

Case study #	2.6
Title	Lightning damage to a payphone
Type of trouble	Damage.
Source of trouble	Lightning.
System affected	Customer equipment (Payphone).
Location	Outdoors (in the street or in a campus).
Keywords	Damage, lightning surge, bonding, protection coordination, GDT.
Version date	2004-01-01

System configuration

The problem equipment is a payphone in an outdoor cabinet installed in a university campus. The earth for the mains supply to the payphone cabinet was tens of metres away from the cabinet. The local earth for the cabinet is 10s of ohms. Inside the cabinet is a double-insulated power supply which supplies 21 V a.c. to power the payphone. The payphone has a local earth for coin metering and lightning protection of the payphone electronics and users. Components were being physically damaged in the equipment. It was assumed that lightning was causing this damage. The system configuration is shown in Figure 2.6-1.

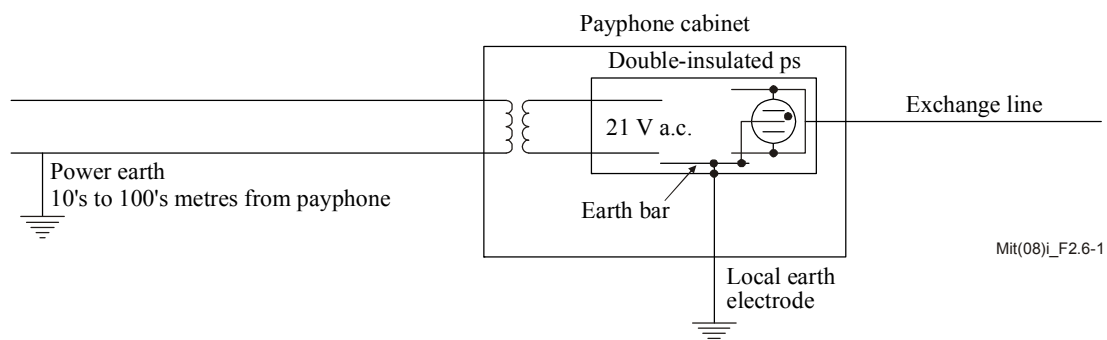


Figure 2.6-1 – System configuration

Measurement/Searching techniques/Experiment

The damaged components were identified by normal service technique. The dies of these components were then examined using both optical and electron microscopes. As recommended in Rec. ITU-T K.21, different types of lightning surges were applied to the payphone external conductors – i.e., the telephone line and the mains cable – in an attempt to replicate the damage. No damage could be caused at K.21-enhanced test levels.

It was then decided to inject surges into the low-voltage cable between the transformer and the electronics. This would not normally be done because the length of the cable between the transformer and the electronics is short and the cable is contained within a metal cabinet.

It was found that current limited 1.2/50 μ s surges applied longitudinally to this low-voltage cable could reproduce the component damage as observed by a microscope.

The damage path was via the power supply port, damaged components and the internal telephone line protection circuit to the payphone earth. To prevent damage, bypass protection was added from the power supply input to the common earth point within the unit.