

SPIRE

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TABLE OF CONTENTS

1.	<u>INTRODUCTION</u>	8
1.1	<u>SCOPE</u>	8
1.2	<u>STRUCTURE OF THE DOCUMENT</u>	8
1.3	<u>DOCUMENTS</u>	8
1.3.1	<u>Applicable Documents</u>	8
1.3.2	<u>Reference Documents</u>	9
2.	<u>THE PACKET INTERFACE</u>	10
2.1	<u>PACKET STRUCTURES</u>	10
2.1.1	<u>Telecommand Packets</u>	10
2.1.2	<u>Telemetry Packets</u>	10
2.2	<u>APIDS</u>	11
2.3	<u>PACKET TRANSFER PROTOCOL</u>	11
3.	<u>TELECOMMAND PACKETS</u>	12
3.1	<u>TELECOMMAND PACKET TYPES</u>	12
3.2	<u>TELECOMMAND PACKET DEFINITION</u>	13
3.2.1	<u>Telecommand Verification Service</u>	13
3.2.2	<u>Device Command Distribution</u>	13
3.2.3	<u>Housekeeping and Diagnostic Data Reporting</u>	13
3.2.4	.....	13
3.2.5	<u>Event Reporting</u>	13
3.2.6	<u>Memory Management</u>	13
3.2.7	.....	13
3.2.8	<u>Function Management</u>	13
3.2.9	<u>Time Management</u>	16
3.2.10	.....	16
3.2.11	<u>On-Board Scheduling</u>	16
3.2.12	<u>On-Board Monitoring</u>	16
3.2.13	.....	16
3.2.14	<u>Packet Transmission Control</u>	16
3.2.15	<u>On-Board Storage and Retrieval</u>	16
3.2.16	<u>On-Board Traffic Management</u>	16
3.2.17	<u>Test Service</u>	16
3.2.18	<u>On-Board Control Procedures</u>	16
3.2.19	<u>Action/Event Service</u>	17
3.2.20	<u>Information Distribution Service</u>	17
3.2.21	<u>Science Data</u>	17
3.2.22	<u>Context Saving Service</u>	17
4.	<u>TELEMETRY PACKETS</u>	18
4.1	<u>TELEMETRY PACKET TYPES</u>	18
4.2	<u>TELEMETRY PACKET DEFINITIONS</u>	19
4.2.1	<u>TC Verification Service</u>	19
4.2.2	<u>Device Command Distribution</u>	20
4.2.3	<u>Housekeeping and Diagnostic Data Reporting</u>	21
4.2.4	.....	21
4.2.5	<u>Event Reporting</u>	22
4.2.6	<u>Memory Management</u>	22
4.2.7	.....	22
4.2.8	<u>Function Management</u>	22
4.2.9	<u>Time Management</u>	23
4.2.10	.....	23
4.2.11	<u>On-Board Scheduling</u>	23
4.2.12	<u>On-Board Monitoring</u>	23

4.2.13	.....	23
4.2.14	Packet Transmission Control	23
4.2.15	On-Board Storage and Retrieval	23
4.2.16	.....	23
4.2.17	Test Service	24
4.2.18	On-Board Control Procedures	24
4.2.19	Action/Event Service	24
4.2.20	Information Distribution Service	24
4.2.21	Science Data	24
4.2.22	Context Saving Service	24
5.	PARAMETERS	25
5.1	TC PARAMETERS	25
5.1.1	Parameter Definition	25
5.1.2	Conversion Curves	26
5.1.3	Constraints	26
5.2	TM PARAMETERS	27
5.2.1	Parameter Definition	27
5.2.2	Conversion Curve	28
5.2.3	Constraints	28

FIGURES

TABLES

Table 2-1	Table of APIDs	11
Table 3-1	Telecommand Packet Types	12
Table 4-1	Telemetry Packet Types	18

Glossary

APID	Application ID
DPU	Digital Processing Unit
OBS	On-Board Software
SID	Structure ID
SPIRE	Spectral and Photometric Imaging REceiver
SVM	Service Module

1. INTRODUCTION

The CDMS Simulator is used to simulate the interface of the Herschel spacecraft CDMS towards the SPIRE DPU. In this role it passes commands it receives from the SPIRE EGSE to the DPU and collects telemetry from the DPU and passes this to the other SPIRE EGSE systems. In this respect it is 'transparent' to telecommand and telemetry packets passing between the SPIRE EGSE and the instrument. However, it is necessary in some circumstances for the EGSE to control the configuration of the CDMS Simulator and it is also required that the CDMS Simulator provide telemetry on the status of its configuration during the course of a test. This ICD describes how this is achieved.

All telemetry data produced by the EGSE systems will follow the same standards as is used in the Herschel Spacecraft and Ground Segment systems (this allows easier transition from the testing to the operational environments). The data is generated in the form of TM Source Packets conforming to the ESA Packet Utilisation Standards (RD01, RD02, RD03), but the set of supported packet types within the Herschel project is restricted. This restricted set is defined in the Herschel Packet Structure ICD (AD01). The CDMS Simulator utilises a reduced set of telemetry packet types and this document details the contents of each of these.

The Operations Interface Requirements Document (AD03) defines how the units on the spacecraft (and hence the CDMS Simulator and EGSE) interact. The CDMS Simulator meets these requirements

1.1 Scope

This document defines the packet types and their contents that will be accepted and generated by the CDMS Simulator during Instrument -Level Testing (ILT). These packets conform to the formats given in the Packet Structure ICD (AD01) and the Ground Segment to Instruments ICD (AD02). They also provide for the functionality described in the CDMS Simulator User Manual (RD04).

1.2 Structure of the Document

Section 2 describes the packet interface used between instrument and the spacecraft. This includes the general format of the packets used by the SPIRE instrument for telecommanding and telemetry (from AD01), the allocation of Application IDs used by the instrument and the functionality of the packet transfer protocol of the instrument/spacecraft interface (from AD01, appendix 9) that is used by the instrument.

Section 3 defines the format and content of each of the telecommand packets accepted by the CDMS Simulator. Section 4 defines the corresponding information for the telemetry packets generated by the CDMS Simulator. A description of how these packets are handled by the Simulator is given in RD04.

Section 5 defines, in detail, the parameters used in the telecommand and telemetry packets.

1.3 Documents

1.3.1 Applicable Documents

- AD01 Herschel/Planck Packet Structure Interface Control Document (SPIRE-ESA-DOC-000433), Issue 2.0 (draft2)
- AD02 Herschel/Planck Operations Interface Requirements Document (SPIRE-ESA-DOC-000188), Issue 2.0 (draft3)
- AD03 Herschel Science Ground Segment to Instruments Interface Control Document (FIRST-FSC-DOC-0200), Issue 1.0
- AD04 Packet Router ICD (SRON-G/HIFI/ICD/2001-001), Issue 1.1

1.3.2 Reference Documents

- RD01 Packet Telemetry Standard (ESA PSS-04-106), Issue 1, 1998
- RD02 Packet Telecommand Standard (ESA PSS-04-107), Issue 2, 1992
- RD03 Telemetry and Telecommand Packet Utilisation Standard (ECSS-E-70/41) Draft 04, April 1999
- RD04 CDMS Simulator Users Manual, TBW

2.2 APIDs

The Application ID is used to identify the source or destination of a telemetry packet. SPIRE has been allocated APIDs for different types of packet (see AD1) as well as for EGSE equipment. The APID(s) to be used by the SPIRE CDMS Simulator are given in the following table:

ID	Telemetry types	APID (hex)
APID1	Telecommands, Telecommand Verification and Events	7F6
APID2	Periodic Housekeeping	7F6
APID3	Science Data	7F6

Table 2-1 Table of APIDs

2.3 Packet Transfer Protocol

The packets are transferred between the CDMS Simulator and the EGSE following the Packet Router ICD.

3. TELECOMMAND PACKETS

This section defines all the telecommand packets accepted by the SPIRE CDMS Simulator.

3.1 Telecommand Packet Types

The Packet Structure ICD (AD1) defines many types of service that can be provided by an Application. The following table shows the telecommand packet types that will be accepted by the SPIRE CDMS Simulator.

Description	Service Type	Service Sub-Type	Comments
Telecommand Verification Service	1		N/A
Device Command Distribution	2		Not Used
Housekeeping and Diagnostic Data Reporting	3		Not Used
Event Reporting	5		N/A
Memory Management	6		Not Used
Function Management			
Start Function	8	1	
Stop Function	8	2	
Perform Activity of Function	8	4	
Report Function Status	8	5	Not Used
Time Management			
Synchronise User	9	3	Not Used (TBC)
Enable Time Synchronisation	9	4	Not Used
Time Code	9	5	Not Used
Verify User Time	9	6	
Enable Time Verification	9	7	Not Used
Synchronise Central Time Reference	9	10	Not Used
On-Board Scheduling	11		Not Used
On-Board Monitoring	12		Not Used
Packet Transmission Control	14		Not Used
On-Board Storage and Retrieval	15		Not Used
On-Board Traffic Management	16		Not Used
Test Service			
Perform Connection Test	17	1	
On-Board Control procedures	18		Not Used
Action/Event Service	19		Not Used
Information Distribution Service	20		Not Used
Science Data	21		N/A
Context Saving Service	22		Not Used

Table 3-1 Telecommand Packet Types

3.2 Telecommand Packet Definition

3.2.1 Telecommand Verification Service

Not Applicable

3.2.2 Device Command Distribution

Not Used

3.2.3 Housekeeping and Diagnostic Data Reporting

Not Used

3.2.4

Not Available

3.2.5 Event Reporting

Not Applicable

3.2.6 Memory Management

Not Used

3.2.7

Not Available

3.2.8 Function Management

3.2.8.1 *Start Function (Service 8,1)*

Not Used

3.2.8.2 *Stop Function (Service 8,2)*

Not Used

3.2.8.3 *(Service 8,3)*

Not Available

3.2.8.4 *Perform an Activity of a Function (Service 8,4)*

All command packets of this type and subtype may give rise to the following Errors:

Error	TM Service	Error Code	Description
Illegal_Activity_ID	(1,2)	0x0802	Activity_ID not known

3.2.8.4.1 **Function 0xC1 Observations, Activity 0x01: Set Observation ID**

This command sets the value for the Observation ID, which is included in all telemetry packets to allow them to be ingested into the HCSS database. This command clears the current BBID value to zero (TBC).

0	0	0	1	1	APID1									
1	1	Src	Count											
Length = 11														
0	0	0	0	0	0	1	0	0	0	0	1	0	FUNCTIONID	ACTIVITYID
0	0	0	0	1	0	0	0	0	0	0	0	0	OBSID	
Checksum														

Parameters

Name	Value and Comments
FUNCTIONID	0xC1
ACTIVITYID	0x01
BBID	Observation ID (32 bits)

3.2.8.4.2 Function 0xC1 Observations, Activity 0x02: Set Building Block ID

0	0	0	1	1	APID1									
1	1	Src	Count											
Length = 11														
0	0	0	0	0	0	1	0	0	0	0	1	0	FUNCTIONID	ACTIVITYID
BBID														
Checksum														

Parameters

Name	Value and Comments
FUNCTIONID	0xC1
ACTIVITYID	0x02
BBID	Building Block ID (32 bits)

3.2.8.4.3 Function 0xCB, CDMS Simulator, Activity 0x01: Select Buslist

Changes the Buslist being used. The change may happen immediately or at a given time. The set of Buslists available is defined in a configuration file of the CDMS Simulator.

0	0	0	1	1	APID1									
1	1	0	0	0	Count									
Length = 15														
0	0	0	0	0	0	1	0	0	0	0	1	0	FUNCTIONID	ACTIVITYID
0	0	0	0	1	0	0	0	0	0	0	0	0	BUSLISTID	
BLTIME														
Checksum														

Parameter	Value and Comments
FUNCTIONID	0xCB
ACTIVITYID	0x01
BUSLISTID	Buslist ID (16 bits)
BLTIME	Time at which to change the Buslist (Zero means immediately)

3.2.8.4.4 Function 0xCB, CDMS Simulator, Activity 0x02: Select Bus Medium

Changes the 1553 bus medium being used. The change may happen immediately or at a given time.

0	0	0	1	1	APID1									
1	1	0	0	0	Count									
Length = 15														
0	0	0	0	0	0	1	0	0	0	0	1	0	FUNCTIONID	ACTIVITYID
0	0	0	0	1	0	0	0	0	0	0	0	0	BUSID	
BMTIME														
Checksum														

Parameter	Value and Comments
FUNCTIONID	0xCB
ACTIVITYID	0x02
BUSID	Bus Medium ID
BUSTIME	Time at which to change the Bus Medium (Zero means immediately)

3.2.9 Time Management

3.2.9.1 Verify User Time (Service 9,6)

0	0	0	1	1	APID1									
1	1	0	0	0	Count									
Length = 7														
0	0	0	0	0	0	1	0	0	0	0	1	0	0	1
0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
0	0	0	1	1	APID1									
Checksum														

Parameter	Type	Value

3.2.10

Not Available

3.2.11 On-Board Scheduling

Not Used

3.2.12 On-Board Monitoring

Not Used

3.2.13

Not Available

3.2.14 Packet Transmission Control

Not Used

3.2.15 On-Board Storage and Retrieval

Not Used

3.2.16 On-Board Traffic Management

Not Used

3.2.17 Test Service

3.2.17.1 Perform Connection Test (Service 17,1)

0	0	0	1	1	APID1									
1	1	0	0	0	Count									
Length = 5														
0	0	0	0	0	0	1	0	0	0	1	0	0	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Checksum														

Parameter	Type	Value

3.2.18 On-Board Control Procedures

Not Used

3.2.19 Action/Event Service

Not Used

3.2.20 Information Distribution Service

Not Used

3.2.21 Science Data

Not Applicable

3.2.22 Context Saving Service

Not Used

4. TELEMETRY PACKETS

This section defines all the TM packets that will be produced by the SPIRE CDMS Simulator.

4.1 Telemetry Packet Types

The Packet Structure ICD (AD1) defines many types of service that can be provided by an Application. The following table shows the telemetry packet types that will be produced by the SPIRE CDMS Simulator.

Description	Service Type	Service Sub-Type	Comments
Telecommand Verification Service			
Telecommand Acceptance Report - Success	1	1	
Telecommand Acceptance Report - Failure	1	2	
Telecommand Execution Report - Started	1	3	Not Used
Telecommand Execution Report - Progress	1	5	Not Used
Telecommand Execution Report - Completed	1	7	Not Used
Telecommand Execution Report - Failure	1	8	Not Used
Telecommand Contents Report	1	9	Not Used
Device Command Distribution	2		N/A
Housekeeping and Diagnostic Data Reporting			
HK Parameter Report Definitions Report	3	10	Not Used
Diagnostic Parameter Definitions Report	3	12	Not Used
Housekeeping Parameter Report	3	25	
Diagnostic Parameter Report	3	26	Not Used
Event Reporting			
Event Report	5	1	TBD
Exception Report	5	2	Not Used
Error/Alarm Report	5	4	TBD
Memory Management	6		Not Used
Function Management	8		Not Used
Time Management			
Central Time Reference	9	8	
Time Verification Report	9	9	Not Used
On-Board Scheduling	11		Not Used
On-Board Monitoring	12		Not Used
Packet Transmission Control	14		Not Used
On-Board Storage and Retrieval	15		Not Used
Test Service			
Link Connection Report	17	2	
On-Board Control procedures	18		Not Used
Action/Event Service	19		Not Used
Information Distribution Service	20		Not Used
Science Data			
Nominal Science Data Report	21	1	Not Used
Science Type B Data Report	21	2	Not Used
Diagnostic Science Data Report	21	3	Not Used
Auxiliary Science Data Report	21	4	Not Used
Context Saving Service	22		Not Used

Table 4-1 Telemetry Packet Types

4.2 Telemetry Packet Definitions

4.2.1 TC Verification Service

4.2.1.1 Telecommand Acceptance Report - Success (1,1)

0	0	0	0	1	APID1										
1	1	Count													
Length = 15															
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TIME															
TC Packet ID															
Packet Sequence Control															
Checksum															

4.2.1.2

4.2.1.3 Telecommand Acceptance Report - Failure (1,2)

The structure of this packet depends on the type of error found.

4.2.1.3.1 Packet Control Errors

0	0	0	0	1	APID1											
1	1	Count														
Length = 19																
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
TIME																
TC Packet ID																
TC Packet Sequence Control																
Failure Code																
Parameter																
Checksum																

Error	Failure Code	Parameter
Illegal APID	0	TC_Packet_APID
Incomplete Packet or invalid Length	1	TC_Packet_Length
Incorrect Checksum	2	TC_Packet_Checksum
Illegal Packet Type	3	TC_Packet_Type
Illegal Packet Sub-Type	4	TC_Packet_Sub-Type

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros

4.2.1.3.2 Packet Content Error

0	0	0	0	1	APID1										
1	1	Count													
Length															
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TIME															
TC Packet ID															
Packet Sequence Control															
Failure Code															
Parameters															
Checksum															

Error	Failure Code	Parameters
Illegal or inconsistent Application Data	5	See Note
Other TBD errors	16-255	See Note
Illegal Function ID	0x0801	See Note
Illegal Activity ID	0x0802	See Note

Note: The parameters for each error are TBD, but as a suggestion this field should contain the first 20 words from the 'source data' field of the received telecommand packet, unless this field is less than 20 words in length, in which case all words from the 'source data' field will be included.

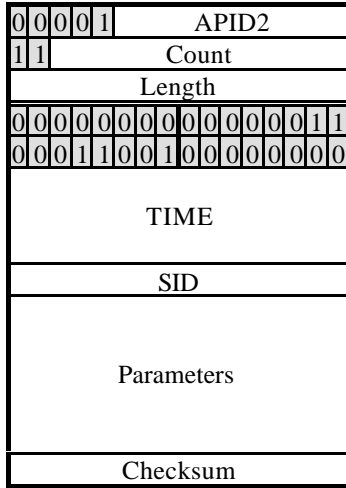
4.2.2 Device Command Distribution

Not Applicable

4.2.3 Housekeeping and Diagnostic Data Reporting

4.2.3.1 Housekeeping Parameter Report (Service 3,25)

The general packet structure is shown below. The Structure ID identifies the housekeeping packet type.



SID	Packet type	Default Frequency (msec)
0x0301	Nominal Housekeeping Report	1000

4.2.3.2 Nominal Housekeeping Report (SID=0x0301)

The following table lists the fields to be found in this report

Location (msb)		Length (bits)	Parameter Name
octet	bit		
18	0	32	OBSID
22	0	32	BBID
26	0	16	BUSID
28	0	16	BUSLISTID
30	0	32	TCN
34	0	32	TMN
38	0	16	BUSACT
40	0	16	BUSSTAT

4.2.4

Not Available

4.2.5 Event Reporting

4.2.5.1 Event Report (5,1)

TBD

4.2.5.2 Exception Report (5,2)

4.2.5.2.1 RT Not Responding

0	0	0	0	1	APID1											
1	1	Count														
Length=21																
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TIME																
SID = 0x0501																
OBSID																
BBID																
RTID																
Checksum																

Parameter	Comment
RTID	Number of RT affected

Others TBD

4.2.6 Memory Management

Not Used

4.2.7

Not Available

4.2.8 Function Management

Not Used

4.2.9 Time Management

4.2.9.1 Central Time Reference (Service 9,4)

0	0	0	0	1	APID1												
1	1	Count															
Length = 17																	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TIME																	
CDMS Time																	
Checksum																	

4.2.10

Not Available

4.2.11 On-Board Scheduling

Not Used

4.2.12 On-Board Monitoring

Not Used

4.2.13

Not Available

4.2.14 Packet Transmission Control

Not Used

4.2.15 On-Board Storage and Retrieval

Not Used

4.2.16

Not Available

4.2.17 Test Service

4.2.17.1 Link Connection Report (Service 17,2)

0	0	0	0	1	APID1									
1	1	Count												
Length = 11														
0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME														
Checksum														

4.2.18 On-Board Control Procedures

Not Used

4.2.19 Action/Event Service

Not Used

4.2.20 Information Distribution Service

Not Used

4.2.21 Science Data

Not Used

4.2.22 Context Saving Service

Not Used

5. PARAMETERS

5.1 TC Parameters

5.1.1 Parameter Definition

Parameter Name	Service Reference	Type	Size (bits)	Conversion Curve	Constraint Table	Comments
ACTIVITYID	(8,4)	Integer	8	None	None	
APID	(20,1) (20,2)	Integer	11	None	None	Application ID
BBID BBINTR BBTYPE BBCOUNT	(8,4)	Constant Integer Integer	32 2 14 16	None None None	None None None	Field is split into 3 parts: Location: Bits 0-1 Value: 2 Location: Bits 2-15 Location: Bits 16-31
BLTIME	(8,4)	Integer	48	None	None	Time to change buslist (Zero = immediately)
BMTIME	(8,4)	Integer	48	None	None	Time to change bus medium (Zero = immediately)
BUSID	(8,4)	Integer	16	Bus_ID	None	Identifier of the Bus
BUSLISTID	(8,4)	Integer	16	None	None	Identifier of the Buslist
CRC	(6,2)	Unsigned Integer	16	None	None	Cyclic Redundancy Check - algorithm TBD
FUNCTIONID	(8,1) (8,2) (8,4) (8,5)	Integer	8	Func_ID	None	
Length	(6,2) (6,5) (6,9)	Unsigned Integer	16	None	None	
OBSID	(8,4)	Unsigned Integer	32	None	None	Observation ID
SID	(8,1) (8,4) (20,1) (20,2)	Unsigned Integer	16	None	None	Unique identifier for parameter list Values are TBD

5.1.2 Conversion Curves

Name	Type	Raw Value	Converted Value	Comments
Bus_ID	Enumerated	0 1	A B	
Func_ID	Enumerated	0xC1 0xCB	Obs CDMS	Observations CDMS Simulator

5.1.3 Constraints

5.2 TM Parameters

5.2.1 Parameter Definition

Name	Length (bits)	Conversion	Limits	Description
BBID	32			Field is split into 3 parts:
BBINTR	2	None	None	Location: Bits 0-1 Value: 2
BBTYPE	14	None	None	Location: Bits 2-15
BBCOUNT	16	None	None	Location: Bits 16-31
BUSACT	16	BUSACT	None	Bus Activity Status
BUSID	16	BUSID	None	Bus Identifier
BUSLISTID	16	None	None	Bus List Identifier
BUSSTAT	16	BUSSTAT	None	Bus Status
OBSID	32	None	None	Observation ID
RTID	16	RTID	None	RT Identifier
TCN	32	None	None	Number of Telecommand packets transferred to the instrument
TMN	32	None	None	Number of Telemetry packets transferred from the instrument

5.2.2 Conversion Curve

Name	Type	Raw Value	Converted Value	Units	Comments
BUSACT	Enumerated	0 1	DEAD ALIVE		
BUSID	Enumerated	0 1	A B		
BUSSTAT	Enumerated	0 1	STOPPED RUNNING		
RTID	Enumerated	0 1 2	TBD		The RTID identifies the instrument (or subsystem)

5.2.3 Constraints