

## **The Nanosecond Pulse Generator-Radiator for Ground Penetrating Systems**

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Ground Penetrating radar (GPR) systems intended for remote non-destructive control and diagnostics of semiconducting dielectric media and also for detection and identification of embedded small-sized low-contrast artificial and natural objects are characterized by the growing use in various branches of economy.

The transmitting channel, which determines the main characteristics (parameters) of GPR systems, is one of the underlying elements of such systems. These parameters are the following: amplitude, duration and repetition frequency of radiated video-pulses. In present GPR system, the radiated video-pulse amplitude can be varied from tens Volts up to several hundreds Volts, depending on the systems purpose, when the pulse duration equals 0.2-3 ns and pulse repetition frequency equals to 10-500 kHz. In general, the transmitting channel consists of a videopulse generator, which effectively works on low-resistance load (from 10 to 40 Ohm), a broad band antenna with high-resistance impedance (from 160 up to 240 Ohm in operation frequency band), and broad band matching device realized with the use of coaxial or long lines like impedance transformer with transformation factor 1:4. When the signal is directed from generator to antenna, an additional energy losses and signal distortions take place, since the real efficiency of such matching transformers equals to 40-70% in operation frequency band (from 500 MHz to 1.5 GHz).

The accomplishment of necessary efficiency for the given parameters (amplitude, duration, form and frequency) of signals is the main problem that appears in designing the GPR system transmitting channel. It is reasonable to find possible solution of the problem in development of the generator-radiator which is functionally and constructively combined with the radiating antenna. Such solution is possible with using the videopulse generator miniaturization and low-impedance antennas.

The horn, biconical, dipole, flat and cone helix antennas used at present in subsurface radar applications have input impedance equals to 140-240 Ohm in operation frequency band that hinders these antennas matching with the generator.

The presented engineering and design solution for the generator-radiator has allowed to increase the energy radiation efficiency, broaden the frequency band and improve the radiated signal form.