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Archive

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## Materials and Your Printed Wiring Board Supplier(s)

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## Our Discussion Topic for Today

- IoT – AI – 5G
  - Can never have too many acronyms, it seems
- Impacts to your Printed Wiring (Circuit) Board supplier(s)
  - Materials
  - Processes
  - \$



Materials and Your Printed Wiring Board Supplier(s)

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## Your ever-changing Requirements

- Design Attributes
- Controlled Impedance
- Signal Integrity
- Power Delivery and Performance
- Signal Fidelity or Loss

All this leads to market segment challenges for your board suppliers



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## IoT Challenges

- Sight count ↑
- Baseline materials
- Low pin count
- Not necessarily high performance



## AI Challenges

- Density
  - Large, high pin-count devices
- Matched lengths
  - Differential pairs
  - Skew
- Some high-speed lanes



IMAGE SOURCE: GETTY IMAGES.

## 5G Challenges

- Microstrip
- Thick copper
  - Plating thickness variances
- Plated via's
- Highest performance needs

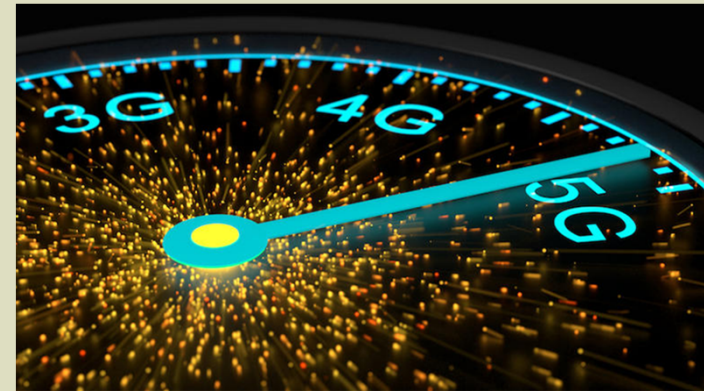
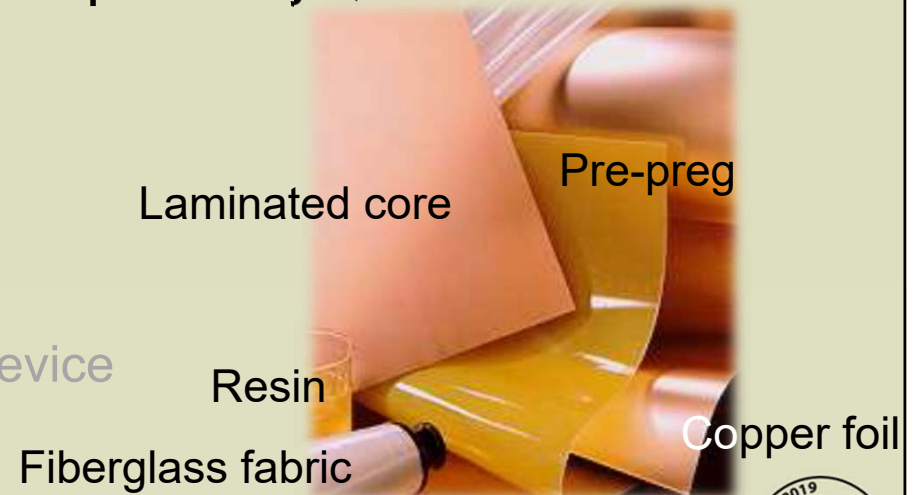


Image: iStockphoto/Michael Borgers

## What Is It?

- Wikipedia...A printed circuit board, or PCB, is used to mechanically support and electrically connect electronic components using conductive pathways, on a non-conductive substrate.
- Simultaneously, a PCB is:
  - Mechanical device
  - Electrical device
  - To a lesser extent, a thermal device



## Laminates

- Pre-preg
  - Fiberglass cloth (woven)
  - Resin
- Copper foil
  - Electrodeposited (ED)



Photo courtesy of Isola

## Materials – ‘Pre-Preg’



Glass Style 106  
Plain Weave  
Count 56x56  
Thickness: 40μ



Glass Style 1080  
Plain Weave  
Count 60x47  
Thickness: 64μ

## Materials – ‘Pre-Preg’

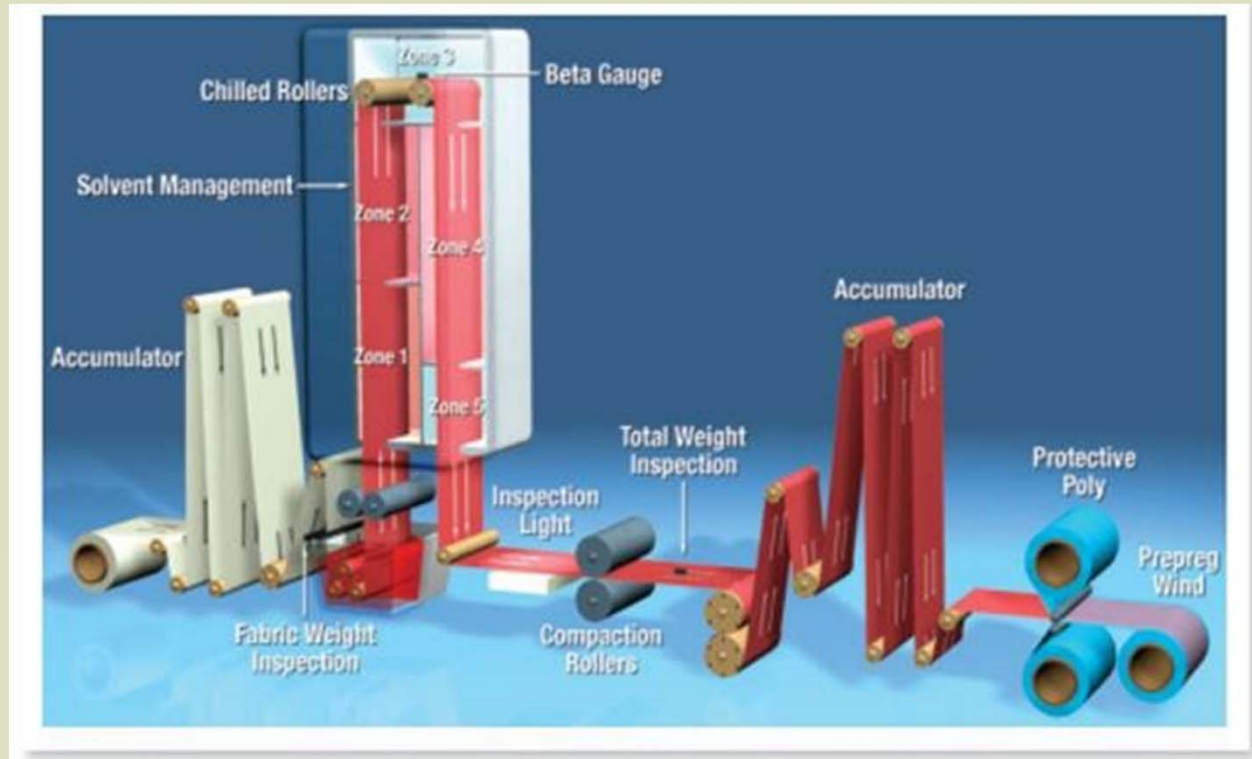


Glass Style 1652  
Plain Weave  
Count 52x52  
Thickness: 100μ



Glass Style 7628  
Plain Weave  
Count 44x32  
Thickness: 170μ

## Pre-Preg - how it's made



## Materials Chart

	Mwave 1000	Mwave 2000	Mwave 3000	Mwave 4000	Meg 6	Rogers 4350	N4000 -13	N4000 -13SI	N4800 -20	N4800 -20SI	Astra MT7	Tachyon 100
<b>Electrical</b>												
Dk												
2 Ghz	3.7	3.4	3.8	3.5	3.71	n.a.	3.7	3.2	3.7	3.55	3	3.04
10 Ghz	3.7	3.4	3.8	3.5	3.61	3.48	3.7	3.3	3.8	3.4	3	3.02
Df												
2 Ghz	0.004	0.003	0.0032	0.002	0.002	0.0031	0.009	0.008	0.007	0.0055	0.0017	0.0021
10 Ghz	0.0055	0.004	0.0048	0.0028	0.004	0.0037	0.008	0.007	0.0075	0.006	0.0017	0.0021
<b>Thermal (Tg)</b>												
TMA	215	215	170	170	n.a.	280	200	200	180	180	n.a.	180
DMA	240	240	200	200	210	n.a.	240	240	210	210	n.a.	220
DSC	n.a.	n.a.	n.a.	n.a.	185	n.a.	210	210	200	200	200	185

DSC, Differential Scanning Calorimetry; TMA, Thermomechanical Analysis; DMA, Dynamic Mechanical Analysis.

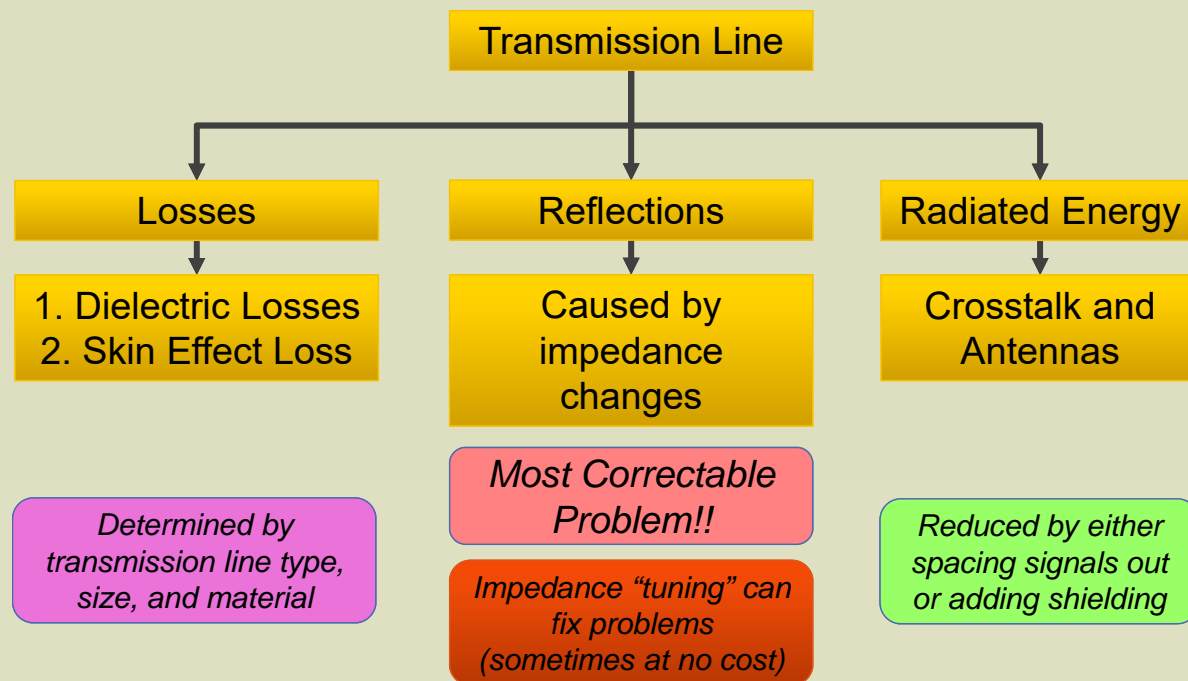


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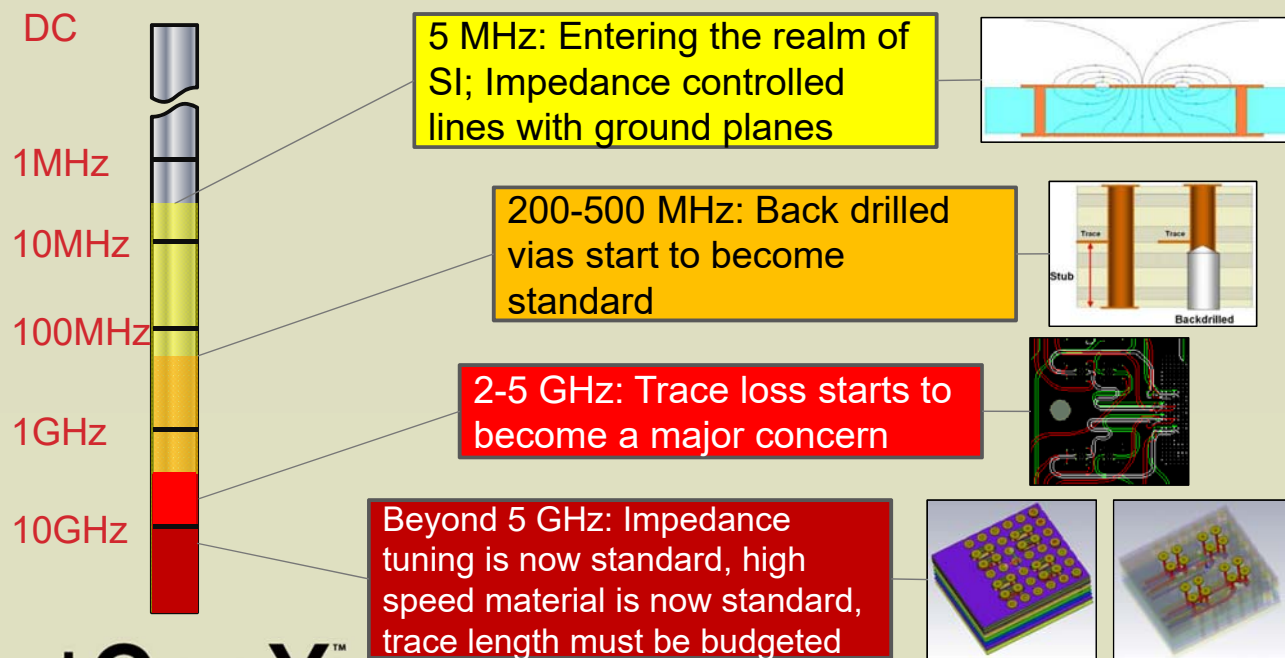
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## Signal Losses Defined

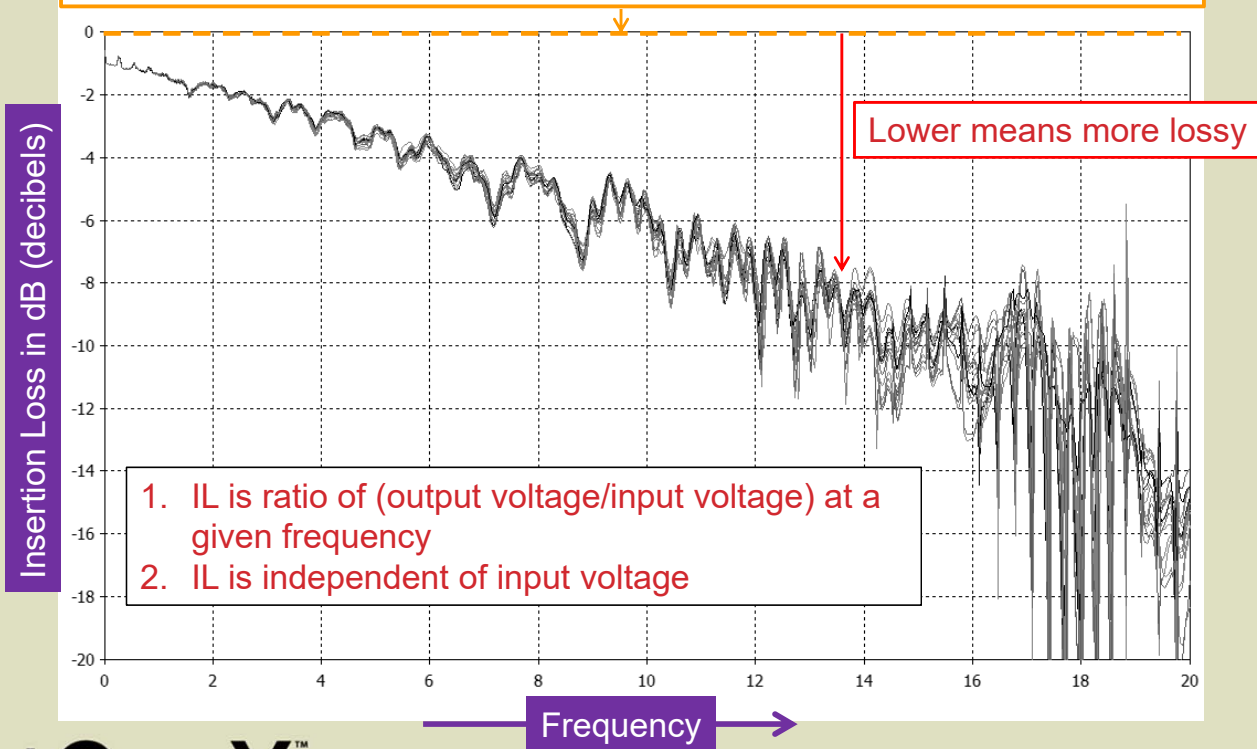


## When do you need to worry about SI?



## Insertion Loss (IL) Plot Basics

Starts at 0dB (which in dB is a ratio of 1, output voltage = input voltage)

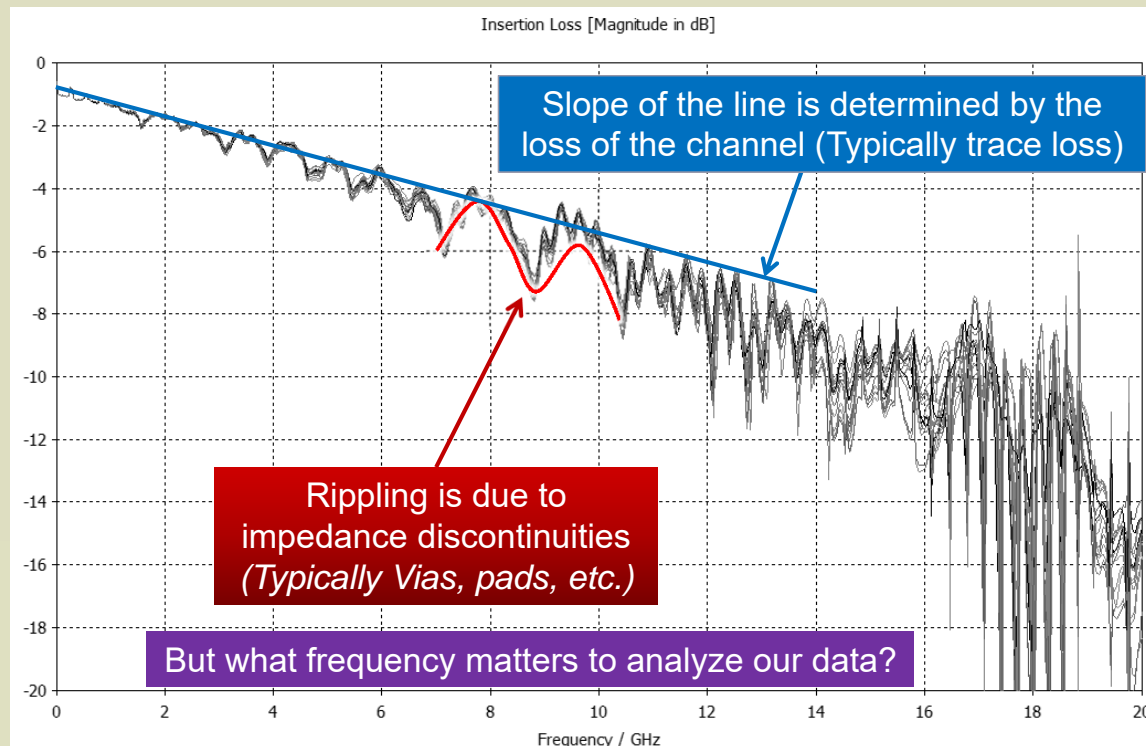


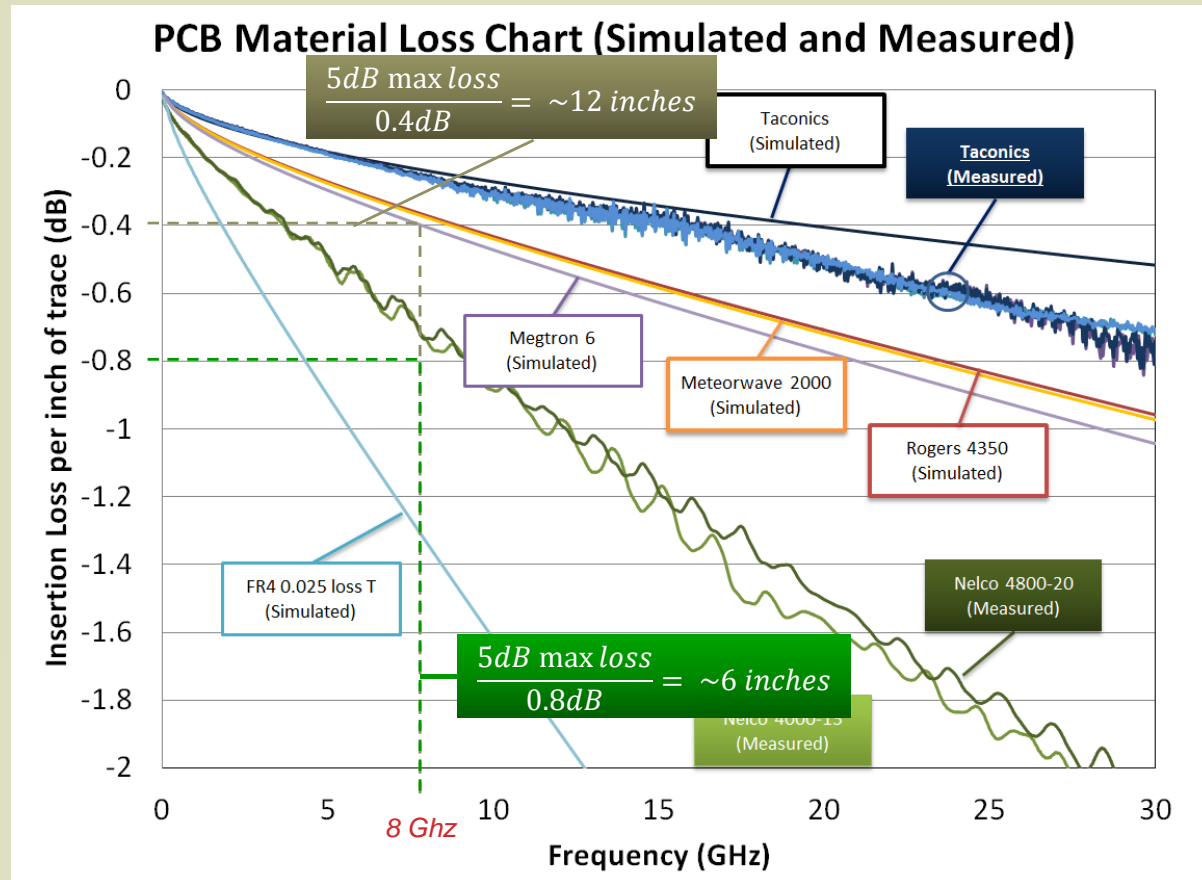
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## Example Insertion Loss Plot





## IoT Materials and Solutions

- Fr4 to Enhanced Fr4's
  - Material cost factor = 1.0
- Controlled Impedance
- Maybe some back-drill's



## AI Materials and Solutions

- Enhanced Fr4's
- Layer count going up
- Low(er) loss materials
  - Material cost factor = 1.3+
- Controlled Impedance
- Back-drill
- Trace length matching



IMAGE SOURCE: GETTY IMAGES.

## 5G Materials and Solutions

- Low loss materials
  - Material cost factor = 1.5+
- Controlled Impedance
- Power delivery concerns
- Power performance concerns
- Back-drill
- Trace length matching

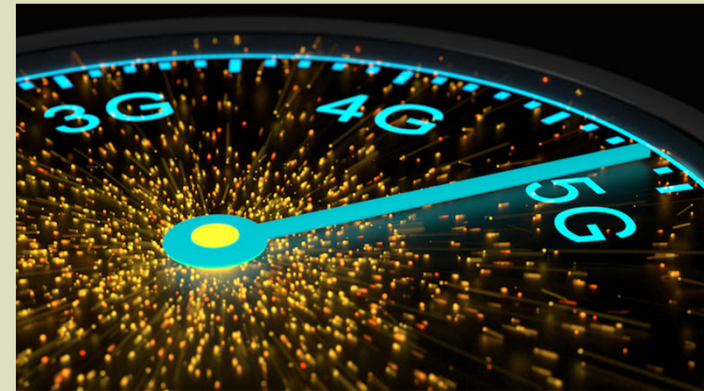


Image: iStockphoto/Michael Borgers

## Other Attributes To Consider

- Via's
  - Formation
  - Tuning
- Copper foil
  - Roughness
- Copper plating



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## Summary

- Challenges for fabricators
- Materials and what they're made of
- Electrical characteristics of materials
- Material cost considerations
- Impacts to IoT, AI and 5G device testing



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