# Time Domain Measurement of IEMI Shielding Effectiveness of Wire Meshes


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***Abstract***—In this paper we report on time domain measurements of the shielding effectiveness of wire mesh, for fast pulses, as would be appropriate for IEMI (intentional electromagnetic interference).



Keywords- IEMI, wire mesh, shielding effectiveness.


## I. INTRODUCTION

For an enclosure, such as a room, metal sheet provides excellent EM (electromagnetic) shielding effectiveness (SE). However, metal mesh might be used instead, such as for lower weight or ventilation, (such as is common for "screen" rooms). We are interested in the basic SE for the material, such as would be seen for a plane wave incident on an infinite sheet. A formula for this (for square mesh openings) is [1]:

$$SE = 103.5 - 20\,\log_{10}(d_{mm}\ f_{MHz})\quad (dB)\,. \qquad (1)$$

where $d_{mm}$ is the mesh spacing and $f_{MHz}$ is the frequency. (In the time domain this corresponds to a scaled time derivative. (This formula will have some lower and upper frequency limits, not given here.) Our measurements will check this formula.

## II. MEASUREMENT APPROACH

For practical reasons (such as limiting sample size and emissions) typical the SE is measured in a setup such as shown in Fig. 1. A screen room is divided into two rooms, with a mesh sample covering a window in the room partition. One room transmits an EM signal, and the other room measures what leaks through the mesh. Usually this is done in the frequency domain. There are complications with this approach, however, such as reflections and diffraction. We can avoid these two issues by using the time domain. Reflections and diffraction have additional path lengths, and so time delays – we use the measured signal only up to the time where corruption from these delayed effects can arrive. With this approach, the partition wall is not needed – the leakage around the screen edge, delayed from extra path length, is also ignored.

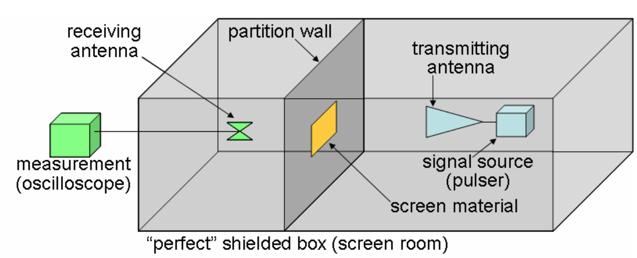


Figure 1. Example of a screen SE measurement setup.

## III. SAMPLE RESULTS

Measurements were made samples of various mesh sizes – Fig. 2 shows the ½ inch mesh. Fig. 3 shows measured signals for the samples. The red line is without any mesh, and the black line is with a very fine copper mesh (100 wires per inch) – with very good SE. Diffraction effects cannot come in until the time marked "edge". Fig. 4 shows a fit of:

$$SE = 99.7 - 20\,\log_{10}(d_{mm}\ f_{MHz})\quad (dB)\,. \qquad (2)$$

compared to the measurements for the 1 inch mesh – good agreement, a constant 3.8 dB poorer SE than Eq. 1. The presentation will also show results for variations, such as rotated and tilted meshes, and use of two meshes.

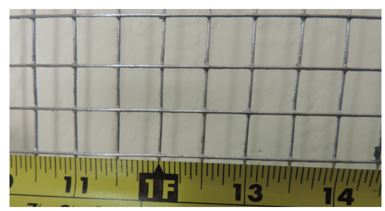

Figure 2. Sample of a wire mesh (with 1/2" spacing).

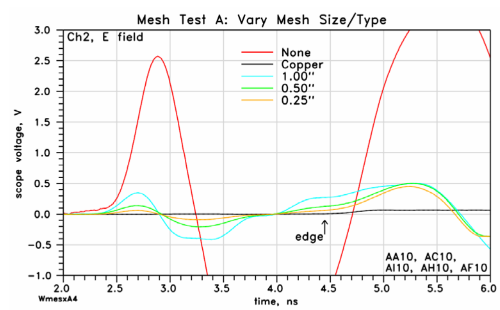


Figure 3. Measured waveforms for various mesh samples.

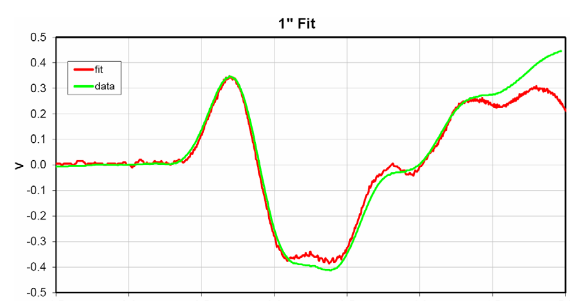


Figure 4. Sample waveform measurement and fit.

## REFERENCES


[1] Donald R. J. White, *Shielding Design, Methodology and Procedures*, Don White Consultants, 1986, 1st ed., page 4.18.