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	Document name: Electromagnetic Radiation from Infrared Saunas			

Electromagnetic Radiation from Infrared Saunas

Based on TylöHelo's products



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Abstract

This report contains data from TylöHelo's infrared emitters placed in their infrared saunas. EMR readings have been established and put into perspective. The readings are observed via a tri-field meter. The report concludes the safety of using an infrared sauna from TylöHelo and compares the data to the radiation of a conventional phone. Results show that the radiation from the far infrared emitters in the sauna is extremely low and close to negligible.



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1. Introduction

1.1 Background

As infrared saunas get more and more common, the concern of them being harmful, due to dangerous electromagnetic radiation, increases.

The electromagnetic radiation (EMR) is measured in the unit Gauss (G) but more commonly with a prefix (mG). TylöHelo's far infrared emitters are supposed to produce a radiation level of less than 2 mG. There is no current official standard of how much electromagnetic radiation an infrared sauna can emit.


1.2 Purpose

The purpose is the following:

To determine how much electromagnetic radiation a user gets exposed to during conventional use of TylöHelo's infrared saunas.

Be able to put the data in perspective and compare the radiation to other regularly used products and standards.

Determine if TylöHelo's far infrared emitters meet the requirements of less than 2 mG radiation everywhere where the human body can exist inside an infrared sauna.

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2. Method

2.1 Overview

All tests consisted of observing readings at regular intervals using a tri-field meter. The tri-field meter used in the experiment outputs a live feed of data and a max value from the last three seconds. The max value was the one used in all the data points. The tri-field meter has been factory calibrated.

When taking readings on infrared panels, the tri-field meter was placed on the wooden part where the user's body leans. The reason for this is based on that the user cannot get any closer to the panels, therefore users will not be exposed to higher levels of radiation.



Figure 2.1 – Tri-field meter

2.2 Readings on Tylösand

Readings were observed on TylöHelo's infrared cabin, Tylösand T-870. The data points were taken in 22 different places inside the cabin (see figure 2.2 – 2.4) with intervals of 5 minutes over the course of an hour. That sums up to 286 data points. It takes about 1.5 minutes to take readings of every marked place in the cabin. There are always approximately 1.5 minutes between the reading on "A1" and "E". This time difference is consistent and does not affect the result.



Figure 2.2 – Panel A



Figure 2.3 – Panel B

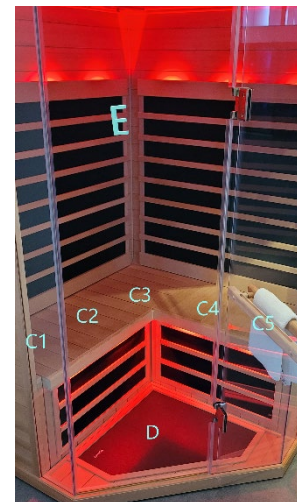



Figure 2.4 – C, D, and E

The places starting with the same letter originate from the same panel. (see figure 2.2 – 2.4). The place labeled "E" is in the center of the cabin. (see figure 2.4).

As shown in figure 2.2 – 2.4, the readings were taken, evenly spread, on the panels. Every panel has a spot where the readings are highest which are not included in the first test. These

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are the spots where the infrared emitters are located. Readings were taken on these spots separately with one-minute intervals over the course of an hour. These locations are labeled “G” and “H”. (see figure 2.5 – 2.6)

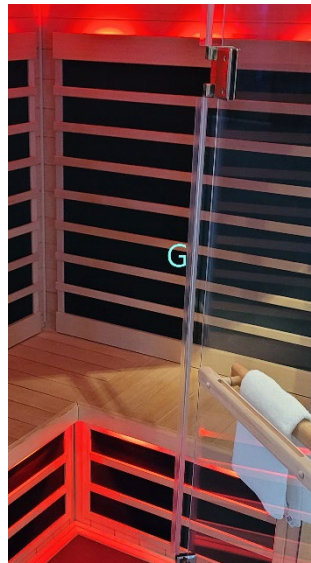



Figure 2.5 – Point G



Figure 2.6 – Panel H

2.3 Readings on phone

Readings were observed on an ordinary mobile phone. The model name used was Samsung Galaxy s20 FE 4G. The phone was turned on and transmitting a call during the entire test. The data points were taken one centimeter from the phone once every minute over the course of an hour. The data could not be taken any closer, because the tri-field meter in use had reached its max reading capacity. The reason for conducting tests on a phone is that it serves as a reference. A phone is something most people use daily and usually keep close to their body, for example in a pocket or to the head while talking. The results from the other tests can be compared to the results from the phone, providing context to the values.

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3. Results

3.1 Readings on Tylösand

	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	D	E		Average	
00:00	0,7	0,7	0,7	0,7	0,7	0,7	0,5	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,6	0,8	0,8	0,8	00:00	0,70	
00:05	0,7	0,7	0,7	1	0,7	0,7	0,5	0,8	0,8	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,6	0,8	0,7	1,0	00:05	0,73	
00:10	0,6	0,6	0,6	0,6	0,6	0,6	0,4	0,6	0,8	0,7	0,6	0,7	0,7	0,6	0,7	0,6	0,6	0,6	0,5	0,7	0,7	0,7	00:10	0,63	
00:15	0,5	0,6	0,6	0,5	0,5	0,5	0,4	0,7	0,7	0,7	0,6	0,7	0,7	0,6	0,7	0,6	0,6	0,6	0,5	0,7	0,7	0,8	00:15	0,61	
00:20	0,7	0,7	0,7	0,7	0,6	0,7	0,5	0,7	0,9	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,6	0,7	0,7	0,8	0,8	00:20	0,70	
00:25	0,7	0,6	0,6	0,6	0,6	0,6	0,4	0,7	0,8	0,7	0,7	0,7	0,6	0,6	0,6	0,6	0,6	0,6	0,5	0,7	0,7	0,8	00:25	0,64	
00:30	0,7	0,6	0,6	0,6	0,6	0,6	0,4	0,7	0,8	0,8	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,6	0,6	0,7	0,7	0,9	00:30	0,67	
00:35	0,7	0,7	0,7	0,6	0,6	0,6	0,5	0,7	0,9	0,8	0,7	0,7	0,7	0,7	0,7	0,5	0,5	0,5	0,4	0,5	0,5	0,7	00:35	0,63	
00:40	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,5	0,5	0,5	0,4	0,4	0,5	0,5	0,5	0,4	0,4	0,4	0,4	0,5	0,5	0,4	00:40	0,44	
00:45	0,5	0,5	0,5	0,4	0,4	0,4	0,4	0,5	0,6	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,4	0,5	0,6	0,6	00:45	0,49	
00:50	0,4	0,4	0,5	0,4	0,4	0,4	0,4	0,5	0,5	0,5	0,4	0,5	0,5	0,4	0,5	0,4	0,4	0,4	0,4	0,5	0,5	0,5	00:50	0,45	
00:55	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,5	0,6	0,4	0,4	0,5	0,5	0,4	0,5	0,4	0,5	0,4	0,5	0,6	0,7	0,7	00:55	0,47	
01:00	0,4	0,4	0,4	0,4	0,3	0,4	0,4	0,4	0,4	0,3	0,3	0,3	0,4	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,2	0,3	01:00	0,34

Figure 3.1 – Observations from point “A1” – “E”

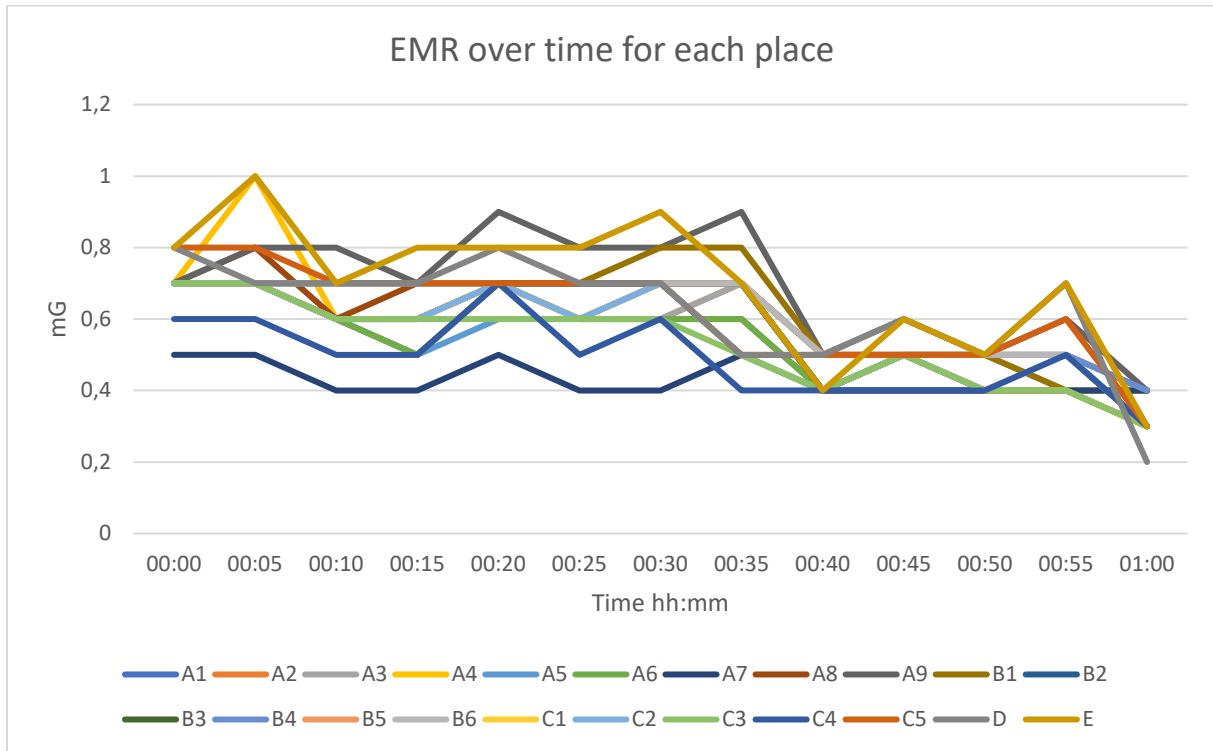


Figure 3.2 – Visualization for data “A1” – “E”

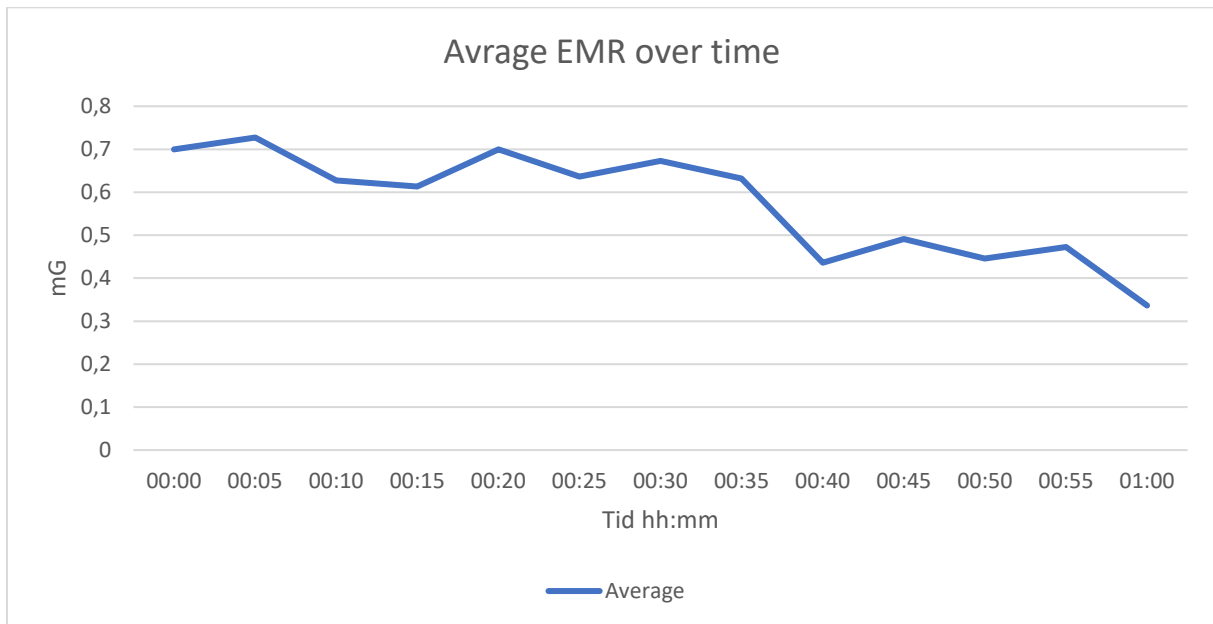


Figure 3.3 – Average visualization for data “A1” – “E”

3.2 Readings on phone

	K			K			K	
00:00	57,2			00:21	63,2		00:42	58,5
00:01	66,9			00:22	57,1		00:43	59,8
00:02	51,3			00:23	60		00:44	57,7
00:03	53,2			00:24	54,5		00:45	69
00:04	60,7			00:25	63,5		00:46	60,4
00:05	65,1			00:26	57,1		00:47	58,7
00:06	49,9			00:27	65,9		00:48	58,4
00:07	67,9			00:28	55,3		00:49	61,4
00:08	45,5			00:29	62,1		00:50	53,5
00:09	53,2			00:30	58,2		00:51	65,7
00:10	56,1			00:31	60,4		00:52	60,7
00:11	59,2			00:32	66,3		00:53	58,2
00:12	53,4			00:33	65,1		00:54	58
00:13	60			00:34	54,3		00:55	63,3
00:14	61,4			00:35	58,8		00:56	57,2
00:15	63			00:36	62,1		00:57	53,1
00:16	62,7			00:37	63,5		00:58	60,6
00:17	60,9			00:38	59,1		00:59	54,1
00:18	53			00:39	55,1		01:00	68,2
00:19	54,1			00:40	47,1			
00:20	67,6			00:41	58,2			

Figure 3.4 – Observations from point “K”

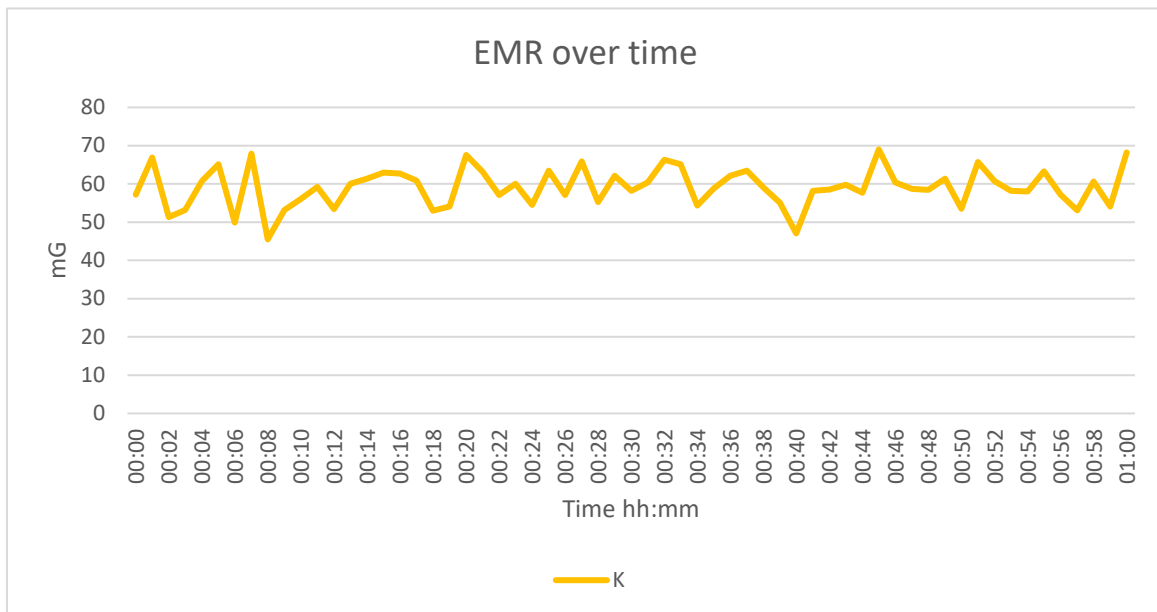


Figure 3.8 – Visualization for data “K”

3.3 Readings on panel hotspots

	G	H		G	H		G	H	
00:00	1,3	1,5		00:21	1,5	1,4	00:42	1,3	1,7
00:01	1,9	1,5		00:22	1,4	1,3	00:43	1,8	1,5
00:02	1,2	1,8		00:23	1,8	1,4	00:44	1,4	1,4
00:03	1,5	1,6		00:24	1,3	1,4	00:45	1,3	1,5
00:04	1,8	1,5		00:25	1,6	1,5	00:46	1,5	1,5
00:05	1,5	1,6		00:26	1,4	1,4	00:47	1,6	1,5
00:06	1,5	1,9		00:27	1,4	1,5	00:48	1,4	1,4
00:07	1,7	1,7		00:28	1,6	1,5	00:49	1,7	1,4
00:08	1,6	1,4		00:29	1,4	1,4	00:50	1,3	1,5
00:09	1,6	1,6		00:30	1,7	1,5	00:51	1,3	1,5
00:10	1,7	1,6		00:31	1,4	1,4	00:52	1,7	1,5
00:11	1,4	1,6		00:32	1,4	1,4	00:53	1,5	1,4
00:12	1,5	1,5		00:33	1,3	1,5	00:54	1,3	1,6
00:13	1,7	1,6		00:34	1,3	1,4	00:55	1,3	1,4
00:14	1,5	1,5		00:35	1,4	1,4	00:56	1,5	1,5
00:15	1,6	1,4		00:36	1,6	1,5	00:57	1,6	1,6
00:16	1,4	1,6		00:37	1,4	1,4	00:58	1,5	1,5
00:17	1,4	1,5		00:38	1,3	1,4	00:59	1,6	1,4
00:18	1,6	1,6		00:39	1,5	1,5	01:00	1,6	1,5
00:19	1,9	1,5		00:40	1,4	1,4			
00:20	1,5	1,4		00:41	1,3	1,4			

Figure 3.9 – Observations from point “G”, and “H”

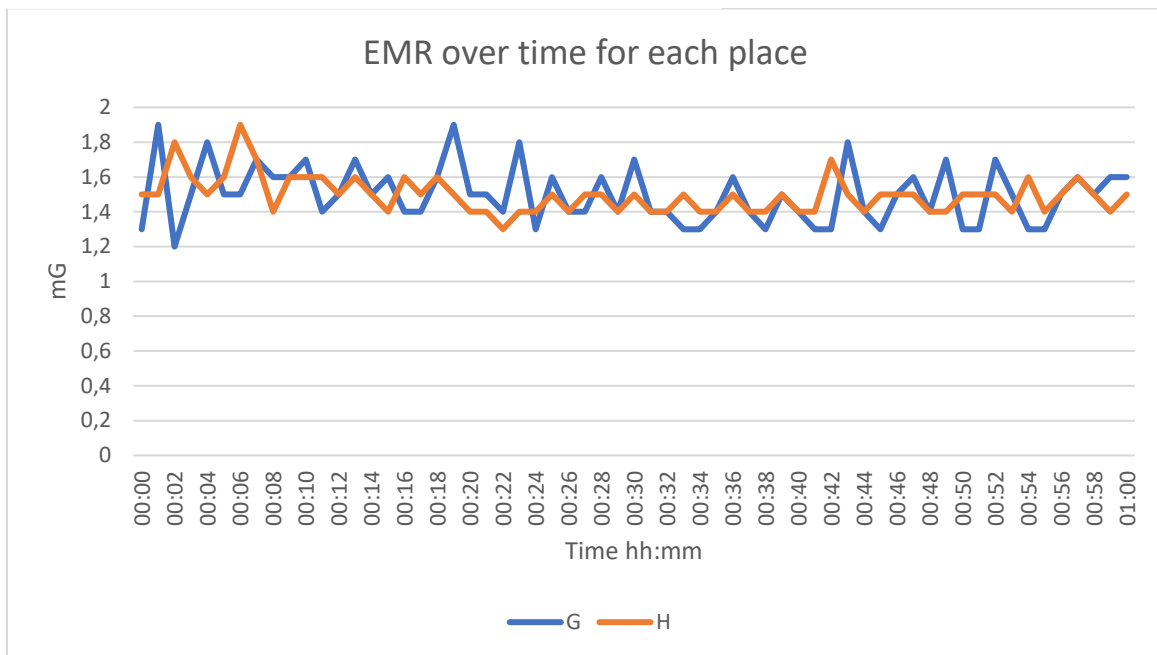



Figure 3.10 – Visualization for data “G”, and “H”

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4. Equations

4.1 Formulas

$$\bar{x} = \frac{x_1 + \dots + x_n}{n}$$

$$s^2 = \frac{(x_1 - \bar{x})^2 + \dots + (x_n - \bar{x})^2}{n - 1}$$

$$I = \bar{x} \pm Z_{\frac{\alpha}{2}} \sqrt{\frac{s^2}{n}}$$

$$\alpha = 0.05$$

$$Z_{\frac{\alpha}{2}} = 1.96$$

$$s = \sqrt{s^2}$$

Empirical rule: $[\bar{x} - 3s, \bar{x} + 3s]$

4.2 A1 to E

$$n = 286$$

$$\bar{x} = 0.576224$$

$$s^2 = 0.021117$$

$$I = [0.559468, 0.59298]$$

4.3 G, H, J and K

$$n = 61$$

$$\bar{G} = 1.498361 \quad G_s = 0.165823001$$


Empirical rule: [1.000892, 1.99583]

$$\bar{H} = 1.495082 \quad H_s = 0.01147541$$

Empirical rule: [1.173712, 1.816452]

$$\bar{K} = 59.10984 \quad K_s = 5.1440809$$

Empirical rule: [43.67759, 74.54208]

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5. Conclusions

5.1 Analyzing the data

The confidence interval, created from data points "A1" - "E", can be used to conclude that the average radiation the user gets exposed to is between 0.559468 and 0.59298 mG with 95% confidence.

By calculating the standard derivation and the mean value of the data from point "G", "H", and "K", the empirical rule can be used. The empirical rule states that the user will be exposed to less than 2 mG of radiation while using TylöHelo's far infrared emitters with near certainty (99.7%). This is true because 1.99583, and 1.816452 are less than 2.

The same reasoning can be used when analyzing the data from the phone. When using a phone similar to the one used during testing, the user should expect to get exposed to more than 43.67 mG of radiation, with near certainty (99.7%).

All calculations can be obtained from chapter 4. Equations.


5.2 Perspective

The user does not get exposed to a large quantity of electromagnetic radiation when using an infrared sauna from TylöHelo. Looking at the readings from inside the cabin, it is hardly more than the electromagnetic radiation that always exists in a room. There will always be some radiation in a room created by household lights, speakers, and electronics. The following table (see figure 5.1) contains other references collected from the Wikipedia article: *Orders of Magnitude (magnetic field)* (2021). This further proves how low the radiation measured in the test is.

Value (mG)	Item
0.001 to 0.1	Magnetic field strength in the heliosphere
0.6 to 7	Magnetic field produced by a toaster, in use, at a distance of 30 cm.
1 to 5	Magnetic field produced by residential electric distribution lines (34.5 kV) at a distance of 15 m,
13 to 27	Magnetic field produced by high power (500 kV) transmission lines at a distance of 30 m.
40 to 80	Magnetic field produced by a microwave oven, in use, at a distance of 30 m.
50 000	The strength of a typical refrigerator magnet

Figure 5.1 – List of orders of magnitude for magnetic fields

Seen from the worst angle, the user still only gets exposed to less than 2 mG of electromagnetic radiation. That is a trivial amount of radiation. Comparing the results from the infrared cabin with the results from the phone, phones emit a lot more radiation than TylöHelo's far infrared emitters. According to the tests, the phone emitted, on average, over 40 times the amount of radiation compared to the far infrared emitters. An argument can be

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made, that if most people do not bother being exposed to the radiation emitted by a phone, then the radiation in an infrared sauna from TylöHelo would not be a bother.

There is no standard established for how much radiation an infrared sauna can emit. The closest reference value is a Swedish standard for computer screens. The values are supposed to be taken 30 centimeters in front of the screen. The standard states that the radiation value cannot exceed 2 mG. This requirement is satisfied in TylöHelo's infrared saunas.

Electromagnetic radiation decreases drastically over distances. In the test, taking readings on the phone, the distance had to be increased to 1 centimeter because the radiation exceeded the amount the tri-field meter could measure. The tri-field meter used in the tests can comprehend a maximum of 99.9 mG. This suggests that if the user keeps a short distance from the wooden panel, it is highly plausible that the user will be exposed to less radiation than measured in the test. TylöHelo's infrared cabins carry the possibility of using a separate curved backrest that adds extra distance to the wooden panel. Note, as mentioned before, this is not necessary concerning the radiation.

5.3 Summary

To summarize. The radiation emitted by the TylöHelo's infrared saunas is not high. Compared to other household products, the radiation is almost negligible. TylöHelo's far infrared emitters, found in the saunas, fulfill the Swedish standard for acceptable radiation from computer screens. They also meet TylöHelo's claims for radiation amount. Because electromagnetic radiation decreases with distance, it is highly plausible that the user will get exposed to less radiation than measured in the test. TylöHelo's infrared saunas are safe.

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6. Further reading

Baubiologie Maes, *Building Biology Evaluation Guidelines*, [Baubiologische Richtwerte \(baubiologie.de\)](https://www.baubiologie.de)

Clearlight Infrared Saunas, *Low EMF and ELF Infrared Saunas*, [Low EMF & ELF Infrared Saunas Benefits | Clearlight® Saunas \(clearlightsaunas.eu\)](https://www.clearlightsaunas.eu)

EMF Academy, *7 Best Low EMF Portable Infrared Sauna [2020]*, [7 Best Low EMF Portable Infrared Sauna \[2020\] - EMF Academy](https://www.emfacademy.com)

National Institute of Environmental Health Science, *Electric & Magnetic Fields*, [Electric & Magnetic Fields \(nih.gov\)](https://www.niehs.nih.gov)

National Institute of Environmental Health Science, *EMF Electric and Magnetic Fields Associated with the Use of Electric Power*, [EMF Electric and Magnetic Fields Associated with the Use of Electric Power \(nih.gov\)](https://www.niehs.nih.gov)

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Wellness Center, *EMF Documentation*, [EMF Documentation | What are Safe and Unsafe Levels? \(wellnesscenter.net\)](https://www.wellnesscenter.net)

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YouTube, *Sauna Use as an Exercise Mimetic for Heart and Healthspan*, [Sauna Use as an Exercise Mimetic for Heart and Healthspan - YouTube](https://www.youtube.com)

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