

Statement of Human Exposure to Radiofrequency Electromagnetic Field

Certified modules:

| | |
|-------------------|-----------------------------|
| Type of Equipment | UHF RFID reader module |
| Model | NUR-10W |
| FCC ID | SCCNUR10W |
| Manufacturer | Nordic ID Oy |
| Type of Equipment | Bluetooth Low Energy module |
| Model | MDBT42Q |
| FCC ID | SH6MDBT42Q |
| Manufacturer | Raytac |

Host device

| | |
|-------------------|-----------------|
| Type of Equipment | Nordic ID EXA51 |
| Model | 818-1A |
| Manufacturer | Nordic ID Oy |

Standards

- 47 CFR §1.1307, §1.1310, §2.1091
- KDB 4477498 D01 V05R02

RF Exposure compliance calculation for FCC

Host device Nordic ID EXA51 (Expert Accessory) is a product which is commonly used by employees working in retail shops performing inventory of products or storage handling, in industry e.g. car factory plant or in logistic centre. Every user will receive a comprehensive training how to use device correctly / safely and ergonomically. EXA51 is not available or used by public customers so it's not consumer product like mobile phones / tablets.

Device does not have holster or any other accessory which bring device close to human body. To ensure ergonomic and safe use of device, Nordic ID has prepared training document "Nordic ID EXA51 RF safety training". This document will be provided to customers and is part of training.

RFID /BLE antenna distance to hand grip area is illustrated in photo "EXA51 RFID and BLE antenna locations".

When user hold device in hand, distance from RFID antenna to fingers in pistol grip is 75mm.

From KDB447498 clause 4.3.1

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:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,³⁰ where $f(\text{GHz})$ is the RF channel transmit frequency in GHz

$$(P_{\text{max}}/d) \cdot \sqrt{0.9\text{GHz}} \leq 7.5$$

For separation distance >50 mm we need P_{max} at $d=50$ mm distance

$$P_{\text{max}} \leq (7.5/\sqrt{0.9}) \cdot 50\text{mm} = \underline{\underline{395.3\text{mW}}}$$

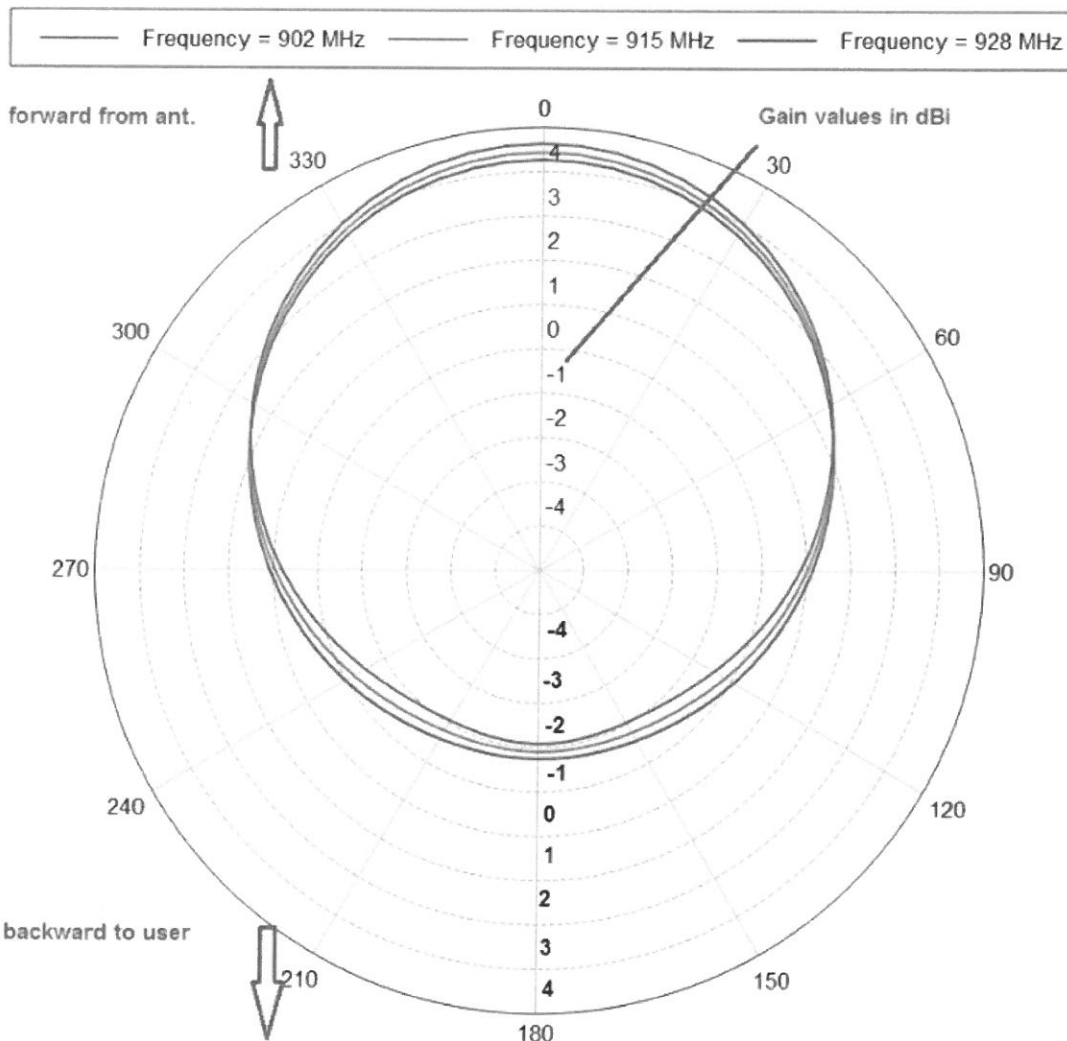
b) For 100 MHz to 6 GHz and test separation distances > 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following (also illustrated in Appendix B):³²
 {[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)·(f_(MHz)/150)]} mW, for 100 MHz to 1500 MHz

$$= \{ [395.3 \text{ mW}] + [(75 \text{ mm} - 50 \text{ mm}) \cdot (900 / 150)] \} \text{ mW}$$

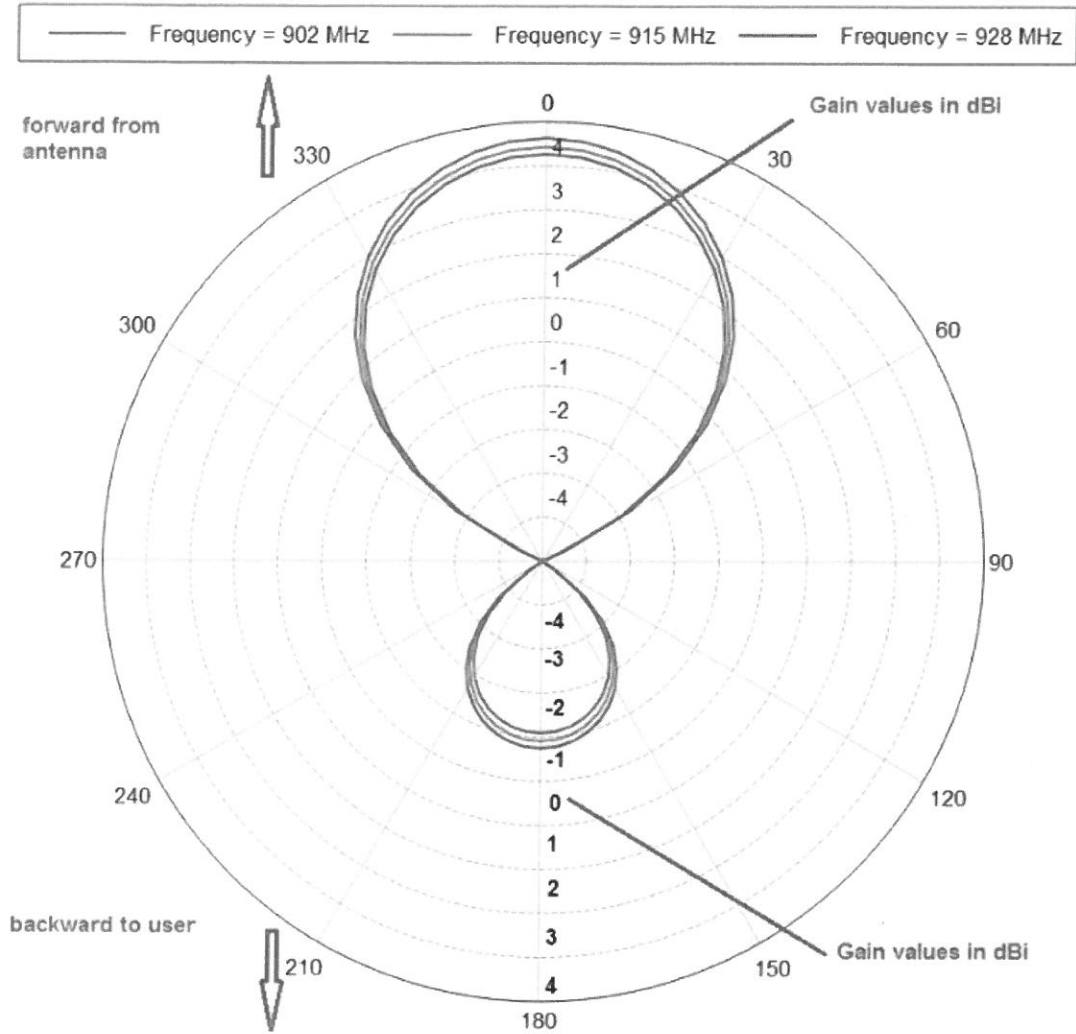
$$= 395.3 + 150 = \mathbf{545.3 \text{ mW}}$$

RFID Device maximum output power is 670mW at 902.5 – 928.5MHz.

Host device ACD antenna max gain is 5dBi. However, antenna directivity is very good and gain backwards to user fingers in pistol grip is -1dBi which means that most of the energy is going forward as user is pointing towards RFID tag's when searching and reading them. If we count module power 28.26dBm -1dBi gain we get result as 27.26dBm / **532.1mW**. This is below exclusion threshold **545.3mW** calculated above. See antenna plots in pictures below illustrating max gain and directions.



Pic 1. EXA51 antenna Phi



Pic 2. EXA51 antenna Theta

KDB802318 includes discussion with FCC and FCC accept and agrees with Nordic ID explanations, SAR testing for RFID can be exempted.

Bluetooth 2.45

When user hold device in hand, distance from BT antenna to fingers in pistol grip is 55mm.

From KDB447498 clause 4.3.1

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:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,³⁰ where $f(\text{GHz})$ is the RF channel transmit frequency in GHz

For separation distance >50 mm we need Pmax at $d=50$ mm distance

$$P_{\text{max}} \leq (7.5/\text{sqrt } 2.45) * 50\text{mm} = \underline{\underline{155.7\text{mW}}}$$

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):³²

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

$$= \{[155.7\text{mW}] + [(55\text{mm} - 50\text{mm}) * 10]\}$$

$$= 155.7\text{mW} + 50\text{mW} = \underline{\underline{205.7\text{mW is max allowed power.}}}$$

Maximum Bluetooth 2.45GHz module power is 2.3mW @2.45GHz

Conclusion is that limb worn SAR testing for 2.45GHz Bluetooth can be exempted.

Simultaneous transmission calculation

Per formula in KDB 447498 4.3.2 b)

RFID:

$[670\text{mW}/50\text{mm}] * [\text{sgrt } 0.9\text{GHz}/18.75] = \mathbf{0.69\text{W/Kg}}$ (670mW is RFID module power)

$[532.1\text{mW}/50\text{mm}] * [\text{sgrt } 0.9\text{GHz}/18.75] = \mathbf{0.54\text{W/kg}}$ (532.1mW is RFID power towards user fingers)

Bluetooth 2.45:

$[2.3\text{mW}/50\text{mm}] * [\text{sgrt } 2.45\text{GHz}/18.75] = \mathbf{0.0038\text{W/Kg}}$ (2.3mW is max Bluetooth power from module @ 2.45GHz)

Now we calculate these together:

$0.0038\text{W/Kg} + 0.69\text{W/Kg} = \mathbf{0.69\text{W/Kg}}$ (This is with RFID max module power + Bluetooth)

$0.0038\text{W/Kg} + 0.54\text{W/Kg} = \mathbf{0.54\text{W/Kg}}$ (This is with ACD RFID antenna + Bluetooth)

Limit is 1W/Kg for 10-g SAR so it's under limit.

Conclusion is that host product EXA51 meets FCC SAR test exclusion limits and can be exempted.

Sincerely,



Rauno Nikkilä
Certification Specialist
Nordic ID Oy