LUMIR Harmony in Differences

ETRI

Korea Lunar Exploration Program

DTNPL Qualification Model

Shock Test Procedure

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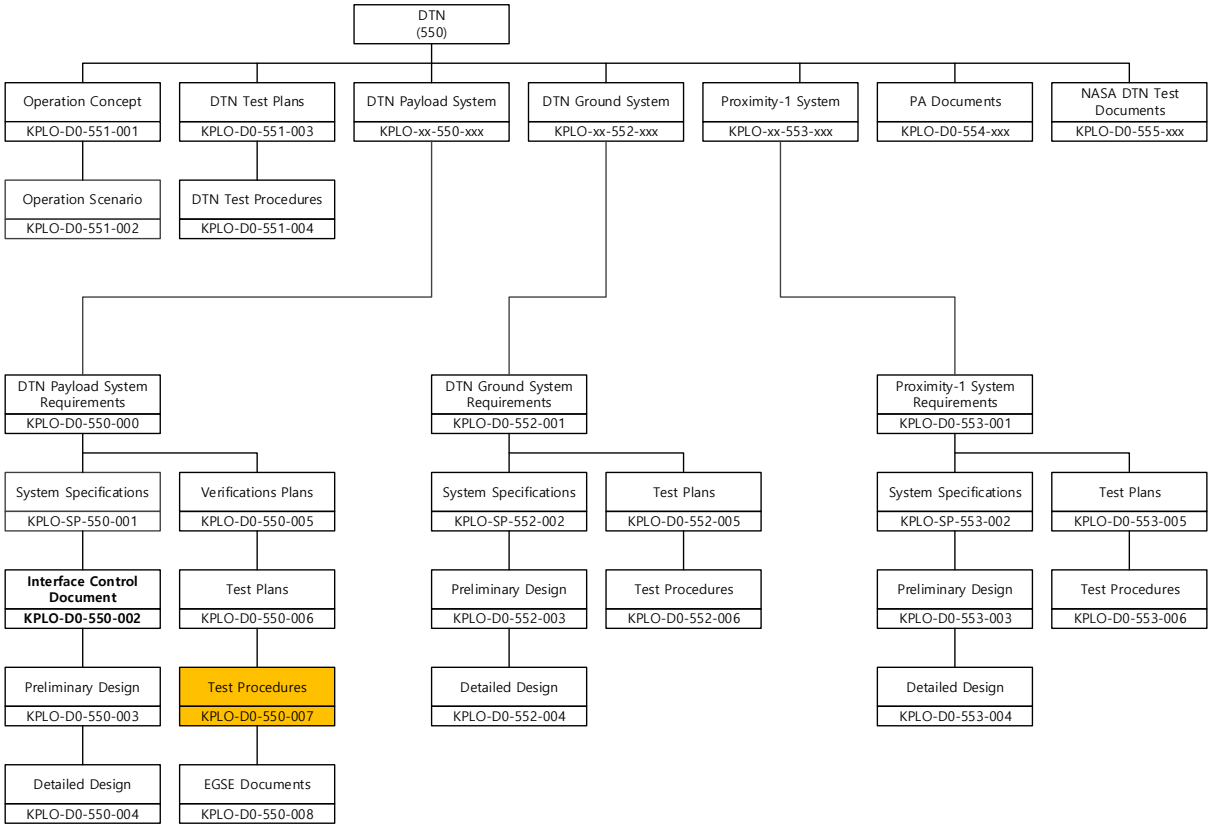
Documents Tree



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1. Introduction

1.1. Purpose and Scope

This document establishes the conditions, requirements and test procedures for Shock testing of the DTNPL payload.

1.2. Applicable & Reference Documents

1.2.1. Applicable Documents

	Document Number	Document Title
AD01	KPLO-D0-550-000	System Requirement of DTN Payload
AD02	KPLO-D0-550-001	System Specification of DTN Payload
AD03	KPLO-SP-320-002	KPLO Environmental Design and Test Specification

1.2.1. Reference Documents

	Document Number	Document Title
RD01	MIL-STD-1540C	Test Requirements for Launch, Upper-Stage, and Space Vehicles
RD02	PSS-01-801	Test Requirements Specification for Space Equipment
RD03	ECSS-E-10-03-A	ECSS Space Engineering-Testing

1.3. Abbreviations

AMS	Asynchronous Message Service
BP	Bundle Protocol
BSS	Bundle Streaming Service
CCSDS	Consultative Committee for Space Data Systems
CFDP	CCSDS File Delivery Protocol
DCC	DTN Control Center
CRC	Cyclical Redundancy Check
DMA	Direct Memory Access
DTN	Delay(Disruption) Tolerant Network
DTNPL	DTN Payload
EOD	End of Data
EOF	End of File
FW	Firm Ware
FSW	Flight Software
ION	Interplanetary Overlay Network
KPLO	Korea Pathfinder Lunar Orbiter
LCM	Lander Communication Model
LTP	Licklider Transmission Protocol
OBC	On Board Computer
PDHU	Payload Data Handling Unit
RCM	Rover Communication Model
SBC	Single Board Computer
SOD	Start of Data
SOF	Start of File
SOH	Start of Head
TBC	To Be Confirmed
TBD	To Be Defined
TC	Tele-command
TCP	Transmission Control Protocol
TM	Telemetry
UART	Universal Asynchronous Receiver Transmitter

2. Test Article

DTNPL is composed by major functional modules as follows :

- SBC (Single Board Computer)

Figure 2-1 shows the DTNPL QM external view and its coordinate system. Size and mass of test article is given in Table-1.

The coordinate system is defined as follows.

- The plane defined by the unit coordinate system axes X and Y is parallel to the mounting surface.
- The unit Z axis is normal to the mounting plane.
- The X axis with the dimension along X (length) being greater than the dimension along Y(width).

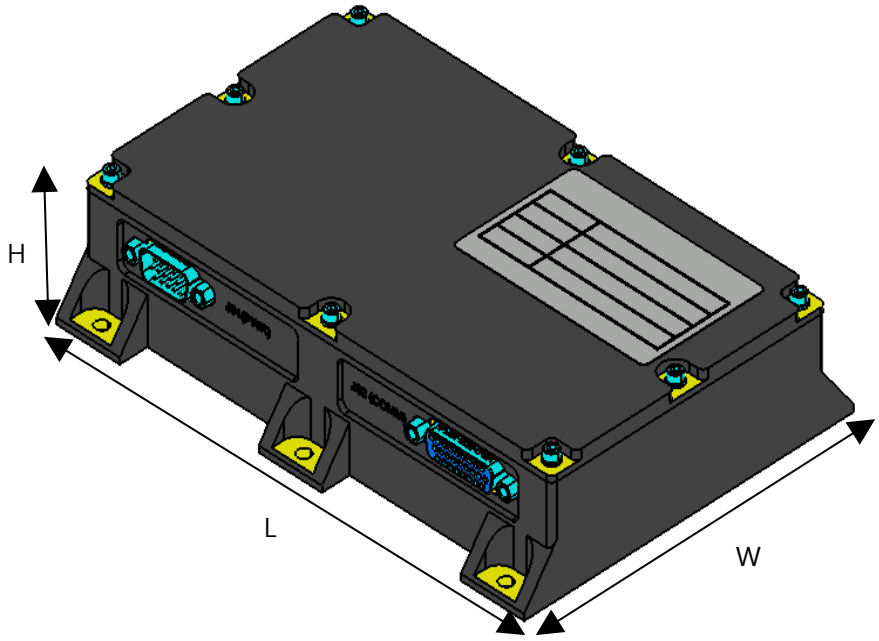

Figure 2-1 DTNPL Configurations

Table 2-1 Dimension Criteria

Description	Value
Length measurement	170 mm
Width measurement	120 mm
Height measurement	39 mm
Weighing	0.98 kg

2.1. Verification Cross Reference

The requirements which have to be verified by a successful performance in the test and its relevant test steps are given below:

Applicable Doc.	Requirement	Verified by Test Step	Compliance
KPLO-SP-320-002	Shock	All	C

2.2. Notification for Qualification and Acceptance Tests

This test procedure shall be approved by the KARI prior to performance of the test, either by signature on cover page of by performance of a dedicated Test Readiness Review(TRR).

2.3. Precaution and Warnings

For all testing and handling, ESD requirements concerning personnel, facilities and test equipment shall be regarded.

No special hazard exists during the test.

The following precautions apply:

- Only trained personnel are allowed to handle the test specimen.
- A test cable or breakout box shall never be connected of disconnected when the test specimen is powered.
- Correct set-up of the test equipment has to be checked carefully prior to the connection/switch-on of flight hardware, e.g. bonding, grounding, voltages, current limiters, etc.
- The test specimen shell be protected by a clean, antistatic bag all the time no activities are performed at the hardware.

3. . Test Specifications

3.1. Shock

Table 3-1 is the qualification sinusoidal Shock specifications for the DTNPL in all three axes.

Table 3-1 Shock Level

Description	Freq. (Hz)	SRS (g)
+/- Y, +/- Z Upper Closure Wall (c)	100	10
	500	40
	1300	100
	2000	700
	100000	700

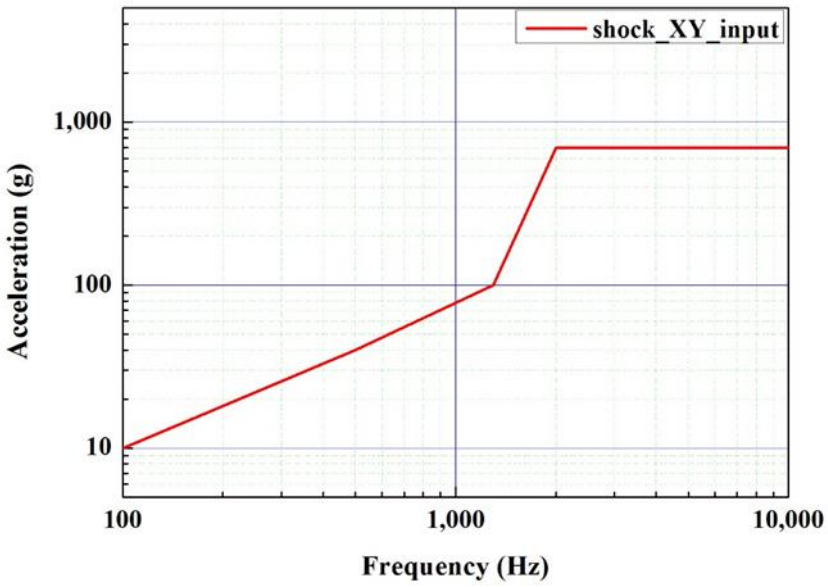

Figure 3-1 Shock Profile

3.2. DTNPL Function test item

- Initialization
- Operation Test

3.3. Test condition tolerances

Table 3-2 Test Condition Tolerances

Items	Tolerances
Response Spectrum Time History	+100%, -50% ±10%

3.4. Pass/fail criteria

The pass/fail for the Shock test is verified by the detailed visual check, function test. The pass/fail criteria are shown in the Table 3-3.

Table 3-3 Pass/Fail Criteria

Item	Requirement
Function	No anomaly

4. Test Equipment

The Shock excitation system and data acquisition system in KARI will be used for the Shock test.
The specifications of the shaker system and data measurement system are as shown in Table 4-1.

Table 4-1 Shock Test Equipment List

Name	Model No.	Manufacturer
Shock Tester	TBD	KARI
Accelerometer	TBD	TBD
Test Fixture Z Axis	DTNE-MD-164003A	Lumir
Test Fixture X-Y Axis	DTNE-MD-164004A	Lumir

5. Shock test configuration

5.1. Sensor location

Information of the sensors are indicated in Table 5-1. Normally two sensors will be attached beside mounting points and the maximum value is going to be used as criteria to know the responsive. The test sensor descriptions will be recorded on the Test Report.

Table 5-1 Sensors for Test

No.	ID	Sensor S/N	Coordinate		Remark
			Sensor	Equip	
1	C1(TBD)				Control
2	D1(TBD)				Measure
3	D2(TBD)				Measure
4	D3(TBD)				Measure

5.2. Shock test setup

5.2.1. Shock Test setup for x Axis

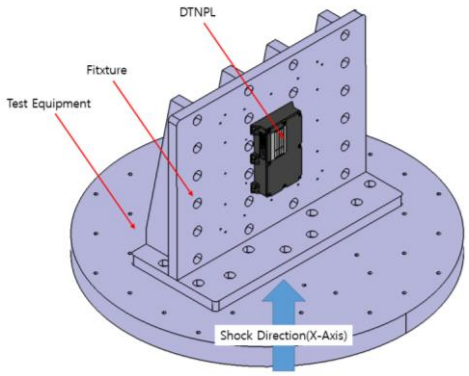

Figure 5-1 Test Configuration for X Axis

5.2.2. Shock Test setup for Y Axis

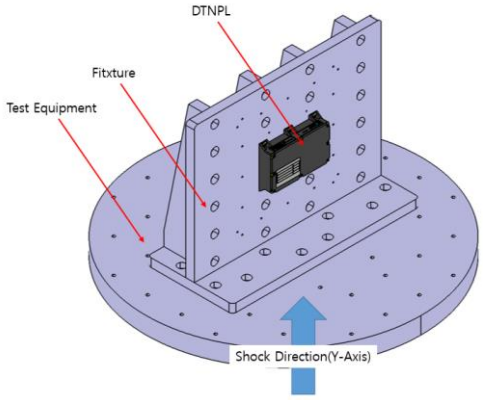

Figure 5-2 Test Configuration for Y Axis

5.2.3. Shock Test setup for Z Axis

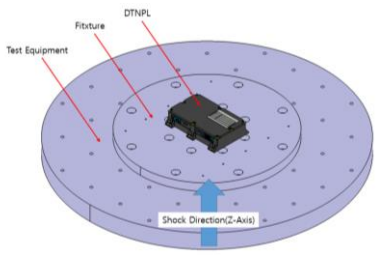

Figure 5-3 Test Configuration for Z Axis

6. Test Environments

The following test environment conditions shall be recorded prior to measurement.

6.1. equipment to be tested

Model Name:_____

6.2. test location

_____

6.3. Test personnel

The personnel required for the performance of the tests is listed below:

Test Engineers

The test engineers are responsible for:

- Operation of measuring instrumentation, data acquisition, data handling, data recording
- Identification and compilation of data sheet
- Safety precaution for test articles
- Test personnel to be present in the test area
- The accuracy of the measured values & Data report

Test Manager

The test manager is responsible for:

- Test articles and technical aspects of the test performance
- Record the correct software version for test article and EGSE
- Examination of disturbances
- Test article integration and handling
- Test performance
- Evaluation of test results & Providing of test reports

Quality Assurance Engineer

The QA engineer is responsible for:

- Surveillance of test equipment according to regulations as well as the test procedure
- Statement that the test articles to be tested have passed all checks before testing
- Checking the identification markings on the test articles
- Supervision of the proceeding with respect to quality assurance performance

The customer has the fight to participate or observe the test

Responsibility	Company /Dep.	Name
Test Engineer	Lumir / R&D	
Test Manager	Lumir / R&D	
Quality Assurance Engineer	Lumir / PA	
Facility Engineer	KARI	

7. Test Description

7.1. Shock test

The test shall be performed in accordance with the following sequences and the test results are recorded per the indicated method.

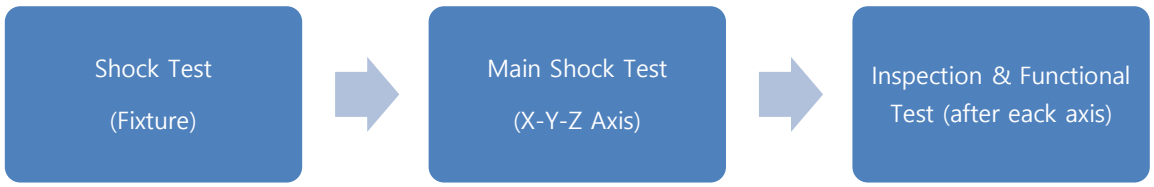

Figure 7-1 Shock Test Flow for DTNPL

8. Test Procedure

The test will be performed in accordance with Figure 2 and Table 6.

8.1. Shock Test For X-AXIS

(a) For the X-axis shock test, check and install the test equipment. (√) _____

(b) Assemble the test fixture and sensors.
(Refer to Figure Figure 2 and Table 8.for the sensor mounting location.) (√) _____

(c) Assemble the dummy model on the test fixture.
(Refer to Figure 3 for the mounting method and location.) (√) _____

(d) Perform the main shock test and calibrate the input data.
(It shall be performed at least three times to assure the input data.) (√) _____

_____

_____

_____

(e) Disassemble the dummy model and assemble the equipment on the test fixture and inspect the test configuration.
(Refer to Figure 3 for the mounting method and location.) (√) _____

_____

_____

_____

(f) Perform the main shock test in accordance with Table 2
(3 times) (√) _____

Start Date / Time	
End Date / Time	
Temperature ℃ (23±5℃)	
Relative Humidity % (60% maximum)	

(g) Generate shock response spectra for verification compliance with the spectrum level and tolerance for each channel and verify the results. (In order to have a successful shock test, more than 50% of the spectrum shall be higher than the nominal shock profile.) (√) _____

(h) After the shock test is finished, perform the visual inspection of the equipment. (If there is anything that does not match with the pass/fail criteria specified, the test shall be aborted.) (√) _____

(i) Test Results (√) _____

(j) Remove the equipment from the test fixture (√) _____

8.2. Shock Test For Y-AXIS

(a) For the X-axis shock test, check and install the test equipment. (√) _____

(b) Assemble the test fixture and sensors.
(Refer to Figure Figure 2 and Table 8.for the sensor mounting location.) (√) _____

(c) Assemble the dummy model on the test fixture.
(Refer to Figure 3 for the mounting method and location.) (√) _____

(d) Perform the main shock test and calibrate the input data.
(It shall be performed at least three times to assure the input data.) (√) _____

_____

_____

_____

(e) Disassemble the dummy model and assemble the equipment on the test fixture and inspect the test configuration. (√) _____
(Refer to Figure 4 for the mounting method and location.)

_____

_____

_____

(f) Perform the main shock test in accordance with Table 2
(3 times) (√) _____

Start Date / Time	
End Date / Time	
Temperature ℃ (23±5℃)	
Relative Humidity % (60% maximum)	

(g) Generate shock response spectra for verification compliance with the spectrum level and tolerance for each channel and verify the results. (In order to have a successful shock test, more than 50% of the spectrum shall be higher than the nominal shock profile.) (√) _____

(h) After the shock test is finished, perform the visual inspection of the equipment. (If there is anything that does not match with the pass/fail criteria specified, the test shall be aborted.) (√) _____

(i) Test Results (√) _____

(j) Remove the equipment from the test fixture (√) _____

8.3. Shock Test For Z-AXIS

(a) For the X-axis shock test, check and install the test equipment. (√) _____

(b) Assemble the test fixture and sensors.
(Refer to Figure Figure 2 and Table 8.for the sensor mounting location.) (√) _____

(c) Assemble the dummy model on the test fixture.
(Refer to Figure 3 for the mounting method and location.) (√) _____

(d) Perform the main shock test and calibrate the input data.
(It shall be performed at least three times to assure the input data.) (√) _____

_____

_____

_____

(e) Disassemble the dummy model and assemble the equipment on the test fixture and inspect the test configuration.
(Refer to Figure 6 for the mounting method and location.) (√) _____

_____

_____

_____

(f) Perform the main shock test in accordance with Table 2
(3 times) (√) _____

Start Date / Time	
End Date / Time	
Temperature ℃ (23±5℃)	
Relative Humidity % (60% maximum)	

g) Generate shock response spectra for verification compliance with the spectrum level and tolerance for each channel and verify the results.
(In order to have a successful shock test, more than 50% of the spectrum shall be higher than the nominal shock profile.) (√) _____

(h) After the shock test is finished, perform the visual inspection of the equipment. (If there is anything that does not match with the pass/fail criteria specified, the test shall be aborted.) (√)

(i) Test Results (√)

(j) Remove the equipment from the test fixture (√)

9. Test conclusions

The PA shall review the test data for acceptance of the Shock test.

The following sign off is verification that the test article has satisfactorily passed Shock test.

PA: _____ Date: _____