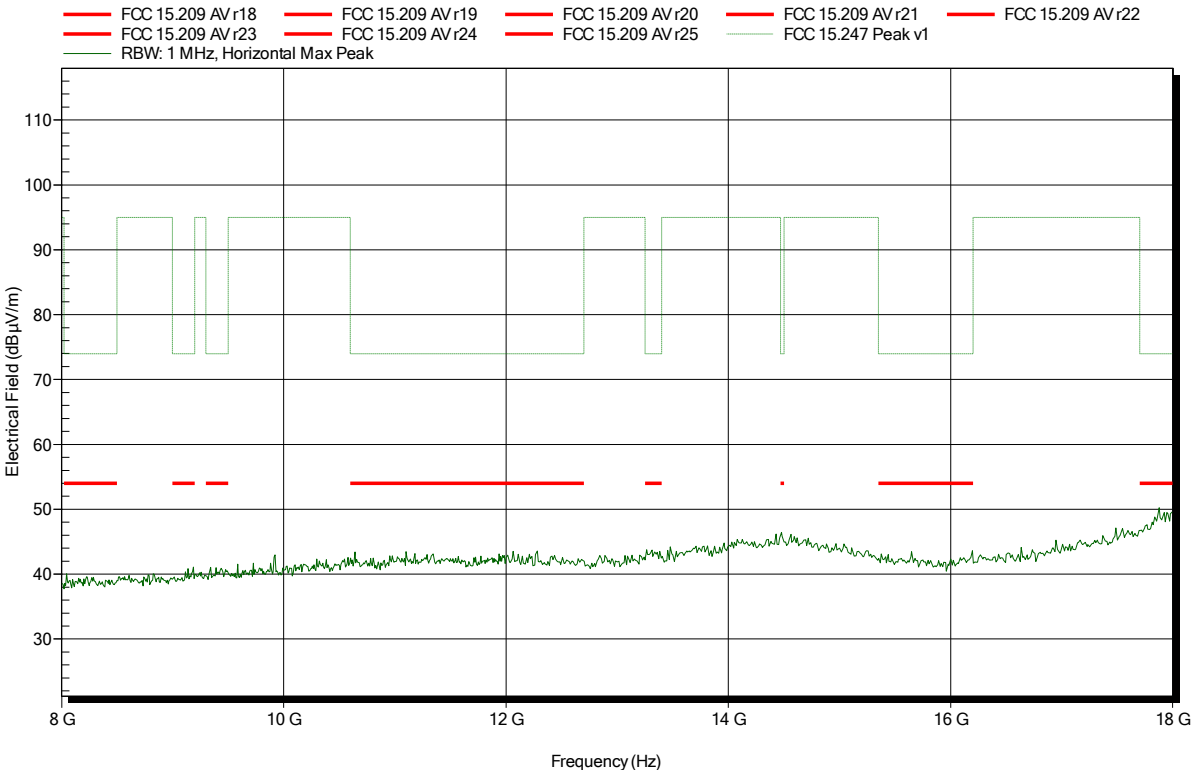
Frequency	Average	Average Limit	Average Difference	Average Status
4.96 GHz	53.34 dBµV/m	54 dBµV/m	-0.66 dB	Pass

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.39, 2480 MHz
Test Date:	2016-03-02
Note:	Power Setting = -4 dBm, Modulated

Index 29

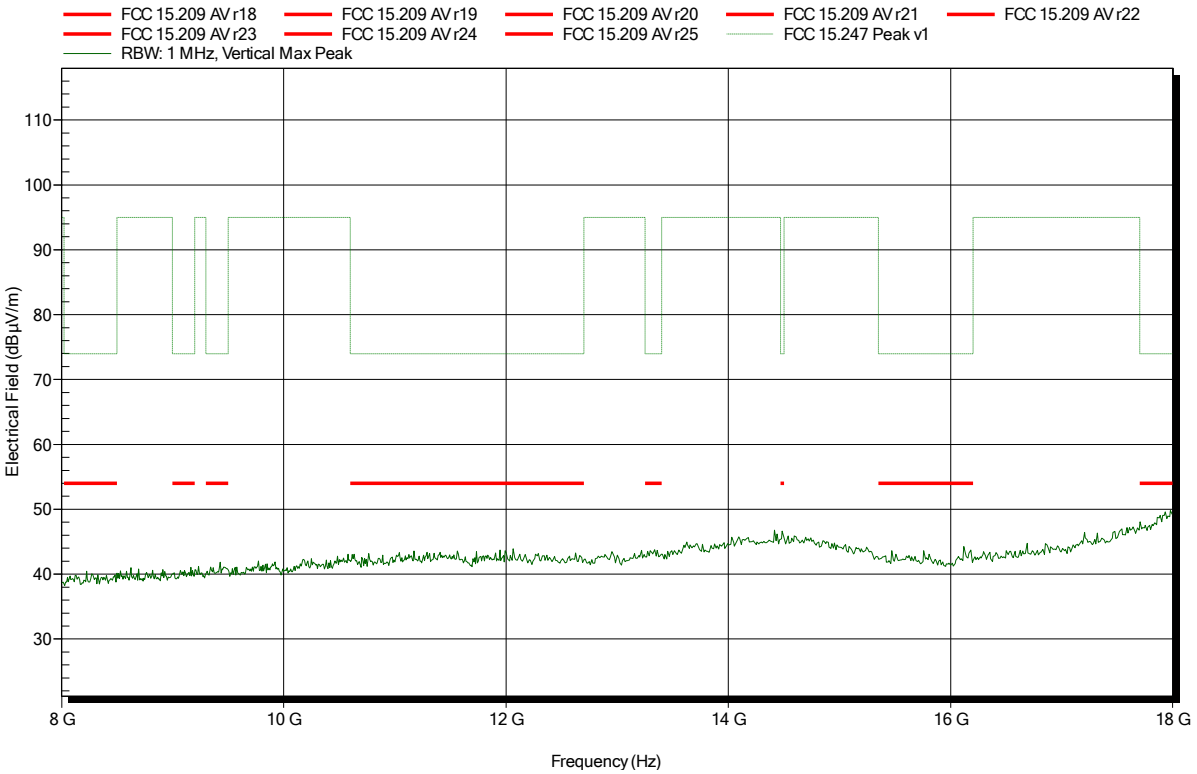


Spurious emissions according to FCC 15.247

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

Index 16

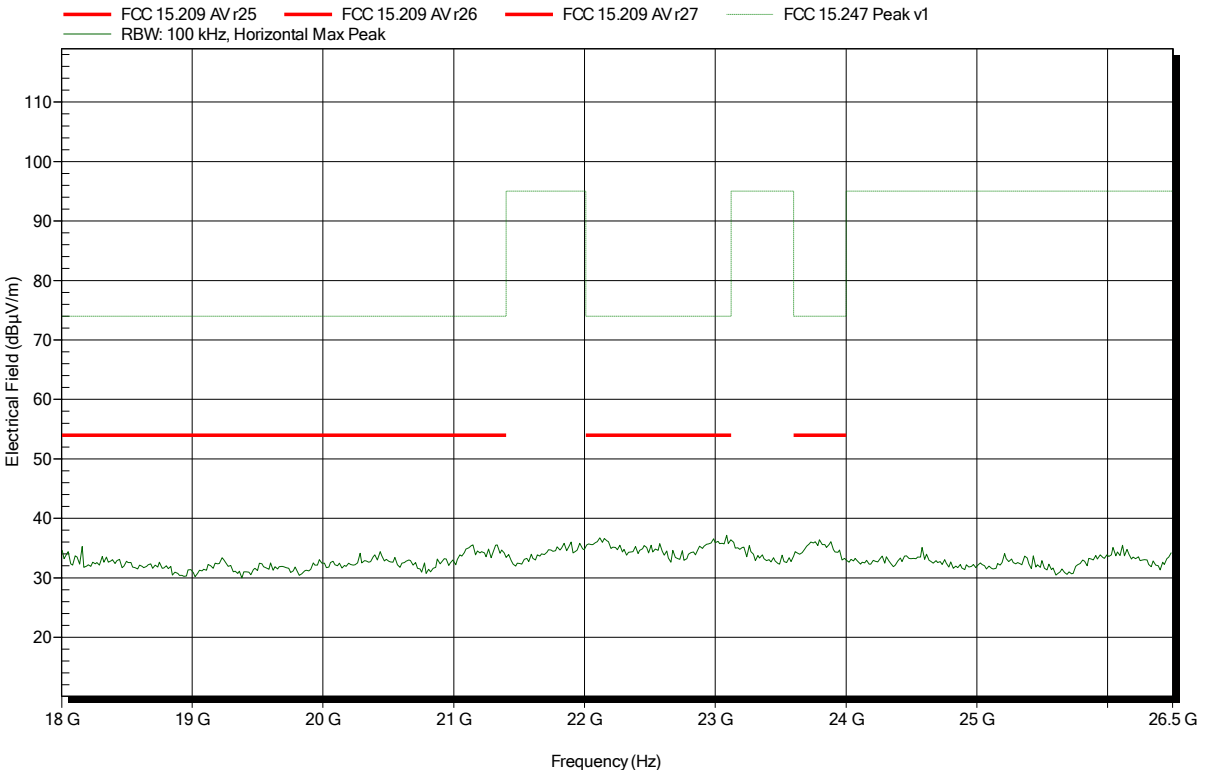


Spurious emissions according to FCC 15.247

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

Index 37



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

Index 40