



## Choosing the Correct RF Shielding for ICD 705 SCIF Rooms

ICD 705 Version 1.5 calls for the RF shielding to be certified by IEEE-299 shielding effectiveness testing. IEEE-299 is the standard method for measuring the effectiveness of electromagnetic shielding enclosures. The shielding effectiveness testing occurs at frequencies from 9 kHz to 18 GHz (extendable to 50 Hz and 100 GHz, respectively) for enclosures having all dimensions greater than or equal to 2.0 m. See IEEE-299 test antennas below.

The antennas required by ICD 705 and IEEE-299 for shielding effectiveness testing play a major role in determining your RF shielded SCIF test results. Small loop and biconical antennas are good at measuring magnetic field and not good for electric field. Most test houses eliminate the dipole antennas and use a 25MHz to 300MHz biconical antenna. The result of this is from 300MHz down to 20MHz, you get some magnetic field readings and some electric field. From 20MHz down to 9KHz you are getting almost all magnetic field readings. Once you get above 300MHz, most test houses are using a log periodic antenna and then horn antenna(s), which is measuring the electric field, plane wave and microwave.

### Standard IEEE-299 Test Antennas

**Table 1—Standard measurement frequencies**

Standard frequency	Antenna type	Clause procedure
<b>Low range <sup>a</sup></b>		
9 kHz–16 kHz	Small loop	5.6
140 kHz–160 kHz	↓	↓
14 MHz–16 MHz	↓	↓
<b>Resonant range <sup>a</sup></b>		
20 MHz–100 MHz	Biconical	5.7
100 MHz–300 MHz	Dipole	↓
<b>High range <sup>b</sup></b>		
0.3 GHz–0.6 GHz	Dipole	5.8
0.6 GHz–1.0 GHz	↓	↓
1.0 GHz–2.0 GHz	Horn	↓
2.0 GHz–4.0 GHz	↓	↓
4.0 GHz–8.0 GHz	↓	↓
8.0 GHz–18 GHz	↓	↓

<sup>a</sup> Actual test frequencies shall be according to the approved test plan.

<sup>b</sup> A single frequency in each band is recommended, but actual test frequencies shall be according to the approved test plan.



**Table 2—Recommended extended range measurement frequencies**

Frequency range	Antenna type	Clause procedure
50 Hz–110 Hz	Small loop	5.6
0.9 kHz–1.1 kHz	↓	↓
35 GHz–45 GHz	Horn	5.8
90 GHz–100 GHz	↓	↓

**Standard RF Shielding Components Available**

RF Shielding Part	Details		RF Shielding Effectiveness
<b>EMI Power Filters</b>	0.5 to 800 Amps	Single to Ten Wire UL & Non-UL	100dB 14KHz to 18GHz 95dB 9KHz to 10GHz 80dB 1KHz to 10GHz
<b>Ethernet Filters</b>	1 Gbps	10/100/1,000 Mbps	100dB 10kHz to 10GHz
	10 Gbps	10/1000/10,000 Mbps	80dB 100MHz to 40GHz
<b>Compact 20 Line Filter</b>	Security, Audio, Video, Switching, Alarm, and RS232/RS422	0-100VDC, 0-48VAC 10A per line	90dB 8MHz to 40GHz
<b>RF Shielded Doors</b>	SCIF	STC 45 to STC 52	60dB 1MHz to 10GHz 80dB 10MHz to 10GHz 85dB 10MHz to 10GHz
	Single Knife Edge	STC 45	100dB 14KHz to 10GHz
	Double Knife Edge	SFC 45	100dB 14KHz to 40GHz
<b>Waveguide Air Vents</b>	3/16" Cell x 1" Long	Flange or In the Duct	100dB 1KHz to 10GHz
	<b>E-Field</b> 1/8" Cell x 1" Long	Flange or In the Duct	100dB 1KHz to 40GHz
<b>H-Field</b>	Steel 1/8" & 3/16"	25dB at 1KHz	100dB at 20KHz
<b>Pipe Penetrations</b> Length ≥ 4 x ID	Standard & Insulated Brass Galvanized Steel Black Iron NPT & NPS	1/2" ID	100dB to 12GHz
		3/4" ID	100dB to 8GHz
		1" ID	100dB to 6GHz
		1.5" ID	100dB to 4GHz
		2" ID	100dB to 3GHz
		2.5" ID	100dB to 2.4GHz
		3" ID	100dB to 2GHz
		4" ID	100dB to 1.5GHz
		6" ID	100dB to 1GHz
<b>Windows</b> Not Recommended For ICD 705 SCIF	Clear No Wire	Laminate	40dB 10MHz to 10GHz
		Double Glazing	45dB 10MHz to 10GHz
	With Wire	Double Glazing	60dB 10MHz to 10GHz

**This is NOT an all-inclusive list, if you don't see what you need, just ask.**



RF Shielding effectiveness below is based on the IEEE-299 test antennas, required by ICD-705, version 1.5, from 9KHz to 10GHz. The **RF Shielding Effectiveness** below, includes the magnetic field, electric field, plane wave and microwave.

40dB Requirement			
RF Shielding Application	Metal	Model Number	RF Shielding Effectiveness
Walls & Ceiling Shielding	Aluminum	AL2.5 AL5	40dB 1MHz to 10GHz 40dB 10KHz to 10GHz
	Copper	CU14 CU50	40dB 200KHz to 10GHz 40dB 14KHz to 10GHz
Floor Shielding	Aluminum, Galv. Steel	Warranted SCIF-USx	90dB 10KHz to 10GHz

60dB Requirement			
RF Shielding Application	Metal	Model Number	RF Shielding Effectiveness
Walls & Ceiling Shielding	Aluminum	AL5	60dB 100KHz to 10GHz
	Copper	CU14 CU50	60dB 200KHz to 10GHz 60dB 100KHz to 10GHz
Floor Shielding	Aluminum, Galv. Steel	Warranted SCIF-USx	90dB 100KHz to 10GHz

80dB Requirement			
RF Shielding Application	Metal	Model Number	RF Shielding Effectiveness
Walls & Ceiling Shielding	Aluminum	AL5	80dB 1MHz to 10GHz
	Copper	CU50	80dB 1MHz to 10GHz
Floor Shielding	Aluminum, Galv. Steel	Warranted SCIF-USx	90dB 1MHz to 10GHz

85dB Requirement			
RF Shielding Application	Metal	Model Number	RF Shielding Effectiveness
Walls & Ceiling Shielding	Aluminum	AL5 Overlap or Tri-Fold	85dB 1MHz to 18GHz
	Copper	CU50	85dB 1MHz to 10GHz
Floor Shielding	Aluminum, Galv. Steel	Warranted SCIF-USx	90dB 1MHz to 10GHz

90dB Requirement			
RF Shielding Application	Metal	Model Number	RF Shielding Effectiveness
Walls & Ceiling Shielding	Galvanized Steel CU50 Seam Taped	GS22 or GS26 Overlapped	90dB 1MHz to 10GHz
	Copper	CU50	90dB 2MHz to 10GHz
Floor Shielding	Aluminum, Galv. Steel	Warranted SCIF-USx	90dB 1MHz to 10GHz

100dB Requirement			
RF Shielding Application	Metal	Model Number	RF Shielding Effectiveness
Floor, Walls & Ceiling Shielding	Galvanized Steel CU50 Seam Taped	2 Layers GS26 Offset and Overlapped	100dB 10MHz to 10GHz
	Modular Room	Series 26 Clamped Together	100dB 1MHz to 10GHz



### High Performance RF Shielding ≥ 100dB

Universal Shielding Corp. Series 26	Uzin/Xalon RF Shielding Systems
Two Layers of 26-gauge Galvanized Steel Clamped Together Modular Room System Solid Floor, Walls & Ceiling Panels Self-supported, Single Point Ground	Two Offset Layers of GS26 or GS22 Galvanized Steel, 4" Overlap with 3" on center screws Seam Taped with 4" ECPSA Copper Tape For built in commercial construction
<b>Magnetic Fields</b>	<b>Magnetic Fields</b>
1 KHz - 28 dB	1 KHz - 20 dB
10 KHz - 58 dB	10 KHz - 40 dB
200 KHz - 100 dB	200 KHz - 70 dB
1 MHz - 110 dB	1 MHz - 100 dB
<b>Electric Field</b>	<b>Electric Field</b>
1 KHz - 120 dB	1 KHz - 100 dB
10 KHz - 120 dB	10 KHz - 100 dB
100 KHz - 120 dB	100 KHz - 100 dB
10 MHz - 120 dB	10 MHz - 100 dB
100 MHz - 120 dB	100 MHz - 100 dB
<b>Plane Wave</b>	<b>Plane Wave</b>
100 MHz - 110+ dB	100 MHz - 100 dB
400 MHz - 110+ dB	400 MHz - 100 dB
1000 MHz - 110+ dB	1000 MHz - 100 dB
<b>Microwave</b>	<b>Microwave</b>
1 GHz - 110+ dB	1 GHz - 100 dB
10 GHz - 110+ dB	10 GHz - 100 dB
18 GHz - 110+ dB	18 GHz - 100 dB
40 GHz - 100+ dB	

Determine the frequency range and RF shielding effectiveness required. This should be in the project specifications or will be given to you by the Certified TEMPEST Technical Authority (CTTA) for the project.

Next, compare the RF shielding requirements to the **RF Shielding Effectiveness** in the **dB Requirement** charts above.

Once you have found the **RF Shielding Effectiveness** that best fits the requirements, on the same row, look to the left under **Model Number** to find the model number(s) of the products what will meet this requirement.

From least expensive to most expensive material cost (per ft<sup>2</sup>) is AL2.5, AL5, CU14, Galvanized Steel, CU50, AL20 and AL125.

Due to labor costs and the RF shielding system design, the least expensive material, may not be the least expensive final solution.



<b>By Model Number</b>			
<b>Model Number</b> US Foils & Xalon RF Systems	<b>Seam Tape</b>	<b>Installation</b>	<b>RF Shielding Effectiveness (Per IEEE-299)</b>
<b>AL2.5</b> 4' x 150' Rolls	AL2.5 180' Rolls	Butt Jointed & Seam Taped	40dB 1MHz to 10GHz
<b>AL5</b> 2' x 150' Rolls 4' x 150' Rolls	AL5 180' Rolls	Butt Jointed & Seam Taped	40dB 10KHz to 10GHz 60dB 100KHz to 10GHz 80dB 1MHz to 10GHz
		Overlap or Tri-Fold & Seam Taped	85dB 1MHz to 10GHz
<b>CU14</b> 2' x 150' Rolls	CU14 180' Rolls	Butt Jointed & Seam Taped	40dB 200KHz to 10GHz 60dB 200KHz to 10GHz
<b>CU50</b> 2' x 150' Rolls 3' x 65' Rolls	CU50 75' Rolls	Butt Jointed & Seam Taped	40dB 14KHz to 10GHz 60dB 100KHz to 10GHz 80dB 1MHz to 10GHz 85dB 1MHz to 10GHz 90dB 2MHz to 10GHz
<b>CU71</b> 2' x 100' Rolls 50" x 100' Rolls	CU71 75' Rolls	Overlap Jointed & Seam Taped	100dB 10KHz to 10GHz
<b>AL20</b> Panels	AL5 180' Rolls	Butt Jointed & Seam Taped	45dB 10KHz to 10GHz 60dB 100KHz to 10GHz 80dB 1MHz to 10GHz 85dB 1MHz to 10GHz
	CU50 75' Rolls	Butt Jointed & Seam Taped	90dB 1MHz to 10GHz
<b>GS22 &amp; GS26</b> Panels	AL5 180' Rolls	Butt Jointed & Seam Taped	45dB 10KHz to 10GHz 60dB 100KHz to 10GHz 80dB 1MHz to 10GHz 85dB 1MHz to 10GHz
	CU50	Butt Jointed & Seam Taped	90dB 1MHz to 10GHz
<b>2 Layers</b> <b>GS22 &amp; GS26</b> Panels	CU50 75' Rolls	Overlapped & Seam Taped	90dB 1MHz to 10GHz
		Overlapped, Screwed & Seam Taped	100dB 10KHz to 10GHz
<b>SCIF-USx</b>	XFS60	Warranted Uzin Contractor Must Install	60dB 10KHz to 18GHz
<b>SCIF-USx</b>	XFS80	Warranted Uzin Contractor Must Install	80dB 10KHz to 18GHz