HPEM Tests of Security Systems

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***Abstract*—Intentional Electromagnetic Interference (IEMI) can be used to support illegal activities ranging from robbery to terroristic attacks. The general idea is to use High Power Electro-magnetics (HPEM) beyond the Electromagnetic Compatibility (EMC) immunity of electronic protection systems to impair its safety level. In particular, surveillance and alarm systems could be in focus of such an attack. Fraunhofer INT did HPEM vulnerability tests with an alarm system. The results allow to discuss possible scenarios.**

HPEM; IEMI; Electromagnetic Threat; Alarm System; Surveillance System; HPM Testing

I. INTRODUCTION

Surveillance and alarm systems are the key tools used for property protection, where the area is large or the observation is automated during night and holidays. An attack with IEMI could be used to disable this functionality directly or indirectly by the "human factor". Fraunhofer INT performed HPM tests to investigate the behavior of an alarm system during pulsed high power RF application.

II. TESTING

A. Test Method

Tests were done using the Fraunhofer INT open TEM waveguide in combination with RF pulsed power oscillators in the range of 10 kW to 35 kW and 1 µs/1 kHz pulse modulation. The frequency range is 150 MHz up to 3450 MHz.

B. Test Object

An easy to purchase alarm system set with the German security quality label 'VdS' has been selected for the tests. There are additional EMC immunity requirements related to this label [1]. The set consists of a central unit, a control panel, an outdoor alarm device, two IR motion sensors, five windows/door relay sensors, and a key switch. The test setup is completed with a wireless extension unit and one relay sensor to test a wireless alarm system path, too.

C. Test Setup

The system has been grouped into a Device Under Test (DUT) with the central unit and the wireless extension unit and a group of sensors, actuators, and operating devices (Fig. 1). The cable harness in between is app. 2 meters with 1.5 meters in a straight length according to automotive EMC test setups. All wire lengths in the cable harness are realized to represent long lines in a real cabling layout. The cable is the original screened one sold by the alarm system manufacturer.

Figure 1. Test setup fixed on rigid foam with groups and cable harness.

The system wiring configuration is the example described in the manual and all installation details have been done exactly following that document. A notable detail is that there is no description how to handle the cable shielding. Consequently, it hasn't been connected in the setup.

III. TEST RESULTS

The alarm system shows two effect groups. Functional state B (blue marks in Fig. 2) is mainly a permanently glowing flash LED of the alarm unit and LCD turn off during RF exposure. It does not affect the alarm functionality and is therefore acceptable. Functional state D (red marks) is a delayed reaction of the IR motion sensors on RF amplitude changes leading to alarm release, which is not acceptable in terms of operation purpose.

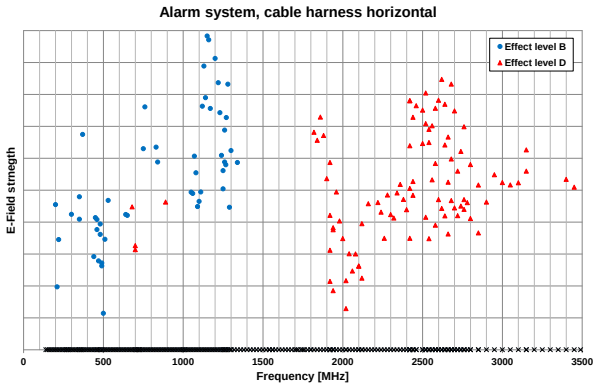

Figure 2. Susceptibility threshold of alarm system.

As the alarm can be released easily in a broad range from 2 GHz to 3 GHz (red marks in Fig. 2), HPM could be used gain access to a facility. In a fictive scenario repeated hidden HPM alarm activation might misguide the operator to disarm the alarm system.

REFERENCES

[1] VdS Guidelines for Control and Indicating Equipment (CIE), "Control and Indicating Equipment (CIE) of classes B and C, Requirements," VdS 2252en, Edition: 2003-12. Link: http://vds.de/en/quick-links/vds-guidelines/