



Electromagnetic fields

When it comes to power lines or electrical devices, electromagnetic radiation and its potential risks are often a topic of discussion. This radiation consists of electric and magnetic fields. Exposure limits are in place to protect us from adverse health impacts. Switzerland's limits are among the strictest in the world.

Electric field

As soon as a device is connected to a power socket, it carries voltage and creates an electric field. This is true even if the device remains switched off and no current flows. The intensity of the electric field is determined by the voltage, which is measured in volts per metre (V/m).

Magnetic field

When current is flowing, a magnetic field is created in addition to the electric field. The electricity volume transported through the line determines the strength of the magnetic field, which is measured in microteslas (μT).

Static fields and alternating fields

Direct current creates static electric and magnetic fields. It is used in all electronic consumer goods, including mobile phones, computers and cameras. Static fields, such as the Earth's magnetic field, have a constant field strength. In the case of alternating current, which comes out of the power sockets in every household, the voltage and current intensity change in a regular rhythm, known as the frequency. The electricity grid has a frequency of 50 Hz.

Voltage

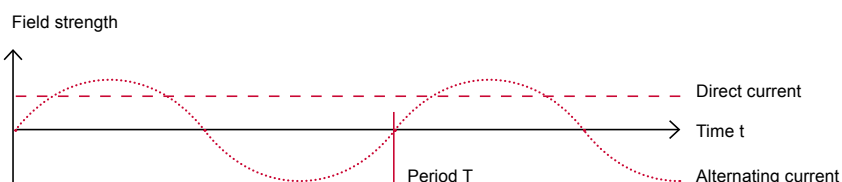
The electric voltage is a force that ensures electric current can flow. It is measured in volts (V).

Current intensity

The movement of electrons generated by the voltage is known as the current intensity. In power transmission, this is the movement of electrons in an electrical conductor. It is measured in ampere (A).

Power

Power is the product of voltage \times current intensity and denotes energy generated over a certain time period. It is measured in watts (W). At a constant voltage, an increase in the current intensity also leads to an increase in power. The current intensity therefore varies with the capacity utilisation of a line.



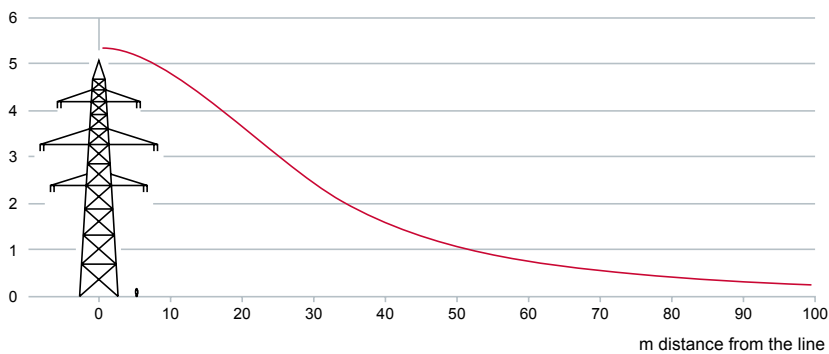
Magnetic fields are dependent on the current intensity and not on the voltage

The lower the current intensity on a line, the lower the magnetic field around the line. As a rule, the capacity of extra-high-voltage lines is not fully utilised, as the transmission grid is operated in such a way that in the event of a line failure, the current can flow via other lines.

Electric and magnetic fields decrease with distance

The greater the distance to the conductor or cable, the lower the electric and magnetic fields. In the case of cables in households, the fields are almost insignificant just a few decimetres away.

Strength of the magnetic field at ground level in microteslas (line under full load at 2240 A)



Limits – Switzerland has one of the strictest guidelines in the world

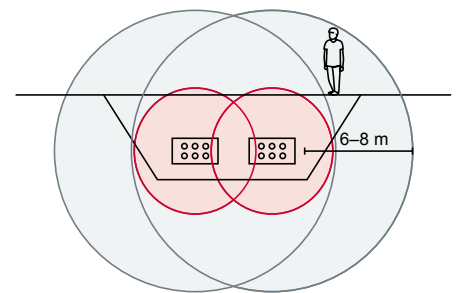
The exposure limit for a magnetic field of 100 microteslas protects against all scientifically known adverse health effects. It applies everywhere that people may be present. In addition, the Swiss Environmental Protection Act demands that the population also be protected from health risks that are not yet proven, but conceivable. The legal installation limit of 1 microtesla is used for this purpose. This is one of the strictest limits in Europe. Both limits apply to the maximum utilisation of a line.

Biology and health

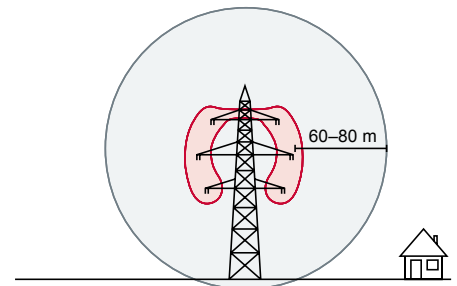
Electric fields are largely prevented from entering the body by clothes and the skin. Magnetic fields, on the other hand, easily penetrate house walls and the body.

The brain controls the body via electric signals, which should not be disturbed. Magnetic fields created by alternating current can create an electric voltage within the body, inducing a flow of electricity. With sufficient strength, this can influence the biological signals. The limits are therefore set so that health risks are ruled out. The effects of weak, long-term exposure (alternating fields with field strengths below the installation limit of 1 microtesla) have still not been scientifically proven. A risk – whatever it may be – can never be ruled out beyond doubt. The fields of direct current do not affect the body in this way and are less of a health concern.

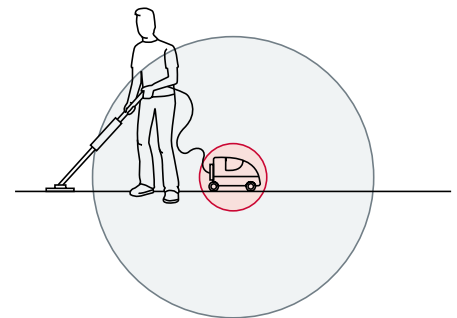
Underground cables



Overhead line



Vacuum cleaner



○ 1 microtesla ○ 100 microteslas

The Swiss Research Foundation for Electricity and Mobile Communication (FSM) is an independent foundation based in Switzerland. It promotes research about technological, biological, health-related and social issues within the context of electromagnetic fields of radio and electricity technologies. For details, visit the FSM website:

www.emf.ethz.ch