

August 27, 2012

Office of Engineering and Technology
Federal Communications Commission
7435 Oakland Mills Road
Columbia, MD 21046

Subject: NeuroPace, Inc.
Application for Grant Certification
FCC ID: WBWRF902
MPE calculation, Rev 1

MPE Calculation:

The following equation uses the law of Biot Savart for a square current loop to obtain the magnetic induction, B, at a distance away from the center of the loop.

$$B = \frac{\mu_0 i}{2\pi \left(\frac{z^2}{L^2} + \frac{1}{4} \right) \sqrt{\left(z^2 + \frac{L^2}{2} \right)}}$$

where

μ_0 is the permeability constant (1.26×10^{-6} H/m)

i is the current flowing in the loop (in amps)

L is the length of one side of the square (in meters)

z is the distance, on axis, from the center of the current loop (in meters)

The following equation converts the magnetic induction to magnetic field.

$$H = \frac{B}{\mu_0} = \frac{i}{2\pi \left(\frac{z^2}{L^2} + \frac{1}{4} \right) \sqrt{\left(z^2 + \frac{L^2}{2} \right)}}$$

NeuroPace Neurostimulator Calculation:

The maximum magnetic field that the patient is exposed to by the Neurostimulator for a single transmit pulse is 14.1 A/m.

Source Based Time Averaging:

Per 47 CFR part 2.1093(d)(5), it is allowable to use source based time averaging based on an inherent property of the device to calculate magnetic field strength in an uncontrolled environment.

The source based magnetic field strength was calculated with the Neurostimulator for the following Use Scenarios:

- 1) a conservative case condition representing a 60% logic level ones transmission for transmission of a single long uplink frame,
- 2) a conservative case condition representing a 60% logic level ones transmission for transmission during interrogation,
- 3) a conservative case condition representing a 60% logic level ones transmission for transmission during programming,
- 4) a representative Programmer or Remote Monitor Wand Test Signal function,
- 5) the highest exposure sub-step of a Clinical (non-theoretical) system interrogation session, and
- 6) the highest exposure sub-step of a Clinical (non-theoretical) system programming session.

Each of these case conditions are described in detail in the operational description. Results are summarized in the table below.

Use Scenarios	Neurostimulator Source Based Duty Cycle (in %)	Resulting maximum source based magnetic field during exposure (A/m)
1) Theoretical Conservative Transmit Long Frames Condition	26.5%	3.7
2) Theoretical Conservative Interrogation	14.1%	2.0
3) Theoretical Conservative	0.01%	0

Use Scenarios	Neurostimulator Source Based Duty Cycle (in %)	Resulting maximum source based magnetic field during exposure (A/m)
Programming		
4) Wand Test Signal ¹	2.2%	0.3
5) Clinical Interrogation ²	9.2%	1.3
6) Clinical Programming	1.4%	0.2

1. Representative of Wand Optimization Step performed during Programming and Interrogation

2. Not including Wand Optimization Step

Exposure Duration:

RF exposure to the patient by the Neurostimulator is limited by the duration of the exposure. The following table shows the maximum duration of each type of communication interaction.

	Maximum Duration (minutes)
Wand Test Signal	10
Interrogation	4.2
Programming	9.6

Daily Average Exposure:

The following table shows the daily average magnetic field strength for the Wand used in daily home use and in the semiannual worst case physician's office use.

Usage	Recurrence	Resulting daily average magnetic field (A/m)
Patient in the home	daily	0.01
Physician prescribed	semiannual	0.05

MPE Limit:

The Neuropace Neurostimulator RNS-300M transmits at a frequency of 47kHz. The lowest frequency listed in FCC 47 CFR part 1.1310 Table 1 limits for maximum



permissible exposure is 300 kHz. The magnetic field strength limit at 300 kHz in uncontrolled environments listed in part 1.1310 Table 1 is 1.63 A/m

Using a conservative theoretical approach to determine the source based duty cycle for the maximum expected duration of exposure and at the distance between Neurostimulator and patient which exposes the patient to the greatest level of exposure, the daily average magnetic field for the patient in the home and for the patient during physician prescribed exposure is below the limit of 1.63A/m.

Sincerely,

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