

Vitatech Electromagnetics

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AC ELF EMF/EMC 2024 REPORT



Good Health Saunas GOAT, Hybrid and Signature

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Contents

Foreword	3
Background	3
Conclusion	5
Abbreviations and Glossary of Terms	6

Foreword

Since 2016, Good Health Saunas has consulted Vitatech for product testing for several heater panel models rated at 300 watts/120V measured in a shielded enclosure to minimize EMI from ambient and localized sources. This study presents recorded electromagnetic interference (EMI) readings within three sauna heater model enclosures at their Waukesha facility. In 2017, Vitatech developed a standardized procedure for recording electric and magnetic emissions at the surface of the heating element at a distance where the customer would position themselves inside the sauna enclosure. The bandwidth for recording the heating elements was established between 10 to 1,000 hertz for Alternating Current (AC) electric and magnetic fields.

Background

Vitatech Electromagnetics LLC (Vitatech) recorded alternating current (AC) electromagnetic interference (EMI) for frequencies from 10-Hertz (Hz) to 1,000 Hz for electric and magnetic fields. The survey documented EMI within three Good Health Saunas models: GOAT, Hybrid, and Signature in Waukesha, Wisconsin. The objective of the study was to verify the maximum EMI exposure levels for customers inside the sauna enclosures at multiple points along the seat and head heights. The following table presents the maximum recommended thresholds based on the Institute of Electric and Electronic Engineers (IEEE) for general public and continuous exposure.

Table 1: Standards and Levels

E-Field [V/m RMS]	B-Field [mG RMS]
EEE Std C95.6-2002	EN 55035:2017
5,000 volts-per-meter (V/m) RMS @60 Hz	1 A/m (12.57 mG RMS)

Maximum recordings at the GOAT, Hybrid and Signature models are presented below at several test points within the enclosure. The test points and maximum EMI levels are presented below in Table 2 and Image 1 and 2.

Table 2: Summary of Maximum Measurements from GOAT, Hybrid and Signature Models

			E-Field [V/m RMS]	B-Field [mG RMS]
Sensor			Narda EHP50F	Narda EHP50F
Frequency Range			10 to 1,000 Hz	10 to 1,000 Hz
Sauna Model	GOAT	Ambient*	0.12 V/m	0.376 mG
	GOAT	Point 1	403.79 V/m	0.502 mG
	GOAT	Point 2	144.64 V/m	0.376 mG
	GOAT	Point 3	68.54 V/m	0.376 mG
	GOAT	Point 4	75 V/m	0.502 mG
	GOAT	Point 5	101.48 V/m	0.376 mG
	GOAT	Point 6	107.75 V/m	0.376 mG
	GOAT	Point 7	94.46 V/m	0.502 mG
	Hybrid	Ambient	0.17 V/m	1.00 mG
	Hybrid	Point 1	118.74 V/m	1.38 mG
	Hybrid	Point 2	49.04 V/m	1.63 mG
	Hybrid	Point 3	12.17 V/m	1.14 mG
	Hybrid	Point 4	17.89 V/m	1.14 mG

	Hybrid	Point 5	45.22 V/m	1.38 mG
	Hybrid	Point 6	47.76 V/m	1.38 mG
	Hybrid	Point 7	76.49 V/m	0.88 mG
	Signature	Ambient	0.29 V/m	1.50 mG
	Signature	Point 1	405.96 V/m	0.12 mG
	Signature	Point 2	144.70 V/m	1.38 mG
	Signature	Point 3	54.51 V/m	0.12 mG
	Signature	Point 4	133.51 V/m	1.00 mG
	Signature	Point 5	99.79 V/m	1.50 mG
	Signature	Point 6	50.44 V/m	1.50 mG
<p>*Ambient measurement point indicates sauna was off and unplugged. Refer to Image 2.</p> <p>- Signature model does not contain alloy heating element</p>				

Image 1: Test points 1 through 7 for GOAT, Hybrid and Signature Models

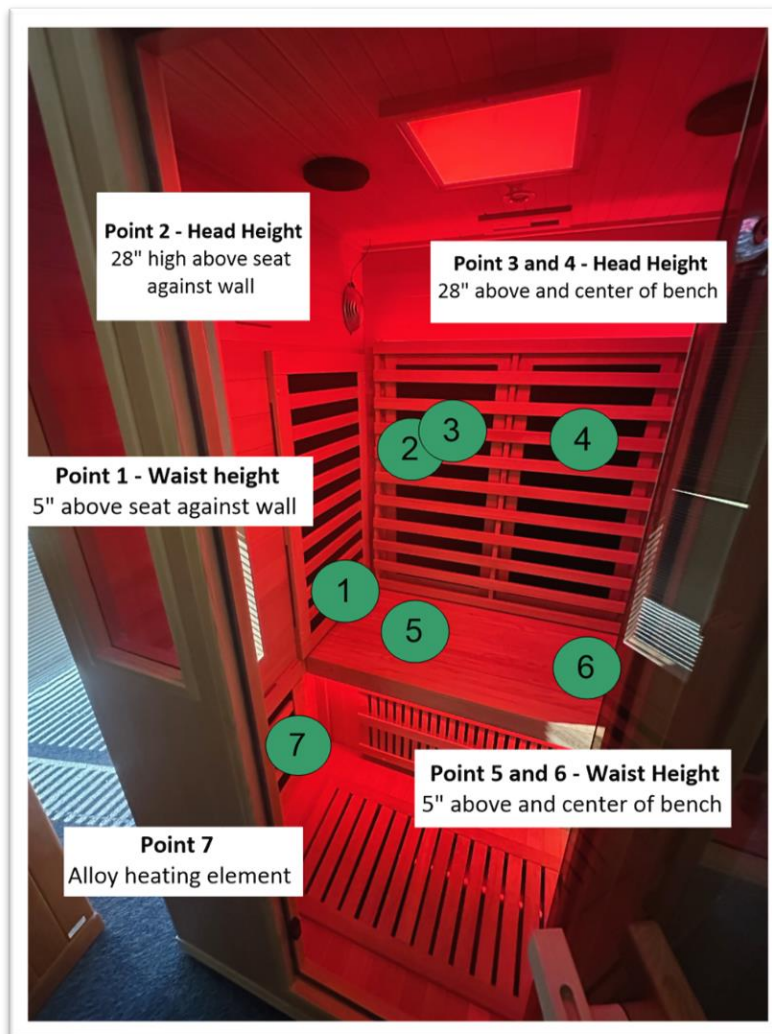


Image 2: Ambient Test Location at Center of All Saunas



Conclusion

The average values recorded at the GOAT, Hybrid and Signature models are below the EN 55035:2017 standard of 1 A/m (12.57 mG RMS) for 60 Hz magnetic fields. Furthermore, the recorded electric field strength is less than the recommended IEEE standard 95.6:2002 of 5,000 V/m for whole body exposure. The following guidelines are not subject to United States regulations or laws for maximum permissible exposure to 60 Hz radiated emissions or otherwise exposure to electromagnetic fields.

This completes the EMI Baseline study report. Please contact Vitatech if you have any further questions.

Abbreviations and Glossary of Terms

Abbreviation	Explanation/Definition
AC	Alternating Current
AFF	Above finished floor
CD	Construction Document
DC	Direct Current
EHF	Extremely high frequency (ITU band 11, 30-300 GHz frequency, 10-1 mm wavelength)
ELF	Extremely Low Frequency (ITU band 1, 3-30 Hz frequency, 100,000-10,000 km wavelength)
EMF	Electromagnetic Field
EMI	Electromagnetic Interference
EMT	Electric Metallic Tube
HF	High frequency (ITU band 7, 3-30 MHz frequency, 100-10 m wavelength)
Hz	hertz
kHz	kilohertz
LF	Low frequency (ITU band 5, 30-300 kHz frequency, 10-1 km wavelength)
MF	Medium frequency (ITU band 6, 300-3,000 kHz frequency, 1,000-100 m wavelength)
mG	Milligauss, equivalent to 1.0×10^{-7} tesla and 1.0×10^2 nanotesla
MHz	megahertz
N.E.C.	National Electric Code
N.E.S.C.	National Electric Safety Code
nT	Nanotesla, equivalent to 1.0×10^{-5} Gauss and 1.0×10^{-2} Milligauss
p-p	Peak to peak
PPE	Personal Protective Equipment
PVC	Polyvinyl chloride
QSDC	Quasi-static direct current
RF	Radio Frequency
RFI	Radio Frequency Interference
RGS	Rigid galvanized steel
RMC	Rigid metal conduit
RMS	Root Mean Square
SELF	Sub-extremely low frequency

SHF	Super High frequency (ITU band 10, 3-30 GHz frequency, 100-10 mm wavelength)
SLF	Super low frequency (ITU band 2, 30-300 Hz frequency, 10,000-1,000 km wavelength)
THF	Tremendously high frequency (ITU band 12, 300-3,000 GHz frequency, 1-0.1 mm wavelength)
UHF	Ultra-high frequency (ITU band 9, 300-3,000 MHz frequency, 1-0.1 m wavelength)
ULF	Ultra-low frequency (ITU band 3, 300-3000 Hz frequency, 1,000-100 km wavelength)
VHF	Very high frequency (ITU band 8, 30-300 MHz frequency, 10-1 m wavelength)
VLF	Very low frequency (ITU band 4, 3-30 kHz frequency, 100-10 km wavelength)

Terminology	Explanation/Definition
Magnetic field	A vector field produced by a magnetic object, electric current or varying electric field and is detected by the force it exerts on other magnetic materials and moving electric charges.
Magnetic flux density	A vector field quantity, B, which results in a force that acts on a moving charge or charges, and is expressed in tesla (T)
Digitizer	A device used to convert an analog signal to a digital signal
Hazard	An intrinsic property or condition of a device, or location, that has the potential to cause harm to people or damage to property
Mains [Mainz]	The primary 50/60 hertz electrical power delivered to a home or business. Typically, it consists of multiple phases/voltages.
Personal Protective Equipment	Equipment designed to protect personnel from serious workplace injuries or illnesses resulting from exposure to RF energy, contact with chemical, radiological, and physical agents, and electrical, mechanical and other workplace hazards. For purposes of RF safety, PPE includes electrically insulating gloves and RF- attenuating clothing in the form of coveralls, gloves, socks, and shielding hood assemblies.
Positive Access Control Barriers	Locked doors and ladder cages, positive access control fences, etc. that are a form of engineering controls and that provide a positive restriction on access.
Radio Frequency	A frequency or band of frequencies suitable for telecommunications. [For this report refers directly to 75 MHz to 3,000 MHz]
Radio Frequency Hazard Area	For purposes of this report an area in which RF fields or contact induced currents or contact voltage may exceed the exposure limit or reference levels of an RF exposure regulation, standard or guideline [FCC Bulletin OET 65]