

Test report No:
 NIE: 71652RAN.001

Test report

RF EXPOSURE REPORT ACCORDING TO IEEE Std C95.3-2021

(*) Identification of item tested	Instrument Cluster incl. immobilizer for Audi Cars
(*) Trademark	Bosch
(*) Model and /or type reference	Audi FPK Gen2+
Other identification of the product	Hw version: H02 Sw version: X010 FCC ID: 2AUXS-AUFPK2P IC: 25847-AUFPK2P HVIN: 0 263 742, 0 263 753
Features	Immobilizer
Manufacturer	Robert Bosch GmbH Robert-Bosch-Platz 1 70839 Gerlingen, Germany
Test method requested, standard	IEEE Std C95.3-2021: "IEEE Recommended Practice for Measurements and Computations of Electric, Magnetic and Electromagnetic Fields With Respect to Such Fields, 0 Hz–300 GHz". FCC 47 CFR Part 2.1093 Radiofrequency radiation exposure evaluation: portable devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Miguel Lacave Antennas Lab Manager
Date of issue	2022-09-28
Report template No	FDT08_24 (*) "Data provided by the client"



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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 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 at the time of performance of the test.

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

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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the documents:

1. IEEE Std C95.3-2021: "IEEE Recommended Practice for Measurements and Computations of Electric, Magnetic and Electromagnetic Fields With Respect to Such Fields, 0 Hz–300 GHz".
2. DEKRA Testing and Certification, S.A.U. internal documents PODT000 and FAN40.

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", "Other identification of the product", "Features", "Manufacturer" and "Test sample description").
2. Installation setup and use distance between the nearby user and the device antenna.

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

Sample M/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
71652/019	Car-Key	-	-	2022/05/04
71652/005	Harness	-	-	2022/05/03
71652/026	Cluster with immobilizer	Audi FPK Gen2+ (Q2 variant)	4161623	2022/05/04
71652/027	Cluster with immobilizer	Audi FPK Gen2+ (Q3 variant)	4161901	2022/06/16

1. Sample M/01 has undergone the test(s) specified in subclause "Test method requested".

Test sample description

The sample of the model Audi FPK Gen2+ is a digital instrument cluster with an immobilizer for Audi cars.

Identification of the client

Robert Bosch GmbH
Robert-Bosch-Platz 1
70839 Gerlingen, Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start) - Date (finish)	2022-05-26
Date (start) - Date (finish)	From 2022-08-02 to 2022-08-03

Document history

Report number	Date	Description
71652RAN.001	2022-09-28	First release

Environmental conditions

Date	Max. Temp. °C	Min. Temp. °C	Max. Hum. %	Min. Hum. %	Limit
2022-05-26	27.85	24.73	40.43	31.38	10-40 °C, 0-90 %
From 2022-08-02 to 2022-08-03	27.10	23.67	51.48	40.69	

Remarks and comments

The tests have been performed by the technical personnel: Francisco J. Sánchez.

The instrumentation utilized to perform the tests covered in this test report is listed in the following table:

	Last Cal. date	Cal. due date	Control Nº
1. Narda EHP-200A E and H Field Analyzer	2021/12	2023/12	7860
2. Low Dielectric Tripod Manfrotto H-491009-01	-	-	5261
3. Temperature and humidity logger HW GROUP HWg-STE	2022/04	2023/04	5780

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Summary

FCC 47 CFR § 2.1093	VERDICT			
	N/A	P	F	N/M
Immobilizer 125 kHz		P		

Appendix A: FCC RF Exposure

General description of the device under evaluation

The sample of the model Audi FPK Gen2+ is a digital instrument cluster with an immobilizer for Audi cars.

According to the manufacturer, during its normal use, the separation distance between the device and the body of nearby users will be smaller than 20 cm.

The device will be installed near the steering wheel of the car at the right side of the plastic case, having a final minimum installation distance to the user greater than 3 centimeters for the worst-case side. Once installed, the car key must be inserted in the lock to start the 125 kHz transmission.

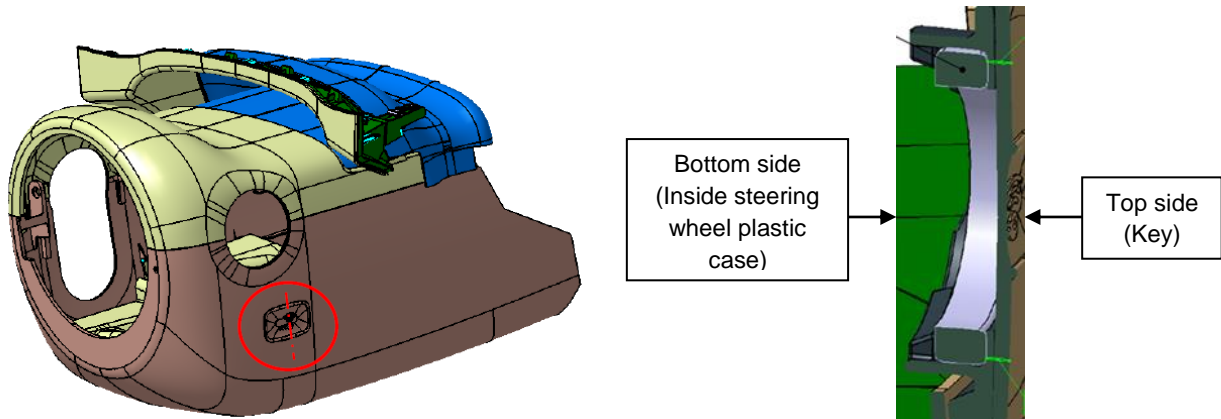


Figure 1: Device installation location.

Evaluation Results

Following results correspond to maximum measured field values:

Technology	Frequency (MHz)	Max. H-field (A/m)	Max. E-field (V/m)	H-field Limit (A/m)	E-field Limit (V/m)	Verdict
Immobilizer 125 kHz	0.1250	0.001	-	1.63	-	PASS
	0.1253	-	67.75	-	614.0	PASS

Table 1: Max H-field and E-field results

Immobilizer 125 kHz Evaluation

Measurements have been made from all sides of the device with a separation distance of 0 cm measured from the center of the probe to the edge of the device (due to the field probe dimensions, 4.5cm is the closest distance between the device edges and the measurement field probe center). The top side was measured with the key inserted to simulate the normal use conditions of the device.

Emissions between 100 kHz to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of Section 1.1310: 614 V/m and 1.63 A/m. Measurements were performed using the equipment listed in the “Used Instrumentation” paragraph of this document using a commercial sample provided by the manufacturer:

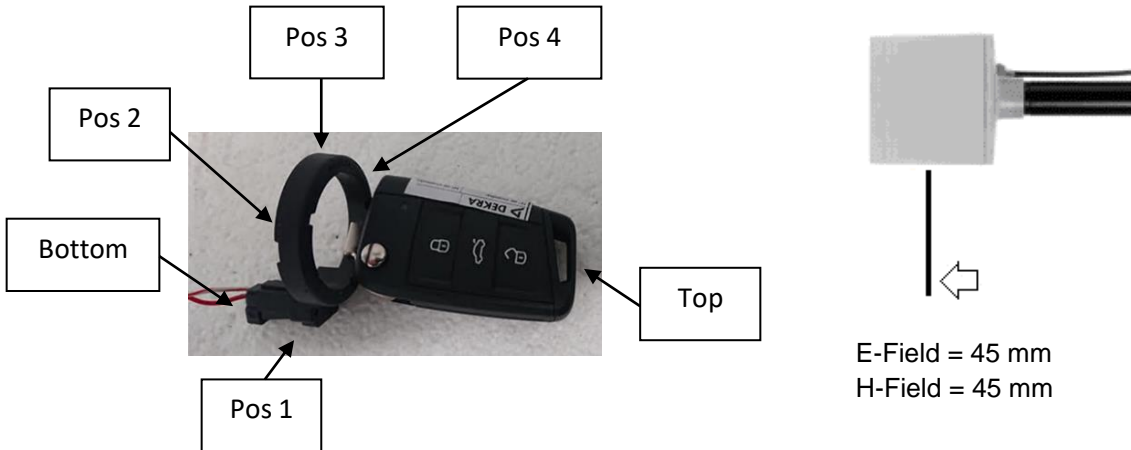


Figure 2: E and H field measurement setup

Following results correspond to maximum measured field values:

Sample	Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
71652/026	Pos 1	0	0.1250	0.798	1.630	49.0	Pass
	Pos 2	0	0.1250	0.499	1.630	30.6	Pass
	Pos 3	0	0.1250	0.115	1.630	7.1	Pass
	Pos 4	0	0.1253	1.059	1.630	64.9	Pass
	Top (with key)	0	0.1253	0.496	1.630	30.4	Pass
	Bottom	0	0.1250	1.485	1.630	91.1	Pass

Table 2: H-field measurement values for sample 71652/026

Sample	Test side	Distance to DUT (cm)	Frequency (MHz)	E-Field (V/m)	Limit (V/m)	% Limit	Verdict
71652/026	Pos 1	0	0.1250	43.03	614.00	7.0	Pass
	Pos 2	0	0.1250	42.36	614.00	6.9	Pass
	Pos 3	0	0.1250	42.46	614.00	6.9	Pass
	Pos 4	0	0.1250	48.82	614.00	8.0	Pass
	Top (with key)	0	0.1250	17.46	614.00	2.8	Pass
	Bottom	0	0.1253	67.75	614.00	11.0	Pass

Table 3: E-field measurements values for sample 71652/026

Sample	Test side	Distance to DUT (cm)	Frequency (MHz)	H-Field (A/m)	Limit (A/m)	% Limit	Verdict
71652/027	Pos 1	0	0.1248	0.475	1.630	29.1	Pass
	Pos 2	0	0.1250	0.181	1.630	11.1	Pass
	Pos 3	0	0.1253	0.1497	1.630	9.2	Pass
	Pos 4	0	0.1250	0.533	1.630	32.7	Pass
	Top (with key)	0	0.1253	0.432	1.630	26.5	Pass
	Bottom	0	0.1253	0.942	1.630	57.8	Pass

Table 4: H-field measurement values for sample 71652/027

Sample	Test side	Distance to DUT (cm)	Frequency (MHz)	E-Field (V/m)	Limit (V/m)	% Limit	Verdict
71652/027	Pos 1	0	0.1250	46.37	614.00	7.6	Pass
	Pos 2	0	0.1250	40.50	614.00	6.6	Pass
	Pos 3	0	0.1253	34.00	614.00	5.5	Pass
	Pos 4	0	0.1253	41.05	614.00	6.7	Pass
	Top (with key)	0	0.1248	20.45	614.00	3.3	Pass
	Bottom	0	0.1255	55.51	614.00	9.0	Pass

Table 5: E-field measurements values for sample 71652/027

All H-Field and E-Field values are in compliance to values shown into §1.1310, paragraph (e), "Table 1: limits for Maximum Permissible Exposure (MPE)".

Appendix B: RF Exposure Information

FCC RF Exposure evaluation for portable devices

When a device qualifies for the categorical exclusion provision of § 2.1093(c), the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to §1.1310 Radiofrequency radiation exposure limits, paragraph (e), the limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields are:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	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/f ²	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/f ²	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