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DOCUMENT

EO generic RAW and L0 specification

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CHANGE LOG

Reason for change	Issue	Revision	Date
new	1	0	22-02-2017
editorials and milliseconds separator	1	1	12-12-2019
Synchronisation with FORUM FFSTD Tailoring	1	2	17-04-2024

CHANGE RECORD

Issue 1	**Revision** 0		
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new	22-02-2017	all	all

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Use of letter d instead of decimal dot	12-12-2019	10-11	all
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Update of FFST from 3.0 to 3.0.1	17-04-2024		
Update of category and descriptors for RAW	17-04-2024		Sec 5.1.3.1 and 5.1.3.2
Update of length of instance id for RAW shape	17-04-2024		Section 5.1

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1 INTRODUCTION

The Space to Ground Interface in EO mission is a critical technical and contractual interface. The data travelling across it satisfies a number of technical standards and best practices at different level from RF to data format.

Its standardisation and harmonisation among all possible subsystems and actors on-board (Satellite, Instrument, Mass memory, modulators and transmitters, avionics in general) and on-ground (EGSE, Test data generators, acquisition systems/FEPs at Ground Stations, AIT and AIV teams, Processor Prototype team, Operational processor teams, Commissioning teams, etc) is therefore of paramount importance to allow easy and efficient exchange of data, resuse of common tools and avoiding any proliferation of specifications.

While CCDSD and ECSS standard care for the specific data unit formatting and for all transport and coding layers definition no standard defines an common file format and naming conventions for files containing these data (called RAW and Level 0 data)

This technical note supports therefore a generic baseline definition at file level to be used as common exchange format for this important system level interface including file naming conventions and the file formats with the aim of:
1) avoid any mission or vendor specific implementation
2) mantaining a content bitwise identical to the data transmitted on the S2G link
3) introducing **minimal** overhead while allow operating on these entities at filesystem level.

The container file format and the filenaming logic selected for RAW and Level 0 Data is based on the ESA Earth Observation File Format Standard [AD-1] while actual data format is based on pure CCSDS/ECSS standards [AD-3] and [AD-4].

From these basic types each of the related subsystem might in turn derive its own internal flavour (e.g. the PDGS might need to define an internal operational Level 0 with additional fields, a specific legacy user might need to add annotations for compatibility, etc) however the baseline type used to support the interface definition will comply to this TN and the process to obtain any internal specific variation from the baseline format will be clearly identified as well as the technical means to achieve that so that an efficient exchange format is available.

This TN is an input to the Tailoring of Filename and Format Standard for every mission.

2 DOCUMENTS

2.1 Applicable Documents

	Title	Reference	Issue
[AD-1]	Ground Segment File Format Standard	PE-TN-ESA-GS-001	3.0.1
[AD-2]	Handbook for EO XML and Binary Schemas	PE-TN-ESA-GS-121	1.7.1
[AD-3]	CCSDS Standards	all	
[AD-4]	ECSS Standards + Adoption Notes	all	

2.2 Reference Documents

	Title	Reference	Issue

3 DATA CONTENT DEFINITION

3.1 RAW data

3.1.1 Space Packet RAW data files

RAW data files are defined as data files containing pure binary CCSDS/PUS Space Packets:
- appended one after the other in the order as transmitted on the RF space to ground link
- without headers,
- without annotation or any other interleaved data
- without using container formats.

Any associated metadata e.g. GS Headers, information, annotation generated by EGSE or by the Ground Station is to be stored in a physical separated file and not within the RAW data file itself.

Each RAW data file can contain either all APIDs as generated on board or only a subset of these (e.g. es result of filtering performed by the EGSE or Ground Acquisition system). Each RAW data file contains data pertaining to a single CCSDS Virtual Channel

The size of each RAW data files is variable and can either be a single (generally corresponding to one acquisition) or chunked for convenience in blocks of smaller size (e.g. 100 Mbyte)

3.1.2 Other RAW data files

Although less common and used primarily for diagnostic it is possible to define RAW data containing other CCSDS data structures in same way that the application layer) Space packets) structure have been defined. Therefore we could have RAW data files containing Transfer Frames or coded CADUs. In these cases, the corresponding RAW files will contain a pure binary CCSDS/PUS Transfer Frames or CADUs appended one after the other in the order as transmitted on the RF space to ground link without headers, without annotation or any other interleaved data and without using container formats.

3.2 Level 0 data

A Level 0 Data file consist of RAW data with Space Packets sorted (per SSC and Timestamp if applicable), duplicate and corrupted (as per CRC) removed.

Level 0 data is naturally split per data type based on specific mission needs and depending different user of that specific Level 0 file, for example different Level 0 data files could contain Space Packets grouped per APID, per VC, or the one correspondingly to HTKM, Measurement Modes, Calibration Modes, Instrument or Platform Ancillary, Navigation, etc.

4 FILE STRUCTURE

4.1 Logical vs Physical Files

The content of [AD-1] fully applies to RAW and Level 0, although RAW data are not required to have an header.

4.2 Header

The content of [AD-1] fully applies to Level 0 but not to RAW

4.3 Data Block

The content of [AD-1] fully applies, noting that the file name extension, which will be "raw" for RAW files.

4.4 Packaging and Distribution of Files

The content of [AD-1] fully applies: baseline packaging and distribution is use of 'zip'.

5 FILE NAMING

5.1 Logical File Names

The content of [AD-1] fully applies. The file naming convention for RAW/Level 0 products is therefore identified by the sequence of fields described here below:

<MMM>_<CCCC>_<TTTTTTTTTT>_<instance ID>

where:

<MMM> = Mission ID (3 characters)
<CCCC> = File Class (4 characters)
<TTTTTTTTT> = File Type (10 characters)
<instance ID> = File Instance ID (28 characters for the RAW, while for L0 it is mission specific).

The above fields constitute the smaller set of information which ensures that each logical file name is unique, within the context of the Ground Segment.

5.1.1 Mission ID

The Mission ID consists of 3 characters, either uppercase letters, digits or underscores "_".

5.1.2 File Class

The File Class element indicates the type of activity for which the file is used. It consists of 4 characters, either uppercase letters or digits.

The following File Class are identified:

- TEST for internal testing
- OGCA for on-ground calibration
- GSOV for ground segment overall validation, system level testing
- EGSE for data related to on-ground instrument validation usage
- OPER for operational processing
- NRTI for near-real time processing
- OFFL for offline processing
- RPRO for reprocessing

Other file classes could be defined if needed.

5.1.3 File Type

The File Type element identifies the product and consists of 10 characters, either uppercase letters, digits or underscores "_".

For RAW and Level 0, the File Type can be subdivided into two sub-elements of respectively 4 and 6 characters, as follow:

<TTTTTTTTTT> = <FFF><DDDDDDD>

where:

<FFF>: File Category
<DDDDDDD>: Product Semantic Descriptor

5.1.3.1 File Category

The File Category element consists of 3 characters (3 uppercase letters, digits or underscores "_").

For RAW, the following file categories have been identified:

- RAW for raw binary CCSDS data
- L0_ for instrument level 0 instrument data files (science data products)

5.1.3.2 Product Semantic Descriptor

The Product Semantic Descriptor must be unique for a given File Type and be as descriptive as possible. It consists of 7 characters, either uppercase letters, digits or underscores "_". (if possible, the first character should be an underscore "_")

For RAW data files identified with the File Type element set to "RAW_", the Product Semantic Descriptor is defined based on the RF link and CCSDS data type as follows:

- _XB_CAD: XB CADU data
- _SB_CAD: SB CADU data

- _XB_TF_: XB Transfer Frame data
- _SB_TF_: SB Transfer Frame data
- _XB_SP_: XB Space Packet data
- _SB_SP_: SB Space Packet data

For Level 0 data files identified with the File Type element set to "L0_", the Product Semantic Descriptor is defined based on the APID and data type as follows for the generic types while for observation and calibration modes are mission specific and need to be tailored per every mission also considering the case of missions with multiple payloads on board:

- _ANCINS: Instrument Ancillary data
- _NAVATT: NAVATT data
- _ANCSAT: Satellite platform ancillary data
- _HKTM__: HKTM data
- *_XXXXX1: Observation Data Type 1*
- *_XXXXX2: Observation Data Type 2*
- *_CALXX1: Calibration Data Type 1*
- *_CALXX2: Calibration Data Type 2*
- *etc*

5.1.4 File Instance ID

For RAW and Level 0, the following shapes are suggested for the File Instance ID.

The first one is used for RAW and L0 files containing observation and calibration data generated by XB Ground Acquisition Station or by the IDS, the second to L0 files containing ancillary and HKTM packet.

5.1.4.1 File Instance ID for RAW or Level 0 data files

5.1.4.1.1 RAW files

For RAW data file with the File Type set "RAW_" and semantic descriptor XB_SP__ or SB_SP__ the suggested File Instance ID consists of 28 characters, either uppercase letters, digits or underscores "_", with the one of the following 3 shapes:

```
<APIDNNNN>_<YYYYMMDDTHHMMSSdmmm>
<VCID__NN>_<YYYYMMDDTHHMMSSdmmm>
<CADU____>_<YYYYMMDDTHHMMSSdmmm>
```

This suggested instance shape can be further tailored if there is the need e.g. to differentiate between the source of the data.

where:

<APIDNNNN>: Space Packet APID in decimal:

- 8 digits corresponding to the decimal APID. In case the file includes multiple APID the value shall be the string “MULTIPLE”

<VCID_NN>: Virtual Channel ID in decimal:

- 8 digits corresponding to the decimal Virtual Channel ID. In case the file includes multiple VCID the value shall be the string “MULTIPLE”
-

<CADU_____>: Fixed string

< YYYYMMDDTHHMMSSdmmm>: file generation (start) time, consisting of 19 characters, either uppercase letters or digits:

- 8 digits for the date: “YYYYMMDD”, year, month, day
- 1 uppercase T: “T”
- 6 digits for the time: “HHMMSS”, hour, minutes, seconds
- 1 lowercase “d” as decimal separator
- 3 digits for millisecond: “mmm”

5.1.4.1.2 Level 0 files

For Level 0 files the definition of instance ID is left to the mission specific tailoring of the Filename and Format Standard.