NORDICID

Statement of Human Exposure to Radiofrequency Electromagnetic Field

Certified modules:

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

Type of Equipment	WLAN / Bluetooth module
Model	SDC-SSD40NBT
FCC ID	SCC-SDCSSD40NBT
Manufacturer	Nordic ID Oy

Host device

Type of Equipment	Nordic ID Morphic CD
Model	811-4A
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 Morphic CD 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. Morphic CD 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 Morphic CD RF safety training". This document will be provided to customers and is part of training.

When user hold device in hand, distance from RFID antenna to fingers in grip area 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:
[(*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,30where
$f_{(GHz)}$ is the RF channel transmit frequency in GHz

(Pmax/d)*sqrt 0.9GHz ≤ 7.5

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

Pmax ≤ (7.5/sqrt 0.9) * 50mm= **395.3mW**

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

={[395.3mW]+[(55-50mm)*(900/150)]}mW
=395.3+30=**425.3mW**
RFID Device maximum output power is 388mW at 902.5 – 928.5MHz.

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

Host device has two WLAN/BT antennas. Antenna 1 is dual band and antenna 2 only 2.45GHz. Antennas cannot transmit simultaneously.

When user hold device in hand, distance from WLAN/BT antenna 1 to fingers in grip area is 60mm.
WLAN 5GHz
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:
[(*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,[30]where
$f_{(GHz)}$ is the RF channel transmit frequency in GHz

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

Pmax ≤ (7.5/sqrt 5.8) * 50mm= **155.7mW**

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
={[155.7mW]+[(60mm-50mm)*10]}
=155.7mW+100mW=**255.7mW is max allowed power.**
Maximum WLAN 5GHz module power is 37.33mW @5.8GHz

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

WLAN 2.45GHz
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:
[(*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,[30]where
$f_{(GHz)}$ is the RF channel transmit frequency in GHz

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

Pmax ≤ (7.5/sqrt 2.45) * 50mm= **239.62mW**

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
={[239.62mW]+[(60mm-50mm)*10]}
=239.62mW+100mW=**339.62mW is max allowed power.**
Maximum WLAN/BT 2.4GHz module power is 39mW @2.45GHz WLAN mode b.

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

Bluetooth 2.45

Maximum Bluetooth 2.45GHz module power is 1.7mW @2.45GHz

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

When user hold device in hand, distance from WLAN/BT antenna 2 to fingers in grip area is 30mm.

WLAN 2.45GHz
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:
[(*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

For separation distance 30mm we need Pmax at d=30mm distance

Pmax ≤ (7.5/sqrt 2.45) *30mm= **143.7mW is max allowed power**

Maximum WLAN/BT 2.4GHz module power is 39mW @2.45GHz WLAN mode b.

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

Bluetooth 2.45

Maximum Bluetooth 2.45GHz module power is 1.7mW @2.45GHz

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

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Simultaneous transmission calculation

Per formula in KDB 447498 4.3.2 b)
RFID:
[388mW/55mm] * [sgrt 0.9GHz/18.75]=**0.35W/Kg** (388mW is max RFID module power)

WLAN / BT ant 1
WLAN 2.45GHz:
[39mW/60mm] * [sgrt 2.45GHz/18.75]=**0.054W/Kg** (39mW is max WLAN module power @ 2.45GHz)

Bluetooth 2.45:
[1.7mW/60mm] * [sgrt 2.45GHz/18.75]=**0.0023W/Kg** (1.7mW is max BT module power @ 2.45GHz)

WLAN 5GHz:
[39mW/60mm] * [sgrt 5.8GHz/18.75]=**0.08W/Kg** (39mW is max WLAN module power @ 5.8GHz)

WLAN / BT ant 2
WLAN 2.45GHz:
[39mW/30mm] * [sgrt 2.45GHz/18.75]=**0.1W/Kg** (39mW is max WLAN module power @ 2.45GHz)

Bluetooth 2.45:
[1.7mW/30mm] * [sgrt 2.45GHz/18.75]=**0.004W/Kg** (1.7mW is max BT module power @ 2.45GHz)

Now we calculate these together:

0.1W/Kg + 0.35W/Kg= **0.45W/Kg** (RFID max module power + 5GHz WLAN ant 1)

0.054W/Kg + 0.35W/Kg= **0.4W/Kg** (RFID max module power + 2.45GHz WLAN ant 1)

0.0023W/Kg + 0.35W/Kg= **0.35W/Kg** (RFID max module power + 2.45GHz Bluetooth ant 1)

0.1W/Kg + 0.35W/Kg= **0.45W/Kg** (RFID max module power + 2.45GHz WLAN ant 2)

0.004W/Kg + 0.35W/Kg= **0.354W/Kg** (RFID max module power + 2.45GHz Bluetooth ant 2)

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

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

Sincerely,

Rauno Nikkilä
Certification Specialist
Nordic ID Oy