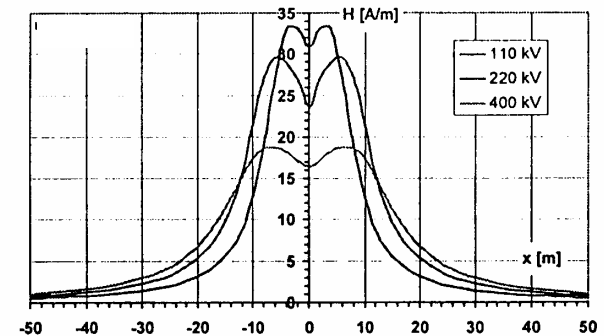
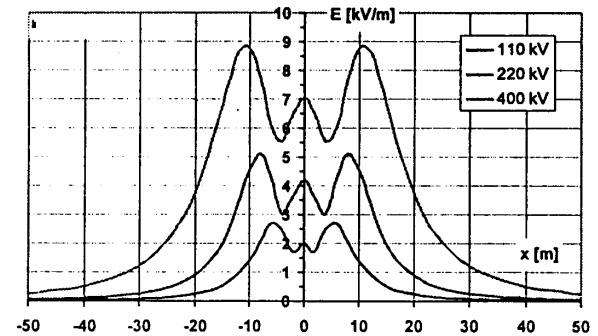


Electromagnetic environment in Electrical Hypersensitives homes and workplaces

Kjell Hansson Mild

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Umeå, Sweden

- **External sources: High voltage power lines, distribution lines**
- magnetic flux density depends on the current in the line
- electric field strengths depends on the towers design (various in particular countries)
- electric and magnetic fields fall to background strengths at distances of about 50-100 m
- under 400 kV power lines - maximum magnetic flux density is about 15 μT
- maximum electric field can be approx. 1 kV/m¹ under 110



Examples of ELF sources inside houses



Overall mean levels in homes in Sweden and Norway

E fields: Swe 54 V/m (SD = 37), Nor 77 V/m (SD = 58)

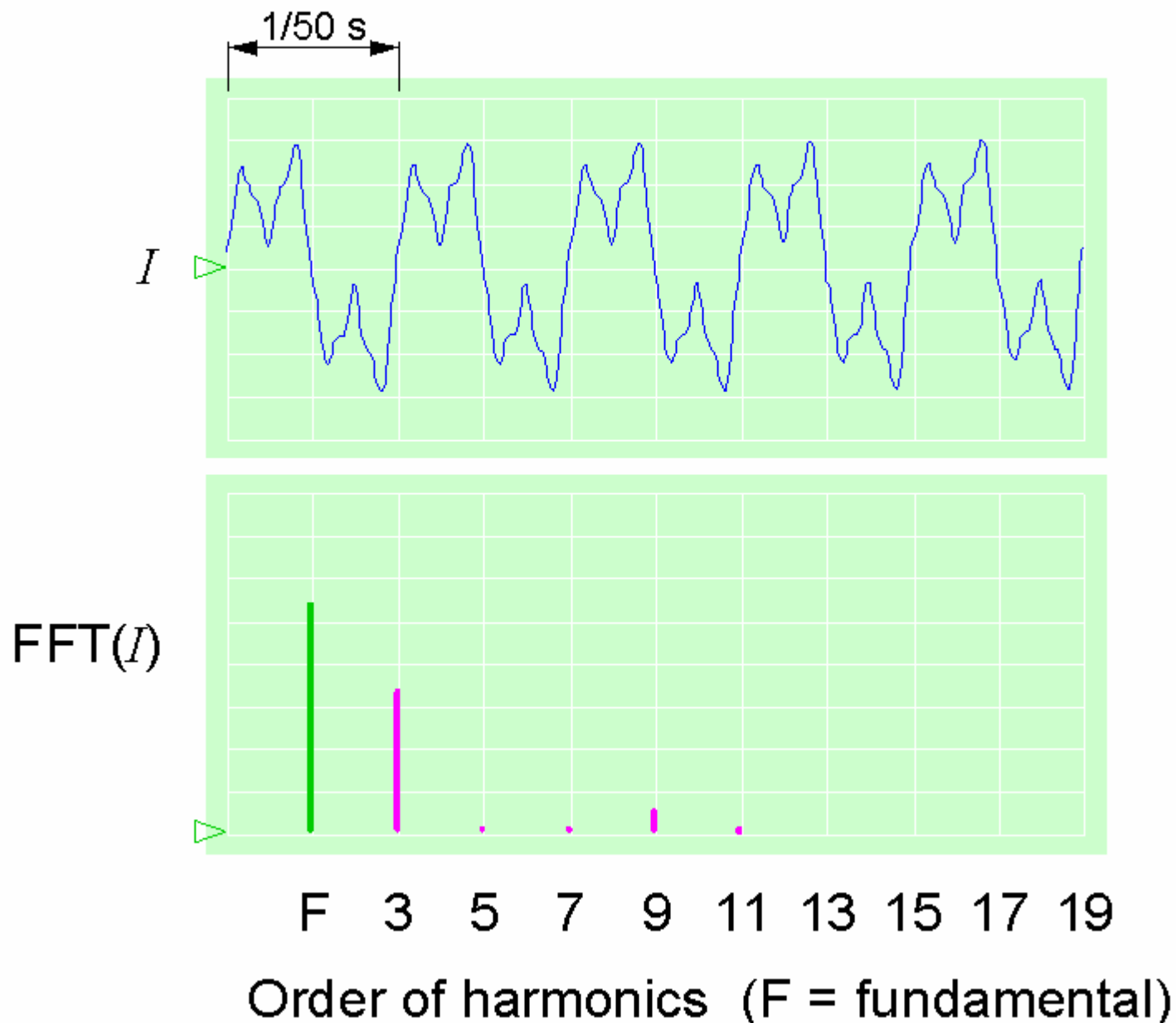
B fields: Swe 40 nT (SD = 37), Nor 13 nT (SD = 17)

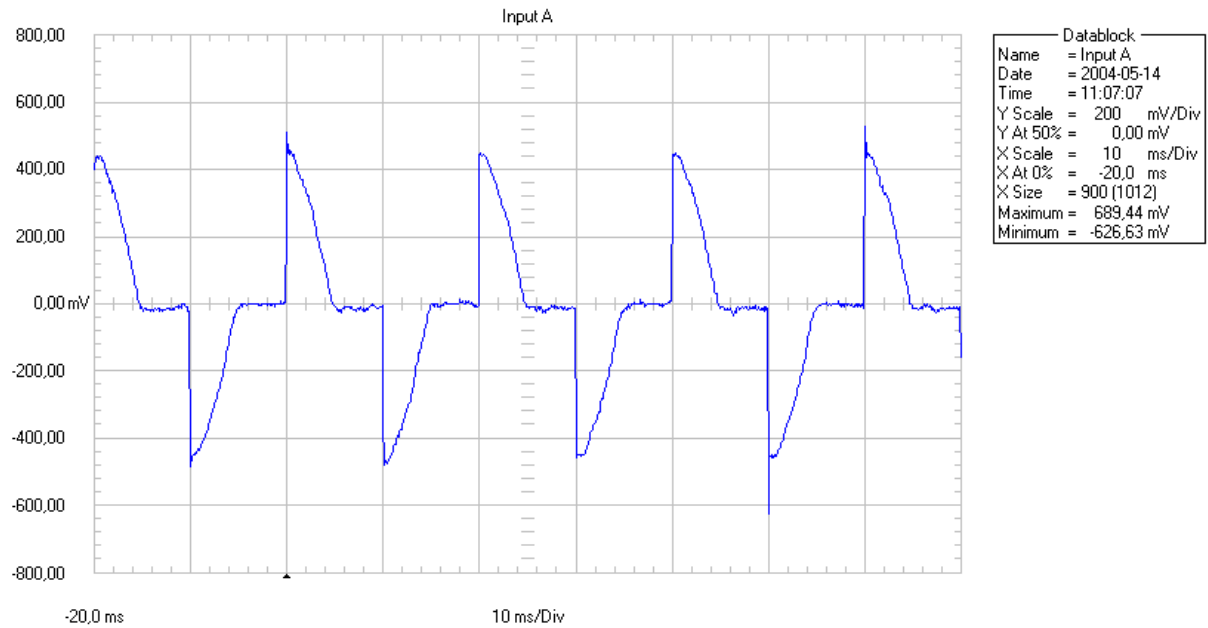
Offices: E fields Swe 40 V/m, Nor 15 V/m

B fields varied from some nT to over 1 μ T in both countries.

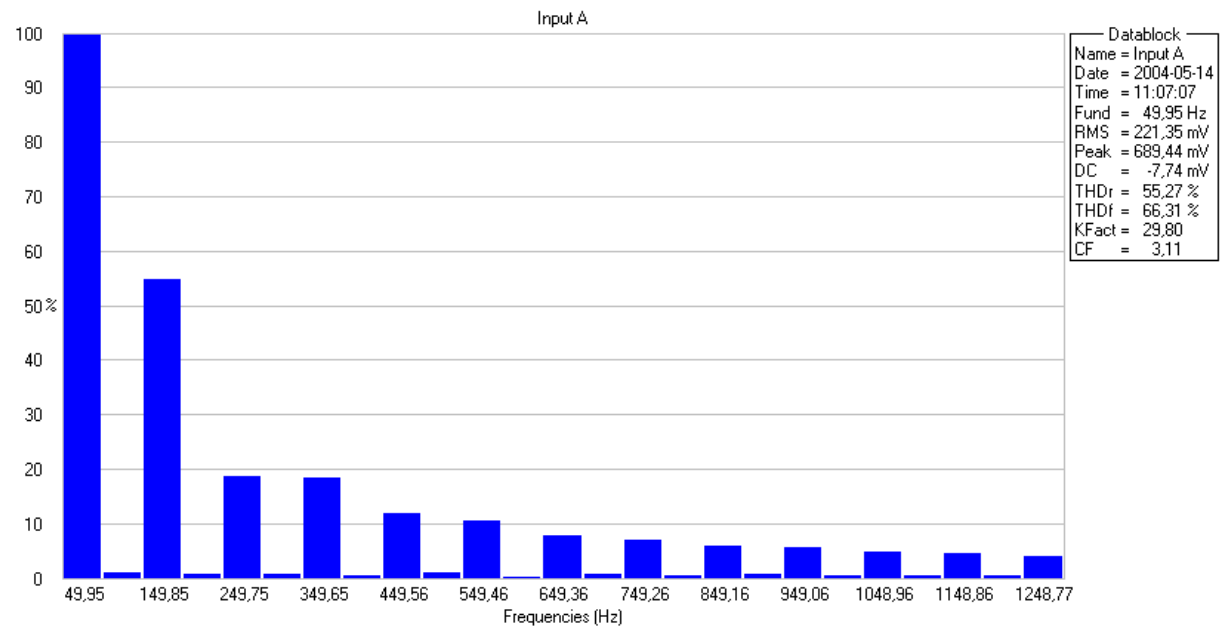
Hansson Mild et al. Measured 50 Hz Electric and Magnetic Fields in Swedish and Norwegian Residential Buildings. IEEE Transactions on Instrumentation and measurement. 1996, 45:3:710-714.

Current in delivery cable



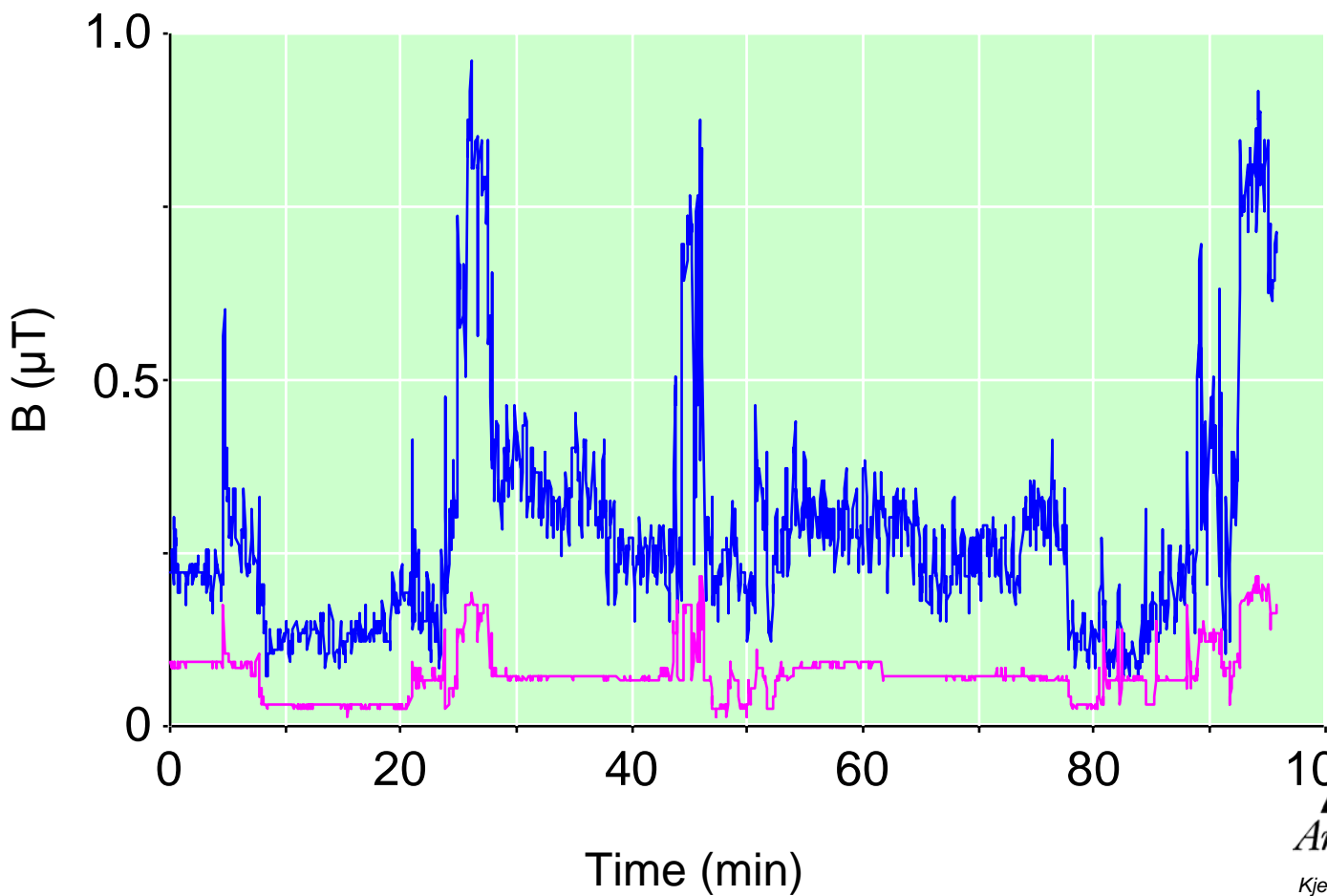


Wave shape for a dimmer



Magnetic field

— Broad band
— Harmonics





Electrical
central



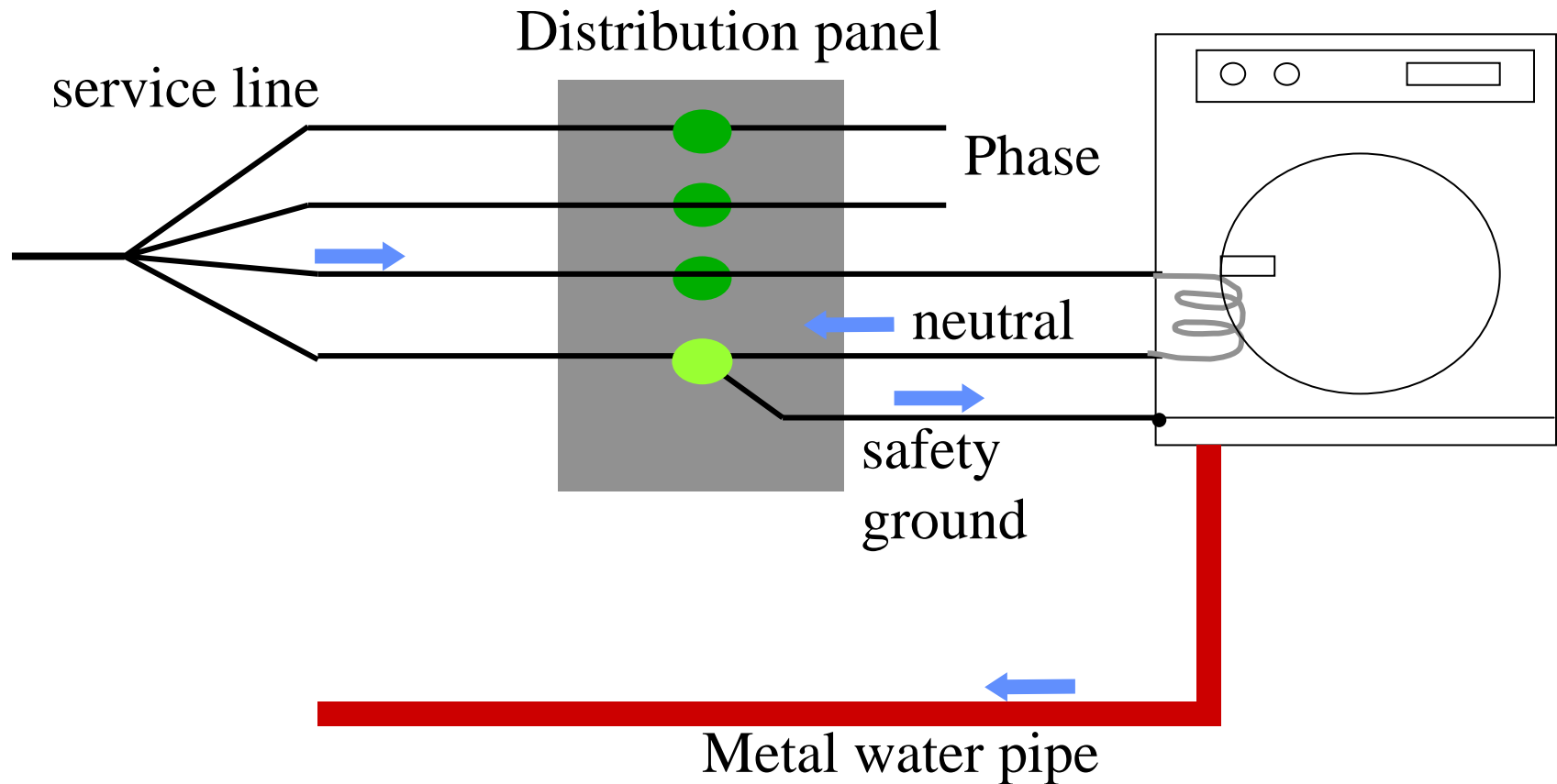
Cables



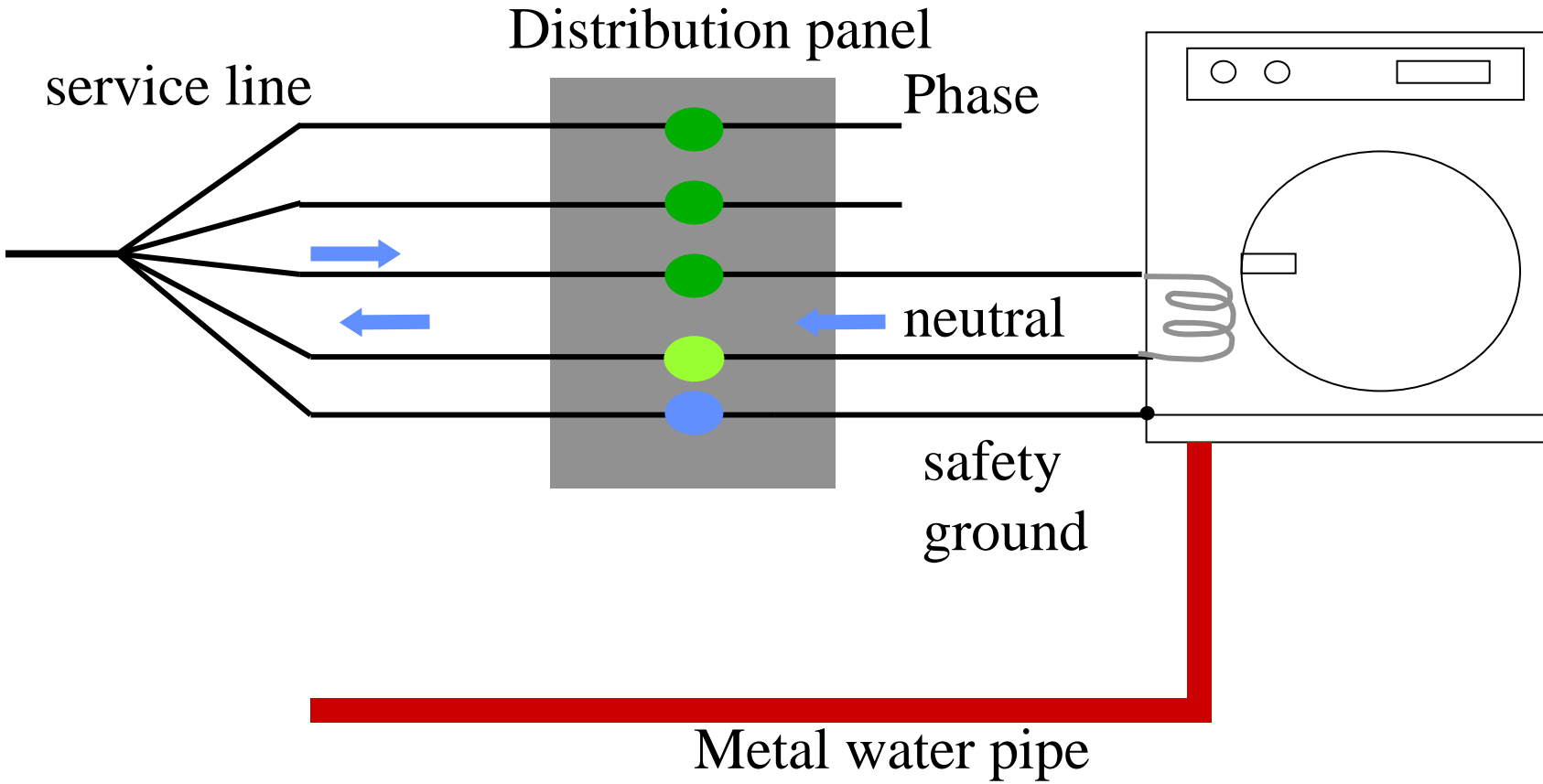
Stray current



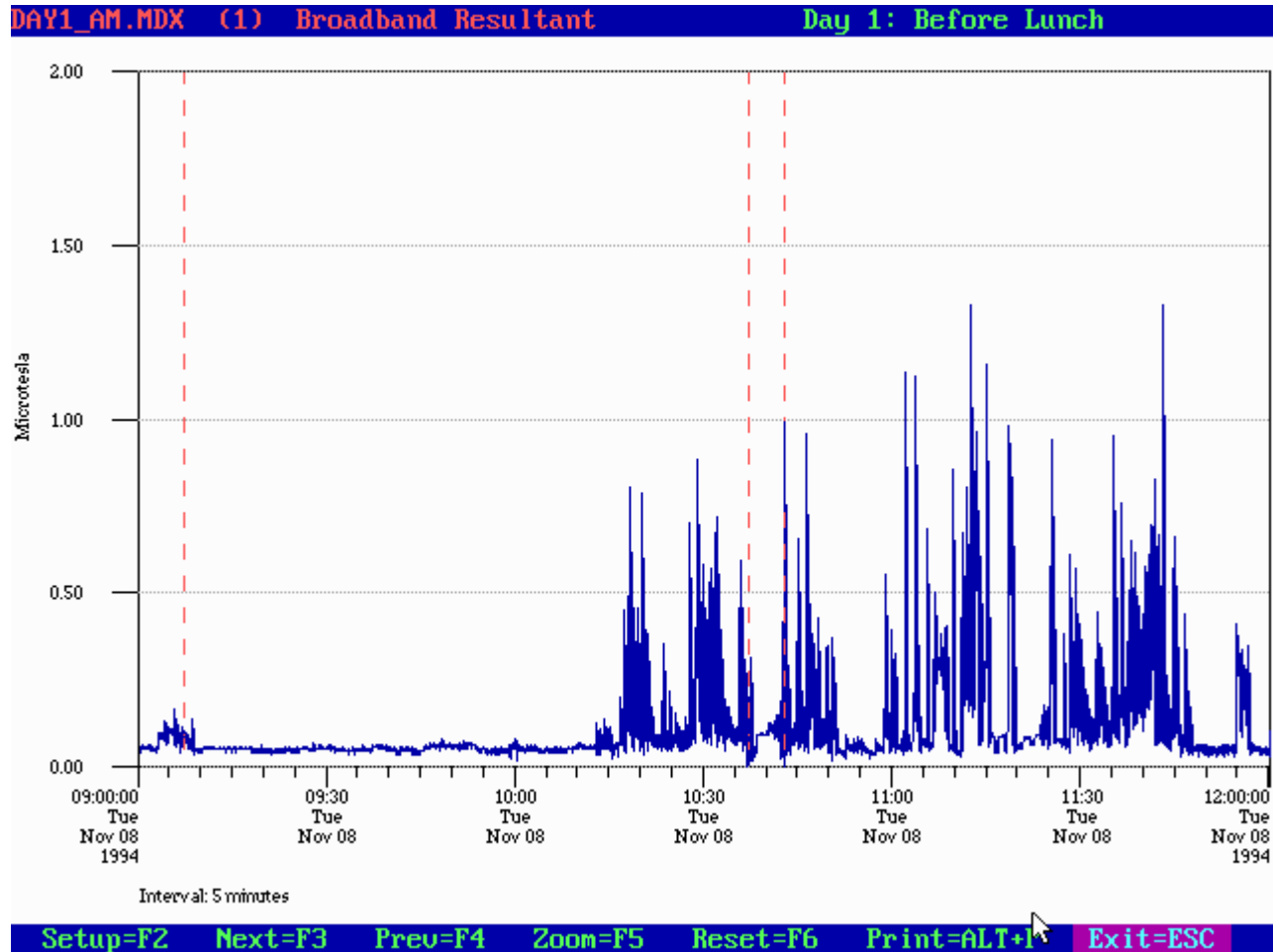
4-wire distribution system



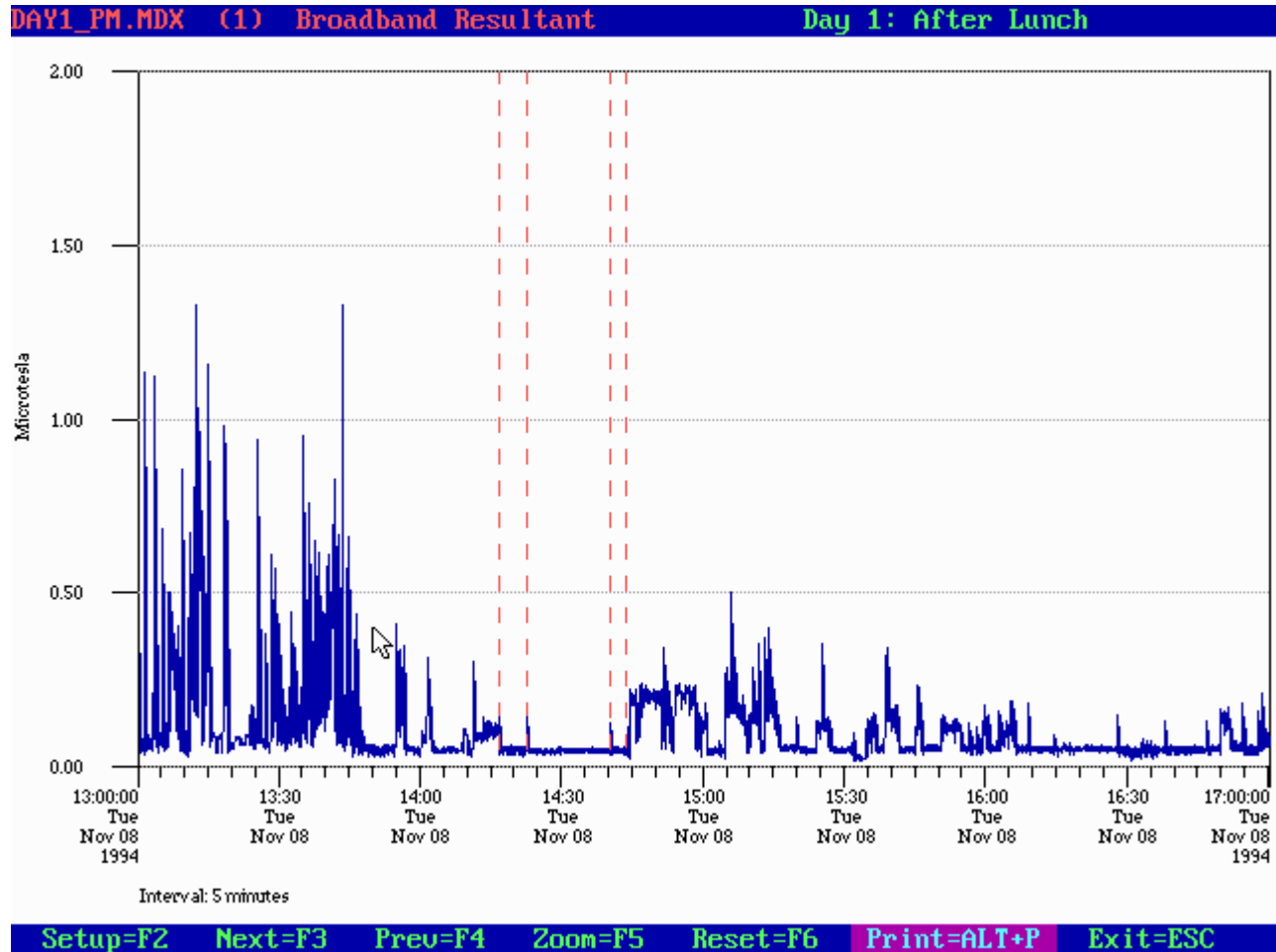
5-wire distribution system



Examples of EMDEX recordings from EHS study Sandström et al, 2003.



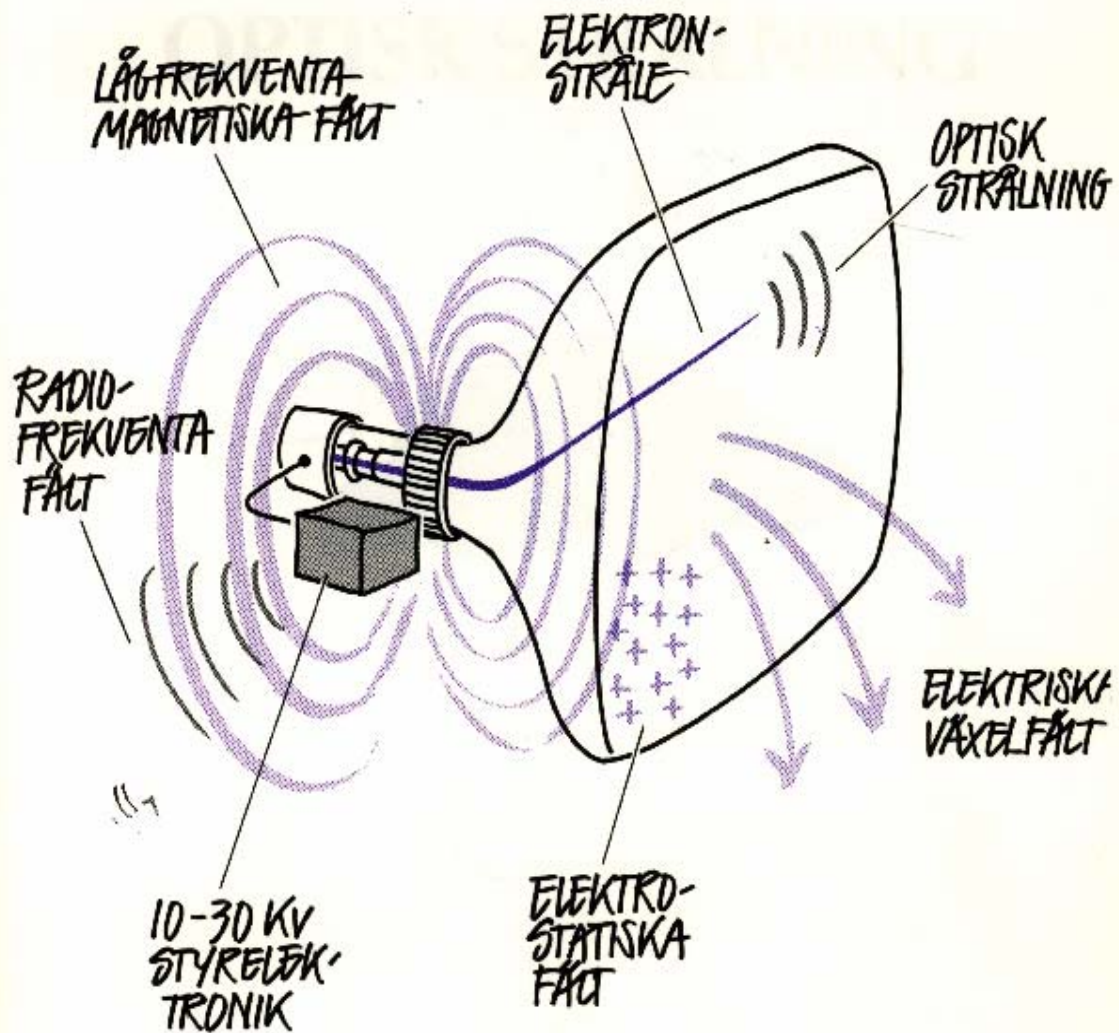
Examples of EMDEX recordings from EHS study Sandström et al, 2003.



Emdex values from 24 h recordings for
EHS patients and controls. Values in μT .

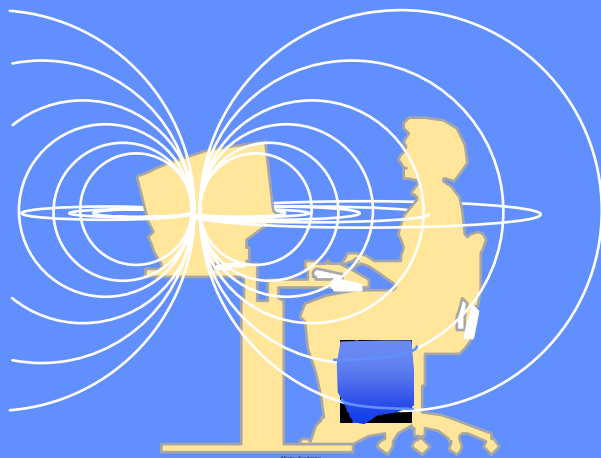
	Mean	Median	Max
Case	0.10	0.05	5.57
Cont.	0.11	0.06	3.87

From Sandström et al.: Long-term Holter ECG recordings
in patients with perceived electrical hypersensitivity.
Internat J Psychophysiol. 49; 227-235, 2003.

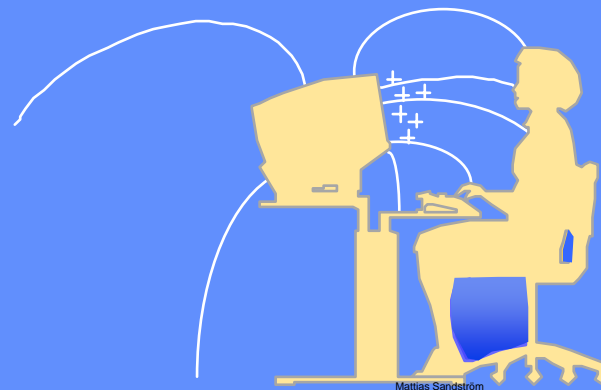


Figur 5

VDT related fields



REFRESH RATE MAGNETIC FIELD
LINE FREQUENCY MAGNETIC FIELD



AC ELECTRIC FIELD
DC ELECTRIC FIELD

EM-fields in offices

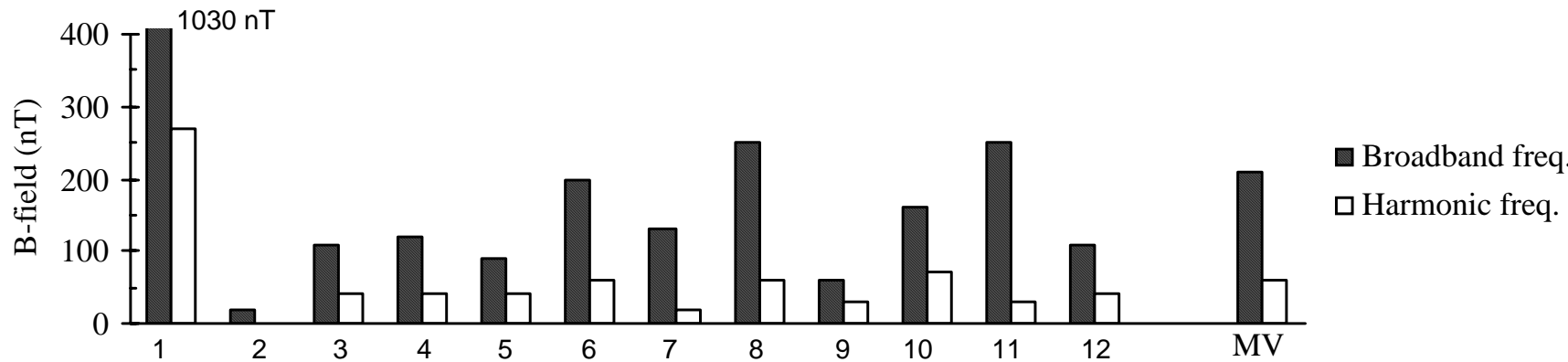
	Md	Max
In rooms		
E-field (V/m)	20	100
B-field (μT)	0.07	1.0
VDT related fields		
E_{ELF}-field (rms) (V/m)	20	330
B_{ELF}-field (rms) (μT)	0.21	1.2
E_{VLF}-field (rms) (V/m)	1.5	15
B_{VLF}-field (rms) (nT)	26	142

Electric fields

- 65 % of the screens had an equivalent surface potential less than 0.5 kV
- Dominating sources in the ELF range were not the VDTs but other ungrounded electric appliances in the room
- Filter screens were used by 53 % of the office workers

Magnetic fields

- Many VDTs had a reduced B-field in the VLF range, $Md=0.03 \mu\text{T}$
- VDTs contributed to the B-field level in the ELF range, $Md=0.21 \mu\text{T}$
Background field, $Md= 0.07 \mu\text{T}$
- 5% of the offices had a background field higher than $0.5 \mu\text{T}$, high enough to induce jitter on the VDT screen



The magnetic field measurements at 12 different offices. The filled bars represent the broadband measurements (both the fundamental and the harmonic frequency magnetic fields). The unfilled bars represent the harmonic content of the magnetic field in each workplace.

Electrical disturbances

Short circuits

Corona discharges

Relay, triac

Fluorescent tubes

Frequency converters

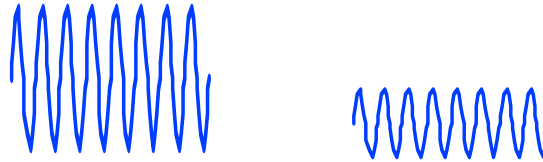
PC, printers...

ESD



High frequency noise on
the electrical net

- Intensity



- rate of change



- Frequency



- transients on-off



- Pulsed



DOSE ?



Far field exposure from base stations (COST281)

SAR = 3 mW/kg per incoming W/m²

Locally SAR-values can be 10 times higher

Max measured from base: 13,4 mW/m²

Median value: 0,01 mW/m²

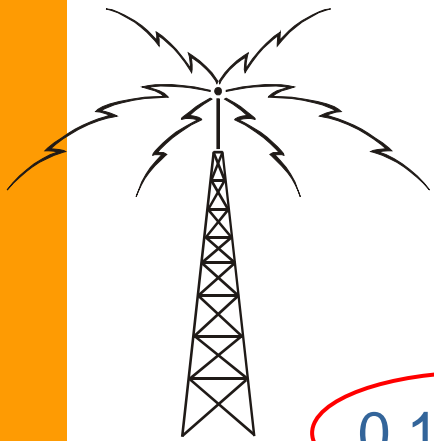
SAR_{wb}max = (3x13,4)= 40 μW/kg

Local max 400 μW/kg = 0,4 mW/kg

EU limit: SAR_{wb} = 0,08 W/kg, SAR_{lok} = 2 W/kg

Max whole body 2 000 times lower, Locally 5 000 times

Median value 2 000 000 times lower, Locally 5 000 000 times



TV-transmitter

0,1 W/m²

1 km

10 km

100 km

0,001 W/m²



Base station

0,00001 W/m²
= 0,01 mW/m²

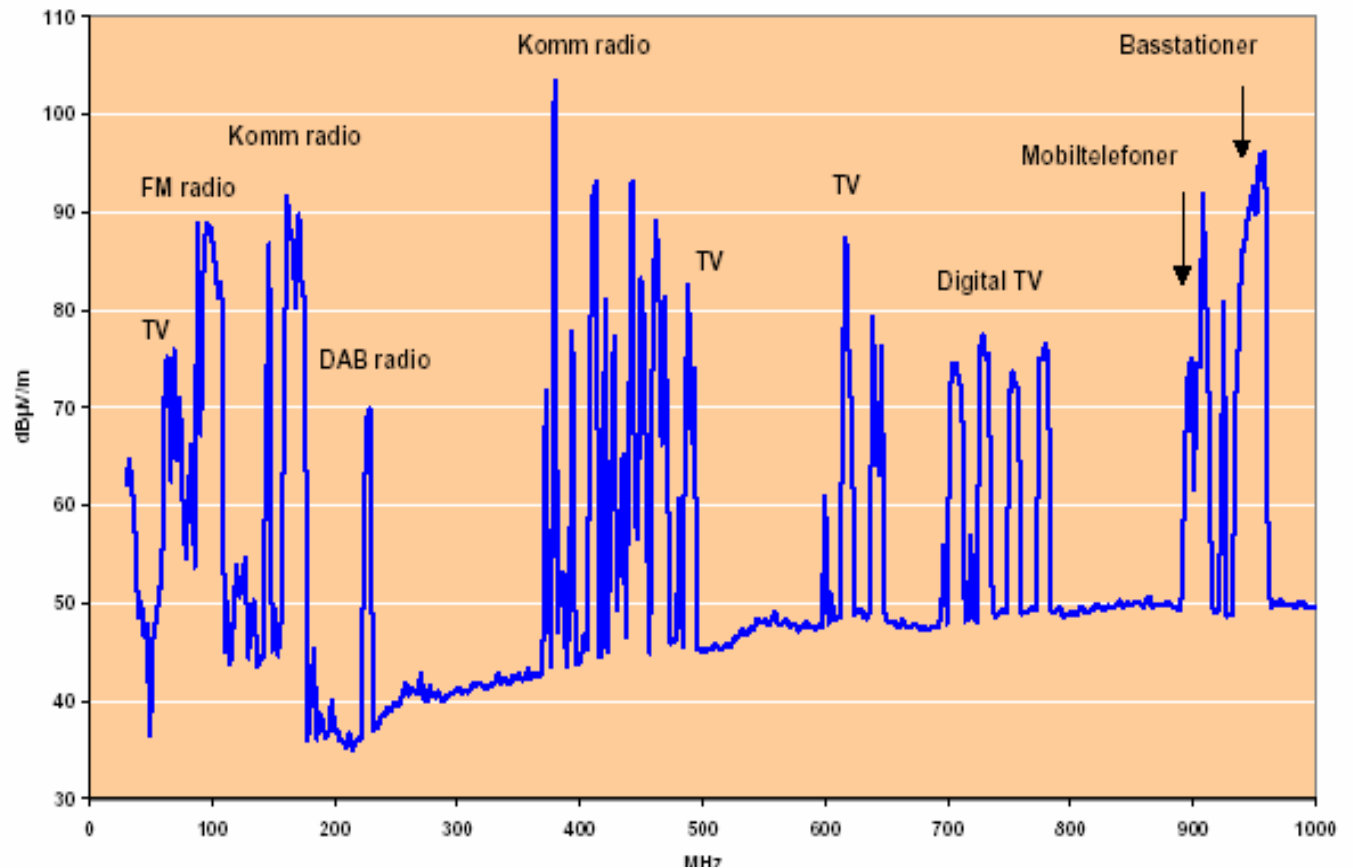


Microwave oven

1 m

10 m

100 m



- Typiskt spektrum 30-1000 MHz registrerat i Stockholm utan fri sikt till radio/TV sändaren i Nacka. Diagrammet visar maximalt värde av den elektriska fältstyrkan under en tvåminuters period i logaritmisk amplitudskala (dB/ μ V/m). (Källa: SSI)

Summary

E and B fields in homes and offices are no longer pure 50 Hz sinusoidal, but have harmonics and transients.

There is an increase in our everyday environment of low level RF signals from different communication devices.

EHS cases do not have an EMF environment different from others.