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Experiment Investigation of the Field radiated by Human Electrostatic Discharge (ESD)

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Summary

More attention was paid to the effects of the electrostatic discharge (ESD) current in the past study of the ESD. The field radiated by the ESD are often ignored. With the rapid development of electronic technology, the influence of field radiated by ESD is more and more obvious. The field radiated by human body ESD is investigated. The result shows the peak-peak field radiated in 27 cm by human body ESD with potential of 2kV is 30V/m. The field band of the spectrum is extremely wide, ranging from several MHz to above 1GHz. The experiments also show that the amplitude of electric field radiated by ESD when holding a metal screw driver discharging to the ground metal is about 5 times large than that the finger discharge directly to the ground.

1. Introduction

It is well know that electrostatic discharge(ESD) can damage electronic devices and electrical explosive devices. More attention was paid to the effects of the ESD current in the past study of the ESD. The field radiated by the ESD is often ignored. With the rapid development of electronic technology, the influence of field radiated by ESD is more and more obvious. The study of field radiated by ESD is becoming more and more interesting[3,4]. This paper investigates the field radiated by human body ESD.

2. Experiments of the field radiated by human body ESD

2.1 Test rig

The main instrument of the experiment is Tektronix TDS680B oscilloscope with sampling speed of 5GS/s and the bandwidth of 1GHz. A customized monopolar antennae is used to measure the field.

2.2 Field radiated by finger discharge to the ground

Fig.1 shows the field in the distance of 27cm radiated by finger discharging to a grounded metal ball with diameter of 8cm. The human is charged with electrostatic potential of 2kV by electrostatic high power generator. The capacitance of the human body to the ground is about 80pF. It can be seen that the peak to peak field E_{pp} is 30V/m. Fig.2 shows the spectrum of this field. The band of the spectrum is very wide ranging from 10MHz to above 1GHz. The main component is between 10MHz to 200MHz.

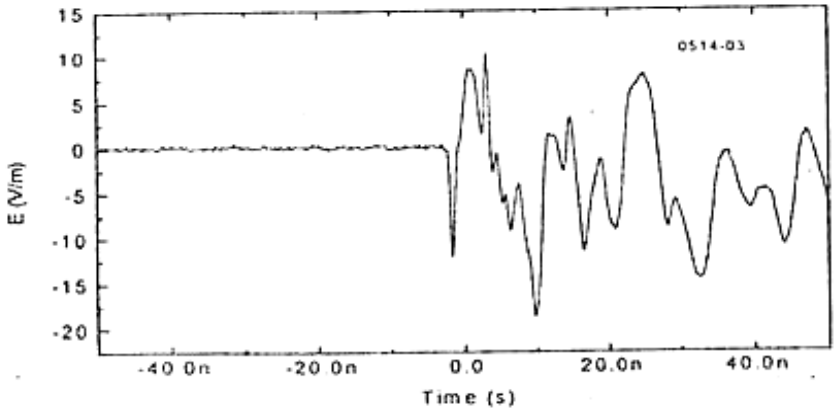

Fig.1 Field radiated by human with potential of 2kV and discharge through finger

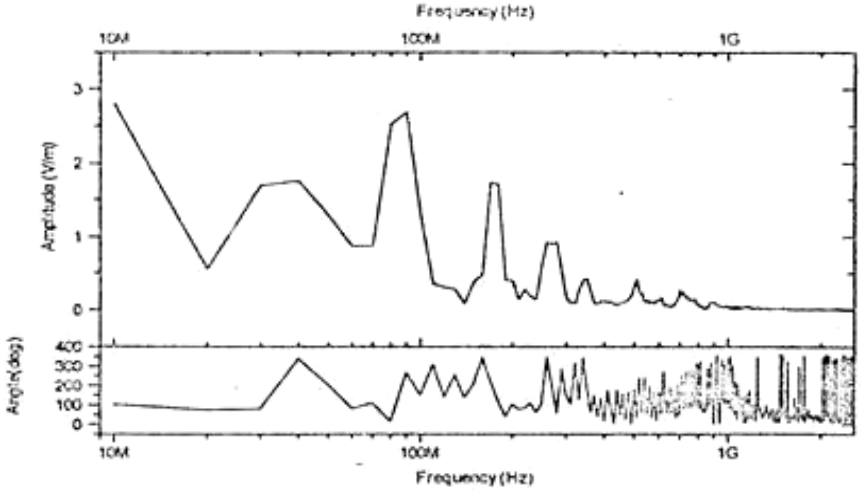

Fig. 2 The spectrum of field radiated by human ESD

2.3 Field radiated by human holding a wood handle screw driver with a metal point discharge to the ground

Fig. 3 shows the field in the distance of 27cm radiated by human holding a wood handle screw driver with a metal point discharging to a grounded metal ball with diameter of 8cm. The human is charged with electrostatic potential of 2kV by electrostatic high power generator. The capacitance of the human body to the ground is about 80pF. It can be seen that the peak to peak field E_{pp} is 165V/m. Fig.4 shows the spectrum of this field. The amplitude of the field radiated by human holding a wood handle screw driver with a metal point is about 5 times than that radiated by human finger discharging directory to the ground. The spectrum is similar but the main component is 10MHz.

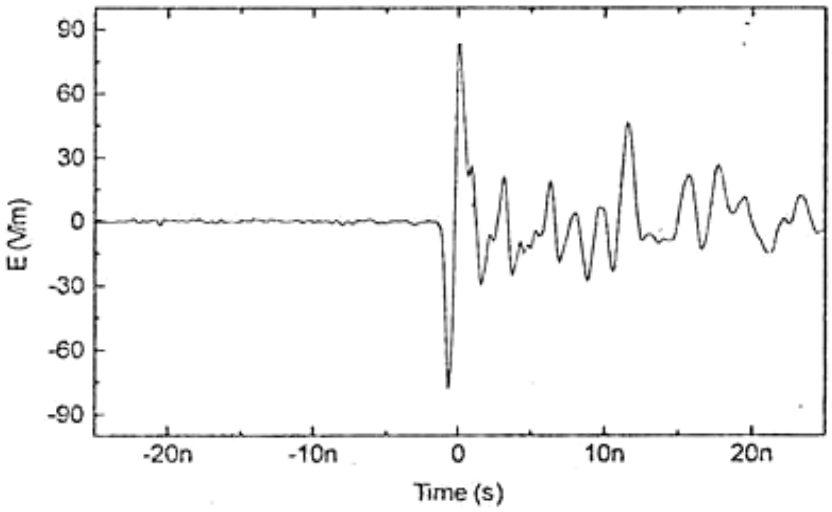

Fig.3 Field radiated by human holding a wood screw driver with a metal point discharging to ground

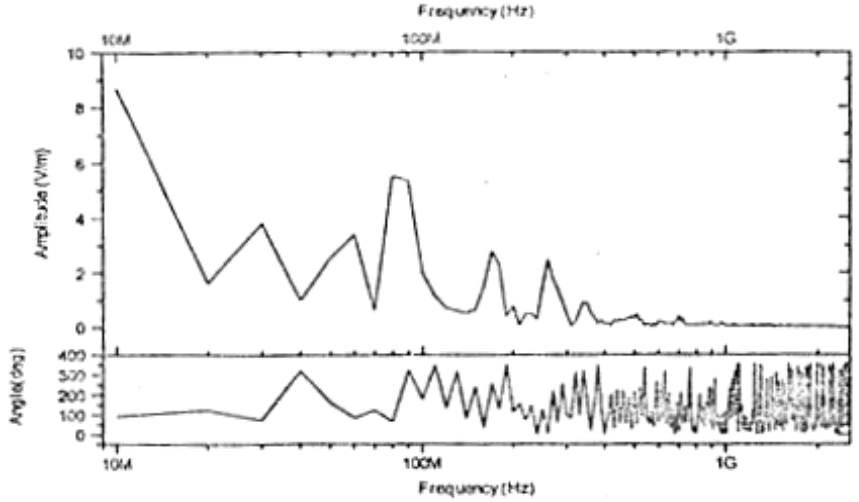

Fig.4 Spectrum of field radiated by human holding a wood screw driver with a metal point discharging to ground

2.3 Field radiated by human holding metal screw driver discharging to the ground

Fig. 5 shows the field in the distance of 10cm radiated by human holding a metal screw driver discharging to a grounded metal ball with diameter of 8cm. The human is charged with electrostatic potential of 2kV. It can be seen that the peak to peak field E_{pp} is 420V/m. Fig.6 shows the spectrum of this field. The amplitude of the field radiated by human holding a metal screw driver is many times than that radiated by human finger directly discharging to ground. The main component is between 200MHz and 500MHz.

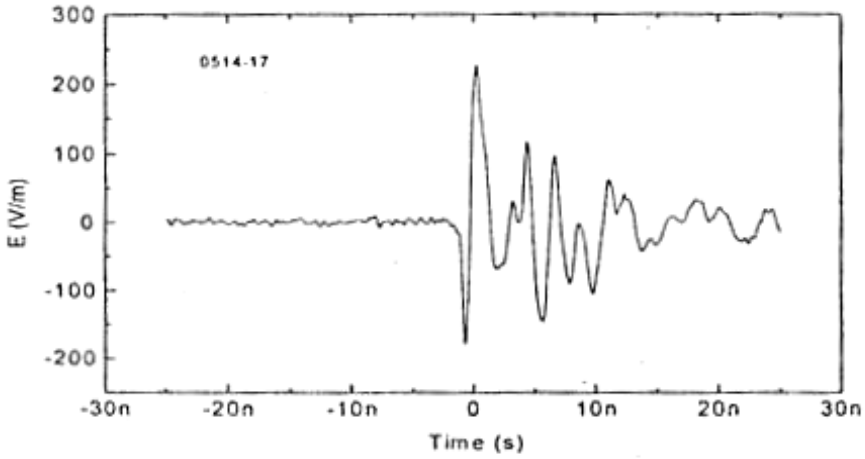

Fig.5 Field radiated by human holding a metal screw driver discharging to ground

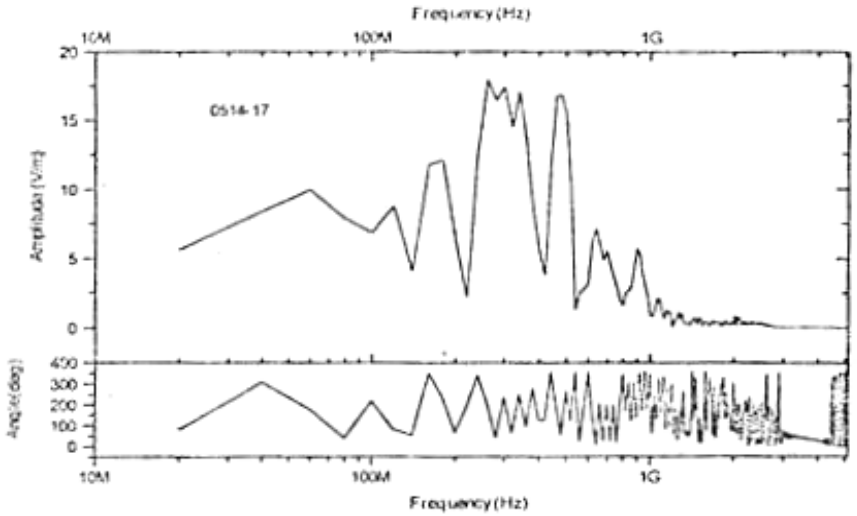

Fig.4 Spectrum of field radiated by human holding a metal driver discharging to ground

3. Conclusions

The field radiated by human body ESD is measured by monopolar antennae. The peak-peak field radiated in 27 cm by human body ESD with potential of 2kV is 30V/m. The band of the spectrum is extremely wide, ranging from several MHz to abover 1GHz. The main component is between 10MHz and 200MHz. The experiments in this paper show that the amplitude of electric field radiated by ESD when holding a screw driver discharging to the ground metal is about 5 times large than that the finger discharge directly to the ground.

4. References

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