

Case study #	1.5
Title	Acoustic noise troubles caused by an electric fence
Type of trouble	Acoustic noise, degradation.
Source of trouble	Electric fence.
System affected	Customer equipment, line.
Location	Customer premises, outdoors.
Keywords	Power transmission line, transformers, screening, mutual coupling earth connection, optical components, optical insulation.
Version date	2004-01-01

System configuration

A customer complained about intense noise troubles on his analogue telephone line. The acoustic noise was permanent with varying intensity. Because of the kind of the problem (clicking interference at regular intervals), it was suspected that the cable (10-pair 0.4-mm copper cable) was being affected by an electric fence close to the cable route, which did not make part of this installation.

An optical fibre cable, with its screen earthed at both ends, was running parallel to the 10-pair copper cable. The optical fibre cable, the multiplexer (optical-electrical) and the 10-pair copper cable ended at the same distribution point. However, a long electric fence was located in the neighbourhood of the optical fibre cable, although not at the copper cable site.

The system configuration of the location is shown in Figure 1.5-1.

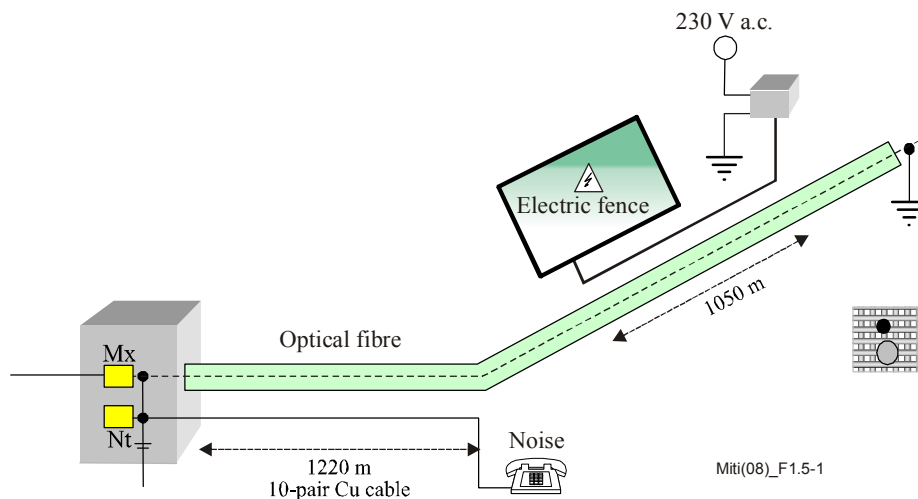


Figure 1.5-1 – System configuration

Measurement/Searching techniques/Experiment

The electric parameters of the line were in line with the requirements. A 148-Vp-p longitudinal voltage line-to-ground at customer installation was measured (Figure 1.5-2). The major frequency of the transients was about 8 kHz and decreased after 2.5 ms (Figure 1.5-3). The transients repeated at 1.3-second intervals. Measurements were also made at the distribution point. On the screen of optical fibre transient, currents with about 27 Ap-p were measured. The peak-to-peak voltage recorded between the earthing conductor of the screen and the ground at the distribution point was 340 Vp-p (Figure 1.5-4). The asymmetrical supplying cable of the electrical fence, which was situated along the route of optical fibre, was identified as the source inducing the transients.

Through the screen that was earthed at both sides (screen resistance 13.5Ω), the optical fibre was the source for the induction into the parallel copper cable. The metallic foil of the 10-pair cable was earthed on only one side, connected to the earth of the distribution point.

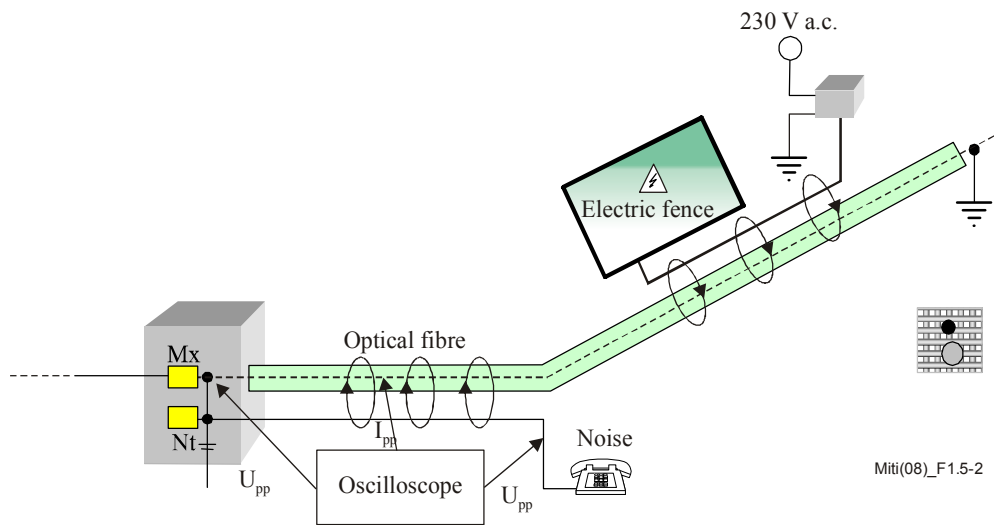


Figure 1.5-2 – Measurement system

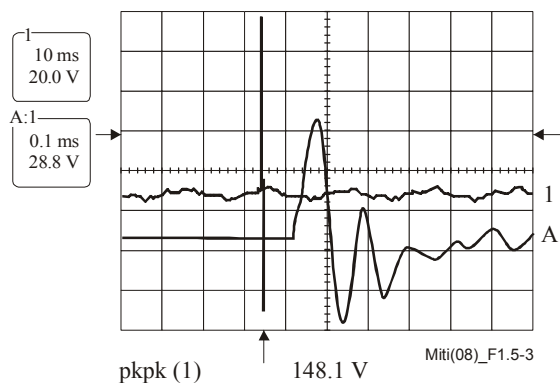


Figure 1.5-3 – Voltage transient on the copper – cable

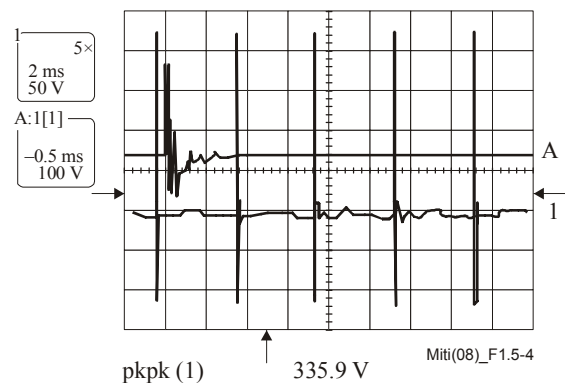


Figure 1.5-4 – Voltage transient on the screen of the optical fibre

Mitigation method

First, the metallic foil of the 10-pair copper cable was connected to the main earthing terminal at the customer site. As a result, the transient voltages were reduced to 1/6 of the value that had before mitigation (Figure 1.5-6). The remaining voltage, which was about 23 Vp-p, still caused some clicking noise. To solve this problem, it was decided to install a neutralizing transformer at the distribution point. This led to a decrease of about 3 Vp-p, making the disturbance vanish.

The buried power supply cable of the fence was poorly isolated, i.e., the connecting points were not isolated. Because of the disturbances, the following solution was found, in agreement with the owner of the electric fence: increase the distance between the power supply cable of the electric fence and the optical fibre cable, and properly isolate the connectors.

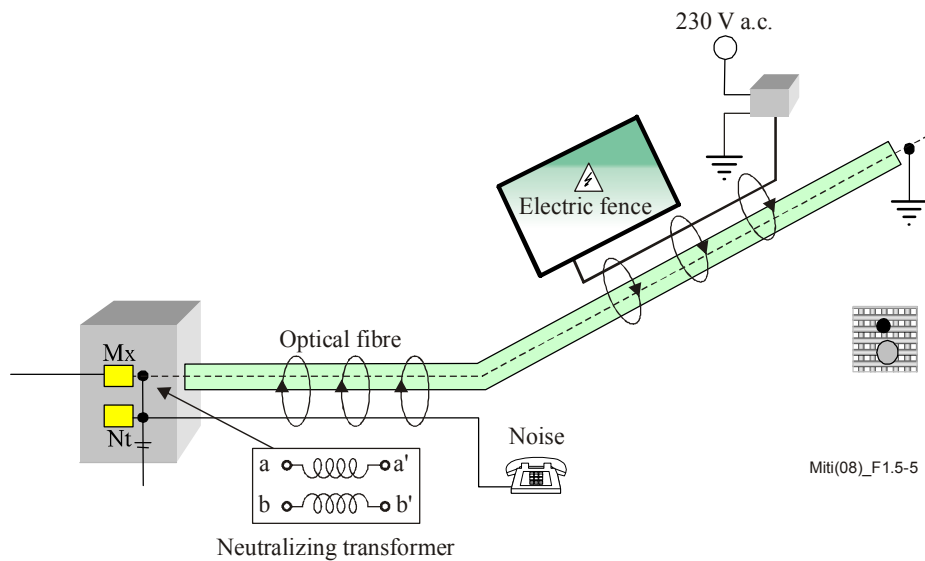


Figure 1.5-5 – Mitigation method

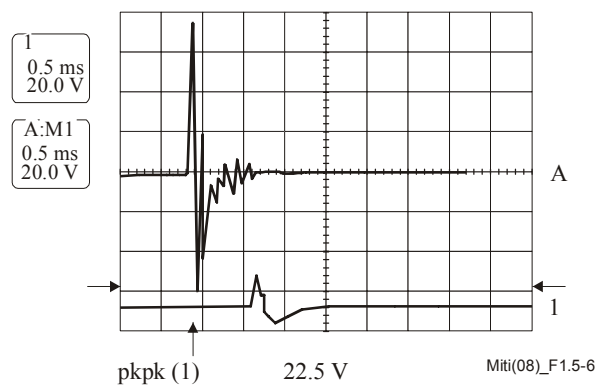


Figure 1.5-6 – Mitigation results