EmiClare: Seeing is believing

Your EMI shielded display will look and perform better when fitted with a EmiClare mesh window

EmiClare mesh is in the center of this demonstration sample.

Compared to the traditional mesh of the outer frame.

A display fitted with EmiClare mesh is brighter and are more legible then compared with traditional mesh.

This is because Optical filters was the first and only window manufacturer to re-engineer wire woven mesh specifically for electronic displays.

Traditional mesh windows with configurations like 100, 80 and 50 openings per inch (opi) where inherited from none optical application like chemical and particle filtration.

A clearer picture is achieved when shielding a display with EmiClare Mesh. The unique construction & geometry of EmiClare mesh creates less distortion and moiré fringing.

EmiClare mesh is designed for electronic displays and has three major benefits;

- Higher light transmission
- Less image distortion & Moiré fringing
- Excellent shielding effectiveness

EmiClare mesh is supplied in the following products:

- **EmiClare Sigma**
  Our regular fully laminated polycarbonate. Highly cost effective and without the wait.
- **EmiClare Sigma XL**
  Large format fully laminated windows for racks and enclosures.
- **EmiClare Ultra**
  Custom laminated windows to meet your exact requirement.
- **EmiClare Solo T**
  Extra thin single substrate windows.

Shielding

EmiClare windows provide exceptional optical performance without sacrificing EMI shielding characteristics.

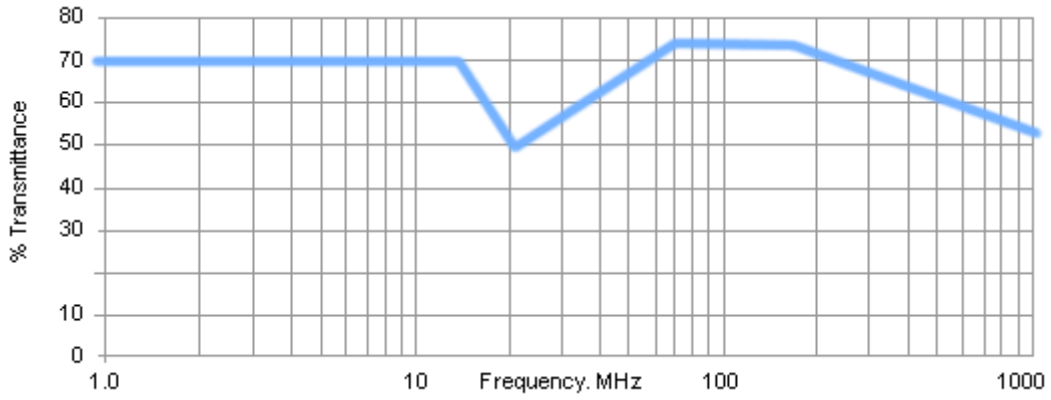
The unique EmiClare mesh configuration eliminates the complexity of wire types, mesh counts and plated finishes found in conventional windows.

This data sheet gives you the means to estimate the EMI/RFI shielding performance of an EmiClare window. The data is based on an extensive development programme followed by testing in accredited test houses in the USA and England.

The attenuation properties of the EMI/RFI shielding medium

Three factors determine the EMI shielding effectiveness of a window:

1: The attenuation properties of the shielding medium
2: The shadow effect of the aperture
3: The efficiency of the termination



Termination Efficiency

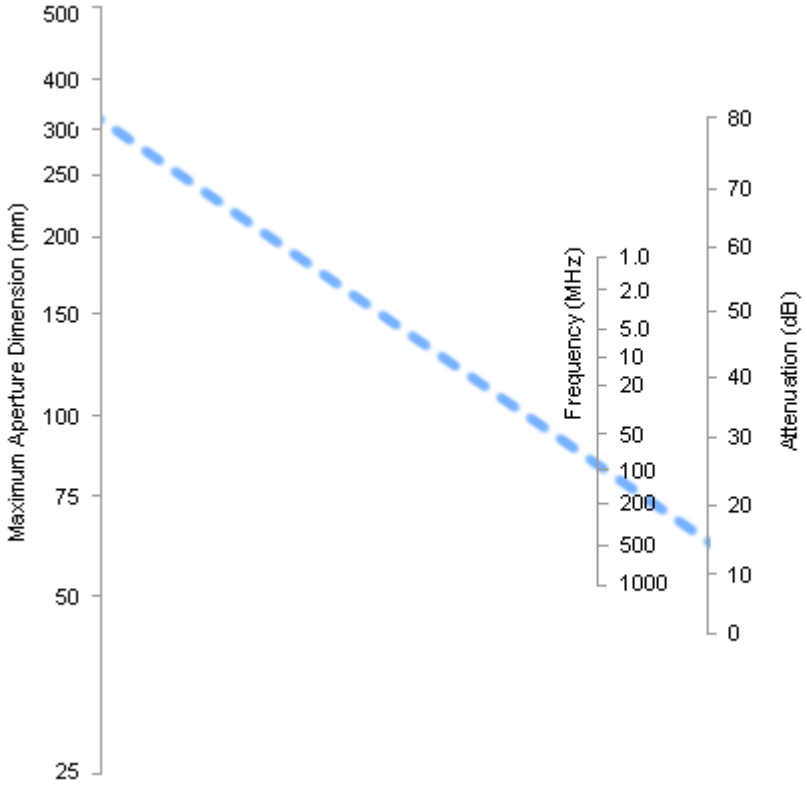
The most efficient termination is the direct contact of the mesh to the bezel / enclosure via a mesh extension. Data for two standard EmiClare terminations are listed below:

Silver busbar	100 MHz - 10GHz	10dB loss
Silver busbar and conductive gasket	100 MHz - 3GHz 4 GHz - 10 GHz	10 dB loss 0 dB loss

(Conductive fabric over foam gasket)

Between 10 and 100 MHz Optical filters has found that traditional terminations, with a silver busbar contacting the cross section of the wire, are ineffective. We advise that the window uses one of the extended mesh terminations.

Aperture Shadow Effect
In cases where the emission levels are known, the shadow effect of the aperture can be estimated from the nomograph and added to the mesh attenuation with allowance for the termination:



Example

Opening Size:	250 x 200 mm
Max. dimension is diagonal	320mm

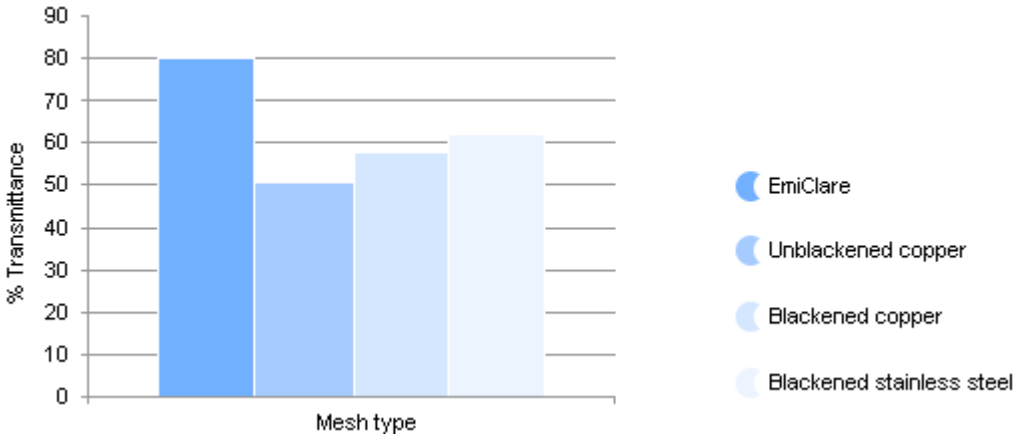
Frequency MHz	**1.0**	**5.0**	**10**	**50**	**100**	**500**	**1000**
Aperture Attn dB	53	39	33	19	13	0	0
Maxh Attn dB	70	70	70	58	73	60	53
Silver busbar	-10	-10	-10	-10	-10	-10	-10
Overall attn. dB	113	99	93	67	76	50	43

Transmission

EmiClare mesh has been optimised to provide exceptional optical performance without sacrificing EMI shielding. The data detailed below is actual transmission of the total window and avoids the confusion caused by quoting the calculated mesh open area as the transmission of the finished window.

The light transmission of an EMI shielded window is determined by the following factors:

Mesh Transmittance



EmiClare mesh provides brighter image quality through higher mesh transmittance.

Substrates
The following chart gives a guide of the light transmittance (T%) of the common substrates.

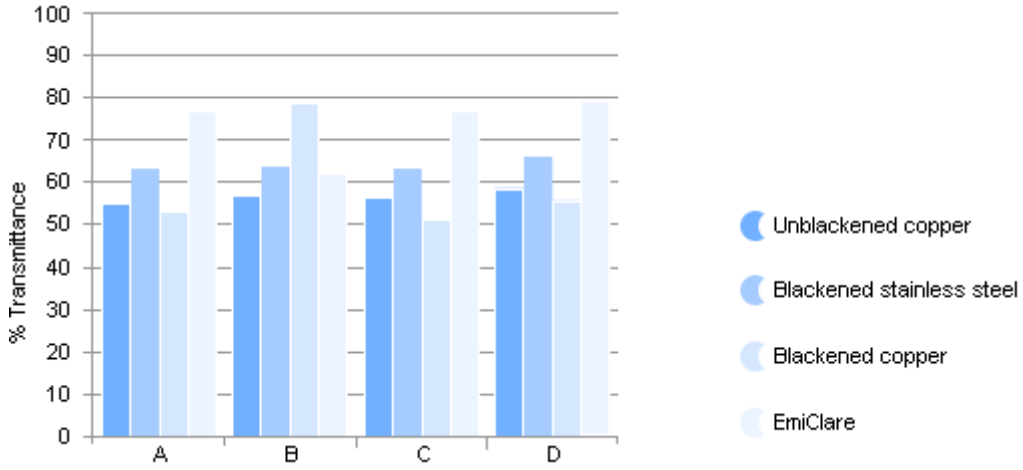
Plain "float" glass	90-92%
Clear polycarbonate*	85-90%
Clear acylic*	85-90%
Clear polyester*	83-88%

* Varies with thickness due to internal dispersion and may also vary between suppliers.

Surface Finish
The following table quantifies the effect of the common surface finishes on optical transmittance.

Surface Finish	Reduction in T%
Non Glare coatings 60-70 gloss	2-3%
Non Glare coatings 80-90	gloss 1%
Clear hard coats	<1%
MLAR coatings on glass	<1%
ITO coatings 12-15 ohms/square	5-10%

Finished Windows
By design EmiClare windows deliver improved optical performance.

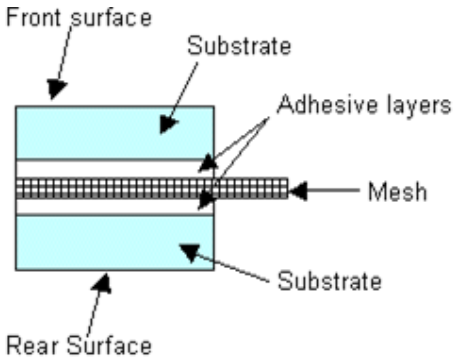


A: Laminate with 0.75mm Non-Glare and clear Hard Coated polycarbonate.
B: Laminate with 1.2mm glass. Plain finish to both surfaces.
C: Laminate with 1.5mm Non-Glare and plain polycarbonate.
D: Laminate with 1.2mm (MLAR) glass and 1.2mm plain glass.

Laminated EMC filters

A fully laminated window consists of two outer substrates with a sandwich construction of alternating layers of adhesive and other elements such as mesh and optical films.

Following the assembly of the adhesive and substrate in a clean room the window are subjected to a heat and pressure process in an autoclave.



The optically matched adhesive layer provides a fully laminated structure in which the entire surface between layers is bonded. There is no limit to the number of layers or materials that you can incorporate into a laminated window, providing they are optically and mechanically compatible.

Substrates
Fully laminated windows allow a wide range of substrates. The standard options are:
Glass, Polycarbonate, Acrylic
The appropriate substrate is selected by matching substrate properties to end-use requirements and cost.

Adhesives
Optical filters knowledge and experience is required for the optimum selection and processing of the dry film adhesive. At least one layer is required between each solid component in the laminate.

Laminated windows have many advantages in strength, form and function. Applications include:

EMC filters
Laminated windows can incorporate either a layer of metal mesh or a conductive coating to provide EMI shielding for a display.

Security Screens
A laminated window has approximately the same impact resistance as a toughened piece of glass of the same thickness. It offers an impact resistance equivalent to BS6206:1981 which specifies the requirements of glass structures. A significant added benefit of laminated glass windows is the safety aspect. If a laminated window were to shatter the glass shards would adhere to the adhesive layers rather than scatter out.

Contrast Enhancement filters
The principal application of colour laminations is in contrast enhancement filters. Colours and tints can be added to any type of window by use of a coloured substrate or a tint layer. Optical filter's tint layer technology allows a wide range of options and where necessary, we can selectively colour different areas of a window to match multi-function display requirements.

Privacy Filters
View control films are an important addition to laminated windows used on ATMs and public information displays. These privacy filters control the positions from which the display can be viewed.

Enhanced Touch Screens

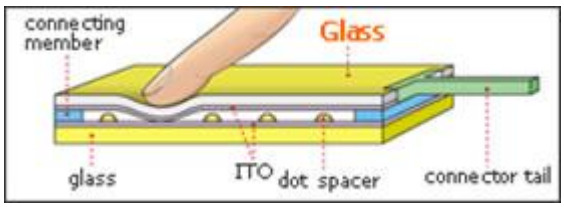
Optical Filters is the specialist for enhanced touch screens:

- Ruggedized touch screen glass to withstand abuse and vandal damage such as a boot test
- EMI shielded touch screens
- Touch screens with integrated privacy filters
- Polarized touch screens for improved sunlight readability

We are also a producer of touch screen protectors worldwide.
We also stock contoller's and our Screen distributors in US and international.

Glass / Glass 4 wire resistive touch screen
A resistive touch screen that features durability to match the most demanding applications such as military, marine, avionics and industrial displays where the tough finish and wide temperature stability are required.

The hard glass front surface provides the scratch resistance and ruggedisation typically associated with glass touch technologies such as capacitive or surface wave acoustic, but has the flexibility of use just like a standard resistive due to the flexible borosilicate glass surface



COTS integrated enhancement options:

- AS anti-sparkle non-glare etch front surface
- EmiClare MicroMesh or EMI-ito coating for EMI shielding
- ThermoClare transparent heaters for low temperature operating
- Chemically strengthened laminated glass for anti-vandal protection
- Circular polarisation for sunlight readability

Glass resistive specification

Rating	Voltage	**DC 5V (Max 5.5V, 1mA)**
	Operation Temperature	**-30°C to +70°C**
	Storage Temperature	**-40°C to +85°C**
Optical	Transmittance	**80% T @ 550nm (standard gloss)**
Electrical	Linearity	**Less than 3%**
	Insulation Resistance	**10MΩ or more at DC 25V**
	Chattering Time	**less than 10ms**
	Controller	**Available for serial / USB / PS2**
Reliability	High Temperature Test	**240 hours at 85° (RH: 40-50%)**
	Low Temperature Test	**240 hours at -40°**
	Thermal Shock Test	**One cycle is 30min at -40° and then 30min at +85° (200cycles)**
	Humidity Test	**240 hours at +60°, 95% RH**
Mechanical	Surface Hardness	**4H (JIS-K5400,350gf)**
	Input Method	**Finger, stylus**
Durability	Touch life	**Touch 1 million Times (Surface Radius 12.0mm Silicone rubber(Hardness 60˚HS)) (force: 3N, speed: 2cycles/sec)**

Standard screens sizes

Size	Outside Dimension	Viewable Area	Active Area
7.0”	**173 x 106mm**	**160.5 x 92mm**	**157.5 x 89mm**
8.4”	**192 x 144mm**	**173.4 x 130.8mm**	**170.4 x 127.8mm**
10.4”	**228.4 x 172.5mm**	**211.4 x 158.5mm**	**207.4 x 154.5mm**
12.1”	**272 x 203.5mm**	**251 x 189mm**	**247 x 185mm**
15.1”	**323.9 x 244.2mm**	**306.9 x 230.2mm**	**302.9 x 226.2mm**
17”	**376 x 282.2mm**	**353.6 x 264.7mm**	**345.5 x 259.1mm**

Optical Lamination

Assembled individually in the **class 100** clean room conditions the touch screen display is bonded to filter materials, glass and plastics in a sandwich construction of index matched dry film adhesive.
Types of flat panel touch screens that can be enhanced:

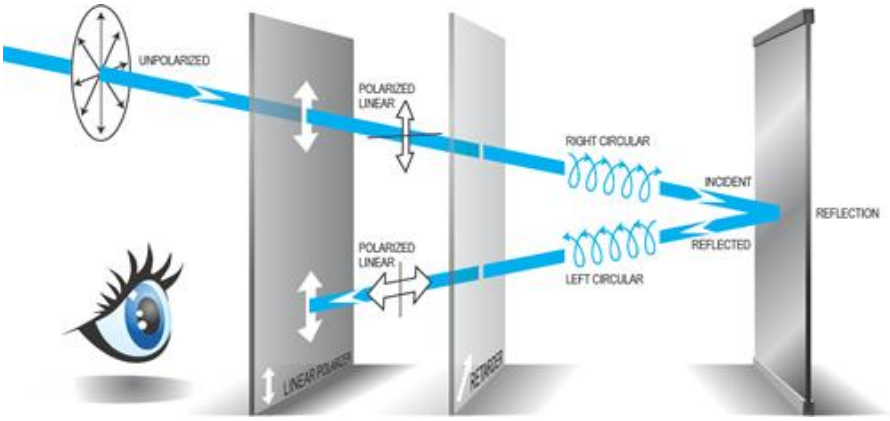
- 4 wire, 5 wire and 8 wire resistive
- Glass / Glass 4 wire resistive
- Capacitive
- Near infra red (NIR)
- Surface Acoustic Wave (SAW)

Ruggedisation
Full optical lamination improves the impact resistance of the touch screen monitor and keeps an industrial touch monitor screen intact when broken, thus protecting the equipment and the safety of the user. Standard ruggedisation is the US military boot and wench test and BS 6206: 1981 Class B and has the ability to withstand heavy repeated blows from objects such as bricks, hammers and crowbars. Impact performance of industrial touch screen displays can be further enhanced to Class A and above by using extra lamination layers and chemically toughened glass.

Ultimate strength in the final touch sensitive monitor is limited by the type and thickness of the touch screen along with its integration.

The laminations are tested for impact resistance, surface damage and penetration in accordance with ISO 6272 using a Falling Block Impact Tester 806/40. BS 6206 (UK standard): Class A impact resistance is achieved on the other touch screen lamination due to the extra filter material layers. Even when broken the lamination layers maintain the integrity of the touch screens, protects the display from damage and prevents the risk glass splinters.

Sunlight Readability
Maximum contrast enhancement and "sunlight readability" is achieved by incorporating a neutral density circular polariser. Circular polarisers are well established as the most efficient form of contrast enhancement available with a 40:1 C.E. ratio. The washed out appearance of the display caused by ambient light reflected from the display is modified by the circular polariser as it passes through and traps the mirror image on reflection from the surface of the touch screen. The signal from the display is allowed to pass through the filter and appears as a bright image against a dark background.

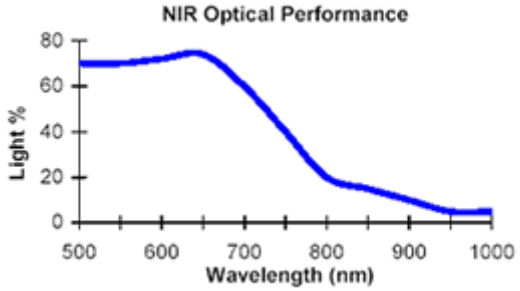


Circular polarization is the ideal solution to improve the sunlight readability or resistive touch screens.

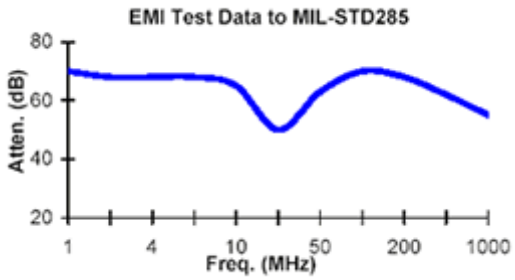
Louver Privacy
A louver privacy film (light control film LCF) can be easily incorporated into a touch screen lamination to form a computer privacy screen. Standing in front of the screen allows you to see the display through the individual louvers, if you were to view at an angle of 30' or great from the center line, the image on the screen would be blocked by the sides of the louvers. A simple analogy for the privacy film is a Venetian blind.
Typical applications for privacy displays are ATMs and public kiosks. A 17" diagonal screen is the maximum size available. The technique is suitable for indoor or outdoor privacy screens.
It's now possible to supply privacy filters is screens large then 17" and with the option of vertical louvers (up and down blocking of the image) as well as the horizontal (privacy filters left and right).

Transparent Heater
To defrost and /or maintaining an optimum screen temperature, a transparent heating element can be bonded to the rear surface of the touch screen. Maximum available size is a 400 x 500mm.

NIR Radiation Control
Direct sunlight heating can be controlled by the addition of a Near Infra-Red filter. Whilst providing a high level of visible light transmission (>70%) the NIR filter blocks 90% of Infra-Red at 850nm increasing to 95% from 950nm.



EmiClare EMI Shielding
EmiClare is an EMI shielding mesh designed for optimum optical performance with a high level of shielding effectiveness at both high and low shielding frequencies. Military, test equipment and medical markets are typical applications requiring extra EMI shielding provided by incorporating EmiClare mesh into a touch screen monitor lamination.



We customize touch screen technology in the UK and supply customers worldwide with:

- Touch sensitive screens
- Touch sensitive monitors
- Touch screen monitors

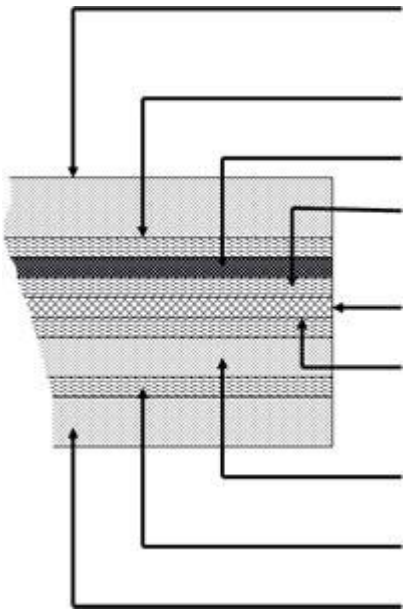
Our UK customization of touch screen technology can be incorporated into computer privacy screens, LCD touch screens, laminate glass and 3M PSA laminate and one touch monitors.

Ultra

EmiClare Ultra are custom built windows either to the customer's design or to meet the requirements of a specific application.

The custom Ultra solution covers the full range of substrates, sizes, termination methods and additional features including heating, contrast enhancement & touch screens.

In cross section EmiClare Ultra could include all of these elements in just one window.



Anti Reflective coated glass

Adhesive

Circular polariser

Adhesive

EmiClare mesh

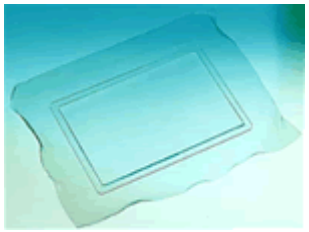
Adhesive

NVIS night vision goggle filter

Adhesive

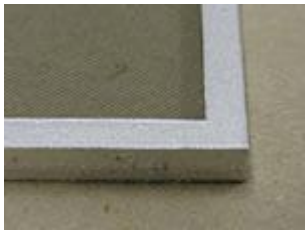
ThermoClare Transparent Heater

Termination options
EmiClare Ultra windows are made to order and can be supplied with the following termination options.



Extended mesh
Allowing direct clamping of the mesh

Extended mesh & gasket
For a more control and rugged integration



Silver busbar
Highly conductive painted finish

Window dimensions

EmiClare Ultra can be made from a very small single LED's size up to the very large sizes often used on public information displays or shielded rooms. Common dimensions are linked to the typically display sizes like 6.4", 10.4", 12.1", 15", 15", 17", 24" etc.

Substrates Options

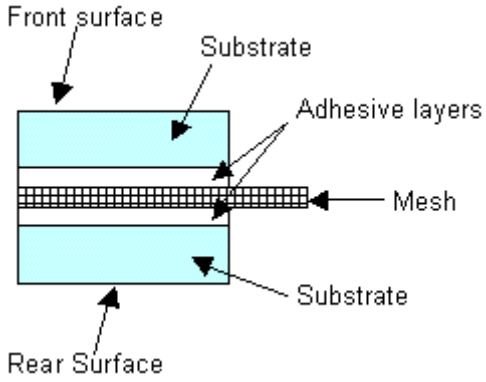
- **Glass**
  - Glass is more cost effective per sq meter then plastic and is superior optical material.
  - With optional surface finishes of Non-Glare dispersive etch or Multi layer Anti- reflective coating.
  - Glass is strengthened due to the lamination process but can also be further improved with Chemical toughening.
- **Polycarbonate**
  - Polycarbonate is stronger and lighter then glass and is supplied with either a clear hard coating for its chemical resistance and surface hardness or a matt non-glare finish to control surface reflections.
  - An Anti-reflective polycarbonate with anti-finger print coating is also available.

Extra functions and filters

- Louver light control film for privacy or contrast enhancement.
- Linear and circular polariser from Optical filters range of XP technical polarisers
- NVIS night vision goggle compatibility filters.
- NIR blocking film for the control of solar radiation.
- ThermoClare transparent heater for de-frosting and anti- misting.
- Touch enabled front surface with the addition of resistive, capacitive or infra-red touch screen solutions

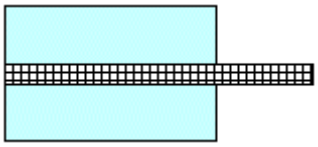
Termination Methods for EMI shielded windows

The diagram below illustrates the basic design which could be used with EMI shielded plastic or other EMI shielded materials:

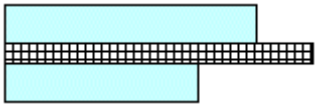


There are several forms of termination in use for shielded windows. Detailed here are those methods that are cost effective and have proven, with over eleven years of EMI shielding applications experience, to provide an efficient termination.

Mesh extensions can be specified for glass and plastic EMI shielding windows. If properly installed into the aperture they yield a higher rf attenuation than a busbar / gasket combination. This edge form is recommended for large format windows and low frequency applications.

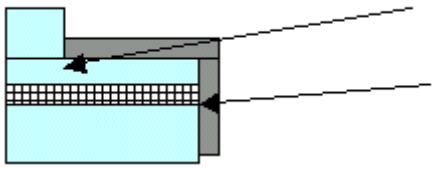


Square edge with
a mesh extension

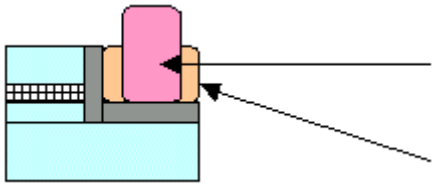


Step edge with
a mesh extension

Machined Edges, Busbar and Gasket



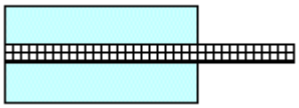
The laminate build and the step profile must be co-ordinated to ensure that the step finishes in a substrate The busbar must include the face that sections the mesh. Depending on the termination required it could be extended over one or both surfaces of the window.



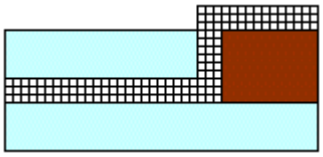
If a gasket is used, the step depth should be designed to allow for the correct compression of the gasket

On compression the conductive surface of the gasket should maximize contact area with the busbar.

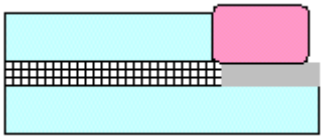
Termination methods for mesh extension windows



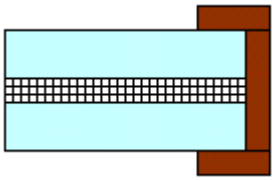
The most effective termination is to clamp the mesh extension to the enclosure. This can be done for windows with either a step or a square edge. This termination is not possible with the new generation ultra-fine meshes.



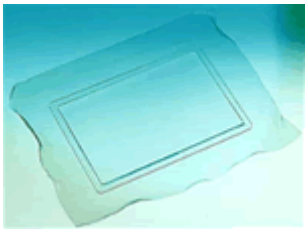
An effective compression gasket can be formed by taking the mesh over a compression gasket material such as neoprene.



A mesh extension can be combined with a silver busbar and a conductive compression gasket. Unless there is a special gasket requirement, this termination is not recommended on the basis of cost. It is effective if a combination gasket is required to give both an environmental and rfi seal.



For large windows such as rack enclosure doors, a cost effective option is to cut the mesh extension close to the edge of the window and finish it with a conductive tape carried over to both faces of the window. This is preferable to a simple mesh extension, which from our experience, is often torn when handling large windows.



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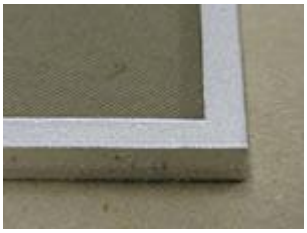

Silver busbar
Highly conductive painted finish

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