Title

Gaia EGSE
General Design and Interface Requirements (GDIR) Specification

	Name and Function	Date	Signature
Prepared by	**C. GABILAN** *AIV Manager*	25/09/06	
Verified by	**M. PENDARIES** *Industrial & AIT APM*	25.09.06	
Approved by	**D. HERBIN** *PA APM*	27/09/06	
Authorized by	**V. POINSIGNON** *Project Manager*	28.09.06.	
Application authorized by			

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SUMMARY

Gaia is a scientific mission of the European Space Agency (ESA)

This document defines the overall general requirements for design and interface of all Gaia Electrical Ground Support Equipment (E.G.S.E).

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DOCUMENT CHANGE LOG

Issue/ Revision	Date	Modification Nb	Modified pages	Observations
00	25/07/05			First Issue (extracted from Apogee's ISS")
01				Replaces same document with old reference CAIT.00676.ASTR
02	14/09/05			Gaia GSE PA requirement applicable: GAIA.ASF.SP.SAT.00035 Add of "waste Electrical and Electronic Equipment (WEEE) Policy" ADS 761 +Few wording corrections
03	13/09/06			Complete review after SRR

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1 SCOPE AND APPLICABILITY

1.1 GENERAL

This document defines the overall general requirements for design and interface of all Electrical Ground Support Equipment (EGSE).

The requirements defined in this specification are applicable at all levels of EGSE items : units, subsystems, system

1.2 APPLICABLE DOCUMENTS

In this section are defined those document which are applicable associated to the present document.

Doc.	Reference	Title
AD1	GAIA.ASF.SP.SAT.00037	PA requirements for GSE Subcontractors
AD2	GAIA.ASF.SP.SAT.00046	PA requirements for EGSE/OGSE Software

1.3 REFERENCE DOCUMENTS

In this section are defined those document which have been used to write the present document and which content information that may be useful for the understanding of the present document.

Doc.	Reference	Title
RD1	CSG-RS-10A-CN CSG-RS-21A-CN CSG-RS-22A-CN	CSG safety regulations volumes 1, 2 part 1, 2 part2

1.4 LIST OF ACRONYMS

AC	Alternative Current
AD	Applicable document
ASCII	American Standard Code for Information Interchange
BER	Bit Error Rate
CCS	Central Checkout System
CDMU	Command and Data Management Unit
CDR	Critical Design Review
CSU	Clock Synchronisation Unit
dB	deciBel
DB	Data Base
EGSE	Electrical Ground Support Equipment
EIDP	End Item Data Package
EM	Engineering Model
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
EPSS	Electrical Power/Pyro Subsystem
FEE	Front End Equipment
FM	Flight Model
GSE	Ground Support Equipment
H/W	Hardware
ICD	Interface Control Document
ICR	Individual Control Register
LAN	Local Area Network
MMI	Man Machine Interface
MSU	Main Supply Unit
NDIU	Network Data Interface Unit
OBA	On Board Access
OBS	On Board Software
OCC	Operations Control Center
OCOE	Overall Check-Out Equipment
PBA	PMC Bus Access
PDR	Preliminary Design Review
PFM	Proto-Flight Model
RD	Reference Document
RF	Radio Frequency
RTS	Real Time Simulator
SA	Solar Array
S/C	Spacecraft
S/S	Subsystem
SA	Scoe Assembly
SCOE	Special Checkout Equipment
SDE	Software Developpment Environment
SOW	Statement of Work
SVF	Software Validation Facility
TBC	To Be Confirmed
TBD	To Be Defined
TC	Telecommand
TM	Telemetry
TX	Transmitter
U	standard cabinet / rack Unit

2 GENERAL REQUIREMENTS

The EGSE is the Electrical Ground Support Equipment required to support electrical, functional and performance tests and related qualification/ acceptance activities.

The EGSE includes all the hardware and software which is necessary to support the Assembly Integration and Test (AIT) activities performed on spacecraft on board hardware, comprising the compatibility test with the Ground Segment and the Spacecraft processing at the launch site.

The following general requirements shall apply :

Item identification	Item description
EGSE-GDIR-200	The EGSE design and assembly shall be consistent with ISO 9000 Metric standard and shall satisfy EU safety standard in accordance with CE certification.
EGSE-GDIR-201	The design of the equipment shall allow good access, for maintenance purposes, especially to those parts requiring regular preventive maintenance or adjustment during operation.
EGSE-GDIR-202	The maximum use shall be made of already developed EGSE.
EGSE-GDIR-203	In general, the EGSE shall have a builtin capability of selfcheck and validation (Hardware and software). Where this is not possible, the external equipment necessary for selfcheck and validation shall be restricted to use of commercially available equipment.
EGSE-GDIR-204	The EGSE shall withstand continuous operations (24H/24H).
EGSE-GDIR-205	The principle of designing the EGSE in a modular and structured form (for both hardware and software) shall be followed in order to achieve the maximum cost effectiveness.
EGSE-GDIR-206	Displays test points and control devices shall be placed on front panels ; connectors shall be placed on rear panels unless practical reasons can justify otherwise.
EGSE-GDIR-207	Interfaces between individual elements of the EGSE shall be simple and compliant with commercially established set of standards.
EGSE-GDIR-208	The EGSE shall be as far as possible based upon commercially available and supported hardware and software

3 ENVIRONMENTAL REQUIREMENTS

Item identification	Item description
EGSE-GDIR-300	The EGSE shall be designed for and compatible to the following major environments : • Terrestrial Environment (open air). • Sheltered areas (i.e. inside buildings without controlled environment). • Controlled environments (i.e. inside buildings with air conditioning). • Transportation environments. (Plane, train, boat, road,…).
EGSE-GDIR-301	The following phases are identified during the life of the EGSE : • Storage. • Transportation (by air, road, boat). • Operation (in clean room, facilities, launch site).

3.1 OPERATION

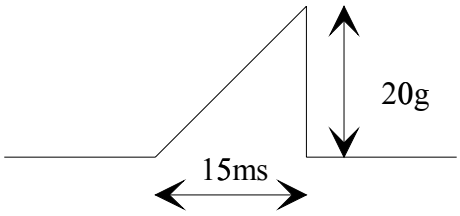
Item identification	Item description
EGSE-GDIR-302	During operations, following limits shall be taken into account: • Temperature +10° C to +30°C • Relative humidity 40% to 80% • Pressure 800 to 1050 mbar

3.2 STORAGE

Item identification	Item description
EGSE-GDIR-303	During storage, following limits shall be taken into account: • Temperature - 40° C to + 60°C • Relative humidity Less than 85% • Pressure 800 to 1050 mbar

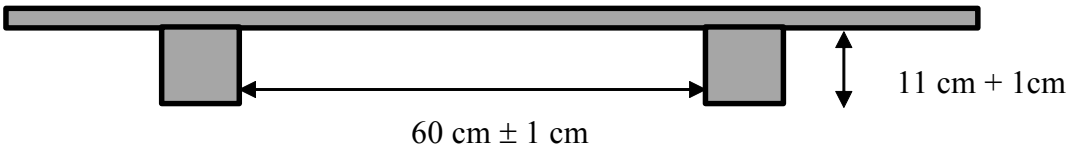
3.3 TRANSPORTATION

<table>
<tr><th>Item identification</th><th>Item description</th></tr>
<tr><td>EGSE-GDIR-304</td><td>
For all transportation requirement, no proof test is required. Conformance to specification shall be demonstrated by design analysis.

The conditions defined in this paragraph are applicable for the EGSE in its associated container :
• Temperature : - 40°C to + 70°C
• Relative humidity < or = 100 %
• Precipitation The EGSE in its container has to withstand up to 64 mm of rain within 2 hours.
• Pressure 250 to 1050 mbar
• Mechanical environment :
○ Vibration : (on each axis)
<table>
<tr><th>FREQUENCIES (Hz)</th><th>LEVEL (0-peak)</th></tr>
<tr><td>0,1 - 2,2</td><td>± 50 mm</td></tr>
<tr><td>2,2 - 12</td><td>1 g</td></tr>
<tr><td>12 - 50</td><td>2 g</td></tr>
<tr><td>50 - 100</td><td>2,5 g</td></tr>
</table>
○ Shock (on vertical axis) up to 20 g during 15 ms


○ Linear acceleration
Maximum loads are expected during hoisting operations. The loads are 3.0 g vertically.
</td></tr>
<tr><td>EGSE-GDIR-305</td><td>All EGSE shall be designed for road, air (including helicopter), and ship transportation by normal commercial facilities readily available in Europe.

Transportation of the EGSE, within Europe, will be mainly by road. Transportation to the launch pad will be by air.</td></tr>
<tr><td>EGSE-GDIR-306</td><td>All EGSE items shall be provided with re-useable containers to comply with the transport and storage environments given herein.</td></tr>
</table>

EGSE-GDIR-307	Containers shall be designed to protect the EGSE from the worst case transportation environment as specified below. If the transported EGSE does not comply with the specified environmental conditions, the containers shall provide adequate protective measures.
EGSE-GDIR-308	The EGSE containers shall be designed such that the EGSE item preparation for packing and the packing process are kept to a minimum.
EGSE-GDIR-309	Access to the containers shall be possible without the use of any tools. If absolutely necessary, simple tools maybe acceptable e.g. screwdriver.
EGSE-GDIR-310	The EGSE containers with a mass > 30 kg when loaded, shall be equipped with forklift provisions (e.g. mounted on a pallet) of dimensions as given bellow 

3.4 LAUNCH PAD ENVIRONMENT

Launch pad environment requirement are applicable for some EGSE only, the specific environment requirement will be described in the dedicated EGSE specification.

NOTE: When environment requirements are conflicting with off the shelf commercial equipment, requirements waivers may be raised after implications and risks analysis

<table>
<tr><th>Item identification</th><th>Item description</th></tr>
<tr><td>EGSE-GDIR-311</td><td>EGSE installed on the launch pad (catacomb) or the umbilical mast shall be compliant with the following conditions:

Temperature 10°C to 27°C (TBC)
Humidity up to 90% RH (condensing) (TBC)
Pressure 800 to 1050 mbar (TBC)
Acoustic noise

<table>
<tr><td>Octave Bands (Hz)</td><td>31.5</td><td>63</td><td>125</td><td>250</td><td>500</td><td>1000</td><td>2000</td><td>Overall</td></tr>
<tr><td>Qualification level (dB)</td><td>133</td><td>132</td><td>128</td><td>126</td><td>123</td><td>122</td><td>118</td><td>137</td></tr>
</table>
Time duration: 1 minute

Ramdom

<table>
<tr><td>Bandwidth</td><td>Overall level (g eff)</td><td>PSD</td><td>Time duration</td></tr>
<tr><td>20 - 2000</td><td>12</td><td>0.0727</td><td>1 minute on 3 axes</td></tr>
</table>

Size

<table>
<tr><td>Length</td><td>Width</td><td>Height (max)</td></tr>
<tr><td>1200 mm</td><td>1110 mm</td><td>2020 mm</td></tr>
</table></td></tr>
</table>

4 INTERFACE REQUIREMENTS

Item identification	Item description
EGSE-GDIR-400	The EGSE shall be designed for easy, safe interchangeable equipment without causing degradation of interfaces with the Spacecraft, subsystems, and facilities.
EGSE-GDIR-401	The EGSE design shall be such as to allow safe functioning, easy handling and simplicity at its interface points.

4.1 EGSE TO FLIGHT EQUIPMENT INTERFACES

4.1.1 Physical

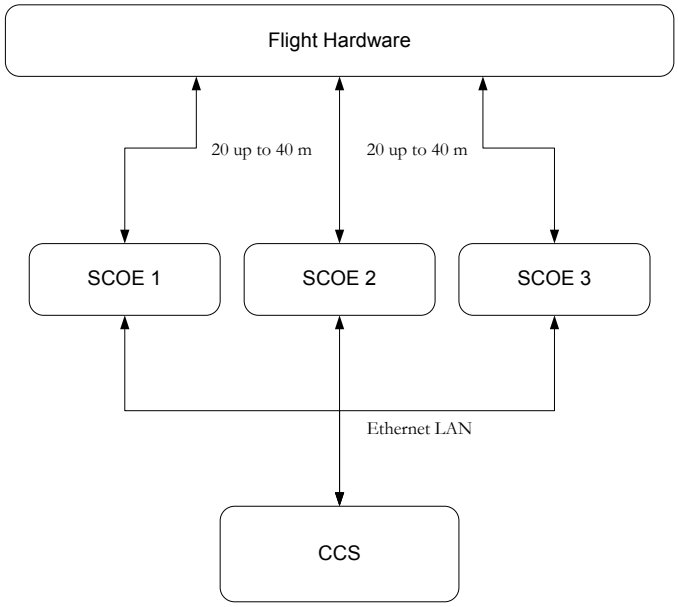
Item identification	Item description
EGSE-GDIR-402	Interfaces shall be designed to drive cable length of 20 meters (the standard for clean room operations) up to 40 meters (the standard for TBTV tests configuration) between the flight hardware and the EGSE.
EGSE-GDIR-403	The connectors mated with on-board hardware shall meet all requirements (Hi-Rel type, material: gold plated , ...) specified for on-board items: procurement in accordance with ESCC level B.

4.1.2 Functional

Item identification	Item description
EGSE-GDIR-404	Interfaces shall provide easy and safe electrical links with the on-board system
EGSE-GDIR-405	Interfaces shall be designed considering the natural and induced environments defined in this specification.
EGSE-GDIR-406	The EGSE shall allow end to end testing (acceptance and commissioning) of proper EGSE functions without using any flight hardware.
EGSE-GDIR-407	Interfaces shall be designed to avoid damage of flight hardware in case of single EGSE functional failures (fail safe concept).
EGSE-GDIR-408	The EGSE shall be designed for tolerance to failures of the interfacing on-board equipment .

4.2 EGSE TO FACILITIES INTERFACES

4.2.1 EGSE Configuration

Item identification	Item description
EGSE-GDIR-409	The maximum physical lengths (cable) to be accounted in the design, shall be as defined in the following figure. EGSE is either a SCOE (Specific Check Out Equipment) or an CCS (Central Check Out System)  *<u>NOTE:</u> This EGSE configuration is applicable to most AIT activities: in dedicated clean rooms and in environment test facilities, as well as the spacecraft processing activities at the launch site.*

4.2.2 Mechanical Interfaces

Item identification	Item description
EGSE-GDIR-410	The EGSE maximum floor loading shall be less than of 1000 kg/m^2 and 250 kg point loads.

4.3 ELECTRICAL INTERFACES

4.3.1 Mains Power, Fusing

Item identification	Item description
EGSE-GDIR-411	Each EGSE shall operate with the following mains power : 110, 220, 240 single phase (all) 50 Hz and/or 60 Hz ± 2 Hz
EGSE-GDIR-412	Each EGSE shall include Mains Supply Unit(s).
EGSE-GDIR-413	Protective devices shall be provided within the equipment for primary and secondary power circuits, and other circuits as required to protect the equipment from damage due to over voltage or excessive current, with visual indicator(s) when tripped (fuse as well).
EGSE-GDIR-414	All fuses shall be easily replaceable either by locating them directly on rear panels, or behind hinged doors on the rear panels.

4.3.2 Connectors

Item identification	Item description
EGSE-GDIR-415	Standardised screw locked connectors with protective removable boots on "wire side" shall be used with special emphasis on male/female type connectors, different sizes of connectors and keyed connectors (if possible) to simplify installation and avoid interconnection errors.
EGSE-GDIR-416	All command or measurement configurations shall be functional without any connector mounting / dismounting (nominal / redundant equipment parts).
EGSE-GDIR-417	Unless otherwise specified, the type of interface connectors shall be BNC, IEEE 488 connectors, SMA or N connectors or SUB D connectors.
EGSE-GDIR-418	As a design goal, separate connectors shall be provided for : - Power supply lines and Power switching lines. - Analog signal lines. - Digital signal lines. - High frequency lines.(over 10 Mhz)
EGSE-GDIR-419	Electrical connections within the equipment shall be secured to prevent breakage or changes in the electrical characteristics of outputs as a result of vibration, acceleration or shocks encountered under the specified environment
EGSE-GDIR-420	The access to all connectors shall be such that any individual connector can be mated or demated without the need to disconnect any other connector

4.3.3 Cabinet, Rack Interfaces

Item identification	Item description
EGSE-GDIR-421	All power inlets to EGSE units shall be located in the lower rear portion of the cabinets and plugged directly on the Mains Supply Unit(s). Intra-cabinet distribution shall be achieved with power suitable cables from distribution boxes(provided with manual power ON/OFF switches), with cables laced clear of all slides and guides.
EGSE-GDIR-422	EGSE signal cables shall be routed and separated as far as possible from power cables.
EGSE-GDIR-423	To give access to all electrical parts, the cabinet cabling shall be routed so as to allow the drawers to be slid to their full forward position without disconnecting the cables, to the extent allowed by weight and cable constraints. Cable guides are to avoid jamming with sliding devices.

4.3.4 Circuit Protection

Item identification	Item description
EGSE-GDIR-424	Circuit protection shall be provided for all electrical EGSE interfaces circuits (between EGSE and spacecraft or between two EGSE(if necessary)), in particular, all connections between the EGSE and the flight hardware shall be protected to prevent any damage of flight equipment due to incorrect operating EGSE (failure in particular).
EGSE-GDIR-425	The design shall include two levels of voltage protection : - first level : at all secondary power supply output(dedicated protection devices), - second level : at EGSE/Flight hardware interface. This requirement is applicable to all EGSE hardware interfaces (between EGSE and spacecraft or between two EGSE) whatever the type is (command, measurement).
EGSE-GDIR-426	Moreover, all EGSE interface shall be protected against short-circuit: they shall withstand permanent short-circuit without damage and shall survive failures of the interface signals.
EGSE-GDIR-427	In any case, either at Power ON or Power OFF, the EGSE shall be in known and steady configuration identified by the prime contractor and called "safe state".

4.3.5 Transient Suppression

Item identification	Item description
EGSE-GDIR-428	Transients shall be suppressed as required for equipment protection and radio frequency interference suppression. In application of suppressers, the operation of associated circuit elements shall not be unduly affected. Transient protection shall be provided in solid-state switching circuits and so packaged that the switching and protection circuits cannot be separated.
EGSE-GDIR-429	The design shall ensure that, in any case,(in particular at switching ON/OFF) there is no undesired transient at EGSE/Flight hardware interface.

4.3.6 Test Points

Item identification	Item description
EGSE-GDIR-430	Test points shall be allocated at least to each critical signal. They shall be provided in the EGSE design to : a) Aid calibration, integration, operation and maintenance. b) Enable fault isolation with a minimum of disassembly and disconnection of EGSE units. c) Allow for maximum utilisation of general purpose test equipment. d) Survey signals at the interfaces.
EGSE-GDIR-431	Test points shall be short circuit protected, to the extent practical.
EGSE-GDIR-432	The test point shall be conventional type terminals in order to allow easy use of measurement probes.
EGSE-GDIR-433	For specific protection using settable fault threshold (e.g. crowbar), dedicated test point on front or rear panel, shall allow to measure the actual fault threshold.

4.4 OPERATOR INTERFACE

4.4.1 General requirements

Item identification	Item description
EGSE-GDIR-434	Operator interface(command and monitoring) shall be done locally and/or from a remote computer (depending on the EGSE specification). When both remote and local interfaces are possible the following requirements shall be met:
EGSE-GDIR-435	A front panel command shall allow to disable the remote function

EGSE-GDIR-436	In any case, the monitoring of the EGSE from the CCS (parameter acquisition) shall be possible whichever mode, remote or local, is set.EGSE
EGSE-GDIR-437	At power ON, all relevant measurements and commands shall be enabled and significative.
EGSE-GDIR-438	An emergency push button will allow to get away the EGSE power.
EGSE-GDIR-439	Critical front panel switches (e.g. power ON / OFF, Remote/Local, Self-test ...) shall be protected against inadvertent activation.

4.4.2 Monitoring and display

Item identification	Item description
EGSE-GDIR-440	For both cases(local and remote), the following requirements shall be met with suitable design implementation.
EGSE-GDIR-441	Available commands and measurements in local mode shall be specified by the customer, in dedicated equipment specification.
EGSE-GDIR-442	All the status locally displayed and/or remotely available shall be got from the direct measurement of the device (e.g. : use of a dedicated contact for relay position monitoring, current/voltage sensing, etc.).
EGSE-GDIR-443	The status of each (digital or analog) command locally displayed and/or remotely available shall be got using a dedicated measurement circuit. The measurement point shall be as close as possible to the output(EGSE interface).
EGSE-GDIR-444	In any case, no "status" shall be built from the corresponding command, but from the actual measurement, or sensing of the actuator, and provided as directly as possible (i.e. no uncontrollable processing or too much hardware/software stages) for local display and/or remote monitoring.
EGSE-GDIR-445	For non permanent commands, the actual status shall be available for a sufficient time period (e.g. few seconds) to allow remote monitoring and/or effective local display (use of local memorising device e.g. monostable)
EGSE-GDIR-446	Monitoring shall be such that the EGSE configuration is unambiguously defined to the operator by local and/or remote monitoring.
EGSE-GDIR-447	Red lamps on front panels shall be reserved for alarm, no-go or failure indications only.

4.4.3 Command

Item identification	Item description
EGSE-GDIR-448	The critical front panel commands (as power ON/OFF, reset commands, remote to local command...) shall be protected against inadvertent activation.

5 HARDWARE DESIGN AND CONSTRUCTION REQUIREMENTS

5.1 PARTS, MATERIALS AND PROCESSES

Item identification	Item description
EGSE-GDIR-501	In no case they shall be the cause of any contamination or degradation of the on-board materials which are interfaced with the test equipment. EGSE directly interfacing with flight hardware shall be subject to interface requirements as specified in chapter 4.
EGSE-GDIR-502	The following materials shall not be used: • Polyvinyl chloride (PVC) materials shall not be used, as contaminant by proximity • Cadmium, zinc and pure tin platings
EGSE-GDIR-503	Metals shall be of a corrosion-resistant type or suitably treated to resist corrosive conditions.
EGSE-GDIR-504	All EGSE to flight hardware interfaces shall be analysed for their material compatibility i.e. electrolytic and / or fretting corrosion shall not occur.

5.2 CONNECTIONS

Item identification	Item description
EGSE-GDIR-505	All interfaces connectors shall be located on the cabinet rear panel bottom and shall be easily accessible.
EGSE-GDIR-506	All cables and connectors must be clearly marked.
EGSE-GDIR-507	Type and construction of connectors shall be such that mismating of connections is not possible (e.g. connector keys).Connectors shall ensure easy but sure mechanical mating. Connector and wiring arrangements shall allow visual inspection in disconnected condition.
EGSE-GDIR-508	Whenever possible, each connector and associated cable mounting/dismounting shall be possible without requiring the dismounting of other connectors.
EGSE-GDIR-509	All electrical power cables shall be heavy duty type. EGSE Mains power plugs accessible shall use locking devices to prevent inadvertent disconnection.
EGSE-GDIR-510	The power plugs type shall be defined by the user.

5.3 FINISHING

Item identification	Item description
EGSE-GDIR-511	EGSE surfaces treatment shall meet clean room and Spacecraft specific cleanliness

	requirement.

5.4 CLEANLINESS

Item identification	Item description
EGSE-GDIR-512	The EGSE can be operated and stored in cleanroom environment (class 100 000). Consequently, the EGSE shall be designed, manufactured, tested, handled, packaged and operated in such a manner as to avoid contamination (attention shall be paid to printer and paper choice).
EGSE-GDIR-513	All EGSE shall be designed for easy cleanability, i.e. flat surfaces and no sensivity to cleaning agents.
EGSE-GDIR-514	Ground support equipment destined for use in clean room shall be solvent cleaned in order to prevent a molecular contamination deposit.

5.5 WORKMANSHIP

Item identification	Item description
EGSE-GDIR-515	Particular attention shall be given to the absence of burrs and sharp edges which might cause injury to personnel or damage to flight or ground hardware.
EGSE-GDIR-516	Paint finish shall be free of runs, voids, dirt, over spray and subsurface voids or contamination.
EGSE-GDIR-517	Markings shall be sharp legible and shall be designed and applied to remain functional over the operating life of the equipment.
EGSE-GDIR-518	Handles shall be securely fitted to that they provide secure and safe support.
EGSE-GDIR-519	All exposed EGSE surfaces shall be free of weld splatter, weld burn through and voids..
EGSE-GDIR-520	Latches shall engage securely without repeated force or distortion required to initiate their engagement..
EGSE-GDIR-521	All controls shall be securely attached and shall operate without binding.
EGSE-GDIR-522	Attention shall be paid to neatness and thoroughness of soldering, wiring, impregnation of coils, markings of parts assemblies, palting, painting, riveting, machine screw assemblage, welding and brazing.
EGSE-GDIR-523	All contact (mechanical or electrical) shall use locking device (e.g. lock nut, thread brake ...)

5.6 SAFETY

Item identification	Item description
EGSE-GDIR-524	All EGSE shall be designed, taking into account the applicable national and international safety standards and shall be tested accordingly. The equipment shall be suitably marked with a CE-identification label and the supplier shall provide the pertinent Declaration of Conformity (DoC) as part of the End-Item Data Package.
EGSE-GDIR-525	Safety for personnel, Spacecraft equipment, test facilities and EGSE shall be ensured by implementation and maintenance of safety precautions.
EGSE-GDIR-526	The EGSE design shall avoid sharp corners and edges and no material shall be used which may constitute a risk to the health of personnel.
EGSE-GDIR-527	All movable equipment shall have locking brake devices
EGSE-GDIR-528	The EGSE design shall be such that no failure will propagate (Fail Safe Design). No equipment single failure shall jeopardise the flight hardware.
EGSE-GDIR-529	At power ON, all protection circuit shall be active.
EGSE-GDIR-530	The circuit protection shall be designed to avoid any undesired inhibition. In particular, the reset or inhibit command (if any) shall not allow permanent protection inhibition even in case of command failure.
EGSE-GDIR-531	Moreover, it shall be impossible to physically interrupt the circuit protection.
EGSE-GDIR-532	If a circuit protection is inhibited, this shall be clearly and unambiguously identified to the operator.
EGSE-GDIR-533	Protection circuit(including both detection and actuators circuits) shall be permanently operational.
EGSE-GDIR-534	The non operational status(due to internal failure for example) shall be immediately externally and unambiguously identified. (e.g. loss of secondary power supply shall be detected).
EGSE-GDIR-535	Safety critical points shall be monitored and any hazardous conditions shall result in an alarm signal being generated.
EGSE-GDIR-536	The design shall ensure that personnel cannot come into contact with exposed conducting surfaces carrying AC or DC voltages above 24 Volts.
EGSE-GDIR-537	The EGSE shall remain stable when inclined at an angle of up to 20°.
EGSE-GDIR-538	The EGSE centre of gravity shall be as low as possible, with any wheels attached as close as possible to the corners of the EGSE rack base. This will ensure maximum stability during movement.
EGSE-GDIR-539	All EGSE to be used at the launch site, shall meet any specific Launch Site Safety Requirements, according to CSG regulations (ref document RD1)

5.7 EMERGENCY PROVISIONS

Item identification	Item description
EGSE-GDIR-540	The EGSE design shall include automatic and manual emergency shutdown capability. The manual shutdown controls shall be located at a readily accessible of a normally manned station and shall be protected against inadvertent activation.

5.8 HUMAN ENGINEERING DESIGN REQUIREMENTS

Item identification	Item description
EGSE-GDIR-541	The design of EGSE shall include consideration of human engineering factors that affect human performance including : • Adequate free space for the effective operation and maintenance tasks under both normal and emergency conditions • Adequate physical, visual and authority links between personnel and equipment under both normal and emergency conditions • Efficient arrangement of operational work stations, cabinets, equipment, controls and displays • Automatic operation shall be employed where necessary to obviate excessive operator workload • Maximum weight of components to be lifted by hand shall be 30 kg. Above this weight hoisting provisions shall be incorporated • Maximum required force for hand operation shall be 12 kg

5.9 PHYSICAL CHARACTERISTICS

Item identification	Item description
EGSE-GDIR-542	The EGSE shall be housed in standard 19 inches 36 U maximum (U=1Unit= 1,75 inch=44,5 mm) cabinets or console, unless this is inconvenient for practical reasons, such as small size of the equipment. A 24 U integrated system is recommended. The height shall be a multiple of 1 unit. The maximum height for a single rack shall be 9 units.
EGSE-GDIR-543	The EGSE standard racks of 482,6 mm (19 inches) width, shall have a maximum depth of 650 mm, (including connectors and output cables).
EGSE-GDIR-544	The total height of a cabinet shall not exceed 1850 mm.
EGSE-GDIR-545	The centre of gravity of each cabinet shall be kept lower than 900 mm.

EGSE-GDIR-546	It shall be possible to roll the EGSE standard cabinet and consoles over a floor (declivity up to 25 mm/m and stepping not more than 2.5 mm).
EGSE-GDIR-547	All EGSE items with a mass > 40 kg - shall be mounted on self-steering wheels (castors) for transport over short distances within a facility. Minimum diameter for these wheels shall be 80 mm.
EGSE-GDIR-548	It shall be possible to hoist the EGSE standard cabinet and consoles via at least 2 balanced hoisting point.
EGSE-GDIR-549	Equipment to be lifted by hand shall not be heavier than 25 kg. The EGSE racks shall be compatible with lifting by standard forklifts if heavier than 25kg.
EGSE-GDIR-550	The maximum force necessary to operate a control or mechanism by hand shall be 120 N.
EGSE-GDIR-551	The ACS(AC control chassis) shall be mounted at the cabinet bottom.
EGSE-GDIR-552	The racks shall be of a modular concept, allowing easy access, maintainability, trouble shooting and replacement.
EGSE-GDIR-553	The racks shall be mounted on slides and locked into the cabinet. Provisions for transportation handling and maintenance shall be incorporated in each cabinet and major units.
EGSE-GDIR-554	The EGSE's computer, if any, and its peripherals, shall not be integrated in the cabinet and shall be usable at a distance of minimum 4 meters from the cabinet unless otherwise specified.
EGSE-GDIR-555	The detailed EGSE layout in a cabinet or a rack shall be accepted by the user.
EGSE-GDIR-556	When possible, a storage drawer with a key lock shall be included in each cabinet.
EGSE-GDIR-557	It shall be possible to slide a drawer to its full forward position without disconnecting any cables
EGSE-GDIR-558	The drawers shall be mounted on telescopic slides or angle bars and shall have locking handles or screw fastenings at the front
EGSE-GDIR-559	All functional setting shall be carried out from the front panels. The manufacturing setting shall be carried out inside the Unit.
EGSE-GDIR-560	When additional component(s) (e.g. extender board, cable ...) is(are) required to perform these settings(functional and manufacturing) , this(these) one(s) shall be considered as deliverable.
EGSE-GDIR-561	All permanent connections shall be made at rear panels. The cabinets/racks shall be equipped with appropriate air inlets and outlets and blowers for air flow cooling, to operate within the ambient facility temperatures. The fans shall blow the air inside the Unit. Filters shall be installed at Unit air inlets level and shall be easily accessible for cleaning.
EGSE-GDIR-562	The rack side walls shall be extended to protect the front panel elements from any possible crash damage during rack movement.
EGSE-GDIR-563	The equipment shall contain adequate cooling capabilities (air in/outlets and fans), to avoid

	overheating in the operating environment
EGSE-GDIR-564	Wherever possible, the on / off operation of cooling fans shall be regulated by temperature sensors.
EGSE-GDIR-565	Air in/outlets shall be on the bottom and top of the rack. In any case, no air outlet shall be located on front panel.
EGSE-GDIR-566	At cabinet level, the air flow shall be from bottom to top. The temperature variation shall not exceed 15°C. If a fan failure is critical, the fan shall include a built-in failure deduction device, used for monitoring.
EGSE-GDIR-567	If possible, each cabinet shall include two independent fans.
EGSE-GDIR-568	The noise of each EGSE shall be lower than 60 dB.

5.10 CONFIDENTIALITY

Item identification	Item description
EGSE-GDIR-569	All the EGSE confidential parts shall be identified and carried separately from the EGSE. (if any)

5.11 RELIABILITY – AVAILABILITY

Item identification	Item description
EGSE-GDIR-570	No numerical reliability assessment shall be performed for the EGSE However, judgement and acceptance of these items will be based on design margins applied, possible failure modes and their effects, and the soundness of the design. A FMECA shall be made to verify the non propagation of failures from ground equipment to flight equipment
EGSE-GDIR-571	Power and critical components shall be used at a 50% of their capability (derating of 50%).
EGSE-GDIR-572	The reliability detailed analysis shall be included in the "Reliability analysis" and / or in the equipment design description.
EGSE-GDIR-573	The design and manufacture of the EGSE shall ensure that a useful operating life of at least 12 years (43200 h) is achieved when operated at an average rate of 300 hours per months.
EGSE-GDIR-574	In order not to jeopardise the overall AIV schedule, the EGSE shall be designed for a minimum downtime, including routine maintenance, as follows: • The equipment shall be available for spacecraft equipment testing for at least 90% of the time. • The remaining time (10% maximum) shall be used for preventive and corrective

	activities. • The 90% availability figure assumes the availability of spare parts, when required
EGSE-GDIR-575	After a regular preventive maintenance, the equipment shall have the capability to operate in its worst condition on a continuous duty cycle of 24 hours per day without performance degradation during 15 days. In such condition faults shall not interrupt spacecraft testing for more than 2 hours, if spare subset assembly is provided. (Repairing in that condition will be achieved by standard exchange with a second sub set assembly).

5.12 MAINTAINABILITY

Item identification	Item description
EGSE-GDIR-576	The equipment shall be designed in such a way as to facilitate maintenance, assembly/disassembly, inspection of vital functioning subassemblies and replacement / substitution of modules / components. The particular features contributing to the attainment of the above are : • minimum scheduled maintenance, • hierarchical (modular) arrangement of assemblies, subassemblies etc..., • accessibility of screws, bolts, fasteners of all kinds, • ruggeness on the part of those elements having to be taken out and reinserted repeatedly, • provision of identification markings wherever necessary, • use of suitably indexed plugs and sockets, • accurate parts making a sliding fit.
EGSE-GDIR-577	With the exception of the built in test capabilities of the test equipment, standard laboratory instruments for measuring and display of voltage, current, time, frequency, etc... shall be adequate to fulfil the tasks of maintenance.
EGSE-GDIR-578	The maintenance cycles and content are to be specified by the manufacturer of the test equipment.
EGSE-GDIR-579	A spares survey exercise shall be performed on the completed EGSE design and an adequate set of spare parts based on its findings shall be accounted for in the delivery.
EGSE-GDIR-580	All critical components shall be identified. The easy replacement of these components shall be accounted for in the equipment design.
EGSE-GDIR-581	Equipment design tolerances shall not be more stringent than necessary to achieve the required performances

EGSE-GDIR-582	The EGSE sub-assemblies, parts and components bearing the same part number shall be both physically and functionally interchangeable.

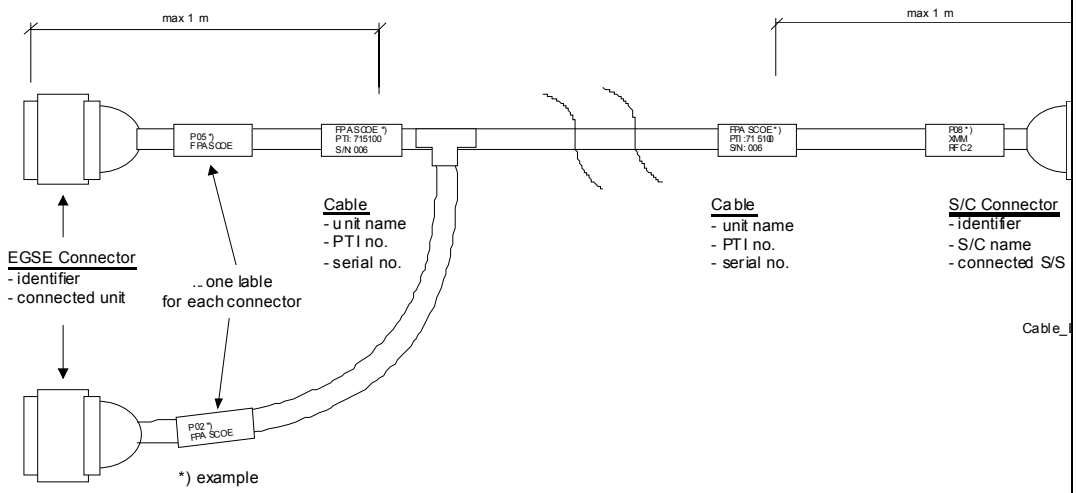
5.13 IDENTIFICATION AND MARKING

5.13.1 Identification

<table>
<tr><th>Item identification</th><th>Item description</th></tr>
<tr><td>EGSE-GDIR-583</td><td>A nameplate shall be attached to each unit or rack of the EGSE. Each nameplate shall state at least :
<table>
<tr><th></th><th colspan="4">ITEM</th></tr>
<tr><th></th><th>Rack</th><th>Unit</th><th>Board</th><th>Cable</th></tr>
<tr><td>Manufacture</td><td>Yes</td><td>Yes</td><td>Optional</td><td>Optional</td></tr>
<tr><td>Item name</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Optional</td></tr>
<tr><td>Contract number</td><td>Yes</td><td>Yes</td><td></td><td></td></tr>
<tr><td>Item part list number</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Serial number</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Delivery date</td><td>Yes</td><td>Yes</td><td>Optional</td><td>Optional</td></tr>
<tr><td>Configuration Item (CI) number</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
</table></td></tr>
<tr><td>EGSE-GDIR-584</td><td>Each container shall, in addition to the above, be marked with the information as follows:
Gaia Project
Item Weight
Item CoG
Safe Working Load
Hoisting Point Identification
Special Safety Instructions
Re-usable container marking
Content identiofication
Nomenclature with S/N</td></tr>
<tr><td>EGSE-GDIR-585</td><td>The name plate shall be attached to the test equipment as follows :
Externally in such a position that it is not obscured by adjacent assemblies or components, or cables.
On a flat surface. (except for cables)</td></tr>
</table>

	▪ On the rear panel for the rack and the Units ▪ Inside a Unit, the connectors, the board locations and the supplies (if any) shall be clearly identified. ▪ In a manner which precludes accidental, removal obstruction or handling damage. ▪ Inside a unit, the connectors, the board and the power supplies(if any) locations shall be **clearly and unambiguously** identified.

5.13.2 Marking

Item identification	Item description
EGSE-GDIR-586	The **front and rear panels** of units and cabinets, excepted Commercial standard equipment's, shall be surface treated (anodic oxidation for aluminium plates, painting for steel plates).
EGSE-GDIR-587	The marking of these Units shall preferably be engraved or silk screen printed.
EGSE-GDIR-588	All harnesses and mating plugs and receptacles shall be marked to clearly indicate the correct mating connection.  **Harness Identification (Example)**
EGSE-GDIR-589	All cabinets, racks and units which contain exposed terminals and similar components shall be clearly marked to indicate the highest operating voltage level present.
EGSE-GDIR-590	Emergency controls (electrical or mechanical) used for shutdown, saving, alarm or corrective

	action shall be clearly marked, visible and readily accessible to operating personnel.
EGSE-GDIR-591	All controls and indicators shall be clearly marked or labelled to indicate system functions.
EGSE-GDIR-592	All front panel, rear panel, internal plates (if any) marking shall be submitted to the Customer for approval. These documents shall be the manufacturing documents (i.e. real scale).
EGSE-GDIR-593	Instruction plates (if any) shall be securely fastened to enclosure panels and shall be located where they easily be read.
EGSE-GDIR-594	Warning markings shall be provided as necessary to "warm" personnel of specific hazardous conditions and precautions to be observed for equipment operations

6 EMC REQUIREMENTS

Item identification	Item description
EGSE-GDIR-600	EGSE shall meet the EMI/EMC European standard and shall be CE certified.

6.1 GROUNDING NETWORK BETWEEN SPACECRAFT AND EGSE

Item identification	Item description
EGSE-GDIR-601	1st case with no insulation transformer : The wire "Ground protection of persons", green/yellow wire shall be linked to the structure of EGSE's. And in this case it is not allowed to disconnect the wire of Protection of Persons (Green/yellow) from the chassis of the ACU rack.
EGSE-GDIR-602	2d case with insulation transformer : The exemption to the previous principle concerns the EGSEs carrying a double insulation at the level of their mains distribution rack, as described above. In this case, the structure of these EGSEs shall be connected imperatively to the star point defined below, and the TEP wire will be opened.
EGSE-GDIR-603	In order to have a reference of potential **at the level of a given specimen**, one must create a **ground star point** on which shall be connected all the EGSE's as well as the reference 0V of the specimen, that is, in fact, its mechanical structure. This star point shall be unique and shall be **connected to the measurement ground** at the level of one of the wall boxes of the clean room (butterfly nut) or otherwise in the clean room distributed.
EGSE-GDIR-604	Interconnection of both types of above described EGSE's, at the level of the star point, is possible without any problem.
EGSE-GDIR-605	The **ground star point** shall be as close as possible of the satellite structure reference point.
EGSE-GDIR-606	Connection of EGSE's to this star point shall be as short as possible.
EGSE-GDIR-607	The electrical connection to this star point shall be safely bolted by the means of torque wrench

6.2 INSULATION OF SECONDARY 0V OF EGSE

Item identification	Item description
EGSE-GDIR-608	All the secondary 0V of EGSE's , interfacing with the 0V network of the Satellite, have to be galvanically uncoupled from the primary mains supply. The impedance between the Secondary 0V and the chassis mass of the EGSE shall be ≥ 100KΩ , measured under ± 10VDC. This rule is not applicable in case if the signal interfacing with the Specimen is itself galvanically decoupled by a transformer, or an opto-coupler, or a relay.
EGSE-GDIR-609	For flowing out the electrostatic charges that may appear, particularly when an EGSE is not connected to the Specimen, a resistance greater than 100KΩ and less than 10MΩ shall be placed between each secondary 0V and the chassis mass of the EGSE. Note that in case a certain number .of interfaces , inside the same EGSE, are applying 100KΩ to 10 MΩ, the equivalent resistance shall not fall below 100KΩ.
EGSE-GDIR-610	When an EGSE1, front-end, interfacing with the Specimen, should be connected to a second EGSE2, that is not interfaced with the Satellite (case of OCOE for example), then the insulation of the EGSE1 defined above shall be kept when the two EGSE's are connected to each other and their respective chassis masses shall be linked to the star mass point. Under these conditions, the interface circuits between the two EGSE's shall provide an insulation ≥ 100KΩ , measured under ± 10VDC. This insulation shall be measured between the two secondary 0V of the EGSE 1 and 2.
EGSE-GDIR-611	All the circuits transmitting and receiving signals in an EGSE whether or not interfaced with the Specimen, with signals coming either from the Specimen, or from another EGSE, shall remain operational with a common mode voltage (VCM)of + or - 7 V DC applied between the secondary 0V of the interface circuits of EGSE's, or between the EGSE and the specimen, where these transmitting and receiving circuits are located respectively While measuring this rejection, the common mode current shall be limited to 100mA. (these values conform to the RS422 standard)

6.3 SHIELDING

Item identification	Item description
EGSE-GDIR-612	The rule therefore shall be to connect shieldings to the mechanical mass of the connectors, therefore to the box, at the two ends of the linking cables.
EGSE-GDIR-613	This shielding shall be grounded on the body of the connector and shall not be grounded by using a pin of the connector connected to the mass inside the EGSE or inside the specimen.

6.4 BONDING

Item identification	Item description
EGSE-GDIR-614	Each unit of a EGSE shall provide a bonding stud connected to the EGSE structure ground.
EGSE-GDIR-615	EGSE racks/cabinets shall be bonded together by not more than 10 mOhm.

6.5 AC LINE FILTERING

Item identification	Item description
EGSE-GDIR-616	Each unit using AC power shall include a filtering device. If a standard commercial unit is used which does not include this device, an external item shall be implemented in the cabinet, as closed as possible of the unit, to replace the missing device. (refer to CEE standard n° 73/23/CEE and 89/386/CEE)

6.6 INRUSH CURRENT

Item identification	Item description
EGSE-GDIR-617	The power current required on switching-on any unit, called Inrush current, shall never exceed 10 times the nominal value, either on the AC power lines or on the DC power lines

7 OPERATIONAL REQUIREMENTS

7.1 GENERAL REQUIREMENTS

Item identification	Item description
EGSE-GDIR-700	The EGSE design shall minimise the number of personnel required for check out and maintenance operations, without compromising the safety of Flight Hardware.
EGSE-GDIR-701	The EGSE design shall minimise the number of different types of tools and test equipment for assembly, disassembly, check out and maintenance.
EGSE-GDIR-702	The EGSE design shall be flexible, modular and with the maximum commonalties of parts, especially for such items as EGSE instrumentation, computers, controllers, computer peripherals, power supplies, compatibility of EGSE racking, cable harnesses and coding systems.
EGSE-GDIR-703	Test sequences and application programmes shall be written in a High Level language.
EGSE-GDIR-704	The EGSE shall be so designed that malfunction of its input power supplies, or malfunction of the EGSE power subsystem delivering power to Flight Hardware, other EGSE, or facility, shall not cause damage to that Flight Hardware, other EGSE, or facility.
EGSE-GDIR-705	Interfaces to flight hardware shall be considered critical, and subjected to failure analysis (FMECA).
EGSE-GDIR-706	Adequate selftest facilities (Built in Test Equipment) shall be incorporated into the EGSE to minimise the Mean Time To Repair (MTTR). As a minimum diagnosis of failure to an individual drawer, instrument, or other self contained module shall be implemented. Self test facility shall also be used for equipment validation / commissioning process.
EGSE-GDIR-707	First line EGSE maintenance philosophy shall be based on instrument/unit replacement to minimise the non-availability of the EGSE to support AIT operations. Repairs to replaced items shall be performed offline.

7.2 USEFUL LIFE

Item identification	Item description
EGSE-GDIR-708	The EGSE shall have a design lifetime of 12 years at an average rate of 300 hours per month. If some components have a shorter lifetime these shall be usage identified on the relevant maintenance procedure and the relevant maintenance operations shall be recommended as part of the maintenance schedule. These components, in adequate quantity to ensure the design lifetime is achieved taking into account anticipated failure rates, shall be bought and made available for spares provisioning at EGSE delivery.
EGSE-GDIR-709	The EGSE shall generally be designed for continuous operation. Test periods of up to 20 days shall be supported without the need for interruptions due to resource limitations such as disk space or storage medium exchange or routine maintenance activities.
EGSE-GDIR-710	Connectors shall be capable of 50 mate/demate cycles as a general rule, and 200 cycles for connections between cabinets/consoles or with external devices. If this requirement cannot be met, the supplier shall define the maximum allowed cycle number (not lower than 50), and the associated procedure which shall be applied for refurbishment.
EGSE-GDIR-711	The EGSE shall be designed to withstand at least 10 cycles of packing, transport, storage, unpacking and preparation for use.

7.3 INTERCHANGE ABILITY

Item identification	Item description
EGSE-GDIR-712	The EGSE used at different locations to support similar or identical operations shall be designed to be functionally interchangeable without revision to hardware, software, documentation or procedures.
EGSE-GDIR-713	Modules/subassemblies and/or subsystems used within the EGSE and carrying identical part numbers shall be physically and functionally interchangeable, and shall not necessitate re calibration or tuning, of either EGSE H/W or S/W or the selection of components in the item being exchanged.
EGSE-GDIR-714	The EGSE design shall allow for expansion of its capabilities by addition of H/W and S/W modules as may be required due to changes in Spacecraft configuration or function with minimum impact on the existing design.

8 QUALITY ASSURANCE

Refer to the applicable PA requirements documents: AD1, AD2, AD3.

9 VERIFICATION REQUIREMENTS

9.1 RESPONSIBILITY

Item identification	Item description
EGSE-GDIR-900	The party which is responsible for manufacturing and delivery of a test equipment item shall also be responsible for verification. Verification includes acceptance.
EGSE-GDIR-901	Verification procedures shall be submitted for approval to the EGSE customer.

9.2 VERIFICATION METHODS

9.2.1 Design Review

Item identification	Item description
EGSE-GDIR-902	Design verification by review of analytical data shall consist of a review of all applicable valid documentation (typically drawings, technical notes and procedures, material lists and calculations) in view of proper reflection and implementation of requirements of applicable specifications.

9.2.2 Visual Inspection

Item identification	Item description
EGSE-GDIR-903	Examination of product shall be based on a visual inspection of the hardware concerned by competent experts. The visual inspection shall serve for a general survey, and inspection of critical areas and for confirmation of the concurrence between hardware workmanship and specified requirements as reflected in the applicable documentation.

9.2.3 Analysis

Item identification	Item description
EGSE-GDIR-904	Analytical techniques may be used in lieu of, or to supplement testing as appropriate to verify specification requirements which cannot be verified by other methods. The selected techniques may include system engineering analysis, static, qualitative analysis and computer simulation.
EGSE-GDIR-905	A matrix in the specification shall identify those of parameters which will be tested or analysed.

9.2.4 Similarity

Item identification	Item description
EGSE-GDIR-906	Similarity assessment may be used if it can be shown that the article is similar or identical in design and manufacturing process to another article that has been previously qualified to equivalent or more stringent criteria.

9.2.5 Acceptance Test

Item identification	Item description
EGSE-GDIR-907	In order to demonstrate the satisfactory performances of the Equipment, an Acceptance Test shall be carried out prior to its use with the flight hardware.
EGSE-GDIR-908	The acceptance test is an exhaustive combination of performances and interfaces test.
EGSE-GDIR-909	The acceptance test procedure shall be approved by the Prime Contractor. The acceptance tests shall be performed according to this procedure, and the equipment characteristics shall be measured at the interface cable end.
EGSE-GDIR-910	Two acceptance tests may be performed: - first, completed one, before EGSE delivery. - second, complementary one, at EGSE integration, when the EGSE element is embedded in a complex system (with CCS and unit to be tested).
EGSE-GDIR-911	EGSE correct functioning with a cable length of 40 meters shall be demonstrated by tests.
EGSE-GDIR-912	For acceptance test, all the documentation shall be available. Documentation consistency with equipment (both hardware and software) shall be verified prior to acceptance test beginning.
EGSE-GDIR-913	All standard measuring equipments have to be calibrated for Acceptance Test.
EGSE-GDIR-914	The acceptance test report shall include the "as run" procedure and measured data record. This test shall, in particular :

	▪ Verify that the test equipment design meets all the performance (including insulation performances) requirements. ▪ Verify that particular hardware meets the performance requirements. ▪ Detect defects in material or workmanship. (long duration test in worst condition for Power equipment). ▪ Discover unexpected interference between assemblies. ▪ Verify the compatibility to interfacing equipment and in particular to spacecraft equipment. ▪ Verify that the test equipment is within the normal calibration period. ▪ Verify the EGSE safety (all protection circuits shall be tested)
EGSE-GDIR-915	The acceptance test shall be conducted, as far as feasible, with a fully integrated and complete EGSE (all cables, all units, final software version), and necessary simuli / stimuli to reproduce as close as possible the interfaces and functions. EGSE acceptance shall include S/W verifications to ensure: ▪ Achievement of functional requirements. ▪ Correct implementation of SW/SW and SW/HW interfaces. ▪ Performance Tests (attainment of timing and load requirements). ▪ Failure Test (reactions of SW and HW failures, operator errors and non-nominal system configuration). ▪ Endurance Test (uninterrupted error free SW operation in a simulated real time environment).
EGSE-GDIR-916	An acceptance test shall be conducted for each model built.
EGSE-GDIR-917	All the specific test Aids or components designed and/or provided especially for the EGSE and used during the acceptance test are deliverable with the EGSE. Note: Test aids and simulators for EGSE verification may be recruited from the manufacturer's laboratory pool. If so, they are not considered deliverable items. However, they shall be kept available in manufacturer's premises over the specified EGSE operational life to support regular maintenance and repair.

9.2.6 Test Report

Item identification	Item description
EGSE-GDIR-918	Test reports are compulsory for the formal requirement verification close out. They are also essential to constitute the reference data source for maintenance and troubleshooting.
EGSE-GDIR-919	The measured parameters of test shall be recorded (physical value) in the test report in order to constitute the reference data for maintenance and trouble shooting. They are also needed to prove that the equipment meets the required specifications. Consequently, test report using "OK" "NOT OK" shall not be used for parameter measurement results.
EGSE-GDIR-920	The test report must also contain all the input /output signal characteristics records.

10 EGSE DOCUMENTATION

Item identification	Item description
EGSE-GDIR-1000	The EGSE documentation, written in English language, shall be provided by the supplier as a minimum with each set of equipment delivered. This documentation shall be available before the acceptance test in order to be approved by the prime contractor.
EGSE-GDIR-1001	When standard commercial equipment's are used, the standard documentation delivered with the equipment shall be provided.
EGSE-GDIR-1002	If not otherwise specified in the equipment SOW, the EGSE deliverable documentation shall typically include : ▪ the compliance certificate to the applicable requirements specification ▪ The CE certificate ▪ the GSE design definition ▪ the firmware description (if any), ▪ the GSE manufacturing file (or industrial file), ▪ the User's manual, Maintenance manual, ▪ the firmware listing with comments (if any), ▪ the acceptance test plan, ▪ the software description of the acceptance test plan (if any) ▪ the FMECA ▪ the software listing with comments of the acceptance test plan (if any) ▪ the acceptance test report ▪ consumable references

11 PREPARATION FOR DELIVERY

11.1 GENERAL REQUIREMENTS

Item identification	Item description
EGSE-GDIR-1100	The requirements specified herein shall govern the preparation for shipment and the transport of the EGSE to the user facilities.

11.2 METHODS OF PRESERVATION AND PACKING

Item identification	Item description
EGSE-GDIR-1101	The methods of preservation, packaging and packing utilised for shipment together with the necessary special control during transportation shall adequately protect the EGSE from damage or degradation of performance due to the natural and induced environments encountered during transportation and subsequent storage.

11.3 PACKAGING DESIGN REQUIREMENTS

Item identification	Item description
EGSE-GDIR-1102	The items shall be easy to pack
EGSE-GDIR-1103	Items subject to deterioration, corrosion or damage in the packed state shall be packed in a manner and with such materials as necessary to prevent damage.
EGSE-GDIR-1104	Detailed requirements and constraints shall be specified in the relevant documentation.
EGSE-GDIR-1105	Sensitive equipment containers shall be equipped of peak level detection shock monitors.
EGSE-GDIR-1106	Packing containers shall be equipped with self locking clamps or countersunk butterfly nuts for closing / opening.
EGSE-GDIR-1107	Packing containers shall be equipped with ramps including guidance for safe cabinet loading and unloading

11.4 HANDLING

Item identification	Item description
EGSE-GDIR-1108	All equipment's and their containers shall be designed so that they can be handled without special equipment's and such that simple cranes and manual or motorised fork lifts can be utilised. The following is required : ▪ use of reusable containers, identification of contents, manufacturer, project, size, total weight, net weight, standard markings for handling (e.g. fork lift points).

12 REQUIREMENTS MATRIX FROM V2.0 TO V3.0

Following table gives correspondence between V2.0 requirements numbers and V3.0 requirements numbers.

Issue 3 Revision 0	Issue 2 Revision 0
EGSE_GDIR_200	2.1
EGSE_GDIR_201	2.3
EGSE_GDIR_202	2.4
EGSE_GDIR_203	2.5
EGSE_GDIR_204	2.7
EGSE_GDIR_205	2.8
EGSE_GDIR_206	2.13
EGSE_GDIR_207	2.17
EGSE_GDIR_208	2.18
EGSE_GDIR_300	3.1/3.2/3.4
EGSE_GDIR_301	3.5/3.6/3.7/3.8
EGSE_GDIR_302	3.3.1/3.3.2/3.3.3
EGSE_GDIR_303	3.1.1/3.1.2/3.1.3
EGSE_GDIR_304	3.2.1/3.2.3/3.2.4/3.2.5/3.2.6/3.2.7/3.2.8/3.2.9
EGSE_GDIR_305	created
EGSE_GDIR_306	created
EGSE_GDIR_307	created
EGSE_GDIR_308	created
EGSE_GDIR_309	created
EGSE_GDIR_310	created
EGSE_GDIR_311	created
EGSE_GDIR_400	No Reference
EGSE_GDIR_401	No Reference
EGSE_GDIR_402	4.1.1.2
EGSE_GDIR_403	4.1.1.3
EGSE_GDIR_404	4.1.2.1
EGSE_GDIR_405	4.1.2.2
EGSE_GDIR_406	4.1.2.3
EGSE_GDIR_407	4.1.2.4
EGSE_GDIR_408	4.1.2.6
EGSE_GDIR_409	No Reference
EGSE_GDIR_410	4.2.2.1
EGSE_GDIR_411	4.3.1.1
EGSE_GDIR_412	4.3.1.2
EGSE_GDIR_413	4.3.1.3
EGSE_GDIR_414	4.3.1.4
EGSE_GDIR_415	4.3.2.1
EGSE_GDIR_416	4.3.2.2
EGSE_GDIR_417	4.3.2.3
EGSE_GDIR_418	4.3.2.5
EGSE_GDIR_419	No Reference
EGSE_GDIR_420	No Reference
EGSE_GDIR_421	4.3.3.1

EGSE_GDIR_422	4.3.3.3
EGSE_GDIR_423	4.3.3.5
EGSE_GDIR_424	4.3.4.1
EGSE_GDIR_425	4.3.4.2
EGSE_GDIR_426	4.3.4.4
EGSE_GDIR_427	4.3.4.5
EGSE_GDIR_428	4.3.7.1
EGSE_GDIR_429	4.3.7.2
EGSE_GDIR_430	4.3.8.1
EGSE_GDIR_431	4.3.8.2
EGSE_GDIR_432	4.3.8.3
EGSE_GDIR_433	4.3.8.4
EGSE_GDIR_434	4.4.1.1
EGSE_GDIR_435	4.4.1.3
EGSE_GDIR_436	4.4.1.5
EGSE_GDIR_437	4.4.1.6
EGSE_GDIR_438	4.4.1.7
EGSE_GDIR_439	Created
EGSE_GDIR_440	Created
EGSE_GDIR_441	4.4.2.1
EGSE_GDIR_442	4.4.2.2
EGSE_GDIR_443	4.4.2.3
EGSE_GDIR_444	4.4.2.5
EGSE_GDIR_445	4.4.2.6
EGSE_GDIR_446	4.4.2.9
EGSE_GDIR_447	Created
EGSE_GDIR_448	4.4.3.1
EGSE_GDIR_501	5.1.2
EGSE_GDIR_502	5.1.6
EGSE_GDIR_503	Created
EGSE_GDIR_504	created
EGSE_GDIR_505	5.2.1
EGSE_GDIR_506	5.2.3
EGSE_GDIR_507	5.2.4
EGSE_GDIR_508	5.2.6
EGSE_GDIR_509	5.2.7
EGSE_GDIR_510	5.2.8
EGSE_GDIR_511	5.3.1
EGSE_GDIR_512	5.4.1
EGSE_GDIR_513	5.4.2
EGSE_GDIR_514	5.4.4
EGSE_GDIR_515	5.5.2
EGSE_GDIR_516	5.5.3 (part)
EGSE_GDIR_517	5.5.3 (part)
EGSE_GDIR_518	5.5.3 (part)
EGSE_GDIR_519	5.5.3 (part)
EGSE_GDIR_520	5.5.3 (part)
EGSE_GDIR_521	5.5.3 (part)
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EGSE_GDIR_537	created
EGSE_GDIR_538	created
EGSE_GDIR_539	created
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EGSE_GDIR_549	Created
EGSE_GDIR_550	Created
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EGSE_GDIR_556	5.9.9
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EGSE_GDIR_558	Created
EGSE_GDIR_559	5.9.11
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EGSE_GDIR_563	Created
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EGSE_GDIR_602	Created
EGSE_GDIR_603	Created
EGSE_GDIR_604	Created
EGSE_GDIR_605	Created
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