ALCATEL SPACE

HERSCHEL / PLANCK

EGSE General Requirements Specification H-P-1-ASPI-SP-0045

Product Code: 00000

		Date	Signature
Rédigé par/*Written by*	**EGSE Engineer** **B. DUBOIS**	10/06/02	
Vérifié par/*Verified by*	**RAIT** **J.Y. CHARNIER**	10/06/02	
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Entité Emettrice: Alcatel Space - Cannes
(détentrice de l'original) :

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(détentrice de l'original) :

ENREGISTREMENT DES EVOLUTIONS / *CHANGE RECORDS*

ISSUE	DATE	§ : DESCRIPTION DES EVOLUTIONS *§ : CHANGE RECORD*	REDACTEUR *AUTHOR*
01	02/10/01	First issue.	
02	12/10/01		
03	10/June/02		
		General : All reference to “Planck Sorption Cooler SCOE” deleted	
		General : All reference to SIS deleted and replaced by PLM EGSE	
		General : all FEE replaced by DFE	
		§ 3.2.3 to § 3.2.10 : EGSE description updated according to all SCOE requirement specification document	
		Figure 6 and 7 added : Launch configuration	
		GRQT-0003 : TM rate 3.5 Mbps	
		GRQT-0225 : precision on operational mode transition	
		GRQT-0440 :maintainability – need to have access to connector and drawer	
		GRQT-0685 : Cable marking rules	
		GRQT-0945 :center of gravity	
		GRQT-1190 :Logo ALCATEL SPACE	

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1. SCOPE

The scope of this document is to provide top level requirements, implementation and interface requirements to be applied to the EGSE (Electrical Ground Support Equipment) to be used during the whole electrical and functional integration activity, environmental testing and launch operations of Herschel and Planck satellites.

The EGSE is designed to allow system level testing of all components during all phases of integration and test of the satellites whatever the integration, environmental and compatibility tests sites.

First it specifies the general functional requirements of the system EGSE. The purpose is to allow an efficient functional breakdown of the EGSE to define all EGSE equipment. The specific requirements of each EGSE equipment are specified by a dedicated requirements specification.

Then it specifies the operational requirements and design & construction requirements that are common to each EGSE equipment. The purpose is to insure a global coherence and uniformity of the whole system EGSE.

This document does not cover the following items:

- RF Suitcase
- SVF

2. DOCUMENTS

2.1 Standards

Ref.	Reference of document	Title
S1	ECSS-E-40B draft dated 28 July 2000	Space Engineering : Software
S2	ESA-PSS-04-105	TM Packet Standard
S3	ESA-PSS-04-106	TC Packet Standard
S4	ECSS-Q-80B Issue draft dated 3 April 2000	Software Product Assurance

2.2 Reference Documents

Ref.	Reference of document	Title
RD1	To be issued	RF suitcase Specification
RD2	To be issued	SVF Specification
RD3	H-P-1-ASPI-TN-0100	*SCOS 2000 Evaluation*

2.3 Applicable Documents

Ref.	Reference of document	Title
AD1	CSG-RS-10A-CN Issue/Rev/Date : 5/1/03.03.99	CSG Safety regulations Volume 1 - General rules (Volume 1 taken precedence)
AD2	CSG-RS-21A-CN Issue/Rev/date :5/0/15.12.97	CSG Safety regulations Specific rules Volume 2 Part 1 - Ground Installations
AD3	CSG-RS-22A-CN Issue/Rev/date :5/1/03/03.97	CSG Safety regulations Specific rules Volume 2 Part 1 - Spacecraft
AD4	SCI-TP-RS-07430	*System AIV REQUIREMENTS*
AD5	H-P-1-ASPI-SP-0029	*Safety Requirements*
AD6	SCI-PT-IF-07527	*Herschel/Planck Packet Structure Interface Control Document (PS-ICD)*
AD7	H-P-1-ASPI-SP-0037	*EMC Specification*
AD8	SCI-PT-RS-07360	Operations Interface Requirements Document
AD9	H-P-1-ASPI-IS-0121	EGSE INTERFACE REQUIREMENTS SPECIFICATIONS
AD11	H-P-1-ASPI-SP-0110	Ground Support Equipment Applicability Matrix of ECSS-E-40B
AD12	H-P-1-ASPI-SP-0018	PA Requirements for Subcontractors

2.4 Acronyms

Abbreviation	Signification
AIT	**A**ssembly, **I**ntegration and **T**est
BCE	**B**attery **C**harge **E**quipment
BER	**B**it **E**rror **R**ate
BHC	**B**loc **H**ouse **C**onsole
BOB	**B**reak **O**ut **B**ox
BPSK	**B**i **P**hase **S**hift **K**eying
CCS	**C**entral **C**heckout **S**ystem
CCSDS	**C**onsultative **C**ommittee for **S**pace **D**ata **S**ystems
CLCW	**C**ommand **L**ink **C**ontrol **W**ord
CLTU	**C**ommand **L**ink **T**ransmission **U**nit
COTE	**C**heck **O**ut **T**erminal **E**quipment
CUC	**C**CSDS **U**nsegmented time **C**ode
EGSE	**E**lectrical **G**round **S**upport **E**quipment
EMC	**E**lectro**M**agnetic **C**ompatibility
DFE	**D**ata **F**ront **E**nd **E**quipment
HK	**H**ouse **K**eeping
HPSDB	**H**erschel/**P**lanck **S**ystem **D**ata**B**ase
IF or I/F	**I**nter**F**aces
JU	**J**unction **U**nit
LAN	**L**ocal **A**rea **N**etwork
MMI	**M**an **M**achine **I**nterface
MTBF	**M**ean **T**ime **B**etween **F**ailure[1]
MTTR	**M**ean **T**ime **T**o **R**epare[2]
MOC	**M**ission **O**peration **C**enter
NA	**N**on **A**pplicable
NDIU	**N**etwork **D**ata **I**nterface **U**nit
NRZ-L	**N**on **R**eturn to **Z**ero-**L**evel
NRZ-M	**N**on **R**eturn to **Z**ero-**M**ark
OBCP	**O**n-**b**oard **C**ontrol **P**rocedures
OBSW	**O**n **B**oard **S**oft**W**are
PIPE	**P**acket **I**nterface **P**rotocol for **E**GSE
RF	**R**adio **F**requency
SAS	**S**olar **A**rray **S**imulator
SCOE	**S**pecific **C**heck **O**ut **E**quipment
TAI	**T**emps **A**tomique **I**nternational
TBC	**T**o **B**e **C**onfirmed
TBD	**T**o **B**e **D**efined
TM/TC	**T**ele**m**etry & **T**ele**c**ommand
UTC	**U**niversal **T**ime **C**oordinated
UUT	**U**nit **U**nder **T**est
VC	**V**irtual **C**hannels

[1] Average time between two breakdown of the system
[2] Average time before complete repair of the system

3. REQUIREMENTS

3.1 General description

3.1.1 FUNCTIONAL DESCRIPTION

This document is applicable to each EGSE equipment used for system AIT.

Interfaces with instrument EGSE are defined in [RD3] and [RD4].

In case of conflicts between a general requirement and a specific requirement, the second one only shall be take into account.

The EGSE requirements in the following sub-sections cover all equipment's required to support the programme (as described above). The requirements are broken down into general requirements (including design, construction, reliability, maintainability etc.) which apply to all equipment, and then into specific sets.

3.1.2 USE AND MISSION

The EGSE implements the interface between the UUT (Unit Under Test) and the AIT team to perform the complete AIT plan.

The EGSE shall be designed to support integration, testing and measurements for all H-P models, for all test sites and all phases of AIT and all launch activities.

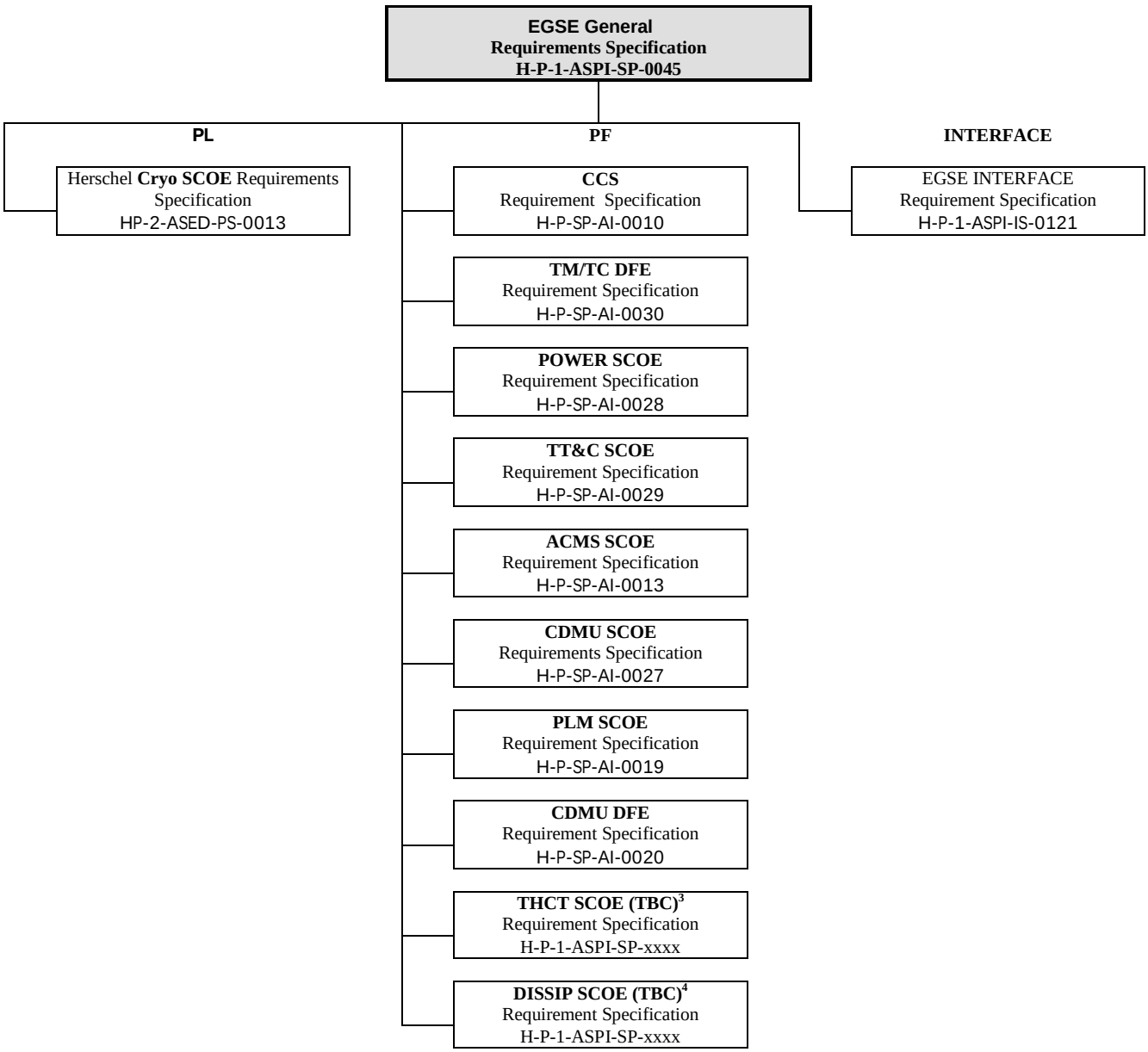
The EGSE equipment shall supply the following functionality:

- Automated sequences to run automated tests (electrical configuration, check program ...)
- Provides external DC power to instruments, SVM or PLM and whole satellites
- Permanent supervision of H/P status
- Provide all necessary link, simulation and stimulation signals
- Telemetry decommutation
- Telecommand sending and monitoring
- Management of Bus 1553
- data acquisition (ANA, TEMP, DR, DB, AS16...)
- command (CR, CC, ...)

The EGSE shall also provide simulation facilities for test preparation.

The EGSE shall also provide the necessary facilities for self-test and validation.

3.1.3 EGSE Specification Tree



[3] SCOE neither specify, procure and use by Alenia
[4] SCOE neither specify, procure and use by Alenia

3.1.4 SPECIFIC TERMS AND DEFINITION

A contractual language is to be used in contractual documents like specifications. However, a few number of statements are need:

- EGSE
- The user
- Requirements
- Use of documents declaration
- Comment
- Check method

EGSE :

The term **EGSE** (Electrical Ground Support Equipment) is used when referring to electrical and electronic equipment which is needed to support the program during assembly, integration, functional testing, environmental testing, ground station compatibility testing and launch support operations.

The User :

The EGSE forms a major part of AIT system. The AIT system is composed by the following topics:

- AIT team
- AIT plan
- AIT means and facilities

The EGSE implements the interface between the satellite (or Unit Under Test –**UUT**-) and the AIT team to perform the complete AIT plan.

The main objective of AIT system is to successfully perform the assembly, the integration, the tests and the launch support of the spacecraft, giving sufficient visibility into the results of tests performed. This visibility will be achieved through test reports.

The test report must be exhaustive and credible. The test report structure is the following:

- The test proceedings document
- The archives of test results to ensure access to the results at any time

Five different kinds of user activities can be identified within the AIT team:

- Test management and EGSE maintenance
- Test design
- Test execution
- Test analysis
- Test maintenance

- The **test management and EGSE maintenance** performs safety operations (priorities; backup, software and hardware configuration management; calibrations operations; health tests etc.)

- The **test design** develops test:

The test design shall be breakdown in:
Documents generation:
- Test procedure design (including text, drawing,...)
- Test report template design.

Software generation:
- Safety monitoring and control for UUT
- Configurations for UUT
- Configurations of EGSE for UUT stimulation.
- Test sequence.
- Report publisher.

- The **test execution** is performed by using paper procedures with permanent EGSE emission of go ahead. In the event of failures (red light), actions are taken to put the UUT into a safe mode. The test execution produce a go ahead authorise and data records.

- The **test analysis** produces the test proceedings and problem proceedings from recorded data.

- The **test maintenance** is the maintenance of test results during the spacecraft life: correlation between flight results and AIT results for example.

The EGSE design shall take into account these different users and activities. It shall provide them with different levels of access to functions, and protection from inadvertent incorrect action.

Requirements
The requirements are contractual expression of the work to be done.
Each requirement is identify with a singular number in the left margin.
Requirements are labelled GRQTxxxx.

- Begin of requirement: [GRQT0000a]

Use of document declaration :
Raw data or raw value duplications can generate bias by new issues with no broadcast process to child documents so duplicate values shall be avoided in requirements. A value shall be declared by reference in an applicable document. Of course, the now known raw value may be present in the associated comment.
- Use of applicable document declaration:[ADzz]
The label ADzz shall be found in the document applicable document list.

Comments
The text out of requirements is called « comments ».
The comments are used to make the requirements understandable by all kinds of users. The text in requirements as only to be understandable by manufacturers of EGSE; however all kinds of users can do a crosscheck between the comments and the requirements.

Check methods:

[Analysis]: Reports to demonstrate why or how the design brings about the requirements.

[Review]: Report status about development (to be included in each progress meeting data package and in the Acceptance Data Package).

[Test]: Tests to be performed to demonstrate compliance with the requirements.
All items with such check method shall be explicitly tested before delivery.

Every requirement shall be checked by one or more method here above.

The check method shall be stated for each requirement.

Specific sub-level checks shall be defined in item specifications.

Subsystem check reports shall be included in the Acceptance Data Package.

The final check is done during the delivery meeting.

3.2 FUNCTIONAL REQUIREMENTS

3.2.1 BASIC RULES AND CONCEPTS

[GRQT-0000a] [Analysis]

The EGSE shall be decomposed in a modular way, breaking the EGSE down into a number of different elements. The interfaces between these elements shall be defined to separate, as far as practically possible, different areas of expertise from each other. This shall facilitate the development of the individual items - the aim being to have at least 80% of an EGSE item that depends on a single technical competence. Currently, a total of six different areas of expertise can be identified:

- Electronics
- Electrotechnics
- Radio Frequencies
- Information Processing
- Instrument
- Launch pads

In order to maximise the use of recent technologies, the delivery of the EGSE items must be located close to the beginning of the AIT program, allowing sufficient time for EGSE integration and AIT program preparation activities.

The EGSE will be composed of a number of different Man Machine Interfaces (MMI). The goal is to have these based as far as possible on state of the art commercial hardware and software products.

[GRQT-0000b] [Analysis]

The design of the EGSE shall be optimised to achieve the maximum utilisation of the same EGSE hardware and software for various levels of test from unit level up to system level.

[GRQT-0000c] [Analysis]

The MMIs to control the test execution shall be centralised into CCS. However, backup MMI shall be available in all SCOEs (for safety reasons etc.).

[GRQT-0000d] [Analysis]

The MMIs for test execution shall provide sufficient display information from the CCS and from different SCOE's for the users to be able to control the execution of the tests and supervise the health and safety of the satellite.

In principle the development of the MMI should consider the potential for 3 categories of user, each of differing levels of S/C and EGSE expertise:

- System administrator, with detailed knowledge of the EGSE internals and usage, but limited AIV and spacecraft knowledge.
- EGSE operator, expert user of EGSE with limited knowledge of internals, responsible for SDB population, test sequence production and test-environment configuration, some spacecraft knowledge.

- Test Conductor, subsystem/instrument engineer, ESA representative or AIV team member who has detailed spacecraft, test or subsystem knowledge, who will actually execute or witness a test, but should be able to do so without being an expert EGSE user.

The CCS performs health and safety TM monitoring, TC sending and control, SCOE control and monitoring.

[GRQT-0000e] Analysis

The CCS shall be responsible for the overall direction of the test.

[GRQT-0000f] Analysis

The EGSE hardware and software design shall follow the modularity concept.

[GRQT-0000g] Analysis

The EGSE shall have sufficient hardware and software self test facilities to allow for proper validation and maintenance of the system during operation.

[GRQT-0000h] Analysis

The EGSE shall provide all necessary functions to support the integration and testing activities at the different levels of H/P AIT.

[GRQT-0000i] Analysis

The main functions shall be the following:

- to process the full H/P housekeeping telemetry to allow real time or near time data evaluation
- to provide safe satellite control by means of telecommanding and stimulation
- to provide all necessary umbilical power and stimulation signals
- to acquire (and process) all useful S/C signals
- to provide the necessary integration and measurement tools.

[GRQT-0000j] Analysis

The EGSE shall also provide simulation facilities for test preparation.

[GRQT-0000k] Analysis

The EGSE shall provide also the necessary facilities for self-test and validation as well as for software development.

3.2.2 COMMONALITY REQUIREMENTS

It is a fundamental design feature of the Herschel/Planck mission that commonality will be pursued, to the maximum extent reasonable throughout the Herschel/Planck Programme. This commonality encompasses 3 major aspects.

Commonality between Instruments

This concerns hardware elements (e.g. identical instrument on-board micro-processors, common chopper designs for PACS and SPIRE, common EGSEs designs, etc.) as well as common software elements (e.g. joint implementation of the on-board software -for Herschel -, common Real Time Assessment software, common instrument commanding scheme, common on-board memory management scheme, etc.)

Commonality/compatibility between Flight Control System and Check-Out System

These Commonality/Compatibility objectives are the outcome of a Department-wide policy which is currently applied (and evaluated) in the Rosetta and Mars Express missions.

RD-3 and RD-4 explain the rationale for the selected SCI-P approach. The major goals are to:
- reduce duplication of effort
- reduce risk
- reduce overall costs
- maximise synergy between AIV and Flight Operations

RD-3 and RD-4 identify the elements for which commonality is considered feasible and cost-effective and the elements for which compatibility is required. The following areas are currently identified:

- Mission Information Base (spacecraft and instrument data bases)
- Man Machine Interfaces
- Data Archiving and Distribution
- On-board Software Management
- On-board Software Maintenance (e.g. Software Development Environment, Software Validation Facility)
- User Language (for Test Procedures and in-orbit operations)

RD-1 contains a preliminary list of high level “requirements” covering these areas. These “requirements” are indicative of the issues to be considered. They do **not** constitute firm, final requirements imposed on the Contractor.

RD-2 proposes a phased implementation approach which is compatible with ESA’s overall policy (EGSE procured by Industry) and which should allow to achieve the objectives listed above.

Commonality/Compatibility between Mission phases

It is a top-level requirement that the transition between the various Integration and Test activities and between Test and Operations be as smooth as possible. In particular the Instrument Teams are working according to the following baseline:

- The same H/W -or compatible H/W- (e.g. the Instrument Stations for RTA/QLA) can be used throughout all phases of the Programme from the Instrument Level Tests (ILTs) to the in-orbit operations.
- To the maximum extent possible a standard set of interfaces will be implemented between the elements of the EGSE and the elements of the Flight Control System in such a way that the Instrument Station S/W can be moved from one test level to the next, up to the operations with no or minimal modifications.
- The Test Procedures developed for the Instrument Level Tests (ILTs) can be re-used during the System Tests in the Central Checkout System (CCS) environment and later on during operations (in particular during the Commissioning phase) with no or minimal modifications.
- The Instrument On-board Control Procedures (OBCPs) -if any- developed for the Instrument Level Tests (ILTs), can be re-used during the System Tests in the Central Checkout System (CCS) environment and later on during operations (in particular during the Commissioning phase) with no or minimal modifications.
- The Instrument EGSEs will be based upon ESOC's SCOS-2000 system
- The Flight Control System (to be provided by ESOC) will be based upon SCOS-2000

RD-7 proposes a preliminary list of CCS requirements supported or not supported by SCOS 2000. This document is indicative and shall be understood as a support for the definition of the CSS to be used on Herschel and Planck.

[GRQT-0001] *(AICO-10) (AIVE-130)* Analysis

The Contractor shall propose the required EGSE which to the maximum extent possible fulfil the Commonality/Compatibility Requirements listed above.
All items that are jointly identified by Alcatel and the Contractor as having the potential for Commonality/Compatibility with the Flight Control system (FCS) shall be deliverable items. The Agency reserves the right to deliver the corresponding source code and supporting documentation to the FSC contractor

3.2.3 GENERALITIES

The EGSE is hereafter described in terms of general functionality required. The EGSE functional requirements will be detailed for each EGSE item by its dedicated requirement specification.

Different context of Test activities for the EGSE are foreseen :
- Herschel/Planck AVM
- PFM Herschel SVM
- PFM Planck SVM
- Herschel PLM EQM
- Planck PLM RF/CQM
- Planck PFM Satellite
- Herschel PFM Satellite

The EGSE equipment required to support the program are listed here-after and in Annex 1:
- **CCS**, Central Checkout System (for support of all system level test activities)
- **SCOE**, Specific Checkout Equipment (for unit/subsystem specific activities or interfaces):
  - TM/TC DFE
  - TT&C SCOE
  - Power SCOE
    - Junction Unit (umbilical Interface)
    - SAS (Solar Array Simulator)
    - BATSIM (Battery simulator)
  - BCE (Battery Conditioning Equipment)
  - CDMU SCOE
  - ACMS SCOE
- **PLM EGSE** (for support of all PLM specific activities)
  - CDMU DFE
  - PLM SCOE
- **Launch operation** interfaces (COTE, S/C simulator, set of cables “A” and “B”)
- **Special Equipment** for :
  - OBSW quick loading function (TBC)
  - special test cabling (EMC/Vacuum tests adapters /class 100.000 room)
  - Pyro tester
  - test equipment required to integrate EGSE
  - BOB (Break Out Boxes)
  - Adapters
  - Power distribution unit
- **Data & www** Server

The EGSE shall include the internal connection cables between the different SCOE’s.

ETHERNET LAN shall connect all the SCOE with the CCS.

The SCOE shall be delivered with the interface wires with the specimen.

All the SCOE shall be delivered with the documentation

All the SCOE shall be delivered with an automated power-on self-test procedure.

The SCOE shall support two main operational modes :
- local mode (under control of peripherals on the SCOE)
- remote mode (under control of the CCS).

In addition, besides the Local and Remote operational modes, the capability to manually operate (Manual Mode) the instrumentation (power supplies, dynamic loads, …) is part of the various POWER SCOE

CCS shall control the SCOE during remote phase without user action at the SCOE peripherals. During these remote phases, SCOE users should only be able to command SCOE in local mode for safety/backup reasons.

There is no requirement for test sequencing on the SCOE. However all functions shall be remotely checkable from the CCS, as well as locally (safety reasons).

The SCOE shall present the following external interfaces:
- Appropriate monitor and control interface to CCS (as defined above),
- Specialised direct interfaces to specific subsystem,
- Standalone local operator interface

The use of industry standard interface and protocol (e.g. TCP/IP over Ethernet), is intended to simplify and standardise the SCOEs as much as possible, such that off-the-shelf equipment may be used.

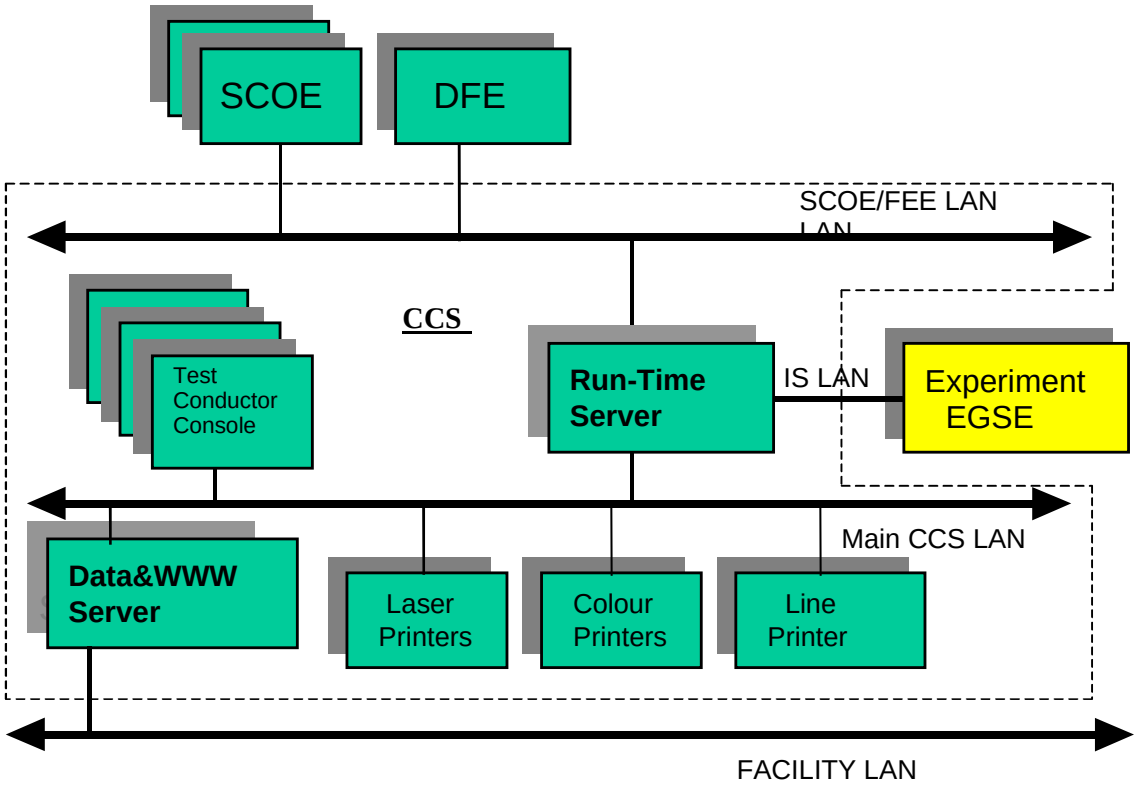


Figure 1 : EGSE General Architecture

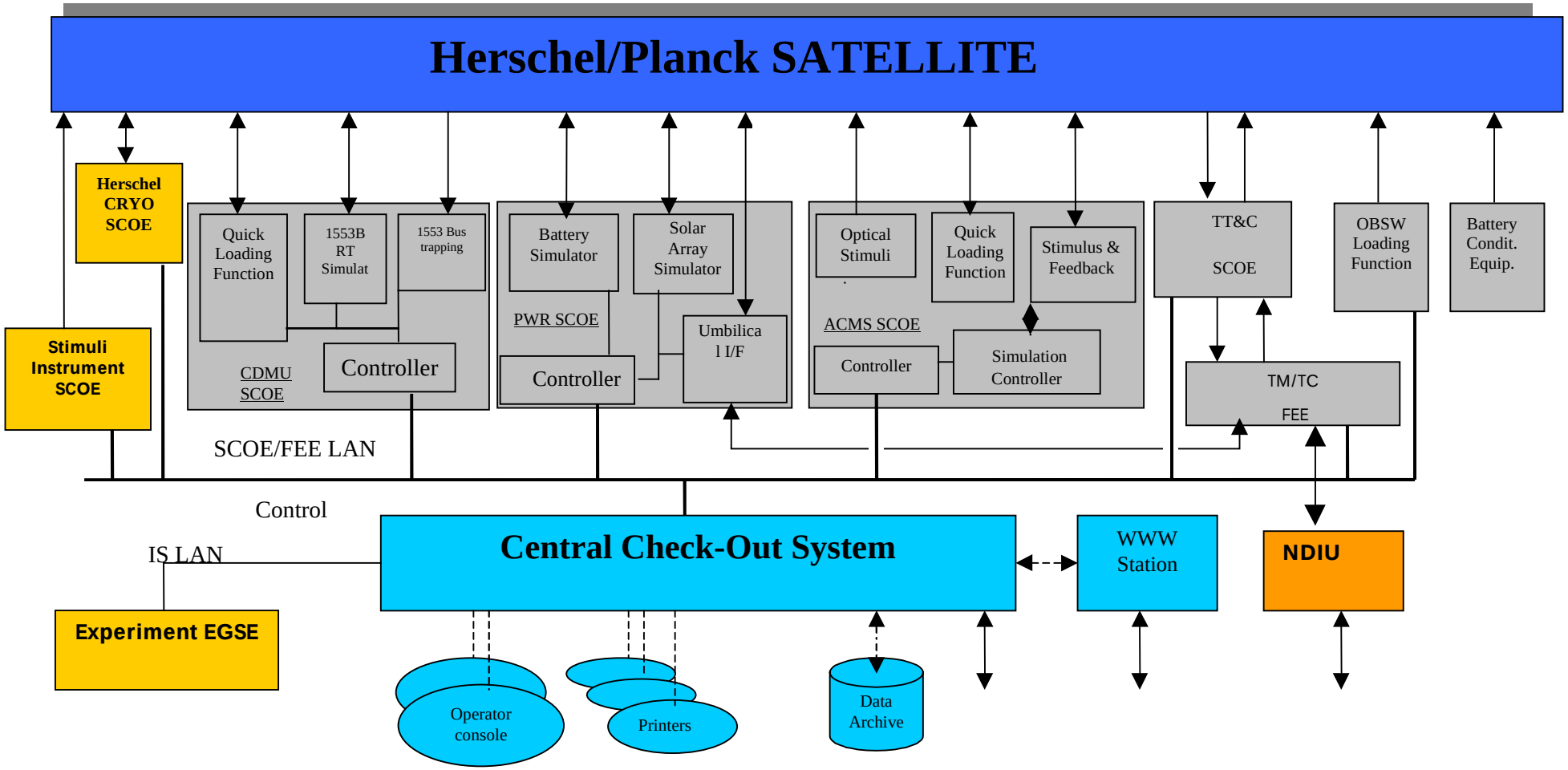


Figure 2 : EGSE System – Architecture (Herschel/Planck Satellites - Test activities)

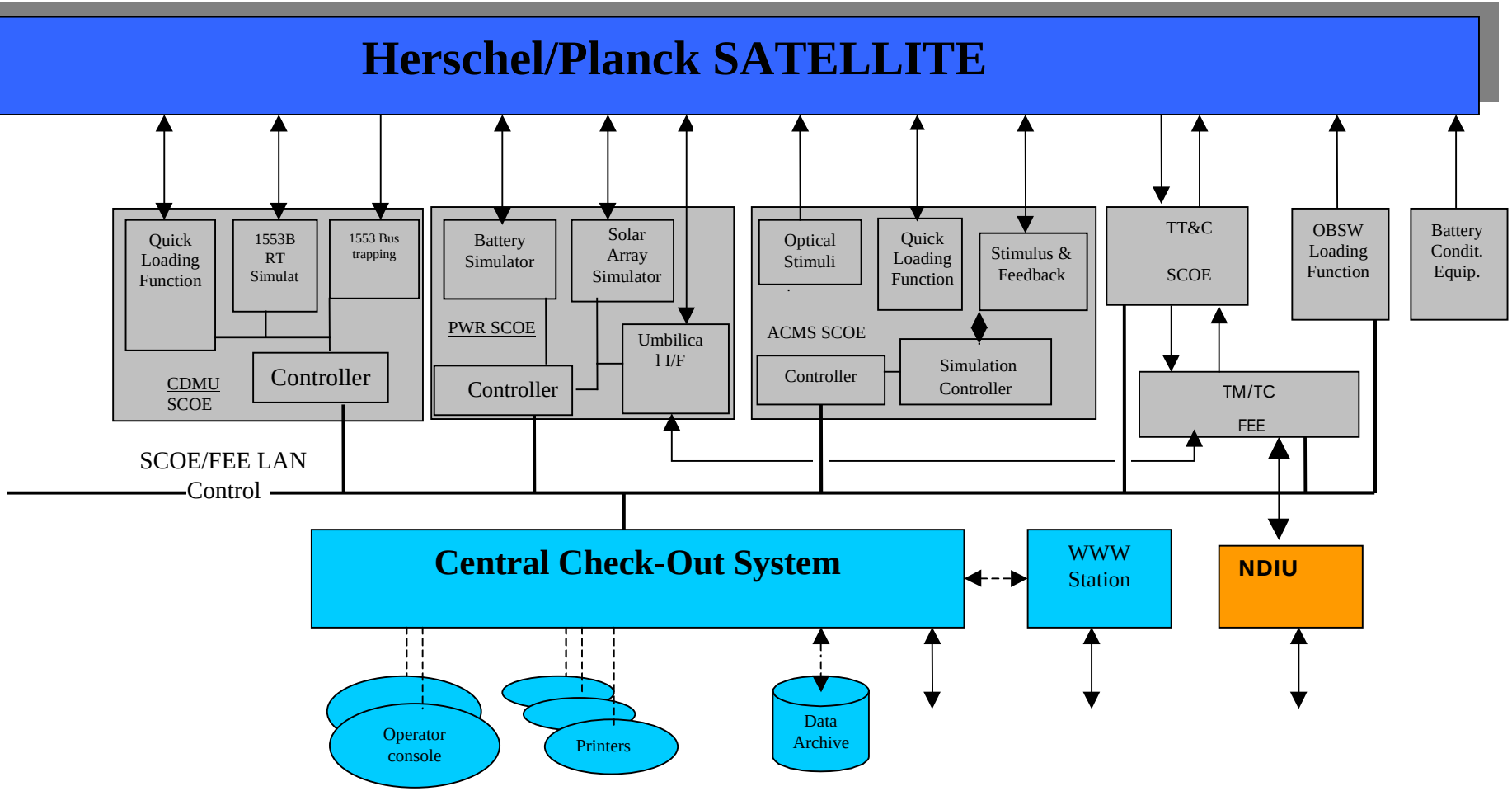


Figure 3 : EGSE SVM – Architecture (PFM Herschel/Planck SVM - Test Activities)

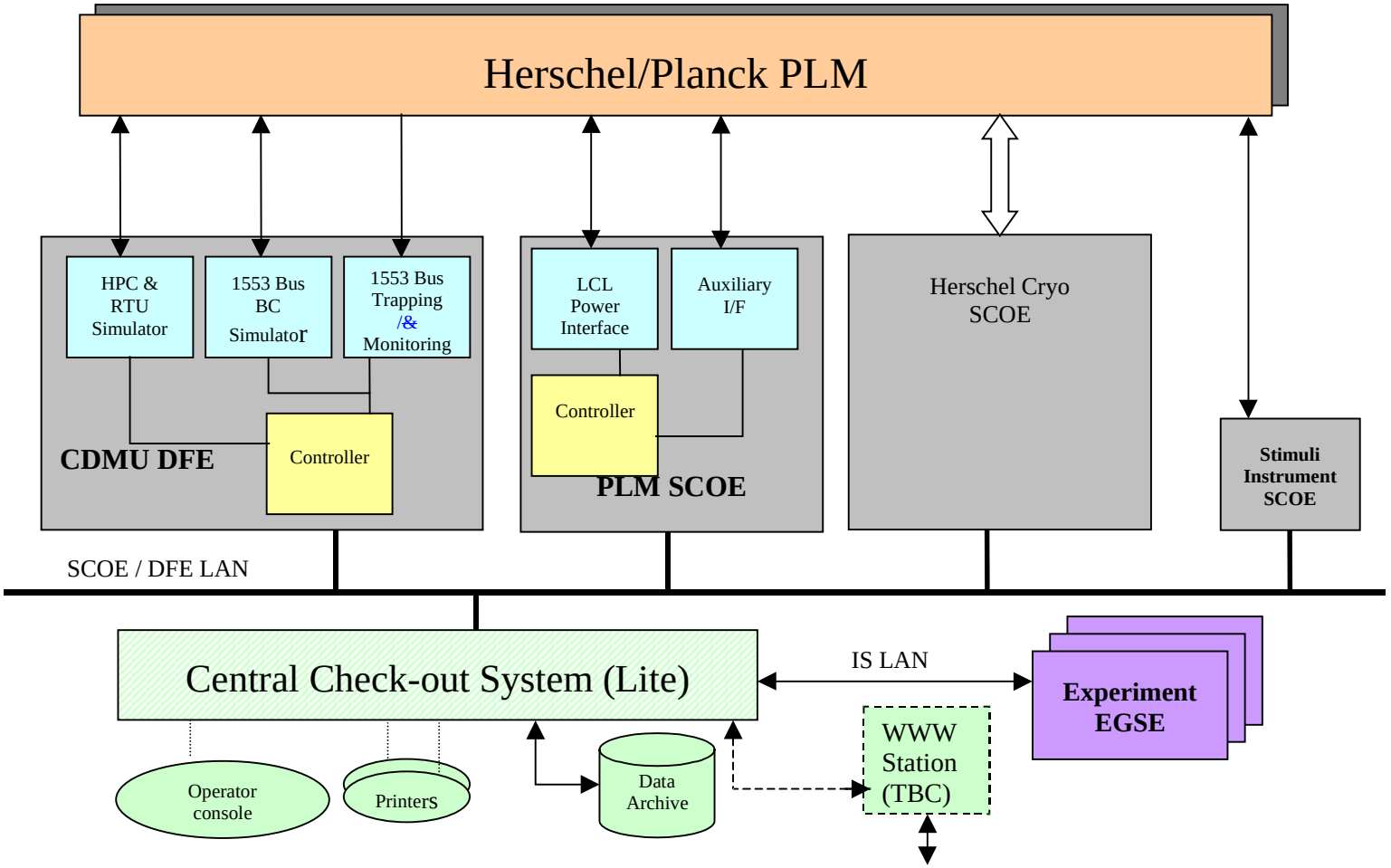


Figure 4 : EGSE PLM – Architecture (Herschel EQM / Planck CQM PLM - Test Activities)

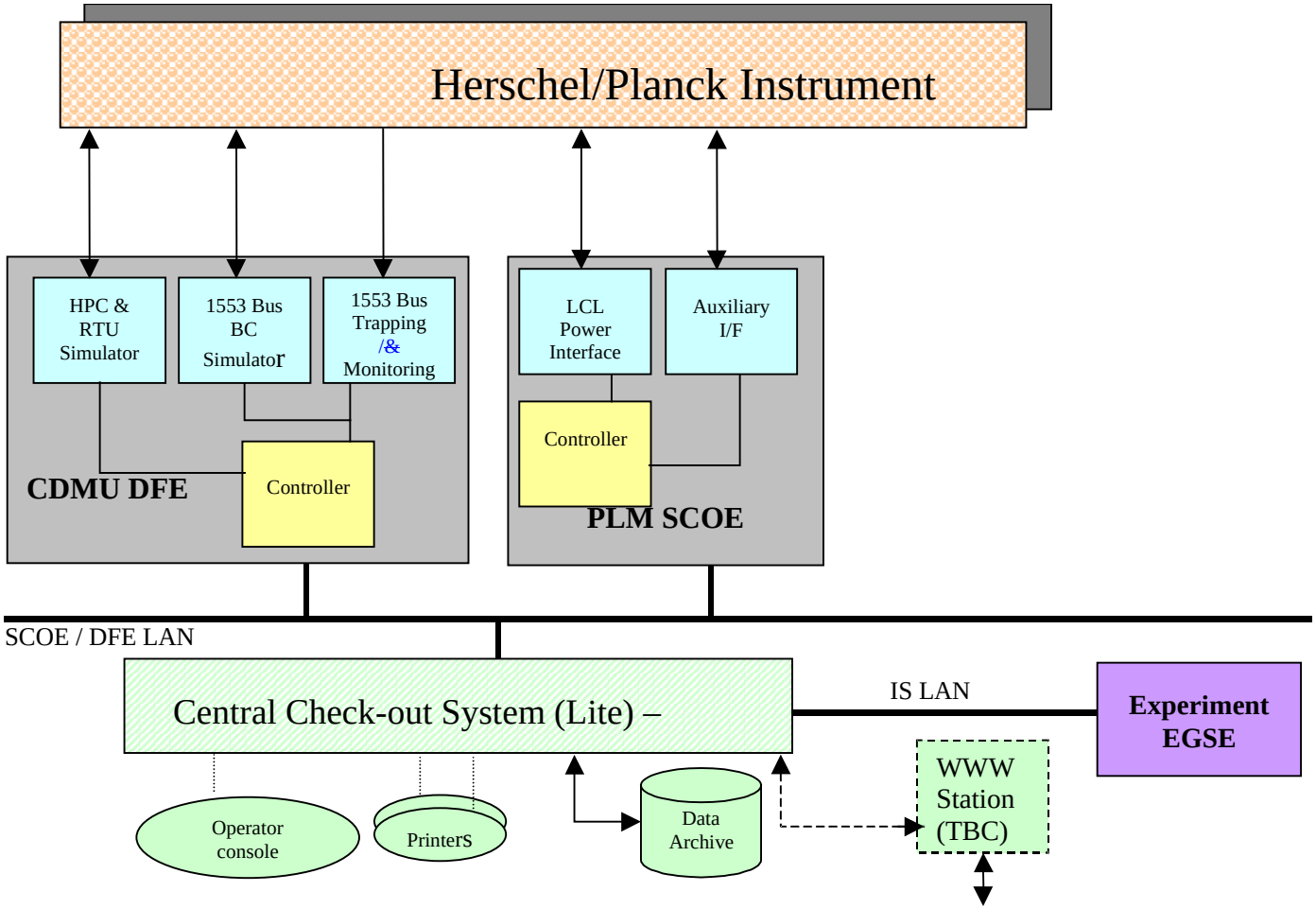


Figure 5 : EGSE Instrument – Architecture (Instrument acceptance and incoming inspection))

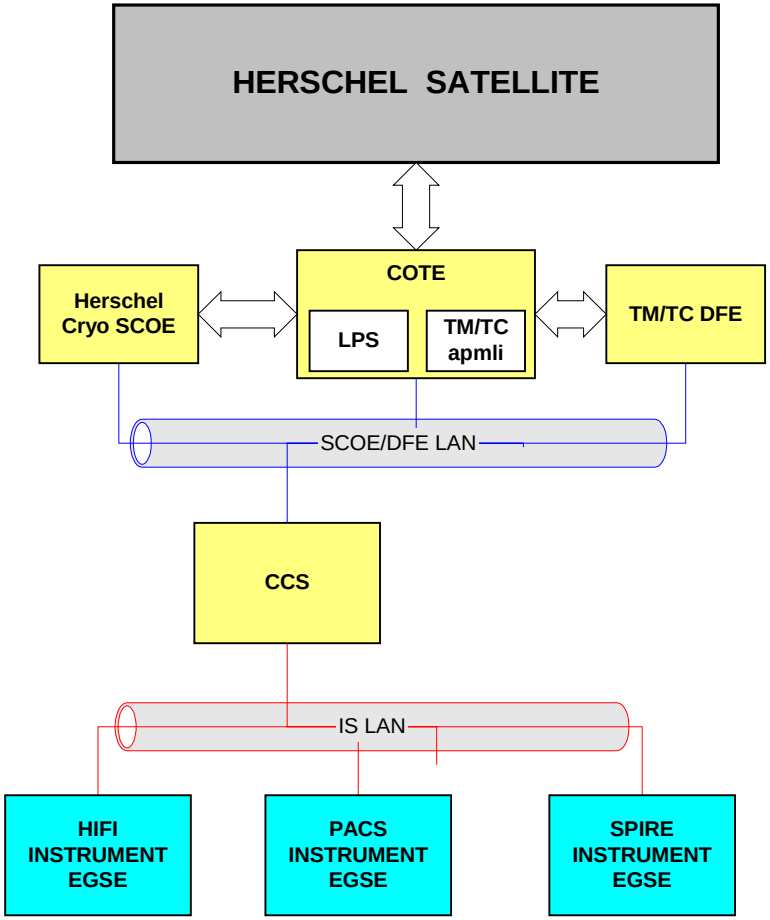


Figure 6 : Herschel Launch Pad configuration

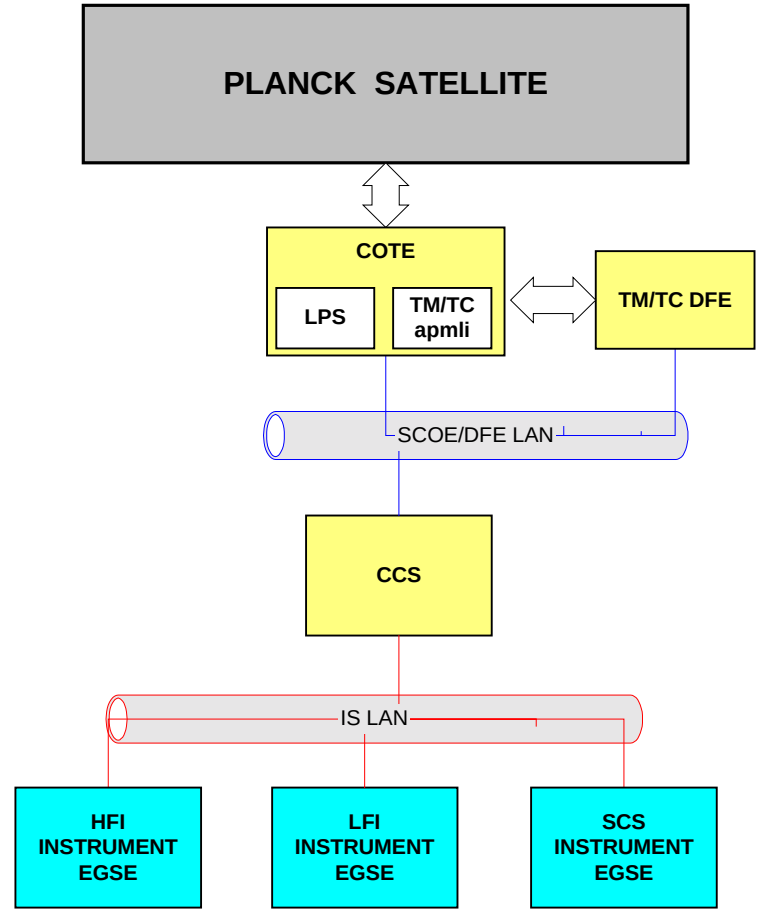


Figure 7 : Planck Launch Pad configuration

3.2.4 SYSTEM EGSE

3.2.4.1 CCS (Central Checkout System)

The Central Checkout System (CCS) is conceptually the core of the System EGSE, from which all testing is prepared, controlled and results archived. It presents the primary operator interfaces, and single point of control, for the supporting of all aspects of the system-level AIV program.

The prime function of the Central Checkout System shall be to provide reliable monitor and control facilities to allow the operators to ensure the integrity of the spacecraft and instruments during all electrical system level activities (AIVE-160).

CCS lite shall be foreseen for EGSE PLM and EGSE Instrument purpose. The only difference between Nominal and CCS Lite is presently the number of servers (one instead of two). All requirements of CCS Specification are still available except the possibility to recover situation where one of the two Servers is no more working

The CCS shall be compatible with [S2] and [S3]

[GRQT-0002a] Analysis

The CCS shall provide at least the following functions, details will be provided in the CCS Requirements Specification.

- standard interface for on-line and off-line data distribution to instrument EGSE equipment. Note - this interface shall not support any real-time control or commanding from the instrument EGSE (AIVE-135)
- standard interface to Front End Equipment for low-level handling of both the TT&C chains from/to the spacecraft, and for high-rate TM output from spacecraft via a ground-test connector (AIVE-140)
- gateway connection for access via public/private Internet, for data and information dissemination to the wider Herschel/Planck community (AIVE-145)

Such standard interfaces as defined above shall be implemented in such a way as to ensure that data distribution and traffic due to off-line activities do not impact upon test critical and real-time traffic (AIVE-150)

- recording of specific Herschel and Planck TM data (spacecraft and Instruments) – format to be agreed jointly between ESA and Contractor (AIVE-151)
- configuration tool facilities for all items, e.g. software modules, calibration and monitor tables, test sequences, command sequences and displays (AIVE-152)

Telecommands shall be subject to a pre-transmission check against the Satellite Database, to restrict and/or provide operator confirmation for the execution of hazardous commands.
In addition during the SVT where spacecraft commanding is done from the MOC a facility shall allow to block/veto specific commands from ESOC if considered dangerous (AIVE-155).

- automated facilities and high-level tools for preparation, execution and results/failure analysis and reporting of all electrical tests of the spacecraft and payload required to meet the system level programme (AIVE-165)

- Display of test progress, processed data error reports and test procedures in real time (AIVE-170)

- simple test sequence language made up of a number of statements that enables the unit/subsystem supplier or the instrument to specify the tests to be performed. Such defined test language shall be useable directly by the operators, and from pre-defined automated sequences (AIVE-175)

- execution of parallel/nested test sequences, as required for a full satellite test/mission – simulation of the spacecraft (AIVE-180)

- comprehensive tools for manipulation of the test sequences, including (AIVE-185):

    - Preparation and inter-active de-bugging,

    - Structured Test Sequence library

    - Configuration Control of Test Sequences

    - Full control over sequence execution

    - Automatic logging of test sequence actions

- development environment for the population and configuration management of the satellite database (AIVE-190)

- database management system supported by, and transferable between, a wide range of environments without modification (AIVE-195)

- processing of all spacecraft housekeeping data, maintaining a comprehensive real-time status of all on-board units, for use by test sequences, for display to operators, and for the automatic monitoring of hazardous conditions (AIVE-200)

- use of information from the SDB to perform the automatic verification of TC reception and successful execution on-board (AIVE-205)

- environment for the development of any On-Board Control Procedures (OBCPs) for execution during the AIV campaign (AIVE-210)

- execution of off-line tasks (e.g. test preparation) in parallel with test execution (AIVE-212)

- facilities for the monitor and control of OBCPs (AIVE-215)

- complete archiving of all data used and generated during testing of the spacecraft, this being called a Test Result Database (AIVE-220)

- archive available on-line and archived to non-volatile medium (AIVE-225)

All archived data shall be time correlated to an accuracy of 1 second (TBC)(AIVE-230)

- high level access tool for archive management, cataloguing and data retrieval (AIVE-235)
- real-time distribution of instrument telemetry data, test status and SCOEs status (where applicable) to the instrument EGSE's (AIVE-240)
- Data from the Test Results Database available off line for both local and remote distribution and interrogation (AIVE-245)
- operator interface user-friendly with a consistent "look and feel" between applications (AIVE-255)
- Display of user information (pertaining to test status, EGSE status and spacecraft status) available to the user in user-definable textual and graphical formats (AIVE-260).

Such information is available in a hierarchical manner to allow an overview, with increasing levels of detail to be provided.

- local printing of on-line status information, and off-line archived data
- capability to perform verification of tests by both RT TM and playback of TM stored on the SSMM
- test sequences broken into test modules and individually controllable steps possible within modules

[GRQT-0002b] Analysis

The CCS shall support HPSDB (Herschel/Planck System DataBase) mirror site.

3.2.4.2 TM/TC DFE

Note : baseline is same up and down link data rates for Herschel and Planck

The CCS via the SCOE/DFE LAN remotely controls the TC/TM DFE.

The TC/TM DFE shall provide the interface between the CCS and the Spacecraft (possibly via a TT&C SCOE - see earlier) for the real-time transfer of TM from the spacecraft and TC to the Spacecraft (AIVE-335) including quick dumping of on-board software.

Note : Quick loading function is part of the ACMS SCOE and CDMU SCOE

The TC/TM DFE shall allow all functions to be controlled and monitored remotely by the CCS. Monitor and control of all primary functions shall also be available to the local operator interface (AIVE-340).

Following power-on all necessary operations for DFE set-up shall be possible via remote control. All such set-up functions shall also be remotely verifiable (AIVE-345).

[GRQT-0003] Analysis

The TC/TM DFE shall provide at least the following functions, details will be provided in the relevant Requirements Specification.

- TM part:
  - TM data flow acquisition from the S/C according to ESA TM/TC packet standards (data rate up to 3.5 Mbps)
  - TM packets reconstruction from the received Transfer Frames
  - Performing validation at the Frame and low-level packet level
  - capability of Telemetry packets simulation

- TC part:
  - Acquire the Telecommands requests coming from the CCS
  - Telecommands sending to the S/C according to ESA TM/TC packet standards (data rate up to 4 Kbps)
  - TC packets encapsulation into the proper Transfer Frames (CLTU)
  - Hazardous Telecommands filtering
  - Extract and evaluate the CLCW.

- Interfaces (AIVE-350):
  - Telemetry and Telecommand packets links to/from the CCS
  - Transfer the acquired Telemetry flow onto the NDIU link with the proper format.
  - Acquire the Telecommands data coming from the NDIU
  - Send back to the CCS the TC Echo of the telecommands received by the NDIU
  - TM and TC video links to/from the TT&C SCOE
  - Interfaces to test connectors,
  - Appropriate monitor and control interface to CCS (as defined above)
  - Quick dumping function

- Other:
- storage of TM and TC at Transfer Frame level
- replay and trouble shooting capability
- sending all data to CCS with associated status information
- Simulation and self test for manual and remote operations

3.2.4.3 TT&C SCOE

Note : baseline is same up and down link data rates for Herschel and Planck

The TT&C SCOE shall provide all the interfaces between the S/C and the TM/TC DFE either via RF link or via the TM/TC Video link.

The SCOE shall contain all facilities to perform the Radio Frequency telecommand/telemetry links and the checkout of the on-board RF subsystem chain, during integration, subsystem and system level testing.

The CCS via the SCOE/DFE LAN remotely controls the TT&C SCOE.

[GRQT-0004] Analysis

The TT&C SCOE shall provide at least the following functions, details will be provided in the relevant Requirements Specification.

- Up-link:
- generation of un-modulated up-link carrier and ranging signal
- modulation of the up-link carrier with TC and ranging signals

- Down -link:
- Down-link signals reception
- Down-link signals demodulation

- Interfaces:
- Interface with TM/TC DFE for Video Telemetry link
- Interface with TM/TC DFE for Video Telecommand link
- Appropriate monitor and control interface to CCS

- Measurements:
- Signals measurement (noise, thresholds, RF power (Up-link/Down-link), etc…)
- Automatic RF subsystem performance testing
- Doppler signal generator
- S/C signal input level protection
- RF path calibration

- Other:
- sending all data to CCS with associated status information
- Simulation and self test for manual and remote operations

3.2.4.4 POWER SCOE

Note : Solar Array Simulator (SAS) detailed configuration (current/section) will be selectable between Herschel and Planck ones

The Power SCOE shall provide all the required electrical power during the whole electrical and functional integration activity, environmental testing and launch operations of the spacecraft.

The CCS via the SCOE/DFE LAN remotely controls the Power SCOE.

[GRQT-0005] Analysis

The Power SCOE shall provide at least the following functions, details will be provided in the relevant Requirements Specification.

- Junction Unit (Umbilical Interface Module)
  The Junction Unit groups all the electrical I/F of the Umbilical connectors.
  Basically the functions provided by this Junction Unit are :
  - Adapt S/C umbilical connectors and distribute signal lines
  - TM/TC umbilical lines
  - Test points facilities
  - Monitor and display signals form S/C
  - Provide external power for S/C operation via umbilical plug
  - Charge/discharge function for battery
  - Over-voltage / over-current protection
  - Simulate and monitor separation switches
  - Provide "High power commands" capability
  - Sense and display battery voltages of the on-board batteries
  - Sense and display Main Bus voltage
  - Simulate and monitor Heaters/Thermistors

- Solar Array Simulator (SAS):
  The Solar Array Simulator is running in local mode or remote mode under CCS control.
  - Simulation of the SA power supply by providing the required I/U output characteristics set independently for each individual array
  - Over-voltage / over-current protection
  - Simulation of Sunlit to Eclipse and Eclipse to Sunlit transitions
  - Sense and display of the section currents and voltages
  - Simulate the 30 **TBD** solar array sections by individual independent current sources
  - Simulate section output capacity

- Li-ion Battery Simulator (BS or BATSIM):
  The Battery Simulator is running in manual mode or local mode or remote mode under CCS control.
  The Battery Simulator Equipment shall provide the simulation of the flight Batteries installed on S/C
  - simulation of flight battery in nominal mode (sun presence)
  - simulation of flight battery in discharge mode (eclipse)
  - simulation of flight battery in charge mode (sun presence after eclipse)
  - simulation of flight battery in trickle (taper) charge
  - Over-voltage / over-current protection
  - Simulate the source impedance
  - Simulate the Li-Ion battery temperature
  - Provide sense and display capability for battery currents and voltages (total battery and cell packets).
  - interface with 1553 Bus

- Li-ion Battery Charge Equipment (BCE):
  The BCE is running in stand-alone mode.
  The BCE Equipment shall provide the facility to charge/discharge the flight batteries.
  - Provide controller capability to manage the standalone configuration
  - Configuration of different charge and discharge profiles
  - Monitoring and archiving of batteries parameters (cell current, cell voltage, temperature)
  - Over-voltage / over-current / over-temperature protection
  - Battery under-voltage protection
  - Simulate sections output capacity.

3.2.4.5 CDMU SCOE

Note : The remote terminal simulator will simulate either the Herschel or Planck ones

The CDMU SCOE shall provide the electrical and functional interfaces between the CCS and the Spacecraft with MIL STD 1553B Bus.
The main function of CDMU SCOE is to act as a Bus Monitor and Remote Terminal simulation system in order to verify that the Telemetry and Telecommand data flows are correctly handled by the CDMU over the Bus.

The CCS via the SCOE/DFE LAN remotely controls the CDMU SCOE.

[GRQT-0006] Analysis

The CDMU SCOE shall provide at least the following functions, details will be provided in the relevant Requirements Specification.

- 1553B Remote Terminal Simulator:
  - Off-line preparation of dummy RTU data source packets (HK, Science and Instruments) to be used during simulation
  - Simulation of missing instruments and relevant RTU in terms of Telemetry generation and TC reception
  - Time pulses generation to correlate simulation and acquisition with the On Board Time

- Bus Monitoring:
  - Capability of MIL STD 1553B Bus traffic trapping and monitoring
  - Reception of interrogations and generation of responses on the Bus
  - Acquisition of interrogation and responses travelling on the Bus
  - Filtering capability
  - Time tagging of all messages acquired over the Bus
  - Injection over the Bus of predefined errors (ex. missing response, wrong response, wrong Litton code, …).
  - archiving capability

- Quick S/W Loading:
  - Quick Loading capability in order to load big amount of data to onboard Mass Memories
  - A special test harness will be required to fulfil this function

3.2.4.6 ACMS SCOE

Note : Some delta due to the different type of mission (type of sensors and actuators)

The ACMS SCOE shall provide facilities to simulate, stimulate and monitor the AOCS equipment.

The CCS via the SCOE/DFE LAN remotely controls the ACMS SCOE.

[GRQT-0007] Analysis

The ACMS SCOE shall provide at least the following functions, details will be provided in the relevant Requirements Specification.

- Host Computer
- F/P SAS, QRS Electrical Stimuli module
- F/P RCS acquisition module
- ACMS Dynamic behaviour and environment simulation
- Planck RWS acquisition module
- Planck STR, FSS, GYR Electrical Stimuli
- Planck STM, AAD electrical stimuli
- Archiving capability
- Quick S/W Loading capability in order to load big amount of data

3.2.5 PLM EGSE

3.2.5.1 CDMU DFE

The CDMU DFE shall provide the electrical and functional interfaces between the CCS and the Payload with MIL STD 1553B Bus. It shall be used for Payload test activities to simulate the missing CDMU equipment

The CCS via the SCOE/DFE LAN remotely controls the CDMU DFE.

[GRQT-0008a] Analysis

The CDMU DFE shall provide at least the following functions, details will be provided in the relevant Requirements Specification.

- CDMU Bus Controller Simulator
- RTU Simulator
- 1553 Bus Monitoring (see CDMU SCOE)
- TM/TC Packet Management

3.2.5.2 PLM SCOE

The PLM SCOE shall provide the electrical and functional interfaces between the CCS and the Payload with MIL STD 1553B Bus.
The PLM SCOE shall be used for Payload test activities to provide to the Module the necessary interfaces usually received from SVM Module when the Spacecraft is completely integrated.

The CCS via the SCOE/DFE LAN remotely controls the PLM SCOE.

[GRQT-0008b] Analysis

The PLM SCOE shall provide at least the following functions, details will be provided in the relevant Requirements Specification.

- Provide external power for Payload operation
- Provide external electrical interfaces
- Over-voltage / over-current protection

3.2.6 Spacecraft Interface Simulator (SIS)

[GRQT-0009] Deleted Analysis

3.2.7 EGSE SPECIFIC Herschel

3.2.7.1 CRYO SCOE

Specific equipment

3.2.7.2 INSTRUMENT EGSE

Specific equipment to be provided by PI's

3.2.8 EGSE SPECIFIC Planck

3.2.8.1 SORPTION COOLER SCOE

Deleted

3.2.8.2 INSTRUMENT EGSE

Specific equipment to be provided by PI's

3.2.9 LAUNCHER INTERFACE

3.2.9.1 COTE

The COTE shall be used during the very last phases of launch campaign (the Spacecraft is encapsulated on top of the Launcher)

The COTE has the same functions that the Junction Unit parts of Power SCOE, but shall be compatible with launch pad conditions (i.e. humidity, acoustic noise, vibration, seismic aspect, etc.).

The CCS shall remotely control the COTE.

The COTE shall provide the following functions:

- Launch Power Supply:
  - Provide Nominal and redundant power to the S/C via Umbilical connector
  - Manage the interface between the SCOE and the S/C Umbilical connectors
  - Provide signals Test points
  - Monitor and display signals coming from the S/C
  - Sense and display battery voltages of the on-board battery
  - Sense and display Main Bus voltage
  - Provide the capability to send High priority commands – **TBC** -
  - Provide Over-voltage / Over-current protections.

- TM/TC Video Signals Amplifier

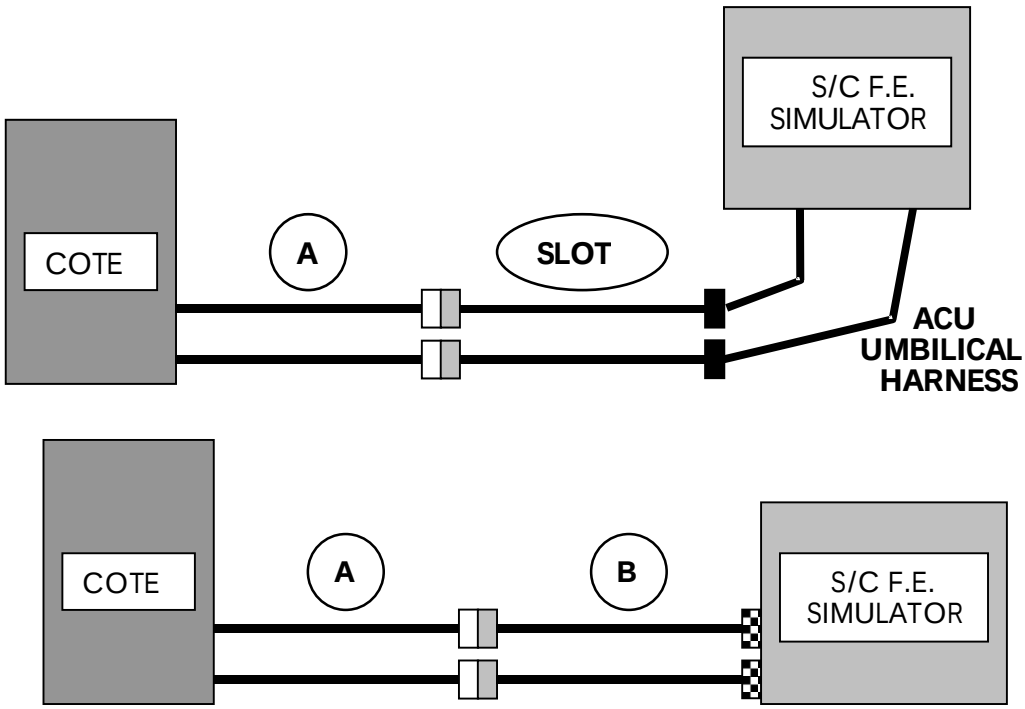
3.2.9.2 S/C simulator

A S/C Simulator or Satellite Front-End simulator shall be used to perform preliminary electrical fit checks regarding launcher interface.

The objective of these preliminary electrical fit checks is to confirm at an early stage the electrical interface between the flight ACU and the Herschel and Planck satellites in terms of:

- global wiring patching of the link = COTE - "Cables A" - "SLOT" - ACU harness - satellite
- Adapt and amplify the Telecommand signals travelling from the remotely located TM/TC DFE, through the Launch Power Supply (LPS) / Umbilical Interface Module, to the Spacecraft mounted on top of the Launcher
- Adapt and amplify the Telemetry signals travelling from the Spacecraft mounted on top of the Launcher to the remotely located TM/TC DFE, through the Launch Power Supply (LPS) / Umbilical Interface Module
- TM video pattern generator
- Provide galvanic signals isolation
- Provide signal encoding and decoding
- Adapt interface signals and lines impedance.

The configuration of these fit checks are illustrated hereafter.



"Cables B" will be used for launch configuration validation before satellite mating onto the launch vehicle. The assembly "Cables A" + "Cables B" will be also used to connect COTE to satellite during filling operations.

The following items are provided by Arianespace:

- the flight ACU umbilical harness with both interfaces = VEB and satellite
- the ground cables "SLOT" (Simulation Liaison Ombilical Table)

3.2.10 AUXILIARY EQUIPMENT

- Computer for Software quick loading function
- Special test harness (EMC/Vacuum tests adapters /class 100.000 room)
    - Cable shall be supplied in sufficient quantity, type and length to meet the requirements of the various test facilities.
- BOB (Break Out Boxes)
- Test equipment required to integrate EGSE
- Connectors Adapters
    - Connectors savers to connect EGSE to flight connectors, will be provided by the associated flight equipment supplier.
- Power distribution unit
    - The power distribution units are used to provide power to the different GSE constituents. It consist in an insulation transformer (3x230V to 3x400V switchable) and in a series of outlets providing 230V / 16A.
      This is required for equipment galvanically refering to the spacecraft grounding point
- Communication Set
    - Micro, amplifier, …
- Voice intercommunication between non co-located EGSE units

3.3 OPERATIONAL REQUIREMENTS

3.3.1 GENERAL

3.3.1.1 Archiving Function

[GRQT-0010] [Analysis]

Each SCOE shall implement a local archive function in order to store all the test data

[GRQT-0020] [Test]

Archive files shall be time tagged and shall be organised in chronological order.

[GRQT-0030] [Test]

The Archive Files shall be identified by names containing the date and time of the test.

[GRQT-0040] [Test]

The Archive function shall start automatically when the SCOE reaches any automatic operating mode.

[GRQT-0050] [Test]

In order to avoid too big files , the Archive Files shall be created and closed on periodical basis or when the file size is higher than the size specified in the configuration file of the SCOE.

3.3.1.2 Logging Function

[GRQT-0060] [Test]

Each SCOE shall implement a local logging function in order to store all system events, all commands received locally from keyboard or remotely, command execution results, diagnostic and error messages, measured data

[GRQT-0070] [Test]

The log function shall start automatically when the SCOE reaches any automatic operating mode.

[GRQT-0080] [Test]

The Log Files shall be identified by names containing the date and time of the test.

[GRQT-0090] [Test]

In order to avoid too big files , the Log Files shall be created and closed on periodical basis or when the file size is higher than the size specified in the configuration file of the SCOE.

3.3.1.3 Start-up – Self Test Functions

[GRQT-0100] [Test]

The start-up of the SCOE's application shall allow two options :

1. 'COLD' start-up : all parameters and functionality's shall be reseted (default value set in a configuration file)
2. 'HOT' start-up: all parameters and functionality shall not be reseted. They all keep the precedent values (in case of unexpected breakdown of the application)

[GRQT-0110] [Test]

The duration of the 'HOT' start-up shall not exceed 5 minutes.

[GRQT-0120] [Test]

A specific configuration file shall contain all the definition of the configuration parameters of SCOE

[GRQT-0130] [Test]

The configuration file could be modifiable by the operator.

[GRQT-0140] [Test]

When application is running, any modification in the configuration file shall have no impact on the actual operations. The configuration file is taken into account only during 'COLD' start-up.

[GRQT-0150] [Test]

For every start-up of the application, each SCOE shall :

- Verify the free space on the local hard disk and emit an alarm if free space < 80%.
- Create a new directory (date/time)
- Open the running Archive file
- Open the running Log file

[GRQT-0160] [Test]

During the start-up of each SCOE application, a self-test (without human intervention) shall be executed in order to verify the good shape of the calculator (Power Supply Interface , Bus I/F, etc…)

[GRQT-0170] [Test]

A report of this self-test shall be transmitted to the CCS.

[GRQT-0180] [Analysis]

During the self-test special attention shall be paid to the interfaces connecting the SCOE with the UUT in order not to send any signal/stimuli toward the UUT.
The self-test shall prove that those interfaces are in a well-defined status such that no hazard is caused to the UUT.

3.3.2 OPERATING MODES

[GRQT-0190] [Analysis]

Each SCOE shall support at least two operational modes : **Local** and **Remote**.

A third mode shall be foreseen for specific SCOE's instrumentation : **Manual**

[GRQT-0200] [Test]

In Remote mode, the SCOE shall only be controlled by remote commands coming from the CCS i.e. no command issued from the local MMI shall be accepted except the command to come back to Local mode.

[GRQT-0210] [Test]

In Local mode, the SCOE shall only be controlled via local keyboard.

In Local mode, the SCOE shall transmit local status (periodic Remote Monitoring Message (RM))to the CCS.

[GRQT-0220] [Test]

Switching between modes from Local to Remote control (and viceversa) shall be possible at any time without affecting any internal setting of the SCOE.

[GRQT-0225] [Test]

The operational mode transition shall be independent from the Local/Remote configuration.

3.3.3 CREATED ENVIRONMENT

3.3.3.1 Controlled environment conditions

[GRQT-0230] *(AIVE-90)* [Analysis]

The EGSE shall be capable of operating in full compliance with the requirements of this specification in :

- temperature environment between + 10 °C and + 40 °C,
- relative humidity range between 60 % ±10
- barometric pressure of ground level to altitudes up to 2000 m.

[GRQT-0240] *(AIVE-80)* [Analysis]

Any EGSE equipment that needs to be used in the clean room shall meet the requirements of the class 100 000-cleanliness specification.

[GRQT-0250] *(AIVE-80)* [Analysis]

EGSE to operate in the presence of optics will meet the standard of class 10 000.

3.3.3.2 Electromagnetic Compatibility (EMC)

[GRQT-0260] [Analysis]

EGSE and cable to be used during functional testing in the front end area shall be designed under the following guidelines :

- Low susceptibility to external interference (conducted interference through signal and power lines, radiated interference direct into the equipment)
- Low conducted emission and radiated emission to avoid interference with satellite and other test equipment

- The use of the equipment shall not introduce ground loops.

[GRQT-0270] [Analysis]

EGSE to be used out of the front-end area shall comply with commercial EMC practices and shall not be required to have special design or EMC acceptance.

3.3.4 LIFE TIME REQUIREMENTS

[GRQT-0280] [Analysis]

The EGSE shall be designed for continuous operations.

MTBF shall be 6 weeks

MTTR shall be 24 hours (24 for detection and 24 for action)

In order to comply with this figure special attention must be paid in the EGSE design to comply with the maintainability and reparability requirements. Sufficient spare policy shall be implemented.

[GRQT-0290] *(AIVE-70)* [Analysis]

The design lifetime and warranty of all equipment shall cover a period extending for 1 years after acceptance review of spacecraft. This warranty shall be extended by any period when the spacecraft is stored and un-powered.

3.3.5 FUNCTIONAL SAFETY REQUIREMENTS

3.3.5.1 Reliability

[GRQT-0300] *(AIVE-35)* [Analysis]

The equipment shall be designed for continuous operation for periods of utilisation required by the AIT plans, and for launch operations.

[GRQT-0310] [Analysis]

Each EGSE equipment shall be designed in order to be completely repaired by using initial spare part or not, in less than two hours in case of failure during operational use, whatever the kind of failure. It means that during operational use, the repair duration between failure apparition and operational status restore shall be less than 2 hours

[GRQT-0320] *(AIVE-40)* [Analysis]

The equipment shall be designed and constructed for ease of maintenance.
Corrective and planned maintenance of any equipment shall not exceed 5% of the planned utilisation period in any one-month.

[GRQT-0330] [Test]

The starting of the complete EGSE shall not exceed 20 minutes.

3.3.5.2 Safety

[GRQT-0340] *(AIVE-20) (AIVM-01)* [Analysis]

The equipment shall comply with applicable European and national and launch site safety regulations (refer to AD-1 & AD-2).

[GRQT-0345] [Analysis]

All EGSE as well as electrical parts of others GSE (TGSE, MGSE, …) used in hazardous (explosive) atmosphere locations shall meet the AD-1 & AD-2.
A location is hazardous when propellants are present.

[GRQT-0350] [Analysis]

EGSE electrical lines between EGSE and satellite subsystems shall be protected by a fuse or a current limiter located in the EGSE.

The relation between wire sizes, wire capacities, wire maximum temperatures (EGSE power wires and wires between EGSE and Satellite) and the ultimate trip limit current value of the protection device must be stated.

[GRQT-0360] *(AIVE-25)* [Analysis]

EGSE shall include over-voltage protection, loss of external power or reverse polarity shall not cause damage to hardware or the loss of significant test data.

[GRQT-0370] [Analysis]

Inhibition of orders activating hazardous functions shall be implemented

[GRQT-0380] [Analysis]

To prevent hazards to personnel and/or equipment, the system has to meet the 15-100 national NF standard or equivalent foreign standards. The system EGSE shall meet the safety requirements of the test facilities during integration, operation, handling, storage, and transportation.

[GRQT-0390] *(AIVE-30)* [Analysis]

Safety for personnel, spacecraft equipment, test facilities and GSE will be ensured by implementation and maintenance of safety precautions resulting from Analyse.

[GRQT-0400] [Analysis]

The design of all EGSE shall be such that during all phases of integration and test, the satellite or parts of the satellite are not damaged.

[GRQT-0410] [Analysis]

A single EGSE failure shall not:

- Damage the specimen under test
- Damage the EGSE (risk of fire, electrical shocks for personal...)

[GRQT-0420] [Analysis]

The EGSE Contractor shall provide a failure analysis report concerning all electrical S/C interfaces.

3.3.5.3 Maintainability

3.3.5.3.1 General

[GRQT-0430] *(AIVE-40)* [Analysis]

The equipment shall be designed in such a way to facilitate maintenance, assembly/disassembly, and inspection of vital functioning subassemblies and replacement/substitution of modules.

[GRQT-0440] [Analysis]

Particular features contributing to the attainment of the above are:

- Hierarchical (modular) **arrangement** of assemblies, subassemblies
- Accessibility of screws, bolts, fasteners of all kinds
- Rigidity on the part of those elements having to be taken out and reinserted repeatedly
- Provision of identification markings on cables, plugs, sockets and units
- Proper colour coding of wires
- Easy Accessibility to connectors, electronic cards, drawers

Use of suitably indexed plugs and sockets.

[GRQT-0450] *(AIVE-45)* [Analysis]

Where two or more units of a given type are required, each shall be electrically, functionally and mechanically compatible, so that they are fully interchangeable.

3.3.5.3.2 Documents

[GRQT-0460] *(AIVE-120)* [Analysis]

Manuals for maintenance shall be delivered and shall include preventative maintenance routine(s). These routines shall cover all tasks and actions required maintaining the equipment in an operational condition by the user, including all calibration activities.

[GRQT-0470] *(AIVE-120)* [Analysis]

The maintenance manuals shall include sufficient information to permit experienced user personnel to carry out repair and re calibration after equipment failure.

[GRQT-0480] *(AIVE-120)* [Analysis]

The maintenance manuals shall also include any special packing/unpacking requirements.

3.3.5.3.3 Reparability

[GRQT-0490] [Analysis]

It shall be possible to strip down the equipment to its lowest level for repair/replacement and reassemble within a one-hour period.

[GRQT-0500] *(AIVE-55)* [Analysis]

Sufficient spares shall be provided to cover the utilisation period of the equipment, bearing in mind contingency work around solutions proposed in the AIT Plan, and for launch operations.

[GRQT-0510] [Analysis]

All equipment not meeting previous requirement shall be identified to be provided by the initial spare part for the most critical ones. A list of all such equipment shall be maintained.

3.3.5.3.4 Maintenance equipment

[GRQT-0520] [Analysis]

Besides the built-in test facilities of the EGSE, the usual laboratory instruments for measuring and display of voltage, current, time, frequency, etc. shall fulfil the tasks of maintenance.

3.3.5.3.5 Maintenance and Re calibration Cycles

[GRQT-0530] *(AIVE-65)* [Analysis]

The maintenance and re calibration cycles are to be specified by the supplier/manufacturer.

Maintenance contracts with service agencies or suppliers shall enable support to be obtained within the 5% utilisation per month maintenance requirement at any envisaged site.

[GRQT-0540] [Analysis]

Each EGSE equipment's delivered by supplier/manufacturer shall be calibrated just before delivery.

[GRQT-0550] *(AIVE-60)* [Analysis]

EGSE shall be calibrated with reference to a National Bureau of Standards.

3.3.5.3.6 Maintenance Kit

[GRQT-0560] [Analysis]

The Subcontractors shall provide spare kits along with deliverable items. These kits will contain all special type and limited life items where feasible.

[GRQT-0570] [Analysis]

A part of the user manual, describes how use the spares items.

3.3.6 INTERCHANGEABILITY REQUIREMENTS

[GRQT-0580] [Analysis]

The units of the EGSE shall be designed for maximum interchangeability or replacement.

[GRQT-0590] [Analysis]

All parts having the same manufacturers pat number shall be interchangeable.

[GRQT-0600] [Analysis]

All electrical equipment shall be designed for compatibility with the 19" racking standard (DIN 41494) wherever possible.

[GRQT-0610] [Analysis]

Plug in units shall be removable from the rack without disconnecting fixed terminals or wiring.

[GRQT-0620] [Analysis]

Any equipment which cannot be removed from it's location, replaced by similar equipment, tested and verified as operating within a one hour period, shall be identified.

[GRQT-0630] [Analysis]

A list of such equipment shall be maintained.

3.4 INTERFACES REQUIREMENTS

3.4.1 EGSE to/from SPACECRAFT INTERFACES

This chapter covers all electrical interfaces between EGSE and S/C and between EGSE items.

[GRQT-0640] *(AIVE-5)* [Analysis]

The EGSE shall be fully compatible with all spacecraft internal and external interface requirements

[GRQT-0660] *(AIVE-100)* [Analysis]

EGSE shall be connected to flight hardware only with flight quality connectors or corresponding connector savers , connector mating/de-mating cycles between GSE and flight equipment shall be minimised.

[GRQT-0670] *(AIVE-105)* [Analysis]

Verification of the design, construction, interfaces and performance shall be carried out in accordance with well-defined procedures approved by ESA, this shall include interface compatibility with the on-board and ground-based elements.

[GRQT-0672] [Analysis]

Test points shall be provided for every critical signal to allow easy isolation and identification of failed items without dismounting or disconnecting other equipment, for calibration, integration and maintenance.

[GRQT-0674] [Analysis]

Test points shall be short circuit protected or they shall be secured by other means.

3.4.2 EGSE EXTERNAL INTERFACES

[GRQT-0680] [Analysis]

Each EGSE item shall be delivered with its associated harness :

- all equipment cables internal to the equipment itself
- all power cables
- all LAN cables
- all cables to interface the UUT.
- one Earthling strip

The length of cables connecting EGSE to the Spacecraft Units shall be at least 30m.

[GRQT-0685] [Analysis]

On both side of each cable, three marks shall be set :

1. cable name
2. Connector side (satellite or SCOE Name)
3. Connector name

[GRQT-0690] [Analysis]

Each EGSE item shall be connected to the EGSE ground with an earthling strip.

[GRQT-0700] [Analysis]

The earthling strip shall be composed at each end of a 10 mm ring terminal plug

[GRQT-0710] [Analysis]

Each earthling strip shall be covered with transparent (vacuum chamber) tubing (length 10m).

[GRQT-0720] [Analysis]

All EGSE item shall be powered by an independent ground power distribution unit (insulation transformer)

[GRQT-0730] [Analysis]

Each rack shall provide at least four additional power outlets for further connection.

3.4.3 EGSE INTERNAL INTERFACES

This chapter covers all general interfaces between EGSE items in control/command point of view.
The specific requirements of communication protocol are specified by a dedicated document [AD09]

[GRQT-0642] [Analysis]

The type and the amount of data to be distributed by the On-line server to the TCCs or to the Experiments EGSE are usually different. For this reason,:

- the TCCs and CCS peripherals shall be connected to the "Main CCS LAN"
- the SCOE and DFE shall be connected to the "SCOE/DFE LAN"
- the Experiments EGSE shall be connected to a separate, dedicated "Instrument Station LAN" (IS LAN)

[GRQT-0644] [Analysis]

The communication and control interface between EGSE item shall be based under 100 Mb/s ETHERNET network using TCP/IP with a class B IP network addressing using protocol defined in [AD09]:

- Communication between CCS and SCOE shall be done via SCOE/DFE LAN
- Communication between CCS and Instrument Station shall be done via IS LAN

[GRQT-0645] *(AIVE-250)* [Analysis]

Data pertaining to spacecraft, EGSE and test campaign status shall be made available to the wider Herschel/Planck community via off-the -shelf protocols (e.g.. WWW).

[GRQT-0650] *(AIVE-15)* [Analysis]

An EGSE interface shall be provided compatible with the ESA provided NDIU for TM and TC interface between the satellites and the Mission Operation Centre (MOC).

3.5 DESIGN AND CONSTRUCTION REQUIREMENTS

3.5.1 GENERAL REQUIREMENTS

The H/P EGSE shall be composed as show in § 3.2.3

3.5.2 SPECIFIC REQUIREMENTS

3.5.2.1 Protection

This covers resistance against moisture, salts, corrosion, fungus etc.
Hygroscopes materials (e.g. wood) and components shall not be used for preservation, casting or similar protection.

Corrosion sensitive materials are to be avoided or shall be provided with an appropriate high quality surface tempering and/or finish for the specified environmental conditions.

[GRQT-0735] *(AIVE-75)* [Analysis]

It shall be a design goal to minimise the number and physical size of any equipment requiring close proximity (<5m) to the spacecraft

3.5.2.2 Electrical Design Requirements

3.5.2.2.1 Power

[GRQT-0740] *(AIVE-10)* [Analysis]

EGSE equipment shall be designed for a mains power supply of 230V (+5%, -10%), 50Hz.

[GRQT-0750] *(AIVE-10)* [Analysis]

For each equipment, the maximum current demand from the AC power line shall be less than 120% of the maximum static input current.

[GRQT-0760] *(AIVE-10)* [Analysis]

The tolerable noise and ripple level on the AC power line shall be 5%.

[GRQT-0770] *(AIVE-10)* [Analysis]

The connector types shall be CEE 240V – 16 A / CEE 240V – 32 A

[GRQT-0780] *(AIVE-10)* [Analysis]

Fuses or circuit breakers shall be implemented on all main inputs of the power lines.

3.5.2.2.2 Grounding and isolation

[GRQT-0790] [Analysis]

The insulation between any output terminal and the AC power line shall be higher than 10 MΩ.

[GRQT-0800] [Analysis]

A ground terminal shall be foreseen on the equipment for grounding connections. For equipment racks used in clean room areas, a grounding bridge shall be provided to allow ground connection either to the main safety ground or facility ground.

[GRQT-0810] [Analysis]

The EGSE grounding concept shall be the following:

- All signal lines are floating ones with respect to S/C I/F
- To respect galvanic insulation, the electronic components of the EGSE side must be referenced to EGSE ground
- To respect galvanic insulation, the electronic components of the S/C side (within the EGSE) must be referenced to the S/C ground (primary or secondary ground)
- The umbilical signals which are referenced to the S/C primary ground (respectively to the secondary ground) shall be processed in EGSE by electronic unit referenced to the S/C primary ground (respectively to the S/C secondary ground) and shall be isolated from EGSE ground

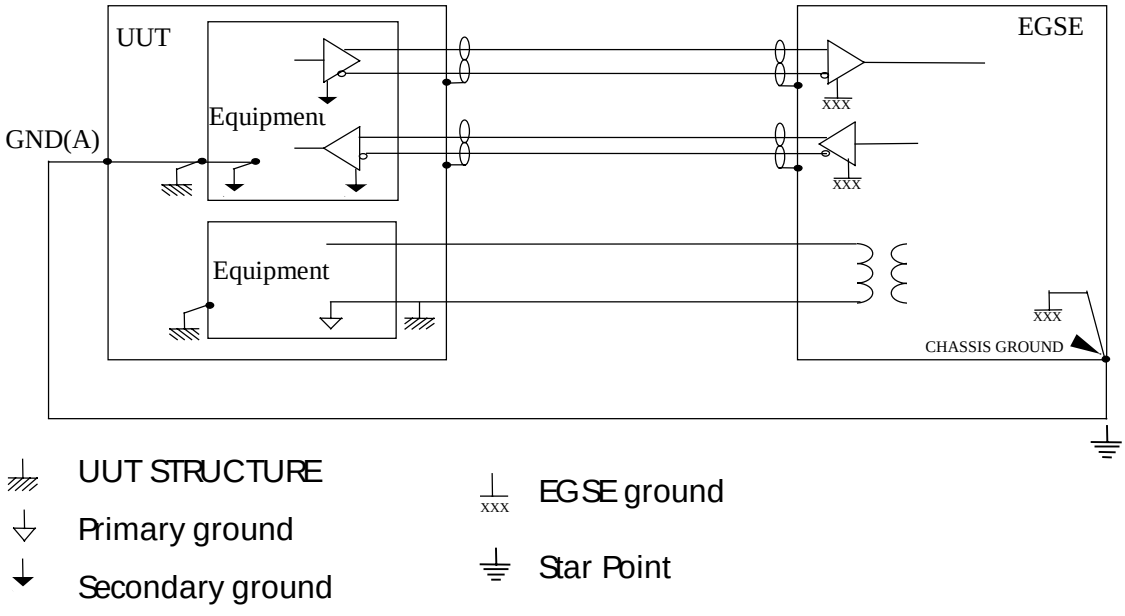


Figure 8 : Grounding concept

3.5.2.2.3 Robustness

[GRQT-0820] [Analysis]

Connectors with the equipment shall be secured to prevent breakage and eliminate changes in characteristics or outputs as a result of vibration and acceleration or shocks encountered under specific environmental conditions.

[GRQT-0830] [Analysis]

All cables and connectors must be clearly marked. Type and construction of connectors shall be such that wrong connections are avoided (e.g. connector keys).

[GRQT-0840] [Analysis]

Connectors and wiring arrangements shall allow visual inspection in disconnected condition.

[GRQT-0850] [Analysis]

The equipment shall employ modular plug-in circuit assemblies permitting simple and convenient replacement.

[GRQT-0860] [Analysis]

Permanent wiring of electronic components shall not be obtained by 'wrapping' method.

[GRQT-0870] [Analysis]

Connections of cables shall be set at least at 30 cm from ground.

3.5.2.2.4 Testability

[GRQT-0880] [Analysis]

Self-test and calibration capability shall be provided whenever possible.

[GRQT-0890] [Analysis]

Test points shall be provided to the lowest sub-assembly level to allow rapid isolation and identification of failed components. System components shall be mounted in a manner that permits convenient access from the front of the rack when the equipment is in the extended position (except commercial equipment).

3.5.2.3 Mechanical Design Requirements

[GRQT-0900] [Analysis]

A 19" rack system shall be used when rack mounting is necessary.

[GRQT-0910] *(AIVE-115)* [Analysis]

All racks shall be movable with the help of large rotating and lockable wheels.

[GRQT-0920] [Analysis]

All adjustments shall be carried out from the front panels.

[GRQT-0930] [Analysis]

All permanent connections shall be made at rear panels

[GRQT-0935] *(AIVE-95)* [Analysis]

The physical properties of the equipment (dimensions, mass, point loading) shall be compatible with all sites (and associated handling devices) including launch site where it is envisaged for the equipment to be used

[GRQT-0940] [Analysis]

When possible, multiple bay racks shall be used. The maximum allowed height of the rack shall be 1950mm (including wheels).

[GRQT-0945] [Analysis]

All rack shall be equipped with :

- lifting eyes
- lockable rear door
- center of gravity as low as possible

3.5.2.4 Thermal Design Requirement

[GRQT-0950] [Analysis]

If any EGSE cannot operate within the requirements given in § 3.3.1, it shall be designed with an appropriate cooling system (fan, cooler…).

This shall take into account the rack mounting requirements for the equipment.

3.5.2.5 Identification and Marking

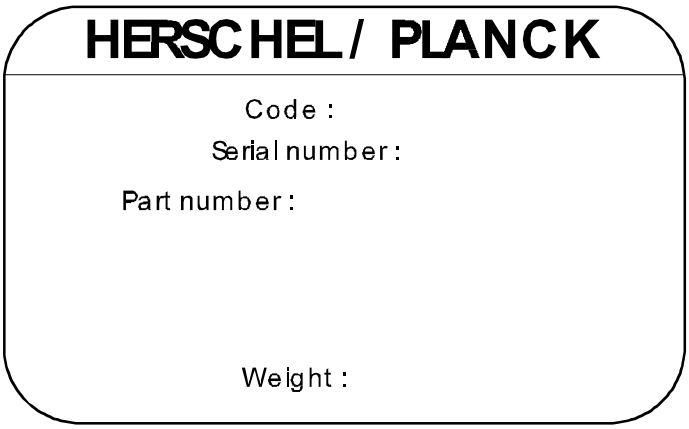
[GRQT-0960] [Analysis]

All subassemblies have to be clearly marked

[GRQT-0970] [Analysis]

As a rule, this is done by means of self-adhesive identification plates. These shall have one of the following size:
- 55 x 90 (mm)
- 130 x 80 (mm)

Type:



3.5.2.6 Cleanliness

[GRQT-0980] [Analysis]

The EGSE shall be constructed in a thoroughly workmanlike manner.

[GRQT-0990] [Analysis]

Particular attention shall be paid to neatness and thoroughness of soldering, wiring, marking of parts and assemblies, plating, painting, brazing and freedom of parts from burrs and sharp edges.

[GRQT-1000] [Analysis]

It shall be possible to clean up the SCOE in accordance of cleaning room reference federal standard 209E.

[GRQT-1005] *(AIVE85)* [Analysis]

Any equipment presenting a direct mechanical interface with the spacecraft shall be non-magnetic, i.e., non-magnetic connectors

3.5.3 IMPOSED DESIGN

[GRQT-1010] *(AIVE-2)* [Analysis]

All EGSE software shall comply with the software standard defined in [S1], [S2], [S3] and [S4] as tailored in [AD11] for [S1] and in [AD12] for [S4].

[GRQT-1020] *(AIVE-4)* [Analysis]

Execution of all EGSE S/W functions shall not load the corresponding system above:

- 60 % under normal conditions
- 80 % under peak conditions.

[GRQT-1030] [Analysis]

The system EGSE shall meet the operational requirements of the project and be designed to assure that it does not degrade or contaminate any associated flight system, equipment or payload during checkout servicing or handling.

[GRQT-1040] [Analysis]

Any failure that can degrade flight hardware shall be identified and listed. The list shall be submitted to ALCATEL for approval.

[GRQT-1050] [Analysis]

The EGSE design shall allow for the maximum utilisation and re-use for one level of testing to the next. It shall follow a modular design approach.

[GRQT-1060] [Analysis]

It shall support the maximum similarity of operator interface.

3.5.4 IMPOSED MATERIAL PROCESS AND COMPONENTS

[GRQT-1070] [Analysis]

The components shall be of the best commercial quality, of the lightest practicable weight, entirely suitable for the purpose and readily available.

[GRQT-1080] [Analysis]

No materials used in the EGSE shall constitute a risk to the health of the personnel involved.

[GRQT-1090] [Analysis]

The communication between computers is based under an 100 Mb/s ETHERNET network using TCP/IP with a class B IP network addressing.

3.5.4.1 Transport

[GRQT-1100] *(AIVE-110)* aa

All equipment delivered to the system level AIT program shall be delivered in re-usable transport containers.

[GRQT-1110] *(AIVE-110)* [Analysis]

All EGSE delivered shall be transportable by road and by cargo aircraft.

European standard :

	Height	Width	Length
Normal road	4.0m	2.5m	18m
Special road	4.75m	4.5m	20m
Aircraft	TBC[0001]	TBC[0002]	TBC[0002]

Tableau 3.5-1 - Maximum dimensions for transport

[GRQT-1120] [Analysis]

The equipment shall be mounted and packed so as to withstand shocks and vibrations of handling and transportation as defined herein:

- Vibration (road and air) : 5.5 - 200 Hz +/- 1.5 g
- Shocks (road and air) : up to 8 g for 5-50 ms
- Acceleration (air) : up to 3 g constant vertical (banking)

[GRQT-1130] [Analysis]

Each equipment shall be provided with an inner and an outer package.
The inner equipment package consists of a welded plastic foil including a desiccant.

The outer package is a transport container. Appropriate packing in the container shall hold the equipment rigidly.

[GRQT-1140] [Analysis]

Each container has to fulfil the following requirements:

- Low weight construction
- Reusability
- Water resistant
- Provision of a cover capable of being locked and sealed
- All 8 corners shall be provided with shock-absorbing rubber ridges
- Handling provisions by foldaway handles and fork lift.
- Class 100 000 compliant
- Depressurisation opercula shall be compatible with flight specification

[GRQT-1150] [Analysis]

Containers must allow for fast loading and unloading of the equipment: (an acceptable solution is a ramp integrated in the box door).

[GRQT-1160] [Analysis]

Design must allow boxes to be manipulated by forklift (without use of pallet).

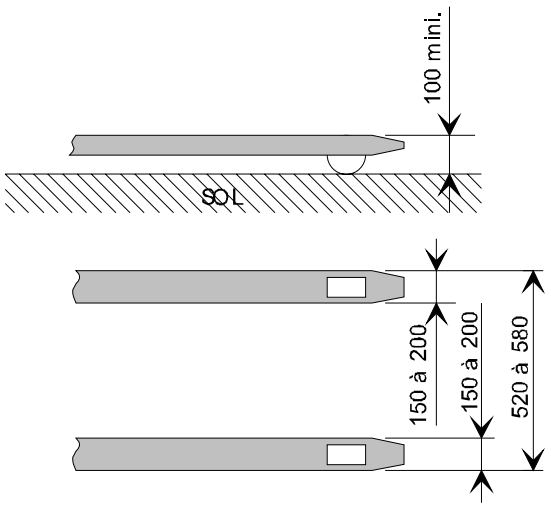


Fig. 3.5.5.1.1 - Dimensions for fork lift use

3.5.4.2 Storage

[GRQT-1170] [Analysis]

Equipment shall be designed for the following non-operating or storage environment (within their containers):

- Temperature : -20°C to +40°C
- Relative Humidity : < 80%
- Pressure : sea level up to 15 000m

3.5.5 PRODUCT IDENTIFICATION

[GRQT-1180] [Analysis]

Each container shall be painted in white colour.

[GRQT-1190] [Analysis]

Following details shall be apply on 3 sides of each transport box :

- project name : "**Herschel/Planck**" paint in black (letters height : 100mm)

- identification of the contents paint in black:
  - **EGSE code** and **serial number** (letters height : 50mm)
  - **PTI number** and identification (letters height : 15mm)

- **contractor name** paint in black (letters height : 30mm)

- "**ALCATEL SPACE**" logo paint in GREY & ORANGE (letters height : 80mm) with respect to the ALCATEL graphic chart.

- Weight paint in black (letters height : 15mm) :
  - **Empty Weight** in Kg and in Lb
  - **Gross Weight** in Kg and in Lb

- Overall dimension in centimetre (letters height : 15mm) :
  - **Length x Width x Height**

- Support points for lifting devices paint in black

- important functional information paint in red :
  - opening cleanliness level (letters height : 20mm): "**Open ONLY in Class 100.000**"
  - Notes (e.g. "**open here**") (letters height : 40mm)
  - etc ...

- Additional information is possible

Hereafter is show a typical example of container identification (PTI number are identified in §5) :

Herschel/Planck

EGSE code - serial number

PTI number
identification

CONTRACTANT name

ALCATEL SPACE

Empty Weight : XX Kg. (XX Lb.)/ Gross Weight : XX Kg. (XX Lb.)
Dimensions : Length x Width x Height

[GRQT-1200] [Analysis]

All cables which must be disconnected for equipment transport, shall be labelled with at least the following information's:

- EGSE name and identification
- cable identification
- cable function
- for each connector, the other equipment side to be connected

4. VERIFICATION REQUIREMENTS

4.1 GENERAL REQUIREMENTS

The acceptance tests of the EGSE shall be distributed in 3 acceptance test levels:

- Level 1 acceptance test at equipment level.
- Level 2 acceptance test of system EGSE level.
- Level 3 acceptance test of H/P EGSE.

Level 1 to 2 acceptances are intermediate.
Final acceptance shall be at level 3 with the H/P satellite.

[GRQT-1300] *(AIVE-50)*

As far as possible the equipment shall have the capability of being checked and calibrated using commercial test equipment. Where not possible, special test aids shall be provided.

[GRQT-1310] [Analysis]

Verification of hazardous orders inhibition shall be performed.

[GRQT-1320] [Analysis]

Certificate of conformity for electrical equipment used in flammable atmosphere (EEx certificate) shall be provided.
EEx certificate shall be obtained by an approved organism.

Level 1 test

These tests shall demonstrate that the equipment meets the design specification and interfaces specification..

Interfaces with the LAN if any shall be verified by software test modules and with a protocol Analysisr.

Level 2 test

These tests demonstrate that each SCOE equipment is correctly operating under CCS software controls.
Interfaces with other GSE, if any, shall be verified by software test modules and with a protocol Analysisr.

Level 3 test

These tests shall demonstrate the full compliance with the requirement of the H/P EGSE.
Interfaces with H/P if any shall be verified.

The electrical tests shall be performed in normal used configuration of the EGSE : all the EGSE equipment shall be connected to each other's, under CCS control.

These tests shall include :

- check of the main performance of each equipment (part of level 1 tests)
- check of the main performance of each equipment under CCS control (part of level 2 tests with all equipment functioning)
- check of functional interfaces between H/P Equipment and EGSE :
    - check of all the connectors
    - check of the pin allocation for each connector (H/P side)
    - check of the tuning range of the signal coming from EGSE toward H/P

4.2 GENERAL TEST CONDITION

The acceptance tests will be done in nominal operating environment.

The necessary **calibration** and maintenance of the above equipment shall be provided.

The subcontractor of the testing EGSE equipment shall provide a document in that can be found the suggested solution for each requirement.

4.3 ACCEPTANCE TESTS

The acceptance tests shall be performed according to an approved acceptance test procedure.
This shall include at least:

- A visual inspection of hardware
- Verification that EGSE equipment design meets the requirements
- Identification of defects in material or workmanship
- Identification of unexpected interference between assemblies
- Compatibility verification to interfacing equipment, in particular with the platform or spacecraft equipment
- Incorporate a review of the logbook and required documents
- An acceptance test for each model built
- Qualification of GSE to be used in working environments.
- Verification of hazardous order inhibition shall be performed

There will be an acceptance test for each model built.

The EGSE system design report will include verification matrixes to define EGSE acceptance tests according to the design and requirements.

The verification matrixes shall have the following structure :

Requirement	Test level 1	Test level 2	Test level 3
[GRQT-0000a]		X	X
[GRQT-0000b]	X		
[GRQT-0000c]	X		
[GRQT-0000d]	X		
[GRQT-0000e]	X		X
[GRQT-0000f]	X		
[GRQT-0000g]	X		
[GRQT-0000h]	X		
[GRQT-0000i]	X		X
[GRQT-0000j]	X		
[GRQT-0000k]	X		
[GRQT-0001]	X		
[GRQT-0002a]		X	
[GRQT-0002b]		X	
[GRQT-0003]	X	X	X
[GRQT-0004]	X	X	X
[GRQT-0005]	X	X	X
[GRQT-0006]	X	X	X
[GRQT-0007]	X	X	X
[GRQT-0008a]	X	X	X
[GRQT-0008b]	X	X	X
[GRQT-0009]	X	X	X
[GRQT-0010]	X		
[GRQT-0020]	X		
[GRQT-0030]	X		
[GRQT-0040]	X		
[GRQT-0050]	X		
[GRQT-0060]	X		
[GRQT-0070]	X		
[GRQT-0080]	X		
[GRQT-0090]	X		
[GRQT-0100]	X		
[GRQT-0110]	X	X	
[GRQT-0120]	X		
[GRQT-0130]	X		
[GRQT-0140]	X		
[GRQT-0150]	X		
[GRQT-0160]	X	X	
[GRQT-0170]		X	
[GRQT-0180]	X	X	X
[GRQT-0190]	X	X	
[GRQT-0200]		X	
[GRQT-0210]	X	X	X
[GRQT-0220]	X	X	X
[GRQT-0225]	X	X	X
[GRQT-0230]	X		
[GRQT-0240]	X		

Requirement	Test level 1	Test level 2	Test level 3
[GRQT-0250]	X		
[GRQT-0260]	X		
[GRQT-0270]	X		
[GRQT-0280]	X		
[GRQT-0290]	X		
[GRQT-0300]	X		X
[GRQT-0310]	X		
[GRQT-0320]	X		
[GRQT-0330]			X
[GRQT-0340]	X		
[GRQT-0345]	X		
[GRQT-0350]	X		
[GRQT-0360]	X		
[GRQT-0370]	X	X	
[GRQT-0380]	X		
[GRQT-0390]	X		
[GRQT-0400]	X		X
[GRQT-0410]	X		
[GRQT-0420]	X		
[GRQT-0430]	X		
[GRQT-0440]	X		
[GRQT-0450]	X		
[GRQT-0460]	X		
[GRQT-0470]	X		
[GRQT-0480]	X		
[GRQT-0490]	X		
[GRQT-0500]	X		X
[GRQT-0510]	X		
[GRQT-0520]	X		
[GRQT-0530]	X		
[GRQT-0540]	X		
[GRQT-0550]	X		
[GRQT-0560]	X		
[GRQT-0570]	X		
[GRQT-0580]	X		
[GRQT-0590]	X		X
[GRQT-0600]	X		
[GRQT-0610]	X		
[GRQT-0620]	X		
[GRQT-0630]	X		
[GRQT-0640]	X		
[GRQT-0660]	X		
[GRQT-0670]	X		
[GRQT-0672]	X		
[GRQT-0674]	X		
[GRQT-0680]	X		
[GRQT-0685]	X		

Requirement	Test level 1	Test level 2	Test level 3
[GRQT-0690]	X		
[GRQT-0700]	X		
[GRQT-0710]	X		
[GRQT-0720]	X		
[GRQT-0730]	X		
[GRQT-0642]	X	X	X
[GRQT-0644]	X	X	X
[GRQT-0645]		X	X
[GRQT-0650]		X	X
[GRQT-0735]	X		
[GRQT-0740]	X		
[GRQT-0750]	X		
[GRQT-0760]	X		
[GRQT-0770]	X		
[GRQT-0780]	X		
[GRQT-0790]	X		
[GRQT-0800]	X		
[GRQT-0810]	X		
[GRQT-0820]	X		
[GRQT-0830]	X		
[GRQT-0840]	X		
[GRQT-0850]	X		
[GRQT-0860]	X		
[GRQT-0870]	X		
[GRQT-0880]	X	X	X
[GRQT-0890]	X		
[GRQT-0900]	X		
[GRQT-0910]	X		
[GRQT-0920]	X		
[GRQT-0930]	X		
[GRQT-0935]	X		
[GRQT-0940]	X		
[GRQT-0945]	X		
[GRQT-0950]	X		
[GRQT-0960]	X		
[GRQT-0970]	X		
[GRQT-0980]	X		
[GRQT-0990]	X		
[GRQT-1000]	X		
[GRQT-1005]	X		
[GRQT-1010]	X		
[GRQT-1020]	X		
[GRQT-1030]	X	X	X
[GRQT-1040]	X	X	X
[GRQT-1050]	X		
[GRQT-1060]	X	X	
[GRQT-1070]	X		
[GRQT-1080]	X		

Requirement	Test level 1	Test level 2	Test level 3
[GRQT-1090]	X	X	
[GRQT-1100]	X		
[GRQT-1110]	X		
[GRQT-1120]	X		
[GRQT-1130]	X		
[GRQT-1140]	X		
[GRQT-1150]	X		
[GRQT-1160]	X		
[GRQT-1170]	X		
[GRQT-1180]	X		
[GRQT-1190]	X		
[GRQT-1200]	X		
[GRQT-1300]	X		
[GRQT-1310]	X		
[GRQT-1320]	X		

5. ANNEX 1 : EGSE LIST

5.1 System EGSE

	PTI N°	Provided By	Nbr	AVM	F-PLM EQM	F-SVM PFM	Herschel Inst.	Herschel PFM	P-PLM CQM	P-SVM PFM	Planck Inst.	Planck PFM
CCS (two servers)	3A211	Alenia	3	#1(*)	-	#2	-	#2	-	#3(*)	-	#3(*)
CCS "light" (one server)	3A212	Alenia	2		#1	-	#1	-	#2	-	#2	-
TM/TC DFE	3A213	Alenia	3	#1	-	#2	-	#2	-	#3	-	#3
PWR SCOE	3A214	Alenia	3	#1	-	#2	-	#2	-	#3	-	#3
TT&C SCOE	3A215	Alenia	2	#1	-	#1	-	#1	-	#2	-	#2
ACMS SCOE	3A216	Alenia	3	#1	-	#2	-	#2	-	#3	-	#3
CDMU SCOE	3A217	Alenia	3	#1	-	#2	-	#2	-	#3	-	#3
Umbilical connectors (set)	N/A	Arianesp.	3	#1	-	#2	-	#2	-	#3	-	#3
Cables (set)	3A218	Alenia	3	#1	-	#2	-	#2	-	#3	-	#3
BOB and savers (set)	3A219	Alenia	3	#1	-	#2	-	#2	-	#3	-	#3

(*) one server from CCS #1 will be part of CCS #3 but will be delivered in advance for thermal testing of P-PLM CQM (CCS "light" #3 redundancy)

5.2 PLM EGSE

	PTI N°	Provided by	Nbr	H-PLM EQM	H-PLM PFM	P-PLM CQM	P-PLM PFM
= CDMU DFE	3A220	Alenia	2	#1	#1	#2	#2
+ PLM (PWR Section) SCOE	3A221	Alenia	2	#1	#1	#2	#2

5.3 SIS

Deleted

5.4 EGSE Specific Herschel

	PTI N°	Provided By	Nbr	E-PLM EQM	Herschel Inst.	E-PLM PFM	Herschel PFM
H-Cryo SCOE	12410	Astrium	2	#1	#1	#2	#2
H-Instrument EGSE	12420	Instrument	3	X	X	X	X
Cables for TV test (set)	12430	Astrium	1	-	-	X	X

5.5 EGSE Specific Planck

	PTI N°	Provided By	Nbr	P-PLM CQM	Planck Inst.	P-PLM PFM	Planck PFM
P-Instrument EGSE	24220	Instrument	2	X	X	X	X
Cables for TV test (set)	24230	Alcatel	1	X	X	X	X

5.6 Launcher interface

	PTI N°	Provided by	Nbr	Herschel PFM	Planck PFM
COTE	3A240	Alenia	4	#1 & #2	#3 & #4
S/C simulator	3A250	Alenia	2	#1	#2
Set Cables "A" (COTE/RCU)	3A260	Alenia	2	#1	#2
Set Cables "B" (S/C sim./CMCU)	3A270	Alenia	2	#1	#2

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