

Test report No:
NIE: 68365REM.002

Test report

**FCC Rules and Regulations CFR 47, Part 15, Subpart B
(10-1-21 Edition) & ICES-003 Issue 7 (October 2020)**

(*) Identification of item tested	Telematic Control Unit, used in automotive industry
(*) Trademark	VOLVO
(*) Model and /or type reference	TCAM2
Other identification of the product	FCC ID: T8GTCAM2 IC: 6434A-TCAM2
(*) Features	Features: BLE, LTE, GNSS, TMPS, SDARS HW version: D0 SW version: 04-08-2022-master-TCAM2-A_Homologation
Manufacturer	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH BECKER-GOERING-STR. 16 76307, KARLSBAD, GERMANY
Test method requested, standard	FCC Rules and Regulations CFR 47, Part 15, Subpart B (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2022-11-25
Report template No	FDT08_24 (*) "Data provided by the client"



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Acronyms

Acronym ID	Acronym Description
Code	EMC Test Code
Freq Rng	Frequency Range
MP	Measurement Point
OM	Operation Mode
RE	Radiated emission
LR	Low Range
HR	High Range
S/	Sample
V	Verdict

Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 30 MHz to 1000 MHz is $I = \pm 4,9$ dB for quasi-peak measurements, $I = \pm 4,6$ dB for peak measurements ($k = 2$).

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 1000 MHz to 26 GHz is $I = \pm 2,6$ dB for peaks and average measurements ($k = 2$).

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested")
2. The sample consists of a Telematics Control Unit with eCall technologies, used in automotive, equipped with eCall modem. The project name TCAM2 has the meaning "Telematic Connectivity Antenna Module" and thus describes the key features of this device as Communication and Data Interface. This unit was designed for automotive usage and contains the following features: GSM/UMTS/LTE/5G, BTLE, TPMS receiver, SDARS and GNSS.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial N°	Date of Reception	Application
S/01	68365_20.1	Telematic Control Unit	TCAM2	HBL172N62F24RY	2022-05-27	Element Under Test
S/01	68365_23.1	USB Cable	2.0 1M	--	2022-05-27	Auxiliary Element
S/01	68365_31.1	I-Box OABR Adapter	--	--	2022-05-27	Auxiliary Element
S/01	68365_39.1	Board Ethernet	--	--	2022-05-27	Auxiliary Element
S/01	68365_48.1	Harness	--	--	2022-05-27	Auxiliary Element
S/01	68365_56.1	Firmware Hub Emulator	FHE	FHEDG0M4004373	2022-05-27	Auxiliary Element
S/01	68365_65.1	Rechargeable Li-ion Battery	BL7981	000000003	2022-05-27	Auxiliary Element
S/01	68365_73.1	Volvo TCAM / TPMS	AD74Q	11678	2022-05-30	Auxiliary Element

Notes referenced to samples during the project:

None.

Test sample description

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
			[]	[]	[]		
.....		[]	[]	[]			
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[]	AC:	[]	[]	[]	[]	[]
	[X]	DC: 12V car battery / alternator (4,5 V ≤ UB ≤ 18 V; UB typical: 12V)					
Rated Power	12V DC						
Clock frequencies..... :							
Other parameters	See Technical description						
Software version	04-08-2022-master-TCAM2-A_Homologation						
Hardware version	D0						
Dimensions in cm (W x H x D)							
Mounting position	[]	Table top equipment					
	[]	Wall/Ceiling mounted equipment					
	[]	Floor standing equipment					
	[]	Hand-held equipment					
	[X]	Other: automotive telematics control unit					
Modules/parts..... :	Module/parts of test item		Type		Manufacturer		
							
Accessories (not part of the test item)	Description		Type		Manufacturer		
	Cable Harness						
							
Documents as provided by the applicant..... :	Description		File name		Issue date		
	Technical Description						
							

⁽³⁾ Only for Medical Equipment

Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
BECKER-GOERING-STR. 16
76307, KARLSBAD, GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-06-08
Date (finish)	2022-06-08

Document history

Report number	Date	Description
68365REM.002	2022-11-25	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860mbar Max. = 1060mbar

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860mbar Max. = 1060mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860mbar Max. = 1060mbar

Remarks and comments

The tests have been performed by the technical personnel: Carlos Haro López.

Testing verdicts

Fail	F
Inconclusive	I
Not applicable	N/A
Not measured	N/M
Pass	P
Partial Passed	P*

List of equipment used during the test

Control No.	Equipment	Model	Manufacturer	Next Calibration
6064	SEMIANECHOIC ABSORBER LINED CHAMBER	SAC-3	FRANKONIA	N/A
6329	SHIELDED ROOM	---	FRANKONIA	N/A
6132	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2023-04-05
6126	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2023-04-05
8866	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2023-09-21
5641	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	EST LINDGREN	2024-09-15
4612	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2024-07-13
9360	PRE-AMPLIFIER G>40dB 1-18 GHz	BLMA 0118-1M	BONN ELEKTRONIK	2023-05-11
2942	EMI TEST RECEIVER 20Hz-40GHz	ESU40	ROHDE AND SCHWARZ	2023-11-22
4657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2023-05-05
8856	PRE-AMPLIFIER G>30dB 17-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2022-09-08
4848	MEASUREMENT SOFTWARE EMC/RF	EMC32	ROHDE AND SCHWARZ	N/A

Summary

Test Specification.	Requirement – Test case	Verdict	Remark
FCC CFR 47, Part 15, Subpart B (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)	RE Radiated emission. Electromagnetic field measure	P	--
	CE Continuous Conducted Emission	N/A	(1)
<u>Supplementary information and remarks:</u> (1) Not applicable according to standard. The equipment is powered in DC.			

Appendix A: Test results

Appendix A content

DESCRIPTION OF THE OPERATION MODES 13

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RE Radiated emission. Electromagnetic field measure 15

Description of the operation modes

The operation modes described in this paragraph constitute a functionality of the sample under test for itself.
The operation modes used by the samples to which the present report refers, are shown in the following table:

Id	Description
OM/01	EUT ON. Bluetooth OFF. Cellular (2G/3G/4G/5G) searching network. GNSS active. Power supply: 12Vdc

Test standards version applied

The product standards and test standards applied for each test cases are shown in the following table:

Product Test Standard	Test standard	Requirement – Test case
FCC CFR 47, Part 15, Subpart B (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 (2014)	RE Radiated emission.

Test Cases Details

RE Radiated emission. Electromagnetic field measure

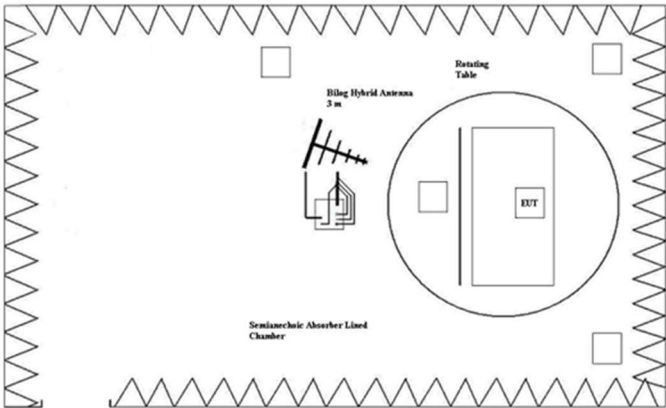
Limits of interference Class B

The applied limit for radiated emissions, 3 m distance, according to the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-1-21 Edition), Secs. 15.109 & ICES-003 Issue 7 (October 2020)

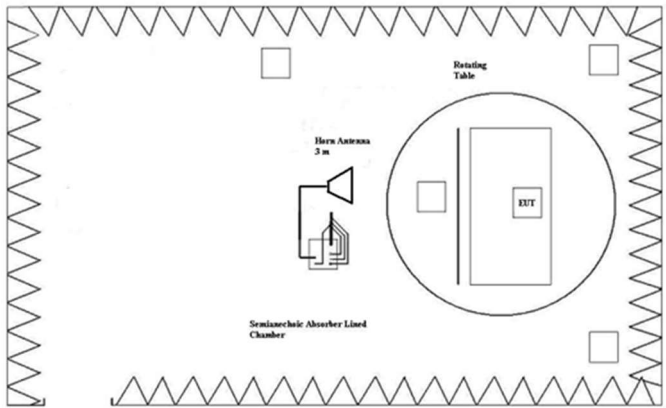
Frequency range (MHz)	FCC Part 15B		ICES-003 Issue 7		FCC Part 15B & ICES-003 Issue 7	
	QP Limit for 3 m		QP Limit for 3 m		PK Limit for 3 m	AVG Limit for 3 m
	($\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)	($\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)
30 to 88	100	40	100	40	---	---
88 to 216	150	43.5	150	43.5	---	---
216 to 230	200	46	200	46	---	---
230 to 960	200	46	224	47		
960 to 1000	500	54	500	54	---	---
Above 1000	---	---	---	---	74	54

Limits according to FCC Part 15B, are equal or more stringent than those of ICES-003 Issue 7.

Setup for measurements



Setup for measurements < 1GHz.



Setup for measurements > 1GHz.

Results

S/	OM	Code	Freq Rng (MHz)	V
01	OM/01	RE0101LR	[30, 1000]	P
01	OM/01	RE0101HR1	[1000, 17000]	P
01	OM/01	RE0101HR2	[17000, 26000]	P

Verdict

Pass

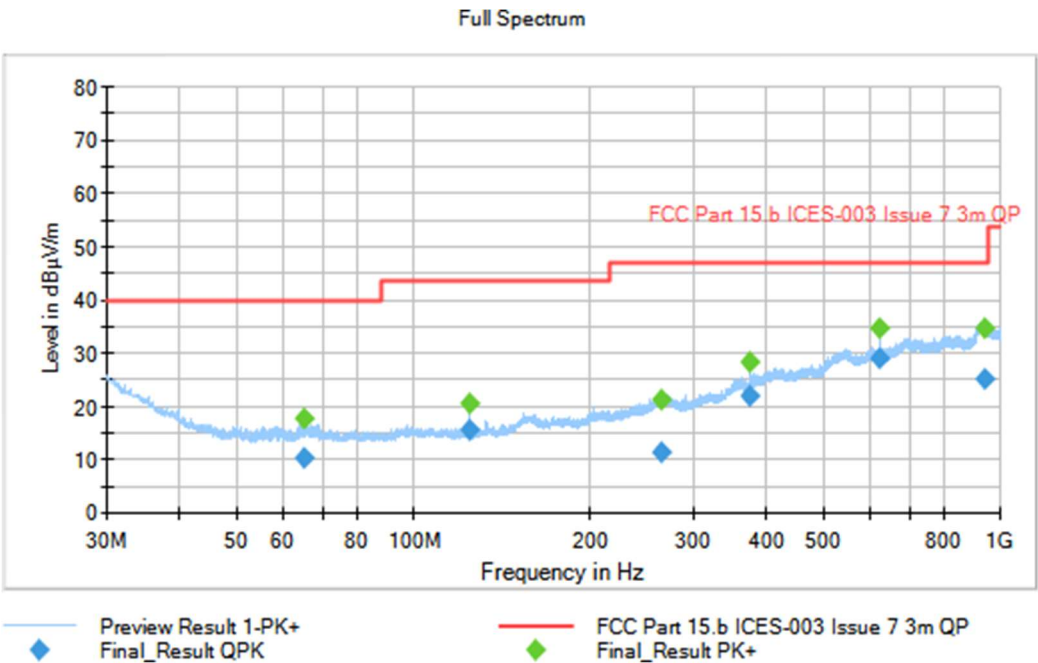
Attachments

EMC Test Code = RE0101LR, Frequency Range MHz = [30, 1000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth OFF. Cellular (2G/3G/4G/5G) searching network. GNSS active.
Power supply: 12Vdc

Images:



Tables:

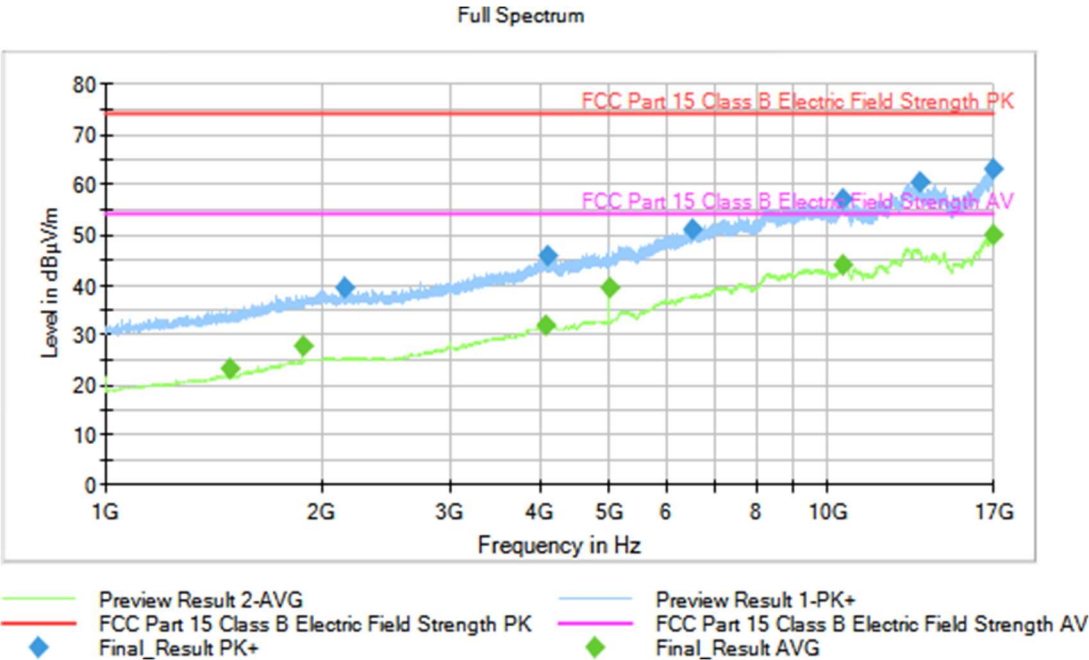
Frequency(MHz)	QuasiPeak(dBµV/m)	MaxPeak(dBµV/m)	Limit(dBµV/m)	Margin(dB)	Height(cm)	Pol	Azimuth(deg)
65.105000	10.17	---	40.00	29.83	143.0	V	110.0
65.105000	---	17.75	---	---	143.0	V	110.0
124.975000	15.73	---	40.00	24.27	105.0	V	268.0
124.975000	---	20.48	---	---	105.0	V	268.0
264.098000	11.32	---	47.00	35.68	104.0	V	0.0
264.098000	---	21.35	---	---	104.0	V	0.0
374.974000	21.90	---	47.00	25.10	106.0	H	94.0
374.974000	---	28.41	---	---	106.0	H	94.0
624.980000	29.10	---	47.00	17.90	142.0	H	109.0
624.980000	---	34.70	---	---	142.0	H	109.0
940.758000	25.13	---	47.00	21.87	361.0	V	221.0
940.758000	---	34.63	---	---	361.0	V	221.0

EMC Test Code = RE0101HR1, Frequency Range MHz = [1000, 17000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth OFF. Cellular (2G/3G/4G/5G) searching network. GNSS active.
Power supply: 12Vdc

Images:



Tables:

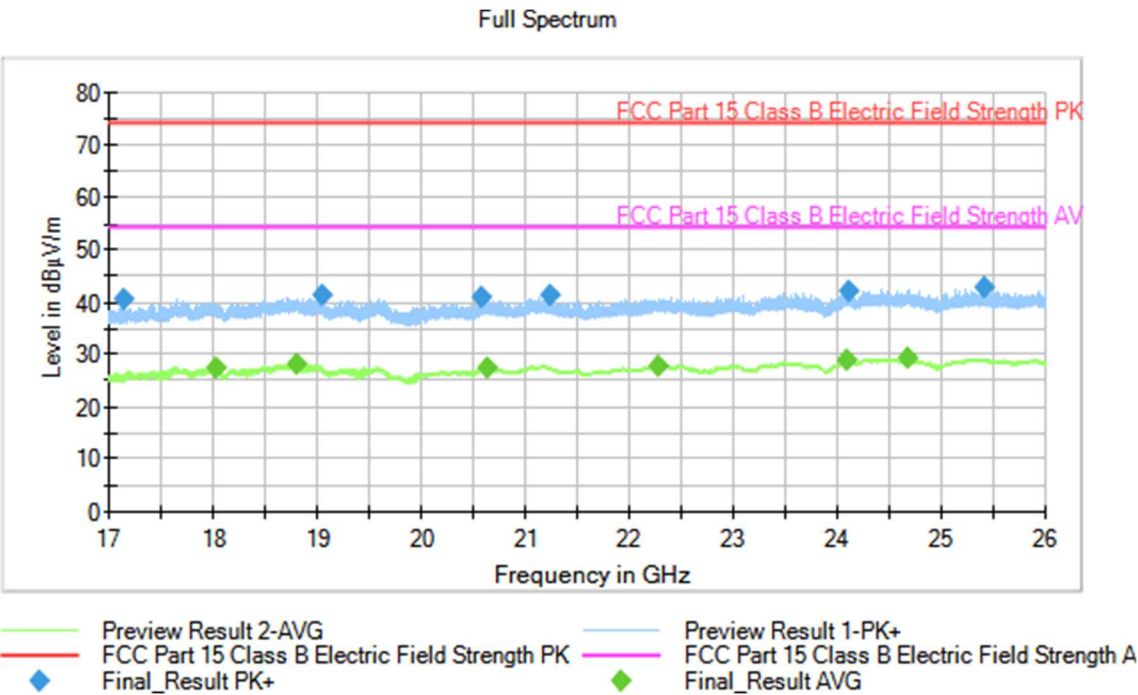
Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
1484.800000	---	23.34	53.97	30.63
1874.800000	---	27.95	53.97	26.02
2146.400000	39.26	---	73.97	34.71
4072.000000	---	31.98	53.97	21.99
4106.400000	45.66	---	73.97	28.31
5000.000000	---	39.55	53.97	14.42
6513.600000	51.01	---	73.97	22.96
10498.400000	---	43.81	53.97	10.16
10503.600000	57.02	---	73.97	16.95
13462.400000	60.46	---	73.97	13.51
16978.800000	---	49.79	53.97	4.18
16998.000000	63.02	---	73.97	10.95

EMC Test Code = RE0101HR2, Frequency Range MHz = [17000, 26000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth OFF. Cellular (2G/3G/4G/5G) searching network. GNSS active.
Power supply: 12Vdc

Images:



Documents:

Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
17137.250000	40.58	---	73.97	33.39
18013.500000	---	27.40	53.97	26.57
18787.750000	---	28.25	53.97	25.72
19044.750000	41.23	---	73.97	32.74
20570.250000	40.86	---	73.97	33.11
20624.250000	---	27.50	53.97	26.47
21230.750000	41.19	---	73.97	32.78
22280.750000	---	27.86	53.97	26.11
24098.500000	---	29.10	53.97	24.87
24113.500000	42.04	---	73.97	31.93
24674.500000	---	29.15	53.97	24.82
25416.750000	42.81	---	73.97	31.16