ESTIMATION OF RADIATED EMISSIONS FROM A PC-AT COMPUTER

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Abstract. The paper proposes a system to measure radiated emissions. The system consists of a PC computer that activates a rotative desk with the tested equipment on the platform. The signal is prelevated with a sniffer probe to a spectral analyzer. The analyzer is coupled to the computer through an IEEE 488 interface. The acquired signal is processed and presented by the computer. Another part of the paper deals with simulating a computer as an electromagnetic emission source. The results of the simulation are compared with the experimental results.

1. INTRODUCTION

Electromagnetic pollution of the environment becomes more and more important in our country at the end of this millennium. The perturbations induced by electric equipment act by two ways: there are conducted disturbances and radiated disturbances. This paper proposes a PC based measurement system for radiated disturbances. The system consists of: a rotative desk, a spectral analyzer and a PC computer. Fig. 1. shows the block diagram of the system.

The rotative desk holds the tested equipment. The rotation of the desk is accomplished by a step by step motor which receives command signals from the parallel port of the computer via optical fiber and an impulse distributor. The supply of the circuits is a "Battery Drive Power Supply" (a method from *TECHNICS*). While the system is operating, the supply is from the battery; the rest of the time, the battery is charged from the mains. The radiated disturbances are acquired with a 50 Ω impedance Sniffer Probe, then measured and analyzed with a spectral analyzer working with a PC-AT computer through the IEEE-488 interface. The system must work in an Anechoic Chamber.

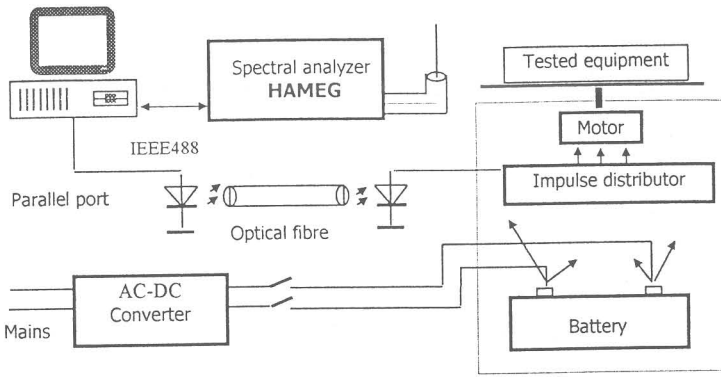

Fig. 1. – Block diagram of the measurement system

We did experiments as far as possible from other perturbation sources. The aim of our measurements was to compare disturbances of different PC-AT computers and for different PC-AT cases.

2. SIMULATION OF A COMPUTER AS AN ELECTROMAGNETIC EMISSION SOURCE

Mathcad allows a simplified modelling of a PC computer. We conssider the following frequecies, 50% square signal:

- 16 MHz (33MHz, 66MHz, 133MHz, 200MHz, 233MHz, 300MHz, 333MHz etc.) – for the processorr's clock
- 32 MHz - main clock (not for the latest boards)
- 33 MHz – PCI clock (if necessary)
- 100MHz - Bus clock (if the board permits)
- 14.3181 MHz – ISA clock
- 1.4181 MHz - serial port clock
- 44.9 MHz - video clock
- 28.322 MHz - video clock

One can conssider as perturbances sources also a 50Hz sinus for the mains and a 20KHz square signal for the PC power supply. All the signals are sumarized and ponderated with coefficients according to the voltages, currents and to the active emissive distance of the signal.

$$s(t) = \sum_{i=1}^{n} U_i I_i d_i c_i(t) \tag{1}$$

$$c_i(t) = \sin 2\pi f_i t \tag{2}$$

$$c_i(t) = \begin{cases} 1 \text{ for } \sin 2\pi f_i t \geq 0 \\ 0 \text{ for } \sin 2\pi f_i t, \prec 0 \end{cases} \tag{3}$$

The signal $s(t)$ is a sum of perturbances $c_i(t)$ generated by the system, multiplied by voltage amplitude (U_i), current amplitude (I_i) and distance (d_i). The result of the simulation is presented in Fig. 2.

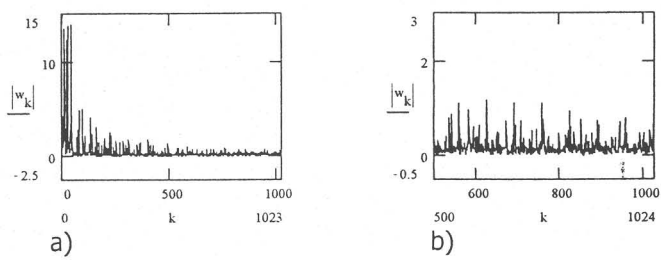

Fig. 2. Simulated spectrum for the emission of a PC-AT computer.
a) 0-1GHz, b) 500MHz –1GHz

3.EXPERIMENTAL RESULTS

The images of the acquired spectrum have been transferred to the PC with *Proscope* programm. To compare the experimental results with the simulation we use a detail placed at 40-50 MHz (to underline the fgrequency 44.9 MHz – generated by the video card) Fig. 3 shows simulated and Fig 4 shows measured spectrum. Both images, simulated and measured show a significant component at 45 MHz (44.9 MHz) and lower components at 43 and 48 MHz. Additional, for the measured signal we can see components at 42.2, 46.5, 47.5, 48.5 MHz.

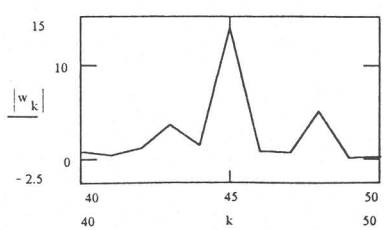

Fig. 3. Simulated spectrum - emission of the PC computer (detail at 40-50 MHz)

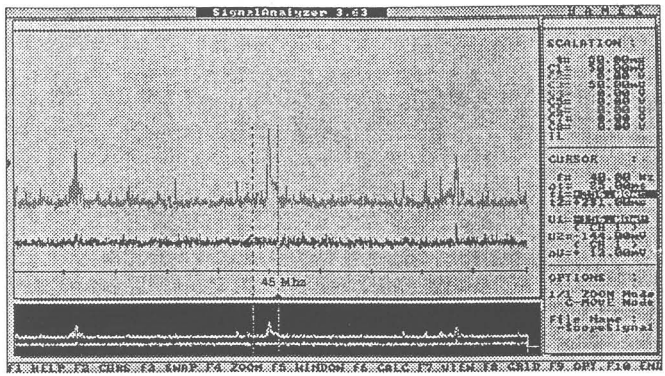

Fig. 4. Measured spectrum - emission of the PC computer (detail at 40-50 MHz)
Top – computer is on; Bottom – computer is off

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