



**PHISON**  
Knows What You Need

# MIPI M-PHY Gear 4 IP

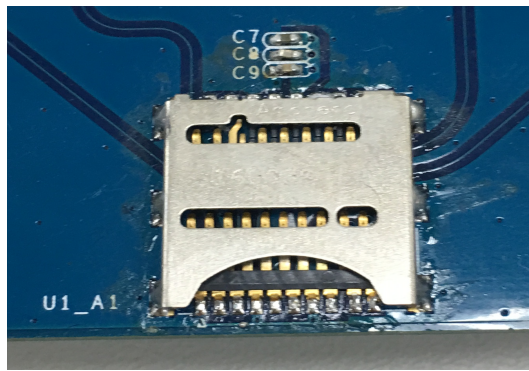
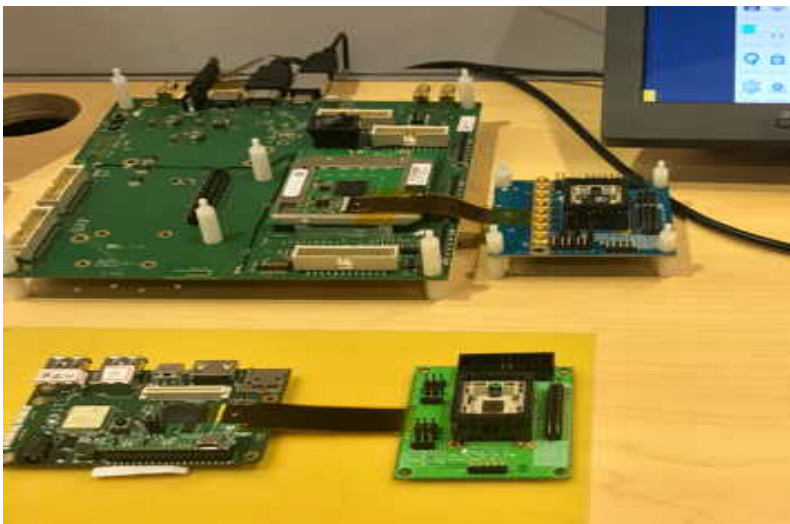
## Introduction & Challenges

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Phison Electronics Corp

# M-PHY Gear 4 Test Challenges

## Very hard to debug interoperability issues at this moment

- No Gear 4 protocol analyzer available (schedule available at end of 2017)
- Hard to measure or probe 12Gbps signal quality in embedded or even a UFS card connector
- Tx/Rx Instruments cost are very high
- Signal quality uncertain after CTLE+DFE equalizer circuit
- Due to these issues, need to try and error when system is not working. Schedule impact



Not Easy



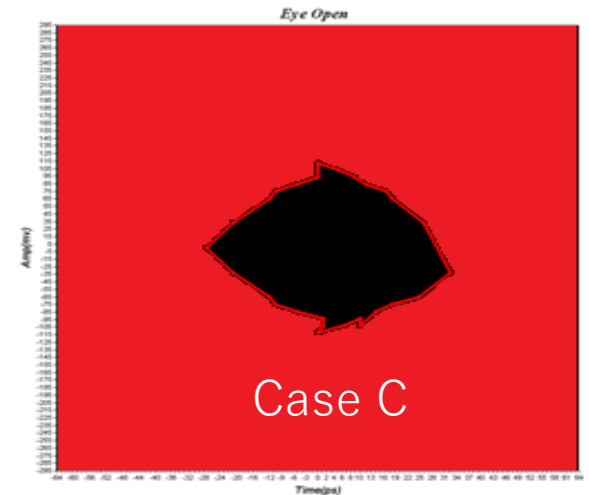
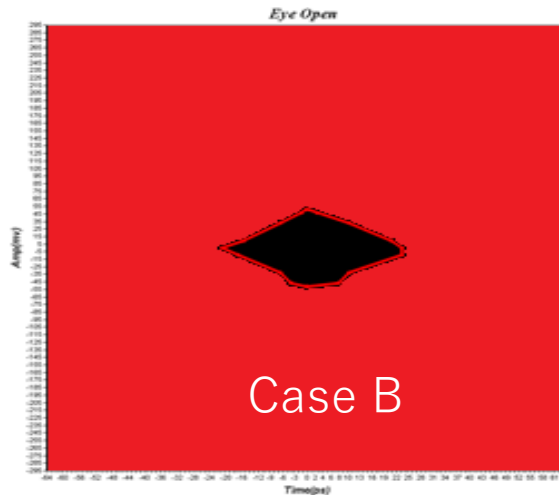
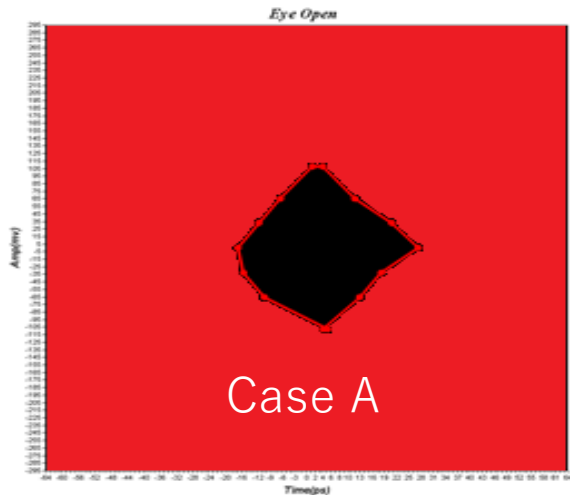
# In Order to Understand Receiver Quality - 1

## Solution 1: **Eye Open**

Pro: 1) Know if Rx sees data stable window

2) Easier to implement circuit

Con: No idea about signal quality information



# In Order to Understand Receiver Quality - 2

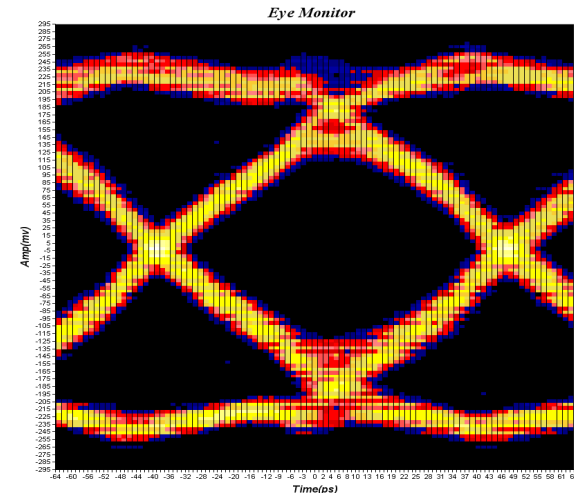
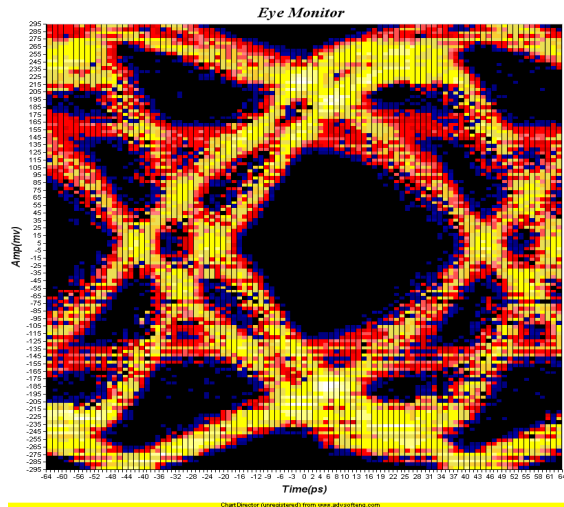
## Solution 2: **Eye Monitor ON THE FLY**

Pro: 1) Detailed information about signal quality available

2) Is there reflection? Too much loss or too much compensation

3) User can provide eye monitor for debugging

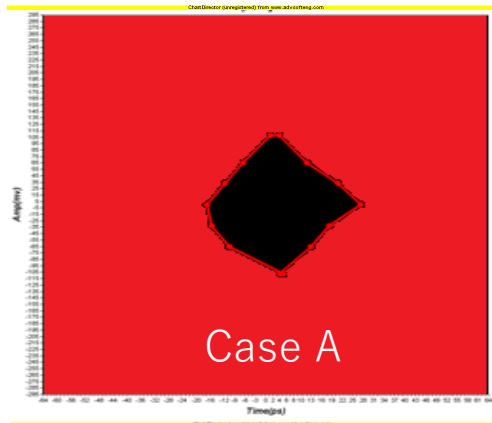
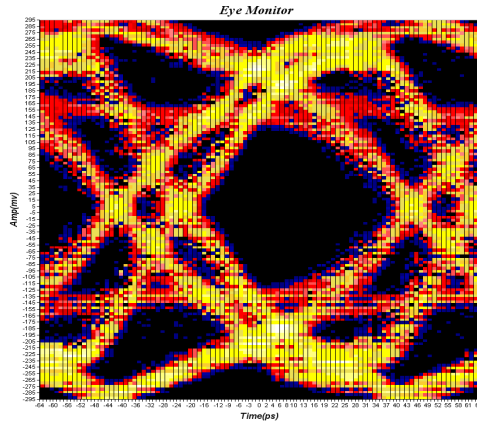
Con: More complicated circuit design



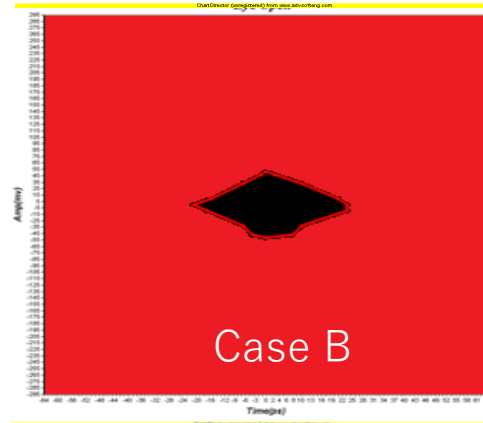
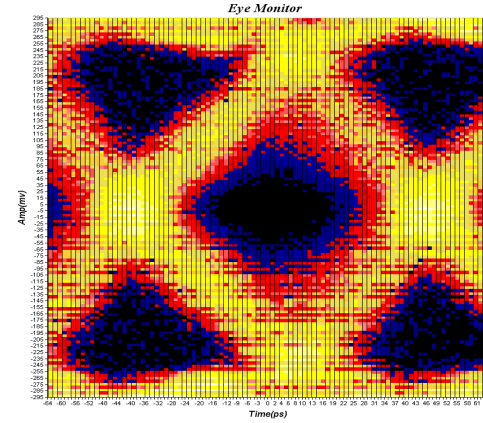
Guess Case A or B?

# Eye Open vs Eye Monitor

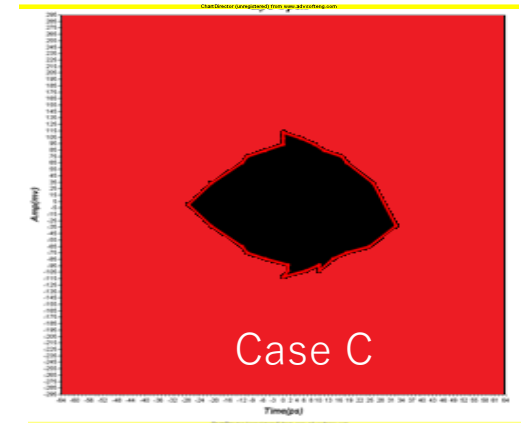
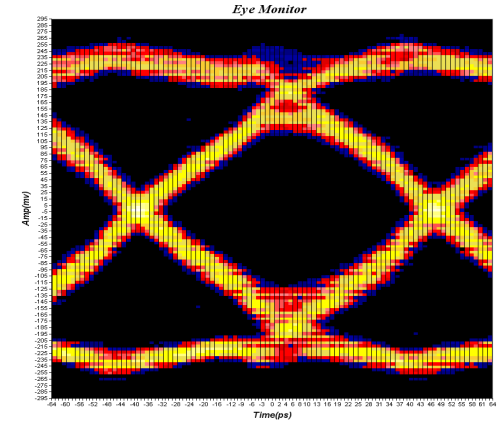
Too Much Compensation



Need More Compensation

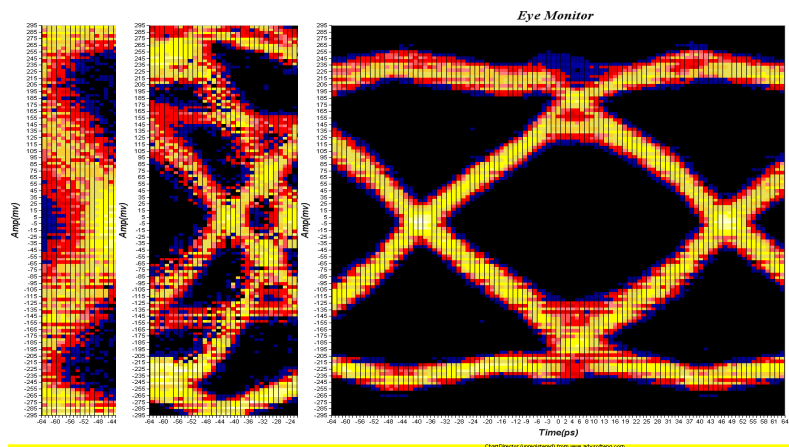


Nice One!



# And More.... Getting Best Cal Setting in Embedded System

With Eye Monitor function + post processing algorithms, each chip is able to select the best eye monitor result in the specific embedded system as its default parameter



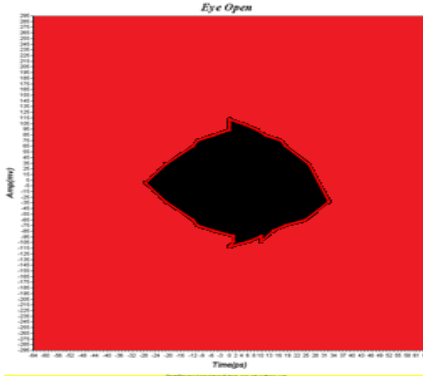
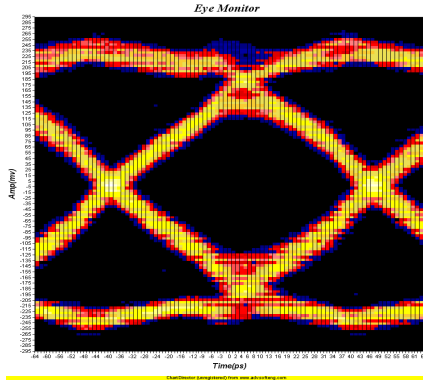
# Eye Open vs Monitor Comparison Table

## Operation Timing

- Take fewer seconds for the detailed eye
- Adjustable scan timing setting

## Signal Quality Info

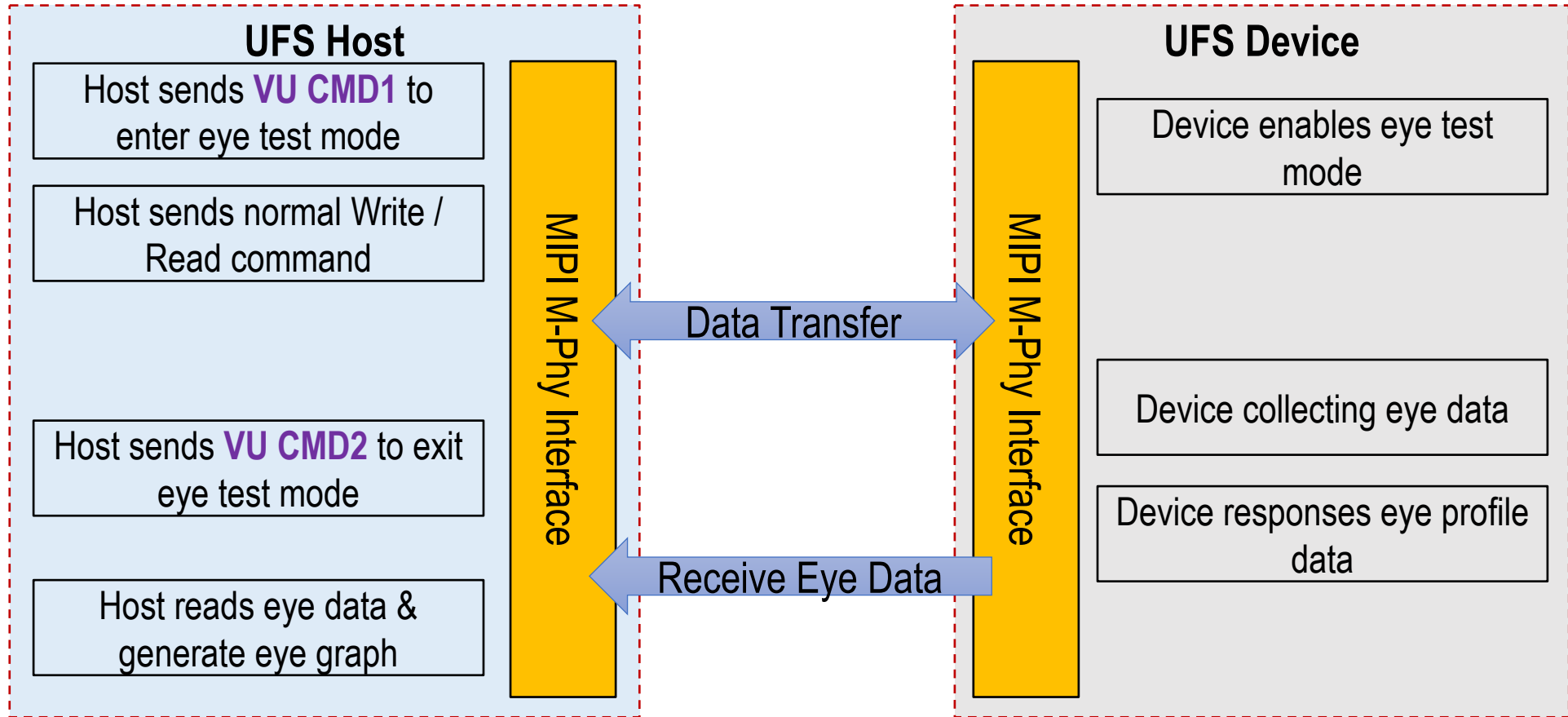
- Great signal quality information
- Good for debugging



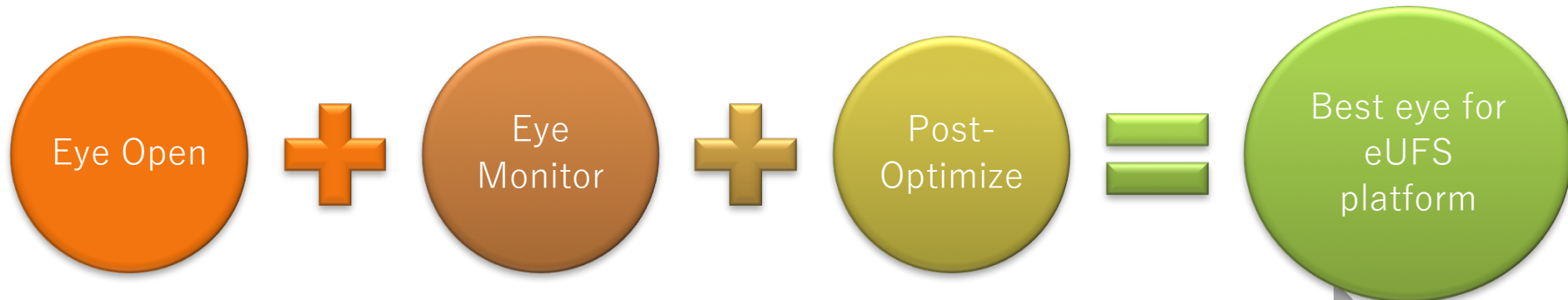
- Fast
- Possible done within Gear 4 ADAPT package (EQ tuning)

- See data stable window only

# How Eye Open/Monitor Works for UFS Debugging



# Best Eye Result for Embedded UFS Platform



## Eye Open

- Fast operating timing
- Apply during ADAPT

## Eye Monitor

- Good signal quality information
- Extract best setting during eUFS shipping

## Post-optimization processing

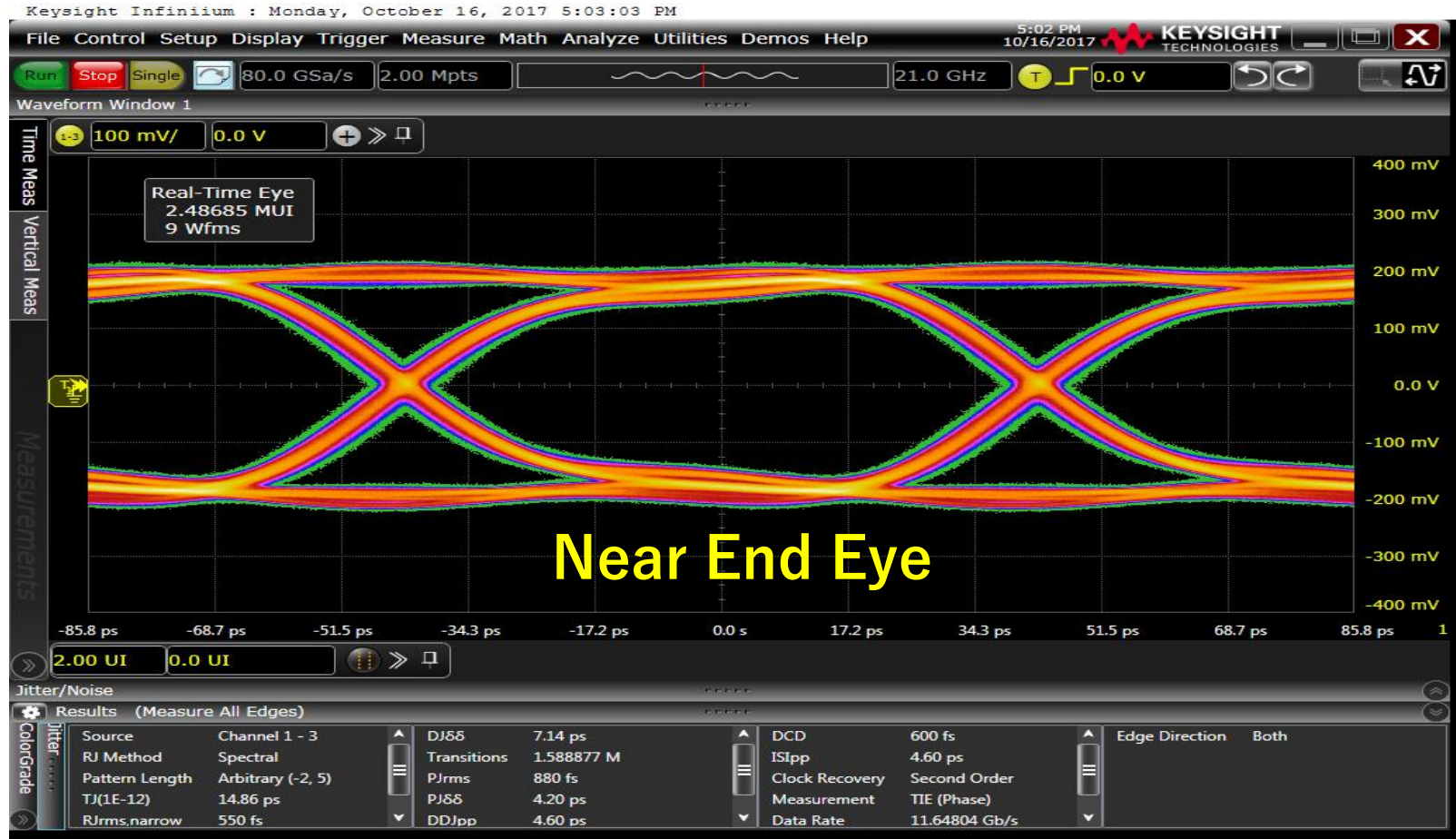
- Select the best eye monitor result in specific embedded system

Best Interoperability

# Phison Gear 4 Performance

- ✓ Power consumption : < 5mW /Lane/Gbps (28nm)
- ✓ Support HS-MODE Gear4(A/B) with data rate up to 11.6 Gbps and backward compatible
- ✓ Support for 2-lane M-TX and 2-lane M-RX
- ✓ Supports LS-MODE PWM-G1 to PWM-G4 with data rate up to 72 Mbps
- ✓ Supports Type-I MODULE state machine for HS and LS mode
- ✓ RMMI M-RX/TX-DATA interface 40 bit for protocol layer data interface

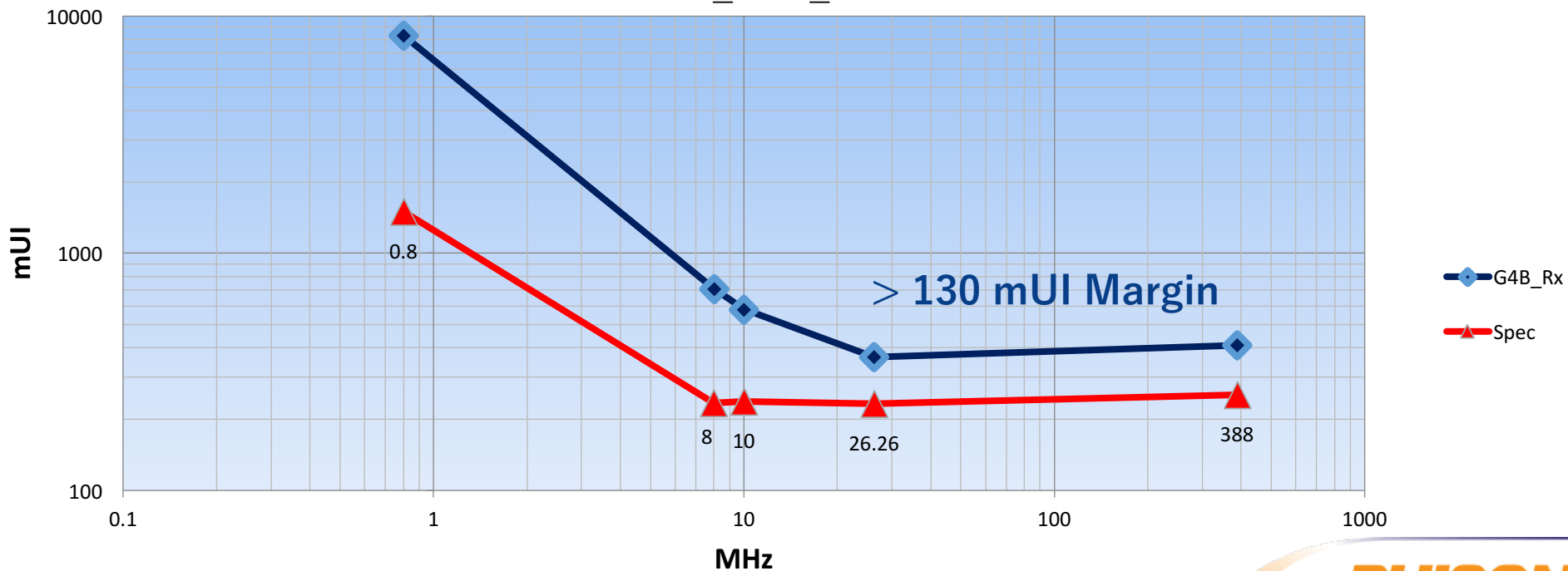
# G4B Tx Eye Results



# G4B 11.648Gbps Rx Compliance Margin Results



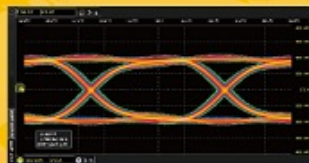
MPHY\_2.45\_Beta18





## PS8313 UFS Storage

- eUFS 2.1, Gear 3, 2 Lanes
- 256GB 3D Nand Flash/LDPC
- Max. R 920MB/s; W 550MB/s



## M-PHY Gear4 IP

- Compliant with M-PHY 4.1
- Receiver Eye open feature (Test Mode)
- 11.6 Gbps, 2 Lanes



## UFS Host Board

- USB 3.0 Device
- Support UFS 2.1 Gear3, 2 Lanes
- Built-in Data Pattern Generator

## NAND Flash-based IC Design

Over 15 years of NAND Flash Controller Experience

- ▶ 1100+ flash related Patents, Internal Phy, ASIC, and Advanced NAND Handling Technologies

## System Integration

Broad Application Expertise

- ▶ from Embedded, Enterprise to PC & Mobile
- ▶ from PATA, SATA, NVMe PCIe, USB, SD, eMMC to UFS

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