

3M Science.
Applied to Life.™

5G indoors. Out of sight.

3M™ Transparent Conductor Film





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“The need for transparent antennas is clear. Network operators are densifying their networks to provide additional capacity and support future use cases. Antennas are increasing in size, number and complexity to support new spectrum allocations.

Data utilization also continues to increase and this trend is not expected to change. There will always be a demand for more data as new devices and use cases are developed.

This eBook identifies two key challenges facing antenna OEMs — reducing conspicuity and meeting 5G network performance requirements — and introduces a material solution that can help you address both.”



Jeff Tostenrude
Advanced Application
Development Specialist, 3M

5G is here. And it's powerful.

Faster data transmission speed

Up to multi-Gbps speeds

Greater capacity

Fueling a massive amount of IoT and other devices

Lower latency

Down to single-digit milliseconds, critically important in applications where near-instantaneous response is needed (e.g., augmented/extended reality)



Network service providers face a challenging marketplace

Network densification

The addition of cell sites and antennas to increase network capacity and enable 5G use cases

Increased data usage

Global mobile data traffic is estimated to grow by a factor of 4.5 by 2026¹

Signal integrity

Greater signal-to-noise ratio required to support higher data rates

¹<https://www.ericsson.com/en/mobility-report/dataforecasts/mobile-traffic-forecast>





Many locations will value inconspicuousness, particularly at high profile venues.



The solution is clear — transparent antennas.



Did you know about 80% of data is originated or terminated indoors?²

That means an immediate need for more in-building antennas to increase 5G coverage.

With innovative materials, antenna OEMs can now design low visual profile antennas for locations previously avoided for aesthetic reasons, allowing wireless service providers to improve in-building 5G coverage.

How?

By addressing two key challenges:

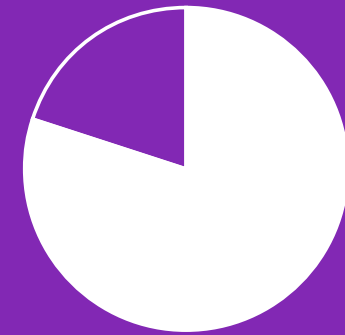


Transparency



5G-ready performance

²<https://www.abiresearch.com/press/abi-research-anticipates-building-mobile-data-traf/>



Increasing data use — 80% of which occurs indoors²





Challenge: Transparency

Places like hotels and restaurants spend a lot of time and money creating a space that resonates with their target customers. These venues and locations will prefer optically transparent antennas to preserve ambiance.

Solution:

A conductive film with more than 80% open area and a neutral gray surface treatment that helps you design small, nearly transparent antennas. The film's excellent flexibility allows your team to have even more design options.



Challenge: 5G-ready performance

5G means new network performance guidelines. In-building antennas for neutral host applications must handle high power levels and require low passive intermodulation (PIM) to improve signal-to-noise ratios — all to maintain signal strength and integrity required to support the highest data rates.

Solution:

A conductive film that enables antenna designers to achieve:

- Voltage standing wave ratio (VSWR), PIM and gain performance typical of conventional antennas
- High power (up to 50W)
- High efficiency and gain with less than 0.1 ohms per square sheet resistance

3M™ Transparent Conductor Film

Inconspicuous, robust and efficient

So far, we've explored key challenges facing antenna OEMs — achieving transparency and meeting new 5G performance benchmarks set by network operators. Now, a solution that addresses these challenges so you can help expand in-building 5G coverage.



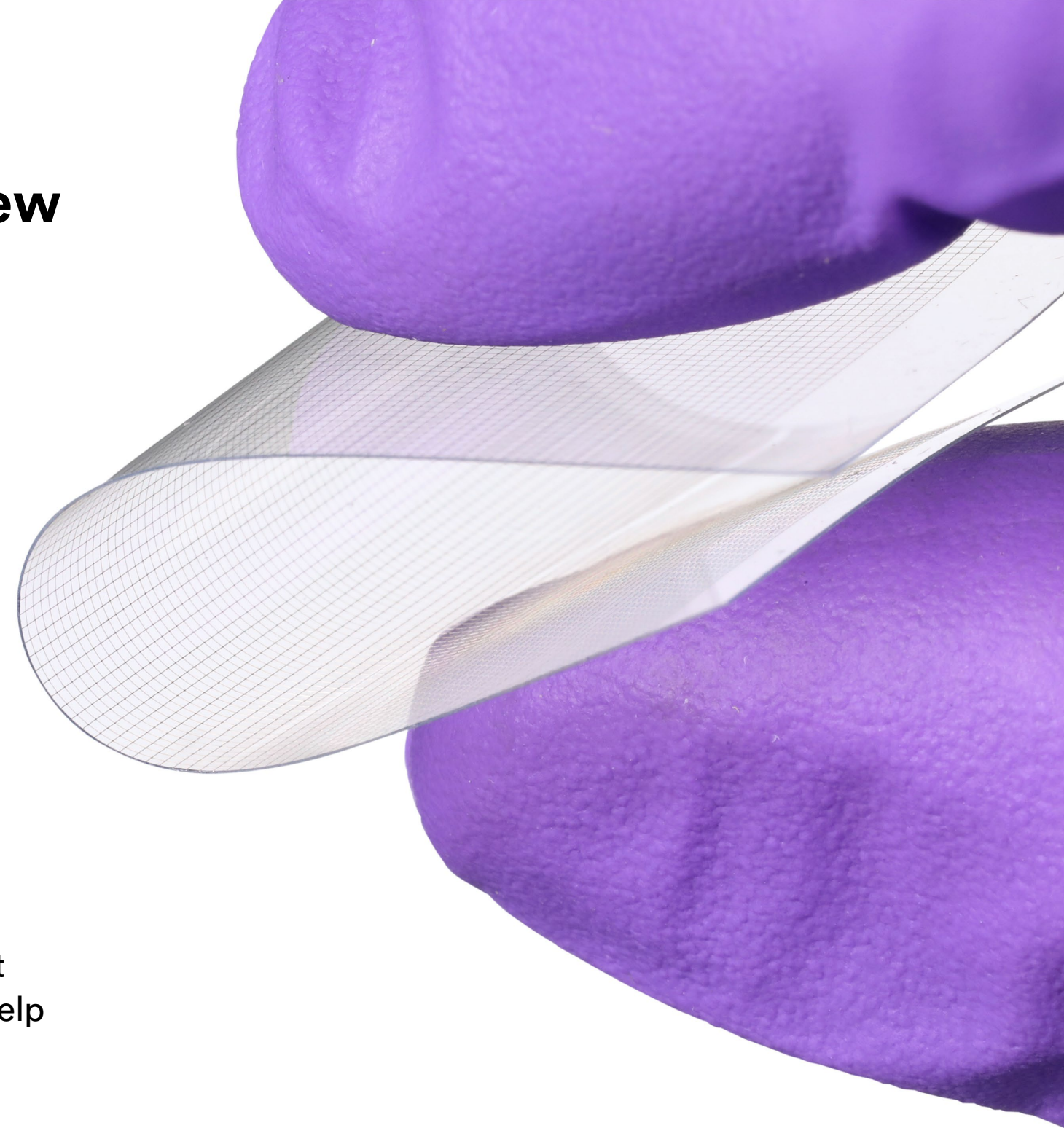
Key features and benefits of the new 3M™ Transparent Conductor Film

Optically transparent

The highly conductive grid construction helps you enable antenna designs with high visible light transmission. With more than 80% open area for clarity and a neutral gray treatment for copper surfaces, 3M™ Transparent Conductor Film can help you enable an inconspicuous antenna, even on curved surfaces — an appealing solution for locations and venues with strict aesthetic requirements.

5G-ready performance

3M™ Transparent Conductor Film allows you to design antennas for high power, up to 50 watts, as well as high efficiency and gain with less than 0.1 ohms per square sheet resistance. With excellent PIM performance, this film can help you maintain 5G signal strength and integrity and achieve similar performance to conventional antennas.



More key features and benefits of the new 3M™ Transparent Conductor Film

Low PIM by design

The materials and processes used in preparing 3M™ Transparent Conductor Film are specifically selected to enable the production of low PIM antennas that meet industry PIM standards.

Proprietary technology

3M™ Transparent Conductor Film features metal mesh technology originally developed for touch screens.





Think big.
Applications for transparent antennas are not limited to communications infrastructure.

- IoT sensors (e.g., vending machines, appliances, supermarket cases)
- Emergency services
- Positioning, navigation and timing (PNT)

Ready to expand in-building 5G coverage?

Let's get started.

[3M.com/transparentantenna](https://www.3m.com/transparentantenna)



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¹<https://www.ericsson.com/en/mobility-report/dataforecasts/mobile-traffic-forecast>

²<https://www.abiresearch.com/press/abi-research-anticipates-building-mobile-data-traf/>

<https://www.fcc.gov/5G#:~:text=The%20FCC%20concluded%20its%20first,other%20flexible%20use%20bands%20combined>

<https://www.fortunebusinessinsights.com/infographics/base-station-antennas-market-103525>

<https://www.allaboutcircuits.com/technical-articles/difference-between-conducted-EMI-radiated-EMI-electromagnetic-interference/>

<https://www.rcrwireless.com/20161109/fundamentals/network-densification-5g-tag31-tag99>

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