

## 3M™ Transparent Conductor Film

### Product Description

3M™ Transparent Conductor Film 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. With high visible light transmittance, low sheet resistance and excellent flexibility, 3M™ Transparent Conductor Film enables antenna designers to create inconspicuous antenna products for indoor and outdoor applications.

3M™ Transparent Conductor Film is patterned according to the customer design, while standard 450mm x 450mm unpatterned sheets will also be available for EMI shielding applications and antenna prototyping.

### 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 at power levels up to 46 dBm at frequencies ranging from 1000 to 4000 MHz
- Copper surface treatment reduces reflected light
- Transparent antennas made of 3M film are capable of meeting VSWR, PIM and gain requirements that are typical for non-transparent antennas depending on the design
- Flexible PET substrate allows for application over surfaces or lamination to rigid support
- Available as a post-patterned sheet (or roll) format using a customer supplied antenna pattern design and available as pre-cut laminated assemblies designed to customer specifications.

### 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	
Property	Value
Substrate material	Polyethylene terephthalate, PET
Substrate permittivity, $\epsilon'$ , $\epsilon''$ (@1GHz)	3.22, 0.021
Conductive layer	Copper grid
Trace dimensions (H x W x Pitch) ( $\mu\text{m}$ )	5 x 30 x 300, typical
Open area for light transmission (%)	>80%, typical at trace dimensions, excluding Fresnel reflections
Haze (%)	<2%, typical
Sheet Resistance ( $\Omega/\square$ )	<0.05, typical
Supported frequency range	3GPP FR1 frequency bands
Minimum Bend Radius	10 mm, radius of curvature
Temperature Range	-40 to +100 °C ( -40 to +212 °F)
<b>Antenna Example</b>	
PIM (2 x 43dBm)	< -153dBc
Max Power Demonstrated	50W continuous

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## Applications

- For use 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
- EMI/EMC applications such as RF shielding for windows

## Assembly Techniques

- Laminate to clear rigid supports
- Adhere to substrates, adhesive solutions may be recommended by contacting your 3M Technical Service Representative
- Cable connections to be provided by the user. For best known methods, please contact your 3M Technical Service Representative
- Use careful handling to ensure the film surfaces do not contact surfaces that may cause scratches.

## Storage and Shelf Life

The shelf life of 3M™ Transparent Conductor Film 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 products 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.

The 3M™ Transparent Conductor Film products are covered by patents in the US and other countries, please see [www.3M.com/patents](http://www.3M.com/patents) for more details.

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

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