RPW Ground Segment

Dataset Description Document for RPW Low Latency CDF Files

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Change Record

Issue	Rev.	Date	Authors	Modifications
0	0	16/01/2016	X.Bonnin	First draft
1	0	16/06/2016	X.Bonnin	First release
1	1	06/03/2017	X.Bonnin	- Rename Potential, Electrical, and Magnetical zVars of RPW-BIA dataset to V, E and B respectively - Rename SBM1/2_QUALITY_FACTOR zVars to SBM1/2_QF - SBM1/2_QF CDF data type is now CDF_REAL4 to provide the engineering value - Add COARSE_TIME zVar in the RPW-TNR dataset - Update the filename naming for each data set - Fix the ACQUISITION_TIME_UNITS value for fine part (s / 65536) - Update data volume information
1	2	26/11/2019	X.Bonnin	- Remove SOLO_LL01_RPW-BIA data product - Update SOLO_LL01_RPW-TNR, SOLO_LL01_RPW-SBM1 and SOLO_LL01_RPW-SBM2 content to be compliant with latest ICD for Solar Orbiter LLD - Update reference documents - Update figure 2 - Fix issue about section title numbering

Acronym List

Acronym	Definition
CCSDS	Consultative Committee for Space Data Systems
CDF	Common Data Format
CLI	Command Line Interface
CUC	CCSDS Unsegmented time Code
ESA	European Space Agency
ESAC	European Space Astronomy Centre
EUI	Extreme Ultraviolet Imager
HF	High Frequency
HK	Housekeeping
ICD	Interface Control Document
ISO	International Organization for Standardization
LESIA	Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique
LF	Low Frequency
LL	Low Latency
LLDP	Low Latency Data Pipeline
LLDPDD	Low Latency Data Product Definition Document
LLVM	Low Latency Virtual Machine
LL01	Low Latency Level 1
LL02	Low Latency Level 2
LL03	Low Latency Level 3
MD5	Message Digest 5
OBT	On-Board Time
OS	Operating System
ROC	RPW Operation Centre
RPW	Radio and Plasma Waves instrument
S/C	Spacecraft
SCET	Spacecraft Elapsed Time
SCM	Search Coil Magnetometer
SEGU	Solar Orbiter Engineering Guidelines for

	External Users
SOAR	Solar Orbiter Science Archive
SFTP	SSH File Transfer Protocol
SGS	Science Ground Segment
SGSE	Software Ground Support Equipment
SOC	Science Operation Centre
SSH	Secure Shell
SVN	SubVersioN
S/W	Software
TDS	Time Domain Sampler
SUM	Software User Manual
UTC	Universal Time Coordinated
VM	Virtual Machine
XML	eXtended Markup Language

Table of Contents

List of Figures

List of Tables

1 GENERAL

1.1 Scope of the Document

This Low Latency Data Product Definition Document (LLDPDD) describes the format and content of the Radio and Plasma Waves instrument (RPW) Low Latency (LL) data. It includes descriptions of the data products and associated metadata, including the data format, content, and generation pipeline, in accordance with the Low Latency CDF ICD [AD1]. These products will be stored and distributed from the Solar Orbiter Science Archive [RD5] of the SOC.

The specifications described in this LLDPDD apply to all RPW Low Latency products generated by the instrument-provided pipeline running at the Solar Orbiter SOC, specified as LL01 data. A similar document will be provided by the SOC, describing the RPW LL02 data that were generated at SOC after processing the LL01 data.

This document only includes descriptions of Low Latency products generated at SOC. It does not address the Science data delivered by the Science pipelines run at the RPW Team premises, as these data products shall be described in [RD2].

1.1 Applicable Documents

This document responds to the requirements of the documents listed in the following table:

Mark	Reference/Iss/Rev	Title of the document	Authors	Date
AD1	SOL-SGS-ICD-0004/1/4	Solar Orbiter Interface Control Document for Low Latency Data CDF Files	A.Walsh	07/11/2017
AD2				
AD3				
AD4				
AD5				

1.2 Reference Documents

This document is based on the documents listed in the following table:

Mark	Reference/Iss/Rev	Title of the document	Authors	Date
RD1	http://cdf.gsfc.nasa.gov	CDF User's Guide v3.7	NASA CDF team	
RD2	SOL-SGS-OTH-004-TPL_DPDD	Solar Orbiter RPW Data Product Description Document, template	X.Bonnin	
RD3	SOL-SGS-TN-0009/2/4	Metadata definition for Solar Orbiter Science Data	Solar Orbiter MADAWG	02/09/2019

RD4	SOL-SGS-TN-0006/1/2	SOC Engineering Guidelines for External Users	Richard Carr	19/09/2017
RD5	SOL-SGS-PL-0009/0/2	Solar Orbiter Archive Plan	Pedro Osuna	01/07/2015
RD6				
RD7				
RD8				

2 RPW INSTRUMENT DESCRIPTION

2.1 Science Objective

RPW will make key measurements in support of the first three, out of four top-level scientific questions, which drive Solar Orbiter overall science objectives:

- How and where do the solar wind plasma and magnetic field originate in the corona?
- How do solar transients drive heliospheric variability?
- Howdosolareruptionsproduceenergeticparticleradiationthatfillstheheliosphere?
- How does the solar dynamo work and drive connections between the Sun and the heliosphere?

Here is the summary of the specific RPW Science Objectives.

Solar & Interplanetary Radio Burst

- What is the role of shocks and flares in accelerating particles near the Sun?
- How is the Sun connected magnetically to the interplanetary medium?
- What are the sources and the global dynamics of eruptive events?
- What is the role of ambient medium conditions on particle acceleration and propagation?
- How do variations and structure in the solar wind affect low frequency radio wave propagation?

Electron density & temperature measurements with the Quasi-Thermal Noise spectroscopy

- Precise measurement of both the electron density and temperature, with accuracies respectively of a few % and around 10 %, at perihelion.
- Study the non-thermal character of the electron distributions at perihelion.

Radio emission processes from electron beams: Langmuir waves and electromagnetic mode conversion

- Measurements for the first time in the Solar Wind of both the electric and magnetic field waveforms at high time resolution (up to 500 kSs).
- Study of the mode conversion from Langmuir to electromagnetic waves.
- Study of the energy balance between electron beams, Langmuir waves and e.m. radio waves at several radial distances

Solar wind microphysics and turbulence

- Measure of the waves associated with the plasma instabilities that are generated by temperature anisotropies in the solar wind.
- First DC/LF electric field measurements in the inner heliosphere and over a large

radial distance in the solar.

Shocks, Reconnection, Current Sheets, and Magnetic Holes

- Identification & study of the reconnection process in current sheets with thickness down to the ion scales and smaller.
- Determination of the interplanetary shock structure down to the spatial and temporal scales comparable and smaller than the typical ion scales.
- Determination of different particle energisation mechanisms within shocks and reconnection regions.
- Distinguish different radio burst generation mechanisms.

Interplanetary Dust

- Determination, in combination with the EPD instrument, the spatial distribution, mass and dynamics of dust particles in the near-Sun heliosphere, in and out of the ecliptic.

To cover its specific Science Objectives, RPW will measure magnetic and electric fields at high time resolution using a number of sensors, to determine the characteristics of electromagnetic and electrostatic waves in the solar wind. More precisely, RPW will:

- Make the first-ever high accuracy, high-sensitivity and low noise measurements of electric fields at low frequencies (below ~1 kHz) in the inner Heliosphere.
- Measure the magnetic and electric fields of the solar wind turbulence with high sensitivity and dynamic range along the spacecraft trajectory.
- Store high-resolution data from scientifically interesting regions such as in-situ shock crossings, in-situ Type III events and others.
- Measure the satellite potential with high temporal resolution permitting to estimate the density fluctuations in the solar wind and allowing higher accuracy particle instrument measurements.
- Measure the quasi thermal noise and Langmuir waves around the local plasma frequency
- Measure for the first type the high frequency magnetic counterpart of Langmuir waves associated with in-situ Type III bursts
- Observe the solar and interplanetary radio burst
- Observe the radio counterpart of dust particle impacts
- Detect on-board in-situ shock crossings and store the corresponding data
- Detect on-board in-situ Type III events and store the corresponding data

2.2 Operational Modes producing LL data

The RPW software modes are managed by the Data Processing Unit (DPU) Software. For their part, the RPW analyzers shall manage the following modes:

- A STANDBY mode: a mode where no scientific measurements are performed.
- A SCIENCE mode: a mode itself decomposed in four sub-modes: NORMAL mode, BURST mode, SBM1 mode, SBM2 mode.

In SCIENCE mode, RPW will have capability to run into basically three different types of modes, a "normal" mode or “SURVEY_NORMAL” mode, a "commanded burst" mode or “SURVEY_BURST” mode, and a "selected-burst" mode divided into two sub-modes “SBM1” and “SBM2”.

The “normal” mode is a low cadence mode that will basically run all the time along the orbit except during time when the “commanded burst” mode will operate. The “normal” mode is intended to provide all the data for synoptic survey of the plasma conditions in the heliosphere.

The “commanded burst” mode is a high cadence mode that will be operated by command.

The “selected-burst” modes will run simultaneously with the "normal" mode, and fill internal (circular or no) buffers in order to enable the RPW DPU to perform the selection of specific events. The existence of “selected-burst” modes involves therefore that two data flows, one at "normal" (low) cadence, the other one at higher cadence, are continuously recorded by the sub-systems and transmitted to the DPU.

The RPW Low Latency (LL) science telemetry (TM) packets are produced only when RPW is operated in the SCIENCE mode, with an average rate of 33 bps.

At the S/C SSMM level, one packet store is dedicated for storing the RPW LL data: PS LL. The size of the packet store PS LL shall allow to store up to 60 days of RPW low latency science; this corresponds to a size of about: 0.17 Gbits.

The RPW LL data stream will be generated by taking the Automatic Gain Value (AGC) as well as the median of the radio flux in the top five frequency bins in band D of the thermal noise receiver (TNR), covering ~850-1024 kHz, and the plasma frequency index measured on-board.

Once a week, calibration data from the regular BIAS sweeping campaign will be added to the LL data stream.

3 DATA GENERATION PROCESS

The RPW LL01 products are produced by the pipeline delivered by the RPW Instrument Team and running at SOC. The data generation is described in this section.

The procedure for delivery of the LL data pipelines from the RPW Instrument Team to the SOC must be fully compliant with the SOC Engineering Guidelines for External Users [RD4].

SOC will host the instrument pipelines and retrieve the low latency data from MOC after downlink, passing it as input to the instrument pipelines. SOC will also post process the output of the pipelines, applying operations that will include, but not necessarily be limited to, time conversion from on-board time (OBT) to UTC and transformation of FOV parameters

from instrument coordinates to an appropriate scientific coordinate system. SOC will not apply calibrations to the output of the instrument pipelines. SOC will also provide a simple web-based visualisation tool for the low latency. SOC will also distribute the low latency data files via the SOAR, hosted at ESAC, following the policies described in the Archive Plan [RD5].

3.1 Scientific Measurements

To meet the science objectives defined above, the RPW instrument has to consist of a sophisticated plasma/radio wave receiver system connected to high sensitivity electric and magnetic sensors. Since the receiver system covers a very wide frequency range (quasi-DC to 20 MHz for electric, and 0.1 Hz to 500 kHz for magnetic), different kinds of sensors are used for the measurements.

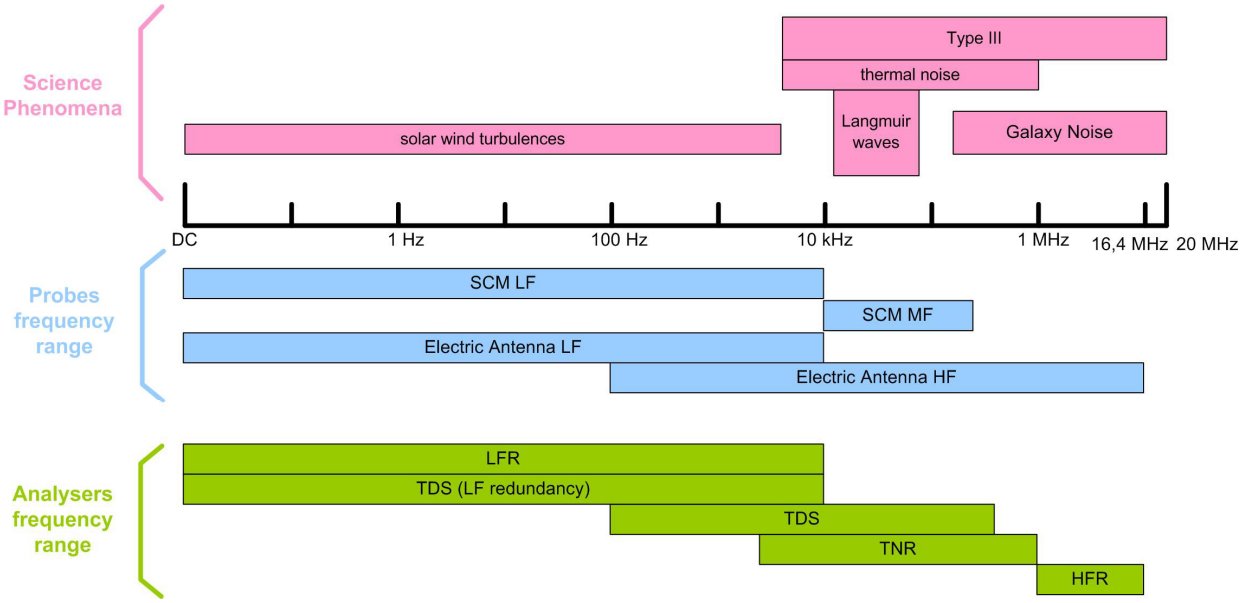

Figure 1. RPW frequency allocation.

The electric antenna (ANT), consisting on a set of three monopoles and the magnetic search coil unit (SCM) are designed to perform correctly for quasi -DC as well as for high frequency measurements. In particular, ANT design is optimised to satisfy the goal of measuring both the quasi-DC/low frequency electric fields and higher frequency radio and thermal noise emissions.

A biasing unit (BIAS) will allow DC electric measurements. The three TDS, LFR and TNR-HFR sub-systems correspond to the core of the receiver system by covering both waveform data and power spectral densities. TDS, LFR and TNR-HFR are connected to a common Data Processing Unit (DPU) that will handle commands, data and communication with S/C.

The science objective of LFR is the study of the electromagnetic wave activity in the extended corona and the solar wind, from a fraction of a Hertz to about 10 kHz, which should cover the electron gyrofrequency and most of the Doppler-shifted frequencies of the low frequency plasma waves. The main waves to be observed in this frequency range are thus kinetic or inertial Alfven waves, ion cyclotron waves, ion acoustic waves, and magnetosonic or whistler mode waves. Their characterization and the determination of their respective role in heating and accelerating the solar wind during its expansion is the main scientific issue addressed by

LFR. Another important subject for LFR is the study of the low frequency plasma waves associated to solar wind disturbances, as for instance interplanetary shocks.

Characterizing the low frequency waves in the solar wind involves the capability of the LFR to distinguish solitary waves from broadband wave activity, to cover turbulence and plasma instabilities, to identify the wave modes at work. Performing a multi-component analysis of the data is thus mandatory, using either a classical Fourier analysis or another treatment of the waveforms more appropriate to turbulence analysis.

Given the limitations in the telemetry, it is necessary to implement specific techniques to take the maximum advantage of the data. The LFR is tailored to optimize the scientific return of the data. The LFR design gives the possibility of mixing different types of output data, from low-level processed data **(waveform data)** to high-level processed data **(averaged spectral matrices and their derived parameters**), with various data rate possibilities (continuous or cyclic transmission, adaptable frequency bandwidth as well as adaptable frequency and time resolutions). A number of predefined working modes will be defined, but it will also be possible to define other working modes in flight.

The main scientific objective of TDS is the study of high frequency plasma waves and electric fields oscillations in the solar wind. The most important phenomenon observed in this frequency range are Langmuir waves associated with solar bursts, interplanetary shocks and other solar wind disturbances. These waves play a significant role in solar wind physics, being the source process of the solar radio emissions. The TDS is designed to study the detailed structure and dynamics of the waves and primarily the poorly understood process of conversion of electron beam energy to electromagnetic radiation via Langmuir waves. The target waves appear close (within 20%) to the local plasma frequency and the conversion to electromagnetic waves can occur both at the plasma frequency and at its first harmonic (2*fp). The waves are typically narrow-band, strongly modulated and appear in bursts lasting from several milliseconds to about one second. Experience from previous experiments (e.g. Cluster, WIND and STEREO) has shown that due to short duration and rich structure, the waves are best studied using broadband waveform data. In particular:

- Multiple field components are required to study wave polarization
- Magnetic field measurements are needed to properly identify the EM radiation process
- Waveform snapshots need to be sufficiently long to capture an entire wave burst.

TDS will be designed to perform **waveform measurements** fulfilling these requirements, offering a range of configurable parameters to tune the instrument to a present region of solar wind and target process. Since the data volume associated with these measurements is enormous and Langmuir wave bursts are relatively rare and short, the on-board logic will attempt to identify snapshots containing potentially interesting measurements and only select these for downlink. Second science objective of the TDS instrument is the study of interplanetary dust by registering voltage spikes measured by spacecraft antenna in response to an impact of a dust particle on the spacecraft Recent studies have shown that the amplitude and shape of the dust impact can be used to gather information about the size and energy of the impacting particle. Full waveform measurements are in general not necessary for this process. TDS on-board software will scan the data for dust impact signatures and collect **statistics of their parameters**.

TNR-HFR is of prime importance for the RPW science objectives since it provides **electric power spectral densities** from 4 kHz up to 16MHz **and magnetic power spectral densities** from 10 kHz up to 500 kHz. Below is a brief overview of the TNR-HFR science objectives:

The TNR-HFR measures the Quasi-thermal Noise due to the motion of solar wind electrons around the electric antennas. The spectroscopy of this noise will provide electron properties such as their density and temperature. The TNR-HFR measures Langmuir-like waves that are frequently observed in the solar wind in association with supra-thermal electron beams produced by either solar flares or accelerated by interplanetary shocks.

The TNR-HFR measures and tracks the solar radio bursts due to particle acceleration and shock waves in the corona and inner heliosphere. By processing **cross-correlations** between two channels connected to different antennas, the TNR- HFR has direction-finding capabilities for tracking the solar radio bursts. Finally, TNR-HFR is also sensitive to dust impacts via the corresponding plasma cloud and pickup signal on the electric field antennas. Actually, TNR-HFR measures, in the spectral domain, the voltage induced when a dust grain impacting the S/C at high velocity is vaporized and ionized, producing a plasma cloud, which is partially recollected by the target.

3.2 Data flow overview

The RPW LL data processing is ensured by the RPW Low Latency Data Pipeline (LLDP), which must be delivered as a virtual appliance to the SOC following the guidelines specified in [RD4].

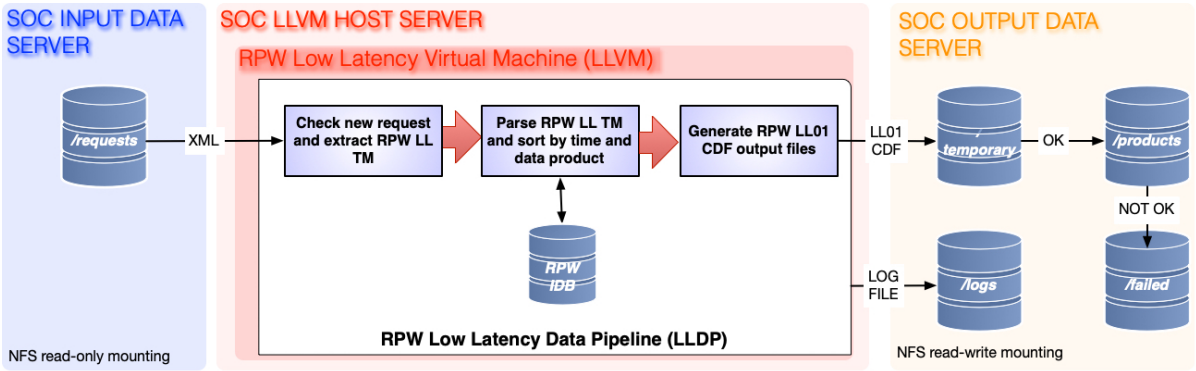

Figure 2. RPW Low Latency Data Pipeline Design.

The LLDP performs the following data processing flow every minute:

- Fetching for new "requests" in the dedicated directory of the SOC input data server. "Requests" already processed, i.e., found in /products folder are ignored.
- If new "requests" have been found, then the LLDP will parse the requests XML files and extract the RPW LL TM data written inside.
- RPW LL TM data are then unpacked and sort by time and LL01 data products. The TM analysis is performed using the RPW instrument database (IDB), which contains a description of all of the TM/TC packet.
- Finally, the LLDP produces the output LL01 data CDF files as defined in the current document. Generated files are first written in a corresponding request folder in the

"temporary" directory, and then moved into the "products". Badly processed files are moved into the "failed" sub-directory.

As long as the LLDP is running, no new data processing flow can be started.

The LLDP processing information (i.e., normal, warning, error messages) are saved in near real-time in a text file in the dedicated /logs folder. New "log" file is generated if the previous one exceeds ~10 GigaBytes. The "log" files older than 180 days are deleted automatically.

4 DATA PRODUCT DESCRIPTIONS

RPW LL01 data products are formatted in accordance with the rules outlined in [AD1]. This section provides details on the filenames, formats and metadata for each of the products included in the RPW LL01 data.

4.1 General Data Format

The RPW LL01 data are formatted in CDF files.

The following sections provide for each type of file produced by the LL pipeline a detailed description of the content and format. Each section, named for the logical source of that file type, should contain the following information, in this order:

- Product filename
- Expected dataset volume per day and time resolution.
- The Global Attributes in the file, in attribute number order, and their values.
- The Variable scope Attributes in the file, in attribute number order.
- The Variables in the file, in variable number order.
- The variable scope attributes that have an entry for that variable, and their values.

Note that the required (meta)data to produce the dataset description document can be extracted from a CDF file of the correct structure using the SkeletonTable utility provided as part of the CDF distribution (see [RD1]). Equivalently, a correctly formatted ASCII skeleton table can be used to create a CDF of the correct structure using the SkeletonCDF utility.

4.2 SOLO_LL01_RPW-TNR data product

The "SOLO_LL01_RPW-TNR" data product concerns the LL data returned in the RPW TNR spectral power TM packets (i.e., "TM_THR_SCIENCE_SPECTRAL_POWER" {YIW00265}). It contains the coarse part of the CUC measurement time, the AGC and the median of the radio flux in the top five frequency bins in band D of the receiver, around 1 MHz, as well as the plasma frequency index measured on-board.

4.2.1 Filename

```
solo_LL01_rpw-tnr_[timefield]_V[version].cdf
```

Where `[timefield]` and `[version]` fields are defined as in [AD1].

4.2.2 Expected data volume and time resolution

The data product will be 64 bits in length with a cadence of between 1 and 15 seconds. Including a 2% overhead for packet headers, this is a data volume of between 48 kB and 718.9 kB per day.

4.2.3 Global Attributes

Name	Entry	Value
Project	1	"Solar Orbiter" #When adding a 2nd entry
Complete	1	#This attribute is not fixed
Source_name	1	"SOLO>Solar Orbiter"
Discipline	1	"Space Physics>Interplanetary Studies"
Data_product	1	"tnr>Thermal Noise Receiver spectral power data"
Data_type	1	"LL01"
Descriptor	1	"rpw-tnr>Radio and Plasma Waves instrument - Thermal Noise Receiver"
Data_version	1	#This attribute is not fixed (format is I12.12, e.g., "201810120000")
Software_version	1	#This attribute is not fixed (format is X.Y.Z, e.g., "01.00.00", X, Y and Z are respectively integer corresponding to major, minor and revision changes)
PI_name	1	"M.Maksimovic"
PI_affiliation	1	"LESIA, Observatoire de Paris - CNRS"
Text	1	"This file contains RPW Low latency TNR spectral power data, produced by the RPW Low Latency Data Pipeline (LLDP)."
Instrument_type	1	"Radio and Plasma Waves (space)"
Mission_group	1	"Solar Orbiter"
Logical_source	1	"source_level_instrument_data-product"
Logical_file_id	1	#This attribute is not fixed (format is "solo_LL01_rpw-tnr_yyyymmdd1-yyyymmdd2_VXX")
Logical_source_description	1	"Solar Orbiter Radio/Plasma Wave, LL01 parameters"
Rules_of_use	1	"Not For Publication"
Generated_by	1	"Solar Orbiter SOC, ESAC"
Generation_date	1	"YYYY-MM-DDTHH:MN:SS"
Mods	1	"July 2015 : initial version, X. BONNIN (CNRS-LESIA)"
Data_Product	1	"TNR>Low Latency TNR Data"
Level	1	"LL01>Level 1 Low Latency Data"
Instrument	1	"RPW>Radio and Plasma Waves"
Provider	1	"Solar Orbiter SOC, ESAC"

Software_name 1 "RPW LLDP"

Skeleton_version 1 #This attribute is not fixed (format is I2.2, e.g., "01")

IDB_version 1 #This attribute is not fixed (format is X.Y.Z, e.g., "1.0.0", X, Y and Z are respectively integer corresponding to major, minor and revision changes)

Parents 1 #This attribute is not fixed. It will depend on the parent files used to generate the CDF data file.

Validate 1 #This attribute is not fixed. It will depend on the LLDP check results.

REFERENCE 1 #This attribute is not fixed. It should be the current document.

SKELETON_PARENT 1 "SOLO_LL01_RPW-TNR"

Skeleton_version 1 "01"

ACCESS_FORMAT 1 "CDF"

SCET_MIN 1 #This attribute is not fixed. It will depend on the SCET minimal value in the CDF data file.

SCET_MAX 1 #This attribute is not fixed. It will depend on the SCET maximal value in the CDF data file.

File_ID 1 #This attribute is not fixed. It will be generated by the LLDP during the CDF data file creation.

Dataset_ID 1 "SOLO_LL01_RPW-TNR" #This is the dataset id in the RPW database system.

PACKET_SRDB_ID 1 "YIW00265"

4.2.4 Variables

Note that SCET must always be the first variable in a LL01 file.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SCET	CDF_REAL8	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"Spacecraft Elapsed Time"
CATDESC	CDF_CHAR	"Elapsed time of the onboard clock"
DISPLAY_TYPE	CDF_CHAR	"time_series"
FILLVAL	CDF_REAL8	-1.0e31
FORMAT	CDF_CHAR	"f14.3"
LABLAXIS	CDF_CHAR	"Spacecraft Elapsed Time (Ticks)"
UNITS	CDF_CHAR	"Ticks"

VALIDMIN	CDF_REAL8	0.0
VALIDMAX	CDF_REAL8	4294967295.999
SCALEMIN	CDF_REAL8	TBC #This will depend on the UTC of zero SCET
SCALEMAX	CDF_REAL8	TBC #and when end of mission is.
VAR_TYPE	CDF_CHAR	"support_data"
SCALETYP	CDF_CHAR	"linear"
TIME_BASE	CDF_CHAR	"Spacecraft onboard clock"
TIME_SCALE	CDF_CHAR	"Spacecraft onboard clock"
REFERENCE_POSITION	CDF_CHAR	"Spacecraft barycentre"
VAR_NOTES	CDF_CHAR	"Primary time used a reference in the file"

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SYNCHRO_FLAG	CDF_UINT1	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"SYNCHRO_FLAG"
CATDESC	CDF_CHAR	"Time synchronisation flag"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	"i1.0"
LABLAXIS	CDF_CHAR	"Time sync. flag"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	1
SCALETYP	CDF_CHAR	"linear"
VAR_TYPE	CDF_CHAR	"data"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	2
VAR_NOTES	CDF_CHAR	Flag to indicate if the RPW clock is synchronized (=0) or not (=1) with the onboard clock.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
QUALITY_FLAG	CDF_UINT1	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"QUALITY_FLAG"
CATDESC	CDF_CHAR	"Quality data flag"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	"I3.0"
LABLAXIS	CDF_CHAR	"Quality flag"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	2
VALIDMAX	CDF_UINT1	2
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	3
VAR_TYPE	CDF_CHAR	"data"
VAR_NOTES	CDF_CHAR	Flag to indicate the quality of the data. It should be always 2 for the LL01 data.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
COARSE_TIME_ONLY_FLAG	CDF_UINT1	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"COARSE_TIME_ONLY_FLAG"
CATDESC	CDF_CHAR	"Coarse time only Flag "
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"

FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	"I1.1"
LABLAXIS	CDF_CHAR	"Coarse Time flag"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	1
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	1
VAR_TYPE	CDF_CHAR	"support_data"
VAR_NOTES	CDF_CHAR	Flag to indicate if only the coarse part of SCET time is valid.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
AGC_BAND_D	CDF_REAL8	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"AGC_BAND_D"
CATDESC	CDF_CHAR	"TNR D band AGC value"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_REAL8	-1.0e31
FORMAT	CDF_CHAR	"f12.0"
LABLAXIS	CDF_CHAR	"TNR-D AGC"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_REAL8	0
VALIDMAX	CDF_REAL8	1.0e31
SCALETYP	CDF_CHAR	"log"
SCALEMIN	CDF_REAL8	0
SCALEMAX	CDF_REAL8	1.0e31
VAR_TYPE	CDF_CHAR	"data"
DETECTOR	CDF_CHAR	"TNR>Thermal Noise Receiver"
VAR_NOTES	CDF_CHAR	Automatic Gain Control value of the TNR D Band.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
AUTO_MEDIAN_1MHZ	CDF_REAL8	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"AUTO_MEDIAN_1MHZ"
CATDESC	CDF_CHAR	"Median value of the 5 top frequency channels of the TNR D band auto-correlations"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_REAL8	-1.0e31
FORMAT	CDF_CHAR	"f12.0"
LABLAXIS	CDF_CHAR	"TNR-D auto median@1MHz"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_REAL8	0
VALIDMAX	CDF_REAL8	1.0e31
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_REAL8	0
SCALEMAX	CDF_REAL8	1.0e31
VAR_TYPE	CDF_CHAR	"data"
DETECTOR	CDF_CHAR	"TNR>Thermal Noise Receiver"
VAR_NOTES	CDF_CHAR	Median value of the 5 top frequency channels of the TNR D band auto-correlations (TM units).

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
POWER_MEDIAN_1MHZ	CDF_REAL8	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"POWER_MEDIAN_1MHZ"

CATDESC	CDF_CHAR	"TNR D band spectral voltage power median value close to 1 MHz"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_REAL8	-1.0e31
FORMAT	CDF_CHAR	"f12.0"
LABLAXIS	CDF_CHAR	"TNR-D auto median@1MHz"
UNITS	CDF_CHAR	"V^2/Hz"
VALIDMIN	CDF_REAL8	0
VALIDMAX	CDF_REAL8	1.0e31
SCALETYP	CDF_CHAR	"log"
SCALEMIN	CDF_REAL8	0
SCALEMAX	CDF_REAL8	1.0e31
VAR_TYPE	CDF_CHAR	"data"
DETECTOR	CDF_CHAR	"TNR>Thermal Noise Receiver"
VAR_NOTES	CDF_CHAR	Spectral voltage power median value of the 5 top frequency channels of the TNR D band auto-correlations.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
PLASMA_FREQ_INDEX	CDF_UINT1	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"PLASMA_FREQ_INDEX"
CATDESC	CDF_CHAR	"Index of the plasma frequency"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	"I3.0"
LABLAXIS	CDF_CHAR	"Plasma freq. index"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	254
SCALETYP	CDF_CHAR	"linear"

SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	254
VAR_TYPE	CDF_CHAR	"data"
DETECTOR	CDF_CHAR	"TNR>Thermal Noise Receiver"
VAR_NOTES	CDF_CHAR	Index of the plasma frequency

4.3 SOLO_LL01_RPW-SBM1 data product

The "SOLO_LL01_RPW-SBM1" data product contains the SBM1 algorithm detection parameters transmitted by the RPW DPU in Event progress TM packets (i.e., "TM_DPU_EVENT_PR_DPU_SBM1" {YIW00304}). Thus, they are not strictly speaking transfered through the LL data stream, since the TM packets are not stored in the PS LL on-board.

4.3.1 Filename

`solo_LL01_RPW-SBM1_[timefield]_V[version].cdf`

Where `[timefield]` and `[version]` fields are defined as in [AD1].

4.3.2 Expected data volume and time resolution

The size of a TM_DPU_EVENT_PR_DPU_SBM1 packet is 34 B. Assuming the detection of 50 events over 60 days, this gives a data rate of 29 B per day.

4.3.3 Global attributes

Name	Entry	Value
Project	1	"Solar Orbiter" #When adding a 2nd entry
Source_name	1	"SOLO>Solar Orbiter"
Complete	1	#This attribute is not fixed
Discipline	1	"Space Physics>Interplanetary Studies"
Data_product	1	"sbm1>SBM1 events detected on-board by RPW."
Data_type	1	"LL01"
Descriptor	1	"rpw-sbm1>Radio and Plasma Waves instrument – SBM1 parameters"
Data_version	1	#This attribute is not fixed (format is I2.2, e.g., "01")
Software_version	1	#This attribute is not fixed (format is X.Y.Z, e.g., "01.00.00", X, Y and Z are respectively integer corresponding to major, minor and revision changes)
PI_name	1	"M.Maksimovic"
PI_affiliation	1	"LESIA, Observatoire de Paris - CNRS"
Text	1	"This file contains RPW Low latency SBM1 algorithm detection parameters, produced by the RPW Low Latency Data Pipeline (LLDP.)"

Instrument_type	1	"Radio and Plasma Waves (space)"
Mission_group	1	"Solar Orbiter"
Logical_source	1	"source_level_instrument_data-product"
Logical_file_id	1	#This attribute is not fixed (format is "solo_LL01_rpw-sbm1_yyyymmdd1-yyyymmdd2_VXX")
Logical_source_description	1	"Solar Orbiter Radio/Plasma Wave, LL01 parameters"
Rules_of_use	1	"Not For Publication"
Generated_by	1	"Solar Orbiter SOC, ESAC"
Generation_date	1	"YYYY-MM-DDTHH:MN:SS"
Mods	1	"V01 First Version"
Data_Product	1	"LL-SBM1-DATA>Low Latency SBM1 Data"
Level	1	"LL01>Level 1 Low Latency Data"
Instrument	1	"RPW>Radio and Plasma Waves"
Provider	1	"Solar Orbiter SOC, ESAC "
Software_name	1	"RPW LLDP"
Skeleton_version	1	#This attribute is not fixed (format is I2.2, e.g., "01")
IDB_version	1	#This attribute is not fixed (format is X.Y.Z, e.g., "1.0.0", X, Y and Z are respectively integer corresponding to major, minor and revision changes)
Parents	1	#This attribute is not fixed. It will depend on the parent files used to generate the CDF data file.
Validate	1	#This attribute is not fixed. It will depend on the LLDP check test results.
REFERENCE	1	#This attribute is not fixed. It should be the current document.
SKELETON_PARENT	1	"SOLO_LL01_RPW-SBM1"
ACCESS_FORMAT	1	"CDF"
SCET_MIN	1	#This attribute is not fixed. It will depend on the SCET minimal value in the CDF data file.
SCET_MAX	1	#This attribute is not fixed. It will depend on the SCET maximal value in the CDF data file.
File_ID	1	#This attribute is not fixed. It will generate by the RLLP during the CDF data file creation.
Dataset_ID	1	"SOLO_LL01_RPW-SBM1" #This is the dataset id in the RPW database system.
PACKET_SRDB_ID	1	"YIW00304"

4.3.4 Variables

Note that SCET must always be the first variable in a LL01 file.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY

SCET CDF_REAL8 0 T

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"Spacecraft Elapsed Time"
CATDESC	CDF_CHAR	"Elapsed time of the onboard clock"
DISPLAY_TYPE	CDF_CHAR	"time_series"
FILLVAL	CDF_REAL8	-1.0e31
FORMAT	CDF_CHAR	"f14.3"
LABLAXIS	CDF_CHAR	"Spacecraft Elapsed Time (Ticks)"
UNITS	CDF_CHAR	"Ticks"
VALIDMIN	CDF_REAL8	0.0
VALIDMAX	CDF_REAL8	4294967295.999
SCALEMIN	CDF_REAL8	TBC #This will depend on the UTC of zero SCET
SCALEMAX	CDF_REAL8	TBC #and when end of mission is.
VAR_TYPE	CDF_CHAR	"support_data"
SCALETYP	CDF_CHAR	"linear"
TIME_BASE	CDF_CHAR	"Spacecraft onboard clock"
TIME_SCALE	CDF_CHAR	"Spacecraft onboard clock"
REFERENCE_POSITION	CDF_CHAR	"Spacecraft barycentre"
VAR_NOTES	CDF_CHAR	"Primary time used a reference in the file"

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SYNCHRO_FLAG	CDF_UINT1	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	SYNCHRO_FLAG
CATDESC	CDF_CHAR	"Time synchronisation flag"
DISPLAY_TYPE	CDF_CHAR	"time_series"

DEPEND_0	CDF_CHAR	"SCET
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	I1.0
LABLAXIS	CDF_CHAR	Time sync. flag
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	1
SCALETYP	CDF_CHAR	linear
VAR_TYPE	CDF_CHAR	data
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	1
DETECTOR	CDF_CHAR	"DPU>RPW DPU"
VAR_NOTES	CDF_CHAR	"Flag to indicate if the RPW DPU clock is synchronized (=0) or not (=1) with the on-board spacecraft clock."

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
QUALITY_FLAG	CDF_UINT1	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"QUALITY_FLAG"
CATDESC	CDF_CHAR	"Quality data flag"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	"I3.0"
LABLAXIS	CDF_CHAR	"Quality flag"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	2
VALIDMAX	CDF_UINT1	2
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	3

VAR_TYPE	CDF_CHAR	"data"
DETECTOR	CDF_CHAR	"BIA>BIAS"
VAR_NOTES	CDF_CHAR	"Flag to indicate the quality of the data. It should be always 2 for the LL01 data."

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SBM1_TIME	CDF_UINT4	1	2	T	T

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	SBM1_TIME
CATDESC	CDF_CHAR	SBM1 event absolute time
DEPEND_0	CDF_CHAR	SCET #DEPEND_0 must always point to a time variable
DISPLAY_TYPE	CDF_CHAR	time_series
FILLVAL	CDF_REAL8	4294967295
FORMAT	CDF_CHAR	I10.0
LABL_PTR_1	CDF_CHAR	SBM1_TIME_LABEL
UNIT_PTR	CDF_CHAR	SBM1_TIME_UNITS
VALIDMIN	CDF_REAL8	0
VALIDMAX	CDF_REAL8	4294967295
SCALETYP	CDF_CHAR	linear
VAR_TYPE	CDF_CHAR	support_data
SCALEMIN	CDF_REAL8	0
SCALEMAX	CDF_REAL8	4294967295
TIME_BASE	CDF_CHAR	RPW DPU onboard clock
TIME_SCALE	CDF_CHAR	RPW DPU onboard clock
VAR_NOTES	CDF_CHAR	Time of the SBM1 event detection in CUC format. It corresponds to the HK_RPW_S20_SBM1_TIME packet parameter.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SBM1_ALGO_STATUS	CDF_UINT1	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"SBM1_ALGO_STATUS"
CATDESC	CDF_CHAR	"SBM1 detection algorithm status"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	"I3.0"
LABLAXIS	CDF_CHAR	"SBM1 algo status"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	2
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	2
VAR_TYPE	CDF_CHAR	"data"
VAR_NOTES	CDF_CHAR	"SBM1 detection algorithm status. Possible values: SBM1_NONE = 0, SBM1_RPW = 1, SBM1_MAG = 2"

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SBM1_QF	CDF_REAL4	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"SBM1_QF"
CATDESC	CDF_CHAR	"SBM1 event quality factor"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	-1.0e31
FORMAT	CDF_CHAR	"f5.5"
LABLAXIS	CDF_CHAR	"SBM1 event Qf"
UNITS	CDF_CHAR	" "

VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	1.0e31
SCALETYP	CDF_CHAR	“linear”
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	1.0e31
VAR_TYPE	CDF_CHAR	“data”
VAR_NOTES	CDF_CHAR	“SBM1 event quality factor (engineering value).”

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
DT1_SBM1	CDF_UINT2	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	“DT1_SBM1 parameter”
CATDESC	CDF_CHAR	“DT1_SBM1 parameter”
DISPLAY_TYPE	CDF_CHAR	“time_series”
DEPEND_0	CDF_CHAR	“SCET”
FILLVAL	CDF_CHAR	65355
FORMAT	CDF_CHAR	“I5.0”
LABLAXIS	CDF_CHAR	“DT1_SBM1”
UNITS	CDF_CHAR	“s”
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	65355
SCALETYP	CDF_CHAR	“linear”
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	65355
VAR_TYPE	CDF_CHAR	“data”
VAR_NOTES	CDF_CHAR	“Value of the SBM1 DT1_SBM1 parameter. ”
PARAM_SRDB_ID	CDF_CHAR	NIW01932

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
DT2_SBM1	CDF_UINT2	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"DT2_SBM1 parameter"
CATDESC	CDF_CHAR	"DT2_SBM1 parameter"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	65355
FORMAT	CDF_CHAR	"I5.0"
LABLAXIS	CDF_CHAR	"DT2_SBM1"
UNITS	CDF_CHAR	"s"
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	65355
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	65355
VAR_TYPE	CDF_CHAR	"data"
VAR_NOTES	CDF_CHAR	"Value of the SBM1 DT2_SBM1 parameter. "

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
DT3_SBM1	CDF_UINT2	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"DT3_SBM1 parameter"
CATDESC	CDF_CHAR	"DT3_SBM1 parameter"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	65355
FORMAT	CDF_CHAR	"I5.0"
LABLAXIS	CDF_CHAR	"DT3_SBM1"
UNITS	CDF_CHAR	"s"
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	65355

SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	65355
VAR_TYPE	CDF_CHAR	"data"
VAR_NOTES	CDF_CHAR	"Value of the SBM1 DT3_SBM1 parameter. "

4.4 SOLO_LL01_RPW-SBM2 data product

The "SOLO_LL01_RPW-SBM2" data product contains the SBM2 algorithm detection parameters transmitted by the RPW DPU in Event progress TM packets (i.e., "TM_DPU_EVENT_PR_DPU_SBM2" {YIW00305}). Thus, they are not strictly speaking transferred through the LL data stream, since the TM packets are not stored in the PS LL on-board.

4.4.1 Filename

`solo_LL01_RPW-SBM2_[timefield]_V[version].cdf`

Where `[timefield]` and `[version]` fields are defined as in [AD1].

4.4.2 Expected data volume and time resolution

The size of a TM_DPU_EVENT_PR_DPU_SBM2 packet is 32 B. Assuming the detection of 4 events over 60 days, this gives a data rate of 2.2 B per day.

4.4.3 Global attributes

Name	Entry	Value
Project	1	"Solar Orbiter" #When adding a 2nd entry
Source_name	1	"SOLO>Solar Orbiter"
Complete	1	#This attribute is not fixed
Discipline	1	"Space Physics>Interplanetary Studies"
Data_product	1	"sbm2>SBM2 event detected on-board by RPW."
Data_type	1	"LL01"
Descriptor	1	"rpw-sbm2>Radio and Plasma Waves instrument - SBM2 parameters"
Data_version	1	#This attribute is not fixed (format is I2.2, e.g., "01")
Software_version	1	#This attribute is not fixed (format is X.Y.Z, e.g., "01.00.00", X, Y and Z are respectively integer corresponding to major, minor and revision changes)
PI_name	1	"M.Maksimovic"
PI_affiliation	1	"LESIA, Observatoire de Paris - CNRS"

Text	1	"This file contains RPW Low latency SBM2 algorithm detection parameters, produced by the RPW Low Latency data Pipeline (RLLP.)"
Instrument_type	1	"Radio and Plasma Waves (space)"
Mission_group	1	"Solar Orbiter"
Logical_source	1	"source_level_instrument_data-product"
Logical_file_id	1	#This attribute is not fixed (format is "solo_LL01_rpw-sbm2_yyyymmdd1-yyyymmdd2_VXX")
Logical_source_description	1	"Solar Orbiter Radio/Plasma Wave, LL01 parameters"
Rules_of_use	1	"Not For Publication"
Generated_by	1	"Solar Orbiter SOC, ESAC"
Generation_date	1	"YYYY-MM-DDTHH:MN:SS"
Mods	1	"V01 First Version"
Data_Product	1	"LL-SBM2-DATA>Low Latency SBM2 Data"
Level	1	"LL01>Level 1 Low Latency Data"
Instrument	1	"RPW>Radio and Plasma Waves"
Provider	1	"Solar Orbiter SOC, ESAC "
Software_name	1	"RPW LLDP"
Skeleton_version	1	#This attribute is not fixed (format is I2.2, e.g., "01")
IDB_version	1	#This attribute is not fixed (format is X.Y.Z, e.g., "01.00.00", X, Y and Z are respectively integer corresponding to major, minor and revision changes)
Parents	1	#This attribute is not fixed. It will depend on the parent files used to generate the CDF data file.
Validate	1	#This attribute is not fixed. It will depend on the RLLP validation test results.
REFERENCE	1	#This attribute is not fixed. It should be the current document.
SKELETON_PARENT	1	"SOLO_LL01_RPW-SBM2"
ACCESS_FORMAT	1	"CDF"
SCET_MIN	1	#This attribute is not fixed. It will depend on the SCET minimal value in the CDF data file.
SCET_MAX	1	#This attribute is not fixed. It will depend on the SCET maximal value in the CDF data file.
File_ID	1	#This attribute is not fixed. It will generate by the RLLP during the CDF data file creation.
DATASET_ID	1	"SOLO_LL01_RPW-SBM2" #This is the dataset id in the RPW database system.
PACKET_SRDB_ID	1	"YIW00305"

4.4.4 Variables

Note that SCET must always be the first variable in a LL01 file.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SCET	CDF_REAL8	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"Spacecraft Elapsed Time"
CATDESC	CDF_CHAR	"Elapsed time of the onboard clock"
DISPLAY_TYPE	CDF_CHAR	"time_series"
FILLVAL	CDF_REAL8	-1.0e31
FORMAT	CDF_CHAR	"f14.3"
LABLAXIS	CDF_CHAR	"Spacecraft Elapsed Time (Ticks)"
UNITS	CDF_CHAR	"Ticks"
VALIDMIN	CDF_REAL8	0.0
VALIDMAX	CDF_REAL8	4294967295.999
SCALEMIN	CDF_REAL8	TBC #This will depend on the UTC of zero SCET
SCALEMAX	CDF_REAL8	TBC #and when end of mission is.
VAR_TYPE	CDF_CHAR	"support_data"
SCALETYP	CDF_CHAR	"linear"
TIME_BASE	CDF_CHAR	"Spacecraft onboard clock"
TIME_SCALE	CDF_CHAR	"Spacecraft onboard clock"
REFERENCE_POSITION	CDF_CHAR	"Spacecraft barycentre"
VAR_NOTES	CDF_CHAR	"Primary time used a reference in the file"

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SYNCHRO_FLAG	CDF_UINT1	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value

FIELDNAM	CDF_CHAR	SYNCHRO_FLAG
CATDESC	CDF_CHAR	"Time synchronisation flag"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	I1.0
LABLAXIS	CDF_CHAR	Time sync. flag
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	1
SCALETYP	CDF_CHAR	linear
VAR_TYPE	CDF_CHAR	data
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	1
DETECTOR	CDF_CHAR	"DPU>RPW DPU"
VAR_NOTES	CDF_CHAR	"Flag to indicate if the RPW DPU clock is synchronized (=0) or not (=1) with the on-board spacecraft clock."

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
QUALITY_FLAG	CDF_UINT1	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"QUALITY_FLAG"
CATDESC	CDF_CHAR	"Quality data flag"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	"I3.0"
LABLAXIS	CDF_CHAR	"Quality flag"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	2
VALIDMAX	CDF_UINT1	2
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0

SCALEMAX	CDF_UINT1	3
VAR_TYPE	CDF_CHAR	"data"
DETECTOR	CDF_CHAR	"BIA>BIAS"
VAR_NOTES	CDF_CHAR	"Flag to indicate the quality of the data. It should be always 2 for the LL01 data."

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SBM2_TIME	CDF_UINT4	1	2	T	T

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	SBM2_TIME
CATDESC	CDF_CHAR	SBM2 event absolute time
DEPEND_0	CDF_CHAR	SCET #DEPEND_0 must always point to a time variable
DISPLAY_TYPE	CDF_CHAR	time_series
FILLVAL	CDF_REAL8	4294967295
FORMAT	CDF_CHAR	I10.0
LABL_PTR_1	CDF_CHAR	SBM2_TIME_LABEL
UNIT_PTR	CDF_CHAR	SBM2_TIME_UNITS
VALIDMIN	CDF_REAL8	0
VALIDMAX	CDF_REAL8	4294967295
SCALETYP	CDF_CHAR	linear
VAR_TYPE	CDF_CHAR	support_data
SCALEMIN	CDF_REAL8	0
SCALEMAX	CDF_REAL8	4294967295
TIME_BASE	CDF_CHAR	RPW DPU onboard clock
TIME_SCALE	CDF_CHAR	RPW DPU onboard clock
VAR_NOTES	CDF_CHAR	Time of the SBM2 event detection in CUC format. It corresponds to the HK_RPW_S20_SBM2_TIME packet parameter.

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY

SBM2_ALGO_STATUS CDF_UINT1 0 T

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"SBM2_ALGO_STATUS"
CATDESC	CDF_CHAR	"SBM2 detection algorithm status"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	"I3.0"
LABLAXIS	CDF_CHAR	"SBM2 algo status"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	2
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	2
VAR_TYPE	CDF_CHAR	"data"
VAR_NOTES	CDF_CHAR	"SBM2 detection algorithm status. Possible values: SBM2_NONE = 0, SBM2_RPW = 1, SBM2_EPD = 2"

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
SBM2_QF	CDF_REAL4	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"SBM2 event quality factor"
CATDESC	CDF_CHAR	"SBM2 event quality factor"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_REAL4	-1.0e31
FORMAT	CDF_CHAR	"f5.5"

LABLAXIS	CDF_CHAR	"SBM2 Q factor"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_REAL4	0
VALIDMAX	CDF_REAL4	1.0e31
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	1.0e31
VAR_TYPE	CDF_CHAR	"data"
VAR_NOTES	CDF_CHAR	"SBM2 event quality factor (engineering value)."

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
DT_SBM2	CDF_UINT2	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"DT_SBM2 parameter"
CATDESC	CDF_CHAR	"DT_SBM2 parameter"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	65355
FORMAT	CDF_CHAR	"I5.0"
LABLAXIS	CDF_CHAR	"DT_SBM2"
UNITS	CDF_CHAR	"s"
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	65355
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	65355
VAR_TYPE	CDF_CHAR	"data"
VAR_NOTES	CDF_CHAR	"Value of the SBM2 DT_SBM2 or DT_SBM2_F parameter. "

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
DT_LW	CDF_UINT2	0		T	

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"SBM2 DT_LW parameter"
CATDESC	CDF_CHAR	"SBM2 DT_LW parameter"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	65355
FORMAT	CDF_CHAR	"I5.0"
LABLAXIS	CDF_CHAR	"DT_LW"
UNITS	CDF_CHAR	"s"
VALIDMIN	CDF_UINT1	0
VALIDMAX	CDF_UINT1	65355
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	65355
VAR_TYPE	CDF_CHAR	"data"
VAR_NOTES	CDF_CHAR	"Value of the SBM2_DT_LW or SBM2_DT_LW_F parameter. "

Variable_Name	Data_type	DIMS	SIZES	R_VARY	D_VARY
EPD_S20_FLAG	CDF_UINT1	1	8	T	T

ATTRIBUTES

Attribute_Name	Data_type	Value
FIELDNAM	CDF_CHAR	"EPD_S20_FLAG"
CATDESC	CDF_CHAR	"Electron fluxes from EPD instrument"
DISPLAY_TYPE	CDF_CHAR	"time_series"
DEPEND_0	CDF_CHAR	"SCET"
FILLVAL	CDF_CHAR	255
FORMAT	CDF_CHAR	"I3.0"
LABLAXIS	CDF_CHAR	"SBM2 EPD S20 flux"
UNITS	CDF_CHAR	" "
VALIDMIN	CDF_UINT1	0

VALIDMAX	CDF_UINT1	1
SCALETYP	CDF_CHAR	"linear"
SCALEMIN	CDF_UINT1	0
SCALEMAX	CDF_UINT1	2
VAR_TYPE	CDF_CHAR	"data"
VAR_NOTES	CDF_CHAR	"Electron fluxes from EPD instrument in the following order: E" - "PD_S20_ESW_FLAG, EPD_S20_EASW_FLAG, EPD_S20_EN_FLAG, EPD_S20_" - "ES_FLAG , EPD_S20_PSW_FLAG, EPD_S20_PASW_FLAG, EPD_S20_PN_FLA" - "G, EPD_S20_PS_FLAG"

5 APPENDIX

5.1 RPW LL01 data product matrix

The following table gives the summary of the data products names and description.

Data Product	Description	Descriptor	Time resolution	Expected Daily Vol
SOLO_LL01_RPW-TNR	RPW Low Latency TNR spectral power data at level LL01	RPW-TNR	1 to 15 sec.	Between 48 kB and 718.9 kB per day
SOLO_LL01_RPW-SBM1	RPW Low Latency SBM1 event detection parameters at level LL01	RPW-SBM1	1 packet per SBM1 event detected on-board	29 B per day, assuming 50 events detected over 60 days
SOLO_LL01_RPW-SBM2	RPW Low Latency SBM2 event detection parameters at level LL01	RPW-SBM2	1 packet per SBM2 event detected on-board	2.2 B per day, assuming 4 events detected over 60 days

Table 1. RPW LL01 data product summary list.

6 LIST OF TBC/TBD/TBWS

TBC/TBD/TBW			
Reference/Page/Location	Description	Type	Status

7 DISTRIBUTION LIST

LISTS See Contents lists in "Baghera Web": Project's informations / Project's actors / RPW_actors.xls and tab with the name of the list or NAMES below		Tech_LESIA
		Tech_MEB
		Tech_RPW
		[Lead-]CoIs
		Science-CoIs

INTERNAL

LESIA CNRS		

LESIA CNRS		

EXTERNAL (To modify if necessary)

CNES		C. FIACHETTI
		C. LAFFAYE
		R.LLORCA-CEJUDO
		E.LOURME
		M-O. MARCHE
		E.GUILHEM
		J.PANH
		B.PONTET
IRFU		L. BYLANDER
		C.CULLY
		A.ERIKSSON
		SE.JANSSON
		A.VAIVADS
LPC2E		P. FERGEAU
		G. JANNET
		T.DUDOK de WIT
		M. KRETZSCHMAR
		V. KRASNOSSELSKIKH
SSL		S.BALE

AsI/CSRC		J.BRINEK
		P.HELLINGER
		D.HERCIK
		P.TRAVNICEK
IAP		J.BASE
		J. CHUM
		I. KOLMASOVA
		O.SANTOLIK
		J. SOUCEK
		L.UHLIR
IWF		G.LAKY
		T.OSWALD
		H. OTTACHER
		H. RUCKER
		M.SAMPL
		M. STELLER
LPP		T.CHUST
		A. JEANDET
		P.LEROY
		M.MORLOT