



Title:

EarthCare Packet Utilization Standard



CI - No:	0000		
DRL Refs :	TBD		
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Change Record

Issue	Date	Sheet	Description of Change
Draft	18.03.2008	all	first draft issue

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1. INTRODUCTION

1.1 Scope of the Document

This document is in response to the EarthCare Statement of Work (SOW) and the EarthCare Operations Interface Requirements Document (OIRD) to provide a specific tailoring of the ECSS Packet Utilisation Standard ECSS-E70-41A.

In order to maximise the application of a heritaged tailoring approach for the ECSS Packet Utilisation Standard, the following documentation approach has been adopted:

- The document has been split into a common Core Packet Utilisation Standard Document and project specific annexes according to the following logic.
- The Core Packet Utilisation Standard Document contains the definitions of service/subservices and their data structures which are intended to be applied across applications. In addition, the TC and TM format definition is to be found in this document. The core PUS is basically the answer to the OIRD, whereas the annexes detail the implementation and mission specific services, functions and definitions.

Note: The document number of the Core PUS in the current draft version of the EarthCare PUS is only temporarily used. Please use the Doc number of the EarthCare PUS EC.STD.ASD.00002 as reference

- The project specific annexes detail the projects specific implementations for all those onboard applications, for which this PUS is applicable. The annexes contain for instance data tables and structures for all OBC/CSW applications and for all downstream applications for which the PUS is made applicable (e.g. packet terminals). It may also contain private PUS services and individual function definitions.
 - Annex A contains the definition of the project specific process identifiers (PID), source and destination ID, common failure ID's (FID) and event ID's (EID) as well as applicability matrix of the individual service/sub-service for the individual on-board applications. Annex A basically reflects the general application hierarchy and distribution of on-board services.
 - Additional application dedicated annexes define the application specific parts (FID, EID, private service/sub-services, functions, parameters etc) of the PUS

PUS specific functional requirements are called up in the Software System Specification or the respective Unit Specifications (TBC).

1.2 References

1.2.1 Applicable Documents

[AD 1]
[AD 2]
[AD 3]
[AD 2]
[AD 3]

1.2.2 Normative Documents

[ND 104]	Packet Telemetry	CCSDS-102.0-B-5
[ND 111]	Telecommand Part 1 – Channel Service, Blue Book, June 2000	CCSDS-201.0-B-3
[ND 112]	Telecommand Part 2 – Data Routing Service, Blue Book, June 2001	CCSDS-202.0-B-3
[ND 113]	Telecommand Part 2.1 – Command Operation Procedures, Blue Book, June 2001	CCSDS-202.1-B-2
[ND 114]	Telecommand Part 3 – Data Management Service, Blue Book, June 2001	CCSDS-203.0-B-2
[ND 115]	Time Code Formats	CCSDS-301.0-B-3
[ND 152]	Space Engineering - Space Segment Operability	ECSS-E-70-11A
[ND 154]	Ground systems and operations - Telemetry and telecommand packet utilization	ECSS-E-70-41A

1.2.3 Reference Documents

[RD 1]	LIST OF ACRONYMS AND ABBREVIATIONS	EC.LI.ASD.SY.0001
[RD 2]	Reference Document 2	
[RD 3]	Reference Document 3	

1.3 Definitions

1.4 Abbreviations

General EarthCare abbreviations are in [RD 1].

Specific abbreviations used in this document are given below.

ABC	Only used in this Document
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2. PACKET UTILIZATION STANDARD BINDER

The EarthCare Packet Utilization Standard is composed by the following elements.

Section No.	Title	File Captain	Filename(pdf)	Filename(doc)	Appl. issue
	Overall Document	Th. Hoffmann	Overall Document	Overall Document	draft
	Core Services	Th. Hoffmann	Main	Main	draft
Annex A	A: Common Data Tables	A. Schwab	Annex A	Annex A	draft
Annex B	B: Parameter Types	Th. Hoffmann	Annex B	Annex B	Will be included in Core
Annex C	C: CSW Private Services	Th. Hoffmann	Annex C	Annex C	Not yet existing
Annex D	D: ATLID Private Services	A. Cataloglou	Annex D	Annex D	Not yet existing
Annex E	E: MSI Private Services	E. Weih	Annex E	Annex E	Not yet existing
Annex F	E: BBR Private Services	E. Weih	Annex F	Annex F	Not yet existing
Annex G	G: CPR Private Services	W. Hilberath	Annex G	Annex G	Not yet existing

PLEASE NOTE THIS DOCUMENT LAYOUT IS SET UP FOR DOUBLE SIDED PRINTING

Doc-No:	EC.RS.ASD.SY.00009	Issue:	draft	Date:	28/02/2008
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Title:	EC/S2 CORE PACKET UTILIZATION STANDARD
CI - No:	<ci_code>
DRL Refs :	

4 SIGNATURE BLOCKS PROVIDED DELETE BLOCKS NOT REQUIRED
INCLUDE SIGNATORY FUNCTION/TITLE WHEN APPLICABLE

	Name:	Date:
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Distribution: See Distribution List

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<i>ISSUE</i>	<i>DATA</i>	<i>SHEET</i>	<i>DESCRIPTION</i>
Draft	28.02.2008	all	Draft Issue

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1. SCOPE AND INTRODUCTION

1.1 Scope

This document describes the data structures for telemetry and telecommand packets to be implemented for the EC / S2 platform.

Note: The provided information in ANNEX B,C,D,E is based on the "as is status". These annexes serve as container to document the implemented status, as far as needed for operational / interface reasons (kind of interface documentation) and shall not be considered as requirements.

Nevertheless, once the information is documented in the annexes, it shall only be changed after confirmation from all related parties..

1.2 Applicability Matrix for Designers

The applicability matrix specifies which of the services is applicable for the different onboard hardware and software elements. The Applicability Matrix for the EC / S2 S/W APIDs is defined in the relevant chapters.

2. DOCUMENTS

The documents listed herein, at their latest issue, form part of this document and are applicable as a whole if not stated otherwise in this document. If any conflict occurs between this document and any other applicable document the contractor shall notify the discrepancy to the customer in order to resolve the conflict.

2.1 Applicable Documents

ID	TITLE	DOCUMENT-REFERENCE
[AD-01]	Packet Telemetry	CCSDS-102.0-B-5
[AD-02]	Telecommand Part 1 – Channel Service, Blue Book, June 2000	CCSDS-201.0-B-3
[AD-03]	Telecommand Part 2 – Data Routing Service, Blue Book, June 2001	CCSDS-202.0-B-3
[AD-04]	Telecommand Part 2.1 – Command Operation Procedures, Blue Book, June 2001	CCSDS-202.1-B-2
[AD-05]	Telecommand Part 3 – Data Management Service, Blue Book, June 2001	CCSDS-203.0-B-2

Table 2-1: Applicable Documents

2.2 Reference Documents

ID	TITLE	DOCUMENT-REFERENCE
[RD-01]	Telemetry and Telecommand Packet Utilisation Standard	ECSS-E70-41A

Table 2-2: Reference Documents

2.3 Standards

ID	TITLE	DOCUMENT-REFERENCE
[STD-01]	Software Engineering Standard ECSS-E-40A	ECSS-E-40A


Table 2-3: Standard Documents

3. TELECOMMAND STRUCTURE

This chapter describes the telecommand structures to be used for the EC / S2 Platform. Telecommand structures have to be consistent for all EC / S2 System Elements (platform and payloads).

Note: The Spacecraft to Ground ICD contains the complete Information on this issue.

3.1 TC Transfer Frame

Refer to Spacecraft to Ground ICD! 

3.2 TC Frame Data (= Segments)

Refer to Spacecraft to Ground ICD!

3.3 TC Source Packet

The TC source packets must conform to the structure defined in **Error! Reference source not found.**, except those addressed to the Command Pulse Distribution Unit (CPDU). Packets addressed to the CPDU (TC(2,3)) do not contain a Packet Data Field Header.



PACKET PRIMARY HEADER								PACKET DATA FIELD		
Version Number	Packet ID				Packet Sequence Control		Packet Data Length	Packet Secondary Header (Data Field Header)	Source Data	Packet Error Control
	Type Indicator	PKT.SEC.HDR.Flag	APID		Grouping (Segmentation) Flag	Source Sequence Count				
			PID	PCAT						
3	1	1	7	4	2	14	16	80		16
2 bytes					2 bytes		2 bytes	10 bytes	Max 1085 bytes	2 bytes
Max 1103 bytes										

Figure 3-1: Reference Documents

3.4 TC Packet Data Field Header

The TC Data Field Header shall conform to the structure as defined in [RD-01]. The structure is shown here below.

CCSDS Secondary Header Flag	TC PUS Version Number	ACK				Service Type	Service Subtype	Source ID
		Execution Completion	Progress of Execution	Start of Execution	Acceptance			
1	3	1	1	1	1	8	8	8
4 Byte								

Figure 3-2: TC Packet Data Field Header

PARAMETER	DESCRIPTION	RANGE OR VALUE
CCSDS Secondary Header Flag	As required by CCSDS 203.1 -- B -- 1	Must be set to 0 (for non-CCSDS defined secondary header)
TC PUS Version Number		1
Acceptance	Indicates if acknowledgement is required for TC acceptance	0 = acceptance report (TM(1,1)) not requested 1 = acceptance report (TM(1,1)) requested
Start of Execution	Indicates if acknowledgement is required for TC Start of Execution	Not supported. <i>Note: The flag can have any value [0,1] it will be ignored</i>
Progress of Execution	Indicates if acknowledgement is required for TC Progress of Execution	Not supported. <i>Note: The flag can have any value [0,1] it will be ignored</i>
Execution Completion	Indicates if acknowledgement is required after TC Execution Completion	0 = completion report (TM(1,7)) not requested 1 = completion report (TM(1,7)) requested
Service Type	Indicates the service to which the packet relates	See relevant chapters of this document
Service Subtype	Indicates the service subtype to which the packet relates	See relevant chapters of this document
Source ID	Identification of the command source issuing the TC packet	See Annex A.

Table 3-1: TC Packet Data Field Header

The two ACK flags to be used in the EC / S2 project shall be usable in any combination, i.e. 0000 bin, 0001 bin, 1000 bin, 1001 bin. etc.



4. TELEMETRY STRUCTURE

This chapter describes the telemetry structures to be used for the EC / S2 Platform.

Note: The Spacecraft to Ground ICD contains the complete Information on this issue.

4.1 TM Transfer Frame

Refer to  Spacecraft to Ground ICD!



4.2 TM Source Packet

Telemetry source packets must conform to the structure defined in [AD-01] except Time Packet and Idle Packet. The structure is shown here below.


PACKET PRIMARY HEADER								PACKET DATA FIELD		
Version Number	Packet ID			Packet Sequence Control		Packet Data Length	Packet Secondary Header (Data Field Header)	Source Data	Packet Error Control	
	Type Indicator	PKT.SEC.HDR.Flag	APID	Grouping (Segmentation) Flag	Source Sequence Count					
			PID							PCAT
3	1	1	7	4	2	14	16	80		16
2 bytes					2 bytes		2 bytes	10 bytes	Max 1085 bytes	2 bytes
Max 1103 bytes										

Figure 4-1: TM Source Packet

PARAMETER	DESCRIPTION	RANGE OR VALUE
Version Number	CCSDS Version Number	Must be set to 0 for all TM source packets
Type	Packet type (0 = telemetry, 1 = telecommand)	Must be set to 0 for all TM source packets
Packet Secondary Header Flag	Indicates the presence of a secondary (data field) header (when set to 1)	Must be set to 1 for all TM source packets, Exceptions: must be set to 0 for Time Packets and Idle Packets
PID	Process ID (part of the APID)	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet category	Must be set to a value according table 6.1 (Annex A)
Grouping (Segmentation) Flag	Indicates the grouping (segmentation) of TM source packets	- 01 _{bin} first packet of a group of packets - 00 _{bin} continuation packet - 10 _{bin} last packet of a group of packets - 11 _{bin} Standalone
Source Sequence Count	Wrap around counter used to count each TM packet from a certain APID. For each APID a separate Sequence Counter is maintained.	Must be set to 0 for first packet, increments up to $2^{14}-1$, wrap around to 0
Packet Length	Number of bytes contained in the packet data field minus 1	The max. number contained in the packet data field is : 1103 (transfer frame data field) minus 6 bytes (packet header) = 1097 bytes, i.e. max. value of the length parameter is 1096
Source Data	This field contains the data of the TM source packet.	The max. number of bytes being contained in the source data field is computed as follows: 1103 bytes (transfer frame data field) minus 6 bytes (packet header) minus 10 bytes (data field header) minus 2 bytes (packet error control) = 1085 bytes

Table 4-1: TM Source Packet

4.2.1 Bandwidth adjustment

In order to avoid flooding of the OBC by large and/or too many TM packets, those sub-services which might generate large amount of data shall be limited according to the following bandwidth adjustment concept:

- each *PID* maintains a global parameter called *Maximum Transmission Unit* called *MTU*.
- The *MTU* is the maximum amount of bytes allowed for the *Source Data Field* within one *Packet Data Field*.
- Only one TM packet per second shall be allowed per sub-service
- The TM packet content shall be aligned to logical data structures, wherever possible
- This mechanism shall be applicable **only for selected** TM sub-services which are marked accordingly
- The global parameter *MTU* can be adjusted by means of Service TC(128,1), (Set parameter)
- If a TM packet is split the *Grouping Flags* shall be set accordingly

Those TM packets for which this function shall be applicable are marked with:

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

TM packet generation for TM's applying to this rule will be aborted as soon as a new TC arrives, which is affecting the data to be downlinked or superseeds the old request.

4.3 TM Packet Secondary (Data Field) Header

The TM Packet Data Field Header must conform to the structure defined in [RD-01]. The structure is shown here below.

SPARE 1	TM SOURCE PACKET PUS VERSION NUMBER	SPARE 2	SERVICE TYPE	SERVICE SUBTYPE	DESTINATION ID	TIME
1	3	4	8	8	8	48
1 byte			1 byte	1 byte	1	6 bytes

Figure 4-2: TM Packet Data Field Header

PARAMETER	DESCRIPTION	RANGE OR VALUE
Spare 1	Not used	Must be set to 0 for all TM source packets
TM Source Packet PUS Version Number		Must be 1
Spare 2	Filler to complete the byte	Must be set to 0 for all TM source packets
Service Type	Indicates the service to which the packet relates	See chapter 0 + Annex A
Service Subtype	Indicates the service subtype to which the packet relates	See chapter 0 + Annex A
Destination ID	Indicates the destination of the packet	Solicited = Source ID of related TC Unsolicited = GROUND See Annex A.
Time	Onboard time (OBT)	For structure and range see Table 6-148: Source Data for TM(9,2)

Table 4-2: TM Packet Data Filed Header.

4.4 Time Source Packet

Refer to section to 6.8.1 TM (9, 2): Time Report !

4.5 Idle Source Packet

Idle Source Packets are used to fill transfer frames in case a transfer frame has to be submitted and the presently available source packets do not yet complete the transfer frame. The length of idle source packets is determined by the size of the unused remainder of a particular transfer frame. The structure of the idle source packet is shown here below.

PACKET HEADER	PACKET DATA FIELD
6 bytes	variable

Figure 4-3: Time Source Packet

The Packet Header structure is identical for all TM Source Packets. The details are defined in chapter 4.2
For parameters of the Packet Header not listed here below see chapter 4.2


PARAMETER	DESCRIPTION	RANGE OR VALUE
Data Field Header Flag	Indicates the presence of a data field header (when set to 1)	Must be set to 0
PID	Process ID (part of the APID)	Must be set to 1111111 bin
PCAT	Packet category	Must be set to 1111 bin
Packet Data Field	Variable length as required to complete a transfer frame	Random data 

Table 4-3: Idle Source Packet



5. DEFINITION OF PUS SERVICES

5.1 Applicability Matrix

SERVICE TYPE	NAME	APPLICABILITY
1	Service 1: Telecommand Verification Service	mandatory
2	Service 2: Device Command Distribution Service	mandatory
3	Service 3: Housekeeping and Diagnostic Data Reporting Service	mandatory
4	Service 4: Parameter Statistics Reporting Service	specific
5	Service 5: Event Reporting Service	mandatory
6	Service 6: Memory Management Service	specific
7	Not used	
8	Service 8: Function Management Service	mandatory
9	Service 9: Time Management Service	specific
10	Not used	
11	Service 11: On Board Operations Scheduling	specific
12	Service 12: On Board Parameter Monitoring	mandatory/specific
13	Service 13: Large Data Transfer Service	specific
14	Service 14: Packet Forwarding Control Service	specific
15	Service 15: On Board Storage and Retrieval	specific
16	Not used	
17	Service 17: Test Service	mandatory
18	Service 18: On Board Operations Procedures	mandatory/specific
19	Service 19: Event/Action Service	mandatory/specific
128	Service 128: Parameter Management	mandatory
129	Service 129: Orbit Position Management Service	specific
130	Service 130: Orbit Position Schedule (OPS)	specific

Table 5-1: Applicability of PUS Services (Overview)



S ... System Control APID
A ... AOCS APID
B ... Bus Control APID
P ... Payload Manager APID

5.2 Deviations from the Standard ECSS-E-40-71A

The following services deviate from the standard:

Service 3:

Deviation:

 For the reports defined for services TM 3,10 (HK Parameter Report Definition Report) and TM 3,12 (Diagnostics Parameter Report Definition Report) an additional parameter is inserted which indicates the actual status of the report (enabled or disabled). 


Affected sub-services: 10 and 12 

Justification:

The PUS-standard does not foresee a report which allows to read back the status of all actually defined HK reports (enable/disable) which can be changed by the commands (TC 3,5 and TC 3,6). As enabling and disabling HK-report is an important operational mean to control the downlink data rate and also the processor load. For this reason this information was added as part of the HK/Diagnostics Definition reports TM 3,10 and TM 3,12. This allows the operator to assess the actual configured TM without analysis of the data stream. The structure of the reports TM 3,10 and TM 3,12 is fully defined in the SRDB, the ground control center shall not have any problem to process these reports.

Service 12:

Deviation:

 The PUS standard requires a parameter ID to define a monitoring on a certain parameter. In deviation to this approach an addition key called monitoring ID has been added to allow identification a one certain monitoring specification.

Affected sub-services: 1,2,5,6,7 and 9


Justification:

The PUS-standard uses the parameter ID to control the monitoring of a parameter. In deviation from the standard, the project introduced an additional monitor-ID to control the different monitorings. This additional parameter helps to reduce the complexity of this service, for both the ASW and the operations:

- with the current implementation, an identification (monitoring id) is assigned to each parameter check, so the ASW can autonomously update the list of checks to be applied using only the validity parameter (no need of additional level of control like the check selection parameter of the ECSS version) and the ground keeps full control by enabling/disabling checks individually (in ECSS version, ground can only enable or disable all checks related to one parameter).
- EC / S2 does not need the ECSS capability that allows to perform different types of checks on the same parameter since the nature of the check depends on the type of the parameter.

Service 14:

Deviation:

 For the report defined for services TM 14,4 (Enabled Telemetry Source Packet Report) additional parameters FSTAT are inserted which indicates the actual status of the report (enabled or disabled) on the different levels (APID, TYPE, SUBTYPE).

Affected sub-services: 4, 8, 16 

Justification:

These services offer to the operations a high flexibility for the control of the TM packets routing (using four levels from APID/TYPE/SUBTYPE to SID/EID). But with the ECSS implementation, in order to produce the TM reports (14, 4/8/12/16 and 15,6) with only one instance of these services on the OBC, the ASW has to know statically the complete list of TM packets (APID, type, subtype, SID/EID) that

may be generated on-board. This creates a coupling with the other packet terminals that was found unacceptable (e.g. if a Payload packet terminal wants to add an EID, a modification of the ASW would be necessary). With the current approach, default routing rules can be defined in the ASW based on simple criteria (e.g. APID only) but full flexibility is granted to the ground to change it on the fly (e.g. to include only one particular Payload TM packet in one service 15 packet store or suppressing the forwarding of one particular EID to the ground).

Service 15:**Deviation:**

For the report defined for services TM 15,6 (Storage Selection Report) additional parameters Store-Id are inserted for each level. Affected sub-services: 6

**Justification:**

See justification for service 14.

6. DETAILED DEFINITIONS OF PUS SERVICES

6.1 Service 1: Telecommand Verification Service




SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(1,1)	TM	Telecommand Acceptance Report – Success	Mandatory
(1,2)	TM	Telecommand Acceptance Report – Failure	Mandatory
(1,3)	TM	Telecommand Execution Started Report – Success	
(1,4)	TM	Telecommand Execution Started Report – Failure	 
(1,5)	TM	Telecommand Execution Progress Report – Success	
(1,6)	TM	Telecommand Execution Progress Report – Failure	
(1,7)	TM	Telecommand Execution Completion Report – Success	Mandatory
(1,8)	TM	Telecommand Execution Completion Report – Failure	Mandatory

Table 6-1: Service 1 sub-services

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

- Static Acceptance Checks (eventually issuing a Telecommand Acceptance 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 ($5_{DEC} \leq \text{value of parameter "Packet Length"} \leq 232_{DEC}$) 
- Check the indicated length w.r.t. the number of received bytes (see note below)
- 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)
- Check the field *PCAT* (always 12 for TC)
- Check whether Service Type/Subtype is supported (result may depend from actual context e.g. unit mode or actually running software).

Consistency Checks (eventually issuing a Telecommand Execution Completion Report):

- 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 Application Data Field are within their defined range (specific for a Service type/subtype).

Notes: 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.

TM (1,2) and TM (1,8) shall always be generated independent from the settings of the ACK flags.



Depending on implementation, it might not be possible to detect an incorrect actual length. If no mechanism guarantees that only single TC packets are transmitted/processed, an incorrect actual length may appear as an incorrect checksum.

In case more than one independent parameter or parameter sets are supplied by a TC, the complete TC shall be rejected if there is an error on one or more of the parameter/parameter sets.

Flight Software Architecture Overview - IV (TC Acknowledge)

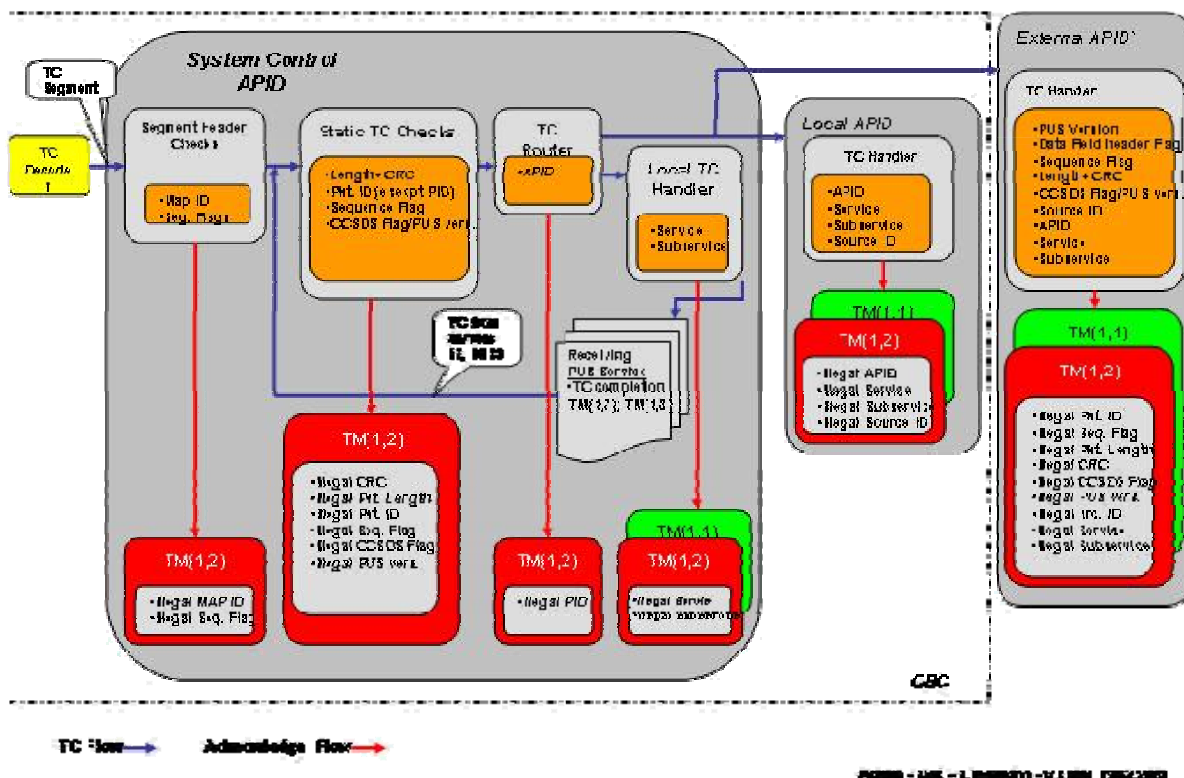


Figure 6-1: TC Acknowledge

6.1.1 TM (1,1) Telecommand Acceptance Report – Success

This report shall be generated if the corresponding ACK flag was set in the TC. The report informs the TC source about the successful reception of the TC by the receiving onboard application (PID).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 1 (acknowledge)

Table 6-2: TM Packet Header for TM(1,1)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 1
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-3: TM Data Field Header for TM(1,1)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

TC PACKET ID	TC PACKET SEQUENCE CONTROL
Unsigned integer	Unsigned integer
2 bytes	2 bytes

Figure 6-2: Source data TM(1,1)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
TC Packet ID	This is a copy of the 16 bits of the TC Packet ID contained in the TC Packet Header	Identical to the value of the <i>Packet ID</i> parameter of the received TC
TC Packet Sequence Control	This is a copy of the 16 bits of the TC Packet Sequence Control contained in the TC Packet Header	Identical to the value of the <i>Packet Sequence Control</i> parameter of the received TC

Table 6-4: Source Data for TM(1,1)

6.1.2 TM (1,2) Telecommand Acceptance Report – Failure

This report shall be generated if the acceptance check of a TC failed. Each application process shall provide TC acceptance failure report independent from the ACK flag settings.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 1 (acknowledge)

Table 6-5: TM Packet Header for TM(1,2)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 1
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-6: TM Data Field Header for TM(1,2)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

TC PACKET ID	TC PACKET SEQUENCE CONTROL	FAULT ID (FID)	PARAMETERS
Unsigned integer	Unsigned integer	Unsigned integer	Any
2 bytes	2 bytes	2 bytes	[0248]bytes

Figure 6-3: Source data TM(1,2)



The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
TC Packet ID	This is a copy of the 16 bits of the TC Packet ID contained in the TC Packet Header	Identical to the value of the Packet ID parameter of the received TC
TC Packet Sequence Control	This is a copy of the 16 bits of the TC Packet Sequence Control contained in the TC Packet Header	Identical to the value of the Packet Sequence Control parameter of the received TC
FID	Fault Identification Code	See Annex
Parameters	Complementary information	See Annex

Table 6-7: Source Data for TM(1,2)



6.1.3 TM (1,7) Telecommand Execution Completion Report – Success

This report shall be generated if the corresponding ACK flag was set in the TC. The report informs the TC source about the successful completion of the TC by the receiving onboard application (PID)

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 1 (acknowledge)

Table 6-8: TM Packet Header for TM(1,7)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 1
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 7

Table 6-9: TM Data Field Header for TM(1,7)

The structure of the *Source Data* field within the *TM Packet Data Field* is identical with the one specified for the service TM (1,1). (see Figure 6-3: Source data TM(1,2))

6.1.4 TM (1,8) Telecommand Execution Completion Report – Failure

This report shall be generated if the execution of a TC failed. Each application process shall provide TC execution failure report independent from the ACK flag settings.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 1 (acknowledge)

Table 6-10: TM Packet Header for TM(1,8)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 1
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 8

Table 6-11: TM Data Field Header for TM(1,8)

The structure of the *Source Data* field within the *TM Packet Data Field* is identical with the one defined for the service TM (1,2). (see [Figure 6-3: Source data TM\(1,2\)](#))



6.2 Service 2: Device Command Distribution Service


SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(2,1)	TC	Distribute ON/OFF Commands	
(2,2)	TC	Distribute Register Load Commands	
(2,3)	TC	Distribute CPDU Commands	
(2,128)	TC	 Direct I/O	
(2,129)	TM	Direct I/O Response	

Table 6-12: Service 2 sub-services

S ... System Control APID
A ... AOCS APID
B ... Bus Control APID
P ... Payload Manager APID



6.3 Service 3: Housekeeping and Diagnostic Data Reporting Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(3,1)	TC	Define new HK Parameter Report	Mandatory
(3,2)	TC	Define new Diagnostic Parameter Report	Mandatory
(3,3)	TC	Clear HK Parameter Report Definitions	Mandatory
(3,4)	TC	Clear Diagnostic Parameter Report Definitions	Mandatory
(3,5)	TC	Enable HK Parameter Report Generation	Mandatory
(3,6)	TC	Disable HK Parameter Report Generation	Mandatory
(3,7)	TC	Enable Diagnostic Parameter Report Generation	Mandatory
(3,8)	TC	Disable Diagnostic Parameter Report Generation	Mandatory
(3,9)	TC	Report HK Parameter Report Definitions	Mandatory
(3,10)	TM	HK Parameter Report Definitions Report	Mandatory
(3,11)	TC	Report Diagnostic Parameter Report Definitions	Mandatory
(3,12)	TM	Diagnostic Parameter Report Definitions Report	Mandatory
(3,13)	TC	Report HK Parameter Sampling-Time Offset	
(3,14)	TC	Report Diagnostic Parameter Sampling-Time Offset	
(3,15)	TM	HK Parameter Sampling-Time Offset Report	
(3,16)	TM	Diagnostic Parameter Sampling-Time Offset Report	
(3,17)	TC	Select Periodic HK Parameter Report Generation Mode	
(3,18)	TC	Select Periodic Diagnostic Parameter Report Generation Mode	
(3,19)	TC	Select Filtered HK Parameter Report Generation Mode	
(3,20)	TC	Select Filtered Diagnostic Parameter Report Generation Mode	
(3,21)	TC	Report Unfiltered Housekeeping Parameters	
(3,22)	TC	Report Unfiltered Diagnostic Parameters	
(3,23)	TM	Unfiltered Housekeeping Parameters Report	
(3,24)	TM	Unfiltered Diagnostic Parameters Report	
(3,25)	TM	Housekeeping Parameter Report	Mandatory
(3,26)	TM	Diagnostic Parameter Report	Mandatory
(3,128)	TC	Request HK Parameter Report	Mandatory
(3,129)	TC	Define HK Parameter Report Collection Interval	Mandatory
(3,130)	TC	Define Diagnostic Parameter Report Collection Interval	Mandatory
(3,131)	TC	Assign Auxiliary Diagnostic parameter	

Table 6-13: Service 3 sub-services

Note: For HK and Diagnostic Reports on EC / S2 the "generation mode" shall always be periodic with one exception: on TC(3,128) the HK Report shall be generated only once.



6.3.1 TC (3,1): Define new HK Parameter Report

Upon reception of TC (3,1) a new HK Report Definition is created in the onboard system. A corresponding "Report Generation Flag" is created and set to "disabled". TM (3,25) for this new defined HK Parameter Report has to be enabled with TC (3,5).

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3. The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-14: TC Packet Header for TC(3,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4. The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-15: TC Data Field Header for TC(3,1)

The structure of the Application Data field within the TC Packet Data field is defined here below.

SID	COLLECTION INTERVAL	NPAR	PARAMETER ID
Enumerated	Unsigned integer	Unsigned integer	Enumerated
1 byte	1 byte	1 byte	4 bytes
			< ----- repeat NPAR times ----- >

Figure 6-4: Application data TC(3,1)

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
SID	Structure ID	OBC: 1 ... 20 Others: unit specific
Collection Interval	data collection interval in sec	1...255
NPAR	number of cumulated parameters in the definition	1 ... 55
Parameter ID	Number uniquely identifying a parameter out of a list	See Annex.

Table 6-16: Application Data for TC(3,1)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the *SID* is not in the allowed range
if the *SID* is still in use (i.e. not cleared or not disabled)
if the specified *SID* exceeds the TM packet size
if the Collection Interval is 0
if *NPAR* is not in the allowed range
if *NPAR* is inconsistent with the real length of the packet data field.
if a *Parameter ID* is not valid

6.3.2 TC (3,2): Define new Diagnostic Parameter Report

Upon reception of TC (3,2) a new Diagnostic Report Definition is created in the onboard system. A corresponding "Report Generation Flag" is created and set to "disabled". TM (3,26) for this new defined Diagnostic Parameter Report has to be enabled with TC (3,7).

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-17: TC Packet Header for TC(3,2)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-18: TC Data Field Header for TC(3,2)

The structure of the Application Data field within the TC Packet Data field is defined here below.

<i>SID</i>	<i>COLLECTION INTERVAL</i>	<i>NPAR</i>		<i>PARAMETER ID</i>
Enumerated	Unsigned integer	Unsigned integer		Enumerated
1 byte	1 byte	1 byte		4 bytes
				< ----- repeat NPAR times ----- >

Figure 6-5: Application data TC

The parameters of the Application Data field are to be inserted according to the following table.


PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>SID</i>	Structure ID	OBC: 21 ... 40 (Reserved for Diagnostic Reports) Others: unit specific
<i>Collection Interval</i>	data collection interval in 1/10 sec	[1,2,5,10,20,50,100] Note: only these fixed values are valid sampling frequencies
<i>Start Slot</i>	Number of Start Slot within a one second cycle where the data acquisition shall start 	1 ... 10 1 = 1st 100 msec 2 = 2nd 100 msec 10 = 10th 100 msec
<i>NPAR</i>	number of cumulated parameters in the definition	1 ... 55
<i>Parameter ID</i>	Number uniquely identifying a parameter out of a list	See Annex.

Table 6-19: Application Data for TC(3,2)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the *SID* is not in the allowed range

if the *SID* is still in use (i.e. not cleared or not disabled)

if the specified *SID* exceeds the TM packet size

if the Collection Interval is 0

if *Start Slot* is not in the allowed range

if *NPAR* is not in the allowed range

if *NPAR* is inconsistent with the real length of the packet data field.

if a *Parameter ID* is not valid

6.3.3 TC (3,3): Clear HK Parameter Report Definitions

Upon reception of TC (3,3) the HK Report Definition specified by the *SID* number is removed from the onboard system. All related flags (Report Generation Mode, Report Generation Flag) shall be cleared

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-20: TC Packet Header for TM(3,3)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-21: TC Data Field Header for TM(3,3)

The structure of the Application Data field within the TC Packet Data field is defined here below.

SID
Enumerated
1 byte

Figure 6-6: Application data TC(3,3)

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
SID	Structure ID of HK Report Definition to be cleared	OBC: 11 ... 20 Others: unit specific

Table 6-22: Application Data for TC(3,3)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the *SID* is not in the allowed range

6.3.4 TC (3,4): Clear Diagnostic Parameter Report Definitions

Upon reception of TC (3,4) the Diagnostic Report Definition specified by the SID number is removed from the onboard system. All related flags (Report Generation Mode, Report Generation Flag) shall be cleared

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-23: TC Packet Header for TM(3,4)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 4

Table 6-24: TC Data Field Header for TM(3,4)

The structure of the Application Data field within the TC Packet Data field is defined here below.

SID
Enumerated
1 byte

Figure 6-7: Application data TC(3,4)

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
SID	Structure ID of Diagnostic Report Definition to be cleared	OBC: 21 ... 40 Others: unit specific

Table 6-25: Application Data for TC(3,4)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the SID is not in the allowed range

6.3.5 TC (3,5): Enable HK Parameter Report Generation

Upon reception of TC (3,5) the HK Report Definition specified by the SID number is enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-26: TC Packet Header for TC(3,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-27: TC Data Field Header for TC(3,5)

The structure of the Application Data field within the TC Packet Data field is defined here below.

SID
Enumerated
1 byte

Figure 6-8: Application data TC(3,5)

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
SID	Structure ID of HK Report Definition	OBC: 1 ... 20 Others: unit specific

Table 6-28: Application Data for TC(3,5)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the *SID* is not in the allowed range
if the *SID* is has no definition assigned

6.3.6 TC (3,6): Disable HK Parameter Report Generation

Upon reception of TC (3,6) the HK Report Definition specified by the SID number is disabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-29: TC Packet Header for TC(3,6)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-30: TC Data Field Header for TC(3,6)

The structure of the Application Data field within the TC Packet Data field is identical with the one defined for TC (3,5). (see [Figure 6-8!](#))

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section [6.1](#) failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section [6.1](#) failed
if the *SID* is not in the allowed range

6.3.7 TC (3,7): Enable Diagnostic Parameter Report Generation

Upon reception of TC (3,7) the Diagnostics Report Definition specified by the *SID* number is enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter [3.3](#) .
The parameters of the TC Packet Header being not yet defined in chapter [3.3](#) are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-31: TC Packet Header for TC(3,7)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter [3.4](#) .
The parameters of the TC Data Field Header not being yet defined in chapter [3.4](#) are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 7

Table 6-32: TC Data Field Header for TC(3,7)

The structure of the Application Data field within the TC Packet Data field is identical with the one defined for TC (3,5). (see [Figure 6-8!](#))

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the *SID* is not in the allowed range

if the *SID* is has no definition assigned

6.3.8 TC (3,8): Disable Diagnostic Parameter Report Generation

Upon reception of TC (3,8) the Diagnostics Report Definition specified by the *SID* number is disabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-33: TC Packet Header for TC(3,8)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 8

Table 6-34: TC Data Field Header for TC(3,8)

The structure of the Application Data field within the TC Packet Data field is identical with the one defined for TC (3,5). (see Figure 6-8!)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the *SID* is not in the allowed range

6.3.9 TC (3,9): Report HK Parameter Report Definition

Upon reception of TC (3,9) the HK Parameter Report Definition Report TM(3,10) specified by the *SID* number shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-35: TC Packet Header for TC(3,9)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 9

Table 6-36: TC Data Field Header for TC(3,9)

The structure of the Application Data field within the TC Packet Data field is identical with the one defined for TC (3,5). (see Figure 6-8!)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the *SID* is not in the allowed range
if the request could not be completed

6.3.10 TM (3,10): HK Parameter Report Definitions Report

TM (3,10) is the response to TC (3,9).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2 . The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-37: TM Packet Header for TM(3,10)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 10

Table 6-38: TM Data Field Header for TM(3,10)

The structure of the Source Data field within the TM Packet Data field is defined here below.

SID	COLLECTION INTERVAL	STATUS	NPAR	PARAMETER ID
Enumerated	Unsigned integer	Enumerated	Unsigned integer	Enumerated
1 byte	1 bytes	1 byte	1 byte	4 bytes
				< ----- repeat NPAR times ----- >

Figure 6-9: Source data TM(3,10)

The parameters of the Source Data field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
SID	Structure ID of the HK Report Definition to be reported	A valid and existing SID
Collection Interval	data collection interval in secs	1 ... 255 0 = n/a 1 = 1 sec 2 = 2 sec 255 = 255 sec
Status	Report generation status	1 = Enabled / 0 = Disabled
NPAR	number of cumulated parameters in the definition	
Parameter ID	Number uniquely identifying a parameter out of a list	Any valid value of the list of predefined parameters See Annex.

Table 6-39: Source Data for TM(3,10)

*Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The **bandwidth adjustment** mechanism is applicable for this TM.*

6.3.11 TC (3,11): Report Diagnostic Parameter Report Definitions

Upon reception of TC (3,11) the Diagnostic Parameter Report Definition Report specified by the SID number shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-40: TC Packet Header for TC(3,11)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 11

Table 6-41: TC Data Field Header for TC(3,11)

The structure of the Application Data field within the TC Packet Data field is identical with the one defined for TC (3,5). (see Figure 6-8!)



TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the SID is not in the allowed range
if the request could not be completed

6.3.12 TM (3,12): Diagnostic Parameter Report Definitions Report

TM (3,12) is the response to TC (3,11).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2 . The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-42: TM Packet Header for TM(3,12)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 12

Table 6-43: TM Data Field Header for TM(3,12)

The structure of the Source Data field within the TM Packet Data field is defined here below.

SID	COLLECTION INTERVAL	START SLOT	STATUS	NPAR	PARAMETER ID
Enumerated	Unsigned integer	Unsigned integer	Enumerated	Unsigned integer	Enumerated
1 byte	1 byte	1 byte	1 byte	1 byte	4 bytes
					< ----- repeat NPAR times ----- >

Figure 6-10: Source data TM(3,12)



The parameters of the Source Data field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
SID	Structure ID of the HK Report Definition to be reported	A valid and existing SID
Collection Interval	data collection interval in 1/10sec	[0,1,2,5,10,20,50,100] Note: only these fixed values are valid sampling frequencies
Start Slot	Number of Start Slot within a one second cycle where the data acquisition shall start	1 ... 10 1 = 1st 100 msec 2 = 2nd 100 msec 10 = 10th 100 msec
Status	Report generation status	Enabled/Disabled
NPAR	number of cumulated parameters in the definition	
Parameter ID	Number uniquely identifying a parameter out of a list	Any valid value of the list of predefined parameters See Annex.

Table 6-44: Source Data for TM(3,12)

*Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfil the request. The **bandwidth adjustment** mechanism is applicable for this TM.*

6.3.13 TM (3,25): Housekeeping Parameter Report

This report shall be generated if the corresponding flags are set appropriately. The flag “Report Generation Flag” must read “enabled”.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 4 (HK)

Table 6-45: TM Packet Header for TM(3,25)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 25

Table 6-46: TM Data Field Header for TM(3,25)

The structure of the Source Data field within the TM Packet Data field is defined here below.

SID	PARAMETER 1	PARAMETER N
Enumerated	Any		Any
1 byte	1 (2,4 or 8) byte		1 (2,4 or 8) byte

Figure 6-11: Source data TM(3,25)

The parameters of the Source Data field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
SID	The structure ID of the HK Report	An existing SID value
Parameter 1 to Parameter N	Parameter meaning according to the definition of this HK Report	A valid value for this parameter

Table 6-47: Source Data for TM(3,25)

6.3.14 TM (3,26): Diagnostic Parameter Report

This report shall be generated if the corresponding flags are set appropriately. The flag “Report Generation Flag” must read “enabled” .

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

<i>PARAMETERS OF TM PACKET HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 4 (HK)

Table 6-48: TM Packet Header for TM(3,26)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

<i>PARAMETERS OF TM PACKET DATA FIELD HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 26

Table 6-49: TM Data Field Header for TM(3,26)

The structure of the Source Data field within the TM Packet Data Field is identical with the one defined for TM (3,25) (see Figure 6-12!)

6.3.15 TC (3,128): Request HK Parameter Report

Upon reception of TC (3,128), TM(3,25) specified by the SID number is generated only once.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

<i>PARAMETERS OF TC PACKET HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-50: TC Packet Header for TC(3,128)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 128

Table 6-51: TC Data Field Header for TC(3,128)

The structure of the Application Data field within the TC Packet Data field is identical with the one defined for TC (3,5). (see [Figure 6-8!](#))



TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section [6.1](#) failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section [6.1](#) failed
if the SID is not in the allowed range

6.3.16 TC (3,129): Define HK Parameter Report Collection Interval

Upon reception of TC (3,129), the collection interval for the specified HK Parameter Report shall be changed. The HK Parameter Report Generation for the specified SID must be disabled in order to fulfill the request.

The parameters of the TC Packet Header are to be set according to the definitions in chapter [3.3](#) .
The parameters of the TC Packet Header being not yet defined in chapter [3.3](#) are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-52: TC Packet Header for TC(3,130)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter [3.4](#) .
The parameters of the TC Data Field Header not being yet defined in chapter [3.4](#) are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 129

Table 6-53: TC Data Field Header for TC(3,129)

The structure of the Application Data field within the TC Packet Data field is defined here below.

<i>SID</i>	<i>COLLECTION INTERVAL</i>
Enumerated	Unsigned integer
1 byte	1 bytes



Figure 6-12: Application Data TC(3,129)

The parameters of the Application Data field are to be inserted according to the following table.

<i>PARAMETERS OF APPLICATION DATA FIELD</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
<i>SID</i>	Structure ID	OBC: 1 ... 20 Others: unit specific
<i>Collection Interval</i>	data collection interval in secs	1 ... 255 1 = 1 sec 2 = 2 sec 255 = 255 sec

Table 6-54: Application Data for TC(3,129)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the SID is not in the allowed range
if the Collection Interval is not in the specified range
the report status of the specified SID status is not "Disabled"

6.3.17 TC (3,130): Define Diagnostic Parameter Report Collection Interval

Upon reception of TC (3,130), 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 fulfil the request.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

<i>PARAMETERS OF TC PACKET HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-55: TC Packet Header for TC(3,130)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 130

Table 6-56: TC Data Field Header for TC(3,130)

The structure of the Application Data field within the TC Packet Data field is defined here below.

SID	COLLECTION INTERVAL	START SLOT
Enumerated	Unsigned integer	Unsigned integer
1 byte	1 bytes	1 byte

Figure 6-13: Application Data TC(3,130)

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
SID	Structure ID	OBC: 21 ... 40 Others: unit specific
Collection Interval	data collection interval in 1/10 secs	[1,2,5,10,20,50,100] Note: only these fixed values are valid sampling times
Start Slot	Number of Start Slot within a one second cycle where the data acquisition shall start	1 ... 10 1 = 1st 100 msec 2 = 2nd 100 msec 10 = 10th 100 msec

Table 6-57: Application Data for TC(3,130)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the SID is not in the allowed range
if the Collection Interval is not in the specified range
if the Start Slot is not in the specified range
the report status of the specified SID status is not "Disabled"

6.3.18 TC (3,131): Assign Auxiliary Diagnostic parameter

TC (3,131) is to assign physical memory addresses to a specific or a set of generic HK parameters.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-58: TC Packet Header for TC(3,131)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 3
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 131

Table 6-59: TC Data Field Header for TC(3,131)

The structure of the Application Data field within the TC Packet Data field is defined here below.

NPAR	PARAMETER ID	MEMADR	LENGTH
Unsigned integer	Enumerated	Unsigned Integer	Unsigend Integer
1 byte	4 bytes	4 bytes	1 byte
< ----- repeat NPAR times ----- >			



Figure 6-14: Application data TC(3,131)

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
NPAR	number of cumulated parameters in the definition	1 ... 24
Parameter ID	Number uniquely identifying a parameter out of a list of generic parameters	Any valid generic ID out of the list of predefined parameters (see Annex)
MemAdr	Memory address building the pointer to the data value to be assigned to the HK	Any valid memory address
Length	Length of memory are to be assigned to Parameter ID	0..255

Table 6-60: Application Data for TC(3,131)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if NPAR is not in the allowed range
if NPAR is inconsistent with the real length of the packet data field.
if a Parameter ID is wrong or not a assigned to the pool of generic parameter values

if *MemAdr* is invalid

6.4 Service 4: Parameter Statistics Reporting Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(4,1)	TC	Report Parameter Statistics	Mandatory
(4,2)	TM	Parameter Statistics Report	Mandatory
(4,3)	TC	Reset Parameter Statistics Reporting	Mandatory
(4,4)	TC	Enable Periodic Parameter Statistics Reporting	Mandatory
(4,5)	TC	Disable Periodic Parameter Statistics Reporting	Mandatory
(4,6)	TC	Add Parameters to Parameter Statistics List	Mandatory
(4,7)	TC	Delete Parameters from Parameter Statistics List	Mandatory
(4,8)	TC	Report Parameter Statistics List	Mandatory
(4,9)	TM	Parameter Statistics List Report	Mandatory
(4,10)	TC	Clear Parameter Statistics List	Mandatory

Table 6-61: Service 4 sub-services

Scope:

This service provides for the reporting to the ground system of maximum, minimum, mean and standard deviation values of on-board parameters during a time interval. The parameters can be sampled at different frequencies.

Service Concept:

The service shall provide the capability for reporting the maximum, minimum and mean of a list of parameters. The ground system may add (to a maximum of <PSLIST_MAX_PARAMS>) or delete parameters from this list at any time or clear it completely. The parameters for which these statistics are reported can be sampled at quite different frequencies, depending on the particular characteristics of the parameter (e.g. slowly varying analogue parameter such as a temperature may be sampled at a very low frequency). This sampling interval (per parameter basis) shall be specified when the parameter is added to the list. The concept for reporting the parameter statistics shall be as follows. The statistics shall be evaluated continuously on the basis of successive samples of each parameter. However, the corresponding reports of the statistics shall be generated either upon request from the ground or periodically. The periodic reporting interval can be specified through ground request. The evaluation of the parameter statistics can be reset (if requested) when such a report is generated. It shall be systematically reset when the report is periodically generated and shall also be reset if an explicit request to do so is received from the ground at any time.

6.4.1 TC (4,1): Report Parameter Statistics

When TC (4,1) is received, a report TM(4,2) shall be generated which contains the current parameter statistics values. The evaluation of the parameter statistics shall be reset after the report is generated, if the *ResetFlag* is "Yes".

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-62: TC Packet Header for TC(4,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-63: TC Data Field Header for TC(4,1)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

RESET FLAG
Enumerated
1 byte

Figure 6-15: Application data TC(4,1)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
ResetFlag	This indicates whether the evaluation of the parameter statistics shall be reset or not.	0 : = No, don't reset 1 : = Yes, reset

Table 6-64: Application Data for TC(4,1)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.4.2 TM (4,2) Parameter Statistics Report

TM (4,2) is the response to TC (4,1).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2 The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 4 (HK)

Table 6-65: TM Packet Header for TM(4,2)


The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-66: TM Data Field Header for TM(4,2)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.



TSTART	NPAR	PARAMETER#	MAXVAL	TMAX	MINVAL	TMIN	MEANVAL
Unsigned Integer	Unsigned Integer	Enumerated	Deduced	Unsigned Integer	Deduced	Unsigned Integer	Deduced
4 byte	1 byte	4 byte		4 byte		4 byte	
< ----- repeat N times ----- >							

Figure 6-16: Source data TM(4,2)

The parameters of the *Source Data* field are to be inserted according to the following table.



PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
TStart	The time at which the evaluation of the parameter statistics started (i.e. the last time the parameter statistics list was reset).	4 byte satellite coarse time in [sec], (see chapter
NPAR	The number of parameters in the parameter statistics list which have been sampled at least once since the list was last reset.	1 .. MAX 
Parameter#	Parameter ID	Any valid Parameter Id (see relevant annex)
MaxVal	The maximum value of the corresponding parameter number.	
TMax	The time at which the maximum value was attained.	4 byte satellite coarse time in [sec], (see chapter
MinVal	The minimum value of the corresponding parameter number.	
TMin	The time at which the minimum value was attained.	4 byte satellite coarse time in [sec], (see chapter 
MeanVal	The mean value of the corresponding parameter number.	

Table 6-67: Source Data for TM(4,2)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.4.3 TC (4,3): Reset Parameter Statistics Reporting

When TC (4,3) is received, the evaluation of the parameter statistics shall be reset immediately, i.e. the current set of values is discarded and the evaluation shall start again from scratch.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-68: TC Packet Header for TC(4,3)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-69: TC Data Field Header for TC(4,3)

TC (4,3) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.4.4 TC (4,4): Enable Periodic Parameter Statistic Reporting

When TC(4,4) is received, the service shall start the periodic reporting and resetting of the parameter statistics using the specified reporting interval (if any).

When in periodic reporting mode, the ground system may still explicitly request a report at any time.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-70: TC Packet Header for TC(4,4)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 4

Table 6-71: TC Data Field Header for TC(4,4)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

REPORTINGINTERVAL
Unsigned Integer
2 byte

Figure 6-17: Application data TC(4,4)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>ReportingInterval</i>	The interval of time for the periodic reporting and resetting of the parameter statistics.	Greater than the sampling interval of any parameter currently in the parameter statistics list Max Value: 65535sec

Table 6-72: Application Data for TC(4,1)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.4.5 TC (4,5): Disable Periodic Parameter Statistic Reporting

When TC (4,5) is received, the periodic reporting and resetting of the parameter statistics shall be disabled and the parameter statistics evaluation shall continue.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-73: TC Packet Header for TC(4,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-74: TC Data Field Header for TC(4,5)

TC (4,5) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.4.6 TC (4,6): Add Parameters to Parameter Statistics List

When TC(4,6) is received, the indicated parameters shall be added to the statistics list and the evaluation of their statistics shall be started immediately.

Within the next report (and only that report), parameters which were added to the list during the previous reporting interval shall be reported over a shorter interval than parameters which were already in the list.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-75: TC Packet Header for TC(4,6)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-76: TC Data Field Header for TC(4,6)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

NPAR	PARAMETER#	SAMPLINGINTERVAL
Unsigned Integer	Enumerated	Unsigned Integer
1 byte	4 byte	2 byte
< ----- repeat NPAR times ----- >		

Figure 6-18: Application data TC(4,6)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
NPAP	The number of parameters in the parameter statistics list which have been sampled at least once since the list was last reset.	1 .. MAX
Parameter#	Parameter ID	Any valid Parameter Id (see relevant annex)
SamplingInterval	The sampling interval to use for the associated parameter.	If the parameter statistics reporting mode is currently periodic, the sampling interval shall be smaller than the reporting interval. Max Value: 65535sec

Table 6-77: Application Data for TC(4,1)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.4.7 TC (4,7): Delete Parameters from Parameter Statistics List

When TC(4,7) is received, the indicated parameters shall be removed from the list and the evaluation of their statistics shall be stopped immediately. These parameters shall not be reported in the succeeding report, even though their statistics have been evaluated over a part of the reporting interval.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-78: TC Packet Header for TC(4,7)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 7

Table 6-79: TC Data Field Header for TC(4,7)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

NPAR	PARAMETER#
Unsigned Integer	Enumerated
1 byte	4 byte
	< ----- repeat NPAR times ----- >

Figure 6-19: Application data TC(4,7)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
NPAR	The number of parameters in the parameter statistics list which have been sampled at least once since the list was last reset.	1 .. MAX
Parameter#	Parameter ID	Any valid Parameter Id (see relevant annex)

Table 6-80: Application Data for TC(4,7)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.4.8 TC (4,8): Report Parameter Statistics List

When TC(4,8) is received, TM(4,9) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-81: TC Packet Header for TC(4,8)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 8

Table 6-82: TC Data Field Header for TC(4,8)

TC (4,8) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.4.9 TM (4,9) Parameter Statistics List Report

TM (4,9) is the response to TC (4,8).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-83: TM Packet Header for TM(4,9)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 9

Table 6-84: TM Data Field Header for TM(4,9)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

REPORTINGINTERVAL	NPAR	PARAMETER#	SAMPLINGINTERVAL
Unsigned Integer	Unsigned Integer	Enumerated	Unsigned Integer
2 byte	1 byte	4 byte	2 byte
< ----- repeat N times ----- >			

Figure 6-20: Source data TM(4,9)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
ReportingInterval	The interval of time for the periodic reporting and resetting of the parameter statistics.	Greater than the sampling interval of any parameter currently in the parameter statistics list Max Value: 65535sec
NPAR	The number of parameters in the parameter statistics list which have been sampled at least once since the list was last reset.	1 .. MAX
Parameter#	Parameter ID	Any valid Parameter Id (see relevant annex)
SamplingInterval	The sampling interval to use for the associated parameter.	If the parameter statistics reporting mode is currently periodic, the sampling interval shall be smaller than the reporting interval. Max Value: 65535sec

Table 6-85: Source Data for TM(4,9)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.4.10 TC (4,10): Clear Parameter Statistics List

When TC(4,10) is received, the statistics list shall be cleared immediately

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-86: TC Packet Header for TC(4,10)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 4
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 10

Table 6-87: TC Data Field Header for TC(4,10)

TC (4,10) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.5 Service 5: Event Reporting Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(5,1)	TM	Normal/Progress Report	Mandatory
(5,2)	TM	Error/Anomaly Report -- Low Severity	Mandatory
(5,3)	TM	Error/Anomaly Report -- Medium Severity	Mandatory
(5,4)	TM	Error/Anomaly Report -- High Severity	Mandatory
(5,5)	TC	Enable Event Packet Generation	Mandatory
(5,6)	TC	Disable Event Packet Generation	Mandatory
(5,133)	TC	Report Enabled Event Packets	Mandatory
(5,134)	TM	Enabled Event Packets Report	Mandatory

Table 6-88: Service 5 sub-services

CLASSIFICATION	DESCRIPTION
Normal/Progress	Report on the normal progress of e.g. an On Board procedure. It is assumed that the On Board Procedure contains "commands" to start the generation of this report. Service TM (5,1) shall not be used to report about TM execution progress. This will be done by TM (1,5), if implemented
Low Severity	Errors or anomalies of <i>low severity</i> are warnings which are worth to be reported, but do not yet initiate any autonomous on board action.
Medium Severity	Errors or anomalies of <i>medium severity</i> are all those which require an action to be started, but the action shall be started by ground command.
High Severity	Errors or anomalies of <i>high severity</i> are all those which require an autonomous on-board action to be started

Table 6-89: Classification of Event Severity

Note: Service 19 "Event/Action Service" will be able to monitor all TM(5,1..4) packets

6.5.1 TM (5,1) Normal/Progress Report

TM (5,1) shall be generated to report the normal progress of an on board action that does not relate to a fault condition.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 7 (event)

Table 6-90: TM Packet Header for TM(5,1)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 5
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-91: TM Data Field Header for TM(5,1)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

EID	PARAMETER
Enumerated	Any
2 bytes	[0,4,8] Bytes

Figure 6-21: Source data TM(5,1)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
EID	Event Identifier	See Annex
Parameter	this field provides complementary information about the event. The structure and the length of this field is uniquely identified by the combination of <i>PID</i> , <i>PCAT</i> and <i>EID</i> .	

Table 6-92: Source Data for TM(5,1)

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

This report shall be generated to report the errors or anomalies of low severity.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 7 (event)

Table 6-93: TM Packet Header for TM(5,2)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 5
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-94: TM Data Field Header for TM(5,2)

The structure of the *Source Data* field within the *TM Packet Data Field* is identical with the one defined for TM (5,1) (see Figure 6-22!)

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

This report shall be generated to report the errors or anomalies of medium severity.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 7 (event)

Table 6-95: TM Packet Header for TM(5,3)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 5
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-96: TM Data Field Header for TM(5,3)

The structure of the *Source Data* field within the *TM Packet Data Field* is identical with the one defined for TM (5,1) (see Figure 6-22 !)

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

This report shall be generated to report the errors or anomalies of high severity.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2 .
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 7 (event)

Table 6-97: TM Packet Header for TM(5,4)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 5
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 4

Table 6-98: TM Data Field Header for TM(5,4)

The structure of the *Source Data* field within the *TM Packet Data Field* is identical with the one defined for TM (5,1) (see Figure 6-22!)

6.5.5 TC (5,5): Enable Event Packet Generation

Upon reception of TC (5,5) the Event Packet generation specified by the *EID* number is enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-99: TC Packet Header for TC(5,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 5
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-100: TC Data Field Header for TC(5,5)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

NEID	EID
Enumerated	Enumerated
1 byte	2 byte
	< ----- repeat NEID times ----- >

Figure 6-22: Application data TC(5,5)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
NEID	Number of EID's	1 ... 112
EID	Event Packet Structure Identifier	Any valid EID See Annex.

Table 6-101: Application Data for TC(5,5)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the NEID is not in the specified range
if NEID is inconsistent with the real length of the packet data field
if an EID is invalid

6.5.6 TC (5,6): Disable Event Packet Generation

Upon reception of TC (5,6) the Event Packet generation specified by the EID number is disabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-102: TC Packet Header for TC(5,6)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 5
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-103: TC Data Field Header for TC(5,6)

The structure of the *Application Data field within the TC Packet Data* field is identical with the one defined for TC (5,5).

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the *NEID* is not in the specified range
if *NEID* is inconsistent with the real length of the packet data field
if an *EID* is invalid

6.5.7 TC (5,133) Report Enabled Event Packets

Upon reception of TC (5,133) the report TM (5,134) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-104: TC Packet Header for TC(5,133)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 5
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 133

Table 6-105: TC Data Field Header for TC(5,133)

TC (5,133) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.5.8 TM (5,134) Enabled Event Packets Report

TM (5,134) is the response to TC (5,133).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-106: TM Packet Header for TM(5,134)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 5
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 134

Table 6-107: TM Data Field Header for TM(5,134)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

NEID	EID
Enumerated	Enumerated
2 byte	2 byte
	< ----- repeat NEID times ----- >

Figure 6-23: Source data TM(5,134)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
NEID	Number of EID's following	1 ... 541
EID	Event Packet Structure Identifier	Any valid EID See Annex.

Table 6-108: Source Data for TM(5,134)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfil the request. The bandwidth adjustment mechanism is applicable for this TM.

6.6 Service 6: Memory Management Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(6,1)	TC	Load Memory using Base plus Offsets	
(6,2)	TC	Load Memory using Absolute Addresses	Mandatory
(6,3)	TC	Dump Memory using Base plus Offsets	
(6,4)	TM	Memory Dump using Base plus Offsets Report	
(6,5)	TC	Dump Memory using Absolute Addresses	Mandatory
(6,6)	TM	Memory Dump using Absolute Addresses Report	Mandatory
(6,7)	TC	Check Memory using Base plus Offsets	
(6,8)	TM	Memory Check using Base plus Offsets Report	
(6,9)	TC	Check Memory using Absolute Addresses	Mandatory
(6,10)	TM	Memory Check using Absolute Addresses Report	Mandatory
(6,128)	TC	Copy Memory	

Table 6-109: Service 6 sub-services

Service 6 uses a *Memory ID* to uniquely identify the different memory blocks

The *memory ID* allocation for dedicated units are given in the relevant annexes The selected addressing scheme shall be "Absolute Addresses" throughout the entire service 6.

Memory sizes are counted by so called SAU's (single addressable unit). For all OBC memory ID's the SAU is always 1Byte.

6.6.1 TC (6,2): Load Memory using Absolute Addresses

TC (6,2) shall load any data or code to the memory onboard identified by the relevant parameters of the TC.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-110: TC Packet Header for TC(6,2)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 6
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-111: TC Data Field Header for TC(6,2)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

MEMORY ID	START ADDRESS	LENGTH	DATA
Enumerated	Unsigned integer	Unsigned integer	Variable
2 bytes	4 bytes	2 bytes	

Figure 6-24: Application data TC(6,2)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Memory ID	Identification Number of the on board memory block	Must be set according to a valid memory ID See Annex.
Start Address	Start Address (in Single Addressable Units, with count starting from zero) within the memory block for loading the data	A valid address of the memory addressed by <i>Memory ID</i> .
Length	Length of data block (in Single Addressable Units, with count starting from zero)	Limited by size of TC Application Data field. <i>Note: Start Address + Length must not exceed the physical memory!</i>
Data	The data to be loaded	Data must be arranged in increasing order of SAU.

Table 6-112: Application Data for TC(6,2)

Note: In case the amount of data to be uploaded exceeds the capacity of a TC Source Packet, as many source packets as required shall be generated, each with consistent parameters.

6.6.2 TC (6,5): Dump Memory using Absolute Addresses

TC (6,5) requests a dump of any data or code from the memory onboard identified by the relevant parameters of the TC.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-113: TC Packet Header for TC(6,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 6
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-114: TC Data Field Header for TC(6,5)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

MEMORY ID	START ADDRESS	LENGTH
Enumerated	Unsigned integer	Unsigned integer
2 bytes	4 bytes	2 bytes

Figure 6-25: Application data TC(6,5)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Memory ID	Identification Number of the on board memory block	Must be set according to a valid memory ID See Annex.
Start Address	Start Address (in Single Addressable Units , with count starting from zero) within the memory block for loading the data	A valid address of the memory addressed by <i>Memory ID</i> .
Length	Length of data block (in Single Addressable Units , with count starting from zero)	<u>Note: Start Address + Length - 1 must not exceed the physical memory !</u>

Table 6-115: Application Data for TC(6,5)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,7): TC Execution Completion Report – Success

a TM(1,7) report shall be generated when the last packet of the requested dump has been released

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the *Memory ID* is invalid

if the addressed memory is not accessible (i.e. if *Start Address* + *Length* exceeds the physical memory)

if physical access is not possible (i.e. EEPROM access failed, time out, write protection etc.)

6.6.3 TM (6,6): Memory Dump using Absolute Addresses Report

TM (6,6) is the response to TC (6,5).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 9 (dump)

Table 6-116: TM Packet Header for TM(6,6)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 6
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-117: TM Data Field Header for TM(6,6)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

MEMORY ID	START ADDRESS	LENGTH	DATA
Enumerated	Unsigned integer	Unsigned integer	Variable
2 bytes	4 bytes	2 bytes	

Figure 6-26: Source data TM(6,6)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>Memory ID</i>	Identification Number of the on board memory block	See Annex.
<i>Start Address</i>	Start Address (in Single Addressable Units , with count starting from zero)	Address of the memory addressed by <i>Memory ID</i> .
<i>Length</i>	Length of data block (in Single Addressable Units , with count starting from zero)	The maximum value is limited by size of TM Source Packet. <i>The amount of words to be down-linked within one packet is adjustable by TC(6,128).</i>
<i>Data</i>	dump data	Data are arranged in increasing order of SAU.

Table 6-118: Source Data for TM(6,6)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM

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

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).

The meaning of Length field shall be the same as for the load command TC(6,2).

6.6.4 TC (6,9): Check Memory using Absolute Addresses

TC (6,9) allows for requesting a checksum report.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-119: TC Packet Header for TC(6,9)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 6
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 9

Table 6-120: TC Data Field Header for TC(6,9)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

MEMORY ID	START ADDRESS	LENGTH
Enumerated	Unsigned integer	Unsigned integer
2 bytes	4 bytes	2 bytes

Figure 6-27: Application data TC(6,9)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>Memory ID</i>	Identification Number of the on board memory block	Must be set according to a valid memory ID See Annex.
<i>Start Address</i>	Start Address (in Single Addressable Units , with count starting from zero)	A valid address of the memory addressed by <i>Memory ID</i> .
<i>Length</i>	Length of data block (in Single Addressable Units , with count starting from zero)	<i>Note: Start Address + Length - 1 must not exceed the physical memory !</i>

Table 6-121: Application Data for TC(6,9)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the *Memory ID* is invalid

if the addressed memory is not accessible (i.e. if *Start Address* + *Length exceeds* the physical memory)

if physical access is not possible (i.e. EEPROM access failed, time out, write protection etc.)

6.6.5 TM (6,10): Memory Check using Absolute Addresses Report

TM (6,10) is the response to TC (6,9).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (Table)

Table 6-122: TM Packet Header for TM(6,10)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 6
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 10

Table 6-123: TM Data Field Header for TM(6,10)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

MEMORY ID	START ADDRESS	LENGTH	CHECKSUM
Enumerated	Unsigned integer	Unsigned integer	Fixed Bit-string
2 bytes	4 bytes	2 bytes	16 bit

Figure 6-28: Source data TM(6,10)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
Memory ID	Identification Number of the on board memory block	See Annex.
Start Address	Start Address (in Single Addressable Units, with count starting from zero)	Address of the memory addressed by <i>Memory ID</i> .
Length	Length of data block (in Single Addressable Units, with count starting from zero)	Limited by size of TM Source Packet.
Checksum	CRC 16 bit checksum (see Error! Reference source not found. annex A.2)	

Table 6-124: Source Data for TM(6,10)

6.6.6 TC (6,128): Copy Memory

TC (6,128) copies the specified number of words from a *Source Memory ID* to a *Destination Memory ID*.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-125: TC Packet Header for TC(6,128)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 6
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 128

Table 6-126: TC Data Field Header for TC(6,128)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

SOURCE MEMORY ID	SOURCE START ADDRESS	DESTINATION MEMORY ID	DESTINATION START ADDRESS	LENGTH
Enumerated	Unsigned integer	Enumerated	Unsigned integer	Unsigned integer
2 bytes	4 bytes	2 bytes	4 bytes	2 bytes

Figure 6-29: Application data TC(6,128)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Source Memory ID	Identification Number of the on board memory block from which the data shall be copied	Must be set according to a valid memory See Annex.
Source Start Address	Start Address (in Single Addressable Units , with count starting from zero)	A valid address of the memory addressed by <i>Memory ID</i> .
Destination Memory ID	Identification Number of the on board memory block to which the data shall be copied	Must be set according to a valid memory ID (see Annex)
Destination Start Address	Start Address (in Single Addressable Units , with count starting from zero)	A valid address of the memory addressed by <i>Memory ID</i> .
Length	Length (in Single Addressable Units , with count starting from zero) of data block to be copied	<i>Note: Start Address + Length - 1 must not exceed the physical memory !</i>

Table 6-127: Application Data for TC(6,129)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,7): TC Execution Completion Report – Success

a TM(1,7) report shall be generated when all data have been copied from source to destination.

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the *Source Memory ID* is invalid

if the *Destination Memory ID* is invalid

if the addressed memory is not accessible (i.e. if *Start Address + Length exceeds* the physical memory)

if physical access is not possible (i.e. EEPROM access failed, time out, write protection etc.)

6.7 Service 8: Function Management Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(8,1)	TC	Perform Function	Mandatory
(8,128)	TC	Enable Function Execution	
(8,129)	TC	Disable Function Execution	
(8,130)	TC	Enable Function Arming	
(8,131)	TC	Disable Function Arming	
(8,132)	TC	Report Function Status	
(8,133)	TM	Function Status Report	

Table 6-128: Service 8 sub-services

6.7.1 TC (8,1): Perform Function

TC (8,1) performs the function with the specified *Function ID* if their execution is allowed. i.e. the current status is “enabled”.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-129: TC Packet Header for TC(8,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 8
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-130: TC Data Field Header for TC(8,1)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

FUNCTION ID	PARAMETER
Enumerated	Any
1 byte	Optional

Figure 6-30: Application data TC(8,1)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>Function ID</i>	Identification number of the function to be activated	See Annex.
<i>Parameter</i>	Parameter relating to the function to be performed	

Table 6-131: Application Data for TC(8,1)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the *Function ID* is invalid
if the execution status of the function is set to “disabled”

6.7.2 TC (8,128): Enable Function Execution

TC (8,128) sets the *execution status* of the function identified by *Function ID* to “Enabled”.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-132: TC Packet Header for TC(8,128)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 8
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 128

Table 6-133: TC Data Field Header for TC(8,128)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N	FUNCTION ID
Unsigned integer	Enumerated
1 byte	1 byte
	< ----- repeat N times ----- >

Figure 6-31: Application data TC(8,128)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Number of function status values to be set	N=0: All functions status values shall be set
Function ID	Identification number of the Function	See Annex.

Table 6-134: Application Data for TC(8,128)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed
if *N* is not consistent with the number of supplied parameters
if one of the *Function ID*'s is invalid

6.7.3 TC (8,129): Disable Function Execution

TC (8,129) sets the *execution status* of the function identified by *Function ID* to "Disabled".

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-135: TC Packet Header for TC(8,129)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 8
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 129

Table 6-136: TC Data Field Header for TC(8,129)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (8,128). (see Figure 6-32)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if *N* is not consistent with the number of supplied parameters

if one of the *Function ID*'s is invalid

6.7.4 TC (8,130): Enable Function Arming

TC (8,130) sets the *arming status* of the function identified by *Function ID* to "Arming 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.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-137: TC Packet Header for TC(8,130)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 8
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 130

Table 6-138: TC Data Field Header for TC(8,131)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (8,128). (see Figure 6-32!)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if *N* is not consistent with the number of supplied parameters

if one of the *Function ID*'s is invalid

6.7.5 TC (8,131): Disable Function Arming

TC (8,131) sets the *arming status* of the function identified by *Function ID* to "Arming disabled". The *execution status* is unaffected. With "Arming disabled" the *execution status* remains statically at the value set by TC(8,128) and TC(8,129), regardless whether the function has been executed or not.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-139: TC Packet Header for TC(8,131)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 8
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 131

Table 6-140: TC Data Field Header for TC(8,131)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (8,128). (see [Figure 6-32!](#))

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if *N* is not consistent with the number of supplied parameters

if one of the *Function ID*'s is invalid

6.7.6 TC (8,132): Report Function Status

TC (8,129) requests the Function Status Report TM(8,133).

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-141: TC Packet Header for TC(8,132)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 8
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 132

Table 6-142: TC Data Field Header for TC(8,132)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (8,128). (see [Figure 6-32!](#))

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if *N* is not consistent with the number of supplied parameters

if one of the *Function ID*'s is invalid
if the request could not be completed

6.7.7 TM (8,133) Function Status Report

TM (8,133) is the response to TC (8,132).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-143: TM Packet Header for TM(8,133)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 8
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 133

Table 6-144: TM Data Field Header for TM(8,133)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N	FUNCTION ID	FILLER	EXECUTION STATUS	FILLER	ARMING STATUS
Unsigned Integer	Enumerated		Boolean		Boolean
1 byte	1 byte	7 bit	1 bit	7 bit	1 bit
< ----- repeat N times ----- >					

Figure 6-32: Source data TM(8,133)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>N</i>	Number of <i>Function IDs</i> to follow	1 .. MAX
<i>Function ID</i>	Identification number of the Function	See Annex.
<i>Execution Status</i>	Defines whether the execution of the function is enabled or disabled	0 = Disabled 1 = Enabled
<i>Arming Status</i>	Defines whether the arming mechanism of the function is enabled or disabled	0 = Disabled 1 = Enabled

Table 6-145: Source Data for TM(8,133)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.8 Service 9: Time Management Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(9,1)	TC	Change Time Report Generation Rate	mandatory
(9,2)	TM	Time Report	mandatory
(9,128)	TC	Time Synchronization of payload applications	
(9,129)	TC	Set absolute OBC time	
(9,130)	TC	Enable Synchronization of GPS / OBC time	
(9,131)	TC	Disable Synchronization of GPS / OBC time	
(9,132)	TC	Trigger Time Synchronization	


Table 6-146: Service 9 sub-services



EC / S2 will derive its OBT automatically from the GPS unit, provided it is active.
In case the GPS is inactive, the on board time is maintained by an independent clock unit.

Reporting of Onboard Time:

The standard Time Report subservice TM(9,2) provides the capability for the generation of Time Reports, such that the satellite time correlation procedures in the ground segment can be performed. The TM(9,2) packet does not have a data field header.

The service has access to a *SCET* timer residing on the TM board of the OBC. With the occurrence of  leading edge of the first bit of the synchronization marker of every VC-0 telemetry transfer frame with frame counter 0x00, this timer is latched.

service acquires the latch counter value using a polling mechanism. Whenever the latched SCET has changed the actual counter value and the current OBT is read. The delta time between latched SCET and current counter value is subtracted from the OBT value in order to derive the OBT when VC-0 transfer frame with frame counter 0x00 has been generated. The service then downlinks the satellite time reference in a spacecraft time source packet at any time before the satellite time reference is next sample.

Calculation of Time Period between two TM(9,2) packets:

The s-band downlink data rate is 32 Kbps = 4000 bytes / sec
the length of a VC0 transfer frame is 1115 bytes
thus appr. 3.59 VC0 frames are generated in one second in average, which means that a TM(9,2) will be generated with a period of 71.03secs.

Time Synchronization concept:

The OBC maintains a 1Hz pulse which is distributed to instrument and payload units like SSMM, ICU and LCT. Each unit maintains its own counter which is synchronized by this pulse, in order to derive its fractions of one second.

The GPS, if operable, provides also a 1PPS signal with much higher accuracy than the OBC. If the ground enables synchronization, TC(9,130), the OBC starts checking stability of the 1Hz pulse sent by the GPS as well as the consistency of the GPS time provided in the GPS Telemetry. Once it is found stable the OBC takes the current GPS as On-board Time (OBT) and keeps checking the stability of the 1Hz clock.

If the GPS 1PPS is instable or the GPS is found inoperable, the OBC maintains the 1 Hz pulse output to the payload unit based on its own clock again.

If synchronization to the GPS 1 PPS is enabled and the GPS becomes stable again the OBC will start a next synchronization cycle autonomously.

Synchronization of the instrument and payload units is initiated by subservice TC (9,132). Synchronization of the instrument or payload unit can either be commanded from ground or as part of an autonomous reaction on an event. Upon reception of TC (9,132) the OBC on-board SW triggers sending of TC(9,128) to payload applications (ICU, SSMM, ACU, LCT) in order to distribute the On-board Time (OBT), which is valid at the next 1 Hz Pulse to these units.

TC(9,128) is issued on any Time Status change:

PPS source change (GPS/OBC)

Synchronisation ENABLED/DISABLED

E format change SCET/OBT

TC(9,128) will carry the On-board Time (GPS/SCET) of the very next SYNC pulse as parameter.

e: at OBC boot time the timer is running on SCET, this will change to OBT if a valid GPS time or TC(9,129) has been received by the application software.

Note: The above is for information only and may be deleted in a further issue of this document.

6.8.1 TM (9, 2): Time Report

TM (9,2) is used to report the spacecraft time to the ground, which is correlated to the last VC0 TM frame with frame counter 0.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETER	DESCRIPTION	RANGE OR VALUE
Data Field Header Flag	Indicates the presence of a data field header (when set to 1)	Must be set to 0
PID	Process ID (part of the APID)	Must be set to 0
PCAT	Packet category	Must be set to 0
Packet Length	Number of bytes contained in the packet data field minus 1	Must be set to 8

Table 6-147: TM Packet Header for TM(9,2)

SATELLITE TIME		TSTATUS	ORBIT POSITION		OPSSSTATUS
Integer Second	Sub-seconds		Orbit Number	Orbit Angle	
Unsigned integer	Unsigned integer	Deduced	Unsigned integer	Unsigned integer	Deduced
4 bytes	2 bytes	1 byte	4 bytes	2 bytes	1 byte

Figure 6-33: Source data TM(9,2)

The parameters of the *Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
Integer Second	GPS Time or SCET	In range 0 .. $2^{32} - 1$
Subseconds	Fine Time LSB = 1/65536 sec	In range 0 .. 65535
TStatus	This shall give the status of the time reporting sub-service, i.e. current PPS source and wither synchronization is enabled	Bit 0 : ... Sync. Source 0 = internal; 1 = external Bit 1 : ... Sync. Source Detail 0 = 1Hz Pulse; 1 = MIL-Bus Bit 2 : ... Time Format 0 = SCET; 1 = OBT Bit 3 : ...Synchronization Enabled/Disabled 0 = Disabled; 1 = Enabled
Orbit Number	Number of orbit. The orbit number is increased at each ascending equator crossing	In range 0 .. $2^{32} - 1$
Orbit Angle	Orbit Angle	The angle in [radians] x 10000.
OPSSStatus		

Table 6-148: Source Data for TM(9,2)

Note:

satellite time in SpaceCraft Elapsed Time (SCET) time format starts at 0 at separation from the launcher when primary power is provided to the OBC and is maintained incrementing throughout the whole satellite life. Neither warm-boot nor cold-boot nor reconfiguration of the OBC resets the satellite time in SCET time format.

The satellite time in On-board Time (OBT) time format is referenced to 00:00:00 UT on January 6th, 1980.

6.8.2 TC (9, 128): Time Synchronization of payload applications

TC (9,128) allows synchronize the onboard time of the payload applications (SSMM1, SSMM2, ICU1, ICU2,LCT) time with the OBC time.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-149: TC Packet Header for TC(9,128)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 9
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 128

Table 6-150: TC Data Field Header for TC(9,128)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

SATELLITE TIME		STATUS
Integer Second	Sub-seconds	
Unsigned integer	Unsigned integer	Deduced
4 bytes	2 bytes	1 byte

Figure 6-34: Application data TC(9,128)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Integer Second	GPS Time or SCET of next SYNC pulse	In range 0 .. $2^{32} - 1$
Subseconds	Fine Time LSB = 1/65536 sec	In range 0 .. 65535
Status	This shall give the status of the time reporting sub-service, i.e. current PPS source and wither synchronization is enabled	Bit 0 : ... PPS Source 0 = GPS; 1 = OBC Bit 1 : ... Time Format 0 = SCET; 1 = OBT Bit 2 : ...Synchronisation Enabled/Disabled 0 = Disabled; 1 = Enabled

Table 6-151: Application Data for TC(9,128)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the addressed unit (i.e. SSMM, ICU) is not accessible from OBC (i.e. interface time out, link problem)

6.8.3 TC (9,129): Set absolute OBC time



TC (9,129) is used to set the OBC time to an absolute value.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-152: TC Packet Header for TC(9,129)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 9
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 129

Table 6-153: TC Data Field Header for TC(9,129)



The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

SATELLITE TIME	
Integer Second	Sub-seconds
Unsigned integer	Unsigned integer
4 bytes	2 bytes

Figure 6-35: Application data TC(9,129)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Integer Second	GPS Time or SCET	In range $0 \dots 2^{32} - 1$
Subseconds	Fine Time LSB = 1/65536 sec	Shall be set to zero

Table 6-154: Application Data for TC(9,129)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.8.4 TC (9,130): Enable Synchronization of GPS / OBC time

Upon reception of TC (9,130) the OBC SW will start permanently synchronizing the OBC time with the time received from the GPS receiver. The 1 Hz cycle and the 1 Hz clock output will be synchronized as well.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-155: TC Packet Header for TC(9,130)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 9
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 130

Table 6-156: TC Data Field Header for TC(9,130)

TC (9,130) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.8.5 TC (9,131): Disable Synchronization of GPS / OBC time

Upon reception of TC(9,131) the OBC SW will stop permanently synchronizing the OBC time with the time received from the GPS receiver.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-157: TC Packet Header for TC(9,131)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 9
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 131

Table 6-158: TC Data Field Header for TC(9,131)

TC (9,131) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.8.6 TC (9,132): Trigger Time Synchronisation

Upon reception of TC (9,132) the OBC SW generate and distribute TC(9,128) to external units.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-159: TC Packet Header for TC(9,132)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 9
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 132

Table 6-160: TC Data Field Header for TC(9,132)

TC (9,132) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.9 Service 11: On Board Operations Scheduling

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(11,1)	TC	Enable Release of Telecommands	mandatory
(11,2)	TC	Disable Release of Telecommands	mandatory
(11,3)	TC	Reset Command Schedule	mandatory
(11,4)	TC	Insert Telecommands in Command Schedule	mandatory
(11,5)	TC	Delete Telecommands	mandatory
(11,6)	TC	Delete Telecommands over Time Period	mandatory
(11,7)	TC	Time-Shift selected Telecommands	
(11,8)	TC	Time-Shift selected Telecommands over Time Period	
(11,9)	TC	Report Subset of Command Schedule in Detailed Form	mandatory
(11,10)	TM	Detailed Schedule Report	mandatory
(11,11)	TC	Report Command Schedule in Detailed Form over Time Period	mandatory
(11,12)	TC	Report Subset of Command Schedule in Summary Form	mandatory
(11,13)	TM	Summary Schedule Report	mandatory
(11,14)	TC	Report Subset of Command Schedule in Summary Form over Time Period	mandatory
(11,15)	TC	Time Shift all Telecommands	
(11,16)	TC	Report Command Schedule in Detailed Form	mandatory
(11,17)	TC	Report Command Schedule in Summary Form	mandatory
(11,18)	TC	Report Status of Command Schedule	mandatory
(11,19)	TM	Command Schedule Status Report	mandatory

Table 6-161: Service 11 sub-services

6.9.1 TC (11,1): Enable Release of Telecommands

TC (11,1) is used to enable the release of Telecommands..

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-162: TC Packet Header for TC(11,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-163: TC Data Field Header for TC(11,1)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N1	SUB-SCHEDULE ID	N2	FILLER	PID
Unsigned	Enumerated	Unsigned	Bool	Enumerated
1 byte	1 byte	1 byte	1bit	7bits
		< ---- repeat N2 times ---->		
	< ---- repeat N1 times ---->			

Figure 6-36: Application data TC(11,1)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Number of sub-schedule / PID combinations to follow	N1 = 0, the command will effect the schedule control bit. N1 > 0, N2 = 0 the command will effect the application level controlling attribute of the telecommands with the specified sub-schedule ID
Sub-schedule ID	The identification of the sub-schedule(s) to be enabled or disabled.	By convention, the value 0 for Sub-schedule ID shall mean "all sub-schedules".
N2	Number of PID combinations to follow	If N1 > 0 and N2 > 0, the application process level controlling attribute of the telecommands with the specified destination application processes and with the specified sub-schedules shall be set according to the request type.
PID	Process ID	Must be set to a value according table 6.1 (Annex A)

Table 6-164: Application Data for TC(11,1)

Release Status:

SCHEDULE	SUB-SCHEDULE	APID	RELEASE STATUS
D(isabled)	E(nabled)	E	D
D	D	E	D
D	E	D	D
D	D	D	D
E	E	E	E
E	D	E	D
E	E	D	D
E	D	D	D

Table 6-165: Release status decision table

If TC is due to be executed, but the release status is “disabled” the TC shall be removed from the command schedule.

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the Number of APID

6.9.2 TC (11,2): Disable Release of Telecommands

TC (11,1) is used to disable the release of Telecommands..

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-166: TC Packet Header for TC(11,2)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-167: TC Data Field Header for TC(11,2)

The structure of the *Application Data field within the TC Packet Data* field is identical with the one defined for TC (11,1).

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the Number of APID

6.9.3 TC (11,3): Reset Command Schedule

Upon reception of TC (11,3) the service provider shall reset the command schedule as follows:
It shall clear all entries in the command schedule. The command schedule shall be disabled and commanding to all application processes shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-168: TC Packet Header for TC(11,3)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-169: TC Data Field Header for TC(11,3)

TC (11,3) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.9.4 TC (11,4): Insert Telecommands in Command Schedule

Upon reception of TC (11,4) the TC specified by the field Telecommand Packet is inserted in the command schedule. TC's in the command schedule are reordered with increasing time tag. TC's with identical time tag are sorted in the sequence they are received. The resolution of the Time Tags is given by the format of the spacecraft time. However, the execution accuracy of the TC's might be less than the Time Tag resolution itself.

Note: TC Packet Header and TC Packet Data Field may be stored separately in order to minimise CPU time for reordering the command schedule.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-170: TC Packet Header for TC(11,4)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 4

Table 6-171: TC Data Field Header for TC(11,4)

SUB-SCHEDULE ID	N	TIME TAG	TC PACKET
Unsigned Integer	Unsigned Integer	Satellite Time (see chapter 6.8)	Any
1 bytes	1 bytes	6 bytes	Variable Min: 12 bytes Max: 219 bytes
< ----- repeat N times ----- >			

Figure 6-37: Application data TC(11,4)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Sub-schedule ID	The identification of the sub-schedule(s) to be enabled or disabled.	1 ... 255
N	Number of Telecommands to be inserted in the schedule	1 ... 18
Time Tag	Absolute release time for the TC	Any valid spacecraft time
TC packet	Complete TC packet	Any TC packet except TC (11,4)

Table 6-172: Application Data for TC(11,4)

Note: Since the Maximum size of the Application Data field is limited to 226 bytes, the TC packet size for commands to be inserted into the MTL can not be larger than $226 - TT - N = 219$ bytes.

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of TC packets

if the Time Tag is already in past

Note: Time Tags later than $OBT + 5\text{secs}$ are considered as past.

if the command could not inserted in the command schedule (no free control structures available)

if the command could not inserted in the command schedule (no free TC buffer available)

if the TC to be inserted is TC(11,4) and/or if the Source of the TC to be inserted is not GROUND

6.9.5 TC (11,5): Delete Telecommands

Upon reception of TC (11,5) all TC's which satisfy the selection criteria defined by the PID, Sequence Count and the Number of TC's shall be deleted.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-173: TC Packet Header for TC(11,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-174: TC Data Field Header for TC(11,5)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

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 ---->					

Figure 6-38: Application data TC(11,5)

Note: Destination PID and Sequence Number correspond to the Packet Header Definition in chapter 3.3 .

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>N</i>	Number of TC areas to be deleted ("scattered delete")	1 ... 56
<i>PID</i>	Destination PID of the TC to be deleted	Must be set to a value according table 6.1 (Annex A) Value is a copy of the corresponding field of the TC Packet Header of the TC's to be deleted from the command schedule
<i>Sequence Count</i>	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
<i>Number of TC's</i>	Number of successive TC's to be deleted	Minimum value = 1, maximum value = all TC's in the command schedule with the specified <i>PID</i> and a <i>Sequence Count</i> value greater than the specified one.

Table 6-175: Application Data for TC(11,5)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if *N* is not consistent to the number of supplied parameter sets

if the 1st TC to be deleted is not found in the command schedule. (for one parameter set)

Note: If the Number of Telecommands exceeds the total number of commands that satisfy the selection criteria, then all commands that satisfy the selection criteria shall be deleted.

6.9.6 TC (11,6): Delete Telecommands over Time Period

Upon reception of TC (11,6) the TC's specified shall be removed from the command schedule. TC's in the command schedule are reordered with increasing time tag.

Note: TC Packet Header and TC Packet Data Field may be stored separately in order to minimise CPU time for reordering the command schedule.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-176: TC Packet Header for TC(11,6)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-177: TC Data Field Header for TC(11,6)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

RANGE	TIME TAG 1	TIME TAG 2	N1	SUB-SCHEDULE ID	N2	FILLER	PID
Enumerated	Satellite Time (see chapter 6.8)	Satellite Time (see chapter 6.8)	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 ----->			

Figure 6-39: Application data TC(11,6)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Range	Parameter for interpretation of the 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	A valid time
N1	Number of Sub-schedules follow	N1 = 0 ... All sub-schedules shall be affected N1 > 0 ... Only selected sub-schedules shall be affected
Sub-schedule ID	The identification of the sub-schedule(s)	
N2	Number of PID combinations to follow	If N1 > 0 and N2 > 0, the application process level controlling attribute of the telecommands with the specified destination application processes and with the specified sub-schedules shall be set according to the request type.
PID	Process ID	Must be set to a value according table 6.1 (Annex A)

Table 6-178: Application Data for TC(11,6)

The meaning and presence of the Time Tag parameters is according following table.

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

Table 6-179: Time Tag Parameters

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if Range is not valid

if N is not consistent to the number of supplied PID parameters

6.9.7 TC (11,9): Report Subset of Command Schedule in Detailed Form

Upon reception of TC (11,9) the report TM (11,10) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-180: TC Packet Header for TC(11,9)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 9

Table 6-181: TC Data Field Header for TC(11,9)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

<i>N</i>	<i>FILLER</i>	<i>PID</i>	<i>FILLER</i>	<i>SEQUENCE COUNT</i>	<i>NUMBER OF TC's</i>
Unsigned integer		Enumerated		Unsigned integer	Unsigned integer
1 byte	1 bit	7 bits	2 bits	14 bits	1 byte
< ---- repeat <i>N</i> times ---->					

Figure 6-40: Application data TC(11,9)

Note: Destination PID and Sequence Number correspond to the Packet Header Definition in chapter 3.3 .

The parameters of the Application Data field are to be inserted according to the following table.

<i>PARAMETERS OF APPLICATION DATA FIELD</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
<i>N</i>	Number of TC areas to be reported ("scattered report")	1 ... 56
<i>PID</i>	Destination PID of the TC to be reported	Must be set to a value according table 6.1 (Annex A) Value is a copy of the corresponding field of the TC Packet Header of the TC's to be reported from the command schedule
<i>Sequence Count</i>	The sequence number of the first TC to be reported	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 reported from the command schedule
<i>Number of TC's</i>	Number of successive TC's to be reported	Minimum value = 1, maximum value = all TC's in the command schedule with the specified <i>PID</i> and a <i>Sequence Number</i> value greater than the specified one.

Table 6-182: Application Data for TC(11,9)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if *N* is not consistent to the number of supplied parameter sets

if the 1st TC to be reported is not found in the command schedule. (for one parameter set)

if the request could not be completed

6.9.8 TM (11,10): Detailed Schedule Report

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

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

<i>PARAMETERS OF TM PACKET HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-183: TM Packet Header for TM(11,10)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 10

Table 6-184: TM Data Field Header for TM(11,10)

N	SUB-SCHEDULE ID	TIME TAG	TC PACKET
Unsigned Integer	Enumerated	Satellite Time (see chapter 6.8)	Any
2 bytes	1 byte	6 bytes	Min: 12 bytes Max: 219 bytes
< ---- repeat N times ---->			

Figure 6-41: Source data TM(11,10)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Number of <i>Time Tag</i> + <i>TC Packets</i> to follow	1 ... 90
Sub-schedule ID	The identification of the sub-schedule	
Time Tag	Absolute release time for the TC	Copy of the time tag of the TC in the command schedule
TC Packet	Raw data of the complete TC	Copy of the TC in the command schedule

Table 6-185: Source Data for TM(11,10)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.9.9 TC(11,11): Report Command Schedule in Detailed Form over Time Period

Upon reception of TC (11,11) the report TM (11,10) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-186: TC Packet Header for TC(11,11)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 11

Table 6-187: TC Data Field Header for TC(11,11)

RANGE	TIME TAG 1	TIME TAG 2	N1	SUB-SCHEDULE ID	N2	FILLER	PID
Enumerated	Satellite Time (see chapter 6.8)	Satellite Time (see chapter 6.8)	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 ---->			

Figure 6-42: Application data TC(11,11)

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Range	Parameter for interpretation of the period given by Time Tags	Range = 0: complete command schedule Range = 1: report between time tags Range = 2: report before Time Tag 1 Range = 3: report after Time Tag 1
Time Tag 1 & 2	Absolute Satellite Time	A valid time
N1	Number of PID's which follow	N1 = 0 ... All TC's are reported N1 > 0 ... those TC's which belong to a specified sub-schedule
Sub-schedule ID	The identification of the sub-schedule	
N2	Number of PID's which follow	If N1 > 0 and N2 > 0, those TC's which have a specified PID and belong to a specified sub-schedule
PID	Process ID	Must be set to a value according table 6.1 (Annex A)

Table 6-188: Application Data for TC(11,11)

The meaning and presence of the Time Tag parameters is according following table.

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

Table 6-189: Time Tag Parameters

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of supplied parameter sets

if Range is invalid

if the request could not be completed

6.9.10 TC (11,12): Report Subset of Command Schedule in Summary Form

Upon reception of TC (11,12) the report TM (11,13) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-190: TC Packet Header for TC(11,12)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 12

Table 6-191: TC Data Field Header for TC(11,12)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (11,9). (see [Figure 6-40!](#))

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of supplied parameter sets

if the 1st TC to be reported is not found in the command schedule. (for one parameter set)

if the request could not be completed

6.9.11 TM (11,13): Summary Schedule Report

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

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-192: TM Packet Header for TM(11,13)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 13

Table 6-193: TM Data Field Header for TM(11,13)

N	SUB-SCHEDULE ID	TIME TAG	FILLER	PID	FILLER	SEQUENCE COUNT
Unsigned integer	Enumerated	Satellite Time (see chapter 6.8)		Enumerated		Unsigned integer
2 bytes	1 byte	6 bytes	1 bit	7 bits	2 bits	14 bits
< ----- Repeat N times ----- >						

Figure 6-43: Source data TM(11,13)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Repetition count for following fields	Number of TC's reported in this TM Source Packet
Sub-schedule ID	The identification of the sub-schedule	
Time Tag		Copy of the time tag of the TC as in the command schedule
PID	PID of the TC	Must be set to a value according table 6.1 (Annex A), value is a copy of the corresponding field of the TC Packet Header.
Sequence Count	The sequence number of the first TC to be deleted	Sequence Count, value is a copy of the corresponding field of the TC Packet Header of the TC

Table 6-194: Source Data for TM(11,13)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

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

Upon reception of TC (11,14) the report TM (11,13) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-195: TC Packet Header for TC(11,14)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 14

Table 6-196: TC Data Field Header for TC(11,14)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (11,6). (see [Figure 6-42: Application data TC\(11,11\)](#))

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed
TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if N is not consistent to the number of supplied parameter sets
if Range is invalid
if the request could not be completed

6.9.13 TC (11,16): Report Command Schedule in Detailed Form

Upon reception of TC (11,16) the report TM (11,10) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-197: TC Packet Header for TC(11,16)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 16

Table 6-198: TC Data Field Header for TC(11,16)

TC (11,16) 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:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed
TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the request could not be completed

6.9.14 TC (11,17): Report Command Schedule in Summary Form

Upon reception of TC (11,17) TM (11,13) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-199: TC Packet Header for TC(11,17)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 17

Table 6-200: TC Data Field Header for TC(11,17)

TC (11,17) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.9.15 TC (11,18): Report Status of Command Schedule

Upon reception of TC (11,18) TM (11,19) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-201: TC Packet Header for TC(11,18)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 18

Table 6-202: TC Data Field Header for TC(11,18)

TC (11,18) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.9.16 TM (11,19): Command Schedule Status Report

TM (11,19) is the response to TC (11,18).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-203: TM Packet Header for TM(11,19)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 11
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 19

Table 6-204: TM Data Field Header for TM(11,19)

<i>N1</i>	<i>SUB-SCHEDULE ID</i>	<i>STATUS</i>	<i>N2</i>	<i>FILLER</i>	<i>PID</i>	<i>STATUS</i>
Unsigned integer	Enumerated	Enumerated	Unsigned integer		Enumerated	Enumerated
1 bytes	1 byte	8 bit	1 bytes	1 bit	7 bits	8 bit
				< ----- Repeat N2 times ----- >		
< ----- Repeat N1 times ----- >						

Figure 6-44: Source data TM(11,19)

The parameters of the *Source Data* field are to be inserted according to the following table.

<i>PARAMETERS OF SOURCE DATA FIELD</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
<i>N1</i>	Repetition count for following fields	Number of TC's reported in this TM Source Packet
<i>Sub-schedule ID</i>	The identification of the sub-schedule	
<i>Status</i>	The status of the corresponding <i>sub-schedule</i>	0... disabled 1... enabled
<i>N2</i>	Number of PID's to follow	
<i>PID</i>	PID of the TC	Must be set to a value according table 6.1 (Annex A), value is a copy of the corresponding field of the TC Packet Header.
<i>Status</i>	The status of the corresponding <i>PID</i>	0... disabled 1... enabled

Table 6-205: Source Data for TM(11,19)

6.10 Service 12: On Board Parameter Monitoring

<i>SERVICE, SUBSERVICE</i>	<i>TM/TC</i>	<i>DESCRIPTION</i>	<i>APPLICABILITY</i>
(12,1)	TC	Enable Monitoring of Parameters	mandatory
(12,2)	TC	Disable Monitoring of Parameters	mandatory
(12,3)	TC	Change Maximum Reporting Delay	mandatory
(12,4)	TC	Clear Monitoring List	mandatory
(12,5)	TC	Add Parameters to Monitoring List	mandatory
(12,6)	TC	Delete Parameters from Monitoring List	mandatory
(12,7)	TC	Modify Parameter Checking Information	
(12,8)	TC	Report Current Monitoring List	mandatory
(12,9)	TM	Current Monitoring List Report	mandatory
(12,10)	TC	Report Current Parameters Out-of-limit List	mandatory
(12,11)	TM	Current Parameters Out-of-limit List Report	mandatory
(12,12)	TM	Check Transition Report	mandatory

Table 6-206: Service 12 sub-services

Note: This service will only support Limit checks and Expected value checks. It will not support Delta checks. Only one check definition of a certain type is supported per parameter.

Scope:

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. When an error is repeated for a configurable number of consecutive times the monitor reports, via a specified event packet. To achieve this, the Service maintains a parameter monitoring list and checks parameters according to the information contained therein.

Service Concept:

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:

- enable or disable the monitoring checks of parameters in the Monitoring List;
- clear the Monitoring List;
- modify the monitoring check information of parameters in the Monitoring List;
- add parameters to, or delete parameters from, the Monitoring List;
- report the monitoring check information for all parameters in the Monitoring List;
- report the set of checks which are currently out-of-limits.

The Monitoring List:

The Onboard Monitoring Service maintains static monitoring check information for each parameter to be monitored, which is provided by the ground by means of Service Requests.

The parameter monitoring check information specifies:

- the definition of a monitoring check ID
- the definition of the monitoring check of a parameter;
- whether the monitoring check of the parameter is enabled or disabled;
- the monitoring check interval for the parameter,

A check definition provides the information required to check a sample of the parameter against either one pair of limits, one expected value. More than one check definition may be associated with a given parameter.

Thus, a check definition indicates:

the nature of the check to be performed. This can be a Limit-check or an Expected-value check. For a Limit-check, a low-limit value and a high-limit value are specified. For an Expected-value-check, an expected value is specified.

a "repetition count". For a limit-check or an expected-value-check, this indicates the number of successive samples of the parameter which must fail (or succeed) the check in order to establish a new **checking status** for the parameter.

The Checking Activity and the Check State:

The Onboard Parameter Monitoring Service maintains a **check state** corresponding to each check definition for each parameter to be monitored.

The check state includes information about the previous and current checking statuses of the parameter for the given check definition (see check filter above) and the time at which the transition to that checking status occurred. This information is downlinked when the ground requests a report of the checks which currently report an out-of-limit condition.

A check definition is "**enabled**" and used for checking a parameter when the monitoring of the parameter is enabled.

Otherwise the check definition is "**disabled**" and is not used for checking the parameter.

By default, the initial checking status of a parameter with respect to the check definition is “Unchecked” when the parameter is added to the monitoring list or if a new check definition for the parameter is added at a later time.

Cyclically, the Service performs the following checking activity independently for each parameter check definition (and updates its check state accordingly):
if the check definition is “disabled” then the new checking status immediately becomes “**Unchecked**”,
if the check definition is “enabled” then the parameter sample is a valid sample for checking. It is checked against the limit pair or expected value.

For a limit-check or expected-value-check, if the last <REP> successive samples of the parameter (including the current one) have consistently failed (or consistently passed) the check, then the parameter is assigned a new checking status. The new checking status is equal to the result of the check of the current sample i.e. either ‘Below low limit’, ‘Above high limit’, ‘Within limits’, ‘Unexpected value’ or ‘Expected value’

Following rules shall be implemented for the following special out-of-limit scenarios:

If the current checking status is NOT “Within Limits” (for example, “Above high limit”) then a sequence which exceeds the number of repetitions limit, of consecutive samples of the other “out of limit” (in the example “Below low limit”) is needed before a new checking status shall be assigned having elaborated a new checking status for the parameter, a comparison between the previous and new checking statuses is performed. If they differ, then a check transition is recorded (conceptually this is recorded in a Transition Reporting List, see below).

When a check transition is detected, the transition time is recorded in the corresponding check state. This is the sampling time of the first parameter sample which was used to establish the new checking status and the specified event out-of-limit report is issued.
The current checking statuses and associated transition times may be reported to the ground on request.

Note: The following proposed concept deviates from PUS !!

6.10.1 TC (12,1): Enable Monitoring of Parameters

Upon reception of TC (12,1) the monitoring of the specified parameters shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-207: TC Packet Header for TC(12,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-208: TC Data Field Header for TC(12,1)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

<i>N</i>	MONITORING ID
Unsigned integer	Unsigned Integer
1 bytes	1 byte
	< ----- repeat <i>N</i> times ----- >

Figure 6-45: Application data TC(12,1)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>N</i>	Number of parameter ID's following	0 .. 225 <i>N</i> = 0: The monitoring status on service level shall be set to "ENABLED/DISABLED" <i>N</i> > 0: Each parameter in the request shall be processed in turn and its parameter level monitoring status shall be set to "ENABLED/DISABLED"
<i>Monitoring Id</i>	Identification of a monitoring control table entry	1 ... 255

Table 6-209: Application Data for TC(12,1)

*Note: For TC (12,1) with *N* = 0 the monitoring service shall be enabled at service level. In this case, the monitoring service shall start to monitor all parameters with individual monitoring status being set to "enable". It shall not change the individual monitoring status of parameters..*

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the *Monitoring Id* is not valid / in range

if *N* does not correspond to the number of supplied *Monitoring Id*'s

6.10.2 TC (12,2): Disable Monitoring of Parameters

Upon reception of TC (12,2) the monitoring of the specified parameters shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-210: TC Packet Header for TC(12,2)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-211: TC Data Field Header for TC(12,2)

The structure of the *Application Data field within the TC Packet Data* field is identical with the one defined for TC (12,1). (see Figure 6-45: Application data TC(12,1)!)

Note: For TC (12,2) with N = 0 the monitoring service shall be disabled at service level. In this case, the monitoring service shall stop to monitor. The individual monitoring status of parameters shall not be changed.

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the *Monitoring Id* is not valid / in range

if *N* does not correspond to the number of supplied *Monitoring Id*s

6.10.3 TC(12,3): Change maximum Reporting Delay

Upon reception of TC (12,3) the service provider shall record the new value for the maximum reporting delay used to determine when to downlink the transition report list. TM(12,12).

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-212: TC Packet Header for TC(12,3)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-213: TC Data Field Header for TC(12,3)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

MAX REPORTING DELAY
Unsigned integer
1 bytes

Figure 6-46: Application data TC(12,3)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>Max Reporting Delay</i>	The maximum reporting delay for the check transition report	0.. 255 expressed in units of <DIAG_MIN_INTERV> . Max Reporting Delay = 0: No TM(12,12) shall be generated. <u><DIAG_MIN_INTERV> in OBC is equal 1 sec.</u>

Table 6-214: Application Data for TC(12,3)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.10.4 TC (12,4): Clear the monitoring list

Upon reception of TC (12,4) the service provider shall act as follows:

set the service monitoring status to "disabled"

clear all entries of the monitoring list

clear all entries of the transition reporting list

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-215: TC Packet Header for TC(12,4)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 4

Table 6-216: TC Data Field Header for TC(12,4)

TC (12,4) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.10.5 TC (12,5): Add Parameters to Monitoring List

Upon reception of TC (12,5) the specified record shall be added to the monitoring list. If the *Monitoring ID* already exists the new record shall replace the old one.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-217: TC Packet Header for TC(12,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-218: TC Data Field Header for TC(12,5)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N	MONITORING ID	PARAMETER ID	& VALIDITY PARAMETER	PARAMETER MONITORING INTERVAL	REP	MONITORING STATUS	CHECK TYPE	MONITORING CRITERIA
Unsigned Integer	Unsigned Integer	Enumerated	Enumerated	Unsigned Integer	Unsigned Integer	Enumerated	Enumerated	Enumerated
1 byte	1 byte	4 bytes	4 bytes	1 byte	1 byte	1byte	1byte	12 byte
< ---- repeat N times ---- >								

Figure 6-47: Application data TC(12,5)

Format of the Monitoring Criteria Field:

FOR MONITORING AGAINST LOW AND/OR HIGH LIMITS	MONITORING CRITERIA			
	LOW LIMIT	EID	HIGH LIMIT	EID
	Unsigned Integer	Unsigned Integer	Unsigned Integer	Unsigned Integer
	4 byte	2 byte	4 byte	2 byte

FOR MONITORING AGAINST EXPECTED VALUES	MONITORING CRITERIA			
	MASK	FILLER	EXPECTED VALUE	EID
	Unsigned Integer	Unsigned Integer	Unsigned Integer	Unsigned Integer
	4 byte	2 byte	4 byte	2 byte

Figure 6-48: Monitoring Criteria for TC(12,5)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>N</i>	Repetition of the following fields	1 ... 9
<i>Monitoring ID</i>	ID of Monitoring Control Table Entry	1...255
<i>Parameter ID</i>	Unique identification of the parameter to monitor	See Annex
<i>& Validity Parameter</i>	A <i>Parameter ID</i> whose value determines whether a parameter is valid or not.	By convention, if the validity parameter# is 0, the corresponding parameter is always valid (i.e. it shall always be checked).
<i>Parameter Monitoring Interval</i>	Monitoring Interval for the parameters	[1,2,4,8,16,32,64] secs <u><DIAG_MIN_INTERV> in OBC is equal 1 sec.</u>
<i>Rep</i>	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 .. 255
<i>Monitoring Status</i>	The Boolean parameter whose value determines whether monitoring of this entry is applied.	0 - disabled 1 – enabled
<i>Check Type</i>	The Boolean parameter whose value determines the type of the check.	0 - expected value check 1 - limit value check
<i>Low Limit</i>	Low limit	Limit value, right aligned if not the complete field length is required
<i>High Limit</i>	High limit	Limit value, right aligned if not the complete field length is required
<i>Expected Value</i>	Expected value	Limit value, right aligned if not the complete field length is required
<i>Mask</i>	Bit mask used to monitor only selected bits from a composite parameter.	n/a
<i>EID</i>	Event ID associated with the monitoring description	Any valid <i>EID</i> (see Annex)

Table 6-219: Application Data for TC(12,5)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if *N* does not correspond to the number of supplied monitoring definitions

if *Monitoring ID* is not a valid value

if Parameter Monitoring Interval is not a valid value

if *Rep* is not a valid value

if Parameter ID is invalid

if *EID* is not a valid value

if the *Validity Parameter* is not accessible

if *Monitoring Status* is not a valid value

if *Check Type* is not a valid value

if the monitoring list is full

6.10.6 TC (12,6): Delete Parameters from Monitoring List

Upon reception of TC (12,6) the specified parameter shall be deleted from the monitoring list, provided the parameters monitoring status is not "active".

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-220: TC Packet Header for TC(12,6)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-221: TC Data Field Header for TC(12,6)

The structure of the Application Data field within the TC Packet Data field is defined here below.

N	MONITORING ID
Unsigned Integer	Unsigned Integer
1 byte	1 byte
	< --- repeat N times --- >

Figure 6-49: Application data TC(12,6)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Number of Parameters follow	1 ... 225
Monitoring ID	ID of Monitoring Control Table Entry	1...255

Table 6-222: Application Data for TC(12,6)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N does not correspond to the number of supplied *Monitoring IDs*

if the *Monitoring ID* is not existing

if the monitoring status for the given Monitoring ID is “active”

6.10.7 TC (12,8): Report Current Monitoring List

Upon reception of TC (12,8) the report TM (12,9) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-223: TC Packet Header for TC(12,8)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 8

Table 6-224: TC Data Field Header for TC(12,8)

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).

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.10.8 TM (12,9): Current Monitoring List Report

TM (12,9) is the response to TC (12,8).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2 . The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-225: TM Packet Header for TM(12,9)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUEZ
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 9

Table 6-226: TM Data Field Header for TM(12,9)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

MONITORING STATUS	MAXIMUM REPORTING DELAY	N	MONITORING ID	PARAMETER ID	& VALIDITY PARAMETER
Enumerated	Unsigned Integer	Unsigned Integer	Unsigned Integer	Enumerated	Enumerated
1 byte	1 byte	1 byte	1 byte	4 bytes	4 bytes
< ----- repeat N times ----- >					

PARAMETER MONITORING INTERVAL	REP	MONITORING STATUS	CHECK TYPE	MONITORING CRITERIA
Unsigned Integer	Unsigned Integer	Enumerated	Enumerated	Enumerated
1 byte	1 byte	1byte	1byte	12 byte
< ----- repeat N times ----- >				

Figure 6-50: Source data TM(12,9)

Format of the Monitoring Criteria Field

FOR MONITORING AGAINST LOW AND/OR HIGH LIMITS	MONITORING CRITERIA			
	LOW LIMIT	EID	HIGH LIMIT	EID
	Unsigned Integer	Unsigned Integer	Unsigned Integer	Unsigned Integer
	4 byte	2 byte	4 byte	2 byte

FOR MONITORING AGAINST EXPECTED VALUES	MONITORING CRITERIA			
	MASK	FILLER	EXPECTED VALUE	EID
	Unsigned Integer	Unsigned Integer	Unsigned Integer	Unsigned Integer
	4 byte	2 byte	4 byte	2 byte

Figure 6-51: Monitoring Criteria for TM(12,9)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>Monitoring Status</i>	Indicates whether the overall monitoring is enabled	(Value = 0) => disabled (Value = 1) => enabled
<i>Maximum Reporting Delay</i>	The maximum reporting delay for the check transition report.	
<i>N</i>	Repetition count for the following fields	Depends on MTU
<i>Monitoring ID</i>	ID of Monitoring Control Table Entry	1...255
<i>Parameter ID</i>	Unique identification of the parameter to monitor	See Annex
<i>& Validity Parameter</i>	A Boolean parameter whose value determines whether a parameter is valid or not.	By convention, if the validity parameter# is 0, the corresponding parameter is always valid (i.e. it shall always be checked).
<i>Parameter Monitoring Interval</i>	Monitoring Interval for the parameters	[1,2,4,8,16,32,64] secs <u><DIAG_MIN_INTERV> in OBC is equal 1 sec.</u>
<i>Rep</i>	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 .. 255
<i>Enable/Disable Status</i>	The Boolean parameter whose value determines whether monitoring of this entry is applied.	0 - disabled (TBC) 1 - enabled (TBC)
<i>Check Type</i>	The Boolean parameter whose value determines the type of the check.	0 - expected value check 1 - limit value check
<i>Low Limit</i>	Low limit	Limit value, right aligned if not the complete field length is required
<i>High Limit</i>	High limit	Limit value, right aligned if not the complete field length is required
<i>Expected Value</i>	Expected value	Limit value, right aligned if not the complete field length is required
<i>Mask</i>	Bit mask used to monitor only selected bits from a composite parameter.	n/a
<i>EID</i>	Event ID associated with the monitoring description	Any valid <i>EID</i> (see Annex)

Table 6-227: Source Data for TM(12,9)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.10.9 TC (12,10): Report Current Parameters Out-of-limit List

Upon reception of TC (12,10) the report TM (12,11) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-228: TC Packet Header for TC(12,10)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 10

Table 6-229: TC Data Field Header for TC(12,10)

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).

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.10.10 TM (12,11): Current Parameters Out-of-limit List Report

TM (12,11) is the response to TC (12,10).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2 . The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-230: TM Packet Header for TM(12,11)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 11

Table 6-231: TM Data Field Header for TM(12,11)

The structure of the *Source Data* field within the TM Packet Data field is defined here below.

N	PARAMETER ID	MASK	PARAMETER VALUE	LIMIT CROSSED	PREVIOUS CHECKING STATUS	CURRENT CHECKING STATUS	TRANSITION TIME
Unsigned integer	Enumerated	Unsigned Integer	Deduced	Deduced	Enumerated	Enumerated	Satellite Time (see chapter 6.8)
2 bytes	4 bytes	4 bytes	4 bytes	4 bytes	1 byte	1 byte	6 bytes
< ----- repeat N times ----- >							

Figure 6-52: Source data TM(12,11)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Repetition count for following fields	Number of entries following (see note below)
Parameter ID	Number uniquely identifying a parameter out of a list	Any valid value of the list of predefined parameters
Mask	Bit mask used to monitor only selected bits from a composite parameter.	<i>Note: List entries for limit checks have all Mask bits set to 0.</i>
Parameter Value	Value of the parameter at last checking status transition	Deduced
Limit crossed	High or low limit or expected state crossed or violated	Copy of the relevant entry of the monitoring definition
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 on TSX) 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

Table 6-232: Source Data for TM(12,11)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.10.11 TM (12,12): Check Transition Report

The check transition report is the only provider-initiated report and shall contain the contents of the transition reporting list established since the last time a check transition report was issued.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-233: TM Packet Header for TM(12,12)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3.

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 12

Table 6-234: TM Data Field Header for TM(12,11)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N	PARAMETER ID	MASK	PARAMETER VALUE	LIMIT CROSSED	PREVIOUS CHECKING STATUS	CURRENT CHECKING STATUS	TRANSITION TIME
Unsigned integer	Enumerated	Unsigned Integer	Deduced	Deduced	Enumerated	Enumerated	Satellite Time (see chapter 6.8)
2 bytes	4 bytes	4 bytes	4 bytes	4 bytes	1 byte	1 byte	6 bytes
< ----- repeat N times ----- >							

Figure 6-53: Source data TM(12,12)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Repetition count for following fields	Number of entries following (see note below)
Parameter ID	Number uniquely identifying a parameter out of a list	Any valid value of the list of predefined parameters
Mask	Bit mask used to monitor only selected bits from a composite parameter.	Note: List entries for limit checks have all Mask bits set to 0.
Parameter Value	Value of the parameter at last checking status transition	Deduced
Limit crossed	High or low limit or expected state crossed or violated	Copy of the relevant entry of the monitoring definition
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 on TSX) 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

Table 6-235: Source Data for TM(12,12)

Only certain combinations of values for the two fields are meaningful for a given type of check as specified below with the (X=>Y) convention in which “X” is a “*Previous Checking Status*” field value and “Y” is a “*Current Checking Status*” field value.

For an expected-value-check, the only reported transition types shall be

(U□□UV, I□□UV, EV□□UV),

where the mnemonics appearing in the transition types mean:

EV: Expected Value

US: UnSelected (not used)

U: Unchecked

UV: Unexpected Value

I: Invalid

For a limit-check, the only reported transition types shall be

(U=>BL, U=>AL, I=>BL, I=>AL, WL=>BL, WL=>AL, BL=>AL, AL=>BL),

where the mnemonics appearing in the transition types mean:

WL: Within Limits

US: UnSelected (not used)

U: Unchecked

BL: Below Low Limit

I: Invalid

AL: Above High Limit

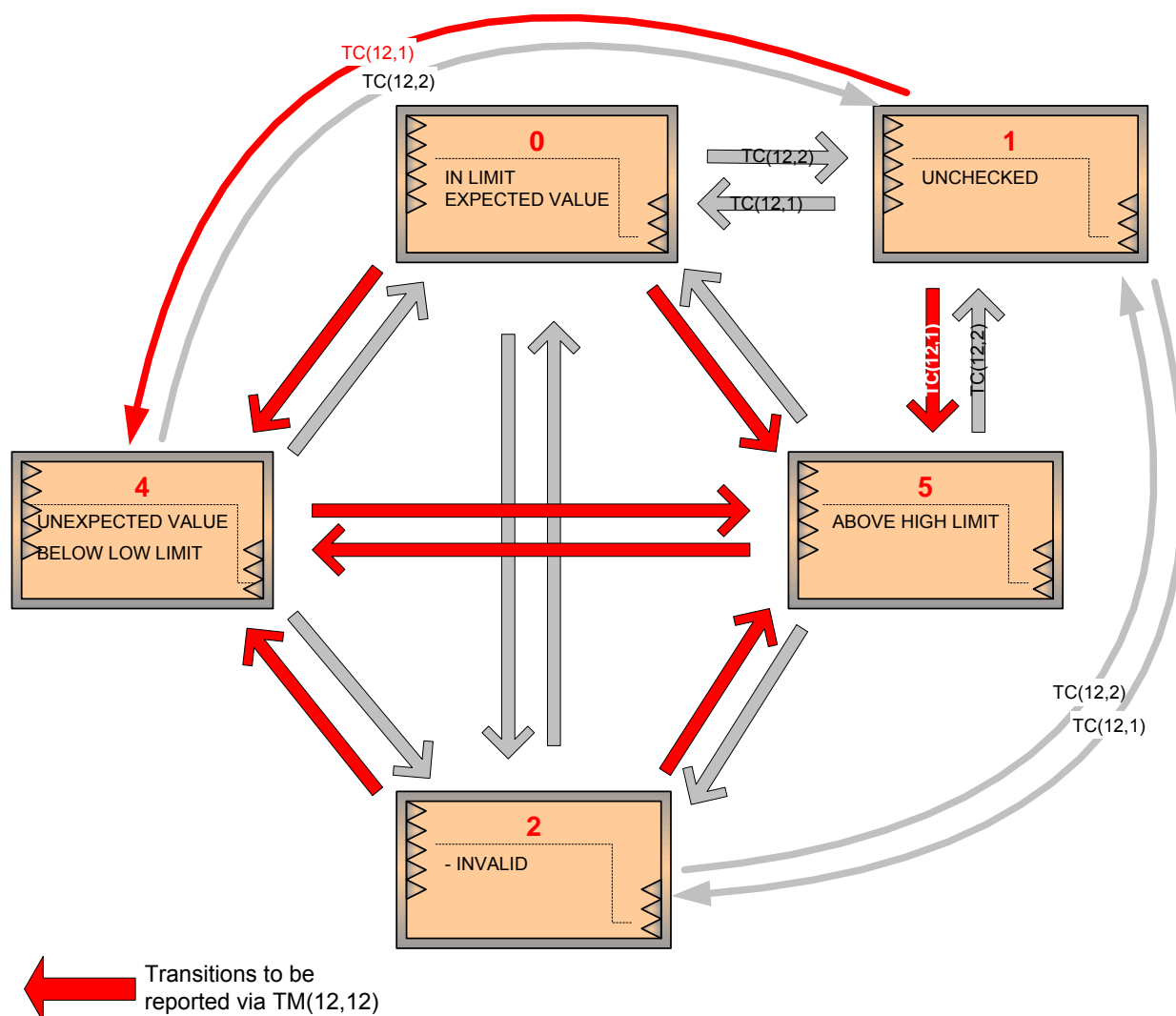


Figure 6-54: Check Status Transitions

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.10.12 TC (12,128): Modify Parameter Limit

Upon reception of TC (12,128) the specified parameter limits shall be changed.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-236: TC Packet Header for TC(12,10)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 12
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 128

Table 6-237: TC Data Field Header for TC(12,128)

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

MONITORING ID	LOW LIMIT	HIGH LIMIT
Unsigned Integer	Unsigned Integer	Unsigned Integer
1 byte	4 bytes	4 bytes

Figure 6-55: Application data TC(12,128)

The parameters of the *Application Data* field are to be inserted according to the following table:

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
Monitoring Id	ID of Monitoring Control Table Entry	1...255
Low Limit	Low Limit check value	
High Limit	High Limit check value	

Table 6-238: Source Data for TM(12,128)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the Monitoring ID is not existing

6.11 Service 13: Large Data Transfer Service



SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(13,9)	TC	Accept First Uplink Part	mandatory
(13,10)	TC	Accept Intermediate Uplink Part	mandatory
(13,11)	TC	Accept Last Uplink Part	mandatory
(13,13)	TC	Aboard Reception of Uplinked Data	mandatory
(13,14)	TM	Uplink Reception Acknowledgement Report	mandatory
(13,15)	TM	Unsuccessful Received Parts Report	mandatory
(13,16)	TM	Reception Aboard report	mandatory

Table 6-239: Service 13 sub-services

Scope:

The large data transfer service is a supporting service used by the ground system or other services to transfer large service data units in a controlled manner. The choice to use the large data transfer service is made by the initiator of a given service data unit.

The large data transfer service provides a common transfer mechanism for all services and avoids the proliferation of service-specific solutions. A service data unit is passed to the large data transfer service which splits it into parts and transmits each part within a single telemetry source packet (on-board to ground) or a single telecommand packet (ground to on-board).

Note: In scope of the EC / S2 project the ASW has receiving sub-service capabilities only.

Service Concept:

The basic concept for the large data downlink (large data uplink) protocol shall be as follows: when a service data unit or portion of it is passed to the sending sub-service provider of the large data transfer service, it shall perform the downlink (uplink) in the following manner:

- It shall split the original Service DataUnit (SDU) in fixed size parts and send the parts one by one, and in order. Each part shall be transmitted within a single telemetry source packet (telecommand packet) as illustrated in [Figure 6-56](#).

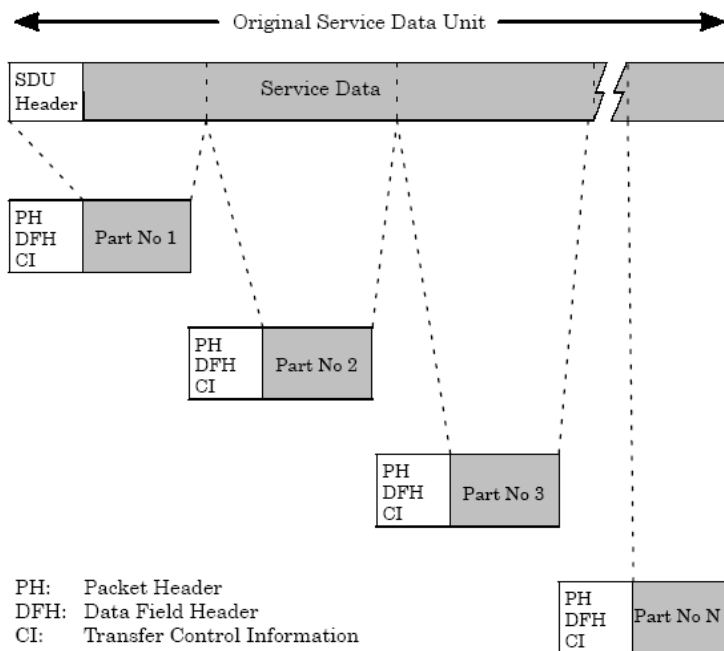


Figure 6-56: Splitting of Service Data into parts to be downlinked (uplinked)

- The sending and receiving sub-service providers shall use the same definition of the size of the parts (Part Size). The parts shall have equal size (except possibly the last part), which shall be less than the maximum size of the source data field of a telemetry source packet (application data field of a telecommand packet).

Service Data Unit to be downlinked (uplinked):

For the large data downlink, the service data unit which an on-board service provider passes to the sending sub-service provider shall consist of either a telemetry source packet or an “extended” telemetry source packet.

For the large data uplink, the service data unit which the ground segment passes to the on-board receiving sub-service provider shall consist of either a telecommand packet or an “extended” telecommand packet. In the remainder of this subclause, depending on the type of transfer, downlink or uplink:

- the term “packet” denotes either a telemetry source packet or a telecommand packet;
- the term “extended packet” denotes either an “extended” telemetry source packet or an “extended” telecommand packet;
- the term “packet data” denotes the source data or the application data of a packet or extended packet.

The format of any service data unit to be downlinked (uplinked) shall be as follows:

UNITTYPE	PACKETHEADER	DATAFIELDHEADER	PACKETDATA
Enumerated	6 bytes	Deduced	Any

Figure 6-57: Service Data Unit (SDU) Format

SDU PARAMETERS	DESCRIPTION	RANGE OR VALUE
<i>UnitType</i>	<p>This parameter indicates whether what follows is a standard packet (value = 0) or an extended packet (value = 1).</p> <p>An extended packet shall have the same structure as a packet, but the size of its packet data field can exceed the maximum size defined for a packet (i.e. if the total length of the packet data plus the data field header exceeds 65 535 octets).</p> <p>For an extended packet, the value of the packet length field in the packet header shall be 0.</p>	<p>0 = standard packet</p> <p>1 = extended packet</p>
<i>PacketHeader</i>	This is a standard packet header, but the interpretation of the packet length field value shall differ for an extended packet (see above).	
<i>DataFieldHeader</i>	This is a data field header as defined in this Standard for a telemetry source packet or a telecommand packet.	
<i>PacketData</i>	This is the source data of a large service report or the application data of a large service request.	

Table 6-240: SDU Data

Large Data downlink (uplink) protocol:

- When a receiving sub-service provider receives an error-free part, this shall become the “last successfully received part” if there is no discontinuity between this part and the previous “last successfully received part”.
- The notification of successful reception shall only be provided on completion of the service data unit reception.
- This ensures that the sending sub-service provider can inform the originating service provider (the ground system) of the success or failure of the downlink (uplink). Only when the destination application on the ground (destination service provider on-board) has received the complete service data unit should notification of successful reception of the final part be uplinked (downlinked) by the receiving end of the large data transfer service.
- When the sending sub-service provider has sent the last part of the service data unit, it shall initiate an “acknowledgement timer”. If it does not receive a notification of “last successfully received part” or an abort notification within a specified timeout interval, then it shall assume that the downlink (uplink) has failed and shall notify the originating service provider (the ground system) accordingly.
- When the first, or an intermediate, part (which can be a re-transmitted part) is received by a receiving sub-service provider, a “reception timer” shall be initiated. If the receiving sub-service provider does not receive a subsequent part within a specified timeout interval, then it shall assume that the downlink (uplink) has failed and the reception activity shall be locally aborted. The destination application on the ground (destination service provider on-board) shall be notified accordingly.
- If the receiving sub-service provider receives an erroneous part or detects a gap in the reception sequence it shall add the erroneous or missing part(s) to the set of “failed parts”. Depending on the implementation, this information may be used by the receiving sub-service provider to automatically request the re-transmission of these parts or simply to inform the ground system (the destination service provider) of the errors in the transferred data
- At any time during the downlink (uplink) activity, the originating (destination) service provider or the ground segment can abort the large data transfer operation.

6.11.1 TC (13,9): Accept First Uplink Part

TC(13,9) is to request to upload the first part of a large data service data unit

On reception of the part, the receiving sub-service provider shall update its context and initiate a reception timer.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-241: TC Packet Header for TC(13,9)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 13
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 9

Table 6-242: TC Data Field Header for TC(13,9)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

LARGEDATAUNITID	SEQUENCENUMBER	SERVICEDATAUNITPART
Enumerated	Unsigned Integer	Fixed Octet String
1 byte	2 byte	TBD

Figure 6-58: Application data TC(13,9)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>LargeDataUnitId</i>	This uniquely identifies the service data unit which is the subject of the transfer.	0 ... 255
<i>SequenceNumber</i>	This is a unique identification for this part of the service data unit. By convention, the sequence number of the first part shall be 1. The sequence number shall then be incremented by one for each part which is subsequently transferred.	0 ... 2 ¹⁶ - 1
<i>ServiceDataUnitPart</i>	This is the first part of the service data unit. Its size shall always be equal to the part size in use.	Size is fixed to TBD

Table 6-243: Application Data for TC(13,9)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.11.2 TC (13,10): Accept Intermediate Uplink Part

TC(13,9) is to request to upload an intermediate part of a large data service data unit

The size of an intermediate part of the service data unit shall always be equal to the part size in use. The ground segment shall use this request to send an intermediate part of the data to be uplinked. On reception of the part, the receiving sub-service provider shall update its context and initiate a reception timer.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-244: TC Packet Header for TC(13,10)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 13
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 10

Table 6-245: TC Data Field Header for TC(13,10)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (13,9). See [Figure 6-58](#).

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section [6.1](#) failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section [6.1](#) failed

6.11.3 TC (13,11): Accept Last Uplink Part

TC(13,9) is to request to upload the last part of a large data service data unit

The size of the last part of a service data unit shall be less than or equal to the part size in use.

The ground segment shall use this request to send the last part of the data to be uplinked. The sending sub-service provider shall always initiate an acknowledgement timer.

On reception of the part, the receiving sub-service provider shall update its context and immediately notify the sending sub-service provider of what is the "last successfully received part" at this point.

The parameters of the TC Packet Header are to be set according to the definitions in chapter [3.3](#) . The parameters of the TC Packet Header being not yet defined in chapter [3.3](#) are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-246: TC Packet Header for TC(13,11)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter [3.4](#) . The parameters of the TC Data Field Header not being yet defined in chapter [3.4](#) are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 13
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 11

Table 6-247: TC Data Field Header for TC(13,11)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (13,9). See [Figure 6-58](#).

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section [6.1](#) failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section [6.1](#) failed

6.11.4 TC (13,13): Aboard Reception of Uplinked Data

TC(13,13) is to notify (during an uplink operation) a transfer abort initiated by the sending end.

The ground segment shall use this request to indicate to the on-board receiving sub-service provider that the large data reception activities should be aborted. The on-board receiving sub-service provider shall inform the destination service provider of the abort.

The parameters of the TC Packet Header are to be set according to the definitions in chapter [3.3](#) . The parameters of the TC Packet Header being not yet defined in chapter [3.3](#) are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-248: TC Packet Header for TC(13,13)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter [3.4](#) . The parameters of the TC Data Field Header not being yet defined in chapter [3.4](#) are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 13
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 13

Table 6-249: TC Data Field Header for TC(13,13)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

LARGEDATAUNITID	REASONCODE
Enumerated	Enumerated
1 byte	1 byte

Figure 6-59: Application data TC(13,13)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>LargeDataUnitId</i>	This uniquely identifies the service data unit which is the subject of the transfer.	0 ... 255
<i>ReasonCode</i>	This indicates the reason for the transfer abort. The values it may take are mission-specific.	Table of Reason Codes:

Table 6-250: Application Data for TC(13,13)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.11.5 TM(13,14): Uplink Reception Acknowledgement Report

TM (13,14) is the report (during an uplink operation) to acknowledge the successful reception of the large service data unit.

The receiving sub-service provider shall use this notification to indicate to the sending sub-service provider that it has successfully received all parts of the large service data unit up to and including the part with the indicated sequence number.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-251: TM Packet Header for TM(13,14)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 13
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 14

Table 6-252: TM Data Field Header for TM(13,14)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

<i>LARGEDATAUNITID</i>	<i>SEQUENCENUMBER</i>
Enumerated	Unsigned Integer
1 byte	2 byte

Figure 6-60: Source data TM(13,14)

The parameters of the *Source Data* field are to be inserted according to the following table.

<i>PARAMETERS OF SOURCE DATA FIELD</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
<i>LargeDataUnitId</i>	This uniquely identifies the service data unit which is the subject of the transfer.	0 ... 255
<i>SequenceNumber</i>	This is a unique identification for this part of the service data unit. By convention, the sequence number of the first part shall be 1. The sequence number shall then be incremented by one for each part which is subsequently transferred.	0 ... 2 ¹⁶ - 1

Table 6-253: Source Data for TM(13,14)

6.11.6 TM(13,15): Unsuccessful Received Parts Report

TM (13,15) is the report (during an uplink operation) to notify the sending sub-service provider that specified parts were not received or were erroneously received.

On reception of this notification, the sending sub-service provider shall record the information. It shall use this information to re-transmit the parts.

A ground system sending sub-service provider may decide not to re-transmit the parts.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

<i>PARAMETERS OF TM PACKET HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-254: TM Packet Header for TM(13,15)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

<i>PARAMETERS OF TM PACKET DATA FIELD HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
Service Type	Indicates the service to which the packet relates	Must be set to 13
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 15

Table 6-255: TM Data Field Header for TM(13,15)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

<i>LARGEDATAUNITID</i>	<i>N</i>	<i>SEQUENCENUMBER</i>
Enumerated	Unsigned Integer	Unsigned Integer
1 byte	1 byte	2 byte
< ----- repeat <i>N</i> times ----- >		

Figure 6-61: Source data TM(13,15)

The parameters of the *Source Data* field are to be inserted according to the following table.

<i>PARAMETERS OF SOURCE DATA FIELD</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
<i>LargeDataUnitId</i>	This uniquely identifies the service data unit which is the subject of the transfer.	0 ... 255
<i>N</i>	Number of to <i>SequenceNumber</i> follow.	0 ... 255
<i>SequenceNumber</i>	This is a unique identification for this part of the service data unit. By convention, the sequence number of the first part shall be 1. The sequence number shall then be incremented by one for each part which is subsequently transferred.	0 ... $2^{16} - 1$

Table 6-256: Source Data for TM(13,14)

6.11.7 TM(13,16): Reception Aboard Report

TM (13,16) is the report (during an uplink operation) to indicate a transfer aboard initiated by receiving end

On reception of this notification, the sending sub-service provider shall inform the originating service provider (the ground system) that the uplink operation shall be aborted.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

<i>PARAMETERS OF TM PACKET HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-257: TM Packet Header for TM(13,16)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

<i>PARAMETERS OF TM PACKET DATA FIELD HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
Service Type	Indicates the service to which the packet relates	Must be set to 13
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 16

Table 6-258: TM Data Field Header for TM(13,16)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

<i>LARGEDATAUNITID</i>	<i>REASONCODE</i>
Enumerated	Enumerated
1 byte	1 byte

Figure 6-62: Source data TM(13,16)

The parameters of the *Source Data* field are to be inserted according to the following table.

<i>PARAMETERS OF SOURCE DATA FIELD</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
<i>LargeDataUnitId</i>	This uniquely identifies the service data unit which is the subject of the transfer.	0 ... 255
<i>ReasonCode</i>	This indicates the reason for the transfer abort. The values it may take are mission-specific.	Table of Reason Codes:

Table 6-259: Source Data for TM(13,16)

6.12 Service 14: Packet Forwarding Control Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(14,1)	TC	Enable Forwarding of Telemetry Source Packets	mandatory
(14,2)	TC	Disable Forwarding of Telemetry Source Packets	mandatory
(14,3)	TC	Report Enabled Telemetry Source Packets	
(14,4)	TM	Enabled Telemetry Source Packets Report	
(14,5)	TC	Enable Forwarding of Housekeeping Packets	mandatory
(14,6)	TC	Disable Forwarding of Housekeeping Packets	mandatory
(14,7)	TC	Report Enabled Housekeeping Packets	mandatory
(14,8)	TM	Enabled Housekeeping Packets Report	mandatory
(14,9)	TC	Enable Forwarding of Diagnostic Packets	mandatory
(14,10)	TC	Disable Forwarding of Diagnostic Packets	mandatory
(14,11)	TC	Report Enabled Diagnostic Packets	mandatory
(14,12)	TM	Enabled Diagnostic Packets Report	mandatory
(14,13)	TC	Enable Forwarding of Event Report Packets	mandatory
(14,14)	TC	Disable Forwarding of Event Report Packets	mandatory
(14,15)	TC	Report Enabled Event Report Packets	
(14,16)	TM	Enabled Event Report Packets Report	
(14,128)	TC	Report Telemetry Source Packet Forwarding Status	mandatory
(14,129)	TM	Telemetry Source Packet Forwarding Status Report	mandatory
(14,130)	TC	Report Event Report Packet Forwarding Status	mandatory
(14,131)	TM	Event Report Packet Forwarding Status Report	mandatory

Table 6-260: Service 14 sub-services

The packet forwarding control service shall maintain the knowledge of which packets can be transmitted to the ground system using the real-time downlink capability of the spacecraft. To manage the downlink from the HK packet stores Service 15 is in charge for.

For a given application process, the forwarding of packets can be “enabled” and “disabled” at the level of:

- PID
- a type of packet; (service)
- a subtype of packet;
- a housekeeping packet definition, a diagnostic packet definition or an event report definition

For each packet definition three independent controlling attributes exist (at PID level, at type level, at subtype level) whose values determine the forwarding of the packet in accordance with [Table 6-261](#).

PID	TYPE	SUBTYPE	FORWARDING STATUS
D(isabled)	D(isabled)	E(nabled)	D
D	D	D	D
D	E	E	D
D	E	D	D
E	D	E	D
E	D	D	D
E	E	E	E
E	E	D	D



Table 6-261: Forwarding status decision table

Telemetry packets of type TM(5,1-4) have the EID as additional packet structure identification level. Telemetry packets of type TM(3,25) and TM(3,26) have the SID as additional packet structure identification level. The forwarding status is determined according to the table below.

PID	TYPE	SUBTYPE	IDENTIFICATION1 (SID/EID)	FORWARDING STATUS
D(isabled)	D(isabled)	E(nabled)	E	D
D	D	D	E	D
D	D	E	D	D
D	D	D	D	D
D	E	E	E	D
D	E	D	E	D
D	E	E	D	D
D	E	D	D	D
E	D	D	E	D
E	D	E	D	D
E	D	D	D	D
E	E	E	E	E
E	E	D	E	D
E	E	E	D	D
E	E	D	D	D

Table 6-262: Forwarding status decision table

6.12.1 TC (14,1): Enable Forwarding of Telemetry Source Packets

Upon reception of TC (14,1) forwarding of the specified TM Source Packets shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

¹ optional

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-263: TC Packet Header for TC(14,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-264: TC Data Field Header for TC(14,1)

The structure of the Application Data field within the TC Packet Data field is defined here below.

N1	FILLER	PID	N2	TYPE	N3	SUBTYPE
Unsigned integer		Enumerated	Unsigned integer	Enumerated	Unsigned integer	Enumerated
1 byte	1 bit	7 bit	1 byte	1 byte	1 byte	1 byte
						< --- repeat N3 times --->
						< --- repeat N2 times --->
						< ----- repeat N1 times ----- >

Figure 6-63: Application data TC(14,1)

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Number of PID's to follow	n/a
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N2/N3	The number of type definition to follow	<p>N2 = 0: all types of telemetry source packets from the corresponding application process shall be placed in the set of enabled types.</p> <p>N2 > 0, N3 = 0: the specified types of telemetry source packets from the corresponding application process shall be added to the set of enabled types.</p> <p>N2 > 0, N3 > 0: 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><i>Note: If N2 > 1 then there can be a mixture of empty (N3 = 0) and non-empty (N3 > 0) arrays.</i></p> <p><i>Note: These requests do not change the forwarding status at the level of the SID/EID.</i></p>
Type	The telemetry source packet type	Any valid service type of the specified PID.
Subtype	The telemetry source packet service subtype for the specified service type.	Any valid Subtype of the specified Type

Table 6-265: Application Data for TC(14,1)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the Application Data Structure is inconsistent

6.12.2 TC (14,2): Disable Forwarding of Telemetry Source Packets

Upon reception of TC (14,2) forwarding of the specified TM Source Packets shall be disabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-266: TC Packet Header for TC(14,2)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-267: TC Data Field Header for TC(14,2)

The structure of the Application Data field within the TC Packet Data field is identical to the one defined for TC (14,1). See [Figure 6-63: Application data TC\(14,1\)](#)

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Number of PID's to follow	1 ... MAX
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N2/N3	The number of type definition to follow	<p>N2 = 0: all types of telemetry source packets from the corresponding application process shall be removed from the set of enabled types.</p> <p>N2 > 0, N3 = 0: the specified types of telemetry source packets from the corresponding application process shall be removed from the set of enabled types.</p> <p>N2 > 0, N3 > 0: 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><i>Note: If N2 > 1 then there can be a mixture of empty (N3 = 0) and non-empty (N3 > 0) arrays.</i></p> <p><i>Note: These requests do not change the forwarding status at the level of the SID/RID.</i></p>
Type	The telemetry source packet type	Any valid service type of the specified PID.
Subtype	The telemetry source packet service subtype for the specified service type.	Any valid Subtype of the specified Type

Table 6-268: Application Data for TC(14,2)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the Application Data Structure is inconsistent

6.12.3 TC (14,5): Enable Forwarding of Housekeeping Packets

Upon reception of TC (14,5) forwarding of the specified HK Packets shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-269: TC Packet Header for TC(14,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-270: TC Data Field Header for TC(14,5)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N1	FILLER	PID	N2	SID
Unsigned integer		Enumerated	Unsigned integer	Enumerated
1 byte	1bit	7 bit	1 byte	1 byte
				< --- repeat N2 times --->
				< ----- repeat N1 times ----- >

Figure 6-64: Application data TC(14,5)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Repetition count for following fields	Number of entries following
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N2	The number of housekeeping packet definitions to be enabled or disabled.	1 ... MAX
SID	Structure ID of a Report Definition (HK, Diagnostic)	Any valid SID (see Annex!)

Table 6-271: Application Data for TC(14,5)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed
TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the Application Data Structure is inconsistent

6.12.4 TC (14,6): Disable Forwarding of Housekeeping Packets

Upon reception of TC (14,6) forwarding of the specified HK Packets shall be disabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-272: TC Packet Header for TC(14,6)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-273: TC Data Field Header for TC(14,6)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (14,5). See [Figure 6-64: Application data TC\(14,5\)](#)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed
TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the Application Data Structure is inconsistent

6.12.5 TC (14,7): Report Enabled Housekeeping Packets

Upon reception of TC (14,7) the report TM (14,8) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-274: TC Packet Header for TC(14,7)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 7

Table 6-275: TC Data Field Header for TC(14,7)

TC (14,7) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.12.6 TM (14,8): Enabled Housekeeping Packets Report

TM (14,8) is the response to TC (14,7).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-276: TM Packet Header for TM(14,8)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 8

Table 6-277: TM Data Field Header for TM(14,8)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N1	FILLER	PID	N2	SID	FSTAT
Unsigned integer		Enumerated	Unsigned integer	Enumerated	Enumerated
1 byte	1bit	7 bit	1 byte	1 byte	1byte
				< --- repeat N2 times --->	
	< ----- repeat N1 times ----- >				

Figure 6-65: Source data TM(14,8)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Repetition count for following fields	1 ... Depending on MTU
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N2	The number of SID's	1 ... Depending on N1
SID	Structure ID	See Annex 0 := All SID's
FSTAT	Packet Forwarding Status	0 := DISABLED 1 := ENABLED

Table 6-278: Source Data for TM(14,8)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.12.7 TC (14,9): Enable Forwarding of Diagnostic Packets

Upon reception of TC (14,9) forwarding of the specified Diagnostic Packets shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-279: TC Packet Header for TC(14,9)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 9

Table 6-280: TC Data Field Header for TC(14,9)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (14,5). See [Figure 6-64: Application data TC\(14,5\)](#)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the Application Data Structure is inconsistent

6.12.8 TC (14,10): Disable Forwarding of Diagnostic Packets

Upon reception of TC (14,10) forwarding of the specified Diagnostic Packets shall be disabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-281: TC Packet Header for TC(14,10)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 10

Table 6-282: TC Data Field Header for TC(14,10)

The structure of the Application Data field within the TC Packet Data field is identical to the one defined for TC (14,5). See [Figure 6-64: Application data TC\(14,5\)](#)

TC verification:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed
TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed
if the Application Data Structure is inconsistent

6.12.9 TC (14,11): Report Enabled Diagnostic Packets

Upon reception of TC (14,11) the report TM (14,12) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-283: TC Packet Header for TC(14,11)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 11

Table 6-284: TC Data Field Header for TC(14,11)

TC (14,11) 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:

TM(1,2): TC Acceptance Report - Failure
if one of the static checks according to section 6.1 failed
TM(1,8): TC Execution Completion Report - Failure
if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.12.10 TM (14,12): Enabled Diagnostic Packets Report

TM (14,12) is the response to TC (14,11).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-285: TM Packet Header for TM(14,12)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 12

Table 6-286: TM Data Field Header for TM(14,12)

The structure of the Source Data field within the TM Packet Data field is defined here below.

N1	FILLER	PID	N2	SID	FSTAT
Unsigned integer		Enumerated	Unsigned integer	Enumerated	Enumerated
1 byte	1bit	7 bit	1 byte	1 byte	1byte
				< --- repeat N2 times --->	
	< ----- repeat N1 times ----- >				

Figure 6-66: Source data TM(14,12)

The parameters of the Source Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Repetition count for following fields	Number of entries following
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N2	The number of SiD's to follow	1 ... MAX
SiD	Structure Identifier	See Annex 0 := All Events
FSTAT	Packet Forwarding Status	0 := DISABLED 1 := ENABLED

Table 6-287: Source Data for TM(14,12)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.12.11 TC (14,13): Enable Forwarding of Event Report Packets

Upon reception of TC (14,13) forwarding of the specified Event Report Packets shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-288: TC Packet Header for TC(14,13)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 13

Table 6-289: TC Data Field Header for TC(14,13)

The structure of the Application Data field within the TC Packet Data field is defined here below.

<i>N1</i>	<i>FILLER</i>	<i>PID</i>	<i>N2</i>	<i>EID</i>
Unsigned integer		Enumerated	Unsigned integer	Enumerated
1 byte	1bit	7 bit	1 byte	2 bytes
				< --- repeat <i>N2</i> times --->
	< ----- repeat <i>N1</i> times ----- >			

Figure 6-67: Application data TC(14,13)

The parameters of the Application Data field are to be inserted according to the following table.

<i>PARAMETERS OF APPLICATION DATA FIELD</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
<i>N1</i>	Repetition count for following fields	1 ... 56
<i>PID</i>	Process ID	Must be set to a value according table 6.1 (Annex A)
<i>N2</i>	The number of event packet definitions to be enabled or disabled.	Depending on <i>N1</i>
<i>EID</i>	Event Identifier	See Annex

Table 6-290: Application Data for TC(14,13)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the Application Data Structure is inconsistent

6.12.12 TC (14,14): Disable Forwarding of Event Report Packets

Upon reception of TC (14,14) forwarding of the specified Even Report Packets shall be disabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

<i>PARAMETERS OF TC PACKET HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-291: TC Packet Header for TC(14,14)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 14

Table 6-292: TC Data Field Header for TC(14,14)

The structure of the Application Data field within the TC Packet Data field is identical to the one defined for TC (14,13). See [Figure 6-67: Application data TC\(14,13\)](#)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the Application Data Structure is inconsistent

6.12.13 TC (14,128): Report Telemetry Source Packet Forwarding Status

Upon reception of TC (14,128) the report TM (14,129) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-293: TC Packet Header for TC(14,128)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 128

Table 6-294: TC Data Field Header for TC(14,128)

TC (14,128) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.12.14 TM (14,129): Telemetry Source Packet Forwarding Status

TM (14,129) is the response to TC (14,128).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-295: TM Packet Header for TM(14,129)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 129

Table 6-296: TM Data Field Header for TM(14,129)

The structure of the Source Data field within the TM Packet Data field is defined here below.

N1	FILLER	PID	FSTAT	N2	TYPE	FSTAT	N3	SUBTYPE	FSTAT
Unsigned integer		Enumerated	Enumerated	Unsigned integer	Enumerated	Enumerated	Unsigned integer	Enumerated	Enumerated
1 byte	1 bit	7 bit	1byte	1 byte	1 byte	1byte	1 byte	1 byte	1byte
								< --- repeat N3 times --->	
					< --- repeat N2 times --->				
	< ----- repeat N1 times ----- >								

Figure 6-68: Source data TM(14,129)

The parameters of the Source Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Number of PID's to follow	Depending on MTU
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N2/N3	The number of type/subtype definition to follow	<p><u>N2 = 0:</u> FSTAT applies to all types of telemetry source packets from the corresponding application process.</p> <p><u>N2 > 0, N3 = 0:</u> FSTAT applies to all sybtypes of the given type.</p> <p><u>N2 > 0, N3 > 0:</u> FSTAT applies to the specified type/subtype combination.</p> <p><u>Note: If N2 > 1 then there can be a mixture of empty (N3 = 0) and non-empty (N3 > 0) arrays.</u></p>
Type	The telemetry source packet type	Any valid service type of the specified PID. 0 := All Types
Subtype	The telemetry source packet service subtype for the specified service type.	Any valid Subtype of the specified Type 0 := All Subtypes
FSTAT	Packet Forwarding Status	0 := DISABLED 1 := ENABLED

Table 6-297: Source data for TM(14,129)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.12.15 TC (14,130): Report Event Report Packet Forwarding Status

Upon reception of TC (14,130) the report TM (14,131) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-298: TC Packet Header for TC(14,130)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 130

Table 6-299: TC Data Field Header for TC(14,130)

TC (14,130) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.12.16 TM (14,131): Event Report Packet Forwarding Status Report

TM (14,131) is the response to TC (14,130).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-300: TM Packet Header for TM(14,131)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 14
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 131

Table 6-301: TM Data Field Header for TM(14,131)

The structure of the Source Data field within the TM Packet Data field is defined here below.

<i>N1</i>	<i>FILLER</i>	<i>PID</i>	<i>N2</i>	<i>EID</i>	<i>FSTAT</i>
Unsigned integer		Enumerated	Unsigned integer	Enumerated	Enumerated
1 byte	1bit	7 bit	1 byte	2 bytes	1byte
				< --- repeat N2 times --->	
	< ----- repeat N1 times ----- >				

Figure 6-69: Source data TM(14,131)

The parameters of the Source Data field are to be inserted according to the following table.

<i>PARAMETERS OF APPLICATION DATA FIELD</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
<i>N1</i>	Repetition count for following fields	
<i>PID</i>	Process ID	Must be set to a value according table 6.1 (Annex A)
<i>N2</i>	The number of <i>EID</i> Packet Forwarding Status values to follow	Depending on <i>N1</i>
<i>EID</i>	Event Identifier	See Annex ! 0 := All Events
<i>FSTAT</i>	Packet Forwarding Status	0 := DISABLED 1 := ENABLED

Table 6-302: Source Data for TM(14,131)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.13 Service 15: On Board Storage and Retrieval

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(15,1)	TC	Enable Storage in Packet Stores	mandatory
(15,2)	TC	Disable Storage in Packet Stores	mandatory
(15,3)	TC	Add Packet Types & Sub-Types to Storage Selection Definition	mandatory
(15,4)	TC	Remove Packet Types & Sub-Types from Storage Selection Definition	mandatory
(15,5)	TC	Report Storage Selection Definition	mandatory
(15,6)	TM	Storage Selection Definition Report	mandatory
(15,7)	TC	Downlink Packet Store Contents for Packet Range	mandatory
(15,8)	TM	Packet Store Contents Report	mandatory
(15,9)	TC	Downlink Packet Store Contents for Time Period	mandatory
(15,10)	TC	Delete Packet Stores Contents up to Specified Packets	mandatory
(15,11)	TC	Delete Packet Stores Contents up to Specified Storage Time	mandatory
(15,12)	TC	Report Catalogues for Selected Packet Stores	mandatory
(15,13)	TM	Packet Store Catalogue Report	mandatory
(15,128)	TC	Start Playback of HK Packet Store Contents	mandatory
(15,129)	TC	Set Packet Store Pointer	mandatory
(15,130)	TC	Format HK Memory	mandatory
(15,131)	TC	Report HK Format	mandatory
(15,132)	TM	HK Format Report	mandatory
(15,133)	TC	Add SID's to Storage Selection Definition	mandatory
(15,134)	TC	Remove SID's from Storage Selection Definition	mandatory
(15,135)	TC	Report SID Storage Selection Definition	mandatory
(15,136)	TM	SID Storage Selection Definition Report	mandatory
(15,137)	TC	Abord Playback of HK Packet Store Contents	mandatory

Table 6-303: Service 15 sub-services

Note: additional failure Id'd still to be defined

Service Overview

The on-board storage and retrieval service is the central service to selectively store the service reports which are generated by all on-board applications in order to give the ground system the capability to request the downlink of the stored data.

In the packet selection sub-services which select which telemetry source packets are sent for storage and the storage maintenance and downlink sub-services are combined in the System Control Application of the OBC application SW. The storage device is the so-called HK memory providing storage capacity of **1GBit on each OBC TTRS board**

The on-board storage and retrieval service consists of three parts:

- packet selection sub-services for selection and transfer of telemetry source packets for storage in different packet stores;
- down-link sub-services for playback of telemetry source packets from packet stores.
- storage maintenance sub-services

Service Concept

For LEO missions with intermittent coverage, packets of high operational significance, instrument and payload HK and payload science data which are generated during a period of non-coverage are stored in a dedicated packet store so that they can be selectively dumped during the next period of coverage. One or more packet types and subtypes generated by one or more application processes can be selected for storage in a given packet store.

A packet store is uniquely identified by a “Store ID”. The definition of the storage selection used by a given packet selection sub-service can either be predefined or changeable by the ground system. Packets are stored according to their sequence of arrival at the storage and retrieval sub-service. By design each TM source packet is time stamped by the generating application.

Telemetry source packets stored in a packet store shall be dumped on request. The downlink sub-services allow specification of the starting point, of the amount of data to be down-linked and of the virtual channel in order to optimally support the data transfer via the Space Link Extended (SLE) services of the Ground Station networks.

Each packet store provides the following capabilities:

- two independent playback pointer to provide independent access to the data store content to two independent ground station networks
- one write pointer to indicate the position resp. filling of the packet store
- parallel writing of data to and down-linking of data from the packet store
- an attribute, which defines whether the storage strategy is circular or bounded
- definition of the storage size and start position for data storage

The attributes of each store shall be accessed by the storage and retrieval

- sub-service which shall indicate:
- whether the storage strategy is circular or bounded
- the filling of the packet store by means of write and playback pointers
- the maximum size of the packet store;
- When a circular packet store is full, any subsequently received packet shall overwrite partly or fully the oldest packet(s) in the list.

When a bounded packet store is full, any subsequently received packet shall be ignored.

By re-positioning of the write pointer it is possible to free storage space and to enable the resumption of storage of new packets. This type of deletion (i.e. overwriting the contents of a packet store) can also be performed on a circular packet store.

In addition to housekeeping data that can be reported on a regular basis, catalogue information are maintained by the storage and retrieval service for each packet store, which shall be reported to ground on request. This catalogue information shall include:

- identification of storage configuration,
- the percentage of filling of the packet store,
- the percentage of the packet store contents that has not yet been down-linked.

In order to achieve a maximum of flexibility the service provides partitioning capabilities of the HK memory. The user can define a fixed number of 5 partitions per TTRS board, so called *Store/d*s. The record and playback pointer values are relative to the begin of the *Store/d*. i.e. the first word of a store is addressed by pointer value 0, the 2nd word is addressed by pointer value 1 and so on. After formatting all pointers are initialized to 0.

During a ground coverage period the stored HK data can be down linked using the “Start Playback” TC. The TSX OBC S/W has two independent playback pointers in order support downlink operations on different HK memory areas for two ground stations.

HK data downlink itself is supported by various S/W and H/W functions:

- downlink procedure is initiated by TC, the OBC S/W writes a HK memory start address and a length value into dedicated H/W registers
- between the actual HK packets, so called sync markers are stored on the HK memory, the TM control FPGE searches for the next sync marker and starts transferring the TM packets following afterwards to the transfer frame assembler, Any sync marker coming in between is removed.
- The “Start Playback” TC allows to select one of the two playback pointers which is used to control the transmission. After successful execution the pointer points to the last down linked HK memory address + 1.
- In case of a failure or if the “Stop Playback” TC has been used to aboard a downlink, to value of the playback pointer remains unchanged.

Operational Aspects

Due to the flexible concept the ground needs just one TC(15,128) per ground station pass to downlink data from different stores. The TC also provides an offset parameter to achieve overlapping data downlink. After completion, the playback pointer used for dump operation points to the last down linked word + 1.

In principle, manual pointer setting by TC(15,129) will not be necessary.

6.13.1 TC (15,1): Enable Storage in Packet Stores

Upon reception of TC (15,1) the specified Packet Store shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-304: TC Packet Header for TC(15,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-305: TC Data Field Header for TC(15,1)

The structure of the *Application Data* field within the TC *Packet Data* field is defined here below.

<i>N</i>	<i>STORE ID</i>
Unsigned Integer	Enumerated
1 byte	1 byte
	< --- repeat <i>N</i> times --->

Figure 6-70: Application data TC(15,1)

The parameters of the *Application Data* field are to be inserted according to the following table.

<i>PARAMETERS OF APPLICATION DATA FIELD</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
<i>N</i>	The number of packet stores to be controlled	<u>N = 0:</u> means "all packet stores"
<i>Store ID</i>	Identifier for the packet store	[1 ... MAX]

Table 6-306: Application Data for TC(15,1)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if *N* does not correspond to the number of supplied Store ID's

if Store ID is invalid

6.13.2 TC (15,2): Disable Storage in Packet Stores

Upon reception of TC (15,1) the specified Packet Store shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

<i>PARAMETERS OF TC PACKET HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-307: TC Packet Header for TC(15,2)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

<i>PARAMETERS OF TC PACKET DATA FIELD HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-308: TC Data Field Header for TC(15,2)

The structure of the *Application Data* field within the TC *Packet Data* field is identical as defined for TC (15,1). (see [Figure 6-71](#) !)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N does not correspond to the number of supplied Store ID's

if Store ID is invalid

6.13.3 TC (15,3): Add Packets to Storage Selection Definition

Upon reception of TC (15,3) the specified packet Store shall be added to the storage selection definition.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-309: TC Packet Header for TC(15,3)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-310: TC Data Field Header for TC(15,3)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

STORE ID	N1	FILLER	PID	N2	TYPE	N3	SUBTYPE
Enumerated	Unsigned integer		Enumerated	Unsigned integer	Enumerated	Unsigned integer	Enumerated
1 byte	1 byte	1bit	7 bit	1 byte	1 byte	1 byte	1 byte
							< --- repeat N3 --- > times
					< --- repeat N2 times --->		
		< ----- repeat N1 times ----- >					

Figure 6-71: Application data TC(15,3)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Store ID	Identifier for the packet store	See Annex <i>Note: value 0 means "No Storage"</i>
N1	Number of PID's to follow	n/a
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N2/N3	The number of type definition to follow	<p>N2 = 0: 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 Store ID.</p> <p>N2 > 0, N3 = 0: 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 Store ID.</p> <p>N2 > 0, N3 > 0: 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 Store ID.</p> <p><i>Note: If N2 > 1 then there can be a mixture of empty (N3 = 0) and non-empty (N3 > 0) arrays.</i></p> <p><i>Note: These requests do not change the forwarding status at the level of the SID/EID.</i></p>
Type	The telemetry source packet type	Any valid service type of the specified PID.
Subtype	The telemetry source packet service subtype for the specified service type.	Any valid Subtype of the specified Type

Table 6-311: Application Data for TC(15,3)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if Store ID is invalid

if the Application Data Structure is inconsistent

The current content of the packet store shall not be affected by the request.

The request shall have no effect for a packet type which is not in the list of packet types to be stored in the specified packet store. (because all its subtypes are already selected for storage).

6.13.4 TC (15,4): Remove Packet from Storage Selection Definition

Upon reception of TC (15,4) the specified packet Store shall be removed from the storage selection definition.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-312: TC Packet Header for TC(15,4)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 4

Table 6-313: TC Data Field Header for TC(15,4)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (15,3). (seeFigure 6-72!)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if Store ID is invalid

if the Application Data Structure is inconsistent

The current content of the packet store shall not be affected by the request.

The request shall have no effect for a packet type which is not in the list of packet types to be stored in the specified packet store.

6.13.5 TC (15,5): Report Storage Selection Definition

Upon reception of TC (15,5) the report TM (15,6) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.


PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-314: TC Packet Header for TC(15,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-315: TC Data Field Header for TC(15,5)

TC (15,5) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.13.6 TM (15,6): Storage Selection Definition Report

TM (15,6) is the response to TC (15,5).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-316: TM Packet Header for TM(15,6)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-317: TM Data Field Header for TM(15,6)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N1	FILLER	PID	STORE ID	N2	TYPE	STORE ID	N3	SUBTYPE	STORE ID
Unsigned integer		Enumerated	Enumerated	Unsigned integer	Enumerated	Enumerated	Unsigned integer	Enumerated	Enumerated
1 byte	1bit	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 ----- >								

Figure 6-72: Source data TM(15,6)

The parameters of the *Application Data* field within the *TC Packet Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Number of PID's to follow	n/a
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N2/N3	The number of type definition to follow	<p>N2 = 0: neither type nor subtype of packet from the corresponding application process is selected for storage.</p> <p>N2 > 0: the specified types of packet from the corresponding application process are selected for storage.</p> <p>N3 > 0: for a type of packet, the specified subtypes of this type from the corresponding application process are selected for storage.</p>
Type	The telemetry source packet type	Any valid service type of the specified PID.
Subtype	The telemetry source packet service subtype for the specified service type.	Any valid Subtype of the specified Type
Store ID	Identifier for the packet store	See Annex
		<u>Note: value 0 means "No Storage"</u>

Table 6-318: Source Data for TM(15,6)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.13.7 TC (15,12): Report Catalogues for Selected Packet Stores

Upon reception of TC (15,12) the catalogue TM(15,13) for the selected packet stores shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-319: TC Packet Header for TC(15,12)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 12

Table 6-320: TC Data Field Header for TC(15,12)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N	STORE ID
Unsigned Integer	Enumerated
1 byte	1 byte
	< --- repeat N times --->

Figure 6-73: Application data TC(15,12)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	The number of packet stores to be controlled	N = 0: means "all packet stores"
Store ID	Identifier for the packet store	[1 ... 10]

Table 6-321: Application Data for TC(15,12)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N does not correspond to the number of supplied Store ID's

if Store ID is invalid

if the request could not be completed

6.13.8 TM (15,13): Packet Store Catalogue Report

TM (15,13) is the response to TC (15,12).

Note: The packet store pointers shall also be defined as standard HK parameters accessible via relevant services.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-322: TM Packet Header for TM(15,13)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3.

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 13

Table 6-323: TM Data Field Header for TM(15,13)



The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N	STORE ID	RECORD POINTER	PLAYBACK POINTER 1	PLAYBACK POINTER 2
Unsigned Integer	Enumerated	Unsigned long	Unsigned long	Unsigned long
1 byte	1 byte	4 byte	4 byte	4 byte
	< --- repeat N times --- >			

Figure 6-74: Source data TM(15,13)

The parameters of the *Application Data* field within the *TC Packet Data* field are to be inserted according to the following table.


PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	The number of packet stores which follow	1 ... 83 
Store ID	Identifier for the packet store	[1 ... 10]
Record Pointer	Current position of the record pointer	Any valid HK Memory Address <i>Note: The values represent physical address pointers to HK memory addresses of the relevant HK memory board.</i>
Playback Pointer 1	Current position of the playback 1 pointer	Any valid HK Memory Address <i>Note: The values represent physical address pointers to HK memory addresses of the relevant HK memory board.</i>
Playback Pointer 2	Current position of the playback 2 pointer	Any valid HK Memory Address <i>Note: The values represent physical address pointers to HK memory addresses of the relevant HK memory board.</i>

Table 6-324: Source Data for TM(15,13)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.13.9 TC (15,128): Start Playback of Packet Store Contents

Upon reception of TC (15,128) the content of the specified packet store shall be down linked to the ground. The specified number of data words will be retrieved from the current position of the playback pointer onwards. After completion the playback pointer points to the next word which is due to be down linked with next request.

If the end of a packet store has been reached the pointer will remain there and has to be set back for the next downlink using TC(15,137).

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.



PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-325: TC Packet Header for TC(15,128)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 128

Table 6-326: TC Data Field Header for TC(15,128)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N	STORE ID	PL POINTER	OFFSET	VCID	NoOfWords
Unsigned Integer	Enumerated	Enumerated	Signed Integer	Enumerated	Unsigned Integer
1 byte	1 byte	1 byte	4byte	1 byte	4 byte
< --- repeat N times --->					

Figure 6-75: Application data TC(15,128)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	The number of packet stores which follow	1... 20
Store ID	Identifier for the packet store	[1 ... 10]
PIPointer	Pointer to be used for the playback operation	[0,1] 0 .. Playbackpointer 1 1 .. Playbackpointer 2
Offset	Relative offset to the current <i>PIPointer</i> value, where the down link shall start	[0...[LAST_PKT_STORE_WORD]] <i>Note: by relative pointer setting the resulting address value must not exceed the packet store boundaries!</i>
VCID	Virtual channel Id where the store shall be downlinked	[1,7]
NoOfWords	The number of words to be down linked from the specified packet store.	N = 0: Nothing will be down linked

Table 6-327: Application Data for TC(15,128)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N does not correspond to the number of supplied parameter sets

if Store ID is not defined or invalid

if VCID is invalid

the PIPointer value is out of range

6.13.10 TC (15,129): Set Packet Store Pointer

TC (15,129) allows to access the packet store pointer in order to realise basic functions, such as RESET, FLUSH, RETRANSMIT etc.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-328: TC Packet Header for TC(15,129)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 129

Table 6-329: TC Data Field Header for TC(15,129)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N	STORE ID	FILLER	REL./ABS.	SELECTION	RECORD POINTER	PLAYBACK POINTER1	PLAYBACK POINTER2
Unsigned Integer	Enumerated			Bit array	Signed long	Signed long	Signed long
	1 byte	4bit	1bit	3 bit	4 byte	4 byte	4 byte
	< --- repeat N times --->						

Figure 6-76: Application data TC(15,129)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>N</i>	The number of packet stores to be controlled	<u>N = 0:</u> mean "all packet stores"
<i>Store ID</i>	Identifier for the packet store	[1 ... 10]
<i>Rel./Abs.</i>	Determines whether the pointers shall be set absolute or relative	0 = All pointer shall be set absolute 1 = All pointer shall be set relative to there current position
<i>Selection</i>	Bit pattern used to identify which pointer value is to be changed.	bit 2 = Record Pointer bit 1 = Playback Pointer 1 bit 0 = Playback Pointer 2
<i>Record Pointer</i>	Relative- or absolute value of the record pointer address within the packet store. i.e. the first word of the packet store has the value 0, the fist word is 1 and so on.	[0...[LAST_PKT_STORE_WORD]] Default: 0x00 <i>Note: by relative pointer setting the resulting address value must not exceed the packet store boundaries!</i>
<i>Playback Pointer 1</i>	Relative- or absolute value of the playback pointer 1 address within the packet store. i.e. the first word of the packet store has the value 0, the fist word is 1 and so on.	[0...[LAST_PKT_STORE_WORD]] Default: 0x00 <i>Note: by relative pointer setting the resulting address value must not exceed the packet store boundaries</i>
<i>Playback Pointer 2</i>	Relative- or absolute value of the playback pointer 2 address within the packet store. i.e. the first word of the packet store has the value 0, the fist word is 1 and so on.	[0...[LAST_PKT_STORE_WORD]] Default: 0x00 <i>Note: by relative pointer setting the resulting address value must not exceed the packet store boundaries</i>

Table 6-330: Application Data for TC(15,129)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N does not correspond to the number of supplied parameter sets

if Store ID is not defined or invalid

if one of the pointer values is out of range

6.13.11 TC (15,130): Format HK Memory

TC (15,130) allows to format the available HK memory into Packet Stores of configurable size.

After sending of TC(5,130) all HK data on the selected HK memory (1 or 2) are lost and all pointer are set back to zero !

During execution of the Format HK Memory TC all generated HK packets are discarded with no notification !

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-331: TC Packet Header for TC(15,130)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 130

Table 6-332: TC Data Field Header for TC(15,130)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N	STORE ID	FILLER	BUFFERPOL	No OfWords
Unsigned Integer	Enumerated	Bit	Bit	Unsigned Integer
	1 byte	7bit	1bit	4 byte
	< --- repeat N times --->			

Figure 6-77: Application data TC(15,130)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N = 5	The number of packet stores to be allocated	Since the HK memory can only be formatted in one go N is fixed to 5, In order to format both HK memories the TC need to be send twice with different Store ID's
Store ID	Identifier for the packet store	[1 ... 10]
BufferPol	Storage Buffer policy: Determines whether the HK Store will work as ring buffer or as container	0:= HK Store works as ring buffer, old data will be overwritten, if store is full 1:= HK Store works as linear buffer, no data will be overwritten in case of overflow
NoOfWords	The number of words to be allocated for the specified packet store.	[0 ... MAX] <u>If NoOfWords = 0 a dummy store is generated.</u>

Table 6-333: Application Data for TC(15,130)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N does not correspond to the number of supplied Store ID's

if Store ID is not defined or invalid

if NoOfWords is invalid

6.13.12 TC (15,131): Report HK Format

TC (15,131) is used trigger the generation of TM(15,132) to downlink the HK memory formatting.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-334: TC Packet Header for TC(15,131)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 131

Table 6-335: TC Data Field Header for TC(15,131)

TC (15,131) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.13.13 TM (15,132): HK Format Report

TM (15,132) is the response to TC (15,131).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-336: TM Packet Header for TM(15,132)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 13

Table 6-337: TM Data Field Header for TM(15,132)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N	STORE ID	FILLER	BUFFERPOL	No Of Words
Unsigned Integer	Enumerated	Bit	Bit	Unsigned Integer
	1 byte	7bit	1bit	4 byte
	< --- repeat N times --->			

Figure 6-78: Source data TM(15,132)

The parameters of the *Application Data* field within the *TC Packet Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
$N = 5$	The number of packet stores to be allocated	Since the HK memory can only be formatted in one go N is fixed to 5, In order to format both HK memories the TC need to be send twice with different Store ID's
Store ID	Identifier for the packet store	[1 ... 10]
BufferPol	Storage Buffer policy: Determines whether the HK Store will work as ring buffer or as container	0:= HK Store works as ring buffer, old data will be overwritten, if store is full 1:= HK Store works as linear buffer, no data will be overwritten in case of overflow
NoOfWords	The number of words to be allocated for the specified packet store.	[0 MAX] <u>If NoOfWords = 0 a dummy store is generated.</u>

Table 6-338: Source Data for TM(15,132)

6.13.14 TC (15,133): Add SID's to Storage Selection Definition

Upon reception of TC (15,133) the *SID*'s of the specified *PID* shall be added to the Storage Selection Definition of the given Packet Store.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-339: TC Packet Header for TC(15,133)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 133

Table 6-340: TC Data Field Header for TC(15,133)

The structure of the *Application Data* field within the TC *Packet Data* field is defined here below.

STORE ID	N1	FILLER	PID	N2	SID
Enumerated	Unsigned integer		Enumerated	Unsigned integer	Enumerated
1 byte	1 byte	1bit	7 bit	1 byte	1 byte
					< --- repeat N2 times --->
		< ----- repeat N1 times ----- >			

Figure 6-79: Application data TC(15,133)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Store ID	Identifier for the packet store	See Annex <u>Note: value 0 means "No Storage"</u>
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N1/N2	The number of PID/HK/DG SID's to be added to storage selection definition.	<u>N1 = 0:</u> all TM(3,25);TM(3,26) telemetry source packets shall be stored in the specified Store ID. <u>N1 > 0, N2 = 0:</u> all TM(3,25);TM(3,26) telemetry source packets from the corresponding application process shall be stored in the specified Store ID. <u>N1 > 0, N2 > 0:</u> the specified SID's of TM(3,25);TM(3,26) telemetry source packets from the corresponding application process shall be stored in the specified Store ID.
SID	Structure ID of a Report Definition (HK, Diagnostic)	See Annex.

Table 6-341: Application Data for TC(15,133)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if Store ID is invalid

if the Application Data Structure is inconsistent

The request shall have no effect for a packet type which is not in the list of packet types to be stored in the specified packet store.(because all its subtypes are already selected for storage).

6.13.15 TC (15,134): Remove SID's from Storage Selection Definition

Upon reception of TC (15,134) the SID's of the specified PID shall be removed to the Storage Selection Definition of the given Packet Store.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-342: TC Packet Header for TC(15,134)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 134

Table 6-343: TC Data Field Header for TC(15,134)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

STORE ID	N1	FILLER	PID	N2	SID
Enumerated	Unsigned integer		Enumerated	Unsigned integer	Enumerated
1 byte	1 byte	1bit	7 bit	1 byte	1 byte
					< --- repeat N2 times --->
		< ----- repeat N1 times ----- >			

Figure 6-80: Application data TC(15,134)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Store ID	Identifier for the packet store	See Annex <u>Note: value 0 means "No Storage"</u>
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N1/N2	The number of PID/HK/DG SID's to be deleted from the storage selection definition.	<u>N1 = 0:</u> all TM(3,25);TM(3,26) telemetry source packets shall be deleted from storage selection definition of the specified Store ID. <u>N1 > 0, N2 = 0:</u> all TM(3,25);TM(3,26) telemetry source packets from the corresponding application process shall be deleted from storage selection definition of the specified Store ID. <u>N1 > 0, N2 > 0:</u> the specified SID's of TM(3,25);TM(3,26) telemetry source packets from the corresponding application process shall be deleted from storage selection definition of the specified Store ID.
SID	Structure ID of a Report Definition (HK, Diagnostic)	See Annex.

Table 6-344: Application Data for TC(15,134)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed
if Store ID is invalid
if the Application Data Structure is inconsistent
The current content of the packet store shall not be affected by the request.
The request shall have no effect for a packet type which is not in the list of packet types to be stored in the specified packet store.

6.13.16 TC (15,135): Report SID Storage Selection Definition

Upon reception of TC (15,135) the report TM (15,136) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

<i>PARAMETERS OF TC PACKET HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-345: TC Packet Header for TC(15,135)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

<i>PARAMETERS OF TC PACKET DATA FIELD HEADER</i>	<i>DESCRIPTION</i>	<i>RANGE OR VALUE</i>
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 135

Table 6-346: TC Data Field Header for TC(15,135)

TC (15,135) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.13.17 TM (15,136): SID Storage Selection Definition Report

TM (15,136) is the response to TC (15,135).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-347: TM Packet Header for TM(15,136)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 136

Table 6-348: TM Data Field Header for TM(15,136)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N1	FILLER	PID	N2	SID	STORE ID
Unsigned integer		Enumerated	Unsigned integer	Enumerated	Enumerated
1 byte	1bit	7 bit	1 byte	1 byte	1 byte
				< --- repeat N2 times --->	
	< ----- repeat N1 times ----- >				

Figure 6-81: Source data TM(15,136)

The parameters of the *Application Data* field within the *TC Packet Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
PID	Process ID	Must be set to a value according table 6.1 (Annex A)
N1/N2	The number of PID/HK/DG SID's to follow.	
SID	Structure ID of a Report Definition (HK, Diagnostic)	A valid SID (see Annex)
Store ID	Identifier for the packet store	See Annex <i>Note: value 0 means "No Storage"</i>

Table 6-349: Source Data for TM(15,136)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.13.18 TC (15,137): Abort Playback of Packet Store Contents

Upon reception of TC (15,137) the currently executed TC(15,128) is aborted. All modified pointers will be set back to its original values.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-350: TC Packet Header for TC(15,137)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 15
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 137

Table 6-351: TC Data Field Header for TC(15,137)

TC (15,137) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed
 TM(1,8): TC Execution Completion Report - Failure
 if one of the consistency checks according to section 6.1 failed

6.14 Service 17: Test Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(17,1)	TC	Perform Connection Test	mandatory
(17,2)	TM	Link Connection Report	mandatory

Table 6-352: Service 17 sub-services

6.14.1 TC (17,1): Perform Connection Test

TC (17,1) is used to test the end-to-end connection between ground and the onboard application process. The addressed onboard application responds with TM (17,2).

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
 The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-353: TC Packet Header for TC(17,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
 The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 17
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-354: TC Data Field Header for TC(17,1)

TC (17,1) 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:

TM(1,2): TC Acceptance Report - Failure
 if one of the static checks according to section 6.1 failed
 TM(1,8): TC Execution Completion Report - Failure
 if one of the consistency checks according to section 6.1 failed

6.14.2 TM (17,2) Link Connection Report

The report informs the TC source about the successful reception of the TC by the receiving onboard application (PID).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 1 (acknowledge)

Table 6-355: TM Packet Header for TM(17,2)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 17
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-356: TM Data Field Header for TM(17,2)

TM (17,2) does not have any source data, i.e. the *Source Data* field within the *TM Packet Data* field does not exist (length = 0).

6.15 Service 18: On Board Operations Procedures

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(18,1)	TC	Load Procedure	
(18,2)	TC	Delete Procedure	
(18,3)	TC	Start Procedure	
(18,4)	TC	Stop Procedure	
(18,5)	TC	Suspend Procedure	
(18,6)	TC	Resume Procedure	
(18,7)	TC	Communicate parameters to a procedure	
(18,8)	TC	Report list of Onboard Operation Procedures	
(18,9)	TM	Onboard Operation Procedures List Report	
(18,10)	TC	Report list of Active Onboard Operation Procedures	
(18,11)	TM	Active Onboard Operation Procedures List Report	
(18,128)	TC	Add TC to OBCP	
(18,129)	TC	Delete TC from OBCP	
(18,130)	TC	Dump Onboard Procedure	
(18,131)	TM	Onboard Procedure Dump	

Table 6-357: Service 18 sub-services

S ... System Control APID
A ... AOCS APID
B ... Bus Control APID
P ... Payload Manager APID

Overall Concept:

A simplified approach of "On Board Procedures" shall be used. OBCP's shall be implemented as TC m... instead of a fully fledged programming language. Thus, an OBCP is a sequence of TC's executed one after the other with pre-defined time delays between two commands. An OBCP shall be identified by a unique OBCP identifier, whereas one single step of such a sequence shall be identified by a sequence step number. An OBCP can be created/modified by TC(18,128) and TC(18,129). For PUS compliance reason TC(18,2) is supported as well. It shall be possible to run OBCP's in parallel, whereas the ground is in charge for resolving possible conflicts caused by this concept. Requests to start an already running OBCP shall be discarded.

6.15.1 TC (18,2) DELETE Procedure

Upon reception of TC (18,2), the specified onboard procedure shall be deleted from the list of loaded onboard procedures and the area occupied by the procedure code shall be cleared. The request shall be rejected if the procedure status is "active".

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-358: TC Packet Header for TC(18,2)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 18
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-359: TC Data Field Header for TC(18,2)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

PROCEDURE ID
Enumerated
1 Byte

Figure 6-82: Application data TC(18,2)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Procedure ID	Unique ID of procedure	[1-254]

Table 6-360: Application Data for TC(18,2)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the Procedure ID is not defined

if the OBCP status was "active".

6.15.2 TC (18,3) START Procedure

Upon reception of TC (18,3), the specified onboard procedure shall be started.

The procedure status shall then be "active". The request shall be ignored if the status of the procedure was "active".

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-361: TC Packet Header for TC(18,3)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 18
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-362: TC Data Field Header for TC(18,3)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (18,2).

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the Procedure ID is not defined

if the OBCP status was "active"

6.15.3 TC (18,4) STOP Procedure

Upon reception of TC (18,4), the specified onboard procedure shall be stopped. The procedure status shall then be "inactive".

The request shall be rejected if the procedure already has the "inactive" status.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.


PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-363: TC Packet Header for TC(18,4)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 18
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 4

Table 6-364: TC Data Field Header for TC(18,4)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (18,2). 

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the Procedure ID is not defined

6.15.4 TC (18,8) Report list of Onboard Operation Procedures

Upon reception of TC (18,8), the report TM(18,9) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-365: TC Packet Header for TC(18,8)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 18
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 8

Table 6-366: TC Data Field Header for TC(18,8)

TC (18,8) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.15.5 TM (18,9) Onboard Operation Procedures List Report

TM (18,9) is the response to TC (18,8).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-367: TM Packet Header for TM(18,9)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 18
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 9

Table 6-368: TM Data Field Header for TM(18,9)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

NPROC	PROCEDURE ID	STATUS	POSITION
Enumerated	Enumerated	Enumerated	Unsigned Byte
1 byte	1 byte	1 byte	1 byte
< ----- repeat NPROC times ----- >			

Figure 6-83: Source data TM(18,9)

The parameters of the Source Data field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
NPROC	The number of procedures loaded on-board that follow	0 .. 255
Procedure ID	Unique ID of procedure that is being loaded	[1-255]
Status	Current OBCP status	Active (running) = 1, Inactive = 0
Position	The last released OBCP step	0 = first step of procedure is not yet released, or procedure is not running (see <i>Status</i>) [1-254] last released procedure step, note that 255 can not occur, because after release of the last step the procedure is no longer running.

Table 6-369: Source Data for TM(18,9)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.15.6 TC (18,128) Add TC to OBCP

Upon reception of TC (18,128), the application process shall add the provided TC to the OBCP selected by the *Procedure ID*. The parameter *Procedure Step* defines the position where the TC shall be inserted. An already existing TC at this position shall be replaced.

Note: Since all delay times are relative to the previous step, insertion of an OBCP step changes the timing of all subsequent procedure steps.

If the procedure with the specified ID does not exist, the application process shall create a new procedure and add the TC as very first command. The status of the new procedure shall be set to "inactive".

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-370: TC Packet Header for TC(18,128)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 18
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 128

Table 6-371: TC Data Field Header for TC(18,128)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

PROCEDURE ID	PROCEDURE STEP	DELAY	TC
Enumerated	Unsigned Byte	Unsigned Byte	Byte
1 Byte	1 Byte	2 Byte	Min: 12 bytes Max: 222 bytes

Figure 6-84: Application data TC(18,128)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Procedure ID	Unique ID of procedure that is being loaded	[0-254]
Procedure Step	Position where the TC should be inserted into the OBCP	Range: [1 .. 255]
Delay	Time Delay in [secs/16] for start of execution of the current step related to the start of execution of the previous step (or start of the procedure in case of first step)	Corresponding to resolution: 1/16sec = 62.5msec Max.: 4095.9375sec Min.: 0 = No Delay
TC	TC packet to be inserted into the OBCP	Any valid TC

Table 6-372: Application Data for TC(18,128)

Note: The Procedure Step shall be maintained similar as a line number. This means that after insertion the procedure steps shall not be renumbered automatically by the software. Therefore it is recommended to let some space between subsequent procedure steps in order to allow later insertion of TC's with minimum effort.

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if status of the procedure is "active"

if Procedure Step is not in range (i.e. 0)

if the Procedure Step could not be added (no free control structures available)

if the Procedure Step could not be added (no free TC buffer available)

6.15.7 TC (18,129) Delete TC from OBCP

Upon reception of TC (18,129), the application process shall delete the provided *Procedure Step* from the OBCP identified by *Procedure ID*.

Note: Since all delay times are relative to the previous step, deletion of an OBCP step changes the timing of all subsequent procedure steps.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-373: TC Packet Header for TC(18,129)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 18
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 129

Table 6-374: TC Data Field Header for TC(18,129)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

PROCEDURE ID	PROCEDURE STEP
Enumerated	Unsigned Byte
1 Byte	1 Byte

Figure 6-85: Application data TC(18,129)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>Procedure ID</i>	Unique ID of procedure that is being loaded	[0-254]
<i>Procedure Step</i>	Position of the TC to be deleted from the OBCP	Range: [0 .. 255] Procedure Step = 0: all procedure steps shall be deleted, the OBCP status shall be set to "Empty" <i>Note; This has the same effect as TC(18,2) !</i>

Table 6-375: Application Data for TC(18,129)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if status of the procedure is "active"

6.15.8 TC (18,130) Dump Onboard Procedure

Upon reception of TC (18,130), the specified onboard procedure shall be dumped. TM(18,131) will be generated as response .

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-376: TC Packet Header for TC(18,130)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 18
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 130

Table 6-377: TC Data Field Header for TC(18,130)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

PROCEDURE ID
Enumerated
1 Byte

Figure 6-86: Application data TC(18,130)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Procedure ID	Unique ID of procedure that is being loaded	[0-254]

Table 6-378: Application Data for TC(18,130)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.15.9 TM (18,131) Onboard Procedure Dump

TM (18,131) is the response to TC (18,130).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-379: TM Packet Header for TM(18,131)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 18
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 131

Table 6-380: TM Data Field Header for TM(18,131)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

PROCEDURE ID	NoPROCSTEPS	PROCEDURE STEP	DELAY	TC
Enumerated	Unsigned Byte	Unsigned Byte	Unsigned Byte	Byte
1 Byte	1 Byte	1 Byte	2 Byte	Min: 12 bytes Max: 222 bytes
< --- repeat NoProcStep times --->				

Figure 6-87: Source data TM(18,131)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>Procedure ID</i>	Unique ID of procedure that is being dumped	[0-254]
<i>NoProcSteps</i>	Number of <i>Procedure Steps</i> in TM Pkt.	Range: [0 .. 255]
<i>Procedure Step</i>	Position	Range: [0 .. 255]
<i>Delay</i>	Time Delay in [secs/16] for for start of execution of the current step related to the start of execution of the previous step (or start of the procedure in case of first step)	Corresponding to resolution: 1/16sec = 62.5msec Max.: 4095.9375sec Min.: 0 = No Delay
TC	TC packet	Any valid TC

Table 6-381: Source Data for TM(18,131)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.16 Service 19: Event/Action Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(19,1)	TC	Add Events to the Detection List	mandatory
(19,2)	TC	Delete Events from the Detection List	mandatory
(19,3)	TC	Clear the Event Detection List	mandatory
(19,4)	TC	Enable Actions	mandatory
(19,5)	TC	Disable Actions	mandatory
(19,6)	TC	Report the Event Detection List	mandatory
(19,7)	TM	Event Detection List Report	mandatory

Table 6-382: Service 19 sub-services

Service Concept:

The service shall maintain a list of events to be detected that contains the following information:

- Application Process ID generating the event report (optional, see below);
- 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.

6.16.1 TC (19,1): Add Events to the Detection List

Upon reception of TC (19,1) the specified event shall be added. If the event is already in the detection list the entry shall be updated. The event action status shall be set to "disabled".

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-383: TC Packet Header for TC(19,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 19
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-384: TC Data Field Header for TC(19,1)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

FILLER	PID	E ID	TC
Default 0 bin	Enumerated	Enumerated	Variable
1 bit	7 bit	2 bytes	Min: 12 bytes Max: 223 bytes

Figure 6-88: Application data TC(19,1)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
PID	Process ID	See Annex. <i>Note: System Control shall accept other PID's, than its own, in order to react on all events system wide</i> <i>The PL Manager shall accept PID's from its payload applications. (SSMM, ICU, LCT)</i> <i>The ICU shall accept PID's from ACE in addition to its own</i>
EID	Event Identifier	Must be set to a valid <i>EID</i> for the given <i>PID</i> . <i>Note: the SW will not check the validity of PID/EID combinations. The ground is in charge for !</i>
TC	Complete telecommand packet	A complete stand alone TC packet including packet header etc.

Table 6-385: Application Data for TC(19,1)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the event could not be added (no free control structures available)

if the event could not be added (no free TC buffer available)

6.16.2 TC (19,2): Delete Events from the Detection List

Upon reception of TC (19,2) the specified event shall be deleted.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-386: TC Packet Header for TC(19,2)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 19
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-387: TC Data Field Header for TC(19,1)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

FILLER	PID	EID
Default 0 bin	Enumerated	Enumerated
1 bit	7 bit	2 bytes

Figure 6-89: Application data TC(19,2)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
PID	Process ID	See Annex. <i>Note: System Control shall accept other PID's, than its own, in order to react on all events system wide</i> <i>The PL Manager shall accept PID's from its payload applications. (SSMM, ICU, LCT)</i> <i>The ICU shall accept PID's from ACE in addition to its own</i>
EID	Event Identifier	Must be set according to a valid <i>EID</i> present in the event detection list.

Table 6-388: Application Data for TC(19,2)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if PID/EID combination is not present in the Detection List

if the selected entry is in enabled/active state

6.16.3 TC (19,3): Clear the Event Detection List

Upon reception of TC (19,3) the all entries in the event detection list shall be deleted.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-389: TC Packet Header for TC(19,3)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 19
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-390: TC Data Field Header for TC(19,3)

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).

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.16.4 TC (19,4): Enable Actions

Upon reception of TC (19,4) the specified event shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-391: TC Packet Header for TC(19,4)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 19
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 4

Table 6-392: TC Data Field Header for TC(19,4)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N	FILLER	PID	EID
Unsigned Integer	Default 0 _{bin}	Enumerated	Enumerated
1 byte	1 bit	7 bit	2 bytes
	< ----- repeat N times ----- >		

Figure 6-90: Application data TC(19,4)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Number of parameter sets to follow	<p>N = 0 : The Event/Action status shall changed on Service level.</p> <p>N > 0: Each parameter set in the request shall be processed in turn and the status shall be set accordingly.</p>
PID	Process ID	<p>See Annex.</p> <hr/> <p><i>Note: System Control shall accept other PID's, than its own, in order to react on all events system wide</i></p> <p><i>The PL Manager shall accept PID's from its payload applications. (SSMM, ICU, LCT)</i></p> <p><i>The ICU shall accept PID's from ACE in addition to its own</i></p> <hr/>
EID	Event Identifier	See Annex.

Table 6-393: Application Data for TC(19,4)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of supplied parameter sets

if PID/EID combination is not present in the Detection List

6.16.5 TC (19,5): Disable Actions

Upon reception of TC (19,5) the specified event shall be disabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-394: TC Packet Header for TC(19,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 19
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-395: TC Data Field Header for TC(19,5)

The structure of the *Application Data* field within the TC Packet Data field is identical to the one defined for TC (19,4). (see Figure 6-91)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of supplied parameter sets

if PID/EID combination is not present in the Detection List

6.16.6 TC (19,6): Report the Event Detection List

Upon reception of TC (19,6) the report TM (19,7) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-396: TC Packet Header for TC(19,6)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 19
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-397: TC Data Field Header for TC(19,6)

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).

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed
 TM(1,8): TC Execution Completion Report - Failure
 if one of the consistency checks according to section 6.1 failed
 if the request could not be completed

6.16.7 TM (19,7): Event Detection List Report

TM (19,7) is the response to TC (19,6).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
 The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-398: TM Packet Header for TM(19,7)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 19
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 7

Table 6-399: TM Data Field Header for TM(19,7)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N	FILLER	PID	E ID	ACTION STATUS	TC
Unsigned integer	Default 0 _{bin}	enumerated	Enumerated	Enumerated	Unsigned integer
1 byte	1 bit	7 bit	2 bytes	1 byte	Min. 12 byte Max. 223 byte
	< ----- repeat N times ----- >				

Figure 6-91: Source data TM(19,7)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Repetition count	0 ... 67
PID	Application Process ID	Copy of the relevant entry in the event detection list
EID	Event Identifier	Copy of the relevant entry in the event detection list
Action Status	Event Action Status for given PID/EID	=DISABLED =ENABLED
TC	Complete telecommand packet	Copy of the relevant entry in the event detection list

Table 6-400: Source Data for TM(19,7)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.17 Service 128: Parameter Management

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(128,1)	TC	Set N Parameters	mandatory
(128,2)	TC	Get N Parameters	mandatory
(128,3)	TM	Parameter Report	mandatory

Table 6-401: Service 128 sub-services

6.17.1 TC (128,1): Set N Parameters

Upon reception of TC (128,1) the values of N predefined parameters shall be set to a given value.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-402: TC Packet Header for TC(128,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 128
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-403: TC Data Field Header for TC(128,1)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

NPAR	PARAMETER ID	PARAMETER VALUE
Unsigned integer	Enumerated	Any
1 bytes	4 bytes	variable
< ----- repeat NPAR times ----- >		

Figure 6-92: Application data TC(128,1)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
NPAR	Amount of parameters to be set	1 to 28 (limited by TC size) For the SSMM N is restricted to 1.
Parameter ID	Number uniquely identifying a parameter out of a list	Any valid value of the list of predefined parameters
Parameter Value	new parameter value	if the parameter size is 1 or 2 octets the first 2 or 3 octets will be ignored

Table 6-404: Application Data for TC(128,1)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if NPAR does not correspond with the number of supplied parameters

if Parameter ID is invalid

if the Parameter Value is out of expected range

if setting of the parameter is not allowed

6.17.2 TC (128,2): Get N Parameters

Upon reception of TC (128,2) the value of *N* predefined parameters shall be reported by TM(128,3)

Note: For the SSMM N is restricted to 1.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-405: TC Packet Header for TC(128,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 128
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-406: TC Data Field Header for TC(128,2)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

NPAR	PARAMETER ID
Unsigned integer	Enumerated
1 bytes	4 bytes
	< --- repeat NPAR times --- >

Figure 6-93: Application data TC(128,2)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
NPAR	Amount of parameters to be reported	1 to 50 (limited by TC) For the SSMM N is restricted to 1.
Parameter ID	Number uniquely identifying a parameter out of a list	Any valid value out of the list of predefined parameters (see relevant annex)

Table 6-407: Application Data for TC(128,2)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if NPAR does not correspond with the number of supplied parameters

if Parameter ID is invalid

6.17.3 TM (128,3): Parameter Report

TM (128,3) is the response to TC (128,2).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2

The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-408: TM Packet Header for TM(128,3)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 128
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-409: TM Data Field Header for TM(128,3)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

NPAR	PARAMETER ID	PARAMETER VALUE
Unsigned integer	Enumerated	Any
1 byte	4 bytes	variable
	< --- repeat NPAR times --- >	

Figure 6-94: Source data TM(128,3)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
NPAR	Amount of parameters in report	1 to 50 (limited by corresponding TC) For the SSMM N is restricted to 1.
Parameter ID	Number uniquely identifying a parameter out of a list	Any valid value out of the list of predefined parameters
Parameter Value	actual parameter value	Defined by PTC/PFC of the parameter, for parameters with length < 4Byte, the value is right aligned.

Table 6-410: TM Data Field Header for TM(128,3)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.18 Service 129: Orbit Position Management Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(129,1)	TC	Change Orbit Position Report Generation Rate	
(129,2)	TM	Orbit Position Report	
(129,3)	TC	Set Orbit Number	

Table 6-411: Service 129 sub-services

6.18.1 TM (129, 2): Orbit Position Report

TM (129,2) is used to report the orbit position to the ground, which is correlated to the last VC0 TM frame with frame counter 0.

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2. The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETER	DESCRIPTION	RANGE OR VALUE
Data Field Header Flag	Indicates the presence of a data field header (when set to 1)	Must be set to 0
PID	Process ID (part of the APID)	Must be set to 0
PCAT	Packet category	Must be set to 0
Packet Length	Number of bytes contained in the packet data field minus 1	Must be set to 8

Table 6-412: TM Packet Header for TM(129,2)

Note: The spacecraft ops source packet TM (129,2) containing the orbit position has no data field header.

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

ORBIT POSITION		OPSSSTATUS
Orbit Number	Orbit Angle	
Unsigned integer	Unsigned integer	Deduced
4 bytes	2 bytes	1 byte

Figure 6-95: Source data TM(129,2)

The parameters of the *Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
Orbit Number	Number of orbit. The orbit number is increased at each ascending equator crossing	In range $0 \dots 2^{32} - 1$
Orbit Angle	Orbit Angle	The angle in [radians] x 10000.
OPSSStatus		

Table 6-413: Source Data for TM(129,2)

6.19 Service 130: Orbit Position Schedule (OPS)

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	APPLICABILITY
(130,1)	TC	Enable Release of OPS Telecommands	mandatory
(130,2)	TC	Disable Release of OPS Telecommands	mandatory
(130,3)	TC	Reset OPS	mandatory
(130,4)	TC	Insert Telecommands into OPS Schedule	mandatory
(130,5)	TC	Delete Telecommands from OPS Schedule	mandatory
(130,6)	TC	Delete Telecommands over Position Range	mandatory
(130,7)	TC	Shift selected OPS Telecommands	
(130,8)	TC	Shift OPS Telecommands over Position Range	
(130,9)	TC	Report Subset of OPS in Detailed Form	mandatory
(130,10)	TM	Detailed OPS Report	mandatory
(130,11)	TC	Report OPS in Detailed Form over Position Range	mandatory
(130,12)	TC	Report Subset of OPS in Summary Form	mandatory
(130,13)	TM	Summary OPS Report	mandatory
(130,14)	TC	Report Subset of OPS in Summary Form over Position Range	mandatory
(130,15)	TC	Time Shift all OPS Telecommands	
(130,16)	TC	Report OPS in Detailed Form	mandatory
(130,17)	TC	Report OPS in Summary Form	mandatory
(130,18)	TC	Report OPS Status	mandatory
(130,19)	TM	OPS Status Report	mandatory

Table 6-414: Service 130 sub-services

6.19.1 TC (130,1): Enable Release of OPS Telecommands

TC (130,1) is used to enable the release of OPS Telecommands..

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-415: TC Packet Header for TC(130,1)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 1

Table 6-416: TC Data Field Header for TC(130,1)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

N1	SUB-SCHEDULE ID	N2	FILLER	PID
Unsigned	Enumerated	Unsigned	Bool	Enumerated
1 byte	1 byte	1 byte	1bit	7bits
		< ----- repeat N2 times ----->		
	< ----- repeat N1 times ----->			

Figure 6-96: Application data TC(130,1)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Number of sub-schedule / PID combinations to follow	N1 = 0, the command will effect the schedule control bit. N1 > 0, N2 = 0 the command will effect the application level controlling attribute of the telecommands with the specified sub-schedule ID
Sub-schedule ID	The identification of the sub-schedule(s) to be enabled or disabled.	By convention, the value 0 for Sub-schedule ID shall mean "all sub-schedules".
N2	Number of PID combinations to follow	If N1 > 0 and N2 > 0, the application process level controlling attribute of the telecommands with the specified destination application processes and with the specified sub-schedules shall be set according to the request type.
PID	Process ID	Must be set to a value according table 6.1 (Annex A)

Table 6-417: Application Data for TC(130,1)

Release Status:

The OPS on-board OPS scheduling service shall maintain appropriate information to determine whether a telecommand should be released or not at its due orbit position.
The release status of a telecommand shall be affected by the user requests to enable or disable the release for all or a subset of the telecommands in the OPS schedule. The telecommand release status shall be either "disabled" or "enabled".

SCHEDULE	SUB-SCHEDULE	APID	RELEASE STATUS
D(isabled)	E(nabled)	E	D
D	D	E	D
D	E	D	D
D	D	D	D
E	E	E	E
E	D	E	D
E	E	D	D
E	D	D	D

Table 6-418: Release status decision table

If TC is due to be executed, but the release status is “disabled” the TC shall be removed from the OPS schedule.

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the Number of APID

6.19.2 TC (130,2): Disable Release of OPS Telecommands

TC (130,1) is used to disable the release of Telecommands.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-419: TC Packet Header for TC(130,2)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 2

Table 6-420: TC Data Field Header for TC(130,2)

The structure of the *Application Data field within the TC Packet Data* field is identical with the one defined for TC (130,1).

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the Number of APID

6.19.3 TC (130,3): Reset OPS Schedule

Upon reception of TC (130,3) the service provider shall reset the OPS schedule as follows:

- It shall clear all entries from the OPS schedule.
- The OPS schedule shall be disabled and commanding to all application processes shall be enabled.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-421: TC Packet Header for TC(130,3)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 3

Table 6-422: TC Data Field Header for TC(130,3)

TC (130,3) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

6.19.4 TC (130,4): Insert Telecommands into OPS Schedule

Upon reception of TC (130,4) the TC specified by the field Telecommand Packet is inserted into the OPS schedule.

- TC's shall be sorted according to their position tag.
- TC's with same position tag shall be sorted in order of their arrival on board
- a newly uplinked TC shall replace an old one eventually uplinked before.

Note: TC Packet Header and TC Packet Data Field may be stored separately in order to minimize CPU time for reordering the command schedule.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-423: TC Packet Header for TC(130,4)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted according to the following table.

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 4

Table 6-424: TC Data Field Header for TC(130,4)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

SUB-SCHEDULE ID	N	OPSTAG	TC PACKET
Unsigned Integer	Unsigned Integer	Orbit Position (See chapter 6.18)	Any
1 bytes	1 bytes	6 bytes	Variable Min: 12 bytes Max: 219 bytes
< ----- repeat N times ----->			

Figure 6-97: Application data TC(130,4)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Sub-schedule ID	The identification of the sub-schedule(s) to be enabled or disabled.	1 ... 255
N	Number of Telecommands to be inserted in the schedule	1 ... 18
OPSTag	Absolute orbit position tag for the TC	Any valid orbit position
TC packet	Complete TC packet	Any TC packet except TC (130,4)

Table 6-425: Application Data for TC(130,4)

Note: Since the Maximum size of the Application Data field is limited to 226 bytes, the TC packet size for commands to be inserted into the OPS can not be larger than $226 - TT - N = 219$ bytes.

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of TC packets

if the Time Tag is already in past

Note: OPS Tags later than Current Position + 2° are considered as past.

if the command could not inserted in the command schedule (no free control structures available)

if the command could not inserted in the command schedule (no free TC buffer available)

if the TC to be inserted is TC(130,4) and/or if the Source of the TC to be inserted is not GROUND

6.19.5 TC (130,5): Delete Telecommands from OPS

Upon reception of TC (130,5) all TC's which satisfy the selection criteria defined by the PID, Sequence Count and the Number of TC's shall be deleted from the OPS.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-426: TC Packet Header for TC(130,5)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 5

Table 6-427: TC Data Field Header for TC(130,5)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

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 ----- >					

Figure 6-98: Application data TC(130,5)

Note: Destination PID and Sequence Number correspond to the Packet Header Definition in chapter 3.3 .

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Number of TC areas to be deleted ("scattered delete")	1 ... 56
PID	Destination PID of the TC to be deleted	Must be set to a value according table 6.1 (Annex A) 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 TC's	Number of successive TC's to be deleted	Minimum value = 1, maximum value = all TC's in the command schedule with the specified <i>PID</i> and a <i>Sequence Count</i> value greater than the specified one.

Table 6-428: Application Data for TC(130,5)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of supplied parameter sets

if the 1st TC to be deleted is not found in the command schedule. (for one parameter set)

Note: If the Number of Telecommands exceeds the total number of commands that satisfy the selection criteria, then all commands that satisfy the selection criteria shall be deleted.

6.19.6 TC (130,6): Delete Telecommands over Position Range

Upon reception of TC (130,6) the TC's specified shall be removed from the OPS schedule. TC's in the OPS schedule are reordered according to their position tag.

Note: TC Packet Header and TC Packet Data Field may be stored separately in order to minimise CPU time for reordering the command schedule.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-429: TC Packet Header for TC(130,6)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 6

Table 6-430: TC Data Field Header for TC(130,6)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

RANGE	OPSTAG 1	OPSTAG 2	N1	SUB-SCHEDULE ID	N2	FILLER	PID
Enumerated	Orbit Position (See chapter 6.18)	Orbit Position (See chapter 6.18)	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 ----->			

Figure 6-99: Application data TC(130,6)

The parameters of the *Application Data* field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
<i>Range</i>	Parameter for interpretation of the period given by Time Tags	Range = 0: complete command schedule Range = 1: clear between OPS tags Range = 2: clear before OPSTag1 Range = 3: clear after OPSTag1
<i>OPS Tag 1 & 2</i>	Absolute orbit position tag for the TC	A valid orbit position
<i>N1</i>	Number of Sub-schedules follow	N1 = 0 ... All sub-schedules shall be affected N1 > 0 ... Only selected sub-schedules shall be affected
<i>Sub-schedule ID</i>	The identification of the sub-schedule(s)	
<i>N2</i>	Number of PID combinations to follow	If N1 > 0 and N2 > 0, the application process level controlling attribute of the telecommands with the specified destination application processes and with the specified sub-schedules shall be set according to the request type.

Table 6-431: Application Data for TC(130,6)

The meaning and presence of the Time Tag parameters is according following table.

RANGE	OPS TAG 1	OPS TAG 2
0 (ALL)	n/a	n/a
1 (between)	Earliest absolute OPS	Latest absolute OPS
2 (before)	Latest absolute OPS	n/a
3 (after)	Earliest absolute OPS	n/a

Table 6-432: OPS Tag Parameters

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if Range is not valid

if N is not consistent to the number of supplied PID parameters

6.19.7 TC (130,9): Report Subset of OPS in Detailed Form

Upon reception of TC (130,9) the report TM (130,10) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-433: TC Packet Header for TC(130,9)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 9

Table 6-434: TC Data Field Header for TC(130,9)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

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 ---->					

Figure 6-100: Application data TC(130,9)

Note: Destination PID and Sequence Number correspond to the Packet Header Definition in chapter 3.3 .

The parameters of the Application Data field are to be inserted according to the following table.

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Number of TC areas to be reported ("scattered report")	1 ... 56
PID	Destination PID of the TC to be reported	Must be set to a value according table 6.1 (Annex A) Value is a copy of the corresponding field of the TC Packet Header of the TC's to be reported from the command schedule
Sequence Count	The sequence number of the first TC to be reported	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 reported from the command schedule
Number of TC's	Number of successive TC's to be reported	Minimum value = 1, maximum value = all TC's in the command schedule with the specified <i>PID</i> and a <i>Sequence Number</i> value greater than the specified one.

Table 6-435: Application Data for TC(130,9)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of supplied parameter sets

if the 1st TC to be reported is not found in the command schedule. (for one parameter set)

if the request could not be completed

6.19.8 TM (130,10): Detailed OPS Report

TM (130,10) is the response to TC (130,9), TC(130,11) or TC(130,16).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-436: TM Packet Header for TM(130,10)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 10

Table 6-437: TM Data Field Header for TM(130,10)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N	SUB-SCHEDULE ID	OPSTAG	TC PACKET
Unsigned Integer	Enumerated	Orbit Position (See chapter 6.18)	Any
2 bytes	1 byte	6 bytes	Min: 12 bytes Max: 219 bytes
	< ---- repeat N times ---->		

Figure 6-101: Source data TM(130,10)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Number of Time Tag + TC Packets to follow	1 ... 90
Sub-schedule ID	The identification of the sub-schedule	
OPSTag	Absolute orbit position tag for the TC	Copy of the ops tag of the TC in the ops schedule
TC Packet	Raw data of the complete TC	Copy of the TC in the command schedule

Table 6-438: Source Data for TM(130,10)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.19.9 TC(130,11): Report OPS in Detailed Form over Position Range

Upon reception of TC (130,11) the report TM (130,10) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-439: TC Packet Header for TC(130,11)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 130

Table 6-440: TC Data Field Header for TC(130,11)

The structure of the *Application Data* field within the *TC Packet Data* field is defined here below.

RANGE	OPSTAG 1	OPS TAG 2	N1	SUB-SCHEDULE ID	N2	FILLER	PID
Enumerated	Orbit Position (See chapter 6.18)	Orbit Position (See chapter 6.18)	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 ---->			

Figure 6-102: Application data TC(130,11)

PARAMETERS OF APPLICATION DATA FIELD	DESCRIPTION	RANGE OR VALUE
Range	Parameter for interpretation of the period given by Time Tags	Range = 0: complete command schedule Range = 1: report between time tags Range = 2: report before Time Tag 1 Range = 3: report after Time Tag 1
OPSTag 1 & 2	Absolute orbit position tag for the TC	A valid orbit position
N1	Number of PID's which follow	N1 = 0 ... All TC's are reported N1 > 0 ... those TC's which belong to a specified sub-schedule
Sub-schedule ID	The identification of the sub-schedule	
N2	Number of PID's which follow	If N1 > 0 and N2 > 0, those TC's which have a specified PID and belong to a specified sub-schedule
PID	Process ID	Must be set to a value according table 6.1 (Annex A)

Table 6-441: Application Data for TC(130,11)

The meaning and presence of the Time Tag parameters is according following table.

RANGE	OPSTAG 1	OPS TAG 2
0 (ALL)	n/a	n/a
1 (between)	Earliest absolute OPS	Latest absolute OPS
2 (before)	Latest absolute OPS	n/a
3 (after)	Earliest absolute OPS	n/a

Table 6-442: OPS Tag Parameters

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of supplied parameter sets

if Range is invalid

if the request could not be completed

6.19.10 TC (130,12): Report Subset of OPS in Summary Form

Upon reception of TC (130,12) the report TM (130,13) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-443: TC Packet Header for TC(130,12)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 12

Table 6-444: TC Data Field Header for TC(130,12)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (130,9). (see Figure 6-40!)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of supplied parameter sets

if the 1st TC to be reported is not found in the command schedule. (for one parameter set)

if the request could not be completed

6.19.11 TM (130,13): Summary OPS Report

TM (130,13) is the response to TC (130,12) , TC(12,14) and TC(130,17).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-445: TM Packet Header for TM(130,13)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 13

Table 6-446: TM Data Field Header for TM(130,13)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N	SUB-SCHEDULE ID	OPSTAG	FILLER	PID	FILLER	SEQUENCE COUNT
Unsigned integer	Enumerated	Orbit Position (See chapter 6.18)		Enumerated		Unsigned integer
2 bytes	1 byte	6 bytes	1 bit	7 bits	2 bits	14 bits
< ----- Repeat N times ----- >						

Figure 6-103: Source data TM(130,13)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N	Repetition count for following fields	Number of TC's reported in this TM Source Packet
Sub-schedule ID	The identification of the sub-schedule	
OPSTag	Absolute orbit position tag for the TC	Copy of the OPS tag of the TC as in the command schedule
PID	PID of the TC	Must be set to a value according table 6.1 (Annex A), value is a copy of the corresponding field of the TC Packet Header.
Sequence Count	The sequence number of the first TC to be deleted	Sequence Count, value is a copy of the corresponding field of the TC Packet Header of the TC

Table 6-447: Source Data for TM(130,13)

Note: In case the amount of data to be down linked exceeds the TM source packet, as many source packets as required shall be generated to fulfill the request. The bandwidth adjustment mechanism is applicable for this TM.

6.19.12 TC (130,14): Report Subset of OPS in Summary Form over Position Range

Upon reception of TC (130,14) the report TM (130,13) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-448: TC Packet Header for TC(130,14)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 14

Table 6-449: TC Data Field Header for TC(130,14)

The structure of the *Application Data* field within the *TC Packet Data* field is identical to the one defined for TC (130,6). (see Figure 6-40)

TC verification:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if N is not consistent to the number of supplied parameter sets

if Range is invalid

if the request could not be completed

6.19.13 TC (130,16): Report OPS in Detailed Form

Upon reception of TC (130,16) the report TM (130,10) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 . The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-450: TC Packet Header for TC(130,16)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 . The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 16

Table 6-451: TC Data Field Header for TC(130,16)

TC (130,16) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.19.14 TC (130,17): Report OPS in Summary Form

Upon reception of TC (130,17) TM (130,13) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .

The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-452: TC Packet Header for TC(130,17)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .

The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 17

Table 6-453: TC Data Field Header for TC(130,17)

TC (130,17) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.19.15 TC (130,18): Report Status of OPS

Upon reception of TC (130,18) TM (130,19) shall be generated.

The parameters of the TC Packet Header are to be set according to the definitions in chapter 3.3 .
The parameters of the TC Packet Header being not yet defined in chapter 3.3 are to be inserted according to the following table.

PARAMETERS OF TC PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 12 (telecommand)

Table 6-454: TC Packet Header for TC(130,18)

The parameters of the TC Data Field Header shall be set according to the definitions in chapter 3.4 .
The parameters of the TC Data Field Header not being yet defined in chapter 3.4 are to be inserted

PARAMETERS OF TC PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 18

Table 6-455: TC Data Field Header for TC(130,18)

TC (130,18) 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:

TM(1,2): TC Acceptance Report - Failure

if one of the static checks according to section 6.1 failed

TM(1,8): TC Execution Completion Report - Failure

if one of the consistency checks according to section 6.1 failed

if the request could not be completed

6.19.16 TM (130,19): OPS Status Report

TM (130,19) is the response to TC (130,18).

The parameters of the TM Packet Header are to be set according to the definitions in chapter 4.2
The parameters of the TM Packet Header being not yet defined in chapter 4.2 are to be inserted according to the following table.

PARAMETERS OF TM PACKET HEADER	DESCRIPTION	RANGE OR VALUE
PID	Process ID Number	Must be set to a value according table 6.1 (Annex A)
PCAT	Packet Category	Must be set to 3 (table)

Table 6-456: TM Packet Header for TM(130,19)

The parameters of the TM Packet Data Field Header are to be set according to the definitions in chapter 4.3 .

The parameters of the TM Packet Data Field Header being not yet defined in chapter 4.3 are to be inserted according to the following table.

PARAMETERS OF TM PACKET DATA FIELD HEADER	DESCRIPTION	RANGE OR VALUE
Service Type	Indicates the service to which the packet relates	Must be set to 130
Service Subtype	Indicates the service subtype to which the packet relates	Must be set to 19

Table 6-457: TM Data Field Header for TM(130,19)

The structure of the *Source Data* field within the *TM Packet Data* field is defined here below.

N1	SUB-SCHEDULE ID	STATUS	N2	FILLER	PID	STATUS
Unsigned integer	Enumerated	Enumerated	Unsigned integer		Enumerated	Enumerated
1 bytes	1 byte	8 bit	1 bytes	1 bit	7 bits	8 bit
				< ----- Repeat N2 times ----- >		
	< ----- Repeat N1 times ----- >					

Figure 6-104: Source data TM(130,19)

The parameters of the *Source Data* field are to be inserted according to the following table.

PARAMETERS OF SOURCE DATA FIELD	DESCRIPTION	RANGE OR VALUE
N1	Repetition count for following fields	Number of TC's reported in this TM Source Packet
Sub-schedule ID	The identification of the sub-schedule	
Status	The status of the corresponding sub-schedule	0... disabled 1... enabled
N2	Number of PID's to follow	
PID	PID of the TC	Must be set to a value according table 6.1 (Annex A), value is a copy of the corresponding field of the TC Packet Header.
Status	The status of the corresponding PID	0... disabled 1... enabled

Table 6-458: Source Data for TM(130,19)

7. LIST OF ACRONYMS

A

AC	Alternating Current
ACE	Antenna Control Electronics Unit
ACS	Attitude Control System
AD	Analogue to Digital
ADC	Analogue/Digital Converter
ADIO	Analogue/Digital Input/Output Interface
AFT	Abbreviated Functional Test
AIT	Assembly, Integration & Test
AIV	Assembly, Integration & Verification
ANT	Antenna
AOC	Attitude and Orbit Control
AOCS	Attitude and Orbit Control System
APID	Application Process Identifier
ASC	Advanced Stellar Compass
ASM	Acquisition and Safe Mode

B

BAQ	Block Adaptive Quantizer
BAT	Battery
BEE	Best Engineering Estimate
BER	Bit Error Rate
BOL	Begin of Life
BPSK	Binary Phase Shift Key
BPT	Beam Pointer Table

C

CAL	Calibration
CC	Communication Controller
CCDH	Command, Control and Data Handling
CCP	Configuration Change Pulse
CCS	Central Check-out System
CCSDS	Consultative Committee ...
CE	Central Electronics
CESS	Coarse Earth and Sun Sensor
CFRP	Carbon Fibre Reinforced Plastic
CGS	Cold Gas System
CHPT	Cold Gas High Pressure Transducer
CLPT	Cold Gas Low Pressure Transducer
CMD	Command
CoG	Centre of Gravity
CoM	Centre of Mass
CPU	Central Processing Unit

D

D/L	Downlink
DC	Direct Current
DCE	Digital Control Electronics Unit
D&D	Design & Development
DMU	Data Management Unit
DoD	Depth of Discharge
DT	Data Take
DWL	Data Window Length
DWP	Data Window Position
DTEZ	Data Take Exclusion Zone

E

EB Echo Buffer
EDAC Error Detection and Correction
EDB Engineering Database
EPROM Erasable Programmable Read only Memory
EMC Electromagnetic Compatibility
EOL End of Life
EWP Echo Window Position

F

FAM Fine Attitude Mode
FDIR Fault Detection, Isolation and Recovery
FDS Flight Dynamics System
FE Front-End
FEE Front-End Equipment
FEM Finite Element Model
FMECA Failure Mode Effects & Criticality Analysis
FOP Flight Operations Plan
FOV Field of View
FSS Fine Sun Sensor

G

GOP Ground Operations Plan
GPS Global Positioning System

H

H Horizontal
HDLC High Level Data Link Protocol
HK Housekeeping
HPA High Power Amplifier
HW Hardware

I

ICD Interface Control Document
ICU Instrument Control Unit
ID Identifier
INSAR Interferometric SAR
IPDU Instrument Power Distribution Unit
ISL Inter-Satellite Link
ISLD Inter-Satellite Link Decoder
ISLR Inter Satellite Link Receiver
IST Integrated System Test

L

LAA Leaf Amplifier Assembly
LAN Local Area Network
LCL Latching Current Limiter
LCT Laser Communication Terminal
LEOP Launch and Early Orbit Phase
LNA Low Noise Amplifier
LSB Least Significant Bit
LSByte Least Significant Byte
LSW Least Significant Word
LUT Look Up Table

M

M&C Monitoring & Control
MAG Magnetometer Unit

MCmd Macro Command
Mol Moment of Inertia
MOP Mission Operations Plan
MPB Main Power Bus
MLI Multi Layer Insulation
MMU Mass Memory Unit
MSB Most Significant Bit
MSByte Most Significant Byte
MSW Most Significant Word
MTBF Mean Time between Failures
MTL Master Time Line

N

NAV Navigation
NCR Non-Conformance Report
NESZ Noise Equivalent Sigma Zero
NM Nominal Mode
NOM Nominal Mode
NRZ N Return to Zero

O

OBC On-Board Computer Unit
OBT On-Board Time
OCM Orbit Control Mode
OCP On-Board Command Packet
OSI Open System Interconnect

P

PCDU Power Control & Distribution Unit
PCU Panel Control Unit
PFR Problem Failure Report
PIB Peripheral Interface Bus
PIC Peripheral Interface Controller
PID Process Identifier
PM Payload Manager in OBC
PPC Panel Power Conditioner Unit
PPS Pulse per second
PRF Pulse Repetition Frequency
PRI Pulse Repetition Interval
PT Pressure Transducer
PT Product Tree
PTI Product Tree Item
PUS Packet Utilisation Standard

Q

QPSK Quad Phase Shift Key

R

RAM Random Access Memory
RC Reaction Control
RCS Radar Cross Section or:
Reaction Control System
RCV Reaction Control Valve
RDB Results Data Base
RDM Rate Damping Mode
RF Radio Frequency
RFE Radio Frequency Electronics
RFEA RF Electronics Assembly
RFDU RF Distribution Unit

ROM Read Only Memory
RPS Reactive Power Source
RQC Reception Quality Control
RS Reed Solomon (Encoding)
RTDB Real Time Data Base
RV Relief Valve
RX Receiver / receive

S

SAR Synthetic Aperture Radar
S/C Space Craft
S/W Software
SA Solar Array
SCOE Special Check-Out Equipment
SDLC Serial Data Link Protocol
SDU SAR Data Unit
SEU Single Event Upset
SFT Short Function Test
SODB Satellite Operations Data Base
SCOS Satellite Operations & Check-Out System
SP Source Packet
SPG Source Packet Generator
SRL System Reconfiguration Logic
SRP Spin Reference Pulse
SSM Second Surface Mirror
SSMM Solid State Mass Memory
SSPC Solid State Power Controller
SST Signal Sequence Table
STR Star Tracker Unit
SW Software

T

T/C Thermal Control
TAFF TanDEM-X Autonomous Formation Flying
TB Thermal Balance
TBC To be confirmed
TBD To be defined
TC Telecommand
TCT TR Module Configuration Table
TDA Telemetry Data Acquisition
TDX TanDEM-X
TGM Timing Generator Module
TM Telemetry
TMM Thermal Mathematical Model
TOR Tracking & Occultation Experiment
TRM Transmit/Receive Module
TRX Transmitter/Receiver
TTC Telemetry, Tracking and Command
TV Thermal Vacuum
TX Transmit, transmit-

U

U/L Uplink
USO Ultra Stable Oscillator
UTC Universal Time Correlated

V

V Vertical



VME Versa Module Eurocard

X

XD Extended Decommuation
XBDA X-band Downlink Assembly
XBDU X-band Downlink Unit

Distribution List:

[illegible][illegible]

Title: **EC PUS Annex A: Common Data Tables**

CI - No:	TBD		
DRL Refs :	TBD		
	Name	Date	Signature
Prepared by:	Schwab, Armin	18.03.2008	
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Change Record

Issue	Date	Sheet	Description of Change
Draft	18.03.2008	all	first issue

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A. COMMON DATA TABLES

In this chapter all data tables which are common for all APIDs on EarthCare are defined. The numbering convention is as follows: Common Identifiers are numbered from 0 to 127. APID specific numbering always starts at 128. Each APID start by itself at these number, i.e. there are no dedicated numbering sections for the APIDs.

A.1 Process ID Table (PID)

PID(HEX)	UNIT	MN	APPLICATION	FUNCTIONS
00			TIME (only TM TBC)	- Time Management
00	OBC CSW- HW		OBC High Priority TC Functions	- High Priority Commanding to CPDU (MAP-0)
01			Spare	
02	OBC CSW- HW		OBC High Priority TM Functions	- for Prime HPTM Packet
03	OBC CSW- HW		OBC High Priority TM Functions	- for Redundant HPTM Packet
04	OBC CSW- HW		Authentication Function	TBC
OBC CSW CSW internal PID's				
10	OBC CSW- SW	SYCT	System Control Application	<ul style="list-style-type: none"> - Packet routing - Packet organization - System logging functions - MTL/OPS functions - OBC functions - Event/action functions - Patch/dump functions - S/C Conf Management - Time Management Functions - OBC MM handling functions - Dedicated PUS services - RF Functions - TCS Command and Control - Power Command and Control
11	OBC CSW- SW	AOCS	AOCS Application	- AOCS Command and Control
12	OBC CSW- SW	PLCT	Payload Control Application (MSI+MMFU)	- Payload Command and Control
OBC CSW CSW external PID's				
20	MMFU- A		MMFU-A Application	TBC
21	MMFU- B		MMFU-B Application	TBC
24	GPS-A		GPS-A Application	TBC
25	GPS-B		GPS-B Application	TBC
30	STR-A		STR-A Application	TBC
31	STR-B		STR-B Application	TBC
32	STR-C		STR-B Application	TBC
Instrument PID's				

40	ATLID-A		ATLID-A ICU Application	TBC
41	ATLID-B		ATLID-B ICU Application	TBC
44	MSI-A		MSI-A ICU Application	TBC
45	MSI-B		MSI-B ICU Application	TBC
48	BBR-A		BBR-A ICU Application	TBC
49	BBR-B		BBR-B ICU Application	TBC
4C	CPR-A		CPR-A ICU Application	TBC
4D	CPR-B		CPR-B ICU Application	TBC
<i>Others</i>				
60-77	EGSE		reserved	TBC
7F			IDLE PACKET	

Table A-1: Process ID Table

A.2 EarthCare PUS Service ID Allocation List (TBC)

Service ID (dec.)	Application
0 - 127	General PUS Services
128 - 139	General EarthCare PUS Services
140 - 149	-
150 - 159	System Control (SYCT) application services
160 - 169	AOCS application services
170 - 179	Payload Control (PLCT) application services
180 - 189	-
190 - 199	-
200 - 209	MMFU application services
210 - 219	ATLID application services
220 - 229	MSI application services
230 - 239	BBR application services
240 - 249	CPR application services
250 - 255	-

Table A-2: PUS Service ID allocation list

A.3 TM/TC Packet Categories (PCAT)

Packet categories are to be defined on EarthCare System level.

Telecommand	
Packet Category	Description
00	CPDU HPC Commands via MAP-ID 0
12	TELECOMMAND

Table A-3: Packet Category Tables TC

Telemetry		
Packet Category (DEC)	Description	TM Packets
0	TIME	TM (9,2)
1	ACKNOWLEDGE	TM(1,1), TM(1,2), TM(1,7), TM(1,8), TM(2,129) TBC , TM(17,2)
2	HPTM	High-Priority TM Packets from OBC CSW (w/o SW)
3	TABLE	TM(3,10), TM(3,12), TM(4,2), TM(4,9) TM(5,134), TM(8,133) TBC , TM(11,10), TM(11,13), TM(11,19) TM(130,10), TM(130,13), TM(130,19) TM(12,9), TM(12,11), TM(12,12) TM(13,14), TM(13,15), TM(13,16) TM(14,4) TBC , TM(14,8), TM(14,12), TM(14,129), TM(14,131) TM(15,6), TM(15,13), TM(15,132), TM(15,136) TM(18,9), TM(18,131) TM(19,7) TM(128,3) TM(129,2) TM(130, 10), TM(130,13), TM(130,19)
4	HK	TM(3,25), TM(3,26)
5	Spare	
6	Spare	
7	EVENT	TM(5,1), TM(5,2), TM(5,3), TM(5,4)
8	Spare	
9	DUMP	TM (6,6) TM (6,10)
10	Spare	
11	Spare	
12	Science 0	Nominal TBC
13	Science 1	Compr. Bypassed TBC
14	Spare	
15	IDLE PACKET	

Table A-4: Packet Category Tables TM

A.4 Source ID of TC Data Field Header

The Source ID in the Telecommand Data Field Header shall be inserted by the relevant application according to the table given here below.

SOURCE ID (DEC)	SOURCE ID (HEX)	APPLICATION
00	00	Ground
01	01	OBC CSW APSW Service 11 (MTL)
02	02	OBC CSW APSW Service 18 / OBC CSWP
03	03	OBC CSW APSW Service 19
04	04	OBC CSW APSW Service 130 (OPS)
		Further TBD

Table A-5: Source ID of TC Data Field Header

A.5 Destination ID of TM Data Field Header

DESTINATION ID (DEC)	DESTINATION ID (HEX)	APPLICATION
00	00	Ground / FOS
		Further TBD

Table A-6: Destination ID of TM Data Field Header

A.6 Common Structure of HK parameters (TBC)

On EarthCare the Parameter ID's have the following structure:

Parameter ID (4 Bytes)		
PID		Local ID
FILLER	PID	
	enumerated	Enumerated
1bit	7 bit	24 bit

Table A-7: Parameter Structure

A.7 Common Fault Identifiers (FID) (TBC)

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
0	0	illegal APID				TM(1,2)	n/a	reserved by ECSS-E-70-41A, not used by EarthCare
1	1	incomplete or invalid length packet				TM(1,2)		
2	2	incorrect checksum				TM(1,2)		
3	3	illegal packet type				TM(1,2)		
4	4	illegal packet subtype				TM(1,2)		
5	5	illegal or inconsistent application data				TM(1,2)		
6	6	illegal segment sequence flag	FID_ILLEGAL_TCS_SF			TM(1,2)		only applicable to OBC CSW system control APID
7	7	illegal MAP ID	FID_ILLEGAL_TCS_MAP_ID			TM(1,2)	n/a	only applicable to OBC CSW system control APID
								reserved for decryption
15	F	overflow of TC receive queue	FID_TC_QUEUE_OVERFLOW			TM(1,2)		only applicable to OBC CSW system control APID
256	100	illegal ccsds packet version number	FID_ILLEGAL_VERSION			TM(1,2)	all	received Packet ID already contained in basic TM format
257	101	illegal packet type	FID_ILLEGAL_P_TYPE			TM(1,2)		received Packet ID already contained in basic TM format
258	102	illegal data field header flag	FID_ILLEGAL_DFHF			TM(1,2)		received Packet ID already contained in basic TM format
259	103	unknown Process Identifier	FID_UNKNOWN_PID			TM(1,2)		received Packet ID already contained in basic TM format
260	104	illegal packet category	FID_ILLEGAL_PCAT			TM(1,2)		received Packet ID already contained in basic TM format
261	105	illegal sequence flag	FID_ILLEGAL_SF			TM(1,2)		received Packet Sequence Control already contained in

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
262	106	(reserved)	(reserved)			TM(1,2)		basic TM format
								reserved for "TC sequence count not contiguous" (FID_TC_SEQCNT_LEAP)
263	107	packet length out of allowed range	FID_INVALID_PLENGTH	received packet length		TM(1,2)		check of general minimum/maximum length of TC
264	108	packet length not in line with given type and subtype	FID_LENGTH_DISCREP	received packet length	expected packet length	TM(1,8)		check of length (range) of TC specific to given type and subtype
265	109	received number of bytes not equal to packet length	FID_CORRUPTED_TC	received packet length	received number of bytes	TM(1,2)		received number of bytes must be equal to (value(Packet Length) + 7)
266	10A	illegal CCSDS secondary header flag	FID_ILLEGAL_SHF	data field header		TM(1,2)		
267	10B	illegal TC packet PUS version number	FID_ILLEGAL_TC_PUS	data field header		TM(1,2)		
268	10C	unknown service type	FID_UNKNOWN_S_TYPE	data field header	unit mode (optional)	TM(1,2)		result of check may depend on actual unit mode of receiving APID
269	10D	unknown service subtype	FID_UNKNOWN_S_SUBTYPE	data field header	unit mode (optional)	TM(1,2)		result of check may depend on actual unit mode of receiving APID
270	10E	(reserved)	(reserved)					
271	10F	calculated checksum not equal to received checksum	FID_CS_DISCREP	received checksum	calculated checksum	TM(1,2)	several (see remark)	
272	110	overflow of TC input buffer	FID_TC_INBUF_OVERFLOW			TM(1,2)		
273	111	service requests a TM output with a logical structure larger than actually set MTU	FID_MTU_TOO_SMALL	size of MTU	size of requested logical structure	TM(1,8)		applicable to services, which generate telemetry output subject to bandwidth limitation mechanism

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
274	112	Ongoing TM request has been aborted by a new TM output request	FID_REPORT_ABORTED			TM(1,8)	several (see remark)	applicable to services, which generate telemetry output subject to bandwidth limitation mechanism
275	113	(reserved)	(reserved)					
276	114	(reserved)	(reserved)					
277	115	(reserved)	(reserved)					
278	116	(reserved)	(reserved)					
279	117	TC cannot be routed/executed due to violation of security level	FID_TC_REJECT_DUE_TO_SECURITY			TM(1,2)	all	
512	200	I/O request identifier out of allowed range	FID_INVALID_IO_REQ_ID	received I/O request ID		TM(1,8)	(2,128)	
513	201	I/O transfer failed	FID_IO_TRANS_FAIL	received I/O request ID	I/O status (optional)	TM(1,8)	(2,128)	
514	202	I/O access failed	FID_IO_ACCESS_FAIL	received I/O request ID	I/O status (optional)	TM(1,8)	(2,128)	
768	300	structure identifier out of allowed range	FID_INVALID_SID	received SID	unit mode (optional)	TM(1,8)	(3,1); (3,2); (3,3); (3,4); (3,5); (3,6); (3,7); (3,8); (3,9); (3,11); (3,128); (3,129); (3,130)	result of check may depend on actual unit mode of receiving APID
769	301	invalid collection interval	FID_INVALID_COLL_INT	received collection interval		TM(1,8)	(3,1); (3,2); (3,129); (3,130)	
770	302	invalid number of HK parameters	FID_INVALID_NPAR_HK	received NPAR		TM(1,8)	(3,1); (3,2); (3,131)	
771	303	amount of parameter identifiers not in line with NPAR parameter	FID_NPAR_LEN_DISCREP	received NPAR	received number of parameters	TM(1,8)	(3,1); (3,2); (3,131)	

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
772	304	invalid parameter ID	FID_INVALID_PAR_ID	received parameter ID		TM(1,8)	(3,1); (3,2); (3,131)	
773	305	too many SID's defined	FID_SID_OVERFLOW	number of defined SID's		TM(1,8)	(3,1); (3,2)	depending on capability of individual APID
774	306	start slot out of allowed range	FID_INVALID_START_SLOT	received start slot		TM(1,8)	(3,2); (3,130)	
775	307	(reserved)	(reserved)					
776	308	(reserved)	(reserved)					
777	309	attempt to modify enabled (active) SID	FID_HK_ACTIVE	received SID		TM(1,8)	(3,1); (3,2); (3,129); (3,130)	
778	30A	structure identifier is not defined	FID_UNKNOWN_SID	received SID		TM(1,8)	(3,5); (3,7)	
779	30B	memory address to be assigned to a HK parameter is out of allowed range	FID_INVALID_HK_MEM_ADDR	received memory address		TM(1,8)	(3,131)	
780	30C	(reserved)	(reserved)					
781	30D	HK/Diagnostic structure exceeds TM size	FID_TM_SIZE_EXCEEDED	type, subtype of TC	SID	TM(1,8)	(3,1); (3,2)	parameter 1 = 16 bit filler + type + subtype
1024	400	To be defined	To be defined			TM(1,8)	(4,6)	
1025	401	To be defined	To be defined			TM(1,8)	(4,7)	
1280	500	invalid number of EID's	FID_INVALID_NEID	received NEID		TM(1,8)	(5,5); (5,6)	
1281	501	amount of event identifiers not in line with N parameter	FID_NEID_LEN_DISCREP	received NEID	received number of event identifiers	TM(1,8)	(5,5); (5,6)	
1282	502	selected EID does not exist	FID_UNKNOWN_EID	index (1 to NEID) of unknown EID	received value of affected parameter	TM(1,8)	(5,5); (5,6)	
1283	503	(reserved)	(reserved)					
1284	504	(reserved)	(reserved)					
1285	505	(deleted)						reserved, deleted
1286	506	end time parameter out of allowed	FID_INVALID_END_TIME	received coarse	received fine	TM(1,8)	(5,130)	

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
		range		end time	end time			
1536	600	memory identifier out of allowed range	FID_INVALID_MEM_ID	received (source) memory ID	(received destination memory ID)	TM(1,8)	(6,2); (6,5); (6,9); (6,128)	2 parameters for copy
1537	601	start address out of allowed range	FID_INVALID_ADDRESS	received (source) memory address	(received destination memory address)	TM(1,8)	(6,2); (6,5); (6,9); (6,128); (6,140)	2 parameters for copy
1538	602	length out of allowed range	FID_INVALID_LENGTH	received memory length		TM(1,8)	(6,2); (6,5); (6,9); (6,128)	
1539	603	amount of data not in line with length parameter	FID_DATA_LEN_DISCREP	received memory length	received amount of data	TM(1,8)	(6,2)	
1540	604	memory access failed	FID_FAILED_MEM_ACCESS	cause (e.g. write protection, timeout, verify failure)		TM(1,8)	(6,2); (6,5); (6,9); (6,128)	
1541	605	(reserved)	(reserved)					
1542	606	NPAR out of allowed range or not in line with the number of supplied parameters	FID_MEM_BLOCK_DISCREP	received NPAR		TM(1,8)	(6,129); (6,130); (6,131)	
2048	800	selected function does not exist	FID_UNKNOWN_FUNC_ID	received function ID		TM(1,8)	(8,1); (8,128); (8,129); (8,130); (8,131); (8,132)	
2049	801	(reserved)	(reserved)					
2050	802	amount of function identifiers not in line with N parameter	FID_FUNC_ID_LEN_DISCREP	received N	received number of function identifiers	TM(1,8)	(8,128); (8,129); (8,130); (8,131); (8,132)	
2051	803	(reserved)	(reserved)					
2052	804	(reserved)	(reserved)					
2053	805	(reserved)	(reserved)					

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
2054	806	(reserved)	(reserved)					
2055	807	function execution failed	FID_FUNCTION_FAIL	received Function ID	error code returned by function (optional)	TM(1,8)	(8,1)	
2056	808	attempt to execute disabled function	FID_FUNCTION_DIS	received Function ID		TM(1,8)	(8,1)	
2057	809	Missing or too many parameter(s) at function call	FID_FUNCTION_PARAM_MISSING	received Function ID		TM(1,8)	(8,1)	
2058	80A	function parameter(s) out of range	FID_FUNCTION_PARAM_INVALID	received Function ID	received parameter value	TM(1,8)	(8,1)	
2304	900	time synchronisation failed	FID_TIME_SYNC_FAIL			TM(1,8)	(9,128)	
2305	901	time setting in OBC CSW failed	FID_TIME_SET_FAIL			TM(1,8)	(9,129)	
2306	902	(reserved)	(reserved)					
2307	903	(reserved)	(reserved)					
2816	B00	(reserved)	(reserved)					
2817	B01	amount of process identifiers not in line with N parameter	FID_PID_LEN_DISCREP	received N	received No of PID's	TM(1,8)	(11,1); (11,2)	
2818	B02	(reserved)	(reserved)					
2819	B03	(reserved)	(reserved)					
2820	B04	unknown process identifier for MTL handling	FID_UNKNOWN_MTL_PID	received PID		TM(1,8)	(11,5)	
2821	B05	(reserved)	(reserved)					
2822	B06	amount of telecommands not in line with N parameter	FID_TC_LENGTH_DISCREP	received N	received number of telecommands	TM(1,8)	(11,4)	
2823	B07	time tag lies in the past	FID_TIME_TAG_PASSED	received time tag (seconds only)	(received time tag 2; seconds only)	TM(1,8)	(11,4); (11,6)	in case of 11,6: (if time tag 2 < time tag 1)
2824	B08	MTL overflow (no free control structures)	FID_MTL_OVERFLOW	number of TC's in MTL		TM(1,8)	(11,4)	

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
2825	B09	(reserved)	(reserved)					
2826	B0A	amount of selection criteria not in line with N parameter	FID_MTL_SEL_DISCREP	received N	received number of selection criteria sets	TM(1,8)	(11,5); (11,6); (11,9); (11,11)	
2827	B0B	first telecommand to be deleted or reported not found	FID_TC_NOT_FOUND	unsuccessful selection criteria set		TM(1,8)	(11,5); (11,9); (11,12)	selection criteria set = 9 bit filler + PID + 2 bit filler + SSC
2828	B0C	range parameter out of allowed range	FID_INVALID_RANGE	received range parameter		TM(1,8)	(11,6); (11,11); (11,14)	
2829	B0D	TC not allowed to be inserted into MTL	FID_FORBIDDEN_TC	type, subtype of TC		TM(1,8)	(11,4)	parameter 1 = 16 bit filler + type + subtype
2830	B0E	(reserved)	(reserved)					
3072	C00	(reserved)	(reserved)					
3073	C01	amount of monitoring identifiers not in line with N parameter	FID_MON_ID_LEN_DISCREP	received N	received number of monitoring identifiers	TM(1,8)	(12,1); (12,2); (12,5); (12,6)	
3074	C02	monitoring identifier is not defined	FID_UNKNOWN_MON_ID	index (1 to N) of unknown monitoring ID	received value of affected parameter	TM(1,8)	(12,1); (12,2); (12,6); (12,128)	
3075	C03	(reserved)	(reserved)					
3076	C04	too many monitoring identifiers enabled	FID_TOO_MANY_MON_ID	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,1)	
3077	C05	(reserved)	(reserved)					
3078	C06	maximal reporting delay out of allowed range	FID_INVALID_REP_DEL	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,3)	
3079	C07	monitoring identifier out of allowed range	FID_INVALID_MON_ID	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	monitoring ID 0 not allowed
3080	C08	monitoring parameter identifier is not defined	FID_UNKNOWN_MON_PAR_ID	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
3081	C09	validity parameter is not defined	FID_UNKNOWN_VAL_PAR	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	
3082	C0A	illegal validity parameter type (not boolean)	FID_ILLEGAL_VAL_PAR	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	
3083	C0B	parameter monitoring interval out of allowed range	FID_INVALID_MON_INTERVAL	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	
3084	C0C	repetition interval out of allowed range	FID_INVALID_REP_INTERVAL	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	
3085	C0D	check selection parameter is not defined	FID_UNKNOWN_CHK_PAR	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	
3086	C0E	illegal check selection parameter type (not boolean)	FID_ILLEGAL_CHK_PAR	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	
3087	C0F	check type out of allowed range	FID_INVALID_CHK_TYPE	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	
3088	C10	selected event identifier is not defined	FID_UNKNOWN_MON_EID	index (1 to N) of affected parameter set	received value of affected parameter	TM(1,8)	(12,5)	
3089	C11	low limit greater than high limit	FID_DISORDERED_LIMITS	index (1 to N) of affected parameter set	received low limit	TM(1,8)	(12,5); (12,128)	
3090	C12	too many monitoring ID's defined	FID_MON_LIST_OVERFLOW	index (1 to N) of affected parameter set	number of defined monitoring ID's	TM(1,8)	(12,5)	
3091	C13	attempt to delete active monitoring identifier	FID_MON_ACTIVE	index (1 to N) of affected parameter set	monitoring ID	TM(1,8)	(12,6); (12,128)	to be handled as an error only if APID is not capable to modify/delete active checks
3092	C14	Monitoring Status is not a valid	FID_MON_STAT_INVALID	index (1 to N) of	received value	TM(1,8)	(12,5)	

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
		value		affected parameter set				
3093	C15	(reserved)	(reserved)					
3094	C16	(reserved)	(reserved)					
3095	C17	(reserved)	(reserved)					
3096	C18	(reserved)	(reserved)					
3584	E00	(reserved)	(reserved)					
3585	E01	unknown process identifier for forwarding control	FID_UNKNOWN_FORW_PID	received PID		TM(1,8)	(14,1); (14,2); (14,5); (14,6); (14,9); (14,10); (14,13); (14,14)	
3586	E02	(reserved)	(reserved)					
3587	E03	(reserved)	(reserved)					
3588	E04	(reserved)	(reserved)					
3589	E05	(reserved)	(reserved)					
3590	E06	(reserved)	(reserved)					
3591	E07	(reserved)	(reserved)					
3592	E08	amount of forward control criteria not in line with N1/N2/N3 parameters	FID_FORW_DISCREP			TM(1,8)	(14,1); (14,2); (14,5); (14,6); (14,9); (14,10); (14,13); (14,14)	if the structure is not as expected, it is not possible to determine the exact location of the discrepancy
3593	E09	too many forward control rules commanded	FID_FORW_OVERFLOW	actual number of rules		TM(1,8)	(14,1); (14,2); (14,5); (14,6); (14,9); (14,10); (14,13); (14,14)	
3840	F00	(reserved)	(reserved)					
3841	F01	amount of store identifiers not in line with N parameter	FID_STORE_DISCREP	received N	received number of store identifiers	TM(1,8)	(15,1); (15,2); (15,12); (15,129);	

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
							(15,130)	
3842	F02	selected store does not exist	FID_UNKNOWN_STORE_ID	received store identifier		TM(1,8)	(15,1); (15,2); (15,3); (15,4); (15,5); (15,12); (15,128); (15,129); (15,130); (15,133); (15,134); (15,135)	
3843	F03	(reserved)	(reserved)					
3844	F04	(reserved)	(reserved)					
3845	F05	(reserved)	(reserved)					
3846	F06	(reserved)	(reserved)					
3847	F07	(reserved)	(reserved)					
3848	F08	(reserved)	(reserved)					
3849	F09	number of virtual segments for downlink out of range	FID_INVALID_NO_VIRT_SEG	received NoOfVirtSegs		TM(1,8)	(15,130)	
3850	F0A	downlink already in progress	FID_DOWNLINK_CONFLICT			TM(1,8)	(15,128)	
3851	F0B	amount of storage control criteria not in line with N1/N2/N3 parameters	FID_STORE_DEF_DISCREP			TM(1,8)	(15,3); (15,4); (15,133); (15,134)	if the structure is not as expected, it is not possible to determine the exact location of the discrepancy
3852	F0C	too many storage control rules commanded	FID_STORE_OVERFLOW	actual number of rules		TM(1,8)	(15,3); (15,133)	
3853	F0D	(reserved)	(reserved)					
4608	1200	unknown procedure identifier	FID_UNKNOWN_PROC_ID	received procedure identifier		TM(1,8)	(18,2); (18,3); (18,4); (18,129); (18,130)	
4609	1201	(reserved)	(reserved)					
4610	1202	procedure to be managed is active	FID_PROC_ACTIVE	received		TM(1,8)	(18,2); (18,3);	

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
		(delete, start, add TC, delete TC not allowed)		procedure identifier			(18,128); (18,129)	
4611	1203	(reserved)	(reserved)	received procedure identifier		TM(1,8)	(18,4)	
4612	1204	procedure memory overflow	FID_PROC_MEM_OVERFLOW	received procedure identifier	received procedure step	TM(1,8)	(18,128)	
4613	1205	too many procedures started	FID_TOO_MANY_PROC	received procedure identifier	number of active procedures	TM(1,8)	(18,3)	
4614	1206	Procedure step is not valid	FID_PROC_STEP_INVA	received procedure identifier	received procedure step	TM(1,8)	(18,128)	
4864	1300	(reserved)	(reserved)					
4865	1301	(reserved)	(reserved)					
4866	1302	(reserved)	(reserved)					
4867	1303	(reserved)	(reserved)					
4868	1304	detection list overflow	FID_DETECTION_OVERFLOW	received PID	received EID	TM(1,8)	(19,1)	
4869	1305	a PID/EID combination not present in the detection list is selected for delete, enable or disable	FID_UNKNOWN_ACTION	received PID	received EID	TM(1,8)	(19,2); (19,4); (19,5)	
4870	1306	attempt to modify or delete an active detection list entry	FID_ACTION_ACTIVE	received PID	received EID	TM(1,8)	(19,1); (19,2)	to be handled as an error only if APID is not capable to modify/delete active entries
4871	1307	No space left in TC Pool	FID_TC_POOL_OVERFLOW	type, subtype of TC		TM(1,8)	(11,4); (18,128); (19,1);	parameter 1 = 16 bit filler + type + subtype
4872	1308	amount of PID/EID sets not in line with N parameter	FID_NACT_LEN_DISCREP	received N	received number of PID/EID sets	TM(1,8)	(19,4); (19,5)	
4873	1309	(reserved)	(reserved)					

FID (dec)	FID (hex)	Description of detected Error	Short Name	Parameter 1 (32 bit)	Parameter 2 (32 bit)	Report Type	Generating Service	Remarks
32768	8000	amount of parameters out of allowed range	FID_INVALID_NPAR	received NPAR		TM(1,8)	(128,1); (128,2)	
32769	8001	length of parameter data not in line with NPAR parameter	FID_PAR_LENGTH_DISCREP	received NPAR	expected data length	TM(1,8)	(128,1); (128,2)	
32770	8002	parameter identifier not defined	FID_UNKNOWN_PAR_ID	affected parameter ID		TM(1,8)	(128,1); (128,2)	
32771	8003	setting of selected parameter not allowed	FID_ILLEGAL_PAR_SET	affected parameter ID		TM(1,8)	(128,1)	
32772	8004	parameter value out of allowed range	FID_INVALID_PAR_VAL	affected parameter ID	affected parameter value	TM(1,8)	(128,1)	
32773	8005	parameter set identifier not defined	FID_UNKNOWN_PAR_SET_ID	received parameter set ID		TM(1,8)	(128,4); (128,5)	
32774	8006	EEPROM read/write for parameter reload/update failed	FID_EEPROM_ACCESS_FAIL	affected parameter set ID		TM(1,8)	(128,4); (128,5)	
33312	8220	(reserved)	(reserved)					
33313	8221	(reserved)	(reserved)					
33314	8222	(reserved)	(reserved)					
33315	8223	(reserved)	(reserved)					
33316	8224	(reserved)	(reserved)					
33317	8225	(reserved)	(reserved)					
33344	8240	(reserved)	(reserved)					
33345	8241	(reserved)	(reserved)					
33346	8242	(reserved)	(reserved)					

Table A-8: Common Fault Identifiers (FID)

A.8 Common Event Identifiers (EID)

There are no common EID allocated to service 5 reports (TBC). APID specific EIDs can be found in the relevant section.

As a general rule, the EID in event reports shall complemented by either none or one or two parameters, which may provide additional information to the cause of the event report. Both parameters have 32 Bit width, information within the parameter field shall be right-adjusted.

A.9 PUS Core service/subservice allocation

Note: The assignment process for the allocation table of sub-service to applications focussed so far on OBC CSW and the instrument applications (ATLID, MSI, BBR and CPR). For the MMFU a very draft for generic services is given, the core functionality concentrated in service 15 is not yet worked out.

The GPS and STR allocation is not yet done, and might also be strongly driven on

A.9.1 Service 1: Telecommand Verification Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(1,1)	TM	Telecommand Acceptance Report – Success	X	X	X	X	X	X	X	x		
(1,2)	TM	Telecommand Acceptance Report – Failure	X	X	X	X	X	X	X	x		
(1,3)	TM	Telecommand Execution Started Report – Success										
(1,4)	TM	Telecommand Execution Started Report – Failure										
(1,5)	TM	Telecommand Execution Progress Report – Success										
(1,6)	TM	Telecommand Execution Progress Report – Failure										
(1,7)	TM	Telecommand Execution Completion Report – Success	X	X	X	X	X	X	X	x		
(1,8)	TM	Telecommand Execution Completion Report – Failure	X	X	X	X	X	X	X	x		

Table A-9: Service 1 sub-services

S ... System Control APID

A ... AOCS APID

P ... Payload Control APID

A.9.2 Service 2: Device Command Distribution Service

Note: The device commanding is a strongly HW resp. IO system dependent service. ON/OFF Command distribution, CPDU resp. high power command support as well as register load commanding will be supported. Depending on the HW supplier these services might be provided by a generic direct IO command service by replicating the IO SW interface.

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(2,1)	TC	Distribute ON/OFF Commands										
(2,2)	TC	Distribute Register Load Commands										
(2,3)	TC	Distribute CPDU Commands										
(2,128)	TC	Direct I/O	X			x	x	x	x			
(2,129)	TM	Direct I/O Response	X			x	x	x	x			

Table A-10: Service 2 sub-services

A.9.3 Service 3: Housekeeping and Diagnostic Data Reporting Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(3,1)	TC	Define new HK Parameter Report	X	X	X	x	x	X	X	x		
(3,2)	TC	Define new Diagnostic Parameter Report	X	X	X	X	x	x	x			
(3,3)	TC	Clear HK Parameter Report Definitions	X	X	X	x	x	x	X	x		
(3,4)	TC	Clear Diagnostic Parameter Report Definitions	X	X	X	x	x	x	X			
(3,5)	TC	Enable HK Parameter Report Generation	X	X	X	X	X	X	X	x		
(3,6)	TC	Disable HK Parameter Report Generation	X	X	X	X	X	X	X	x		
(3,7)	TC	Enable Diagnostic Parameter Report Generation	X	X	X	x	x	x	X			
(3,8)	TC	Disable Diagnostic Parameter Report Generation	X	X	X	x	x	x	X			
(3,9)	TC	Report HK Parameter Report Definitions	X	X	X	X	X	X	X	x		
(3,10)	TM	HK Parameter Report Definitions Report	X	X	X	X	X	X	X	x		
(3,11)	TC	Report Diagnostic Parameter Report Definitions	X	X	X	x	x	x	X			
(3,12)	TM	Diagnostic Parameter Report Definitions Report	X	X	X	x	x	x	x			
(3,13)	TC	Report HK Parameter Sampling-Time Offset										
(3,14)	TC	Report Diagnostic Parameter Sampling-Time Offset										
(3,15)	TM	HK Parameter Sampling-Time Offset Report										
(3,16)	TM	Diagnostic Parameter Sampling-Time Offset Report										
(3,17)	TC	Select Periodic HK Parameter Report Generation Mode										
(3,18)	TC	Select Periodic Diagnostic Parameter Report Generation Mode										
(3,19)	TC	Select Filtered HK Parameter Report Generation Mode										
(3,20)	TC	Select Filtered Diagnostic Parameter Report Generation Mode										
(3,21)	TC	Report Unfiltered Housekeeping Parameters										
(3,22)	TC	Report Unfiltered Diagnostic										

		Parameters										
(3,23)	TM	Unfiltered Housekeeping Parameters Report										
(3,24)	TM	Unfiltered Diagnostic Parameters Report										
(3,25)	TM	Housekeeping Parameter Report	X	X	X	X	X	X	X	x		
(3,26)	TM	Diagnostic Parameter Report	X	X	X	x	x	x	X			
(3,128)	TC	Request HK Parameter Report	X	X	X	X	X	X	X	x		
(3,129)	TC	Define HK Parameter Report Collection Interval	X	X	X	x	x	x	X	x		
(3,130)	TC	Define Diagnostic Parameter Report Collection Interval	X	X	X	X	x	x	x			
(3,131)	TC	Assign Auxiliary Diagnostic parameter	X	X	X	x	x	x	x			

Table A-11: Service 3 sub-services

A.9.4 Service 4: Parameter Statistics Reporting Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(4,1)	TC	Report Parameter Statistics	X									
(4,2)	TM	Parameter Statistics Report	X									
(4,3)	TC	Reset Parameter Statistics Reporting	X									
(4,4)	TC	Enable Periodic Parameter Statistics Reporting	X									
(4,5)	TC	Disable Periodic Parameter Statistics Reporting	X									
(4,6)	TC	Add Parameters to Parameter Statistics List	X									
(4,7)	TC	Delete Parameters from Parameter Statistics List	X									
(4,8)	TC	Report Parameter Statistics List	X									
(4,9)	TM	Parameter Statistics List Report	X									
(4,10)	TC	Clear Parameter Statistics List	X									

Table A-12: Service 4 sub-services

A.9.5 Service 5: Event Reporting Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(5,1)	TM	Normal/Progress Report	X	X	X	X	X	X	x	x		
(5,2)	TM	Error/Anomaly Report -- Low Severity	X	X	X	x	X	x	x	x		
(5,3)	TM	Error/Anomaly Report – Medium Severity	X	X	X	x	X	x	x	x		
(5,4)	TM	Error/Anomaly Report – High Severity	X	X	X	X	X	X	x	x		
(5,5)	TC	Enable Event Packet Generation	X	X	X	x	X	x	x	x		
(5,6)	TC	Disable Event Packet Generation	X	X	X	x	X	x	x	x		
(5,128)	TC	Downlink the System Log										
(5,129)	TM	System Log Report										
(5,130)	TC	Clear the System Log										
(5,133)	TM	Report Enabled Event Packets										
(5,134)	TC	Enabled Event Packets Report										

Table A-13: Service 5 sub-services

A.9.6 Service 6: Memory Management Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(6,1)	TC	Load Memory using Base plus Offsets										
(6,2)	TC	Load Memory using Absolute Addresses	X			X	X	X	x	x		
(6,3)	TC	Dump Memory using Base plus Offsets										
(6,4)	TM	Memory Dump using Base plus Offsets Report										
(6,5)	TC	Dump Memory using Absolute Addresses	X			X	X	X	x	x		
(6,6)	TM	Memory Dump using Absolute Addresses Report	X			X	X	X	x	x		
(6,7)	TC	Check Memory using Base plus Offsets										
(6,8)	TM	Memory Check using Base plus Offsets Report										
(6,9)	TC	Check Memory using Absolute Addresses	X			X	X	X	x	x		
(6,10)	TM	Memory Check using Absolute Addresses Report	X			X	X	X	x	x		
(6,128)	TC	Copy Memory	X			X						

Table A-14: Service 6 sub-services

A.9.7 Service 8: Function Management Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(8,1)	TC	Perform Function	X	X	X	X	X	X	x	x		
(8,128)	TC	Enable Function Execution	X	X	X							
(8,129)	TC	Disable Function Execution	X	X	X							
(8,130)	TC	Enable Function Arming	X	X	X							
(8,131)	TC	Disable Function Arming	X	X	X							
(8,132)	TC	Report Function Status	X	X	X							
(8,133)	TM	Function Status Report	X	X	X							

Table A-15: Service 8 sub-services

A.9.8 Service 9: Time Management Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(9,1)	TC	Change Time Report Generation Rate										
(9,2)	TM	Time Report	X									
(9,128)	TC	Time Synchronization of payload applications				x	x	x	x	x		
(9,129)	TC	Set absolute OBC CSW time	X									
(9,130)	TC	Enable Synchronization of GPS / OBC CSW time	X									
(9,131)	TC	Disable Synchronization of GPS / OBC CSW time	X									
(9,132)	TC	Trigger Time Synchronisation	X									

Table A-16: Service 9 sub-services

* This TC is generated by the PL Manager application, it can not be sent by ground.

A.9.9 Service 11: On Board Operations Scheduling

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(11,1)	TC	Enable Release of Telecommands	X									
(11,2)	TC	Disable Release of Telecommands	X									
(11,3)	TC	Reset Command Schedule	X									
(11,4)	TC	Insert Telecommands in Command Schedule	X									
(11,5)	TC	Delete Telecommands	X									
(11,6)	TC	Delete Telecommands over Time Period	X									
(11,7)	TC	Time-Shift Telecommands										
(11,8)	TC	Time-Shift Telecommands over Time Period										
(11,9)	TC	Report Subset of Command Schedule in Detailed Form	X									
(11,10)	TM	Detailed Schedule Report	X									
(11,11)	TC	Report Command Schedule in Detailed Form over Time Period	X									
(11,12)	TC	Report Subset of Command Schedule in Summary Form	X									
(11,13)	TM	Summary Schedule Report	X									
(11,14)	TC	Report Subset of Command Schedule in Summary Form over Time Period	X									
(11,16)	TC	Report Command Schedule in Detailed Form	X									
(11,17)	TC	Report Command Schedule in Summary Form	X									
(11,18)	TC	Report Status of Command Schedule	X									
(11,19)	TM	Command Schedule Status Report	X									

Table A-17: Service 11 sub-services

A.9.10 Service 12: On Board Parameter Monitoring

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(12,1)	TC	Enable Monitoring of Parameters	X	X	X	X	X	X	X	x		
(12,2)	TC	Disable Monitoring of Parameters	X	X	X	X	X	X	X	x		
(12,3)	TC	Change Maximum Reporting Delay										
(12,4)	TC	Clear Monitoring List	X	X	X	x	x	x	X	x		
(12,5)	TC	Add Parameters to Monitoring List	X	X	X	X	X	X	X	x		
(12,6)	TC	Delete Parameters from Monitoring List	X	X	X	X	X	X	X	x		
(12,7)	TC	Modify Parameter Checking Information										
(12,8)	TC	Report Current Monitoring List	X	X	X	X	X	X	X	x		
(12,9)	TM	Current Monitoring List Report	X	X	X	X	X	X	X	x		
(12,10)	TC	Report Current Parameters Out-of-limit List	X	X	X							
(12,11)	TM	Current Parameters Out-of-limit List Report	X	X	X							
(12,12)	TM	Check Transition Report										

Table A-18: Service 12 sub-services

A.9.11 Service 13: Large Data Transfer

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(13,9)	TC	Accept First Uplink Part	X									
(13,10)	TC	Accept Intermediate Uplink Part	X									
(13,11)	TC	Accept Last Uplink Part	X									
(13,13)	TC	Aboard Reception of Uplinked Data	X									
(13,14)	TM	Uplink Reception Acknowledgement Report	X									
(13,15)	TM	Unsuccessful Received Parts Report	X									
(13,16)	TM	Reception Aboard Report	X									

Table A-19: Service 13 sub-services

A.9.12 Service 14: Packet Forwarding Control Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(14,1)	TC	Enable Forwarding of Telemetry Source Packets	X									
(14,2)	TC	Disable Forwarding of Telemetry Source Packets	X									
(14,3)	TC	Report Enabled Telemetry Source Packets										
(14,4)	TM	Enabled Telemetry Source Packets Report										
(14,5)	TC	Enable Forwarding of Housekeeping Packets	X									
(14,6)	TC	Disable Forwarding of Housekeeping Packets	X									
(14,7)	TC	Report Enabled Housekeeping Packets	X									
(14,8)	TM	Enabled Housekeeping Packets Report	X									
(14,9)	TC	Enable Forwarding of Diagnostic Packets	X									
(14,10)	TC	Disable Forwarding of Diagnostic Packets	X									
(14,11)	TC	Report Enabled Diagnostic Packets	X									
(14,12)	TM	Enabled Diagnostic Packets Report	X									
(14,13)	TC	Enable Forwarding of Event Report Packets	X									
(14,14)	TC	Disable Forwarding of Event Report Packets	X									
(14,15)	TC	Report Enabled Event Report Packets										
(14,16)	TM	Enabled Event Report Packets Report										
(14,128)	TC	Report Telemetry Source Packet Forwarding Status	X									
(14,129)	TM	Telemetry Source Packet Forwarding Status Report	X									
(14,130)	TC	Report Event Report Packet Forwarding Status	X									
(14,131)	TM	Event Report Packet Forwarding Status Report	X									

Table A-20: Service 14 sub-services

A.9.13 Service 15: On Board Storage and Retrieval

Notes:

- (1) The MMFU supported sub-services are not yet defined. Concept trades are still in work.
- (2) The Start, Stop, Resume based ESOC downlink concept is not yet, but will be reflected

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(15,1)	TC	Enable Storage in Packet Stores	X									
(15,2)	TC	Disable Storage in Packet Stores	X									
(15,3)	TC	Add Packet Types & Sub-Types to Storage Selection Definition	X									
(15,4)	TC	Remove Packet Types & Sub-Types from Storage Selection Definition	X									
(15,5)	TC	Report Storage Selection Definition	X									
(15,6)	TM	Storage Selection Definition Report	X									
(15,7)	TC	Downlink Packet Store Contents for Packet Range										
(15,8)	TM	Packet Store Contents Report										
(15,9)	TC	Downlink Packet Store Contents for Time Period										
(15,10)	TC	Delete Packet Stores Contents up to Specified Packets										
(15,11)	TC	Delete Packet Stores Contents up to Specified Storage Time										
(15,12)	TC	Report Catalogues for Selected Packet Stores	X									
(15,13)	TM	Packet Store Catalogue Report	X									
(15,128)	TC	Start Playback of HK Packet Store Contents	X									
(15,129)	TC	Set Packet Store Pointer	X									
(15,130)	TC	Format HK Memory	X									
(15,131)	TC	Report HK Format	X									
(15,132)	TM	HK Format Report	X									
(15,133)	TC	Add SID's to Storage Selection Definition	X									
(15,134)	TC	Remove SID's from Storage Selection Definition	X									
(15,135)	TC	Report SID Storage Selection Definition	X									
(15,136)	TM	SID Storage Selection Definition Report	X									
(15,137)	TC	Abord Playback of HK Packet Store Contents	X									

Table A-21: Service 15 sub-services

A.9.14 Service 17: Test Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(17,1)	TC	Perform Connection Test	X	X	X	X	X	X	x	x		
(17,2)	TM	Link Connection Report	X	X	X	X	X	X	x	x		

Table A-22: Service 17 sub-services

A.9.15 Service 18: On Board Operations Procedures

Note:

- The concept so far supports simple, but strictly sequential relative time sequences of commands without decision taking features.

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(18,1)	TC	Load Procedure										
(18,2)	TC	Delete Procedure	X	X	X	x	x	x	x			
(18,3)	TC	Start Procedure	X	X	X	x	x	x	X			
(18,4)	TC	Stop Procedure	X	X	X	x	x	x	X			
(18,5)	TC	Suspend Procedure										
(18,6)	TC	Resume Procedure										
(18,7)	TC	Communicate parameters to a procedure										
(18,8)	TC	Report list of Onboard Operation Procedures	X	X	X	x	x	x	x			
(18,9)	TM	Onboard Operation Procedures List Report	X	X	X	x	x	x	X			
(18,10)	TC	Report list of Active Onboard Operation Procedures										
(18,11)	TM	Active Onboard Operation Procedures List Report										
(18,128)	TC	Add TC to OBC CSWP	X	X	X	x	x	x	X			
(18,129)	TC	Delete TC from OBC CSWP	X	X	X	x	x	x	X			
(18,130)	TC	Dump Onboard Procedure	X	X	X	x	x	x	X			
(18,131)	TM	Onboard Procedure Dump	X	X	X	x	x	x	X			

Table A-23: Service 18 sub-services

A.9.16 Service 19: Event/Action Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(19,1)	TC	Add Events to the Detection List	X	X	X	x	x	x	X			
(19,2)	TC	Delete Events from the Detection List	X	X	X	x	x	x	x			
(19,3)	TC	Clear the Event Detection List	X	X	X	x	x	x	x			
(19,4)	TC	Enable Actions	X	X	X	x	x	x	x			
(19,5)	TC	Disable Actions	X	X	X	x	x	x	x			
(19,6)	TC	Report the Event Detection List	X	X	X	x	x	x	x			
(19,7)	TM	Event Detection List Report	X	X	X	x	x	x	x			

Table A-24: Service 19 sub-services

A.9.17 Service 128: Parameter Management

Note: This services provides a generic access capability to on-board parameters

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(128,1)	TC	Set N Parameters	X	X	X	X	X	X	x	x		
(128,2)	TC	Get N Parameters	X	X	X	X	X	X	x	x		
(128,3)	TM	Parameter Report	X	X	X	X	X	X	x	x		

Table A-25: Service 128 sub-services

A.9.18 Service 129: Orbit Position Management

Note: The need and support of this service is TBD, since

- As required it is foreseen to provide an extended Time Report TM(9,2) which includes the orbit position information as used by the orbit position scheduler, which makes TM(129,2) obsolete
- If TM(129,2) is obsolete, TC(129,1) is obsolete as well
- It is proposed to support setting of the current orbit number via the generic parameter management service, which would make TC(129,3) obsolete.

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(129,1)	TC	Change Orbit Position Report Rate										
(129,2)	TM	Orbit Position Report										
(129,3)	TC	Set Orbit Number										

Table A-26: Service 129 sub-services

A.9.19 Service 130: Orbit Position Scheduling Service

SERVICE, SUBSERVICE	TM/TC	DESCRIPTION	OBC CSW			ATLID	MSI	BBR	CPR	MMFU	GPS	STR
			S	A	P							
(130,1)	TC	Enable Release of OPS Telecommands	X									
(130,2)	TC	Disable Release of OPS Telecommands	X									
(130,3)	TC	Reset OPS	X									
(130,4)	TC	Insert Telecommands in OPS	X									
(130,5)	TC	Delete Telecommands from OPS	X									
(130,6)	TC	Delete Telecommands over Position Range	X									
(130,7)	TC	Shift Telecommands										
(130,8)	TC	Shift Telecommands over Position Range										
(130,9)	TC	Report Subset of OPS in Detailed Form	X									
(130,10)	TM	Detailed OPS Report	X									
(130,11)	TC	Report OPS in Detailed Form over Position Range	X									
(130,12)	TC	Report Subset of OPS in Summary Form	X									
(130,13)	TM	Summary OPS Report	X									
(130,14)	TC	Report Subset of OPS in Summary Form over Position Range	X									
(130,16)	TC	Report OPS in Detailed Form	X									
(130,17)	TC	Report OPS in Summary Form	X									
(130,18)	TC	Report Status of OPS	X									
(130,19)	TM	OPS Status Report	X									

Table A-27: Service 130 sub-services