



UFS Test Fixtures

User Manual

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This document describes Astek's UFS Test Fixture product family.

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1 Introduction / Overview

This document outlines the features and use of Astek's UFS Test Fixtures used for compliance testing and protocol testing of UFS card devices and UFS host systems.

Astek's UFS test fixture product line consists of the following part numbers:

Part Number	Purpose
A9-UFS-01	UFS Host Test Fixture
A9-UFS-02	UFS Device Test Fixture
A9-UFS-03	UFS Protocol Sniffer
A9-PWR-01	Power Kit for Device Test Fixture
A9-SMPF-SMAF	SMP-female to SMA-female adapter

Astek UFS Test Fixtures utilize SMP connectors for all high-speed signal paths. Care should be taken when inserting and removing SMP cables from the test fixtures.

Astek UFS test fixtures utilize Amphenol's UFS Connector, part number: 1010170469#2A for connectivity to UFS card devices.

Detailed operation and use of each test fixture is documented in the following sections.

CAUTION

Astek recommends using a Ground strap when handling Astek's UFS test fixtures.

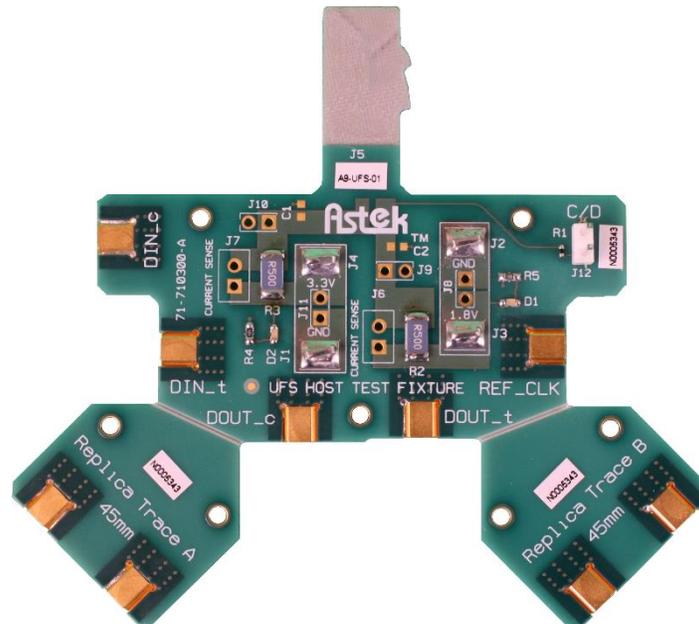
Warranty

Astek's test fixture products carry a 3-month limited warranty.

Additional Support

Astek can be reached for additional support by email at support@astekcorp.com.

A9-UFS-01 - UFS Host Test Fixture



The Astek Corporation A9-UFS-01 UFS Host Test Fixture provides signal access for UFS card hosts. The test fixture can be used for UFS card host characterization, compliance testing, and protocol analysis.

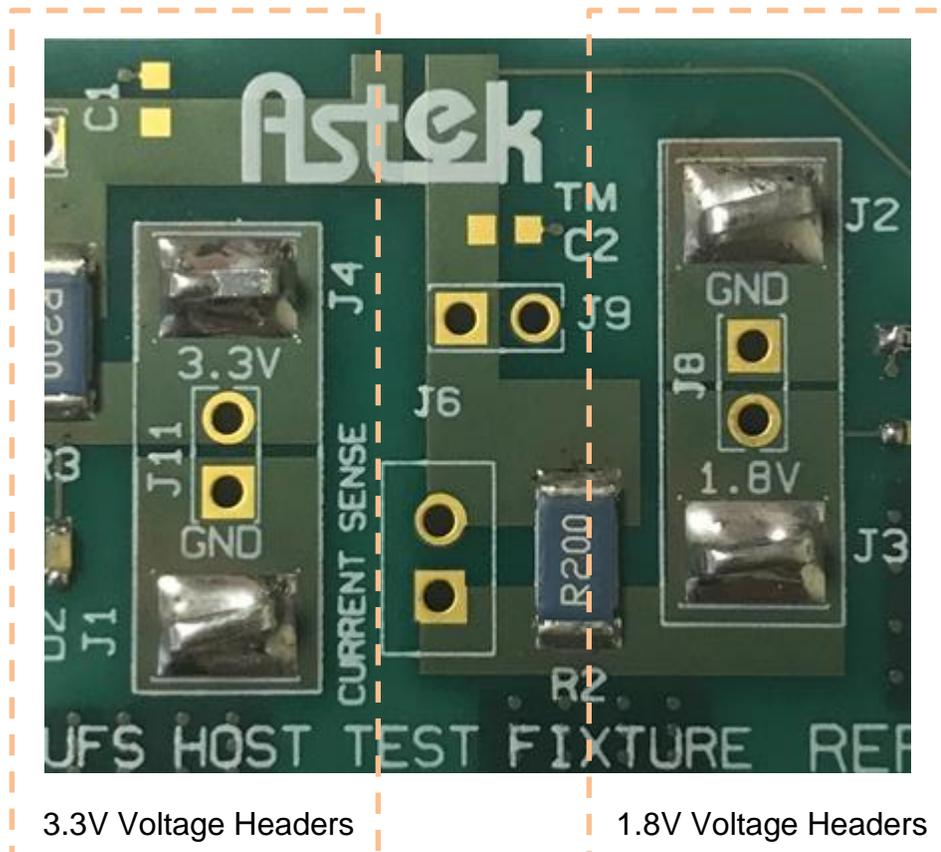
Pinout

UFS Card Edge Pin #	Signal	A9-UFS-01 Location
1	VSS	Ground
2	DIN_C	DIN_c SMP connector
3	DIN_T	DIN_t SMP connector
4	VSS	Ground
5	DOUT_C	DOUT_c SMP connector
6	DOUT_T	DOUT_T SMP connector
7	VSS	Ground
8	REF_CLK	REF_CLK SMP connector
9	VCCQ2	1.8V
10	C/D (GND)	C/D header
11	VSS	Ground
12	VCC	3.3V

Power / Current Measurements

The A9-UFS-01 fixture provides a method for measuring the amount of power that can be delivered by a UFS host to a UFS card device. UFS hosts must provide 1.8V and 3.3V to UFS card devices for proper operation.

To make a power delivery measurement, a load must be applied to 1.8V and 3.3V on the host fixture. The load is attached to J2/J3 to measure 1.8V delivery capability or to J1/J4 to measure 3.3V delivery capability. J6 and J7 are used to measure the current being provided by each rail as noted below.



3.3V Voltage Headers

1.8V Voltage Headers

Header / Pin	Signal
J1	Ground
J2	Ground
J3	1.8V
J4	3.3V

Alternately, J8 and J11 can be used to apply a load to the fixture.

Header / Pin	Signal
J8 – pin 1	Ground
J8 – pin 2	1.8V
J11 – pin 1	Ground
J11 – pin 2	3.3V

*pin 1 is denoted with a square pad.

Voltage to the card can be monitored using J8 or J9 for 1.8V and J10 or J11 for 3.3V.

A 200mΩ resistor is provided to measure current for each of the power rails, 1.8V and 3.3V. The voltage across each resistor can be measurements using a volt-meter and converted to current using the following formulas:

$$I_{1.8V} = 5 * V_{across J6}$$

$$I_{3.3V} = 5 * V_{across J7}$$

High-Speed Connections

SMP connectors are provided for connecting to REF_CLK, DIN_t, DIN_c, DOUT_t, and DOUT_c of the host under test. Each trace is length matched from the SMP connector to the point where the UFS connector pin contacts the UFS host.

Signal	UFS Card Pin #
REF_CLK	8
DIN_t	3
DIN_c	2
DOUT_t	6
DOUT_c	5

* Signals are labeled with respect to the UFS card. Therefore, DIN is the output from the UFS host and DOUT is the input to the UFS host.

Two Replica Traces are provided on the test fixtures. These traces are the same length as the high-speed traces on the board. These traces can be used for calibration of test equipment or can be used to measure traces for de-embedding and/or probe correction. Due to the delicate nature of the host fixture, the Replica Traces may be detached from the fixture to create a smaller, more stable fixture.

Two Replica traces are provided to allow for 2-port or 4-port calibration and correction.

Astek provides a typical .s2p file and .s4p file for the test fixture at <http://www.astekcorp.com>. These files can be used for de-embedding purposes as an alternate to the Replica Traces.

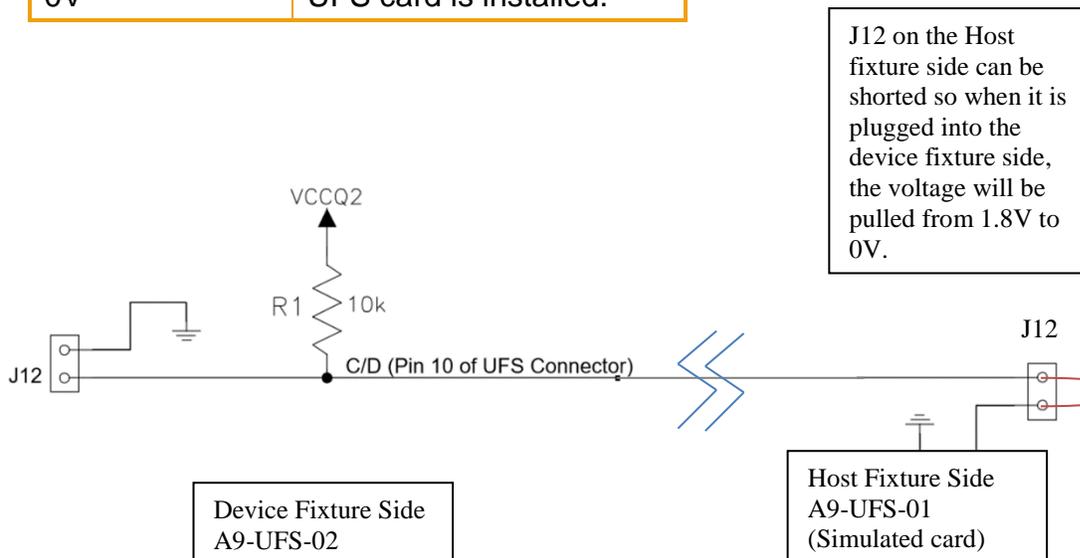
CAUTION Measurement and use of Replica Traces provides a more accurate measurement than using the typical .s2p/.s4p files.

CAUTION Keep objects, materials, and noisy electronics such as cell phones and laptops away from the high-speed traces located on the bottom surface of the test fixture. Failure to do so could introduce measurement error.

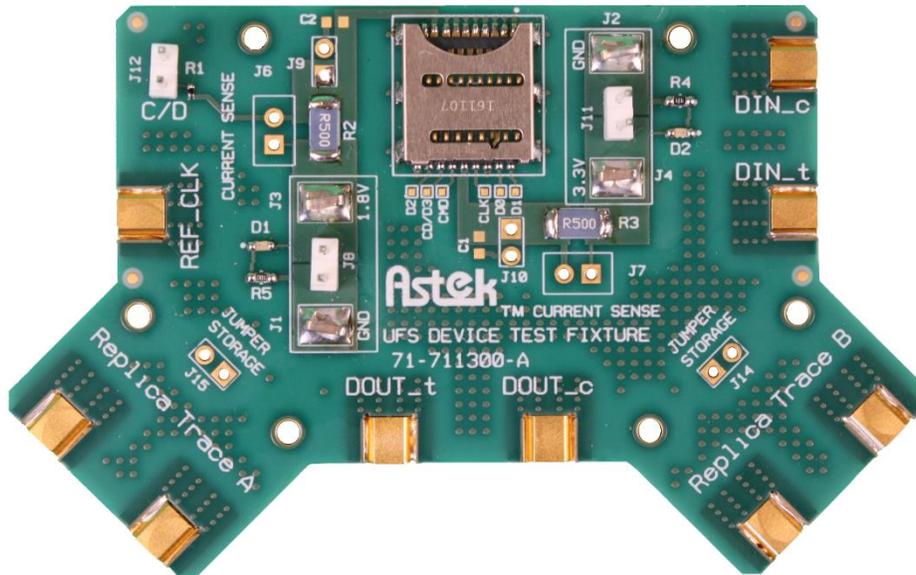
Other Signals

Card Detect (C/D) is connected to J12 header as illustrated below. C/D can be used to signal to the host that a card has been “inserted” in the fixture.

Voltage across J12	Result
1.8V	No card is installed.
0V	UFS card is installed.



A9-UFS-02 – UFS Device Test Fixture



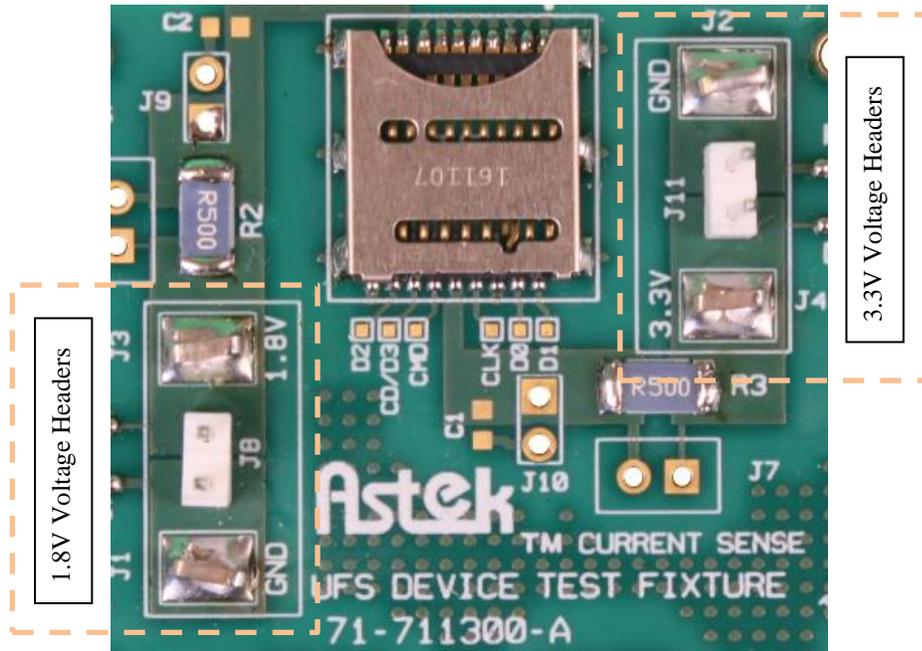
The Astek Corporation A9-UFS-02 UFS Device Test Fixture provides signal access for UFS card devices. The test fixture can be used for UFS card device characterization, compliance testing, and protocol analysis.

Pinout

UFS Card Pin #	Signal	A9-UFS-02 Location
1	VSS	Ground
2	DIN_C	DIN_c SMP connector
3	DIN_T	DIN_t SMP connector
4	VSS	Ground
5	DOUT_C	DOUT_c SMP connector
6	DOUT_T	DOUT_T SMP connector
7	VSS	Ground
8	REF_CLK	REF_CLK SMP connector
9	VCCQ2	1.8V
10	C/D (GND)	C/D header
11	VSS	Ground
12	VCC	3.3V

Powering the device card

UFS device cards require 1.8V and 3.3V for proper operation and testing. Power for the device under test is provided using test headers on the A9-UFS-02 test fixture. When power is applied to the fixtures, D1 and D2 will illuminate to indicate power for 1.8V and 3.3V, respectively, has been applied.



Header / Pin	Signal
J1	Ground
J2	Ground
J3	1.8V
J4	3.3V

Alternately, J8 and J11 can be used to apply power to the test fixture.

Header / Pin	Signal
J8 – pin 1	Ground
J8 – pin 2	1.8V
J11 – pin 1	Ground
J11 – pin 2	3.3V

*pin 1 is denoted with a square pad.

Voltage to the card can be monitored using J8 or J9 for 1.8V and J10 or J11 for 3.3V.

NOTE: An alternative method for powering the A9-UFS-02 fixture is to use A9-PWR-01. This allows the user to power the fixture from any USB port.

Power / Current Measurements

The A9-UFS-02 fixture provides a method for measuring the amount of power that can be consumed by a UFS card device. UFS hosts must provide 1.8V and 3.3V to UFS card devices for proper operation.

To make a power delivery measurement, a load must be applied to 1.8V and 3.3V on the host fixture. The load is attached to J1/J3 to measure 1.8V delivery capability or to J2/J4 to measure 3.3V delivery capability. J6 and J7 are used to measure the current being provided by each rail as noted below.

A 200mΩ resistor is provided to measure current for each of the power rails, 1.8V and 3.3V. The voltage across each resistor can be measurements using a volt-meter and converted to current using the following formulas:

$$I_{1.8V} = 5 * V_{across J6}$$

$$I_{3.3V} = 5 * V_{across J7}$$

High-Speed Connections

SMP connectors are provided for connecting to REF_CLK, DIN_t, DIN_c, DOUT_t, and DOUT_c of the device card under test. Each trace is length matched from the SMP connector to the point where the UFS connector pin contacts the UFS card device.

Signal	UFS Card Pin #
REF_CLK	8
DIN_t	3
DIN_c	2
DOUT_t	6
DOUT_c	5

* Signals are labeled with respect to the UFS card. Therefore, DIN is the input to the UFS device and DOUT is the output from the UFS device.

Two Replica Traces are provided on the test fixtures. These traces are the same length as the high-speed traces on the board. These traces can be used for calibration of test equipment or can be used to measure traces for de-embedded and/or probe correction.

Two Replica traces are provided to allow for 2-port or 4-port calibration and correction.

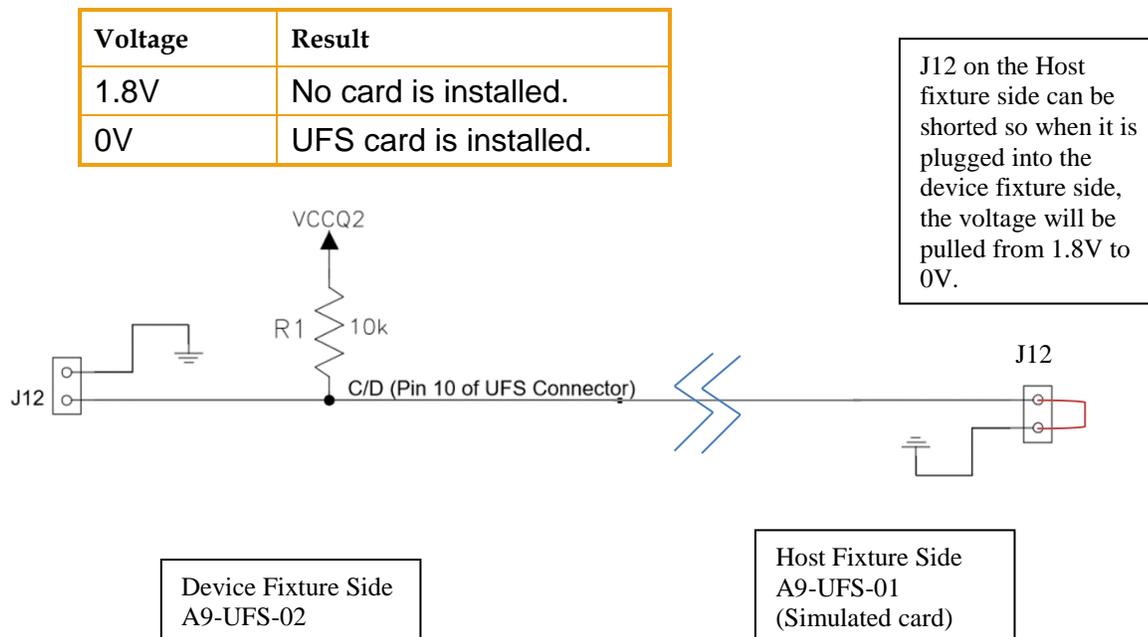
Astek provides a typical .s2p file and .s4p file for the test fixture at <http://www.astekcorp.com>. These files can be used for de-embedding purposes as an alternate to the Replica Traces.

CAUTION Measurement and use of Replica Traces provides a more accurate measurement than using the typical .s2p/.s4p files.

CAUTION Keep objects, materials, and noisy electronics such as cell phones and laptops away from the high-speed traces located on the bottom surface of the test fixture. Failure to do so could introduce measurement error.

Other Signals

Card Detect (C/D) is connected to J12 header as illustrated below. C/D can be monitored to verify a card has been inserted into the UFS connector.



Additional SD card signals are available as test points on the A9-UFS-02 test fixture. These signals may or may not be present on the card under test. Please refer to the documentation for the device card under test to determine if these signals are available.

Signal	Description	Location
D2	Data Line (bit 2)	Testpoint below J5
CD/D3	SD Card Detect / Data Line (bit 3)	Testpoint below J5
CMD	SD Command Response	Testpoint below J5
CLK	SD Clock	Testpoint below J5
D0	Data Line (bit 0)	Testpoint below J5
D1	Data Line (bit 1)	Testpoint below J5

Signal Integrity Measurements

Refer to the MIPI Alliance M-PHY Physical Layer Conformance Test Suite,
Appendix B – Test Setups

CAUTION

Keep wires and conductive materials away from the high-speed traces located on the bottom surface of the test fixture to avoid measurement interference.

Technical Specifications (UFS Test Fixtures)

Bus Type	UFS		
Bus Speeds Supported	TBD (Gear 3 reqd, Gear 4 design goal)		
Fixture Bandwidth	5.8 GHz		
Impedance	100-ohm differential / 50-ohm single-ended (tolerance +/- 5%, +/- 8% absolute limit) Insertion and return loss (constrained for MIPI fixtures)		
Replica trace loss and impedance	Matches fixture SMP to point where UFS connector pin contacts UFS device.		
Max Power Consumption Allowed (Device Fixture)	1.8V - 2A Power dist. Impedance (0.1 ohm max) – current consumption to calculate impedance. Remote power and Gnd sense at device is supported to eliminate effects of voltage drop across current sense resistor. 3.3V - 2A – Same current measurement and remote sense as for 1.8V supply.		
De-embedding support	2 & 4 port s-parameter files based on a typical test fixture.		
Agency Approval	EU RoHS Compliant (lead-free)		
	Device Test Fixture	Host Test Fixture	Protocol Sniffer
UFS Connections	UFS Socket	Per JEDEC UFS 1.0 Card spec	
Signal Connections	REF_CLK – SMP DIN_t/c – SMP DOUT_t/c – SMP Cal Trace – SMP C/D – 2-pin header	REF_CLK – SMP DIN_t/c – SMP DOUT_t/c – SMP Cal Trace – SMP C/D – 2-pin header	REF_CLK – SMP DIN_t/c – SMP DOUT_t/c – SMP C/D – 2-pin header
Power Connections	2-pin header and test clip for 1.8V and 3.3V	2-pin header and test clip for 1.8V and 3.3V	
Power LEDs	1.8V and 3.3V	1.8V and 3.3V	
Current Monitoring	Supported. 2-pin headers for 1.8V and 3.3V current measurement.	Low impedance connection to external load for measuring host power supply capability.	
Power Conditioning	Decoupling as required by UFS specification.	N/A	
Environments	Storage	Operating	
Temperature	-40° to +85° C	0° to 55° C	
Relative Humidity	5 to 90% non-condensing	5 to 90% non-condensing	