Case study #	1.1
Title	Acoustic noise troubles caused by an amateur radio base station
Type of trouble	Acoustic noise.
Source of trouble	Amateur radio base station.
System affected	Customer's equipment.
Location	Customer premises.
Keywords	Immunity, amateur radio.
Version date	2004-01-01

System configurations

Acoustic noise trouble occurred at a customer premises. The customer complained that a strange sound could be heard through the handset of the telephone. The telecom line pair was changed as a usual mitigation measure; however, the problem continued.

The system configuration of this issue is shown in Figure 1.1-1. The telephone set was connected to the host equipment. The customer premises were located 20 to 30 m away from an amateur radio base station. The frequency of the radio base station was 7 MHz and its radiation power was estimated at more than 100 W. After the investigations, the electric field strength was found to be greater than 110 dBμV/m around and in the customer premises. The noise was caused by the electromagnetic waves of the amateur radio base station.

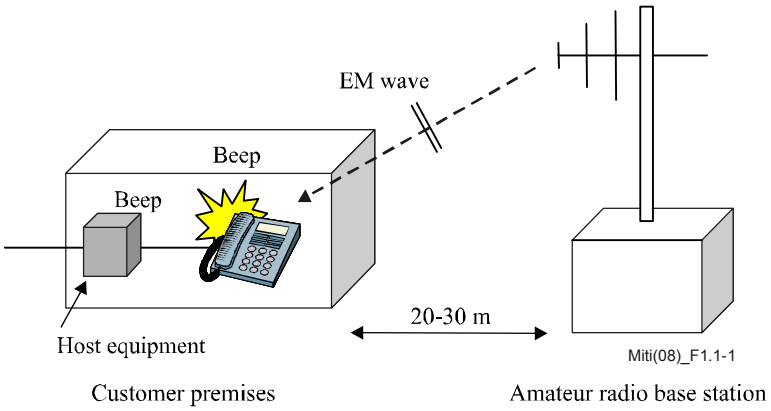

Figure 1.1-1 – System configuration

Measurement/Searching techniques/Experiment

To consider mitigation procedures, testing using a shielded room was carried out as shown in Figure 1.1-2. The test can be also carried out in an anechoic chamber. A signal generator was used to generate a 7 MHz signal with 80% amplitude modulation, which was then amplified and loaded to the monopole antenna. The resulting electromagnetic wave was applied to the telephone set and its host equipment. The monopole antenna was used as radiation antenna, and a loop antenna was utilized as receiving antenna. The loop antenna was connected to an electric field strength receiver (RX).

The immunity level of the telephone sets are shown in Figure 1.1-3. The immunity level of Telephone 1 was less than 110 dBμV/m, compared to the electric field at the real location. After testing, it was found that noise can be induced through the telecom port and the inner port connecting the telephone and the handset cord.

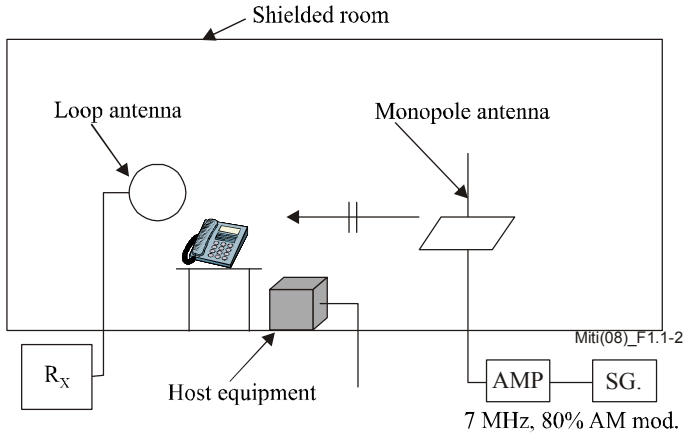

Figure 1.1-2 – Experiment configuration

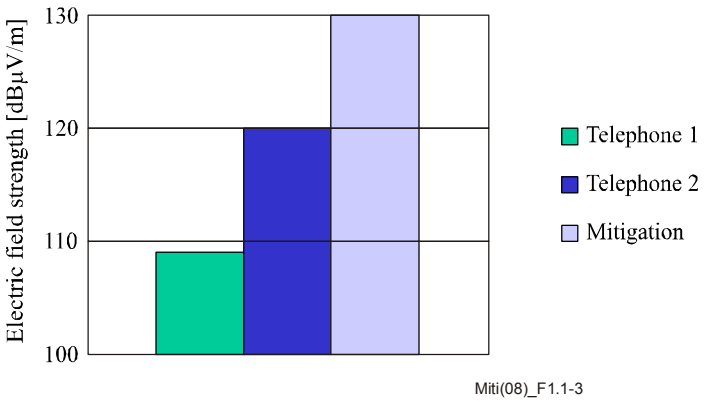

Figure 1.1-3 – Immunity levels of the telephone sets

Mitigation method/Results/Conclusion

In this case, common mode filters and capacitors were used as a mitigation measure. For the telephone set, a common mode filter was inserted into the inner port of the telephone: A 1000-pF capacitor was applied to the handset of the telephone set. The capacitance was selected considering the insertion loss and noise reduction. As for the host equipment, a common mode filter and capacitors were applied to the telecom port and the inner ports. The central frequency of the common mode filter was set to 20 MHz in this case. This filter is also effective for a 7 MHz electromagnetic field. One port of the capacitances was connected to the earth terminal of the host equipment. According to the mitigations, the immunity level is more than 130 dBμ/m; the acoustic noise problem was resolved.

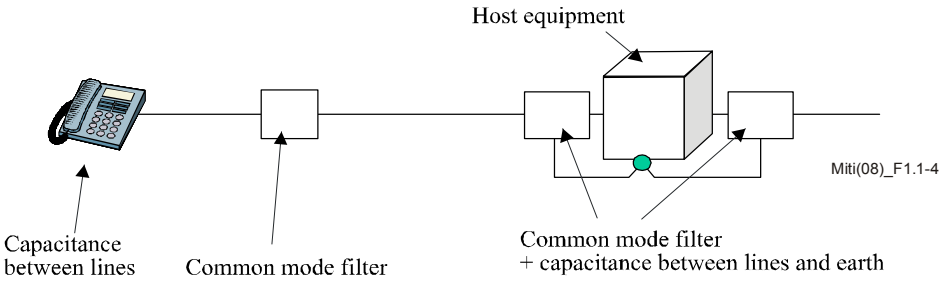

Figure 1.1-4 – Mitigations

References

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