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EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada ICES-003

Electromagnetic compatibility - Unintentional radiators

Report Reference No. ..... :	G0M-1602-5411-EF0115B-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 ..... :	Hellberg Safety AB
Address ..... :	Stakebergsvägen 2 443 61 Stenkullen SWEDEN
Test specification:	
Standard..... :	47 CFR Part 15 Subpart B ICES-003, Issue 5:2012 ANSI C63.4:2014
Equipment under test (EUT):	
Product description	Hearing protector
Model No.	Secure Synergy 2H
Additional Models	None
Hardware version	Rev-2
Firmware / Software version	1.01
Contains	FCC-ID: QF9-SYNERGY IC: 5808A-SYNERGY
Test result	**Passed**

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 ..... :	2016-02-29
Date (s) of performance of tests ..... :	2016-03-17 - 2016-03-21
Compiled by ..... :	Matthias Laurisch
Responsible for test (+ signature) .... :	Jens Marquardt / M. Laurisch
Approved by (+ signature) ..... : Deputy Head of Lab	Jens Zimmermann
Date of issue ..... :	2016-06-17
Total number of pages ..... :	41
General remarks:	
The test results presented in this report relate only to the object tested. **The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.**	
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.	
Additional comments:	

Version History

Version	Issue Date	Remarks	Revised by
V01	2016-06-17	Initial Release	

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

REPORT INDEX

1 Equipment (Test item) Description

Description	Hearing protector	
Model	Secure Synergy 2H	
Additional Models	None	
Serial number	None	
Hardware version	Rev-2	
Software / Firmware version	1.01	
Contains FCC-ID	N/A	
Contains IC	N/A	
Power supply	2.4V DC or 120V AC	
AC/DC-Adaptor	Model : K-T5050100E1 Manufacturer : Bestgk Input : 100-240VAC / 50-60Hz Output : 5VDC / 1.0A	
AC/DC-Adaptor	None	
Radio module	Type	BT Module
	Model	CSR8670
	Manufacturer	Cambridge Silicon Radio Ltd.
	HW Version	CSR8670-BGA CSR8670-CSP
	SW Version	CSR BT4.1 Dual Mode Stack
Manufacturer	Hellberg Safety AB Stakebergsvägen 2 443 61 Stenkullen SWEDEN	
Highest emission frequency	2440 MHz	
Device classification	Class B	
Equipment type	Tabletop	
Number of tested samples	1	

1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments (e.g. serial no.)
1	Mobile phone	Motorola	Moto X	
2	Audio analyzer	R&S	UPL	THDN Measurement

***Note:** Use the following abbreviations:

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

1.5 Input / Output Ports

Port #	Name	Type*	Max. Cable Length	Cable Shielded	Comments (e.g. Cat. of Cable)
1	Audio In	I/O	>3m	Yes	3.5 mm Audio Input
2	Power	AC	<3m	No	The AC/DC adapter

***Note:** Use the following abbreviations:

AC : AC power port

DC : DC power port

N/E : Non electrical

I/O : Signal input or output port

TP : Telecommunication port

1.6 Operating Modes and Configurations

Mode #	Description
1	Charging with A/C adapter, playing sound via BT connection
2	Battery powered, playing sound via BT connection

Configuration #	EUT Configuration
1	EUT fully assembled with AC/DC adapter
2	EUT fully assembled without AC/DC adapter

1.7 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2015.1.12

Radiated emissions – 3m Chamber					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Biconical Antenna	R&S	HK 116	EF00012	2014-03	2017-03
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	2016-01	2017-01

Conducted emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Current probe	R&S	EZ-17	EF00215	2015-11	2017-11
Absorbing Clamp	R&S	MDS 21	EF00035	2014-10	2019-10
ISN	R&S	ENY41	EF00255	2014-04	2016-04
AMN	R&S	ESH2-Z5	EF00182	2014-11	2016-11
CDN	Teseq	ST08AS	EF00411	2015-10	2017-10
AMN	R&S	ESH3-Z5	EF00036	2014-12	2016-12
EMI Test Receiver	R&S	ESR7	EF00943	2015-09	2016-09

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 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 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°C			
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					
	2440MHz					
Fully configured sample scanned over the following frequency range	Frequency range					
	30 MHz to 14 GHz					
Operating mode	1 / 2					
Configuration	1 / 2					
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	-		-	-
> 1000	-	-	54	PASS	74	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:

Exploratory measurement:

- The EUT was placed on a non-conductive table at a height of 0.8m.
- The EUT and support equipment, if needed, were set up to simulate typical usage.
- Cables, of type and length specified by the manufacturer, were connected to at least one port of each type and were terminated by a device or simulating load of actual usage.
- The antenna was placed at a distance of 3 or 10 m.
- The received signal was monitored at the measurement receiver.
    - Cables not bundled were manipulated within the range of likely arrangements to produce the highest emission amplitude
    - To maximize the suspected emissions the EUT is rotated 360 degrees. If the signal exceeds the previous amplitude, go back to the corresponding azimuth and manipulate the cables again for maximizing the emissions if possible.
    - Move the antenna from 1 to 4m to maximize the suspected highest amplitude signal.
- This procedure has to be performed in both antenna polarizations, horizontal and vertical.
- The arrangement of the equipment with the maximum emission level is shown on the setup picture at item 1.3.

Final measurement:

- The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver
- 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
- The EUT and cable arrangement were based on the exploratory measurement results
- Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.
- The test data of the worst-case conditions were recorded and shown on the next pages.

Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1602-5411

Applicant:	Hellberg Safety AB
EUT Name:	Bluetooth Headset
Model:	SECURE Synergy
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Laurisch
Test Conditions:	Tnom: 23°C, Unom: 120VAC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	1
Test Date:	2016-03-21
Note:	

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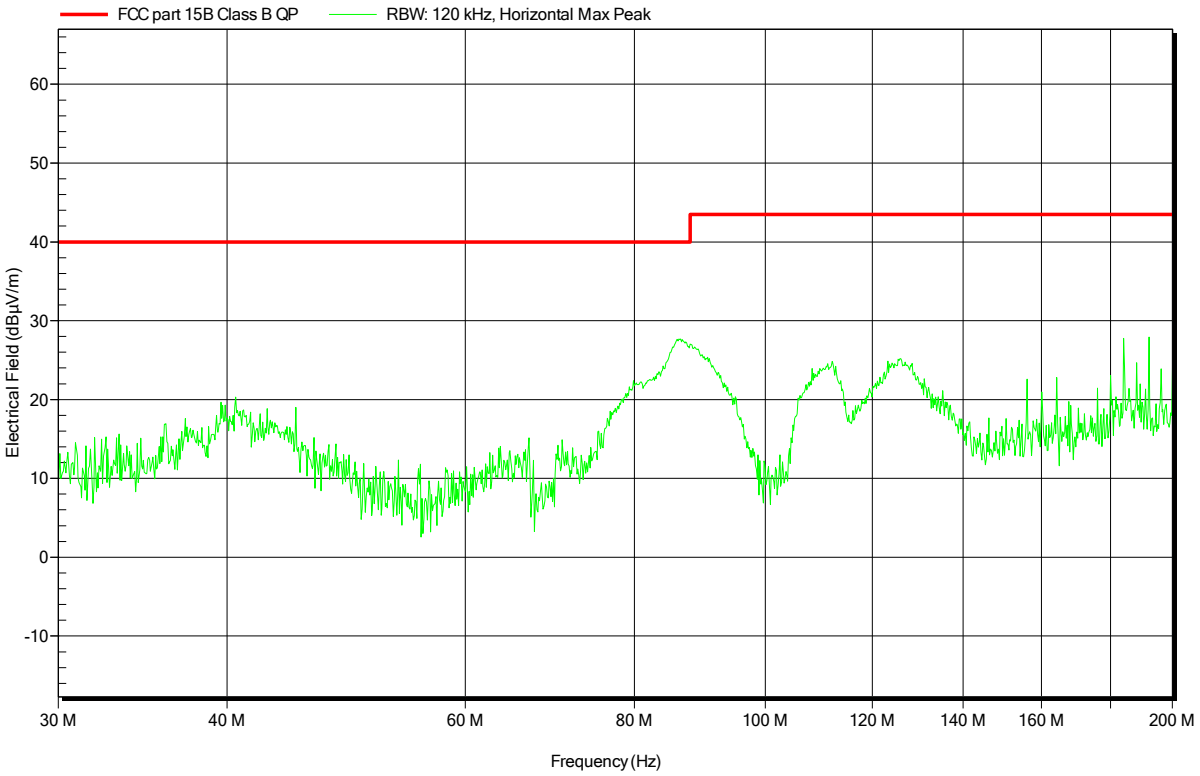

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Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
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Test Date:	2016-03-21
Note:	

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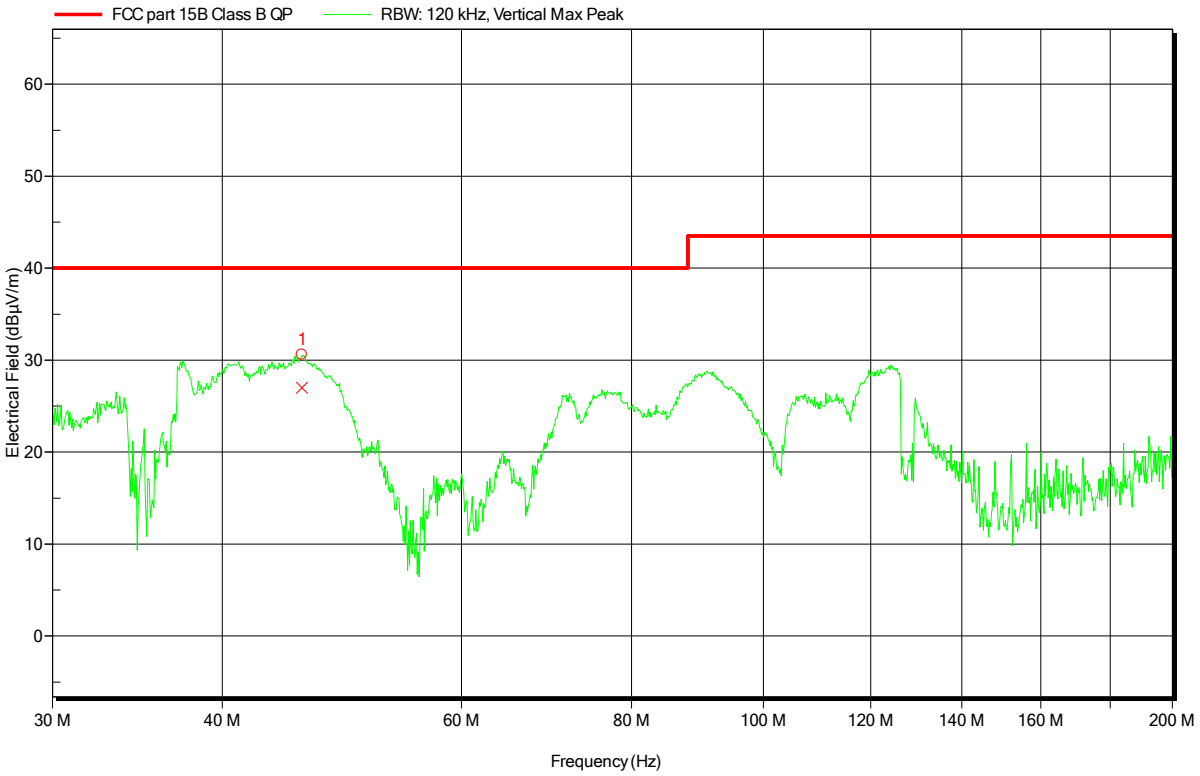

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	45.78 MHz	26.98 dBµV/m	40 dBµV/m	-13.02 dB	Pass	0 Degree	1 m

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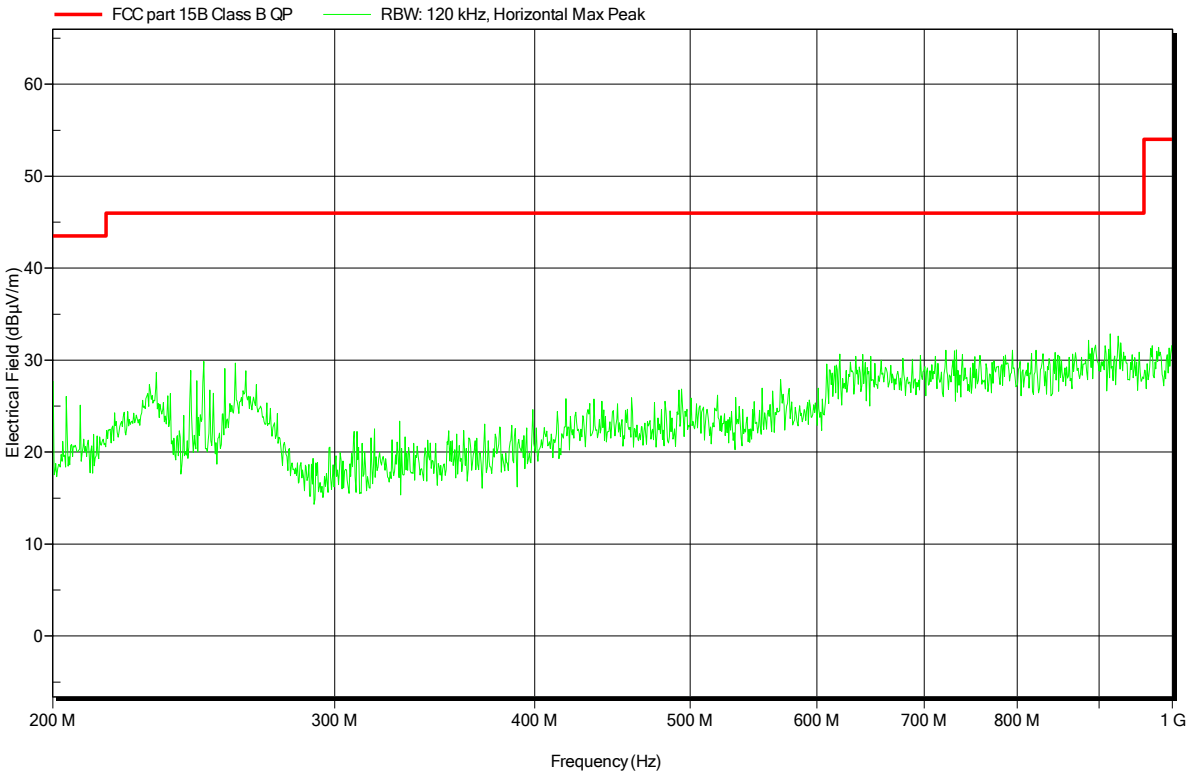

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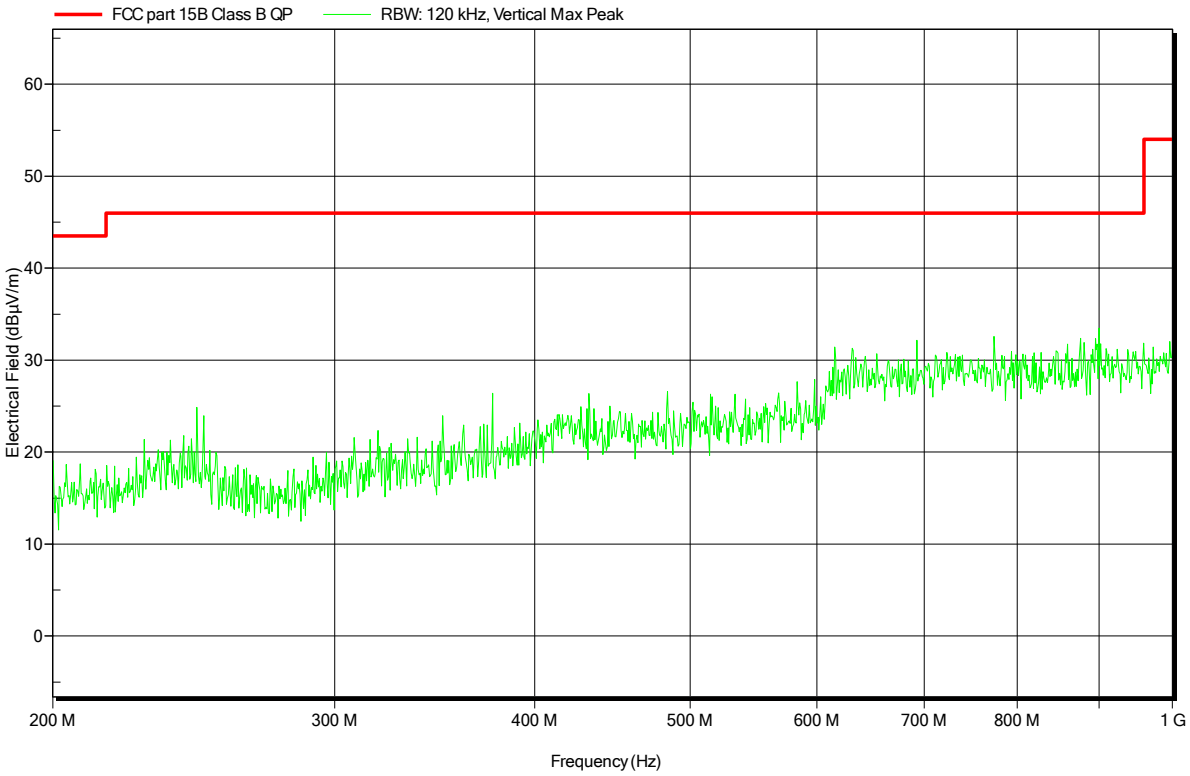

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Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3m
Mode:	1
Test Date:	2016-03-21
Note:	

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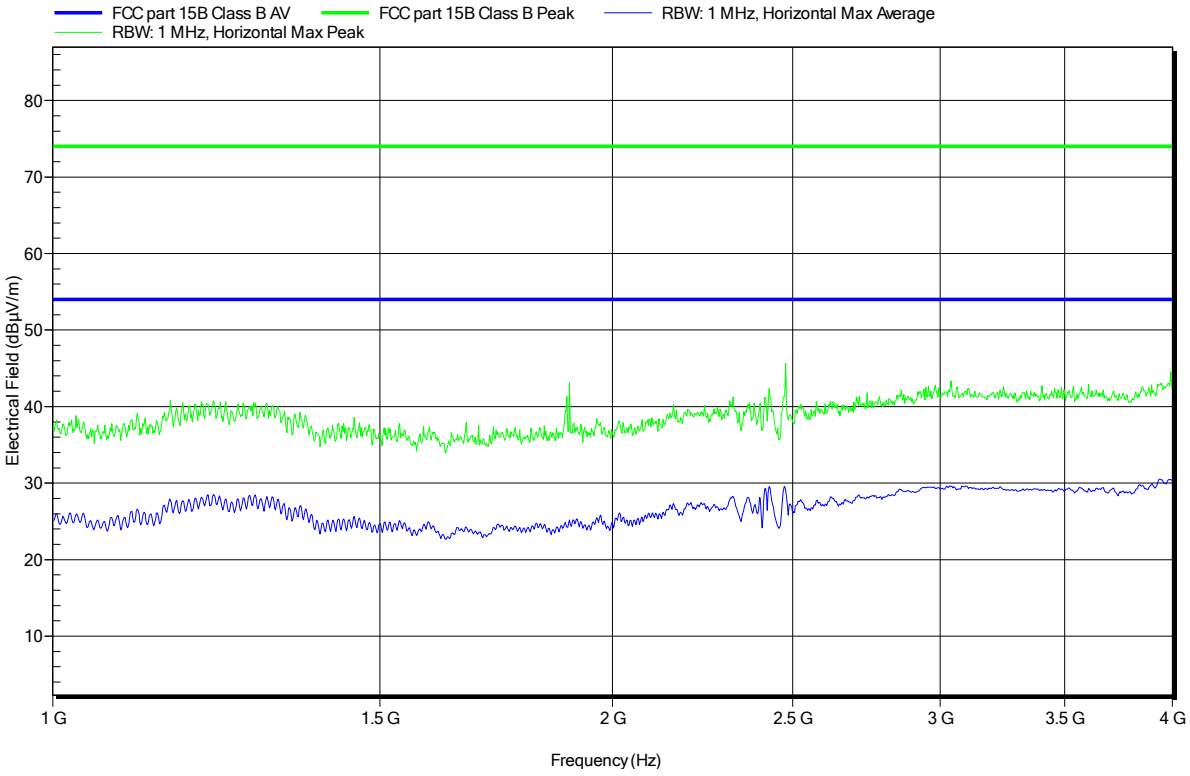

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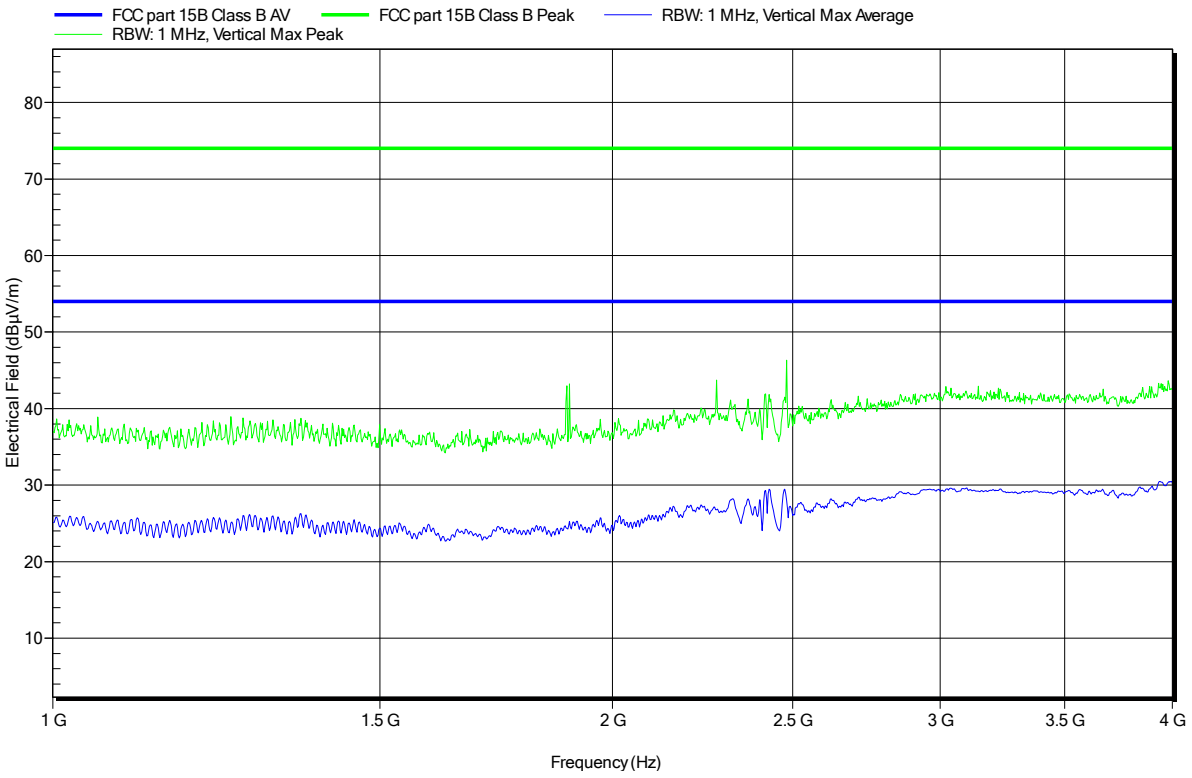

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Note:	

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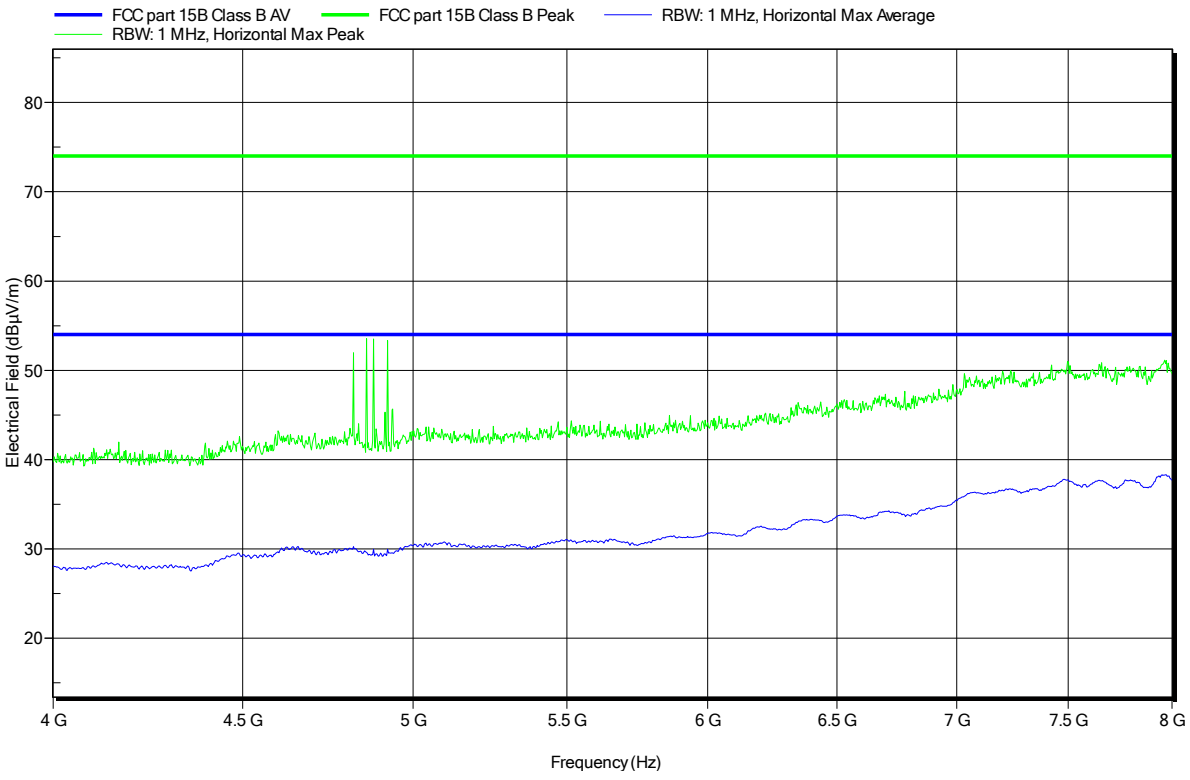

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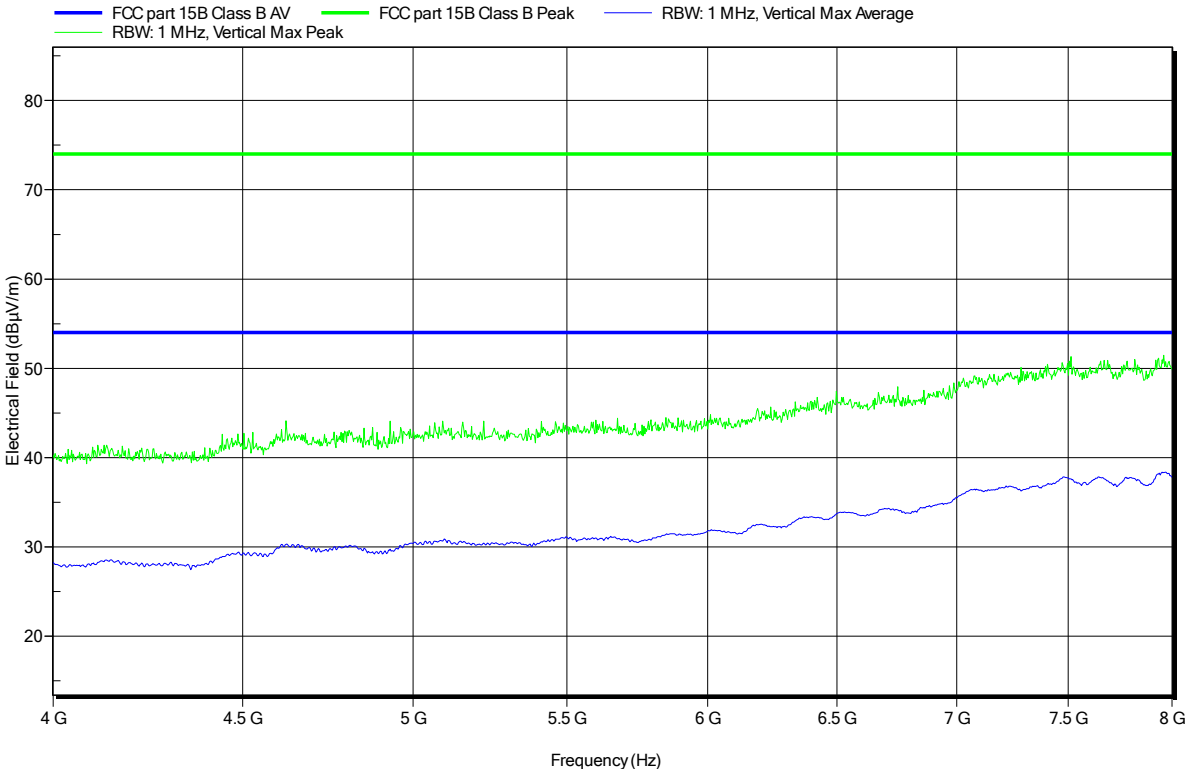

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Note:	

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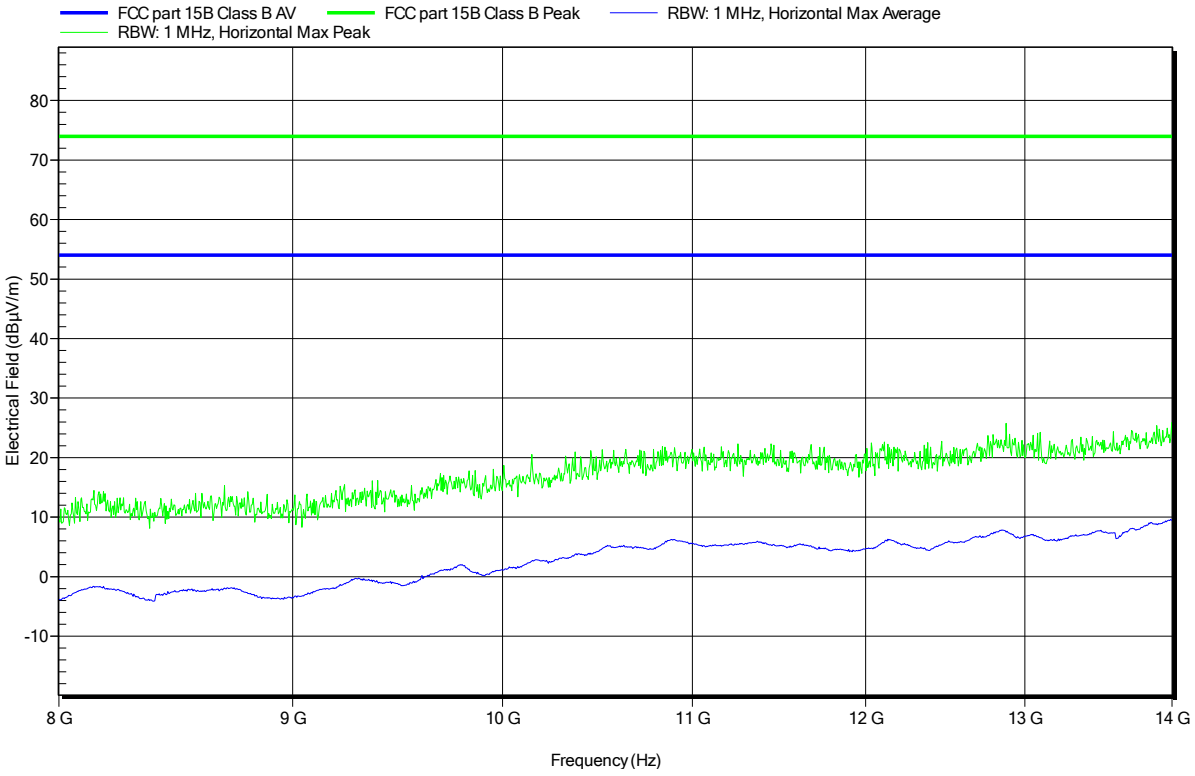

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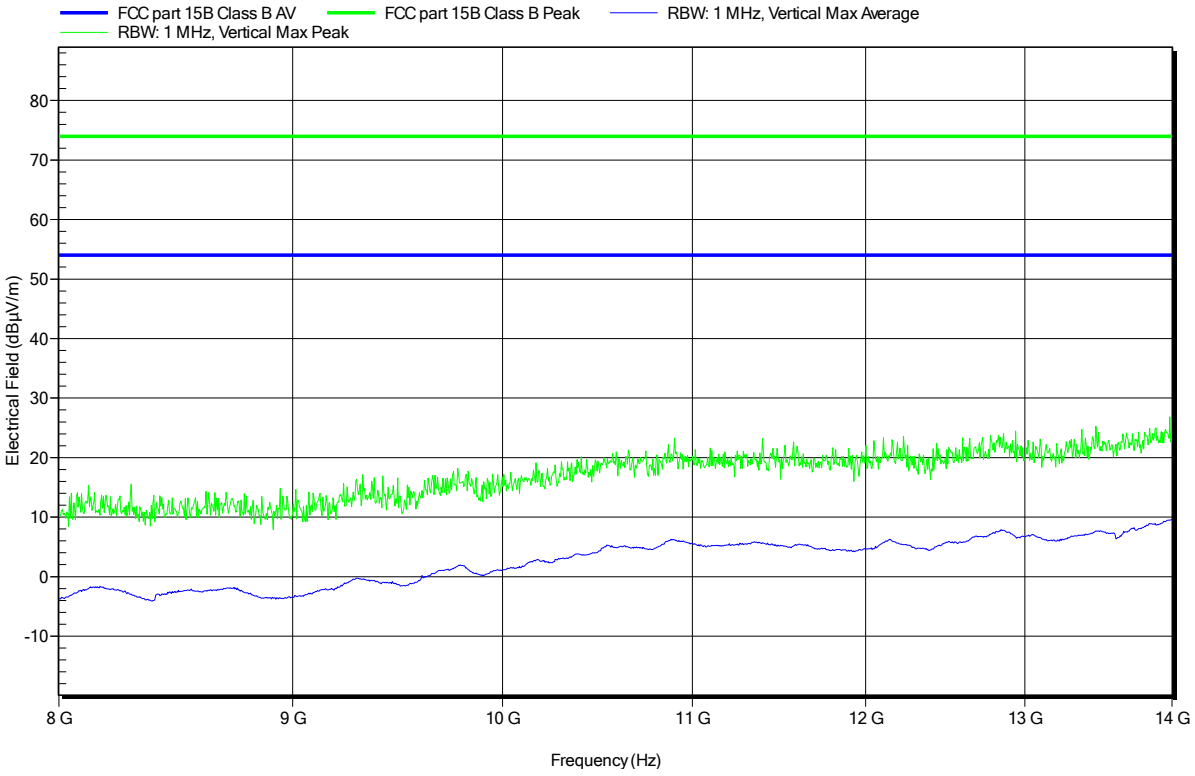

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Antenna:	Rohde & Schwarz HK 116, Horizontal
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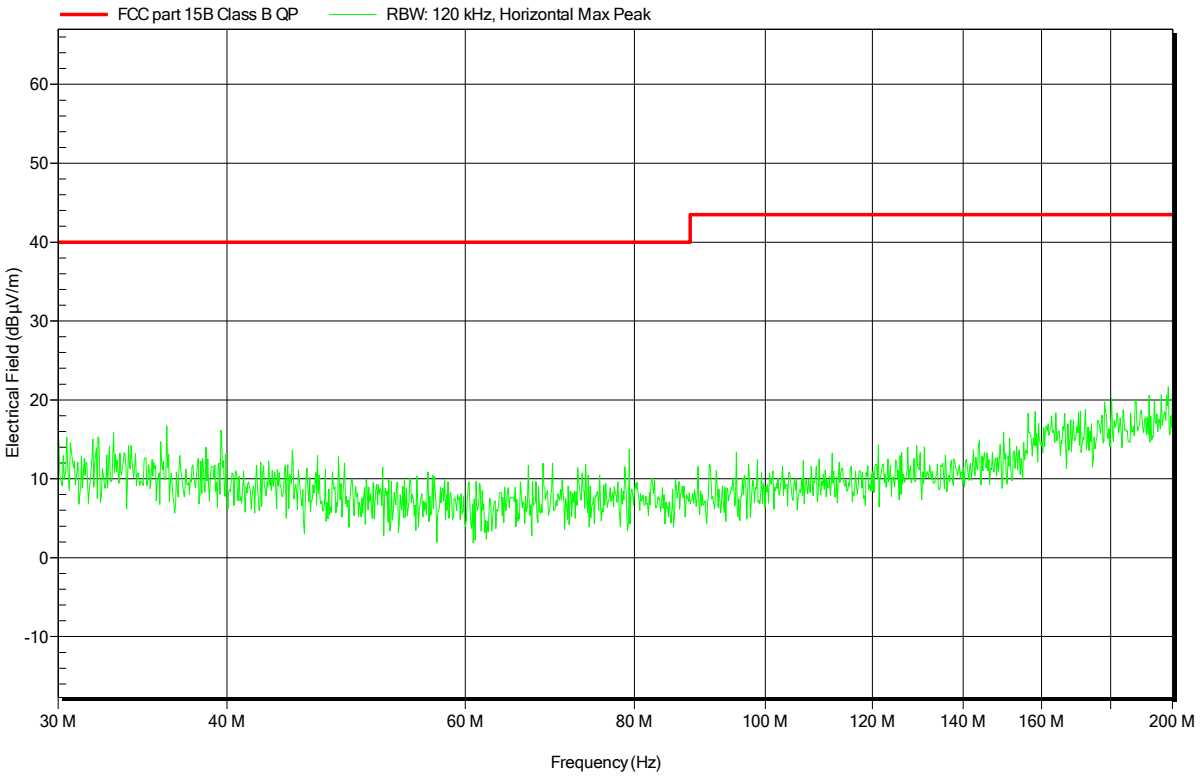

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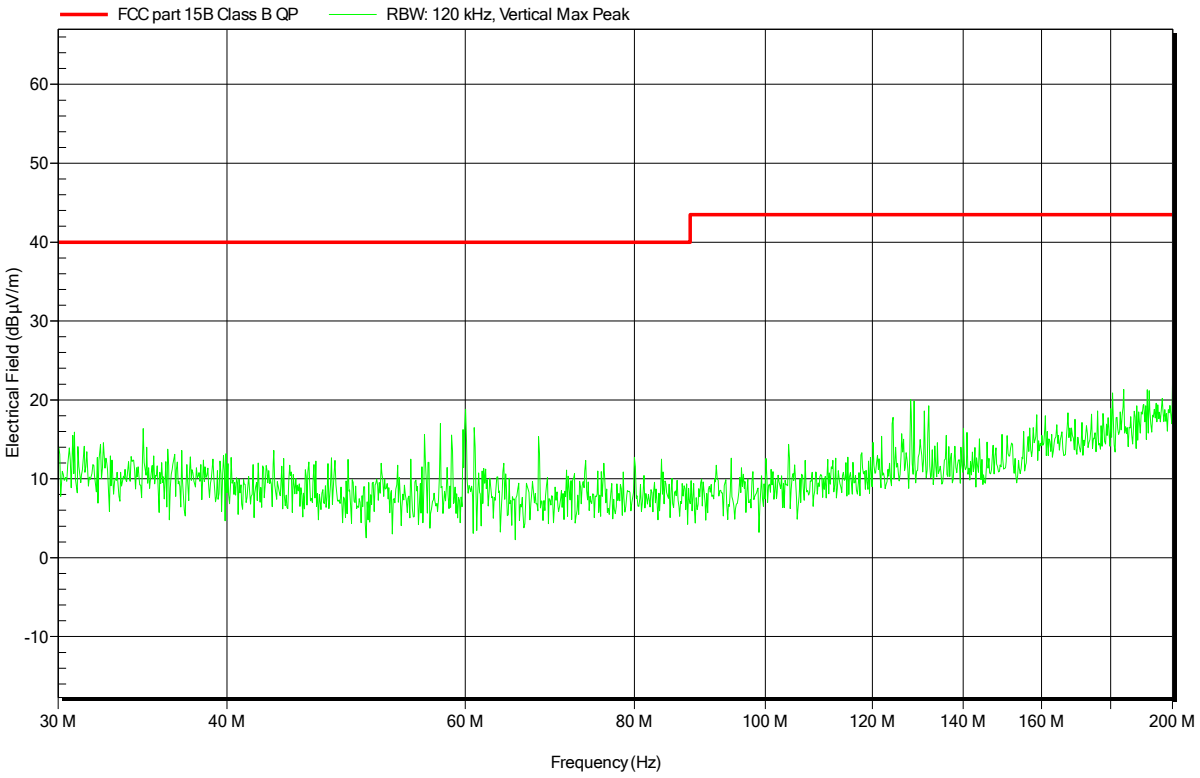

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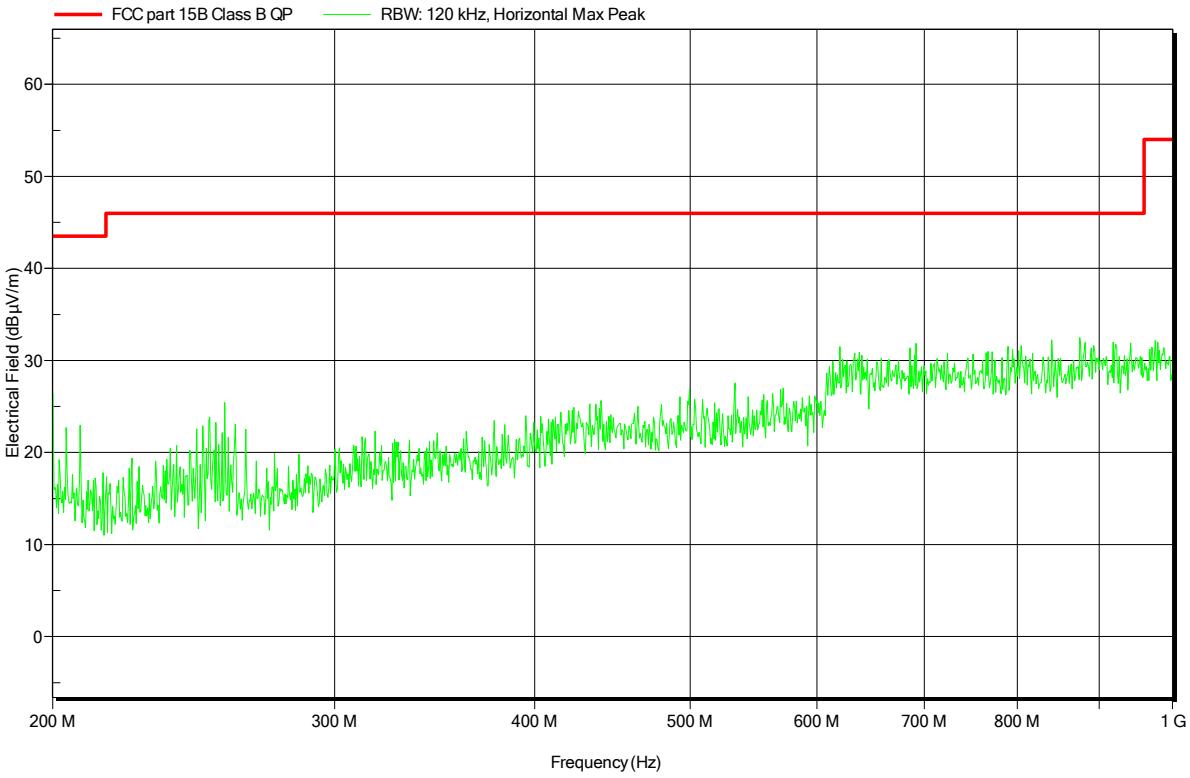

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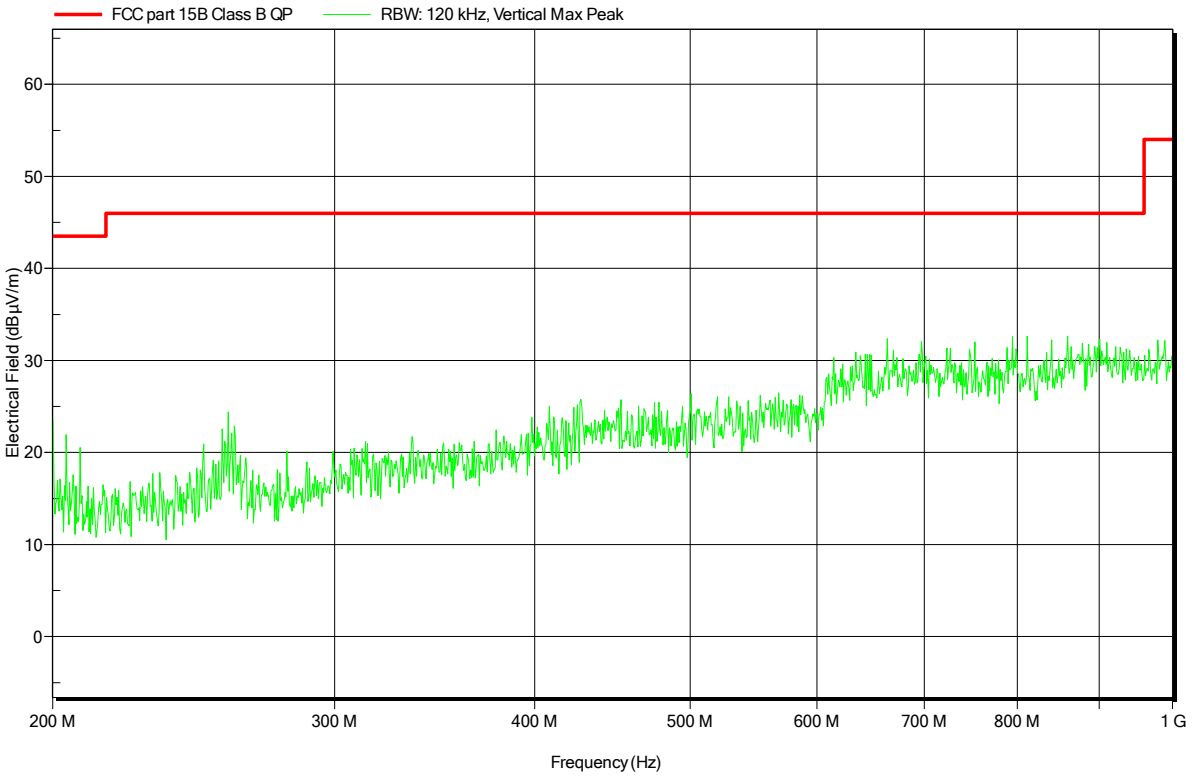

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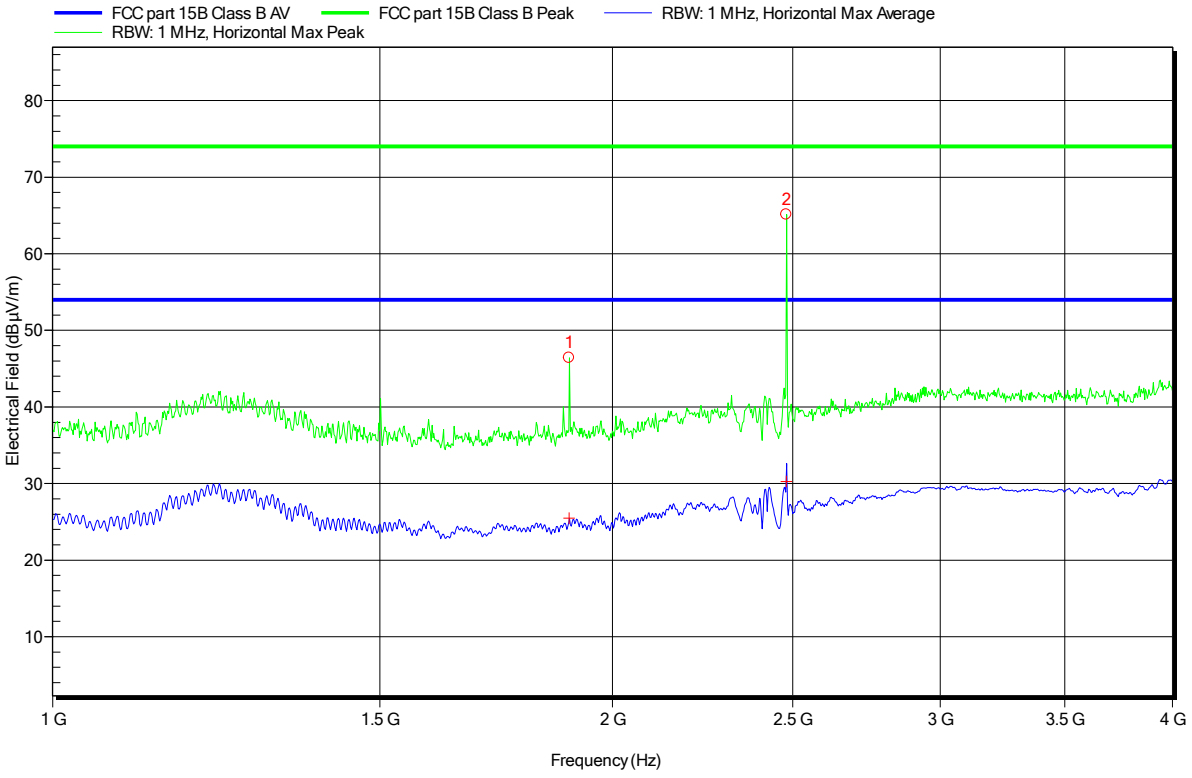

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	1.895 GHz	25.49 dBµV/m	54 dBµV/m	-28.51 dB	Pass	250 Degree	1 m
2	2.48 GHz	30.27 dBµV/m	54 dBµV/m	-23.73 dB	Pass	250 Degree	1 m

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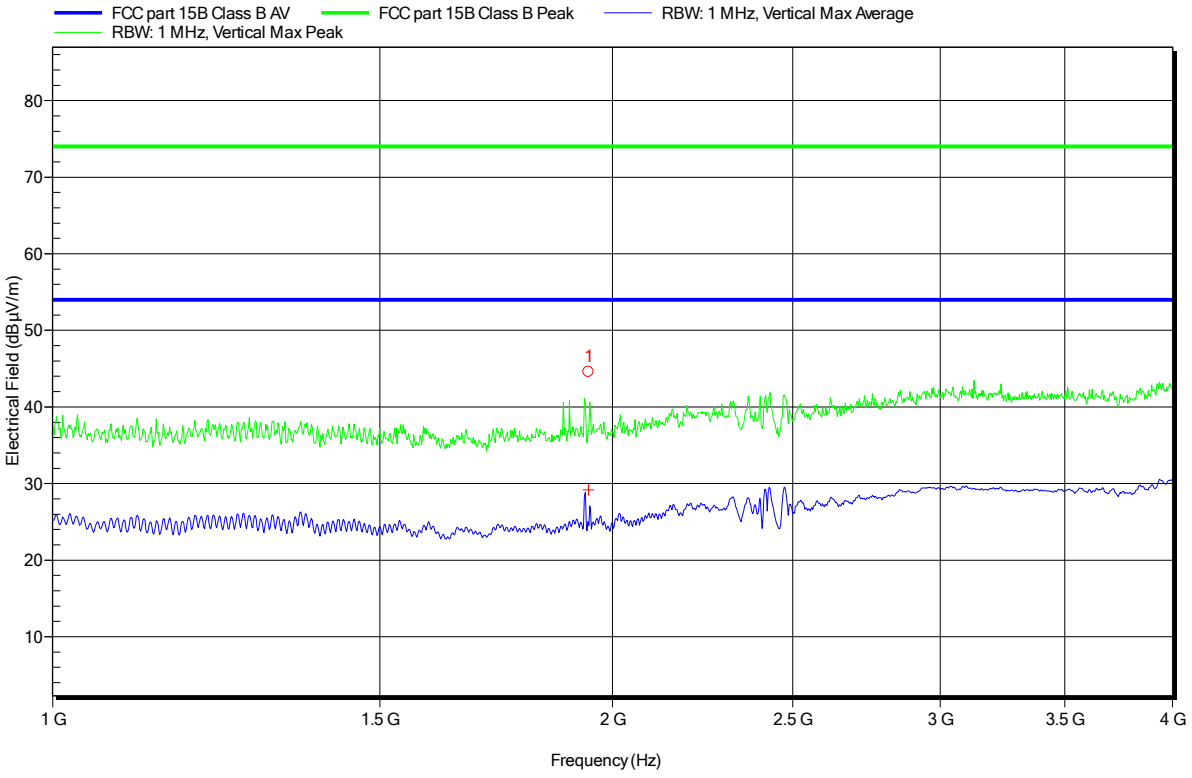

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	1.942 GHz	29.16 dBµV/m	54 dBµV/m	-24.84 dB	Pass	0 Degree	1 m

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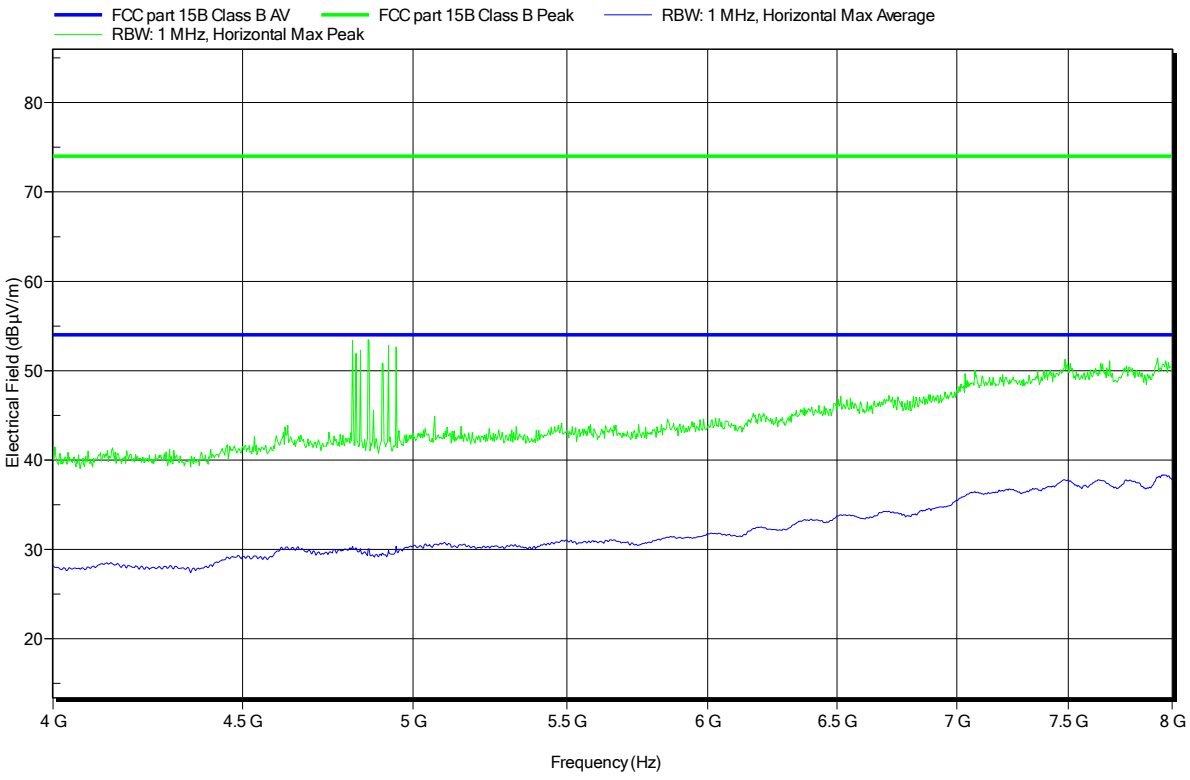

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Measurement distance:	3m
Mode:	2
Test Date:	2016-03-21
Note:	

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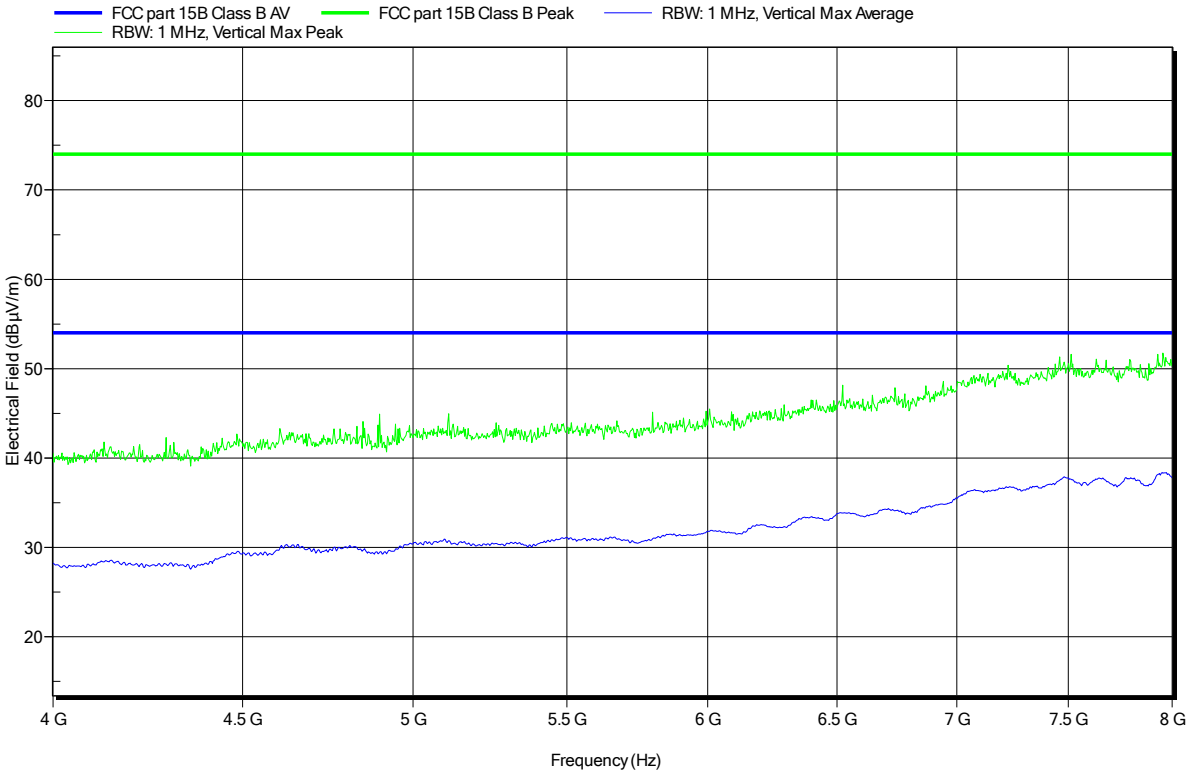

Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1602-5411

Applicant:	Hellberg Safety AB
EUT Name:	Bluetooth Headset
Model:	SECURE Synergy
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Laurisch
Test Conditions:	Tnom: 23°C, Unom: 120VAC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3m
Mode:	2
Test Date:	2016-03-21
Note:	

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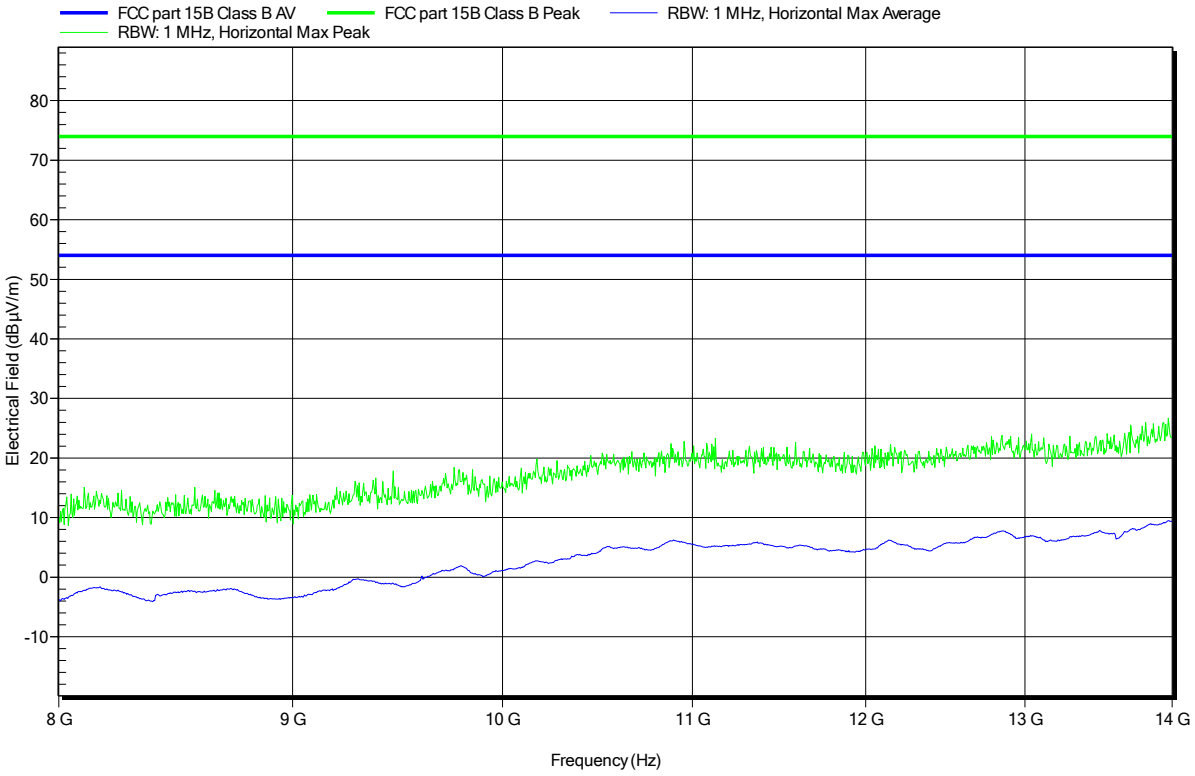

Spurious emissions under normal conditions according to FCC 15B

Project number: G0M-1602-5411

Applicant:	Hellberg Safety AB
EUT Name:	Bluetooth Headset
Model:	SECURE Synergy
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Laurisch
Test Conditions:	Tnom: 23°C, Unom: 120VAC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3m
Mode:	2
Test Date:	2016-03-21
Note:	

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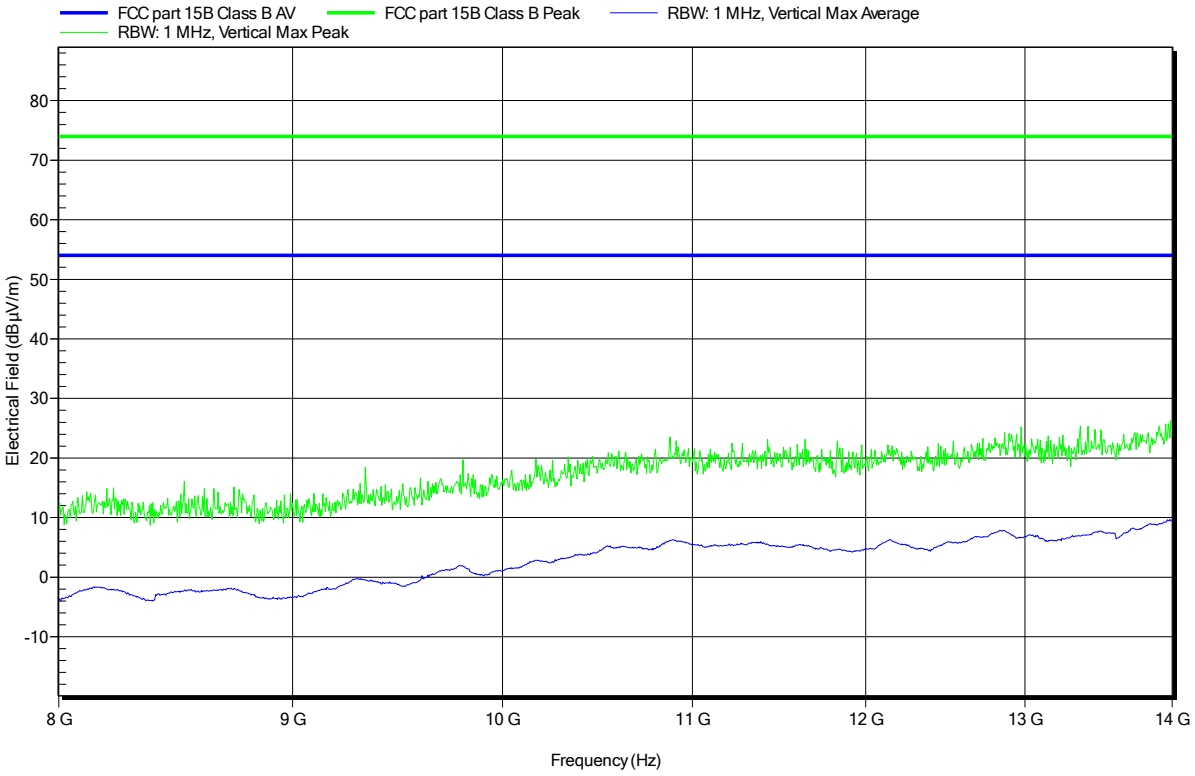

3.2 Test Conditions and Results – AC power line conducted emissions

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°C
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:

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

Exploratory measurement:

- 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)
- The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- 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).
- The LISN measurement port was connected to a measurement receiver
- I/O cables were bundled not longer than 0.4 m
- Measurement was performed in the frequency range 0.15 – 30MHz on each current-carrying conductor
- To maximize the emissions the cable positions were manipulated
- The worst configuration of EUT and cables is shown on a test setup picture at item 1.3

Test Procedure:

Final measurement:

- 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)
- The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- 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).
- The LISN measurement port was connected to a measurement receiver
- The EUT and cable arrangement were based on the exploratory measurement results
- The test data of the worst-case conditions were recorded and shown on the next pages.

EMI voltage test in the ac-mains according to FCC 15B
Project number: G0M-1602-5411

Applicant:	Hellberg Safety AB
EUT Name:	Bluetooth Headset
Model:	SECURE Synergy
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Laurisch
Test Conditions:	Tnom: 23°C, Unom: 120VAC
LISN:	ESH2-Z5 L
Mode:	1
Test Date:	2016-03-17
Note:	

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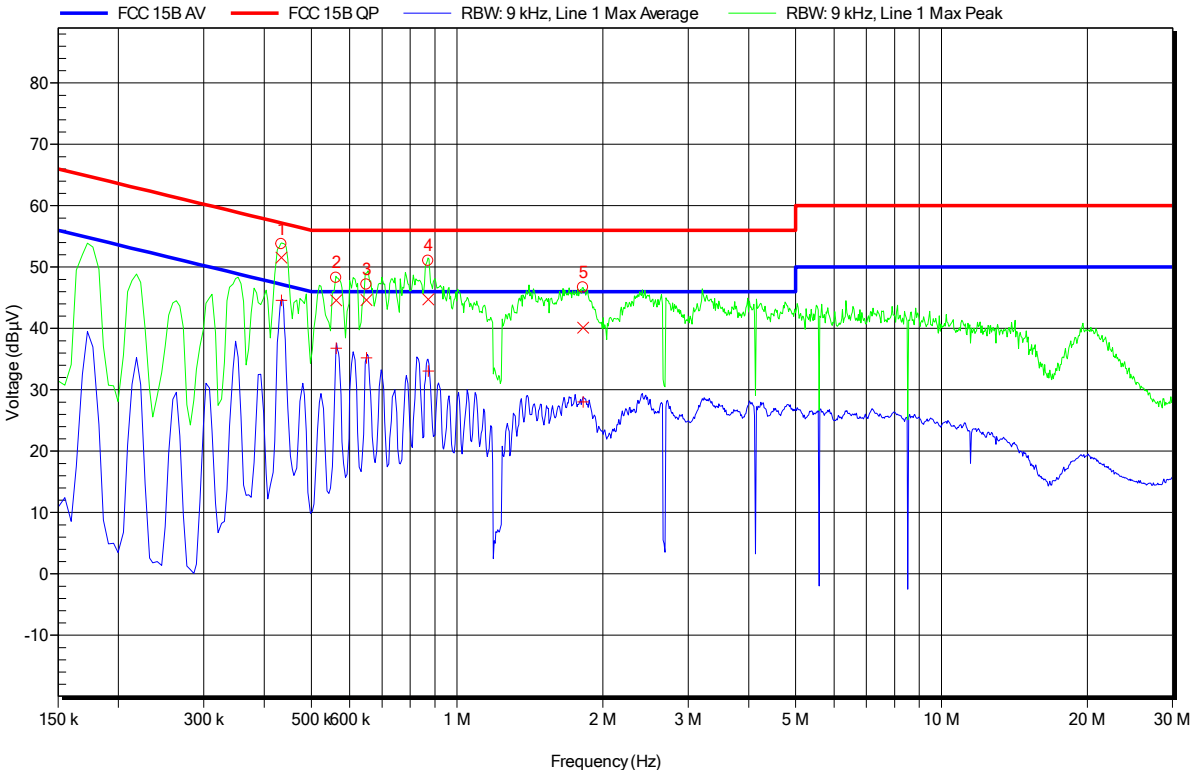

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
1	433.95 kHz	51.56 dBµV	57.18 dBµV	-5.62 dB	Pass
2	563.1 kHz	44.59 dBµV	56 dBµV	-11.41 dB	Pass
3	650.4 kHz	44.64 dBµV	56 dBµV	-11.36 dB	Pass
4	872.25 kHz	44.73 dBµV	56 dBµV	-11.27 dB	Pass
5	1.82 MHz	40.14 dBµV	56 dBµV	-15.86 dB	Pass

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status
1	433.95 kHz	44.56 dBµV	47.18 dBµV	-2.62 dB	Pass
2	563.1 kHz	36.78 dBµV	46 dBµV	-9.22 dB	Pass
3	650.4 kHz	35.22 dBµV	46 dBµV	-10.78 dB	Pass
4	872.25 kHz	33.07 dBµV	46 dBµV	-12.93 dB	Pass
5	1.82 MHz	28.02 dBµV	46 dBµV	-17.98 dB	Pass

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

Project number: G0M-1602-5411

Applicant:	Hellberg Safety AB
EUT Name:	Bluetooth Headset
Model:	SECURE Synergy
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Laurisch
Test Conditions:	Tnom: 23°C, Unom: 120VAC
LISN:	ESH2-Z5 N
Mode:	1
Test Date:	2016-03-17
Note:	

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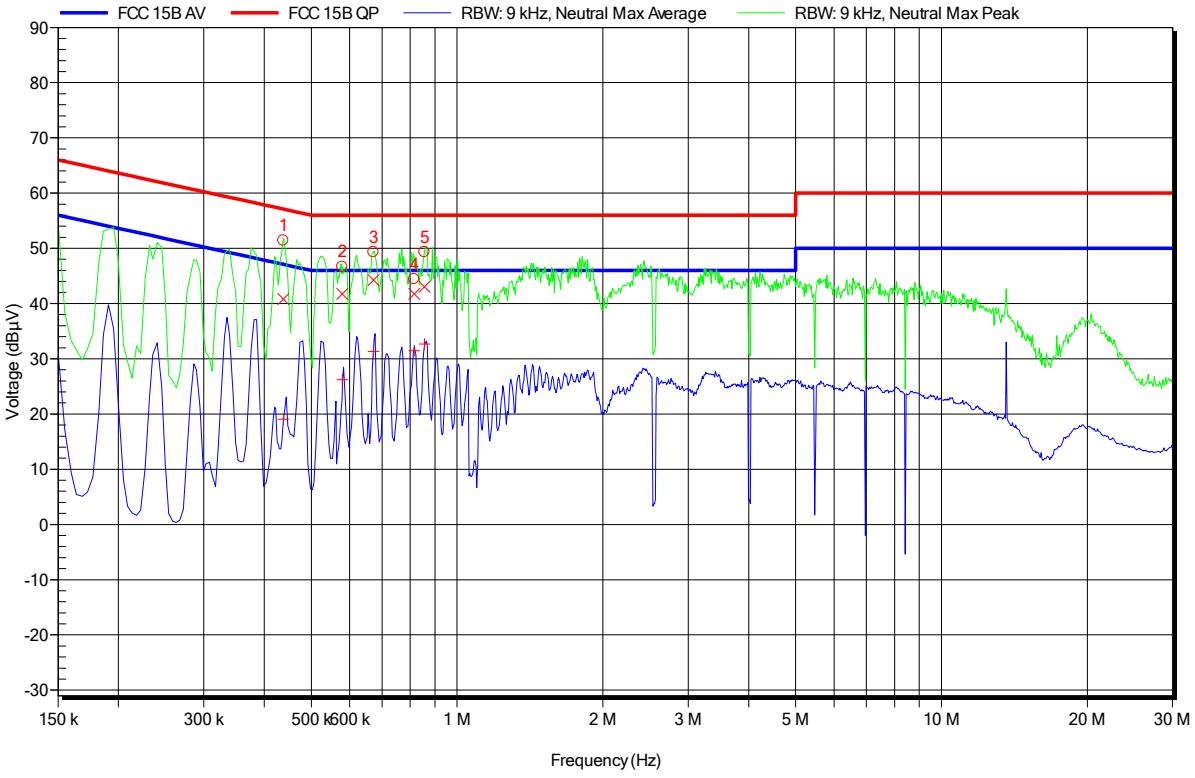

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status
1	438 kHz	40.79 dBµV	57.1 dBµV	-16.31 dB	Pass
2	579.3 kHz	41.73 dBµV	56 dBµV	-14.27 dB	Pass
3	672.45 kHz	44.23 dBµV	56 dBµV	-11.77 dB	Pass
4	816.45 kHz	41.72 dBµV	56 dBµV	-14.28 dB	Pass
5	856.95 kHz	43.01 dBµV	56 dBµV	-12.99 dB	Pass

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status
1	438 kHz	19.04 dBµV	47.1 dBµV	-28.06 dB	Pass
2	579.3 kHz	26.23 dBµV	46 dBµV	-19.77 dB	Pass
3	672.45 kHz	31.35 dBµV	46 dBµV	-14.65 dB	Pass
4	816.45 kHz	31.42 dBµV	46 dBµV	-14.58 dB	Pass
5	856.95 kHz	32.68 dBµV	46 dBµV	-13.32 dB	Pass