

# Microwave Attack Detection System

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**Abstract**— A microwave attack detecting system on the basis of high power microwave resistive sensor was developed, prototyped and tested in field conditions. The system operates at severe conditions of microwave radiation measures the high power microwave pulse and presents the circular diagram of radiation. It was tested up to several tens of kV/m.

**Keywords**— high power microwave; microwave power resistive sensor.

## I. INTRODUCTION

The modern environment and infrastructure are inseparably related with a plenty of complicated electronic systems and consumable electronic products. Therefore the problems like electromagnetic compatibility, radiation immunity, intentional or accidental electromagnetic attacks are relevant and critical for infrastructure. It is important to register the event of microwave attack, detect the direction of microwave source and measure the radiation level. That enables to assess the risk, value of possible damage and consequence. After the detection and evaluation of microwave attack it is possible to prevent the damage by replacement of most critical components of system, apply the corresponding service measures to prevent the possible accidents and casualties in such critical systems of infrastructure like railway or air traffic control systems.

The application of high power microwave pulse resistive sensors, developed in microwave laboratory, horn antennas and step motor driven antenna actuators, microwave attack detecting system was developed and applied in high power

immunity tests in the frame of NATO task group SCI-250 [1] and project HIPOW supported by European community. The exclusive property of the developed system is the capability to operate at very strong radiation, detect the direction of attacking microwave source and measure the radiation in free space from 400 V/m up to 100 and more kV/m in the frequency range of 1-18 GHz.

## II. DETECTING SYSTEM

The diagram of structure and operation principle of the developed system is shown in Figure 1. The horn antenna with high power microwave pulse resistive sensor is mounted on actuator which rotates continuously enabling measurement of radiation diagram. The resistive sensor converts the microwave pulse into analog video pulse corresponding to the envelope of microwave pulse. The output signal  $U_s$  is captured by digital oscilloscope "Picoscope 630B". The master computer of the system controls the azimuth angle  $\alpha$  of the antenna and picks up the signals, when antenna is rotated. Each signal sample  $U_{si}$  corresponds to antenna position  $\alpha_i$ . On the basis of the captured signal array, the calibration data of antennas and resistive sensors, the circular radiation diagram of the power density or electric field strength is plotted on the screen. The thresholds of dangerous radiation levels can be set. As a result of the analysis of the radiation diagram the azimuth angle of the radiation source  $\theta$  is computed and antenna is directed towards it. The accuracy of  $\theta$  evaluation depends on signal level and signal to noise ratio. The mechanical accuracy of antenna actuator is  $\pm 1^\circ$ .

## III. RESULTS and CONCLUSIONS

The system was tested at field trials. It demonstrated high electromagnetic immunity and uninterruptible operation under radiated electric field conditions up to 30 kV/m. The microwave sensors with horn antennas were tested up to 200 kV/m and demonstrated stable operation. The improvement of radiation direction calculation at noisy signal conditions and application of a few sensors widening frequency range is under development.

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## REFERENCES

- [1] NATO Youtube: Suicide bombers and how to beat them, <http://www.youtube.com/watch?v=56veH8-KbEM>.

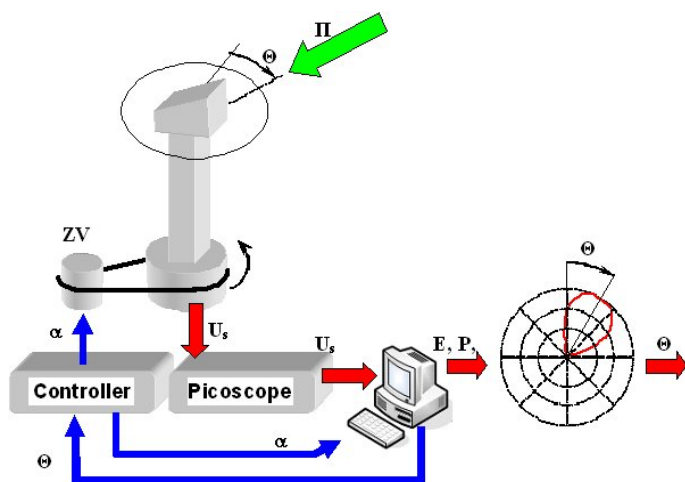


Figure 1. The diagram of microwave attack detecting system.