Report on the FCC and IC Testing of the Marquardt GmbH NFC door handle Model: HH1 In accordance with FCC 47 CFR Part 15 C and ISED RSS-210 and ISED RSS-GEN

Product Service

Add value.
Inspire trust.

Prepared for: Marquardt GmbH
Schloss-Str. 16
78604 Rietheim-Weilheim
Germany

FCC ID: IYZHH1
IC: 2701A-HH1

COMMERCIAL-IN-CONFIDENCE

Date: 2021-06-11
Document Number: TR-33652-09346-02 | Issue 1

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Alex Fink	2021-06-11	SIGN-ID 519050
Authorised Signatory	Matthias Stumpe	2021-06-14	SIGN-ID 519536

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

Engineering Statement:

This measurement shown in this report were made in accordance with the procedures described on test pages.
All reporded testing was carried out on a sample equipment to demonstrate limited compilance with with FCC 47 CFR Part 15 C and ISED RSS-210 and RSS-GEN.
The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Alex Fink	2021-06-11	SIGN-ID 519050

Laboratory Accreditation	Laboratory recognition	Industry Canada test site registration
DAkkS Reg. No. D-PL-11321-11-02 DAkkS Reg. No. D-PL-11321-11-03	Registration No. BNetzA-CAB-16/21-15	3050A-2

Executive Statement:

A sample of this product was tested and found to be compilant with FCC 47 CFR Part 15 C:2019 and ISED RSS-210:2020 and RSS-GEN:2019

ACCREDITATION
Our BNetzA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our BNetzA Accreditation.

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Product Service

Content

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1 Report Summary

1.1 Modification Report

Alternations and additions of this report will be issued to the holders of each copy in the form of a complete document.

Issue	*Description of changes*	*Date of Issue*
1	First Issue	2021-06-11

Table 1: Report of Modifications

1.2 Introduction

Applicant	Marquardt GmbH
Manufacturer	Marquardt GmbH
Model Number(s)	HH1
HVIN	KA4N
Serial Number(s)	8421000064196010
Hardware Version(s)	H13
Software Version(s)	21.04.02
Number of Samples Tested	1
Test Specification(s) /	FCC 47 CFR Part 15 C: 2019
Issue / Date	ISED RSS-210, Issue 10, Amendment 1: 2020 ISED RSS-GEN, Issue 5, Amendment 1: 2019
Test Plan/Issue/Date	---
Order Number	6200452275-I51
Date	2021-01-12
Date of Receipt of EUT	2021-03-24
Start of Test	2021-04-07
Finish of Test	2021-04-30
Name of Engineer(s)	Alex Fink
Related Document(s)	ANSI C63.10: 2013

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1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15 C, ISED RSS-210 and ISED RSS-GEN is shown below.

Section	*Specification Clause*	*Test Description*	*Result*
12 V power supply – Continuously transmitting			
2.1	15.209, 15.225	Radiated Disturbance	Pass
2.2	15.212 (1)(viii)	RF Exposure	Pass

Table 2: Results according to FCC 47 CFR Part 15 C

Section	*Specification Clause*	*Test Description*	*Result*
12 V power supply – Continuously transmitting			
2.1	A.1.1	Radiated Emissions	Pass

Table 3: Results according to ISED RSS-210

Section	*Specification Clause*	*Test Description*	*Result*
12 V power supply – Continuously transmitting			
2.1	8.9, 8.10	Radiated Emissions	Pass
2.2	3.4	RF Exposure	Pass

Table 4: Results according to RSS-Gen

Product Service

1.4 Product Information

Functional description

The **HH1** is a door handle for a car with capacitive touch sensors and NFC. An integrated NFC antenna inside into the door handle, smartphones, wearables and NFC tags can be identified and a driver can be authorized by the car so the door can be opened.
The **HH1** is connected to the car using a CAN-FD interface. It acts as communication channel between CAR Electronics control Unit and NFC Readers. The car ECU NFC Reader requests to the **HH1** which communicates with the NFC device on the integrated antenna using a magnetic field.

User manual

The user places his authorized NFC device (a smartcard or a mobile phone / wearable with an integrated secure element ID) onto the door handle. The **HH1** authorizes the user to the car automatically as soon as a valid device is recognized. Then the door is unlocked and the driver can access the car. The NFC communication is only activated once a NFC device is placed onto the door handle.

Test mode

For the radio testing, a test mode is configured in software. After providing the power supply, **HH1** will transmit continuously at 13.56 MHz.

Product Service

Technical Data

Temperature Range

Working temperature:	-40 °C to +80 °C
Storage temperature:	-40 °C to +85 °C

Data of RF-Part

Transmission Mode	Continous Transmission mode
Reader to card	100 % ASK, Miller Coded, 106 kbit/s
Card to reader	Subcarrier Load Modulation, Manchester Coded, 106 kbit/s
Transmission center frequency	**13.56 MHz**
3 dB bandwidth	400 kHz
Maximum magnetic field strength	7.5 A/m
Antenna	Flex loop antenna, approx. 60x13 mm.

1.5 EUT Modifications Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	*Description of Modification still fitted to EUT*	*Modification Fitted By*	*Date Modification Fitted*
0	As supplied by the customer, S/N: 8421000064196010 - test sample with antenna	Not Applicable	Not Applicable

Table 5

1.6 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing test laboratory:

Test Name	Name of Engineer(s)
Configuration and Mode: 12 V power supply – Continuously polling	
Radiated Emissions	Alex Fink
RF Exposure	Alex Fink

Office Address:
Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 Radiated emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.205, 15.209 and 15.225
ISED RSS-210, Clause 7.7 and B.6
ISED RSS-Gen, Clause 8.9 and 8.10

2.1.2 Equipment under Test and Modification State

HH1, S/N: 8421000064196010 - Modification State 0

2.1.3 Date of Test

2020-04-07 and 2020-04-30

2.1.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	33 %

Product Service

2.1.5 Specification Limits

Radiated emission limits:					
Frequency Range	*Test distance*	*Field strength*		*Field strength*	
(MHz)	*(m)*	*(µA/m)*	*(dBµA/m)*	*(µV/m)*	*(dBµV/m)*
0.009 – 0.49	300	6.37 / *f*	20*lg(6.37 / *f*)	2400 / *f*	20*lg(2400 / *f*)
0.49 – 1.705	30	63.7 / *f*	20*lg(63.7 / *f*)	24000 / *f*	20*lg(24000 / *f*)
1.705 – 13.110	30	0.08	-21.94	30	29.54
13.110 – 13.410	30	0.283	-11.0	106	40.5
13.410 – 13.553	30	0.891	-1.0	334	50.5
13.553 – 13.567	30	42.26	32.5	15848	84
13.567 – 13.710	30	0.891	-1.0	334	50.5
13.710 – 14.010	30	0.283	-11.0	106	40.5
14.010 - 30	30	0.08	-21.94	30	29.54
30 – 88	3	---	---	100	40
88 – 216	3	--	---	150	43.5
126 – 960	3	--	---	200	46
above 960	3	--	---	500	54
Note 1: *f* in kHz					

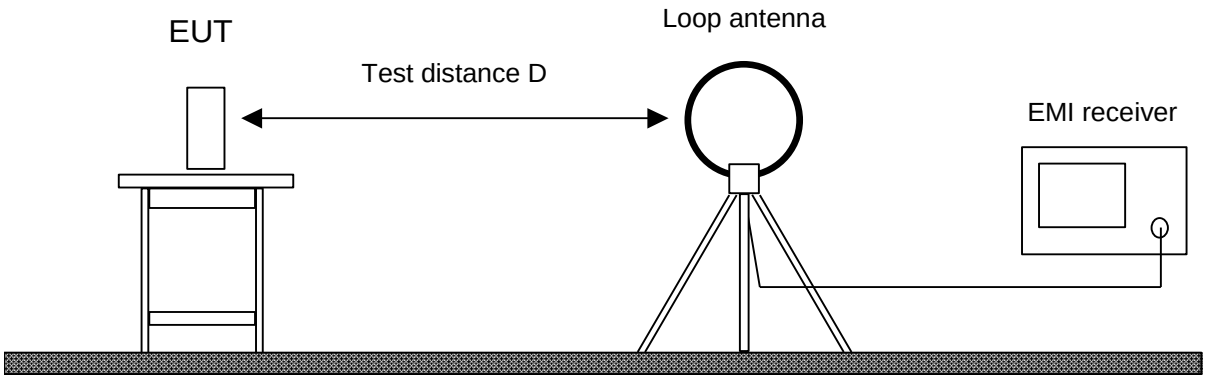
Product Service

2.1.6 Test Method

The test was performed according to ANSI C63.10, sections 11.11 and 11.12

Prescans are performed in six positions of the EUT to get the full spectrum of emission caused by the EUT with the measuring antenna raised and lowered from 1 m to 4 m with vertical and horizontal polarisation to find the combination of table position, antenna height and antenna polarisation for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB or exceeding the limit using subranges and limited number of maximums.
Further maximisation for adjusting the maximum position is following.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

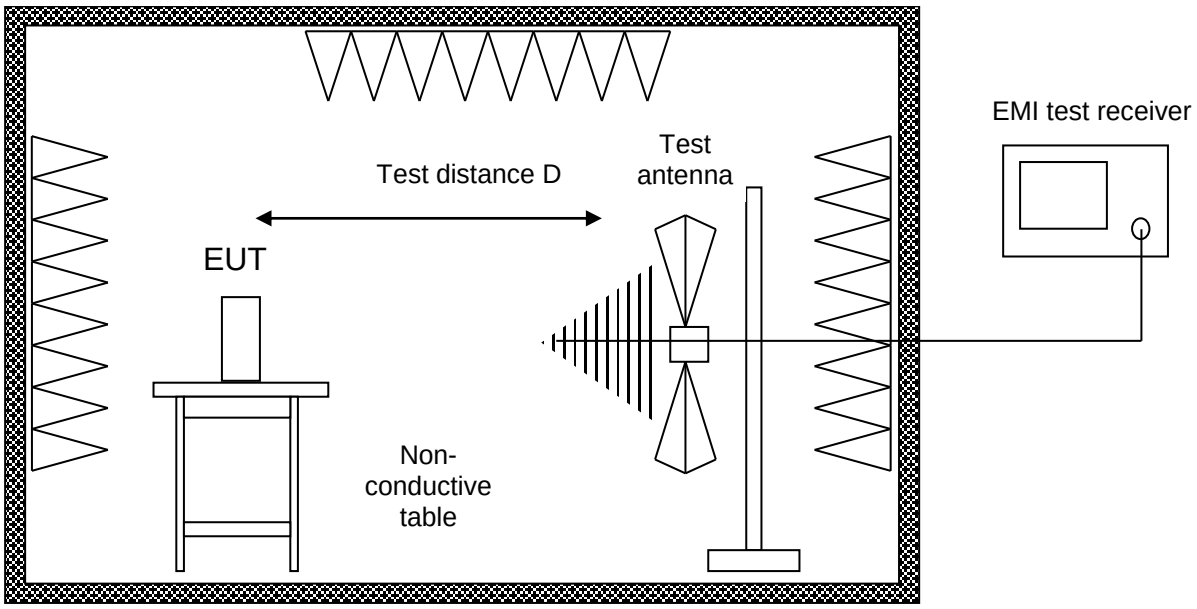
2.1.6.1 Frequency range 9 kHz – 30 MHz



The EUT was placed on a non-conductive table, 0.8 m above the ground.
Radiated emissions in the frequency 9 kHz – 30 MHz is measured within a semi-anechoic room with an active loop antenna with the measurement detector set to peak. In addition, in the frequency range 9 kHz to 490 kHz also an average detector was used. The measurement bandwidth of the receiver was set to 300 Hz in the frequency range 9 kHz to 150 kHz and 10 kHz in the frequency range 150 kHz to 30 MHz. Prescans were performed in six positions of the EUT.
For final measurements the detector was set to CISPR quasi-peak and in addition to CISPR average in the frequency range 9 kHz to 490 kHz with a resolution bandwidth 200 Hz in the frequency range 9 kHz to 150 kHz and 9 kHz in the frequency range 150 kHz to 30 MHz. Final tests were performed immediately after a final frequency and zoom (for drifting disturbances) and maximum adjustment.

Product Service

2.1.6.2 Frequency range 30 MHz – 1 GHz



Alternate test site (semi anechoic room)

The EUT was placed on a non-conductive table, 0.8 m above the ground plane
Radiated emissions in the frequency range 30 MHz – 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4. for alternative test sites. A linear polarised logarithmic periodic antenna combined with a 4:1 broadband dipole (“Trilog broadband antenna”) is used.
For prescan tests the test receiver is set to peak-detector with a bandwidth of 120 kHz.
With the measurement bandwidth of the test receiver set to 120 kHz CISPR quasi-peak detector is selected for final measurements following immediately after a final frequency zoom (for drifting disturbances) and maximum adjustment.

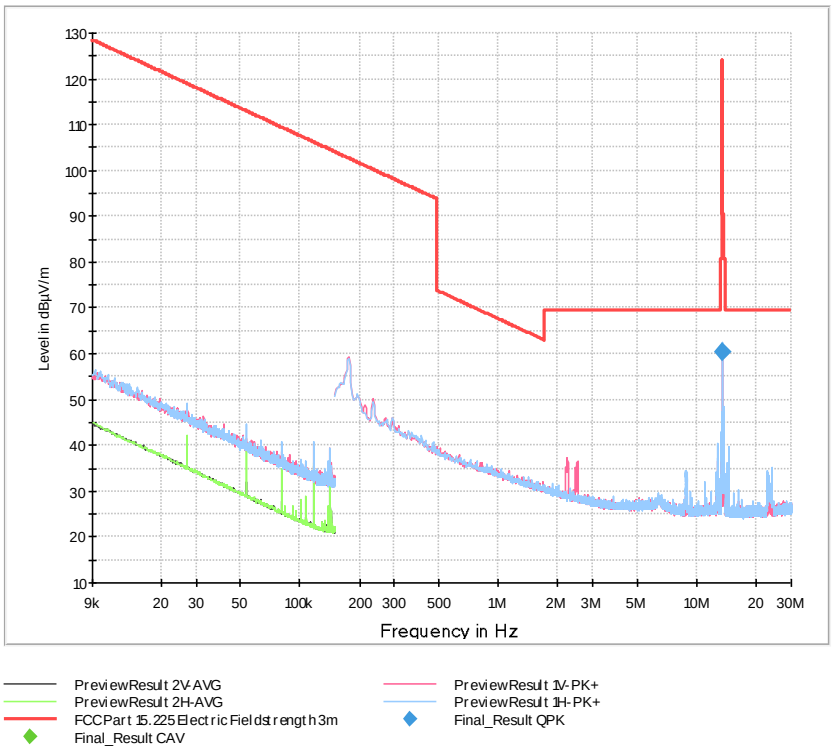
Product Service

2.1.7 Test Results

Sample calculation:

Final Value (dBµV/m) = Reading Value (dBµV) + (Cable attenuation (dB) + Antenna Transducer (dB(1/m)))

12 V DC power supply – reading RFID card

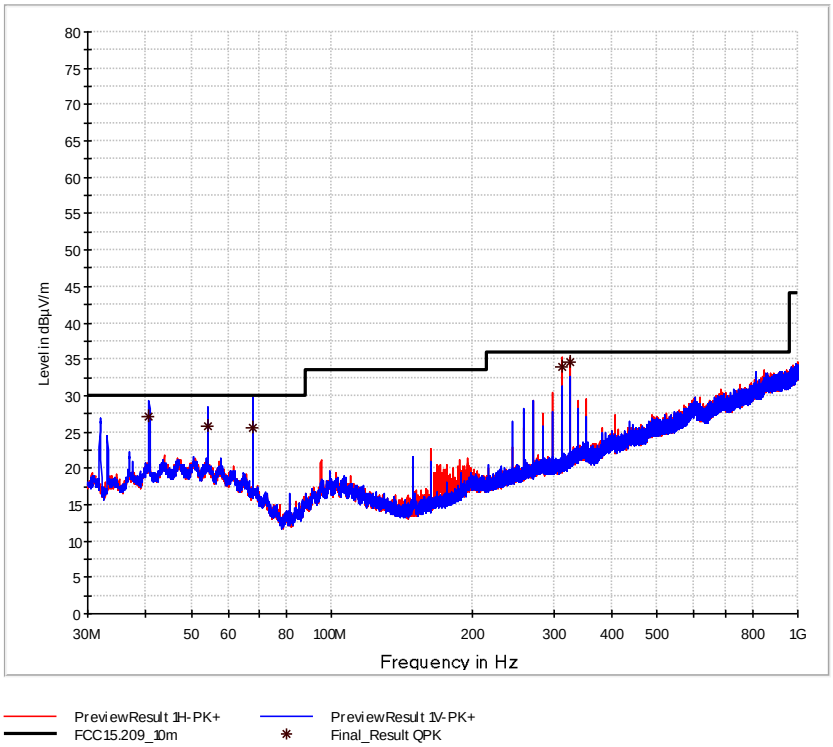


Final Results:

Frequency MHz	*Qua-siPeak dBµV/m*	*CAver-age dBµV/m*	*Limit dBµV/m*	*Mar-gin dB*	*Meas. Time ms*	*Band-width kHz*	*Height cm*	*Pol*	*Azi-muth deg*	*Corr. dB/m*
13.560000	60.22	---	124.00	63.78	1000.0	9.000	100.0	H	0.0	18.9

Product Service

12 V DC power supply – Continuously transmitting



Final Results:

Frequency MHz	*QuasiPeak dBµV/m*	*Limit dBµV/m*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB/m*
40.680000	27.20	30.00	2.80	1000.0	120.000	336.0	V	-119.0	17.1
54.240000	25.86	30.00	4.14	1000.0	120.000	110.0	V	136.0	18.3
67.800000	25.56	30.00	4.44	1000.0	120.000	107.0	V	-125.0	15.5
311.880000	33.88	36.00	2.12	1000.0	120.000	280.0	H	139.0	19.4
325.440000	34.64	36.00	1.36	1000.0	120.000	192.0	H	127.0	20.0

Product Service

2.1.8 Test Location and Test Equipment

The test from 9 kHz to 30 MHz was carried out in Semi anechoic room - cabin no. 11
The test from 30 MHz to 1GHz was carried out in Semi anechoic room - cabin no. 8

Instrument	*Manufacturer*	*Type No*	*TE No*	*Calibration Period (months)*	*Calibration Due*
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2022-04-30
Loop antenna	Schwarzbeck	FMZB 1519 B	44334	36	2023-01-31
TRILOG Broadband Antenna	Rohde & Schwarz	VULB 9162	20116	36	2022-01-31
EMC measurement software	Rohde & Schwarz	EMC32 Emission K8 - V10.50.10	42986	---	---
EMC measurement software	Rohde & Schwarz	EMC32 Emission K11 - V10.50.10	42986	---	---
Semi Anechoic Room	Albatross	Cabin No. 8	19917	36	2023-10-31
Semi Anechoic Room	Frankonia	Cabin No. 11	42961	36	2022-08-31

Table 6

Product Service

2.2 RF Exposure

2.2.1 Specification Reference

FCC 47 CFR Part 2 J, Clause 2.1093
KDB 447498 D01 V06, section 4.3.1
ISED RSS-Gen, Clause 3.4
ISED RSS-102, Clause

2.2.2 Equipment under Test and Modification State

HH1, S/N: 8421000064196010 - Modification State 0

2.2.3 Date of Test

2021-04-07

2.2.4 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	33 %

2.2.5 Test Method

Estimation is based on output power test.
For details please refer to section 2.1.7 of this test report.

2.2.6 Specification Limits

FCC 47 CFR Part 15 C, Clause 15.212(viii)
Systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy levels in excess of the Commission's guideline.
Acc. to KDB 477498:
The 1 g and 10 g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separations distances ≤ 50 mm are determined by:

$$\frac{max.\ power\ of\ channel, incl.\ tune-up\ tol., mW}{min.\ test\ separation\ distance, mm} \cdot \sqrt{f, GHz} \leq \begin{Bmatrix} 3.0\ \ for\ 1\ g \\ 7.5\ for\ 10\ g \end{Bmatrix}\ extremity\ SAR$$

1. *f* (GHz) is the RF channel frequency in GHz;
2. Power and distance are rounded to the nearest mW and mm before calculation;
3. The result is rounded to one decimal place for comparison;
4. 3.0 and 7.5 are referred to as the numeric thresholds

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The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied.

ISED RSS-102, Clause 2.5.1
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table.
For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.
For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.:

Frequency (MHz)	Exemption limits (mW)[1] at separation distance of									
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
≤300 [2]	71	101	132	162	193	223	254	284	315	345
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

[1] The excemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separaton distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from alinear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from athird order polynomial fit.
[2] Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

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2.2.7 Test Results

acc. to KDB 447498 D01:

Maximum Radiated Power (EIRP) Pmax:	-35.00 dBm = 316 nW (see section 2.1.7 for measurement)
Compliance Boundary d:	5 mm
Frequency f:	13.56 MHz

Calculation according to Section 4.3.1

1. $\frac{1}{2}\left[1+\log\left(\frac{100}{100}\right)\right]*\left[\left((Power\ allowed\ at\ numeric\ threshold\ for\ 50\ mm\ in\ step\ a)\right)+(50mm-50mm)*\left(\frac{100}{150}\right)\right]$
2. $\frac{1}{2}[1+0]*\left[\left((Power\ allowed\ at\ numeric\ threshold\ for\ 50\ mm\ in\ step\ a)\right)+0*\left(\frac{100}{150}\right)\right]$
3. $\frac{1}{2}[Power\ allowed\ at\ numeric\ threshold\ for\ 50\ mm\ in\ step\ a]$
4. $\frac{\max power}{\min distance}*\sqrt{f}\leq 3.0$
5. $\max power\leq\frac{3.0*\min distance}{\sqrt{f}}$
6. $\max power\leq\frac{3.0*50\ mm}{\sqrt{0{,}1GHz}}=474\ mW$
7. $\frac{1}{2}*474\ mW=237\ mW$ → maximal allowed Power
8. 316 nW < 237 mW → criteria fulfilled

Product Service

IC RSS-GEN Issue 5, section 3.2 and IC RSS-102, Issue 5, section 2.5

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP =			☐	
The effective isotropic radiated power (EIRP in watts) is calculated using				
☐ the numerical antenna gain: G = $EIRP = G \cdot CP \Rightarrow EIRP$ =		☐		
☐ the field strength[3] in V/m: FS = ... V/m $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = mW			☐	
with: Distance between the antennas in m: D = mm		☐		
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = 0.316 µW				
with: Field strength in V/m: FS = 60.22 dBµV/m			☒	
Distance between the two antennas in m: D = 3 m			☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = 0.316 µW				

[3] The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses.
If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

Product Service

Exposure of Humans to RF Fields (continued)		Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is					
☒ less than or equal to 20 cm	☐ greater than 20 cm		☒		
Transmitting device is					
☐ in the vicinity of the human head	☐ body-worn		☐		

Product Service

SAR evaluation				
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.				

Frequency (MHz)	Exemption limits (mW)[4] at separation distance of									
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

Carrier frequency:	f	=	13.56 MHz	
Distance:	d	=	5 mm	☒
Transmitter output power:	TP	=	316 nW	
Limit:	TP_{limit}	=	52 mW	☒

[4] The exemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separaton distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

Product Service

3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

The measurement uncertainty in the laboratory is less than or equal to the maximum measurement uncertainty according to CISPR16-4-2: 2011 + A1 + A2 + Cor1 (U_{CISPR}). This normative regulation means that the measured value is also the value to be assessed in relation to the limit value.

Radio Interference Emission Testing		
Test Name	*kp*	*Expanded Uncertainty*
Conducted Voltage Emission		
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB
Discontinuous Conducted Emission		
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB
Conducted Current Emission		
9 kHz to 200 MHz	2	± 3.5 dB
Magnetic Fieldstrength		
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB
Radiated Emission		
30 MHz to 300 MHz	2	± 4.9 dB
300 MHz to 1 GHz	2	± 5.0 dB
1 GHz to 6 GHz	2	± 4.6 dB
Test distance 10 m		
30 MHz to 300 MHz	2	± 4.9 dB
300 MHz to 1 GHz	2	± 4.9 dB
The expanded uncertainty reported according to to CISPR16-4-2: 2011 + A1 + A2 + Cor1 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%		

Table 7 Measurement uncertainty based on CISPR 16-4-2

Product Service

Radio Interference Emission Testing		
Test Name	*kp*	*Expanded Uncertainty*
Occupied Bandwdith	2	± 5 %
Conducted Power		
9 kHz ≤ f < 30 MHz	2	± 1.0 dB
30 MHz ≤ f < 1 GHz	2	± 1.5 dB
1 GHz ≤ f ≤ 40 GHz	2	± 2.5 dB
1 MS/s power sensor (TS8997)	2	± 1.5 dB
Occupied Bandwidth	2	± 5 %
Power Spectral Density	2	± 3.0 dB
Radiated Power		
9 kHz ≤ f < 26.5 GHz	2	± 6.5 dB
26.5 GHz ≤ f < 60 GHz	2	± 8.0 dB
60 GHz ≤ f < 325 GHz	2	± 10 dB
Conducted Spurious Emissions	2	± 3.0 dB
Radiated Spurious Emissions	2	± 6.0 dB
Voltage		
DC	2	± 1.0 %
AC	2	± 2.0 %
Time (automatic)	2	± 5 %
Frequency	2	± 10^{-7}
The expanded uncertainty reported according to to ETSI TR 100 028:2001 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%		

Table 8 Measurement uncertainty based on ETSI TR 100 028