European Space Agency
Research and Science Support Department
Planetary Missions Division

ROSETTA - CONSERT

To Planetary Science Archive Interface Control Document

RO-OCN-IF-3800

Issue 2.1

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Distribution List

Recipient	Organisation	Recipient

Change Log

Date	Sections Changed	Reasons for Change
21/12/2010		Delivery of Issue 1.0 to PSA after peer review
26/05/2015	*Updated:* *2.4.3 In-Flight data products* *2.4.5 Ancillary Data Usage* *4.2 Datasets, Definition and Content* *Added:* *3.2.2.2.5 Spacecraft Clock Count in PDS Labels* *Deleted:* *3.4.3.4.2 Geometric Index File*	Delivery of Issue 1.1 updated for the comet phase
04/01/2016	*Added:* *4.3.2 Data Product Design (Level3) - Preliminary*	Delivery of Issue 1.2 for CONSERT L3 preliminary description
16/12/2016	*Modified:* *[All] Structure of the document to keep consistency with level 3 description* *[All] CONSERT team review for L2* *Added:* *App7 on raw data conversion functions*	Delivery of Issue 2.0 for CONSERT L2 final delivery and L3 preparation. Switch to v2.0 of the document due to the change in structure.
16/01/2017	Compression code put into the DOCUMENT folder instead of DATA	Delivery 2.1 for CONSERT L2.

TBD ITEMS

Section	Description
5	CONSERT Level 3 Specifications and Design
6	CONSERT Level 4 Specifications and Design

Table Of Contents

1 Introduction

1.1 Purpose and Scope

The purpose of this EAICD (Experimenter to Planetary Science Archive Interface Control Document) is twofold. First it provides users of the CONSERT instrument with detailed description of the product and a description of how it was generated, including data sources and destinations. Secondly, the EAICD describes the interface to the Planetary Science Archive (PSA) of ESA and is the official document between each experimenter team and the PSA.

This version of EAICD present the Level 2 CONSERT archive products. It will be updated with upper level deliveries.

1.2 Archiving Authorities

The Planetary Data System Standard is used as archiving standard by

- NASA for U.S. planetary missions, implemented by PDS

  ESA for European planetary missions, implemented by the Research and Scientific Support Department (RSSD) of ESA

1.3 Contents

This document describes the data flow of the CONSERT instrument on ROSETTA from the s/c until the insertion into the PSA. 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.

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

1.4 Intended Readership

The staff of the Planetary Science Archive design team and any potential user of the CONSERT data.

1.5 Applicable Documents

AD 1. Planetary Data System Data Preparation Workbook, February 17, 1995, Version 3.1, JPL, D-7669, Part1
AD 2. Planetary Data System Standards Reference, August 1, 2003, Version 3.6, JPL, D-7669, Part 2
AD 3. Consert User Manual Orbiter RO-OCN-TN-3044
AD 4. Consert User Manual Lander RO-LCN-TN-3048
AD 5. Consert Data Format RO-OCN-TN-3823
AD 6. Mission Calender RO-ESC-TN-5026
AD 7. Consert experiment ; description and performances in view of the new targets. Rosetta. The new Rosetta targets. W. Kofman, A. Herique, J-P. Goutail, and Consert team. Edited by L. Colangeli et al., Kluwer Academic Publishers, 2004
AD 8. ROSETTA MISSION: Surface Science Instruments for Champollion and Roland, Comet Nucleus Sounding

Experiment by Radio wave Transmission CONSERT, volume I, Investigation and Technical Plan

AD 9. ROSETTA Archive Conventions RO-EST-TN-3372 Issue 9, Rev. 0, 20 Oct 2015

AD 10. CDMS Command and Data Management System - Subsystem Specification RO-LCD-SP-3101 29/08/2001, Issue 3, Rev. 5

AD 11. Rosetta Time handling RO-EST-TN-3165, issue 1 rev 0, February 9, 2004

AD 12. CDMS Command and Data Management System - Operation Manual RO-LCD-SW-3402 12/02/2001, Issue 1, Rev. 2

AD 13. DDID- Data Delivery Interface Document RO-ESC-IF-5003 Issue B6 23/10/2003

AD 14. ROSETTA Archive Generation, Validation and Transfer Plan, January 10, 2006, Issue 2, Rev. 3, RO-EST-PL-5011

AD 15. Calibration FMO-FSL at Kourou, November 01, 2003, Issue 1, Rev.0, RO-CN-TR-3805

AD 16. The CONSERT instrument for the ROSETTA mission, Advances in Space Research, Volume 24, Issue 9, 1999, pages 1115-1126, Y. Barbin et al.

AD 17. The CONSERT operations planning process for the Rosetta mission, Y Rogez & al., Acta Astronautica, Volume 125, August–September 2016, Pages 212-233, ISSN 0094-5765, http://dx.doi.org/10.1016/j.actaastro.2016.03.010.

1.6 Relationships to Other Interfaces

N/A

1.7 Acronyms and Abbreviations

AD	Applicable Document
APID	Application Process IDentifier.
CDMS	Command and Data Management System
CIVA	Cometary Infrared and Visible Analyser
CNES	Centre National d'Etudes Spatiales
CONSERT	Comet Nucleus Sounding Experiment by Radiowave Transmission
DN	Digital Number
DDS	Data Delivery System (ESOC server)
DECW	Data Error Control Word
EAICD	Experiment Archive Interface Control Document
ESA	European Space Agency
ESOC	European Space Operation Center
ESS	Electrical Support System
ESTEC	European Space Research and Technology Center
GRM	Ground Reference Model
HK	Housekeeping
IPAG	*Institut de Planétologie et d'Astrophysique de Grenoble*
LPG	Former Laboratoire de Planétologie de Grenoble (now IPAG)
MJT	Modified Julian Time
OBDH	On Board Data Handling
OBT	On Board Time
NAIF	Navigation Ancillary Information Facility
PDS	Planetary Data System
PECW	Packet Error Control Word
PI	Principal Investigator
PID	Process Identifier
PSA	Planetary Science Archive
PVV	PSA Volume Verifier
RF	Radio Frequency
S/C	Spacecraft
SCET	Spacecraft Elapsed Time
SFDU	Standard Formatted Data Unit
SONC	Science Operations and Navigation Center (CNES Toulouse)

1.8 Contact Names and Addresses

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

2.1 Scientific Objectives

The scientific objectives of the CONSERT experiment on the ROSETTA mission are described in the original proposal (see AD 8) and in a paper (see AD 16). The purpose of the experiment is to determine the main dielectric properties from the propagation delay and, through modelling, to set constraints on the cometary composition (materials, porosity…) to detect large-size structures (several tens of meters) and stratification, to detect and characterize small-scale irregularities within the nucleus. A detailed analysis of the radio-waves which have passed through all or parts of the nucleus puts real constraints on the materials and on inhomogeneities and helps to identify blocks, gaps or voids. From this information we attempt to answer some fundamental questions of cometary physics: How is the nucleus built up? Is it homogeneous, layered or composed of accreted blocks (cometesimals, boulders)? What is the nature of the refractory component? Is it chondritic as generally expected or does it contain inclusions of unexpected electromagnetic properties? With the answer to these questions, it should also be possible to provide answers to the basic question of the formation of the comet. Did it form directly from unprocessed interstellar grain-mantle particles or from grains condensed in the presolar nebular? Did the accretion take place in a multi step process leading first to the formation of cometesimals which then collided to form a kilometre size body?

2.2 Instrument Design

Our experiment concerns the rough tomography of the comet nucleus performed by the CONSERT instrument (COmet Nucleus Sounding Experiment by Radiowave Transmission). This tomography is not a full tomography because it will be performed on a limited number of slices with only one mobile and one fixed sensor. It works as a time domain transponder between one module which lands on the comet surface (Lander) and another which flies around the comet (Orbiter). *Figure 1* gives a schematic diagram of the experiment which is detailed in AD 16. Basically, a 90 MHz sinusoidal waveform is phase modulated by a pseudorandom code or PSK (Phase Shift Keying) Coding. Such frequency, in the radio range, is expected to minimize the losses during the propagation inside the comet material and the generated pulse code maximizes the signal to noise ratio. In these experimental conditions great attempt is made on the good measurement of the mean dielectric properties and on the detection of large size embedded structures or small irregularities within the comet nucleus.

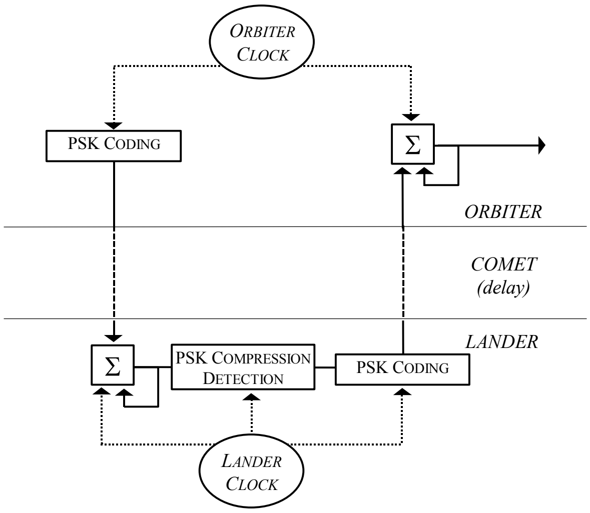


Figure 1 : Block diagram of the CONSERT experiment. The coded signal is emitted from the Orbiter. The Lander makes a coherent addition and a detection of the correlation principal peak. A clean coded signal is finally emitted with the found delay. The Orbiter accumulates the signal and send it to the earth (via the satellite interface).

The complete CONSERT experiment is composed of:

- One Orbiter part (Electronics, antenna, harness)
- One Lander part (Electronics, antennas, harness)

Each scientific measurement sequence (called scanning sequence) involves the orbiter and the lander parts, by transmitting radio waves through the comet nucleus.
The duration of a scanning sequence is typically of the order of one revolution around the nucleus. It should correspond to the time when the Lander and the orbiter are separated by the comet.

Each measurement sequence have to begin in visibility orbiter-lander to perform the synchronization between the two units. This is the tuning phase. Between visibility and occultation, CONSERT instrument is waiting, not taking measurements. Some minutes before the occultation occurs, CONSERT starts its scientific measurement, acquiring the signal passing through the comet nucleus. This is the “ping-pong” phase of the CONSERT measurement sequence.

In a first order approach, one can consider that the number of samples taken around a spherical comet for a full rotation is given by the following formula:

2 * PI * Radius of comet / (lambda/2)

Where lambda is wavelength

During the scanning sequence, for a circular comet with a 750m radius, about 3000 individual measurements, called soundings are taken. The individual duration of this sounding is less than one second.

The general structure of the CONSERT operational scenario does not depend on the comet type that is explored during the Rosetta mission. But a certain amount of the parameters depend on the shape and size of the comet nucleus and of the orbit of the spacecraft and nucleus rotation.

When the comet nucleus was still unknown, we had to make assumptions on the CONSERT operation scenarios. When the information about the comet shape and dynamical parameters where available, we had a more complete approach described in [AD 17].

The initial first order assumptions used to derive the numerical parameters are in this document:

• Radius of the comet nucleus: 500 to 1500 m;	**Nominal radius = 750 m**
• Spacecraft orbit period around the comet:	Minimum 3 hours
	Nominal: 10 hours
	Maximum: 30 hours
• Number of CONSERT soundings during one orbit:	3000

Parameters:

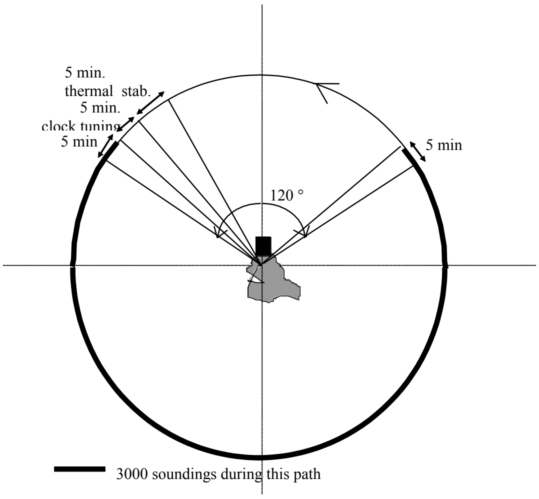
- T ON $_O$: CONSERT /Orbiter switch-on time (in UT)
- T ON $_L$: CONSERT /Lander switch-on time (in UT)
- TUNESTART $_O$: Start time for CONSERT/Orbiter Clock Tuning mode (in UT)
- TUNESTART $_L$: Start time for CONSERT/Lander Clock Tuning mode (in UT)
- SOUND START: CONSERT/Orbiter & CONSERT/Lander sounding start time (in UT)
- NB SOUND: total number of soundings performed by CONSERT/Orbiter & CONSERT/Lander
- DELTA SOUND: period between each sounding

The Rosetta Orbiter Spacecraft should be able to initiate the CONSERT Orbiter instrument Switch-on, Switch-off and Clock tuning time-tagged procedures with a time accuracy of 10 seconds with respect to ground UT.

The Rosetta Lander Spacecraft should be able to initiate the CONSERT Lander instrument Switch-on, Switch-off and Clock tuning time-tagged procedures with a time accuracy of 10 seconds with respect to ground UT.

Typical values of these numbers:

We suppose here that the soundings are made during the two third orbit 'behind' the comet and 5 minutes before and after this 2/3 turn.



T ON o: calculated on ground, based on orbit

T ON $_L$: calculated on ground, based on orbit

TUNESTART $_O$ = T ON o + 5 minutes

TUNESTART $_L$ = T ON $_L$ + 5 minutes

And: TUNESTART $_O$ = TUNESTART $_{L+}$ 30 seconds (+/- 20 seconds)

SOUNDSTART = TUNESTART + 5minutes

The time accuracy that the experiment requires defines the necessary clock stability. This accuracy is given by the time-transponder structure of CONSERT. The simplest explanation of this technique is to imagine Philae as a simple reflector of the signal coming from Rosetta. The signal is thus measured in the time reference of Rosetta and this enables one to relax the constraints on the stability of clocks. It is technically impossible to use Philae as a simple reflector; but it is possible to use it as a delayed active reflector.

In practice, both the orbiter and Philae have their own clocks. Both clocks are tuned and they drift during the experiment. This small frequency shift induces a drift of Philae internal time relative to the orbiter one. This drift is by-passed by the in-time transponder structure of the experiment.

- During a single measurement sequence the orbiter transmits a long signal lasting 200 ms but Philae receive the signal for only 26 ms. This localisation of Philae's receiving window within the orbiter transmitting window has to be preserved during the whole of the CONSERT measurement cycle (up to 10h). This is the first constraint on the clock accuracy.

- The transmitted signal is periodic and consists of the repetition of a 25.5µs-long Binary Phase Shift Keying (hereafter BPSK) code. At Philae, this signal is coherently accumulated with this period of 25.5µs. To have a coherent summation during the 26ms receive window, the lander carrier phase used for the signal demodulation has to remain coherent with the orbiter one. This is the second clock accuracy constraint, improving the signal to noise ratio.

- At Philae, the received signal is convolved with the BPSK code and the arrival time of the main propagation path is measured. This epoch is the time reference for the second wave transmission: a known delay after this epoch, Philae transmits the BPSK signal lasting 200 ms which is received during 26 ms and accumulated by the orbiter. This signal is processed on ground. The arrival time of the main propagation path corresponds to twice the main propagation delay (one for each propagation way) plus the known delay added by the lander. This is because the lander was synchronized on the main path (shortest one) and due to the fact that on the time scale of measurements the orbiter is almost stationary, the paths between Philae and the orbiter and the orbiter and Philae are the same. This transponder processing delay has to be known with accuracy compliant with the scientific requirements on the propagation delay accuracy (third clock constraint).

To summarize, the propagation from the orbiter to Philae synchronizes both time systems while the scientific measurement is in the propagation from Philae to the orbiter. These constraints on the clocks stability allow a relaxation to $\Delta f/f = 10^{-7}$ during a 10-hour period. The time diagram for the synchronization principle is shown *Figure 2*.

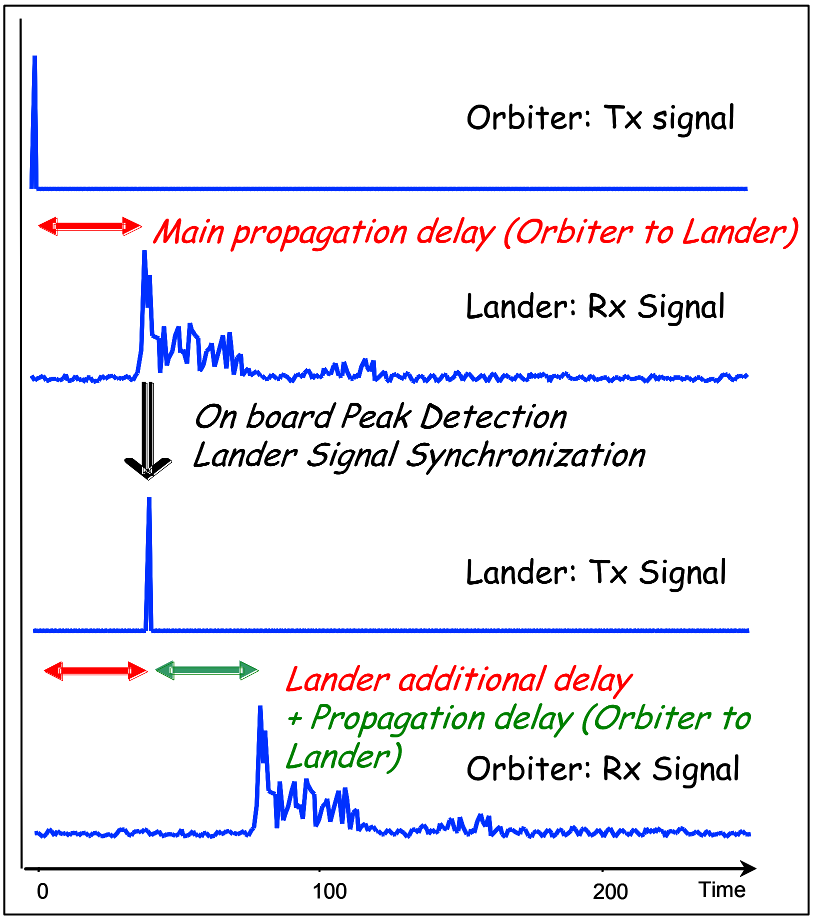


Figure 2 : In-Time transponder

The description of the instrument is done in AD 3, AD 4, AD 7, and AD 17.

CONSERT acquired signals are collected from both orbiter unit and lander units. By regards to data rate constraints on Philae, the main source of data is given on CONSERT orbiter data with 255 samples signal on I and Q channels. CONSERT lander data provides information on the transponder peak detection with a shortened and compressed signal (21 samples). In addition, periodically typically every 25 soundings, CONSERT lander provides also a long 255 samples signal. The 255 samples signal in the Level 2 archive data is not compressed and should be processed with inter-correlation of the code (also provided in the archive).

2.3 Data Handling Process

The SONC and the IPAG are responsible for PDS CONSERT (Orbiter and Lander) data sets generation and delivery to the PSA. The SONC for the L2 format, the IPAG for all the other levels.

The CONSERT telemetry data are provided by the ESA DDS (Data Distribution Server). Following the operations plan the SONC/IPAG pulls out archived packets (Science, HK, ACK, EVENT) by direct request to the DDS via FTP.

SONC Process:

As soon as they are received, the raw data packets are passed through data processing software. The SONC data processing system takes as input raw telemetry data (packets) and reconstructs the scanning sequence. Each record of the resulting data contains information from one sounding (housekeeping, I and Q signals, correlation peak …). There are two processors, one for the Lander and one for the Orbiter.

The following data are immediately available through W3-SONC server (http://soncv2-rosetta.cnes.fr) and the authorized[1] users can get them for a selected time interval:

- Raw telemetry packets (SC, HK, EVENT, ACK) as binary files
- SONC level 0 data as binary files arranged in chronological order containing one all information (SC and HK) from one sounding per record).

Moreover, the W3-SONC provides interactive plots of CONSERT science and housekeeping data.

The delivery format in Level 2 is described in this document.

IPAG Process:

Based on the raw telemetry data and Level 2 products, IPAG processes the CONSERT signal and produces higher level products:

- Level 3 : Calibrated data and geometry files
- Level 4 : Post-processed and derived scientific measurements (signal time of flight)

No software is delivered to process the data.
For any questions refer to contacts in section 1.8.

2.4 Overview of Data Products

2.4.1 Pre-Flight Data Products

The IPAG provided pre-flight data obtained during on ground tests and calibrations during Kourou Tests in September 2003 (two files). They are improved with lab tests sequences which constitutes separated data sets. Those datasets are only useful for calibration purposes. Full data volumes and documentation will be provided along with Level 4 CONSERT archive products.

[1] The authorization is controlled by PI. At his request, SONC delivers a login/password to the authorized user.

2.4.2 Instrument Calibrations

Due to the design of the instrument, there is no systematic internal on-board calibration data. The calibration of the instrument is a post-process performed to produce Level 3 data by using mostly the on-ground data sets and thermal information provided in ancillary data for Level 3.

2.4.3 In-Flight Data Products

The science data is the propagation channel of the comet nucleus as a function of time:

- The propagation time is the main data to be inverted and its accuracy is guaranteed by the CONSERT clock absolute accuracy and stability.
- The signal amplitude can also provide information about the nucleus structure but there is no internal calibration channel to increase the link budget accuracy.

These information is derived in high level products (Level 4). For lower level products, the raw (L2) and calibrated (L3) signals are provided. These signal data come along with instrumental parameters for each sounding (e.g. sounding number, instrument internal time stamps, temperatures, oscillator tuning result..). The details are described in Level related chapters.

CONSERT doesn’t use a cross-instrument calibration and cross-instrument scientific analysis.

The in-flight data correspond to all the on board data. They can be produced during following mission phases:

Table 2-1 Mission phases

MISSION_PHASE_NAME	**Abbreviation**	**Start Date** (dd/mm/yyyy)	**End Date** (dd/mm/yyyy)	**CONSERT data** (1)	
				C. Lander	**C. Orbiter**
Commissioning (part 1)	CVP1	05/03/2004	06/06/2004	**X**	
Cruise 1	CR1	07/06/2004	05/09/2004		
Commissioning (part 2)	CVP2	06/09/2004	16/10/2004	**X**	
Earth Swing-by 1 (including PC#0)	EAR1	17/10/2004	04/04/2005	**X**	**X** (HK)
Cruise 2 (including PC#1,2)	CR2	05/04/2005	28/07/2006	**X**	
Mars Swing-by (including PC#3,4,5)	MARS	29/07/2006	28/05/2007	**X**	
Cruise 3	CR3	29/05/2007	12/09/2007		
Earth Swing-by 2 (including PC#6,7)	EAR2	13/09/2007	27/01/2008	**X**	
Cruise 4-1 (including PC#8)	CR4A	28/01/2008	03/08/2008	**X**	
Steins Flyby	AST1	04/08/2008	05/10/2008		
Cruise 4-2 (including PC#9)	CR4B	06/10/2008	13/09/2009	**X**	
Earth Swing-by 3 (including PC#10)	EAR3	14/09/2009	13/12/2009	**X**	
Cruise 5 (including PC#12)	CR5	14/12/2009	06/06/2010	**X**	
Lutetia Flyby	AST2	07/06/2010	10/09/2010		
RV Manoeuver 1 (including PC#13)	RMV1	11/09/2010	13/07/2011	**X**	
Cruise 6	CR6	14/07/2011	22/01/2014		
Post Hibernation Commissionning	PHC	09/04/2014	24/04/2014	**X**	
Pre-delivery calibration Science	PDCS	25/04/2014	11/11/2014	**X**	

(1) The last column indicates if CONSERT data are available

After the release of the Lander, we distinguish four phases, characterized by:
- The Start and Stop dates need to be expressed in seconds
- The Lander has its own Auxiliary data

Separation/Descent/Landing	SDL	2014/11/12 08:35:02	2014/11/12 15:34:04	**X**
Rebounds	RBD	2014/11/12 15:34:05	2014/11/12 17:30:20	**no data**
First Science Sequence	FSS	2014/11/12 17:30:21	2014/11/15 01:00:00	**X**

The CONSERT data products are edited raw data organized according to soundings. Each record in the file contains all information related to a sounding (including tuning data).

2.4.4 Ancillary Data Usage

CONSERT archive uses ancillary data to provide different additional information to the signal itself and associated sounding parameters. Typically for CONSERT currents, temperature sensors and OCXO tuning frequency. In level 2 archive, the temperature and frequency values are given in ADC raw units ("ADC_COUNTS", as stated in the FMT description file). Currents are given in mA. In the level 3 archive, they are converted into physical units. The conversion formulas are given in Appendix 7.

Information is provided on Rosetta high-gain antenna parameters and solar panel positions in CONSERT archive data for Level 2 products (AOCS files in DATA directory). They are extracted from the S/C database as edited parameters in radians. Below table gives the signification of extracted parameters:

Table 2: Rosetta S/C AOCS parameter full description

AOCS Param. Lbl	AOCS short description	Full description for parameters of interest
NACW1102	APME Cur Onbrd Cmd Elv	
NACW1103	APME Cur Onbrd Cmd Az	
NACW1104	APME Ground Cmd Elev	
NACW1105	APME Ground Cmd Az	
NACW1106	APME Encdr Measured Elev	Measured elevation angle of the high gain antenna in radians
NACW1107	APME Encdr Measured Azi	Measured azimuth angle of HGA in radians
NACW1300	SADE Grd Cmd Ang Pos YP	
NACW1301	SADE Grd Cmd Ang Pos YM	
NACW1304	SADE Cmd Ang Position YP	
NACW1305	SADE Cmd Ang Position YM	
NACW1306	SADE Measured Ang Pos YP	Measured angular position of the +Y axis solar panel in radians
NACW1307	SADE Measured Ang Pos YM	Measured angular position of the –Y axis solar panel in radians

CONSERT needs the following geometric orbitography data in a Comet Fixed Frame:

- The Orbiter and Lander positions with 1 m resolution.
- A model of the comet surface with 1 m resolution

For Level 3 and above, the orbitography is provided as data tables giving position vectors, velocity vectors and attitude quaternions for each sounding. These values have been processed using the NAIF Spice toolkit and Rosetta relevant kernels provided by ESA. The Spice toolkit provide routines and techniques in several programming languages to compute geometry information for space-based instruments and robotic exploration (http://naif.jpl.nasa.gov/naif/).

The shape model is not provided in CONSERT archive, as it is produced by Rosetta OSIRIS team.

In Philae archive, the Lander Auxiliary Data on the comet (Position/Orientation/Illumination at any time + Comet models + Ancillary Data from the instruments) will be available in an ANCDR (Ancillary Data Record) whose definition is in progress, pending the Lander auxiliary data reconstruction.

3 Archive Format and Content

3.1 Format and Conventions

Data processing level number used in CONSERT naming scheme conforms to CODMAC norm. Only level 2 (SONC level 0) and level 3 data are provided.

Level 2 is defined as follows: Edited Data Corrected for telemetry errors and split or de-commuted into a data set for a given instrument. Sometimes called Experimental Data Record. Data are also tagged with time and location of acquisition. It corresponds to NASA Level 0 data. The signal is not compressed (matched filter is not applied), please refer to Appendix 8 for more details.

Level 3 data will be delivered in a second phase, as they are still being defined. They will include (to be finalized): calibrated and compressed data (after matched filter), calibrated time of measurement on the orbit, position on the orbit.

Level 4 data will be delivered in a third phase, as they are still being defined. They will include (to be finalized): signal peak detection with derived travel time and amplitude attenuation values.

3.1.1 Deliveries and Archive Volume Format

A data set is delivered for each **simple mission phase** (see Table 2-1 and AD 9 for simple mision phase definition). Each data set contains **only one level data processing**. The formats, naming and conventions are common for all levels, but some of the data are only relevant for some Levels. For details, please refer to Levels specific description chapters.

The list of mission phases is given in AD 9.

3.1.2 Data Set ID Formation

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

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

See AD 9.

Examples of DATA_SET_ID and DATA_SET_NAME for CONSERT data obtained in-flight during CVP :

DATA_SET_ID = "RO/RL-CAL-CONSERT-2-CVP-V1.0"
DATA_SET_NAME = "ROSETTA-ORBITER/ROSETTA-LANDER CVP CONSERT 2 V1.0"

3.1.3 Data Directory Naming Convention

See § 3.4.3

3.1.4 File naming Convention

The file naming is produced as follows:

{exp}_{inst}_{level}_{begin of observation}.{ext}

- **exp** (2 characters) = CN (fixed)
- **inst** = instrument origin :
  - O for Orbiter
  - O_ATT for Orbiter attitude (Geometry data)
  - O_POS for Orbiter position (Geometry data)
  - L for Lander
  - L_ATT for Lander attitude (Geometry data)
  - L_POS for Lander position (Geometry data)
  - A for auxiliary data AOCS
- **level** (1 character) = data processing level number norm CODMAC (CONSERT archives only level 2 and level 3 data)

  begin of observation (13 characters) = time of measurement in UTC yymmddThhmmss (e.g 020415T100013) :
  - yy = year
  - mm = month
  - dd = day
  - hh=hour
  - mm = minute
  - ss = secondes
- **ext** = extension of file. For CONSERT possible extensions are:
  - LBL for label file associated to data file .TAB or .DAT
  - TAB for ASCII tables (low volume and low precision data)
  - DAT for binary tables (high volume and/or high preicison data)

Three files will be generated in the data directory. Two with the same format: one for Lander instrument and one for the Orbiter instrument. Both files are located in the same directory. They contain complete information (science and housekeeping) related to all the soundings of a measurement sequence. The third one concerns the auxiliary **AOCS** data.

For the Level 2, each file corresponds to a slot:
- A slot is a consecutive sequence of operation with a maximum gap of 10 days between two successive operations. In practice, during cruise, a payload checkout test is a slot.
- This gap of 10 day is reduced at 4 days during the comet phase.

Ex. : CN_O_2_ 100221T122501.TAB
The file contains the CONSERT Orbiter slot beginning at 2010/02/21 12:25:01 (level 2)

3.2 Standards Used in Data Product Generation

3.2.1 PDS Standards

The archive structure given in this document complies with PDS standard version 3.6.

3.2.2 Time Standards

3.2.2.1 Generalities

This paragraph gives a summary of the different existing formats in the Rosetta Ground segment, from their generation by the instruments to their availability at SONC :

- The Lander CDMS requires the scientific instruments to transmit the data by bursts of 8 or 64 bytes (4 or 32 16-bit words)

- When sufficient data are received, the CDMS builds packets containing 256 bytes of instrument data. The CDMS adds 18 bytes header (unit PID, sequence count, OOBT : Orbiter OBT, data type) and a 2 bytes checksum (DECW) and creates packets with a fixed length of 276 bytes[2]. For transmission between Lander and Orbiter, a 4 bytes synchro header and a 2 bytes trailing checksum (PECW) are added, increasing the packet size to 282 bytes. The extra bytes are removed by the ESS.

  To comply with ESA requirements, the time registered in the CDMS packets is the **OOBT**. It is reconstituted from the LOBT, as shown in Figure 3 :

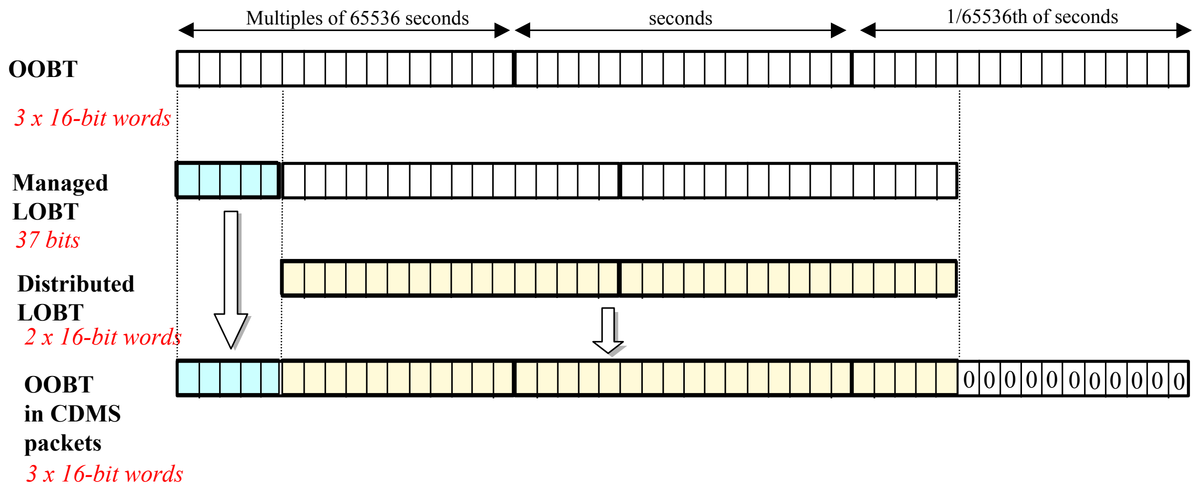


Figure 3 Reconstruction of on board time in CDMS packets

- The ESS groups together several packets and passes them to the Orbiter OBDH, which transmits them according to the Space/Ground interface. This part is transparent for the Lander ground segment.

[2] The Lander CDMS header and the headers of the telemetry source packets from the Orbiter instruments are quite similar. There is a difference in the data field header. The byte containing PUS version, checksum flag and spare fields is set to zero in the CDMS header. Besides the last byte of the OOBT is set to zero in the CDMS header. The CDMS header has an additional word (2 bytes) after the data field header named "FORMAT ID". This word is mainly used for HK data and it contains the HK scanning period and the SID (structure identification).

- The data are delivered by the Rosetta Data Distribution System (DDS) to the SONC in SFDU format. A SFDU file is basically a collection of 276-byte packets interspersed with auxiliary information records. An 18 bytes SFDU header is added to the CDMS 276-byte packets. This header contains information added at the ground station (time correlated OBT, ground station id, virtual channel id, service channel, type of data, time quality)

- SONC processes the SFDU files to retrieve the 276-byte packets. This format is available in the SONC database. After archive formating, this leads to the Level 2 CONSERT data products.

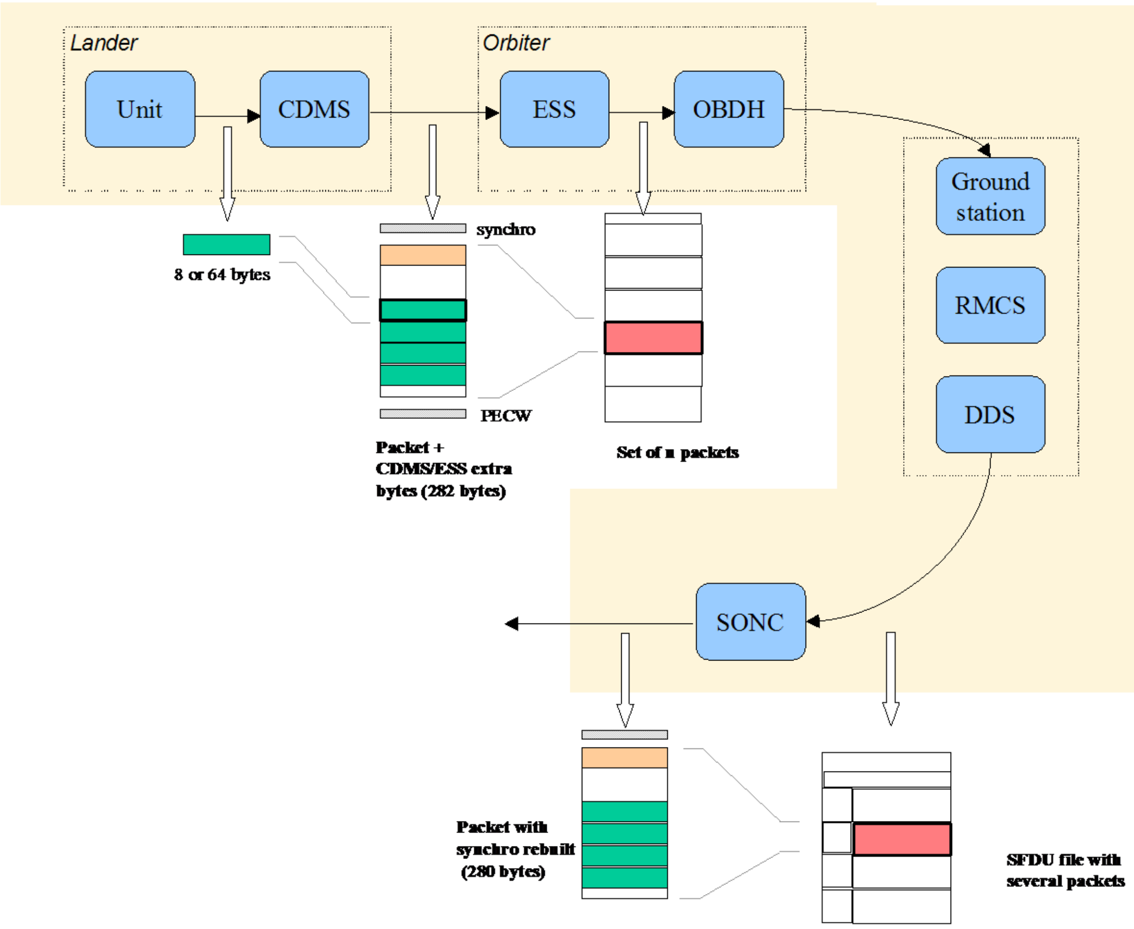


Figure 4 On board data flow

- Then IPAG processes the raw data for calibration (Level 3 data products) and derived scientific values (Level 4 data products).

Figure 4 gives an overview of this data flow.

Only the following principles are applied:

- the packet wrapping is removed, and science frames that had to be split into several raw data packets are rebuilt. Basic error detection controls are applied, to recover from possible problems in the transmission chain.

- the Lander On-Board time (LOBT) (synchronised with OOBT) extracted from the packet, and corresponding UTC time coming from the SFDU header, are added.

- UTC time is calculated from the On-Board time taking into account the On-Board clock drift as following :
UTC (seconds since 01/01/1970) = LOBT(seconds) * Gradient + Offset (these coefficients are extracted from TCP packets delivered by DDS).
LOBT is either the LOBT extracted from CDMS header or the Experiment internal clock when it exists (CIVA, COSAC, PTOLEMY, ROMAP, ROLIS, SESAME). In the last case, it must be taken into account that the Internal clock (32 bits) resets all 4 years, 4 months, 3 days (first reset : 03/04/2007 10 :42 :07).

- in few cases, bit fields are expanded : flags that were stored as bits in the telemetry (to save bandwidth) are stored as integer values instead ; the aim is to ease further processing.

UTC time-stamped Science and HK data are available in the SONC database and used to generate PDS format for level 2 products.

3.2.2.2 CONSERT time standards

3.2.2.2.1 The CONSERT internal Time

There are three different times for CONSERT:

- Rebuilt Time on ground : SCET Time (in SFDU Header)
- On-Board Set Time : OBT time
- CONSERT own Time: counter in TIC sets to zero when CONSERT is turned on and resets to zero after tuning phase, allows the precise synchronization between CONSERT Orbiter and CONSERT. Lander

All the CONSERT operation are synchronized on the CONSERT own Time. This times are given in TIC:
1 TIC = 2^{14} / 10^{7} = 1.6384 millisecond

3.2.2.2.2 The Lander On-Board Time (LOBT)

The instruments on board the spacecraft (Orbiter) generate telemetry source packets with an OOBT (orbiter on board time) time stamp in the header.
The OOBT written into the packet header specifies the time, when CDMS can complete a packet.

In terms of HK packets this is the time of the last HK word. Using the HK scanning rate, which is given in word #9 of the packet, one can calculate the OBT of every individual word in this packet. Note that this is only valid if packets with SID (word #9) 1 or 2 are generated. Packets with SID 4 and 5 are "snapshots", which means you can apply the packet OOBT for every word in this packet. SID 3 packets have to be analysed case by case.

In terms of SC packets this is the reception of the last 32 word block by CDMS, which also completes the SC packet. How often 32 word blocks are created (and sent) by the unit, and corresponding to this the delta time between each block, might be different for each unit. So, re-calculation of OOBT for SC words depends on this unit feature.

The Orbiter On-Board Time (OOBT) is a linear binary counter having a resolution of 1/65536 sec stored in 3 16-bit words.

The Lander On-Board Time (LOBT) is a linear binary counter having a resolution of 1/32 sec, kept in 37 bits. Only the 32 least significant bits are distributed to the instruments, in 2 16-bit words. The 5 most significant bits are supposed constant during most of the mission, they are available through a specific service.
The LOBT is derived from the Orbiter On-Board Time (OOBT) : the 11 least significant bits of the OOBT are discarded to obtain the LOBT, hence the reduced resolution. A re-synchronization between OOBT and LOBT is performed regularly (see AD 10).
The Lander is synchronized prior to Separation and during every RF link after landing. So, during descent

and the First Science Sequence this should not be a problem, since LOBT is kept synchronized as long as the Lander is powered.

Technical details about Sychronisation of Lander On-board Time can be found in § 2.3.2.6 AD 10.

For a description of time handling in the Rosetta project see AD 11.
For a description of Lander on board time handling see AD 10 :
§ 2.3.2.6 Sychronisation and Adjustment of Lander On-board Time
§ 2.3.2.6.1 Absolute vs. relative time references
§ 2.3.2.6.2 On-board Time Failure Modes and Recovery Procedures
and AD 12 § 6. About Lander On-board Time.

3.2.2.2.3 The DDS header time correlated

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

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

Time correlation is described in AD 13 § 18.1.2.1.

3.2.2.2.4 The UTC

The **UTC** used as time stamp for CONSERT data products (level 2) is obtained from the OOBT and LOBT. The start of LOBT = 01/01/2003 0h.

This UTC time is of the main interest for geometry.

For level 3 and higher, CONSERT sounding times are given in a UTC time calibrated on the wave propagation mid-time. The details of the time calibration will be described along with level 3 product archive.

3.2.2.2.5 Spacecraft Clock Count in PDS Labels

The PDS keywords SPACECRAFT_CLOCK_START_COUNT and SPACECRAFT_CLOCK_STOP_COUNT refer to LOBT.
The LOBT is represented in the following format:
SPACECRAFT_CLOCK_START/STOP_COUNT = "<reset number>/<unit seconds>.<fractional seconds>"
The unit seconds and the fractional seconds are separated by the full stop character. **Note that this is not a decimal point.** The fractional seconds are expressed as multiples of 2^{-5} = 0.03125 seconds and count from 0 to 2^5-1 = 31. E.g. in SPACECRAFT_CLOCK_START_COUNT = "3/356281394.21" the 21 fractional seconds correspond to 21 × 2^{-5}= 0.65625 decimal seconds.
The reset number is an integer starting at 1, i.e. "1/" means LOBT = 0 at 2003-01-01T00:00:00 UTC.

3.2.3 Reference Systems

CONSERT uses the Comet Fixed Frame reference system in which Philae is fixed when landed at the surface of the comet nucleus. All reference systems used to produce geometry ancillary data is based on the NAIF SPICE system (cf. 2.4.4).

4 Level 2 Specifications and Design

This part will describe the L2 design and specifications.

4.1 Data Validation

The CONSERT data products are delivered to PSA by SONC. All the data produced by SONC are validated by CONSERT PI. These data are also distributed via the W3-SONC server and used by all the experiment team.

All the data are published in the archive.

4.1.1 Data Quality ID

Data quality ID is equal to:

- 0 when there is a good quality (less than 30% of loss)
- 1 when there is a bad quality (more than 30% of loss)

.

4.2 Content

4.2.1 Volume Set

One volume corresponds to one data set. The possible values of VOLUME keywords can be found in AD 9. The volume keyword values for the CR4A mission phase are given in the following example.

```
VOLUME_NAME                  = "CONSERT RAW DATA FOR THE
                                CR4A PHASE"
VOLUME_SERIES_NAME           = "ROSETTA SCIENCE ARCHIVE"
VOLUME_SET_ID                = "FR_CNRSUG_IPAG_RORLCN_10XX"
VOLUME_SET_NAME              = "ROSETTA COSAC DATA"
VOLUME_ID                    = "RLCOS2_1007"
VOLUME_VERSION_ID            = "VERSION 1"
VOLUME_FORMAT                = "ISO-9660"
MEDIUM_TYPE                  = "ELECTRONIC"
VOLUMES                      =  15
PUBLICATION_DATE             = 2006-11-13
DESCRIPTION                  = " This volume contains data
                                 and supporting documentation
                                 from the Rosetta CR4A
                                 mission phase "
```

4.2.2 Data Set

The CONSERT data are archived in as many Data Sets as simple mission phase (Table 2-1 and AD 9) and level data processing. The descriptions of the fields of the keywords DATA_SET_ID and DATA_SET_NAME are given in the following table.

Field of DATASET_ID or DATA_SET_NAME	**DATA_SET_ID**	**DATA_SET_NAME**
INSTRUMENT_HOST_ID / INSTRUMENT_HOST_NAME	RO/RL	ROSETTA-ORBITER/ROSETTA-LANDER
Target id / target name	See AD 9	See AD 9
INSTRUMENT_ID	CONSERT	
Data processing level number	CODMAC level 2 (contains level 2 science and housekeeping data)	
mission phase abbreviation	See AD 9	
description	Field not used in DATA_SET_ID	Field not used in DATA_SET_NAME
version	The first version of a data set is V1.0	

4.2.3 Directories

The organisation (directories) of a level 2 dataset is shown below.

```
                        |-AAREADME.TXT
                        |-CATALOG-
                        |            |--2004-
                        |-DATA------|
                        |            |--2005-
                        |            |--2006-
                        |            |-- …
|-root directory------ |            |--2016-
                        |-DOCUMENT-
                        |-INDEX-
                        |-LABEL-
                        |-VOLDESC.CAT
```

4.2.3.1 Root Directory

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

The name of the root directory is the data set ID.

4.2.3.2 Calibration Directory

There are no calibration data connected to the measurement.

4.2.3.3 Catalog Directory

The catalog directory provides a top level understanding of the mission, spacecraft, instruments and data sets.The catalog directory contains the following files:

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

4.2.3.4 Index Directory

The index directory contains the indices for all data products on the volume. The following files are included in the index directory:

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

File Name	Contents
INDEX.LBL	PDS label for the volume index file, INDEX.TAB
INDEX.TAB	Volume index in tabular format
INDXINFO.TXT	A description of the contents of the Index Directory

4.2.3.5 Geometry Directory

CONSERT measurements are time measurements, there is no specific instrument geometry applicable.

4.2.3.6 Label Directory

The label directory contains include files (.FMT files with label definitions) referenced by data files on the data set. The following files are included in the index directory:

File Name	Contents
LABINFO.TXT	A description of the contents of this directory (.FMT files)
AOCS.FMT	Edited auxiliary (AOCS) data
L0_PARAMETER_DEF.FMT	Edited SC and HK data for Orbiter and Lander

4.2.3.7 Document Directory

This directory contains all original documents necessary to understand the data.
The following files are included in the document directory:

File Name	Contents
DOCINFO.TXT	identifies and describes the function of each file in the DOCUMENT subdirectory.
RO-OCN-TN-3823.LBL	PDS label of file RO-OCN-TN-3823.PDF
RO-OCN-TN-3823.PDF	CONSERT data formats
RO-LCN-TN-3048.LBL	PDS label of file RO-LCN-TN-3048.PDF
RO-LCN-TN-3048.PDF	CONSERT experiment user manual, Lander instrument
RO-OCN-TN-3044.LBL	PDS label of file RO-OCN-TN-3044.PDF
RO-OCN-TN-3044.PDF	CONSERT experiment user manual, Orbiter instrument
RO-OCN-TR-3805.LBL	PDS label of file RO-OCN-TR-3805.PDF
RO-OCN-TR-3805.PDF	Calibration FMO-FSL at Kourou
EAICD_CONSERT.LBL	PDS label of EAICD_CONSERT.PDF
EAICD_CONSERT.PDF	CONSERT EAICD (this document)
TIMELINE_*ph*.TXT	Timeline Ascii file with the PDS label attached for phase *ph*
TIMELINE_*ph*_DESC.TXT	Description of the timeline file for phase *ph*
TIMELINE_*ph*_*obty*.PNG	Timeline Image file for phase *ph* and observation type *obty*
TIMELINE_*ph*_*obty*.LBL	PDS label for image TIMELINE_*ph*_*obty*.PNG

4.2.3.8 Data Directory

The structure and naming scheme of the data directory is described in chapter 4.2.3.

The DATA directory also contain AOCS data.

During the Cruise phase (Lander attached on the Orbiter), the Solar Array attitude and the High Gain Antenna attitude impact on the propagation paths between CONSERT Orbiter and Lander antennas. These parameters determine the shape of the calibration signals.

During the Science Phase (Landed Lander) the SA attitude and the HGA attitude impact on the antenna pattern of CONSERT Orbiter (gain, position of the measurement).
The SA attitude and the HGA attitude are given in the files that are one to one mapping of the corresponding SC files. The file naming is the same as for SC data : {**exp**}_{**inst**}_{**level**}_{**begin of observation**}.{**TAB**} with inst = A (for AOCS data).

Finally, the data directory includes the CONSERT BPSK code to be used to apply the matched filter to the signal (cf. Appendix 8 for details).

4.3 Data Sets Definition

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

Data Set ID	Data Set Name
RO/RL-CAL-CONSERT-2-GRND-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER GRND CONSERT 2 V1.0
RO/RL-CAL-CONSERT-2-CVP-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER CAL CONSERT 2 CVP V1.0
RO/RL-E-CONSERT-2-EAR1-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER EARTH CONSERT 2 EAR1 V1.0
RO/RL-E-CONSERT-2-EAR2-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER EARTH CONSERT 2 EAR2 V1.0
RO/RL-E-CONSERT-2-EAR3-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER EARTH CONSERT 2 EAR3 V1.0
RO/RL-M-CONSERT-2-MARS-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER MARS CONSERT 2 MARS V1.0
RO/RL-CAL-CONSERT-2-CR2-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER CAL CONSERT 2 CR2 V1.0
RO/RL-CAL-CONSERT-2-CR4A-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER CAL CONSERT 2 CR4A V1.0
RO/RL-CAL-CONSERT-2-CR4B-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER CAL CONSERT 2 CR4B V1.0
RO/RL-CAL-CONSERT-2-CR5-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER CAL CONSERT 2 CR5 V1.0
RO/RL-A-CONSERT-2-AST2-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER LUTETIA CONSERT 2 AST2 V1.0
RO/RL-CAL-CONSERT-2-RVM1-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER CAL CONSERT 2 RVM1 V1.0
RO/RL-CAL-CONSERT-2-RVM2-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER CAL CONSERT 2 RVM2 V1.0
RO/RL-CAL-CONSERT-2-PHC-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER CAL CONSERT 2 PHC V1.0
RO/RL-CAL-CONSERT-2-PDCS-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER CAL CONSERT 2 PDCS V1.0
RO/RL-C-CONSERT-2-SDL-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER C CONSERT 2 SDL V1.0
RO/RL-C-CONSERT-2-FSS-V1.0	ROSETTA-ORBITER/ROSETTA-LANDER C CONSERT 2 FSS V1.0

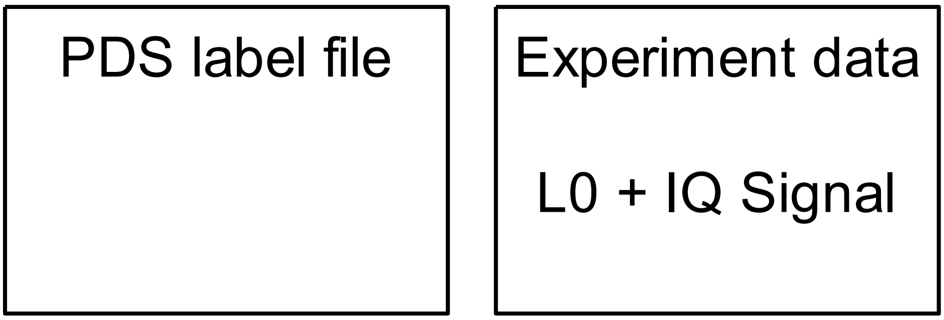
4.4 Data Product Design

The CONSERT data products delivered to PSA are edited data (CODMAC level 2) in ADC units containing sounding information (from tuning phase to the I an Q signals and correlation peak)

All CONSERT data products have PDS detached labels.

4.4.1 Data Product Design

The global data product structure is shown below.



One experiment data file consists in identical records. Each record consists in 3 parts (3 x 255 words - Integer 2 bytes): header (named L0), I signal and Q signal. The corresponding data product is organized as three TABLE objects using ROW_PREFIX_BYTES and ROW_SUFFIX_BYTES for defining the 3 parts.

At first phases of the experiment (init, mission table received, tuning, waiting), there is no sounding and the records are completed by nulls. The length of these phases depends in the mission table and the time interval between records varies.
In sounding mode the time interval between two records is fixed (Mission Table)

L0	I signal	Q signal	Record # 1
L0	I signal	Q signal	Record # 2
		…	
L0	I signal	Q signal	Record # n-1
L0	I signal	Q signal	Record # n

The record structure is shown in annex 4.

4.4.1.1 File Characteristics Data Elements

The PDS file characteristic data elements for CONSERT edited science data (level 2 Lander and Orbiter) are:

```
RECORD_TYPE   = FIXED_LENGTH
RECORD_BYTES  = 1530
FILE_RECORDS
LABEL_RECORDS
```

The PDS file characteristic data elements for AOCS edited auxiliary data (level 2) are:

```
RECORD_TYPE          = FIXED_LENGTH
RECORD_BYTES         = 156
FILE_RECORDS         =
```

4.4.1.2 Data Object Pointers Identification Data Elements

The CONSERT edited data are organized as binary tables. The data object pointers (^TABLE) reference TAB files.

4.4.1.3 Instrument and Detector Descriptive Data Elements

```
INSTRUMENT_HOST_NAME       = {"ROSETTA-ORBITER","ROSETTA-LANDER"}
INSTRUMENT_HOST_ID         = {"RO","RL"}
INSTRUMENT_ID              = CONSERT
INSTRUMENT_NAME            = "COMET NUCLEUS SOUNDING EXPERIMENT BY RADIOWAVE
                           TRANSMISSION"
INSTRUMENT_TYPE            = "RADAR"
INSTRUMENT_MODE_ID         = "PINGPONG"
INSTRUMENT_MODE_DESC       = "CONSERT IN SOUNDING MODE"
```

4.4.1.4 Data Object Definition

For the Lander and Orbiter data:

```
OBJECT               = L0_TABLE
  NAME                       = L0_TABLE
  INTERCHANGE_FORMAT         = BINARY
  ROWS                       = FILE_RECORDS
  COLUMNS                    = 115
  ROW_BYTES                  = 510
  ROW_SUFFIX_BYTES           = 1020
```

```
  ^STRUCTURE                  = "L0_PARAMETER_DEF.FMT"
END_OBJECT           = L0_TABLE
```

```
OBJECT               = I_TABLE
  NAME                        = I_TABLE
  INTERCHANGE_FORMAT          = BINARY
  ROWS                        = FILE_RECORDS
  ROW_BYTES                   = 510
  ROW_PREFIX_BYTES            = 510
  ROW_SUFFIX_BYTES            = 510
  COLUMNS                     = 1

  OBJECT                      = COLUMN
       NAME                   = "I SIGNAL"
       DATA_TYPE              = LSB _INTEGER
       START_BYTE             = 1
       BYTES                  = 510
       ITEMS                  = 255
       ITEM_BYTES             = 2
       ITEM_OFFSET            = 2
       DESCRIPTION            = "THIS TABLE REPRESENTS THE I VALUES OF THE CONSERT RADIO
                             SOUNDING"
  END_OBJECT = COLUMN

END_OBJECT                    = I_TABLE
```

```
OBJECT               = Q_TABLE
  NAME                        = Q_TABLE
  INTERCHANGE_FORMAT          = BINARY
  ROWS                        = FILE_RECORDS
  ROW_PREFIX_BYTES            = 1020
  COLUMNS                     = 1
  ROW_BYTES                   = 510
  OBJECT                      = COLUMN

       NAME                   = "Q SIGNAL"
       DATA_TYPE              = LSB _INTEGER
       START_BYTE             = 1
       BYTES                  = 510
       ITEMS                  = 255
       ITEM_BYTES             = 2
       ITEM_OFFSET            = 2
       DESCRIPTION            = "THIS TABLE REPRESENTS THE Q VALUES OF THE CONSERT
                             RADIO SOUNDING"
  END_OBJECT = COLUMN

END_OBJECT                    = Q_TABLE
```

The structure of the TABLE object is described in the file L0_PARAMETER_DEF.FMT (LABEL directory) as follows:

```
OBJECT                          = COLUMN
    NAME                        = "PROCESSING LEVEL"
    UNIT                        = "N/A"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 1
    BYTES                       = 2
    COLUMN_NUMBER               = 1
    DESCRIPTION                 = "0 for decommutated raw data (internally
```

```
                            named level 0), Data level takes only the
                            value 0"
END_OBJECT                = COLUMN

/* ----------------------------------------------------- */

OBJECT                    = COLUMN
    NAME                  = "FORMAT VERSION"
    DATA_TYPE             = MSB_UNSIGNED_INTEGER
    START_BYTE            = 3
    BYTES                 = 2
    COLUMN_NUMBER         = 2
    DESCRIPTION           = "Version of the format used by the spacecraft
                            to transmit data (the table data structure).
                            Valid value: 00"
END_OBJECT                = COLUMN

/* ----------------------------------------------------- */

OBJECT                    = COLUMN
    NAME                  = "DATA SOURCE"
    DATA_TYPE             = MSB_UNSIGNED_INTEGER
    START_BYTE            = 5
    BYTES                 = 2
    COLUMN_NUMBER         = 3
    DESCRIPTION           = "This column indicates the format of the raw
                            data set. There are 5 formats to store data
                            with different headers and ends These formats
                            differ only in the headers and ends which is
                            deleting when we stored data in PDS format.
                            The indication of format allows us to know
                            where data come from.
                            The possible values are:
                                  0-OBDH format from CCS
                                  1-SISH KFKI orbiter interface simulator
                                  2-ROLBIN Lander data format (CCS and
                                    fly),
                                  3-CDMS KFKI lander interface simulator,
                                  4-SFDU (Standard Formatted Data Units)"
END_OBJECT                = COLUMN

/* ----------------------------------------------------- */

OBJECT                    = COLUMN
    NAME                  = "INSTRUMENT HOST"
    DATA_TYPE             = MSB_UNSIGNED_INTEGER
    START_BYTE            = 7
    BYTES                 = 2
    COLUMN_NUMBER         = 4
    DESCRIPTION           = " 1 for Orbiter
                              2 for Lander"
END_OBJECT                = COLUMN

/* ----------------------------------------------------- */

OBJECT                    = COLUMN
    NAME                  = "SIGNAL FORMAT"
    DATA_TYPE             = MSB_UNSIGNED_INTEGER
    START_BYTE            = 9
    BYTES                 = 2
    COLUMN_NUMBER         = 5
    DESCRIPTION           = "Onboard Software version for lander short
                            signal formatting
```

```
                               1=SWL12 data= I2+Q2 on 16 bits for long signal
                               2=SWL15 data= I&Q on 8 bits for short signal
                               SWL stands for Software lander"
END_OBJECT                    = COLUMN

/* ----------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "BLOCK NUMBER"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 11
    BYTES                     = 2
    COLUMN_NUMBER             = 6
    DESCRIPTION               = "Incremental number of record a block contains
                                 data and an header"
END_OBJECT = COLUMN

/* ----------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "YEAR ACQUISITION DATA"
    UNIT                      = "YEAR"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 13
    BYTES                     = 2
    COLUMN_NUMBER             = 7
    DESCRIPTION               = "Year of the date for the raw data file
                                 (when the spacecraft acquire data)"
END_OBJECT                    = COLUMN

/* ----------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "MONTH ACQUISITION DATA"
    UNIT                      = "MONTH"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 15
    BYTES                     = 2
    COLUMN_NUMBER             = 8
    DESCRIPTION               = "Month of the date for the raw data file
                                (when the spacecraft acquires data)"
END_OBJECT = COLUMN

/* ----------------------------------------------------- */

OBJECT                        = COLUMN
   NAME                       = "DAY ACQUISITION DATA"
   UNIT                       = "DAY"
   DATA_TYPE                  = MSB_UNSIGNED_INTEGER
   START_BYTE                 = 17
   BYTES                      = 2
   COLUMN_NUMBER              = 9
   DESCRIPTION                = "Day of the date for the raw data file
                                 (when the spacecraft acquires data)"
END_OBJECT                    = COLUMN

/* ----------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "HOUR ACQUISITION DATA"
    UNIT                      = "HOUR"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 19
```

```
    BYTES                      = 2
    COLUMN_NUMBER              = 10
    DESCRIPTION                = "Hour of the date for the raw data file
                                  (when the spacecraft acquires data)"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "MINUTE ACQUISITION DATA"
    UNIT                       = "MINUTE"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 21
    BYTES                      = 2
    COLUMN_NUMBER              = 11
    DESCRIPTION                = "Minutes of the date for the raw data
                                  file (when the spacecraft acquires data)"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "SECONDS ACQUISITION DATA"
    UNIT                       = "SECOND"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 23
    BYTES                      = 2
    COLUMN_NUMBER              = 12
    DESCRIPTION                = "Seconds of the date for the raw data
                                  file (when the spacecraft acquires data)"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "YEAR L0 DATA"
    UNIT                       = "YEAR"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 25
    BYTES                      = 2
    COLUMN_NUMBER              = 13
    DESCRIPTION                = "Year of the created date for the L0 file"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "MONTH L0 DATA"
    UNIT                       = "MONTH"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 27
    BYTES                      = 2
    COLUMN_NUMBER              = 14
    DESCRIPTION                = "Month of the created date for the L0 file"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "DAY L0 DATA"
    UNIT                       = "DAY"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 29
```

```
    BYTES                       = 2
    COLUMN_NUMBER               = 15
    DESCRIPTION                 = "Day of the created date for the L0 file"
END_OBJECT                      = COLUMN

/* ----------------------------------------------------- */

OBJECT                          = COLUMN
    NAME                        = "HOUR L0 DATA"
    UNIT                        = "HOUR"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 31
    BYTES                       = 2
    COLUMN_NUMBER               = 16
    DESCRIPTION                 = "Hour of the created date for the L0 file"
END_OBJECT                      = COLUMN

/* ----------------------------------------------------- */

OBJECT                          = COLUMN
    NAME                        = "MINUTE L0 DATA"
    UNIT                        = "MINUTE"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 33
    BYTES                       = 2
    COLUMN_NUMBER               = 17
    DESCRIPTION                 = "Minutes of the created date for the L0 file"
END_OBJECT                      = COLUMN

/* ----------------------------------------------------- */

OBJECT                          = COLUMN
    NAME                        = "SECONDS L0 DATA"
    UNIT                        = "SECOND"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 35
    BYTES                       = 2
    COLUMN_NUMBER               = 18
    DESCRIPTION                 = "Seconds of the created date for the L0 file"
END_OBJECT                      = COLUMN

/* ----------------------------------------------------- */

OBJECT                          = COLUMN
    NAME                        = "EMPTY_19"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 37
    BYTES                       = 2
    COLUMN_NUMBER               = 19
    DESCRIPTION                 = "=0 Nothing in this column"
END_OBJECT                      = COLUMN

/* ----------------------------------------------------- */

OBJECT                          = COLUMN
    NAME                        = "EMPTY_20"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 39
    BYTES                       = 2
    COLUMN_NUMBER               = 20
    DESCRIPTION                 = "=0 Nothing in this column"
END_OBJECT                      = COLUMN
```

```
/* ------------------------------------------------------ */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_21"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 41
    BYTES                   = 2
    COLUMN_NUMBER           = 21
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ------------------------------------------------------ */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_22"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 43
    BYTES                   = 2
    COLUMN_NUMBER           = 22
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ------------------------------------------------------ */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_23"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 45
    BYTES                   = 2
    COLUMN_NUMBER           = 23
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ------------------------------------------------------ */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_24"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 47
    BYTES                   = 2
    COLUMN_NUMBER           = 24
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ------------------------------------------------------ */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_25"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 49
    BYTES                   = 2
    COLUMN_NUMBER           = 25
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ------------------------------------------------------ */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_26"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 51
    BYTES                   = 2
    COLUMN_NUMBER           = 26
```

```
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_27"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 53
    BYTES                      = 2
    COLUMN_NUMBER              = 27
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_28"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 55
    BYTES                      = 2
    COLUMN_NUMBER              = 28
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_29"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 57
    BYTES                      = 2
    COLUMN_NUMBER              = 29
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_30"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 59
    BYTES                      = 2
    COLUMN_NUMBER              = 30
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_31"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 61
    BYTES                      = 2
    COLUMN_NUMBER              = 31
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_32"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
```

```
    START_BYTE              = 63
    BYTES                   = 2
    COLUMN_NUMBER           = 32
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_33"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 65
    BYTES                   = 2
    COLUMN_NUMBER           = 33
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "TUNING STATUS"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 67
    BYTES                   = 2
    COLUMN_NUMBER           = 34
    DESCRIPTION             = "- Orbiter:
                               + ETM00501-NCNA0EID = (41002=Tuning OK) or
                               + ETM00502-NCNA0EID = (41020 = Timeout Pb)
                               (ETM00501 is a telemetry packet name a
                               progress report and NCNA0EID is a CONSERT
                               telemetry parameter name) [AD 3]
                               - Lander: N/A"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "TUNING OCXO FREQUENCY"
    UNIT                    = "ADC_COUNTS"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 69
    BYTES                   = 2
    COLUMN_NUMBER           = 35
    DESCRIPTION             = "- Orbiter: OCXO after tuning
                               + NCND0511-ETM00501 (field 9 MSB):
                                 Clock frequency OCXO_freq at end of
                                 tuning phase (ETM00501 is a telemetry packet
                                 name: CONSERT PROGRESS REPORT and NCND0511
                                 is a CONSERT telemetry parameter name)
                                 [AD 3]
                               + Lander: OCXO for tuning - TM_Type_standard
                                 (field 6 MSB): OCXO Frequency
                                 (TM_Type_standard is a telemetry packet
                                 name) [AD 4]"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "TUNING INTERCARTILE"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 71
    BYTES                   = 2
```

```
    COLUMN_NUMBER            = 36
    DESCRIPTION              = "- Orbiter: Interquartile after tuning
                                 + NCND0512 - ETM00501 (field 9 LSB)
                                   Confidence indicator of tuning phase
                                   or 1: good confidence
                                   The interquartile range is a measure of
                                   dispersion (ETM00501: is a telemetry packet
                                   name: CONSERT PROGRESS REPORT and NCND0512
                                   is a CONSERT telemetry parameter name)
                                   [AD 3]
                                 - Lander: N/A"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "TUNING GCW"
    UNIT                     = "DECIBEL"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 73
    BYTES                    = 2
    COLUMN_NUMBER            = 37
    DESCRIPTION              = "GCW: Gain control word of this sounding
                                 - Orbiter: GCW after tuning
                                 + NCND0513-ETM00501 (field 10 MSB)
                                  Tuning Phase GCW (ETM00501: is a telemetry
                                  packet name: CONSERT PROGRESS REPORT and
                                  NCND0513 is a CONSERT telemetry parameter
                                  name) [AD 3]
                                 - Lander: N/A"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "TUNING NBL GCW"
    UNIT                     = "DECIBEL"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 75
    BYTES                    = 2
    COLUMN_NUMBER            = 38
    DESCRIPTION              = "- Orbiter: NBLL tuning
                                 + NCND0514 - ETM00501 (field 10 LSB)
                                   Level GCW: ADC level achieved on NBL signal
                                   at end of tuning phase AGC
                                   NBLL: Narrow Band Line Level
                                   (ETM00501: is a telemetry packet name:
                                   CONSERT PROGRESS REPORT and NCND0514 is a
                                   CONSERT telemetry parameter name) [AD 3]
                                 + Lander: N/A"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "TUNING NBLL ZERO"
    UNIT                     = "DECIBEL"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 77
    BYTES                    = 2
    COLUMN_NUMBER            = 39
    DESCRIPTION              = "- Orbiter: NBLL after tuning
                                   ETM00501-NCND0515- (field 11 MSB)
```

```
                              level zero: ADC level achieved on NBLL
                              signal at end of tuning phase, zero
                              detection
                              NBLL: Narrow Band Line Level
                              (ETM00501 is a telemetry packet name:
                              CONSERT PROGRESS REPORT and NCND0515 is a
                              CONSERT telemetry parameter name) [AD 3]
                            - Lander: N/A"
END_OBJECT                 = COLUMN

/* ----------------------------------------------------- */

OBJECT                     = COLUMN
    NAME                   = "OCXO TEMPERATURE"
    UNIT                   = "ADC_COUNTS"
    DATA_TYPE              = MSB_UNSIGNED_INTEGER
    START_BYTE             = 79
    BYTES                  = 2
    COLUMN_NUMBER          = 40
    DESCRIPTION            = "- Obiter: OCXO Temperature
                              ETM00325 - NCND0339 - (field 11 LSB)
                              (ETM00325 is a telemetry packet name:
                              CONSERT PROGRESS REPORT and NCND00339 is a
                              CONSERT telemetry parameter name: CONSERT
                              HOUSEKEEPING REPORT) [AD 3]
                            - Lander: OCXO Temperature
                              TM type 1- (field 4 MSB)
                              (TM type 1 is a LANDER telemetry packet
                              name) [AD 4]"
END_OBJECT                 = COLUMN

/* ----------------------------------------------------- */

OBJECT                     = COLUMN
    NAME                   = "EMPTY_41"
    DATA_TYPE              = MSB_UNSIGNED_INTEGER
    START_BYTE             = 81
    BYTES                  = 2
    COLUMN_NUMBER          = 41
    DESCRIPTION            = "=0 Nothing in this column"
END_OBJECT                 = COLUMN

/* ----------------------------------------------------- */

OBJECT                     = COLUMN
    NAME                   = "EMPTY_42"
    DATA_TYPE              = MSB_UNSIGNED_INTEGER
    START_BYTE             = 83
    BYTES                  = 2
    COLUMN_NUMBER          = 42
    DESCRIPTION            = "=0 Nothing in this column"
END_OBJECT                 = COLUMN

/* ----------------------------------------------------- */

OBJECT                     = COLUMN
    NAME                   = "EMPTY_43"
    DATA_TYPE              = MSB_UNSIGNED_INTEGER
    START_BYTE             = 85
    BYTES                  = 2
    COLUMN_NUMBER          = 43
    DESCRIPTION            = "=0 Nothing in this column"
END_OBJECT                 = COLUMN
```

```
/* ------------------------------------------------------ */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_44"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 87
    BYTES                    = 2
    COLUMN_NUMBER            = 44
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ------------------------------------------------------ */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_45"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 89
    BYTES                    = 2
    COLUMN_NUMBER            = 45
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ------------------------------------------------------ */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_46"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 91
    BYTES                    = 2
    COLUMN_NUMBER            = 46
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ------------------------------------------------------ */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_47"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 93
    BYTES                    = 2
    COLUMN_NUMBER            = 47
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ------------------------------------------------------ */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_48"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 95
    BYTES                    = 2
    COLUMN_NUMBER            = 48
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ------------------------------------------------------ */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_49"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
```

```
    START_BYTE               = 97
    BYTES                    = 2
    COLUMN_NUMBER            = 49
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */


OBJECT                       = COLUMN
    NAME                     = "EMPTY_50"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 99
    BYTES                    = 2
    COLUMN_NUMBER            = 50
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "OBDH PACKET NUMBER"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 101
    BYTES                    = 2
    COLUMN_NUMBER            = 51
    DESCRIPTION              = "Source sequence count
                                - Orbiter: ETM00325 (field 2-14bits LSB)
                                  (ETM00325 is a telemetry packet name:
                                  CONSERT HOUSEKEEPING REPORT) [AD 3]
                                - Lander: APID 112,12
                                  (field 2-14bits LSB)
                                  (APID :  Application Process ID)[AD 4]"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "OBT SECOND MSW"
    UNIT                     = "SECOND"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 103
    BYTES                    = 2
    COLUMN_NUMBER            = 52
    DESCRIPTION              = "On Board Time second MSW
                                - Orbiter: ETM00325 (field 3)
                                  (ETM00325 is a telemetry packet name:
                                   CONSERT HOUSEKEEPING REPORT) [AD 3]
                                - Lander: APID 112,12 (field 3)
                                  (APID :  Application Process ID)[AD 4]"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "OBT SECOND LSW"
    UNIT                     = "SECOND"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 105
    BYTES                    = 2
    COLUMN_NUMBER            = 53
    DESCRIPTION              = "On Board Time - second LSW
                                - Orbiter: ETM00325 (field 4)
```

```
                                   (ETM00325 is a telemetry packet name:
                                   CONSERT HOUSEKEEPING REPORT) [AD 3]
                                 - Lander: APID 112,12 (field 4)
                                   (APID :  Application Process ID)[AD 4]"
END_OBJECT                    = COLUMN

/* ---------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "OBT FRACTION MSW"
    UNIT                      = "MILLISECOND"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 107
    BYTES                     = 2
    COLUMN_NUMBER             = 54
    DESCRIPTION               = "This column contains the MSW part of
                                 the On Board Time fraction (milliseconds)
                                 - Orbiter: ETM00325 (field 5)
                                  (ETM00325 is a telemetry packet name:
                                   CONSERT HOUSEKEEPING REPORT) [AD 3]
                                 - Lander: APID 112,12 (field 5)
                                   (APID :  Application Process ID)[AD 4]"
END_OBJECT                    = COLUMN

/* ---------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "CONSERT TIC MSW"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 109
    BYTES                     = 2
    COLUMN_NUMBER             = 55
    DESCRIPTION               = "CONSERT internal time in TICs - MSW
                                 - Orbiter: ETM00325 (field 9)
                                   (ETM00325 is a telemetry packet name:
                                    CONSERT HOUSEKEEPING REPORT) [AD 3]
                                 - Lander: TM type 1 (field 1)[AD 4]"
END_OBJECT                    = COLUMN

/* ---------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "CONSERT TIC LSW"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 111
    BYTES                     = 2
    COLUMN_NUMBER             = 56
    DESCRIPTION               = "CONSERT internal time in TIC - LSW
                                 - Orbiter: ETM00325 (field 10)
                                   (ETM00325 is a telemetry packet name:
                                    CONSERT HOUSEKEEPING REPORT) [AD 3]
                                 - Lander: TM type 1 (field 2) [AD 4]"
END_OBJECT                    = COLUMN

/* ---------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "CONSERT UTC MINUTES"
    UNIT                      = "MINUTE"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 113
    BYTES                     = 2
    COLUMN_NUMBER             = 57
```

```
    DESCRIPTION                 = "decoded CONSERT internal time minutes
                                   - From Orbiter: ETM00325 (field 9&10)
                                     (ETM00325 is a telemetry packet name:
                                      CONSERT HOUSEKEEPING REPORT) [AD 3]
                                   - From Lander: TM type 1 (field 1&2)[AD 4]"
END_OBJECT                      = COLUMN

/* ----------------------------------------------------- */

OBJECT                          = COLUMN
    NAME                        = "CONSERT UTC SECONDS"
    UNIT                        = "SECOND"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 115
    BYTES                       = 2
    COLUMN_NUMBER               = 58
    DESCRIPTION                 = "decoded CONSERT internal time second
                                   - From Orbiter: ETM00325 (field 9&10)
                                     (ETM00325 is a telemetry packet name:
                                      CONSERT HOUSEKEEPING REPORT)[AD 3]
                                   - From Lander: TM type 1(field 1&2)[AD 4]"
END_OBJECT                      = COLUMN

/* ----------------------------------------------------- */

OBJECT                          = COLUMN
    NAME                        = "CONSERT UTC MILLISECONDS"
    UNIT                        = "MILLISECOND"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 117
    BYTES                       = 2
    COLUMN_NUMBER               = 59
    DESCRIPTION                 = "decoded CONSERT internal time millisecond
                                   - From Orbiter: ETM00325 (field 9&10)
                                     (ETM00325 is a telemetry packet name:
                                      CONSERT HOUSEKEEPING REPORT) [AD 3]
                                   - From Lander: TM type 1 (field 1&2)[AD 4]"
END_OBJECT                      = COLUMN

/* ----------------------------------------------------- */

OBJECT                          = COLUMN
    NAME                        = "DATA TYPE"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 119
    BYTES                       = 2
    COLUMN_NUMBER               = 60
    DESCRIPTION                 = "- Orbiter: 0
                                   -  Lander:
                                   + with long signal: 1;
                                   + with short signal only: 2[AD 4]"
END_OBJECT                      = COLUMN

/* ----------------------------------------------------- */

OBJECT                          = COLUMN
    NAME                        = "SCANNING SEQUENCE COUNT"
    DATA_TYPE                   = MSB_UNSIGNED_INTEGER
    START_BYTE                  = 121
    BYTES                       = 2
    COLUMN_NUMBER               = 61
    DESCRIPTION                 = "Scanning sequence count"
END_OBJECT                      = COLUMN
```

```
/* ---------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "SOUNDING NUMBER"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 123
    BYTES                     = 2
    COLUMN_NUMBER             = 62
    DESCRIPTION               = "Present Sounding number
                                 - Orbiter: ETM02003 (field 11)
                                 (ETM02003: is a telemetry packet name:
                                  CONSERT SCIENCE REPORT) [AD 3]
                                 - Lander: TM type 1 (field 8) [AD 4]"
END_OBJECT                    = COLUMN

/* ---------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "ACK SOURCE SEQUENCE COUNT"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 125
    BYTES                     = 2
    COLUMN_NUMBER             = 63
    DESCRIPTION               = "Last ACK report number
                                 - Orbiter: last ETM00101 or ETM00102
                                   (field 2-14bits LSB)(ETM00101/ETM00102
                                   is a telemetry packet name: CONSERT
                                   ACKNOWLEDGEMENT SUCCESS/FAILURE) [AD 3]
                                 - Lander: last TM type 2
                                   (field 0-14bits LSB) [AD 4]"
END_OBJECT                    = COLUMN

/* ---------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "ACK TC SEQ CONTROL"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 127
    BYTES                     = 2
    COLUMN_NUMBER             = 64
    DESCRIPTION               = "TC number for the Last ACK
                                 - Orbiter: last ETM00101 or ETM00102 field 9
                                   (ETM00101/ETM00102 is a telemetry packet
                                   name : CONSERT ACKNOWLEDGEMENT
                                   SUCCESS/FAILURE) [AD 3]
                                 - Lander: =0 Nothing in this column"
END_OBJECT                    = COLUMN

/* ---------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "ACK FAILURE CODE"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 129
    BYTES                     = 2
    COLUMN_NUMBER             = 65
    DESCRIPTION               = "Failure code for the Last ACK
                                 - Orbiter: zero for an ETM00101 No failure
                                   Or field 10 for an ETM00102
                                   1: ERR_TC_TIMEOUT: TC packet not complete
                                      after 2 seconds
                                   2: ERR_TYPE_WRONG CRC: Calculated CRC is
```

```
                                    not egal to CRC at end of TC packet
                                 3: ERR_TYPE_WRONGAPID: TC packet has
                                    wrong APID (ID # 59 or Cat #12)
                                 4: ERR_TC_TYPE_UNKNOWN: TC packet has
                                    unknown Type or Subtype
                                 5: ERR_TWO_MISS_TAB: TC with mission table
                                    received and other table already received
                                 6: ERR_TC_DIRECT_UNKNOWN: Direct TC of
                                    unknown type received
                                 (ETM00101/ETM00102 is a telemetry packet
                                  name: CONSERT ACKNOWLEDGEMENT
                                  SUCCESS/FAILURE)[AD 3]
                               - Lander: =0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "PROGRESS REPORT NUMBER"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 131
    BYTES                    = 2
    COLUMN_NUMBER            = 66
    DESCRIPTION              = "Last Progress report number
                               - Orbiter:last ETM00501 or ETM00502 field 2
                                 (ETM00501/ETM00502 is a telemetry packet
                                 name: CONSERT PROGRESS/EVENT REPORT) [AD 3]
                               - Lander: =0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EVENT ID"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 133
    BYTES                    = 2
    COLUMN_NUMBER            = 67
    DESCRIPTION              = "Event id for the Last Progress report
                               - Orbiter:
                               + ETM00501-NCNA0EID=
                               (41003=Sounding started, 41004=Sounding
                               finished)
                               + ETM00502-NCNA0EID=
                               (41008 = Timeout Data, 41007 = Time OUt AGC)
                               (ETM00501/ETM00502 is a telemetry packet name:
                                CONSERT PROGRESS/EVENT REPORT and NCNA0EID is
                                a CONSERT telemetry parameter name) [AD 3]
                               - Lander: TM type 1 (field 7 LSB) [AD 4]"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "LAST HK"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 135
    BYTES                    = 2
    COLUMN_NUMBER            = 68
    DESCRIPTION              = "Last HK number
                                - Orbiter: ETM00325 (field 2-14bits LSB)
                                  (ETM00325 is a telemetry packet name:
                                   CONSERT HOUSEKEEPING REPORT) [AD 3]
```

```
                               - Lander: =0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_69"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 137
    BYTES                   = 2
    COLUMN_NUMBER           = 69
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_70"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 139
    BYTES                   = 2
    COLUMN_NUMBER           = 70
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_71"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 141
    BYTES                   = 2
    COLUMN_NUMBER           = 71
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_72"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 143
    BYTES                   = 2
    COLUMN_NUMBER           = 72
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "STATUS BIT INIT OK"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 145
    BYTES                   = 2
    COLUMN_NUMBER           = 73
    DESCRIPTION             = "status vector bit 7 - Init OK
                               0=Init not performed, 1=init OK
                               - Orbiter:ETM00325 (field 11-bit 15)
                                 (ETM00325 is a telemetry packet name:
                                  CONSERT HOUSEKEEPING REPORT) [AD 3]
                               - Lander: TM type 1-INSTRUMENT STATUS
                                 (field 3 - bit 7) [AD 4]"
END_OBJECT                  = COLUMN
```

```
/* ----------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "STATUS BIT MISS TAB OK"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 147
    BYTES                   = 2
    COLUMN_NUMBER           = 74
    DESCRIPTION             = "status vector bit 6 - mission table received
                                 0 = Mission table not received
                                 1 = Mission table received
                                 - Orbiter: ETM00325 (field 11-bit 14)
                                   (ETM00325 is a telemetry packet
                                   name: CONSERT HOUSEKEEPING
                                   REPORT) [AD 3]
                                 - Lander: TM type 1 (field 3-bit 6) [AD 4]"
END_OBJECT                  = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "STATUS BIT TUNING OK"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 149
    BYTES               = 2
    COLUMN_NUMBER       = 75
    DESCRIPTION         = "status vector bit 5 - tuning finished
                             0 = Tuning not performed
                             1 = Tuning performed
                             - Orbiter: ETM00325 (field 11-bit 13)
                               (ETM00325 is a telemetry packet name:
                                CONSERT HOUSEKEEPING REPORT) [AD 3]
                            - Lander: TM type 1 (field 3-bit 5) [AD 4]"
END_OBJECT              = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "STATUS BIT SOUNDING"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 151
    BYTES               = 2
    COLUMN_NUMBER       = 76
    DESCRIPTION         = "status vector bit 4-sounding started
                             0 = Not in sounding mode
                             1 = In sounding mode
                             - Orbiter: ETM00325 (field 11-bit 12)
                               (ETM00325 is a telemetry packet name:
                                CONSERT HOUSEKEEPING REPORT) [AD 3]
                            - Lander: TM type 1 (field 3-bit 4) [AD 4]"
END_OBJECT              = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "STATUS BIT END"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 153
    BYTES               = 2
    COLUMN_NUMBER       = 77
    DESCRIPTION         = "status vector bit 3-sounding finished
                             0 = Sounding not finished yet
```

```
                           1 = Sounding finished
                           - Orbiter: ETM00325 (field 11-bit 10)
                             (ETM00325 is a telemetry packet name:
                              CONSERT HOUSEKEEPING REPORT)  [AD 4]
                           - Lander: TM type 1 (field 3-bit 3) [AD 4]"
END_OBJECT              = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "STATUS BIT HKREP"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 155
    BYTES               = 2
    COLUMN_NUMBER       = 78
    DESCRIPTION         = "status vector bit 2-HK report enabled
                           0= no HK reporting
                           1= HK reporting enabled (default)
                           - Orbiter: ETM00325 (field 11-bit 9)
                            (ETM00325 is a telemetry packet name:
                             CONSERT HOUSEKEEPING REPORT)  [AD 3]
                           - Lander: =0 Nothing in this column"
END_OBJECT              = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "STATUS BIT SCREP"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 157
    BYTES               = 2
    COLUMN_NUMBER       = 79
    DESCRIPTION         = "status vector bit 1-science report enabled
                           0= no SCreporting
                           1= SC reporting enabled (default)
                           - Orbiter: ETM00325 (field 11 - bit 8)
                             (ETM00325 is a telemetry packet name:
                              CONSERT HOUSEKEEPING REPORT)  [AD 3]
                           - Lander: =0 Nothing in this column"
END_OBJECT              = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "STATUS BIT LOBT"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 159
    BYTES               = 2
    COLUMN_NUMBER       = 80
    DESCRIPTION         = "status vector bit 0-SCET (LOBT) received
                           0 = LOBT updated not received yet
                           1 = LOBT update received
                           - Orbiter: ETM00325 (field 11 - bit 7)
                             (ETM00325 is a telemetry packet name:
                              CONSERT HOUSEKEEPING REPORT) [AD 3]
                           - Lander: =0 Nothing in this column"
END_OBJECT              = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "EMPTY_81"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
```

```
    START_BYTE          = 161
    BYTES               = 2
    COLUMN_NUMBER       = 81
    DESCRIPTION         = "=0 Nothing in this column"
END_OBJECT              = COLUMN

/* ------------------------------------------------------ */

OBJECT                  = COLUMN
    NAME                = "EMPTY_82"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 163
    BYTES               = 2
    COLUMN_NUMBER       = 82
    DESCRIPTION         = "=0 Nothing in this column"
END_OBJECT              = COLUMN

/* ------------------------------------------------------ */

OBJECT                  = COLUMN
    NAME                = "GCW"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 165
    BYTES               = 2
    COLUMN_NUMBER       = 83
    DESCRIPTION         = "Gain control word
                           - Orbiter: ETM02003 (field 12 MSB)
                             (ETM02003: is a telemetry packet name:
                              CONSERT SCIENCE REPORT) [AD 3]
                           - Lander: Last TM type 1 or
                             Last TM type 3 (field 9 MSB) [AD 4]"
END_OBJECT              = COLUMN

/* ------------------------------------------------------ */

OBJECT                  = COLUMN
    NAME                = "FRAM"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 167
    BYTES               = 2
    COLUMN_NUMBER       = 84
    DESCRIPTION         = "Lander Framing word
                           - Orbiter: N/A
                           - Lander: Last TM type 1 or Last TM type 3
                             (field 9 LSB) [AD 4]"
END_OBJECT              = COLUMN

/* ------------------------------------------------------ */

OBJECT                  = COLUMN
    NAME                = "PEAK POSITION"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 169
    BYTES               = 2
    COLUMN_NUMBER       = 85
    DESCRIPTION         = "On board calculated peak position
                           - Orbiter: N/A
                           - Lander: Last TM type 1or Last TM type 3
                             (field 10 MSB) [AD 4]"
END_OBJECT              = COLUMN

/* ------------------------------------------------------ */
```

```
OBJECT                  = COLUMN
    NAME                = "FREQUENCY OXCO"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 171
    BYTES               = 2
    COLUMN_NUMBER       = 86
    DESCRIPTION         = "Present OXCO value
                           - Orbiter: ETM02003 (field 12 LSB)
                             (ETM02003 is a telemetry packet name:
                              CONSERT SCIENCE REPORT) [AD 3]
                           - Lander: Last TM type 1or Last TM type 3
                             (field 6 MSB) [AD 4]"
END_OBJECT              = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "TEMPERATURE OXCO"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 173
    BYTES               = 2
    COLUMN_NUMBER       = 87
    DESCRIPTION         = "OCXO board temperature
                           - Orbiter: ETM02003 (field 10 MSB)
                             (ETM02003 is a telemetry packet name:
                              CONSERT SCIENCE REPORT) [AD 3]
                           - Lander: Last TM type 1 or Last TM type 3
                             (field 4 MSB) [AD 4]"
END_OBJECT              = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "DIGITAL BOARD TEMPERATURE"
    UNIT                = "ADC_COUNTS"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 175
    BYTES               = 2
    COLUMN_NUMBER       = 88
    DESCRIPTION         = "Digital board temperature
                           - Orbiter: ETM02003 (field 10 LSB)
                             (ETM02003 is a telemetry packet name:
                              CONSERT SCIENCE REPORT) [AD 3]
                           - Lander: Last TM type 1 or Last TM type 3
                             (field 4 LSB)   [AD 4]"
END_OBJECT              = COLUMN

/* ----------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "NBLS LEVEL"
    UNIT                = "N/A"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 177
    BYTES               = 2
    COLUMN_NUMBER       = 89
    DESCRIPTION         = "NBLS level
                           - Orbiter: ETM00325 (field 12 LSB)
                             (ETM00325 is a telemetry packet name:
                              CONSERT HOUSEKEEPING REPORT)  [AD 3]
                           - Lander: Last TM type 1 or Last TM type 3
                             (field 5 MSB) [AD 4]"
END_OBJECT              = COLUMN
```

```
/* ---------------------------------------------------- */

OBJECT                  = COLUMN
    NAME                = "TMIX LEVEL"
    UNIT                = "N/A"
    DATA_TYPE           = MSB_UNSIGNED_INTEGER
    START_BYTE          = 179
    BYTES               = 2
    COLUMN_NUMBER       = 90
    DESCRIPTION         = "NBLS level
                           - Orbiter: ETM00325 (field 13 MSB)
                             (ETM00325 is a telemetry packet name:
                              CONSERT HOUSEKEEPING REPORT) [AD 3]
                           - Lander: Last TM type 1 or Last TM type 3
                             (field 5 LSB) [AD 4]"
END_OBJECT              = COLUMN

/* ---------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_91"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 181
    BYTES                   = 2
    COLUMN_NUMBER           = 91
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ---------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_92"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 183
    BYTES                   = 2
    COLUMN_NUMBER           = 92
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ---------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_93"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 185
    BYTES                   = 2
    COLUMN_NUMBER           = 93
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ---------------------------------------------------- */

OBJECT                      = COLUMN
    NAME                    = "EMPTY_94"
    DATA_TYPE               = MSB_UNSIGNED_INTEGER
    START_BYTE              = 187
    BYTES                   = 2
    COLUMN_NUMBER           = 94
    DESCRIPTION             = "=0 Nothing in this column"
END_OBJECT                  = COLUMN

/* ---------------------------------------------------- */
```

```
OBJECT                         = COLUMN
    NAME                       = "EMPTY_95"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 189
    BYTES                      = 2
    COLUMN_NUMBER              = 95
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_96"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 191
    BYTES                      = 2
    COLUMN_NUMBER              = 96
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_97"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 193
    BYTES                      = 2
    COLUMN_NUMBER              = 97
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_98"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 195
    BYTES                      = 2
    COLUMN_NUMBER              = 98
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_99"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 197
    BYTES                      = 2
    COLUMN_NUMBER              = 99
    DESCRIPTION                = "=0 Nothing in this column"
END_OBJECT                     = COLUMN

/* ----------------------------------------------------- */

OBJECT                         = COLUMN
    NAME                       = "EMPTY_100"
    DATA_TYPE                  = MSB_UNSIGNED_INTEGER
    START_BYTE                 = 199
    BYTES                      = 2
    COLUMN_NUMBER              = 100
    DESCRIPTION                = "=0 Nothing in this column"
```

```
END_OBJECT                    = COLUMN

/* ----------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "L1_DATA"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 201
    BYTES                     = 200
    ITEMS                     = 100
    ITEM_BYTES                = 2
    COLUMN_NUMBER             = 101
    DESCRIPTION               = "Contains L1 DATA: 0 for a L0 TABLE"
END_OBJECT                    = COLUMN

/* ----------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "SHORTS PIC I"
    UNIT                      = "N/A"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 401
    BYTES                     = 42
    ITEMS                     = 21
    ITEM_BYTES                = 2
    COLUMN_NUMBER             = 102
    DESCRIPTION               = "On board calculated correlation
                                 21 points around the detected max.
                                 - Orbiter: =0 Nothing in these columns
                                 - Lander:
                                    + For SWL15 I channel for bytes
                                    + For SWL12 correlation power on word
                                 Last TM type 1 or Last TM type 3 [AD 4]"
END_OBJECT                    = COLUMN

/* ----------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "SHORTS PIC Q"
    UNIT                      = "N/A"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 443
    BYTES                     = 42
    ITEMS                     = 21
    ITEM_BYTES                = 2
    COLUMN_NUMBER             = 103
    DESCRIPTION               = "On board calculated correlation
                                 21 points around the detected max
                                 - Orbiter: =0 Nothing in these columns
                                 - Lander:
                                    + For SWL15 Q channel for bytes
                                    + For SWL12 Zero (N/A)
                                 Last TM type 1 or Last TM type 3 [AD 4]"
END_OBJECT                    = COLUMN

/* ----------------------------------------------------- */

OBJECT                        = COLUMN
    NAME                      = "EMPTY_244"
    DATA_TYPE                 = MSB_UNSIGNED_INTEGER
    START_BYTE                = 485
    BYTES                     = 2
    COLUMN_NUMBER             = 104
```

```
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_245"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 487
    BYTES                    = 2
    COLUMN_NUMBER            = 105
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_246"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 489
    BYTES                    = 2
    COLUMN_NUMBER            = 106
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_247"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 491
    BYTES                    = 2
    COLUMN_NUMBER            = 107
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_248"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 493
    BYTES                    = 2
    COLUMN_NUMBER            = 108
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_249"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 495
    BYTES                    = 2
    COLUMN_NUMBER            = 109
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_250"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
```

```
    START_BYTE               = 497
    BYTES                    = 2
    COLUMN_NUMBER            = 110
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_251"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 499
    BYTES                    = 2
    COLUMN_NUMBER            = 111
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_252"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 501
    BYTES                    = 2
    COLUMN_NUMBER            = 112
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_253"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 503
    BYTES                    = 2
    COLUMN_NUMBER            = 113
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_254"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 505
    BYTES                    = 2
    COLUMN_NUMBER            = 114
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

/* ----------------------------------------------------- */

OBJECT                       = COLUMN
    NAME                     = "EMPTY_255"
    DATA_TYPE                = MSB_UNSIGNED_INTEGER
    START_BYTE               = 507
    BYTES                    = 2
    COLUMN_NUMBER            = 115
    DESCRIPTION              = "=0 Nothing in this column"
END_OBJECT                   = COLUMN

END
```

For the Auxiliary data (AOCS):

```
OBJECT                = AOCS_TABLE
  NAME                  = "AOCS"
  INTERCHANGE_FORMAT = ASCII
  ROWS                  = 81000
  ^STRUCTURE            = "AOCS.FMT"
  COLUMNS               = 8
  ROW_BYTES             = 156
END_OBJECT            = AOCS_TABLE
```

The structure of the TABLE object is described in the file AOCS.FMT (LABEL directory) as follows:

```
OBJECT                  = COLUMN
    NAME                 = "UTC_TIME"
    DATA_TYPE            = TIME
    START_BYTE           = 1
    BYTES                = 23
    DESCRIPTION          = "This column represents the UTC 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
    DESCRIPTION          = "This column represents On Board Time represented as :
                            Reset number (integer starting at 1) / seconds
                            The time resolution is 1/65536 s"
 END_OBJECT              = COLUMN

OBJECT                = COLUMN
    NAME                = "SID"
    DATA_TYPE           = ASCII_INTEGER
    START_BYTE          = 45
    BYTES               = 3
    UNIT                = "N/A"
    FORMAT              = "I3"
    DESCRIPTION         = "SID reading in CDMS packet header
                           Possible values are :
                           110 or
                           101"
END_OBJECT            = COLUMN

OBJECT                = COLUMN
    NAME                = "AOCS_PARAM_ID"
    DATA_TYPE           = ASCII_INTEGER
    START_BYTE          = 49
    BYTES               = 3
    UNIT                = "N/A"
    FORMAT              = "I3"
    DESCRIPTION         = "AOCS parameter identifier
                           Possible values are:
                           [1,...,12]"
END_OBJECT            = COLUMN

OBJECT                = COLUMN
    NAME                = "AOCS_UNIT"
    DATA_TYPE           = CHARACTER
    START_BYTE          = 54
```

```
    BYTES            = 3
    UNIT             = "N/A"
    DESCRIPTION      = "Unit of AOCS parameter
                        Possible value is:
                        rad (for radian)"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
    NAME             = "AOCS_PARAM_LABEL"
    DATA_TYPE        = CHARACTER
    START_BYTE       = 60
    BYTES            = 20
    FORMAT           = "N/A"
    UNIT             = "N/A"
    DESCRIPTION      = "AOCS parameter label
                        Possible values are:
                        NACW1102,NACW1103,NACW1104,
                        NACW1105,NACW1106,NACW1107
                        NACW1300,NACW1301,NACW1304,
                        NACW1305,NACW1306,NACW1307"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
    NAME             = "AOCS_PARAM_DESC"
    DATA_TYPE        = CHARACTER
    START_BYTE       = 83
    BYTES            = 60
    FORMAT           = "N/A"
    UNIT             = "N/A"
    DESCRIPTION      = "AOCS parameter describtion
                        Possible values are:
                        APME Cur Onbrd Cmd Elv
                        APME Cur Onbrd Cmd Az
                        APME Ground Cmd Elev
                        APME Ground Cmd Az
                        APME Encdr Measured Elev
                        APME Encdr Measured Azi
                        SADE Grd Cmd Ang Pos YP
                        SADE Grd Cmd Ang Pos YM
                        SADE Cmd Ang Position YP
                        SADE Cmd Ang Position YM
                        SADE Measured Ang Pos YP
                        SADE Measured Ang Pos YM"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
    NAME             = "AOCS_VALUE"
    DATA_TYPE        = ASCII_REAL
    START_BYTE       = 145
    BYTES            = 10
    FORMAT           = "F10.7"
    UNIT             = "N/A"
    DESCRIPTION      = "AOCS parameter VALUE,
                        with MIL-STD-1750A, PC(5,2) format describes on
                        the website:
                        http://www.xgc.com/manuals/m1750-ada/m1750/book1.html"
END_OBJECT         = COLUMN
```

4.4.1.5 Mission Specific Keywords (Lander and Orbiter)

ROSETTA:CON_MISSION_TABLE_STARTTIC

- **Type** : integer (4 Bytes)

- **Standard values** :
- **Description** : Date of the first sounding in TIC

5 Level 3 Specifications and Design

This section will be written at Level 3 delivery time

6 Level 4 Specifications and Design

This section will be written at Level 4 delivery time

1 Appendix: structure of Lander/Orbiter CONSERT level 2 data product

The level 2 data product has the same structure as the L0 data at SONC:

Block	**N°**	**Size in bytes**	**Description**
L0 Header	0-49	50	General parameters
	50-99	50	raw data parameters
	100-149	50	reserved for L1 format
	150-199	50	reserved for L1 format
	200-249	50	short signal for lander only
	250-254	5	free
I signal	255-509	255	Signal I
Q signal	510-764	255	Signal Q

Structure of the L0 Header (/XF means the most significant byte of the Xth word and /Xf means the least significant byte of the Xth word)

		General Parameters		Orbiter		Lander	
N°	**Name**	**Description**	**For**	**Value**		**Value**	
0	Data_level	Data level		0		0	
1	Version	Format version : 00		00		00	
2	Source	Acquisition system identifier 0: obdh, 1: Sish kfki 2: rolbin, 3: cdms, 4 :sfdu		File		File	
3	Box	Type : 1: Orbiter, 2:Lander		Prg		Prg	
4	Court	Short signal format on lander 1: SW12 2: SW15 [3]		2		Prg	
5	Nb	Incremental record number	NS	Internal		Internal	
6	Time_Fich	Year: *Raw file date*		File		File	
7		Month		File		File	
8		Day		File		File	
9		Hours		File		File	
10		Minutes		File		File	
11		Seconds		File		File	
12	Time_Pres	Year: L0 file creation date		Internal		Internal	
13		Month		Internal		Internal	
14		Day		Internal		Internal	
15		Hours		Internal		Internal	
16		Minutes		Internal		Internal	
17		Seconds		Internal		Internal	
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33	TUN_stat	EV_ID code 41002/41020		59,7/8	L0		
34	TUN_ocxo	OCXO after tuning		59,7/9F [4]	L0	TM1/6F	L0
35	TUN_Inter	Intercartile		59,7/9f	L0		
36	TUN_gcw	Tuning GCW		59,7/10F	L0		
37	TUN_nblg	NBLL GCW		59,7/10f	L0		
38	TUN_nblz	NBLL Zero		59,7/ 11F	L0		
39	TUN_Tocxo	Temperature OCXO Tuning		59,4/10F	L0	TM1/4F	L0
40							
41							
42							
43-49							
		Raw data		**Orbiter**		**Lander**	
N°	**Name**	**Description**	**For**	**Value**	**L.**	**Value**	**L.**

[3] The SW Lander version determines the format of the short signal (I&Q / 8 bits or I2+Q2 / 16 bits)
The short signal from the Orbiter is computed in I&Q. It is thus compatible with the format SW15 Lander
[4] The TM used is of type TM 59,7 having the 8th word set to 41002

50	OBDH_PN	OBDH Packet Number	NS	59,12 / 1		112,12 / 1	
51	COBT	COBT Time second MSW	NS	59,12 / 3		112,12 / 3	
52		COBT Time second LSW	NS	59,12 / 4		112,12 / 4	
53		COBT Time fraction. second MSW	NS	59,12 / 5		112,12 / 5	
54	CTIC	Temps CONSERT en TIC MSW	NS	59,12/8		TM / 1	
55		LSW	NS	59,12/9		TM / 2	
56		Temps CONSERT TIC decoded : minutes	NS	Compute		Compute	
57		seconds	NS	Compute		Compute	
58		Milliseconds	NS	Compute		Compute	
59	Data_Type	Data type: For orbiter : 0, For Lander :TM long signal: 1, short signal:2		0		Prg [5]	
60	Sca_Seq_Ct	Scanning Sequence Count		Prg[6]		Prg	
61	S_Nb	Present Sounding Number	NS	59,12/ 11		TM / 8	
62	AK	Index of the last AK_report	NS	59,1 / 1		TM / 0	
63		AK TC nb		59,1 / 8		0	
64		AK failure code		59,1/10		0	
65	PR	Index of the last progress report	NS	59,7		TM/7F	
66		EV_ID	NS	59,7		TM/7f	
67	HK	Index of the last HK	NS	59,4 / 1		TM/0	
68							
69							
70							
71							
72	Status	Experiment sequence status bit 7 (0/1)		59,4 / 11		TM / 3f	
73		Experiment sequence status bit 6 (0/1)		59,4 / 11		TM / 3f	
74		Experiment sequence status bit 5 (0/1)		59,4 / 11		TM / 3f	
75		Experiment sequence status bit 4 (0/1)		59,4 / 11		TM / 3f	
76		Experiment sequence status bit 3 (0/1)		59,4 / 11		TM / 3f	
77		Experiment sequence status bit 2 (0/1)		59,4 / 11		0	
78		Experiment sequence status bit 1 (0/1)		59,4 / 11		0	
79		Experiment sequence status bit 0 (0/1)		59,4 / 11		0	
80							
81							
82	GCW	GCW		59,12/12 F		TM / 9F	
83	FRAM	Framing		0		TM / 9f	
84	Peak_P	Peak position		0		TM / 10F	
85	Ocxo	OCXO DAC		59,12 / 12f		TM / 6F	
86	T_ocxo	T ocxo		59,12 / 10F		TM / 4F	
87	T_digi	T digit		59,12 / 10f		TM / 4f	
88	NBLS	NBL level		59,4/ 12f		TM / 5F	
89	TMIX	TMIX Level		59,4/ 13F		TM / 5f	

[5] Lander TM Type : Long signal (Type 3) or Short Signal (Type 1)
[6] Number of scanning sequence count, each sounding number begins at 1

		L1 data		Orbiter		Lander	
N°	**Name**	**Description**	**For**	**Value**	**L.**	**Value**	**L.**
100-199		reserved for L1 data					

		Short signal (2*21 pts)		Orbiter		Lander	
N°	**Name**	**Description**	**For**	**Value**	**L.**	**Value**	**L.**
200-220	Pic_I	Correlated signal I or SQRT(I ^ 2 + Q ^ 2)		0		TM	L0
221-242	Pic_Q	Q or 0		0		TM	L0
243-249		free		0		0	

		free		Orbiter		Lander	
N°	**Name**	**Description**	**For**	**Value**	**L.**	**Value**	**L.**
250-254							

I and Q signal

		Signal I and signal Q		Orbiter		Lander	
N°	**Name**	**Description**	**For**	**Value**	**L.**	**Value**	**L.**
1 - 255	Signal I	Signal I		59,12/13-268	L0	TM 32 – 286 [7]	L0
1 - 255	Signal Q	Signal Q		59,12/269-524	L0	TM 288 - 542	L0

2 Appendix: Available Software to read PDS files

The level 2 housekeeping and science PDS files can be read with the PDS table verifier tool “tbtool” and readpds (Small Bodies Node tool).

3 Appendix: Example of Directory Listing of Data Set RO-RL-CAL-CONSERT-2-CVP-V1.0

```
|-AAREADME.TXT
|
|               |-CATINFO.TXT
```

[7] Zero for short signal , else TM

```
                                 |                |-DATASET.CAT
                                 |-CATALOG------|-INST.CAT
                                 |                |-INSTHOST.CAT
                                 |                |-MISSION.CAT
                                 |                |-PERSON.CAT
                                 |                |-REF.CAT
                                 |                |-SOFTWARE.CAT
                                 |
                                 |                          |-CN_L_2_040412T000921.LBL
                                 |                          |-CN_L_2_040412T000921.TAB
                                 |                          |-CN_L_2_040514T205525.LBL
                                 |                          |-CN_L_2_040514T205525.TAB
                                 |                          |-CN_L_2_041001T050823.LBL
                                 |                          |-CN_L_2_041001T050823.TAB
|-RO-RL-CAL-CONSERT-2-CVP-V1.0-|-DATA---------|-2004----|-CN_O_2_040520T211035.LBL
                                 |                          |-CN_O_2_040520T211035.TAB
                                 |                          |-CN_O_2_040920T080759.LBL
                                 |                          |-CN_O_2_040920T080759.TAB
                                 |                          |-CN_O_2_041001T050804.LBL
                                 |                          |-CN_O_2_041001T050804.TAB
                                 |
                                 |                |-DOCINFO.TXT
                                 |                |-EAICD_CONSERT.LBL
                                 |                |-EAICD_CONSERT.PDF
                                 |                |-RO-OCN-TN-3823.LBL
                                 |                |-RO-OCN-TN-3823.PDF
                                 |                |-RO-LCN-TN-3848.LBL
                                 |                |-RO-LCN-TN-3848.PDF
                                 |-DOCUMENT-----|-RO-OCN-TN-3044.LBL
                                 |                |-RO-OCN-TN-3044.PDF
                                 |                |-RO-OCN-TR-3805.LBL
                                 |                |-RO-OCN-TR-3805.PDF
                                 |                |-TIMELINE_CVP.TXT
                                 |                |-TIMELINE_CVP_DESC.TXT
                                 |                |-TIMELINE_CVP_PART1.LBL
                                 |                |-TIMELINE_CVP_PART1.PNG
                                 |                |-TIMELINE_CVP_PART2.LBL
                                 |                |-TIMELINE_CVP_PART2.PNG
                                 |
                                 |-INDEX--------|-INDXINFO.TXT
                                 |                |-INDEX.LBL
                                 |                |-INDEX.TAB
                                 |
                                 |                |-LABINFO.TXT
                                 |-LABEL--------|-L0_PARAMETER_DEF.FMT
                                 |
                                 |-VOLDESC.CAT
```

4 Appendix: Example of Consert Lander level 2 data product label

```
PDS_VERSION_ID               = PDS3
LABEL_REVISION_NOTE  = "2007-07-16, SONC, version 1.0"
/* PVV version 3.6 */

/*              Raw data (Level 2)               */

/* FILE CHARACTERISTIC DATA ELEMENTS */

RECORD_TYPE          = FIXED_LENGTH
RECORD_BYTES         = 1530
FILE_RECORDS         = 398

FILE_NAME            = "CN_L_2_080718T184822.DAT"


/* DATA OBJECT POINTERS  */

^L0_TABLE       = ("CN_L_2_080718T184822.DAT",1 <BYTES>)
^I_TABLE        = ("CN_L_2_080718T184822.DAT",511 <BYTES>)
^Q_TABLE        = ("CN_L_2_080718T184822.DAT",1021 <BYTES>)


/* IDENTIFICATION KEYWORDS */
DATA_SET_ID     = "RO/RL-CAL-CONSERT-2-CR4A-V1.0"
DATA_SET_NAME   = "ROSETTA-ORBITER CAL CONSERT 2 CR4A V1.0"
PRODUCT_ID      = "CN_L_2_080718T184822"
PRODUCT_CREATION_TIME  = 2011-05-13T09:54:21
MISSION_NAME           = "INTERNATIONAL ROSETTA MISSION"
MISSION_ID             = ROSETTA
INSTRUMENT_HOST_NAME   = {"ROSETTA-ORBITER","ROSETTA-LANDER"}
INSTRUMENT_HOST_ID     = {"RO","RL"}
OBSERVATION_TYPE    = "ACTIVE CHECKOUT 8"

MISSION_PHASE_NAME     = "CRUISE 4-1"
PRODUCT_TYPE         = EDR

START_TIME           = 2008-07-18T18:48:22
STOP_TIME            = 2008-07-18T23:49:27
SPACECRAFT_CLOCK_START_COUNT = "2/175027666.22528"
SPACECRAFT_CLOCK_STOP_COUNT  = "2/175045731.08192"
ORBIT_NUMBER          ="N/A"

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

INSTRUMENT_ID        = CONSERT
INSTRUMENT_NAME      = "COMET NUCLEUS SOUNDING EXPERIMENT BY RADIOWAVE
                       TRANSMISSION"
INSTRUMENT_TYPE      = "RADAR"
INSTRUMENT_MODE_ID   = "PINGPONG"
INSTRUMENT_MODE_DESC = "CONSERT IN SOUNDING MODE"
TARGET_NAME         = "CALIBRATION"
TARGET_TYPE         = "CALIBRATION"
```

```
PROCESSING_LEVEL_ID = "2"
DATA_QUALITY_ID    = "N/A"
DATA_QUALITY_DESC = "N/A"

/* GEOMETRY PARAMETERS */

/* SPACECRAFT LOCATION: Position <km> */
SC_SUN_POSITION_VECTOR = (  158966620.3, 227582449.3, 103671796.1)
/* TARGET PARAMETERS: Position <km>, Velocity <km/s> */
SC_TARGET_POSITION_VECTOR = ("N/A", "N/A", "N/A")
SC_TARGET_VELOCITY_VECTOR = ("N/A", "N/A", "N/A")
/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */
SPACECRAFT_ALTITUDE =  "N/A"
SUB_SPACECRAFT_LATITUDE =  "N/A"
SUB_SPACECRAFT_LONGITUDE =  "N/A"
NOTE = "The values of the keywords SC_SUN_POSITION_VECTOR,
       SC_TARGET_POSITION_VECTOR and SC_TARGET_VELOCITY_VECTOR
       are related to the EMEJ2000 reference frame.
       The values of SUB_SPACECRAFT_LATITUDE and SUB_SPACECRAFT_LONGITUDE
       are northern latitude and eastern longitude in the standard
       planetocentric IAU_<TARGET_NAME> frame.
       All values are computed for the time = START_TIME.
       Distances are given in <km> velocities in <km/s>, Angles in <deg>"

/* DATA OBJECT DEFINITION  */


ROSETTA:CON_MISSION_TABLE_STARTTIC = 45686

OBJECT                = L0_TABLE
  NAME                = "L0_TABLE"
  INTERCHANGE_FORMAT = BINARY
  ROWS                = 398
  COLUMNS             = 115
  ROW_BYTES           = 510
  ROW_SUFFIX_BYTES    = 1020
  ^STRUCTURE          = "L0_PARAMETER_DEF.FMT"
END_OBJECT            = L0_TABLE

OBJECT                = I_TABLE
  NAME                = "I_TABLE"
  INTERCHANGE_FORMAT = BINARY
  ROWS                = 398
  ROW_BYTES           = 510
  ROW_PREFIX_BYTES    = 510
  ROW_SUFFIX_BYTES    = 510
  COLUMNS             = 1
  OBJECT                = COLUMN
    NAME                = "I_SIGNAL"
    DATA_TYPE           = MSB_INTEGER
    START_BYTE          = 1
    BYTES               = 510
    ITEMS               = 255
    ITEM_BYTES          = 2
    ITEM_OFFSET         = 2
```

```
    DESCRIPTION          = "THIS TABLE REPRESENTS THE I VALUES OF THE CONSERT
                              RADIO SOUNDING"
  END_OBJECT             = COLUMN
END_OBJECT             = I_TABLE

OBJECT                 = Q_TABLE
  NAME                 = "Q_TABLE"
  INTERCHANGE_FORMAT   = BINARY
  ROWS                 = 398
  ROW_BYTES            = 510
  ROW_PREFIX_BYTES     = 1020
  COLUMNS              = 1
  OBJECT                 = COLUMN
    NAME                 = "Q_SIGNAL"
    DATA_TYPE            = MSB_INTEGER
    START_BYTE           = 1
    BYTES                = 510
    ITEMS                = 255
    ITEM_BYTES           = 2
    ITEM_OFFSET          = 2
    DESCRIPTION          = "THIS TABLE REPRESENTS THE Q VALUES OF THE CONSERT
                              RADIO SOUNDING"
  END_OBJECT             = COLUMN
END_OBJECT             = Q_TABLE

END
```

5 Appendix: Example of Consert Orbiter level 2 data product label

```
PDS_VERSION_ID               = PDS3
LABEL_REVISION_NOTE  = "2007-07-16, SONC, version 1.0"
/* PVV version 3.6 */

/*                Raw data (Level 2)               */

/* FILE CHARACTERISTIC DATA ELEMENTS */

RECORD_TYPE          = FIXED_LENGTH
RECORD_BYTES         = 1530
FILE_RECORDS         = 11385

FILE_NAME            = "CN_O_2_080718T191812.DAT"


/* DATA OBJECT POINTERS  */

^L0_TABLE       = ("CN_O_2_080718T191812.DAT",1 <BYTES>)
^I_TABLE        = ("CN_O_2_080718T191812.DAT",511 <BYTES>)
^Q_TABLE        = ("CN_O_2_080718T191812.DAT",1021 <BYTES>)


/* IDENTIFICATION KEYWORDS */
DATA_SET_ID     = "RO/RL-CAL-CONSERT-2-CR4A-V1.0"
DATA_SET_NAME   = "ROSETTA-ORBITER CAL CONSERT 2 CR4A V1.0"
PRODUCT_ID      = "CN_O_2_080718T191812"
PRODUCT_CREATION_TIME  = 2011-05-13T09:54:31
MISSION_NAME           = "INTERNATIONAL ROSETTA MISSION"
MISSION_ID             = ROSETTA
INSTRUMENT_HOST_NAME   = {"ROSETTA-ORBITER","ROSETTA-LANDER"}
INSTRUMENT_HOST_ID     = {"RO","RL"}
OBSERVATION_TYPE     = "ACTIVE CHECKOUT 8"

MISSION_PHASE_NAME     = "CRUISE 4-1"
PRODUCT_TYPE         = EDR

START_TIME           = 2008-07-18T19:18:12
STOP_TIME            = 2008-07-20T11:28:47
SPACECRAFT_CLOCK_START_COUNT = "2/175029456.13824"
SPACECRAFT_CLOCK_STOP_COUNT  = "2/175174091.38400"
ORBIT_NUMBER          ="N/A"

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

INSTRUMENT_ID        = CONSERT
INSTRUMENT_NAME      = "COMET NUCLEUS SOUNDING EXPERIMENT BY RADIOWAVE
                       TRANSMISSION"
INSTRUMENT_TYPE      = "RADAR"
INSTRUMENT_MODE_ID   = "PINGPONG"
INSTRUMENT_MODE_DESC = "CONSERT IN SOUNDING MODE"
TARGET_NAME         = "CALIBRATION"
TARGET_TYPE         = "CALIBRATION"
```

```
PROCESSING_LEVEL_ID = "2"
DATA_QUALITY_ID    = "N/A"
DATA_QUALITY_DESC = "N/A"

/* GEOMETRY PARAMETERS */

/* SPACECRAFT LOCATION: Position <km> */
SC_SUN_POSITION_VECTOR = (  158947231.8, 227604762.8, 103686122.7)
/* TARGET PARAMETERS: Position <km>, Velocity <km/s> */
SC_TARGET_POSITION_VECTOR = ("N/A", "N/A", "N/A")
SC_TARGET_VELOCITY_VECTOR = ("N/A", "N/A", "N/A")
/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */
SPACECRAFT_ALTITUDE =  "N/A"
SUB_SPACECRAFT_LATITUDE =  "N/A"
SUB_SPACECRAFT_LONGITUDE =  "N/A"
NOTE = "The values of the keywords SC_SUN_POSITION_VECTOR,
       SC_TARGET_POSITION_VECTOR and SC_TARGET_VELOCITY_VECTOR
       are related to the EMEJ2000 reference frame.
       The values of SUB_SPACECRAFT_LATITUDE and SUB_SPACECRAFT_LONGITUDE
       are northern latitude and eastern longitude in the standard
       planetocentric IAU_<TARGET_NAME> frame.
       All values are computed for the time = START_TIME.
       Distances are given in <km> velocities in <km/s>, Angles in <deg>"

/* DATA OBJECT DEFINITION  */


ROSETTA:CON_MISSION_TABLE_STARTTIC = 36624

OBJECT                = L0_TABLE
  NAME                = "L0_TABLE"
  INTERCHANGE_FORMAT = BINARY
  ROWS                = 11385
  COLUMNS             = 115
  ROW_BYTES           = 510
  ROW_SUFFIX_BYTES    = 1020
  ^STRUCTURE          = "L0_PARAMETER_DEF.FMT"
END_OBJECT            = L0_TABLE

OBJECT                = I_TABLE
  NAME                = "I_TABLE"
  INTERCHANGE_FORMAT = BINARY
  ROWS                = 11385
  ROW_BYTES           = 510
  ROW_PREFIX_BYTES    = 510
  ROW_SUFFIX_BYTES    = 510
  COLUMNS             = 1
  OBJECT                = COLUMN
    NAME                = "I_SIGNAL"
    DATA_TYPE           = MSB_INTEGER
    START_BYTE          = 1
    BYTES               = 510
    ITEMS               = 255
    ITEM_BYTES          = 2
    ITEM_OFFSET         = 2
```

```
    DESCRIPTION         = "THIS TABLE REPRESENTS THE I VALUES OF THE CONSERT
                             RADIO SOUNDING"
  END_OBJECT            = COLUMN
END_OBJECT            = I_TABLE

OBJECT                = Q_TABLE
  NAME                = "Q_TABLE"
  INTERCHANGE_FORMAT  = BINARY
  ROWS                = 11385
  ROW_BYTES           = 510
  ROW_PREFIX_BYTES    = 1020
  COLUMNS             = 1
  OBJECT                = COLUMN
    NAME                = "Q_SIGNAL"
    DATA_TYPE           = MSB_INTEGER
    START_BYTE          = 1
    BYTES               = 510
    ITEMS               = 255
    ITEM_BYTES          = 2
    ITEM_OFFSET         = 2
    DESCRIPTION         = "THIS TABLE REPRESENTS THE Q VALUES OF THE CONSERT
                             RADIO SOUNDING"
  END_OBJECT            = COLUMN
END_OBJECT            = Q_TABLE

END
```

6 Appendix: Example of Consert AOCS level 2 data product label

```
PDS_VERSION_ID               = PDS3
LABEL_REVISION_NOTE            = "2007-07-16, SONC, version 1.0"
/* PVV version 3.1 */

/*              Raw data (Level 2)               */

/* FILE CHARACTERISTIC DATA ELEMENTS */

RECORD_TYPE          = FIXED_LENGTH
RECORD_BYTES         = 132
FILE_RECORDS         = 8100

FILE_NAME            = "CN_A_2_070225T000130.TAB"


/* DATA OBJECT POINTERS  */



/* IDENTIFICATION KEYWORDS */
DATA_SET_ID            = "RO-RL-CAL-CONSERT-2-MARS-V1.0"
DATA_SET_NAME          = "ROSETTA-ORBITER MARS CONSERT 2 MARS V1.0"
PRODUCT_ID             = "CN_A_2_070225T000130"
PRODUCT_CREATION_TIME  = 2009-09-18T15:54:26
MISSION_NAME           = "INTERNATIONAL ROSETTA MISSION"
MISSION_ID             = ROSETTA
INSTRUMENT_HOST_NAME   = {"ROSETTA-ORBITER","ROSETTA-LANDER"}
INSTRUMENT_HOST_ID     = {"RO","RL"}
OBSERVATION_TYPE       = "MARS SWING-BY"

MISSION_PHASE_NAME     = "MARS SWING-BY"
PRODUCT_TYPE           = EDR

START_TIME           = 2007-02-25T00:01:30
STOP_TIME            = 2007-02-25T23:59:23
SPACECRAFT_CLOCK_START_COUNT = "1/130982462.04371"
SPACECRAFT_CLOCK_STOP_COUNT  = "1/131068734.08113"
ORBIT_NUMBER         ="N/A"

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

INSTRUMENT_ID        = CONSERT
INSTRUMENT_NAME      = "COMET NUCLEUS SOUNDING EXPERIMENT BY RADIOWAVE
                       TRANSMISSION"
INSTRUMENT_TYPE      = "RADAR"
INSTRUMENT_MODE_ID   = "PINGPONG"
INSTRUMENT_MODE_DESC = "CONSERT IN SOUNDING MODE"
TARGET_NAME          = "MARS"
TARGET_TYPE          = "PLANET"


PROCESSING_LEVEL_ID = 2
```

```
DATA_QUALITY_ID   = "N/A"
DATA_QUALITY_DESC = "N/A"

/* GEOMETRY PARAMETERS */

/* SPACECRAFT LOCATION: Position <km> */
SC_SUN_POSITION_VECTOR = (  -18392147.6, 195586521.2,  90211464.9)
/* TARGET PARAMETERS: Position <km>, Velocity <km/s> */
SC_TARGET_POSITION_VECTOR = ( -153539618.6, 251085093.4, 114271891.0)
SC_TARGET_VELOCITY_VECTOR = (        -36.3,        -20.8,         -9.1)
/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */
SPACECRAFT_ALTITUDE =   315709008.7 <km>
SUB_SPACECRAFT_LATITUDE =   -21.07 <deg>
SUB_SPACECRAFT_LONGITUDE =   151.15 <deg>
NOTE = "The values of the keywords SC_SUN_POSITION_VECTOR,
       SC_TARGET_POSITION_VECTOR and SC_TARGET_VELOCITY_VECTOR
       are related to the EMEJ2000 reference frame.
       The values of SUB_SPACECRAFT_LATITUDE and SUB_SPACECRAFT_LONGITUDE
       are northern latitude and eastern longitude in the standard
       planetocentric IAU_<TARGET_NAME> frame.
       All values are computed for the time = START_TIME.
       Distances are given in <km> velocities in <km/s>, Angles in <deg>"

/* DATA OBJECT DEFINITION  */


OBJECT                 = FILE
  RECORD_TYPE          = FIXED_LENGTH
  FILE_RECORDS         = 8100
  RECORD_BYTES         = 132
  ^AOCS_TABLE          = "CN_A_2_070225T000130.TAB"
  OBJECT               = AOCS_TABLE
    NAME                 = AOCS
    INTERCHANGE_FORMAT = ASCII
    ROWS                 = 8100
    ^STRUCTURE           = "AOCS.FMT"
    COLUMNS              = 7
    ROW_BYTES            = 132
  END_OBJECT           = AOCS_TABLE
END_OBJECT             = FILE

END
```

7 Appendix: CONSERT ADC raw units (ADC_COUNTS) to physical units conversion

7.1 Temperature

The temperature in degrees Celsius $T_{°C}$ are calculated from ADC raw data T_{ADC} using the following formula:

For $T_{ADC} < 196$, $T_{°C} = 1940 – 10 * T_{ADC}$

For $T_{ADC} \geq 196$, $T_{°C} = -0.00075 * (T_{ADC} – 188) ^ 3 - 0.05 * (T_{ADC} – 188) ^ 2 - 2.4 * (T_{ADC} – 188) - 1$

7.2 Frequency

The CONSERT OCXO tuning frequency is calculated using the following table. To get the absolute frequency value of the OCXO tuning result frequency, the given values have to be added to 90 MHz. Given values are taken from CONSERT Flight Model Orbiter (FMO) DAC calibration tests.

Table 3: CONSERT OCXO raw data to frequency conversion table

ADC raw value	OCXO frequency difference to 90 MHz (Hz)
0	-614.66
1	-612.36
2	-610.06
3	-607.77
4	-605.47
5	-603.17
6	-600.49
7	-598.19
8	-595.51
9	-593.21
10	-590.53
11	-587.85
12	-585.17
13	-582.49
14	-579.43
15	-576.75
16	-573.68
17	-570.62
18	-567.17
19	-564.11
20	-560.28
21	-556.83
22	-553
23	-549.17
24	-545.34
25	-541.13
26	-536.53
27	-531.94
28	-526.58
29	-521.6
30	-516.24
31	-510.49
32	-503.98
33	-497.86
34	-491.34

35	-484.45
36	-476.79
37	-469.9
38	-462.24
39	-454.96
40	-446.92
41	-439.64
42	-431.99
43	-424.71
44	-416.67
45	-409.39
46	-402.11
47	-394.84
48	-387.56
49	-380.67
50	-373.77
51	-366.88
52	-359.6
53	-353.09
54	-346.58
55	-340.07
56	-333.56
57	-327.05
58	-320.93
59	-314.8
60	-308.29
61	-302.54
62	-296.42
63	-290.67
64	-284.54
65	-278.8
66	-273.05
67	-267.31
68	-261.57
69	-255.82
70	-250.46
71	-245.1
72	-239.35
73	-234.38
74	-229.01
75	-224.03
76	-218.29
77	-213.31
78	-208.33
79	-203.35
80	-197.99
81	-193.4
82	-188.42
83	-183.44
84	-178.46
85	-173.48
86	-168.89
87	-164.29
88	-159.31
89	-154.72
90	-150.12

91	-145.53
92	-140.55
93	-136.34
94	-131.74
95	-127.14
96	-122.93
97	-118.34
98	-114.12
99	-109.53
100	-104.93
101	-100.72
102	-96.51
103	-92.68
104	-88.08
105	-83.87
106	-80.04
107	-75.83
108	-71.23
109	-67.4
110	-63.19
111	-59.36
112	-55.15
113	-51.32
114	-47.1
115	-43.28
116	-39.06
117	-35.23
118	-31.4
119	-27.57
120	-23.74
121	-19.91
122	-16.47
123	-12.64
124	-8.04
125	-4.6
126	-0.77
127	2.68
128	5.36
129	8.81
130	12.64
131	16.85
132	20.68
133	24.13
134	27.57
135	31.02
136	34.85
137	38.3
138	41.74
139	45.19
140	49.02
141	52.47
142	55.91
143	59.36
144	62.81
145	66.25
146	69.7

147	72.76
148	76.21
149	79.66
150	83.1
151	86.17
152	89.61
153	92.68
154	96.12
155	99.19
156	102.63
157	105.7
158	108.76
159	111.83
160	115.66
161	118.34
162	121.4
163	124.46
164	127.91
165	130.97
166	134.04
167	137.1
168	140.17
169	143.23
170	145.91
171	148.97
172	152.04
173	155.1
174	158.16
175	160.85
176	163.91
177	166.59
178	169.65
179	172.33
180	175.4
181	178.08
182	181.14
183	183.82
184	186.5
185	189.57
186	192.25
187	194.93
188	197.61
189	200.29
190	202.97
191	205.65
192	207.95
193	210.63
194	213.31
195	215.99
196	218.67
197	221.35
198	224.03
199	226.33
200	229.01
201	231.69
202	233.99

203	236.67
204	239.35
205	241.65
206	243.95
207	246.63
208	249.31
209	251.61
210	253.91
211	256.2
212	258.88
213	261.18
214	263.48
215	265.78
216	268.08
217	270.37
218	272.67
219	274.97
220	277.27
221	279.56
222	281.86
223	283.78
224	286.46
225	288.37
226	290.67
227	292.59
228	294.88
229	297.18
230	299.48
231	301.39
232	303.31
233	305.61
234	307.52
235	309.82
236	312.12
237	314.03
238	315.95
239	317.86
240	320.16
241	322.07
242	323.99
243	325.9
244	328.2
245	**-5685.51**
246	332.03
247	333.95
248	335.86
249	337.78
250	339.69
251	341.61
252	343.52
253	345.44
254	347.35
255	349.26

8 Appendix: CONSERT Matched Filter

The CONSERT experiment main objective is to measure travel time of a radio signal through the comet nucleus. This transmitted signal is a binary phase shift key (BPSK). The received signal has to be compressed by this code. The matched filter operation is performed by applying an inter-correlation between the CONSERT signal and the code.

The BPSK code is composed of 255 symbols at -1 or 1 level sampled at 10 MHz (on sample per symbol). The code table is provided in the archive DOCUMENT folder in the CONSERT_COMPRESSION_CODE.TAB.

– END OF DOCUMENT –