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INGENIEURBÜRO LENHARDT

Bundesnetzagentur BNetzA-CAB-19/21-51

Assessment Report

Test report no.: 20114715-21244-0
Date of issue: 2021-10-19

Test result: The test item **- passed - and complies** with the listed standards.

Applicant

Robert Bosch GmbH

Manufacturer

Same as applicant

Test Item

CR5TPCC

MPE Assessment according to:

FCC 47 CFR Part 15
Radio frequency devices
Parts 1.1307, 1.1310, 2.1091, 2.1093

Canada RSS-102 Issue 5
Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

Tested by (name, function, signature)	*Andreas Bender* *Head of Laboratory*	signature
Approved by (name, function, signature)	*Dr.-Ing. Harald Ansorge* *Managing Director*	signature

Applicant and Test item details	
Applicant	Robert Bosch GmbH Daimlerstrasse 6 71229 , Leonberg , Germany Fon: +49 711 400 40990 Fax: +49 711 400 40999
Manufacturer	Same as applicant
Test item description	Radar sensor
Model/Type reference	CR5TPCC
Standard specific information	
Frequency	76.0 GHz to 77.0 GHz
Antenna	integrated patch antenna
Power supply	8.0 to 32.0 VDC
Temperature range	-40°C to +85°C
FCC ID	NF3-CR5TPCC
Company number:	3887A
IC	3887A-CR5TPCC
HMN	N/V
PMN	Corner Radar Gen5 Truck Plus CAN/CAN
HVIN	CR5TPCC
FVIN	N/V

Disclaimer and Notes

The content of this rest report relates to the mentioned test sample(s) only.
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Within this test report, a ☒ point / ☐ comma is used as a decimal separator.
If otherwise, a detailed note is added adjected to its use.

IBL-Lab GmbH does not take samples. The samples used for testing are provided by the applicant.

Decision rule: See parent Test Report IBL-Lab GmbH.
Decision rule based on simple acceptance without guard bands, binary statement, based on mutually agreed uncertainty tolerances with expansion factor k=2.

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2 GENERAL INFORMATION

2.1 Administrative details

Testing laboratory	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 Sankt Ingbert / Germany Fon: +49 6894 38938-0 Fax: +49 6894 38938-99 URL: www.ib-lenhardt.de E-Mail: info@ib-lenhardt.de
Accreditation	The testing laboratory is accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025:2018. Scope of testing and registration number: • Electronics D-PL-21375-01-01 • Electromagnetic Compatibility D-PL-21375-01-02 • Electromagnetic Compatibility and Telecommunication (FCC requirements) D-PL-21375-01-03 • Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards D-PL-21375-01-04 ISED Company Number 27156 Testing Laboratory CAB Identifier DE0020 • Telecommunication (TC) D-PL-21375-01-05 Website DAkkS: https://www.dakks.de/ The Deutsche Akkreditierungsstelle GmbH (DAkkS) is also a signatory to the ILAC Mutual Recognition Arrangement.
Testing location	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany
Date of receipt of test samples	-
Start – End of tests	- – -

2.2 Possible test case verdicts

Test sample meets the requirements	P (PASS)
Test sample does not meet the requirements	F (FAIL)
Requirement does not apply to the test sample	N/A (Not applicable)
Requirement not performed	N/P (Not performed)
Requirement not available	N/V (Not available)

2.3 Observations

No additional observations other than the reported observations within this test report have been made.

2.4 Opinions and Interpretations

Note: In the opinion of the laboratory, the measured maximum output power should be within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

The range of expected maximum output power variations from the rated nominal maximum output power specified for the product or wireless mode is referred to as the tune-up tolerance.

No additional appropriate opinions or interpretations according ISO/IEC 17025:2017 clause 7.8.7 are within this test report.

2.5 Document History

-0 Initial Version

-

3 ENVIRONMENTAL & TEST CONDITIONS

3.1 Environmental conditions of test lab

Temperature	25°C ± 5°C
Relative humidity	25-75% r.H.
Barometric Pressure	860-1060 mbar
Power supply	230/400 V AC 50Hz

4 TEST STANDARDS AND REFERENCES

Test standard (accredited)	Description
FCC 47 CFR Part 15	*RADIO FREQUENCY DEVICES*
RSS-102 Issue 5	*Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)*

Test standard (not accredited)	Description
-	-

Reference	Description
FCC KDB 447498 D01 v06	*RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES*
FCC 47 CFR Part 1.1307(b)	*Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.*
FCC 47 CFR Part 1.1310	*Radiofrequency radiation exposure limits.*
FCC 47 CFR Part 2.1091	*Radiofrequency radiation exposure evaluation: mobile devices.*
FCC 47 CFR Part 2.1093	*Radiofrequency radiation exposure evaluation: portable devices.*

5 Device Data

Parameters declared by the manufacturer:

The declared maximum output powers including tune-up tolerances are used with regard to the maximum antenna gains to find the maximum EIRP and ERP values.

Type	Band [GHz]	Max. Conducted Output Power [dBm] peak	Transmit antenna gain [dBi]	Duty cycle [%]	Cycle duration [ms]	Duty cycle factor [db]	FCC Tune Up Tolerance [dB]	Calculated mean power [dBm]	Max. EIRP + Tune Up Mean [dBm]
Radar	77	11.76	15.07	25.5	16.7	-5.93	--	20.9	20.9

Measurements of power levels and declared antenna gains detailed in this test report and were taken from the following RF module test report(s). EUT test information such as test equipment used, date of actual test, environmental conditions, measurement uncertainty and the person who performed the original tests are referenced in the listed test report/s.

Test Report	Radio Standard	Issued by
20114715-18789-0 2021-10-15	47 CFR Part 95 Subpart M	IBL-Lab GmbH
20114715-18777-0 2021-10-15	RSS-251 Issue 2	IBL-Lab GmbH

Type	Band [GHz]	Measured EIRP Peak detector [dBm]	Measured EIRP RMS detector [dBm]
Radar	77	-	19.61

6 MPE Assessment Requirements

6.1 FCC 47 CFR Part 1.1310 Radiofrequency radiation exposure limits.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3–3.0	614	1.63	*100	6
3.0–30	1842/f	4.89/f	*900/f²	6
30–300	61.4	0.163	1.0	6
300–1,500	.....	.....	f/300	6
1,500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*100	30
1.34–30	824/f	2.19/f	*180/f²	30
30–300	27.5	0.073	0.2	30
300–1,500	.....	.....	f/1500	30
1,500–100,000	.....	.....	1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

6.1.1 FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices.
(a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b), chapter (6.1).
(b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of **at least 20 centimeters** is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term ''fixed location'' means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they **meet the 20 centimeter** separation requirement.
(c)(1) Mobile devices that operate in the Commercial Mobile Radio Services pursuant to part 20 of this chapter; the Cellular Radiotelephone Service pursuant to part 22 of this chapter; the Personal Communications Services pursuant to part 24 of this chapter; the Satellite Communications Services pursuant to part 25 of this chapter; the Miscellaneous Wireless Communications Services pursuant to part 27 of this chapter; the Upper Microwave Flexible Use Service pursuant to part 30 of this chapter; the Maritime Services (ship earth station devices only) pursuant to part 80 of this chapter; the Specialized Mobile Radio Service, and the 3650 MHz Wireless Broadband Service pursuant to part 90 of this chapter; the 76–81 GHz Band Radar Service pursuant to part 95 of this chapter; and the Citizens Broadband Radio Service pursuant to part 96 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if: (i) They operate at frequencies of **1.5 GHz or below** and their effective radiated power **(ERP) is 1.5 watts or more**, or (ii) They operate at frequencies **above 1.5 GHz and their ERP is 3 watts or more.**
(2) Unlicensed personal communications service devices, unlicensed millimeter-wave devices, and unlicensed NII devices authorized under §§15.255(g), 15.257(g), 15.258, 15.319(i), and 15.407(f) of this chapter are also subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if their **ERP is 3 watts or more** or if they meet the definition of a portable device as specified in §2.1093(b) requiring evaluation under the provisions of that section.
(3) All other mobile and unlicensed transmitting devices are categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, except as specified in §§1.1307(c) and 1.1307(d) of this chapter.

6.1.2 KDB 447498 D01 General RF Exposure Guidance v06, 4.3.2. Simultaneous transmission SAR test exclusion considerations
When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

6.2 ISED RSS-102 Issue 5 - Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

6.2.1 ISED MPE limits

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Table 6: RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[23]	170	180	-	Instantaneous*
1-10	-	$1.6/f$	-	6**
1.29-10	$193/f^{0.5}$	-	-	6**
10-20	61.4	0.163	10	6
20-48	$129.8/f^{0.25}$	$0.3444/f^{0.25}$	$44.72/f^{0.5}$	6
48-100	49.33	0.1309	6.455	6
100-6000	$15.60 f^{0.25}$	$0.04138 f^{0.25}$	$0.6455 f^{0.5}$	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	$616000/f^{1.2}$
150000-300000	$0.354 f^{0.5}$	$9.40 \times 10^{-4} f^{0.5}$	$3.33 \times 10^{-4} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

General public use is the type of approval given to a device that can be used by the general public.

Controlled use is the type of approval given to a device that is intended to be used by persons who are fully aware of, and can exercise control over, their exposure. **Controlled use devices** are typically installed in non-public areas and are not intended for use by members of the general public.

6.2.2 RSS-102 Section 2.5 - Exemption Limits for Routine Evaluation

All transmitters are exempt from routine SAR and RF exposure evaluations provided that they comply with the requirements of sections 2.5.1 or 2.5.2. **If the equipment under test (EUT) meets the requirements of sections 2.5.1 or 2.5.2, applicants are only required to submit a properly signed declaration of compliance (see Annex C).** The information contained in the RF exposure technical brief may be limited to the value(s) of the maximum output power, the information that demonstrates how the maximum output power of the transmitter was derived and the rationale for the separation distances applied (see Table 1), which must be based on the most conservative exposure condition for the applicable module or host platform test procedure requirements.

6.2.3 RSS-102 Section 2.5.2 - Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element **is greater than 20 cm**, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

6.2.4 RSS-102 Section 3.1.2 SAR Measurement of Devices Containing Multiple Transmitters

Compliance of devices with multiple transmitters capable of simultaneous transmission shall be assessed in accordance with the latest version of IEEE 1528. However, other recognized methods — such as the procedures published by the FCC proven to provide a conservative estimate of the SAR value (KDB 447498 D01) — can also be used. Applicants shall include in the RF exposure technical brief all information relevant to the exact test methodology used.

7 MPE Calculation Method

7.1 Standalone MPE Calculation Method

Conversion of output power

$$P(mW) = 10^{\left(\frac{Lp(dBm)}{10}\right)} \times 1mW$$

E:	E-field strength [V/m]
P:	Power input to antenna [W]
G:	Gain of the antenna in the direction of interest relative to an isotropic radiator [dBi]
PG:	EIRP (effective isotropic radiated power) [W]
r:	Distance [m]

$$E = \frac{\sqrt{30PG}}{r}$$

S:	Power density [W/m2]
P:	Power input to antenna [W]
G:	Gain of the antenna in the direction of interest relative to an isotropic radiator [dBi]
PG:	EIRP (effective isotropic radiated power) [W]
r:	Distance [m]

$$S = \frac{PG}{4\pi r^2}$$

The EUT is a wireless device with a distance of at least 0.2m from any body part of nearby persons.

Type	Band [GHz]	Max. EIRP [dBm]	Max. EIRP [W]	Power Density [W/m²]	Power Density [mW/cm²]	FCC Limit [mW/cm²]	FCC Verdict	FCC Exemp. [W]	FCC Exemp. fulfilled	ISED Limit [W/m²]	ISED Verdict	ISED Exemp. [W]	ISED Exemp. fulfilled
Manufacturer declared values													
Radar	77	20.9	0.12303	0.24488	0.024488	1	P	3	P	10	P	5	P
Measured values													
Radar	77	19.61	0.09142	0.18195	0.018195	1	P	3	P	10	P	5	P

8 MPE Conclusion

FCC: The results do comply with the requirements.

ISED: The results do comply with the requirements.

9 List of test equipment used

#	Equipment Class	ID	Calibration due date
	N/A		

Annex 1 RSS-102 – Annex A - RF Technical Brief Cover Sheet

All fields must be completed with the requested information or the following codes:
N/A for Not Applicable, N/P for Not Performed or N/V for Not Available.
Where applicable, check appropriate box.

Applicant/Product Information	
1. Company Number:	3887A
2. Product Marketing Name (PMN):	Corner Radar Gen5 Truck Plus CAN/CAN
3. Hardware Version ID. (HVIN):	CR5TPCC
4. Firmware version identification number (FIN):	N/V
5. Host Marketing Name (HMN):	N/V
6. IC Certification Number:	3887A-CR5TPCC
7. Applicant	Robert Bosch GmbH
SAR/RF Test Lab Information	
8. SAR/RF Exposure Test Laboratory	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 Sankt Ingbert / Germany Fon: +49 6894 38938-0 Fax: +49 6894 38938-99 URL: www.ib-lenhardt.de E-Mail: info@ib-lenhardt.de ISED Company Number 27156 Testing Laboratory CAB Identifier DE0020
Type of Evaluation Information	
9. Type of Evaluation:	☐ (a) Vicinity Of The Human Head. ☐ (b) Body Worn or Body Supported Device ☐ (c) Limb-Worn Device ☒ (d) Exposure Evaluation Information
(a) Vicinity Of The Human Head.	
Multiple Transmitter:	☐ Yes ☐ No
Evaluated against exposure limits:	☐ General public use ☐ Controlled use
Duty Cycle:	%
Standard(s)/Procedure(s) used for evaluation (e.g. IEEE 1528, KDB 447498):	-
SAR Value:	W/kg ☐ measured ☐ computed ☐ calculated
(b) Body Worn or Body Supported Device.	
Multiple Transmitter:	☐ Yes ☐ No
Evaluated against exposure limits:	☐ General public use ☐ Controlled use
Duty Cycle:	%
Standard(s)/Procedure(s) used for evaluation (e.g. IEC62209-2):	-

SAR Value:	W/kg ☐ measured ☐ computed ☐ calculated		
(c) Limb-Worn Device.			
Multiple Transmitter:	☐ Yes ☐ No		
Evaluated against exposure limits:	☐ General public use ☐ Controlled use		
Duty Cycle:	%		
Standard(s)/Procedure(s) used for evaluation (e.g. IEC62209-2):	-		
SAR Value:	W/kg ☐ measured ☐ computed ☐ calculated		
(d) Exposure Evaluation Information.			
Evaluated against exposure limits:	☒ General public use ☐ Controlled use		
Duty Cycle:	%		
Standard(s)/Procedure(s) used for evaluation (e.g. IEEE C95.3):	RSS 102 Issue 5		
Measurement distance:	0.2 m		
RF field strength value:	0.24488	☐ V/m	
		☐ A/m	
		☒ W/m^2	
	☐ measured ☐ computed ☒ calculated		

Annex 2 RSS-102 – Annex B - Declaration of RF Exposure Compliance

(NOTE: Annex 1 & 2 are required when SAR or RF Evaluation Measurements are applicable)

ATTESTATION: **I attest:** a) that the information provided in Annex 1 – RSS102 - Annex A is correct; b) that the Technical Brief was prepared and the information contained therein is correct; c) that the device evaluation was performed or supervised by me; d) that applicable measurement methods and evaluation methodologies have been followed; e) and that the device meets the SAR and/or RF field strength limits of RSS-102.	
Signature	-
Date	-
Name:	-
Title:	-
Product Marketing Name (PMN):	-
Hardware Version ID. (HVIN):	-
Firmware version identification number (FIN):	-
Host Marketing Name (HMN):	-
IC Certification Number:	-

Note: In cases of exemption according to RSS-102, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. or output power was derived (Annex 3 – RSS102 - Annex C).

Annex 3 RSS-102 – Annex C - Declaration of RF Exposure Compliance for Exemption from Routine Evaluation Limits

(NOTE: Annex 1 & 3 are required when RF Exposure Compliance for Exemption from Routine Evaluation Limits are applicable)

ATTESTATION:	
I attest: a) that the radiocommunication apparatus meets the exemption from the routine evaluation limits in Section 2.5 of RSS-102; b) that the Technical Brief was prepared and the information contained therein is correct; c) that the device evaluation was performed or supervised by me; d) that applicable measurement methods and evaluation methodologies have been followed; e) and that the device meets the SAR and/or RF field strength limits of RSS-102.	
Signature	
Date	2021-10-19
Name:	Andreas Bender
Title:	Head of Laboratory
Company:	3887A
Product Marketing Name (PMN):	Corner Radar Gen5 Truck Plus CAN/CAN
Hardware Version ID. (HVIN):	CR5TPCC
Firmware version identification number (FIN):	N/V
Host Marketing Name (HMN):	N/V
IC Certification Number:	3887A-CR5TPCC

Note: The submission of Annex C is only required if the device meets the exemption limits for the routine evaluation in Section 2.5 of RSS-102.

End of Assessment Report