ZONE OVERPASS TOOL – FILE TRANSFER DOCUMENT

1. INTRODUCTION

This is the File Transfer Document for the ZoneOverPass executable program that calculates the entry and exit time when a given instrument swath passes over a zone or set of zones.

1.1 Change History

Issue	Change Description
1.3	First Issue
1.3.1	Update *mission_configuration_files* folder to v1.2
1.4	Update *mission_configuration_files* folder to v1.3 ZoneOverPass generates HTML output files Corrected path to ORBIT SDF for Aeolus

1.2 Distribution List

Project/Unit	Name	Project/Unit	Name	Project/Unit	Name

1.3 Reference Documents

[RD 01] Earth Observation Mission CFI Software. EO_DATA_HANDLING Software User Manual.
Ref. EO-MA-DMS-GS-0007. Issue 4.11- 15/04/15

[RD 02] OGC® KML Standard
Ref. OGC 12-007r2 - Version: 2.3.0 - Date: 2015-08-04

2. ARCHIVE CONTENT

Separate archive files are available, to support execution in Linux, Mac OS X and Windows platforms.

2.1 Linux 64-bit

The following archive file has been delivered (compressed with the zip utility):
ZoneOverPass_LINUX64_v1_4_date_26_MAR_2017.zip

The archive has the following MD5 checksum:
b2f05c4600d4b9a12a6c36bc42d82de4

The archive contains the following files:

```
EXAMPLE_ZONEDBFILE.EOF
input_config_file_S2A_MSI.txt
input_config_file_S2A_ORBIT.txt
input_config_file_S3A_OLCI.txt
mission_configuration_files/…
overpass_table.css
Readme.txt
ZoneOverPass
```

2.2 Mac OS X 64-bit

The following archive file has been delivered (compressed with the zip utility):
ZoneOverPass_MACIN64_v1_4_date_26_MAR_2017.zip

The archive has the following MD5 checksum:

d45ceeec938d8f989eaf29cbeb3798b9

The archive contains the following files:

```
EXAMPLE_ZONEDBFILE.EOF
input_config_file_S2A_MSI.txt
input_config_file_S2A_ORBIT.txt
input_config_file_S3A_OLCI
mission_configuration_files/…
overpass_table.css
Readme.txt
ZoneOverPass
```

2.3 Windows 32-bit

The following archive file has been delivered (compressed with the zip utility):
ZoneOverPass_WINDOWS32_v1_4_date_26_MAR_2017.zip

The archive has the following MD5 checksum:
f14ac0bbf5f940a0e16ce9f7421ff066

The archive contains the following files:

```
EXAMPLE_ZONEDBFILE.EOF
input_config_file_S2A_MSI.txt
input_config_file_S2A_ORBIT.txt
input_config_file_S3A_OLCI
overpass_table.css
pthreadVC2.dll
mission_configuration_files\…
Readme.txt
ZoneOverPass.exe
```

3. ARCHIVE CONTENT DESCRIPTION

The files contained in the archives are described in table below:

File		Description
EXAMPLE_ZONEDBFILE.EOF		Example Zone Database File
input_config_file_S2A_MSI.txt		Example configuration file of SENTINEL2A with MSI swath, with example zone database file
input_config_file_S2A_ORBIT.txt		Example configuration file of SENTINEL2A with ORBIT ground-track, with example zone database file
input_config_file_S3A_OLCI.txt		Example configuration file of SENTINEL3A with OLCI swath, with example zone database file
mission_configuration_files/…		Default input orbit files and swath files for Aeolus, Sentinel1A, Sentinel1B, Sentinel2A, Sentinel3A, Sentinel5P
Readme.txt		Readme file with example commands and input/output file description
overpass_table.css		CSS stylesheet file for HTML output
For LINUX 64-bit	ZoneOverPass	Executable file for Linux
For MAC OS X 64-bit	ZoneOverPass	Executable file for Mac OS X
For WINDOWS 32-bit	ZoneOverPass.exe	Executable file for Windows
	pthreadVC2.dll	Auxiliary pthread library for Windows

4. INSTALLATION

The archive can be expanded with Winzip / 7-zip (in MS Windows) or with the command unzip (in Linux/Mac OS).

5. USAGE

5.1 Executable program *ZoneOverPass*

For a requested UTC time interval, the executable program *ZoneOverPass* calculates the entry and exit times when a given instrument swath passes over a zone or set of zones. The program expects as input a configuration file setting the various input parameters, among them the mission name, orbit file, zone database file and instrument swath name.

The default orbit and swath characteristics are defined in the mission configuration files folder. It is possible to provide as orbit file other types of EOCFI-compatible OSV-based orbit files see ([RD 01]), e.g. Predicted Orbit File (ORBPRE file type) or Restituted Orbit Files (ORBRES file type).

The program generates a set of output files with the overpass tables per zone (in .CSV, .KML format and .HTML format).

5.1.1 Command line input parameters description

The command line parameters of the executable routine are the following (provided in the order in which they have to be supplied):

INPUT PARAMETERS	Definition	Value
Input Configuration File	Filename (it may include the path to the file)	Given by the user
UTC Start Time	UTC start time of the time interval CCSDS-A ASCII format with seconds (YYYY-MM-DDTHH:mm:ss)	Given by the user
UTC Stop Time	UTC stop time of the time interval CCSDS-A ASCII format with seconds (YYYY-MM-DDTHH:mm:ss)	Given by the user

5.1.2 Input configuration file format description

The contents of the input configuration file are detailed below:

INPUT PARAMETERS	Definition	Value	
Satellite	Satellite identifier	AEOLUS SENTINEL1A SENTINEL1B SENTINEL2A SENTINEL3A SENTINEL5P	
Orbit Filename	Orbit Filename Default: Orbit Scenario Filename in mission_configuration_files folder	Given by the user	
Zone Database Filename	File with list of zones, in EO CFI / Esov NG Zone Database format	Given by the user	
Instrument Swath	Instrument swath name	AEOLUS	ORBIT ALADIN

		SENTINEL1A SENTINEL1B	ORBIT SM1 to SM6 EW1 to EW5 IW1 to IW3 WV1 to WV2 WEW WIW
		SENTINEL2A	ORBIT MSI
		SENTINEL2B	ORBIT MSI
		SENTINEL3A	ORBIT OLCI SRAL SLSTR_N SLSTR_B MWR
		SENTINEL5P	ORBIT TROPOMI

5.1.3 Output file format description

The executable program *ZoneOverPass* produces two output files per zone in Zone Database file:

- Comma Separated Value (.CSV)
- Google Earth KML file (.KML)
- Web browser HTML file (.HTML)

The output file names are automatically generated using the satellite identifier, the zone name, the swath name and the start and stop UTC times.

5.1.3.1 CSV Files

The CSV output file contains one row per each entry/exit visibility time segment, format of the CSV output file:

- Row 1-7: Header containing execution input information
- From Row 8:
  - Column 1: UTC Time Start in calendar format (CCSDS format “yyyy-mm-ddThh:mm:ss”)
  - Column 2: Absolute Orbit Start
  - Column 3: Start Seconds since Ascending Node Crossing (ANX)
  - Column 4: UTC Time Stop in calendar format (CCSDS format “yyyy-mm-ddThh:mm:ss”)
  - Column 5: Absolute Orbit Stop
  - Column 6: Stop Seconds since Ascending Node Crossing (ANX)
  - Column 7: Pass Duration (seconds)
  - Column 8: Ascending or Descending Pass (ASC/DESC)
  - Column 9: Zone Name
  - Column 10: Instrument Swath Name
- Last Row: End of file (EOF)

The CSV files can be opened with dedicated spreadsheet software (e.g. Excel, LibreOffice) or any text editor.

5.1.3.2 KML Files

The KML output file contains the same information as the CSV but presented graphically.
The format of the provided KML files is defined in KML Version 2.3 standard (see [RD 02]).

The KML files can be opened with Google Earth v7 or higher.

5.1.3.3 HTML Files

The HTML output file contains the same information as the CSV but presented in a tabular format, ready to be displayed in a web browser. A CSS stylesheet (*overpass_table.css*) is provided as part of the package to apply a given style to the HMTL elements. The HTML output file requires the CSS stylesheet to be located in the same folder.

The HTML files can be opened with any web browser (e.g. Firefox). Once opened in a web browser, it is possible to export the HTML report to PDF.

5.1.4 Example

5.1.4.1 Running the executable

The executable program can be called in the following way:

- From Mac OSX / Linux Terminal window

```
./ZoneOverPass input_config_file_S2A_MSI.txt 2016-06-06T00:00:00 2016-06-08T00:00:00
```

- From Windows command prompt window

```
ZoneOverPass.exe input_config_file_S2A_MSI.txt 2016-06-06T00:00:00 2016-06-08T00:00:00
```

The executable program shows the following messages:

```
Execution of program ZoneOverPass v1.4

Input data set by the user:
Satellite: SENTINEL2A
Orbit File:
./mission_configuration_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.
EOF
Swath ID: MSI
Zone File: EXAMPLE_ZONEDBFILE.EOF
Start Time: 2016-06-06T00:00:00
Stop  Time: 2016-06-08T00:00:00
Start Time: 6001.000000000000
Stop Time: 6003.000000000000
Start Orbit: 4989
Stop  Orbit: 5018
Output Filename KML:
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
Output Filename CSV:
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
Output Filename HTML:
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Output Filename KML:
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
Output Filename CSV:
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
Output Filename HTML:
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Output Filename KML: S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
```

```
Output Filename CSV: S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
Output Filename HTML: S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Output Filename KML: S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
Output Filename CSV: S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
Output Filename HTML:
S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Output files created successfully
```

5.1.4.2 Input File

Contents of the input configuration file used as example (`input_config_file_S2A_MSI.txt`):

```
SENTINEL2A
./mission_configuration_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.
EOF
EXAMPLE_ZONEDBFILE.EOF
MSI
```

5.1.4.3 Output Files

5.1.4.3.1 CSV Files

Several CSV output files are created (on per zone in zone database file):

```
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
```

Example output file *S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV*:

```
FILENAME,  S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV,,
 CREATION_DATE,  2017-03-06T11:10:15,,
 EXECUTABLE_NAME_VERSION,  ZoneOverPass_v1.4,,
 ORBIT_FILE,
./mission_configuration_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.
EOF,,
 VALIDITY_START,  2016-06-06T00:00:00,,
 VALIDITY_STOP,  2016-06-08T00:00:00,,
 PASS,    UTC_TIME_START,      ABS_ORBIT_START,    ANX_TIME_START[s],    UTC_TIME_STOP,
ABS_ORBIT_STOP,    ANX_TIME_STOP[s],  DURATION[s],   ASCENDING/DESCENDING PASS,  ZONE,   SWATH
   1,   2016-06-06T08:04:58,   4994,   2709.512780,   2016-06-06T08:19:39,   4994,   3590.399234,
0880.886454,   DESC,  AFRICA,  MSI,
   2,   2016-06-06T09:42:05,   4995,   2494.592276,   2016-06-06T09:51:21,   4995,   3050.444357,
0555.852081,   DESC,  AFRICA,  MSI,
   3,   2016-06-06T11:21:32,   4996,   2419.690834,   2016-06-06T11:29:09,   4996,   2876.397840,
0456.707006,   DESC,  AFRICA,  MSI,
   4,   2016-06-06T19:06:43,   5001,   0119.981559,   2016-06-06T19:07:48,   5001,   0185.651548,
0065.669989,   ASC,  AFRICA,  MSI,
   5,   2016-06-06T20:37:27,   5001,   5564.158086,   2016-06-06T20:54:06,   5002,   0521.888342,
0999.688426,   ASC,  AFRICA,  MSI,
   6,   2016-06-06T22:27:43,   5003,   0096.122194,   2016-06-06T22:35:48,   5003,   0581.624151,
0485.501957,   ASC,  AFRICA,  MSI,
   7,   2016-06-07T07:36:53,   5008,   2836.619703,   2016-06-07T07:40:21,   5008,   3045.035446,
0208.415743,   DESC,  AFRICA,  MSI,
   8,   2016-06-07T07:42:35,   5008,   3178.817503,   2016-06-07T07:44:52,   5008,   3315.290661,
0136.473158,   DESC,  AFRICA,  MSI,
   9,   2016-06-07T09:11:43,   5009,   2484.276092,   2016-06-07T09:26:31,   5009,   3372.797484,
0888.521392,   DESC,  AFRICA,  MSI,
  10,   2016-06-07T10:50:56,   5010,   2395.346026,   2016-06-07T11:00:03,   5010,   2942.840904,
0547.494878,   DESC,  AFRICA,  MSI,
  11,   2016-06-07T20:10:12,   5015,   5742.044916,   2016-06-07T20:24:09,   5016,   0536.574156,
0836.487410,   ASC,  AFRICA,  MSI,
  12,   2016-06-07T21:47:23,   5016,   5530.873373,   2016-06-07T21:51:43,   5016,   5791.333251,
0260.459878,   ASC,  AFRICA,  MSI,
  13,   2016-06-07T21:55:22,   5016,   6010.181800,   2016-06-07T21:56:03,   5017,   0008.881835,
0040.658204,   ASC,  AFRICA,  MSI,
  14,   2016-06-07T21:57:10,   5017,   0076.513713,   2016-06-07T22:05:57,   5017,   0602.952671,
0526.438958,   ASC,  AFRICA,  MSI,
EOF,,,,,,,,
```

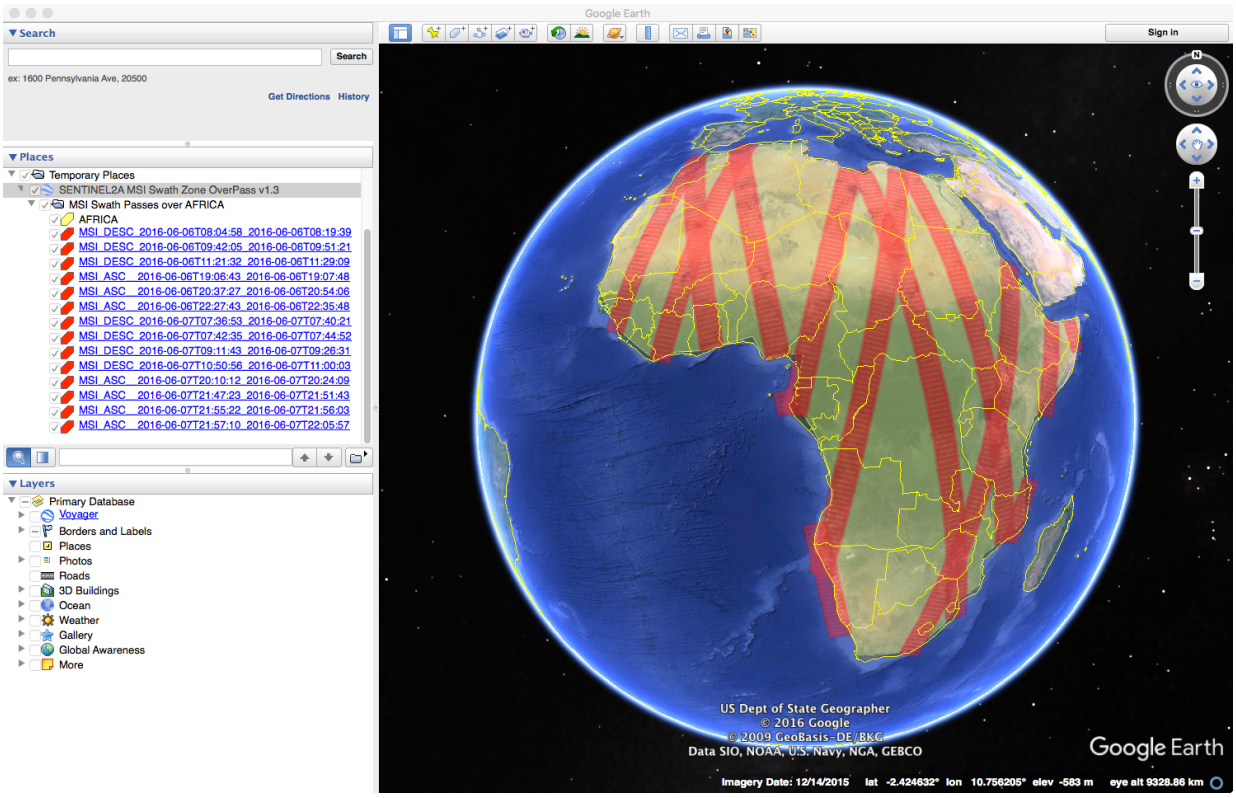
5.1.4.3.2 KML Files

Several KML output files are created (on per zone in zone database file):

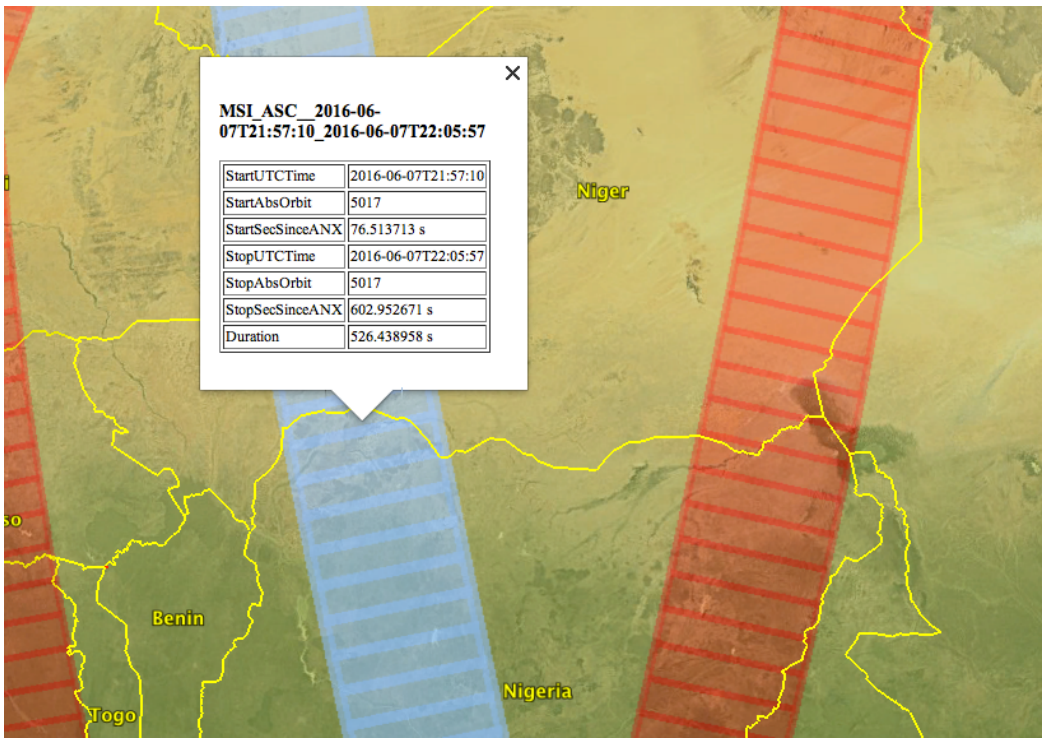
```
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
```

After loading the files with Google Earth, the overpass data can be found in the “Places” window, under “Temporary Places”.

Example output file *S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML*:



When moving the mouse over the swaths, the lines are highlighted (increase in thickness and lighter in colour). Then by clicking on top of the track, a balloon showing additional information is displayed, namely the absolute and relative orbit number sand the longitude and UTC time of the ascending node crossing of the selected orbit.



5.1.4.3.3 HTML Files

Several HTML output files are created (on per zone in zone database file):

```
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
```

By double-clicking on the HTML file, it opens with the default browser, applying the style from CSS stylesheet.
Example output file
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML:

ZONE OVERPASS TABLE HTML REPORT

Creation Date: 2017-03-26T10:29:29

Filename	S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Executable Name and Version	ZoneOverPass_v1.4
Orbit File	./mission_configuration_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.EOF
Validity Start	2016-06-06T00:00:00
Validity Stop	2016-06-08T00:00:00

Zone Overpass Table

Pass	UTC Time Start	Abs Orbit Start	ANX Time Start[s]	UTC Time Stop	Abs Orbit Stop	ANX Time Stop[s]	Duration[s]	Ascending / Descending	Zone	Swath
1	2016-06-06T08:04:58	4994	2709.512780	2016-06-06T08:19:39	4994	3590.399234	880.886454	DESC	AFRICA	MSI
2	2016-06-06T09:42:05	4995	2494.592276	2016-06-06T09:51:21	4995	3050.444357	555.852081	DESC	AFRICA	MSI
3	2016-06-06T11:21:32	4996	2419.690834	2016-06-06T11:29:09	4996	2876.397840	456.707006	DESC	AFRICA	MSI

6. TECHNICAL DETAILS AND ASSUMPTIONS

6.1 Earth Observation CFI Software Version

The dataset will be generated using EO CFI v4.11.