

RPW Operation Centre

Bias Operations Interface Control Document

ROC-OPS-OTH-ICD-XXXXX-LES
Iss.01, Rev.00

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Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES
Issue: 01
Revision: 00
Date: 27/06/2017

- 2 / 14 -

Change Record

Issue	Rev.	Date	Authors	Modifications
1	0		X.Bonnin	First issue

Acronym List

Acronym	Definition
BP	Basic Parameters
CDF	Common Data Format
CLI	Command Line Interface
CSV	Comma Separated Values
ICD	Interface Control Document
ID	Identifier
I/F	Interface
I/O	Input/Output
JSON	JavaScript Object Notation
ROC	RPW Operation Centre
RPW	Radio and Plasma Waves instrument
SCM	Search Coil Magnetometer
SGSE	Software Ground Support Equipment
SVN	SubVersion
S/W	Software
TDS	Time Domain Sampler
LFR	Low Frequency Receiver
THR	Thermal Noise and High Frequency Receivers
WF	Waveform
XML	eXtended Markup Language



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES

Issue: 01

Revision: 00

Date: 27/06/2017

- 3 / 14 -



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES

Issue: 01

Revision: 00

Date: 27/06/2017

- 4 / 14 -

Table of Contents

1	General	6
1.1	Scope of the Document	6
1.2	Applicable Documents	6
1.3	Reference Documents.....	6
2	Considerations & objectives	7
2.1	Context	7
2.2	Bias operations strategy.....	7
2.3	Objectives of the document	7
3	Bias operations inputs.....	7
3.1	Bias operations inputs overview.....	7
3.2	Bias current predictive model	8
3.2.1	<i>Description</i>	<i>8</i>
3.2.2	<i>Format and file naming</i>	<i>8</i>
3.2.3	<i>Data organization</i>	<i>8</i>
3.3	Bias calibration and sweeping configuration mechanism	9
4	Bias operations products.....	10
4.1	Bias operations products overview.....	10
4.2	Bias sweeping data.....	10
4.3	Bias calibration data	10
4.4	On-board Bias current data	10
5	Bias operations interfaces.....	10
5.1	Mechanism to deliver the Bias current predictive model file	10
5.2	Mechanism to distribute the Bias operations products	11
6	List of TBC/TBD/TBWs	13
7	Distribution list.....	14



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES

Issue: 01

Revision: 00

Date: 27/06/2017

- 5 / 14 -

List of figures

Aucune entrée de table d'illustration n'a été trouvée.
Dans le document, sélectionnez les mots à inclure dans la table des matières, puis, sur l'onglet Accueil, sous Styles, cliquez sur un style d'en-tête. Répétez l'opération pour chaque en-tête à inclure, puis insérez la table des matières dans le document. Pour créer manuellement une table des matières, sur l'onglet Éléments de document, sous Table des matières, pointez sur un style, puis cliquez sur la flèche vers le bas. Cliquez sur un des styles sous Table des matières manuelle, puis tapez les entrées manuellement.



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES

Issue: 01

Revision: 00

Date: 27/06/2017

- 6 / 14 -

1 GENERAL

1.1 Scope of the Document

The Bias operations Interface Control Document (BIOPS ICD) describes the interfaces to be implemented between the ROC and Bias teams, in order to perform the operations related to the RPW Bias unit during the Solar Orbiter mission.

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				
AD2				
AD3				
AD4				

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				
RD6				
RD7				
RD8				



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES

Issue: 01

Revision: 00

Date: 27/06/2017

- 7 / 14 -

2 CONSIDERATIONS & OBJECTIVES

2.1 Context

Solar Orbiter is an “off-line” mission: regular spacecraft (S/C) visibilities are not guaranteed, and the downlink data rates can be very low or null during some periods of time.

It results that the overall mission operations planning must be scheduled in advance, in order to optimize the science return, even when the S/C is out of visibility.

In the same time, the cadence of payload operations requests is about once a week during the mission nominal phase (NMP), and thus the reaction time for the instrument teams (IT) to discuss, prepare and submit commands for a given week of operations is short.

This requires the chain of processes, which leads to the instrument operation submission, must be as much as possible optimized and automated.

2.2 Bias operations strategy

During the mission, the bias currents applied on each of the three RPW antennas shall ensure that the electrical potential V_a of the antennas is always close to the local plasma value V_p (in theory we should have $V_a = V_p = 0V$).

The setting of the Bias current values is commanded from ground. The frequency at which the on-board current values must be set depends of the spacecraft location along the orbit.

In practice the ROC plans to execute this command at least every week from the inputs provided by the Bias team. It does not mean the Bias team needs to deliver updated inputs every week, but the ROC must be capable of submitting the command within a week.

In the same time, the ROC shall be able of providing all of the necessary products required to the Bias team to prepare and deliver the inputs.

2.3 Objectives of the document

The objectives of the present document is to:

- Define the inputs to be delivered to the ROC by the Bias team, in order to prepare and submit the Bias current setting command.
- Identify the products required by the Bias team to prepare and submit the inputs to the ROC.
- Specify the way the data will be exchanged between the ROC and Bias teams.

3 BIAS OPERATIONS INPUTS

3.1 Bias operations inputs overview

Three types of inputs are needed by the ROC to perform the Bias operations:

- A Bias current predictive model, which gives expected current values along the spacecraft orbit. This model will serve as a baseline to the ROC to define command values as explained in the section 3.2.



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES
Issue: 01
Revision: 00
Date: 27/06/2017

- The Bias calibration configuration, which is the list of command parameters to be applied when executing a Bias unit calibration on-board.
- The Bias sweeping configuration, which is the list of command parameters to be applied when executing a Bias sweeping on-board.

3.2 Bias current predictive model

3.2.1 Description

The Bias current predictive model will be used by the ROC to set the on-board current values every week. It shall contain predictive current values along the orbit with enough time accuracy. It will be updated by the Bias team when required.

3.2.2 Format and file naming

The Bias current predictive model shall be delivered as a XML 1.0 file. The XML schema (.xsd) is visible in the section **TBD**.

The file naming convention shall be:

RPW_BIAS_CURRENT_MODEL_V[YYYYMMDDHHNN].xml

Where “YYYY”, “MM”, “DD”, “HH” and “NN” are respectively the 4-digit year, 2-digit month, 2-digit day, 2-digit hours, 2-digit minutes of the file creation.

3.2.3 Data organization

The tables below give the description of the expected structure. The first column (**Field**) provides the name of the element (tag value) or attribute as seen in the resulting XML file. The second column (**E/A**) indicates whether the field is an XML element (using ‘E’), or an attribute (using ‘A’) of an XML element. The third column (**Type**), describes the basic type of the field. The fourth field (**Description**) provides a textual definition of the field which may contain examples, format specifications and conditional statements about what the field may contain. The final column (**Need**) indicates whether the field’s value is Mandatory (M), Optional (O), or Qualified (Q) – the latter requiring explanation in the Description column.

3.2.3.1 Header

Field	E/A	Type	Description	Need
Project	E	string	It shall be “RPW”	M
Description	E	string	Short description of the file content	M
Author	E	string	Author of the file	M
GenerationDate	E	dateTime	Local date/time of the file creation	M
Reference	E	string	Reference to the document used to compute the Bias current model over the orbit (the reference shall include the version of the document)	M
ValidityRange	E	ComplexType	ComplexType containing the validity range	M



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES
Issue: 01
Revision: 00
Date: 27/06/2017

- 9 / 14 -

			start/end time
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Table 1. Bias current model file - header content.

The ValidityRange ComplexType must contain the following fields.

Field	E/A	Type	Description	Need
StartTime	E	dateTime	Validity range start time in UTC	M
EndTime	E	dateTime	Validity range end time in UTC	M

Table 2. Bias current model file - ValidityRange content.

3.2.3.2 BiasModel

Field	E/A	Type	Description	Need
Current	E	ComplexType	CompleType containing the list of current values and time from Bias model	M

Table 3. Bias current model file - BiasModel content.

The Current ComplexType must contain the following fields.

Field	E/A	Type	Description	Need
Bias_1	A	FloatType	Current value in uA to be applied on the first antenna	M
Bias_2	A	FloatType	Current value in uA to be applied on the second antenna	M
Bias_2	A	FloatType	Current value in uA to be applied on the third antenna	M
Time	A	dateTime	UTC date/time when the current values must be applied on-board	M

Table 4. Bias current model file - Current content.

3.3 Bias calibration and sweeping configuration mechanism

The configuration of the Bias calibration and sweeping operations will be performed by the ROC using the dedicated commands.

The default values of the command parameters will be defined by the ROC prior to the launch, with the help of the Bias team. Furthermore, the parameters tagged as “formal parameters” (FP) in the corresponding command sequences will be also identified at this stage.

During the mission, the initial configurations may be refined if necessary.



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES

Issue: 01

Revision: 00

Date: 27/06/2017

- 10 / 14 -

4 BIAS OPERATIONS PRODUCTS

4.1 Bias operations products overview

Three data products will be provided by the ROC to the Bias team:

- Bias sweeping data
- Bias calibration data
- Bias current values actually applied on-board

4.2 Bias sweeping data

The Bias sweeping execution will be performed as a routine operation, at least every week during the NMP.

The resulting telemetry will be downlinked through the Low Latency data stream and processed at SOC, in order to produce LL01 Bias sweeping data files. The LL01 Bias sweeping data file will be then retrieved by the ROC, in order to generate L1 Bias sweeping data files. These files shall contain the measured LFR voltage and the corresponding intensity values for each sweeping step. The intensity values will be extracted by the ROC from the sweeping configuration command.

The content of the L1 Bias sweeping data is described in [RD?].

4.3 Bias calibration data

The calibration of the Bias unit will be also executed on-board at least every week during the NMP.

The resulting telemetry will be downlinked through the science survey data stream and processed at ROC. The data acquired during a Bias calibration will be written into the daily science survey data files at level L1 and L2. Moreover, the status of the Bias unit over time will be indicated in the files, in order to promptly identify calibration time windows in the data.

The content of the L1 science survey data files is described in [RD?].

4.4 On-board Bias current data

The ROC shall generate a specific data product to store the Bias currents actually applied on-board.

TBW

The content of on-board Bias current data files is described in [RD?].

5 BIAS OPERATIONS INTERFACES

5.1 Mechanism to deliver the Bias current predictive model file

Any new version of the Bias current predictive model file shall be uploaded by the Bias team on the dedicated Git repository TBD.



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES

Issue: 01

Revision: 00

Date: 27/06/2017

- 11 / 14 -

5.2 Mechanism to distribute the Bias operations products

The Bias operations products shall be distributed using the same interface than other RPW data products.

6 BIAS OPERATIONS PLAN

6.1 Bias current setting operation life-cycle

The overall life cycle is illustrated on the figure below:

1. Before the launch, the Bias team built a first initial Bias current predictive model from planned orbital data.
2. This initial model is delivered to the ROC to be used as a baseline to prepare on-board Bias current setting operations. Especially, the ROC will generate commands from intensity values provided by the model.
3. Commands to set the on-board Bias current values are submitted to the SOC through the Instrument Operations Request (IOR) mechanism. This task should be done at least every Short Term Planning cycle (~1 week during the NMP). In addition, execution of Bias calibration and sweeping will be also requested.
4. Resulting Bias calibration/sweeping telemetry is retrieved and processed by the ROC, in order to generate “digest” data products as described in the section 4. These products are then distributed to the Bias team for analysis.
5. From the analysis results, the Bias team can decide at some point to refine the predictive model. In this case, a new version of the model file shall be delivered to the ROC. This new version will be used for operations.



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES
Issue: 01
Revision: 00
Date: 27/06/2017

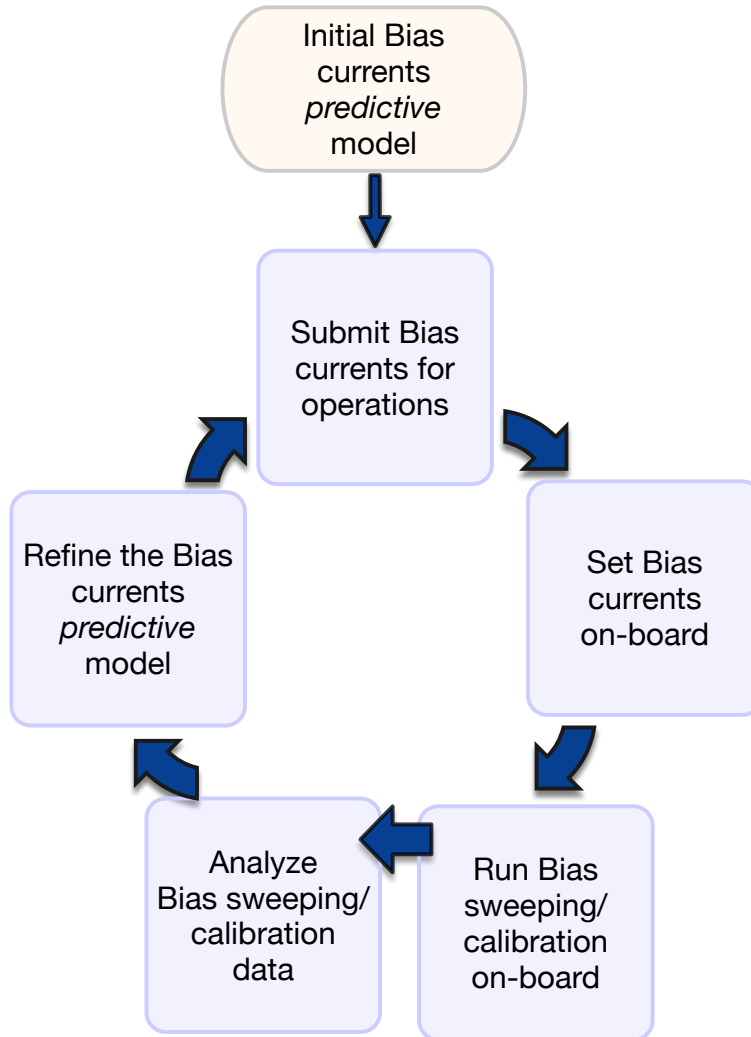


Figure 1. Bias current setting operation life-cycle.



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES
Issue: 01
Revision: 00
Date: 27/06/2017

7 LIST OF TBC/TBD/TBWs

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



Bias Operations Interface Control Document

Ref: ROC-OPS-OTH-ICD-XXXXX-LES
 Issue: 01
 Revision: 00
 Date: 27/06/2017

8 DISTRIBUTION LIST

<p style="text-align: center;">LISTS</p> <p>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</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 2px;">Tech_LESIA</td></tr> <tr><td style="padding: 2px;">Tech_MEB</td></tr> <tr><td style="padding: 2px;">Tech_RPW</td></tr> <tr><td style="padding: 2px;">[Lead-]Cols</td></tr> <tr><td style="padding: 2px;">Science-Cols</td></tr> </table>	Tech_LESIA	Tech_MEB	Tech_RPW	[Lead-]Cols	Science-Cols
Tech_LESIA						
Tech_MEB						
Tech_RPW						
[Lead-]Cols						
Science-Cols						

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