## Juno Software Interface Specification

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<th>Mission: <strong>Juno</strong></th>
<th>Date: <strong>26-September-2016</strong></th>
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<td>Module ID: <strong>JPL D-66541</strong></td>
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CHANGE LOG

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<td>Original signed copy with review edits</td>
<td>V2.1.1</td>
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<td>7-Aug-2014</td>
<td>Numerous edits were made to incorporate modifications made during the development of the MWR software pipeline for Level 2 and 3 data products. These include:</td>
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<td>2. Clarifying the nature of the data records as 1-hour records and eliminating the explicit mention of intermediate products as opposed to “merged” products.</td>
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<td>3. Redoing the product naming convention in Appendix A to reflect changes in file process and structure.</td>
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<td>4. Providing updated and complete PDS label file examples in Appendix B.</td>
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<td>5. Numerous edits in all applicable sections of the text to reflect these changes.</td>
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<td>C. PRODUCT_VERSION_ID example updated</td>
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Table 1.1: ACRONYMS AND ABBREVIATIONS

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<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>ASCII</td>
<td>American Standard Code for Information Interchange</td>
</tr>
<tr>
<td>CODMAC</td>
<td>Committee on Data Management and Computation</td>
</tr>
<tr>
<td>CSV</td>
<td>Comma Separated Values</td>
</tr>
<tr>
<td>DAWG</td>
<td>Data Archive Working Group</td>
</tr>
<tr>
<td>DOM</td>
<td>Data Object Manager (Part of multi-mission GDS) TBD</td>
</tr>
<tr>
<td>EDA</td>
<td>End of Data Acquisition</td>
</tr>
<tr>
<td>EDR</td>
<td>Experiment Data Record</td>
</tr>
<tr>
<td>EFB</td>
<td>Earth Flyby</td>
</tr>
<tr>
<td>EPP</td>
<td>Engineering Packet Processor</td>
</tr>
<tr>
<td>ET</td>
<td>Ephemeris time</td>
</tr>
<tr>
<td>FEI</td>
<td>File Exchange Interface</td>
</tr>
<tr>
<td>GDS</td>
<td>Ground Data System</td>
</tr>
<tr>
<td>GRDR</td>
<td>Geometry Data Record</td>
</tr>
<tr>
<td>ICD</td>
<td>Interface Control Document</td>
</tr>
<tr>
<td>IOT</td>
<td>Instrument Operations Team. MWR instrument team is an IOT</td>
</tr>
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<td>IRDR</td>
<td>Instrument Data Record</td>
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<tr>
<td>ISO</td>
<td>International Standards Organization</td>
</tr>
<tr>
<td>JPL</td>
<td>Jet Propulsion Laboratory</td>
</tr>
<tr>
<td>JSOC</td>
<td>Juno Science Operations Center (located at SwRI)</td>
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<tr>
<td>LSB</td>
<td>Least Significant Byte</td>
</tr>
<tr>
<td>MIPL</td>
<td>Multi-mission Image Processing Laboratory</td>
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<td>MSB</td>
<td>Most Significant Byte</td>
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<td>MWR</td>
<td>Microwave Radiometer for the Juno mission.</td>
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<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<td>PDS</td>
<td>Planetary Data System</td>
</tr>
<tr>
<td>PEL</td>
<td>Payload Element Lead</td>
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<tr>
<td>RAM</td>
<td>Random Access Memory</td>
</tr>
<tr>
<td>RDR</td>
<td>Reduced Data Record</td>
</tr>
<tr>
<td>RSP</td>
<td>Raw Science Processor</td>
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<tr>
<td>SCLK</td>
<td>Spacecraft Clock Count</td>
</tr>
<tr>
<td>SCET</td>
<td>Spacecraft Event Time</td>
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<td>SCM</td>
<td>Spacecraft Configuration Manager</td>
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<td>SDS</td>
<td>Science Data System</td>
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<td>SIS</td>
<td>Software Interface Specification</td>
</tr>
<tr>
<td>SwRI</td>
<td>Southwest Research Institute</td>
</tr>
<tr>
<td>TBD</td>
<td>To Be Determined</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>--------------</td>
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<tr>
<td>TDS</td>
<td>Telemetry Data Staging</td>
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<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>UTC</td>
<td>Universal Time Coordinated</td>
</tr>
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<td>WMS</td>
<td>Working Mission Storage</td>
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1. INTRODUCTION

1.1 Purpose and Scope

The purpose of this data product Software Interface Specification (SIS) is to provide users of the Microwave Radiometer (MWR) data with a detailed description of the data products and a description of how they were generated, including data sources and destinations. We deal here with data at both levels 2 and 3 (We use CODMAC data level definitions throughout, see Table 1.2) and the PDS data archive structure. The scope in this release is limited to the MWR data obtained during cruise up until Jupiter Orbit Insertion. It is planned that this document will be updated and released to include Jupiter orbital operations before JOI; however, it is expected that no changes in the structure of the data products defined in this release will be changed except to add new columns at the end of the level 3 geometry data records (GRDRs).

1.2 Summary of Contents and Data Products

This data product SIS describes how the Juno MWR instrument acquires its data, and how the data are formatted, labeled, and uniquely identified. It is meant to be consistent with the Juno Data Management and Archive Plan [4]. Details of instrument function and data calibration are left to documents listed in Section 1.3. This document discusses standards used in generating the product and software that may be used to access the product. The data product structure and organization is described in sufficient detail to enable a user to read the product. Finally, examples of product labels are provided. See the GDS data flow diagram, Figure 2.4 in Section 2.3.3, to see the flow of data through the MWR ground data system.

An Experiment Data Record (EDR) is the first level of product and contains uncalibrated MWR data. It corresponds to NASA science product level 0, and CODMAC level 2. An MWR EDR contains data from one of the instrument’s five data modes: science, engineering only (housekeeping), plus three types of utility data modes that will be used infrequently if at all. The science EDRs contain time-ordered 100-ms radiometric observations from all six channels of the MWR, along with ancillary engineering parameters such as the various temperatures and voltages measured in that interval, captured as raw values directly from the decommutated instrument data stream. The time-ordered sequence of these comprises the level 2 science data. The engineering EDRs are the same except that they contain no radiometric data. These plus the three diagnostic EDRs are covered in Section 3. Data from each mode are stored in separate files and never mixed.

The EDRs obtained in the science mode only are then processed to produce a sequence of calibrated data records, the Reduced Data Records (RDRs). These correspond to NASA product level 1-A, and CODMAC level 3. Each sequence of RDRs consists of two parallel files. The first are the instrument RDRs (IRDRs). The format of the engineering data in these parallels that of the science EDRs except that the missing data are interpolated to fill the empty slots in each record, and both the raw and calibrated science data are interpolated to fill columns for all receiver switch and noise diode settings. The second set of files, the geometry RDRs, or GRDRs, contains the ancillary geometry data for each IRDR. The instrument and geometry RDRs then comprise the level-3 data product.
Each level 2 and level 3 product is accompanied by a label file which, taken together with that product, forms a complete description of the data that is compliant with the Planetary Data System (PDS) and suitable for archiving through the Juno Science Operations Center (JSOC). Only the science EDRs, and the RDRs derived from them, are sent to JSOC and archived in the PDS. All products are named according to the Juno science product naming convention, which uniquely identifies each and every MWR data record for the life of the mission. See Appendix-A for information about naming conventions.

1.3 Applicable Documents and Constraints

This data product SIS is responsive to or refers to information in the following documents:

5. Juno Mission Science Operations Center (SOC) and PDS Atmospheres Node/PPI Node Interface Control Document, Version 0.2
7. Juno Project, Microwave Radiometer (MWR) Algorithm Theoretical Basis Document and Error Analysis, version 0.0, JPL D-41415
8. JSOC-IOT Interface Control Document, 12029.02-JSOC_IOT_ICD-01
9. Juno Mission Science Operations Center (SOC) and PDS Atmospheres Node/PPI Node Interface Control Document, Version 0.2

1.4 Relationships with Other Interfaces

Changes to this MWR SIS document affect the products, software, and/or documents listed in Table 1.2.

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<td>Michael Janssen</td>
</tr>
<tr>
<td>Any science analysis tools</td>
<td>S</td>
<td>Michael Janssen</td>
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2. DATA PRODUCT CHARACTERISTICS AND ENVIRONMENT

2.1 Instrument Overview

The Microwave Radiometer (MWR) is one of a suite of instruments on Juno, which was launched to Jupiter in 2011. The Juno mission has the overall goal of answering the outstanding questions about Jupiter’s structure and origin. The MWR specifically addresses the question of the global water and nitrogen abundances, which are central to understanding Jupiter’s origin, and Jupiter’s atmospheric structure extending deep below the visible clouds, and about which we currently know virtually nothing.

The MWR experiment uses a microwave sounding approach described in Janssen et al., 2005. The MWR instrument measures the atmospheric thermal emission at six frequencies. Thermal emission from an atmosphere arises because of the presence of absorbing constituents in the atmosphere, and the measured emission contains information on both the concentration and temperature of these constituents. The information content changes with frequency, and the determination of the spectrum of atmospheric thermal emission can be used to infer key parameters of both the temperature and compositional structure of the atmosphere. Water and ammonia are the only significant sources of microwave opacity in Jupiter’s atmosphere, so their concentrations are the unique target of any microwave sounding approach. Figure 2.1 shows the contribution functions for thermal emission from the atmosphere as a function of depth for the six MWR frequencies.

Figure 2.1: Contribution functions for the emission from Jupiter’s atmosphere at nominal MWR frequencies. The ammonia cloud tops lie above the 1-bar pressure altitude, below which we have only very limited information at present. The lowest frequency of the MWR is sensitive to atmospheric temperature and water content to depths well below 100 bars.

The instrument comprises what are essentially six independent radiometers, each of which measures the microwave emission viewed through its own independent antenna. The six antennas are distributed around the spacecraft body as shown in Figure 2.2, and view in a direction perpendicular to the spin axis of the spacecraft. Since the spin axis of the spacecraft is oriented approximately perpendicular to the orbit plane, the beam of each antenna sweeps through a great circle on the sky that passes along the sub-spacecraft track on Jupiter and through the nadir direction. Each point along this track is thus observed numerous times, at different emission angles, as the spacecraft spins and moves along its orbit. The accumulated data at each such point and its dependence on emission angle and frequency is then analyzed to obtain vertical atmospheric composition and structure using a radiative transfer model.

Figure 2.2: MWR Antennas are distributed as shown on two sides of the spacecraft. Antennas A1 and A2 have beamwidths of 20°, while A3 through A6 have 12°beamwidths. The spin axis is vertical, and the beams scan orthogonally to this axis as the spacecraft rotates.

Each receiver makes contiguous radiometric measurements, or integrations, of fixed 100-ms duration. In a typical sequence of such integrations an internal switch is cycled from the antenna input to periodically view an internal load, and three independent internal reference noise sources are periodically switched on and off as illustrated in Figure 2.3. The load and internal source are thus intermittently observed to provide a calibration for the sky observations. The cycle for such switching is synchronous for all receivers and is set by selecting from a table contained in the flight software. The table may be changed by an uplink command. The choice of specific sequences depends on instrument performance and optimization of the calibration algorithm [7], work still in progress during cruise. For Jupiter observations any such sequence is intended to run continuously, producing contiguous data. However, for calibration purposes during cruise and before and after perijove, the data rate in this mode is unnecessarily high. A command is available to reduce the total data volume in which the instrument continues to cycle continuously, while only a selected fraction of the data is retained and sent to ground. The command, sent with the parameter \( n \), sends only every \( n \)-second’s worth of data to be downlinked. In other words, ten contiguous 100-ms observations are sent to the spacecraft for downlink, after which \( n-1 \) seconds pass before the next ten 100-ms observations are sent, and so on. A different
switching sequence is typically used to optimize the calibration for such reduced sampling rates depending on the spacecraft spin rate in order to best sample the sky.

\[
A = \text{antenna}, \quad R = \text{reference}, \quad \text{ND} = \text{noise diode}
\]

\[
(N_A = 10, \quad t_{\text{ND}} = 1.2s, \quad \text{and} \quad t_A = 1s)
\]

\[
t_{\text{ND}} = t_A + 2\tau
\]

\[
t_R = t_A + 2\tau
\]

\[
t_A = N_A\tau
\]

Figure 2.3: Nominal switching scheme for MWR receivers. The antenna input is observed for \(N\) times with duration \(\tau = 100\) msec, after which an internal switch is set to observe an internal thermal load (R). Each of the three noise diodes is periodically switched on for the time \(\tau\) (ND) while looking at either the antenna input or internal load for calibration purposes. Preset cycles for such switching may be found in reference 6.

2.2 Data Product Overview

Each MWR science EDR and its associated RDR is organized as a time-ordered series of data collected in 100-ms intervals similar in structure and identical in length as described in Section 3. The flow of data is described in Section 2.3.2 and the detailed sequence of processing is summarized as follows. Packets consisting of ten contiguous 100-ms observations are sent to the spacecraft each second by the MWR instrument, where they are accumulated until 40 packets are received. These correspond to four hundred 100-ms observations that are time-ordered but not necessarily contiguous. These 40 packets are bundled and downlinked, and ultimately received through the SAS as a telemetry data product. In the case that the instrument is operated at a lowered data rate (i.e., \(n > 1\) in Section 2.1), only every \(n\)th seconds-worth of data is contained in the telemetry product, which then spans an observing period of \(n \times 40\) seconds. These data packets are then processed by the MWR pipeline to produce the final data products, the MWR EDRs and RDRs, each containing the data obtained during 1-hour intervals bounded by the hour marks. For example, records obtained at full data rate \((n = 1)\) will contain \(60 \times 60 \times 10 = 36000\) lines of data, while records obtained at lower data rates will be \(n\) times smaller.

Every MWR EDR or RDR has a unique detached PDS label. The PDS label contains the ancillary and metadata associated with a given record. The PDS label, at a general level, is described in the PDS reference document [2]. The specific MWR PDS keywords are defined in Appendix C of this document.

If missing records become available, new versions will be generated. The MWR RDRs in particular will also change as calibrations are improved and new geometry data are obtained. Old versions of the records may be deleted or overwritten as necessary since each subsequent version is more complete.
2.3 Data Processing

2.3.1 Data Processing Level

This SIS uses the Committee On Data Management And Computation (CODMAC) data level numbering system to describe the processing level of the EDR data product. MWR EDR data products are considered CODMAC “Level 2” or “Edited Data” (equivalent to NASA level 0) products. The EDR data files are generated from “Level 1” or “Raw Data”, which are the telemetry products within the project specific Standard Formatted Data Unit (SFDU) record. RDR data products are considered CODMAC “Level 3” or “Calibrated Data”. The RDR data files are generated from the EDR files, to which are added geometry data for each record. Refer to Table 2.2 for a breakdown of the CODMAC and NASA data processing levels.

Table 2.2: Processing Levels for Science Data Sets

<table>
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<tr>
<th>NASA</th>
<th>CODMAC</th>
<th>Description</th>
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<tbody>
<tr>
<td>Packet data</td>
<td>Raw – Level 1</td>
<td>Telemetry data stream as received at the ground station, with science and engineering data embedded.</td>
</tr>
<tr>
<td>Level-0</td>
<td>Edited – Level 2</td>
<td>Instrument science data (e.g., raw voltages, counts) at full resolution, time ordered, with duplicates and transmission errors removed.</td>
</tr>
<tr>
<td>Level 1-A</td>
<td>Calibrated - Level 3</td>
<td>Level 0 data that have been located in space and may have been transformed (e.g., calibrated, rearranged) in a reversible manner and packaged with needed ancillary and auxiliary data (e.g., radiances with the calibration equations applied).</td>
</tr>
<tr>
<td>Level 1-B</td>
<td>Re-sampled - Level 4</td>
<td>Irreversibly transformed (e.g., resampled, remapped, calibrated) values of the instrument measurements (e.g., radiances, magnetic field strength).</td>
</tr>
<tr>
<td>Level 2</td>
<td>Derived - Level 5</td>
<td>Geophysical parameters, generally derived from Level 1 data, and located in space and time commensurate with instrument location, pointing, and sampling.</td>
</tr>
<tr>
<td>Level 3</td>
<td>Derived - Level 5</td>
<td>Geophysical parameters mapped onto uniform space-time grids.</td>
</tr>
</tbody>
</table>

2.3.2 Data Product Generation and Flow

The MWR data enters the Juno Ground Data System (GDS) as telemetry data products obtained through JPL’s DSN, using the Multimission Ground System and Services (MGSS) tools and services as shown in Fig. 2.4. These products are converted into raw data products by the Science Analysis System (SAS) of the Juno GDS and transferred to the MWR pipeline processing system in the Multimission Instrument Processing Lab (MIPL). They are processed by the MWR IOT in MIPL to Levels 2 (Experiment Data Records) and 3 (Reduced Data Records) as described in this SIS. These records are then archived in the Atmospheres node of the Planetary Data System (PDS), which is accomplished through submission to the Juno Science Operations Center (JSOC) at SwRI. Separately, the Level 3
data are analyzed by the MWR Instrument Operations Team (MWR IOT) to produce higher-level data products, presently not defined. The science objectives of the MWR experiment are achieved through these higher-level products.

![Figure 2.4: MWR Ground System Data Flow](image)

2.3.3 **Labeling and Identification**

The MWR EDR and RDR files are labeled both internally and externally. The internal identification is through the PDS detached labels. External identification is through the product’s file name, which conforms to the Juno science product naming convention [4]. See appendix A for details.

2.4 **Standards Used in Generating Data Products**

2.4.4 **PDS Standards**

The MWR EDR and RDR files comply with the Planetary Data System Archive Preparation Guide [1], the Planetary Data System standards for file formats and labels, as specified in the PDS Standards Reference [2], the Planetary Science Data Dictionary Document [3], and the Juno Mission Science Operations Center (JSOC) and PDS Atmospheres Node/PPI Node Interface Control Document [5].
2.4.5 Time Standards
The PDS label for an MWR EDR or RDR uses keywords containing time values, such as start and stop times in UTC, start and stop spacecraft clock (SCLK). Each time value standard is defined according to the keyword definition. See appendix C for detailed keyword definitions.

2.4.6 Coordinate Systems
The nominal antenna coordinate systems \((X_i, Y_i, Z_i)\) are shown in Figure 2.5 in context with the spacecraft coordinate system. All are right-hand orthogonal coordinate systems. The spacecraft Z axis \((Z)\) is directed along the spacecraft spin axis (out of the plane in Fig. 5), with the X axis \((Xs)\) directed along the solar panel that carries the magnetometer boom. The antenna coordinate system of the A3 antenna is shown on the right and is the same for all antennas on that panel (i.e., A2 through A6). The antenna Z axes for A1 and for A2 through 6 are rotated around the body of the spacecraft by \(\pm 60^\circ\) respectively relative to the spacecraft X axis, as shown. These nominal coordinate systems are contained in the Juno fk kernel, while the (small) alignment offsets are contained in the Juno MWR instrument (ik) kernel, so that the SPICE call for MWR antenna pointing delivers the correct boresight pointing at any time. The polarizations (E-field direction) of all antennas are parallel to the spacecraft spin axis (spacecraft Z axis), which is also the Y axis of each antenna.

![Figure 2.5: Antenna and spacecraft coordinate systems.](image)

2.4.7 Data Storage Conventions
Each EDR, IRDR, and GRDR comprises two files, the first containing the MWR data and the second containing the PDS label. These files have identical base names but different file extensions. See appendix A for the file naming convention.

Science and instrument engineering records will be in ASCII comma-separated values (CSV). Other diagnostic and engineering type EDR products, such as memory dumps, command/error history list etc., will be stored in binary format, in the same format received in telemetry.

2.5 Data Validation
Validation of the Juno Data Records will fall into two primary categories: automated and
manual. Automated validation will be performed on every Data Record produced for the mission. Members of the MWR science team will perform manual validation on a subset of products prior to release of archive volume to the PDS.

Automated validation will be performed as a part of the archiving process, and will be done simultaneously with the archive volume validation. Validations performed will include such things as verification that the checksum in the label matches a calculated checksum for the data product (i.e., that the data product included in the archive is identical to that produced by the real-time process), a validation of the PDS syntax of the label, a check of the label values against the database and against the index tables included on the archive volume, and checks for internal consistency of the label items. The latter include such things as verifying that the product creation date is later than the earth received time, and comparing the geometry pointing information with the specified target. As problems are discovered and/or new possibilities identified for automated verification, they will be added to the validation procedure.

Manual validation of the data will be performed both as spot-checking of data throughout the life of the mission, and comprehensive validation of a subset of the data (for example, a couple of days' worth of data). These products will be viewed by humans. Validation in this case will include inspection of the file for errors (like missing lines) not specified in the label parameters, verification that the target shown / apparent geometry matches that specified in the labels, verification that the product is viewable using the specified software tools, and a general check for any problems that might not have been anticipated in the automated validation procedure.
3. DETAILED DATA PRODUCT SPECIFICATIONS FOR LEVEL 2

Each MWR EDR consists of a pair of files that should be treated as one logical data product. These two files will have identical file names with different file extensions. The detached PDS label file has extension “.LBL”, and MWR science file has the extension “.CSV” or “.DAT”.

The EDR file naming convention is described in Appendix A. Examples of the MWR EDR PDS labels are shown in Appendix B, and the PDS label keywords are described in Appendix C.

The MWR instrument can generate five different types of raw data: science, engineering-only, diagnostics, memory dumps, and error dumps. For detailed description of these data types, see the MWR’s Flight Software User’s Guide [6].

On the ground, these five data types are stored as separate products and as different EDRs, each with its own detached PDS label file.

3.1 Science EDR

The science EDR is an ASCII file, with comma-separated values (CSV format), thus it is suitable for reading with Microsoft Excel, IDL, TextEdit, etc. The first line (or row) of the file contains the column headings. The rest of the lines are the values. Each line consists of one 100-msec observation identified by a time tag that corresponds to the midpoint time of measurement. Lines are arranged in time order; thus, the EDR has the structure of a table. Missing lines are not filled, so gaps or jumps in time may exist. Missing values within a single line are left empty. For instance, two or more consecutive commas will be present when one or two consecutive values are missing.

When new, or additional, data for a given product become available on the ground, a new and more complete version of that product is produced. The new version will have the same filename but with a new record number. The record number is increased by the number of the new records (lines) added to the product file. The record-count field allows for 100000 unique values (0 – 99999), but the maximum value will usually be 36000. The maximum value for products associated with hourly intervals that contain leap seconds will be 36010. See the file naming convention in Appendix-A.

In a science EDR, each line starts with the ephemeris time (et) of the midpoint time of the observation as derived from the SCLK and MWR offset-since-last-SCLK clock data contained in the MWR header data that follows, which is then followed by the housekeeping data, and finally by 100-ms-worth of science observations. The structure of one line of the science EDR file is described in Table 3.1. The header is copied directly from the output science packet and is more fully described in Tables 27 and 28 of the MWR’s Flight Software User’s Guide [6] (in case of discrepancies, this User’s Guide should take precedence). The column headings, or fields, for the engineering EDR are shown in table 3 below with orange background. These plus the columns shown with green background constitute the science EDR. See Appendix D for an example of an EDR data file.
Table 3.1: EDR column headings and definitions

<table>
<thead>
<tr>
<th>Col. #</th>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>t_ephem_time</td>
<td>Time at midpoint of 100-ms integration expressed in seconds since 12:00 AM Jan. 1, 2000.</td>
</tr>
<tr>
<td>2</td>
<td>t_utc_doy</td>
<td>UTC at midpoint of 100-ms integration expressed in yyyy-ydoyThh:mm:ss.sss format</td>
</tr>
<tr>
<td>3</td>
<td>pktType</td>
<td>MWR packet type. 0 is science, the nominal packet type, issued normally at 1 Hz. 2 is engineering-only, with the most recent values for all HKU sensors, issued every 20 seconds by default. 3 is diagnostics, with flight software state data replacing science data, as commanded by the MWR_SETMODE command. 4 indicates a memory dump, commanded by the MWR_DOWNLOAD command. 5 is an error dump, issued autonomously by the flight software in place of science data every 25 errors.</td>
</tr>
<tr>
<td>4</td>
<td>pktCnt</td>
<td>Count of packets sent since bootup. Rolls over to 0 after 65535.</td>
</tr>
<tr>
<td>5</td>
<td>fswVer</td>
<td>Flight software version number. The PROM version of flight software is version 36 (hex).</td>
</tr>
<tr>
<td>6</td>
<td>ScienceVer</td>
<td>Version number of the current science configuration table. The default PROM table is version 20 (hex).</td>
</tr>
<tr>
<td>7</td>
<td>SensorVer</td>
<td>Version number of the current sensor configuration table. The default PROM table is version 20 (hex).</td>
</tr>
<tr>
<td>8</td>
<td>DumpError</td>
<td>1 if the current packet is an error dump, 0 otherwise. Error dumps are autonomously issued whenever the instrument flight software has detected a multiple of 25 errors, in place of science data.</td>
</tr>
<tr>
<td>9</td>
<td>DumpMemory</td>
<td>1 if the current packet is a memory dump, 0 otherwise. Memory dumps are issued only on an MWR_DOWNLOAD command from the spacecraft.</td>
</tr>
<tr>
<td>10</td>
<td>UploadEnabled</td>
<td>1 if uploads have been enabled through an MWR_PARAM command, 0 otherwise. Uploads must be enabled before MWR_UPLOAD commands will be accepted.</td>
</tr>
<tr>
<td>11</td>
<td>LogBufFull</td>
<td>1 if the flight software log buffer is full, 0 otherwise. Some flight software activity may be logged to a 4 KB buffer for later download and ground analysis. Logging is enabled using the MWR_SETMODE command, and configured using the MWR_PARAM command (parameter 10). The full-flag is cleared by disabling and then re-enabling logging. For more details, see the Juno MWR Flight Software User’s Guide, sections 2.2, 2.6, A.4.3 and A.6.3.</td>
</tr>
<tr>
<td>12</td>
<td>BootState</td>
<td>0 at power-on, 1 when receivers are powering up, 2 if no spacecraft communication has been detected and FSW is listening on spacecraft side A, 3 if no communication has been detected and FSW is listening on spacecraft side B, 4 if bootup is complete. No other values are legal.</td>
</tr>
<tr>
<td>13</td>
<td>R6Power</td>
<td>1 if receiver R6 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.</td>
</tr>
<tr>
<td>14</td>
<td>R5Power</td>
<td>1 if receiver R5 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.</td>
</tr>
<tr>
<td>15</td>
<td>R4Power</td>
<td>1 if receiver R4 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.</td>
</tr>
<tr>
<td></td>
<td>Name</td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>---------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>16</td>
<td>R3Power</td>
<td>1 if receiver R3 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.</td>
</tr>
<tr>
<td>17</td>
<td>R2Power</td>
<td>1 if receiver R2 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.</td>
</tr>
<tr>
<td>18</td>
<td>R1Power</td>
<td>1 if receiver R1 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.</td>
</tr>
<tr>
<td>19</td>
<td>IdleMode</td>
<td>1 if the instrument is in idle mode, 0 otherwise. In idle mode, the instrument is forced to execute receiver sequence 0 for science and sensor sequence 0 for housekeeping. Idle mode is entered through an MWR_SETMODE command from the spacecraft. Memory uploads are only accepted in idle mode.</td>
</tr>
<tr>
<td>20</td>
<td>ForcedSide</td>
<td>2 if flight software was commanded to use spacecraft communication channel A, 3 if flight software was commanded to use channel B, 0 otherwise. Normally the side (A or B) to use is determined autonomously by the instrument electronics at bootup and this value will be 0.</td>
</tr>
<tr>
<td>21</td>
<td>SensorSynth</td>
<td>1 if sensor data is simulated, 0 otherwise. Simulated sensor data may be commanded for testing purposes, using the MWR_SETMODE command. For more details, see the Juno MWR Flight Software User’s Guide, section B.2.2.</td>
</tr>
<tr>
<td>22</td>
<td>ReceiverSynth</td>
<td>1 if receiver data is simulated, 0 otherwise. Simulated receiver data may be commanded for testing purposes, using the MWR_SETMODE command. For more details, see the Juno MWR Flight Software User’s Guide, section B.2.2.</td>
</tr>
<tr>
<td>23</td>
<td>DiagMode</td>
<td>1 if flight software is issuing diagnostic packets in place of science data, 0 otherwise. Diagnostic packets may be commanded using the MWR_SETMODE command for software debugging.</td>
</tr>
<tr>
<td>24</td>
<td>LogIdle</td>
<td>1 if the flight software log buffer is full, 0 otherwise. Some flight software activity (CPU idle time, by default) may be logged to a 4 KB buffer for later download and ground analysis. Logging is enabled using the MWR_SETMODE command, and configured using the MWR_PARAM command (parameter 10). For more details, see the Juno MWR Flight Software User’s Guide, sections 2.2, 2.6, A.4.3 and A.6.3.</td>
</tr>
<tr>
<td>25</td>
<td>CRCInROM</td>
<td>1 if the CRC transmitted with each packet is being calculated over ROM, 0 for RAM. Which memory is being scanned is specified using the MWR_SETMODE command. RAM scanning is the default.</td>
</tr>
<tr>
<td>26</td>
<td>SCTimeSec</td>
<td>The seconds component of the last spacecraft time received. Note that spacecraft times are “clocked in” by a hardware time tick. This value is not updated until the tick itself has been received.</td>
</tr>
<tr>
<td>27</td>
<td>SCTimeSubSec</td>
<td>The subseconds component of the last spacecraft time received. Also see “SCTimeSec” above. Each subsecond represents 1/65536 of a second.</td>
</tr>
<tr>
<td>28</td>
<td>ClksSinceSCTime</td>
<td>Count of 2 KHz clock pulses since last S/C time tick, when data integration for the frame started. That is, if data integration for the current science packet started 150 ms after the last S/C time was clocked in, this value will be 300.</td>
</tr>
<tr>
<td>29</td>
<td>CRC</td>
<td>The last-calculated CRC (PROM or RAM). This value will be 0 before the first CRC has been calculated, or (temporarily) when the area to be scanned is changed with the MWR_SETMODE command.</td>
</tr>
<tr>
<td>30</td>
<td>Resets</td>
<td>The number of watchdog resets since power-on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>31</td>
<td>MissedSCTime</td>
<td>The number of spacecraft times expected and not received, since instrument bootup.</td>
</tr>
<tr>
<td>32</td>
<td>ReceiverStatus</td>
<td>The status reported by the receivers at the end of the frame. If receiver data is synthesized, this reads out as 0xAABBCC.</td>
</tr>
<tr>
<td>33</td>
<td>SeqNumber</td>
<td>Number of the receiver sequence executing at the start of the frame. The PROM contains 22 pre-defined sequences (numbered 0 through 21), with 10 more available to be defined using the MWR_UPLOAD command. For more details, see the Juno MWR Flight Software User's Guide, section 2.3.</td>
</tr>
<tr>
<td>34</td>
<td>SeqIndex</td>
<td>The index into the current receiver sequence corresponding to the first reading of the frame; the first index is 0.</td>
</tr>
<tr>
<td>35</td>
<td>CmdsRecvd</td>
<td>The number of instrument commands received since bootup. Does not include spacecraft time messages.</td>
</tr>
<tr>
<td>36</td>
<td>CmdsExec</td>
<td>The number of instrument commands executed since bootup. Not all commands execute immediately, but in general, the number of commands received should be the same as the number of commands executed, unless one or more commands were rejected, or a command (such as a memory dump) is completing over multiple telemetry products.</td>
</tr>
<tr>
<td>37</td>
<td>CmdsReject</td>
<td>The number of commands which were received but which could not be executed. This includes instrument commands with format errors, and dump commands which were interrupted. It does not include spacecraft messages which were so corrupted that they couldn’t even be recognized as potential instrument commands; these messages provoke an error but no change in command counters.</td>
</tr>
<tr>
<td>38</td>
<td>LastSCMsgRecvd</td>
<td>The first 8 non-pad bytes of the last instrument command received from the spacecraft. Does not include S/C time messages.</td>
</tr>
<tr>
<td>39</td>
<td>LastMsgTime</td>
<td>The time (SCLK seconds) at which the last spacecraft message was received.</td>
</tr>
<tr>
<td>40</td>
<td>RecentErr</td>
<td>An 8-byte descriptor of the last error encountered. For more details, see the Juno MWR Flight Software User’s Guide, section 2.4.</td>
</tr>
<tr>
<td>41</td>
<td>ErrorCnt</td>
<td>The number of errors detected by flight software since instrument bootup.</td>
</tr>
<tr>
<td>42</td>
<td>CDU_P5V</td>
<td>Current on the +5 volt line for the command data unit</td>
</tr>
<tr>
<td>43</td>
<td>LNA_P7V</td>
<td>Current on the +7 volt line for the low noise amplifiers</td>
</tr>
<tr>
<td>44</td>
<td>LNA_N5V</td>
<td>Current on the -5 volt line for the low noise amplifiers</td>
</tr>
<tr>
<td>45</td>
<td>ND_P15V</td>
<td>Current on the +15 volt line for the noise diodes</td>
</tr>
<tr>
<td>46</td>
<td>VFC_P12V</td>
<td>Current on the +12 volt line for the voltage to frequency converter</td>
</tr>
<tr>
<td>47</td>
<td>VFC_N12V</td>
<td>Current on the -12 volt line for the voltage to frequency converter</td>
</tr>
<tr>
<td>48</td>
<td>HKU_P12V</td>
<td>Current on the +12 volt line for the housekeeping unit</td>
</tr>
<tr>
<td>49</td>
<td>HKU_N12V</td>
<td>Current on the -12 volt line for the housekeeping unit</td>
</tr>
<tr>
<td>50</td>
<td>HKU1_VCAL_A</td>
<td>Calibration resistor value A for the voltage telemetry on housekeeping unit #1</td>
</tr>
<tr>
<td>51</td>
<td>HKU1_VCAL_B</td>
<td>Calibration resistor value B for the voltage telemetry on housekeeping unit #1</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>HKU2_VCAL_A Calibration resistor value A for the voltage telemetry on housekeeping unit #2</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>HKU2_VCAL_B Calibration resistor value B for the voltage telemetry on housekeeping unit #2</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>HKU1_RTD_CAL_LO Low calibration value for thermistors on housekeeping unit #1</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>HKU1_RTD_CAL_HI High calibration value for thermistors on housekeeping unit #1</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>HKU1_PRT_CAL_LO Low calibration value for PRTs on housekeeping unit #1</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>HKU1_PRT_CAL_HI High calibration value for PRTs on housekeeping unit #1</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>HKU2_RTD_CAL_LO Low calibration value for thermistors on housekeeping unit #2</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>HKU2_RTD_CAL_HI High calibration value for thermistors on housekeeping unit #2</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>HKU2_PRT_CAL_LO Low calibration value for PRTs on housekeeping unit #2</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>HKU2_PRT_CAL_HI High calibration value for PRTs on housekeeping unit #2</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>PDUR_A Power distribution unit – A temperature</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>PDUR_B Power distribution unit – B temperature</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>HKU_1 Housekeeping unit – 1 temperature</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>HKU_2 Housekeeping unit – 2 temperature</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>CDU Command and data unit temperature</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>PDUD Power distribution unit – D temperature</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>R1T1 R1 internal receiver thermistor 1</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>R1T2 R1 internal receiver thermistor 2</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>R1T3 R1 internal receiver thermistor 3</td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>R1T4 R1 internal receiver thermistor 4</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>INT_RFTL1T1 R1 inside vault RFTL thermistor 1</td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>INT_RFTL1T2 R1 inside vault RFTL thermistor 2</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>RFTL1T1 R1 external to vault RFTL PRT 1</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>RFTL1T2 R1 external to vault RFTL PRT 2</td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>RFTL1T3 R1 external to vault RFTL PRT 3</td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>A1T1 R1 antenna PRT 1</td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>A1T2 R1 antenna PRT 2</td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>A1T3 R1 antenna PRT 3</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>A1T4 R1 antenna PRT 4</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>R2T1 R2 internal receiver thermistor 1</td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>R2T2 R2 internal receiver thermistor 2</td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>R2T3 R2 internal receiver thermistor 3</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>R2T4 R2 internal receiver thermistor 4</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>INT_RFTL2T1 R2 inside vault RFTL thermistor 1</td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>INT_RFTL2T2 R2 inside vault RFTL thermistor 2</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>RFTL2T1 R2 external to vault RFTL PRT 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>88</td>
<td>RFTL2T2</td>
<td>R2 external to vault RFTL PRT 2</td>
</tr>
<tr>
<td>89</td>
<td>RFTL2T3</td>
<td>R2 external to vault RFTL PRT 3</td>
</tr>
<tr>
<td>90</td>
<td>A2T1</td>
<td>R2 antenna PRT 1</td>
</tr>
<tr>
<td>91</td>
<td>A2T2</td>
<td>R2 antenna PRT 2</td>
</tr>
<tr>
<td>92</td>
<td>A2T3</td>
<td>R2 antenna PRT 3</td>
</tr>
<tr>
<td>93</td>
<td>R3T1</td>
<td>R3 internal receiver thermistor 1</td>
</tr>
<tr>
<td>94</td>
<td>R3T2</td>
<td>R3 internal receiver thermistor 2</td>
</tr>
<tr>
<td>95</td>
<td>R3T3</td>
<td>R3 internal receiver thermistor 3</td>
</tr>
<tr>
<td>96</td>
<td>R3T4</td>
<td>R3 internal receiver thermistor 4</td>
</tr>
<tr>
<td>97</td>
<td>INT_RFTL3T1</td>
<td>R3 inside vault RFTL thermistor 1</td>
</tr>
<tr>
<td>98</td>
<td>INT_RFTL3T2</td>
<td>R3 inside vault RFTL thermistor 2</td>
</tr>
<tr>
<td>99</td>
<td>RFTL3T1</td>
<td>R3 external to vault RFTL PRT 1</td>
</tr>
<tr>
<td>100</td>
<td>RFTL3T2</td>
<td>R3 external to vault RFTL PRT 2</td>
</tr>
<tr>
<td>101</td>
<td>RFTL3T3</td>
<td>R3 external to vault RFTL PRT 3</td>
</tr>
<tr>
<td>102</td>
<td>A3T1</td>
<td>R3 antenna PRT 1</td>
</tr>
<tr>
<td>103</td>
<td>A3T2</td>
<td>R3 antenna PRT 2</td>
</tr>
<tr>
<td>104</td>
<td>A3T3</td>
<td>R3 antenna PRT 3</td>
</tr>
<tr>
<td>105</td>
<td>R4T1</td>
<td>R4 internal receiver thermistor 1</td>
</tr>
<tr>
<td>106</td>
<td>R4T2</td>
<td>R4 internal receiver thermistor 2</td>
</tr>
<tr>
<td>107</td>
<td>R4T3</td>
<td>R4 internal receiver thermistor 3</td>
</tr>
<tr>
<td>108</td>
<td>R4T4</td>
<td>R4 internal receiver thermistor 4</td>
</tr>
<tr>
<td>109</td>
<td>INT_RFTL4T1</td>
<td>R4 inside vault RFTL thermistor 1</td>
</tr>
<tr>
<td>110</td>
<td>INT_RFTL4T2</td>
<td>R4 inside vault RFTL thermistor 2</td>
</tr>
<tr>
<td>111</td>
<td>RFTL4T1</td>
<td>R4 external to vault RFTL PRT 1</td>
</tr>
<tr>
<td>112</td>
<td>RFTL4T2</td>
<td>R4 external to vault RFTL PRT 2</td>
</tr>
<tr>
<td>113</td>
<td>RFTL4T3</td>
<td>R4 external to vault RFTL PRT 3</td>
</tr>
<tr>
<td>114</td>
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</tr>
<tr>
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<td>R4 antenna PRT 2</td>
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</tr>
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<tr>
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<td>R5T2</td>
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</tr>
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<td>R5 inside vault RFTL thermistor 1</td>
</tr>
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<td>R5 inside vault RFTL thermistor 2</td>
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<td>R6 antenna PRT 1</td>
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<td>139</td>
<td>RecvrConfig</td>
<td>Field to identify receiver state (switch position and noise diodes on/off)</td>
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<tr>
<td>140</td>
<td>R1_1Count</td>
<td>R1 low gain counts</td>
</tr>
<tr>
<td>141</td>
<td>R1_2Count</td>
<td>R1 high gain counts</td>
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<tr>
<td>142</td>
<td>R2_1Count</td>
<td>R2 low gain counts</td>
</tr>
<tr>
<td>143</td>
<td>R2_2Count</td>
<td>R2 high gain counts</td>
</tr>
<tr>
<td>144</td>
<td>R3Count</td>
<td>R3 counts</td>
</tr>
<tr>
<td>145</td>
<td>R4Count</td>
<td>R4 counts</td>
</tr>
<tr>
<td>146</td>
<td>R5Count</td>
<td>R5 counts</td>
</tr>
<tr>
<td>147</td>
<td>R6Count</td>
<td>R6 counts</td>
</tr>
</tbody>
</table>

### 3.2 Engineering-only EDR

The engineering data are collected and downlinked independently from the science data. Engineering-only EDRs are produced and stored independently from the science EDRs. The structure of the engineering-only EDR is the same as the science EDR shown in Table 3.1 with the exceptions that 1) the times in columns 1 and 2 are only the time of the start of the integration of the packet; and 2) only the orange background columns are included. Since the data they contain are redundant with those in the science EDRs, and because in practice we never plan to operate the instrument without taking science data, we have no plan at present to further use or archive the engineering-only EDRs.

### 3.3 Diagnostic dump EDR

Similar to the engineering-only data, the diagnostic dump data generated by the instrument is stored in the EDR in ascending time order, each record containing the S/C time, as a record header followed by the entire data as sent by the spacecraft.
The detailed description of the diagnostics dump data is defined in table 29 of the MWR Software User’s guide [6].

In case of discrepancies, the User’s Guide should take precedence.

<table>
<thead>
<tr>
<th>Table 3.1: The MWR Diagnostic Dump EDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t(0)$</td>
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<tr>
<td>$t(1)$</td>
</tr>
<tr>
<td>$t(2)$</td>
</tr>
<tr>
<td>$t(3)$</td>
</tr>
<tr>
<td>$t(4)$</td>
</tr>
</tbody>
</table>

### 3.4 Memory Dump EDR

The MWR can be commanded to send a dump the contents of its internal memory in packet format. When present, the memory data replaces the normal science data in the downlink telemetry. The memory dump data are 376 bytes long, including a 36-byte header.

The structure of the record is defined in section B.5 of the MWR Software User’s guide and in the table below.

In case of discrepancies, the User’s Guide should take precedence.

<table>
<thead>
<tr>
<th>Table 3.2: The MWR Memory Dump EDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t(0)$</td>
</tr>
<tr>
<td>$t(1)$</td>
</tr>
<tr>
<td>$t(2)$</td>
</tr>
<tr>
<td>$t(3)$</td>
</tr>
<tr>
<td>$t(4)$</td>
</tr>
</tbody>
</table>

### 3.5 Error Dump EDR

The MWR can be commanded to send and downlink the contents of its onboard error cache memory where a history of error messages or codes are store. The error dump EDRs are an engineering product and are only used by the instrument engineers. The definition and content of these binary data are outside the scope of this document.

<table>
<thead>
<tr>
<th>Table 3.3: The MWR Error Dump EDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t(0)$</td>
</tr>
<tr>
<td>$t(1)$</td>
</tr>
<tr>
<td>$t(2)$</td>
</tr>
<tr>
<td>$t(3)$</td>
</tr>
<tr>
<td>$t(4)$</td>
</tr>
</tbody>
</table>

### 3.6 Label and Header Descriptions

#### 3.6.1 PDS Label

MWR EDR data products have detached PDS labels stored as ASCII. A PDS label is object-oriented and describes the objects in the data file. The PDS label contains keywords for
product identification and for data object definitions. The label also contains descriptive information needed to interpret or process the data objects in the file.

PDS labels are written in Object Description Language (ODL) [2]. PDS label statements have the form of "keyword = value". Each label statement is terminated with a carriage return character (ASCII 13) and a line feed character (ASCII 10) sequence to allow the label to be read by many operating systems. Pointer statements with the following format are used to indicate the location of data objects in the file:

^object = location

where the caret character (^, also called a pointer) is followed by the name of the specific data object. The location is the starting record number for the data object within the file.
4. DETAILED DATA PRODUCT SPECIFICATIONS FOR LEVEL 3

Each RDR comprises four files: an instrument RDR (the IRDR) and a geometry RDR (the GRDR), each with data and detached PDS label files (.CSV and .LBL respectively). The file naming convention is the same as with the EDRs and is described in Appendix A. Examples of the IRDR and GRDR PDS labels are shown in Appendix B, and the PDS label keywords are described in Appendix C. There are no engineering-only level 3 products.

4.1 IRDR

The instrument RDR (IRDR) is the calibrated data from the science EDR, and is an ASCII file with comma-separated values (CSV format). It is a table with the same structure as an EDR, largely parallel with but having different columns and entries as described in this section. As with the EDR, the first elements of each line begin with the ephemeris time and UTC. This is followed by housekeeping temperature measurements, now filled in by interpolation from the sparse values in the EDR to provide the best-estimated temperature value for each line for a given sensor. The header values from the EDR and other engineering data are not carried to the RDR, however. These are followed by the radiometric measurements, now expanded and interpolated to provide the best estimates for the radiometric output from the radiometers for each possible setting of the noise diode and Dicke switches, as interpolated from the sparse, uncalibrated values in the EDR. Both the raw counts and calibrated values in Kelvin units are included. The algorithms for producing calibrated radiometric values are given in [7]. In the RDR only those times in which the radiometer is observing through the antenna (e.g., see Fig 2.3) are retained in the time-ordered data, and all other data from the EDR are calibrated and interpolated to those times. Typically every sixth 100-ms interval is skipped when the MWR is commanded to return data at full data rate, and every fifth interval is skipped in low data rate mode.

The column headings, or fields, for the IRDR are shown in table 4. Note, during normal operations, noise diode 1 is not fired in the reference load position so that the ND1R field is typically empty.

Table 4.1: IRDR column headings and definitions

<table>
<thead>
<tr>
<th>Col. #</th>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>t_ephem_time</td>
<td>Time at midpoint of 100-ms integration expressed in seconds since 12:00 AM Jan. 1, 2000.</td>
</tr>
<tr>
<td>2</td>
<td>t_utc_doy</td>
<td>UTC time at midpoint of 100-ms integration expressed in yyyy-doyThh:mm:ss.sss format</td>
</tr>
<tr>
<td>3</td>
<td>R1T1</td>
<td>R1 internal receiver thermistor 1</td>
</tr>
<tr>
<td>4</td>
<td>R1T2</td>
<td>R1 internal receiver thermistor 2</td>
</tr>
<tr>
<td>5</td>
<td>R1T3</td>
<td>R1 internal receiver thermistor 3</td>
</tr>
<tr>
<td>6</td>
<td>R1T4</td>
<td>R1 internal receiver thermistor 4</td>
</tr>
<tr>
<td>7</td>
<td>INT_RFTL1T1</td>
<td>R1 inside vault RFTL thermistor 1</td>
</tr>
<tr>
<td>8</td>
<td>INT_RFTL1T2</td>
<td>R1 inside vault RFTL thermistor 2</td>
</tr>
<tr>
<td>9</td>
<td>RFTL1T1</td>
<td>R1 external to vault RFTL PRT 1</td>
</tr>
<tr>
<td>10</td>
<td>RFTL1T2</td>
<td>R1 external to vault RFTL PRT 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>11</td>
<td>RFTL1T3</td>
<td>R1 external to vault RFTL PRT 3</td>
</tr>
<tr>
<td>12</td>
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<td>R2T2</td>
<td>R2 internal receiver thermistor 2</td>
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<td>28</td>
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</tr>
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<td>74</td>
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<td>R1 low gain counts switched to antenna</td>
</tr>
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<td>75</td>
<td>R1_2AntCnt</td>
<td>R1 high gain counts switched to antenna</td>
</tr>
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<td>76</td>
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<td>R4AntCnt</td>
<td>R4 counts switched to antenna</td>
</tr>
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</tr>
<tr>
<td>82</td>
<td>R1_1RefCnt</td>
<td>R1 low gain counts switched to internal load</td>
</tr>
<tr>
<td>83</td>
<td>R1_2RefCnt</td>
<td>R1 high gain counts switched to internal load</td>
</tr>
<tr>
<td>84</td>
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<td>R3RefCnt</td>
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</tr>
<tr>
<td>87</td>
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<td>R5RefCnt</td>
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</tr>
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<td>R6RefCnt</td>
<td>R6 counts switched to internal load</td>
</tr>
<tr>
<td>90</td>
<td>R1_1ND1ACnt</td>
<td>R1 low gain noise diode 1 deflection in antenna position, counts</td>
</tr>
<tr>
<td>91</td>
<td>R1_2ND1ACnt</td>
<td>R1 high gain noise diode 1 deflection in antenna position, counts</td>
</tr>
<tr>
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<td>R2_1ND1ACnt</td>
<td>R2 low gain noise diode 1 deflection in antenna position, counts</td>
</tr>
<tr>
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<td>R2_2ND1ACnt</td>
<td>R2 high gain noise diode 1 deflection in antenna position, counts</td>
</tr>
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<td>R1_2TOFF</td>
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</table>
4.2 GRDR

The geometry RDR (GRDR) contains the pointing information for the IRDR that locates each MWR beam with respect to sources and frames of interest. It is a time-ordered table that complements the IRDR line for line, with the same structure. For the cruise phase of the mission only the galactic background is of interest, so that only coordinates relating to this are included in the present release. These coordinates are J2000 and galactic coordinates. Each column contains the respective beam boresights and polarizations for each receiver in these coordinate frames. The polarization for each antenna is defined as the angle between the Y axis of the respective antenna and the polar axis of the respective spherical coordinate system, both projected onto the plane of the sky, the latter given as a plane perpendicular to the boresight direction. This angle is defined as the degrees of counter-clockwise rotation of the projected antenna Y axis from the projected polar axis. The release before JOI will retain these columns and will incorporate the appropriate geometrical information for Jupiter and the sun in additional columns.

Table 4.2: GRDR column headings and definitions

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<th>Label</th>
<th>Description</th>
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<td>Time at midpoint of 100-ms integration expressed in seconds since 12:00 AM Jan. 1, 2000.</td>
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<td>gal_rot_1</td>
<td>Antenna 1 polarization in galactic coordinates</td>
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5. ARCHIVE VOLUME

5.1 Overview

The MWR Data Record archive collection is produced by the MWR IOT in cooperation with the JSOC, and with the support of the PDS Planetary Atmospheres Node (Atmospheres Node, or Atmos). The archive volume creation process described in this section sets out the roles and responsibilities of both these groups. The assignment of tasks has been agreed by both parties, and codified herein. Archived data received by the Atmos Node from the MWR IOT will be made electronically available to PDS users as soon as practicable but no later than as laid out in Table 5.1.

Data products delivered to PDS will accrue on one of two volumes. EDR products will be added to volume JNOMWR_0000, while the calibrated science RDR products become part of the JNOMWR_1000 volume. This version of the MWR SIS considers only the archiving of data obtained during cruise, and it is planned that a separate pair of volumes will be produced for Jupiter orbital data, with some differences in their structure that will be defined in a future release of this document. Allowance for these volumes is made in Table 5.1.

Table 5.1: Archive Schedule and Responsibilities

<table>
<thead>
<tr>
<th>Data Product (CODMAC)</th>
<th>Volume</th>
<th>Provider</th>
<th>Inner Cruise</th>
<th>Outer Cruise</th>
<th>Orbital Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDR (level 2)</td>
<td>JNOMWR_0000</td>
<td>MWR, M. Janssen</td>
<td>EFB + 18 months</td>
<td>Jupiter + 4 months</td>
<td>N/A</td>
</tr>
<tr>
<td>IRDR, GRDR (level 3)</td>
<td>JNOMWR_1000</td>
<td>MWR, M. Janssen</td>
<td>EFB + 18 months</td>
<td>Jupiter + 4 months</td>
<td>N/A</td>
</tr>
<tr>
<td>EDR* (level 2)</td>
<td>JNOMWR_0100</td>
<td>MWR, M. Janssen</td>
<td>N/A</td>
<td>N/A</td>
<td>EDA + 3 to 6 months</td>
</tr>
<tr>
<td>IRDR*, GRDR* (level 3)</td>
<td>JNOMWR_1100</td>
<td>MWR, M. Janssen</td>
<td>N/A</td>
<td>N/A</td>
<td>EDA + 3 to 6 months</td>
</tr>
</tbody>
</table>

- Jupiter orbit phase data with content and structure to be defined.

5.2 Interface with the PDS

The MWR IOT will deliver data to JSOC. JSOC in turn will transfer the data to the Atmos Node in standard product packages containing three months of data, also adhering to the schedule set out in Table 5.1. Each package will comprise both data and ancillary data files organized into directory structures consistent with the volume design described below, and combined into a deliverable file(s) using file archive and compression software. When these files are unpacked at the Atmos Node in the appropriate location, the constituent files will be organized into the archive volume structure.
The archive products will be sent electronically from the MWR IOT to the JSOC using the SFTP protocol. JSOC, acting as an agent of the MWR Team, will transfer the data to the Atmos node. The IOT operator will copy volume files (see Table 5.1) to an appropriate location within the JSOC file system. Only those files that have changed since the last delivery will be included. The JSOC operator or software will run basic validation checks as defined in the JSOC-IOT Interface Control Document [8]. JSOC will transfer the contents of the data delivery to the Atmos node using the process defined in [9].

Following receipt of a data delivery, Atmos will organize the data into PDS archive volume structure within its online data system. Atmos will generate all of the required files associated with a PDS archive volume (index file, read-me files, etc.) as part of its routine processing of incoming MWR data. Newly delivered data will be made available publicly through the Atmos online system once accompanying labels and other documentation have been validated. It is anticipated that this validation process will require at least fourteen working days from receipt of the data by Atmos. The first two data deliveries are expected to require somewhat more time for the Atmos Node to process before making the data publicly available.

All PDS data are subject to Peer Review under the auspices of the PDS.

5.3 Labeling and Identification

Each MWR data volume bears a unique volume ID using the last two components of the volume set ID [2, sec. 19.1]. The volume IDs are USA_NASA_PDS_JNOMWR_nnnn, where JNOMWR is the VOLUME_SET_ID defined by the PDS and nnnn is either 0000, for the level 2 (EDR) data volume, or 1000 for the level 3 (RDR) data volume. This is summarized in Table 5.2.

<table>
<thead>
<tr>
<th>DATA_SET_ID</th>
<th>VOLUME_SET_ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>JNO-X-MWR-2-EDR-V1.2</td>
<td>USA_NASA_PDS_JNOMWR_0000</td>
</tr>
<tr>
<td>JNO-X-MWR-3-RDR-V2.1</td>
<td>USA_NASA_PDS_JNOMWR_1000</td>
</tr>
<tr>
<td>JNO-J-MWR-2-EDR-V1.0*</td>
<td>USA_NASA_PDS_JNOMWR_0100</td>
</tr>
<tr>
<td>JNO-J-MWR-3-RDR-V1.0*</td>
<td>USA_NASA_PDS_JNOMWR_1100</td>
</tr>
</tbody>
</table>

* Jupiter orbit phase data with content and structure to be defined.

5.4 EDR Archive Volume Contents

The JNOMWR_0000 volume contains Experiment Data Records (EDRs) from the Juno MWR instrument obtained from launch through the end of outer cruise. All files defined in this section, except those specifically noted, are to be provided by the MWR IOT. The complete directory structure is shown in Figure 5.1.
5.4.2 Root Directory Contents

Files in the Root Directory include an overview of the archive, a description of the volume for the PDS Catalog, and a list of errata or comments about the archive. The following files are contained in the Root Directory.

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAREADME.TXT</td>
<td>Volume content and format information</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>ERRATA.TXT</td>
<td>A cumulative listing of comments and updates concerning all archive volumes published to date</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>VOLDESC.CAT</td>
<td>A description of the contents of this volume in a PDS format readable by both humans and computers</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>

5.4.3 DATA Directory Contents

The DATA directory contains the data files produced by the IOT for level 2 and are the EDR files described in Section 3. Each data record in the set is paired in the same subdirectory with its corresponding header file as described further in Section 3. Each data file contains a complete set of housekeeping information along with radiometric data. They are organized as time-ordered data in ASCII format, and edited to remove obviously bad data. All data files are of the highest quality possible.

Any residual issues are documented in AAREADME.TXT and ERRATA.TXT. Users are referred to these files for a detailed description of any outstanding matters associated with the archived data. Additional files relevant to the data files are located in the ANCILLARY sub-directory. These include ancillary information files (command sequences, ancillary headers) provided to facilitate data processing and analysis.
### Table 5.4: DATA Directory contents and description

<table>
<thead>
<tr>
<th>Item Name</th>
<th>Description</th>
<th>Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANCILLARY</td>
<td>Sub-directory containing command sequences and ancillary headers</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>yyyy</td>
<td>Subdirectories containing data ordered by year (yyyy)</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>yyyydoy</td>
<td>EDR directories ordered by day of year doy. Each directory contains up to 24 EDR files corresponding to all data records obtained within a given hour of that day. A pair of files is produced for each hour: 1) a header file with a filename described in Appendix A and a suffix of .LBL and contents described in Appendix B, and 2) a data file with the same filename and a suffix .CSV, with contents described in Table 3.</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>

#### 5.4.4 Index Directory Contents

Files in the Index Directory are provided to help the user locate products on this archive volume and on previously released volumes in the archive. The following files are contained in the Index Directory

### Table 5.5: Index Directory Contents

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDEXINFO.TXT</td>
<td>A description of the contents of this directory</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>INDEX.TAB</td>
<td>A table listing all data products on this volume</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>INDEX.LBL</td>
<td>A PDS detached label that describes INDEX.TAB</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>

#### 5.4.5 Document Directory Contents

The Document Directory contains documentation to help the user understand and use the archive data. The following files are contained in the Document Directory.
Table 5.6: Document Directory Contents

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCINFO.TXT</td>
<td>A description of the contents of this directory</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>MWR_SIS_V4.1.PDF</td>
<td>The Data Product and Archive Volume SIS (this document) as a PDF file</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>DPSIS.LBL</td>
<td>A PDS detached label that describes DPS_ARCH_SIS.PDF</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>

5.4.6 Catalog Directory Contents

The files in the Catalog Directory provide a top-level understanding of the mission, spacecraft, instruments, and data sets. The files in this directory are coordinated with the PDS data engineer, who is responsible for loading them into the PDS catalog. The following files are found in the Catalog Directory.

Table 5.7: Catalog Directory Contents

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>File Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATINFO.TXT</td>
<td>A description of the contents of this directory</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>DATASET.CAT</td>
<td>Data set information for the PDS catalog</td>
<td>MWR IOT, Atmos node</td>
</tr>
<tr>
<td>INSTHOST.CAT</td>
<td>Instrument host (i.e., spacecraft) information for the PDS catalog</td>
<td>Juno Project</td>
</tr>
<tr>
<td>INST.CAT</td>
<td>Instrument information for the PDS catalog</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>MISSION.CAT</td>
<td>Mission information for the PDS catalog</td>
<td>Juno Project</td>
</tr>
<tr>
<td>PERSON.CAT</td>
<td>Personnel information for the PDS catalog (Team and PDS personnel responsible for generating the archive)</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>REF.CAT</td>
<td>References mentioned in other *.CAT files</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>

5.4.7 Label Directory Contents

The Label Directory contains files required for reading the data files. The following files are found in the Label Directory.

Table 5.8: Label Directory Contents

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>File Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>LABELINFO.TXT</td>
<td>A description of the contents of this directory</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>MWR_EDR_V04.FMT</td>
<td>File required for reading the .CSV files in the Data EDR Folder</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>
5.5 RDR Archive Volume Format

The JNOMWR_1000 volume contains Reduced Data Records (RDRs) from the Juno MWR instrument obtained from launch through the end of outer cruise. All files defined in this section, except those specifically noted, are to be provided by the MWR IOT. The complete directory structure is shown in Figure 5.2.

![Figure 5.2: RDR Archive Volume Directory Structure](image)

5.5.8 Root Directory Contents

Files in the Root Directory include an overview of the archive, a description of the volume for the PDS Catalog, and a list of errata or comments about the archive. The following files are contained in the Root Directory

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAREADME.TXT</td>
<td>Volume content and format information</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>ERRATA.TXT</td>
<td>A cumulative listing of comments and updates concerning all archive volumes published to date</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>VOLDESC.CAT</td>
<td>A description of the contents of this volume in a PDS format readable by both humans and computers</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>
5.5.9 DATA Directory Contents

The DATA directory contains the data files produced by the MWR IOT for level 3 and are the RDR files described in Section 4. Each data record in the set is paired in the same subdirectory with its corresponding header file. The instrument and geometry RDRs (IRDRs and GRDRs respectively) are kept in separate folders in the day-of-year subdirectories; otherwise they are named and organized using the same conventions as the EDRs.

Any residual issues are documented in AAREADME.TXT and ERRATA.TXT. Users are referred to these files for a detailed description of any outstanding matters associated with the archived data. Additional files relevant to the data files are located in the ANCILLARY sub-directory. These include ancillary information files (command sequences, ancillary headers) provided to facilitate data processing and analysis.

<table>
<thead>
<tr>
<th>Item Name</th>
<th>Description</th>
<th>Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANCILLARY</td>
<td>Sub-directory containing command sequences and ancillary headers</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>yyyy</td>
<td>Subdirectories containing data files ordered by year (yyyy)</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>yyyydoy</td>
<td>Each yyyydoy subdirectory contains IRDR and GRDR files in separate folders for that day. Each folder contains up to 24 RDR (IRDR and GRDR files respectively) corresponding to all data records produced within a given hour of that day. A pair of files is produced for each hour: 1) a header file with a filename described in Appendix A and a suffix of .LBL and contents described in Appendix B, and 2) a data file with the same filename and a suffix .CSV, with contents described in Table 3.</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>

5.5.10 Index Directory Contents

Files in the Index Directory are provided to help the user locate products on this archive volume and on previously released volumes in the archive. The following files are contained in the Index Directory.

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDXINFO.TXT</td>
<td>A description of the contents of this directory</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>INDEX.TAB</td>
<td>A table listing all data products on this volume</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>INDEX.LBL</td>
<td>A PDS detached label that describes INDEX.TAB</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>
5.5.11 Document Directory Contents

The Document Directory contains documentation to help the user understand and use the archive data. The following files are contained in the Document Directory.

Table 5.11: Document Directory Contents

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCINFO.TXT</td>
<td>A description of the contents of this directory</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>MWR_SIS_V4.1.PDF</td>
<td>The Data Product and Archive Volume SIS (this document) as a PDF file</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>DPSIS.LBL</td>
<td>A PDS detached label that describes DPS_ARCH_SIS.PDF</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>

5.5.12 Catalog Directory Contents

The files in the Catalog Directory provide a top-level understanding of the mission, spacecraft, instruments, and data sets. The files in this directory are coordinated with the PDS data engineer, who is responsible for loading them into the PDS catalog. The following files are found in the Catalog Directory.

Table 5.12: Catalog Directory Contents

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATINFO.TXT</td>
<td>A description of the contents of this directory</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>DATASET.CAT</td>
<td>Data set information for the PDS catalog</td>
<td>MWR IOT, Atmos node</td>
</tr>
<tr>
<td>INSTHOST.CAT</td>
<td>Instrument host (i.e., spacecraft) information for the PDS catalog</td>
<td>Juno Project</td>
</tr>
<tr>
<td>MWRINST.CAT</td>
<td>Instrument information for the PDS catalog</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>MISSION.CAT</td>
<td>Mission information for the PDS catalog</td>
<td>Juno Project</td>
</tr>
<tr>
<td>PERSON.CAT</td>
<td>Personnel information for the PDS catalog (Team and PDS personnel responsible for generating the archive)</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>REF.CAT</td>
<td>References mentioned in other *.CAT files</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>

5.5.13 Label Directory Contents

The Label Directory contains files required for reading the data files. The following files are found in the Label Directory.
### Table 5.8: Label Directory Contents

<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
<th>File Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>LABELINFO.TXT</td>
<td>A description of the contents of this directory</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>MWR_IRDR_V05.FMT</td>
<td>File required for reading the .CSV files in the Data IRDR Folder</td>
<td>MWR IOT</td>
</tr>
<tr>
<td>MWR_GRDR_V04.FMT</td>
<td>File required for reading the .CSV files in the Data GRDR Folder</td>
<td>MWR IOT</td>
</tr>
</tbody>
</table>
Appendix A – File Naming Convention

All MWR products will follow the following file naming convention.

```
III0OTTYYYDDHHMMSS_RCCCC_VNN.XXX
```

Where:

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Instrument Id</td>
</tr>
</tbody>
</table>
| O      | Orbit Number | Orbit number, zero padded decimal integer starting at 01.  
  “00” cruise data  
  “NN” Orbit number (NN ≠ “00”) |
| T      | Product Type | Two-letter designator for data product type.  
  DR - EDR, nominal science data, including housekeeping.  
  RI - RDR instrument data  
  RG - RDR geometry data  
  HK - Housekeeping or Engineering-only data  
  DD - Diagnostics dump  
  MD - Memory Dump  
  ED - Error Dump |
| Y      | Year | Year, 4 decimal digits. |
| D      | Day | Day of year, from S/C event time (SCLK converted to SCET),  
  zero-padded decimal value 001-366 |
| H      | Hour | Hour of day, from S/C event time (SCLK converted to SCET),  
  zero-padded decimal value 00-23 |
| M      | Minute | Minutes of hour, from S/C event time (SCLK converted to SCET),  
  zero-padded decimal value 00-59 |
| S      | Second | Seconds of minute, from S/C event time (SCLK converted to  
  SCET), zero-padded decimal value 00-59 |
| _R     | reserved | Always set to ”_R” |
| C      | Number of data rows | Same as ROWS that appears in the SPREADSHEET object section  
  of the PDS label file associated with the product |
| V      | Reserved | Always set to ”_V” |
| N      | Algorithm/format version | Version number is incremented when there is an algorithmic  
  change in data production or a file format change. |
| .      | Period | Always set to ”.” (period) |
| X      | File Extension | “LBL” Detached PDS label file.  
  “DAT” Binary data, used for diagnostic, command history and  
  memory dump products only.  
  “CSV” ASCII file, with comma separated values. Used for all  
  science and housekeeping products |
## Appendix B - Examples of MWR Labels

### MWR_EDR

```plaintext
PDS_VERSION_ID = "PDS3"
/* FILE DATA ELEMENTS */
RECORD_TYPE = "STREAM"
RECORD_BYTES = 1275
FILE_RECORDS = 1631
MD5_CHECKSUM = "27a14b60f055bab7650c61e0e3c2f0e1"
/* IDENTIFICATION DATA ELEMENTS */
DATA_SET_ID = "JNO-X-MWR-2-EDR-V1.2"
PRODUCT_ID = "MWR00DR2015220000000_R01630_V03.CSV"
STANDARD_DATA_PRODUCT_ID = "EDR"
PRODUCT_TYPE = "EDR"
PRODUCT_VERSION_ID = "03"
INSTRUMENT_HOST_ID = "JNO"
INSTRUMENT_HOST_NAME = "JUNO"
INSTRUMENT_ID = "MWR"
INSTRUMENT_TYPE = "RADIOMETER"
INSTRUMENT_NAME = "MICROWAVE RADIOMETER"
MISSION_NAME = "JUNO"
MISSION_PHASE_NAME = "QUIET CRUISE"
PRODUCER_INSTITUTION_NAME = "MULTIMISSION IMAGE PROCESSING SUBSYSTEM, JET PROPULSION LAB"
PRODUCT_CREATION_TIME = 2016-04-11T16:04:08
SPACECRAFT_CLOCK_START_COUNT = "5/492265948.60452"
SPACECRAFT_CLOCK_STOP_COUNT = "5/492267730.60452"
START_TIME = 2015-08-08T00:30:13.079
STOP_TIME = 2015-08-08T00:59:56.072
TARGET_NAME = "SKY"
/* TELEMETRY DATA ELEMENTS */
SPICE_FILE_NAME = { "ops_sci_new_kernels.txt",
                   "juno_mwr_v01.ti",
                   "naif0011.tls",
                   "JNO_SCLKSCET.00037.tsc" }
TELEMETRY_PROVIDER_ID = "SAS"
/* HISTORY DATA ELEMENTS */
SOFTWARE_NAME = "MWR_LEVEL2"
SOFTWARE_VERSION_ID = "1.2"
PROCESSING_LEVEL_ID = "2"
/* HEADER REFERENCE */
^HEADER = ("MWR00DR2015220000000_R01630_V03.CSV",1)
OBJECT = HEADER
BYTES = 1275
HEADER_TYPE = "TEXT"
DESCRIPTION = "See "STRUCTURE"
END_OBJECT = HEADER
/* DATA REFERENCE */
^SPREADSHEET = ("MWR00DR2015220000000_R01630_V03.CSV",1276<BYTES>)
OBJECT = SPREADSHEET
ROWS = 1630
ROW_BYTES = 318
FIELDS = 147
FIELD_DELIMITER = "COMMA"
"STRUCTURE" = "MWR_EDR_V04.FMT"
END_OBJECT = SPREADSHEET
END
```
MWR_IRDR

PDS_VERSION_ID = "PDS3"

/* FILE DATA ELEMENTS */
RECORD_TYPE = "STREAM"
RECORD_BYTES = 1752
FILE_RECORDS = 1305
MD5_CHECKSUM = "1cf18f4e908f2ec4c6f454c451ad2a04"

/* IDENTIFICATION DATA ELEMENTS */
DATA_SET_ID = "JNO-X-MWR-3-RDR-V2.1"
PRODUCT_ID = "MWR00RI20150808000000_R01304_V04.CSV"
STANDARD_DATA_PRODUCT_ID = "IRDR"
PRODUCT_TYPE = "IRDR"
PRODUCT_VERSION_ID = "04"
INSTRUMENT_HOST_ID = "JNO"
INSTRUMENT_HOST_NAME = "JUNO"
INSTRUMENT_ID = "MWR"
INSTRUMENT_TYPE = "RADIOMETER"
MISSION_NAME = "MICROWAVE RADIOMETER"
MISSION_PHASE_NAME = "QUIET CRUISE"
PRODUCER_INSTITUTION_NAME = "MULTIMISSION IMAGE PROCESSING SUBSYSTEM, JET PROPULSION LAB"
PRODUCT_CREATION_TIME = 2016-04-04T16:04:57
SPACECRAFT_CLOCK_START_COUNT = "5/492265948.60452"
SPACECRAFT_CLOCK_STOP_COUNT = "5/492267730.60452"
START_TIME = 2015-08-08T00:30:13.079
STOP_TIME = 2015-08-08T00:59:56.072
TARGET_NAME = "SKY"

/* TELEMETRY DATA ELEMENTS */
TELEMETRY_PROVIDER_ID = "SAS"

/* HISTORY DATA ELEMENTS */
SOFTWARE_NAME = "MWR_LEVEL3"
SOFTWARE_VERSION_ID = "2.1"
PROCESSING_LEVEL_ID = "3"

/* HEADER REFERENCE */
^HEADER = (^MWR00RI20150808000000_R01304_V03.CSV":1)
OBJECT = HEADER
BYTES = 1752
HEADER_TYPE = "TEXT"
DESCRIPTION = "See ^STRUCTURE"
END_OBJECT = HEADER

/* DATA REFERENCE */
^SPREADSHEET = (^MWR00RI20150808000000_R01304_V03.CSV":1753<BYTES>)
OBJECT = SPREADSHEET
ROWS = 1304
ROW_BYTES = 1629
FIELDS = 201
FIELD_DELIMITER = "COMMA"
STRUCTURE = "MWR_IRDR_V05.FMT"
END_OBJECT = SPREADSHEET
END
MWR_GRDR

PDS_VERSION_ID = "PDS3"

/* FILE DATA ELEMENTS */
RECORD_TYPE = "STREAM"
RECORD_BYTES = 420
FILE_RECORDS = 1305
MD5_CHECKSUM = "06d92743bda7e92e33af4433faa87b08"

/* IDENTIFICATION DATA ELEMENTS */
DATA_SET_ID = "JNO-X-MWR-3-RDR-V2.0"
PRODUCT_ID = "MWR00RG2015220000000_R01304_V03.CSV"
STANDARD_DATA_PRODUCT_ID = "GRDR"
PRODUCT_TYPE = "GRDR"
PRODUCT_VERSION_ID = "03"
INSTRUMENT_HOST_ID = "JNO"
INSTRUMENT_ID = "MWR"
INSTRUMENT_TYPE = "RADIOMETER"
INSTRUMENT_NAME = "MICROWAVE RADIOMETER"
MISSION_NAME = "JUNO"
MISSION_PHASE_NAME = "QUIET CRUISE"
PRODUCT_CREATION_TIME = 2016-04-11T16:04:57
SPACECRAFT_CLOCK_START_COUNT = "5/492265948.60452"
SPACECRAFT_CLOCK_STOP_COUNT = "5/492267730.60452"
START_TIME = 2015-08-08T00:30:13.079
STOP_TIME = 2015-08-08T00:59:56.072
TARGET_NAME = "SKY"

/* TELEMETRY DATA ELEMENTS */
SPICE_FILE_NAME = { "ops_sci_new_kernels.txt", "juno_mwr_v08.tf", "naif0011.tls", "JNO_SCLKSETC.00037.tsc", "spk_pre_151003_160701_1608317 jc063.bsp", "spk_rec_140903151003_1510103_160110.bsp", "juno_v08.tf", "pck00010.tpc", "juno_sc_rec_150808_150808_v01.bc", "juno_sc_rec_150809_150815_v01.bc", "juno_sc_rec_150816_150822_v01.bc" }
TELEMETRY_PROVIDER_ID = "SAS"

/* HISTORY DATA ELEMENTS */
SOFTWARE_NAME = "MWR_LEVEL3"
SOFTWARE_VERSION_ID = "2.0"
PROCESSING_LEVEL_ID = "3"

/* HEADER REFERENCE */
^HEADER = ("MWR00RG2015220000000_R01304_V03.CSV",1)
OBJECT = HEADER
BYTES = 420
HEADER_TYPE = "TEXT"
DESCRIPTION = "See ^STRUCTURE"
END_OBJECT = HEADER

/* DATA REFERENCE */
^SPREADSHEET = ("MWR00RG2015220000000_R01304_V03.CSV",421<BYTES>)
OBJECT = SPREADSHEET
ROWS = 1304
ROW_BYTES = 327
FIELDS = 38
FIELD_DELIMITER = "COMMA"
^STRUCTURE = "MWR_GRDR_V04.FMT"
END_OBJECT = SPREADSHEET
END
Appendix C – MWR Label Keyword Definitions

<table>
<thead>
<tr>
<th>Keyword Name</th>
<th>Definition</th>
<th>Type</th>
<th>Units</th>
<th>Valid Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA_SET_ID</td>
<td>A unique alphanumeric identifier for a data set or a data product. The</td>
<td>string</td>
<td></td>
<td>“JNO-X-MWR-2-EDR-V1.2”</td>
</tr>
<tr>
<td></td>
<td>DATA_SET_ID value for a given data set or product is constructed according to flight project naming conventions. In most cases the DATA_SET_ID is an abbreviation of the DATA_SET_NAME. The version number will change for each archive set and shall be determined by PDS. Note: In the PDS, the values for both DATA_SET_ID and DATA_SET_NAME are constructed according to standards outlined in the Standards Reference [2].</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIELDS</td>
<td>Number of data columns in the CSV file.</td>
<td>integer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FILE_RECORDS</td>
<td>Indicates the number of physical file records, including both label records and data records. Note: In the PDS the use of FILE_RECORDS along with other file-related data elements is fully described in the Standards Reference [2].</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTRUMENT_HOST_ID</td>
<td>Provides a unique identifier for the host where an instrument is located. This host can be either a spacecraft or an earth base (e.g., and observatory or laboratory on the earth). Thus, INSTRUMENT_HOST_ID can contain values which are either SPACERCRAFT_ID values or EARTH_BASE_ID values.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTRUMENT_HOST_NAME</td>
<td>Provides the full name of the host on which an instrument is based. This host can be either a spacecraft or an earth base. Thus, the INSTRUMENT_HOST_NAME element can contain values which are either SPACERCRAFT_NAME values or EARTH_BASE_NAME values. Note that mosaics may contain more than one value in an array.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTRUMENT_ID</td>
<td>Provides a unique identifier for the instrument.</td>
<td>string</td>
<td></td>
<td>“MWR”</td>
</tr>
<tr>
<td>INSTRUMENT_NAME</td>
<td>Full name of the instrument, always set to the same string for MWR.</td>
<td>string</td>
<td></td>
<td>“MICROWAVE RADIOMETER”</td>
</tr>
<tr>
<td>INSTRUMENT_TYPE</td>
<td>Identifies the type of an instrument. Example values: MICROWAVE RADIOMETER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note that mosaics may contain more than one value in an array.</td>
<td>string</td>
<td></td>
<td>“RADIOMETER”</td>
</tr>
<tr>
<td>Keyword Name</td>
<td>Definition</td>
<td>Type</td>
<td>Units</td>
<td>Valid Values</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| MD5_CHECKSUM           | Computed MD5 checksum value of the data file, represented as a hexadecimal value  
Currently using the MD5 algorithm of OpenSSL library                                                                                     | string |       |                                                                            |
| MISSION_NAME           | Identifies a major planetary mission or project. A given planetary mission may be associated with one or more spacecraft.  
Note that mosaics may contain more than one value in an array.                                                                                                                                       | string |       | “JUNO”                                                                     |
| PDS_VERSION_ID         | Represents the version number of the PDS standards document that is valid when a data product label is created.  
Values for the PDS_version_id are formed by appending the integer for the latest version number to the letters ‘PDS’.  
Examples: PDS3, PDS4.                                                                                                                                                           | string(6) |       | “PDS3”                                                                     |
| PROCESSING_LEVEL_ID    | Identifies the CODMAC product level.  
Set to “2” for MWR EDRs, set to “3” for MWR RDRs. Other values as applicable to higher product levels.                                                                                                                | integer |       | 2, 3                                                                        |
| PRODUCER_INSTITUTION_NAME | Identifies a university, research center, NASA center or other institution associated with the production of a data set. This would generally be an institution associated with the element PRODUCER_FULL_NAME.                                                                                              | string(60) |       | “MULTIMISSION IMAGE PROCESSING SUBSYSTEM, JET PROPULSION LAB” |
| PRODUCT_CREATION_TIME  | Defines the UTC system format time when a product was created.  
Formation rule:  
YYYY-MM-DDThh:mm:ss                                                                                                                                                                                                  | string |       |                                                                            |
| PRODUCT_ID             | Represents a permanent, unique identifier assigned to a data product by its producer. Usually the name of the data *.CVS file.  
Note: In the PDS, the value assigned to product_id must be unique within its data set.  
Additional note: The product_id can describe the lowest-level data object that has a PDS label.                                                                 | string(40) |       |                                                                            |
<table>
<thead>
<tr>
<th>Keyword Name</th>
<th>Definition</th>
<th>Type</th>
<th>Units</th>
<th>Valid Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODUCT_TYPE</td>
<td>Identifies the type or category of a data product within a data set.</td>
<td>string(8)</td>
<td></td>
<td>“EDR”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“IRDR”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“GRDR”</td>
</tr>
<tr>
<td>PRODUCT_VERSION_ID</td>
<td>Identifies the version of an individual product within a data set.</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRODUCT_VERSION_ID is intended for use within AMMOS to identify separate iterations of a given product, which will also have a unique FILE_NAME.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Example: “R02392_V01”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note: This might not be the same as the data set version that is an element of the DATA_SET_ID value.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECORD_BYTES</td>
<td>Indicates the number of bytes in a physical file record, including record terminators and separators.</td>
<td>integer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note: In the PDS, the use of record_bytes, along with other file-related data elements is fully described in the Standards Reference [2].</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECORD_TYPE</td>
<td>Indicates the record format of a file.</td>
<td>string(20)</td>
<td></td>
<td>“STREAM”</td>
</tr>
<tr>
<td></td>
<td>Note: In the PDS, when record_type is used in a detached label file it always describes its corresponding detached data file, not the label file itself. The use of record_type along with other file-related data elements is fully described in the PDS Standards Reference [2].</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROW_BYTES</td>
<td>Maximum length for any data row/line in EDR. For MWR EDRs, this value is set to a constant, which is based on the worst case scenario.</td>
<td>integer</td>
<td>Bytes</td>
<td>4000</td>
</tr>
<tr>
<td>ROWS</td>
<td>Number of rows/lines of data in the EDR. Excludes lines of header, if any.</td>
<td>integer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOFTWARE_NAME</td>
<td>Identifies data processing software such as a program or a program library.</td>
<td>string(60)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOFTWARE_VERSION_ID</td>
<td>Indicates the version (development level) of a program or a program library.</td>
<td>string(20)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPACECRAFT_CLOCK_START_COUNT</td>
<td>Provides the value of the spacecraft clock at the beginning of a time period of interest.</td>
<td>string(30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Format is p/ddddddddddd, dddd, which is partition-number/sclk-seconds.sclk-subseconds.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPACECRAFT_CLOCK_STOP_COUNT</td>
<td>Provides the value of the spacecraft clock at the end of a time period of interest.</td>
<td>string(30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Format is p/ddddddddddd, dddd, which is partition-number/sclk-seconds.sclk-subseconds.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keyword Name</td>
<td>Definition</td>
<td>Type</td>
<td>Units</td>
<td>Valid Values</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>------------</td>
<td>-------</td>
<td>------------------</td>
</tr>
<tr>
<td>SPICE_FILE_NAME</td>
<td>Provides the names of the SPICE files used in processing the data.</td>
<td>string</td>
<td>(180)</td>
<td></td>
</tr>
<tr>
<td>STANDARD_DATA_PRODUCT_ID</td>
<td>Generic tag used by JSOC to determine the type of data for each instrument.</td>
<td>string</td>
<td></td>
<td>“EDR”, “IRDR”, “GRDR”</td>
</tr>
<tr>
<td>START_TIME</td>
<td>Provides the date and time of the beginning of an event or observation (whether it be a spacecraft, ground-based, or system event) in UTC system format. Formation rule: YYYY-MM-DDThh:mm:ss.fff Note absence of quotes</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOP_TIME</td>
<td>Provides the date and time of the ending of an event or observation (whether it be a spacecraft, ground-based, or system event) in UTC system format. Formation rule: YYYY-MM-DDThh:mm:ss.fff Note absence of quotes</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TARGET_NAME</td>
<td>Identifies a target. The target may be a planet, satellite, ring, region, feature, asteroid or comet. See TARGET_TYPE.</td>
<td>string(30)</td>
<td></td>
<td>“JUPITER”, “SKY”</td>
</tr>
</tbody>
</table>

## Appendix D – Examples of MWR EDRs and RDRs

### D.1 Science EDR in CSV format:

```csv
In the above example, the first line/record contains the column headings. Subsequent lines are science records corresponding to 100-m integrations centered on the time (et in column 1, UTC in column 2) of the midpoint of the respective record.
```

### D.2 Instrument RDR (IRDR) in CSV format:

```csv
In the above example, the first line/record contains the column headings. Subsequent lines are science records corresponding to 100-m integrations centered on the time (et in column 1, UTC in column 2) of the midpoint of the respective record.
```
D.3 Geometry RDR (GRDR) in CSV format:

<table>
<thead>
<tr>
<th>t_ephem_time, t_utc_doy, 1_gal_lon, 1_gal_lat, 1_gal_rot, 2_gal_lon, 2_gal_lat, 2_gal_rot, 3_gal_lon, 3_gal_lat, 3_gal_rot, 4_gal_lon, 4_gal_lat, 4_gal_rot, 5_gal_lon, 5_gal_lat, 5_gal_rot, 6_gal_lon, 6_gal_lat, 6_gal_rot, 1_J2000_lon, 1_J2000_lat, 1_J2000_rot, 2_J2000_lon, 2_J2000_lat, 2_J2000_rot, 3_J2000_lon, 3_J2000_lat, 3_J2000_rot, 4_J2000_lon, 4_J2000_lat, 4_J2000_rot, 5_J2000_lon, 5_J2000_lat, 5_J2000_rot, 6_J2000_lon, 6_J2000_lat, 6_J2000_rot</th>
</tr>
</thead>
</table>
Appendix E – PDS object format description

E.1 EDR

OBJECT

NAME = t_ephem_time
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 1
BYTES = 20
DESCRIPTION = "Time at midpoint of 100-ms integration expressed in seconds since 12:00 AM Jan. 1, 2000"

END_OBJECT

OBJECT

NAME = t_utc_doy
DATA_TYPE = TIME
FIELD_NUMBER = 2
BYTES = 21
DESCRIPTION = "UTC at midpoint of 100-ms integration expressed in yyyy-doyThh:mm:ss.sss format"

END_OBJECT

OBJECT

NAME = pktType
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 3
BYTES = 10
DESCRIPTION = "MWR packet type. 0=science, 2=engineering only, 3=diagnostics, 4=memory dump, 5=error dump"

END_OBJECT

OBJECT

NAME = pktCnt
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 4
BYTES = 10
DESCRIPTION = "Count of packets sent since bootup. Rolls over to 0 after 65535."

END_OBJECT

OBJECT

NAME = fswVer
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 5
BYTES = 10
DESCRIPTION = "Flight software version number. The PROM version of flight software is version 36 (hex)."

END_OBJECT

OBJECT

NAME = ScienceVer
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 6
BYTES = 10
DESCRIPTION = "Version number of the current science configuration table. The default PROM table is version 20 (hex)."

END_OBJECT

OBJECT

NAME = SensorVer
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 7
BYTES = 10
DESCRIPTION = "Version number of the current sensor configuration table. The default PROM table is version 20 (hex)."

END_OBJECT

OBJECT

NAME = DumpError
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 8
BYTES = 10
DESCRIPTION = "1 if the current packet is an error dump, 0 otherwise."

END_OBJECT

OBJECT

NAME = DumpMemory
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 9
BYTES = 10
DESCRIPTION = "1 if the current packet is a memory dump, 0 otherwise."
END_OBJECT

OBJECT = FIELD
NAME = UploadEnabled
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 10
BYTES = 10
DESCRIPTION = "1 if uploads have been enabled through an MWR_PARAM command, 0 otherwise."
END_OBJECT

OBJECT = FIELD
NAME = LogBufFull
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 11
BYTES = 10
DESCRIPTION = "1 if the flight software log buffer is full, 0 otherwise."
END_OBJECT

OBJECT = FIELD
NAME = BootState
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 12
BYTES = 10
DESCRIPTION = "State of instrument after bootup"
END_OBJECT

OBJECT = FIELD
NAME = R6Power
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 13
BYTES = 10
DESCRIPTION = "1 if receiver R6 is powered on, 0 otherwise"
END_OBJECT

OBJECT = FIELD
NAME = R5Power
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 14
BYTES = 10
DESCRIPTION = "1 if receiver R5 is powered on, 0 otherwise"
END_OBJECT

OBJECT = FIELD
NAME = R4Power
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 15
BYTES = 10
DESCRIPTION = "1 if receiver R4 is powered on, 0 otherwise"
END_OBJECT

OBJECT = FIELD
NAME = R3Power
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 16
BYTES = 10
DESCRIPTION = "1 if receiver R3 is powered on, 0 otherwise"
END_OBJECT

OBJECT = FIELD
NAME = R2Power
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 17
BYTES = 10
DESCRIPTION = "1 if receiver R2 is powered on, 0 otherwise"
END_OBJECT

OBJECT = FIELD
NAME = R1Power
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 18
BYTES = 10
DESCRIPTION = "1 if receiver R1 is powered on, 0 otherwise"
END_OBJECT

OBJECT = FIELD
NAME = IdleMode
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 19
BYTES = 10
DESCRIPTION = "1 if the instrument is in idle mode, 0 otherwise"
END_OBJECT

OBJECT = FIELD
NAME = ForcedSide
<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCTimeSec</td>
<td>The seconds component of SCLK</td>
</tr>
<tr>
<td>SCTimeSubSec</td>
<td>The subseconds component of SCLK</td>
</tr>
<tr>
<td>ClksSinceSCTime</td>
<td>Count of 2 KHz clock pulses since last SCLK</td>
</tr>
<tr>
<td>CRC</td>
<td>The last-calculated CRC (PROM or RAM)</td>
</tr>
<tr>
<td>Resets</td>
<td>The number of watchdog resets since power-on</td>
</tr>
<tr>
<td>MissedSCTime</td>
<td>The number of SCLKs expected and not received since boot-up</td>
</tr>
<tr>
<td>CRCInROM</td>
<td>The number of SCLKs expected and not received since boot-up</td>
</tr>
</tbody>
</table>

**Data Type**: ASCII_INTEGER
**Field Number**: 2
**Bytes**: 10
**Description**: "2-channel A, 3-channel B, 0 otherwise"

**Data Type**: ASCII_INTEGER
**Field Number**: 2
**Bytes**: 10
**Description**: "1=simulated sensor, 0 otherwise"

**Data Type**: ASCII_INTEGER
**Field Number**: 2
**Bytes**: 10
**Description**: "1=simulated receiver, 0 otherwise"

**Data Type**: ASCII_INTEGER
**Field Number**: 2
**Bytes**: 10
**Description**: "Diag mode state"

**Data Type**: ASCII_INTEGER
**Field Number**: 2
**Bytes**: 10
**Description**: "LOG BUFFER STATE, 1=FULL"

**Data Type**: ASCII_INTEGER
**Field Number**: 2
**Bytes**: 10
**Description**: "CRC state:1=ON, 0=RAM"
OBJECT  = FIELD
NAME    = ReceiverStatus
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 32
BYTES = 10
DESCRIPTION = "The status reported by the receivers at the end of the frame"

OBJECT  = FIELD
NAME    = SeqNumber
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 33
BYTES = 10
DESCRIPTION = "Number of the receiver sequence executing at the start of the frame"

OBJECT  = FIELD
NAME    = SeqIndex
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 34
BYTES = 10
DESCRIPTION = "Index into current receiver sequence"

OBJECT  = FIELD
NAME    = CmdsRecvd
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 35
BYTES = 10
DESCRIPTION = "Number of commands received since bootup"

OBJECT  = FIELD
NAME    = CmdsExec
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 36
BYTES = 10
DESCRIPTION = "Number of instrument commands executed since bootup"

OBJECT  = FIELD
NAME    = CmdsReject
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 37
BYTES = 10
DESCRIPTION = "Number of commands received but not executed"

OBJECT  = FIELD
NAME    = LastSCMsgRecvd
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 38
BYTES = 10
DESCRIPTION = "1st 8 non-pad bytes of the last instrument command received"

OBJECT  = FIELD
NAME    = LastMsgTime
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 39
BYTES = 10
DESCRIPTION = "The time (SCLK seconds) at which the last spacecraft message was received."

OBJECT  = FIELD
NAME    = RecentErr
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 40
BYTES = 10
DESCRIPTION = "An 8-byte descriptor of the last error encountered"

OBJECT  = FIELD
NAME    = ErrorCnt
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 41
BYTES = 10
DESCRIPTION = "Number of errors detected by flight software since instrument bootup."

OBJECT  = FIELD
NAME    = CDU_P5V
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 42
BYTES = 10
DESCRIPTION = "Current on the +5 volt line for the command data unit"

END_OBJECT

OBJECT = FIELD
NAME = LNA_P7V
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 43
BYTES = 10
DESCRIPTION = "Current on the +7 volt line for the low noise amplifiers"

END_OBJECT

OBJECT = FIELD
NAME = LNA_N5V
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 44
BYTES = 10
DESCRIPTION = "Current on the -5 volt line for the low noise amplifiers"

END_OBJECT

OBJECT = FIELD
NAME = ND_P15V
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 45
BYTES = 10
DESCRIPTION = "Current on the +15 volt line for the noise diodes"

END_OBJECT

OBJECT = FIELD
NAME = ND_P15V
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 46
BYTES = 10
DESCRIPTION = "Current on the +15 volt line for the noise diodes"

END_OBJECT

OBJECT = FIELD
NAME = HKU_P12V
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 48
BYTES = 10
DESCRIPTION = "Current on the +12 volt line for the housekeeping unit"

END_OBJECT

OBJECT = FIELD
NAME = HKU1_VCAL_A
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 50
BYTES = 10
DESCRIPTION = "Calibration resistor value A for the voltage telemetry on housekeeping unit #1"

END_OBJECT

OBJECT = FIELD
NAME = HKU1_VCAL_B
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 51
BYTES = 10
DESCRIPTION = "Calibration resistor value B for the voltage telemetry on housekeeping unit #1"

END_OBJECT

OBJECT = FIELD
NAME = HKU2_VCAL_A
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 52
BYTES = 10
DESCRIPTION = "Calibration resistor value A for the voltage telemetry on housekeeping unit #2"

END_OBJECT
OBJECT                   = FIELD
NAME                  = HKU2_VCAL_B
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 53
BYTES                 = 10
DESCRIPTION           = "Calibration resistor value B for the voltage telemetry on housekeeping unit #2"
END_OBJECT

OBJECT                   = FIELD
NAME                  = HKU1_RTD_CAL_LO
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 54
BYTES                 = 10
DESCRIPTION           = "Low calibration value for thermistors on housekeeping unit #1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = HKU1_RTD_CAL_HI
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 55
BYTES                 = 10
DESCRIPTION           = "High calibration value for thermistors on housekeeping unit #1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = HKU1_PRT_CAL_LO
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 56
BYTES                 = 10
DESCRIPTION           = "Low calibration value for PRTs on housekeeping unit #1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = HKU1_PRT_CAL_HI
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 57
BYTES                 = 10
DESCRIPTION           = "High calibration value for PRTs on housekeeping unit #1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = PDUR_A
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 62
BYTES                 = 10
DESCRIPTION           = "Power distribution unit A temperature"
END_OBJECT

OBJECT                   = FIELD
NAME                  = PDUR_B
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 63
BYTES                 = 10
DESCRIPTION           = "Power distribution unit – A1 B temperature"

END_OBJECT

OBJECT                   = FIELD
NAME                  = HKU_1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 64
BYTES                 = 10
DESCRIPTION           = "Housekeeping unit – A1 1 temperature"

END_OBJECT

OBJECT                   = FIELD
NAME                  = HKU_2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 65
BYTES                 = 10
DESCRIPTION           = "Housekeeping unit – A1 2 temperature"

END_OBJECT

OBJECT                   = FIELD
NAME                  = CDU
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 66
BYTES                 = 10
DESCRIPTION           = "Command and data unit temperature"

END_OBJECT

OBJECT                   = FIELD
NAME                  = PDUD
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 67
BYTES                 = 10
DESCRIPTION           = "Power distribution unit – A1 D temperature"

END_OBJECT

OBJECT                   = FIELD
NAME                  = R1T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 68
BYTES                 = 10
DESCRIPTION           = "R1 internal receiver thermistor 1"

END_OBJECT

OBJECT                   = FIELD
NAME                  = R1T2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 69
BYTES                 = 10
DESCRIPTION           = "R1 internal receiver thermistor 2"

END_OBJECT

OBJECT                   = FIELD
NAME                  = R1T3
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 70
BYTES                 = 10
DESCRIPTION           = "R1 internal receiver thermistor 3"

END_OBJECT

OBJECT                   = FIELD
NAME                  = R1T4
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 71
BYTES                 = 10
DESCRIPTION           = "R1 internal receiver thermistor 4"

END_OBJECT

OBJECT                   = FIELD
NAME                  = INT_RFL1T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 72
BYTES                 = 10
DESCRIPTION           = "R1 inside vault RFL thermistor 1"

END_OBJECT

OBJECT                   = FIELD
NAME                  = INT_RFL1T2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 73
BYTES                 = 10
DESCRIPTION           = "R1 inside vault RFL thermistor 2"

END_OBJECT

OBJECT                   = FIELD
NAME                  = RFT1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 74
BYTES                 = 10
DESCRIPTION           = "R1 external to vault RFL PRT 1"

END_OBJECT
DESCRIPTION "R2 inside vault RFTL thermistor 2"
END_OBJECT

OBJECT
  NAME = RFTL2T1
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 87
  BYTES = 10
  DESCRIPTION = "R2 external to vault RFTL PRT 1"
END_OBJECT

OBJECT
  NAME = RFTL2T2
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 88
  BYTES = 10
  DESCRIPTION = "R2 external to vault RFTL PRT 2"
END_OBJECT

OBJECT
  NAME = RFTL2T3
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 89
  BYTES = 10
  DESCRIPTION = "R2 external to vault RFTL PRT 3"
END_OBJECT

OBJECT
  NAME = A2T1
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 90
  BYTES = 10
  DESCRIPTION = "R2 antenna PRT 1"
END_OBJECT

OBJECT
  NAME = A2T2
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 91
  BYTES = 10
  DESCRIPTION = "R2 antenna PRT 2"
END_OBJECT

OBJECT
  NAME = A2T3
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 92
  BYTES = 10
  DESCRIPTION = "R2 antenna PRT 3"
END_OBJECT

OBJECT
  NAME = R3T1
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 93
  BYTES = 10
  DESCRIPTION = "R3 internal receiver thermistor 1"
END_OBJECT

OBJECT
  NAME = R3T2
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 94
  BYTES = 10
  DESCRIPTION = "R3 internal receiver thermistor 2"
END_OBJECT

OBJECT
  NAME = R3T3
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 95
  BYTES = 10
  DESCRIPTION = "R3 internal receiver thermistor 3"
END_OBJECT

OBJECT
  NAME = R3T4
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 96
  BYTES = 10
  DESCRIPTION = "R3 internal receiver thermistor 4"
END_OBJECT

OBJECT
  NAME = INT_RFTL3T1
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 97
  BYTES = 10
  DESCRIPTION = "R3 inside vault RFTL thermistor 1"
END_OBJECT

OBJECT
  NAME = INT_RFTL3T2
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 98
  BYTES = 10
  DESCRIPTION = "R3 inside vault RFTL thermistor 2"
END_OBJECT
FIELD_NUMBER          = 98
BYTES                 = 10
DESCRIPTION           = "R3 inside vault RFTL thermistor 2"
END_OBJECT

OBJECT                   = FIELD
NAME                  = RFTL3T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 99
BYTES                 = 10
DESCRIPTION           = "R3 external to vault RFTL PRT 1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = RFTL3T2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 100
BYTES                 = 10
DESCRIPTION           = "R3 external to vault RFTL PRT 2"
END_OBJECT

OBJECT                   = FIELD
NAME                  = RFTL3T3
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 101
BYTES                 = 10
DESCRIPTION           = "R3 external to vault RFTL PRT 3"
END_OBJECT

OBJECT                   = FIELD
NAME                  = A3T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 102
BYTES                 = 10
DESCRIPTION           = "R3 antenna PRT 1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = A3T2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 103
BYTES                 = 10
DESCRIPTION           = "R3 antenna PRT 2"
END_OBJECT

OBJECT                   = FIELD
NAME                  = A3T3
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 104
BYTES                 = 10
DESCRIPTION           = "R3 antenna PRT 3"
END_OBJECT

OBJECT                   = FIELD
NAME                  = R4T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 105
BYTES                 = 10
DESCRIPTION           = "R4 internal receiver thermistor 1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = R4T2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 106
BYTES                 = 10
DESCRIPTION           = "R4 internal receiver thermistor 2"
END_OBJECT

OBJECT                   = FIELD
NAME                  = R4T3
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 107
BYTES                 = 10
DESCRIPTION           = "R4 internal receiver thermistor 3"
END_OBJECT

OBJECT                   = FIELD
NAME                  = R4T4
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 108
BYTES                 = 10
DESCRIPTION           = "R4 internal receiver thermistor 4"
END_OBJECT

OBJECT                   = FIELD
NAME                  = INT_RFTL4T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 109
BYTES                 = 10
DESCRIPTION           = "R4 inside vault RFTL thermistor 1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = INT_RFTL4T2
NAME = INT_RFTL4T2
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 11
BYTES = 10
DESCRIPTION = "R4 inside vault RFTL thermistor 2"
END_OBJECT

OBJECT = FIELD
NAME = RFTL4T1
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 111
BYTES = 10
DESCRIPTION = "R4 external to vault RFTL PRT 1"
END_OBJECT

OBJECT = FIELD
NAME = RFTL4T2
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 112
BYTES = 10
DESCRIPTION = "R4 external to vault RFTL PRT 2"
END_OBJECT

OBJECT = FIELD
NAME = RFTL4T3
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 113
BYTES = 10
DESCRIPTION = "R4 external to vault RFTL PRT 3"
END_OBJECT

OBJECT = FIELD
NAME = RFTL4T4
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 114
BYTES = 10
DESCRIPTION = "R4 external to vault RFTL PRT 4"
END_OBJECT

OBJECT = FIELD
NAME = R4T1
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 115
BYTES = 10
DESCRIPTION = "R4 antenna PRT 1"
END_OBJECT

OBJECT = FIELD
NAME = A4T2
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 116
BYTES = 10
DESCRIPTION = "R4 antenna PRT 2"
END_OBJECT

OBJECT = FIELD
NAME = A4T3
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 117
BYTES = 10
DESCRIPTION = "R4 antenna PRT 3"
END_OBJECT

OBJECT = FIELD
NAME = R5T1
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 118
BYTES = 10
DESCRIPTION = "R5 internal receiver thermistor 1"
END_OBJECT

OBJECT = FIELD
NAME = R5T2
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 119
BYTES = 10
DESCRIPTION = "R5 internal receiver thermistor 2"
END_OBJECT

OBJECT = FIELD
NAME = R5T3
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 120
BYTES = 10
DESCRIPTION = "R5 internal receiver thermistor 3"
END_OBJECT

OBJECT = FIELD
NAME = R5T4
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 121
BYTES = 10
DESCRIPTION = "R5 internal receiver thermistor 4"
END_OBJECT
OBJECT                   = FIELD
NAME                  = INT_RFTL5T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 122
BYTES                 = 10
DESCRIPTION           = "R5 inside vault RFTL thermistor 1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = INT_RFTL5T2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 123
BYTES                 = 10
DESCRIPTION           = "R5 inside vault RFTL thermistor 2"
END_OBJECT

OBJECT                   = FIELD
NAME                  = RFTL5T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 124
BYTES                 = 10
DESCRIPTION           = "R5 external to vault RFTL PRT 1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = RFTL5T2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 125
BYTES                 = 10
DESCRIPTION           = "R5 external to vault RFTL PRT 2"
END_OBJECT

OBJECT                   = FIELD
NAME                  = RFTL5T3
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 126
BYTES                 = 10
DESCRIPTION           = "R5 external to vault RFTL PRT 3"
END_OBJECT

OBJECT                   = FIELD
NAME                  = A5T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 127
BYTES                 = 10
DESCRIPTION           = "R5 antenna PRT 1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = A5T2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 128
BYTES                 = 10
DESCRIPTION           = "R5 antenna PRT 2"
END_OBJECT

OBJECT                   = FIELD
NAME                  = R6T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 129
BYTES                 = 10
DESCRIPTION           = "R6 internal receiver thermistor 1"
END_OBJECT

OBJECT                   = FIELD
NAME                  = R6T2
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 130
BYTES                 = 10
DESCRIPTION           = "R6 internal receiver thermistor 2"
END_OBJECT

OBJECT                   = FIELD
NAME                  = R6T3
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 131
BYTES                 = 10
DESCRIPTION           = "R6 internal receiver thermistor 3"
END_OBJECT

OBJECT                   = FIELD
NAME                  = R6T4
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 132
BYTES                 = 10
DESCRIPTION           = "R6 internal receiver thermistor 4"
END_OBJECT

OBJECT                   = FIELD
NAME                  = INT_RFTL6T1
DATA_TYPE             = ASCII_INTEGER
FIELD_NUMBER          = 133
BYTES                 = 10
DESCRIPTION           = "R6 inside vault RFTL thermistor 1"
OBJECT
NAME = INT_RFTL6T2
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 134
BYTES  = 10
DESCRIPTION  = "R6 inside vault RFTL thermistor 2"
END_OBJECT

OBJECT
NAME = RFTL6T1
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 135
BYTES  = 10
DESCRIPTION  = "R6 external to vault RFTL PRT 1"
END_OBJECT

OBJECT
NAME = RFTL6T2
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 136
BYTES  = 10
DESCRIPTION  = "R6 external to vault RFTL PRT 2"
END_OBJECT

OBJECT
NAME = RFTL6T3
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 137
BYTES  = 10
DESCRIPTION  = "R6 external to vault RFTL PRT 3"
END_OBJECT

OBJECT
NAME = A6T1
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 138
BYTES  = 10
DESCRIPTION  = "R6 antenna PRT 1"
END_OBJECT

OBJECT
NAME = RecvrConfig
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 139
BYTES  = 10
DESCRIPTION  = "Field to identify receiver state (switch position and noise diodes on/off)"
END_OBJECT

OBJECT
NAME = R1_1Count
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 140
BYTES  = 10
DESCRIPTION  = "R1 low gain counts"
END_OBJECT

OBJECT
NAME = R1_2Count
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 141
BYTES  = 10
DESCRIPTION  = "R1 high gain counts"
END_OBJECT

OBJECT
NAME = R2_1Count
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 142
BYTES  = 10
DESCRIPTION  = "R2 low gain counts"
END_OBJECT

OBJECT
NAME = R2_2Count
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 143
BYTES  = 10
DESCRIPTION  = "R2 high gain counts"
END_OBJECT

OBJECT
NAME = R3Count
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 144
BYTES  = 10
DESCRIPTION  = "R3 counts"
END_OBJECT

OBJECT
NAME = R4Count
DATA_TYPE  = ASCII_INTEGER
FIELD_NUMBER  = 145
BYTES  = 10
DESCRIPTION  = ""
E.2 IRDR

OBJECT = FIELD
NAME = t_ephem_time
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 1
BYTES = 20
DESCRIPTION = "Time at midpoint of 100-ms integration expressed in seconds since 12:00 AM Jan. 1, 2000"

END_OBJECT

OBJECT = FIELD
NAME = t_utc_doy
DATA_TYPE = TIME
FIELD_NUMBER = 2
BYTES = 21
DESCRIPTION = "UTC at midpoint of 100-ms integration expressed in yyyy-doyThh:mm:ss.sss format"

END_OBJECT

OBJECT = FIELD
NAME = R1T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 3
BYTES = 20
DESCRIPTION = "R1 internal receiver thermistor 1"

END_OBJECT

OBJECT = FIELD
NAME = R1T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 4
BYTES = 20
DESCRIPTION = "R1 internal receiver thermistor 2"

END_OBJECT

OBJECT = FIELD
NAME = R1T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 5
BYTES = 20
DESCRIPTION = "R1 internal receiver thermistor 3"

END_OBJECT

OBJECT = FIELD
NAME = R1T4
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 6
BYTES = 20
DESCRIPTION = "R1 internal receiver thermistor 4"

END_OBJECT

OBJECT = FIELD
NAME = INT_RFTL1T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 7
BYTES = 20
DESCRIPTION = "R1 inside vault RFTL thermistor 1"

END_OBJECT

OBJECT = FIELD
NAME = INT_RFTL1T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 8
BYTES = 20
DESCRIPTION = "R1 inside vault RFTL thermistor 2"

END_OBJECT
OBJECT = FIELD
NAME = RFTL1T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 9
BYTES = 20
DESCRIPTION = "R1 external to vault RFTL PRT 1"
END_OBJECT

OBJECT = FIELD
NAME = RFTL1T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 10
BYTES = 20
DESCRIPTION = "R1 external to vault RFTL PRT 2"
END_OBJECT

OBJECT = FIELD
NAME = RFTL1T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 11
BYTES = 20
DESCRIPTION = "R1 external to vault RFTL PRT 3"
END_OBJECT

OBJECT = FIELD
NAME = A1T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 12
BYTES = 20
DESCRIPTION = "R1 antenna PRT 1"
END_OBJECT

OBJECT = FIELD
NAME = A1T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 13
BYTES = 20
DESCRIPTION = "R1 antenna PRT 2"
END_OBJECT

OBJECT = FIELD
NAME = A1T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 14
BYTES = 20
DESCRIPTION = "R1 antenna PRT 3"
END_OBJECT

OBJECT = FIELD
NAME = A1T4
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 15
BYTES = 20
DESCRIPTION = "R1 antenna PRT 4"
END_OBJECT

OBJECT = FIELD
NAME = R2T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 16
BYTES = 20
DESCRIPTION = "R2 internal receiver thermistor 1"
END_OBJECT

OBJECT = FIELD
NAME = R2T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 17
BYTES = 20
DESCRIPTION = "R2 internal receiver thermistor 2"
END_OBJECT

OBJECT = FIELD
NAME = R2T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 18
BYTES = 20
DESCRIPTION = "R2 internal receiver thermistor 3"
END_OBJECT

OBJECT = FIELD
NAME = R2T4
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 19
BYTES = 20
DESCRIPTION = "R2 internal receiver thermistor 4"
END_OBJECT

OBJECT = FIELD
NAME = INT_RFTL2T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 20
BYTES = 20
DESCRIPTION = "R2 inside vault RFTL thermistor 1"
END_OBJECT

OBJECT = FIELD
NAME = INT_RFTL2T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 21
BYTES = 20
DESCRIPTION = "R2 inside vault RFTL thermistor 2"
END_OBJECT

OBJECT = FIELD
NAME = RFTL2T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 22
BYTES = 20
DESCRIPTION = "R2 external to vault RFTL PRT 1"
END_OBJECT

OBJECT = FIELD
NAME = RFTL2T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 23
BYTES = 20
DESCRIPTION = "R2 external to vault RFTL PRT 2"
END_OBJECT

OBJECT = FIELD
NAME = RFTL2T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 24
BYTES = 20
DESCRIPTION = "R2 external to vault RFTL PRT 3"
END_OBJECT

OBJECT = FIELD
NAME = A2T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 25
BYTES = 20
DESCRIPTION = "R2 antenna PRT 1"
END_OBJECT

OBJECT = FIELD
NAME = A2T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 26
BYTES = 20
DESCRIPTION = "R2 antenna PRT 2"
END_OBJECT

OBJECT = FIELD
NAME = A2T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 27
BYTES = 20
DESCRIPTION = "R2 antenna PRT 3"
END_OBJECT

OBJECT = FIELD
NAME = R3T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 28
BYTES = 20
DESCRIPTION = "R3 internal receiver thermistor 1"
END_OBJECT

OBJECT = FIELD
NAME = R3T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 29
BYTES = 20
DESCRIPTION = "R3 internal receiver thermistor 2"
END_OBJECT

OBJECT = FIELD
NAME = R3T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 30
BYTES = 20
DESCRIPTION = "R3 internal receiver thermistor 3"
END_OBJECT

OBJECT = FIELD
NAME = R3T4
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 31
BYTES = 20
DESCRIPTION = "R3 internal receiver thermistor 4"
END_OBJECT
OBJECT       = FIELD
NAME         = INT_RFTL3T1
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 32
BYTES        = 20
DESCRIPTION  = "R3 inside vault RFTL thermistor 1"
END_OBJECT

OBJECT       = FIELD
NAME         = INT_RFTL3T2
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 33
BYTES        = 20
DESCRIPTION  = "R3 inside vault RFTL thermistor 2"
END_OBJECT

OBJECT       = FIELD
NAME         = RFTL3T1
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 34
BYTES        = 20
DESCRIPTION  = "R3 external to vault RFTL PRT 1"
END_OBJECT

OBJECT       = FIELD
NAME         = RFTL3T2
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 35
BYTES        = 20
DESCRIPTION  = "R3 external to vault RFTL PRT 2"
END_OBJECT

OBJECT       = FIELD
NAME         = RFTL3T3
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 36
BYTES        = 20
DESCRIPTION  = "R3 external to vault RFTL PRT 3"
END_OBJECT

OBJECT       = FIELD
NAME         = A3T1
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 37
BYTES        = 20
DESCRIPTION  = "R3 antenna PRT 1"
END_OBJECT

OBJECT       = FIELD
NAME         = A3T2
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 38
BYTES        = 20
DESCRIPTION  = "R3 antenna PRT 2"
END_OBJECT

OBJECT       = FIELD
NAME         = A3T3
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 39
BYTES        = 20
DESCRIPTION  = "R3 antenna PRT 3"
END_OBJECT

OBJECT       = FIELD
NAME         = R4T1
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 40
BYTES        = 20
DESCRIPTION  = "R4 internal receiver thermistor 1"
END_OBJECT

OBJECT       = FIELD
NAME         = R4T2
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 41
BYTES        = 20
DESCRIPTION  = "R4 internal receiver thermistor 2"
END_OBJECT

OBJECT       = FIELD
NAME         = R4T3
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 42
BYTES        = 20
DESCRIPTION  = "R4 internal receiver thermistor 3"
END_OBJECT

OBJECT       = FIELD
NAME         = R4T4
DATA_TYPE    = ASCII_REAL
FIELD_NUMBER = 43
BYTES        = 20
FIELD_NUMBER = 49
BYTES = 20
DESCRIPTION = "R4 external to vault RFTL PRT 4"

END_OBJECT

OBJECT = FIELD
NAME = A4T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 50
BYTES = 20
DESCRIPTION = "R4 antenna PRT 1"

END_OBJECT

OBJECT = FIELD
NAME = A4T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 51
BYTES = 20
DESCRIPTION = "R4 antenna PRT 2"

END_OBJECT

OBJECT = FIELD
NAME = A4T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 52
BYTES = 20
DESCRIPTION = "R4 antenna PRT 3"

END_OBJECT

OBJECT = FIELD
NAME = R5T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 53
BYTES = 20
DESCRIPTION = "R5 internal receiver thermistor 1"

END_OBJECT

OBJECT = FIELD
NAME = R5T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 54
BYTES = 20
DESCRIPTION = "R5 internal receiver thermistor 2"

END_OBJECT

OBJECT = FIELD
NAME = RFTL4T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 44
BYTES = 20
DESCRIPTION = "R4 inside vault RFTL thermistor 1"

END_OBJECT

OBJECT = FIELD
NAME = RFTL4T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 45
BYTES = 20
DESCRIPTION = "R4 inside vault RFTL thermistor 2"

END_OBJECT

OBJECT = FIELD
NAME = RFTL4T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 46
BYTES = 20
DESCRIPTION = "R4 external to vault RFTL PRT 1"

END_OBJECT

OBJECT = FIELD
NAME = RFTL4T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 47
BYTES = 20
DESCRIPTION = "R4 external to vault RFTL PRT 2"

END_OBJECT

OBJECT = FIELD
NAME = RFTL4T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 48
BYTES = 20
DESCRIPTION = "R4 external to vault RFTL PRT 3"

END_OBJECT

OBJECT = FIELD
NAME = RFTL4T4
DATA_TYPE = ASCII_REAL

DESCRIPTION = "R4 internal receiver thermistor 4"

END_OBJECT
NAME = R5T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 55
BYTES = 20
DESCRIPTION = "R5 internal receiver thermistor 3"

END_OBJECT

OBJECT = FIELD
NAME = R5T4
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 56
BYTES = 20
DESCRIPTION = "R5 internal receiver thermistor 4"

END_OBJECT

OBJECT = FIELD
NAME = INT_RFTL5T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 57
BYTES = 20
DESCRIPTION = "R5 inside vault RFTL thermistor 1"

END_OBJECT

OBJECT = FIELD
NAME = INT_RFTL5T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 58
BYTES = 20
DESCRIPTION = "R5 inside vault RFTL thermistor 2"

END_OBJECT

OBJECT = FIELD
NAME = RFTL5T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 59
BYTES = 20
DESCRIPTION = "R5 external to vault RFTL PRT 1"

END_OBJECT

OBJECT = FIELD
NAME = RFTL5T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 60
BYTES = 20
DESCRIPTION = "R5 external to vault RFTL PRT 2"

END_OBJECT

OBJECT = FIELD
NAME = RFTL5T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 61
BYTES = 20
DESCRIPTION = "R5 external to vault RFTL PRT 3"

END_OBJECT

OBJECT = FIELD
NAME = A5T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 62
BYTES = 20
DESCRIPTION = "R5 antenna PRT 1"

END_OBJECT

OBJECT = FIELD
NAME = A5T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 63
BYTES = 20
DESCRIPTION = "R5 antenna PRT 2"

END_OBJECT

OBJECT = FIELD
NAME = R6T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 64
BYTES = 20
DESCRIPTION = "R6 internal receiver thermistor 1"

END_OBJECT

OBJECT = FIELD
NAME = R6T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 65
BYTES = 20
DESCRIPTION = "R6 internal receiver thermistor 2"

END_OBJECT

OBJECT = FIELD
NAME = R6T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 66
BYTES = 20
DESCRIPTION = "R6 internal receiver thermistor 3"
OBJECT = FIELD
NAME = R6T4
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 67
BYTES = 20
DESCRIPTION = "R6 internal receiver thermistor 4"
END_OBJECT

OBJECT = FIELD
NAME = INT_RFTL6T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 68
BYTES = 20
DESCRIPTION = "R6 inside vault RFTL thermistor 1"
END_OBJECT

OBJECT = FIELD
NAME = INT_RFTL6T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 69
BYTES = 20
DESCRIPTION = "R6 inside vault RFTL thermistor 2"
END_OBJECT

OBJECT = FIELD
NAME = RFTL6T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 70
BYTES = 20
DESCRIPTION = "R6 external to vault RFTL PRT 1"
END_OBJECT

OBJECT = FIELD
NAME = RFTL6T2
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 71
BYTES = 20
DESCRIPTION = "R6 external to vault RFTL PRT 2"
END_OBJECT

OBJECT = FIELD
NAME = RFTL6T3
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 72
BYTES = 20
DESCRIPTION = "R6 external to vault RFTL PRT 3"
END_OBJECT

OBJECT = FIELD
NAME = A6T1
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 73
BYTES = 20
DESCRIPTION = "R6 antenna PRT 1"
END_OBJECT

OBJECT = FIELD
NAME = R1_1AntCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 74
BYTES = 10
DESCRIPTION = "R1 low gain counts switched to antenna"
END_OBJECT

OBJECT = FIELD
NAME = R1_2AntCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 75
BYTES = 10
DESCRIPTION = "R1 high gain counts switched to antenna"
END_OBJECT

OBJECT = FIELD
NAME = R2_1AntCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 76
BYTES = 10
DESCRIPTION = "R2 low gain counts switched to antenna"
END_OBJECT

OBJECT = FIELD
NAME = R2_2AntCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 77
BYTES = 10
DESCRIPTION = "R2 high gain counts switched to antenna"
END_OBJECT

OBJECT = FIELD
NAME = R3AntCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 78
BYTES = 10
DESCRIPTION = "R3 counts switched to antenna"

END_OBJECT

OBJECT = FIELD
NAME = R4AntCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 79
BYTES = 10
DESCRIPTION = "R4 counts switched to antenna"

END_OBJECT

OBJECT = FIELD
NAME = R5AntCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 80
BYTES = 10
DESCRIPTION = "R5 counts switched to antenna"

END_OBJECT

OBJECT = FIELD
NAME = R6AntCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 81
BYTES = 10
DESCRIPTION = "R6 counts switched to antenna"

END_OBJECT

OBJECT = FIELD
NAME = R1_1RefCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 82
BYTES = 10
DESCRIPTION = "R1 low gain counts switched to internal load"

END_OBJECT

OBJECT = FIELD
NAME = R1_2RefCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 83
BYTES = 10
DESCRIPTION = "R1 high gain counts switched to internal load"

END_OBJECT

OBJECT = FIELD
NAME = R2_1RefCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 84
BYTES = 10
DESCRIPTION = "R2 low gain counts switched to internal load"

END_OBJECT

OBJECT = FIELD
NAME = R2_2RefCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 85
BYTES = 10
DESCRIPTION = "R2 high gain counts switched to internal load"

END_OBJECT

OBJECT = FIELD
NAME = R3RefCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 86
BYTES = 10
DESCRIPTION = "R3 counts switched to internal load"

END_OBJECT

OBJECT = FIELD
NAME = R4RefCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 87
BYTES = 10
DESCRIPTION = "R4 counts switched to internal load"

END_OBJECT

OBJECT = FIELD
NAME = R5RefCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 88
BYTES = 10
DESCRIPTION = "R5 counts switched to internal load"

END_OBJECT

OBJECT = FIELD
NAME = R6RefCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 89
BYTES = 10
DESCRIPTION = "R6 counts switched to internal load"
OBJECT = FIELD
NAME = R1_1ND1ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 90
BYTES = 10
DESCRIPTION = "R1 low gain noise diode 1 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R1_2ND1ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 91
BYTES = 10
DESCRIPTION = "R1 high gain noise diode 1 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R2_1ND1ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 92
BYTES = 10
DESCRIPTION = "R2 low gain noise diode 1 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R2_2ND1ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 93
BYTES = 10
DESCRIPTION = "R2 high gain noise diode 1 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R3ND1ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 94
BYTES = 10
DESCRIPTION = "R3 noise diode 1 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R4ND1ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 95
BYTES = 10
DESCRIPTION = "R4 noise diode 1 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R5ND1ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 96
BYTES = 10
DESCRIPTION = "R5 noise diode 1 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R6ND1ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 97
BYTES = 10
DESCRIPTION = "R6 noise diode 1 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R1_1ND2ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 98
BYTES = 10
DESCRIPTION = "R1 low gain noise diode 2 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R1_2ND2ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 99
BYTES = 10
DESCRIPTION = "R1 high gain noise diode 2 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R2_1ND2ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 100
BYTES = 10
DESCRIPTION = "R2 low gain noise diode 2 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R2_2ND2ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 101
BYTES = 10
DESCRIPTION = "R2 high gain noise diode 2 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R3ND2ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 102
BYTES = 10
DESCRIPTION = "R3 noise diode 2 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R4ND2ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 103
BYTES = 10
DESCRIPTION = "R4 noise diode 2 deflection in antenna position"
END_OBJECT
FIELD_NUMBER = 101
BYTES = 10
DESCRIPTION = "R2 high gain noise diode 2 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R3ND2ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 102
BYTES = 10
DESCRIPTION = "R3 noise diode 2 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R4ND2AC
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 103
BYTES = 10
DESCRIPTION = "R4 noise diode 2 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R5ND3ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 104
BYTES = 10
DESCRIPTION = "R5 noise diode 2 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R6ND2ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 105
BYTES = 10
DESCRIPTION = "R6 noise diode 2 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R1_1ND3ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 106
BYTES = 10
DESCRIPTION = "R1 low gain noise diode 3 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R1_2ND3ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 107
BYTES = 10
DESCRIPTION = "R1 high gain noise diode 3 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R2_1ND3ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 108
BYTES = 10
DESCRIPTION = "R2 low gain noise diode 3 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R2_2ND3ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 109
BYTES = 10
DESCRIPTION = "R2 high gain noise diode 3 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R3ND3ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 110
BYTES = 10
DESCRIPTION = "R3 noise diode 3 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R4ND3ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 111
BYTES = 10
DESCRIPTION = "R4 noise diode 3 deflection in antenna position"

END_OBJECT

OBJECT = FIELD
NAME = R5ND3ACnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 112
BYTES = 10
DESCRIPTION = "R5 noise diode 3 deflection in antenna position"

END_OBJECT
OBJECT = FIELD
NAME = R6ND3Acnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 113
BYTES = 10
DESCRIPTION = "R6 noise diode 3 deflection in antenna position"
END_OBJECT

OBJECT = FIELD
NAME = R1_1ND1Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 114
BYTES = 10
DESCRIPTION = "R1 low gain noise diode 1 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R1_2ND1Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 115
BYTES = 10
DESCRIPTION = "R1 high gain noise diode 1 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R2_1ND1Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 116
BYTES = 10
DESCRIPTION = "R2 low gain noise diode 1 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R2_2ND1Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 117
BYTES = 10
DESCRIPTION = "R2 high gain noise diode 1 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R3ND1Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 118
BYTES = 10
DESCRIPTION = "R3 noise diode 1 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R4ND1Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 119
BYTES = 10
DESCRIPTION = "R4 noise diode 1 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R5ND1Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 120
BYTES = 10
DESCRIPTION = "R5 noise diode 1 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R6ND1Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 121
BYTES = 10
DESCRIPTION = "R6 noise diode 1 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R1_1ND2Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 122
BYTES = 10
DESCRIPTION = "R1 low gain noise diode 2 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R1_2ND2Rcnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 123
BYTES = 10
DESCRIPTION = "R1 high gain noise diode 2 deflection in internal load position"
END_OBJECT

OBJECT = FIELD
NAME = R2_1ND2RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 124
BYTES = 10
DESCRIPTION = "R2 low gain noise diode 2 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R2_2ND2RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 125
BYTES = 10
DESCRIPTION = "R2 high gain noise diode 2 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R3ND2RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 126
BYTES = 10
DESCRIPTION = "R3 noise diode 2 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R4ND2RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 127
BYTES = 10
DESCRIPTION = "R4 noise diode 2 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R5ND2RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 128
BYTES = 10
DESCRIPTION = "R5 noise diode 2 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R6ND2RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 129
BYTES = 10
DESCRIPTION = "R6 noise diode 2 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R1_1ND3RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 130
BYTES = 10
DESCRIPTION = "R1 low gain noise diode 3 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R1_2ND3RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 131
BYTES = 10
DESCRIPTION = "R1 high gain noise diode 3 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R2_1ND3RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 132
BYTES = 10
DESCRIPTION = "R2 low gain noise diode 3 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R2_2ND3RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 133
BYTES = 10
DESCRIPTION = "R2 high gain noise diode 3 deflection in internal load position"

END_OBJECT

OBJECT = FIELD
NAME = R3ND3RCnt
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 134
BYTES = 10
DESCRIPTION = "R3 noise diode 3 deflection in internal load position"
<table>
<thead>
<tr>
<th>OBJECT</th>
<th>FIELD</th>
<th>NAME</th>
<th>DATA_TYPE</th>
<th>FIELD_NUMBER</th>
<th>BYTES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>END_OBJECT</td>
<td></td>
<td>R4ND3RCnt</td>
<td>ASCII_REAL</td>
<td>135</td>
<td>10</td>
<td>&quot;R4 noise diode 3 deflection in internal load position&quot;</td>
</tr>
<tr>
<td>OBJECT</td>
<td>FIELD</td>
<td>R5ND3RCnt</td>
<td>ASCII_REAL</td>
<td>136</td>
<td>10</td>
<td>&quot;R5 noise diode 3 deflection in internal load position&quot;</td>
</tr>
<tr>
<td>END_OBJECT</td>
<td></td>
<td>R6ND3RCnt</td>
<td>ASCII_REAL</td>
<td>137</td>
<td>10</td>
<td>&quot;R6 noise diode 3 deflection in internal load position&quot;</td>
</tr>
<tr>
<td>OBJECT</td>
<td>FIELD</td>
<td>R1_1TA</td>
<td>ASCII_REAL</td>
<td>138</td>
<td>20</td>
<td>&quot;R1 low gain calibrated antenna temperature, Kelvin&quot;</td>
</tr>
<tr>
<td>END_OBJECT</td>
<td></td>
<td>R1_2TA</td>
<td>ASCII_REAL</td>
<td>141</td>
<td>20</td>
<td>&quot;R1 high gain calibrated antenna temperature, Kelvin&quot;</td>
</tr>
<tr>
<td>OBJECT</td>
<td>FIELD</td>
<td>R2_1TA</td>
<td>ASCII_REAL</td>
<td>142</td>
<td>20</td>
<td>&quot;R2 low gain calibrated antenna temperature, Kelvin&quot;</td>
</tr>
<tr>
<td>END_OBJECT</td>
<td></td>
<td>R2_2TA</td>
<td>ASCII_REAL</td>
<td>144</td>
<td>20</td>
<td>&quot;R2 high gain calibrated antenna temperature, Kelvin&quot;</td>
</tr>
<tr>
<td>OBJECT</td>
<td>FIELD</td>
<td>R3TA</td>
<td>ASCII_REAL</td>
<td>143</td>
<td>20</td>
<td>&quot;R3 calibrated antenna temperature, Kelvin&quot;</td>
</tr>
<tr>
<td>END_OBJECT</td>
<td></td>
<td>R4TA</td>
<td>ASCII_REAL</td>
<td>145</td>
<td>20</td>
<td>&quot;R4 calibrated antenna temperature, Kelvin&quot;</td>
</tr>
<tr>
<td>OBJECT</td>
<td>FIELD</td>
<td>R5TA</td>
<td>ASCII_REAL</td>
<td>146</td>
<td>20</td>
<td>&quot;R5 calibrated antenna temperature, Kelvin&quot;</td>
</tr>
<tr>
<td>END_OBJECT</td>
<td></td>
<td>R6TA</td>
<td>ASCII_REAL</td>
<td>147</td>
<td>20</td>
<td>&quot;R6 calibrated antenna temperature, Kelvin&quot;</td>
</tr>
<tr>
<td>OBJECT</td>
<td>FIELD</td>
<td>R1_1TND1A</td>
<td>ASCII_REAL</td>
<td>148</td>
<td>20</td>
<td>&quot;R1 calibrated antenna temperature, Kelvin&quot;</td>
</tr>
</tbody>
</table>
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 146
BYTES = 20
DESCRIPTION = "R1 low gain noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R1_2TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 147
BYTES = 20
DESCRIPTION = "R1 high gain noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R2_1TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 148
BYTES = 20
DESCRIPTION = "R2 low gain noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R2_2TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 149
BYTES = 20
DESCRIPTION = "R2 high gain noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R3TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 150
BYTES = 20
DESCRIPTION = "R3 noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R4TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 151
BYTES = 20
DESCRIPTION = "R4 noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R5TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 152
BYTES = 20
DESCRIPTION = "R5 noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R6TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 153
BYTES = 20
DESCRIPTION = "R6 noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R1_1TND2A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 154
BYTES = 20
DESCRIPTION = "R1 low gain noise diode 2 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R1_2TND2A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 155
BYTES = 20
DESCRIPTION = "R1 high gain noise diode 2 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R1_1TND2A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 156
BYTES = 20
DESCRIPTION = "R1 high gain noise diode 2 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R1_2TND2A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 157
BYTES = 20
DESCRIPTION = "R1 low gain noise diode 2 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R3TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 158
BYTES = 20
DESCRIPTION = "R3 noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R4TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 159
BYTES = 20
DESCRIPTION = "R4 noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R5TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 160
BYTES = 20
DESCRIPTION = "R5 noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT

OBJECT = FIELD
NAME = R6TND1A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 161
BYTES = 20
DESCRIPTION = "R6 noise diode 1 brightness in the antenna position, Kelvin"

END_OBJECT
OBJECT = FIELD
NAME = R2_2TND2A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 157
BYTES = 20
DESCRIPTION = "R2 high gain noise diode 2 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R3TND2A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 158
BYTES = 20
DESCRIPTION = "R3 noise diode 2 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R4TND2A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 159
BYTES = 20
DESCRIPTION = "R4 noise diode 2 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R5TND2A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 160
BYTES = 20
DESCRIPTION = "R5 noise diode 2 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R6TND2A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 161
BYTES = 20
DESCRIPTION = "R6 noise diode 2 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R1_1TND3A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 162
BYTES = 20
DESCRIPTION = "R1 low gain noise diode 3 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R1_2TND3A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 163
BYTES = 20
DESCRIPTION = "R1 high gain noise diode 3 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R2_1TND3A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 164
BYTES = 20
DESCRIPTION = "R2 low gain noise diode 3 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R2_2TND3A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 165
BYTES = 20
DESCRIPTION = "R2 high gain noise diode 3 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R3TND3A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 166
BYTES = 20
DESCRIPTION = "R3 noise diode 3 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R4TND3A
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 167
BYTES = 20
DESCRIPTION = "R4 noise diode 3 brightness in the antenna position, Kelvin"
END_OBJECT
OBJECT = FIELD
  NAME = R5TND3A
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 168
  BYTES = 20
  DESCRIPTION = "R5 noise diode 3 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R6TND3A
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 169
  BYTES = 20
  DESCRIPTION = "R6 noise diode 3 brightness in the antenna position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R1_1TND1R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 170
  BYTES = 20
  DESCRIPTION = "R1 low gain noise diode 1 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R1_2TND1R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 171
  BYTES = 20
  DESCRIPTION = "R1 high gain noise diode 1 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R2_1TND1R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 172
  BYTES = 20
  DESCRIPTION = "R2 low gain noise diode 1 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R2_2TND1R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 173
  BYTES = 20
  DESCRIPTION = "R2 high gain noise diode 1 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R3TND1R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 174
  BYTES = 20
  DESCRIPTION = "R3 noise diode 1 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R4TND1R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 175
  BYTES = 20
  DESCRIPTION = "R4 noise diode 1 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R5TND1R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 176
  BYTES = 20
  DESCRIPTION = "R5 noise diode 1 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R6TND1R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 177
  BYTES = 20
  DESCRIPTION = "R6 noise diode 1 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R1_1TND2R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 178
  BYTES = 20
  DESCRIPTION = "R1 low gain noise diode 2 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
  NAME = R1_2TND2R
  DATA_TYPE = ASCII_REAL
  FIELD_NUMBER = 179
  BYTES = 20
  DESCRIPTION = "R1 high gain noise diode 2 brightness in the reference position, Kelvin"
END_OBJECT
OBJECT = FIELD
NAME = R1_2TND2R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 179
BYTES = 20
DESCRIPTION = "R1 high gain noise diode 2 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R2_1TND2R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 180
BYTES = 20
DESCRIPTION = "R2 low gain noise diode 2 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R2_2TND2R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 181
BYTES = 20
DESCRIPTION = "R2 high gain noise diode 2 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R3TND2R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 182
BYTES = 20
DESCRIPTION = "R3 noise diode 2 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R4TND2R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 183
BYTES = 20
DESCRIPTION = "R4 noise diode 2 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R5TND2R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 184
BYTES = 20
DESCRIPTION = "R5 noise diode 2 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R6TND2R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 185
BYTES = 20
DESCRIPTION = "R6 noise diode 2 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R1_1TND3R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 186
BYTES = 20
DESCRIPTION = "R1 low gain noise diode 3 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R1_2TND3R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 187
BYTES = 20
DESCRIPTION = "R1 high gain noise diode 3 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R2_1TND3R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 188
BYTES = 20
DESCRIPTION = "R2 low gain noise diode 3 brightness in the reference position, Kelvin"

OBJECT = FIELD
NAME = R2_2TND3R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 189
BYTES = 20
DESCRIPTION = "R2 high gain noise diode 3 brightness in the reference position, Kelvin"
OBJECT = FIELD
NAME = R2_2TND3R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 189
BYTES = 20
DESCRIPTION = "R2 high gain noise diode 3 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R3TND3R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 190
BYTES = 20
DESCRIPTION = "R3 noise diode 3 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R4TND3R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 191
BYTES = 20
DESCRIPTION = "R4 noise diode 3 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R5TND3R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 192
BYTES = 20
DESCRIPTION = "R5 noise diode 3 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R6TND3R
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 193
BYTES = 20
DESCRIPTION = "R6 noise diode 3 brightness in the reference position, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R1_1TOFF
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 194
BYTES = 20
DESCRIPTION = "R1 low gain internal load brightness referenced to the input, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R1_2TOFF
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 195
BYTES = 20
DESCRIPTION = "R1 high gain internal load brightness referenced to the input, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R2_1TOFF
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 196
BYTES = 20
DESCRIPTION = "R2 low gain internal load brightness referenced to the input, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R2_2TOFF
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 197
BYTES = 20
DESCRIPTION = "R2 high gain internal load brightness referenced to the input, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R3TOFF
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 198
BYTES = 20
DESCRIPTION = "R3 internal load brightness referenced to the input, Kelvin"
END_OBJECT

OBJECT = FIELD
NAME = R4TOFF
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 199
BYTES = 20
DESCRIPTION = "R4 internal load brightness referenced to the input, Kelvin"

ENDOBJECT

OBJECT = FIELD
NAME = R3OFF
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 200
BYTES = 20
DESCRIPTION = "R4 internal load brightness referenced to the input, Kelvin"

ENDOBJECT

E.3 GRDR

OBJECT - FIELD
NAME = t_ephem_time
DATA_TYPE = ASCII_REAL
FIELD_NUMBER = 1
BYTES = 20
DESCRIPTION = "Time at midpoint of 100-ms integration expressed in seconds since 12:00 AM Jan. 1, 2000"

ENDOBJECT

OBJECT - FIELD
NAME = t_utc_doy
DATA_TYPE = TIME
FIELD_NUMBER = 2
BYTES = 21
DESCRIPTION = "UTC at midpoint of 100-ms integration expressed in yyyy-doyTh:mm:ss.sss format"

ENDOBJECT

OBJECT - FIELD
NAME = gal_lon_1
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 3
BYTES = 20
DESCRIPTION = "Antenna 1 boresight longitude in galactic coordinates"

END_OBJECT

OBJECT - FIELD
NAME = gal_lat_1
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 4
BYTES = 20
DESCRIPTION = "Antenna 1 boresight latitude in galactic coordinates"

END_OBJECT

OBJECT - FIELD
NAME = gal_rot_1
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 5
BYTES = 20
DESCRIPTION = "Rotation of antenna 1 frame X axis with respect to galactic pole"

END_OBJECT

OBJECT - FIELD
NAME = gal_lon_2
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 6
BYTES = 20
DESCRIPTION = "Antenna 2 boresight longitude in galactic coordinates"

END_OBJECT

OBJECT - FIELD
NAME = gal_lat_2
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 7
BYTES = 20
DESCRIPTION = "Antenna 2 boresight latitude in galactic coordinates"

END_OBJECT

OBJECT - FIELD
NAME = gal_rot_2
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 8
BYTES = 20
DESCRIPTION = "Rotation of antenna 2 frame X axis with respect to galactic pole"

END_OBJECT

OBJECT = FIELD
NAME = gal_lon_3
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 9
BYTES = 20
DESCRIPTION = "Antenna 3 boresight longitude in galactic coordinates"

END_OBJECT

OBJECT = FIELD
NAME = gal_lat_3
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 10
BYTES = 20
DESCRIPTION = "Antenna 3 boresight latitude in galactic coordinates"

END_OBJECT

OBJECT = FIELD
NAME = gal_rot_3
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 11
BYTES = 20
DESCRIPTION = "Rotation of antenna 3 frame X axis with respect to galactic pole"

END_OBJECT

OBJECT = FIELD
NAME = gal_lon_4
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 12
BYTES = 20
DESCRIPTION = "Antenna 4 boresight longitude in galactic coordinates"

END_OBJECT

OBJECT = FIELD
NAME = gal_lat_4
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 13
BYTES = 20
DESCRIPTION = "Antenna 4 boresight latitude in galactic coordinates"

END_OBJECT

OBJECT = FIELD
NAME = gal_rot_4
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 14
BYTES = 20
DESCRIPTION = "Rotation of antenna 4 frame X axis with respect to galactic pole"

END_OBJECT

OBJECT = FIELD
NAME = gal_lon_5
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 15
BYTES = 20
DESCRIPTION = "Antenna 5 boresight longitude in galactic coordinates"

END_OBJECT

OBJECT = FIELD
NAME = gal_lat_5
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 16
BYTES = 20
DESCRIPTION = "Antenna 5 boresight latitude in galactic coordinates"

END_OBJECT

OBJECT = FIELD
NAME = gal_rot_5
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 17
BYTES = 20
DESCRIPTION = "Rotation of antenna 5 frame X axis with respect to galactic pole"

END_OBJECT

OBJECT = FIELD
NAME = gal_lon_6
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 18
BYTES = 20
DESCRIPTION = "Antenna 6 boresight longitude in galactic coordinates"

END_OBJECT

OBJECT = FIELD
NAME = gal_lat_6
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 19
BYTES = 20
DESCRIPTION = "Antenna 6 boresight latitude in galactic coordinates"

END_OBJECT
<table>
<thead>
<tr>
<th>OBJECT</th>
<th>NAME</th>
<th>DATA_TYPE</th>
<th>FIELD_NUMBER</th>
<th>BYTES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIELD</td>
<td>gal_lat_6</td>
<td>ASCII_INTEGER</td>
<td>19</td>
<td>20</td>
<td>&quot;Antenna 6 boresight latitude in galactic coordinates&quot;</td>
</tr>
<tr>
<td>FIELD</td>
<td>gal_rot_6</td>
<td>ASCII_INTEGER</td>
<td>20</td>
<td>20</td>
<td>&quot;Rotation of antenna 6 frame X axis with respect to galactic pole&quot;</td>
</tr>
<tr>
<td>FIELD</td>
<td>J2000_lon_1</td>
<td>ASCII_INTEGER</td>
<td>21</td>
<td>20</td>
<td>&quot;Antenna 1 boresight longitude in J2000 coordinates&quot;</td>
</tr>
<tr>
<td>FIELD</td>
<td>J2000_lat_1</td>
<td>ASCII_INTEGER</td>
<td>22</td>
<td>20</td>
<td>&quot;Antenna 1 boresight latitude in J2000 coordinates&quot;</td>
</tr>
<tr>
<td>FIELD</td>
<td>J2000_rot_1</td>
<td>ASCII_INTEGER</td>
<td>23</td>
<td>20</td>
<td>&quot;Rotation of antenna 1 frame X axis with respect to J2000 pole&quot;</td>
</tr>
<tr>
<td>FIELD</td>
<td>J2000_lon_2</td>
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<td>&quot;Antenna 2 boresight longitude in J2000 coordinates&quot;</td>
</tr>
<tr>
<td>FIELD</td>
<td>J2000_lat_2</td>
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</tr>
<tr>
<td>FIELD</td>
<td>J2000_rot_2</td>
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<td>20</td>
<td>&quot;Rotation of antenna 2 frame X axis with respect to J2000 pole&quot;</td>
</tr>
<tr>
<td>FIELD</td>
<td>J2000_lon_3</td>
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<td>27</td>
<td>20</td>
<td>&quot;Antenna 3 boresight longitude in J2000 coordinates&quot;</td>
</tr>
<tr>
<td>FIELD</td>
<td>J2000_lat_3</td>
<td>ASCII_INTEGER</td>
<td>28</td>
<td>20</td>
<td>&quot;Antenna 3 boresight latitude in J2000 coordinates&quot;</td>
</tr>
<tr>
<td>FIELD</td>
<td>J2000_rot_3</td>
<td>ASCII_INTEGER</td>
<td>29</td>
<td>20</td>
<td>&quot;Antenna 3 boresight longitude in J2000 coordinates&quot;</td>
</tr>
</tbody>
</table>
DESCRIPTION = "Rotation of antenna 3 frame X axis with respect to J2000 pole"

END_OBJECT

OBJECT = FIELD
NAME = J2000_lon_4
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 30
BYTES = 20
DESCRIPTION = "Antenna 4 boresight longitude in J2000 coordinates"

END_OBJECT

OBJECT = FIELD
NAME = J2000_lat_4
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 31
BYTES = 20
DESCRIPTION = "Antenna 4 boresight latitude in J2000 coordinates"

END_OBJECT

OBJECT = FIELD
NAME = J2000_rot_4
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 32
BYTES = 20
DESCRIPTION = "Rotation of antenna 4 frame X axis with respect to J2000 pole"

END_OBJECT

OBJECT = FIELD
NAME = J2000_lon_5
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 33
BYTES = 20
DESCRIPTION = "Antenna 5 boresight longitude in J2000 coordinates"

END_OBJECT

OBJECT = FIELD
NAME = J2000_lat_5
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 34
BYTES = 20
DESCRIPTION = "Antenna 5 boresight latitude in J2000 coordinates"

END_OBJECT

OBJECT = FIELD
NAME = J2000_rot_5
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 35
BYTES = 20
DESCRIPTION = "Rotation of antenna 5 frame X axis with respect to J2000 pole"

END_OBJECT

OBJECT = FIELD
NAME = J2000_lon_6
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 36
BYTES = 20
DESCRIPTION = "Antenna 6 boresight longitude in J2000 coordinates"

END_OBJECT

OBJECT = FIELD
NAME = J2000_lat_6
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 37
BYTES = 20
DESCRIPTION = "Antenna 6 boresight latitude in J2000 coordinates"

END_OBJECT

OBJECT = FIELD
NAME = J2000_rot_6
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 38
BYTES = 20
DESCRIPTION = "Rotation of antenna 6 frame X axis with respect to J2000 pole"

END_OBJECT