The DDR Detective®

FuturePlus Systems

Power Tools for Bus Analysis

**DDR Protocol, Compliance, Performance, Trace and System Characterization all in one tool!**

Key Features

➤ Supports **DDR3**, **DDR4**, **LPDDR3** and soon **LPDDR4**!

➤ Thousands of counters for DDR4 count performance metrics real time *all the time*

➤ Analyzes bus speeds up to 2667 MT/s

➤ 8GB Internal memory can store up to 512M Captured States!

➤ Real time analysis, not only post-processing

➤ Eye Detector guarantees valid data acquisition

➤ Protocol Violation Detector executes hundreds of simultaneous real time tests

➤ **Row Hammer Detection** captures those unexplained DDR3 memory failures!

➤ Interactions among up to 8 ranks, over two slots are analyzed.

➤ Mode register capture is supported on up to 8 ranks, in 1 or 2 slots.

➤ Performance Counters, Reads, Writes, total Clocks, by rank, also power management information

➤ Supports Auto-Clock rate detect and clock stoppage for LPDDR3 and DDR4

➤ Connects to the target under test with DIMM, SO-DIMM, and BGA interposers or a midbus probe

➤ Integrated MicroSoft Charts gives quick insight into large trace captures

FS2800
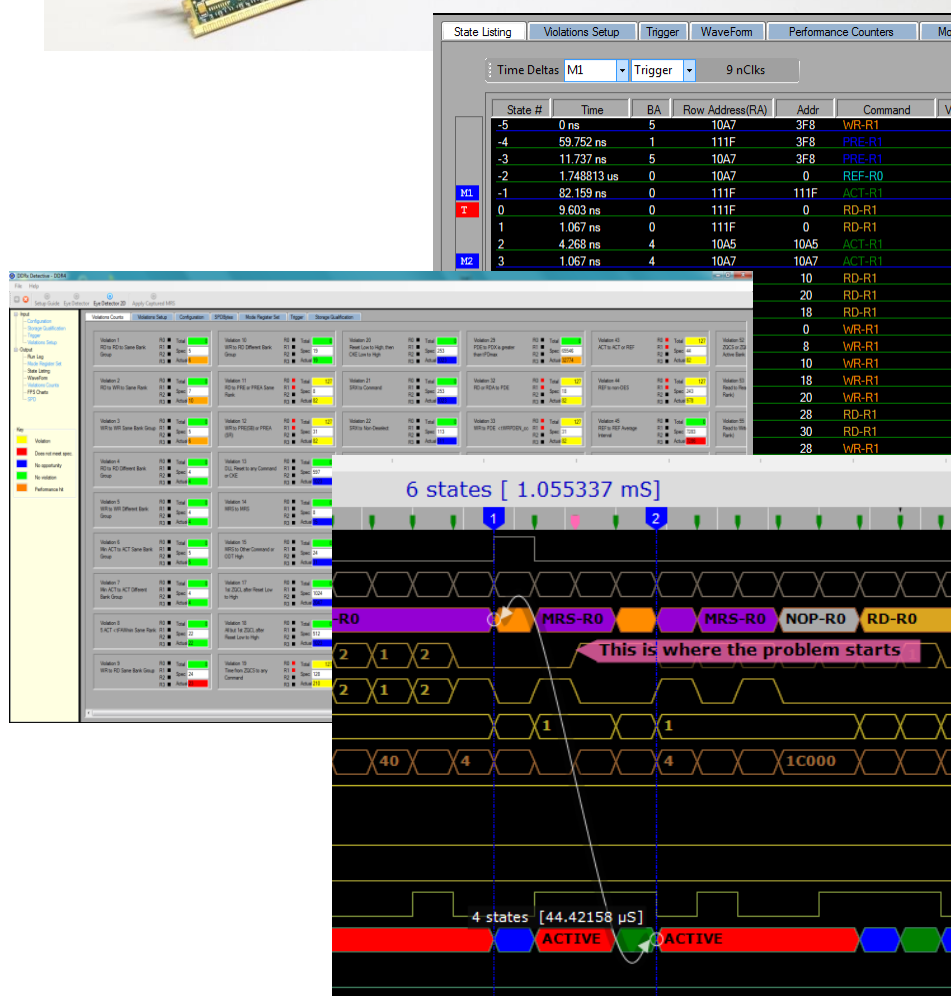
Up to 512M captured states!
**Hardware Filtering (storage qualification) gives 70% more!**
State Listing and State Waveform

Helping you Design Tomorrow's Computers, Today

FuturePlus Systems is the technology leader in protocol analysis tools for the computer design industry. Our protocol, performance and power management analyzers combined with our Interposers and software help you monitor and verify complex activities on your advanced-technology computer bus design. FuturePlus Systems offerings include bus-analysis solutions for most popular computer buses. Visit www.futureplus.com for more information.
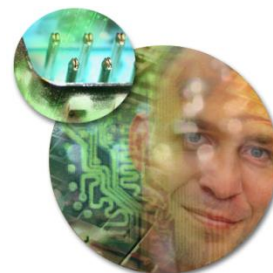
DDR4 Performance event
reporting in real time *all the time uploaded every second for as long as you have disk space!*
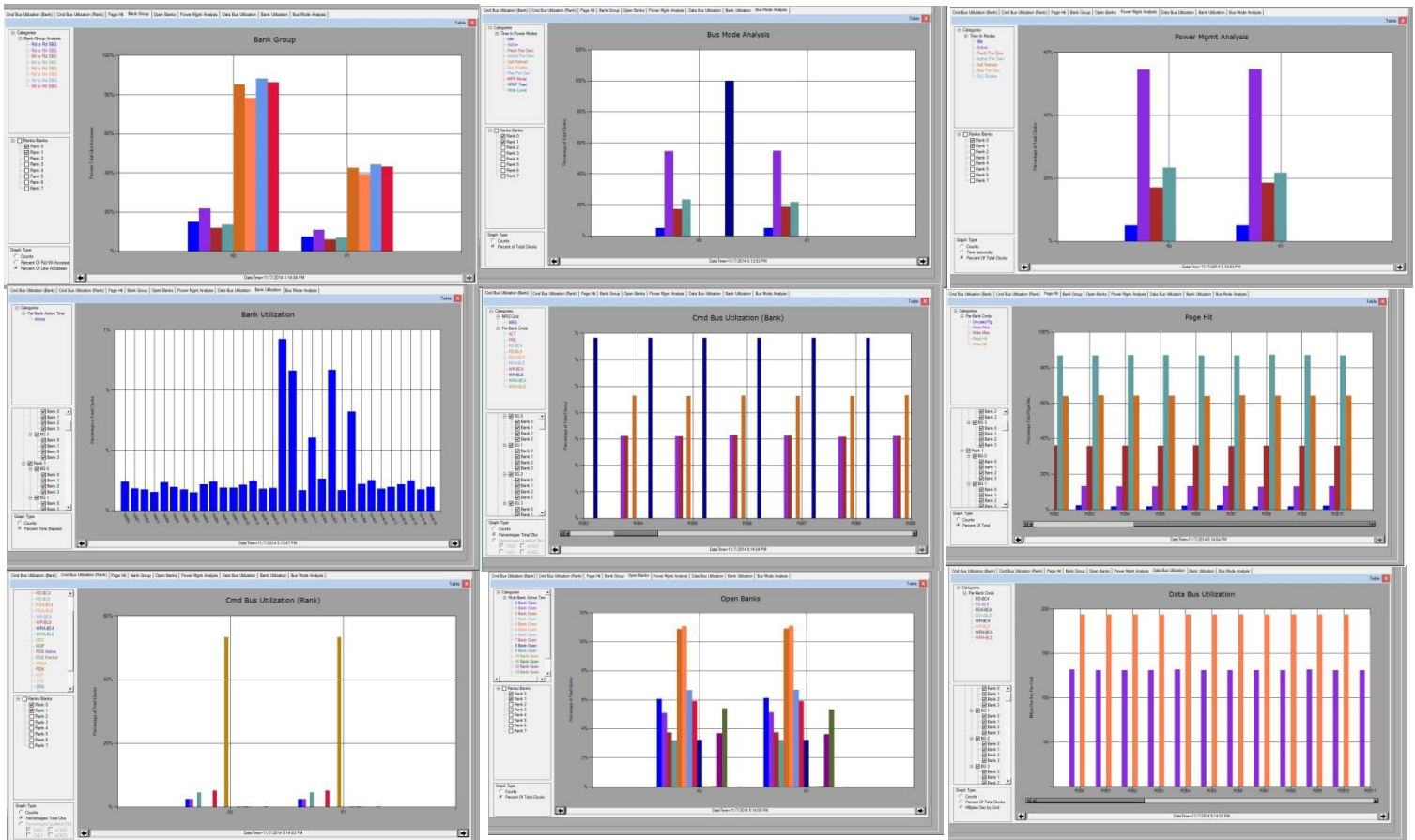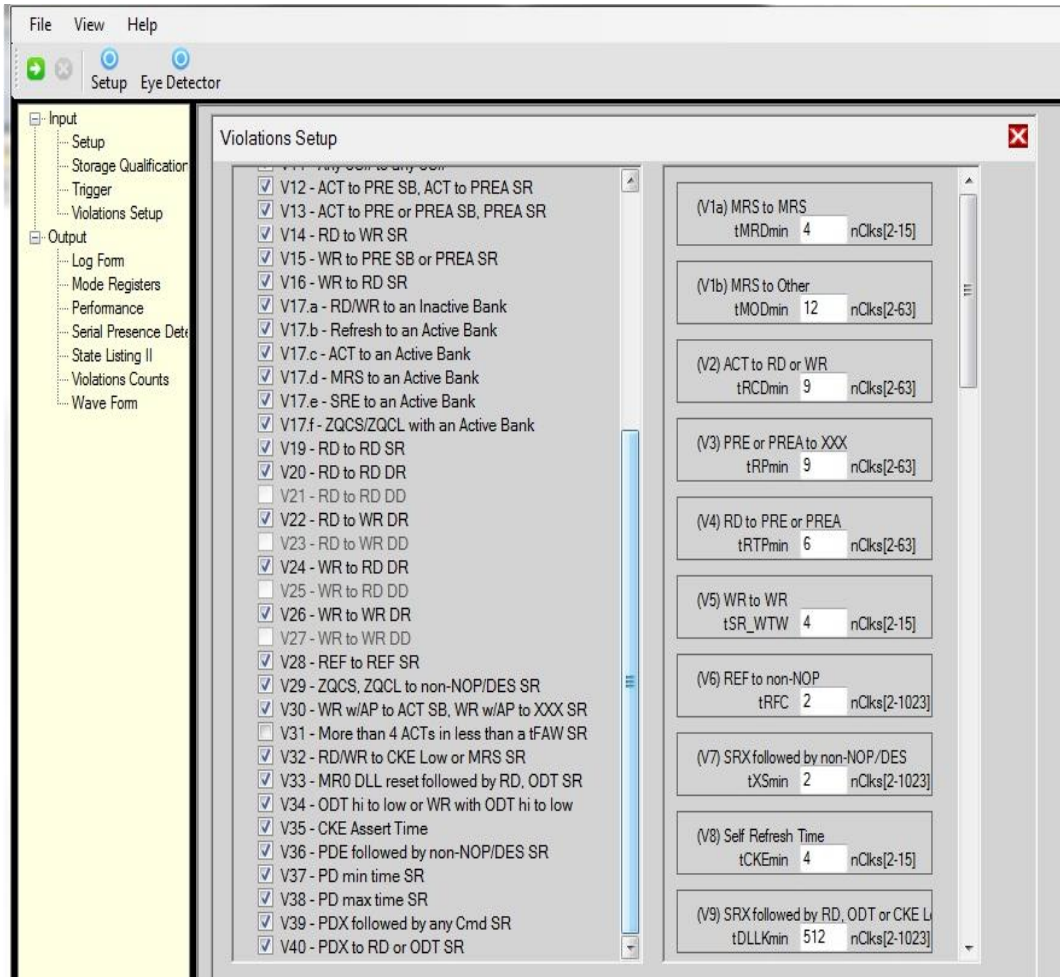

New DDR4 Performance features

- ➢ **Bus Command Utilization Analysis**
- ➢ **Page Hit Analysis**
- ➢ **Bank Group Analysis**
- ➢ **Power Management Analysis**
- ➢ **Multiple Open Bank Analysis**
- ➢ **Bank Utilization Analysis**
- ➢ **Data bus Utilization Analysis**
- ➢ **Bus Mode Analysis (**Reset, Idle, Active, Precharge PD, Active PD,Max PD,SRX, DLL Dis, Write Leveling, MPR mode and Vref Training)
- ➢ **Summary/Drill down mode shows hours and even days of results in a single view**
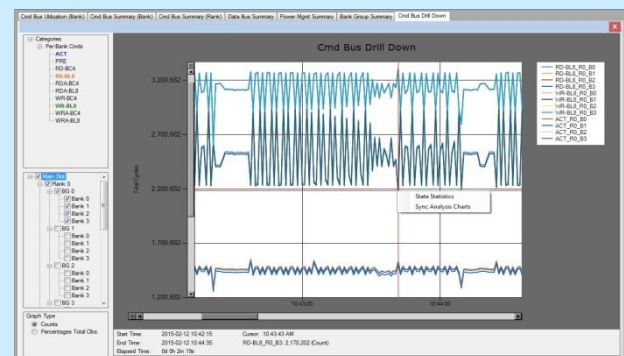
On every clock cycle! Real Time *All The Time* **Continuous** Analysis

What does this mean? Currently available products capture a miniscule amount of DDR traffic, count the events in the trace and then display. Deadtime between traces and trace depth give only a small sampling of actual DDR events. The DDR Detective use new breakthrough architecture to accumulate events on EVERY cycle! Thus no bus events are missed. This never been done before feature gives unprecedented insight into DDR bus activity for validation, system architects, software engineers and designers.

The DDR Detective® Protocol Compliance

Unique Scoreboard displays errors in real time using counters not post processed information

The DDR Detective® :

➢Covers 65 tests on all banks and ranks for over 1000 concurrent checks

➢Stored Log file lists test failure, day and time of day when the failure occurred

➢Scoreboard display gives quick indication of what test is failing and on what rank

➢8Gb of trace memory has advanced Charting feature

➢Auto configures the sampling window for acquisition of address, command and control for the DDR Detective and does not rely on latches that need stable clock/data relationship

Additional Protocol Probe Features:

➢Automatically calculates protocol parameters based on JEDEC specifications and loads into the protocol checking function.

➢Allows user to override and enter new parameter values

➢Ability to enable and disable each compliance test

➢Allows user to load the DDR Detective configuration or save parameters

➢Monitors and displays running totals of the test failures and performance counters once per second.

➢512M states with store qualification on any command and trigger on any DDR event

Margin Testing

- Measure your memory sub-systems latencies
- Characterize memory latency performance
- Learn what how much margin your system is operating at
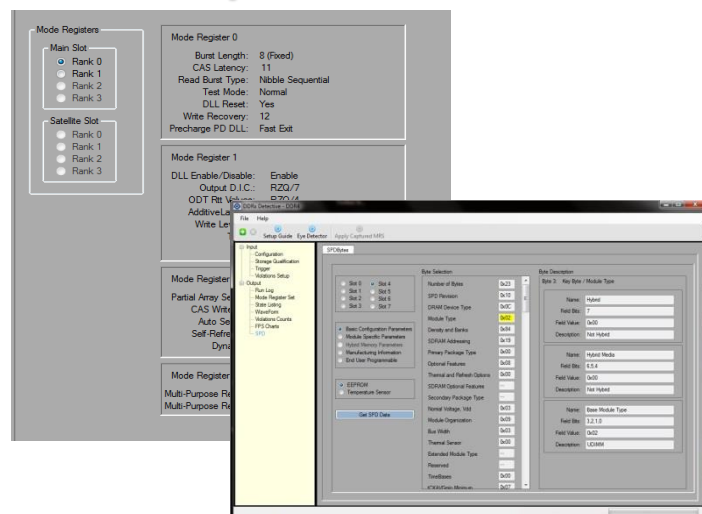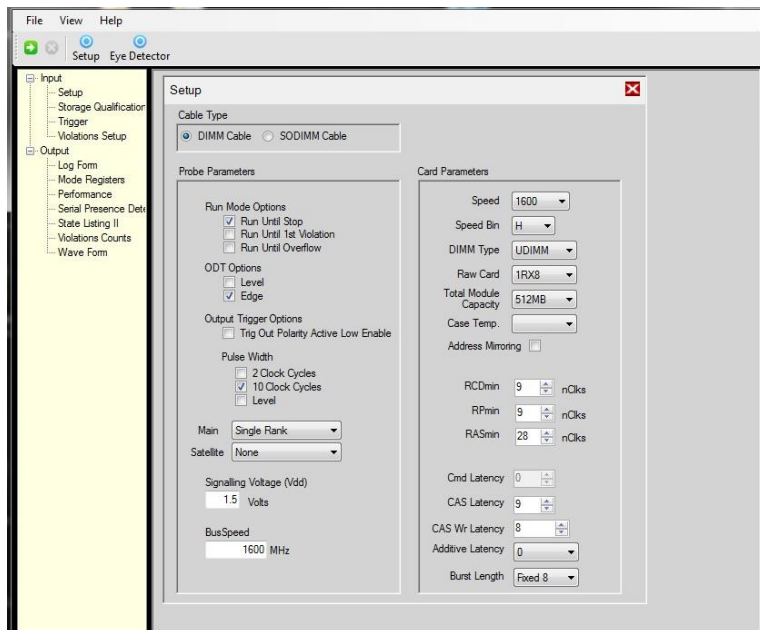- See if test coverage is complete
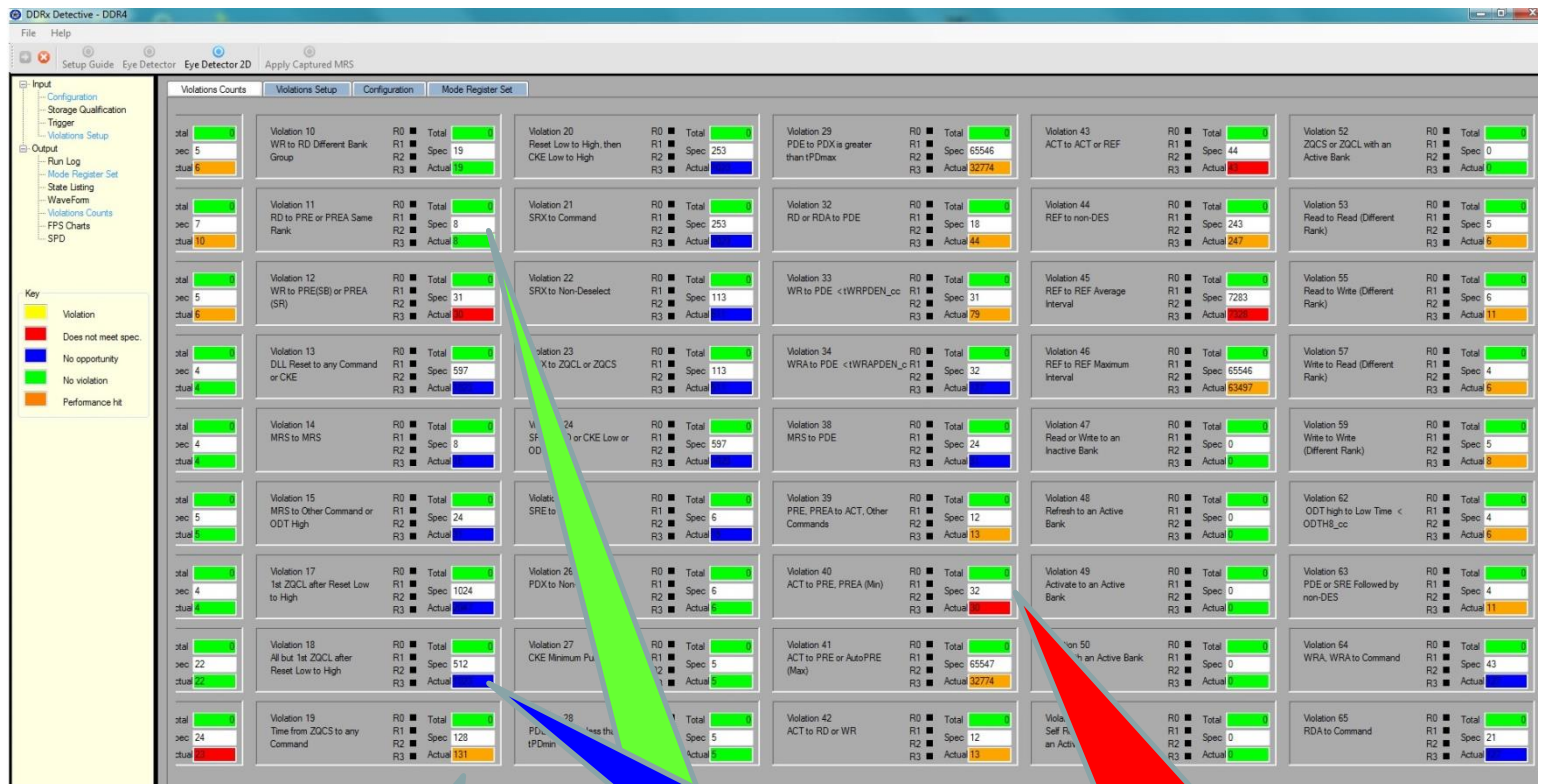
Performance Hit! Transactions could be closer together to increase bandwidth

Event not occuring so no margin can be measured

JEDEC Spec violation! Commands are too close together, risk data corruption

Perfect! Operating right at specification
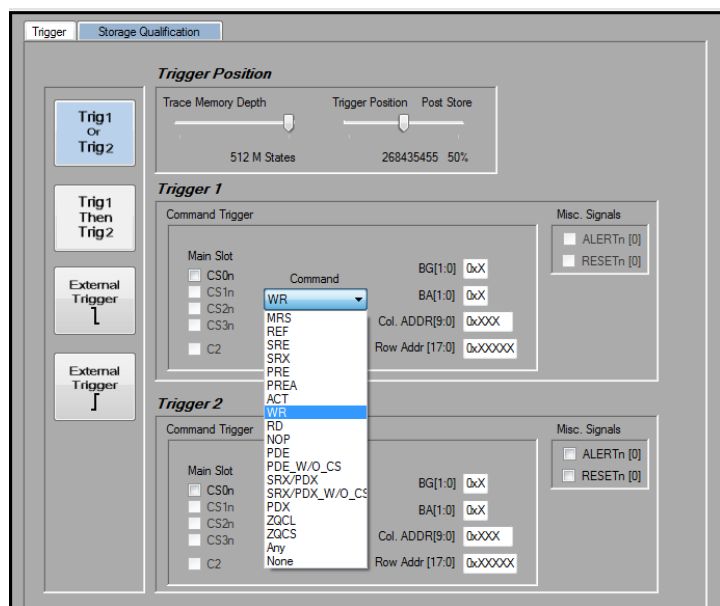
Automated Setup

- ➢ MRS Capture
- ➢ SPD Capture
- ➢ Eye Detector*

no interposer latches allows for use in marginal systems

Easy Triggering and Storage Qualification
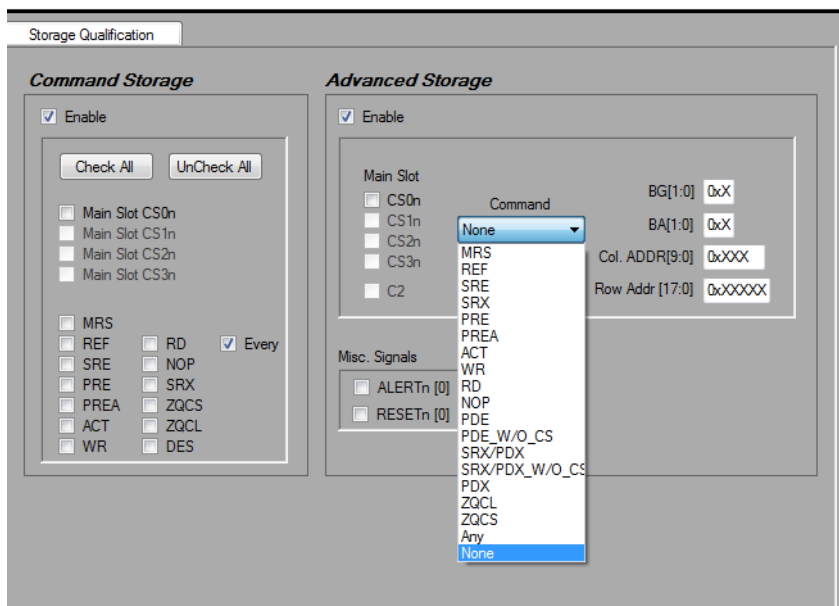
- ➢ Full address/command triggering in one step*
- ➢ Use any transaction with address as a store qualifier*
- ➢ Store only certain commands or just violations*
- ➢ Store only Accesses to a certain bank group/bank/rank*

* Features found only on the NEW DDR Detective

State Listing and Waveform
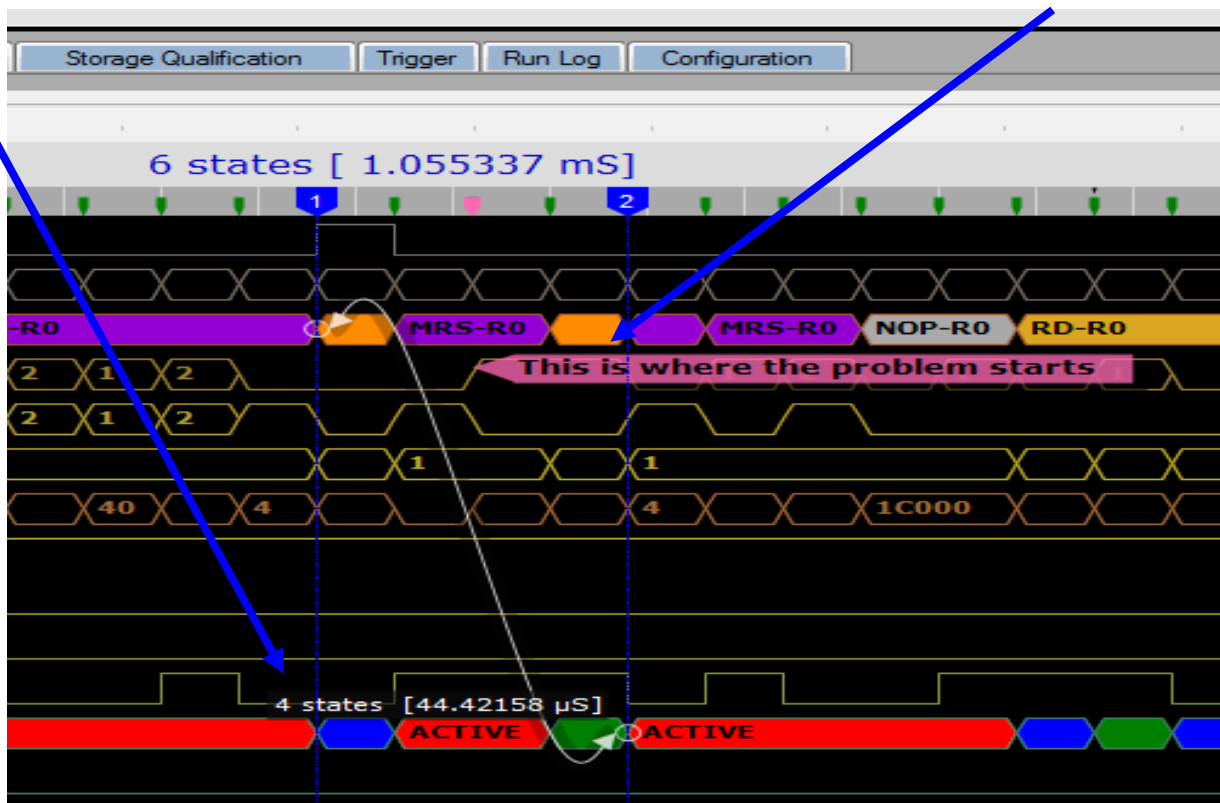
The **FS2800** displays 512M states with Time Stamps

Tool tracks Rank Power Status a metric only found in the FS2800!

HW store qualification stores only transactions of interest

Shows the violation on the exact state it occurs on.

Innovative State Waveform lets you add markings and notes to the waveform display
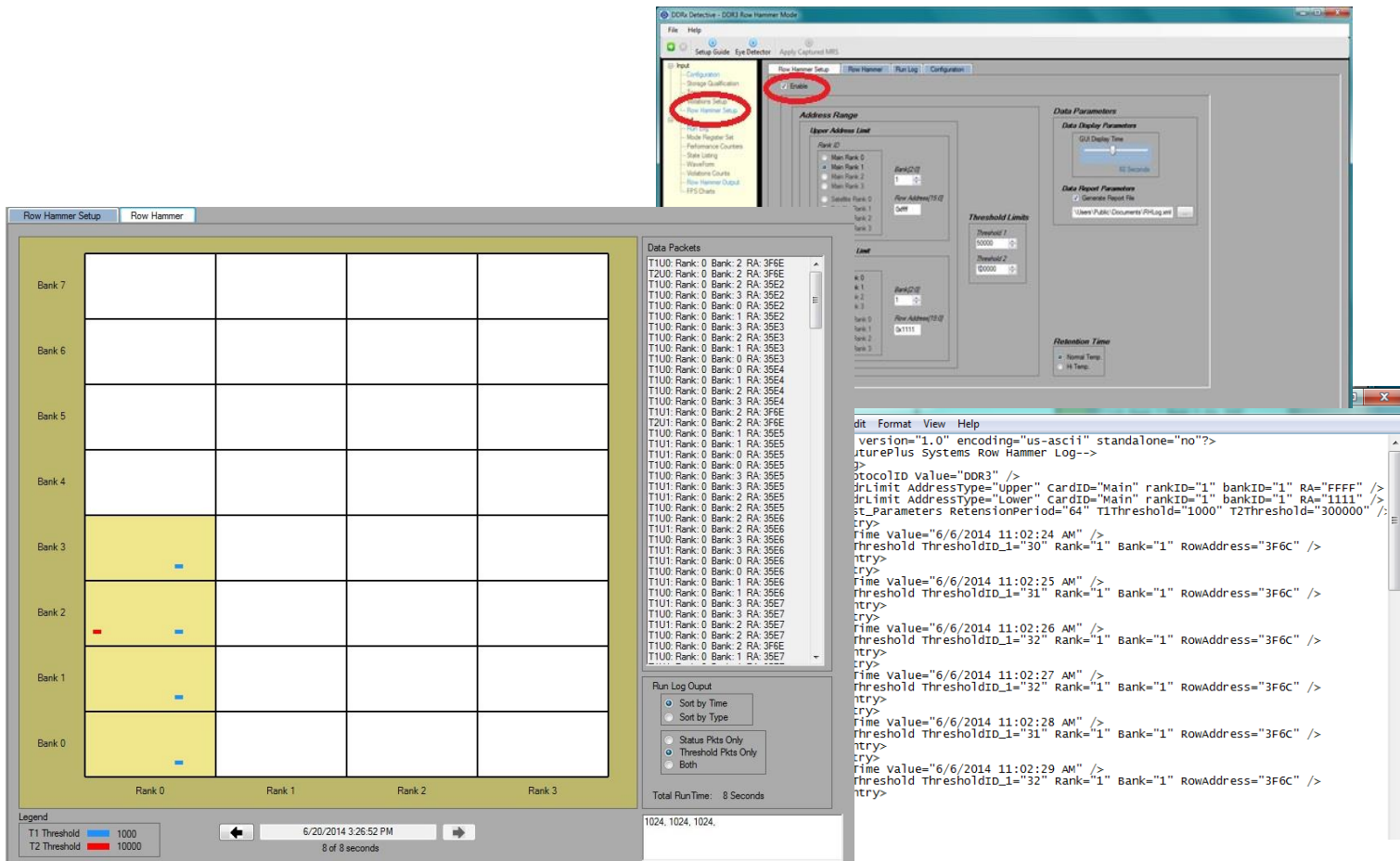
Row Hammer Detection

DDR3 memory is plagued by a known failure mechanism called Row Hammer. See an informative video here: Row Hammer explained. A white paper on the topic can be found here.

Row Hammer Detection feature for DDR3

➢ Tracks and counts every ACTIVATE command
➢ Indicates if thresholds are crossed
➢ Output displays rank and bank of rows that show excessive ACTIVATE commands
➢ Exact Row Address indicated
➢ Address Range feature makes Row Hammer Detection even more accurate!
➢ Helps find those unexplained memory errors!
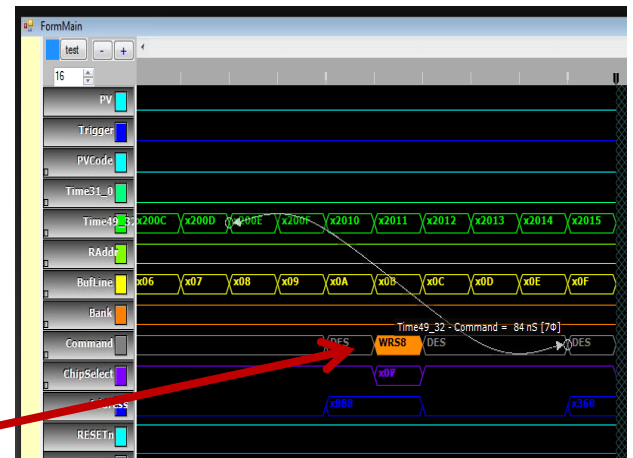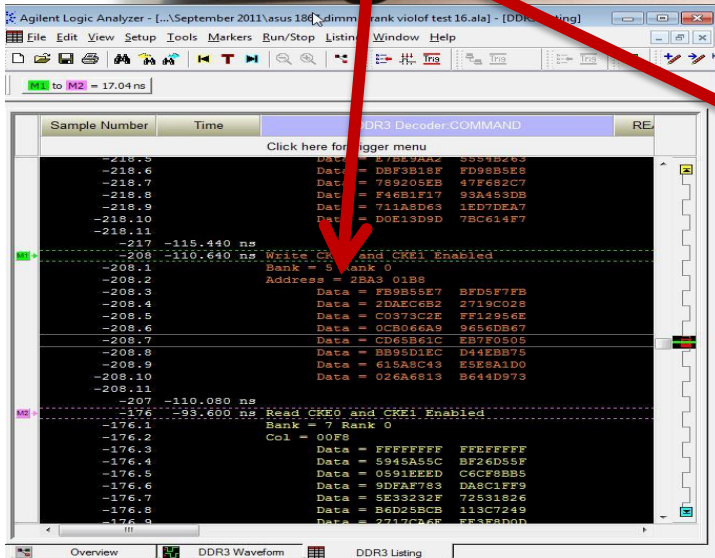➢ See a video of this tool in action
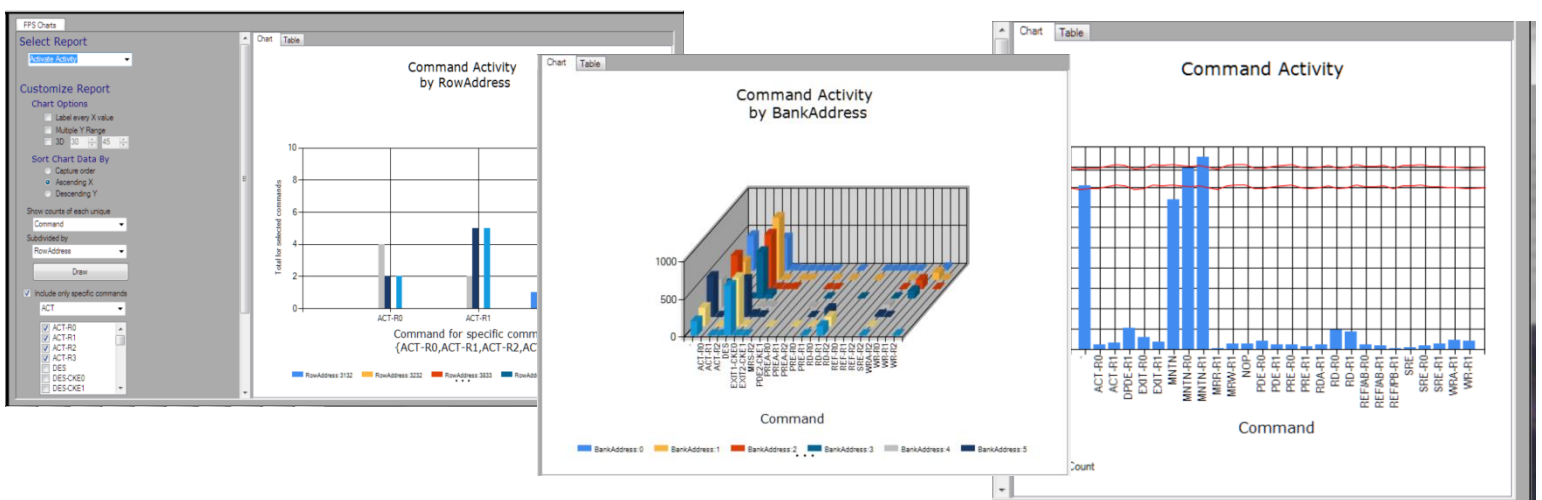
Trigger out to Logic Analyzer or scope

Find Problems Faster!

Charting feature quickly sorts stored data

Functional Diagram

The satellite interposer brings second slot signals to the Protocol Probe logic: CKE 1:0, S 3:0, ODT 1:0, CK0/CK0B, CK1/CK1B

Satellite probe slot specific signals

Logic Analyzer or Oscilloscope (Optional Connection)

Main probe A/C/C signals
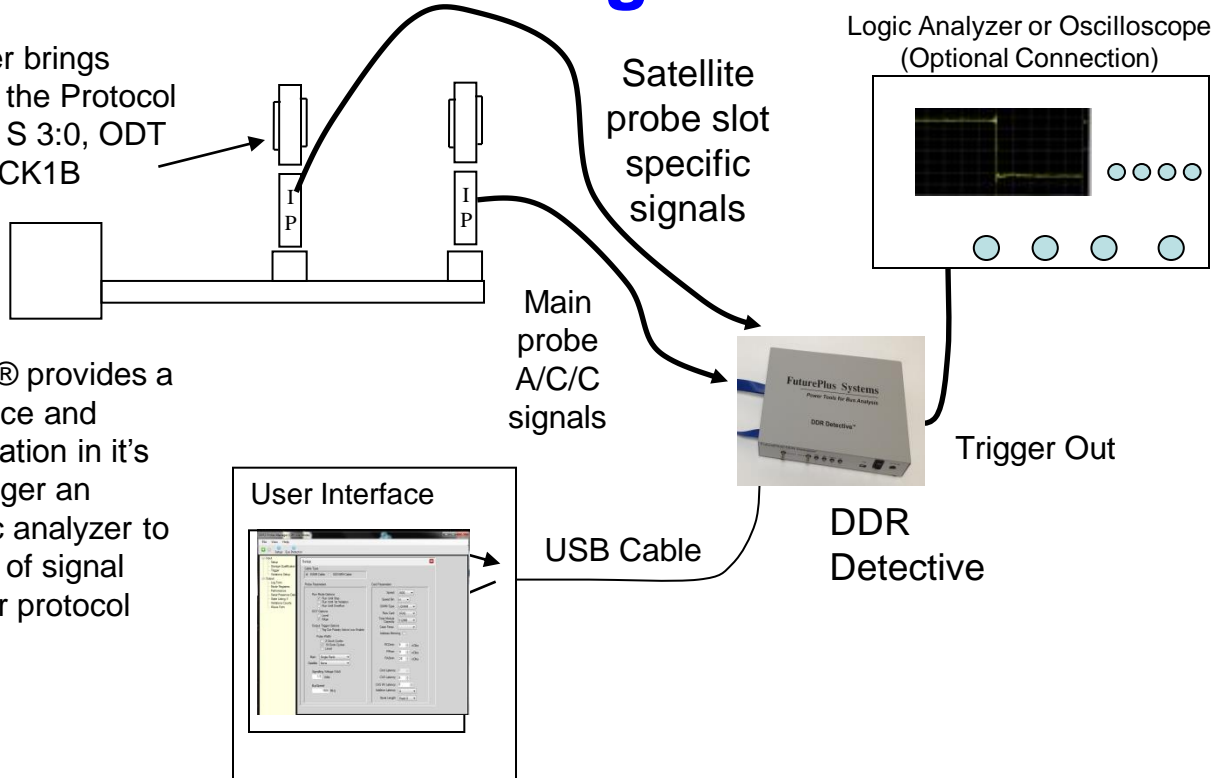
The DDR Detective® provides a rich set of Compliance and Performance information in it's display, and can trigger an oscilloscope or logic analyzer to give a detailed view of signal integrity problems or protocol errors.

User Interface

USB Cable

FuturePlus Systems
Power Tools for Bus Analysis
DDR Detective™

Trigger Out

DDR Detective

Connecting to the Target

- DIMM and SODIMM Interposers
- BGA Interposers
- MidBus Footprint
- DIMM and SODIMM interposers that also connect to the Logic Analyzer for full DQ/DQS trace
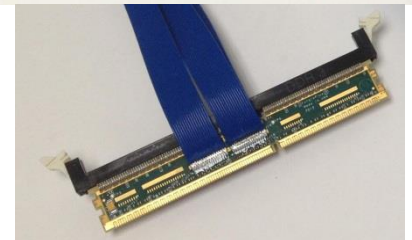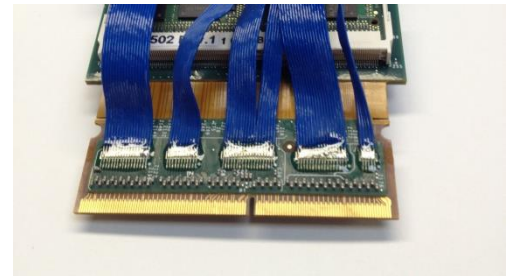
Ordering Information

FS2800   **DDR3/DDR4 Trace DDR Detective**
FS2821   **Add FS2801 LPDDR3 functionality to the FS2800**

FS2820   **Add DDR4 Violation Detection to DDR Detective**
FS2850   **Add DDR4 Performance Counters to DDR Detective**

FS2801   **LPDDR3 DDR Detective**
FS2851   **ADD FS2800 DDR3/DDR4 Trace to the FS2801**

Probing Options

FS2363   **Add DDR3 DIMM A/C/C Interposer for DDR Detective**
FS2424   **Add DDR3 SO-DIMM A/C/C Interposer for DDR Detective**
FS2367   **Add DDR3 DIMM Satellite* Interposer for DDR Detective**
FS2422   **Add DDR3 SO-DIMM Satellite* Interposer for DDR Detective**

FS2823   **Add DDR4 DIMM A/C/C Interposer for DDR Detective**
FS2824   **Add DDR4 SO-DIMM A/C/C Interposer for DDR Detective**
FS2853   **Add DDR4 DIMM Satellite* Interposer for DDR Detective**
FS2854   **Add DDR4 SO-DIMM Satellite* Interposer for DDR Detective**

FS2826   **Add DDR Midbus A/C/C Connection for DDR Detective**

FS2425   **DDR3 BGA Cable Adapter and SW upgrade to support BGA**
FS2852   **DDR4 BGA Cable Adapter and SW upgrade to support BGA**

Probing Options that include Logic Analyzer connections

FS2362   **DDR3 2400 DIMM Interposer A/C/C/DQ for the FS280x/U4154A**
FS2436   **DDR3 SO-DIMM Interposer A/C/C/DQ for the FS280x and LA**
FS2835   **DDR4 DIMM Interposer A/C/C/DQ for the FS280x/U4154A**
FS2836   **DDR4 SO-DIMM Interposer A/C/C/DQ for the FS280x/U4154A**

* Satellite gives Slot 2 Probing for same channel

See http://www.futureplus.com/products for detailed requirements.

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KEYSIGHT
TECHNOLOGIES

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