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Technical Data | October 2022

3M™ Transparent Conductor Film Assembly

Product Description

3M™ Transparent Conductor Film Assembly is a thin transparent conductive film that utilizes proprietary 3M technology enabling high power, high current, low surface resistivity, and low PIM transparent antenna designs, secured to a rigid transparent, stable substrate. 3M™ Transparent Conductor Film Assembly can be tailored to customers' connection preferences. With high visible light transmittance, low sheet resistance and excellent flexibility, 3M™ Transparent Conductor Film Assembly enables antenna designers to create inconspicuous antenna products for indoor and outdoor applications.

Key Features

- Highly transparent conductive film is ideal for indoor and outdoor inconspicuous sub-6GHz antennas
- Proprietary construction using a copper grid conductive layer provides low sheet resistance to enable efficient high power transparent antenna designs
- Demonstrated continuous power operation of 47.1 dBm forward power for 100 hours within FR1 frequency bands (450MHz – 6GHz) with no sign of degradation in performance.
- Copper surface treatments available to help reduce reflected light and increase solder friendliness
- Transparent antennas using of 3M film assemblies are capable of meeting VSWR, PIM and gain requirements that are typical for non-transparent antennas depending on the design
- Available as pre-cut laminated assemblies designed to customer specifications. 3M™ Transparent Conductor Film is also available as a post-patterned sheet (or roll) format using a customer supplied antenna pattern design.

Product Construction/Material Description

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

3M™ Transparent Conductor Film Assembly	
Property	**Value**
Available transparent rigid substrate materials	Polycarbonate (PC) or PMMA
Typical number of layers	Single or multiple conductor layers separated sandwiched between layers of a transparent rigid substrate with mounting holes.
Typical transparent rigid substrate layer thickness range (1 layer)	0.1mm - 3.0mm (Thicknesses outside the range can be considered.)
Substrate material (antenna layer)	Polyethylene terephthalate, PET
Substrate permittivity, ε', ε" (@1GHz)	3.22, 0.021
Conductive layer	Copper grid
Trace dimensions (H x W x Pitch) (μm)	5 x 30 x 300, typical
Open area for light transmission (%)	>80%, typical at trace dimensions, excluding Fresnel reflections
Haze (%)	<2%, typical
Rigid substrate layer haze	<0.55%, typical
Sheet resistance (Ω/□)	<0.05, typical
Temperature range	-40 to +100 °C (-40 to +212 °F)

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Antenna Example	
PIM (2 x 43dBm)	< -153dBc
Max power demonstrated	50W continuous
Supported frequency range	3GPP FR1 frequency bands

Applications

- For use in indoor and outdoor inconspicuous sub-6GHz antenna designs
- Antenna power capabilities up to 50W (continuous), dependent upon antenna design
- 5G transparent antenna for vehicles, trains, building windows, street luminaries and many others
- 5G IoT transparent antenna

Assembly Techniques

- Cable connections to be provided by the user. For best known methods, please contact your 3M Technical Service Representative
- 3M can provide samples with removable protective liners upon request. Please contact your 3M Technical Service Representative

Storage and Shelf Life

The shelf life of 3M™ Transparent Conductor Film Assembly is 24 months from the date of manufacture when stored in the original packaging materials and stored at 21°C (70°F) and 50% relative humidity.

Certificate of Analysis (COA)

The 3M Certificate of Analysis (COA) for this product is established when the product is manufactured and is deemed commercially available from 3M. The COA contains the 3M specifications, test methods and test results for the product's performance attributes that the product will be supplied against. Contact your local 3M representative for this product's COA.

This technical data sheet may contain preliminary data and may not match the COA specification limits and/or test methods that may be used for COA purposes.

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Regulatory: For regulatory information about this product, contact your 3M representative.

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