2805 Columbia Street
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RF EXPOSURE ASSESSMENT, NFC
METOR 900M

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A – Added, M – Modified, D – Deleted

S.No	Date	Version No	Page No	Change Mode (A/M/D)	Brief description of change
1	4/20/2020	1	All		Initial Document Creation
2	4/28/2020	1.1	5	M	Section 4.1, Updated Magnetic Field Strength limit value from FCC1.1310(e).
			6	M	Section 5, Changed formula for Power Density to W/m^2 from mW/cm^2
			6	M	Section 6, Use E-Field Value instead of 20 dB bandwidth measurement in calculation of Power density.

Approval List

Department	Name	Date	Signature
Engineering			
Marketing / Sales			
Quality Assurance			
Manufacturing			
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1 Document Summary

This document analyses the RF exposure by NFC module in Metor 900M. It provides the general assessment of the RF exposure and demonstrates that the product Metor 900M with NFC module to be in compliant with the applicable codes for US, EU, and Canada.

2 Product Brief Description:

Metor 900M is a walk-through metal detector (WTMD) designed to detect metal objects people are carrying with them. Metor 900M is equipped with NFC capability. You can use Rapiscan supplied NFC cards to quickly change unit's parameter values. NFC read area is indicated by NFC symbol on the cross piece between status LED window and display as shown below.

The NFC module is situated at about 214cm (84 inch) height from the ground level and the spiral rectangular antenna is situated parallel to the cross piece surface with maximum field strength perpendicular to the center of the surface.

3 RF General Information:

Evaluation Mode	Frequency MHz	Operating Frequency Range MHz	Modulation Type
NFC	13.56	13.553-13.567	Amplitude Modulation

4 Limits of Maximum Permissible Exposure:

4.1 Limits of MPE as per IEEE Standard C95.1-2005 (US)

(A) Limits for Occupational / Controlled Exposure

Frequency f Range MHz	Electric Field Strength E (V/m)	Magnetic Field Strength H (A/m)	Power Density S (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$, S (minutes)
3-30	1842/f	4.89/f	$900/f^2$	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency f Range MHz	Electric Field Strength E (V/m)	Magnetic Field Strength H (A/m)	Power Density S (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$, S (minutes)
1.34-30	823.8/f	2.19/f	$180/f^2$	30

4.2 Limits of MPE as per ICNIRP Guidelines -1998 (EU)

(C) Limits for Occupational / Controlled Exposure

Frequency f Range MHz	Electric Field Strength E (V/m)	Magnetic Field Strength H (A/m)	Power Density S (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$, S (minutes)
10-100	61	0.16	1	6

(D) Limits for General Population / Uncontrolled Exposure

Frequency f Range MHz	Electric Field Strength E (V/m)	Magnetic Field Strength H (A/m)	Power Density S (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$, S (minutes)
10-100	28	0.073	0.2	6

4.3 Limits of MPE as per Safety Code 6 of Health Canada -2015 (Canada)

(E) Limits for Occupational / Controlled Exposure

Frequency f Range MHz	Electric Field Strength E (V/m)	Magnetic Field Strength H (A/m)	Power Density S (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$, S (minutes)
10-20	61.4	0.163	1	6

(F) Limits for General Population / Uncontrolled Exposure

Frequency f Range MHz	Electric Field Strength E (V/m)	Magnetic Field Strength H (A/m)	Power Density S (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$, S (minutes)
10-20	27.46	0.0728	0.2	6

5 MPE Calculation Method:

The MPE calculation is calculated at 5 cm distance for card operator hand as well as at 20 cm distance for general public to show compliance with the power density limit.

The following formula is used to calculate the power density:

$E(V/m) = SQRT(30*P*G)/d$ Power Density S (W/m^2) = $E^2/377$

where E = Electric Field (V/m),
P = RF Output Power W,
G = Antenna Gain,
d = Separation distance between radiator and Human body (m).

6 Calculated Results and Limits:

Exposure Environment: Occupational / Controlled Exposure

Mode	Frequency f MHz	E-Field (dBuV/m) @3m	EIRP (mW)	Distance (cm)	S (mW/cm^2)	S-Limit (mW/cm^2) (US)	S-Limit (mW/cm^2) (EU)	S-Limit (mW/cm^2) (CANADA)
NFC	13.56	4.06	$1.648x10^{-9}$	5	$0.524x10^{-11}$	4.894667	1	1

Exposure Environment: General Population / Uncontrolled Exposure

Mode	Frequency f MHz	E-Field (dBuV/m) @3m	EIRP (mW)	Distance (cm)	S (mW/cm^2)	S-Limit (mW/cm^2) (US)	S-Limit (mW/cm^2) (EU)	S-Limit (mW/cm^2) (CANADA)
NFC	13.56	4.06	$1.648x10^{-9}$	20	$0.328x10^{-12}$	0.9789334	0.2	0.2

As can be seen, the calculated power density (S) for both card operator as well as for general public is fraction of the limits of the power density allowed by the three applicable codes for US, EU and Canada.

7 Conclusion:

The Metor 900M with NFC module passes all the criteria for the RF exposure with very high margin and is compliant to all the applicable standards for US, EU, and CANADA.

8 References:

[1] IEEE. 2005. IEEE Std C95.1 Standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz – 300 GHz

[2] ICNIRP. 1998. Guidelines for limiting exposure to time varying electric, magnetic, and electromagnetic fields (up to 300 GHz). Health Physics, Vol. 74:494-522

[3] Health Canada. 2015. Safety Code 6 (2015). Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range From 3 kHz to 300 GHz.

[4] Test Report (EMC) by SGS reference number 297479-1-4.