

Test report No:
NIE: 69535RAN.002

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	Automotive infotainment System
(*) Trademark	Mercedes-Benz
(*) Model and /or type reference	NTG7Q MID, NTG7Q HIGH, NTG7Q PREMIUM
(*) Other identification of the product	FCC ID: T8GNTG7QHIG IC: 6434A-NTG7QHIG HW version: D11 SW version: E329
(*) Features	FM/AM/DAB, USB, Bluetooth, WLAN, GNSS.
(*) Manufacturer	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY
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)	Miguel Lacave Antennas Lab Manager
Date of issue	2022-09-20
Report template No	FAN36_02 (*) "Data provided by the client"

Index

Competences and guarantees3

General conditions3

Data provided by the client.....3

Identification of the client.....3

Document history5

Appendix A: FCC RF Exposure assessment result6

 General description of the device under evaluation7

 Evaluation Results.....8

Appendix B: FCC RF Exposure information9

 RF Exposure determination of exemption.....10

 RF Exposure evaluation12

Competences and guarantees

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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 tested", "Trademark", "Model and/or type reference tested", "Other identification of the product", "Features" and "Test sample description").
2. Maximum output power, maximum antenna gain and installation distance.
3. Derived model not tested. These models have been declared by the supplier of the sample as being the same as the model under test.

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Declaration of similarity

Karlsbad, 19.09.2022

Dear Ladies and Gentlemen,

we, **Harman Becker Automotive Systems GmbH,** located in
Becker-Goering-Str. 16; 76307 Karlsbad, Germany

hereby declare that the following units: **NTG7Q MID,**
NTG7Q HIGH,
NTG7Q PREMIUM,

are using the identical BT/WLAN module with the same layout and schematic.
The RF-Path of this module is going to the external 4x RF-Connector, where our
customer Mercedes-Benz is connecting the dedicated car antennas.
From radio transmitter perspective and from RF point of view the above mentioned
units of the NTG7Q family can be considered as identical.

In case of any question please do not hesitate and contact us.

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Regards



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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

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY
BECKER-GOERING-STR. 16;
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Document history

Report number	Date	Description
69535RAN.002	2022-09-20	First release

Appendix A: FCC RF Exposure assessment result

General description of the device under evaluation

The device under evaluation consists of an automotive infotainment system, which will be installed into different car models, using a specific installation setup for each carline.

According to the manufacturer, the device has two different antennas that will be installed into different car positions resulting in a distance minor to 20 cm to the closest passenger:

PIN	Antenna	Functionality	Minimum distance
Pin1	-	Not used	-
Pin2	-	Not used	-
Pin3	Co-pilot	SISO 5G, Bluetooth	131.72 mm
Pin4	Pilot	SISO 2G4	171.25 mm

Table 1: Antenna minimum installation distances

In order to perform the assessment a conservative evaluation distance of 13.1 cm has been used for both antennas.

The equipment specifications declared by the manufacturer for each supported technology and band are:

Technology / Mode	Band	Frequency (MHz)	Maximum Conducted Output Power (dBm)	Antenna peak gain (dBi)	Cable loss (dBi)	Maximum E.R.P. (dBm)	Maximum E.R.P. (mW)
802.11b/g/n	2.4 GHz	2412 - 2484	7.50	3.00	0.60	7.75	5.96
802.11a/n/ac	5 GHz	5150 - 5850	11.50	4.50	2.00	11.85	15.31
Bluetooth	2.4 GHz	2400 - 2483.5	7.00	3.00	1.20	6.65	4.62

Table 2: Equipment specifications

Evaluation Results

For an intended installation distance of 13.10 cm, the evaluation for the applicable output power levels and exemption limits for each operating frequency will be as follow:

Technology / Mode	Band	Frequency (MHz)	Distance (cm)	Maximum E.R.P. (mW)	§1.1307(b)(3).i.(C) Exposure Limit (mW)	Verdict
802.11b/g/n	2.4 GHz	2412 - 2484	13.10	5.96	329.49	Pass
802.11a/n/ac	5 GHz	5150 - 5850	13.10	15.31	329.49	Pass
Bluetooth	2.4 GHz	2400 - 2483.5	13.10	4.62	329.49	Pass

Table 3: FCC Evaluation Results

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

Simultaneous transmission assessment:

The device under evaluation is able to transmit simultaneously using WLAN and Bluetooth transmitters, therefore the most conservative approach for the evaluation of the simultaneous transmission will be:

Simultaneous technologies and modes	Result ($\sum$ of Pout/Pmax ratios)	Verdict ($\sum \leq 1$)
802.11b/g/n 2.4 GHz + 802.11a/n/ac 5 GHz + Bluetooth 2.4 GHz	0.08	Pass

Table 4: 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 P_{th} (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). P_{th} 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	$19.2 R^2$.

(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.

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:

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

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 output power (including tune-up tolerance)

G_T = gain of the transmitting antenna

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