Rosetta RPC-MIP
to Planetary Science Archive
Interface Control Document

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Version 2	2019-06-06	Add information related to RPC-MIP L5 archives

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1. Introduction

1.1 Purpose and scope

The purpose of this EAICD, Experimenter to (Science) Archive Interface Control Document, is twofold. First, it is the official interface between the RPC-MIP instrument team and the archiving authority. Secondly, it provides users of the RPC-MIP instrument datasets with description of the product and a description of how it was generated, including data sources and destinations. Note that a more detailed description can be found in the RPC-MIP user guide (*RD1*).

1.2 Archiving authorities

The **Planetary Data System (PDS)** Standard is used as archiving standard by

- NASA for U.S. planetary missions, implemented by PDS
- ESA for European planetary missions, originately 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 described. Examples of these are given in 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

AD1	Planetary Data System Data Preparation Workbook, February 17, 1995, Version 3.1, JPL, D-7669, Part1
AD2	Planetary Data System Standards Reference, August 1, 2003, Version 3.6, JPL, D-7669, Part2
AD3	Rosetta Time handling RO-EST-TN-3165, issue 1 rev 0, February 9, 2004
AD4	ROSETTA Archive Generation, Validation and Transfer Plan, January 10, 2006, Issue 2, Rev. 3, RO-EST-PL-5011
AD5	ROSETTA Archive Conventions, RO-EST-TN-3372, Issue 5, Rev. 0, 28 April 2009.
AD6	Rosetta Project - MIP experiment - Onboard Data Handling, RPC/MIP/RP/13/980317/LPC2E, Ed. 3, Rev. 4, September 20 2000.
AD7	Rosetta Project - MIP experiment - MIP/PIU Data Handling Interface, PC/MIP/RP/126/990253/LPC2E, Ed. 3, Rev. 3, May 23 200
AD8	Rosetta Project - MIP experiment - Manuel d'utilisation du FS, RPC/MIP/OP/1/020125/LPC2E, Ed. 1, Rev. 0, 15 mars 2002.
AD9	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
AD10	DDID- Data Delivery Interface Document RO-ESC-IF-5003 Issue B6 23/10/2003

1.6 Reference documents

RD1	User Guide to the RPC-MIP Science Datasets in the ESA's Planetary Science Archive (PSA), RPC-MIP-UG-LPC2E, 2019
RD2	RPCMIP/RPCLAP Cross-Calibration Report, RPC_MIPLAP_CROSSCAL_REPORT, 2019

1.7 Relationship to other interfaces

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

1.8 Acronyms and abbreviations

ASCII	American Standard Code for Information Interchange
CDPP	Centre de Données de la Physique des Plasmas
CVS	Comma Separated Values
DDS	Data Disposition System (ESA server)

DFT	Direct Fourier Transform
EAICD	Experiment to Archive Interface Control Document
FFT	Fast Fourier Transform
FPGA	Field Programmable Gate Array
HK	House keeping
LAP	Langmuir probe instrument
LDL	Long Debye Length (instrumental mode)
LPC2E	Laboratoire de Physique et Chimie de l'Environnement et de l'Espace (Orléans)
LSB	Least Significant Byte
MIP	Mutual Impedance Probe
MJT	Modified Julian Time
MSB	Most Significant Byte
OBT	On Board Time
OOBT	Orbiter On Board Time
PDS	Planetary Data System
PIU	Plasma Interface Unit
PSA	Planetary Science Archive
RPC	Rosetta Plasma Consortium
SC	Science
S/C	Spacecraft
SDL	Short Debye Length (instrumental mode)
SONC	Spacecraft Operations and Navigation Center
UTC	Universal Time Coordinated

1.9 Contact names and addresses

Pierre Henri	Pierre.Henri*(at)*cnrs-orleans.fr	RPC-MIP Principal Investigator
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2. Overview of Instrument Design, Data Handling Process and Product Generation

The RPC-MIP (Mutual Impedance Probe) is one of the five instruments of the Rosetta Plasma Consortium (RPC) on board the ESA Rosetta mission. It 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. In its active mode, RPC-MIP can be operated with different transmitting configurations:

- T1 and T2 can be used as transmitters, independently or conjointly in phase or anti-phased. Due to its technical principle, this enables to properly analyze plasmas with Debye length lower than a few tens of cm and give rise to the so-called Short Debye Length mode.
- To overcome this limit, the Long Debye Length mode has been implemented. In this mode, one of the two Langmuir probes of the RPC-LAP instrument (LAP2) is used as a transmitter, enabling plasmas with Debye length up to ~2m to be investigated.

The orientation of the RPC-MIP sensor with respect to the S/C is also given in the SPICE FK kernel ROS_V*xx*.TF (*xx* is the version) which can be found on the PSA, under the Ancillary Data section of the Rosetta mission.

In its passive mode, the RPC-MIP instrument has also the capability of a plasma wave analyser. The electronics board is located inside the RPC-0 box. It assumes four functions:

- acquisition of the analog 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.

2.1 Scientific objectives

The RPC-MIP measures the transmission properties of the electric field in a plasma through the mutual impedance of two electric antennas. Under certain conditions of the sounded cometary plasma, a careful on-ground analysis of the acquired spectra can lead to some of the plasma bulk characteristics of the plasma, such as the electron density and potentially the electron temperature.

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 and temperature 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.

RPC-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.

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 LPC2E is responsible for the RPC-MIP data sets generation and delivery to the PSA, with support from SONC for the level 3 datasets.

The RPC-MIP telemetry data is provided by the ESA DDS (Data Distribution Server).

The raw data are passed through the SONC data processing software for decommutation, conversion to physical values and calibration of L3 products and through LPC2E processing software for L5 products.

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 in physical units.
The 'Edited raw data' are:

- science data (electric field spectra with modulus and phase and resonance values in active mode, electric field spectra with modulus in passive mode, mean passive power inside a particular frequency bandwidth) for both SDL and LDL modes
- house-keeping data (sequence counters, mean passive power, resonance values, sensor temperature, configuration table)

The "Derived higher-level data products" are:

- (RPC-MIP) Electron density (in m^{-3}) derived from RPC-MIP measurements
- (RPC-MIP/RPC-LAP) Electron density (in m^{-3}) derived from the cross-calibration between certain RPC-LAP measurements and the previous (RPC-MIP) density

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 Instrument calibrations

Data produced on board are already calibrated (active and passive mutual impedance spectra). An on-board calibration sequence is run each time the instrument is switched on. First, an auto-loop process connects directly the transmitted signal to the analogue reception inside the RPC-MIP board enabling to verify on ground that levels are correct for each frequency. Second, a short FFT is processed on given values to verify that FFT calculation is correct.

2.3.2 Determination of the electron density

Electron plasma density is derived from the frequency response modulus and phase of the mutual impedance, using results from plasma environment simulations (Beghin et al, 1995; Gilet et al, 2017) and from a model of the RPC-MIP response (Trotignon et al, 2007). Practical details about this determination process are given in *RD1*.

In order to overcome RPC-MIP instrumental limits, a cross-calibration between selected high-time resolution RPC-LAP measurements and RPC-MIP density values is performed when possible. This leads to a common high-time resolution electron plasma density. Description of this common products and details about their derivation processes can be found in *RD1* and *RD2*.

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 and HK data (CODMAC level 3):
  - (i) operational parameters
  - (ii) HK data, amplitudes and frequencies of the electric field spectrum from 7 kHz up to 3.5 MHz in passive mode
  - (iii) HK data, amplitudes, phases and frequencies of the electric field in active mode.
  - (iv) HK data concerning the active and passive sweeps: MIP power in Passive mode, resonance power in active mode, resonance frequency in active mode.

The SONC and LPC2E produce and deliver the level 3 data to PSA after the proprietary period. A level 3 file contains data from one RPC-MIP measurement interval, i.e. data associated to one configuration table.

- Reduced (or derived) data (CODMAC level 5): Plasma electron density derived from RPC-MIP measurements. LPC2E 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 LPC2E. It has been run at SONC with maintenance performed by LPC2E. Reprocessing and updates are under LPC2E's responsibility.

Level 5 data software is developed and operated at LPC2E. 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:

Document name	***Content***	***Enclosed in***		
		L3	***RPC-MIP L5***	***Cross-calibrated L5***
RO_RPCMIP_LOGBOOK_*xxx*.TXT	A logbook, containing information on the instrument operations or caveats (one single file for the mission lifetime)	✓		
BOARD_PROC_*xx*.PDF	MIP experiment Onboard Data Handling	✓	✓	
MIP_PIU_INTERF_*xx*.PDF	MIP/PIU Data Handling Interface	✓	✓	
RPC_UM_*xx*.PDF	Rosetta plasma consortium users' manual	✓	✓	
RPC-MIP_EAICD.PDF	RPC-MIP/PSA Interface Control Document	✓	✓	✓
RO-IRFU-LAP-EAICD	RPC-LAP/PSA Interface Control Document			✓
RPC-MIP-UG-LPC2E.PDF	User Guide to the RPC-MIP datasets in the ESA's PSA (this document)	✓	✓	✓
RPC_USER_GUIDE.PDF	RPC user guide	✓	✓	✓
MIP_EXP_OVERVIEW.PDF (L3) or TROTIGNON2007.PDF (L5)	RPC-MIP experiment description: Trotignon et al (2007)	✓	✓	✓
ERIKSSON2007A.PDF ERIKSSON2008A.PDF	RPC-LAP experiment description: Eriksson et al (2008)			✓
RPC_MIPLAP_CROSSCAL_REPORT.PDF	RPCMIP/RPCLAP cross-calibration report describing the RPCMIP/RPCLAP cross-calibrated science dataset on the PSA			✓

2.3.6 Derived and other data products

RPC-MIP derived data products are:

- Reduced (or derived) data (CODMAC level 5): Plasma electron density derived from the cross-calibration between selected RPC-LAP measurements and density derived from RPC-MIP. LPC2E will produce and deliver the level 5 data to PSA without time constraint (i.e. when ready).

- Browse products: L3 browse images and L5 browse images are produced to help the user in searching the RPC-MIP archive

Cross-calibration software and browse software are developed and operated at LPC2E.

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 RPC-MIP naming scheme conforms to CODMAC norm :

- Level 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.
- Level 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 *AD5*.

- 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 documentation (see chapter 2.3.5)

A new dataset version is provided when:

- calibration information is refined

- 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 (see *AD5*) 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>

Several examples of DATA_SET_ID and DATA_SET_NAME for RPC-MIP are given below:

- level 3 data – PRL1 phase:
  - DATA_SET_ID = "RO-C-RPCMIP-3-PRL1-V1.0"
  - DATA_SET_NAME= "ROSETTA-ORBITER 67P RPCMIP 3 PRL1 V1.0"
- level 5 data (RPC-MIP electron density) – ESC1 phase:
  - DATA_SET_ID = "RO-C-RPCMIP-5-ESC1-V1.0"
  - DATA_SET_NAME= "ROSETTA-ORBITER 67P RPCMIP 5 ESC1 V1.0"
- level 5 data (RPC-MIP/RPC-LAP cross-calibrated electron density) – EXT2 phase:
  - DATA_SET_ID = "RO-C-RPCMIP_RPCLAP-5-EXT2-V1.0"
  - DATA_SET_NAME= "ROSETTA-ORBITER 67P RPCMIP/RPCLAP 5 EXT2 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 directory structure of RPC-MIP datasets is described in more details in section 3.4.3.

3.1.4 Filenaming convention

For level 3 datasets, each RPC-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.

For level 5 datasets, files timespan are defined as follows:

- 24 hours for RPC-MIP density files
- identical to RPC-LAP files used as input of the cross-calibration process for RPC-MIP/RPC-LAP density files

The filenaming convention is given in the following table:

Level	*Physical quantity*	*Operating mode*		*Filename*	*FMT file*
L3	E-field Power spectrum	Active	SDL	RPCMIPS3WS**X***yymmddhhmn_xxxxx*.TAB	MIP_SPECTRUM_S_SS_PO_**X**.FMT
				*with **X** = {F, W, M} for sub-modes Full, Window and MinMax*	
			LDL	RPCMIPS3WL**X***yymmddhhmn_xxxxx*.TAB	MIP_SPECTRUM_L_PO_**X**.FMT
				*with **X** = {F, W} for sub-modes Full and Window*	
		Passive	SDL	RPCMIPS3ES**X***yymmddhhmn_xxxxx*.TAB	MIP_SPECTRUM_P_PO_**X**.FMT
				*with **X** = {F, W, P} for sub-modes Full, Window and Power*	
			LDL	RPCMIPS3EL**X***yymmddhhmn_xxxxx*.TAB	MIP_SPECTRUM_P_PO_**X**.FMT
				*with **X** = {W, P} for sub-modes Window and Power*	
	E-field Phase spectrum	Active	SDL	RPCMIPS3HSF*yymmddhhmn_xxxxx*.TAB	MIP_SPECTRUM_S_SS_PH.FMT
			LDL	RPCMIPS3HLF*yymmddhhmn_xxxxx*.TAB	MIP_SPECTRUM_L_PH.FMT
	Housekeeping parameters	All		RPCMIPSH3XXX*yymmddhhmn_xxxxx*.TAB	MIP_CALIBRATED_HK.FMT
	Operational parameters	All		RPCMIPS3XXX*yymmddhhmn_xxxxx*.TAB	MIP_CONFIG_TABLE.FMT
L5	Electron density (derived from RPC-MIP measurements)	Active (SDL + LDL)		RPCMIPS5DXX*yymmddhhmn_xxxxx*.TAB	MIP_DENSITY.FMT
	Electron density (derived from the cross-calibration between RPC-MIP and RPC-LAP measurements)	MIP: Active SDL LAP: selected operational macros		RPCMIPLAPS5*yymmddhhmn_xxxxx*.TAB	MIPLAP_PLASMA_DENSITY.FMT

Where:

- *yymmddhhmn* is the start of observation (10 characters):
  - yy = year
  - mm = month
  - dd = day
  - hh = hour
  - mn = minute

- *xxxxx* (5 characters) is the duration of observation (= duration of a RPC-MIP session) in minutes

Examples :

- Science data: RPCMIPS3ESF1406160559_01080.TAB (Passive Power SDL Full)
- Housekeeping data: RPCMIPH3XXX1403240809_00456.TAB
- Electron density data from RPC-MIP: RPCMIPS5DXX1510230030_01265.TAB

Remark: The configuration tables appear in files of type S3XXX (e.g. RPCMIPS3XXX1403241232_00187.TAB).

3.2 Standards used in data product generation

3.2.1 PDS standards

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

3.2.2 Time standards

The time standards used in the RPC-MIP data products are:

- the Orbiter On-Board Time (OOBT)
- the UTC (from the DDS header time correlated)

3.2.2.1 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.

3.2.2.2 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 *AD10* (Appendix 18 – section 18.1.2.1)

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

3.2.3 Reference systems

RPC-MIP provides scalar in situ measurements, not linked to any reference system.

3.3 Data validation

The RPC-MIP data products are delivered to PSA by SONC (L3) or LPC2E (L3 updates and L5). Data will be scanned for internal consistency when decommutating to edited raw format. Derived data will be validated by comparison to independent measurements by other instruments, i.e. densities from RPC-LAP. Validation and associated quality indexes are described in *RD1* and *RD2*. 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 through several servers (SONC, CDPP, RPC) and used by all the experiment team.

3.3.1 Data quality index for L3 datasets

For **L3 datasets** (CALIBRATED data), a quality index is given in the label file (.LBL) file associated to each data file. Possible values are:

-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%)

3.3.2 Data quality index for L5 datasets

For **L5 datasets** (DERIVED data), each electron density record is associated with an estimated uncertainty and several quality indexes. These supporting parameters are estimated together with the electron density value, as part of the derivation or cross-calibration process (see *RD1* and *RD2* for more details).

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
```

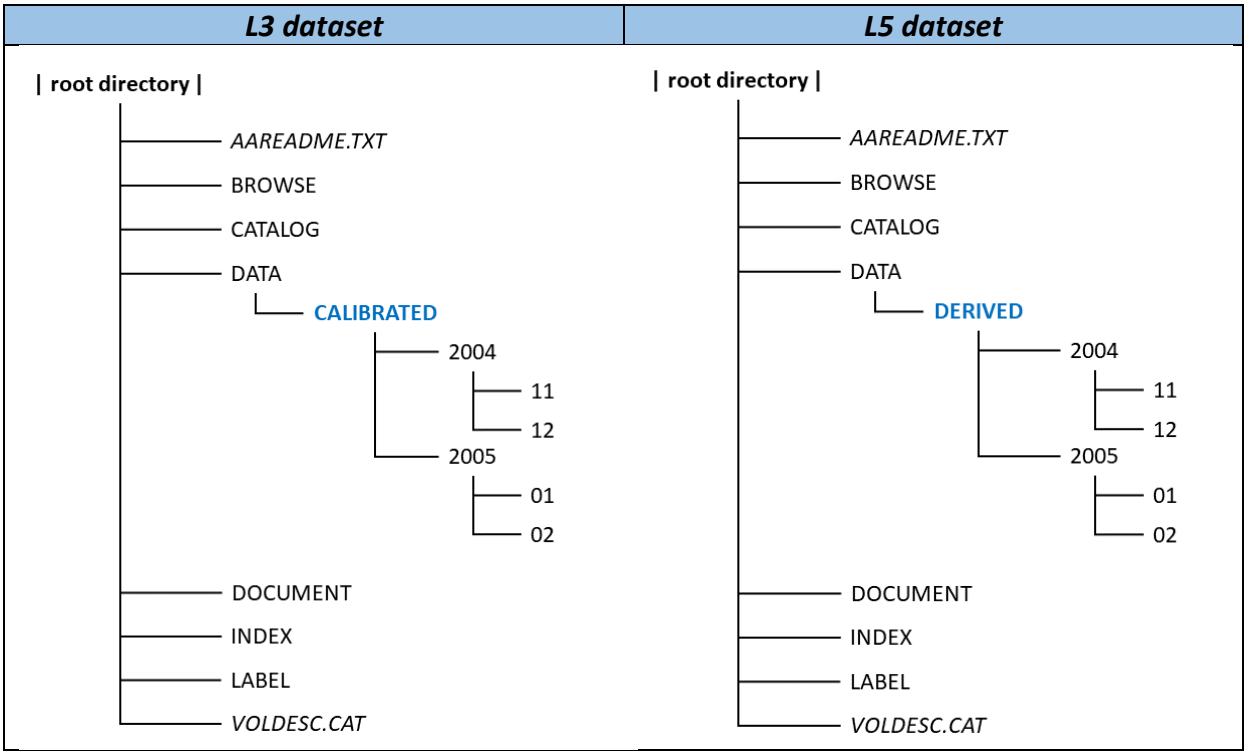
3.4.2 Data set

The MIP data will be archived 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 *AD5* 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 *AD5* table 3	
version	The first version of a data set is V1.0	

3.4.3 Directories

MIP data sets have the following directory structure :



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

There 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.

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
BROWSE_INDEX.LBL	A PDS detached label that describes BROWSE_INDEX.TAB
BROWSE_INDEX.TAB	A table listing all browse products on this volume

3.4.3.5 Browse directory

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.
The browse files will are available only for the comet phase.

3.4.3.6 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	Level	File Contents
MIP_SPECTRUM_SS_PO.FMT	3	The description of the spectrum table for the Survey/Sweep modes and Full, Window and MinMax sub-modes.
MIP_SPECTRUM_SS_PH.FMT	3	The description of the structure of the TABLE object for the Phase spectrum for the Survey/Sweep modes.
MIP_SPECTRUM_L_PO.FMT	3	The description of the power spectrum table for the LDL modes, Full/Window sub-modes
MIP_SPECTRUM_L_PH.FMT	3	The description of the phase spectrum table for the LDL modes, Full/Window sub-modes
MIP_SPECTRUM_P_PO.FMT	3	The description of the spectrum table for the Passive mode and Full, Window and Power sub-modes
MIP_CONFIG_TABLE.FMT	3	The description of the TABLE object for the RPC-MIP configuration table
MIP_CALIBRATED_HK.FMT	3	The description of the TABLE object for RPC-MIP calibrated HK data
MIP_DENSITY.FMT	5	The description of the TABLE object for RPC-MIP density data
MIPLAP_DENSITY.FMT	5	The description of the TABLE object for RPC-MIP/RPC-LAP cross-calibrated density data

3.4.3.7 Document directory

See section 2.3.5.

3.4.3.8 Data directory

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

4. Detailed interface specifications

4.1 Structure and organization overview

The RPC-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 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)		
				Level 3	Level 5	Level 5 Cross-cal
Commissioning (part 1)	CVP1	2004-03-05	2004-06-06	**X**		
Cruise 1	*CR1*	*2004-06-07*	*2004-09-05*			
Commissioning (part 2)	CVP2	2004-09-06	2004-10-16	**X**		

Earth Swing-by 1	EAR1	2004-10-17	2005-04-04	**X**		
Cruise 2	CR2	2004-05-05	2006-07-28	**X**		
Mars Swing-by	MARS	2006-07-29	2007-05-28	**X**		
Cruise 3	*CR3*	*2007-05-29*	*2007-09-12*			
Earth Swing-by 2	EAR2	2007-09-13	2008-01-27	**X**		
Cruise 4-1	CR4A	2008-01-28	2008-08-03	**X**		
Steins Flyby	AST1	2008-08-04	2008-10-05	**X**		
Cruise 4-2	CR4B	2008-10-06	2009-09-13	**X**		
Earth Swing-by 3	EAR3	2009-09-14	2009-12-13	**X**		
Cruise 5	CR5	2009-12-14	2010-05-16	**X**		
Lutetia Flyby	AST2	2010-05-17	2010-09-03	**X**		
RV Manoeuver 1	RMV1	2010-09-04	2011-06-07	**X**		
Cruise 6	*CR6*	*2011-06-08*	*2014-01-20*			
Prelanding	*PRL*	*2014-01-21*	*2014-07-22*		**X**	
Prelanding 1	PRL1	2014-01-21	2014-07-22	**X**		
Prelanding 2	PRL2	2014-07-23	2014-10-16	**X**		
Prelanding 3	PRL3	2014-10-19	2014-11-19	**X**		
Comet	*COM*	*2014-11-20*	*2015-12-31*			
Escort 1	ESC1	2014-11-20	2013-03-10	**X**	**X**	**X**
Escort 2	ESC2	2015-03-11	2015-06-30	**X**	**X**	
Escort 3	ESC3	2015-07-01	2015-10-21	**X**	**X**	**X**
Escort 4	ESC4	2015-10-22	2015-12-31	**X**	**X**	**X**
Mission extension	*EXT*	*2016-01-01*	*2016-09-30*			
Extension 1	EXT1	2016-01-01	2016-04-05	**X**	**X**	**X**
Extension 2	EXT2	2016-04-06	2016-06-30	**X**	**X**	**X**
Extension 3	EXT3	2016-07-01	2016-09-30	**X**	**X**	**X**

(1) The last column indicates foreseen RPC-MIP data sets available in the final archives, depending on the onboard data availability and/or data processing feasibility (in particular for L5 cross-calibrated density data set).

4.3 Data product design

4.3.1 File characteristics data elements

The PDS file characteristic data elements for RPC-MIP calibrated and derived 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 section 3.1.4.

4.3.2 Data object pointers identification data elements

The RPC-MIP 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 Instrument description

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

4.3.4 Data product design of calibrated SC data (level 3)

Level 3 SC contains calibrated RPC-MIP power and phase spectra, with PDS detached labels. Each power spectrum is composed of several frequency sweeps. However, the RPC-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.
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

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

Active Power spectrum in SDL

Full sub-mode

The description of the spectrum table for the Survey/Sweep modes for the Full sub-mode is:

```
OBJECT                = S_SS_PO_F_SPECTRUM_TABLE
  NAME                = " S_SS_PO_F_SPECTRUM "
```

```
      INTERCHANGE_FORMAT = ASCII
      ROWS               = x
      COLUMNS            = 8
      ROW_BYTES          = y
      ^STRUCTURE         = "MIP_SPECTRUM_S_SS_PO_F.FMT"
    END_OBJECT           = S_SS_PO_F_SPECTRUM_TABLE
```

The structure of the TABLE object for the Power spectrum in Full sub-mode is described in the file MIP_SPECTRUM_S_SS_PO_F.FMT as follows:

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_UT"
  DATA_TYPE             = TIME
  START_BYTE            = 1
  BYTES                 = 23
  UNIT                  = "N/A"
  DESCRIPTION           = "UTC Time (start of acquisition)
                           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           = "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                  = "MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 46
  BYTES                 = 6
  UNIT                  = "N/A"
  DESCRIPTION           = "Possible values:
                           SURVEY
                           SWEEP"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "SUB_MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 55
  BYTES                 = 6
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           FULL"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
```

```
  NAME                    = "SPECTRUM_TYPE"
  DATA_TYPE               = CHARACTER
  START_BYTE              = 64
  BYTES                   = 5
  UNIT                    = "N/A"
  DESCRIPTION             = "One possible value:
                             POWER"
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"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  NAME                    = "FREQUENCY"
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 79
  UNIT                    = "KILOHERTZ"
  FORMAT                  = "I7"
  ITEMS                   = 92
  ITEM_BYTES              = 7
  ITEM_OFFSET             = 8
  DESCRIPTION             = "Frequency"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  NAME                    = "POWER"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 815
  ITEMS                   = 92
  ITEM_BYTES              = 7
  ITEM_OFFSET             = 8
  UNIT                    = "DECIBEL"
  FORMAT                  = "F7.2"
  DESCRIPTION             = "Power
                             0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT                = COLUMN
```

Window sub-mode

The description of the spectrum table for the Survey/Sweep modes for the Window sub-mode is:

```
OBJECT                = S_SS_PO_W_SPECTRUM_TABLE
  NAME                = " S_SS_PO_W_SPECTRUM "
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = x
  COLUMNS             = 8
  ROW_BYTES           = y
```

```
    ^STRUCTURE          = "MIP_SPECTRUM_S_SS_PO_W.FMT"
  END_OBJECT            = S_SS_PO_W_SPECTRUM_TABLE
```

The structure of the TABLE object for the Power spectrum in Window sub-mode is described in the file MIP_SPECTRUM_S_SS_PO_W.FMT as follows:

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_UT"
  DATA_TYPE             = TIME
  START_BYTE            = 1
  BYTES                 = 23
  UNIT                  = "N/A"
  DESCRIPTION           = "UTC Time (start of acquisition)
                           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           = "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                  = "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           = "One possible value:
                           WINDOW"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_TYPE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 64
  BYTES                 = 5
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           POWER"
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"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "FREQUENCY"
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 79
  UNIT                  = "KILOHERTZ"
  FORMAT                = "I7"
  ITEMS                 = 14
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  DESCRIPTION           = "Frequency
                           3 values before resonance frequency
                           1 value at resonance frequency
                           10 values after resonance frequency"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "POWER"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 191
  ITEMS                 = 14
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  UNIT                  = "DECIBEL"
  FORMAT                = "F7.2"
  DESCRIPTION           = "Power
                           0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT              = COLUMN
```

MinMax sub-mode

The description of the spectrum table for the Survey/Sweep modes for the MinMax sub-mode is:

```
OBJECT                = S_SS_PO_M_SPECTRUM_TABLE
  NAME                = " S_SS_PO_M_SPECTRUM "
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = x
  COLUMNS             = 8
  ROW_BYTES           = y
  ^STRUCTURE          = "MIP_SPECTRUM_S_SS_PO_M.FMT"
END_OBJECT            = S_SS_PO_M_SPECTRUM_TABLE
```

The structure of the TABLE object for the Power spectrum in MinMax sub-mode is described in the file MIP_SPECTRUM_S_SS_PO_W.FMT as follows:

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_UT"
```

```
  DATA_TYPE              = TIME
  START_BYTE             = 1
  BYTES                  = 23
  UNIT                   = "N/A"
  DESCRIPTION            = "UTC Time (start of acquisition)
                            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            = "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                   = "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            = "One possible value:
                            MINMAX"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  NAME                   = "SPECTRUM_TYPE"
  DATA_TYPE              = CHARACTER
  START_BYTE             = 64
  BYTES                  = 5
  UNIT                   = "N/A"
  DESCRIPTION            = "One possible value:
                            POWER"
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
                            Always equal to MISSING_CONSTANT
```

```
                          for MINMAX sub-mode"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "FREQUENCY"
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 79
  UNIT                  = "KILOHERTZ"
  FORMAT                = "I7"
  ITEMS                 = 4
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  DESCRIPTION           = "Frequency"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "POWER"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 111
  ITEMS                 = 4
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  UNIT                  = "DECIBEL"
  FORMAT                = "F7.2"
  DESCRIPTION           = "Power
                           0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT              = COLUMN
```

Active Phase Spectrum in SDL

The description of the spectrum table for the Survey/Sweep modes is:

```
OBJECT                = S_SS_PH_F_SPECTRUM_TABLE
  NAME                = "S_SS_PH_F_SPECTRUM"
  INTERCHANGE_FORMAT  = ASCII
  ROWS                =
  COLUMNS             = 8
  ROW_BYTES           =
  ^STRUCTURE          = "MIP_SPECTRUM_S_SS_PH_F.FMT"
END_OBJECT            = S_SS_PH_F_SPECTRUM_TABLE
```

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

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_UT"
  DATA_TYPE             = TIME
  START_BYTE            = 1
  BYTES                 = 23
  UNIT                  = "N/A"
  DESCRIPTION           = "UTC Time (start of acquisition)
                           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           = "Orbiter On board Time
                           OOOBT 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:
                           SURVEY
                           SWEEP"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "SUB_MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 55
  BYTES                 = 6
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           FULL"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_TYPE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 64
  BYTES                 = 5
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           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
  UNIT                  = "KILOHERTZ"
  FORMAT                = "I7"
  ITEMS                 = 28
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  DESCRIPTION           = "Frequency"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
```

```
  NAME                  = "PHASE"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 303
  ITEMS                 = 28
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  UNIT                  = "DEGREE"
  FORMAT                = "F7.2"
  DESCRIPTION           = "Phase"
END_OBJECT              = COLUMN
```

Active Power spectrum in LDL

Full sub-mode

The description of the spectrum table for the Active LDL modes for the Full sub-mode is:

```
OBJECT                = L_PO_F_SPECTRUM_TABLE
  NAME                = " L_PO_F_SPECTRUM "
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = x
  COLUMNS             = 7
  ROW_BYTES           = y
  ^STRUCTURE          = "MIP_SPECTRUM_L_PO_F.FMT"
END_OBJECT            = L_PO_F_SPECTRUM_TABLE
```

The structure of the TABLE object for the LDL Power spectrum in Full sub-mode is described in the file MIP_SPECTRUM_L_PO_F.FMT as follows:

```
OBJECT                = COLUMN
  NAME                = "SPECTRUM_UT"
  DATA_TYPE           = TIME
  START_BYTE          = 1
  BYTES               = 23
  UNIT                = "N/A"
  DESCRIPTION         = "UTC Time (start of acquisition)
                         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         = "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                = "MODE"
```

```
  DATA_TYPE              = CHARACTER
  START_BYTE             = 46
  BYTES                  = 3
  UNIT                   = "N/A"
  DESCRIPTION            = "One possible value:
                            LDL"
END_OBJECT               = COLUMN

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

OBJECT                   = COLUMN
  NAME                   = "SPECTRUM_TYPE"
  DATA_TYPE              = CHARACTER
  START_BYTE             = 61
  BYTES                  = 5
  UNIT                   = "N/A"
  DESCRIPTION            = "One possible value:
                            POWER"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  NAME                   = "FREQUENCY"
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 68
  UNIT                   = "KILOHERTZ"
  FORMAT                 = "I7"
  ITEMS                  = 24
  ITEM_BYTES             = 7
  ITEM_OFFSET            = 8
  DESCRIPTION            = "Frequency"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  NAME                   = "POWER"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 260
  ITEMS                  = 24
  ITEM_BYTES             = 7
  ITEM_OFFSET            = 8
  UNIT                   = "DECIBEL"
  FORMAT                 = "F7.2"
  DESCRIPTION            = "Power
                            0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT               = COLUMN
```

Window sub-mode

The description of the spectrum table for the Active LDL modes for the Window sub-mode is:

```
      OBJECT                = L_PO_W_SPECTRUM_TABLE
        NAME                = " L_PO_W_SPECTRUM "
        INTERCHANGE_FORMAT  = ASCII
        ROWS                = x
        COLUMNS             = 7
        ROW_BYTES           = y
        ^STRUCTURE          = "MIP_SPECTRUM_L_PO_W.FMT"
      END_OBJECT            = L_PO_W_SPECTRUM_TABLE
```

The structure of the TABLE object for the LDL Power spectrum in Full sub-mode is described in the file MIP_SPECTRUM_L_PO_F.FMT as follows:

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_UT"
  DATA_TYPE             = TIME
  START_BYTE            = 1
  BYTES                 = 23
  UNIT                  = "N/A"
  DESCRIPTION           = "UTC Time (start of acquisition)
                           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           = "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                  = "MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 46
  BYTES                 = 3
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           LDL "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "SUB_MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 52
  BYTES                 = 6
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           WINDOW"
END_OBJECT              = COLUMN
```

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_TYPE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 61
  BYTES                 = 5
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           POWER"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "FREQUENCY"
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 68
  UNIT                  = "KILOHERTZ"
  FORMAT                = "I7"
  ITEMS                 = 15
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  DESCRIPTION           = "Frequency
                           3 values before resonance frequency
                           1 value at resonance frequency
                           11 values after resonance frequency"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "POWER"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 188
  ITEMS                 = 15
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  UNIT                  = "DECIBEL"
  FORMAT                = "F7.2"
  DESCRIPTION           = "Power
                           0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT              = COLUMN
```

Active Phase spectrum in LDL

The description of the spectrum table for the Active LDL modes is:

```
OBJECT                = L_PH_F_SPECTRUM_TABLE
  NAME                = " L_PH_F_SPECTRUM "
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = x
  COLUMNS             = 7
  ROW_BYTES           = y
  ^STRUCTURE          = "MIP_SPECTRUM_L_PO_F.FMT"
END_OBJECT            = L_PH_F_SPECTRUM_TABLE
```

The structure of the TABLE object for the LDL Power spectrum in Full sub-mode is described in the file MIP_SPECTRUM_L_PH_F.FMT as follows:

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_UT"
  DATA_TYPE             = TIME
  START_BYTE            = 1
  BYTES                 = 23
  UNIT                  = "N/A"
  DESCRIPTION           = "UTC Time (start of acquisition)
                           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           = "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                  = "MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 46
  BYTES                 = 3
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           LDL"
END_OBJECT              = COLUMN

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

OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_TYPE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 61
  BYTES                 = 5
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           PHASE "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "FREQUENCY"
  DATA_TYPE             = ASCII_INTEGER
```

```
  START_BYTE            = 68
  UNIT                  = "KILOHERTZ"
  FORMAT                = "I7"
  ITEMS                 = 24
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  DESCRIPTION           = "Frequency"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "PHASE"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 260
  ITEMS                 = 24
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  UNIT                  = "DEGREE"
  FORMAT                = "F7.2"
  DESCRIPTION           = "Phase"
END_OBJECT              = COLUMN
```

Passive Power spectrum

Full sub-mode

The description of the spectrum table for the Passive modes for the Full sub-mode is:

```
OBJECT                = P_PO_F_SPECTRUM_TABLE
  NAME                = " P_PO_F_SPECTRUM "
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = x
  COLUMNS             = 7
  ROW_BYTES           = y
  ^STRUCTURE          = "MIP_SPECTRUM_P_PO_F.FMT"
END_OBJECT            = P_PO_F_SPECTRUM_TABLE
```

The structure of the TABLE object for the Passive Power spectrum in Full sub-mode is described in the file MIP_SPECTRUM_P_PO_F.FMT as follows:

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_UT"
  DATA_TYPE             = TIME
  START_BYTE            = 1
  BYTES                 = 23
  UNIT                  = "N/A"
  DESCRIPTION           = "UTC Time (start of acquisition)
                           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           = "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                  = "MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 46
  BYTES                 = 7
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           PASSIVE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "SUB_MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 56
  BYTES                 = 6
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           FULL"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_TYPE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 65
  BYTES                 = 5
  UNIT                  = "N/A"
  MISSING_CONSTANT      = "XXXXX"
  DESCRIPTION           = "One possible value:
                           POWER"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "FREQUENCY"
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 72
  UNIT                  = "KILOHERTZ"
  FORMAT                = "I7"
  ITEMS                 = 96
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  DESCRIPTION           = "Frequency"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "POWER"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 840
  ITEMS                 = 96
```

```
  ITEM_BYTES              = 7
  ITEM_OFFSET             = 8
  UNIT                    = "DECIBEL"
  FORMAT                  = "F7.2"
  DESCRIPTION             = "Power
                             0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT              = COLUMN
```

Window sub-mode

The description of the spectrum table for the Passive modes for the Window sub-mode is:

```
OBJECT                  = P_PO_W_SPECTRUM_TABLE
  NAME                  = " P_PO_W_SPECTRUM "
  INTERCHANGE_FORMAT    = ASCII
  ROWS                  = x
  COLUMNS               = 7
  ROW_BYTES             = y
  ^STRUCTURE            = "MIP_SPECTRUM_P_PO_W.FMT"
END_OBJECT              = P_PO_W_SPECTRUM_TABLE
```

The structure of the TABLE object for the Passive Power spectrum in Full sub-mode is described in the file MIP_SPECTRUM_P_PO_W.FMT as follows:

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_UT"
  DATA_TYPE             = TIME
  START_BYTE            = 1
  BYTES                 = 23
  UNIT                  = "N/A"
  DESCRIPTION           = "UTC Time (start of acquisition)
                           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           = "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                  = "MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 46
  BYTES                 = 7
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
```

```
                          PASSIVE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  NAME                   = "SUB_MODE"
  DATA_TYPE              = CHARACTER
  START_BYTE             = 56
  BYTES                  = 6
  UNIT                   = "N/A"
  DESCRIPTION            = "One possible value:
                           WINDOW"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  NAME                   = "SPECTRUM_TYPE"
  DATA_TYPE              = CHARACTER
  START_BYTE             = 65
  BYTES                  = 5
  UNIT                   = "N/A"
  MISSING_CONSTANT       = "XXXXX"
  DESCRIPTION            = "One possible value:
                           POWER"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  NAME                   = "FREQUENCY"
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 72
  UNIT                   = "KILOHERTZ"
  FORMAT                 = "I7"
  ITEMS                  = 48
  ITEM_BYTES             = 7
  ITEM_OFFSET            = 8
  DESCRIPTION            = "Frequency"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  NAME                   = "POWER"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 456
  ITEMS                  = 48
  ITEM_BYTES             = 7
  ITEM_OFFSET            = 8
  UNIT                   = "DECIBEL"
  FORMAT                 = "F7.2"
  DESCRIPTION            = "Power
                           0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT              = COLUMN
```

Power sub-mode

The description of the spectrum table for the Passive modes for the Power sub-mode is:

```
OBJECT                = P_PO_P_SPECTRUM_TABLE
  NAME                = " P_PO_P_SPECTRUM "
  INTERCHANGE_FORMAT = ASCII
```

```
      ROWS                = x
      COLUMNS             = 7
      ROW_BYTES           = y
      ^STRUCTURE          = "MIP_SPECTRUM_P_PO_P.FMT"
    END_OBJECT            = P_PO_P_SPECTRUM_TABLE
```

The structure of the TABLE object for the Passive Power spectrum in Power sub-mode is described in the file MIP_SPECTRUM_P_PO_P.FMT as follows:

```
OBJECT                  = COLUMN
  NAME                  = "SPECTRUM_UT"
  DATA_TYPE             = TIME
  START_BYTE            = 1
  BYTES                 = 23
  UNIT                  = "N/A"
  DESCRIPTION           = "UTC Time (start of acquisition)
                           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           = "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                  = "MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 46
  BYTES                 = 7
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           PASSIVE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "SUB_MODE"
  DATA_TYPE             = CHARACTER
  START_BYTE            = 56
  BYTES                 = 6
  UNIT                  = "N/A"
  DESCRIPTION           = "One possible value:
                           POWER"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = SPECTRUM_TYPE
  DATA_TYPE             = CHARACTER
```

```
  START_BYTE            = 65
  BYTES                 = 5
  UNIT                  = "N/A"
  MISSING_CONSTANT      = "XXXXX"
  DESCRIPTION           = "Always equal to MISSING_CONSTANT
                           for POWER sub-mode"
  END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "FREQUENCY"
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 72
  UNIT                  = "KILOHERTZ"
  FORMAT                = "I7"
  ITEMS                 = 2
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  DESCRIPTION           = "Frequency
                           Central frequency of LF and HF parts:
                            220 kHz for LF part [  7 kHz -  448 kHz]
                           2554 kHz for HF part [476 kHz - 3584 kHz]"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = "POWER"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 88
  ITEMS                 = 2
  ITEM_BYTES            = 7
  ITEM_OFFSET           = 8
  UNIT                  = "DECIBEL"
  FORMAT                = "F7.2"
  DESCRIPTION           = "Power
                           0 dB = 0.6 microV*Hz**-0.5"
END_OBJECT              = COLUMN
```

4.3.5 Data product design of RPC-MIP configuration table data (level 3)

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

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                = x
```

```
  COLUMNS              = 21
  ROW_BYTES            = y
  ^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      = "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      = "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      = "Possible values:
                      TBL for Configuration table containing the operational
                      parameters which can be modified in the onboard software
                      CTL for Control sequence, used to get a detailed status
                      of the experiment (also containing the configuration table"

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/y , where:
                      x is the current number of the table in the PDS dataset
                      y is the maximum number of tables found in the PDS dataset"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = "TABLE_BYTES_HEX"
  DATA_TYPE        = CHARACTER
  START_BYTE       = 67
  BYTES            = 17
  DESCRIPTION      = "Configuration table, containing all the operational
```

```
                    parameters, given as 6 bytes in Hexadecimal format
                    (one link-packet between PIU and RPC-MIP), separated by
                    a blank character.
                    The description is given below :

                    byte 0
                                bits 4,3   : Interference frequency #1
                    byte 1
                                bits 4,3   : Interference frequency #2
                    byte 2
                                bits 4,3   : Interference frequency #3
                    byte 3
                                bits 7,6   : Transmission_level
                                bits 5,4   : Transmitter_odd_sweeps
                                bits 3,2   : Transmitter_even_sweeps
                                bits 1,0   : 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
                      i.e. frequency to be ignored during the on-boar
                      extremum detection 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
                      i.e. frequency to be ignored during the on-boar
                      extremum detection 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
                      i.e. frequency to be ignored during the on-boar
                      extremum detection 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       = "Level of the transmitted signal
                       Possible values: {1.000, 0.500, 0.250, 0.125}
                       1.000 for full level,
                          (156 mV RMS in MIP mode, 30 V RMS in LDL mode)
                       0.500 for nominal level,
                          (78 mV RMS in MIP mode, 15 V RMS in LDL mode)
                       0.250 for low level,
                          (39 mV RMS in MIP mode, 7.5 V RMS in LDL mode)
                       0.125 for 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       = "Transmitter configuration for odd sweeps (1, 3, ...)
                       Possible 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       = "Transmitter configuration for even sweeps (2, 4, ...)
                       Possible 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       = "SDL/LDL transmitter configuration:
                       Possible values: {MIP alone, LDL mode}
                       MIP alone for SDL
                       LDL mode for LDL"
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
                      Possible 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 Passive mode
                      0 dB = 0.6 microV*Hz**-0.5
                      Possible values: {2, 4}
                      2, for 16 values from 0 to 30 dB
                      4, for 16 values from 0 to 60 dB"
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
                      0 dB = 0.6 microV*Hz**-0.5
                      Possible values:
                      1
                      2
                      4
                      8"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = "SURVEY_BAND"
  DATA_TYPE        = ASCII_INTEGER
  START_BYTE       = 206
  BYTES            = 1
  UNIT             = "N/A"
  FORMAT           = "I1"
  DESCRIPTION      = "Frequency table used in Survey modes
                      Possible values: 0 to 7
                      Frequency tables are described below, with details on
                      bandwidth         resolution        number of steps

                      Table #0 (nominal) from 28 kHz to 3472 kHz, decomposed as:
                        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

                      Table #1 from 28 kHz to 665 kHz
                        28 - 665 kHz        7 kHz           92
```

```
                    Table #2 from 259 kHz to 896 kHz
                     259 - 896  kHz       7 kHz           92

                    Table #3 from 518 kHz to 1792 kHz
                     518 - 1792 kHz      14 kHz           92

                    Table #4 from 924 kHz to 3472 kHz
                     924 - 3472 kHz      28 kHz           92

                    Table #5 from 357 kHz to 987 kHz, decomposed as:
                      28 - 343  kHz       7 kHz           46
                     357 - 987  kHz      14 kHz           46

                    Table #6 from 28 kHz to 1582 kHz, decomposed as:
                      28 - 224  kHz       7 kHz           29
                     238 - 630  kHz      14 kHz           29
                     658 - 1582 kHz      28 kHz           34

                    Table #7 from 266 kHz to 2184 kHz, decomposed as:
                     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     = "Frequency table used in Sweep modes
                     Possible values: 0 to 7
                     Frequency tables are described below, with details on
                     bandwidth         resolution        number of steps

                    Table #0 (nominal) from 28 kHz to 3472 kHz, decomposed as:
                      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

                    Table #1 from 28 kHz to 665 kHz
                      28 - 665 kHz       7 kHz           92

                    Table #2 from 259 kHz to 896 kHz
                     259 - 896  kHz       7 kHz           92

                    Table #3 from 518 kHz to 1792 kHz
                     518 - 1792 kHz      14 kHz           92

                    Table #4 from 924 kHz to 3472 kHz
                     924 - 3472 kHz      28 kHz           92

                    Table #5 from 357 kHz to 987 kHz, decomposed as:
                      28 - 343  kHz       7 kHz           46
                     357 - 987  kHz      14 kHz           46

                    Table #6 from 28 kHz to 1582 kHz, decomposed as:
                      28 - 224  kHz       7 kHz           29
                     238 - 630  kHz      14 kHz           29
                     658 - 1582 kHz      28 kHz           34
```

```
                    Table #7 from 266 kHz to 2184 kHz, decomposed as:
                     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      = "MIP watchdog status
                     Possible 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      = "Telemetry rate
                     Possible 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      = "MIP sequence number
                     Possible 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
                     Possible values:
                     normal LDL
                     mixed LDL"
END_OBJECT         = COLUMN
```

4.3.6 Data product design of RPC-MIP calibrated HK data (level 3)

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   = "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   = "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 in Passive mode, LF part
                  averaged over [7 kHz - 224 kHz]
                  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 in Passive mode, HF part
```

```
                averaged over [479 kHz - 3584 kHz]
                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 = "R2 (reception electrode #2) temperature"
END_OBJECT    = COLUMN
```

4.3.7 Data product design of RPC-MIP derived density data (level 5)

Level 5 RPC-MIP density contains plasma electron density derived from the analysis of RPC-MIP power and phase spectra, with PDS detached labels. Note that the derivation process is not always possible, so that each RPC-MIP acquired spectrum Is not always associated with a RPC-MIP density value. The density time tag is recorded in the first colum and corresponds to the center of the associated spectrum acquisition period. The time tag of the spectrum, corresponding to the start of the acquistion is given in a separate column.

The description of the table for level 5 derived density is:

```
OBJECT                = DENSITY_TABLE
  NAME                = "CALIBRATED_HK"
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = x
  COLUMNS             = 11
  ROW_BYTES           = y
  ^STRUCTURE          = "MIP_DENSITY.FMT"
END_OBJECT            = DENSITY_TABLE
```

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

```
OBJECT            = COLUMN
 COLUMN_NUMBER    = 1
 NAME             = "ELECTRON_DENSITY_UTC_TIME"
 DATA_TYPE        = TIME
 START_BYTE       = 1
 BYTES            = 23
 FORMAT           = "A23"
 DESCRIPTION      = "UTC time of the plasma electron density, in PDS standard
                     format YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
 COLUMN_NUMBER    = 2
 NAME             = "DELTA_TIME"
 DATA_TYPE        = ASCII_REAL
 START_BYTE       = 25
 BYTES            = 5
 UNIT             = "S"
 FORMAT           = "F5.3"
 DESCRIPTION       = "Each RPCMIP measurement is acquired and averaged on-
board
                     during a certain duration.
                     DELTA_TIME  is  half  the  acquisition  duration  (in
seconds)"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
 COLUMN_NUMBER    = 3
 NAME             = "ELECTRON_DENSITY"
 DATA_TYPE        = ASCII_REAL
 START_BYTE       = 31
 BYTES            = 9
 UNIT             = "CM^-3"
 FORMAT           = "F9.2"
 DESCRIPTION      = "Plasma electron density"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
 COLUMN_NUMBER    = 4
 NAME             = "UNCERTAINTY_ELECTRON_DENSITY"
 DATA_TYPE        = ASCII_REAL
 START_BYTE       = 41
 BYTES            = 9
 UNIT             = "CM^-3"
 FORMAT           = "F9.2"
 DESCRIPTION      = "Estimated uncertainty of the plasma electron density"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
 COLUMN_NUMBER    = 5
 NAME             = "QUALITY_SNR"
 DATA_TYPE        = ASCII_REAL
 START_BYTE       = 51
 BYTES            = 4
```

```
 UNIT                = "N/A"
 FORMAT              = "F4.2"
 DESCRIPTION         = "Local quality of the plasma frequency signature in the
                        spectrum between 0 (worst quality) and 1 (best quality)
                        see RPCMIP User Guide for more details"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
 COLUMN_NUMBER       = 6
 NAME                = "QUALITY_SPECTRUM"
 DATA_TYPE           = ASCII_REAL
 START_BYTE          = 56
 BYTES               = 4
 UNIT                = "N/A"
 FORMAT              = "F4.2"
 DESCRIPTION         = "Quality describing the spectrum complexity between
                        0 (worst quality) and 1 (best quality)
                        see RPCMIP User Guide for more details"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
 COLUMN_NUMBER       = 7
 NAME                = "DETECTION_RATE"
 DATA_TYPE           = ASCII_REAL
 START_BYTE          = 61
 BYTES               = 4
 UNIT                = "N/A"
 FORMAT              = "F4.2"
 DESCRIPTION        = "Density detection rate in a 320 sec (10 operation cycles)
                        window centered on the considered density value
                        between 0 (worst quality) and 1 (best quality)
                        see RPCMIP User Guide for more details"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
 COLUMN_NUMBER       = 8
 NAME                = "SPECTRUM_UTC_TIME"
 DATA_TYPE           = TIME
 START_BYTE          = 66
 BYTES               = 23
 FORMAT              = "A23"
 DESCRIPTION         = "UTC start time of the spectrum used for the derivation
of
                        the electron density, in PDS standard format
                        YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
 COLUMN_NUMBER       = 9
 NAME                = "INSTRUMENT_MODE"
 DATA_TYPE           = CHARACTER
 START_BYTE          = 91
 BYTES               = 14
 UNIT                = "N/A"
 FORMAT              = "A14"
 DESCRIPTION         = "Instrument mode at the time of acquisition (LDL, SDL)"
END_OBJECT           = COLUMN
```

```
OBJECT              = COLUMN
 COLUMN_NUMBER      = 10
 NAME               = "TRANSMISSION_LEVEL"
 DATA_TYPE          = CHARACTER
 START_BYTE         = 108
 BYTES              = 4
 UNIT               = "N/A"
 FORMAT             = "A4"
 DESCRIPTION        = "Instrument transmission level (Full, 1/2, 1/4, 1/8)"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
 COLUMN_NUMBER      = 11
 NAME               = "TMRATE"
 DATA_TYPE          = CHARACTER
 START_BYTE         = 115
 BYTES              = 11
 UNIT               = "N/A"
 FORMAT             = "A11"
 DESCRIPTION        = "Instrument telemetry rate (Normal rate, Burst rate)"
END_OBJECT          = COLUMN
```

4.3.8 Data product design of RPC-MIP/RPC-LAP cross-calibrated density data (level 5)

Level 5 RPC-MIP/RPC-LAP density contains plasma electron density derived from the cross-calibration between RPC-MIP density and RPC-LAP measurements, with PDS detached labels. Note that the derivation process is not always possible, so that the RPC-MIP/RPC-LAP density coverage and time resolution are not identical to RPC-MIP density. The cross-calibrated density time tag is recorded in the first colum and corresponds to the time of the RPC-LAP measurement used as input of the corss-calibration process.

The description of the table for level 5 cross-calibrated density is:

```
OBJECT                = PLASMA_DENSITY_TABLE
  NAME                = "PLASMA_DENSITY"
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = x
  COLUMNS             = 9
  ROW_BYTES           = y
  ^STRUCTURE          = "MIPLAP_PLASMA_DENSITY.FMT"
END_OBJECT            = PLASMA_DENSITY_TABLE
```

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

```
OBJECT              = COLUMN
 COLUMN_NUMBER      = 1
 NAME               = "PLASMA_DENSITY_UTC_TIME"
 DATA_TYPE          = TIME
 START_BYTE         = 1
 BYTES              = 23
```

```
 FORMAT              = "A23"
 DESCRIPTION         = "UTC time of the plasma density, in PDS standard
                        format YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
 COLUMN_NUMBER       = 2
 NAME                = "DELTA_TIME"
 DATA_TYPE           = ASCII_REAL
 START_BYTE          = 25
 BYTES               = 6
 UNIT                = "S"
 FORMAT              = "F6.4"
 DESCRIPTION         = "Estimated uncertainty of the plasma density UTC Time"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
 COLUMN_NUMBER       = 3
 NAME                = "PLASMA_DENSITY"
 DATA_TYPE           = ASCII_REAL
 START_BYTE          = 32
 BYTES               = 9
 UNIT                = "CM^-3"
 FORMAT              = "F9.2"
 DESCRIPTION         = "Plasma density"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
 COLUMN_NUMBER       = 4
 NAME                = "UNCERTAINTY_ELECTRON_DENSITY"
 DATA_TYPE           = ASCII_REAL
 START_BYTE          = 42
 BYTES               = 9
 UNIT                = "CM^-3"
 FORMAT              = "F9.2"
 DESCRIPTION         = "Estimated uncertainty of the plasma electron density"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
 COLUMN_NUMBER       = 5
 NAME                = "QUALITY"
 DATA_TYPE           = ASCII_REAL
 START_BYTE          = 52
 BYTES               = 4
 UNIT                = "N/A"
 FORMAT              = "F4.2"
 DESCRIPTION         = "Quality of the cross-calibration process.
                        Value ranges from 0 (worst quality) to 1 (best
quality).
                        See RPCMIP User Guide and RPCMIP/RPCLAP Cross-
Calibration
                        Report for more details"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
 COLUMN_NUMBER       = 6
 NAME                = "LAP_MODE"
```

```
 DATA_TYPE          = CHARACTER
 START_BYTE         = 58
 BYTES              = 2
 UNIT               = "N/A"
 FORMAT             = "A2"
 DESCRIPTION        = "RPC-LAP measurement used as input for the cross-
calibration.
                      Possible values are:
                        I1 for ion current collected by RPC-LAP probe 1
                        I2 for ion current collected by RPC-LAP probe 2
                        V1 for floating potential collected by RPC-LAP probe
1
                        V2 for floating potential collected by RPC-LAP probe
2"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
 COLUMN_NUMBER      = 7
 NAME               = "LAP_MACRO"
 DATA_TYPE          = ASCII_INTEGER
 START_BYTE         = 62
 BYTES              = 3
 UNIT               = "N/A"
 FORMAT             = "I3"
 DESCRIPTION        = "RPC-LAP macro_ID (three digits):
                       each RPC-LAP macro_ID is typical of particular
settings
                       of the two RPC-LAP probes.
                       See RPC-LAP documentation and RPCMIP/RPCLAP Cross-
Calibration
                       Report for more details"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
 COLUMN_NUMBER      = 8
 NAME               = "MIP_MODE"
 DATA_TYPE          = CHARACTER
 START_BYTE         = 67
 BYTES              = 14
 UNIT               = "N/A"
 FORMAT             = "A14"
 DESCRIPTION        = "RPC-MIP instrument mode at the time of acquisition
                       (SDL_E1, SDL_E2, SDL_Phased, SDL_AntiPhased)"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
 COLUMN_NUMBER      = 9
 NAME               = "MIP_TMRATE"
 DATA_TYPE          = CHARACTER
 START_BYTE         = 84
 BYTES              = 11
 UNIT               = "N/A"
 FORMAT             = "A11"
 DESCRIPTION        = "RPC-MIP instrument telemetry rate (Normal rate, Burst
rate)"
END_OBJECT          = COLUMN
```

5. References

Beghin, C. (1995). Series expansion of electrostatic potential radiated by a point source in isotropic Maxwellian plasma. *Radio Science*, *30*, 307–322. https://doi.org/10.1029/94RS03167

Gilet, N., Henri, P., Wattieaux, G., Cilibrasi, M., and Béghin, C. (2017). Electrostatic potential radiated by a pulsating charge in a two-electron temperature plasma. Radio Science, 52, 1432–1448. https://doi.org/10.1002/2017RS006294

Odelstad E., A.I. Eriksson, F. Johansson, E. Vigren, P. Henri, N. Gilet, K. Heritier, X. Vallières, M. Rubin, and M. André. (2018), Ion velocity and electron temperature inside and around the diamagnetic cavity of comet 67P, J. Geophys. Res. Space Physics, 123. https://doi.org/10.1029/2018JA025542

Trotignon J. G., Michau, J.-L., Lagoutte D., et al. (2007), RPC-MIP: The Mutual Impedance Probe of the Rosetta Plasma Consortium, Space Science Rev, 128, 7133-728. https://doi.org/10.1007/s11214-006-9005-1

A.1 Appendix 1: Example of directory listing of dataset RO-CAL-RPCMIP-3-CR2-V1.0

```
RO-CAL-RPCMIP-3-CR2-V1.0
|
|---AAREADME.TXT
|
|---CATALOG
|   |---CATINFO.TXT
|   |---DATASET.CAT
|   |---INST.CAT
|   |---INSTHOST.CAT
|   |---MISSION.CAT
|   |---PERSON.CAT
|   |---REF.CAT
|   |---SOFTWARE.CAT
|
|---DATA
|   |---CALIBRATED
|       |---2005
|       |   |---10
|       |       |---RPCMIPH3XXX0510031922_00039.LBL
|       |       |---RPCMIPH3XXX0510031922_00039.TAB
|       |       |---RPCMIPS3ESF0510031923_00038.LBL
|       |       |---RPCMIPS3ESF0510031923_00038.TAB
|       |       |---RPCMIPS3ESP0510031933_00028.LBL
|       |       |---RPCMIPS3ESP0510031933_00028.TAB
|       |       |---RPCMIPS3HSF0510031933_00028.LBL
|       |       |---RPCMIPS3HSF0510031933_00028.TAB
|       |       |---RPCMIPS3WSF0510031933_00028.LBL
|       |       |---RPCMIPS3WSF0510031933_00028.TAB
|       |       |---RPCMIPS3WSM0510031933_00027.LBL
|       |       |---RPCMIPS3WSM0510031933_00027.TAB
|       |       |---RPCMIPS3XXX0510031923_00009.LBL
|       |       |---RPCMIPS3XXX0510031923_00009.TAB
|       |---2006
|           |---03
|           |   |---RPCMIPH3XXX0603070740_00039.LBL
|           |   |---RPCMIPH3XXX0603070740_00039.TAB
|           |   |---RPCMIPS3ESF0603070741_00038.LBL
|           |   |---RPCMIPS3ESF0603070741_00038.TAB
|           |   |---RPCMIPS3ESP0603070751_00028.LBL
|           |   |---RPCMIPS3ESP0603070751_00028.TAB
|           |   |---RPCMIPS3HSF0603070751_00028.LBL
|           |   |---RPCMIPS3HSF0603070751_00028.TAB
|           |   |---RPCMIPS3WSF0603070751_00028.LBL
|           |   |---RPCMIPS3WSF0603070751_00028.TAB
|           |   |---RPCMIPS3WSM0603070751_00027.LBL
|           |   |---RPCMIPS3WSM0603070751_00027.TAB
|           |   |---RPCMIPS3XXX0603070741_00009.LBL
|           |   |---RPCMIPS3XXX0603070741_00009.TAB
|           |---07
|               |---RPCMIPH3XXX0607040012_07168.LBL
|               |---RPCMIPH3XXX0607040012_07168.TAB
|               |---RPCMIPS3ESF0607040013_07166.LBL
|               |---RPCMIPS3ESF0607040013_07166.TAB
|               |---RPCMIPS3ESP0607040013_07167.LBL
|               |---RPCMIPS3ESP0607040013_07167.TAB
|               |---RPCMIPS3HSF0607040013_07166.LBL
|               |---RPCMIPS3HSF0607040013_07166.TAB
|               |---RPCMIPS3WSF0607040013_07166.LBL
```

```
│                   ├──RPCMIPS3WSF0607040013_07166.TAB
│                   ├──RPCMIPS3WSM0607040013_07166.LBL
│                   ├──RPCMIPS3WSM0607040013_07166.TAB
│                   ├──RPCMIPS3XXX0607040012_00000.LBL
│                   └──RPCMIPS3XXX0607040012_00000.TAB
│
├──DOCUMENT
│   ├──BOARD_PROC_34.LBL
│   ├──BOARD_PROC_34.PDF
│   ├──DOCINFO.TXT
│   ├──MIP_EXP_OVERVIEW.LBL
│   ├──MIP_EXP_OVERVIEW.PDF
│   ├──MIP_PIU_INTERF_33.LBL
│   ├──MIP_PIU_INTERF_33.PDF
│   ├──RO_RPCMIP_LOGBOOK_004.LBL
│   ├──RO_RPCMIP_LOGBOOK_004.TXT
│   ├──RPC_UM_218.LBL
│   ├──RPC_UM_218.PDF
│   ├──RPC_USER_GUIDE.LBL
│   ├──RPC_USER_GUIDE.PDF
│   ├──RPC-MIP-UG-LPC2E.LBL
│   └──RPC-MIP-UG-LPC2E.PDF
│
├──INDEX
│   ├──INDEX.LBL
│   ├──INDEX.TAB
│   └──INDXINFO.TXT
│
└──LABEL
    ├──LABINFO.TXT
    ├──MIP_CALIBRATED_HK.FMT
    ├──MIP_CONFIG_TABLE.FMT
    ├──MIP_SPECTRUM_P_PO_F.FMT
    ├──MIP_SPECTRUM_P_PO_P.FMT
    ├──MIP_SPECTRUM_S_SS_PH_F.FMT
    ├──MIP_SPECTRUM_S_SS_PO_F.FMT
    └──MIP_SPECTRUM_S_SS_PO_M.FMT
    │
    └──VOLDESC.CAT
```

A.2 Appendix 2: Example of PDS label for RPC-MIP level 3 data product

```
PDS_VERSION_ID          = PDS3

LABEL_REVISION_NOTE     = "2017-01-11, SONC, version 1.0
                           2018-04-24, LPC2E, N. TRAORE, version 2.0"

/* PVV version 3.13 */

/*                       Calibrated HK data (Level 3)                      */

/* FILE CHARACTERISTIC DATA ELEMENTS */

RECORD_TYPE             = FIXED_LENGTH
RECORD_BYTES            = 69
FILE_RECORDS            = 35100

FILE_NAME               = "RPCMIPH3XXX1411262359_18719.TAB"

/* DATA OBJECT POINTERS  */

^CALIBRATED_HK_TABLE  = ("RPCMIPH3XXX1411262359_18719.TAB",1 <BYTES>)

DATA_SET_ID             = "RO-C-RPCMIP-3-ESC1-V3.0"
DATA_SET_NAME           = "ROSETTA-ORBITER 67P RPCMIP 3 ESC1 V3.0"
DATA_SET_PARAMETER_NAME = "HOUSEKEEPING PARAMETERS"

CALIBRATION_SOURCE_ID   = "RPCMIP"
PRODUCT_ID              = "RPCMIPH3XXX1411262359_18719"
PRODUCT_CREATION_TIME   = 2018-05-03T17:50:53.000

MISSION_ID              = ROSETTA
MISSION_NAME            = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME      = "COMET ESCORT 1"
INSTRUMENT_HOST_ID      = RO
INSTRUMENT_HOST_NAME    = "ROSETTA-ORBITER"
OBSERVATION_TYPE        = "COMET ESCORT 1"

PRODUCT_TYPE            = RDR
START_TIME              = 2014-11-26T23:59:30.803
STOP_TIME               = 2014-12-09T23:58:59.174
SPACECRAFT_CLOCK_START_COUNT = "1/375667099.15681"
SPACECRAFT_CLOCK_STOP_COUNT  = "1/376790267.15681"

PRODUCER_ID             = {"LPC2E", "SONC"}
PRODUCER_FULL_NAME      = {"LAB DE PHYSIQUE ET CHIMIE DE
                           L'ENVIRONNEMENT ET DE L'ESPACE",
                          "SCIENCE OPERATIONS AND NAVIGATION CENTER"}
PRODUCER_INSTITUTION_NAME = {"CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE",
                             "CNES"}

INSTRUMENT_ID           = RPCMIP
INSTRUMENT_NAME         = "ROSETTA PLASMA CONSORTIUM - MUTUAL IMPEDANCE PROBE"
INSTRUMENT_TYPE         = "PLASMA ANALYZER"
INSTRUMENT_MODE_ID      = "N/A"
INSTRUMENT_MODE_DESC    = "N/A"
^RPC_SCIENCE_USAGE_DESC    = "RPC_USER_GUIDE.PDF"
^RPCMIP_SCIENCE_USAGE_DESC = "RPC-MIP-UG-LPC2E.PDF"

TARGET_NAME             = "67P/CHURYUMOV-GERASIMENKO 1 (1969 R1)"
TARGET_TYPE             = "COMET"
```

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


/* GEOMETRY PARAMETERS  */

/* SPACECRAFT LOCATION: Position <km> */
SC_SUN_POSITION_VECTOR = ( -249166381.0, 300781450.5, 186352377.7)
/* TARGET PARAMETERS: Position <km>, Velocity <m/s> */
SC_TARGET_POSITION_VECTOR = (        -23.4,       -18.3,         5.6)
SC_TARGET_VELOCITY_VECTOR = ( -0.057, 0.032,-0.135)
/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */
SPACECRAFT_ALTITUDE =          28.3 <km>
SUB_SPACECRAFT_LATITUDE =    -5.68 <deg>
SUB_SPACECRAFT_LONGITUDE =   120.97 <deg>
NOTE = "The values of the keywords SC_SUN_POSITION_VECTOR,
        SC_TARGET_POSITION_VECTOR and SC_TARGET_VELOCITY_VECTOR
        are related to the equatorial J2000 inertial frame (EMEJ200).
        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 <m/s>, angles in <deg>"


/* DATA OBJECT DEFINITION  */

OBJECT                  = CALIBRATED_HK_TABLE
  NAME                   = "CALIBRATED_HK"
  INTERCHANGE_FORMAT     = ASCII
  ROWS                   = 35100
  COLUMNS                = 7
  ROW_BYTES              = 69
  ^STRUCTURE             = "MIP_CALIBRATED_HK.FMT"
END_OBJECT              = CALIBRATED_HK_TABLE

END
```