SOLAR ORBITER RPW ROC

RPW Operation Centre

RPW/THR THR_CAlbar Software Requirements Specification

ROC-PRO-SFT-SPC-00125-LES
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Change Record

Issue	Rev.	Date	Authors	Modifications
1	0	31/08/2020	A.Vecchio	First issue

Acronym List

Acronym	Definition
RCS	RPW Calibration Software
ROC	RPW Operation Centre
RPW	Radio and Plasma Waves instrument
SUM	Software User Manual

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GENERAL

1.1 Scope of the Document

This document provides a specification of the ground calibration software for RPW-THR data (THR_CALBAR). This version of the document applies to THR_CALBAR version 2.2.2

1.2 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	ROC-TST-GSE-ICD-00023-LES	ROC-SGSE Calibration Software ICD	X.Bonnin	Iss. 02, Rev. 02 06/06/2016
AD2	ROC-TST-GSE-NTT-00017-LES	Data format and metadata definition for the ROC-SGSE data	X.Bonnin	Iss. 02, Rev. 01 14/10/2016
AD3	ROC-GEN-SYS-NTT-00019- LES	ROC Engineering Guidelines For External Users	X.Bonnin	Iss. 02, Rev. 00 12/10/2017

1.3 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				
RD2				
RD3				
RD4				
RD5				

2 THR MODES AND DATA PRODUCTS

2.1 Modes of operation

The THR software implements two modes of operation for the two receivers, TNR and HFR.

3 THE THR_CALBAR SOFTWARE PRODUCTS

THR_CALBAR is a software designed to convert THR Level 1 CDF files to Level 2 CDF files where the measured electrical (TNR and HFR) and magnetic (TNR) spectral densities are provided in physical units.

The mode determines what science TM is generated as defined in the table below.

Mode	Description	Data Product
tnr_l2_cal	Calibration of TNR data	RPW-TNR- SURV
hfr_l2_cal	Calibration of HFR data	RPW-HFR- SURV

3.1 TNR electric spectra (mode tnr_l2_cal)

TNR receiver provides both the Automatic Gain Control (AGC) value, from the analog part of the receiver, and the digitalized frequency dependent Auto and Cross values. The THR_CALBAR combines AGC, Auto and Cross providing as output the electric spectral density in physical units V^2/Hz and W/(m^2 Hz), when the effective length of the antenna is taken into account. The phase difference in degrees between the two TNR channels, corrected for the instrumental contribution, is also provided. The calibration is performed by using calibration tables obtained during the system level calibration performed on ground when all the instruments of the RPW suite were connected with the respective preamplifier and the Main Electronic Box (MEB).

3.2 TNR magnetic spectra (mode tnr_l2_cal)

The THR_CALBAR combines AGC, Auto and Cross providing as output the magnetic spectral density in physical units nT^2/Hz. The phase difference in degrees between the two TNR channels, corrected for the instrumental contribution, is also provided. The calibration is performed by using the MF spectral transfer function provided by the SCM team and the calibration tables obtained during the TNR-HFR standalone calibration performed on ground.

3.3 HFR electric spectra (mode hfr_l2_cal)

The receiver HFR only provides the Automatic Gain Control (AGC) values. The THR_CALBAR provides, as output, the electric spectral density in physical units V^2/Hz and W/(m^2 Hz), when the effective length of the antenna is taken into account. The calibration is performed by using the calibration tables obtained during the system level calibration performed on ground when all the instruments of the RPW suite were connected with the respective preamplifier and the Main Electronic Box (MEB).

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4 THR_CALBAR SOFTWARE REQUIREMENTS

In this section, the requirements on the functionality of THR_CALBAR software are outlined.

4.1 General requirements

Basic function: THR_CALBAR software shall allow processing any properly formatted THR L1 CDF file (described in AD2) and convert it into corresponding L2 files. Any anomalies in the source file shall be reported.

Additional input files: to properly calibrate magnetic data, the LFR HK L1 file, including the SCM instantaneous temperature, is also required as input of the THR_CALBAR

Programming language: THR_CALBAR is written in IDL language with the aid of bash scripts.

Version control: The version control is maintained in the ROC git software repository.

Master CDF: For each data product, THR_CALBAR uses a dedicated master CDF. The master files are generated from skeletons and maintained in the ROC git repository.

Global attributes: They follows the specification in AD2 are included in the output L2 files. These can be copied from the master CDF, from the source L1 file or calculated based on data and configuration.

Software Interface: The interface of the software (command line parameters, environment variables and configuration file) shall be compliant with AD1 and described in RD1.

4.2 TNR calibration requirements

THR_CALBAR process data products L1_RPW-THR-SURV, where the data are in uncalibrated integer units, into L2 files. A single TNR L1 file, containing both electric and magnetic data, should be provided. In L2 files, calibrated electric and magnetic data are provided in V^2/Hz in the variables AUTO. Values in W/m^2/Hz and nT/sqrt(Hz) are provided in the variables FLUX_DENSITY and MAGNETIC_SPECTRAL_POWER.

4.3 HFR calibration requirements

THR_CALBAR process data products L1_RPW-THR-SURV, where the data are in uncalibrated integer units, into L2 files. A single HFR L1 file containing electric data only, should be provided. In L2 files, calibrated electric data are provided in V^2/Hz in the variables AUTO. Values in W/m^2/Hz and nT/sqrt(Hz) are provided in the variables FLUX_DENSITY.

5 DISTRIBUTION LIST

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