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| | X | |

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YODA Platform Functional Specification

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DIFFUSION

| Organization | Recipient | A/I | Qty | Organization | Recipient | A/I | Qty |
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| YODA | YODA Satellite team | I | | | | | |
| HEMERIA | Nanosat team | A | | | | | |
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| | | | | | | | |

A: for acceptance / I for information

Recipients - for acceptance - have a period of 10 calendar days from the receipt of this document to their comments, remarks and reserves. Beyond this period, it is considered formally accepted without any restriction.

TABLE OF REVISIONS

| Issue | Date | Author | Description |
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| Preliminary Version | 2022/11/03 | Y.BAOUANE | Creation |
| A1 | 2023/01/03 | Y.BAOUANE | Update equipments requirements |
| A | 2023/02/08 | Y.BAOUANE | Update OBT, and Thermal management Take into account Peer Review remarks |
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| B2 | 2023/08/03 | Y.BAOUANE | - delete requirement dealing with TC_TTC_SET_GROUND_STATION_AVAILABLE (E_YODA_SYS-1426, 1427, 1500, 1501) - add activation / deactivation procedure for flight Unit - initiate FDIR -Delete TC (131,111) TC_DHS_HIGH_REBOOT_SC (Reboot spacecraft) from req E_YODA_SYS-2056 and 1369 -Delete E_YODA_SYS-1493 for TC_DHS_SET_BAT_PARAM - update due to ICD AOCS, NAV, Propulsion |

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1 Introduction

1.1 Scope

This document contains the functional specification requirements of the YODA Platform, describing the functionalities and services necessary to support intended missions of YODA project.

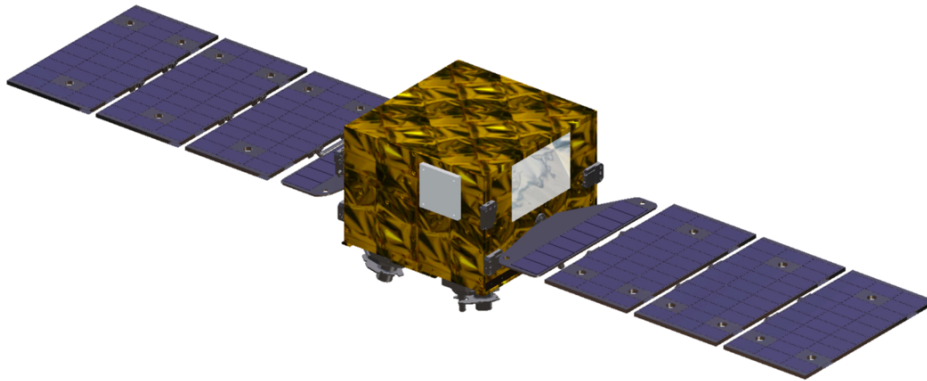


Figure 1 YODA Satellite

The scope of this specification is limited to System functional platform behavior. Payload features are not explicated in this document as developed in standalone and integrated to platform

The System specified herein encompasses the following components:

- The platform itself providing the services to the Payload in order for it to fulfil the mission
- The Database that configures the Satellite according to the mission and the deployment environment. The Database is also an asset to the Operational Data
- The Operational Data that encompass the necessary platform artefacts to support the operation.

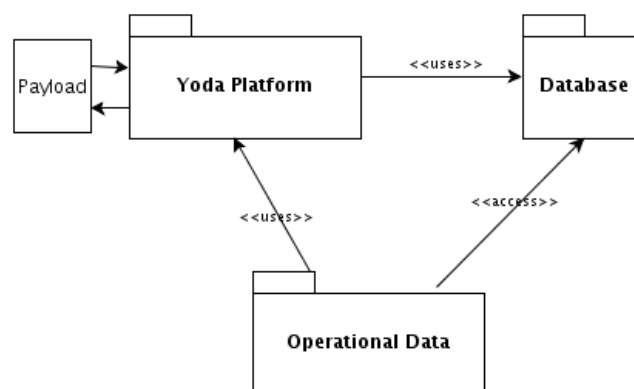


Figure 1-2 Platform System Components

1.2 Requirement convention

1.2.1 Requirement Syntax

For traceability purpose, each requirement is described as follows:

| E_<Project>_<Module>_<Subject>-<Index> |
|--|
| <p>Title</p> <p>SubSystem Allocation: BDS, FSW</p> <p>ValidationMethod: T</p> <p>ValidationLevel: SYSTEM</p> <p>LinkedUpReq: Requirement 1</p> <p>Requirement 2</p> <p>?</p> <p>Requirement</p> <p>ImplementationVersion: VAIT</p> <p>Note</p> |

Where:

- **<Project / Module>_<Document>_<Subject>_<Index>** : is an absolute requirement identifier defined as following :

E_ : Exigence

<Project> : Project Name [YODA] or [GEN]

<Module> : Module Level (System, SW, Validation...)=> [SYS]

<Subject> : Short description describing category of subject=> Not Used

<Index> : Increment on 4 digits (0000-9999)=> unique ID directly set by Polarion

=> **E_YODA_SYS-xxxx** for this project

Note that some requirements are tagged **E_GEN_<EQPT_name>_SYS-XXXX** (for PCPU , SADM) because equipment needs are provided by GENeric requirements (multiproject scope) on HEMERIA Side and are used as is, in YODA project as follow:

- E_GEN_PCDU_EREMS_SYS-XXX for PCPU req from GENERIC PCPU equipment platform
- E_GEN_SADM200_SYS-XXX for PCPU req from GENERIC SADM equipment platform

When GENeric requirement of used equipment shall become specific for YODA, due to minor/major modification, requirement name shall become E_YODA_SYS-XXXX

Each requirement is composed as follow:

- **Title** is an inscription of the text, which indicates its content.
- **Description** is the text dealing with the required functionality to implement and to test
- **subSystemAllocation** is the allocation field to state the requirement, it can be

HW : Hardware (allocation to all HW device except FPGA)

FPGA : FPGA

PCDU : deals with all electric power system (batterie, solar array, power distrubution)

OPS : Operation

FSW : Fligth Software (ou LV Logiciel de Vol)

SDB: Satellite Data Base ou BDS Base de données satellite (database for TM/TC)

- **ValidationMethod** is the means used to be compliant to the linked requirement, it can have the following values :

I (Inspection) : Compliance with requirements is determined by formal examination (ex: visual inspection)

A (Analysis): Compliance with requirements is determined by computation, modeling/simulation or by comparison to historical or experimental data.

D (Demonstration) : Compliance with requirements is validated by observing the item in operation

T (Test): Compliance with requirements is validated by evaluating or executing an item under controlled conditions, configurations, and inputs in order to observe the response. Results are quantified and analyzed.

- **ValidationLevel** is test means used to perform test [T (Test)] compliance with requirement. It shall be at SW Level or Sytem Level:

SOFTWARE : Requirement tested at SW Level. Not needed to be tested at SYS Level even if the req is provided by FuncSpecification document

SYSTEM : Requirement tested at SYSTEM Level. Not needed to run a test at SOFTWARE Level to validate the requirement

Note : As some kind of tests are run twice on previous project (at SW and SYS level), by this tag, on YODA, these tests are only ran once but shall get double tracability (to SRS req and to SysFuncSpec Req).

- **LinkedUpReq** is the **traceability** link to the other requirements, either management requirement or upward requirement. The tag shall be the identifier of the upward requirement.
When "-p" is followed in LinkedUpReq (for example YODA-IRD-PFPL-REQ-2040-p"), that mean only a part of the upward requirement is taken into account in the fonctionnal requirement specification.
The other part shall be specified in an other fonctionnal requirement to get the fully traceabiity of the upward requirement.
- **ImplementationVersion** is the first Software version where the req is implemented. If many version are tagged in this fields, that means the req was modified for each displayed version
Ex : ImplementationVersion: VAIT, V1 => that means requirement was created for VAIT perimeter and modified for V1
ImplementationVersion: V0, V2 => that means requirement was created for V0 perimeter and modified for V2

For generic equipement used in YODA projetc, as for each project, this implementation version field should be different because implementation field is specific on project, an implementationVersion table is used and modified by the project where the Generic equipment is instanced.
In this table , ImplementationVersion column will be updated in accordance with the version where the requirement will be implemented for YODA
- **Note** is a text field allowing to add explanations or assumptions taken related to the requirements

1.2.2 Definition of terms

- **SHALL**: The word **SHALL** in the text expresses a mandatory requirement which has to be followed without exception.
- **SHOULD**: The word **SHOULD** in the text expresses a strongly recommended practice. A justification is expected if they are not followed.
- **MUST**: The word **MUST** in the text is used for legislative or regulatory requirements and shall be complied with.
- **WILL**: The word **WILL** in the text denotes a provision, service or intention in connection with a requirement.
- **MAY**: The word **MAY** in the text expresses a guideline. No justification is required if they are not followed.

2 Documentation

2.1 Applicable documents

This refers to all documents contractually applicable to the product development.

| N° | Title | Ref | Issue | Date (YY-MM-DD) |
|--------|--|---|----------|--------------------|
| [AD01] | ISIS SATELLITE DATA INTERFACE SPECIFICATION: ON-BOARD SOFTWARE | DA14 ISIS-SY-IF-346-CNES | Issue 7 | 2021-02-01 |
| [AD02] | CCSDS Time code formats | CCSDS 301.0-B-4 | | |
| [AD03] | CNES YODA ? SPECIFICATIONS SATELLITE | DA01 - YODA_Specifications_Satellite | Ed1_Rev1 | 2022-03-29 |
| [AD04] | CNES AVIONIC / ELECTRIC / SOFTWARE / COMMANDCONTROL PLATFORM / PAYLOAD INTERFACE REQUIREMENTS DOCUMENT (IRD) | DA08- YODA-SP-0-0070-CNES | Ed1_Rev1 | 2022-03-29 |
| [AD05] | SATELLITE TO GROUND S-BAND INTERFACE SPECIFICATION | DA26 - YODA-IF-11-0043-CNES_0100 | Ed: 1.0 | 2021-06-15 |
| [AD06] | YODA monitoring and control specification | YODA-SP-11-0128-CNES | 2.0 | 2023-02-03 |
| [AD07] | AOCS PARTITION - INTERFACE CONTROL DOCUMENT | YODA-IF-23-0068-CNES | V2.0 | 2023-06-16 |
| [AD08] | NAVIGATION PARTITION - INTERFACE CONTROL DOCUMENT | YODA-IF-23-0069-CNES | V1.4 | 2023-02-08 |
| [AD09] | S Band Ground-to-Board Interface Security Specification for YODA Mission | YODA-IF-11-0125-CNES | V1.0 | 2022-05-18 |

Table 2-1 : Applicable documents

2.2 Standards et regulation documents

| | Référence | Titre |
|------|-----------------------------|--|
| ST1 | Arrêté du 31 mars 2011 | Arrêté du 31 mars 2011 relatif à la Réglementation Technique (RT) en application du décret n° 2009-643 du 9 juin 2009 relatif aux autorisations délivrées en application de la loi n° 2008-518 du 3 juin 2008 relative aux opérations spatiales pour ce qui concerne la maîtrise en orbite et retour sur terre d'un objet spatial (Article 28 à 53). |
| ST2 | LOS-GR-CNF-8-CNES | LOS - Système orbitaux Guide des bonnes pratiques Maîtrise d'un objet spatial |
| ST3 | ITU/RR:2004 | ITU Radio Regulations |
| ST4 | Règlement (CE) n° 1907/2006 | REACH regulation |
| ST5 | ECSS-E-ST-50-12C | SpaceWire – Links, nodes, routers and networks |
| ST6 | ECSS-E-ST-50-01 | Space data links- Telemetry synchronization and channel coding |
| ST7 | ECSS-E-ST-50-03 | Space data links- Telemetry transfer frame protocol |
| ST8 | ECSS-E-ST-50-04C | Space data links- Telecommand protocols synchronization and channel coding |
| ST9 | CCSDS 232.1 B 2 | Communications operation procedure 1 (COP-1) |
| ST10 | CCSDS 232.0-B-3 | TC Space Data Link Protocol |

2.3 Reference documents

These constitute the bibliography that is necessary for a good context understanding.

| N° | Title | Ref | Issue. | Date (YY-MM-DD) |
|--------|--|---|---------------|--------------------|
| [RD01] | ISIS-SY-IF-123-CNES_09- PUS Tailored PUS for ISIS mission | ISIS-SY-IF-123-CNES_09- PUS | Ed.9 Rev.0 | |
| [RD02] | ISIS SATELLITE DATA INTERFACE SPECIFICATION: ON-BOARD SOFTWARE | DA14 ISIS-SY-IF-346-CNES | Issue 7 | 2021/02/01 |
| [RD03] | YODA TM/TC ICD | H21900D000026 | A | 2023-02-08 |
| [RD04] | Gyro IxBlue ASTRIX NS TM/TC Interface Control Document | ASTRIX NS TM_TC Interface Control Document | 00019926 F | 2023-05-02 |
| [RD05] | | Deleted | | |
| [RD06] | Astrix NS User Guide Gyro | 00021614-D AstrixNS_User Guide | D | 2023-05 |
| [RD07] | VECTRONIX Reaction Wheel VRW- B-02 CNES | TD-VAS-VRWB02-CNES- ICD11 | 11 | 2021-06-14 |
| [RD08] | STRINT STR Functional Specification | H20771D000002 | A | 2022-10-19 |

| | | | | |
|--------|--|--------------------------------------|---------|------------|
| [RD09] | BiSon64-ET-B Sun Sensor Interface Control Document | 20-LRD-ICD-0002 | issue 1 | 2020-08-14 |
| [RD10] | BiSon64-ET-B SUN SENSOR PRODUCT SPECIFICATION DOCUMENT | 17-LRD-SP-0006 | V6 | 2021-06-30 |
| [RD11] | GNSS N-SPHERE - Interface Control Document | 900797-040-303 ICD UART OBC N-SPHERE | Ed1.2 | 2021-11-22 |
| [RD12] | GNSS Receiver Interface Control Definition - TMTC | 900751-210-006 | 1.9 | 2021-11-30 |
| [RD13] | GNSS Orbital NAVigator Interface Control Definition | 900800-210-002 | Ed1.5 | 2021-02-02 |
| [RD14] | Propulsion - Exotrail - CAN Software Interface | EXO-DTE_USM_221007_1PPO | V3 | 2023-07-04 |
| [RD15] | Interface Control Document S-band TT&C Transceiver EWC31 | IRD YODA EWC 31 NG | 0.9 | 2023-03-29 |
| [RD16] | S-BAND EICD Electrical Interface Control Document EWC31-NG | 900886-040-300 | V1.3 | 2023/03/21 |

Table 2-2 : Reference documents

Generic Equipement Reference :

| N° | Title | Ref | Issue. | Date |
|---------------------|----------------------------|----------------------|--------|------------|
| RD_GENPF_PCDU_01 | PCDU YODA SOFTWARE ICD | PDY-01100-ICD-02-ERM | 1/A | 16/08/2022 |
| RD_GENPF_SADM200_01 | COMAT SADM 200 User manual | 21106-UM-0052 | RevC | 2023-03-13 |
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Table 3 Generic Equipement Reference

2.4 Glossary

This defines the terminology and acronyms used in the document.

| Acronym | Description |
|---------------|---|
| ACS | Attitude Control Sub-system |
| AIT | Assembly, Integration, Test |
| AOCS | Attitude and Orbit Control Sub-system |
| APID | Application Process Identifier |
| CCSDS | Consultative Committee for Space Data Systems |
| CDHS | Command and Data Handling System |
| CLCW | Command Link Control Word |
| COMSEC | Communication Security |
| | |

| | |
|---------------|--|
| COP-1 | Command Operation Procedure-1 |
| CU | Charge Utile (= PAYLOAD) |
| CUC | CCSDS Unsegmented Code |
| DET | Direct Energy Transfer |
| DHS | Data Handling Sub-system |
| EEP | Error End of Packet (for SpaceWire Transmission) |
| EOP | Nominal End of Packet (for SpaceWire Transmission) |
| EPS | Electrical Power Sub-system |
| FDIR | Failure Detection, Isolation, and Recovery |
| FO | Fail Operational |
| FS | Fail Safe |
| FSOA | French Space Operation Act |
| FSW | Flight Software |
| GCS | Ground Control Segment |
| GNSS | Global navigation satellite system |
| HK | Housekeeping |
| LEOP | Launch & Early Operations Phase |
| MOC | Mission Operations Center |
| MPPT | Maximum Power Point Tracking |
| OBC | On-Board Computer |
| OBCP | On-Board Control Procedure |
| OBT | On-Board Time |
| OCM | Orbit Correction Maneuvers |
| OOL | Out-Of-Limit |
| OPS | Orbit Position Schedule |
| PCDU | Power Conditioning and Distribution Unit |
| PPS | Pulse Per Second |
| PPU | Propulsion Power Processing Unit |
| PUS | Packet Utilization Service |
| PVT | Position, Velocity, Time |
| RW | Reaction Wheel |
| SAP | Solar Array Panel |
| SimOps | Operational Simulator |
| SN | Stations Network |
| SOC | Satellite Operations Center |
| SSO | Sun Synchronous Orbit |
| STR | Star Tracker |
| TBC | To Be Confirmed |
| TBD | To Be Determined |
| TBR | To Be Revised |
| TBW | To Be Written |
| TC | Telecommand |
| TCU | Thruster Controller Unit |

| | |
|------------|---------------------------------|
| TM | Telemetry |
| TSP | Time and Space Partitioning |
| TTC | Telemetry, Tracking and Command |

Table 2-4 : Acronyms

| Terminology | Definition |
|-------------|---|
| Platform | Satellite infrastructure customized (via e.g. instantiation and/or configuration) for YODA satellite mission. |
| | |
| | |
| | |

Table 2-5 : Terminology

3 System Overview

3.1 Platform Overview

Figure 2 below provides the breakdown of the functions further specified herein.

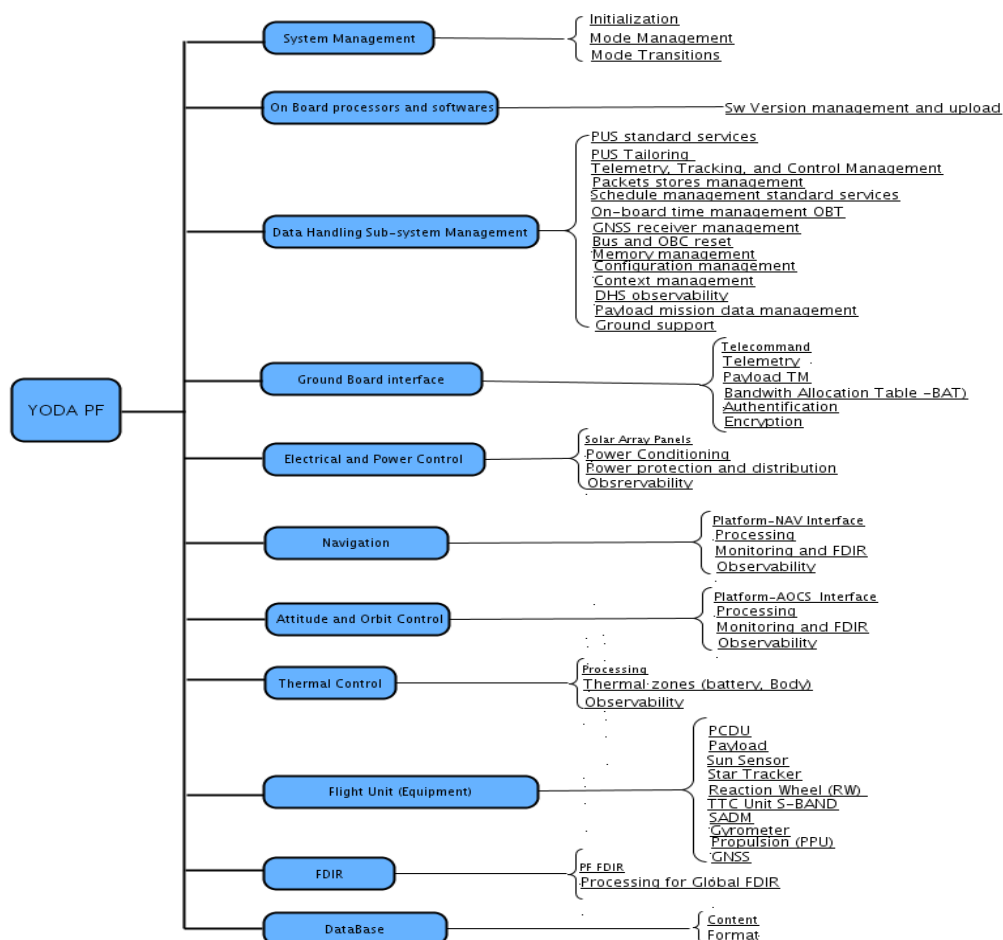


Figure 3 Platform Functional Breakdown

To illustrates the breakdown of the logical components implementing the functions of the Platform, the details is given in the "Component Logical Breakdown" Figure.

For the sake of completeness, Payload is also illustrated as part of the complete satellite.

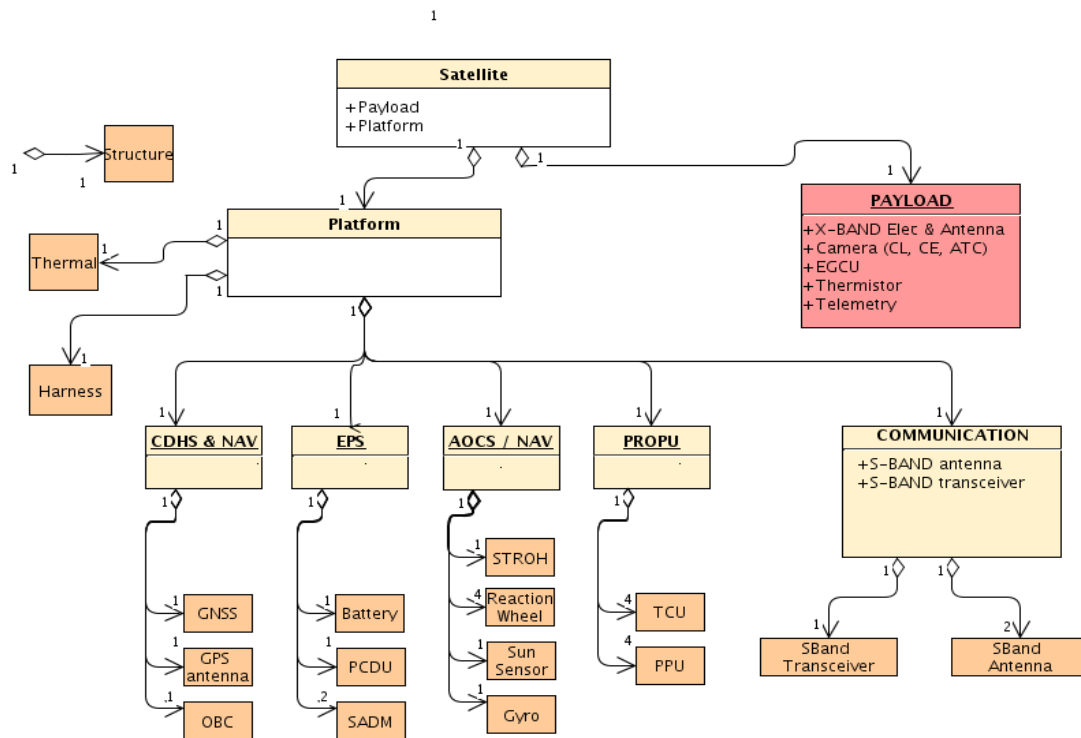


Figure 4 Component Logical Breakdown

The architecture of the Platform with its interface to the Payload and other equipments, are given in the following figure

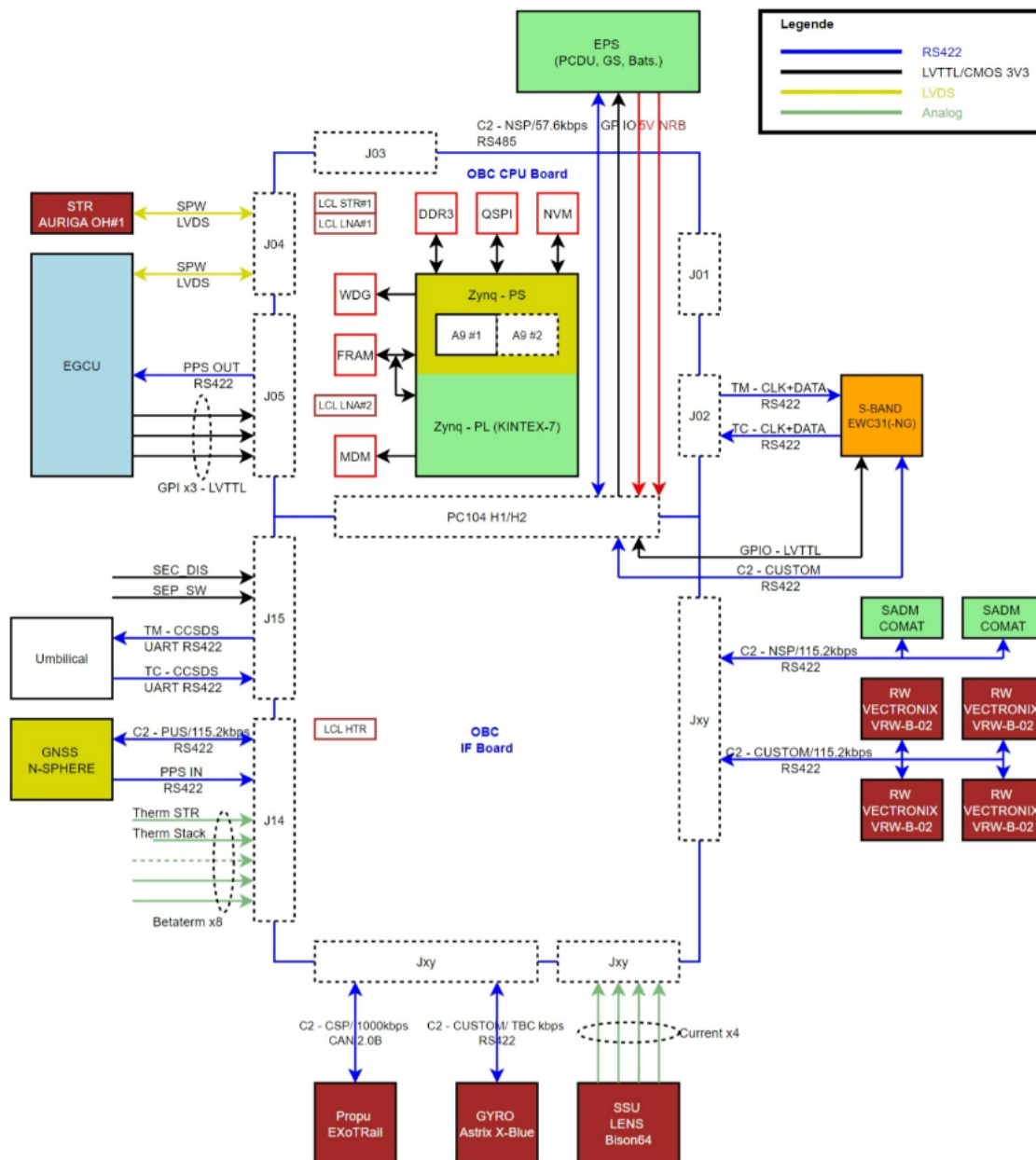


Figure 5 YODA System Architecture

3.2 Database Overview

The HP-EOS Bus system features a database that collects all the engineering data used to identify commands required to operate the Bus and its units and all information items (parameters) relevant to each Bus's function/unit downloaded in telemetry packets. Moreover, the database includes operational information necessary for a safe and correct use of on-board HW and SW systems (e.g. thresholds, verification checks, etc.).

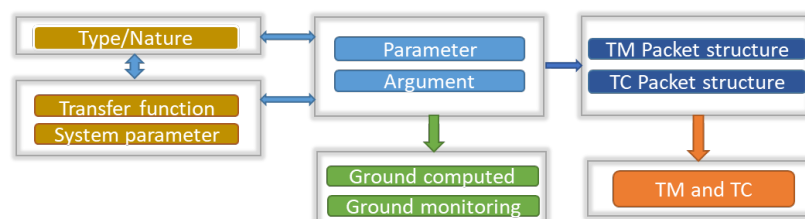


Figure 4-6 Database Content

It consists of several objects, each containing a portion of the data. The objects are interrelated in that one object can refer to items further described in other objects. The database structure is influenced not only by the characteristics of the controlled domain (i.e. the spacecraft), but also by the design features of the control system itself. Therefore the HP-EOS Bus database follows a standardized information model to support the exchange of data across the different actors.

The main actors are represented in the figure below:

- DB manager will be in charge of the production, consistency and check of the database.
- Subsystem expert will fill part(s) of the database, such as TM parameters that he/she wants to be reported in HK TM.
- FSW team can fill the database with elements needed for configure the FSW. FSW team will use database in internal format to configure the FSW.
- AIT/VCF expert and Customer will be the main users of the output database.
- The simulation bay is used for testing and checking first step of database configuration

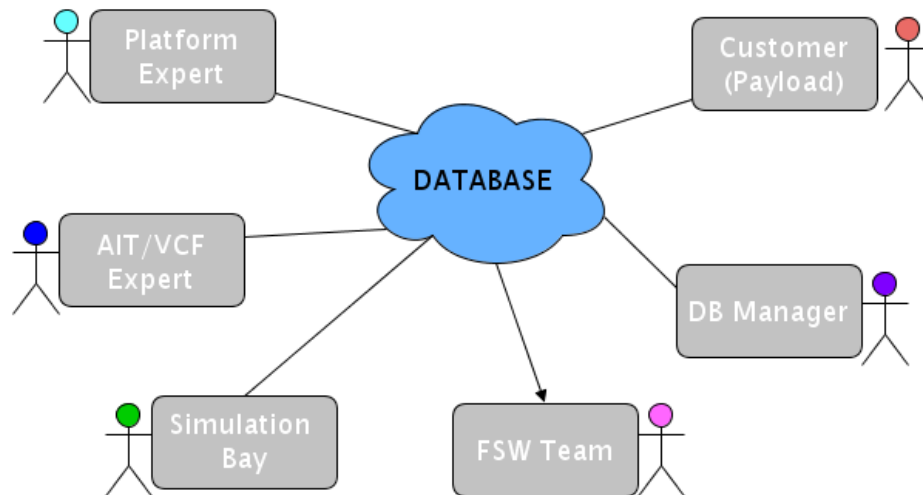


Figure 4-7 Database Environment

3.3 Operational Data Overview

TBWritten


4 Functional and Performance Requirements

4.1 System Management

E_YODA_SYS-772 - Satellite functions

The platform shall provide the following functions

- Time Management to provide to all needed equipment
- processing and transmission of data (TC reception, TM emission, TM storage)
- command and control for the platform and flight units (ensured by an OBC and main on-board software)
- transmission of data to/from the payload and monitoring of the payload
- attitude and orbit control,
- mission execution (payload),
- power management
- thermal control,


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA_SAT_REQ_0020 |
| KineisLink | E_KINEIS_SYS-422 |
| subSystemAllocation | FSW, BDS, HW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-02-27 15:38 |

E_YODA_SYS-842 - Platform Reliability (Deleted)

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | redundant with STB_Satellite requirement YODA_TRD_SAT_2840 |
| Updated | 2023-02-27 15:29 |

E_YODA_SYS-843 - unavailability cumulative duration

Cumulated time of unavailability (inc. degradation of pointing performances or temporary payload switch off) of the mission due to temporary event or on board FDIR actions shall not be more than 15 days per year.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_2670 |
| KineisLink | N/A |
| subSystemAllocation | OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | Done by Availability Analysis. |
| Updated | 2023-03-22 15:55 |

4.1.1 Mode management

The satellite modes and their transitions are represented on the diagram below.

The conditions which do not lead to satellite mode transitions are not represented.

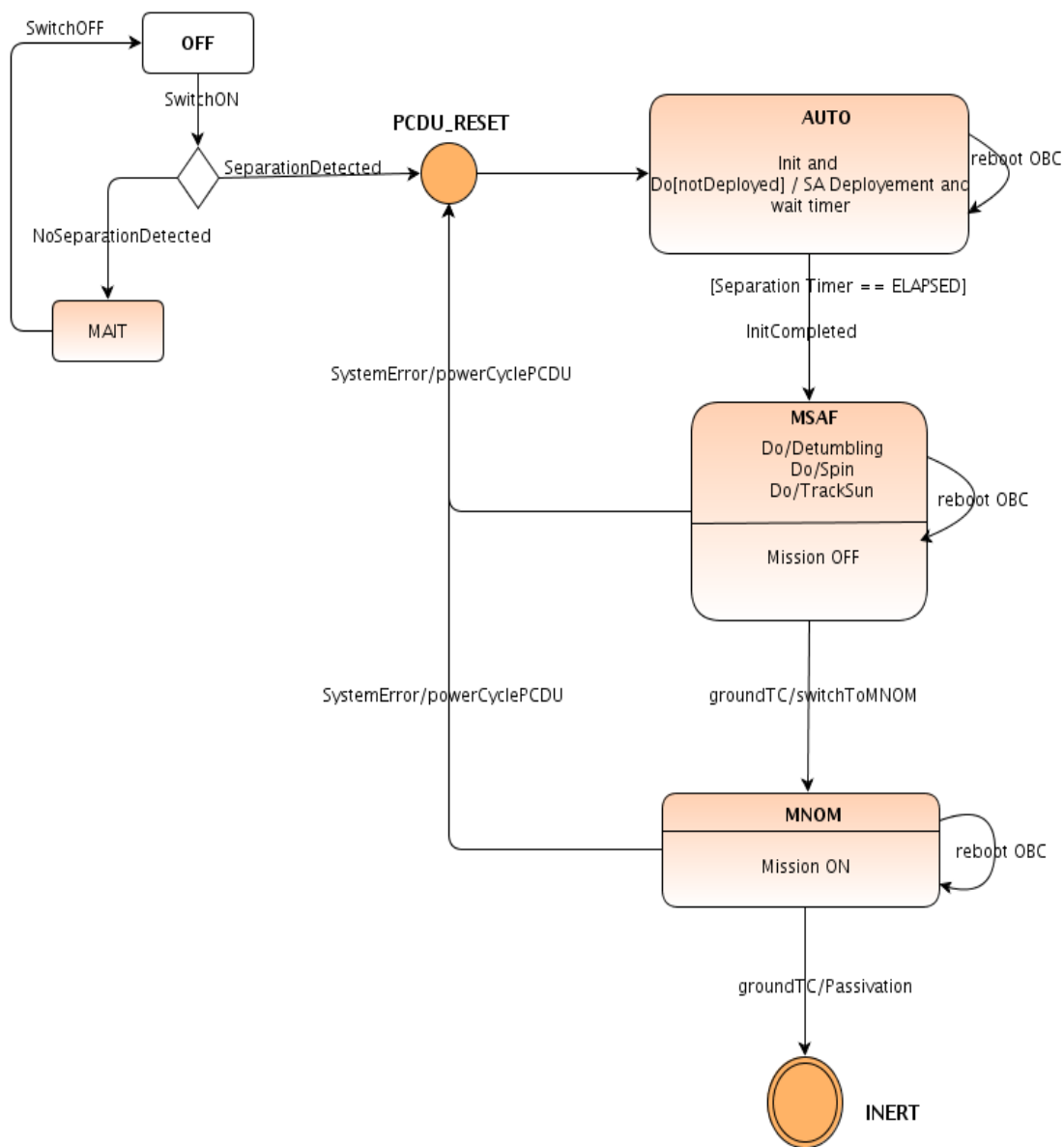


Figure 5-8 Satellite Modes State Diagram

Note:

- "PCDU-RESET" is a pseudo state corresponding to a reset (power cycling) of the PCDU unit.
- "Mission Off" because Payload is OFF on MSAF. Mission is only performed during MNOM State
- "INERT" is the "end of life" mode after passivation action leading to empty all tankers, all batteries of the satellite.

The default flight unit power state is:

| Unit \ Mode | MAIT | AUTO | MSAF | MNOM | Note |
|----------------|------|------|------|----------------------|---|
| PCDU | ON | ON | ON | ON | automatically powered ON when platform is powered |
| OBC | ON | ON | ON | ON | automatically powered ON when platform is powered (permanent link with PCDU) |
| SADM | OFF | OFF | ON | ON | SA Deployment during AUTO mode |
| SBAND | ON | ON | ON | ON | automatically powered ON when platform is powered (permanent link with PCDU) |
| GYRO | OFF | OFF | ON | ON | |
| STAR TRACKER | OFF | OFF | OFF | ON | |
| Reaction Wheel | OFF | OFF | ON | ON | |
| PROPU | OFF | OFF | OFF | ON | |
| GNSS | OFF | OFF | OFF | ON | |
| SSU | OFF | OFF | ON | ON (but not used) | Solar sensor unit is passive device, so already ON. In nominal mode, as STR is used, acquisition data of SSU are not taken into account. |
| PAYLOAD | OFF | OFF | OFF | ON | |

Table 6 flight units power state


4.1.1.1 General

4.1.1.1.1 Satellite Mode definition

E_YODA_SYS-769 - Satellite Modes


The platform shall implement the following modes:

- MAIT mode (or STANDBY Mode): ground mode allowing to perform all ground functional testing and configuration operations.
- AUTO mode: Automatic sequence starting at launcher ejection.
- MSAF mode: Safe mode ensuring the safety of the spacecraft, during which the payload is inactive.
- MNOM mode: Nominal mode allowing to perform the spacecraft mission.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0540 YODA-MC-REQ-0010 (GEN) YODA-MC-REQ-0020 (GEN) YODA-MC-REQ-0030 (GEN) YODA-MC-REQ-0040 (GEN) YODA-MC-REQ-0120 (GEN) YODA-MC-REQ-0290 (GEN) YODA-MC-REQ-0300 (GEN) |
| KineisLink | E_KINEIS_SYS-421 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>OFF mode and INERT mode are not considered as operationnel mode as no satellite function is active. So these modes are not described anymore in this fonctionnal specification</p> <p><u>Info:</u></p> <p>OFF mode: the satellite is powered OFF. Used on ground, for transportation and during the launch.</p> <p>INERT: Satellite mode for end of life for passivation (no more energy at tanker and battery Level)</p> |
| Updated | 2023-08-10 16:00 |


4.1.1.1.2 Mode observability**E_YODA_SYS-770 - Satellite modes observability**

The satellite mode shall be available in the telemetry through <AM_GEN_SAT_MODE>.

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_1110 YODA-MC-REQ-0220 (GEN) YODA-MC-REQ-0300 (GEN) YODA-MC-REQ-0310 (GEN) |
| KineisLink | E_KINEIS_SYS-422 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-10 16:00 |


4.1.1.1.3 Mode Commanding

E_YODA_SYS-1358 - Mode transition by TC : Deleted

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | redundant with E_YODA_SYS-1359 |
| Updated | 2023-02-14 15:36 |


E_YODA_SYS-1359 - Command mode transition

TC_DHS_MODE_TRANSITION command, shall be implemented in order to command mode transition. The command shall contain one argument representing the target mode.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0070 (GEN) YODA-MC-REQ-0340 (GEN) |
| KineisLink | E_KINEIS_SYS-629 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This TC allow only transition from MSAF to MNOM. Transition from MNOM to MSAF should be done after reboot. |
| Updated | 2023-08-10 16:00 |

E_YODA_SYS-2552 - Mode in Context

At each mode entry, the platform shall set the current mode in context memory <CTX_FSW_MODE> .

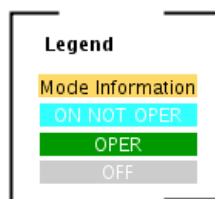
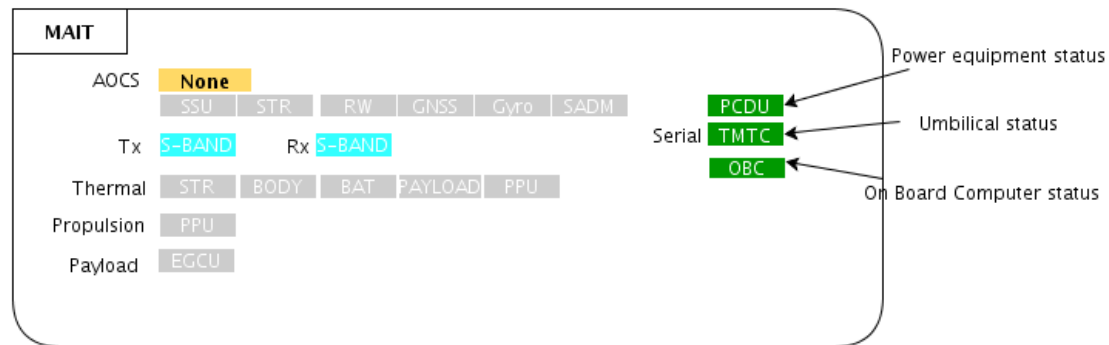
| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This parameter is used at OBC reboot. |
| Updated | 2023-08-03 18:04 |

4.1.1.2 MAIT mode

The MAIT mode is the test mode on ground. It is only used for AIT activities.


No AOCS processing is possible in this mode.

There is a hardware protection to ensure that this MAIT mode cannot be entered in flight.




E_YODA_SYS-1531 - Software upload in MAIT mode

In MAIT mode, the platform shall allow uploading any On Board Software through the umbilical link.

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | VAIT |
| ValidationLevel | |
| ValidationMethod | |
| Note | redundant with E_YODA_SYS-907 |
| Updated | 2023-08-03 18:04 |

E_YODA_SYS-497 - MAIT mode flight units default power status


On MAIT mode entry, the platform shall switch OFF all switchable Platform flight units and all Payload units.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0560 YODA-MC-REQ-0030 (GEN) |
| KineisLink | <u>E_KINEIS_SYS-445</u> |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 17:15 |

E_YODA_SYS-498 - On-Board function in MAIT Mode

In MAIT mode, the platform shall activate or deactivate the following on-board function:


- Power Production Storage and distribution: active
PCDU is powered ON and powers ON the OBC permanent load
- Platform equipments command-control:
 - OBC and FSW are active.
 - all Flight units shall be OFF (default power state)
 - Flight units may be switch ON/OFF by a ground telecommand
 - Thermal control : inactive, may be switch ON/OFF by ground telecommand
- Data transmission and processing: TM storage active; TC reception active; no TM emission:
 - TM/TC is performed by default through umbilical interface
 - TM emission mode through SBand shall be in SBAND_TX_MODE_STANDBY mode (No emission)
- Payload communication and management may be switch ON/OFF by ground telecommand
- AOCS/NAV : inactive.
- Time management : active

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0560 |
| KineisLink | E_KINEIS_SYS-423 E_KINEIS_SYS-445 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | - In this mode, only equipments commandability need to be performed by platform -SBAND already ON because of connected on electrical permanent link |
| Updated | 2023-02-27 18:24 |

E_YODA_SYS-904 - MAIT mode activities

For ground specific activities, the MAIT mode shall allow:

- To perform RF testing, with ground board TM/TC transmission.
- Low level TC execution to perform flight units activation/deactivation and testing, with associated observability.
This will be performed using PUS service 150, 185, and TMTC routing to Payloads.
- it shall allow platform communication with all equipments
- Synchronous real time housekeeping TM emission according to mode definition.
- Upload of any On Board Software through the umbilical link
- Modification of any On Board Software parameter


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0540 (GEN) |
| KineisLink | E_KINEIS_SYS-424 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>The MAIT mode shall not perform any activity autonomously, especially FDIR and AOCS.</p> <p>But It is acceptable that the FSW performs acquisitions on all equipments,</p> <p>Service 150 is for PCDU command and control</p> <p>Service 185 is for other flight units command and control</p> <p>Upload of any On Board Software through the umbilical link could be done for V1</p> |
| Updated | 2023-08-08 10:15 |

E_YODA_SYS-905 - MAIT mode Monitoring and FDIR

On MAIT mode entry, the FDIR are activated according to their monitoring configuration table values.

The default configuration values shall be:


- PCDU communication monitoring: inactive
- Other powered ON flight units monitoring: inactive
- TC reception delay monitoring : active
- Battery monitoring : inactive
- Reboot number monitoring: active
- Separation status : active

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-497 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <ul style="list-style-type: none"> • PUS service 12 monitoring configuration table : CONF_MONx_MAIT_ENABLE • TC reception delay monitoring and Reboot number monitoring are always active independently of the mode and are not configurable separation status is not configurable |
| Updated | 2023-02-23 09:48 |

E_YODA_SYS-906 - Separation status FDIR


In MAIT mode, the platform shall monitor the OBC separation status every second.

If the separation status is set to SEPARATED , the flight software shall trigger an OFF_ON_SAT, as per **TC_DHS_HIGH_RESTART_SC**

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0040 |
| KineisLink | E_KINEIS_SYS-570 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <ul style="list-style-type: none"> • This cyclical monitoring ensure that the platform can not stay in MAIT mode in flight in case of erroneous mode entry. • The separation status detection is done as per E_YODA_SYS-1342 |
| Updated | 2023-08-10 10:35 |


E_YODA_SYS-907 - Flight software load on the Launch Site in MAIT mode

For the specific ground activities on the Launch Site the MAIT mode shall allow full platform main OBC On Board Software load for the three software copies in less than 8 hours, through the umbilical link, from the first software load TC to the verification of the last software image load.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0540 (GEN) |
| KineisLink | E_KINEIS_SYS-426 |
| subSystemAllocation | FSW, BDS, OPS |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-01 18:37 |

E_YODA_SYS-908 - Satellite Platform configuration on the Launch Site in MAIT mode

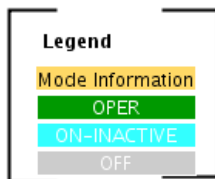
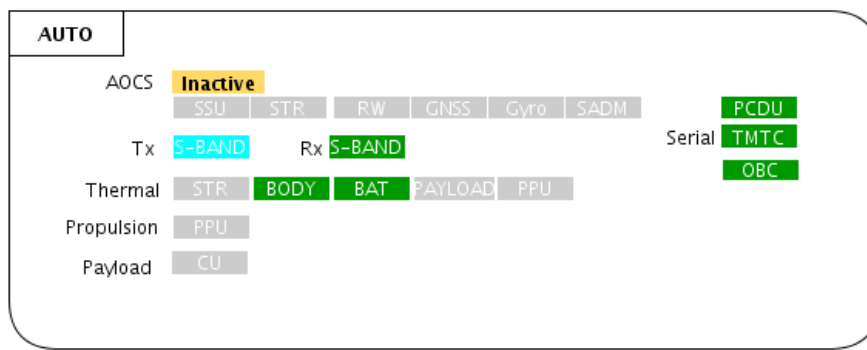
For the specific ground activities on the Launch Site the MAIT mode shall allow configuration parameters update, including AUTO mode countdowns and TM/TC countdowns, and context memory in less than two hours, through the umbilical link, from the first parameter load TC to the loading verification.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-427 |
| subSystemAllocation | FSW, BDS, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 10:19 |

4.1.1.3 AUTO mode

The AUTO mode is the mode at platform launcher separation. It minimizes the power consumption during the waiting time before solar arrays deployment. It performs solar arrays deployment after a configurable waiting time. In this mode, the AOCS is inactive. The mode is robust to erroneous on board time. After solar arrays deployment, the transition to MSAF mode is performed autonomously.

This mode is entered temporarily on major FDIR, and immediately exited to MSAF, to simplify the FDIR implementation.



E_YODA_SYS-1328 - Active Functions in AUTO mode


In AUTO mode, the satellite functions shall be activated as per the following:

- Power Production Storage and distribution: active
 - PCDU is powered ON and powers ON the OBC and S-BAND unit
 - communication between OBC and PCDU is started
- Platform equipments command-control:
 - OBC and FSW are active.
 - FSW performs the countdown before solar arrays deployment
- Thermal control :
 - Battery and Body temperature maintenance in operational range.
- Data transmission and processing: TM storage active, TC reception active, TM emission inactive.
- Payload communication and management : inactive.
- AOCs : inactive.
- Time management : active.

| | |
|-----------------------|--|
| ReqStatus | In Review |
| LinkedUpReq | YODA-MC-REQ-0060 (SPE) |
| KineisLink | E_KINEIS_SYS-495 E_KINEIS_SYS-582 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Inspection |
| Note | |
| Updated | 2023-06-15 11:32 |

E_YODA_SYS-500 - AUTO mode flight units default power status

On AUTO mode entry, the platform shall switch OFF all switchable Platform flight units and all Payload units except S-BAND


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-498 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | S-BAND unit is directly connected to PCPU with a permanent link |
| Updated | 2023-02-15 10:19 |

E_YODA_SYS-2606 - AUTO mode default FDIR

On AUTO mode entry, the FDIR are activated according to their configuration tables values as per < **CONF_MONx_AUTO_ENABLE**>.

The default configuration shall be:

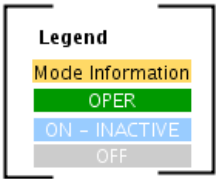
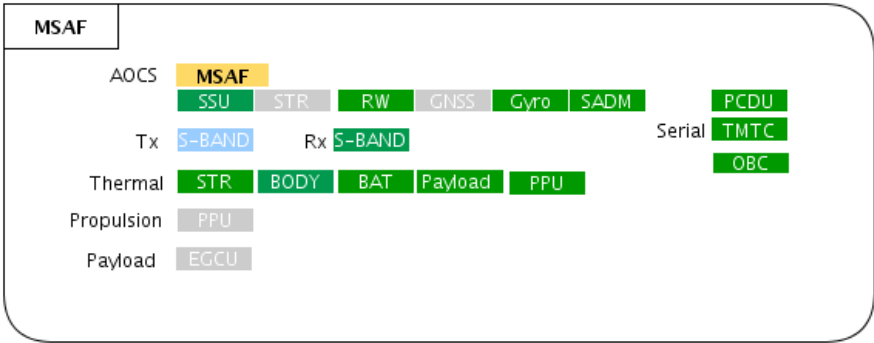
- PCPU communication monitoring: active
- Other powered ON flight units monitoring: inactive
- TC reception delay monitoring : active
- Battery monitoring : inactive
- Reboot number monitoring: active

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-496 |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-15 12:02 |

4.1.1.4 MSAF mode

The MSAF mode is the safe mode of the platform. It is designed to ensure the survival of the platform after the launch or after a major FDIR, for an undetermined duration. It minimizes the power consumption, maximizes the power generation and only switch ON the flight units required for the survival of the platform. In this mode, the AOCS performs stabilization of the platform and points the solar arrays in the sun direction. The mode is robust to erroneous on board time and does not use orbital localization data.


It is entered either autonomously from the AUTO mode, or on major FDIR occurrence (through the AUTO mode), or on ground TC request.



E_YODA_SYS-503 - Active Functions in MSAF mode

In MSAF mode, the satellite functions shall be activated as per the following:

- Power Production Storage and distribution: active
- Platform equipments command-control: active
- Thermal control:
 - Battery and Body temperature maintenance in operational range.
 - Propu Temperature monitoring: active
 - PAYLOAD Plate Monitoring Thermistor : active
 - PAYLOAD ECGU Thermistor : active
 - Star tracker temperature maintenance in non-operational range.(STR OFF)
- Data transmission and processing: TM storage active; TC reception active; TM emission in SBAND_TX_MODE_STANDBY mode (No emission).
- Payload communication and management : inactive (PAYLOAD shall be OFF)
- AOCS/NAV : active, in MAS mode for sun pointing
- SSU, SADM, Gyro: active
- OBCx_Propu (x=1,2,3,4) : ON
- RWs: active (as per E_YODA_SYS-1541 and <CONF_RW_AVAILABLE>)
- Time management : internal platform OBT active.
- STR, GNSS, PPUx_Propu : OFF
- Propu and Manoeuver subschedule on MTL: deactivated

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0090 (GEN) YODA-MC-REQ-0100 (GEN) YODA-MC-REQ-0110 (SPE) |
| KineisLink | E_KINEIS_SYS-562 |
| subSystemAllocation | FSW, BDS, OPS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | - Pour la Propulsion, il y a 4 LCLs pour les PPUx_Propu qui doivent etre a OFF en MSAF, et il y a aussi 4 LCLs pour l'OBCx_Propu qui elles sont toujours ON. |
| Updated | 2023-08-10 14:47 |


E_YODA_SYS-504 - MSAF mode flight units default power status

On MSAF mode entry, the platform shall switch OFF:

- STR (Star TrackerR)
- GNSS
- PAYLOAD
- PPUx_Propu (x=1,2,3,4)

On MSAF mode entry, the platform shall switch ON:


- Gyro
- RWs in accordance with available wheel <CONF_RW_AVAILABLE>
- SBAND (with RX activated / TX in standby mode)
- SADM
- OBCx_Propu (x=1,2,3,4)

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0110 (SPE) |
| KineisLink | E_KINEIS_SYS-563 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | -SSU is already ON as it is a passive Device and as defined in req E_YODA_SYS-503. -in MSAF, SSU is active and PF shall take into account its acquired data to provide them to AOCS. |
| Updated | 2023-08-04 10:03 |

E_YODA_SYS-2301 - SADM behaviour at MSAF mode entry

At MSAF mode entry the platform shall perform the following actions if <CTX_SADMx_MSAF_TOP_TURN> is set to TRUE on the corresponding SADM :


- Perform SADM Activation procedure
- Inform AOCS that SADM is no more available for being commanding by AOCS by setting parameter <AM_SADMx_CONTROL_MODE> to **EXTERNAL_CONTROL**.
- Perform a TOP_TURN command
- Once TOP-TURN is done, set position to canonical
- set <AM_SADMx_CONTROL_S> to **AOCS_CONTROL**

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0110 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | canonical position is initial position of Solar Array when angle is 0° |
| Updated | 2023-04-18 14:12 |

E_YODA_SYS-2565 - SADM External control


When **<AM_SADMx_CONTROL_MODE>** is set to **EXTERNAL_CONTROL**, the platform shall perform the following actions:

- ignore SADM commands provided by AOCS partition
- set to invalid all SADM data send to AOCS partition with interface parameter SADM_state = Standby

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | ICD-YODAOCS-GEN-200 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 10:38 |


E_YODA_SYS-505 - MSAF mode unlimited duration

The satellite shall be able to stay safely in MSAF mode until reception of a ground TC for transition to MNOM operating mode.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0440 (GEN) |
| KineisLink | E_KINEIS_SYS-574 |
| subSystemAllocation | FSW, OPS, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-17 13:42 |

E_YODA_SYS-1779 - MSAF mode TM emission rate

In MSAF mode, the platform shall set the TM emission bit rate to **<CONF_TM_SBAND_BIT_RATE_LOW>**


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1570 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-23 09:48 |

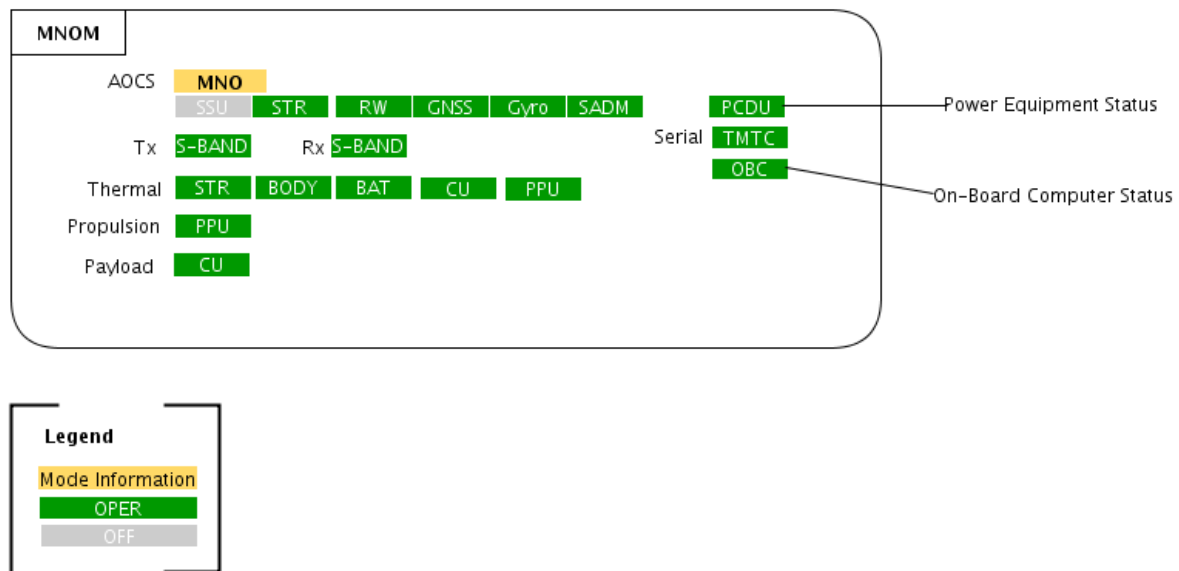
E_YODA_SYS-2607 - MSAF mode default FDIR

On MSAF mode entry, the FDIR are activated according to their configuration tables values as per <CONF_MONx_MSAF_ENABLE>.

The default configuration shall be:

- PCDU communication monitoring: active
- Powered ON equipment monitoring: active
- TC reception delay monitoring : active
- Battery monitoring : inactive, but can be activated by ground TC when the satellite is pointing the sun.
- Reboot number monitoring: active
- Powered ON platform flight unit monitoring: active


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-573 FDIR_KINEIS |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | For information dealing with <CONF_MONx_MSAF_ENABLE>, please refer to E_YODA_SYS-572 |
| Updated | 2023-06-15 16:08 |

4.1.1.5 MNOM mode

E_YODA_SYS-1469 - MNOM mode flight units power status


On MNOM mode entry, the platform shall switch ON and perform activation procedures of:

- the Star tracker
- the GNSS
- the Payload
- Propulsion

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <ul style="list-style-type: none">- Propulsion is electrically Switched ON on MNOM and ready to react on AOCS command for Thruster ON- For SSU, passive equipment already ON, acquired SSU data are no more take into account as AOCS use STR data (so no more SSU data are exchanged with AOCS in MNOM as defined in E_YODA_SYS-2543)- SBAND, RW, Gyro , SBAND, was already ON in previous MSAF State and so stay ON on MNOM entry |
| Updated | 2023-08-03 18:24 |

E_YODA_SYS-1333 - MNOM mode AOCS activation

On MNOM mode entry, the platform shall inform AOCS to transit to its MNO mode

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-787 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, +++, SOFTWARE |
| ValidationMethod | Test, +++, Inspection |
| Note | |
| Updated | 2023-06-27 10:58 |


E_YODA_SYS-1334 - Active Functions in MNOM mode

In MNOM mode, the satellite functions shall be activated as per the following:

- Power Production Storage and distribution: active
- Platform equipments command-control:
 - Active equipments as per E_YODA_SYS-1469
- Thermal control : active.
- Data transmission and processing: active.


The satellite shall emit TM as per ground programmed schedule.

- Payload communication and management : active.
- AOCS : active in MNO, ground pointing with yaw steering or fixed yaw.
- Time management : active.
- Propu and Manoeuver subschedule on MTL: deactivated

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0130 (SPE) |
| KineisLink | E_KINEIS_SYS-776 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-10 15:44 |

E_YODA_SYS-1780 - TM emission rate in MNOM mode

In MNOM mode, the platform shall set the TM emission bit rate to <CONF_TM_SBAND_BIT_RATE_LOW>

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1740 |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | CONF_TM_SBAND_BIT_RATE_HIGH will be set if needed by ground TC via TC_TTC_TM_BIT_RATE (see E_YODA_SYS-2571) |
| Updated | 2023-08-09 11:05 |

E_YODA_SYS-2608 - MNOM mode default FDIR

In MNOM mode, the FDIR are activated according to their configuration values as per <CONF_MONx_MNOM_ENABLE>. The default configuration values shall be :

- PCDU communication monitoring: active
- Powered ON equipment monitoring: active
- TC reception delay monitoring : active
- Batteries monitoring : active
- Reboot number monitoring: active
- Powered ON platform flight unit monitoring: active


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-780 |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | For information dealing with <CONF_MONx_MNOM_ENABLE>, please refer to E_YODA_SYS-572 |
| Updated | 2023-06-15 16:08 |

4.1.2 Mode transitions**4.1.2.1 To AUTO**

Direct transition from MNOM to AUTO or from MSAF to AUTO is not possible as shown in [Figure Satellite Mode Diagram](#).

The only way to perform this kind of transition is to restart the spacecraft or reboot the OBC, in accordance with requirement E_YODA_SYS-1345


E_YODA_SYS-1335 - OFF state to AUTO mode (deleted)

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | redundant with E_YODA_SYS-1345 |
| Updated | 2023-02-15 18:40 |

4.1.2.2 To MAIT

The satellite shall perform transition from OFF to AUTO mode in accordance with requirement E_YODA_SYS-1345


E_YODA_SYS-1336 - OFF state to MAIT mode (deleted)

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | redundant with E_YODA_SYS-1345 |
| Updated | 2023-02-15 18:35 |

4.1.2.3 to MSAF

E_YODA_SYS-1337 - AUTO mode to MSAF mode

When <CTX_SOLAR_DEPLOYEMENT_FLAG> is set, the FSW shall perform transition to safe mode (MSAF).


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0070 (GEN) |
| KineisLink | E_KINEIS_SYS-547 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | On YODA, only Solar Arrays need to be deployed. No other appendix need to be deployed |
| Updated | 2023-02-16 10:16 |

4.1.2.4 To MNOM

E_YODA_SYS-1338 - MSAF mode to MNOM mode

The FSW shall perform transition from MSAF mode to MNOM mode on ground **TC_DHS_MODE_TRANSITION** command and shall perform the following action:

- MNOM mode flight units set to default power status as per E_YODA_SYS-1469
- Active all functions and mode used in MNOM mode as per E_YODA_SYS-1334

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0350 (GEN) YODA-MC-REQ-0130 (SPE) YODA-MC-REQ-0140 (SPE) |
| KineisLink | E_KINEIS_SYS-630 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This requirement could be tested in the same time as E_YODA_SYS-1469, 1333, 1334 |
| Updated | 2023-08-10 15:44 |


E_YODA_SYS-2611 - MNOM mode to MNOM mode

The FSW shall reboot in MNOM mode:

- On ground TC request TC_DHS_HIGH_REBOOT_OBC
- On FSW request on FDIR needing a reboot to MNOM
- On OBC reboot, caused by an internal transient anomaly.

In this case,

- Activate all equipments set to ON on the previous MNOM mode
- Retrive all context information as per E_YODA_SYS-1798
- bitrate TM emission shall be set to CONF_TM_SBAND_BIT_RATE_LOW
- PAYLOAD shall be switched OFF

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-783 E_KINEIS_SYS-521 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | - FDIR dealing with transient anomlay is described in E_YODA_SYS-2612 - ON/OFF state of equipement powered by PCDU link, could be checked through PCDU LCL or checked via a context parameter. |
| Updated | 2023-08-08 09:22 |

4.1.3 Initialization

4.1.3.1 Separation management

E_YODA_SYS-1342 - Separation detection

The Platform shall independently detect satellite separation from the launcher and its ejection into orbit by setting the separation state to SEPARATED only after three consecutives acquisitions of the two separation straps state .

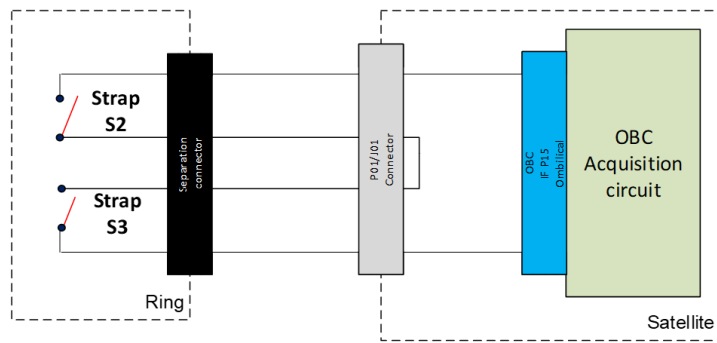


Figure 9 strap Switch


| | |
|-----------------------|---|
| ReqStatus | In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-93 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>This automatic detection triggers the initial post-separation operations, to be performed outside of ground control. This device triggers the separation timer. If the device oscillates, the separation shall not be detected.</p> <p>Strap S2 & S3 are the second barrier for untimely deployment and RF emission (the first strap S1, not represented in the figure is the PCDU powering the OBC at separation)</p> |
| Updated | 2023-02-16 09:52 |

4.1.3.2 Software selection after OBC Reboot

E_YODA_SYS-1343 - FSW load after OBC reboot

Following an OBC reboot (whatever the previous mode) the platform shall load the software version as follow:


- IF the part of the context memory needed for the boot is not valid, OR
 IF the reboot counter <CTX_OBC_REBOOT_COUNT> is upper or equal to <CTX_OBC_NB_REBOOT_MAX>, OR
 IF the next FSW version identifier is not valid.
 THEN the SECURE FSW version is loaded
- ELSE
 The FSW version, provided by the next FSW version parameter <CTX_FSW_NEXT_VERSION> in context memory, is loaded.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0560 (GEN) |
| KineisLink | E_KINEIS_SYS-566 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-17 17:14 |

4.1.3.3 Mode selection after OBC Reboot**E_YODA_SYS-1345 - Mode after OBC reboot**

Following an OBC reboot, the FSW shall run the mode:

- MAIT if separation status is NOT_SEPARATED
- OR
- AUTO if the current mode in context memory <CTX_FSW_MODE> is NOT_VALID or MAIT
- ELSE
- the current mode in context memory <CTX_FSW_MODE>


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0040 (SPE) YODA-MC-REQ-0050 (SPE) YODA-MC-REQ-0450 (GEN) |
| KineisLink | E_KINEIS_SYS-567 E_KINEIS_SYS-539 E_KINEIS_SYS-431 E_KINEIS_SYS-432 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | confer req E_YODA_SYS-1342 for separation detection |
| Updated | 2023-08-10 16:27 |

4.1.3.4 Reboot performance

E_YODA_SYS-1346 - Reboot duration

When booting on a software version stored in NVM and with target mode MNOM, the boot duration shall not exceed 35s (TBC) from last TM before reboot to the first AOCs activation.


When booting on a software version stored in NVM , the boot duration shall not exceed 35s (TBC) to reach one of the following mode: MAIT, AUTO MSAF, MNOM,

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-773 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-05 09:28 |

4.1.3.5 Observability

E_YODA_SYS-1348 - reboot Timing monitoring


The platform shall provide HKTM to share the boot duration from last TM before reboot to first action to enter in the target flight mode.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-773 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This time is stored in : AM_HK_INIT_DURATION_FSBL AM_HK_INIT_DURATION_SSBL AM_HK_INIT_DURATION_FSW |
| Updated | 2023-03-17 11:47 |

E_YODA_SYS-1349 - Boot report event

At the end of its initialization, the FSW shall generate a low severity TM(5,1) event with at least the following parameters:

- version number of all partitions and configuration tables used
- boot software report allowing to deduce which branches of the boot software have been executed.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-969 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 11:16 |

4.1.4 Decommissioning - FSOA

For the decommissioning phase, the satellite will be completely passivated as specified in article 40 point 3 of the order relating to regulations in application of the space act [ST1].

This passivation will be performed by first sending a passivation arming TC to the platform OBC. Then a passivation command will be sent to the platform PCDU. This will stop the power generation, and the battery will start discharging, the xenon tanker will be emptied.


When the battery level will be below the passivation limit value, the process will be irreversible.

4.1.4.1 General**E_YODA_SYS-2637 - End-of-life passivation**

The power chain shall implements a passivation function allowing for

- definitive disconnection of sources of electrical power from the rest of the satellite
- discharge of the battery.
- empty the xenon tanker

The implementation of this function shall be protected by 2 barriers, ARM and FIRE commands, preventing its unintentional triggering, including as a result of human error.


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-430 |
| subSystemAllocation | FSW, SDB, OPS, PCDU |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | The passivation will be performed by an arming function by the OBC and an execution function by the PCDU and PROPULSION . Both functions have to be activated independently by two ground commands. Those commands will be concealed outside of the nominal commands list. |
| Updated | 2023-07-05 10:01 |

4.1.4.2 Processing

E_YODA_SYS-2635 - Passivation arming

On **TC_DHS_SET_ARM_PASSIVATION**, the platform shall


- raise the OBC to PCDU passivation arming signal.
- set Propulsion in "Standby" mode (to be Ready for passivation)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-428 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-05 11:48 |

E_YODA_SYS-2636 - Passivation fire

On passivation raw TC (**TC_EPS_RAW_CMD_PCDU**) from ground, if the passivation arming signal is raised,

- the PCDU shall stop electrical production.
- the Propulsion shall be set in EOL_PASSIVATION mode (Mode 4)


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-429 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | The raw TC is used in order to ensure that the platform does not know the passivation command, to avoid unsolicited passivation. |
| Updated | 2023-07-05 09:58 |

4.1.4.3 Observability

E_YODA_SYS-2634 - Passivation arm status

The platform shall report the status of passivation arming through **<AM_DHS_ARM_PASS_S>** parameter.


- 0 value meaning not arming
- 1 value meaning arming

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-20 17:12 |


4.2 Satellite general requirements**4.2.1.1 Processing****E_YODA_SYS-2055 - OFF/ON sat with return to MSAF from ground TC**

On command **TC_DHS_HIGH_RESTART_SC**, the platform shall command a satellite OFF/ON with return to MSAF as follow:

- set the current mode in the context to AUTO
- command the PCDU to perform a PCDU hardware reset (see PCDU hardware reset section)

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-571 E_KINEIS_SYS-569 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <ol style="list-style-type: none"> 1. TC_DHS_HIGH_RESTART_SC Command have no argument. 2. Note 1 : This will reboot the OBC and shutdown all flight units and Payloads 3. Note 2 : The OBC will stop too to refresh its watchdog, to restart the OBC in the unlikely case the OFF/ON request to the PCDU is not executed by the PCDU. 4. After the deployments, the transition from AUTO to MSAF will take place after one second in AUTO |
| Updated | 2023-03-17 11:48 |


E_YODA_SYS-2056 - OFF/ON sat in current mode from ground TC (Deleted)

| | |
|-----------------------|--|
| ReqStatus |  Deleted |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-905 E_KINEIS_SYS-741 |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | ON/OFF satellite always returns to MSAFE on YODA So (131,111)TC_DHS_HIGH_REBOOT_SC with return in current mode is no more re needed |
| Updated | 2023-06-27 10:43 |

4.2.1.2 FDIR**E_YODA_SYS-2612 - Autonomous PF OBC reboot**

The OBC FSW shall autonomously reboot in case of internal transient anomaly.

On internal anomaly detectable by the software prior to the reboot, the FSW should store in a non volatile memory or emit an event with all data necessary to investigate the anomaly

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-521 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-06-19 10:06 |

4.3 Ground Board interface

This chapter specify all need about TM and TC at frame Level

How the frames should be managed and how the frame format need to be.


4.3.1 General

E_YODA_SYS-1451 - Satellite ID

Satellite shall be differentiated at TMTC level through their satellite ID.


TM and TC transfert frame shall contain this satellite ID.

The satellite IDs shall be configuration parameters, <CONF_SPACECRAFT_ID>.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-SBIF-REQ-0190 YODA-SBIF-REQ-0340 |
| KineisLink | E_KINEIS_SYS-717 |
| subSystemAllocation | FSW, SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | CONF_SPACECRAFT_ID shall take the value provided by CNES, one for each YODA satellite: <SBAND_SAT1_ID> = 0x2AB <SBAND_SAT2_ID> = 0x31B |
| Updated | 2023-07-21 15:40 |


4.3.2 Telecommand**E_YODA_SYS-1452 - Telecommands Frame format**

The platform shall be able to manage Telecommand in transfer frame format as per [AD05]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-SBIF-REQ-0280 YODA-MC-REQ-0640 (GEN) |
| KineisLink | E_KINEIS_SYS-112 |
| subSystemAllocation | FSW, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-17 17:14 |

E_YODA_SYS-1457 - Maximum number of TCs per segment

Only a single TC packet shall be carried in one segment of the segmentation sublayer

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBIF-REQ-0320 |
| KineisLink | E_KINEIS_SYS-294 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | According CCSDS recommended standard, there is only one segment in a TC frame |
| Updated | 2023-02-27 18:24 |


E_YODA_SYS-1453 - Segment structure

The telecommand Segment structure shall be compliant with [ST8] as given here after:

Sequence Flag of the Segment Header shall be set to ' 11' (meaning no segmentation)


MAP Identifier values shall be set to 000010 binary

| SEGMENT HEADER (1 byte) | | SEGMENT DATA FIELD (variable) |
|----------------------------|----------------------------|----------------------------------|
| SEQUENCE FLAG (2 bits) | MAP IDENTIFIER (6 bits) | |
| =11 b | 000010 b | |

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-SBIF-REQ-0300 YODA-SBIF-REQ-0310 |
| KineisLink | N/A |
| subSystemAllocation | FSW, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Sequence flag = 11 b means no segmentation |
| Updated | 2023-08-03 18:45 |

E_YODA_SYS-1458 - Security Header and trailer


Security header and trailer (MAC) shall be present in TC frame and specified in [ST8].

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-125 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-03 18:54 |

E_YODA_SYS-1454 - TC maximum length


The maximum length of a TC packet shall be 994bytes

| | | |
|-----------------------|------------------|-----------------------|
| TC packet | 6 bytes | <= 988 bytes bytes |
| Max: 994 bytes | packet header | Packet Data field |

| ReqStatus |  Reviewed | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------|--|-------------------------------|----------------------------|---------------|--------------------------|----------------------------------|-----------------|-----------------------------|-------------------|----------------------------------|--------------------|---------------|---------------------|------------------------------------|--|----------------|----------------------------|------------------------------------|--------------------------|----------------------------------|-----------------|-----------------------------|--------|-------|-------|--------|---------|--------|---------|--------|--|--|--|--|--|---------|--|--|--|--|--|--|--|--------|---------|----------------------------------|----------|---------|
| LinkedUpReq | YODA-SBIF-REQ-0330 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| KineisLink | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| subSystemAllocation | FSW, SDB, OPS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| implementationVersion | VAIT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ValidationLevel | SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ValidationMethod | Test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Note | TC packet max length is not the same as TC Transfer frame length (1024 bytes) detailed here after | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | <table><tr><th colspan="8">TRANSFER FRAME PRIMARY HEADER</th><th rowspan="2">SEGMENT HEADER</th><th rowspan="2">SECURITY HEADER</th><th rowspan="2">FRAME DATA</th><th rowspan="2">SECURITY TRAILER</th><th rowspan="2">FRAME ERROR CONTROL FIELD</th></tr><tr><th>TRANSFER FRAME VERSION NUMBER</th><th>BYPASS FLAG</th><th>CONTROL COMMAND FLAG</th><th>RSVD SPARE</th><th>SPACECRAFT IDENTIFIER</th><th>VIRTUAL CHANNEL IDENTIFIER</th><th>FRAME LENGTH</th><th>FRAME SEQUENCE NUMBER</th></tr><tr><td>2 bits</td><td>1 bit</td><td>1 bit</td><td>2 bits</td><td>10 bits</td><td>6 bits</td><td>10 bits</td><td>8 bits</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td colspan="8">5 bytes</td><td>1 byte</td><td>6 bytes</td><td>variable (< 994 bytes)</td><td>16 bytes</td><td>2 bytes</td></tr></table> | TRANSFER FRAME PRIMARY HEADER | | | | | | | | SEGMENT HEADER | SECURITY HEADER | FRAME DATA | SECURITY TRAILER | FRAME ERROR CONTROL FIELD | TRANSFER FRAME VERSION NUMBER | BYPASS FLAG | CONTROL COMMAND FLAG | RSVD SPARE | SPACECRAFT IDENTIFIER | VIRTUAL CHANNEL IDENTIFIER | FRAME LENGTH | FRAME SEQUENCE NUMBER | 2 bits | 1 bit | 1 bit | 2 bits | 10 bits | 6 bits | 10 bits | 8 bits | | | | | | 5 bytes | | | | | | | | 1 byte | 6 bytes | variable (< 994 bytes) | 16 bytes | 2 bytes |
| | TRANSFER FRAME PRIMARY HEADER | | | | | | | | SEGMENT HEADER | | | | | | SECURITY HEADER | FRAME DATA | SECURITY TRAILER | FRAME ERROR CONTROL FIELD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | TRANSFER FRAME VERSION NUMBER | BYPASS FLAG | CONTROL COMMAND FLAG | RSVD SPARE | SPACECRAFT IDENTIFIER | VIRTUAL CHANNEL IDENTIFIER | FRAME LENGTH | FRAME SEQUENCE NUMBER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 bits | 1 bit | 1 bit | 2 bits | 10 bits | 6 bits | 10 bits | 8 bits | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 bytes | | | | | | | | 1 byte | 6 bytes | variable (< 994 bytes) | 16 bytes | 2 bytes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Updated | 2023-02-15 11:16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

E_YODA_SYS-1455 - number of TCs per second

The platform shall be able to manage up to 10 TC frame from ground per second

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBIF-REQ-0490 |
| KineisLink | E_KINEIS_SYS-746 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-27 18:24 |


E_YODA_SYS-1456 - TC frame integrity verification on board

The platform shall verify the integrity of the data uploaded as well as the value of the following fields.

At frame level


- Spacecraft ID
- VCID
- frame length
- CRC

In case of error in the TC frame such as invalid SCID or VCID or CRC, the platform shall discard the frame and an event error shall be generated.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-115 E_KINEIS_SYS-465 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | there is only one TC chain and one VCID on YODA (see E_YODA_SYS-3070) |
| Updated | 2023-08-09 11:05 |


E_YODA_SYS-1468 - PUS packets routing

The platform shall route up to <SPC_MAX_NB_PACK> PUS telecommands extracted from the received frame to their intended recipients as identified by the APID in the PUS primary header.

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-294 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | on YODA, as only one TC in one segment, one segment in on TC frame, <SPC_MAX_NB_PACK> is equal to 1 |
| Updated | 2023-02-27 18:24 |


E_YODA_SYS-3073 - Telecommand VCID

The TC frame shall have VCID set to <CONF_TC_VCID>

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-110 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Default Value for <CONF_TC_VCID> is 1 |
| Updated | 2023-08-02 09:56 |

4.3.3 Telemetry**E_YODA_SYS-1479 - Telemetry Frame format**

The platform shall be able to develop Telemetry in transfert frame format as per [AD05]

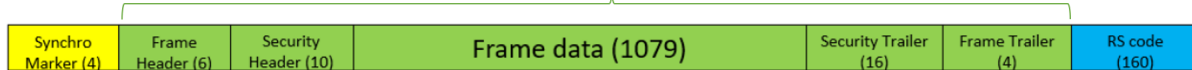
| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-28 17:29 |

E_YODA_SYS-1481 - TM transfer frame size

TM transfer frame shall have 1279 bytes total size composed as follow:

- 4 bytes for attached Synchro Marker
- 1115 bytes for TM transfer frame which contains 1079 bytes of data
- 160 bytes for RS code data

TM Transfer frame size (1115 bytes)



| | |
|-----------------------|--|
| ReqStatus | Reviewed |
| LinkedUpReq | YODA-SBIF-REQ-0180 |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | synchronization Marker and channel coding is inherited from [ST7] ECSS-E-ST-50-01 as defined in [AD05] |
| Updated | 2023-02-28 17:29 |

E_YODA_SYS-1482 - Channeling

The platform shall transmit telemetry frames over up to 3 virtual channels.


Virtual Channel Identifier values shall be defined in the following TM VCID Table:

- <SYS_HKTMP_VCID> for real time housekeeping telemetry
- <SYS_HKTMR_VCID> for differed housekeeping telemetry
- <SYS_IDLE_VCID> for IDLE frames

| | |
|-----------------------|----------------------------------|
| ReqStatus | In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-278 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-10 10:16 |


E_YODA_SYS-1483 - Channels multiplexing

Telemetry frames from each virtual channel shall be multiplexed to form a continuous stream of telemetry frames.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-283 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-02-15 11:16 |


E_YODA_SYS-1484 - IDLE frame transmission

During transmission period, in case of no useful frame need to be sent, the platform shall produce IDLE frames in the related Virtual Channel.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBIF-REQ-0070 |
| KineisLink | E_KINEIS_SYS-458 |
| subSystemAllocation | FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-28 17:29 |


E_YODA_SYS-1485 - Packet filling for TM Frame

End of TM frame shall be completed by IDLE packet if needed in order to fill fully the CCSDS packets frame

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-287 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | No segmentation is performed on project |
| Updated | 2023-02-15 11:18 |


E_YODA_SYS-1812 - HK telemetry within TM Transfer Frames

For platform HKTM packets, the platform shall perform frame data assembly.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-124 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-02-15 11:18 |


E_YODA_SYS-1809 - Ground time correlation in HKTMP frame

A time packet report shall be generated and inserted at the end of HKTMP frame just before the transferring the frame to the S-Band Tx.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-408 |
| subSystemAllocation | FSW, OPS, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | The time packet report shall be built with OBT |
| Updated | 2023-02-15 11:18 |


E_YODA_SYS-1486 - HKTMR flow content

HKTMR flow shall contain the onboard recorded housekeeping telemetry

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-122 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | HKTMR_R is used to downlink the on-board recorded telemetry for PF and PL. This flow gives housekeeping telemetry to provide the ?history? of the satellite for long term trend analysis. |
| Updated | 2023-02-15 11:18 |


E_YODA_SYS-1487 - HKTMR frame building

For HKTMR the platform shall be able to build telemetry frames from a stream of variable length TM packets.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-449 |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-02-15 11:18 |


E_YODA_SYS-1813 - HKTMP frame building

For HKTMP the platform shall be able to build telemetry frames from a stream of variable length TM packets.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-286 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-03-17 11:55 |


E_YODA_SYS-1488 - HKTMP data

HKTMP shall contain at least synthetic packets

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-199 |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-20 09:51 |

E_YODA_SYS-1489 - Telemetry frame loses


In case of OBC reboot, telemetry frame that will be lost during reboot shall be limited to <SPC_TM_OVERALL_FRAME_FIFO_SIZE>

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-558 |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test, Inspection |
| Note | |
| Updated | 2023-02-15 11:18 |

E_YODA_SYS-1822 - Real time flow frame transmission

For real time flow the platform shall transmit the frame if one of the two conditions below is meet:


- Frame is full
- <CONF_HKTMP_FRAME_TIMEOUT> timeout has elapsed

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-851 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-23 09:48 |

4.3.4 COP-1**E_YODA_SYS-2574 - COP-1 within the transfer layer**

The transfer layer of the telecommand and telemetry links shall implement the Command Operation Procedure 1 (COP-1) as per [ST9].


Only the Open state (S1) of of FARM-1 is mandatory for space segment.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-135 |
| subSystemAllocation | FSW, OPS |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | Wait (S2) and Lockout (S3) states are not mandatory for space segment. |
| Updated | 2023-05-25 16:02 |

E_YODA_SYS-2575 - TC frames type


The following kind of TC frames shall be handled by the system:

- Type-AD TC frames: Accepted on-board only if they are received in strict sequential order.
- Type-BD TC frames (or Bypass frames): Always accepted on-board (if valid), there is no order control.
- Type BC TC frames: Frames carrying protocol control information for configuring COP-1

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-138 |
| subSystemAllocation | FSW, OPS |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | For BC frame only set V(R) directive is used |
| Updated | 2023-05-25 16:02 |

E_YODA_SYS-2576 - BC TC frames


The Transfer Frame Data Field of a type?BC frame shall contain exactly one COP?1 control command. BC TC frames shall not include security layer

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-708 |
| subSystemAllocation | FSW, OPS |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-05-25 16:02 |

E_YODA_SYS-2577 - COP-1: AD and BD services

The following services shall be handled by the system:

- AD Service: Sequence-Controlled Service (including AD and BC TC frames)
- BD Service: Expedited Service


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-139 |
| subSystemAllocation | FSW, OPS |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-05-25 16:31 |

E_YODA_SYS-2578 - FARM-1 protocol: Positive and negative window

Only the TC frame with the frame counter equal to the expected counter $V(R)$ shall be accepted on-board, and then the expected counter $V(R)$ shall be incremented .

In case of frame in the negative window ($(\text{expected counter} - \text{counter}) \bmod 256 \leq \text{NW}$), the TC frame shall be rejected (no impact on retransmission).

In case of frame in the positive window ($(\text{counter} - \text{expected counter}) \bmod 256 \leq \text{PW}-1$), the TC frame shall be rejected, and the satellite shall ask for retransmission from last received TC.


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-141 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Positive window PW (CONF_COP1_PW) = 128 Negative window NW (CONF_COP1_NW) = 128 |
| Updated | 2023-05-25 16:50 |

E_YODA_SYS-2579 - Configuration of COP-1 window

COP-1 positive and negative window shall be configurable parameters :

<CONF_COP1_PW> : COP-1 positive window


<CONF_COP1_NW> : COP-1 negative window

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | CONF_COP1_PW = 128 CONF_COP1_NW = 128 |
| Updated | 2023-05-25 16:50 |

E_YODA_SYS-2580 - COP-1: BC Set V(R)


The platform shall allow to set onboard receiver frame sequence number V(R) (COP-1 control command) to a given value from ground command.

Value shall be stored in context parameter <CTX_COP1_VR>.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-142 |
| subSystemAllocation | FSW, SDB, OPS |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Format of the COP command is defined in ST10 CCSDS 232.0-B-3 "TC Space Data Link Protocol" section 4.1.3.3 |
| Updated | 2023-05-25 16:50 |

E_YODA_SYS-2581 - CLCW addition

The operational control field shall be included in each telemetry frame and checked by FOP-1.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-136 |
| subSystemAllocation | FSW, OPS |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Analysis |
| Note | |
| Updated | 2023-05-25 16:58 |

E_YODA_SYS-2582 - CLCW format


The CLCW shall contain the following fields:

- **Control word type** (type flag operational control field) shall be set to '0'
- **CLCW version number** shall be set to the binary value '00' (Indicates CLCW is a Version 1)
- **Status field** shall be set to '0'
- **COP in effect** shall be set to the binary value '01'
- **The Virtual Channel Identification** shall identify the virtual channel to which the CLCW belongs (only one TC VCID on the project <CONF_TC_VCID>)
- **RSDV** spare bit shall be set to '00'
- **No RF available**
 - Set to ?0? when the RF physical connection is available, when LOCK_DETECT of SBAND is active
 - Set to ?1? when the RF physical connection is not available, when LOCK_DETECT of SBAND is inactive
- **No BIT lock flag**
 - Set to ?0? when bit lock is detected, when DATA_VALID signal of SBAND is active
 - Set to ?1? when no bit lock detected, when DATA_VALID signal of SBAND is inactive
- **Lockout flag**
 - Set to ?1? when the FARM?1 is in Lockout state
 - Set to ?0? when the FARM?1 is not in Lockout state
- **Wait flag** : not use (set to 0 for not disturb ground)
 - Set to ?1? when the FARM?1 is in Wait state
 - Set to ?0? when the FARM?1 is not in Wait state
- **Retransmit flag** :
 - Set to ?0? when the FARM?1 does not request retransmission
 - Set to ?1? when the FARM?1 requests retransmission of type?A Transfer Frames, starting with the frame whose sequence number is indicated in the Report Value field of the CLCW
- **FARM-B counters** shall contain the two least significant bits of the internal counter used by FARM?1 to count the accepted type?B Transfer Frames
- Reserved spare shall be set to '0'
- **Report value** shall contain the COP-1 value N(R)

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-466 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Inspection |
| Note | LOCK_DETECT and DATA_VALID are discrete signals provided by SBAND as described in E_YODA_SYS-2659. |
| Updated | 2023-08-03 18:54 |

E_YODA_SYS-2583 - Latest CLCW


The platform shall update the CLCW with data from the last TC received with maximum one second of delay.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-284 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-05-25 16:58 |

4.3.5 Bandwidth Allocation Table (BAT)**E_YODA_SYS-1490 - BAT serializer**


The satellite shall serialize and transmit telemetry of the different TM VCID according to a bandwidth allocated to each TM flow.

The BAT shall cyclically scan the different TM VCID except IDLE and real time and forward telemetry according the BAT configuration (sizes of bandwidth for each TM source in number of frames).

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-529 |
| subSystemAllocation | FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test, Analysis |
| Note | |
| Updated | 2023-03-28 12:14 |


E_YODA_SYS-1491 - BAT: Flow priority

The real time telemetry (HKTMP) flow shall have higher priority compared to the other sources. After each TM frame forwarded the BAT shall forward one real time frame if present.


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-531 |
| subSystemAllocation | FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-17 12:01 |

E_YODA_SYS-1492 - BAT configuration

BAT shall be configured at OBC start-up from the BAT configuration table <CONF_TM_BAT_TABLE> which contains the frame number for each VCID.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-684 |
| subSystemAllocation | FSW, SDB, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>In the datapool, the configuration table will be parameters of 1 bytes (one by VCID). FSW will produce the 4 bytes parameter to forward to FPGA.</p> <p><CONF_TM_BAT_TABLE> =</p> <ul style="list-style-type: none"> • CONF_TM_BAT_HKTMP • CONF_TM_BAT_HKTMR |
| Updated | 2023-03-29 16:37 |

E_YODA_SYS-1493 - BAT reconfiguration (deleted)

| | |
|-----------------------|--|
| ReqStatus |  Deleted |
| LinkedUpReq | N/A |
| KineisLink | E_KINEIS_SYS-530 |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | TC_DHS_SET_BAT_PARAM no more used on YODA as no BAT reconfiguration needed (only HKTMP and HKTMR with HKTMP priority on HKTMR) |
| Updated | 2023-06-27 10:53 |

4.3.6 TMTC security management

E_YODA_SYS-2594 - TMTC HW security disabling on ground


It shall be possible to disable the TMTC security by grounding the security hardware input signal.

The OBC shall every second read the status of the the SEC_DIS signal (inversion of the security hardware signal) and make it available for telemetry.

IF read of the SEC_DIS signal are high,

- then the security hardware input signal is grounded, the TMTC authentication and encryption shall be disabled (clear mode)


ELSE the TMTC authentication and encryption shall be enabled

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-SBand-Secur-REQ-0470 |
| KineisLink | E_KINEIS_SYS-868 |
| subSystemAllocation | HW, FPGA, FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | -By reading every second the HW signal, this ensure that TMTC authentication and encryption enable state is robust to SEUs -SEC_DIS: means Security Disable. |
| Updated | 2023-08-04 12:17 |

4.3.7 TC Authentication**E_YODA_SYS-2584 - TC security performed by LVCUGEN**


the OBSW shall integrate the LVCUGEN AUTHENTICATION partition.

The interfaces with the partition shall be compliant with [AD9]

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA_SAT_REQ_1050 YODA-SBand-Secur-REQ-0470 |
| KineisLink | E_KINEIS_SYS-870 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Authentication partition has its own APID given by SYS_TC_AUTHENTICATION_APID (see req E_YODA_SYS_-1505) |
| Updated | 2023-08-09 11:05 |


E_YODA_SYS-2586 - TC frames format in clear mode

In clear mode (authentication disabled) the TC frames format shall be the same as the format of classical CCSDS TC format (without security field and without MAC field).

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBand-Secur-REQ-0480 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-06 18:13 |

E_YODA_SYS-2587 - TC frames routing to AUTHENTICATION


When the TC authentication is enabled, after FARM-1 processing, the received AD and BD TC frames shall be routed to the AUTHENTICATION partition.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-871 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection, Test |
| Note | |
| Updated | 2023-08-03 18:58 |

E_YODA_SYS-2588 - current TC key index observability

The last key index and ARSN counter provided by the AUTHENTICATION partition shall be stored as observable parameters AM_SECURITY_TC_KEY_INDEX and AM_SECURITY_TC_KEY_ARSN.


These parameters shall be included in a cyclical telemetry packet in any flight mode

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-896 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-05-26 11:40 |

4.3.8 TM Authentication and Encryption

E_YODA_SYS-2593 - TM authentication and encryption

When the TM encryption is not disabled, The payload TM frames received through the SPW interfaces and the platform TM frames shall be authenticated and encrypted using an AES256 algorithm in ?Galois /Counter Code? mode as per [AD9] .

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBand-Secur-REQ-0170 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-06-22 08:05 |


E_YODA_SYS-2595 - TM IV incrementation

The in use IV shall be incremented before each TM frame authentication and encryption.

If the in use IV reach its maximum value then

- the IV shall stay at its value,
- the key status shall be set to invalid


The initialization vector (IV) shall have a length of 64 bits and shall exactly correspond to the initialization vector field

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBand-Secur-REQ-0190 |
| KineisLink | E_KINEIS_SYS-900 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-09 18:18 |

E_YODA_SYS-2596 - TM authentication and encryption initialization


At TM encryption enabling, the function shall be initialized with the key associated to <CTX_SECURITY_CURRENT_TM_KEY_INDEX> read from QSPI.

At TM encryption enabling, the function shall be initialized with the sum of the IV associated to <CTX_SECURITY_CURRENT_TM_KEY_INDEX> and the value of <CF_SECURITY_IV_JUMP>

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-899 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Analysis |
| Note | |
| Updated | 2023-06-06 18:26 |

E_YODA_SYS-2597 - TM key IV storage in case of reboot


the platform shall store in FRAM, at least once per second, the current value of TM KEY IV

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-898 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-20 10:58 |

E_YODA_SYS-2598 - Security: TM key selection

On TC_SELECT_TM_KEY execution, the platform shall check the validity status of the key index and if valid, the according TM Key shall be loaded and used for TM cyphering and authentication.


The key index shall be stored in <CTX_SECURITY_CURRENT_TM_KEY_INDEX>.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-625 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-07 16:42 |

E_YODA_SYS-2599 - Security: TM keys integrity verification

On TC_TM_KEY_INVENTORY execution, the platform shall :


- verify the CRC of the key in parameter
- answer with a TM_TM_KEY_INVENTORY, with parameters :
 - CRC verification result (TRUE/FALSE)
 - validity status (TRUE/FALSE)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-626 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-07 16:42 |

E_YODA_SYS-2600 - Security: TM keys IV verification

On TC_READ_IV execution, the platform shall answer with a TM_READ_IV, with parameters:


- IV of key in parameter
- validity status (TRUE/FALSE)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-889 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-07 16:42 |

E_YODA_SYS-2601 - current TM key index observability

The last TM key index used for TM authentication and encryption and IV counter stored in FRAM shall be stored as observable parameters AM_SECURITY_TM_KEY_INDEX and AM_SECURITY_TM_KEY_IV.

These parameters shall be included in a cyclical telemetry packet in any flight mode

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-897 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-07 16:42 |

4.4 On Board processors and softwares**4.4.1 Processing****E_YODA_SYS-1352 - Secure version of the MOBSW**

A secure version of the on-board software shall be present on board to ensure start-up in case of current on-board software corruption.


This version shall be stored in the QSPI flash, and the QSPI flash shall be OFF when not used, in order to be:

- immune to heavy ions,
- write-protected to avoid the risk of damage by other software.

This version shall be complete (i.e. it can perform all modes).

When ON, the QSPI internal write protection shall be activated (except for boot)


This version shall be rewritable but with huge precautions : A separate TC shall be necessary to disable the QSPI internal write protection only on the needed address range, before performing the software loading.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-446 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, SOFTWARE |
| ValidationMethod | Test, Test |
| Note | |
| Updated | 2023-02-15 11:18 |

E_YODA_SYS-1353 - Working versions of the MOBSW

Two working versions of the on-board software shall be present on board.

Each of those versions shall be stored in three copies in the NVM flash, in order to be robust to SEUs


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0550 (GEN) YODA-MC-REQ-0560 (GEN) YODA-MC-REQ-0570 (GEN) YODA-MC-REQ-0580 (GEN) |
| KineisLink | E_KINEIS_SYS-585 |
| subSystemAllocation | FSW, OPS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, SOFTWARE |
| ValidationMethod | Test, Test |
| Note | |
| Updated | 2023-02-17 17:14 |

E_YODA_SYS-1354 - On board software versions, partitions and default configuration

Secure Version and the 2 working versions shall have their own default configuration.

Each version shall be composed by several partition and for each partition, a configuration Table is associated and shall be stored in the same memory than the linked partition.


The platform shall allow to reload from ground a partition configuration table without reloading the associated partition.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0540 (GEN) YODA-MC-REQ-0550 (GEN) |
| KineisLink | E_KINEIS_SYS-584 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, SOFTWARE |
| ValidationMethod | Test, Test |
| Note | |
| Updated | 2023-02-17 17:14 |

E_YODA_SYS-1355 - Configuration of the MOBSW by the SDB

The MOBSW shall be configurable using data from the Satellite Database, this data to include at least:


- the description of the TM,
- the (default) values of the system and configurable parameters (e.g. for the AOCS functions),
- the (default) configuration of the on-board monitoring.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-599 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, SOFTWARE |
| ValidationMethod | Test, Inspection |
| Note | |
| Updated | 2023-03-20 11:05 |

E_YODA_SYS-1356 - Software delivery format and content


Each new software version shall be delivered in the following format:

- Binary files corresponding to the exactly data to be uploaded (raw data)
- A meta-data file by binary file containing at least the CRC of the binary file

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0620 (SPE) |
| KineisLink | E_KINEIS_SYS-720 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | requirement necessary for delivery to the command and control centre for in flight software upload. exact format will be described in the platform user manual. One binary file by software partition could be delivered |
| Updated | 2023-02-17 18:21 |


E_YODA_SYS-1797 - MOBSW selection at next Boot

It shall be possible by TC to modify the next FSW version identifier in context memory, <CTX_FSW_NEXT_VERSION>, to choose between the secure version or any of the two working versions.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0600 (GEN) |
| KineisLink | E_KINEIS_SYS-536 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Service 140 can be used |
| Updated | 2023-04-04 17:28 |

E_YODA_SYS-2560 - Integrity of the working MOBSW before start up


The OBC shall check perform a bitwise majority voting between the three copy of the working MOBSW version before launching the software.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-586 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-11 18:02 |

E_YODA_SYS-2561 - Reloading of the main on-board software in RAM buffer


It shall be possible, independantly of the mode, to reload a software from ground in the OBC RAM buffer dedicated to software load by service 6 TCs.

This load could be for a full software or a part of it (one or serveral SW partitions).

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-587 |
| subSystemAllocation | FSW, OPS, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-11 18:13 |

E_YODA_SYS-2562 - In-flight configuration of the main on-board softwar

It shall be possible to modify the values of the configuration data of any MOBSW version by ground TC. It shall be possible to dump these values. In case of reboot, the configuration stored in non volatile memory shall be used rather than the values modified by this TC.


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-589 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Modification is performed only in RAM with TC service 140 A save of the parameter in NVM shall be then done with Service (132,195) to save configuration data in NVM |
| Updated | 2023-04-11 18:13 |

E_YODA_SYS-2563 - Copying the main on-board software in NVM memory

It shall be possible, on ground TC request, **TC_DHS_LOW_COPY_BUFFER_NVM**, independantly of the mode, to copy the content of the OBC RAM buffer dedicated to software load into any of the three non volatile NVM memory zones dedicated to a MOBSW version.

Command containt the argument below:

- NVM address copy 1
- NVM adress copy 2
- NVM adress copy 3
- Data length to copy
- Offset inside buffer memory


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Command TC (132,115) |
| Updated | 2023-04-12 09:00 |

E_YODA_SYS-2564 - Copying the main on-board software in QSPI memory

It shall be possible, on ground TC request, **TC_DHS_LOW_COPY_BUFFER_QSPI**, independantly of the mode, to copy the content of the OBC RAM buffer dedicated to software load into any of the non volatile QPSI memory zones dedicated to a MOBSW version.


Command containt the argument below:

- QSPI address
- Data length to copy
- Offset inside buffer memory

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Command TC (132,125) |
| Updated | 2023-04-12 09:00 |

4.4.2 Observability**E_YODA_SYS-1495 - Software uploading observability**

An event shall be generated at the end of each NVM copy during FSW load. This event shall contain the copy number.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0550 (GEN) |
| KineisLink | E_KINEIS_SYS-732 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-17 17:14 |

E_YODA_SYS-1496 - Partition/OBSW Version

the platform shall make available for telemetry the following data:


- all partitions versions
- the current running OBSW version, <AM_DHS_CURRENT_OBSW_VERSION>,
- secure version
- one of the two working version.

All these parameters shall be inserted into synthetic packet, except partitions versions which should be into expertise packet.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-705 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | OBSW/partitions versions could be part of datapool. |
| Updated | 2023-02-15 11:18 |

4.5 Data Handling Sub-system Management**4.5.1 PUS standard services****4.5.1.1 General Standard LibPUS Services****E_YODA_SYS-865 - Use of LibPUS**

LibPus shall be used for the definition of PUS standard services.

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3090 YODA-MC-REQ-1110 (SPE) YODA-MC-REQ-1120 (SPE) YODA-MC-REQ-0160 (GEN) YODA-MC-REQ-0640 (GEN) YODA-MC-REQ-1090 (SPE) |
| KineisLink | E_KINEIS_SYS-451 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | LibPUS is based on PUS ISIS, [RD01]. |
| Updated | 2023-02-20 19:31 |

The following standard PUS services are implemented by the Platform.

| Service | Description |
|---------|-------------|
|---------|-------------|

| | |
|------|--|
| 1 | TC acknowledgement |
| 3 | Housekeeping service |
| 5 | Event management |
| 6 | Memory management |
| 9 | Time management |
| 11 | Time-based scheduling |
| 12 | On board monitoring |
| 14 | Packet forwarding service |
| 15 | On-board storage and retrieval |
| 17 | Test service |
| 19 | Event-action service |
| 140 | Parameter management |
| Note | Non conformance with the following services: Service 13 not implemented Service TC (3,130) not implemented |


4.5.1.2 PUS service 1 - TC Acknowledgement

E_YODA_SYS-541 - TC PUS Service 1

- The platform shall implement and use PUS Service 1 for Telecommand verification. Only acceptance and completion stage shall be implemented with the following sub-service :


| Service | Name | Description |
|---------|------------------------|--------------------------------|
| (1,1) | TM_001_001_TAR_SUCCESS | TC Acceptance report - Success |
| (1,2) | TM_001_002_TAR_FAILURE | TC Acceptance report - Failure |
| (1,7) | TM_001_007_TER_SUCCESS | TC Execution report - Success |
| (1,8) | TM_001_008_TER_FAILURE | TC Execution report - failure |

- The Platform shall notify to Ground, the success in the acceptance and the execution of commands only when a success report is requested by the Ground in the ACK field of the TC packet Data Field Header

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) YODA-MC-REQ-1310 (GEN) YODA-MC-REQ-1320 (GEN) |
| KineisLink | E_KINEIS_SYS-645 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | TAR: Tc Acceptance Report TER: Tc Execution Report |
| Updated | 2023-02-21 15:03 |


E_YODA_SYS-844 - Default acknowledgement request in Data Field Header

By default the positive acknowledgement (for acceptance and execution) shall be set for command sent by ground.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1340 (GEN) YODA-MC-REQ-1360 (GEN) |
| KineisLink | E_KINEIS_SYS-863 |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This shall be fixed into database by default to directly allow operation to check acceptance and execution result. |
| Updated | 2023-02-21 15:03 |


E_YODA_SYS-845 - NACK and NEXEC counter

A counter representing the number of TM(1,2) and TM(1,8) generated shall be implemented by FSW. Counter shall be cyclical

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1360 (GEN) |
| KineisLink | E_KINEIS_SYS-852 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 15:03 |

E_YODA_SYS-846 - Number of TC received


A counter representing the number of TC received from the ground dedicated to the platform shall be implemented by FSW.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-865 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This kind of TC shall get an APID= <SYS_PF_APID> |
| Updated | 2023-03-17 10:42 |

E_YODA_SYS-542 - Acknowledgement delay


The time between the completion of a command and the production of the related execution report shall not exceed a configurable value

<SPC_TC_VERIF_DELAY>

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1330 (GEN) |
| KineisLink | E_KINEIS_SYS-203 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | SPC_TC_VERIF_DELAY default value could be set to 1sec |
| Updated | 2023-02-21 15:03 |

E_YODA_SYS-543 - Acknowledgement for long command


For command that completion report (service 1) took place before the end of execution, observability about the end of execution shall be provided through HKTM (e.g event or parameter in cyclical packets).

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived (from KINEIS) |
| KineisLink | E_KINEIS_SYS-447 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | a list of long command could be defined in user manual |
| Updated | 2023-02-15 14:13 |

4.5.1.3 PUS service 3 - Housekeeping service**E_YODA_SYS-546 - PUS Service 3**


The platform shall implement and use PUS Service 3 for the generation of Housekeeping (HKTM) packet with the following sub-services:

| Service | Name | Description |
|---------|------------------------|--|
| (3,5) | TC_003_005_ENA_HK_GEN | Enable HK parameter report generation |
| (3,6) | TC_003_006_DIS_HK_GEN | Disable HK parameter report generation |
| (3,25) | TM_003_025 | HK parameter report |
| (3,144) | TC_003_144_REQ_HK_STAT | HK parameter report status report |
| (3,145) | TM_003_145_OR_HK_STAT | Report HK parameter report status |

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) |
| KineisLink | E_KINEIS_SYS-646 E_KINEIS_SYS-329 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Service TC (3,130) [Change HKTM dated collection interval] not implemented |
| Updated | 2023-02-15 15:35 |


E_YODA_SYS-547 - Service 3 : Mode configuration

The activation status of each TM_HK packets depending of the mode shall be defined in configuration table <CONF_SIDx_mode_S3_ENABLE> with "x" corresponding of the HK structure ID and "mode" to the mode of the satellite

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived (from KINEIS) |
| KineisLink | E_KINEIS_SYS-762 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-08-10 19:18 |

E_YODA_SYS-548 - Service 3 : Mode configuration at mode entry


On mode entry, the platform shall activate (enable or disable) each PUS service 3 Sid according to the respective mode configuration table <CONF_SIDx_mode_S3_ENABLE>..

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived (from KINEIS) |
| KineisLink | E_KINEIS_SYS-763 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-10 19:18 |

E_YODA_SYS-549 - Housekeeping Structure ID range

Within the same APID each HK packet defined shall have its own SID in order to differentiate them.

The platform SID shall be in range [0x0; 0x7FFFFFFF]


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1700 (SPE) |
| KineisLink | E_KINEIS_SYS-713 |
| subSystemAllocation | BDS |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | For Payload the defined range is [0x80000000, 0xFFFFFFFF] |
| Updated | 2023-02-21 15:14 |

4.5.1.4 Pus service 5 - Event management

E_YODA_SYS-551 - PUS Service 5

The platform shall implement and use PUS Service 5 for Event management and generation with the following sub-services:


| Service | Name | Description |
|---------|-------------------------|--|
| (5,1) | TM | Normal/Progress report |
| (5,2) | TM | Error or anomaly report of low severity |
| (5,3) | TM | Error or anomaly report of medium severity |
| (5,4) | TM | Error or anomaly report high severity |
| (5,5) | TC_005_005_ENA_EVT_GEN | Enable event report generation |
| (5,6) | TC_005_006_DIS_EVT_GEN | Disable event report generation |
| (5,131) | TC_005_131_REQ_EVT_STAT | Report status of event report generation |
| (5,132) | TM_005_132_OR_EVT_STAT | Status of event report generation report |

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1370-p YODA-MC-REQ-1110 (SPE) |
| KineisLink | E_KINEIS_SYS-330 E_KINEIS_SYS-647 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 15:35 |

E_YODA_SYS-552 - Event report Criticality level definition


Event report should be classified according to its criticality. Four level are defined:

- Level 1: Normal or progress report
- Level 2: Minor errors not triggering a FDIR directly
- Level 3: Autonomous FDIR with limited ground needs - (TBC -thermal control)
- Level 4: Mission data loses or autonomous FDIR critical or needing ground to fully recover

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0760 (GEN) |
| KineisLink | E_KINEIS_SYS-813 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-04-07 09:47 |


E_YODA_SYS-849 - Event report counters

A counter for each level of event should be managed on-board. These counters should be roll over and available in the housekeeping telemetry.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-706 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | AM_DHS_EVENT_COUNTER_HIGH AM_DHS_EVENT_COUNTER_MEDIUM AM_DHS_EVENT_COUNTER_LOW AM_DHS_EVENT_COUNTER_NOM |
| Updated | 2023-02-15 14:13 |


E_YODA_SYS-553 - PF RID range.

Event report RID generated by the platform shall be in the range <PF_RID_RANGE> = [0, 65535]

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-810 (SPE) |
| KineisLink | E_KINEIS_SYS-707 |
| subSystemAllocation | BDS, FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | On Payload side, RID PL range = [65536, 4 294 967 295] |
| Updated | 2023-02-20 15:44 |


E_YODA_SYS-554 - Event report ID unicity.

The event report RID shall identify uniquely the event reported.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-828 |
| subSystemAllocation | BDS, FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-02-15 14:13 |


E_YODA_SYS-1796 - Event report spare

<FSW_NB_SPARE_EVENT> Spare event shall be instantiated into database and service 5 for operational FDIR needs.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1540 (SPE) |
| KineisLink | E_KINEIS_SYS-814 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | <FSW_NB_SPARE_EVENT> = 30 |
| Updated | 2023-06-16 17:29 |

E_YODA_SYS-555 - Event report content

An event reports shall contain at least the type of failure and its location.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-830 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:13 |

E_YODA_SYS-850 - Last critical event observability

The RID and the date of the last critical event (High and medium only) should be stored in context parameters. This parameters should be reported into HK packet


<CTX_LAST_CRIT_EVENT_RID>

<CTX_LAST_CRIT_EVENT_DATE>

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-727 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Minor event are not saved in context |
| Updated | 2023-02-28 16:20 |

E_YODA_SYS-851 - Event Id management

The list of Event ID shall be defined in database.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-542 |
| subSystemAllocation | BDS |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | This list shall be the same for both satellite |
| Updated | 2023-02-15 14:13 |

4.5.1.5 Pus service 6 - Memory management

E_YODA_SYS-557 - PUS Service 6

The platform shall implement and use PUS Service 6 for memory area access with the following sub-services:


| Service | Name | Description |
|---------|------------------------|---|
| (6,2) | TC_006_002_LOAD_MEMORY | Load memory using absolute addresses |
| (6,5) | TC_006_005_DUMP_MEMORY | Dump memory using absolute addresses |
| (6,6) | TM_006_006_MEMORY_DUMP | Memory dump using absolute addresses report |
| (6,9) | TC_006_009_REQ_CHK_MEM | Check memory using absolute addresses |
| (6,10) | TM_006_010_OR_CHK_MEM | Memory check using absolute addresses |

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) YODA-MC-REQ-0540 (GEN) YODA-MC-REQ-0610 (GEN) YODA-MC-REQ-0630 (GEN) YODA-MC-REQ-0660 (GEN) YODA-MC-REQ-0670 (GEN) YODA-MC-REQ-0680 (GEN) YODA-MC-REQ-0700 (GEN) |
| KineisLink | E_KINEIS_SYS-648 E_KINEIS_SYS-518 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-28 16:16 |

E_YODA_SYS-558 - Service 6 memory access

The following memory areas shall be accessible by PUS service 6 for read and write accesses:


- OBC RAM, except areas used for cryptography
- NVM
- QSPI, except areas used for cryptograph

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-688 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:14 |

E_YODA_SYS-852 - Service 6 LibPUS configuration

The service 6 memory ID shall be configured as follow to allow access to the listed memories:

| MID | Memory | Range/Size | Access | Type of Memory | Comment/Constraints | Parameter of Size in bytes of the smallest addressable unit (SAU) | Parameter of The maximum size of data (in SAU) that can be addressed in one TC | Parameter of Size in SAUs of the elementary memory word handled |
|-----|--------------|---|----------------|-------------------------|---|---|--|---|
| 0 | OBC_BUFFER | 20 MB | Read and Write | OBC internal RAM | RAM buffer for PUS132 | S6_MEMORY_0_SAU | S6_MEMORY_0_LSIZE | S6_MEMORY_0_WSIZE |
| 1 | OBC_RAM | 448 MB (exclude crypto size according to mapping) | Read and Write | OBC internal RAM | except areas used for cryptography | S6_MEMORY_1_SAU | S6_MEMORY_1_LSIZE | S6_MEMORY_1_WSIZE |
| 2 | OBC_NVM | 1 GB | Read and Write | OBC internal NAND Flash | page size = 2KB | S6_MEMORY_2_SAU | S6_MEMORY_2_LSIZE | S6_MEMORY_2_WSIZE |
| 3 | OBC_QSPI | 16 MB | Read and Write | OBC internal QSPI | page size = 256B except areas used for cryptography | S6_MEMORY_3_SAU | S6_MEMORY_3_LSIZE | S6_MEMORY_3_WSIZE |
| 4 | FGPA_REG | 320 KB | Read Only | FPGA registers | except areas used for cryptography | S6_MEMORY_4_SAU | S6_MEMORY_4_LSIZE | S6_MEMORY_4_WSIZE |
| 5 | QSPI_CONTROL | all | Read Only | ZYNQ registers | except areas used for cryptography | S6_MEMORY_5_SAU | S6_MEMORY_5_LSIZE | S6_MEMORY_5_WSIZE |


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-690 |
| subSystemAllocation | SDB, OPS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-10 10:16 |

4.5.1.6 Pus service 9 - Time management

E_YODA_SYS-560 - PUS Service 9

The platform shall implement and use PUS Service 9 for Time Management with the following sub-services:

| Service | Name | Description |
|---------|----------------------------|-------------------------------------|
| (9,2) | TM_009_002_TR_TIME | Time report |
| (9,128) | TC_009_128_CHG_TIME_ABS | Change on-board time absolute value |
| (9,129) | TC_009_129_CHG_TIME_OFFSET | Change time offset |

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) |
| KineisLink | E_KINEIS_SYS-331 E_KINEIS_SYS-649 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Non Standard TM9.2 generation. On YODA, at the end of each HKTM-P, frame generation tag is added |
| Updated | 2023-02-15 15:35 |

E_YODA_SYS-853 - Time packet format

Time packet (9,2) shall respect PUS ISIS format defined as follow:

| Rate | Satellite Time | Status |
|------------------|----------------|------------|
| Unsigned Integer | Absolute Time | Enumerated |
| 1 byte | 7 bytes | 1 byte |
| Optional | | Optional |


Figure 10 structure of time packet

The optional field **Rate** shall be absent(not used).

Satellite time: time of generation of the packet, computed from the ?time? message broadcasted by the spacecraft bus, and expressed with TAI reference under the CUC format with OBT.

Status: status time composed of:

- Synchronization state (bit0) filled with <AM_OBT_SOURCE> as follow:
 - 1= "GNSS-slaved" time mode" (time synchronized with GNSS time)
 - 0 ="Free-running" time mode (time propagated from free-running local oscillator)
- Quality of time (bit 1 to 7): shall not be used

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-2060 (SPE) |
| KineisLink | E_KINEIS_SYS-799 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | <p>-The packet definition can be found in "Tailored PUS for ISIS missions" ref ISIS-SY- IF-123- CNES</p> <p>- Filled data follow time in packet header as defined in E_YODA_SYS-1523</p> <p>- As 'Rate' Field is not needed, Time packet is on 8 bytes only (Satellite Time + Status time)</p> |
| Updated | 2023-07-18 10:27 |


4.5.1.7 Pus service 11 - On-Board Operations Scheduling Service

Management of this service 11 is detailed in chapter 4.4.5 [Schedule management \(MTL\)](#) .

E_YODA_SYS-562 - Pus service 11

The platform shall implement PUS service 11 to perform operation in differed time, with the following sub-services:

| Service | Name | |
|---------|--------------------------|--|
| (11,1) | TC_011_001_ENA_TCSCCH | TC enable release of TCs |
| (11,2) | TC_011_002_DIS_TCSCCH | TC disable release of TCs |
| (11,3) | TC_011_003_RST_TCSCCH | TC reset command schedule |
| (11,4) | TC_011_004_INSERT_TC_TTG | TC insert TCs in command schedule |
| (11,6) | TC_011_006_DEL_TC | TC delete TC over time period |
| (11,13) | TM_011_013_OR_SCH_SUM | TM summary schedule report |
| (11,17) | TC_011_017_REQ_SCH_SUM | TC report command schedule in summary form |
| (11,18) | TC_011_018_REQ_SCH_STAT | Report status of command schedule |
| (11,19) | TM_011_019_OR_SCH_STAT | Command schedule status report |


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) YODA-MC-REQ-1370 (GEN) YODA-MC-REQ-1370 (GEN) YODA-MC-REQ-1380 (GEN) YODA-MC-REQ-1390 (GEN) YODA-MC-REQ-1400 (GEN) YODA-MC-REQ-1420 (GEN) YODA-MC-REQ-1490 (SPE) |
| KineisLink | E_KINEIS_SYS-478 E_KINEIS_SYS-650 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>-The following service are not implemented (TBC implementation of these service on YODA)::</p> <ul style="list-style-type: none"> • S(11,14): Report Subset of command Schedule in summary Form over a Time Period • S(11,129): Enable Safely release of TC <p>-Specific TC(132,150) will be used to save schdule in NVM.</p> |
| Updated | 2023-02-21 15:03 |

4.5.1.8 Pus service 12 - On board monitoring

E_YODA_SYS-570 - Service 12 sub-service applicable


The platform shall implement PUS service 12 to perform on-board parameters monitoring, with the following sub-services:

| Service | Name | Description |
|----------|---------------------------|--|
| (12,1) | TC_012_001_ENA_MON | Enable monitoring of parameters |
| (12,2) | TC_012_002_DIS_MON | Disable monitoring of parameters |
| (12,5) | TC_012_005_ADD_MON | Add parameter monitoring to parameter monitoring list |
| (12,6) | TC_012_006_DEL_MON | Delete parameter monitoring to parameter monitoring list |
| (12,7) | TC_012_007_CHG_MON | Modify parameter checking information |
| (12,140) | TC_012_140_REQ_MON_ITEMS | Report current parameter monitoring items |
| (12,141) | TM_012_141_OR_MON_ITEMS | Current parameter monitoring items report |
| (12,142) | TC_012_142_REQ_ALL_MID_ST | TC report all MID status |
| (12,143) | TM_012_143_OR_ALL_MID_ST | TM all MID status report |

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) YODA-MC-REQ-2230 (GEN) YODA-MC-REQ-2280 (GEN) YODA-MC-REQ-2290 (GEN) ISIS-MC-REQ-2300 (GEN) YODA-MC-REQ-2310 (GEN) |
| KineisLink | E_KINEIS_SYS-332 E_KINEIS_SYS-651 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-03 19:10 |

E_YODA_SYS-571 - Spare monitoring

The platform shall implement PUS service 12 in order to have <FSW_NB_SPARE_MONITORING> spare monitorings available for operation needs.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-2320 (GEN) |
| KineisLink | E_KINEIS_SYS-448 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <FSW_NB_SPARE_MONITORING> = 15 |
| Updated | 2023-02-21 18:05 |

E_YODA_SYS-572 - Service 12 : Mode configuration

On mode entry, the Flight software shall activate (enable or disable) each PUS service 12 monitoring according to the respective mode defined in a configuration table


<CONF_MONx_MAINT_ENABLE>

<CONF_MONx_AUTO_ENABLE>

<CONF_MONx_MSAF_ENABLE>


<CONF_MONx_MNOM_ENABLE>

With x the monitoring ID

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-2270 (GEN) |
| KineisLink | E_KINEIS_SYS-770 E_KINEIS_SYS-769 |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-15 16:06 |


E_YODA_SYS-573 - Service 12 Monitoring check type.

The onboard monitoring check type shall be limit or expected-value.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-815 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | delta check is not implemented |
| Updated | 2023-02-15 14:14 |


E_YODA_SYS-868 - Service 12 : Default configuration

The platform shall implement PUS service 12 default configuration for each monitoring depending of the satellite mode.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-683 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:14 |

E_YODA_SYS-869 - Service 12 : Onboard monitoring status change report

The platform shall report to the ground segment all changes of monitoring


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-832 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | Done in LibBus LibPUS do not generate event when monitoring enter into the nominal limit. |
| Updated | 2023-02-15 14:14 |

4.5.1.9 Pus service 14 - Packet forwarding service

E_YODA_SYS-575 - Service 14 - Packet forwarding service


The platform shall implement PUS service 14 to perform packet forwarding control, with the following sub-services:

| Service | Name | Description |
|---------|----------------------|--|
| (14,5) | TC_014_005_ENA_TM_HK | Enable forwarding of housekeeping packets |
| (14,6) | TC_014_006_DIS_TM_HK | Disable forwarding of housekeeping packets |
| (14,7) | TC_014_007_REQ_TM_HK | Report enabled housekeeping packets |
| (14,8) | TM_014_008_OR_TM_HK | Enabled housekeeping packets report |

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) |
| KineisLink | E_KINEIS_SYS-652 E_KINEIS_SYS-349 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | The following Sub-service are not implemented on YODA: TC (14,1) : Enable forwarding of Telemetry Source Packets TC (14,2) : Disable forwarding of Telemetry Source Packets TC (14,3) / TM (14,4) : Report enabled Telemetry Source Packets TC (14,13) : Enable Forwarding of Event Report Packets TC (14,14) : Disable Forwarding of Event Report Packets TC (14,15) : Report Enabled Event Report Packets TM (14,16) : Enabled Event Report Packets Report |
| Updated | 2023-02-15 15:35 |


E_YODA_SYS-870 - Service 14 : PUS Service 14 default configuration

the platform shall implement for service 14, a default configuration for each HK packet depending of the satellite mode. This include PL and Tx HK packet.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-456 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:14 |

E_YODA_SYS-871 - Service 14 : Packet forwarding frequency


Packet frequency forwarding shall be defined using PUS service 14.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-373 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:14 |

4.5.1.10 Pus service 15 - On-board storage and retrieval**E_YODA_SYS-577 - Service 15: On-board storage and retrieval**

The platform shall implement PUS service 15 for packets on-board storage, with the following sub-services:

| Service | Name | Description |
|----------|-----------------------------|---------------------------------------|
| (15,9) | TC_015_009_DWLK_BT_DATE | Downlink store contents between dates |
| (15,10) | TC_015_010_DEL_FULL_CONTENT | Delete packet stores full content |
| (15,128) | TC_015_128_START_RETRIEVAL | Start packet store retrieval |
| (15,129) | TC_015_129_STOP_RETRIEVAL | Stop packet store retrieval |


| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) YODA-MC-REQ-1850 (GEN) YODA-MC-REQ-1950 (GEN) YODA-MC-REQ-1960 (GEN) YODA-MC-REQ-1970 (GEN) |
| KineisLink | E_KINEIS_SYS-479 E_KINEIS_SYS-653 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-03 19:10 |

4.5.1.11 Pus service 17 - Test service

E_YODA_SYS-890 - PUS Service 17

The platform shall implement PUS service 17 for test service, with the following sub-services:

| Service | Name | Description |
|---------|-------------------------------|--------------------------------|
| (17,1) | TC_017_PING (TBD for name) | Perform connection Test (ping) |
| (17,2) | TM_017_TEST_CONNECTION_REPORT | Connection Test report |


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p |
| KineisLink | E_KINEIS_SYS-333 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 15:35 |

4.5.1.12 Pus service 19 - Event-Action service

E_YODA_SYS-581 - PUS Service 19


The platform shall implement PUS service 19 for on-board event action management, with the following sub-services:

| Service | Name | Description |
|----------|-------------------------|------------------------------------|
| (19,1) | TC_019_001_ADD_EVT | Add events to the detection list |
| (19,2) | TC_019_002_DEL_EVT | Delete event to the detection list |
| (19,4) | TC_019_004_ENA_ACTION | Enable actions |
| (19,5) | TC_019_005_DIS_ACTION | Disable actions |
| (19,6) | TC_019_006_REQ_EVT_LIST | Report the event detection list |
| (19,7) | TM_019_007_OR_EVT_LIST | Event detection list report |
| (19,130) | TC_019_130_REQ_EVT | Report event detection |
| (19,131) | TM_019_131_OR_EVT | Event detection report |

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) YODA-MC-REQ-1500 (GEN) YODA-MC-REQ-1520 (GEN) |
| KineisLink | E_KINEIS_SYS-555 E_KINEIS_SYS-654 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-03 19:10 |


E_YODA_SYS-582 - Event to action coupling spare

The platform shall reserve <FSW_NB_EVT_ACT_SPARE> spare event actions to be available for operation.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1530 (SPE) |
| KineisLink | E_KINEIS_SYS-812 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | <FSW_NB_EVT_ACT_SPARE>=30 (TBD) |
| Updated | 2023-02-21 15:03 |


E_YODA_SYS-583 - Service 19 high priority command

Commands triggered as a result of service 19 shall have the highest priority.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1510 (GEN) |
| KineisLink | E_KINEIS_SYS-692 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-02-21 15:05 |

E_YODA_SYS-584 - Event action command


The platform shall allow any commands available for transmission from the ground segment as service 19 Onboard actions

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-810 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, +++, SOFTWARE |
| ValidationMethod | Test, +++, Analysis |
| Note | At system Level, a validation is performed for some event only |
| Updated | 2023-02-15 14:16 |

E_YODA_SYS-891 - Acknowledgements and sequence count for events actions

Into satellite database the actions should be configured to :

- Generate the positive acceptance and completion positive acknowledgements
- One unique specific sequence count by action
- source ID set to <ID_OBC_FDIR>


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-811 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Analysis |
| Note | |
| Updated | 2023-02-15 14:16 |

4.5.1.13 Pus service 140 - Parameter management

E_YODA_SYS-586 - PUS Service 140

The platform shall implement PUS service 140 to perform on-board parameters management, with the following sub-services:

| Service | Name | Description |
|---------|----------------------------|------------------------|
| (140,1) | TC_140_001_SET_PARAM_VALUE | Set parameter Value |
| (140,2) | TC_140_002_REPORT_REQUEST | Report parameter Value |
| (140,3) | TM_140_003_REPORT_VALUE | parameter Value report |

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_3100-p YODA-MC-REQ-1110 (SPE) YODA-MC-REQ-0720 (GEN) YODA-MC-REQ-0730 (GEN) |
| KineisLink | E_KINEIS_SYS-655 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-02 10:10 |

4.5.2 PUS Tailoring


4.5.2.1 General PUS Specific services

For platform mission need a PUS specific services will be implemented. Applicability of each service will be describe in the next requirements of this chapter.

| Service | Description |
|---------|--|
| 130 | DHS On board management (DHS) |
| 131 | DHS High priority function (DHS_HIGH) |
| 132 | DHS On bord management Low priority (long Command) (DHS_LOW) |
| 135 | TTC function (TTC) |
| 150 | EPS function (EPS) |
| 160 | TC Security function (SECURITY_TC) |
| 161 | Security Management and TM function (SECURITY_TM) |
| 180 | Thermal function (THERMAL) |
| 185 | Asynchronous management of platform units (AIT/IOT) (ASYN) |
| 187 | Functional management of platform units (AIT/IOT) (FUNC) |
| 220 | Payload management EGCU Service |
| 225 | Payload management GYSELE Service |


E_YODA_SYS-1363 - Mission specific PUS service range

Platform mission specific PUS services shall be in the range <SPC_PF_MISSION_PUS_SERVICE_RANGE>

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-642 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, SYSTEM |
| ValidationMethod | Test, Inspection |
| Note | <ul style="list-style-type: none">• <SPC_PF_MISSION_PUS_SERVICE_RANGE> = [128, 191]• For payload, defined Specific PUS range is [192, 255] but don't care at PF level as Dest_ID will be PAYLOAD |
| Updated | 2023-02-20 19:31 |


E_YODA_SYS-1364 - Mission specific sub-service of standard PUS services range

Sub-service mission specific of standard PUS services shall be in the range <SPC_PF_MISSION_SUBSERVICE_OF_STD_PUS_RANGE>

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1090 (SPE) |
| KineisLink | E_KINEIS_SYS-642 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-02-28 16:33 |

E_YODA_SYS-1365 - Specific PUS services - TMTC format

For specific PUS services packet header and trailer shall be encoded according the Packet Utilisation Standard (PUS) ECSS-E-70-41A as tailored (PUS ISIS, [RD01])


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-2130 (GEN) |
| KineisLink | E_KINEIS_SYS-105 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | Since the LibPUS is used for header forming, the subcounter will be set to 0 in non conformity with the PUS ISIS |
| Updated | 2023-02-21 17:41 |

4.5.2.2 Specific PUS Service 130

E_YODA_SYS-1367 - Specific PUS service 130 and sub-services used

The platform shall implement the Specific PUS service 130 to be used for On-board DHS management with the sub-service listed in the following table:

| Service | Name | Description | Reference |
|----------|----------------------------|---------------------------------------|-----------------|
| (130,1) | TC_DHS_SET_ARM_PASSIVATION | Passivation arming or desarming | |
| (130,2) | TC_DHS_SET_OBT_DRIFT | Correct drift OBT for packet time tag | E_YODA_SYS-1814 |
| | | | |
| (130,10) | TC_DHS_MODE_TRANSITION | Command mode transition | E_YODA_SYS-1359 |


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-663 E_KINEIS_SYS-664 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-03 19:10 |

4.5.2.3 Specific PUS Service 131

E_YODA_SYS-1369 - Specific PUS service 131 and sub-services used

The platform shall implement the Specific PUS service 131 to be used for DHS on board management high priority function with the sub-service listed in the following table:

| Service | Name | Description | Reference |
|-----------|-------------------------|------------------------------------|-----------------|
| (131,2) | TC_DHS_HIGH_RESTART_SC | Restart spacecraft and go to MSAF | E_YODA_SYS-2055 |
| (131,110) | TC_DHS_HIGH_REBOOT_OBC | Reboot OBC | E_YODA_SYS-2545 |
| (131,112) | TC_DHS_LOW_BATTERY_FDIR | Reboot spacecraft with secure OBSW | E_YODA_SYS-2547 |


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-665 E_KINEIS_SYS-666 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-03 19:10 |

4.5.2.4 Specific PUS Service 132

E_YODA_SYS-1371 - Specific PUS service 132 and sub-services used

The platform shall implement the Specific PUS service 132 to be used for DHS on board management low priority function with the sub-service listed in the following table:

| Service | Name | Description | Reference |
|-----------|---|--|--------------------------|
| (132,110) | TC_DHS_LOW_SET_MEM_STATUS | Set memory write status for NVM or QSPI | E_YODA_SYS-670 |
| (132,115) | TC_DHS_LOW_COPY_BUFFER_NVM | Copy buffer memory in NVM | E_YODA_SYS-2563 |
| (132,160) | TC_DHS_LOW_AUTORISATION_WRITE_QSPI | Autorisation to write in some QSPI sectors | E_YODA_SYS-1535 |
| (132,125) | TC_DHS_LOW_COPY_BUFFER_QSPI | Copy buffer memory to QSPI | E_YODA_SYS-2564 |
| (132,170) | TC_DHS_LOW_READ_FRAM | Read FRAM | E_YODA_SYS-2604 |
| (132,175) | TM_DHS_LOW_READ_FRAM | TM read of FRAM | E_YODA_SYS-2604 |
| (132,180) | TC_DHS_LOW_WRITE_FRAM | Write FRAM | E_YODA_SYS-2605 |
| (132,150) | TC_DHS_LOW_SAVE_SCD_NVM | Save schedule to NVM memory | E_YODA_SYS-1807 |
| (132,140) | TC_DHS_LOW_TRANSFERT_DATA_PCDU | Transfert data to PCPU (data in RAM) | E_GEN_PCDU_EREMS_SYS-535 |
| (132,190) | TC_DHS_LOW_SAVE_PUS_SERVICE_CONFIGURATION | Save the configuration of PUS service | E_YODA_SYS-866 |
| (132,195) | TC_DHS_LOW_SAVE_CONF_TABLE | Save configuration table to NVM | E_YODA_SYS-677 |


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0610 (GEN) |
| KineisLink | E_KINEIS_SYS-668 E_KINEIS_SYS-667 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-03 19:10 |

4.5.2.5 Specific PUS Service 135

E_YODA_SYS-1373 - Specific PUS service 135 and sub-services used

The platform shall implement the Specific PUS service 135 to be used for TTC function with the sub-service listed in the following table:

| Service | Name | Description | Reference |
|---------|-----------------------------|---|------------------------------------|
| (135,2) | TC_TTC_RESET_SBAND | Reset the SBAND | E_YODA_SYS-1440 |
| (135,4) | TC_TTC_TX_TRANSMISSION_MODE | Set Tx transmission mode (Modulation or Standby Mode) | E_YODA_SYS-1475 |
| (135,5) | TC_TTC_SET_SBAND_TMTC_FREQ | Select communication frequency (TC frequency or TM frequency of SBAND | E_YODA_SYS-1441 E_YODA_SYS-1442 |
| (135,6) | TC_TTC_SET_ACTIVATION_TX | Activation or deactivation for a transmitter | E_YODA_SYS-1476 E_YODA_SYS-1477 |
| (135,8) | TC_TTC_TM_BIT_RATE | HIGH (50kbits) or LOW (2Kbit/s) | E_YODA_SYS-2571 |


| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-670 E_KINEIS_SYS-669 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | To keep all TC name on HEMERIA side in accordance with service/subService, the sub service 1,3,7 are not used on YODA because already used on other Hemeria project |
| Updated | 2023-08-03 19:15 |

4.5.2.6 Specific PUS Service 150

E_YODA_SYS-1375 - Specific PUS service 150 and sub-services used

The platform shall implement the Specific PUS service 150 to be used for EPS function with the sub-service listed in the following table:

| Service | Name | Description | Reference |
|----------|------------------------|-----------------------------|--|
| (150,60) | TC_EPS_RAW_CMD_PCDU | Send command to PCDU | E_GEN_PCDU_EREMS_SYS-493 E_YODA_SYS-900 |
| (150,61) | TM_EPS_REPORT_PCDU_CMD | Report of TM PCDU ask by TC | E_GEN_PCDU_EREMS_SYS-493 |


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-672 E_KINEIS_SYS-671 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-24 12:18 |

4.5.2.7 Specific PUS Service 160

E_YODA_SYS-1379 - Specific PUS service 160 and sub-services used

The platform shall implement the Specific PUS service 160 to be used for TC security function with the sub-service listed in the following table:

| Service | Name | Description | Reference |
|---------|-----------------------|--|-----------|
| (160,1) | TC_TC_KEY_DESTRUCTION | Invalidate a TC key | |
| (160,2) | TC_TC_KEY_INVENTORY | Request the validity and CRC status for a given TC key index | |
| (160,3) | TM_TC_KEY_INVENTORY | Return the validity and CRC status for a given TC key index | |
| (160,4) | TC_READ_ARSN | Read the ARSN counter for a given TC key index | |
| (160,5) | TM_READ_ARSN | Return the ARSN counter for a given TC key index | |


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-873 E_KINEIS_SYS-872 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-03 19:15 |

4.5.2.8 Specific PUS Service 161

E_YODA_SYS-1381 - Specific PUS service 161 and sub-services used

The platform shall implement the Specific PUS service 161 to be used for TM security function with the sub-service listed in the following table:

| Service | Name | Description | Reference |
|----------|---------------------|--|-----------|
| (161,2) | TC_TM_KEY_INVENTORY | Request the validity and CRC status for a given TM key index | |
| (161,3) | TM_TM_KEY_INVENTORY | Return the validity and CRC status for a given TM key index | |
| (161,4) | TC_READ_IV | Read the IV counter for a given TM key index | |
| (161,5) | TM_READ_IV | Return the IV counter for a given TM key index | |
| (161,10) | TC_SELECT_TM_KEY | Select the TM key to be used for Payload TM emission | |


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-662 E_KINEIS_SYS-661 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 11:10 |

4.5.2.9 Specific PUS Service 180

E_YODA_SYS-1385 - Specific PUS service 180 and sub-services used

The platform shall implement the Specific PUS service 180 to be used for Thermal function with the sub-service listed in the following table:


| Service | Name | Description | Reference |
|---------|------------------------------------|---|-----------------|
| (180,1) | TC_THERMAL_SET_ACT_STATUS | Activation or desactivation of a thermal control | E_YODA_SYS-2313 |
| (180,2) | TC_THERMAL_SET_STATUS_THERMAL_ZONE | Activation or desactivation of thermal control for a specified thermal zone | E_YODA_SYS-2314 |

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-676 E_KINEIS_SYS-675 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-28 11:45 |

4.5.2.10 Specific PUS Service 185**E_YODA_SYS-1387 - Specific PUS service 185 and sub-services used**

The platform shall implement the Specific PUS service 185 to be used for Asynchronous management of platform units thanks the sub-service listed in the following table:

| Service | Name | Description | Reference |
|-----------|------------------------|-------------------------------|--|
| (185,2) | TC_ASYNC_SET_POWER_LCL | Switch ON/OFF specified LCL | E_YODA_SYS-897 |
| (185,150) | TC_ASYNC_RAW_UNIT_CMD | Raw command for a flight unit | E_GEN_SADM200_SYS-1035 E_YODA_SYS-900 |
| (185,151) | TM_ASYNC_RAW_UNIT_REQ | Flight unit raw TM response | |


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-678 E_KINEIS_SYS-677 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-24 12:18 |

4.5.2.11 Specific PUS Service 187

E_YODA_SYS-1389 - Specific PUS service 187 and sub-services used

The platform shall implement the Specific PUS service 187 to be used for Functional Management of platform units thanks the sub-service listed in the following table:

| Service | Name | Description | Reference |
|----------|-----------------------------|--|-----------------------|
| (187,1) | TC_FUNC_CYCLIC_UNIT_ACQ | Start or stop cyclic acquisitions of a flight unit | E_YODA_SYS-901 |
| (187,2) | TC_FUNC_ACT_DEACT_UNIT | Activation/Deactivation of a flight unit | E_YODA_SYS-902 |
| (187,25) | TC_FUNC_SET_RW_TORQUE | Set torque programming of a RW | E_YODA_SYS-1543 |
| (187,26) | TC_FUNC_STOP_RW_TORQUE | Stop torque programming of a RW | E_YODA_SYS-1544 |
| (187,40) | TM_FUNC_STR_DIAG_REPORT | This telemetry is STR diagnostic TM | |
| (187,30) | TC_FUNC_FORCE_SADM_POSITION | Set SADM Position | E_GEN_SADM200_SYS-970 |


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-2450 (SPE) YODA-MC-REQ-2460 (SPE) |
| KineisLink | E_KINEIS_SYS-679 E_KINEIS_SYS-680 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-09 18:20 |

4.5.2.12 Specific PUS Service 220 PAYLOAD EGPU

E_YODA_SYS-1391 - Specific PAYLOAD PUS service 220 and sub-services

The platform shall implement the Specific PUS service 220 to be used for Payload EGCU Management with the sub-service listed in the following table:


| Service | Name | Description | Reference |
|---------|------|-------------|-----------|
| (220,1) | TBD | TBD | |
| (220,2) | TBD | TBD | |
| | | | |

| | |
|-----------------------|---|
| ReqStatus |  Draft |
| LinkedUpReq | YODA-MC-REQ-0320 (GEN) |
| KineisLink | E_KINEIS_SYS-682 E_KINEIS_SYS-681 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-10 16:00 |

4.5.2.13 Specific PUS Service 225 PAYLOAD GYSELE**E_YODA_SYS-2300 - Specific PAYLOAD PUS service 225 and sub-services**

The platform shall implement the Specific PUS service 220 to be used for Payload EGCU Management with the sub-service listed in the following table:

| Service | Name | Description | Reference |
|---------|------------------------|---------------------|-----------|
| (225,1) | TC_PAYLD_ATTITUDE_TBC | Attitude | |
| (225,2) | TC_PAYLD_MANOEUVRE_TBC | Manoeuvrer commanbd | |

| | |
|-----------------------|---|
| ReqStatus |  Draft |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-12 11:14 |

4.5.3 Telemetry, Tracking, and Control Management

This chapter specifies all need about on board management of TM/TC packets

4.5.3.1 TTC Function

E_YODA_SYS-1426 - Command when Ground station available (deleted)

| | |
|-----------------------|----------------------------------|
| ReqStatus | ✖ Deleted |
| LinkedUpReq | |
| KineisLink | E_KINEIS_SYS-317 |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | No more needed on YODA |
| Updated | 2023-04-12 11:16 |

E_YODA_SYS-1427 - Autonomous actions to performed at ground station contact (deleted)

| | |
|-----------------------|----------------------------------|
| ReqStatus | ✖ Deleted |
| LinkedUpReq | |
| KineisLink | E_KINEIS_SYS-322 |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | No more needed on YODA |
| Updated | 2023-04-12 11:16 |

E_YODA_SYS-1499 - Tx emission flag (Deleted)

| | |
|-----------------------|---------------------------------------|
| ReqStatus | ✖ Deleted |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-748 |
| subSystemAllocation | |
| implementationVersion | V0 |
| ValidationLevel | |
| ValidationMethod | |
| Note | CTX_TX_EMISSION no more needed |
| Updated | 2023-07-12 18:15 |

E_YODA_SYS-1500 - Ground station available elapse time (deleted)

| | |
|-----------------------|------------------------|
| ReqStatus | ✖ Deleted |
| LinkedUpReq | |
| KineisLink | E_KINEIS_SYS-774 |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | No more nedeed on YODA |
| Updated | 2023-04-12 11:12 |


E_YODA_SYS-1501 - Behavior in case of reboot during a ground station contact (deleted)

| | |
|-----------------------|------------------------|
| ReqStatus | ✖ Deleted |
| LinkedUpReq | |
| KineisLink | E_KINEIS_SYS-745 |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | No more nedeed on YODA |
| Updated | 2023-04-12 11:12 |

4.5.3.2 TM/TC management**4.5.3.2.1 General**


E_YODA_SYS-1502 - TM and TC packets standard

Telecommands and telemetry packets shall be encoded according to the Packet Utilisation Standard (PUS). Tailoring PUS ISIS shall be implemented.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1120 (SPE) YODA-MC-REQ-1130 (SPE) YODA-MC-REQ-1160 (GEN) |
| KineisLink | E_KINEIS_SYS-105 E_KINEIS_SYS-106 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | Structure and format of the TM and TC PUS packets shall be defined in a [RD03] (TM/TC ICD document). |
| Updated | 2023-02-21 10:35 |


E_YODA_SYS-1503 - APID differentiation

PF and PL packets shall be differentiated using APID values and PF packets APID shall be in the range <PF_APID_RANGE> with value of <PF_APID_RANGE> in range [31, 134]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0280 (SPE) |
| KineisLink | E_KINEIS_SYS-106 |
| subSystemAllocation | FSW, SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | APID 0 is reserved for time packet PL range is defined on CNES side (see E_YODA_SYS-2065) |
| Updated | 2023-02-16 18:10 |


E_YODA_SYS-1504 - Platform own APID

PF packets APID shall be <SYS_PF_APID> for TM and TC packets, except for TC authentication function TM and TC packets.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-107 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | SYS_PF_APID : 31 |
| Updated | 2023-03-29 10:19 |


E_YODA_SYS-1505 - TC AUTHENTICATION APID

PF packets APID shall be <SYS_TC_AUTHENTICATION_APID> for TC authentication function TM and TC packets.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-874 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | AUTHENTICATION partition needs its own APID SYS_TC_AUTHENTICATION_APID : 13 |
| Updated | 2023-07-17 10:13 |


4.5.3.3 TC packets**E_YODA_SYS-1507 - Satellite commandability**

The satellite operational commandability shall be ensured using only known commands. All unknown comand is rejected

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1150 (GEN) |
| KineisLink | E_KINEIS_SYS-508 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-29 10:18 |

E_YODA_SYS-1509 - Telecommands execution


It shall be possible to execute any telecommand in any mode, exception will be noticed in telecommand description.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1150 (GEN) YODA-MC-REQ-1200 (GEN) |
| KineisLink | E_KINEIS_SYS-728 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-02-21 10:43 |

E_YODA_SYS-1510 - Telecommands scheduling

Telecommands processed by the on-board software shall be either:


- "event tagged TC": Event action TC
- "Auto TC" : Autonomously generated by the PF (other than event action)
- Immediate: to be executed immediately after their reception,
- Time-tagged: stored in an onboard schedule for later execution.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1170 (GEN) |
| KineisLink | E_KINEIS_SYS-482 |
| subSystemAllocation | FSW, SDB, OPS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 10:43 |

E_YODA_SYS-1511 - Telecommands priority


In case of conflict between TCs, the following priority shall be taken into account (descending order) for TC management:

- Event tagged TC
- Auto TC
- Time-tagged TC coming from ground
- Immediate TC coming from ground

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-632 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test, Analysis |
| Note | |
| Updated | 2023-03-20 11:31 |

E_YODA_SYS-1512 - Number of TC received


A counter <AM_DHS_TC_COUNT> representing the number of TC received from the ground with APID <SYS_PF_APID> shall be implemented by the platform.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-865 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | This counter is on 16bits and re-initialised to 0 at each reboot. |
| Updated | 2023-08-04 10:38 |

E_YODA_SYS-1513 - Source ID of TC packets

The platform shall set source ID of built packet in regard with the following list

- Any PUS direct command built by the ground segment shall have its source ID set to <CONF_SYS_ID_SCC_TCI>.
- Any PUS time tag command built by the ground segment shall have its source ID set to <SYS_ID_SCC_TTG>.
- Any PUS command built by the platform shall have its source ID set to <CONF_SYS_ID_OBC_NOM>.
- Any PUS command built by the platform that is the result of an FDIR action shall have its source ID set to <SYS_ID_OBC_FDIR>


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-114 E_KINEIS_SYS-703 |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-14 18:32 |

E_YODA_SYS-1459 - TC packet tailored structure

the platform shall manage TC packet as PUS TC packet as defined in RD and tailored as follow :

| Packet Header (48 Bits) | | | | | | Packet Data Field (Variable) | | | |
|-------------------------|-----------|----------------------------|------------------------|------------------------------------|----------------|------------------------------|-------------------|------------------|-------------------------|
| Packet ID | | | | Packet Sequence Control | | Packet Length | Data Field Header | Application Data | Packet Error Control ** |
| Version Number (=0) | Type (=1) | Data Field Header Flag (1) | Application Process ID | Sequence Flags (Unsegmented = 11b) | Sequence Count | | * | | CRC |
| 3 | 1 | 1 | 11 | 2 | 14 | | | | |
| 16 | | | | 16 | | 16 | 32 | Variable | 16 |


Figure 11 Tailored TC packet structure

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-SBIF-REQ-0280 |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:20 |

E_YODA_SYS-1514 - TC packets integrity verification on board


The platform shall verify the integrity of the data uploaded as well as the value of the following fields.

- APID
- packet length
- PUS service and sub-service
- CRC

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-20 11:32 |


E_YODA_SYS-1515 - Procedural telecommand

For telecommand leading to several actions, observables shall be implemented for each actions or group of actions.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-808 |
| subSystemAllocation | OPS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Observables can be HK parameters or events and will be defined into requirements defining the telecommand actions |
| Updated | 2023-06-12 10:18 |

4.5.3.4 TM packets**E_YODA_SYS-1517 - HK packet size**


Synthetic and expertise packets shall be designed in order to be compliant with TM data budget.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0790 (SPE) YODA-MC-REQ-1550 (GEN) YODA-MC-REQ-1610 (GEN) YODA-MC-REQ-1590 (GEN) YODA-MC-REQ-1610 (GEN) |
| KineisLink | E_KINEIS_SYS-698 |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 15:14 |

E_YODA_SYS-1518 - Synthetic packet flight unit content


Synthetic packet shall contain the following information on flight units to determine their switching status and all preconditions informations for switching transition:

- TBD

| | |
|-----------------------|---|
| ReqStatus |  Draft |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-551 |
| subSystemAllocation | SDB, OPS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2022-11-03 15:16 |


E_YODA_SYS-1519 - Expertise packet

Expertise packet shall contain detailed data on satellite mode, subsystem behaviour or flight units status.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-198 |
| subSystemAllocation | SDB, OPS, FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:20 |


E_YODA_SYS-1520 - TM validity condition

For parameters set conditionally to valid, the platform shall provide parameters determining their validity with a frequency that is the same as, or higher than, the conditionally valid parameter.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-370 |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Inspection |
| Note | |
| Updated | 2023-02-21 15:05 |

E_YODA_SYS-1521 - TM consistency

When the interpretation of a parameter in a variable packet depends on the values of other onboard parameters, the platform shall provide all these parameters in the same packet.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-371 |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection, Test |
| Note | |
| Updated | 2023-02-15 14:20 |

E_YODA_SYS-1522 - Vital health function

Vital space segment health functions should be monitored with redundant telemetry parameters.

The vital function are listed here :

- TBD with CNES

| | |
|-----------------------|---|
| ReqStatus |  Draft |
| LinkedUpReq | YODA-MC-REQ-2570 (GEN) |
| KineisLink | E_KINEIS_SYS-553 |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | |
| ValidationMethod | |
| Note | function that is essential to mission success and that can cause permanent mission degradation if not executed when it should be, or wrongly executed, or executed in the wrong context |
| Updated | 2023-03-20 15:25 |

E_YODA_SYS-1523 - Generation time in packet header

All telemetry packet shall be timestamp using the dedicated field in packet header (except for time report TM(9,2) that doesn't contain data field header)

The Time and time status structure of timestamp is as follow :

| Time (7 bytes) | | | | | | | Time status (1 byte) |
|----------------|----------|-------|-------|----------|-----------|-----------|----------------------|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1 byte |
| 2^{24} | 2^{16} | 2^8 | 2^0 | 2^{-8} | 2^{-16} | 2^{-24} | |


Figure 12 Time and time status of timestamp

Time: time of generation of the packet, computed from the ?time? message broadcasted by the spacecraft bus, and expressed with TAI reference under the CUC format.

For each one of the 7 bytes of the field Time, the table gives the value of the LSB in seconds.


Time status: this on byte field is composed of:

- Synchronization state (bit0) filled with <AM_OBT_SOURCE> as follow:
 - 1= "GNSS-slaved" time mode" (time synchronized with GNSS time)
 - 0 ="Free-running" time mode (time propagated from free-running local oscillator)
- Quality of time (bit 1 to 7): shall not be used

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-2130 (GEN) YODA-MC-REQ-2060 (SPE) YODA-MC-REQ-2110 (GEN) YODA-SBIF-REQ-0170 |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Time pacjket format is set according req E_YODA_SYS-853 |
| Updated | 2023-06-22 09:10 |


E_YODA_SYS-1524 - Destination ID in TM packets

The TM packet generated by the PF with the Ground Command Segment as destination shall use Destination ID <SYS_ID_GCS_TCIM>

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-128 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | Default value: SYS_ID_GCS_TCIM = 1 |
| Updated | 2023-05-25 10:10 |


E_YODA_SYS-1525 - Destination ID related to TC in TM packets

TM packet corresponding to a report of TC packet shall have a Destination ID identical to the Source ID in TC packet.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-129 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This applies also to PUS service 1 with respect to related TC. |
| Updated | 2023-02-15 14:20 |


E_YODA_SYS-1526 - Source Sequence Count in TM packets

The Source Sequence Count for telemetry packets shall be incremented separately for each couple (Application Process, Destination Id) and shall roll over when the maximum value is reached. Source sequence count of IDLE packet shall remain to 0

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-130 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 15:03 |


E_YODA_SYS-1527 - Source Sequence Count incrementation

Source Sequence Count shall be incremented at the packet generation

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-131 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-20 11:39 |

E_YODA_SYS-1528 - Packet Sub-Counter in HKTM packets


The Packet Sub-Counter for telemetry packets should keep the value zero all the time.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-132 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:20 |

E_YODA_SYS-1529 - IDLE packet format

IDLE packet format shall respect CCSDS format packet with the following field and their value:


- Version number set to 0
- Type set to 0
- Data field header flag set to 0
- APID set to 2047
- Sequence flag set to 3
- Sequence count set to 0
- Packet length set to data field length minus 1
- Data field bytes set to 0x55

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-687 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection, Test |
| Note | IDLE packet have no CRC computed |
| Updated | 2023-02-15 14:20 |

4.5.4 Packet stores management**E_YODA_SYS-872 - List of packet store**


The platform shall implement the following packet store:

- Anomaly packet store (circular)
- Asynchronous TM (circular)
- Synthetic TM (Circular)
- Expertise TM (circular)

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0200 (GEN) YODA-MC-REQ-0210 (GEN) YODA-MC-REQ-1770 (SPE) YODA_SAT_REQ_3200 |
| KineisLink | E_KINEIS_SYS-480 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-27 09:04 |

E_YODA_SYS-873 - Events in onboard store(s)


The platform shall store all events (service 5 TM) generated by the satellite (even those before/after a reboot) in order to be available for recorded telemetry downlink.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0240 (GEN) YODA-MC-REQ-1770 (SPE) |
| KineisLink | E_KINEIS_SYS-512 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 15:31 |

E_YODA_SYS-874 - Service 15: "Anomaly" store content


The "Anomaly" store shall contain the telemetry packets of the following subtypes:

- (1,2) Telecommand Acceptance Report - Failure
- (1,8) Telecommand Execution Report ? Failure
- (5,2) Error/anomaly Report of low severity
- (5,3) Error/anomaly Report of medium severity
- (5,4) Error/anomaly Report of high severity

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1800 (GEN) |
| KineisLink | E_KINEIS_SYS-513 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 15:31 |


E_YODA_SYS-875 - “Asynchronous” store content

The “Asynchronous” store shall contain all asynchronous telemetry packets (except those included in “Anomaly” store content).

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0200 (GEN) YODA-MC-REQ-1840 (GEN) |
| KineisLink | E_KINEIS_SYS-514 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 15:33 |


E_YODA_SYS-876 - “Synthetic TM” store content

The ?Synthetic TM? store shall contain all synthetic packets (PL, Tx and PF).

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1840 (GEN) |
| KineisLink | E_KINEIS_SYS-638 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-20 11:52 |


E_YODA_SYS-877 - “Expertise TM” store content

The ?Expertise TM? store shall contain all expert packets (PL, Tx and PF).

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1820 (SPE) YODA-MC-REQ-1840 (GEN) |
| KineisLink | E_KINEIS_SYS-639 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Expertise packet allow the necessary investigations that follow a safe mode transition or predefined critical events occurrence |
| Updated | 2023-02-21 15:33 |


E_YODA_SYS-878 - PacketStore configuration

The platform shall allow to configure by TC the packet stores to download autonomously as well as the related frequency for each packet in case of cyclical packets.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1900 (SPE) |
| KineisLink | E_KINEIS_SYS-481 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 16:39 |


E_YODA_SYS-879 - PacketStore autonomous downlink

The platform shall provide a configuration parameter <CONF_PKS_AUTO_DOWNLINK_x> which contain the order of packet stores downlinked autonomously during ground station available.

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0190 (GEN) YODA-MC-REQ-1860 (GEN) |
| KineisLink | E_KINEIS_SYS-656 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | At BDS level, the parameter is declined in several parameters (CONF_PKS_AUTO_DOWNLINK_1, CONF_PKS_AUTO_DOWNLINK_2, ...) corresponding to the number of packet store. Low level number correspond to higher priority. |
| Updated | 2023-02-23 09:48 |

E_YODA_SYS-880 - PacketStore Cyclical packets downlink frequency


For each packet, the platform shall store the default downlink information (including downlink frequency). This information shall be transmitted to FPGA before each packet store downlink.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-841 |
| subSystemAllocation | FSW, HW, BDS, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-03-28 12:18 |


E_YODA_SYS-881 - Configuration of PacketStore size

The size of packet store shall be defined as follow :

- Anomaly : 2 Go
- Synthetic : 8 Go
- Expertise : 16 Go
- Asynchronous : 2 Go


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0850 (GEN) |
| KineisLink | E_KINEIS_SYS-503 |
| subSystemAllocation | FSW, HW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-29 18:09 |

E_YODA_SYS-882 - Memory allocation for low level report debugging (Deleted)

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-831 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | FSW report log will be not implemented on YODA . Hope first to keep this memory zone for future application, but taken decision for no action |
| Updated | 2023-08-04 14:34 |


E_YODA_SYS-883 - Packet Store Retrieval persistence

For each packet store, the platform shall save the point where telemetry downlink was suspended (reading point). This reading point shall be persistent in case of OBC reboot.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1830 (GEN) |
| KineisLink | E_KINEIS_SYS-515 |
| subSystemAllocation | FSW, FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 15:33 |


E_YODA_SYS-884 - Packet Store reading pointer

The platform shall implement a ground command used to set the value of the reading pointer for each packet store.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1960 (GEN) YODA-MC-REQ-1980 (GEN) YODA-MC-REQ-1990 (GEN) |
| KineisLink | E_KINEIS_SYS-719 |
| subSystemAllocation | FSW, FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 16:52 |

E_YODA_SYS-885 - Onboard Storage constraint

The platform shall not interrupt the storage of packets if any kind of retrieval of the onboard storage is requested by the ground segment or autonomous onboard function


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1940 (GEN) |
| KineisLink | E_KINEIS_SYS-556 |
| subSystemAllocation | FSW, FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 16:07 |

E_YODA_SYS-886 - Storage observability

The platform shall provide Housekeeping information on the state of the onboard storage and retrieval function for each onboard store.


At least , the following element shall be present:

- Retrieval state by store : <AM_DHS_PKS_DUMP_STATUS>
- Number of frame dumped by store downlink : <AM_DHS_HKTMR_FRAME_COUNT>
- Date of last dumped packet
- Rate of store filling
- Date of oldest packet in store

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1850 (GEN) |
| KineisLink | E_KINEIS_SYS-516 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-29 18:09 |


E_YODA_SYS-887 - Onboard stores - Sampling capability

In case of onboard stores with cyclical packets, the platform shall allow sub-sampling of the packets to retrieve. The sub sampling rate shall be configurable by ground command. Configuration shall be dependent of APID and packet SID

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1900 (SPE) |
| KineisLink | E_KINEIS_SYS-517 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-02-21 16:39 |


E_YODA_SYS-889 - Onboard stores - Packet Store Retrieval order

In case of several packet store retrieval request (i.e. in the same TC), packet store downlink order shall be consistent with TC's arguments order.

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-640 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | Here nothing is implemented by Hemeria, the product Libpus will be used. Test or analysis of libpus will be performed to determine if the product is compliant with this requirement. |
| Updated | 2023-02-15 14:23 |

E_YODA_SYS-888 - Onboard stores - New retrieval request while another retrieval on-going

In case of a new retrieval request while there is still a retrieval on-going, the platform shall reject the new request and generate a negative acknowledgement.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-641 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:23 |

4.5.5 Schedule management (MTL)**4.5.5.1 General**

E_YODA_SYS-1801 - Onboard schedule status

The platform shall implement a Context parameters <CTX_mode_S11_ACTIVE_SUBSCHEDULES> in order to save the default enable status of each subschedule depending of the mode.

At each mode entry, the platform shall activate the MTL sub-schedules according to the context parameter of the mode.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0220 (GEN) YODA-MC-REQ-0520 (GEN) YODA-MC-REQ-1410 (GEN) |
| KineisLink | E_KINEIS_SYS-721 |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | _mode_ , in the context parameter name, shall be MAIT,AUTO,MSAF, or MNOM |
| Updated | 2023-02-21 15:03 |


E_YODA_SYS-1805 - Onboard schedule : Default configuration

By default, the <CTX_MAIT_S11_ACTIVE_SUBSCHEDULES> shall have all subschedules deactivated.

By default, the <CTX_AUTO_S11_ACTIVE_SUBSCHEDULES> shall have all subschedules deactivated.

By default, the <CTX_MSAF_S11_ACTIVE_SUBSCHEDULES> shall have one contingency operation activated and all other subschedules deactivated.


By default, the <CTX_MNOM_S11_ACTIVE_SUBSCHEDULES> shall have all subschedules activated (TBC for contingency subschedules).

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-615 |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:23 |

4.5.5.2 Processing

E_YODA_SYS-563 - Onboard schedule: Several sub-schedules.


The platform shall implement an MTL with <FSW_OBSW_SSID_NB> number of sub-schedules.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1370 (GEN) |
| KineisLink | E_KINEIS_SYS-487 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 15:03 |

E_YODA_SYS-854 - List of sub-schedule


The following sub-schedule shall be implemented :

- PF Operation
- PAYLOAD Operation
- SBAND operation
- 'Guidance TC' Operation
- Maneuvers Operation
- SUBSCHEDULE_SPARE_1
- SUBSCHEDULE_SPARE_2

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1491 (SPE) |
| KineisLink | E_KINEIS_SYS-633 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | 'Guidance TC' and Maneuvers Operation are dedicated to SCAO and shall not be activated at MNOM entry mode Activation of this MTL subschedule shall be done by ground TC |
| Updated | 2023-07-12 10:51 |

E_YODA_SYS-1807 - Onboard schedule : save in NVM


The platform shall implement a ground command **TC_DHS_LOW_SAVE_SCD_NVM**, in order to copy on board schedule from volatile to non volatile memory. This allow to not loss schedule contents in case of reboot.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-1430 (GEN) |
| KineisLink | E_KINEIS_SYS-534 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Specific command service (132,150) |
| Updated | 2023-02-21 15:03 |

E_YODA_SYS-1808 - Onboard schedule: Integrity in case of reboot


The platform shall verify by CRC, the integrity of the onboard schedule saved in NVM, at the moment of transfer to volatile memory.

In case of memory corruption, the schedule in non-volatile memory shall not be considered and an event shall be raised and transfert to ground.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-634 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis, Test |
| Note | |
| Updated | 2023-02-15 14:25 |


E_YODA_SYS-564 - Onboard sub schedules : number of commands

The onboard sub-schedules shall contain up to <FSW_TTG_NB_TC_BY_SS> commands of up to <FSW_TTG_MAX_TC_SIZE> size.

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-488 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <FSW_TTG_NB_TC_BY_SS> = 300 <FSW_TTG_MAX_TC_SIZE> = 1024 bytes total number of TCs that can be loaded in the schedule is 3400 |
| Updated | 2023-02-15 14:25 |


E_YODA_SYS-1821 - Onboard schedule: Accepted source ID and APID

The TC scheduler shall accept all incoming source ID and APID, this included Payload APID.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0520 |
| KineisLink | E_KINEIS_SYS-751 |
| subSystemAllocation | FSW, SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-03-27 09:34 |


E_YODA_SYS-858 - Onboard schedule : Modification capability

A TM(1,8) shall be raised when sub schedules is full or when sub schedule ID is out of range.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-829 |
| subSystemAllocation | FSW, FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | No implementation at HEMERIA Side as the product Libpus will be used. Test or analysis of libpus will be performed to determine if the product is compliant with this requirement. |
| Updated | 2023-02-15 14:25 |

E_YODA_SYS-860 - Onboard schedule: Same TTG execution date

If several telecommands are time tagged at the same date in the same sub-schedule, they should be executed in order of arrival.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-554 |
| subSystemAllocation | FSW, FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | that means when a telecommand is added in the schedule, it should be inserted after the last telecommand with same date. |
| Updated | 2023-02-15 14:25 |

E_YODA_SYS-861 - Onboard schedule : save in NVM (Deleted)

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | Redundant Req (E_YODA_SYS-1807) |
| Updated | 2023-01-17 19:11 |


E_YODA_SYS-863 - Onboard schedule : Sub-schedule status in case of sub-schedule empty

When a sub-schedule is empty, it shall be automatically disabled.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-809 |
| subSystemAllocation | FSW, FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | Nothing to implement at Hemeria side. Already cover by the use of LibPUS |
| Updated | 2023-02-15 14:25 |


E_YODA_SYS-565 - Onboard schedule: TTG validity

The platform shall reject the insertion of any time-tagged command with an onboard release time earlier that the current onboard time (OBT) + <FSW_INSERT_TTG_MIN_DELAY>.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-490 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:25 |


E_YODA_SYS-566 - Onboard schedule: TTG release date accuracy

The platform shall release a command stored in the MTL with an accuracy of <SPC_TTG_EXEC_ACCURACY> ms with respect to the expected release date of the command (except potentially in case of reboot or if several close TCs related to the same service).

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-491 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:25 |

E_YODA_SYS-567 - Onboard schedule: number of TC/s


The platform shall be able to release at least <FSW_TTG_MIN_CAPABILITY> command per second.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-492 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | on previous Hemeria project <FSW_TTG_MIN_CAPABILITY> = 10 |
| Updated | 2023-05-09 14:31 |

E_YODA_SYS-568 - Onboard schedule: TC period validity


The platform shall remove from the MTL any TC whose release time has expired of more than <FSW_TTG_EXEC_TIMEOUT>. This shall not be executed and an event shall be sent to the ground segment.

The TC between the <FSW_TTG_EXEC_TIMEOUT> and current date shall be executed.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-510 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <FSW_TTG_EXEC_TIMEOUT> to be defined according to OBC reboot duration. |
| Updated | 2023-06-28 09:43 |


E_YODA_SYS-855 - Onboard schedule: TTG execution scheduling

The order of command TTG execution over the different sub-schedule shall be deterministic. The platform shall be able to determine the order of execution of 2 commands at the same date but in 2 different sub-schedule.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-493 |
| subSystemAllocation | FSW, FSW, PCDU |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-02-15 14:25 |


E_YODA_SYS-856 - Onboard schedule : Memory management

Management of the memory area used for the onboard operations schedule shall be performed autonomously on-board and shall not restrict schedule operation or schedule editing operations. In case of problem, an event or a negative acknowledgement shall be raised in telemetry.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-614 |
| subSystemAllocation | FSW, FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | add info to indicate when event or a negative acknowledgement is raised |
| Updated | 2023-02-15 14:25 |

E_YODA_SYS-862 - Onboard schedule: Clearing onboard schedule in non-volatile memory

The platform shall allow to invalidate the schedule in flash memory with a TC sequence.


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-635 |
| subSystemAllocation | OPS, SDB |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-20 11:54 |

4.5.5.3 Observability

E_YODA_SYS-859 - Onboard schedule : HK observability


The informations below shall be inserted into cyclical telemetry :

- Command sub-schedule and sub-schedule status <AM_DHS_SCHEDULE_STATUS>
- Total number of TC in each subschedule <AM_DHS_SCx_TC_COUNT>

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-723 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-16 14:39 |


E_YODA_SYS-1810 - Onboard schedule: Status Observability

The status of onboard telecommand schedules (and sub-schedules) shall be part of datapool, <AM_DHS_SCHEDULE_STATUS>, and shall be in HK synthetic packet.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-486 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | One bit of parameter for the schedule status and one bit for each sub-schedule status. |
| Updated | 2023-02-15 14:25 |

E_YODA_SYS-1811 - Onboard schedule: observability on TC number

The number of TC in each sub-schedule shall part of datapool, <AM_DHS_SCx_TC_COUNT>, and shall be in HK synthetic packet.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-902 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | x representing the sub-schedule ID, one parameter by sub-schedule. |
| Updated | 2023-02-15 14:25 |

4.5.5.4 FDIR

No FDIR on schedule management.

4.5.6 On-board time management

4.5.6.1 Introduction

The platform maintains the master spacecraft time referred to as the On-Board Time (OBT).

The OBT is the reference time base for the following on-board processes:

- Time tagged commands execution: the MTL contains a list of time tagged commands to be executed at predefined times. The time base for the time tags is the OBT
- Telemetry time stamping: any telemetry packet generated by the software is time stamped with the value of the OBT counter at the time of generation of the packet
- Telemetry time strobe: time stamping the transmission of a particular telemetry frame

At startup, the OBT is initialized to a given epoch and synchronizes to GNSS time.

The OBT is stored in CUC format with 4 bytes of coarse time and 3 bytes of fine time.

The OBC also provides high-accuracy synchronization between the Platform and Payload(s) through dedicated links and time report.


Once a second the OBC broadcasts a time report announcing OBT time at the start of the next second epoch (PPS). The OBC provides this report to a payload controller over the active point-to-point link. The time distribution requires the Payload acquiring the PPS signal distributed by the OBC for low-level synchronization.

The PPS signal consists of a 1Hz pulse; it is generated through GNSS when GNSS is working. When GNSS is OFF or not working, the PPS is generated by platform.

4.5.6.2 On-Board Time


E_YODA_SYS-1414 - General

The platform shall maintain the on-board time.

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0860 YODA-MC-REQ-2000 (GEN) YODA-MC-REQ-2070 (GEN) YODA-MC-REQ-2090 (GEN) YODA-MC-REQ-2100 (GEN) |
| KineisLink | E_KINEIS_SYS-222 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | OBT is the reference time for all the spacecraft |
| Updated | 2023-02-21 17:41 |

E_YODA_SYS-1331 - OBT for mode time management


The internal OBT of the platform shall be used for TM datation and On Board Schedule ground TC release,

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0880 |
| KineisLink | E_KINEIS_SYS-538 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 11:53 |

E_YODA_SYS-1415 - OBT increasing through constant gap


The platform shall use a Time Gap reference (a constant gap) defined in context as <CTX_MON_FRC_DRIFT> to increment sequentially the OBT.

In case of drift compensation based on this gap, the platform shall allow modification of the constant gap by TC.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0860 YODA_SAT_REQ_0890 |
| KineisLink | E_KINEIS_SYS-725 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, +++, SOFTWARE |
| ValidationMethod | Test, +++, Analysis |
| Note | CTX_MON_FRC_DRIFT could be modified through service 140 or 132. CTX_MON_FRC_DRIFT unit is in "ms". |
| Updated | 2023-08-08 17:13 |


E_YODA_SYS-1416 - OBT Format

The OBT shall be kept in CCSDS Coarse Unsegmented time Code (CUC) format, with 4 bytes of coarse time (seconds) and 3 bytes of fine time (sub-second).

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0860 YODA-MC-REQ-2010 (SPE) YODA-MC-REQ-2140 (GEN) |
| KineisLink | E_KINEIS_SYS-223 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | When OBT is provided through TM(9.2) , time status is added as described in E_YODA_SYS-853 |
| Updated | 2023-02-28 19:15 |


E_YODA_SYS-1417 - OBT reference

The OBT standard reference time scale shall be IAT with epoch time on the 1st of January 2000 at 00:00:00.

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-2010 (SPE) |
| KineisLink | E_KINEIS_SYS-386 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-02-28 19:15 |


E_YODA_SYS-1814 - OBT drift correction

The platform shall provide a command which, upon reception, applies a corrective adjustment between the OBC internal counters and the OBT.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-225 |
| subSystemAllocation | FSW, OPS, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | -Done with TC_DHS_SET_OBT_DRIFT (Service 130,2) -corrective adjustment parameter unit is ms |
| Updated | 2023-08-08 17:13 |

E_YODA_SYS-1815 - OBT drift range


The OBT drift shall not exceed <SPC_OBT_DRIFT> (?natural? drift, without board/ground correction but taking into account a potential reboot)

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0910 YODA_SAT_REQ_0920 |
| KineisLink | E_KINEIS_SYS-616 |
| subSystemAllocation | OPS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | <p>OBT drift could be at least 50us on one sec.</p> <p>so :</p> <p><SPC_OBT_DRIFT> = 5.32 (4.32s/j (50 ppm) + 1s/j (reboot error))</p> <p>No actual implementation for this requirement. Only calibration using drift correction command and verification will be performed</p> <p>This req is not conform with YODA_SAT_REQ_0910 and YODA_SAT_REQ_0920</p> |
| Updated | 2023-03-27 09:20 |

E_YODA_SYS-1816 - Time packet timing transmission

The delay from time packet insertion at the end HKTMP frame to the sending of the last bit to Tx by FPGA shall not exceed

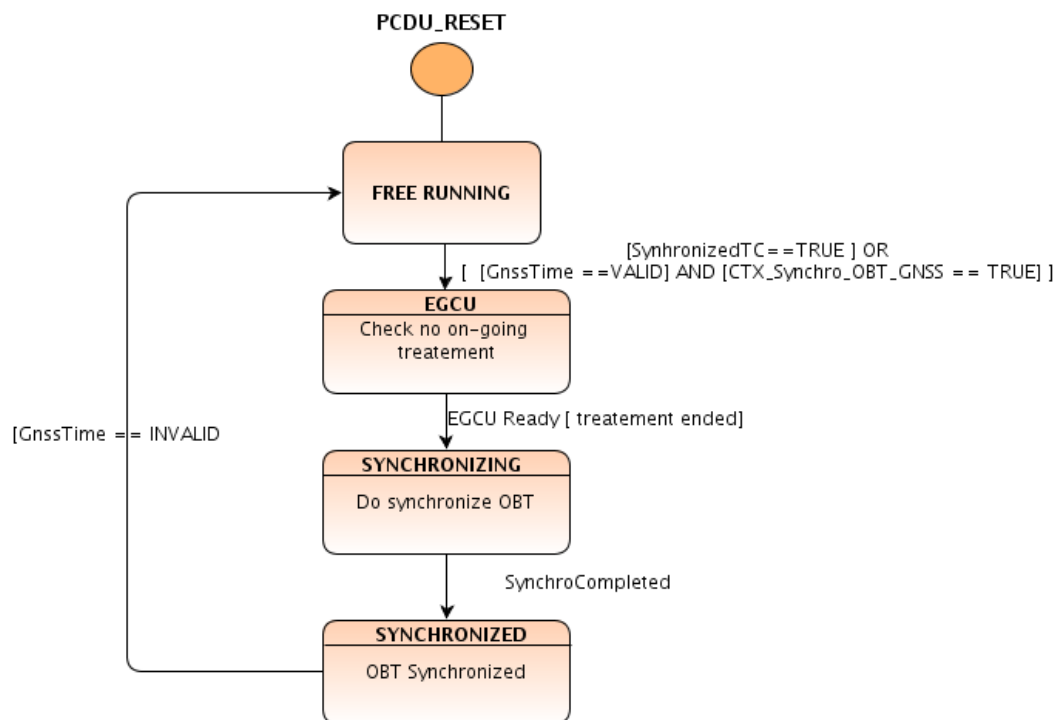
<SPC_PK_TIME_MAX_DELAY>.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-544 |
| subSystemAllocation | FSW, SDB, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | Propose value for SPC_PK_TIME_MAX_DELAY : 200 ms (equal +/- 5 frames) |
| Updated | 2023-06-12 09:53 |

4.5.6.3 OBT update

E_YODA_SYS-1418 - OBT update (deleted)

| | |
|-----------------------|--|
| ReqStatus | ✖ Deleted |
| LinkedUpReq | YODA_SAT_REQ_0870 (deleted) |
| KineisLink | E_KINEIS_SYS-224 |
| subSystemAllocation | |
| implementationVersion | VAIT |
| ValidationLevel | |
| ValidationMethod | |
| Note | Redondance with E_YODA_SYS-1420 : The platform shall update OBT full Time on ground TC of service 9 only [TC(9,128) and TC(9,129)] to not disturb EGCU treatment when OBT update is requested. Synchronization with GNSS oscillator (at round second Level) is only performed thanks PPS a requested by E_YODA_SYS-1419 |
| Updated | 2023-08-08 11:57 |

4.5.6.4 OBT synchronization for Time management


E_YODA_SYS-1419 - OBT time synchronization with GNSS time for Time management

IF GNSS time is VALID

- the platform shall perform OBT synchronization with GNSS time where a round second of the OBT shall be aligned with a round second of the GNSS time.
- the platform shall set parameter <AM_OBT_SOURCE> to OBT_GNSS_Synchronised

ELSE:


- the platform shall continue maintaining the OBT in free running mode
- the platform shall set parameter <AM_OBT_SOURCE> to OBT_PF_FreeRunning

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-3030 YODA-MC-REQ-2020 (GEN) YODA-MC-REQ-2030 (SPE) YODA-MC-REQ-2120 (GEN) YODA-MC-REQ-2200 (GEN) YODA_SAT_REQ_0860 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <p>- not conform with YODA_SAT_REQ_0890 only OBT synhro is done with GNSS Time, no time difference is computed</p> <p>-Free running mode is performed with PF FRC counter</p> <p>-OBT_PF_FreeRunning = 0 ; OBT_GNSS_Synchronised = 1</p> <p>- OBT-GNSS synchro is performed in accordance with GNSS PSS reception to do the correction of OBT at round second.</p> <p>OBT time value is not set to GNSS time value, only second drift correction is done with this synchronization</p> |
| Updated | 2023-08-08 18:55 |

E_YODA_SYS-2651 - GNSS synchronization permission

The platform shall be able to modify CTX_Synchro_OBT_GNSS value (TRUE or FALSE) through service 140

Its default value is FALSE


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-2200 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | When FALSE, this parameter allow no synchronization with GNSS time in order to to not disrupt the SCAO algorithm due to a time gap due to the synchronization |
| Updated | 2023-07-13 09:58 |

E_YODA_SYS-1420 - OBT time update from Ground

The platform shall request OBT synchronization upon reception of TC (PUS Service 9),

When update request is with absolute time value, the update shall be done with 1sec coarse accuracy

When update request is with time offset value, the update shall be done at least with 1ms accuracy

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_930 |
| KineisLink | N/A |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | The following TC could be used for OBT synchro (9,128)TC_009_128_CHG_TIME_ABS (9,129)TC_009_129_CHG_TIME_OFFSET |
| Updated | 2023-02-15 14:27 |


E_YODA_SYS-637 - GNSS time validity

IF

- CTX_Synchro_OBT_GNSS is TRUE AND
- GNSS is ON AND
- GNSS PPS is received AND
- GNSS STIME is received and valid

THEN, GNSS time is considered as valid


ELSE GNSS time is considered as not valid

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | If the GPS function becomes unavailable (due to GPS receiver reboot for instance), the platform shall continue maintaining the OBT in free running mode. |
| Updated | 2023-07-13 09:58 |

E_YODA_SYS-2057 - FPGA with GNSS Time Validity

When GNSS time is valid, the platform shall set FPGA data <FPGA_REG_GNSS_VALIDITY> to 1.


When GNSS time is invalid, the platform shall set FPGA data <FPGA_REG_GNSS_VALIDITY> to 0.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | Please refer to FPGA architecture document to found requirement (thanks traceability) linked to the dedicated register This dedicated register shall allow FPGA to generate or not its own PPS for the next second Depending on E_YODA_SYS-637 |
| Updated | 2023-08-09 11:05 |

4.5.6.5 OBT broadcasting


E_YODA_SYS-641 - OBT time providing

The platform shall send to Payload (EGCU) at 1Hz over SPW link a TC(9,128) Change On board Time command message carrying the time information in CCSDS Unsegmented Code (CUC) format.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4110 YODA-MC-REQ-2090 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 17:41 |

4.5.6.6 PPS forwarding**E_YODA_SYS-1825 - PPS interface with Payload**

The platform shall provide to Payload (EGCU) a PPS signal , each seconds, through RS422 link

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-3050 YODA-IRD-PFPL-REQ-3060 YODA-IRD-PFPL-REQ-2030 YODA-MC-REQ-2050 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | FPGA |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-22 09:10 |

E_YODA_SYS-1824 - PPS source command (Deleted)

| | |
|-----------------------|---|
| ReqStatus | ✖ Deleted |
| LinkedUpReq | YODA-MC-REQ-2990 |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | <p>Req no more needed</p> <p>To force platform PPS selection, GMESS TC should be sent to GNSS with STIME frequency acquisition set to 0.</p> <p>By this way, STIME should be no more provided by GNSS and also considered as invalid by platform which will use its own PPS</p> |
| Updated | 2023-01-05 15:23 |

E_YODA_SYS-645 - GNSS PPS forwarding to Payload (EGCU)

The platform shall enable PPS forwarding to the Payload (EGCU) as follow:

- IF previous received GNSS PPS (GNSS_PPS_VALIDITY) is valid and provided to EGCU AND $[TppsCurrent - TppsPrevious < 1s + 100\text{ us}]$
THEN the platform shall provide current received GNSS PPS signal
ELSE the platform shall generate and provide its own FPGA_PPS

The platform shall ensure that only one PPS is provided to Payload (EGCU) over 1 second.

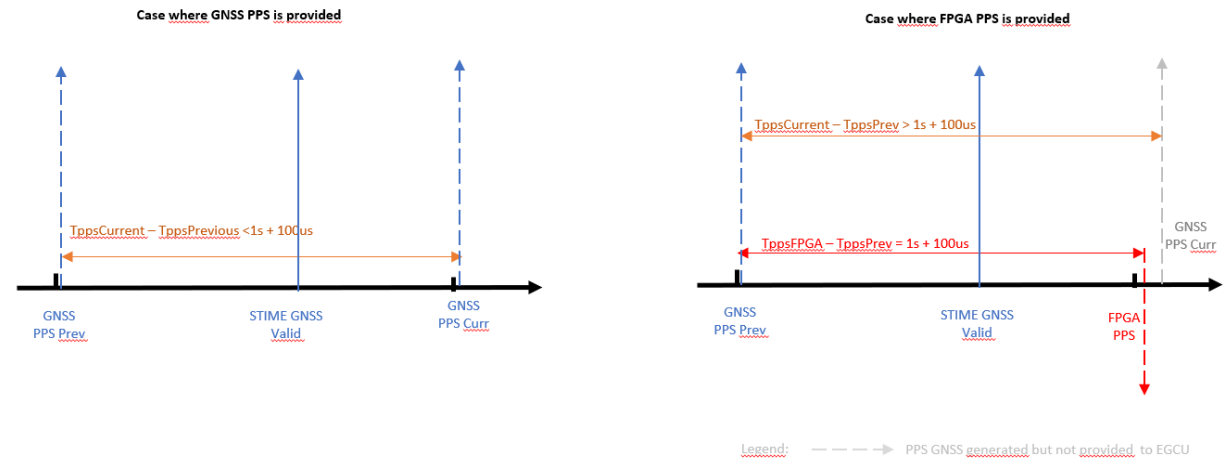


Figure 13 GNSS PPS and FPGA PPS providing

| | |
|-----------------------|---|
| ReqStatus | In Review |
| LinkedUpReq | YODA-MC-REQ-2040 (SPE) YODA-MC-REQ-2050 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis, Test |
| Note | 2 PPS in the same seconds is not permitted at EGCU side |
| Updated | 2023-08-04 14:59 |

E_YODA_SYS-2550 - GNSS_PPS resynchronization after FPGA_PPS generation

- IF previous provided PPS is FPGA_PPS (PPS3_FPGA in the figure) and the current STIME (STIME 3 in the figure) indicate a valid PPS from GNSS (PP3_GNSS in the figure)
THEN the platform shall try a synchronization with next PPS_GNSS (PPS4_GNSS), one seconde after previous FPGA_PPS (PPS3_FPGA) and until timeout of 2 seconds after previous provided FPGA_PPS (PPS3)
- ELSE the platform shall generate and provide again a FPGA_PPS after delay of 2seconds from previous provided FPGA_PPS

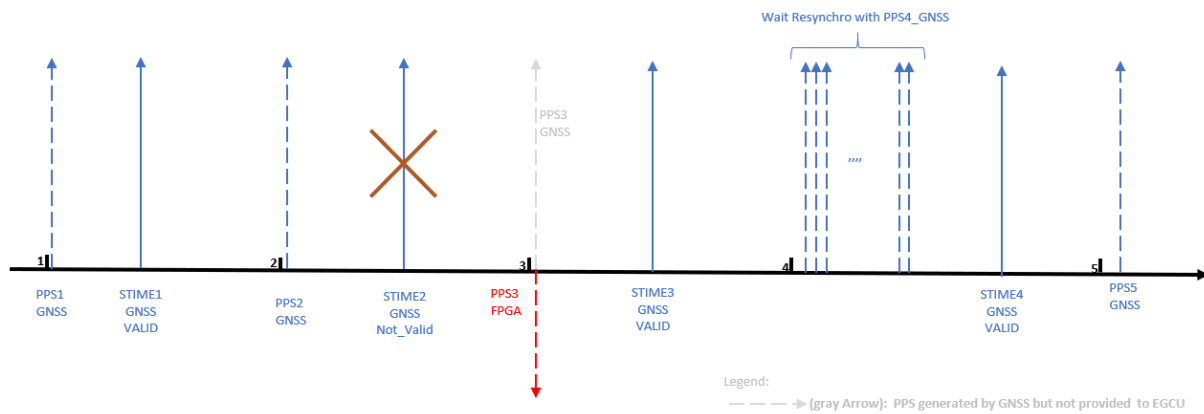



Figure 14 PPS GNSS resynchronization

| | |
|-----------------------|------------------|
| ReqStatus | In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-03 15:55 |

E_YODA_SYS-1823 - GNSS PPS validity


The GNSS PPS (GNSS_PPS_VALIDITY) is considered valid when:

- GNSS is ON AND
- previous GNSS PPS is received
- previous STIME TM validity byte [byte 0] is VALID.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 14:59 |

E_YODA_SYS-2051 - OBT - Save into context memory

Current OBT shall be saved as context parameter <CTX_OBT_CUC> in CUC format


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-833 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-21 14:55 |

4.5.6.7 observability

E_YODA_SYS-2050 - OBT parameter for Telemetry

The platform shall make available for telemetry the following parameter :


- The current OBT in CUC format with its time_status field filled with <AM_OBT_SOURCE>
- GNSS time validity
- reception Time of GNSS PPS

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-2060 (SPE) YODA-MC-REQ-2110 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | in free-running mode, when time of valid PPS GNSS is received, ground could know the gap between internal OBT time and time provided by GNSS and could perform a TC correction to correct internal time. |
| Updated | 2023-07-11 17:24 |

4.5.7 OBC**4.5.7.1 Processing****E_YODA_SYS-2548 - OBC frequency configuration**


The OBC frequency shall be configured as follow:

- CPU : 416MHz
- DDRAM : 533MHz

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-04-03 13:59 |

E_YODA_SYS-2545 - OBC reboot from TC


On TC request, **TC_DHS_HIGH_REBOOT_OBC**, the FSW shall command a OBC reboot by stopping servicing the OBC watchdog.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-22 09:10 |

4.5.7.2 MOBC observability**E_YODA_SYS-2080 - MOBC voltages and Zynq temperature measurements**

The platform shall be able to provide in Telemetry the following OBC monitoring

- OBC 3V3 internal measure
- OBC 3V3 PC104 measure
- OBC 5V measure
- OBC NRB voltage mesure
- OBC Internal Temperature measure
- all FPGA registers (except those used for cryptography)
- all Zynq PS registers

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0230 (GEN) YODA-MC-REQ-0530 (GEN) |
| KineisLink | E_KINEIS_SYS-363 |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | The measurement are not used on board. |
| Updated | 2023-04-03 13:58 |

4.5.7.3 Monitoring and FDIR


E_YODA_SYS-2610 - OBC reboot number

The number of OBC reboot shall be monitored.

In case of OBC reboot number \geq **<CTX_OBC_NB_REBOOT_MAX>** (typical value=5) , without ground intervention, the FSW shall command a PCDU OFF/ON.


After the restart, all FDIR except the "Absence TC" FDIR shall be deactivated.

This FDIR shall be applied autonomously by the FSW only once

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-606 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | when CTX_OBC_NB_REBOOT_MAX is reached, the satellite restart in AUTO mode with the SECURE FSW as defined in E_YODA_SYS-1343 |
| Updated | 2023-06-19 09:51 |


4.5.8 Memory management**4.5.8.1 General****E_YODA_SYS-1533 - Buffer memory size**

The size of the buffer memory dedicated to software load shall be at least 20 Mega bytes.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-710 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | Buffer memory is used for software upload |
| Updated | 2023-06-01 11:38 |

E_YODA_SYS-1534 - Write rate of NVM memory

The write rate of NVM memory shall be 300 kbits/s

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-697 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | Previous project ask a rate of <SW_BUFFER_TO_FLASH_RATE> = 300 kbits/s This is required to limit software update duration |
| Updated | 2023-08-04 16:34 |


4.5.8.2 Processing**E_YODA_SYS-669 - Clearing buffer memory for software uploading by TC (Deleted)**

| | |
|-----------------------|--|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | E_KINEIS_SYS-731 |
| subSystemAllocation | |
| implementationVersion | VAIT |
| ValidationLevel | |
| ValidationMethod | |
| Note | Deleted because not needed on YODA. |
| Updated | 2023-08-07 17:40 |

E_YODA_SYS-670 - Set memory write status

Platform shall implement ground command **TC_DHS_LOW_SET_MEM_STATUS** in order to switch ON/OFF the NVM or QSPI memory. Command is composed with arguments:

- Memory to set, NVM or QSPI
- Status of the memory, ON or OFF


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-749 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 17:16 |

E_YODA_SYS-1535 - QSPI unprotect sector

Platform shall implement ground command **TC_DHS_LOW_AUTORISATION_WRITE QSPI** that unprotect all QSPI sectors to write access:


Command is composed with arguments:

- Address of the first sector to be unprotected
- Number of sector to be unprotected

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-750 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | TBC if Crypto sector should not follow this requirement |
| Updated | 2023-02-15 14:27 |


E_YODA_SYS-2604 - FRAM read memory

Platform shall implement ground command TC_DHS_LOW_READ_FRAM that allow read the FRAM and send the read to the Ground in TM(132, 175) TM_DHS_LOW_READ_FRAM

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-668 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-20 18:21 |

E_YODA_SYS-2605 - FRAM write memory

Platform shall implement ground command TC_DHS_LOW_WRITE_FRAM that allow to write the FRAM with the sent data.


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-668 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-20 18:21 |

4.5.8.3 Observability

E_YODA_SYS-1537 - Memory state

Memory ON/OFF state **AM_OBC_MEM_STATE** and memory fault status **AM_OBC_MEM_F_STATE** shall be in datapool. One bit by memory:


- Bit 0 (LSB) : Switches QSPI
- Bit 1 : QSPI
- Bit 2 : NVM

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB, FSW, FPGA |
| implementationVersion | V2 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | These information dealing with memory state are register provided by FPGA to FSW. FSW shall set its own data in datapool for observability |
| Updated | 2023-08-07 17:36 |

4.5.9 Configuration management**4.5.9.1 Processing****E_YODA_SYS-866 - PUS state configuration backup**

A ground command **TC_DHS_LOW_SAVE_PUS_SERVICE_CONFIGURATION** shall be implemented in order to save service PUS state configuration. This command have one argument representing the PUS service state configuration to save. PUS service concerned by the command :


- Service 5
- Service 12
- Service 14
- Service 19

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-754 E_KINEIS_SYS-756 E_KINEIS_SYS-757 E_KINEIS_SYS-759 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | - command is through S(132,195) - Configuration is software dependant |
| Updated | 2023-06-01 10:50 |

E_YODA_SYS-867 - Load of service state configuration

At software init, the flight software shall load the saved state configuration of the following services:


- Service 5
- Service11
- Service 12
- Service 14
- Service 19

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-764 E_KINEIS_SYS-768 E_KINEIS_SYS-771 E_KINEIS_SYS-772 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-21 18:48 |

E_YODA_SYS-677 - PUS service configuration table backup


A ground command **TC_DHS_LOW_SAVE_CONF_TABLE** shall be implemented in order to save one current configuration table into NVM memory.

The command take into argument the configuration table to save (one by software partition).

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-775 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | -commadin is through (132,195) |
| Updated | 2023-03-21 18:56 |


4.5.9.2 Commanding

E_YODA_SYS-679 - configuration management request (Deleted)

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | Deleted because redundant with E_YODA_SYS-1371 |
| Updated | 2023-08-09 11:05 |

4.5.10 Context management**E_YODA_SYS-1798 - OBC Context management**

If OBC is reset or temporary switched off, the platform shall save, in non volatile memory, the operational context data to allow to retrieve all context information.


| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-522 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | saved context is used in E_YODA_SYS-2611 |
| Updated | 2023-08-08 09:25 |

E_YODA_SYS-1799 - FSW context memory

The context memory to allow a FSW restart shall be stored in FRAM.


The context memory shall be duplicated and each instance shall be controlled by a CRC.

Each context memory instance shall be modified with a separate write access

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-610 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>The context memory shall at least contain all parameters in this document starting with the "<CTX_" characters.</p> <p>Context memory duplication, CRC and separate write access are required to prevent context memory corruption in case of SEU or anomaly.</p> |
| Updated | 2023-02-15 14:27 |


4.5.11 DHS Management**E_YODA_SYS-2303 - PF PUS PID range**

Parameter ID for platform telemetries shall be in the range [PF_PID_MIN - PF_PID_MAX]

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0750 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>PF_PID_MIN = 0x00000000</p> <p>PF_PID_MAX = 0x007FFFE (8388606decimal)</p> <p><i>AOCS and Navigation application are in Payload Parameter ID range as software partitions are provided by CNES</i></p> |
| Updated | 2023-06-12 10:15 |

E_YODA_SYS-2304 - RAW TM observability


The platform shall be able to provide to ground all flight units acquisitions telemetry.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-369 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-20 10:47 |

4.5.12 Ground support**4.5.12.1 Umbilical Links****E_YODA_SYS-2298 - Communication through umbilical**

The platform shall use UART RS422 for communication to equipment through umbilical link and shall operate at 460.8 Kbps, full duplex.

There are 1 start bit, 8 data bits, 1 stop bit, no parity.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA_SAT_REQ_1630 |
| KineisLink | E_KINEIS_SYS-846 E_KINEIS_SYS-847 |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-28 12:23 |

4.6 Electrical and Power Control**4.6.1 Solar Array Panels deployment**


E_YODA_SYS-1329 - Minimum delay before deployment of the solar generator

After separation from the launcher, in AUTO mode, the solar generator shall be deployed after a configurable delay

<CTX_SOLAR_DEPLOYEMENT_DELAY> seconds

This delay shall be configurable between 10 minutes and 60 minutes

This delay shall be a context parameter in order to be easily modifiable at a late stage including on the launch site.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0060 (SPE) |
| KineisLink | E_KINEIS_SYS-94 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 17:15 |

E_YODA_SYS-1339 - Solar Deployment Counter

In AUTO mode, the platform shall use a counter <CTX_SOLAR_DEPLOYEMENT_CPT>, to follow the delay provided by CTX_SOLAR_DEPLOYEMENT_DELAY.

This counter <CTX_SOLAR_DEPLOYEMENT_CPT> associated to this delay shall be stored in context parameter in order to be robust to an OBC reboot.


When CTX_SOLAR_DEPLOYEMENT_DELAY has expired, the platform shall active the Solar generator deployment procedure.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-94 E_KINEIS_SYS-550 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-13 14:54 |

E_YODA_SYS-1340 - restart in AUTO Mode before Solar Deployment Countdown

When the satellite boot in AUTO mode:

- if the <CTX_SOLAR_DEPLOYEMENT_DELAY> is not expired , the FSW shall continue the countdown of <CTX_SOLAR_DEPLOYEMENT_CPT from the context memory value.
- if the <CTX_SOLAR_DEPLOYEMENT_DELAY> is reached and the <CTX_SOLAR_DEPLOYEMENT_FLAG> indicator is not set, the FSW shall continue the solar generator deployment procedure.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-581 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-17 10:12 |

E_YODA_SYS-1330 - Solar generator deployment procedure

in AUTO mode, when the delay <CTX_SOLAR_DEPLOYEMENT_DELAY> is expired, the FSW shall command the solar generator deployment as follow :

- Command the PCDU to switch ON simultaneously TK0 and TK2, to deploy the +Y panel
- wait <CONF_TIME_SAP_TK_ON> seconds (typically 240s)
- command the PCDU to switch OFF simultaneously TK0 and TK2
- wait <CONF_TIME_SAP_TK_OFF> seconds (typically 60s)
- command the PCDU to switch ON simultaneously TK1 and TK3, to deploy the -Y panel
- wait <CONF_TIME_SAP_TK_ON> seconds
- command the PCDU to switch OFF simultaneously TK1 and TK3
- wait <CONF_TIME_SAP_TK_OFF> seconds
- command the PCDU to switch ON simultaneously TK0 and TK2, to retry deployment of the +Y panel
- wait <CONF_TIME_SAP_TK_ON> seconds
- command the PCDU to switch OFF simultaneously TK0 and TK2
- wait <CONF_TIME_SAP_TK_OFF> seconds
- command the PCDU to switch ON simultaneously TK1 and TK3, to retry deployment of the -Y panel
- wait <CONF_TIME_SAP_TK_ON> seconds
- command the PCDU to switch OFF simultaneously TK1 and TK3
- wait <CONF_TIME_SAP_TK_OFF> seconds
- set the <CTX_SOLAR_DEPLOYEMENT_FLAG> indicator in the context.

In case of OBC or platform reboot, the procedure shall restart from the current step.

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-550 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | the retry is to ensure deployment in case of a OBC or PCDU reboot or in case of a command loss between OBC and PCDU |
| Updated | 2023-04-04 15:52 |

4.6.2 Power conditioning

- Passivation
- Power conditioning observability

4.6.3 Power protection and distribution

[Switching power lines; Power protection and distribution observability]

4.6.4 Power Observability

4.7 Attitude and Orbit Control

AOCS parts are fully developed as black box by CNES.


AOCS black box will be then integrated in the FSW.

This chapter list the inter-connexion provided by Platform to allow AOCS operation and treatment by using needed unit such as RW, PROPU, SSU GYRO, SADM

4.7.1 AOCS management

E_YODA_SYS-1431 - AOCS-FSW communication protocol

The platform shall use PMU protocol as defined in document "AOCS Partition ? Interface Control Document" [AD07] for data exchange with AOCS and in "NAVIGATION Partition ? Interface Control Document" [AD08] for data exchange with NAV

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | ICD-AOCSSW-GEN-400 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-27 11:29 |


4.7.2 AOCS observability

E_YODA_SYS-2543 - AOCS exchange data and monitoring

The platform shall follow requirement defined in document :

"AOCS Partition ? Interface Control Document" [AD07] for data exchange with AOCS

"NAVIGATION Partition ? Interface Control Document" [AD08] for data exchange with NAV

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | AOCS Partition ? Interface Control Document [AD07] NAV Partition ? Interface Control Document" [AD08] |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | All data format exchange, in accordance with the mode (MNOM/MSAF) are defined in [AD07] and [AD08] |
| Updated | 2023-08-03 18:21 |

4.7.3 AOCS FDIR


E_YODA_SYS-2615 - Restart FDIR action on AOCS Event

Upon reception of the following AOCS event :

- EVENT_AOCS_FDIR_SST
- EVENT_AOCS_FDIR_GYRO
- EVENT_AOCS_FDIR_RW
- EVENT_AOCS_FDIR_NORM_HRW
- EVENT_AOCS_FDIR_SADM
- EVENT_AOCS_FDIR_MISPOINTING
- EVENT_AOCS_FDIR_ANGULAR_SPEED

The platform shall :

- trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC**
- deactivate from MTL, the time tagged 'Guidance TC' and Maneuvers operation

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | [AD07] |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | -see FDIR_AOCS - on TC_DHS_HIGH_RESTART_SC , the platform shall return in MSF state and in MSF state time tagged 'Guidance TC' and Maneuvers are deactivated |
| Updated | 2023-07-20 17:12 |


E_YODA_SYS-2616 - No restart FDIR action on AOCS Event

Upon reception of the following AOCS event :

- EVENT_AOCS_FDIR_MANEUVER

The platform shall :

- deactivate from MTL, the time tagged 'Guidance TC' and Maneuvers operation TC

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | [AD07] |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-20 17:12 |

4.8 Active Thermal Control

The thermal control function of the platform is in charge of maintaining the satellite temperatures at operational levels in all satellite modes and during all phases of the satellite life time. Temperatures of specific points of the satellite are monitored with temperature sensors and maintained within pre-set limits by the powering on and off of heaters.

The thermal control logic operates in close loop i.e. it is based on temperature regulation between ON and OFF set points.

The platform manages 6 thermal zones. Each zone features two thermistors, one heater, and the related control function. On critical thermal zones, a third thermistor is used for consistency verification.

The thermal control needs are cyclically evaluated and heaters commands cyclically sent as needed.

Depending on the zone, the thermistors are acquired by the OBC or the PCDU, and the heater is controlled by the OBC or the PCDU:

- Battery zone: thermistors acquired by the PCDU, heater controlled by the PCDU
- Body platform zone: thermistors acquired by the PCDU, heater controlled by the PCDU
- Star tracker Zone: thermistors acquired by the OBC, heater controlled by the OBC
- Propulsion Tanker zone : thermistors are acquired by PCDU and OBC, heater controlled by the PCDU
- Survival power plate zone : thermistors are acquired by OBC, heater controlled by the PCDU
- CAM_CE survival zone : thermistors are acquired by OBC, heater controlled by the PCDU


4.8.1 General

E_YODA_SYS-721 - Thermal control temperature ENG unit

Thermal control shall use engineering temperature in degrees celsius.

When sensor acquisition is in RAW value, the platform shall apply a calibration by using a polynomial approximation of order 3.


Polynomial approximation shall be configurable parameters modifiable by ground command.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-434 E_KINEIS_SYS-437 E_KINEIS_SYS-440 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-17 17:54 |


E_YODA_SYS-2058 - Thermal control sensors topologies

Thermal control shall use two kinds of sensors topology:

- One sensor topology defined by one main sensor and one backup sensor
- Two sensors topology defined by two main sensors and one disambiguation sensor


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | in case of only one main sensor is used with no backup, one sensor topology algorithm shall be used with main sensor is taken into account as backup sensor too to ease the re-use from previous project |
| Updated | 2023-06-20 09:11 |

4.8.2 Thermal zone**4.8.2.1 Temperature measurements location****E_YODA_SYS-2625 - Number max of thermal zones (deleted)**

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | deleted (redundant with E_YODA_SYS-2666 and 2667) |
| Updated | 2023-08-04 17:28 |

E_YODA_SYS-2566 - Number of used thermal zones


The platform shall defined the number of used thermal zones for the project with SYS_TCS_THERM_ZONE_N.
The value of SYS_TCS_THERM_ZONE_N shall be set to 12

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | -The number max of thermal zone that can be used by the platform shall be fixed to 12 - SYS_TCS_THERM_ZONE_N shall be set to 12 (7 defined and 5 spares) - SYS_TCS_THERM_ZONE_N shall not be modifiable in flight (constant value) |
| Updated | 2023-08-04 17:28 |

E_YODA_SYS-2567 - Thermal zones ID definition

The platform shall defined the thermal zone ID as follow;


- ZONE_00 for Battery zone
- ZONE_01 for Body platform zone
- ZONE_02 for Star tracker zone
- ZONE_03 for Propulsion Tanker zone
- ZONE_04 for Survival power plate 1 zone
- ZONE_05 for Survival power plate 2 zone
- ZONE_06 for CAM_CE survival zone
- ZONE_07 for spare7
- ZONE_08 for spare8
- ZONE_09 for spare9
- ZONE_10 for spare10
- ZONE_11 for spare11

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-08-04 17:28 |

E_YODA_SYS-2059 - PCDU thermal acquisitions

The platform shall manage the following temperature acquired at PCDU level:


- **Batterie**
 - The fine battery temperature at two different locations, AM_PCDU_PM0_BAT_TEMP0_T and AM_PCDU_PM1_BAT_TEMP0_T.
 - the disambiguation battery temperature, AM_PCDU_PM1_GS_TEMP0_T.
- **Solar Array (SA)**
 - One SA temperature acquired through AM_PCDU_PM0_GS_TEMP0_T.
- **Platform**
 - The fine platform temperature at two different locations, AM_PCDU_PM0_BAT_TEMP1_T and AM_PCDU_PM1_BAT_TEMP1_T.
 - The disambiguation platform temperature, AM_PCDU_PM0_GS_TEMP1_T.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-826 |
| subSystemAllocation | SDB, FSW, PCDU |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | - Name of PCDU acquired data are done according ICD PCDU [RD04] PMX Data chapter - These thermal acquisitions are then used by control loop function as defined in E_YODA_SYS-2315, 2316 and 2317 |
| Updated | 2023-08-07 09:55 |

E_YODA_SYS-2060 - OBC thermal acquisition


The platform shall manage the following temperature acquired at OBC level:

- **Star Tracker (STR)**
 - The STR backup temperature acquired through AM_OBC_TEMP_TH1
- **Tanker (Propulsion)**
 - The fine tanker temperature acquired through AM_OBC_TEMP_TH2.
- **Platform**
 - the stack PC104 temperature acquired through AM_OBC_TEMP_TH3
- **SSU (Solar Sensor Unit)**
 - the SSU temperature acquired through AM_OBC_TEMP_TH4
- **Payload**
 - The EGCU temperature acquired through AM_OBC_TEMP_TH5
 - The Payload plate 1 temperature acquired through AM_OBC_TEMP_TH6
 - The CAM_CE survival temperature acquired through AM_OBC_TEMP_TH7
 - The Payload plate 2 temperature acquired through AM_OBC_TEMP_TH8

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-827 E_KINEIS_SYS-440 |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | - for STR, the main temperature AM_STR_OH1_T is provided directly by equipment through SPW link - for SSU, no thermal zone is defined (no heater associated to SSU) , only temperature acquisition for monitoring (no action) -- These thermal acquisitions are then used by control loop function as defined in E_YODA_SYS-2315, 2316 and 2317 |
| Updated | 2023-08-07 09:55 |

E_YODA_SYS-2082 - PAYLOAD THERMAL acquisition


The platform shall acquire the PAYLOAD temperature with a precision better than 2°C in the range [-30°C / +60°C]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-2065 |
| KineisLink | N/A |
| subSystemAllocation | FSW, HW, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Payload Temperature is given through AM_OBC_TEMP_TH5, TH6, TH7 and acquired by OBC FPGA via IP ANA |
| Updated | 2023-08-04 20:32 |

4.8.2.2 Heaters control commands


E_YODA_SYS-2074 - Battery Heater Command

To command the battery heater, the platform shall use the TC_EPS_SET_HTR_CMD_PCDU command with PM_0 and HEATER_0 parameters.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-435 |
| subSystemAllocation | FSW, SDB, PCDU |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-13 14:54 |


E_YODA_SYS-2075 - Body platform Heater Command

To command the Body heater, the platform shall use the TC_EPS_SET_HTR_CMD_PCDU command with PM_0 and HEATER_1 parameters.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-438 |
| subSystemAllocation | FSW, SDB, PCDU |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-13 14:54 |


E_YODA_SYS-2076 - Propulsion Tanker Heater Command

To command the Propulsion Tanker heater, the platform shall use the TC_EPS_SET_HTR_CMD_PCDU command with PM_1 and HEATER_1 parameters.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB, PCDU |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-29 16:28 |

E_YODA_SYS-2077 - Star Tracker Heater Command


To command the Star Tracker heater, the platform shall use the MOBC_Limiter_HTR_5V.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-441 |
| subSystemAllocation | FSW, SDB, PCDU |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | TC_ASYNC_SET_POWER_LCL (S185,2) command could be used by ground to set the star tracker heater |
| Updated | 2023-03-29 16:27 |

E_YODA_SYS-2309 - Payload plate 1 Heater Command


To command the Payload plate 1 heater, the platform shall use the CDM1_NPL_TIMED_0 signal

To command the Payload plate 2 heater, the platform shall use the CDM1_NPL_TIMED_1 signal

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB, PCDU |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-06 16:08 |

E_YODA_SYS-2310 - CAM_CE Heater Command

To command the Payload Camera CE heater, the platform shall use the CDM1_NPL_HV_1 signal


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB, PCDU |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-06 16:08 |

4.8.3 Processing

E_YODA_SYS-2063 - Thermal control mode independence

The thermal control processing shall be independant of the platform modes, except for default activation/deactivation on mode entry.


It shall be possible to activate or deactivate any of the 9 thermal control zones by TC in any platform mode

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0830 (GEN) YODA-MC-REQ-2590 (SPE) |
| KineisLink | E_KINEIS_SYS-442 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | TBD for TC to managed activation/deactivation |
| Updated | 2023-04-14 14:40 |

E_YODA_SYS-2081 - EGPU Temperature Reference Point (TRP)


The platform shall maintain the temperature of the PAYLOAD in the respective operational and non-operational temperature ranges

[PAYLOAD_TRP_MIN; PAYLOAD_TRP_MAX]

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-IRD-PFPL-REQ-1090 |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | - PAYLOAD_TRP_MIN and MAX is defined by CNES (value not yet defined) - PAYLOAD_TRP_MIN is the COLD limit and PAYLOAD_TRP_MAX is the WARM Limit of ZONE_4 (Survival power plate zone) |
| Updated | 2023-04-21 12:05 |

E_YODA_SYS-2313 - Thermal control global status


Ground command **TC_THERMAL_SET_ACT_STATUS** shall be implemented in order to set the global thermal activation status (activated or deactivated). The command have one argument, the target status.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-676 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | command (180,1) |
| Updated | 2023-03-22 10:26 |

E_YODA_SYS-2314 - Thermal control zone activation

Ground command **TC_THERMAL_SET_STATUS_THERMAL_ZONE** shall be implemented in order to set the activation status (activated or deactivated) of one thermal zone. The command have the argument below:


- Thermal zone ID
- Activation status (activated or deactivated)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-676 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | command (180,2) |
| Updated | 2023-04-14 11:17 |

E_YODA_SYS-2315 - Temperature reference computing for one sensor topology

The temperature reference used by thermal control shall be computed as follow for one sensor thermal topology.


- If main sensor temperature acquisition is valid, reference temperature of the zone **AM_TH_ZONE_xx_REF_TEMP_ENG** is main sensor temperature.
- If main sensor temperature acquisition is invalid and backup temperature acquisition is valid, reference temperature of the zone **AM_TH_ZONE_xx_REF_TEMP_ENG** is backup sensor temperature.
- If both sensor temperature acquisition are invalid raise an event.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>When backup sensor does not exist, only one main sensor is used. In this case algo "one sensor topology" is followed with backup sensor set to main sensor . This concern the following item:</p> <ul style="list-style-type: none">- For tank (AM_OBC_TEMP_TH2),- PL plate 1 (AM_OBC_TEMP_TH6),- PL plate 2 (AM_OBC_TEMP_TH8),- CAM_CE (AM_OBC_TEMP_TH7), |
| Updated | 2023-07-06 16:40 |

E_YODA_SYS-2316 - Temperature reference computing for two sensors topology


The temperature reference used by thermal control shall be computed as follow for two sensors thermal topology:

- If both main sensor temperature acquisition is valid and delta temperature of the 2 sensors is less than the configurable temperature consistency check (**TEMP_CONSISTENCY**), reference temperature of the zone **AM_TH_ZONE_xx_REF_TEMP_ENG** is the arithmetic mean of the 2 sensor temperature acquisition.
- If one of the main temperature acquisition is invalid or the delta temperature of the 2 sensors is more than the configurable temperature consistency check (**TEMP_CONSISTENCY**), reference temperature of the zone **AM_TH_ZONE_xx_REF_TEMP_ENG** is the closest value to the Disambiguation temperature amongst first main sensor and second main sensor.
- If both main sensor temperature acquisition are invalid raise an event.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This topology shall be used for : - battery temperature - platform temperature |
| Updated | 2023-06-22 12:04 |

E_YODA_SYS-2603 - Consistency temperature configuration


Consistency temperature check (**TEMP_CONSISTENCY**) shall be configurable parameter, **CONF_THERM_ZONE_xx_TEMP_CONSISTENCY** with xx the thermal zone ID.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-434 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-17 10:09 |

E_YODA_SYS-2317 - Thermal control loop for heater activation

Thermal control function shall operate in close loop based on temperature regulation between two temperature setting point. Thermal Control shall be performed for each zone as follow:

- If dedicated zone temperature reference is colder than a configurable threshold **COLD_LIMIT** temperature for a configurable **FILTER_DURATION** in second, the FSW shall switch ON the heater associated to the thermal zone
- If dedicated zone temperature reference is warmed than a configurable threshold **WARM_LIMIT** temperature for a configurable **FILTER_DURATION** in second, the FSW shall swith OFF the heater associated to the thermal zone

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-439 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | For each zone, a COLD_LIMIT, WARM_LIMIT and FILTER_DURATION shall be defined see E_YODA_SYS-2639 |
| Updated | 2023-08-10 19:18 |


E_YODA_SYS-2639 - Thermal control loop configuration

Thermal control temperature limit (**WARM_LIMIT** and **COLD_LIMIT**) depending of operational mode (operational or not operational) and filtering duration (**FILTER_DURATION**) by thermal zone shall be part of context parameters

- CTX_THERM_ZONE_xx_OP_COLD_LIMIT
- CTX_THERM_ZONE_xx_OP_WARM_LIMIT
- CTX_THERM_ZONE_xx_NOP_COLD_LIMIT
- CTX_THERM_ZONE_xx_NOP_WARM_LIMIT
- CTX_THERM_ZONE_xx_FILTER_DURATION

with xx the thermal zone ID

It shall be possible by TC to modify any thermal control temperature limit and filtering duration


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | For each zone Operational and No-Operational limit is defined for the thermal control and heater activation/deactivation |
| Updated | 2023-08-10 19:18 |

E_YODA_SYS-2640 - Thermal control setting point at MODE entry

On platform mode transition, thermal control setting point shall be configured depending on the operational mode defined by configuration parameters:


- CONF_THERM_ZONE_xx_OP_STATE_AUTO
- CONF_THERM_ZONE_xx_OP_STATE_AIT
- CONF_THERM_ZONE_xx_OP_STATE_SAFE
- CONF_THERM_ZONE_xx_OP_STATE_NOM

with xx the thermal zone ID

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>Value that can be set for these configuration parameter is OPERATIONAL or NO_OPERATIONAL</p> <p>With this configuration of thermal zone, it shall be able to defined for each MODE which between OPERATIONAL or NO_OPERATIONAL limits (COLD/WARM) are taken into account for the thermal control.</p> <p>On YODA, all CONF_THERM_ZONE_xx_OP_STATE_NOM are set to OPERATIONAL</p> <p>The other CONF_THERM_ZONE_xx_OP_STATE_AUTO, AIT, SAFE are set to NO_OPERATIONAL</p> |
| Updated | 2023-07-06 19:13 |


E_YODA_SYS-2318 - Thermal control checks persistence

When a thermal command is issued, the associated thermal control shall be reset and the check filtering duration restarted, in order that if the temperature stays out of range, the command is repeated after filtering duration (**FILTER_DURATION**), and so on.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-824 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | if PUS service 12 is used, it implies that it is restarted after each out of range event. |
| Updated | 2023-03-22 11:05 |


E_YODA_SYS-2319 - Thermal control configurability

The platform shall allow to to modify by TC any thermal control temperature limit (**WARM_LIMIT** and **COLD_LIMIT**) and any filtering duration (**FILTER_DURATION**)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | see E_YODA_SYS-2319 |
| Updated | 2023-07-06 19:49 |

4.8.4 Thermal Control observability**E_YODA_SYS-2078 - Thermal control observability**

All thermistance value, all temperatures used for thermal control and all heater status shall be available for telemetry.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-576 |
| subSystemAllocation | SDB, FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-20 18:25 |

4.8.5 Thermal Control FDIR


E_YODA_SYS-2321 - Battery Thermal control FDIR in Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_00_BATTERY_OPER> shall be implemented on Battery thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on MNOM mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_00_REF_TEMP_T>
- Low limit : 10 degC (TBC)
- High limit : 30 degC (TBC)
- Monitoring interval : 1
- Repetition value : 3

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-951 |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2638 - Battery Thermal control FDIR in No-Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_00_BATTERY_NO_OPER> shall be implemented on Battery thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO, MSAF mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_00_REF_TEMP_T>
- Low limit : xx degC (TBC)
- High limit : xx degC (TBC)
- Monitoring interval : 1
- Repetition value : 3

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Low and high limit range for no-operational should be equal or greater than limit defined for operational |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2322 - Body Thermal control FDIR in Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_01_BODY_OPER> shall be implemented on Body thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on MNOM mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_01_REF_TEMP_ENG>
- Low limit : -15 degC (TBC)
- High limit : 50 degC (TBC)
- Monitoring interval : 1
- Repetition value : 3

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-951 |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2641 - Body Thermal control FDIR in No-Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_01_BODY_NO_OPER> shall be implemented on Body thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO, MSAF
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_01_REF_TEMP_ENG>
- Low limit : -xxx degC (TBC)
- High limit : xxx degC (TBC)
- Monitoring interval : 1
- Repetition value : 3

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Low and high limit range for no-operational should be equal or greater than limit defined for operational |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2323 - Star Tracker Thermal control FDIR in Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_02_STR_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on MNOM mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_02_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value :TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-952 |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2324 - Star Tracker Thermal control FDIR in No-Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_02_STR_NO_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO and MSAF mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_02_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value : TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-953 |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Low and high limit range for no-operational should be equal or greater than limit defined for operational |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2642 - Propulsion Thermal control FDIR in Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_03_PROPU_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on MNOM mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_03_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value :TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2643 - Propulsion Thermal control FDIR in No-Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_03_PROPU_NO_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO and MSAF mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_03_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value : TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Low and high limit range for no-operational should be equal or greater than limit defined for operational |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2644 - Survival Power Plate 1 Thermal control FDIR in Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_04_PWRPLATE_1_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO and MSAF mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_04_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value : TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2645 - Survival Power Plate 1 Thermal control FDIR in No-Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_04_PWRPLATE_1_NO_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO and MSAF mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_04_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value : TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Low and high limit range for no-operational should be equal or greater than limit defined for operational |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2646 - Survival Power Plate 2 Thermal control FDIR in Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_05_PWRPLATE_2_NO_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO and MSAF mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_05_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value : TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2647 - Survival Power Plate 2 Thermal control FDIR in No-Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_05_PWRPLATE_2_NO_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO and MSAF mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_05_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value : TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Low and high limit range for no-operational should be equal or greater than limit defined for operational |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2648 - Camera CE Thermal control FDIR in Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_06_CAMCE_NO_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO and MSAF mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_06_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value : TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 20:25 |


E_YODA_SYS-2649 - Camera CE Thermal control FDIR in No-Operational Mode

A service 12 monitoring <FM_FDIR_TH_ZONE_06_CAMCE_OPER> shall be implemented on STR thermal control reference temperature parameter.

This monitoring shall be configure as follow:

- Active on AUTO and MSAF mode
- Monitoring type :Check Limit
- Parameter monitored : <AM_TH_ZONE_06_REF_TEMP_ENG>
- Low limit : TBD degC
- High limit : TBD degC
- Monitoring interval : TBD
- Repetition value : TBD

On high and low limit cross event, the plaform shall trig a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Low and high limit range for no-operational should be equal or greater than limit defined for operational |
| Updated | 2023-08-04 20:25 |

4.9 Flight Units

Each external module connected to OBC, as defined in [Figure 4- YODA Bus Architecture](#) , are listed and specified in the following chapter.


4.9.1 General

4.9.1.1 Processing

E_YODA_SYS-897 - Switch OBC LCL

A Ground command **TC_ASYN_SET_POWER_LCL** with following argument shall be implemented in order to switch OBC LCL.


- LCL addressed (2 bytes address)
- Command state of LCL (OPEN / CLOSE)

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-839 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Test |
| Note | TC_ASYN_SET_POWER_LCL Command is (185,2) Commandable OBC LCL is for equipment connected to OBC. The only equipment connected to OBC and using this TC is StartTracker (OBC shall be resetable but unable to Switch OFF OBC, and in case of reset , LCL is switched OFF.) |
| Updated | 2023-02-15 14:29 |

E_YODA_SYS-900 - Platform device commanding

Platform shall provide 2 ground commands to command platform devices without any check by the FSW (except check perform by COP-1, security and PUS service 1). The provided command are :


- Specific service (185, 150) **TC_ASYNC_RAW_UNIT_CMD**
- Specific service (150, 60) , specially used for PCDU, **TC_EPS_RAW_CMD_PCDU**

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-208 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Test |
| Note | <p>TC_ASYNC_RAW_UNIT_CMD should be used for</p> <ul style="list-style-type: none">• Reaction Wheel• Star Tracker• PROPU• RW• S-BAND• Gyrometer <p>TC_EPS_RAW_CMD_PCDU should be used only for PCDU</p> |
| Updated | 2023-03-01 09:49 |

E_YODA_SYS-901 - Device Cyclic acquisition

Ground command **TC_FUNC_CYCLIC_UNIT_ACQ** with following argument shall be implemented in order to start the cyclic acquisition of a device.

- Equipement ID
- Status of activation (START or STOP)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-840 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-29 17:50 |

E_YODA_SYS-902 - Platform flight unit Activation / Deactivation


The platform shall provide a command to ACTIVATE / DEACTIVATE a given platform flight unit in any mode through specific TC (187,2),

TC_FUNC_ACT_DEACT_UNIT:

- **Activation** includes power on, any configuration setting required by the flight unit, acquisition starting, as applicable.
At the end of the activation process, the platform shall generate an activation complete event report, with parameter data allowing to assess the correct activation of the flight unit
- **Deactivation** includes disabling monitoring, stopping acquisitions, setting the unit in any state required before power down,


The identified unit, listed in the following list, shall be used in parameter of this TC :

- RW#, SADM#, PPU#, GYRO, SSU, STR, GNSS.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0830 (GEN) YODA_SAT_REQ_0350 |
| KineisLink | E_KINEIS_SYS-334 E_KINEIS_SYS-335 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | For SSU , Power ON/OFF is not used as it is a passive device.. |
| Updated | 2023-03-27 08:47 |


E_YODA_SYS-1409 - Link Error detection

The platform shall record message error per link and per connected device when multiple devices are connected to the link

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-402 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:29 |


E_YODA_SYS-1410 - Link Error Counter

The platform shall produce error counters per link, per connected device, per error type.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-403 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:54 |


E_YODA_SYS-1411 - Counter reset by ground

The platform shall allow the Ground to reset all error counter

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-470 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:54 |

E_YODA_SYS-1817 - Counters saturation


All link error counters shall be "saturated" when they reach the maximum value authorized by the implementation.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-470 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-29 18:16 |

E_YODA_SYS-1412 - Error Types

Error types shall be defined as follows:


- UART protocol errors (parity, lack of stop bit,...)
- SpW protocol errors (parity, timeout,...)
- Message structure error (as per device transfer message protocol, including CRC)
- Framing error (when applicable to the device)
- Missing Response (on-request or expected periodically)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-404 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-29 18:16 |

4.9.1.2 Observability**E_YODA_SYS-903 - Invalid acquisitions**


While a flight unit is ON, the parameters from the same acquisition shall have their acquisition status set to invalid when at least one of the following conditions is met:

- Response to an acquisition query did not happen within a per device configurable timeout
- Message/transfer was erroneous (at link, word, and transfer layers)

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-406 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, +++, SOFTWARE |
| ValidationMethod | Test, +++, Inspection |
| Note | <p>The parameters concerned are those from an erroneous message: e.g. in case of two consecutive messages and one of them is erroneous, the parameters acquired from the erroneous message are set invalid whereas the parameters from the valid message are set valid.</p> <p>When flight unit is OFF, acquisition status should not be used (nothing to do)</p> |
| Updated | 2023-03-01 10:02 |

E_YODA_SYS-1413 - Error counter in Telemetry

The platform shall provide all error counters available for telemetry

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-450 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:54 |

4.9.2 Payload Unit

The Payload unit is the main module of YODA mission, composed of its own equipments and managed through EGCU.

An overview of Payload is given in the following picture:

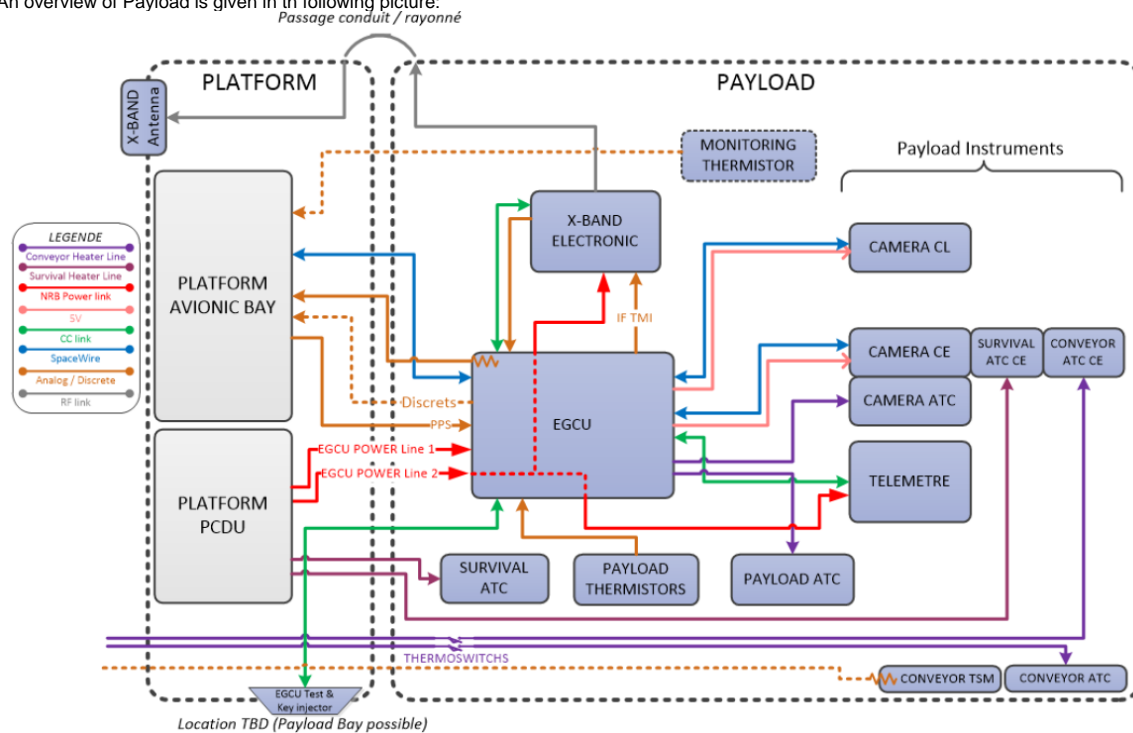


Figure 15 PAYLOAD Overview


4.9.2.1 Links

4.9.2.1.1 Payload (EGCU) Spacewire Interface

All exchanges for TC and TM between Platform and EGCU are performed on SpaceWire bus, by using PUS ISIS Standard (v8).
The Platform will route TC Packets received from ground to EGCU without modifying TC Packets.

E_YODA_SYS-776 - EGCU Spacewire Link configuration

Platform TM/TC data exchange with EGCU is performed on one SpaceWire Link configured in Autostart mode, with a link speed set to 32Mbps(+/-5%) in nominal functioning.


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-IRD-PFPL-REQ-3000 YODA-IRD-PFPL-REQ-3010 YODA-IRD-PFPL-REQ-2040 YODA-IRD-PFPL-REQ-2050-p YODA-IRD-PFPL-REQ-2070-p |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | - On payload side, Spw Link is configured in LinkStart - reconstructed clock required by YODA-IRD-PFPL-REQ-2050, not done at platform Level |
| Updated | 2023-06-20 11:24 |

E_YODA_SYS-1403 - EGCU Spacewire Link Management

Each TM/TC packet shall be separated with EOP character for Spw communciation between Platform and Payload.

If the emitter of the packet receives an EEP during the transmission, it shall abort the packet transmission with an EEP and then try to send again the packet.

If the emitter send a correct Spw packet but the packet is received with EEP by the receiver, the packet data shall be discarded.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-IRD-PFPL-REQ-3020 YODA-IRD-PFPL-REQ-3030 YODA-MC-REQ-2500 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | - This EOP shall be used to determine the end of TC/TM packet by the processing software - EEP management is defined in E_YODA_SYS-2312 |
| Updated | 2023-03-22 09:50 |


4.9.2.1.2 Payload (EGCU) Discretes Interface

E_YODA_SYS-777 - EGCU Discrete Link

The platform shall acquire and monitor at least 3 CMOS input discretes

The platform shall manage 3 CMOS discretes as follow:

- 2 CMOS discretes as input
 - Input used for health status of EGCU (0-FAILED / 1 OK)
 - Input as spare
- 1 CMOS discretes as output
 - output signal to synchronize PF sequencing frame with EGCU sequencing frame

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-2060 YODA-IRD-PFPL-REQ-2070-p |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-07 18:54 |

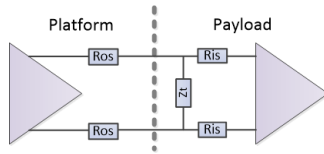
4.9.2.1.3 Payload (EGCU) Time Synchronization Interface

E_YODA_SYS-778 - EGCU PPS Link

An electrical link is used by the platform to provided to EGCU a synchronization pulse (PPS).


This link shall get the following characteristic :

- Electrical standard: RS422/RS485. Line termination as in the electrical schematic :



With $R_{os} = 33\Omega$ (TBC), $R_{is} = 1K\Omega$ (TBC) , $Z_t = 120\Omega$

- Accuracy of the active edge with respect to the GPS time : $\pm 4\mu s$ @3sigma (TBC)
- Active edge : Falling edge of the pulse (TBC)
- Shape : $5\mu s$ pulse (value '1') (TBC)


| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-2030 YODA-IRD-PFPL-REQ-2070-p |
| KineisLink | |
| subSystemAllocation | HW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | Time synchronization is provided by GNSS Accuracy takes into account GNSS performance ($\pm 2\mu s$ @3sigma) and OBC propagation delay ($< 2\mu s$ estimated through drivers and FPGA) |
| Updated | 2023-02-15 14:54 |

4.9.2.1.4 Payload (EGCU) Power Interface

E_YODA_SYS-792 - EGCU Power Line Link


the platform shall provide to payload 2 power lines with the following characteristics:

- The link shall be a non-permanent link (NPL) with NRB Busbar
- Voltage range : [11V - 17V]. The instrument shall operate nominally and meet full performances when powered within this voltage range.
- Voltage ripple : +/- 150 mVpp with a 100MHz bandwidth
- Power Line 1 consumption shall ensure to manage at least 25W max
- Power Line 2 consumption shall ensure to manage at least 45W max

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-2070-p YODA-IRD-PFPL-REQ-1080 YODA-IRD-PFPL-REQ-2000 YODA-MC-REQ-2470 (SPE) YODA-MC-REQ-2480 (SPE) |
| KineisLink | |
| subSystemAllocation | HW, PCDU |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | at payload level, In case of under voltage protection is implemented, the voltage range is reduced to [UVD-OFF-MAX ; 17V] where UVD-OFF-MAX = 12V) |
| Updated | 2023-02-21 18:26 |

E_YODA_SYS-1402 - Payload LCL


The platform shall provided a latching current Limiter (LCL) for each power line connected to the Payload

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-1000 YODA-MC-REQ-2470 (SPE) YODA-MC-REQ-2480 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | HW, PCDU |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-21 18:26 |

4.9.2.2 Processing

E_YODA_SYS-1494 - Ground Command for PAYLOAD

When EGCU is ON and operational, the platform shall send TC PUS packets received from ground to EGCU without modifying them.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4070 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:54 |

E_YODA_SYS-2064 - PLATEFORM - EGCU ON-BOARD DATA FORMAT for "Internal PUS" packet

The TM "Internal PUS" packet used for exchange data from PF to EGCU shall get the following structure :


| Packet Primary Header (6 bytes) | | | | | | Packet Data field (<= 1018 bytes) | | | | | | | | | | User Data Field | | | |
|---------------------------------|-------|------------------------|------------------------|-------------------------|-----------------------|-----------------------------------|-------------------|------------------------------|--------|--------------|------------------|--------------------|----------------|---------------------------|--|-----------------|---------------|--------------------------|-----------|
| Packet Identification | | | | Packet Sequence Control | | Packet data Length | Data field Header | | | | | | | | Packet Time (CUC format) and Time status | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Version Number | Type | Data Field Header Flag | Application Process ID | Sequence Flags | Source Sequence Count | | spare | TM Source Packet PUS Version | spare | Service type | Service sub-type | Packet sub-counter | Destination ID | Coarse time (LSb = 1 sec) | Fine time (LSb = 2 ⁻²⁴ sec) | | Source Data | Packet error control PEC | |
| 3 bits | 1 bit | 1 bit | 11 bits | 2 bits | 14 bits | | 1 bit | 3 bits | 4 bits | 8 bits | 8 bits | 8 bits | 8 bits | 32 bits | 24 bits | 1 byte | | | |
| 000 | 0 | 1 | | 11 | | | 0 | 001 | 0 | 3 | 25 | 00000000 | | | | | | | |
| 2 bytes | | | | 2 bytes | | 2 bytes | 5 bytes | | | | | | | 8 bytes | | | <= 1003 bytes | | 2 bytes 0 |
| TM packet length: <= 1024 bytes | | | | | | | | | | | | | | | | | | | |

Figure 16 "Internal PUS" packets

Each bytes shall be filled according the following value:


- **Version number:** set to 000 binary
- **Type:** set to 0 (binary) for telemetry packets
- **Data Field Header Flag:** set to 1 (binary) to indicates the presence of a Data Field Header
- **Application Process ID (APID):** set to a Payload or Platform APID value according to APIDs allocation
- **Sequence Flag:** set to 11 (binary) to indicate stand-alone packets (not segmented)
- **Source Sequence Count:** a counter maintained for each APID, incremented by one whenever this APID releases a packet.
- **Length:** specifies the number of bytes contained within the Packet Data Field. The number shall be an unsigned integer C, where C = (number of bytes contained within the Packet Data Field -1).
- **Data Field Header:** secondary header used for packet time stamping
- **Spare:** spare bit set to 0 to maintain symmetry with TC packet data field header
- **TM Source Packet PUS Version:** set to 1
- **Spare:** spare bits set to 0 to make up an integral octet.
- **Service Type:** the service type to which this telemetry source packet relates. Is equal to 3 for internal PUS packet.
- **Service Subtype:** the service sub-type to which this telemetry source packet relates. Is equal to 25 for internal PUS packet
- **Packet Sub-counter:** set to 0

- **Destination Id** : this field identifies the destination of the telemetry source packet which is the APID of the application in case of internal PUS packet
- **Time**: time of generation of the packet using TAI reference in CUC format, computed from the ?time? TC delivered by the platform on platform-to-payload interface bus
CUC format: the elapsed time represented as an unsegmented binary count of seconds and binary powers of sub-seconds counting from the arbitrary epoch set to: 2000/01/01 0h0min0s.
- **Source Data**: the data of the packet
- **Packet error control**: not used for internal PUS packets

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4410 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-22 09:10 |


E_YODA_SYS-2602 - TC command to EGCU

When EGCU is ON and operational, the platform shall be able to send up to 10 TC PUS packets by second, to EGCU.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4080 |
| KineisLink | N/A |
| subSystemAllocation | FPGA |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-12 17:55 |

E_YODA_SYS-2072 - Max internal PUS packet

When EGCU is ON and operational, the platform shall be able to send up to 50 (TBC) ?internal PUS? packets by second, to EGCU.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4090 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-22 09:10 |

E_YODA_SYS-2065 - Used APID for on board exchange with PAYLOAD

The APID values allocated to the PAYLOAD shall be in the range <PAYLD_APID_RANGE> [135, 236] and defined with the following configuration parameter:


<CONF_PAYLD_APID_AOCS>

<CONF_PAYLD_APID_NAV>

<CONF_PAYLD_APID_GYRO>

<CONF_PAYLD_APID_GYSELE>


<CONF_PAYLD_APID_EGCU>

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4380 YODA-IRD-PFPL-REQ-4420 YODA-MC-REQ-0280 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 17:46 |

E_YODA_SYS-2066 - Gyrometer data in Source Data container


The platform shall provide at 5Hz to Payload through TM (3.25) with **Destination Id = <PAYLD_APID_GYSELE>**, the Gyrometer data with the following information in "Source Data" field:

- 4 bytes (uint32): Gyro_X_Axis measure (No Unit)
- 4 bytes (uint32): Gyro_Y_Axis measure (No Unit)
- 4 bytes (uint32): Gyro_Z_Axis measure (No Unit)
- 1 byte (int8): measure validity flag (0 -> invalid measure; 1 -> valid measure)
- 4 bytes (int32): Gyro health status (same values as equipment, cf. RD04)
- 4 bytes (uint32): measure date (second)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4450 YODA_SAT_REQ_0834 |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 17:32 |


E_YODA_SYS-2067 - AOCS data for PAYLOAD

The platform shall provide to Payload at 5Hz, all emitted AOCS partition TM (3,25) with **Destination Id = <PAYLD_APID_RANGE>**, without modifying them.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4430 YODA-IRD-PFPL-REQ-4020 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:54 |


E_YODA_SYS-2068 - NAV data for PAYLOAD

The platform shall provide to Payload at 1Hz, all emitted NAV partition TM (3,25) with **Destination Id = <PAYLD_APID_RANGE>**, without modifying them.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4440 YODA-IRD-PFPL-REQ-4030 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-12 18:02 |


E_YODA_SYS-2070 - Time laps between PF partition data to PAYLOAD

Time laps management once AOCS, NAV or Gyro data are available and transmission to PAYLOAD through TM(3,25) shall be less that 100ms

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-IRD-PFPL-REQ-4095 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-02-15 14:54 |

E_YODA_SYS-2069 - Provided data from Payload

The platform shall directly route all received TM(3,25) from PAYLOAD, to dedicated partition according its destination ID (AOCS or NAV)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-22 09:12 |

E_YODA_SYS-2302 - PAYLOAD - PUS PID range :Deleted


Parameter ID for Payload telemetries shall be in the range [PAYLD_PID_MIN - PAYLD_PID_MAX]

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | - |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | Test |
| Note | Deleted because only allocated to payload |
| Updated | 2023-03-21 19:19 |

4.9.2.3 Observability**E_YODA_SYS-2071 - Monitoring PAYLOAD Data for Telemetry downlink**

The platform shall make the following PAYLOAD parameters available for downlink :


- ON/OFF status
- EGCU Temperature
- SPW link health
- 3 CMOS discretes state
- Number of error on SPW link

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-2500 (SPE) YODA-IRD-PFPL-REQ-2060 |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-29 18:16 |

4.9.2.4 FDIR

E_YODA_SYS-2312 - Spw EEP Management

An EEP counter shall be managed to restart the SPW link and once this counter reach <CONF_NB_EEP_MAX_FOR_SPW_RESTART>, Spw shall be restarted to establish the connection again and an event shall be generated.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-IRD-PFPL-REQ-3030 YODA-IRD-PFPL-REQ-3040 |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <ul style="list-style-type: none">- EEP detection and counter are managed by FPGA.- This counter shall not be roll over (resetable only by ground)- FSW shall restart the link once the counter reach CONF_NB_EEP_MAX_FOR_SPW_RESTART.-CONF_NB_EEP_MAX_FOR_SPW_RESTART = 3 |
| Updated | 2023-08-09 18:54 |

4.9.3 Start Tracker Unit

Used STR is from SODERN. It is composed of one OH (Optical Head).

As it is a re-use from used previous project at Hemeria, all requirements of [RD08] shall be taken into account.

The following picture show the true STR equipment:




Figure 17 View of STR equipment

4.9.3.1 Links


E_YODA_SYS-1548 - Star Tracker Spacewire

The Star tracker spacewire shall be integrated by implementing [RD08]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-789 |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:54 |

E_YODA_SYS-1549 - Link number


The platform shall support the communication with one Star Tracker Optical Head (STROH) using the full duplex SpaceWire link.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-301 |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:54 |

4.9.3.2 Processing


E_YODA_SYS-1550 - Star tracker processing

The Star tracker processing shall be as per [RD08]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-790 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:54 |


E_YODA_SYS-3071 - Scheduling StarTracker measures to AOCS

The platform shall provide to AOCS at 10Hz, in MNOM only, all STR quaternion measurement as defined in [AD07]

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | ICD [YODASCAO-34] STR Data |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-18 13:58 |

4.9.3.3 Observability**E_YODA_SYS-1551 - Star tracker observability**

The Star tracker observability shall be as per [RD08]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-791 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:54 |

4.9.3.4 FDIR


E_YODA_SYS-2621 - Star Tracker data FDIR monitoring

A service 12 monitoring shall be implemented on AOCS SW star tracker validity status output parameter.

This monitoring shall be configure as follow:

- Monitoring definition:
 - Active: MNOM
 - parameter monitored : FLAG_FDIR_MNO
- Checking information:
 - Monitoring interval : 1
 - Repetition value :0
 - Monitoring type : CHECK_EXPECTED_VALUE
 - mask : 0x01
 - Expected Value :0
- Validity condition:
 - Validity parameter : STR_ON (LCL_start Tracker
 - Mask : 0xFF
 - Expected Value :

On generation event of this monitoring, the plaform shall trig a spacecraft restart with TC_DHS_HIGH_RESTART_SC command.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-924 |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | the AOCS SW validity status includes communication and processing error status. the repetition value is only 3 because the AOCS SW takes into account the necessary time to reach tracking mode |
| Updated | 2023-07-20 17:12 |

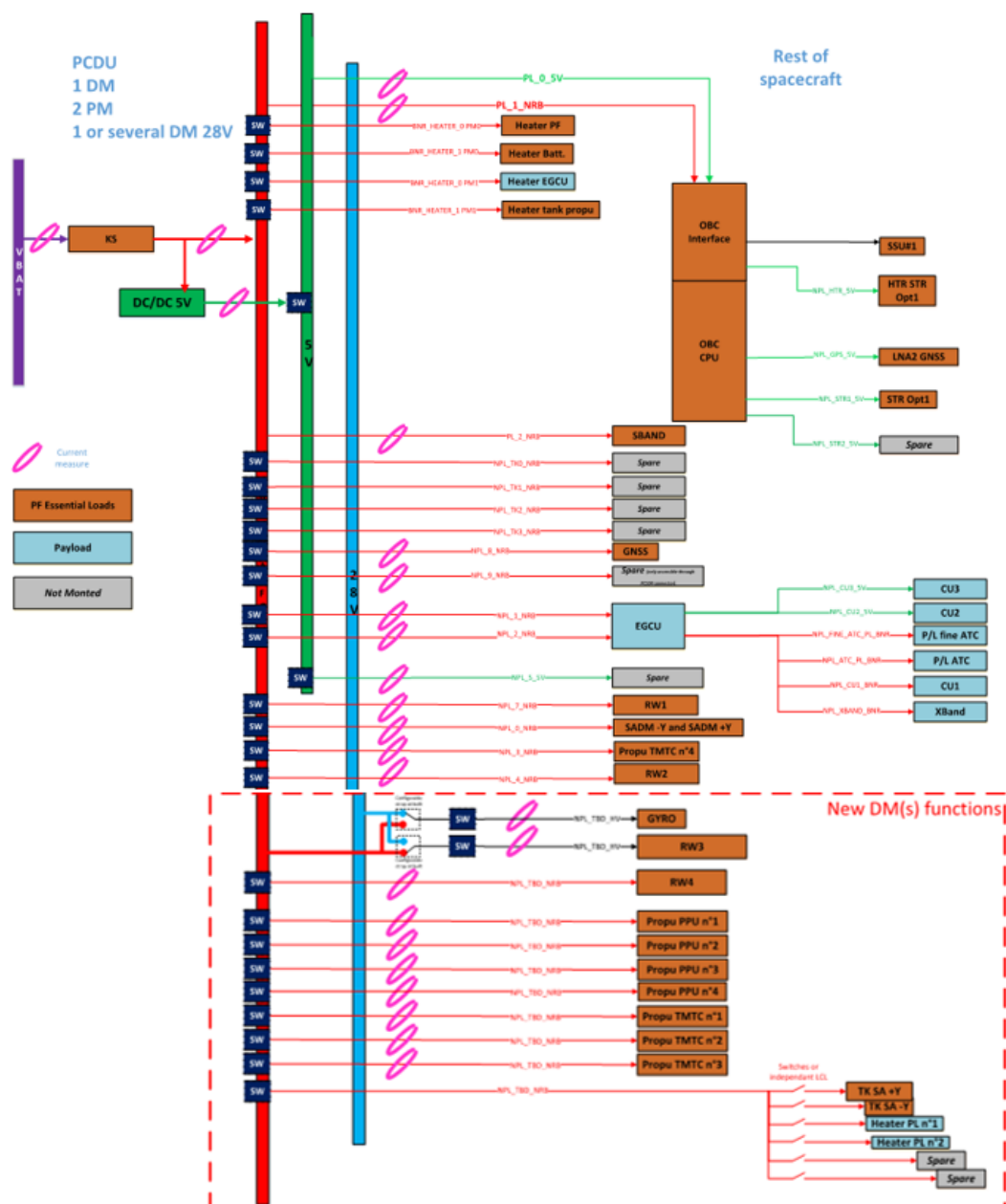
4.9.4 EPS PCDU Unit

The PCDU is from EREMS.

The PCDU provide alimentation of all fligth unit. PCDU is divide in 3 blocks :

- 2 PM cards for Power Module which manage all power provided by Solar Array and batteries pack
- DM1 Card for Distribution Module1 which interface power between PM and units alimented with 16V BNR, 5V
- 2 CDM Complementary Card for Distribution Module2 which interface power between PM and units alimented with 16V BNR, 28V

The OBC communicates only with the DM board. If the OBC send a command for another board, the DM board will forward the command to the other board.




EPS Block Diagram

4.9.4.1 Links

E_GEN_PCDU_EREMS_SYS-488 - PCDU communication link characteristics

The platform shall use UART RS485 for communication with PCDU equipment and shall operate at 57600 bps, half duplex with data exchange in NSP format, encapsulated into packets using SLIP framing as defined in "PCDU ICD " [RD_GENPF_PCDU_01].


There are 8 bits per byte little endianness., no parity, and 1 stop bit

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | [RD_GENPF_PCDU_01] |
| subSystemAllocation | FSW, FPGA, PCDU |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2022-10-26 11:35 |

4.9.4.2 Processing**E_GEN_PCDU_EREMS_SYS-491 - PCDU message transfers**

The platform shall communicate with PCDU by using the following command in accordance with "PCDU ICD " [RD_GENPF_PCDU_01]:

- PEEK command for reading the unit's memory
- POKE command for writing the unit's memory (for PCDU software update)
- APPLICATION_TELEMETRY command for requesting the unit's parameters
- CRC command to compute the checksum of memory Area
- APPLICATION_COMMAND command for configuring / triggering unit's action (e.g. stop watchdog, setting LCL state for NPL, setting heaters state)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | RD_GENPF_PCDU_01 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Command PEEK, POKE and CRC are only allocated to SDB (no implementation required at FSW Level) |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-492 - PCDU hardware Reset

The platform shall provide a function to hardware reset the PCDU that performs autonomously the following:

- Remove power from all permanent and non-permanent power distribution lines
- Reboot the PCDU
- Apply permanent power distribution lines

This PCDU reset shall be triggered with a single hardware signal **MOBC_PCDU_HW_RESET**, robust to SETs



| | |
|-----------------------|------------------|
| ReqStatus | Reviewed |
| LinkedUpReq | RD_GENPF_PCDU_01 |
| subSystemAllocation | FSW, HW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-493 - PCDU Raw command

The platform shall provide a Ground command **TC_EPS_RAW_CMD_PCDU** and this corresponding telemetry **TM_EPS_REPORT_PCDU_CMD** to command PCDU without any check by the FSW.

The command shall route the data field to PCDU and send to ground the response if requested.

Command contain the following argument


- Length of the command
- Message control field of NSP protocol
- the raw data of command

| | |
|-----------------------|------------------|
| ReqStatus | Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | FSW, PCDU, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-506 - Instanciated PCDU command Reset PCDU

The platform shall provide an instanciated command **TC_EPS_RESET_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 3 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow
 - One argument of 8 bits representing the Application command code set to STOP_WATCHDOG_REFRESH
 - One argument of 8 bits representing the ID Board to address

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-507 - Instanciated PCDU command Ack error

The platform shall provide an instanciated command **TC_EPS_ACK_ERR_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 2 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow
 - One argument of 8 bits representing the Application command code set to ACK_ERROR

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-508 - Instanciated PCDU command set DM LCL

The platform shall provide an instanciated command **TC_EPS_SET_LCL_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 7 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow:
 - One argument of 8 bits representing the Application command code set to DM_SET_LCL_NPL_STATE
 - One argument of 8 bits representing the DM Board to address
 - One argument of 16 bits with one bit dedicated to one NPL for the NPL state
 - One argument of 16 bits with one bit dedicated to one NPL for the NPL state Mask

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | BOARD should be - DM0 board |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-512 - Instanciated PCDU command set status of DM thermal knife

The platform shall provide an instanciated command **TC_EPS_SET_TK_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 6 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow
 - One argument of 8 bits representing the Application command code set to DM_SET_LCL_TK_STATE
 - One argument of 8 bits representing the DM Board to address
 - One argument of 8 bits with one bit dedicated to one TK for the TK State (LCL_TK_STATE)
 - One argument of 8 bits with one bit dedicated to one TK for the TK mask (LCL_TK_MASK)
 - One argument of 8 bits for the TK activation time (LCL_TK_MASK)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | ID BOARD should be - DM0 board |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-527 - Instanciated PCDU command set CDM LCL NPL

The platform shall provide an instanciated command **TC_EPS_SET_CDM_LCL_NPL_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 5 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow:
 - One argument of 8 bits representing the Application command code set to CDM_SET_LCL_NPL
 - One argument of 8 bits representing the CDM Board to address
 - One argument of 8 bits with one bit dedicated to one NPL for the NPL state
 - One argument of 8 bits with one bit dedicated to one NPL for the NPL Mask

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | ID BOARD should be - CDM0 board - CDM1 board |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-528 - Instanciated PCDU command set CDM LCL NPL HC

The platform shall provide an instanciated command **TC_EPS_SET_CDM_LCL_NPL_HC_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 5 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow:
 - One argument of 8 bits representing the Application command code set to CDM_SET_LCL_NPL_HC
 - One argument of 8 bits representing the CDM Board to address
 - One argument of 8 bits with one bit dedicated to one NPL_HC for the NPL_HC state
 - One argument of 8 bits with one bit dedicated to one NPL_HC for the NPL_HC Mask

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | ID BOARD should be - CDM0 board - CDM1 board |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-529 - Instanciated PCDU command set CDM LCL NPL HV

The platform shall provide an instanciated command **TC_EPS_SET_CDM_LCL_NPL_HV_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 5 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow:
 - One argument of 8 bits representing the Application command code set to CDM_SET_LCL_NPL_HV
 - One argument of 8 bits representing the CDM Board to address
 - One argument of 8 bits with one bit dedicated to one NPL_HV for the NPL_HV state
 - One argument of 8 bits with one bit dedicated to one NPL_HV for the NPL_HV Mask

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | ID BOARD should be - CDM0 board - CDM1 board |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-530 - Instanciated PCDU command set CDM LCL TIMED

The platform shall provide an instanciated command **TC_EPS_SET_CDM_LCL_TIMED_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 5 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow:
 - One argument of 8 bits representing the Application command code set to CDM_SET_LCL_TIMED
 - One argument of 8 bits representing the CDM Board to address
 - One argument of 8 bits with one bit dedicated to one LCL_TIMED for the LCL_TIMED state
 - One argument of 8 bits with one bit dedicated to one LCL_TIMED for the LCL_TIMED Mask
 - One argument of 8 bits with one bit dedicated to the LCL_TIMED Duration

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>This 'LCL_TIMED Duration' argument is relevant only when switching ON a LCL TIMED.</p> <p>It applies to all LCL_TIMED_x that the PCDU will switch ON.</p> <p>The value corresponds to a multiple of 10ms (0x02 = 20ms ...).</p> <p>A value of 0x00 is equivalent to an infinite time.</p> <p>At the end of the DURATION the PCDU switch OFF the LCL TIMED</p> |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-513 - Instanciated PCDU command set heater status

The platform shall provide an instanciated command **TC_EPS_SET_HTR_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 5 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow
 - One argument of 8 bits representing the Application command code set to PM_SET_HEATER_BATTERY
 - One argument of 8 bits representing the PM ID Board
 - One argument of 8 bits with one bit dedicated to one Heater for the Heater State (HEATER_STATE)
 - One argument of 8 bits with one bit dedicated to one Heater for the Heater mask (HEATER_MASK)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-514 - Instanciated PCDU command Set fire passivation

The platform shall implement an instanciated command **TC_EPS_SET_FIRE_PASSIVATION_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 2 bytes
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow
 - One argument of 8 bits representing the Application command code set to PASSIVATION

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-515 - Instanciated PCDU command to clear LCL trip status

The platform shall implement an instanciated command **TC_EPS_ACK_LCL_TRIP_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 2
- Message control field fixed to
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION COMMAND
- Raw data shall be defined as follow
 - One argument of 8 bits representing the Application command code set to LCL_ACK_TRIPPED

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-516 - Instanciated PCDU command to GET software telemetry

The platform shall implement an instanciated command **TC_EPS_GET_SW_TM_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 2 bytes
- Message control field fixed to
 - TM return set to 1
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to APPLICATION TELEMETRY
- Raw data shall be defined as follow
 - One argument of 8 bits representing the Application telemetry code set to GET_SOFTWARE_HK

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-517 - Instanciated PCDU command PEEK

The database shall implement an instanciated command **TC_EPS_PEEK_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 6 bytes
- Message control field fixed to
 - TM return set to 1
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to PEEK
- Raw data shall be defined as follow
 - One argument of 32 bits representing the Peek address
 - One argument of 8 bits representing the length of Peek

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-518 - Instanciated PCDU command get CRC

The platform shall implement an instanciated command **TC_EPS_CRC_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Length of command shall be fixed to 9 bytes
- Message control field fixed to
 - TM return set to 1
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to CRC
- Raw data shall be defined as follow
 - One argument of 32 bits representing the Start address
 - One argument of 32 bits representing the End address

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-519 - Instanciated PCDU command POKE

The platform shall implement an instanciated command **TC_EPS_POKE_CMD_PCDU** based on the command **TC_EPS_RAW_CMD_PCDU**.


- Message control field fixed to TBD
 - B BIT set to 0
 - ACK BIT set to 0
 - COMMAND CODE set to POKE
- Raw data shall be defined as follow
 - One argument of 32 bits representing the Poke address
 - Raw data write (TBD)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | To confirm with SPE Android the legth and type of Raw datat |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-520 - Instanciated PCDU telemetry Application Command

The platform shall implement an instanciated telemetry **TM_EPS_ACOM_PCDU_CMD** based on the telemetry **TM_EPS_REPORT_PCDU_CMD** with :


- Command code check to APPLICATION_COMMAND

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-521 - Instanciated PCDU telemetry Application Telemetry

The platform shall implement an instanciated telemetry **TM_EPS_ATM_PCDU_CMD** based on the telemetry **TM_EPS_REPORT_PCDU_CMD** with :


- Command code check to APPLICATION_TELEMETRY

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-522 - Instanciated PCDU telemetry PEEK command

The platform shall implement an instanciated telemetry **TM_EPS_PEEK_PCDU_CMD** based on the telemetry **TM_EPS_REPORT_PCDU_CMD** with :


- Command code check to PEEK
- Parameter for the PEEK address

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-523 - Instanciated PCDU telemetry POKE command

The platform shall implement an instanciated telemetry **TM_EPS_POKE_PCDU_CMD** based on the telemetry **TM_EPS_REPORT_PCDU_CMD** with :


- Command code check to POKE
- Parameter for the POKE address

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-524 - Instanciated PCDU telemetry CRC command


The platform shall implement an instanciated telemetry **TM_EPS_CRC_PCDU_CMD** based on the telemetry **TM_EPS_REPORT_PCDU_CMD** whith :

- Command code check to CRC
- Parameter for the CRC value

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:55 |

E_GEN_PCDU_EREMS_SYS-525 - PCDU - PUS PID range

Parameter ID for PCDU telemetries shall be in the range [PCDU_PID_MIN - PCDU_PID_MAX]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection, Test |
| Note | most of project , PCDU_PID_MIN = 10 000 PCDU_PID_MAX = 10 999 |
| Updated | 2023-07-05 10:29 |


E_GEN_PCDU_EREMS_SYS-531 - Secure version of the PCDU SW

A secure version of the on-board PCDU software shall be present on board to ensure start-up in all cases.

This version shall be in a memory area:

- protected against heavy ions,
- write-protected to avoid the risk of damage by other software.


This version shall be ?non rewritable? in flight or rewritable but with huge precautions.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, PCDU |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Analysis |
| Note | Protection against heavy ions can be performed either by using a memory immune to heavy ions or by storing two copies and performing scrubbing |
| Updated | 2023-06-14 17:37 |

E_GEN_PCDU_EREMS_SYS-532 - Working version of the PCDU SW

A working version of the on-board PCDU software shall be present on board


This version shall be rewritable.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, PCDU |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-14 17:36 |

E_GEN_PCDU_EREMS_SYS-533 - Integrity check of the PCDU SW before start up


The PCDU shall check the integrity of the PCDU version before launching the software.

The integrity check shall ensure that the stored software has not been corrupted since the software write in non volatile memory.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, PCDU |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Analysis |
| Note | |
| Updated | 2023-06-14 17:36 |


E_GEN_PCDU_EREMS_SYS-534 - Reboot of the PCDU SW

All reboots are done with the current version if uncorrupted . If the current version is corrupted or if the number of reboot exceed a configurable value, the reboot will be done with the secure version.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-06-14 17:36 |

E_GEN_PCDU_EREMS_SYS-535 - Reloading of the PCDU software


It shall be possible, on ground TC request **TC_DHS_LOW_TRANSFERT_DATA_PCDU**, independantly of the mode, to copy the content of the OBC RAM buffer dedicated to software load to the PCDU non volatile memory zone dedicated to the non secure version of the PCDU software Command have one argument , the offset to take in consideration in buffer memory.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, SDB, FSW, PCDU |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-14 17:36 |

E_GEN_PCDU_EREMS_SYS-536 - Number of command transfer to PCDU during PCDU software upload


The number of command transfer from buffer memory to PCDU during PCDU software upload shall be part of datapool :

AM_PCDU_LV_LOAD_TC_NUMBER

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-06-14 17:36 |

E_GEN_PCDU_EREMS_SYS-537 - Selecting version of the PCDU SW

It shall be possible by ground TC to select which version of the PCDU software shall be loaded at next PCDU reboot.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, SDB, FSW, PCDU |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-14 17:36 |


E_GEN_PCDU_EREMS_SYS-538 - PCDU software delivery format

The PCDU software shall be delivered into binary format. There shall be two binary file:

Binary file containing the raw data


Binary file containing the raw data embedded into commands directly interpretable by the PCDU. The maximum command size shall be defined.

The software delivery shall also include a meta-data file containing the CRC of each binary file.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | PCDU |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-06-14 18:06 |

E_YODA_SYS-2062 - PCDU Data acquisition frequency


The platform shall acquire PCDU data through TM_HK (see [RD_GENPF_PCDU_01]) at 1Hz

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | PCDU TM_HK is requested thanks APPLICATION_TELEMETRY (TC_GET_HK) |
| Updated | 2023-02-15 14:54 |

E_GEN_PCDU_EREMS_SYS-539 - PCDU frozen data observable


The OBSW shall compare the battery voltage measurement **AM_PCDU_PMx_BAT_U** and battery current measurements **AM_PCDU_PMx_BAT_I** from each PCDU PM BOARDS.

If for one board, both measurements are identical to the previous cycle, the flag **<AM_PCDU_DAT_FROZEN>** shall be set to TRUE

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-20 18:22 |

4.9.4.3 Observability**E_GEN_PCDU_EREMS_SYS-526 - PCDU parameters observability**

The platform shall make available for cyclic housekeeping telemetry, all parameters values provided by TM_HK [RD_GENPF_PCDU_01].

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <ul style="list-style-type: none">- a TM_HK (called TM_GENERAL_HK on old project such as KINEIS) exists for each board composing PCDU as defined in RD_GENPF_PCDU_01]- Note that TM_HK content is different form TM_SOFTWARE_HK- Time defined for cyclic Telemetry is not generic and depends on the project |
| Updated | 2023-04-04 17:55 |

E_YODA_SYS-1408 - EBAT Battery level determination for monitoring

The FSW shall perform a configurable polynomial approximation of order 3 on <AM_PCDU_PM0_BAT_U>, <AM_PCDU_PM0_BAT_I>, <AM_PCDU_PM1_BAT_U>, <AM_PCDU_PM1_BAT_I> to compute the engineering values for both batteries voltage measurement and the two battery current measurement.


The FSW shall eliminate inconsistent measurement by comparing the engineering values with configurable low and high limits.

If both voltage engineering values are available, the battery voltage used for computation <AM_VBAT_FOR_MONITORING> shall be the least of both. if only one voltage engineering value is available it shall be used for <AM_VBAT_FOR_MONITORING>. if no voltage engineering value is available, the <AM_VBAT_FOR_MONITORING> shall be set to 0V.

If both current engineering values are available, the current used for computation 'leng' shall be the sum of both. if only one current engineering value is available, it shall be doubled and used for 'leng'. if no current engineering value is available, the 'leng' shall be set to 0A.

The EBAT Battery level <AM_EBAT_FOR_MONITORING> shall be the voltage used for computation plus the product of the current used for computation with the battery internal resistance configurable parameter <CONF_BAT_INTERNAL_RES>:

<AM_EBAT_FOR_MONITORING> = <AM_VBAT_FOR_MONITORING> + <CONF_BAT_INTERNAL_RES> * <AM_IBAT_FOR_MONITORING>

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-2540 (GEN) YODA-MC-REQ-2530 (GEN) YODA-MC-REQ-0510 (GEN) |
| KineisLink | E_KINEIS_SYS-605 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis, Test |
| Note | <ul style="list-style-type: none"> - Default low limit for voltage consistency is 10V which is slightly below passivation voltage - Default high limit for voltage consistency is 16.9V which is slightly above max battery charge before launch. This value allows the <AM_EBAT_FOR_MONITORING> FDIR as per low level monitoring to monitor also overcharging. - Default low limit for current consistency is -6A, which is slightly below the half the maximum discharge current. - Default high limit for current consistency is +3A, which is slightly above the maximum solar generator production. |
| Updated | 2023-08-10 17:10 |

4.9.4.4 FDIR

E_YODA_SYS-2546 - Low/high level Battery monitoring


A service 12 monitoring <FM_EPS_EBAT> shall be implemented on the EBAT Battery level parameter.

This monitoring shall be configure as follow:

- Monitoring definition:
 - Active : MSAF, MNOM
 - Parameter monitored : <AM_EBAT_FOR_MONITORING>
- Checking Information:
 - Monitoring interval : 1
 - Repetition value : <SYS_FDIR_EBAT_FILTER_DURATION>
 - Monitoring type : CHECK_LIMIT
 - Low limit : <SYS_FDIR_EBAT_LOW_LIMIT>
 - High limit : 1000
- Validity condition:
 - Validity parameter : <CTX_LOW_BATTERY_FDIR_STATUS>
 - Expected Value : False

On low limit cross event only, plaform shall trigger TC_DHS_LOW_BATTERY_FDIR command.


On high limit cross event, nothing to trigg.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-604 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>The default filtering value is sized to cover a PCDU restart delay and to guarantee the battery will not be completely empty before returning to normal battery charging conditions. <SYS_FDIR_EBAT_FILTER_DURATION> default value is 10s.</p> <p>The default low limit value <SYS_FDIR_EBAT_LOW_LIMIT> shall be from the energy analysis.</p> <p><SYS_FDIR_EBAT_LOW_LIMIT> default value is 14.95V</p> <p>Battery overcharge is managed too with this FDIR since overcharge measurements are considered invalid and replaced with 0 in requirement EBAT Battery level</p> <p>Blocked data is checked by ?absence dialogue monitoring?.</p> |
| Updated | 2023-08-10 16:54 |

E_YODA_SYS-2547 - Low level Battery FDIR ACTION

On **TC_DHS_LOW_BATTERY_FDIR** execution, the OBSW shall :

- set the context to load the secure OBSW version at next reboot
- set **<CTX_LOW_BATTERY_FDIR_STATUS>** context parameter to true, to disable the FDIR after next reboot
- request a spacecraft restart with **TC_DHS_HIGH_RESTART_SC** command.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-934 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-29 18:09 |

E_YODA_SYS-2613 - Low level Battery FDIR reenabling


A service 12 monitoring **<FM_BAT_FDIR_REENABLING>** shall be implemented on the Battery FDIR status parameter.

This monitoring shall be configure as follow:

- Monitoring definition:
 - Active : MSAF
 - Parameter monitored : **<CTX_LOW_BATTERY_FDIR_STATUS>**
- Checking information:
 - Monitoring interval : 1
 - Repetition value : **<SYS_FDIR_EBAT_RECOVER_TIME>**
 - Monitoring type : CHECK_EXPECTED_VALUE
 - Monitoring mask :0xFF
 - Monitoring expected value : FALSE
- Validity condition : None


On monitoring event triggering the OBC platform shall set **<CTX_LOW_BATTERY_FDIR_STATUS>** to FALSE using

TC_140_001_SET_PARAM_VALUE command.


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-935 |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | The purpose of this monitoring is to autonomously re-enable the Low battery FDIR after the duration necessary to ensure battery recharge |
| Updated | 2023-06-19 10:30 |

E_GEN_PCDU_EREMS_SYS-540 - Autonomous PCDU reboot


The PCDU shall autonomously reboot in case of internal anomaly.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, PCDU |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-20 18:36 |

E_GEN_PCDU_EREMS_SYS-541 - PCDU reboot number

The number of PCDU reboot on the working PCDU SW version shall be  monitored.

In case of PCDU_REBOOT_MAX successive PCDU reboots without ground intervention, the PCDU SW shall restart with the SECURE PCDU SW.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, PCDU |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-20 18:36 |


E_GEN_PCDU_EREMS_SYS-542 - PCDU frozen data monitoring

A service 12 monitoring <FM_PCDU_DATA_FROZEN> shall be implemented on PCDU data frozen flag parameter.

This monitoring shall be configure as follow:

- Monitoring definition:
 - Active : MSAF, MNOM
 - Parameter monitored : <AM_PCDU_DAT_FROZEN>
- Checking information:
 - Monitoring interval : 1
 - Repetition value : 3
 - Monitoring type : CHECK_EXPECTED_VALUE
 - Mask : 0xFF
 - Expected value : 0
- Validity condition : None

On monitoring trig, the OBSW shall release a **TC_DHS_HIGH_RESTART_SC**

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Generic |
| subSystemAllocation | SDB, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-20 18:36 |


4.9.5 TTC Unit (S-BAND)

Used S-BAND module is from SYRLINKS, model EWC31-NG.

4.9.5.1 Links**E_YODA_SYS-1428 - S-BAND communication link characteristics**


The platform shall use UART RS422 for communication with S-BAND equipment and shall operate at 38400bps, full duplex as defined in [RD15].

Each data byte transmitted over the UART link shall be 1 start bit, 8 data bits LSB first, 1 stop bit, no parity.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | E_GEN_SBAND_EWC31NG_SYS-507 |
| KineisLink | N/A |
| subSystemAllocation | FPGA, FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-04 17:37 |


E_YODA_SYS-1430 - S-BAND used protocol

Messages exchange between platform and S-BAND transmitter shall be compliant with Syrlink UART Command-response protocol as defined in the [RD15] IRD YODA EWC 31 NG .

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0220 YODA_SAT_REQ_0240 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-13 09:30 |

E_YODA_SYS-2659 - SBAND signal acquisition


The platform shall acquire every seconds the state of signals FAULT, LOCK_DETECT and DATA_VALID.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | E_GEN_SBAND_EWC31NG_SYS-509 |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-13 18:29 |

4.9.5.2 Processing

E_YODA_SYS-1440 - S-BAND Reset Command

The platform shall implement a ground **TC_TTC_RESET_SBAND** command to reset the S-BAND.

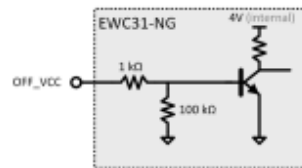
| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-230 |
| subSystemAllocation | FSW, BDS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | It is recommended to send after the reset TC_TTC_RESET_SBAND , the TC_TTC_SET_ACTIVATION_TX to (activate or deactivate) in order to set all SBAND parameter (such as CTX_SBAND_MODULATION_N or CTX_SBAND_STANDBY_N) to a known value. |
| Updated | 2023-07-13 09:59 |


E_YODA_SYS-1471 - Reset function

The platform shall be able to perform a reset of the S-BAND by executing the following actions :

- apply active HIGH signal on OFF_VCC pin (to disconnect from VBATT as defined in [RD16] EICD EWC31-NG)
- wait CONF_TX_POWER_OFF_DELAY ms
- apply inactive signal on OFF_VCC pin (to connect to VBAT again)

OFF_VCC CMOS 3V3 input (+10V tolerant).
Keep unconnected or to GND if not used.




| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | E_GEN_SBAND_EWC31NG_SYS-514 |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | CONF_TX_POWER_OFF_DELAY shall be defined in order to execute all reset action in one given slot time |
| Updated | 2023-08-07 14:23 |

E_YODA_SYS-1775 - SBAND uplink TC frequency default value


In case of reboot, (OFF/ON), the platform shall set uplink TC frequency to default value:

- CONF_SBAND_DEFAULT_TC_FREQUENCY = (TBD) MHz

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBIF-REQ-0590 YODA-SBIF-REQ-0710 |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Each satellite has its own uplink TC frequency |
| Updated | 2023-02-23 15:20 |

E_YODA_SYS-1441 - S-BAND Uplink TC frequency tuning

The platform shall allow to modify the TC frequency ,in flight, by TC command TC_TTC_SET_SBAND_TMTC_FREQ

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBIF-REQ-0590 YODA-SBIF-REQ-0710 |
| KineisLink | N/A |
| subSystemAllocation | BDS, FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | The uplink TC frequency shall be in the 2025-2110 MHz range. The uplink TC frequency could be configured in flight by command while respecting a 221/240 ratio with TM frequency. The configured frequency has to be in the range [2085.158;2090.994] U [2099.5;2103.183] U [2107.788;2108.708] [MHz] |
| Updated | 2023-07-13 17:59 |


E_YODA_SYS-2571 - S-BAND TM bit rate command

The platform shall allow to modify the TM Bit rate, in flight, by TC command TC_TTC_TM_BIT_RATE with a range of value between [CONF_TM_SBAND_BIT_RATE_LOW , CONF_TM_SBAND_BIT_RATE_HIGH] and a step of 0.5 Kbit/s

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FPGA, FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Only both operationnal CONF_TM_SBAND_BIT_RATE_LOW and CONF_TM_SBAND_BIT_RATE_HIGH bit rate are tested . All bit rate defined by ground with other value are not tested and could lead to unexpected malfunction. |
| Updated | 2023-04-28 10:49 |

E_YODA_SYS-1777 - TC bitrate


The platform shall configure SBAND equipment with a bitrate TC reception of **CONF_TC_SBAND_BIT_RATE** = 8 Kbps

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-SBIF-REQ-0650 YODA_SAT_REQ_0250 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection, Test |
| Note | For the chosen modulation, available data rate values are 8, 16, 32, 64, 128 and 256 kbps. 8 kbps allows to respect margin in TC link budget |
| Updated | 2023-02-23 09:48 |

E_YODA_SYS-1776 - SBAND downlink TM frequency default value


In case of reboot, (OFF/ON), the platform shall set downlink TM frequency to default value:

- CONF_SBAND_DEFAULT_TM_FREQUENCY = (TBD) MHz

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBIF-REQ-0600 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Each satellite has its own downlink TM frequency |
| Updated | 2023-03-20 18:38 |

E_YODA_SYS-1442 - S-BAND downlink TM frequency tuning


The platform shall allow to modify the TM frequency ,in flight, by TC command TC_TTC_SET_SBAND_TMTC_FREQ

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-SBIF-REQ-0600 |
| KineisLink | N/A |
| subSystemAllocation | BDS |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>The downlink TM frequency shall be in the 2200-2290 MHz range.</p> <p>The downlink TM frequency could beconfigured in flight by command while respecting a 240/221 ratio with TC frequency.</p> <p>The configured frequency has to be in the range [2264.425;2270.763] U [2280;2284] U [2289;2290] [MHz]</p> |
| Updated | 2023-07-10 09:53 |

E_YODA_SYS-1778 - TM bitrate

The platform shall allow SBAND equipment to work with the following bitrate TM emission:

- CONF_TM_SBAND_BIT_RATE_HIGH = 50 Kbps.
- CONF_TM_SBAND_BIT_RATE_LOW = 2 Kbps.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-SBIF-REQ-0640 YODA_SAT_REQ_0250 YODA-MC-REQ-1390 YODA-MC-REQ-1570 (GEN) YODA-MC-REQ-1740 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test, Inspection |
| Note | To test with E_YODA_SYS-1779 and E_YODA_SYS-1780 Note that according RD15, data rates is from 10 kbps to 1 Mbps |
| Updated | 2023-03-29 18:16 |


E_YODA_SYS-1472 - Minimum delay before activation of TM emission

In MSAF mode, the platform shall command Tx activation in emission mode procedure after a configurable delay <CTX_TM_ON_DELAY> (typical of 45 minutes for ejection).

This delay shall be configurable between 0 and 180 minutes

This delay shall be a context parameter in order to be easily modifiable at a late stage including on the launch site and after the end of the autonomous sequence.

The elapsed time counter for this delay <CTX_TM_ON_CPT> shall be saved in context parameter in order to be robust to a reboot.


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0061 (SPE) YODA_SAT_REQ_0350 |
| KineisLink | E_KINEIS_SYS-97 |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | -The FSW does not have to verify that the duration is between 0 and 180 min. It will be performed by the BDS - SBAND emission from the satellite shall be inhibited from the beginning of LAUNCH unit! <CTX_TM_ON_DELAY> - The case of reboot occurs, whereas the counter roll over , could leads again to waiting time delay before activating again the Transmission |
| Updated | 2023-08-07 17:13 |

E_YODA_SYS-1473 - Tx modulation counter

The platform shall implement a context parameter <CTX_SBAND_MODULATION_N> counter.

This counter shall be incremented every second when the Tx is in modulation mode.

It shall be reset when Tx is in standby mode.


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <ul style="list-style-type: none"> - This counter allow to know the time spent in Tx Emission - When limit of this counter is reached , the expected behaviour is hold by E_YODA_SYS-3076 - Note that In ?Modulation? mode on EWC31 , the product has been designed to continuously work for a maximum of 15 minutes. <p>Transmission can not exceed 20 % of total time. These limitation constraints allow temperature dissipation in vacuum environment.</p> <p>No information on EWC31-NG, keep the same constraint as on EWC31</p> |
| Updated | 2023-08-09 11:05 |

E_YODA_SYS-1474 - Tx Standby counter

The platform shall implement a context parameter <CTX_SBAND_STANDBY_N> counter.

This counter shall be incremented every second when the Tx is in standby mode.


It shall be reset when Tx is in modulation mode.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <ul style="list-style-type: none"> - This counter allow to know the time spent inTx standby Mode - When limit of this counter is reached , the expected behaviour is hold by E_YODA_SYS-2618 |
| Updated | 2023-08-09 11:05 |

E_YODA_SYS-1475 - Tx set Transmission mode

Platform shall implement a ground **TC_TTC_TX_TRANSMISSION_MODE** to set the transmitter activation mode in dedicated mode :


- - SBAND_TX_MODE_STANDBY
- - SBAND_TX_MODE_MODULATION

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-01 17:11 |

E_YODA_SYS-1476 - Tx activation procedure to allow emission

Upon reception of TC_TTC_SET_ACTIVATION_TX for Tx "Activation", Tx activation procedure for emission mode shall follow the steps below:


- If <CONF_TX_RESET_ACTIVATION> is set to true
 - reboot SBAND using **TC_TTC_RESET_SBAND**
 - wait <CONF_TX_REST_DELAY> ms
- Send **TC_TTC_TX_TRANSMISSION_MODE** command to switch transmitter to modulation mode
- Wait <CONF_TX_CMD_DELAY> ms
- Send command to switch transmitter to modulation mode
- Wait <CONF_TX_CMD_DELAY> ms
- Reset counter <CTX_SBAND_STANDBY_N>

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB, FSW |
| implementationVersion | VAIT, V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <p>Some command are set twice in order to be sure that the action of the command is realised if the first command is not taken into account</p> <p>Note that Delay (in ms) shall be in accordance to execute whole of TC in the given LV slot (TBC with LV)</p> <p>CTX_SBAND_STANDBY_N shall be reset in this requirement because of FDIR (req E_YODA_SYS-2618), where FDIR dealing this counter occurs,the counter need to be reset and this it not be done by FDIR.</p> |
| Updated | 2023-07-12 17:09 |

E_YODA_SYS-1477 - Tx emission mode de-activation


Upon reception of TC_TTC_SET_ACTIVATION_TX for Tx "De-activation", Tx de-activation procedure for emission mode shall follow the steps below:

- Send TC_TTC_TX_TRANSMISSION_MODE command to switch transmitter to standby mode
- Wait <CONF_TX_CMD_DELAY> ms
- Send command to switch transmitter to standby mode
- Wait <CONF_TX_CMD_DELAY> ms
- Reset counter <CTX_SBAND_STANDBY_N>

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0830 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | Some command are set twice in order to be sure that the action of the command is realised if the first command is not taken into account |
| Updated | 2023-03-01 17:46 |

E_YODA_SYS-1478 - SBAND - PUS PID range


Parameter ID for SBAND telemetries shall be in the range [SBAND_PID_MIN - SBAND_PID_MAX]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0170 (GEN) YODA-MC-REQ-0180 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | For YODA SBAND_PID_MIN = 201 SBAND_PID_MAX = 400 |
| Updated | 2023-02-16 17:55 |

E_YODA_SYS-2657 - SBAND measures Aquisition

The platform shall acquire, every seconds, the following measure :


- LCL_STATUS register
- RX_STATUS register
- RX_SENSITIVITY register
- RX_FREQUENCY_SHIFT register
- RX_IQ_POWER register
- RX_AGC_VALUE register
- RX_DEMOD_EB register
- RX_DEMOD_N0 register
- TX_STATUS register
- TX_AGC_VALUE register

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-17 09:27 |

E_YODA_SYS-2655 - SBAND acquisition validity flag

AM_SBAND_MEAS_VALIDITY validity SBAND measure flag shall be provided by FSW.

This validity flag shall be set to VALID when all the measure is refreshed else set to INVALID.


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | E_GEN_SBAND_EWC31NG_SYS-533 |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-13 17:59 |

4.9.5.3 Observability

E_YODA_SYS-1439 - Monitoring Data for Telemetry downlink

The platform shall make the following S-BAND parameters available for downlink :

- Counter of TM packets received with CRC errors
- LCL_STATUS register
- RX_STATUS register
- RX_SENSITIVITY register
- RX_FREQUENCY_SHIFT register
- RX_IQ_POWER register
- RX_AGC_VALUE register
- RX_DEMOD_EB register
- RX_DEMOD_N0 register
- TX_STATUS register
- TX_AGC_VALUE register
- FAULT signal state
- LOCK_DETECT signal state
- DATA_VALID signal state

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-1570 (GEN) YODA-MC-REQ-1580 (GEN) E_GEN_SBAND_EWC31NG_SYS-526 |
| KineisLink | E_KINEIS_SYS-345 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Rx frequency shift Rx IQ power Rx and Tx AGC value Rx Eb and N |
| Updated | 2023-07-13 17:59 |

4.9.5.4 FDIR


E_YODA_SYS-2618 - Tx monitoring on CTX_SBAND_STANDBY_N

A service 12 monitoring <FM_SBAND_STANDBY> shall be implemented on SBAND standby counter parameter **CTX_SBAND_STANDBY_N**.

This monitoring shall be configure as follow:

- Monitoring definition:
 - Active : MSAF
 - Parameter monitored : <CTX_SBAND_STANDBY_N>
- Checking information:
 - Monitoring interval : 1
 - Repetition value :1
 - Monitoring type : CHECK_LIMIT
 - Low limit : 0
 - High limit :TBD
 - Validity condition : None

On monitoring trig, the platform shall release a TTC_TX_TRANSMISSION_MODE with argument SBAND_TX_MODE_MODULATION

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-22 18:06 |


E_YODA_SYS-3076 - Tx monitoring on CTX_SBAND_MODULATION_N

A service 12 monitoring <FM_SBAND_MODULATION> shall be implemented on SBAND modulation counter parameter.

This monitoring shall be configure as follow:

- Monitoring definition:
 - Active : MSAF, MNOM
 - Parameter monitored : <CTX_SBAND_MODULATION_N>
- Checking information:
 - Monitoring interval : 1
 - Repetition value :
 - Monitoring type : CHECK_LIMIT
 - Low limit : 0
 - High limit : TBD
- Validity condition : None

On monitoring trig, the OBSW shall release a **TTC_TX_TRANSMISSION_MODE** with argument SBAND_TX_MODE_STANDBY

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>In ?Modulation? mode on EWC31 , the product has been designed to continuously work for a maximum of 15 minutes. Transmission can not exceed 20 % of total time. These limitation constraints allow temperature dissipation in vacuum environment.</p> <p>No information on EWC31-NG, keep the same constraint as on EWC31</p> |
| Updated | 2023-08-07 17:13 |


E_YODA_SYS-2656 - Transmitter communication status monitoring

A service 12 monitoring <FM_SBAND_COMM_STATUS> shall be implemented on SBAND

This monitoring shall be configure as follow:

- Monitoring definition:
 - Active : MSAF, MNOM
 - Parameter monitored : <AM_SBAND_MEAS_VALIDITY >
- Checking information:
 - Monitoring interval : 1
 - Repetition value :5
 - Monitoring type : CHECK_EXPECTED_VALUE
 - Expected value : VALID(1)
- Validity condition : None

On monitoring trig, the platform shall release a **TC_DHS_HIGH_RESTART_SC**

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-13 17:59 |


4.9.6 SADM Unit

Used SADMs are from COMAT, model SADM 200.

4.9.6.1 Links**E_GEN_SADM200_SYS-965 - SADM communication link characteristics**

The platform shall use UART RS422 for communication with SADM equipment and shall operate at 115200 bps, full duplex with data exchange in NSP format, encapsulated into packets using SLIP framing as defined in "SADM 200 User manual " [RD_GENPF_SADM200_01].


There are 8 bits per byte, no parity, and 1 stop bit.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | [RD_GENPF_SADM200_01] |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-07 12:02 |

E_GEN_SADM200_SYS-966 - SADM protocol Address

The platform shall manage two SADMs. with the following characteristics:

- SADM_1 with a communication protocol adress defined by configuration parameter [**CONF_SADM_1_ADDR**]
- SADM_2 with a communication protocol adress defined by configuration parameter [**CONF_SADM_2_ADDR**]


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | RD_GENPF_SADM200_01 |
| subSystemAllocation | FSW, BDS, OPS |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-07 12:02 |

4.9.6.2 Processing**E_GEN_SADM200_SYS-962 - SADM commanding**

The platform shall communicate with dedicated SADM by using the following command in accordance with SADM 200 User manual "
[RD_GENPF_SADM200_01]

- STOP : request to set SADM to IDLE mode
- SET POSITION TARGET: set position Target value in STEPS in RALLY mode
- SET NB OF STEP : set number of steps in STEPS mode
- SET SWITCH DETECTION : request a switch detection (TOP TURN mode)
- REQUEST DATA: command to get all SADM monitoring data
- CLEAR STATUS: clear status
- NON-VOLATILE MEMORY WRITE : command to write value at the specified address in Non-Volatile Memory (FRAM)
- NON-VOLATILE MEMORY READ : command to read value at the specified address in Non-Volatile Memory (FRAM)



| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | RD_GENPF_SADM200_01 |
| subSystemAllocation | FSW |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-07 12:02 |

E_GEN_SADM200_SYS-967 - SADM Commands and measures scheduling (Deleted)


E_YODA_SYS-1392 - Scheduling AOCS Commands to SADM

As defined in [AD07], the platform shall send command requested every [SYS_SADM_SCHEDULING_PERIOD] by AOCS, to dedicated SADM.

The command is provided by AOCS with the following content:


- ID of the targetted SADMs
- Presence of absence of a new command (linked to AOCS_TO_SADM_NEW_COMMAND)
- Position in "step value" validity

If a new command is provided, the platform shall transmit this new command to SADM as per E_YODA_SYS-1397

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0110 (SPE) ICD [YODASCAO-34] SADM command |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <ul style="list-style-type: none">• on MSAF , SADM commands coming from AOCS are ignored as requested by YODA-MC-REQ-0110 (SPE) |
| Updated | 2023-07-18 11:19 |

E_YODA_SYS-1393 - Scheduling SADM measures to AOCS


The platform shall provide to AOCS at [SYS_SADM_SCHEDULING_PERIOD], all SADM position measurement as defined in [AD07]

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | ICD [YODASCAO-34] SADM current position |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-18 11:19 |

E_YODA_SYS-1394 - Time laps information management between SADM and AOCS

The platform shall ensure that :

- Time laps between AOCS sent command and its expected status from SADM shall be less than 200ms
- Time laps between SADM provided measures and received measures by AOCS shall be less than 200ms
- Each measure shall be dated by the platform with at least 1ms precision.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM, SOFTWARE |
| ValidationMethod | Test, Test |
| Note | from [AD07] constraint chapter |
| Updated | 2023-07-18 11:19 |

E_GEN_SADM200_SYS-968 - SADM Activation

The platform shall provide a function to activate the SADM that executes the following procedure:

- Set SADM ON by switching ON the associated power distribution line of the PCDU
- Wait <CONF_SADM_STARTUP_DELAY> ms
- Start SADM cyclic acquisition at [SYS_SADM_SCHEDULING_PERIOD]
- Set AM_SADMx_STATE to 1 (ON)



| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| subSystemAllocation | FSW, PCDU |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | LCL for switch ON/OFF are commanded through PCDU |
| Updated | 2023-08-07 12:02 |

E_GEN_SADM200_SYS-969 - SADM De-Activation

The platform shall provide a function to deactivate SADM that executes the following procedure:

- Set parameter AM_SADMx_STATE to 0 (OFF)
- Stop cyclic acquisition
- Set SADM to OFF by switching OFF the associated power distribution line of the PCPU



| | |
|-----------------------|---|
| ReqStatus | In Review |
| LinkedUpReq | Derived |
| subSystemAllocation | FSW |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | -LCL for switch ON/OFF are commanded through PCPU - AM_SADMx_STATE is used as activation of monitoring |
| Updated | 2023-08-07 12:02 |

E_GEN_SADM200_SYS-971 - SADM control Mode

Parameter <AM_SADMx_CONTROL> shall be implemented in order to inform how SADM mode is controlled and should take the following value :


- **AOCS_CONTROL** when SADMx is managed by AOCS. This is the default value
- **EXTERNAL_CONTROL** when SADMx is managed by FSW or Ground

After a reboot or platform mode transition this parameter shall be set to default value.

| | |
|-----------------------|---|
| ReqStatus | In Review |
| LinkedUpReq | Derived |
| subSystemAllocation | FSW |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-07 12:02 |


E_GEN_SADM200_SYS-970 - Force SADM position

The platform shall implement a specific command **TC_FUNC_FORCE_SADM_POSITION** to force the SADM to reach a targetted position.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| subSystemAllocation | FSW, BDS |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | - Before using this TC_FUNC_FORCE_SADM_POSITION command, the parameter AM_SADMx_CONTROL need to be set to EXTERNAL_CONTROL through service 140, else AOCs command could overwrite FORCE_SADM_POSITION command |
| Updated | 2023-08-07 12:02 |

E_GEN_SADM200_SYS-1035 - Instanciated SADM raw command TOP-TURN


The database shall implement an instanciated command **TC_SADM_SET_TOPTURN** based on the command **TC_ASYNC_RAW_UNIT_CMD**

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| subSystemAllocation | BDS |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | - Before using this TC_SADM_SET_TOPTURN command, the parameter AM_SADMx_CONTROL need to be set to EXTERNAL_CONTROL through service 140. |
| Updated | 2023-08-07 12:02 |

Note2: The requirement E_GEN_SADM200_SYS-1035 replace deleted requirement E_GEN_SADM200_SYS-972

E_GEN_SADM200_SYS-977 - IDLE mode transition


When SADM mode is "MAINTAIN", the platform shall set SADM mode to "IDLE"

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| subSystemAllocation | FSW |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | After each position command execution (command is reached) , the SADM shall return automatically to MAINTAIN mode |
| Updated | 2023-08-07 12:02 |

E_GEN_SADM200_SYS-979 - TOP TURN flag


A context parameter <CTX_SADMx_MSAF_TOP_TURN> type TRUE/FALSE, shall be implemented in order to command the SADM top turn in MSAF mode entry, one parameter by SADM.

Default value shall be set to FALSE and shall be modified by ground command.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| subSystemAllocation | BDS, FSW |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-07 12:02 |

E_YODA_SYS-2311 - TOP TURN flag specific default values for YODA


Default value of <CTX_SADMx_MSAF_TOP_TURN> shall be specific for YODA and shall be set to TRUE by sending ground TC service 140


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | On the first MSAF mode entry , after SA deployment , no Top-turn shall be performed. Modification of default value of <CTX_SADMx_MSAF_TOP_TURN> is only for next MSAF mode entry (and not the first) |
| Updated | 2023-06-22 09:12 |

E_GEN_SADM200_SYS-976 - SADM acquisition validity

Each SADM acquisition provided <AM_SADMx_MEAS_VALIDITY> by the platform to AOCS shall be associated to a validity flag.

This validity flag shall be set to VALID when the measure is refreshed else set to INVALID.

This validity flag shall be provided to the AOCS with its measure. 

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| subSystemAllocation | FSW, BDS |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-07 12:02 |

E_GEN_SADM200_SYS-975 - AOCS command conversion to SADM command

The platform shall implements a first order polynome to convert AOCS command in used SADM values as defined in the following table :

| | AOCS | SADM |
|---------|----------------------------|--------------------------|
| Command | angle deg, angle rad, step | should converted in step |


2 Parameters of the polynome shall be managed as configuration parameters :

<CONF_SADM_POLYNOME_COEF_A>

<CONF_SADM_POLYNOME_COEF_B>


to get position as follow:

Position in step = <CONF_SADM_POLYNOME_COEF_A> x AOCS value + <CONF_SADM_POLYNOME_COEF_B>

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| subSystemAllocation | FSW |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | AOCS need to manage coordinate reference to work with SADM reference |
| Updated | 2023-08-07 14:59 |

E_GEN_SADM200_SYS-980 - SADM - PUS PID range


Parameter ID for the SADM telemetries shall be in the range of [SADM_PID_MIN - SADM_PID_MAX]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| subSystemAllocation | BDS |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | In most of project the used value are: SADM_PID_MIN = 5 000 SADM_PID_MAX = 5 999 |
| Updated | 2023-08-07 12:02 |

E_YODA_SYS-1397 - AOCS new position request

When AOCS partition ask to set a new position command (AOCS_TO_SADM_NEW_COMMAND = PRESENCE) , the platform shall send order to SADM with the AOCS new "set position" command in RALLY mode

IF AOCS new command is identical to the last sent command (AOCS_TO_SADM_NEW_COMMAND= ABSENCE), no new position command and no new mode is send to SADM by platform.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | ICD [YODASCAO-34] SADM command |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | AOCS_TO_SADM_NEW_COMMAND is parameter interface provided by AOCS partition [AD07] |
| Updated | 2023-07-18 11:19 |

E_YODA_SYS-1398 - AOCS coefficient command processing values

The platform shall provide AOCS position command to SADM as is, without any transformation, any conversion or any check.

For this the first order polynome parameter (ax+b) shall be defined as follow :

- CONF_SADM_POLYNOME_COEF_A = 1
- CONF_SADM_POLYNOME_COEF_B = 0

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | ICD-YODAOCS-GEN-200 |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | provided position command from AOCS is already in understandable unit of SADM (Steps) in a range of [0, 11805] steps This requirement is linked with E_GEN_SADM200_SYS-975 |
| Updated | 2023-08-07 15:02 |

4.9.6.3 Observability

E_YODA_SYS-1401 - SADM parameters observability (Deleted)

| | |
|-----------------------|---|
| ReqStatus | ✖ Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | replaced by generic requirement :E_GEN_SADM200_SYS-978 |
| Updated | 2023-04-18 14:12 |

E_GEN_SADM200_SYS-978 - SADM parameters observability

For each SADM, the platform shall make available for housekeeping telemetry, the following parameter :

- all parameters values provided by SADM for a "REQUEST DATA" reply as defined in [RD_GENPF_SADM200_01 : COMAT SADM 200 User manual]

| | |
|-----------------------|---|
| ReqStatus | 🔄 In Review |
| LinkedUpReq | Derived |
| subSystemAllocation | FSW, BDS, OPS |
| implementationVersion | see Table SADM200_COMAT ImplementationVersion |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-07 12:02 |

4.9.6.4 FDIR

SADMx FDIR is holded by AOCS event EVENT_AOCS_FDIR_SADM as described in E_YODA_SYS-2615

4.9.6.5 Implementation Version on Project

As for each project, implementation version should be different because field is specific on project, the following table is used and modified for YODA project where SADM200 is instancied:

| REQ ID | Title | implementation Version |
|---------------------------------------|---|------------------------|
| E_GEN_SADM200_SYS-965 | SADM communication link characteristics | VAIT |
| E_GEN_SADM200_SYS-966 | SADM protocol Address | VAIT |
| E_GEN_SADM200_SYS-962 | SADM commanding | VAIT |
| E_GEN_SADM200_SYS-968 | SADM Activation | VAIT |
| E_GEN_SADM200_SYS-969 | SADM De-Activation | VAIT |

| | | |
|--|---|------|
| E_GEN_SADM200_SYS-971 | SADM control Mode | VAIT |
| E_GEN_SADM200_SYS-970 | Force SADM position | VAIT |
| E_GEN_SADM200_SYS-1035 | Instanciated SADM raw command TOP-TURN | V0 |
| E_GEN_SADM200_SYS-979 | TOP TURN flag | V0 |
| E_GEN_SADM200_SYS-975 | AOCS command conversion to SADM command | VAIT |
| E_GEN_SADM200_SYS-976 | SADM acquisition validity | VAIT |
| E_GEN_SADM200_SYS-1036 | SADM last time acquisition | VAIT |
| E_GEN_SADM200_SYS-977 | IDLE mode transition | V0 |
| E_GEN_SADM200_SYS-980 | SADM - PUS PID range | VAIT |
| E_GEN_SADM200_SYS-978 | SADM parameters observability | VAIT |
| | | |

Table 7 Table SADM200_COMAT ImplementationVersion

4.9.7 RW Unit (Reaction Wheel)


Used RWs are from Vectronix , model VRW-B02.

4.9.7.1 Links

E_YODA_SYS-1498 - RW communication link characteristics

The platform shall use UART RS422 for communication with RWs equipment and shall operate at 115200 bps, full duplex as defined in "RW User manual " [RD07].


There are 1 start bit, 8 data bits, 1 stop bit, no parity. LSBit is sent first, MSByte first (Big Endian)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-298 E_KINEIS_SYS-297 |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test, Inspection |
| Note | |
| Updated | 2023-03-22 15:55 |

E_YODA_SYS-1538 - RW device ID

The platform shall manage four RWs on 2 uart buses (2 RWs per bus) with the following characteristics:

- Communication with **RW1** is done through
 - addressID defined by configuration parameter **[CONF_RW1_ADDR]**
 - bus ID defined by configuration parameter **[CONF_RW1_BUS]**
- Communication with **RW2** is done through
 - addressID defined by configuration parameter **[CONF_RW2_ADDR]**
 - bus ID defined by configuration parameter **[CONF_RW2_BUS]**
- Communication with **RW3** is done through
 - addressID defined by configuration parameter **[CONF_RW3_ADDR]**
 - bus ID defined by configuration parameter **[CONF_RW3_BUS]**
- Communication with **RW4** is done through
 - addressID defined by configuration parameter **[CONF_RW4_ADDR]**
 - bus ID defined by configuration parameter **[CONF_RW4_BUS]**


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-875 |
| subSystemAllocation | FSW, FPGA, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <p>The address Device ID XX is a specific defined parameter in each RW device which is in this case the last byte from the serial number of the VRW. For example serial number of the RW is 0x6128 so the address device ID of the VRW is 0x28. It is possible to connect the VRW for example in a four line multi drop configuration because the command</p> <p>CONF_RWx_ADDR value shall also be the last byte from the serial number of the VRW</p> <p>[CONF_RWx_BUS] shall be on BUS1 or BUS2</p> |
| Updated | 2023-03-20 18:08 |

4.9.7.2 Processing

E_YODA_SYS-1539 - RW message transfers

Communication with the RW shall be performed with the following message transfers as a minimum, in accordance with [RD07]:


- SET_CURRENT_VALUE: command to set motor current value and that can be used to stop the wheel. The wheel will slowly run down in friction when the current set value is zero.
- SET_NET_TORQUE command to set the torque setpoint to the specified torque
- SEND_TELEMETRY command to request the RW to send essential HKTM data
- SET_NET_TORQUE_SEND_TELEMETRY: command to set the torque value and then, RW device sends essential HKTM data

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-474 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:57 |

E_YODA_SYS-1829 - RW commanding

The platform shall command a RW, only when the dedicated RW is activated.

If a command need to be sent to the dedicated RW but the RW is not activated, the platform shall activate first the selected RW before sending the command.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:57 |

E_YODA_SYS-1540 - One Reaction wheel activation

The platform shall perform one selected RW activation by executing the following procedure:


IF dedicated bit of selected RW is set in <CONF_RW_AVAILABLE> then

- Apply power of the selected RW by switching on the associated power distribution line of the OBC
- Wait <CONF_RW_STARTUP_DELAY> ms (default 100 ms) to allow equipment entering in steady state
- Start selected RW acquisitions by sending "SEND_TELEMETRY" at 5 Hz.
- set dedicated Bit of <AM_RW_NUMBER_IN_USE> to 1 according selected RW. (Bit 0 for RW0, Bit1, for RW1, Bit2 for RW2, Bit3 for RW3)

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-359 |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | Steady state means that the control loops (STATUS_REGISTER) are not active and the motor current is adjusted to zero, the default target speed of the wheel is also zero |
| Updated | 2023-08-10 20:07 |

E_YODA_SYS-1541 - All Reaction wheels activation


To activate all reaction wheels, the FSW shall activate one by one sequentially all available reaction wheels listed in <CONF_RW_AVAILABLE>, one bit by reaction wheels,

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-968 |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | <p>- the sequential activation is to avoid a LCL triggering that could be caused if all RW are started simultaneously.</p> <p>- If a RW become invalid, the associated bit of this parameter can be set to 0 to no more use the dysfonctionning RW.in case of reboot</p> |
| Updated | 2023-08-03 14:37 |

E_YODA_SYS-1542 - Reaction wheel deactivation

The platform shall provide a function to de-activate one RW, that executes the following procedure:

- Disable unit monitoring
- Stop unit cyclic acquisition
- Remove power by switching off the associated power distribution line of the OBC
- set Bit x of <AM_RW_NUMBER_IN_USE> to 0 (selected RW is no more in use)

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0830 (GEN) |
| KineisLink | E_KINEIS_SYS-360 |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-01 18:12 |

E_YODA_SYS-1830 - RW acquisition data validity

The platform shall consider each acquired RW data "VALID" when:

- Send Telemetry response message CRC is valid AND
- Send Telemetry response shall be received less than 5 ms after last transmission bit of the request.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <p>The time response is analysed according the response of the biggest telemetry provided by RW device (3 bytes + 32bytes data)</p> <p>So at 115kbps, response data should be transmitted in less than 2.5 ms after command request [see RD07]</p> |
| Updated | 2023-03-22 15:55 |

Table 6 Send Telemetry


| Send Telemetry | | | | | | | | | | | | | | | | |
|----------------|----|------|------|------|------|------|------|----|----|------|----|----|------|-----|------|--|
| Byte No | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | ... | 33 | 34 | |
| Host | XX | 0xD9 | 0xFF | 0xFF | 0xFF | 0xFF | 0xFF | YY | | | | | | | | |
| VRW | | | | | | | | | XX | 0xD9 | T0 | T1 | T... | T31 | CKSM | |

E_YODA_SYS-1543 - AIT reaction wheel commanding

Upon reception of ground TC **TC_FUNC_SET_RW_TORQUE**, the platform shall cyclically command the RW torque selected with the torque TC parameter value.

The command have the following argument:

- The reaction wheel to be torque commanding
- The target torque of the wheel


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA_SAT_REQ_0780 |
| KineisLink | E_KINEIS_SYS-793 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This TC shall be used only in AIT mode when SCAO partion is stubed. In other mode, this ground command shall be overwritten by AOCS request |
| Updated | 2023-07-17 15:09 |

E_YODA_SYS-1544 - AIT reaction wheel commanding stop

Upon reception of ground TC **TC_FUNC_STOP_RW_TORQUE**, the platform shall stop to cyclically command the selected RW and send the command SET_CURRENT_VALUE to the RW, with a current value = 0

Command have the following argument:


- The reaction wheel to be stopped

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-864 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | When current value is zero, the wheel will slowly run down in friction until stopping. This command is used in AIT mode only This TC shall not switch off the RW (RW stays activate) |
| Updated | 2023-03-01 17:46 |

E_YODA_SYS-3068 - Provided RW measures to AOCS


As defined in [AD07], the platform shall acquire every 200ms each RW measure and provide every 200ms to AOCS partition, each RW measure with the following content:

- Source ID of the acquired reaction wheel
- measured speed of the RW
- measure validity
- measure date

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | ICD [YODASCAO-34] RW data |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | <ul style="list-style-type: none">• more precision about the content is given in [AD07] ICD AOCS• measure speed is in rad/s unit• measure date shall be in TAI with micro-second precision• measure validity is given with E_YODA_SYS-1830 |
| Updated | 2023-08-09 11:05 |


E_YODA_SYS-3069 - Provided AOCS command to RW

As defined in [AD07], the platform shall send command requested every 200ms by AOCS, to dedicated RW.
The command is provided by AOCS in torque unit N.m

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | ICD [YODASCAO-34] RW command |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-07-17 18:49 |

E_YODA_SYS-1545 - RW - PUS PID range


Parameter ID for RWs telemetries shall be in the range [RW_PID_MIN - RW_PID_MAX]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0170 (GEN) YODA-MC-REQ-0180 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | RW_PID_MIN = 401 RW_PID_MAX = 600 |
| Updated | 2023-02-16 17:55 |

4.9.7.3 Observability**E_YODA_SYS-1546 - RWs telemetry for downlink**


The platform shall make available for downlink the following parameters for each RWs

- All parameters of the reply to "Send Telemetry" data message, as per [RD07]

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-394 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:57 |

E_YODA_SYS-1547 - Number of Valid Reaction Wheels

The platform shall maintain a <AM_RW_NUMBER_IN_USE> parameter to count the number of active reaction wheel.


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-928 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | bit 0 of AM_RW_NUMBER_IN_USE shall be set when RW0 is in use bit 1 of AM_RW_NUMBER_IN_USE shall be set when RW1 is in use bit 2 of AM_RW_NUMBER_IN_USE shall be set when RW2 is in use bit 3 of AM_RW_NUMBER_IN_USE shall be set when RW3 is in use |
| Updated | 2023-03-01 16:57 |

4.9.7.4 FDIR

RWs FDIR is holded by AOCS event EVENT_AOCS_FDIR_RW as described in E_YODA_SYS-2615

E_YODA_SYS-2617 - RW AOCS monitoring

When requested by AOCS through message TBD, the platform shall deactivate the corresponding RW.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | for RW deactivation procedure refer to E_YODA_SYS-1542 - Reaction wheel deactivation |
| Updated | 2023-06-20 10:51 |

4.9.8 Solar Sensor Unit

Used SSU is from LENS R&D, model BiSon64-ET-B.

This SSU is a passive device which catch light source through 4 zones (Q1, Q2, Q3, Q2) and provide measure through 4 currents, allowing to recover the sun position as defined in [RD10]

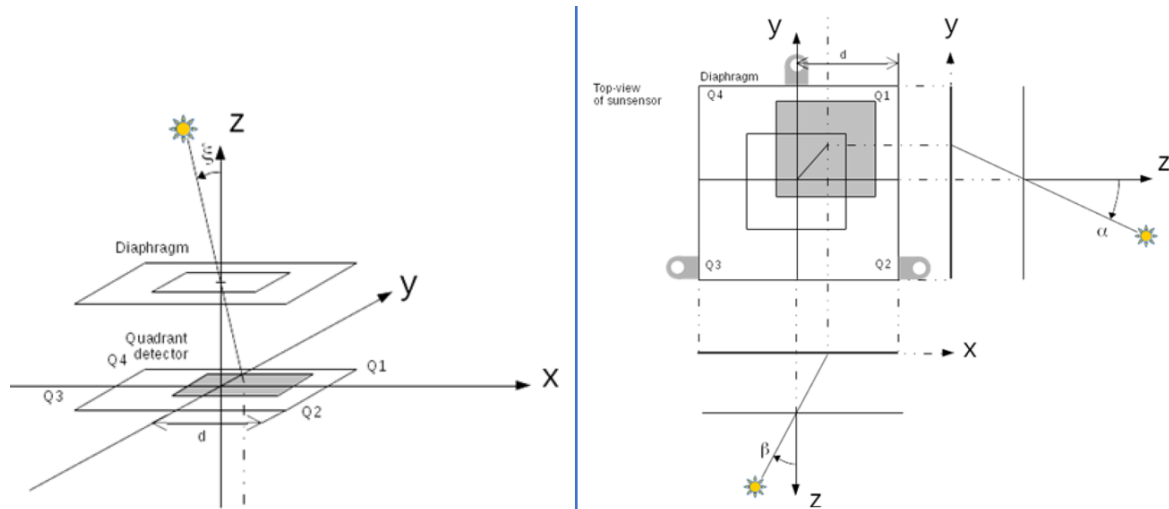



Figure 19 SunSensor View with angle visualization

4.9.8.1 Links

E_YODA_SYS-1766 - SSU Analogic communication link characteristics

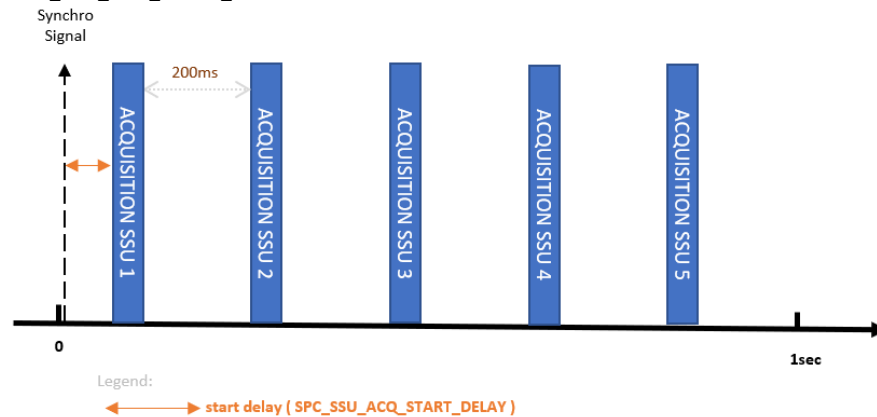
The platform shall acquire analogic signal from SSU and use ADCconverter to make data available for dedicated modules requiring SSU measure..

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FPGA |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:57 |

E_YODA_SYS-2556 - Synchro Signal for starting SSU acquisition

The platform shall provide at 1Hz, a synchronization signal to inform SSU to start its first measure acquisition after a specific delay

<SPC_SSU_ACQ_START_DELAY> in ms



| | |
|-----------------------|---|
| ReqStatus | In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <p>- this synchronisation signal and delay are used to respond to constraints defined in [AD07] AOCS PARTITION - INTERFACE CONTROL DOCUMENT YODA-IF-23-0068-CNES (chapter SSU CONSTRAINTS)</p> <p>- SPC_SSU_ACQ_START_DELAY value shall be defined accordingly with [AD07] and SW partition sequencing plan</p> |
| Updated | 2023-08-10 16:36 |

4.9.8.2 Processing**E_YODA_SYS-1769 - Acquisition rate**

The platform shall bufferize 1 SSU measure every 5Hz and shall provide at 1Hz, the five bufferized SSU measurements to dedicated modules needing these measures.

| | |
|-----------------------|---|
| ReqStatus | In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FPGA, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <p>- On YODA, module using SSU mesures is AOCS and NAV.</p> <p>- As AOCS sample frequency was previously not net defined, The SSU sample period was set to be configurable by adding configuration parametre in BDS (CONF_SSU_SAMP_OFFSET_0,1,2,3)</p> |
| Updated | 2023-08-01 10:53 |

E_YODA_SYS-1771 - Measure and validity format

One SSU measure shall be followed with its validity and formatted as follow:

- 4 current values on 4 bytes float for each current
- a validity on 1 byte (VALID or NOT_VALID) for each current value

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection, Test |
| Note | A SSU measure is also composed of 4currents value on 4 bytes float each value (16 bytes) and each current value is followed by one byte Validity. So one SSU measure is 20bytes. |
| Updated | 2023-08-04 16:22 |

E_YODA_SYS-1772 - SSU validity


-The platform shall set a current measure validity to "NOT_VALID" when :

- ['acquisition date of Qx measure' - 'acquisition date of previous Qx measure'] is upper than 210 ms (200ms+5%) OR
- measure is not refreshed

-Else the current measure validity shall be set to "VALID"


-When 3 successives SSU measures get at least one current measure NOT_VALID, then **<AM_SSU_VALIDITY>** is set to NOT_VALID

-When 3 successives SSU measures get all current measures VALID, then **<AM_SSU_VALIDITY>** is set to VALID

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | - Validity deals only with refresh of data. It does not care about Out of range data. - FPGA provides measures and FSW manage the validity |
| Updated | 2023-08-04 16:22 |


E_YODA_SYS-1774 - SSU Thermal acquisition

The platform shall acquire SSU temperature provided through thermistor signal as defined in '[RD09] BiSon64-ET-B Sun Sensor Interface Control Document'

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | SSU Temperature acquisition is only used for information (sent also on Telemetry.) No current correction is performed with Temperature. |
| Updated | 2023-06-22 09:12 |

E_YODA_SYS-1768 - SSU - PUS PID range

Parameter ID for SSU telemetries shall be in the range [SSU_PID_MIN - SSU_PID_MAX]


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0170 (GEN) YODA-MC-REQ-0180 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | On common project : SSU_PID_MIN = 601 SSU_PID_MAX = 800 |
| Updated | 2023-03-22 15:55 |

4.9.8.3 Observability

E_YODA_SYS-1767 - SSU telemetry for downlink

The platform shall make the following SSU parameters for downlink

- SSU measure (current and validity)
- Time tag of each acquired measure
- SSU Temperature

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB, FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-03-22 15:55 |


4.9.8.4 FDIR**E_YODA_SYS-2542 - Solar Sensor Unit Data monitoring**

A service 12 monitoring <FM_SSU_VALIDITY> shall be implemented for sun sensor validity status output parameter.

This monitoring shall be configure as follow:

- Monitoring definition:
 - Active : MSAF
 - Parameter monitored : <AM_SSU_VALIDITY>
- Checking information:
 - Monitoring interval : 1
 - Repetition value :2
 - Monitoring type : CHECK_EXPECTED_VALUE
 - Mask : 0xFF
 - Expected value : 1 (VALID)
- Validity condition:
 - Validity parameter : Not Applicable

On generation event of this monitoring the platform shall trig a **TC_DHS_HIGH_REBOOT_OBC**

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-29 18:09 |

4.9.9 Gyrometer Unit


Used Gyro from iXblue , model ASTRIX NS

4.9.9.1 Links

E_YODA_SYS-893 - Gyro communication link characteristics


The platform shall communicate with the Gyro equipment over the UART RS422 interfaces allocated to it and shall operate at 1Mbps, full duplex as defined in [RD04]

There are 1 start bit, 8 data bits, 1 stop bit, odd parity.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test, Inspection |
| Note | LSB bit transmitted first (after start bit) |
| Updated | 2023-03-28 12:26 |

E_YODA_SYS-2557 - External Synchro Signal for Gyro acquisition

The platform shall provide an external synchronization signal sequenced at 20 Hz, to inform gyrometer equipment to perform its measure acquisition and to provide "TM Full Gyro Data"


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | this synchronisation signal is used to respond to constraints defined in [AD07] AOCS PARTITION - INTERFACE CONTROL DOCUMENT YODA-IF-23-0068-CNES (chapter Gyro CONSTRAINTS) |
| Updated | 2023-07-18 17:36 |

E_YODA_SYS-2568 - Gyro Data acquisition validity

-The platform shall set the Gyro measure validity <AM_GYRO_VALIDITY> to "VALID" when :

- checksum of received TM full Gyro is valid OR
- measure is refreshed


-Else the Gyro measure validity shall be set to "NOT_VALID"

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-17 10:55 |

4.9.9.2 Processing**E_YODA_SYS-1786 - Gyro message transfer**


Communication with the GYRO shall be performed with the following message transfers as a minimum, in accordance with [RD04]:

- ?TC Technological Data? command to set configuration
- ?TM Technological Data? command to read back the configuration parameters

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:57 |

E_YODA_SYS-1782 - Gyro protocol Address


The platform shall manage the Gyro equipment with a communication protocol address defined by configuration parameter **[CONF_GYRO_ADDR]**

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>[CONF_GYRO_ADDR] = 00111 (binary)</p> <p>Address of the remote Terminal is given by pin RT_A0, A1 and A2 of Gyro equipment</p> <p>According [RD6] : when address pins are unconnected, they will be in Hiz state so ?111?.</p> <p>This is the case on project.</p> |
| Updated | 2023-08-04 16:22 |

E_YODA_SYS-1783 - Gyro Configuration command parameter

Thanks "TC Technological Data" command described in [RD04], the platform shall configure the gyrometer equipment with the following value:


- Address of the remote Terminal: GYRO_ADDR_FIELD = 5bits (value = CONF_GYRO_ADD = 00111b)
- Master Mode = 22 (Gyro in Autonomous with "TM Frame ID22")
- Synchro Mode = 1 (External synchro)
- Configuration Mode = 0 (NOMINAL)
- Synchro Internal Speed = 5 (20Hz) but don't care as managed by External Synchro signal
- Communication Mode: Bit 7 = 0 (Point to Point RS422)
- Communication Mode: Bit 0-1 = "011" (1 Mega baud)
- Calibration Mode : all bit set to 1.
- Calibration Selection : bit0 = 1 (SEL_ANGLE_INT is enabled) / bit1 = 1 (SEL_ANGLE_FLT is enabled)
- Configuration Filter register = X?3? (10Hz)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection, Test |
| Note | <p>This configuration will allow to receive all needed gyro data through "TM Full Gyro Data" received each time requested by External Synchro Signal</p> <p>Address of the remote Terminal is given by pin RT_A0, A1 and A2 of Gyro equipment</p> <p>According [RD6] : when address pins are unconnected, they will be in Hiz state so ?111?.</p> <p>This is the case on project.</p> |
| Updated | 2023-08-04 16:22 |

E_YODA_SYS-1784 - Gyro Configuration modification


The platform shall be able to modify only the following fields of gyrometer configuration command through raw TC **TC_ASYNC_RAW_UNIT_CMD**

- Calibration Selection
- Configuration Filter register

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | - Configuration and calibration fields modification are allowed when write configuration is enabled on Gyrometer (via ?TC Write Enable Configuration?) - all other fields hold by "?TC Technological Data?" shall not be modified in flight. |
| Updated | 2023-08-04 16:22 |

E_YODA_SYS-1785 - Gyro - PUS PID range

Parameter ID for Gyro telemetries shall be in the range [GYRO_PID_MIN - GYRO_PID_MAX]

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0170 (GEN) YODA-MC-REQ-0180 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | GYRO_PID_MIN = 6000 GYRO_PID_MAX = 6999 |
| Updated | 2023-02-16 17:55 |


E_YODA_SYS-2572 - Gyrometer activation

The platform shall provide a function to activate Gyrometer that executes the following procedure:

- set it to ON by switching ON the associated power distribution line of the PCDU
- Wait <CONF_GYRO_STARTUP_DELAY> ms
- Send command configuration as defined in E_YODA_SYS-1783 - Gyro Configuration command parameter
- Request ?TM Technological Data? to read back the configuration parameters and ensure that configuration is correct.

IF?TM Technological Data? is not received or received with ERROR status, the event EVENT_GYRO_TBD1 shall be raised.


IF?TM Technological Data? is received with unexpected configuration fields, the event EVENT_GYRO_TBD2 shall be raised.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | -The gyrometer 's power supplie LCL is connected through CDM0.NPL_HV_0Astrix NS Gyro shall not be restarted within 1sec after switch OFF. -Note that before using activation, better to perform a de-activation before. |
| Updated | 2023-08-10 20:07 |

E_YODA_SYS-2573 - Gyrometer deactivation


The platform shall provide a function to deactivate the Gyrometer that executes the following procedure:

- Set gyrometer to OFF by switching OFF the associated power distribution line of the PCDU and wait <CONF_GYRO_POWER_OFF_DELAY>

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | Astrix NS Gyro can be switch OFF at any time whatever the working mode is (Init, Running). |
| Updated | 2023-04-28 14:32 |

E_YODA_SYS-3070 - Scheduling Gyrometer measures to AOCS


The platform shall provide to AOCS at 5Hz, all Gyrometer measurements as defined in [AD07]

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | ICD [YODASCAO-34] Gyro Data |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | As one acquisition is performed at 20Hz, 4 measurements is also provided to SCAO at 5Hz |
| Updated | 2023-07-18 17:59 |

4.9.9.3 Observability**E_YODA_SYS-892 - Gyro Data Acquisition**

The platform shall use TM Full Gyro Data to make the following Gyro data available for downlink :

- Gyro Integrated Time base "TimeTag"
- Raw angle "RawAngX", "RawAngY", "RawAngZ",
- Filtered angle "FilAngX", "FilAngY", "FilAngZ"
- Health Status
- Board Temperature "BoardTemp"
- Source input current "SoInCur"

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:57 |

4.9.9.4 FDIR

Gyro FDIR is holded by AOCS event EVENT_AOCS_FDIR_Gyro as described in E_YODA_SYS-2615

4.9.10 Propulsion Unit

The propulsion system of YODA mission is composed with 4 motors (TCUs) , a Xenon Tanker and an electronic management system of the 4 motors.

A system view is given in the following picture :

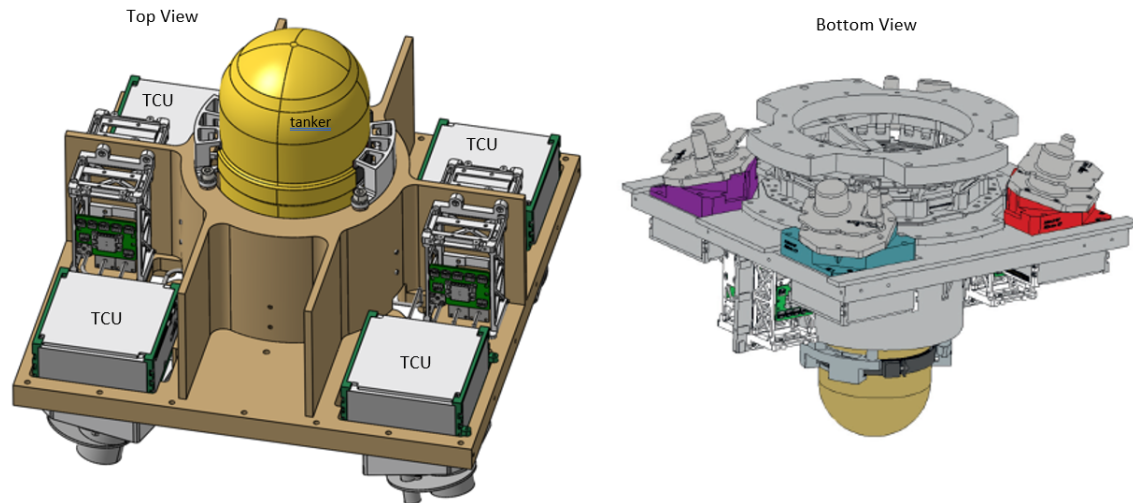


Figure 20 System view of Propulsion module

4.9.10.1 Links

E_YODA_SYS-1788 - Propulsion communication link characteristics

The platform shall communicate with the 4 TCUs over a CAN bus interfaces with the following characteristics as defined in RD[14]:

- BitRate fixed at 1Mbps
- Used protocol is CSP for data format exchange over CAN bus.
- CAN2.0B standard shall be followed for data exchange.

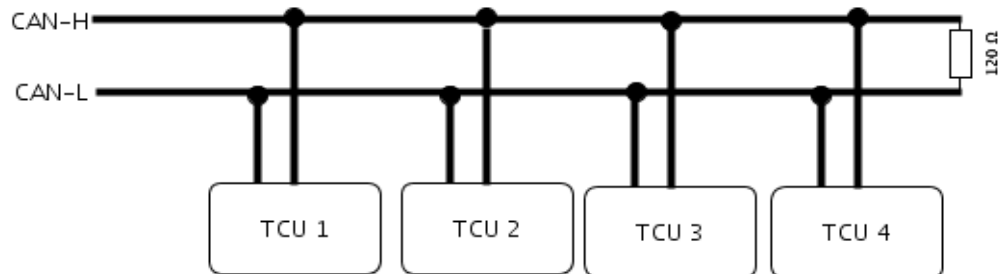


Figure 21 Connection of the four TCUs module of Propulsion Unit on the CAN bus

| | |
|-----------------------|------------------|
| ReqStatus | Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-11 16:49 |

E_YODA_SYS-1789 - TCUs Identifier

The platform shall exchange data with the four TCUs on CAN bus thanks the following specification as per [RD14]

- Communication with **TCU1** is done through device ID defined by configuration parameter **[CONF_TCU_1_ID] = 13**
- Communication with **TCU2** is done through device ID defined by configuration parameter **[CONF_TCU_2_ID] = 14**
- Communication with **TCU3** is done through device ID defined by configuration parameter **[CONF_TCU_3_ID] = 15**
- Communication with **TCU4** is done through device ID defined by configuration parameter **[CONF_TCU_4_ID] = 16**

[CONF_PPU_x_ID] is set as DestinationID of CAN TC frame when sending the TC command to dedicated PPU.

| | |
|-----------------------|------------------|
| ReqStatus | Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection, Test |
| Note | |
| Updated | 2023-02-23 09:48 |


4.9.10.2 Processing

E_YODA_SYS-1790 - Propulsion message transfer

Communication over the CAN bus with the TCUs shall be performed thanks "Exotrail TC frame" of 139 bytes.

The parameters of this frame shall be filled, according [RD14], to allow at least:


- Tune firing duration time (how long the thruster shall be in firing)
- start of firing sequence
- stop of firing sequence

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | please confer to [AD07] AOCS PARTITION - ICD to fill "Exotrail TC frame" |
| Updated | 2023-07-18 17:59 |

E_YODA_SYS-1791 - Thruster commanding field


The platform shall provide a fonction to fill the following "Exotrail TC frame" field according AOCS provided data :

- OBC mode request
- Firing duration
- radiator heating duration

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:57 |

E_YODA_SYS-1792 - Thruster Command request

When requested by AOCS,the platform shall send "Exotrail TC frame" over CAN bus.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-02-15 14:57 |


E_YODA_SYS-2628 - Truster Command to stop firing

When a stop of firing sequence is requested by AOCS,the platform shall send a STOP FIRING command over CAN bus to stop the firing sequence, even if the time delay programmed for the thrust duration is not reached.

In this case the thruster shall return to IDLE mode.

The STOP FIRING TC command is defined as follow:


- Exotrail TC frame with OBC Mode Request = IDLE and Magic-Number set to OTF (OnTheFly)

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>In exotrail ICD, the TC controlling thrust (mode 2) includes the "thrust duration" parameter. Concretely, on Yoda, it is not this parameter that will determine the end of the thrust</p> <p>The platform SW shall be able to give the order to the PCDU to stop (or put directly back into AC standby) the propulsion equipment,.</p> <p>In this case, the equipment shall immediately end the thrust even if the duration indicated in the TC is not reached.</p> |
| Updated | 2023-07-19 09:48 |

E_YODA_SYS-1793 - TCUs configuration parameters


The platform shall use configuration parameter [CONF_TCUX_<ParameterName>] to fill all constant parameters of "Exotrail TC frame" as defined in [RD14]:

- Fluidic valves selection value,
- all Heaters Low et Up values
- all Safe Limits Min/Max values
- all reserved Parameter Name

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | <p>x represent de dedicated TCU (TCU1,2,3 or 4)</p> <p><ParameterName> is the name of parameter</p> <p>Ex: for safe limit byte 92 (max limit of thermistor) of TCU1 , configuration parameter shall be CONF_TCU1_TM_TH_RAD_1</p> <p>Reserved Parametre Name are defined as configuration parameter to allow SW development to fill directly the frame.</p> |
| Updated | 2023-02-23 09:48 |

E_YODA_SYS-1794 - TCU provided data

The platform shall configure each TCUs to provide the 248 bytes of "Exotrail TM frame" at 1Hz. Once received by the platform, these data are then sent to AOCS.


| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | <p>Warning. Time constraint provided by new ICD Propu no more match with SW platform sequencing plan. Modification shall be done. wiat discussion and feedback from Exotrail for requirement modification.</p> |
| Updated | 2023-07-19 13:41 |

E_YODA_SYS-2569 - TCU activation

The platform shall activate a cabled TCU by executing the following procedure in this order:

- set it to ON by switching ON the associated power distribution line of the PCDU
- Wait <CONF_TCU_STARTUP_DELAY> ms
- Send "TM on Demand" command] to request TCU TM status
- Check "CSP TC frame acknowledge" is correct.


IF "CSP TC frame acknowledge" is not received or received with ERROR status, the event EVENT_TBD shall be raised.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <p>The TCU's power supplies LCL are connected to the PCDU as follows:</p> <ul style="list-style-type: none">• TCU1: CDM0.NPL_HC_0• TCU2: CDM0.NPL_HC_1• TCU3: CDM1.NPL_HC_0• TCU4: CDM1.NPL_HC_1 <p>Note that before using activation, better to perform a de-activation before.</p> |
| Updated | 2023-08-10 20:07 |

E_YODA_SYS-2570 - TCU deactivation

The platform shall deactivate a cabled TCU by executing the following procedure in this order:

- set cabled TCU to OFF by switching OFF the associated power distribution line of the PCDU
- Wait <CONF_TCU_POWER_OFF_DELAY> ms


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-06-28 09:43 |

4.9.10.3 Observability

E_YODA_SYS-1795 - TCU Telemetry

The platform shall make the following TCUs parameters available for downlink

- TCUX LCL state (ON / OFF)
- TCUX Mode
- TCUX Error code
- Tank Pressure
- Temperature TM_TNK_1_1 and TM_TNK_1_2
- Temperature TM_TNK_2_1 and TM_TNK_2_2
- Temperature TM_TNK_3_1 and TM_TNK_3_2

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-0510 (GEN) YODA-MC-REQ-1470 YODA-MC-REQ-2350 (GEN) YODA-MC-REQ-2360 (GEN) YODA-MC-REQ-2380 (GEN) |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | <ul style="list-style-type: none">• x represent de dedicated TCU (TCU1,2,3 or 4)• Tank pressure and T° TM_TNK_x_y allow the ground to determine the fuel (xenon) quantity consumption |
| Updated | 2023-08-10 16:27 |

4.9.10.4 FDIR


E_YODA_SYS-2623 - Propulsion communication monitoring

A service 12 monitoring shall be implemented on PPU loss of communication counter

This monitoring shall be active by default in MNOM mode.


This monitoring shall trig on 1 occurrences.

On monitoring trig, the OBSW shall release a TC_DHS_HIGH_RESTART_SC to restart the PPU through a restart of the PCDU.

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-956 |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | FDIR to update after WS with CNES. As TM is send in response to TC (with ACK/NACK), other FDIR could be managed in NACK response. |
| Updated | 2023-08-01 18:12 |

E_YODA_SYS-2624 - Propulsion loss of communication counter

The OBSW shall implement the parameter AM_DHS_TIME_SINCE_LAST_PPU_DATA to count in second the time elapsed since the last received TM packet.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-1044 |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | FDIR to update after WS with CNES |
| Updated | 2023-07-17 10:09 |

4.9.11 GNSS Unit

Used GNSS is from SYRLINKS, modele N-SPHERE. This modele has been jointly designed with CNES.


It provide position to OBC through PUS packet and time synchronization thanks PPS signal.

4.9.11.1 Links

E_YODA_SYS-1781 - GNSS communication link characteristics

The platform shall communicate with the GNSS over the UART RS422 interfaces allocated to it and shall operate at 115200 bps as defined in RD[11]


There are 1 start bit, 8 data bits, 1 stop bit, no parity.

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, FPGA |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection, Test |
| Note | [N-SPHERE-ICD-0360] |
| Updated | 2023-02-15 14:57 |

4.9.11.2 Processing**E_YODA_SYS-1826 - GNSS RECEIVER Cyclical data configuration**

The platform shall configure GNSS RECEIVER, through GMESS TC (see [RD12]), to provide every second


- STIME

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection, Test |
| Note | STIME is synchronised with TAI as GNSS provide datation of the PPS signal in GPS or GAL time (both synchronzied with TAI) |
| Updated | 2023-08-03 19:50 |

E_YODA_SYS-2558 - GNSS Orbital Navigator Cyclical data on request

The platform shall request, every second, the following TM of GNSS Orbital Navigator, through GTMREQUEST TC (see [RD13]):


- SNAVN TM
- SRAWN TM
- SSTATE TM(TBD: no information on Symlink RD13 to know which TC is requested for SSTATE TM, but hope that is GTMREQUEST TC)

| | |
|-----------------------|--|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection, Test |
| Note | Configuration of GNSS via GMESS TC, to get cylically these TM should not be used. These TM shall be acquired on plateform request to avoid time gap delay between time PF partition sequencing and time GNSS TM providing |
| Updated | 2023-08-03 19:44 |

E_YODA_SYS-2559 - GNSS RECEIVER Cyclical data on request

The platform shall request, every second, the following TM of GNSS RECEIVER through GTMREQUEST TC (see [RD12]):


- SRECEIVST TM
- SRAWD TM
- SCHANST TM

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test, Inspection |
| Note | |
| Updated | 2023-07-03 18:07 |

E_YODA_SYS-2551 - GNSS Health status Request PUS Packet Command

The platform shall request, every second, the following TM of GNSS RECEIVER through TC_REQUEST_TM_HK_SU (see [RD11]):


- TM_HK_SU

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-2440 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | SDB, FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test, Inspection |
| Note | -TC_REQUEST_TM_HK_SU ((TC Service 3, sub_service 128)) request health status of GNSS with TM_HK_SU response |
| Updated | 2023-07-03 18:09 |

E_YODA_SYS-1827 - GNSS Receiver PUS Packet Command

The platform shall implement the following RECEIVER TC command defined in [RD12], with GNSS_RECEIVER_APID (TBD), to be directly transferred to GNSS without any content check performed by platform:


- GTMREQUEST (TC 35,7 with Function ID 0x1018)
- GMESS (TC 35,7 with Function ID 0x1104)
- GALEPH (TC 35,7 with Function ID 0x1106)
- RALEPH (TC 35,7 with Function ID 0x1016)
- RCACQ (TC 35,7 with Function ID 0x1308)
- RCANT (TC 35,7 with Function ID 0x1102)
- RCPVT (TC 35,7 with Function ID 0x1101)
- RCTR (TC 35,7 with Function ID 0x1300)
- RNAV (TC 35,7 with Function ID 0x1006)
- RTIME (TC 35,7 with Function ID 0x1004)
- WMODE (TC 35,7 with Function ID 0x1000)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-2440 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | GNSS_RECEIVER_APID not defined in ICD (TBD) |
| Updated | 2023-07-04 18:43 |

E_YODA_SYS-1828 - GNSS NAV PUS Packet Command

The platform shall implement the following NAV TC commands defined in [RD13], with GNSS_NAV_APIID (TBD), to be directly transferred to GNSS without any content check performed by platform:


- GTMREQUEST (TC Service TBD, sub_service TBD)
- GMESS (TC Service TBD, sub_service TBD)
- NMODE (TC Service TBD, sub_service TBD)
- NORBIT (TC Service TBD, sub_service TBD)
- NMANO (TC Service TBD, sub_service TBD)
- NECO (TC Service TBD, sub_service TBD)
- NMRT (TC Service TBD, sub_service TBD)
- NPRS (TC Service TBD, sub_service TBD)
- NMOTE (TC Service TBD, sub_service TBD)
- NPOL (TC Service TBD, sub_service TBD)
- NADV (TC Service TBD, sub_service TBD)
- NCSAT (TC Service TBD, sub_service TBD)
- NCLOCK (TC Service TBD, sub_service TBD)
- NANT (TC Service TBD, sub_service TBD)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | YODA-MC-REQ-2440 (SPE) |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-17 10:09 |

E_YODA_SYS-1831 - GNSS Receiver and NAV PUS Packet provided Asynchronous TM

The platform shall manage as "Asynchronous" TM, the following TM :


- all TM requested by an asynchronous TC command.
- ACK or NACK TM regarding to sent Telecommand

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | V0 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | Asynchronous TM shall be in Asynchronous Packet Store |
| Updated | 2023-07-05 08:51 |


E_YODA_SYS-1832 - GNSS Receiver and NAV PUS Packet provided ExpertiseTM

The platform shall manage as "Expertise" TM, the following cyclic TM :

- SRECEIVST
- STIME
- SNAVN
- SRAWN
- SSTATE
- SCHANST
- SRAWD
- TM_HK_SU

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | Expertise TM shall be in Expertise Packet Store |
| Updated | 2023-07-05 08:37 |


E_YODA_SYS-2306 - GNSS data for AOCS (deleted)

| | |
|-----------------------|---|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | NA |
| subSystemAllocation | |
| implementationVersion | V1 |
| ValidationLevel | |
| ValidationMethod | |
| Note | Deleted since 1.3 version of ICD NAV (no more GNSS data for AOCS) |
| Updated | 2023-08-03 19:44 |

E_YODA_SYS-2307 - GNSS data for NAV

The platform shall provide GNSS data to NAV partition.


All NAV requested data from GNSS, with their format and timing, are defined in [AD08] NAVIGATIONPartition ?
Interface Control Document'

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-03-22 15:55 |

E_YODA_SYS-2591 - GNSS activation

When the GNSS in OFF state, the platform shall perform the following action to activate the GNSS :


- Set GNSS ON by switching ON the associated power distribution line of the PCDU thanks **TC_EPS_SET_LCL_CMD_PCDU**
- Wait <**CONF_GNSS_STARTUP_DELAY**> ms
- Perform configuration and acquisition defined in E_YODA_SYS-1826, E_YODA-SYS_2558, E_YODA_SYS-2559
- reload ephemeride/almanach saved in NVM
- Set AM_GNSS_STATE to (ON)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-09 11:05 |

E_YODA_SYS-2592 - GNSS deactivation

The platform shall provide a function to deactivate GNSS that executes the following procedure:

- Disable monitoring
- Stop cyclic acquisition
- Set GNSS to OFF by switching OFF the associated power distribution line of the PCPU thanks
TC_EPS_SET_LCL_CMD_PCDU
- Set AM_GNSS_STATE to 0 (OFF)

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | This function |
| Updated | 2023-07-03 18:32 |


E_YODA_SYS-2627 - GNSS Validity

The platform shall set the equipment validity **<AM_GNSS_VALIDITY>** as follow :
IF :

- SRECEIVER TM is received with correct CRC, Size, Type, FonctionID AND
- SNAV TM is received with correct CRC, Size, Type, FonctionID AND
- STIME TM is received with correct CRC, Size, Type, FonctionID

- THEN **<AM_GNSS_VALIDITY>** shall be set to "VALID"

-ELSE **<AM_GNSS_VALIDITY>** is set to "NOT_VALID"


| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-03 18:32 |

4.9.11.3 Observability

E_YODA_SYS-1833 - GNSS Telemetry

The platform shall make the following GNSS parameters available for downlink:

- GNSS ON/OFF Status
- SRECEIVST data defined in [RD12]
- GNSS STIME data defined in [RD12]

| | |
|-----------------------|---|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | For data provided by SRECEIVST, the following data shall be provided at least : TM /TC Status Snapshot resolution GNSS functional mode |
| Updated | 2023-08-03 19:48 |

4.9.11.4 FDIR


E_YODA_SYS-2629 - GNSS Unit Data monitoring

A service 12 monitoring <FM_GNSS_VALIDITY> shall be implemented for GNSS validity status output parameter.

This monitoring shall be configure as follow:

- Monitoring definition:
 - Active : MSAFE, MNOM
 - Parameter monitored : <AM_GNSS_VALIDITY>
- Checking information:
 - Monitoring interval : 1
 - Repetition value :2
 - Monitoring type : CHECK_EXPECTED_VALUE
 - Mask : 0xFF
 - Expected value : 1 (VALID)
- Validity condition:
 - Validity parameter : AM_GNSS_STATE set to (ON)


On generation event of this monitoring, the plaform shall trig a switch OFF of equipment through **TC_FUNC_ACT_DEACT_UNIT** command

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-07-04 12:06 |

4.10 FDIR**4.10.1 General****E_YODA_SYS-1818 - FDIR Design and Analysis**


A document shall be produced to described the full design of the Failure Detection Isolation and Recovery (FDIR) implemented on the Platform.

This document shall demonstrate that on each identified possible failure, the design guarantee the safety of the Platform without ground intervention in less than seven days.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-954 |
| subSystemAllocation | OPS |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-02-15 14:57 |

E_YODA_SYS-1819 - Anomalies notifications to ground

All anomalies detected on board shall be notified to the ground with an event TM.


| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | YODA-MC-REQ-0760 (GEN) YODA-MC-REQ-0080 (GEN) YODA-MC-REQ-0310 (GEN) YODA-MC-REQ-0410 (GEN) |
| KineisLink | E_KINEIS_SYS-612 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-10 16:27 |

E_YODA_SYS-1820 - Deactivation of onboard autonomous functions (deleted)

| | |
|-----------------------|--|
| ReqStatus |  Deleted |
| LinkedUpReq | |
| KineisLink | |
| subSystemAllocation | |
| implementationVersion | |
| ValidationLevel | |
| ValidationMethod | |
| Note | deleted because only function getting “activation” method shall get also de-activation because all Embedded SW functions are autonomous but not all function could be deactivated (SCAO function shall not get deactivation, SW load shall not get deactivation ..) YODA-MC-REQ-0830 (GEN) is traced in all function getting deactivation |
| Updated | 2023-03-22 15:50 |


E_YODA_SYS-2553 - 'Absence TC' counter

The FSW shall implement a context parameter <CTX_TC_ABSENCE_CPT> that represent the number of seconds elapsed since the generation of the last TM(1,7) generated by Platform with destination ID <CONF_SYS_ID_SCC_TCI>, to monitor the elapsed time since the last succesful ground TC.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-602 |
| subSystemAllocation | FSW, SDB |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-04-04 17:23 |

E_YODA_SYS-2554 - 'Absence TC' counter management after an on board reset

The <CTX_TC_ABSENCE_CPT> counter shall be restored to its current value if an OFF/ON_OBC or an OFF/ON_SAT is triggered.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-603 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SYSTEM |
| ValidationMethod | Test |
| Note | |
| Updated | 2023-08-03 19:46 |

E_YODA_SYS-2555 - 'Absence TC' monitoring FDIR


The platform shall monitor the absence of TC as follow:

If <CTX_TC_ABSENCE_CPT> is bigger than <CTX_TC_ABSENCE_DELAY> and bigger than 3600, the OBSW shall:

- set <CTX_TC_ABSENCE_CPT> to 0, to reset the monitoring
- request platform OFF/ON with return to MSAF by releasing **TC_DHS_HIGH_RESTART_SC**

This monitoring shall be performed without using any PUS services, to ensure independance with the TC processing chain as much as possible.

This monitoring shall be active independently of the mode or satellite configuration (no deactivation mechanism).

| | |
|-----------------------|--|
| ReqStatus |  Reviewed |
| LinkedUpReq | Derived |
| KineisLink | E_KINEIS_SYS-602 |
| subSystemAllocation | FSW |
| implementationVersion | V1 |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Test, Inspection |
| Note | |
| Updated | 2023-07-17 09:45 |

5 Database Requirements


5.1 Content

E_YODA_SYS-752 - Database Content

The DB shall contain all information needed for commanding spacecraft and identifying telemetries in TM packets.

Database shall contain at least the following elements.

- TMTC structures definition
- TM parameters description
- TC arguments description
- Transfer functions
- Ground computed data
- On board monitoring definition
- System parameter

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SOFTWARE |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-03-22 15:50 |

5.2 DB Format


5.2.1 HNSDB Format

HNSDB is the internal Hemeria database format, this database contain all the data to produce the XTCE exchange format. This internal data is also used to generate configuration file of flight software. HNSDB format is based on XML format, storing the data in this format allows us to free ourselves from the complexity of the XTCE format structuring rules. Our main goal is to truly focus on the data.

5.2.2 XTCE Format


E_YODA_SYS-756 - Database exchange format, ISIS XTCE

Database exchange format shall be compliant with ISIS XTCE format (specific implementation of XTCE standard) this include PF, PL and satellite database.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Analysis |
| Note | |
| Updated | 2023-03-22 15:55 |

E_YODA_SYS-757 - XTCE generic data pattern


Each XTCE shall include the same generic part. This generic part describe the main structure of CCSDS and PUS packets.

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB, OPS |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-03-22 15:55 |

E_YODA_SYS-758 - XTCE data hierarchy.

XTCE global hierarchy shall be as follow:

- GENERIC
 - CUSTOM
 - YODA
 - PAYLOAD
 - PLATFORM

| | |
|-----------------------|---|
| ReqStatus |  In Review |
| LinkedUpReq | Derived |
| KineisLink | N/A |
| subSystemAllocation | SDB |
| implementationVersion | VAIT |
| ValidationLevel | SYSTEM |
| ValidationMethod | Inspection |
| Note | |
| Updated | 2023-03-22 15:50 |

6 ANNEXE**6.1 Mission constants**

Mission constants defined and used within the requirements of this specification are summarized and defined below.

| Name | Description | Unit |
|--|---|------------------|
| SPC_MAX_NB_PACK | Number max of packet to be extract from TC frame | N.A |
| SPC_OBT_DRIFT | ?natural? drift, without board/ground correction | N.A |
| SPC_PF_MISSION_PUS_SERVICE_RANGE | range of specific PUs service of PF | N.A |
| SPC_PF_MISSION_SUBSERVICE_OF_STD_PUS_RANGE | range of specific PUs sub-service of PF | N.A |
| SPC_PK_TIME_MAX_DELAY | Time packet timing transmission | N.A |
| SPC_SSU_ACQ_START_DELAY | waiting delay befor first SSU acquisitionin a frmae | milli-second(ms) |
| SPC_TC_VERIF_DELAY | Delay for service 1 acknowledgement | second |
| SPC_TM_OVERALL_FRAME_FIFO_SIZE | maximum frame that could be lost during reboot | N.A |
| SPC_TTG_EXEC_ACCURACY | max accuracy to release a | milli- |

| | command stored in the MTL | second(ms) |
|-------------------------------|---|------------|
| SYS_FDIR_EBAT_FILTER_DURATION | max step time for FDIR EBAT monitoring | second |
| SYS_FDIR_EBAT_LOW_LIMIT | Low limit of the battery to not reach | V |
| SYS_FDIR_EBAT_RECOVER_TIME | time step to ensure battery recharge after battery FDIR re-enabling | second |
| SYS_HKTMP_VCID | HKTMP VCID | N.A |
| SYS_HKTMR_VCID | HKTMR VCID | N.A |
| SYS_ID_GCS_TCIM | ID of GCS for TM packet | N.A |
| SYS_ID_OBC_FDIR | Source ID from command generated by FDIR | N.A |
| SYS_ID_SCC_TTG | PUS time tag ID built by the ground segment | N.A |
| SYS_IDLE_VCID | IDLE Frame VCID | N.A |
| SYS_PF_APID | APID of platform | N.A |
| SYS_SADM_SCHEDULING_PERIOD | Time scheduling to get/send SADM data | ms |
| SYS_TC_AUTHENTICATION_APID | APID of AUTHENTICATION partition | N.A |
| SYS_TCS_THERM_ZONE_N | number of thermal zone in the project | N.A |
| | | |

6.2 Configuration variables

Configuration variables defined and used within the requirements of this specification are summarized and defined below. BDS is in charge to specify the value.

| Name | Description | Unit |
|-------------------------|---|------|
| CONF_BAT_INTERNAL_RES | internal resistance for battery level computation | Ohm |
| CONF_COP1_NW | negative window of COP-1 | N.A |
| CONF_COP1_PW | positive window of COP-1 | N.A |
| CONF_GNSS_STARTUP_DELAY | time delay to ensure GNSS is in stable state after power-on | ms |
| CONF_GYRO_ADDR | gyrometer address used for equipment communication | N.A |
| CONF_GYRO_STARTUP_DELAY | time delay to ensure Gyro is in stable state after power-on | ms |
| | | |

| | | |
|----------------------------------|--|-----|
| CONF_GYRO_POWER_OFF_DELAY | time delay to ensure Gyro is Power-OFF state | ms |
| CONF_HKTMP_FRAME_TIMEOUT | Timeout for the emission of HKTMP frame | ms |
| CONF_MONx_AUTO_ENABLE | Table of monitoring x activation for FDIR in AUTO mode | N.A |
| CONF_MONx_MAINT_ENABLE | Table of monitoring x activation for FDIR in MAINT mode | N.A |
| CONF_MONx_MNOM_ENABLE | Table of monitoring x activation for FDIR in MNOM mode | N.A |
| CONF_MONx_MSAF_ENABLE | Table of monitoring x activation for FDIR in MSAF mode | N.A |
| CONF_NB_EEP_MAX_FOR_SPW_RESTART | max of SPW error to reach before allowing SPW link restart | N.A |
| CONF_PAYLD_APID_AOCS | AOCS APID value | N.A |
| CONF_PAYLD_APID_EGCU | EGCU APID value | N.A |
| CONF_PAYLD_APID_GYRO | GYRO APID value | N.A |
| CONF_PAYLD_APID_GYSELE | GYSELE APID value | N.A |
| CONF_PAYLD_APID_NAV | NAV APID value | N.A |
| CONF_PKS_AUTO_DOWNLINK_x | order of packet stores downlinked autonomously during ground station available | N.A |
| CONF_PPU_x_ID | PPU ID used for communication with each of 4 propulsion PPU | N.A |
| CONF_RW_AVAILABLE | number of available reaction wheel | N.A |
| CONF_RW_STARTUP_DELAY | time delay to ensure RW is in stable state after power-on | ms |
| CONF_RWx_ADDR | Address used for communication with each of 4 reaction wheels | N.A |
| CONF_RWx_BUS | dedicated bus to communicate with reaction wheel (2 RW by buse) | N.A |
| CONF_SADM_1_ADDR | address to communicate with SADM1 equipment | N.A |
| CONF_SADM_2_ADDR | address to communicate with SADM2 equipment | N.A |
| CONF_SADM_POLYNOME_COEF_A | coefficient of polynome used for angle to step conversion | N.A |
| CONF_SADM_POLYNOME_COEF_B | constante of polynome used for angle to step conversion | N.A |
| CONF_SADM_STARTUP_DELAY | time delay to ensure SADM is in stable state after power-on | ms |
| CONF_S BAND_DEFAULT_TC_FREQUENCY | Tuned frequency for TC | N.A |
| | | |

| | | |
|--|--|-----|
| CONF_SBAND_DEFAULT_TM_FREQUENCY | Tuned frequency for TM | N.A |
| CONF_SIDx_mode_S3_ENABLE | | N.A |
| CONF_SPACECRAFT_ID | Spacecraft Identifier | N.A |
| CONF_SSU_SAMP_OFFSET_x (CONF_SSU_SAMP_OFFSET_0,1,2,3) | SSU sampling used for AOCS exchange data with SSUs | |
| CONF_SYS_ID_OBC_NOM | Source ID of TC build by OBSW PF | N.A |
| CONF_SYS_ID_SCC_TCI | Source ID of TC immediate build by control center | N.A |
| CONF_TC_SBAND_BIT_RATE | bit rate emission of Sband | bps |
| CONF_TC_VCID | VCID for TC | N.A |
| CONF_TCU_STARTUP_DELAY | time delay to ensure TCU is in stable state after power-on | ms |
| CONF_TCU_x_ID | Identifiand of one of he 4 TCUs | N.A |
| CONF_TCUx_<ParameterName> | parameter used to fill easily datastructure of TCU for communcation | N.A |
| CONF_THERM_ZONE_xx_OP_STATE_AIT | thermal control setting point | N.A |
| CONF_THERM_ZONE_xx_OP_STATE_AUTO | thermal control setting point | N.A |
| CONF_THERM_ZONE_xx_OP_STATE_NOM | thermal control setting point | N.A |
| CONF_THERM_ZONE_xx_OP_STATE_SAFE | thermal control setting point | N.A |
| CONF_THERM_ZONE_xx_TEMP_CONSISTENCY | TEMP_CONSISTENCY for temperature computation according sensor topology | deg |
| CONF_TIME_SAP_TK_OFF | waiting delay after thermal knife swithed OFF | s |
| CONF_TIME_SAP_TK_ON | waiting delay after thermal knife swithed ON | s |
| CONF_TM_BAT_HKTMP | BAT value in configuration table for HKTMP | N.A |
| CONF_TM_BAT_HKTMR | BAT value in configuration table for HKTMR | N.A |
| CONF_TM_BAT_TABLE | BAT configuration table | N.A |
| CONF_TM_SBAND_BIT_RATE_HIGH | Lowest bit rate rate for emission | N.A |
| CONF_TM_SBAND_BIT_RATE_LOW | Highest bit rate rate for emission | N.A |
| CONF_TX_CMD_DELAY | waiting delay for activation/deactivation emission | ms |
| CONF_TX_POWER_OFF_DELAY | delay for pulse creation to reset SBAND with HW signal | ms |
| CONF_TX_RESET_ACTIVATION | flag allowing reset of SBAND before activation | N.A |
| CONF_TX_REST_DELAY | delay after SBAND reset to ensure SBAND is in stable state after reset | ms |

6.3 Context variables

Context variables defined and used within the requirements of this specification are summarized and defined below.

BDS is in charge to specify the value.

| Name | Description | Unit |
|-----------------------------------|--|------|
| CTX_AUTO_S11_ACTIVE_SUBSCHEDULES | number of sub-schedule activated in MTL in AUTO mode | N.A |
| CTX_COP1_VR | frame sequence number V(R) (COP-1 control command) stored in context | N.A |
| CTX_FSW_MODE | FSW operational mode | N.A |
| CTX_FSW_NEXT_VERSION | FSW next reboot version | N.A |
| CTX_LAST_CRIT_EVENT_DATE | last critical event date | N.A |
| CTX_LAST_CRIT_EVENT_RID | last critical event RID | N.A |
| CTX_MAIT_S11_ACTIVE_SUBSCHEDULES | number of sub-schedule activated in MTL in AUTO mode | N.A |
| CTX_MNOM_S11_ACTIVE_SUBSCHEDULES | number of sub-schedule activated in MTL in AUTO mode | N.A |
| CTX_MON_FRC_DRIFT | Drift correction used for OBT time computation | N.A |
| CTX_MSAF_S11_ACTIVE_SUBSCHEDULES | number of sub-schedule activated in MTL in AUTO mode | N.A |
| CTX_OBC_NB_REBOOT_MAX | number of max reboot allowed before reboot with secure version | N.A |
| CTX_OBC_REBOOT_COUNT | Reboot counter | N.A |
| CTX_SADMx_MSAF_TOP_TURN | permission flag to perform TOP-TURN of SADMx in MSAF mode entry (TRUE/FALSE) | N.A |
| CTX_SECURITY_CURRENT_TM_KEY_INDEX | index of used security key for TM in a table | N.A |
| CTX_SOLAR_DEPLOYMENT_FLAG | Flag of solar array deployment state | N.A |
| CTX_Synchro_OBT_GNSS | permission flag to perform OBT synchro with GNSS (TRUE/FALSE) | N.A |
| CTX_LOW_BATTERY_FDIR_STATUS | flag to enable battery FDIR | N.A |
| CTX_OBT_CUC | OBT time in CUC format | N.A |
| CTX_SBAND_MODULATION_N | time counter in modulation(emission) mode of SBAND | N.A |
| CTX_SBAND_STANDBY_N | time counter in standby (no-emission) mode of SBAND | N.A |
| CTX_SOLAR_DEPLOYMENT_CPT | Time counter to know spent time in deployment | s |

| | state | |
|-----------------------------------|---|--------|
| CTX_SOLAR_DEPLOYMENT_DELAY | Delay to take into account for the start of solar array deployment | s |
| CTX_SOLAR_DEPLOYMENT_FLAG | Flag to indicate the status (deploy or not) of solar array | N.A |
| CTX_TC_ABSENCE_CPT | Counter of No TC | second |
| CTX_TC_ABSENCE_DELAY | waiting delay without TC to perform "absence TC" FDIR | second |
| CTX_TM_ON_CPT | elapsed time after launch before starting emission mode | second |
| CTX_TM_ON_DELAY | Delay to take into account for the start of RF emission | second |
| CTX_THERM_ZONE_xx_FILTER_DURATION | filter associated to the zone for time spend outside warm/cold limit | second |
| CTX_THERM_ZONE_xx_NOP_COLD_LIMIT | Low limit T° used as threshold for heater activation in in No-Operational Mode | Deg |
| CTX_THERM_ZONE_xx_NOP_WARM_LIMIT | High limit T° used as threshold for heater activation in in No-Operational Mode | Deg |
| CTX_THERM_ZONE_xx_OP_COLD_LIMIT | Low limit T° used as threshold for heater activation in in Operational Mode | Deg |
| CTX_THERM_ZONE_xx_OP_WARM_LIMIT | High limit T° used as threshold for heater activation in in Operational Mode | Deg |
| | | |