Coaxial Elastomer Socket for High-bandwidth and High-density Package Test

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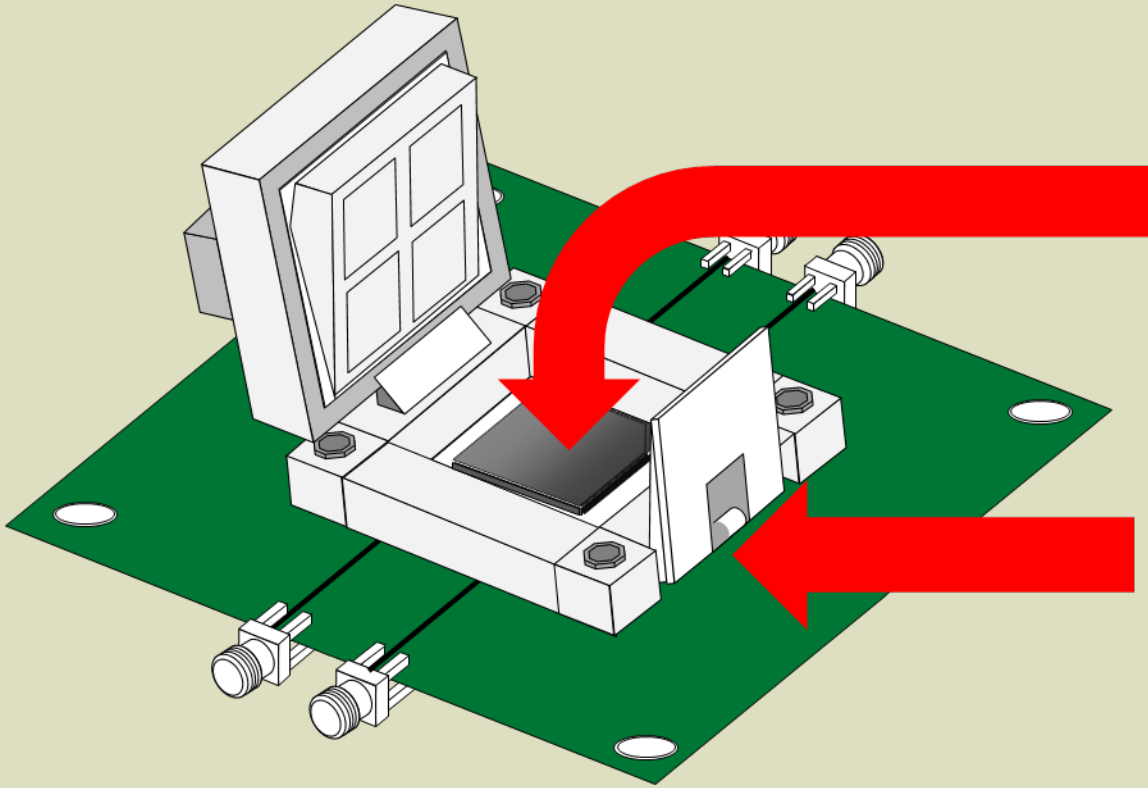
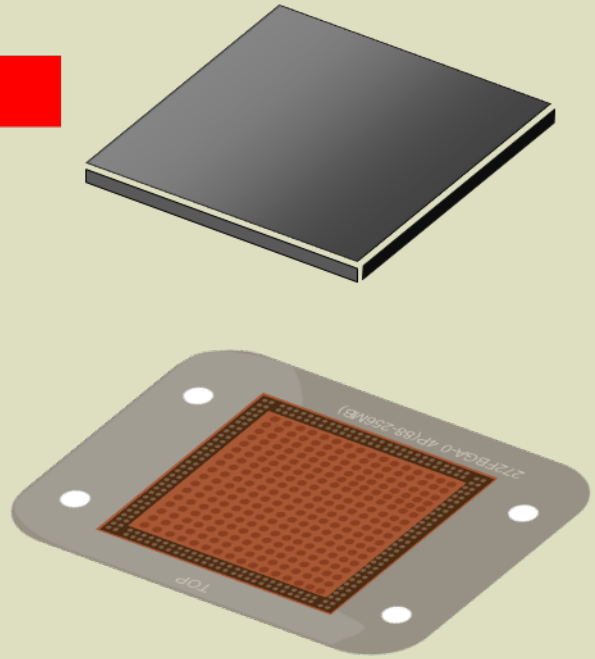
Suwon ▪ November 18, 2025

Contents

Burn-in Socket for Package Test (1/2)

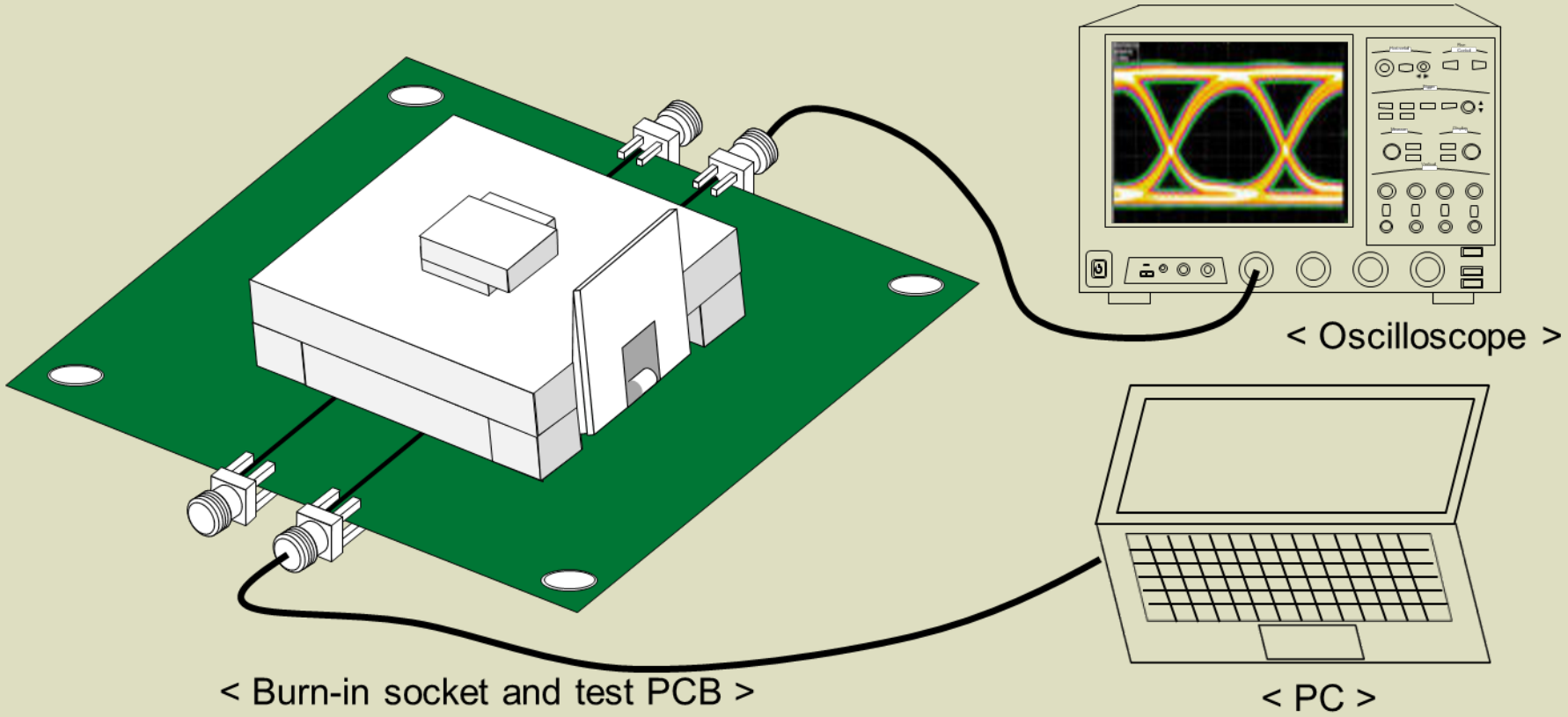


<Burn-in socket and test PCB>

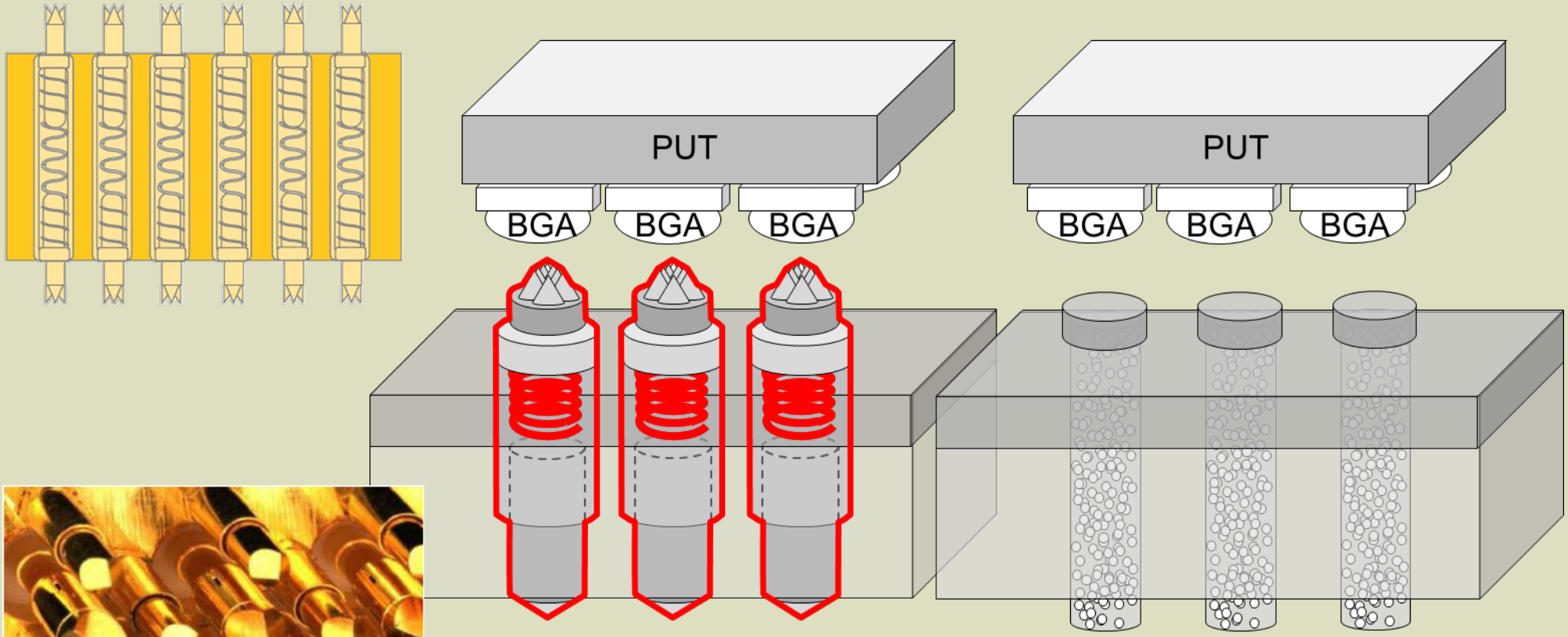


<DUT and test socket>

Burn-in Socket for Package Test (2/2)

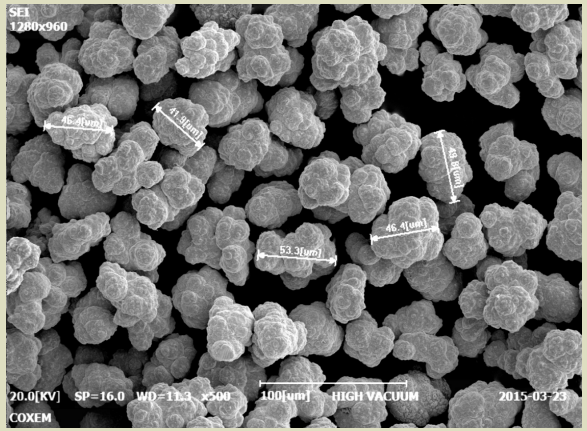


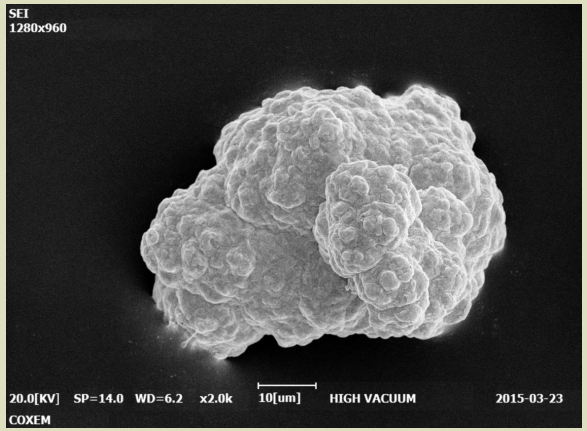
Two Types of Test Sockets in Burn-in Socket

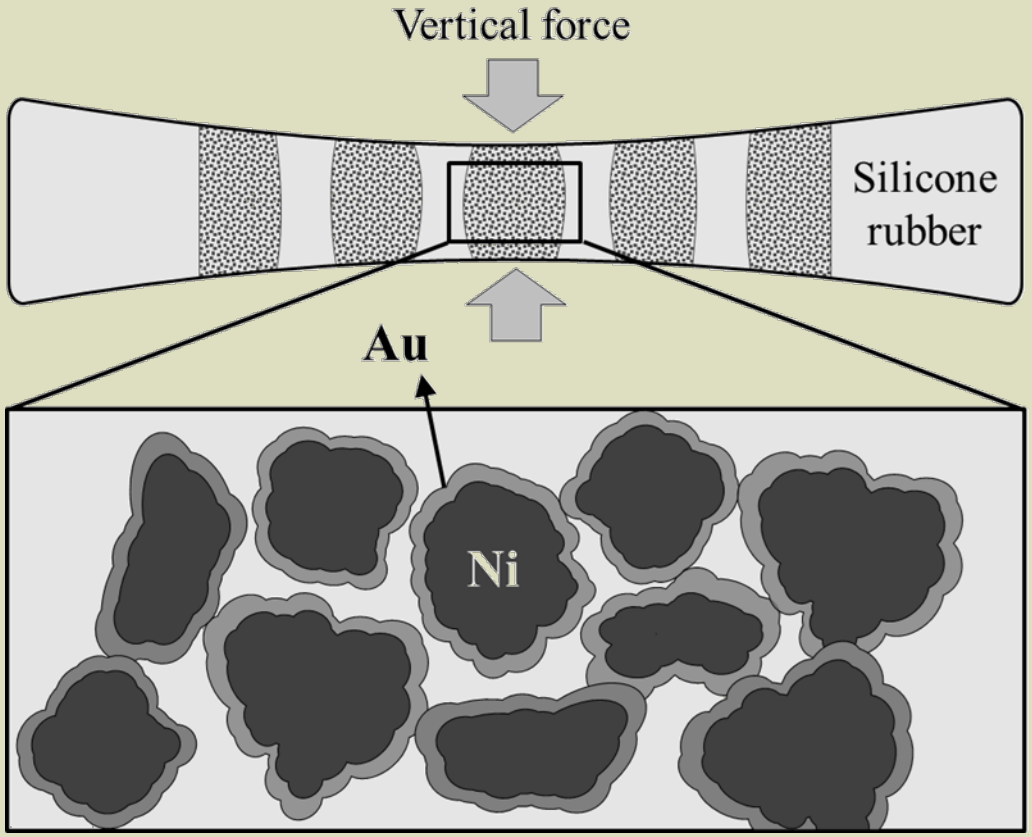


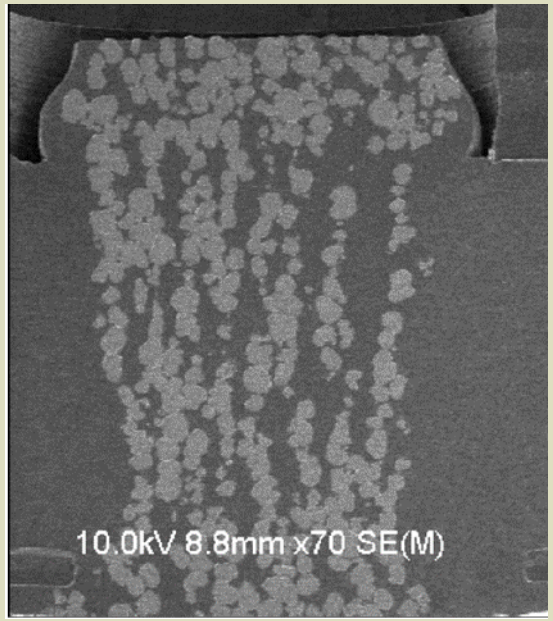
< Pogo type and Elastomer type test socket >

Principle of Conductivity in Silicone Rubber Socket









- Silicone rubber socket becomes conductive when it is under compression

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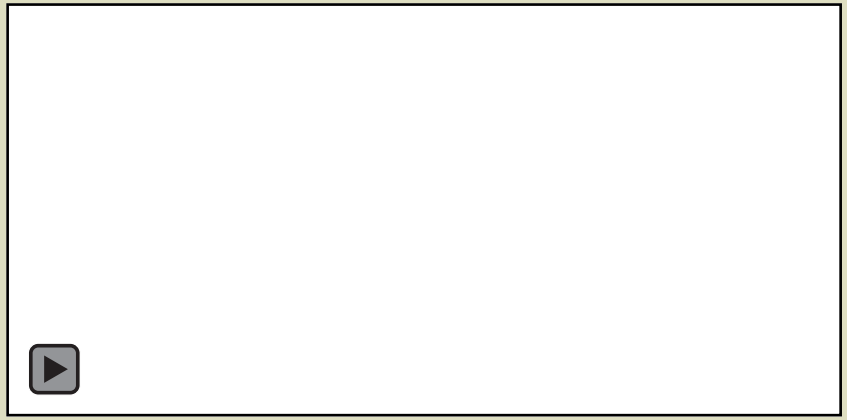
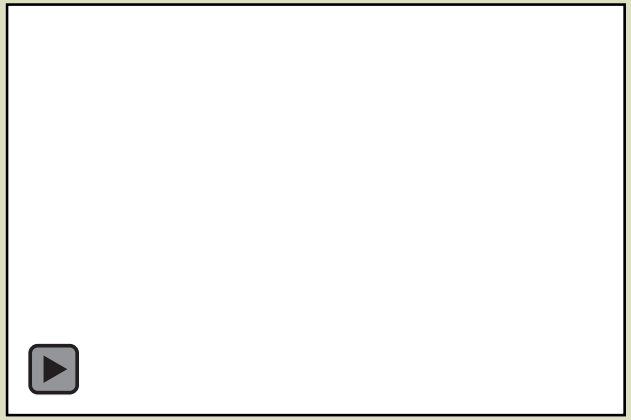
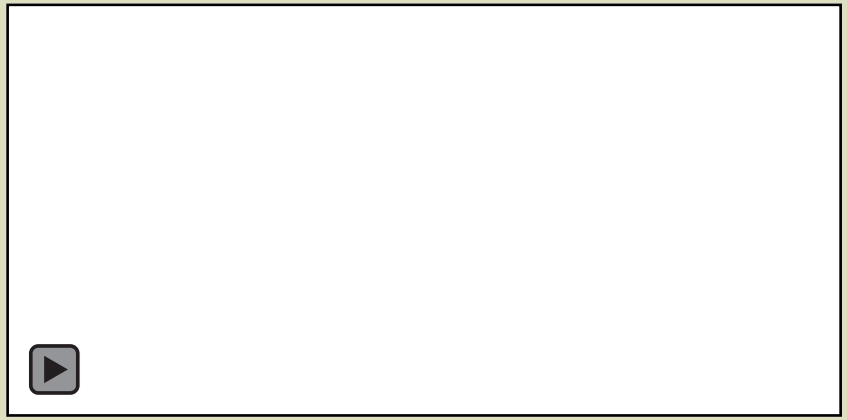
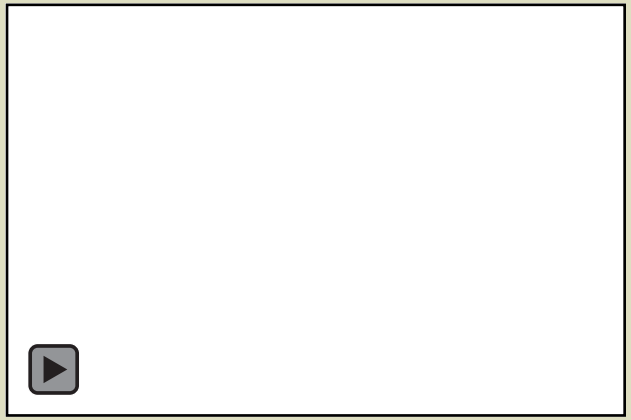
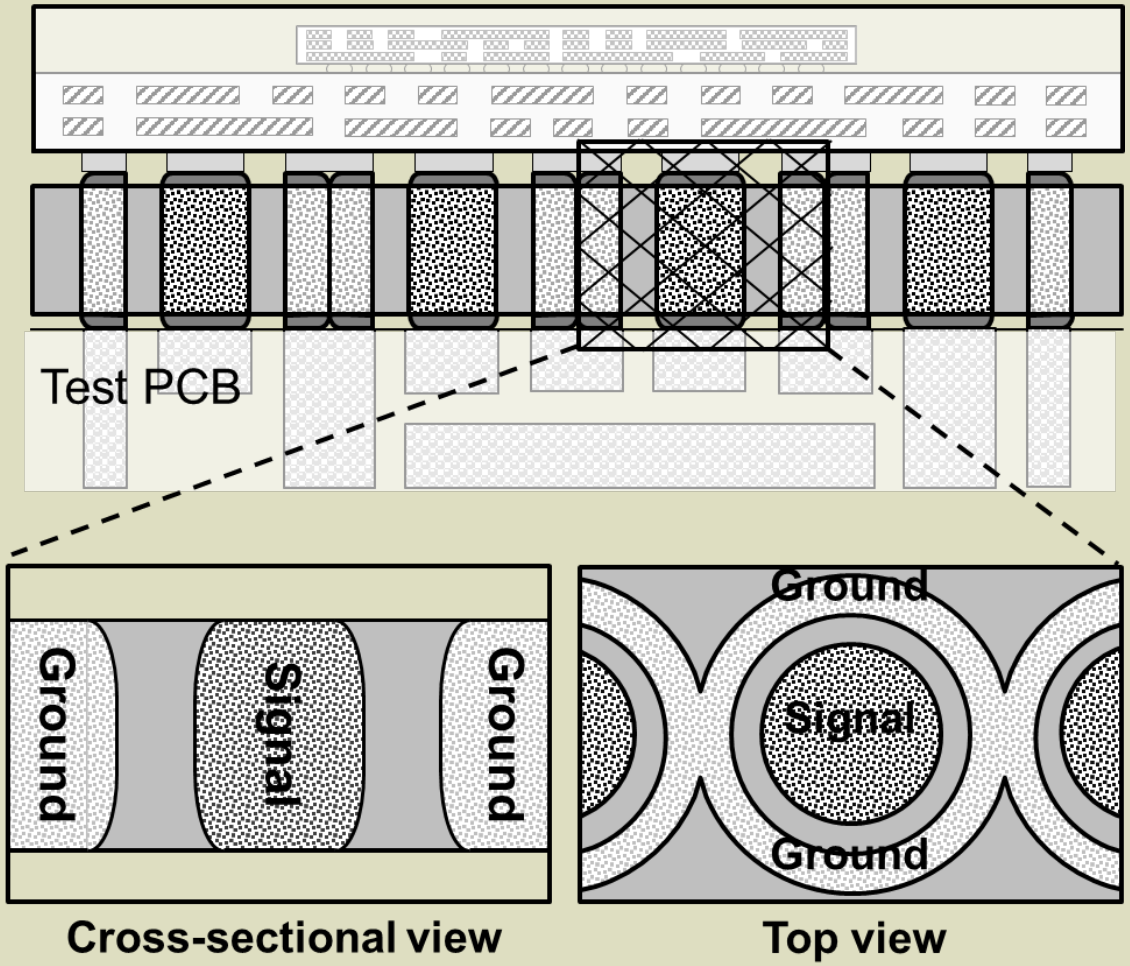
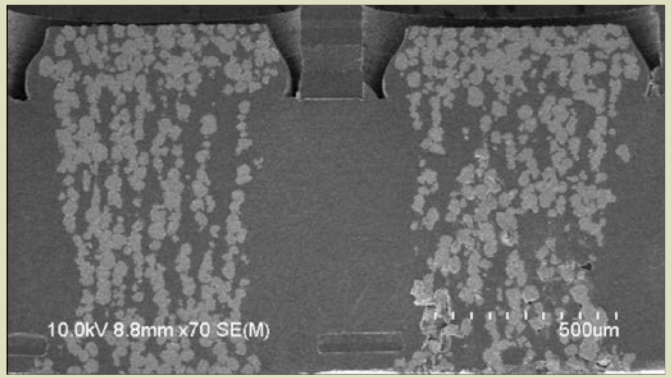
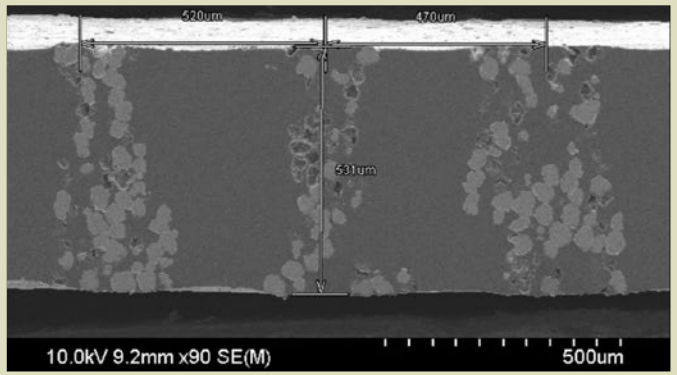
EM Fields depending on Coaxial Structure

	Non-coaxial	Coaxial
Electric field		
Magnetic field		

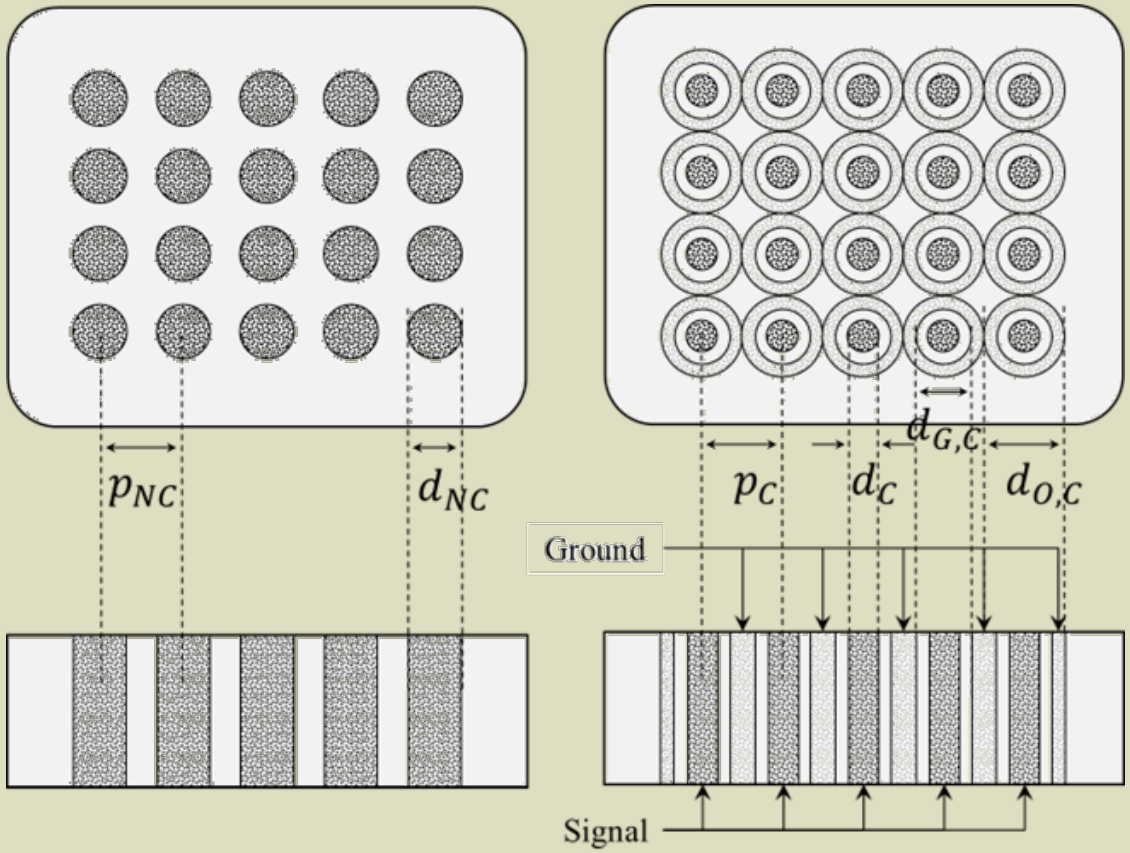
Concept of Coaxial Silicone Rubber Socket



Comparison b/w Coaxial and Non-coaxial Socket

	Non-coaxial socket	Coaxial socket
Top view		
SEM		

Comparison b/w Coaxial and Non-coaxial Socket



Socket type	parameter	Value [μm]
Non-coaxial socket	p_{NC}	1000
	d_{NC}	700
Coaxial socket	p_c	1000
	d_c	300
	$d_{G,C}$	700
	$d_{O,C}$	1200

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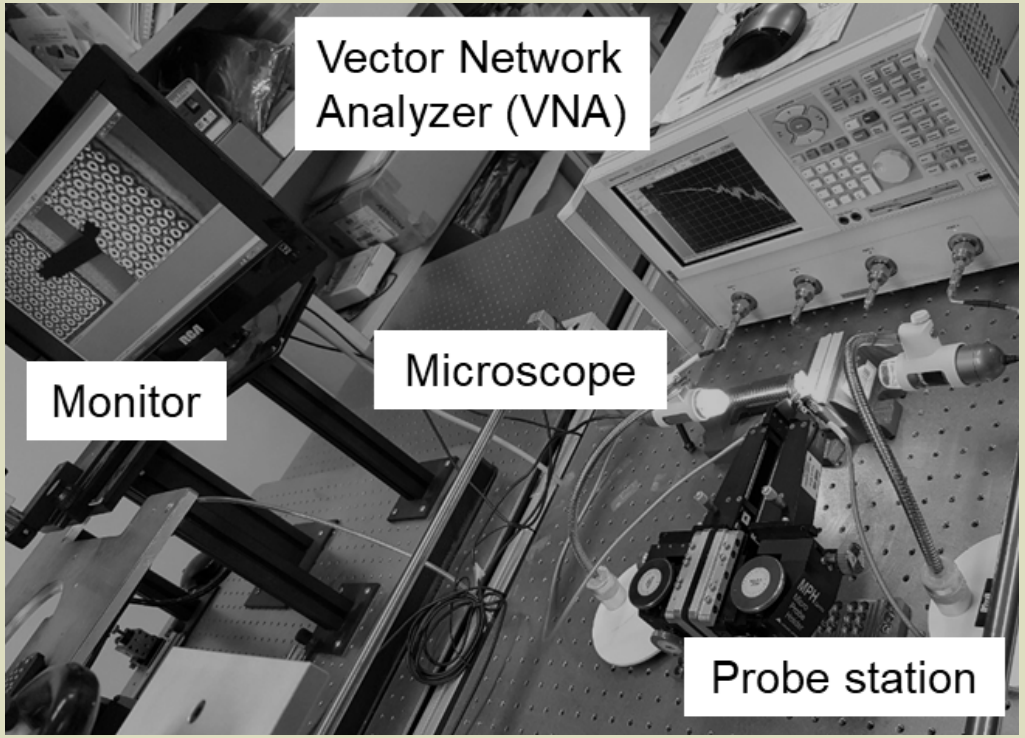
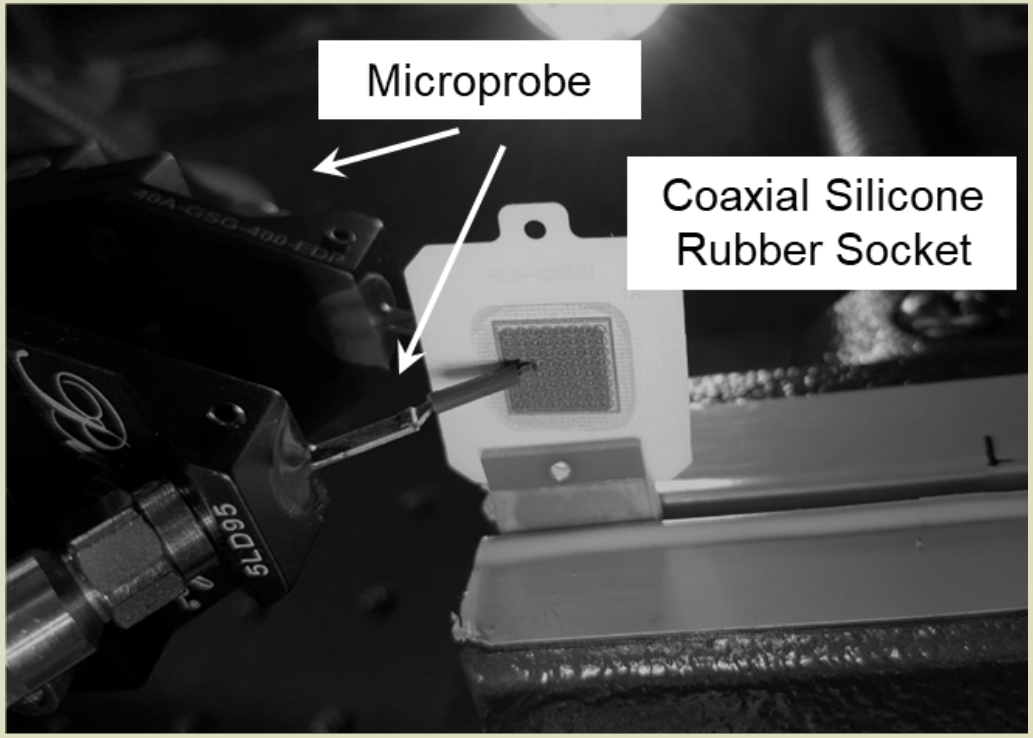
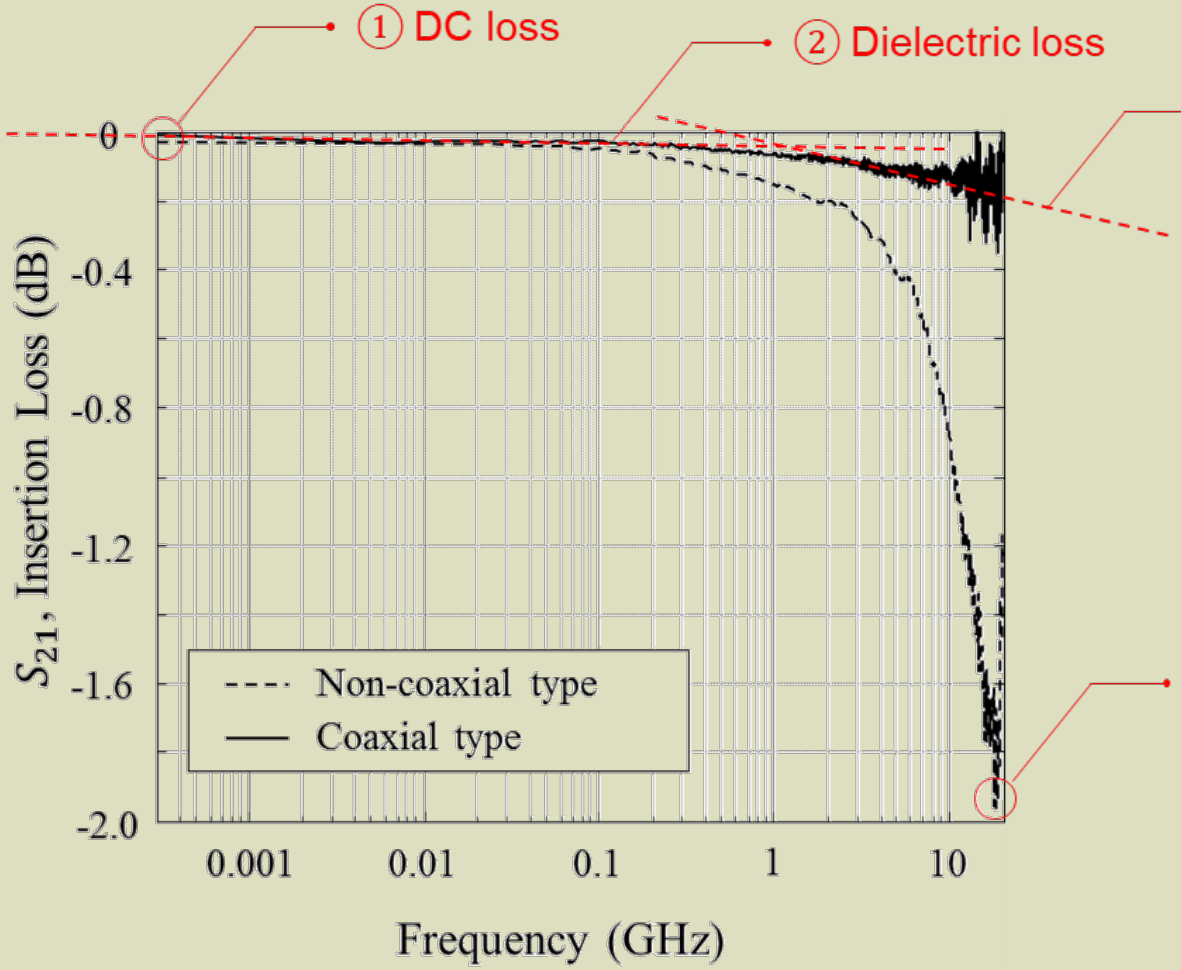
Measurement setup for Frequency-Domain





- The bandwidth of the measurement was 20 GHz
- Microprobes had a pitch of 1000 um in ground-signal-ground (GSG) configuration

Measured Insertion Losses for Non-coaxial/Coaxial Silicone Rubber Socket



- Measured insertion losses had 4 loss terms
- Both had the common loss terms of ① ② ③
- Non-coaxial had additional loss term of ④

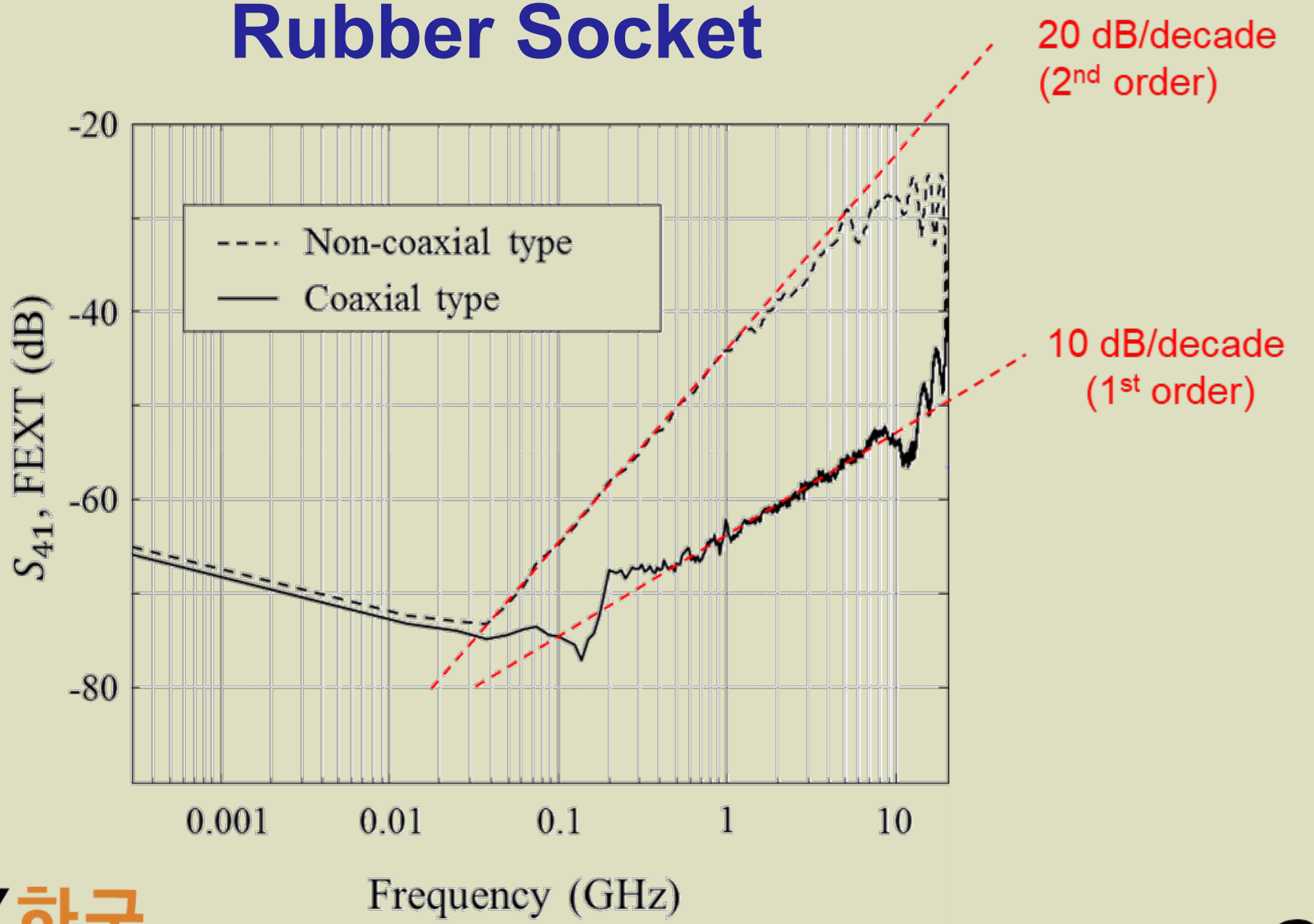
Dominant Factors Degrading the Insertion Loss for the Non-coaxial Socket

- Characteristic impedance
  - Definition: Ratio between H-field and E-field
  - The desired values are
    - 50 ohm for single-ended / 100 ohm for differential signaling
  - Signal reflection occurs
    - when the signal goes through different characteristic impedance
  - Multiple reflection may cause resonances

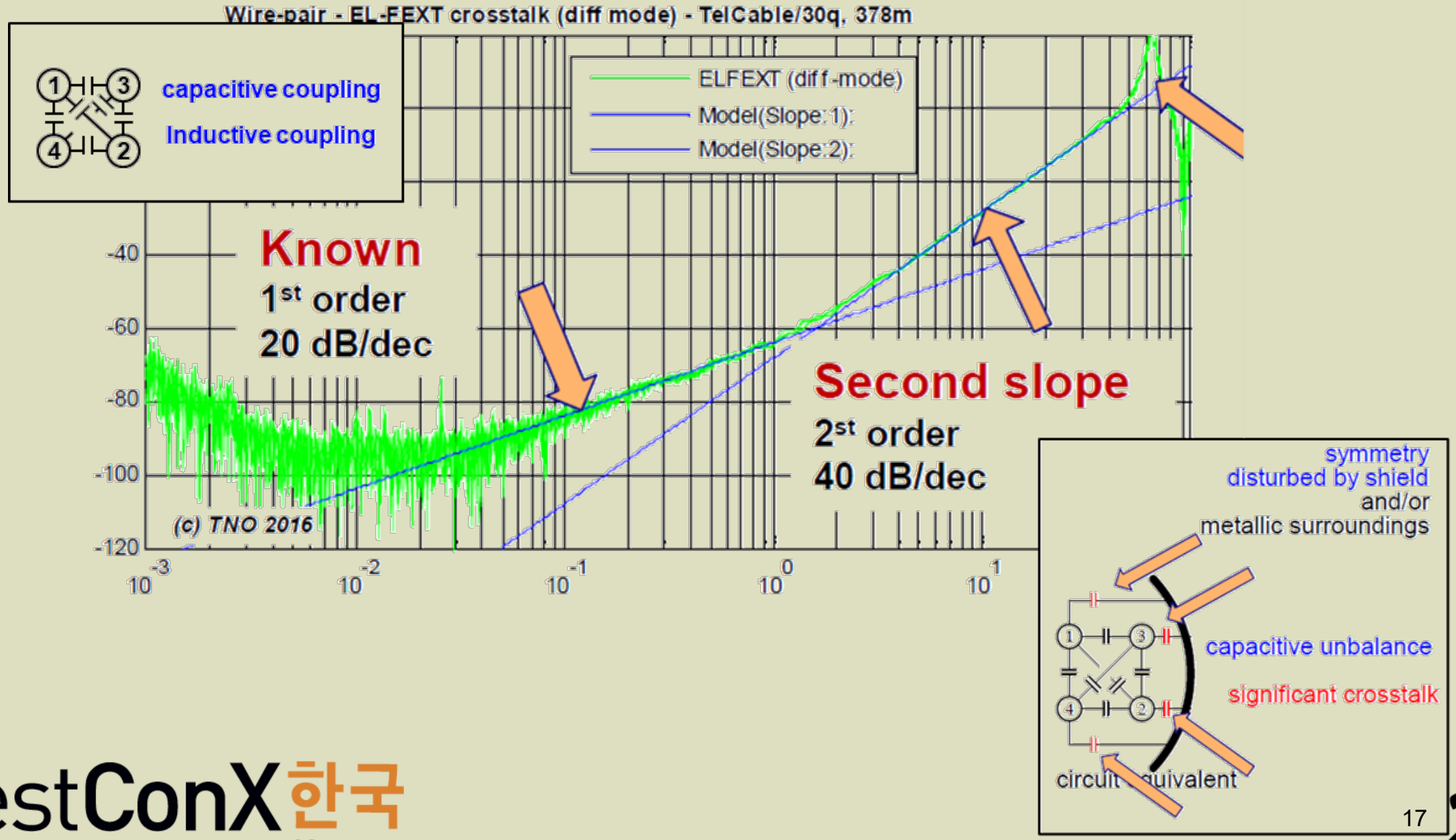
- Non-coaxial silicone rubber socket had the above problem (impedance mismatching)
  - The limited number of powders in the silicone rubber
  - Limitation in socket dimension
  - Therefore, 50-ohm impedance design cannot be achieved

- Coaxial socket had an advantage in impedance control
  - Coaxial structure was easy to control the socket design

Measured FEXT for Non-coaxial/Coaxial Silicone Rubber Socket

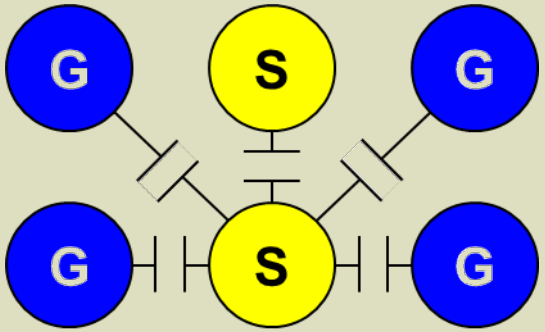


Second Order Effect on FEXT



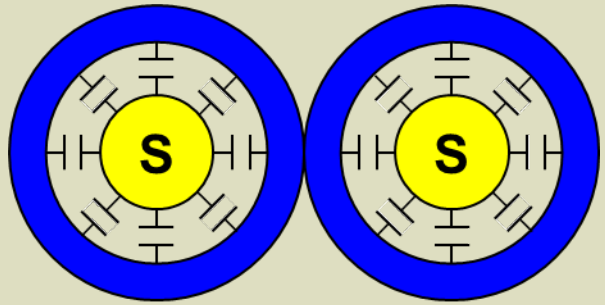
ref] "**Understanding the dual-slope effect in crosstalk (EL-FEXT),**" Rob F.M. van den Brink in TNO

Capacitive Unbalance in Non-coaxial Silicone Rubber Socket



< Non-coaxial >

- ✓ **Asymmetric** capacitive structure
- ✓ Ground-signal configuration
- ✓ Crosstalk from capacitive coupling
- ✓ Crosstalk from unbalanced capacitance to near grounds



< Coaxial >

- ✓ **Symmetric** capacitive structure
- ✓ Coaxial configuration
- ✓ Crosstalk from capacitive coupling

Conclusion

- Silicone rubber socket had some limitations on the insertion loss and far-end crosstalk (FEXT)
- Coaxial silicone rubber socket was proposed to overcome the limitations of the silicone rubber socket
- For verification, the coaxial socket had better electrical performances than those of the non-coaxial socket
- We analyzed the difference b/w the coaxial and non-coaxial silicone rubber socket in the insertion loss and FEXT
- Difference b/w the coaxial and non-coaxial silicone rubber socket came from the configuration b/w the coaxial and single-ended, not socket itself

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