



Vibration Testing of the ADM-VPX3-9Z5

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Introduction

This white paper provides an overview of the vibration testing of the Alpha Data ADM-VPX3-9Z5 board. It documents the test standards used and the relevant report confirming that the board withstood the testing levels stipulated by the adopted standard.

The purpose of this vibration test was to subject the board to conditions typical of a low Earth Orbit Space launch as well as in excess of other in-atmosphere rugged deployment environments, and verify that it can operate after exposure to such conditions.

The ADM-VPX3-9Z5 is an OpenVPX MPSoC FPGA System on Module (SoM) utilizing the Xilinx Zynq UltraScale+ XQZU19EG M-temp device. The ADM-VPX3-9Z5 has been developed in partnership with Xilinx and Texas Instruments and features Mil-temp range (-55C to +125C) board components throughout for reliability. The ADM-VPX3-9Z5 is suitable for high-altitude applications and is compliant with LVAUX mode for Single Event Effects (SEE) mitigation. The ADM-VPX3-9Z5 is SOSA compliant.

The ADM-VPX3-9Z5 provides flexible IO via an FMC+ site and via the VPX backplane, dual 8GB DDR4-2400 SDRAM (PL and PS), 1Gb QSPI configuration Flash, System Monitoring and Mil-temp enhanced products for Power and Temperature Sensing solutions from Texas Instruments.

Test Fixture

The test fixture was designed to hold the 9Z5 board as it is intended to be held in its final application so that testing is representative of a real set-up. Since Random Vibration is usually conducted up to 2000Hz, the test fixture was made stiff enough so that its first resonance frequency is above 2000Hz to avoid resonating during a Random Vibration run and potentially affecting the vibration input to the 9Z5.

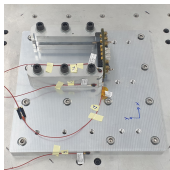


Figure 1 : Test Fixture

Test Subjects

The ADM-VPX-9Z5 board was first subjected to the vibration testing. The FMC CLINK MINI card was then installed and the same set of vibration testing carried out. The FMC card was secured with two screws near the front of the board.

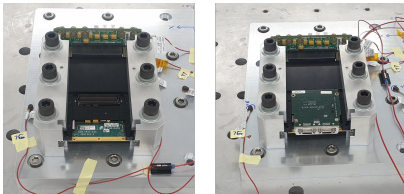


Figure 2 : DUTs (Left - 9Z5 Only, Right - 9Z5 with FMC Card)

Test Specifications

The vibration testing was performed to acceptance level first and the board was put through functional tests to check it still functioned properly before doing the higher qualification level tests. Functional tests were also performed before the acceptance tests and after the qualification tests.

Random Vibration

For the random vibration, we tested to both the Acceptance and Qualification random levels in all 3 axes (X, Y, and Z). The test standard used is the NASA GSFC-STD-7000A, which is a generalized random vibration test environment for components weighing 22.7 kg or less. Also please note that this test exceeded the vibration specification for VITA47, which specifies 0.1 g^2/Hz . The test peaked at 0.16 g^2/Hz .

Configuration	Values
Frequency range	20 - 2000 Hz
Acceptance profile	10.0 Grms
Qualification profile	14.1 Grms

Table 1 : Random Vibration Test Specifications

Sine Resonance Sweep

The Sine Resonance Sweep was performed to check for any resonances of the hardware over frequency range 20 to 2000 Hz. The accelerometers were fixed to the test fixture to ensure it did not have any unwanted resonances. The Sine Resonance Sweep was performed before and after the environmental vibration profile (for each axis) so that we could check if there had been a change in resonance after vibrating.

Configuration	Values
Frequency range	20 - 2000 Hz
Sweep rate	3 oct/min
Level	0.15 g

Table 2 : Sine Resonance Sweep Test Specifications

Vibration Test Results

The indicated graphs in Figures 3 and 4 are for the X axis only, but these are representative of the other axes. Functional tests before, in-between, and after the vibration test runs confirmed that the 9Z5 board was still functional.

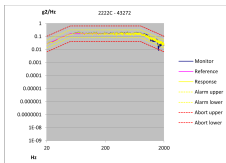
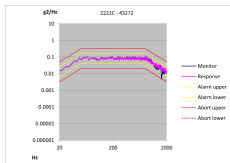


Figure 3 : 9Z5 Only (Left - Acceptance, Right - Qualification)

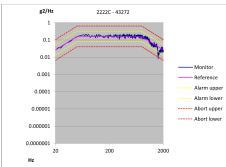
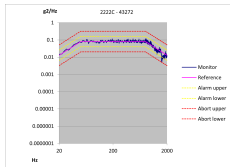


Figure 4 : 9Z5 with FMC Card (Left - Acceptance, Right - Qualification)

Revision History

Date	Revision	Nature of Change
31/08/2022	1.0	Initial release