

1. Purpose and Scope

This criterion is applicable to any kind of textile product including woven, knitted, coated/laminated and nonwoven textiles. The repeated washing and weathering test might be needed for mentioned products if necessary to measure the electromagnetic shielding effectiveness.

2. Terminology

2.1 dB (Decibels) : the unit of electromagnetic shielding effectiveness

2.2 Shielding Effectiveness (SE) : The ratio of power received with and without a material present for the same incident power.

(1) If the receiver readout is in units of power, use the following equation:

$$SE = 10 \log P1/P2 \text{ (Decibels, dB)} \text{---} P1 = \text{receiver power with the material present}$$

$$P2 = \text{receiver power without the material present}$$

(2) If the receiver readout is in units of voltage, use the following equation:

$$SE = 20 \log E1/E2 \text{ (Decibels, dB)} \text{---} E1 = \text{receiver voltage levels with material present}$$

$$E2 = \text{receiver voltage levels without material present}$$

3. Classification

3.1 The criterion

3.1.1 Class I— Professional use: medical equipment, quarantine material, professional security uniform for electronic manufacturer, electronic kit or other new applications.

3.1.2 Class II— General use: casual wear, office uniform, maternity dress, apron, consumptive electronic products and communication related products or other new applications.

Table1. Class I— Professional use.

Grade	5	4	3	2	1
	Excellent	Very Good	Good	Moderate	Fair
Electromagnetic effectiveness range	SE > 60dB	60dB ≥ SE > 50dB	50dB ≥ SE > 40dB	40dB ≥ SE > 30dB	30dB ≥ SE > 20dB

Table2. Class II— General use.

Grade	5	4	3	2	1
	Excellent	Very Good	Good	Moderate	Fair
Electromagnetic effectiveness range	SE > 30dB	30dB ≥ SE > 20dB	20dB ≥ SE > 10dB	10dB ≥ SE > 7dB	10dB ≥ SE > 7dB

Note 1: SE : Shielding Effectiveness (dB).

2: Regarding electromagnetic shielding effectiveness transfer to percentage of electromagnetic shielding, refer to table I, II in remark.

Revise Date: Mar/03/2005

Publish Date: Sep/01/2003

3.2 General requirement:

Table3.General requirements of Electromagnetic Shielding Textiles.

Item	Basic requirement	Standard
Durability to washing	Professional use: test as received mainly. General use: test as received, 20 washes, or 50 washes; or according to client's request.	Woven, coated/laminated, and nonwoven: AATCC 135 (1) IV (A) ii method. Knitted: AATCC 135 (2) IV (A) ii method.
Durability to weathering	Above 4 Grade	ISO 105 B2

4. Test method

4.1 Test sample:

4.1.1 Take 3 specimens in 30 cm × 30 cm.

4.1.2 Tested sample should be preconditioned in a 23±2 °C, 65±5 % RH environment for 24 hours prior to test. The test should be carried out immediately after conditioning.

4.2 Apparatus

4.2.1 Coaxial fixture: There are two different types— Flange Version and Capacitive Coupling

4.2.2 Vector Network Analyzer: The measurement method is valid over a frequency range of 30 MHz ~ 3 GHz.

4.3 Test procedure

(1) The initial test for electric field (E2) shall be conducted with no sample being mounted.

(2) The following test for electric field (E1) shall be conducted with sample being mounted.

(3) Shield effectiveness (SE) can be calculated according to the following formula:

$$SE = 20 \log E1/E2 \text{ (Decibels, dB)}$$

4.4 Result

4.4.1 The test report should give test values of SE at 300, 900, 1800, 1900 and 2450 MHz or any frequency requested by client.

Revise Date: Mar/03/2005

Publish Date: Sep/01/2003

**Specified Requirements of Electromagnetic Shielding
Textiles**

Document No. FTTS-FA-003

Version: 2.0

5. Mark

Table4. Mark of Electromagnetic Shielding Textiles.

Type	Grade	Shielding Effectiveness (dB)	Classification
Class I	AAAAA	$SE > 60\text{dB}$	Excellent
	AAAA	$60\text{dB} \geq SE > 50\text{dB}$	Very Good
	AAA	$50\text{dB} \geq SE > 40\text{dB}$	Good
	AA	$40\text{dB} \geq SE > 30\text{dB}$	Moderate
	A	$30\text{dB} \geq SE > 20\text{dB}$	Fair
Class II	AAAAA	$SE > 30\text{dB}$	Excellent
	AAAA	$30\text{dB} \geq SE > 20\text{dB}$	Very Good
	AAA	$20\text{dB} \geq SE > 10\text{dB}$	Good
	AA	$10\text{dB} \geq SE > 7\text{dB}$	Moderate
	A	$7\text{dB} \geq SE > 5\text{dB}$	Fair

6. Reference

ASTM D4935 Standard test method for measuring the electromagnetic shielding effectiveness of planar materials

MIL-STD-285 Attenuation measurements for enclosures, electromagnetic shielding, for electronic test purposes, method of

7. Remark

(1) Class I—Professional use.

Table5. Remark: Class I—Professional use.

Grade	5	4	3	2	1
	Excellent	Very Good	Good	Moderate	Fair
Percentage of Electromagnetic Shielding	$ES > 99.9999\%$	$99.9999\% \geq ES > 99.999\%$	$99.999\% \geq ES > 99.99\%$	$99.99\% \geq ES > 99.9\%$	$99.9\% \geq ES > 99.0\%$
Shielding Effectiveness	$SE > 60\text{dB}$	$60\text{dB} \geq SE > 50\text{dB}$	$50\text{dB} \geq SE > 40\text{dB}$	$40\text{dB} \geq SE > 30\text{dB}$	$30\text{dB} \geq SE > 20\text{dB}$

Revise Date: Mar/03/2005

Publish Date: Sep/01/2003

**Specified Requirements of Electromagnetic Shielding
Textiles**

Document No. FTTS-FA-003

Version: 2.0

(2) Class II—General use.

Table6. Remark: Class II—General use.

Grade	5 Excellent	4 Very Good	3 Good	2 Moderate	1 Fair
Percentage of Electromagnetic Shielding	ES > 99.9%	99.9% ≥ ES > 99.0%	99.0% ≥ ES > 90%	90.% ≥ ES > 80.%	80% ≥ ES > 70%
Shielding Effectiveness	SE > 30dB	30dB ≥ SE > 20dB	20dB ≥ SE > 10dB	10dB ≥ SE > 7dB	7dB ≥ SE > 5dB

Note1: SE= Shielding Effectiveness (dB)

2: ES= Percentage of Electromagnetic Shielding (%)

Revise Date: Mar/03/2005

Publish Date: Sep/01/2003