



SPECIFICATIONS

Sentinel-2 Product Unit Definition and Metadata ICD

Reference	ESA-EOPG-EOPGC-SP-2
Issue/Revision	1.8
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CHANGE LOG

Sentinel-2 Product Unit Definition and Metadata ICD	Issue Nr.	Revision Number	Date
Update of Sentinel-2 Product Data Items, Auxiliary Products and consolidation of Tables	1	1	Feb. 2020
Addition of format for AUX data; Update on the usage of “qualityInfo” attribute; Updates to the “Sentinel-2 Product Attributes Mapping” document	1	2	Apr. 2020
Update in line with EOP GMQ review	1	4	Sep. 2020
Addition of OLQC files	1	5	Nov. 2020
Update following “Checkpoint 2020”	1	6	Apr. 2021
Update for “Checkpoint 2022”	1	7	Oct. 2022
“Checkpoint 2022” comments update	1	8	Apr. 2023

CHANGE RECORD

Issue Number 1	Revision Number 1		
Reason for change	Date	Pages	Paragraph(s)
Update of Sentinel-2 Product Items and Table 2-1	Jan. 2020	7	2.1
Significant update to Table 2-2	Jan. 2020	8-11	2.2
Removal of Properties that do not map to Sentinel-2 metadata from Table 3-1	Jan. 2020	12	3
Consolidation of OData Attributes in Table 4-1 and mapping to the newly introduced Product Items	Jan. 2020	12	4
Addition of L2A TCI Product Item	Feb. 2020	Multiple	Multiple

Issue Number 1	Revision Number 2		
Reason for change	Date	Pages	Paragraph(s)
Update of [RD-1] version, containing the updated TCI PDI format description	Apr. 2020	6	Table 1-1
Addition of format column for the Sentinel-2 Auxiliary Data	Apr. 2020	8-11	Table 2-2
Update on the usage of “qualityInfo” attribute	Apr. 2020	15	Table 4-1
Updates to the “Sentinel-2 Product Attributes Mapping” to align with the clarifications provided as part of the LTA ITT	Apr. 2020	“Sentinel-2 Product Attributes Mapping.xls”	All spreadsheets

Issue Number 1	Revision Number 3		
Reason for change	Date	Pages	Paragraph(s)
Update to Reference Documents	Jun. 2020	6	1.3

Issue Number 1	Revision Number 4		
Reason for change	Date	Pages	Paragraph(s)
Update to Reference Documents	Sep. 2020	6	1.3
Addition of Auxiliary Data definition	Sep. 2020	7	1.5
Addition of GIP_CLOPAR and AUX_GRIXXX Auxiliary product types	Sep. 2020	8-11	Table 2-2
Removal of GS Element Applicability columns	Sep. 2020	7	Table 2-1

Issue Number 1	Revision Number 5		
Reason for change	Date	Pages	Paragraph(s)
Addition of OLQC files	Nov. 2020	11, 15	2.3, Table 4-1

Issue Number 1	Revision Number 6		
Reason for change	Date	Pages	Paragraph(s)
Reference Documents update	Apr. 2021	6	1.3
Addition of ADG and CAMS acronyms	Apr. 2021	7	1.4
Update of Data Provider for AUX_PREORB and AUX_RESORB	Apr. 2021	8	Table 2-2
Addition of AUX_CAMSFO, AUX_CAMSAN and AUX_CAMSRE auxiliary product types	Apr. 2021	8	Table 2-2
Removal of DD applicability	Apr. 2021	13, 15	Table 3-1, Table 4-1
Removal of GS Applicability from Table 3-1	Apr. 2021	13	Table 3-1
Addition of ADG applicability for OData attributes related to AUX products	Apr. 2021	15	Table 4-1

Issue Number 1	Revision Number 7		
Reason for change	Date	Pages	Paragraph(s)
Addition of [AD-1] applicable document	Oct. 2022	6	1.2
Removal of Table 2-1 (New reference to [AD-1])	Oct. 2022	7	2.1
Addition of GeoFootprint property	Oct. 2022	12	Table 3-1
Removal of “coordinates” OData attribute in favour of the usage of Footprint and GeoFootprint properties	Oct. 2022	15	Table 4-1
Replacement of Data Distribution (DD) with Data Access (DA)	Oct. 2022	7, 15	1.4, Table 4-1
Addition of DA applicability	Oct. 2022	15	Table 4-1
Addition of L1C and L2A End User Products attributes mapping	Oct. 2022	15	Table 4-1
Alignment of OLQC attributes	Oct. 2022	15	Table 4-1



Issue Number 1	Revision Number 8		
Reason for change	Date	Pages	Paragraph(s)
Addition of GIP_HRTPAR Auxiliary Data	Apr. 2023	11	Table 2-1
Removal of L1C and L2A EUP attributes mapping	Apr. 2023	15	Table 4-1
Addition of datastripId attribute applicability for TCI products	Apr. 2023	15	Table 4-1



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1 INTRODUCTION

1.1 Purpose and Scope

The scope of this document is to be used as an annex for the CSC Common Entity Definition Document [RD-2] in order to describe the Product Entity Properties, the Product Attributes and the corresponding metadata elements that shall be catalogued and queryable for Sentinel products. This document provides the mapping and packaging format for the Sentinel-2 product items.

1.2 Applicable Documents

ID	Document Reference	Document Title	Issue	Date
[AD-1]	ESA-EOPG-EOPGC-TN-58	Copernicus Ground Segment Sentinels Data Flow Configuration	1.2	06/04/2023

Table 1-1 – Applicable Documents

1.3 Reference Documents

ID	Document Reference	Document Title
[RD-1]	S2-PDGS-TAS-DI-PSD	Sentinel-2 Products Specification Document
[RD-2]	ESA-EOPG-EOPGC-IF-5	Copernicus Space Component Ground Segment - Common Entity Definition Document
[RD-3]	OGC 17-003r2	OGC EO Dataset Metadata GeoJSON(-LD) Encoding Standard
[RD-4]	OGC 10-157r4	OGC Earth Observation Metadata profile of Observations & Measurements
[RD-5]	ESA-EOPG-EOPGC-TN-13	Copernicus Space Component Ground Segment Operations Glossary
[RD-6]	GMES-S2GS-EOPG-TN-13-0004	Sentinel-2 GRI Format Specification Document

Table 1-2 – Reference Documents

1.4 Acronyms, Definitions and Abbreviations

Acronym	Description
ADG	Auxiliary Data Gathering
AUX	Auxiliary
CAMS	Copernicus Atmosphere Monitoring Service
CSC	Copernicus Space Component
DA	Data Access
EUP	End User Product
GS	Ground Segment
ICD	Interface Control Document
JSON	JavaScript Object Notation
LTA	Long Term Archiving
MPC	Mission Performance Cluster
ODP	On-Demand Processing
OLQC	On Line Quality Control
PDGS	Payload Data Ground Segment
PDI	Product Data Item
PR	Systematic Production
TCI	True Colour Image
SAFE	Standard Archive Format for Europe

Table 1-3 – Acronyms and Abbreviations

1.5 Definitions

Auxiliary Data – Data which enhance processing and utilization of remote sensing instrument data. The auxiliary data are not necessarily captured by the same data collection process as the instrument data. Auxiliary data include data collected by any other platform or process (e.g. meteorological data from ECWMF or NCEP), data providing processing configuration information typically for data calibration and or instrument characterisation (e.g. processing auxiliary files), and data providing information on satellite position and velocity (orbit auxiliary files). Auxiliary data help in data processing, but are also data sets in their own right and may be relevant for end-users in specific *User Level Data* exploitation scenarios.

2 SENTINEL-2 PRODUCTS AND AUXILIARY DATA

2.1 Sentinel-2 Product Items

[AD-1] describes the list of Sentinel-2 product items which are required to be circulated within the Copernicus Space Component (CSC) GS elements (e.g. from Systematic Production to Long Term Archiving or Data Access systems).

Each Sentinel-2 PDI will be packaged independently of other related PDIs (e.g. of the same datatake), and it is these PDIs that will be circulated between the various CSC GS elements. Each Granule and Datastrip PDI is a tar file consisting of data and metadata. The structures of these Granules and Datastrip PDIs are defined in [RD-1].

A Sentinel-2 Granule PDI contains among its metadata the “Parent_ID” / “DATASTRIP_ID” (corresponding to the “datastripId” attribute, Table 4-1) related to the corresponding Datastrip PDI linked to the Granule. This link establishes the hierarchy between Granule and Datastrip, thus maintaining the relationship at metadata level. Moreover, each Datastrip PDI contains among its metadata the “Group_ID” (“productGroupId” attribute) and this link establishes the hierarchy between Granule/Datastrip and the Datatake.

Level-1C True Colour Image products will be generated and archived independently as well. A Level-1C TCI product will consist of a JPEG 2000 file (jp2), which will have the product metadata embedded in the jp2 file structure.

The Level-1C and Level-2A Granule PDIs represent ortho-images/tiles of 100x100km² in UTM/WGS84 projection, the Granule is in this case a Tile.

Sentinel-2 Level-1 and Level-2 products disseminated via the Data Access service are currently not included in this document. These products will not be disseminated as PDIs, instead, they will be assembled into final User Level Data.

The specifications and structures of all Sentinel-2 Product Data Items and User Products are defined in the Sentinel-2 Products Specification Document [RD-1].

2.2 Sentinel-2 Auxiliary Data

[AD-1] and Table 2-1 presents the list of Sentinel-2 Auxiliary Data which are required to be circulated between the CSC GS elements.

Product Type	Data Provider	Description	Format	Band-ID Discriminator
AUX_ECMWFD	ECMWF	Auxiliary Data File which contains weather forecast parameters for 3 geophysical variables: total column ozone, total column water vapour and mean sea level pressure.	TGZ	
AUX_PREORB	POD	This file contains the predicted Orbit State Vectors (OSV) generated by the orbit determination process of the POD Service. The OSV is calculated in Earth-	EOF	

		fixed Coordinate Frame, whenever the S/C crosses the J2000 equator.		
AUX_RESORB	POD	This file contains the restituted Orbit State Vectors (OSV) based on the orbit determination performed by the POD Service. The State Vectors will be in Earth-fixed reference.	EOF	
AUX_GNSSRD	POD	Daily GNSS L1b RINEX files	EOF	
AUX_PROQUA	POD	Processed Quaternions Files	EOF	
AUX_UT1UTC	IERS	The International Earth Rotation Service (IERS) Bulletin A, which contains rapid determinations for earth orientation parameters (Earth orientation parameters x/y pole, UT1-UTC and their errors).	TGZ	
AUX_CAMSFO	CAMS	Copernicus CAMS 'Forecast' Dataset with a sub-selection of 10 geophysical variables	TGZ	
AUX_CAMSAN	CAMS	Copernicus CAMS 'Analysis' Dataset	TGZ	
AUX_CAMSRE	CAMS	Copernicus CAMS 'Re-analysis' Dataset	TGZ	
GIP_ATMIMA	Cal/Val (MPC)	IAS AnaTm image parameters file (Type_1)	TGZ	
GIP_ATMSAD	Cal/Val (MPC)	IAS AnaTm image parameters file (Type_1)	TGZ	
GIP_DATATI	Cal/Val (MPC)	IAS Datation parameters file (Type_1)	TGZ	
GIP_LREXTR	Cal/Val (MPC)	LR Extraction parameters file (Type_1)	TGZ	
GIP_INVLOC	Cal/Val (MPC)	InitLoc Inv parameters file (Type_1)	TGZ	
GIP_VIEDIR	Cal/Val (MPC)	Pixel line of sight for each bands in the focal plane reference frame (Type_1)	TGZ	X
GIP_SPAMOD	Cal/Val (MPC)	Platform model (Type_1)	TGZ	
GIP_BLINDP	Cal/Val (MPC)	List of blind pixels (Type_1)	TGZ	
GIP_CLOINV	Cal/Val (MPC)	CloudInv parameter file (Type_1)	TGZ	
GIP_CLOPAR	Cal/Val (MPC)	Cloud mask file	TGZ	
GIP_PRDLOC	Cal/Val (MPC)	InitLoc production parameters file (Type_1)	TGZ	
GIP_R2PARA	Cal/Val (MPC)	RadioS2 parameters file (Type_1)	TGZ	
GIP_R2SWIR	Cal/Val (MPC)	SWIR detectors arrangement parameters (Type_1)	TGZ	
GIP_R2EQOG	Cal/Val (MPC)	Radiometric equalization parameters on ground (on-ground correction) (Type_1)	TGZ	X

GIP_R2DEPI	Cal/Val (MPC)	List of defective pixels (Type_1)	TGZ	
GIP_R2DEFI	Cal/Val (MPC)	Deconvolution filter for each deconvoluted band (Type_1)	TGZ	X
GIP_R2WAFI	Cal/Val (MPC)	Wavelets filters (Type_1)	TGZ	X
GIP_R2L2NC	Cal/Val (MPC)	L2 Norm coefficients (denoising) (Type_1)	TGZ	X
GIP_R2DENT	Cal/Val (MPC)	Denoising thresholds (denoising) (Type_1)	TGZ	X
GIP_R2DECT	Cal/Val (MPC)	Threshold file for deconvolution through wavelet Packets (Type_1)	TGZ	X
GIP_R2NOMO	Cal/Val (MPC)	Noise model (denoising) (Type_1)	TGZ	
GIP_R2ABCA	Cal/Val (MPC)	Absolute calibration parameters (Type_1)	TGZ	
GIP_R2BINN	Cal/Val (MPC)	Binning for 60m bands parameters (filters and undersampling) (Type_1)	TGZ	
GIP_R2CRCO	Cal/Val (MPC)	Crosstalk correction (Type_1)	TGZ	
GIP_G2PARA	Cal/Val (MPC)	GeoS2 parameters file (preProc) (Type_1)	TGZ	
GIP_G2PARE	Cal/Val (MPC)	Geometric parameter to refine (Type_1)	TGZ	
GIP_EARMOD	Cal/Val (MPC)	Earth model (Type_1)	TGZ	
GIP_GEOPAR	Cal/Val (MPC)	Global geometrical parameters (Type_1)	TGZ	
GIP_INTDET	Cal/Val (MPC)	Description of the inter detectors overlapping area (Type_1)	TGZ	
GIP_TILPAR	Cal/Val (MPC)	TilingS2 parameters file (Type_1)	TGZ	
GIP_RESPAR	Cal/Val (MPC)	ResampleS2 parameters file (preProc) (Type_1)	TGZ	
GIP_MASPAR	Cal/Val (MPC)	MaskS2 parameters file (Type_1)	TGZ	
GIP_JP2KPA	Cal/Val (MPC)	Compression JP2K parameters file (Type_2)	TGZ	
GIP_ECMWFP	Cal/Val (MPC)	ECMWF parameters file (Type_2)	TGZ	
GIP_DECOMP	Cal/Val (MPC)	On board decompression parameters file (Type_2)	TGZ	
GIP_OLQCPA	Cal/Val (MPC)	OLQC configuration parameters file (Type_2)	TGZ	

GIP_PROBAS	Cal/Val (MPC)	Processing Baseline parameters (Type_2)	TGZ	
GIP_CONVER	Cal/Val (MPC)	Mapping parameters from 16 to 18 bits (Type_2)	TGZ	
GIP_R2EOB2	Cal/Val (MPC)	Radiometric equalization parameters on board (dark current, on-board inter pixel calibration) (Type_3)	TGZ	X
GIP_L2ACAC	Cal/Val (MPC)	Calibration parameter for the atmospheric correction algorithm	TGZ	
GIP_L2ACSC	Cal/Val (MPC)	Calibration parameter for the scene classification algorithm	TGZ	
GIP_PROBA2	Cal/Val (MPC)	Processing baseline identifier of the generated L2A products	TGZ	
GIP_HRTPAR	Cal/Val (MPC)	Auxiliary file from S2 IPF 6.x	TGZ	
AUX_GRIXXX ¹	Cal/Val (MPC)	Global Reference Image provided to the Sentinel-2 operational processor, for the Level-1B product generation		

Table 2-1 – Sentinel-2 Auxiliary Data list

Some Sentinel-2 Auxiliary Products come as separate files, one for each spectral band. These are indicated in the last column in Table 2-1 and concern the following products: GIP_VIEDIR, GIP_R2EQOG, GIP_R2DEFI, GIP_R2WAFI, GIP_R2L2NC, GIP_R2DENT, GIP_R2DECT and GIP_R2EOB2. Each of these products shall be indexed separately, by spectral band. The productType attribute of these products (Table 4-1) shall be concatenated by extracting the “File Type” (e.g. GIP_R2DECT) and the band number (e.g. B01) from the product filename and then joining them together, separating them by an underscore: <File_Type>_<Band Number> (e.g. GIP_R2DECT_B01).

2.3 Sentinel-2 OLQC Reports

The On-Line Quality Control (OLQC) performs essential quality checks on each product generated by the processing chain. The results of the quality checks are presented as XML reports. OLQC reports may be issued for each Checklistname for each Sentinel-2 PDI and the contents of each report are configurable. These files are described in detail in [RD-1].

The OLQC reports will be exposed by the Production Service on the Production Interface delivery Point (PRIP).

¹ Archived manually as a one-off.

Where: XXX = Relative Orbit (001-143)

3 SENTINEL-2 PRODUCT ENTITY PROPERTIES MAPPING

[RD-2] defines the Generic CSC Common Entity Properties. Table 3-1, below, provides the mapping between these Generic Product Entity Properties and the Sentinel-2 product metadata. Most of the properties defined in [RD-2] are generated by the CSC services. The following table describes the properties that map directly to the Sentinel-2 product metadata.

OData Product Entity Properties	Type	Description	Cardinality	Corresponding Sentinel-2 Metadata						Example
				L0, L1B, L1C, L2A Datastrip	L0, L1B Granule L1C, L2A Tile	L1C, L2A TCI	HKTM	SAD	AUX	
Name	String	Data file name (according to the Sentinel file naming conventions) plus the file extension	1	n/a Based on file name.	n/a Based on file name.	n/a Based on file name.	n/a Based on file name.	n/a Based on file name.	n/a Based on file name.	S2A_MSIL1C_20180710T100031_N0208_R122_T32TQL_20180710T110910.zip
ContentDate	TimeRange	The sensing range period. Compound property with start and end times in UTC in the format YYYY-MM-DDThh:mm:ss.sssZ	1	Validity_Start Validity_Stop	Validity_Start Validity_Stop	Validity_Start Validity_Stop	acquisition Period/ startTime acquisition Period/ stopTime	Validity_Start Validity_Stop	Validity_Start Validity_Stop	"ContentDate": { "Start": "2018-07-10T10:00:31.022Z", "End": "2018-07-10T10:00:31.022Z" }
Footprint	Geography	Footprint of the product expressed as Edm.GeographyPolygon	0..1	The footprint coordinates are to be constructed from the Geographic_Localization metadata (i.e. the Geo_Pnt LATITUDE – LONGITUDE information in the Inventory_Metadata.xml)			n/a	n/a	n/a	geography'SRID=4326; Polygon(),(-41.1574966.766701,-31.74092767.629135,-31.47988366.860405,-40.61684466.011871,-41.1574966.766701))'

OData Product Entity Properties	Type	Description	Cardinality	Corresponding Sentinel-2 Metadata						Example
				L0, L1B, L1C, L2A Datastrip	L0, L1B Granule L1C, L2A Tile	L1C, L2A TCI	HKTM	SAD	AUX	
GeoFootprint	Geography	Footprint of the product following the GeoJSON format	0..1	The footprint coordinates are to be constructed from the Geographic_Localization metadata (i.e. the Geo_Pnt LATITUDE – LONGITUDE information in the Inventory_Metadata.xml)			n/a	n/a	n/a	<pre> "GeoFootprint":{ "type": "Polygon", "coordinates": [[[-59.3169, 2.6367], [-63.105, -14.0539], [-60.8506, -14.4245], [-57.1309, 2.3269], [-59.3169, 2.6367]]] } </pre>

Table 3-1 – Product Entity Properties mapping to Sentinel-2 metadata

4 SENTINEL-2 PRODUCT ATTRIBUTES MAPPING

All relevant metadata elements of the Sentinel-2 products shall be indexed in the Product Attributes; additional metadata elements may also be identified if appropriate. In order to provide a harmonised model across the Sentinel missions the JSON property naming from [RD-3] is preferred for the Attribute Names. In case an attribute is not defined in [RD-3] the naming used in the mission specific metadata files, harmonised across the Sentinel missions, is preferred. The Product Attributes mapping for all Sentinel-2 products is described in the Excel file “Sentinel-2 Product Attributes Mapping”, which is packaged with this document. A summary of the Sentinel-2 Product Attributes mapping across all products is presented in Table 4-1. It should be highlighted that, in order to harmonise the metadata model across the Sentinel missions, in some cases an “alias” for the value defined in the metadata is mapped to a standardised value to be used by the CSC GS elements, in other cases a standard value is defined where it is otherwise unavailable from the product.

OData Attribute Name	Sentinel-2 Metadata Mapping								Applicability			
	L0, L1B, L1C, L2A Datastrip	L0, L1B Granule	L1C, L2A Tile	L1C, L2A TCI	HKTM	SAD	AUX	OLQC Report	PR	LTA	ADG	DA
beginningDateTime	x	x	x	x	x	x	x	x	x	x	x	x
endingDateTime	x	x	x	x	x	x	x	x	x	x	x	x
productType	x	x	x	x	x	x	x ²	x	x	x	x	x
processorVersion	x	x	x	x			x	x	x	x	x	x
processingCenter	x	x	x	x	x	x	x	x	x	x	x	x
processingDate	x	x	x	x	x	x	x	x	x	x	x	x
platformShortName	x	x	x	x	x	x	x	x	x	x	x	x
platformSerialIdentifier	x	x	x	x	x	x	x ³	x	x	x	x	x
instrumentShortName	x	x	x	x	x	x			x	x		x
operationalMode	x								x	x		x
orbitNumber	x	x	x	x	x	x			x	x		x
lastOrbitNumber					x	x			x	x		x
relativeOrbitNumber	x				x				x	x		x
cloudCover		x	x	x					x	x		x
productGroupId	x	x	x	x					x	x		x
datastripId		x	x	x					x	x		x
tileId			x	x					x	x		x
illuminationZenithAngle			x						x	x		
qualityStatus	x	x	x	x		x			x	x		x
qualityInfo	x	x	x	x		x			x	x		x
checklistResult								x	x			
checklistParentId								x	x			

² For AUX Products separated by bands the productType shall be concatenated using the File Type and the Band Number

³ Used where available

checklistName								x	x			
inspectedProduct								x	x			
inspectedProductType								x	x			

Table 4-1 – Sentinel-2 Product Attributes Mapping