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FCC RF Exposure Evaluation

Report Number:

F230729E12

Equipment under Test (EUT):

MiNexx ® Indicator C

Applicant:

Minebea Intec GmbH

Manufacturer:

Minebea Intec GmbH



References

- [1] **CFR 47 Rule part 1** Practice and Procedure
- [2] **CFR 47 Rule part 2** Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
- [3] **KDB 447498 D04 Interim General RF Exposure Guidance v01**

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test. The complete test results are presented in the following.

“Passed” indicates that the equipment under test conforms with the relevant limits of the testing standard without taking any measurement uncertainty into account. However, the measurement uncertainty is calculated and shown in this test report.

Assessed and
written by:

Signature

Reviewed and
approved by:

Signature

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The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

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1 Identification

1.1 Applicant

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Country:	Germany
Name for contact purposes:	Mr. Oliver FREITAG
Phone:	+49 (0)40-67960-303
eMail address:	info@minebea-intec.com
Applicant represented during the test by the following person:	N/A

1.2 Manufacturer

Name:	Minebea Intec GmbH
Address:	Meiendorfer Str. 205 A, 22145 Hamburg
Country:	Germany
Name for contact purposes:	Mr. Oliver FREITAG
Phone:	+49 (0)40-67960-303
eMail address:	info@minebea-intec.com
Manufacturer represented during the test by the following person:	N/A

1.3 Test Laboratory

The tests were carried out by:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) according to DIN EN ISO/IEC 17025:2018. The accreditation is only valid for the scope of accreditation listed in the annex of the certificate D-PL-17186-01-00. FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

Test object: *	Weighing Indicator with various I/Os	
Model name: *	MiNexx ® Indicator C	
Model number: *	NICC	
Order number: *	NICC	
Contains FCC ID: *	MCQ-CCIMX6UL	
Contains IC certification number: *	1846A-CCIMX6UL	
FCC ID: *	2BPI4-NICC	
IC certification number: *	34282-NICC	
PMN: *	Weight indicator MiNexx® C	
HVIN: *	NICCL1	
FVIN: *	WLAN and Bluetooth part:	82004060
	RFID part:	10.01.A0

* declared by the applicant

	EUT number		
	1	2	3
Serial number: *	45564012	-	-
PCB identifier: *	N/A	-	-
Hardware version: *	MB_C_220V, Rev. 08	-	-
Software version: *	00.02.00-trunk.596860	-	-

* Declared by the applicant

One EUT was used for all tests.

Note: PHOENIX TESTLAB GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

General EUT data			
Power supply EUT: *	DC		
Supply voltage EUT: *	$U_{Nom} = 120 \text{ V}_{DC}$	$U_{Min} = 100 \text{ V}_{DC}$	$U_{Max} = 240 \text{ V}_{DC}$
Temperature range: *	-10°C to $+85^{\circ}\text{C}$		
Lowest / highest internal clock frequency: *	32.768 kHz / 5.835 GHz		

IEEE 802.11 frequencies (2.4 GHz)	
20 MHz	
Channel 1	2412 MHz
Channel 2	2417 MHz
Channel 3	2422 MHz
Channel 4	2427 MHz
Channel 5	2432 MHz
Channel 6	2437 MHz
Channel 7	2442 MHz
Channel 8	2447 MHz
Channel 9	2452 MHz
Channel 10	2457 MHz
Channel 11	2462 MHz

IEEE 802.11 frequencies (5 GHz)					
20 MHz		40 MHz		80 MHz	
Channel 36	5180 MHz	Channel 38	5190 MHz	-	-
Channel 40	5200 MHz	-	-	Channel 42	5210 MHz
Channel 44	5220 MHz	Channel 46	5230 MHz	-	-
Channel 48	5240 MHz	-	-	-	-
Channel 149	5745 MHz	-	-	-	-
Channel 153	5765 MHz	Channel 151	5755 MHz	-	-
Channel 157	5785 MHz	-	-	Channel 155	5775 MHz
Channel 161	5805 MHz	Channel 159	5795 MHz	-	-
Channel 165	5825 MHz	-	-	-	-

Bluetooth® low energy frequencies			
Channel 00	2402 MHz	Channel 01	2404 MHz
Channel 02	2406 MHz	Channel 03	2408 MHz
...
...
Channel 18	2438 MHz	Channel 19	2440 MHz
...
...
Channel 36	2474 MHz	Channel 37	2476 MHz
Channel 38	2478 MHz	Channel 39	2480 MHz

IEEE 802.11 radio mode				
Fulfils radio specification: ^{*1}	IEEE 802.11 b IEEE 802.11 g IEEE 802.11 n (20 MHz) IEEE 802.11 n (40 MHz)			
Radio chip: ^{*1}	DIGI ConnectCore® 6UL			
Antenna type: ^{*2}	WLAN / BT / Zigbee Tunable Embedded PCB Antenna			
Antenna name: ^{*2}	Ethertronics 1001932PT			
Antenna gain: ^{*2}	2.5 dBi @ 2.4 GHz 4.4 dBi @ 5 GHz			
Antenna connector: ^{*1}	U.FL			
Supply voltage WLAN module: ^{*1}	$U_{\text{nom}} = 4.4 \text{ V}_{\text{DC}}$	$U_{\text{min}} = 4.3 \text{ V}_{\text{DC}}$	$U_{\text{max}} = 4.55 \text{ V}_{\text{DC}}$	
Type of modulation: ^{*1}	IEEE 802.11b	DSSS (1 Mbps DSSS (2 Mbps DSSS (5.5/11 Mbps	DBPSK) DQPSK) CCK)	
	IEEE 802.11g	OFDM (6/9 Mbps OFDM (12 / 18 Mbps OFDM (24/36 Mbps OFDM (48/54 Mbps	BPSK) QPSK) 16-QAM) 64-QAM)	
	IEEE 802.11n 20 MHz (SISO 1x1:1)	MCS0 MCS1/2 MCS3/4 MCS5/6/7	OFDM (7 Mbps OFDM (14 – 22 Mbps OFDM (28 – 43 Mbps OFDM (58 - 72 Mbps	BPSK) QPSK) 16-QAM) 64-QAM)
	IEEE 802.11n 40 MHz (SISO 1x1:1)	MCS0 MCS1/2 MCS3/4 MCS5/6/7	OFDM (15 Mbps OFDM (30 / 45 Mbps OFDM (60 – 90 Mbps OFDM (120 - 150Mbps	BPSK) QPSK) 16-QAM) 64-QAM)
Operating frequency range: ^{*1}	IEEE 802.11b	2412 – 2462 MHz		
	IEEE 802.11g	2412 – 2462 MHz		
	IEEE 802.11n 20 MHz	2412 – 2462 MHz		
	IEEE 802.11n 40 MHz	2422 – 2452 MHz		
Number of channels: ^{*1}	IEEE 802.11b	11 (5 MHz channel spacing)		
	IEEE 802.11g	11 (5 MHz channel spacing)		
	IEEE 802.11n 20 MHz	11 (5 MHz channel spacing)		
	IEEE 802.11n 40 MHz	9 (5 MHz channel spacing)		

^{*1} declared by the applicant

^{*2} based on the antenna data sheet provided by the applicant

IEEE 802.11 radio mode (5 GHz)			
Fulfils radio specification: * ¹	IEEE 802.11 a, IEEE 802.11 n (20 MHz), IEEE 802.11 n (40 MHz) IEEE 802.11 ac (20 MHz), IEEE 802.11 ac (40 MHz) IEEE 802.11 ac (80 MHz)		
Radio chip: * ¹	DIGI ConnectCore® 6UL		
Antenna type: * ²	WLAN / BT / Zigbee Tunable Embedded PCB Antenna		
Antenna name: * ²	Ethertronics 1001932PT		
Antenna gain: * ²	2.5 dBi @ 2.4 GHz 4.4 dBi @ 5 GHz		
Antenna connector: * ¹	U.FL		
Supply voltage WLAN module: * ¹	U _{nom} = 4.4 V _{DC}	U _{min} = 4.3 V _{DC}	U _{max} = 4.55 V _{DC}
Type of modulation: * ¹	IEEE 802.11 a	BPSK, QPSK, 16-QAM, 64-QAM (6/9/12/18/24/36/48/54 Mbit/s)	
	IEEE 802.11 n20	BPSK, QPSK, 16-QAM, 64-QAM (up to 72.2 Mbit/s 1 spatial stream) (up to 144.4 Mbit/s 2 spatial stream)	
	IEEE 802.11 n40	BPSK, QPSK, 16-QAM, 64-QAM (up to 150 Mbit/s 1 spatial stream) (up to 300 Mbit/s 2 spatial stream)	
	IEEE 802.11 ac20	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM (up to 86.65 Mbit/s 1 spatial stream) (up to 173.3 Mbit/s 2 spatial stream)	
	IEEE 802.11 ac40	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM (up to 200 Mbit/s 1 spatial stream) (up to 400 Mbit/s 2 spatial stream)	
	IEEE 802.11 ac80	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM (up to 433.35 Mbit/s 1 spatial stream) (up to 866.7 Mbit/s 2 spatial stream)	
Operating frequency range: *	IEEE 802.11a	5180 – 5240 MHz, 5745 – 5825 MHz	
	IEEE 802.11n 20 MHz	5180 – 5240 MHz, 5745 – 5825 MHz	
	IEEE 802.11n 40 MHz	5190 – 5230 MHz, 5755 – 5795 MHz	
	IEEE 802.11ac 20 MHz	5180 – 5240 MHz, 5745 – 5825 MHz	
	IEEE 802.11ac 40 MHz	5190 – 5230 MHz, 5755 – 5795 MHz	
	IEEE 802.11ac 80 MHz	5210, 5755 MHz	
Number of channels: *	IEEE 802.11a	9	
	IEEE 802.11n 20 MHz	9	
	IEEE 802.11n 40 MHz	4	
	IEEE 802.11ac 20 MHz	9	
	IEEE 802.11ac 40 MHz	4	
	IEEE 802.11ac 80 MHz	2	

*¹ declared by the applicant

*² based on the antenna data sheet provided by the applicant

Bluetooth® low energy radio mode		
Fulfils radio specification: *	Bluetooth® Low Energy (BLE) 4.2	
Radio chip: *	DIGI ConnectCore® 6UL	
Antenna type: *	WLAN / BT / Zigbee Tunable Embedded PCB Antenna	
Antenna name: *	Ethertronics 1001932PT	
Antenna gain: *	2.5 dBi @ 2.4 GHz 4.4 dBi @ 5 GHz	
Antenna connector: *	Internal antenna ^{*2} :	None ^{*3}
Type of modulation: *	BLE (1 Mbps PHY)	GFSK
Operating frequency range: *	BLE (1 Mbps PHY)	2402 – 2480 MHz
Number of channels: *	BLE (1 Mbps PHY)	40 (2 MHz channel spacing)

* Declared by the applicant

^{*2} Bluetooth Low Energy only uses the internal antenna

^{*3} Temporary antenna connector for test purposes was provided by the applicant.

Bluetooth® radio mode			
Fulfils radio specification: ^{*1}	Bluetooth classic		
Radio module: ^{*1}	DIGI ConnectCore® 6UL		
Antenna type: ^{*2}	WLAN / BT / Zigbee Tunable Embedded PCB Antenna		
Antenna name: ^{*2}	Ethertronics 1001932PT		
Antenna gain: ^{*2}	2.5 dBi @ 2.4 GHz 4.4 dBi @ 5 GHz		
Antenna connector: ^{*1}	U.FL		
Supply voltage radio module: ^{*1}	$U_{nom} = 4.4 \text{ V}_{DC}$	$U_{nom} = 4.4 \text{ V}_{DC}$	$U_{nom} = 4.4 \text{ V}_{DC}$
Type of modulation: ^{*1}	BT (1 Mbps PHY)		
	BT (2 Mbps PHY)		
	BT (3 Mbps PHY)		
Operating frequency range: ^{*1}	2402 – 2480 MHz		
	BT (1 Mbps PHY)		
	BT (2 Mbps PHY)		
Number of channels: ^{*1}	2402 – 2480 MHz		
	BT (1 Mbps PHY)		
	79 (1 MHz channel spacing)		

^{*1} declared by the applicant

^{*2} based on the antenna data sheet provided by the applicant

1.6 Dates

Date of receipt of test sample:	14.01.2025
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2 Evaluation Method

2.1 RF exposure test exemptions for single sources

2.1.1 General Exemption CFR 47 §1.1307(b)(3)(i)(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);

2.1.2 SAR Based Exemption CFR 47 §1.1307(b)(3)(i)(B)

The available maximum time-averaged power of 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 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz inclusive.

For the following separation distances [d] and frequency ranges P_{th} is given by the following formulas

	0.5 cm ≤ d ≤ 20cm	20 cm < d ≤ 40 cm
0.3 GHz ≤ f < 1.5 GHz	$P_{th}(mW) = ERP_{20cm} \left(\frac{d}{20} \right)^x$ $ERP_{20cm} (mW) = 2040f$ $x = -\log_{10} \left(\frac{60}{ERP_{20cm}\sqrt{f}} \right)$	$P_{th}(mW) = ERP_{20cm}$ $ERP_{20cm} (mW) = 2040f$
1.5 GHz ≤ f ≤ 6 GHz	$P_{th}(mW) = ERP_{20cm} \left(\frac{d}{20} \right)^x$ $ERP_{20cm} (mW) = 3060$ $x = -\log_{10} \left(\frac{60}{ERP_{20cm}\sqrt{f}} \right)$	$P_{th}(mW) = ERP_{20cm}$ $ERP_{20cm} (mW) = 3060$

2.1.3 MPE Based Exemption CFR 47 §1.1307(b)(3)(i)(C)

By using Table 1 and the minimum separation distance (d 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, d 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).

RF Source frequency [MHz]	Threshold ERP [W]
0.3 -1.34	1920 d ²
1.34 – 30	3450 d ² /f ²
30 – 300	3.83 d ²
300 – 1500	0.0128 d ² /f
1500 - 100000	19.2 d ²

d: Minimal separation distance from antenna to the user

2.1.4 Stand alone MPE evaluation limits

The human exposure to RF emissions from such devices could be evaluated based on the MPE limits adopted by the FCC for electric and magnetic field strength and / or power density. The limits for General Population / Uncontrolled Exposure are given in the following table from CFR 47 §1.1310(e):

Frequency range [MHz]	Electric field strength (E) [V/m]	Magnetic field strength (H) [A/m]	Power density (S) [mW/cm ²]	Averaging time [min]
(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 – 1500			f/1500	< 30
1500 – 100,000			1.0	< 30

Note: f = frequency in MHz; * Plane – wave equivalent power density

The power density is calculated as follows:

$$S = \frac{P \cdot G \cdot D}{4 \cdot \pi \cdot d^2}$$

Where:

P: conducted power

G: Antenna gain (linear)

D: Duty Cycle

d: Minimal separation distance from antenna to the user

2.2 RF exposure test exemptions for simultaneous transmission sources

2.2.1 1 mW Test Exemption for simultaneous transmission sources

As discussed in CFR 47 §1.1307(b)(3)(ii)(A) [1] the 1 mW exemption intended for single transmitters may be also applied to simultaneous transmission conditions, within the same host device, according one of the following criteria:

- a. When the maximum available power each individual transmitting antenna with the same time averaging period is ≤ 1 mW, and the nearest parts of the antenna structures of the simultaneously operating transmitters are separated by at least 2 cm
- b. When the aggregate maximum available power of all transmitting antennas is ≤ 1 mW in the same time-averaging period

This exemption may not be combined with any other exemption.

2.2.2 Simultaneous transmission SAR based and MPE based test exemptions

Although this is not a module integration in the sense of product approval, the procedure for simultaneous transmission specified in KDB 447498 D04 Interim General RF Exposure Guidance v01 [3] in chapter 2.2 was taken into account:

According to the RF exposure KDB 447498 D04 General RF Exposure Guidance v01 [3] in chapter 2.2.2: This case is described in detail in CFR 47 §1.1307(b)(3)(ii)(B) and covers the situations where both SAR-based and MPE-based exemption may be considered for test exemption in fixed, mobile, or portable device exposure conditions. For these cases, a device with multiple RF sources transmitting simultaneously will be considered an RF exempt device if the condition of the following formular is satisfied.

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

For these test exemptions to apply, the maximum output power, duty factor, and other applicable parameters used in the standalone ERP determination tests, must be the same, or corresponding to a more conservative choice, than those required for simultaneous transmission.

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0 , according to calculated/estimated, numerically modelled, or measured field strengths or power density. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to the MPE limit at the test frequency.

2.2.3 Test exemption based on the SAR to Peak Location Separation Ratio

When the ERP-based condition in the previous section does not apply, a test exemption may be still applicable based on the SAR to peak location separation ratio (SPLSR) procedure.

In this case, the simultaneously transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SPLSR that qualifies for the additional test exemption.

This ratio is defined as:

$$SPLSR = \frac{(SAR_1 + SAR_2)^{1.5}}{R_i}$$

Where: SAR_1 and SAR_2 = highest reported SAR or estimated SAR values for the two sources in the pair i , and R_i is their distance in mm.

When $SPLSR \leq 0.04$ (rounded to two decimal digits), for all antenna pairs in the configuration, then the device qualifies for 1 g SAR test exemption.

When 10 g SAR applies (e.g. for extremities) the corresponding test exemption condition is $SPLSR \leq 0.10$.

If any antenna pair does not qualify for simultaneous transmission SAR test exemption, then the device must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Pub. 865664 D01.

3 Results of evaluation

3.1 Used evaluation methods

RF Exposure test exemptions for single sources			
Used	Method	See sub-clause	Comment
<input type="checkbox"/>	General Exemption acc. CFR 47 §1.1307(b)(3)(i)(A)	2.1.1	-
<input type="checkbox"/>	SAR Based Exemption acc. CFR 47 §1.1307(b)(3)(i)(B)	2.1.2	-
<input checked="" type="checkbox"/>	MPE Based Exemption acc. CFR 47 §1.1307(b)(3)(i)(C)	2.1.3	-
<input type="checkbox"/>	MPE Calculation	2.1.4	-

RF Exposure test exemptions for simultaneous transmission sources			
Used	Method	See sub-clause	Comment
<input type="checkbox"/>	Not applicable		No simultaneous possible
<input type="checkbox"/>	1 mW test Exemption acc. 2.2.1 [3]	2.2.1	-
<input type="checkbox"/>	SAR Based Exemption acc. 2.2.2 [3]	2.2.2	
<input checked="" type="checkbox"/>	MPE Based Exemption acc. 2.2.2 [3]	2.2.2	
<input type="checkbox"/>	SAR to Peak location separation ratio acc. 2.2.3 [3]	2.2.3	

3.2 Evaluation Distance

According to the CFR47 §2.1091 the device as declared by the applicant is a mobile device which is used at least with the following separation distances between the device and the users.

Antenna	Min separation distance as declared by the applicant
Antenna 0	20 cm
Antenna 1	20 cm

3.3 WLAN 2.4 GHz Emissions

The following information are based on Test-Report "1-3116/16-01-17-A" issued by CTC advanced GmbH

Antenna 0 MPE Based Exemption CFR 47 §1.1307(b)(3)(i)(C)

P_{con} [dBm] incl. Tuneup	P_{con} [mW] incl. Tuneup	Ant. Gain [dBi]	$P_{\text{e.i.r.p}}$ [dBm]	$P_{\text{e.i.r.p}}$ [mW]	$P_{\text{e.r.p}}$ [dBm]	$P_{\text{e.r.p}}$ [mW]	
21.3	134.90	2.5	23.8	239.88	21.65	146.27	
Frequency [GHz]	Wavelength λ [cm]	$\lambda/2\pi$ [cm]	d [cm]	$d > \lambda/2\pi$			
2.462	12.1767855	1.9379956	20	fulfilled			
Frequency [GHz]	d [cm]	Threshold ERP [mW]		$P_{\text{e.r.p.}}$ [mW]	Result		
2.462	20	768		146.27	exempted		

The separation distance d is larger than the wavelength divided by 2π . Therefore, the MPE Exemption could be used.

Because for separation distances larger than d the value for $P_{\text{e.r.p.}}$ is lower than the threshold ERP this emission is exempted from SAR Evaluation

3.4 WLAN 5 GHz Emissions

The following information are based on Test-Report "1-3116/16-01-20" issued by CTC advanced GmbH

Antenna 0 MPE Based Exemption CFR 47 §1.1307(b)(3)(i)(C)

P_{con} [dBm] incl. Tuneup	P_{con} [mW] incl. Tuneup	Ant. Gain [dBi]	$P_{\text{e.i.r.p}}$ [dBm]	$P_{\text{e.i.r.p}}$ [mW]	$P_{\text{e.r.p}}$ [dBm]	$P_{\text{e.r.p}}$ [mW]	
11.4	13.80	4.4	15.8	38.02	13.65	23.18	
Frequency [GHz]	Wavelength λ [cm]	$\lambda/2\pi$ [cm]	d [cm]	$d > \lambda/2\pi$			
5.24	5.72123011	0.9105621	20	fulfilled			
Frequency [GHz]	d [cm]	Threshold ERP [mW]		$P_{\text{e.r.p.}}$ [mW]	Result		
5.24	20	768		23.18	exempted		

The separation distance d is larger than the wavelength divided by 2π . Therefore, the MPE Exemption could be used.

Due to the fact that for separation distances larger than d the value for $P_{\text{e.r.p.}}$ is lower than the threshold ERP this emission is exempted from SAR Evaluation

3.5 BT EDR 2.4 GHz Emissions

The following information are based on Test-Report "1-3116/16-01-18-A" issued by CTC advanced GmbH

Antenna 0 MPE Based Exemption CFR 47 §1.1307(b)(3)(i)(C)

P_{con} [dBm] incl. Tuneup	P_{con} [mW] incl. Tuneup	Ant. Gain [dBi]	$P_{\text{e.i.r.p}}$ [dBm]	$P_{\text{e.i.r.p}}$ [mW]	$P_{\text{e.r.p}}$ [dBm]	$P_{\text{e.r.p}}$ [mW]	
5.7	3.72	2.5	8.2	6.61	6.05	4.03	
Frequency [GHz]	Wavelength λ [cm]	$\lambda/2\pi$ [cm]	d [cm]	$d > \lambda/2\pi$			
2.402	12.4809516	1.9864051	20	fulfilled			
Frequency [GHz]	d [cm]	Threshold ERP [mW]		$P_{\text{e.r.p.}}$ [mW]	Result		
2.402	20	768		4.03	exempted		

The separation distance d is larger than the wavelength divided by 2π . Therefore, the MPE Exemption could be used.

Due to the fact that for separation distances larger than d the value for $P_{\text{e.r.p.}}$ is lower than the threshold ERP this emission is exempted from SAR Evaluation

3.6 BLE 2.4 GHz Emissions

The following information are based on Test-Report "1-3116/16-01-19" issued by CTC advanced GmbH

Antenna 0 MPE Based Exemption CFR 47 §1.1307(b)(3)(i)(C)

P _{con} [dBm] incl. Tuneup	P _{con} [mW] incl. Tuneup	Ant. Gain [dBi]	P _{e.i.r.p} [dBm]	P _{e.i.r.p} [mW]	P _{e.r.p} [dBm]	P _{e.r.p} [mW]
-1.1	0.78	2.5	1.4	1.38	-0.75	0.84
Frequency [GHz]	Wavelength λ [cm]	$\lambda/2\pi$ [cm]	d [cm]	$d > \lambda/2\pi$		
2.44	12.2865761	1.9554693	20	fulfilled		
Frequency [GHz]	d [cm]	Threshold ERP [mW]		P _{e.r.p.} [mW]	Result	
2.44	20	768		0.84	exempted	

The separation distance d is larger than the wavelength divided by 2π . Therefore, the MPE Exemption could be used.

Because for separation distances larger than d the value for P_{e.r.p} is lower than the threshold ERP this emission is exempted from SAR Evaluation.

3.7 RFID Emissions

The following information are based on Test-Report F230729E10 issued by PHOENIX TESTLAB GmbH.

Antenna 1 MPE Based Exemption CFR 47 §1.1307(b)(3)(i)(C)

P_{con} [dBm] incl. Tuneup	P_{con} [mW] incl. Tuneup	Ant. Gain [dBi]	$P_{e.i.r.p}$ [dBm]	$P_{e.i.r.p}$ [mW]	$P_{e.r.p}$ [dBm]	$P_{e.r.p}$ [mW]	
-	-	2.5	-67.16	0.00	-69.31	0.00	
Frequency [GHz]	Wavelength λ [cm]	$\lambda/2\pi$ [cm]	d [cm]	$d > \lambda/2\pi$			
13.56	2.21085883	0.3518691	20	fulfilled			
Frequency [GHz]	d [cm]	Threshold ERP [mW]		$P_{e.r.p.}$ [mW]	Result		
13.56	20	768		0.00	exempted		

The separation distance d is larger than the wavelength divided by 2π . Therefore, the MPE Exemption could be used.

Because for separation distances larger than d the value for $P_{e.r.p}$ is lower than the threshold ERP this emission is exempted from SAR Evaluation.

3.8 Simultaneous transmission

As declared by the applicant the WLAN/BT module and the RFID module are able to transmit simultaneously. WLAN 2.4 GHz, Bluetooth EDR, Bluetooth low energy and WLAN 5 GHz are not able to transmit simultaneously. Therefore, calculations for the simultaneous transmission are needed as described in chapter 2.2.2.

RFID + 2.4GHz WLAN:

$$\text{Calculation: } \frac{146.27\text{mW}}{768\text{mW}} + \frac{0.000000192\text{mW}}{768\text{mW}} = 0.190 + 2.5e^{-10} \leq 1$$

RFID + 5GHz WLAN:

$$\text{Calculation: } \frac{23.18\text{mW}}{768\text{mW}} + \frac{0.000000192\text{mW}}{768\text{mW}} = 0.030 + 2.5e^{-10} \leq 1$$

RFID + BLE:

$$\text{Calculation: } \frac{0.77\text{mW}}{768\text{mW}} + \frac{0.000000192\text{mW}}{768\text{mW}} = 0.001 + 2.5e^{-10} \leq 1$$

Because the ratios of all simultaneous transmissions are below 1, they fulfil the equation in chapter 2.2.2. Therefore, these emissions are exempted from SAR Evaluation.

4 Conclusion

The EUT complies in all operational modes to the limits given in CFR 47 §1.1310(e)1 in a separation distance of 20 cm for antenna 0 and antenna 1.

5 Report History

Report Number	Date	Comment
F230729E12	12.08.2025	Initial Test Report
-	-	-
-	-	-