

Response of an Electrical and Communication Raceway to HPEM Transient Field Illumination

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Abstract— We present measurements of currents and voltages in power, telephone, and Ethernet cablings of a commercial raceway induced by a transient HPEM field.

Keywords- IEMI; HPEM; GTEM Cell

I. INTRODUCTION

An efficient hardening of infrastructures against intentional electromagnetic interferences (IEMI) requires the characterization of the expected disturbances at the equipment to be protected.

The main objective of the tests reported in this contribution was to characterize the voltages and currents induced by a HPEM transient field inside the power, telephone, and Ethernet cablings of a commercial raceway.

II. EXPERIMENTAL SETUP

A 200-cm long test raceway containing several power, network, and telephone cables typical of an office environment was built. Three different types of Ethernet cables were used for the network cabling: Category 7 S/FTP cable (C7), Category 6 SF/UTP cable (C6-S), and Category 6 U/UTP cable (C6-U). Category 5 was not included since most new installations are expected to use category 6 or higher. The raceway was illuminated inside the GTEM Cell of Armasuisse (20 kV/m peak and 100 ps risetime), and induced common mode currents and differential mode voltages in the lines were measured. The measured signals were relayed with a fiberoptic link to a Lecroy SDA1000 oscilloscope located in the measurement cabin outside the GTEM cell. In order to test the effect of having a grazing or parallel E field polarization, the tests were made with the raceway in horizontal or vertical positions.

III. OBTAINED DATA

More than 100 measurements were performed for the induced currents and voltages. Figure 1 shows an example of an induced current waveform measured in the Ethernet C6-S cable. Table I shows the range of the measured peak values of

the induced currents and voltages for each type of cabling.

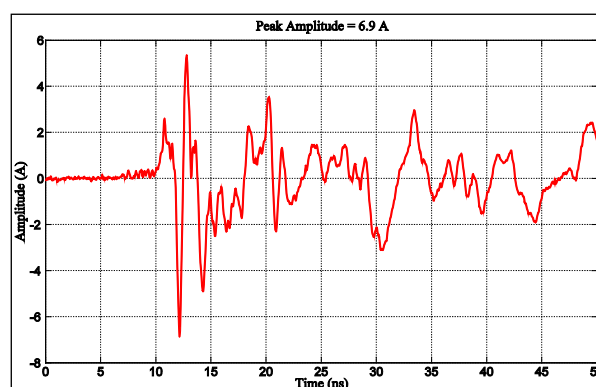


Figure 1. Example of a current waveform measured in the Ethernet C6-S cable.

TABLE I. MEASURED RANGE FOR THE INDUCED CURRENT AND VOLTAGE PEAKS

Network	Induced Current range (A)	Induced Voltage Range (V)
LV power cabling	2.1-8.5	122-474
Telephone cabling	1.7-9.8	40-298
Ethernet C7 cabling	4-6.8	13-34
Ethernet C6-S cabling	4.4-6.8	10-49
Ethernet C6-U cabling	2.2-5.6	91-107

IV. CONCLUSIONS

It is found in general that the effect of the considered disturbances highly depends on the equipment connected to the lines. Ethernet equipment may be compromised due to the low voltage requirements in the communication protocols of network cards. The signals induced in the telephone and power lines are not likely to harm the connected equipment since the induced levels are in the same order of the working levels.

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