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HIGH-FREQUENCY ELECTROMAGNETIC FIELDS

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Appendix 3: Use of HF protective clothing

1. General

Ref.: AFS (Provisions of the Swedish National Board of Occupational Safety and Health) 1987:2 High-frequency electromagnetic fields

SS-ENV 50 166-2 Electromagnetic fields - Limit values and measurement methods - High-frequency fields (10 kHz to 300 GHz)

ANSI/IEEE C95.1-1991 Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

This regulation is an application of the above regulations and standards and applies at Teracom's facilities.

2. Limit values

The hygienic limit values that apply in the event of exposure to HF fields in Sweden were established by the Swedish National Board of Occupational Safety and Health in 1987. The limit values for the electric field (E) and the magnetic field (H) apply individually.

For frequency areas outside of the Swedish National Board of Occupational Safety and Health's provisions, Swedish Standard SS-ENV 50 166-2 applies within Teracom. This also applies to limit values for contact current, which is not covered in the National Board's regulations. At frequencies of 3-100 MHz, the American ANSI standards apply for contact current.

Regarding limit values for the E and H fields, an average value over an optional 6-minute period applies. A ceiling value for average value over 1 second applies in Sweden. In the event of pulsed fields, the average value over 1 second applies.

For contact current or induced current, the limit value for the relevant ankle or wrist applies.

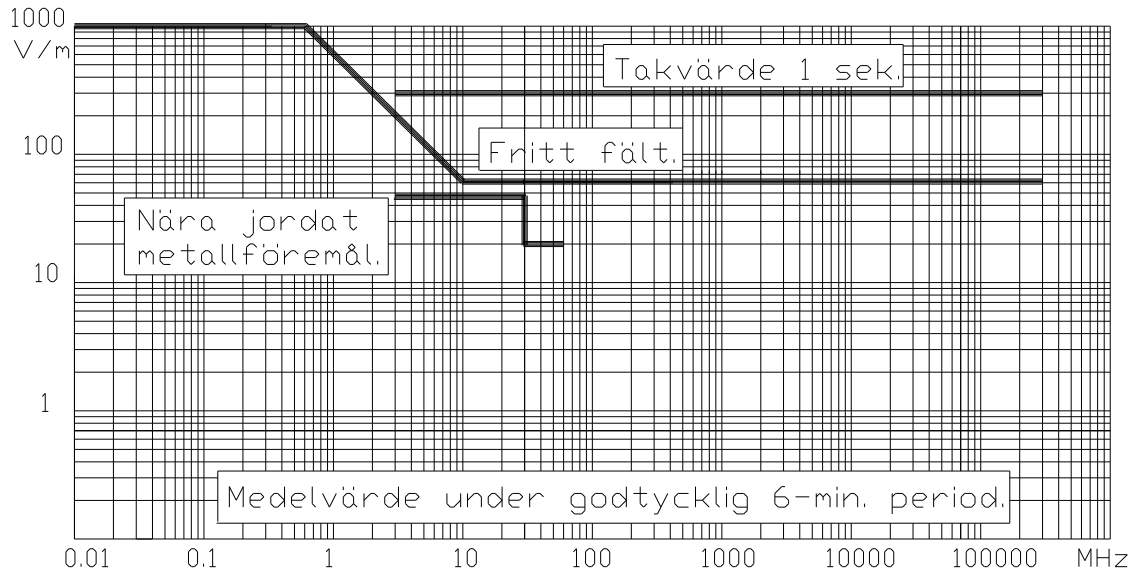
If contact current and induced current are measured, and consideration is given to measured value, limit values will apply for values measured a minimum of 100 mm from metal objects when measuring electrical and magnetic fields.

Limit values do not need to be observed if the total input power to a human body does not exceed 7 W at frequencies lower than 1 GHz and if a total SAR value for the entire body of 0.4 W/kg is not exceeded. For parts of the body, 10 W/kg applies for the most exposed 10 g part. If the body part is a hand or a foot, 20 W/kg applies.

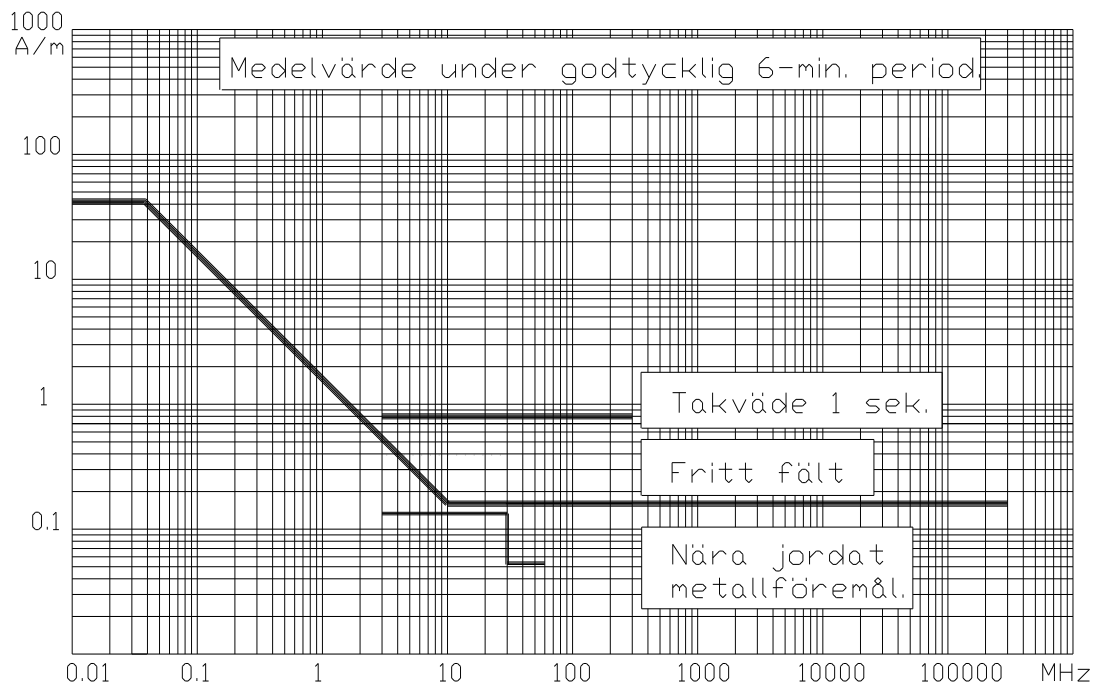


The following limit values apply:

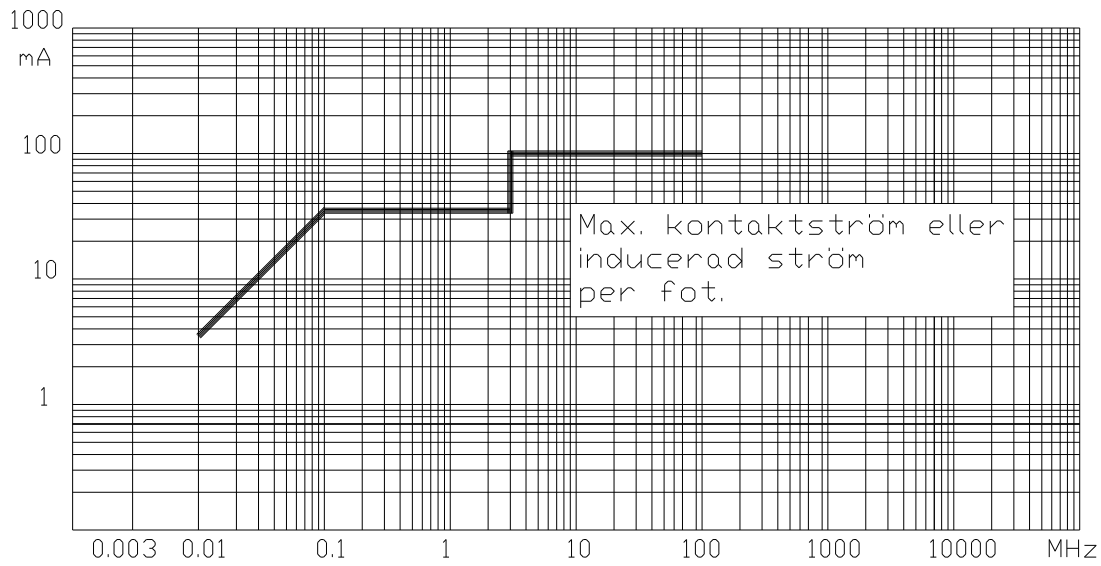
Limit value, Electrical fields



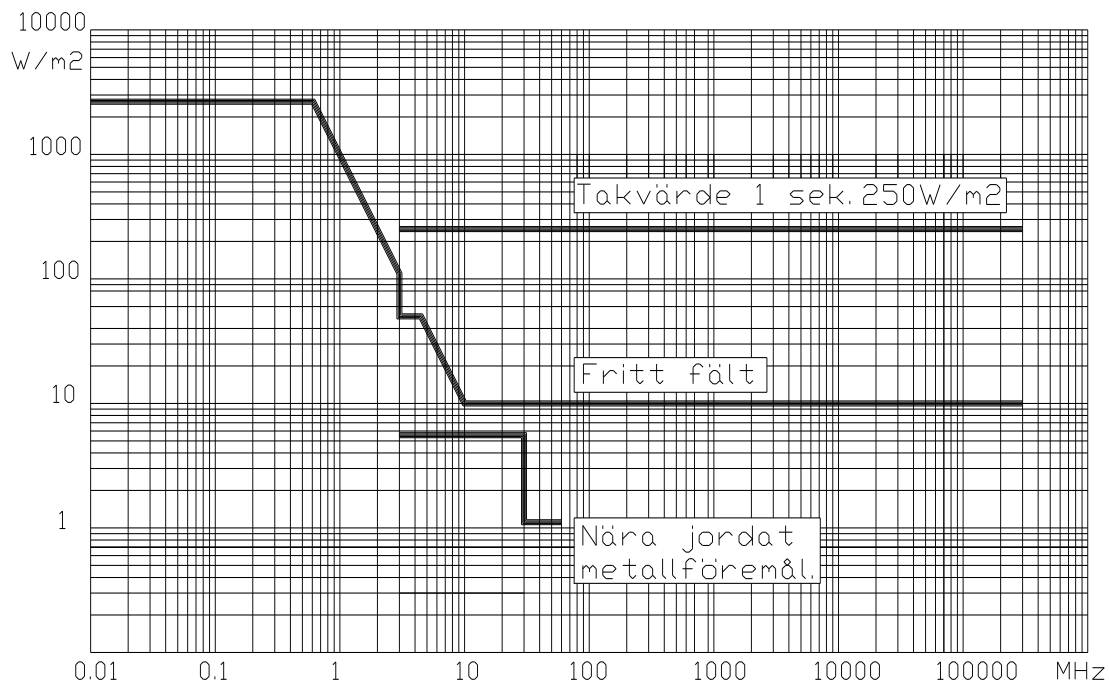
Limit value, Magnetic fields



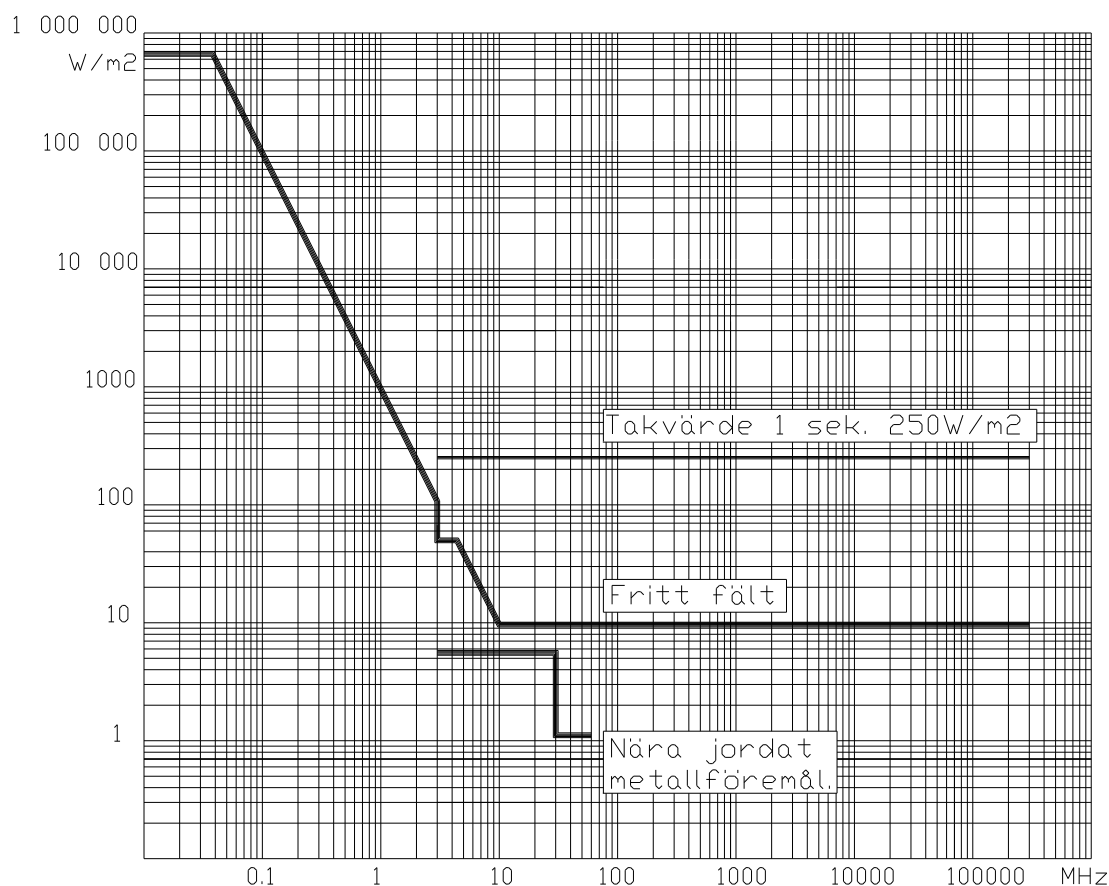
Limit value, Contact current and induced current



Limit value, Equivalent power flux density from electrical fields



Limit value, Equivalent power flux density from magnetic fields



3. Responsibility

It is the duty of the operations manager to ensure that affected personnel are notified of applicable regulations. This responsibility includes ensuring that the regulations are complied with and that the necessary measures are taken to protect against injury.

4. Training and information

All personnel who work with radio equipment or who regularly visit radio stations must receive training regarding HF fields and their effects on the body. Course no. 151301

Temporary visitors must be monitored and if necessary notified by instructed personnel.



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5. Actions in the event of feared over-exposure

If it is feared that a person may have been exposed to non-permitted HF exposure, this must be notified immediately to the person's superior. The superior will then decide on further action, **after consultation with the environmental officer and the safety representative.**

6. Warning signs

At entrances to areas where there is a risk of people being exposed to HF fields that exceed the limit value, a warning sign as per the figure below must be set out in clearly visible location, e.g. by the gate to the mast yard or by the hatch in the climbing barrier. If a warning sign is present, easily accessible information must be available at the facility regarding where the HF fields exceed the applicable limit values. For areas where the HF fields exceed the limit values, measurement reports containing conditions regarding e.g. climbing or work must be set out in a clearly visible location in the station building, ideally at the entrance. The measurement report must also be present in the mast lift (preferably laminated). If an external company is entitled to access locations that can entail a risk of non-permitted HF fields, corresponding information must be provided. A proposed report can be found in appendix 2, 14.6 ab Drawing appendix.



**Elektro-
magnetiska fält**
iakttag gällande
skyddsföreskrifter

Warning sign for electromagnetic fields



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7. Barriers and prohibition signs

Areas where the limit values are exceeded (= risk zones) must be enclosed with a “line of flags” as well as marked with signs in accordance with the figure below. Does not apply in masts.



Prohibition sign for electromagnetic fields.

8. Personal equipment

8.1 Pacemakers

Individuals fitted with a pacemaker must not work in a radio station unless the treating doctor has given his written permission.

8.2 Metal objects inserted during operations

Individuals who have had metal objects inserted in their body during operations should avoid exposure to HF fields.

9. Protective equipment

9.1 HF-resistant overall

Protective overalls with woven-in metal wires and a face visor (Faraday cage) can be worn for special work where there is a significant requirement for minimal power reduction.

The overall's attenuation properties as regards E and H fields as well as the contact current must be taken into consideration.

The wearing of overalls requires special rules to be observed, and may only take place under the supervision of instructed personnel.



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10. General requirements for equipment that can emit HF fields

Equipment that can emit HF fields (transmitters, combination filters, etc.) must be designed so that as low a field strength as practically possible is achieved at locations where people may spend time or pass through.

Where there is a risk of harmful fields arising in conjunction with the removal of cover plates or equivalent, a blocking system that disrupts the output must be present. This does not apply if tools are required for removal.

When acquiring new equipment that can emit HF fields, the required safety regulations for operation must be demanded from supplier, in addition to that stated above.

11. Measurement

In order to check that the limit values are not exceeded, an evaluation and possibly measurements must be carried out. Checks with an indicator must be performed immediately after the installation or replacement of the relevant equipment. If there is no leakage, a measurement must be taken at the next regular occasion and subsequently at max. 2-year intervals at large FM/TV facilities. Smaller facilities are measured once initially, and subsequently in the event of changes to Teracom's equipment/antenna system. Small facilities, with an output power of less than 7 W/antenna element, do not need to be measured, although they should be fitted with a clearly visible sign bearing the text: **"It has been established that no equipment belonging to Teracom exceeds the limit values for HF fields."**

At frequencies above 1 GHz, practically all equipment present must be measured.

Measurement must be performed by a specially trained person.

Measuring equipment must be calibrated at max. 2-year intervals at the supplier or equivalent.

Measurement reports must be archived for at least 20 years. For mobile equipment, the report is stored at the unit to which the equipment belongs (in terms of its usage).

An example of a measurement report is presented in appendix 14.6a HF measurement report with figure appendix, example.

12. Work at HF facilities

12.1. Equipment with shared antenna system

In the event of a shared antenna system, high output can be transferred from a transmitter that is in operation to a transmitter that is switched off. When working with a transmitter that is switched off, this must therefore be disconnected or short-circuited on the antenna side before work may be carried out, if the total power leakage exceeds 7 watts or if the frequency is higher than 1 GHz.



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12.2. Radio link and ground station equipment

Special care must be taken in the case of operation with an incomplete waveguide.

For OB links and portable ground stations, these must be set up so that individuals cannot enter a measured risk zone. (For actions in the event of a risk zone, see point 7.)

12.3. Masts and towers

In order to minimize disruptions to operations, the following rules must be applied when passing through or working on antenna systems in those cases where the measurement report indicates that the measured value is sufficiently high that power reduction or switching off must be performed:

- Before starting to pass the (relevant) antenna system, personnel in the mast must establish radio/telephone contact with a person at the transmitter. The terminology can be: From mast: *We want to pass the FM antennas*. After the person at the transmitter has reduced the power or switched off the transmitter(s), he responds: *You are clear to pass the FM antennas*. **The implemented measures must be noted in a logbook!**
- Immediately after completing passage, the personnel in the mast submit the completion signal *We have passed the FM antennas*. If the completion signal is not submitted within the time specified in the measurement report as the maximum time for climbing through with reduced power, the transmitter power to the antenna system must immediately be switched off. An investigation must immediately be carried out to ascertain why no completion signal has been submitted.
- In the event of passage over a longer period or during work, a corresponding procedure must be applied observing the requirements for reduction/switching off that apply in this case.

Transmitters that have been disconnected or transmitters with reduced output due to mast work must be fitted with a sign: **“Must not be operated. Work in progress!”**. The person who has set up this sign must himself check with mast personnel that the mast work on the transmitter antenna has been completed before the sign may be removed. The potential for remote operation of the transmitter or the connection of a reserve transmitter must be blocked.

A logbook must be kept by the person responsible at the transmitter’s disconnection point.

An example of a logbook is presented in appendix 3, Logbook.

12.4. Antenna measurement by helicopter

When measuring an antenna system from a helicopter, the distance to the transmitter antenna must be such that the applicable limit values are not exceeded inside the helicopter.



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