

PROTECTED MICROCOMPUTERS FROM VÚVT-ENGINEERING

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Summary The paper presents properties of new protected microcomputer prototypes that recently developed VÚVT-Engineering a.s. Žilina. The five new prototypes of protected microcomputers and displays provide users with important protection against radiated information leaking from a computer and suppress unfavorable effects of electromagnetic radiation on a man. The first part of contribution describes technical parameters of protected microcomputers and displays. The results of optical characteristics measurement and measurement of electric field radiation from the protected microcomputers are discussed in the second part of the contribution.

1. INTRODUCTION

Company VÚVT-Engineering, Žilina (VÚVT-E) [1] is in computer industry and in related application branches since 1992 as a direct successor of VUVT Žilina leading institute in the field of research, development and implementation of computers for office, industrial and special purposes. VÚVT-E is stable company with own buildings and appropriate technical and technological equipment. Its development programs, which are on a real commercial basis, mean guarantee for development and prosperity of the company.

Products of VÚVT-E can be found in food, construction, engineering, electrotechnical and gas industry, in health care institutions and in defense.

VÚVT-E has developed five prototypes of protected computer systems and displays in the period 2003-2005. The applied research was solved as the partial task 04 in the frame of State Research & Development 2003 SP 26 028 0A 04 Sophisticated processes and products supporting export capability of electrotechnical sector of industry in the Slovakia – Research and development of human-machine and human-technology interfaces (HMI).

Protected computers from VÚVT-E prevent information from leaking by way of electromagnetic radiation as well as from leaking in supply and interface cables. Shielding technology and connection through optical fibers are used to prevent radiation.

Electromagnetic shielding technology, which is applied at the computer system, provides two practical aspects:

- Protection of a user against unfavorable effects of electromagnetic field radiated from a computer
- Reduction in risk of abuse of information leaking from computer.

2. PROTOTYPES OF PROTECTED MICROCOMPUTERS

Assortment of protected microcomputers from VÚVT-Engineering includes five new prototypes. Next text describes basic technical parameters of the prototypes.

Configuration of Prototype 1

Display part is separated from computer part in prototype 1 (Fig. 1). LCD display (10,4 ") is placed into a ferromagnetic cage. Both low input power industrial computer 3,5 " size or PC/104 can be built in the computer part. It is together with keyboard placed in removable part. Performance of processor Intel LV is 400 MHz or Vortex86 500 MHz. Resolution of LCD display is maximum 800 x



Fig. 1. Prototype 1

600 pixels.

The prototype 1 is reconfigurable similarly to common computers of the same class. Under internal modularity the configuration can be supplemented with internal peripheral devices for

optical data transfer through connectors ST or special filtered connectors DIN9.

Configuration of Prototype 2

Prototype 2 (Fig. 2) is the smallest one in the standard series. It belongs to mobile devices. The supply and filter systems are adapted due to the demands. The prototype input power is minimized. Monochromatic graphic LCD display 6,4 " placed in a ferromagnetic cage and the low power industry computer PC/104 create one unit. Performance of processor Vortex86 is 500 MHz, resolution of LCD panel is 240 x 128 pixels.



Fig. 2. Prototype 2

Prototype 2 is functionally divided into two parts, display and computer. Prototype 2 can be reconfigured as independent monochromatic graphic LCD display which uses intelligent means of the own display or the display which works with low power industrial PC format computer. Due to internal modularity the configuration can be supplemented with internal peripheries and data transfer through special filtered connectors DIN9 and DIN25. Touch sensitive panel is used for control and operation.

Configuration of Prototype 3

Prototype 3 consists of a computer and a flat LCD monitor in one block. A keyboard and a mouse are supplemented. The monitor diagonal is 17 ". All devices are connected to optical interfaces. Prototype 3 can be divided into two logic parts, display and computer.

Prototype 3 is reconfigurable in three ways similarly to PC computers. The modular construction enables to extend prototype 3 with internal peripheral devices, with authorized access module (dactyloscopic (fingerprint) recognition) and with circuits for voice and sound stimulus recognition and identification.

The system has got free positions for internal peripheral devices, for PCMCIA card and a free space for minimum four pieces of HDD.

Authorized access can be implemented through PCMCIA card and a fingerprint scanner. The prototype is convenient to standards NATO (AMSG 720B, AMSG 788A and AMSG 784) and to standards MIL STD 461 at EMC radiation level.

Signal buzzer of opened wicket door to internal peripheral devices identifies disturbance of protection.

The system of prototype 3 can be modified through:

- exchange of motherboard without modification of internal mechanical parts
- exchange of internal peripheral devices including HDD
- connection of external peripheral devices to USB with optical output
- completion of configuration with modules in free positions of the motherboard.

Configuration of Prototype 4 "Projection Display"

The prototype (Fig. 3) represents the class of projection displays with DMD (Digital Micromirror Device) technology. DMD is a matrix of micro mirrors on one chip. The number of micro mirrors corresponds to resolution of VGA, SVGA, XGA standards.



Fig. 3. Prototype 4

Prototype 4 is functionally divided into two parts, a projection part and a computer one. The projection module is placed in the upper part of a ferromagnetic cage. The optical converter RGB-VGA, occasionally low power industrial computer, supply and filtration system are built in the lower part of the ferromagnetic cage. Access to the both parts is through an upper and bottom cover. Mechanical construction is single coat. It means the shielding cage is self-bearing skeleton of the entire prototype too. The bottom cover is sealed with special metal gasket and allows an access to modifiable components. The skeleton of prototype



Fig. 4. Prototype 5

has got special shielding mesh that allows using of internal ventilator and enables access of cooling air to lead heat away from projection system.

Such way designed prototype allows configuring either a projection panel with direct access through optical input RGB, or DVI, or configuration of “IP client” type.

Distance of projection plane is 1 to 4 meter, active (effective) display area is 0,7 – 3,7 meter, resolution XGA 1280 x 1024, light flux 230 cd/m²,

contrast 2000:1, input power 190 W.

Configuration of Prototype 5 “LCD 21”

Prototype 5 (Fig. 4) represents the class of large protected displays with diagonal greater than 20”.

The prototype can be functionally divided into two parts, the display and the computer. The both parts are connected together and represent one unit. LCD-TFT display 21” is placed into ferromagnetic cage in front part. Low power industry computer and other electronic circuits are built in back separate ferromagnetic cage. Both parts are connected together through a metal gasket. Mechanical construction is single coat. It means the shielding cage is self-bearing skeleton of the entire prototype too. An access to the modifiable components is through back cover, which is sealed with special metal gasket. In case a powerful computer system is built-in, the system needs an access of cooling air. The back cover can get special shielding meshes used at prototype 3 and 4.

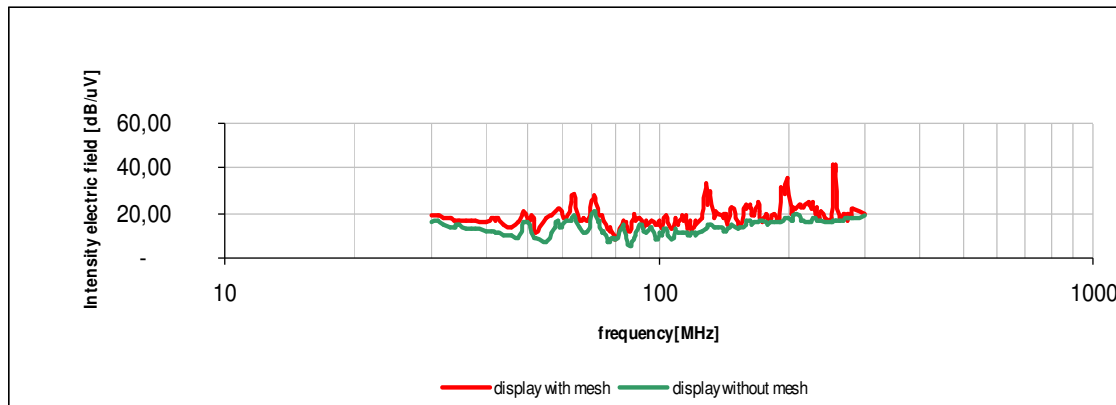


Fig. 5. Measurement of disturbing electric field in range of 30 to 300 MHz

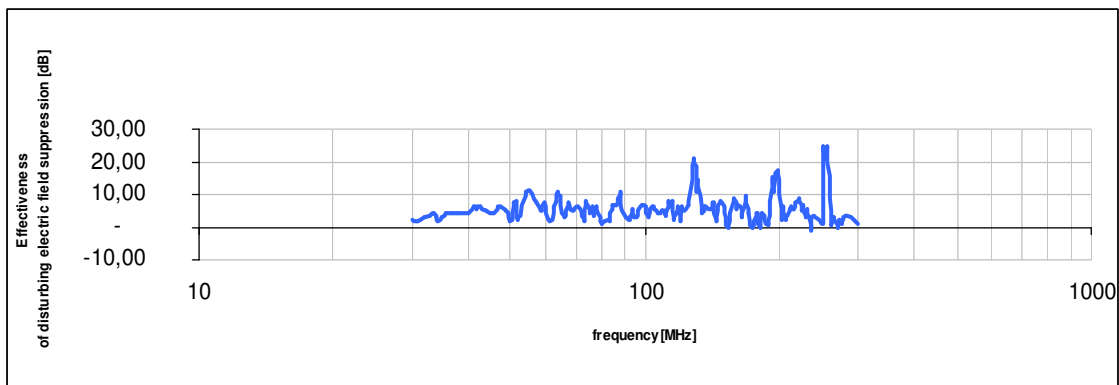


Fig. 6. Effectiveness of field shielding disturbing electric field by built in screen mesh

3. EFFECTIVENESS OF SHIELDING

Leaking of electric field of chosen prototype was measured at TÜV Product Service Slovakia, s.r.o., Divina 595. The measured prototype was prototype 3 – protected display with fused-in microscopic metal mesh. An antenna of horizontal polarization has scanned radiated energy in frequency interval from 30 MHz to 300MHz. Fig.5 and Fig.6 show graphic results of measurement of the display with metal mesh and without metal mesh. Fig.6 presents considerable suppression of radiation in range of 5 dB to 25 dB mainly at frequency more than 100 MHz after the shielding metal mesh was set on.

Tab. 1. Critical value of view angle of prototype 3.

Critical value of view angle	without metal mesh				with metal mesh			
	R	G	B	W	R	G	B	W
vertical - $\alpha_{krit} [^\circ]$	79	80	76	80	68	67	66	67
horizontal - $\beta_{krit} [^\circ]$	78	75	77	79	63	62	61	63

4. VIEWING ANGLE OF DISPLAYS OF PROTECTED MICROCOMPUTERS

The microscopic metal mesh hinders optical radiation and thereby makes worse optical parameters of display. The aim of measurement was to evaluate detachedly an influence of mesh on viewing angle of display in both horizontal and vertical direction. The measurement was performed on displays of prototype 3 and prototype 5 according to method in [2]. Each display was measured two times with metal mesh and without metal mesh. Tab.1 and Tab.2 contain results of measurement and allow their comparison. Viewing quality of prototype 3 with metal mesh got worse in range of -14° to -30°. The critical values of viewing angle at prototype 5 without and with protective mesh are better than at prototype 3. The metal mesh got worse the viewing quality at prototype 5 too, but only in range of -10° to -16°.

Tab. 2. Critical value of view angle of prototype 3.

Critical value of view angle	without metal mesh				with metal mesh			
	R	G	B	W	R	G	B	W
vertical - $\alpha_{krit} [^\circ]$	70	64	54	67	47	45	40	45
horizontal - $\beta_{krit} [^\circ]$	53	53	40	66	29	24	26	36

5. CONCLUSION

The result of applied research at VÚVT-Engineering a.s. Žilina is five prototypes of protected microcomputer display devices. New protected computers allow the protection of user against unfavorable effects of electromagnetic field radiated from computer. Performed measurement proved that the protected computers reduce risk of misuse of information leak from computer into an environment. Although the electromagnetic radiation of protected microcomputers and displays is reduced considerably, the optical display parameters decreased marginally.

REFERENCES

- [1] <http://www.vuvt.sk/produkty.htm>
- [2] Čuntala, J., Hargaš, L.: Measurement LCD display viewing angle with and without clear metallic grating, Applied Electronics 2005 International Conference, University of West Bohemia, Department of Applied Electronics and Telecommunications, Pilsen, Czech Republic, September 7-8, 2005. ISBN 80-7043-369-8