eurofins | Product Service

RADIO REPORT

FCC 47 CFR Part 15C
ISED Canada RSS-247

Digital transmission systems operating within the 2400 – 2483.5 MHz band

Report Reference No	G0M-1707-6706-TFC247BL-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Test Firm Designation Number: DE0008 IC Testing Laboratory site: 3470A-2
Applicant	Kinematics GmbH
Address	Spreeallee 2 16321 Bernau bei Berlin GERMANY
Test Specification	According to FCC/ISED rules
Standard	47 CFR Part 15C RSS-247, Issue 2, 2017-02
Non-Standard Test Method	None
Test Scope	Full compliance test
Equipment under Test (EUT):	
Product Description	Energy module with haptical user interface + bluetooth interface for toy building set
Model(s)	Powerbrain 2IM.1PB.300
Additional Model(s)	None
Brand Name(s)	TinkerBots
Hardware Version(s)	2IM.1PB.300
Software Version(s)	Powerbrain Version 0.1
FCC-ID	2AFV5-TB1701
IC	20598-TB1701
Test Result	**PASSED**

Possibe test case verdicts:		
required by standard but not tested		N/T
not required by standard		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		2017-07-20
Report:		
Compiled by	Wilfried Treffke	
Tested by (+ signature) (Responsible for Test)	Wilfried Treffke	
Approved by (+ signature) (Head of Lab)	Christian Weber	
Date of Issue	2017-08-23	
Total number of pages	85	
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 History			
Version	Issue Date	Remarks	Revised By
01	2017-08-23	Initial Release	

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
RBW	Resolution bandwidth
RMS	Root mean square
VBW	Video bandwidth
V_{NOM}	Nominal supply voltage

REPORT INDEX

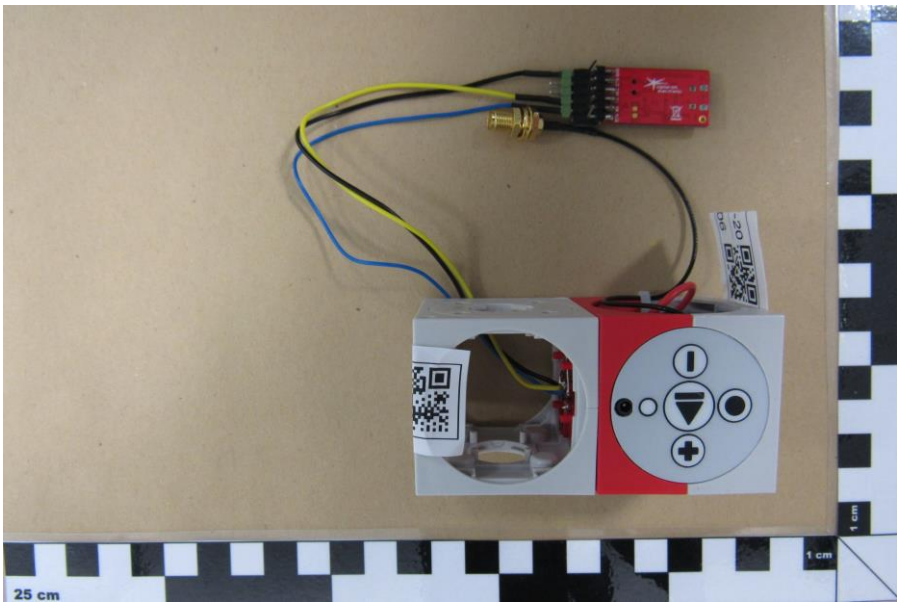
1 Equipment (Test Item) Under Test 6
1.1 Photos – Equipment External 7
1.2 Photos – Equipment Internal 10
1.3 Photos – Test Setup 11
1.4 Support Equipment 12
1.5 Test Modes 13
1.6 Test Frequencies 14
1.7 Sample emission level calculation 15
2 Result Summary 16
3 Test Conditions and Results 17
3.1 Test Conditions and Results - Occupied bandwidth 17
3.2 Test Conditions and Results - 6 dB bandwidth 22
3.3 Test Conditions and Results - Maximum peak conducted output power 27
3.4 Test Conditions and Results - Power spectral density 28
3.5 Test Conditions and Results - Band-edge compliance 32
3.6 Test Conditions and Results - Conducted spurious emissions 35
3.7 Test Conditions and Results - Transmitter radiated emissions 39
3.8 Test Conditions and Results - Receiver radiated emissions 42

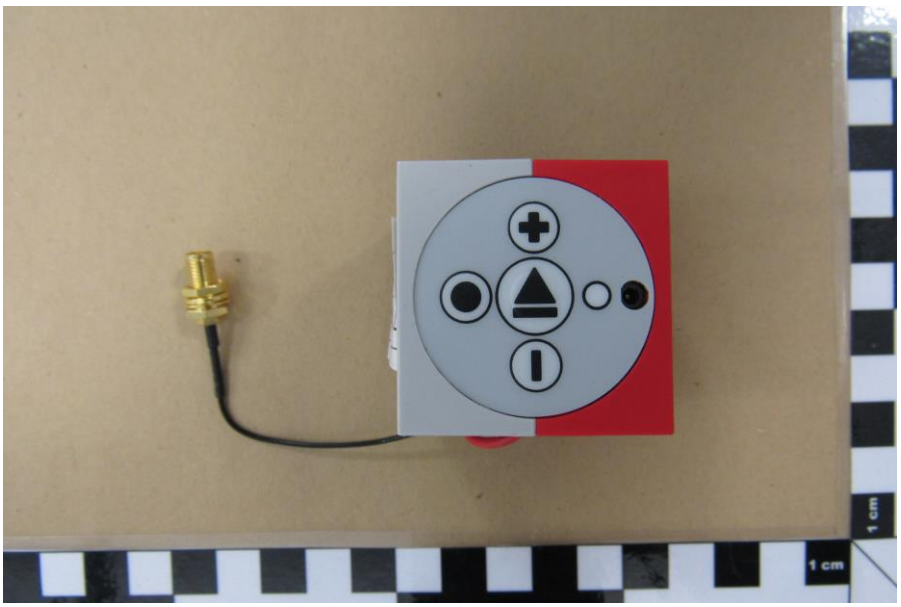
ANNEX A Transmitter spurious emissions 44
ANNEX B Receiver spurious emissions 76

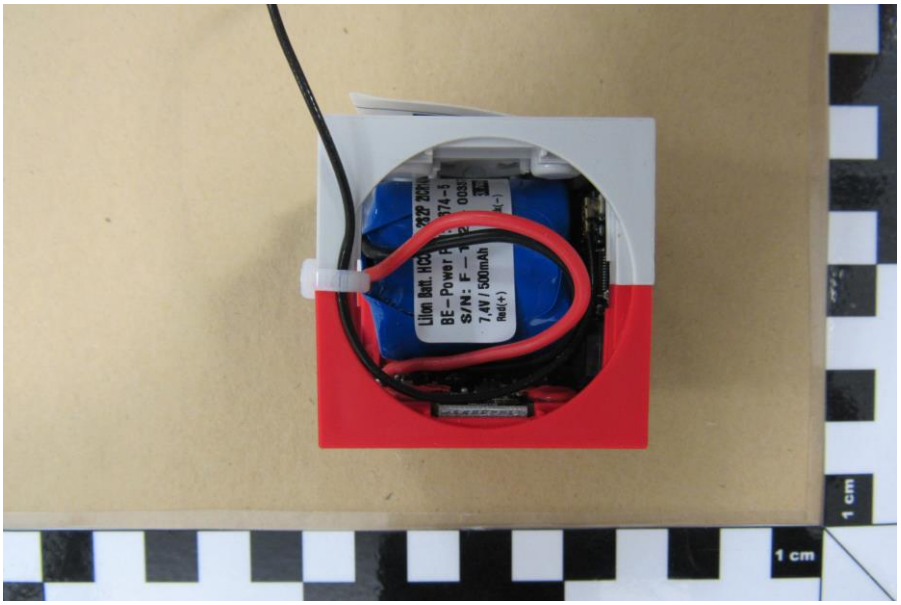
1 Equipment (Test Item) Under Test

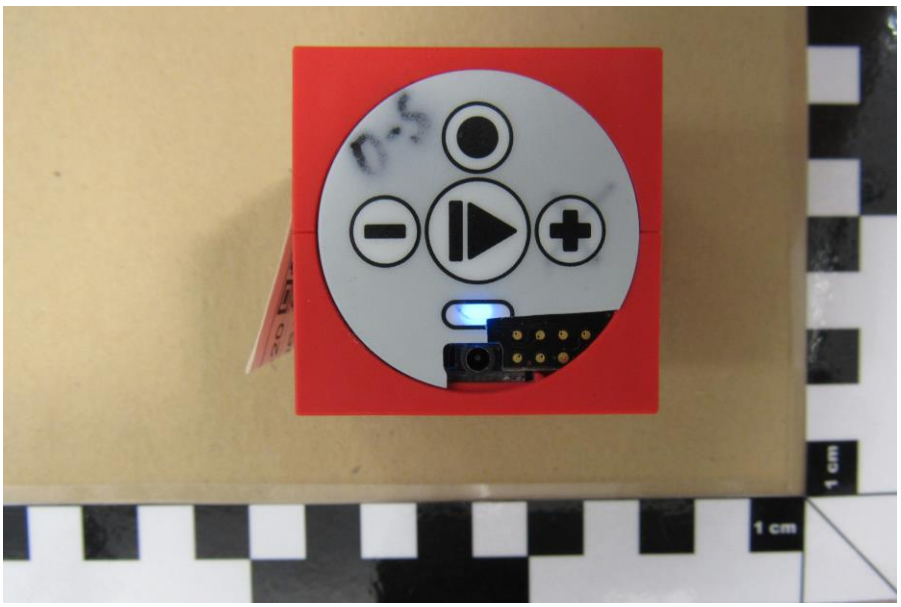
Description	Energy module with haptical user interface + bluetooth interface for toy building set	
Model	Powerbrain 2IM.1PB.300	
Additional Model(s)	None	
Brand Name(s)	TinkerBots	
Serial Number(s)	None	
Hardware Version(s)	2IM.1PB.300	
Software Version(s)	Powerbrain Version 0.1	
PMN	TINKERBOTS	
HVIN	TB1701	
FVIN	N/A	
HMN	N/A	
FCC-ID	2AFV5-TB1701	
IC	20598-TB1701	
Equipment type	End Product	
Radio type	Transceiver	
Assigned frequency bands	2400 - 2483.5 MHz	
Radio technology	Bluetooth LE	
Modulation	GFSK	
Number of antenna ports	1	
Antenna	Type	PCB Antenna
	Model	PCB
	Manufacturer	Kinematics GmbH
	Gain	0 dBi (manufacturer declaration)
Supply Voltage	V_{NOM}	7.2 VDC
Operating Temperature	T_{NOM}	25 °C
AC/DC-Adaptor	Model	HNP06-090L6
	Vendor	HN Electronics Component GmbH
	Input	100 – 240 VAC
	Output	9.0 V DC
Manufacturer	Grünwald Electronic GmbH Ringbahnstraße 123 12103 Berlin Germany	

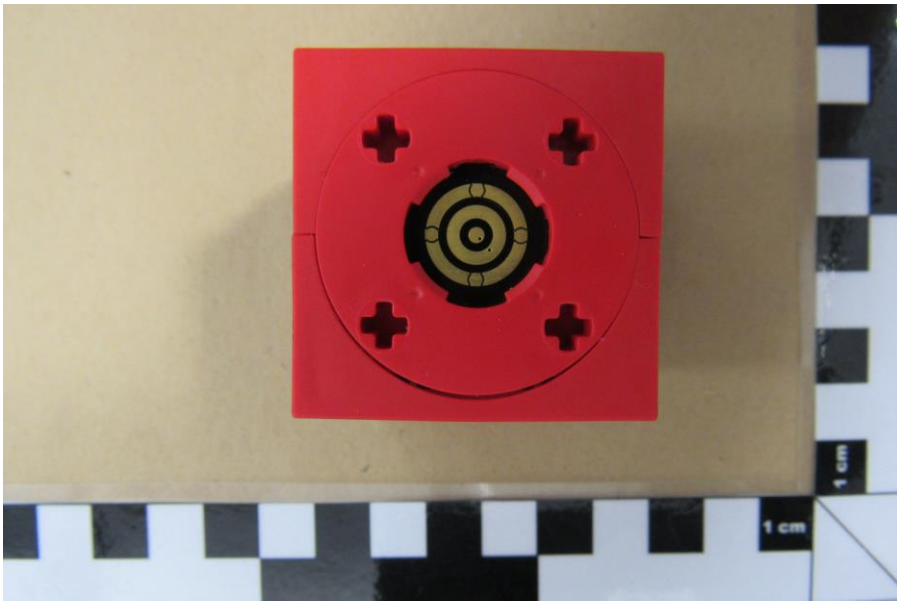
1.1 Photos – Equipment External

Overview Conducted Sample with Program Interface


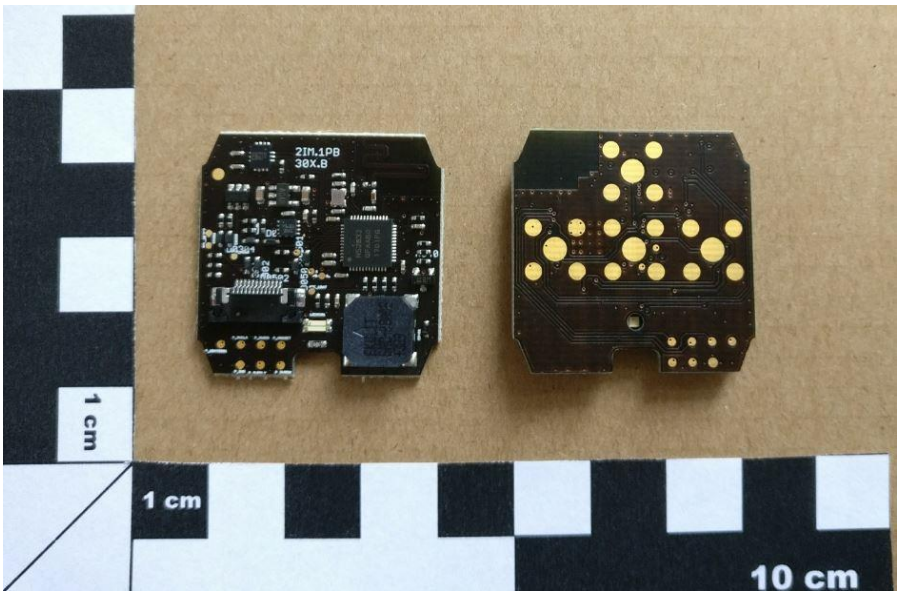
EUT Conducted Top


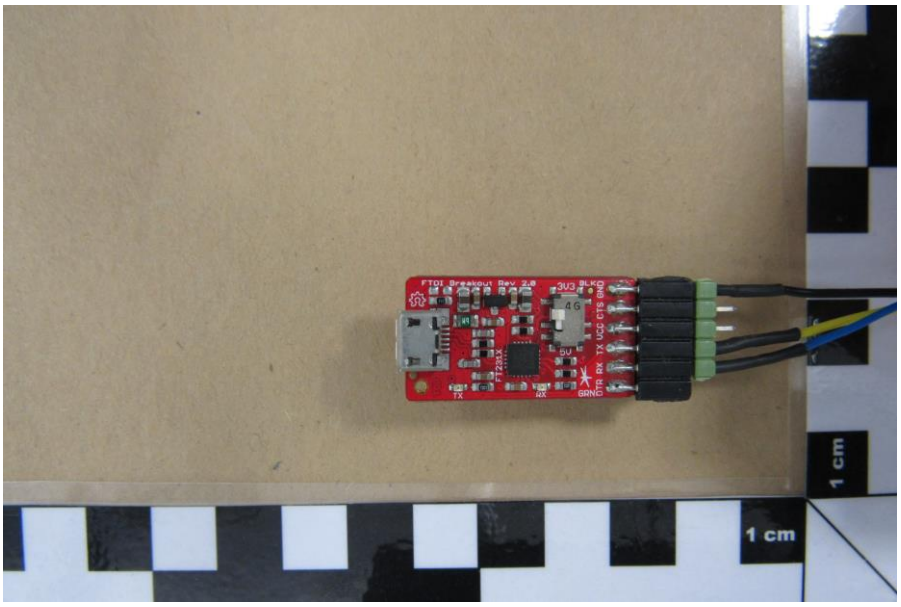
EUT Conducted Open


EUT Radiated Top


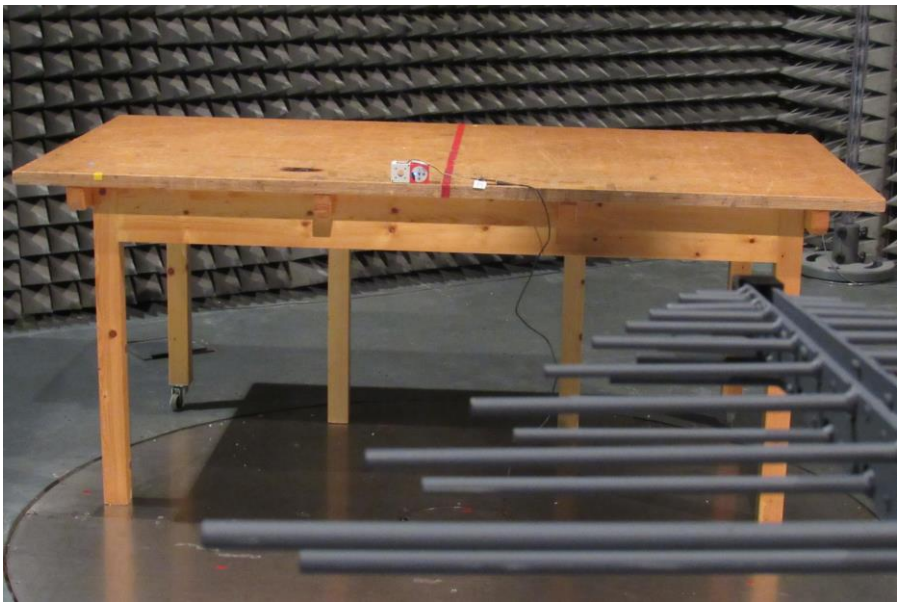
EUT Radiated Bottom


1.2 Photos – Equipment Internal

PCB Front and Back


Program Interface


1.3 Photos – Test Setup

Radiated Test Setup


1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Laptop	Dell	Latitude E6420	S/N HPJ4R1
Description:				
AE	Auxillary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
Comment:				

1.5 Test Modes

Mode	Description
GFSK	Mode = Transmit Modulation = GFSK Spreading = None Duty cycle = 100%
Receive	Mode = Receive
Comment:	

1.6 Test Frequencies

Designator	Mode	Channel	Frequency [MHz]
F1	Tx / Rx	0	2402
F2	Tx / Rx	19	2440
F3	Tx / Rx	39	2480

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 Standard Reference	**Requirement**	**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	6 dB 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	
FCC § 15.207 ISED RSS-247 § 3.1	AC power line conducted emissions	ANSI C63.10	N/R	No transitions during charging
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-GEN § 8.9	Transmitter radiated spurious emissions	ANSI C63.10	PASS	
ISED RSS-247 § 3.1	Receiver radiated spurious emissions	ANSI C63.10	PASS	
Comment:				

Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

3 Test Conditions and Results

3.1 Test Conditions and Results - Occupied bandwidth

3.1.1 Information

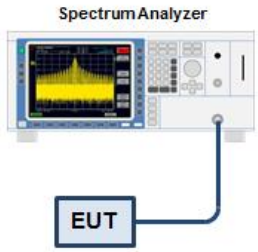
Test Information	
Reference	ISED RSS-Gen 6.6
Measurement Method	ANSI C63.10 6.9.3
Operator	Wilfried Treffke
Date	2017-07-25

3.1.2 Limits

Limits
None (Informational only)

3.1.3 Setup

Test Setup



3.1.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSW 43	EF00896	2017-01	2017-07

3.1.5 Procedure

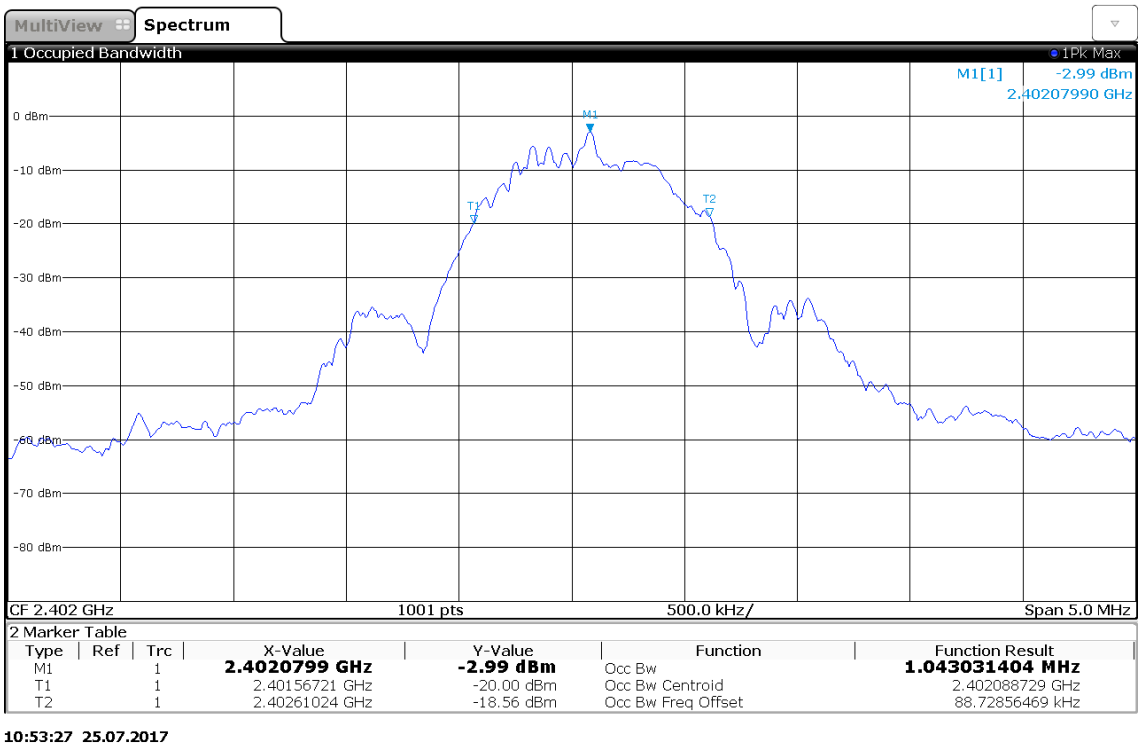
Test Procedure
1. EUT transmitter is activated in test mode under normal conditions
2. The spectrum analyzer is set to peak detection and maximum hold with a span twice the emission spectrum
3. The resolution bandwidth is set to 1 % of the bandwidth
4. The occupied bandwidth is measured with the build-in analyzer function

3.1.6 Results

Test Results		
Mode	Frequency [MHz]	Bandwidth [MHz]
GFSK	2402	1.043
GFSK	2440	1.048
GFSK	2480	1.049

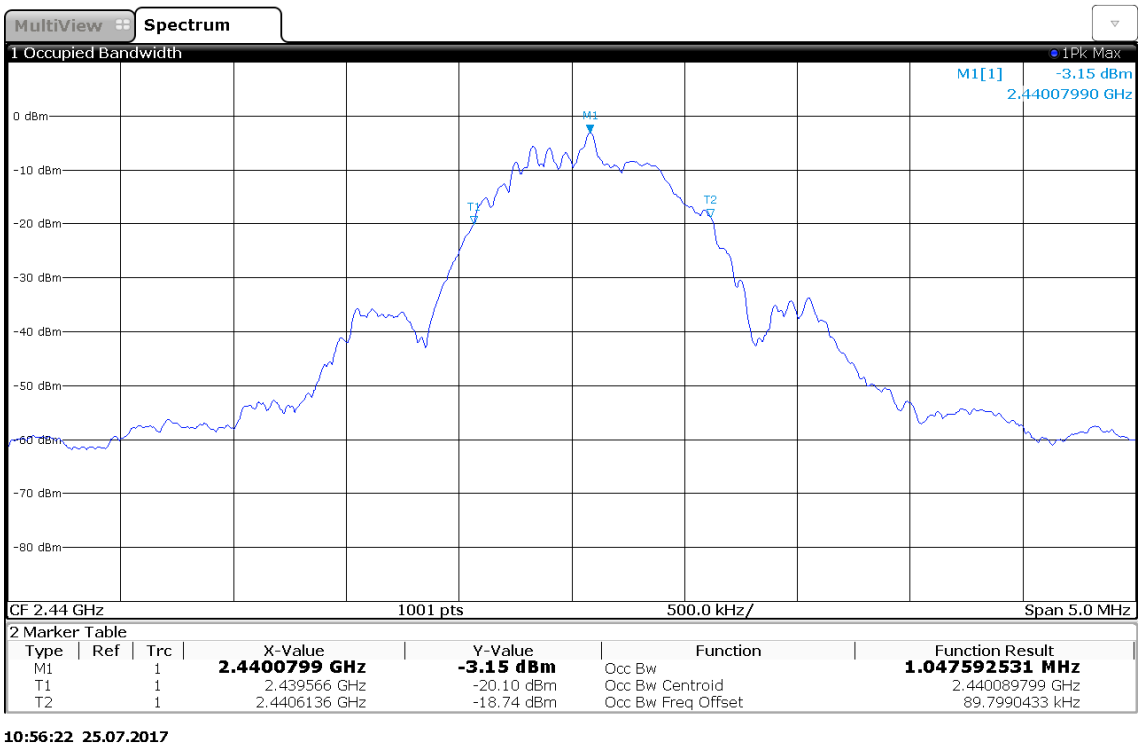
Occupied Bandwidth

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Occupied Bandwidth [MHz]:	1.043



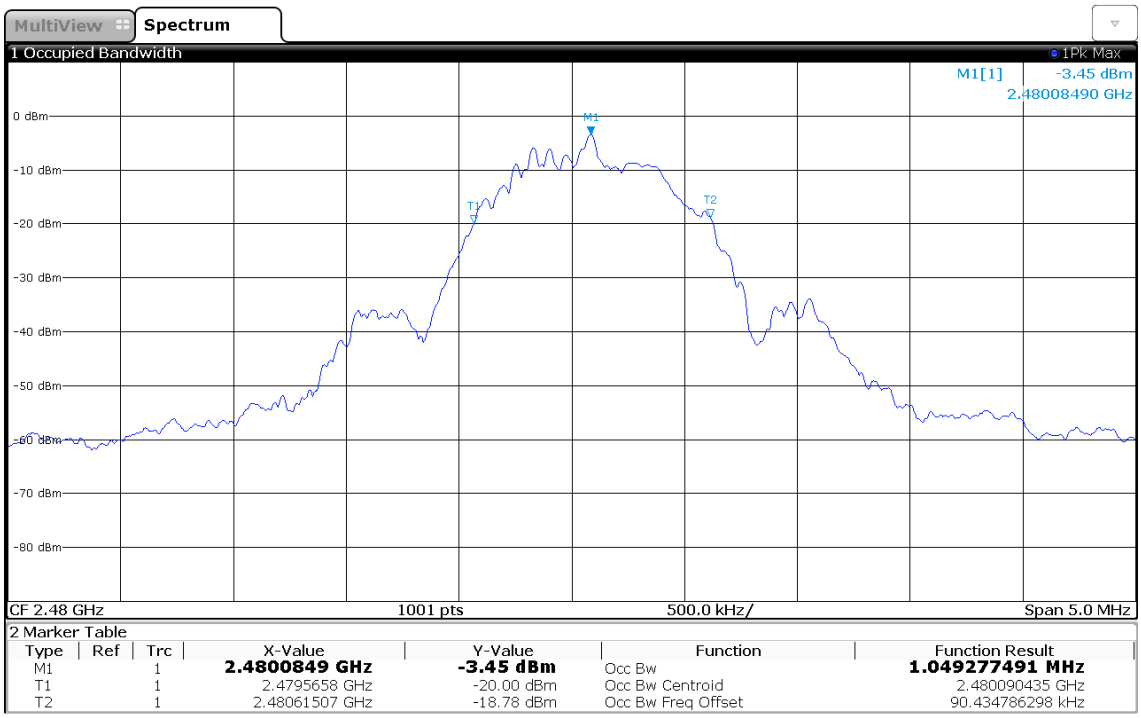
Occupied Bandwidth

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Occupied Bandwidth [MHz]:	1.048



Occupied Bandwidth

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Occupied Bandwidth [MHz]:	1.049



3.2 Test Conditions and Results - 6 dB bandwidth

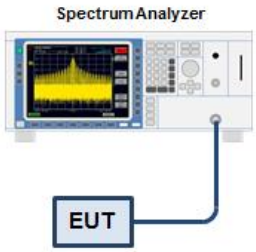
3.2.1 Information

Test Information	
Reference	FCC 15.247(a)(2) / ISED RSS-247 5.2
Measurement Method	ANSI C63.10 11.8
Operator	Wilfried Treffke
Date	2017-07-25

3.2.2 Limits

Limits
≥ 500kHz

3.2.3 Setup

Test Setup


3.2.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSW 43	EF00896	2017-01	2017-07

3.2.5 Procedure

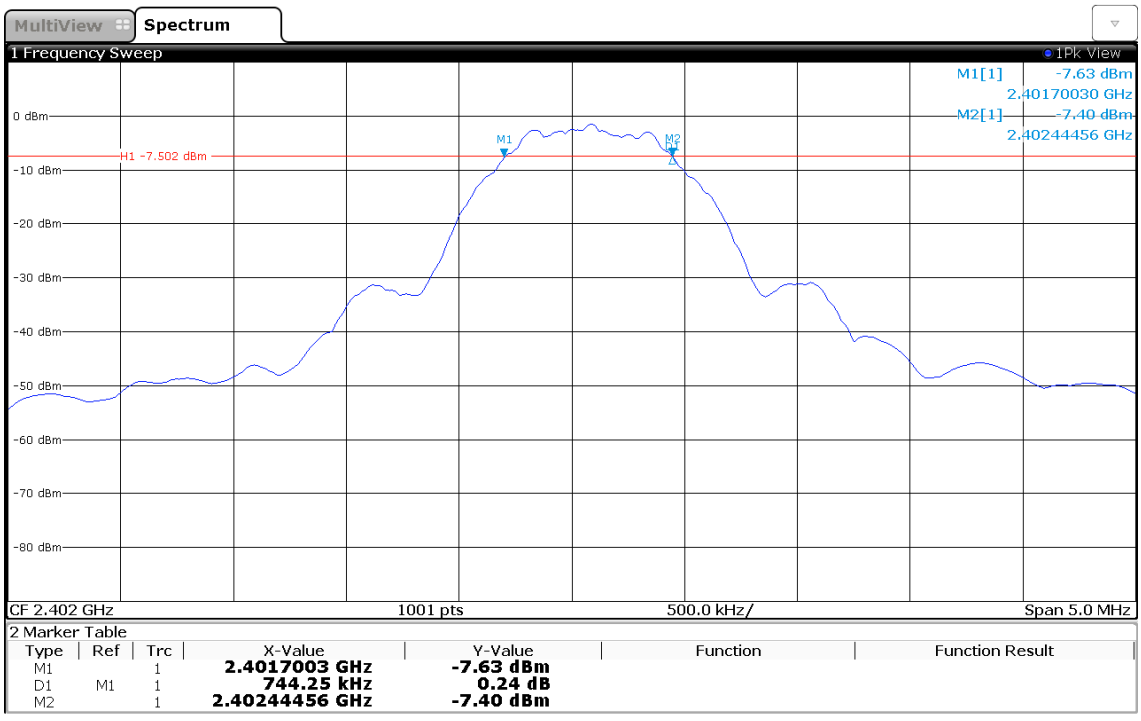
Test Procedure
1. EUT set to test mode 2. Span set to at least twice the emission spectrum 3. Detector set to peak and max hold and RBW is set to 100 kHz 4. Envelope peak value of emission spectrum is selected 5. Marker on envelope of spectrum is set to level of -6 dB to the left of the peak 6. Marker 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

3.2.6 Results

Test Results				
Mode	Frequency [MHz]	Bandwidth [kHz]	Limit [kHz]	Verdict
GFSK	2402	744	500	PASS
GFSK	2440	714	500	PASS
GFSK	2480	744	500	PASS

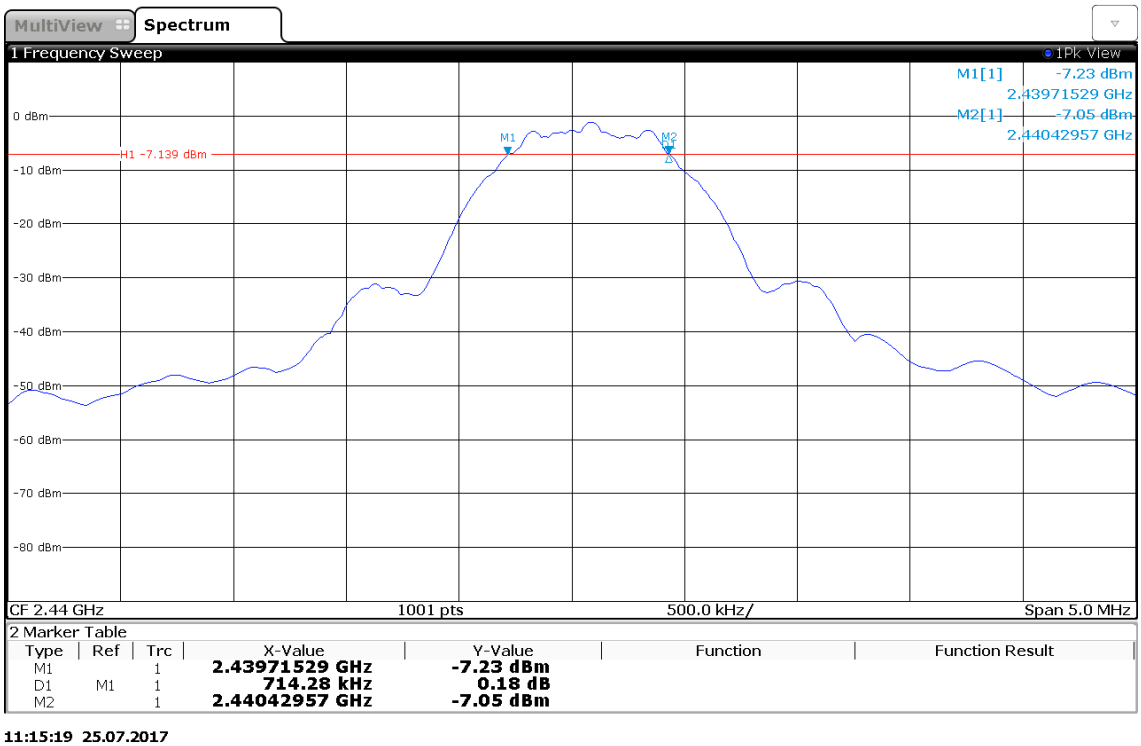
DTS (6 dB) Bandwidth

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Lower Frequency [MHz]:	2401.700
Upper Frequency [MHz]:	2402.445
6 dB Bandwidth [kHz]:	744



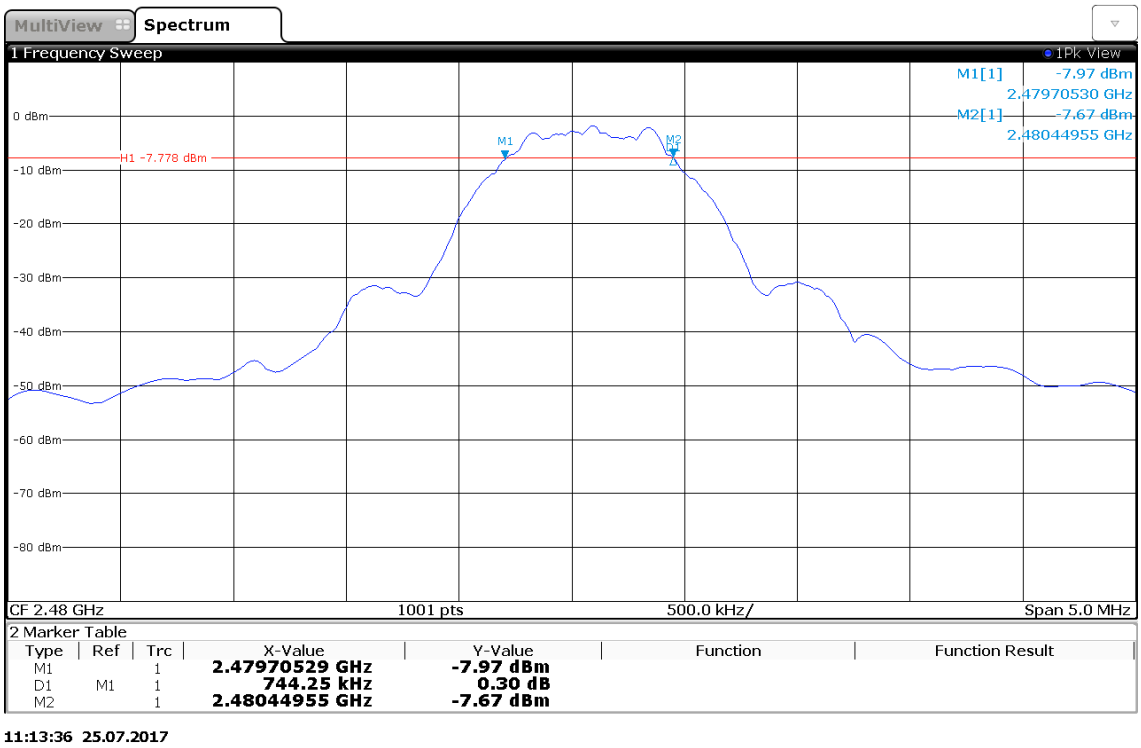
DTS (6 dB) Bandwidth

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Lower Frequency [MHz]:	2439.715
Upper Frequency [MHz]:	2440.430
6 dB Bandwidth [kHz]:	714



DTS (6 dB) Bandwidth

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Lower Frequency [MHz]:	2479.705
Upper Frequency [MHz]:	2480.450
6 dB Bandwidth [kHz]:	744



3.3 Test Conditions and Results - Maximum peak conducted output power

3.3.1 Information

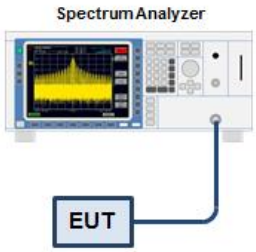
Test Information	
Reference	FCC 15.247(b)(1) / ISED RSS-247 5.4
Measurement Method	ANSI C63.10 11.9.1
Operator	Wilfried Treffke
Date	2017-07-25

3.3.2 Limits

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.

3.3.3 Setup

Test Setup



3.3.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSW 43	EF00896	2017-01	2017-07

3.3.5 Procedure

Test Procedure

1. EUT set to test hopping mode (Communication tester is used if needed)
2. Analyzer resolution bandwidth is set ≥ DTS bandwidth
3. Detector set to peak and max hold
4. Sweep time is set to auto
5. After the trace has stabilized a marker is set to peak of envelope

3.3.6 Results

Test Results				
Channel [MHz]	Power [dBm]	Power [W]	Limit [W]	Verdict
2402	-0.207	0.00095	1.0	PASS
2440	-0.309	0.00093	1.0	PASS
2480	-0.581	0.00087	1.0	PASS

3.4 Test Conditions and Results - Power spectral density

3.4.1 Information

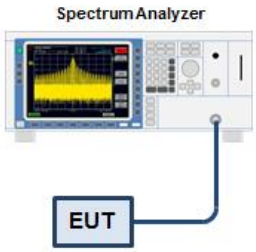
Test Information	
Reference	FCC 15.247(e) / ISED RSS-247 5.2
Measurement Method	ANSI C63.10 11.10.2, 14.3.2
Operator	Wilfried Treffke
Date	2017-07-25

3.4.2 Limits

Limits
8 dBm / 3 kHz

3.4.3 Setup

Test Setup



3.4.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSW 43	EF00896	2017-01	2017-07

3.4.5 Procedure

Test Procedure

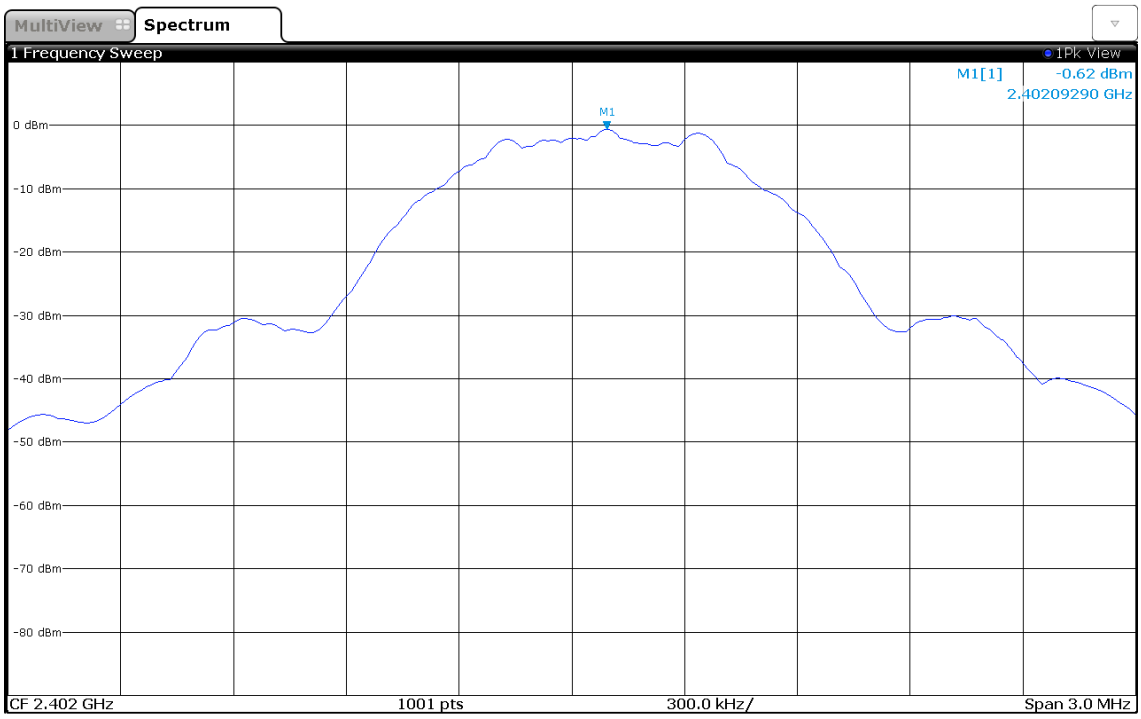
1. EUT set to test mode
2. The analyzer is set to DTS channel center frequency with a span of 1.5 times the DTS bandwidth
3. The RBW is set to 100 kHz with VBW ≥ RBW and the detector is set to peak with max hold
4. After the trace has stabilized a marker is set to the envelope maximum
5. If the power spectral density is above the limit the RBW is reduced (not lower than 3 kHz) and the measurement is repeated
6. If the EUT has more than one transmit chain the procedure is repeated for each transmit chain

3.4.6 Results

Test Results			
Channel [MHz]	PSD [dBm/RBW]	Limit [dBm/3kHz]	Verdict
2402	-0.615	8.0	PASS
2440	-0.517	8.0	PASS
2480	-0.920	8.0	PASS
RBW = 100 kHz			

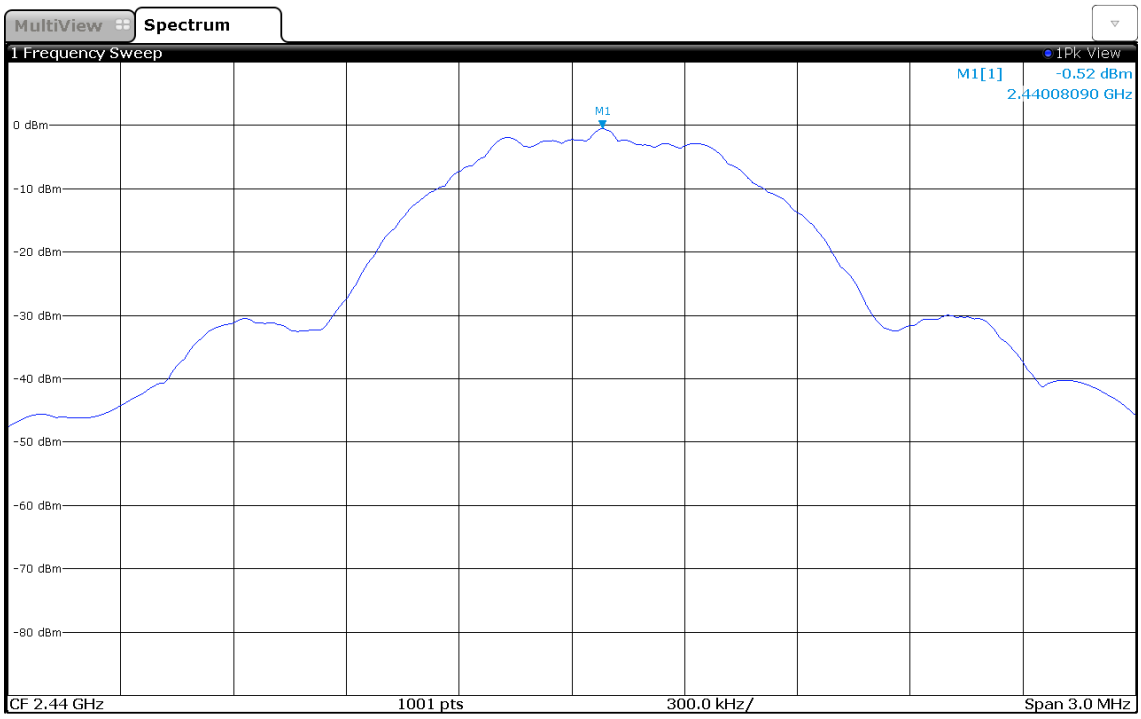
Peak Power Spectral Density

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.10.2
Operational Mode:	GFSK, Channel: 0, 2402 MHz
Operating Conditions:	Tnom/Vnom
Operator:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Peak Frequency [MHz]:	2402.093
Spectral Density [dBm/RBW]:	-0.615
Resolution Bandwidth [kHz]:	100 kHz



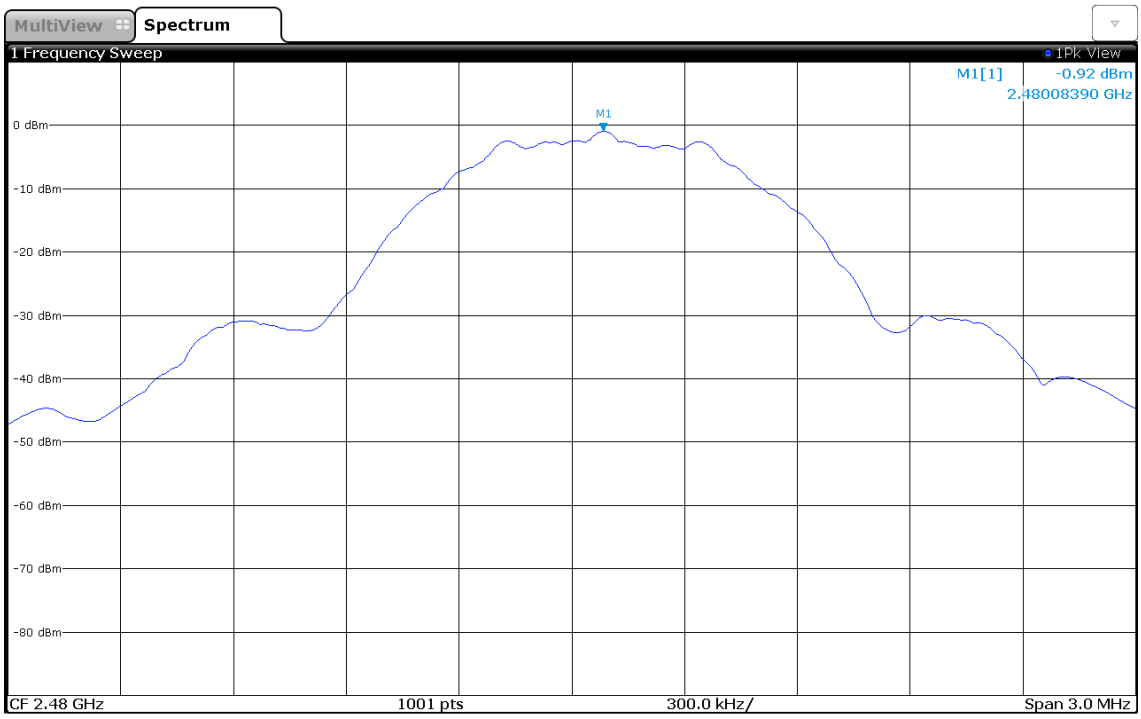
Peak Power Spectral Density

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.10.2
Operational Mode:	GFSK, Channel: 19, 2440 MHz
Operating Conditions:	Tnom/Vnom
Operator:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Peak Frequency [MHz]:	2440.081
Spectral Density [dBm/RBW]:	-0.517
Resolution Bandwidth [kHz]:	100 kHz



Peak Power Spectral Density

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.10.2
Operational Mode:	GFSK, Channel: 39, 2480 MHz
Operating Conditions:	Tnom/Vnom
Operator:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Peak Frequency [MHz]:	2480.084
Spectral Density [dBm/RBW]:	-0.920
Resolution Bandwidth [kHz]:	100 kHz



3.5 Test Conditions and Results - Band-edge compliance

3.5.1 Information

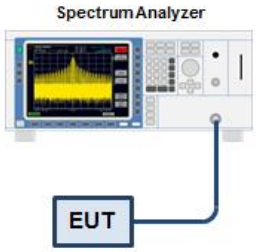
Test Information	
Reference	FCC 15.247(d) / ISED RSS-247 5.5
Measurement Method	ANSI C63.10 11.13
Operator	Wilfried Treffke
Date	2017-07-25

3.5.2 Limits

Limits	
Power Measurement	Out-of-band attenuation [dB]
Peak	20
RMS	30

3.5.3 Setup

Test Setup



3.5.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSW 43	EF00896	2017-01	2017-07

3.5.5 Procedure

Test Procedure

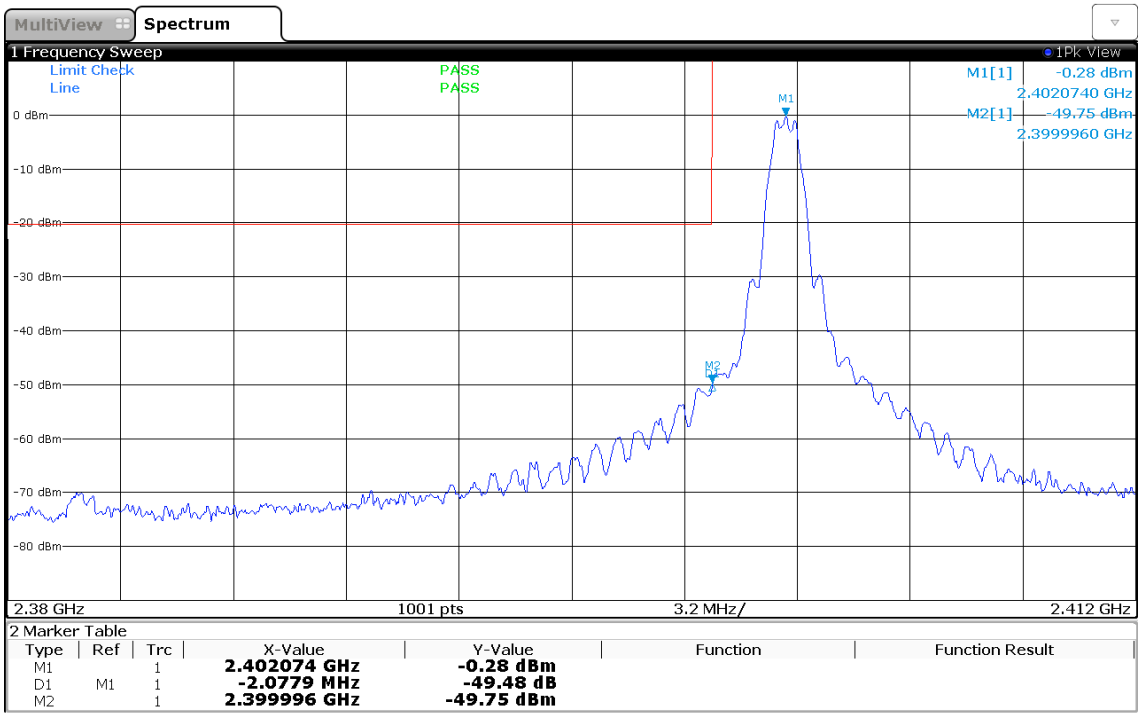
1. EUT set to test mode (Communication tester is used if needed)
2. Span set around lower band edge and detector is set to peak and max hold
3. Resolution bandwidth is set to 100 kHz
4. Markers are set to peak emission levels within frequency band and outside frequency band
5. Band edge attenuation is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

3.5.6 Results

Test Results				
Mode	Channel [MHz]	Out-of-band Attenuation [dB]	Limit [dB]	Verdict
GFSK	2402	-49.48	-20	PASS
GFSK	2480	-53.61	-20	PASS

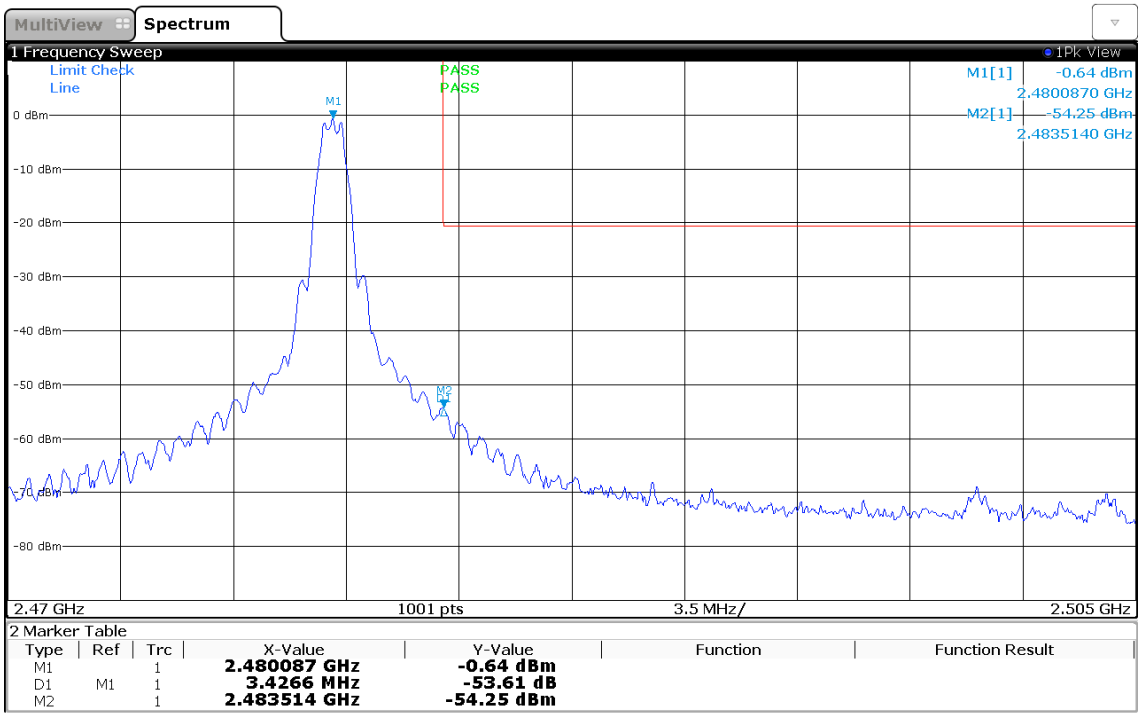
Band-edge Compliance

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Band-edge	Lower
In-band Frequency [MHz]:	2402.074
Max. in-band Level [dBm/100 kHz]:	-0.277
Out-of-band Frequency [MHz]:	2399.996
Max. out-of-band Level [dBm/100 kHz]:	-49.754
Attenuation [dB]:	-49.48



Band-edge Compliance

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Band-edge	Upper
In-band Frequency [MHz]:	2480.087
Max. in-band Level [dBm/100 kHz]:	-0.637
Out-of-band Frequency [MHz]:	2483.514
Max. out-of-band Level [dBm/100 kHz]:	-54.248
Attenuation [dB]:	-53.61



11:54:50 25.07.2017

3.6 Test Conditions and Results - Conducted spurious emissions

3.6.1 Information

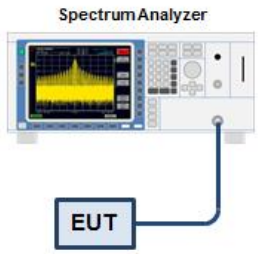
Test Information	
Reference	FCC 15.247(d) / ISED RSS-247 5.5
Measurement Method	ANSI C63.10 11.11
Operator	Wilfried Treffke
Date	2017-07-25

3.6.2 Limits

Limits	
Power Measurement	Out-of-band attenuation [dB]
Peak	20
RMS	30

3.6.3 Setup

Test Setup



3.6.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSW 43	EF00896	2017-01	2017-07

3.6.5 Procedure

Test Procedure

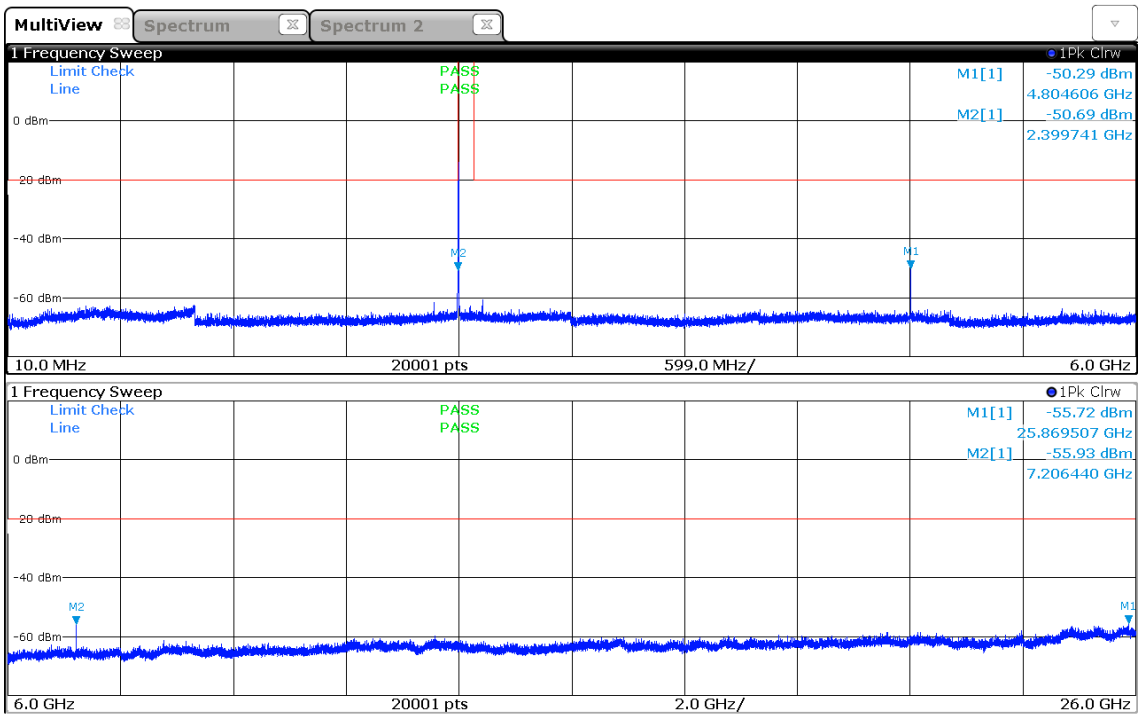
1. EUT set to test mode (Communication tester is used if needed)
2. Span set around lower band edge and detector is set to peak and max hold
3. Resolution bandwidth is set to 100 kHz
4. Markers are set to peak emission levels within frequency band and outside frequency band
5. Band edge attenuation is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

3.6.6 Results

Test Results		
Mode	Channel [MHz]	Verdict
GFSK	2402	PASS
GFSK	2440	PASS
GFSK	2480	PASS

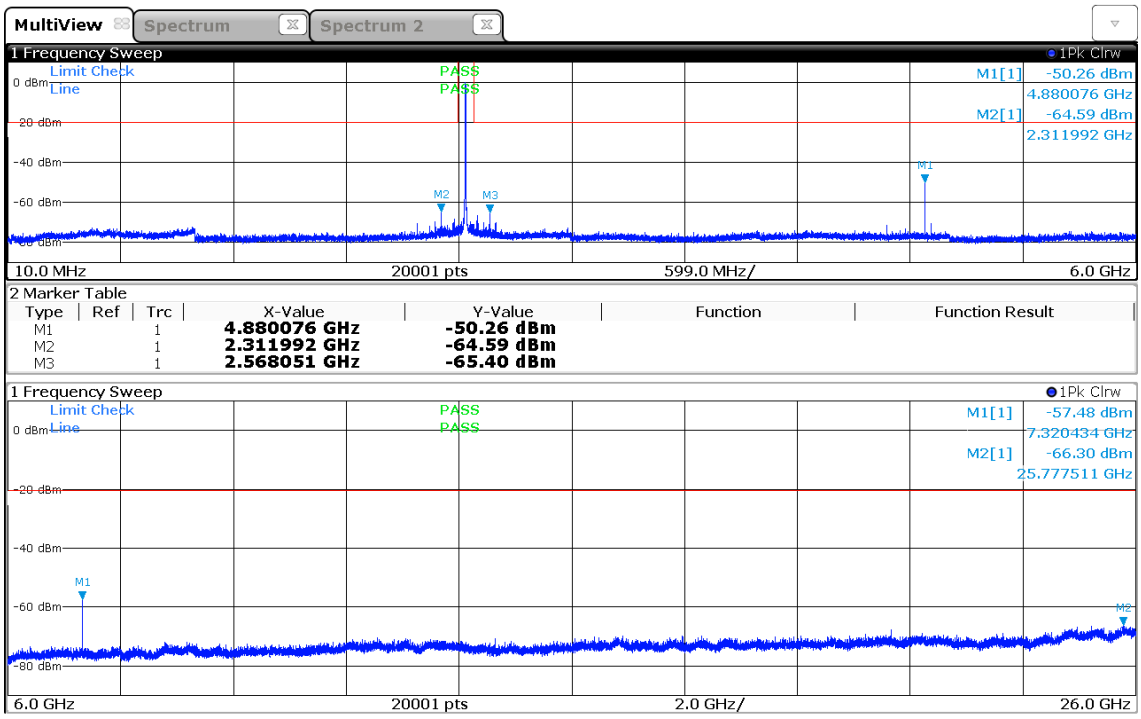
Conducted Spurious Emissions

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Max. in-band Frequency [MHz]:	2402.1
Max. in-band Level [dBm/100 kHz]:	-0.1
Out-of-band Limit [dBm/100 kHz]:	-20.1



Conducted Spurious Emissions

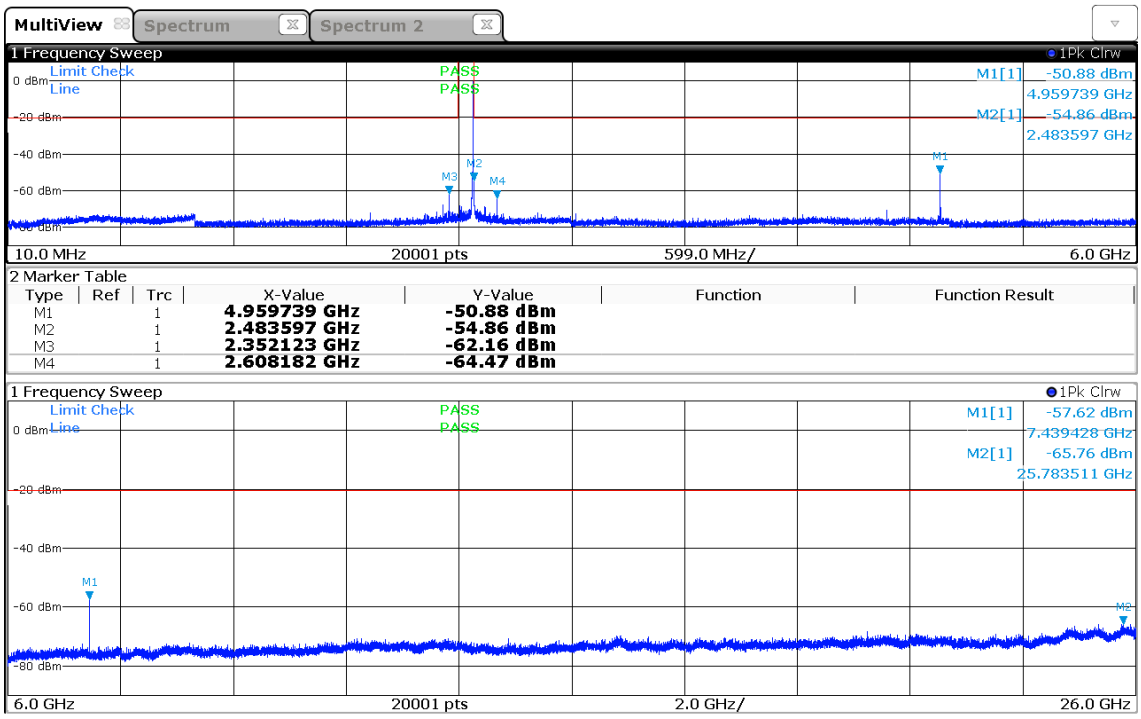
Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	GFSK, Channel: 19, 2440 MHz
Operating Conditions:	Tnom/Vnom
Operator:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Max. in-band Frequency [MHz]:	2440.1
Max. in-band Level [dBm/100 kHz]:	-0.3
Out-of-band Limit [dBm/100 kHz]:	-20.3



12:47:27 25.07.2017

Conducted Spurious Emissions

Project Number:	G0M-1707-6706
Applicant	Kinematics GmbH
Model Description	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Sample ID:	14370
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:	W. Treffke
Test Site:	Eurofins Product Service GmbH
Test Date:	2017-07-25
Max. in-band Frequency [MHz]:	2480.1
Max. in-band Level [dBm/100 kHz]:	-0.5
Out-of-band Limit [dBm/100 kHz]:	-20.5



3.7 Test Conditions and Results - Transmitter radiated emissions

3.7.1 Information

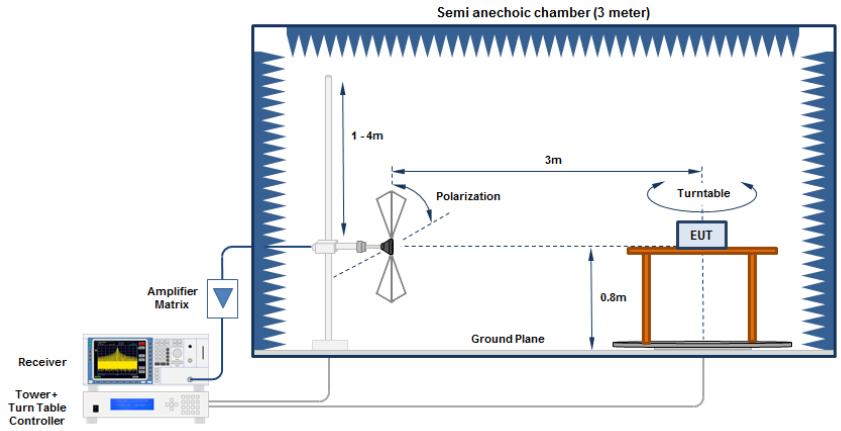
Test Information	
Reference	FCC 15.247(d) / ISED RSS-GEN 8.9
Measurement Method	ANSI C63.10 6.4, 6.5, 6.6, 11.12
Operator	Wilfried Treffke
Date	2017-07-25

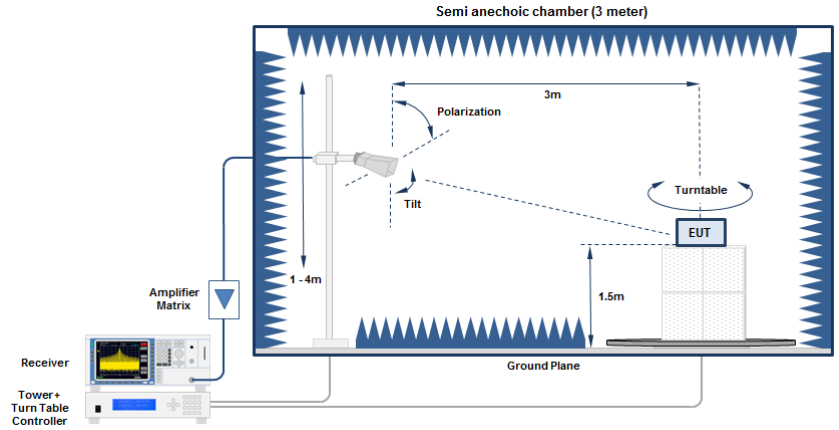
3.7.2 Limits

Limits			
Frequency [MHz]	Detector	Field strength [dBµV/m]	Measurement distance [m]
0.009 - 0.09	Average	2400/F[kHz]	300
0.09 - 0.110	Quasi-Peak	2400/F[kHz]	300
0.110 - 0.490	Average	2400/F[kHz]	300
0.490 - 1.705	Quasi-Peak	24000/F[kHz]	30
1.705 - 30.0	Quasi-Peak	30	30
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.7.3 Setup

Test Setup 30 - 1000 MHz



Test Setup > 1 GHz


3.7.4 Equipment

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2016-08	2017-08
Antenna	R&S	HK 116	EF00012	2016-05	2019-05
Antenna	R&S	HL 223	EF00212	2016-04	2019-04

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2016-08	2017-08
Antenna	R&S	BBHA 9120D	EF00018	2016-09	2019-09
Antenna	Amplifier Research	AT4560	EF00302	2017-03	2018-03

3.7.5 Procedure

Test Procedure < 30 MHz
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground 2. EUT set to test mode 3. The EUT is rotated through 360° 4. The emissions are measured with peak detector and max hold 5. All significant emissions are measured again using the corresponding final detector

Test Procedure 30 - 1000 MHz
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz	
1.	EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground
2.	EUT set to test mode
3.	The receiver is set to peak detection with max hold
4.	The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5.	All significant emissions are measured again using the corresponding final detector

3.7.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
2402	2390	50.98	pk	hor	74.00	-23.02
2402	2390	38.19	RMS	hor	54.00	-15.81
2440	4877	41.30	pk	hor	74.00	-32.70
2440	7318	45.48	pk	ver	74.00	-28.52
2440	7320	46.91	pk	hor	74.00	-27.09
2480	2483.5	54.37	pk	ver	74.00	-19.63
2480	2483.5	39.30	RMS	ver	54.00	-14.70
2480	2483.6	57.00	pk	hor	74.00	-17.00
2480	2483.6	41.80	RMS	hor	54.00	-12.20
2480	7432	48.41	pk	hor	74.00	-25.59
2480	7436	46.10	pk	ver	74.00	-27.90

3.8 Test Conditions and Results - Receiver radiated emissions

3.8.1 Information

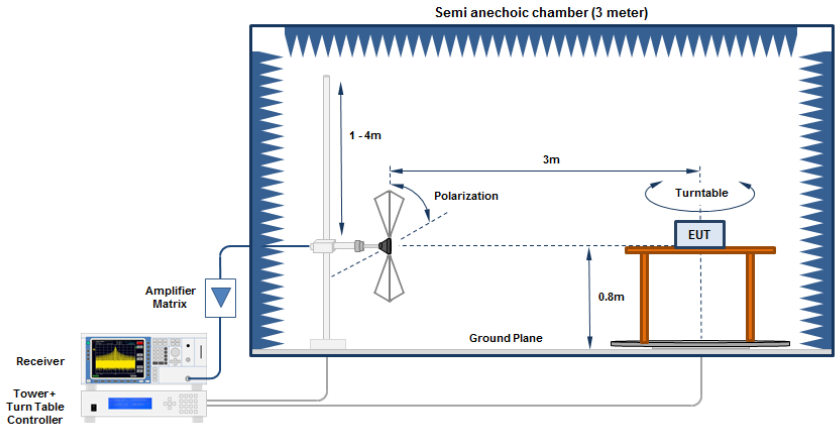
Test Information	
Reference	ISED RSS-247 3.1
Measurement Method	ANSI C63.10 6.5, 6.6, 11.12
Operator	Wilfried Treffke
Date	2017-07-25

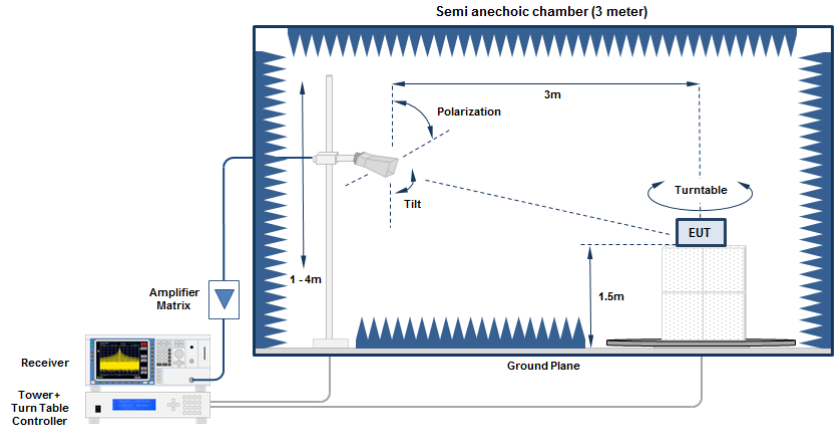
3.8.2 Limits

Limits			
Frequency [MHz]	Detector	Field strength [dBµV/m]	Measurement distance [m]
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.8.3 Setup

Test Setup 30 - 1000 MHz



Test Setup > 1 GHz


3.8.4 Equipment

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2016-08	2017-08
Antenna	R&S	HK 116	EF00012	2016-05	2019-05
Antenna	R&S	HL 223	EF00212	2016-04	2019-04

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2016-08	2017-08
Antenna	R&S	BBHA 9120D	EF01153	2016-07	2017-07
Antenna	Amplifier Research	AT4560	EF00302	2017-03	2018-03

3.8.5 Procedure

Test Procedure 30 - 1000 MHz
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz
1. EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

3.8.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
2440	4872	49.40	pk	hor	53.98	-04.58
2440	4872	47.84	pk	ver	53.98	-06.14

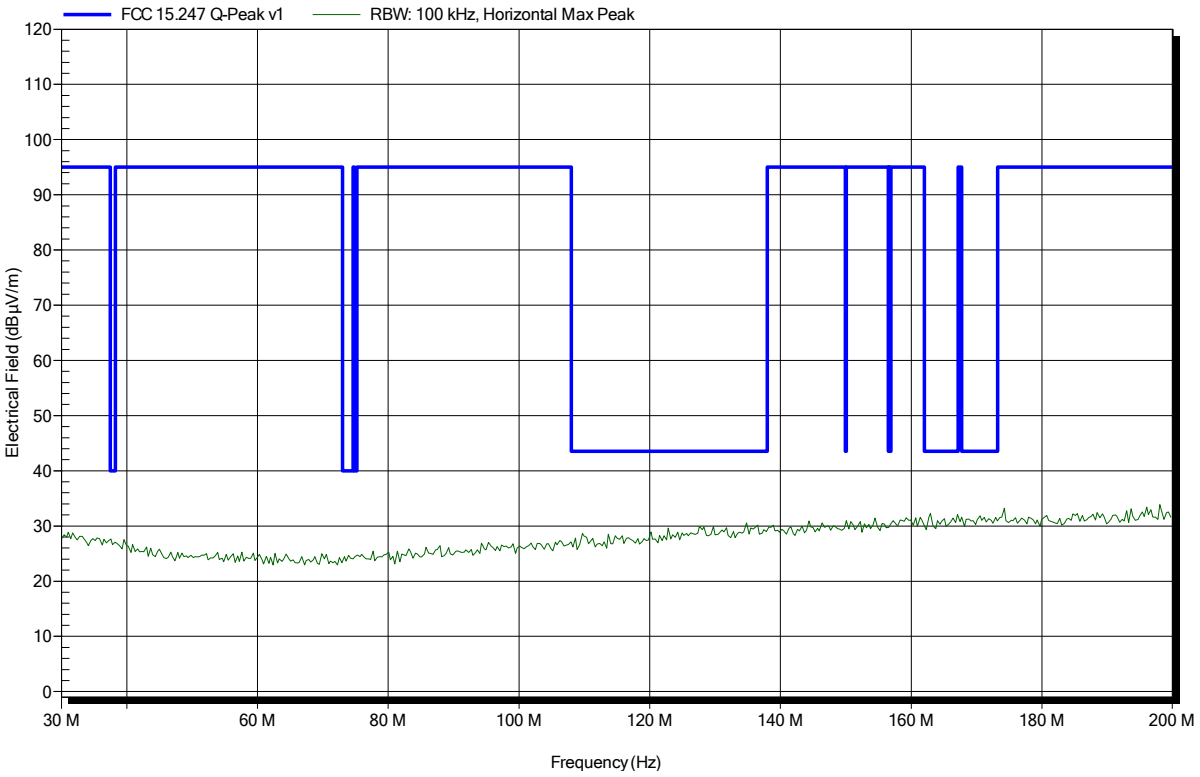
ANNEX A Transmitter spurious emissions

Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 42

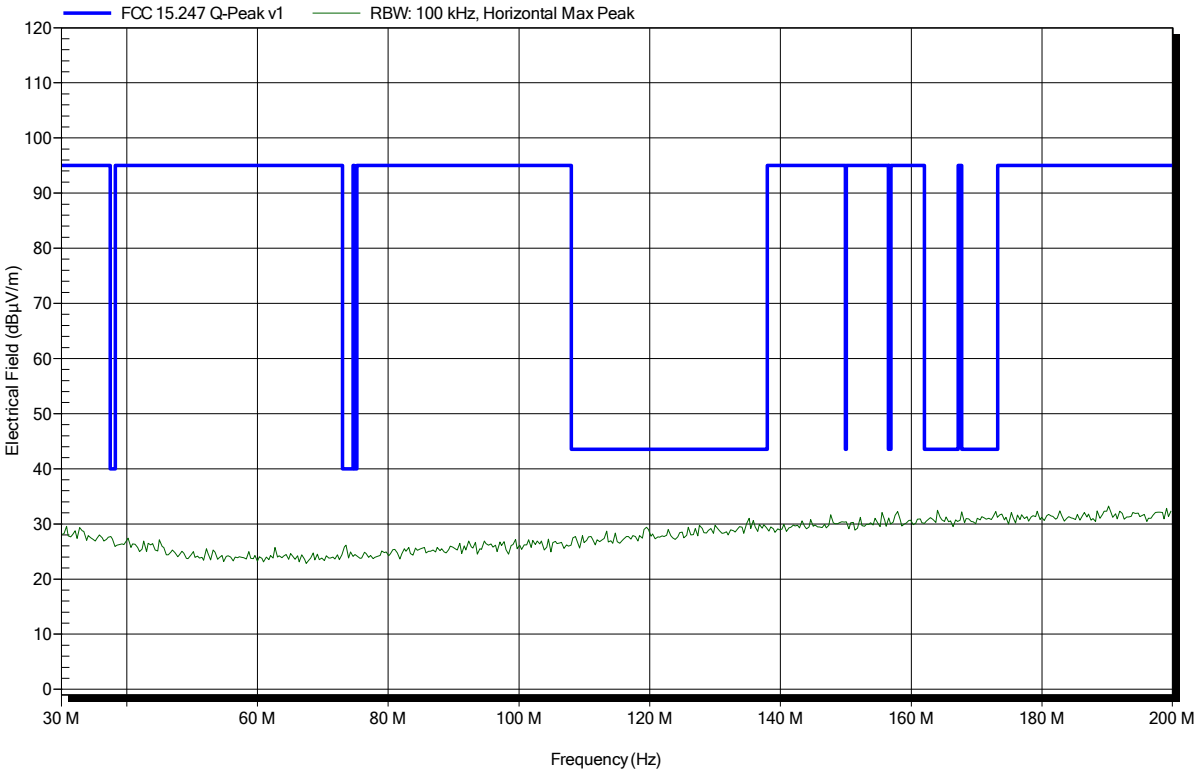


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 43

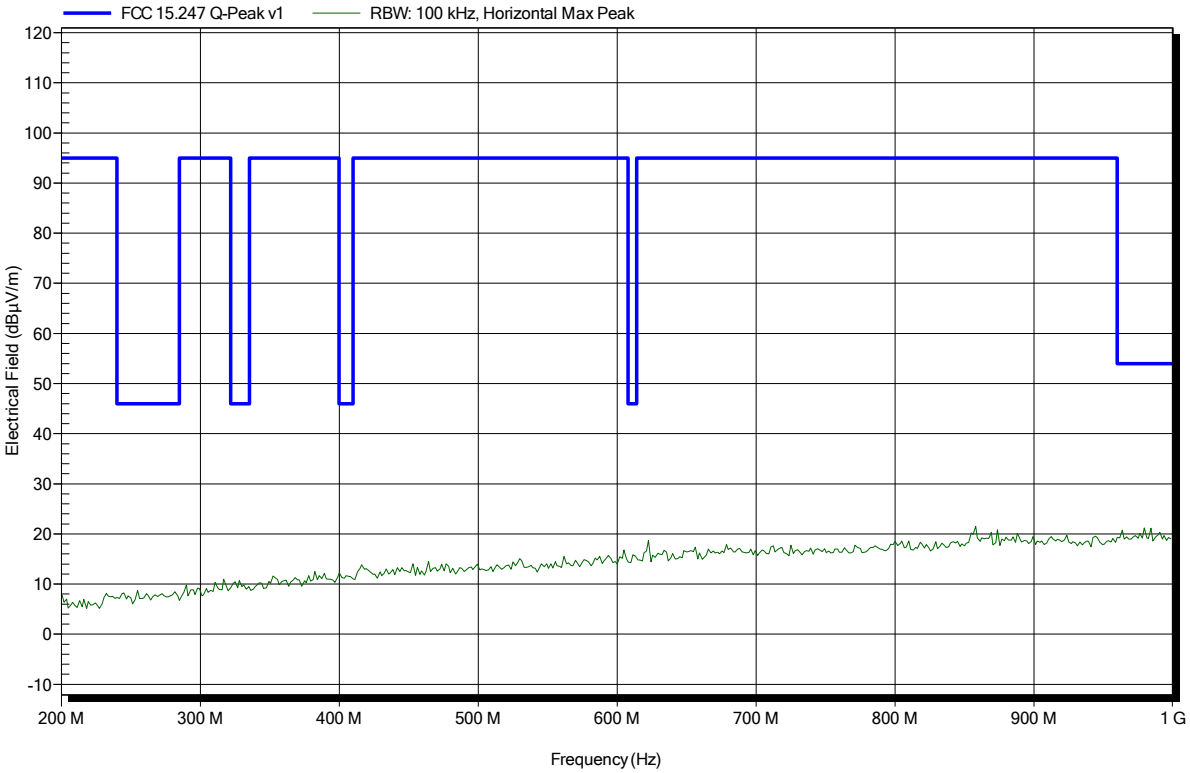


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 44

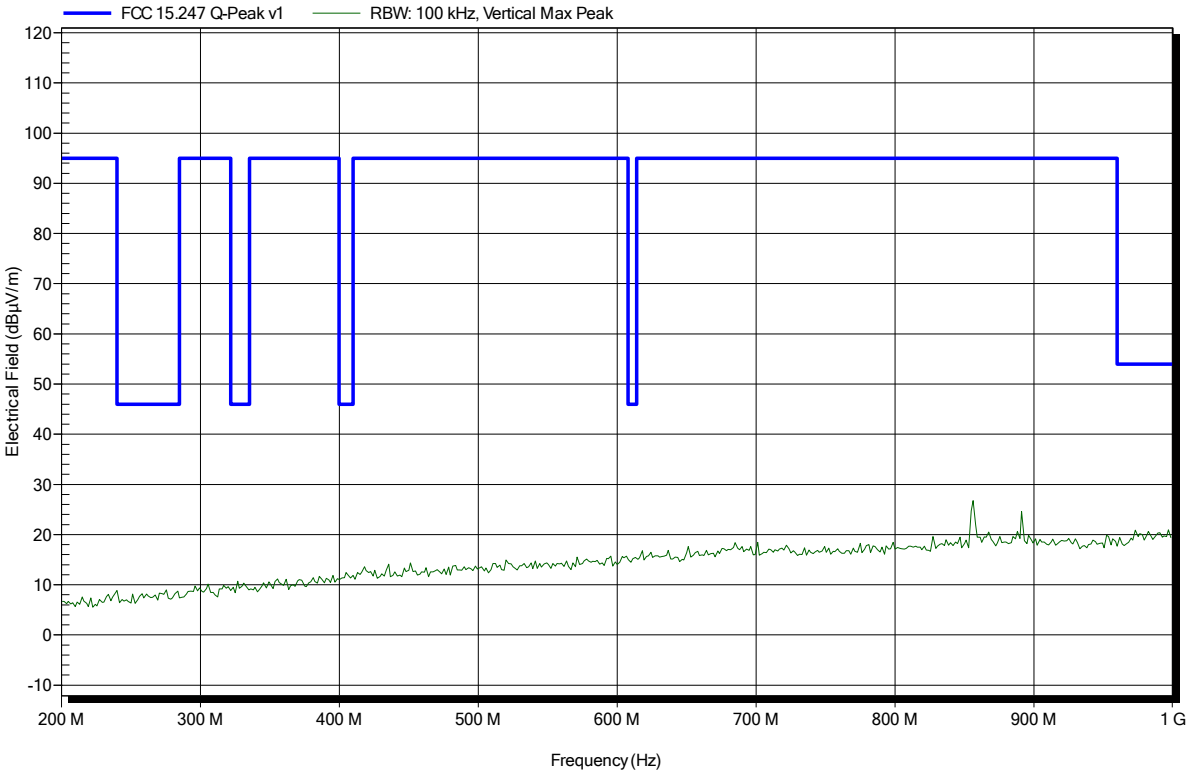


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 45

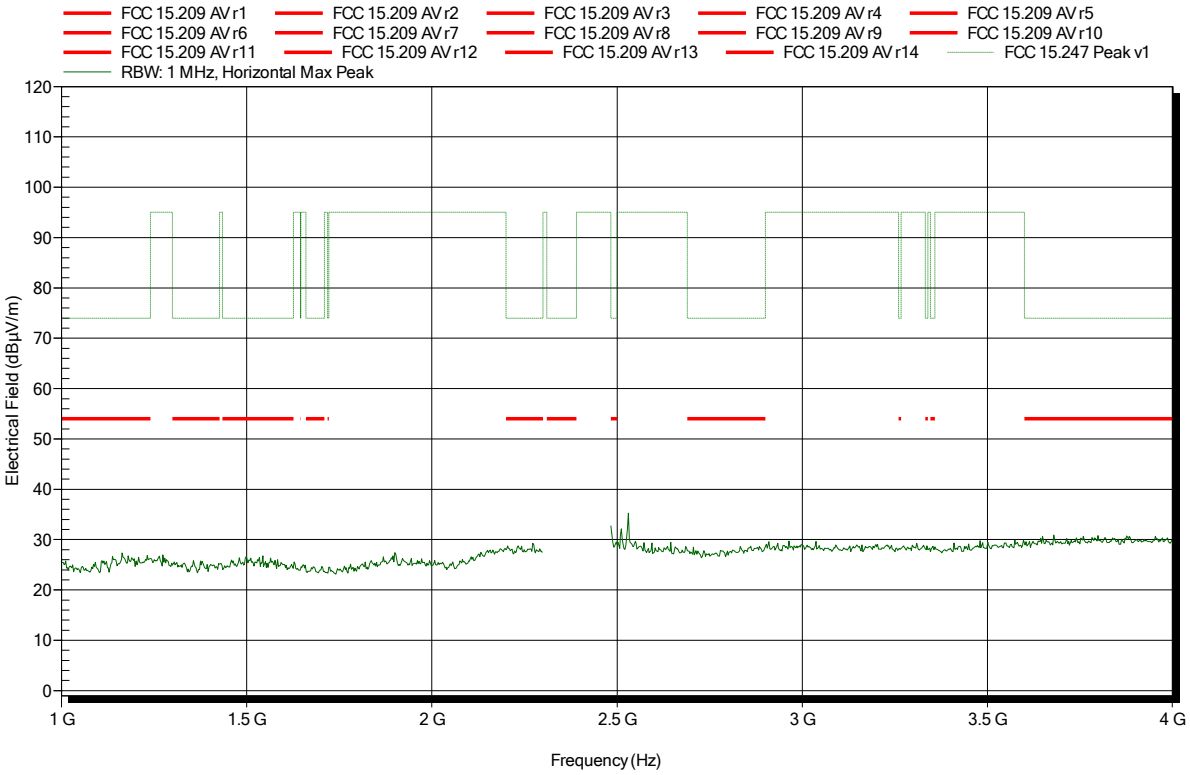


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 56

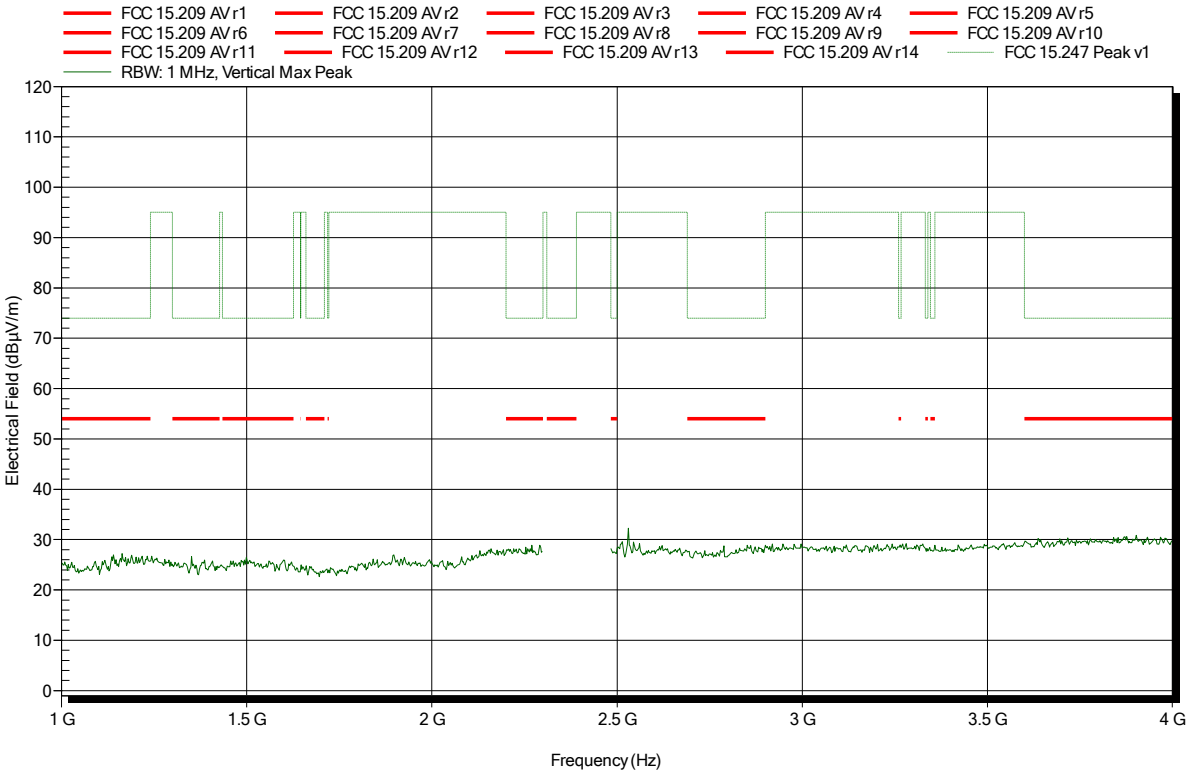


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 55

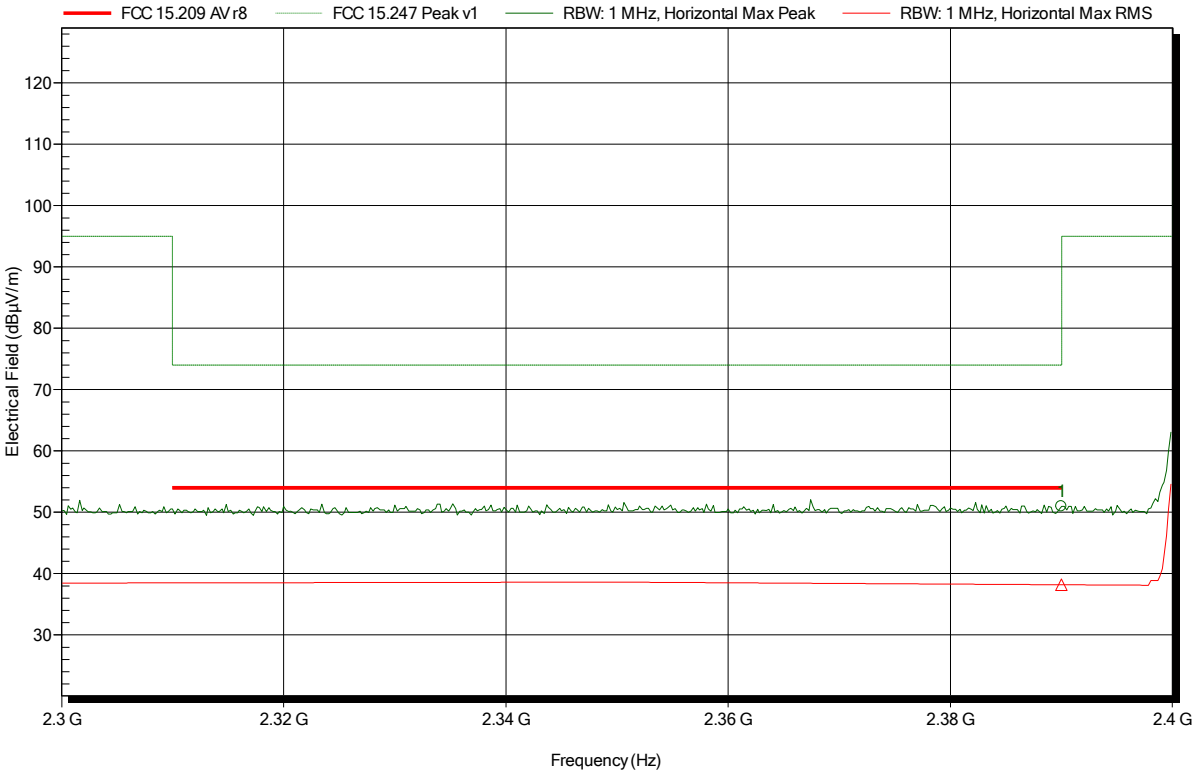


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	lower bandedge

Index 47



Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.39 GHz	50.98 dBµV/m	74 dBµV/m	-23.02 dB	Pass

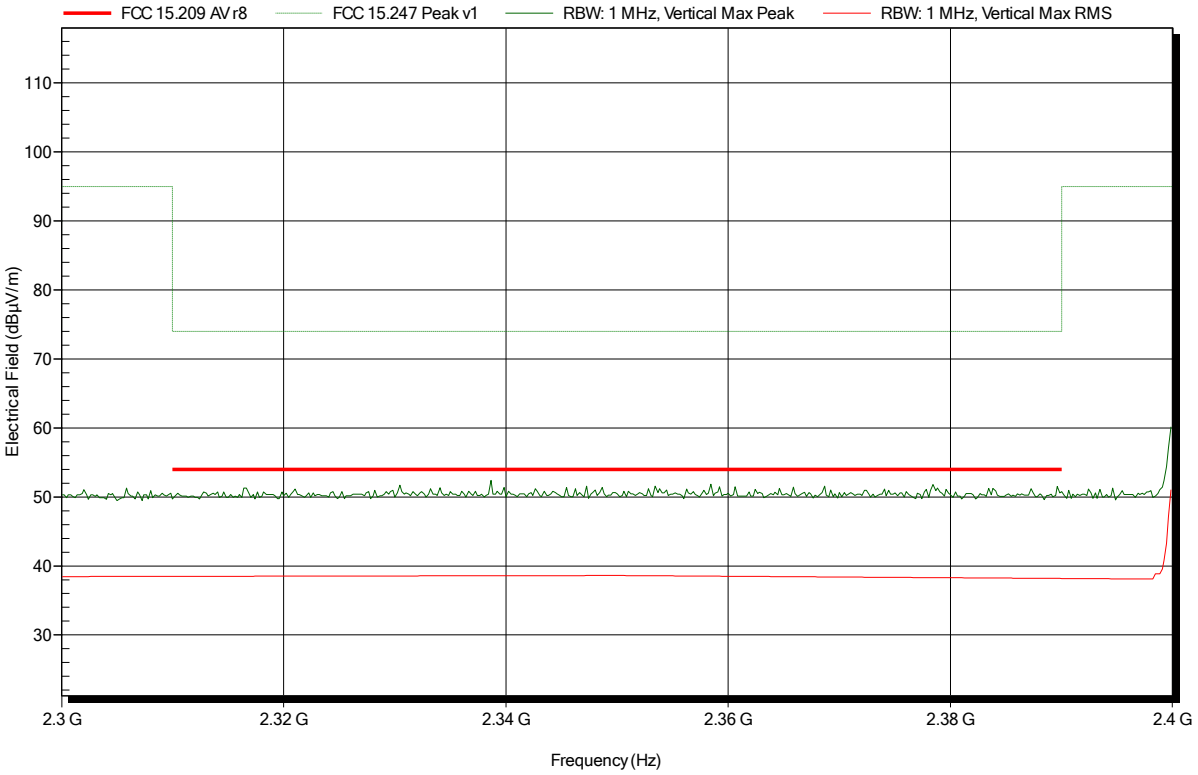
Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.39 GHz	38.19 dBµV/m	54 dBµV/m	-15.81 dB	Pass

Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-25
Note:	lower bandedge

Index 86

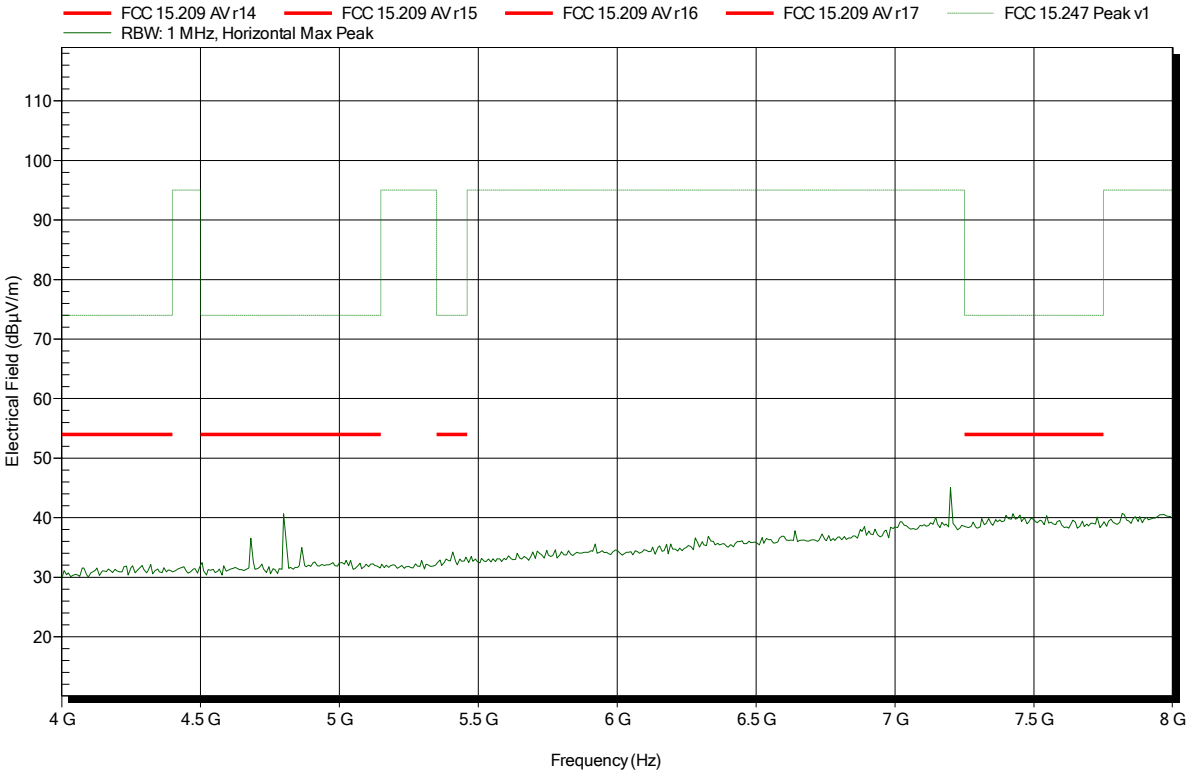


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 49

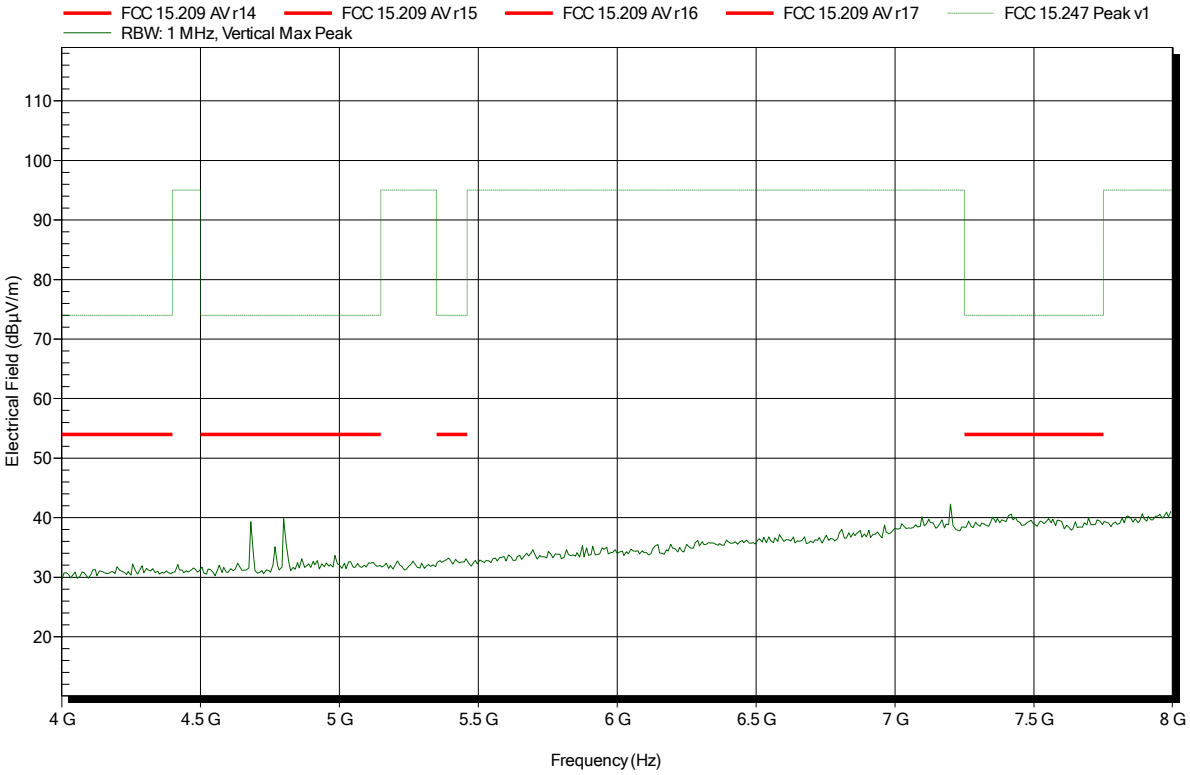


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 58

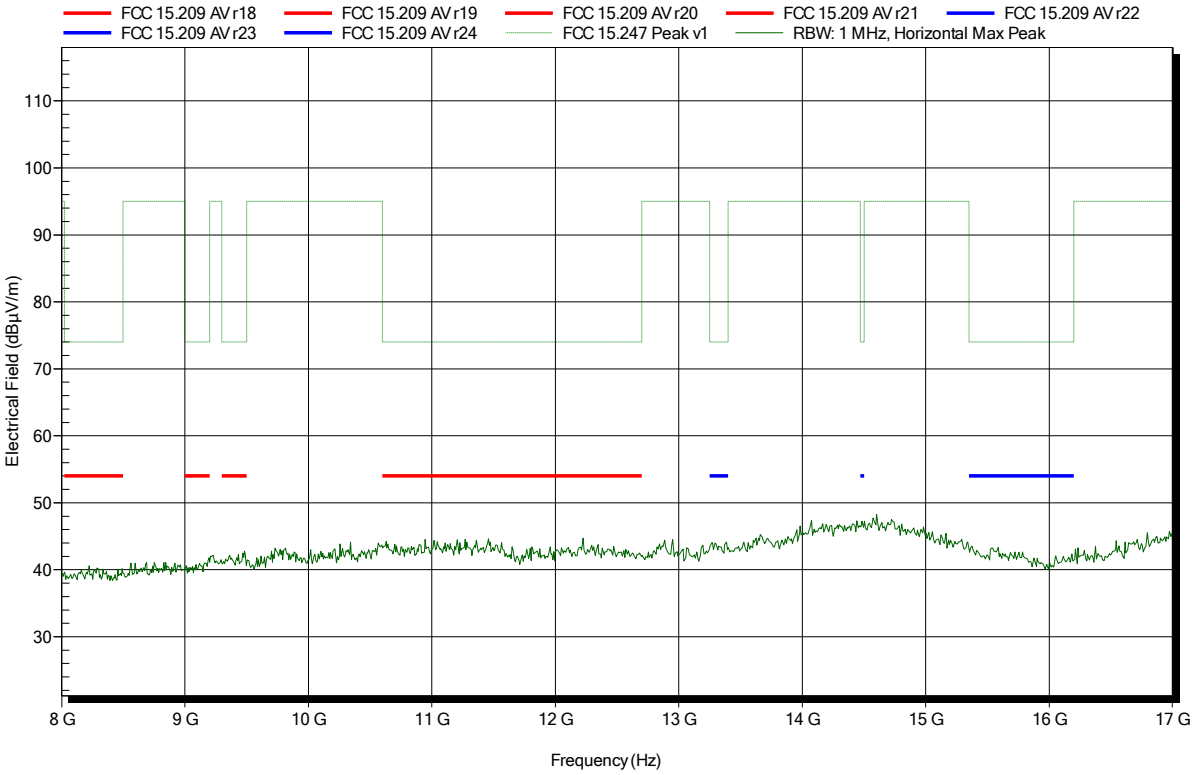


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 50

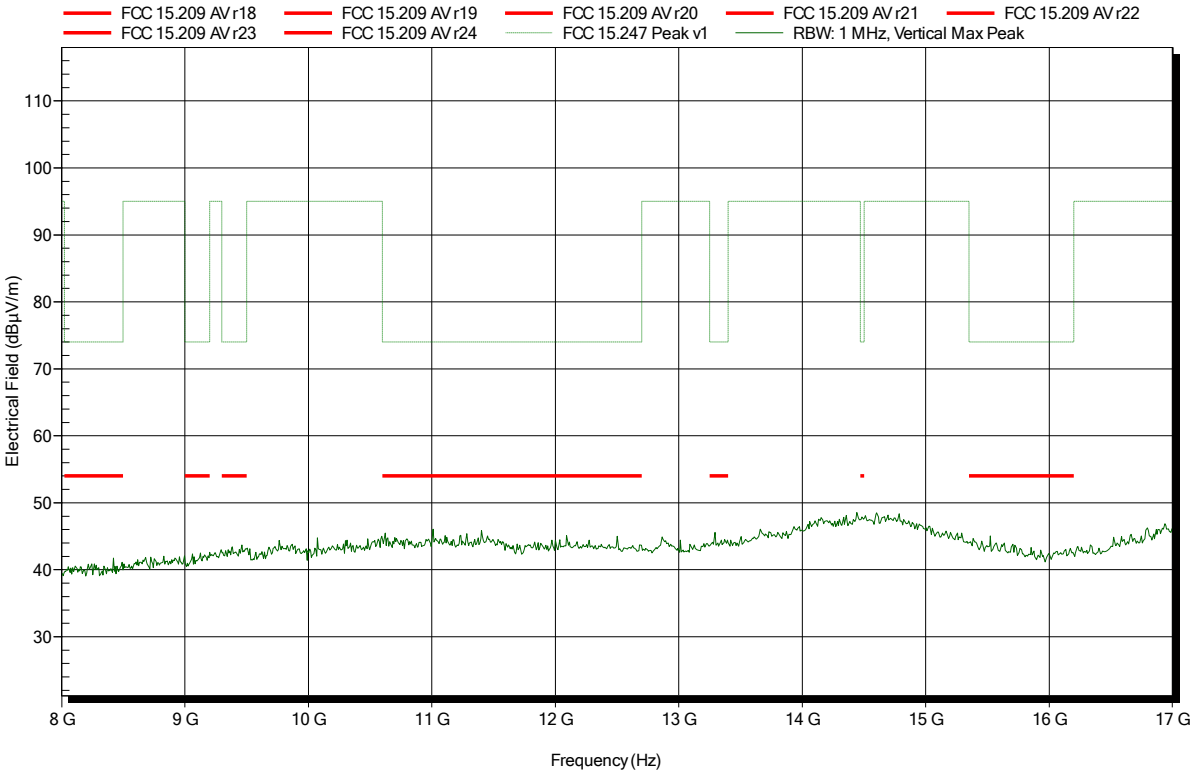


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 59

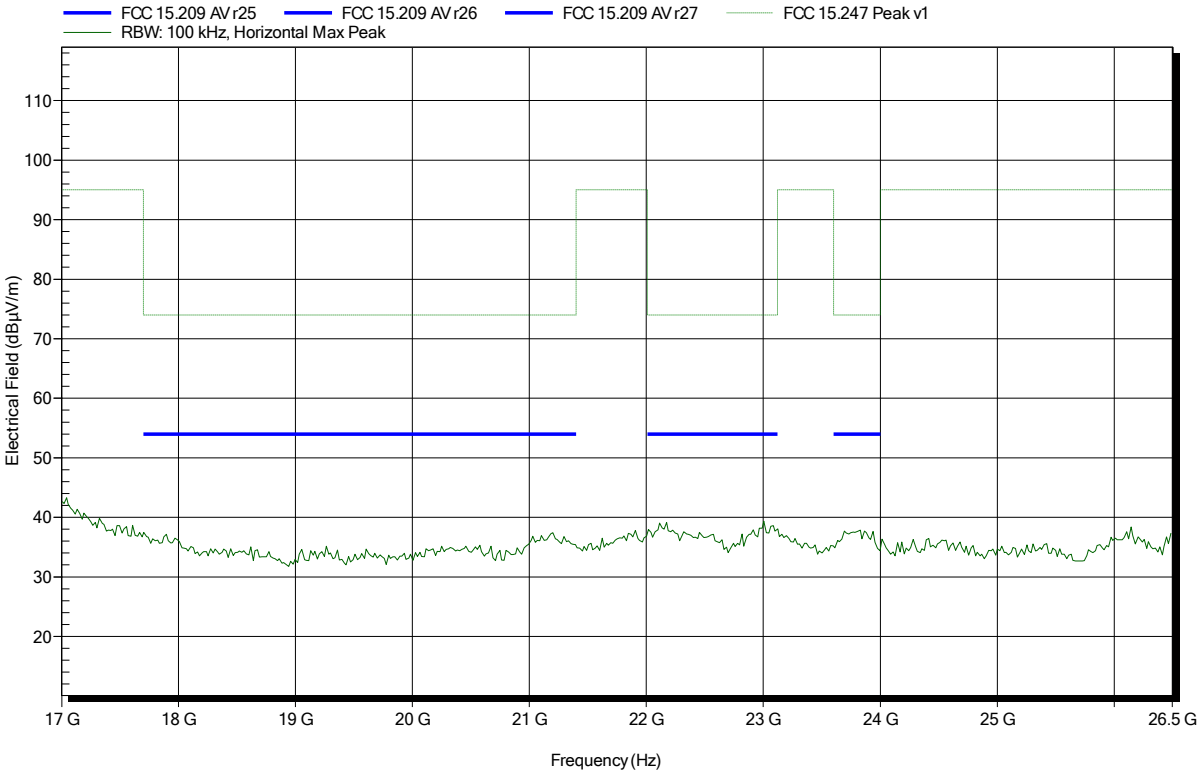


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 52

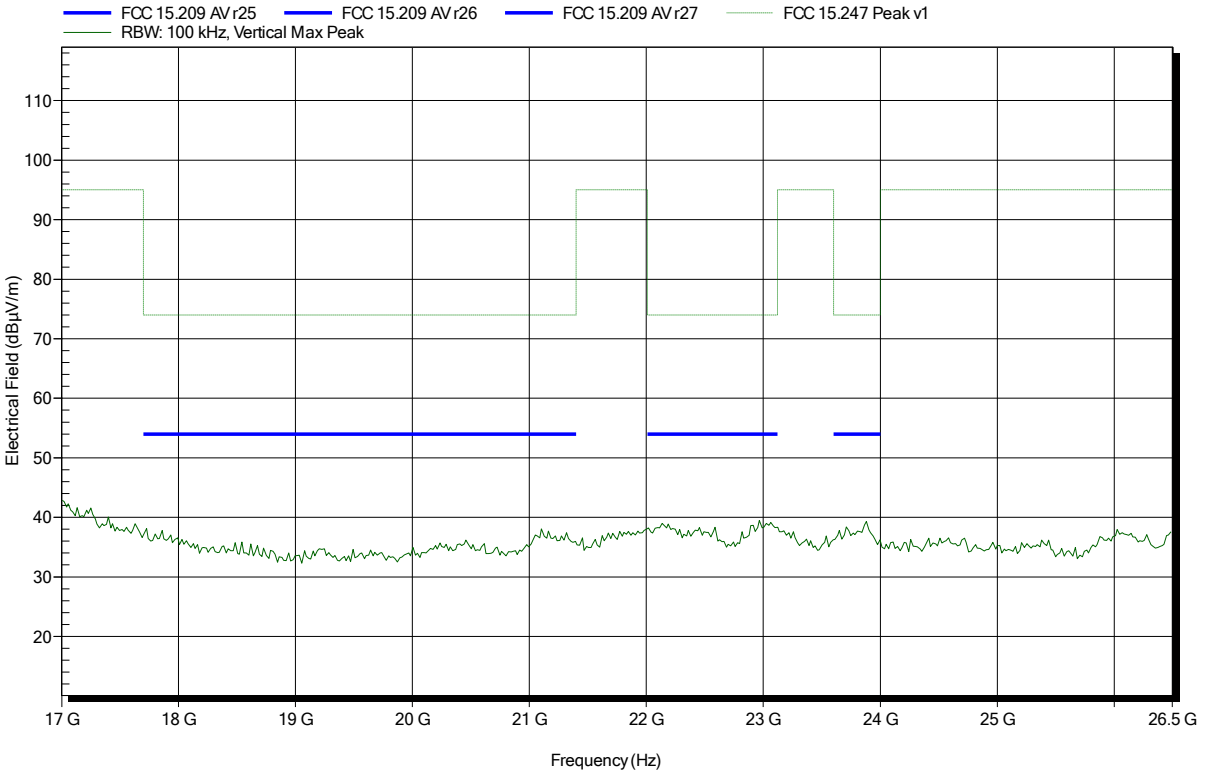


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2402 MHz
Test Date:	2017-07-24
Note:	

Index 60

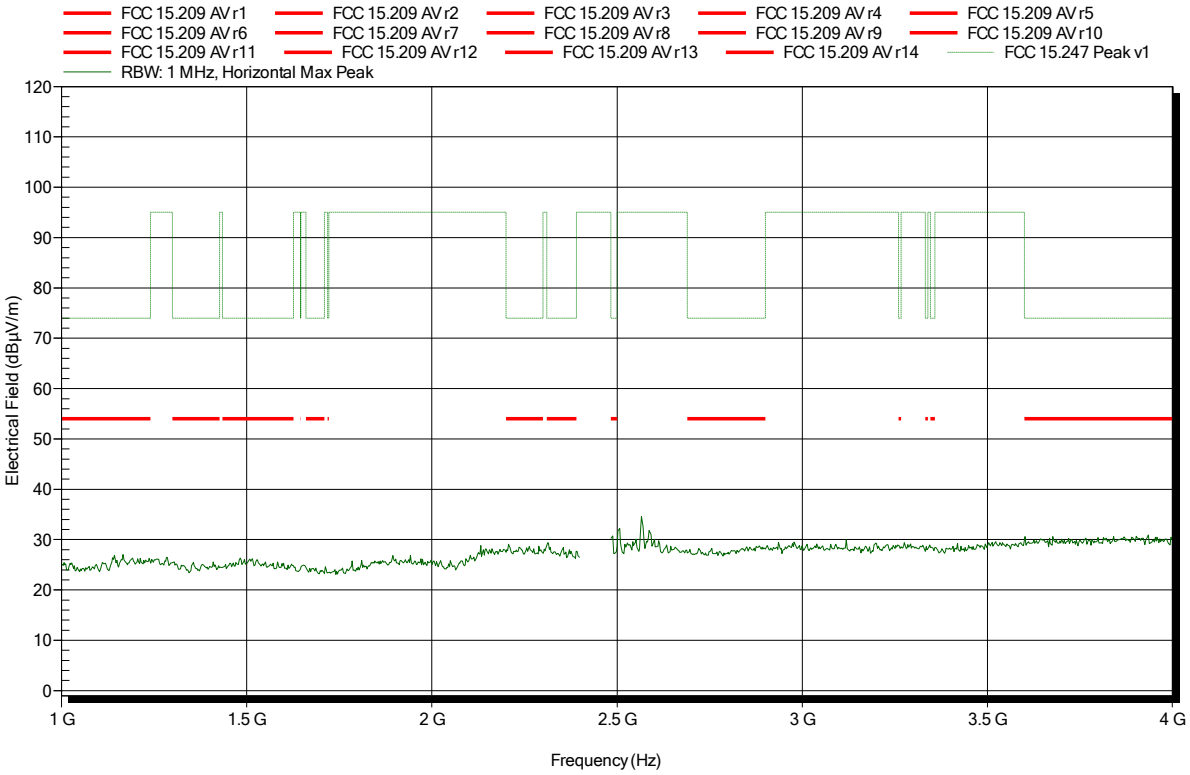


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2440 MHz
Test Date:	2017-07-24
Note:	

Index 61

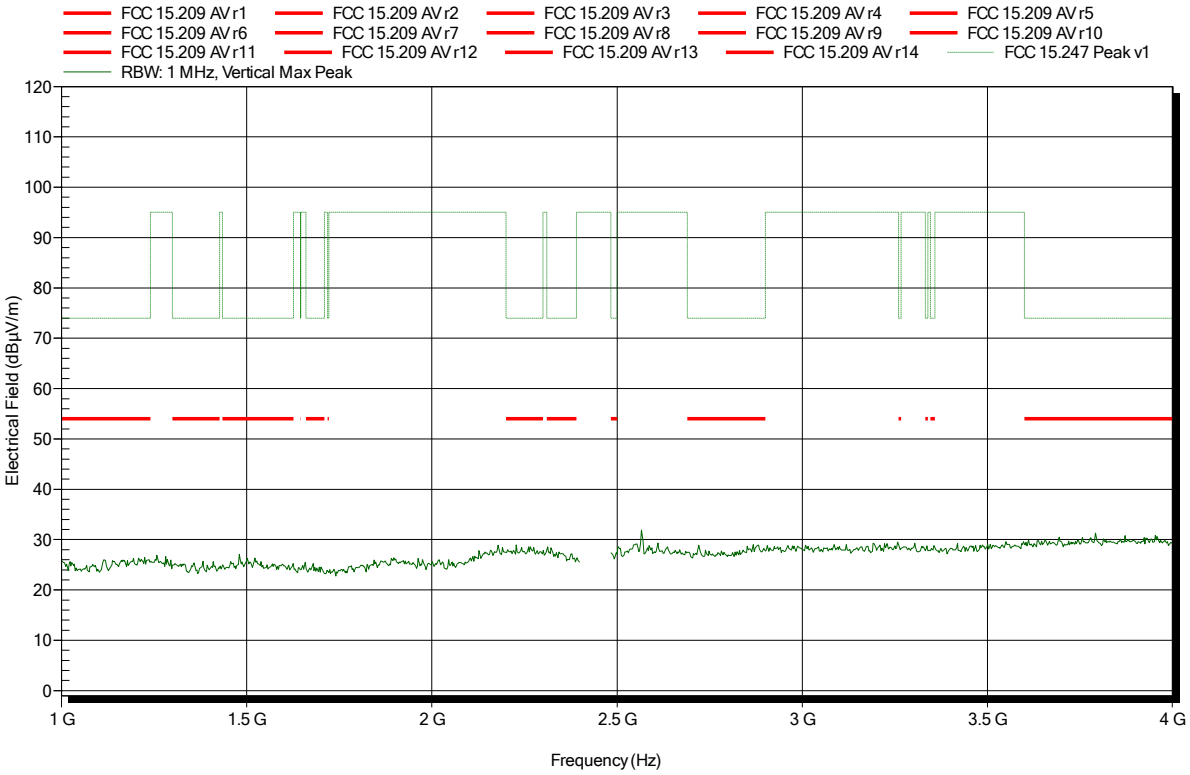


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2440 MHz
Test Date:	2017-07-24
Note:	

Index 66

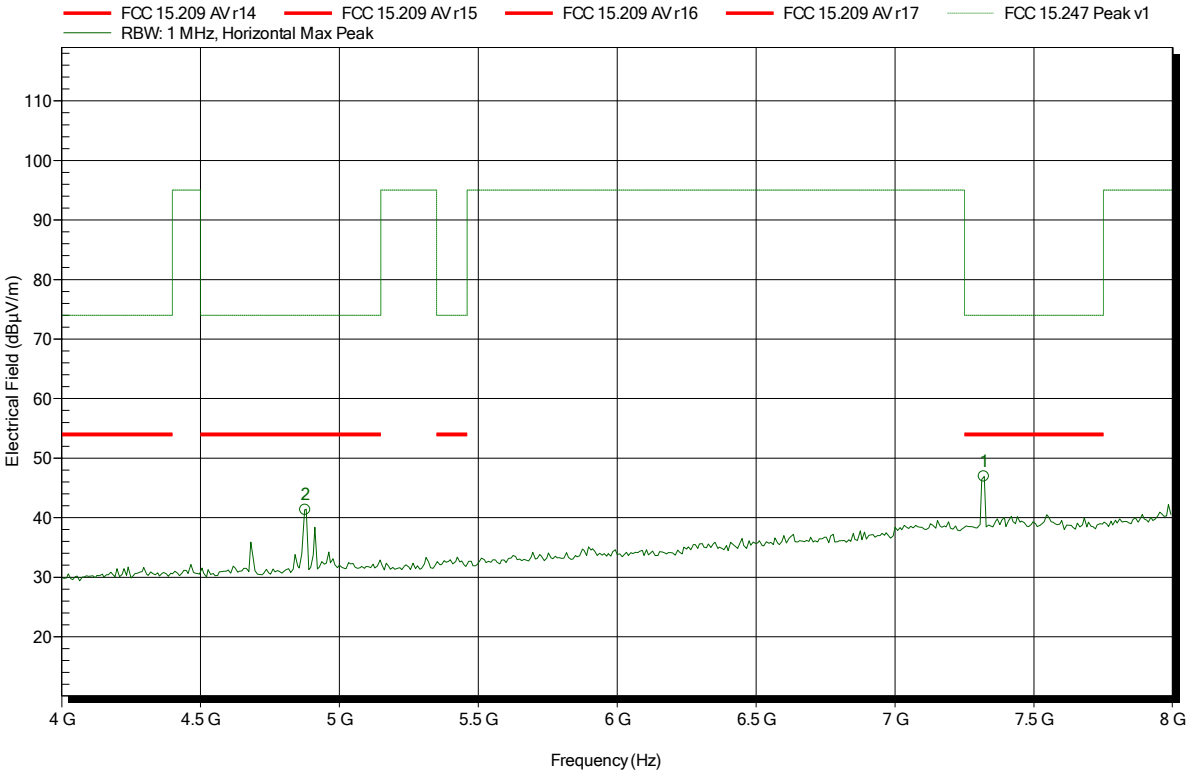


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2440 MHz
Test Date:	2017-07-24
Note:	

Index 62



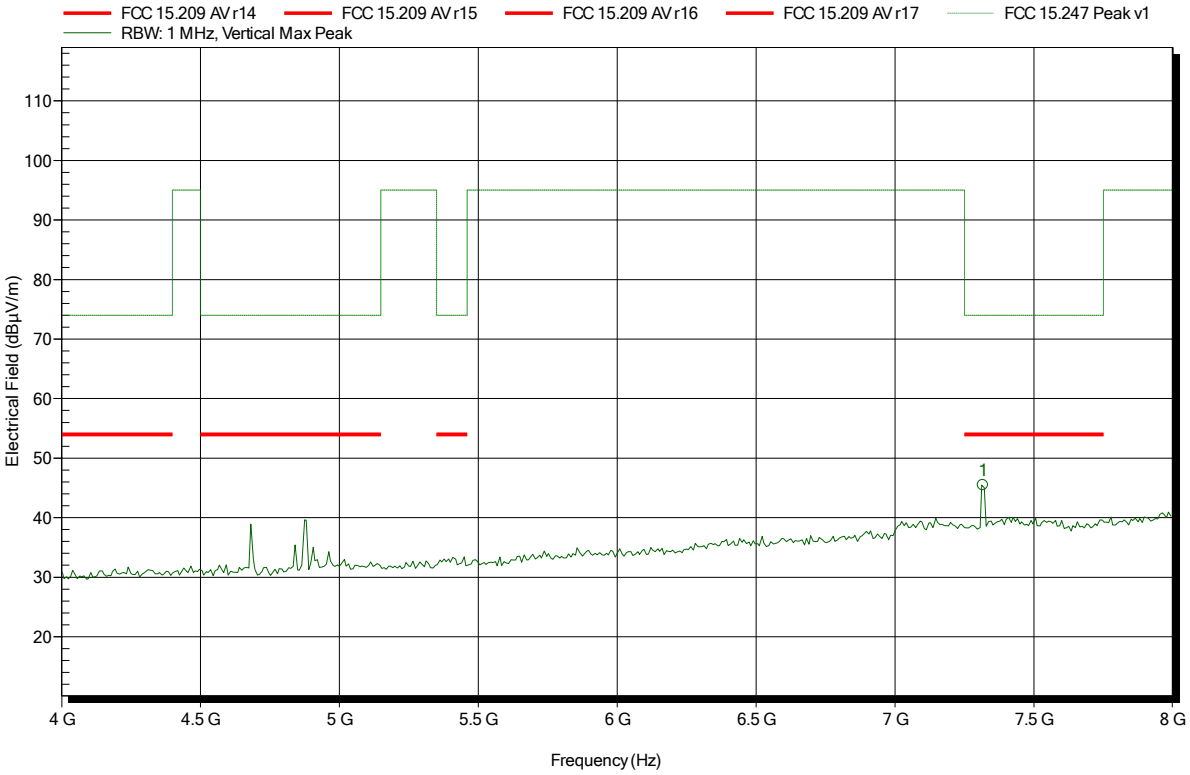
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.877 GHz	41.3 dBµV/m	74 dBµV/m	-32.7 dB	Pass
7.32 GHz	46.91 dBµV/m	74 dBµV/m	-27.09 dB	Pass

Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2440 MHz
Test Date:	2017-07-24
Note:	

Index 67



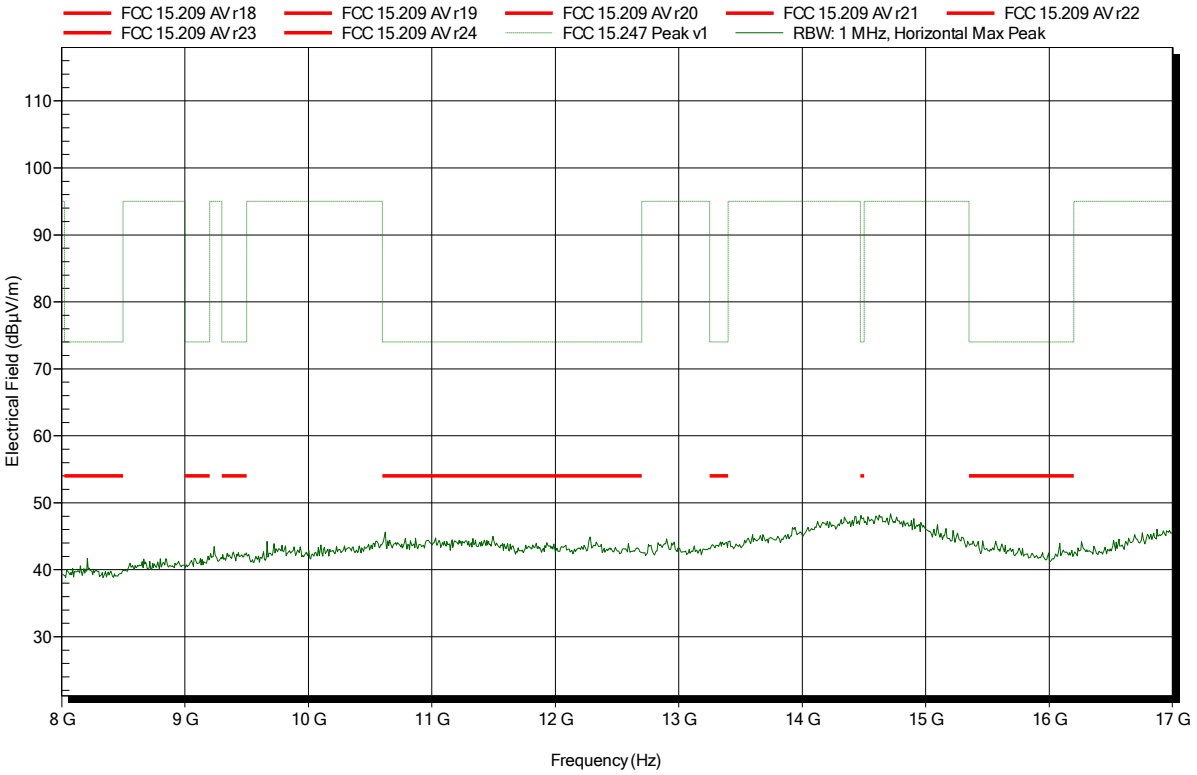
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
7.318 GHz	45.48 dBµV/m	74 dBµV/m	-28.52 dB	Pass

Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2440 MHz
Test Date:	2017-07-24
Note:	

Index 63

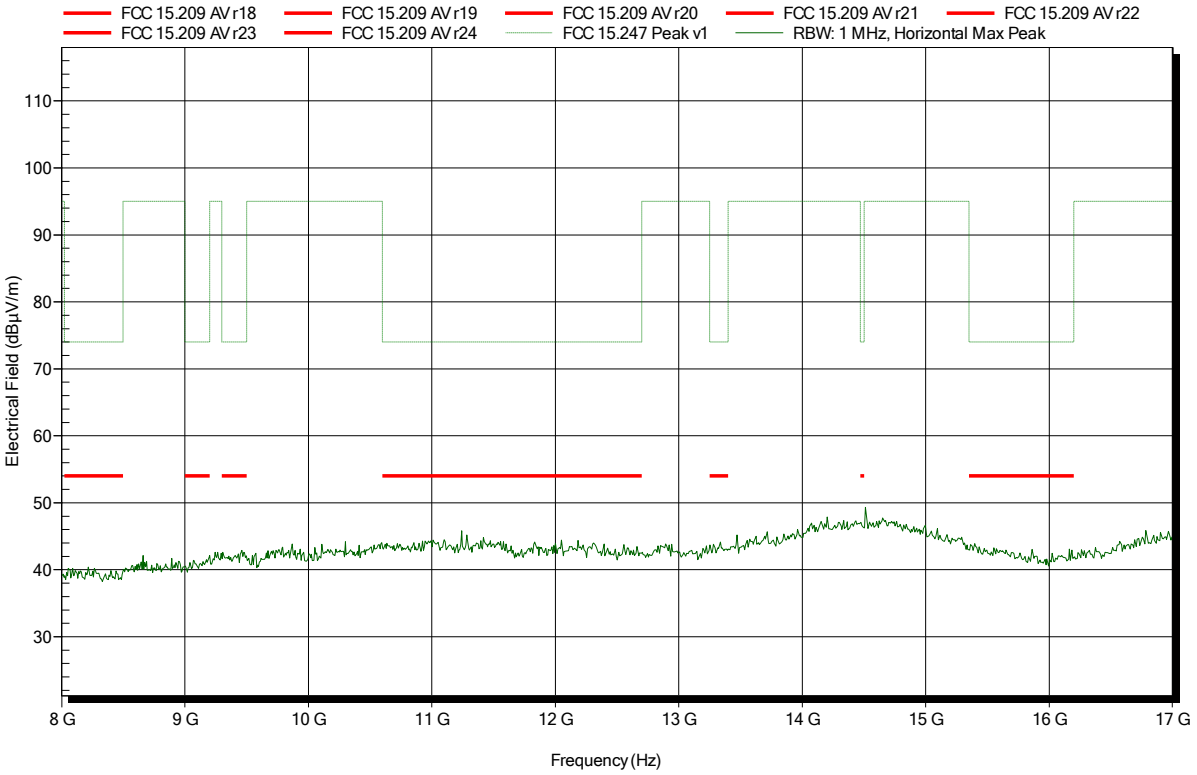


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2440 MHz
Test Date:	2017-07-24
Note:	

Index 68

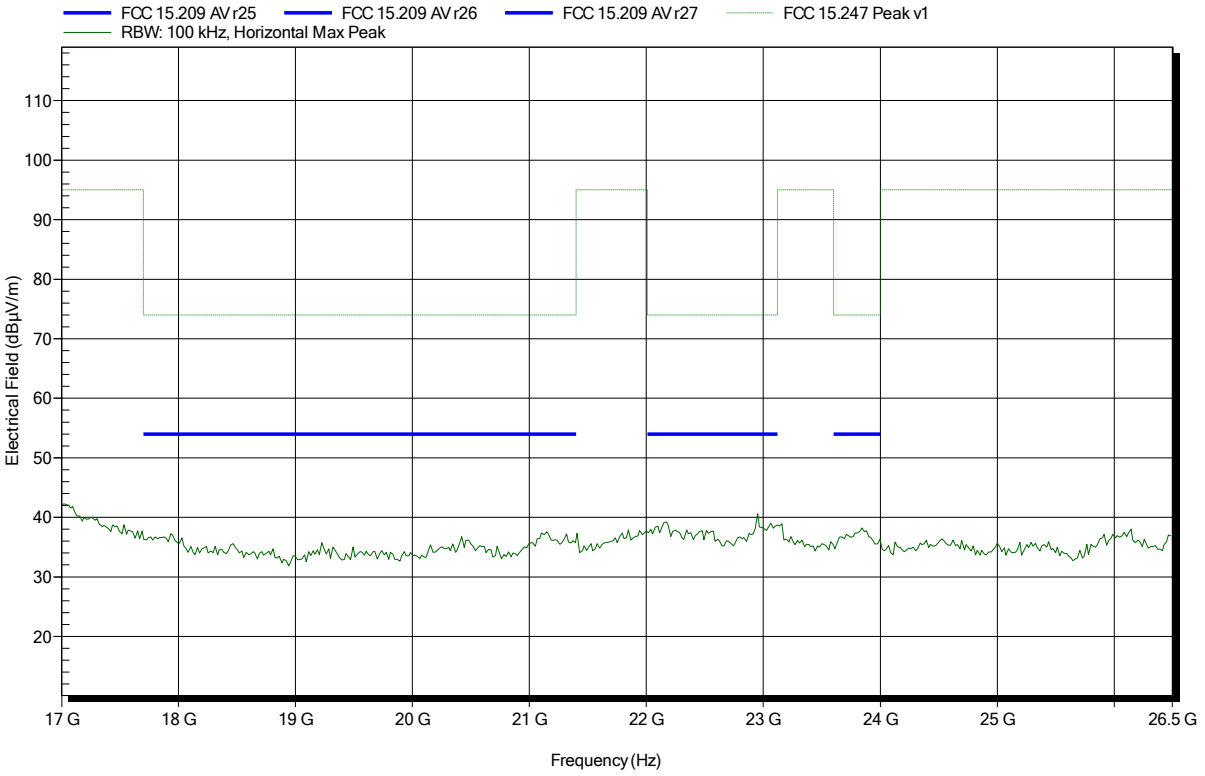


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2440 MHz
Test Date:	2017-07-24
Note:	

Index 64

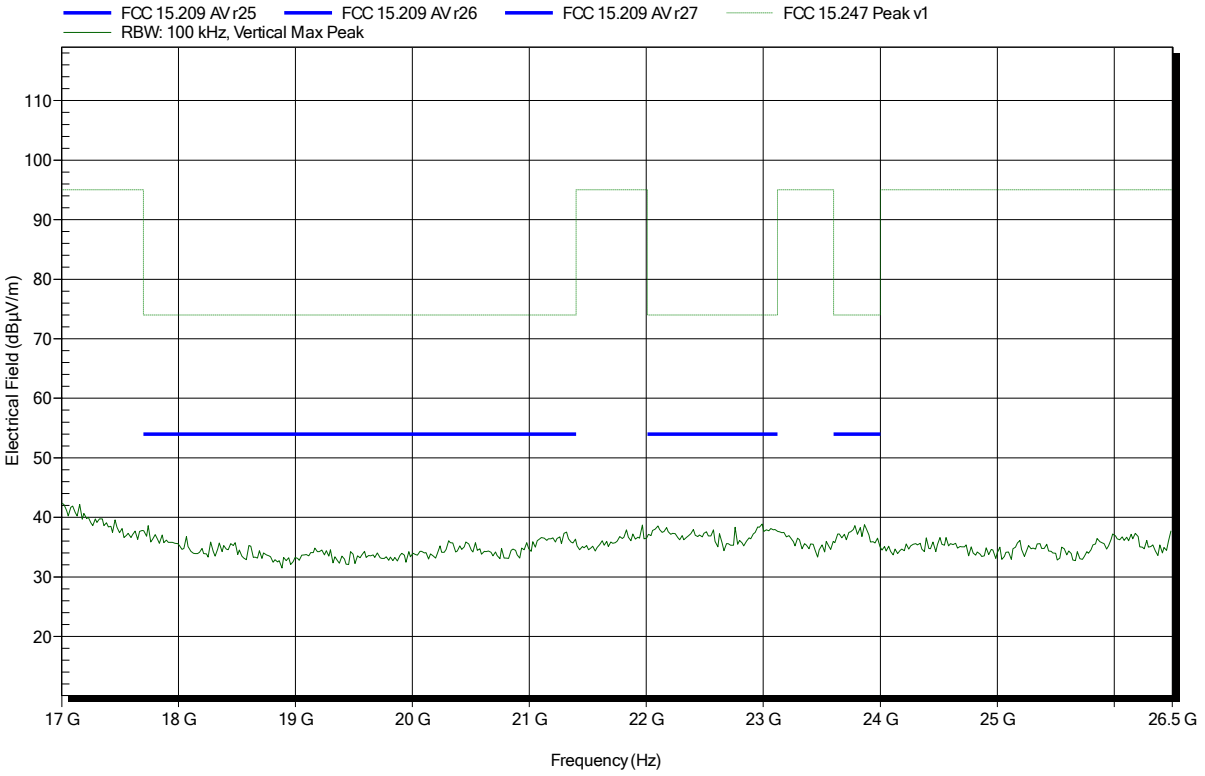


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2440 MHz
Test Date:	2017-07-24
Note:	

Index 70

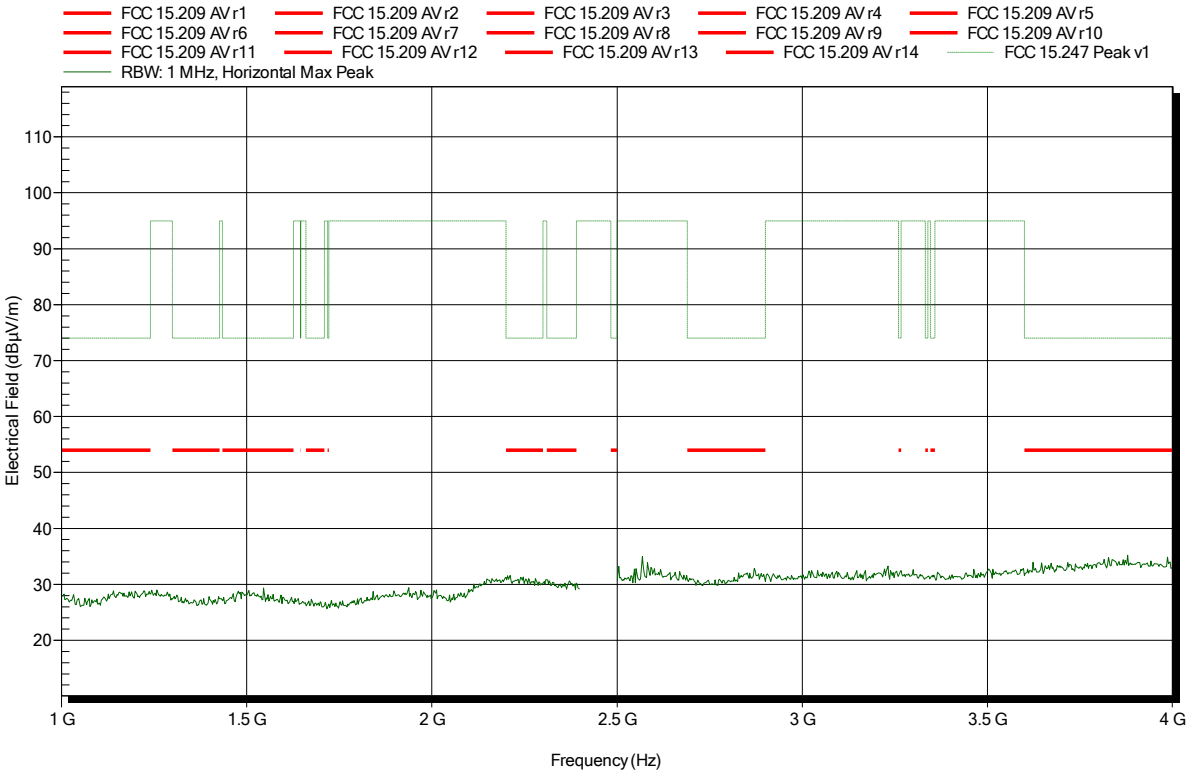


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	

Index 71

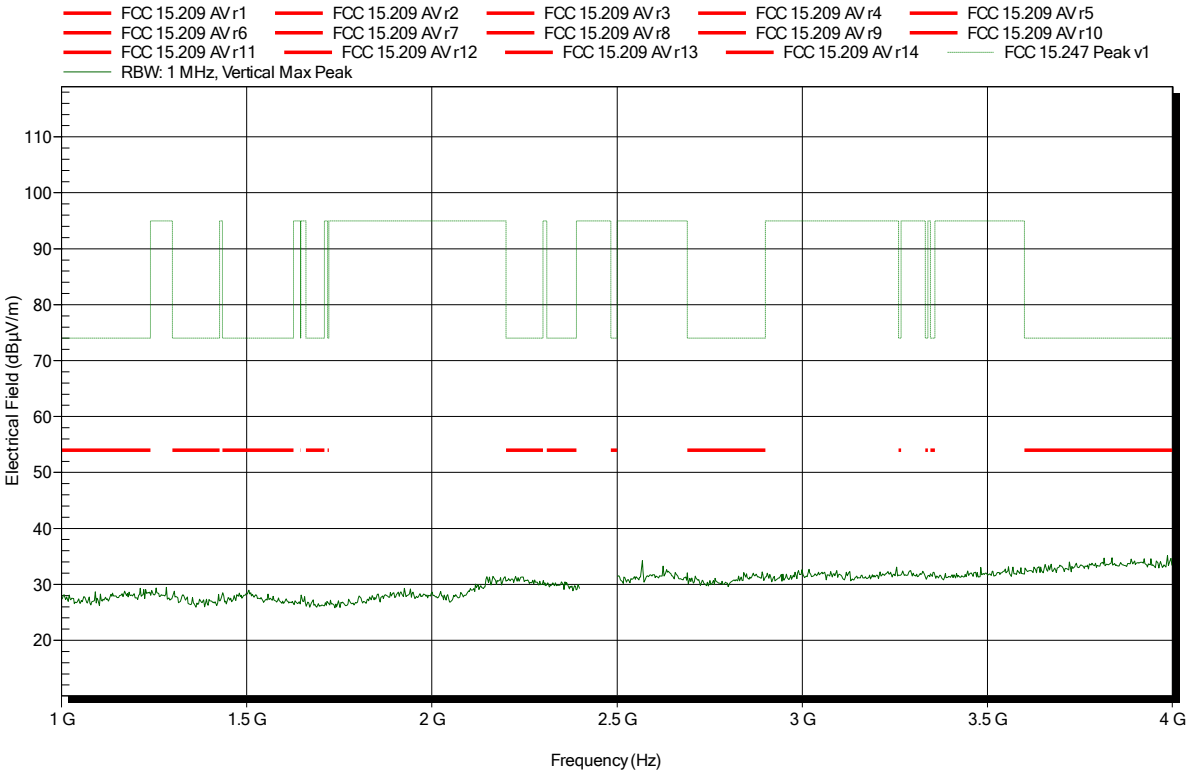


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	

Index 77



Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	upper bandedge

Index 79

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4836 GHz	57 dBµV/m	74 dBµV/m	-17 dB	Pass

Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.4836 GHz	41.8 dBµV/m	54 dBµV/m	-12.2 dB	Pass

Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	upper bandedge

Index 82

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
2.4835 GHz	54.37 dBµV/m	74 dBµV/m	-19.63 dB	Pass

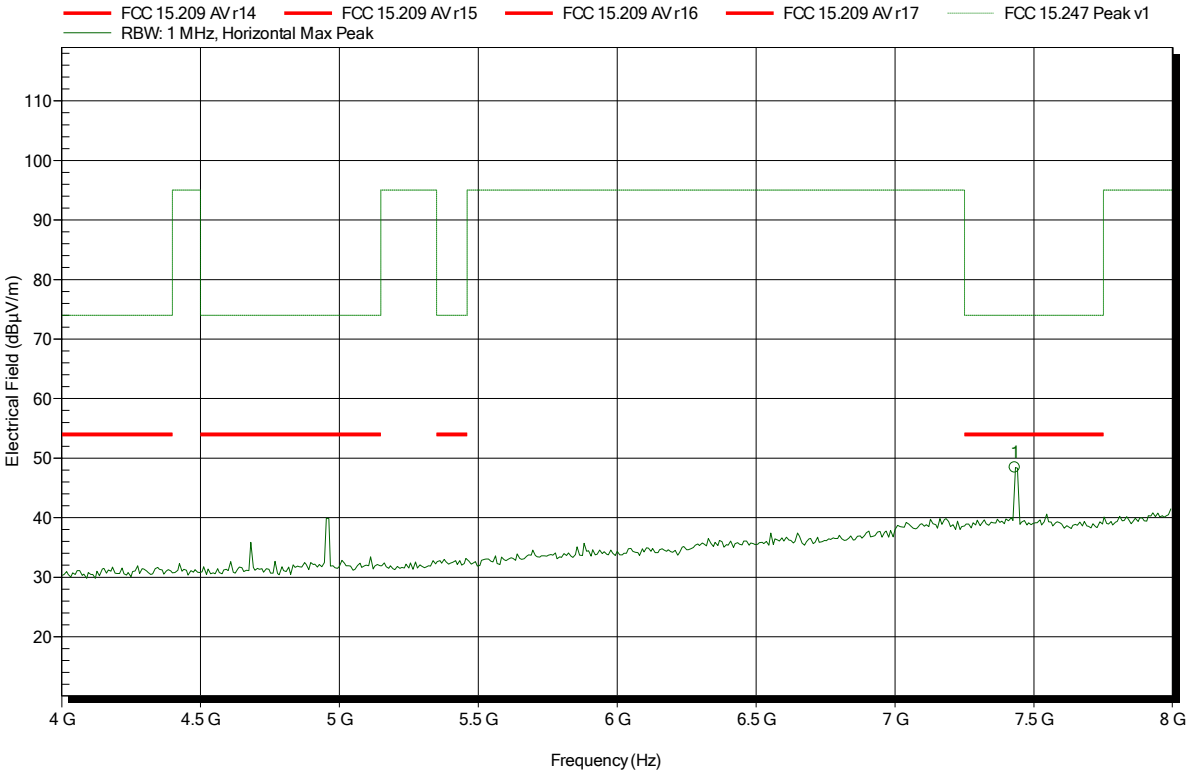
Frequency	RMS	RMS Limit	RMS Difference	RMS Status
2.4835 GHz	39.3 dBµV/m	54 dBµV/m	-14.7 dB	Pass

Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	

Index 80



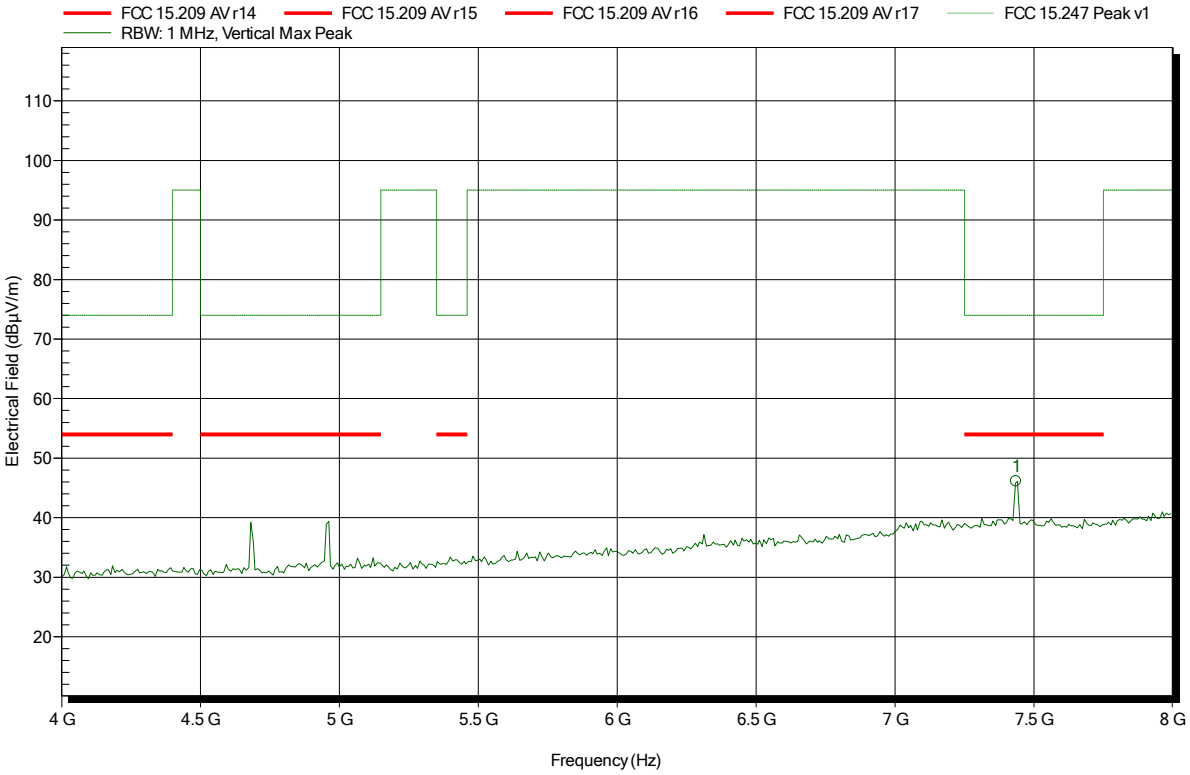
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
7.432 GHz	48.41 dBµV/m	74 dBµV/m	-25.59 dB	Pass

Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	

Index 83



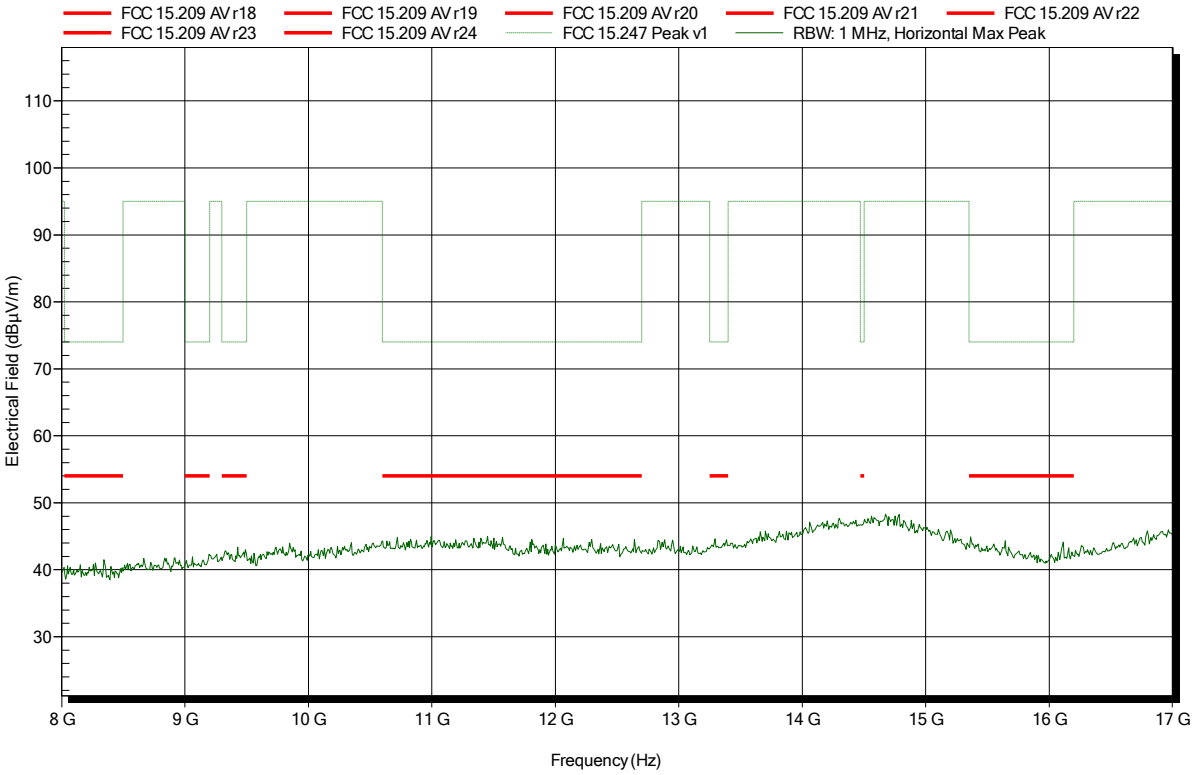
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
7.436 GHz	46.1 dBµV/m	74 dBµV/m	-27.9 dB	Pass

Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	

Index 75

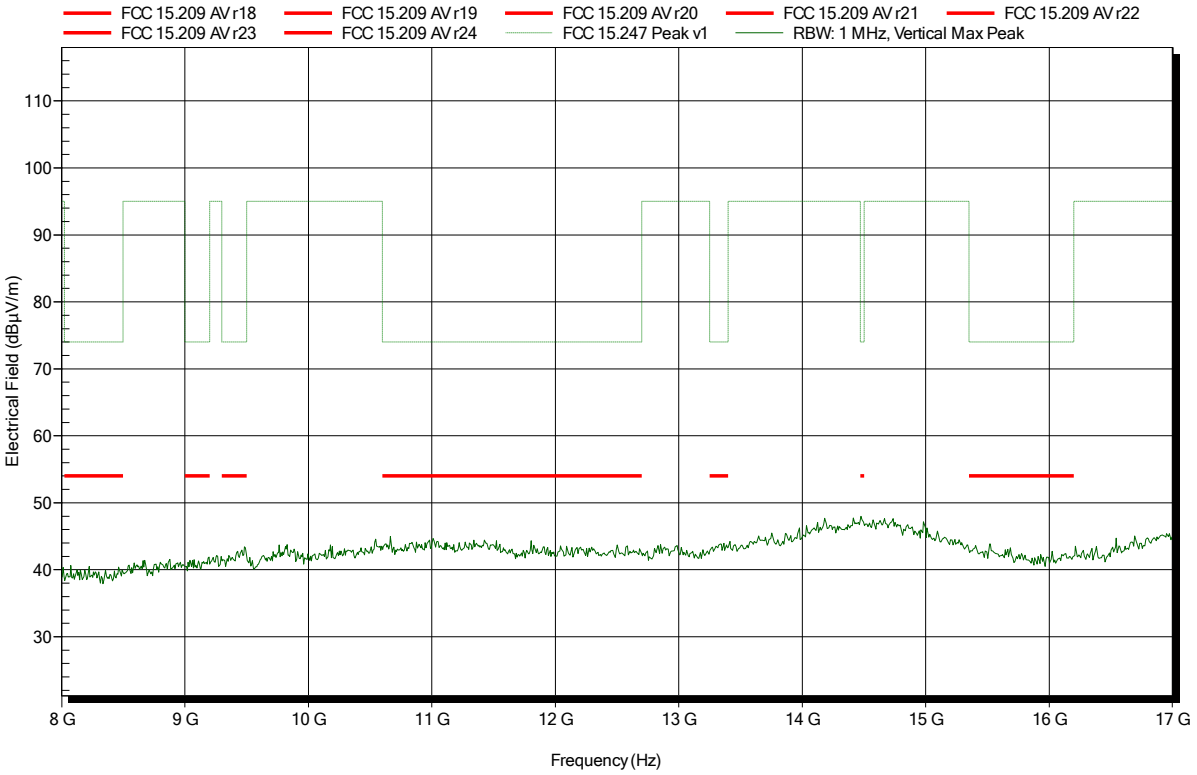


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	

Index 84

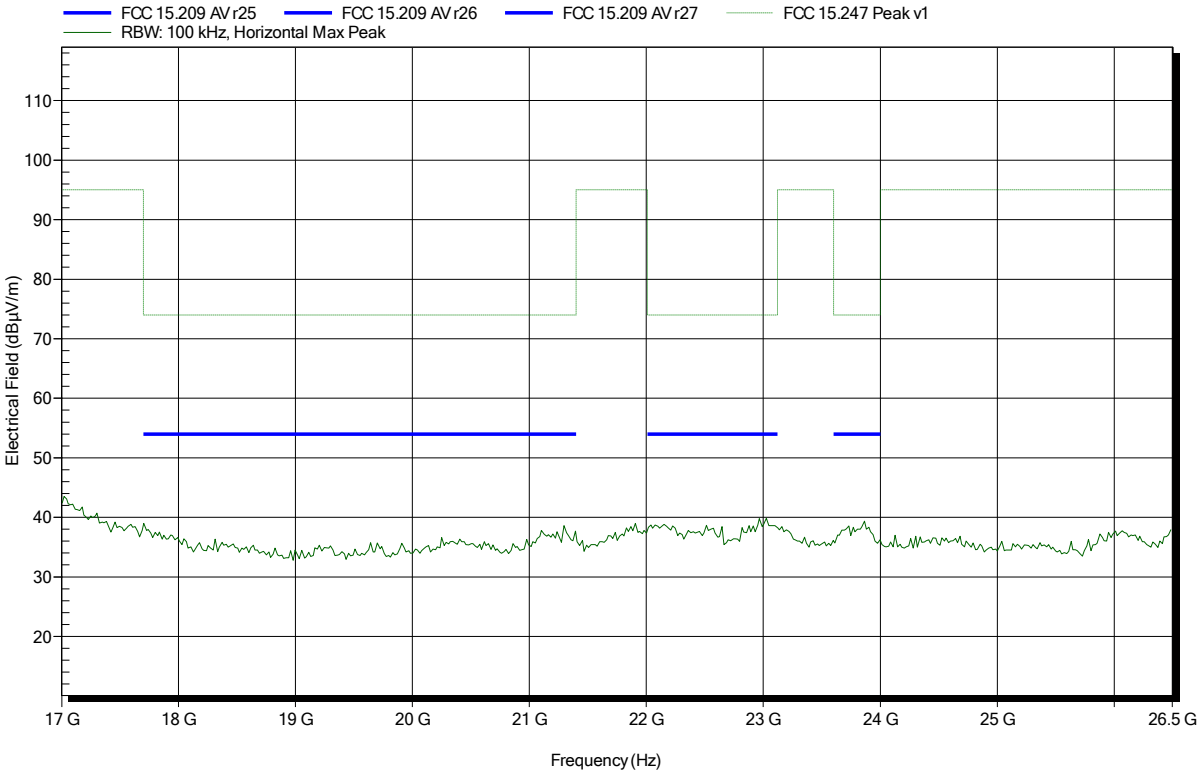


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	

Index 76

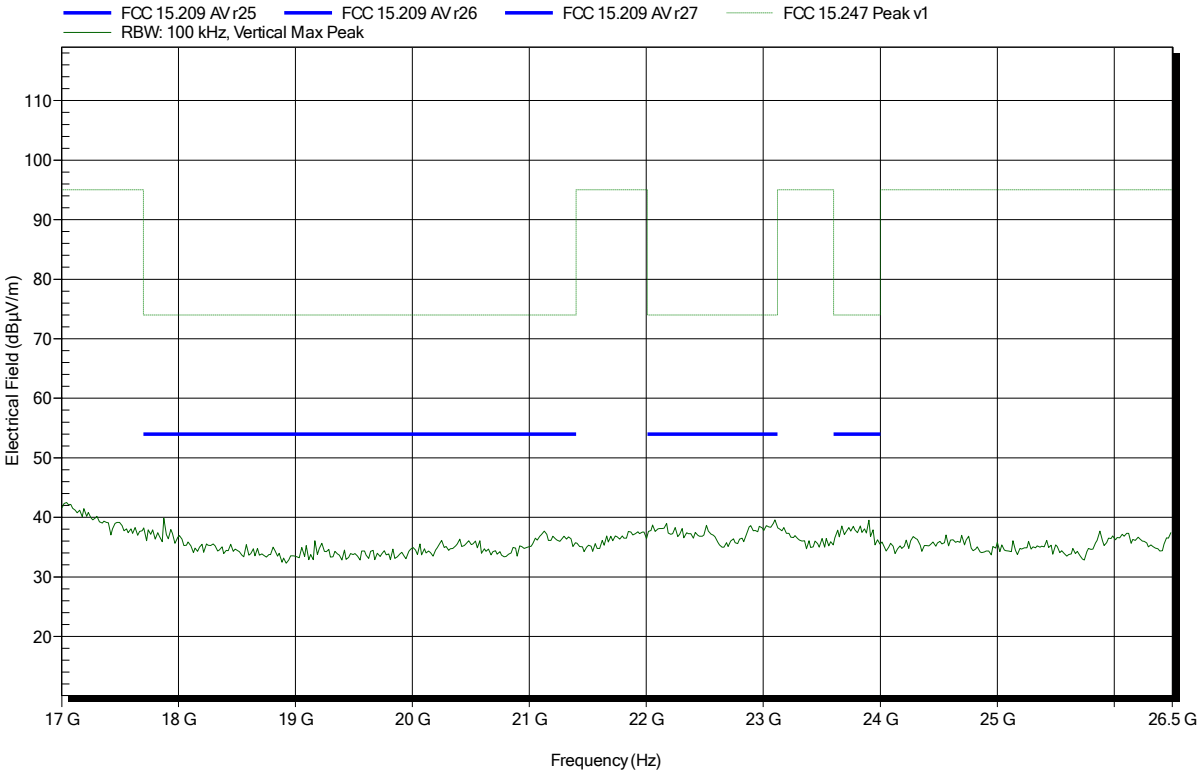


Spurious emissions according to FCC 15.247, RSS-247

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; BLE; 2480 MHz
Test Date:	2017-07-24
Note:	

Index 85



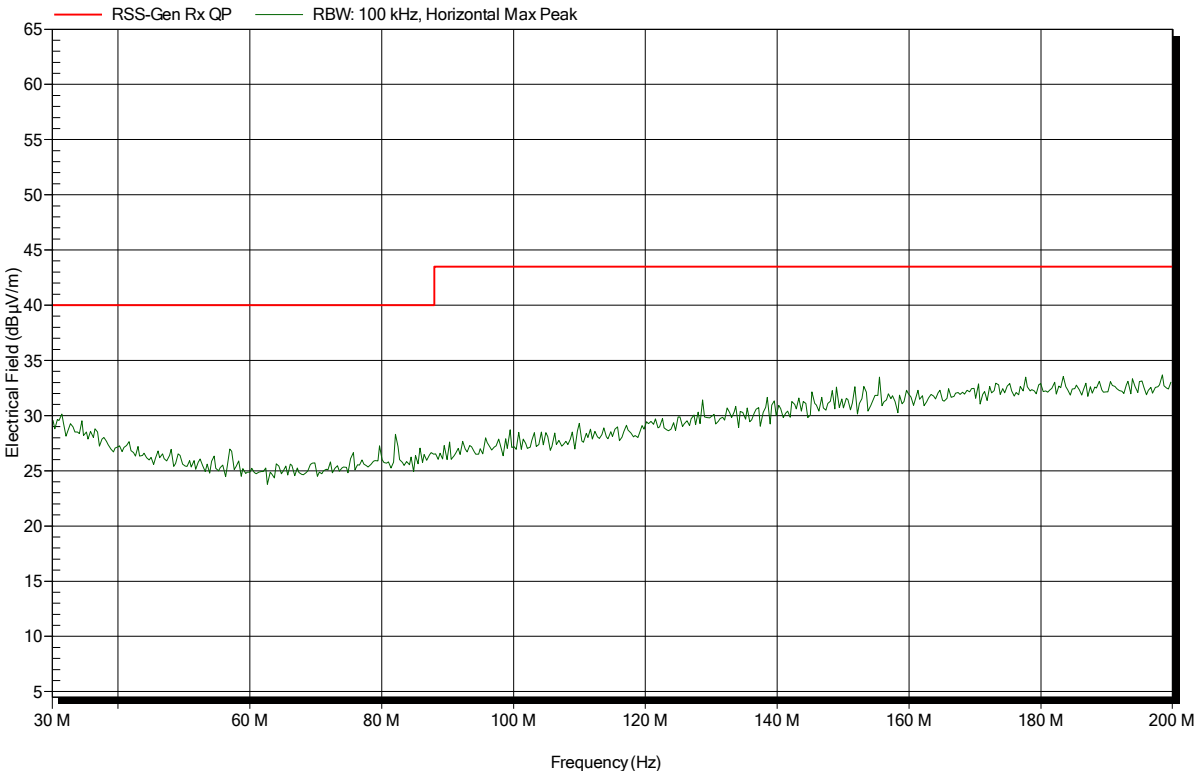
ANNEX B Receiver spurious emissions

Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 51

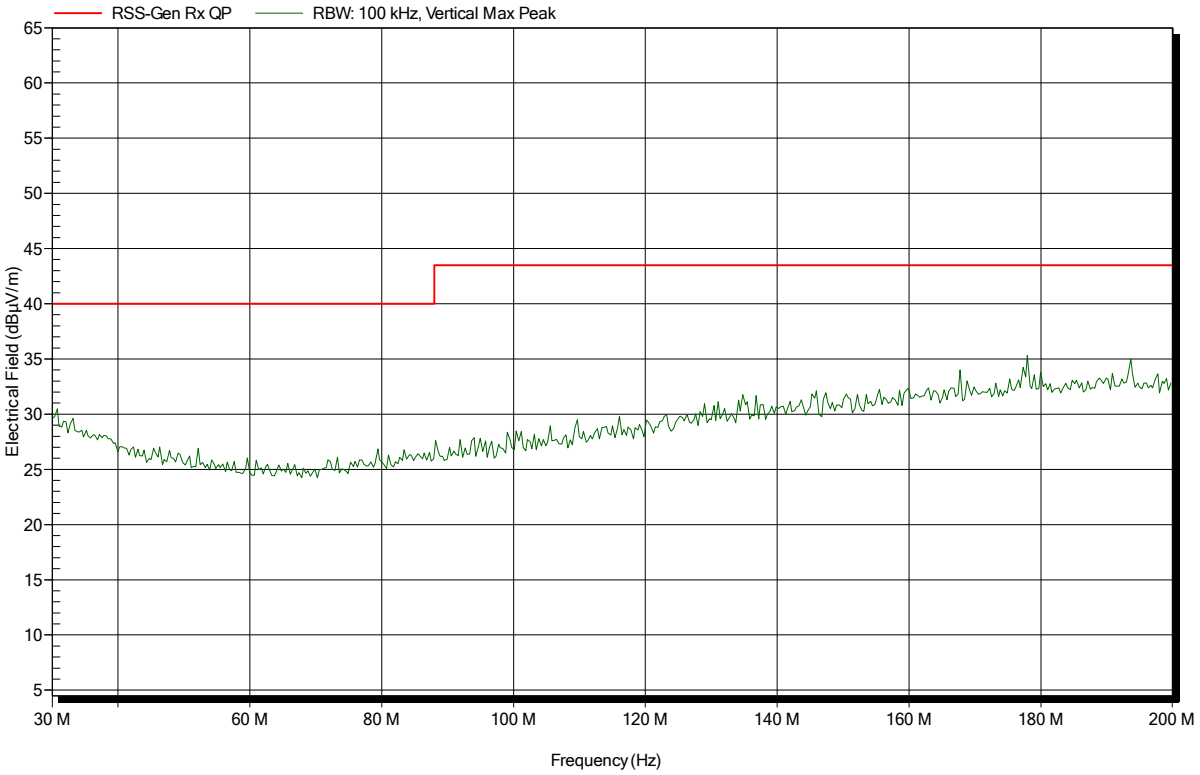


Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 52

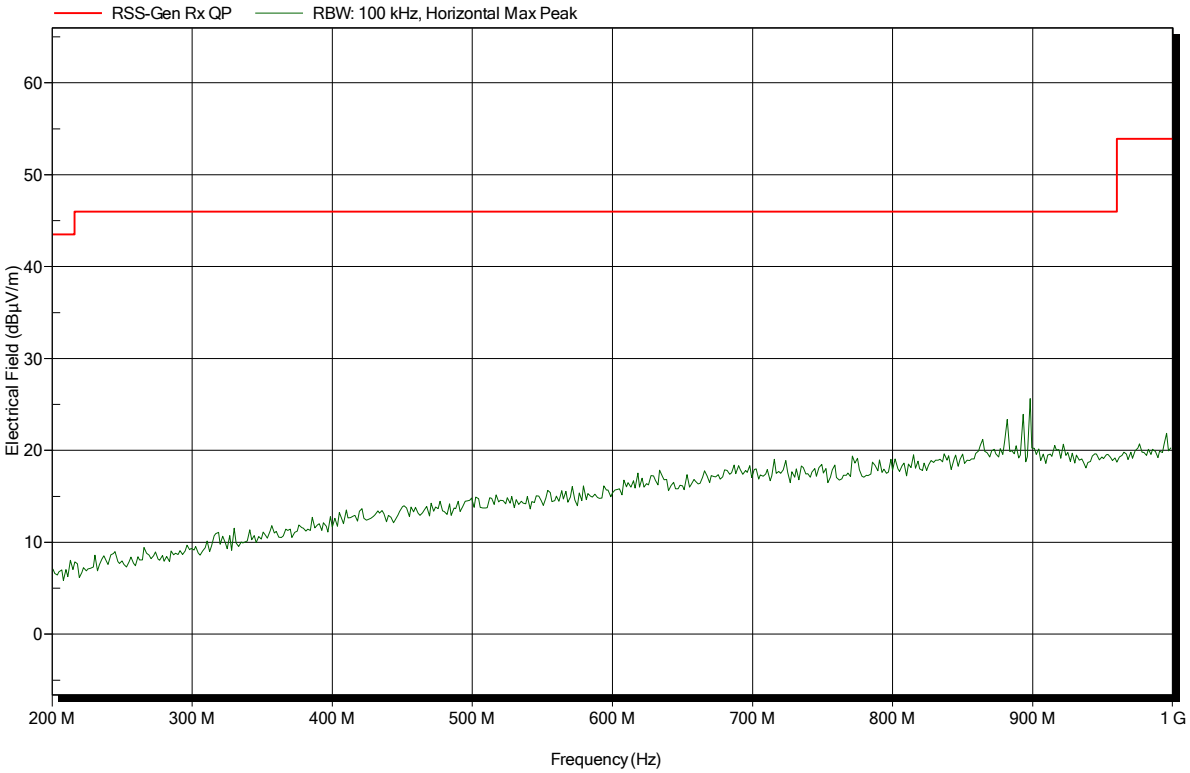


Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 53

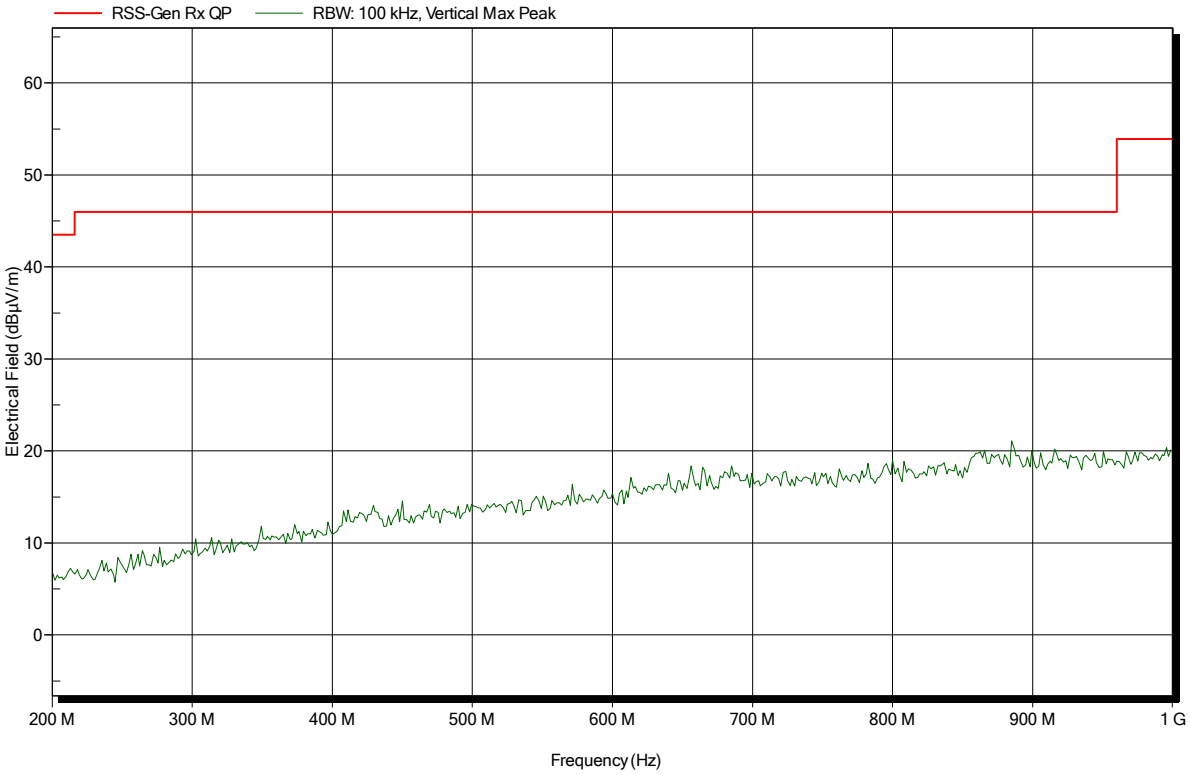


Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 54

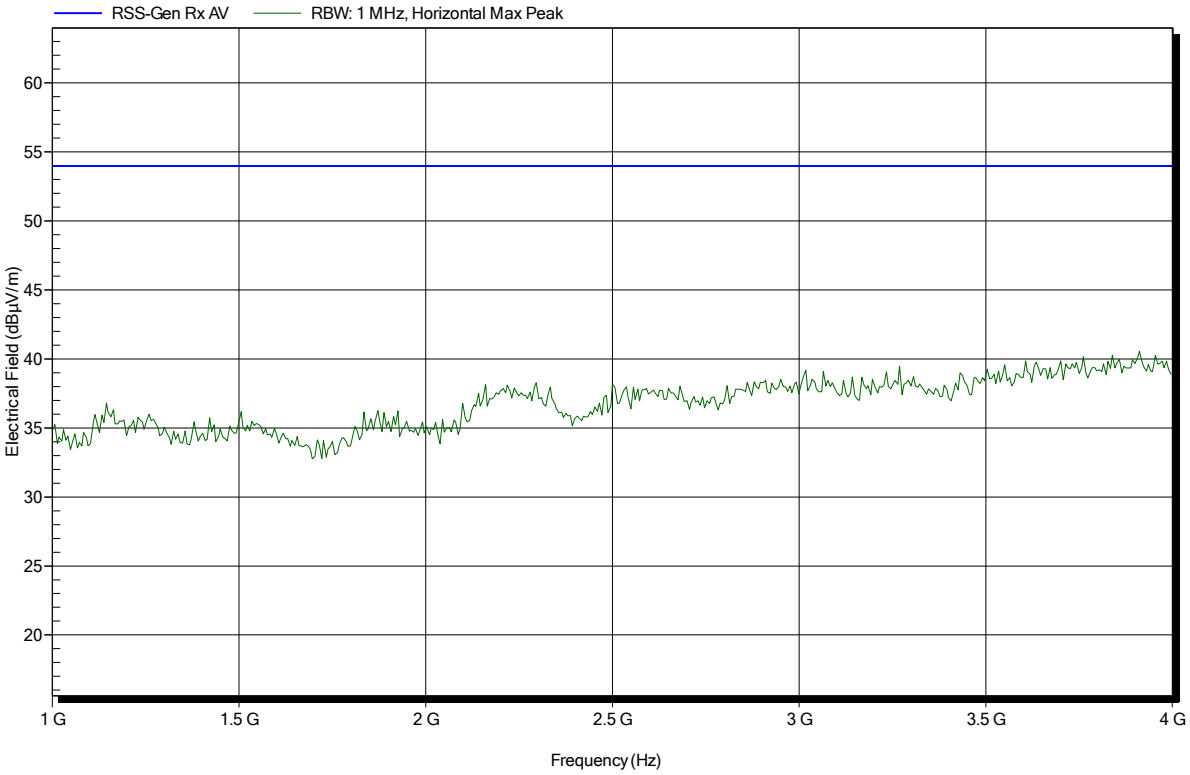


Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 42

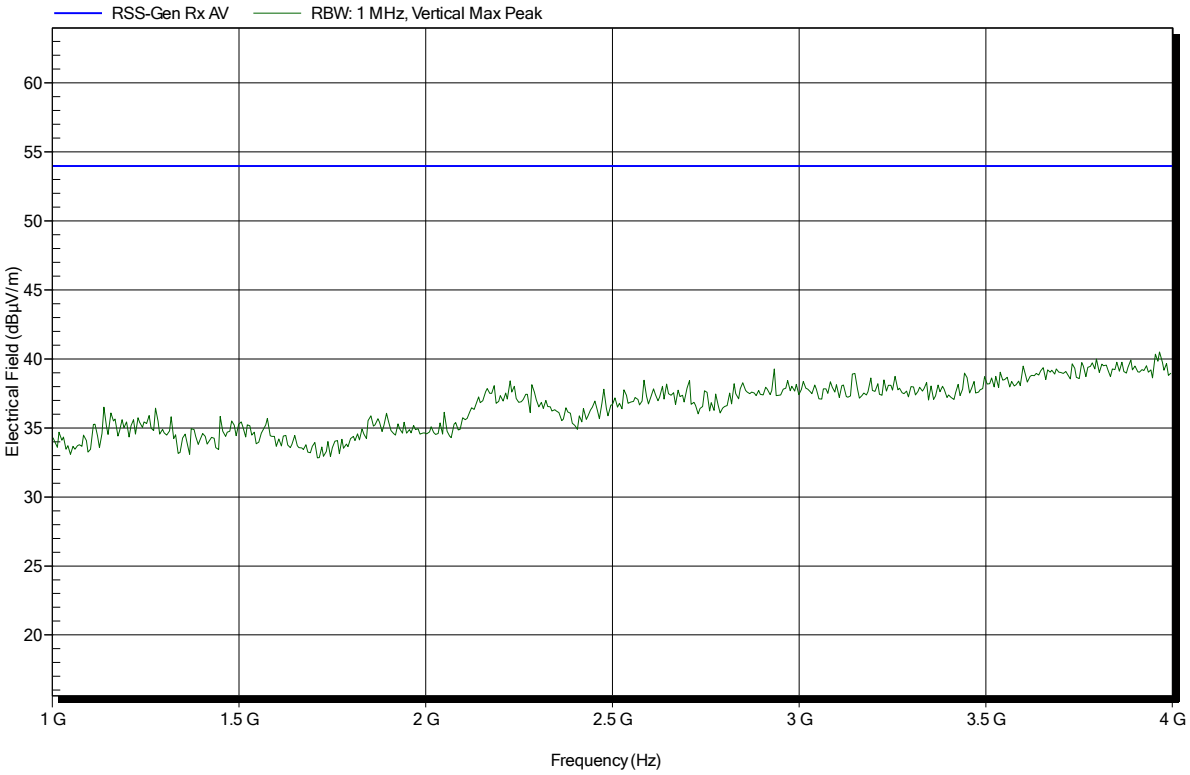


Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 47

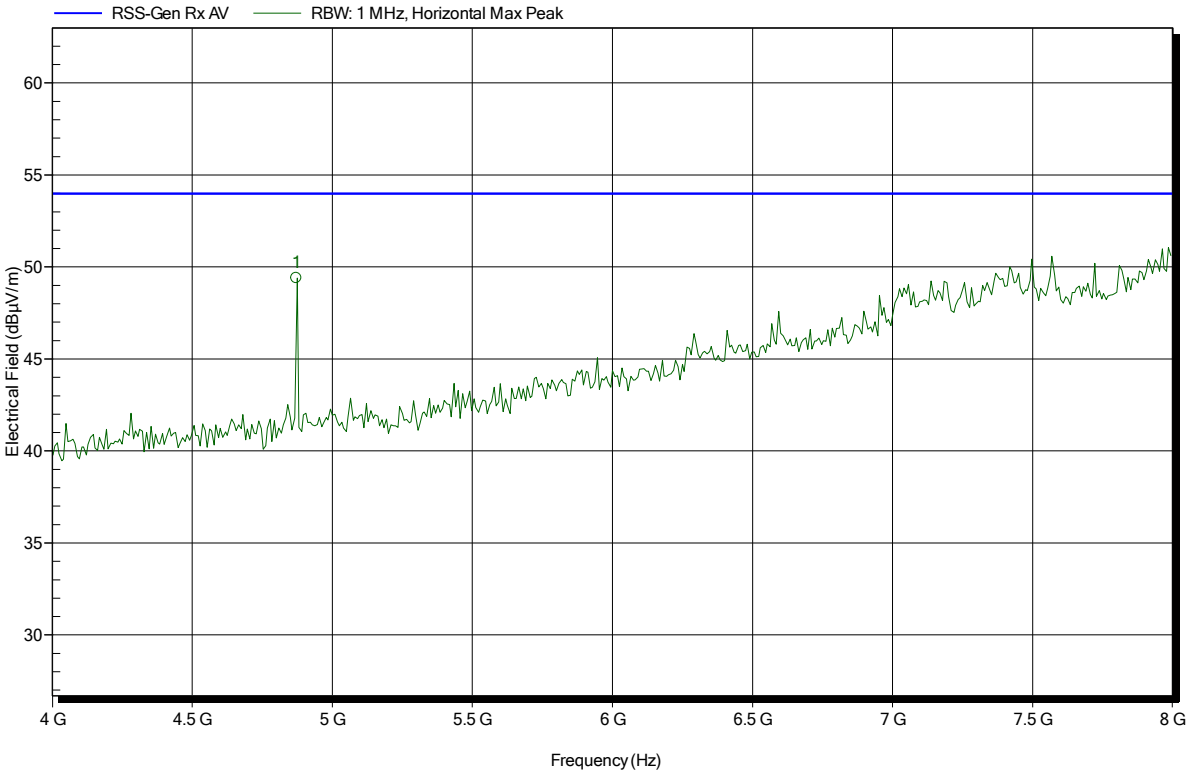


Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 43



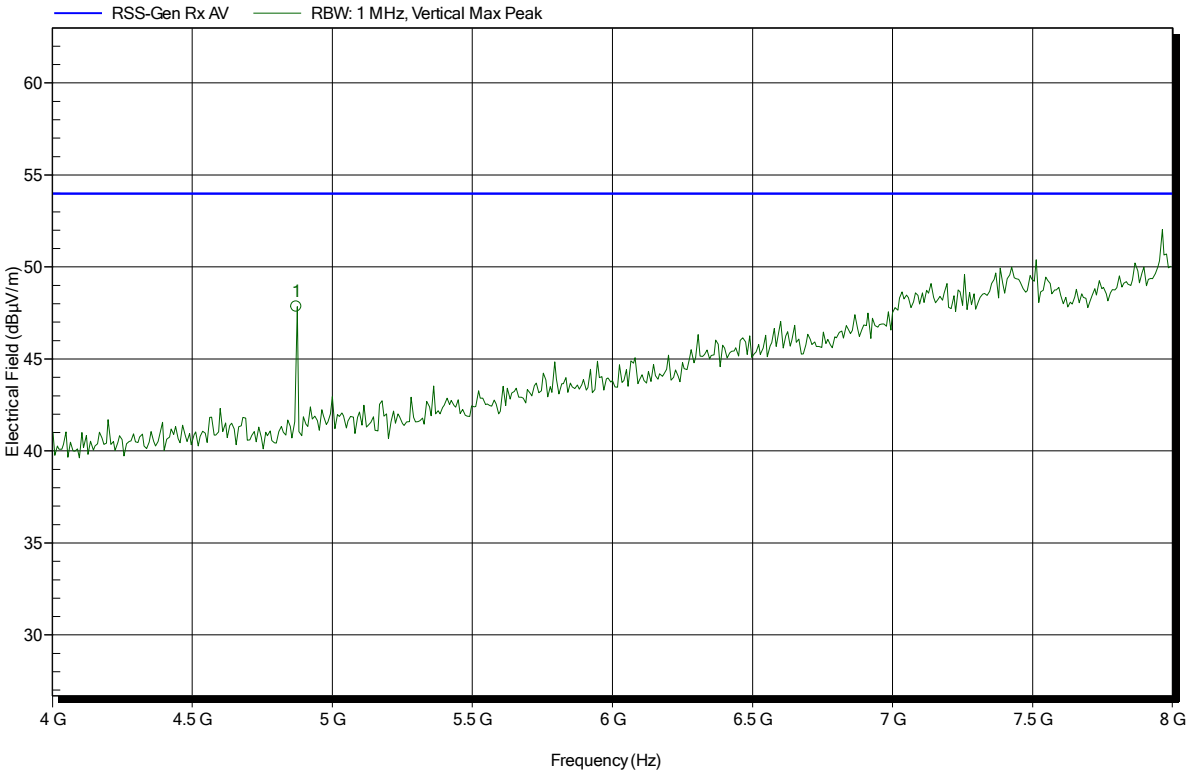
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.872 GHz	49.4 dBµV/m	53.98 dBµV/m	-4.58 dB	Pass

Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 48



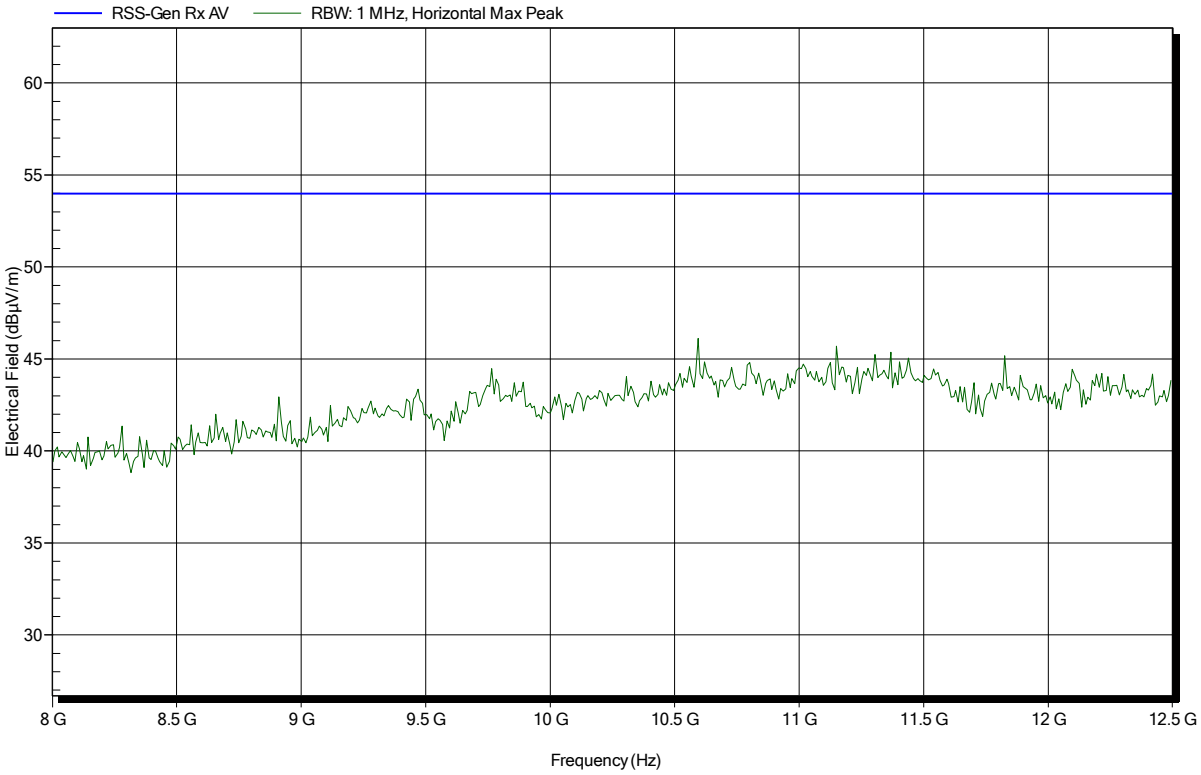
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.872 GHz	47.84 dBµV/m	53.98 dBµV/m	-6.14 dB	Pass

Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 50



Spurious emissions according to RSS-Gen Issue 4

Project number: G0M-1707-6706

Applicant:	Kinematics GmbH
EUT Name:	Energy module with haptical user interface + bluetooth interface
Model:	Powerbrain 2IM.1PB.300
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Treffke
Test Conditions:	Tnom: 24°C, Vnom: 7.2 VDC (lithium battery)
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	RX; BLE; 2440 MHz
Test Date:	2017-07-25
Note:	

Index 49