

**Solar Orbiter TM-TC and Packet Structure ICD**

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## 1 INTRODUCTION

### 1.1 Scope and Purpose

This document is in response to the ESA Solar Orbiter Statement Of Work (SOW) and Operations Interface Requirements Document (OIRD) to provide a Solar Orbiter TM-TC and Packet Structure Interface Control Document based on the Generic Frame and Packet Structure document provided by ESA [AD2].

This document is the baseline detailed definition for structures and syntax of all digitized data traffic onboard the Solar Orbiter spacecraft at application/ user level. The definitions and requirements of the Packet Structure ICD are applicable for the data exchange between the following units of the Solar Orbiter spacecraft:

- Onboard Computer,
- Solid State Mass Memory,
- 10 Payload Instruments,
- Star Tracker

More specifically, this ICD is applicable for all relevant higher data communication layers above the Segmentation Layer of the onboard data communication network. At this level, Application-Layer data structures are processed, i.e. (only) data structures according to ESA Standard

ECSS-E-70-41A [AD1]. The same data structures are handled in the corresponding peer entities on ground, after having been passed through several other sub-networks with, in general, different layers, encoding, and protocols.

As a consequence of this, all relevant definitions for the onboard SpaceWire network are not found in this document, and are defined in document SOL.S.ASTR.RS.00038, "SpaceWire Application Protocol Specification".

The Packet Structure ICD specifies all generic TM/TC-Packet data structures and associated service capabilities. Table 5.1-1 of this document provides an overview of all generic TM/TC-Packet data, indicating, which of the detailed TM/TC Type/Subtypes are mandatory, optional, reserved, or not applicable for a certain user.

If a user/ instrument needs a certain generic service capability or functionality, then the associated data structures for commands, telemetry, and related parameters, shall be used exactly as defined in this document. For each Type/Subtype, the potential adaption of that service for an individual user is described in this document. This adaptation can be achieved through choosing options, or restricting parameter ranges. Each user needs to document its specific choices in the related User Manual or TMTICD.

The non-standard use of standardized services as defined through the PUS [AD 1], or change of definitions of standard services (for any unit), is forbidden.

There may, however, be a need to extend, or introduce service capabilities beyond the ones defined in this document. Such an extension, or other user-specific additions, are possible. However, for Solar Orbiter the agreed approach is, to define all user-specific TM/TC-Packets as so-called Private TM/TC-Services according to section 3.22 of the OIRD, however, they must not be mixed/ merged with existing standardized Services. Private Services can be introduced through an approval process, as spelled out in OIRD PRIV-1 and PRIV-2. The currently agreed private service ranges for each of the users is provided in Table 5.1-1.

The details of Private Services will not be defined in this document, in general terms. These detailed definitions will be provided in unit TMTICDs.

## 1.2 Document Configuration

This document has been generated from an export of the PUS module in DOORS.

5475

## 2 DOCUMENTS

The following documents form the applicable and reference documents to this specification. If no issue is quoted for a document the latest issue is deemed to apply.

### 2.1 Applicable Documents

AD1	ECSS-E-70-41A	Telemetry and telecommand packet utilization; 30 January 2003	7
AD2	SO-ESC-RS-05002	Solar Orbiter Generic Frame and Packet Structure; March 2010	8
AD3	SOL.S.ASTR.RS.00037 MIL-STD-1553B	Bus Protocol Specification	8785
AD4	SOL.S.ASTR.RS.00038	SpaceWire Protocol Specification	13384

### 2.2 Reference Documents

RD1	ECSS-E-ST-50-03C	TM Transfer Frame Protocol (July 2008)	10
RD2	ECSS-E-ST-50-04C	TC Synchronisation and Channel coding (July 2008)	11
RD3	SO-ESC-RS-05001	Solar Orbiter OIRD	12
RD4	SOL.S.ASTR.TN.00011	Mission Operations Concept Document	11377
RD5	SOL.S.ASTR.ICD.00017	System-SW ICD	12139
RD6	BC-TAM-IF-00003	BepiColombo SSMM - SW TM/TC ICD (May 2011)	12160
RD7	P-SOLO-ICD-10131-RSE	Solar Orbiter OBC Hardware Software Interface	13058
RD8	SOL.S.ASTR.ICD.00030	Solar Orbiter CSW TM/TC Interface Control Document	13385
RD9	SOL.A.TAS.ICD.00001	Solar Orbiter SSMM SW TMTICD	14263
RD10	SOL.ASTR.TN.00169	OBC Resource Allocations	14290

### 3 TELECOMMAND STRUCTURE

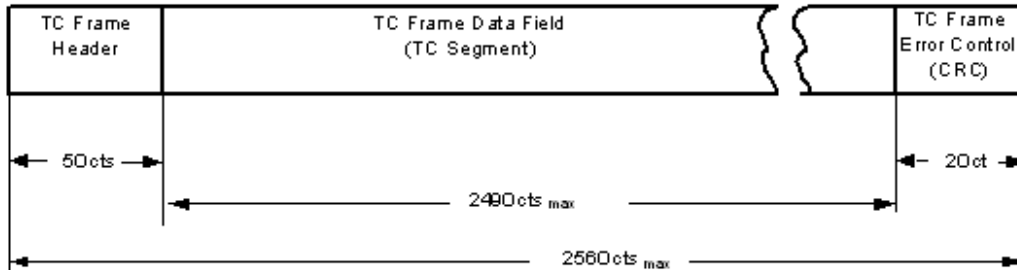
#### 3.1 Telecommand Overview

The following diagram presents an overview of the Telecommand organisation. The TC Frames are the entities going from Ground to the spacecraft. The TC source packet are entities communicating between applications onboard.

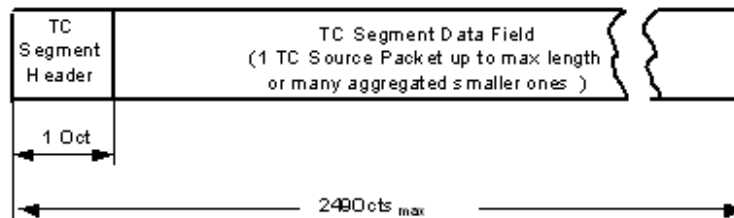
15

Telecommand Frame

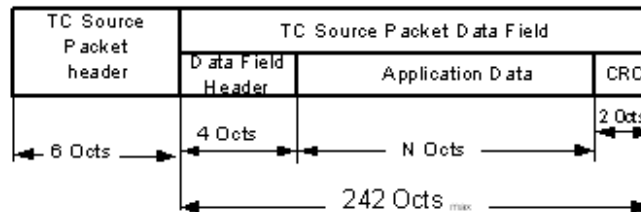
16



Telecommand Segment



Telecommand Source Packet



Comment:  
 - Smallest Telecommand Source Packet is 12 Ocs when  $N = 0$   
 -  $N_{max} = 236$  Ocs

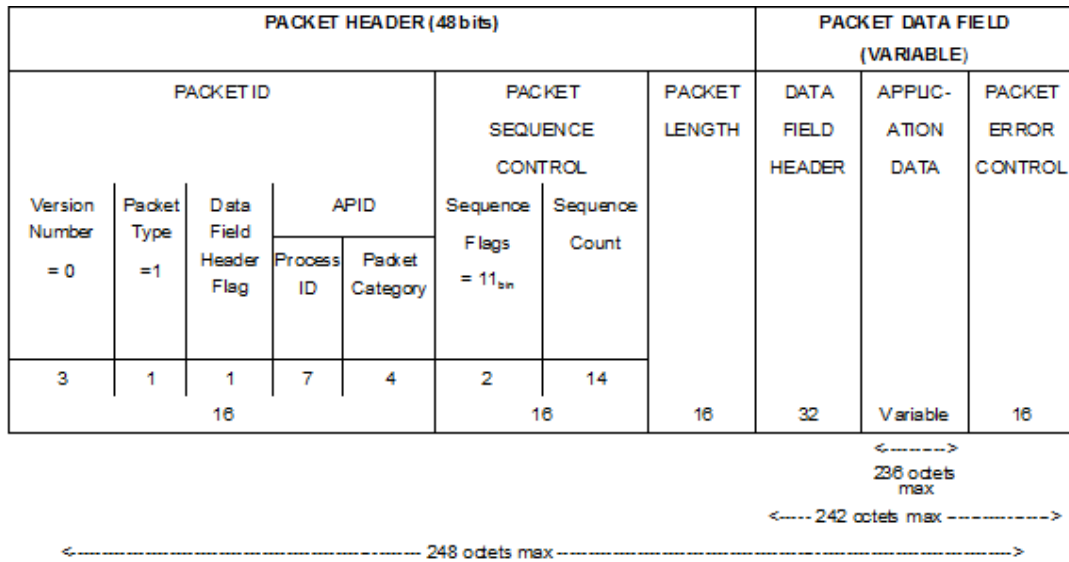
Figure 3.1-1: Telecommand Overview

#### 3.2 Telecommand Source Packet

PUS-19/SGICD-4364/

*All telecommand source packets (except those for distribution by the CPDU) must conform to the structure defined in [AD1] and shown in the figure below.*

20



**Figure 3.2-1: TC Source Packet Structure**

### 3.2.1 TC Packet Header

#### 3.2.1.1 TC Packet ID

##### PUS-24//

**Version Number:**

The Version Number must be set to '000' BIN for all commands.

##### PUS-26//

**Packet Type:**

This bit distinguishes between telecommand packets and telemetry source packets. For telecommand packets, the type = 1.

##### PUS-28//

**Data Field Header Flag:**

This indicates the presence of the Data Field Header when set to 1.

For Solar Orbiter all commands except CPDU commands (defined under service 2 subtype 3) will have a data field header.

##### PUS-31//

**Application Process ID:**

The application ID (APID) is structured into two fields:

- The most significant 7 bits of the APID form a field called «Process ID» (PID), which defines the application which the telecommand is addressed to.
- The least significant 4-bits within the APID form a field called «Packet Category» fixed to decimal 12.

The Application Process ID to be used on Solar Orbiter are specified in Annex 8.

### 3.2.1.2 TC Packet Sequence Control

#### PUS-37//

**Sequence Flags:**

For Solar Orbiter these 2 bits are set to “11”BIN, which means “stand-alone” packet.

#### PUS-39//

**Sequence Count (14 bits):**

This field is provided to identify a particular telecommand packet so that it can be traced within the end-to-end telecommand system implemented in the ground control system. This counter has to be maintained by APID and Source ID. For the meaning of the Source ID see definition below.

No check is to be performed by the addressed application (defined by the APID in the Packet Header) regarding sequence counter. The application shall accept commands regardless of the sequence counter.

### 3.2.1.3 TC Packet Length

#### PUS-43//

The Packet Length field specifies the number of octets contained within the Packet Data Field. The number is an unsigned integer “C” where:

$$C = (\text{Number of octets in Packet Data Field}) - 1$$

Maximum length of a Telecommand source packet data field is 242 octets, this includes 4 octets data field header, 236 octets application data and 2 octets packet error control. However, for all telecommand types that may be contained inside the application data field of another command type (e.g. service 11 and 19), shall have the maximum size of the packet to be further restricted. TCs that are not concerned by this restriction are exceptions (e.g. no TC(11,4) can be contained inside a TC(11,4) or no service 2 HW commands inside the MTL).

## 3.2.2 TC Packet Data Field

### 3.2.2.1 TC Data Field Header

#### PUS-49//

The data field header is preceded by the packet header and followed by application data and error control in the telecommand packet, refer to [Figure 3.2-1](#). The data field header is defined as follows:

CCSDS Secondary header flag = 0	PUS Version = 1	Ack	Service Type	Service Subtype	Source ID
Boolean	Enumerated	Enumerated	Enumerated	Enumerated	Enumerated
1 bit	3 bits	4 bits	8 bits	8 bits	8 bits

50

**Figure 3.2-2: TC Packet Data Field Header**

#### PUS-51//

**CCSDS Secondary header flag:**

This field shall be set to zero to indicate that this header is a non-CCSDS defined header.



**PUS-53//****PUS Version:**

*This field shall be set to 1.*

**PUS-55//****Ack:**

*This field indicates the acknowledgements required in the form of telemetry packets to verify acceptance and execution of this telecommand packet.*

*The bit settings defined for BepiColombo are as follows (with bit zero as start of the data field header):*

- - - - x      *Acceptance of packet by application [0/1; no report required/report required]*
- - - x -      *Not used (Acknowledge start of execution) - Shall be set to zero*
- - x - -      *Not used (Acknowledge progress of execution) - Shall be set to zero*
- x - - -      *Completion of execution [0/1; no report required/report required]*

*All applications, which receive telecommands, must generate acknowledgements as specified in the telecommand message.*

*An encapsulated Telecommand packet shall be acknowledged separately from its transport command depending on the Ack flag of each command.*

**PUS-64//****Service Type:**

*This indicates the service type to which the command packet relates.*

**PUS-66//****Service Sub-type:**

*Together with the Type, the Sub-type uniquely identifies the nature of the command contained within the telecommand packet.*

*For standard services (i.e. services based on the Packet Utilisation Standard [AD1]), the same Packet Type and Subtype definitions shall apply to all applications.*

### 3.2.2.2 TC Application Data

**PUS-80//**

*The telecommand application data constitutes the data element of the command.*

### 3.2.2.3 TC Packet Error Control

The Packet Error Control field provides an error detection code (checksum) in the packet, allowing the receiving application to verify the integrity of the telecommand packet data.

82

**PUS-83//**

*The checksum shall be calculated over the complete packet less the final 16 bits Packet Error Control field.*

Annex 6 provides a specification of the checksum method selected (CRC checksum).

84

### 3.3 Telecommand Segments

#### PUS-86/SGICD-4365/

The Telecommand Segment defined in [RD2], and shown in the figure below, shall be used as TC Frame Data Unit (i.e. the data unit transferred from the Segmentation Layer to the Transfer layer to be inserted in the Frame Data Field of the Telecommand Frame).

#### PUS-87/SGICD-4396/

The Segment Header contains the following two fields:

- Sequence Flags (Bits 0,1), and
- Multiplexer Access Point (MAP) Identifier (Bits 2 through 7)

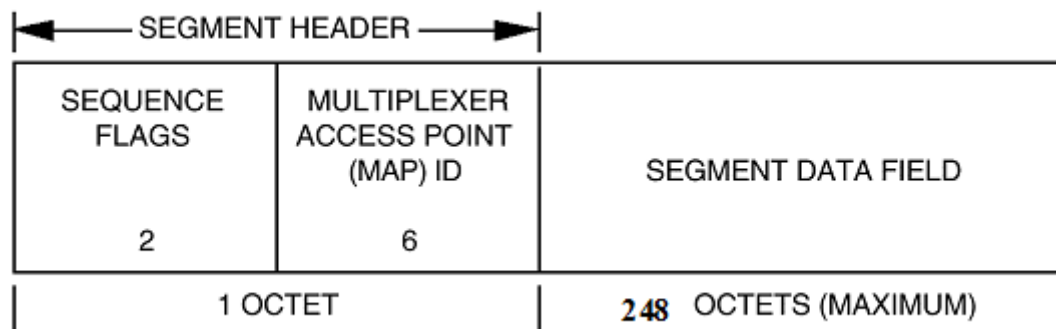


Figure 3.3-1: TC Segment Structure

#### 3.3.1 TC Segment Header

##### PUS-93/SGICD-4369/

##### Sequence Flags:

There shall be no command packet segmentation for Solar Orbiter, so the sequence flags shall be set to 11 BIN.

##### PUS-95/SGICD-4371/

##### Multiplexer Access Point (MAP) Identifier:

MAP ID's shall be used to route the telecommands from the decoder depending on the type of handling required for the command (e.g. DMS software or Command Pulse Distribution Unit). MAP ID's shall not be used to address the currently active CSW processor.

- MAP-ID = "CPDU" = 0 is used for CPDU command (i.e. TC(2,3))
- MAP-ID = "Normal" = 1 is used for normal commanding other than CPDU command.

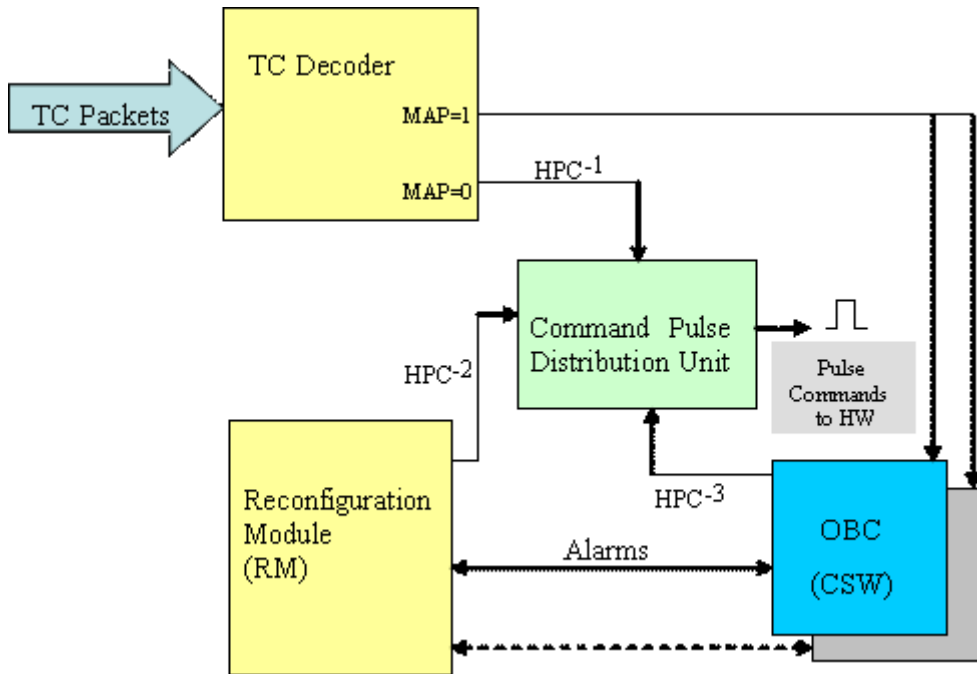
#### 3.3.1.1 CPDU Telecommands

A TC can be sent directly from ground to the Command Pulse Distribution Unit (CPDU) within the On-Board Computer without involving the Central S/W. The CPDU will then generate a command pulse of a commanded length on a defined output line. In this way vital spacecraft units and functions can be switched (i.e. ON and OFF or ENABLED and DISABLED) independent of the onboard SW. These telecommands are also called HPC-1 commands.

The CPDU can as well be commanded directly from the Reconfiguration Module in the On Board Computer using the same command lines used for the HPC-1 commands which are then called HPC-2 commands.

Also the CSW has the possibility to write dedicated registers within the CPDU generating the same pulse commands. These commands are called HPC-3 commands.

An overview is given in the following figure.



**Figure 3.3-2: CPDU Commands Overview**

### 3.3.2 TC Segment Data Field

The Segment Data Field contains all or a portion of the higher layer TC User Data Unit, i.e. (in the Solar Orbiter context) a TC Packet or an aggregation of TC Packets.

#### PUS-108/SGICD-4397/

*In order to maximise the throughput of commands on the uplink, packet aggregation will be used where possible. Aggregation is a CCSDS concept where several complete packets can be put into a single segment. Therefore at the start of a segment there will always be the start of a packet, the length of the first packet will define the start position of the next packet.*

Segment Data Field		
Packet #1	Packet #2	Packet #3

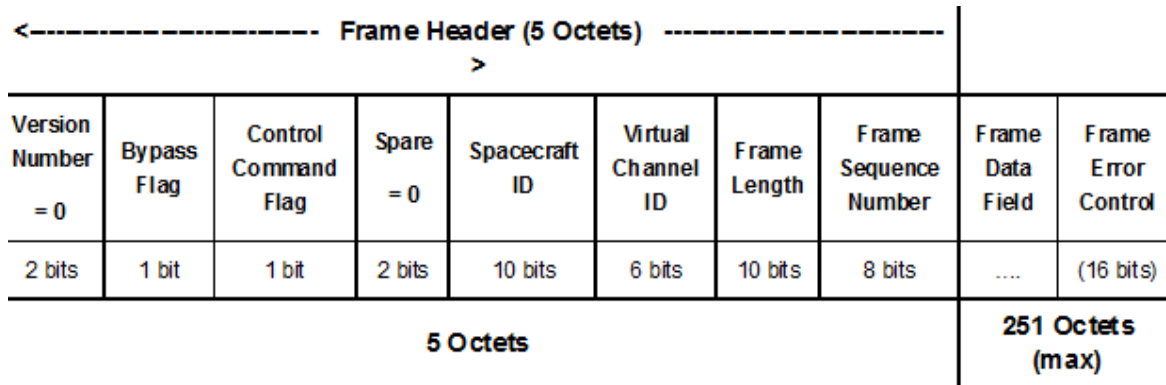
(« Packet Length » of packet #1)+7octets = Start address Octet of Packet #2

Start address Octet of Packet #2+(« Packet Length » of packet #2)+7octets = Start address Octet of Packet #3.

### 3.4 Telecommand Frame

#### PUS-113/SGICD-4375/

The Telecommand Frame must conform to the structure defined in [RD-2].



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#### PUS-115/SGICD-4378/

##### Version Number:

This field occupies the two most significant bits of the Frame Header. Future changes in the TC Transfer Frame structure may be accommodated by changing the VERSION NUMBER. At present, only Version "1" of the TC Transfer Frame (the format specified herein) is defined. It shall be identified by setting the first two bits to '00'<sub>BIN</sub>.

#### PUS-117/SGICD-4379/

##### Bypass Flag:

The single-bit Bypass Flag controls the application of "Frame Acceptance Checks" by the receiving spacecraft. ALL Frames received by the spacecraft first undergo a basic standard set of "Frame Validation Checks", which are applied regardless of the setting of the Bypass Flag.

The Frame Acceptance and Reporting Mechanism (FARM) associated with the COP can be made to operate in a normal Acceptance (frame "Type-A") mode or a "Bypass" (frame "Type-B") mode, according to the setting of the Bypass Flag.

- Setting Bit 2 to value '0'<sub>BIN</sub> specifies a Type-A TC Frame; acceptance of this Type of frame by the spacecraft shall be subject to the normal frame acceptance checks of the FARM.
- Setting Bit 2 to value '1'<sub>BIN</sub> specifies a Type-B TC Frame; the normal frame acceptance checks of the FARM shall be bypassed.

Necessarily, it must be possible to send Type-A and Type-B TC Frames on the same TC Virtual Channel in order to conduct some operations.

#### PUS-123/SGICD-4380/

##### Control Command Flag:

The Control Command Flag specifies whether the data field of the TC Transfer Frame is conveying transfer "Control Commands" (the "C" mode), or "Data" (the "D" mode).

In the "C" mode the Frame Data Field contains control information which is used to set the parameters of the FARM to the proper configuration to accept telecommand data.

In the "D" mode the Frame Data Field contains a Frame Data Unit (e.g., a packet or a TC Segment).

- Setting Bit 3 to value '0' BIN indicates the "D" mode to the receiving spacecraft, i.e., that the Frame Data Field contains data.
- Setting Bit 3 to value '1' BIN indicates the "C" mode to the receiving spacecraft, i.e., that the Frame Data Field contains Control Commands.

#### PUS-129/SGICD-4380/

The combined states of the BYPASS FLAG and the CONTROL COMMAND FLAG are interpreted by the receiving spacecraft as shown below:

ByPass Flag	Command Control Flag	Interpretation
0	0	<b>Type-AD.</b> Frame Data Field carries TC data (e.g., Packets or Segments), subject to acceptance check under control of the FARM. These Frames use the Sequence-Controlled (or AD) Service of the COP.
0	1	Reserved for future application.
1	0	<b>Type-BD.</b> Frame Data Field carries TC data (e.g., Packets or Segments), with all frame acceptance checks bypassed under control of the FARM. These Frames use the Expedited (or BD) Service of the COP.
1	1	<b>Type-BC.</b> Frame Data Field carries FARM Control Commands, with all frame acceptance checks bypassed under control of the FARM. These Frames control the Sequence-Controlled Service of the COP.

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#### PUS-151/SGICD-4383/

##### Spare Bits:

These bits shall be set to '00' BIN

#### PUS-153/SGICD-4385/

##### Spacecraft ID:

This field shall contain the Solar Orbiter Spacecraft Identifier. The assigned CCSDS global spacecraft ID is 28A (HEX), 650 (DEC).

NOTE: Same spacecraft ID will be used for the Flight model, ETB and OBC-DM.

#### PUS-155/SGICD-4387/

##### Virtual Channel ID:

Only two Virtual Channels Identifiers shall be used addressing the two on-board decoders. The suggested values are Zero and One:

- VC1 = TC decoder 1 = '000001' BIN
- VC2 = TC decoder 2 = '000010' BIN

These two values shall be used consistently in the CLCWs.

#### PUS-160/SGICD-4389/

##### Frame Length:

This 10-bit field contains a length count «C» which equals one fewer than the total octets in the TC Transfer Frame. The count is measured from the first bit of the FRAME HEADER to the last bit of the FRAME ERROR CONTROL FIELD (if present), or the last bit of the FRAME DATA FIELD if the error control is omitted. The size of this field limits the maximum length of a TC Transfer Frame to 1024 octets. The length count «C» is expressed as:

«C» = (Total Number of Octets) - 1

The maximum frame length applicable to Solar Orbiter is 256 octets. Therefore, in a maximum length TC frame, the Frame Length parameter will occupy only bits 24-31 of the Transfer Frame Primary Header. The two preceding bits of the Frame Length field (bits 22-23 of the Transfer Frame Primary Header) must always be set to 00BIN, leaving an effective "ESA Frame Length Field" of 8 bits.

#### **PUS-164/SGICD-4392/**

##### **Frame Sequence Number:**

The Frame Sequence Number is related to the implementation of the CLCW and is set according to PUS service standards, i.e. for service type:

- AD = xxxxxxxx V(s) counter
- BC = '00000000' BIN
- BD = '00000000' BIN

#### **PUS-169/SGICD-4394/**

##### **Frame Data Field:**

The Frame Data Field contains the full TC segment.

## 4 TELEMETRY STRUCTURE

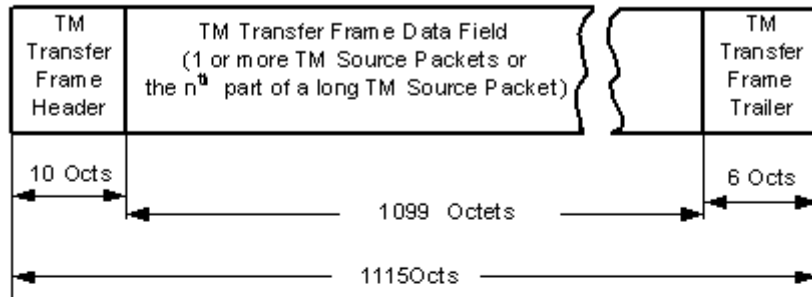
### 4.1 Telemetry Overview

The following diagram presents an overview of the Telemetry organisation. The TM Frames are the entities going from the spacecraft to Ground. The TM Frame Data Field can contain 1 or more TM Source Packets or the  $n^{\text{th}}$  part of a long TM Source Packet.

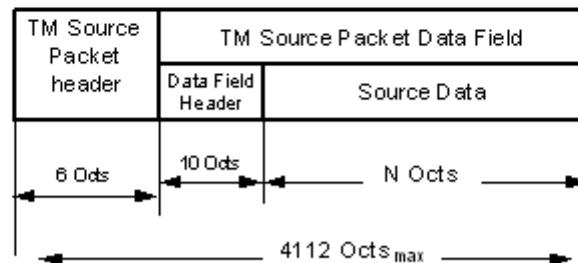
173

Telemetry (transfer) Frame X-Band

174



Telemetry Source Packet



Comment:  
 $N_{\text{max}} = 4096$  Octets

**Figure 4.1-1: Telemetry Overview**

PUS-176/Created/

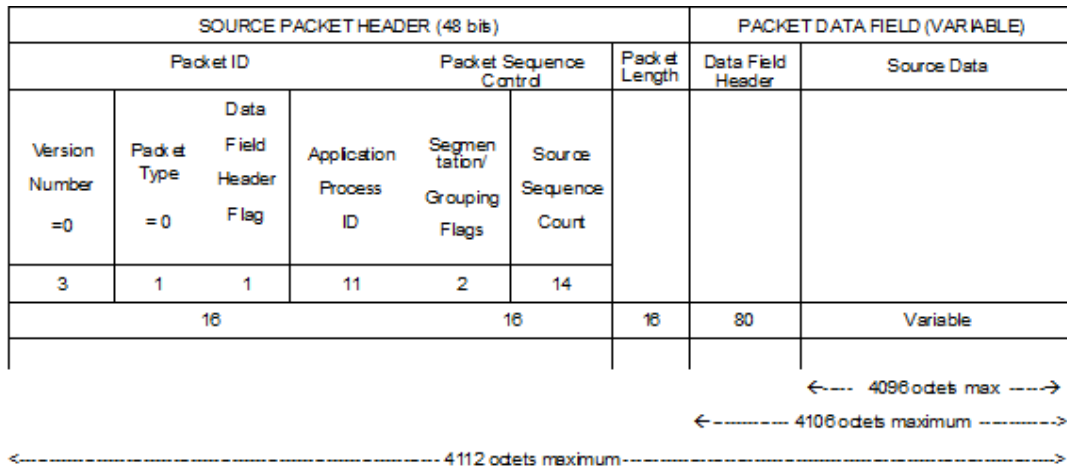
*The maximum length of a TM Source Packet is 4112 Octets. TM Source Packets longer than the constant size of the TM Transfer Frame Data Field, 1099 Octets, are partitioned.*

### 4.2 Telemetry Source Packet

PUS-178/SGICD-4317/

*All telemetry source packets must conform to the structure defined in [AD-1] and shown in the figure below. Note that some settings specified in [AD-1] are superseded by statements in this document*

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**Figure 4.2-1: TM Source Packet Structure**

## 4.2.1 TM Packet Header

### 4.2.1.1 TM Packet ID

PUS-182//

**Version Number :**

The Version Number must be set to '000' BIN for all telemetry issued on-board. The ground segment shall reject with an alarm any packet received with a version number other than zero.

PUS-184//

**Packet Type :**

For telemetry source packets, the type must be set to zero.

PUS-186//

**Data Field Header Flag :**

This indicates the presence or absence of a Data Field Header and must be set to 1 except for the Standard Spacecraft Time Packet.

PUS-188//

**Application Process ID (APID):**

The Application Process ID uniquely identifies the on board source of the packet.

The application ID (APID) is structured into two fields:

- The most significant 7 bits of the APID form a field called «Process ID» (PID), which defines the application which is the source of the telemetry packet.
- The least significant 4-bits within the APID form a field called «Packet Category», which identifies different types or categories of packets to be processed by the addressee.

The Application Process ID to be used on Solar Orbiter are specified in Annex 8.

Note that two Application Process ID's shall be reserved for special purposes, namely the Standard Spacecraft Time Source Packet and the Idle Packet.

- APID = 0 is reserved for the time packet



- APID = "1111111 1111" is reserved for idle packets

#### 4.2.1.2 TM Packet Sequence Control

PUS-198//

##### **Segmentation [Grouping] Flags:**

The grouping flags shall be used when a number of telemetry source packets originating from the same application process are sent in a group. The interpretation of the grouping flags shall be:

- '01' BIN means first packet of a group of packets;
- '00' BIN means continuation packet;
- '10' BIN means last packet of a group of packets;
- '11' BIN means "stand-alone" packet.

The grouping flags will be available for Dump (Service 6) but also for any request to downlink onboard data structures/reports like Service 3 (TM housekeeping definition), Service 11 (MTL content), S12 (monitoring description), S14, S15, S19, etc.

Each packet structure, even if part of a group, shall conform to the telemetry source packet structure described in this document (i.e. no segmentation of big source packets is allowed).

Note: this field is not used to indicate segmented or unsegmented TM packets but as an indicator to the ground that the related TM packets are belonging to one answer of a command which is altogether longer than one max length TM packet. However each of these TM packets is a consistent self-standing TM packet.

The use of these bits as grouping flags will be agreed with ESA.

PUS-208//

##### **Source Sequence Count:**

This field is used to represent the actual Sequence Count. A separate source sequence count is maintained for each Application Process ID and Destination ID and shall be incremented by 1 whenever the source (APID) releases a packet. Therefore the counter corresponds to the order of release of packets by the source with consideration of the Destination ID and enables the receiver (ground/destination) to detect missing packets. The ground segment shall issue an alarm for each detected source sequence count discontinuity. Ideally, this counter should never re-initialise, however under no circumstances shall it "short-cycle" (i.e. have a discontinuity other than to a value zero). The counter wraps around from  $2^{14}-1$  to zero, and shall start at zero at power on of the unit or on start of the application generating the packet data.

#### 4.2.1.3 TM Packet Length

PUS-211//

The Packet Length field specifies the number of octets contained within the Packet Data Field. The number is an unsigned integer "C" where :

$$C = (\text{Number of octets in Packet Data Field}) - 1$$

For Solar Orbiter, the maximum length of a Telemetry Source Packet Data Field is 4106 octets, this includes 4096 source data and 10 data field header.

## 4.2.2 TM Packet Data Field

### 4.2.2.1 TM Data Field Header

#### PUS-216//

The data field header precedes the source data in the telemetry packet. All data field headers have the same basic structure, as follows:

Spare	PUS Version = 1	Spare = 0	Service Type	Service Subtype	Destination ID	S/C Time
1 bit	3 bits	4 bits	8 bits	8 bits	8 bits	48 bits
Fixed bit string	Enumerated	Fixed bit string	Enumerated	Enumerated	Enumerated	Enumerated CUC

217

**Figure 4.2-2: TM Data Field Header**

Note: The above structure uses optional fields compared with [AD1].

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#### PUS-219//

##### Spares:

All spares shall be set to all zeros, i.e. '0000'BIN.

Spares are allocated so as to conform to the rules given in Annex 1.2 regarding field alignments.

#### PUS-222//

##### PUS Version:

Set to value one, e.g. '001'BIN.

#### PUS-224//

##### Service Type:

This indicates the type to which the telemetry source packet relates.

#### PUS-226//

##### Service Sub-type:

Together with the Type, the Sub-type uniquely identifies the nature of the telemetry contained within the telemetry source packet.

#### PUS-233//

##### S/C Time:

This defines the time when the generation of the packet was started. The acquisition time of the data contained in the packet must be deterministic such that it can be calculated by the ground segment using data supplied in the Solar Orbiter Users Manual.

The time code format (i.e. CUC 9/17; 4 octets of coarse time and 2 octets of fine time) shall be used as defined in Annex 4.

Note: The structure of the time field allows the identification of non-synchronised time.

### 4.2.2.2 TM Source Data

#### PUS-238//

The packet source data constitutes the data element of the telemetry reports.

### 4.3 Telemetry Frame

#### PUS-240/ SGICD-4319/

All telemetry Transfer Frames must conform to the structure defined in [RD1] with the remarks listed here below.

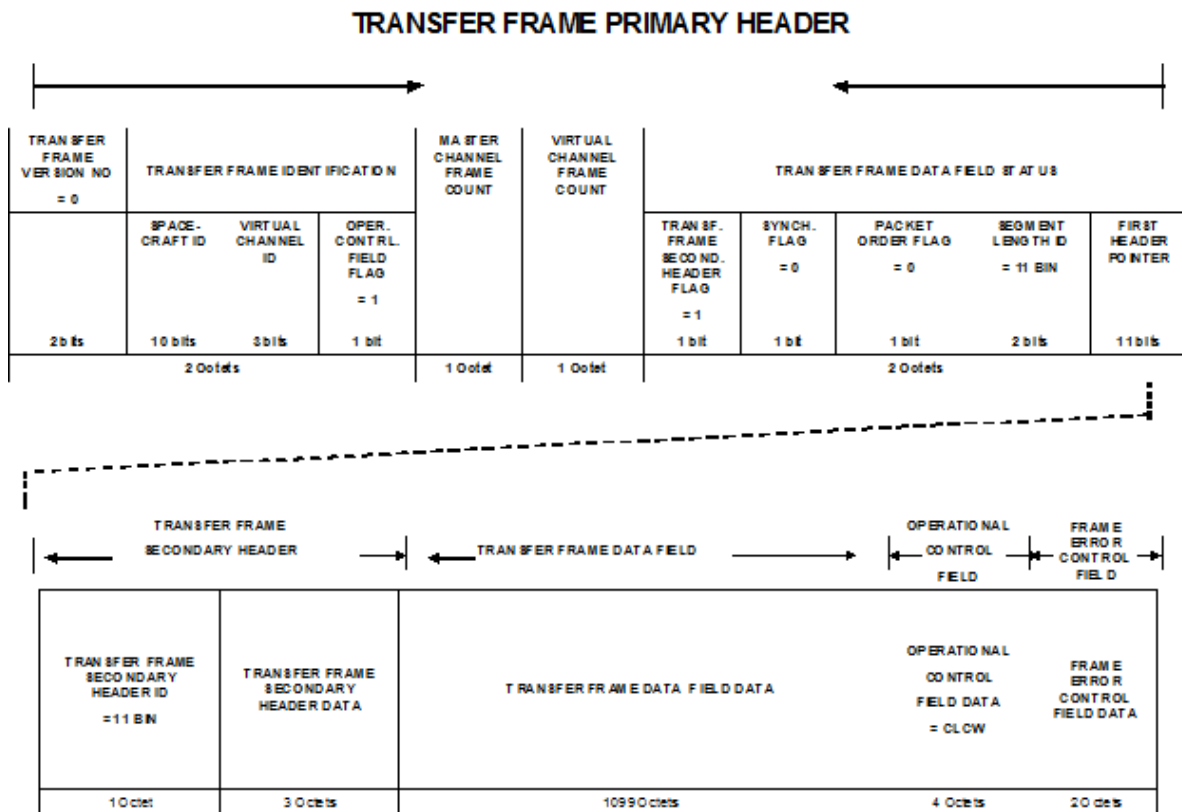


Figure 4.3-1: Telemetry Transfer Frame

#### PUS-242/SGICD-4323/

##### Transfer Frame Length

The only allowed frame length (before encoding) shall be 1115 octets (i.e. 8920 bits).

#### PUS-244/SGICD-4325/

##### Version Number

The Version Number shall be set to 00BIN.

#### PUS-246/SGICD-4327/

##### Spacecraft ID

This field shall contain the Solar Orbiter Spacecraft Identifier. The assigned CCSDS global spacecraft ID is 28A (HEX), 650 (DEC)

*NOTE: Same spacecraft ID will be used for the Flight model, ETB and OBC-DM*

## PUS-248/SGICD-4341/

### Virtual Channel ID

Data sources on board will be allocated a virtual channel number to identify them to the ground processing facilities. The virtual channel Identifier (ID) usage and mapping with the physical virtual channels in OBC Telemetry Encoder Module (TME) (see RD7) is as follows:

Virtual Channel ID		Physical Virtual Channel in OBC TME	Description
DEC	BIN		
VC 0	VC '000'	VC A	Real Time TM (Real time packets directly from the CSW on OBC PM)
VC 1	VC '001'	VC C	Play Back TM (Play Back packets from OMM)
VC 2	VC '010'	VC E	Play Back TM (Play Back packets from SSMM)
VC 3	VC '011'	VC D	Play Back TM (Play Back packets from SSMM)
VC 4	VC '100'	VC B	Real Time HPTM
VC 5	VC '101'	VC F	Critical Event Log TM (Play Back packers from SGM-CEL)
VC 6	VC '110'	VC G	Not Required
VC 7	VC '111'	VC H	Idle Frames

Note:

- VC0, 1, 4 & 5 shall never contain compressed packets.
- VC2 & 3 may contain compressed packets.
- VC7 shall contain only Idle Frames while other Virtual Channels may contain Idle Packets if no data is available when they have to be transmitted.

## PUS-262//

*It shall be possible to downlink any combination of VC's independent of the selected bit rate.*

## PUS-263//

*It shall be possible to downlink partially filled frames by completing the frame with an idle packet.*

## PUS-264//

*The priority scheme for downlinking of VCs will be:*

- VC4 Real Time High Priority TM - When ready
- VC5 Critical Event Log TM (PB) - When ready and no VC4 or VC0 available
- VC0 Real Time TM (RT) - When ready or when time packet should be sent, and no VC 4 available
- VC1 Play Back TM (PB) from OBC MM - When ready and no VC4, VC0 or VC5 available
- VC2 Play Back TM (PB) from SSMM - When ready and no VC4, VC0, VC5 or VC1 available
- VC3 Play Back TM (PB) from SSMM - When ready and no VC4, VC0, VC5, VC1 or VC2 available
- VC7 Idle Frames - When neither VC4 nor VC0 nor VC5 nor VC1 nor VC2 nor VC3 is available

**PUS-271/SGICD-4342/****Operational Control Field Flag**

*The Operational Control Field Flag shall be set to 1 and a Command Link Control Word (CLCW) shall be inserted in the Operational Control Field (OCF) for all frames.*

**PUS-273/SGICD-4343/****Master Channel Frame Count Field**

*The Master Channel Frame Count field shall contain a sequential binary count (modulo 256) of each Transfer Frame transmitted. A re-setting of the MASTER CHANNEL FRAME COUNT before reaching 255 shall not take place unless it is unavoidable. Any case when it is unavoidable shall be documented in the Spacecraft user manual.*

**PUS-275/SGICD-4344/****Virtual Channel Frame Count Field**

*The Virtual Channel Frame Count field shall contain a sequential binary count (modulo 256) of each Transfer Frame transmitted through a specific Virtual Channel of a Master Channel. A re-setting of the Virtual Channel Frame Count before reaching 255 shall not take place unless it is unavoidable. Any case when it is unavoidable shall be documented in the Spacecraft user manual.*

**PUS-277/SGICD-4345/****Secondary Header Flag**

*The Secondary Header shall always be set to one indicating a secondary header shall be inserted in the frame.*

**PUS-279/SGICD-4346/****Data Field Synchronisation Flag**

*The Data Field Synchronisation Flag shall be set to zero; i.e. octet-synchronised and forward-ordered Telemetry Source Packet or Idle Data (only for VC7) shall be inserted in the Transfer Frame Data Field.*

**PUS-281/SGICD-4347/****Packet Order Flag**

*The Packet Order Flag shall be set to zero. The Packet sequence count order shall be forward.*

**PUS-283/SGICD-4348/****Segment Length Identifier**

*Being the Data Field Synchronisation Flag set to zero, the Segment Length Identifier shall be set to 11BIN.*

**PUS-285/SGICD-4349/****First Header Pointer**

*Being the Synchronisation Flag set to zero, the First Header Pointer shall contain information on the position of the first Telemetry Source Packet within the Transfer Frame Data Field; i.e. the binary representation of the location of the first octet of the first Packet Primary Header. The locations of any subsequent headers within the same Transfer Frame Data Field will be determined by calculating these locations using the Packet Data Length Field.*

*If no Packet Primary Header starts in the Transfer Frame Data Field, the First Header Pointer shall be set to «1111111111» BIN.*

For Idle Frames (VC7) the First Header Pointer shall be set to «1111111110» BIN.

**PUS-289/SGICD-4350/**

**TM Transfer Frame Secondary Header**

A Transfer Frame Secondary Header shall be inserted in all frames. This shall contain a header and an expansion of the virtual channel frame counter.

**PUS-291/SGICD-4353/**

**Secondary Header ID**

The secondary header ID shall be 8 bits in length and shall indicate the version number and the header length for Solar Orbiter, this shall be set to 00000011 BIN.

**PUS-293/SGICD-4354/**

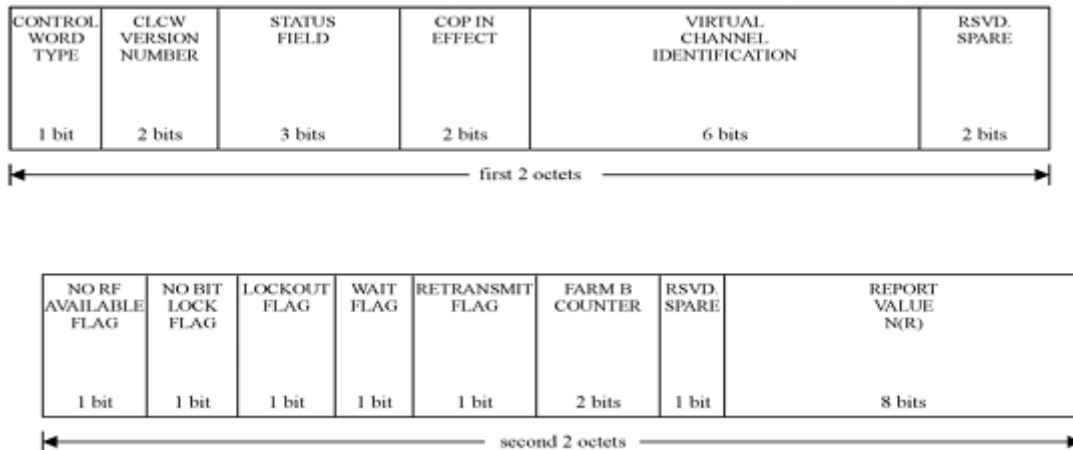
**Secondary Header Data**

The secondary header data shall be a 3 Octet field containing an additional 24 bits of the virtual channel frame count.

**PUS-295/SGICD-4351/**

**Operational Control Field**

The Operational Control Field shall be inserted in each frame and it shall contain the CLCW (i.e. the Type-Flag shall be set to zero) with the format defined in [RD2].



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**Figure 4.3-2: CLCW Structure**

**PUS-5783/SGICD-4357/**

The values of the (Telecommand) VC Identifiers inserted in the CLCWs shall be consistent with those used for the Telecommand Frames.

**PUS-5784/SGICD-4352/**

**Frame Error Control Word**

The Frame Error Control Word shall be inserted in each frame. See Appendix 6.

## 5 SOLAR ORBITER TM / TC SERVICES

### 5.1 Summary

The following table defines the list of TM / TC services and sub-services tailored from the original ESA PUS [AD1] and the ESA OIRD [RD3], as well as an indication of which on-board software they are applicable to. 298

The following mnemonics are applied in the shaded Service Header rows; 5515

R – This service is reserved for the specified user and the user is free to specify any TM or TC providing the concerned functionality is not already specified in Services 1 to 22. No other user is allowed to implement the reserved service.

M – This means that the user must implement the service. Those TM and TC marked with M represent the minimum capability set that must be implemented; those marked with O are optional capabilities that may be implemented while respecting the capability sets defined in ECSS-E-70-41A; other TM or TC are only allowed if agreed with ESA and Astrium.

O – This means that the user can choose to implement the service. If the service is implemented those TM and TC marked with M represent the minimum capability set that must be implemented; those marked with O are optional capabilities that may be implemented while respecting the capability sets defined in ECSS-E-70-41A; other TM or TC are only allowed if agreed with ESA and Astrium.

X – For the CSW, SSMM and STR columns an X means that the TM or TC shall be implemented.

**PUS-3709//**

TC/TM	Type	Sub type	Service Description	CSW	SSMM SW	STR SW	P/L SW
			<b>Service 1: TC Verification Service</b>				<b>M</b>
TM	1	1	TC acceptance success report	X	X	X	M
TM	1	2	TC acceptance failure report	X	X	X	M
TM	1	7	TC execution success report	X	X	X	M
TM	1	8	TC execution failure report	X	X	X	M
			<b>Service 2: Device Command Distribution Service</b>				<b>O</b>
TC	2	3	CSW Distribute CPDU commands	X			
TC	2	128	Distribute Milbus 1553 commands	X			
TM	2	129	Milbus 1553 commands answer	X			
TC	2	130	Distribute SpaceWire Packet	X			O
			<b>Service 3: Housekeeping and Diagnostic Data Reporting Service</b>				<b>M</b>
TC	3	1	Define New Housekeeping Parameter Report	X			O
TC	3	2	Define New Diagnostic Parameter Report	X			O
TC	3	3	Clear Housekeeping Parameter Report Definitions	X			O
TC	3	4	Clear Diagnostic Parameter Report Definitions	X			O
TC	3	5	Enable Housekeeping Parameter Report Generation	X	X		O
TC	3	6	Disable Housekeeping Parameter Report Generation	X	X		O
TC	3	7	Enable Diagnostic Parameter Report Generation	X			O
TC	3	8	Disable Diagnostic Parameter Report Generation	X			O

TC	3	9	Report Housekeeping Parameter Report Definition	X			O
TM	3	10	Housekeeping Parameter Report Definition Report	X			O
TC	3	11	Report Diagnostic Parameter Report Definition	X			O
TM	3	12	Diagnostic Parameter Report Definition Report	X			O
TM	3	25	Housekeeping Parameter Report	X	X	X	M
TM	3	26	Diagnostic Parameter Report	X			O
TC	3	128	Report HK/Diag Parameter Report Definitions in Summary Form	X			O
TC	3	129	Update HK Report Generation Period		X	X	O
TC	3	130	Define Housekeeping Parameter Report Collection Interval	X			O
TC	3	131	Define Diagnostic Parameter Report Collection Interval	X			O
TM	3	134	HK/Diag Parameter Report Definitions Report	X			O
TC	3	136	Request Housekeeping Parameter Report	X			O
TC	3	138	Add HK Parameters to Existing HK Definition	X			O
TC	3	139	Request Snapshot HK Parameter Anomaly Report	X			O
			<b>Service 5: Event Reporting Service</b>				<b>M</b>
TM	5	1	Normal / Progress Report	X	X	X	M
TM	5	2	Error / Anomaly Report - Low Severity –Warning	X	X	X	M
TM	5	3	Error / Anomaly Report - Medium Severity - Ground Action	X	X	X	M
TM	5	4	Error / Anomaly Report - High Severity - On-board Action	X	X	X	M
TC	5	5	Enable Event Report Generation	X			O
TC	5	6	Disable Event Report Generation	X			O
TC	5	128	Clear Event Log	X			
TC	5	129	Downlink Event Log	X			
TM	5	130	Event Log Occurrence Table Report	X			
TC	5	131	Report Enabled Event Packets	X			O
TM	5	132	Enabled Event Packets Report	X			O
TC	5	133	Report Disabled Event Packets	X			O
TM	5	134	Disabled Event Packets Report	X			O
			<b>Service 6: Memory Management Service</b>				<b>M</b>
TC	6	2	Load data into memory area using absolute address	X	X	X	M
TC	6	5	Dump memory area using absolute address	X	X	X	M
TM	6	6	Memory dump using absolute address Report	X	X	X	M
TC	6	9	Check memory area using absolute address	X	X	X	M
TM	6	10	Memory check using absolute address Report	X	X	X	M
TC	6	128	Apply pre-loaded set of RAM patches	X			O
TC	6	129	Abort Dump		X		
TC	6	130	Enable SSMM EEPROM Patch		X		
TC	6	131	Disable SSMM EEPROM Patch		X		
TC	6	140	Load Memory With Mask	X			O



			<b>Service 8: Function Management Service</b>				<b>O</b>
TC	8	1	Perform Function	X			O
TC	8	140	Enable Function Execution	X			O
TC	8	141	Disable Function Execution	X			O
TC	8	142	Enable Autoreset of Execution Enable Flag	X			O
TC	8	143	Disable Autoreset of Execution Enable Flag	X			O
TC	8	144	Report Function Status	X			
TM	8	145	Function Status Report	X			
			<b>Service 9: Time Management Service</b>				<b>M</b>
TC	9	1	Change Time Report Generation Rate	X			
TM	9	2	Time Management	X			
TC	9	128	Set OBT	X			
TC	9	129	Accept Time Update to User	X	X	X	M
TC	9	130	Start Time Update to User	X			
TC	9	131	Stop Time update to User	X			
			<b>Service 11: On-Board Operations Scheduling Service</b>				
TC	11	1	Enable Release of Telecommands	X			
TC	11	2	Disable Release of Telecommands	X			
TC	11	3	Reset Command Schedule	X			
TC	11	4	Insert Telecommands in Command Schedule	X			
TC	11	5	Delete Telecommands from Command Schedule	X			
TC	11	6	Delete Telecommands from Command Schedule over Time Period	X			
TC	11	7	Time-shift selected telecommands	X			
TC	11	8	Time-shift selected telecommands over a time period	X			
TC	11	9	Report Subset of Command Schedule in Detailed Form	X			
TM	11	10	Detailed Schedule Report	X			
TC	11	11	Report Subset of Command Schedule in Detailed Form over Time Period	X			
TC	11	12	Report Subset of Command Schedule in Summary Form	X			
TM	11	13	Summary Schedule Report	X			
TC	11	14	Report Subset of Command Schedule in Summary Form over Time Period	X			
TC	11	15	Time-shift all time-tagged telecommands	X			
TC	11	16	Report Command Schedule in Detailed Form	X			
TC	11	17	Report Command Schedule in Summary Form	X			
TC	11	18	Report Status of Command Schedule	X			
TM	11	19	Command Schedule Status Report	X			
			<b>Service 12: On-Board Monitoring Service</b>				<b>O</b>
TC	12	1	Enable Monitoring of Parameters	X			M
TC	12	2	Disable Monitoring of Parameters	X			M

TC	12	3	Change Maximum Report Delay	X			O
TC	12	4	Clear Monitoring List	X			O
TC	12	5	Add Parameters to Monitoring List	X			O
TC	12	6	Delete Parameters from Monitoring List	X			O
TC	12	7	Modify Parameter Checking Information	X			O
TC	12	8	Report Current Monitoring List	X			O
TM	12	9	Current Monitoring List Report	X			O
TC	12	10	Report Current Parameters Out-of-limit List	X			O
TM	12	11	Current Parameters Out-of-limit List Report	X			O
TM	12	12	Check Transition Report	X			M
<b>Service 13: Large Data Transfer Service</b>							
<b>Uplink File transfer (Ground to Space)</b>							
TC	13	9	Transferring the first part of a Service Data Unit	X			
TC	13	10	Accept intermediate Uplink Part	X			
TC	13	11	Accept Last Uplink Part	X			
TC	13	13	Abort reception of uplink data	X			
TM	13	14	Uplink reception Acknowledgement report	X			
TM	13	15	Unsuccessfully received part report	X			
TM	13	16	Transfer Abort initiated by the receiving end	X			
TM	13	128	Change Timeout value	X			
<b>Downlink File Transfer (Space to Ground)</b>							
TC	13	129	Start file transfer session		X		
TM	13	130	Report of start of low-level file transfer		X		
TC	13	131	Suspend file transfer session		X		
TC	13	132	Resume file transfer session		X		
TC	13	133	Terminate file transfer session		X		
TC	13	134	Abort file transfer session		X		
TC	13	135	Change file transfer session parameters		X		
TC	13	136	Change file transfer session End Of File Transfer Timeout		X		
TC	13	137	Change file transfer downlink VC		X		
TC	13	138	Change file transfer retransmit limit		X		
TC	13	139	Request file transfer parameter report		X		
TM	13	140	File transfer parameter report		X		
TC	13	141	Enable/disable low-level file transfer		X		
TC	13	142	Start low-level file transfer		X		
TC	13	143	Suspend low-level file transfer		X		
TC	13	144	Resume low-level file transfer		X		
TC	13	145	Abort low-level file transfer		X		
TC	13	146	Repeat low-level file transfer parts		X		
TC	13	147	Confirm successful reception of all low-level file transfer parts		X		
TC	13	148	Request low-level file transfer end of transfer report		X		

TM	13	149	Low-level file transfer end of file transfer report		X		
TM	13	150	Retransmission limit reached		X		
TM	13	151	End Of File Transfer Timeout		X		
TM	13	152	Low-level file transfer abort report		X		
TM	13	153	File data unit		X		
<b>Service 14: Packet Forwarding Control Service</b>							
TC	14	1	Enable Forwarding of Telemetry Source Packets	X			
TC	14	2	Disable Forwarding of Telemetry Source Packets	X			
TC	14	5	Enable Forwarding of Housekeeping Packets	X			
TC	14	6	Disable Forwarding of Housekeeping Packets	X			
TC	14	7	Report Enabled Housekeeping Packets	X			
TM	14	8	Enabled Housekeeping Packets Report	X			
TC	14	9	Enable Forwarding of Diagnostic Packets	X			
TC	14	10	Disable Forwarding of Diagnostic Packets	X			
TC	14	11	Report Enabled Diagnostic Packets	X			
TM	14	12	Enabled Diagnostic Packets Report	X			
TC	14	13	Enable Forwarding of Event Report Packets	X			
TC	14	14	Disable Forwarding of Event Report Packets	X			
TC	14	128	Report Telemetry Source Packet Forwarding Status	X			
TM	14	129	Telemetry Source Packet Forwarding Status Report	X			
TC	14	130	Report Event Report Packet Forwarding Status	X			
TM	14	131	Event Report Packet Forwarding Status Report	X			
<b>Service 15: On-Board Storage and Retrieval Service</b>							
TC	15	1	Enable Storage in Packet Stores	X	X		
TC	15	2	Disable Storage in Packet Stores	X	X		
TC	15	3	Add Packets to Storage Selection Definition	X	X		
TC	15	4	Remove Packets from Storage Selection Definition	X	X		
TC	15	5	Report Storage Selection Definition		X		
TM	15	6	Storage Selection Definition Report		X		
TC	15	9	Downlink Packet Store Contents for Time Period	X	X		
TC	15	10	CSW: Delete Content of Packet Store	X	X		
			SSMM SW: Delete Content of Packet Store Up to specified packet				
TC	15	11	Delete Content of Packet Store up to specified storage time	X	X		
TC	15	12	Report Catalogues for Selected SSMM Packet Store		X		
TM	15	13	SSMM Packet Store Catalogue Report		X		
TC	15	128	Stop Playback of Packet Store Contents	X			
TC	15	129	CSW: Start Playback of Packet Store Contents	X	X		
			SSMM SW: Create packet store on SSMM				
TC	15	130	Resize packet store on SSMM		X		
TC	15	131	Delete packet store on SSMM		X		

TC	15	132	Rename packet store on SSMM		X		
TC	15	133	List packet store on SSMM		X		
TM	15	134	SSMM Packet stores list report		X		
TC	15	135	Stop downlink from packet store on SSMM		X		
TC	15	136	Set packet store to cyclic on SSMM		X		
TC	15	137	Set packet store to non-cyclic on SSMM		X		
TC	15	138	Change packet store default Virtual Channel on SSMM		X		
TC	15	139	Change packet store default priority on SSMM		X		
TC	15	140	CSW: Add HK/Diag Packets to Storage Selection Definition	X	X		
			SSMM SW: Report packet position in packet store on SSMM				
TC	15	141	Remove HK/Diag Packets from Storage Selection Definition	X			
TM	15	141	Packet position on SSMM report		X		
TC	15	142	CSW: Report HK/Diag Packets Storage Selection Definition	X	X		
			SSMM SW: Copy SSMM packet store				
TC	15	143	SSMM SW: Abort copy on SSMM		X		
TC	15	144	Reset copy queue on SSMM		X		
TC	15	145	CSW: Report Storage Routing Definition Table	X	X		
			SSMM: Unbounded downlink for Packet Store				
TC	15	146	SSMM: Delete Packet Store content for non-cyclic PS		X		
TM	15	148	CSW: HK/Diag Packets Storage Selection Definition Report	X			
TM	15	149	Storage Routing Definition Table Report	X			
TC	15	150	Format PS memory on OMM	X			
TC	15	151	Get Format of PS	X			
TM	15	152	Format of PS Report	X			
TC	15	153	Set PS playback pointer	X			
TC	15	154	Change PS attributes	X			
<b>Service 16: On-Board Traffic Management Service</b>							
TC	16	1	Set Milbus Configuration	X			
TC	16	2	Switch MilBus to Nominal	X			
TC	16	3	Reconfigure Milbus (to Redundant)	X			
TC	16	4	Switch MilBus RT Channel to Nominal	X			
TC	16	5	Reconfigure Milbus RT channel (to Redundant)	X			
<b>Service 17: Test Service</b>							<b>M</b>
TC	17	1	Connection Test Response	X	X	X	M
TM	17	2	Connection Test Response Report	X	X	X	M
TC	17	3	Request Connection Test	X			
TC	17	128	Test Command of Maximum Length		X	X	O
<b>Service 18: On-Board Control Procedure Service</b>							

TC	18	5	Suspend an OBCP	X			
TC	18	6	Resume an OBCP	X			
TC	18	7	Communicate Parameters to an OBCP	X			
TC	18	8	Report List of OBCP	X			
TM	18	9	OBCP List Report	X			
TC	18	140	Load and Start an OBCP	X			
TC	18	141	Stop and Delete an OBCP	X			
TC	18	142	Set OBCP HKTM	X			
TM	18	144	OBCP Telemetry	X			
<b>Service 19: Event-Action Service</b>							<b>O</b>
TC	19	1	Add an Event to the Detection List	X			M
TC	19	2	Delete an Event from the Detection List	X			O
TC	19	3	Clear the Event Detection List	X			O
TC	19	4	Enable Actions	X			M
TC	19	5	Disable Actions	X			M
TC	19	6	Report the Event Detection List	X			O
TM	19	7	Event Detection List Report	X			O
TC	19	130	Report Single Event Detection Entry	X			O
TM	19	131	Single Event Detection Entry Report	X			O
<b>Service 20: Information Distribution Service</b>							<b>O</b>
TC	20	1	Start Information Distribution for User	X			
TC	20	2	Stop Information Distribution for User	X			
TC	20	128	Inter-Instruments Communication				O
<b>Service 21: Science Data Transfer Service</b>							<b>M</b>
TC	21	1	Enable/Start Science Transfer from User to SSMM				M
TC	21	2	Disable/Stop Science Transfer from User to SSMM				M
TM	21	3	Science Data Transfer <sup>1</sup>				M
	21	4					
	21	5					
	21	6					
TC	21	128	Reset Output Buffer				M
<b>Service 22: Context Saving Service</b>							<b>O</b>
TC	22	1	Request User to Report Context				O
TM	22	2	Context Report from User				O
TC	22	3	Accept Requested Context				O
TC	22	4	Request Retrieval of Stored Context	R			
TC	22	5	Request CSW to perform Context saving from User	R			
<b>Service 128 – 129: EPD Private Services</b>							<b>R</b>
<b>Service 130: TM Extraction Service</b>							<b>R</b>
TC	130	1	Define TM Extraction Descriptors	X			
TC	130	2	Delete TM Extraction Descriptors	X			
TC	130	3	Report TM Extraction Descriptors	X			
TM	130	4	TM Extraction Descriptors Report	X			

			<b>Service 131: Device Management</b>	<b>R</b>			
TC	131	1	Perform Function	X			
			<b>Service 132: SGM Management Service</b>	<b>R</b>			
TC	132	1	Read SGM Group	X			
TM	132	2	SGM Group Report	X			
TC	132	3	Write SGM Group	X			
			<b>Service 133: File Management Service</b>	<b>R</b>			
TC	133	6	File Management Copy File	X			
TC	133	7	File Management Delete File	X			
TC	133	8	File Management Modify File	X			
TC	133	9	File Management Request Report	X			
TM	133	10	File Management Report Info	X			
TC	133	11	File Management Request Mapping	X			
TM	133	12	File Management Report Mapping	X			
TC	133	128	Verify File Checksum	X			
			<b>Service 134: TC Sequencer Service</b>	<b>R</b>			
TC	134	1	Star TC Sequencer	X			
TC	134	2	Abort TC Sequencer	X			
TC	134	3	TC Sequence Wait Delay	X			
TC	134	4	TC Sequence Set Frequency	X			
			<b>Service 139: Datapool Management Service</b>	<b>R</b>			
TC	139	1	Change Value of On-board Parameters	X			
TC	139	2	Get Value of On-board Parameters	X			
TM	139	3	On-board Parameters Value Report	X			
TC	139	4	Define On-board Parameters	X			
			<b>Service 140: SSMM SW Mode Transition</b>		<b>R</b>		
TC	140	1	Enter BIT Mode		X		
TM	140	2	Operational BIT Test Report		X		
TC	140	3	Enter INIT Mode		X		
TC	140	4	Enter OPERA Mode		X		
TC	140	5	Enable SERVICE Transition		X		
TC	140	6	Disable SERVICE Transition		X		
			<b>Service 141: Direct Commanding</b>		<b>R</b>		
TC	141	1	Direct Command Write		X		
TC	141	2	Direct Command Read		X		
TM	141	3	Direct Read Report		X		
			<b>Service 142:</b>				
			<b>CSW: Functional Monitoring Service</b>	<b>R</b>	<b>R</b>		
			<b>SSMM SW: Redundancies Management</b>				
TC	142	1	CSW: Enable Functional Monitoring	X	X		
			SSMM SW: Select Redundancy				
TC	142	2	CSW: Disable Functional Monitoring	X	X		

			SSMM SW: EGSE I/F Enable				
TC	142	3	EGSE I/F Disable		X		
TC	142	4	Select P/L SpW I/F		X		
TC	142	5	CSW: Add Functional Monitoring to the Monitoring List	X	X		
			SSMM SW: Configure Router				
TC	142	6	CSW: Delete a Functional Monitoring from the Monitoring List	X	X		
			SSMM SW: Request Router Configuration report				
TM	142	7	Router Configuration Report		X		
TC	142	8	Report Current Functional Monitoring List	X			
TM	142	9	Current Functional Monitoring List Report	X			
TC	142	10	Report Current FMON Status List	X			
TM	142	11	Current FMON Status List Report	X			
TC	142	12	Protect Functional Monitoring of Parameters	X			
TC	142	13	Unprotect Functional Monitoring of Parameters	X			
			<b>Service 143: Memory Array Management</b>		<b>R</b>		
TC	143	1	Test Memory Module		X		
TM	143	2	Memory Test Report		X		
TC	143	3	Configure Memory Module		X		
TC	143	4	Switch Memory Module		X		
TC	143	5	Activate Module Scrubbing		X		
TC	143	6	Deactivate Module Scrubbing		X		
TC	143	7	Change Module Scrubbing Frequency		X		
TC	143	8	Abort Test		X		
			<b>Service 144: Reboot</b>		<b>R</b>		
TC	144	1	Reboot		X		
			<b>Service 145: BIT Report Management</b>		<b>R</b>		
TC	145	1	Request Start-Up BIT Tests Report		X		
TM	145	2	Start-Up BIT Tests Report		X		
			<b>Service 150 to Service 157: STR Private Services</b>			<b>R</b>	
			<b>Service 180-184: RPW Private Services</b>				<b>R</b>
			<b>Service 200-205: SWA Private Services</b>				<b>R</b>
			<b>Service 206-218: EUI Private Services</b>				<b>R</b>
			<b>Service 226-230: MAG Private Services</b>				<b>R</b>
			<b>Service 231-235: PHI Private Services</b>				<b>R</b>
			<b>Service 236 to Service 240: STIX Private Services</b>				<b>R</b>
			<b>Service 241-245: METIS Private Services</b>				<b>R</b>
			<b>Service 246-250: SoIO-Hi Private Services</b>				<b>R</b>
			<b>Service 251-255: SPICE Private Services</b>				<b>R</b>

**Table 5.1-1: Solar Orbiter TM/TC Service and Subservice List**

Note 1: At least one of the TM (21,3; 21,4; 21,5; 21,6) defined for science data transfer must be used by the instruments.

Services 4, 7 and 10 are not used at all.

## 5.2 Service 1: Telecommand Verification

### Objective

1199

This service allows the command source to verify identified commands at acceptance and/or execution by asking the addressed application to generate service type 1 reports in the telemetry stream.

### Description

1202

By setting the relevant two bits in the **ACK** field of command packet header the command source can ask for an acceptance report and/or an execution report. The two bits can be set to any value.

The addressed application uses these bits to generate the required reports. No systematic check is done by the Central S/W (CSW) on the report. This may be done by the command sender if required.

An acceptance report is generated immediately after completion of checks on validity of the packet header; an execution report after internal verification of TC execution.

For Solar Orbiter the response required is restricted to:

- 0000 No Response (acceptance / execution success acknowledge report not required; not applicable to acceptance and execution failure)
- 0001 Acceptance Success or Failure (service report sub-type 1 or 2 required; sub-type 7 or 8 not generated)
- 1000 Execution Success or Failure (service report sub-type 7 or 8 required; sub-types 1 or 2 not generated)
- 1001 Acceptance and Execution Success or Failure

The type of response required for each command depends on the function of the command and is coded with the command definition in the Spacecraft Reference Data Base.

### Notes

1203

Each TC packet received by the CSW shall be submitted to the checks defined here below independently from the **ACK** flags settings.

### **Static Acceptance Checks** (possibly issuing a Telecommand Acceptance Failure Report):

- Check the constant fields in the packet header (version number, type, data field header flag, and sequence flag) and data field header (PUS version)
- Check the indicated length of the TC ( $5_{DEC} \leq \text{value of parameter "Packet Length"} \leq 241_{DEC}$ )
- Check the indicated length w.r.t. the number of received bytes
- Compute packet error control word and check w.r.t. received packet error control word
- Check the APID:
  - Check the PID w.r.t. the assigned PID number(s) (see annex 8)
  - Check the field CAT (always 12 for TC)



The addressed PID shall additionally check whether the Service Type/Subtype is supported (result may depend from actual context e.g. unit mode or actually running software).

**Consistency Checks** (possibly issuing a Telecommand Execution Completion Failure Report) to be performed by the addressed PID only:

- Check the actual TC length w.r.t. expected TC length associated with actual service type and service subtype
- Check whether parameters included in the Source Data Field are defined and within their defined range (specific for a Service type/subtype) and are compatible with their expected type.

TC consistency checks shall only be performed after all static checks have been passed successfully. TC execution shall only start after all consistency checks have been passed successfully.

In addition to the consistency checks execution, success checks (specific for a Service type/subtype, e.g. read back written data from H/W) may be performed, before eventually a Telecommand Execution Completion Report is issued.

When issuing a command for distribution to a user (e.g. for Service 2 commands) the CSW shall distribute the command data field, and generate an acceptance success report, if this is requested in the commands ACK field.

## 5.2.1 TM (1,1) TC Acceptance Report Success

### Description:

1205

This telemetry service will report to the command source the successful acceptance of the TC sent to the addressed APID.

### Structure:

1207

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 1

Packet Data Field Info:

- Service Type: 1
- Service Subtype: 1

Application/Source Data:

TC Packet ID	TC Packet Sequence Control
Unsigned Integer	Unsigned Integer
2 bytes	2 bytes

4500

1215

**Parameter definition:**

Parameter	Description	Value
TC Packet ID	16-bit copy of the Packet ID fields of the TC Source Packet Header of the command being reported on	Identical to the value of the received TC
TC Packet Sequence Control	16-bit copy of the Packet Sequence Control fields of the TC Source Packet Header of the command being reported on	Identical to the value of the TC sequence Control of the received TC

4510

## 5.2.2 TM (1,2) TC Acceptance Report Failure

**Description:**

This telemetry service shall report to the command source an acceptance failure of the TC sent to the addressed APID.

1217

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 1

3820

Packet Data Field Info:

- Service Type: 1
- Service Subtype: 2

Application/Source Data:

TC Packet ID	TC Packet Sequence Control	Failure ID	Parameters
Unsigned Integer	Unsigned Integer	Unsigned Integer	Optional
2 bytes	2 bytes	2 bytes	Any size

4523

**Parameter definition:**

Parameter	Description	Value
TC Packet ID	16-bit copy of the Packet ID fields of the TC Source Packet Header of the command being reported on	Identical to the value of the received TC
TC Packet Sequence Control	16-bit copy of the Packet Sequence Control fields of the TC Source Packet Header of the command being reported on	Identical to the value of the TC sequence Control of the received TC
Failure ID	Failure Identification code	See Annex 9
Parameters	Complementary information relating to a specific failure code	See Annex 9

1227

4539

**Remark 1:**

The standard Failure IDs (to be used for acceptance / execution failures) listed in Annex 9 shall be the same across the various PIDs.

Any other Failure IDs for specific application shall be allocated uniquely per PID as defined in Annex 9.

4560

### 5.2.3 TM (1,7) TC Completion Report Success

**Description:**

1229

This telemetry service shall report to the command source the successful execution of the TC sent to the addressed APID.

**Structure:**

3821

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 1

Packet Data Field Info:

- Service Type: 1
- Service Subtype: 7

Application/Source Data:

TC Packet ID	TC Packet Sequence Control
Unsigned Integer	Unsigned Integer
2 bytes	2 bytes

4656

**Parameter definition**

1239

Parameter	Description	Value
TC Packet ID	16-bit copy of the Packet ID fields of the TC Source Packet Header of the command being reported on	Identical to the value of the received TC
TC Packet Sequence Control	16-bit copy of the Packet Sequence Control fields of the TC Source Packet Header of the command being reported on	Identical to the value of the TC sequence Control of the received TC

4667

### 5.2.4 TM (1,8) TC Completion Report Failure

**Description:**

1241

This telemetry service shall report to the command source an execution failure of the TC sent to the addressed APID.

**Structure:**

3822

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 1

Packet Data Field Info:

- Service Type: 1
- Service Subtype: 8

Application/Source Data:

TC Packet ID	TC Packet Sequence Control	Failure ID	Parameters
Unsigned Integer	Unsigned Integer	Unsigned Integer	Optional
2 bytes	2 bytes	2 bytes	Any size

4680

### Parameter definition

Parameter	Description	Value
TC Packet ID	16-bit copy of the Packet ID fields of the TC Source Packet Header of the command being reported on	Identical to the value of the received TC
TC Packet Sequence Control	16-bit copy of the Packet Sequence Control fields of the TC Source Packet Header of the command being reported on	Identical to the value of the TC sequence Control of the received TC
Failure ID	Failure Identification code	See Annex 9
Parameters	Complementary information relating to a specific failure code	See Annex 9

1251

4696

## 5.3 Service 2: Device Command Distribution

### Objective

This service provides the capability for the distribution of:

- Command Pulse Distribution Unit (CPDU) commands for reconfiguration of vital unit functions. It is distinguished whether the OBC Central Software is involved or not. If the processing of a CPDU command packet is not completed, then any new command received will be ignored.
- Some TC packets are received by the CPDU TC decoder via MAP = 0 to generate a CPDU output pulse. No Software is involved. These commands have a non-PUS structure and are hence not presented here.
- TC(2,3) will be the SW distributed CPDU commands.
- 1553 bus command messages
- SpaceWire command messages

1253

1254

### Description

### Notes

No Register Load commands are needed for the CSW since all OBC registers are mapped and hence available via service 6.

1255

### 5.3.1 TC (2,3) CSW-distributed CPDU commands (HPC3)

#### **Description:**

This TC packet is received by the OBC CSW via MAP = 1 and routed to the CPDU to generate a CPDU output pulse.

1270

3824

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 2
- Service Subtype: 3

Application/Source Data:

Command Number	Filler	Pulse Length
Enumerated		Unsigned Integer
1 byte	5 bit	3 bit

8587

**Parameter definition**

Parameter	Description	Value
Command Number	Number for the specific CPDU command	see RD10
Pulse Length	Length of CPDU Pulse(3bits)	see relevant unit documentation

1280

8600

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13039

**5.3.2 TC (2,128) Distribute MilBus 1553 Commands**

**Description:**

This TC allows issuing low level MilBus 1553 commands on the selected MilBus to the addressed unit.

1257

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

3823

Packet Data Field Info:

- Service Type: 2
- Service Subtype: 128

Application/Source Data:

Bus	Bus Coupler	N	RT Add.	R/T Bit	SA/ Mode Field	Data Word Count / Mode Code	M	Data Words
Enum.	Enum.	Uns. Int.	Uns. Int.	Boolean	Uns. Int.	Unsigned Integer	Uns. Int.	Unsigned Integer
1 byte	1 byte	1 byte	5 bits	1 bit	5 bits	5 bits	1 byte	2 bytes
1553 command word (2 bytes)								<- M times ->
								<- N times ->

## Parameter definition

1268

8743

Parameter	Description	Value
Bus	Addressed Mil-Bus	0 = Bus 1 1 = Bus 2
Bus Coupler	Selected BusCoupler for the addressed Bus	0 = default 1 = A 2 = B
N	number of command words	[1; TBD]
RT Add	Remote Terminal address of the addressed unit	see AD3
R/T Bit	Flag indicating to the Remote Terminal whether the message is to be Received or Transmitted	0= RT to receive 1= RT to transmit
SA/ Mode Field	Remote Terminal SubAddress or Mode Commands	see AD3
DataWord Count/ Mode Code	number of Data Words to be either received or transmitted, or Mode Code	0 = mode code 1..30 = number of words 31 = mode code
M	number of repeated Data Word fields	0, if mode code  1..30 = number of 16 bit words 31, Data Word Count = 0
Data Words	Data words of the MilBus message	

## TC Verification

13044

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.3.3 TM (2,129) MilBus 1553 Commands Answer

#### Description:

8614

This TM packet contains the Remote Terminal Status Word returned in response to a direct Mil-Bus command TC(2,128) and may also contain any returned data words arising from a direct Mil-Bus command to request data TC(2,128).

8586

**Structure:**

Packet ID Info:

- Process ID: see annex 8
- Packet Cat: 2

Packet Data Field Info:

- Service Type: 2
- Service Subtype: 129

Application/Source Data:

Bus	Bus Command Word	Bus Coupler	BusCoupler Status Word	RT Status Word	N	Data Words
Enumerated	Enumerated.	Uns. Int.	Unsigned Integer	Boolean	Uns. Int.	Unsigned Integer
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte	2 bytes
						<- N times ->

**Parameter definition**

Parameter	Description	Value
Bus	Addressed MilBus	0 = Bus 1 1 = Bus 2
Mil-Bus 1553 Command Word	Command word sent by the BC (echo of the command word in the MilBus command TC): - RT address - R/T - SA / Mode Field - Data Word Count / Mode code	
Bus Coupler	Selected BusCoupler for the addressed Bus	0 = default 1 = A 2 = B
BusCoupler Status Word	Status Word from the Bus Coupler	see AD3
RT Status Word	Status Word from the Remote Terminal	see AD3
N	Number of received Data Words	0, if mode code  1..30 = number of words 31, Data Word Count = 0
Data Words	The data words of the MilBus message	Data Words

8613

8786

### 5.3.4 TC (2,130) Distribute SpaceWire Commands

**Description:**

This TC sends a single (raw) command on a Spacewire bus.

**Structure:**

Packet ID Info:

- Process ID: as per annex 8

8619

8620

- Packet Cat: 12

Packet Data Field Info:

- Service Type: 2
- Service Subtype: 130

Application/Source Data:

SpW Link	Coupler	N	Command Data
enum	enum	Unsigned Integer	
1 byte	1 byte	2 bytes	Variable

8833

### Parameter definition

Parameter	Description	Value / Range
SpW Link	Identification of the spacewire link	1 = SSMM router
Coupler	Selected spacewire coupler for the selected link	0 = link coupler A 1 = link coupler B 2 = Default
N	Number of bytes of SpW command data	
Command Data	Raw content of the SpW packet containing the command	SpW packet containing PUS command plus 4 byte SpW header, as defined in [AD4].

8621

8846

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13050

## 5.4 Service 3: Housekeeping and Diagnostic Data Reporting

### Objective

This service provides the means to report together with the event reporting service 5 all spacecraft information of operational significance.

1282

The reporting service comprises two major sub-services:

- Housekeeping data reporting (i.e. TM (3,25))
- Diagnostic data reporting (i.e. TM (3,26))

The Housekeeping sub-services are used for nominal operations and can be configured to the needs of different mission phases. The diagnostic sub-services shall be used for error investigation and other exceptional cases, requiring access to a dedicated set of HK parameters.

Housekeeping and diagnostic packets are defined according to definitions described by Structure IDs (SID). Structure IDs are unique within a PID. SID assignment is defined in Annex 10 of the present document.

Additional sub types of this service shall allow to define and modify the content of the packets and to modify their generation frequency.

1283



## Description

Generation start, stop, frequency and content of report packets are controlled by this service.

- Housekeeping data:

The housekeeping data reporting sub-service samples sets of housekeeping parameters in accordance with a set of reporting definitions stored onboard. There will be a pre-defined set of such definitions onboard as deemed appropriate for the housekeeping monitoring of the mission. However, for the CSW these definitions may be modified, deleted and new definitions may be added by the ground at any time (note that the default ones will be reloaded after SW reset).

A Structure Identification (SID) is associated with each distinct reporting definition and associated housekeeping report packet. The SID will be used on the ground, together with the Application Process ID and knowledge of the nature of the packet (i.e. that it is a housekeeping packet, as opposed to a diagnostic packet), Service Type and Subtype to identify the housekeeping report packet and to interpret its content. The SID shall be unique to a given service implementation and packet nature (i.e. housekeeping or diagnostic), however different instances of the service within different application processes can use the same values of SID.

- Diagnostic data:

The diagnostic data reporting sub-service shall be functionally identical to the housekeeping data reporting sub-service. Different service subtypes shall be used, however, primarily for the purposes of distinguishing the diagnostic parameter reports for routing and (ground) processing.

A means to disable the generation of certain diagnostic parameter reports (whose definitions can remain on-board for intermittent use, for example, when a particular anomaly occurs) shall be provided. Because of the nature of diagnostic mode, it is anticipated that the parameter reports contain a predominance of fixed-length arrays corresponding to parameters sampled at very high rates, many times per report.

- Data Collection:

Each reporting definition has an associated time stamp, which is the time when the housekeeping report is generated. The sampling/acquisition of the parameters themselves however is independent of this generation time and the generation frequency of the report, but known per analysis. Parameters within a reporting definition may be either simply commutated (included only once in the report) or super commutated (included N times over a predefined sampling time).

### 5.4.1 TC (3,1) Define New HK Parameter Report

#### **Description:**

This TC defines a new HK Report Definition on board. TM(3,25) for this new defined HK Parameter Report has to be enabled with TC(3,5).

#### **Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3

- Service Subtype: 1

Application/Source Data:

SID	Collection Interval	NPAR	Parameter ID
Unsigned integer	Unsigned integer	Unsigned integer	Unsigned integer
1 byte	2 bytes	1 byte	4 bytes
			<-Repeat NPAR times->

5801

## Parameter definition

1296

Parameter	Description	Range or Value
SID	Structure ID	See Annex 10
Collection Interval	Generation period for this HK TM packet expressed in number of cycles	1...65535 <i>cycle</i> identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)
NPAR	Number of parameters in the definition that are sampled once per collection interval	1..TBD
Parameter ID	Identifier of the Parameter in the Datapool.	

5822

### Note:

The Structure ID must be unique across the HK and Diagnostic packet definitions (for any given Process ID).

11777

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13051

## 5.4.2 TC (3,2) Define New diagnostic Parameter Report

### Description:

This TC defines a new Diagnostic Report Definition on board. TM(3,26) for this new defined Diagnostic Report has to be enabled with TC(3,7).

1298

### Structure:

3826

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 2

Application/Source Data:

SID	Collection Interval	NPAR1	Parameter ID	NFA	NREP	NPAR2	Parameter ID
Uns Int	Uns Int	Uns Int	Uns Int	Enum	Uns Int	Uns Int	Enum
1 byte	2 bytes	1 byte	4 bytes	1 byte	1 byte	1 byte	4 bytes
			<-Repeat NPAR1 times->				<-Repeat NPAR2 times->
					<- Repeat NFA times ->	<- Repeat NFA times ->	<- Repeat NFA times ->

5843

## Parameter definition

Parameters	Description	Range or Value
SID	Structure ID	See Annex 10
Collection Interval	Generation period for this HK TM packet expressed in number of cycles	1..65535 <i>cycle</i> identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)
NPAR1	Number of parameters in the definition that are sampled once per collection interval	1..TBD
Parameter ID	Identifier of the Parameter in the Datapool	
NFA	Number of fixed length arrays	0 or 1
NREP	number of values to be sampled for each parameter within this fixed length array	
NPAR2	Number of different parameters within this fixed length array, each of which shall be sampled NREP times per collection interval	
Parameter Id	Identifier of the Parameter in the Datapool	

1308

5864

### Note:

The Structure ID must be unique across the HK and Diagnostic packet definitions (for any given process ID).

11778

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13052

### 5.4.3 TC (3,3) Clear HK Parameter Report Definition

**Description:**

This TC clears the addressed HK Report Definition structure specified by the SID. This TC can only be sent if the associated report generation for this *SID* has been disabled before via TC(3,6).

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 3

Application/Source Data:

<b>SID</b>
Unsigned Integer
1 byte

**Parameter definition**

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID of HK Report Definition to be cleared	See Annex 10

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.4.4 TC (3,4) Clear Diag Parameter Report Definition

**Description:**

This TC clears the addressed Diagnostic Report Definition structure specified by the SID. This TC can only be sent if the associated report generation for this *SID* has been disabled before via TC(3,8).

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 4

Application/Source Data:

<b>SID</b>
Unsigned Integer
1 byte

5908

### Parameter definition

1332

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID of Diagnostic Report Definition to be cleared	See Annex 10

5915

### TC Verification

13056

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.4.5 TC (3,5) Enable HK Parameter Report Generation

#### Description:

1334

This TC enables the Report generation of one defined HK report structure.

#### Structure:

3829

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 5

Application/Source Data:

<b>SID</b>
Unsigned Integer
1 byte

5924

### Parameter definition

1344

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID of HK Report Definition	See Annex 10

5931

### TC Verification

13110

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.4.6 TC (3,6) Disable HK Parameter Report Generation

### Description:

1346

This TC disables the Report generation of one defined HK report structure.

### Structure: Identical to TC(3,5)

3830

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 6

Application/Source Data:

<b>SID</b>
Unsigned Integer
1 byte

11378

### Parameter definition:

1356

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID of HK Report Definition	See Annex 10

11385

### TC Verification

13112

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if one of the Service 1 consistency checks defined in section 5.2 has failed.

## 5.4.7 TC (3,7) Enable Diag Parameter Report Generation

### Description:

1358

This TC enables the Report generation of one defined diagnostic report structure.

### Structure:

3831

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 7

Application/Source Data:

<b>SID</b>
Unsigned Integer
1 byte

5940

## Parameter definition

1368

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID of Diagnostic Report Definition	See Annex 10

5947

## TC Verification

13114

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.4.8 TC (3,8) Disable Diag Parameter Report Generation

#### Description:

1370

This TC disables the Report generation of one defined diagnostic report structure.

#### Structure:

3832

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 8

Application/Source Data:

<b>SID</b>
Unsigned Integer
1 byte

11394

## Parameter definition

1380

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID of Diagnostic Report Definition	See Annex 10

11401

## TC Verification

13116

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.4.9 TC (3,9) Report HK Parameter Report Definition

#### Description:

1382

This TC requests the generation of TM(3,10) of the HK Parameter Report specified by the SID number.

**Structure:**

3833

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 9

Application/Source Data:

<b>SID</b>
Unsigned Integer
1 byte

11410

**Parameter definition**

1392

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID of HK Parameter Report Definition	See Annex 10

13398

**TC Verification**

13117

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.4.10 TM (3,10) HK Parameter Report Definition Report**

**Description:**

1394

This TM is the response to TC(3,9).

**Structure:**

3834

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 10

Application/Source Data:

SID	Collection Interval	NPAR	Parameter ID
Unsigned Integer	Unsigned Integer	Unsigned Integer	Unsigned Integer
1 byte	2 bytes	1 byte	4 bytes
			<-repeat NPAR times->

7569

1404



## Parameter definition

Parameters of Source Data Field	Description	Range or Value
SID	Structure ID of the HK Report Definition to be reported	See Annex 10
Collection Interval	Generation period for this HK TM packet expressed in number of cycles	1..TBD <i>cycle</i> identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)
NPAR	Number of cumulated parameters in the definition	0..TBD
Parameter ID	Number uniquely identifying a parameter out of a list	Any valid value of the list of predefined parameters

7590

### 5.4.11 TC (3,11) Report Diag Parameter Report Definition

#### Description:

This TC requests the generation of TM(3,12) of the Diagnostic Parameter Report specified by the SID number.

1406

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

3835

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 11

Application/Source Data:

<b>SID</b>
Unsigned Integer
1 byte

11426

## Parameter definition

1416

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID of Diagnostic Report Definition	See Annex 10

11433

## TC Verification

13119

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.4.12 TM (3,12) Diag Parameter Report Definition Report

### Description:

This TM is the response to TC(3,11).

1418

### Structure:

3836

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 12

Application/Source Data:

SID	Collection Interval	NPAR1	Parameter ID	NFA	NREP	NPAR2	Parameter ID
Uns Int	Uns Int	Uns Int	Uns Int	Enum	Uns Int	Uns Int	Enum
1 byte	2 bytes	1 byte	4 bytes	1 byte	1 byte	1 byte	4 bytes
			<-Repeat NPAR1 times->				<-Repeat NPAR2 times->
					<- Repeat NFA times ->	<- Repeat NFA times ->	<- Repeat NFA times ->

11522

### Parameter definition

1428

Parameters	Description	Range or Value
SID	Structure ID	See Annex 10
Collection Interval	Generation period for this HK TM packet expressed in number of cycles	1...TBD <i>cycle</i> identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)
NPAR	Number of parameters in the definition that are sampled once per collection interval	1..TBD
Parameter ID	Identifier of the Parameter in the Datapool	
NFA	Number of fixed length arrays	0 or 1
NREP	number of values to be sampled for each parameter within this fixed length array	
NPAR2	Number of different parameters within this fixed length array, each of which shall be sampled NREP times per collection interval	
Parameter Id	Identifier of the Parameter in the Datapool	

11568

### 5.4.13 TM (3,25) HK Parameter Report

**Description:**

A TM(3,25) is periodically generated for every HK Report Definition Structure that is enabled.

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 25

Application/Source Data:

SID	Parameters
Enumerated	Any
1 byte	n bytes

**Parameter definition**

Parameter	Description	Value
SID	The structure identification of the Housekeeping packet being reported.	An existing SID value
Parameters	Parameter meaning according to the definition of this HK Report	A valid value for this parameter

**Note**

In SSMM TM(3,25) packets, the first parameter (1byte) after the SID is indicating the current SSMM mode among INIT, OPERA,SERVICE,TEST (see RD9)

### 5.4.14 TM (3,26) Diag Parameter Report

**Description:**

A TM(3,26) is periodically generated for every Diagnostic Report Definition Structure that is enabled.

Conceptually TM(3,26) has got the same structure than TM(3,25), i.e. what is reported is a SID and the parameters included in this SID. The difference is that there could be one or more parameters (supercommutated) whose values are reported more than one time (i.e. NREP times).

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 3

1430

3837

6002

1440

6012

12375

1442

3838

- Service Subtype: 26

Application/Source Data:

SID	Parameter 1	...	Parameter M	Parameter N	...	Parameter P
Uns Integer	Any		Any			
1 byte	Variable		Variable			

← repeated NREP times →

## Parameter definition

Parameter	Description	Value
SID	The Structure Identifier of the Diagnostic TM(3,26) definition	
Parameters	This field consists of a sequence of values of diagnostic parameters that are sampled cyclically with TM(3,26) generation period (collection interval). The sequence of parameter corresponds to the TM(3,26) definition, as per TM(3,12).	

### 5.4.15 TC (3,128) Report HK/Diag Parameter Report Definitions in Summary Form

#### Description:

Upon reception of TC(3,128) the HK/Diagnostic Parameter Report Definition Report TM(3,134) shall be generated providing the enable/disable status and collection interval of each SID.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 128

Application/Source Data:

#### Parameter definition

TC(3,128) does not have any application data, i.e. the Application Data field within the TC Packet Data Field does not exist (length = 0).

#### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.4.16 TC (3,129) Update HK Report Generation Period

### Description:

TC(3,129) is implemented in SSMM SW only. It allows to update the generation period of the HK Parameter Report.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 129

Application/Source Data:

SID	Filler	Collection Interval
Unsigned integer		Unsigned integer
1 byte	1 byte	2 bytes

### Parameter definition

Parameters of Source Data Field	Description	Range or Value
SID	Structure ID of the SSMM HK Report Definition	0..255
Collection Interval	Collection Interval in number of cycles  <i>cycle</i> identifies the maximum scheduling rate of the SSMM application, i.e. 8Hz	8..65535  LSB = 8 Hz  Minimum allowed interval: 1s, allowed intervals in 1s increments.

### Notes:

The default collection interval at power On of the SSMM is 16s.

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.4.17 TC (3,130) Define HK Parameter Report Collection Interval

### Description:

Upon reception of TC(3,130), the collection interval for the specified HK Parameter Report shall be changed.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8

- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 130

Application/Source Data:

SID	Collection Interval
Unsigned Integer	Unsigned Integer
1 byte	2 bytes

8625

### Parameter definition

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID	See Annex 10
Collection Interval	Generation period for this HK TM packet expressed in number of cycles.	1..TBD  <i>cycle</i> identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)

7614

7625

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13122

### 5.4.18 TC (3,131) Define Diagnostic Parameter Report Collection Interval

#### Description:

Upon reception of TC(3,131), the collection interval for the specified Diagnostic Parameter Report shall be changed. The Diagnostic Parameter Report Generation for the specified SID must be disabled in order to change the collection interval.

1466

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

3840

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 131

Application/Source Data:

SID	Collection Interval
Unsigned Integer	Unsigned Integer
1 byte	2 bytes

11442

## Parameter definition

1476

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID	
Collection Interval	<p>Generation period for this HK TM packet expressed in number of cycles.</p> <p>The collection interval divided by NREP must be an integer number.</p>	<p>1..TBD</p> <p><i>cycle</i> identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)</p>

11452

## TC Verification

13123

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.4.19 TM(3,134) HK/Diag Parameter Report Definitions Report in Summary Form

#### Description:

TM(3,134) is the response to TC(3,128)

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 134

Application/Source Data:

NPAR	SID	Status	Collection Interval
Unsigned integer	Unsigned integer	Enumerated	Unsigned integer
1 byte	1 byte	1 byte	2 bytes
← repeat NPAR times →			

6083

6084

6085

## Parameter definition

Parameters of Source Data Field	Description	Range or Value
NPAR	number of SID's	1..255
SID	Structure ID of the HK/Diag Report Definition to be reported	A valid and existing SID for HK and Diag. Reports
Status	Report generation status	0 = Disabled 1 = Enabled
Collection Interval	Generation period for this HK TM packet expressed in number of cycles  <i>cycle</i> identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)	1...65535

6107

### 5.4.20 TC (3,136) Request HK/Diagnostic Parameter Report

#### Description:

This TC requests the generation of a single occurrence of a defined housekeeping (or diagnostic) packet. The TM(3,25) (or TM(3,26)) specified by the SID number is generated only once.

1454

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

3839

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 136

Application/Source Data:

<b>SID</b>
Unsigned Integer
1 byte

11465

## Parameter definition

1464

Parameters of Application Data Field	Description	Range or Value
SID	Structure ID of HK/Diag Report Definition	See Annex 10

11472

## TC Verification

13124

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].



## 5.4.21 TC (3,138) Append Parameters to a HK Parameter Report

### Description:

TC(3,138) is used to add HK parameters to the end of an already defined HK Report TM(3,25).

### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3
- Service Subtype: 138

Application/Source Data:

SID	NPAR	Parameter ID
Unsigned Integer	Unsigned Integer	Unsigned Integer
1 byte	1 byte	4 bytes
		<-repeat NPAR times->

### Parameter definition

Parameters of Application Data Field	Description	Range or value
SID	Structure ID	See Annex 10
NPAR	Number of appended parameters in the definition	1..TBD
Parameter ID	Number uniquely identifying a parameter out of a list	

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.4.22 TC (3,139) Request Snapshot HK Parameter Anomaly Report

### Description:

Upon reception of TC(3,139), one TM(5,x) event report with the given EID is generated.

The event severity (i.e. service 5 subtype) is deduced from the EID as indicated in Annex 9.

The event parameters are the parameters of the HK TM packet identified by the given SID.

### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 3

- Service Subtype: 139

Application/Source Data:

EID	SID
Unsigned integer	Unsigned integer
2 bytes	1 byte

8863

### Parameter definition

Parameters of Application Data Field	Description	Range or Value
EID	Event identifier	See Annex 9
SID	Structure identifier of HK TM report (Diagnostic TM packets are excluded)	See Annex 10

8624

8873

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13126

## 5.5 Service 4: Not Used

## 5.6 Service 5: Event Reporting

### Objective

This Service provides the capability to generate Event TM packets of different categories providing information of different operational significance for on-board or on-ground use. It is applicable to each application process.

1491

This service is also the manager of the Critical Event Log stored in SGM-RAM.

### Description

The service provides the capability to generate 4 different categories of events. These are:

- TM(5,1): Reporting of normal progress of operations and activities
- Reporting of failures or anomalies detected on board:
  - TM(5,2): Low criticality (warning, no recovery action required)
  - TM(5,3): Medium criticality (ground recovery action required)
  - TM (5,4): High criticality (on-board recovery action required)

1492

Note: the use of the different levels will be defined during the design of the process issuing them. Typically "low" will just be stored for downlink to ground, "high" will always have a pre-defined response by the Central software to recover the anomaly.

Event reports will be one of the prime methods used to control day to day operations during the mission to report normal progress, warnings, errors requiring ground action or autonomous actions performed on-board.

The source data field of the Event packet shall not exceed the maximum length of 40 bytes. Exceptions will be agreed with ESA.

The Event ID allocation is unique across a given PID as defined in Appendix 9.

Once generated, events may be:

- filtered and recorded in the Safe Guard Memory (SGM) as part of the so called Critical Event Log (CEL) for "medium" and "high" levels,
- and/or forwarded toward ground
- and/or recorded in the OBC Mass Memory (OMM)
- and/or forwarded to Service 19.

When recorded in the SGM as part of the Critical Event Log (CEL), the events will be stored in a combination of a linear and a circular buffer.

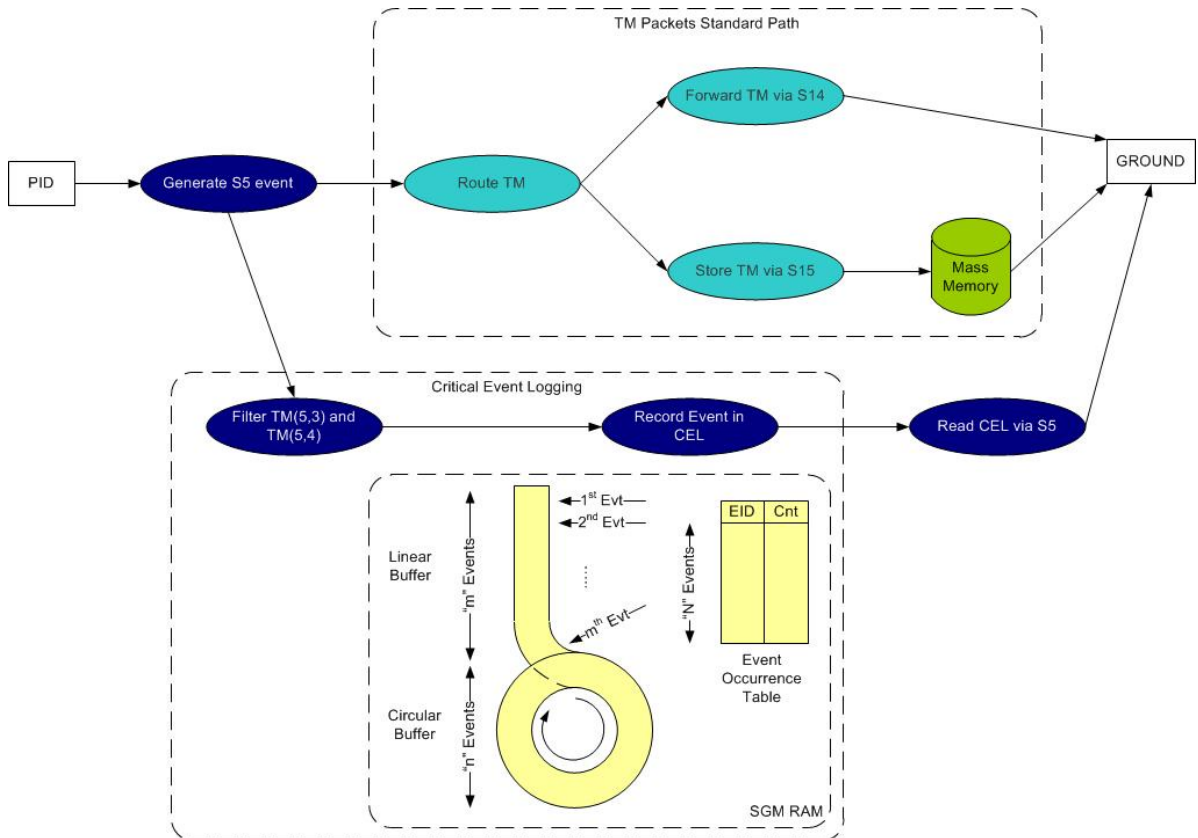
The Linear buffer contains the "m" first events generated (the oldest ones) and the circular buffer the last "n" events generated (the youngest ones).

In an ordinary case, the full size of the CEL allows to record up to "m + n" events. In case of burst of events, the "m" first events and the "n" last events are recorded in the CEL. In addition, a counter of occurrence is available which counts event occurrences per EID with "N" entries (value of N TBC). This will allow to keep track of most of the event history even in the case the buffers are not large enough to record the whole sequence of events.

Service 5 provides telecommand to:

- Read the CEL buffers and the Occurrence table. This telecommand may produce several TM packets as result (TM for the circular buffer, TM for linear buffer and TM for event occurrence table)
- Clear the CEL buffers and the Occurrence table (via 1 single TC in order to ensure consistency between the three entities).

14744



**Figure 5.6-1: Critical Event Log Overview<Picture>**

**Notes**

1493

**5.6.1 TM (5,1) Nominal/Progress Report**

**Description:**

1495

This TM reports the normal progress of an on-board action.

**Structure:**

3842

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 7

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 1

Application/Source Data:

Event ID	Parameters
Enumerated	Any
2 bytes	n bytes

4876

1505

## Parameter definition

Parameter	Description	Value
Event ID	Event identification	See Annex 9
Parameters	Complementary information relating to a specific Event ID. The structure and length of this field is uniquely identified by the combination of Event ID and APID.	Must not be greater than 38 bytes (exceptions to be agreed with ESA)

4886

## Remark

4908

### 5.6.2 TM (5,2) Error/Anomaly Report - Low Severity

#### Description:

1507

This TM reports an error or anomaly of low severity that has been detected on-board.

#### Structure:

3843

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 7

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 2

Application/Source Data:

Event ID	Parameters
Enumerated	Any
2 bytes	n bytes

4909

## Parameter definition

1517

Parameter	Description	Value
Event ID	Event identification	See Annex 9
Parameters	Complementary information relating to a specific Event ID. The structure and length of this field is uniquely identified by the combination of Event ID and APID.	Must not be greater than 38 bytes (exceptions to be agreed with ESA)

4919

## Remark

4933

### 5.6.3 TM (5,3) Error/Anomaly Report - Medium Severity

#### Description:

1519

This TM reports an error or anomaly of medium severity that has been detected on-board.

#### Structure:

3844

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 7

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 3

Application/Source Data:

Event ID	Parameters
Enumerated	Any
2 bytes	n bytes

4934

### Parameter definition

Parameter	Description	Value
Event ID	Event identification	See Annex 9
Parameters	Complementary information relating to a specific Event ID. The structure and length of this field is uniquely identified by the combination of Event ID and APID.	Must not be greater than 38 bytes (exceptions to be agreed with ESA)

1529

4946

### Remark

4945

## 5.6.4 TM (5,4) Error/Anomaly Report - High Severity

### Description:

This TM reports an error or anomaly of high severity that has been detected on-board.

1531

### Structure:

3845

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 7

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 4

Application/Source Data:

Event ID	Parameters
Enumerated	Any
2 bytes	n bytes

4959

### Parameter definition

Parameter	Description	Value
Event ID	Event identification	See Annex 9
Parameters	Complementary information relating to a specific Event ID. The structure and length of this field is uniquely identified by the combination of Event ID and APID.	Must not be greater than 38 bytes (exceptions to be agreed with ESA)

1541

4970

### Remark

4969

## 5.6.5 TC (5,5) Enable Event Packet Generation

### Description:

This TC enables the generation of the specified Event Packet defined by the EID parameters.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 5

Application/Source Data:

NEID	EID
Unsigned integer	Enumerated
1 byte	2 bytes
	<- repeat NEID times ->

### Parameter definition

Parameters of Source Data Field	Description	Range or Value
NEID	Number of EID	1 .. TBD
EID	Event Packet Structure Identifier	See Annex 9

### Remark:

This functionality is intended for use during Ground testing. It is NOT recommended to use it in Flight.

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.6.6 TC (5,6) Disable Event Packet Generation

### Description:

This TC allows to disable the generation of a specified Event Packet.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 6

Application/Source Data:

NEID	EID
Unsigned integer	Enumerated
1 byte	2 bytes
	<- repeat NEID times ->

8912

## Parameter definition

8827

Parameters of Source Data Field	Description	Range or Value
NEID	Number of EID	1 .. TBD
EID	Event Packet Structure Identifier	See Annex 9

8925

## Remark:

8828

This functionality is intended for use during Ground testing. It is NOT recommended to use it in Flight.

## TC Verification

13128

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.6.7 TC (5,128) Clear Critical Event Log

### Description:

1543

This TC clears the Critical Event Log linear and circular buffers as well as the Occurrence Table in both SGM.

This service is implemented in CSW only.

### Structure:

3846

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 128

Application/Source Data:

NoOfEntries
Uns Int
2 bytes

10747

1553



## Parameter definition

Parameters	Description	Range or Value
NoOfEntries	<p>Number of CEL entries to be deleted</p> <p>If the specified number is greater or equal to the number of entries in the log then all entries will be deleted.</p>	

10754

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be before the cases identified in [RD8].

13129

### 5.6.8 TC (5,129) Downlink Critical Event Log

#### Description:

This TC allows dumping all stored packets of the Critical Event Log, i.e. from circular and linear buffers. The reported information is sent directly to the Real Time TM. This command also requests the report of the Table of Occurrence in TM(5,130).

1555

This service is implemented in CSW only.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

3847

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 129

Application/Source Data:

SGM ID
Uns Int
1 byte

10763

## Parameter definition

Parameters	Description	Value or range
SGM ID	SGM Identifier	01bin = SGM A 10bin = SGM B 11bin = SGM A or B

1565

10770

## Remark

The Events are reported "as recorded" in Real time TM flow. A consequence of this is that Event packets with a time stamp in the past will appear within the real time TM flow.

4983

In the case of SGM ID = 11bin, the CSW is expected to read data from SGM-A if it is healthy, if it is not from SGM-B if it is healthy

13130

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.6.9 TM (5,130) Critical Event Log Occurrence Table Report

#### Description:

10780

This TM is the response to TC 5,129 and reports the Table of Occurrence.

This service is implemented in CSW only.

#### Structure:

10781

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 130

Application/Source Data:

SGM ID	NEID	Filler	PRID	EID	Occurrence
Uns Int	Uns Int		Enum	Enum	Uns Int
1 byte	2 bytes	1 bit	7 bits	2 bytes	2 bytes
← repeat <i>NEID</i> times →					

#### Parameter definition

10782

Parameters	Description	Range or Value
SGM ID	SGM Identifier	01bin = SGM A 10bin = SGM B
NEID	Number of EID	
PID	Process ID	See Annex 8
EID	Event Packet Structure Identifier	See Annex 9
Occurrence	Number of times the event EID has occurred since the last time the CEL was cleared	

10783

### 5.6.10 TC (5,131) Report Enabled EID

#### Description:

10809

This TC requests the report TM(5,132) to be generated with the list of enabled EID

#### Structure:

10810

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 131

Application/Source Data: none

**Parameter definition**

10811

n/a

**Remark:**

10812

The functionality to disable events is intended for use during Ground testing. It is NOT recommended to use it in Flight.

**TC Verification**

13131

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.6.11 TM (5,132) Enabled EID Report**

**Description:**

11611

This TM report is the answer to TC(5,131) and list the enabled EID.

**Structure:**

11612

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 132

Application/Source Data:

NEID	EID
Uns Int	Enumerated
2 bytes	2 bytes
	<-- repeat <i>NEID</i> times -->

11615

**Parameter definition**

11613

Parameters	Description	Range or value
NEID	Number of EID	
EID	Event Packet Structure Identifier	See Aneex 9

11628

**Remark:**

11614

The functionality to disable events is intended for use during Ground testing. It is NOT recommended to use it in Flight.

## 5.6.12 TC (5,133) Report Disabled EID

### Description:

11606

This TC requests the report TM(5,134) to be generated with the list of disabled EID

### Structure:

11607

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 133

Application/Source Data: none

### Parameter definition

11608

n/a

### Remark:

11609

The functionality to disable events is intended for use during Ground testing. It is NOT recommended to use it in Flight.

### TC Verification

13132

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if for the cases identified in [RD8].

## 5.6.13 TM (5,134) Disabled EID Report

### Description:

10814

The TM 5,134 is the response to TC 5,133 and reports the list of disabled EID.

### Structure:

10815

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 5
- Service Subtype: 134

Application/Source Data:

NEID	EID
Uns Int	Enumerated
2 bytes	2 bytes
	<-- repeat <i>NEID</i> times -->

10818

10816

## Parameter definition

Parameters	Description	Range or value
NEID	Number of EID	
EID	Event Packet Structure Identifier	See Annex 9

10831

### Remark:

10817

The functionality to disable events is intended for use during Ground testing. It is NOT recommended to use it in Flight.

## 5.7 Service 6: Memory Management

### Objective

1567

This service provides the capability for loading, dumping and checking the contents of a contiguous memory area on-board (e.g. RAM, PROM, EEPROM, SGM or mass memory).

### Description

1568

This service provides the basic dump, load and check capabilities w.r.t on-board memory blocks uniquely identified by "Memory ID".

The addressing technique used on Solar Orbiter for memory load, dump and check requests and reports is absolute addressing. This allows the user to specify a real address start loading or dumping from. The address is expressed in Single Addressable Unit (SAU) corresponding to the one of the selected memory ID.

The service supports block load and dump. This means that TC(6,2) and TC(6,5) only contains one block of memory word(s) to be loaded or dumped, TC(6,128) allows to apply pre-loaded set of patches to effectively produce the effect of a scatter patch.

The TM (6,6) Memory dump report is not limited in length. The dump -application will generate as many TM dump packets as required to cover the entire commanded dump-area.

The TC (6,9) requests the check of a block of on board memory and to send down the checksum result in TM (6,10) via Real Time telemetry.

An allocation for the Memory IDs and their memory -types available on board are shown in the following table:

Memory ID for Unit A (hex)	Memory ID for Unit B (hex)	Memory Description	Memory mapping (hex)	Size	Smallest Addressable Unit [bit] (dec)	Address Multiplier (dec)	Allowed Operation		
							Patch	Dump	Check
OBC - PM									
0x0003	0x0103	PROM (BSW image)	0x0000 0000	64 kB	32	4	-	X	X
0x0013	0x0113	PM EEPROM Bank 0 and Bank 1	0x0080 0000 to 0x00BF FFFF	4 MB	32	4	X	X	X
0x0023	0x0123	Processor RAM	0x0200 0000 to 0x027F FFFF	8 MB	32	4	X	X	X
0x0050	0x0150	ERC32 System Register	0x01F8 0000 to 0x01FF FFFF	512 kB	32	4	X	X	X
0x0051	0x0151	COCOS I/O area 0	0x1000 0000 to 0x1001 FFFF	128 kB	32	4	X	X	X
0x0052	0x0152	Outport Register	0x1007 FFFF to 1100 0000	512 kB	32	4	X <sup>1</sup>	X	X
0x0053	0x0153	COCOS	0x2000 0000 to 0xFFFF FFFF	else	32	4	X	X	X
OBC - TTR									
0x0005	0x0105	TTR PROM	0000_0000 to 0000_8000	32 kB	32	4		X	X
0x0033	0x0133	SGM RAM Bank 1	0x0300 8000 to 0x0304 7FFF	256 kB	32	4	X	X	X
0x0034	0x0134	SGM RAM Bank 2	0x0304 8000 to 0x0307 7FFF	256 kB	32	4	X	X	X
0x0043	0x0143	SGM EEPROM Bank 1	0x0102 0000 to 0x0103 FFFF	128 kB	32	4	X	X	X
0x0044	0x0144	SGM EEPROM Bank 2	0x0200 0000 to 0x0201 FFFF	128 kB	32	4	X	X	X
0x0045	0x0145	OBC Mass Memory	0x0000 0000 to 0x7FFF FFFF	2 GB	32	4	X	X	X
0x0060	0x0160	RM Memory EEPROM Bank 0	0x0100 0000 to 0x0101 FFFF	128 kB	32	4	X	X	X

0x0061	0x0161	EEPROM Bank 3	0x0202 0000 to 0x0203 FFFF	128 kB	32	4	X	X	X
0x0062	0x0162	CROME SRAM	0x0300 0000 to 0x0300 7FFF	32 kB	32	4	X	X	X
0x0063	0x0163	TME buffer	0x0308 8000 to 0x030F FFFF	480 kB	32	4	X	X	X
0x0064	0x0164	HAMSTER internal Registers	0x0400 0000 to 0x0400 7FFF	32 kB	32	4	X	X	X
0x0065	0x0165	CROME Registers	0x0700 0000 to 0x0701 FFFF	128 kB	32	4	X	X	X
		<b>SSMM</b>							
0x0020		PROM	0x0000 0000 to 0x0001 FFFC	128 kB	32	4	-	X	X
0x001E		RAM	0x0200 0000 to 0x027F FFFC	8 MB	32	4	X	X	X
0x001F		EEPROM	0x0400 0000 to 0x041F FFFC	2MB	32	4	X	X	X
0x00D2 - 0x00EF		Memory Array	0x0000 0000 to 0xFFFF FFFC					X	
		<b>STR</b>							
0x0040		RAM	0x 0200 0000 to 0x 0207 FFFC		32	4	X	X	X
0x0041		EEPROM	0x 0008 0000 to 0x 000F FFFF		32	4	X	X	X
0x0042		PIXEL RAM	0x 1008 0000 to 0x 100F FFFC		32	4		X	
		<b>Spares</b>							
		<b>Payload (TBC)</b>							
0x50--	0x51--	EPD							
0x60--	0x61--	MAG							
0x70--	0x71--	RPW							
0x80--	0x81--	SWA							
0x90--	0x91--	Spice							
0xA0--	0xA1--	PHI							
0xB0--	0xB1--	EUI							
0xC0--	0xC1--	METIS							

0xD0--	0xD1--	STIX							
0xE0--	0xE1--	SoloHi							
		Spares							

**Figure 5.7-1: Memory ID allocation**

14748  
14749

Note 1: The output register cannot be patched on the PM in service mode, via the inter-PM link.

8829

**Note:** the different Memory types of an equipment shall be addressed via Memory IDs (MemID). The MemID is represented at the begin of the packet datafield by 2 Bytes. The MemIDs shall be used as defined in the following table.

The SAU is the “Smallest Addressable Unit” of a memory area, it can be 8 bit, 16 bit or 32 bit.

The MUL defines the “Address MULTIplier”, it is the address increment needed to jump from one addressed SAU to the next following.

Nominally unit A and B use the same MemIDs, i.e. the unit A or B is selected by APID and always the same MemIDs are used for the active Processor.

In case of cross memory access between redundant units, the MemIDs are related to the PHYSICAL Unit. In this case the memory on the Unit A shall use the MemIDs range from 1 to 255dec (LSByte) and the memory on the Unit B shall use MemIDs from (257) until (511) (i.e. MSByte=1 plus MemID of Unit A).

Memory ID „Unit A“ (HEX)	Memory ID „Unit B“ (HEX)	Memory Description	SAU [bit] (dec)	MUL (dec)
1	Unit A + 100 <sub>HEX</sub>	PROM	8	1
2	Unit A + 100 <sub>HEX</sub>	PROM	16	2
3	Unit A + 100 <sub>HEX</sub>	PROM	32	4
11	Unit A + 100 <sub>HEX</sub>	EEPROM	8	1
12	Unit A + 100 <sub>HEX</sub>	EEPROM	16	2
13	Unit A + 100 <sub>HEX</sub>	FFPROM	32	4
21	Unit A + 100 <sub>HEX</sub>	Processor RAM	8	1
22	Unit A + 100 <sub>HEX</sub>	Processor RAM	16	2
23	Unit A + 100 <sub>HEX</sub>	Processor RAM	32	4
31	Unit A + 100 <sub>HEX</sub>	SGM RAM	8	1
32	Unit A + 100 <sub>HEX</sub>	SGM RAM	16	2
33	Unit A + 100 <sub>HEX</sub>	SGM RAM	32	4
41	Unit A + 100 <sub>HEX</sub>	SGM EEPROM	8	1
42	Unit A + 100 <sub>HEX</sub>	SGM EEPROM	16	2
43	Unit A + 100 <sub>HEX</sub>	SGM EEPROM	32	4
for individual use		for individual use		

8831

**Figure 5.7-2: Memory ID basic rules**

1569



## Notes

- A specific function (TC 6,128) is used within the CSW to allow a safe loading/patching of different memory addresses in RAM.
- A specific function (TC 6,140) is used by the CSW to load memory with a mask.

### 5.7.1 TC (6,2) Load Memory (patch)

#### Description:

The TC 6,2 loads continuous block of data in addressed On Board Memory using absolute addresses.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 2

Application/Source Data:

Memory ID	Start Address	Length	Data
Enumerated	Unsigned Integer	Unsigned Integer	Any
2 bytes	4 bytes	4 bytes	n bytes

#### Parameter definition

Parameter	Description	Value
Memory ID	Identification of the destination memory	See Table {XRef Filtered}
Start Address	Start Address (in single addressable unit, with count starting from zero) within the memory block for loading data	valid address of the memory addressed by Memory ID
Length	Length of the data to be loaded (in single addressable unit with count starting from zero). This information allows in particular to define the end of the block.	Start Address + Length -1 must not exceed the physical memory.
Data	Data block to be loaded	

#### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8]

### 5.7.2 TC (6,5) Dump Memory

#### Description:

This TC requests a dump via TM(6,6) of a continuous block of data from the addressed On Board memory using absolute addresses.

The requested block must lie entirely within the defined area. It is not allowed to cross the boundaries of the Memory IDs. In case a boundary is exceeded, a warning event will be generated and the Dump will only be performed up to the boundary.

**Structure:**

3849

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 5

Application/Source Data:

Memory ID	Start Address	Length
Enumerated	Unsigned Integer	Unsigned Integer
2 bytes	4 bytes	4 bytes

5229

**Parameter definition**

1593

Parameter	Description	Value
Memory ID	Identification of the destination memory	See Table {XRef Filtered}
Start Address	Start Address (in single addressable unit, with count starting from zero) within the memory block for dumping data	valid address of the memory addressed by Memory ID
Length	Length of the data to be dumped (in single addressable unit with count starting from zero). This information allows in particular defining the end of the block.	Start Address + Length -1 must not exceed the physical memory.

5245

**Remark:**

5266

The length of the area to be dumped is not limited by the size of the maximum TM packet size. The addressed application shall generate as a result of the TC(6,5) as many TM dump packets TM(6,6) as required to cover the entire commanded dump area.

**TC Verification**

13134

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8]

**5.7.3 TM (6,6) Memory Dump Report**

**Description:**

1595

The TM 6,6 is the response to TC 6,5 giving the dump report of the requested memory area.

**Structure:**

3850

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 9

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 6

Application/Source Data:

Memory ID	Start Address	Length	Data
Enumerated	Unsigned Integer	Unsigned Integer	Any
2 bytes	4 bytes	4 bytes	n bytes

5267

### Parameter definition

Parameter	Description	Value
Memory ID	Identification of the dumped memory area	See Table {XRef Filtered}
Start Address	Start Address (in single addressable unit, with count starting from zero) within the memory block for loading data	valid address of the memory addressed by Memory ID
Length	Length of the dumped data (in single addressable unit with count starting from zero). This information allows in particular to define the end of the block.	Start Address + Length -1 must not exceed the physical memory.
Data	Data block dumped	

1605

5280

### Remarks:

Each of these TM packets will be self-contained, i.e. Start Address and Length of dump are consistent with the dumped data presented in the TM dump packet.

5304

The 'Data' field shall contain data referring to memory addresses which are contiguous i.e. increasing without gaps (e.g. page boundaries shall be taken into account such that several dump packets are generated if the dump request goes across them).

If the requested length of the dump by TC(6,5) is longer than the maximum length of a packet, the dump will be split into as many TM(6,6) packets as necessary to downlink the full length as requested by service TC(6,5). In this case the first, last and continued Dump packets shall be identified using the Segmentation/Grouping Flags within the Source Packet Header.

There are no constraints imposed on how to break-down the dump area into TM dump packets.

The Destination ID of memory dumps shall always be set to Ground.

### 5.7.4 TC (6,9) Check Memory

#### Description:

The TC 6,9 requests the execution of a memory check on board and the report of the check result via TM 6,10.

1607

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

3851

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 9

Application/Source Data:

Memory ID	Start Address	Length
Enumerated	Unsigned Integer	Unsigned Integer
2 bytes	4 bytes	4 bytes

5305

**Parameter definition**

Parameter	Description	Value
Memory ID	Identification of the destination memory	See Table {XRef Filtered}
Start Address	Start Address (in single addressable unit, with count starting from zero) within the memory block for checking data	valid address of the memory addressed by Memory ID
Length	Length of the data to be checked (in single addressable unit with count starting from zero). This information allows in particular to define the end of the block.	Start Address + Length -1 must not exceed the physical memory.

1617

5321

**Remark:**

When the service provider receives this request it shall read and compute the checksum value of the commanded area of the memory block using the CRC 16-bit checksum defined in Annex 6 (the checksum shall be calculated based on the basic wordlength of the memory).

5344

It shall then generate a TM(6,10) report containing the checksum value computed.

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13135

## 5.7.5 TM (6,10) Memory Check Report

**Description:**

The TM 6,10 is the response to TC 6,9.

1619

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 9

3852

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 10

Application/Source Data:

Memory ID	Start Address	Length	Checksum
Enumerated	Unsigned Integer	Unsigned Integer	Unsigned Integer

5345

Memory ID	Start Address	Length	Checksum
2 bytes	4 bytes	4 bytes	2 bytes

### Parameter definition

Parameter	Description	Value
Memory ID	Identification of the destination memory	See Table {XRef Filtered}
Start Address	Start Address (in single addressable unit, with count starting from zero) within the memory block of checked data	valid address of the memory addressed by Memory ID
Length	Length of the checked data (in single addressable unit with count starting from zero). This information allows in particular to define the end of the block.	Start Address + Length -1 must not exceed the physical memory.
Checksum	Computed CRC for associated block	

### Remark:

The Destination ID for this TM packet shall always be set to Ground

## 5.7.6 TC (6,128) Apply Pre-loaded Set of RAM Patches

### Description:

This TC triggers the application of a set of RAM patches, previously loaded thanks to TC(6,2) in an intermediate buffer / area.

This service is implemented only in CSW.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 128

Application/Source Data:

<b>Pre-Loaded Patches Number</b>
Unsigned Integer
4 bytes

### Parameter definition

Parameter	Description	Value
Pre-Loaded Patches Number	Number of pre-loaded RAM patches to be triggered for effective application	1 .. 30

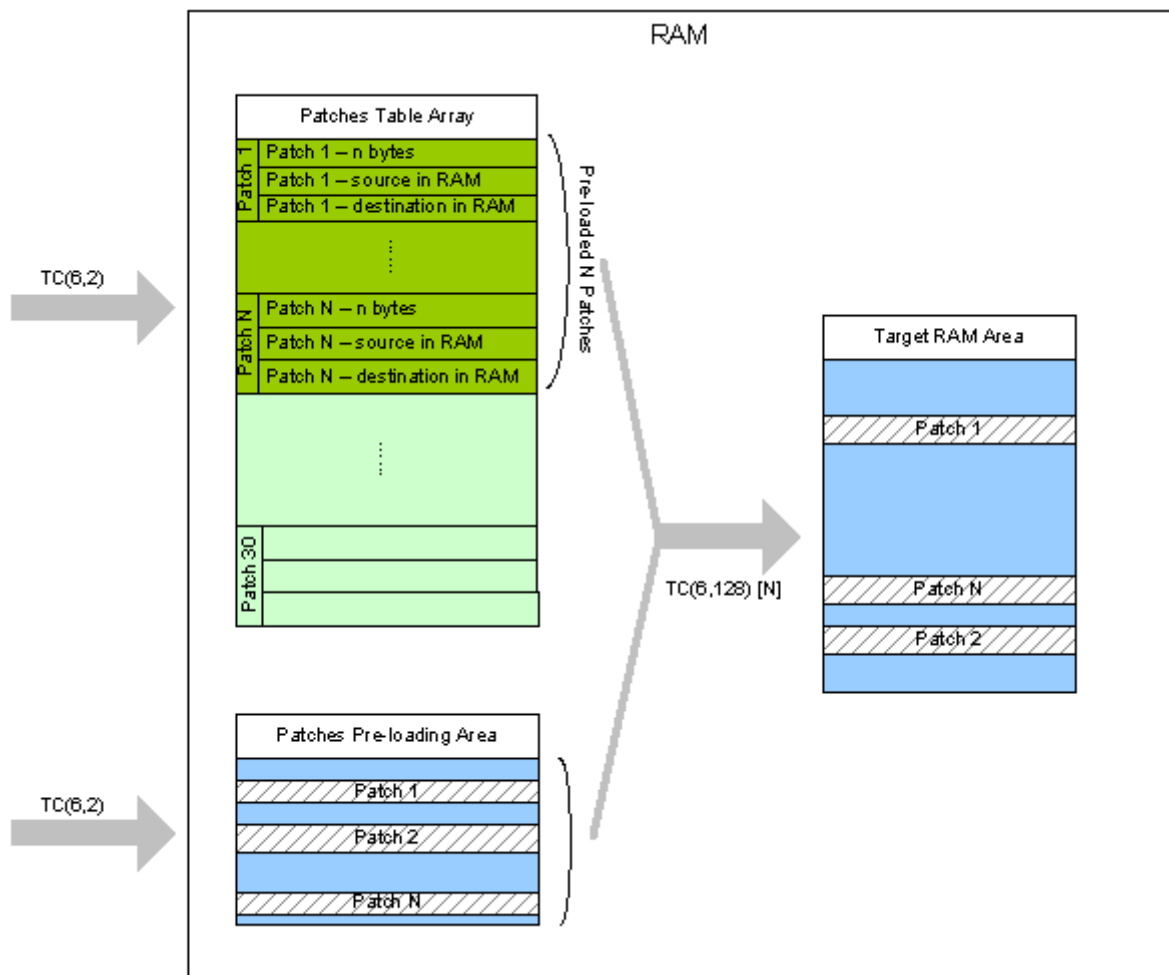
### Remarks:

The patching buffer is a RAM area which consists in:

- A Patches table array containing up to 30 descriptors: {Nb bytes to patch, Patch Source Address in pre-loading area, Patch Destination Address}. Each descriptor corresponds to an individual patch to be applied.
- A Patches pre-loading area that contains the effective patches. Each individual patch consists in a series of contiguous data bytes (by increasing addresses).

It is assumed that the patches to be loaded correspond to the first consecutive descriptors of the Patches Table Array from 1 to "Pre-loaded Patches Number".

Before issuing the TC(6,128), Ground shall check the proper content and consistency of both areas above. After the TC execution, the patching buffer is erased.



5435

**Figure 5.7-3: RAM Patch Mechanism Overview**

### TC Verification

13136

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.7.7 TC (6,129) Abort Dump****Description:**

12197

The TC 6,129 is implemented in SSMM SW only.

It aborts an on-going dump.

**Structure:**

12198

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 129

Application/Source Data:

**Parameter definition**

12215

TC(6,129) does not have any application data, i.e. the Application Data field within the TC Packet Data Field does not exist (length = 0).

**Notes**

12319

This TC is rejected if there is no on-going dump.

**TC Verification**

13137

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.7.8 TC (6,130) Enable EEPROM Patch****Description:**

12238

The TC 6,130 is implemented in SSMM SW only.

Upon reception of TC 6,130 the SSMM EEPROM banks are powered on and patches are enabled.

**Structure:**

12239

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 130

Application/Source Data:

**Parameter definition**

12256

TC(6,130) does not have any application data, i.e. the Application Data field within the TC Packet Data Field does not exist (length = 0).

**TC Verification**

13138

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.7.9 TC(6,131) Disable EEPROM Patch****Description:**

12279

The TC 6,131 is implemented in SSMM SW only.

Upon reception of TC 6,131 the SSMM EEPROM banks are powered off and patches are disabled.

**Structure:**

12280

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 131

Application/Source Data:

**Parameter definition**

12297

TC(6,131) does not have any application data, i.e. the Application Data field within the TC Packet Data Field does not exist (length = 0).

**TC Verification**

13139

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.7.10 TC (6,140) Load Memory with Mask****Description:**

5189

This TC loads single or multiple bits of data to the addressed On Board memory.

This service is implemented only in CSW.

**Structure:**

5190

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 6
- Service Subtype: 140

Application/Source Data:

5436



Memory ID	Start Address	Data	Mask
Enumerated	Unsigned Integer	Unsigned Integer	Unsigned Integer
2 bytes	4 bytes	4 bytes	4 bytes

## Parameter definition

Parameter	Description	Value
Memory ID	Identification of the destination memory	See Table {XRef Filtered}
Start Address	Start Address (in single addressable unit, with count starting from zero) within the memory block for loading data	valid address of the memory addressed by Memory ID
Data	Data to be loaded	
Mask	Mask to be applied in the following way: {Existing data in memory (defined by start address) AND INVerse Mask} OR {Loaded Data AND mask}	<p>Loaded Data: Bits to be modified: set to required value</p> <p>Mask: Bits to be modified: set to 1 Bits NOT to be modified: set to 0</p>

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.8 Service 7: Not Used

## 5.9 Service 8: Function Management

### Objective

This service supports the FDIR recovery actions which are not implemented on board via standard services.

### Description

The service 8 functions (i.e. recovery actions) will be defined in the PM-RAM at fixed addresses for a given CSW release. They can be modified via service 6 without need of CSW recompilation.

The service 8 will be based on a mapping between Function IDs and start addresses of the function codes. There will be 2 spare Function IDs mapped to a Non-Operational function code. It will then be possible to:

- modify the function codes via service 6 patch,
- add up to 2 new functions, i.e. patch up to 2 new function codes in PM-RAM and patch up to 2 spare function IDs to the new start addresses via service 6,
- remove functions by either patching the mapping to the NOP (no-operational) function via service 6 or by disabling the function via service 8 dedicated command.

The functions will typically consist of a sequence of commands with branching logic (e.g. IF and WHILE) and stop steps as needed.

The functions will interact with the system datapool to read and write any needed data.

The functions will be able to generate events and TM snapshots as needed.

## Notes

1646

### 5.9.1 TC (8,1) Start Function

#### Description:

1648

The TC 8,1 performs the function with the specified Function ID if its execution is allowed (i.e the function is currently enabled).

#### Structure:

3854

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 8
- Service Subtype: 1

Application/Source Data:

Function ID	Parameter
Unsigned Integer	N parameters of any Type
1 byte	0 .. m bytes

8938

#### Parameter definition

1658

Parameters of Application Data Field	Description	Range or value
Function ID	Identification number of the function to be activated	1..255
Parameter	Parameter relating to the function to be performed	

8948

#### TC Verification

13141

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.9.2 TC (8,140) Enable Function Execution

#### Description:

8984

The TC (8,140) enables the execution of the given function ID.

It shall be noted that a parameter value NFID = 0 enables execution at service level, i.e. for all functions while preserving the enable/disable status of the individual functions.

#### Structure:

8985

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 8
- Service Subtype: 140

Application/Source Data:

NFID	FID
Unsigned integer	Unsigned Integer
1 byte	1 byte
	<- repeat NFID times ->

8991

### Parameter definition

Parameters of Application Data Field	Description	Range or value
NFID	Number of Function ID to be enabled	NFID = 0 enable at service level NFID = [1..255]
FID	Identification of the functions to be enabled	n/a if NFID= 0 TBD

8986

9004

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13142

### 5.9.3 TC (8,141) Disable Function Execution

#### Description:

The TC (8,141) disables the execution of the given function ID.

It shall be noted that a parameter value NFID = 0 disables execution at service level, i.e. for all functions while preserving the enable/disable status of the individual functions.

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 8
- Service Subtype: 141

Application/Source Data:

NFID	FID
Unsigned integer	Unsigned Integer
1 byte	1 byte
	<- repeat NFID times ->

8988

8989

9017

8990

## Parameter definition

Parameters of Application Data Field	Description	Range or value
NFID	Number of Function ID to be disabled	NFID = 0 disable at service level NFID = [1..255]
FID	Identification of the functions to be disabled	n/a if NFID= 0  TBD

9030

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13144

### 5.9.4 TC (8,142) Enable Autoreset of Execution Enable Flag

#### Description:

The TC (8,142) sets the autoreset status of the function identified by Function ID to "Autoreset Enabled" and the execution status to "Disabled". This means the function must be explicitly enabled before it can be executed only once. After execution the function status is set back to "Disabled" automatically.

11718

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

11719

Packet Data Field Info:

- Service Type: 8
- Service Subtype: 142

Application/Source Data:

NFID	FID
Unsigned integer	Unsigned Integer
1 byte	1 byte
	<- repeat NFID times ->

11721

## Parameter definition

Parameters of Application Data Field	Description	Range or value
NFID	Number of Function ID for which autoreset is to be enabled	NFID = 0 enable at service level NFID = [1..255]
FID	Identification of the functions	n/a if NFID= 0  TBD

11720

11734

13145

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.9.5 TC (8,143) Disable Autoreset of Execution Enable Flag

### Description:

11748

The TC (8,143) sets the autoreset status of the function identified by Function ID to "Autoreset Disabled". The execution status is unaffected. With "Autoreset Disabled" the execution status remains statically at the value set by TC 8,140 or TC 8,141, regardless whether the function has been executed or not.

### Structure:

11749

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 8
- Service Subtype: 143

Application/Source Data:

NFID	FID
Unsigned integer	Unsigned Integer
1 byte	1 byte
	<- repeat NFID times ->

11751

### Parameter definition

11750

Parameters of Application Data Field	Description	Range or value
NFID	Number of Function ID for which autoreset is to be disabled	NFID = 0 disable at service level NFID = [1..255]
FID	Identification of the functions	n/a if NFID= 0  TBD

11764

## TC Verification

13146

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.9.6 TC (8,144) Report Function Status

### Description:

11642

The TC (8,144) requests the Function status report TM 8,145.

11643

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 8
- Service Subtype: 144

Application/Source Data:

N	Function ID
Uns Int	Uns Int
1 byte	1 byte
	<- repeat N times ->

11645

**Parameter definition**

Parameter	Description	Value or range
N	Number of function status values to be reported	0 = all functions status values will be reported > 0
Function ID	Identification number of the function to be reported	n/a if N= 0 TBD

11644

13408

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13407

**5.9.7 TM (8,145) Function Status Report**

**Description:**

The TM 8,145 is the answer to TC (8,144) and provides the Function status report.

11672

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 8
- Service Subtype: 145

11673

Application/Source Data:

N	Function ID	Execution Status	Autoreset status
Uns Int	Enum	Enum	Enum
1 byte	1 byte	1 byte	1 byte
	<-----	-----repeat N times-----	----->

11675

## Parameter definition

Parameter	Description	Value or range
N	Number of function ID reported	
Function ID	Identification number of the function	
Execution status	Defines whether the execution of the function is enabled/disabled	0= Disabled 1 = Enabled
Autoreset status	Defines whether the autoreset mechanism of the function is enabled or disabled	0= Disabled 1 = Enabled

11674

11696

## 5.10 Service 9: Time Management

### Objective

The Solar Orbiter On-Board Computer (OBC) maintains its own On Board Time (OBT). During normal operation the OBT is synchronised with a controlled oscillator. From there several clock signals and the PPS (Pulse per Second) signal is distributed to external users and OBC internal usage.

1732

The solar orbiter zero time reference is 00:00 on 1<sup>st</sup> January 2000.

The Time Management service allows the ground to modify the OBT TC(9,128) and provides the ground with the OBT information TM(9,2). The generation frequency of this time packet can be commanded using TC(9,1).

Latching of the ground time at arrival of the VC0 frame allows the ground to correlate OBT with ground segment time (e.g. UTC).

The OBT format is CCSDS unsegmented Time Code (CUC) split into a seconds and subseconds field. The single format used for Solar Orbiter consists of a 4 bytes coarse time and a 2 bytes fine time as shown in Annex 4.

### Description

The On-Board Time is initialised at OBC power up with the value 0.

The OBT is set up via TC(9,128) to real time with respect to an arbitrary zero point reference time.

The OBT is maintained on board in the OBC PM and the 2 TTR.

1733

### Notes

1734

## 5.10.1 TC (9,1) Change Time Report Generation Rate

### Description:

The TC 9,1 allows to change the generation frequency of the spacecraft time report packets (i.e TM 9,2).

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 9
- Service Subtype: 1

Application/Source Data:

<b>Rate</b>
Unsigned Integer
1 byte

### Parameter definition

Parameter	Description	Value
Rate	The generation rate is equal to once every $2^{\text{Rate}}$ VC0 TM Transfer Frame.	0 .. 8

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.10.2 TM (9,2) Time Report

### Description:

The TM 9,2 reports the On-Board Time.

Note that this TM Packet does not have any data field header (see Annex 4 Standard Spacecraft Time Source Packet). Nevertheless this TM is allocated to Service 9 with subtype 2.

### Structure:

Source Packet Header: Packet ID Info:

- Process ID: 0
- Packet Cat: 0

Application/Source Data:

Rate	P_FIELD	OBT
Enum	Unsigned Integer	Unsigned Integer
1 byte	1 byte	6 bytes



## Parameter definition

Parameters of Source Data Field	Description	Range or Value
Rate	S-Field parameter corresponding to the generation frequency of standard time packet	
P_FIELD	P-Field parameter	
OBT	On-Board Time expressed with CUC format: <ul style="list-style-type: none"> <li>the first 4 bytes give the number of Seconds (Coarse Time Field),</li> <li>the 2 next bytes give the number of SubSeconds (Fine Time).</li> </ul>	

6952

### 5.10.3 TC (9,128) Set OBT

#### Description:

The TC 9,128 allows setting the On-Board Time to an absolute time value or via a delta time.

1770

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

3863

Packet Data Field Info:

- Service Type: 9
- Service Subtype: 128

Application/Source Data:

Action	OBT - Second	OBT - Subsecond
Enumerated	Unsigned integer	Unsigned integer
1 byte	4 bytes	2 bytes

9043

## Parameter definition

Parameters of Application Data Field	Description	Range or value
Action	Definition of time set operation	0 = set new OBT absolute value 1 = add delta time to OBT 2 = subtract delta time from OBT
OBT - second	Coarse time	
OBT - subsecond	Fine time	n/a if action = 0

1780

9060

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13148

### 5.10.4 TC (9,129) Accept Time Synchronisation

#### Description:

The TC 9,129 allows on board applications and intelligent users to accept synchronisation of their internal time reference with the system master clock.

1782

This TC is not executed by the CSW but is generated by the CSW and sent to other packet terminals (e.g. SSMM) at a frequency defined by TC(9,130). The distributed time corresponds to the time of the next synchronisation signal (e.g. PPS, or MilBus Major Frame Synch, or SpaceWire Time Code) received by the addressed packet terminal.

**Structure:**

3864

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 9
- Service Subtype: 129

Application/Source Data:

<b>OBT at next synchronisation</b>
CUC time format
6 bytes

9077

**Parameter definition**

1792

Parameter	Description	Value
OBT	On-board time: <ul style="list-style-type: none"> <li>• 4 bytes coarse</li> <li>• 2 bytes fine time set to zero</li> </ul>	CUC format

9084

**TC Verification**

13149

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.10.5 TC (9,130) Start Time Synchronisation to User**

**Description:**

8637

The TC 9,130 initiates the time synchronisation of the selected user with the system master clock, i.e. the CSW starts sending the TC(9,129) to the user.

It is possible to select time synchronisation over a given period of time or as a single shot.

**Structure:**

8638

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 9
- Service Subtype: 130

Application/Source Data:

<b>PID</b>	Period
enumerated	Unsigned integer
1 byte	1 byte

9093

### Parameter definition

8639

Parameter	Description	Value or range
PID	Process ID of the User which is receiver of the time update	SSMM STR Payload  (see annex 8)
Period	Period of time in period of time in secs with which the time update is sent to user	0 = one-shot time update 1 .. 255 = time in seconds

9103

### TC Verification

13150

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.10.6 TC (9,131) Stop Time Synchronisation to User

#### Description:

1794

The TC 9,131 stops the time synchronisation of the selected user with the system master clock, i.e. the CSW stops sending the TC(9,129) to the user.

#### Structure:

3865

#### Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

#### Packet Data Field Info:

- Service Type: 9
- Service Subtype: 131

#### Application/Source Data:

<b>PID</b>
enumerated
1 byte

9116

### Parameter definition

1804

Parameter	Description	Value or range
PID	Process ID of the User which is receiver of the time update	SSMM STR Payload  (see annex 8)

9123

13151

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.11 Service 10: Not Used

## 5.12 Service 11: Onboard Operations Scheduling

### Objective

1807

The on-board operations scheduling service provides the capability to command on-board application processes using telecommands pre-loaded on-board the satellite and released at their due time. To achieve this, the service maintains an on-board command schedule and ensures the timely execution of telecommands contained therein.

### Description

1808

The on-board operations scheduling service shall maintain a command schedule which contains telecommand packets and their associated scheduling information.

The service user(s) can request the following activities:

- Enable the scheduling of all, or a subset of, the telecommands in the command schedule (e.g. those to be sent to specified application processes).
- Disable the scheduling of all, or a subset of, the telecommands in the command schedule.
- Add telecommands to the command schedule.
- Delete or time shift all, or a subset of, the telecommands in the command schedule (e.g. the telecommands becoming due for release within a specified time period).
- Report on all, or a subset of, the telecommands in the command schedule.
- Report the status of the command schedule.

### Notes

1809

The Back-Up Timeline is effectively a file of service 11 Time-Tagged TCs loaded in the SGM by Ground. At SW initialisation the TC sequencer service 134 will execute the selected TC file hence loading the MTL application queue with the Back-Up TT-TC.

All service 11 functionalities are hence applicable to the Back-Up MTL once loaded in the MTL queue.

To allow safe updating of the Back-Up MTL in the SGM, there are at least 2 file placeholders. The file to use at SW initialisation is identified, the other one can be updated by Ground.

### 5.12.1 TC (11,1) Enable Release of TCs

#### **Description:**

1811

The TC 11,1 enables the release of TC from the Command Schedule.

#### **Structure:**

3866

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 1

Application/Source Data:

N1	Sub-schedule ID	N2	Filler	PRID
Unsigned	Enumerated	Unsigned	Boolean	Enumerated
1 byte	1 byte	1 byte	1 bit	7 bits
				<-repeat N2 times->
<-repeat N1 times->				

Parameter definition

Parameters of Application Data Field	Description	Range or Value
N1	Number of Sub-schedule IDs which follow	<p>N1=0, the whole MTL is enabled</p> <p>N1&gt;0, N2=0, sub-schedules are enabled, according to the specified sub-schedule ID</p> <p>N1=1, N2&gt;0 and SubScheduled=0, PIDs are enabled, according to the specified PID.</p> <p>Note that the PID status and SubSchedule statuses are completely independent from each other. This means in particular that when a given PID is disabled, no TC of this PID will be released at all, whatever the subschedule</p>
Sub-Schedule ID	The identification of the sub-schedule(s) to be enabled or disabled	<p>By convention, the value 0 for Sub-schedule ID shall mean "all sub-schedules".</p> <p>0..255</p>
N2	Number of PIDs which follow	Same as for N1
PID	Process ID	as per annex 8

TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

5.12.2 TC (11,2) Disable Release of TCs

Description:

The TC 11,2 disables the release of TC from the Command Schedule.

**Structure:**

## Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

## Packet Data Field Info:

- Service Type: 11
- Service Subtype: 2

Application/Source Data: The structure is identical with the one defined for TC(11,1)

**Parameter definition**

1833

**TC Verification**

13153

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.12.3 TC (11,3) Reset Command Schedule****Description:**

1835

The TC 11,3 clears all entries from the Command Schedule.

**Structure:**

3868

## Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

## Packet Data Field Info:

- Service Type: 11
- Service Subtype: 3

Application/Source Data: TC(11,3) does not have any application data, i.e the Application Data field does not exist (length = 0)

**Parameter definition**

1845

**TC Verification**

13154

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.12.4 TC (11,4) Insert TCs in Command Schedule****Description:**

1847

The TC 11,4 inserts the specified TC in the Command Schedule.

**Structure:**

3869

## Packet ID Info:

- Process ID: as per Annex 8

- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 4

Application/Source Data:

Sub-Schedule ID	N	Time Tag	TC Packet
Unsigned Integer	Unsigned Integer	Onboard Format	Byte String
1 byte	1 byte	6 bytes	
		←-----repeat	N times----->

6236

## Parameter definition

Parameters of Application Data Field	Description	Range or value
Sub-schedule ID	The identification of the sub-schedule to which the execution time command is assigned.	1..255
N	Number of TCs to add in the Sub-schedule	
Time Tag	Absolute release time for the TC	Any valid spacecraft time in the specified format
TC packet	Complete TC packet	Max size 228 octets

1857

6276

Commands to be executed via the MTL must have maximum length 228 octets, which includes the 48 bit packet header, as well as 32 bit data field header and 16 bit error control, therefore leaving 216 octets application data. This limitation ensures that the TC 11,4 which contains the TC packet meets the maximum length constraint for uplink of 248 octets.

14272

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13155

### 5.12.5 TC (11,5) Delete TCs from Command Schedule

#### Description:

The TC 11,5 deletes the specified TC from the Command Schedule.

1859

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

3870

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 5

Application/Source Data:

N	Filler	PID	Filler	Sequence Count	Number of TC's
Unsigned integer		Enumerated		Unsigned Integer	Unsigned Integer
1 byte	1 bit	7 bits	2 bits	14 bits	1 byte
	←-----	-----	repeat N times	-----	----->

6297

## Parameter definition

Parameters of Application Data Field	Description	Range or Value
N	Number of TC areas to be deleted	1..TBD
PID	Destination PID of the TC to be deleted	See Annex 10  Value is a copy of the corresponding field of the TC Packet Header of the TC's to be deleted from the command schedule
Sequence Count	The sequence number of the first TC to be deleted	An existing <i>Sequence Count</i> , value is a copy of the corresponding field of the TC Packet Header of the first TC to be deleted from the command schedule
Number of TCs	Number of successive TCs to be deleted. Note that successive TCs are determined by time tag (and not SSC).	All TCs with given PID between Sequence Count and Sequence Count + <i>Number of TC's</i> - 1 shall be deleted.

1869

6326

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13156

### 5.12.6 TC (11,6) Delete TCs from Command Schedule by Time Range

#### Description:

The TC 11,6 deletes all TCs of the Command Schedule between time 1 and time 2.

1871

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

3871

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 6



Application/Source Data:

Range	Time Tag 1	Time Tag 2	N1	Sub-schedule ID	N2	Filler	PID
Enumerated	Onboard time format	Onboard time format	Unsigned Integer	Enumerated	Unsigned Integer		Enum
1 byte	6 bytes	6 bytes	1 byte	1 byte	1 byte	1 bit	7 bits
						<-repeat	N2 times->
				←-----	repeat N1 times--	-----	----->

6347

## Parameter definition

Parameters of Application Data Field	Description	Range or Value
Range	Parameter for interpretation of period given by Time Tags	Range = 0: complete command schedule Range = 1: clear between time tags Range = 2: clear before Time Tag 1 Range = 3: clear after Time Tag 1
Time Tag 1 & 2	Absolute Satellite Time	Onboard time value
N1	Number of Sub-schedules to follow	$N1 = 0$ , the command will effect the TCs of any PID in all sub-schedules  $N1 > 0, N2 = 0$ the command will effect the TCs of any PID in the identified subschedule  $N1 = 1, N2 > 0$ and SubScheduled=0 the command affect the TCs of the selected PIDs in all sub-schedules.
Sub-schedule ID	The identification of the subschedule(s)	By convention, the value 0 for Sub-schedule ID means "all sub-schedules". 1 ... 255
N2	Number of PID combinations to follow	see N1 description
PID	Process ID	See Annex 10

1881

6393

## Remark:

The meaning of Time Tag parameters is as follows:

Range	Time Tag 1	Time Tag 2
0 (ALL)	n/a	n/a
1 (between)	earliest absolute time	latest absolute time
2 (before)	latest absolute time	n/a
3 (after)	earliest absolute time	n/a

11779

11780

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13157

## 5.12.7 TC (11,7) Time-Shift Selected Telecommands

### Description:

8643

The TC 11,7 is a request to shift in time a subset of telecommands selected in the command schedule by the sequence count.

### Structure:

8645

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 7

Application/Source Data:

Time Offset	N	Filler	PRID	Filler	Sequence Count	Number of TC
Relative Time	Unsigned integer		Enumerated		Unsigned integer	Unsigned integer
6 bytes	1 byte	1 bit	7 bits	2 bits	14 bits	1 byte
← repeat N times →						

### Parameter Definition:

8644

Parameters	Description	Range or value
Time Offset	Interval of time to add to the time tag of all selected TC, expressed in OBT format	
N	Number of TC to be shifted	1..Nmax
PID	Destination Process ID of the TC to be time shifted	copy of the PID in the TC Packet Header
Sequence count	Sequence count of the first TC to be time shifted in the command schedule	copy of the sequence count field in the TC Packet Header
Number of TC	Number of successive TC to be time shifted  Note that successive TCs will be determined by time tag (and not SSC).	

9132

### Note:

9157

Nmax is defined by the maximum TC(11,7) size knowing that nesting TC11 into the MTL is to be avoided.

Max data field size = 236 octets => Nmax = 57

### TC Verification

13158

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.12.8 TC (11,8) Time-Shift Selected Telecommands over a Time Period

### Description:

8646

This TC 11,8 is a request to shift in time a subset of telecommands selected in the command schedule by a time period.

### Structure:

8647

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 8

Application/Source Data:

Range	Time Tag 1	Time Tag 2	Time Offset	N1	Sub-schedule ID	N2	Filer	PRID
Enumerated	CUC format	CUC format	CUC format	Unsigned integer	Enumerated	Unsigned integer		Enumerated
1 byte	6 bytes	6 bytes	6 bytes	1 byte	1 byte	1 byte	1 bit	7 bits
							← repeat N2 times →	
←--repeat N1 times -->								

### Parameter Definition:

8648

Parameters	Description	Range or value
Range	Indicating the type of time period covering the TC to shift	0 = complete command schedule 1 = between time tag 1 and time tag 2 2 = before time tag 1 3 = after time tag 1
Time Tag 1	Start time	0 if (Range = 0)
Time Tag 2	End time	0 if Range <> 1
Time Offset	Interval of time to add to the time tag of all selected TC, expressed in OBT format	
N1	Number of concerned Subschedules	0 = all sub-schedules 1 = no subschedule selection (i.e. selection by PID) 2..TBD number of subscheduled to be shifted (=> no PID selection)
Sub-Schedule ID	Sub-schedule ID	1..TBD
N2	Number of concerned Process ID	n/a if N1 = 0 0 if N1 > 1, i.e. no PID selection 1..TBD = number of PID to be shifted
PID	Process Identifier of the TC to be time-shifted	

9158

### Remark:

11801

The meaning of Time Tag parameters is as follows:

Range	Time Tag 1	Time Tag 2
0 (ALL)	n/a	n/a
1 (between)	earliest absolute time	latest absolute time
2 (before)	latest absolute time	n/a
3 (after)	earliest absolute time	n/a

11802

## TC Verification

13159

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.12.9 TC (11,9) Report Subset of Command Schedule in Detailed Form

#### Description:

8649

Upon reception of TC 11,9 the report TM 11,10 will be generated.

#### Structure:

8650

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 9

Application/Source Data:

N	Filler	PRID	Filler	Sequence Count	Number of TC
Unsigned integer		Enumerated		Unsigned integer	Unsigned integer
1 byte	1 bit	7 bits	2 bits	14 bits	1 byte
< -- repeat N times -- >					

#### Parameter Definition:

8651

Parameters	Description	Range or value
N	Number of process IDs to be reported	1..Nmax
PID	Destination Process ID of the TC to be reported	copy of the PID in the TC Packet Header
Sequence count	Sequence count of the first TC to be reported	copy of the sequence count field in the TC Packet Header
Number of TC	Number of successive TC to be reported. Note that successive TCs are determined by time tag (and not SSC).	

9195

#### Note:

9220

Nmax is defined by the maximum TC(11,9) size knowing that nesting TC11 into the MTL is to be avoided.

Max data filed size = 236 octets => Nmax = 58

## TC Verification

13160

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.12.10 TM (11,10) Detailed Schedule Report

#### Description:

1883

The TM 11,10 is the response to TC 11,9, TC 11,11 or TC 11,16.

#### Structure:

3872

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 10

Application/Source Data:

N	Sub-schedule ID	Sub-schedule Status	PID status	Time Tag	TC Packet
uint	enum	uint	uint	CUC	
2 bytes	1 byte	1 byte	1 byte	6 bytes	Variable

←----- N times -----→

#### Parameter definition

1893

Parameters of Source Data Field	Description	Range or Value
N	Number of <i>Time Tag</i> + <i>TC Packets</i> to follow	1..TBD
Sub-schedule ID	The identification of the subschedule	
Sub-schedule Status	Sub-schedule enable status	1 = Enabled 0 = Disabled
PID Status	(TC Packet destination) PID enabled status	1 = Enabled 0 = Disabled
Time Tag	Absolute release time for the TC	Copy of the time tag of the TC in the command schedule
TC Packet	TC packet	Variable

13447

## TC Verification

13421

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.12.11 TC (11,11) Report Subset of Command Schedule in Detailed Form over Time Period

### Description:

The TC 11,11 requests the detailed report of a subset of TCs from the Command Schedule between time 1 and time 2 via TM 11,10.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 11

Application/Source Data:

Range	Time Tag 1	Time Tag 2	N1	Sub-schedule ID	N2	Filler	PRID
Enumerated	CUC format	CUC format	Unsigned integer	Enumerated	Unsigned integer		Enumerated
1 byte	6 bytes	6 bytes	1 byte	1 byte	1 byte	1 bit	7 bits
						← repeat N2 times →	
						←-- repeat N1 times →	

### Parameter definition

Parameters	Description	Range or value
Range	Indicating the type of time period covering the TC to report	0 = complete command schedule 1 = between time tag 1 and time tag 2 2 = before time tag 1 3 = after time tag 1
Time Tag 1	Start time	0 if (Range = 0)
Time Tag 2	End time	0 if Range <> 1
N1	Number of subschedules to be reported	0 = all sub-schedules 1 = no subschedule selection (i.e. selection by PID) 2..TBD number of subscheduled to be reported (=> no PID selection)
Sub-Schedule ID	Sub-schedule ID	1..TBD
N2	Number of concerned Process ID	n/a if N1 = 0 0 if N1 > 1, i.e. no PID selection 1..TBD = number of PID to be reported
PID	Process Identifier of the TC to be reported	See Annex 10

### Remark:

The meaning of Time Tag parameters is as follows:

Range	Time Tag 1	Time Tag 2
0 (ALL)	n/a	n/a
1 (between)	earliest absolute time	latest absolute time
2 (before)	latest absolute time	n/a
3 (after)	earliest absolute time	n/a

11824

## TC Verification

13161

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.12.12 TC (11,12) Report Subset of Command Schedule in Summary Form

#### Description:

8653

Upon reception of TC 11,12 the report TM 11,13 will be generated

#### Structure:

8654

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 12

Application/Source Data:

N	Filler	PRID	Filler	Sequence Count	Number of TC
Unsigned integer		Enumerated		Unsigned integer	Unsigned integer
1 byte	1 bit	7 bits	2 bits	14 bits	1 byte
< -- repeat N times -- >					

#### Parameter Definition:

8655

Parameters	Description	Range or value
N	Number of PIDs to be reported	1..Nmax
PID	Destination Process ID of the TC to be reported	copy of the PID in the TC Packet Header
Sequence count	Sequence count of the first TC to be reported	copy of the sequence count field in the TC Packet Header
Number of TC	Number of successive TC to be reported Note that successive TCs will be determined by time tag (and not SSC).	

9259

#### Note:

9221

Nmax is defined by the maximum TC(11,11) size knowing that nesting TC11 into the MTL is to be avoided.

Max data filed size = 236 octets => Nmax = 58

## TC Verification

13162

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.12.13 TM (11,13) Summary Schedule Report

#### Description:

1907

The TM 11,13 is the response to TC 11,12, TC 11,14 and TC 11,17.

#### Structure:

3874

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 13

Application/Source Data:

N	Sub-schedule ID	Sub-schedule status	PRID status	Time-Tag	TC Packet Header	TC Data Field Header
Unsigned integer	Enumerated	Unsigned integer	Unsigned integer	CUC format	Unsigned integer	Unsigned integer
2 bytes	1 byte	1 byte	1 byte	6 bytes	6 bytes	4 bytes
< --- repeat N times --- >						

#### Parameter definition

1917

Parameters of Source Data Field	Description	Range or Value
N	Number of TC's reported in this TM Source Packet	0..TBD
Sub-schedule ID	The identification of the subschedule	
Sub-schedule Status	Status of the Sub-schedule	1 = enabled 0 = disabled
PID Status	Status of the PID	1 = enabled 0 = disabled
Time Tag		Copy of the time tag of the TC
TC Packet Header	TC Packet Header	
TC Data Field Header	TC Data Field Header	

6604

### 5.12.14 TC (11,14) Report Subset of Command Schedule in Summary Form over Time Period

#### Description:

1919

The TC 11,14 requests the summary report of a subset of TCs from the Command Schedule between time 1 and time 2 via TM 11,13.



## Structure:

3875

### Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

### Packet Data Field Info:

- Service Type: 11
- Service Subtype: 14

### Application/Source Data:

Range	Time Tag 1	Time Tag 2	N1	Sub-schedule ID	N2	Filler	PRID
Enumerated	CUC format	CUC format	Unsigned integer	Enumerated	Unsigned integer		Enumerated
1 byte	6 bytes	6 bytes	1 byte	1 byte	1 byte	1 bit	7 bits
						← repeat N2 times →	
				←-- repeat N1 times →			

## Parameter definition

1929

9280

Parameters	Description	Range or value
Range	Indicating the type of time period covering the TC to report	0 = complete command schedule 1 = between time tag 1 and time tag 2 2 = before time tag 1 3 = after time tag 1
Time Tag 1	Start time	0 if (Range = 0)
Time Tag 2	End time	0 if Range <> 1
N1	Number of subschedules to be reported	0 = all sub-schedules 1 = no subschedule selection (i.e. selection by PID) 2..TBD number of subscheduled to be reported (=> no PID selection)
Sub-Schedule ID	Sub-schedule ID	1..TBD
N2	Number of concerned Process ID	n/a if N1 = 0 0 if N1 > 1, i.e. no PID selection 1..TBD = number of PID to be reported
PID	Process Identifier of the TC to be reported	

## Remark:

11845

The meaning of Time Tag parameters is as follows:

Range	Time Tag 1	Time Tag 2
0 (ALL)	n/a	n/a
1 (between)	earliest absolute time	latest absolute time
2 (before)	latest absolute time	n/a
3 (after)	earliest absolute time	n/a

11846

## TC Verification

13163

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.

- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.12.15 TC (11,15) Time-Shift all time-tagged telecommands

### Description:

1931

The TC 11,15 allows to shift all time-tagged telecommands in time.

### Structure:

3876

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 15

Application/Source Data:

<b>Time Offset</b>
CUC format
6 bytes

9313

### Parameter definition

1941

Parameter	Description	Range or value
Time Offset	Interval of time to add to the time tag of all selected TC, expressed in OBT format	

9320

### TC Verification

13164

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed
  - The computed new time tag is in past (Note: Time Tags later than OBT + 5secs are considered as past)

## 5.12.16 TC (11,16) Report Command Schedule in Detailed Form

### Description:

1943

The TC 11,16 reports the command schedule in a detailed form via TM 11,10.

### Structure:

3877

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11

- Service Subtype: 16

Application/Source Data: none

## Parameter definition

1953

N/A

## TC Verification

13165

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.12.17 TC (11,17) Report Command Schedule in Summary Form

#### Description:

8659

Upon reception of TC 11,17 TM 11,13 will be generated.

#### Structure:

8660

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 17

Application/Source Data: none

#### Parameter Definition:

8661

N/A

## TC Verification

13166

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.12.18 TC (11,18) Report Status of Command Schedule

#### Description:

8662

Upon reception of TC 11,18 TM 11,19 is generated

#### Structure:

8663

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 18

Application/Source Data: none

**Parameter Definition:**

8664

N/A

**TC Verification**

13167

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.12.19 TM (11,19) Command Schedule Status Report**

**Description:**

8665

TM 11,19 is the response to TC 11,18

**Structure:**

8666

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 11
- Service Subtype: 19

Application/Source Data:

N1	Sub-schedule ID	Sub-schedule status	N2	Filler	PRID	PRID status
Unsigned integer	Enumerated	Unsigned integer	Unsigned integer		Enumerated	Unsigned integer
1 byte	1 byte	1 byte	1 byte	1 bit	7 bits	1 byte
				< - repeat N2 times ->		
< --- repeat N1 times --- >						

**Parameter Definition:**

8667

Parameters	Description	Range or value
N1	Repetition counter for subschedule related information	
Sub-schedule ID	identification of the sub-schedule	0 = global status report
Sub-Schedule status	Status of the corresponding sub-schedule	0 = disabled 1 = enabled
N2	Repetition counter for PID related information	= number of registered PIDs when Sub-Sch ID = 0  =0 for all other Sub-Sch ID
PID	Process identification of the TC	copy of the field in TC Packet Header
Status	Status of the corresponding PID	0 = disabled 1 = enabled

9329

## 5.13 Service 12: Onboard Parameter Monitoring

### Objective

1955

**Parameter monitoring** allows a single parameter contained in the on-board data pool to be monitored against a limit set or an expected status value and react with a specified event report, if the parameter gets out-of-limit. To achieve this, the Service maintains a parameter monitoring list, which checks the parameters according to the defined monitoring constraints and the related filtering rule.

### Description

1956

A **Parameter Monitoring List** is maintained which contains the parameter monitoring information, drives the parameter monitoring activity and the generation of Out-of-Limit Reports.

The ground segment can modify or report the contents of the Parameter Monitoring List using Service requests to:

- reset the monitoring list;
- add parameters to, or delete parameters from, the monitoring list;
- modify the monitoring information of parameters in the monitoring list;
- enable or disable the monitoring of parameters in the monitoring list;
- report the monitoring information for all parameters in the monitoring list;
- report the set of parameters which are currently out-of-limits.

The ground system can also modify an attribute of the on-board monitoring service which determines whether the monitoring of parameters is enabled or disabled at service level.

### Notes

1957

When one of the monitoring triggers, an event with the event ID defined in the monitoring entry is generated. The parameters associated to that monitoring have the following structure:

Parameter	Description	Range or Value
MON_ID	(Parameter) Monitoring Identifier	Unsigned integer on 1 byte 1..255
PARAMETER_ID	Identifier of the monitored (Data Pool) Parameter	Enumerated on 4 bytes Any valid value of the list of predefined parameters
MASK	Bit mask used to monitor only selected bits from a composite parameter	Unsigned integer on 4 bytes bit pattern
MON_PARAMETER_VALUE	Parameter value	Type depends on the monitored parameter 8 bytes
LIMIT_CROSSED	This shall be the value of the Expected, Low Limit or High Limit, w.r.t. which the monitoring triggered. The format and length is deduced from the monitored parameter type.	Type depends on the monitored parameter 8 bytes
PREVIOUS_CHECK_STATUS	Checking status of the parameter before the transition to the current checking status.	Enumerated on 1 byte 0x00 = VALID 0x01 = UNCHECKED 0x02 = INVALID 0x04 = UNEXP_OR_BELOW 0x05 = ABOVE_HIGH
CURRENT_CHECK_STATUS	Current value of the checking status	Enumerated on 1 byte 0x00 = VALID 0x01 = UNCHECKED 0x02 = INVALID 0x04 = UNEXP_OR_BELOW 0x05 = ABOVE_HIGH
TRANSITION_TIME	The time at which the transition occurred, i.e. the time of the first sample used to elaborate the current checking status.	CUC format (6 bytes): <ul style="list-style-type: none"> <li>the first 4 bytes give the number of seconds (coarse part of the time),</li> <li>the 2 next bytes give the number of subseconds (fine part of the time).</li> </ul>

13476

### 5.13.1 TC (12,1) Enable Monitoring of Parameters

#### Description:

The TC 12,1 allows to enable the monitoring of parameters globally or for the specified Monitoring entries.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

1959

3878

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 1

Application/Source Data:

N	Monitoring ID
Unsigned Integer	Unsigned integer
1 byte	1 byte
	<-repeat N times->

6969

**Parameter definition**

Parameters of Application Data Field	Description	Range or Value
N	Number of Monitoring ID to be enabled	<p><b>N = 0:</b> The monitoring at service level will be set to "ENABLED" with each individual entry remaining in its current state.</p> <p><b>N &gt; 0:</b> Each specified monitor will be set to "ENABLED"</p>
Monitoring ID	Identification of the monitoring to enable in the Parameter Monitoring List for a given CSW application (see note)	1..255

1969

6982

**Note:**

This command applies only to service 12 instantiation corresponding to the CSW Application ID specified in the command header (e.g. System or AOCS).

9362

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13168

### 5.13.2 TC (12,2) Disable Monitoring of Parameters

**Description:**

The TC 12,2 allows to disable the monitoring of parameters globally or for the specified Monitoring entries.

1971

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

3879

Packet Data Field Info:

- Service Type: 12

- Service Subtype: 2

Application/Source Data:

N	Monitoring ID
Unsigned Integer	Unsigned integer
1 byte	1 byte
	<-repeat N times->

9363

## Parameter definition

Parameters of Application Data Field	Description	Range or Value
N	Number of Monitoring ID to be disabled	<p><b>N = 0:</b> The monitoring at service level will be set to "DISABLED" with each individual entry remaining in its current state.</p> <p><b>N &gt; 0:</b> Each specified monitor will be set to "DISABLED"</p>
Monitoring ID	Identification of the monitoring to disable in the Parameter Monitoring List for a given CSW application (see note)	1..255

1981

9376

### Note:

This command applies only to service 12 instantiation corresponding to the CSW Application ID specified in the command header (e.g. System or AOCS).

9389

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13169

### 5.13.3 TC (12,3) Change Maximum Report Delay

#### Description:

The TC 12,3 modifies the maximum reporting delay which is used for Check Transition Report TM(12,12) generation.

11341

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 3

11342



Application/Source Data:

<b>Max Reporting Delay</b>
Unsigned Integer
1 byte

11344

### Parameter definition

11343

Parameter	Description	Value or range
Max Reporting Delay	the maximum reporting delay for the check transition report expressed in number of 8Hz cycle.	0 = no transition report generated

11351

### TC Verification

13170

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.13.4 TC (12,4) Clear Monitoring List

#### Description:

1983

The TC 12,4 clears all entries from the Parameter Monitoring List.

It is recommended NOT to use this TC in Flight.

#### Structure:

3880

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 4

Application/Source Data: none

#### Parameter definition

1993

N/A

#### TC Verification

13171

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.13.5 TC (12,5) Add/Modify Parameters to the Monitoring List

#### Description:

1995

The TC 12,5 adds/modifies one Monitoring entry to the Parameter Monitoring List. If the *Monitoring ID* already exists the new record shall replace the old one.

#### Structure:

3881

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 5

Application/Source Data:

Z	Monitoring ID	Parameter ID	Validity Parameter	Parameter Monitoring Interval	Rep	Monitoring Status	NOL	Limit Monitoring Criteria	NOE	Expected Value Monitoring Criteria
Uns Int	Uns Int	Enum	Enum	Uns Int	Uns Int	Enum	Uns Int	Enum	Uns Int	Enum
1 byte	1 byte	4 bytes	4 bytes	2 bytes	1 byte	1 byte	1 byte	20 bytes	1 byte	10 bytes

<-repeat N times->

Limit Monitoring Criteria			
Low Limit	EID	High Limit	EID
Deduced	Uns Int	Deduced	Uns Int
8 bytes	2 bytes	8 bytes	2 bytes

Expected Value Monitoring Criteria		
Mask	Expected Value	EID
Uns Int	Deduced	Uns Int
4 bytes	4 bytes	2 bytes

Parameter definition

Parameters of Application Data Field	Description	Range or Value
N	Repetition of the following fields	1..TBD
Monitoring ID	ID of Monitoring Control Table Entry	1..TBD
Parameter ID	Unique identification of the parameter to monitor	
Validity Parameter	A <i>Parameter ID</i> whose value determines whether a parameter to be monitored is valid or not.	By convention, if the validity ParameterID is 0, the corresponding parameter monitoring is always valid (i.e. it shall always be checked).  Note that the validity parameter can have values true (1), indicating the monitoring is valid, and false (0) indicating invalid.

2005

7044

Parameters of Application Data Field	Description	Range or Value
Parameter Monitoring Interval	Defines the number of cycles in between two subsequent monitorings	1..TBD  <i>cycle</i> identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)
Rep	Repetition Interval; The number of successive samples of the parameter required to establish a new checking status for an expected-value-check or a limit-check (i.e. the number of samples before a parameter is declared as out of limit/unexpected value, or as having returned within limit/expected value)	1..255
Monitoring Status	The Boolean parameter whose value determines whether monitoring of this entry is applied.	0 - disabled 1 - enabled
NOL	Presence of limit check definition	0 - no limit check definition, mandatory if NOE=1  1 - limit value check, mandatory if NOE=0
Low Limit	Low Limit	Limit value, right aligned if not the complete field length is required (pad with zeroes to the left)
EID	Event ID associated with the low limit of the monitoring description	Any valid EID, see Annex 9
High Limit	High Limit	Limit value, right aligned if not the complete field length is required (pad with zeroes to the left).
EID	Event ID associated with the high limit of the monitoring description	Any valid EID, see Annex 9
NOE	Presence of expected value check definition	0 = no expected value check, mandatory if NOL = 1  1 = expected value check, mandatory if NOL =0
Mask	Bit mask used to monitor only selected bits from a composite parameter	
Expected Value	Expected value	Limit value, right aligned if not the complete field length is required (pad with zeroes to the left).
EID	Event ID associated with the expected value of the monitoring description	Any valid EID, see Annex 9

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.13.6 TC (12,6) Delete Parameters from the Monitoring List

#### Description:

2007

The TC 12,6 deletes one Monitoring entry from the Parameter Monitoring List.

#### Structure:

3882

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 6

Application/Source Data:

N	Monitoring ID
Unsigned Integer	Unsigned Integer
1 byte	1 byte
	<-repeat N times->

7097

#### Parameter definition

2017

Parameters of Application Data Field	Description	Range or value
N	Number of Parameters to follow	1..TBD
Monitoring ID	ID of Monitoring Control Table Entry	1..TBD

7110

## TC Verification

13173

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.13.7 TC (12,7) Modify Parameter Checking Information

#### Description:

2019

The TC 12,7 allows to modify the monitoring criteria of one Monitoring entry.

#### Structure:

3883

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 7

Application/Source Data:

Limit Monitoring Criteria			
Low Limit	EID	High Limit	EID
Deduced	Uns Int	Deduced	Uns Int
8 bytes	2 bytes	8 bytes	2 bytes

Expected Value Monitoring Criteria		
Mask	Expected Value	EID
Uns Int	Deduced	Uns Int
4 bytes	4 bytes	2 bytes

N	Monitoring ID	NOL	Limit Monitoring Criteria	NOE	Expected Value Monitoring Criteria
Unsigned Integer	Unsigned Integer	Unsigned Integer	Enumerated	Unsigned Integer	Enumerated
1 byte	1 byte	1 byte	20 bytes	1 byte	10 bytes
	<-repeat N times->	<-repeat N times->	<-repeat N times->	<-repeat N times->	<-repeat N times->

7123

Parameter definition

Parameters of Application Data Field	Description	Range or Value
N	Repetition of the following fields	1..TBD
Monitoring ID	ID of Monitoring Control Table Entry	1..TBD
NOL	Presence of limit check definition	0 - no limit check definition, mandatory if NOE=1  1 - limit value check, mandatory if NOE=0
Low Limit	Low Limit	Limit value, right aligned if not the complete field length is required (pad with zeroes to the left).
EID	Event ID associated with the low limit of the monitoring description	Any valid EID, see Annex 9
High Limit	High Limit	Limit value, right aligned if not the complete field length is required (pad with zeroes to the left).

2029

7152

Parameters of Application Data Field	Description	Range or Value
EID	Event ID associated with the high limit of the monitoring description	Any valid EID, See Annex 9
NOE	Presence of expected value check definition	0 - no expected value check, mandatory if NOL=1  1 - expected value check, mandatory if NOL=0
Mask	Bit mask used to monitor only selected bits from a composite parameter.	bit pattern
Expected Value	Expected Value	Limit value, right aligned if not the complete field length is required (pad with zeroes to the left).
EID	Event ID associated with the expected value of the monitoring description	Any valid EID, see Annex 9

## TC Verification

13174

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.13.8 TC (12,8) Report Current Parameter Monitoring List

### Description:

2031

The TC 12,8 requests the report of all entries in the current PML via TM 12,9.

### Structure:

3884

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 8

Application/Source Data: TC(12,8) does not have any application data, i.e. the *Application Data* field within the *TC Packet Data* field

does not exist (length = 0).

### Parameter definition

2041

N/A

## TC Verification

13175

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.13.9 TM (12,9) Current Parameter Monitoring List Report

### Description:

2043

The TM 12,9 is the response to TC 12,8.

### Structure:

3885

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 9

Application/Source Data:

Monitoring	Maximum reporting Delay	N	Monitoring ID	Parameter ID	Validity Parameter	Parameter Monitoring Interval	Rep	Monitoring Status	NOL	Limit Monitoring Criteria	NOE	Expected Value Monitoring Criteria
Enum	Uns Int	Uns Int	Uns Int	Enum	Enum	Uns Int	Uns Int	Enum	Uns Int	Enum	Uns Int	Enum
1 byte	1 byte	1 byte	1 byte	4 bytes	4 bytes	2 bytes	1 byte	1 byte	1 byte	20 bytes	1 byte	10 bytes
<-repeat N times->												

Limit Monitoring Criteria			
Low Limit	EID	High Limit	EID
Deduced	Uns Int	Deduced	Uns Int
8 bytes	2 bytes	8 bytes	2 bytes

Expected Value Monitoring Criteria		
Mask	Expected Value	EID
Uns Int	Deduced	Uns Int
4 bytes	4 bytes	2 bytes

### Parameter definition

2053

Parameters of Source Data Field	Description	Range or value
Monitoring	Indicates whether the overall monitoring is enabled	(Value = 0 ) => disabled (Value = 1 ) => enabled
Maximum Reporting Delay	The maximum reporting delay for the check transition report	
N	Repetition count for the following fields	

7300

Parameters of Source Data Field	Description	Range or value
Monitoring ID	ID of Monitoring Control Table Entry	1..TBD
Parameter ID	Unique identification of the parameter to monitor	
Validity Parameter	A Boolean parameter whose value determines whether a parameter is valid or not.	By convention, if the validity ParameterID is 0, the corresponding parameter is always valid (i.e. it shall always be checked).  Note that the validity parameter can have values true (1), indicating the monitoring is valid, and false (0) indicating invalid.
Parameter Monitoring Interval	Defines the number of cycles in between two subsequent monitorings	1...TBD <i>cycle</i> identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10).
Rep	Repetition Interval; The number of successive samples of the parameters to establish a new checking status for an expected-value-check or a limit-check.	1..TBD
Monitoring Status	The Boolean parameter whose value determines whether monitoring of this entry is applied.	0 - disabled 1 - enabled
NOL	Presence of limit check definition	0 - no limit check definition, mandatory if NOE=1  1 - limit value check, mandatory if NOE=0
Low Limit	Low Limit	Limit value, right aligned if not the complete field length is required (pad with zeroes to the left).
EID	Event ID associated with the low limit of the monitoring description	See Annex 9
High Limit	High Limit	Limit value, right aligned if not the complete field length is required (pad with zeroes to the left).
EID	Event ID associated with the high limit of the monitoring description	See Annex 9



Parameters of Source Data Field	Description	Range or value
NOE	Presence of expected value check definition	0 - no expected value check, mandatory if NOL=1  1 - expected value check, mandatory if NOL=0
Mask	Bit mask used to monitor only selected bits from a composite parameter	bit pattern
Expected Value	Expected Value	Limit value, right aligned if not the complete field length is required (pad with zeroes to the left).
EID	Event ID associated with the monitoring description	See Annex 9

### 5.13.10 TC (12,10) Report Current Out of Limit List

#### Description:

2055

The TC 12,10 requests the report of all the current out of limits via TM 12,11.

#### Structure:

3886

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 10

Application/Source Data: TC(12,10) does not have any application data, i.e. the *Application Data* field within the *TC Packet Data* field does not exist (length = 0).

#### Parameter definition

2065

N/A

#### TC Verification

13176

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.13.11 TM (12,11) Current Out of Limit List Report

#### Description:

2067

The TM 12,11 is the response to TC 12,10.

#### Structure:

3887

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 11

Application/Source Data:

N	Monitoring ID	Parameter ID	Mask	Parameter Value	Limit Crossed	Previous Checking Status	Current Checking Status	Transition Time <sup>7377</sup>
Unsigned Integer	Unsigned Integer	Enumerated	Unsigned Integer	Deduced	Deduced	Enumerated	Enumerated	Satellite Time
2 bytes	1 byte	4 bytes	4 bytes	8 bytes	8 bytes	1 byte	1 byte	6 bytes
	<-----	-----	-----	-----Repeat	N times-----	-----	-----	----->

Parameter definition

2077

7418

Parameters of Source Data Field	Description	Range or Value
N	Repetition count for following fields	Number of entries following
Monitoring ID	Identification of a monitoring control table entry	1..TBD
Parameter ID	Number uniquely identifying a parameter out of a list	Any valid value of the list of predefined parameters
Parameter Value	Value of the parameter at last checking status transition	Deduced
Mask	Bit mask used to monitor only selected bits from a composite parameter	bit pattern
Limit Crossed	High or low limit or expected state crossed or violated	Copy of the relevant entry of the monitoring definition. Note value is right aligned if not all bytes are used (pad with zeroes to the left).
Previous Checking Status	Checking status of the parameter before the detected transition of the checking status	0 = "in limits" or "expected value" 1 = unchecked 2 = invalid 3 = unselected (not used) 4 = "unexpected value" or "below low limit", "below low threshold" 5 = "above high limit" or "above high threshold"
Current Checking Status	Checking status of the parameter after the detected transition of the checking status	Same as above
Transition Time	-Time of the transition detection	value at detection of transition of checking status

## 5.13.12 TM(12,12) Check Transition Report

### Description:

The TM12,12 check transition report is an on-board autonomously initiated telemetry, which reports the content of the transition reporting list established since the last time a check transition report was issued.

### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 12
- Service Subtype: 12

Application/Source Data:

N	Monitoring ID	Parameter ID	Mask	Parameter Value	Limit crossed	Previous Checking Status	Current Checking Status	Transition Time
Uns. Int.	Enum.	Enum.	Uns. Int.	(deduced)	(deduced)	Enum.	Enum.	CUC format
2 bytes	1 byte	4 bytes	4 bytes	8 bytes	8 bytes	1 byte	1 byte	6 bytes
← repeat N times →								

### Parameter definition

Parameters	Description	Value or range
N	Number of monitoring reported in the current TM(12,9) packet	
Monitoring ID	Monitoring Identifier in the monitoring List for the specific CSW application	
Parameter ID	Identification of the monitored parameter	
Mask	Bit mask used to monitor only selected bits from a composite parameter	
Parameter Value	Value of the TM parameter at the time the last checking status transition was detected.  The format and length of this parameter are deduced from the monitored parameter type.	Note value is right aligned if not all bytes are used (pad with zeroes to the left).
Limit Crossed	Value of the limit (i.e Expected Status, Low Limit or High Limit) that triggered.  The format and length of this parameter are deduced from the monitored parameter type.	
Previous Checking Status	Checking status of the parameter before the transition to the current	0 = Expected Value/ Within Limits 1 = Unchecked

Parameters	Description	Value or range
	checking status	2 = Invalid 4 = Unexpected / Below Low Limit 5 = Above High Limit
Current Checking Status	Current checking status	0 = Expected Value/ Within Limits 1 = Unchecked 2 = Invalid 4 = Unexpected / Below Low Limit 5 = Above High Limit
Transition Time	Time at which the transition occurred (i.e. time of the first sample used to elaborate the current checking status)	

## 5.14 Service 13: Large Data Transfer

### Objective

The service 13 provides the Ground with the capability to transfer large data files with the spacecraft in a controlled manner.

The service 13 uplink capability will be implemented between the Ground and the CSW in the OBC. The transfer mechanism will split the large data units into parts and transmit each part within a single service 13 TC packet. The large data files will be transferred on-board into so-called partitions, e.g. in OBC Mass Memory or SGM.

The service 13 downlink capability will be implemented between the SSMM and the Ground. The transfer mechanism will split the large data units into parts and transmit each part within a single service 13 TM source packet. The detailed TM/TC structures are available in RD9.

### Description

Large data files to be uplinked via service 13 will be split into the following parts:

- first part containing the Data Unit characteristics (e.g. File size) and a first part of data
- intermediate part(s) containing the Data Unit data
- last part containing the last split of data and a CRC

Each part will be uplinked by a dedicated service 13 command.

At the end of a File Transfer it will be possible to confirm the reception of all File Transfer data units. In case of unsuccessful transfer it will be possible to request a retransmission of the relevant File Transfer data units.

A File has an associated "Attribute" parameter which define the type of file being transferred, and is in the following range:

Attribute	Meaning
1	OBCP
2	TC sequence - delayed
3	TC sequence - immediate
4	UNUSED
5	UNUSED
6	Other
7	Fat – internal SW use only

The File Transfer service 13 will be typically used to uplink:

- TC files (for immediate or delayed execution)
- Profiles and Ephemeris
- OBCP

The File Transfer service 13 will be typically used to downlink:

- data files from the SSMM (e.g. science files).

The type of file to transfer will be specified in the attribute field of the Data Unit Header.

## Notes

2081

### 5.14.1 TC (13,9) Accept First Uplink Part

#### **Description:**

2083

The TC 13,9 starts a new File Transfer session.

#### **Structure:**

3888

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 9

Application/Source Data:

Large Data Unit ID	Sequence Number	Service Data Unit (SDU)				
		SDU Header				SDU Data
		Partition ID	File ID	File Size	File Attribute	Data
Uns. int.	Uns. int.	Enum.	Uns. Int	Uns.int.	Uns. Int.	
1 byte	2 bytes	1 byte	4 bytes	4 bytes	4 bytes	N*bytes

2092

## Parameter definition

Parameters	Description	Value or range
Large Data Unit ID	Identifier of the File Transfer session	>0
Sequence Number	Number used to reconstruct the file on board.  The File Transfer data will be merged sequentially by increasing Sequence number.	1 (fixed for first part command)
Partition ID	Target storage area for the uploaded data	Partition IDs are defined in [RD5]
File ID	Identifier of the uploaded File	
File Size	Actual file size in bytes for the useful data (for allocation on target storage area), i.e. without SDU header and file checksum	
File Attribute	Attribute of the uploaded File	See general description above (section 5.14)
Data	Useful data for the file content	

9431

## Notes

The length of the Service Data Unit (SDU) (including header and data) of TC(13,9) will determine the expected size of the TC(13,10) intermediate SDUs.

9464

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13179

### 5.14.2 TC (13,10) Accept Intermediate Uplink Part

#### Description:

The command 13,10 continues an on-going File Transfer session.

2094

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

3889

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 10

Application/Source Data:

Large Data Unit ID	Sequence Number	SDU Data
Uns. int.	Uns. int.	Data
1 byte	2 bytes	Variable (same size as TC(13,9) SDU)

## Parameter definition

Parameters	Description	Value or Range
Large Data Unit ID	Identifier of the File Transfer session	
Sequence Number	Number used to reconstruct the file on board.  The File Transfer data will be merged sequentially by increasing Sequence number.	> 1
SDU Data	Useful data for the file content	

## Notes

The TC(13,10) SDU length shall be the same as the TC(13,9) SDU length.

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.14.3 TC (13,11) Accept Last Uplink Part

#### Description:

The command 13,11 ends a File Transfer session.

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 11

Application/Source Data:

Large Data Unit ID	Sequence Number	Service Data Unit (SDU)	
		SDU Data	SDU Trailer
		Data	File Checksum
Uns. int.	Uns. int.		Uns. Int.
1 byte	2 bytes	Variable	4 bytes

## Parameter definition

Parameters	Description	Value or Range
Large Data Unit ID	Identifier of the File Transfer session	
Sequence Number	Number used to reconstruct the file on board.  The File Transfer data will be	> 1

Parameters	Description	Value or Range
	merged sequentially by increasing Sequence number.	
SDU Data	Useful data for the file content	
File Checksum	Checksum for file content verification	

## Notes

The TC(13,11) SDU length will not be the same as the TC(13,9) or TC(13,10) SDU length. It will depend on the size of the File Transfer data.

The File Checksum can be broken down into another TC(13,11) packet if the SDU data and File checksum do not fit in the last data packet.

If the File attribute is "TC SEQUENCE - IMMEDIATE", the file is executed as a TC sequence once the TC(13,11) has been successfully completed. In this case the CSW will create a TC 134,1 with "TC Sequence Identifier" set by default to 1, and with TC execution rate of 1 Hz.

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.14.4 TC (13,13) Abort Reception of Uplinked Data

#### Description:

The command 13,13 aborts a file transfer session, or confirms an on-board autonomous abort as reported by TM 13,16.

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 13

Application/Source Data:

<b>Large Data Unit ID</b>
Unsigned integer
1 byte

#### Parameter definition

Parameter	Description	Value or range
Large Data Unit ID	Identifier of the File Transfer session	



## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.14.5 TM (13,14) Uplink Reception Acknowledgement Report

#### Description:

2127

The TM 13,14 reports the acknowledgement of the successful reception of the large service data units up to a sequence number, and the completion of the file upload and storage.

#### Structure:

3892

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 14

Application/Source Data:

Large Data unit ID	Sequence Number
Unsigned integer	Unsigned integer
1 byte	2 bytes

9521

#### Parameter definition

2136

Parameter	Description	Value or range
Large Data unit ID	Identifier of the File Transfer session	
Sequence Number	Number up to which (included) the File Transfer has successfully received the SDU	

9531

### 5.14.6 TM (13,15) Unsuccessfully Received Parts Report

#### Description:

2138

The TM 13,15 reports the parts which have not been successfully received on board (not yet received or erroneously received).

It is sent as an answer to TC(13,11) when it is not possible to end the current file transfer session because some segments are missing.

#### Structure:

3893

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 13

- Service Subtype: 15

Application/Source Data:

Large Data Unit ID	N	Sequence Number
Unsigned integer	Unsigned integer	Unsigned integer
1 byte	2 bytes	2 bytes
		<-- N times -->

9544

### Parameter definition

Parameter	Description	Value or range
Large Data unit ID	Identifier of the File Transfer session	
N	Number of NOT received parts reported in the current TM(13,15) packet	
Sequence Number	Sequence number of not successfully received parts	

2147

9561

### 5.14.7 TM (13,16) Reception Abort Report

#### Description:

The TM 13,16 reports the abort of the uplink session.

2149

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

3894

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 16

Application/Source Data:

Large Date Unit ID	Reason Code
Unsigned integer	enumerated
1 byte	4 bytes

9578

### Parameter definition

Parameter	Description	Value or range
Large Data Unit ID	Identifier of the File Transfer session	
Reason code	Reason of the Abort	0 = File Manager Service Storage Error 1 = Checksum Error 2 = File Transfer time-out

2158

9588

## 5.14.8 TC (13,128) Change File Transfer Time-out value

### Description:

The command 13,128 changes the File Transfer time-out value.

### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 128

Application/Source Data:

<b>File transfer Time-out</b>
Unsigned integer
4 bytes

### Parameter definition

Parameter	Description	Value or Range
FT time-out	Value of the File Transfer Time-out (in seconds)	

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.14.9 TC (13,129) Start file transfer session

### Description:

The command 13,129 starts a File Transfer session downlink. This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 129

Application/Source Data: See RD9

### Parameter definition

See RD9

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.14.10 TM (13,130) Report of start of low-level file transfer

#### Description:

2182

This is implemented in the SSMM SW only.

#### Structure:

3897

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 130

Application/Source Data: See RD9

#### Parameter definition

2191

See RD9

### 5.14.11 TC (13,131) Suspend file transfer session

#### Description:

2193

This is implemented in the SSMM SW only.

#### Structure:

3898

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 131

Application/Source Data: See RD9

#### Parameter definition

2202

See RD9

## TC Verification

13185

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.14.12 TC (13,132) Resume file transfer session

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 132

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

2204

3899

2213

13186

## 5.14.13 TC (13,133) Terminate file transfer session

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 133

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

2215

3900

2224

13187

## 5.14.14 TC (13,134) Abort file transfer session

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 134

Application/Source Data: see RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

2226

3901

2235

13188

## 5.14.15 TC (13,135) Change file transfer session parameters

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 135

Application/Source Data: see RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

2237

3902

2246

13189

## 5.14.16 TC (13,136) Change file transfer session End Of File Transfer timeout

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 136

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

2248

3903

2257

13190

## 5.14.17 TC (13,137) Change file transfer downlink VC

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 137

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

8673

8674

8675

13191

## 5.14.18 TC (13,138) Change file transfer retransmit limit

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 138

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

2259

3904

2268

13192

## 5.14.19 TC (13,139) Request file transfer parameter report

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 139

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

2270

3905

2279

13193



## 5.14.20 TM (13,140) File transfer parameter report

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 140

Application/Source Data: See RD9

### Parameter definition

See RD9

2281

3906

2290

## 5.14.21 TC (13,141) Enable/disable low-level file transfer

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 141

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

2292

3907

2301

13195

## 5.14.22 TC (13,142) Start low-level file transfer

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

2303

3908

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 142

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.14.23 TC (13,143) Suspend low-level file transfer

#### Description:

This is implemented in the SSMM SW only.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 143

Application/Source Data: see RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.14.24 TC (13,144) Resume low-level file transfer

#### Description:

This is implemented in the SSMM SW only.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 144

Application/Source Data: see RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.14.25 TC (13,145) Abort low-level file transfer

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 145

Application/Source Data: see RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.14.26 TC (13,146) Repeat low-level file transfer parts

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13

- Service Subtype: 146

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.14.27 TC (13,147) Confirm successful reception of all low-level file transfer parts

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 147

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.14.28 TC (13,148) Request low-level file transfer end of transfer report

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 148

Application/Source Data: See RD9

**Parameter definition**

See RD9

2378

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13202

**5.14.29 TM (13,149) Low-level file transfer end of file transfer report****Description:**

This is implemented in the SSMM SW only.

2380

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

3915

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 149

Application/Source Data: see RD9

**Parameter definition**

See RD9

2389

**5.14.30 TM (13,150) Retransmission limit reached****Description:**

This is implemented in the SSMM SW only.

2391

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

3916

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 150

Application/Source Data: see RD9

**Parameter definition**

See RD9

2400

## 5.14.31 TM (13,151) End Of File Transfer timeout

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 151

Application/Source Data: see RD9

### Parameter definition

See RD9

8677

8678

8679

## 5.14.32 TM (13,152) Low-level file transfer abort report

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13
- Service Subtype: 152

Application/Source Data: see RD9

### Parameter definition

See RD9

2402

3917

2411

## 5.14.33 TM (13,153) File data unit

### Description:

This is implemented in the SSMM SW only.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 13

2413

3918

- Service Subtype: 153

Application/Source Data: See RD9

## Parameter definition

See RD9

2422

## 5.15 Service 14: Packet Forwarding Control

### Objective

The packet forwarding control service provides the capability to control the forwarding to the ground of telemetry source packets issued by on-board services. This only applies to the real time VC.

2424

### Description

The packet forwarding control service maintains the knowledge of which packets can be transmitted to the ground system per Process ID.

2425

Per default the packet forwarding status for all packets of the on-board Process ID's is enabled.

For a given Process ID, the forwarding of packets can be "enabled" and "disabled" at the level of:

- a type of packet
- a subtype of packet
- a housekeeping packet definition, a diagnostic packet definition or an event report definition.

The forwarding of packets with a given type and subtype shall be "enabled" if and only if the packet type and the packet subtype are both enabled (i.e. if the type is in the set of enabled types and the subtype is in the set of enabled subtypes for that type).

In addition, the forwarding of housekeeping (or diagnostic or event report) packets shall be "enabled" if and only if the packet type, the packet subtype and the housekeeping packet definition (or the diagnostic packet definition or the event report definition) are all enabled.

2426

### Notes

#### 5.15.1 TC (14,1) Enable Forwarding of TM Packets

##### **Description:**

This TC 14,1 enables the transmission of the specified TM Source Packet.

2428

##### **Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 1

3919

Application/Source Data:

N1	Filler	PRID	N2	Type	N3	Sub type
Uns. Int.		Enum.	Uns. Int.	Enum.	Uns. Int.	Enum.
1 byte	1 bit	7 bit	1 byte	1 byte	1 byte	1 byte
						← repeat N3 times →
					← repeat N2 times →	
← repeat N1 times →						

## Parameter definition

2438

Parameters of Application Data Field	Description	Range or Value
N1	Number of PID's to follow	1 .. TBD
PID	Process ID	See Annex 8
N2/N3	The number of type definition to follow	<p><b>N2 = 0:</b> all types of telemetry source packets from the corresponding application process shall be placed in the set of enabled types.</p> <p><b>N2 &gt; 0, N3 = 0:</b> the specified types of telemetry source packets from the corresponding application process shall be added to the set of enabled types.</p> <p><b>N2 &gt; 0, N3 &gt; 0:</b> the specified subtypes of telemetry source packets from the corresponding application process shall be added to the set of enabled subtypes for the specified type.</p> <p>Note: If N2 &gt; 1 then there can be a mixture of empty (N3 = 0) and non-empty (N3 &gt; 0) arrays.</p>
Type	The telemetry source packet type	Any valid service type of the specified <i>PID</i> .
Subtype	The telemetry source packet service subtype for the specified service type	Any valid <i>Subtype</i> of the specified <i>Type</i>

6815

## TC Verification

13203

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.15.2 TC (14,2) Disable Forwarding of TM Packets

#### Description:

2440

This TC 14,2 disables the transmission of the specified TM Source Packet.

#### Structure:

3920

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

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- Service Type: 14
- Service Subtype: 2

Application/Source Data:

N1	Filler	PRID	N2	Type	N3	Sub type
Uns. Int.		Enum.	Uns. Int.	Enum.	Uns. Int.	Enum.
1 byte	1 bit	7 bit	1 byte	1 byte	1 byte	1 byte
						← repeat N3 times →
					← repeat N2 times →	
← repeat N1 times →						

## Parameter definition

2450

6840

Parameters of Application Data Field	Description	Range or Value
N1	Number of PID's to follow	1..TBD
PID	Process ID	See Annex 8
N2/N3	The number of type definition to follow	<p><b>N2 = 0:</b> all types of telemetry source packets from the corresponding application process shall be removed from the set of enabled types.</p> <p><b>N2 &gt; 0, N3 = 0:</b> the specified types of telemetry source packets from the corresponding application process shall be removed from the set of enabled types.</p> <p><b>N2 &gt; 0, N3 &gt; 0:</b> the specified subtypes of telemetry source packets from the corresponding application process shall be removed from the set of enabled subtypes for the specified type.</p> <p>Note: If N2 &gt; 1 then there can be a mixture of empty (N3 = 0) and non-empty (N3 &gt; 0) arrays.</p>
Type	The telemetry source packet type	Any valid service type of the specified <i>PID</i> .
Subtype	The telemetry source packet service subtype for the specified service type.	Any valid <i>Subtype</i> of the specified <i>Type</i>

## TC Verification

13204

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.15.3 TC (14,5) Enable Forwarding of HK Packets

#### Description:

2452

The TC 14,5 enables the forwarding of the specified HK packets.

3921

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 5

Application/Source Data:

N1	Filler	PRID	N2	SID
Uns. Int.		Enum.	Uns. Int.	Enum.
1 byte	1 bit	7 bit	1 byte	1 byte
			← repeat N2 times →	
← repeat N1 times →				

**Parameter definition**

Parameters	Description	Range or value
N1	Repetition count for the following fields	
PID	Process ID	See Annex 8
N2	Number of HK packet definitions to be enabled	
SID	Structure ID of a HK Report Definition	See Annex 10

2462

9617

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13205

**5.15.4 TC (14,6) Disable Forwarding of HK Packets**

**Description:**

The TC 14,6 disables the forwarding of the specified HK packets.

2464

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 6

3922

Application/Source Data:

N1	Filler	PRID	N2	SID
Uns. Int.		Enum.	Uns. Int.	Enum.
1 byte	1 bit	7 bit	1 byte	1 byte
← repeat N2 times →				
← repeat N1 times →				

## Parameter definition

2474

Parameters	Description	Range or value
N1	Repetition count for the following fields	
PID	Process ID	See Annex 8
N2	Number of HK packet definitions to be disabled	
SID	Structure ID of a HK Report Definition	See Annex 10

9638

## TC Verification

13206

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.15.5 TC (14,7) Request HK Packets Forwarding Status Report

#### Description:

9660

Upon reception of TC 14,7 the report TM 14,8 will be generated listing the HK packets forwarding status.

#### Structure:

9661

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 7

Application/Source Data: none

#### Parameter definition

9662

N/A

#### TC Verification

13207

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.15.6 TM (14,8) HK Packets Forwarding Status Report

### Description:

TM 14,8 is the answer to TC 14,7 and report the list of HK Packets forwarding status.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 8

Application/Source Data:

N1	Filler	PRID	N2	SID	FSTAT
Uns. Int.		Enum.	Uns. Int.	Enum.	Enum.
1 byte	1 bit	7 bit	1 byte	1 byte	1 byte
				← repeat N2 times →	
← repeat N1 times →					

### Parameter definition

Parameters	Description	Value or range
N1	Repetition count for following fields	
PID	Process ID	See Annex 8
N2	Number of SID	
SID	Structure ID	0 = all SID See Annex 10
FSTAT	PAcket Forwarding Status	0 = disabled 1 = enabled

## 5.15.7 TC (14,9) Enable Forwarding of Diagnostic Packets

### Description:

The TC 14,9 enables the forwarding of the specified diagnostic packets.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 9

Application/Source Data:

N1	Filler	PRID	N2	SID
Uns. Int.		Enum.	Uns. Int.	Enum.
1 byte	1 bit	7 bit	1 byte	1 byte
← repeat N2 times →				
← repeat N1 times →				

## Parameter definition

Parameters	Description	Range or value
N1	Repetition count for the following fields	
PID	Process ID	See Annex 8
N2	Number of Diag. packet definitions to be enabled	
SID	Structure ID of a Diagnostic Report Definition	See Annex 10

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.15.8 TC (14,10) Disable Forwarding of Diagnostic Packets

#### Description:

The TC 14,10 disables the forwarding of the specified Diagnostic packets.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 6

Application/Source Data:

N1	Filler	PRID	N2	SID
Uns. Int.		Enum.	Uns. Int.	Enum.
1 byte	1 bit	7 bit	1 byte	1 byte
← repeat N2 times →				
← repeat N1 times →				

## Parameter definition

Parameters	Description	Range or value
N1	Repetition count for the following fields	
PID	Process ID	See Annex 8
N2	Number of Diag. packet definitions to be disabled	

Parameters	Description	Range or value
SID	Structure ID of a Diag. Report Definition	See Annex 10

## TC Verification

13209

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.15.9 TC (14,11) Request Diagnostic Packets Forwarding Status Report

### Description:

9743

Upon reception of TC 14,11 the report TM 14,12 will be generated listing the Diagnostic packets forwarding status.

### Structure:

9744

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 11

Application/Source Data: none

### Parameter definition

9745

N/A

## TC Verification

13210

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.15.10 TM (14,12) Diagnostic Packets Forwarding Status Report

### Description:

9747

TM 14,12 is the answer to TC 14,11 and report the list of Diagnostic Packets forwarding status.

### Structure:

9748

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 12

Application/Source Data:

N1	Filler	PRID	N2	SID	FSTAT
Uns. Int.		Enum.	Uns. Int.	Enum.	Enum.
1 byte	1 bit	7 bit	1 byte	1 byte	1 byte
			← repeat N2 times →		
← repeat N1 times →					

## Parameter definition

9749

Parameters	Description	Value or range
N1	Repetition count for following fields	
PID	Process ID	See Annex 8
N2	Number of SID	
SID	Structure ID	0 = all SID See Annex 10
FSTAT	Packet Forwarding Status	0 = disabled 1 = enabled

9750

### 5.15.11 TC (14,13) Enable Forwarding of Event Report Packets

#### Description:

The TC 14,13 enables the forwarding of the specified event packets.

9776

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 13

Application/Source Data:

N1	Filler	PRID	N2	EID
Uns. Int.		Enum.	Uns. Int.	Uns. Int.
1 byte	1 bit	7 bit	1 byte	2 bytes
			← repeat N2 times →	
← repeat N1 times →				

9777

## Parameter definition

9778

Parameters	Description	Range or value
N1	Repetition count for the following fields	
PID	Process ID	See Annex 8
N2	Number of event packet definitions to be enabled	
EID	Event Identifier	See Annex 9

9779

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.15.12 TC (14,14) Disable Forwarding of Event Report Packets

#### Description:

The TC 14,14 disables the forwarding of the specified event packets.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 14

Application/Source Data:

N1	Filler	PRID	N2	EID
Uns. Int.		Enum.	Uns. Int.	Uns. Int.
1 byte	1 bit	7 bit	1 byte	2 bytes
				← repeat N2 times →
← repeat N1 times →				

#### Parameter definition

Parameters	Description	Range or value
N1	Repetition count for the following fields	
PID	Process ID	See Annex 8
N2	Number of event packet definitions to be disabled	
EID	Event Identifier	See Annex 9

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.15.13 TC (14,128) Request TM Source Packet Forwarding Status Report

#### Description:

Upon reception of TC 14,128 the report TM 14,129 will be generated listing the TM source packets forwarding status.

#### Structure:

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Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 128

Application/Source Data: none

**Parameter definition**

9828

N/A

**TC Verification**

13215

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.15.14 TM (14,129) TM Source Packet Forwarding Status Report**

**Description:**

9830

TM 14,129 is the answer to TC 14,128 and report the list of TM Source Packets forwarding status.

**Structure:**

9831

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 129

Application/Source Data:

N1	Filler	PRID	FSTAT	N2	Type	FSTAT	N3	Subtype	FSTAT
Uns. Int.		Enum.	Enum.	Uns. Int.	Enum.	Enum.	Uns. Int.	Enum.	Enum.
1 byte	1 bit	7 bit	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte
								← repeat N3 times →	
						← repeat N2 times →			
← repeat N1 times →									

**Parameter definition**

9832

Parameters	Description	Value or range
N1	Repetition count for following fields	
PID	Process ID	
N2/N3	Number of type/subtype definition to follow	<b>N2 = 0</b> FSTAT applies to all types of TM source packets from the corresponding Process ID

9833

Parameters	Description	Value or range
		<p><b>N2 &gt; 0, N3 = 0</b> FSTAT applies to all subtypes of the given type from the corresponding Process ID</p> <p><b>N2 &gt; 0, N3 &gt; 0</b> FSTAT applies to the specified type/subtype combination from the corresponding Process ID</p>
Type	TM source packet type	0 = all types
Subtype	TM source packet subtype	0 = all subtypes
FSTAT	Packet Forwarding Status	0 = disabled 1 = enabled

### 5.15.15 TC (14,130) Request Event Packet Forwarding Status Report

#### Description:

Upon reception of TC 14,130 the report TM 14,131 will be generated listing the event packets forwarding status.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 14
- Service Subtype: 130

Application/Source Data: none

#### Parameter definition

N/A

#### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.15.16 TM (14,131) Event Packet Forwarding Status Report

#### Description:

TM 14,131 is the answer to TC 14,130 and report the list of Event Packets forwarding status.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

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9867

9868

9869

13216

9871

9872

- Service Type: 14
- Service Subtype: 131

Application/Source Data:

N1	Filler	PRID	N2	EID	FSTAT
Uns. Int.		Enum.	Uns. Int.	Uns. Int.	Enum.
1 byte	1 bit	7 bit	1 byte	2 bytes	1 byte
				← repeat N2 times →	
← repeat N1 times →					

## Parameter definition

Parameters	Description	Value or range
N1	Repetition count for following fields	
PID	Process ID	See Annex 8
N2	Number of EID packet forwarding status values to follow	
EID	Event Identifier	See Annex 9 0 = all events
FSTAT	Packet Forwarding Status	0 = disabled 1 = enabled

## 5.16 Service 15: Onboard Storage and Retrieval

### Objective

The on-board storage and retrieval service allows the applications to store TM packets generated by all on-board applications in the on board Mass Memory areas, as well as Ground to manage the downlink of the stored data.

### Description

On Solar Orbiter the service 15 is implemented in the Central SW to manage the OBC Mass Memory, and in the SSMM SW to manage the Solid State Mass Memory.

Note that functionalities are not identical in both SW. All detailed TM/TC described in this section are applicable to CSW unless otherwise stated. The SSMM detailed service 15 structures are available in RD 6 and only the SSMM (type, subtype) structures providing a different functionality than the CSW are described in this section.

The on-board storage and retrieval service on both SSMM SW and CSW consists of three parts:

- packet selection sub-services for routing of telemetry source packets for storage in a dedicated packet store;
- down-link sub-services for playback of telemetry source packets from packet stores to ground;
- storage maintenance sub-services.

The packet selection is based on Process ID of the source application as well as type and subtype of the TM packet for CSW. It uses the APID in SSMM SW.

## Notes

2478

In the SSMM SW the storage management allows to set up a Virtual Channel and Priority for downlink from a specific Packet Store. This is not implemented in the CSW. The Memory Block management is not implemented in CSW either.

The type and subtype applicability in the different SW is listed in [Table 5.1-1](#) and will be reflected by the Process ID of the TM/TC.

### 5.16.1 TC (15,1) Enable Storage in Packet Store

#### Description:

2480

This TC 15,1 enables storage in the specified Packet Store.

#### Structure:

3923

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 1

Application/Source Data:

N	Store ID
Unsigned Integer	Enumerated
1 byte	1 byte
	<-repeat N times->

7459

#### Parameter definition

2490

Parameters of Application Data Field	Description	Range or Value
N	The number of packet stores to be controlled	1..TBD Note: 0 means all packet stores
Store ID	Identifier for the packet store	

7472

#### TC Verification

13217

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.16.2 TC (15,2) Disable Storage in Packet Store

#### Description:

2492

This TC 15,2 disables storage in the specified Packet Store.

#### Structure:

3924

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 2

Application/Source Data:

N	Store ID
Unsigned Integer	Enumerated
1 byte	1 byte
	<-repeat N times->

9903

### Parameter definition

Parameters of Application Data Field	Description	Range or Value
N	The number of packet stores to be controlled	1..TBD Note: 0 means all packet stores
Store ID	Identifier for the packet store	

2502

9916

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13218

### 5.16.3 TC (15,3) Add Packet to Storage Selection Definition

#### Description:

This TC 15,3 adds the specified packet to the Storage Selection Definition.

2504

The detailed structure presented here is applicable to CSW.

TC 15,3 has the same functionality in SSMM SW but a different detailed structure.

#### Structure:

3925

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 3

Application/Source Data:

Store ID	N1	Filler	PRID	N2	Type	N3	Sub type
Enum.	Uns. Int.		Enum.	Uns. Int.	Enum.	Uns. Int.	Enum.
1 byte	1 byte	1 bit	7 bit	1 byte	1 byte	1 byte	1 byte
							← repeat N3 times →
						← repeat N2 times →	
← repeat N1 times →							

## Parameter definition

2514

Parameters of Application Data Field	Description	Range or Value
Store ID	Identifier for the packet store	Note: value 0 means 'No Storage'
N1	Number of Process IDs	1...7
PID	Process ID	
N2/N3	The number of type definition to follow	<p><b>N2 = 0:</b> all types of telemetry source packets from the corresponding application process shall be placed in the set of enabled types to be stored in the specified <i>Store ID</i>.</p> <p><b>N2 &gt; 0, N3 = 0:</b> the specified types of telemetry source packets from the corresponding application process shall be added to the set of enabled types to be stored in the specified <i>Store ID</i>.</p> <p><b>N2 &gt; 0, N3 &gt; 0:</b> the specified subtypes of telemetry source packets from the corresponding application process shall be added to the set of enabled subtypes for the specified type to be stored in the specified <i>Store ID</i>.</p> <p>Note: If N2 &gt; 1 then there can be a mixture of empty (N3 = 0) and non-empty (N3 &gt; 0) arrays.</p>
Type	The telemetry source packet type	
Subtype	The telemetry source packet service subtype for the specified service type	

7540

## TC Verification

13219

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.16.4 TC (15,4) Remove Packet from Storage Selection Definition

#### Description:

2516

This TC 15,4 removes the specified packet from the Storage Selection Definition.

The detailed structure presented here is applicable to CSW.

TC 15,4 has the same functionality in SSMM SW but a different detailed structure.

**Structure:**

3926

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 4

Application/Source Data:

Store ID	N1	Filler	PRID	N2	Type	N3	Sub type
Enum.	Uns. Int		Enum.	Uns. Int.	Enum.	Uns. Int	Enum.
1 byte	1 byte	1 bit	7 bit	1 byte	1 byte	1 byte	1 byte
							← repeat N3 times →
						← repeat N2 times →	
← repeat N1 times →							

**Parameter definition**

2526

Parameters of Application Data Field	Description	Range or Value
Store ID	Identifier for the packet store	Note: value 0 means 'No Storage'
N1	Number of Process IDs	1...7
PID	Process ID	
N2/N3	The number of type definition to follow	<p><b>N2 = 0:</b> all types of telemetry source packets from the corresponding application process shall be placed in the set of enabled types to be stored in the specified <i>Store ID</i>.</p> <p><b>N2 &gt; 0, N3 = 0:</b> the specified types of telemetry source packets from the corresponding application process shall be added to the set of enabled types to be stored in the specified <i>Store ID</i>.</p> <p><b>N2 &gt; 0, N3 &gt; 0:</b> the specified subtypes of telemetry source packets from the corresponding application process shall be added to the set of enabled subtypes for the specified type to be stored in the specified <i>Store ID</i>.</p> <p>Note: If N2 &gt; 1 then there can be a mixture of empty (N3 = 0) and non-empty (N3 &gt; 0) arrays.</p>
Type	The telemetry source packet type	
Subtype	The telemetry source packet service subtype for the specified service type	

9929

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.16.5 TC (15,5) Report Storage Selection Definition

#### Description:

2528

This TC 15,5 requests the report of the Storage Selection definition via TM 15,6.

This TC is implemented in SSMM SW only.

This TC functionality is implemented in CSW as TC 15, 145.

#### Structure:

3927

Packet ID Info:

- Process ID: see annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 5

Application/Source Data:

Filler	PS ID
	Enum
1 byte	1 byte

12376

#### Parameter definition

2538

Parameters	Description	Range or Value
PS ID	SSMM Packet Store Identifier	0..63

12386

## TC Verification

13221

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.16.6 TM (15,6) Storage Selection Definition Report

#### Description:

2540

This TM 15,6 is the response to TC 15,5.

This is implemented in SSMM SW only.

This TM functionality is implemented in CSW as TM 15,146.

#### Structure:

3928

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8



Packet Data Field Info:

- Service Type: 15
- Service Subtype: 6

Application/Source Data:

Filler	PS ID	N	Filler	APID
	Enum	Unsigned Integer		Enum
1 byte	1 byte	2 bytes	5 bits	11 bits
			Repeat N times	Repeat N times

12395

### Parameter definition

Parameters	Description	Range or Value
PS ID	SSMM Packet Store Identifier	0..63
N	Number of specified APID	
APID	APID stored in selected PS (repeated N times)	

2550

12420

## 5.16.7 TC (15,9) Downlink Packet Store Contents for Time Period

### 5.16.7.1 TC(15,9) Downlink Packet Store contents for Time Period

#### Description:

This TC 15,9 allows to downlink the content of the specified Packet Store for a defined time period.  
This TC 15,9 is specific to CSW.

2552

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

3929

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 9

Application/Source Data:

N	Store ID	Time Span	Storage Time 1	Storage Time 2
Uns Int	Enum.	Enum	CUC format	CUC format
1 byte	1 byte	1 byte	6 bytes	6 bytes
← repeat N times →				

### Parameter definition

Parameters	Description	Range or value
N	Number of PS to be downlinked from at the same time	
Store ID	identifier for the packet store	
Time Span	specification of the	0 = full contents of PS

2562

9954

Parameters	Description	Range or value
	packet range	1 = between time 1 and time 2 inclusive 2 = less than or equal to time 1 3 = greater than or equal to time 1
Storage time 1	Start time	Coarse time (in seconds) with sub-second field set to 0; n/a if timespan = 0
Storage time 2	End time	Coarse time (in seconds) with sub-second field set to 0; only used if timespan = 1

## TC Verification

13222

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.16.7.2 TC(15,9) Downlink Packet Store contents for Time Period

### Description:

12594

This TC 15,9 allows to downlink the content of the specified Packet Store for a defined time period.

This TC 15,9 is specific to SSMM SW.

### Structure:

12595

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 9

Application/Source Data:

Read ID	PS ID	VC Flag	VC	Priority Flag	Priority	Filler	Mode	Range Start Time	Range End Time
								CUC coarse	CUC coarse
1 byte	1 byte	4 bits	4 bits	4 bits	4 bits	1 byte	1 byte	4 bytes	4 bytes

12597

### Parameter definition

12596

Parameters	Description	Range or Value
Read ID	Read operation identifier	
PS ID	SSMM Packet Store ID	
VC Flag	Enable/Disable use of the VC parameter in TC	0: do not use specified VC else: use specified VC
VC	Virtual Channel	not used if VC Flag is 0  0: VC 3 1: VC 2
Priority Flag	Enable/Disable use of the Priority parameter in TC	0: do not use specified priority else: use specified priority
Priority	Downlink priority	not used if Priority Flag = 0

12631

Parameters	Description	Range or Value
Mode	Downlink criterion:  unbound read is achieved with Mode = 01 and Range End Time equal to 0xFFFF FFFF	0 = retrieve all packets from the specified time 1 = retrieve all packets since end of the last retrieval until th Range End Time 2 = retrieve all packets between Range Start and Range End Time
Range Start Time		Not used if Mode = 01
Range End Time		Not used if Mode = 00

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

13223

## 5.16.8 TC (15,10) Delete Packet Store Contents

### 5.16.8.1 TC (15,10) Delete complete Packet Store Contents

#### Description:

This TC 15,10 is specific to CSW.

2564

Upon reception of TC(15,10) the content of the selected packet store will be deleted.

#### Structure:

3930

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 10

Application/Source Data:

N	Store ID
Unsigned integer	Enumerated
1 byte	1 byte
	<- repeat N times ->

9979

## Parameter definition

2574

Parameters	Description	Range or value
N	Number of PS to be controlled	0 = all PS
Store ID	Identifier for the PS	

9992

## TC Verification

13224

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.

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- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.16.8.2 TC (15,10) Delete Packet Store Contents up to Specified Packet

### Description:

12321

This TC 15,10 is specific to SSMM SW.

Upon reception of TC(15,10) the content of the selected packet store will be deleted starting from the oldest packet (based on packet time) to the specified one.

### Structure:

12322

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 10

Application/Source Data:

Mode	Store ID	Filler	APID	Filler	SSC
Unsigned integer	Enumerated		Enumerated		Unsigned integer
1 byte	1 byte	5 bits	11 bits	2 bits	14 bits

12323

### Parameter definition

12336

Parameters	Description	Range or value
Mode	Number of PS to be controlled	0 = delete all packets in PS 1= delete all packets up to specified Packet (included)
Store ID	Identifier for the PS	Maximum 64 PS allowed
APID	APID of the target packet	Not used if Mode = 0
SSC	Source Sequence Counter of the target packet	Not used if Mode = 0

12337

### TC Verification

13225

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed
  - TBD

## 5.16.9 TC (15,11) Delete Packet Store Contents up to Specified Time

### Description:

8685

Upon reception of TC 15,11 the content of the selected Packet Store up to the specified storage time will be deleted.

The detailed structure presented here is applicable to CSW.

TC 15,11 has the same functionality in SSMM SW but a different detailed structure.

**Structure:**

8686

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 11

Application/Source Data:

End Time	N	Store Id
CUC format	Unsigned Integer	Enumerated
6 bytes	1 byte	1 byte
		<- repeat N times ->

10005

**Parameter definition**

8687

Parameters	Description	Range or Value
End Time	Absolute time defining the upper boundary (inclusive) of the packet range to be deleted	
N	Number of PS to be controlled	0 = all PS
Store ID	Identifier for the PS	

10022

**TC Verification**

13226

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.16.10 TC (15,12) Report Catalogue for Selected Packet Store**

**Description:**

2576

This TC 15,12 requests the report of the catalogue of the selected Packet Store via TM 15,13.

This is implemented in SSMM SW only.

This is not applicable to the CSW.

**Structure:**

3931

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 12

Application/Source Data:

Filler	N	Filler	PS ID
	Uns Int		Enum
1 byte	1 byte	1 byte	1 byte
		repeat N times	repeat N times

12680

## Parameter definition

2586

Parameters	Description	Range or Value
N	Number of PS ID	0 = no action 1..64
PS ID	SSMM Packet Store Identifier	

12701

## TC Verification

13227

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.16.11 TM (15,13) Packet Store Catalogue Report

#### Description:

2588

This TM 15,13 is the response to TC 15,12.

This is implemented in SSMM SW.

This is not applicable to the CSW.

#### Structure:

3932

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 13

Application/Source Data:

Filler	N	Type	PS ID	Size	VC ID	Priority	...
	Uns. Int		Enum				...
1 byte	1 byte	1 byte	1 byte	2 bytes	1 byte	1 byte	...
		Repeat N times	Repeat N times	Repeat N times	Repeat N times	Repeat N times	...

12437

...	Creation Time	% Downlinked	Health	First Pkt Header	Last Pkt Header	Partitions Used
...	CUC Coarse					
...	4 bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes
...	Repeat N times	Repeat N times	Repeat N times	Repeat N times	Repeat N times	Repeat N times

12502

2598

## Parameter definition

Parameters	Description	Range or Value
N	Number of reported Packet Stores	0..63
Type	PS Type	0 = non cyclic 1 = cyclic
PS ID	SSMM Packet Store identifier	
Size	PS size in sectors of 1 MB	
VC ID	PS default VC	0 = VC 3 1 = VC 2
Priority	Dowlink priority	0..15
Creation Time	File creation time	
% downlinked		0..100%
Health	Health status	0 = good 255 = corrupted
First Pkt Header	Header of first not read packet in selected PS	
Last Pkt Header	Header of last written packet in selected PS	
Partitions used	Partitions used by the PS	0 = PS has no sectors in the partition 1 = PS has at least one sector in the partition

12539

### 5.16.12 TC (15,128) Stop Playback of Packet Store Contents

#### Description:

Upon execution of TC 15,128 the currently executing TC 15,129 or TC 15,9 is stopped. the playback pointers are maintained for the next playback.

2600

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

3933

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 128

Application/Source Data: none

#### Parameter definition

N/A

2610

#### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13228

## 5.16.13 TC (15,129)

### 5.16.13.1 TC(15,129) Start Playback of Packet Store Contents

#### Description:

Upon reception of TC 15, 129 the content of the specified PS will be downlinked to the Ground from the playback pointer until the playback is stopped or all data are read.

This TC structure is specific to CSW only.

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 129

Application/Source Data:

N	Store ID	Playback Pointer
Unsigned Integer	Enumerated	Enumerated
1 byte	1 byte	1 byte
	<----- repeat N	times ----->

#### Parameter definition

Parameters of Application Data Field	Description	Range or Value
N	The number of packet stores to be controlled	1 ...N_Max N_Max = 96 to be consistent with data field size.
Store ID	Identifier for the packet store	
Playback Pointer	Pointer to be used for playback operation	[0,1] 0 .. playback pointer 1 1 .. playback pointer 2

#### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.16.13.2 TC(15,129) Create File

#### Description:

Upon reception of TC 15,129 a new Packet Store is create in SSMM and added in the FAT. The required number of sectors are taken from thefree list and reserved for the new Packet Store.

This TC structure is specific to SSMM SW only.



**Structure:**

12717

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 129

Application/Source Data:

Type	PS ID	Size	VC ID	Priority
	Enum		Enum	
1 byte	1 byte	2 bytes	1 byte	1 byte

12719

**Parameter definition**

12718

Parameters	Description	Range or Value
Type	Packet Store Type	0 = non cyclic <> 0 = cyclic
PS ID	SSMM Packet Store Identifier	0..63
size	Packet Store size in sectors of 1MB	
VC ID	Packet Store Default Virtual Channel	0 = VC 3 1 = VC 2
Priority	Packet Store default downlink priority	0..15

12738

**TC Verification**

13230

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.16.14 TC(15,130) Resize File**

**Description:**

12764

Upon reception of the TC (15,130) the selected SSMM PS size is changed to the specified value.

This is implemented in the SSMM SW only

**Structure:**

13231

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 130

Application/Source Data: see RD9

**Parameter definition:**

See RD9

**TC Verification:**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

13232

13233

### 5.16.15 TC(15,131) Delete File

**Description:**

Upon reception of the TC (15,131) the selected SSMM PS is deleted from the FAT and all its sectors released.

12766

This is implemented in the SSMM SW only

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 131

Application/Source Data: See RD9

**Parameter definition:**

See RD9

**TC Verification:**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

13234

13235

13236

### 5.16.16 TC(15,132) Rename File

**Description:**

Upon reception of the TC (15,132) the SSMM PS ID is changed according to the TC parameter.

12768

This is implemented in the SSMM SW only

**Structure:**

Packet ID Info:

- Process ID: as per annex 8

13237

- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 132

Application/Source Data: See RD9

**Parameter definition:**

See RD9

**TC Verification:**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed
  - TBD

13238

13239

## 5.16.17 TC(15,133) List Files

**Description:**

Upon reception of the TC (15,133) a TM(15,134) is produced reporting the identifiers of all ground defined SSMM PS.

12770

This is implemented in the SSMM SW only

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 133

Application/Source Data: See RD9

**Parameter definition:**

See RD9

**TC Verification:**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed
  - TBD

13240

13241

13242

## 5.16.18 TM(15,134) Files List Report

### Description:

12772

TM(15,134) is reporting the identifiers of all ground defined SSMM PS. It is generated in response to TC(15,133).

This is implemented in the SSMM SW only

### Structure:

13243

TBD

### Parameter definition

13244

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 134

Application/Source Data: See RD9

## 5.16.19 TC(15,135) Stop Downlink for Packet Store

### Description:

12774

Upon reception of TC(15,135) the data retrieval activity identified by the specified Read ID is stopped and the related HW programming deleted.

This is implemented in the SSMM SW only

### Structure:

13246

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 135

Application/Source Data: See RD9

### Parameter definition:

13247

See RD9

### TC Verification:

13248

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

## 5.16.20 TC(15,136) Set File to Cyclic

### Description:

12776

Upon reception of TC(15,136) the selected SSMM PS type is set to cyclic.

This is implemented in the SSMM SW only

### Structure:

13249

#### Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

#### Packet Data Field Info:

- Service Type: 15
- Service Subtype: 136

Application/Source Data: See RD9

### Parameter definition:

13250

See RD9

### TC Verification:

13251

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

## 5.16.21 TC(15,137) Set File to Non-Cyclic

### Description:

12778

Upon reception of TC(15,137) the selected SSMM PS type is set to non-cyclic.

This is implemented in the SSMM SW only

### Structure:

13252

#### Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

#### Packet Data Field Info:

- Service Type: 15
- Service Subtype: 137

Application/Source Data: See RD9

### Parameter definition:

13253

See RD9

### TC Verification:

13254

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

## 5.16.22 TC(15,138) Change PS Default VC

### Description:

Upon reception of TC(15,138) the selected SSMM PS default downlink Virtual Channel is set according to the TC parameter.

This is implemented in the SSMM SW only

### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 138

Application/Source Data: See RD9

### Parameter definition:

See RD9

### TC Verification:

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

## 5.16.23 TC(15,139) Change PS Default Priority

### Description:

Upon reception of TC(15,139) the selected SSMM PS default downlink priority is set according to the TC parameter.

This is implemented in the SSMM SW only

### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15

- Service Subtype: 139

Application/Source Data: See RD9

**Parameter definition:**

See RD9

**TC Verification:**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

**5.16.24 TC (15,140)**

**5.16.24.1 TC (15,140) Add SID to Storage Selection Definition**

**Description:**

Upon reception of the TC (15,140) the SID of the specified Process ID will be added to the Storage Selection Definition of the given OMM Packet Store in CSW.

This is implemented in CSW only

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 140

Application/Source Data:

Store ID	N1	Filler	PRID	N2	SID
Enum.	Uns. Int		Enum.	Uns. Int	Enum.
1 byte	1 byte	1 bit	7 bits	1 byte	1 byte
			← repeat N2 times →		
			← repeat N1 times →		

13259

13260

2612

3934

2622

## Parameter definition

Parameters	Description	Range or value
Store ID	Identifier for the packet store	0 = all PS
PID	Process ID	See Annex 8
N1 / N2	number of PID/HK/Diag SID to be added to the storage selection definition	N1 = 0: all TM(3,25) & TM(3.26) TM source packets N1 > 0, N2 = 0: all TM(3,25) and TM(3,26) from the specified PID N1 > 0, N2 > 0: specified SID of TM(3,25) and TM(3,26) from the specified PID
SID	Structure ID of a report definition (HK, Diagnostic)	See Annex 10

10056

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13261

### 5.16.24.2 TC (15,140) Find Packet in PS

#### Description:

Upon reception of the TC (15,140) a TM(15,141) is produced with the search result (positive or negative).

12785

This is implemented in SSMM SW only

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 140

Application/Source Data: See RD9

#### Parameter definition

See RD9

#### TC Verification:

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

13264

13265

13266



**5.16.25 TM (15,141)****5.16.25.1 TM (15,141) Packet Position on SSMM Report****Description:**

TM(15,141) is generated in response to TC(15,140).

This is implemented in SSMM SW only.

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 141

Application/Source Data: See RD9

**Parameter definition**

See RD9

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed
  - Error during the elaboration of the requested TM: the requested TM output structure is larger than the current set MTU or the requested TM generation has aborted (e.g. superseded by new request)

**5.16.26 TC (15,142)****5.16.26.1 TC (15,142) Request SID Storage Selection Definition Report****Description:**

Upon reception of TC(15,142) the report TM(15,143) will be generated to report the SID storage selection definition in CSW (i.e. on OBC MM).

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 142

Application/Source Data: none

**Parameter definition**

N/A

**TC Verification**

13269

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.16.26.2 TC (15,142) Copy File****Description:**

12790

Upon reception of TC(15,142) a portion or the complete SSMM source PS is copied (appended) into the destination one.

This is implemented in SSMM SW only.

**Structure:**

13270

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 142

Application/Source Data: See RD9

**Parameter definition**

13271

See RD9

**TC Verification**

13272

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

**5.16.27 TC (15,143) Abort Copy****Description:**

12795

Upon reception of TC(15,143) the current SSMM copy operation is aborted.

This is implemented in SSMM SW only

**Structure:**

13273

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 143

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

### 5.16.28 TC (15,144) Reset Copy TC Queue

#### Description:

Upon reception of TC 15,144 the copy TC queue is reset.

This is implemented in SSMM SW only.

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 144

Application/Source Data: See RD9

### Parameter definition

See RD9

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed

#### Description:

Upon reception of TN (15,145) an unbounded downlink is started from the specified packet stores, on the specified virtual channel. This command applies to the SSMM only.

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 145

Application/Source Data: See RD9

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if:
  - One of the Service 1 consistency checks defined in section 5.2 has failed
  - See RD9

14262

### 5.16.29 TC (15,145) Request Storage Routing Definition Table Report

#### Description:

Upon reception of TC 15,145 the report TM 15, 146 will be generated to report the storage routing definition table in CSW (i.e. for OBC Mass Memory).

2660

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

3938

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 145

Application/Source Data: none

#### Parameter definition

N/A

2670

#### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13280

### 5.16.30 TC (15,146) Delete Packet Store content for non-cyclic PS

#### Description:

TC (15,146) performs a deletion of a non-cyclic packet store.

2672

This is implemented by the SSMM SW only.

3939

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 146

Application/Source Data: See RD9

**Parameter definition**

See RD9

**5.16.31 TC (15,147) Remove SID from Storage Selection Definition**

**Description:**

Upon reception of TC 15,147 the SID of the specified Process ID will be removed from the Storage Selection Definition of the given OMM Packet Store in CSW.

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 141

Application/Source Data:

Store ID	N1	Filler	PRID	N2	SID
Enum.	Uns. Int		Enum.	Uns. Int	Enum.
1 byte	1 byte	1 bit	7 bits	1 byte	1 byte
			← repeat N2 times →		
			← repeat N1 times →		

**Parameter definition**

Parameters	Description	Range or value
Store ID	Identifier for the packet store	0 = all PS
PID	Process ID	
N1 / N2	number of PID/HK/Diag SID to be removed to the storage selection definition	<p>N1 = 0: all TM(3,25) &amp; TM(3,26) TM source packets</p> <p>N1 &gt; 0, N2 = 0: all TM(3,25) and TM(3,26) from the specified PID</p> <p>N1 &gt; 0, N2 &gt; 0: specified SID of TM(3,25) and TM(3,26) from the specified PID</p>

2682

2624

3935

2634

10081

Parameters	Description	Range or value
SID	Structure ID of a report definition (HK, Diagnostic)	

## TC Verification

13262

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.16.32 TM (15,148) SID Storage Selection Definition Report

#### Description:

2648

TM 15,148 is the response to TC 15,142 and reports the SID storage selection in CSW (i.e. in OBC MM).

This is implemented in CSW only.

#### Structure:

3937

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 148

Application/Source Data:

N1	Filler	PRID	N2	SID	Store ID
Uns. Int		Enum.	Uns. Int	Enum.	Enum.
1 byte	1 bit	7 bits	1 byte	1 byte	1 byte
				← repeat N2 times →	
← repeat N1 times →					

#### Parameter definition

2658

Parameters	Description	Range or value
PID	Process ID	See Annex 8
N1 / N2	number of reported PID/HK/Diag SID	
SID	Structure ID of a report definition (HK, Diagnostic)	
Store ID	Identifier for the packet store	0 = all PS

10102

### 5.16.33 TM (15,149) Storage Routing Definition Table Report

**Description:**

TM 15,149 is the response to TC 15,145 and reports the defined routing table definition in the on-board CSW (i.e. for OBC Mass Memory).

**Structure:**

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 149

Application/Source Data:

I	Filler	PRID	Store ID	N2	Type	Store ID	N3	Subtype	Store ID
Int		Enum.	Enum.	Uns. Int.	Enum.	Enum.	Uns. Int.	Enum.	Enum.
yte	1 bit	7 bit	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte
									← repeat N3 times →
							← repeat N2 times →		
← repeat N1 times →									

**Parameter definition**

Parameters	Description	Range or Value
N1	number of Process ID to follow	
PID	Process ID	
N2/N3	Number of type definition to follow	<p>N2 = 0: neither type nor subtype of packet from the corresponding PID is selected for storage</p> <p>N2 &gt; 0: the specified types of packet from the corresponding PID are selected for storage</p> <p>N3 &gt; 0: for a type of packet, the specified subtypes of this type from the corresponding PID are selected for storage</p>
Type	TM source packet type	
Subtype	TM source packet service subtype for the specified service type	
Store ID	identifier for the packet store	

### 5.16.34 TC (15,150) Format Packet Store Memory

**Description:**

The TC 15,150 allows to redefine in-flight the PS allocation on OBC MM via CSW : some PS can be kept/repeated, some others

can be suppressed and new ones can be added.

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14424

14425

14426

14427

2684

After execution of this telecommand, the “old” content of the Mass Memory is lost, even for PS that have been repeated. During execution of this telecommand, the TM packets routed to the HK mass memory will be discarded without notification.

The enabling/disabling status of repeated PS is unchanged by this TC, such as, if the storage was enabled before, the storage will restart immediately after execution of the TC.

The newly created Packet Stores, instead, are disabled and need to be enabled by Ground before data will be written into it.

**Structure:**

3940

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 150

Application/Source Data:

N	Store ID	Size
Unsigned integer	Enumerated	Unsigned Integer
1 byte	1 byte	4 byte
	<----- repeat	N times ----->

12845

**Parameter definition**

2694

Parameters of Application Data Field	Description	Range or value
N	The number of packet stores to be allocated	See OBC User Manual
Store ID	Identifier for the packet store	See OBC User Manual
Size	Size of buffer, in SAUs, as a multiple of 128KiB (min size 1 MiB). This parameter is checked so that the end address is within the memory limit.	See OBC User Manual

12862

**TC Verification:**

13282

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.16.35 TC (15,151) Get Format of Packet Store Memory**

**Description:**

2696

TC 15,151 allows retrieving via CSW the current OMM Packet Store configuration (i.e. size, cyclic/linear buffer mode, allocated Virtual Channel). TM 15,152 is generated in response.

**Structure:**

3941

Packet ID Info:



- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 151

Application/Source Data: None

### Parameter definition

2706

N/A

### TC Verification:

13283

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated if one of the Service 1 consistency checks defined in section 5.2 has failed

## 5.16.36 TM (15,152) Packet Store Format Report

### Description:

2708

TM 15,152 is the response to TC 15,151 and report the current OMM Packet Store configuration via CSW.

### Structure:

3942

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 152

Application/Source Data:

N	Store ID	Size	Mode	Virtual Channel
Unsigned Integer	Enumerated	Unsigned Integer	Enumerated	Enumerated
1 byte	1 byte	4 bytes	1 byte	1 byte
	<-----	----- repeated	N times ----- --	----->

12879

### Parameter definition

2718

Parameters of Application Data Field	Description	Range or Value
N	Number of packet stores that follow	
Store ID	Identifier for the packet store	
Size	Packet store size in HAU	
Mode	Packet Store mode of storage.	0:= Store works as ring

12904

Parameters of Application Data Field	Description	Range or Value
	Bounded is used for packet store which stops recording when full, circular type allows overwriting of oldest data with newest ones	(circular) buffer, old data will be overwritten, if store is full 1:= Store works as linear (bounded) buffer, no data will be overwritten in case of overflow
Virtual Channel	Virtual Channel allocated for the downlink.	VC1 (see PUS-248)

### 5.16.37 TC (15,153) Set Packet Store Playback Pointer

#### Description:

The TC 15,153 is used to set the playback pointer(s) of an OBC-MM PS to a TM source packet specified by its coarse generation time, its APID and SSC via CSW. The function will first search for the specified coarse time and will then try to find a packet with a matching APID/SSC combination by moving forward in time.

A subsequent "Start Playback" command for this store will start with the identified packet.

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 153

Application/Source Data:

N	Store ID	PointerID	PktTime	Filler	APID	Filler	SSC
Unsigned integer	Enumerated	Enumerated	Coarse Time				
1 byte	1 byte	1 byte	4 byte	5 bits	11 bits	2 bits	14 bits
	-----		-----	N times		-----	-----
			repeat	-			>

#### Parameter definition

Parameters of Application Data Field	Description	Range or value
N	The number of packet stores for which a Playback Pointer shall be set	N = 1....10
Store ID	Identifier for the packet store	
PointerID	Selector which pointer shall be moved	01bin ... PlaybackPointer_01 10bin ... PlaybackPointer_02 11bin ... both
PktTime	Coarse Start Time to look for packet	4 byte coarse time, [sec]
APID	Packet Identification	See Annex 8
SSC	Source Sequence Count	0 .. (2e14)-1

**TC Verification:**

13285

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.16.38 TC (15,154) Change Packet Store Attributes**

**Description:**

10157

The TC 15,154 specifies for a given OMM packet store the storage mode and the associated virtual channel to be used for downlink in CSW.

**Structure:**

10158

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 15
- Service Subtype: 154

Application/Source Data:

Store ID	Mode	Virtual Channel
Enumerated	Enumerated	Enumerated
1 byte	1 byte	1 byte

12995

**Parameter definition**

10159

Parameters of Application Data Field	Description	Range or value
Store ID	Identifier for the packet store	
Mode	Packet Store mode of storage. Bounded is used for packet store which stops recording when full, circular type allows overwriting of oldest data with newest ones	0:= Store works as ring (circular) buffer, old data will be overwritten, if store is full 1:= Store works as linear (bounded) buffer, no data will be overwritten in case of overflow
Virtual Channel	Virtual Channel allocated for the downlink.	VC1 (see PUS-248)

13008

**TC Verification:**

13286

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.17 Service 16: Onboard Traffic Management

### Objective

2732

The Onboard Traffic Management service is in charge of controlling the bus channel alternatives (used for commands and acquisitions) when there are several available.

### Description

2733

The Onboard Traffic Management service allows managing A/B channel selection at a *global* level (overall traffic) for the following links:

- MilBus 1
- MilBus 2

This effectively manages all individual destinations of a single bus at the same time.

The Onboard Traffic Management service allows managing A/B channel selection at *individual* destination level for the following links:

- MilBus 1
- MilBus 2

The service 16 is not intended for nominal operations in Flight. It could be used for Ground investigation / recovery in case of MilBus FDIR triggering.

The configuration set by service 16 will be available in HK TM.

### Notes

2734

### 5.17.1 TC (16,1) Set MilBus Configuration

#### **Description:**

10845

This TC 16,1 allows to assign the Nominal/ Redundant logical MilBus configuration to the physical A/B channels.

This will effectively select on which bus channel all messages of the given BUS are transferred.

#### **Structure:**

10846

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 16
- Service Subtype: 1

Application/Source Data:

Bus	Nominal Coupler
Enum	Enum
1 byte	1 byte

10848

10847

## Parameter definition

Parameter	Description	Value or Range
Bus	Selected Bus	Bus 1 Bus 2
Nominal Coupler	Physical Bus Coupler/Channel to be assigned as Nominal Configuration for the selected Bus	0 = Bus coupler A 1 = Bus coupler B

10858

## TC Verification:

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13287

## 5.17.2 TC (16,2) Switch MilBus to Nominal

### Description:

This TC 16,2 is used to switch back a 1553 MilBus to its Nominal channel configuration.

This will effectively select the Nominal channel for all RT of the given Bus to use.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 16
- Service Subtype: 2

Application/Source Data:

<b>BUS</b>
Enum
1 byte

10872

10873

10875

## Parameter definition

Parameter	Description	Value or range
Bus	Selected Bus	MilBus 1 MilBus 2

10874

10882

## TC Verification:

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13288

### 5.17.3 TC (16,3) Reconfigure MilBus (to Redundant)

**Description:**

10892

This TC 16,3 is used to reconfigure a 1553 MilBus to its Redundant channel configuration.

This will effectively select the Redundant channel for all RT of the given Bus to use.

**Structure:**

10893

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 16
- Service Subtype: 3

Application/Source Data:

<b>BUS</b>
Enum
1 byte

10904

**Parameter definition**

10894

Parameter	Description	Value or range
Bus	Selected Bus	MilBus 1 MilBus 2

10911

**TC Verification:**

13289

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.17.4 TC (16,4) Switch MilBus RT Channel to Nominal

**Description:**

10896

This TC 16,4 is used to switch a given 1553 MilBus remote terminal (RT) to its Nominal channel configuration.

Note that other RT configurations remain unchanged by this command.

**Structure:**

10897

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 16
- Service Subtype: 4

Application/Source Data:

Bus	RT
Enum	Enum
1 byte	1 byte

10920

**Parameter definition**

10898

Parameter	Description	Value or range
Bus	Selected bus	MilBus 1 MilBus 2
RT	Target Remote Terminal	logical ID

10930

**TC Verification:**

13290

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.17.5 TC (16,5) Reconfigure MilBus RT Channel (to Redundant)

10900

**Description:**

This TC 16,5 is used to switch a given 1553 MilBus remote terminal (RT) to its Redundant channel configuration.

Note that other RT configurations remain unchanged by this command.

**Structure:**

10901

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 16
- Service Subtype: 5

Application/Source Data:

Bus	RT
Enum	Enum
1 byte	1 byte

10943

**Parameter definition**

10902

Parameter	Description	Value or range
Bus	Selected bus	MilBus 1 MilBus 2
RT	Target Remote Terminal	

10953

**TC Verification:**

13291

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.

- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.18 Service 17: Connection Test

### Objective

2736

The test service provides the capability to activate test functions implemented on-board and to report the results of such tests.

### Description

2737

The function exercised by the connection test service request shall be the generation of a corresponding one-shot service report by the application process.

The reception on the ground of the service report shall serve to confirm that the routes (uplink and downlink) between itself and the application process are operational and that the application process itself is performing a minimum set of functions (which includes telecommand processing).

### Notes

2738

### 5.18.1 TC (17,1) Perform Connection Test

#### **Description:**

2740

This TC 17,1 performs a connection test between Ground and a specified onboard application process. The test result is provided via TM 17,2 and relevant TM 1.

#### **Structure:**

3944

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 17
- Service Subtype: 1

Application/Source Data: none

#### **Parameter definition**

2750

N/A

#### **TC Verification:**

13292

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8] (only applies to CSW, not to SSMM).

### 5.18.2 TM (17,2) Connection Test Report

#### **Description:**

2752

This TM 17,2 is the response to TC 17,1 when the connection test is successfully executed.

#### **Structure:**

3945

Packet ID Info:



- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 17
- Service Subtype: 2

Application/Source Data: none

### Parameter definition

2762

N/A

### TC Verification:

13293

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.18.3 TC (17,3) Request Connection Test

#### Description:

10717

This TC 17,3 requests the CSW to perform a connection test by TC 17,1 to a given Process ID and with a time-out.

#### Structure:

10718

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 17
- Service Subtype: 3

Application/Source Data:

PID	Time-out
Enum	Uns Int
1 byte	1 byte

10720

### Parameter definition

10719

Parameter	Description	Value or range
PID	Destination Process ID for test connection	See Annex 8
Time out	Time-out for the test connection, in seconds	>0

10730

### TC Verification:

13294

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

#### 5.18.4 TC (17,128) Test Command of Maximum Length

##### Description:

12799

Upon reception of TC 17,128 a TM 17,2 is generated and sent to the OBC.  
This TC 17,128 contains filler paramters to build the maximum size packet.

This is implemented in SSMM SW only.

##### Structure:

13295

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 17
- Service Subtype: 128

Application/Source Data: TBD

##### Parameter definition

13296

TBD

##### TC Verification:

13297

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

#### 5.19 Service 18: Onboard Control Procedures

##### Objective

2764

An On-Board Control Procedure (OBCP) is an interpretable program which is compiled on Ground (with a dedicated compiler) and then uploaded on-board thanks to Service #13, into one of the file partitions.

OBCPs stored on-board are controlled mainly by the Ground thanks to Service #18, but can also be started autonomously on-board, e.g. as the result of detection of a specific on-board event.

##### Description

2765

##### **OBCP Characteristics**

An OBCP is uniquely identified by an "OBCP ID". An OBCP has an execution status which indicates whether it is currently "inactive", "running" or "held" (the latter two states together constituting "active").

An OBCP design can include (user convenience) setting of a "Step ID" at chosen points. This Step ID is then used to report OBCP execution progress.

##### **OBCP Execution**

The OBCPs are executed by the OBCP Interpreter in a dedicated RAM area. So in order to be executed, an OBCP is *loaded* from its storage area (e.g. OMM) into the RAM execution area – in a so called "execution slot". The number of slots being limited, the service provides:

- An "auto-delete" capability (from execution area) at end of OBCP execution, to be specified when using the TC(18,140) "Load and Start OBCP".

An OBCP execution can be performed with “Normal” or “Emergency” priority, which is to be specified when starting the OBCP. There can be only one OBCP running with emergency priority at a time.

The service also:

- Provides a TC to send parameters to an OBCP when it is started, or even after when it is “running”
- Maintains a list of the currently loaded OBCPs (e.g. in RAM), and a list of the currently active OBCPs (i.e. running); these lists can be reported to the ground on request.

## Notes

2766

### 5.19.1 TC (18,5) Suspend OBCP

#### Description:

2816

This telecommand allows suspending a currently running OBCP.

#### Structure:

3950

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 18
- Service Subtype: 5

Application/Source Data:

OBCP ID	Step ID (optional)
uint	uint
4 bytes	2 bytes

14459

#### Parameter definition

2826

Parameter	Description	Value / Range
OBCP ID	Identifier of the OBCP to be suspended	
Step ID	(Optional) Step after which the OBCP shall be suspended. The following values are defined: -1 : immediate suspend 0 : suspend at end of current step “Other step” values are OBCP design dependant. When no Step ID is defined, the -1 value (immediate suspend) is used as default.	

13527

#### TC Verification

13298

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## Remarks

When this request is received, the specified on-board procedure is suspended at end of requested step, and the OBCP state becomes "held".

Because suspend can be not immediate, the execution acknowledge is sent when step at end of which to suspend is set, then an event report is generated when suspend is effective.

An immediate suspend can be not *strictly* immediate in case OBCP is executing a library call, to let it cleanly terminates this call (as releasing used resource if there is some).

### 5.19.2 TC (18,6) Resume OBCP

#### Description:

This telecommand allows resuming a currently held OBCP

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 18
- Service Subtype: 6

Application/Source Data:

<b>OBCP ID</b>
uint
4 bytes

#### Parameter definition

Parameter	Description	Range / Value
OBCP ID	Identifier of the OBCP to be resumed	

#### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.19.3 TC (18,7) Communicate parameters to OBCP

#### Description:

This telecommand allows communicating parameters to a currently executing OBCP

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 18
- Service Subtype: 7

Application/Source Data:

OBCP ID	N	OBCP Param ID	Value
uint	uint	uint	(deduced)
4 bytes	2 bytes	4 bytes	variable
		<--Repeated N times	----->

14476

### Parameter definition

Parameter	Description	Value / Range
OBCP ID	Identifier of the OBCP	
N	Number of Parameters	
OBCP Param ID	Identifier of a parameter, which is <b>local</b> to the OBCP (i.e. this identifier is associated to a variable in the OBCP source code, at declaration)	
Value	Value to be used for OBCP parameter setting	

2850

13556

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13300

### 5.19.4 TC (18,8) Report List of OBCP

#### Description:

This telecommand generates a TM(18,9) report with on-board control procedures list.

2852

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

3953

Packet Data Field Info:

- Service Type: 18
- Service Subtype: 8

Application/Source Data:

#### Parameter definition

None

2862

#### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13301

## 5.19.5 TM (18,9) OBCP List Report

### Description:

This telemetry reports the on-board control procedures list as answer of TC(18,8).

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 18
- Service Subtype: 9

Application/Source Data:

N	OBCP ID	Checksum	State	Instruction pointer	Step ID
uint	uint	uint	enum	uint	uint
2 byte	4 byte	2 bytes	1 byte	2 bytes	2 bytes
	<-----	Repeated N	times-----	-----	----->

### Parameter definition

Parameter	Description	Value / Range
N	Number of reported OBCPs	
OBCP ID	Identifier of the OBCP	
Checksum	Checksum of the OBCP	
State	OBCP state	1 : loading 2 : inactive 3 : running 4 : held
Instruction Pointer	Current Instruction pointer of the OBCP	
Step ID	Last current Step ID reached by the OBCP	

## 5.19.6 TC (18,140) Load and Start an OBCP

### Description:

This telecommand loads an OBCP from its storage location into RAM execution area, and starts it.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 18
- Service Subtype: 140

Application/Source Data:

OBCP ID	Emergency	Auto-delete	spare	NL	Load parameters	NS	OBCP Param ID	Value
uint	enum	enum	n/a	uint	N/A	uint	uint	(deduced)
4 bytes	1 bit	1 bit	6 bits	2 bytes	1byte	2 bytes	4 bytes	variable
					←---NL times---->		<-----NS	times---->

## Parameter definition

Parameter	Description	Value / Range
OBCP ID	Identifier of the OBCP	
Emergency	Defines if the OBCP has to be started as an emergency OBCP	0 : no 1 : emergency
Auto-delete	Defines if the OBCP has to be automatically deleted when it ends.	1 : auto-delete
spare	Current Instruction pointer of the OBCP	
NL	Number of load parameters that follow, in bytes.	
Load parameters	Parameters definition. If NL is greater than 0, first byte gives loading protocol identifier that can be: 0: no specific protocol is used (OBCP is loaded and if it fails, the failure is reported), 1: retry protocol: second byte gives number of retry that will be performed in case loading fails. The failure will be reported only if load fails number of retry + 1 times (having this second byte equals to 0 will be equivalent to previous case).	
NS	Number of OBCP parameters to communicate at start	
OBCP Param ID	Identifier of a parameter, which is <b>local</b> to the OBCP (i.e. this identifier is associated to a variable in the OBCP source code, at declaration)	
Value	Value to be used for OBCP parameter setting	

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## Remarks

In case TC is to load and start an emergency OBCP, and this TC is queued into emergency list because emergency slot is used, the execution acknowledge is sent when start is effective, and an event report is generated to signal that execution acknowledge will be delayed.

Since the "Autodelete" Flag is forced, in case where the start fails, or in case of successful execution completion, the OBCP is deleted from RAM.

## 5.19.7 TC (18,141) Stop and Delete an OBCP

### Description:

This telecommand allows to stop a currently executing OBCP, and to delete it from RAM execution area afterwards.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 18
- Service Subtype: 141

Application/Source Data:

OBCP ID	Step ID
uint	uint
4 bytes	2 bytes

### Parameter definition

Parameter	Description	Value / Range
OBCP ID	Identifier of the OBCP to be stopped	
Step ID	(Optional) Step after which the OBCP shall be stopped. The following values are defined: -1 : immediate stop 0 : stop at end of current step "Other step" values are OBCP design dependant. When no Step ID is defined, the -1 value (immediate stop) is used as default.	

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### Remarks

When this request is received, the specified on-board procedure is stopped at end of requested step, and the OBCP execution slot is freed. Because stop can be not immediate, the execution acknowledge is sent when step at end of which to stop is set, then an event report is generated when stop is effective.

An immediate stop can be not *strictly* immediate in case OBCP is executing a library call, to let it cleanly terminates this call (as releasing used resource if there is some).

In case stop request fails, automatic delete flag is reset to the value it had before TC execution. When this request is received, the specified on-board procedure is stopped at end of requested step, and the OBCP state becomes "inactive".



## 5.19.8 TC (18,142) Set OBCP HKTM

### Description:

This TC allows to activate the OBCP telemetry generation of TM(18,144), or to define the frequency of OBCP telemetry generation.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 18
- Service Subtype: 142

Application/Source Data:

OBCP ID	TM Status	TM Period
uint	enum	uint
4 bytes	1 bit	15 bits

### Parameter definition

Parameter	Description	Value / Range
OBCP ID	Identifier of the OBCP	
TM Status	Enabling status of the HK TM generation	0 : disabled 1 : enabled
TM Period	Indicate the number of 8 Hz cycles between two consecutive TM generation	

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.19.9 TM (18,144) OBCP TM

### Description:

This telemetry reports cyclically the OBCP telemetry, as controlled by TC(18,142).

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 18
- Service Subtype: 144

Application/Source Data:

OBCP ID	Checksum	N	OBCP Param ID	Value
uint	uint	uint	uint	(deduced)
4 bytes	2 bytes	2 bytes	4 bytes	variable
			<----repeated N	times----->

14593

## Parameter definition

2814

Parameter	Description	Value / Range
OBCP ID	Identifier of the OBCP	
Checksum	Checksum of the OBCP	
N	Number of Parameters of the OBCP	
OBCP Param ID	Identifier of a parameter, which is <b>local</b> to the OBCP (i.e. this identifier is associated to a variable in the OBCP source code, at declaration)	
Value	Current Value of the OBCP Parameter	

13685

## 5.20 Service 19: Event-Action

### Objective

2876

As an extension to the on-board capability for detecting events and reporting them asynchronously to the ground system, this service provides the capability to define an action that is executed autonomously onboard when a given event is detected. The class of events that can give rise to an action are those that also give rise to an event report and the associated action can be a telecommand of any standard type or any mission-specific telecommand.

### Description

2877

The service shall maintain a list of events that can be detected that contains the following information:

- Process ID generating the event report;
- Event report ID;
- Associated action (telecommand packet);
- Status of the action - enabled or disabled;

The list shall be updated in accordance with requests from ground and the list information shall be reported to ground on request. The service can be designed to detect event reports (TM(5,[1-4]) generated by one (e.g. its own) or more application process. On reception of an event report, the service shall scan the detection list and if a matching event report is detected and the associated action is enabled, the corresponding telecommand packet shall be sent to the destination application process.

### Notes

2878

### 5.20.1 TC (19,1) Add an Event to the Detection List

#### **Description:**

2880

This TC 19,1 adds the specified event to the Detection List.

#### **Structure:**

3955

Packet ID Info:

- Process ID: as per Annex 8

- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 19
- Service Subtype: 1

Application/Source Data:

Filler	PID	EID	TC
Default 0 bin	Enumerated	Uns. Int.	Byte String
1 bit	7 bit	2 bytes	TBD

7638

## Parameter definition

Parameters of Application Data Field	Description	Range or Value
PID	Process ID	See Annex 8
EID	Event Identifier	Must be set to a valid <i>EID</i> for the given <i>PID</i> . See Annex 9
TC	Complete TC Packet	A complete stand alone TC packet.

2890

7654

Note that, the default status of a newly created event-action entry is disabled.

14227

### TC Verification:

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13305

## 5.20.2 TC (19,2) Delete an Event from the Detection List

### Description:

This TC 19,2 deletes the specified event from the Detection List.

2892

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

3956

Packet Data Field Info:

- Service Type: 19
- Service Subtype: 2

Application/Source Data:

Filler	PID	EID
Default 0 bin	Enumerated	Uns. Int
1 bit	7 bit	2 bytes

7671

2902

## Parameter definition

Parameters of Application Data Field	Description	Range or Value
PID	Process ID	
EID	Event Identifier	Must be set according to a valid <i>EID</i> present in the event detection list. See Annex 9

7684

## TC Verification:

13306

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.20.3 TC (19,3) Clear the Event Detection List

#### Description:

2904

This TC 19,3 removes all entries from the Event Detection List.

#### Structure:

3957

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 19
- Service Subtype: 3

Application/Source Data: TC(19,3) does not have any application data, i.e. the *Application Data* field within the *TC Packet Data* field does not exist (length = 0).

#### Parameter definition

2914

N/A

## TC Verification:

13307

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.20.4 TC (19,4) Enable Action

#### Description:

2916

This TC 19,4 enables the action associated to the specified event.

#### Structure:

3958

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 19
- Service Subtype: 4

Application/Source Data:

N	Filler	PID	EID
Unsigned Integer	Default 0 bin	Enumerated	Uns. Int
1 byte	1 bit	7 bit	2 bytes
	<-repeat N times->	<-repeat N times->	<-repeat N times->

7697

### Parameter definition

Parameters of Application Data Field	Description	Range or Value
N	Number of parameter sets to follow	<b>N = 0</b> : The Event/Action status shall be changed on Service level. All individual entries remain unchanged. <b>N &gt; 0</b> : Each parameter set in the request shall be processed in turn and the status shall be set accordingly.
PID	Process ID	See Annex 8
EID	Event Identifier	See Annex 9

2926

7718

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13308

### 5.20.5 TC (19,5) Disable Action

#### Description:

This TC 19,5 disables the action associated to the specified event.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 19
- Service Subtype: 5

Application/Source Data: The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for

TC(19,4).

### Parameter definition

### TC Verification

2928

3959

2938

13309

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.20.6 TC (19,6) Report the Event Detection List

### Description:

2940

This TC 19,6 requests to report the Event Detection List via TM 19,7.

### Structure:

3960

#### Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

#### Packet Data Field Info:

- Service Type: 19
- Service Subtype: 6

Application/Source Data: TC(19,6) does not have any application data, i.e. the *Application Data* field within the *TC Packet Data* field

does not exist (length = 0).

### Parameter definition

2950

N/A

### TC Verification:

13310

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.20.7 TM (19,7) Event Detection List Report

### Description:

2952

This TM 19,7 is the response to TC 19,6.

### Structure:

3961

#### Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

#### Packet Data Field Info:

- Service Type: 19
- Service Subtype: 7

Application/Source Data:

N	Filler	PID	EID	Action Status	TC Header
Unsigned Integer	Default 0 bin	Enumerated	Uns. Int.	Enumerated	Unsigned Integer
1 byte	1 bit	7 bit	2 bytes	1 byte	10 bytes
	←-----	-----	--repeat N times	-----	----->

7735

## Parameter definition

Parameters of Source Data Field	Description	Range or Value
N	Repetition Count	0..MAX
PID	Application Process ID	Copy of the relevant entry in the event detection list See Annex 8
EID	Event Identifier	Copy of the relevant entry in the event detection list See Annex 9
Action Status	Event Action Status for given PID/EID	0 =DISABLED 1 =ENABLED
TC Header	Telecommand packet header plus Data Field Header	Copy of the relevant entry in the event detection list

2962

7764

### 5.20.8 TC (19,130) Request Single Event Detection Entry Report

#### Description:

Upon reception of TC 19,130 the TM 19,131 will be generated.

10161

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

10162

Packet Data Field Info:

- Service Type: 19
- Service Subtype: 130

Application/Source Data:

Filler	PID	EID
	Enumerated	Uns. Int.
1 bit	7 bits	2 bytes

10164

## Parameter definition

Parameters	Description	Range or Value
PID	Process ID	See Annex 8
EID	Event Identifier	See Annex 9

10163

10177

#### TC Verification:

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13311

## 5.20.9 TM (19,131) Single Event Detection Entry Report

### Description:

TM 19,131 is generated in response to TC 19,130 and report for a given PID and Event ID the Action TC and the Action status.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 19
- Service Subtype: 131

Application/Source Data:

Filler	PID	EID	Action Status	TC
	Enumerated	Uns. Int.	Enumerated	Unsigned integer
1 bit	7 bits	2 bytes	1 byte	variable

### Parameter definition

Parameters	Description	Range or Value
PID	Process ID	
EID	Event identifier	See Annex 9
Action Status	Event Action Status for given PID/EID	0 = Disabled 1 = Enabled
TC	Complete TC packet	

## 5.21 Service 20: Information Distribution

### Objective

Service 20 packets are sent from the OBC to the payload instruments in order to:

- act as a OBC heartbeat to the payload instruments so that they can perform a controlled switch down in case the spacecraft enters Survival Mode
- to distribute inter-instrument communication data

### Description

To simplify interfaces on both OBC and payload sides, inter-instruments information distribution is defined as a single TC packet TC(20,128).

### Notes

### 5.21.1 TC (20,1) Start Information Distribution for User

#### Description

This TC requests the CSW to start the Information Distribution to a given User.

#### Structure:

Packet ID Info:

- Process ID:



- Packet Cat: 12

Packet Data Field Info:

- Service Type: 20
- Service Subtype: 1

Application/Source Data:

Instrument ID	Period
1 byte	2 bytes

13349

### Parameter definition

13316

Parameter	Description	Value / Range
Instrument ID	Destination instrument ID for which information distribution shall be started	See Table 7-1 in AD04
Period	Information distribution period	= 0 : One-shot distribution > 0 : Period in SW cycle

13358

Note that, the information distribution period determines the period at which the 2,128 packets are sent to the user by the CSW. The period is an integer number of SW cycles, where one SW cycle is 125 ms.

14157

### TC Verification:

14158

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.21.2 TC (20,2) Stop Information Distribution for User

### Description

13319

This command requests the CSW to stop the Information Distribution to a given User.

### Structure:

13320

Packet ID Info:

- Process ID:
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 20
- Service Subtype: 2

Application/Source Data:

Instrument ID
1 byte

13323

13321

## Parameter definition

Parameter	Description	Value / Range
Instrument ID	Destination instrument ID for which information distribution shall be stopped	See Table6-1 in AD04

13332

## TC Verification:

13322

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.21.3 TC (20,128) Inter-Instruments Communication

### Description

13077

This TC sends cyclically at (up to) 8Hz the inter-instrument communication packet to all the payload instruments. The packet has the following characteristics:

- APID = 796 (PID = 49, meaning PL Broadcast; CAT = 12)
- Sequence count = incrementing counter at 8Hz (wraps around every 2048s).
- Ack = 0 (meaning that no TM(1,1) and TM(1,7) verification packets are generated by the payloads in response to receiving this packet).
- Source ID = 14 (System Control)

The data field will contain 236 octets (max application data field size) of data which will be extracted from the system data pool. The data will consist of a 200 octet field for data from the ten instruments, plus a 36 octet field containing platform data.

14160

All payload instruments will receive an identical packet, but each payload instrument will receive the packet at an agreed frequency up to 8Hz. Those receiving the packet at 8Hz will see an incrementing Sequence Count. Those receiving the packets at a lower frequency will see gaps in the sequence count.

14161

Note: To aid interface verification during the ground test program, the in-flight checkout and commissioning and for failure investigation, it is recommended that the payload instruments report the sequence count of the last received TC(20,128) packet in their telemetry (either cyclic or solicited).

14162

### Structure

2966

Packet ID Info:

- Process ID: 49 (Payload broadcast) as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 20
- Service Subtype: 128

Application/Source Data:

13962

<b>PF data</b> Comm- andable flags	<b>PF Data -</b> AOCS sub- mode	<b>PF data -</b> convergence flag	<b>PF Data -</b> roll rate	<b>PF data -</b> roll rate	<b>PF data -</b> RW 1 speed (TBC)	<b>PF data -</b> RW 2 speed (TBC)	<b>PF data -</b> RW 3 speed (TBC)	<b>PF data -</b> RW 4 data (TBC)	<b>PF data -</b> TBC
2 octets	4 octets	1 octet	4 octets	4 octets	4 octets	4 octets	4 octets	4 octets	5 octets

<b>EPD Data</b>	<b>EUI data</b>	<b>MAG data</b>	<b>METIS data</b>	<b>PHI data</b>	<b>RPW data</b>	<b>SoloHI data</b>	<b>SPICE data</b>	<b>STIX data</b>	<b>SWA data</b>
20 octets	20 octets	20 octets	20 octets	20 octets	20 octets	20 octets	20 octets	20 octets	20 octets

**Note:**

The total number of octets assigned to instruments is 200. 20 octets are therefore assigned to each instrument; any deviation must be agreed between the PIs and ESA.

**Parameter Definition**

Parameters of Source data field	Description	Range or Value
Platform Data - commandable flags	Flags indicating platform operation	Bit 0: Thruster firing flag (1 = thruster fire expected within 5s; 0 = no thruster fire) Bit 1: Science data outage flag (1 = interruption to science data storage in SSMM occurring within TBC seconds; 0 = science data storage nominal) Bits 2-15: Commandable flags, content TBC
Platform Data - AOCS sub-mode	Parameter indicating current AOCS mode	TBC
Platform data - convergence flag	Flag indicating whether AOCS mode performance is achieved	TBC
Platform data - roll rate	Roll rate, around Xsc wrt interial frame expressed in SC frame	TBC
Platform data - roll angle	Roll angle component of AOCS Estimated Attitude Quaternion; angle around Xsc wrt J2000 interial reference frame	TBC
Platform data - RW 1 speed (TBC)	Speed of reaction wheel 1, in rad/s	TBC
Platform data - RW 2 speed (TBC)	Speed of reaction wheel 2, in rad/s	TBC
Platform data - RW 2 speed (TBC)	Speed of reaction wheel 3, in rad/s	TBC
Platform data - RW 3 speed (TBC)	Speed of reaction wheel 4, in rad/s	TBC
EPD Data	Data provided by EPD	
EUI Data	Data provided by EUI	

Parameters of Source data field	Description	Range or Value
MAG Data	Data provided by MAG	
METIS Data	Data provided by METIS	
PHI Data	Data provided by PHI	
RPW Data	Data provided by RPW	
SoloHI Data	Data provided by SoloHI	
SPICE Data	Data provided by SPICE	
STIX Data	Data provided by STIX	
SWA Data	Data provided by SWA	

Remarks:

- The content of the platform data field will be determined based on requirements from the payload users. This field has a length of 36 octets. The bit allocation is on-going and must be agreed between PIs and ESA.
- The data for each payload instrument is provided via a specific TM(3,25) sent to the OBC by the instrument with max source data field size of 20 octets. This data is extracted as one block via the TM extraction service, buffered in the System Data Pool (SPD), and retransmitted in TC(20,128) as described.

13079

**TC Verification**

None.

14036

**5.22 Service 21: Science Data Transfer**

**Objective**

Service 21 performs management of the science data transfer between the SSMM and the payloads. Upon receipt of a TC (21,1), the payload user starts transmission of its science data to the SSMM in a sequence of TM (21,x) s as defined by the user.

Note that, enable of science data transmission may also be achieved directly by a commanded mode-change of the instrument. This process is halted by the payload user upon receipt of a TC (21,2), or can also be achieved implicitly by a mode-change.

2968

**5.22.1 TC (21,1) Enable/Start Science transfer from User to SSMM**

**Description**

As defined by the user.

At least one set of commands TC (21,1) and TC(21,2) needs to be defined for activating or deactivating globally the generation of Service-21-TM-packets.

Recommendation: In case of a need to enable/ disable individually different subsets of Science TM-packets the corresponding telecommands may be defined additionally.

14279

2969

14281

**5.22.2 TC (21,2) Enable/Stop Science transfer from User to SSMM**

As defined by the user, see TC(21,1).

14165

14282

**5.22.3 TM (21,3) Science Data Transfer (fixed length, with SSID)**

**Description**

14303

This TM contains science data from the user of fixed length, and with a structure ID which can be used to identify up to 256 different variations of TM (21,3) containing different parameter lists, defined by the user. The packet definition including parameter list, per structure ID, should be included in the user TMTICID. Each packet variation must be of the same, fixed, length.

Note that, the TM Packet Header and the TM Data Field Header have to be compliant in syntax and functionality to the definitions given in section 4.2.1 and 4.2.2.

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 21
- Service Subtype: 3

Application/Source data:

SSID	Parameter List
Uns Int	-
1 byte	Any size, up to max allowed

**Parameter Definition**

Parameters of source data field	Description	Range or Value
SSID	Science structure ID identifying the type of 21,3 packet	0 - 255
Parameter List	Science data parameters, according to User TMTICID	

**5.22.4 TM (21,4) Science data Transfer (fixed length, no SSID)**

**Description**

This TM contains science data from the user of fixed length. The science data contained within the packet is defined by the user and must be of fixed length. The packet definition should be included in the user TMTICID.

Note that, the TM Packet Header and the TM Data Field Header have to be compliant in syntax and functionality to the definitions given in section 4.2.1 and 4.2.2.

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 21

- Service Subtype: 4

Application/Source data: As defined by user

## 5.22.5 TM (21,5) Science Data Transfer (variable length data stream, with SSID)

### Description

This TM packet structure is intended to represent an 'anonymous data stream' (a series of octets or words, of variable length), as seen by Solar Orbiter Operations. Further (detailed) interpretation of the data stream remains private within the Payload Operator's environment and is therefore not specified here.

The science data is encoded into the "Data" field, which is typically of size 1, 2 or 4 octets. The Data field repeats (N times) to accommodate the full data stream (up to the maximum TM packet length). The value of N is variable and is determined by the payload software dynamically when emitting the packet.

The SSID allows up to 256 different variations of TM (21,5) for different purposes. The size of each "Data" element is fixed in each SSID but can vary between SSIDs.

Note that, the TM Packet Header and the TM Data Field Header have to be compliant in syntax and functionality to the definitions given in section 4.2.1 and 4.2.2. The source data field must be compatible with the TM packet definition in the user's TM/TC ICD.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 21
- Service Subtype: 5

Application/Source data:

SSID	N	Data
Uns Int	Uns Int	Uns Int or Binary
1 byte	2 bytes	Any size
		<-- Repeat N times -->

### Parameter Definition

Parameters of Source Data field	Description	Range or Value
SSID	Science structure ID, identifying the type of 21,5 packet	0-255
N	Number of words or bytes of science data following in data field	
Data	Science data word or byte, repeated N times, as defined in user TMTICD	

## 5.22.6 TM (21,6) Science Data Transfer (variable length, with structure and SSID)

14302

### Description

14364

This TM packet is intended to contain complex, user-defined TM structures of variable length, where both fixed and variable parts are present. The variable part may be an 'anonymous data stream' (a series of octets or words, of variable length), as seen by Solar Orbiter Operations. Further (detailed) interpretation of the variable-length data stream remains private within the Payload Operator's environment and is therefore not specified here.

The fixed part of the science data is encoded into the Fixed Parameters blocks (one start and one end). These parts are optional and, if included, consist of a parameter list containing any (fixed) quantity, size and type of parameters, according to the instrument design.

The variable-length part is encoded into Repeating Block 1. Two typical scenarios are anticipated:

- A repeating set of decodable parameters is defined by the user with known size, type and description, allowing interpretation of the data by Ground systems. The set of parameters repeats N1 times.
- The Repeating Block 1 contains an anonymous data stream of variable-length. The block is defined with only one parameter, called "Data". The Data field is typically of size 1, 2 or 4 octets. It repeats N1 times to accommodate the full data stream (up to the maximum TM packet length).

The value of N1 is variable and is determined by the payload software dynamically when emitting the packet.

The SSID allows up to 256 different variations of TM (21,6) for different purposes. The SSID is at the same position in all variations of TM (21,6). The size, type, length and structure of all parameter lists following the SSID can vary between SSIDs.

Note that, the TM Packet Header and the TM Data Field Header have to be compliant in syntax and functionality to the definitions given in section 4.2.1 and 4.2.2. The source data field must be compatible with the TM packet definition in the user's TM/TC ICD.

### Structure:

14373

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 21
- Service Subtype: 6

Application/Source data:

SSID	Fixed Parameters (start)	N1	Repeating Block 1	Fixed Parameters (end)
Uns Int	Any	Uns Int	Any	Any
1 byte	Any	Any size	Any	Any
<--- Repeat N1 times -->				

14374

## Parameter Definition

Parameters of source data field	Description	Value or Range
SSID	Science structure ID, identifying the type of 21,6 packet	0-255
Fixed Parameters (start)	0 or more parameters of science data.	
N1	The number of the Repeating Block 1 follows	0-Max Int
Repeating Block 1 or Data	1 or more parameters of science data. <ul style="list-style-type: none"> <li>An anonymous data stream in this block is usually best represented as a single "Data" parameter representing one octet (or word) of the stream.</li> <li>In case of more complex structures with nested repetition, it is possible to embed a N2 + Repeating Block 2 here.</li> </ul>	
Fixed Parameters (end)	0 or more parameters of science data.	

14384

14385

As defined by the user

14283

14167

## Notes

2970

## 5.23 Service 22: Context Saving

### Objective

2972

This service provides the payload users with the ability to store their operational context as a file in the OBC OMM and then retrieve it at a later stage. This is called Context Saving and allows the payload user to save an operational configuration before switch off and have it restored at switch on. On Ground request, the CSW sends a request to an instrument to transmit its context data. The payload responds by transmitting a TM packet containing its data which is stored by the CSW as a file in the OMM. Similarly, upon Ground request, the CSW restores the context data to the user.

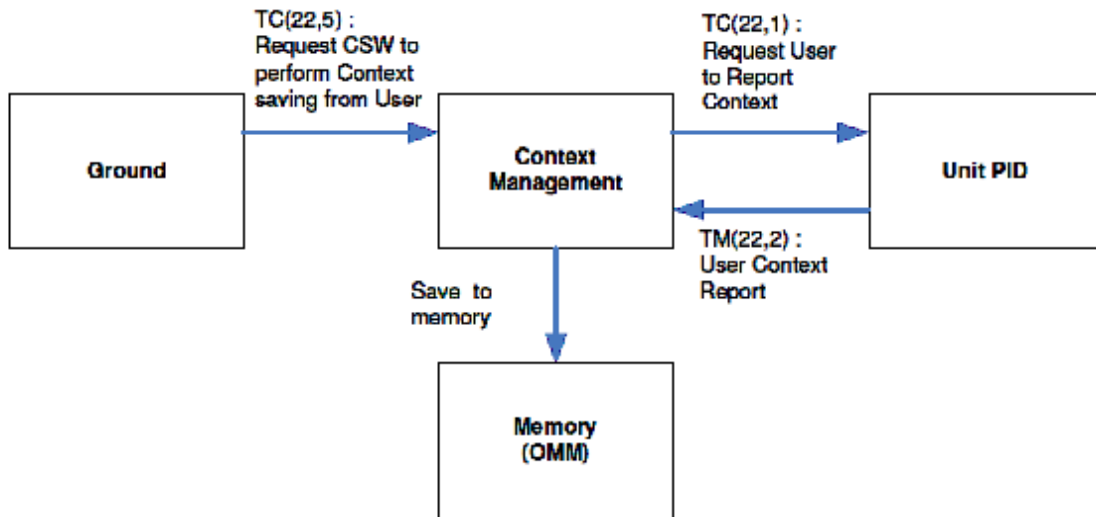
### Description

2973

Upon receipt of a TC (22,5) from Ground, the CSW will send a TC (22,1) to the instrument identified in (22,5), to provide its context. In response the instrument will send a single TM (22,2) which contains data, as defined by the user, which the CSW stores as a dedicated file in the OBC MM. This upload (to OMM) of the user context is shown in the figure below.

14039



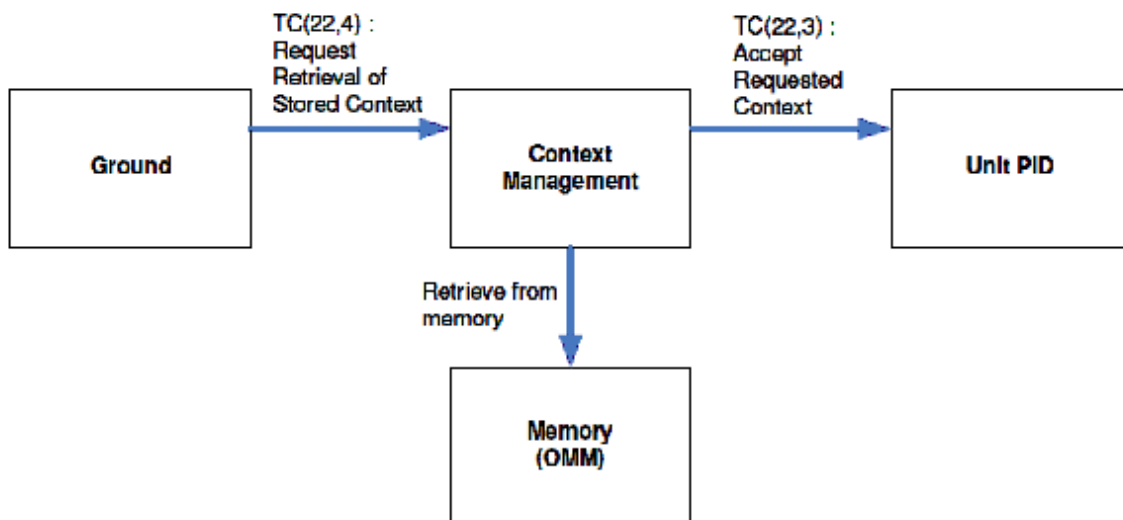


**Figure 5.23-1: Service 22 Context data saving concept**

Note that the context is stored in the OMM as a file and is therefore accessible to Ground using Service 133. 14044

In order to restore the unit context, upon receipt of a TC (22,4) from Ground, the CSW will restore the context data to the unit by sending a series of n TCs (22,3) each containing one segment of the context information. The number of TM(22,3) commands necessary to fully restore the context is dependant on the size of the TM (22,2) received from the user ( $n_{max} = 18$ ).

This download (from the OMM) of the user context can be seen in the figure below. 14043



**Figure 5.23-2: Service 22 Context data restoration concept**

### 5.23.1 TC (22,1) Request User to report context 14286

#### Description 14046

This TC requests a user to provide its context, and is sent by the CSW upon receipt of a (22,5). 14047

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12
- Source ID: 14 (System Control)

Packet Data Field Info:

- Service Type: 22
- Service Subtype: 1

Application/Source Data: TC(22,1) does not have any application data, i.e. the *Application Data* field within the *TC Packet Data* field does not exist (length = 0).

14048

**Parameter definition**

14049

N/A

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

14050

Remarks: The user must respond with a TM (22,2) within 5 seconds

2974

**5.23.2 TM (22,2) User Context Report**

14285

**Description**

14052

This TM provides the user context data and is sent by the payload user upon receipt of a TC(22,1).

**Structure:**

14053

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 22
- Service Subtype: 2

Application/Source Data:

14179

<b>Context Data</b>
Up to 4094 Octets

14061

**Parameter definition**

14060

Parameters of Source data field	Description	Range or Value
Context Data	Context data as provided by payload instrument	

14067

14066

The content of the context data field is as defined by each payload instrument, the length of the field must be fixed for each instrument.

### 5.23.3 TC (22,3) Accept requested context

14287

#### Description

14078

This TC is sent by the CSW and returns the last stored context data to the user, upon receipt of a TC (22,4) from ground.

#### Structure:

14079

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12
- Source ID: 14 meaning system control

Packet Data Field Info:

- Service Type: 22
- Service Subtype: 3

Application/Source Data:

14168

<b>N</b>	<b>Context Data</b>
2 byte	Up to 234 octets

14170

#### Parameter definition

14076

Parameters of Application data field	Description	Range or Value
N	Segment counter	1 to 18
Context Data	Context data as provided by payload instrument	

14095

Note that TC (22,3) is used to return the context data provided by the payload instrument in TM (22,2) therefore a number of TCs (up to 18), dependant on the size of the context data, may be necessary with max data transferrable per TC, 236 octets.

14081

N is determined by the size of the data field in TM(22,2) and is therefore fixed for each instrument. It is recommended that the instrument uses the segment count to ensure that the packets are received in order and that all packets, up to N, are received before restoring context.

14177

#### TC Verification:

14108

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

Remark: The TCs containing successive segments will be sent to the user at a rate of 1Hz.

14109

14288

### 5.23.4 TC (22,4) Request CSW to restore context data to User

#### Description

14111

This TC requests the CSW to return the saved context data to the user, via a sequence of TCs (22,3).

**Structure:**

14112

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 22
- Service Subtype: 4

Application/Source Data:

14178

<b>Instrument PID</b>
1 byte

14116

**Parameter definition**

14114

Parameters of Application data field	Description	Range or Value
Instrument PID	PID of payload user to whom context data is to be restored	See Figure 13.1-2 of Annex 8

14121

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

14115

14289

**5.23.5 TC (22,5) Request CSW to perform context saving from User**

**Description**

14131

This TC requests the CSW to request context data from the payload user, via TC (22,1).

**Structure:**

14132

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 22
- Service Subtype: 5

Application/Source Data:

14180

<b>Instrument PID</b>
1 byte

14138

14135

## Parameter definition

Parameters of Application data field	Description	Range or Value
Instrument PID	PID of payload user from whom context is requested	See Figure 13.1-2 of Annex 8

14143

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

14137

14094

## Notes

### 5.24 Service 130: TM Extraction

#### Objective

This service allows to extract data from remote Process ID specific TM packets (TM(3,25), TM(3,26) and TM(5,x)) and to put the extracted data in a dedicated reserved areas in the Data Pool.

5755

#### Description

A default TM Extraction List will be defined in the SRDB and the on-board SW image.

5756

It will also be possible to define some default entries in the SGM.

#### Notes

5757

#### 5.24.1 TC (130, 1) Define TM Extraction Descriptors

##### Description:

This telecommand allows defining one or several new TM extraction descriptors.

13715

##### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 130
- Service Subtype: 1

Application/Source Data:

N	Target Param ID	TM APID	TM SID	Offset in TM
uint	enum	uint	enum	uint
1 byte	4 bytes	2 bytes	2 bytes	2 bytes
	<-----	----Repeated N	times-----	----->

13716

14618

##### Parameter definition:

Parameter	Description	Value / Range
N	Number of added TM extraction Descriptors	1..23
Target Param ID	Identification of the Parameter ID in the Datapool where the extraction will be copied	

13717

13718

Parameter	Description	Value / Range
	into.	
TM APID	APID of the TM from which data are extracted	
TM SID	Identifier of the TM from which data are extracted : either SID (in case of TM with category "HK" or "Diagnostic") or EID (in case of TM with category "Event")	SID: 0..255
Offset in TM	Offset –in bytes- of the data to be extracted, relatively to the beginning of the TM Packet Data Field.	

13743

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## Remarks

- The "Target Param ID" parameter shall have been previously created.

Note: this pre-condition is the user responsibility. Whenever a Target Param ID does not exist among the "N" in the telecommand, despite there is a TC execution failure, all the preceeding Param IDs in the TC have been nevertheless added in the extraction descriptor.

- The Length of the copied (=extracted) data is the length defined for the Target Param ID.

As a result, when an extraction descriptor is defined and a Target Parameter ID is provided to store the extraction data in, the size of the extracted data will be such that it fits the parameter size definition. This ensures that there will not be any mismatch between parameter definitions and extraction descriptors.

- The offset is not checked: it is up to the Ground to ensure that it is consistent with the extracted TM definition.

### 5.24.2 TC (130, 2) Delete TM Extraction Descriptors

#### Description:

This telecommand allows deleting one or several TM extraction descriptors.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 130
- Service Subtype: 2

Application/Source Data:

N	Target Param ID
uint	enum
1 byte	4 bytes

13745

13746

14643

N	Target Param ID
	<---Repeated N times----- ----->

**Parameter definition:**

Parameter	Description	Value / Range
N	Number of TM extraction descriptors to be deleted	1..58
Target Param ID	Identification of the Parameter ID in the Datapool where the extraction is copied into.	

13747

13750

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**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.24.3 TC (130, 3) Report TM Extraction Descriptors**

**Description:**

This telecommand allows requesting the TM extraction descriptors table.

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 130
- Service Subtype: 3

Application/Source Data: none

**Parameter definition:**

None

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13776

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13779

**5.24.4 TM (130, 4) TM Extraction Descriptors Report**

**Description:**

This telemetry reports the content of the TM extraction descriptors table.

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8

13781

13782

- Packet Cat: as per Annex 8

Packet Data Field Info:

- Service Type: 130
- Service Subtype: 4

Application/Source Data:

N	Target Param ID	TM APID	TM SID	Offset in TM
uint	enum	uint	enum	uint
1 byte	4 bytes	2 bytes	2 bytes	2 bytes
	<-----	----Repeated N	times-----	----->

14656

Parameter definition:

Parameter	Description	Value / Range
N	Number of reported TM extraction Descriptors	1 to 255
Target Param ID	Identification of the Parameter ID in the Datapool where the extraction will be copied into.	
TM APID	APID of the TM from which data are extracted	
TM SID	Identifier of the TM from which data are extracted : either SID (in case of TM with category "HK" or "Diagnostic") or EID (in case of TM with category "Event")	SID: 0..255
Offset in TM	Offset -in bytes- of the data to be extracted, relatively to the beginning of the TM Packet Data Field.	

13783

13784

## 5.25 Service 131: Private Function Management

### Objective

This service supports the control of SW functions of an APID which are not implemented on-board as standard services and which are not dedicated to FDIR recovery purposes (these FDIR functions are implemented via service 8).

For example the functions will be the equipment management functions to switch on, off or activate units at SW level.

### Description

Each application function of an application process will be uniquely identified by a Function ID.

If identical application functions exist in different application process then they should have the same Function ID.

### Notes

TM(1,7) and TM(1,8) will be generated at the start of function execution.

For long duration functions a TM(5,1) should be generated on completion of the function execution.

10744

10745

10746

### 5.25.1 TC (131,1) Perform Functions

#### **Description:**

This TC 131,1 will perform functions of different applications. All functions on board shall be uniquely identified by a Function Identifier (FID) defined in [RD05].

12031



**Structure:**

12032

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 131
- Service Subtype: 1

Application/Source Data:

Function ID	Parameters
Unsigned Integer	Any
2 octets	up to 234 octets

12141

**Parameter definition**

12033

Parameter	Description	Range or value
Function ID	Identification of which function to perform	The list of the function IDs can be found in RD5.
Parameters	the number and structure of the parameters for specific Function ID is known by the SW and will be documented in the SW User Manual.	Detailed parameters for each function ID and their structure will be refined during SW development and provided at the relevant CSW DRB.

12130

**TC Verification**

12140

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.26 Service 132: SGM Management**

**Objective**

5763

This service provides a dedicated interface to access data within Data Groups located in SGM EEPROM and SGM RAM.

**Description**

5764

This service 132 will update data in specified data groups on both SGM A and B and will autonomously update the group CRC and OBT (indicating the last update time).

This service 132 will read data from the master SGM (e.g. A).

**Notes**

5765

Service 132 accesses data in the data groups via the physical memory properties (e.g. offset in group and parameter length).

## 5.26.1 TC (132,1) Report SGM Parameters

### Description:

This TC 132,1 requests a reading of data within a given SGM group. The response is TM 132,2

### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 132
- Service Subtype: 1

Application/Source Data:

Report ID	Group ID	Offset in Group	Length
Enum	Enum	Uns Int	Uns Int
2 bytes	1 byte	4 bytes	4 bytes

### Parameter definition

Parameters of Application Data Field	Description	Range or value
Report ID	Identification of the SGM Parameter Report to be generated. This field is required in the corresponding TM so that the packet can be decoded by the database on Ground.	
Group ID	Data Group Identifier	
Offset in Group	Offset in bytes starting from 0, of the functional data to be read within the Group.	
Length	Length in bytes of the functional useful data	

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.26.2 TM (132,2) SGM Parameters Report

### Description:

This TM 132,2 is the response to TC 132,1 and report SGM parameter values.

### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 132

- Service Subtype: 2

Application/Source Data:

Report ID	Group ID	Offset in Group	N	Data
Enum	Enum	Uns Int	Uns Int	
2 bytes	1 byte	4 bytes	4 bytes	N*bytes

10637

### Parameter definition

Parameter	Description	Value or Range
Report ID	Copy of the Report ID from the request command. This field is required so that the packet can be decoded by the database on Ground.	
Group ID	Data group identifier	
Offset in Group	Offset in bytes, starting from 0, of the functional data within the group	
N	number of data bytes reported	
Data	reported data	

10636

10653

### 5.26.3 TC (132,3) Write SGM Parameters

#### Description:

This TC 132,3 allows to write data within a given SGM group.

10676

#### Structure:

Packet ID Info:

- Process ID: as per annex 8
- Packet Cat: 12

10677

Packet Data Field Info:

- Service Type: 132
- Service Subtype: 3

Application/Source Data:

Group ID	Offset in Group	N	Data
Enum	Uns Int	Uns Int	
1 byte	4 bytes	4 bytes	

10679

### Parameter definition

Parameter	Description	Value or Range
Group ID	Data group identifier	
Offset in Group	Offset in bytes, starting from 0, of the functional data within the group	
N	number of data bytes to be written from offset position	
Data	data	

10678

10695

#### Note

The writing on SGM EEPROM needs to be enabled before this command is sent. It should then be disabled again to ensure protection of the SGM EEPROM.

10674

13832

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.27 Service 133: File Management

### Objective

This service provides the interface to manage Files on OBC local storage areas (OMM, SGM RAM, SGM EEPROM).

5767

5768

### Description

Operationally files will be used on-board to upload commands to the spacecraft (OBCP, TC files, Back-Up MTL), to upload profiles and ephemeris or to upload SW patch data.

This service will not manage the execution/application of the data but will provide the interface with the relevant functions.

### Notes

5769

### 5.27.1 TC (133,6) Copy File

#### **Description:**

This TC 133,6 allows copying an existing File into a new File of the same partition, or copying an existing file to a new location in a different partition.

11306

#### **Structure:**

11307

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 133
- Service Subtype: 6

Application/Source Data:

Source Partition ID	Source File ID	Destination Partition ID	Destination File ID
Enum	Uns Int	Enum	Uns Int
1 byte	4 bytes	1 bytes	4 bytes

11309

#### **Parameter definition**

11308

Parameter	Description	Value or range
Source Partition ID	Storage Partition of source file	
Source File ID	Source file name	
Destination partition ID	Destination storage partition of file	
Destination File ID	Destination file name	

11322

**Note:**

The following parameter combinations are accepted:

- 1) DESTINATION\_FILE\_ID=SOURCE\_FILE\_ID,  
SOURCE\_PART\_ID<>DESTINATION\_PART\_ID
- 2) DESTINATION\_FILE\_ID<>SOURCE\_FILE\_ID,  
SOURCE\_PART\_ID=DESTINATION\_PART\_ID
- 3) DESTINATION\_FILE\_ID<>SOURCE\_FILE\_ID,  
SOURCE\_PART\_ID<>DESTINATION\_PART\_ID

The following parameter combinations are accepted:

- 1) DESTINATION\_FILE\_ID=SOURCE\_FILE\_ID,  
SOURCE\_PART\_ID=DESTINATION\_PART\_ID

11339

**TC Verification**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8]

14298

**5.27.2 TC (133,7) Delete File**

**Description:**

This TC 133,7 deletes a File on a given partition.

11087

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

11088

Packet Data Field Info:

- Service Type: 133
- Service Subtype: 7

Application/Source Data:

Partition ID	File ID
Enum	Uns Int
1 byte	4 bytes

11114

**Parameter definition**

Parameter	Description	Value or range
Partition ID	Storage Partition	
File ID	Identifier of the File to be deleted on the given Partition	

11089

11124

13833

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.27.3 TC (133,8) Modify File Attributes

#### Description:

This TC 133,8 allows to modify some attributes of a given File.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 133
- Service Subtype: 8

Application/Source Data:

Partition ID	File ID	Type	Protection
Enum	Uns Int	Enum	Enum
1 byte	4 bytes	4 bytes	4 bytes

#### Parameter definition

Parameter	Description	Value or range
Partition ID	Storage Partition	
File ID	Identifier of the File	
Type	File Type	
Protection	File Delete Protection Status	0 = Delete Enabled 1 = Delete Disabled

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.27.4 TC (133,9) Request File Information

#### Description:

This TC 133,9 requests an information report of a given File.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 133
- Service Subtype: 9

Application/Source Data:

Partition ID	File ID
Enum	Uns Int
1 byte	4 bytes

11174

### Parameter definition

Parameter	Description	Value or range
Partition ID	Storage Partition	
File ID	Identifier of the File	

11097

11184

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13835

### 5.27.5 TM (133,10) File Information Report

#### Description:

This TM 133,10 reports a given File information as answer to TC 133,9.

11099

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per annex 8

11100

Packet Data Field Info:

- Service Type: 133
- Service Subtype: 10

Application/Source Data:

Partition ID	File ID	Address	Size	Type	Protection	Mode	Creation time
Enum	Uns Int	Uns Int	Uns Int	Enum	Enum	Enum	CUC
1 byte	4 bytes	4 bytes	4 bytes	4 bytes	4 bytes	4 bytes	6 bytes

### Parameter definition

Parameter	Description	Value or range
Partition ID	Storage Partition	
File ID	File Name	
Address	file Address (physical address on storage area)	
Size	File Size in bytes	
Type	File Type	
Protection	File "Delete enable" Protection Status	0 = Delete Disabled 1 = Delete Enabled

11101

11197

Parameter	Description	Value or range
Mode	Current File mode	0 = closed 1 = open
Creation Time	File creation time	

## 5.27.6 TC (133,11) Request Partition Mapping

### Description:

This TC 133,11 requests the report of the File mapping of a given partition. The response is provided in TM 133,12.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 133
- Service Subtype: 11

Application/Source Data:

Partition ID
Enum
1 byte

### Parameter definition

Parameter	Description	Value or range
Partition ID	Storage Partition whose mapping will be reported	

### TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.27.7 TM (133,12) Partition Mapping Report

### Description:

This TM 133,12 reports the File mapping of a given partition as answer to TC 133,11.

### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 133
- Service Subtype: 12



Application/Source Data:

Partition ID	N	File ID	Address	Size
Enum	Uns Int	Uns Int	Uns Int	Uns Int
1 byte	4 bytes	4 bytes	4 bytes	4 bytes
← repeat N times →				

## Parameter definition

Parameter	Description	Range or value
Partition ID	Storage Partition for which the mapping will be reporting	
N	Number of Files reported	
File ID	File name	
Address	File address (physical address on storage area)	
Size	File size in bytes	

### 5.27.8 TC (133,128) Verify File Checksum

#### Description:

This TC 133,128 request to verify the Checksum of a given File.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 133
- Service Subtype: 128

Application/Source Data:

Partition ID	File ID	Expected Checksum
Enum	Uns Int	Uns Int
1 byte	4 bytes	4 bytes

## Parameter definition

Parameter	Description	Value or range
Partition ID	Storage Partition	
File ID	Identifier of the File	
Expected checksum	Checksum	

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.28 Service 134: TC Sequencer

### Objective

5759

This service allows to manage TC Sequences (also called “TC Files”), which are Files previously uploaded and stored on-board thanks to service #13 capabilities.

### Description

5760

A TC File contains TC Packets. The TC sequence execution consists in reading sequentially the TC Packets contained in the File, and in releasing (i.e. sending) them at a given rate, with potentially some delays between chosen consecutive TCs.

The nominal operational approach is to store TC Files in the OBC Mass Memory (OMM). The uploading by service #13 allows to specify the following TC Sequence File Attribute:

- TC File - Delayed: the TC sequence will be executed on explicit request by TC(134,1)
- TC File - Immediate: in this case the execution immediately (and automatically) follows the successful completion of the TC File Upload, for Ground Ops convenience. This is the intended mechanism for MTL uploading.

In order to allow the management of several TC sequences in parallel, the TC sequence service provides the following capabilities:

- Control of the TC Sequences by using of a logical identifier: the TC Sequence ID (TcSeq ID)
- For one given TcSeq ID, capability to have (at maximum) one queued sequence, which is waiting for its execution when another sequence with the same ID is already running.

### Notes

5761

### 5.28.1 TC (134,1) Start TC Sequence

#### **Description:**

10966

This TC 134,1 allows to start, i.e. execute, one given TC Sequence File.

#### **Structure:**

10967

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 134
- Service Subtype: 1

Application/Source Data:

TcSeq ID	Partition ID	File ID	TC Exec Rate
Enum	Enum	Uns Int	Float
1 byte	1 byte	4 bytes	4 bytes

10981

10968

## Parameter definition

Parameter	Description	Value or range
TcSeq ID	Logical identifier of the TC Sequence	
Partition ID	Storage Area of the TC Sequence	
File ID	Name of the TC File to be executed	
TC Exec Rate	Frequency of TC to be released per second during the TC Sequence execution  Note that the corresponding period will be computed and upper-rounded to 125ms resolution	0.1 to 16 Hz. Note that this reflects the available range of the TC sequencer function, the selected rate must be compatible with the processing capability of the receiving function(s).

10997

## TC Verification

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13838

## 5.28.2 TC (134,2) Abort TC Sequence

### Description:

This TC 134,2 allows to abort one currently executing TC sequence.

10970

### Structure:

10971

#### Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

#### Packet Data Field Info:

- Service Type: 134
- Service Subtype: 2

#### Application/Source Data:

TcSeq ID	Partition ID	File ID
Enum	Enum	Uns Int
1 byte	1 byte	4 bytes

11018

## Parameter definition

Parameter	Description	Value or range
TcSeq ID	Logical identifier of the TC Sequence	
Partition ID	Storage Area of the TC Sequence	
File ID	Name of the TC File to be executed	

10972

11031

## TC Verification

13839

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.28.3 TC (134,3) TC Sequence Wait Delay

#### Description:

10974

This TC is to be used exclusively within a TC sequence. It allows to put a delay between its preceding TC and its following TC in the sequence.

#### Structure:

10975

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 134
- Service Subtype: 3

Application/Source Data:

<b>Delay</b>
Unsigned Integer
2 bytes

11052

#### Parameter definition

10976

Parameter	Description	Value or Range
Delay	Delay to wait before next TC release, as a multiple of 125 ms (8Hz cycle duration)	

11059

## TC Verification

13840

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.28.4 TC (134,4) TC Sequence Set Frequency

#### Description:

10978

This TC is to be used exclusively within a TC sequence. It allows to change "on the fly" the TC release rate for the current TC Sequence execution.

#### Structure:

10979

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 134
- Service Subtype: 4

Application/Source Data:

<b>TC Exec Rate</b>
Float
4 bytes

11069

## Parameter definition

10980

Parameter	Description	Value or Range
TC Execution Rate	<p>Frequency of TCs to be released per second during the TC Sequence execution</p> <p>Note that the corresponding period will be computed and upper-rounded to 125ms resolution</p>	0.1 to 16 Hz. Note that this reflects the available range of the TC sequencer function, the selected rate must be compatible with the processing capability of the receiving function(s).

11076

## TC Verification

13841

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.29 Service 139: Parameter Management service

### Objective

5751

This service allows the ground to manage on board data, which can be either software variables or equipment acquisitions, by changing or reading their values.

### Description

5752

The onboard parameter function manages an onboard parameters list per application process ID. Onboard parameters list definition is extracted from the SDB. This service manages On-board Parameters by using a logical identifier, namely the "Parameter ID", which is associated to a CSW data.

There are two kinds of such CSW data:

- Variables: those contain data which are intended to be used by the following services:

Housekeeping and Diagnostic Reporting (S#3), Monitoring (S#12).

- Updatable constants: those are typically system level tuneable parameters, which are involved in algorithms (ex: AOCS), and for which a more convenient interface than service #6 shall be used for update or reporting.

On-board parameters allow Ground to access CSW data. They can be SW variables or equipment acquisition data.

The on-board parameters are accessed by a Parameter ID defined in the SRDB and composed of:

- Process ID

- Flag specifying whether the parameter is available in read only or in read and write
- Local ID

The Parameter ID are mapped in the the SRDB and in the CSW to the on-board parameter following information:

- start address
- length
- parameter type

### Notes

The on-board parameters definition is defined in SRDB and is frozen for a given CSW release. It is nevertheless possible to define new parameters via TC(139,4).

5753

### 5.29.1 TC (139,1) Change Value of onboard Parameters

#### Description:

This telecommand sets the value of one or several given CSW data which have been declared in the SDB in order to be controllable/updatable Datapool parameters.

10235

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

10236

Packet Data Field Info:

- Service Type: 139
- Service Subtype: 1

Application/Source Data:

NPAR	Parameter ID	Parameter Value
Uns Int	enum	(deduced)
1 byte	4 bytes	variable
	<-- Repeat NPAR time	----->

13842

#### Parameter definition

Parameters	Description	Value or range
NPAR	Number of parameters whose value is to be changed	
Parameter ID	Logical Identifier (unique) of the control Parameter in the Datapool	
Parameter Value	Value to be assigned to the control parameter	

10237

10238

#### TC Verification:

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.

13859

- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## Remarks

13860

This TC can't be used to change the value of "Byte Array" parameters.

## 5.29.2 TC (139,2) Get Value of On-board Parameters

### Description:

10256

This telecommand requests a report containing the value of one or several CSW onboard Datapool parameters. TM(139,3) is returned in response to the request.

### Structure:

10257

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 139
- Service Subtype: 2

Application/Source Data:

NPAR	Parameter ID
Uns. Int.	Enumerated
1 byte	4 bytes
	<- repeat NPAR times ->

10259

### Parameter definition

10258

Parameters	Description	Range or Value
NPAR	number of parameters to be reported	
Parameter ID	Logical Identifier (unique) of the Parameter in the Datapool	

10272

### TC Verification:

13861

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.29.3 TM (139,3) On-board Parameters Value Report

### Description:

10286

This telemetry reports the value of on-board parameters, as an answer to TC(139,2).

### Structure:

10287

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per annex 8

Packet Data Field Info:

- Service Type: 139

- Service Subtype: 3

Application/Source Data:

NPAR	Parameter ID	Parameter Value
Uns. Int	Enumerated	Any
1 byte	4 bytes	deduced
	←-----Repeated NPAR	times-----→

### Parameter definition

Parameters	Description	Value or range
NPAR	number of parameters reported	
Parameter ID	Logical Identifier (unique) of the control Parameter in the Datapool	
Parameter Value	Parameter value	

### 5.29.4 TC (139,4) Define Onboard Parameters

#### Description:

This telecommand defines new onboard Parameters, or replaces existing ones.

This definition maps a predefined "spare" Parameter ID to a physical PM-RAM memory location which corresponds to a data of the CSW. Once the new parameter is mapped via TC 139,4, the Parameter ID can be used in other services (e.g. HK reporting)

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 139
- Service Subtype: 4

Application/Source Data:

NPAR	Parameter ID	RAM address	Parameter Length	Parameter Type
Uint	uint	uint	uint	uint
1 byte	4 bytes	4 bytes	1 byte	4 bytes
	←-----	----repeated	NPAR times--	-----→



## Parameter definition

Parameters	Description	Value or range
NPAR	number of parameters to be defined	1..18
Parameter ID	Logical Identifier (unique) of the Parameter in the Datapool.	
RAM address	Physical RAM address of the associated data	
Parameter length	Length in bytes of the associated data	this must be consistent with the parameter type
Parameter type	type of data assigned to Parameter ID	0x0002 0008: enum 8 0x0002 0010: enum 16 0x0002 0020: enum 32 0x0003 0004: UINT8 0x0003 000C: UINT16 0x0003 000E: UINT32 0x0004 0004: INT8 0x0004 000C: INT 16 0x0004 000E: INT 32 0x0005 0001: Float Single Precision 0x0005 0002: Float Double Precision 0x0005 0003: Float Double Precision read as Float Single Precision

10310

## TC Verification:

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13862

### 5.30 Service 140: SSMM SW Mode Transition

#### Objective

This service 140 is implemented in the SSMM SW only for mode management (see RD9).

14747

### 5.31 Service 141: Direct Commanding

#### Objective

This service 141 is implemented in the SSMM SW only for direct commanding (see RD9).

12801

### 5.32 Service 142: Functional Monitoring

#### Objective

The on-board Functional Monitoring service provides the capability to monitor an on-board function (e.g. SW applications or HW units) by managing an association of individual service 12 parameter monitoring, which altogether represent the current health status of the function.

8689

Note that a service 142 is implemented in the SSMM SW to manage redundancy (see RD9).

## Description

This service is used for FDIR. It provides additional functionality to service 12 in that it allows to group service 12 monitors together and define monitoring with AND / OR logic.

The service allows to:

- add/delete service 12 monitors to an Functional Monitor (FMON)
- enable/disable an FMON
- report all FMON entries in the FMON list
- report individual states of the FMON entries
- protect/unprotect the FMON definition wrt any modification or deletion

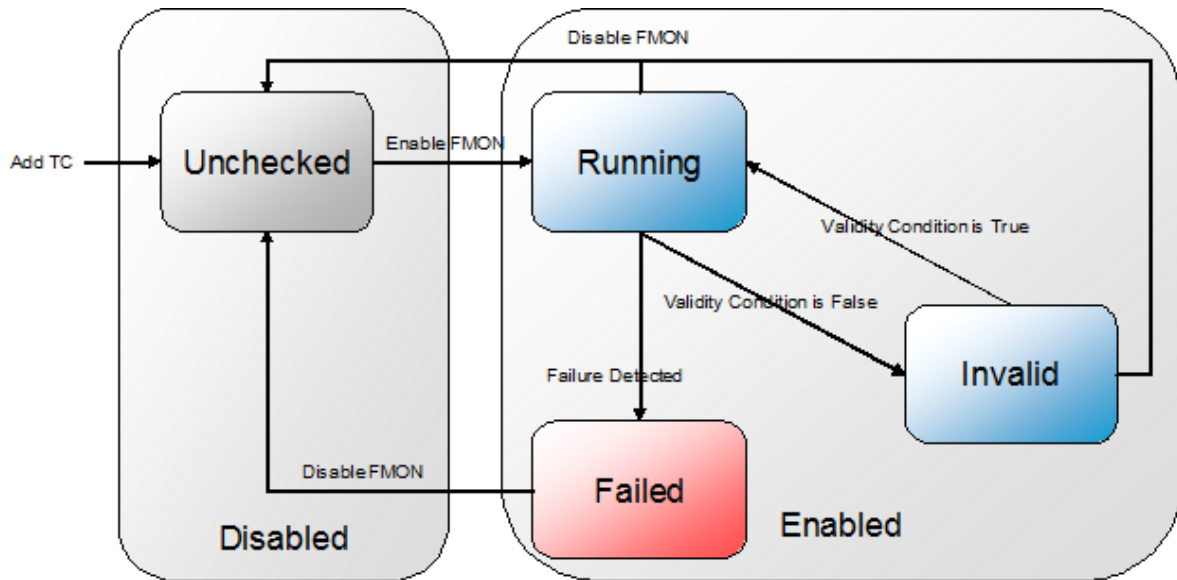
The user can also enable/disable the Functional Monitoring at service level.

The on-board Functional Monitoring service follows the following rules:

- if FMON becomes "Disabled" then the new FMON state becomes "Unchecked" immediately
- if FMON becomes "Enabled" and if current FMON state is "Unchecked" then the new FMON states becomes "Running" immediately
- if the FMON validity condition becomes FALSE (e.g. invoked via connected service 12 Monitoring ID) then prior to any other action the "Running" FMON is immediately set to "Invalid"
- if the FMON validity condition becomes TRUE (e.g. invoked via connected service 12 Monitoring ID) then prior to any other action the "Invalid" FMON is immediately set to "Running"
- After an FMON has triggered, it remains enabled but in a failed state, and therefore is "Unchecked". Note that this state can only be left by disabling and then enabling the FMON.

Any service 12 Monitoring ID transition when FMON is in another state than "Running" is ignored by FMON. Hence there is no report generation in that case. Furthermore, evolution of FMON current state will not impact states of service 12 Monitoring ID to which it is connected.

The following state diagram illustrates transitions of the FMON state.



By default, when the FMON is added to the Functional Monitoring list, its initial setup will be:

- FMON status disabled;
- FMON status protected;
- FMON state “Unchecked”.

The FMON state includes information about the source that caused the transition to “Failed”. This source is one of the connected service 12 Monitoring ID. The time at which this transition occurred will be appended to the information report.

The connected service 12 Monitoring ID will be checked as long as:

- the Functional Monitoring is enabled at service-level, and
- the FMON state is “Operational”, which implicitly means:
  - the FMON definition is enabled, and
  - the FMON validity condition is valid.

### Notes

When one of the functional monitoring triggers, an event with the event ID defined in the monitoring entry can generated. The parameters associated to that monitoring have the following structure:

Parameter	Description	Range or Value
FMON_ID	(Functional) Monitoring Identifier	Unsigned integer on 4 bytes 1..255
FMON_TIMEOUT	The FMON timeout value	Unsigned integer on 2 bytes 0..65535 (expressed in SW cycles)
FMON_LOGIC_TYPE	The FMON combination type	Enumerated on 1 byte 0x00 = OR 0x01 = AND
PMON_ID	PMON ID of one of the	Unsigned integer on 4 bytes

Parameter	Description	Range or Value
	PMON that caused the FMON triggering If Logic Type is <ul style="list-style-type: none"> <li>• OR : ID of the first triggered monitoring</li> <li>• AND : ID of the last triggered monitoring</li> </ul>	1..255
PMON_CHECK_STATE	The PMON check state value which caused the FMON triggering	Enumerated on 1 byte 0x00 = VALID 0x01 = UNCHECKED 0x02 = INVALID 0x04 = UNEXP_OR_BELOW 0x05 = ABOVE_HIGH
TRANSITION_TIME	The time of the monitoring triggering	CUC format (6 bytes): <ul style="list-style-type: none"> <li>• the first 4 bytes give the number of seconds (coarse part of the time)</li> <li>• the 2 next bytes give the number of subseconds (fine part of the time)</li> </ul>

### 5.32.1 TC (142,1) Enable Functional Monitoring

#### Description:

TC 142,1 allows to enable given functional monitoring.

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 142
- Service Subtype: 1

Application/Source Data:

N	FMON ID
Uns Int	Uns Int
2 bytes	4 bytes
	<- repeat N times ->

#### Parameter definition

Parameters	Description	Range or Value
N	Number of parameter	N = 0: Functional Monitoring enabled at service level  N > 0 : number of FMON to enable
FMON ID	Identification of a FMON control table entry	

**TC Verification:**

13865

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.32.2 TC (142,2) Disable Functional Monitoring**

**Description:**

10340

TC 142,2 allows to disable given functional monitoring.

**Structure:**

10341

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 142
- Service Subtype: 2

Application/Source Data:

N	FMON ID
Uns Int	Uns Int
2 bytes	4 bytes
<- repeat N times ->	

10401

**Parameter definition**

10342

Parameters	Description	Range or Value
N	Number of parameter	N = 0: Functional Monitoring disabled at service level  N > 0 : number of FMON to disable
FMON ID	Identification of a FMON control table entry	

10414

**TC Verification:**

13866

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.32.3 TC (142,5) Add Functional Monitoring to the Monitoring List**

**Description:**

10344

TC 142,5 allows to add the Functional Monitoring information to the Functional Monitoring list.

By default the added FMON will be set to "Disabled".

FMON can only be overwritten if unprotected and disabled.

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 142
- Service Subtype: 5

Application/Source Data:

FMON ID	Validity Parameter	EID	Time out	Type	NMON	Monitoring ID	Check State Type
Uns Int	Enum	Enum	Uns Int	Enum	Uns Int	Enum	Enum
4 bytes	4 bytes	2 bytes	2 bytes	1 byte	1 byte	4 bytes	1 byte
						← repeat <i>NMON</i> times →	

**Parameter definition**

Parameters	Description	Range or value
FMON ID	Identification of a FMON control table entry	1..255
Validity Parameter	A Parameter whose value determines whether the Functional Monitoring item is valid (i.e. can be executed) or not	0 = always valid  Note that the validity parameter can have values true (1), indicating the monitoring is valid, and false (0) indicating invalid.
EID	Identifier of the event report to be generated in the event of a Functional Monitoring violation.  A FMON violation occurs when at least one or all (depending on Type) of the attached parameters monitoring returns a monitoring violation as stated in service 12.	See Annex 9 0 = no event generated
Timeout	Number of cycles to wait before the Functional Monitoring is re-enabled if not done as part of event action sequence connected to the released event	
Type	Logic to be applied for combination of the parameter monitoring states	0 = OR (at least one of the defined parameter monitoring entries reaches the defined state)  1 = AND (all defined parameter monitoring entries reach the defined state)
NMON	Number of parameters monitoring attached to the	

Parameters	Description	Range or value
	Functional Monitoring FMON ID	
Monitoring ID	ID of Monitoring Control Table Entry (see service 12)	
Check State Type	Value identifying the check state which causes triggering of the FMON ID	0 = In Limit / Expected Value 1 = N/A 2 = Invalid 3 = N/A 4 = Below Low Limit / Unexpected Value 5 = Above High Limit 6 = Out of Limit (Below Low Limit or Above High Limit)

### TC Verification:

13867

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.32.4 TC (142,6) Delete Functional Monitoring from the Monitoring List

#### Description:

10348

Upon reception of TC 142,6 for each FMON the service will:

- disconnect parameter monitorings attached to the specified FMON
- remove the corresponding FMON information, if any, from the FMON list (the entry becomes free)

If the FMON ID is not defined in the FMON list or is currently enabled or is protected then the TC will not be executed and a failure report of service type 1 will be issued.

#### Structure:

10349

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 142
- Service Subtype: 6

Application/Source Data:

N	FMON ID
Unsigned Integer	Unsigned Integer
2 bytes	4 bytes
	<- repeat N times ->

10464

10350

## Parameter definition

Parameters	Description	Range or value
N	number of FMON entries to be deleted	
FMON ID	Identification of FMON control table entry	

10477

## TC Verification:

13868

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.32.5 TC (142,8) Report Current Functional Monitoring List

### Description:

10352

Upon reception of TC 142,8 a report with the current static contents of the Functional Monitoring list will be issued.

### Structure:

10353

#### Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

#### Packet Data Field Info:

- Service Type: 142
- Service Subtype: 8

Application/Source Data: none

## Parameter definition

10354

N/A

## TC Verification:

13869

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

## 5.32.6 TM (142,9) Current Functional Monitoring List Report

### Description:

10356

TM 142,9 is the response to TC 142,8 and provides the report of the current static contents of the Functional Monitoring list.

### Structure:

10357

#### Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

#### Packet Data Field Info:



- Service Type: 142
- Service Subtype: 9

Application/Source Data:

Functional Monitoring Status	N	FMON Information
Enum	Uns Int	(see below)
1 byte	1 byte	
		← repeat <i>N</i> times →

FMON ID	FMON Protection	FMON Status	Validity Parameter	EID	Timeout	Type	NMON	Monitoring ID	Check State Type
Uns Int	Enum	Enum	Enum	Enum	Uns Int	Enum	Uns Int	Enum	Enum
4 bytes	1 byte	1 byte	4 bytes	2 bytes	2 bytes	1 byte	1 byte	4 bytes	1 byte
								← repeat <i>NMON</i> times →	

## Parameter definition

Parameters	Description	Range and value
Functional Monitoring Status	This indicates whether the overall Functional Monitoring is enabled/ disabled	1 = enabled 0 = disabled
N	The current number of Functional Monitoring entries of the functional monitoring list	
FMON ID	Identification of a FMON control table entry	
FMON Protection	This indicates the current status of each Functional Monitoring item, i.e. whether one functional monitoring entry is "read-only" or "read-write"	0 = Read - Write 1 = Read only
FMON Status	This indicates whether the monitoring of the corresponding parameter is enabled/disabled	0 = Disabled-Unchecked 2 = Enabled-Running 6 = Enabled-Failed 10 = Enabled-Invalid
Validity Parameter	Parameter whose value determines whether the Functional Monitoring item is valid or not	
EID	Identifier of the event report to be generated in the event of a Functional Monitoring item violation.  Violation occurs when at least one or all (depending on Type) of the attached parameters	See Annex 9

Parameters	Description	Range and value
	monitoring returns a monitoring violation as stated in service 12.	
Timeout	Number of cycles to wait before the Functional Monitoring is re-enabled	
Type	Logic to be applied for combination of the single parameter monitoring state	0 = OR (at least one of the defined parameter monitoring entries reaches the defined state)  1 = AND (all defined parameter monitoring entries reach the defined state)
NMON	Number of parameters monitoring attached to the Functional Monitoring item FMON ID	
Monitoring ID	Monitoring identification of the monitoring list of service 12	
Check State Type	Value identifying the check state which causes triggering of the FMON ID	0 = In Limit / Expected Value 1 = N/A 2 = Invalid 3 = N/A 4 = Below Low Limit / Unexpected Value 5 = Above High Limit 6 = Out of Limit (Below Low Limit or Above High Limit)

### 5.32.7 TC (142,10) Report Current FMON Status List

#### Description:

This TC 142,10 requests the report of the current FMON status in TM 142,11.

10360

#### Structure:

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

10361

Packet Data Field Info:

- Service Type: 142
- Service Subtype: 10

Application/Source Data: none

#### Parameter definition

N/A

10362

#### TC Verification:

13870

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

### 5.32.8 TM (142,11) Current FMON Status List Report

#### Description:

This is the response to TC 142,10 and reports the current FMON status list.

#### Structure:

##### Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: as per annex 8

##### Packet Data Field Info:

- Service Type: 142
- Service Subtype: 11

##### Application/Source Data:

N	FMON ID	FMON Protection	FMON Status
Uns Int	Uns Int	Enum	Enum
2 bytes	4 bytes	1 byte	1 byte
← repeat N times →			

#### Parameter definition

Parameters	Description	Range or Value
N	Number of Functional Monitoring item entries of the Functional Monitoring item list	
FMON Id	Identification of a FMON control table entry	
FMON Protection	This indicates the current status of each Functional Monitoring item, i.e. whether one functional monitoring entry is "Read-only" or "Read-Write"	1 = Read Only 0 = Read - Write
FMON Status	this indicates the current status of each Functional Monitoring item	0 = Disabled-Unchecked 2 = Enabled-Running 6 = Enabled-Failed 10 = Enabled-Invalid

### 5.32.9 TC (142,12) Protect Functional Monitoring of Parameters

#### Description:

Upon reception of TC 142,12 each specified FMON will be processed in turn and set to "protected".

#### Structure:

##### Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 142
- Service Subtype: 12

Application/Source Data:

N	FMON ID
Unsigned Integer	Unsigned Integer
2 byte	4 bytes
	<-- repeat N times -->

10564

**Parameter definition**

Parameters	Description	Range or Value
N	Number of FMON entries which will be protected	>0
FMON ID	Identification of a FMON control table entry	

10370

10577

**TC Verification:**

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

13871

### 5.32.10 TC (142,13) Unprotect Functional Monitoring of Parameters

**Description:**

Upon reception of TC 142,13 each specified FMON will be processed in turn and set to "unprotected".

**Structure:**

Packet ID Info:

- Process ID: as per Annex 8
- Packet Cat: 12

Packet Data Field Info:

- Service Type: 142
- Service Subtype: 13

Application/Source Data:

N	FMON ID
Unsigned Integer	Unsigned Integer
2 byte	4 bytes
	<-- repeat N times -->

10590

**Parameter definition**

Parameters	Description	Range or Value
N	Number of FMON entries which will be unprotected	>0
FMON ID	Identification of a FMON control table entry	

10374

10603

**TC Verification:**

13872

- A TM(1,2) *TC Acceptance Report Failure* shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.
- A TM(1,8) *TC Completion Report Failure* shall be generated for the cases identified in [RD8].

**5.33 Service 143: Memory Array Management****Objective**

This service 143 is implemented in the SSMM SW only for memory array management (see RD9).

12803

**5.34 Service 144: Reboot****Objective**

This service 144 is implemented in the SSMM SW only for reboot functionality (see RD9).

12806

**5.35 Service 145: BIT Report Management****Objective**

This service 145 is implemented in the SSMM SW only for BIT report management (see RD9).

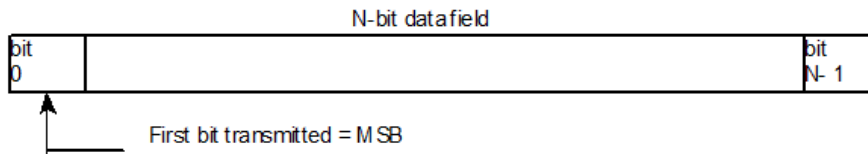
12807

## 6 ANNEX 1 BIT NUMBERING CONVENTION

### 6.1 Bit Numbering Convention

PUS-2976//

The following convention shall be used to identify each bit in an N-bit field:



2977

**Figure 6.1-1: Bit Numbering Convention**

PUS-2979//

1- The first bit in the field (starting from the left) is defined to be "Bit 0" and will be represented as the left most justified bit in a figure. The next bit is called "Bit 1", and so on, up to "Bit N-1", the bits being represented in this order from left to right in a figure.

PUS-2980/SGICD-v2-292/

2- If the N-Bit field is to be interpreted as "Unsigned Integer" value, Bit 0 is the MSB and Bit N-1 is the LSB.

PUS-2981//

3- If the N-Bit field is to be interpreted as "Signed Integer" value, Bit 0 indicates the sign with Bit 0 = 0 corresponding to a positive number and Bit 0 = 1 corresponding to a negative number.

PUS-2982//

4- Adjacent groups of bits are described in terms of octets and words.

PUS-2983//

5- Octet = 1 byte = 8 bits (1 word = 2 octets = 16 bits).

PUS-2984//

6- For multiple-byte words, the byte orientation is the same as the bit orientation. The first byte in the word (starting from the left) is defined to be "Byte 0", is the Most Significant Byte and is transmitted first. The next byte is called "Byte 1", and so on, up to "Byte N-1".

## 7 ANNEX 2 FIELD ALIGNMENT CONVENTION

### **PUS-2986//**

*The following convention shall be used to construct packet parameter fields:*

### **PUS-2987//**

*1- Parameters with a length longer or equal 8 bits shall be right aligned with respect to the octet boundaries, i.e. the LSB shall coincide with the right hand octet boundary.*

### **PUS-2988//**

*2- Parameters with a length shorter than 8 bits shall not be allowed to span over octet boundaries.*

### **PUS-2989//**

*3- Parameters with a length shorter than 8 bits shall be right-adjusted within the occupied 8-bit octet. If padding-bits are needed they shall occupy the most significant bits of the octet.*

### **PUS-2990//**

*4- If more than one parameter is held in a single octet the parameters shall be right adjusted.*

## 8 ANNEX 3 PACKET NUMBERING CONVENTION

Packet class and function is provided by packet type and packet subtype, included in the data field header of the packet.

2992

### **PUS-2993//**

*The Packet Type numbering scheme is devised to provide correlation between TC packets and the resulting TM packets and is therefore non-contiguous: there are cases where for a certain TC type, there is no corresponding TM type.*

To make identification simpler, service type and subtype are represented by two numbers, separated by a comma. The notation TC(a,b) or TM(a,b) for telecommands and telemetry describes TC or TM of Service Type “a” and Subtype “b”, for example : TM (1,2) is a telemetry packet type 1, subtype 2, and TC (2,1) is a telecommand packet type 2, subtype 1.

2994

### **PUS-2995//**

*Subtype numbers within a service type shall be unique.*



## 9 ANNEX 4 STANDARD SPACECRAFT TIME SOURCE PACKET

### 9.1 Standard Spacecraft Time Source Packet

#### PUS-2997//

The Standard Spacecraft Time Source Packet shall be used to transport the regular Spacecraft Elapsed Time samples to ground for time correlation with UTC by the ground segment during periods of ground contact. Its structure conforms to that of a standard TM packet as defined in section 4 and it is shown in the figure below.

SOURCE PACKET HEADER (48 bits)						PACKET DATA FIELD (64 bits)					
PACKET ID				PACKET SEQUENCE CONTROL		PACKET LENGTH = 7 DEC	S-FIELD		P-FIELD = 00101110 BIN	T-FIELD	
Version Number = 0	Type = 0	Data Field Header Flag = 0	Application Process ID = 0	Segmentation Flags	Source Sequence Count		= 0	Generation Freq.		Coarse Time	Fine Time
3	1	1	11	2	14		4	4		32	16
16				16		16	8		8	48	

2998

Figure 9.1-1: Spacecraft Time Source Packet Fields

#### PUS-3000//

The time carried by the T-field of the packet shall relate to the instant of occurrence of the leading edge of the first bit of the attached synchronisation marker of the telemetry transfer frame of virtual channel "0" with a virtual channel frame count of "0".

The Time Source Packet-specific field contents of the header and data fields are specified below:

3001

#### Packet ID

3002

#### PUS-3003//

##### **Version Number:**

The version number must be set 000BIN.

#### PUS-3005//

##### **Type:**

The type must be set to zero.

#### PUS-3007//

##### **Data Field Header Flag:**

The data field header flag must be set to zero. No data field!

#### PUS-3009//

##### **Application Process ID:**

The Application process ID shall be set to all zeros.

#### PUS-3011//

##### **Packet Length:**

The packet length field specifies the number of octets contained within the Packet Data Field. The number is an unsigned integer "C" where:

$$C = (\text{Number of octets in Packet Data Field}) - 1$$

In this case, the number of octets is eight (i.e. C=7).

*It should be noted that the actual length of the entire Standard Spacecraft Time Source Packet, including the Packet Header, is 6 octets longer.*

## **Packet Data Field**

3016

### **PUS-3017//**

#### **S-Field:**

- *Bits 0 through 3 are not used and must be set to zeros.*
- *Bits 4 through 7 shall be set to a value corresponding to the generation frequency of a Standard time packet*

### **PUS-3020//**

#### **P-Field:**

*Must be set to "00101110"BIN to indicate that the following time format consists of 4 coarse time octets and 2 fine time octets.*

### **PUS-3022//**

#### **T-Field:**

*This field will contain the Spacecraft Elapsed Time, consistent with the CCSDS Unsegmented Time Code (CUC) format.*

- *Bits 0 through 31 must contain the coarse Spacecraft Elapsed Time as an unsegmented binary count of seconds.*
- *Bits 32 through 47 must contain the fine Spacecraft Elapsed Time as an unsegmented binary power of subseconds.*

## 10 ANNEX 5 IDLE PACKET STRUCTURE

### 10.1 Idle Packet Structure

The idle packet will be used to fill the telemetry transfer frame when a frame has to be transmitted and an insufficient number of source packets are available to complete the transfer frame. This may be the case when the source data rate is low compared to the frame period. Its structure is as shown in figure below.

SOURCE PACKET HEADER (48 bits)						PACKET DATA FIELD (variable)	
PACKET ID				PACKET SEQUENCE CONTROL		PACKET LENGTH	Filler Pattern
Version Number = 0	Type = 0	Data Field Header Flag = 0	Application Process ID = 1111 1111 11 BIN	Segmentation Flags	Source Sequence Count		
3	1	1	11	2	14		
16				16		16	Variable

Figure 10.1-1: Spacecraft Idle Packet

The field contents of the Idle Packet header and data field are specified below:

#### Packet ID

##### PUS-3031//

**Version Number:**

The version number must be set to 000BIN

##### PUS-3033//

**Type:**

The type must be set to zero.

##### PUS-3035//

**Data Field Header Flag:**

The data field header flag must be set to zero.

##### PUS-3037//

**Application Process ID:**

The Application process ID must be set to all ones.

##### PUS-3039//

**Filler Pattern**

The content of the Idle Packet data field shall be random data.

## 11 ANNEX 6 CRC CHECKSUM ALGORITHMS

### 11.1 CRC Checksum Algorithms

#### Cyclic Redundancy Code Specification

The Packet Error Control Field is a 16-bit field, which occupies the two trailing octets of a TC Packet.

The purpose of this field is to provide a capability for detecting errors which may have been introduced into the frame by the lower protocol layers during the transmission process and may have remained undetected.

The standard error detection encoding/decoding procedure, which is described in detail in the following paragraphs, produces a 16 bit Frames or Packet Check Sequence (PCS) which is placed in the Packet Error Control Field.

#### PUS-3046/SGICD-4398/

*This code is intended only for error detection purpose and shall not be used for error correction.*

The characteristics of the PCS are those of a cyclic redundancy code (CRC) and are generally expressed as follows:

#### PUS-3048/SGICD-4400/

*The generator polynomial is*  $G(x) = X^{16} + X^{12} + X^5 + 1$

#### PUS-3049/SGICD-4401/

*1- Both encoder and decoder are initialised to the "all-ones" state for each Packet.*

#### PUS-3050/SGICD-4407/

*2- PCS generation is performed over the entire Packet including the Packet Header less the final 16-bit PCS.*

#### PUS-3051/SGICD-4408/

*3- The code has the following capabilities when applied to an encoded block of less than 32768 bits (  $2^{15}$  bits ) :*

- *All error sequences composed of an odd number of bit errors will be detected*
- *All error sequences containing two bit errors anywhere in the coded block will be detected*
- *If a random error sequence containing an even number of bit errors (greater than or equal to four) occurs within the block, the probability that the error will be undetected is approximately  $2^{-15}$  (or  $3 \times 10^{-5}$ ).*
- *All single error bursts spanning 16 bits or less will be detected provided no other errors occur within the block.*
- *For blocks longer than 32768 bits, the specified performance cannot be guaranteed.*

#### Encoding Procedure

#### PUS-3058/SGICD-4304/

*The encoding procedure accepts an (n-16)-bit message and generates a systematic binary (n, n-16) block code by appending a 16-bit Packet Check Sequence (PCS) as the final 16 bits of the block. This PCS is inserted into the Packet Error Control Field. The equation for PCS is:*

$$PCS = [X^{16} \cdot M(X) + X^{(n-16)} \cdot L(X)] \text{ MODULO } G(X)$$

#### PUS-3060/SGICD-4404/

*Where*

- $M(X)$  is the  $(n-16)$ -bit message to be encoded expressed as a polynomial with binary coefficients,  $n$  being the number of bits in the encoded message (i.e. the number of bits in the complete Packet).
- $L(X)$  is the pre-setting polynomial given by:  
$$L(X) = \sum_{i=0}^{15} X^i$$
 (all "1" polynomial of order 15)
- $G(X)$  is the CCITT Recommendation V.41 generating polynomial given by:  
$$G(X) = X^{16} + X^{12} + X^5 + 1$$
, where  $+$  is the modulo 2 addition operator (exclusive OR)

Note that the encoding procedure differs from that of a conventional cyclic block encoding operation in that the  $X^{(n-16)}$ .  $L(X)$  term has the effect of presenting the shift register to an all ones state (rather than a conventional all zeros state) prior to encoding.

## Decoding Procedure

### PUS-3068/SGICD-4306/

The error detection syndrome,  $S(X)$  is given by:

$$S(X) = [X^{16} \cdot C^*(X) + X^n \cdot L(X)] \text{ MODULO } G(X)$$

### PUS-3070/SGICD-4409/

Where

- $C^*(X)$  is the received block in polynomial form.
- $S(X)$  is the syndrome polynomial which will be zero if no error has been detected.

## Verification of Compliance

The binary sequences defined in this section are provided to the designers of packet systems as samples for testing and verification of a specific CRC error detection implementation.

All data are given in hexadecimal notation. For a given field (data or CRC), the left most hexadecimal character contains the most significant bit (i.e. bit 0 of the CCSDS convention).

DATA	Packet Check Sequence (CRC)
00 00	1D 0F
00 00 00	CC 9C
AB CD EF 01	04 A2
14 56 F8 9A 00 01	7F D5

**Figure 11.1-1: CRC Check examples**

## Possible realisations of Packet Check Sequence Encoders/Decoders

CRC encoders and decoders can be implemented in hardware as well as in software.

## 12 ANNEX 7 ACRONYMS AND GLOSSARY OF TERMS

### 12.1 Annex 7.1 Acronyms

AOCS	Attitude & Orbit Control Subsystem	3111
APID	Application Process Identifier	3112
BIN	Binary	3113
CCSDS	Consultative Committee for Space Data Systems	3114
CLCW	Command Link Control Word	3115
CLTU	Command Link Transfer Unit	3116
COP-1	Command Operation Procedure number 1	3117
CPDU	Command Pulse Distribution Unit	3118
CRC	Cyclic Redundancy Code	3119
CSW	Central Software	3120
CUC	CCSDS Unsegmented time Code	3121
DEC	Decimal	3122
DMS	Data Management System	3123
EID	Event Identifier	3124
ESA	European Space Agency	3125
FARM	Frame Acceptance and Reporting Mechanism	3126
HEX	Hexadecimal	3127
HPC	High Power Command	3128
HPTM	High Priority TeleMetry	3129
ICD	Interface Control Document	3130
ID	Identifier	3131
LSB	Least Significant Bit	3132
MAP	Multiplexed Access Point	3133
MSB	Most Significant Bit	3134
MTL	Mission TimeLine	3135
N/A	Not Applicable	3136
OBC	On-Board Computer	3137
OBCP	On-Board Control Procedure	3138
OCF	Operational Control Field	3139
PB	PlayBack	3140
PCS	Packet Check Sequence	3141
PID	Process Identifier	3142
PUS	Packet Utilisation Standard	3143
RT	Real Time	3144
S/C	SpaceCraft	3145
		3146

SID	Structure Identifier	
SSMM	Solid State Memory Mass	3147
TBC	To Be Confirmed	3148
TBD	To Be Defined	3149
TBW	To Be Written	3150
TC	Telecommand	3151
TM	Telemetry	3152
UTC	Universal Time Coordinated	3153
VC	Virtual Channel	3154

## 12.2 Annex 7.2 Glossary of Terms

Application process 3156

A continuous series of actions to bring about a result for a user. Such process may be on-board or on ground. Usually an application process can be associated with a subsystem or instrument. An application process can receive TC packets and/or generate TM packets.

Application data 3158

Data destined to an on-board application process, encapsulated in a TC packet.

Channel 3160

Physical input or output line(s).

Source Data 3162

Data generated by an on-board application process, encapsulated in a TM packet.

## 13 ANNEX 8 APPLICATION PROCESS ID ASSIGNMENT

The APID is composed of the PID-field and CAT-field according to the definitions in section 3.2.1.1 and 4.2.1.1.

14183

### 13.1 Application Process ID Assignment

PUS-3165//

*The table below defines the Packet Categories to be used on Solar Orbiter. The numbers in the table below are in decimal radix.*

Packet Category (dec)	Meaning
0	TIME: Exclusive for Service 9, Time packet, telemetry
1	TC Verification: Exclusive for Service 1 (1,x), TC acknowledgement telemetry
2	HPTM: Exclusive for HPTM HK packets (platform only)
3	Table generation: To be used for variable length tabular reports
4	HK (routine): All routine, cyclic 3,25 HK produced as part of default Service 3 TM
5	FUNCTIONAL CYCLIC (high frequency measurement): To be used for private Service 3 (3,25) cyclic packets produced only upon Ground request
6	FUNCTIONAL NON CYCLIC (ad-hoc measurement): To be used only for private report packets (fixed length, tabular) produced upon Ground request
7	Event generation: Exclusive for Service 5 (5,x) event packets, and Service 17 (17,2) telemetry
8	Diagnostic: To be used only for Service 3 (3,26) or private diagnostic packets produced upon Ground request
9	Dump TM: Exclusive for Service 6 (6,x) telemetry
10	FILE TRANSFER: Exclusive for Service 13 telemetry
11	CONTEXT: Exclusive for Service 22 telemetry
12	PRIVATE-SCIENCE or TELECOMMAND: Exclusive for Service 21 telemetry/ Telecommand
13	Spare
14	Reserved OCC/EGSE
15	IDLE: To be used for idle packets (platform only)

3166

**Figure 13.1-1: Packet Category Allocation**

3218

PUS-3219/Created/

*The table below defines the Process ID to be used on Solar Orbiter. The numbers in the table below are in decimal radix.*

Process ID (dec)	Component	Meaning
0		TIME
1		Spare
2	OBC HW	High Priority TC Functions to CPDU (MAP ID = 0); High Priority TM Functions



3 to 9		Spares
10	OBC CSW	<p><b>Data Management System (DMS) Application</b></p> <p>OBC management:</p> <ul style="list-style-type: none"> <li>• PM board</li> <li>• Mil-1553-B bus control</li> <li>• SpaceWire communication</li> <li>• TTRM board: TC Decoder, TM Encoder, On-Board Time (OBT), Reconfiguration Module (RM), SafeGuard Memory (SGM), Mass Memory (MM), Command Pulse Distribution Unit (CPDU)</li> <li>• TM/TC ground communication</li> </ul> <p>DMS Services management:</p> <ul style="list-style-type: none"> <li>• PUS services</li> </ul>
11	OBC CSW	<p><b>Attitude Orbit Control Subsystem (AOCS) Application</b></p> <ul style="list-style-type: none"> <li>• AOCS Non Core Functions: AOCS equipments HW I/F, configuration and FDIR</li> <li>• AOCS Core Functions: AOCS modes, sensors processing, attitude estimation, actuators commanding, guidance profiles processing)</li> <li>• AOCS units management: STR, IMU, FSS, RW, CPS (functional, torque demand)</li> </ul>
12	OBC CSW	<p><b>Payload Application</b></p> <ul style="list-style-type: none"> <li>• Payload instruments management: EPD, MAG, RPW, SWA, SPICE, PHI, EUI, METIS, STIX, SOLOHI</li> </ul>
13	OBC CSW	<p><b>Platform Application</b></p> <ul style="list-style-type: none"> <li>• EPS units management: PCDU, SADE</li> <li>• DHS units management: RIU (which gives access to FSS, CPS, I-Boom and thermistors), SSMM</li> <li>• COMS units management: DST, TWTA, APME-H (HGA), APME-M (MGA)</li> <li>• CPS units management (HW I/F, configuration, FDIR)</li> <li>• Payload Interface units/mechanisms management: DCU</li> </ul>
14	OBC CSW	<p><b>System Control Application</b></p> <ul style="list-style-type: none"> <li>• System initialisation</li> <li>• System modes</li> <li>• System configuration</li> <li>• System FDIR</li> <li>• System autonomy including LEOP auto-sequence</li> </ul>
15	OBC SW	<p><b>OBCP</b></p> <ul style="list-style-type: none"> <li>• OBCP generated TM</li> </ul>
16	OBC SW	<p><b>Thermal Control Subsystem (TCS) Application</b></p> <ul style="list-style-type: none"> <li>• Thermal control units management</li> </ul>

17 to 29		Spares
30	SSMM	Operational SSMM memory controller
31	SSMM	SSMM memory controller A in debug mode
32	SSMM	SSMM memory controller B in debug mode
33 to 39		Spares
40	STR	Star Tracker A
41	STR	Star Tracker B
42 to 48		Spares
49	OBC SW	Payload broadcast
50 to 56, 100	Payload	EPD
57 to 62	Payload	EUI
63 to 66	Payload	MAG
67 to 71	Payload	METIS
72 to 74	Payload	PHI
75 to 81	Payload	RPW
82 to 84	Payload	SOLOHI
85 to 89, 101-104	Payload	SPICE
90 to 94	Payload	STIX
95 to 99	Payload	SWA
105 to 111		Spares
112 to 127		EGSE

**Figure 13.1-2: Figure 13.1-2 Process ID Allocation**

3320

The table below shows the APID allocation for the Spacecraft. The numbers in the table below are in decimal radix.

**PUS-3665//**

		CAT	Time	TC Verification	HPTM	Table Generation	HK (routine)	Functional cyclic	Functional non-cyclic	Event Generation	Diagnostic	Dump TM	File Transfer	Context	Science/TC	Spare	EGSE	Idle
PID			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
OBC	HPTM_A				X													
	HPTM_B				X													
OBC CSW	DMS	10	X	X		X	X			X	X	X	X	X	X			X
	AOCS	11		X		X	X			X	X				X			
	Payload	12		X		X	X	X	X	X	X	X			X			
	Platform	13		X		X	X			X	X				X			
	System Control	14		X		X	X			X	X				X			
	Thermal Control	15		X		X	X			X	X				X			
SSMM	SSMM Operational	30		X		X	X		X	X		X	X		X	X		
	SSMM A Debug	31		X			X			X		X			X			
	SSMM B Debug	32		X			X			X		X			X			
STR	40-41		X			X	X	X	X		X				X			
Payload	50-103		X			X	X	X	X	X	X		X	X				

**Figure 13.1-3: Figure 13.1-3 APID allocation**

**PUS-14184//**

Note that, for the PIs, the following CATs must be respected for those packets routed to the OBC for processing as defined in SOL.S.ASTR.TN.00088.

Service 3,25 HK TM packets should have CAT = 4 with the exception of the 3,25 generated for the purposes of inter-instrument communication, which should have CAT = 5

Service 1 acknowledgement packets should have CAT = 1;

Service 5 event TM packets should have CAT = 7;

Service 22 context TM packets should have CAT = 11.

**13.2 Source ID**

**PUS-13387//**

**Source ID:**

This field indicates the sender of the command and is used together with the Destination ID field in the TM packet for routing purposes on-board.

Several source IDs will be reserved for ground and on-board processes:

- Ground sources (set by ground):
  - Mission TimeLine: 110
  - TC Sequences: 111
  - Recovery Action commands (Service 19 Event Action List): 112

- *Back-Up Mission TimeLine: 113*
- *Direct commands: 120*
- *Spare Ground source 1: 121*
- *Spare Ground source 2: 122*
- *On-board sources (set by CSW):*
  - *OBCP: 15*
  - *System Control: 14*
  - *AOCS: 11*

Note that on-board generated commands will use one of the three identified source IDs, with mapping of PID to Source ID defined in RD8.

14299

### 13.3 Destination ID

PUS-13389//

#### ***Destination ID:***

*This field identifies the destination of the TM source packet:*

- *For telemetry generated as an answer to a telecommand (so called solicited TM) it shall be the copy of the command Source ID field with exception of all TM packets having the packet category = 2 (HK essential), = 3 (Table), = 4 (HK routine), = 8 (diagnostic) and = 9 (dump), for which the Destination ID shall always be set to all zeros (i.e. '00000000'BIN), meaning Ground. This is described in the table below.*
- *For telemetry resulting from a process designed to produce data for another process in another SW item it shall contain the Destination ID of the receiving process*
- *For telemetry not covered by the above the field shall be set to all zeros (i.e. '00000000'BIN) meaning Ground.*

PUS-13390//

	CAT														
	0 TIME	1 ACK	2 HPTM	3 TAB	4 HK	5 Func Cyc	6 Func NCyc	7 Event	8 Diag	9 Dump	10 File Trans	11 Cont- ext	12 TC/ PrvScn	13 Spare	14 Resd/ EGSE
Service 1		Source ID													
Service 2		Source ID													
Service 3				0	0		Source ID <sup>1</sup>		0						
Service 5				0				0							
Service 6										0					
Service 8				0											
Service 9	2														
Service 11				0											
Service 12				0											
Service 13				0							0			0	
Service 14				0											
Service 15				0											
Service 17		Source ID						Source ID							
Service 18				0											
Service 19				0											
Service 21													0		
Service 22												Source ID			
Service 132				0											
Service 133				0											
Service 139				0											
Service 140				0											
Service 141				0				0							
Service 142				0											
Service 143				0											
Service 145				0											

**Figure 13.3-1: Destination ID allocation for solicited TM**

Note 1 - TM (3,25) intended for use with Inter Instrument Communication will have CAT 5, with destination ID = receiving process

Note 2 - Time packet TM (9,2) has no data field header, and therefore no destination ID

Source Data

Data generated by an on-board application process, encapsulated in a TM packet.

## 14 ANNEX 9 FAILURE AND EVENT ID ASSIGNMENT

### 14.1 Standard Failure ID

This table defines the allocation of standard Failure ID to be used for PUS Service 1 (TM(1,2) and TM(1,8)) on Solar Orbiter as well as the corresponding parameters if any. This approach is applicable to CSW and optional to other SW on board.

4563

4564

Failure ID (2 bytes)	Meaning	Parameter 1	Parameter 2	Parameter 3	Parameter 4
0	Illegal APID	Packet type from the received TC (1 byte)	Packet sub-type from the received TC (1 byte)		
1	Incomplete or invalid length	Packet type from the received TC (1 byte)	Packet sub-type from the received TC (1 byte)		
2	Incorrect checksum (CRC)	Packet type from the received TC (1 byte)	Packet sub-type from the received TC (1 byte)	Received checksum (2 bytes)	Computed checksum (2 bytes)
3	Illegal packet type	Packet type from the received TC (1 byte)	Packet sub-type from the received TC (1 byte)		
4	Illegal packet subtype	Packet type from the received TC (1 byte)	Packet sub-type from the received TC (1 byte)		
5	Illegal or inconsistent application data field	Packet type from the received TC (1 byte)	Packet sub-type from the received TC (1 byte)	Position in byte of the first inconsistent parameter (1 byte)	Received value of the first inconsistent parameter (1 byte)
6	Illegal segment sequence flag	Packet type from the received TC (1 byte)	Packet sub-type from the received TC (1 byte)	Application specific (2 bytes)	Application specific (2 bytes)
7	Illegal MAP ID	Packet type from the received TC (1 byte)	Packet sub-type from the received TC (1 byte)		
TBD	Selected by specific application	TBD	TBD	TBD	TBD

**Figure 14.1-1: Allocation of Standard Failure ID**

4654

Parameter 1 and Parameter 2 will be significant only if they have been received. Otherwise they will be set to zero in the TC verification report.

4749

The user will be responsible for allocating these standard Failure IDs to TM(1,2) or TM(1,8).

It may be more appropriate to use dedicated Failure ID with specific parameters rather than the standard Failure ID 5 "illegal or inconsistent data field".

## 14.2 Standard Event ID

This table defines the Event ID allocation to be used for PUS Service 5 on Solar Orbiter. This approach is applicable to CSW and optional to other SW on board.

Event ID 5,1	Event ID 5,2	Event ID 5,3	Event ID 5,4	Comments
0 x 0000	0 x 4000	0 x 8000	0 x C000	reserved
0x0001 .. 0x001F	0x4001 .. 0x401F	0x8001 .. 0x801F	0xC001 .. 0xC01F	Boot SW Events
0x0020 .. 0x041F	0x4020 .. 0x441F	0x8020 .. 0x841F	0xC020 .. 0xC41F	General Application SW Events
0x0420 .. 0x141F	0x4420 .. 0x541F	0x8420 .. 0x941F	0xC420 .. 0xD41F	Specific Application SW Events
0x1420 .. 0x149F	0x5420 .. 0x549F	0x9420 .. 0x949F	0xD420 .. 0xD49F	Events from unexpected SW and HW Errors
0x14A0 .. 0x349F	0x54A0 .. 0x749F	0x94A0 .. 0xB49F	0xD4A0 .. 0xF49F	Monitoring Events  (0x2700 to 0x27FF: reserved for CDHS)
0x34A0 .. 0x3EFF	0x74A0 .. 0x7EFF	0xB4A0 .. 0xBEFF	0xF4A0 .. 0xFEFF	OBCP Events
0x3F00 .. 0x3FFE	0x7F00 .. 0x7FFE	0xBF00 .. 0xBFFE	0xFF00 .. 0xFFFE	ESOC
0x3FFF	0x7FFF	0xBFFF	0xFFFF	reserved

Figure 14.2-1: Event ID allocation

## 14.3 Specific Failure ID allocation across APID

The following table defined the range of ID allocated to the Solar Orbiter APIDs for the Failure ID in TM(1,2) or TM(1,8).

Range (decimal)	User	Remarks
0 to 500	Reserved	Failure ID: used for standard error codes only
501 to 999	Spares	
1000 to 1999	SSMM	
2000 to 2999	STR	
3000 to 3999	Spares	
4000 to 9999	OBCP	
<b>10000 to 39999</b>	<b>CSW</b>	
10000 to 19999	Command and Control	
20000 to 29999	AOCS	
30000 to 39999	Other PIDs within CSW	
<b>40000 to 59999</b>	<b>Payload</b>	
40000 to 40999	EPD	
41000 to 41999	MAG	
42000 to 42999	RPW	
43000 to 43999	SWA	

Range (decimal)	User	Remarks
44000 to 44999	Spice	
45000 to 45999	PHI	
46000 to 46999	EUI	
47000 to 47999	METIS	
48000 to 48999	STIX	
49000 to 49999	SoloHi	
50000 to 59999	Spares	
<b>60000 to 64999</b>	<b>Ground</b>	
60000 to 63999	SCOEs	
64000 to 64999	Mission Control System (ESOC)	
<b>65000 to 65535</b>	<b>Spares</b>	

**Table 14.3-1: Specific Failure and Event ID allocation across APID**

5187



## 15 ANNEX 10 SERVICE 3 SID ASSIGNMENT

### 15.1 Service 3 SID Assignment

The TM(3,25) and TM(3,26) Structures ID (SID) will use the following assigned ranges. This approach is applicable to CSW and optional to other SW on board. Note that other SW than CSW should identify a range available for external user (e.g. Ground) and define the range that will be coded by default on-board.

11868

SID Range (dec)	Assignment
1 - 10	General Status and Summary Information HK SID
11 - 30	Mode related HK SID
31 - 60	Equipment related HK SID
61 - 90	Specific Data Request HK SID
91 - 100	Spare
101 - 104	ESOC
105 -127	Spacecraft Ancillary Data

11869

**Table 15.1-1: Service (3,25) SID allocation list**

11935

SID Range (dec)	Assignment
128 - 137	General Status and Summary Information Diagnostic SID
138 - 157	Mode related Diagnostic SID
158 - 187	Equipment Diagnostic SID
188 - 217	Specific Diagnostic SID
218 - 227	Spare
228 - 231	ESOC
232 - 255	Diagnostic to Packet Store only

11936

**Table 15.1-2: Service (3,26) SID allocation list**

11969

## 16 ANNEX 11 COMMON STRUCTURE OF PARAMETER ID

Each parameter of the system data pool in the Central SW will be defined via a 32 bits parameter identification as follows:

11971

Filler = 0	Process ID	Read/ Write Flag	Local ID			
			Filler = 010 bin	Unit ID	Counter	
					First Part	Functional Part
					8 bits	4 bits
			3 bits	8 bits	12 bits	
1 bit	7 bits	1 bit	23 bits			

This approach is applicable to CSW and optional to other SW on board Solar Orbiter.

- Process ID will be the process identification as defined in Annex 8.
- Read/Write Flag will identify whether the parameter is accessible in read and write or read only:  
0 = read and write  
1 = read only (i.e. not modifiable via service 132)
- Local ID will be the identification of the parameter:
  - Unit ID will identify the unit for which the parameter is relevant (e.g. CSW or IMU)
  - Counter will be a free running number to identify the parameter itself.

11972

For CSW generated parameters the last 4 bits shall be used to identify the functional type of parameter (e.g. TM status or delay)

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
1	SOL.S.ASTR.ECO.00022	1	ADDED TO THE BASELINE FOR THE SRR DATAPACK
2	SOL.S.ASTR.ECO.00025	-	<p>Updated for PDR Datapack:</p> <ul style="list-style-type: none"> <li>Description of standard Services and Subservices added in Section 5 as needed for CSW V1</li> <li>Description of private Services and Subservices needed for CSW V1 added in Section 5</li> <li>Service 20 made Mandatory for Instrument (EID-A issue 2.8)</li> <li>APID table updated (based on SW donor being Sentinel 2)</li> <li>Change of Title following RID SRR-ELT-0114</li> </ul>
3	SOL.S.ASTR.ECO.00064	-	<p>The description of TC(3,139) has been updated to clarify the severity definition of the Snapshot Event.</p> <p>The structure of TC(131,1) has been added.</p> <p>The Virtual Channel definition and priority rule have been updated in section 4.3 in line with agreed outcome of Progress Meeting #8.</p> <p>TM-TC Service and Subservice List in section 5 has been updated to reflect the SSMM SW implementation.</p>
4			<p>This document has been upissued for CSW V2 SRR data pack.</p> <p>CSW PDR V1 actions:</p> <ul style="list-style-type: none"> <li>PDR1-52-02: Annex 8 updated with PID table detailing subsystems assignment</li> <li>PDR1-97-01 not implemented</li> <li>PDR1-199-01: included in PUS-248 a table showing the Virtual Channels mapping (ID, physical, description)</li> <li>PDR1-208-01 not implemented</li> <li>PDR1-210-01: partially implemented: added TC verification in all telecommands of Services 1 to 20 inclusive.</li> </ul> <p>Other updates:</p> <ul style="list-style-type: none"> <li>Section 3.2.1.3: updated the note in the section</li> <li>Section 5.3.1.6 TM(142,9) updated</li> </ul>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>structure and parameter definition</p> <ul style="list-style-type: none"> <li>Section 5.14.6: updated description of "sequence number" parameter</li> <li>Section 2.21: described Service 20 with addition of TC(20,128)</li> <li>Annex 8: Updated PID table with further details on CSW applications, added thermal control application PID (provision in case needed), defined payload instruments PIDs. Updated APID table for payload instruments.</li> </ul>
5			<p>This document has been up issued following CSW V2 SRR actions for the CSW V2 baseline checkpoint.</p> <p><b>CSW PDR V1 actions:</b></p> <ul style="list-style-type: none"> <li>PDR1-210-01: TC verification referred to SW TMTIC ICD [RD08]</li> <li>PDR1-97-01: after review of the action, there is no impact on the present document.</li> <li>PDR1-208-01: Source ID table (PUS-68) and Destination ID (PUS-228) moved to Annex 8. Destination ID will be further described in next issue with table showing explicit allocation per applicable PUS services/CAT.</li> </ul> <p><b>CSW SRR V2 actions:</b></p> <ul style="list-style-type: none"> <li>SRR2-79-01: Service 130 added</li> <li>SRR2-82-01: TM(142,11) and diagram page 242</li> <li>SRR2-344-01: text in object PUS-43 updated</li> <li>SRR2-345-01: text in object PUS-248 updated</li> <li>SRR2-348-01: TM(11,19)</li> <li>SRR2-349-01: tables added in Service 12 and service 142</li> <li>SRR2-350-01: section 5.14 updated</li> <li>SRR2-353-01: Service 18, Service 130 added</li> <li>SRR2-354-01: TC(20,2)</li> <li>SRR2-383-01: Service 131</li> <li>SRR2-237-01: general formatting</li> <li>SRR2-77-01: TC verification referred to SW TMTIC ICD [RD08]</li> </ul> <p><b>Change requests:</b></p> <ul style="list-style-type: none"> <li>SOL.S.ASTR.CR.00083 Renumbering of PUS services: TC(15,141) is re-numbered into TC(15,147); Service 140 is re-numbered into Service 139; Note that Service 139 description is updated</li> </ul>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>to be consistent with BC re-use baseline.</p> <p><b>Other updates:</b></p> <ul style="list-style-type: none"> <li>Annex 9 Section 14.3: defined the Payload instruments Failure ID allocation across APID</li> <li>Section 5.9.1: added missing parameter in TC(8.1)</li> <li>Section 5.21: updated TC(20,1) and TC(20,2)</li> <li>Section 5.7.4 and Annex 6: option of using the XOR rotate algorithm in service 6 has been removed (ESA PM#14 action)</li> <li>Section 5.10.2: corrected TM(9,2) packet length is equal to 7 bytes with OBT on 6 bytes.</li> <li>Various formatting and typo corrected, PRID replaced by PID.</li> </ul>
6			Updated according to SOL.S.ASTR.MN.00808
7			<p>Sect 2.2 RD 9 added, issue numbers removed, latest issue of all documents is deemed to apply; RD10 added, according to CSW v2 PDR, RID-35 (AI 20-35-01)</p> <p>Sect 3.2.2.1 PUS-55: description of ACK flag updated to correct typo 'acknowledge progress of execution'</p> <p>Sect 3.4: PUS-55 updated – VCIDs confirmed by RUAG, updated to ensure 2 bit difference between channels – VC1 &amp; VC2.</p> <p>Sect 4.3: PUS-264 updated in line with agreed OBC implementation (VC5 before VC0)</p> <p>Sect 5.1: TM 3,129 deleted, replaced by TM 3,134; TM 15,143 deleted, replaced by TM 15,148, TM 15,146 deleted, replaced by TM 15,149 in accordance with CSW CR-00327; TC 15,146 added, in line the SSMM TMTICID Iss 4</p> <p>Sect 5.2.2: TM(1,2) note regarding padding bytes removed, unnecessary 'requirement' and not restricted at CSW or DB level</p> <p>Sect 5.2.4: TM(1,8) note regarding padding bytes removed, unnecessary 'requirement' and not restricted at CSW or DB level</p> <p>Sect 5.3.1: TC(2,3) reference to RD10 added, according to CSW v2 PDR, RID-35 (AI 20-35-01)</p>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>Sect 5.3.2: TC (2,128) Bus parameter value updated to Bus 1, and bus 2, according to Solo implementation</p> <p>Sect 5.3.3: TC (2,129) Bus parameter value updated to Bus 1, and bus 2, according to Solo implementation</p> <p>Sect 5.3.4: TC (2,130) updated to allow transmission of odd or even sized commands via 2,130, in line with CSW implementation according to CR-321. Note added to clarify that data field contains SpW packet including header.</p> <p>Sect 5.4.1: TC (3,1) note updated to clarify that SID is unique for any given PID</p> <p>Sect 5.4.2: TC (3,2) note updated to clarify that SID is unique for any given PID</p> <p>Sect 5.4.9: TC (3,9) SID parameter description updated to correct typo</p> <p>Sect 5.4.16: TM (3,129) deleted, moved to Sect 5.4.19, renamed TM (3,134), in accordance with CSW CR-00327</p> <p>Sect 5.4.16: TC (3,129) TBC removed, wording updated to clarify SSMM implementation</p> <p>Sect 5.6: Description and diagram updated to clarify table of occurrence functionality which stores N instances of generated events</p> <p>Sect 5.7, Figure 5.7-1 updated for SSMM memory IDs, and corrected for MM IDs, memory ID for TTRM PROM added.</p> <p>Note added to clarify that output register cannot be patched via inter PM link, in line with AI #10, NCR-28</p> <p>Sect 5.7.3: TM(6,6) parameter descriptions updated to remove typos; note regarding padding to even number of bytes removed – not a requirement.</p> <p>Sect 5.7.4: TC (6,9) parameter description updated to correct typo – checking rather than loading</p> <p>Sect 5.7.5: TM (6,10) parameter description updated to correct typo – checking rather than</p>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>loading</p> <p>Sect 5.7.10: TC (6,140) parameter description and value updated to correctly specify use of the mask</p> <p>Sect 5.10: Updated to include Solar Orbiter zero time reference of 00:00 on 1<sup>st</sup> January 2000</p> <p>Sect 5.12.1: TC(11,1) description of parameter value updated to clarify usage of command (remove schedule control bit reference); Sub-schedule ID range (1-255) updated in line with CSW v2.1 PDR RID-72</p> <p>Sect 5.12.4: TC (11,4) Sub-schedule ID range (1-255) updated in line with CSW v2.1 PDR RID-72</p> <p>Sect 5.12.5: TC (11,5) Number of TCs parameter description updated to clarify that successive TCs are determined by time tag, in accordance with SOL.S.ASTR.CR.00081</p> <p>Sect 5.12.5: TC (11,6) Sub-schedule ID range (1-255) updated in line with CSW v2.1 PDR RID-72</p> <p>Sect 5.12.7: TC (11,7) Number of TCs parameter description updated to clarify that successive TCs are determined by time tag, in accordance with SOL.S.ASTR.CR.00081</p> <p>Sect 5.12.9: TC (11,9) Number of TCs parameter description updated to clarify that successive TCs are determined by time tag, in accordance with SOL.S.ASTR.CR.00081; N parameter typo updated to 'number of PIDs to be reported'</p> <p>Sect 5.12.12: TC (11,12) Number of TCs parameter description updated to clarify that successive TCs are determined by time tag, in accordance with SOL.S.ASTR.CR.00081; N parameter typo updated to 'number of PIDs to be reported'</p> <p>Sect 5.13.5: TC (12,5) Clarification sentence added to description of Rep parameter; description of third EID corrected to state 'associated with the expected value'; clarification added on low and high limit, and expected value, values – to be right aligned with padding to the left.</p>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>Clarification note added to validity parameter value that value of the parameter is true/false</p> <p>Sect 5.13.7: TC (12,7) Clarification sentence added to description of Rep parameter; description of third EID corrected to state 'associated with the expected value';</p> <p>Clarification added on low and high limit, and expected value, values – to be right aligned with padding to the left.</p> <p>Sect 5.13.9: TM (12,9) Clarification added on low and high limit, and expected value, values – to be right aligned with padding to the left.</p> <p>Clarification note added to validity parameter value that value of the parameter is true/false</p> <p>Sect 5.13.11: TM (12,11) Source data Table updated to correct N repeater value over all TM parameters; limit crossed value updated to clarify right aligned.</p> <p>Sect 5.13.12: TM (12,12) Parameter value, value updated to clarify right aligned.</p> <p>Sect 5.14: SSMM Service 13 TMTC updated description to reference RD9 (SSMM TMTC ICD)</p> <p>All instances of file ID parameter updated to use Uns Int, instead of Enum to allow new file IDs to be assigned with need for DB update.</p> <p>Sect 5.14.1: TC (13,9) Repeater parameter N removed (not used, in line with CSW implementation)</p> <p>Sect 5.14.2: TC (13,10) Repeater parameter N removed (not used, in line with CSW implementation)</p> <p>Sect 5.14.3: TC (13,11) Repeater parameter N removed (not used, in line with CSW implementation)</p> <p>Note updated to clarify CSW processing of file containing TC sequence for immediate execution.</p> <p>Sect. 5.15.11: TC(14,13) Parameter type for EID updated to Unsigned Integer (to ensure that EIDs from all on-board sources can be assigned)</p>



ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>Sect. 5.15.12: TC(14,14) Parameter type for EID updated to Unsigned Integer (to ensure that EIDs from all on-board sources can be assigned)</p> <p>Sect. 5.15.16: TM(14,131) Parameter type for EID updated to Unsigned Integer (to ensure that EIDs from all on-board sources can be assigned)</p> <p>Sect 5.16: SSMM Service 15 TMTC updated description to reference RD9 (SSMM TMTC ICD)</p> <p>Sect 5.16.3: TC (15,3) Description of N1 parameter added to parameter definition</p> <p>Sect 5.16.4: TC (15,4) Description of N1 parameter added to parameter definition</p> <p>Sect 5.16.6: TM (15,6) Filler and APID fields updated - APID is 11 bits, and filler 5 bits, according to APID size, and SSMM implementation.</p> <p>Sect 5.16.7.1: TC (15,9) updated to clarify that coarse time only is used by CSW for downlink criteria – sub-seconds must be set to zero.</p> <p>Sect 5.16.7.2: TC (15,9) VC allocation updated according to SSMM implementation, and mapping to OBC VCs</p> <p>Sect 5.16.8.2: TC (15,10) Filler and APID fields updated - APID is 11 bits, and filler 5 bits, according to APID size, and SSMM implementation</p> <p>Sect 5.16.11: TC (15,13) VC allocation updated according to SSMM implementation, and mapping to OBC VCs</p> <p>Sect 5.16.13.2: TC (15,129) VC allocation updated according to SSMM implementation, and mapping to OBC VCs</p> <p>Sect 5.16.27: TM (15,143) deleted, moved to TM (15,148), in accordance with CSW CR-00327</p> <p>Sect 15.16.29 TC (15,145) for SSMM details added</p> <p>Sect 5.16.31: TM (15,146) deleted, moved to TM (15,149), in accordance with CSW CR-00327; TC (15,146) added in line with SSMM</p>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>TMTICID Iss 4</p> <p>TC(15,141) updated to TC (15,147) in line with RID#33 v2.1 SRR and CR-0083 On CSW to remove conflict between CSW TC and SSMM TM; see also CR-00083</p> <p>Sect 5.15.32: TC(15,150) Size parameter description updated to clarify input format required, in line with CSW &amp; OBC implementation, and in accordance with AI#2 of NCR-19.</p> <p>Sect 5.16.38: TC (15,153) N parameter updated for range 1-10, according to CSW implementation.</p> <p>Sect 5.19.1: TC (18,5) OBCP ID &amp; step ID parameter type updated to unsigned integer (to allow introduction of new OBCPs post flight without change to calibration in DB).</p> <p>Sect 5.19.2: TC (18,6) OBCP ID parameter type updated to unsigned integer (to allow introduction of new OBCPs post flight without change to calibration in DB).</p> <p>Sect 5.19.1: TC (18,7) OBCP ID &amp; OBCP parameter ID parameter type updated to unsigned integer (to allow introduction of new OBCPs post flight without change to calibration in DB).</p> <p>Sect 5.19.5: TM (18,9) OBCP ID parameter type updated to unsigned integer (to allow introduction of new OBCPs post flight without change to calibration in DB).</p> <p>Sect 5.19.5: TC (18,140) OBCP ID and OBCP parameter ID parameter type updated to unsigned integer (to allow introduction of new OBCPs post flight without change to calibration in DB).</p> <p>Sect 5.19.7: TC (18,141) OBCP ID and step ID parameter type updated to unsigned integer (to allow introduction of new OBCPs post flight without change to calibration in DB).</p> <p>Sect 5.19.8: TC (18,142) OBCP ID parameter type updated to unsigned integer (to allow introduction of new OBCPs post flight without change to calibration in DB); description of OBCP ID updated to correct typo</p>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>Sect 5.19.9: TC (18,144) OBCP ID, checksum, OBCP parameter ID parameter type updated to unsigned integer (to allow introduction of new OBCPs post flight without change to calibration in DB).</p> <p>Sect 5.20.1: TC (19,1) Note added to clarify that the default state of a newly created S19 entry is disabled.</p> <p>Parameter type for EID updated to Unsigned Integer (to ensure that EIDs from all on-board sources can be assigned)</p> <p>Sect. 5.20.2: TC(19,2) Parameter type for EID updated to Unsigned Integer (to ensure that EIDs from all on-board sources can be assigned)</p> <p>Sect. 5.20.4: TC(19,4) Parameter type for EID updated to Unsigned Integer (to ensure that EIDs from all on-board sources can be assigned)</p> <p>Sect. 5.20.7: TM(19,7) Parameter type for EID updated to Unsigned Integer (to ensure that EIDs from all on-board sources can be assigned)</p> <p>Sect. 5.20.8: TC(19,130) Parameter type for EID updated to Unsigned Integer (to ensure that EIDs from all on-board sources can be assigned); description of period parameter updated for clarification.</p> <p>Sect. 5.20.9: TM(19,131) Parameter type for EID updated to Unsigned Integer (to ensure that EIDs from all on-board sources can be assigned)</p> <p>Sect 5.21.1: TC(20,1) Range on instrument ID parameter updated to correctly reference table 7-1 in AD04</p> <p>Sect 5.21.3: TC(20,128) updated to include the thruster firing bit as detailed in CR-TBC (for inclusion in EID-A Iss5); and the science data storage flag, as agreed in SOL.S.ASTR.MN.01249). Quality flags updated to 'commandable flags'.</p> <p>AOCS data added to platform data field, according to ESA request.</p> <p>Sect 5.22: TM (21,3) updated, TM (21,4),</p>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>(21,5), (21,6) added for different types of science data, as directed by ESA, in order to ensure consistency of SCOS DB.</p> <p>Sect 5.23.4: TC (22,4) updated to use instrument PID rather than SpW address, in line with CSW implementation and removing need for CSW to retain information of which instrument PID accepts TC 22,3</p> <p>Sect 5.23.5: TC (22,5) updated to use instrument PID rather than SpW address, in line with CSW implementation and removing need for CSW to retain information of which instrument PID accepts TC 22,3</p> <p>Sect. 5.24.1: TC(130,1) Parameter type for TM APID updated to unsigned integer</p> <p>Sect. 5.24.4: TM (130,4) Range of N parameter corrected to 1 to 255, description clarified</p> <p>Parameter type for TM APID updated to unsigned integer</p> <p>Sect 5.27.3: TC(133,8) Description corrected to remove reference to TM 133,10.</p> <p>Sect 5.28.1: TC (134,1) noted added to clarify that rate of up to 16 Hz is according to TC sequencer capabilities and not according to on-board command processing rates.</p> <p>Sect 5.28.3: TC (134,3) incorrect note stating that no S1 are generated deleted</p> <p>Sect 5.28.4: TC (134,4) Noted added to clarify that rate of up to 16 Hz is according to TC sequencer capabilities and not according to on-board command processing rates.</p> <p>Incorrect note stating that no S1 are generated deleted</p> <p>Sect 5.27: All instances of file ID parameter updated to use Uns Int, instead of Enum to allow new file IDs to be assigned with need for DB update.</p> <p>Sect 5.27.1: TC (133,6) updated to allow copy from one partition to another, in line with CSW CR-0235.</p> <p>Sect 5.28: All instances of file ID parameter updated to use Uns Int, instead of Enum to</p>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			<p>allow new file IDs to be assigned with need for DB update.</p> <p>Sect 5.29.1: TC (139,1) NPAR parameter updated to 1 byte, in line with CSW implementation (see also NCR-0006 AI 3)</p> <p>Sect 5.32: Description updated to include enabled-failed state of FMON</p> <p>Sect 5.32.1 TC (142,1) Parameter type for FMON ID corrected to Unsigned Integer</p> <p>Sect 5.32.1 TC (142,2) Parameter type for FMON ID corrected to Unsigned Integer</p> <p>Sect 5.32.3 TC (142,5): Clarification note added to validity parameter value that value of the parameter is true/false; Parameter type for FMON ID corrected to Unsigned Integer</p> <p>Sect 5.32.4 TC (142,6) Parameter type for FMON ID corrected to Unsigned Integer</p> <p>Sect 5.32.6 TC (142,9) Parameter type for FMON ID corrected to Unsigned Integer</p> <p>Sect 5.32.8 TC (142,11) Parameter type for FMON ID corrected to Unsigned Integer</p> <p>Sect 5.32.9 TC (142,12) Parameter type for FMON ID corrected to Unsigned Integer</p> <p>Sect 5.32.10 TC (142,13) Parameter type for FMON ID corrected to Unsigned Integer</p> <p>Annex 8, Figure 13.1-3 updated for CAT availability to payloads, note updated for Service 1 routed to the OMM with CAT 1, and TM(3,25) for IIC with CAT 5 (according to TN-88 Iss 4)</p> <p>Sect 13.2: Note added to source ID requirement referencing CSW mapping of source IDs to PIDs to CSW TMTICID, in accordance with CSW v2.1 PDR RID-125</p> <p>Sect 13.3: Table 13.3-1 updated Service 3 can use CAT 5 (functional cyclic) for 3,25 created for purposes of inter-instrument communication. Note 1 added.</p> <p>Service 9 TM (time packet) does not have a destination ID as no data field header is included, therefore removed from the table,</p>

ISSUE	CHANGE AUTHORITY	CLASS	RELEVANT INFORMATION/INSTRUCTIONS
			note 2 added  Sect 15.1: Table 15.1-1 & 15.1-2 column for CAT deleted, CAT specified in Annex 8.
INTERNAL		EXTERNAL	
A Whitehouse		P. Kleztkine (ESTEC)	
S. King		S. Strandmoe (ESTEC)	
T. Hunt		S. Thuerey (ESTEC)	
T. Colegrove		A. Oganessian (ESTEC)	
J-F. Dalozé		Bruno Sousa (ESOC)	
C. McCrorie		I. Tanco (ESOC)	
M. Yu		D. Lakey (ESOC)	
L. Kirk			
S. Brady		ESA Configuration Management	
I. Cantiello			
A. Ewbank			
N. Ravillious			
G. Richardson			
Configuration Management			

## CHANGE LOG

### Note:

This log is autogenerated from Doors. Special symbols may not be rendered correctly and hence the main body of the document shall always take precedence for requirements. Thus it should only be used as a guide to the modifications in the document and not as a substitute.

### Modified Objects

In the following table modifications to the Object Text attribute are shown using red line markup. For other attributes the new value and the old value are shown in separate columns.

The codes used in the object type (OT) column are: Rq = Requirement, Inf = Information, Hd = Heading, TC = Table Cell, Ah = Applicability Matrix Heading, Ar = Applicability Matrix Requirement

Identifier	Attribute	OT	New Text	Old Text
PUS-12 section 2.2	Object Text	Inf	RD3 SO-ESC-RS-05001	Solar Orbiter OIRD, <del>issue 1.6</del> <del>August 2011</del>
PUS-55 section 3.2.2.1	Object Text	Rq	<p>Ack:</p> <p>This field indicates the acknowledgements required in the form of telemetry packets to verify acceptance and execution of this telecommand packet.</p> <p>The bit settings defined for BepiColombo are as follows (with bit zero as start of the data field header):</p> <ul style="list-style-type: none"> <li>- - - x Acceptance of packet by application [0/1; no report required/report required]</li> <li>- - x - Not used (Acknowledge start of execution) - Shall be set to zero</li> <li>- x - - Not used (Acknowledge <del>start</del><u>progress</u> of execution) - Shall be set to zero</li> <li>x - - - Completion of execution [0/1; no report required/report required]</li> </ul> <p>All applications, which receive telecommands, must generate acknowledgements as specified in the telecommand message.</p> <p>An encapsulated Telecommand packet shall be acknowledged separately from its transport command depending on the Ack flag of each command.</p>	

Identifier	Attribute	OT	New Text	Old Text
PUS-153 section 3.4	Object Text	Rq	Spacecraft ID: This field shall contain the Solar Orbiter Spacecraft Identifier. The assigned CCSDS global spacecraft ID is 28A (HEX), 650 (DEC) <del>[RD-29]</del> .  NOTE: Same spacecraft ID will be used for the Flight model, ETB and OBC-DM <del>[RD-30]</del> .	
PUS-155 section 3.4	Object Text	Rq	Virtual Channel ID: Only two Virtual Channels Identifiers shall be used addressing the two on-board decoders. The suggested values are Zero and One: <del>VC0</del> VC1 = TC decoder 1 = '000000000001' BIN <del>VC1</del> VC2 = TC decoder 2 = '000001000010' BIN These two values shall be used consistently in the CLCWs. <del>NOTE: VC identifier values are provisional until RUAG provides the definitive values</del>	
PUS-299 section 5.1	Object Text	Inf	<u>Note 1: At least one of the TM (21,3; 21,4; 21,5; 21,6) defined for science data transfer must be used by the instruments.</u> Services 4, 7 and 10 are not used at all.	
PUS-1253 section 5.3	Object Text	Inf	Objective This service provides the capability for the distribution of: Command Pulse Distribution Unit (CPDU) commands for reconfiguration of vital unit functions. It is distinguished whether the OBC Central Software is involved or not. If the processing of a CPDU command packet is not completed, then any new command received will be ignored. · Some TC packets are received by the CPDU TC decoder via MAP = 0 to generate <del>one (TBC)</del> a CPDU output pulse. No Software is involved. These commands have a non-PUS structure and are hence not presented here. TC(2,3) will be the SW distributed CPDU commands. 1553 bus command messages SpaceWire command messages	
PUS-1270 section 5.3.1	Object Text	Inf	Description: This TC packet is received by the OBC CSW via MAP = 1 and routed to the CPDU to generate <del>one (TBC)</del> a CPDU output pulse.	



Identifier	Attribute	O T	New Text	Old Text
PUS-1492 section 5.6	Object Text	Inf	<p>Description</p> <p>The service provides the capability to generate 4 different categories of events. These are:</p> <p>TM(5,1): Reporting of normal progress of operations and activities</p> <p>Reporting of failures or anomalies detected on board:</p> <p>TM(5,2): Low criticality (warning, no recovery action required)</p> <p>TM(5,3): Medium criticality (ground recovery action required)</p> <p>TM (5,4): High criticality (on-board recovery action required)</p> <p>Note: the use of the different levels will be defined during the design of the process issuing them. Typically "low" will just be stored for downlink to ground, "high" will always have a pre-defined response by the Central software to recover the anomaly.</p> <p>Event reports will be one of the prime methods used to control day to day operations during the mission to report normal progress, warnings, errors requiring ground action or autonomous actions performed on-board.</p> <p>The source data field of the Event packet shall not exceed the maximum length of 40 bytes. Exceptions will be agreed with ESA.</p> <p>The Event ID allocation is unique across a given PID as defined in Appendix 9.</p> <p>Once generated, events may be:</p> <p>filtered and recorded in the Safe Guard Memory (SGM) as part of the so called Critical Event Log (CEL) for "medium" and "high" levels,</p> <p>and/or forwarded toward ground</p> <p>and/or recorded in the OBC Mass Memory (OMM)</p> <p>and/or forwarded to Service 19.</p> <p>When recorded in the SGM as part of the Critical Event Log (CEL), the events will be stored in a combination of a linear and a circular buffer.</p> <p>The Linear buffer contains the "m" first events generated (the oldest ones) and the circular buffer the last "n" events generated (the youngest ones).</p> <p>In an ordinary case, the full size of the CEL allows to record up to m + n events.</p> <p>In case of burst of events, the "m" first events and the "n" last events are recorded in the CEL. <del>A counter of occurrence is available for the "p" events that are generated</del> In addition, the Linear counter</p>	

Identifier	Attribute	OT	New Text	Old Text
PUS-1568 section 5.7	Object Text	Inf	<p>Description</p> <p>This service provides the basic dump, load and check capabilities w.r.t on-board memory blocks uniquely identified by "Memory ID".</p> <p>The addressing technique used on Solar Orbiter for memory load, dump and check requests and reports is <del>the</del> absolute addressing. This allows the user to specify a real address start loading or dumping from. The address is expressed in Single Addressable Unit (SAU) corresponding to the one of the selected memory ID.</p> <p>The service supports block load and dump. This means that TC(6,2) and TC(6,5) only contains one block of memory word(s) to be loaded or dumped, TC(6,128) allows to apply pre-loaded set of patches to effectively produce the effect of a scatter patch.</p> <p>The TM (6,6) Memory dump report is not limited in length. The dump -application will generate as many TM dump packets as required to cover the entire commanded dump-area.</p> <p>The TC (6,9) requests the check of a block of on board memory and to send down the checksum result in TM (6,10) via Real Time telemetry.</p> <p>An allocation for the Memory IDs and their memory -types available on board are shown in the following table:</p>	

Identifier	Attribute	OT	New Text	Old Text
PUS-1732 section 5.10	Object Text	Inf	<p>Objective</p> <p>The Solar Orbiter On-Board Computer (OBC) maintains its own On Board Time (OBT). During normal operation the OBT is synchronised with a controlled oscillator. From there several clock signals and the PPS (Pulse per Second) signal is distributed to external users and OBC internal usage.</p> <p>The <a href="#">solar orbiter zero time reference is 00:00 on 1st January 2000.</a></p> <p><a href="#">The</a> Time Management service allows the ground to modify the OBT TC(9,128) and provides the ground with the OBT information TM(9,2). The generation frequency of this time packet can be commanded using TC(9,1).</p> <p>Latching of the ground time at arrival of the VC0 frame allows the ground to correlate OBT with ground segment time (e.g. UTC).</p> <p>The OBT format is CCSDS unsegmented Time Code (CUC) split into a seconds and subseconds field. The single format used for Solar Orbiter consists of a 4 bytes coarse time and a 2 bytes fine time as shown in Annex 4.</p>	
PUS-2079 section 5.14	Object Text	Inf	<p>Objective</p> <p>The service 13 provides the Ground with the capability to transfer large data files with the spacecraft in a controlled manner.</p> <p>The service 13 uplink capability will be implemented between the Ground and the CSW in the OBC. The transfer mechanism will split the large data units into parts and transmit each part within a single service 13 TC packet. The large data files will be transferred on-board into so-called partitions, e.g. in OBC Mass Memory or SGM.</p> <p>The service 13 downlink capability will be implemented between the SSMM and the Ground. The transfer mechanism will splits the large data units into parts and transmit each part within a single service 13 TM source packet. The detailed TM/TC structures are available in <a href="#">RD6RD9</a>.</p>	

Identifier	Attribute	OT	New Text	Old Text
PUS-2180 section 5.14.9	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2191 section 5.14.10	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2202 section 5.14.11	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2213 section 5.14.12	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2224 section 5.14.13	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2235 section 5.14.14	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2246 section 5.14.15	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2257 section 5.14.16	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2268 section 5.14.18	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2279 section 5.14.19	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2290 section 5.14.20	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-2301 section 5.14.21	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2312 section 5.14.22	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2323 section 5.14.23	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2334 section 5.14.24	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2345 section 5.14.25	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2356 section 5.14.26	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2367 section 5.14.27	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2378 section 5.14.28	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2389 section 5.14.29	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2400 section 5.14.30	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2411 section 5.14.32	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-2422 section 5.14.33	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2623 section 5.16.25	Object Heading	Head	TM (15,141)	TC-TM (15,141)
PUS-2624 section 5.16.31	Object Text	Inf	Description: Upon reception of TC 15, <del>141</del> <a href="#">147</a> the SID of the specified Process ID will be removed from the Storage Selection Definition of the given OMM Packet Store in CSW.	
PUS-2648 section 5.16.32	Object Text	Inf	Description: TM 15, <del>143</del> <a href="#">148</a> is the response to TC 15,142 and reports the SID storage selection in CSW (i.e. in OBC MM).  This is implemented in CSW only.	
PUS-2671 section 5.16.30	Object Heading	Head	TC (15,146) Delete Packet Store content for non-cyclic PS	TM (15,146) Storage Routing Definition Table Report
PUS-2672 section 5.16.30	Object Text	Inf	Description: <del>TMTC (15,146 is the response) to performs TCa 15,145deletion and of reports a thenon-cyclic defined packet routingstore.</del>  <del>This table is definition implemented in by the on-board CSW (i.e. for OBCSSMM MassSW Memory)only.</del>	
PUS-2682 section 5.16.30	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-2968 section 5.22	Object Text	Inf	Objective Service 21 performs management of the science data transfer between the SSMM and the payloads. Upon receipt of a TC (21, <del>21</del> ), the payload user starts transmission of its science data to the SSMM in a sequence of TM (21, <del>3x</del> )s as defined by the user. Note that, enable of science data transmission may also be achieved directly by a commanded mode-change of the instrument. This process is halted by the payload user upon receipt of a TC (21,2), or can also be achieved implicitly by a mode-change.	

Identifier	Attribute	OT	New Text	Old Text
PUS-2969 section 5.22.1	Object Text	Inf	<p>Description</p> <p><del>TC (21,1) Enable/Start Science transfer from User to SSMM</del></p> <p>As defined by the user.</p> <p>At least one set of commands TC (21,1) and TC(21,2) needs to be defined for activating or deactivating globally the generation of Service-21-TM-packets.</p> <p>Recommendation: In case of a need to enable/ disable individually different subsets of Science TM-packets the corresponding telecommands may be defined additionally.</p>	
PUS-3165 section 13.1	Object Text	Rq	The table below defines the Packet Categories to be used on Solar Orbiter <del>(TBC)</del> . The numbers in the table below are in decimal radix.	
PUS-3172 section 13.1	Object Text	TC	TIME: <a href="#">Exclusive for Service 9, Time packet, telemetry</a>	
PUS-3175 section 13.1	Object Text	TC	TC Verification: <a href="#">Exclusive for Service 1 (1,x), TC acknowledgement telemetry</a>	
PUS-3178 section 13.1	Object Text	TC	HPTM: <a href="#">Exclusive for HPTM HK packets (platform only)</a>	
PUS-3181 section 13.1	Object Text	TC	Table generation: <a href="#">To be used for variable length tabular reports</a>	
PUS-3184 section 13.1	Object Text	TC	HK (routine): <a href="#">All routine, cyclic 3,25 HK produced as part of default Service 3 TM</a>	
PUS-3187 section 13.1	Object Text	TC	FUNCTIONAL CYCLIC (high frequency measurement): <a href="#">To be used for private Service 3 (3,25) cyclic packets produced only upon Ground request</a>	
PUS-3190 section 13.1	Object Text	TC	FUNCTIONAL NON CYCLIC (ad-hoc measurement): <a href="#">To be used only for private report packets (fixed length, tabular) produced upon Ground request</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3193 section 13.1	Object Text	TC	Event generation: <a href="#">Exclusive for Service 5 (5,x) event packets, and Service 17 (17,2) telemetry</a>	
PUS-3196 section 13.1	Object Text	TC	Diagnostic: <a href="#">To be used only for Service 3 (3,26) or private diagnostic packets produced upon Ground request</a>	
PUS-3199 section 13.1	Object Text	TC	Dump TM: <a href="#">Exclusive for Service 6 (6,x) telemetry</a>	
PUS-3202 section 13.1	Object Text	TC	FILE TRANSFER: <a href="#">Exclusive for Service 13 telemetry</a>	
PUS-3205 section 13.1	Object Text	TC	CONTEXT: <a href="#">Exclusive for Service 22 telemetry</a>	
PUS-3208 section 13.1	Object Text	TC	PRIVATE-SCIENCE or TELECOMMAND: <a href="#">Exclusive for Service 21 telemetry/ Telecommand</a>	
PUS-3217 section 13.1	Object Text	TC	IDLE: <a href="#">To be used for idle packets (platform only)</a>	
PUS-3218 section 13.1	Object Text	Inf	Figure 13.1-1: Packet Category Allocation— <del>TBC</del>	



Identifier	Attribute	OT	New Text	Old Text																																				
PUS-3219 section 13.1	Object Text	Rq	<p>The table below defines the Process ID to be used on Solar Orbiter. The numbers in the table below are in decimal radix.</p> <table border="1"> <thead> <tr> <th>Process ID (dec)</th> <th>Component</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>TIME</td> <td></td> </tr> <tr> <td>1</td> <td>Spare</td> <td></td> </tr> <tr> <td>2</td> <td>OBC HW</td> <td>High Priority TC Functions to CPDU (MAP ID = 0); High Priority TM Functions</td> </tr> <tr> <td>3 to 9</td> <td>Spares</td> <td></td> </tr> <tr> <td>10</td> <td>OBC CSW</td> <td>Data Management System (DMS) Application</td> </tr> </tbody> </table> <p>OBC management:</p> <ul style="list-style-type: none"> <li>• PM board</li> <li>• Mil-1553-B bus control</li> <li>• SpaceWire communication</li> <li>• TTRM board: TC Decoder, TM Encoder, On-Board Time (OBT), Reconfiguration Module (RM), SafeGuard Memory (SGM), Mass Memory (MM), Command Pulse Distribution Unit (CPDU)</li> <li>• TM/TC ground communication</li> </ul> <p>DMS Services management:</p> <ul style="list-style-type: none"> <li>• PUS services</li> </ul> <table border="1"> <thead> <tr> <th>Process ID (dec)</th> <th>Component</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>11</td> <td>OBC CSW</td> <td>Attitude Orbit Control Subsystem (AOCS) Application</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• AOCS Non Core Functions: AOCS equipments HW I/F, configuration and FDIR</li> <li>• AOCS Core Functions: AOCS modes, sensors processing, attitude estimation, actuators commanding, guidance profiles processing)</li> <li>• AOCS units management: STR, IMU, FSS, RW, CPS (functional, torque demand)</li> </ul> <table border="1"> <thead> <tr> <th>Process ID (dec)</th> <th>Component</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>12</td> <td>OBC CSW</td> <td>Payload Application</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• Payload instruments management: EPD, MAG, RPW, SWA, SPICE, PHI, EUI, METIS, STIX, SOLOHI</li> </ul> <table border="1"> <thead> <tr> <th>Process ID (dec)</th> <th>Component</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>13</td> <td>OBC CSW</td> <td>Platform Application</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• EPS units management: PCPU, SADE</li> <li>• DHS units management: RIU (which gives access to FSS, CPS, I-Boom and thermistors), SSMM</li> <li>• COMS units management: DST, TWTA, APME-H (HGA), APME-M (MGA)</li> <li>• CPS units management (HW I/F, configuration, FDIR)</li> <li>• Payload Interface units/mechanisms management: DCU</li> <li>• Thermal control units management <del>(TBC)</del></li> </ul> <p><del>14 OBC CSW System Control Application</del></p> <ul style="list-style-type: none"> <li>• System initialisation</li> <li>• System modes</li> <li>• System configuration</li> <li>• System FDIR</li> </ul>	Process ID (dec)	Component	Meaning	0	TIME		1	Spare		2	OBC HW	High Priority TC Functions to CPDU (MAP ID = 0); High Priority TM Functions	3 to 9	Spares		10	OBC CSW	Data Management System (DMS) Application	Process ID (dec)	Component	Meaning	11	OBC CSW	Attitude Orbit Control Subsystem (AOCS) Application	Process ID (dec)	Component	Meaning	12	OBC CSW	Payload Application	Process ID (dec)	Component	Meaning	13	OBC CSW	Platform Application	
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11	OBC CSW	Attitude Orbit Control Subsystem (AOCS) Application																																						
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12	OBC CSW	Payload Application																																						
Process ID (dec)	Component	Meaning																																						
13	OBC CSW	Platform Application																																						

Identifier	Attribute	OT	New Text	Old Text
PUS-3320 section 13.1	Object Text	Inf	Figure 13.1-2: Figure 13.1-2 Process ID Allocation The table below shows the APID allocation ( <del>TBC</del> ) for the Spacecraft. The numbers in the table below are in decimal radix.	
PUS-3665 section 13.1	OLE	Rq	Figure/Table modified	
PUS-3700 section 17.2	Object Text	TC	<del>DL</del> . <a href="#">HidalgoKirk</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3709 section 5.1	Object Text	Rq	<del>TC/TM Type Sub</del> <del>type Service Description CSW SSMM SW STR SW</del> <del>P/L SW</del>  <del>Service 1: TC Verification Service</del> <del>M</del> <del>TM 1 1 TC acceptance success report X</del> <del>X X M</del> <del>TM 1 2 TC acceptance failure report X</del> <del>X X M</del> <del>TM 1 7 TC execution success report X</del> <del>X X M</del> <del>TM 1 8 TC execution failure report X X</del> <del>X M</del>  <del>Service 2: Device Command</del> <del>Distribution Service O</del> <del>TC 2 3 CSW Distribute CPDU commands</del> <del>X</del> <del>TC 2 128 Distribute Milbus 1553 commands</del> <del>X</del> <del>TM 2 129 Milbus 1553 commands answer X</del>  <del>TC 2 130 Distribute SpaceWire Packet X</del> <del>O</del>  <del>Service 3: Housekeeping and</del> <del>Diagnostic Data Reporting Service</del> <del>M</del> <del>TC 3 1 Define New Housekeeping Parameter</del> <del>Report X O</del> <del>TC 3 2 Define New Diagnostic Parameter</del> <del>Report X O</del> <del>TC 3 3 Clear Housekeeping Parameter</del> <del>Report Definitions X O</del> <del>TC 3 4 Clear Diagnostic Parameter Report</del> <del>Definitions X O</del> <del>TC 3 5 Enable Housekeeping Parameter</del> <del>Report Generation X X O</del> <del>TC 3 6 Disable Housekeeping Parameter</del> <del>Report Generation X X O</del> <del>TC 3 7 Enable Diagnostic Parameter Report</del> <del>Generation X O</del> <del>TC 3 8 Disable Diagnostic Parameter Report</del> <del>Generation X O</del> <del>TC 3 9 Report Housekeeping Parameter</del> <del>Report Definition X O</del> <del>TM 3 10 Housekeeping Parameter Report</del> <del>Definition Report X O</del> <del>TC 3 11 Report Diagnostic Parameter Report</del> <del>Definition X O</del> <del>TM 3 12 Diagnostic Parameter Report</del> <del>Definition Report X O</del>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3888 section 5.14.1	OLE	Inf	Figure/Table modified	
PUS-3889 section 5.14.2	OLE	Inf	Figure/Table modified	
PUS-3890 section 5.14.3	OLE	Inf	Figure/Table modified	
PUS-3896 section 5.14.9	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">129</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3897 section 5.14.10	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">130</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3898 section 5.14.11	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">131</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3899 section 5.14.12	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">132</a> Application/Source Data: <a href="#">See RD9</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3900 section 5.14.13	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">133</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3901 section 5.14.14	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">134</a> Application/Source Data: <a href="#">see RD9</a>	
PUS-3902 section 5.14.15	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">135</a> Application/Source Data: <a href="#">see RD9</a>	
PUS-3903 section 5.14.16	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">136</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3904 section 5.14.18	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">138</a> Application/Source Data: <a href="#">See RD9</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3905 section 5.14.19	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">139</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3906 section 5.14.20	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">140</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3907 section 5.14.21	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">141</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3908 section 5.14.22	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">142</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3909 section 5.14.23	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">143</a> Application/Source Data: <a href="#">see RD9</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3910 section 5.14.24	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">144</a> Application/Source Data: <a href="#">see RD9</a>	
PUS-3911 section 5.14.25	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">145</a> Application/Source Data: <a href="#">see RD9</a>	
PUS-3912 section 5.14.26	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">146</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3913 section 5.14.27	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">147</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3914 section 5.14.28	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">148</a> Application/Source Data: <a href="#">See RD9</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3915 section 5.14.29	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">149</a> Application/Source Data: <a href="#">see RD9</a>	
PUS-3916 section 5.14.30	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">150</a> Application/Source Data: <a href="#">see RD9</a>	
PUS-3917 section 5.14.32	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">152</a> Application/Source Data: <a href="#">see RD9</a>	
PUS-3918 section 5.14.33	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">153</a> Application/Source Data: <a href="#">See RD9</a>	
PUS-3937 section 5.16.32	Object Text	Inf	Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: as per annex 8 Packet Data Field Info: Service Type: 15 Service Subtype: <del>143</del> 148 Application/Source Data:	



Identifier	Attribute	OT	New Text	Old Text
PUS-3939 section 5.16.30	Object Text	Inf	Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: <del>as per annex 8</del> <a href="#">12</a> Packet Data Field Info: Service Type: 15 Service Subtype: 146 Application/Source Data: <a href="#">See RD9</a>	
PUS-3939 section 5.16.30	OLE	Inf	Figure/Table deleted	
PUS-3946 section 5.19.6	Object Text	Inf	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 18 Service Subtype: 140 Application/Source Data:  <del>OBCP ID — Emergency Auto-delete spare NL            — Load parameters NS OBCP Param ID            — Value            enum enum enum n/a uint N/A uint enum            (deduced)            4 bytes 1 bit 1 bit 6 bits 2 bytes 1 byte 2            bytes 4 bytes variable            ————— &lt; NL times —&gt; —&lt;—            NS times —————&gt;</del>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3947 section 5.19.7	Object Text	Inf	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 18 Service Subtype: 141 Application/Source Data:  <del>OBCP ID Step ID</del> <del>enum enum</del> <del>4 bytes 2 bytes</del> <del>(optional)</del>	
PUS-3948 section 5.19.8	Object Text	Inf	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 18 Service Subtype: 142 Application/Source Data:  <del>OBCP ID TM status TM Period</del> <del>enum enum uint</del> <del>4 bytes 1 bit 15 bits</del> <del>_____</del>	
PUS-3949 section 5.19.9	Object Text	Inf	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: as per Annex 8 Packet Data Field Info: Service Type: 18 Service Subtype: 144 Application/Source Data:  <del>OBCP ID Checksum N OBCP Param ID</del> <del>Value</del> <del>enum enum uint enum (deduced)</del> <del>4 bytes 2 bytes 2 bytes 4 bytes</del> <del>variable</del> <del>_____ &lt; Repeated N times _____</del> <del>&gt;</del>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3950 section 5.19.1	Object Text	Inf	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 18 Service Subtype: 5 Application/Source Data:  <del>OBCP ID    Step ID</del> <del>enum-enum-</del> <del>4 bytes    2 bytes</del> <del>(optional)</del>	
PUS-3951 section 5.19.2	Object Text	Inf	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 18 Service Subtype: 6 Application/Source Data:  <del>OBCP ID</del> <del>enum-</del> <del>4 bytes</del> <del>_____</del>	
PUS-3952 section 5.19.3	Object Text	Inf	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 18 Service Subtype: 7 Application/Source Data:  <del>OBCP ID    N    OBCP Param ID    Value</del> <del>enum uint    enum (deduced)</del> <del>4 bytes    2 bytes    4 bytes    variable</del> <del>_____ &lt;----- Repeated N times -----&gt;</del> <del>-----&gt;</del>	

Identifier	Attribute	OT	New Text	Old Text
PUS-3954 section 5.19.5	Object Text	Inf	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: as per Annex 8 Packet Data Field Info: Service Type: 18 Service Subtype: 9 Application/Source Data:  <del>             N OBCP ID Checksum State Instruction              Pointer Step ID              uint enum uint enum uint uint              2 byte 4 bytes 2 bytes 1 bytes 2 bytes              2 bytes              ← Repeated N times →           </del>	
PUS-4653 section 14.2	Object Text	Inf	Figure 14.2-1: Event ID allocation	<del>TBC</del>
PUS-4654 section 14.1	Object Text	Inf	Figure 14.1-1: Allocation of Standard Failure ID	<del>TBC</del>
PUS-4786 section 14.3	Object Text	TC	___ 10000 to 19999	
PUS-4790 section 14.3	Object Text	TC	___ 20000 to 29999	
PUS-4804 section 14.3	Object Text	TC	___ 30000 to 39999	
PUS-4808 section 14.3	Object Text	TC	___ 40000 to 40999	
PUS-4812 section 14.3	Object Text	TC	___ 41000 to 41999	

Identifier	Attribute	OT	New Text	Old Text
PUS-4816 section 14.3	Object Text	TC	__42000 to 42999	
PUS-4820 section 14.3	Object Text	TC	__43000 to 43999	
PUS-4824 section 14.3	Object Text	TC	__44000 to 44999	
PUS-4828 section 14.3	Object Text	TC	__45000 to 45999	
PUS-4832 section 14.3	Object Text	TC	__46000 to 46999	
PUS-4836 section 14.3	Object Text	TC	__47000 to 47999	
PUS-4840 section 14.3	Object Text	TC	__48000 to 48999	
PUS-4844 section 14.3	Object Text	TC	__49000 to 49999	
PUS-4848 section 14.3	Object Text	TC	__50000 to 59999	
PUS-4860 section 14.3	Object Text	TC	10000 to 39999 (TBC)	
PUS-4862 section 14.3	Object Text	TC	<del>Allocation between various CSW applications is TBC</del>	

Identifier	Attribute	OT	New Text	Old Text
PUS-4864 section 14.3	Object Text	TC	<u>  </u> 60000 to 63999	
PUS-4868 section 14.3	Object Text	TC	<u>  </u> 64000 to 64999	
PUS-5187 section 14.3	Object Text	Inf	Table 14.3-1: Specific Failure and Event ID allocation across APID— <del>TBC</del>	
PUS-5287 section 5.7.3	Object Text	TC	Identification of the <del>destination</del> <u>dumped</u> memory <u>area</u>	
PUS-5295 section 5.7.3	Object Text	TC	Length of the <del>data to be</del> <u>dumped loaded</u> data (in single addressable unit with count starting from zero). This information allows in particular to define the end of the block.	
PUS-5302 section 5.7.3	Object Text	TC	Data block <del>to be</del> dumped	

Identifier	Attribute	OT	New Text	Old Text
PUS-5304 section 5.7.3	Object Text	Inf	<p>Remarks:</p> <p>Each of these TM packets will be self-contained, i.e. Start Address and Length of dump are consistent with the dumped data presented in the TM dump packet.</p> <p>The 'Data' field shall contain data referring to memory addresses which are contiguous i.e. increasing without gaps (e.g. page boundaries shall be taken into account such that several dump packets are generated if the dump request goes across them).</p> <p>If the requested length of the dump by TC(6,5) is longer than the maximum length of a packet, the dump will be split into as many TM(6,6) packets as necessary to downlink the full length as requested by service TC(6,5). In this case the first, last and continued Dump packets shall be identified using the Segmentation/Grouping Flags within the Source Packet Header.</p> <p>There are no constraints imposed on how to break-down the dump area into TM dump packets.</p> <p>The Destination ID of memory dumps shall always be set to Ground.</p> <p><del>In cases where the data to be dumped is not an even number of octets/bytes it is possible to add a padding octet/byte as last octet of the data field to get overall an even number of octets.</del></p>	
PUS-5332 section 5.7.4	Object Text	TC	Start Address (in single addressable unit, with count starting from zero) within the memory block for <del>loading</del> <u>checked</u> data	
PUS-5336 section 5.7.4	Object Text	TC	Length of the data to be <del>loaded</del> <u>checked</u> (in single addressable unit with count starting from zero). This information allows in particular to define the end of the block.	
PUS-5372 section 5.7.5	Object Text	TC	Start Address (in single addressable unit, with count starting from zero) within the memory block <del>for</del> <u>of</u> <del>loading</del> <u>checked</u> data	
PUS-5376 section 5.7.5	Object Text	TC	Length of the <del>data to be</del> <u>checked</u> <del>loaded</del> <u>data</u> (in single addressable unit with count starting from zero). This information allows in particular to define the end of the block.	

Identifier	Attribute	OT	New Text	Old Text
PUS-5471 section 5.7.10	Object Text	TC	Mask to be applied in the <del>foolowing</del> following way: { <del>Start Existing Address data content</del> in memory (defined by <u>start address</u> ) AND <u>INVerse</u> Mask} OR { <u>Loaded</u> Data <u>AND</u> <u>mask</u> }	
PUS-5472 section 5.7.10	Object Text	TC	<u>Loaded Data: Bits to be modified: set to required value</u>  <u>Mask: Bits to be modified: set to 1</u> <u>Bits NOT to be modified: set to 0</u>	
PUS-5475 section 1.2	Object Text	Inf	This document has been generated from an export of the PUS module in DOORS. <del>The export was taken from baseline 3 on 11/06/2012.</del>	
PUS-5753 section 5.29	Object Text	Inf	Notes The on-board parameters definition is defined in SRDB and is frozen for a given CSW release. It is nevertheless possible to define new parameters via TC( <del>140</del> <u>139</u> ,4).	
PUS-5834 section 5.4.1	Object Text	TC	1... <del>TBD</del> <u>65535</u> cycle identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)	
PUS-5876 section 5.4.2	Object Text	TC	1... <del>TBD</del> <u>65535</u> cycle identifies the maximum scheduling rate of one application (e.g. if application scheduling is done with 10 Hz and 1 sec HK data provision is wanted then the value needs to be set to 10)	
PUS-6082 section 5.4.19	Object Heading	Hd	TM(3,134) HK/Diag Parameter Report Definitions Report in Summary Form	TM(3,129) HK/Diag Parameter Report Definitions Report in Summary Form
PUS-6083 section 5.4.19	Object Text	Inf	Description: TM(3, <del>129</del> <u>134</u> ) is the response to TC(3,128)	
PUS-6084 section 5.4.19	Object Text	Inf	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: as per Annex 8 Packet Data Field Info: Service Type: 3 Service Subtype: <del>129</del> <u>134</u> Application/Source Data:	



Identifier	Attribute	OT	New Text	Old Text
PUS-6209 section 5.12.1	Object Text	TC	<p>N1=0, the <del>command will effect the whole schedule</del> <u>MTL controls</u> <del>is bit enabled</del></p> <p>N1&gt;0, N2=0 <del>the command will effect the</del> <u>sub-schedule level controlling attribute</u> <del>schedules of are the enabled,</del> <u>telecommands according with to</u> the specified sub-schedule ID</p> <p>N1=1, N2&gt;0 and SubScheduled=0 <del>the application process level controlling, attribute</del> <u>PIDs of are the enabled,</u> <del>telecommands according with to</del> the specified <del>destination application processes will be affected</del> <u>PID.</u></p> <p>Note that the PID status and SubSchedule statuses are completely independent from each other. This means in particular that when a given PID is disabled, no TC of this PID will be released at all, whatever the subschedule</p>	
PUS-6215 section 5.12.1	Object Text	TC	<p>By convention, the value 0 for Sub-schedule ID shall mean "all sub-schedules".</p> <p>0..<del>TBC</del> <u>255</u></p>	
PUS-6220 section 5.12.1	Object Text	TC	<p>Number of <del>PID combinations</del> <u>PIDs</u> which follow</p>	
PUS-6284 section 5.12.4	Object Text	TC	<p>1..<del>TBD</del> <u>255</u></p>	
PUS-6296 section 5.12.4	Object Text	TC	<p><u>Max size 228 octets</u></p>	
PUS-6344 section 5.12.5	Object Text	TC	<p>Number of <del>TC's</del> <u>TCs</u></p>	
PUS-6345 section 5.12.5	Object Text	TC	<p>Number of successive <del>TC's</del> <u>TCs</u> to be deleted. <u>Note that successive TCs are determined by time tag (and not SSC).</u></p>	
PUS-6346 section 5.12.5	Object Text	TC	<p>All <del>TC's</del> <u>TCs</u> with given PID between Sequence Count and Sequence Count + Number of TC' s - 1 shall be deleted.</p>	

Identifier	Attribute	OT	New Text	Old Text
PUS-6409 section 5.12.6	Object Text	TC	<p>N1 = 0, the command will effect the <del>TC's</del><u>TCs</u> of any PID in all sub-schedules</p> <p>N 1&gt; 0, N 2= 0 the command will effect the <del>TC's</del><u>TCs</u> of any PID in the identified subschedule</p> <p>N1=1, N2&gt;0 and SubScheduled=0 the command affect the <del>TC's</del><u>TCs</u> of the selected <del>PID's</del><u>PIDs</u> in all sub-schedules.</p>	
PUS-6413 section 5.12.6	Object Text	TC	<p>By convention, the value 0 for Sub-schedule ID means "all sub-schedules".</p> <p>1 ... <del>31</del><u>255</u></p>	
PUS-7064 section 5.13.5	Object Text	TC	<p>By convention, if the validity ParameterID is 0, the corresponding parameter <u>monitoring</u> is always valid (i.e. it shall always be checked).</p> <p><u>Note that the validity parameter can have values true (1), indicating the monitoring is valid, and false (0) indicating invalid.</u></p>	
PUS-7071 section 5.13.5	Object Text	TC	<p>Repetition Interval;</p> <p>The number of successive samples of the <del>parameters</del><u>parameter required</u> to establish a new checking status for an expected-value-check or a limit-check (<u>i.e. the number of samples before a parameter is declared as out of limit/unexpected value, or as having returned within limit/expected value</u>)</p>	
PUS-7084 section 5.13.5	Object Text	TC	<p>Limit value, right aligned if not the complete field length is required (<u>pad with zeroes to the left</u>)</p>	
PUS-7092 section 5.13.5	Object Text	TC	<p>Limit value, right aligned if not the complete field length is required (<u>pad with zeroes to the left</u>).</p>	
PUS-7172 section 5.13.7	Object Text	TC	<p>Limit value, right aligned if not the complete field length is required (<u>pad with zeroes to the left</u>).</p>	
PUS-7180 section 5.13.7	Object Text	TC	<p>Limit value, right aligned if not the complete field length is required (<u>pad with zeroes to the left</u>).</p>	

Identifier	Attribute	OT	New Text	Old Text
PUS-7196 section 5.13.7	Object Text	TC	Limit value, right aligned if not the complete field length is required <a href="#">(pad with zeroes to the left)</a> .	
PUS-7199 section 5.13.7	Object Text	TC	Event ID associated with the <del>low</del> <a href="#">expected</a> <del>limit</del> <a href="#">value</a> of the monitoring description	
PUS-7328 section 5.13.9	Object Text	TC	By convention, if the validity ParameterID is 0, the corresponding parameter is always valid (i.e. it shall always be checked).  <a href="#">Note that the validity parameter can have values true (1), indicating the monitoring is valid, and false (0) indicating invalid.</a>	
PUS-7348 section 5.13.9	Object Text	TC	Limit value, right aligned if not the complete field length is required <a href="#">(pad with zeroes to the left)</a> .	
PUS-7356 section 5.13.9	Object Text	TC	Limit value, right aligned if not the complete field length is required <a href="#">(pad with zeroes to the left)</a> .	
PUS-7372 section 5.13.9	Object Text	TC	Limit value, right aligned if not the complete field length is required <a href="#">(pad with zeroes to the left)</a> .	
PUS-7410 section 5.13.11	Object Text	TC	<del>&lt;repeat N times-&gt;</del> <a href="#">-----</a>	
PUS-7411 section 5.13.11	Object Text	TC	<del>&lt;repeat N times-&gt;</del> <a href="#">-----</a>	
PUS-7412 section 5.13.11	Object Text	TC	<del>&lt;repeat N times-&gt;</del> <a href="#">-----</a>	
PUS-7413 section 5.13.11	Object Text	TC	<del>&lt;repeat</del> <a href="#">Repeat</a> N times-> <a href="#">----</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-7414 section 5.13.11	Object Text	TC	<repeat N times> <u>-----</u>	
PUS-7415 section 5.13.11	Object Text	TC	<repeat N times> <u>-----</u>	
PUS-7416 section 5.13.11	Object Text	TC	<repeat N times <u>-----</u> >	
PUS-7446 section 5.13.11	Object Text	TC	Copy of the relevant entry of the monitoring definition. <u>Note value is right aligned if not all bytes are used (pad with zeroes to the left).</u>	
PUS-7647 section 5.20.1	Object Text	TC	<del>Enumerated</del> <u>Uns. Int.</u>	
PUS-7679 section 5.20.2	Object Text	TC	<del>Enumerated</del> <u>Uns. Int</u>	
PUS-7707 section 5.20.4	Object Text	TC	<del>Enumerated</del> <u>Uns. Int</u>	
PUS-7747 section 5.20.7	Object Text	TC	<del>Enumerated</del> <u>Uns. Int.</u>	
PUS-8608 section 5.3.1	Object Text	TC	see <del>relevant unit documentation</del> <u>RD10</u>	
PUS-8674 section 5.14.17	Object Text	Inf	Structure: Packet ID Info: Process ID: <u>as per Annex 8</u> Packet Cat: <u>as per Annex 8</u> Packet Data Field Info: Service Type: <u>13</u> Service Subtype: <u>137</u> Application/Source Data: <u>See RD9</u>	

Identifier	Attribute	OT	New Text	Old Text
PUS-8675 section 5.14.17	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-8678 section 5.14.31	Object Text	Inf	Structure: Packet ID Info: Process ID: <a href="#">as per Annex 8</a> Packet Cat: <a href="#">as per Annex 8</a> Packet Data Field Info: Service Type: <a href="#">13</a> Service Subtype: <a href="#">151</a> Application/Source Data: <a href="#">see RD9</a>	
PUS-8679 section 5.14.31	Object Text	Inf	Parameter definition <a href="#">See RD9</a>	
PUS-8689 section 5.32	Object Text	Inf	Objective The on-board Functional Monitoring service provides the capability to monitor an on-board function (e.g. SW applications or HW units) by managing an association of individual service 12 parameter monitoring, which altogether represent the current health status of the function.  Note that a service 142 is implemented in the SSMM SW to manage redundancy (see <del>RD6</del> <a href="#">RD9</a> ).	

Identifier	Attribute	OT	New Text	Old Text
PUS-8690 section 5.32	Object Text	Inf	<p>Description</p> <p>This service is used for FDIR. It provides additional functionality to service 12 in that it allows to group service 12 monitors together and define monitoring with AND / OR logic.</p> <p>The service allows to:</p> <ul style="list-style-type: none"> <li>add/delete service 12 monitors to an Functional Monitor (FMON)</li> <li>enable/disable an FMON</li> <li>report all FMON entries in the FMON list</li> <li>report individual states of the FMON entries</li> <li>protect/unprotect the FMON definition wrt any modification or deletion</li> </ul> <p>The user can also enable/disable the Functional Monitoring at service level.</p> <p>The on-board Functional Monitoring service follows the following rules:</p> <ul style="list-style-type: none"> <li>if FMON becomes "Disabled" then the new FMON state becomes "Unchecked" immediately</li> <li>if FMON becomes "Enabled" and if current FMON state is "Unchecked" then the new FMON states becomes "Running" immediately</li> <li>if the FMON validity condition becomes FALSE (e.g. invoked via connected service 12 Monitoring ID) then prior to any other action the "Running" FMON is immediately set to "Invalid"</li> <li>if the FMON validity condition becomes TRUE (e.g. invoked via connected service 12 Monitoring ID) then prior to any other action the "Invalid" FMON is immediately set to "Running"</li> </ul> <p><u>After an FMON has triggered, it remains enabled but in a failed state, and therefore is "Unchecked". Note that this state can only be left by disabling and then enabling the FMON.</u></p> <p>Any service 12 Monitoring ID transition when FMON is in an other state than "Running" is ignored by FMON. Hence there is no report generation in that case. Furthermore, evolution of FMON current state will not impact states of service 12 Monitoring ID to which it is connected.</p> <p>The following state diagram illustrates transitions of the FMON state.</p> <p>By default, when the FMON is added to the Functional Monitoring list, its initial setup will be: FMON status disabled:</p>	

Identifier	Attribute	OT	New Text	Old Text
PUS-8691 section 5.32	Object Text	Inf	<p>Notes</p> <p>When one of the functional monitoring triggers, an event with the event ID defined in the monitoring entry can generated. The parameters associated to that monitoring have the following structure:</p> <p><del>Parameter — Description — Range or value —</del>  <del>FMON_ID — (Functional) Monitoring Identifier — Unsigned integer on 4 bytes</del>  <del>1..255</del>  <del>FMON_TIMEOUT — The FMON timeout value — Unsigned integer on 2 bytes</del>  <del>0..65535 (expressed in SW cycles) —</del>  <del>FMON_LOGIC_TYPE — The FMON combinaison type</del>  <del>— Enumerated on 1 byte</del>  <del>0x00 = OR</del>  <del>0x01 = AND</del>  <del>—</del>  <del>PMON_ID — PMON ID of one of the PMON that caused the FMON triggering</del>  <del>If Logic Type is</del>  <del>- OR : ID of the first triggered monitoring</del>  <del>- AND : ID of the last triggered monitoring — Unsigned integer on 4 bytes</del>  <del>1..255</del>  <del>PMON_CHECK_STATE — The PMON check state value which caused the FMON triggering — Enumerated on 1 byte</del>  <del>0x00 = VALID</del>  <del>0x01 = UNCHECKED</del>  <del>0x02 = INVALID</del>  <del>0x04 = UNEXP_OR_BELOW</del>  <del>0x05 = ABOVE_HIGH —</del>  <del>TRANSITION_TIME — The time of the monitoring triggering. — CUG format (6 bytes):</del>  <del>- the first 4 bytes give the number of seconds (coarse part of the time)</del>  <del>- the 2 next bytes give the number of subseconds (fine part of the time) —</del></p>	
PUS-8751 section 5.3.2	Object Text	T C	<p>0 = <del>external avionics</del><a href="#">Bus (TBC)</a><u>1</u></p> <p>1 = <del>external platform</del><a href="#">Bus (TBC)</a><u>2</u></p>	

Identifier	Attribute	OT	New Text	Old Text
PUS-8754 section 5.3.2	Object Text	TC	Selected BusCoupler for the addressed Bus	(TBC)
PUS-8779 section 5.3.2	Object Text	TC	0, if mode code 1..30 = number of <u>16 bit</u> words 31, Data Word Count = 0	
PUS-8794 section 5.3.3	Object Text	TC	0 = <del>external avionics</del> Bus (TBC) <u>1</u> 1 = <del>external platform</del> Bus (TBC) <u>2</u>	
PUS-8801 section 5.3.3	Object Text	TC	Selected BusCoupler for the addressed Bus	(TBC)
PUS-8861 section 5.3.4	Object Text	TC	Raw content of the <u>SpW packet containing the</u> command	
PUS-8862 section 5.3.4	Object Text	TC	<u>SpW packet containing PUS command plus 4 byte SpW header, as defined in [AD4].</u>	
PUS-9114 section 5.10.5	Object Text	TC	Period of time in <del>second</del> <u>period</u> <del>during of time in secs with</del> which the time <del>synchronisation</del> <u>update</u> is sent to <del>the</del> <u>User</u>	
PUS-9115 section 5.10.5	Object Text	TC	0 = one- <del>hotshot</del> time update 1 .. 255 = time in seconds	
PUS-9155 section 5.12.7	Object Text	TC	Number of successive TC to be time shifted  <del>all TC Note between that Sequence successive Counter TCs and will (Sequence be Counter determined +by Number time of tag TC (and -not 1SSC) will be time shifted.</del>	
PUS-9206 section 5.12.9	Object Text	TC	Number of <del>TC</del> <u>process IDs</u> to be reported	



Identifier	Attribute	OT	New Text	Old Text
PUS-9218 section 5.12.9	Object Text	TC	Number of successive TC to be reported. <a href="#">Note that successive TCs are determined by time tag (and not SSC).</a>	
PUS-9266 section 5.12.12	Object Text	TC	Number of <del>TC</del> CPIDs to be reported	
PUS-9278 section 5.12.12	Object Text	TC	Number of successive TC to be reported <a href="#">Note that successive TCs will be determined by time tag (and not SSC).</a>	
PUS-9414 section 5.13.12	Object Text	TC	<a href="#">Note value is right aligned if not all bytes are used (pad with zeroes to the left).</a>	
PUS-9483 section 5.14.3	Object Text	Inf	Notes The TC(13,11) SDU length will not be the same as the TC(13,9) or TC(13,10) SDU length. It will depend on the size of the File Transfer data. The File Checksum can be broken down into another TC(13,11) packet if the SDU data and File checksum do not fit in the last data packet.  If the File attribute is "TC SEQUENCE - IMMEDIATE", the file is executed as a TC sequence once the TC(13,11) has been successfully completed. In this case the <del>"TC Sequence CSW Identifier"</del> will used create for a execution TC (see 134.1 service with 134 "TC description") Sequence is Identifier" fixed set by default to 1 (TBC), and the default with TC execution rate is of 1 Hz (TBC).	
PUS-9777 section 5.15.11	OLE	Inf	Figure/Table modified	
PUS-9802 section 5.15.12	OLE	Inf	Figure/Table modified	
PUS-9872 section 5.15.16	OLE	Inf	Figure/Table modified	

Identifier	Attribute	OT	New Text	Old Text
PUS-9974 section 5.16.7.1	Object Text	TC	<a href="#">Coarse time (in seconds) with sub-second field set to 0;</a> n/a if timespan = 0	
PUS-9978 section 5.16.7.1	Object Text	TC	<a href="#">Coarse time (in seconds) with sub-second field set to 0;</a> only used if timespan = 1	
PUS-10172 section 5.20.8	Object Text	TC	<del>Enumerated</del> <a href="#">Uns. Int.</a>	
PUS-10204 section 5.20.9	Object Text	TC	<del>Enumerated</del> <a href="#">Uns. Int.</a>	
PUS-10307 section 5.29.4	Object Text	Inf	<p>Description: This telecommand defines new onboard Parameters, or replaces existing ones. This definition maps a predefined "spare" Parameter ID to a physical PM-RAM memory location which corresponds to a data of the CSW. Once the new parameter is mapped via TC <del>440</del><a href="#">139</a>,4, the Parameter ID can be used in other services (e.g. HK reporting)</p>	
PUS-10308 section 5.29.4	Object Text	Inf	<p>Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 139 Service Subtype: 4 Application/Source Data:</p>	
PUS-10308 section 5.29.4	OLE	Inf	Figure/Table deleted	
PUS-10345 section 5.32.3	OLE	Inf	Figure/Table modified	
PUS-10357 section 5.32.6	OLE	Inf	Figure/Table modified	

Identifier	Attribute	OT	New Text	Old Text
PUS-10365 section 5.32.8	OLE	Inf	Figure/Table modified	
PUS-10381 section 5.32.1	Object Text	TC	<del>Enum</del> <u>Uns Int</u>	
PUS-10407 section 5.32.2	Object Text	TC	<del>Enum</del> <u>Uns Int</u>	
PUS-10439 section 5.32.3	Object Text	TC	0 = always valid  <u>Note that the validity parameter can have values true (1), indicating the monitoring is valid, and false (0) indicating invalid.</u>	
PUS-10470 section 5.32.4	Object Text	TC	<del>Enumerated</del> <u>Unsigned Integer</u>	
PUS-10570 section 5.32.9	Object Text	TC	<del>Enumerated</del> <u>Unsigned Integer</u>	
PUS-10596 section 5.32.10	Object Text	TC	<del>Enumerated</del> <u>Unsigned Integer</u>	
PUS-10806 section 5.6.9	Object Text	TC	Number of times the event EID has occurred since the last time the CEL was <del>reset</del> <u>cleared</u>	
PUS-11017 section 5.28.1	Object Text	TC	0.1 to 16 Hz. <u>Note that this reflects the available range of the TC sequencer function, the selected rate must be compatible with the processing capability of the receiving function(s).</u>	
PUS-11084 section 5.28.4	Object Text	TC	0.1 to 16 Hz. <u>Note that this reflects the available range of the TC sequencer function, the selected rate must be compatible with the processing capability of the receiving function(s).</u>	

Identifier	Attribute	OT	New Text	Old Text
PUS-11091 section 5.27.3	Object Text	Inf	Description: This TC 133,8 allows to modify some attributes of a given File. <del>The response is provided in TM 133,10</del>	
PUS-11306 section 5.27.1	Object Text	Inf	Description: This TC 133,6 allows copying an existing File into a new File of the same partition, <u>or copying an existing file to a new location in a different partition.</u>	
PUS-11311 section 5.27.1	Object Text	TC	<u>Source</u> Partition ID	
PUS-11312 section 5.27.1	Object Text	TC	<del>File</del> <u>Destination</u> <del>4</del> <u>Partition</u> ID	
PUS-11313 section 5.27.1	Object Text	TC	<del>File</del> <u>Source</u> <del>2</del> <u>File</u> ID	
PUS-11320 section 5.27.1	Object Text	TC	<del>4</del> <u>1</u> bytes	
PUS-11328 section 5.27.1	Object Text	TC	<u>Source</u> Partition ID	
PUS-11329 section 5.27.1	Object Text	TC	Storage Partition <u>of source file</u>	
PUS-11332 section 5.27.1	Object Text	TC	<del>File</del> <u>Destination</u> <del>4</del> <u>partiton</u> ID	
PUS-11333 section 5.27.1	Object Text	TC	<del>Source</del> <u>Destination</u> <del>File</del> <u>storage</u> <del>Name</del> <u>partition of file</u>	
PUS-11336 section 5.27.1	Object Text	TC	<del>File</del> <u>Source</u> <del>2</del> <u>File</u> ID	

Identifier	Attribute	OT	New Text	Old Text
PUS-11337 section 5.27.1	Object Text	TC	<del>Destination</del> <u>Source Filefile Name</u> <del>name</del>	
PUS-11339 section 5.27.1	Object Text	Inf	<p>Note:</p> <p><del>Both</del><u>The files following have</u><del>parameter to</del><u>combinations</u> <del>have</del><u>are the</u><del>accepted:</del></p> <p>1) <u>DESTINATION FILE ID=SOURCE FILE ID,</u> <del>same</del><u>SOURCE PART ID&lt;&gt;DESTINATION PART ID</u></p> <p>2) <u>DESTINATION FILE ID&lt;&gt;SOURCE FILE ID,</u> <del>size</del><u>SOURCE PART ID=DESTINATION PART ID</u> <del>and</del></p> <p>3) <u>DESTINATION FILE ID&lt;&gt;SOURCE FILE ID,</u> <del>attribute</del><u>SOURCE PART ID&lt;&gt;DESTINATION PART ID</u></p> <p><del>The (i.e.</del><u>following Type</u><del>parameter and</del><u>combinations</u> <del>Protection</del><u>are accepted:</u></p> <p>1)- <u>DESTINATION FILE ID=SOURCE FILE ID,</u> <u>SOURCE PART ID=DESTINATION PART ID</u></p>	
PUS-11372 section 5.13.5	Object Text	TC	Limit value, right aligned if not the complete field length is required ( <u>pad with zeroes to the left</u> ).	
PUS-11375 section 5.13.5	Object Text	TC	Event ID associated with the <u>expected value of the</u> monitoring description	
PUS-11377 section 2.2	Object Text	Inf	RD4 SOL.S.ASTR.TN.00011 Mission Operations Concept Document, <del>issue 7</del>	
PUS-11479 section 5.4.20	Object Text	TC	Structure ID of HK/ <u>Diag</u> Report Definition	
PUS-11777 section 5.4.1	Object Text	Inf	Note: The Structure ID must be unique across the HK and Diagnostic packet definitions ( <u>for any given Process ID</u> ).	
PUS-11778 section 5.4.2	Object Text	Inf	Note: The Structure ID must be unique across the HK and Diagnostic packet definitions ( <u>for any given process ID</u> ).	

Identifier	Attribute	OT	New Text	Old Text
PUS-12016 section 5.3.4	Object Text	TC	<del>TBC</del> <a href="#">Number of bytes of SpW command data</a>	
PUS-12189 section 5.4.16	Object Text	TC	Collection Interval in number of cycles cycle identifies the maximum scheduling rate of the SSMM application, i.e. 8Hz ( <del>TBC</del> )	
PUS-12190 section 5.4.16	Object Text	TC	8..65535 LSB = 8 Hz Minimum allowed interval: 1s, <a href="#">allowed intervals in 1s increments.</a>	
PUS-12195 section 5.4.16	Object Text	Inf	Notes: The default collection interval at power On of the SSMM is 16s. ( <del>TBC</del> )	
PUS-12352 section 5.16.8.2	Object Text	TC	<del>4</del> <a href="#">5</a> bits	
PUS-12356 section 5.16.8.2	Object Text	TC	<del>12</del> <a href="#">11</a> bits	
PUS-12375 section 5.4.13	Object Text	Inf	Note In SSMM TM(3,25) packets, the first parameter (1byte) after the SID is indicating the current SSMM mode among INIT, OPERA,SERVICE,TEST (see <del>RD6RD9</del> ).	
PUS-12412 section 5.16.6	Object Text	TC	<del>4</del> <a href="#">5</a> bits	
PUS-12413 section 5.16.6	Object Text	TC	<del>12</del> <a href="#">11</a> bits	
PUS-12563 section 5.16.11	Object Text	TC	0 = VC <del>2</del> ( <del>TBC</del> ) <a href="#">3</a> 1 = VC <del>3</del> ( <del>TBC</del> ) <a href="#">2</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-12651 section 5.16.7.2	Object Text	TC	not used if VC Flag is 0 0: VC <del>2 (TBC)</del> <u>3</u> 1: VC <del>3 (TBC)</del> <u>2</u>	
PUS-12758 section 5.16.13.2	Object Text	TC	0 = VC <del>2 (TBC)</del> <u>3</u> 1 = VC <del>3 (TBC)</del> <u>2</u>	
PUS-12791 section 5.16.31	Object Heading	HD	TC (15,147) Remove SID from Storage Selection Definition	TC (15,141) Remove SID from Storage Selection Definition
PUS-12793 section 5.16.32	Object Heading	HD	TM (15,148) SID Storage Selection Definition Report	TM (15,143) SID Storage Selection Definition Report
PUS-12801 section 5.31	Object Text	Inf	Objective This service 141 is implemented in the SSMM SW only for direct commanding (see <del>RD6</del> <u>RD9</u> ).	
PUS-12803 section 5.33	Object Text	Inf	Objective This service 143 is implemented in the SSMM SW only for memory array management (see <del>RD6</del> <u>RD9</u> ).	
PUS-12806 section 5.34	Object Text	Inf	Objective This service 144 is implemented in the SSMM SW only for reboot functionality (see <del>RD6</del> <u>RD9</u> ).	
PUS-12807 section 5.35	Object Text	Inf	Objective This service 145 is implemented in the SSMM SW only for BIT report management (see <del>RD6</del> <u>RD9</u> ).	
PUS-12877 section 5.16.34	Object Text	TC	Size of buffer, in <del>massSAUs, memory as</del> <u>HWa Allocation multiple Units of 128KiB (min size 1 MiB)</u> . This parameter is checked so that the end address is within the memory limit.	
PUS-12974 section 5.16.37	Object Text	TC	N = 1..... <del>20 (TBC) (mission specific)</del> <u>10</u>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13058 section 2.2	Object Text	Inf	RD7 P-SOLO-ICD-10131-RSE Solar Orbiter OBC Hardware Software Interface,	<del>Issue 4</del>
PUS-13079 section 5.21.3	Object Text	Inf	Remarks: <ul style="list-style-type: none"> <li>The content of the platform data field will be determined based on requirements from the payload users. This field has a length of 36 octets. The bit allocation <a href="#">is on-going and</a> must be agreed between PIs and ESA.</li> <li>The data for each payload instrument is provided via a specific TM(3,25) sent to the OBC by the instrument with max source data field size of 20 octets. This data is extracted as one block via the TM extraction service, buffered in the System Data Pool (SPD), and retransmitted in TC(20,128) as described.</li> </ul>	
PUS-13187 section 5.14.13	Object Text		TC Verification A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	
PUS-13223 section 5.16.7.2	Object Text		TC Verification A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	
PUS-13231 section 5.16.14	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 130 Application/Source Data: <del>TBD</del> <a href="#">see RD9</a>	



Identifier	Attribute	O T	New Text	Old Text
PUS-13232 section 5.16.14	Object Text		Parameter definition: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13233 section 5.16.14	Object Text		TC Verification: A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	
PUS-13234 section 5.16.15	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 131 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13235 section 5.16.15	Object Text		Parameter definition: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13236 section 5.16.15	Object Text		TC Verification: A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	
PUS-13237 section 5.16.16	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 132 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13238 section 5.16.16	Object Text		Parameter definition: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13240 section 5.16.17	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 133 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13241 section 5.16.17	Object Text		Parameter definition: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13244 section 5.16.18	Object Text		Parameter definition Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 134 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13246 section 5.16.19	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 135 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13247 section 5.16.19	Object Text		Parameter definition: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13248 section 5.16.19	Object Text		TC Verification: A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13249 section 5.16.20	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 136 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13250 section 5.16.20	Object Text		Parameter definition: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13251 section 5.16.20	Object Text		TC Verification: A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	
PUS-13252 section 5.16.21	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 137 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13253 section 5.16.21	Object Text		Parameter definition: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13254 section 5.16.21	Object Text		TC Verification: A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13255 section 5.16.22	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 138 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13256 section 5.16.22	Object Text		Parameter definition: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13257 section 5.16.22	Object Text		TC Verification: A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	
PUS-13258 section 5.16.23	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 139 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13259 section 5.16.23	Object Text		Parameter definition: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13260 section 5.16.23	Object Text		TC Verification: A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13263 section 5.16.25.1	Object Text		<p>TC Verification</p> <p>A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.</p> <p>A TM(1,8) TC Completion Report Failure shall be generated if:</p> <p>One of the Service 1 consistency checks defined in section 5.2 has failed</p> <p>Error during the elaboration of the requested TM: the requested TM output structure is larger than the current set MTU or the requested TM generation has aborted (e.g. superseded by new request)</p> <p><del>TBD</del></p>	
PUS-13264 section 5.16.24.2	Object Text		<p>Structure:</p> <p>Packet ID Info:</p> <p>Process ID: as per annex 8</p> <p>Packet Cat: 12</p> <p>Packet Data Field Info:</p> <p>Service Type: 15</p> <p>Service Subtype: 140</p> <p>Application/Source Data: <del>TBD</del><a href="#">See RD9</a></p>	
PUS-13265 section 5.16.24.2	Object Text		<p>Parameter definition</p> <p><del>TBD</del><a href="#">See RD9</a></p>	
PUS-13266 section 5.16.24.2	Object Text		<p>TC Verification:</p> <p>A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.</p> <p>A TM(1,8) TC Completion Report Failure shall be generated if:</p> <p>One of the Service 1 consistency checks defined in section 5.2 has failed</p> <p><del>TBD</del></p>	
PUS-13267 section 5.16.25.1	Object Text		<p>Structure:</p> <p>Packet ID Info:</p> <p>Process ID: as per annex 8</p> <p>Packet Cat: 12</p> <p>Packet Data Field Info:</p> <p>Service Type: 15</p> <p>Service Subtype: 141</p> <p>Application/Source Data: <del>TBD</del><a href="#">See RD9</a></p>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13268 section 5.16.25.1	Object Text		Parameter definition <del>TBD</del> <a href="#">See RD9</a>	
PUS-13270 section 5.16.26.2	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 142 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13271 section 5.16.26.2	Object Text		Parameter definition <del>TBD</del> <a href="#">See RD9</a>	
PUS-13272 section 5.16.26.2	Object Text		TC Verification A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	
PUS-13273 section 5.16.27	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 15 Service Subtype: 143 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13274 section 5.16.27	Object Text		Parameter definition <del>TBD</del> <a href="#">See RD9</a>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13275 section 5.16.27	Object Text		TC Verification A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	
PUS-13277 section 5.16.28	Object Text		Structure: Packet ID Info: Process ID: as per annex 8 Packet Cat: as per annex 8 Packet Data Field Info: Service Type: 15 Service Subtype: 144 Application/Source Data: <del>TBD</del> <a href="#">See RD9</a>	
PUS-13278 section 5.16.28	Object Text		Parameter definition <del>TBD</del> <a href="#">See RD9</a>	
PUS-13279 section 5.16.28	Object Text		TC Verification A TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed. A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed <del>TBD</del>	
PUS-13366 section 5.21.1	Object Text	TC	See <del>Table 6</del> <a href="#">Table 7-1</a> in AD04	

Identifier	Attribute	OT	New Text	Old Text
PUS-13387 section 13.2	Object Text	Rq	<p>Source ID:</p> <p>This field indicates the sender of the command and is used together with the Destination ID field in the TM packet for routing purposes on-board.</p> <p>Several source IDs will be reserved for ground and on-board processes:</p> <p style="padding-left: 40px;">Ground sources (set by ground):</p> <p style="padding-left: 80px;">Mission TimeLine: 110 <del>(TBC)</del></p> <p style="padding-left: 80px;">TC Sequences: 111 <del>(TBC)</del></p> <p style="padding-left: 80px;">Recovery Action commands (Service 19 Event Action List): 112 <del>(TBC)</del></p> <p style="padding-left: 80px;">Back-Up Mission TimeLine: 113 <del>(TBC)</del></p> <p style="padding-left: 80px;">Direct commands: 120 <del>(TBC)</del></p> <p style="padding-left: 80px;">Spare Ground source 1: 121 <del>(TBC)</del></p> <p style="padding-left: 80px;">Spare Ground source 2: 122 <del>(TBC)</del></p> <p style="padding-left: 40px;">On-board sources (set by CSW):</p> <p style="padding-left: 80px;">OBCP: 15 <del>(TBC)</del></p> <p style="padding-left: 80px;">System Control: 14 <del>(TBC)</del></p> <p style="padding-left: 80px;">AOCS: 11 <del>(TBC)</del></p>	



Identifier	Attribute	OT	New Text	Old Text
PUS-13390 section 13.3	Object Text	Rq	<del>CAT</del> <del>0</del> <del>TIME 1</del> <del>ACK 2</del> <del>HPTM 3</del> <del>TAB 4</del> <del>HK 5</del> <del>Func Cyc 6</del> <del>Func NCyc 7</del> <del>Event 8</del> <del>Diag 9</del> <del>Dump 10</del> <del>File</del> <del>Trans 11</del> <del>Context 12</del> <del>TC/</del> <del>PrvScn 13</del> <del>Spare 14</del> <del>Rsvd</del> <del>EGSE 15</del> <del>IDLE</del> <del>Service 1 Source ID</del> <del>Service 2 Source ID</del> <del>Service 3 0 0</del> <del>Service 5 0</del> <del>Service 6 0</del> <del>Service 8 0</del> <del>Service 9 Source ID</del> <del>Service 11 0</del> <del>Service 12 0</del> <del>Service 13 0 0 0</del>	

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Identifier	Attribute	OT	New Text	Old Text
PUS-13390 section 13.3	OLE	Rq	Figure/Table inserted	
PUS-13405 section 5.4.9	Object Text	TC	Structure ID of <del>Diagnostic</del> <a href="#">HK Parameter</a> Report Definition	
PUS-13675 section 5.19.8	Object Text	TC	Identifier of the OBCP <del>to be stopped</del>	
PUS-13716 section 5.24.1	Object Text		Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 130 Service Subtype: 1 Application/Source Data:  <del>N</del> <del>Target Param ID</del> <del>TM APID</del> <del>TM SID</del> <del>Offset in TM</del> <del>uint</del> <del>enum</del> <del>enum</del> <del>enum</del> <del>uint</del> <del>1 byte</del> <del>4 bytes</del> <del>2 bytes</del> <del>2 bytes</del> <del>2 bytes</del> <del>-----</del> <del>&lt;-----Repeated N times-----</del> <del>-----&gt;</del>	
PUS-13746 section 5.24.2	Object Text		Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: 12 Packet Data Field Info: Service Type: 130 Service Subtype: 2 Application/Source Data:  <del>N</del> <del>Target Param ID</del> <del>uint</del> <del>enum</del> <del>1 byte</del> <del>4 bytes</del> <del>-----</del> <del>&lt;-----Repeated N times-----&gt;</del>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13782 section 5.24.4	Object Text		Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: as per Annex 8 Packet Data Field Info: Service Type: 130 Service Subtype: 4 Application/Source Data: <del>none</del>  <del>N Target Param ID TM APID TM SID</del> <del>Offset in TM</del> <del>uint enum enum enum uint</del> <del>1 byte 4 bytes 2 bytes 2 bytes 2 bytes</del>  <del>← Repeated N times →</del>	
PUS-13791 section 5.24.4	Object Text	TC	Number of <del>added</del> <u>reported</u> TM extraction Descriptors	
PUS-13792 section 5.24.4	Object Text	TC	<del>1..23</del> <u>to 255</u>	
PUS-13848 section 5.29.1	Object Text	TC	<del>enum</del> <u>Uns Int</u>	
PUS-13852 section 5.29.1	Object Text	TC	<del>41 bytes</del> <u>byte</u>	
PUS-13894 section 17.2	Object Text	TC	<del>JLD. Pellon Bailon</del> <u>Lakey</u> (ESOC)	
PUS-13964 section 5.21.3	Object Text	TC	<del>Platform</del> <u>PF</u> data <u>Comm- andable flags</u>	
PUS-13967 section 5.21.3	Object Text	TC	<del>MAG</del> <u>PF</u> data <u>- RW 2 speed</u>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13968 section 5.21.3	Object Text	TC	<del>METIS</del> <u>PF data - RW 3 speed</u>	
PUS-13969 section 5.21.3	Object Text	TC	<del>PHI</del> <u>PF data - RW 4 data</u>	
PUS-13976 section 5.21.3	Object Text	TC	<del>362</del> octets	
PUS-13979 section 5.21.3	Object Text	TC	<del>204</del> octets	
PUS-13980 section 5.21.3	Object Text	TC	<del>204</del> octets	
PUS-13981 section 5.21.3	Object Text	TC	<del>204</del> octets	
PUS-13993 section 5.21.3	Object Text	TC	Platform Data <u>- commandable flags</u>	
PUS-13994 section 5.21.3	Object Text	TC	<del>Platform data requested</del> <u>Flags for indicating payload platform use operation</u>	
PUS-13995 section 5.21.3	Object Text	TC	<del>Bits Bit 0-15: Quality Thruster flags firing indicating flag on-board (1 disturbances = thruster fire expected within 5s; 0 = no thruster fire)</del> <u>Bit 1: Science data outage flag (1 = interruption to science data storage in SSMM occuring within TBC seconds; 0 = science data storage nominal)</u> <del>Bits 162-28715: TBC</del> <u>Commandable flags, content TBC</u>	
PUS-13997 section 5.21.3	Object Text	TC	<del>EPD</del> <u>Platform Data - AOCS sub-mode</u>	

Identifier	Attribute	OT	New Text	Old Text
PUS-13998 section 5.21.3	Object Text	TC	<del>Data</del> <a href="#">Parameter provided</a> <del>indicating by current</del> <a href="#">EPDAOCS mode</a>	
PUS-13999 section 5.21.3	Object Text	TC	<a href="#">TBC</a>	
PUS-14118 section 5.23.4	Object Text	TC	Instrument <del>ID</del> <a href="#">PID</a>	
PUS-14127 section 5.23.4	Object Text	TC	Instrument <del>ID</del> <a href="#">PID</a>	
PUS-14128 section 5.23.4	Object Text	TC	<del>Address-ID</del> <a href="#">PID</a> of payload user to whom context data is to be restored	
PUS-14129 section 5.23.4	Object Text	TC	See <del>Table</del> <a href="#">Figure 7-13.1-2</a> <del>in</del> <a href="#">of AD04 Annex 8</a>	
PUS-14140 section 5.23.5	Object Text	TC	Instrument <del>ID</del> <a href="#">PID</a>	
PUS-14149 section 5.23.5	Object Text	TC	Instrument <del>ID</del> <a href="#">PID</a>	
PUS-14150 section 5.23.5	Object Text	TC	<del>Address-ID</del> <a href="#">PID</a> of payload user from whom context is requested	
PUS-14151 section 5.23.5	Object Text	TC	See <del>Table</del> <a href="#">Figure 7-13.1-2</a> <del>in</del> <a href="#">of AD04 Annex 8</a>	
PUS-14165 section 5.22.2	Object Text	Inf	<del>TC (21,2) Disable/Stop Science transfer from User to SSMM</del> As defined by the user, see TC(21,1).	

Identifier	Attribute	OT	New Text	Old Text
PUS-14167 section 5.22.7	Object Text	Inf	<del>TC (21,128) Reset output buffer</del> As defined by the user	
PUS-14184 section 13.1	Object Text	Rq	Note that, for the PIs, the following CATs must be respected for those packets routed to the OBC for processing as defined in SOL.S.ASTR.TN.00088. Service 3,25 HK TM packets should have CAT = 4; <u>with the exception of the 3,25 generated for the purposes of inter-instrument communication, which should have CAT = 5</u> <u>Service 1 acknowledgement packets should have CAT =1;</u> Service 5 event TM packets should have CAT = 7; Service 22 context TM packets should have CAT = 11.	
PUS-14187 section 17.2	Object Text	TC	<del>SJ-F. Meik</del> <u>Daloze</u>	

## Inserted Objects

Identifier	Object Type	Text
PUS-14227 section 5.20.1	TBD	Note that, the default status of a newly created event-action entry is disabled.
PUS-14232 section 5.32	TBD	Parameter
PUS-14233 section 5.32	TBD	Description
PUS-14234 section 5.32	TBD	Range or Value
PUS-14236 section 5.32	TBD	FMON_ID

Identifier	Object Type	Text
PUS-14237 section 5.32	TBD	(Functional) Monitoring Identifier
PUS-14238 section 5.32	TBD	Unsigned integer on 4 bytes 1..255
PUS-14240 section 5.32	TBD	FMON_TIMEOUT
PUS-14241 section 5.32	TBD	The FMON timeout value
PUS-14242 section 5.32	TBD	Unsigned integer on 2 bytes 0..65535 (expressed in SW cycles)
PUS-14244 section 5.32	TBD	FMON_LOGIC_TYPE
PUS-14245 section 5.32	TBD	The FMON combination type
PUS-14246 section 5.32	TBD	Enumerated on 1 byte 0x00 = OR 0x01 = AND
PUS-14248 section 5.32	TBD	PMON_ID
PUS-14249 section 5.32	TBD	PMON ID of one of the PMON that caused the FMON triggering If Logic Type is OR : ID of the first triggered monitoring AND : ID of the last triggered monitoring
PUS-14250 section 5.32	TBD	Unsigned integer on 4 bytes 1..255

Identifier	Object Type	Text
PUS-14252 section 5.32	TBD	PMON_CHECK_STATE
PUS-14253 section 5.32	TBD	The PMON check state value which caused the FMON triggering
PUS-14254 section 5.32	TBD	Enumerated on 1 byte 0x00 = VALID 0x01 = UNCHECKED 0x02 = INVALID 0x04 = UNEXP_OR_BELOW 0x05 = ABOVE_HIGH
PUS-14256 section 5.32	TBD	TRANSITION_TIME
PUS-14257 section 5.32	TBD	The time of the monitoring triggering
PUS-14258 section 5.32	TBD	CUC format (6 bytes):· the first 4 bytes give the number of seconds (coarse part of the time)· the 2 next bytes give the number of subseconds (fine part of the time)
PUS-14259 section 5.16.29	TBD	
PUS-14260 section 5.16.29	TBD	Description: Upon reception of TN (15,145) an unbounded downlink is started from the specified packet stores, on the specified vitrual channel. This command applies to the SSMM only.
PUS-14261 section 5.16.29	TBD	Structure:Packet ID Info:Process ID: as per annex 8Packet Cat: as per annex 8Packet Data Field Info:Service Type: 15Service Subtype: 145Application/Source Data: See RD9
PUS-14262 section 5.16.29	TBD	TC VerificationA TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.A TM(1,8) TC Completion Report Failure shall be generated if: One of the Service 1 consistency checks defined in section 5.2 has failed See RD9



Identifier	Object Type	Text
PUS-14263 section 2.2	Information	RD9 SOL.A.TAS.ICD.00001 Solar Orbiter SSMM SW TMTICID
PUS-14266 section 2	Information	The following documents form the applicable and reference documents to this specification. If no issue is quoted for a document the latest issue is deemed to apply.
PUS-14269 section 13.3	TBD	Note 1 - TM (3,25) intended for use with Inter Instrument Communication will have CAT 6, with destination ID = receiving process Note 2 - Time packet TM (9,2) has no data field header, and therefore no destination ID
PUS-14272 section 5.12.4	TBD	Commands to be executed via the MTL must have maximum length 228 octets, which includes the 48 bit packet header, as well as 32 bit data field header and 16 bit error control, therefore leaving 216 octets application data. This limitation ensures that the TC 11,4 which contains the TC packet meets the maximum length constraint for uplink of 248 octets.
PUS-14279 section 5.22.1	TBD	
PUS-14281 section 5.22.2	TBD	
PUS-14282 section 5.22.3	TBD	
PUS-14283 section 5.22.7	TBD	
PUS-14285 section 5.23.2	TBD	
PUS-14286 section 5.23.1	TBD	

Identifier	Object Type	Text
PUS-14287 section 5.23.3	TBD	
PUS-14288 section 5.23.4	TBD	
PUS-14289 section 5.23.5	TBD	
PUS-14290 section 2.2	Information	RD10 SOL.ASTR.TN.00169 OBC Resource Allocations
PUS-14292 section 5.27.1	TBD	Destination File ID
PUS-14293 section 5.27.1	TBD	Destination file name
PUS-14294 section 5.27.1	TBD	
PUS-14295 section 5.27.1	TBD	Destination File ID
PUS-14296 section 5.27.1	TBD	Enum
PUS-14297 section 5.27.1	TBD	4 bytes
PUS-14298 section 5.27.1	TBD	TC VerificationA TM(1,2) TC Acceptance Report Failure shall be generated if one of the Service 1 static checks defined in section 5.2 has failed.A TM(1,8) TC Completion Report Failure shall be generated for the cases identified in [RD8]

Identifier	Object Type	Text
PUS-14299 section 13.2	TBD	Note that on-board generated commands will use one of the three identified source IDs, with mapping of PID to Source ID defined in RD8.
PUS-14300 section 5.22.4	TBD	
PUS-14301 section 5.22.5	TBD	
PUS-14302 section 5.22.6	TBD	
PUS-14303 section 5.22.3	Information	Description This TM contains science data from the user of fixed length, and with a structure ID which can be used to identify up to 256 different variations of TM (21,3) containing different parameter lists, defined by the user. The packet definition including parameter list, per structure ID, should be included in the user TMTCID. Each packet variation must be of the same, fixed, length. Note that, the TM Packet Header and the TM Data Field Header have to be compliant in syntax and functionality to the definitions given in section 4.2.1 and 4.2.2.
PUS-14305 section 5.22.3	Information	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: as per Annex 8 Packet Data Field Info: Service Type: 21 Service Subtype: 3 Application/Source data:
PUS-14308 section 5.22.3	TBD	SSID
PUS-14309 section 5.22.3	TBD	Parameter List
PUS-14312 section 5.22.3	TBD	1 byte

Identifier	Object Type	Text
PUS-14313 section 5.22.3	TBD	Any size, up to max allowed
PUS-14316 section 5.22.3	TBD	Uns Int
PUS-14317 section 5.22.3	TBD	-
PUS-14319 section 5.22.3	TBD	Parameter Definition
PUS-14322 section 5.22.3	TBD	Parameters of source data field
PUS-14323 section 5.22.3	TBD	Description
PUS-14324 section 5.22.3	TBD	Range or Value
PUS-14326 section 5.22.3	TBD	SSID
PUS-14327 section 5.22.3	TBD	Science structure ID identifying the type of 21,3 packet
PUS-14328 section 5.22.3	TBD	0 - 255
PUS-14330 section 5.22.3	TBD	Parameter List

Identifier	Object Type	Text
PUS-14331 section 5.22.3	TBD	Science data parameters, according to User TMTICD
PUS-14332 section 5.22.3	TBD	
PUS-14333 section 5.22.4	Information	Description This TM contains science data from the user of fixed length. The science data contained within the packet is defined by the user and must be of fixed length. The packet definition should be included in the user TMTICD. Note that, the TM Packet Header and the TM Data Field Header have to be compliant in syntax and functionality to the definitions given in section 4.2.1 and 4.2.2.
PUS-14334 section 5.22.4	Information	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: as per Annex 8 Packet Data Field Info: Service Type: 2 Service Subtype: 4 Application/Source data: As defined by user
PUS-14335 section 5.22.5	Information	Description This TM packet structure is intended to represent an 'anonymous data stream' (a series of octets or words, of variable length), as seen by Solar Orbiter Operations. Further (detailed) interpretation of the data stream remains private within the Payload Operator's environment and is therefore not specified here. The science data is encoded into the "Data" field, which is typically of size 1, 2 or 4 octets. The Data field repeats (N times) to accommodate the full data stream (up to the maximum TM packet length). The value of N is variable and is determined by the payload software dynamically when emitting the packet. The SSID allows up to 256 different variations of TM (21,5) for different purposes. The size of each "Data" element is fixed in each SSID but can vary between SSIDs. Note that, the TM Packet Header and the TM Data Field Header have to be compliant in syntax and functionality to the definitions given in section 4.2.1 and 4.2.2. The source data field must be compatible with the TM packet definition in the user's TM/TC ICD.
PUS-14336 section 5.22.5	Information	Structure: Packet ID Info: Process ID: as per Annex 8 Packet Cat: as per Annex 8 Packet Data Field Info: Service Type: 2 Service Subtype: 5 Application/Source data:
PUS-14339 section 5.22.5	TBD	SSID

Identifier	Object Type	Text
PUS-14340 section 5.22.5	TBD	N
PUS-14341 section 5.22.5	TBD	Data
PUS-14343 section 5.22.5	TBD	Uns Int
PUS-14344 section 5.22.5	TBD	Uns Int
PUS-14345 section 5.22.5	TBD	Uns Int or Binary
PUS-14347 section 5.22.5	TBD	1 byte
PUS-14348 section 5.22.5	TBD	2 bytes
PUS-14349 section 5.22.5	TBD	Any size
PUS-14350 section 5.22.5	TBD	Parameter Definition
PUS-14353 section 5.22.5	TBD	Parameters of Source Data field
PUS-14354 section 5.22.5	TBD	Description

Identifier	Object Type	Text
PUS-14355 section 5.22.5	TBD	Range or Value
PUS-14357 section 5.22.5	TBD	SSID
PUS-14358 section 5.22.5	TBD	Science structure ID, identifying the type of 21,5 packet
PUS-14359 section 5.22.5	TBD	0-255
PUS-14361 section 5.22.5	TBD	N
PUS-14362 section 5.22.5	TBD	Number of words or bytes of science data following in data field
PUS-14363 section 5.22.5	TBD	

Identifier	Object Type	Text
PUS-14364 section 5.22.6	Information	<p>Description This TM packet is intended to contain complex, user-defined TM structures of variable length, where both fixed and variable parts are present. The variable part may be an 'anonymous data stream' (a series of octets or words, of variable length), as seen by Solar Orbiter Operations. Further (detailed) interpretation of the variable-length data stream remains private within the Payload Operator's environment and is therefore not specified here. The fixed part of the science data is encoded into the Fixed Parameters blocks (one start and one end). These parts are optional and, if included, consist of a parameter list containing any (fixed) quantity, size and type of parameters, according to the instrument design. The variable-length part is encoded into Repeating Block 1. Two typical scenarios are anticipated: A repeating set of decodable parameters is defined by the user with known size, type and description, allowing interpretation of the data by Ground systems. The set of parameters repeats N1 times. The Repeating Block 1 contains an anonymous data stream of variable-length. The block is defined with only one parameter, called "Data". The Data field is typically of size 1, 2 or 4 octets. It repeats N1 times to accommodate the full data stream (up to the maximum TM packet length). The value of N1 is variable and is determined by the payload software dynamically when emitting the packet. The SSID allows up to 256 different variations of TM (21,6) for different purposes. The SSID is at the same position in all variations of TM (21,6). The size, type, length and structure of all parameter lists following the SSID can vary between SSIDs. Note that, the TM Packet Header and the TM Data Field Header have to be compliant in syntax and functionality to the definitions given in section 4.2.1 and 4.2.2. The source data field must be compatible with the TM packet definition in the user's TM/TC ICD.</p>
PUS-14366 section 5.22.5	TBD	
PUS-14367 section 5.22.5	TBD	
PUS-14368 section 5.22.5	TBD	<-- Repeat N times -->



Identifier	Object Type	Text
PUS-14370 section 5.22.5	TBD	Data
PUS-14371 section 5.22.5	TBD	Science data word or byte, repeated N times, as defined in user TMTICD
PUS-14372 section 5.22.5	TBD	
PUS-14373 section 5.22.6	Information	Structure:Packet ID Info:Process ID: as per Annex 8Packet Cat: as per Annex 8Packet Data Field Info:Service Type: 21Service Subtype: 6Application/Source data:
PUS-14376 section 5.22.6	TBD	SSID
PUS-14377 section 5.22.6	TBD	Fixed Parameters (start)
PUS-14379 section 5.22.6	TBD	Uns Int
PUS-14380 section 5.22.6	TBD	Any
PUS-14382 section 5.22.6	TBD	1 byte
PUS-14383 section 5.22.6	TBD	Any
PUS-14384 section 5.22.6	TBD	Parameter Definition

Identifier	Object Type	Text
PUS-14387 section 5.22.6	TBD	Parameters of source data field
PUS-14388 section 5.22.6	TBD	Description
PUS-14390 section 5.22.6	TBD	SSID
PUS-14391 section 5.22.6	TBD	Science structure ID, identifying the type of 21,6 packet
PUS-14392 section 5.22.6	TBD	Value or Range
PUS-14393 section 5.22.6	TBD	0-255
PUS-14395 section 5.22.6	TBD	Fixed Parameters (start)
PUS-14396 section 5.22.6	TBD	0 or more parameters of science data.
PUS-14397 section 5.22.6	TBD	
PUS-14423 section 5.16.33	Heading	TM (15,149) Storage Routing Definition Table Report
PUS-14424 section 5.16.33	Information	Description: TM 15,149 is the response to TC 15,145 and reports the defined routing table definition in the on-board CSW (i.e. for OBC Mass Memory).

Identifier	Object Type	Text
PUS-14425 section 5.16.33	Information	Structure:Packet ID Info:Process ID: as per annex 8Packet Cat: as per annex 8Packet Data Field Info:Service Type: 15Service Subtype: 149Application/Source Data:
PUS-14426 section 5.16.33	Information	Parameter definition
PUS-14429 section 5.16.33	Information	Parameters
PUS-14430 section 5.16.33	Information	Description
PUS-14431 section 5.16.33	Information	Range or Value
PUS-14433 section 5.16.33	Information	N1
PUS-14434 section 5.16.33	Information	number of Process ID to follow
PUS-14435 section 5.16.33	Information	
PUS-14437 section 5.16.33	Information	PID
PUS-14438 section 5.16.33	Information	Process ID
PUS-14439 section 5.16.33	Information	

Identifier	Object Type	Text
PUS-14441 section 5.16.33	Information	N2/N3
PUS-14442 section 5.16.33	Information	Number of type definition to follow
PUS-14443 section 5.16.33	Information	N2 = 0: neither type nor subtype of packet from the corresponding PID is selected for storage N2 > 0: the specified types of packet from the corresponding PID are selected for storage N3 > 0: for a type of packet, the specified subtypes of this type from the corresponding PID are selected for storage
PUS-14445 section 5.16.33	Information	Type
PUS-14446 section 5.16.33	Information	TM source packet type
PUS-14447 section 5.16.33	Information	
PUS-14449 section 5.16.33	Information	Subtype
PUS-14450 section 5.16.33	Information	TM source packet service subtype for the specified service type
PUS-14451 section 5.16.33	Information	
PUS-14453 section 5.16.33	Information	Store ID

Identifier	Object Type	Text
PUS-14454 section 5.16.33	Information	identifier for the packet store
PUS-14455 section 5.16.33	Information	
PUS-14461 section 5.19.1	TBD	OBCP ID
PUS-14462 section 5.19.1	TBD	Step ID (optional)
PUS-14464 section 5.19.1	TBD	uint
PUS-14465 section 5.19.1	TBD	uint
PUS-14467 section 5.19.1	TBD	4 bytes
PUS-14468 section 5.19.1	TBD	2 bytes
PUS-14471 section 5.19.2	TBD	OBCP ID
PUS-14473 section 5.19.2	TBD	uint
PUS-14475 section 5.19.2	TBD	4 bytes

Identifier	Object Type	Text
PUS-14478 section 5.19.3	TBD	OBCP ID
PUS-14479 section 5.19.3	TBD	N
PUS-14480 section 5.19.3	TBD	OBCP Param ID
PUS-14481 section 5.19.3	TBD	Value
PUS-14483 section 5.19.3	TBD	uint
PUS-14484 section 5.19.3	TBD	uint
PUS-14485 section 5.19.3	TBD	uint
PUS-14486 section 5.19.3	TBD	(deduced)
PUS-14488 section 5.19.3	TBD	4 bytes
PUS-14489 section 5.19.3	TBD	2 bytes
PUS-14490 section 5.19.3	TBD	4 bytes

Identifier	Object Type	Text
PUS-14491 section 5.19.3	TBD	variable
PUS-14493 section 5.19.3	TBD	
PUS-14494 section 5.19.3	TBD	
PUS-14495 section 5.19.3	TBD	<--Repeated N times
PUS-14496 section 5.19.3	TBD	----->
PUS-14499 section 5.19.5	TBD	N
PUS-14500 section 5.19.5	TBD	OBCP ID
PUS-14501 section 5.19.5	TBD	Checksum
PUS-14502 section 5.19.5	TBD	State
PUS-14503 section 5.19.5	TBD	Instruction pointer
PUS-14504 section 5.19.5	TBD	Step ID

Identifier	Object Type	Text
PUS-14506 section 5.19.5	TBD	uint
PUS-14507 section 5.19.5	TBD	uint
PUS-14508 section 5.19.5	TBD	uint
PUS-14509 section 5.19.5	TBD	enum
PUS-14510 section 5.19.5	TBD	uint
PUS-14511 section 5.19.5	TBD	uint
PUS-14513 section 5.19.5	TBD	2 byte
PUS-14514 section 5.19.5	TBD	4 byte
PUS-14515 section 5.19.5	TBD	2 bytes
PUS-14516 section 5.19.5	TBD	1 byte
PUS-14517 section 5.19.5	TBD	2 bytes



Identifier	Object Type	Text
PUS-14518 section 5.19.5	TBD	2 bytes
PUS-14520 section 5.19.5	TBD	
PUS-14521 section 5.19.5	TBD	<-----
PUS-14522 section 5.19.5	TBD	Repeated N
PUS-14523 section 5.19.5	TBD	times-----
PUS-14524 section 5.19.5	TBD	-----
PUS-14525 section 5.19.5	TBD	----->
PUS-14528 section 5.19.6	TBD	OBCP ID
PUS-14529 section 5.19.6	TBD	Emer-gency
PUS-14530 section 5.19.6	TBD	Auto-delete
PUS-14531 section 5.19.6	TBD	spare

Identifier	Object Type	Text
PUS-14532 section 5.19.6	TBD	NL
PUS-14533 section 5.19.6	TBD	Load param-ters
PUS-14534 section 5.19.6	TBD	NS
PUS-14535 section 5.19.6	TBD	OBCP Param ID
PUS-14536 section 5.19.6	TBD	Value
PUS-14538 section 5.19.6	TBD	uint
PUS-14539 section 5.19.6	TBD	enum
PUS-14540 section 5.19.6	TBD	enum
PUS-14541 section 5.19.6	TBD	n/a
PUS-14542 section 5.19.6	TBD	uint
PUS-14543 section 5.19.6	TBD	N/A

Identifier	Object Type	Text
PUS-14544 section 5.19.6	TBD	uint
PUS-14545 section 5.19.6	TBD	uint
PUS-14546 section 5.19.6	TBD	(deduced)
PUS-14548 section 5.19.6	TBD	4 bytes
PUS-14549 section 5.19.6	TBD	1 bit
PUS-14550 section 5.19.6	TBD	1 bit
PUS-14551 section 5.19.6	TBD	6 bits
PUS-14552 section 5.19.6	TBD	2 bytes
PUS-14553 section 5.19.6	TBD	1byte
PUS-14554 section 5.19.6	TBD	2 bytes
PUS-14555 section 5.19.6	TBD	4 bytes

Identifier	Object Type	Text
PUS-14556 section 5.19.6	TBD	variable
PUS-14558 section 5.19.6	TBD	
PUS-14559 section 5.19.6	TBD	
PUS-14560 section 5.19.6	TBD	
PUS-14561 section 5.19.6	TBD	
PUS-14562 section 5.19.6	TBD	
PUS-14563 section 5.19.6	TBD	<--NLtimes---->
PUS-14564 section 5.19.6	TBD	
PUS-14565 section 5.19.6	TBD	<-----NS
PUS-14566 section 5.19.6	TBD	times---->
PUS-14569 section 5.19.7	TBD	OBCP ID

Identifier	Object Type	Text
PUS-14570 section 5.19.7	TBD	Step ID
PUS-14572 section 5.19.7	TBD	uint
PUS-14573 section 5.19.7	TBD	uint
PUS-14575 section 5.19.7	TBD	4 bytes
PUS-14576 section 5.19.7	TBD	2 bytes
PUS-14582 section 5.19.8	TBD	OBCP ID
PUS-14583 section 5.19.8	TBD	TM Status
PUS-14584 section 5.19.8	TBD	TM Period
PUS-14586 section 5.19.8	TBD	uint
PUS-14587 section 5.19.8	TBD	enum
PUS-14588 section 5.19.8	TBD	uint

Identifier	Object Type	Text
PUS-14590 section 5.19.8	TBD	4 bytes
PUS-14591 section 5.19.8	TBD	1 bit
PUS-14592 section 5.19.8	TBD	15 bits
PUS-14595 section 5.19.9	TBD	OBCP ID
PUS-14596 section 5.19.9	TBD	Checksum
PUS-14597 section 5.19.9	TBD	N
PUS-14598 section 5.19.9	TBD	OBCP Param ID
PUS-14599 section 5.19.9	TBD	Value
PUS-14601 section 5.19.9	TBD	uint
PUS-14602 section 5.19.9	TBD	uint
PUS-14603 section 5.19.9	TBD	uint

Identifier	Object Type	Text
PUS-14604 section 5.19.9	TBD	uint
PUS-14605 section 5.19.9	TBD	(deduced)
PUS-14607 section 5.19.9	TBD	4 bytes
PUS-14608 section 5.19.9	TBD	2 bytes
PUS-14609 section 5.19.9	TBD	2 bytes
PUS-14610 section 5.19.9	TBD	4 bytes
PUS-14611 section 5.19.9	TBD	variable
PUS-14613 section 5.19.9	TBD	
PUS-14614 section 5.19.9	TBD	
PUS-14615 section 5.19.9	TBD	
PUS-14616 section 5.19.9	TBD	<----repeated N

Identifier	Object Type	Text
PUS-14617 section 5.19.9	TBD	times----->
PUS-14620 section 5.24.1	TBD	N
PUS-14621 section 5.24.1	TBD	Target Param ID
PUS-14622 section 5.24.1	TBD	TM APID
PUS-14623 section 5.24.1	TBD	TM SID
PUS-14624 section 5.24.1	TBD	Offset in TM
PUS-14626 section 5.24.1	TBD	uint
PUS-14627 section 5.24.1	TBD	enum
PUS-14628 section 5.24.1	TBD	uint
PUS-14629 section 5.24.1	TBD	enum
PUS-14630 section 5.24.1	TBD	uint



Identifier	Object Type	Text
PUS-14632 section 5.24.1	TBD	1 byte
PUS-14633 section 5.24.1	TBD	4 bytes
PUS-14634 section 5.24.1	TBD	2 bytes
PUS-14635 section 5.24.1	TBD	2 bytes
PUS-14636 section 5.24.1	TBD	2 bytes
PUS-14638 section 5.24.1	TBD	
PUS-14639 section 5.24.1	TBD	<-----
PUS-14640 section 5.24.1	TBD	----Repeated N
PUS-14641 section 5.24.1	TBD	times-----
PUS-14642 section 5.24.1	TBD	----->
PUS-14645 section 5.24.2	TBD	N

Identifier	Object Type	Text
PUS-14646 section 5.24.2	TBD	Target Param ID
PUS-14648 section 5.24.2	TBD	uint
PUS-14649 section 5.24.2	TBD	enum
PUS-14651 section 5.24.2	TBD	1 byte
PUS-14652 section 5.24.2	TBD	4 bytes
PUS-14654 section 5.24.2	TBD	
PUS-14655 section 5.24.2	TBD	<---Repeated N times----->
PUS-14658 section 5.24.4	TBD	N
PUS-14659 section 5.24.4	TBD	Target Param ID
PUS-14660 section 5.24.4	TBD	TM APID
PUS-14661 section 5.24.4	TBD	TM SID

Identifier	Object Type	Text
PUS-14662 section 5.24.4	TBD	Offset in TM
PUS-14664 section 5.24.4	TBD	uint
PUS-14665 section 5.24.4	TBD	enum
PUS-14666 section 5.24.4	TBD	uint
PUS-14667 section 5.24.4	TBD	enum
PUS-14668 section 5.24.4	TBD	uint
PUS-14670 section 5.24.4	TBD	1 byte
PUS-14671 section 5.24.4	TBD	4 bytes
PUS-14672 section 5.24.4	TBD	2 bytes
PUS-14673 section 5.24.4	TBD	2 bytes
PUS-14674 section 5.24.4	TBD	2 bytes

Identifier	Object Type	Text
PUS-14676 section 5.24.4	TBD	
PUS-14677 section 5.24.4	TBD	<-----
PUS-14678 section 5.24.4	TBD	-----Repeated N
PUS-14679 section 5.24.4	TBD	times-----
PUS-14680 section 5.24.4	TBD	----->
PUS-14683 section 5.29.4	TBD	NPAR
PUS-14684 section 5.29.4	TBD	Parameter ID
PUS-14685 section 5.29.4	TBD	RAM address
PUS-14686 section 5.29.4	TBD	Parameter Length
PUS-14687 section 5.29.4	TBD	Parameter Type
PUS-14689 section 5.29.4	TBD	Uint

Identifier	Object Type	Text
PUS-14690 section 5.29.4	TBD	uint
PUS-14691 section 5.29.4	TBD	uint
PUS-14692 section 5.29.4	TBD	uint
PUS-14693 section 5.29.4	TBD	uint
PUS-14695 section 5.29.4	TBD	1 byte
PUS-14696 section 5.29.4	TBD	4 bytes
PUS-14697 section 5.29.4	TBD	4 bytes
PUS-14698 section 5.29.4	TBD	1 byte
PUS-14699 section 5.29.4	TBD	4 bytes
PUS-14701 section 5.29.4	TBD	
PUS-14702 section 5.29.4	TBD	<-----

Identifier	Object Type	Text
PUS-14703 section 5.29.4	TBD	-----repeated
PUS-14704 section 5.29.4	TBD	NPAR times--
PUS-14705 section 5.29.4	TBD	----->
PUS-14707 section 5.16.3	TBD	N1
PUS-14708 section 5.16.3	TBD	Number of Process IDs
PUS-14709 section 5.16.3	TBD	1...7
PUS-14711 section 5.16.4	TBD	N1
PUS-14712 section 5.16.4	TBD	Number of Process IDs
PUS-14713 section 5.16.4	TBD	1....7
PUS-14714 section 5.22.6	TBD	N1
PUS-14715 section 5.22.6	TBD	Uns Int

Identifier	Object Type	Text
PUS-14716 section 5.22.6	TBD	Any size
PUS-14717 section 5.22.6	TBD	Repeating Block 1
PUS-14718 section 5.22.6	TBD	Any
PUS-14719 section 5.22.6	TBD	Any
PUS-14720 section 5.22.6	TBD	Fixed Parameters (end)
PUS-14721 section 5.22.6	TBD	Any
PUS-14722 section 5.22.6	TBD	Any
PUS-14724 section 5.22.6	TBD	
PUS-14725 section 5.22.6	TBD	
PUS-14726 section 5.22.6	TBD	
PUS-14727 section 5.22.6	TBD	<--- Repeat N1 times -->

Identifier	Object Type	Text
PUS-14728 section 5.22.6	TBD	
PUS-14730 section 5.22.6	TBD	N1
PUS-14731 section 5.22.6	TBD	The number of the Repeating Block 1 follows
PUS-14732 section 5.22.6	TBD	0-Max Int
PUS-14734 section 5.22.6	TBD	Repeating Block 1or Data
PUS-14735 section 5.22.6	TBD	1 or more parameters of science data.An anonymous data stream in this block is usually best represented as a single "Data" parameter representing one octet (or word) of the stream.In case of more complex structures with nested repetition, it is possible to embed a N2 + Repeating Block 2 here.
PUS-14736 section 5.22.6	TBD	
PUS-14738 section 5.22.6	TBD	Fixed Parameters (end)
PUS-14739 section 5.22.6	TBD	0 or more parameters of science data.
PUS-14740 section 5.22.6	TBD	



Identifier	Object Type	Text
PUS-14741 section 5.1	TBD	<Picture>
PUS-14744 section 5.6	TBD	Figure 5.6-1: Critical Event Log Overview<Picture>
PUS-14747 section 5.30	Information	ObjectiveThis service 140 is implemented in the SSMM SW only for mode management (see RD9).
PUS-14748 section 5.7	TBD	<Picture>
PUS-14749 section 5.7	Information	Figure 5.7-1: Memory ID allocationNote 1: The output register cannot be patched on the PM in service mode, via the inter-PM link.
PUS-14750 section 5.21.3	TBD	PF Data - AOCs sub-mode
PUS-14751 section 5.21.3	TBD	4 octets
PUS-14754 section 5.21.3	TBD	PF data - convergence flag
PUS-14755 section 5.21.3	TBD	1 octet
PUS-14756 section 5.21.3	TBD	PF Data - roll rate
PUS-14757 section 5.21.3	TBD	4 octets

Identifier	Object Type	Text
PUS-14758 section 5.21.3	TBD	PF data - roll rate
PUS-14759 section 5.21.3	TBD	4 octets
PUS-14760 section 5.21.3	TBD	PF data - RW 1 speed
PUS-14761 section 5.21.3	TBD	4 octets
PUS-14765 section 5.21.3	TBD	EPD Data
PUS-14766 section 5.21.3	TBD	EUI data
PUS-14767 section 5.21.3	TBD	MAG data
PUS-14768 section 5.21.3	TBD	METIS data
PUS-14769 section 5.21.3	TBD	PHI data
PUS-14770 section 5.21.3	TBD	RPW data
PUS-14771 section 5.21.3	TBD	SoloHI data

Identifier	Object Type	Text
PUS-14772 section 5.21.3	TBD	SPICE data
PUS-14773 section 5.21.3	TBD	STIX data
PUS-14774 section 5.21.3	TBD	SWA data
PUS-14776 section 5.21.3	TBD	20 octets
PUS-14777 section 5.21.3	TBD	20 octets
PUS-14778 section 5.21.3	TBD	20 octets
PUS-14779 section 5.21.3	TBD	20 octets
PUS-14780 section 5.21.3	TBD	20 octets
PUS-14781 section 5.21.3	TBD	20 octets
PUS-14782 section 5.21.3	TBD	20 octets
PUS-14783 section 5.21.3	TBD	20 octets

Identifier	Object Type	Text
PUS-14784 section 5.21.3	TBD	20 octets
PUS-14785 section 5.21.3	TBD	20 octets
PUS-14787 section 5.21.3	TBD	Platform data - convergence flag
PUS-14788 section 5.21.3	TBD	Flag indicating whether AOCS mode performance is achieved
PUS-14789 section 5.21.3	TBD	TBC
PUS-14791 section 5.21.3	TBD	Platform data - roll rate
PUS-14792 section 5.21.3	TBD	Roll rate, around Xsc wrt interial frame expressed in SC frame
PUS-14793 section 5.21.3	TBD	TBC
PUS-14795 section 5.21.3	TBD	EPD Data
PUS-14796 section 5.21.3	TBD	Data provided by EPD
PUS-14797 section 5.21.3	TBD	

Identifier	Object Type	Text
PUS-14799 section 5.21.3	TBD	Platform data - roll angle
PUS-14800 section 5.21.3	TBD	In quaterion form, angle around Xsc wrt inertial frame expressed in SC frame
PUS-14801 section 5.21.3	TBD	TBC
PUS-14803 section 5.21.3	TBD	Platform data - RW 1 speed
PUS-14804 section 5.21.3	TBD	Speed of reaction wheel 1, in rad/s
PUS-14805 section 5.21.3	TBD	TBC
PUS-14807 section 5.21.3	TBD	Platform data - RW 2 speed
PUS-14808 section 5.21.3	TBD	Speed of reaction wheel 2, in rad/s
PUS-14809 section 5.21.3	TBD	TBC
PUS-14811 section 5.21.3	TBD	Platform data - RW 2 speed
PUS-14812 section 5.21.3	TBD	Speed of reaction wheel 3, in rad/s

Identifier	Object Type	Text
PUS-14813 section 5.21.3	TBD	TBC
PUS-14815 section 5.21.3	TBD	Platform data - RW 3 speed
PUS-14816 section 5.21.3	TBD	Speed of reaction wheel 4, in rad/s
PUS-14817 section 5.21.3	TBD	TBC
PUS-14818 section 5.21.3	TBD	PF data - TBC
PUS-14819 section 5.21.3	TBD	5 octets
PUS-14821 section 17.1	TBD	7
PUS-14822 section 17.1	TBD	
PUS-14823 section 17.1	TBD	

Identifier	Object Type	Text
PUS-14824 section 17.1	TBD	<p>Sect 2.2 RD 9 added, issue numbers removed, latest issue of all documents is deemed to apply; RD10 added, according to CSW v2 PDR, RID-35 (AI 20-35-01)Sect 3.2.2.1 PUS-55: description of ACK flag updated to correct typo 'acknowledge progress of execution'Sect 3.4: PUS-55 updated – VCIDs confirmed by RUAG, updated to ensure 2 bit difference between channels – VC1 &amp; VC2.Sect 5.1: TM 3,129 deleted, replaced by TM 3,134; TM 15,143 deleted, replaced by TM 15,148, TM 15,146 deleted, replaced by TM 15,149in accordance with CSW CR-00327; TC 15,146 added, in line the SSMM TMTCID Iss 4Sect 5.2.2: TM(1,2) note regarding padding bytes removed, unnecessary 'requirement' and not restricted at CSW or DB levelSect 5.2.4: TM(1,8) note regarding padding bytes removed, unnecessary 'requirement' and not restricted at CSW or DB levelSect 5.3.1: TC(2,3) reference to RD10 added, according to CSW v2 PDR, RID-35 (AI 20-35-01)Sect 5.3.2: TC (2,128) Bus parameter value updated to Bus 1, and bus 2, according to SolO implementationSect 5.3.3: TC (2,129) Bus parameter value updated to Bus 1, and bus 2, according to SolO implementationSect 5.3.4: TC (2,130) updated to allow transmission of odd or even sized commands via 2,130, in line with CSW implementation according to CR-321. Note added to clarify that data field contains SpW packet including header.Sect 5.4.1: TC (3,1) note updated to clarify that SID is unique for any given PIDSect 5.4.2: TC (3,2) note updated to clarify that SID is unique for any given PIDSect 5.4.9: TC (3,9) SID parameter description updated to correct typoSect 5.4.16: TM (3,129) deleted, moved to Sect 5.4.19, renamed TM (3,134), in accordance with CSW CR-00327Sect 5.6: Description and diagram updated to clarify table of occurrence functionality which stores N instances of generated eventsSect 5.7, Figure 5.7-1 updated for SSMM memory IDs, and corrected for MM IDs, memory ID for TTRM PROM added. Note added to clarify that output register cannot be patched via inter PM link, in line with AI #10, NCR-28Sect 5.7.3: TM(6,6) parameter descriptions updated to remove typos; note regarding padding to even number of bytes removed – not a requirement.Sect 5.7.4: TC (6,9) parameter description updated to correct typo – checking rather than loadingSect 5.7.5: TM (6,10) parameter description updated to correct typo – checking rather than loadingSect 5.7.10: TC (6,140) parameter description and value updated to correctly specify use of the maskSect 5.10: Updated to include Solar Orbiter zero time reference of 00:00 on 1st January 2000Sect 5.12.1: TC(11,1) description of parameter value updated to clarify <b>Usage of Command (remove schedule control bit reference)</b>; Sub-schedule ID range (1-255) updated in line with CSW v2.1 PDR RID-72Sect 5.12.4: TC (11,4) Sub-schedule ID range (1-255) updated in line with CSW v2.1 PDR RID-72Sect 5.12.5: TC (11,5) Number of TCs parameter description updated to</p>

## Deleted Objects

PUS-2647 section 5.16.27 : Heading  
PUS-4655 section 5.2.2 : Information  
PUS-4875 section 5.2.4 : Information  
PUS-5186 section 5.7 : Information  
PUS-8830 section 5.7 : Information  
PUS-10129 section 5.16.30 : Information  
PUS-10130 section 5.16.30 : Information  
PUS-10131 section 5.16.30 : Information  
PUS-10133 section 5.16.30 : Information  
PUS-10134 section 5.16.30 : Information  
PUS-10135 section 5.16.30 : Information  
PUS-10137 section 5.16.30 : Information  
PUS-10138 section 5.16.30 : Information  
PUS-10139 section 5.16.30 : Information  
PUS-10141 section 5.16.30 : Information  
PUS-10142 section 5.16.30 : Information  
PUS-10143 section 5.16.30 : Information  
PUS-10145 section 5.16.30 : Information  
PUS-10146 section 5.16.30 : Information  
PUS-10147 section 5.16.30 : Information  
PUS-10149 section 5.16.30 : Information  
PUS-10150 section 5.16.30 : Information  
PUS-10151 section 5.16.30 : Information  
PUS-10153 section 5.16.30 : Information  
PUS-10154 section 5.16.30 : Information  
PUS-10155 section 5.16.30 : Information  
PUS-11068 section 5.28.3 : Information  
PUS-11085 section 5.28.4 : Information  
PUS-11360 section 5.6 : Information  
PUS-11873 section 15.1 : Information  
PUS-11877 section 15.1 : Information  
PUS-11881 section 15.1 : Information  
PUS-11885 section 15.1 : Information  
PUS-11889 section 15.1 : Information  
PUS-11893 section 15.1 : Information  
PUS-11897 section 15.1 : Information  
PUS-11901 section 15.1 : Information  
PUS-11940 section 15.1 : Information  
PUS-11944 section 15.1 : Information  
PUS-11948 section 15.1 : Information  
PUS-11952 section 15.1 : Information  
PUS-11956 section 15.1 : Information  
PUS-11960 section 15.1 : Information  
PUS-11964 section 15.1 : Information



PUS-11968 section 15.1 : Information  
PUS-12019 section 5.14.1 : Information  
PUS-12020 section 5.14.1 : Information  
PUS-12021 section 5.14.1 : Information  
PUS-12023 section 5.14.2 : Information  
PUS-12024 section 5.14.2 : Information  
PUS-12025 section 5.14.2 : Information  
PUS-12027 section 5.14.3 : Information  
PUS-12028 section 5.14.3 : Information  
PUS-12029 section 5.14.3 : Information  
PUS-12161 section 5.4.16 : Heading  
PUS-13864 section 5.30 : TBD  
PUS-13965 section 5.21.3 : Information  
PUS-13966 section 5.21.3 : Information  
PUS-13970 section 5.21.3 : Information  
PUS-13971 section 5.21.3 : Information  
PUS-13972 section 5.21.3 : Information  
PUS-13973 section 5.21.3 : Information  
PUS-13974 section 5.21.3 : Information  
PUS-13977 section 5.21.3 : Information  
PUS-13978 section 5.21.3 : Information  
PUS-13982 section 5.21.3 : Information  
PUS-13983 section 5.21.3 : Information  
PUS-13984 section 5.21.3 : Information  
PUS-13985 section 5.21.3 : Information  
PUS-13986 section 5.21.3 : Information  
PUS-14045 section 5.23 : Information  
PUS-14051 section 5.23 : Information  
PUS-14077 section 5.23 : Information  
PUS-14110 section 5.23 : Information  
PUS-14130 section 5.23 : Information  
PUS-14166 section 5.22 : Information

838 differences found

Total number of requirements = 116  
Number of inserted requirements = 0  
Number of changed requirements = 10  
Number of unchanged requirements = 106  
Number of deleted requirements = 0

## Requirement/Section Cross Reference

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