



SD Quality and Host Interoperability – The Varieties of SD Ecosystem

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About Allion

As a leading authority in IT product validation and standards compliance, Allion provides world-class test services and consulting engineering solutions.

**Founded in
1991**



10,000+
**Pieces of Test Equipment
and Devices**



700+
Qualified Engineers



20+ **Years of Product
Test Experience**

30+
**Logo Standard
Certification Programs**



**ISO/IEC
17025
Accredited**

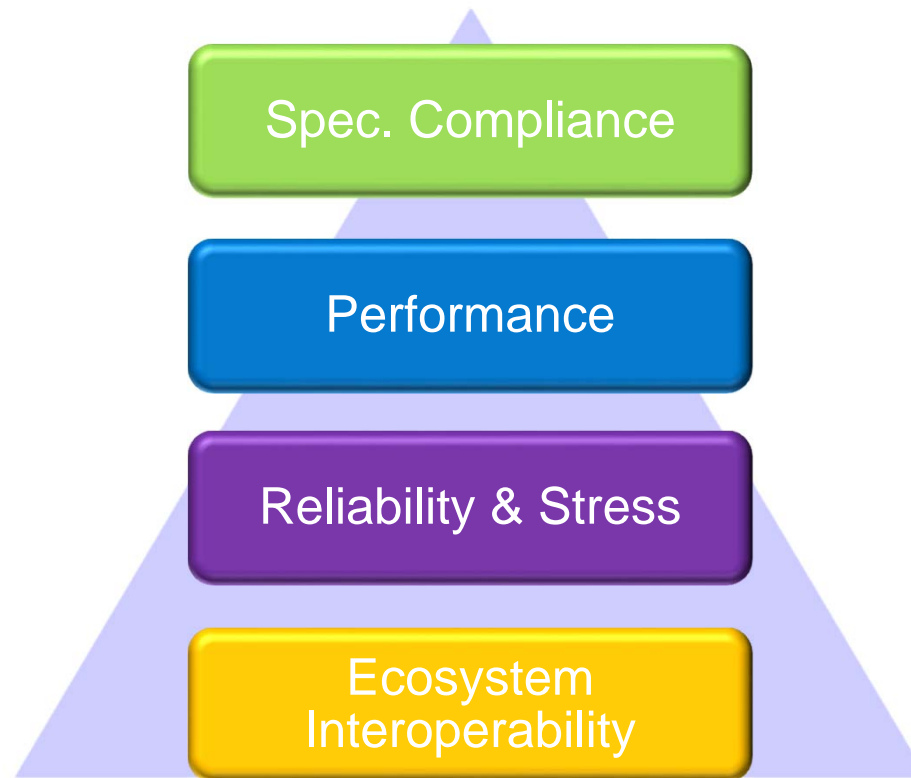


300,000+
Test Projects Performed





SD Cards Validation Hierarchy





UHS-II PHY Test

SD Specifications Part 1 UHS-II PHY Test Guideline, version 1.00 (July 24, 2014)

Host	TG1-5 RCLK Transmitter Test TG1-6 Transmitter Test TG1-7 Receiver Test TG1-8 Pin Parameter Test
Card	TG1-1 Device Transmitter Test TG1-2 Device Receiver Test TG1-3 Device RCLK Receiver Test TG1-4 Device Pin Parameter Test

*Test Tools/Test Lab available for self compliance



UHS-II Protocol Test

SD Physical Layer Spec Ver. 4.20, UHS-II Addendum Ver. 1.01

Data Rate	All data rates
Host Tests	TG1: UHS-II System Feature (6 Tests) TG2: Link Layer Specification (46 Tests) TG3: CM-TRAN Layer Specification (17 Tests) TG4: SD-TRAN Layer Specification (18 Tests) TG5: 2L-HD Mode (6 Tests)
Card Tests	TG1: UHS-II System Feature (7 Tests) TG2: Link Layer Specification (48 Tests) TG3: CM-TRAN Layer Specification (63 Tests) TG4: SD-TRAN Layer Specification (41 Tests) TG5: 2L-HD Mode (9 Tests)

*Test Tools/Test Lab available for self compliance

Popular SD Host Ecosystem Nowadays





SD Host Interoperability Requirements

- SD cards need to be compatible to higher capacity type of SD hosts (SDXC/SDHC/SD), and mostly important different version of SD hosts.
- Consider your SD cards to be used on various types of SD host (microSD w/ adaptor)
- Content generated by one SD host could be consumed on another



SD Hosts Interoperability Issues Study

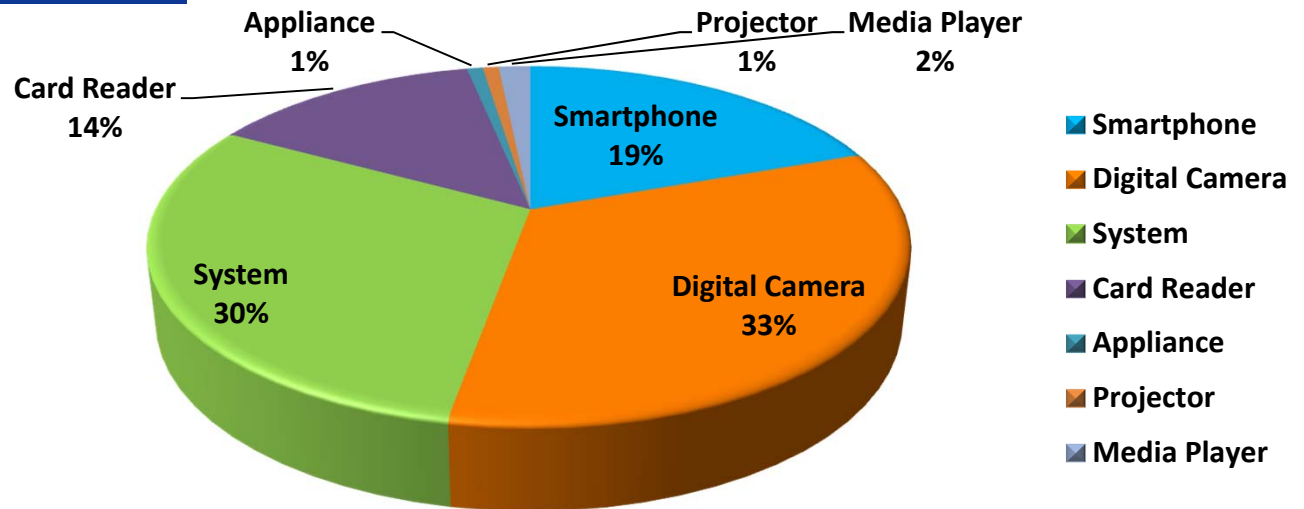
- 1000+ SD host devices test result was studied, 120 issues are collected for analysis.
- Common Test Scenario:
 - Plug/Unplug & Enumeration
 - User behavior operation (format, I/O)
 - Power management (cold/warm boot, sleep, hibernate)
 - Performance Evaluation

SD Host Type	Number
System	270+
Card reader	120+
Camcorder	130+
Digital camera	450+
Mobile phone	170+
Video Player	60+
Tablet	70+
TV	30+
Printer	50+
Appliances	40+



Platforms With Most Interoperability Issues

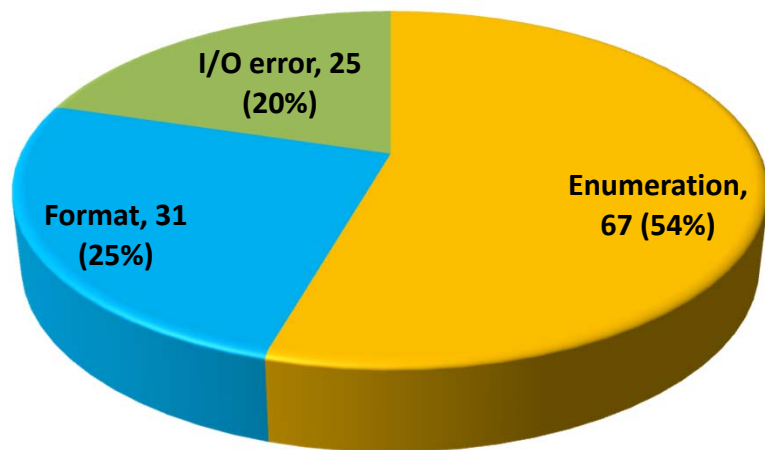
- Digital Camera and System are the most prevalent SD hosts with compatibility issues, following by Smartphone and Card Reader.





Host Interoperability Issues Analysis

Most Common SD Host Interoperability Risks



Source: Allion Labs, Inc.

	Enumeration	Format	I/O error
Smartphone	16%	2%	2%
Digital Camera	15%	7%	12%
System	11%	13%	7%
Card Reader	11%	3%	0%
Appliance	1%	0%	0%
Projector	1%	0%	0%
Media Player	2%	0%	0%
TOTAL	55%	25%	20%

Source: Allion Labs, Inc.



Symptoms Of Interoperability Issues

Enumeration

- SD card can't be detected (w/ adaptor)
- SD card detection failure on reset and power management
- SD card capacity error

Format

- Format error (w/ adaptor)
- Take too long to quick format

I/O Error

- Stop recording at maximum resolution
- Can't take/display picture
- Data Corruption
- Can't copy file into SD card
- Hangs the host



Summary for SD Quality Focus

- Validate SDA SPECIFICATION on Electrical, Protocol and Mechanical chapters for basic level quality.
- Always consider HOW AND WHERE the SD cards will be used when making the test plan. (Performance, Reliability, Interoperability)
- Ensure Host Interoperability Test coverage is good enough (i.e. DEVICE VARIETIES AND TEST SCENARIOS) and pay attention to high risks issues.
- PERFORMANCE USER EXPERIENCE (read/write throughput) is another key factor of Host Interoperability except functionality.