

# Juno

## Software Interface Specification

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# Juno Project

## MWR Data Product and Archive Volume Software Interface Specification (SIS)

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Jet Propulsion Laboratory  
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CHANGE LOG

DATE	REASON FOR CHANGE	REVISION
9-Jan-2014	Original signed copy with review edits	V2.1.1
7-Aug-2014	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:  1. Minor modifications to the EDR and RDR definitions in Tables 3.1 and 4.1, including elimination of unnecessary lines in the EDRs and making column labeling consistent. 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. 3. Redoing the product naming convention in Appendix A to reflect changes in file process and structure. 4. Providing updated and complete PDS label file examples in Appendix B. 5. Numerous edits in all applicable sections of the text to reflect these changes.	V2.2
11-Nov-2014	Edits in Appendices A through C made as a result of experience with archive delivery to JSOC: A. File naming convention modified to give version number only B. MWR label examples updated C. PRODUCT_VERSION_ID example updated D. Sample data lines added	V2.2.1
23-Nov-2014	DATA_SET_ID renamed to comply with PDS standards.	V2.2.2
14-May-2015	Numerous modifications made following peer review on 8 Apr 2015: A. GRDR labels modified everywhere to put channel number last	V3.0

	<p>B. Correct Data Label assignments in Table 5.2 and elsewhere</p> <p>C. Add LABEL folder to EDR and RDR volumes to contain .FMT files</p> <p>D. Examples of Labels corrected in App. B</p> <p>E. Label Keyword Definitions Corrected in App. C.</p>	
19-May-2015	Cleanup, minor typos	V3.1
13-July-2016	<p>Replacement of noise diode counts with noise diode deflections</p> <p>Changed integer data in IRDR to floating point format</p> <p>Changed EDR and RDR versions to 1.2 and 2.0 respectively</p>	V4.0
26-Sept-2016	<p>Changed RDR version to 2.1</p> <p>Missing lines in the level-3 time-ordered data are explained in Sec. 4.</p>	V4.1

Table 1.1: ACRONYMS AND ABBREVIATIONS

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

TDS	Telemetry Data Staging
URL	Uniform Resource Locator
UTC	Universal Time Coordinated
WMS	Working Mission Storage



## 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:

1. Planetary Data System Archive Preparation Guide, <http://pds.nasa.gov/tools/archiving.shtml>
2. Planetary Data System Standards Reference, Version 3.8, JPL D-7669.
3. Planetary Science Data Dictionary Document, JPL D-7116, August 28, 2002.
4. Juno Project, Data Management Plan, JPL D-34032, 26-Aug-2009
5. Juno Mission Science Operations Center (SOC) and PDS Atmospheres Node/PPI Node Interface Control Document, Version 0.2
6. Juno Project, Microwave Radiometer Flight Software User’s Guide, JPL D-47902, Revision C, 2010-May-25
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.

**Table 1.2: Product and Software Interfaces to this SIS**

Name	Type P=product S=software D=document	Owner
MWR level 4+ product SIS	D	Michael Janssen
Any science analysis tools	S	Michael Janssen

## 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<sup>1</sup>. 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.

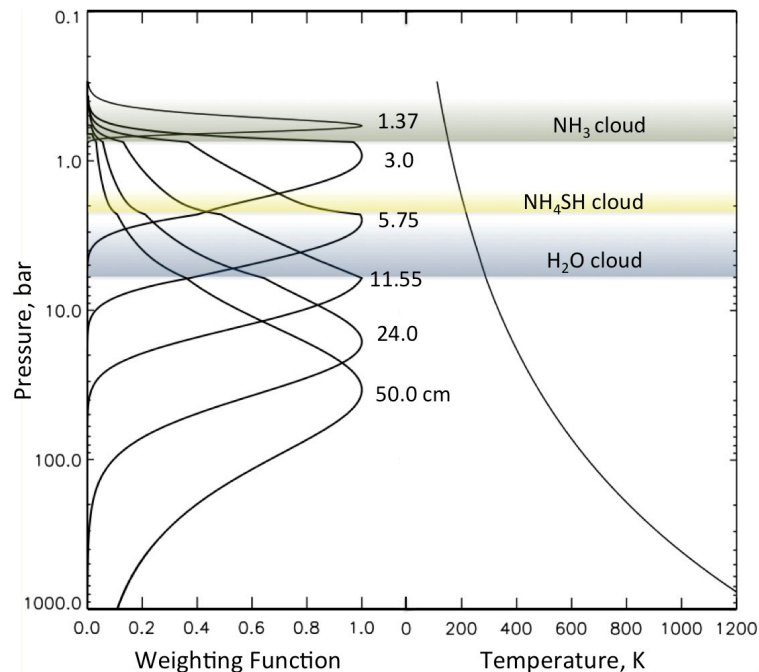


Figure 2.1: Contribution functions for the emission from Jupiter's atmosphere at nominal MWR frequencies. The ammonia cloud tops lie above the 1-bar pressure altitude, below which we have only very limited information at present. The lowest frequency of the MWR is sensitive to atmospheric temperature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

<sup>1</sup> Janssen, M.A., et al., "Microwave Remote Sensing of Jupiter's Atmosphere from an Orbiting Spacecraft", *Icarus*, 173, 447-453, 2005

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.

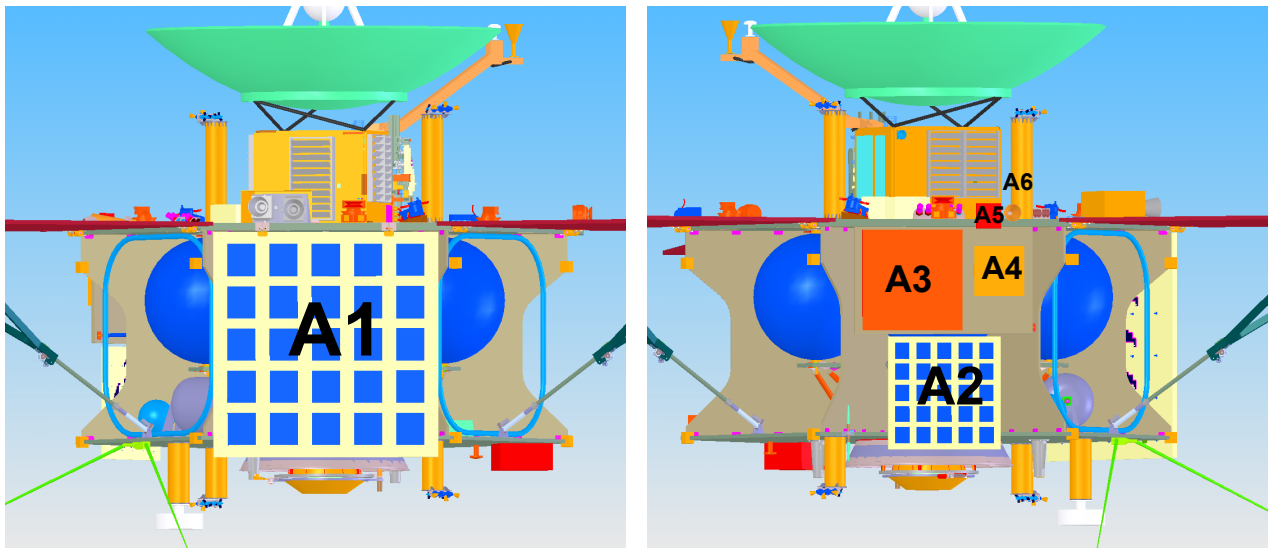


Figure 2.2: MWR Antennas are distributed as shown on two sides of the spacecraft. Antennas A1 and A2 have beamwidths of  $20^\circ$ , while A3 through A6 have  $12^\circ$  beamwidths. The spin axis is vertical, and the beams scan orthogonally to this axis as the spacecraft rotates.

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  $n^{\text{th}}$  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.

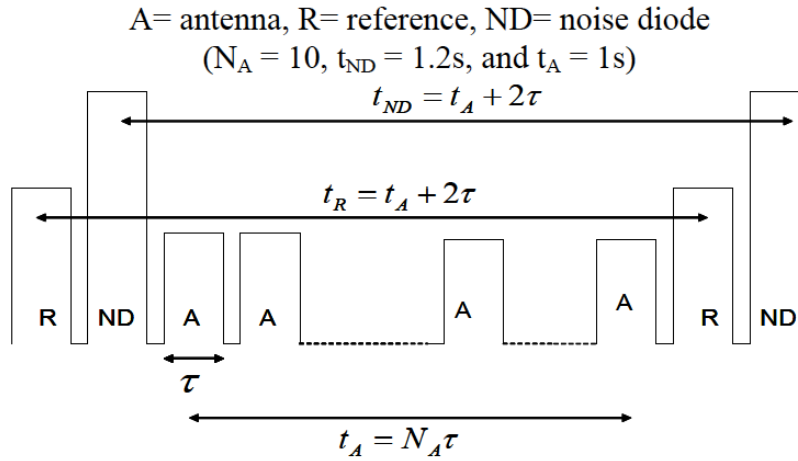


Figure 2.3: Nominal switching scheme for MWR receivers. The antenna input is observed for  $N_A$  times with duration  $\tau = 100$  msec, after which an internal switch is set to observe an internal thermal load (R). Each of the three noise diodes is periodically switched on for the time  $\tau$  (ND) 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  $n^{\text{th}}$  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**

NASA	CODMAC	Description
Packet data	Raw – Level 1	Telemetry data stream as received at the ground station, with science and engineering data embedded.
Level-0	Edited – Level 2	Instrument science data (e.g., raw voltages, counts) at full resolution, time ordered, with duplicates and transmission errors removed.
Level 1-A	Calibrated - Level 3	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).
Level 1-B	Re-sampled - Level 4	Irreversibly transformed (e.g., resampled, remapped, calibrated) values of the instrument measurements (e.g., radiances, magnetic field strength).
Level 2	Derived - Level 5	Geophysical parameters, generally derived from Level 1 data, and located in space and time commensurate with instrument location, pointing, and sampling.
Level 3	Derived - Level 5	Geophysical parameters mapped onto uniform space-time grids.

### 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.

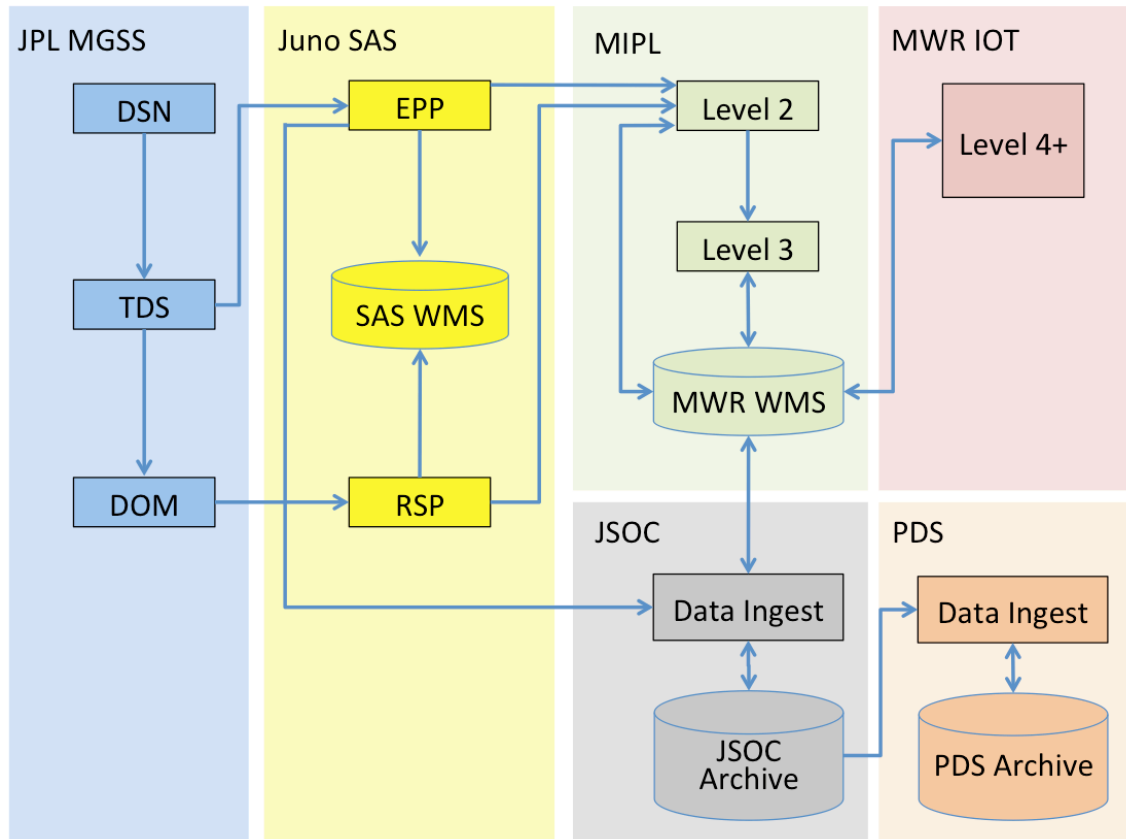


Figure 2.4: MWR Ground System Data Flow

### 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 ( $Z_s$ ) is directed along the spacecraft spin axis (out of the plane in Fig. 5), with the X axis ( $X_s$ ) 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.

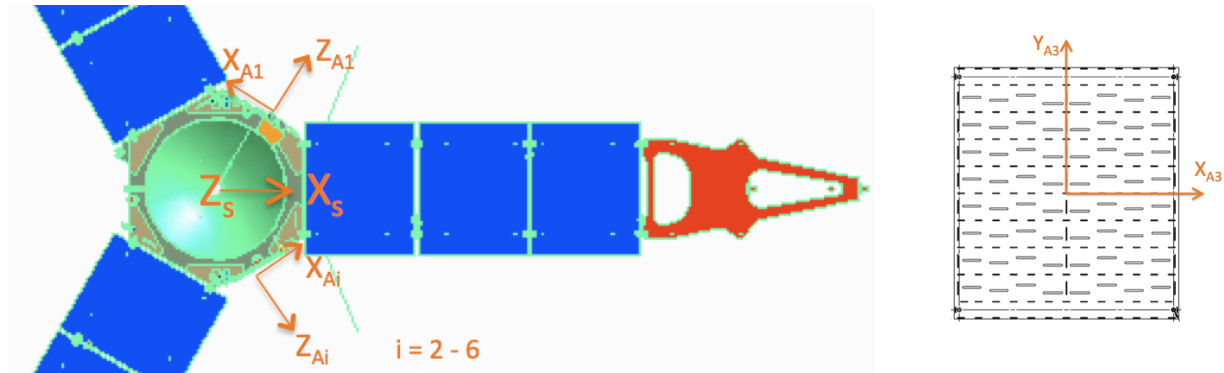


Figure 2.5: Antenna and spacecraft coordinate systems.

### 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**

Col. #	Label	Description
1	t_ephem_time	Time at midpoint of 100-ms integration expressed in seconds since 12:00 AM Jan. 1, 2000.
2	t_utc_doy	UTC at midpoint of 100-ms integration expressed in yyyy-doyThh:mm:ss.sss format
3	pktType	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.
4	pktCnt	Count of packets sent since bootup. Rolls over to 0 after 65535.
5	fswVer	Flight software version number. The PROM version of flight software is version 36 (hex).
6	ScienceVer	Version number of the current science configuration table. The default PROM table is version 20 (hex).
7	SensorVer	Version number of the current sensor configuration table. The default PROM table is version 20 (hex).
8	DumpError	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.
9	DumpMemory	1 if the current packet is a memory dump, 0 otherwise. Memory dumps are issued only on an MWR_DOWNLOAD command from the spacecraft.
10	UploadEnabled	1 if uploads have been enabled through an MWR_PARAM command, 0 otherwise. Uploads must be enabled before MWR_UPLOAD commands will be accepted.
11	LogBufFull	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.
12	BootState	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.
13	R6Power	1 if receiver R6 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.
14	R5Power	1 if receiver R5 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.
15	R4Power	1 if receiver R4 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.

16	R3Power	1 if receiver R3 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.
17	R2Power	1 if receiver R2 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.
18	R1Power	1 if receiver R1 is powered on, 0 otherwise. Receivers are powered on using the MWR_POWER command.
19	IdleMode	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.
20	ForcedSide	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.
21	SensorSynth	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.
22	ReceiverSynth	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.
23	DiagMode	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.
24	LogIdle	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.
25	CRCInROM	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.
26	SCTimeSec	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.
27	SCTimeSubSec	The subseconds component of the last spacecraft time received. Also see "SCTimeSec" above. Each subsecond represents 1/65536 <sup>th</sup> of a second.
28	ClksSinceSCTime	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.
29	CRC	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.
30	Resets	The number of watchdog resets since power-on.

31	MissedSCTime	The number of spacecraft times expected and not received, since instrument bootup.
32	ReceiverStatus	The status reported by the receivers at the end of the frame. If receiver data is synthesized, this reads out as 0xAABBCC.
33	SeqNumber	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.
34	SeqIndex	The index into the current receiver sequence corresponding to the first reading of the frame; the first index is 0.
35	CmdsRecvd	The number of instrument commands received since bootup. Does not include spacecraft time messages.
36	CmdsExec	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.
37	CmdsReject	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.
38	LastSCMsgRecvd	The first 8 non-pad bytes of the last instrument command received from the spacecraft. Does not include S/C time messages.
39	LastMsgTime	The time (SCLK seconds) at which the last spacecraft message was received.
40	RecentErr	An 8-byte descriptor of the last error encountered. For more details, see the Juno MWR Flight Software User's Guide, section 2.4.
41	ErrorCnt	The number of errors detected by flight software since instrument bootup.
42	CDU_P5V	Current on the +5 volt line for the command data unit
43	LNA_P7V	Current on the +7 volt line for the low noise amplifiers
44	LNA_N5V	Current on the -5 volt line for the low noise amplifiers
45	ND_P15V	Current on the +15 volt line for the noise diodes
46	VFC_P12V	Current on the +12 volt line for the voltage to frequency converter
47	VFC_N12V	Current on the -12 volt line for the voltage to frequency converter
48	HKU_P12V	Current on the +12 volt line for the housekeeping unit
49	HKU_N12V	Current on the -12 volt line for the housekeeping unit
50	HKU1_VCAL_A	Calibration resistor value A for the voltage telemetry on housekeeping unit #1
51	HKU1_VCAL_B	Calibration resistor value B for the voltage telemetry on housekeeping unit #1

52	HKU2_VCAL_A	Calibration resistor value A for the voltage telemetry on housekeeping unit #2
53	HKU2_VCAL_B	Calibration resistor value B for the voltage telemetry on housekeeping unit #2
54	HKU1_RTD_CAL_LO	Low calibration value for thermistors on housekeeping unit #1
55	HKU1_RTD_CAL_HI	High calibration value for thermistors on housekeeping unit #1
56	HKU1_PRT_CAL_LO	Low calibration value for PRTs on housekeeping unit #1
57	HKU1_PRT_CAL_HI	High calibration value for PRTs on housekeeping unit #1
58	HKU2_RTD_CAL_LO	Low calibration value for thermistors on housekeeping unit #2
59	HKU2_RTD_CAL_HI	High calibration value for thermistors on housekeeping unit #2
60	HKU2_PRT_CAL_LO	Low calibration value for PRTs on housekeeping unit #2
61	HKU2_PRT_CAL_HI	High calibration value for PRTs on housekeeping unit #2
62	PDUR_A	Power distribution unit – A temperature
63	PDUR_B	Power distribution unit – B temperature
64	HKU_1	Housekeeping unit – 1 temperature
65	HKU_2	Housekeeping unit – 2 temperature
66	CDU	Command and data unit temperature
67	PDUD	Power distribution unit – D temperature
68	R1T1	R1 internal receiver thermistor 1
69	R1T2	R1 internal receiver thermistor 2
70	R1T3	R1 internal receiver thermistor 3
71	R1T4	R1 internal receiver thermistor 4
72	INT_RFTL1T1	R1 inside vault RFTL thermistor 1
73	INT_RFTL1T2	R1 inside vault RFTL thermistor 2
74	RFTL1T1	R1 external to vault RFTL PRT 1
75	RFTL1T2	R1 external to vault RFTL PRT 2
76	RFTL1T3	R1 external to vault RFTL PRT 3
77	A1T1	R1 antenna PRT 1
78	A1T2	R1 antenna PRT 2
79	A1T3	R1 antenna PRT 3
80	A1T4	R1 antenna PRT 4
81	R2T1	R2 internal receiver thermistor 1
82	R2T2	R2 internal receiver thermistor 2
83	R2T3	R2 internal receiver thermistor 3
84	R2T4	R2 internal receiver thermistor 4
85	INT_RFTL2T1	R2 inside vault RFTL thermistor 1
86	INT_RFTL2T2	R2 inside vault RFTL thermistor 2
87	RFTL2T1	R2 external to vault RFTL PRT 1

88	RFTL2T2	R2 external to vault RFTL PRT 2
89	RFTL2T3	R2 external to vault RFTL PRT 3
90	A2T1	R2 antenna PRT 1
91	A2T2	R2 antenna PRT 2
92	A2T3	R2 antenna PRT 3
93	R3T1	R3 internal receiver thermistor 1
94	R3T2	R3 internal receiver thermistor 2
95	R3T3	R3 internal receiver thermistor 3
96	R3T4	R3 internal receiver thermistor 4
97	INT_RFTL3T1	R3 inside vault RFTL thermistor 1
98	INT_RFTL3T2	R3 inside vault RFTL thermistor 2
99	RFTL3T1	R3 external to vault RFTL PRT 1
100	RFTL3T2	R3 external to vault RFTL PRT 2
101	RFTL3T3	R3 external to vault RFTL PRT 3
102	A3T1	R3 antenna PRT 1
103	A3T2	R3 antenna PRT 2
104	A3T3	R3 antenna PRT 3
105	R4T1	R4 internal receiver thermistor 1
106	R4T2	R4 internal receiver thermistor 2
107	R4T3	R4 internal receiver thermistor 3
108	R4T4	R4 internal receiver thermistor 4
109	INT_RFTL4T1	R4 inside vault RFTL thermistor 1
110	INT_RFTL4T2	R4 inside vault RFTL thermistor 2
111	RFTL4T1	R4 external to vault RFTL PRT 1
112	RFTL4T2	R4 external to vault RFTL PRT 2
113	RFTL4T3	R4 external to vault RFTL PRT 3
114	RFTL4T4	R4 external to vault RFTL PRT 4
115	A4T1	R4 antenna PRT 1
116	A4T2	R4 antenna PRT 2
117	A4T3	R4 antenna PRT 3
118	R5T1	R5 internal receiver thermistor 1
119	R5T2	R5 internal receiver thermistor 2
120	R5T3	R5 internal receiver thermistor 3
121	R5T4	R5 internal receiver thermistor 4
122	INT_RFTL5T1	R5 inside vault RFTL thermistor 1
123	INT_RFTL5T2	R5 inside vault RFTL thermistor 2
124	RFTL5T1	R5 external to vault RFTL PRT 1

125	RFTL5T2	R5 external to vault RFTL PRT 2
126	RFTL5T3	R5 external to vault RFTL PRT 3
127	A5T1	R5 antenna PRT 1
128	A5T2	R5 antenna PRT 2
129	R6T1	R6 internal receiver thermistor 1
130	R6T2	R6 internal receiver thermistor 2
131	R6T3	R6 internal receiver thermistor 3
132	R6T4	R6 internal receiver thermistor 4
133	INT_RFTL6T1	R6 inside vault RFTL thermistor 1
134	INT_RFTL6T2	R6 inside vault RFTL thermistor 2
135	RFTL6T1	R6 external to vault RFTL PRT 1
136	RFTL6T2	R6 external to vault RFTL PRT 2
137	RFTL6T3	R6 external to vault RFTL PRT 3
138	A6T1	R6 antenna PRT 1
139	RecvrConfig	Field to identify receiver state (switch position and noise diodes on/off)
140	R1_1Count	R1 low gain counts
141	R1_2Count	R1 high gain counts
142	R2_1Count	R2 low gain counts
143	R2_2Count	R2 high gain counts
144	R3Count	R3 counts
145	R4Count	R4 counts
146	R5Count	R5 counts
147	R6Count	R6 counts

### 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 3.1: The MWR Diagnostic Dump EDR**

<i>t(0)</i>	S/C Time	Diagnostic Dump Data
<i>t(1)</i>	S/C Time	Diagnostic Dump Data
<i>t(2)</i>	S/C Time	Diagnostic Dump Data
<i>t(3)</i>	S/C Time	Diagnostic Dump Data
<i>t(4)</i>	S/C Time	Diagnostic Dump Data

### 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 3.2: The MWR Memory Dump EDR**

<i>t(0)</i>	S/C Time	Memory Dump Data
<i>t(1)</i>	S/C Time	Memory Dump Data
<i>t(2)</i>	S/C Time	Memory Dump Data
<i>t(3)</i>	S/C Time	Memory Dump Data
<i>t(4)</i>	S/C Time	Memory Dump Data

### 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 3.3: The MWR Error Dump EDR**

<i>t(0)</i>	S/C Time	Error Dump Data
<i>t(1)</i>	S/C Time	Error Dump Data
<i>t(2)</i>	S/C Time	Error Dump Data
<i>t(3)</i>	S/C Time	Error Dump Data
<i>t(4)</i>	S/C Time	Error Dump Data

### 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**

Col. #	Label	Description
1	t_ephem_time	Time at midpoint of 100-ms integration expressed in seconds since 12:00 AM Jan. 1, 2000.
2	t_utc_doy	UTC time at midpoint of 100-ms integration expressed in yyyy-doyThh:mm:ss.sss format
3	R1T1	R1 internal receiver thermistor 1
4	R1T2	R1 internal receiver thermistor 2
5	R1T3	R1 internal receiver thermistor 3
6	R1T4	R1 internal receiver thermistor 4
7	INT_RFTL1T1	R1 inside vault RFTL thermistor 1
8	INT_RFTL1T2	R1 inside vault RFTL thermistor 2
9	RFTL1T1	R1 external to vault RFTL PRT 1
10	RFTL1T2	R1 external to vault RFTL PRT 2

11	RFTL1T3	R1 external to vault RFTL PRT 3
12	A1T1	R1 antenna PRT 1
13	A1T2	R1 antenna PRT 2
14	A1T3	R1 antenna PRT 3
15	A1T4	R1 antenna PRT 4
16	R2T1	R2 internal receiver thermistor 1
17	R2T2	R2 internal receiver thermistor 2
18	R2T3	R2 internal receiver thermistor 3
19	R2T4	R2 internal receiver thermistor 4
20	INT_RFTL2T1	R2 inside vault RFTL thermistor 1
21	INT_RFTL2T2	R2 inside vault RFTL thermistor 2
22	RFTL2T1	R2 external to vault RFTL PRT 1
23	RFTL2T2	R2 external to vault RFTL PRT 2
24	RFTL2T3	R2 external to vault RFTL PRT 3
25	A2T1	R2 antenna PRT 1
26	A2T2	R2 antenna PRT 2
27	A2T3	R2 antenna PRT 3
28	R3T1	R3 internal receiver thermistor 1
29	R3T2	R3 internal receiver thermistor 2
30	R3T3	R3 internal receiver thermistor 3
31	R3T4	R3 internal receiver thermistor 4
32	INT_RFTL3T1	R3 inside vault RFTL thermistor 1
33	INT_RFTL3T2	R3 inside vault RFTL thermistor 2
34	RFTL3T1	R3 external to vault RFTL PRT 1
35	RFTL3T2	R3 external to vault RFTL PRT 2
36	RFTL3T3	R3 external to vault RFTL PRT 3
37	A3T1	R3 antenna PRT 1
38	A3T2	R3 antenna PRT 2
39	A3T3	R3 antenna PRT 3
40	R4T1	R4 internal receiver thermistor 1
41	R4T2	R4 internal receiver thermistor 2
42	R4T3	R4 internal receiver thermistor 3
43	R4T4	R4 internal receiver thermistor 4
44	INT_RFTL4T1	R4 inside vault RFTL thermistor 1
45	INT_RFTL4T2	R4 inside vault RFTL thermistor 2
46	RFTL4T1	R4 external to vault RFTL PRT 1
47	RFTL4T2	R4 external to vault RFTL PRT 2

48	RFTL4T3	R4 external to vault RFTL PRT 3
49	RFTL4T4	R4 external to vault RFTL PRT 4
50	A4T1	R4 antenna PRT 1
51	A4T2	R4 antenna PRT 2
52	A4T3	R4 antenna PRT 3
53	R5T1	R5 internal receiver thermistor 1
54	R5T2	R5 internal receiver thermistor 2
55	R5T3	R5 internal receiver thermistor 3
56	R5T4	R5 internal receiver thermistor 4
57	INT_RFTL5T1	R5 inside vault RFTL thermistor 1
58	INT_RFTL5T2	R5 inside vault RFTL thermistor 2
59	RFTL5T1	R5 external to vault RFTL PRT 1
60	RFTL5T2	R5 external to vault RFTL PRT 2
61	RFTL5T3	R5 external to vault RFTL PRT 3
62	A5T1	R5 antenna PRT 1
63	A5T2	R5 antenna PRT 2
64	R6T1	R6 internal receiver thermistor 1
65	R6T2	R6 internal receiver thermistor 2
66	R6T3	R6 internal receiver thermistor 3
67	R6T4	R6 internal receiver thermistor 4
68	INT_RFTL6T1	R6 inside vault RFTL thermistor 1
69	INT_RFTL6T2	R6 inside vault RFTL thermistor 2
70	RFTL6T1	R6 external to vault RFTL PRT 1
71	RFTL6T2	R6 external to vault RFTL PRT 2
72	RFTL6T3	R6 external to vault RFTL PRT 3
73	A6T1	R6 antenna PRT 1
74	R1_1AntCnt	R1 low gain counts switched to antenna
75	R1_2AntCnt	R1 high gain counts switched to antenna
76	R2_1AntCnt	R2 low gain counts switched to antenna
77	R2_2AntCnt	R2 high gain counts switched to antenna
78	R3AntCnt	R3 counts switched to antenna
79	R4AntCnt	R4 counts switched to antenna
80	R5AntCnt	R5 counts switched to antenna
81	R6AntCnt	R6 counts switched to antenna
82	R1_1RefCnt	R1 low gain counts switched to internal load
83	R1_2RefCnt	R1 high gain counts switched to internal load
84	R2_1RefCnt	R2 low gain counts switched to internal load

85	R2_2RefCnt	R2 high gain counts switched to internal load
86	R3RefCnt	R3 counts switched to internal load
87	R4RefCnt	R4 counts switched to internal load
88	R5RefCnt	R5 counts switched to internal load
89	R6RefCnt	R6 counts switched to internal load
90	R1_1ND1ACnt	R1 low gain noise diode 1 deflection in antenna position, counts
91	R1_2ND1ACnt	R1 high gain noise diode 1 deflection in antenna position, counts
92	R2_1ND1ACnt	R2 low gain noise diode 1 deflection in antenna position, counts
93	R2_2ND1ACnt	R2 high gain noise diode 1 deflection in antenna position, counts
94	R3ND1ACnt	R3 noise diode 1 deflection in antenna position, counts
95	R4ND1ACnt	R4 noise diode 1 deflection in antenna position, counts
96	R5ND1ACnt	R5 noise diode 1 deflection in antenna position, counts
97	R6ND1ACnt	R6 noise diode 1 deflection in antenna position, counts
98	R1_1ND2ACnt	R1 low gain noise diode 2 deflection in antenna position, counts
99	R1_2ND2ACnt	R1 high gain noise diode 2 deflection in antenna position, counts
100	R2_1ND2ACnt	R2 low gain noise diode 2 deflection in antenna position, counts
101	R2_2ND2ACnt	R2 high gain noise diode 2 deflection in antenna position, counts
102	R3ND2ACnt	R3 noise diode 2 deflection in antenna position, counts
103	R4ND2ACnt	R4 noise diode 2 deflection in antenna position, counts
104	R5ND2ACnt	R5 noise diode 2 deflection in antenna position, counts
105	R6ND2ACnt	R6 noise diode 2 deflection in antenna position, counts
106	R1_1ND3ACnt	R1 low gain noise diode 3 deflection in antenna position, counts
107	R1_2ND3ACnt	R1 high gain noise diode 3 deflection in antenna position, counts
108	R2_1ND3ACnt	R2 low gain noise diode 3 deflection in antenna position, counts
109	R2_2ND3ACnt	R2 high gain noise diode 3 deflection in antenna position, counts
110	R3ND3ACnt	R3 noise diode 3 deflection in antenna position, counts
111	R4ND3ACnt	R4 noise diode 3 deflection in antenna position, counts
112	R5ND3ACnt	R5 noise diode 3 deflection in antenna position, counts
113	R6ND3ACnt	R6 noise diode 3 deflection in antenna position, counts
114	R1_1ND1RCnt	R1 low gain noise diode 1 deflection in internal load position, counts
115	R1_2ND1RCnt	R1 high gain noise diode 1 deflection in internal load position, counts
116	R2_1ND1RCnt	R2 low gain noise diode 1 deflection in internal load position, counts
117	R2_2ND1RCnt	R2 high gain noise diode 1 deflection in internal load position, counts
118	R3ND1RCnt	R3 noise diode 1 deflection in internal load position, counts
119	R4ND1RCnt	R4 noise diode 1 deflection in internal load position, counts
120	R5ND1RCnt	R5 noise diode 1 deflection in internal load position, counts
121	R6ND1RCnt	R6 noise diode 1 deflection in internal load position, counts

122	R1_1ND2RCnt	R1 low gain noise diode 2 deflection in internal load position, counts
123	R1_2ND2RCnt	R1 high gain noise diode 2 deflection in internal load position, counts
124	R2_1ND2RCnt	R2 low gain noise diode 2 deflection in internal load position, counts
125	R2_2ND2RCnt	R2 high gain noise diode 2 deflection in internal load position, counts
126	R3ND2RCnt	R3 noise diode 2 deflection in internal load position, counts
127	R4ND2RCnt	R4 noise diode 2 deflection in internal load position, counts
128	R5ND2RCnt	R5 noise diode 2 deflection in internal load position, counts
129	R6ND2RCnt	R6 noise diode 2 deflection in internal load position, counts
130	R1_1ND3RCnt	R1 low gain noise diode 3 deflection in internal load position, counts
131	R1_2ND3RCnt	R1 high gain noise diode 3 deflection in internal load position, counts
132	R2_1ND3RCnt	R2 low gain noise diode 3 deflection in internal load position, counts
133	R2_2ND3RCnt	R2 high gain noise diode 3 deflection in internal load position, counts
134	R3ND3RCnt	R3 noise diode 3 deflection in internal load position, counts
135	R4ND3RCnt	R4 noise diode 3 deflection in internal load position, counts
136	R5ND3RCnt	R5 noise diode 3 deflection in internal load position, counts
137	R6ND3RCnt	R6 noise diode 3 deflection in internal load position, counts
138	R1_1TA	R1 low gain calibrated antenna temperature, Kelvin
139	R1_2TA	R1 high gain calibrated antenna temperature, Kelvin
140	R2_1TA	R2 low gain calibrated antenna temperature, Kelvin
141	R2_2TA	R2 high gain calibrated antenna temperature, Kelvin
142	R3TA	R3 calibrated antenna temperature, Kelvin
143	R4TA	R4 calibrated antenna temperature, Kelvin
144	R5TA	R5 calibrated antenna temperature, Kelvin
145	R6TA	R6 calibrated antenna temperature, Kelvin
146	R1_1TND1A	R1 low gain noise diode 1 brightness in the antenna position, Kelvin
147	R1_2TND1A	R1 high gain noise diode 1 brightness in the antenna position, Kelvin
148	R2_1TND1A	R2 low gain noise diode 1 brightness in the antenna position, Kelvin
149	R2_2TND1A	R2 high gain noise diode 1 brightness in the antenna position, Kelvin
150	R3TND1A	R3 noise diode 1 brightness in the antenna position, Kelvin
151	R4TND1A	R4 noise diode 1 brightness in the antenna position, Kelvin
152	R5TND1A	R5 noise diode 1 brightness in the antenna position, Kelvin
153	R6TND1A	R6 noise diode 1 brightness in the antenna position, Kelvin
154	R1_1TND2A	R1 low gain noise diode 2 brightness in the antenna position, Kelvin
155	R1_2TND2A	R1 high gain noise diode 2 brightness in the antenna position, Kelvin
156	R2_1TND2A	R2 low gain noise diode 2 brightness in the antenna position, Kelvin
157	R2_2TND2A	R2 high gain noise diode 2 brightness in the antenna position, Kelvin
158	R3TND2A	R3 noise diode 2 brightness in the antenna position, Kelvin

159	R4TND2A	R4 noise diode 2 brightness in the antenna position, Kelvin
160	R5TND2A	R5 noise diode 2 brightness in the antenna position, Kelvin
161	R6TND2A	R6 noise diode 2 brightness in the antenna position, Kelvin
162	R1_1TND3A	R1 low gain noise diode 3 brightness in the antenna position, Kelvin
163	R1_2TND3A	R1 high gain noise diode 3 brightness in the antenna position, Kelvin
164	R2_1TND3A	R2 low gain noise diode 3 brightness in the antenna position, Kelvin
165	R2_2TND3A	R2 high gain noise diode 3 brightness in the antenna position, Kelvin
166	R3TND3A	R3 noise diode 3 brightness in the antenna position, Kelvin
167	R4TND3A	R4 noise diode 3 brightness in the antenna position, Kelvin
168	R5TND3A	R5 noise diode 3 brightness in the antenna position, Kelvin
169	R6TND3A	R6 noise diode 3 brightness in the antenna position, Kelvin
170	R1_1TND1R	R1 low gain noise diode 1 brightness in the reference position, Kelvin
171	R1_2TND1R	R1 high gain noise diode 1 brightness in the reference position, Kelvin
172	R2_1TND1R	R2 low gain noise diode 1 brightness in the reference position, Kelvin
173	R2_2TND1R	R2 high gain noise diode 1 brightness in the reference position, Kelvin
174	R3TND1R	R3 noise diode 1 brightness in the reference position, Kelvin
175	R4TND1R	R4 noise diode 1 brightness in the reference position, Kelvin
176	R5TND1R	R5 noise diode 1 brightness in the reference position, Kelvin
177	R6TND1R	R6 noise diode 1 brightness in the reference position, Kelvin
178	R1_1TND2R	R1 low gain noise diode 2 brightness in the reference position, Kelvin
179	R1_2TND2R	R1 high gain noise diode 2 brightness in the reference position, Kelvin
180	R2_1TND2R	R2 low gain noise diode 2 brightness in the reference position, Kelvin
181	R2_2TND2R	R2 high gain noise diode 2 brightness in the reference position, Kelvin
182	R3TND2R	R3 noise diode 2 brightness in the reference position, Kelvin
183	R4TND2R	R4 noise diode 2 brightness in the reference position, Kelvin
184	R5TND2R	R5 noise diode 2 brightness in the reference position, Kelvin
185	R6TND2R	R6 noise diode 2 brightness in the reference position, Kelvin
186	R1_1TND3R	R1 low gain noise diode 3 brightness in the reference position, Kelvin
187	R1_2TND3R	R1 high gain noise diode 3 brightness in the reference position, Kelvin
188	R2_1TND3R	R2 low gain noise diode 3 brightness in the reference position, Kelvin
189	R2_2TND3R	R2 high gain noise diode 3 brightness in the reference position, Kelvin
190	R3TND3R	R3 noise diode 3 brightness in the reference position, Kelvin
191	R4TND3R	R4 noise diode 3 brightness in the reference position, Kelvin
192	R5TND3R	R5 noise diode 3 brightness in the reference position, Kelvin
193	R6TND3R	R6 noise diode 3 brightness in the reference position, Kelvin
194	R1_1TOFF	R1 low gain internal load brightness referenced to the input, Kelvin
195	R1_2TOFF	R1 high gain internal load brightness referenced to the input, Kelvin



196	R2_1TOFF	R2 low gain internal load brightness referenced to the input, Kelvin
197	R2_2TOFF	R2 high gain internal load brightness referenced to the input, Kelvin
198	R3TOFF	R3 internal load brightness referenced to the input, Kelvin
199	R4TOFF	R4 internal load brightness referenced to the input, Kelvin
200	R5TOFF	R5 internal load brightness referenced to the input, Kelvin
201	R6TOFF	R6 internal load brightness referenced to the input, Kelvin

## 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**

Col. #	Label	Description
1	t_ephem_time	Time at midpoint of 100-ms integration expressed in seconds since 12:00 AM Jan. 1, 2000.
2	t_utc_doy	UTC time at midpoint of 100-ms integration expressed in yyyy-doyThh:mm:ss.sss format
3	gal_lon_1	Antenna 1 boresight longitude in galactic coordinates
4	gal_lat_1	Antenna 1 boresight latitude in galactic coordinates
5	gal_rot_1	Antenna 1 polarization in galactic coordinates
6	gal_lon_2	Antenna 2 boresight longitude in galactic coordinates
7	gal_lat_2	Antenna 2 boresight latitude in galactic coordinates
8	gal_rot_2	Antenna 2 polarization in galactic coordinates
9	gal_lon_3	Antenna 3 boresight longitude in galactic coordinates
10	gal_lat_3	Antenna 3 boresight latitude in galactic coordinates
11	gal_rot_3	Antenna 3 polarization in galactic coordinates
12	gal_lon_4	Antenna 4 boresight longitude in galactic coordinates
13	gal_lat_4	Antenna 4 boresight latitude in galactic coordinates
14	gal_rot_4	Antenna 4 polarization in galactic coordinates
15	gal_lon_5	Antenna 5 boresight longitude in galactic coordinates

16	gal_lat_5	Antenna 5 boresight latitude in galactic coordinates
17	gal_rot_5	Antenna 5 polarization in galactic coordinates
18	gal_lon_6	Antenna 6 boresight longitude in galactic coordinates
19	gal_lat_6	Antenna 6 boresight latitude in galactic coordinates
20	gal_rot_6	Antenna 6 polarization in galactic coordinates
21	J2000_lon_1	Antenna 1 boresight longitude in J2000 coordinates
22	J2000_lat_1	Antenna 1 boresight latitude in J2000 coordinates
23	J2000_rot_1	Antenna 1 polarization in J2000 coordinates
24	J2000_lon_2	Antenna 2 boresight longitude in J2000 coordinates
25	J2000_lat_2	Antenna 2 boresight latitude in J2000 coordinates
26	J2000_rot_2	Antenna 2 polarization in J2000 coordinates
27	J2000_lon_3	Antenna 3 boresight longitude in J2000 coordinates
28	J2000_lat_3	Antenna 3 boresight latitude in J2000 coordinates
29	J2000_rot_3	Antenna 3 polarization in J2000 coordinates
30	J2000_lon_4	Antenna 4 boresight longitude in J2000 coordinates
31	J2000_lat_4	Antenna 4 boresight latitude in J2000 coordinates
32	J2000_rot_4	Antenna 4 polarization in J2000 coordinates
33	J2000_lon_5	Antenna 5 boresight longitude in J2000 coordinates
34	J2000_lat_5	Antenna 5 boresight latitude in J2000 coordinates
35	J2000_rot_5	Antenna 5 polarization in J2000 coordinates
36	J2000_lon_6	Antenna 6 boresight longitude in J2000 coordinates
37	J2000_lat_6	Antenna 6 boresight latitude in J2000coordinates
38	J2000_rot_6	Antenna 6 polarization in J2000 coordinates

## 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**

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

- 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 5.2: PDS Data Set Name Assignments

DATA_SET_ID	VOLUME_SET_ID
JNO-X-MWR-2-EDR-V1.2	USA_NASA_PDS_JNOMWR_0000
JNO-X-MWR-3-RDR-V2.1	USA_NASA_PDS_JNOMWR_1000
JNO-J-MWR-2-EDR-V1.0*	USA_NASA_PDS_JNOMWR_0100
JNO-J-MWR-3-RDR-V1.0*	USA_NASA_PDS_JNOMWR_1100

\* 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.

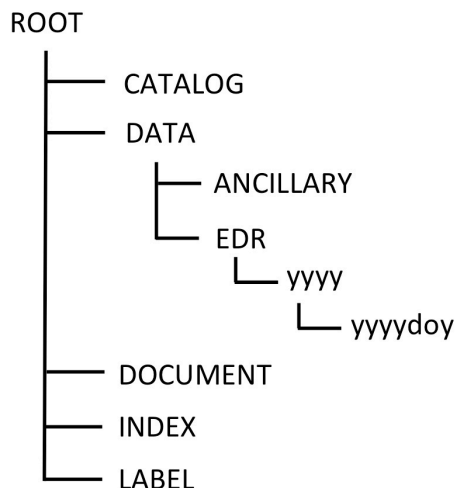


Figure 5.1: EDR Archive Volume Directory Structure

### 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 5.3: Root Directory Contents

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

### 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**

Item Name	Description	
ANCILLARY	Sub-directory containing command sequences and ancillary headers	MWR IOT
yyyy	Subdirectories containing data ordered by year (yyyy)	MWR IOT
yyyydoy	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.	MWR IOT

**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**

File Name	File Contents	Provided By
INDXINFO.TXT	A description of the contents of this directory	MWR IOT
INDEX.TAB	A table listing all data products on this volume	MWR IOT
INDEX.LBL	A PDS detached label that describes INDEX.TAB	MWR IOT

**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**

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

#### 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**

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

#### 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**

File Name	File Contents	File Provided By
LABELINFO.TXT	A description of the contents of this directory	MWR IOT
MWR_EDR_V04.FMT	File required for reading the .CSV files in the Data EDR Folder	MWR IOT

### 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.

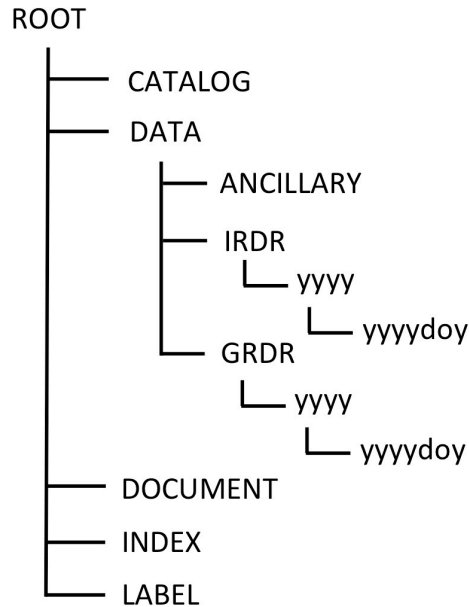


Figure 5.2: RDR Archive Volume Directory Structure

#### 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 5.8: Root Directory Contents

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



### 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 5.9: DATA Directory contents and description**

Item Name	Description	Provided By
ANCILLARY	Sub-directory containing command sequences and ancillary headers	MWR IOT
yyyy	Subdirectories containing data files ordered by year (yyyy)	MWR IOT
yyyydoy	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.	MWR IOT

### 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 5.10: Index Directory Contents**

File Name	File Contents	MWR IOT
INDXINFO.TXT	A description of the contents of this directory	MWR IOT
INDEX.TAB	A table listing all data products on this volume	MWR IOT
INDEX.LBL	A PDS detached label that describes INDEX.TAB	MWR IOT

### 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**

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

### 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**

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

### 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**

File Name	File Contents	File Provided By
LABELINFO.TXT	A description of the contents of this directory	MWR IOT
MWR_IRDR_V05.FMT	File required for reading the .CSV files in the Data IRDR Folder	MWR IOT
MWR_GRDR_V04.FMT	File required for reading the .CSV files in the Data GRDR Folder	MWR IOT

## Appendix A –File Naming Convention

All MWR products will follow the following file naming convention.

IIIIOOTYYYYDDDDHHMMSS\_RCCCCC\_VNN.XXX

Where:

I (1-3)	Instrument Id	Always set to "MWR"
O (4,5)	Orbit Number	Orbit number, zero padded decimal integer starting at 01.  "00" cruise data "NN" Orbit number (NN ≠ "00")
T (6,7)	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 (8-11)	Year	Year, 4 decimal digits.
D (12-14)	Day	Day of year, from S/C event time (SCLK converted to SCET), zero-padded decimal value 001-366
H (15,16)	Hour	Hour of day, from S/C event time (SCLK converted to SCET), zero-padded decimal value 00-23
M (17,18)	Minute	Minutes of hour, from S/C event time (SCLK converted to SCET), zero-padded decimal value 00-59
S (19,20)	Second	Seconds of minute, from S/C event time (SCLK converted to SCET), zero-padded decimal value 00-59
_R (21,22)	reserved	Always set to "_R"
C (23-27)	Number of data rows	Same as ROWS that appears in the SPREADSHEET object section of the PDS label file associated with the product
_V (28,29)	Reserved	Always set to "_V"
N (30,31)	Algorithm/format version	Version number is incremented when there is an algorithmic change in data production or a file format change.
. (32)	Period	Always set to "." (period)
X (33-34)	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

```

PDS_VERSION_ID          = "PDS3"

/* FILE DATA ELEMENTS */

RECORD_TYPE             = "STREAM"
RECORD_BYTES            = 1275
FILE_RECORDS            = 1631
MD5_CHECKSUM            = "27a14860f055bab7650c61e0e3c2f0e1"

/* IDENTIFICATION DATA ELEMENTS */

DATA_SET_ID             = "JNO-X-MWR-2-EDR-V1.2"
PRODUCT_ID              = "MWR00DR201522000000_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 = "MULTIMISSIION 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                  = ("MWR00DR201522000000_R01630_V03.CSV", 1)
OBJECT                   = HEADER
BYTES                    = 1275
HEADER_TYPE              = "TEXT"
DESCRIPTION              = "See ^STRUCTURE"
END_OBJECT               = HEADER

/* DATA REFERENCE */

^SPREADSHEET             = ("MWR00DR201522000000_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               = "MWR00RI2015220000000_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"
INSTRUMENT_NAME          = "MICROWAVE RADIOMETER"
MISSION_NAME             = "JUNO"
MISSION_PHASE_NAME       = "QUIET CRUISE"
PRODUCER_INSTITUTION_NAME = "MULTIMISSIION IMAGE PROCESSING SUBSYSTEM,
                           JET PROPULSION LAB"
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_v01.ti",
                             "naif0011.tls",
                             "JNO_SCLKSCET.00037.tsc",
                             "spk_pre_151003_160701_160317_jc063.bsp",
                             "spk_rec_140903_151003_160118.bsp",
                             "juno_v08.tf",
                             "pck00010.tpc",
                             "juno_sc_rec_150802_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      = "2.1"
PROCESSING_LEVEL_ID      = "3"

/* HEADER REFERENCE */

^HEADER                  = ("MWR00RI2015220000000_R01304_V03.CSV", 1)
OBJECT                   = HEADER
BYTES                    = 1752
HEADER_TYPE              = "TEXT"
DESCRIPTION              = "See ^STRUCTURE"
END_OBJECT               = HEADER

/* DATA REFERENCE */

^SPREADSHEET             = ("MWR00RI2015220000000_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_HOST_NAME     = "JUNO"
INSTRUMENT_ID            = "MWR"
INSTRUMENT_TYPE          = "RADIOMETER"
INSTRUMENT_NAME          = "MICROWAVE RADIOMETER"
MISSION_NAME              = "JUNO"
MISSION_PHASE_NAME       = "QUIET CRUISE"
PRODUCER_INSTITUTION_NAME = "MULTIMISSIION IMAGE PROCESSING SUBSYSTEM,
                             JET PROPULSION LAB"
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_v01.ti",
                             "naif0011.tls",
                             "JNO_SCLKSCET.00037.tsc",
                             "spk_pre_151003_160701_160317_jc063.bsp",
                             "spk_rec_140903_151003_160118.bsp",
                             "juno_v08.tf",
                             "pck00010.tpc",
                             "juno_sc_rec_150802_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

Keyword Name	Definition	Type	Units	Valid Values
DATA_SET_ID {value not in PDS dictionary}	A unique alphanumeric identifier for a data set or a data product. The 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].	string(40)		"JNO-X-MWR-2-EDR-V1.2" "JNO-X-MWR-3-RDR-V2.1" "JNO-J-MWR-2-EDR-V1.0" "JNO-J-MWR-3-RDR-V1.0"
FIELDS	Number of data columns in the CSV file.	integer		
FILE_RECORDS	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].	integer		
INSTRUMENT_HOST_ID	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 SPACECRAFT_ID values or EARTH_BASE_ID values.	string(6)		"JNO"
INSTRUMENT_HOST_NAME	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 SPACECRAFT_NAME values or EARTH_BASE_NAME values.  Note that mosaics may contain more than one value in an array.	string		"JUNO"
INSTRUMENT_ID	Provides a unique identifier for the instrument.	string		"MWR"
INSTRUMENT_NAME	Full name of the instrument, always set to the same string for MWR.	string		"MICROWAVE RADIOMETER"
INSTRUMENT_TYPE	Identifies the type of an instrument.  Example values: MICROWAVE RADIOMETER  Note that mosaics may contain more than one value in an array.	string		"RADIOMETER"



Keyword Name	Definition	Type	Units	Valid Values
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"
MISSION_PHASE_NAME (to be provided by Kurth)	Provides the commonly-used identifier of a mission phase.	string(30)		"INNER CRUISE 1", "INNER CRUISE 2", "INNER CRUISE 3", "QUIET CRUISE", "JUPITER APPROACH", "JUPITER ORBIT INSERTION", "CAPTURE ORBIT", "PERIOD REDUCTION MANEUVER", "ORBITS 1-2", "DEORBIT"
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)		

Keyword Name	Definition	Type	Units	Valid Values
PRODUCT_TYPE	Identifies the type or category of a data product within a data set.	string(8)		"EDR" "IRDR" "GRDR"
PRODUCT_VERSION_ID	Identifies the version of an individual product within a data set.  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.  Example: "R02392_V01"  Note: This might not be the same as the data set version that is an element of the DATA_SET_ID value.	string		
RECORD_BYTES	Indicates the number of bytes in a physical file record, including record terminators and separators.  Note: In the PDS, the use of record_bytes, along with other file-related data elements is fully described in the Standards Reference [2].	integer		
RECORD_TYPE	Indicates the record format of a file.  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].	string(20)		"STREAM"
ROW_BYTES	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.	integer	Bytes	4000
ROWS	Number of rows /lines of data in the EDR. Excludes lines of header, if any.	integer		
SOFTWARE_NAME	Identifies data processing software such as a program or a program library.	string(60)		
SOFTWARE_VERSION_ID	Indicates the version (development level) of a program or a program library.	string(20)		
SPACECRAFT_CLOCK_START_COUNT	Provides the value of the spacecraft clock at the beginning of a time period of interest.  Format is p/ddddddddd.dddd, which is <i>partition-number/sclk-seconds.sclk-subseconds</i> .	string(30)		
SPACECRAFT_CLOCK_STOP_COUNT	Provides the value of the spacecraft clock at the end of a time period of interest.  Format is p/ddddddddd.dddd, which is <i>partition-number/sclk-seconds.sclk-subseconds</i> .	string(30)		

Keyword Name	Definition	Type	Units	Valid Values
SPICE_FILE_NAME	Provides the names of the SPICE files used in processing the data.	string (180)		
STANDARD_DATA_PRODUCT_ID	Generic tag used by JSOC to determine the type of data for each instrument.	string		"EDR", "IRDR", "GRDR"
START_TIME	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	string		
STOP_TIME	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	string		
TARGET_NAME	Identifies a target. The target may be a planet, satellite, ring, region, feature, asteroid or comet. See TARGET_TYPE.	string(30)		"JUPITER", "SKY"

## Appendix D – Examples of MWR EDRs and RDRs

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

```
t_ephem_time,t_utc_doy,pktType,pktCnt,fswVer,ScienceVer,SensorVer,DumpError,DumpMemory,UploadEnabled,
LogBufFull,BootState,R6Power,R5Power,R4Power,R3Power,R2Power,R1Power,IdleMode,ForcedSide,SensorSynth,
ReceiverSynth,DiagMode,LogIdle,CRCInROM,SCTimeSec,SCTimeSubSec,CklsSinceSCTime,CRC,Resets,MissedSCTim
e,ReceiverStatus,SeqNumber,SeqIndex,CmdsRecvd,CmdsExec,CmdsReject,LastSCMsgRecvd,LastMsgTime,RecentEr
r,ErrorCnt,CDU_P5V,LNA_P7V,LNA_N5V,ND_P15V,VFC_P12V,VFC_N12V,HKU_P12V,HKU_N12V,HKU1_VCAL_A,HKU1_VCAL_
B,HKU2_VCAL_A,HKU2_VCAL_B,HKU1_RTD_CAL_LO,HKU1_RTD_CAL_HI,HKU1_PRT_CAL_LO,HKU1_PRT_CAL_HI,HKU2_RTD_CA
L_LO,HKU2_RTD_CAL_HI,HKU2_PRT_CAL_LO,HKU2_PRT_CAL_HI,PDUR_A,PDUR_B,HKU_1,HKU_2,CDU,PDUD,R1T1,R1T2,R1T
3,R1T4,INT_RFTL1T1,INT_RFTL1T2,RFTL1T1,RFTL1T2,RFTL1T3,A1T1,A1T2,A1T3,A1T4,R2T1,R2T2,R2T3,R2T4,INT_RF
TL2T1,INT_RFTL2T2,RFTL2T1,RFTL2T2,RFTL2T3,A2T1,A2T2,A2T3,R3T1,R3T2,R3T3,R3T4,INT_RFTL3T1,INT_RFTL3T2,
RFTL3T1,RFTL3T2,RFTL3T3,A3T1,A3T2,A3T3,R4T1,R4T2,R4T3,R4T4,INT_RFTL4T1,INT_RFTL4T2,RFTL4T1,RFTL4T2,RF
TL4T3,RFTL4T4,A4T1,A4T2,A4T3,R5T1,R5T2,R5T3,R5T4,INT_RFTL5T1,INT_RFTL5T2,RFTL5T1,RFTL5T2,RFTL5T3,A5T1
,A5T2,R6T1,R6T2,R6T3,R6T4,INT_RFTL6T1,INT_RFTL6T2,RFTL6T1,RFTL6T2,RFTL6T3,A6T1,RecvrConfig,R1_1Count,
R1_2Count,R2_1Count,R2_2Count,R3Count,R4Count,R5Count,R6Count
```

```
386769676.404,2012-095T00:00:10.218,0,19302,54,32,32,0,0,0,0,4,1,1,1,1,1,0,0,0,0,0,0,0,386769645,
47205,292,41571,0,5,0,2,28,5,5,0,217581256693514240,386769645,0,0,,,,,,,,,9996,,,,,,,,,
,,,,,,,,,0,11910,10147,14619,9038,23248,3112
2,33940,21514

386769676.504,2012-095T00:00:10.318,0,19302,54,32,32,0,0,0,0,4,1,1,1,1,1,0,0,0,0,0,0,0,386769645,
47205,292,41571,0,5,0,2,28,5,5,0,217581256693514240,386769645,0,0,,,,,,,,,7691,,,,,,,,,
,,,,,,,,,0,11914,10148,14617,9038,23252,3112
3,33940,21516
```

```
:
:
```

In the above example, the first line/record contains the column headings. Subsequent lines are science records corresponding to 100-ms 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:

```
t_ephem_time,t_utc_doy,R1T1,R1T2,R1T3,R1T4,INT_RFTL1T1,INT_RFTL1T2,RFTL1T1,RFTL1T2,RFTL1T3,A1T1,A1T2,
A1T3,A1T4,R2T1,R2T2,R2T3,R2T4,INT_RFTL2T1,INT_RFTL2T2,RFTL2T1,RFTL2T2,RFTL2T3,A2T1,A2T2,A2T3,R3T1,R3T
2,R3T3,R3T4,INT_RFTL3T1,INT_RFTL3T2,RFTL3T1,RFTL3T2,RFTL3T3,A3T1,A3T2,A3T3,R4T1,R4T2,R4T3,R4T4,INT_RF
TL4T1,INT_RFTL4T2,RFTL4T1,RFTL4T2,RFTL4T3,RFTL4T4,A4T1,A4T2,A4T3,R5T1,R5T2,R5T3,R5T4,INT_RFTL5T1,INT_
RFTL5T2,RFTL5T1,RFTL5T2,RFTL5T3,A5T1,A5T2,R6T1,R6T2,R6T3,R6T4,INT_RFTL6T1,INT_RFTL6T2,RFTL6T1,RFTL6T2
,RFTL6T3,A6T1,R1_1AntCnt,R1_2AntCnt,R2_1AntCnt,R2_2AntCnt,R3AntCnt,R4AntCnt,R5AntCnt,R6AntCnt,R1_1Ref
Cnt,R1_2RefCnt,R2_1RefCnt,R2_2RefCnt,R3RefCnt,R4RefCnt,R5RefCnt,R6RefCnt,R1_1ND1ACnt,R1_2ND1ACnt,R2_1
ND1ACnt,R2_2ND1ACnt,R3ND1ACnt,R4ND1ACnt,R5ND1ACnt,R6ND1ACnt,R1_1ND2ACnt,R1_2ND2ACnt,R2_1ND2ACnt,R2_2N
D2ACnt,R3ND2ACnt,R4ND2ACnt,R5ND2ACnt,R6ND2ACnt,R1_1ND3ACnt,R1_2ND3ACnt,R2_1ND3ACnt,R2_2ND3ACnt,R3ND3A
Cnt,R4ND3ACnt,R5ND3ACnt,R6ND3ACnt,R1_1ND1RCnt,R1_2ND1RCnt,R2_1ND1RCnt,R2_2ND1RCnt,R3ND1RCnt,R4ND1RCnt
,R5ND1RCnt,R6ND1RCnt,R1_1ND2RCnt,R1_2ND2RCnt,R2_1ND2RCnt,R2_2ND2RCnt,R3ND2RCnt,R4ND2RCnt,R5ND2RCnt,R6
ND2RCnt,R1_1ND3RCnt,R1_2ND3RCnt,R2_1ND3RCnt,R2_2ND3RCnt,R3ND3RCnt,R4ND3RCnt,R5ND3RCnt,R6ND3RCnt,R1_1T
A,R1_2TA,R2_1TA,R2_2TA,R3TA,R4TA,R5TA,R6TA,R1_1TND1A,R1_2TND1A,R2_1TND1A,R2_2TND1A,R3TND1A,R4TND1A,R5
TND1A,R6TND1A,R1_1TND2A,R1_2TND2A,R2_1TND2A,R2_2TND2A,R3TND2A,R4TND2A,R5TND2A,R6TND2A,R1_1TND3A,R1_2T
ND3A,R2_1TND3A,R2_2TND3A,R3TND3A,R4TND3A,R5TND3A,R6TND3A,R1_1TND1R,R1_2TND1R,R2_1TND1R,R2_2TND1R,R3TN
D1R,R4TND1R,R5TND1R,R6TND1R,R1_1TND2R,R1_2TND2R,R2_1TND2R,R2_2TND2R,R3TND2R,R4TND2R,R5TND2R,R6TND2R,R
1_1TND3R,R1_2TND3R,R2_1TND3R,R2_2TND3R,R3TND3R,R4TND3R,R5TND3R,R6TND3R,R1_1TOFF,R1_2TOFF,R2_1TOFF,R2_
2TOFF,R3TOFF,R4TOFF,R5TOFF,R6TOFF
```

```
492265881.312,2015-
220T00:30:13.129,297.135,296.687,297.167,297.186,284.566,282.426,256.545,232.524,194.066,177.736,173.
190,170.465,172.614,297.348,296.964,297.326,297.365,285.206,282.538,251.607,217.894,195.050,174.705,1
76.550,177.561,296.471,296.100,296.455,296.518,286.258,284.355,249.435,234.198,192.474,183.326,183.27
8,183.505,296.722,296.619,297.035,297.063,286.235,284.549,253.175,241.158,213.635,187.237,184.655,184
.352,184.717,297.358,297.209,298.076,297.990,287.261,284.142,259.712,245.031,219.487,208.907,208.956,
296.215,296.882,296.860,296.524,293.944,277.827,262.039,245.899,220.113,212.935,11724.000,10083.000,1
4405.000,8977.000,23287.000,31370.000,36842.000,22268.000,14557.000,10450.000,17288.000,9429.000,2967
8.000,38619.000,47327.000,27231.000,2702.000,351.500,4473.500,704.000,7569.500,8791.000,15103.500,440
7.500,2564.000,337.500,2255.500,356.000,4884.500,9901.000,14664.500,4229.000,2883.000,376.000,2640.00
0,415.500,5661.500,12309.500,12653.500,4190.000,,,,,,,,,2568.136,337.000,2293.273,361.000,5093.091,99
43.909,15155.045,4262.273,2879.000,376.045,2645.818,415.045,5696.727,12321.727,12643.136,4196.091,12.
```

048,13.258,4.220,5.650,5.661,-  
5.382,2.112,6.305,314.845,314.845,548.281,548.281,372.305,403.070,434.270,266.183,314.845,314.845,548  
.281,548.281,372.305,403.070,434.270,266.183,314.845,314.845,548.281,548.281,372.305,403.070,434.270,  
266.183,314.863,314.863,548.286,548.286,372.306,403.070,434.270,266.183,314.863,314.863,548.286,548.2  
86,372.306,403.070,434.270,266.183,314.863,314.863,548.286,548.286,372.306,403.070,434.270,266.183,34  
2.418,342.418,357.884,357.884,320.018,326.746,303.588,306.280  
.  
.  
.

### D.3 Geometry RDR (GRDR) in CSV format:

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\_la  
t,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\_J2  
000\_rot,4\_J2000\_lon,4\_J2000\_lat,4\_J2000\_rot,5\_J2000\_lon,5\_J2000\_lat,5\_J2000\_rot,6\_J2000\_lon,6\_J2000\_l  
at,6\_J2000\_rot

410266868.850,2012-  
366T23:00:01.666,49.354,6.913,123.703,176.923,24.637,65.311,176.923,24.637,65.311,176.923,24.637,65.3  
11,176.923,24.637,65.311,176.923,24.637,65.311,-75.886,17.738,-172.623,112.684,41.735,-  
9.433,112.684,41.735,-9.433,112.684,41.735,-9.433,112.684,41.735,-9.433,112.684,41.735,-9.433  
.  
.  
.

## Appendix E – PDS object format description

### E.1 EDR

```

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          = 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          = FIELD
  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

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

---

```

END_OBJECT

OBJECT          = FIELD
  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          = FIELD
  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          = FIELD
  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          = FIELD
  NAME          = DumpMemory
  DATA_TYPE    = ASCII_INTEGER
```

```

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

```

```

DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 20
BYTES = 10
DESCRIPTION = "2=channel A, 3=channel B, 0 otherwise"

END_OBJECT

OBJECT = FIELD
NAME = SensorSynth
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 21
BYTES = 10
DESCRIPTION = "1=simulated sensor, 0 otherwise"

END_OBJECT

OBJECT = FIELD
NAME = ReceiverSynth
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 22
BYTES = 10
DESCRIPTION = "1=simulated receiver, 0 otherwise"

END_OBJECT

OBJECT = FIELD
NAME = DiagMode
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 23
BYTES = 10
DESCRIPTION = "Diag mode state"

END_OBJECT

OBJECT = FIELD
NAME = LogIdle
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 24
BYTES = 10
DESCRIPTION = "LOG BUFFER STATE, 1=FULL"

END_OBJECT

OBJECT = FIELD
NAME = CRCInROM
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 25
BYTES = 10
DESCRIPTION = "CRC state:1=ON, 0=RAM"

END_OBJECT

OBJECT = FIELD

```

```

NAME = SCTimeSec
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 26
BYTES = 10
DESCRIPTION = "The seconds component of SCLK"

END_OBJECT

OBJECT = FIELD
NAME = SCTimeSubSec
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 27
BYTES = 10
DESCRIPTION = "The subseconds component lf SCLK"

END_OBJECT

OBJECT = FIELD
NAME = ClksSinceSCTime
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 28
BYTES = 10
DESCRIPTION = "Count of 2 KHz clock pulses since last SCLK"

END_OBJECT

OBJECT = FIELD
NAME = CRC
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 29
BYTES = 10
DESCRIPTION = "The last-calculated CRC (PROM or RAM)"

END_OBJECT

OBJECT = FIELD
NAME = Resets
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 30
BYTES = 10
DESCRIPTION = "The number of watchdog resets since power-on."

END_OBJECT

OBJECT = FIELD
NAME = MissedSCTime
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 31
BYTES = 10
DESCRIPTION = "The number of SCLKs expected and not received since bootup"

```



```

END_OBJECT

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"

END_OBJECT

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"

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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

END_OBJECT

OBJECT          = FIELD

```

```

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

END_OBJECT

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"

END_OBJECT

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."

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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 = VFC_P12V
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 46
BYTES = 10
DESCRIPTION = "Current on the +12 volt line for the
              voltage to frequency converter"

END_OBJECT

OBJECT = FIELD
NAME = VFC_N12V
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 47
BYTES = 10
DESCRIPTION = "Current on the -12 volt line for the
              voltage to frequency converter"

```

```

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 = HKU_N12V
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 49
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          = HKU2_RTD_CAL_LO
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 58
  BYTES         = 10
  DESCRIPTION   = "Low calibration value for thermistors
                  on housekeeping unit #2"

```

```

END_OBJECT

OBJECT          = FIELD
  NAME          = HKU2_RTD_CAL_HI
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 59
  BYTES         = 10
  DESCRIPTION   = "High calibration value for thermistors
                  on housekeeping unit #2"

```

```

END_OBJECT

OBJECT          = FIELD
  NAME          = HKU2_PRT_CAL_LO
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 60
  BYTES         = 10
  DESCRIPTION   = "Low calibration value for PRTs on
                  housekeeping unit #2"

```

```

END_OBJECT

OBJECT          = FIELD
  NAME          = HKU2_PRT_CAL_HI
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 61
  BYTES         = 10
  DESCRIPTION   = "High calibration value for PRTs on
                  housekeeping unit #2"

```

```

END_OBJECT

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

```

```

END_OBJECT

OBJECT          = FIELD
  NAME          = PDUR_B

```

```

DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 63
BYTES = 10
DESCRIPTION = "Power distribution unit ,Äi B
              temperature"

END_OBJECT

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

END_OBJECT

OBJECT = FIELD
NAME = HKU_2
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 65
BYTES = 10
DESCRIPTION = "Housekeeping unit ,Äi 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 ,Äi 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_RFTL1T1
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 72
BYTES = 10
DESCRIPTION = "R1 inside vault RFTL thermistor 1"

END_OBJECT

OBJECT = FIELD
NAME = INT_RFTL1T2
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 73
BYTES = 10
DESCRIPTION = "R1 inside vault RFTL thermistor 2"

END_OBJECT

OBJECT = FIELD
NAME = RFTL1T1
DATA_TYPE = ASCII_INTEGER
FIELD_NUMBER = 74
BYTES = 10
DESCRIPTION = "R1 external to vault RFTL PRT 1"

```

```

END_OBJECT

OBJECT          = FIELD
  NAME          = RFTL1T2
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 75
  BYTES         = 10
  DESCRIPTION   = "R1 external to vault RFTL PRT 2"

END_OBJECT

OBJECT          = FIELD
  NAME          = RFTL1T3
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 76
  BYTES         = 10
  DESCRIPTION   = "R1 external to vault RFTL PRT 3"

END_OBJECT

OBJECT          = FIELD
  NAME          = A1T1
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 77
  BYTES         = 10
  DESCRIPTION   = "R1 antenna PRT 1"

END_OBJECT

OBJECT          = FIELD
  NAME          = A1T2
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 78
  BYTES         = 10
  DESCRIPTION   = "R1 antenna PRT 2"

END_OBJECT

OBJECT          = FIELD
  NAME          = A1T3
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 79
  BYTES         = 10
  DESCRIPTION   = "R1 antenna PRT 3"

END_OBJECT

OBJECT          = FIELD
  NAME          = A1T4
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 80
  BYTES         = 10
  DESCRIPTION   = "R1 antenna PRT 4"

```

```

END_OBJECT

OBJECT          = FIELD
  NAME          = R2T1
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 81
  BYTES         = 10
  DESCRIPTION   = "R2 internal receiver thermistor 1"

END_OBJECT

OBJECT          = FIELD
  NAME          = R2T2
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 82
  BYTES         = 10
  DESCRIPTION   = "R2 internal receiver thermistor 2"

END_OBJECT

OBJECT          = FIELD
  NAME          = R2T3
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 83
  BYTES         = 10
  DESCRIPTION   = "R2 internal receiver thermistor 3"

END_OBJECT

OBJECT          = FIELD
  NAME          = R2T4
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 84
  BYTES         = 10
  DESCRIPTION   = "R2 internal receiver thermistor 4"

END_OBJECT

OBJECT          = FIELD
  NAME          = INT_RFTL2T1
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 85
  BYTES         = 10
  DESCRIPTION   = "R2 inside vault RFTL thermistor 1"

END_OBJECT

OBJECT          = FIELD
  NAME          = INT_RFTL2T2
  DATA_TYPE    = ASCII_INTEGER
  FIELD_NUMBER  = 86
  BYTES         = 10

```

```

DESCRIPTION          = "R2 inside vault RFTL thermistor 2"
END_OBJECT

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

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

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

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

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

OBJECT               = FIELD
  NAME                = A2T3
  DATA_TYPE          = ASCII_INTEGER
  FIELD_NUMBER        = 92

```

```

BYTES                = 10
DESCRIPTION          = "R2 antenna PRT 3"
END_OBJECT

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

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

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

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

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

OBJECT               = FIELD
  NAME                = INT_RFTL3T2
  DATA_TYPE          = ASCII_INTEGER

```

```

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
DATA_TYPE           = ASCII_INTEGER
FIELD_NUMBER        = 110
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                = A4T1
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"

```

```

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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

END_OBJECT

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

END_OBJECT

OBJECT          = FIELD
  NAME          = R4Count

```

```
DATA_TYPE      = ASCII_INTEGER
FIELD_NUMBER   = 145
BYTES          = 10
DESCRIPTION    = "R4 counts"
```

END\_OBJECT

```
OBJECT         = FIELD
NAME           = R5Count
DATA_TYPE      = ASCII_INTEGER
FIELD_NUMBER   = 146
BYTES          = 10
DESCRIPTION    = "R5 counts"
```

## 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           = R6Count
DATA_TYPE      = ASCII_INTEGER
FIELD_NUMBER   = 147
BYTES          = 10
DESCRIPTION    = "R6 counts"
```

END\_OBJECT

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

```

DESCRIPTION      = "R4 internal receiver thermistor 4"
END_OBJECT

OBJECT          = FIELD
NAME            = INT_RFTL4T1
DATA_TYPE      = ASCII_REAL
FIELD_NUMBER   = 44
BYTES          = 20
DESCRIPTION    = "R4 inside vault RFTL thermistor 1"
END_OBJECT

OBJECT          = FIELD
NAME            = INT_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

```

```

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          = 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"

```



END\_OBJECT

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"

```

END\_OBJECT

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
```

```

OBJECT          = FIELD
NAME            = R5ND2ACnt
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"

END\_OBJECT

OBJECT = FIELD  
 NAME = R4ND3RCnt  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 135  
 BYTES = 10  
 DESCRIPTION = "R4 noise diode 3 deflection in internal load position"

END\_OBJECT

OBJECT = FIELD  
 NAME = R5ND3RCnt  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 136  
 BYTES = 10  
 DESCRIPTION = "R5 noise diode 3 deflection in internal load position"

END\_OBJECT

OBJECT = FIELD  
 NAME = R6ND3RCnt  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 137  
 BYTES = 10  
 DESCRIPTION = "R6 noise diode 3 deflection in internal load position"

END\_OBJECT

OBJECT = FIELD  
 NAME = R1\_1TA  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 138  
 BYTES = 20  
 DESCRIPTION = "R1 low gain calibrated antenna temperature, Kelvin"

END\_OBJECT

OBJECT = FIELD  
 NAME = R1\_2TA  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 139  
 BYTES = 20  
 DESCRIPTION = "R1 high gain calibrated antenna temperature, Kelvin"

END\_OBJECT

OBJECT = FIELD  
 NAME = R2\_1TA  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 140

BYTES = 20  
 DESCRIPTION = "R2 low gain calibrated antenna temperature, Kelvin"

END\_OBJECT

OBJECT = FIELD  
 NAME = R2\_2TA  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 141  
 BYTES = 20  
 DESCRIPTION = "R2 high gain calibrated antenna temperature, Kelvin"

END\_OBJECT

OBJECT = FIELD  
 NAME = R3TA  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 142  
 BYTES = 20  
 DESCRIPTION = "R3 calibrated antenna temperature, Kelvin"

END\_OBJECT

OBJECT = FIELD  
 NAME = R4TA  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 143  
 BYTES = 20  
 DESCRIPTION = "R4 calibrated antenna temperature, Kelvin"

END\_OBJECT

OBJECT = FIELD  
 NAME = R5TA  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 144  
 BYTES = 20  
 DESCRIPTION = "R5 calibrated antenna temperature, Kelvin"

END\_OBJECT

OBJECT = FIELD  
 NAME = R6TA  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 145  
 BYTES = 20  
 DESCRIPTION = "R6 calibrated antenna temperature, Kelvin"

END\_OBJECT

OBJECT = FIELD  
 NAME = R1\_1TND1A

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 = R2\_1TND2A  
 DATA\_TYPE = ASCII\_REAL  
 FIELD\_NUMBER = 156  
 BYTES = 20  
 DESCRIPTION = "R2 low gain noise diode 2 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"

```

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

END\_OBJECT

```
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"
```

END\_OBJECT

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

END\_OBJECT

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

END\_OBJECT

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

END\_OBJECT

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

END\_OBJECT

```
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"
```

END\_OBJECT

```
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"
```

END\_OBJECT

```
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"
```

END\_OBJECT

```

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"
END_OBJECT
OBJECT           = FIELD
NAME             = R5TOFF
DATA_TYPE       = ASCII_REAL
FIELD_NUMBER    = 200
BYTES           = 20
DESCRIPTION     = "R5 internal load brightness referenced to the input, Kelvin"
    
```

```

END_OBJECT
OBJECT           = FIELD
NAME             = R6TOFF
DATA_TYPE       = ASCII_REAL
FIELD_NUMBER    = 201
BYTES           = 20
DESCRIPTION     = "R6 internal load brightness referenced to the input, Kelvin"
END_OBJECT
    
```

### 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"
    
```

```

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             = 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             = gal_lon_2
DATA_TYPE       = ASCII_INTEGER
FIELD_NUMBER    = 6
BYTES           = 20
DESCRIPTION     = "Antenna 2 boresight longitude in
                  galactic coordinates"
    
```

```

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_2
DATA_TYPE       = ASCII_INTEGER
FIELD_NUMBER    = 7
BYTES           = 20
DESCRIPTION     = "Antenna 2 boresight latitude 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_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

OBJECT      = FIELD
  NAME      = gal_rot_6
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 20
  BYTES     = 20
  DESCRIPTION = "Rotation of antenna 6 frame X axis
with respect to galactic pole"

END_OBJECT

OBJECT      = FIELD
  NAME      = J2000_lon_1
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 21
  BYTES     = 20
  DESCRIPTION = "Antenna 1 boresight longitude in J2000
coordinates"

END_OBJECT

OBJECT      = FIELD
  NAME      = J2000_lat_1
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 22
  BYTES     = 20
  DESCRIPTION = "Antenna 1 boresight latitude in J2000
coordinates"

END_OBJECT

OBJECT      = FIELD
  NAME      = J2000_rot_1
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 23
  BYTES     = 20
  DESCRIPTION = "Rotation of antenna 1 frame X axis
with respect to J2000pole"

END_OBJECT

OBJECT      = FIELD
  NAME      = J2000_lon_2
  DATA_TYPE = ASCII_INTEGER

```

```

  FIELD_NUMBER = 24
  BYTES     = 20
  DESCRIPTION = "Antenna 2 boresight longitude in J2000
coordinates"

END_OBJECT

OBJECT      = FIELD
  NAME      = J2000_lat_2
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 25
  BYTES     = 20
  DESCRIPTION = "Antenna 2 boresight latitude in J2000
coordinates"

END_OBJECT

OBJECT      = FIELD
  NAME      = J2000_rot_2
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 26
  BYTES     = 20
  DESCRIPTION = "Rotation of antenna 2 frame X axis
with respect to J2000 pole"

END_OBJECT

OBJECT      = FIELD
  NAME      = J2000_lon_3
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 27
  BYTES     = 20
  DESCRIPTION = "Antenna 3 boresight longitude in J2000
coordinates"

END_OBJECT

OBJECT      = FIELD
  NAME      = J2000_lat_3
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 28
  BYTES     = 20
  DESCRIPTION = "Antenna 3 boresight latitude in J2000
coordinates"

END_OBJECT

OBJECT      = FIELD
  NAME      = J2000_rot_3
  DATA_TYPE = ASCII_INTEGER
  FIELD_NUMBER = 29
  BYTES     = 20

```

```

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
              J2000coordinates"

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

```