

Case study #	3.1
Title	Power and telecommunication systems grounding
Type of trouble	Abnormal operation, damage.
Source of trouble	Intermittently connected power neutral.
System affected	Customer's equipment – occasional continuous ring tone (no cadence) sometimes resulting in damaged customer apparatus.
Location	Customer premises.
Keywords	Safety, power transmission line, GDT, SPD, earth electrode
Version date	2004-01-01

System configurations

Normal PSTN line, isolated/exposed location on very high resistivity soil. Power feed and telecoms line to premises via aerial cables. The area was prone to lightning activity, and surge protective devices (SPDs) were fitted at the customers' premises to the telecom line (bonded to the power system earth).

Searching techniques

All measurements on the telephone line indicated that the line was well within specification and that there were no faults with it. The line-card at the exchange was replaced, just in case the fault was due to a 'sticky' relay or faulty subscriber line interface circuit (SLIC). The line was no better. Speaking with the customer revealed that the power to the premises appeared to fluctuate at times, sometimes just dimming, and other times going out completely for a few seconds. The power company had been asked to check the supply quality and claimed it was all OK. The last few instances of continuous ringing caused the SPD mains fail-safe to operate, resulting in an engineer call-out. The engineer put this down to lightning activity, but was later told that this was unlikely, so the investigation continued. Measurements of the earth electrode resistance at the customer premises revealed it to be higher than expected (note, the power supply necessitated that an earth electrode be used).

Mitigation method/Results/Conclusion

Due to the power fluctuations and the SPD going S/C, it was thought that the problem was likely to be due to system supply. The only possibility was if the neutral became temporarily disconnected, and as the earth electrode resistance was not particularly good, the return current route was via the telephone line.

As the power company could not immediately find any fault, the customer SPD was moved out of the premises, to a telecom pole about 25 m away, and a suitable earth electrode made. This still gave a good level of protection for lightning, and also removed the continuous ringing problem. The increase in resistance between the power earth and the telecom earth was enough to avoid the power return current flowing into the telecom line. Whilst the solution was not ideal (possibly giving rise to unwanted EPR during lightning) it has not resulted in any further damage due to the power of lightning. The power companies were informed of our findings and subsequently renewed part of the route.

References

Rec. ITU-T K.37, Annexes A and B.