ELECTROMAGNETIC PULSE AND WEAPONS

Teiberman E.M., student
National Technical University ‘Kharkiv Polytechnic Institute

The fact that a nuclear explosion would necessarily be accompanied by electromagnetic radiation was clear to theoretical physicists even before the first test of a nuclear device in 1945. During the nuclear explosions in the atmosphere and outer space, carried out in the late 50s - early 60s, the presence of EMP was recorded experimentally.

However, the quantitative characteristics of the pulse were insufficiently measured, firstly, because there was no control and measuring equipment capable of registering extremely powerful electromagnetic radiation that exists for an extremely short time (millionths of a second), and secondly, because in those years in radio electronic equipment only electrovacuum devices were used, which are little affected by EMP, which reduced interest in its study. The creation of semiconductor devices, and then of integrated circuits, especially digital technology devices based on them, and the widespread introduction of funds into military electronic equipment, forced military specialists to assess the EMP threat in a different way.

Electromagnetic pulse and weapons

The EMR generation mechanism is as follows. In a nuclear explosion, gamma and X-rays are generated and a neutron flux is formed. Gamma radiation, interacting with molecules of atmospheric gases, knocks out the so-called Compton electrons from them. If the explosion is carried out at an altitude of 20-40 km, then these electrons are captured by the Earth's magnetic field and, rotating relative to the lines of force of this field, create currents that generate EMP. In this case, the EMP field is coherently summed towards the earth's surface, i.e. Earth's magnetic field plays a role similar to a phased array antenna. As a result, the field strength sharply increases, and, consequently, the EMP amplitude in the regions south and north of the epicenter of the explosion. The duration of this process from the moment of explosion is from 1 - 3 to 100 ns.

At the next stage, lasting from about 1 μs to 1 s, EMP is created by Compton electrons knocked out of molecules by multiple reflected gamma radiation and due to the inelastic collision of these electrons with the flux of neutrons emitted during the explosion. In this case, the intensity of EMR turns out to be about three orders of magnitude lower than at the first stage.

At the final stage, which takes a period of time after the explosion from 1 s to several minutes, EMP is generated by the magnetohydrodynamic effect generated by disturbances of the Earth's magnetic field by the conductive fireball of the explosion. The EMR intensity at this stage is very low and amounts to several tens of volts per kilometer.

Sources of EMP (non-lethal weapon). EMP weapons can be created both in the form of stationary and mobile electronic complexes of directed radiation, and in the form of electromagnetic ammunition (EMB) delivered to the target using artillery shells, mines, guided missiles (Fig. 2), aerial bombs, etc.

The stationary generator allows you to reproduce EMP with horizontal polarization of the electric field. It includes a high-voltage electrical pulse generator (4 MV), a symmetrical dipole radiating antenna on two masts, and an open concrete test site. The installation provides for the formation of an EMP over the test site (at heights of 3 and 10 m) with a field strength equal to 35 and 50 kV / m, respectively.

Mobile (Transportable) generator HPDII is designed to simulate horizontally polarized EMP. It includes a high-voltage pulse generator and dipole antenna mounted on the trailer platform, as well as data collection and processing equipment housed in a separate van.

The current state of the EMP problem can be assessed as follows. The mechanisms of EMP generation and the parameters of its damaging effect have been sufficiently well studied theoretically and experimentally confirmed. Equipment security standards have been developed and effective protection means are known. However, to achieve sufficient confidence in the reliability of protection of systems and facilities from EMP, it is necessary to carry out tests using a simulator. As for the full-scale testing of communication and control systems, this task is unlikely to be solved in the foreseeable future.

References

1.Military electronics. Generators of super-powerful electromagnetic impulses.Moscow-2007 V. Slyusar.

2. The action of nuclear weapons. Ed. 2nd.Military.published. Ministry of Defense of the USSR, Moscow, 1965, 670 p.

BOND TYPE AND CHEMICAL PROPERTIES

Liachova A., student
National Technical University ‘Kharkiv Polytechnic Institute’

A chemical bond is a set of forces acting between atoms that bind them into stable structures, the electron-nuclear interaction of atoms Associate with the restructuring of their electronic structures and the release of energy.

Valence electrons - electrons participating in the formation of a chemical bond. Types of chemical bond:

1. Covalent bond (Covalent non-polar and polar bond)
2. Ionic bond
3. Metallic bond
4. Hydrogen bond

1. Covalent bond - a chemical bond formed by the overlap of a pair of valence electron clouds.

If there is one common electron pair between two atoms, then such a bond is called single (ordinary), if two - double, if three - triple. There are two mechanisms for the formation of a covalent bond: the exchange mechanism and the donor-acceptor mechanism: