Statement of Human Exposure to Radiofrequency Electromagnetic Field

Certified modules:

Type of Equipment	UHF RFID reader module
Model	NUR3-1W
FCC ID	SCCNUR31W
Manufacturer	Nordic ID Oyj

Type of Equipment	WLAN/BT/BLE module
Model	SC680A-WF
FCC ID	SCCSC680AWF
Manufacturer	Nordic ID Oyj

Host device

Type of Equipment	HH86
Model	837-5A
Manufacturer	Nordic ID Oyj

Standards

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

RF Exposure compliance calculation for FCC

Host device Nordic ID HH86 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.

Product is designated / intended to be operated only in a hand. No support for belt clip, holster, lanyard etc.

When user hold HH86 in hand, distance from RFID antenna to fingers in grip area is 95mm.

From KDB447498 D01 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:
[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [√$f_{(GHz)}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,[30]where
$f_{(GHz)}$ is the RF channel transmit frequency in GHz

(Pmax/d)*sqrt 0.928GHz ≤ 7.5

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

Pmax ≤ (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]+[(95mm-50mm)*(928/150)]}mW

=389.3+278.4=**667.7mW**

RFID module maximum conducted output power is **659mW at 902.5 – 928.5MHz.**

RFID module + antenna is located in separate unit which can be installed to main chassis of HH86.

As RFID antenna is pointing away from user, most of the energy goes away.

Power that goes backwards from antenna to user fingers is ~4dBi less than conducted power.

Based on calculation above, RFID SAR testing can be excluded.

See RFID antenna location with distance in separate document.

Product has WLAN functionality which is typically used when some inventory data is transferred from device to company network / cloud. When user hold HH86 in hand, distance from WLAN / BT antenna to fingers in grip area is 65mm.

2.4GHz WLAN and Bluetooth

From KDB447498 D01 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:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [√$f_{(GHz)}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,[30]where

$f_{(GHz)}$ is the RF channel transmit frequency in GHz

(Pmax/d)*sqrt 2.48GHz ≤ 7.5

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

Pmax ≤ (7.5/sqrt 2.48) * 50mm= **238.2mW**

2.4GHz WLAN maximum conducted output power is **113mW.**

Bluetooth Device maximum output power is **10mW at 2.4GHz**.

Because of this, WLAN and Bluetooth 2.4GHz SAR testing can be excluded.

See WLAN / Bluetooth antenna location with distance in separate document.

5GHz

(Pmax/d)*sqrt 5.8GHz ≤ 7.5

Pmax ≤ (7.5/sqrt 5.8) * 50mm= **156.25mW**

5GHz WLAN maximum conducted output power is **34mW.**

Because of this, WLAN 5GHz SAR testing can be excluded.

See WLAN antenna location with distance in separate document.

Simultaneous transmission calculation

Per formula in KDB 447498 4.3.2 b)

RFID:
[659mW/95mm] * [sgrt 0.9GHz/18.75]=**0.35W/Kg** (659mW is RFID module power)

Bluetooth 2.4:
[10mW/65mm] * [sgrt 2.4GHz/18.75]=**0.012W/Kg** (10mW is max Bluetooth power from module @ 2.4GHz)

WLAN 2.4:
[113mW/65mm] * [sgrt 2.4GHz/18.75]=**0.14W/Kg** (113mW is max WLAN power from module @ 2.4GHz

WLAN 5GHz:
[34mW/65mm] * [sgrt 5GHz/18.75]=**0.06W/Kg** (34mW is max WLAN power from module @ 5GHz

Now we calculate these together:

RFID+2.4GHz WLAN:
0.35W/Kg + 0.14W/Kg= **0.49W/Kg**

RFID+ 5GHz WLAN:
0.35W/Kg + 0.06W/Kg= **0.41W/Kg**

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

Sincerely,

Rauno Nikkilä
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