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Herschel


DPU/ICU ESD Control Procedure

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Prepared by: Renato Orfei

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1 Introduction

1.1 Purpose of the document


The Istituto di Fisica per lo Spazio Interplanetario (IFSI) of the Italian Consiglio Nazionale delle Ricerche (CNR) is responsible for the design and manufacturing of the three Digital Processing Units/Instrument Control Unit for the three instruments to be flown on board of the ESA satellite Herschel: HIFI, PAX and SPIRE.

The scope of this procedure is to define criteria and actions to be taken into account during the handling of electrostatic sensitive devices and of the handling of the DPU/ICU in order to avoid its damage or degradation as a consequence of mis-handling and ElectroStatic Discharges (ESD).

1.2 References

1.2.1 Applicable Documents

Document Reference	Name
AD1	HIFI Instrument Specification
AD2	PACS Instrument Specification
AD3	SPIRE Instrument Specification
AD4	Herschel/Planck Instrument Interface Document Part A
AD5	Herschel/Planck Instrument Interface Document Part B Instrument “HIFI”
AD6	Herschel/Planck Instrument Interface Document Part B Instrument “PACS”
AD7	Herschel/Planck Instrument Interface Document Part B Instrument “SPIRE”
AD8	Herschel HIFI ICU Subsystem Specification
AD9	Herschel PACS DPU Subsystem Specification
AD10	Herschel SPIRE DPU Subsystem Specification
AD11	Herschel DPU/ICU Subsystem Development Plan
AD12	DPU-ICU P.A. Plan
AD-13	Guideline for the Preparation of an ESD Control Plan

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1.2.2 Reference Documents

Document Reference	Name
RF 01	GD-PR-CGS-012 by Carlo Gavazzi Space

2 Applicability

This procedure is applicable under Q.A. responsibility by authorised and qualified personnel:

- to prevent damage, deterioration of sensitive ESD components during their handling, assembly soldering etc. in work areas;
- during operations to be carried-out after the delivery phase;
- prior to electrical integration with the other instrument subsystems;
- prior to electrical integration on-board the satellite structure;
- whenever the DPU/ICU unit is handled.

3 Static Control and sensitive devices definition

All static sensitive devices will be controlled as far as their handling is concerned from the time of receipt through their storage, kitting, inspection and assembling.

Static sensitive devices are those devices susceptible to damage from Electro-Static Discharge (ESD) including integrated circuits, MOS parts, junction Field-Effect-Transistors (FET), bipolar digital and linear circuits, op-amps, monolithic microcircuits with MOS networks, hybrid microcircuits and thin film passive devices.

The minimum required packaging protection for these components is a conductive container or an anti-static container within an electrostatic-field shielding barrier.

3.1 Protective Materials and Equipment

ESD protective materials are classified in three categories based on their capability for resisting static electricity:

ANTISTATIC: Material having surface resistivity between 10^9 and 10^{14} Ohm/square inch

STATIC DISSIPATIVE: Material having surface resistivity between 10^5 and 10^9 Ohm/square Inch

CONDUCTIVE: Material having a maximum surface resistivity of less than 10^5 Ohm/square Inch.

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In order to minimise the conditions that result in ESD and damage to static sensitive devices, the following protective equipment and materials are required in each work area where these products are handled:

3.1.1 Static-free workstation:

- a) the minimum acceptable static-free workstation must have a static dissipative or conductive table top or covering connected to an earth ground and to an attached conductive wrist strap for the operator.
- b) Grounded conductive floor covering, along with the grounding wrist strap for non seated personnel.

3.1.2 Grounding Requirements

- a) Grounding is required for all metal parts of fixtures and tools, storage racks, operator wrist straps, work surface and conductive floor covering (if any).
- b) To protect the operators from possible back surges of electricity, a 1.0 MOhm (+/- 10%) resistor must be present between each wrist strap and work surface and between the work surface and its ground connector.
- c) Any electrical equipment positioned on top of the static-free workstation must be hard grounded.

3.1.3 Packing Requirements

- a) All static-sensitive products must be packaged in accordance with the following:

INNERMOST PACKAGING: anti-static tubes or ant-static foam.


OUTERMOST PACKAGING: Static-shielding bags or conductive package tray.

- b) The use of staples, tape or plain plastic bags is not allowed.

4 Handling the parts for kitting

While handling static sensitive parts the following requirements shall be followed:

- a) Static sensitive parts will never be inspected, split, picked, handled or packed with human hands at any location other than a static-free workstation and must never be removed from their containers unless by a grounded operator working at a static-free workstation.
- b) Grounded wrist straps and conductive smocks must be worn the full time an operator is at a static-free workstation. The wrist strap must be snug against the operator's bare skin.

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- c) The static-free work area should be clear of any unnecessary static hazard including desk calendars, plastic cosmetic bottle or boxes, cigarettes packages, ashtrays, tissue boxes, tape, or any other similar static-generating materials.

If the static-free workstation is in a clean area the above mentioned items are already not allowed to be in the area.

- d) The operators must first touch the grounded bench top before handling any static-sensitive part and should repeat this procedure each time they move from any other place in the facility to the static-free workstation.
- e) All handling operations should be accomplished without removing the parts from the original protective packaging, whenever possible.
- f) When removing any items from packages, operators should avoid to touch any device leads or contacts and should ensure that their clothing never comes in contact with the items.
- g) Any person not grounded while standing at or near a static-free workstation shall not come in contact or close proximity to any static-sensitive items.

4.1 Handling the units after assembly

The opening of the unit container (an aluminium box with suitable shock adsorbing material) and the handling of the unit itself shall be carried-out in a clean ambient (at least class 100000) at normal temperature and humidity conditions. The humidity level is very important for the build-up of Electro-Static Discharges. The qualified personnel in charge of handling:

- shall wear cotton or nylon (with conductive fibres) gloves. Gloves made of PVC shall not be used.
- Shall wear garments suitable for the ambient cleanliness level and appropriate to avoid electrostatic discharges.
- Shall take the DPU/ICU box and carry it avoiding to touch the connectors side.

Once the box is mechanically integrated on-board the spacecraft and always prior to:

- removing the dust protection covers (if it is the case),
- mating or de-mating the connectors,

the qualified operator has to positively check that he/she is at the S/C potential e.g. by means of a wire connection between his/her wrist and the spacecraft structure.