AIAA S-133-8-2013

Standard

Space Plug-and-Play Architecture Standard

Test Bypass

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Sponsored by

American Institute of Aeronautics and Astronautics

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Abstract

This document describes the function and application of the test bypass mechanism for systems based on the Space Plug-and-Play Architecture (SPA). The test bypass function supports hardware-in-the-loop testing with simulated component data. Incorporating test bypass into SPA components allows for rapid component assembly, integration, test, and system verification.

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Contents

Tables

Figures

Foreword

This standard was developed through a partnership of the Air Force Research Laboratory Space Vehicles Directorate, the Air Force's Office of Operationally Responsive Space, numerous government contractor teams, independent contractor teams, and academic experts. The Test Bypass standard is one piece of the Space Plug-and-Play Architecture (SPA), which is a system that aims to reduce the cost and timeline of getting spacecraft into operational use. SPA incorporates the use of design tools, standard interfaces for hardware and software, and standard, modular structures and wiring. Test Bypass functionality allows for rapid testing and verification of components and systems. SPA components may or may not support a bypass function. This standard provides instruction on implementing Test Bypass for those components that do support it.

This particular volume of the SPA Physical Interface Standard contains information not recorded in previous documentation. It is part of a set of 10 documents describing other components of the standard:

- SPA Guidebook
- SPA Networking Standard
- SPA Logical Interface Standard
- SPA Physical Interface Standard
- SPA 28V Power Service Standard
- SPA System Timing Standard
- SPA Ontology Standard
- SPA SpaceWire Subnet Adaptation Standard
- SPA System Capability Guide

At the time of approval, the members of the AIAA SPA Committee on Standards were:

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The above consensus body approved this document in June 2013.

The AIAA Standards Executive Council (VP-Standards, Laura McGill, Chairperson) accepted the document for publication in August 2013.

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*Alternate CoS participant.

Introduction

Space Plug-and-Play Avionics (SPA) is a collection of standard hardware and software interfaces, physical structures, and messaging protocols that are designed to facilitate rapid design, assembly, integration, and testing of spacecraft systems. There are many building blocks of the plug-and-play architecture that are necessary to meet those goals and Test Bypass (TB) is one of them. The TB function enables rapid functional testing of a system by allowing the integrator to bypass SPA hardware devices and to use detailed external simulations to inject simulated data into the device's ASIM to understand how the rest of the system responds to that input. This provides the capability to rapidly perform functional tests on assembled systems for verification of SPA networks, computing resources, communications links, and flight software. System on-orbit performance can also be determined based upon the realism of the simulation used.

1 Scope

This document provides detail for incorporation of Test Bypass (TB) functionality in SPA components and systems, and describes the messaging protocol for TB. Test Bypass is the mechanism by which test data may be injected into the running SPA system, or by which operational data may be extracted from various test points within the system during integration and test. The concept of TB was developed to further enhance the rapid assembly, integration, and test (AI&T) for SPA compliant vehicles. More general discussion on TB functions and interfaces is available in the SPA Guidebook.

This document defines the current state of practice for TB. This standard is applicable to all SPA devices and systems that support a bypass function for testing purposes. Further development of this method will be updated within this standard. Other developments that address testing functions will be defined in other documents.

2 Applicable Documents

The following documents contain provisions which, through reference in this text, constitute provisions of this standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

AIAA G-133-1-2013	*Space Plug-and-Play Architecture Guidebook*
AIAA S-133-3-2013	*Space Plug-and-Play Architecture Logical Interface Standard*
AIAA S-133-7-2013	*Space Plug-and-Play Architecture Ontology Standard*

3 Vocabulary

3.1 Acronyms and Abbreviated Terms

AIAA	American Institute of Aeronautics and Astronautics
AI&T	assembly, integration, and test
ASIM	Appliqué Sensor Interface Module
DPM	dual-ported memory
DNC	does not care
DUT	device under test
EP	endpoint
GSE	ground support equipment
SPA	Space Plug-and-Play Architecture
TB	test bypass
TBI	test bypass interface