Case study #	1.3
Title	Acoustic noise troubles caused by switching noise of an elevator (lift)
Type of trouble	Acoustic noise.
Source of trouble	Elevator.
System affected	Customer's equipment.
Location	Customer premises.
Keywords	Elevator, mutual coupling, switching noise.
Version date	2004-01-01

System configuration

Acoustic noise trouble occurred at a customer premises. The customer complained that the acoustic noise could sometimes be heard; however, it was not clear what the trouble source was. The system configuration of this issue is shown in Figure 1.3-1. At the customer premises, the telecom lines and power mains cable for the elevator (lift) were parallel in the cable duct. The motor of the elevator used a switching power source. The telecom line connected to the telephone set was also connected to the MDF where the power transformer was located. The telecommunication line was changed; however, the acoustic problem continued.

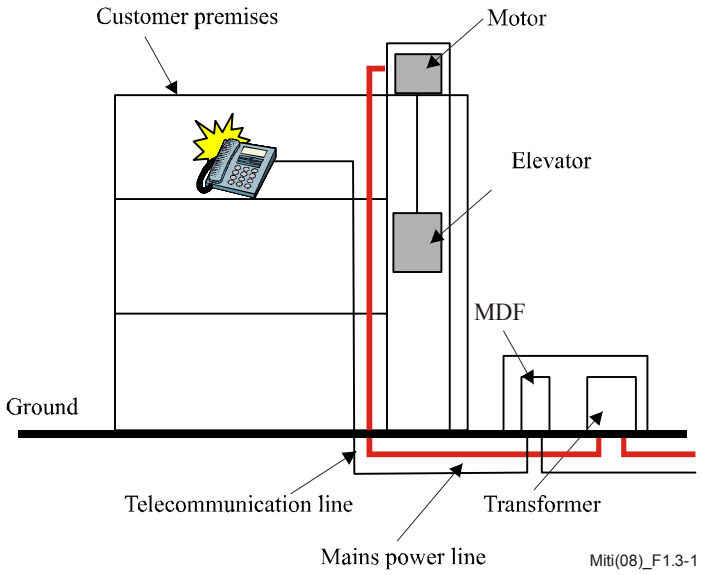

Figure 1.3-1 – System configuration

Measurement/Searching techniques/Experiment

To solve this acoustic problem, the current in the telecommunication line was measured (Figure 1.3-2). The common mode current wave shape is shown in Figure 1.3-3. A typical period 200-300 µs periodic characteristic can be seen in the figure. Its major frequency is about 5 kHz and it was estimated that the noise source must be a switching power source. The investigations showed that the power mains cable was wired parallel to the telecommunication line, and that the telecommunication line was connected to the main distribution frame (MDF) room, where the mains power transformer was located.

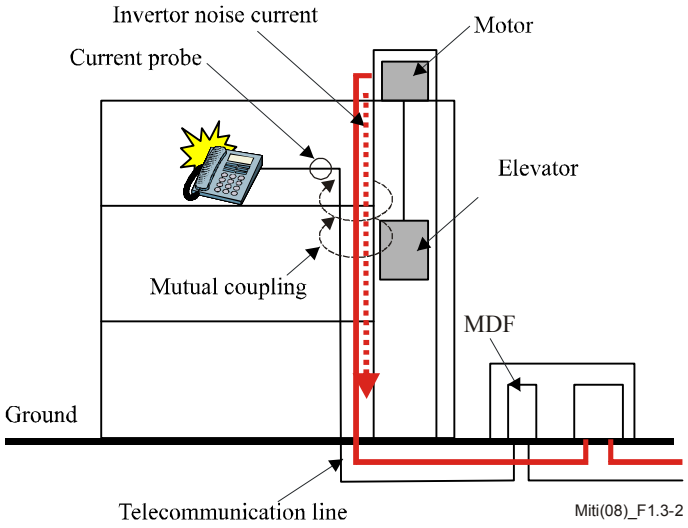

Figure 1.3-2 – Measurement of noise current

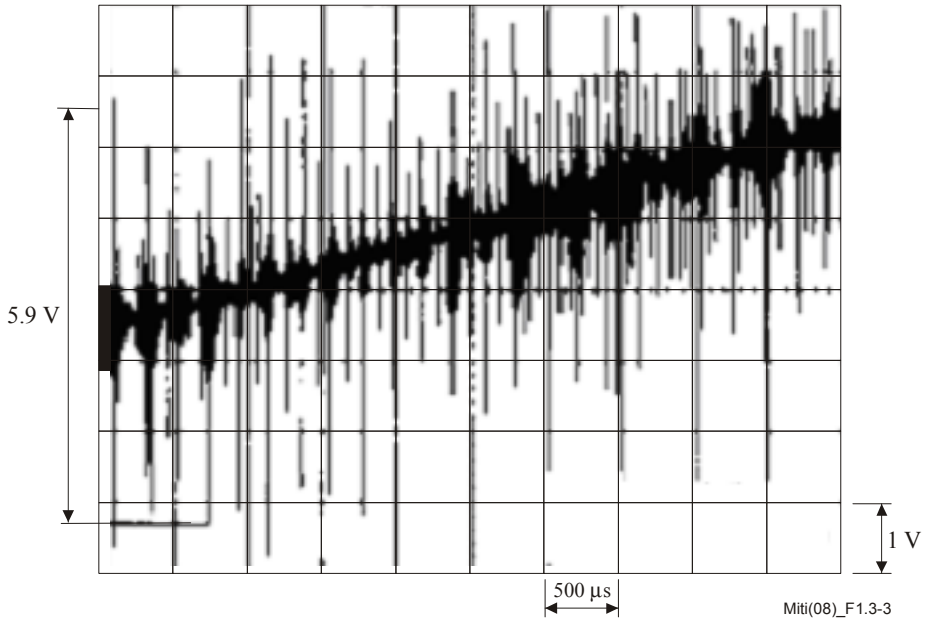

Figure 1.3-3 – Current wave shape on the line connected to the telephone

Mitigation method/Results/Conclusion

The acoustic problem originated in the mutual coupling of the switching noise of the motor. To solve this problem, it was decided to apply a common mode filter to the telecommunication line and an isolation transformer to the mains power line (see Figure 1.3-4). The isolation transformer with a filter was attached to the mains power line, and the filter was located as near as possible to the motor, so as to prevent the switching noise from travelling along the cable. The common mode filter at the MDF was attached to the telecommunication line.

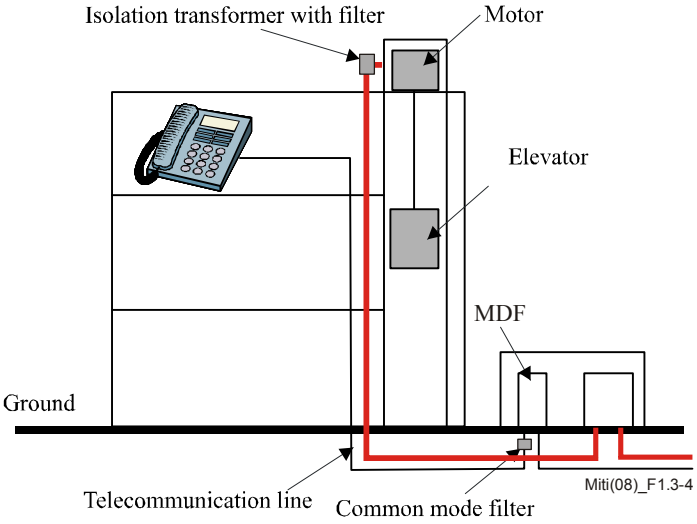

Figure 1.3-4 – Applied mitigation using common mode filter

References

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