

Development of Lightning Surge Protection for Telecommunications Equipment.

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Telecommunications equipment is damaged by surges induced by the lightning discharges near telecommunication lines. This paper therefore describes the development of lightning surge protection for telecommunications equipment; it describes lightning surge observations, theoretical analysis of the inducing mechanisms, a lightning surge test circuit, and the classification of lightning surge immunity levels.

Newly developed equipment, for example a lightning surge observation system using optical fiber, is used to obtain the dependence of surge waveform on the telecommunications line conditions and the lightning surge distributions. Theoretical analysis using a hybrid underground and overhead line model shows that calculated results roughly agree with the observed data.

A lightning surge test circuit that can predict malfunctions in telecommunications equipment is developed. This circuit uses an equivalent impedance and a voltage source to model the lightning surge occurring at the telecommunication line end. The test surge waveform is determined from the voltage source waveform distribution based on the equipment malfunction rate. In experiments using a key telephone, the malfunction rates predicted by the test closely agree with observed rates.

The cost of the lightning surge protection can be reduced by about 50 percent when the immunity level of the equipment is divided into three classes.