

Test report No:
NIE: 78973RAN.002A2

Assessment report

RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1091; FCC 47 CFR Part 1.1307 FCC 47 CFR Part 1.1310

(*) Identification of item under evaluation	Radio Navigation Systems (NAV), Display Audio systems (DA)
(*) Trademark	BOSCH
(*) Model and /or type reference	MMCSBXNAR
(*) Other identification of the product	HW version: 001 SW Version: 6830_240319 FCC ID: 2AUXS-MMCSBXNAR IC: 25847 - MMCSBXNAR
(*) Features	AM/FM, BT, Wi-Fi, GNSS, Highspeed CAN -M-CAN and V-CAN, USB, Ethernet
(*) Manufacturer	Robert Bosch GmbH Robert-Bosch-Platz 1, 70839 Gerlingen
Test method requested, standard	FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices. FCC 47 CFR Part 1.1307: 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.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Manuel García Antennas Laboratory Technical Responsible
Date of issue	2024-12-03
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Index

Competences and guarantees3

General conditions3

Data provided by the client.....3

Identification of the client.....4

Document history4

Appendix A: FCC RF Exposure assessment result5

 General description of the device under evaluation6

 Evaluation Results.....7

Appendix B: FCC RF Exposure information8

 RF Exposure determination of exemption.....9

 RF Exposure evaluation11

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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 under evaluation", "Trademark", "Model and/or type reference", "General description of the device", "Other identification of the product").
2. Maximum antenna gain and use distance information.
3. The device under evaluation consists of a Radio Navigation Systems (NAV). Display Audio systems (DA) with following features:
 - Units without fascia and keys
 - Linux-based software
 - Key Features:
 - o Connectivity (Highspeed CAN -M-CAN and V-CAN bus- 500kbit/s, BT, Wi-Fi SISO, Ethernet)
 - o USB
 - 1st port: Connect Molex or Mitsumi USB hub 2port hub. The hub supports connection to MSC or MTP devices containing media playback data or download data. Also supporting connection to devices supporting Apple iPod playback, Apple Carplay and Android Auto

- 2nd port: Connect TCU box. Using USB subclass CDC-EEM for data transmission (Telematic / eCall box) o Smartphone integration
 - o GNSS localization (details see GNSS chapter)
 - o Audio: Arkamys, ESE
 - o Radio: AM/FM, SXM (optional only NAR)
 - o Display of vehicle functions HMI
 - o LVDS connection to RearViewCamera, RearSeatEntertainment, Media Player and external Display
 - o Analogue RearViewCamera
 - o LVDS audio connection A2B for external amplifier with digital A2B input

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.

Identification of the client

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Document history

Report number	Date	Description
78973RAN.002	2024-11-20	First release
78973RAN.002A1	2024-11-21	Second release: the model name has been updated on the cover page. This modification test report cancels and replaces the test report 78973RAN.002
78973RAN.002A2	2024-12-03	Third release: The FCC ID and IC number have been included on the cover page; UNII-2 conducted value has been updated and antenna peak gain value for UNII-3 has been updated. This modification test report cancels and replaces the test report 78973RAN.002A1

Appendix A: FCC RF Exposure assessment result

General description of the device under evaluation

Table 1 shows information used for the RF Evaluation, taking into account the following declared specifications for the device:

Description and technologies: the device under evaluation consists of a Radio Navigation Systems (NAV). Display Audio systems (DA) with following features:

- Units without fascia and keys
- Linux-based software
- Key Features:
 - o Connectivity (Highspeed CAN -M-CAN and V-CAN bus- 500kbit/s, BT, Wi-Fi SISO, Ethernet)
 - o USB
- 1st port: Connect Molex or Mitsumi USB hub 2port hub. The hub supports connection to MSC or MTP devices containing media playback data or download data. Also supporting connection to devices supporting Apple iPod playback, Apple Carplay and Android Auto
- 2nd port: Connect TCU box. Using USB subclass CDC-EEM for data transmission (Telematic / eCall box) o Smartphone integration
 - o GNSS localization (details see GNSS chapter)
 - o Audio: Arkamys, ESE
 - o Radio: AM/FM, SXM (optional only NAR)
 - o Display of vehicle functions HMI
 - o LVDS connection to RearViewCamera, RearSeatEntertainment, Media Player and external Display
 - o Analogue RearViewCamera
 - o LVDS audio connection A2B for external amplifier with digital A2B input

with the following features: AM/FM, BT, Wi-Fi, GNSS, Highspeed CAN -M-CAN and V-CAN, USB Ethernet. For RF Exposure evaluation, only transmission technologies: Bluetooth and Wi-Fi 2.4GHz and 5GHz are taken into account.

Evaluation Distance: according to the manufacturer, during its normal use, the separation distance between the radiating structures of the device and nearby users will be greater than 20 cm. In order to perform the assessment a conservative evaluation distance of 20 cm has been used.

Maximum output power:

- Values corresponding to Wi-Fi 2.4GHz and BT conducted output power have been measured and stated into DEKRA Testing and Certification, S.A.U. test report num. 78973RRF.001A1.
- Values corresponding to Wi-Fi 5GHz conducted output power have been measured and stated into DEKRA Testing and Certification, S.A.U. test report num. 78973RRF.002A1.

Antennas under evaluation: the device supports two different antennas for the Bluetooth and Wi-Fi transmitting technologies:

- Values corresponding to Bluetooth peak antenna gain have been declared and stated in antenna manufacturer's datasheet.

Values corresponding to Wi-Fi peak antenna gain have been declared and stated in antenna manufacturer's datasheet. (That values have been taken into account without WLAN cable, due to that represent a worst case respect to the antenna gain value).

The following table shows the information provided above:

Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Maximum Conducted Output Power (Incl. Tune-Up) (dBm)	Antenna peak gain (dBi)	Maximum E.R.P. (dBm)	Maximum E.R.P. (mW)	Maximum E.I.R.P. (dBm)	Maximum E.I.R.P. (mW)
802.11b/g/n	2.4 GHz	2412 - 2462	11.17	2.90	11.92	15.56	14.07	25.53
802.11a/n/ac	U-NII-1	5150 - 5250	5.15	3.45	6.45	4.42	8.60	7.24
802.11a/n/ac	U-NII-2	5260 - 5320	5.12	3.26	6.23	4.20	8.38	6.89
802.11a/n/ac	U-NII-2C	5500 - 5720	5.66	3.05	6.56	4.53	8.71	7.43
802.11a/n/ac	U-NII-3	5725 - 5850	4.76	1.06	3.67	2.33	5.82	3.82
Bluetooth	2.4 GHz	2400 - 2483.5	6.26	1.91	6.02	4.00	8.17	6.56

Table 1: Equipment specifications

Evaluation Results

RF Exposure Exemption evaluation:

Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Distance (cm)	Maximum E.R.P. (mW)	§1.1307(b)(3).i.(C) Exposure Limit (mW)	Verdict for exemption § 1.1307(b)(3).i
802.11b/g/n	2.4 GHz	2412 - 2462	20.00	15.56	768.00	Pass
802.11a/n/ac	U-NII-1	5150 - 5250	20.00	4.42	768.00	Pass
802.11a/n/ac	U-NII-2	5260 - 5320	20.00	4.20	768.00	Pass
802.11a/n/ac	U-NII-2C	5500 - 5720	20.00	4.53	768.00	Pass
802.11a/n/ac	U-NII-3	5725 - 5850	20.00	2.33	768.00	Pass
Bluetooth	2.4 GHz	2400 - 2483.5	20.00	4.00	768.00	Pass

Table 2: FCC Exemption Evaluation Results

The computed value(s) are below the exemption limit(s), so these modes meet the requirements stated in FCC 47 CFR Part 1.1307.

Simultaneous transmission assessment:

Simultaneous technologies and modes	Result (Σ of Pout/Pmax ratios)	Verdict (Σ ≤ 1)
802.11a/n/ac U-NII-2 + Bluetooth 2.4 GHz	0.01	Pass
802.11b/g/n 2.4 GHz + Bluetooth 2.4 GHz	0.03	Pass

Table 3: Simultaneous Transmission assessment

Appendix B: FCC RF Exposure information

RF Exposure determination of exemption

According to FCC 47 CFR §1.1307 (b)(3) Determination of exemption:

(i) For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2), a single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

TABLE 1 TO §1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R ² .
1.34-30	3,450 R ² /f ² .
30-300	3.83 R ² .
300-1,500	0.0128 R ² f.
1,500-100,000	19.2R ² .

(ii) For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for Pth, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

Pi = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

Pth,i = the exemption threshold power (Pth) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.

ERPj = the ERP of fixed, mobile, or portable RF source j.

ERPth,j = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$ according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

Evaluated,k = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

Exposure Limit,k = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from §1.1310 of this chapter.

The available maximum time-averaged power or effective radiated power (ERP), can be calculated using the following formula to assess compliance with the Exemption Limits:

$$P_{E.I.R.P.} = P_T + G_T - L_C$$

Where:

P_T= transmitter time-averaged output power (including Duty Cycle and tune-up tolerance, if applicable)

G_T= gain of the transmitting antenna

L_C = signal attenuation in the connecting cable between the transmitter and the antenna if applicable

$$P_{E.R.P.} = P_{E.I.R.P.} - 2.15 \text{ dB}$$

RF Exposure evaluation

Limits for Maximum Permissible Exposure (MPE) for RF sources are defined in FCC 47 CFR “§1.1310 Radiation Exposure limits, paragraph (e)”:

TABLE 1 TO §1.1310(E)(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)
(i) 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
(ii) 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.

Each supported transmission technology will be evaluated to determine if it is in compliance with limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst-case" or conservative prediction:

$$\text{Power density: } S[mW/cm^2] = \frac{P_{E.I.R.P.}[mW]}{4\pi R[cm]^2}$$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

$$P_{E.I.R.P.} = P_T + G_T - L_C$$

Where:

P_T = transmitter time-averaged output power (including Duty Cycle and tune-up tolerance, if applicable)

G_T = gain of the transmitting antenna

L_C = signal attenuation in the connecting cable between the transmitter and the antenna if applicable