# RF Exposure Evaluation according to KDB 447498 D01 v06

## Report identification number: 1-3390/21-01-09_FCC

| Certification numbers and labeling requirements | |
|---|---|
| FCC ID | XKB-D3500CLWIV2 |

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## Document authorised:

| | |
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## 1.  SAR test exclusion (KDB 447498 D01 General RF Exposure Guidance v06)

### 4.3.1. Standalone SAR test exclusion considerations

Unless specifically required by the *published RF exposure KDB procedures*, standalone 1-g head or body  and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or  numerical simulation, is not required when the corresponding *SAR Test Exclusion Threshold* condition(s),  listed below, is (are) satisfied. These test exclusion conditions are based on source-based time-averaged  maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance,  and the minimum *test separation distance* required for the exposure conditions. The minimum *test  separation distance* defined in 4.1 f) is determined by the smallest distance from the antenna and radiating  structures or outer surface of the device, according to the host form factor, exposure conditions and  platform requirements, to any part of the body or extremity of a user or bystander. To qualify for SAR test  exclusion, the *test separation distances* applied must be fully explained and justified, typically in the SAR  measurement or SAR analysis report, by the operating configurations and exposure conditions of the  transmitter and applicable host platform requirements, according to the required *published RF exposure  KDB procedures*. When no other RF exposure testing or reporting are required, a statement of justification  and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for SAR  test exclusion. When required, the device specific conditions described in the other *published RF exposure KDB procedures* must be satisfied before applying these SAR test exclusion  provisions; for example, handheld PTT two-way radios, handsets, laptops and tablets, etc.

a)  For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm, the 1-g and 10-g *SAR test exclusion thresholds* are determined by the following:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as *numeric thresholds* in step b) below

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 according to 4.1 f) is applied to determine SAR test  exclusion.

b)  For 100 MHz to 6 GHz and *test separation distances* > 50 mm, the 1-g and 10-g *SAR test exclusion thresholds* are determined by the following (also illustrated in Appendix B):

1)  {[Power allowed at *numeric threshold* for 50 mm in step a)] + [(test separation distance – 50 mm)·($f_{(MHz)}$/150)]} mW, for 100 MHz to 1500 MHz

2)  {[Power allowed at *numeric threshold* for 50 mm in step a)] + [(test separation distance – 50 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz

c)  For frequencies below 100 MHz, the following may be considered for SAR test exclusion (also illustrated in Appendix C):

1)  For *test separation distances* > 50 mm and < 200 mm, the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by [1 + log(100/$f_{(MHz)}$)]

2)  For *test separation distances* ≤ 50 mm, the power threshold determined by the equation in c) 1)  for 50 mm and 100 MHz is multiplied by ½

3)  SAR measurement procedures are not established below 100 MHz.

## 2. MPE at given distance (KDB 447498 D01 General RF Exposure Guidance v06)

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG / 4\pi R^2$

where:  S = Power density
P = Power input to the antenna
G = Antenna gain
R = Distance to the center of radiation of the antenna
PG = Output Power including antenna gain

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled "Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure"

| Frequency Range (MHz) | Power Density (mW/cm²) | Averaging Time (minutes) |
|---|---|---|
| 300 -1500 | f/1500 | 30 |
| 1500 - 100000 | 1.0 | 30 |

where f = Frequency (MHz)

## 3. EUT technologies

Declared minimum safety distance: **20 cm**

| SRD Technology | Frequency [MHz] | | Reference | Output Power [dBm] | | | Power [mW] | | Share of Limit |
|---|---|---|---|---|---|---|---|---|---|
| | $f_{Min}$ | $f_{Max}$ | # | $P_{cond}$ | $P_{EIRP}$ | $P_{RF\ Exp}$ | $P_{Result}$ | $P_{Limit}$ | % |
| RFID 13.56 MHz | 13.56 | 13.56 | A, B | 33.6 | -15.0 | **33.6** | **2290.87** | **2400.40** | **95.44%** |

Note: For SAR test exclusion a test separation distance of 199 mm was considered.

| SRD Technology | Frequency [MHz] | | Reference | Output Power [dBm] | | | Power Density [mW/cm²] | | Share of Limit |
|---|---|---|---|---|---|---|---|---|---|
| | $f_{Min}$ | $f_{Max}$ | # | $P_{ERP}$ | $P_{EIRP}$ | $P_{RF\ Exp}$ | $S_{Result}$ | $S_{Limit}$ | % |
| WLAN 2.4 GHz | 2412 | 2462 | C | 22.2 | 20.5 | **20.5** | **0.02** | **1.00** | **2.23%** |
| WLAN 5 GHz | 5180 | 5240 | D | 12.0 | 16.0 | **16.0** | **0.01** | **1.00** | **0.79%** |
| WLAN 5 GHz | 5260 | 5320 | D | 12.5 | 17.2 | **17.2** | **0.01** | **1.00** | **1.04%** |
| WLAN 5 GHz | 5500 | 5700 | D | 15.7 | 21.0 | **21.0** | **0.03** | **1.00** | **2.50%** |
| WLAN 5 GHz | 5745 | 5825 | D | 14.8 | 18.7 | **18.7** | **0.01** | **1.00** | **1.47%** |

Note: For MPE a test separation distance of 20 cm was considered.

Referenced Documents:

| # | Results from: |
|---|---|
| A | Test Report 1-3390/21-01-02, page 19 |
| B | Datasheet PN5190.pdf, page 7 (see Annex A) |
| C | Test Report 1-3390/21-01-06, pages 16 & 17 |
| D | Test Report 1-3390/21-01-07, pages 16 & 19 |

## 4. Collocation overview:

| Technology | Share of Limit [%] |
|---|---|
| RFID 13.56 MHz | 95.44% |
| WLAN 5 GHz | 2.50% |
| Sum | **97.94%** |

## 5. Conclusion

This prediction demonstrates the following:
The power/power density levels for FCC at a distance of 20 cm are below the maximum levels allowed by regulations.

**Conclusion:** RF exposure evaluation is not required.

**Annex A: Technical Documentation PN5190 (Extract) – Max. Power:**

## 5 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VDD$_{(VBAT)}$ | supply voltage on pin VBAT (analog and digital supply) | VBAT ≥ VDDIO | 2.4 | - | 5.5 | V |
| VDD$_{(VDDIO)}$ | supply voltage on pin VDDIO (supply for host interface and GPIO's) | 1.8 V supply | 1.62 | - | 1.98 | V |
| | | 3.3 V supply | 2.4 | - | 3.6 | V |
| I$_{pd}$ | power-down current | VDD$_{(VDDPA)}$ = VDD$_{(VDDIO)}$ =VDD$_{(VDD)}$ 3.0 V; hard power-down state; pin VEN set LOW, T$_{amb}$ = 25 °C, External supply by VDDIO | - | 40 | 105 | µA |
| I$_{stb}$ | standby current | T$_{amb}$ = 25 °C | - | 45 | 110 | µA |
| I$_{ULPCD}$ | average ultra-low-power card detection current | T$_{amb}$ = 25 °C, VDD(VDDPA) = VDD(VDDIO) =VDD(VDD) 3.0 V, 330 ms Polling interval, 50 R antenna matching | - | 22 | - | µA |
| IDD$_{(VDDPA)}$ | supply current on pin VDDPA | supplied via VUP_TX (TX_LDO active) | - | - | 350 | mA |
| | | supplied without DC-DC and TXLDO active | - | - | 400 | mA |
| P$_{(PA)}$ | Transmitter output power | supplied via VUP_TX (TX_LDO active) | - | - | 2.0 | W |
| | | supplied without DC-DC and TXLDO active | - | - | 2.3 | W |
| T$_{amb}$ | ambient operating temperature | in still air with exposed pins soldered on a 4 layer JEDEC PCB, | -40 | - | +85 | °C |
| | | in still air with exposed pins soldered on a 4 layer JEDEC PCB, TX current = 120 mA @ VDDPA=3.6 V | -40 | - | +105 | °C |
| T$_{stg}$ | storage temperature | no supply voltage applied | -55 | - | +150 | °C |
| T$_{J\_max}$ | maximum junction temperature | - | - | - | +125 | °C |