

Intense Radio Frequency (RF) radiation as a tool for graded action.

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Background.

The effects of intense RF radiation is being studied by the Swedish defence authorities in co-operation with industry and other countries. One important aspect is to find means for protection of military materiel against RF-weapons. The offensive possibilities, to cause disruption or degradation of electronic functions in order to disarm an opponent is another important aspect.

The effects of intense RF-radiation on electronics have been investigated for more than 20 years in Sweden. The studies have shown that RF-weapons when effective, have some very important features for controlling an opponent. The character, particularly of RF-radiation in short intense pulses, makes it ideal for concentrating the weapon effects to electronic functions in technical systems. Any collateral damage could thus be minimized. Other effects e.g. bioeffects are normally small or insignificant. There is no risk for direct mechanical or thermal damage by RF radiation. However, the disruption of electronic functions may cause severe hazards if safety critical functions are affected. Risks for any such secondary effects can be limited if RF-weapons are used in a planned way at tactical situations.

Many systems with electronic functions have been investigated at the Swedish research. Principles for design reviews and measurements on objects in order to survey the RF-vulnerability have been developed. Effects have been analysed of RF-pulses having a varying character, unmodulated and microwave frequency modulated radiation, monopulses and repetitive pulse bursts. The coupling of EM radiation into equipment to electronic circuits has been analysed and measured. The physics guiding such phenomena is well understood and computer programs for analysis of RF-weapon effects have been developed. It has been shown that statistical methods can be used to predict the effectiveness of an attack.

The application of RF-radiation weapons is limited to some very distinct niches where they are effective. The obvious application is related to electronic sensor and communication functions and other exposed electronic circuits and components with poor EM-protection. On the other hand it has been demonstrated that electronic boxes with a traditional metallic cover may render a protection effective enough to make many RF-weapons unpredictable and useless. Another problem is that the direct effects caused by a RF-weapons are microscopic and invisible from the outside. Any damage can only be detected according to the malfunction of the attacked object. Only the "intelligent" electronic functions of a system are affected. A classical truck diesel-engine will not be disturbed by RF-radiation nor the mechanical steering. The primary functions of a classical truck remain intact after an RF attack. Thus such an attack is not an effective way to stop the truck while it may have become "stone-dead" if the functions were regulated by electronic sensors and agents. It has been shown at experiments that it would be easy to stop a modern car and to "kill" a poorly protected communication channel and a sensor at very long distances, several km.

If an attacked object is temporarily at rest or in a low functionality mode it may be impossible to detect any damage at a distance. The very limited direct effects, undetectable at a distance, also indicate that RF-weapons may be more suitable as a supplement to other means of action. Hard targets may be difficult to stop by ordinary ammunition but their sensors and communication may be killed by RF-weapons. RF-protected functions in their turn are unharmed by RF-weapons but may be blocked by other Electronic Warfare means.

Attacks also by comparatively small RF-generators occurring at short distances may cause severe damage to electronics. The action is silent and invisible. For this reason it has been mentioned as a terrorist weapon. Several civil authorities in Sweden are concerned about this and have initiated surveys of their vulnerability. The same RF-features are of interest for military purposes at sabotage actions.