

GIS

Good Health Saunas

AC ELF EMF/EMC 2019 REPORT

April 16th, 2019



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ELECTROMAGNETICS

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2019 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 2019 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 April 16th, 2019, 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-to-peak (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 peak-to-peak 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-means-square) units. All electric field strength levels are presented in isotropic V/m (volt-per-meter) 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.



FIGURE #1, Good Health Sauna EMF/EMC Magnetic Field Testing

AC ELF Magnetic Flux Density 10 Hz to 3000 Hz Data
Instrument: Three Single-Axis Sensys Magneometer 24-Bit
Model: LOWEMF300*400*1.2MM
No: RF181217-109



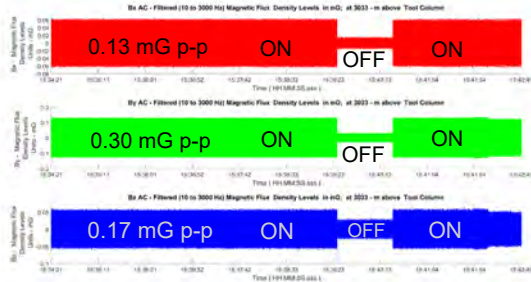
Maximum Peak to Peak at 10"
Bx (Horizontal) p-p = 0.13 mG
By (Horizontal) p-p = 0.30 mG
Bz (Vertical) p-p = 0.17 mG

Maximum Peak to Peak at 24"
Bx (Horizontal) p-p = 0.33 mG
By (Horizontal) p-p = 0.29 mG
Bz (Vertical) p-p = 0.18 mG



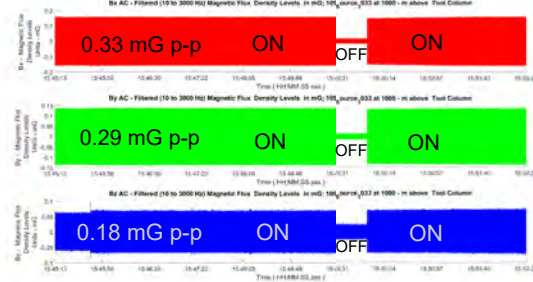
At 10" in elevation

10 Hz to 3000 Hz AC ELF



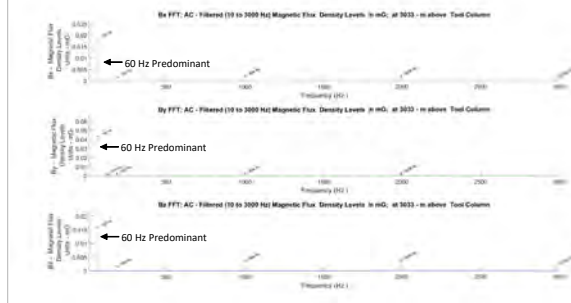
At 24" in elevation

10 Hz to 3000 Hz AC ELF



At 10" in elevation

FFT



At 24" in elevation

FFT

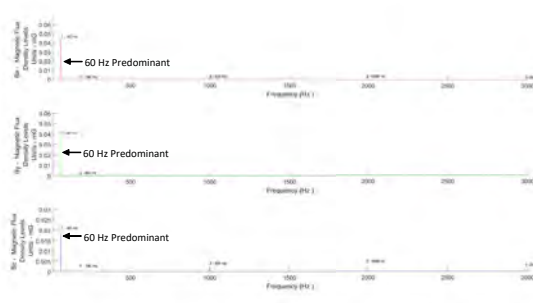


FIGURE #2, Good Health Sauna EMF/EMC Magnetic Field Testing

AC ELF Magnetic Flux Density 10 Hz to 3000 Hz Data
Instrument: Three Single-Axis Sensys Magneometer 24-Bit
Model: LOWEMF300*400*1.2MM
No: RF181217-120



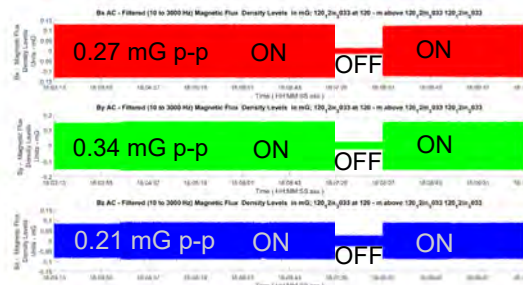
Maximum Peak to Peak at 10"
Bx (Horizontal) p-p = 0.27 mG
By (Horizontal) p-p = 0.34 mG
Bz (Vertical) p-p = 0.21 mG

Maximum Peak to Peak at 24"
Bx (Horizontal) p-p = 0.56 mG
By (Horizontal) p-p = 0.52 mG
Bz (Vertical) p-p = 0.76 mG



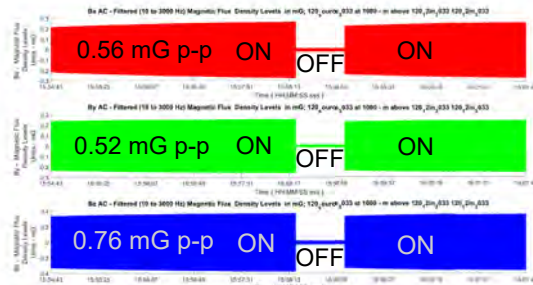
At 10" in elevation

10 Hz to 3000 Hz AC ELF



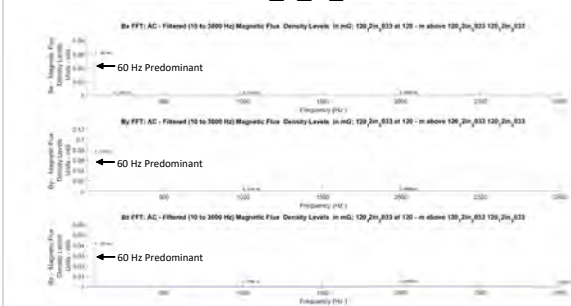
At 24" in elevation

10 Hz to 3000 Hz AC ELF



At 10" in elevation

FFT



At 24" in elevation

FFT

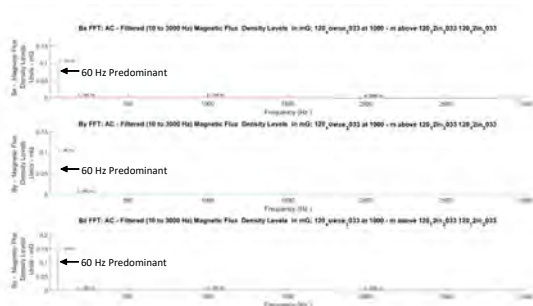


FIGURE #3, Good Health Sauna EMF/EMC Magnetic Field Testing

AC ELF Magnetic Flux Density 10 Hz to 3000 Hz Data
Instrument: Three Single-Axis Sensys Magnetometer 24-Bit
Model: LOWEMF300*400*1.2MM
No: QD181217-002

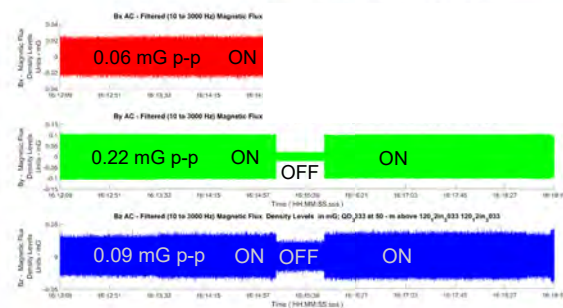


Maximum Peak to Peak at 7"
Bx (Horizontal) p-p = 0.06 mG
By (Horizontal) p-p = 0.22 mG
Bz (Vertical) p-p = 0.09 mG



At 7" in elevation

10 Hz to 3000 Hz AC ELF



At 7" in elevation

FFT

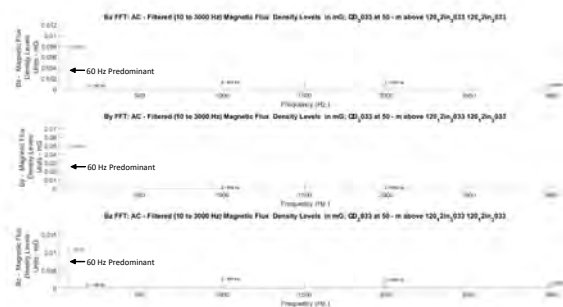


FIGURE #4, Good Health Sauna EMF/EMC Magnetic Field Testing

AC ELF Electric (E) and Magnetic (H) Field Testing
Instrument: EHP 50B Probe, 10 Hz to 1kHz
Model: LOWEMF300*400*1.2MM
Model Numbers: RF181217-109, RF181217-120, QD181217-002



Model No: RF181217-109

Model No: RF181217-120

Model No: QD181217-002



Current Draw from Panel 1.44 amps

Current Draw fr

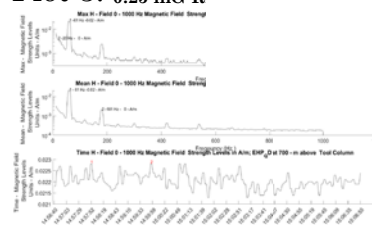
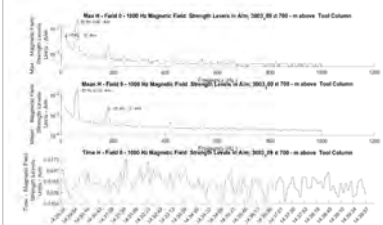
Model No: RF181217-109

Model No:

**Plot 1: Max Magnetic (H) Field:
0.25 mG RMS (0.02 A/m) at 60Hz**

**Plot 2: Max Magnetic (H) Field:
0.25 mG RMS (0.02 A/m) at 60Hz**

Plot 3: Max Magn



Model No: RF181217-109

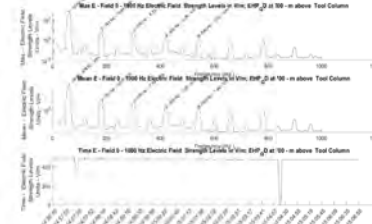
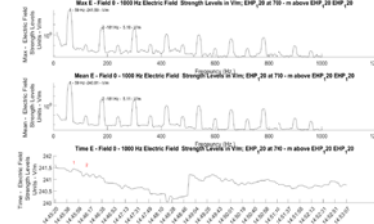
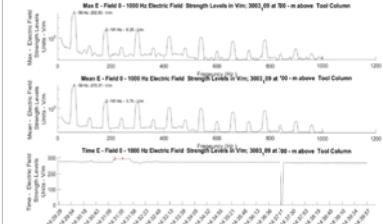
Model No: RF181217-120

Model No: QD181217-002

**Plot 1A: Max Electric (E) Field:
292.83 V/m at 60Hz**

**Plot 2A: Max Electric (E) Field:
241.59 V/m at 60Hz**

**Plot 3A: Max Electric (E) Field:
481.21 V/m at 60Hz**



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-to-peak (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 peak-to-peak 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). Finally, peak electric field strength levels recorded at all three (3) panels are within ICNIRP recommendations of 4,167 V/m for human health exposure for the general public (see Figure #4).

Background

Vitatech Electromagnetics, LLC was commissioned by Good Health Saunas to perform comprehensive AC ELF EMF/EMC (electromagnetic compatibility) testing for the new 2019 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 April 16th, 2019, by a Vitatech EMF Technician.

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-means-square) units. All electric field strength levels are presented in isotropic V/m (volt-per-meter) units which is similar to the Br resultant for magnetic fields.

Task #1- Site Survey Data Collection

AC Wideband Magnetic Flux Density

Vititech 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. Vititech 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	Peak Magnetic Field Level At 7" to 10" from floor	Peak Magnetic Field Level At 24" from floor (at source)	Baseline Peak Ambient Magnetic
Figure #1 RF181217-109	0.30 mG p-p By axis (0.84 mG RMS)	0.33 mG p-p Bx axis (0.92 mG RMS)	0.06 mG p-p (0.16 mG RMS)
Figure #2 RF181217-120	0.34 mG p-p By axis (0.95 mG RMS)	0.76 mG p-p Bz axis (2.66 mG RMS)	0.06 mG p-p (0.16 mG RMS)
Figure #3 QD181217-002	0.22 mG p-p By axis (0.61 mG RMS)	n/a	0.06 mG p-p (0.16 mG RMS)

Table #1, AC Wideband Summary

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.

Figure #3, Panel QD181217-002 Magnetic Field Testing, presents the magnetic flux density levels recorded at the panel heater powered ON and OFF at 7" from the floor and within 2" from panel heater. As shown in Figure #3, a peak of 0.22 mG RMS was recorded at 2" from the panel. A baseline level of 0.06 mG RMS was recorded at the shielded enclosure.

Electric and Magnetic Field Strength

Vititech 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.

Figure #4	Magnetic Field Strength Powered ON	Electric Field Strength (Isotropic Levels)
RF181217-109	0.25 mG RMS	292.83 V/m
RF181217-120	0.25 mG RMS	241.59 V/m
QD181217-002	0.25 mG RMS	481.21 V/m

Table #2, Magnetic and Electric Field Strength Summary

This completes the AC ELF EMF/EMC Magnetic and Electric Field Testing for Good Health Saunas.

Glossary of Abbreviations

Abbreviation	Explanation/Definition
AC	Alternating Current
DC	Direct Current
ELF	Extremely Low Frequency
EMF	Electromagnetic Field
EMI	Electromagnetic Interference
EMP	Electromagnetic pulse
Hz	Hertz
kHz	Kilohertz
MHz	Megahertz
mG	Milligauss, equivalent to 1.0×10^{-7} tesla
N.E.C.	National Electric Code
N.E.S.C.	National Electric Safety Code
p-p	Peak to peak
PPE	Personal Protective Equipment
PVC	Polyvinyl chloride
RF	Radio Frequency
RFI	Radio Frequency Interference
RFSP	Radio Frequency Safety Program
RGS	Rigid galvanized steel
RMS	Root Mean Square
ROW	Right of way
SELF	Sub-extremely low frequency

Glossary of Terms

Terminology	Explanation/Definition
Access Controls	A practice of restricting access to areas wherein RF exposure may exceed applicable exposure limits via physical means such as indicative or positive access control barriers or by the installation of appropriate signage. RF safety signage, when used in controlled environments and combined with appropriate RF safety training or information can be a sufficient means of access control
Administrative Controls	Procedures and information provided to personnel for the purpose of reducing exposure to potential RF hazards and that generally depend on the awareness and participation of personnel for their

	effectiveness. Examples include warning signs and alarms, indicative barriers, standard operating procedures, personal protective equipment (PPE), time limits on the duration of exposure, and RF safety training
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
Controlled Environment	An area where the occupancy and activity of those within is subject to control and accountability as established by an RFSP for the purpose of protections from RF exposure hazards. See also: general public exposure and occupational exposure Contrast: Uncontrolled Environment
General Public Exposure	RF exposure of persons who have not received any form of RF safety awareness information or training. Typically, general public exposure occurs in uncontrolled environments and includes individuals of all ages and varying health status, including children, pregnant women, individuals with impaired thermoregulatory systems, individuals equipped with electronic medical devices, and persons using medications that may result in poor thermoregulatory system performance.
Hazard	An intrinsic property or condition of a device, or location, that has the potential to cause harm to people or damage to property
Indicative barrier	Barriers, such as chains, rails, and demarcated areas that require awareness and participation of personnel as a form of administrative control
Maximum Permissible Exposure (MPE)	Derived limits in RF exposure standards for time averaged and peak exposures to ambient electric (E) and magnetic (H) fields;
Normally Accessible Area	For RF protection purposes an area that can be accessed without recourse to special actions, special equipment, or personal protective equipment without which access is not feasible

Occupational Exposure	RF exposure of persons resulting as a consequence of their employment who have been made fully aware of the potential for exposure and can exercise control over their exposure such as through the use of administrative or engineering controls or safe work practices
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]

FIGURE #1, Good Health Sauna EMF/EMC Magnetic Field Testing

AC ELF Magnetic Flux Density 10 Hz to 3000 Hz Data
Instrument: Three Single-Axis Sensys Magneometer 24-Bit
Model: LOWEMF300*400*1.2MM
No: RF181217-109



Maximum Peak to Peak at 10"

Bx (Horizontal) p-p = 0.13 mG
By (Horizontal) p-p = 0.30 mG
Bz (Vertical) p-p = 0.17 mG

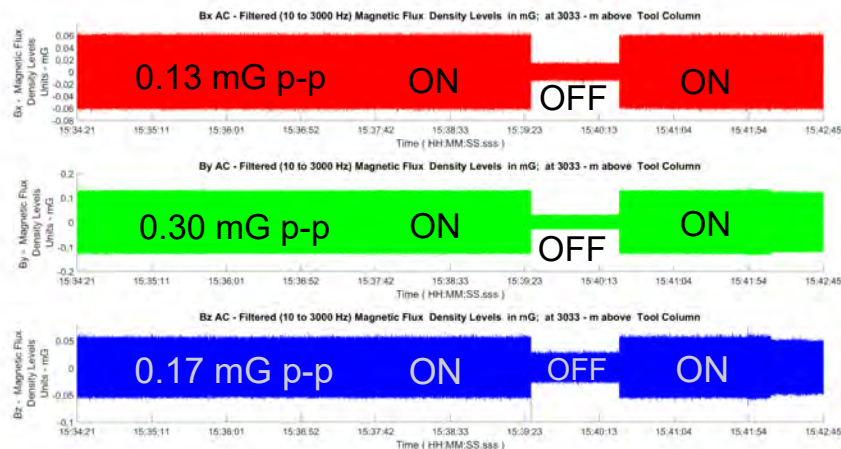
Maximum Peak to Peak at 24"

Bx (Horizontal) p-p = 0.33 mG
By (Horizontal) p-p = 0.29 mG
Bz (Vertical) p-p = 0.18 mG



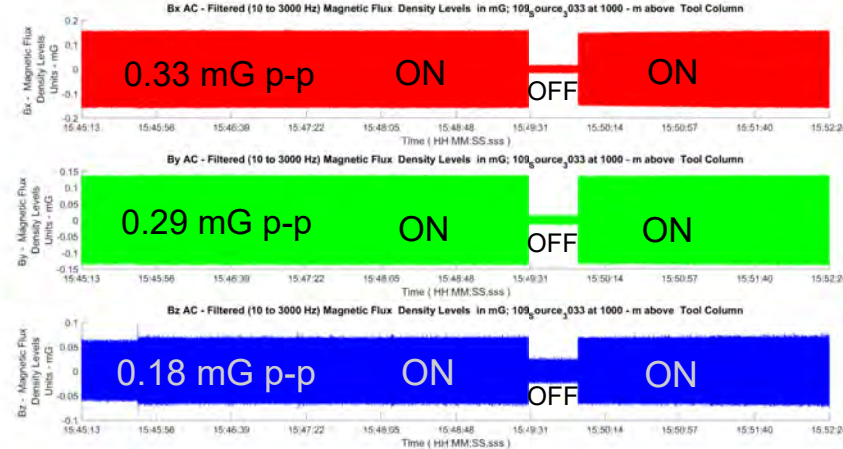
At 10" in elevation

10 Hz to 3000 Hz AC ELF



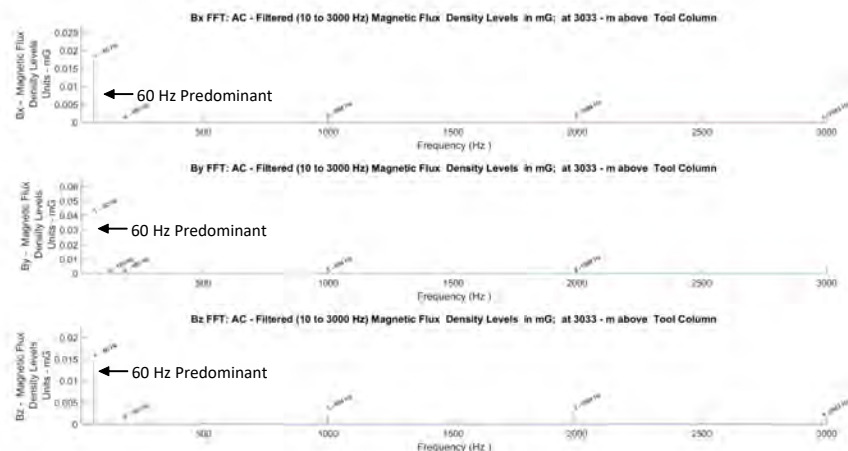
At 24" in elevation

10 Hz to 3000 Hz AC ELF



At 10" in elevation

FFT



At 24" in elevation

FFT

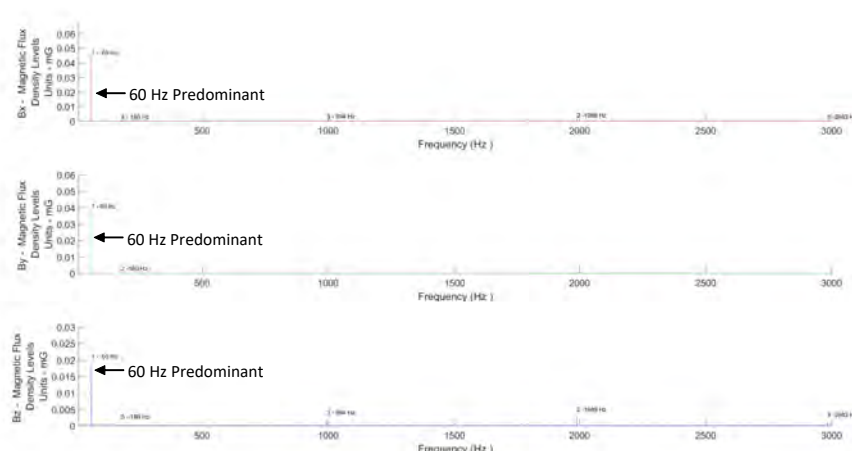


FIGURE #2, Good Health Sauna EMF/EMC Magnetic Field Testing

AC ELF Magnetic Flux Density 10 Hz to 3000 Hz Data

Instrument: Three Single-Axis Sensys Magneometer 24-Bit

Model: LOWEMF300*400*1.2MM

No: RF181217-120



Maximum Peak to Peak at 10"

Bx (Horizontal) p-p = 0.27 mG

By (Horizontal) p-p = 0.34 mG

Bz (Vertical) p-p = 0.21 mG

Maximum Peak to Peak at 24"

Bx (Horizontal) p-p = 0.56 mG

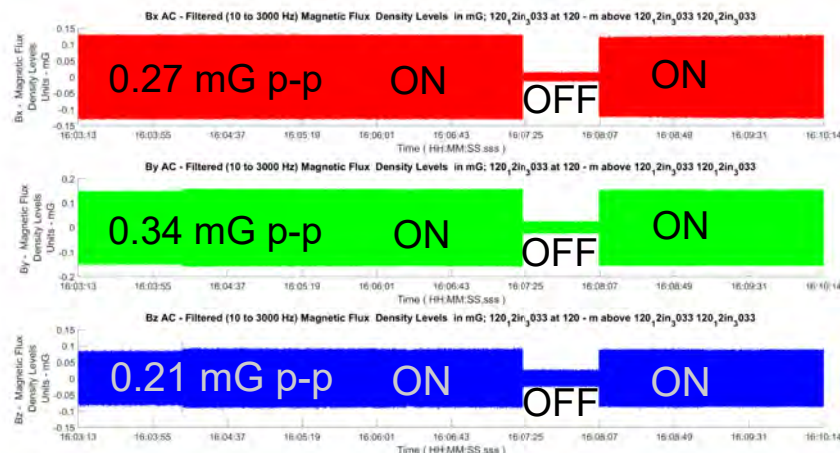
By (Horizontal) p-p = 0.52 mG

Bz (Vertical) p-p = 0.76 mG



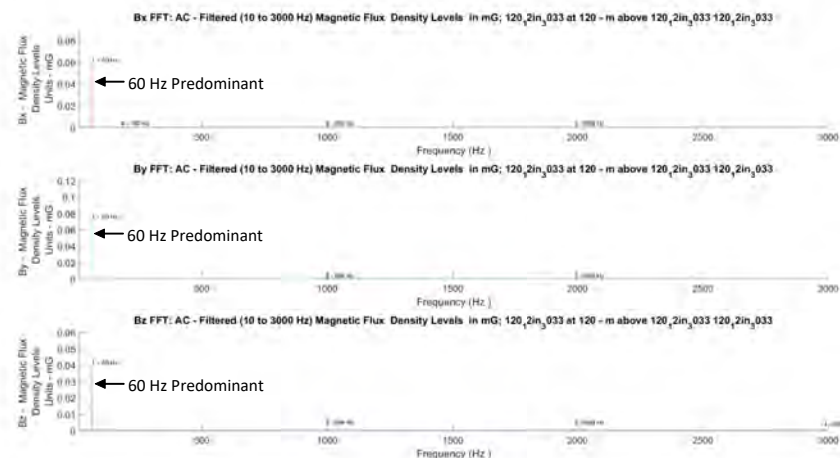
At 10" in elevation

10 Hz to 3000 Hz AC ELF



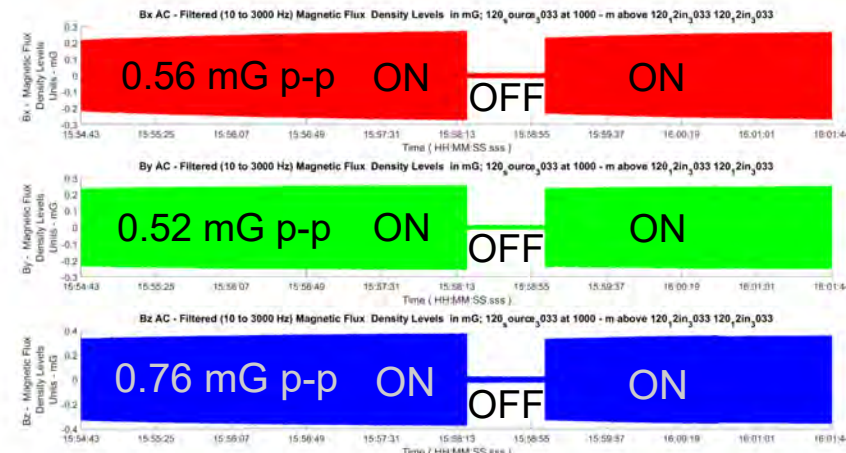
At 10" in elevation

FFT



At 24" in elevation

10 Hz to 3000 Hz AC ELF



At 24" in elevation

FFT

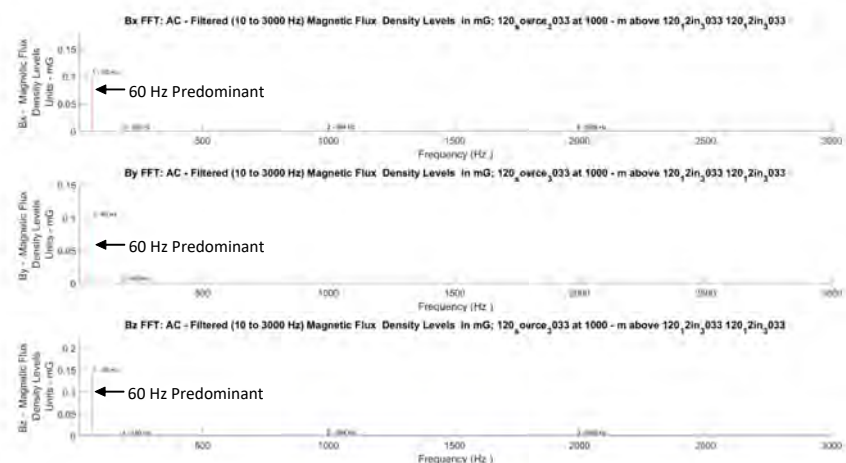


FIGURE #3, Good Health Sauna EMF/EMC Magnetic Field Testing

AC ELF Magnetic Flux Density 10 Hz to 3000 Hz Data

Instrument: Three Single-Axis Sensys Magneometer 24-Bit

Model: LOWEMF300*400*1.2MM

No: QD181217-002



Maximum Peak to Peak at 7"

Bx (Horizontal) p-p = 0.06 mG

By (Horizontal) p-p = 0.22 mG

Bz (Vertical) p-p = 0.09 mG



At 7" in elevation

10 Hz to 3000 Hz AC ELF



At 7" in elevation

FFT

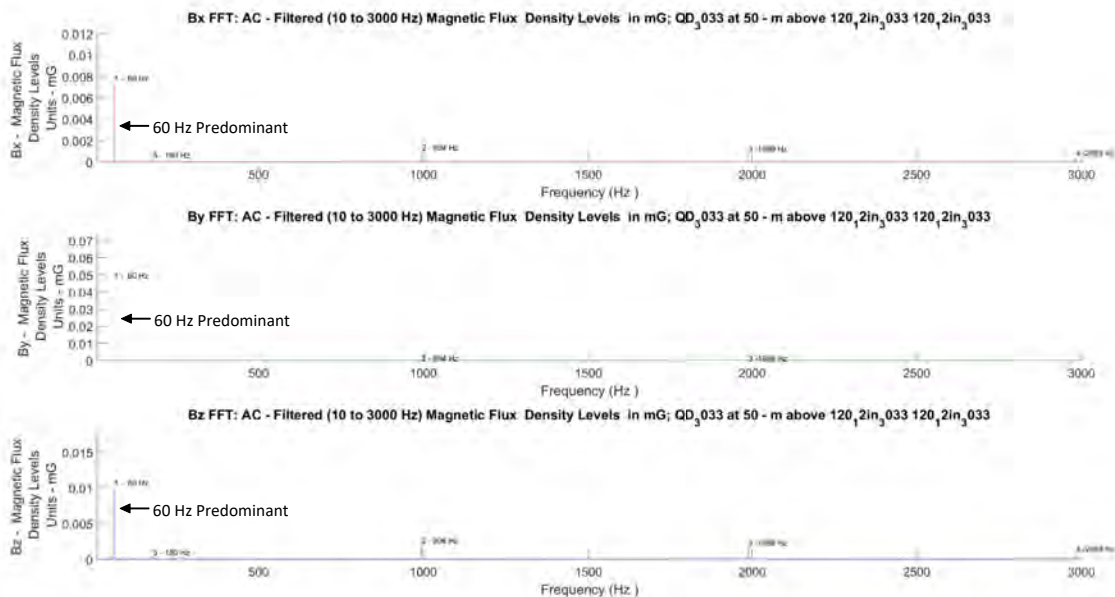


FIGURE #4, Good Health Sauna EMF/EMC Magnetic Field Testing

AC ELF Electric (E) and Magnetic (H) Field Testing

Instrument: EHP 50B Probe, 10 Hz to 1kHz

Model: LOWEMF300*400*1.2MM

Model Numbers: RF181217-109, RF181217-120, QD181217-002



Model No: RF181217-109



Model No: RF181217-120



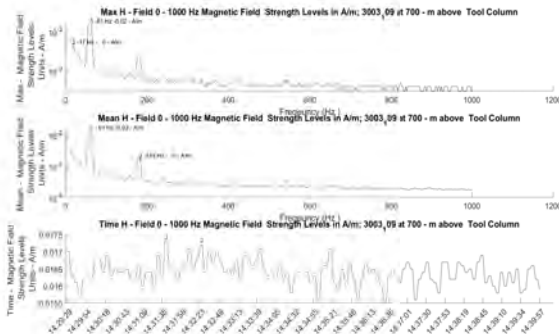
Model No: QD181217-002



Current Draw from Panel **1.44 amps**

Model No: RF181217-109

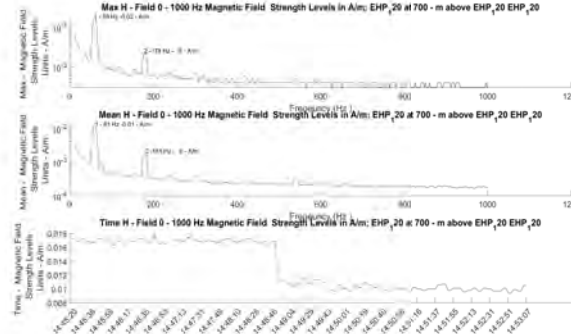
Plot 1: Max Magnetic (H) Field:
0.25 mG RMS (0.02 A/m) at 60Hz



Current Draw from Panel **1.39 amps**

Model No: RF181217-120

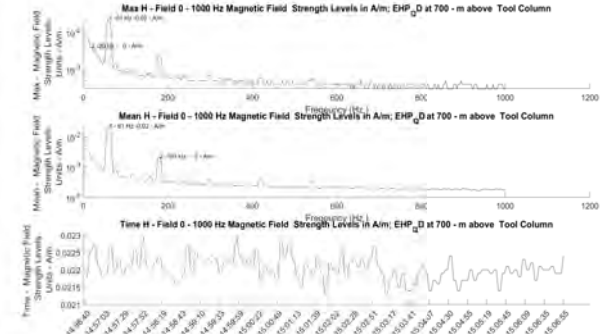
Plot 2: Max Magnetic (H) Field:
0.25 mG RMS (0.02 A/m) at 60Hz



Current Draw from Panel **0.65 amps**

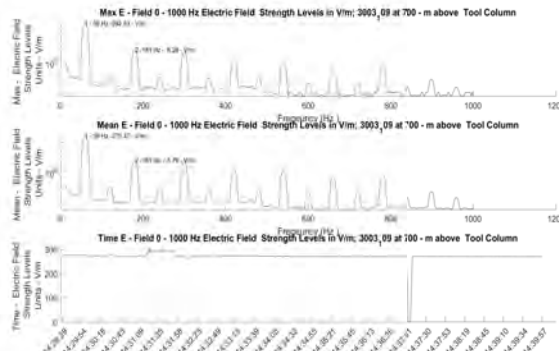
Model No: QD181217-002

Plot 3: Max Magnetic (H) Field:
0.25 mG RMS (0.02 A/m) at 60Hz



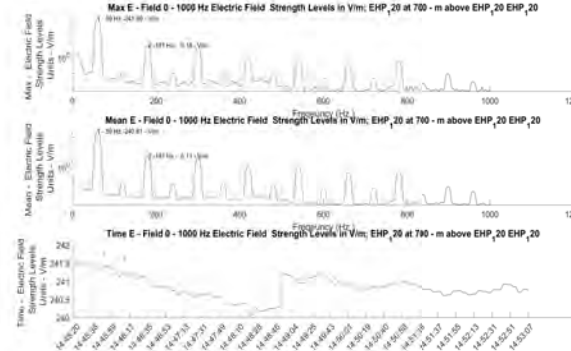
Model No: RF181217-109

Plot 1A: Max Electric (E) Field:
292.83 V/m at 60Hz



Model No: RF181217-120

Plot 2A: Max Electric (E) Field:
241.59 V/m at 60Hz



Model No: QD181217-002

Plot 3A: Max Electric (E) Field:
481.21 V/m at 60Hz

