

EMC TEST REPORT							
	FCC 47 CFR Part 15B Industry Canada ICES-003						
Electromagr	Electromagnetic compatibility - Unintentional radiators						
Report Reference No	G0M-1705-6514-EF0215B-V02						
Testing Laboratory	Eurofins Product Service GmbH						
Address:	Storkower Str. 38c 15526 Reichenwalde Germany						
	A2LA Accredited Testing Laborato FCC Test Firm Designation Number IC Testing Laboratory site: 3470A-	er: DE0008					
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.	GLM400CL						
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 7	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	( pent			
Approved by (+ signature): Jens Marquardt Deputy Head of Lab	J- Kyw			
Date of issue 2018-01-31				
Total number of pages 32				
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.				



### **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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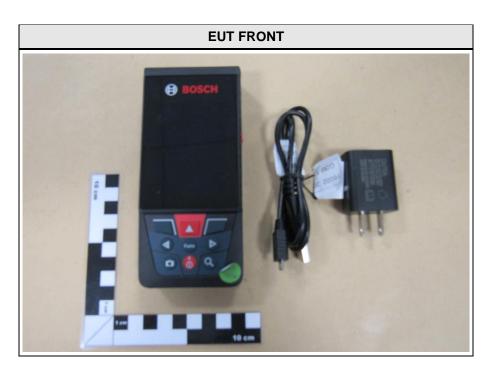


### 1 Equipment (Test item) Description

Description	Laser Rangefinder		
Model	GLM 400CL		
Additional Models	None		
Serial number	None		
Hardware version	Main PCBA 3.1 (BO	M 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	3.6V DC		
AC/DC-Adaptor	Model : 1600A0143H Manufacturer : Bosch Input : 100-240VAC / 50-60Hz Output : 5V DC / 1.0A		
	Туре	Bluetooth Low Energy	
	Model	unspecified	
	Manufacturer	unspecified	
Radio module	HW Version	unspecified	
	SW Version	unspecified	
	SVN	unspecified	
	FCC-ID	unspecified	
	IC	unspecified	
	Robert Bosch Power	Tools GmbH	
Manufacturer	70538 Stuttgart		
	Germany		
Highest emission frequency	2480MHz		
Device classification	Class B		
Equipment type	Tabletop		
Number of tested samples	1		



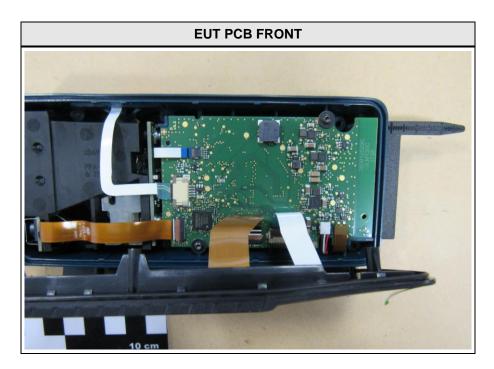
#### 1.1 Photos – Equipment external

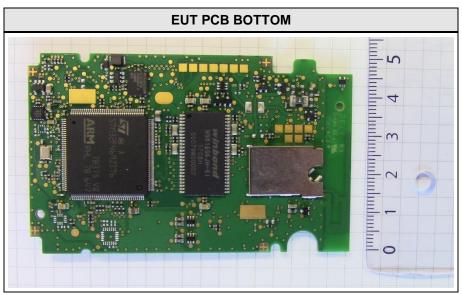






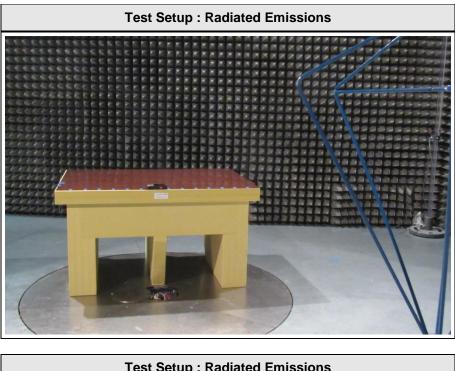
#### 1.2 Photos – Equipment internal

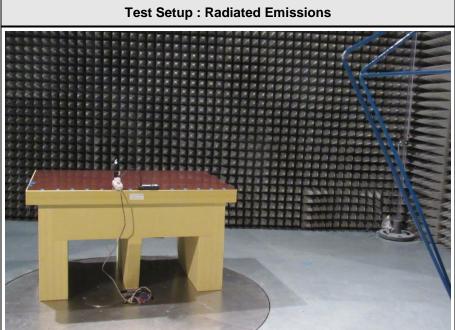




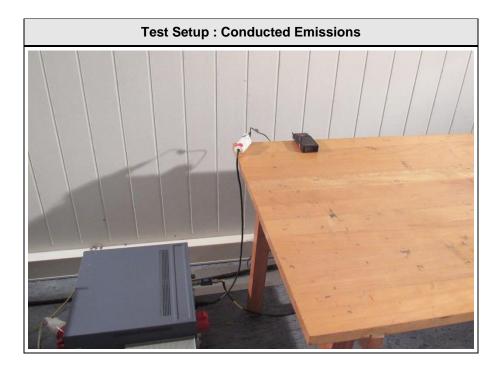


#### 1.3 Photos – Test setup











#### 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	AC adapter	Bosch	1600A0143H			
AE	USB cable	Bosch	2609120670			
AE	Software application	Bosch	App version: 1.2.0.7942	Measuring Master		
		None				
*Note: Use	e the following abbrevia	ations:				
AE :	AE : Auxiliary/Associated Equipment, or					
SIM :	SIM : Simulator (Not Subjected to Test)					
CABL :	CABL : Connecting cables					

#### 1.5 Input / Output Ports

Port #	Name	Туре*	Max. Cable Length	Cable Shielded	Comments (e.g. Cat. of Cable)	
1	USB	DC / I/O	60cm			
*Note: U	*Note: Use the following abbreviations:					
AC	AC : AC power port					
DC	DC : DC power port					
N/E	N/E : Non electrical					
I/C	I/O : Signal input or output port					
TF	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.
2	Charging via AC/DC adaptor

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.	
Charging	EUT connected via USB cable to AC/DC adaptor.	



#### 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  $dB\mu V$ . 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:

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

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  $dB\mu V/m$ :

Limit (dB
$$\mu$$
V/m) = 20\*log ( $\mu$ 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:

Reading + AF =	<ul> <li>Net Reading</li> </ul>	:	Net reading - FCC limit = Margin
21.5 dBµV + 26 dB =	47.5 dBμV/m	:	$47.5 \text{ dB}\mu\text{V/m} - 57.0 \text{ dB}\mu\text{V/m} = -9.5 \text{ dB}$



### 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 %		28%		
Test according referenced		Reference Method					
	dards	ANSI C63.4					
Sample is tested	with respect to the		Equipme	ent class	•		
	ne equipment class	Class B					
Test frequency ran	ge determined from	Highest emission frequency					
	sion frequency	2480MHz					
Fully configured sa	ample scanned over	Frequency range					
	equency range	30 MHz to 13 GHz					
Operating mode		1/2					
Configuration		Bluetooth / Charging					
	Limits and results Class B						
Frequency [MHz]	Quasi-Peak [dBµV/m	n] 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:

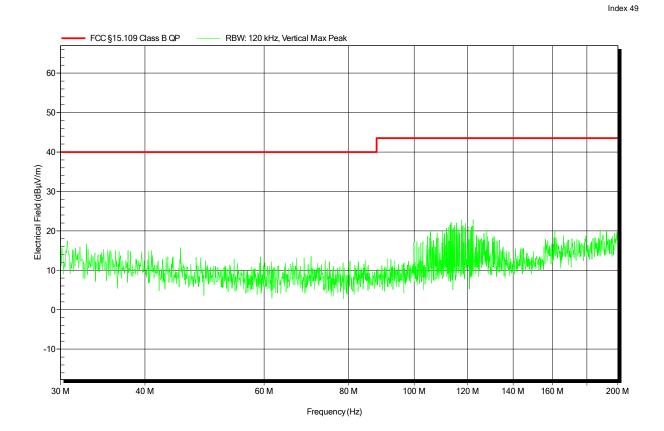
- The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver
- A biconical antenna was used for the frequency range 30 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 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: EUT Name: Model: Test Site: Operator: Test Conditions: Antenna: Measurement distance: Mode:	Robert Bosch GmbH Laser Rangefinder GLM400CL Eurofins Product Service GmbH Mr. Handrik Tnom: 23°C, Unom: 3.6V DC Rohde & Schwarz HK 116, Vertical 3m Mode#1
Test Date:	2017-12-15
Note:	

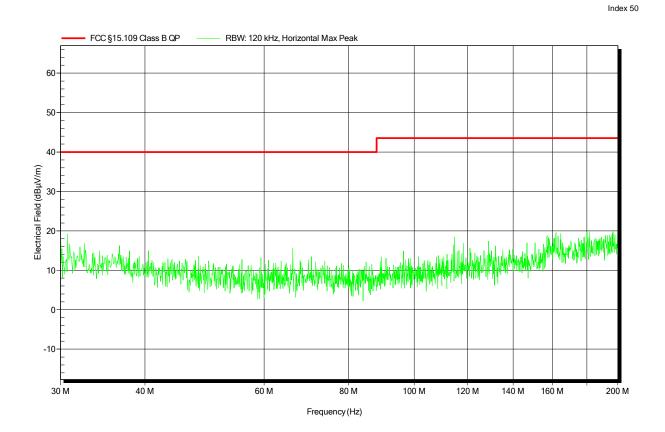




#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400CL
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 3.6V DC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3m
Mode:	Mode#1
Test Date:	2017-12-15
Note:	

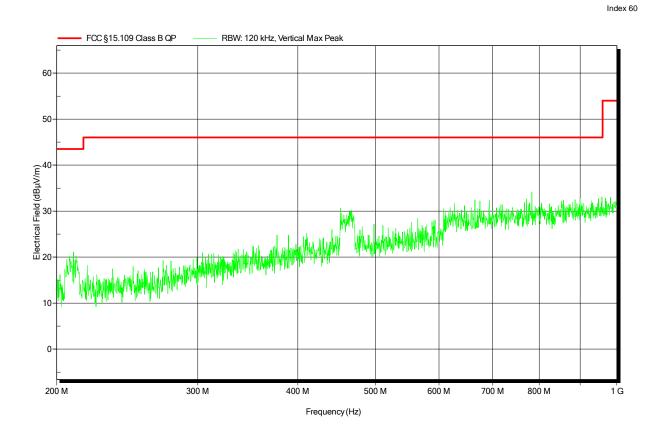




#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant: EUT Name: Model: Test Site: Operator: Test Conditions: Antenna: Measurement distance: Mode: Test Date:	Robert Bosch GmbH Laser Rangefinder GLM400CL Eurofins Product Service GmbH Mr. Handrik Tnom: 23°C, Unom: 3.6V DC Rohde & Schwarz HL 223, Vertical 3m mode#1 2017-12-15
Test Date:	2017-12-15
Note:	





#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400CL
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 3.6V DC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3m
Mode:	mode#1
Test Date:	2017-12-15
Note:	

FCC §15.109 Class B QP RBW: 120 kHz, Horizontal Max Peak RBW: 120 kHz, Horizontal Max Quasi Peak 60 50 Electrical Field (dBμV/m) 00 00 00 Very and an and and and and an and 10 0 200 M 300 M 400 M 500 M 600 M 700 M 800 M 1 G Frequency (Hz) Quasi-Peak Quasi-Peak Peak Number Quasi-Peak Quasi-Peak Height Frequency Angle Limit Difference Status 749.96 MHz 38.3 dBµV/m 46.02 dBµV/m -7.72 dB Pass -19 Degree 1 m 1 803.8 MHz 38.52 dBµV/m 46.02 dBµV/m -7.5 dB Pass -19 Degree 1 m 2 3 4 5 866.262 MHz 38.36 dBµV/m 46.02 dBµV/m -7.67 dB Pass -19 Degree 1 m -19 Degree -19 Degree 898.303 MHz -9.37 dB 36.65 dBµV/m 46.02 dBµV/m Pass 1 m 950.205 MHz -11.02 dB 35 dBµV/m 46.02 dBµV/m Pass 1 m

Test Report No.: G0M-1705-6514-EF0215B-V02

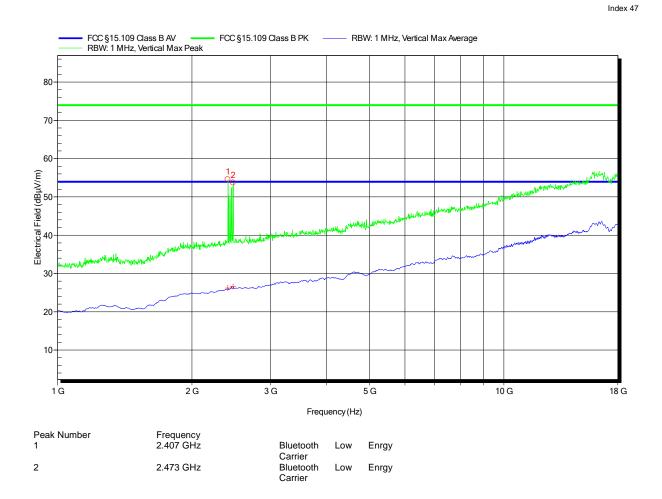
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#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400CL
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 3.6V DC
Antenna:	ETS-Lindgren 3117, Vertical
Measurement distance:	3m
Mode:	Mode#1
Test Date:	2017-12-15
Note:	

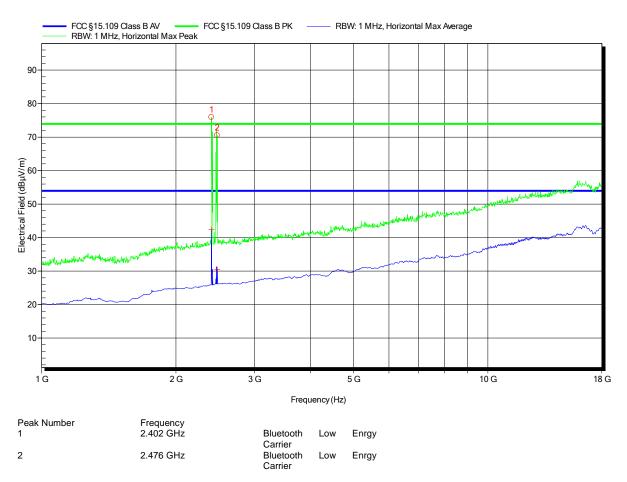




#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

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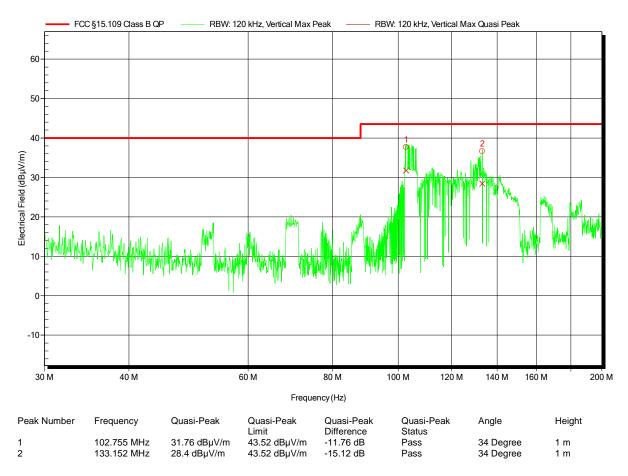
#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant:	Robert Bosch GmbH
EUT Name:	Laser Rangefinder
Model:	GLM400CL
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Handrik
Test Conditions:	Tnom: 23°C, Unom: 120V AC (AC/DC adaptor)
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3m
Mode:	mode#2
Test Date:	2017-12-15

Note:

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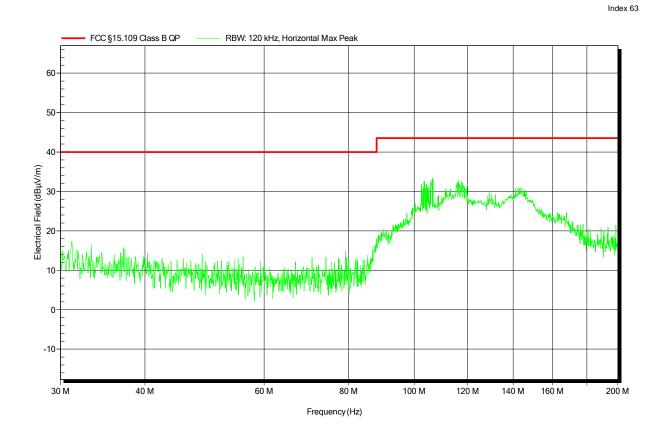




#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant: EUT Name: Model: Test Site: Operator: Test Conditions: Antenna: Measurement distance: Mode: Test Date:	Robert Bosch GmbH Laser Rangefinder GLM400CL Eurofins Product Service GmbH Mr. Handrik Tnom: 23°C, Unom: 120V AC (AC/DC adaptor) Rohde & Schwarz HK 116, Horizontal 3m mode#2 2017-12-15
Test Date: Note:	2017-12-15
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#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant: EUT Name: Model: Test Site: Operator: Test Conditions: Antenna: Measurement distance: Mode: Test Date:	Robert Bosch GmbH Laser Rangefinder GLM400CL Eurofins Product Service GmbH Mr. Handrik Tnom: 23°C, Unom: 120V AC (AC/DC adaptor) Rohde & Schwarz HL 223, Vertical 3m mode#2 2017-12-15
	2017-12-15

FCC §15.109 Class B QP RBW: 120 kHz, Vertical Max Peak 60 50 Electrical Field (dBµV/m) 10 0 800 M 200 M 300 M 400 M 500 M 600 M 700 M 1 G Frequency (Hz)

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#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

FCC §15.109 Class B QP RBW: 120 kHz, Horizontal Max Peak 60 50 valitan ju pavilan mening an han hat the same at the standard and the same at the standard and the same at the s 10 0 200 M 300 M 400 M 500 M 600 M 700 M 800 M 1 G Frequency (Hz)

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#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant: EUT Name: Model: Test Site: Operator: Test Conditions: Antenna: Measurement distance: Mode: Test Date:	Robert Bosch GmbH Laser Rangefinder GLM400CL Eurofins Product Service GmbH Mr. Handrik Tnom: 23°C, Unom: 120V AC (AC/DC adaptor) ETS-Lindgren 3117, Vertical 3m mode#2 2017-12-15
Test Date:	2017-12-15
Note:	

FCC §15.109 Class B AV FCC §15.109 Class B PK - RBW: 1 MHz, Vertical Max Average \_ RBW: 1 MHz, Vertical Max Peak 80 70 Electrical Field (dBµV/m) 00 00 00 William ut la wither 30 Mana 20 10 G 2 G 3<sup>'</sup>G 5G 13 G 1 G Frequency (Hz)

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#### Radiated emissions under normal conditions according to FCC Part 15b

Project number: G0M-1705-6514

Applicant: EUT Name: Model: Test Site: Operator: Test Conditions: Antenna: Measurement distance: Mode: Test Date:	Robert Bosch GmbH Laser Rangefinder GLM400CL Eurofins Product Service GmbH Mr. Handrik Tnom: 23°C, Unom: 120V AC (AC/DC adaptor) ETS-Lindgren 3117, Horizontal 3m mode#2 2017-12-15
	2017-12-15
Note:	

FCC §15.109 Class B AV FCC §15.109 Class B PK - RBW: 1 MHz, Horizontal Max Average -RBW: 1 MHz, Horizontal Max Peak 80 70 Electrical Field (dBµV/m) 00 00 00 alamber and the لامهار المرادي MAN MAN 30 www.www.minneleuluw 20 10 G 2 G 3<sup>'</sup>G 5G 13 G 1 G Frequency (Hz)

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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: F					Verdict: PASS		
Laboratory Para	meters:	Req	uired prior to the t	est	Durin	g the test	
Ambient Temperature			15 to 35 °C		23°C		
Relative Humidity			30 to 60 %		27%		
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 Appli	cation		Application Interface				
AC Mains			LISN				
Operating mode		2					
Configuration			Charging				
Limits and results Class B							
Frequency [MHz]	Quasi-Peak [	dBµV]	Result	Aver	age [dBµV]	Result	
0.15 to 5	66 to 56*		PASS	5	6 to 46*	PASS	
0.5 to 5	56		PASS		46	PASS	
5 to 30	60		PASS		50	PASS	
Comments: * Limit decreases linearly w	vith the logarithm o	f the frequ	ency.				



#### 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:

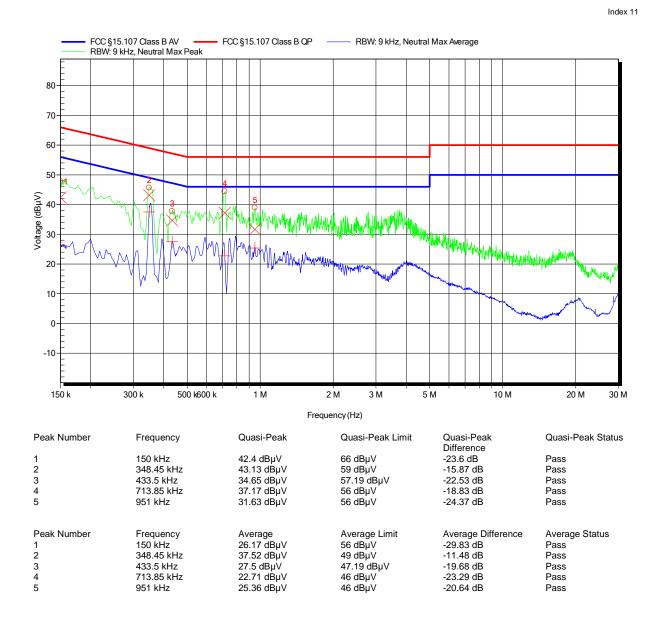
- The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
- The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- The distance between the outer 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-1705-6514

Applicant: EUT Name: Model: Test Site: Operator: Test Conditions: LISN: Mode: Test Date:	Robert Bosch GmbH Laser Rangefinder GLM400CL Eurofins Product Service GmbH Mr. Handrik Tnom: 22°C, Unom: 120V AC (AC/DC adaptor) ESH2-Z5 N mode#2 2017-12-15
Test Date:	2017-12-15
Note:	





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

Project number: G0M-1705-6614

