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Joint Polar Satellite System (JPSS) Algorithm Specification Volume II: Data Dictionary for the AMSR-3 RDR

NOAA / NASA

Goddard Space Flight Center Greenbelt, Maryland

Joint Polar Satellite System (JPSS)
Algorithm Specification Volume II:
Data Dictionary for the AMSR-3 RDR

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Preface

This document is under JPSS Ground configuration control. Once this document is approved, JPSS approved changes are handled in accordance with Class I and Class II change control requirements as described in the JPSS Configuration Management Procedures, and changes to this document shall be made by complete revision.

Any questions should be addressed to:

JPSS Configuration Management Office
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Greenbelt, MD 20771

Change History Log

Revision	Effective Date	Description of Changes (Reference the CCR & CCB/ERB Approve Date)	Sections Affected
-	Mar 31, 2022	This version incorporates 474-CCR-22-5845 which was approved by the JPSS Ground ERB on Mar 22, 2022 and by the JPSS Ground Segment CCB on the effective date shown.	All

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1 INTRODUCTION

1.1 Scope

The Joint Polar Satellite System (JPSS) Algorithm Specification for AMSR-3 RDR - Volume II: Data Dictionary contains the specifications for the format of the Advanced Microwave Scanning Radiometer-3 (AMSR-3) Raw Data Records (RDRs). This specification includes the format of the Hierarchical Data Format Release 5 (HDF5) files, as well as the product definitions. These formats are available to external users of the JPSS. For an overview of the data product formats, see 474-00001-01, JPSS CDFCB-X Vol I. For an overview of the metadata formats for data products, see 474-00448-02-01, JPSS Algorithm Specification Volume II: Data Dictionary for the Common Algorithms.

1.2 Organization

Section	Contents
Section 1	Provides information regarding the scope and organization of this document, as reference material only.
Section 2	Lists parent documents and related documents that were used as sources of information for this document or that provide additional background information to aid understanding of the interface implementations.
Section 3	Provides an overview of the HDF5 UML for the data product types.
Section 4	Provides a description of the contents of each JPSS RDR.
Section 5	Provides a description of the contents of each JPSS TDR if applicable.
Section 6	Provides a description of the contents of each JPSS SDR if applicable.
Section 7	Provides a description of relevant Look-Up Tables (LUTs) and Processing Coefficient Tables (PCTs).
Section 8	Provides a description of each Intermediate Product if applicable.
Appendix A	Provides the Data Mnemonic to Interface Mapping for the data products in this volume.
Appendix B	Provides common RDR static header values in this volume.
Appendix C	Provides the maps the quality flags by sensor and product that are reportable to the associated data product quality flag Test ID used in the processing environment.
Appendix D	Provides reference to acronyms and glossary of terms found within the JPSS Program Lexicon (470-00041).
Attachment A	Provides the list of applicable xml files for this Data Dictionary.

2 RELATED DOCUMENTATION

The latest JPSS documents can be obtained from URL: https://jpssmis.gsfc.nasa.gov/frontmenu_dsp.cfm. JPSS Project documents have a document number starting with 470, 472 or 474 indicating the governing Configuration Control Board (CCB) (Program, Flight, or Ground) that has the control authority of the document.

2.1 Parent Documents

The following reference document(s) is (are) the Parent Document(s) from which this document has been derived. Any modification to a Parent Document will be reviewed to identify the impact upon this document. In the event of a conflict between a Parent Document and the content of this document, the JPSS Program Configuration Change Board has the final authority for conflict resolution.

Document Number	Title
474-00448-01-31	JPSS Algorithm Specification Volume I: Software Requirements Specification (SRS) for the AMSR-3 RDR
474-01543	Joint Polar Satellite System (JPSS) Ground Segment Data Product Specification (GSegDPS)

2.2 Applicable Documents

The following document(s) is (are) the Applicable Document(s) from which this document has been derived. Any modification to an Applicable Document will be reviewed to identify the impact upon this document. In the event of conflict between an Applicable Document and the content of this document, the JPSS Program Configuration Change Board has the final authority for conflict resolution.

Document Number	Title
NPR 7150.2A	NASA Software Engineering Requirements
474-00167	Joint Polar Satellite System (JPSS) Common Ground System (CGS) Requirements Document
474-00005	Joint Polar Satellite System (JPSS) Government Resource for Algorithm Verification, Independent Testing, and Evaluation (GRAVITE) Requirements Document
474-00448-04-31	Joint Polar Satellite System (JPSS) Algorithm Specification Volume IV: Software Requirements Specification Parameter File (SRSPF) for the AMSR-3 RDR
N/A	Hierarchical Data Format, Version 5 (HDF5), http://www.hdfgroup.org/HDF5/

2.3 Information Documents

The following documents are referenced herein and amplify or clarify the information presented in this document. These documents are not binding on the content of this document.

Document Number	Title
474-00333	Joint Polar Satellite System (JPSS) Ground System (GS) Architecture Description Document (ADD)
474-00054	Joint Polar Satellite System (JPSS) Ground System (GS) Concept of Operations (ConOps)
470-00041	Joint Polar Satellite System (JPSS) Program Lexicon
474-00001-01	Joint Polar Satellite System (JPSS) Common Data Format Control Book, Vol I - Overview
474-00448-02-01	Joint Polar Satellite System (JPSS) Algorithm Specification Volume II: Data Dictionary for the Common Algorithms
474-REF-01794	GOSAT-GW Mission Operations Interface Specification (MOIS)
470-REF-00394	Memorandum of Understanding (MOU) Between National Oceanic and Atmospheric Administration (NOAA) and Japan Aerospace and Exploration Agency (JAXA) In relation to the Cooperation For Global Observing Satellite Missions (12/11/20)
IS-GPS-200	Global Positioning System Wing Systems Engineering & Integration Interface Specification, IS-GPS-200

3 UML FOR HDF5 PRODUCTS

3.1 RDR HDF5 Details

Figure 3.1-1, Science and Diagnostic RDR Generalized UML Diagram, depicts the HDF5 RDR file organization as a Unified Modeling Language (UML) class diagram for Science and Diagnostic RDRs. This also describes the science calibration RDRs generated by OMPS. Figure 3.1-2, Dwell, Dump, and Telemetry RDR Generalized UML Diagram, depicts the HDF5 RDR file organization as a UML Class Diagram for Dwell, Dump and Telemetry RDRs.

Each HDF5 RDR file contains an HDF5 Root Group, '/', a Data_Products Group, one or more Product Groups (CollectionShortName), and an All_Data Group containing one or more (CollectionShortName)_All groups. The latter group contains the Dataset_Array which holds the common RDR structures of Consultative Committee for Space Data Systems (CCSDS) structured APs. For Science and Diagnostic RDRs a Spacecraft Diary Group is also included in the Data_Products group. The Product Groups and Spacecraft Diary Group both contain datasets - an Aggregation Dataset (CollectionShortName_Aggr) and Granule Datasets (CollectionShortName_Gran_n - where n indicates the nth granule in a temporal aggregation of granules (1 .. n)). A granule is a general term used to describe the minimum quanta of data collected per processing period, generally on the order of seconds. For the definition and organization of the metadata attributes contained in the HDF5 files, see 474-00448-02-01, JPSS Algorithm Specification Volume II: Data Dictionary for the Common Algorithms. Attributes that are specific to a particular RDR are listed with the specific RDR's data format definition. Note: In the UML diagrams, an '*' following the name of an attribute indicates an element with exceptions; see JPSS Algorithm Specification Volume II: Data Dictionary for the Common Algorithms (474-00448-02-01), for the details of the exception.

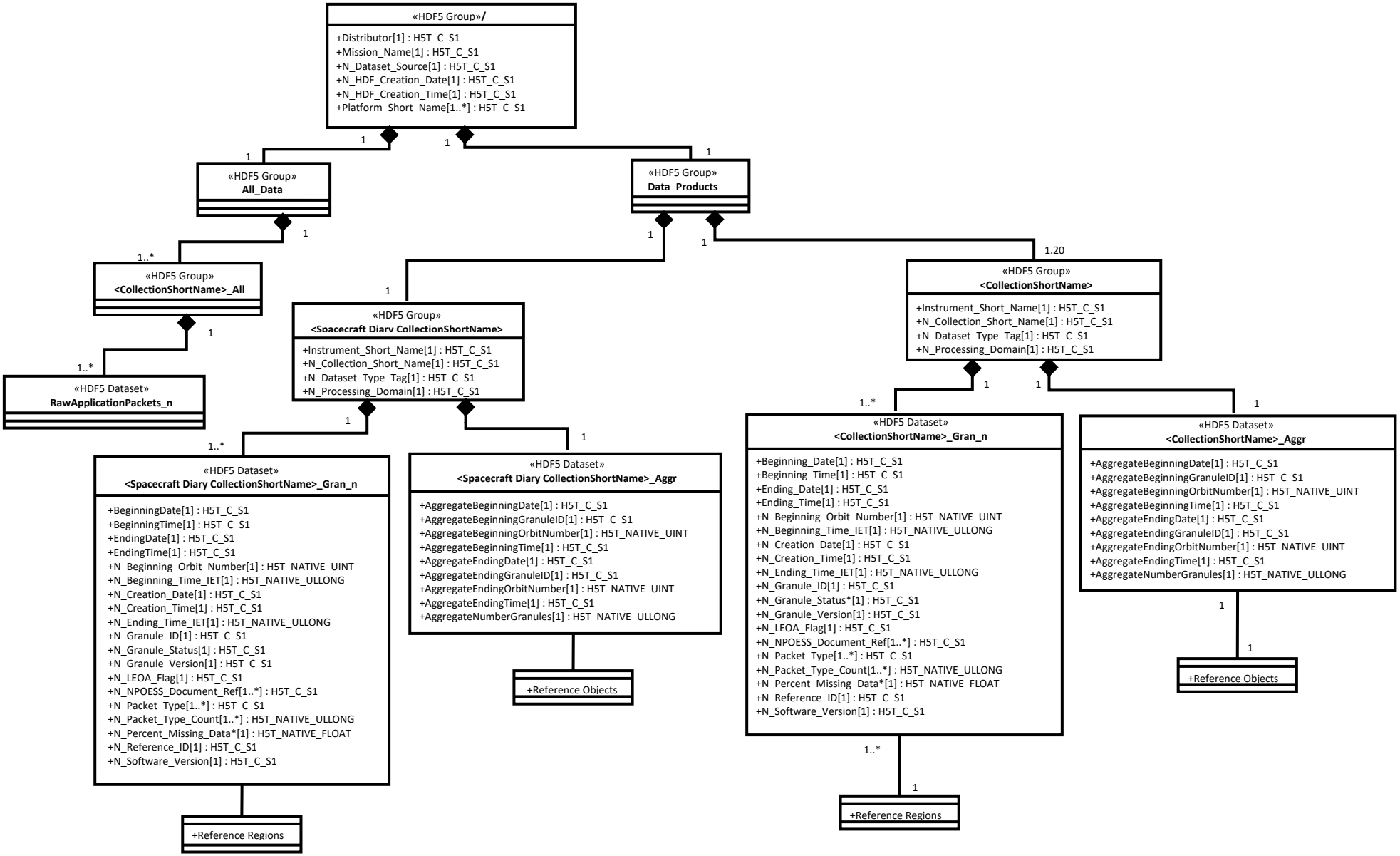

Figure: 3.1-1 Science and Diagnostic RDR Generalized UML Diagram

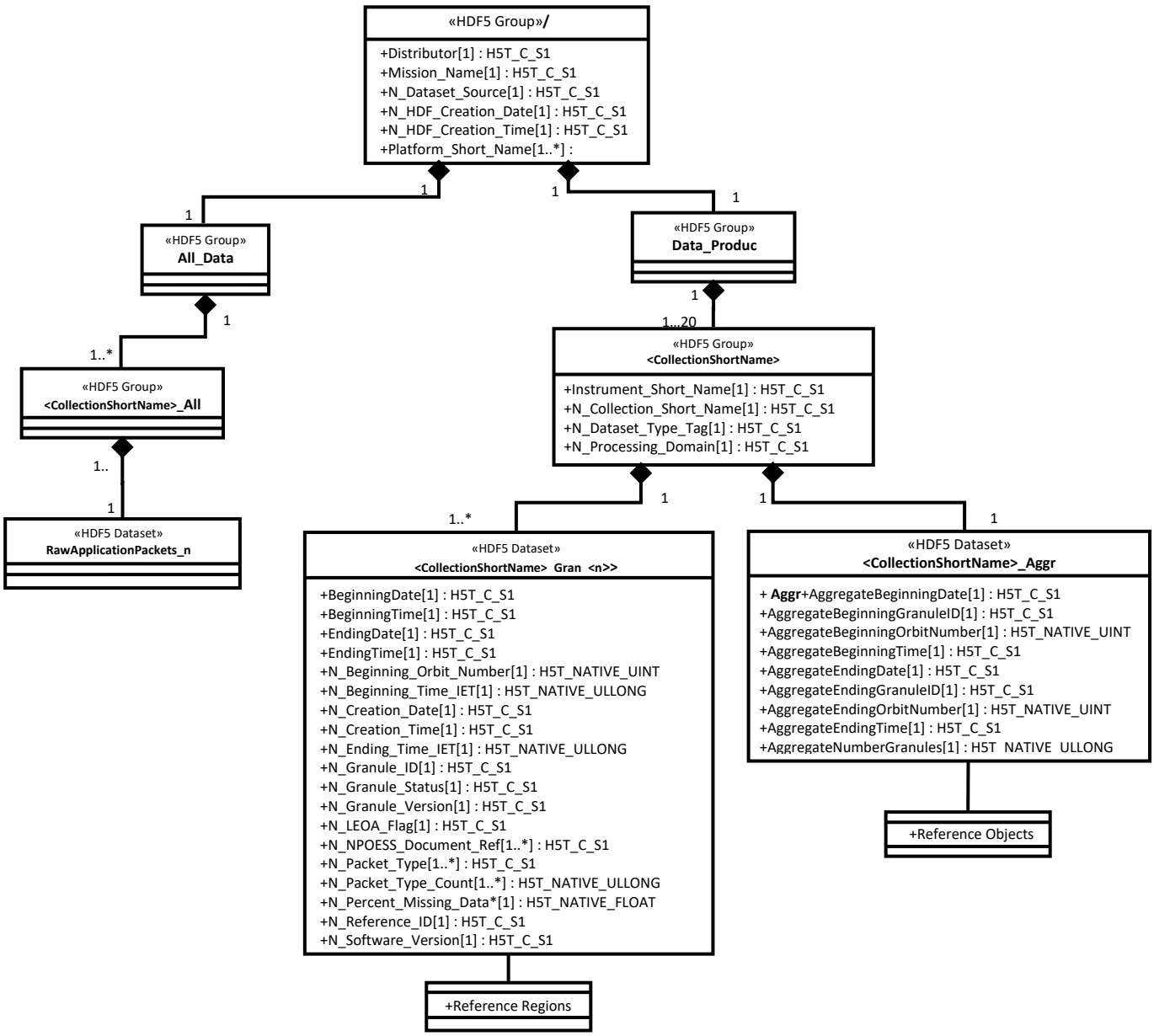

Figure: 3.1-2 Dwell, Dump, Telemetry, and Spacecraft Diary (when requested separately) RDR Generalized UML Diagram

4 JPSS RAW DATA RECORDS (RDRS)

The following paragraphs describe the structure and contents of the RDR granules formed by the JPSS ground processing software. The ground processing software generates several RDRs for each sensor by accumulating one or more specific APs into a single collection. The accumulated APs are not byte-aligned or otherwise altered. They are merely collected and placed into storage in the order that they are received. The following paragraphs describe the binary packaging structure for these accumulated APs. Table 4-1, Common RDR Structure, shows the common JPSS RDR Structure. All JPSS RDRs are based on the same generic granule storage framework and is illustrated conceptually in Figure 4-1 Common RDR Layout.

In addition to the common "structured" RDR formal detailed below, RDRs for some missions are identified as "unstructured". This means that each binary RDR only contains a buffer of APs (effectively the AP Storage Area only from structured RDRs). These RDRs will contain the standard RDR metadata and will follow the HDF format for Dump, Dwell and Telemetry. RDRs in this volume are "structured" except where specifically noted otherwise.

The detailed structure and contents of the APs are documented in the MOIS (474-REF-01794). For more information on AP formatting, see the Recommendations for Advanced Orbiting Systems, Networks and Data Links, CCSDS 701.0-B-2, Section 3.3.3.

Table: 4-1 Common RDR Structure

Field Name	Description
Static Header	Static header describing the RDR
APID List	Array of structures that contains information about each APID that is collected in the RDR
Packet Tracker	Array of structures that contains information about each AP that is in the RDR
AP Storage area	General buffer where the APs are stored back-to-back in the order that they are received

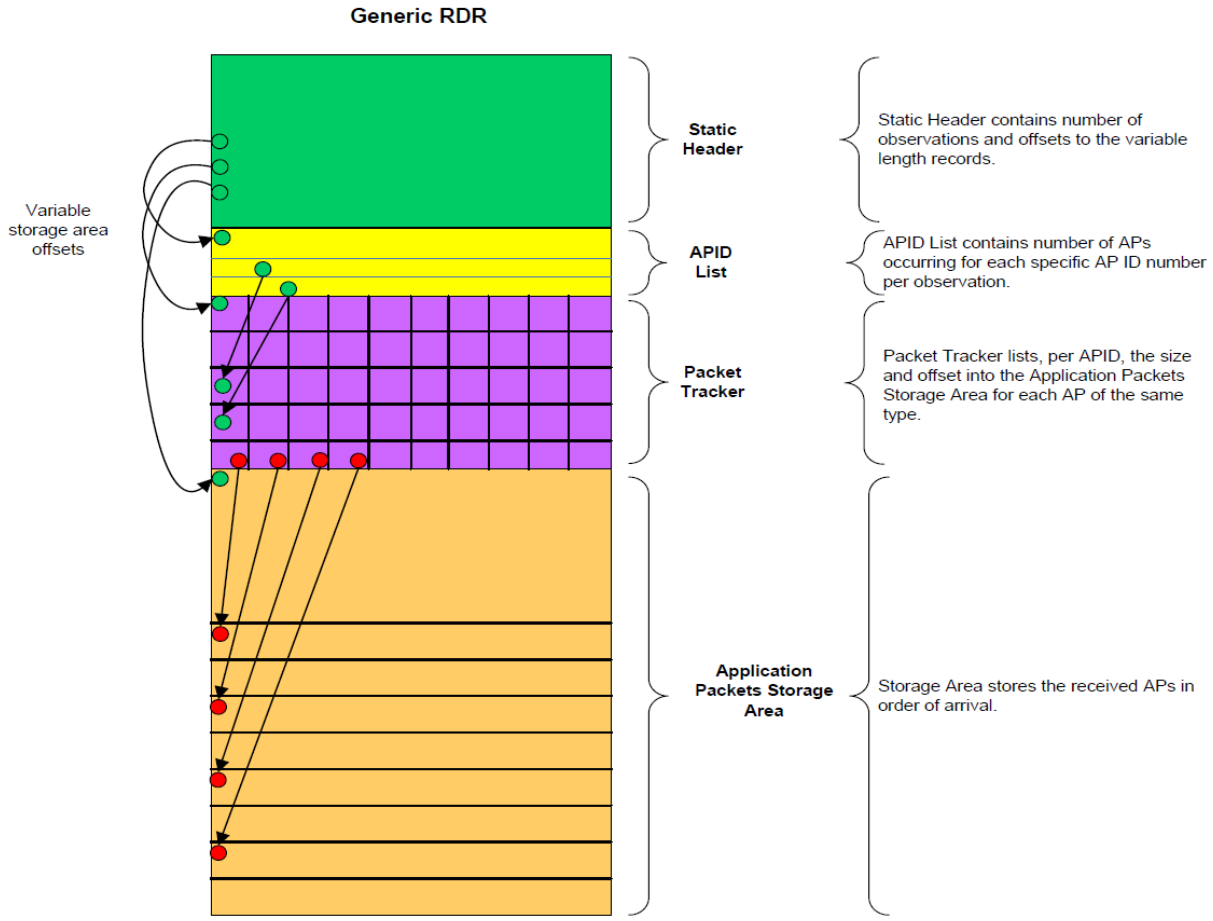

Figure: 4-1 Common RDR Layout

4.1 Common RDR Structures

The following section defines these structures and provides methods for determining the variable length RDR components.

Description/ Purpose	The following tables describe the four structures found in the common RDR Structure. The common RDR Structure granules are referenced by the HDF5 Object and Reference Region pointers in the CollectionShortName_Aggr and CollectionShortName_Gran_# datasets, respectively.
File-Naming Construct	See the JPSS CDFCB-X Vol. I-Overview, Section 3.0 for details.
File Size	Nominally specified per RDR
File Format Type	Big Endian Binary (structure stored within HDF5)
Production Frequency	Common structure created for each RDR granule Granule durations specified per RDR

Data Content and Data Format	Each RDR has a single RDR Static Header and a dynamic Application Packet content area with three major entries: 1) APID List, 2) Packet Tracker List, and 3) Application Packet Storage Area. Table 4.1-1, RDR Static Header, details the spacecraft and sensor that the RDR data originated from, the type of data the RDR contains, and the start and end boundary times of the RDR granule. It also provides byte offset information needed to access individual APs and the number of AP types that are contained in the RDR. Tables 4.1-2, 4.1-3, and 4.1-4 define the Dynamic Application Packet content area. Table 4.1-2, RDR APID List, defines the structure used to identify the AP data type and it provides information necessary for accessing the RDR Packet Tracker. The APID List has details for each APID including number expected and received. Table 4.1-3, RDR Packet Tracker provides information about individual APs. Table 4.1-4, Application Packet Storage Area, describes the storage area containing the APs.

Table 4.1-1, RDR Static Header, details the spacecraft and sensor that the data originated from, the type of the data the RDR contains, and the start and end boundary times of the RDR granule. The RDR contains APs that have observation times which are greater than or equal to the start boundary and less than the end boundary time. The total size of the RDR Static Header is 72 bytes.

Table: 4.1-1 RDR Static Header

Field Name	DataType	Description
satellite	char[4]	Source satellite name as found in JPSS CDFCB-X Vol. I, Table 3.4.1-1, Spacecraft ID.
Sensor	char[16]	The RDR sensor name in a case-sensitive string (Example: “VIIRS”, “ATMS”, “CrIS”, etc. See Appendix B, Common Static Header Values, for specific values.)
typeID	char[16]	The RDR type in an upper case string (Example: “SCIENCE”, “DIAGNOSTIC”, “TELEMETRY”, “MEMORY DUMP”, “DWELL”. See Appendix B, Common Static Header Values, for specific values.)
numAPIDs	Uint32	The number of different types of expected APIDs that make the RDR. (numAPIDs is specific for each type of RDR, see Appendix B, Common Static Header Values, for specific values.)
apidListOffset	Uint32	Byte offset of the APID List (this is equivalent to the size of the static header: 72). The APID List starts immediately after the Generic RDR Static Header. Note: Always use this value to find the APID address.

Field Name	DataType	Description
pktTrackerOffset	Uint32	Byte offset from the beginning of the Common RDR to the Packet Tracker list Note: Always use this value to find the Packet Tracker list.
apStorageOffset	Uint32	Byte offset from the beginning of the Common RDR to the AP Storage Note: Always use this value to find the AP Storage.
nextPktPos	Uint32	Byte offset from the beginning of the Application Packet Storage Area (apStorageOffset) to the end of valid data within the Application Packet Storage Area
startBoundary	int64	All APs occur at or after this time in IDPS Epoch Time (IET) format. Note IET begins January 1, 1958 and is measured in microseconds. For more information on IET see JPSS CDFCB-X Vol. I, Section 3.3.1.
endBoundary	int64	The RDR non-inclusive boundary time in IET format. All APs occur before this time.

Table 4.1-2, RDR APID List, details the APIDs that are in the RDR. The number of elements in the list is equal to the numAPIDs field in the RDR Static Header. The size of a single RDR APID list element is 32 bytes.

Table: 4.1-2 RDR APID List

Field Name	DataType	Description
name	char[16]	Shortname describing the data type (Example: M01 for VIIRS. See individual RDR sections for specific values.)
value	Uint32	This field stores an APID that is in the RDR.
pktTrackerStartIndex	Uint32	The first index in the pktTracker array that will contain an AP of this APID. This index is zero based.
pktsReserved	Uint32	This field stores the number of APs reserved for this APID in this RDR. This value accounts for the worst case expected for the temporal granule period. Due to variability in scan rates, the actual number of packets received can be less than the "reserved" and still be 100% complete as shown in the metadata.
pktsReceived	Uint32	The number of APs of this APID that have been received for this RDR

Table 4.1-3 Application Packet Storage Area, describes the AP storage area.

Table: 4.1-3 Application Packet Storage Area

Field Name	Data Type	Description
apStorage	Array of unsigned int8	Storage area where application packets are stored as they arrive in consecutive order

Table 4.1-4, Application Packet Tables, provides explanations of the fields given for each RDR described in the following sections. APIDs are listed in the JPSS Alg. Spec. for AMSR3 Volume IV: SRSPF (474-00448-04-31).

Table: 4.1-4 Application Packet Tables

APID Short Name	Description
Short name of this Application Packet as an upper-case string	Brief description of this application packet

Note: Grouped or segmented packets contain mission data exceeding the size of a single CCSDS packet.

Accessing APs can be achieved in two fashions; Random Access or Sequential Access.

To access APs in random order by AP type:

- Get the range for a specific type of data from the APID List
  - Find desired AP type using name field
  - Get pktTrackerStartIndex
  - Get pktsReserved
- Loop over the elements in Packet Tracker array starting at pktTrackerStartIndex
  - Get offset (if -1 stop processing no packet received)
  - Get size
  - Access the AP by adding the offset to the apStorageOffset value found in the Static Header
  - Extract size (the AP size in bytes) from the AP Storage Area
  - Repeat above for pktsReserved

To access APs in sequential order:

- Get the apStorageOffset from the Static Header to determine memory location for start of APs in AP Storage Area
- Get the nextPktPos from the Static Header (The nextPktPos value indicates the end of valid RDR data within the AP Storage Area)
- Parse AP's manually by reading the primary header, accessing the size of the packet, and accessing the user data section in the CCSDS packet

Repeat until nextPktPos equals current position.

4.2 Advanced Microwave Scanning Radiometer 3 (AMSR3) RDR

Data Mnemonic	Telemetry: RDRE-AMS3-C0036 Mission Data: RDRE-AMS3-C0037
Description/ Purpose	The JAXA Global Observing Satellite for Greenhouse gases and Water cycle (GOSAT-GW) is a satellite project for the purpose of global and long-term observation of the Earth environment. GOSAT-GW consists of two satellite series, GOSAT and GOSAT-2. The Advanced Microwave Scanning Radiometer 3 (AMSR3) sensor on GOSAT-GW observes water-

	related targets including precipitation, water vapor, sea surface wind speed, sea surface temperature, soil moisture, and snow depth.
File-Naming Construct	See the JPSS CDFCB-X Vol. I, Section 3.0 for details.
File Format Type	Variable due to contact periods
Data Content and Data Format	Section 4.2.1 describes the AMSR3 Telemetry RDR Section 4.2.2 describes the AMSR3 Mission Data RDR

4.2.1 AMSR3 Telemetry RDR

Table 4.2.1-1, AMSR3 Telemetry RDR Application Packets, lists the APs accumulated for the AMSR3 Telemetry RDR. The APID assignment listed in Table 4.2.1-1, AMSR3 Telemetry RDR Application Packets, applies to GOSAT-GW only. In the event of a discrepancy in APIDs listed here or for details of the AP content, see the GOSAT-GW Mission Operations Interface Specification (MOIS), 474-REF-01794 (JAXA #: FTZ-190050). In addition, for details about GPS data refer to the Global Positioning System Wing Systems Engineering & Integration Interface Specification, IS-GPS-200.

Table: 4.2.1-1 AMSR3 Telemetry RDR Data Application Packets

APID Short Name	Description	Value APID$_{10}$
AMSR3_HK	AMSR3 Telemetry Data	16

4.2.2 AMSR3 Mission Data RDR

Table 4.2.2-1, AMSR3 Mission Data RDR Application Packets, lists the APs accumulated for the AMSR3 Mission Data RDR. The APID assignment listed in Table 4.2.2-1, AMSR3 Mission Data RDR Application Packets, applies to GOSAT-GW only. In the event of a discrepancy in APIDs listed here or for details of the AP content, see the GOSAT-GW Mission Operations Interface Specification (MOIS), 474-REF-01794 (JAXA #: FTZ-190050). In addition, for details about GPS data refer to the Global Positioning System Wing Systems Engineering & Integration Interface Specification, IS-GPS-200.

Table: 4.2.2-1 AMSR3 Mission Data RDR Application Packets

APID Short Name	Description	Value APID$_{10}$
AMSR3_OBS	AMSR3 Mission Data	1424

5 TEMPERATURE DATA RECORDS (TDRS)

Not Applicable

6 SENSOR DATA RECORDS (SDRS)

Not applicable.

7 LOOK-UP TABLES AND PROCESSING COEFFICIENT TABLES

7.1 Look-up Tables

Algorithm Look-up Table (LUT) files contain tables of pre-computed values used in lieu of real-time algorithm computations to reduce processing resource demands. Table values are typically the result of RTM executions and other environmental model simulations. These data generally cover broad, multi-dimensional parameter spaces which are unique to each algorithm.

7.1.1 AMSR-3 RDR LUTs

The AMSR-3 RDR currently uses no LUTs.

7.2 Processing Coefficient Tables

The S-NPP/JPSS-1/JPSS-2 ground system data product generation subsystem uses Processing Coefficient Table (PCT) file parameters. PCT files can be either Automated or Manual coefficient tables. Within the Manual table type are two coefficient classes: Initial and Ephemeral. Sections below describe tables of that type for the product.

7.2.1 Automated Processing Coefficients

Automated Processing Coefficient (PC) files contain parameters updated and/or created during the processing of the S-NPP/JPSS Data Products by the processing algorithms. The processing environment subsequently uses these files without human review of their contents. Files can be used immediately after creation or in future processing such as the next granule in the production data stream processing.

7.2.1.1 AMSR-3 RDR Automated PCs

The AMSR-3 RDR currently uses no Automated PCs.

7.2.2 Manual Processing Coefficients

Manual Processing Coefficient (PC) files contain parameters used for S-NPP/JPSS Data Product generation which require human review prior to operational processing environment insertion. Manual Processing Coefficients have two classes:

- Initialization PCTs contain infrequently updated initial parameters sets S-NPP/JPSS uses for data product generation.
- Ephemeral PCTs contain frequently updated parameters sets S-NPP/JPSS uses for data product generation.

7.2.2.1 AMSR-3 RDR Initialization PCs

The AMSR-3 RDR currently uses no Initialization PCs.

7.2.2.2 AMSR-3 RDR Ephemeral PCs

The AMSR-3 RDR currently uses no Ephemeral PCs.

8 INTERMEDIATE PRODUCTS (IPS)

Not Applicable

Appendix A. Data Mnemonic to Interface Mapping

For a complete list of Data Mnemonic to Interface Mapping, see 474-00001-01, JPSS CDFCB-X Vol I. The CDFCB contains Data Mnemonics, Identifiers, Collection Short Names, Interface Documents, and Collection Long Names for each JPSS Data Product and for Geolocation data.

Appendix B. Common RDR Static Header Values

Not Applicable

Appendix C. DQTT Quality Flag Mapping

Not Applicable

Appendix D. Abbreviations and Acronyms

See 470-00041 JPSS Program Lexicon for abbreviations and acronyms.

Attachment A. XML Formats for Related Data products

Table: ATT-1 XML Formats for Related Products

File Number	XML Filename
None	