



Standard Test Method for Measuring the Electromagnetic Shielding Effectiveness of Planar Materials¹

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1. Scope

1.1 This test method provides a procedure for measuring the electromagnetic (EM) shielding effectiveness (SE) of a planar material for a plane, far-field EM wave. From the measured data, near-field SE values may be calculated for magnetic (H) sources for electrically thin specimens.^{2,3} Electric (E) field SE values may also be calculated from this same far-field data, but their validity and applicability have not been established.

1.2 The measurement method is valid over a frequency range of 30 MHz to 1.5 GHz. These limits are not exact, but are based on decreasing displacement current as a result of decreased capacitive coupling at lower frequencies and on overmoding (excitation of modes other than the transverse electromagnetic mode (TEM)) at higher frequencies for the size of specimen holder described in this test method. Any number of discrete frequencies may be selected within this range. For electrically thin, isotropic materials with frequency independent electrical properties of conductivity, permittivity, and permeability, measurements may be needed at only a few frequencies as the far-field SE values will be independent of frequency. If the material is not electrically thin or if any of the parameters vary with frequency, measurements should be made at many frequencies within the band of interest.

1.3 This test method is not applicable to cables or connectors.

1.4 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appro-*

priate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 *ASTM Standards*:⁴

D1711 Terminology Relating to Electrical Insulation

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology **D1711**.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *dynamic range (DR)*, *n*—difference between the maximum and minimum signals measurable by the system.

3.2.1.1 *Discussion*—Measurement of materials with good SE require extra care to avoid contamination of extremely low power or voltage values by unwanted signals from leakage paths.

3.2.2 *electrically thin*, *adj*—thickness of the specimen is much smaller ($<1/100$) than the electrical wavelength within the specimen.

3.2.3 *far field*, *n*—that region where vectors E and H are orthogonal to each other and both are normal to the direction of propagation of energy.

3.2.4 *near field*, *n*—that region where E and H are not related by simple rules.

3.2.4.1 *Discussion*—The transition region between near field and far field is not abrupt but is located at the distance close to $\lambda/2\pi$ from a dipole source, where λ is the free-space wave length of the frequency of the source. This concept of regions is further blurred by reradiating as a result of scattering by reflecting materials or objects that may be distant from the source. The interior of metallic structures often contains a mixture of near-field regions.

3.2.5 *shielding effectiveness (SE)*, *n*—ratio of power received with and without a material present for the same incident power.

¹ This test method is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.12 on Electrical Tests.

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² Wilson, P. F., and Ma, M. T., “A Study of Techniques for Measuring the Electromagnetic Shielding Effectiveness of Materials,” NBS Technical Note 1095, May 1986.

³ Adams, J. W., and Vanzura, E. J., “Shielding Effectiveness Measurements of Plastics,” NBSIR 85-3035, January 1986.

⁴ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.