

# Electrical Shielding (Screening)



## Applications

In many applications, screening of cables is important, whether it be to minimize crosstalk within the cable, prevent interference from external sources, or eliminate radiation from the cable itself. Designing cables to provide effective shielding over a broad frequency spectrum is complex, and cables must be tailored to specific electromagnetic environments. From simple aluminized Mylar—providing electrostatic screening—progressively more complex shielding can be designed incorporating plated copper braids and Mu metal wraps.

Performance of conventional braiding can be significantly improved by computer optimization. This tightly controlled process can give many times the screening performance of a basic braided screen without weight penalty or increase in optical coverage. Superscreened cables combine Mu metal wraps with optimized braids to provide even further enhanced performance, especially at low frequencies.

## Features/Benefits

- Range of shield designs to cover a broad frequency band.
- Optimization tailored for each cable design.
- EMP shields for nuclear hardening.
- System compatible components for harness assemblies.

## Available Shields

| Screen type            | Typical application                  |
|------------------------|--------------------------------------|
| Aluminized Mylar       | Electrostatic screening              |
| Single braid           | Low-level EMI<br>Low sensitivity     |
| Single optimized braid | Sensitive lines<br>High EMI          |
| Double optimized braid | Highly sensitive lines<br>Severe EMI |
| Superscreened          | EMP/Tempest                          |
| Double superscreened   | Severest of applications             |

## Measuring Shielding (Screening) Efficiency—Surface Transfer Impedance ( $Z_t$ )

To assess the effectiveness of a shield, Raychem has adopted a modified triaxial configuration to MIL-C-85485 or the wire injection method, as described in IEC 96, to measure the surface transfer impedance ( $Z_t$ ) of a cable. This relates the open circuit voltage generated on a component wire inside the cable to the current injected on the overall shield.

The unit of  $Z_t$  is ohms per meter. Thus, the voltage coupling is length dependent and long cables exhibit more leakage than similar but shorter-length ones.

The understanding of leakage mechanisms has enabled Raychem to design cables with specified minimum  $Z_t$  values for the desired operating environment.

The requirements for nuclear hardened cables present the engineer with a range of problems. The waveform of the EMP is such that the majority of power is dissipated in a frequency band between 1 kHz and 5 MHz where conventionally screened cables provide little protection. Raychem has solved this problem with a range of superscreened cables that give screening performance

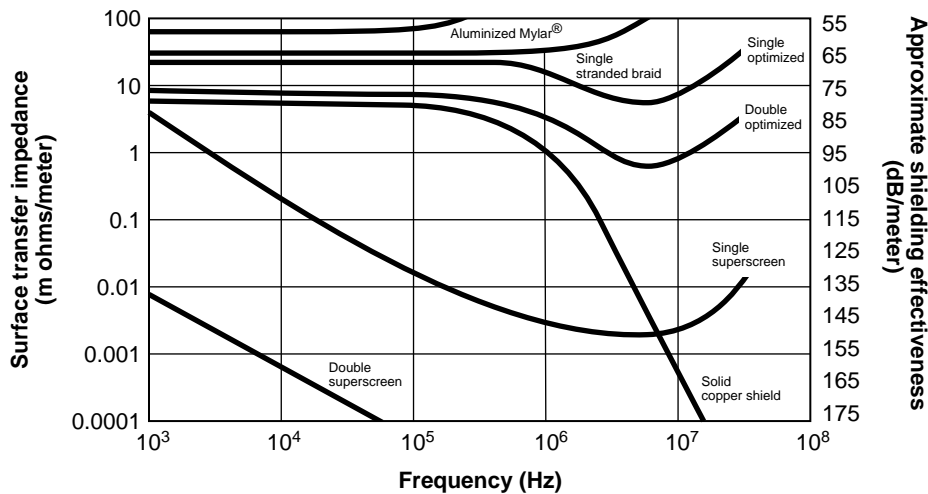
at these frequencies by incorporating materials that change the inductance of the shield and lower the transfer impedance.

Raychem superscreened cables have a sandwich construction of Mu metal tapes between optimized braids. Mu metal is a ferro-magnetic material that has a high permeability over a wide range of field

strengths. It is applied to the cable in a way that maintains cable flexibility and minimizes work hardening and any consequent reduction in permeability. Superscreened cables not only provide protection against EMP but also against other major interference modes (Tempest, for example).

Screened Cables

Relative differences in surface transfer impedance for different shield constructions on a representative core construction



Testing

Raychem's EMC test facilities have the capability for current injection and radiation field testing in addition to surface transfer impedance measurements. The installation is a proven facility in characterizing new design parameters.

Design and Manufacturing Expertise

The problems of shielding cables are complex. However, with the introduction of optimized braids and superscreened cables, Raychem has the capability to solve the most difficult shielding problems. Shielding of cables without degrading cable flexibility can be provided for

coaxial and multiconductor (multicore) cables for all EMC and EMP conditions. To complement this range of cables, Raychem manufactures cable terminations and connector back fittings to give total interconnection system screening performance.

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