

Probe Card Crosstalk: How to Control the RF Fields

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Agenda

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2. *What is Crosstalk*
 1. Impact of crosstalk
 2. Types of crosstalk
 3. How to measure crosstalk
3. *Probe Card Crosstalk*
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 2. Pyramid probe investigation 700-3455
 3. Pyramid probe investigation 700-4696
4. *Conclusion*

Overview

In testing RF devices at frequencies above 1 GHz, the RF crosstalk can be challenging to control properly. This is especially important when measuring RF Front-End devices that require good signal integrity and tight tolerances in order to continue to increase the spectral efficiency. By keeping crosstalk below a certain level, accurate measurements in a production test environment with a low rate of false rejects and false accepts will be maintained. A few different designs in the Pyramid Probe were made to investigate which features provide the best RF crosstalk.

Crosstalk

What is crosstalk

The unwanted signal from one part of a system to another.

- It's the energy coupled from where we want it to where we don't want it.
 - It disrupts system operations.
 - It causes performance degradation in high-frequency analog and high-speed digital circuits.

Crosstalk

Types of Crosstalk

Crosstalk can occur going either direction in a circuit.

- When close to the source of noise, it's often referred to as near-end crosstalk.
- When detected away from the source of noise, it's often referred to as far-end crosstalk.

RF/MW circuits are susceptible to crosstalk due to several factors:

- Types of transmission line:
 - Microstrip
 - Stripline
 - Coplanar Waveguide (CPW)
- Space
 - Due to the complexity of the circuit layout, closely spaced transmission lines act as antennas.

Crosstalk

How to measure Crosstalk:

Crosstalk measurements are typically made in

- Time domain, using a time domain reflectometer.
- Frequency domain, with a microwave network analyzer.
- the digital realm, with the aid of a bit-error-rate tester.

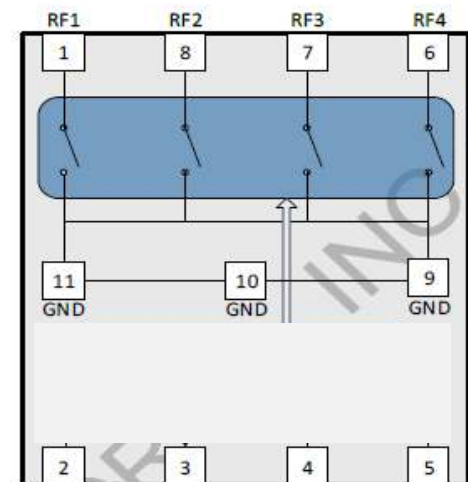
Probe Card Crosstalk

Device 1 (700-3500) is a 4XSPST shunt switch:

- The two outer branches, RF1 & RF4, measured HB.
- The two inner branches, RF2 & RF3, measured LB.
- Typical HB on state $2f_0 \sim -80$ dBm & $3f_0 \sim -41$ dBm.
- Typical LB on state $2f_0 \sim -85$ dBm & $3f_0 \sim -36$ dBm.

Due to crosstalk, HB harmonic degraded by ~ 30 dBm.

Functional Block Diagram



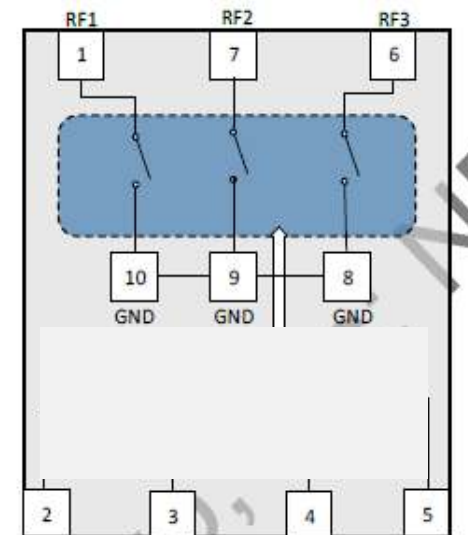
Probe Card Crosstalk

Device 2 (700-4696) is a 3XSPST shunt switch:

- The two outer branches, RF1 & RF3, measured HB.
- The inner branch, RF2 , measured LB.
- Typical HB on state $2f_0 \sim -85$ dBm & $3f_0 \sim -55$ dBm.
- Typical LB on state $2f_0 \sim -85$ dBm & $3f_0 \sim -35$ dBm.

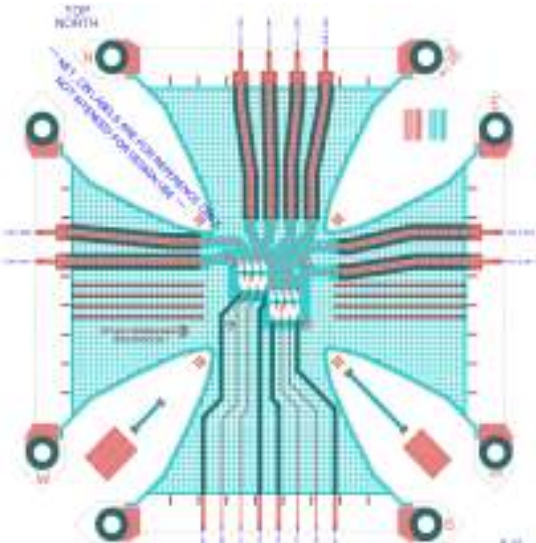
Due to crosstalk, HB harmonic degraded by ~ 20 dBm.

Functional Block Diagram



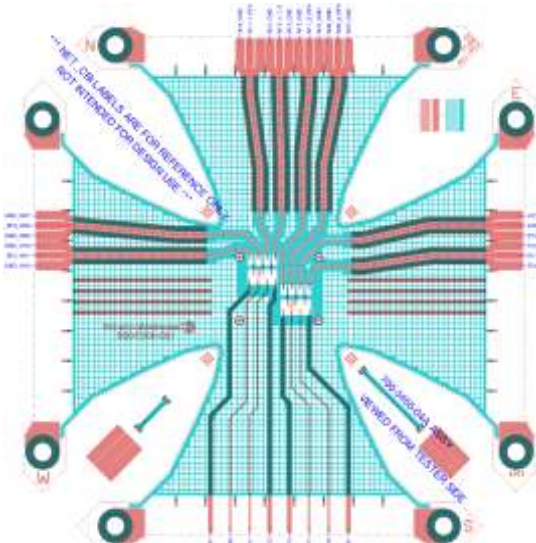
Probe Card Crosstalk

700-3455-00



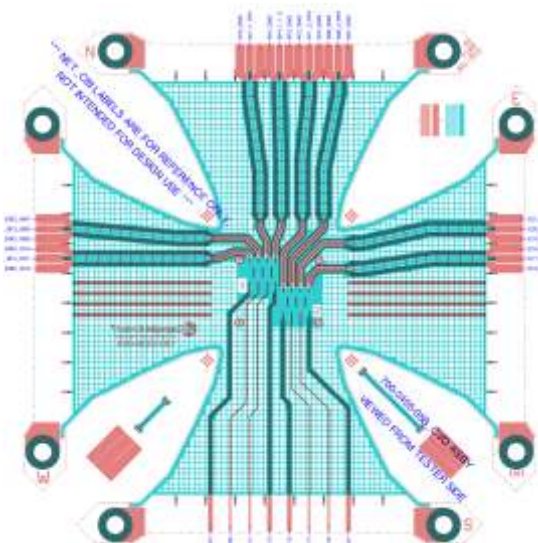
Original design

700-3455-04



Ground pulled up to CBI

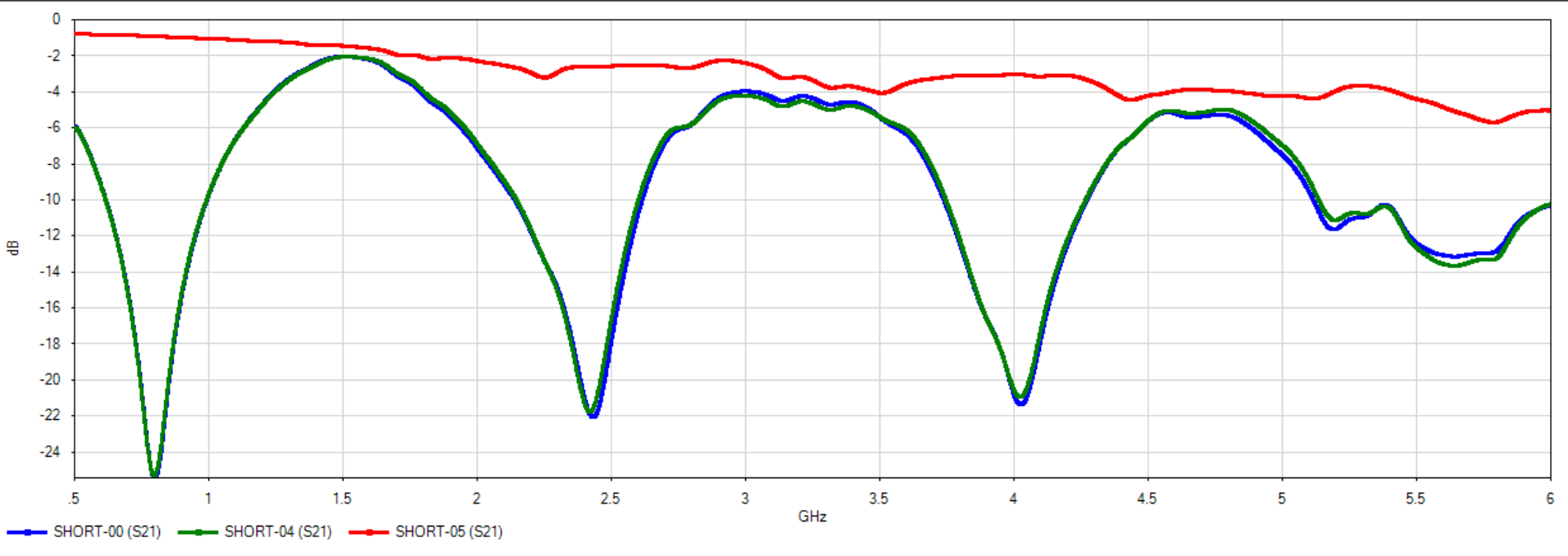
700-3455-05



Inverted microstrip
Inverted CPW
Solid ground all over probe face

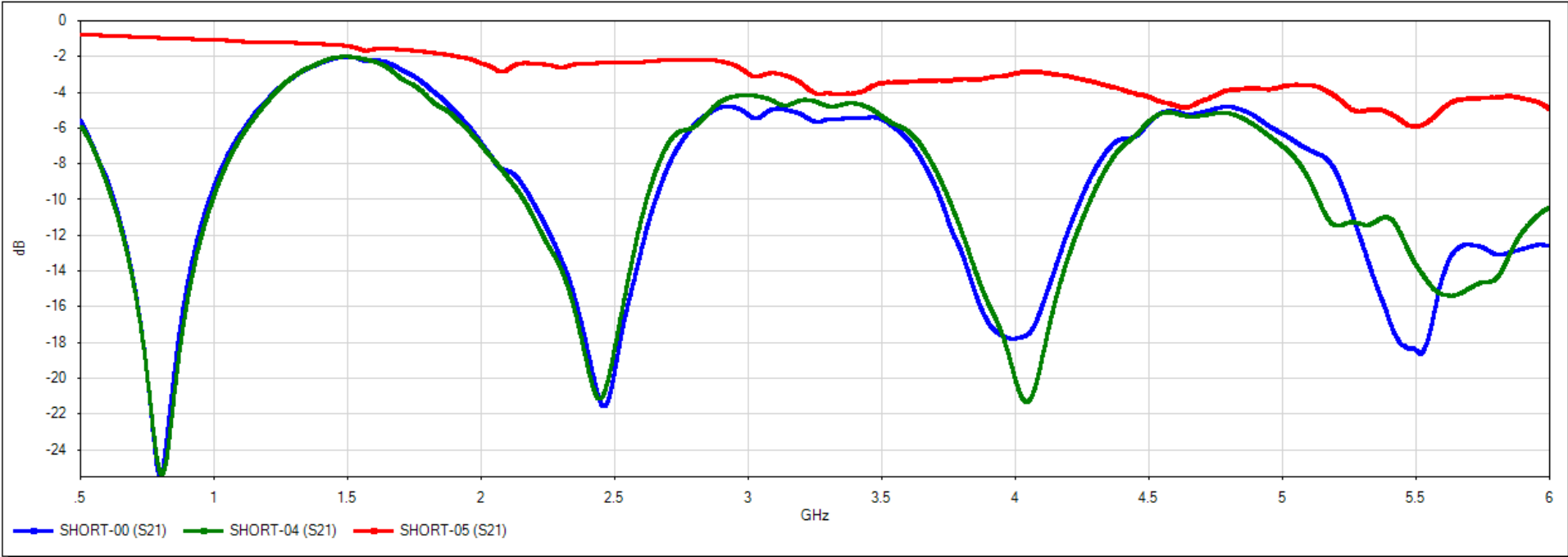
Probe Card Crosstalk

700-3455 Result Comparison RF2 to RF1



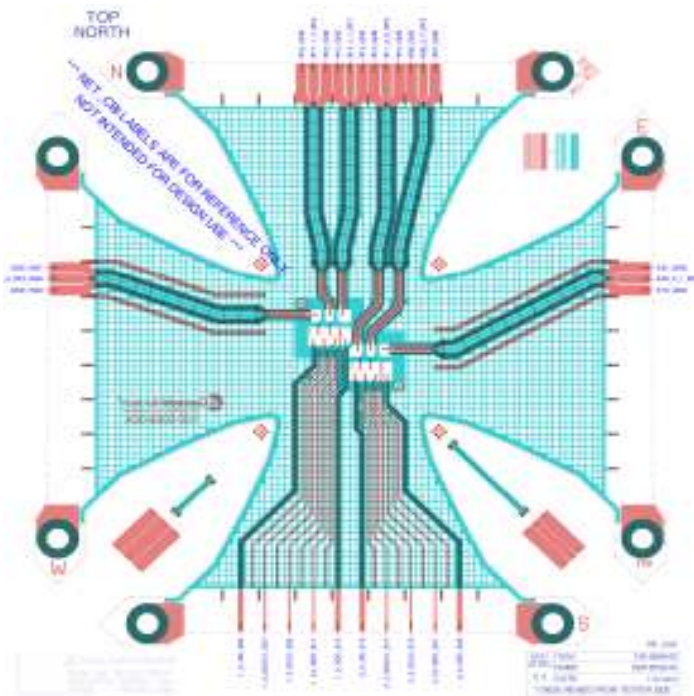
Probe Card Crosstalk

700-3455 Result Comparison RF3 to RF4



Probe Card Crosstalk

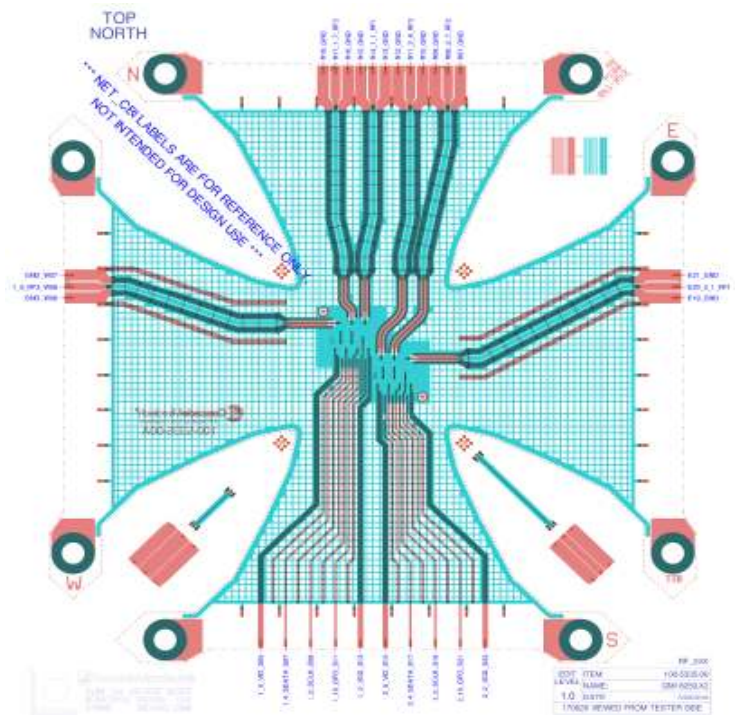
700-4696-00A



Design comparison

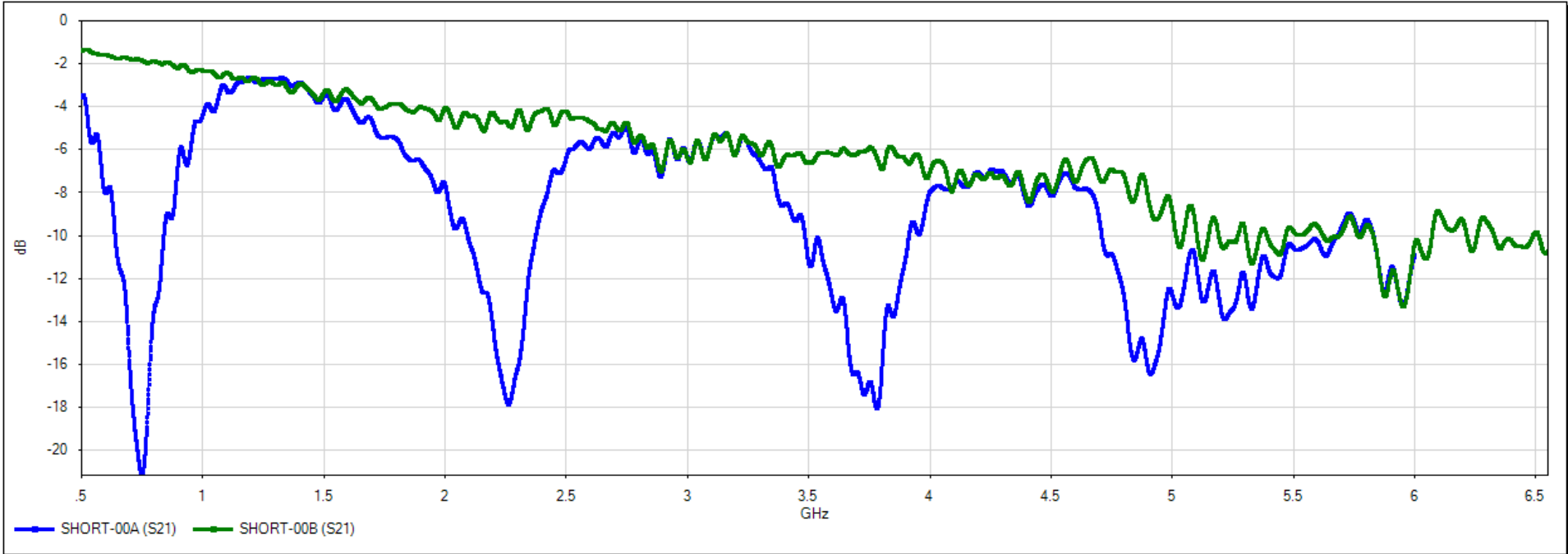
- Inverted microstrip
- Inverted CPW
- Solid ground all over probe face of -00B compared to -00A

700-4696-00B



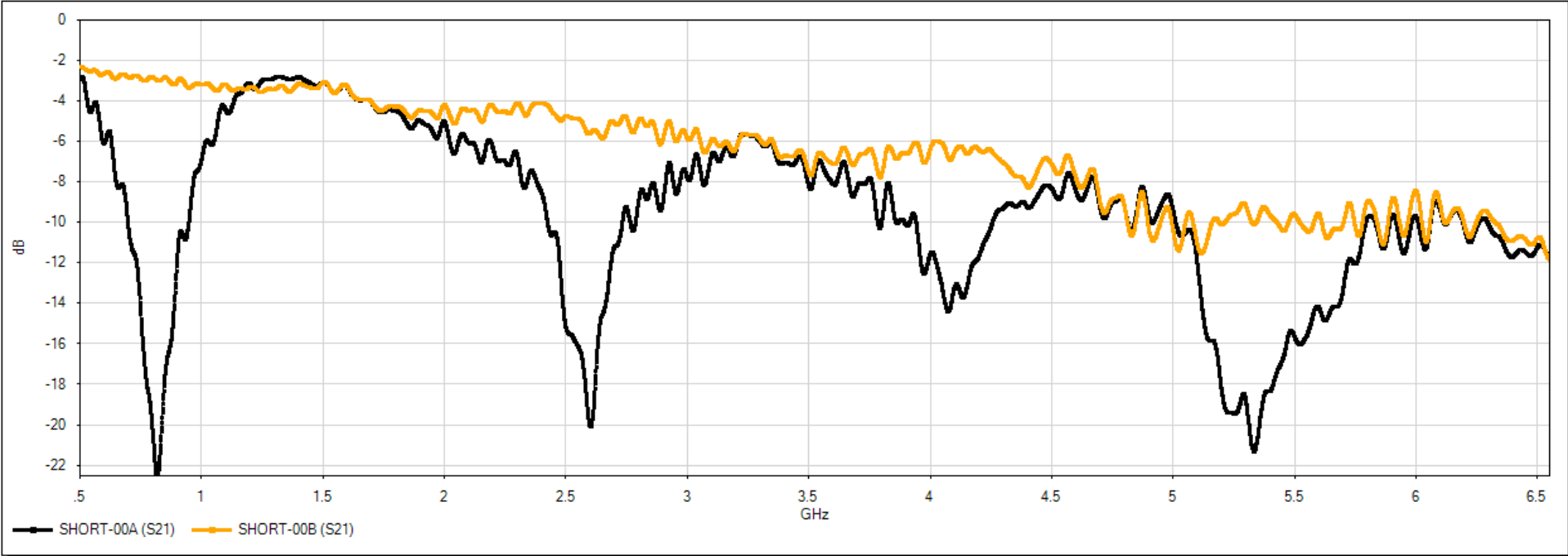
Probe Card Crosstalk

700-4696 Result Comparison RF2 to RF1



Probe Card Crosstalk

700-4696 Result Comparison RF2 to RF3



Summary

- It's important to know the effect crosstalk has on a circuits performance.
- Crosstalk can be monitored and minimized at any given frequency.
- For our application, the Inverted Microstrip with Inverted CPW & Solid ground all over the probe face reduced crosstalk and improved our harmonic measurement

Thank You!

For questions, please contact:

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