



IEEE SW Test Workshop
Semiconductor Wafer Test Workshop

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High Bandwidth (>2.5Gbps) and Fine Pitch (<30um) Cantilever Probe Card for High Speed LCD Driver Testing



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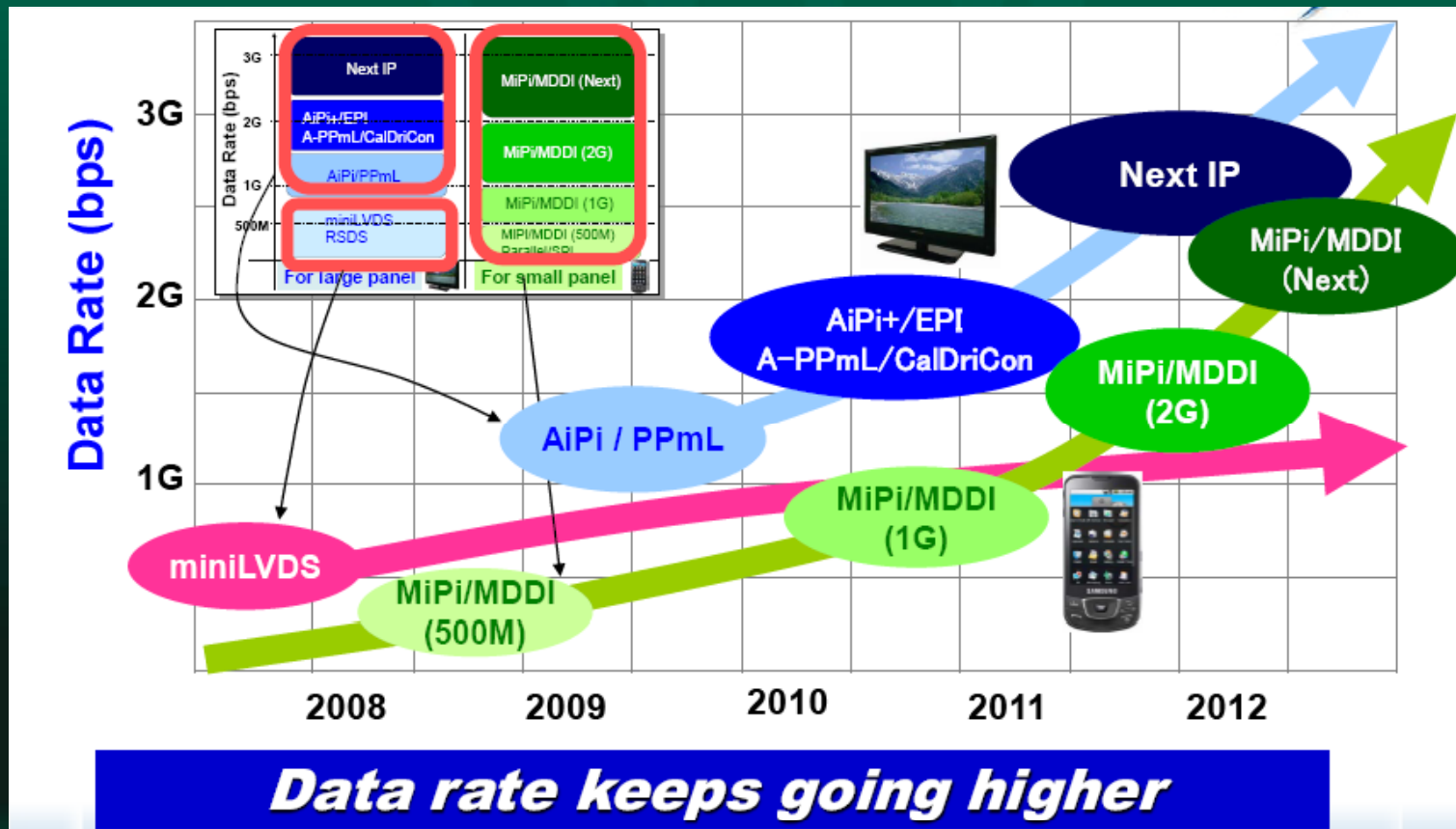
Presentation Overview

- Introduction & Background
- Objectives & Goal
- Modeling & Analysis
- Experiment, Validation & Customer Verification
- Summary & Conclusion
- Follow-On Work



Introduction & Background

- High speed LCD drive IC market



Source: Yokogawa Testing Technologies



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Objectives & Goal

● Objectives – Reduce the total cost for high speed device testing

- High speed performance ($>2.5\text{Gbps}$)
- Low total cost (CP/FT test cost...)
- Fine pitch ($< 30\text{ }\mu\text{m}$)

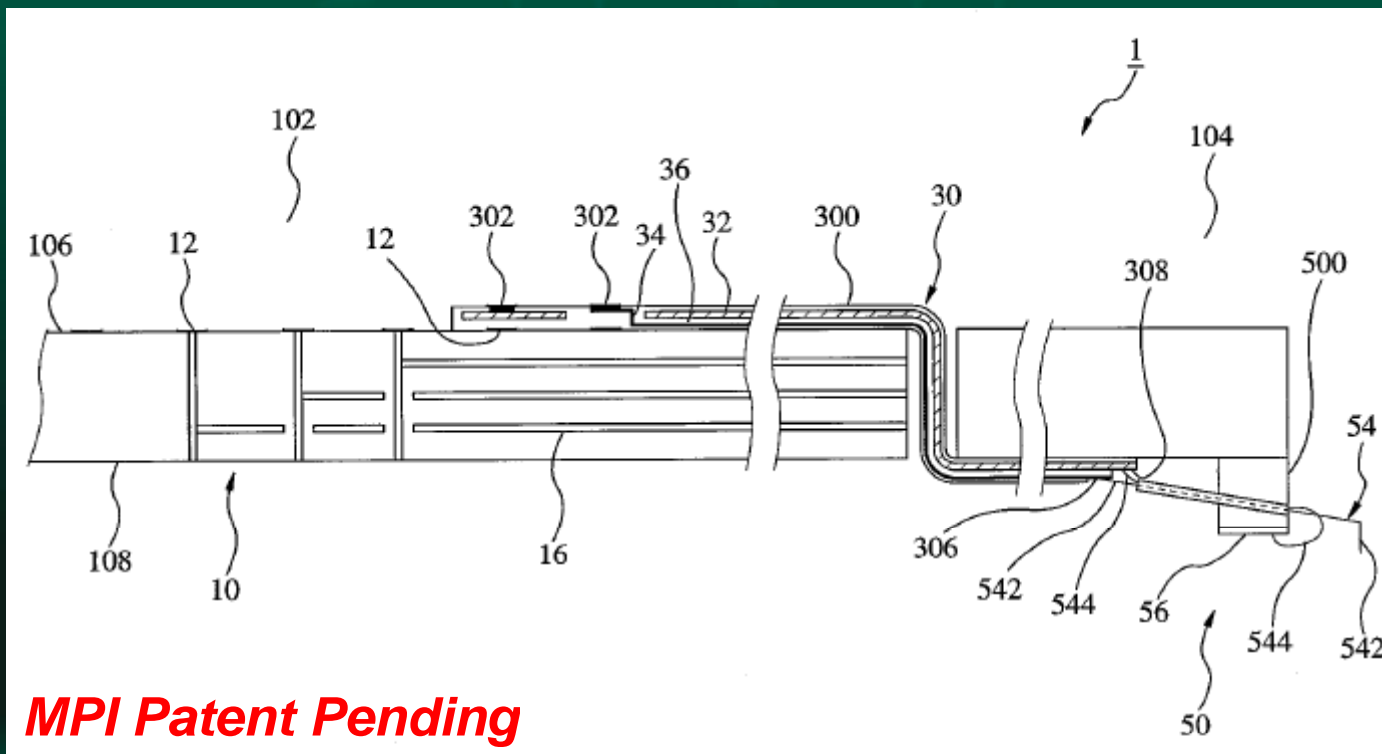
● Strategy – How ??

- Improve the “Signal Integrity” issue of the normal cantilever probe card.



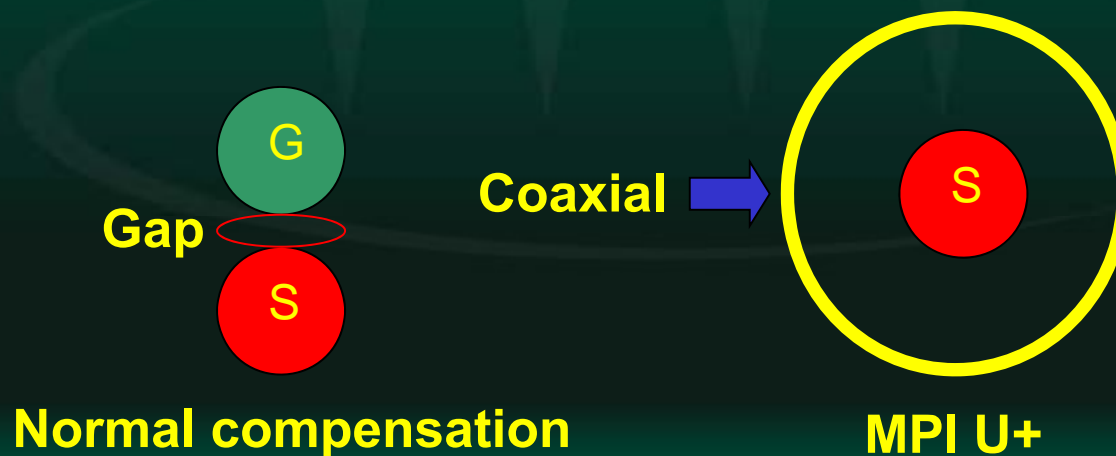
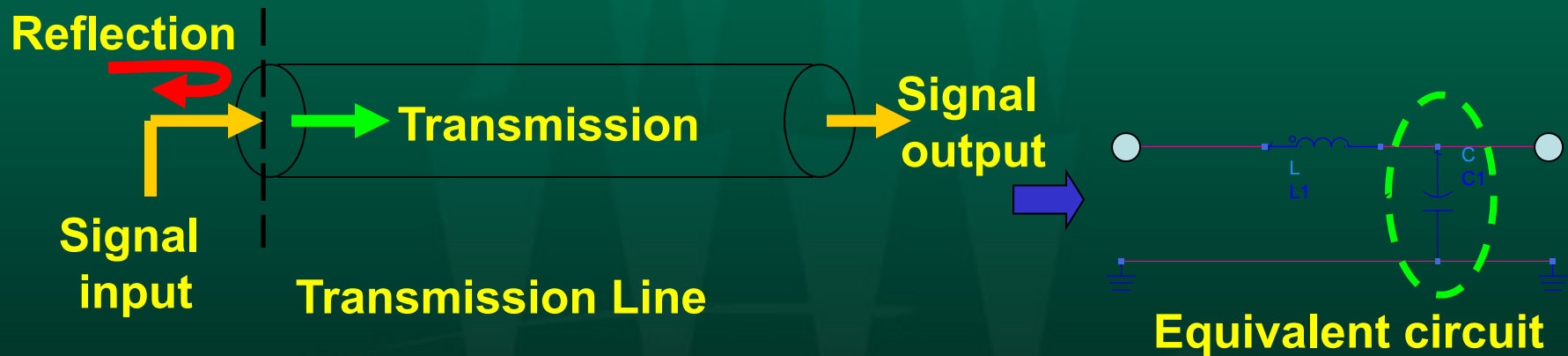
Objectives & Goal

- Goal – Advanced cantilever probe card for high speed solution



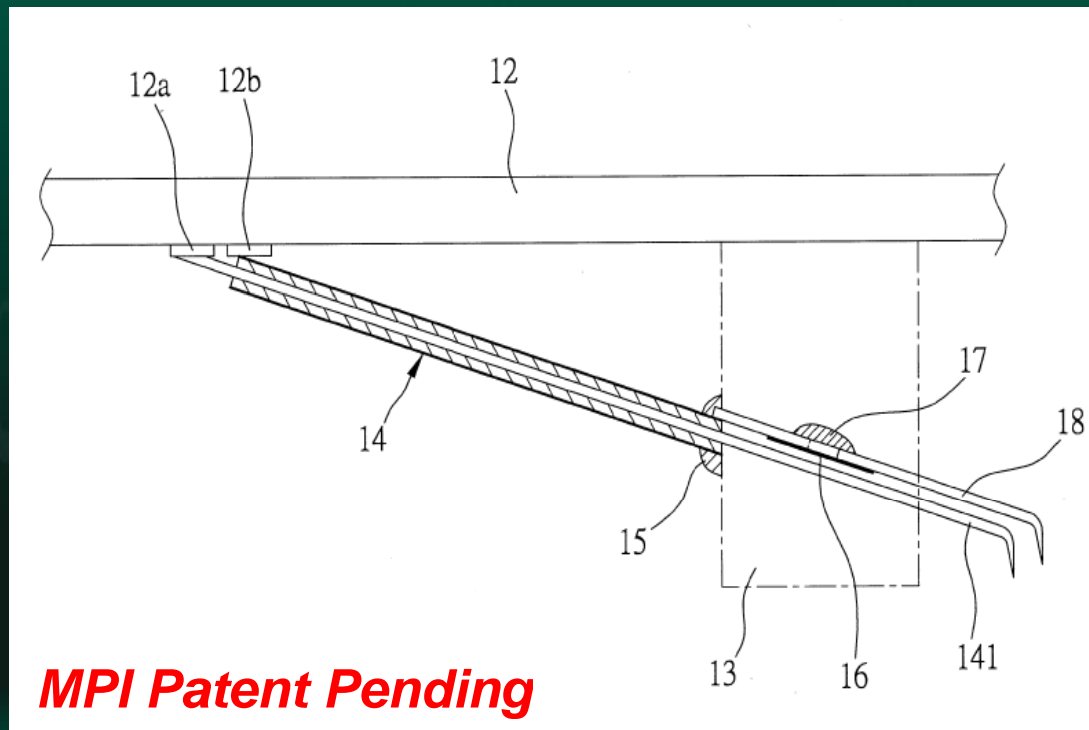
Modeling & Analysis

● Signal path compensation



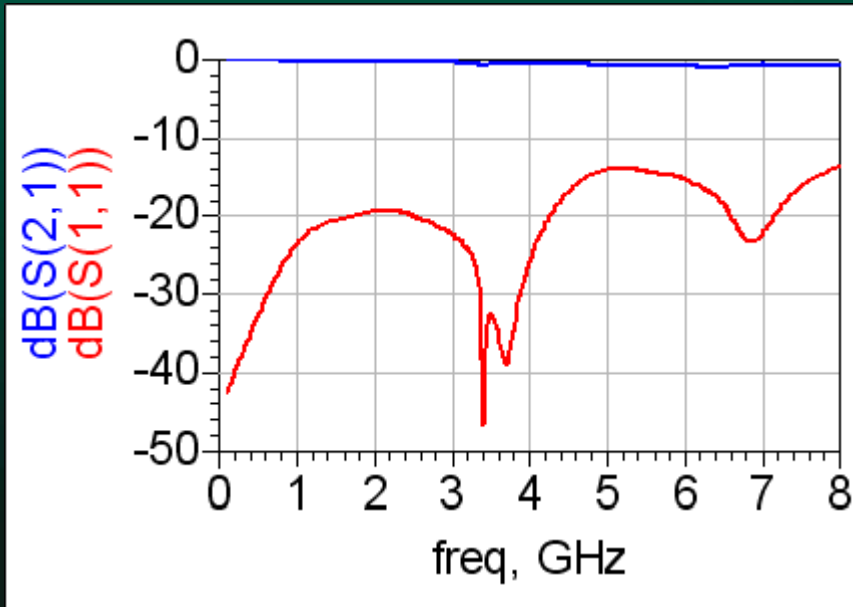
Modeling & Analysis

- Modeling – The impedance compensated cantilever probe (U+)

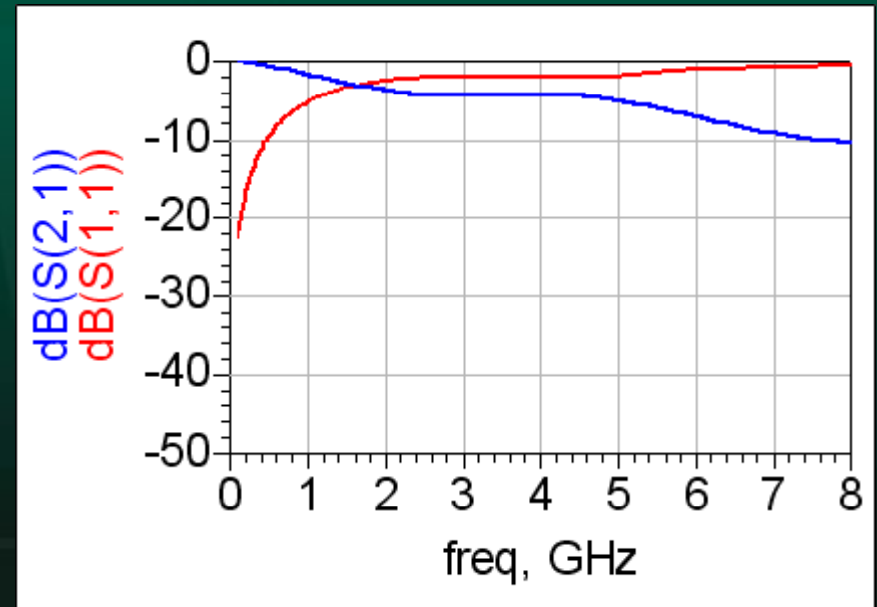


Modeling & Analysis

- Analysis – The frequency response of the cantilever probe



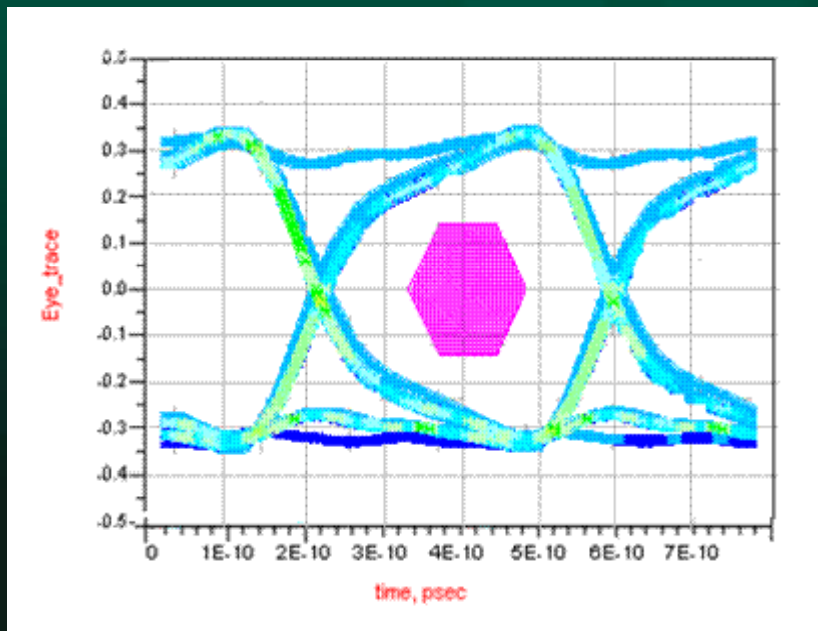
U+ probe



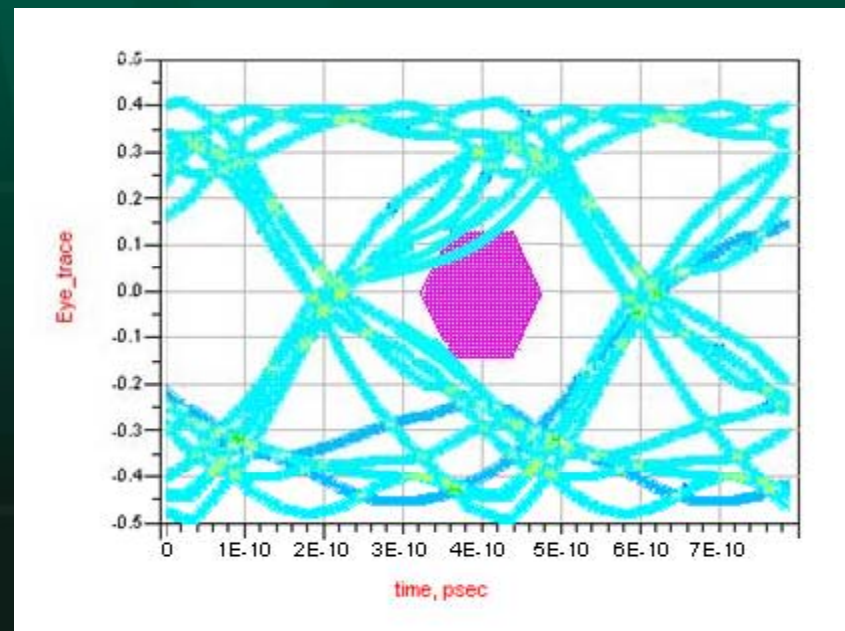
STD. probe

Modeling & Analysis

- Analysis – The eye pattern of the cantilever probe. (Data Rate 2.5Gbps)



U+ probe



STD. probe

Experiment Validation

● Experiment set up

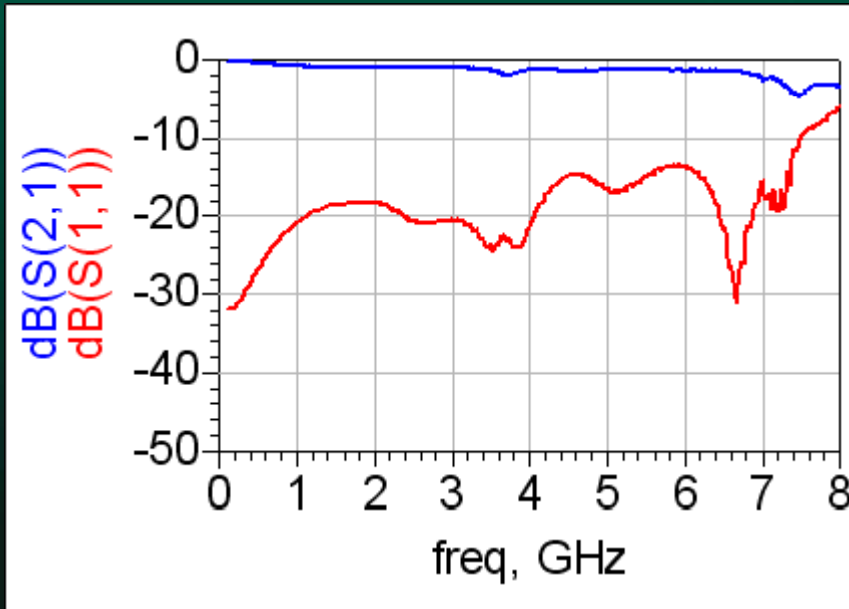


Advanced cantilever probe card

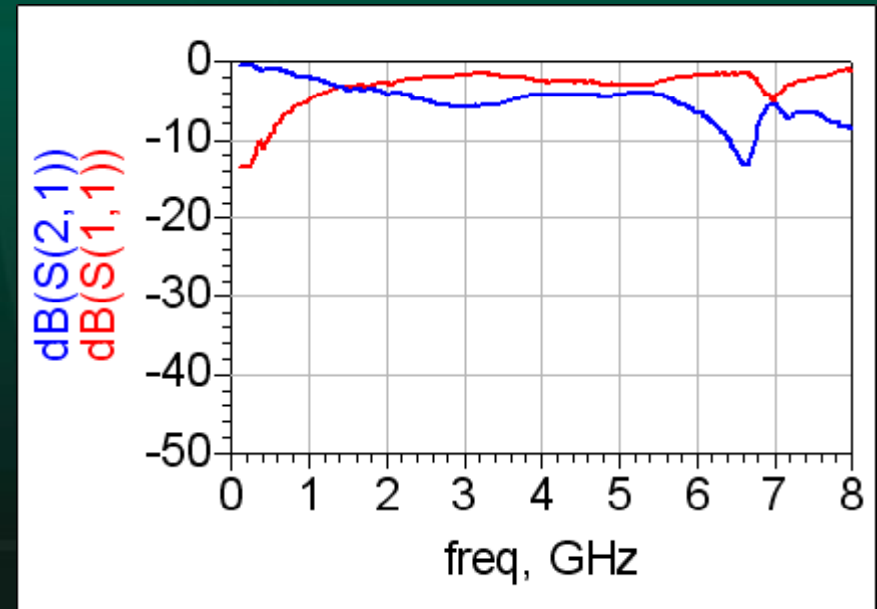


Experiment Validation

- Frequency domain response result
 - HF response



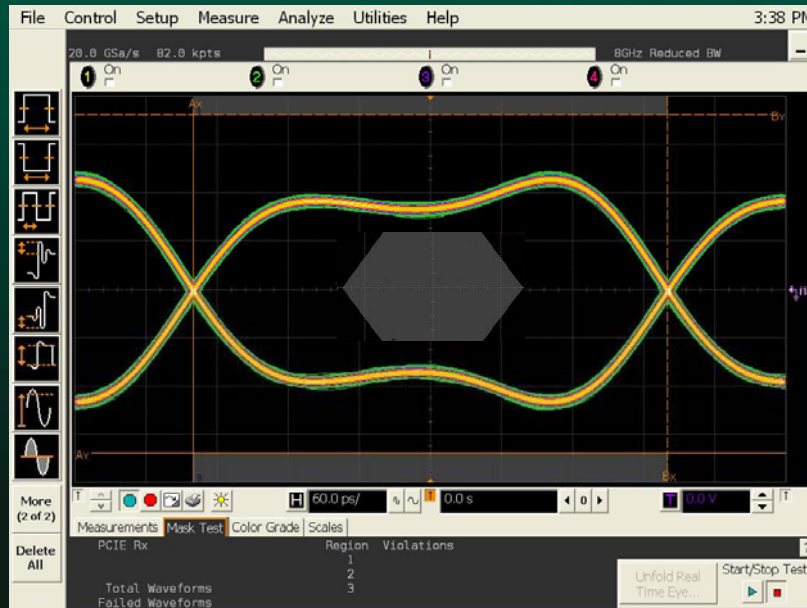
U+ probe



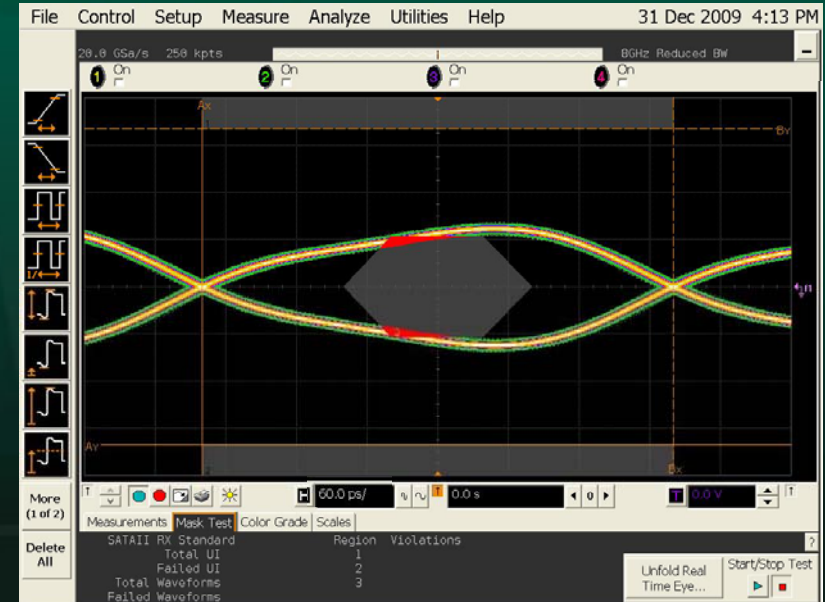
STD. probe

Experiment Validation

- Time domain response result
 - Eye pattern (Data Rate 2.5Gbps)



U+ probe



STD. probe



● Time domain response result

- TDR Impedance



Customer Verification

● High speed data rate testing

```
*** term enable ***
*** TEST6 L ***
*** scramble 5 dummy,10mS I ***
freq=2.500Gbps, tcom=1.200, swing=0.2000V
period=0.400nS
***** tset *****
VCC 3.800 | .....PPPP....
VCC 3.700 | .....PPPPP....
VCC 3.600 | .....PPPPP....
VCC 3.500 | .....PPPPP....
VCC 3.400 | .....PPPPP....
VCC 3.300 | .....PPPPP....
VCC 3.200 | .....PP.PP....
VCC 3.100 | .....PP.PP....
-----
!.....!.....!.....!.....!.....!.....!.....!.....!.....!
0      200    400    600    800   1000 pS
Saving now...
PASS BIN:1 CAT:0
Stopped by sequential count.
test result data
```

Interface: PPML
Data Rate: 2.5 Gbps
Application: Large Panel



Summary & Conclusion

- The probe is the main factor to decrease the frequency bandwidth performance of the cantilever probe card.
- The impedance compensated cantilever probe (U+) has successfully been developed and validated the superior SI performance of the probe card. (Patent pending)
- U+ probe cards have been verified of customer's high speed device testing.



Application & Specification

- High Data Rate: > 2.5Gbps
- Inductance: <5 nH
- Fine pitch: < 30 μm
- Real application of U+ probe card on 2.5Gbps high speed LCD driver IC testing.



Follow-On Work

- Higher speed device testing probe card for HS application devices.
- Released to mass production.



Acknowledgement

Special thanks to:

- **Raydium Application and Product Solution Team**
- **MPI Probe Card Center Engineering Team**



Q & A

Thank You For Your Attention !

