

Document ID: SS-TRI-TEST-001

Document Title: Trident-S Environmental Stress Screening (ESS) Procedure

Version: 1.0

Status: Released

Date: 13 August 2025

## 1. Introduction

### 1.1 Purpose

This document provides the detailed procedure for conducting Environmental Stress Screening (ESS) on the Trident-S Antenna Array, hereafter referred to as the Unit Under Test (UUT). The purpose of ESS is to precipitate latent defects in hardware by subjecting the UUT to thermal and vibration stresses that exceed its expected operational environment. This screening is a critical step in ensuring the long-term reliability of the system.

### 1.2 Scope

This procedure applies to all production units of the Trident-S Antenna Array. It defines the test profiles, equipment, and pass/fail criteria for the ESS campaign. All test activities described herein shall be planned, executed, and reported in accordance with the master framework established in **SS-TEST-PLAN-001: Test & Evaluation Master Plan (TEMP)**.

## 2. Applicable Documents

- **SS-TRI-SPEC-001:** Trident-S Mechanical & RF Specification
- **SS-TEST-PLAN-001:** Test & Evaluation Master Plan (TEMP)
- **MIL-STD-810G:** Environmental Engineering Considerations and Laboratory Tests

## 3. Test Prerequisites

### 3.1 Personnel Requirements

- **Test Engineer:** 1x Certified Test Engineer
- **Quality Assurance Witness:** 1x Synthetic Systems QA Representative

### 3.2 Unit Under Test (UUT)

- **UUT:** Trident-S Antenna Array (Above-Deck Equipment)
- **UUT Serial Number:** \_\_\_\_\_

### 3.3 Required Test Equipment

- Vibration Shaker System (capable of meeting the profile in Section 5.1)
- Thermal Chamber (capable of meeting the profile in Section 5.2)
- Tri-axial Accelerometers

- Thermocouples
- Data Acquisition System / Logger
- Test Control Laptop with UUT control software

#### 4. Pre-Test Procedure

##### 4.1 Initial Inspection

Conduct a thorough visual inspection of the UUT. Check for any pre-existing physical damage, loose fasteners, or improperly seated connectors. Document any findings on the test log sheet.

##### 4.2 Pre-Test Functional Check

1. Mount the UUT to the test fixture in its standard orientation.
2. Connect the power and data interface cables to the UUT.
3. Power on the UUT.
4. Using the Test Control Laptop, establish a connection to the UUT's control interface.
5. Command the UUT to perform a self-test and a full range-of-motion check.
6. **Expected Result:** The UUT powers on, establishes communication, and completes the self-test and range-of-motion check without any reported errors.
7. Record the result (Pass/Fail) on the test log sheet. Power down the UUT.

#### 5. ESS Test Procedure

##### 5.1 Part A: Random Vibration

This test verifies the UUT's resistance to vibration as required by **SS-TRI-SPEC-001**, Section 3.3.3.

1. **Setup:** Securely mount the UUT on the vibration shaker table. Attach control accelerometers to the test fixture adjacent to the UUT mounting points.
2. **Execution:** Subject the UUT (unpowered) to the random vibration profile defined below for 60 minutes on each of the three orthogonal axes (X, Y, Z).

Frequency (Hz)	Power Spectral Density (PSD) Level (g <sup>2</sup> /Hz)
20	0.02
20 - 150	+3 dB/octave
150 - 1000	0.1
1000 - 2000	-6 dB/octave

Overall RMS	10.5 g
-------------	--------

## 5.2 Part B: Thermal Cycling

This test verifies the UUT's resilience to temperature extremes as required by **SS-TRI-SPEC-001**, Section 3.3.4.

1. **Setup:** Place the UUT (unpowered) inside the thermal chamber. Attach thermocouples to specified locations on the UUT chassis to monitor its temperature.
2. **Execution:** Subject the UUT to **10 thermal cycles** as defined by the profile below.

Step	Parameter	Value
1	Starting Temperature	+25°C (Ambient)
2	Ramp Down To	-30°C
3	Ramp Rate	5°C / minute (minimum)
4	Dwell at -30°C	60 minutes
5	Ramp Up To	+60°C
6	Ramp Rate	5°C / minute (minimum)
7	Dwell at +60°C	60 minutes
8	Ramp Down To	+25°C (Ambient)

## 6. Post-Test Procedure

### 6.1 Post-Test Inspection

1. After the UUT has returned to ambient temperature, remove it from the chamber.
2. Conduct a detailed visual inspection of the UUT. Use a checklist to look for:
  - Cracks or fractures in the radome or pedestal housing.
  - Loose or missing fasteners (screws, bolts).
  - Damage to connectors or cable harnesses.
  - Signs of internal component shifting.
  - Evidence of moisture ingress.
3. Document all findings on the test log sheet.

## 6.2 Post-Test Functional Check

Repeat the functional check procedure exactly as described in Section 4.2. Record the result (Pass/Fail) on the test log sheet.

## 7. Pass/Fail Criteria

- **PASS:** The UUT is considered to have passed ESS if it meets **both** of the following criteria:
  1. The post-test inspection reveals no physical damage, degradation, or loose components.
  2. The UUT successfully passes the post-test functional check without any errors.
- **FAIL:** The UUT has failed ESS if **either** of the following occurs:
  1. Physical damage is discovered during the post-test inspection.
  2. The UUT fails the post-test functional check.

## 8. Test Reporting and Defect Management

A formal Test Report shall be generated upon completion of this procedure, summarizing all activities and results.

In the event of a FAIL result, the UUT shall be quarantined, and a Defect Report (DR) shall be raised immediately. The management and resolution of the defect shall be handled in accordance with the Defect Management process defined in **SS-TEST-PLAN-001**. The UUT cannot be accepted until the defect is resolved and the ESS procedure has been successfully re-run.