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VITATECH
ELECTROMAGNETICS

Vitatech Electromagnetics

JUNE 21ST, 2021

AC ELF EMF/EMC 2021 REPORT

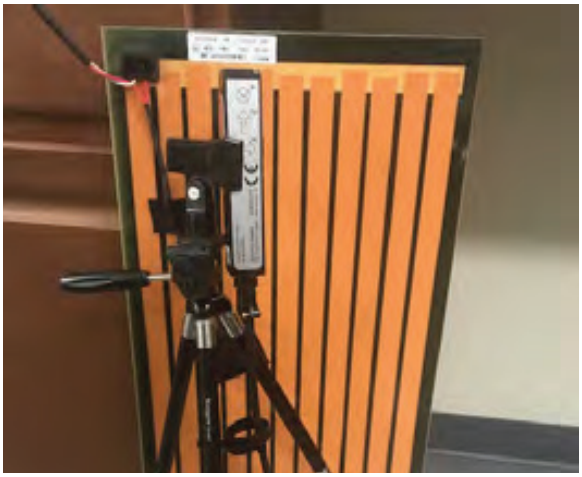
CARBON • CERTIFIED • LOW EMF • TECHNOLOGY

GHS
Good Health Saunas

CERTIFIED • LIFETIME • WARRANTY

2021 EMF Report for Good Health Saunas®

Vitatech Electromagnetics, LLC was commissioned by Good Health Saunas to perform comprehensive AC ELF EMF/EMC (electromagnetic compatibility) testing for the new 2021 models of two (2) 180-watt 120 V and one (1) 80-watt 120 V panel heaters.



Vitatech operated the heater under normal electrical load in its regular ON/OFF settings to identify the peak magnetic and electric field emission levels emitted from the heater per full compliance testing. In addition to the normal magnetic and electric field testing at the common power frequency of 60 Hz, Vitatech measured magnetic and electric field strength emanating from 10 Hz to 1 kHz frequency range. For this test, two comparable models, ending in model numbers 109 and 120 and one smaller model ending in QD, was tested in a low shielded environment. The survey was performed on June 21st, 2021, by a Vitatech EMF Technician.

Executive Summary

The results of the electromagnetic compatibility testing indicate that all three (3) heaters emit very low electromagnetic fields (EMF) and meet all known federal, state, and industry standards. Two (2) 180-watt 120V panels measured between 0.33 mG and 0.76 mG peak-topeak (0.92 mG and 2.12 mG RMS) at the power source or 24" in elevation when standing upright (see Figures #1 and #2). The smaller 80-watt 120V panel measures at 0.22 mG peaktopeak or 0.61 mG RMS at the power source (see Figure #3). These panels comply with Vitatech's recommendation of 10 mG RMS or less for long term human exposure to electromagnetic fields (EMF).

Objective

The objective of the AC ELF EMF testing services performed for the three sauna heaters was to identify the peak magnetic flux density levels emanating from the sauna heaters under normal ON and OFF settings and compare the recorded data with both current federal/state/industry standards and Vitatech Electromagnetics' 10 mG RMS recommended long-term human health exposure as presented in Exhibit A, Recommended 50/60 Hz Magnetic Field Human Exposure & EMI Immunity Standards (July 2015). It should be noted that all recorded time-varying 60 Hz magnetic flux density levels within this report are presenting in peak-to-peak units of mG (milligauss) in the Bx, By and Bz axes and then converted to Br resultant RMS (root-meanssquare) units. All electric field

strength levels are presented in isotropic V/m (volt-permeter) units which is similar to the Br resultant for magnetic fields.

AC ELF Magnetic Flux Density Product Emissions Testing

Vitatech recorded timed AC ELF magnetic flux density levels at a separation distance of two (2") inches from the Good Health Saunas 180-watt 120-volt and 80-watt 120- volt panel heaters for 7 to 10 minutes at 12" and 24" from the floor and/or base. Vitatech recorded the AC ELF (10 to 3000 Hz) magnetic fields in peak-to-peak units as shown in Figures #1 to #3 within our magnetic shielded enclosure. It should be noted that all recorded time-varying 60 Hz magnetic flux density levels within this report are presenting in peak-to-peak units of mG (milligauss) in the Bx, By and Bz axes and converted to root-means-square (RMS).

Figure #1, Panel RF181217-109 Magnetic Field Testing, presents the magnetic flux density levels recorded at the panel heater powered ON and OFF at 10" and 24" from the floor and within 2" from panel heater. As shown in Figure #1, a peak of 0.33 mG RMS was recorded at 24" from floor (nearby power supply). At 10" from floor and almost center of panel, a peak of 0.30 mG RMS was recorded. A baseline level of 0.06 mG RMS was recorded at the shielded enclosure.

Figure #2, Panel RF181217-120 Magnetic Field Testing, presents the magnetic flux density levels recorded at the panel heater powered ON and OFF at 10" and 24" from the floor and within 2" from panel heater. As shown in Figure #2, a peak of 0.76 mG RMS was recorded at 24" from floor (nearby power supply). At 10" from floor and almost center of panel, a peak of 0.34 mG RMS was recorded. A baseline level of 0.06 mG RMS was recorded at the shielded enclosure.

AC ELF Electric Field Strength Site Assessments

Vitatech recorded timed AC ELF electric and magnetic field strength with the EHP-50D isotropic three-axis electric field meter at a separation distance of two (>2") inches from all three (3) panel heaters for five minutes. The following table presents the isotropic peaks while heater panel is operational. All electric field strength levels are presented in isotropic V/m (volt-per-meter) units and magnetic field strength displayed in root-means-square (RMS) units. Note: the EHP50-D has a less sensitive measurement range for magnetic field strength and does not record below 0.25mG RMS.

Good Health Sauna – Sauna Heater
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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 – Director of Engineering	Date: 8 July 2021
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.		

Subject to the terms of the contract between Vitatech, Good Health Saunas
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Foreword

In 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. 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 Alternating Current (AC) electric fields with a compact field analyzer and 10 to 3,000 hertz for a laboratory grade fluxgate magnetometer. Together 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 electromagnetic field (EMF) exposure may differ from the measurements recorded during Vitatech's testing and that of the completed sauna.

Background

On Monday 21st of June 2021, EMF Technician Christina Vitale, 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 three (3) different Good Health Saunas heating devices. Vitatech conducted the assessment in a magnetically shielded 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 regular use of a sauna equipped with a heating device. During testing, the larger heater device's current draw was 1.8 Amperes at 120 volts. The smaller devices (see Image 1) had a current draw of 0.7 Amperes at 120 volts. Vitatech found and measured the locations of the highest peak of electromagnetic emissions on the surface of each device.

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

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Table 1: Summary of measurements from heating element (supply wires, etc.)

		E-Field [V/m RMS]	B-Field [mG RMS]
Sensor		Narda EHP-50D	Sensys FGM3D-SV
Frequency Range		10 to 1,000 Hz	10 to 3,000 Hz
Model #355	1. Power Source	269.40 V/m	0.30 mG RMS
	2. Middle	287.52 V/m	0.11 mG RMS
	3. Bottom	483.25 V/m	0.05 mG RMS
Model #016	Power Source (Center of heater)	520.47 V/m	0.23 mG RMS
Model #035	Power Source (Center of heater)	511.04 V/m	0.27 mG RMS

Red indicates the maximum value recoded during testing.

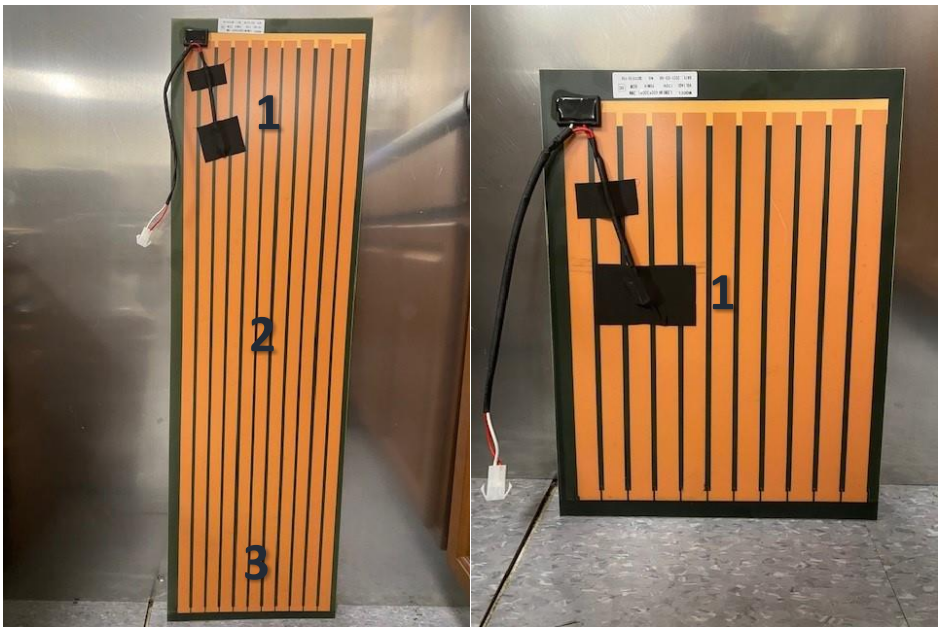

Image 1 Measurement Locations

Conclusions

The average values for the Good Health Saunas device are below the EN 55035:2017 standard 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 United States regulations nor laws regarding the maximum permissible exposure.

This completes the Good Health Saunas – sauna heater – Electromagnetic emissions survey documentation and assessment.

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Survey Equipment

NARDA EHP-50D

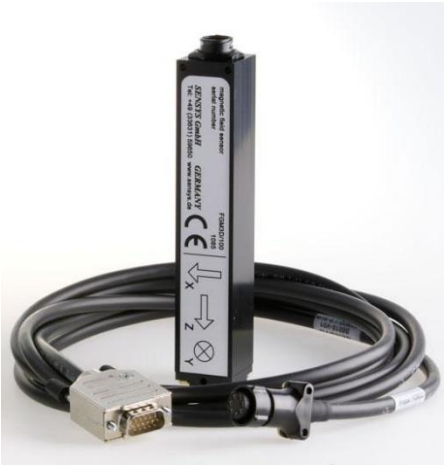
The NARDA EHP-50D records electric field strength in Volt-per-meter(V/m) and magnetic field strength in micro-Tesla (µT) from one (1) hertz to one-hundred thousand hertz (100 kHz). With a measurement range of 5 mV/m to 1 kV/m for electric fields and 0.3 nano-Tesla to 100 micro-Tesla for magnetic fields. The EHP-50D 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.

Table 1-1 Technical specifications of the EHP-50D Electric and Magnetic Field Analyzer

	Electric Field	Magnetic Field
Frequency range	5 Hz ÷ 100 kHz	
Measurement range (1)	5 mV/m ÷ 1 kV/m 500mV/m ÷ 100 kV/m (146 dB)	0.3 nT ÷ 100 µT 30 nT ÷ 10 mT (150 dB)
Overload	200 kV/m	20 mT
Dynamic range	106 dB	110 dB
Resolution (2)	1 mV/m with NBM-550 0.1 mV/m with EHP-TS SW 1 mV/m Stand alone	0.1 nT with NBM-550 0.1 nT with EHP-TS SW 1 nT Stand alone
Displayed average noise level (3) **Isotropic result** **Single axis**	 5 mV/m 3 mV/m	 0.3 nT 0.2 nT
Flatness (@ 100 V/m and 2 µT) **(5 Hz ÷ 40 Hz)** **(40 Hz ÷ 100kHz)**	 0.8 dB 0.35 dB	 0.8 dB 0.35 dB
Anisotropicity	0.54 dB	0.12 dB
Linearity (referred to 100 V/m and 1 µT)	0.2 dB (1 V/m ÷ 1 kV/m)	0.2 dB (200 nT ÷ 10 mT)
Internal memory	Up to 24 hours regardeless the logging rate.	
Internal data logger	1 measurement every 30 or 60 seconds	
Spectrum analysis method	FFT	
Acquisition method	Simultaneous three axis acquisition	
SPAN	100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 10 kHz, 100 kHz (500Hz to 100kHz in Stand Alone mode)	
Start frequency	1.2 % of the SPAN	
Stop frequency	Equal to the SPAN	
Rejection to E fields	---	> 20 dB
Rejection to H fields	> 20 dB	---
Calibration	internal E^2PROM	
Typical temperature deviation @ 55 Hz referred to 23°C (@ 50% of relative humidity when applicable)	$-4x10^{-3}$ dB/°C between -20 and +55 °C	$-8x10^{-3}$ dB/°C between -20 and +23 °C $+13x10^{-3}$ dB/°C between 23 and 55 °C
Typycal relative humidity deviation @ 55 Hz referred to 50% (@ 23 °C)	$+11x10^{-3}$ dB/% between 10 and 50 % $+22x10^{-3}$ dB/% between 50 and 90 %	$-7x10^{-3}$ dB/% between 10 and 50 % $+10x10^{-3}$ dB/% between 50 and 90 %
Dimensions	92 x 92 x 109 mm	
Weight	550 g	
Tripod support	Threaded insert ¼"	
Internal battery	3.7 V / 5.4 Ah Li-Ion, rechargeable	

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 $pT_{RMS}/\sqrt{Hz}$. 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 $pT_{rms}/\sqrt{Hz}$	< 8 $pT_{rms}/\sqrt{Hz}$	@ 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		