

## EMC TEST REPORT

FCC 47 CFR Part 15B  
Industry Canada ICES-003

Electromagnetic compatibility - Unintentional radiators

Report Reference No. .... : G0M-1509-5041-EF01-V01

Testing Laboratory ..... : Eurofins Product Service GmbH

Address ..... : Storkower Str. 38c  
15526 Reichenwalde  
Germany

Accreditation ..... :



A2LA Accredited Testing Laboratory, Certificate No.: 1983.01  
FCC Filed Test Laboratory, Reg.-No.: 96970  
IC OATS Filing assigned code: 3470A

Applicant's name ..... : Kinematics GmbH

Address ..... : Börnicker Chaussee 1 – 2  
16321 Bernau bei Berlin  
GERMANY

### Test specification:

Standard..... : 47 CFR Part 15 Subpart B  
ICES-003, Issue 5:2012  
ANSI C63.4:2014

### Equipment under test (EUT):

Product description	Energy module with haptical user interface + bluetooth interface for toy building set	
Model No.	TB1501	
Additional Models	None	
Hardware version	1IM.1PB.300.D	
Firmware / Software version	PowerBrain Version 0.1	
IDs	FCC-ID: 2AFV5-TB1501	IC: 20598-TB1501
<b>Test result</b>	<b>Passed</b>	

Test Report No.: G0M-1509-5041-EF01-V01

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

**Possible test case verdicts:**

- not applicable to test object .....: N/A
- test object does meet the requirement.....: P (Pass)
- test object does not meet the requirement.....: F (Fail)

**Testing:**

Date of receipt of test item .....: 2015-10-09

Date (s) of performance of tests .....: 2015-10-22

Compiled by .....: Andreas Pflug

Tested by (+ signature).....: Andreas Pflug

Approved by (+ signature) .....: Marcus Klein  
Head of Lab

Date of issue.....: 2015-10-29

Total number of pages.....: 31

*A. Pflug*

*Marcus Klein*

**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:**

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## Version History

Version	Issue Date	Remarks	Revised by
V01	2015-10-29	Initial Release	

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## 1 Equipment (Test item) Description

<b>Description</b>	Energy module with haptical user interface + bluetooth interface for toy building set
<b>Model</b>	TB1501
<b>Additional Models</b>	None
<b>Serial number</b>	None
<b>Hardware version</b>	1IM.1PB.300.D
<b>Software / Firmware version</b>	PowerBrain Version 0.1
<b>FCC-ID</b>	2AFV5-TB1501
<b>IC-ID</b>	20598-TB1501
<b>Power supply</b>	7.4 VDC rechargeable battery
<b>AC/DC-Adaptor</b>	Model : HNP18-09L6 Manufacturer : HN Power Germany Input : 100-240VAC / 50-60Hz Output : 9VDC / 2.0A with TB1501 (Tinker bots)
<b>Manufacturer</b>	Kinematics GmbH Börnicker Chaussee 1 – 2 16321 Bernau bei Berlin GERMANY
<b>Highest emission frequency</b>	Fmax [MHz] = 16 MHz
<b>Device classification</b>	Class B
<b>Equipment type</b>	Tabletop
<b>Number of tested samples</b>	1

#### 1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
None				
<p><b>*Note:</b> Use the following abbreviations:</p> <p>AE : Auxiliary/Associated Equipment, or</p> <p>SIM : Simulator (Not Subjected to Test)</p> <p>CABL : Connecting cables</p>				

#### 1.5 Input / Output Ports

Port #	Name	Type*	Max. Cable Length	Cable Shielded	Comments
1	USB	DC	0.5m	yes	charging only with Power Supply TB 1501
<p><b>*Note:</b> Use the following abbreviations:</p> <p>AC : AC power port</p> <p>DC : DC power port</p> <p>N/E : Non electrical</p> <p>I/O : Signal input or output port</p> <p>TP : Telecommunication port</p>					

## 1.6 Operating Modes and Configurations

Mode #	Description
1	transmitting
2	charging

Configuration #	EUT Configuration
1	Normal configuration

## 1.7 Test Equipment Used During Testing

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

Radiated emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Biconical Antenna	R&S	HK 116	EF00012	2013-02	2016-02
LPD-Antenne	R&S	HL 223	EF00187	2014-03	2017-03
Horn antenna	Schwarzbeck	BBHA 9120D	EF00018	2013-09	2016-09
EMI Test Receiver	R&S	ESU26	EF00887	2015-01	2016-01

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	2014-10	2015-10



## 1.8 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 dB $\mu$ V. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

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

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

Net:

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

Limit:

This is the FCC Class B radiated emission limit (in units of dB $\mu$ V/m). The FCC limits are given in units of  $\mu$ V/m. The following formula is used to convert the units of  $\mu$ V/m to dB $\mu$ V/m:

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

Margin:

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

Example only:

$$\begin{array}{rclclcl} \text{Reading} & + & \text{AF} & = & \text{Net Reading} & : & \text{Net reading - FCC limit} & = & \text{Margin} \\ 21.5 \text{ dB}\mu\text{V} & + & 26 \text{ dB} & = & 47.5 \text{ dB}\mu\text{V/m} & : & 47.5 \text{ dB}\mu\text{V/m} - 57.0 \text{ dB}\mu\text{V/m} & = & -9.5 \text{ dB} \end{array}$$

## 2 Result Summary

FCC 47 CFR Part 15B, Industry Canada ICES-003				
Product Specific Standard	Requirement – Test	Reference Method	Result	Remarks
47 CFR 15.109 ICES-003 Item 6.2	Radiated emissions	ANSI C 63.4	PASS	
47 CFR 15.107 ICES-003 Item 6.1	AC power line conducted emissions	ANSI C63.4	PASS	
Remarks:				

### 3 Test Conditions and Results

#### 3.1 Test Conditions and Results – Radiated emissions

Radiated emissions acc. FCC 47 CFR 15.109 / ICES-003					Verdict: PASS		
Laboratory Parameters:		Required prior to the test			During the test		
Ambient Temperature		15 to 35 °C			23°		
Relative Humidity		30 to 60 %			35%		
Test according referenced standards		Reference Method					
		ANSI C63.4					
Sample is tested with respect to the requirements of the equipment class		Equipment class					
		Class B					
Test frequency range determined from highest emission frequency		Highest emission frequency					
		Fmax [MHz] = 16 MHz					
Fully configured sample scanned over the following frequency range		Frequency range					
		30 MHz to 1 GHz					
Operating mode		1 & 2					
Configuration		1					
Limits and results Class B							
Frequency [MHz]	Quasi-Peak [dBµV/m]	Result	Average [dBµV/m]	Result	Peak [dBµV/m]	Result	
30 – 88	40	PASS	-		-	-	
88 – 216	43.5	PASS	-		-	-	
216 – 960	46	PASS	-		-	-	
960 – 1000	54	PASS	-		-	-	
Comments:							

**Test Procedure:**

The test site is in accordance with ANSI C63-4:2014 requirements and is listed by FCC.

The measurement procedure is as follows:

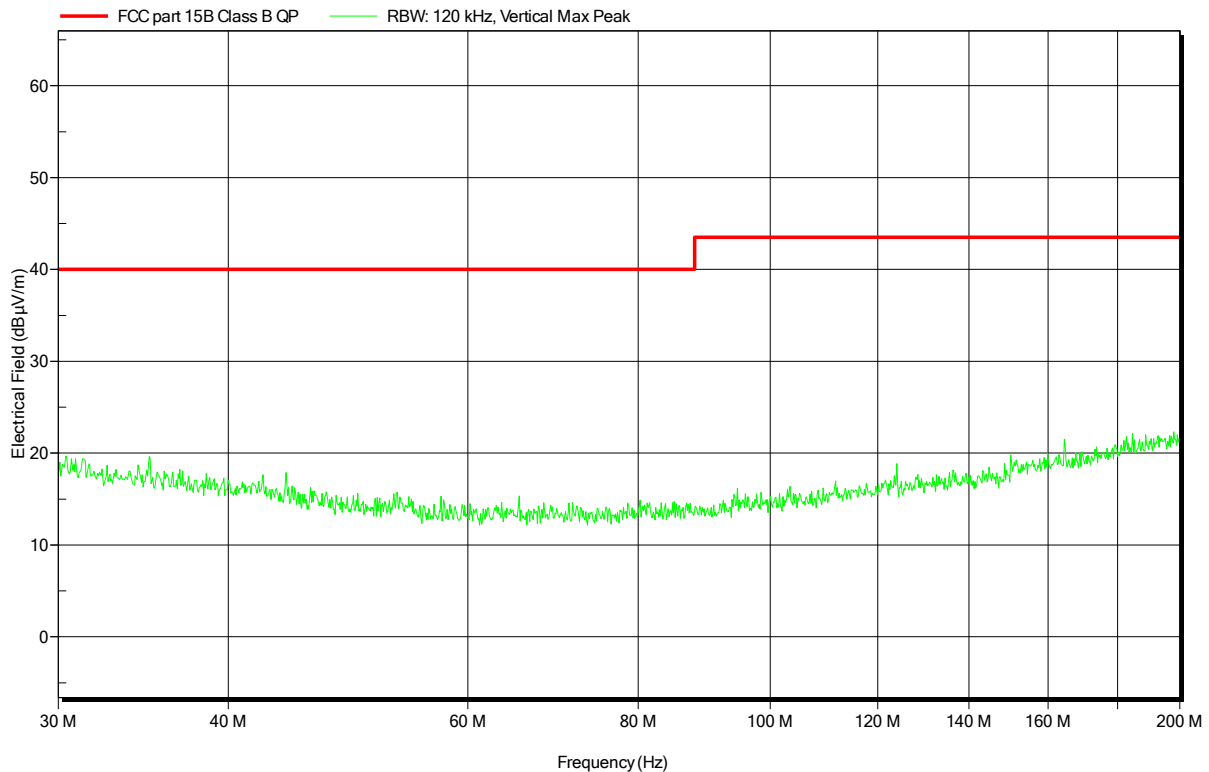
- 1) The EUT was placed on a 0.8 m non conductive table at a 3 m distance from the receive antenna (ANSI C63.4: 2009 item 6.2)
- 2) The antenna output was connected to the measurement receiver
- 3) A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 1000 MHz. Above one 1 GHz a Double Ridged Broadband Horn antenna was used. The antenna was placed on an adjustable height antenna mast
- 4) Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.

## Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1509-5041

Applicant:	Kinematics GmbH
EUT Name:	TB1501
Model:	Energy module with haptical user interface + bluetooth interface for toy building set
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: battery
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	transmitting
Test Date:	2015-10-22
Note:	

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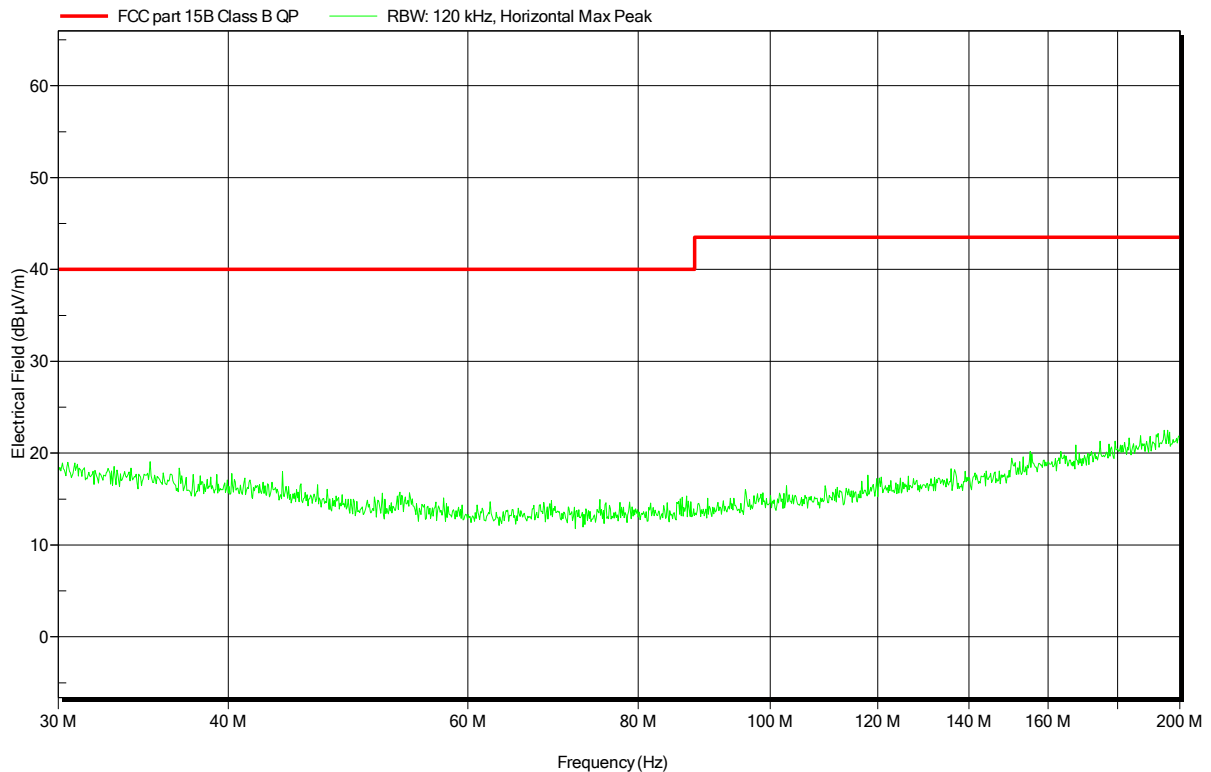


## Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1509-5041

Applicant:	Kinematics GmbH
EUT Name:	TB1501
Model:	Energy module with haptical user interface + bluetooth interface for toy building set
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: battery
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	transmitting
Test Date:	2015-10-22
Note:	

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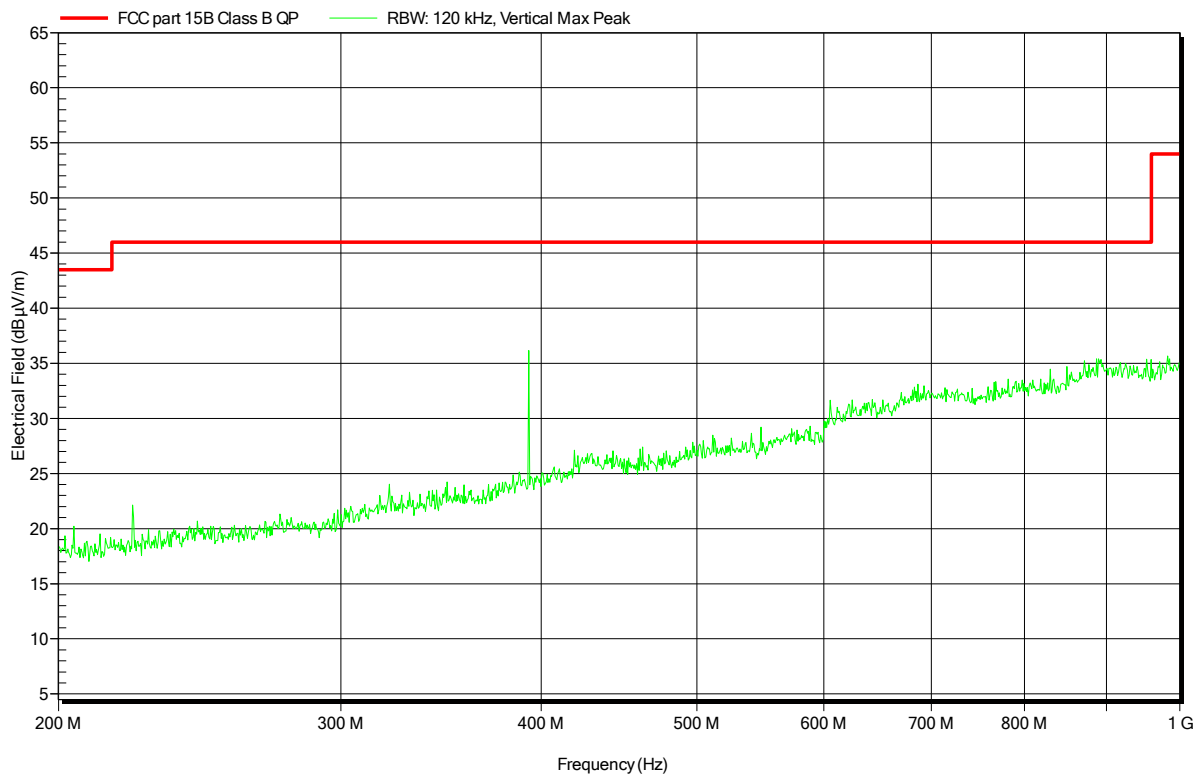


**Spurious emissions under normal conditions according to FCC 15B**

Project number: G0M-1509-5041

Applicant:	Kinematics GmbH
EUT Name:	TB1501
Model:	Energy module with haptical user interface + bluetooth interface for toy building set
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: battery
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3m
Mode:	transmitting
Test Date:	2015-10-22
Note:	

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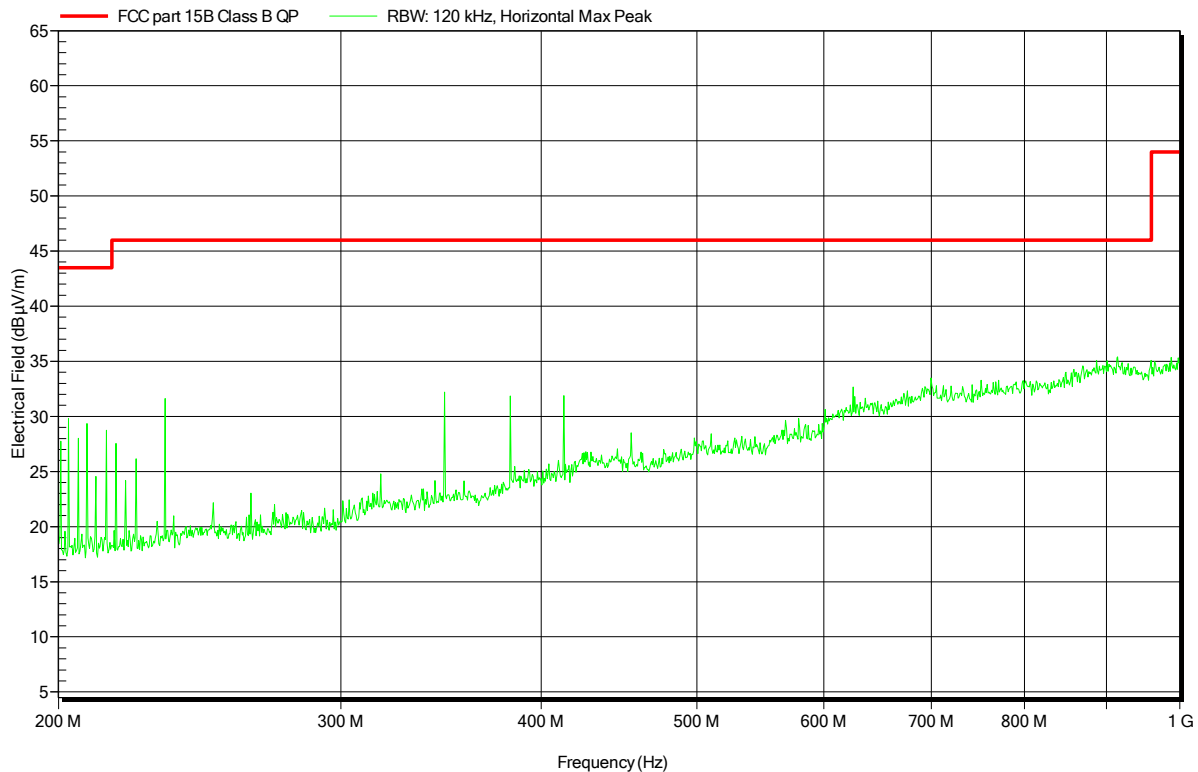


## Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1509-5041

Applicant:	Kinematics GmbH
EUT Name:	TB1501
Model:	Energy module with haptical user interface + bluetooth interface for toy building set
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: battery
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	transmitting
Test Date:	2015-10-22
Note:	

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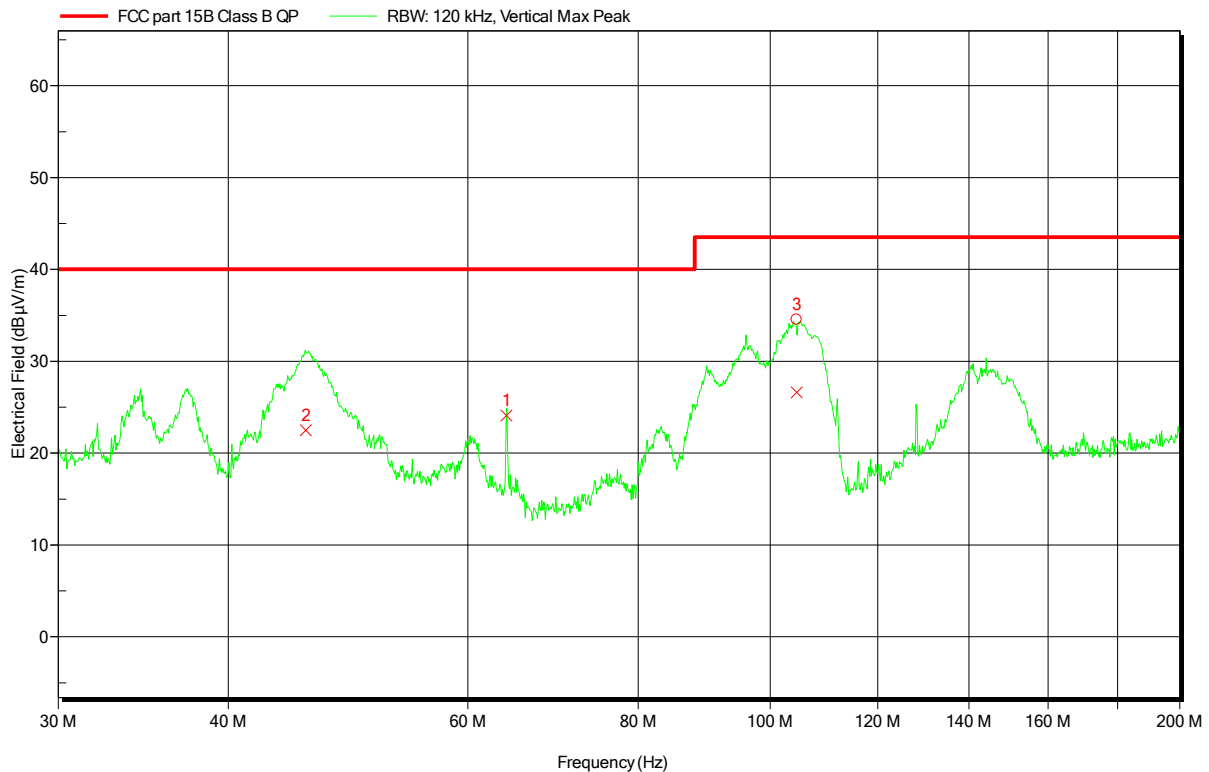


## Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1509-5041

Applicant: Kinematics GmbH  
 EUT Name: TB1501  
 Model: Energy module with haptical user interface + bluetooth interface for toy building set  
 Test Site: Eurofins Product Service GmbH  
 Operator: Mr. Pflug  
 Test Conditions: Tnom: 23°C, Unom: 120VAC(AC/DC-adapter)  
 Antenna: Rohde & Schwarz HK 116, Vertical  
 Measurement distance: 3m  
 Mode: charging  
 Test Date: 2015-10-22  
 Note: PS: HNP-18-090L6 with TINKER-BOTS model: TB1501

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Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
104.58 MHz	26.61 dBµV/m	43.5 dBµV/m	-16.89 dB	Pass	280 Degree	1.08 m
45.6 MHz	22.48 dBµV/m	40 dBµV/m	-17.52 dB	Pass	310 Degree	1.00 m
64.02 MHz	24.09 dBµV/m	40 dBµV/m	-15.91 dB	Pass	302 Degree	1.00 m

Test Report No.: G0M-1509-5041-EF01-V01

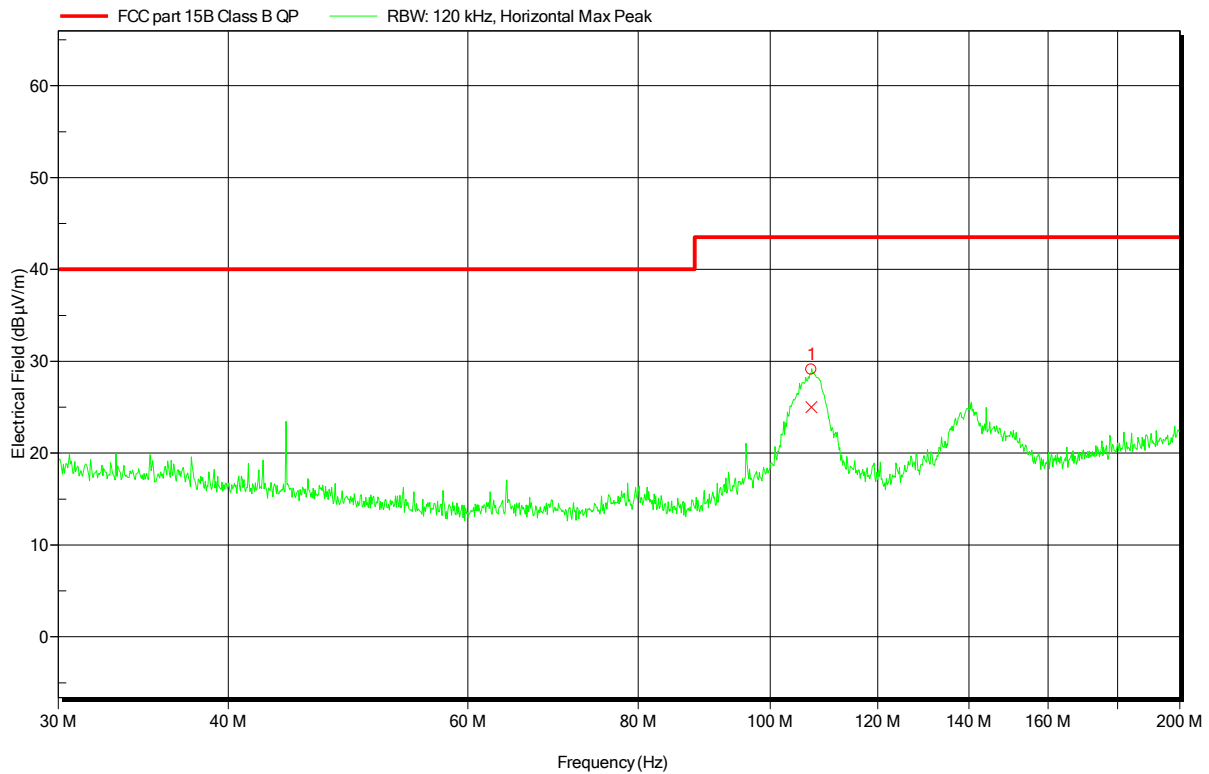
Eurofins Product Service GmbH  
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

## Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1509-5041

Applicant: Kinematics GmbH  
 EUT Name: TB1501  
 Model: Energy module with haptical user interface + bluetooth interface for toy building set  
 Test Site: Eurofins Product Service GmbH  
 Operator: Mr. Pflug  
 Test Conditions: Tnom: 23°C, Unom: 120VAC(AC/DC-adapter)  
 Antenna: Rohde & Schwarz HK 116, Horizontal  
 Measurement distance: 3m  
 Mode: charging  
 Test Date: 2015-10-22  
 Note: PS: HNP-18-090L6 with TINKER-BOTS model: TB1501

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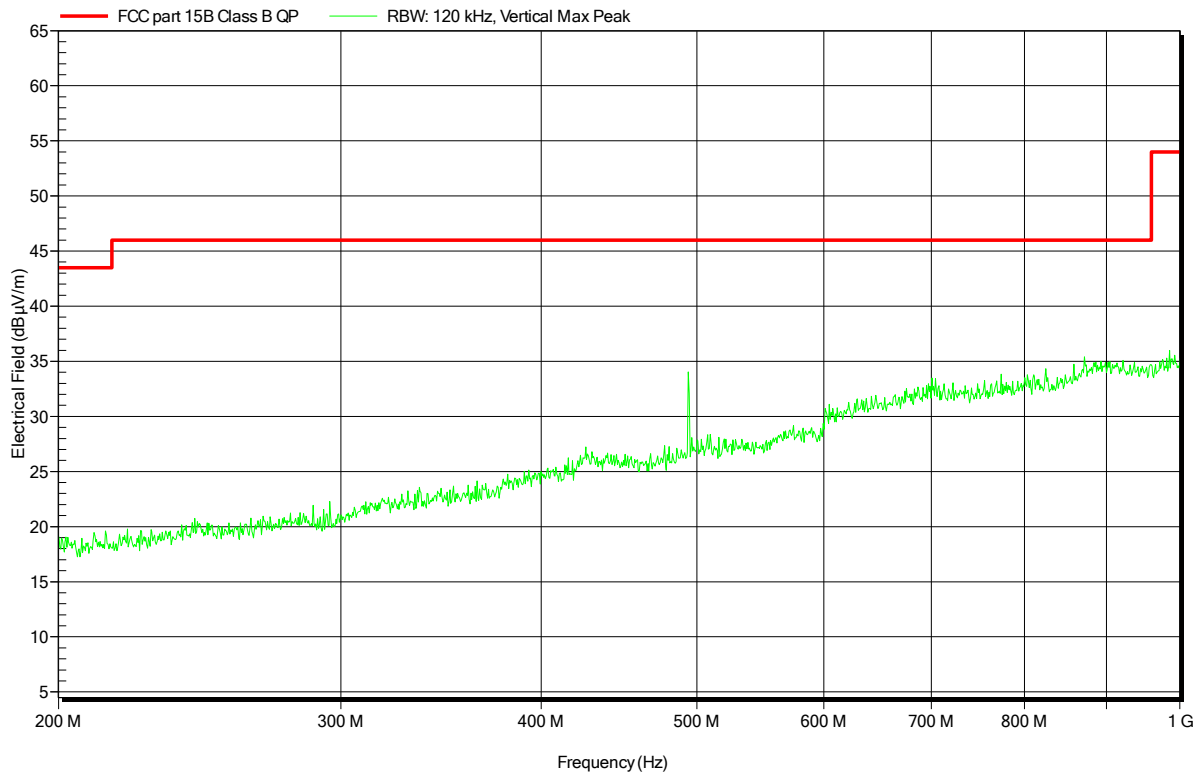
Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
107.22 MHz	25.02 dBµV/m	43.5 dBµV/m	-18.48 dB	Pass	145 Degree	2.16 m

## Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1509-5041

Applicant:	Kinematics GmbH
EUT Name:	TB1501
Model:	Energy module with haptical user interface + bluetooth interface for toy building set
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: 120VAC(AC/DC-adapter)
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3m
Mode:	charging
Test Date:	2015-10-22
Note:	PS: HNP-18-090L6 with TINKER-BOTS model: TB1501

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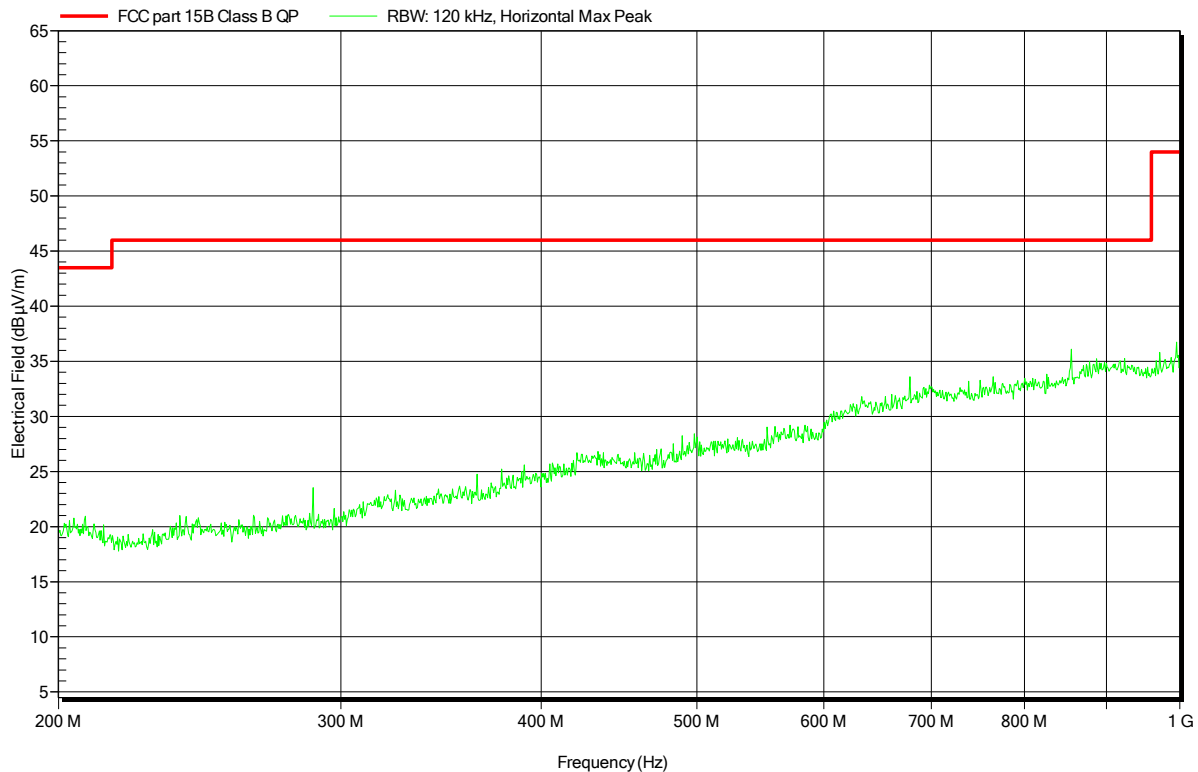


## Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1509-5041

Applicant:	Kinematics GmbH
EUT Name:	TB1501
Model:	Energy module with haptical user interface + bluetooth interface for toy building set
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: 120VAC(AC/DC-adapter)
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	charging
Test Date:	2015-10-22
Note:	PS: HNP-18-090L6 with TINKER-BOTS model: TB1501

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### 3.2 Test Conditions and Results – AC power line conducted emissions

Conducted emissions acc. FCC 47 CFR 15.107 / ICES-003			Verdict: PASS	
Laboratory Parameters:		Required prior to the test	During the test	
Ambient Temperature		15 to 35 °C	23°	
Relative Humidity		30 to 60 %	35%	
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		
Sample is tested with respect to the requirements of the equipment class		Equipment class		
		Class B		
Points of Application		Application Interface		
AC Mains		LISN		
Operating mode		1		
Configuration		1		
Limits and results Class B				
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.				

**Test Procedure:**

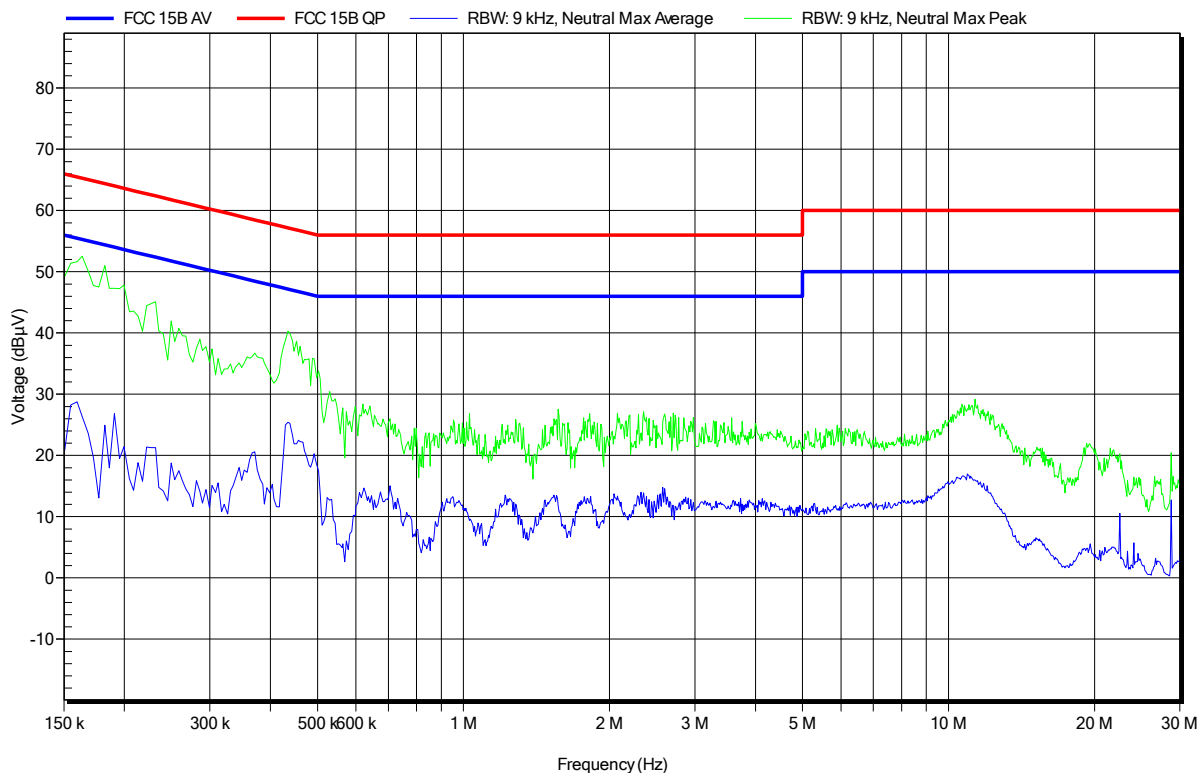
- 1) The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
- 2) The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- 3) The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
- 4) The LISN measurement port was connected to a measurement receiver
- 5) I/O cables were bundled not longer than 0.4 m
- 6) Measurement was performed in the frequency range 0.15 – 30MHz on each current-carrying conductor

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

Project number: G0M-1509-5041

Applicant:	Kinematics GmbH
EUT Name:	TB1501
Model:	Energy module with haptical user interface + bluetooth interface for toy building set
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: 120VAC(AC/DC-adapter)
LISN:	ESH2-Z5 N
Mode:	charging
Test Date:	2015-10-22
Note:	PS: HNP-18-090L6 with TINKER-BOTS model: TB1501

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

Project number: G0M-1509-5041

Applicant:	Kinematics GmbH
EUT Name:	TB1501
Model:	Energy module with haptical user interface + bluetooth interface for toy building set
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Pflug
Test Conditions:	Tnom: 23°C, Unom: 120VAC(AC/DC-adapter)
LISN:	ESH2-Z5 L
Mode:	charging
Test Date:	2015-10-22
Note:	PS: HNP-18-090L6 with TINKER-BOTS model: TB1501

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