

Emission of Smart Meter Electric Fields (50–100 kHz) in Finland

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Abstract— This paper presents example measurements of electric field exposure to smart meters for cable-transmitted (50–100 kHz) signal emissions. The operator of a utility company remotely read the smart meters when we measured electric fields. Altogether, we measured 27 smart meters, which used power line communication (PLC). Meters used plan and lon protocols. We used the Holaday 3603 directional electric field meter, and the measurement distance was at the surface of the meter. The highest electric field was 5.2 V/m, which is only 6% of the recommended public exposure limit according to the ICNIRP guidelines.

1. INTRODUCTION

Discussion of the possible health effects of electromagnetic field (EMF) exposure caused by smart meters has become livelier as the use of smart meters has increased, for example, in Finland [3, 5]. Therefore, we have done measurements and also published data on the measurements of smart meters [6–10]. The International Commission on Non-ionizing Radiation Protection (ICNIRP) has suggested 83 V/m as the limit for the general public at the frequency range of 3–300 kHz, which we will use to evaluate EMF exposure [2, 4]. For work-related exposure, there is also a relatively new EU directive [1].

The aim of this paper is to present example measurements of electric field exposure to smart meters for cable-transmitted (50–100 kHz) signal emissions.

2. MATERIALS AND METHODS

We used a Holaday 3603, a one-directional electric field meter (linear frequency response 2–300 kHz, 1–2000 V/m, ± 2 dB). The measurement distance was at the surface of the meter because the values were so small that it was not possible to get values from other distances. The operator of a utility company remotely read the smart meters when we measured electric fields. Figures 1–3 show examples of the measurements.



Figure 1: Examples of electric field measurements of houses with smart meter.

3. RESULTS AND DISCUSSION

Altogether, we measured 27 smart meters, which used power line communication (PLC). Meters used plan and lon protocols. Only one meter used a DLC protocol. Table 1 shows the measurement results.

The highest measured electric field was 5.2 V/m, which is only 6% of the recommended public exposure limit according to the ICNIRP guidelines. The smart meter readings were very short (about 20 s); therefore, the possible exposure time is also very short. Secondly, the electric field is much less at a distance of 0.5 m from the smart meters. This is important to take into account when we analyze the measurement results and compare them to guidelines.



Figure 2: Example of electric field measurements of the basement.

Table 1: Electric field measurement results of the smart meters.

n	Type of the smart meter	Protocol of the meter	Electric field, V/m
1	E450-3P	plan	0.7
2	E450-3P	plan	2.2
3	E450-3P	plan	0.8
4	E450-3P	plan	2.1
5	E450-3P	plan	4.3
6	E120LiME	lon	0.2
7	ET10	lon	0.6
8	E120LiME	lon	5.2
9	E120LiME	lon	0.7
10	E450-1P	plan	2.8
11	E450-1P	plan	0.6
12	E450-1P	plan	1.2
13	E450-1P	plan	0.5
14	E450-3P	plan	2.3
15	E450-3P	plan	4.1
16	E450-3P	plan	2.3
17	E450-3P	plan	2.5
18	E450-3P	plan	1.8
19	Iskra	DLC	2.9
20	E120LiME	lon	3.5
21	E120LiME	lon	2.8
22	E120LiME	lon	4.7
23	E120LiME	lon	3.5
24	E120LiME	lon	2.6
25	E120LiME	lon	2.3
26	E120LiME	lon	3.1
27	E120LiME	lon	2.2

On the other hand, the meter was one-directional; hence, we measured only in the direction where the electric field vectors were coming from the smart meter towards the person conducting the reading. However, we also checked some sites that there did not contain more significant electric field vectors to other directions. Although, if we even multiply measured values by three (geometrical summing), the values obtained would still be far below the limit values.

4. CONCLUSION

Based on our measurements, it is possible to conclude that the electric field exposure of smart meters is significantly less than the guideline values for the general public. There is no specific need to improve the sheltering of the meters from the public. However, it is possible to more precisely measure electromagnetic field emissions from smart meters, but our preliminary results did not warrant further concern.

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