

# Electromagnetic Shielding in Rock Tunnels

## Cables creating path through the coverage

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**Abstract**—For various reasons, some facilities are constructed below ground. One reason could be protection, but not necessarily against IEMI. The ground or rock will however provide some shielding. In this work, measurements has been carried out to explore protection in underground facilities that was not planned for IEMI protection. Originally, the study was only meant to investigate the rock.

Keywords-IEMI protection; underground facilities

## I. INTRODUCTION

Soil and rock can provide a certain protection against IEMI. The attenuation will depend on several parameters, like thickness, humidity and chemical composition. Concrete lining, with rebar will also have an effect. The shielding will be greatly dependent on frequency. However, like for shielding enclosures there is an issue about access to shielded space and connection to the outside world. When the shield is quite thick, handling these penetrations can be more complicated.

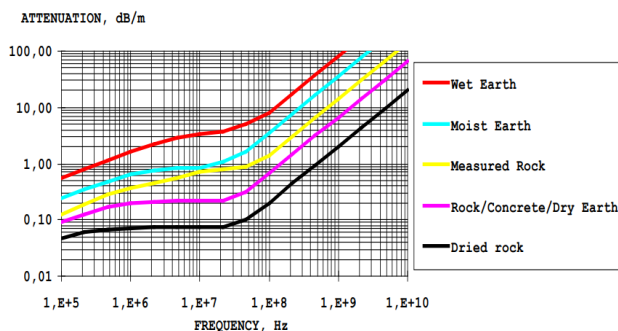


Figure 1 Some calculations of attenuation in coverage[1]

## II. MEASUREMENTS

The first investigation of the facility was planned to be done by using whatever transmitters that were present for the higher frequencies, and for lower frequencies a magnetic field transmitter was placed on the inside of the facility.

### A. High frequency measurements

Simple measurements were done by measuring field strength from transmitters for radio, TV and cellular base stations on the outside and on the way inside the facility. The signal was dramatically reduced after the first bend of the tunnel.

### B. Low frequency measurements

For low frequency measurements, a magnetic transmitter was placed inside of the facility. Measurements were then done on the outside of the facility with some distance to the tunnel opening. Attenuation in rock and concrete lining could be up to 50 dB at 10 MHz.

At a location a road with lampposts were crossing over the facility. Stronger signal was found near the lampposts than closer to the transmitter. Between the road lighting and the location of the transmitter there were transformers, and the cabling between them were in a quite long trace.

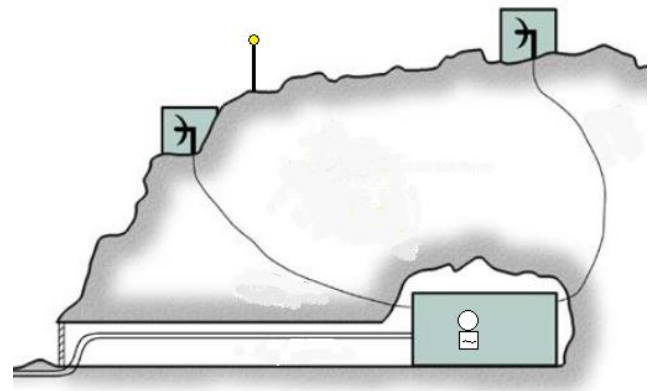


Figure 2 Low frequency measurements, magnetic transmitter inside facility

## REFERENCES

- [1] K. L. Grønhaug, "Shielding Against HPM by Overhead Covers", Tactical Implications of HPM Copenhagen, Denmark 11-13 June 2002