Health Mate Sauns – Sauna Heater
Document Number: VTE-3076-HMS

Document History:

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Vitatech Electromagnetics Review and Acceptance Status		
☒	Code 1.	AC 50/60 Hz magnetic flux density levels are within acceptable levels
☒	Code 2.	For documentation of conditions
Review/Accepted by: (signature)		
Print Name:	Jan Patrick Heindel	Date: 19 October 2018
Acceptance by Vitatech Electromagnetics does not relieve the designer/supplier from full compliance with their contractual obligations and does not constitute Vitatech Electromagnetics approval of design, details, calculations, analyses, test methods or materials developed or selected by the designer/supplier.		

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Foreword

On September of 2017 Vitatech Electromagnetics, LLC defined a set of testing parameters and steps to simplify and standardize the measurement of electromagnetic emissions from sauna heating elements. The product of that effort can be found in reports provided to clients after September 2017. These standardized procedures call for recording the electric and magnetic emissions from sauna heating at the surface of the heating element and at the closest distance that could be occupied near the heating element. The bandwidth for surveying the sauna heating elements was limited to 10 to 1,000 hertz for AC-ELF electric and magnetic fields with a compact field analyzer and 0 to 4,000 hertz for a laboratory grade fluxgate magnetometer. In conjunction, these two sensor types provide a complete profile of the electromagnetic emissions of a sauna heating element. Note, the recorded measurements are only of the sauna heating element and **not** of the sauna in its installed configuration, actual EMF exposure may differ from the measurements recorded during Vitatech's testing and that of the completed sauna.

Background

On Wednesday 10th of October 2018 Engineering Manager Jan Patrick Heindel employed by Vitatech Electromagnetics LLC (Vitatech) recorded alternating current (AC) for frequencies from 10 Hertz to 1,000 Hertz to identify electromagnetic interference (EMI) generated by one (1) Health Mate Sauna, sauna heating device. Vitatech conducted the assessment in a magnetically shielded and grounded enclosure to ensure no external interference would be recorded during the measurements. The testing objective was to determine the magnitude of electromagnetic emissions, that an individual would be exposed to, during typical use of a sauna equipped with the heating device. During testing, the heater panel's current draw was 2.45 Amp at 120 volts. Vitatech found and measured the location of the highest peak of electromagnetic emissions on the surface of the heater. This maximum was measured at location #1, #2, and location #3.

Scope

The purpose of this survey and report is to document the electric field strength and magnetic flux density emissions from the Health Mate Sauna heater device. These recorded measurements can be used by a consumer to determine their risk of exposure to non-ionizing radiation. Vitatech recommends a long-term human health exposure rate (4+ hours) of no more than 1 A/m (12.57 mG RMS) for 60 Hz magnetic fields or no more than 1 V/m for 60 Hz electric fields. Note the actual electromagnetic emissions from a fully assembled sauna may vary from the values included in this report.

Table #1 shows the summary of the electromagnetic data recorded during this assessment and Image #1 illustrates the locations of the measurements.

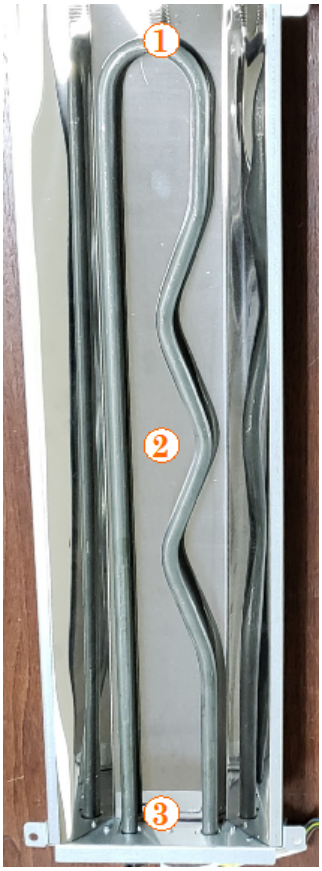


Image # 1: Measurement locations

		B-Field [mG RMS]	E-Field [V/m]	B-Field [mG RMS]
Sensor		Narda EHP50f	Narda EHP50f	Sensys FGM3D-SV 4kHz
Frequency Range		30 to 1,000 Hz	30 to 1,000 Hz	12 to 4,000 Hz
Location	1 - At surface	0.89	32.69	3.76
	1 – At 2" from surface	1.19	29.21	0.84
	2 - At surface	0.65	26.76	1.22
	2 – At 2" from surface	2.66	32.62	1.87
	3 - At surface	1.02	35.59	1.61
	3 – At 2" from surface	0.68	56.42	1.42

Table 1: Summary of measurements from heating element (supply wires, etc.)
Red indicates the maximum values recorded during testing.

Conclusions

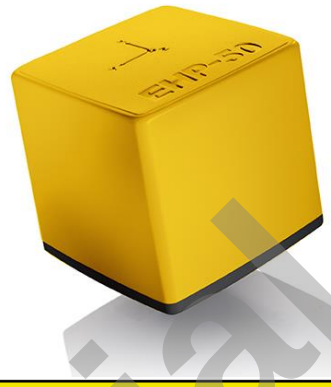
The average values for the Health Mate Sauna sauna-heater device were less than the thresholds listed in EN 55035:2017 of 1 A/m (12.57 mG RMS) for 60 Hz magnetic fields and less than the standard IEEE 95.6:2002 of 5,000 V/m for whole body exposure. Though there are guidelines for an individual's exposure to electromagnetic fields, there are no North American regulations or laws regarding the maximum permissible exposure. The peak recorded levels for the heater unit were recorded at location #1, #2, and #3. These values were 2.66 mG RMS (at location #2 – 2-inches from surface) and 56.42 V/m RMS from 30 to 1,000 Hertz (at location #3 – 2-inches from surface), and 3.76 mG RMS from 12 to 4,000 Hertz (at location #1 – at surface).

This completes the Health Mate Sauna – sauna heater – Electromagnetic emissions survey documentation and assessment.

Survey Equipment

B NARDA EHP-50f

The NARDA EHP-50f records electric field strength in Volt-per-meter(V/m) and magnetic field strength in micro-Tesla (μT) from one (1) hertz to four-hundred thousand hertz (400 kH). With a measurement range of 5 mV/m to 100 kV/m for electric fields and 0.3 nano-Tesla to 100 micro-Tesla for magnetic fields. The EHP-50f system when used with the EHP-TS software interface has a resolution of 0.1 mV/m for electric fields and 0.1 nT for magnetic fields.



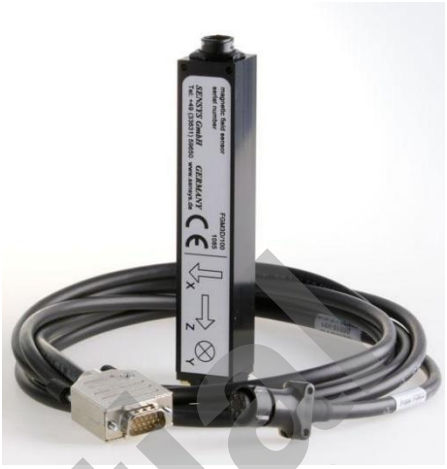
FREQUENCY					
	Range (SPAN)	**Fstart**	**Fstop**	**Resolution**	**Bandwidth RBW**
All measurement functions except Weighted Peak	400 kHz [a]	4800 Hz	400 kHz	976.56 Hz	3600 Hz
	100 kHz	1200 Hz	100 kHz	244.14 Hz	900 Hz
	10 kHz	120 Hz	10 kHz	24.414 Hz	90 Hz
	2 kHz	24 Hz	2 kHz	4.8828 Hz	18 Hz
	1 kHz	12 Hz	1 kHz	2.4414 Hz	9 Hz
	500 Hz	6 Hz	500 Hz	1.2207 Hz	4.5 Hz
	200 Hz [a]	2.4 Hz	200 Hz	0.48828 Hz	1.8 Hz
	100 Hz [a]	1 Hz	100 Hz	0.24414 Hz	0.9 Hz
Weighted Peak mode		1 Hz to 400 kHz			

LEVEL [b]		**Electric Field**	**Magnetic Field**
Level range (manual selection)	Low Range	5 mV/m to 1 kV/m	0.3 nT to 100 μT
	High Range	500 mV/m to 100 kV/m	30 nT to 10 mT
Overload limit		200 kV/m	20 mT
Dynamic range		106 dB	110 dB
Display resolution (NBM-550)	Low Range	4 digits, ≥ 1 mV/m	4 digits, ≥ 0.1 nT
	High Range	4 digits, ≥ 0.1 V/m	4 digits, ≥ 0.1 μT
DANL displayed average noise level (f ≥ 50 Hz and SPAN ≤ 1 kHz)		5 mV/m (isotropic) 3 mV/m (single axis)	0.3 nT (isotropic) 0.2 nT (single axis)
E/H field immunity		< 10 V/m @ 1 mT (H field)	< 0.2 μT @ 20 kV/m (E field)

UNCERTAINTY [b]		**Electric Field**	**Magnetic Field**
Expanded measurement uncertainty [c]		±9 % (typ. ±5 %) @ 40 Hz to 100 kHz, ≥ 1 V/m	±5.6 % (typ. ±3 %) @ 40 Hz to 100 kHz, ≥ 200 nT
Flatness @ 100 V/m, 2 μT	5 Hz to 40 Hz	±0.35 dB (5 Hz to 400 kHz)	±0.7 dB
	40 Hz to 100 kHz		±0.35 dB
	100 kHz to 400 kHz		±0.7 dB
Linearity (referred to 100 V/m, 2 μT)		±0.2 dB (1 V/m to 1 kV/m)	±0.2 dB (200 nT to 10 mT)
Isotropic response		±0.54 dB typ.	±0.12 dB typ.
Temperature deviation (typ. at 55 Hz) (referred to 23 °C, 50 % relative humidity)		-0.004 dB/°C (-20 °C to 55 °C)	-0.008 dB/°C (-20 °C to 23 °C) +0.013 dB/°C (23 °C to 55 °C)
Humidity deviation (typ. at 55 Hz) (referred to 23 °C, 50 % relative humidity)		+0.011 dB/% (10 % - 50 % humidity) +0.022 dB/% (50 % - 90 % humidity)	-0.007 dB/% (10 % - 50 % humidity) +0.01 dB/% (50 % - 90 % humidity)

Sensys FGM3D - 4kHz – Three Axis Magnetometer

Sensys FGM3D-4kHz special low noise version 3-axis fluxgate magnetometers were used to collect magnetic flux density levels. The Sensys have a maximum range of ±1 Gauss (±100 µT), a bandwidth of 0 Hertz to 4,000 Hertz (to the -3 dB), a resolution of <70 pT, and a noise level of <8 pT_{RMS} /√Hz. Three channel AC ELF and DC EMI data from the fluxgate probes were sampled at 10,240 Hz with a National Instruments (NI) 24 bit USB-4432 A/D system and processed/stored by a custom design NI evaluation program that displays the peak-to-peak AC ELF and DC three-axis Bx, By and Bz data in units of milligauss (mG), and, provides a Fast Fourier Transform (FFT) analysis in units of RMS of the AC power harmonic content. 24-bit A/D and portable computer.



Technical data FGM3D/100

	Standard	Special version	
Measurement range	**±100,000 nT**	**±100,000 nT**	
Point of reference single axes	See below (14.5/34.5/54.5 from reference edge)		
Point of reference total intensity	34.5mm		
Declination between axes	≤ ±0,5°	≤ ±0,1°	
Declination total	≤ ±1°	≤ ±0,12°	
Resolution	< 150 pT	< 70 pT	
Noise	< 15 pT_{rms}/√Hz	< 8 pT_{rms}/√Hz	@ 0,1 ... 10 Hz
Cut off frequency (bandwidth)	4 kHz (DC…4 kHz)		
Temperature drift	<0.3 nT/K		
Drift over time	t.b.d.		
Zero error	≤ ±5 nT		
Stability	< 5 nT		
Linearity	±2 nT / < 20 ppm		
Compensation range	n.a.		
Sensitivity	0,1 V/µT		