



# ROC User Requirements

Ref: ROC-GEN-OTH-SPC-00064-LES  
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SOLAR ORBITER



## RPW Operations Centre

# ROC User Requirements

ROC-GEN-OTH-SPC-00064-LES  
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| Prepared by:     | Function:                             | Signature: | Date       |
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PUBLIC



RESTRICTED



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### Change Record

| Issue | Rev. | Date       | Authors  | Modifications |
|-------|------|------------|----------|---------------|
| 0     | 0    | DD/MM/YYYY | X.Bonnin | First draft   |
|       |      |            |          |               |



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### Acronym List

| Acronym  | Definition   |
|----------|--|
| AIT      | Assembly Integration Test  |
| AIV      | Assembly Integration Validation  |
| ANT      | (Electrical) antennas  |
| APID     | Application Process ID   |
| CDPP     | Centre de Données de Physique des Plasmas                              |
| CIRD     | Concept and Implementation Requirements Document                       |
| CNES     | Centre National d'Etudes Spatiales                                     |
| CNRS     | Centre National de Recherche Scientifique                              |
| CoI      | Co Investigator  |
| CP       | Cruise Phase   |
| DDS      | Data Dissemination System  |
| DPU      | Digital Processing Unit  |
| EDDS     | EGOS Data Dissemination System   |
| EID-A    | Experiment Interface Document - Part A                                 |
| EMP      | Extended Mission Phase   |
| EPD      | Energetic Particles Detector   |
| ESA      | European Space Agency  |
| ESAC     | European Space Astronomy Centre  |
| ESOC     | European Space Operation Centre  |
| FDIR     | Failure Detection Isolation and Recovery                               |
| FOP      | Flight Operation Plan  |
| GIGL     | Groupe d'Informatique Générale du LESIA                                |
| HFR      | High Frequency Receiver  |
| HK       | Housekeeping parameters  |
| IAP      | Institute of Atmospheric Physics                                       |
| ID       | Identifier   |
| IOR      | Instrument Operation Request   |
| IT       | Instrument Team  |
| ISM      | Instrument State Model   |
| IOP      | Instrument Operation Planner   |
| IOR      | Instrument Operation Request   |
| LEOP     | Launch & Early Operations Phase  |
| LESIA    | Laboratoire d'Etudes Spatiales et d'Instrumentations en Astrophysiques |
| LFR      | Low Frequency Receiver   |
| LLVM     | Low Latency Virtual Machine  |
| LPC2E    | Laboratoire de Physique et Chimie de l'Environnement et de l'Espace    |
| LPP      | Laboratoire de Physique des Plasma                                     |
| LVPS-PDU | Low Voltage Power Supply - Power Distribution Unit                     |
| MDOR     | Memory Direct Operation Request  |



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|             |  |
|-------------|--|
| <b>MOC</b>  | Solar Orbiter Mission Operation Centre                     |
| <b>NECP</b> | Near Earth Commissioning Phase                             |
| <b>NMP</b>  | Nominal Mission Phase                                      |
| <b>OGS</b>  | Operations Ground Segment                                  |
| <b>OS</b>   | Operating System   |
| <b>PDOR</b> | Payload Direct Operation Request                           |
| <b>PI</b>   | Principal Investigator                                     |
| <b>PM</b>   | Ground Segment Project Manager                             |
| <b>PMP</b>  | Project Management Plan                                    |
| <b>POR</b>  | Payload Operations Request                                 |
| <b>RFP</b>  | RPW Flight Procedure                                       |
| <b>RGS</b>  | RPW Ground Segment   |
| <b>ROC</b>  | RPW Operation Centre                                       |
| <b>RPW</b>  | Radio and Plasma Waves                                     |
| <b>RSR</b>  | RPW Science Requirements document                          |
| <b>RSS</b>  | ROC Software System  |
| <b>RSW</b>  | Remote-sensing Window                                      |
| <b>SDP</b>  | Software Development Plan                                  |
| <b>S/C</b>  | Spacecraft   |
| <b>S/W</b>  | Software   |
| <b>SBM</b>  | Selective Burst Mode                                       |
| <b>SCM</b>  | Search Coil Magnetometer                                   |
| <b>SGS</b>  | Science Ground Segment                                     |
| <b>SGSE</b> | Software Ground Support Equipment                          |
| <b>SIRD</b> | Solar Orbiter Science Implementation Requirements Document |
| <b>SOC</b>  | Solar Orbiter Science Operation Centre                     |
| <b>SOOP</b> | Solar Orbiter Observing Plan                               |
| <b>SOV</b>  | System Operation Validation                                |
| <b>SOWG</b> | Science Operations Working Group                           |
| <b>SSL</b>  | Space Science Laboratory                                   |
| <b>SSMM</b> | Solid State Mass Memory                                    |
| <b>SVT</b>  | System Validation Tests                                    |
| <b>SWT</b>  | Science Working Team                                       |
| <b>TC</b>   | Telecommand  |
| <b>TDS</b>  | Time Domain Sampler  |
| <b>TM</b>   | Telemetry  |
| <b>TNR</b>  | Thermal Noise Receiver                                     |
| <b>VM</b>   | Virtual Machine  |



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## 1 GENERAL

### 1.1 Scope of the Document

The Users Requirements Document (URD) addresses the users requirements related to the exploitation of the RPW Operations Centre (ROC).

Especially, it precises the user needs for the ROC software system (RSS) in support of:

- RPW operations requests preparation, submission and verification
- Operations planning visualization at mission and instrument levels
- Instrument monitoring
- RPW data visualization
- RSS monitoring

The URD covers the user requirements for the RSS deployed and run at the Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique (LESIA) in Meudon (France), during the RPW instrument exploitation starting at the Cruise Phase (CP). The user specific needs for the RPW instrument commissioning phase are defined in a separated document [RD1].

### 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-GEN-SYS-PLN-00002-LES/1/4 | ROC Concept and Implementation Requirements Document (CIRD) | Y. de Conchy<br>X. Bonnin | 17/11/2017 |
| AD2  | TBD                           | ROC Requirements  | Milan Maksimovic          |            |
| 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  | TBD                             | RPW Commissioning requirements      | Eric Lorfevre | TBD        |
| RD2  | ROC-GEN-SYS-PLN-00015-LES/02/03 | ROC Software Development Plan (SDP) | Xavier Bonnin | 17/11/2017 |
| RD3  | ROC-GEN-OTH-NTT-00044-LES/1/1   | ROC Glossary of terms (RGT)         | Xavier Bonnin | 08/11/2018 |

### 1.4 About this document

#### 1.4.1 Access policy

This document is accessible without any restriction.





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**Any modification of the URD requires formal approval of the RPW Ground Segment Project Manager (PM) before publication.**

### 1.4.2 Requirement identification

The structure of requirement is a following:

| Req. reference   | Req. title  | Req. verif. |
|------------------|-------------|-------------|
| Req. description |             |             |
| Req. target      | Implements: |             |
| Req. comment     |             |             |

Where:

- “Req. reference” is the reference identifier of the requirement. It must “REQ-ROC-URD-XXXX”, where “XXXX” is a unique 4-digits integer over the document. This field must be defined.
- “Req. title” is the title of the requirement. This field must be defined.
- “Req. description” gives the description of the requirement. This field must be defined.
- The way the requirement is verified must be reported into the “Req. verif.” cell. The possible values are: “Test”, “Demo”, “Code inspection”, “Review”. This field must be defined.
- “Req. target” indicates for which system or entity the requirement must be applied. This field is optional.
- The reference of the parent requirement(s) (i.e., the higher-level requirements covered by the requirement) must be listed in the “Implements:” cell. This field is mandatory if any parent requirement is identified.
- “Req. comment” cell can be used to add any comment or justification relative to the requirement. This field is optional.



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## 2 INTRODUCTION

### 2.1 Context and purpose

The ROC has the overall responsibility of the RPW ground segment. In support to its activities, dedicated infrastructure shall be implemented at LESIA, allowing the ROC to cover the required functions as defined in the ROC CIRD [AD1].

In the same time, the needs of the RSS users shall be taken account in order to develop and deliver expected software and related interfaces. This is the purpose of the URD.

### 2.2 Software covered by the ROC User Requirements

The RSS is presented in the ROC Software Development Plan (SDP) [RD2].

The RSS software units covered by the URD are:

- RPW Operation and Data processing Pipeline (RODP), to retrieve, process and distribute RPW TM and operational data related to the Solar Orbiter mission.
- Monitoring and control subsystem User Interface (MUSIC), to visualize RPW data and support operations activities.

### 2.3 Definitions

The ROC-related terms definitions can be found in the ROC glossary of terms [RD3].

## 3 MONITORING AND CONTROL SUBSYSTEM USER INTERFACE (MUSIC) USER REQUIREMENTS

### 3.1 Overview

The MUSIC application gathers graphical user interface (GUI) components used by the ROC to:

- Visualize RPW data, via the MUSIC-TV GUI component
- Prepare and submit instrument operation requests (IOR), via the MUSIC-FAUST GUI component
- Generate instrument command (TC) sequences inside flight procedures, via the MUSIC-FIGARO GUI component
- View the mission and instrument levels operation planning, via the MUSIC-OPERA GUI component.
- Select the SBM event data to downlink, via the MUSIC-SISSI GUI component.

The next sections list the user requirements related to the MUSIC GUI.

### 3.2 MUSIC general user requirements

#### 3.2.1 General features

|                  |               |      |
|------------------|---------------|------|
| REQ-ROC-URD-0010 | MUSIC Web GUI | Test |
|------------------|---------------|------|



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The ROC MUSIC shall be provided as a Web-based GUI.

MUSIC

**Implements:**

**REQ-ROC-URD-0020**

MUSIC Web GUI accessibility

**Test**

The MUSIC Web GUI shall only be reachable from the RPW PI-ship laboratory intranet.

MUSIC

**Implements:**

**REQ-ROC-URD-0030**

MUSIC Web GUI user registration

**Demo**

A user shall be registered in the MUSIC database in order to access to its GUI components. The registration form shall contain at least the following fields related to the user:

- First name
- Last name
- Email address
- Type of permission requested by the user for each MUSIC component tool: "observer", "operator" or "no access" (default).

MUSIC

**Implements:**

*This mechanism should permit to identify the users as well as control their access and permissions to the MUSIC GUI components.*

**REQ-ROC-URD-0040**

MUSIC Web GUI user registration validation

**Test**

Any user registration request shall be validated by a ROC administrator before being effective.

MUSIC

**Implements:**

**REQ-ROC-URD-0040**

Change the MUSIC Web GUI user permissions

**Test**

A ROC administrator shall be capable of changing the observer/operator permissions of a given registered user for each MUSIC GUI component.

Other users (observer/operator) shall not be able to set their permissions.

MUSIC

**Implements:**



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|  |
|--|
|  |
|--|

| REQ-ROC-URD-0050   | MUSIC Web GUI main page | Demo |
|--|-------------------------|------|
| <p>The MUSIC Web GUI shall have a main page where the users, registered or not, can:</p> <ul style="list-style-type: none"> <li>- Sign up (i.e., access to the registration form)</li> <li>- Sign in</li> <li>- Access to the MUSIC GUI components (FIGARO, FAUST, OPERA, SISSI and TV tools)</li> <li>- Contact the ROC support (i.e., webmaster)</li> <li>- Access to the ROC MUSIC GUI user manual</li> <li>- Check the version of MUSIC and its components</li> <li>- Go to the RPW Web portail at LESIA and SOC Web interfaces (SOOPKitchen and LL Web page)</li> </ul> |                         |      |
| MUSIC  | <b>Implements:</b>      |      |
| <p><i>Additionally, it could be useful to view the status and news related to the application (i.e., application is up-and-running, application is stopped for upgrades/bugs fixing, Upgrade will be performed in 2 days)</i></p>  |                         |      |

## 3.3 MUSIC-TV Graphical User Interface (GUI) user requirements

### 3.3.1 Context

The MUSIC-TV GUI component shall offer graphical features to view the RPW data retrieved and processed by the ROC.

This GUI is not designed to perform fine analysis of RPW data, but to have a quick overview of instrument data and related events in support to the flight operations.

This component is dedicated to be used by the ROC team at LESIA first. Nevertheless an access should be also allowed to external people involved in the RPW ground segment activities, and more particularly the RPW instrument and science teams.

The SOC team will make available to the Solar Orbiter payload teams a Web page dedicated to the Low Latency data visualization.

### 3.3.2 Expected functionalities

#### 3.3.2.1 General features

| REQ-ROC-URD-0070   | Plot RPW data      | Test |
|--|--------------------|------|
| <p>The MUSIC-TV GUI shall allows users to plot the RPW data retrieved and processed by the ROC for a given time range.</p> |                    |      |
| MUSIC-TV   | <b>Implements:</b> |      |
|  |                    |      |

By default the MUSIC-TV GUI should display RPW data for the last spacecraft transmission window, however a user should be able to modify the length of the time range.



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An option should allow users to automatically refresh the RPW data plots as soon as new data are available.

|  |                               |             |
|--|-------------------------------|-------------|
| <b>REQ-ROC-URD-0090</b>  | Flag RPW time synchronization | <b>Test</b> |
| The MUSIC-TV GUI shall allow users to know when the RPW on-board time is not synchronized. |                               |             |
| MUSIC-TV   | <b>Implements:</b>            |             |
|  |                               |             |

Additionally, the MUSIC-TV GUI shall allow users to export a RPW data plot in the following formats:

- JPG

### 3.3.2.2 RPW science survey data visualization

#### 3.3.2.2.1 General features

|   |   |             |
|---|---|-------------|
| <b>REQ-ROC-URD-0130</b>   | Plot RPW data by science survey submode | <b>Test</b> |
| The MUSIC-TV GUI shall allow users to plot the science survey data for the following RPW science submodes:<br>- SURVEY_NORMAL<br>- SURVEY_BURST<br>- SBM_DETECTION<br>- SURVEY_BACKUP |   |             |
| MUSIC-TV  | <b>Implements:</b> REQ-ROC-CIRD-0020    |             |
|   |   |             |

|  |                                      |             |
|--|--------------------------------------|-------------|
| <b>REQ-ROC-URD-0140</b>                                      | Plot RPW calibration data            | <b>Test</b> |
| The MUSIC-TV GUI shall allow users to plot calibration data. |                                      |             |
| MUSIC-TV   | <b>Implements:</b> REQ-ROC-CIRD-0020 |             |
|  |                                      |             |

|  |  |             |
|--|--|-------------|
| <b>REQ-ROC-URD-0150</b>  | Plot RPW science survey data by processing level | <b>Test</b> |
| The MUSIC-TV GUI shall allow users to plot the RPW science data for the following processing levels: |  |             |



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|                     |                                      |
|---------------------|--------------------------------------|
| - L1 (uncalibrated) |                                      |
| - L2 (calibrated)   |                                      |
| MUSIC-TV            | <b>Implements:</b> REQ-ROC-CIRD-0020 |
|                     |                                      |

### 3.3.2.2.2 Plot RPW TDS science survey data

| REQ-ROC-URD-0150  | Plot RPW TDS science survey data     | Test |
|---|--------------------------------------|------|
| <p>The MUSIC-TV GUI shall allow users to plot the following specific TDS science survey data for a given time range:</p> <ul style="list-style-type: none"> <li>- Regular Waveform Snapshots (E+B)</li> <li>- Triggered Waveform Snapshots (E+B)</li> <li>- 1D histograms</li> <li>- 2D histograms</li> <li>- Low rate information</li> <li>- Dust statistics</li> <li>- LFR redundancy mode parameters (only in available with SURVEY_BACKUP)</li> </ul> |                                      |      |
| MUSIC-TV  | <b>Implements:</b> REQ-ROC-CIRD-0020 |      |
|   |                                      |      |

### 3.3.2.2.3 Plot RPW LFR science survey data

| REQ-ROC-URD-  | Plot LFR science survey data | Test |
|---|------------------------------|------|
| <p>The MUSIC-TV GUI shall allow users to plot the following LFR data for a given time range:</p> <ul style="list-style-type: none"> <li>- Snapshots waveforms: <ul style="list-style-type: none"> <li>- V, E1, E2, B1, B2, B3 of a given frequency f0, f1 or f2 at the same time or separately.</li> <li>- Snapshots waveforms should be displayed for a given time range and in TM units</li> </ul> </li> <li>- Continuous waveforms: <ul style="list-style-type: none"> <li>- V, E1, E2, B1, B2, B3 of a given frequency f1, f2 or f3 at the same time or separately.</li> <li>- Continuous waveforms should be displayed for a given time range and in TM units.</li> </ul> </li> <li>- Average spectral matrices (ASM): <ul style="list-style-type: none"> <li>- Values in TM and physical units</li> <li>- Possibility to plot frequency spectra (up to 9 elements of the matrix amongst 25 on the same window to be chosen by user).</li> <li>- Possibility to plot color dynamical spectra: all frequencies (from f0, f1 and f2) for a given time range and for up to 9 elements of the matrices.</li> </ul> </li> </ul> |                              |      |



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- Basic parameters (BP):
  - For BP2, same as ASM
  - For BP1, same as ASM applied to the de-commuted BP1 parameters (11 max.): PE, PB, NVEC\_V0/V1/V2, ELLIP, DOP, SX, SX\_Arg, VPHI, VPHI\_Arg.
- LFR waveforms versus TDS waveforms:
  - TDS "Low frequency mode" parameters (TC\_TDS\_LOAD\_LFM\_PAR)
  - It shall be able to combine LFR and TDS "low frequency mode" waveforms, cross and power spectrum plots (TM\_TDS\_SCIENCE\_LFM\_\*) for a given time range overlaid on same graph/window.

MUSIC-TV

**Implements:** REQ-ROC-CIRD-0020

*It could be useful to be able to overlay snapshots and continuous waveforms of the different frequencies ( $f_0$ ,  $f_1$ ,  $f_2$  and  $f_3$ ).*

### 3.3.2.2.4 Plot RPW TNR-HFR science survey data

| REQ-ROC-URD-  | Plot TNR science survey data         | Test |
|---|--------------------------------------|------|
| <p>The MUSIC-TV GUI shall allow users to plot the following TNR data for a given time range:</p> <ul style="list-style-type: none"> <li>- AGC values as a function of time.</li> <li>- Auto-correlation and cross-correlation values as a function of time for a given frequency range. -</li> <li>- If more than one time series are found in the frequency range, it shall be able to plot the individual data curves, an integrated curve or the maximal values.</li> <li>- Auto-correlation and cross-correlation values as a function of frequency for a given time range. If more than one spectrum are in the time range, it shall be able to plot individual data curves, an integrated curve, or max.</li> <li>- Auto-correlation and cross-correlation values as functions of time and frequency (i.e., dynamical spectrum).</li> <li>- Phase in degrees as a function of frequency.</li> <li>- Moreover, it shall be able to display AGC, auto and cross-correlation values in TM units (i.e., L1) or calibrated values (i.e., L2) if possible. Time shall be given in count since the beginning of the test or in seconds and frequency in kHz.</li> <li>- It shall be possible to plot TNR data for one or both channels (1 and 2) on the same plot and for each receiver band (A, B, C and D).</li> </ul> |                                      |      |
| MUSIC-TV  | <b>Implements:</b> REQ-ROC-CIRD-0020 |      |

| REQ-ROC-URD-   | Plot HFR science survey data | Test |
|--|------------------------------|------|
| <p>The MUSIC-TV GUI shall allow user to plot the following HFR data for a given time range:</p> <ul style="list-style-type: none"> <li>- AGC values as a function of time for a given frequency range. If more than one time series are found in the frequency range, it shall be able to plot individual data curves or an integrated curve.</li> <li>- AGC values as a function of frequency for a given time range. If more than one spectrum are found in the time range, it shall be able to plot individual data curves or an integrated curve.</li> </ul> |                              |      |



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- AGC values as functions of time and frequency (i.e., dynamical spectrum).

It shall be able to display AGC values in TM units or calibrated values (i.e., dB(V<sup>2</sup>/Hz)) if possible. Time shall be given in count since the beginning of the test or in seconds and frequency in kHz.

It shall be possible to plot HFR data for one or both channels (1 and 2) on the same plot and for each receiver band (HF1 and HF2).

|          |                                      |
|----------|--------------------------------------|
| MUSIC-TV | <b>Implements:</b> REQ-ROC-CIRD-0020 |
|----------|--------------------------------------|

### 3.3.2.3 RPW specific data visualization user requirements

#### 3.3.2.3.1 RPW snapshot data visualization user requirements

| REQ-ROC-URD-   | Plot RPW snapshot data               | Test |
|--|--------------------------------------|------|
| The MUSIC-TV GUI shall allow users to plot RPW data for a given snapshot only. |                                      |      |
| MUSIC-TV   | <b>Implements:</b> REQ-ROC-CIRD-0020 |      |

#### 3.3.2.3.2 RPW BIAS data visualization user requirements

| REQ-ROC-URD-  | Plot Bias sweeping data              | Test |
|---|--------------------------------------|------|
| The MUSIC-TV GUI shall allow users to plot RPW data for a given Bias sweeping only. |                                      |      |
| MUSIC-TV  | <b>Implements:</b> REQ-ROC-CIRD-0020 |      |

| REQ-ROC-URD-  | Plot Bias sweeping data              | Test |
|---|--------------------------------------|------|
| The MUSIC-TV GUI shall allow users to plot RPW Bias unit current intensity data for a given time range. |                                      |      |
| MUSIC-TV  | <b>Implements:</b> REQ-ROC-CIRD-0020 |      |

#### 3.3.2.3.3 RPW SBM data visualization user requirements

| REQ-ROC-URD-  | Plot RPW SBM1 event data             | Test |
|---|--------------------------------------|------|
| The MUSIC-TV GUI shall allow user to plot RPW data for a given SBM1 event only. |                                      |      |
| MUSIC-TV  | <b>Implements:</b> REQ-ROC-CIRD-0020 |      |

| REQ-ROC-URD- | Plot RPW SBM2 event data | Test |
|--------------|--------------------------|------|
|--------------|--------------------------|------|





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The MUSIC-TV GUI shall allow users to plot RPW data for a given SBM2 event only.

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**Implements:** REQ-ROC-CIRD-0020

### 3.3.2.4 RPW engineering data visualization

#### 3.3.2.4.1 Plot RPW HK parameters

| REQ-ROC-URD-   | Plot HK parameter                    | Test |
|--|--------------------------------------|------|
| The MUSIC-TV GUI shall allow users to plot RPW HK parameters for a given time range. |                                      |      |
| MUSIC-TV   | <b>Implements:</b> REQ-ROC-CIRD-0020 |      |

It should be possible to display HK parameters using graphical or tabular views.

#### 3.3.2.4.2 Display RPW telemetry (TM) packet data

| REQ-ROC-URD-  | Display RPW TM downlinked packets list | Test |
|---|--|------|
| <p>The MUSIC-TV GUI shall allow users to display the list of RPW TM downlinked packets, as a table, with the following columns:</p> <ul style="list-style-type: none"> <li>- Packet count, sequence number of the packet, related to the DAS packet counter.</li> <li>- Packet index. First 7 characters of the packet ROC ID in the MDB.</li> <li>- Packet reception time – It must be the reception local time of the TM. (The format is “YYYY-MM-DD HH:MM:SS.FFF”.)</li> <li>- Packet creation time – It must be the on-board TM packet creation time (The format is “YYYY-MM-DD HH:MM:SS.FFF”.)</li> <li>- Packet time synchronization flag</li> <li>- Packet APID – Apid of the packet</li> <li>- Packet name – human-readable name of the packet</li> <li>- Packet processing status – One of the following TM statuses: “Received” (received by the ROC), “Validated” (packet integrity and identification validated), “Corrupted” (packet content is partially or fully corrupted), “Processed” (packet data has been processed correctly)</li> </ul> |  |      |
| MUSIC-TV  | <b>Implements:</b> REQ-ROC-CIRD-0020   |      |

By default, the TMs could be sorted by decreasing packet creation time (i.e., most recent TM at the top of the list).

In the case where a packet has been identified but the content is corrupted (i.e., partially corrupted), all columns should be provided, but the status should be set to “Corrupted”.

In the case where a packet cannot be identified (i.e., fully corrupted), only the packet count, index, reception time and status - with “Corrupted” value - columns should be provided.



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| REQ-ROC-URD-  | Display RPW TM packet content | Test |
|---|-------------------------------|------|
| The MUSIC-TV GUI shall allow a user to view the content of a given TM packet, including the binary/human-readable parameter values. |                               |      |
| MUSIC-TV  | <b>Implements:</b>            |      |
|   |                               |      |

### 3.3.2.4.3 Display RPW command (TC) packet data

| REQ-ROC-URD-   | Display RPW TC uplinked packets list | Test |
|--|--------------------------------------|------|
| The MUSIC-TV GUI shall allow an user to display the list of uplinked RPW TC packets, as a table with the following columns:  |                                      |      |
| <ul style="list-style-type: none"> <li>- Packet count, sequence number of the packet.</li> <li>- Packet index. First 7 characters of the packet ROC ID in the MDB.</li> <li>- Packet submission time – It must be the submission local time of the TC. (The format is “YYYY-MM-DD HH:MM:SS.FFF”.) The submission local time corresponds to the time when the corresponding operation request file has been sent to the SOC/MOC.</li> <li>- Packet execution time – It must be the on-board TC packet execution time in UTC. (The format is “YYYY-MM-DD HH:MM:SS.FFF”.)</li> <li>- Packet APID – Apid of the packet</li> <li>- Packet name – human-readable name of the packet</li> <li>- Packet processing status – Status from the corresponding Service 1 (S1) TM (accepted/executed)</li> </ul> |                                      |      |
| MUSIC-TV   | <b>Implements:</b> REQ-ROC-CIRD-0020 |      |
|  |                                      |      |

By default, the TCs shall be sorted by decreasing packet execution time (i.e., last executed packets at the top of the list).

| REQ-ROC-URD-  | Display TC packet content | Test |
|---|---------------------------|------|
| The MUSIC-TV GUI shall allow a user to view the content of a given TC packet, including the binary/human-readable parameter values. |                           |      |
| MUSIC-TV  | <b>Implements:</b>        |      |
|   |                           |      |

It should be also helpful for users to have extra information concerning the related operation request and planning (e.g., IOR, STP/MTP) (TBC).



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### 3.3.2.4.4 Display instrument general and sub-systems status

| REQ-ROC-URD-  | Display instrument status | Test              |
|---|---------------------------|-------------------|
| The MUSIC-TV GUI shall allow an user to display the instrument general and sub-systems status for a given time range. It concerns the parameters listed in the Table 1. |                           |                   |
| MUSIC-TV  | Implements:               | REQ-ROC-CIRD-0020 |
| <i>The MUSIC-TV GUI should allow users to overplot more than one instrument general and sub-system status parameter on the same figure.</i>                             |                           |                   |

| Parameter name                  | Possible values                   |
|---------------------------------|-----------------------------------|
| <b>DPU Status</b>               |                                   |
| Active DPU                      | Nominal, Redundant                |
| Active SW                       | DBS, DAS                          |
| DBS SW Version                  |                                   |
| DAS SW Version                  |                                   |
| FPGA Version                    |                                   |
| Current Mode                    |                                   |
| Compr.                          | ON, OFF                           |
| Reset cause                     |                                   |
| DAS Sw Addr                     | Unknown, RAM, EEPROM1, EEPROM2    |
| Boot Addr. LFR                  | Not booted, RAM, EEPROM1, EEPROM2 |
| Boot Addr TDS                   | Not booted, RAM, EEPROM1, EEPROM2 |
| Boot Addr THR                   | Not booted, RAM, EEPROM1, EEPROM2 |
| DAS Config in EEPROM            | Missing, OK, Corrupted            |
| BIAS Calib                      |                                   |
| DPU Recovery                    | ON, OFF                           |
| <b>DPU Anomalies statistics</b> |                                   |
| Anomalies count - Low           |                                   |
| Anomalies count - Medium        |                                   |
| Anomalies count - High          |                                   |
| Last error - Code               |                                   |
| Last error - RID                |                                   |
| Last error - Time               |                                   |
| <b>Sub-Systems State</b>        |                                   |
| THR – Hear beat                 | ON, OFF                           |
| THR – Link Err.                 | ON, OFF                           |
| THR – Transp. Mode              | ON, OFF                           |
| LFR – Hear beat                 | ON, OFF                           |
| LFR – Link Err.                 | ON, OFF                           |
| LFR – Transp. Mode              | ON, OFF                           |
| TDS – Hear beat                 | ON, OFF                           |
| TDS – Link Err.                 | ON, OFF                           |



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|                               |         |
|-------------------------------|---------|
| TDS – Transp. Mode            | ON, OFF |
| BIAS – Hear beat              | ON, OFF |
| BIAS – Link Err.              | ON, OFF |
| PDU – Hear beat               | ON, OFF |
| PDU – Link Err.               | ON, OFF |
| <b>TM Statistics</b>          |         |
| DPU - SSMM                    |         |
| DPU - OBC                     |         |
| LFR – w/o SBM                 |         |
| LFR - SBM                     |         |
| TDS – w/o SBM                 |         |
| TDS - SBM                     |         |
| THR – w/o SBM                 |         |
| <b>Link Status</b>            |         |
| LVDS Status – THR/LFR         |         |
| LVDS Status – TDS/BIAS        |         |
| SiS Status - PDU              |         |
| SiS Status - BIAS             |         |
| SpW Links – Link S/C - Enable |         |
| SpW Links – Link S/C - State  |         |
| SpW Links – Link S/C – Rx Max |         |
| SpW Links – Link S/C – Tx Max |         |
| SpW Links – Link THR - Enable |         |
| SpW Links – Link THR - State  |         |
| SpW Links – Link THR – Rx Max |         |
| SpW Links – Link THR – Tx Max |         |
| SpW Links – Link TDS - Enable |         |
| SpW Links – Link TDS - State  |         |
| SpW Links – Link TDS – Rx Max |         |
| SpW Links – Link TDS – Tx Max |         |
| SpW Links – Link LFR - Enable |         |
| SpW Links – Link LFR - State  |         |
| SpW Links – Link LFR – Rx Max |         |
| SpW Links – Link LFR – Tx Max |         |
| <b>DPU Statistics</b>         |         |
| CPU load – Max.               |         |
| CPU Load Ave.                 |         |
| S/C TX FIFO Rate Ave          |         |
| DPU Elapsed Time              |         |
| Maximal FIFO Size - TC        |         |
| Maximal FIFO Size - COMP      |         |
| Maximal FIFO Size – HK TM     |         |
| Maximal FIFO Size – SVY TM    |         |



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|                                |         |
|--------------------------------|---------|
| Maximal FIFO Size – OBC TM     |         |
| Maximal FIFO Size – SBM TM     |         |
| <b>PDU Cmd/TM Counters</b>     |         |
| Cmd (Write)                    |         |
| Cmd (Failed)                   |         |
| Telem. (Read)                  |         |
| <b>PDU Primary Power</b>       |         |
| Voltage - Primary              |         |
| Voltage - Heater               |         |
| Current - Primary              |         |
| Current - Heater               |         |
| <b>PDU Temperature</b>         |         |
| Temp1                          |         |
| Temp2                          |         |
| <b>PDU Power / Overcurrent</b> |         |
| CONV – Power On/Off            | ON, OFF |
| SCM – Power On/Off             | ON, OFF |
| ANT1 – Power On/Off            | ON, OFF |
| ANT2 – Power On/Off            | ON, OFF |
| ANT3 – Power On/Off            | ON, OFF |
| BIAS – Power On/Off            | ON, OFF |
| TNR/HFR – Power On/Off         | ON, OFF |
| LFR – Power On/Off             | ON, OFF |
| TDS – Power On/Off             | ON, OFF |
| SCM – Over Current             | ON, OFF |
| ANT1 – Over Current            | ON, OFF |
| ANT2 – Over Current            | ON, OFF |
| ANT3 – Over Current            | ON, OFF |
| BIAS – Over Current            | ON, OFF |
| TNR/HFR – Over Current         | ON, OFF |
| LFR – Over Current             | ON, OFF |
| TDS – Over Current             | ON, OFF |
| <b>BIAS Mode</b>               |         |
| Version                        |         |
| ActiveLink                     |         |
| HV                             |         |
| BIAS 1                         |         |
| BIAS 2                         |         |
| BIAS 3                         |         |
| Diff. Probe 1                  |         |
| Diff. Probe 2                  |         |
| Diff. Probe 3                  |         |
| Byp. Probe 1                   |         |



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|                             |  |
|-----------------------------|--|
| Byp. Probe 2                |  |
| Byp. Probe 3                |  |
| Multiplexer Set - Mode      |  |
| Multiplexer Set – BIAS_1    |  |
| Multiplexer Set – BIAS_2    |  |
| Multiplexer Set – BIAS_3    |  |
| Multiplexer Set – BIAS_4    |  |
| Multiplexer Set – BIAS_5    |  |
| Multiplexer Set – Operation |  |
| <b>BIAS Status</b>          |  |
| Cmd Count                   |  |
| Cur. Select. PAge           |  |
| Dummy                       |  |
| AC Diff. gain               |  |



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| BIAS Temperature      |         |
|-----------------------|---------|
| ANT1                  |         |
| ANT2                  |         |
| ANT3                  |         |
| PCB                   |         |
| BIAS Saturation       |         |
| Probe 1               |         |
| Probe 2               |         |
| Probe 3               |         |
| BIAS Setting          |         |
| Probe 1               |         |
| Probe 2               |         |
| Probe 3               |         |
| BIAS Voltage          |         |
| Reference - Ground    |         |
| Reference - +1.5V     |         |
| Reference - +2.5V     |         |
| High Voltage - -100V  |         |
| High Voltage - + 100V |         |
| LFR Status            |         |
| Current Mode          |         |
| Reset Cause           |         |
| Watchdog              | ON, OFF |
| Calibration           | ON, OFF |
| Sw Version            |         |
| FPGA Version          |         |
| Gain                  |         |
| LFR Configuration     |         |
| V                     |         |
| E1_F0                 |         |
| E1_F1                 |         |
| E1_F2                 |         |
| E1_F3                 |         |
| E2_F0                 |         |
| E2_F1                 |         |
| E2_F2                 |         |
| E2_F3                 |         |
| LFR Temperature       |         |
| PCB                   |         |
| SCM                   |         |
| FPGA                  |         |
| LFR SpW Links         |         |
| Enable                | ON, OFF |



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|                                  |         |
|----------------------------------|---------|
| State                            | ON, OFF |
| <b>LFR TC Statistics</b>         |         |
| TC Count – Update Info           |         |
| TC Count – Update Time           |         |
| TC Count – Exe Tc                |         |
| TC Count – Rejected TC           |         |
| Last Executed TC - ID            |         |
| Last Executed TC - Type          |         |
| Last Executed TC - SubType       |         |
| Last Executed TC - Time          |         |
| Last Rejected TC - ID            |         |
| Last Rejected TC - Type          |         |
| Last Rejected TC - SubType       |         |
| Last Rejected TC - Time          |         |
| <b>LFR Anomalies statistics</b>  |         |
| Anomalies Count - Low            |         |
| Anomalies Count - Medium         |         |
| Anomalies Count - High           |         |
| Last Error - Code                |         |
| Last Error -RID                  |         |
| Last Error - Time                |         |
| <b>TDS Status</b>                |         |
| Current Mode                     |         |
| Reset Cause                      |         |
| Watchdog                         | ON, OFF |
| Calibration                      | ON, OFF |
| Sw Version                       |         |
| FPGA Version                     |         |
| <b>TDS SpW Links</b>             |         |
| SpW Links - Enable               | ON, OFF |
| SpW Links - State                | ON, OFF |
| <b>TDS Configuration Status</b>  |         |
| Common                           | ON, OFF |
| Normal                           | ON, OFF |
| Burst                            | ON, OFF |
| SBM1                             | ON, OFF |
| SBM2                             | ON, OFF |
| LFM                              | ON, OFF |
| <b>TDS Snapshot Statistics</b>   |         |
| Processed since last dump        |         |
| Q Factor - Min                   |         |
| Q Factor - Max                   |         |
| Valid snapshot in queue - Normal |         |





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|                                 |         |
|---------------------------------|---------|
| Valid snapshot in queue – SBM2  |         |
| <b>TDS Temperature</b>          |         |
| PCB                             |         |
| FPGA                            |         |
| SRAM                            |         |
| <b>TDS TC Statistics</b>        |         |
| TC Count – Update Info          |         |
| TC Count – Update Time          |         |
| TC Count – Exe Tc               |         |
| TC Count – Rejected TC          |         |
| Last Executed TC - ID           |         |
| Last Executed TC - Type         |         |
| Last Executed TC - SubType      |         |
| Last Executed TC - Time         |         |
| Last Rejected TC - ID           |         |
| Last Rejected TC - Type         |         |
| Last Rejected TC - SubType      |         |
| Last Rejected TC - Time         |         |
| <b>TDS Anomalies statistics</b> |         |
| Anomalies Count - Low           |         |
| Anomalies Count - Medium        |         |
| Anomalies Count - High          |         |
| Last Error - Code               |         |
| Last Error -RID                 |         |
| Last Error - Time               |         |
| <b>THR Status</b>               |         |
| Current Mode                    |         |
| Reset Cause                     |         |
| Watchdog                        | ON, OFF |
| Calibration                     | ON, OFF |
| Sw Version                      |         |
| FPGA Version                    |         |
| <b>THR Anomalies statistics</b> |         |
| Anomalies Count – Low           |         |
| Anomalies Count – Medium        |         |
| Anomalies Count – High          |         |
| Last Error - Code               |         |
| Last Error - RID                |         |
| Last Error - Time               |         |
| <b>THR Temperature</b>          |         |
| PCB                             |         |
| FPGA                            |         |
| ANT1                            |         |



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|                            |         |
|----------------------------|---------|
| ANT2                       |         |
| ANT3                       |         |
| <b>THR TC Statistics</b>   |         |
| TC Count – Update Info     |         |
| TC Count – Update Time     |         |
| TC Count – Exe Tc          |         |
| TC Count – Rejected TC     |         |
| Last Executed TC - ID      |         |
| Last Executed TC - Type    |         |
| Last Executed TC - SubType |         |
| Last Executed TC - Time    |         |
| Last Rejected TC - ID      |         |
| Last Rejected TC - Type    |         |
| Last Rejected TC - SubType |         |
| Last Rejected TC - Time    |         |
| <b>THR SpW Links</b>       |         |
| Enable                     | ON, OFF |
| State                      | ON, OFF |

**Table 1. Instrument status parameters.**

Additionally, it shall be possible to export the instrument status parameters in **TBD** format file.

### 3.3.2.4.5 Display instrument packet statistics

| REQ-ROC-URD-  | Display statistics data | Test              |
|---|-------------------------|-------------------|
| <p>The MUSIC-TV GUI shall allow an user to view the following statistics parameters:</p> <ul style="list-style-type: none"> <li>- TM total count number</li> <li>- TM count number since last counter reset on-board</li> <li>- Received/validated/corrupted/processed TM total count number</li> <li>- Received/validated/corrupted/processed TM count number since last counter reset on-board</li> <li>- TC total count number</li> <li>- TC failed (acceptance)/failed (execution) total count number</li> <li>- These parameters can be viewed over all the TM/TC, but it shall also be possible to see statistics for a given TM/TC or by category (e.g., Low/medium/high event reporting TM).</li> </ul> |                         |                   |
| MUSIC-TV  | <b>Implements:</b>      | REQ-ROC-CIRD-0020 |

It should be possible for a user to display the statistics data in a table or using histograms.

The MUSIC-TV GUI shall allow users to export statistics data in one of the following file formats:

- CSV



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### 3.3.2.4.6 Display RPW DAS events

| REQ-ROC-URD-  | Display RPW DAS event log | Test |
|---|---------------------------|------|
| <p>The MUSIC-TV GUI shall allow an user to view the log of RPW DAS events (CAT = 7, Type = 5) generated on-board since the first in-flight switch-on. The following information shall be provided for each event:</p> <ul style="list-style-type: none"> <li>- PUS date</li> <li>- RPW TM event packet name and SRDB ID</li> <li>- Event code</li> <li>- RPW TM event Packet description</li> </ul> |                           |      |
| MUSIC-TV  | <b>Implements:</b>        |      |
|   |                           |      |

| REQ-ROC-URD-   | Filter RPW DAS event log | Test |
|--|--------------------------|------|
| <p>The MUSIC-TV GUI shall allow an user to filter the log of RPW DAS events by:</p> <ul style="list-style-type: none"> <li>- PUS sub-type (progress / low failure / medium failure / high failure)</li> <li>- Event code</li> <li>- Start/end date</li> <li>- Day, week, month, trimester, semester</li> </ul> |                          |      |
| MUSIC-TV   | <b>Implements:</b>       |      |
|  |                          |      |

| REQ-ROC-URD-  | Export RPW DPU software event log | Test |
|---|-----------------------------------|------|
| <p>The MUSIC-TV GUI shall allow an user to export the RPW DPU software event log as:</p> <ul style="list-style-type: none"> <li>- XML format files</li> </ul> |                                   |      |
| MUSIC-TV  | <b>Implements:</b>                |      |
| <i>The current applied filters shall be applied when exporting the log.</i>   |                                   |      |

The RPW DPU software event log shall also be exportable in a file format compatible with the Microsoft Excel software.

## 3.4 MUSIC-FIGARO GUI user requirements

### 3.4.1 Context

The MUSIC-FIGARO GUI is dedicated to the creation of the RPW TC sequences.

Any TC sequence generated by the ROC team has to be submitted for validation to the MOC. After the validation process, a TC sequence can be inserted into the MOC MIB and used by the ROC team for the RPW instrument flight operations.



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The validation and the insertion into the MIB of a new RPW TC sequence are performed by the MOC team, with the support of the ROC team. Each of these two steps can require several iterations between the teams. In consequence, the full process can take a long time before a new operational MIB, including the new RPW TC sequence, is released by the MOC.

## 3.4.2 Expected functionalities

### 3.4.2.1 General features

A TC sequence in the MUSIC-FIGARO GUI is associated with the following metadata:

- TC sequence name (used as an ID by the GUI). The sequences delivered to the MOC shall be named with the expected convention [RD?].
- Procedure name (used as a sequence “folder” by the GUI). The name of the procedure shall be consistent with the associated TC sequences name [RD?].
- Short description – short description of the sequence
- Author (set automatically to the login name by default)
- Creation local date/time (set automatically by the GUI at the sequence creation)
- Mode at start (can be left blank) – expected RPW software mode(s)/submode(s) at the sequence execution start
- Mode at end (can be left blank) -- expected RPW software mode(s)/submode(s) at the sequence execution end
- Config at start (can be left blank) – expected RPW configuration(s) at the sequence execution start
- Config at end (can be left blank) – expected RPW configuration(s) at the sequence execution end
- Comment (can be left blank) – Any additional comment. Especially, this field can be used by an operator to indicate the delivery status of the sequence (e.g., “tested on GSE”, “sent to MOC, waiting for feedback”, “validated by MOC”, etc.)

| REQ-ROC-URD-   | RPW TC sequence name uniqueness | Test              |
|--|---------------------------------|-------------------|
| A given TC sequence shall be uniquely named in the MUSIC-FIGARO GUI. |                                 |                   |
| MUSIC-FIGARO   | Implements:                     | REQ-ROC-CIRD-0031 |
|  |                                 |                   |

### 3.4.2.2 Handle RPW TC sequences

| REQ-ROC-URD-  | Create RPW TC sequence | Test              |
|---|------------------------|-------------------|
| The MUSIC-FIGARO GUI shall allow an operator to create a new TC sequence. |                        |                   |
| MUSIC-FIGARO  | Implements:            | REQ-ROC-CIRD-0031 |



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|  |                                |             |
|--|--------------------------------|-------------|
| <b>REQ-ROC-URD-</b>  | Select TC sequence IDB version | <b>Test</b> |
| The MUSIC-FIGARO GUI shall allow an operator to select the initial RPW IDB source/version to be applied when the sequence is created or imported for the first time. |                                |             |
| MUSIC-FIGARO   | <b>Implements:</b>             |             |
| <i>In operations, FIGARO should always propose the MIB version working at MOC as the default version.</i>  |                                |             |

|   |                    |             |
|---|--------------------|-------------|
| <b>REQ-ROC-URD-</b>   | Save TC sequence   | <b>Test</b> |
| The MUSIC-FIGARO GUI shall allow an operator to save a TC sequence. |                    |             |
| MUSIC-FIGARO  | <b>Implements:</b> |             |
|   |                    |             |

|  |                          |             |
|--|--------------------------|-------------|
| <b>REQ-ROC-URD-</b>  | View TC sequence content | <b>Test</b> |
| The MUSIC-FIGARO GUI shall allow users to view the content of a TC sequence already saved. |                          |             |
| MUSIC-FIGARO   | <b>Implements:</b>       |             |
|  |                          |             |

|   |                     |             |
|---|---------------------|-------------|
| <b>REQ-ROC-URD-</b>   | Delete TC sequences | <b>Test</b> |
| The MUSIC-FIGARO GUI shall allow an operator to delete TC sequences.                          |                     |             |
| MUSIC-FIGARO  | <b>Implements:</b>  |             |
| <i>MUSIC-FIGARO should ask to the operator to confirm before doing the sequence deletion.</i> |                     |             |

|  |                     |             |
|--|---------------------|-------------|
| <b>REQ-ROC-URD-</b>  | Import TC sequences | <b>Test</b> |
| It shall be possible for an operator to import a TC sequence into the MUSIC-FIGARO GUI using the following formats:<br>- MOIS importer Excel format file [AD6] |                     |             |
| MUSIC-FIGARO   | <b>Implements:</b>  |             |
| <i>As decided with the MOC, the MOIS importer Excel format is now used to deliver sequence files instead of procedures.</i>                                    |                     |             |

|                     |                     |             |
|---------------------|---------------------|-------------|
| <b>REQ-ROC-URD-</b> | Export TC sequences | <b>Test</b> |
|---------------------|---------------------|-------------|



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The MUSIC-FIGARO GUI shall allow a user to export a TC sequence in the following formats:

- MOIS importer Excel format file [AD6]
- CSV format files
- C-SGSE XML script

MUSIC-FIGARO

**Implements:** REQ-ROC-CIRD-0031

**REQ-ROC-URD-**

Duplicate TC sequence

**Test**

The MUSIC-FIGARO GUI shall allow an operator to duplicate of an existing TC sequence. The copy shall be considered as a new TC sequence.

MUSIC-FIGARO

**Implements:**

**REQ-ROC-URD**

Lock/unlock TC sequences

**Test**

The MUSIC-FIGARO GUI shall allow an operator to lock/unlock the sequences she/he has created. When a sequence is locked, other operators shall not be able to modify or delete it. (Nevertheless it shall be still possible to duplicate it, in order to create a new sequence). A ROC administrator can unlock/lock any sequence if required.

MUSIC-FIGARO

**Implements:**

*TC sequences which have been delivered to the MOC shall be systematically locked.*

**REQ-ROC-URD-**

View RPW TC sequences list

**Test**

The MUSIC-FIGARO GUI shall allow users to view the list of RPW TC sequences already saved.

MUSIC-FIGARO

**Implements:** REQ-ROC-CIRD-0031

### 3.4.2.3 Edit RPW TC sequences

**REQ-ROC-URD-**

Edit TC sequence

**Test**

The MUSIC-FIGARO GUI shall allow an operator to edit a TC sequence that is not locked. The edition shall consist of adding/removing/editing TC sequence statements.

MUSIC-FIGARO

**Implements:**



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|  |
|--|
|  |
|--|

| REQ-ROC-URD-  | Edit TC sequence metadata | Test |
|---|---------------------------|------|
| The MUSIC-FIGARO GUI shall allow an operator to edit the metadata of unlocked TC sequences. |                           |      |
| MUSIC-FIGARO  | Implements:               |      |
|   |                           |      |

| REQ-ROC-URD-  | Change TC sequence IDB version | Test |
|---|--------------------------------|------|
| The MUSIC-FIGARO GUI shall allow an operator to change the RPW IDB source/version of a given TC sequence. |                                |      |
| MUSIC-FIGARO  | Implements:                    |      |
|   |                                |      |

A alert message with confirmation should be displayed to alert the user when changing the IDB.

### 3.4.2.4 Check RPW TC sequences

| REQ-ROC-URD-   | Check TC sequences | Test |
|--|--------------------|------|
| The MUSIC-FIGARO GUI shall allow an operator to check if a given TC sequence is compliant with the expected specification. |                    |      |
| The check process shall at least include:  |                    |      |
| - sequence and associated procedure names compliance with the MOC convention [AD?].  |                    |      |
| - sequence TC parameters values consistency w.r.t. to the associated IDB source/version: value range and format            |                    |      |
| MUSIC-FIGARO   | Implements:        |      |
|  |                    |      |

## 3.5 MUSIC-FAUST GUI user requirements

### 3.5.1 Context

The MUSIC-FAUST GUI shall support the ROC operator when creating and submitting the RPW instrument operations requests (IOR) to the SOC during the mission.

A IOR basically consists of a timeline populated with TC sequences. In the FAUST GUI framework, this timeline is labelled as a scenario.

Additionally, the GUI shall also permit to export scenarios as:

- Payload direct operation requests (PDOR) or memory direct operation requests (MDOR) files for special operations with the MOC.



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- RPW TC script files, which can be imported into and run with the MEB GSE C-SGSE tool.

A scenario is associated at least with the following metadata:

- A validity time range
- A scenario ID, unique in the system
- A date of creation
- An author
- A version
- List of TC sequence calls (empty at the sequence creation)
- Scenario status (“created”, “submitted”, “rejected”, “accepted” (TBC), “executed” (TBC)).
- locked/unlocked status
- Associated mission-level planning cycles (MTP/STP)
- Tag (e.g., IOR, MDOR, PDOR, C-SGSE)
- Comment (can be left blank)

## 3.5.2 Expected functionalities

### 3.5.2.1 General features

| REQ-ROC-URD-   | Scenario uniqueness | Test |
|--|---------------------|------|
| A scenario shall be uniquely named in the MUSIC-FAUST GUI. |                     |      |
| MUSIC-FAUST  | Implements:         |      |
|  |                     |      |

### 3.5.2.2 Handle RPW scenarios

In practice the operation request timeline is populated with TC sequence calls. The way the TC sequences are inserted and the operations are requested depends of the mission planning and the related point of contact. In the nominal case, the operation requests are delivered to the SOC as IOR files at the MTP, STP or VSTP cycle planing levels. In case of special operations, operations requests are directly sent to MOC as MDOR or PDOR files. In both cases, building the RPW operations timeline is not straightforward and the MUSIC-FAUST GUI shall let the possibility to define several scenarios of operations planning before delivering a single resulting scenario.

| REQ-ROC-URD-  | Create new scenario | Test |
|---|---------------------|------|
| The MUSIC-FAUST GUI shall allow an operator to create a new scenario. |                     |      |





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|             |  |
|-------------|--|
| MUSIC-FAUST | <b>Implements:</b><br>REQ-ROC-CIRD-0022<br>REQ-ROC-CIRD-0026<br>REQ-ROC-CIRD-0029<br>REQ-ROC-CIRD-0030 |
|             |  |

| REQ-ROC-URD-   | Lock/unlock scenario | Test |
|--|----------------------|------|
| The MUSIC-FAUST GUI shall allow an operator to lock/unlock a scenario she/he has created. (An operator cannot lock/unlock a scenario created by another person.) |                      |      |
| MUSIC-FAUST  | <b>Implements:</b>   |      |
|  |                      |      |

| REQ-ROC-URD-  | Save scenario      | Test |
|---|--------------------|------|
| FAUST shall allow an operator to save a scenario into the MUSIC database. |                    |      |
| MUSIC-FAUST   | <b>Implements:</b> |      |
|   |                    |      |

| REQ-ROC-URD-   | Delete scenario    | Test |
|--|--------------------|------|
| The MUSIC-FAUST GUI shall allow a user to delete an existing scenario, only if it is not locked. |                    |      |
| MUSIC-FAUST  | <b>Implements:</b> |      |
|  |                    |      |

| REQ-ROC-URD-   | Duplicate scenario | Test |
|--|--------------------|------|
| The MUSIC-FAUST GUI shall allow an operator to copy an existing scenario. In this case the duplicated scenario shall be seen as a new one with its own name. |                    |      |
| MUSIC-FAUST  | <b>Implements:</b> |      |
|  |                    |      |

This feature is helpful to generate multiple scenarios for a given planning. But also, if an operator wants to create a new scenario from a scenario already played in a previous planning cycle.

Additionally, the MUSIC-FAUT GUI shall allow an operator to:

- Split a scenario into two scenarios



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- Insert a scenario into another one. The GUI shall stop the insertion and notify the operator if a conflict is found (i.e., incompatible scenarios).
- Merge scenarios. The GUI shall stop the insertion and notify the operator if a conflict is found (i.e., incompatible scenarios).

| REQ-ROC-URD-   | Import scenario    | Test |
|--|--------------------|------|
| <p>It shall be possible for an operator to import the following format files as a new scenario into the MUSIC-FAUST GUI:</p> <ul style="list-style-type: none"> <li>- MTP/STP IOR XML file</li> <li>- MDOR XML file</li> <li>- PDOR XML file</li> <li>- MEB GSE TC script</li> </ul> |                    |      |
| MUSIC-FAUST  | <b>Implements:</b> |      |
|  |                    |      |

| REQ-ROC-URD-  | Export scenario    | Test |
|---|--------------------|------|
| <p>FAUST shall allow an operator to export a saved scenario as:</p> <ul style="list-style-type: none"> <li>- MTP/STP IOR XML file</li> <li>- MDOR XML file</li> <li>- PDOR XML file</li> <li>- MEB GSE TC script</li> </ul> |                    |      |
| MUSIC-FAUST   | <b>Implements:</b> |      |
|   |                    |      |

| REQ-ROC-URD-  | View scenarios     | Test |
|---|--------------------|------|
| <p>The MUSIC-FAUST GUI shall allow users to view the list of saved scenarios.</p> |                    |      |
| MUSIC-FAUST   | <b>Implements:</b> |      |
|   |                    |      |

| REQ-ROC-URD-   | Search scenario | Test |
|--|-----------------|------|
| <p>The MUSIC-FAUST GUI shall allow an user to search saved scenarios by:</p> <ul style="list-style-type: none"> <li>- scenario name</li> <li>- creation date</li> <li>- validity time range (start and/or end time)</li> </ul> |                 |      |



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- mission-level planning cycle number (STP/MTP)
- author
- scenario tag
- scenario status

MUSIC-FAUST

**Implements:**

*Especially, the scenario status and tag search filters should help the user to easily retrieve the list of already submitted scenarios as IOR, PDOR or MDOR to the SOC or MOC.*

| REQ-ROC-URD-   | View scenario content | Test |
|--|-----------------------|------|
| The MUSIC-FAUST GUI shall allow users to view the content of a saved scenario. |                       |      |
| MUSIC-FAUST  | <b>Implements:</b>    |      |
|  |                       |      |

### 3.5.2.3 Edit RPW scenarios

| REQ-ROC-URD-  | Edit scenario timeline               | Test |
|---|--------------------------------------|------|
| The MUSIC-FAUST GUI shall allow an operator to edit a scenario that has not been locked.  |                                      |      |
| The edition of a scenario shall consist of building its timeline with instrument TC sequence calls. The values of the formal parameters shall be set at this stage. |                                      |      |
| A given sequence calls in the timeline shall always be associated to a scenario.  |                                      |      |
| MUSIC-FAUST   | <b>Implements:</b> REQ-ROC-CIRD-0022 |      |
|   |                                      |      |

In the case of PDOR, MDOR and C-SGSE, it shall be also possible to insert TC in the scenario timeline.

| REQ-ROC-URD-  | Edit scenario metadata | Test |
|---|------------------------|------|
| The MUSIC-FAUST GUI shall allow an operator to edit the metadata of an unlocked scenario. |                        |      |
| MUSIC-FAUST   | <b>Implements:</b>     |      |
|   |                        |      |

| REQ-ROC-URD-  | Fill scenario | Test |
|---|---------------|------|
| The MUSIC-FAUST GUI shall allow use all the RPW TC sequences saved in the MUSIC-FIGARO GUI to a fill a scenario timeline, even those that are not already in the working MIB. |               |      |



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|   |                                      |
|---|--------------------------------------|
| MUSIC-FAUST   | <b>Implements:</b> REQ-ROC-CIRD-0032 |
| <i>It should be possible for an operator to select only working MIB TC sequences.</i> |                                      |

| REQ-ROC-URD-  | Filter TC sequences | Test |
|---|---------------------|------|
| <p>The MUSIC-FAUST GUI shall allow an user to filtering TC sequences to insert into a scenario timeline by:</p> <ul style="list-style-type: none"> <li>- Sequence name</li> <li>- Parent procedure name</li> <li>- Sequence category</li> <li>- Sequence tags</li> <li>- Sequence origin (e.g., working MIB)</li> </ul> |                     |      |
| MUSIC-FAUST   | <b>Implements:</b>  |      |
|   |                     |      |

| REQ-ROC-URD-  | Check scenario                       | Test |
|---|--------------------------------------|------|
| <p>The MUSIC-FAUST GUI shall allow an operator to check a scenario against expected specifications related to IOR, MDOR, PDOR or C-SGSE files.</p> <p>It concerns the file structure and content consistency.</p> |                                      |      |
| MUSIC-FAUST   | <b>Implements:</b> REQ-ROC-CIRD-0032 |      |
| <i>It should be an option that can be deactivated by the operator if required.</i>  |                                      |      |

### 3.5.2.4 Submit RPW IOR to SOC

| REQ-ROC-URD-  | Submit RPW IOR to SOC                | Test |
|---|--------------------------------------|------|
| <p>The MUSIC-FAUST GUI shall allow an operator to submit a scenario as IOR to SOC.</p> <p>A scenario submitted to the SOC as IOR shall:</p> <ul style="list-style-type: none"> <li>- Be compliant with the specification defined in [AD?]</li> <li>- Be submitted to SOC using the transfer mechanism defined in [AD?]</li> <li>- Be not delivered twice. If an IOR file is rejected, a new version shall be generated and submitted.</li> <li>- Be completed (i.e., the entire IOR validity range shall be filled with scenarios)</li> <li>- Be automatically locked</li> <li>- Be automatically tagged as "IOR"</li> <li>- Be automatically versioned applying the convention defined in [AD?]</li> <li>- Contain only TC sequences from the working MOC MIB</li> </ul> |                                      |      |
| MUSIC-FAUST   | <b>Implements:</b> REQ-ROC-CIRD-0022 |      |



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|  |                   |
|--|-------------------|
|  | REQ-ROC-CIRD-0024 |
| <p><i>The operator should also ensure that the submitted IOR is consistent with the TM rate constraints (as defined in the TMC).</i></p> |                   |

### 3.5.2.5 Submit RPW MDOR/PDOR files to MOC

| REQ-ROC-URD-  | Submit RPW MDOR to MOC | Test |
|---|------------------------|------|
| <p>The MUSIC-FAUST GUI shall allow an operator to submit a scenario as MDOR to MOC.</p> <p>A scenario submitted to the MOC as MDOR shall:</p> <ul style="list-style-type: none"> <li>- Be compliant with the specification defined in [RD?]</li> <li>- Be submitted to MOC using the transfer mechanism defined in [RD?]</li> <li>- Be not delivered twice. If an MDOR file is rejected, a new version shall be generated and submitted.</li> <li>- Be completed (i.e., the entire MDOR validity range shall be filled with scenarios)</li> <li>- Be automatically locked</li> <li>- Be automatically tagged as “MDOR” or “</li> <li>- Be automatically versioned applying the convention defined in [RD?]</li> <li>- Contain only TC sequences from the working MOC MIB</li> </ul> |                        |      |
| MUSIC-FAUST   | <b>Implements:</b>     |      |
|   |                        |      |

| REQ-ROC-URD-  | Submit RPW PDOR to MOC | Test |
|---|------------------------|------|
| <p>The MUSIC-FAUST GUI shall allow an operator to submit a scenario as PDOR to MOC.</p> <p>A scenario submitted to the MOC as PDOR shall:</p> <ul style="list-style-type: none"> <li>- Be compliant with the specification defined in [RD?]</li> <li>- Be submitted to MOC using the transfer mechanism defined in [RD?]</li> <li>- Be not delivered twice. If an PDOR file is rejected, a new version shall be generated and submitted.</li> <li>- Be completed (i.e., the entire PDOR validity range shall be filled with scenarios)</li> <li>- Be automatically locked</li> <li>- Be automatically tagged as “PDOR” or “</li> <li>- Be automatically versioned applying the convention defined in [RD?]</li> <li>- Contain only TC sequences from the working MOC MIB</li> </ul> |                        |      |
| MUSIC-FAUST   | <b>Implements:</b>     |      |
|   |                        |      |



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### 3.6 MUSIC-OPERA GUI user requirements

#### 3.6.1 Context

The MUSIC-OPERA GUI shall allow the ROC to view all the necessary data to establish the instrument operation planning.

The operation planning data gather:

- Enhanced Flight Event Communication Skeleton (E-FECS) [RD?] -- the E-FECS files contain the mission planning cycles as well as events that impact the payload operations.
- Observation timeline at both RPW and payload levels, as provided by SOC via the SOOPKitchen tool export data [RD?].

Additionally, the GUI shall support the visualization of the following resource allocation data:

- Telemetry corridor (TMC) [RD?] -- The telemetry corridor is a maximum and minimum curve of allocated cumulative telemetry downlink through the ~six month planning period. Providing an instrument team maintains their data-production between the maximum and the minimum curves then their data-return can be considered guaranteed.

#### 3.6.2 Expected functionalities

The SOOPKitchen tool [RD?] implemented by the SOC can potentially cover a part of the expected functionalities related to the RPW operation planning visualization. Especially, this tool tends to become the main interface to discuss about the operations at mission-level during the SOWG. The SOOPKitchen export data specification is not yet published by SOC.

##### 3.6.2.1 Operations input data visualization

###### 3.6.2.1.1 Display operations planning data

The MUSIC-OPERA GUI shall allow users to display the operation planning data as a timeline. An option to view the planning as a calendar could be helpful too.

###### 3.6.2.1.2 Display resource allocation data

The MUSIC-OPERA GUI shall allow users to display a chart for the RPW TMC data. The chart shall plot 3 curves: “allowed minimum”, “allowed maximum” and “RPW data production” cumulative TM rates, when the “RPW data production” rate can be the expected or the real values.

### 3.7 MUSIC-SISSI GUI user requirements

#### 3.7.1 Context

The MUSIC-SISSI GUI is dedicated to the visualization and the selection of the SBM1/SBM2 event data to downlink.



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## 3.7.2 Expected functionalities

### 3.7.2.1 Display SBM1/SBM2 event detected on-board

| REQ-ROC-SSS-0107  | Display SBM events list | Test |
|---|-------------------------|------|
| <p>The MUSIC-SISSI GUI shall allow a user to view the list of detected SBM events in a table with at least the following columns:</p> <ul style="list-style-type: none"> <li>- Sequence counter of the SBM event (shall be two different counters for SBM1 and SBM2 events)</li> <li>- Type of event (SBM1 or SBM2)</li> <li>- Date/time of detection on-board (in UTC by default, but switching to on-board time should be possible)</li> <li>- Quality factor value</li> <li>- Approximate duration before deletion (computed from the rank of the event in the SSMM buffer and the size of the buffer) (TBC)</li> <li>- Status ("available", "downlinked", "selected", "deleted", "partially downlinked", "lost") (TBC)</li> </ul> |                         |      |
| MUSIC-SISSI   | <b>Implements:</b>      |      |

| REQ-ROC-SSS-0107   | Display SBM1/SBM2 event summary information | Test |
|--|---|------|
| <p>The MUSIC-SISSI GUI shall allow a user to view following information for a given SBM event detected on-board:</p> <ul style="list-style-type: none"> <li>- Information displayed in the SBM events list</li> <li>- SBM event-related source_data parameters from the corresponding TM_DPU_EVENT_PR_DPU_SBM1 {YIW00304} packet for a SBM1 event and from TM_DPU_EVENT_PR_DPU_SBM2 {YIW00305} packet for a SBM2 event.</li> </ul> |   |      |
| MUSIC-SISSI  | <b>Implements:</b>                          |      |

### 3.7.2.2 Select SBM1/SBM2 event data to downlink

| REQ-ROC-SSS-0108  | Selecting SBM events                 | Test |
|---|--------------------------------------|------|
| <p>The MUSIC-SISSI GUI shall allow an operator to select the SBM event(s) to be downlinked.</p> |                                      |      |
| MUSIC-SISSI   | <b>Implements:</b> REQ-ROC-CIRD-0028 |      |

The SBM event selection process shall be only possible for a very restricted number of well identified people, such as the ROC project manager, RPW PI or the RPW Operations Board (ROB) leader.



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## 4 RPW OPERATIONS AND DATA PIPELINE (RODP) USER REQUIREMENTS

### 4.1 Context

The RODP is the main data processing pipeline run by the ROC in order to produce RPW science/HK data files.

In principle, the RODP is designed to work in an autonomous way, without human intervention, except for maintenance.

Nevertheless, functionalities can be implemented in support to the ROC activities.

### 4.2 Expected functionalities

#### 4.2.1 Monitor RPW

##### 4.2.1.1 Report RPW commands status

| REQ-ROC-URD-  | Produce RPW commands status report files | TBD |
|---|--|-----|
| The RODP shall produce every day a human-readable file reporting the status of RPW commands uplinked on-board. The file shall contain the following parameters: <ul style="list-style-type: none"><li>- The TC name (SRDB_ID) and description</li><li>- The UTC date/time of execution</li><li>- The Service 1 status (accepted/rejected/executed/failed)</li></ul> |  |     |
| RODP  | Implements:                              |     |

The RPW commands status report file format is described in [RD?].

N.B. The RPW commands status will be also available from the MUSIC-TV GUI.

| REQ-ROC-URD-   | Distribute RPW commands status report files | TBD |
|--|---|-----|
| The RPW commands status report files shall be available through the restricted area of the ROC Web site, as soon as they have been produced by the RODP. |   |     |
| RODP   | Implements:                                 |     |

##### 4.2.1.2 Report RPW equipment status

| REQ-ROC-URD-   | Produce RPW equipment status report files | TBD |
|--|---|-----|
| The RODP shall produce every day a human-readable file reporting the status of the RPW equipment. The file shall contain the parameters listed in the Table 1. |   |     |
| RODP   | Implements:                               |     |





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The RPW equipment status report file format is described in [RD?].

N.B. The RPW equipment status parameters will be also available from the MUSIC-TV GUI.

|   |  |            |
|---|--|------------|
| <b>REQ-ROC-URD-</b>   | Distribute RPW equipment status report files | <b>TBD</b> |
| The RPW equipment status report files shall be available through the restricted area of the ROC Web site, as soon as they have been produced by the RODP. |  |            |
| RODP  | <b>Implements:</b>                           |            |

## 4.2.2 Report RPW DAS events

|   |                                 |             |
|---|---------------------------------|-------------|
| <b>REQ-ROC-URD-</b>   | Produce RPW DAS events log file | <b>Test</b> |
| The RODP shall produce a human-readable log file providing the list of RPW DAS events (CAT = 7, Type = 5) generated on-board since the first in-flight switch-on. The following information shall be provided for each event: |                                 |             |
| <ul style="list-style-type: none"> <li>- PUS date</li> <li>- RPW TM event packet name and SRDB ID</li> <li>- Event code</li> <li>- RPW TM event Packet description</li> </ul>   |                                 |             |
| There shall be a single file for the whole mission. The file shall be updated at least every day.   |                                 |             |
| RODP  | <b>Implements:</b>              |             |

The RPW DAS events log file format is described in [RD?].

|   |                                     |            |
|---|-------------------------------------|------------|
| <b>REQ-ROC-URD-</b>   | Distribute RPW DAS events log files | <b>TBD</b> |
| The RPW DAS events log file shall be visible through the restricted area of the ROC Web site. |                                     |            |
| RODP  | <b>Implements:</b>                  |            |

## 4.2.3 Monitor RODP

### 4.2.3.1 Report RODP status

|   |                        |             |
|---|------------------------|-------------|
| <b>REQ-ROC-URD-</b>   | Produce RODP log files | <b>Test</b> |
| The RODP shall produce log files in a human-readable format reporting in near real-time its activity. |                        |             |
| RODP  | <b>Implements:</b>     |             |



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*The information provided in the RODP log files will have to be flagged by severity (debug, info, warning, error) and time-stamped (local date and time).*

|  |                           |            |
|--|---------------------------|------------|
| <b>REQ-ROC-URD-</b>  | Distribute RODP log files | <b>TBD</b> |
| The RODP log files shall be visible through the restricted area of the ROC Web site. |                           |            |
| Req. target  | <b>Implements:</b>        |            |
|  |                           |            |

## 4.3 RODP interface user requirements

### 4.3.1 External interfaces

#### 4.3.1.1 Export RPW MEB GSE « test log » XML files

Additionally to the RPW science data products, the ROC shall make available the RPW TM/TC packet data retrieved and processed at LESIA, in a format and through an interface that are compatible with the MEB GSE tools. These tools are more particularly used by the RPW instrument teams, i.e., DPU flight software, MEB, for testing and anomaly investigations activities on-ground.

|   |                               |            |
|---|-------------------------------|------------|
| <b>REQ-ROC-URD-</b>   | Produce MEB GSE test log file | <b>TBD</b> |
| The RODP shall be able of producing RPW TM/TC data for a given time range as MEB GSE “test log” files.    |                               |            |
| RODP  | <b>Implements:</b>            |            |
| <i>When building the MEB GSE “test log” file, the RODP shall convert the CCSDS time into “SGSE” time.</i> |                               |            |

One MEB GSE “test log” file shall be automatically generated by the RODP every day.

|  |                                  |            |
|--|----------------------------------|------------|
| <b>REQ-ROC-URD-</b>  | Distribute MEB GSE test log file | <b>TBD</b> |
| The MEB GSE “test log” files shall be available through the restricted area of the ROC Web site, as soon as they have been produced by the RODP. |                                  |            |
| RODP   | <b>Implements:</b>               |            |
|  |                                  |            |

N.B. It should be possible to import directly the RPW TM/TC packet data into a well identified MEB GSE database (**TBC**).

### 4.3.1 Internal interfaces

#### 4.3.1.1 Human-machine interfaces (HMI) user requirements



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|  |                             |            |
|--|-----------------------------|------------|
| <b>REQ-ROC-URD-</b>  | RODP command line interface | <b>TBD</b> |
| The RODP shall be executable using a command line interface (CLI). |                             |            |
| RODP   | <b>Implements:</b>          |            |
|  |                             |            |

|   |                          |            |
|---|--------------------------|------------|
| <b>REQ-ROC-URD-</b>   | RODP execution mechanism | <b>TBD</b> |
| The RODP shall be executable as batch jobs.                               |                          |            |
| RODP  | <b>Implements:</b>       |            |
| <i>It allows automated executions using dedicated tools (e.g., cron).</i> |                          |            |

|  |                        |            |
|--|------------------------|------------|
| <b>REQ-ROC-URD-</b>                                      | RODP access permission | <b>TBD</b> |
| The RODP shall be accessible to ROC administrators only. |                        |            |
| RODP   | <b>Implements:</b>     |            |
|  |                        |            |

Especially, the production instance of the RODP shall be hosted on a dedicated server with a very restricted access.

The list of people authorized to connect this server shall be approved by the RPW Ground Segment Project Manager.

## 5 LIST OF TBC/TBD/TBWs

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



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## 6 DISTRIBUTION LIST

|   |              |
|---|--------------|
| <p style="text-align: center;"><b>LISTS</b></p> <p>See Contents lists in “Baghera Web”:<br/>Project’s informations / Project’s actors / RPW_actors.xls<br/>and tab with the name of the list<br/>or NAMES below</p> | Tech_LESIA   |
|   | Tech_MEB     |
|   | Tech_RPW     |
|   | [Lead-]Cols  |
|   | Science-Cols |

### INTERNAL

|               |  |  |
|---------------|--|--|
| LESIA<br>CNRS |  |  |
|               |  |  |
|               |  |  |
|               |  |  |
|               |  |  |
|               |  |  |
|               |  |  |
|               |  |  |

|               |  |  |
|---------------|--|--|
| LESIA<br>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. KRASNOSELSKIKH |
| SSL   | S.BALE            |

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