European Space Agency
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Planetary Missions Division

ROSETTA-RPC-MIP

to Planetary Science Archive Interface Control Document

RPC-MIP-EAICD
RPC/MIP/OP/14/030247/LPC2E

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Date	Sections Changed	Reasons for Change
7/11/03	Issue 0.0	Draft
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TBD/TBC ITEMS

Section	Description
2.2	Time sampling for electron density end electron temperature
2.3.4	Description of the software for science analysis
2.3.6	Definition of the derived data
3.4.3.4.2	Definition of the geometric index file
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3.4.3.6	Description of the contents of the Geometry directory
4.3.4	Definition of the level 5 (derived) data products

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1 Introduction

1.1 Purpose and Scope

The purpose of this EAICD (Experimenter to (Science) Archive Interface Control Document) is two fold. First it provides users of the RPC-MIP instrument with detailed description of the product and a description of how it was generated, including data sources and destinations. Secondly, it is the official interface between the RPC-MIP instrument team and archiving authority.

1.2 Archiving Authorities

The Planetary Data System Standard is used as archiving standard by

- NASA for U.S. planetary missions, implemented by PDS
- ESA for European planetary missions, implemented by the Research and Scientific Support Department (RSSD) of ESA

ESA's Planetary Science Archive (PSA)

ESA implements an online science archive, the PSA,

- to support and ease data ingestion
- to offer additional services to the scientific user community and science operations teams as e.g.
    - search queries that allow searches across instruments, missions and scientific disciplines
    - several data delivery options as
        - direct download of data products, linked files and data sets
        - ftp download of data products, linked files and data sets

The PSA aims for online ingestion of logical archive volumes and will offer the creation of physical archive volumes on request.

1.3 Contents

This document describes the data flow of the RPC-MIP instrument on the Rosetta mission from the s/c until the insertion into the PSA for ESA. It includes information on how data were processed, formatted, labeled and uniquely identified. The document discusses general naming schemes for data volumes, data sets, data and label files. Standards used to generate the product are explained. Software that may be used to access the product is explained further on.

The design of the data set structure and the data product is given. Examples of these will be given in the appendix.

1.4 Intended Readership

The staff of the archiving authority (Planetary Science Archive, ESA, RSSD, design team) and any potential user of the RPC-MIP data.

1.5 Applicable Documents

AD 1. Planetary Data System Data Preparation Workbook, February 17, 1995, Version 3.1, JPL, D-7669, Part1
AD 2. Planetary Data System Standards Reference, August 1, 2003, Version 3.6, JPL, D-7669, Part2
AD 3. Rosetta Time handling RO-EST-TN-3165, issue 1 rev 0, February 9, 2004
AD 4. ROSETTA Archive Generation, Validation and Transfer Plan, January 10, 2006, Issue 2, Rev. 3, RO-EST-PL-5011
AD 5. ROSETTA Archive Conventions, RO-EST-TN-3372, Issue 5, Rev. 0, 28 April 2009.
AD 6. Rosetta Project - MIP experiment - Onboard Data Handling, RPC/MIP/RP/13/980317/LPC2E, Ed. 3, Rev. 4, September 20 2000.
AD 7. Rosetta Project - MIP experiment - MIP/PIU Data Handling Interface, PC/MIP/RP/126/990253/LPC2E, Ed. 3, Rev. 3, May 23 2001.
AD 8. Rosetta Project - MIP experiment - Manuel d'utilisation du FS, RPC/MIP/OP/1/020125/LPC2E, Ed. 1, Rev. 0, 15 mars 2002.
AD 9. Rosetta RPC - PIU Interfaces Document - Part II - Data-Handling Interfaces, Issue 2, Revision 2, 5th October 2000, Imperial College, Réf. RPC/PIU/RP/0/990452/IC
AD 10. DDID- Data Delivery Interface Document RO-ESC-IF-5003 Issue B6 23/10/2003

1.6 Relationships to Other Interfaces

No products, software and documents would be affected by a change in this EAICD.

1.7 Acronyms and Abbreviations

DDS	Data disposition system (ESA server)
DFT	Direct Fourier Transform
EAICD	Experiment to Archive Interface Control Document
FFT	Fast Fourier Transform
FM	Flight Model

FPGA	Field Programmable Gate Array
FS	Flight Spare
GRM	Ground Reference Model
GSE	Geocentric Solar Ecliptic
GSM	Geocentric Solar Magnetic
HK	House keeping
LAP	Langmuir probe instrument
LDL	Long Debye Length
LPC2E	Laboratoire de Physique et Chimie de l'Environnement et de l'Espace (Orléans)
MIP	Mutual Impedance Probe
MSO	Mars Solar Orbital
OBDH	On Board Data Handling
OBT	On Board Time
OOBT	Orbiter On Board Time
ONERA	Office National d'Etudes et de Recherches Aérospatiales.
PDS	Planetary Data System
PIU	Plasma Interface Unit
PSA	Planetary Science Archive
QM	Qualification Model
RPC	Rosetta Plasma Consortium
SC	Science
SM	Solar Magnetic system
UTC	Universal Time Coordinated

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2 Overview of Instrument Design, Data Handling Process and Product Generation

The instrument is composed of two main elements:

- a sensor unit and
- an electronics board.

The sensor is mounted on the upper boom. The electrode array is linear and includes one receiving dipole (R1 - R2) and two transmitting monopoles (T1 and T2) supported by a conductive bar, about 1 m in length and 2 cm in diameter. This bar is insulated from the S/C structure, and is kept at a reference potential. The separation between each receiving electrode and the nearest transmitting monopole is 40 cm. The receiving electrodes are located at the ends of the bar in order to maximise the effective length of the antenna for wave measurements, in the passive mode.

Each electrode is made of a small surface conducting cylinder mounted at the tip of a stud and electrically decoupled from this stud with an insulating sheath. The stud is longer than the tip cylinder in order to reduce the perturbing effect of the supporting bar. The overall dimensions of the electrodes and supports are 20 cm in length and 1.1 cm in diameter.

The electronics board is located inside the RPC-0 box. It assumes four functions :

- acquisition of the analogue signal from 7 kHz to 3.5 MHz
- data processing using FFT and DFT calculations and some mathematical functions
- a FPGA controls the frequency synthesis and the data storage
- a second FPGA manages the transfer protocol (IEEE 1355) with the PIU.

The RPC-MIP instrument measures the electrical coupling of a transmitting antenna and a receiving antenna, and identifies plasma parameters from the features of the frequency response. No direct contact between the sensor and the plasma is required because the coupling is capacitive only. So, RPC-MIP performance is independent of the chemical composition and photoemissive properties of the probe. It is also immune to contamination by dust and ice deposits. Extremely low energetic plasmas can then be explored, an important advantage in a medium where temperatures as low as a few tens of K have been predicted.

In its passive mode, this instrument has also the capability of a plasma wave analyser.

The sensor orientation in the S/C frame is the following (values are in mm):

R1 (X S/C) = -967

R1 (Y S/C) = +1569

R1 (Z S/C) = +3019

R2 (X S/C) = -967

R2 (Y S/C) = +2277

R2 (Z S/C) = +3727

T1 (X S/C) = -967

T1 (Y S/C) = +1852

T1 (Z S/C) = +3302

T2 (X S/C) = -967

T2 (Y S/C) = +1994

T2 (Z S/C) = +3444

LAP2 (X S/C) = -2482

LAP2 (Y S/C) = +780

LAP2 (Z S/C) = -670

where

- R1 and R2 are the receivers and T1 and T2 are the transmitters of the MIP antenna (from the hinge to the end of the upper boom)
- LAP2 is the transmitter used in LDL mode (fixed at the end of the lower boom)

2.1 Scientific Objectives

The RPC-MIP measures the electron density and temperature and determines the bulk velocity of the ionised outflowing atmosphere. The investigation of these plasma parameters will contribute to our understanding of the ionisation, thermalisation and expansion of the cometary atmosphere. Observing the variability of the electron density, temperature and drift velocity will provide an additional insight into the scale length of the gas jets and lead to possible correlative studies with the results obtained from Rosetta's particle and optical instruments.

MIP's additional goals include defining the spectral distribution of natural plasma waves in the frequency range from 7 kHz to 3.5 MHz, and monitoring the dust and gas activities. Strong plasma waves were observed in the plasma region upstream of 1P/Halley by Vega 1 and Vega 2, and in the tail of 21P/Giacobini-Zinner by ICE. Nevertheless, no wave measurements were made inside the contact surface, in the close vicinity of the nucleus. Plasma-wave emissions are a very sensitive indicator of outgassing activity. Dust particles impacting spacecraft structures and electric antennas also generate electrostatic impulsive signals that can be detected with an electric-field experiment.

The scientific rationale underpinning the RPC-MIP archive is as follows:

- Maximize the scientific return from the experiment by making available the data to the world-wide scientific community.
- Ensure that the unique data set returned by RPC-MIP is preserved in a stable, long-term archive for scientific analysis beyond the end of the Rosetta mission.
- Provide this archive as a part of the valuable contribution by ESA and the Rosetta science community to the exploration of comets.

2.2 Data Handling Process

The SONC is responsible for MIP data sets generation and delivery to the PSA.
The MIP telemetry data is provided by the ESA DDS (Data Distribution Server). Following the operations plan the SONC pulls out archived packets (SC and HK) by direct request to the DDS via FTP and stores them into SONC database.
The raw data are passed through the SONC data processing software for decommutation, conversion to physical values and calibration. The calibrated data are also stored into SONC database.

Data levels as defined in Archive plan	
Calibrated science (SC) and housekeeping (HK) data	CODMAC 3
Derived higher-level data products	CODMAC 5

Note that for RPC-MIP the raw data are already calibrated.

The 'Edited raw data' are:

- science data (electric field spectra with modulus and phase and resonance values, mean passive power inside a particular frequency bandwidth)
- house-keeping data (sequence counters, mean passive power, resonance values, sensor temperature, configuration table)

For the RPC-MIP use, these two kinds of data are merged into a single file, because the HK contain the configuration tables necessary to process the science data. This file is stored in the RPC format, after removing DDS header, and processed as it is by the EGSE MIP software.

The data of the common mode RPC-MIP-LAP are part of the RPC-MIP data; consequently, they are processed by the MIP team.

The "Derived higher-level data products" are:

- Electron density (given in m^{-3} every TBD time)
- Electron Temperature (given in K every TBD time)

Geometrical and important housekeeping information is associated with these data. It is stored in the index table and mentioned in the label. If this information is not available when archiving derived data, the index files will be updated later. In this case a note in the labels will precise: "The geometrical and housekeeping values represent the best knowledge at YYYY-MM-DD. Updated values can be found in the index table <filename>.TAB".

2.3 Overview of Data Products

2.3.1 Pre-Flight Data Products

LPC2E shall provide data from ground tests in a plasma chamber at ONERA and representative tests on the GRM.

2.3.2 Instrument Calibrations

Data produced on board are already calibrated (active and passive sweeps). At each switching on a calibration sequence is ran. First an auto-loop process connects directly the transmitted signal to the analogue reception inside the RPC-MIP board; thus one can verify that the levels are correct at every frequencies. Second a short FFT is processed on given values to verify that FFT calculation is correct.

2.3.3 In-Flight Data Products

The main structure of the data products is the same for all mission phases. RPC-MIP in flight data products cover 2 levels:

- Calibrated SC data (CODMAC level 3) : contains HK data, amplitudes, phases and frequencies of the electric field spectrum from 7 kHz up to 3.5 MHz in active and passive modes. The SONC will produce and deliver the level 3 data to PSA after the proprietary period. A level 3 file contains data from one MIP measurement, i.e. data associated to one configuration table.

- Calibrated HK data (CODMAC level 3) : contains HK type I data concerning the active and passive sweeps: MIP power in Passive mode, resonance power in Survey mode, resonance frequency in survey mode.

- Reduced (or derived) data (CODMAC level 5) : electron density and temperature in relation with spacecraft attitude. The LPC2E will produce and deliver the level 5 data to PSA without time constraint (i.e. when ready).

2.3.4 Software

Level 3 data software has been developed under the responsibility of the lab. It is run at SONC with maintenance performed by the lab.

Level 5 data software is developed and operated at the lab. It consists of data visualizations and density determination; the latter could not be fully automatic and needs scientific expertise.

None of these software packages is planned to be distributed in the archives.

2.3.5 Documentation

The documentation directory contains the following documents:

RPC-MIP EAICD, Ed. 1, Rev. 2, 04/03/2009 (this document)
MIP experiment Onboard Data Handling, Ed. 3, Rev. 4, 20/09/2000,
MIP/PIU Data Handling Interface, Ed. 3, Rev. 3, 23/05/2001,
RPC-MIP experiment description, 28/06/2008
Rosetta plasma consortium users' manual, Ed. 2, Rev. 08, 10/04/2006

2.3.6 Derived and other Data Products

LPC2E will produce derived data from RPC-MIP data combined with RPC-LAP or RPC-MAG data (TBD).

2.3.7 Ancillary Data Usage

RPC-MIP will use orbit, attitude and event data for the high level data products.

3 Archive Format and Content

3.1 Format and Conventions

Data processing level number used in MIP naming scheme conforms to CODMAC norm :

3: Calibrated Data: Edited data that are still in units produced by instrument, but that have been corrected so that values are expressed in or are proportional to some physical unit such as radiance. No resampling, so edited data can be reconstructed. NASA Level 1A.
5: Derived Data: Derived results, as maps, reports, graphics, etc. NASA Levels 2 through 5.

3.1.1 Deliveries and Archive Volume Format

A data set will be delivered for each **simple mission phase.** Each data set will contain **only one level data processing**.

The list of simple mission phases is given in [AD 5] §2.1, table 3(a).
A level 3 data set contains SC an HK calibrated data.
A level 5 data set contains derived data.
In addition a data set will contain :

- Software (see chapter 2.3.4)
- Documents (see chapter 2.3.5)

A new dataset version is provided when :
- calibration information refining
- new data processing algorithms are implemented

A new dataset is provided when producing data of higher levels.

3.1.2 Data Set ID Formation

The following naming formation scheme will be used for the data sets :

DATA_SET_ID = <INSTRUMENT_HOST_ID>-<target id>-<INSTRUMENT_ID>-<data processing level number>-<mission phase abbreviation>-<version>

DATA_SET_NAME = <INSTRUMENT_HOST_NAME> <target name> <INSTRUMENT_ID> <data processing level number> <mission phase abbreviation> <version>

See AD 5 §2.1.1, §2.1.2.

Examples of DATA_SET_ID and DATA_SET_NAME for MIP level 3 data obtained from the Comet phase :

DATA_SET_ID = "RO-C-RPCMIP-3-COM-V1.0"

DATA_SET_NAME= "ROSETTA-ORBITER 67P RPCMIP 3 COM V1.0"

3.1.3 Data Directory Naming Convention

The DATA directory of each data set is divided in subdirectories corresponding to years and months. The following tree represents the structure of the DATA directory

```
                     |-MAR-
              |-2004-|-APR-
              |       …
DATA—CALIBRATED--|    |-DEC-
              |
              |      |-JAN-
              |-2005-|-FEB-
                      …
                     |-DEC-
              ...
              |      |-JAN-
              |-2014-|-FEB-
                     …
                     |-DEC-
```

3.1.4 Filenaming Convention

Each MIP file contains data from one measurement session (period between instrument ON and instrument OFF). One session can be determined using the time difference between successive (chronomogicaly) data (spectra, configuration tables or HK parameters). If this difference is greater than 100 minutes than we consider that a new session begins and a new file is created.
We define the filenaming convention for SC, HK type I data and configuration tables:

RPCMIP{data characteristics}_{begin of observation}_{duration of observation }.{ext}

- **data characteristics** (4 characters) = abcd
  - a = data type, S (science) or H (housekeeping)
  - b = data level, 3 or 5
  - c = physical parameters
    - E = electric field power spectrum (passive)

        - W = Active power spectrum (induced electric field)
        - H = active phase spectrum (induced electric field)
        - D = electron density
        - T = electron temperature
        - X = N/A (for HK and configuration tables)
    - d = working mode
        - S = SDL (MIP), Short Debye Length. MIP does the transmission and reception in Sweep and Survey modes
        - L = LDL (MIP/LAP), Long Debye Length. LAP does the transmission and MIP the reception.
        - X = N/A (for HK and configuration tables)
- **begin of observation** (10 characters) = time of test or working session yymmddhhmn:
    - yy = year
    - mm = month
    - dd = day
    - hh = hour
    - mn = minute
- **duration of observation** (5 characters) = duration of MIP session in minutes.

- **ext** = extension of file, TAB

Examples

- Science data: RPCMIPS5ES_0610122510_04520.TAB
- Hosekeeping data: RPCMIPH3XX_0610122510_04520.TAB

Remark:The configuration tables will appear in files of type S3XX
Example: RPCMIPS3XX_0610122510_04520.TAB

3.2 Standards Used in Data Product Generation

3.2.1 PDS Standards

The MIP archive complies with the version 3.6 of the PDS standard.

3.2.2 Time Standards

The time standards used in the MIP data products are :
- the Orbiter On-Board Time (OOBT**)**
- the UTC (from the DDS header time correlated)

3.2.2.1.1 The Orbiter On-Board Time (OOBT**)**

It is a linear binary counter having a resolution of 1/65536 sec stored in 3 16-bit words in the telemetry source packets header. The OOBT is based on the spacecraft High Frequency Clock.

3.2.2.1.2 The UTC and the DDS header time correlated

The OOBT is converted to UTC (Coordinated Universal Time) by means of time correlation and included in the additional DDS packet header when the packets are distributed via the DDS server. The **DDS header time correlated** (SCET field in the DDS header) is the UTC of the start of measurement derived from the OOBT by time correlation.

Its format is the Sun Modified Julian Time (MJT) i.e. two 32 bit integers. The first (MSB) contains the number of seconds since 00:00:00 on 1st January 1970 and the second (LSB) integer the number of micro-seconds from seconds in the first field.

Time correlation is described in AD 10 (Appendix 18 § 18.1.2.1)

The **UTC** used as time stamp for MIP SC, HK and configuration tables products is the DDS header time correlated.

3.2.3 Reference Systems

The coordinates system that may be used to analyze the expected MIP data are as follows:

The GSE, GSM, and SM systems are Earth-centered coordinate systems, they are used to study the space ionized environment of the Earth and its interaction with the interplanetary medium (solar wind and its embedded interplanetary magnetic field).

The geocentric solar ecliptic system, GSE, has its X-axis and Y-axis in the ecliptic plane. The X-axis points from the Earth towards the Sun and the Y-axis points towards dusk. The Z-axis is therefore parallel to the ecliptic north pole. Relative to an inertial system this system has a yearly rotation (one Earth's year).

The geocentric solar magnetospheric system, GSM, has its X-axis in common with the GSE, while now the Y-axis is defined to be perpendicular to the Earth's magnetic dipole. In this way, the X-Z plane turns out to contain the dipole axis. It is worth noting that the GSM is then deduced from the GSE by a rotation about the X-axis.

In the solar magnetic coordinates SM the Z-axis is parallel to the north magnetic pole and the Y-axis is perpendicular to the Earth-Sun line towards dusk. The difference between this system and the GSM system is a rotation about the Y-axis. The amount of rotation is the dipole tilt angle.

The MSO is a Mars-centered coordinate system, it is the one actually used to study the space environment of Mars and its interaction with the solar wind.
The X-axis and Y-axis of the Mars solar orbital system, MSO, are in the Mars solar orbital plane. This plane is inclined at 1.9 degree above the ecliptic plane. The X-axis points to the Sun, the Z-axis is the cross-product of the X-axis and Y-axis, and points to the North Mars solar orbital plane. The Y-axis is thus in the Mars solar orbital plane and points towards dusk (opposing planetary motion). Relative to an inertial system this system has a yearly rotation (two Earth's years).

At comet and asteroids, body-centered coordinate systems will also be used. They are similar to the GSE (for the Earth) and MSO (for Mars) systems. The X-axis and Y-axis are in the respective body solar
orbital planes. The X-axis points towards the Sun.

For cruise phases the ECLIPJ2000 will be used. (Ecliptic coordinates based upon the J2000 frame, i.e. the Earth mean equator and dynamical equinox of J2000). The X-axis is aligned with the cross product of the north-pointing vectors normal to the Earth's mean equator and mean orbital plane of J2000 epoch. The Z-axis is aligned with the second of these normal vectors. The Y axis is the cross product of the Z and X axes.

3.3 Data Validation

The MIP data products are delivered to PSA by SONC. Data will be scanned for internal consistency when decommutating to edited raw format. Derived data, when possible, will be compared to independent measurements by other instruments, i.e. temperatures and densities from RPC-LAP. Before archiving a data set from some mission phase, this set will have been used internally by RPC scientists and engineers. These data are also distributed via the W3-SONC server and used by all the experiment team.

3.3.1 Data Quality ID

The values of the DATA_QUALITY_ID for CODMAC level 3 data:
-1 not yet qualified
0 Good quality (number of reliable points > 75%)
1 Acceptable quality (number of reliable points > 50% and < 75%)
2 Bad quality (number of reliable points < 50%)

The values of the DATA_QUALITY_ID for CODMAC levels 5 data:
-1 not yet qualified
0 Good quality - Unambiguous determination (number of reliable points > 75%)
1 Acceptable quality - Difficulties encountered in the determination (number of reliable points > 50% and < 75%)
2 Bad quality - Possible errors in the determination (number of reliable points < 50%)

3.4 Content

3.4.1 Volume Set

One volume corresponds to one data set.

```
DESCRIPTION          = "This volume contains …"
VOLUME_ID            = "ROMIP_1002"
VOLUME_NAME          = "RPCMIP CALIBRATED DATA FOR
                        THE FIRST EARTH FLYBY"
VOLUME_SERIES_NAME   = "ROSETTA SCIENCE ARCHIVE"
VOLUME_SET_ID        = "FR_CNRS_LPCE_ROMIP_1000"
VOLUME_SET_NAME      = "ROSETTA RPC MIP DATA"
VOLUME_VERSION_ID    = "VERSION 1"
VOLUMES              = "1"
VOLUME_FORMAT        = "ISO-9660"
MEDIUM_TYPE          = "ONLINE"
PUBLICATION_DATE     = 2010-01-25
```

3.4.2 *Data Set*

The MIP data will be archived in as many data sets as simple mission phase and data processing levels. The following table shows how the DATA_SET_ID and DATA_SET_NAME are formed.

Name element	**Data Set ID**	**Data Set Name**
INSTRUMENT_HOST_ID / INSTRUMENT_HOST_NAME	RO	ROSETTA-ORBITER
Target id / target name	See AD 5 Table 5	
INSTRUMENT_NAME	ROSETTA PLASMA CONSORTIUM - MUTUAL IMPEDANCE PROBE	
INSTRUMENT_ID	RPCMIP	
Data processing level number	* Level 3 contains level 3 SC and HK. * Level 5 contains the derived data products.	
mission phase abbreviation	See AD 5 table 3	
Description	N/A	
version	The first version of a data set is V1.0	

3.4.3 Directories

A MIP data set has the following directory structure :

```
                  |-AAREADME.TXT
                  |-BROWSE--
                  |-CATALOG--
                  |                            |-MAR-
                  |                     |-2004- |-APR-
                  |                     |       …
                  |-DATA---CALIBRATED--|       |-DEC-
                  |                     |
|-root directory-|                     |      |-JAN-
                  |                     |-2005-|-FEB-
                  |                             …
                  |                             |-DEC-
                  |                             …
                  |                             |       |-JAN-
                  |                             |-2014-|-FEB-
                  |                             …
                  |                             |-DEC-
                  |-
                  |-DOCUMENT--
                  |-INDEX--
                  |-LABEL—
                  |-VOLDESC.CAT
```

3.4.3.1 Root Directory

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.

File Name	File Contents
AAREADME.TXT	Volume content and format information
VOLDESC.CAT	A description of the contents of this volume in a PDS format readable by both humans and computers

3.4.3.2 Calibration Directory

Ther is no calibration directory for RPC-MIP data sets.

3.4.3.3 Catalog Directory

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 PSA team, who is responsible for loading them into the PDS catalog. The Catalog Directory contains the following files.

File Name	File Contents
CATINFO.TXT	A description of the contents of this directory
DATASET.CAT	Data set information for the PDS catalog
INST.CAT	Instrument information for the PDS catalog
INSTHOST.CAT	Instrument host (spacecraft-Orbiter) information for the PDS catalog
MISSION.CAT	Mission information for the PDS catalog
PERSON.CAT	PDS personnel catalog information about the instrument team responsible for generating the data products. There will be one file for each instrument team providing data to this data set.
REF.CAT	Full citations for references mentioned in any and all of the catalog files, or in any associated label files.
SOFTWARE.CAT	Information about the software included in the SOFTWARE directory

3.4.3.4 Index Directory

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.

3.4.3.4.1 Dataset Index File, INDEX.LBL and INDEX.TAB

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

3.4.3.4.2 Geometric Index File

The following Geometry index files will be created, according to reference targets. They are available in a general dataset TBD

File Name	File Contents
GEO_EARTH.LBL	A PDS detached label that describes GEO_EARTH.TAB
GEO_EARTH.TAB	A table listing the geometric index parameters for reference target EARTH
GEO_MARS.LBL	A PDS detached label that describes GEO_MARS.TAB
GEO_MARS.TAB	A table listing the geometric index parameters for reference target MARS
GEO_STEINS.LBL	A PDS detached label that describes GEO_STEINS.TAB
GEO_STEINS.TAB	A table listing the geometric index parameters for reference target STEINS
GEO_LUTETIA.LBL	A PDS detached label that describes GEO_LUTETIA.TAB
GEO_LUTETIA.TAB	A table listing the geometric index parameters for reference target LUTETIA

3.4.3.5 Browse Directory and Browse Files

The structure of the Browse directory is similar to the structure of the Data directory, i.e. it is sub-divided by year and then by month.
Browse files will be produced only for the comet phase.
Will be defined for the comet phase (TBD).

3.4.3.6 Geometry Directory

TBD

3.4.3.7 Software Directory

There is no software provided in the software directory. However software for conversion of TAB files in CSV format is provided in the extras directory.

3.4.3.8 Label Directory

The label directory contains include files referenced by data files on the data set, e.g. FMT files containing label definitions used in data label files. The following files are contained in the Label directory.

File Name	File Contents
MIP_SPECTRUM_SS_PO.FMT	The description of the spectrum table for the Survey/Sweep modes and Full, Window and MinMax sub-modes.
MIP_SPECTRUM_SS_PH.FMT	The description of the structure of the TABLE object for the Phase spectrum for the Survey/Sweep modes.
MIP_SPECTRUM_L_PO.FMT	The description of the power spectrum table for the LDL modes, Full/Window sub-modes
MIP_SPECTRUM_L_PH.FMT	The description of the phase spectrum table for the LDL modes, Full/Window sub-modes
MIP_SPECTRUM_P_PO.FMT	The description of the spectrum table for the Passive mode and Full, Window and Power sub-modes
MIP_CONFIG_TABLE.FMT	The description of the TABLE object for the MIP configuration table

File Name	File Contents
MIP_CALIBRATED_HK.FMT	The description of the TABLE object for MIP calibrated HK data

3.4.3.9 Document Directory

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

File Name	File Contents
DOCINFO.TXT	A description of the contents of this directory
MIP_EXP_OVERVIEW.PDF	Description of the RPCMIP experiment
MIP_EXP_OVERVIEW.LBL	PDS label for file MIP_EXP_OVERVIEW.PDF
RPC-MIP_EAICD.PDF	The MIP Experiment Archive Interface Control Document (this document) as an PDS file.
RPC-MIP_EAICD.LBL	PDS label for file RPC-MIP_EAICD.PDF
BOARD_PROC_34.PDF	MIP Onboard Data Handling
BOARD_PROC_34.LBL	PDS label for file BOARD_PROC_34.PDF
MIP_PIU_INTERF_33.PDF	MIP/PIU Data Handling Interface in PDF format
MIP_PIU_INTERF_33.LBL	PDS label for file MIP_PIU_INTERF_33.PDF
RPC_UM_208.PDF	Rosetta plasma consortium users' manual
RPC_UM_208.LBL	PDS label for file RPC_UM_208.PDF

3.4.3.10 Extras Directory

The Extras directory contains software to convert the RPC-MIP data (.TAB files) to CSV (comma-separated values**)** format. The software (convert_pds_rpcmip.exe) is an executable compiled under SunOS 5.10.
The command line syntax is:
convert_pds_rpcmip.exe -d=<directory>
<directory> is the name of the directory containing the TAB/LBL files.

3.4.3.11 Data Directory

The structure and naming scheme of the data directory is described in § 3.1.3.

4 Detailed Interface Specifications

4.1 Structure and Organization Overview

The MIP data will be archived in a data set on the basis data processing level and mission phase relative to the production of the data. The DATA directory contains subdirectories corresponding to years and months. The subdirectories contain calibrated SC and HK data (file extension TAB)

4.2 Data Sets, Definition and Content

The following table gives the definition of the name and id of the foreseen data sets :

Data Set ID	Data Set Name
RO-CAL-RPCMIP-3-GRND-V1.0	ROSETTA-ORBITER CAL RPCMIP 3 GRND V1.0
RO-CAL-RPCMIP-3-CVP-V1.0	ROSETTA-ORBITER CAL RPCMIP 3 CVP V1.0
RO-CAL-RPCMIP-3-CR2-V1.0	ROSETTA-ORBITER CAL RPCMIP 3 CR2 V1.0
RO-CAL-RPCMIP-3-CR4A-V1.0	ROSETTA-ORBITER CAL RPCMIP 3 CR4A V1.0
RO-CAL-RPCMIP-3-CR4B-V1.0	ROSETTA-ORBITER CAL RPCMIP 3 CR4B V1.0
RO-CAL-RPCMIP-3-CR5-V1.0	ROSETTA-ORBITER CAL RPCMIP 3 CR5 V1.0
RO-CAL-RPCMIP-3-CR6-V1.0	ROSETTA-ORBITER CAL RPCMIP 3 CR6 V1.0
RO-E-RPCMIP-3-EAR1-V1.0	ROSETTA-ORBITER EARTH RPCMIP 3 EAR1 V1.0
RO-E-RPCMIP-3-EAR2-V1.0	ROSETTA-ORBITER EARTH RPCMIP 3 EAR2 V1.0
RO-E-RPCMIP-3-EAR3-V1.0	ROSETTA-ORBITER EARTH RPCMIP 3 EAR3 V1.0
RO-M-RPCMIP-3-MARS-V1.0	ROSETTA-ORBITER MARS RPCMIP 3 MARS V1.0
RO-A-RPCMIP-3-AST1-V1.0	ROSETTA-ORBITER STEINS RPCMIP 3 AST1 V1.0
RO-A-RPCMIP-3-AST2-V1.0	ROSETTA-ORBITER LUTETIA RPCMIP 3 AST2 V1.0
RO-CAL-RPCMIP-3-RVM1-V1.0	ROSETTA-ORBITER CAL RPCMIP 3 RVM1 V1.0
RO-CAL-RPCMIP-3-RVM2-V1.0	ROSETTA-ORBITER CAL RPCMIP 3 RVM2 V1.0
RO-C-RPCMIP-3-COM-V1.0	ROSETTA-ORBITER 67P RPCMIP 3 COM V1.0
RO-CAL-RPCMIP-5-GRND-V1.0	ROSETTA-ORBITER CAL RPCMIP 5 GRND V1.0
RO-CAL-RPCMIP-5-CVP-V1.0	ROSETTA-ORBITER CAL RPCMIP 5 CVP V1.0
RO-CAL-RPCMIP-5-CR2-V1.0	ROSETTA-ORBITER CAL RPCMIP 5 CR2 V1.0
RO-CAL-RPCMIP-5-CR4A-V1.0	ROSETTA-ORBITER CAL RPCMIP 5 CR4A V1.0
RO-CAL-RPCMIP-5-CR4B-V1.0	ROSETTA-ORBITER CAL RPCMIP 5 CR4B V1.0
RO-CAL-RPCMIP-5-CR5-V1.0	ROSETTA-ORBITER CAL RPCMIP 5 CR5 V1.0
RO-CAL-RPCMIP-5-CR6-V1.0	ROSETTA-ORBITER CAL RPCMIP 5 CR6 V1.0
RO-E-RPCMIP-5-EAR1-V1.0	ROSETTA-ORBITER EARTH RPCMIP 5 EAR1 V1.0
RO-E-RPCMIP-5-EAR2-V1.0	ROSETTA-ORBITER EARTH RPCMIP 5 EAR2 V1.0
RO-E-RPCMIP-5-EAR3-V1.0	ROSETTA-ORBITER EARTH RPCMIP 5 EAR3 V1.0
RO-M-RPCMIP-5-MARS-V1.0	ROSETTA-ORBITER MARS RPCMIP 5 MARS V1.0
RO-A-RPCMIP-5-AST1-V1.0	ROSETTA-ORBITER STEINS RPCMIP 5 AST1 V1.0
RO-A-RPCMIP-5-AST2-V1.0	ROSETTA-ORBITER LUTETIA RPCMIP 5 AST2 V1.0
RO-CAL-RPCMIP-5-RVM1-V1.0	ROSETTA-ORBITER CAL RPCMIP 5 RVM1 V1.0
RO-CAL-RPCMIP-5-RVM2-V1.0	ROSETTA-ORBITER CAL RPCMIP 5 RVM2 V1.0
RO-C-RPCMIP-5-COM-V1.0	ROSETTA-ORBITER 67P RPCMIP 5 COM V1.0

The mission phases are defined in the following table.

MISSION_PHASE_NAME	**Abbreviation**	**Start Date** (dd/mm/yyyy)	**End Date** (dd/mm/yyyy)	**RPCMIP data (1)**
Commissioning (part 1)	CVP1	05/03/2004	06/06/2004	**X**
Cruise 1	CR1	07/06/2004	05/09/2004	
Commissioning (part 2)	CVP2	06/09/2004	16/10/2004	**X**
Earth Swing-by 1	EAR1	17/10/2004	04/04/2005	**X** : PC#0
Cruise 2	CR2	05/04/2005	28/07/2006	**X** : PC#1,2
Mars Swing-by	MARS	29/07/2006	28/05/2007	**X** : PC#3,4,5
Cruise 3	CR3	29/05/2007	12/09/2007	
Earth Swing-by 2	EAR2	13/09/2007	27/01/2008	**X** : PC#6,7
Cruise 4-1	CR4A	28/01/2008	03/08/2008	**X** : PC#8
Steins Flyby	AST1	04/08/2008	05/10/2008	**X**
Cruise 4-2	CR4B	06/10/2008	13/09/2009	**X** : PC#9
Earth Swing-by 3	EAR3	14/09/2009	13/12/2009	**X** (tbc)
Cruise 5	CR5	14/12/2009	06/06/2010	**X** (tbc)
Lutetia Flyby	AST2	07/06/2010	10/09/2010	**X** (tbc)
Rendez-vous Manoeuver 1	RMV1	11/09/2010	13/07/2011	**X** (tbc)
Cruise 6	CR6	14/07/2011	22/01/2014	**X** (tbc)
Rendez-vous Manoeuver 2	RVM2	23/01/2014	17/08/2014	**X** (tbc)
Comet (Lander delivery)	COM	18/08/2014	31/12/2015	**X** (tbc)

(1) The last column indicates if RPCMIP data are available (and if data can come from Payload Checkout).

4.3 Data Product Design

4.3.1 Data Product Design of calibrated SC data (level 3)

Level 3 SC contains calibrated MIP power and phase spectra, with PDS detached labels. Each power spectrum is composed of several frequency sweeps. However, the MIP on-board software generates a single time tag for the entire spectrum. In the PSA the spectra are represented as tables with frequency and power in separate columns. The spectrum time tag is recorded in a separate column and is repeated for the whole frequencies of a spectrum. This representation was chosen in order to avoid variable length records. It allows fixed length records (RECORD_TYPE=FIXED_LENGTH) which should be easier to read by other software.

In “passive” modes the power is coded on-board on 2 bits (0 to 20 db) or 4 bits (0 to 60 dB) . This gives integer power steps (2 or 4 dB digitization steps). In “survey” modes the power is coded on 8 bits (0 to 64 dB) giving 0.25 dB digitization steps. However, the power values are always listed as ASCII_REAL with format F7.2 in order to have the same format in different data files.

In passive modes the effective length of antenna is needed in order to obtain the electrical field in appropriate units. However, obtaining the effective length of the antenna is not trivial and is subject to discussion, this length depending on the characteristics of the plasma. That is why the power is given in decibels relative to 0.6 $\mu V.Hz^{-1/2}$.

The frequency values are expressed in kHz. They are onboard coded with the same rule as for the interference frequency in the configuration table :

$1 \leq i \leq 128$	$f_i = i \times 7$	$7 \leq f_i \leq 896$ kHz
$129 \leq i \leq 192$	$f_i = (i-128) \times 14 + 896$	$910 \leq f_i \leq 1792$ kHz
$193 \leq i \leq 255$	$f_i = (i-192) \times 28 + 1792$	$1820 \leq f_i \leq 3556$ kHz

4.3.1.1 File Characteristics Data Elements

The PDS file characteristic data elements for MIP calibrated science data (level 3) are:

```
RECORD_TYPE            = FIXED_LENGTH
RECORD_BYTES           =
FILE_RECORDS           =
PRODUCT_TYPE           = RDR
PROCESSING_LEVEL_ID    =  3
```

The FILE_NAME is described in § 3.1.4

4.3.1.2 Data Object Pointers Identification Data Elements

The MIP level 3 SC data are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files. The data contains power and phase spectra.

4.3.1.3 Data Object Definition

Each data file (TAB) contains several tables. The number of tables is variable and depends on the type of measurement (sequence).

The description of the spectrum table for the Survey/Sweep modes and Full, Window and MinMax sub-modes is:

Power spectrum

```
OBJECT               = SS_PO_SPECTRUM_TABLE
  NAME               = "SS_PO_SPECTRUM"
  INTERCHANGE_FORMAT = ASCII
  ROWS               =
  COLUMNS            = 8
  ROW_BYTES          =
  ^STRUCTURE         = "MIP_SPECTRUM_SS_PO.FMT"
END_OBJECT           = SS_PO_SPECTRUM_TABLE
```

The structure of the TABLE object for the Power spectrum is described in the file MIP_SPECTRUM_SS_PO.FMT as follows:

```
OBJECT                  = COLUMN
   NAME                 = "SPECTRUM_UT"
   DATA_TYPE            = TIME
   START_BYTE           = 1
   BYTES                = 23
   UNIT                 = "N/A"
   DESCRIPTION          = "Spectrum UT
                           Format : YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "SPECTRUM_OBT"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 26
   BYTES                = 17
   UNIT                 = "N/A"
   MISSING_CONSTANT     = "  9/9999999.99999"
   DESCRIPTION          = "Spectrum On board Time :
```

```
                            OOBT IS REPRESENTED AS :
                            Reset number (integer starting at 1) / seconds.
                            Reset number 1 starts at 2003-01-01T00:00:00 UTC
                            The time resolution is 1/65536 s "
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                    = "MODE"
   DATA_TYPE               = CHARACTER
   START_BYTE              = 46
   BYTES                   = 6
   UNIT                    = "N/A"
   DESCRIPTION             = "Possible values are :
                            SURVEY
                            SWEEP"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                    = "SUB_MODE"
   DATA_TYPE               = CHARACTER
   START_BYTE              = 55
   BYTES                   = 6
   UNIT                    = "N/A"
   DESCRIPTION             = " Possible values are :
                            FULL
                            WINDOW"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                    = "SPECTRUM_TYPE"
   DATA_TYPE               = CHARACTER
   START_BYTE              = 64
   BYTES                   = 5
   UNIT                    = "N/A"
   DESCRIPTION             = " Possible values are :
                            POWER
                            PHASE "
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                    = "RES_FREQ"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 71
   BYTES                   = 7
   UNIT                    = "KILOHERTZ"
   FORMAT                  = "I7"
   MISSING_CONSTANT        = 9999999
   DESCRIPTION             = "Resonance frequency
                            MISSING_CONSTANT in case of minmax sub-mode"
END_OBJECT                = COLUMN

 OBJECT                    = COLUMN
   NAME                    = "FREQUENCY"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 79
   BYTES                   = 7
   UNIT                    = "KILOHERTZ"
   FORMAT                  = "I7"
   DESCRIPTION             = "Frequency"
 END_OBJECT                = COLUMN
```

```
 OBJECT                   = COLUMN
   NAME                   = "POWER"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 87
   BYTES                  = 7
   UNIT                   = "DECIBEL"
   FORMAT                 = "F7.2"
   DESCRIPTION            = "Power
                             0 dB = 0.6 microV*Hz**-0.5"
 END_OBJECT               = COLUMN
```

Phase Spectrum

```
OBJECT                 = SS_PH_SPECTRUM_TABLE
  NAME                 = "SS_PH_SPECTRUM"
  INTERCHANGE_FORMAT = ASCII
  ROWS                 =
  COLUMNS              = 8
  ROW_BYTES            =
  ^STRUCTURE           = "MIP_SPECTRUM_SS_PH.FMT"
END_OBJECT             = SS_PH_SPECTRUM_TABLE
```

The structure of the TABLE object for the Phase spectrum is described in the file MIP_SPECTRUM_SS_PH.FMT as follows:

```
OBJECT                    = COLUMN
   NAME                   = "SPECTRUM_UT"
   DATA_TYPE              = TIME
   START_BYTE             = 1
   BYTES                  = 23
   UNIT                   = "N/A"
   DESCRIPTION            = "Spectrum UT
                             Format : YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT               = COLUMN

OBJECT                    = COLUMN
   NAME                   = "SPECTRUM_OBT"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 26
   BYTES                  = 17
   UNIT                   = "N/A"
   MISSING_CONSTANT       = "  9/9999999.99999"
   DESCRIPTION            = "Spectrum On board Time :
                             OOBT IS REPRESENTED AS :
                             Reset number (integer starting at 1) / seconds.
                             Reset number 1 starts at 2003-01-01T00:00:00 UTC
                             The time resolution is 1/65536 s "
 END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                   = "MODE"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 46
   BYTES                  = 6
   UNIT                   = "N/A"
   DESCRIPTION            = "Possible values are :
                             SURVEY
                             SWEEP"
END_OBJECT               = COLUMN
```

```
OBJECT                 = COLUMN
   NAME                 = "SUB_MODE"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 55
   BYTES                = 6
   UNIT                 = "N/A"
   DESCRIPTION          = " Possible values are :
                            FULL
                            WINDOW"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
   NAME                 = "SPECTRUM_TYPE"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 64
   BYTES                = 5
   UNIT                 = "N/A"
   DESCRIPTION          = " Possible values are :
                            POWER
                            PHASE "
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
   NAME                 = "RES_FREQ"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 71
   BYTES                = 7
   UNIT                 = "KILOHERTZ"
   FORMAT               = "I7"
   DESCRIPTION          = "Resonance frequency"
 END_OBJECT             = COLUMN

 OBJECT                 = COLUMN
   NAME                 = "FREQUENCY"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 79
   BYTES                = 7
   UNIT                 = "KILOHERTZ"
   FORMAT               = "I7"
   DESCRIPTION          = "Frequency"
 END_OBJECT             = COLUMN

 OBJECT                 = COLUMN
   NAME                 = "PHASE"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 87
   BYTES                = 7
   UNIT                 = "DEGREE"
   FORMAT               = "F7.2"
   DESCRIPTION          = "Phase"
 END_OBJECT             = COLUMN
```

The description of the spectrum table for the LDL modes, Full/Window sub-modes is:

Power spectrum

```
OBJECT               = L_PO_SPECTRUM_TABLE
  NAME               = "L_PO_SPECTRUM"
```

```
  INTERCHANGE_FORMAT = ASCII
  ROWS               =
  COLUMNS            = 7
  ROW_BYTES          =
  ^STRUCTURE         = "MIP_SPECTRUM_L_PO.FMT"
END_OBJECT           = L_PO_SPECTRUM_TABLE
```

The structure of the TABLE object for the Power spectrum is described in the file MIP_SPECTRUM_L_PO.FMT as follows:

```
OBJECT                  = COLUMN
   NAME                 = "SPECTRUM_UT"
   DATA_TYPE            = TIME
   START_BYTE           = 1
   BYTES                = 23
   UNIT                 = "N/A"
   DESCRIPTION          = "Spectrum UT
                           Format : YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "SPECTRUM_OBT"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 26
   BYTES                = 17
   UNIT                 = "N/A"
   MISSING_CONSTANT     = "  9/9999999.99999"
   DESCRIPTION          = "Spectrum On board Time :
                           OOBT IS REPRESENTED AS :
                           Reset number (integer starting at 1) / seconds.
                           Reset number 1 starts at 2003-01-01T00:00:00 UTC
                           The time resolution is 1/65536 s "
END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "MODE"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 46
   BYTES                = 3
   UNIT                 = "N/A"
   DESCRIPTION          = "Possible value is :
                           LDL "
END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "SUB_MODE"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 52
   BYTES                = 6
   UNIT                 = "N/A"
   DESCRIPTION          = "Possible value are :
                           FULL
                           WINDOW"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
   NAME                 = "SPECTRUM_TYPE"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 61
   BYTES                = 5
```

```
   UNIT                 = "N/A"
   DESCRIPTION          = "Possible values are :
                            POWER
                            PHASE "
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
   NAME                 = "FREQUENCY"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 68
   BYTES                = 7
   UNIT                 = "KILOHERTZ"
   FORMAT               = "I7"
   DESCRIPTION          = "Frequency"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
   NAME                 = "POWER"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 76
   BYTES                = 7
   UNIT                 = "DECIBEL"
   FORMAT               = "F7.2"
   DESCRIPTION          = "Power
                            0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT             = COLUMN
```

Phase Spectrum

```
OBJECT               = L_PH_SPECTRUM_TABLE
  NAME               = "L_PH_SPECTRUM"
  INTERCHANGE_FORMAT = ASCII
  ROWS               =
  COLUMNS            = 7
  ROW_BYTES          =
  ^STRUCTURE         = "MIP_SPECTRUM_L_PH.FMT"

END_OBJECT           = L_PH_SPECTRUM_TABLE
```

The structure of the TABLE object for the Phase spectrum is described in the file MIP_SPECTRUM_L_PH.FMT as follows:

```
OBJECT                  = COLUMN
   NAME                 = "SPECTRUM_UT"
   DATA_TYPE            = TIME
   START_BYTE           = 1
   BYTES                = 23
   UNIT                 = "N/A"
   DESCRIPTION          = "Spectrum UT
                            Format : YYYY-MM-DDThh:mm:ss.sss"
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "SPECTRUM_OBT"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 26
   BYTES                = 17
   UNIT                 = "N/A"
   MISSING_CONSTANT     = "  9/9999999.99999"
```

```
   DESCRIPTION           = "Spectrum On board Time :
                            OOBT IS REPRESENTED AS :
                            Reset number (integer starting at 1) / seconds.
                            Reset number 1 starts at 2003-01-01T00:00:00 UTC
                            The time resolution is 1/65536 s "
 END_OBJECT              = COLUMN

OBJECT                   = COLUMN
   NAME                  = "MODE"
   DATA_TYPE             = CHARACTER
   START_BYTE            = 46
   BYTES                 = 3
   UNIT                  = "N/A"
   DESCRIPTION           = "Possible value is :
                            LDL "
 END_OBJECT              = COLUMN

OBJECT                   = COLUMN
   NAME                  = "SUB_MODE"
   DATA_TYPE             = CHARACTER
   START_BYTE            = 52
   BYTES                 = 6
   UNIT                  = "N/A"
   DESCRIPTION           = "Possible value are :
                            FULL
                            WINDOW"
 END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                  = "SPECTRUM_TYPE"
   DATA_TYPE             = CHARACTER
   START_BYTE            = 61
   BYTES                 = 5
   UNIT                  = "N/A"
   DESCRIPTION           = "Possible values are :
                            POWER
                            PHASE "
 END_OBJECT              = COLUMN

OBJECT                   = COLUMN
   NAME                  = "FREQUENCY"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 68
   BYTES                 = 7
   UNIT                  = "KILOHERTZ"
   FORMAT                = "I7"
   DESCRIPTION           = "Frequency"
 END_OBJECT              = COLUMN

 OBJECT                  = COLUMN
   NAME                  = "PHASE"
   DATA_TYPE             = ASCII_REAL
   START_BYTE            = 76
   BYTES                 = 7
   UNIT                  = "DEGREE"
   FORMAT                = "F7.2"
   DESCRIPTION           = "Phase"
 END_OBJECT              = COLUMN
```

The description of the header table for the Passive mode, Full/Window and Power sub-modes is:

```
OBJECT                = P_PO_SPECTRUM_TABLE
  NAME                = "P_PO_SPECTRUM"
  INTERCHANGE_FORMAT = ASCII
  ROWS                =
  COLUMNS             = 7
  ROW_BYTES           =
  ^STRUCTURE          = "MIP_SPECTRUM_P_PO.FMT"
END_OBJECT            = P_PO_SPECTRUM_TABLE
```

The structure of the TABLE object for the Power spectrum is described in the file MIP_SPECTRUM_P_PO.FMT as follows:

```
OBJECT                    = COLUMN
   NAME                   = "SPECTRUM_UT"
   DATA_TYPE              = TIME
   START_BYTE             = 1
   BYTES                  = 23
   UNIT                   = "N/A"
   DESCRIPTION            = "Spectrum UT
                             Format : YYYY-MM-DDThh:mm:ss.sss"
 END_OBJECT               = COLUMN

OBJECT                    = COLUMN
   NAME                   = "SPECTRUM_OBT"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 26
   BYTES                  = 17
   UNIT                   = "N/A"
   MISSING_CONSTANT       = "  9/9999999.99999"
   DESCRIPTION            = "Spectrum On board Time :
                             OOBT IS REPRESENTED AS :
                             Reset number (integer starting at 1) / seconds.
                             Reset number 1 starts at 2003-01-01T00:00:00 UTC
                             The time resolution is 1/65536 s "
 END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                   = "MODE"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 46
   BYTES                  = 7
   UNIT                   = "N/A"
   DESCRIPTION            = "Possible value is :
                             PASSIVE"
 END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                   = "SUB_MODE"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 56
   BYTES                  = 6
   UNIT                   = "N/A"
   DESCRIPTION            = " Possible values are :
                             FULL
                             WINDOW"
 END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                   = "SPECTRUM_TYPE"
```

```
   DATA_TYPE            = CHARACTER
   START_BYTE           = 65
   BYTES                = 5
   UNIT                 = "N/A"
   MISSING_CONSTANT     = "XXXXX"
   DESCRIPTION          = "Possible values are : POWER or MISSING_CONSTANT
                          in case of power sub-mode"
 END_OBJECT             = COLUMN

OBJECT                 = COLUMN
   NAME                 = "FREQUENCY"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 72
   BYTES                = 7
   UNIT                 = "KILOHERTZ"
   FORMAT               = "I7"
   DESCRIPTION          = "Frequency
                          For power sub-mode, the central frequency of
                          frequency bandwidth is given:
                          LF part [7-448]: 220
                          HF part [476-3584]: 1554"
 END_OBJECT             = COLUMN

 OBJECT                 = COLUMN
   NAME                 = "POWER"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 80
   BYTES                = 7
   UNIT                 = "DECIBEL"
   FORMAT               = "F7.2"
   DESCRIPTION          = "Power
                           0 dB = 0.6 microV*Hz**-0.5"
 END_OBJECT             = COLUMN
```

4.3.1.4 Description of Instrument

The description of the instrument is done in the INST.CAT catalog file.

4.3.2 Data Product Design of MIP Configuration Table data (level 3)

This data product contains information from the MIP configuration table needed to decode the commands which arrive during a science MIP or LDL sequence. This data product has PDS detached labels.

4.3.2.1 File Characteristics Data Elements

The PDS file characteristic data elements for MIP configuration table data (level 3) are:

```
RECORD_TYPE            = FIXED_LENGTH
RECORD_BYTES           =
FILE_RECORDS           =
PRODUCT_TYPE           = RDR
PROCESSING_LEVEL_ID    =  3
```

The FILE_NAME is described in §3.1.4

4.3.2.2 Data Object Pointers Identification Data Elements

The MIP configuration tables are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files. The data contains instrument configuration.

4.3.2.3 Data Object Definition

Each data file (TAB) contains several tables. The number of tables is variable and depends on the type of measurement (sequence).

The description of the TABLE object for the MIP configuration table:

```
OBJECT                 = CONFIG_TABLE_TABLE
  NAME                 = "CONFIG_TABLE"
  INTERCHANGE_FORMAT = ASCII
  ROWS                 =
  COLUMNS              = 21
  ROW_BYTES            =
  ^STRUCTURE           = "MIP_CONFIG_TABLE.FMT"
END_OBJECT             = CONFIG_TABLE_TABLE
```

The structure of the TABLE object is described in the file MIP_CONFIG_TABLE.FMT as follows:

```
OBJECT              = COLUMN
    NAME            = "TABLE_TIME_UTC"
    DATA_TYPE       = TIME
    START_BYTE      = 1
    BYTES           = 23
    UNIT            = "N/A"
    DESCRIPTION     = "This column represents the UTC Time in PDS standard format
                       YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
    NAME            = "TABLE TIME_OOBT"
    DATA_TYPE       = CHARACTER
    START_BYTE      = 26
    BYTES           = 17
    MISSING_CONSTANT     = "  9/9999999.99999"
    DESCRIPTION     = "This column represents the Orbiter On Board Time
                        OOBT IS REPRESENTED AS :
                        Reset number (integer starting at 1) / seconds.
                        Reset number 1 starts at 2003-01-01T00:00:00 UTC
                        The time resolution is 1/65536 s "
END_OBJECT          = COLUMN

OBJECT              = COLUMN
   NAME             = "TABLE_TYPE"
   DATA_TYPE        = CHARACTER
   START_BYTE       = 46
   BYTES            = 3
   DESCRIPTION      = "The type can be :
                       Configuration table containing the
                       parameters which can be modified in the onboard software
                       Control sequence used to get a detailed status
                       of the experiment; it contains the configuration table ;
                       This field takes one of the following values :
                           CTL
                           TBL"
```

```
END_OBJECT        = COLUMN

OBJECT            = COLUMN
   NAME           = "TABLE_NUMBER"
   DATA_TYPE      = CHARACTER
   START_BYTE     = 52
   BYTES          = 12
   FORMAT         = "N/A"
   DESCRIPTION    = "Table number, given in the form x of y , where :
                     x is the current number of the table in the PDS file
                     y is the maximum number of tables found in the PDS file"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
   NAME           = "TABLE_BYTES_HEX"
   DATA_TYPE      = CHARACTER
   START_BYTE     = 67
   BYTES          = 17
   DESCRIPTION    = "The configuration table contains all the parameters which
                     can be modified in the onboard software.The size of 6
                     bytes corresponds to one link-packet between PIU and MIP.
                     All the commands are inserted into the table.
                     The Hexadecimal format is used, each byte is separated by
                     a blank character. The description is done below :

                     byte 0
                                bits 4,3   :  Interference frequency nr 1
                     byte 1
                                bits 4,3   :  Interference frequency nr 2
                     byte 2
                                bits 4,3   :  Interference frequency nr 3
                     byte 3
                                bits 7,6   : Transmission_level
                                bits 5,4   : Transmitter_odd_sweeps
                                bits 3,2   : Transmitter_even_sweeps
                                bits 3,2   : Extremum_threshold
                     byte 4
                                bits 7,6,5 : Sweep_mode_bandwidth
                                bits 4,3,2 : Survey_mode_bandwidth
                                bit 1      : Ampl_pas
                                bit 0      : Autoloop
                     byte 5
                                bit  7     : Watchdog
                                bits 6,5,4 : Science_sequence_number
                                bit  3     : LDL_type
                                bit  2     : Mode
                                bits 1,0   : TM_rate"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
   NAME           = "INTERF_FREQ1"
   DATA_TYPE      = ASCII_INTEGER
   START_BYTE     = 86
   BYTES          = 4
   UNIT           = KILOHERTZ
   FORMAT         = "I4"
DESCRIPTION       = " Interference frequency number 1
                      The interference frequencies to be
                      suppressed during the extremum computation in
                      the active modes"
END_OBJECT        = COLUMN
```

```
OBJECT            = COLUMN
   NAME           = "INTERF_FREQ2"
   DATA_TYPE      = ASCII_INTEGER
   START_BYTE     = 91
   BYTES          = 4
   UNIT           = KILOHERTZ
   FORMAT         = "I4"
   DESCRIPTION    = " Interference frequency number 2
                      The interference frequencies to be
                      suppressed during the extremum computation in
                      the active modes"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
   NAME           = "INTERF_FREQ3"
   DATA_TYPE      = ASCII_INTEGER
   START_BYTE     = 96
   BYTES          = 4
   UNIT           = KILOHERTZ
   FORMAT         = "I4"
   DESCRIPTION    = " Interference frequency number 3
                      The interference frequencies to be
                      suppressed during the extremum computation in
                      the active modes"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
   NAME           = "TRANSMISSION_LEVEL"
   DATA_TYPE      = ASCII_REAL
   START_BYTE     = 101
   BYTES          = 5
   UNIT           = "N/A"
   FORMAT         = "F5.3"
   DESCRIPTION    = " The level of the transmission signal
                      Takes one of the following values:
                      1.000 full level (156 mV RMS in MIP mode,
                      30 V RMS in LDL mode)
                      0.500 nominal level (78 mV RMS in MIP mode,
                      15 V RMS in LDL mode)
                      0.250 low level (39 mV RMS in MIP mode,
                      7.5 V RMS in LDL mode)
                      0.125 minimum level (19.5 mV RMS in MIP mode,
                      3.75 V RMS in LDL mode) "
END_OBJECT        = COLUMN

OBJECT            = COLUMN
   NAME           = "TRANSMISSION_ODD"
   DATA_TYPE      = CHARACTER
   START_BYTE     = 108
   BYTES          = 29
   UNIT           = "N/A"
   DESCRIPTION    = " selection of the transmitter for all
                      the odd sweeps (1, 3, ...)
                      Takes one of the following values:
                           mono with E1
                           mono with E2
                           stereo with E1-E2 phased
                           stereo with E1-E2 anti-phased"
END_OBJECT        = COLUMN
```

```
OBJECT              = COLUMN
   NAME             = "TRANSMISSION_EVEN"
   DATA_TYPE        = CHARACTER
   START_BYTE       = 140
   BYTES            = 29
   UNIT             = "N/A"
   DESCRIPTION      = " selection of the transmitter for
                        all the even sweeps (2, 4, ...)
                        Takes one of the following values:
                             mono with E1
                             mono with E2
                             stereo with E1-E2 phased
                             stereo with E1-E2 anti-phased"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
   NAME             = "MODE"
   DATA_TYPE        = CHARACTER
   START_BYTE       = 172
   BYTES            = 9
   UNIT             = "N/A"
   DESCRIPTION      = " selection of a MIP alone mode or LDL mode
                        The field takes one of the following the values:
                            MIP alone
                            LDL mode"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
   NAME             = "AUTOLOOP"
   DATA_TYPE        = CHARACTER
   START_BYTE       = 184
   BYTES            = 16
   UNIT             = "N/A"
   DESCRIPTION      = " Autoloop : an auto-loop can be set between emission
                        and reception
                        The field takes one of the following the values:
                            MIP with sensor
                            MIP auto-loop ON"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
   NAME             = "AMPL_PAS"
   DATA_TYPE        = ASCII_INTEGER
   START_BYTE       = 202
   BYTES            = 1
   UNIT             = DECIBEL
   FORMAT           = "I1"
   DESCRIPTION      = " Coding level for the power spectrum in the
                        Passive mode
                        The field takes one of the following the values:
                              2 (16 values from 0 to 30 dB)
                              4 (16 values from 0 to 60 dB)
                        0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
   NAME             = "EXT_THRESHOLD"
   DATA_TYPE        = ASCII_INTEGER
   START_BYTE       = 204
   BYTES            = 1
   UNIT             = DECIBEL
```

```
   FORMAT            = "I1"
   DESCRIPTION       = " Amplitude threshold for the extremum detection
                         The field takes one of the following the values:
                               1
                               2
                               4
                               8
                        0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
   NAME              = "SURVEY_BAND"
   DATA_TYPE         = ASCII_INTEGER
   START_BYTE        = 206
   BYTES             = 1
   UNIT              = "N/A"
   FORMAT            = "I1"
   DESCRIPTION       = "Selection of the frequency bandwidth in Survey modes ;
                        Three parameters (Frequency bandwidth,Frequency resolution
                        and Number of frequency steps) are given for all intervals
                        (nominal frequency interval -0- and the 7 complementary
                         ones - nr 1 to nr 7 - ) :

                         Frequency           Frequency              Number of
                         bandwidth           resolution           frequency steps

                                  0 nominal interval from 28 to 3472 kHz
                          28 - 224  kHz             7 kHz                   29
                         238 - 448  kHz            14 kHz                   16
                         476 - 896  kHz            28 kHz                   16
                         952 - 1792 kHz            56 kHz                   16
                        1904 - 3472 kHz           112 kHz                   15
                                  1 interval nr 1 from 28  to 665 kHz
                          28 - 665 kHz              7 kHz                   92

                                  2 interval nr 2 from 259 to 896 kHz
                         259 - 896  kHz             7 kHz                   92
                                  3 interval n r3 from 518 to 1792 kHz
                         518 - 1792 kHz            14 kHz                   92
                                  4 interval nr 4 from 924 to 3472 kHz
                         924 - 3472 kHz            28 kHz                   92
                                  5 interval n r5 from 357 to 987 kHz
                          28 - 343  kHz             7 kHz                   46
                         357 - 987  kHz            14 kHz                   46
                                  6 interval nr 6 from 28  to 1582 kHz
                          28 - 224  kHz             7 kHz                   29
                         238 - 630  kHz            14 kHz                   29
                         658 - 1582 kHz            28 kHz                   34
                                  7 interval nr 7 from 268 to 2184 kHz
                         266 - 896  kHz             14 kHz                  46
                         924 - 2184 kHz             28 kHz                  46"

END_OBJECT            = COLUMN

OBJECT                = COLUMN
   NAME               = "SWEEP_BAND"
   DATA_TYPE          = ASCII_INTEGER
   START_BYTE         = 208
   BYTES              = 1
   UNIT               = "N/A"
   FORMAT             = "I1"
```

```
   DESCRIPTION     = "Selection of the frequency bandwidth in Sweep modes
                     Three parameters (Frequency bandwidth,Frequency resolution
                     and Number of frequency steps) are given for all intervals
                     (nominal frequency interval -0- and the 7 complementary
                      ones - nr 1 to nr 7 - ) :

                      Frequency           Frequency             Number of
                      bandwidth           resolution          frequency steps

                               0 nominal interval from 28 to 3472 kHz
                                 selection made automatically by the
                                 onboard software
                     28 - 224  kHz             7 kHz                   29
                    238 - 448  kHz            14 kHz                   16
                    476 - 896  kHz            28 kHz                   16
                    952 - 1792 kHz            56 kHz                   16
                   1904 - 3472 kHz           112 kHz                   15
                               1 interval nr 1 from 28  to 665 kHz
                     28 - 665 kHz              7 kHz                   92

                               2 interval nr 2 from 259 to 896 kHz
                    259 - 896  kHz             7 kHz                   92
                               3 interval nr 3 from 518 to 1792 kHz
                    518 - 1792 kHz            14 kHz                   92
                               4 interval nr 4 from 924 to 3472 kHz
                    924 - 3472 kHz            28 kHz                   92
                               5 interval nr 5 from 357 to 987 kHz
                     28 - 343  kHz             7 kHz                   46
                    357 - 987  kHz            14 kHz                   46
                               6 interval nr 6 from 28  to 1582 kHz
                     28 - 224  kHz             7 kHz                   29
                    238 - 630  kHz            14 kHz                   29
                    658 - 1582 kHz            28 kHz                   34
                               7 interval nr 7 from 268 to 2184 kHz
                    266 - 896  kHz             14 kHz                  46
                    924 - 2184 kHz             28 kHz                  46"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
   NAME            = "WATCHDOG"
   DATA_TYPE       = CHARACTER
   START_BYTE      = 211
   BYTES           = 12
   UNIT            = "N/A"
   DESCRIPTION     = "Possibility to inhibit the MIP watchdog
                      The field takes one of the following the values:
                            watchdog on
                            watchdog off"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
   NAME            = "TM_RATE"
   DATA_TYPE       = CHARACTER
   START_BYTE      = 226
   BYTES           = 12
   UNIT            = "N/A"
   DESCRIPTION     = "Selection of the telemetry rate
                      The field takes one of the following the values:
                            minimum rate
                            normal rate
                            burst rate"
```

```
END_OBJECT         = COLUMN

OBJECT             = COLUMN
   NAME            = "SEQUENCE_NR"
   DATA_TYPE       = CHARACTER
   START_BYTE      = 241
   BYTES           = 27
   UNIT            = "N/A"
   DESCRIPTION     = "Selection of the sequence number
                      The field takes one of the following the values:
                               nominal sequence
                               complementary sequence nr 1
                               complementary sequence nr 2
                               complementary sequence nr 3
                               complementary sequence nr 4
                               complementary sequence nr 5
                               complementary sequence nr 6
                               complementary sequence nr 7"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
   NAME            = "LDL_TYPE"
   DATA_TYPE       = CHARACTER
   START_BYTE      = 271
   BYTES           = 10
   UNIT            = "N/A"
   DESCRIPTION     = "LDL type
                      The field takes one of the following the values:
                             normal LDL
                             mixed LDL"
END_OBJECT         = COLUMN
```

4.3.3 Data Product Design of calibrated HK data (level 3)

Level 3 HK contains calibrated MIP HK data, with PDS detached labels.

4.3.3.1 File Characteristics Data Elements

The PDS file characteristic data elements for MIP calibrated HK data (level 3) are:

```
RECORD_TYPE             = FIXED_LENGTH
RECORD_BYTES            =
FILE_RECORDS            =
PRODUCT_TYPE            = RDR
PROCESSING_LEVEL_ID     =  3
```

The FILE_NAME is described in §3.1.4

4.3.3.2 Data Object Pointers Identification Data Elements

The calibrated HK data are organized as an ASCII table with comma separated values (CSV). The PDS label refers to a single data object which is a TABLE. The data object pointers (^TABLE) reference TAB files.

4.3.3.3 Data Object Definition

The description of the table for calibrated HK level 3:

```
OBJECT                = CALIBRATED_HK_TABLE
  NAME                = "CALIBRATED_HK"
  INTERCHANGE_FORMAT = ASCII
  ROWS                =
  COLUMNS             = 7
  ROW_BYTES           =
  ^STRUCTURE          = "MIP_CALIBRATED_HK.FMT"
END_OBJECT            = CALIBRATED_HK_TABLE
```

The structure of the TABLE object is described in the file MIP_CALIBRATED_HK.FMT as follows:

```
OBJECT          = COLUMN
  NAME          = "UTC_TIME"
  DATA_TYPE     = TIME
  START_BYTE    = 1
  BYTES         = 23
  DESCRIPTION   = "This column represents the UTC Time in PDS standard format
                    YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT        = COLUMN

OBJECT          = COLUMN
  NAME          = "OOBT_TIME"
  DATA_TYPE     = CHARACTER
  START_BYTE    = 26
  BYTES         = 17
  MISSING_CONSTANT     = "  9/9999999.99999"
  DESCRIPTION   = "This column represents the Orbiter On Board Time ;
                   OOBT IS REPRESENTED AS :
                         Reset number (integer starting at 1) / seconds.
                         Reset number 1 starts at 2003-01-01T00:00:00 UTC
                         The time resolution is 1/65536 s "
END_OBJECT       = COLUMN

OBJECT         = COLUMN
  NAME         = "MEAN_POW_PASSIVE_LF"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE   = 45
  BYTES        = 2
  UNIT         = DECIBEL
  FORMAT       = "I2"
  DESCRIPTION = "Mean power for low frequency in Passive mode
                 0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
  NAME         = "MEAN_POW_PASSIVE_HF"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE   = 48
  BYTES        = 2
  UNIT         = DECIBEL
  FORMAT       = "I2"
  DESCRIPTION = "Mean power for high frequency in Passive mode
                 0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
  NAME         = "RES_POW_SURVEY"
  DATA_TYPE    = ASCII_REAL
  START_BYTE   = 51
  BYTES        = 5
```

```
  UNIT        = DECIBEL
  FORMAT      = "F5.2"
  DESCRIPTION = "Resonance power in Survey mode
                 0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT    = COLUMN

OBJECT        = COLUMN
  NAME        = "RES_FREQ_SURVEY"
  DATA_TYPE   = ASCII_INTEGER
  START_BYTE  = 57
  BYTES       = 4
  UNIT        = KILOHERTZ
  FORMAT      = "I4"
  DESCRIPTION = " Resonance frequency in Survey mode "
END_OBJECT    = COLUMN

OBJECT        = COLUMN
  NAME        = "TEMPERATURE"
  DATA_TYPE   = ASCII_REAL
  START_BYTE  = 62
  BYTES       = 6
  UNIT        = KELVIN
  FORMAT      = "F6.2"
  DESCRIPTION = " Second Sensor (reception electrode) temperature"
END_OBJECT    = COLUMN
```

4.3.4 Data Product Design of derived SC data (level 5)

Level 5 SC contains electron density and temperature, with PDS detached labels.

TBD

5 Appendix: Available Software to read PDS files

The level 3 housekeeping and science PDS files can be read with the PDS table verifier tool “w_readpds”.

6 Appendix: Example of Directory Listing of Data Set RO-CAL-RPCMIP-3-GRND-V1.1

```
                                  |-AAREADME.TXT
                                  |
                                  |              |-CATINFO.TXT
                                  |              |-DATASET.CAT
                                  |              |-INST.CAT
                                  |-CATALOG------|-INSTHOST.CAT
                                  |              |-MISSION.CAT
                                  |              |-PERSON.CAT
                                  |              |-REF.CAT
                                  |              |-SOFTWARE.CAT
                                  |              |
                                  |              |             |         |        |-RPCMIPH3XX_0210170634_00147.LBL
                                  |              |             |         |        |-RPCMIPH3XX_0210170634_00147.TAB
                                  |              |             |         |        |-RPCMIPS3ES_0210170635_00142.LBL
                                  |              |             |         |        |-RPCMIPS3ES_0210170635_00142.TAB
                                  |              |             |         |        |-RPCMIPS3HS_0210170635_00121.LBL
                                  |              |             |         |        |-RPCMIPS3HS_0210170635_00121.TAB
                                  |              |             |         |        |-RPCMIPS3WS_0210170635_00123.LBL
                                  |              |             |         |        |-RPCMIPS3WS_0210170635_00123.TAB
                                  |              |             |-2002----|-OCT----|-RPCMIPS3EL_0210170723_00041.LBL
                                  |              |             |         |        |-RPCMIPS3EL_0210170723_00041.TAB
                                  |              |             |         |        |-RPCMIPS3HL_0210170723_00041.LBL
                                  |              |             |         |        |-RPCMIPS3HL_0210170723_00041.TAB
                                  |              |             |         |        |-RPCMIPS3WL_0210170723_00041.LBL
                                  |              |             |         |        |-RPCMIPS3WL_0210170723_00041.TAB
                                  |              |             |         |        |-RPCMIPS3XX_0210170634_00124.LBL
                                  |              |             |         |        |-RPCMIPS3XX_0210170634_00124.TAB
|-RO-CAL-RPCMIP-3-GRND-V1.1---|-DATA---------|-CALIBRATED--|         |        |-
                                  |              |             |         |        |-RPCMIPH3XX_0309110836_00086.LBL
                                  |              |             |         |        |-RPCMIPH3XX_0309110836_00086.TAB
                                  |              |             |         |        |-RPCMIPS3WS_0309110836_00063.LBL
                                  |              |             |         |        |-RPCMIPS3WS_0309110836_00063.TAB
                                  |              |             |-2003----|-SEP----|-RPCMIPS3HS_0309110836_00063.LBL
                                  |              |             |         |        |-RPCMIPS3HS_0309110836_00063.TAB
                                  |              |             |         |        |-RPCMIPS3ES_0309110836_00086.LBL
                                  |              |             |         |        |-RPCMIPS3ES_0309110836_00086.TAB
                                  |              |             |         |        |-RPCMIPS3XX_0309110836_00064.LBL
```

```
|              |             |         |        |-RPCMIPS3XX_0309110836_00064.TAB
|              |
|              |- DOCINFO.TXT
|              |- BOARD_PROC_34.PDF
|              |- BOARD_PROC.LBL
|              |- RPC-MIP_EAICD.PDF
|-DOCUMENT-----|- RPC-MIP_EAICD.LBL
|              |- MIP_EXP_OVERVIEW.PDF
|              |- MIP_EXP_OVERVIEW.LBL
|              |- MIP_PIU_INTERF_33.PDF
|              |- MIP_PIU_INTERF.LBL
|              |- RPC_UM_208.PDF
|              |- RPC_UM_208.LBL
|
|              |-INDXINFO.TXT
|-INDEX--------|-INDEX.LBL
|              |-INDEX.TAB
|
|              |-LABINFO.TXT
|              |-MIP_SPECTRUM_L_PO.FMT
|              |-MIP_SPECTRUM_SS_PO.FMT
|              |-MIP_CALIBRATED_HK.FMT
|-LABEL--------|-MIP_CONFIG_TABLE.FMT
|              |-MIP_SPECTRUM_L_PH.FMT
|              |-MIP_SPECTRUM_P_PO.FMT
|              |-MIP_SPECTRUM_SS_PH.FMT
|
|-VOLDESC.CAT
```

7 Appendix: Example of PDS label for RPCMIP level 3 data product

```
PDS_VERSION_ID               = PDS3
LABEL_REVISION_NOTE  = "2007-07-16, SONC, version 1.0"

/*          Electric Field Power Spectrum (Passive) in LDL mode            */

/* FILE CHARACTERISTIC DATA ELEMENTS */

RECORD_TYPE          = FIXED_LENGTH
RECORD_BYTES         = 88
FILE_RECORDS         = 2502576

FILE_NAME            = "RPCMIPS3EL_0809051739_06500.TAB"


/* DATA OBJECT POINTERS  */

^P_PO_SPECTRUM_TABLE     = ("RPCMIPS3EL_0809051739_06500.TAB",1 <BYTES>)


DATA_SET_ID     = "RO-A-RPCMIP-3-AST1-V1.0"
DATA_SET_NAME   = "ROSETTA-ORBITER STEINS RPCMIP 3 AST1 V1.0"
PRODUCT_ID      = "RPCMIPS3EL_0809051739_06500"
PRODUCT_CREATION_TIME  = 2010-04-09T07:53:05
MISSION_NAME           = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME     = "STEINS FLY-BY"
MISSION_ID             = ROSETTA
INSTRUMENT_HOST_NAME   = "ROSETTA-ORBITER"
INSTRUMENT_HOST_ID     = RO
OBSERVATION_TYPE    = "STEINS FLYBY"

PRODUCT_TYPE         = RDR
START_TIME           = 2008-09-05T17:39:19.571
STOP_TIME            = 2008-09-10T06:00:07.644
SPACECRAFT_CLOCK_START_COUNT = "2/179257122.01653"
SPACECRAFT_CLOCK_STOP_COUNT  = "2/179647170.01653"

PRODUCER_ID          = "SONC"
PRODUCER_FULL_NAME   = "SCIENCE OPERATIONS AND NAVIGATION CENTER"
PRODUCER_INSTITUTION_NAME = "CNES"

INSTRUMENT_ID        = RPCMIP
INSTRUMENT_NAME="ROSETTA PLASMA CONSORTIUM - MUTUAL IMPEDANCE PROBE"
INSTRUMENT_TYPE      = "MUTUAL IMPEDANCE PROBE"
INSTRUMENT_MODE_ID   = "N/A"
INSTRUMENT_MODE_DESC = "N/A"
TARGET_NAME          = "2867 STEINS"
TARGET_TYPE          = "ASTEROID"

PROCESSING_LEVEL_ID = 3
DATA_QUALITY_ID = -1
DATA_QUALITY_DESC = "-1 : NOT QUALIFIED"

/* GEOMETRY PARAMETERS  */

/* SPACECRAFT LOCATION: Position <km> */
SC_SUN_POSITION_VECTOR = (  107139433.4, 270109493.5, 132746568.8)
/* TARGET PARAMETERS: Position <km>, Velocity <km/s> */
SC_TARGET_POSITION_VECTOR = (  251647317.2, 230548302.6, 115595003.9)
SC_TARGET_VELOCITY_VECTOR = (         -5.4,         33.8,         17.0)
/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */
SPACECRAFT_ALTITUDE =   360328325.4 <km>
SUB_SPACECRAFT_LATITUDE =   -18.63 <deg>
```

```
SUB_SPACECRAFT_LONGITUDE =   337.67 <deg>
NOTE = "The values of the keywords SC_SUN_POSITION_VECTOR,
       SC_TARGET_POSITION_VECTOR and SC_TARGET_VELOCITY_VECTOR
       are related to the EMEJ2000 reference frame.
       The values of SUB_SPACECRAFT_LATITUDE and SUB_SPACECRAFT_LONGITUDE
       are northern latitude and eastern longitude in the standard
       planetocentric IAU_<TARGET_NAME> frame.
       All values are computed for the time = START_TIME.
       Distances are given in <km> velocities in <km/s>, Angles in <deg>"

/* DATA OBJECT DEFINITION  */


OBJECT               = P_PO_SPECTRUM_TABLE
  NAME               = "P_PO_SPECTRUM"
  INTERCHANGE_FORMAT = ASCII
  ROWS               = 2502576
  COLUMNS            = 7
  ROW_BYTES          = 88
  ^STRUCTURE         = "MIP_SPECTRUM_P_PO.FMT"
END_OBJECT           = P_PO_SPECTRUM_TABLE
END
```