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EMC TEST REPORT

FCC 47 CFR Part 15B
Industry Canada ICES-003

Electromagnetic compatibility - Unintentional radiators

Report Reference No. ..... :	G0M-1705-6514-EF0115B-V02
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's name ..... :	Robert Bosch Tool Corporation
Address ..... :	1800 W. Central Road 60056 Mount Prospect, IL USA
Test specification:	
Standard..... :	47 CFR Part 15 Subpart B ICES-003, Issue 6:2016 ANSI C63.4:2014
Equipment under test (EUT):	
Product description	Laser Rangefinder
Model No.	GLM400C
Additional Models	None
Hardware version	Main PCBA 3.1 (BOM 3.2), Long-Range PCBA 3.3
Firmware / Software version	CPU 1.0.0, MCU 1.0.0, Bluetooth 1.2.0
	FCC-ID: TXTGLM400C IC: 909H-GLM400C
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 ..... :	2017-11-22	
Date (s) of performance of tests ..... :	2017-12-15	
Compiled by ..... :	Matthias Handrik	
Tested by (+ signature) ..... :	Matthias Handrik	.....
Approved by (+ signature) ..... : Deputy Head of Lab	Jens Marquardt	.....
Date of issue ..... :	2018-01-31	
Total number of pages ..... :	21	

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

Additional comments:

Version History

Version	Issue Date	Remarks	Revised by
V01	2017-12-19	Initial Release	
V02	2018-01-31	FCC ID / IC added.	M. Handrik

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1 Equipment (Test item) Description

Description	Laser Rangefinder	
Model	GLM400C	
Additional Models	None	
Serial number	None	
Hardware version	Main PCBA 3.1 (BOM 3.2), Long-Range PCBA 3.3	
Software / Firmware version	CPU 1.0.0, MCU 1.0.0, Bluetooth 1.2.0	
FCC-ID	TXTGLM400C	
IC	909H-GLM400C	
Power supply	3x1.5V DC (non-rechargeable battery)	
AC/DC-Adaptor	None	
Radio module	Type	Bluettoh Low Energy
	Model	unspecified
	Manufacturer	unspecified
	HW Version	unspecified
	SW Version	unspecified
	SVN	unspecified
	FCC-ID	unspecified
	IC	unspecified
Manufacturer	Robert Bosch Power Tools GmbH 70538 Stuttgart Germany	
Highest emission frequency	2480MHz	
Device classification	Class B	
Equipment type	Tabletop	
Number of tested samples	1	

1.1 Photos – Equipment external

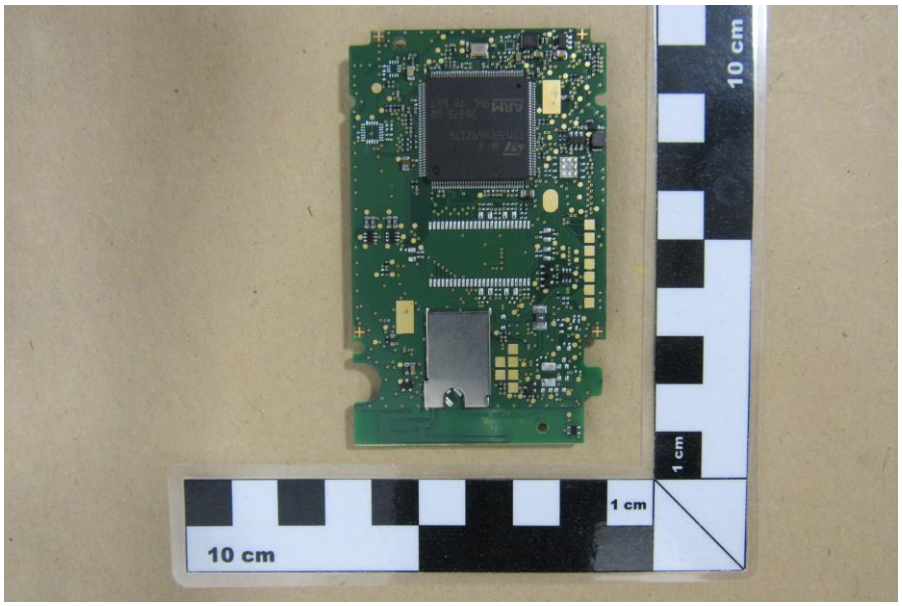
EUT FRONT


EUT BACK

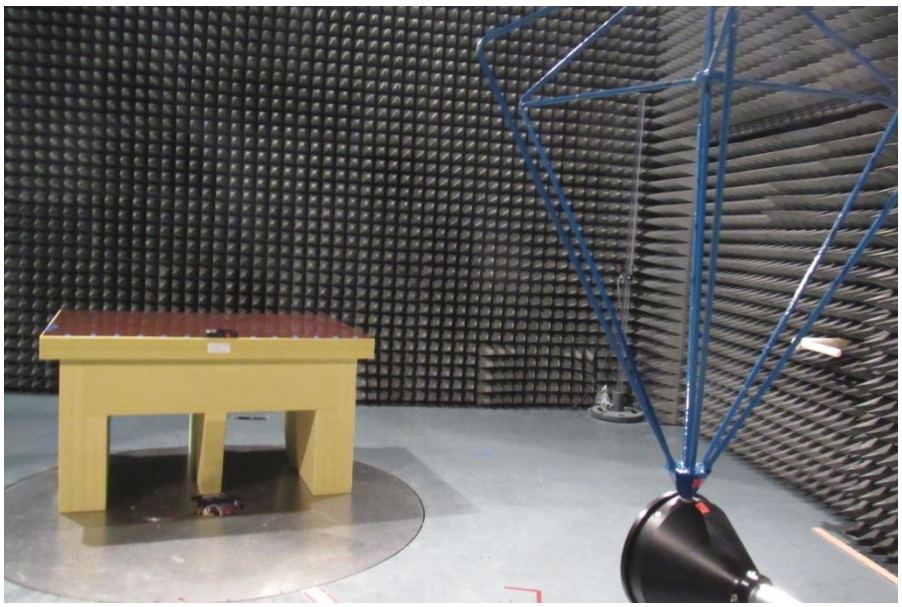

1.2 Photos – Equipment internal

EUT PCB FRONT

EUT PCB BACK



1.3 Photos – Test setup

Test Setup : Radiated Emissions


1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments (e.g. serial no.)
AE	iPhone	Apple	A1429 EMC 2610	
AE	Software application	Bosch	App version: 1.2.0.7942	Measuring Master

***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	-	-	-	-	-

***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	EUT powered up. Bluetooth Low Energy connection to iPhone. Software application: continuous measurement mode.

Configuration #	EUT Configuration
Bluetooth	EUT powered up. Software application on iPhone controlled EUT via Bluetooth Low Energy. iPhone is placed outside the measurement chamber. Measurement values transmit via Bluetooth Low Energy to iPhone.

1.7 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2016.1.10

Conducted emissions SR1					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
AMN	R&S	ESH2-Z5	EF00182	2017-01	2019-01
AMN	R&S	ESH3-Z5	EF00036	2017-01	2019-01
EMI Test Receiver	R&S	ESR7	EF00943	2017-07	2018-07
Cable	-	RG223/U	-	System Cal.	System Cal.

Radiated emissions AC1					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Biconical Antenna	R&S	HK 116	EF00030	2016-04	2019-04
LPD Antenna	R&S	HL 223	EF00187	2016-05	2019-05
Double-Ridged Guide Antenna	ETS-Lindgren USA	3117	EF01256	2017-07	2018-07
MXE EMI Receiver	Keysight Technologies	N9038A-526/WXP	EF01070	2017-08	2018-08
RF Cable			-	System Cal.	System Cal
RF Cable			-	System Cal.	System Cal

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	N/A	
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 %		28%			
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					
	2480MHz					
Fully configured sample scanned over the following frequency range	Frequency range					
	30 MHz to 13 GHz					
Operating mode	1					
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	-		-	-
> 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.

Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400C
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 3 x 1.5V DC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	Mode# 1
Test Date:	2017-12-15
Note:	

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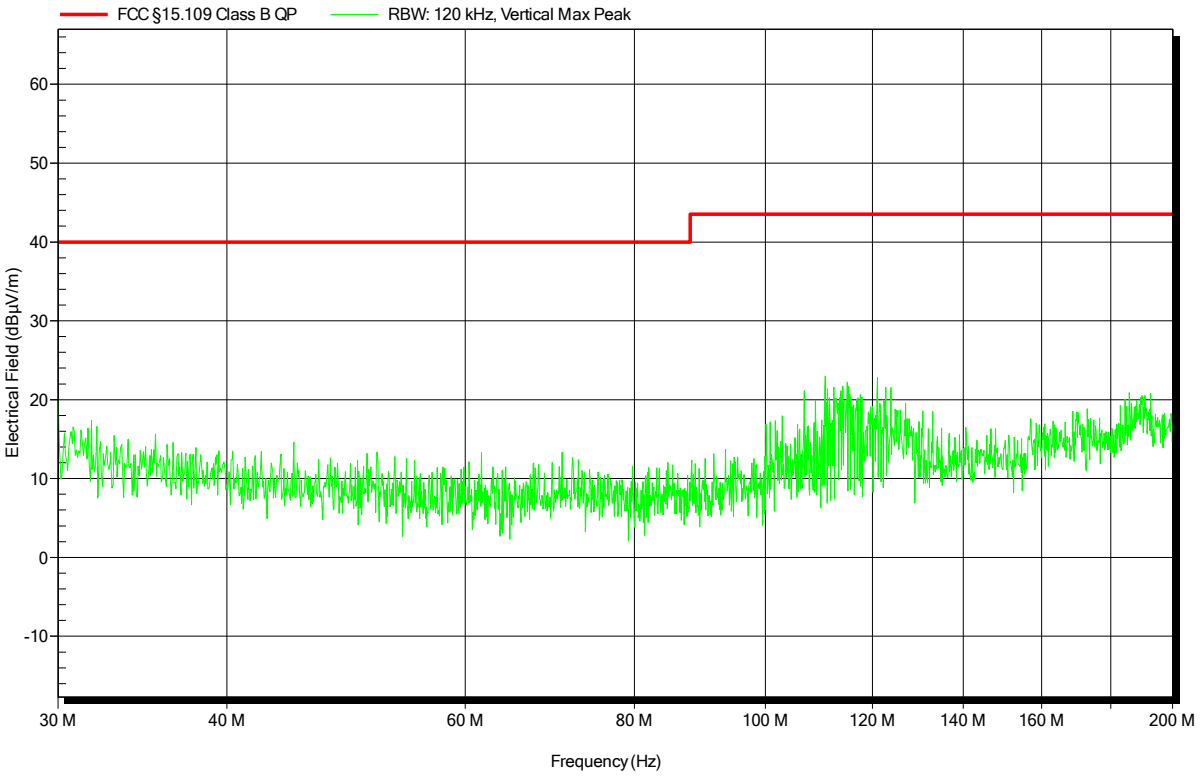

Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400C
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 3 x 1.5V DC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	Mode# 1
Test Date:	2017-12-15
Note:	

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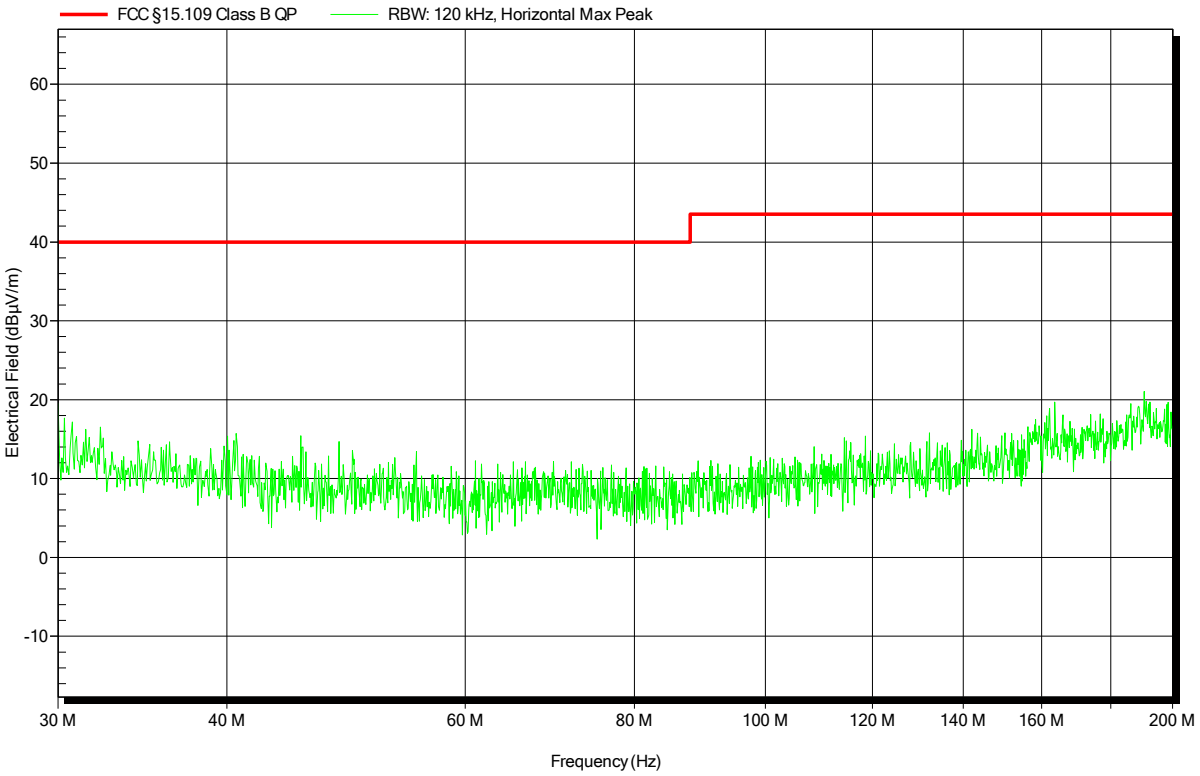

Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400C
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 3 x 1.5V DC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3m
Mode:	mode#1
Test Date:	2017-12-15
Note:	

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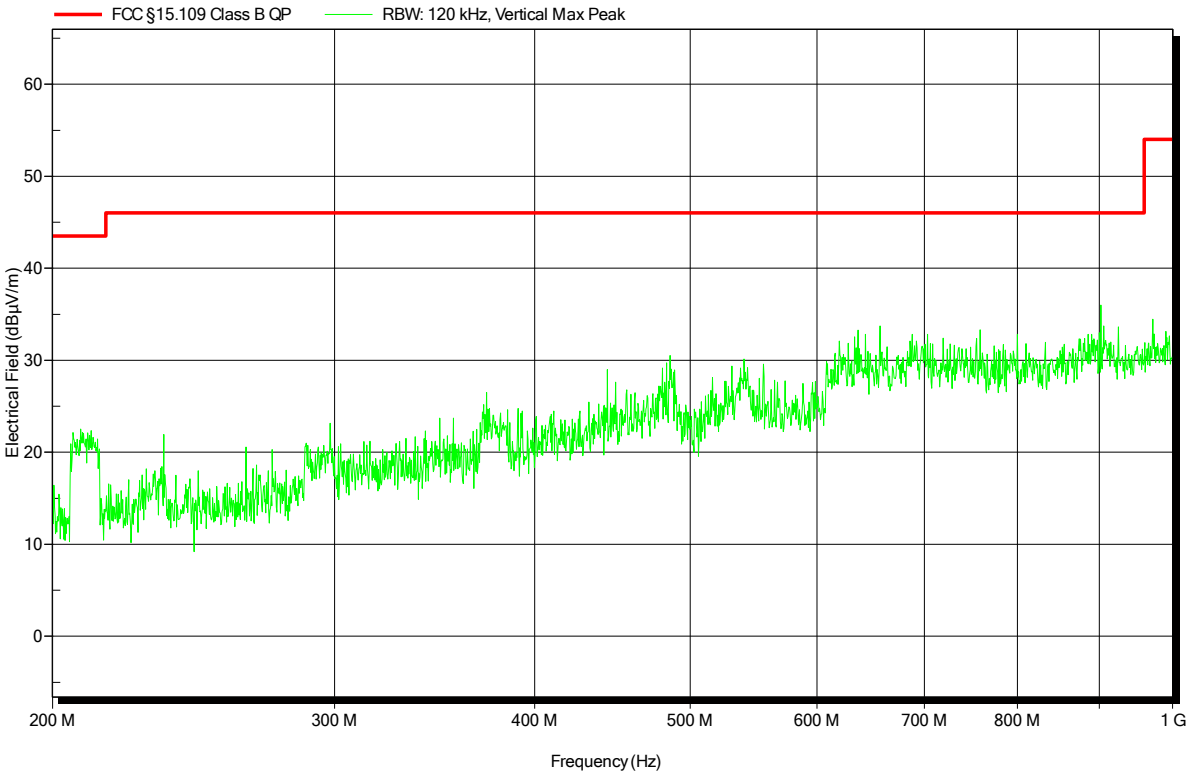

Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400C
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 3 x 1.5V DC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	mode#1
Test Date:	2017-12-15
Note:	

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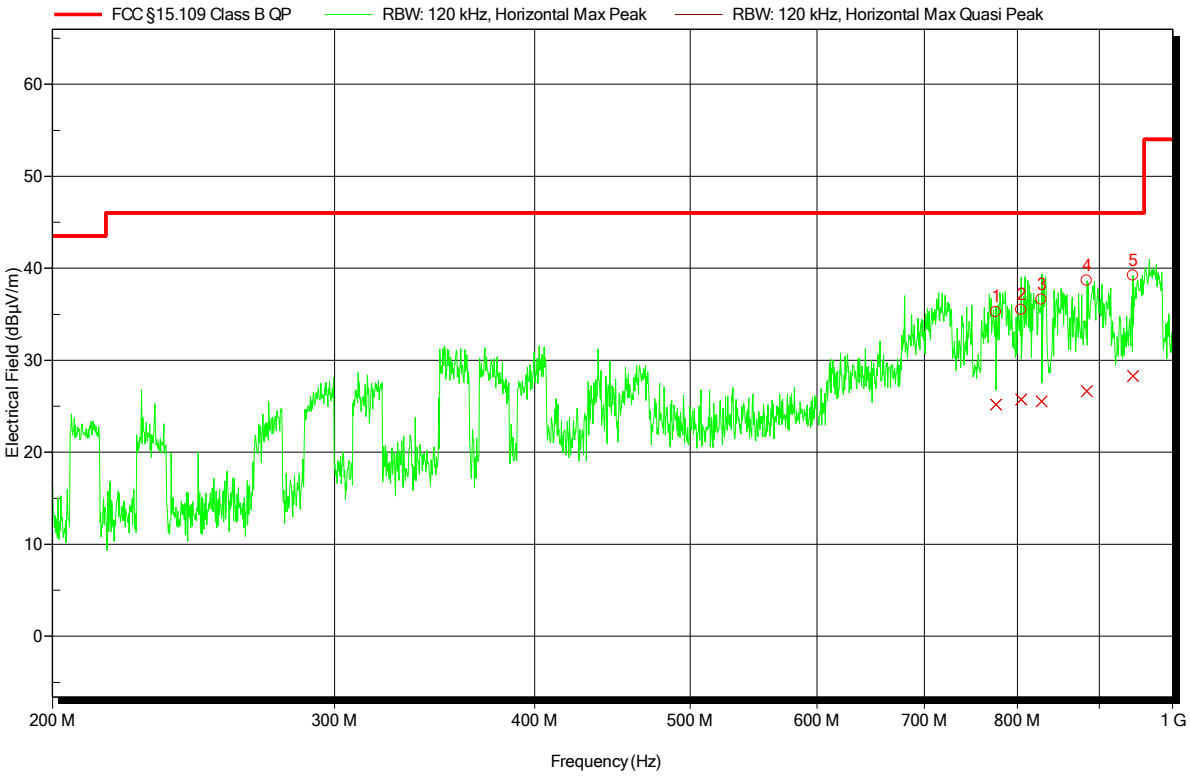

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	775.749 MHz	25.17 dBµV/m	46.02 dBµV/m	-20.85 dB	Pass	-25 Degree	1 m
2	804.485 MHz	25.74 dBµV/m	46.02 dBµV/m	-20.28 dB	Pass	-25 Degree	1 m
3	828.466 MHz	25.54 dBµV/m	46.02 dBµV/m	-20.48 dB	Pass	-25 Degree	1 m
4	884.052 MHz	26.66 dBµV/m	46.02 dBµV/m	-19.36 dB	Pass	-25 Degree	1 m
5	944.527 MHz	28.28 dBµV/m	46.02 dBµV/m	-17.74 dB	Pass	-25 Degree	1 m

Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400C
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 3 x 1.5V DC
Antenna:	ETS-Lindgren 3117, Vertical
Measurement distance:	3m
Mode:	Mode# 1
Test Date:	2017-12-15
Note:	

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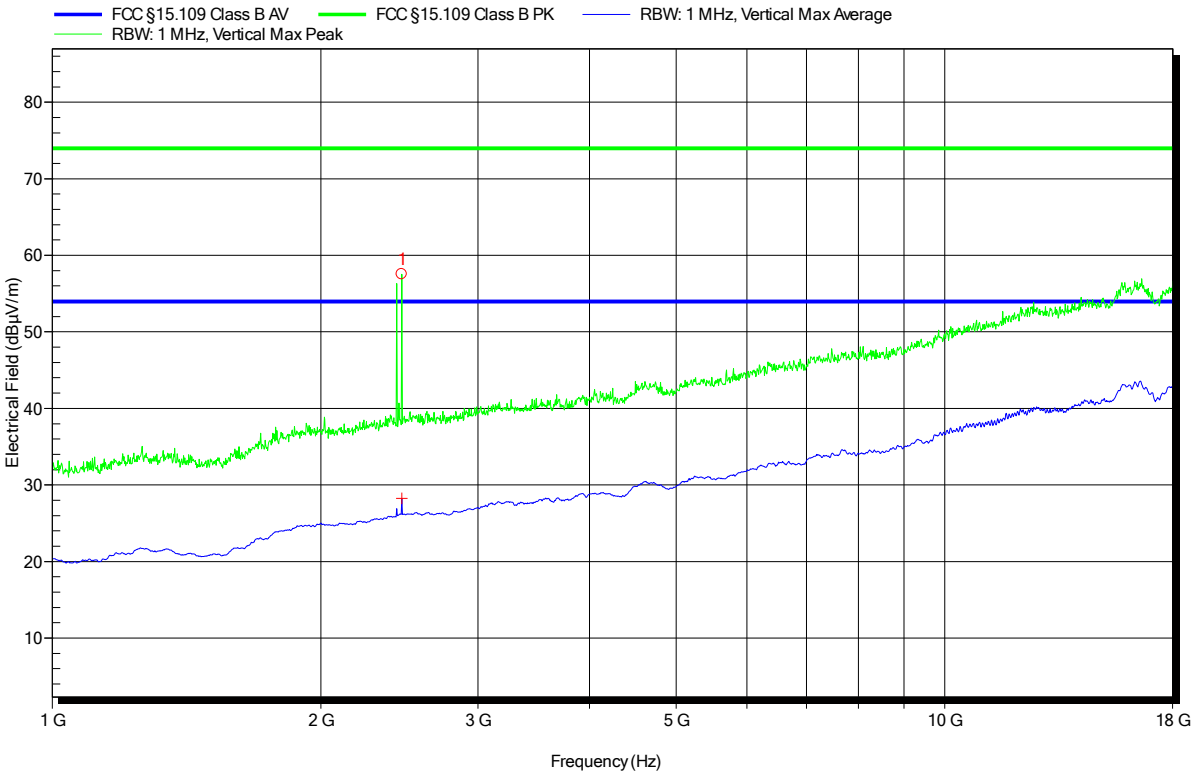

Peak Number	Frequency			
1	2.464 GHz	Bluetooth carrier	Low	Energy

Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400C
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 3 x 1.5V DC
Antenna:	ETS-Lindgren 3117, Horizontal
Measurement distance:	3m
Mode:	Mode# 1
Test Date:	2017-12-15
Note:	

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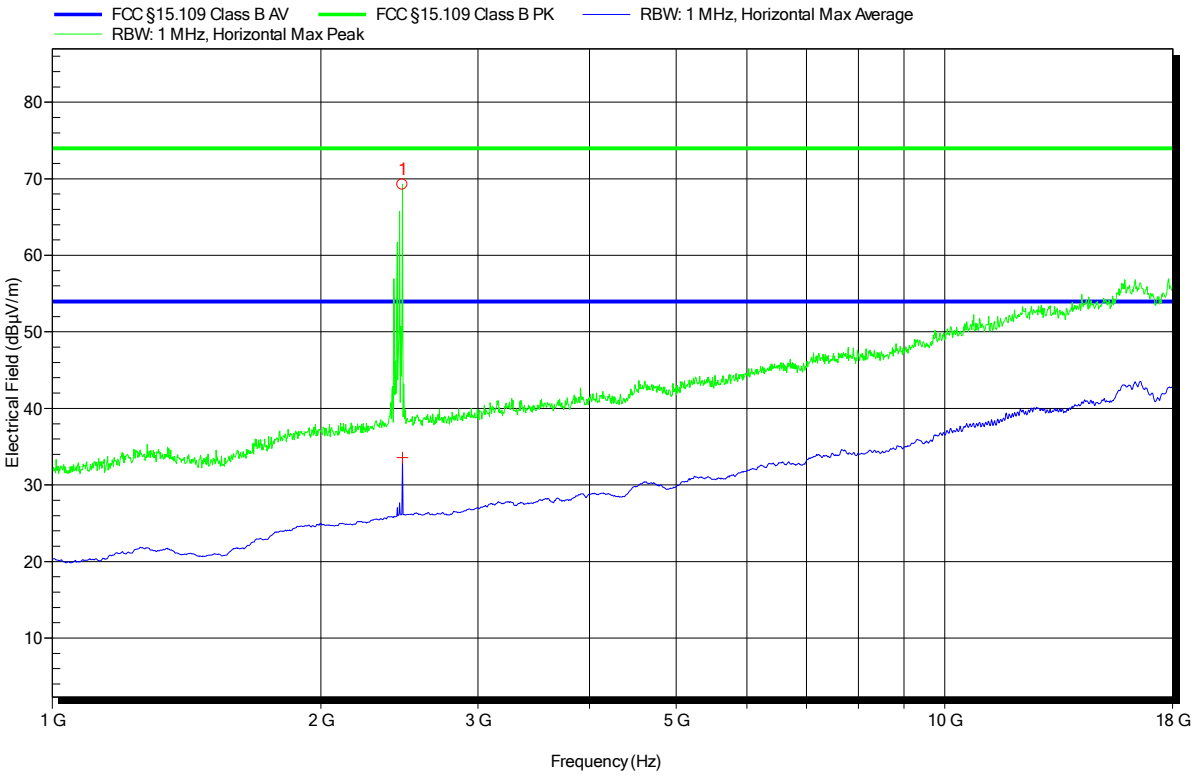

Peak Number	Frequency			
1	2.469 GHz	Bluetooth carrier	Low	Energy