**Unitary Test Reports**

**Earth Observation Data Processing**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Name** | **Function** | **Signature** |
| **Prepared by** | Alberto Ignacio Ruiz Méndez |  |  |
| **Approved by** | Lucía Soto Santiago |  |  |
| **Authorised by** | Lucía Soto Santiago |  |  |

|  |  |
| --- | --- |
| **Date:** | 06/11/2023 |
| **Revision:** | 1.0 |
|  |  |

Revision Record

| **Review** | **Modification reference** | **Change Description** | **Date** |
| --- | --- | --- | --- |
| 1.0 | - | First issue | 14/09/2020 |

Table of Contents

[1. Introduction 5](#_Toc149775786)

[2. References 6](#_Toc149775787)

[2.1. Applicable Documents 6](#_Toc149775788)

[2.2. Reference Documents 6](#_Toc149775789)

[2.3. Acronyms 6](#_Toc149775790)

[3. EODP-TS-GEO-0001. DEM 7](#_Toc149775791)

[3.1. Pass/fail Criteria 7](#_Toc149775792)

[3.1.1. State Vector in ECEF 7](#_Toc149775793)

[3.1.2. Sun-synchronous Orbit 7](#_Toc149775794)

[3.1.3. Quaternions in ECEF 7](#_Toc149775795)

[3.1.4. Geolocation Matrices 7](#_Toc149775796)

[3.1.5. Acquisition Country 8](#_Toc149775797)

[3.1.6. Altitude Plots 8](#_Toc149775798)

[3.2. Summary: PASS/FAIL 8](#_Toc149775799)

[3.3. Test Results 8](#_Toc149775800)

[3.3.1. State Vector in ECEF 8](#_Toc149775801)

[3.3.2. Sun-synchronous Orbit 9](#_Toc149775802)

[3.3.3. Quaternions in ECEF 10](#_Toc149775803)

[3.3.4. Geolocation Matrices 10](#_Toc149775804)

[3.3.5. Acquisition Country 10](#_Toc149775805)

[3.3.6. Altitude Plots 11](#_Toc149775806)

[4. EODP-TS-ISM-0001. OPTICAL Optical Stage 12](#_Toc149775807)

[4.1. Pass/fail Criteria 12](#_Toc149775808)

[4.2. Summary: PASS/FAIL 12](#_Toc149775809)

[4.3. Test Results 12](#_Toc149775810)

[5. EODP-TS-ISM-0002. DETECTION and VIDEO CONVERSION 13](#_Toc149775811)

[5.1. Pass/fail Criteria 13](#_Toc149775812)

[5.2. Summary: PASS/FAIL 13](#_Toc149775813)

[5.3. Test Results 13](#_Toc149775814)

[6. EODP-TS-L1B-0001. EQUALIZATION AND RESTORATION 14](#_Toc149775815)

[6.1. Pass/fail Criteria 14](#_Toc149775816)

[6.2. Summary: PASS/FAIL 14](#_Toc149775817)

[6.3. Test Results 14](#_Toc149775818)

[7. EODP-TS-L1C-0001. MGRS 15](#_Toc149775819)

[7.1. Pass/fail Criteria 15](#_Toc149775820)

[7.2. Summary: PASS/FAIL 15](#_Toc149775821)

[7.3. Test Results 15](#_Toc149775822)

[8. EODP-TS-E2E-0001. TLS. 16](#_Toc149775823)

[8.1. Pass/fail Criteria 16](#_Toc149775824)

[8.2. Summary: PASS/FAIL 16](#_Toc149775825)

[8.3. Test Results 16](#_Toc149775826)

[9. Summary of test results 17](#_Toc149775827)

[10. Section 18](#_Toc149775828)

[10.1. Subsection 18](#_Toc149775829)

[10.1.1. Subsection 18](#_Toc149775830)

[10.1.1.1. Subsection 18](#_Toc149775831)

[10.1.1.1.1. Subsection 18](#_Toc149775832)

List of Tables

[Table 2‑1: Applicable Documents 6](#_Toc149775833)

[Table 2‑2: Reference Documents 6](#_Toc149775834)

[Table 2‑3: Acronyms 6](#_Toc149775835)

[Table 9‑1: Summary of test execution reports 17](#_Toc149775836)

List of Figures

[Figure 10‑1: Initial State Vector in ECEF. 8](#_Toc149775837)

[Figure 10‑1: Final State Vector in ECEF. 9](#_Toc149775838)

[Figure 10‑1: Total Number of State Vectors. 9](#_Toc149775839)

[Figure 10‑1: Sun-Synchronous Orbit Parameters. 9](#_Toc149775840)

[Figure 10‑1: First Quaternion in ECEF. 10](#_Toc149775841)

[Figure 10‑1: Last Quaternion in ECEF. 10](#_Toc149775842)

[Figure 10‑1: Geolocation Matrices Dimensions. 10](#_Toc149775843)

[Figure 10‑1: Geolocation Matrices Dimensions. 11](#_Toc149775844)

[Figure 10‑1: ISS low-res (weak). 18](#_Toc149775845)

# Introduction

This document provides the Unitary Test Reports for each of the algorithms specified in [EODP\_ATBD] and whose test is specified in [EODP\_SPE].

# References

## Applicable Documents

Table 2‑1: Applicable Documents

| **Ref.** | **Code** | **Title** | **Issue** |
| --- | --- | --- | --- |
| [EODP\_ATBD] | - | EODP Algorithm Theoretical Baseline Document | 1.0 |
| [EODP\_SPE] | - | EODP Unitary Test Specifications | 1.0 |

## Reference Documents

Table 2‑2: Reference Documents

| **Ref.** | **Code** | **Title** | **Issue** |
| --- | --- | --- | --- |
|  |  |  |  |

## Acronyms

Table 2‑3: Acronyms

| **Acronym** | **Description** |
| --- | --- |
| AD | Applicable Document |
| FYI | For Your Information |
| ISS | International Space Station |
| RD | Reference Document |
| TN | Technical Note |

# EODP-TS-GEO-0001. DEM

The goal of this test is to run the Geometry Module (GM) and to acquaint oneself with the EOCFIs. The Geometry Module is delivered as a functional code, no implementation is needed. In this test the GM shall be run with a DEM, and the goal is to obtain the profile of the altitudes.

## Pass/fail Criteria

The PASS/FAIL criteria defined for the Geometry Module contains the following test with a summarized justification of how they were obtained.

### State Vector in ECEF

* **Criteria**: What is the first and last state vector in ECEF; how many state vectors there are. Verify that the number of samples is coherent with the duration of the acquisition and the sampling time.

To identify the initial and final state vectors and calculate the total count of state vectors, you should examine the "*real\_orbit.xml*" file within the designated GM output folder. It can be verified the number of samples, acquisition duration, and sampling time (available in "gm\_local\_conf.xml") by performing the following calculations:

* To determine the acquisition duration, multiply the sampling time by the number of samples.
* To find the sampling time, divide the number of samples by the acquisition duration.

### Sun-synchronous Orbit

* **Criteria**: What is the Sun-synchronous orbit (defined in the Orbit Scenario File in the auxiliary folder).

The parameters governing the sun-synchronous orbit are specified within the auxiliary folder, “*osf\_sentinel2a.xml*”. The essential parameters to be verified include the repeat cycle, cycle length, ANX longitude, MLST, and MLST drift. These specific parameters define the sun-synchronous orbit.

### Quaternions in ECEF

* **Criteria**: What is the first and last quaternion in ECEF.

To ascertain the initial and final quaternions, it's essential to inspect the "*real\_attitude.xml*" file situated within the chosen GM output directory.

### Geolocation Matrices

* **Criteria**: What is the size of the geolocation matrices (lat, lon, alt).

The dimensions of the geolocation matrices can be found in the "*geolocation.nc*" file within the designated GM output folder. To access the projection images containing altitude, latitude, and longitude, open this file using Panoply. Finally, ensure you examine the file dimensions, specifically the variables "*n\_lines*" and "n\_columns."

### Acquisition Country

* **Criteria**: Over which country is the acquisition passing; what DEM file do you need to use.

After importing the geolocation file into Panoply, it is possible to observe the country through which the acquisition transpires. Following this, the DEM file can be procured by conducting a search within the ESA GETASSE repository. It is crucial to emphasize that the correct DEM file must be determined by referencing the South-West corner of the image's covered area.

### Altitude Plots

* **Criteria**: Plot the altitudes (in Panoply). Verify that the altitudes are not zeros (the simulation is correctly using the DEM).

After updating the relevant DEM file, altitudes can be plotted using Panoply. To verify the accuracy of the data, a comparison can be conducted between the data array obtained from Panoply and a thorough check to ensure that there are no zero values.

## Summary: PASS/FAIL

This exercise is a **PASS**.

## Test Results

This section contains the results, plots and descriptions that supports the pass/fail criteria.

### State Vector in ECEF

A screenshot of a computer code

Description automatically generated

Figure 3‑1: Initial State Vector in ECEF.

A screenshot of a computer code

Description automatically generated

Figure 3‑2: Final State Vector in ECEF.



Figure 3‑3: Total Number of State Vectors.

Considering the configuration parameters specified in the [EODP\_SPE] for both the total propagation time (20 seconds) and the sampling time (0.00672 seconds, it is readily ascertainable that the total count of samples aligns with these defined values.

In accordance with this configuration, if one were to divide the total propagation time or acquisition duration by the number of samples, it should yield the sampling time as the result. Thus:

Conversely, when the sampling time is multiplied by the number of samples, it should yield the total propagation time as the outcome.

### Sun-synchronous Orbit

A screenshot of a computer code

Description automatically generated

Figure 3‑4: Sun-Synchronous Orbit Parameters.

### Quaternions in ECEF

A number and date on a white background

Description automatically generated

Figure 3‑5: First Quaternion in ECEF.

A number and numbers on a white background

Description automatically generated

Figure 3‑6: Last Quaternion in ECEF.

### Geolocation Matrices

The number of lines and columns is obtained from Panoply. Therefore, the geolocation matrices (latitude, longitude and altitude) dimensions are **2976 x 1000**.

A white screen with black text

Description automatically generated

Figure 3‑7: Geolocation Matrices Dimensions.

### Acquisition Country

In Figure *3*‑*8*, a depiction of the acquisition path in terms of latitude is presented alongside the corresponding geographical coordinates, including latitude and longitude (in this case, approximate values of 30.8°N and 3.55°E, respectively), displayed in Google Earth.

Upon examining Figure *3*‑*8*, it is evident that the country encompassing the acquisition path is Algeria.

A map of the world

Description automatically generated

A map of the world

Description automatically generated A map of the world

Description automatically generated

Figure 3‑8: Location of Data Acquisition Country.

To accurately select the appropriate Digital Elevation Model (DEM) file from the ESA GETASSE repository, one must focus on the South-West corner of the imaged area. As mentioned earlier, an estimated midpoint of the acquisition path is situated at approximately 30.8°N and 3.55°E. Consequently, the corresponding South-West corner coordinates are approximately 30.0°N and 0.0°E, considering that the set of Digital Elevation Model tiles covers an area spanning 15 degrees of longitude by 15 degrees of latitude. The requisite DEM file in this case is "***30N000E.GETASSE30***."

### Altitude Plots

After updating the DEM file, altitude data can be visualized and plotted using Panoply, as demonstrated in Figure *3*‑*8*. A straightforward method to confirm the presence of non-zero values within the altitude array is to examine this figure. The minimum value for altitude, which is 335.1 meters, serves as the reference point on the color bar. In the event of encountering a zero value, it would correspond to the lower limit of the color scale.

A blue and yellow chart with red and yellow flames

Description automatically generated with medium confidence

Figure 3‑8: Altitude Plot.

# EODP-TS-ISM-0001. OPTICAL Optical Stage

The goal of this test is to run the ISM Module and to check the optical stage: the spectral integration of

the ISRF filter, the conversion of radiances to irradiances and the spatial filter (MTF).

## Pass/fail Criteria

The PASS/FAIL criteria defined for the ISM Module the following test with a summarized justification of how they were obtained.

### Instrument Spectral Response TOA

* **Criteria**:

### Optical Stage TOA

* **Criteria**:

### Radiance to Irradiance Conversion Factor

* **Criteria**:

### System MTF Plots

* **Criteria**:

### Border Effect Cause

* **Criteria**:

### TOA Plots

* **Criteria**:

## Summary: PASS/FAIL

This exercise is a PASS.

## Test Results

*Plots, results, description, anything that supports the pass/fail criteria*

# EODP-TS-ISM-0002. DETECTION and VIDEO CONVERSION

## Pass/fail Criteria

*In this section justify point by point each of the pass/fail criteria defined in [EODP\_SPE].*

## Summary: PASS/FAIL

This exercise is a PASS.

*(If all the pass fail criteria are met)*

## Test Results

*Plots, results, description, anything that supports the pass/fail criteria*

# EODP-TS-L1B-0001. EQUALIZATION AND RESTORATION

## Pass/fail Criteria

*In this section justify point by point each of the pass/fail criteria defined in [EODP\_SPE].*

## Summary: PASS/FAIL

This exercise is a PASS.

*(If all the pass fail criteria are met)*

## Test Results

*Plots, results, description, anything that supports the pass/fail criteria*

# EODP-TS-L1C-0001. MGRS

## Pass/fail Criteria

*In this section justify point by point each of the pass/fail criteria defined in [EODP\_SPE].*

## Summary: PASS/FAIL

This exercise is a PASS.

*(If all the pass fail criteria are met)*

## Test Results

*Plots, results, description, anything that supports the pass/fail criteria*

# EODP-TS-E2E-0001. TLS.

## Pass/fail Criteria

*In this section justify point by point each of the pass/fail criteria defined in [EODP\_SPE].*

## Summary: PASS/FAIL

This exercise is a PASS.

*(If all the pass fail criteria are met)*

## Test Results

*Plots, results, description, anything that supports the pass/fail criteria*

# Summary of test results

This table summarizes the results of the execution:

*Fill in with the results (PASS/FAIL) of the tests above.*

Table 9‑1: Summary of test execution reports

|  |  |  |
| --- | --- | --- |
| **Test ID** | **PASS/FAIL** | **Comments** |
| EODP-TS-GEO-0001 | PASS |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# Section

This section has example of titles levels:

## Subsection

Example Text.

### Subsection

Example Text.

#### Subsection

Example Text.

##### Subsection

Example Text.

* Indent
* Indent
* Indent



Figure 10‑1: ISS low-res (weak).

END OF DOCUMENT