

Statement of Human Exposure to Radiofrequency Electromagnetic Field

Certified modules:

Type of Equipment Model FCC ID Manufacturer

Type of Equipment Model FCC ID Manufacturer UHF RFID reader NUR-05WL2 SCCNUR05WL2 Nordic ID Oy

WLAN / Bluetooth module SDC-SSD40NBT SCC-SDCSSD40NBT Nordic ID Oy

Host device

Type of Equipment Model Manufacturer Nordic ID Merlin UHF RFID 805-2C Nordic ID Oy

Standards

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

RF Exposure compliance calculation for FCC

Nordic ID Merlin UHF RFID 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. Merlin UHF RFID is not available or used by public customers so it's not consumer product like mobile phones / tablets.

Merlin UHF RFID users will receive training before they use device. In training, they are guided how to hold device correctly and how to use it ergonomically. Merlin UHF RFID does not have a holster so it would not be operated close to body. Merlin UHF RFID has a strap but it's not designed to be used so that device is mounted to user belt.

RFID antenna distance to hand grip area is illustrated in photo "Merlin UHF RFID RFID antenna distance to hand grip area"

When user hold device in hand, distance from RFID antenna to hand grip is 122.21mm.

From KDB447498 clause 4.3.1

a) For 100 MHz to 6 GHz and *test separation distances* \leq 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)] \leq 3.0 for 1-g SAR, and \leq 7.5 for 10-g extremity SAR,30where f(GHz) is the RF channel transmit frequency in GHz

 $(Pmax/d)*sqrt\ 0.928GHz \leq 7.5$

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

 $Pmax \le (7.5/sqrt \ 0.928) * 50mm = 389.3mW$



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

={[389.3mW]+[(122.21mm-50mm)*(928/150)]}mW

=389.3mW+446.7mW=836.0mW

RFID Device maximum output power is 388mW at 902.5 – 928.5MHz.

Conclusion is that limb worn SAR testing for RFID can be excluded.

WLAN / Bluetooth antenna distance to hand grip area is illustrated in photo "Merlin UHF WLAN_BT antenna distance to hand grip area"

When user hold device in hand, distance from WLAN antenna to hand grip is 86.09mm.

WLAN 5GHz

From KDB447498 clause 4.3.1

a) For 100 MHz to 6 GHz and *test separation distances* \leq 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*)] $\cdot [\sqrt{f_{(GHz)}}] \leq$ 3.0 for 1-g SAR, and \leq 7.5 for 10-g extremity SAR,30where f_(GHz) is the RF channel transmit frequency in GHz

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

 $Pmax \le (7.5/sqrt \ 5.85) \ * \ 50mm = \frac{155.04mW}{155.04mW}$

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 \leq 6 GHz

={[155.04mW]+[(86.09mm-50mm)*10]}

=155.04mW+360.9mW=515.94mW is max allowed power.

Maximum WLAN 5GHz module power is 37.33mW @5GHz

Conclusion is that limb worn SAR testing for 5GHz WLAN can be excluded.

WLAN 2.4GHz

From KDB447498 clause 4.3.1 a) For 100 MHz to 6 GHz and *test separation distances* \leq 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)] \leq 3.0 for 1-g SAR, and \leq 7.5 for 10-g extremity SAR,30where f(GHz) is the RF channel transmit frequency in GHz



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

 $Pmax \le (7.5/sqrt 2.48) * 50mm = 238.13mW$

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 \leq 6 GHz

={[238.13mW]+[86.09mm-50mm)*10]}

=238.13mW+360.09mW=599.03mW is max allowed power.

Maximum WLAN 2.4GHz module power is 39mW @2.4GHz WLAN mode b

Conclusion is that limb worn SAR testing for 2.4GHz WLAN can be excluded.

Bluetooth 2.4

From KDB447498 clause 4.3.1 a) For 100 MHz to 6 GHz and *test separation distances* \leq 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*)] $\cdot [\sqrt{f_{(GHz)}}] \leq$ 3.0 for 1-g SAR, and \leq 7.5 for 10-g extremity SAR,₃₀where f_(GHz) is the RF channel transmit frequency in GHz

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

 $Pmax \le (7.5/sqrt \ 2.48) * 50mm = 238.13mW$

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 \leq 6 GHz

={[238.13mW]+[86.09mm-50mm)*10]}

=238.13mW+360.09mW=599.03mW is max allowed power.

Maximum Bluetooth 2.4GHz module power is 1.7mW

Conclusion is that limb worn SAR testing for 2.4GHz Bluetooth can be excluded.



Simultaneous transmission calculation

Per formula in KDB 447498 4.3.2 b)

When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:³⁶ 1) [(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[Vf(GHz)/x] W/kg, for test separation distances \leq 50 mm; where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR. 2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is > 50 mm.³⁷ **RFID + WLAN 2.4GHz:**

1W/Kg + 1W/Kg = 2W/Kg

RFID + Bluetooth 2.4GHz:

1W/Kg + 1W/Kg = 2W/Kg

RFID + WLAN 5GHz:

1W/Kg + 1W/Kg = 2W/Kg

Limit is 4W/Kg for 10-g SAR so it's under limit.

<u>Conclusion is that host product Merlin UHF RFID meets FCC SAR test exclusion limits and SAR tests can</u> <u>be excluded.</u>

Sincerely,

Rame Willia

Rauno Nikkilä Certification Specialist Nordic ID Oy