On Measurement of Electromagnetic Radiation by Computer System in Indoor Electromagnetic Environment

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Abstract. The source of electromagnetic radiation in the computer system will not only cause biological effects of electromagnetic radiation on the human body, but also cause pollution to the ecosystem, so the measurement of the amount of electromagnetic radiation in the computer system is particularly important. In this paper, the current situation and types of electromagnetic radiation pollution and indoor electromagnetic environment in the computer system electromagnetic radiation measurement instruction, and electromagnetic radiation occupational protection measures are analyzed, for the reference of readers.

Keywords: Indoor Electromagnetic Environment, Computer System, Electromagnetic Radiation Measurement, Radiator Frequency

1. Introduction
With the development of The Times, there are a series of standards for the measurement of electromagnetic radiation in the computer system. Most of the standards for the measurement of electromagnetic radiation amount in the computer system require testing in OATS (open field test) and microwave anechoic chamber, and many test experiments should be conducted to ensure the reliability of the experiment. The influence of computer radiation on human body is analyzed by measuring the electromagnetic radiation in computer system.

2. Current situation and types of electromagnetic radiation pollution

2.1 Current status of electromagnetic radiation pollution
Electromagnetic radiation pollution exists in both outdoor and indoor environments, which requires people to pay enough attention to. At present, the systems of communication, power transmission, transportation and launching weapons will produce electromagnetic radiation pollution outdoors. Especially at present, the communication industry develops at a fast speed. Some high-power electromagnetic-wave transmitting base stations appear more and more in suburban areas, and a large amount of electromagnetic radiation is generated. As the communication infrastructure, base station antenna can be seen everywhere in the city [1-3]. If the base station antenna is not set properly, residents will be affected.

Serious electromagnetic radiation pollution. High voltage power transmission equipment is
distributed densely in both urban and rural areas, which also leads to the aggravation of electromagnetic radiation pollution.

Some transmitting systems are installed to facilitate the exchange of information and culture, but if not properly planned, serious electromagnetic interference will be brought to the nearby areas. With the rapid development of the current transportation industry, various means of transportation will interfere with the normal signals of communication and broadcasting facilities [4-6].

Relative to outdoor electromagnetic radiation pollution, indoor electromagnetic radiation pollution can not be ignored, part of the electromagnetic radiation products are also constantly into the family, to bring greater convenience to people's life, so loved by people, but it brought serious electromagnetic radiation pollution to the indoor.

In recent years, the increasing of electromagnetic pollution also makes people pay more and more attention to electromagnetic radiation pollution, and pay more attention to the protective measures of electromagnetic radiation pollution. In this case, it is necessary to strictly enforce the laws and regulations related to electromagnetic radiation pollution, at the same time, strengthen the application of electromagnetic radiation control technology, do a good job of individual electromagnetic radiation pollution protection measures, so as to improve the effect of electromagnetic pollution protection (Figure 1 electromagnetic radiation pollution is around us).

![Figure 1. Electromagnetic radiation pollution is all around us.](image)

2.2. Types of electromagnetic radiation pollution

Electromagnetic radiation pollution will bring serious electromagnetic interference to the environment. At present electromagnetic interference source is divided into strong electromagnetic interference source and weak electromagnetic interference source, strong electromagnetic interference source its radiation spectrum is narrower, will not only make the system or equipment efficiency is reduced, but also will bring greater impact on the organism. But the weak electromagnetic interference source its spectrum is wider, often will cross the frequency range of order of magnitude, its to some strong anti-interference system, electronic equipment and electrical efficiency will bring certain influence. We can classify the sources of electromagnetic radiation according to different purposes of electromagnetic energy utilization. Some equipment, such as voltage transformer, power supply wire, electronic equipment, household appliances and information technology equipment, can also produce electromagnetic energy in normal operation, but will not exceed the standard scope; At the same time in the medical

Radiofrequency equipment used in medical science and industry, which needs electromagnetic energy for normal operation, but these equipment only serve specific objects in a certain area, and can control electromagnetic energy within a certain range; In addition, radar, communications, television
and broadcasting equipment, only radiation electromagnetic waves can complete the normal work. There are electromagnetic radiation implications for electronic equipment and electrical installations, such as radio, television and telecommunications equipment, industrial electromagnetic radiation equipment, power system equipment, means of transport and various household appliances.

3. Electromagnetic radiation measurement by computer system in indoor electromagnetic environment

Electromagnetic radiation has two fields acting together, the induction field and radiation field, in which the induction field is also called the near field, which is mainly induced, and the radiation field is also called the far field, which is mainly radiated. According to different distances, the determination of the electromagnetic radiation technology can be divided into near-zone and far determination in jobsite, the determination of the related equipment is divided into the near-zone apparatus of the electromagnetic radiation and electromagnetic radiation meter far district, no matter which one is suitable for the electromagnetic field area, related to the measuring instrument is made up of antenna and the host, the former is used to detect the signal, which is used to calculate and output.

3.1. Domestic and foreign near field electromagnetic radiation measurement technology

In the measurement of the induction field, the upper limit value is large, so the integrated field intensity meter, namely the non-frequency selective wideband radiation meter, is generally used for the measurement. This kind of electromagnetic radiation measuring instrument is generally wide-band, direct-reading type, equipped with 2-3 3D probes, with high measurement accuracy, easy to carry and easy to operate. The electric field probe and the magnetic field probe can be selected according to different measuring purposes. The former is divided into dipole and detector diode probe and thermocouple probe. For the detection of near-field area, foreign research on electromagnetic radiation detection is earlier than that in China, and relevant technologies are relatively mature. For example, the electromagnetic radiation measurement in the United States has realized automatic environmental monitoring, and the frequency band can reach up to 26GHZ. The electromagnetic radiation research in China is relatively late. The electromagnetic radiation near field instrument is "broadband electromagnetic field intensity meter" (model 1) developed by 701 Research Institute of Ship Corporation. 0.1-3000 - m band; The range is 0.1U W/cm2-200w /cm2; Three-dimensional probe), "Microwave leakage instrument" developed by Jiangsu Suqian wireless Power Plant (model: Dch-y-801; 1-10 g band; 0.005-30 mw/cm2 range; Non-omnidirectional probe), etc. It can be seen that in terms of the detection of the near field area, the detection range of China is relatively narrow and the detection function is poor in comprehensiveness. In addition, the reliability is still to be studied.

3.2. Far field electromagnetic radiation measurement technology at home and abroad

In the far field radiation measurement, compared with the near field measurement, the electrical and magnetic intensity of the former are proportional to each other, so they can be derived from each other. China stipulates that the boundary is 300MHz. If the frequency of the radiator exceeds this value, only the electric field intensity can be measured. However, if it is lower than this value, the two strengths should be measured separately, which determines that the instrument does not need to undertake more detection and calculation functions in the remote field measurement, but it needs to have a high precision. According to the different detection methods, the system can be divided into peak detection and quasi-peak detection. The former is suitable for the detection of narrow spectral radiation sources, while the latter is opposite.

4. Analysis of occupational protection measures against electromagnetic radiation

4.1. Shielding and control of electromagnetic radiation sources

Shielding protection technology is the most common way of radiation protection. Shielding protection technology is the process of limiting the effect and influence of electromagnetic radiation within a
certain range to prevent radiation from being diffused. There are two ways of active shielding and passive shielding. Radiation-shielding can generally be done by using metal-clad objects such as plates or sheets. At the same time, some measures should be taken to prevent the shield from becoming a secondary emitter, and the shield should be grounded. Reflection and absorption can also be used to enhance the damage caused by radiation leakage. In the area of electromagnetic radiation pollution, comprehensive protective measures should be taken, such as the construction of industrial plants in residential areas, and the widespread use of remote control and telemetry after the improvement of electrical equipment. Through the test, it is proved that the electromagnetic radiation can be effectively reduced by shielding and controlling the radiation source, and the electromagnetic radiation of the electromagnetic field of the radiation source can be reduced by more than 50%, even up to 85%, so as to realize the protection of human radiation.

4.2. Electromagnetic radiation protection of production equipment

The electromagnetic radiation protection of production units should take active measures to protect, such as shielding equipment to use more advanced and more stable effect of equipment, for the use of electromagnetic radiation shielding equipment also need to be updated in a timely manner. In the process of production, monitor equipment shielding effect and rf grounding response regularly to ensure that equipment parameters are set within a reasonable range. Electromagnetic radiation parameter recorder and inspector should check the equipment regularly, and use the function of monitoring to find problems in electromagnetic radiation shielding in a timely manner. If there are problems, they must be corrected in a timely manner to reduce the possibility of electromagnetic radiation leakage in the production process of the equipment, thus causing greater harm. If an electromagnetic radiation isolation layer or electromagnetic radiation protection layer is attached to the production equipment and passes through the isolation layer, Protection construction can adjust the electromagnetic radiation shielding of production equipment by 70% ~ 80%, greatly reducing the electromagnetic radiation injury of electromagnetic radiation professionals (Figure 2 radiation suit can effectively shield radiation).

4.3. Protection against electromagnetic radiation in the workplace

Workplace electromagnetic radiation protection compared with the protective equipment, electromagnetic radiation protection more passive, workplace specific measures in experts and scholars on the electromagnetic radiation equipment layout spacing after a detailed analysis and measurement, management personnel for metal objects that exist in the workplace, difference can't use or not use in the production, adopt measures to remove and replace. Work period to do a good job of monitoring, electromagnetic rf and microwave equipment should be updated and maintained in a timely manner, data monitoring instruments should be monitored by professional personnel, play the role of supervision. For example, if the individual is working for 8 h, the absorption rate within 6 min
should be less than 0 and 1 W/kg, and if the public is exposed to 24 h, the absorption rate within 6 min should be less than 0 and 0.02 W/kg according to the ratio of systemic absorption. Take occupational radiation effects as an example and summarize them as Shown in Table 1.

Table 1. Occupational radiation effects.

| frequency range/MHz | electric field intensity(V/m) | magnetic field intensity(A/m) | Power density(W/m²) |
|---------------------|------------------------------|------------------------------|--------------------|
| 0.1 ~ 3             | 87                           | 0.25                         | 20                 |
| 3 ~ 30              | 150                          | 0.40                         | 60                 |
| 30 ~ 000            | 28                           | 0.075                        | 2                  |

5. Conclusion

To sum up, electromagnetic radiation measurement of computer system can be completed through electromagnetic radiation measurement technology. At the same time, effective protective measures should be taken against the hazards of electromagnetic radiation in daily life. The harm of electromagnetic radiation to human body can be reduced by shielding and controlling the radiation source, adopting advanced shielding equipment and supervising the detection of electromagnetic radiation.

References

[1] Shen Di. Energy saving and occupational radiation protection measures (2011, 11-163).
[2] Yu Chao. Health hazards and protection of electromagnetic radiation [a]. Chinese society of toxicology: Chinese society of toxicology, 2019:1.
[3] Li Changjin, Chen Qi, Li Jianlong. Discussion on the harm and Protection of radiation [J]. Neijiang Science and Technology, 2016,39 (09): 108-110 + 118.
[4] Wang Liuhui. Occupational hazards of electromagnetic radiation and protective measures [J]. China new technology and new products, 2017 (05): 147-148.
[5] Wang Chenglin. Harm and protection of electromagnetic radiation pollution [J]. Engineering construction and design, 2017 (04): 131-132.
[6] Cui Fu. Research on electromagnetic radiation protection standards [J]. Western radio and television, 2015 (20): 193.