

 CARLO GAVAZZI CARLO GAVAZZI SPACE SpA	<h1 style="margin: 0;">ACOP</h1>
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ABBREVIATIONS AND ACRONYMS

AAA Avionics Air Assembly
 ABCL As-Built Configuration data List
 ACOP AMS-02 Crew Operation Post
 ACOP-SW ACOP Flight Software
 ADP Acceptance Data Package
 AMS-02 Alpha Magnetic Spectrometer 02
 APS Automatic Payload Switch
 AR Acceptance Review
 ASI Agenzia Spaziale Italiana (*Italian Space Agency*)
 ATP Authorization To Proceed

B

BC Bus Coupler
 BDC Baseline Data Collection
 BDCM Baseline Data Collection Model

C

CAD Computer Aided Design
 CCB Configuration Control Board
 CCSDS Consultative Committee on Space Data Standards (standard format for data transmission)
 C&DH Command & Data Handling
 CDR Critical Design Review
 CGS Carlo Gavazzi Space
 CI Configuration Item
 CIDL Configuration Item data List
 CM Configuration Management
 COTS Commercial Off The Shelf
 cPCI CompactPCI (Euro Card sized standard interface to the PCI)
 CSCI Computer Software Configuration Item
 CSIST Chung Shan Institute of Science and Technology

D

DCL Declared Components List
 DIL Deliverable Items List
 DIO Digital Input / Output
 DML Declared Materials List
 DMPL Declared Mechanical Parts List

DPL Declared Processes List
 DRB Delivery Review Board
 DRD Document Requirements Description

E

EEE Electrical, Electronic & Electromechanical
 EGSE Electrical Ground Support Equipment
 EM Engineering Model
 ER EXPRESS Rack
 ERL EXPRESS Rack Laptop
 ERLC EXPRESS Rack Laptop Computer
 ERLS EXPRESS Rack Laptop Software
 EMC Electro-Magnetic Compatibility
 ESA European Space Agency
 EXPRESS EXpedite the PROcessing of Experiments to Space Station

F

FEM Finite Element Model
 FFMAR Final Flight Model Acceptance Review
 FLASH Rewriteable persistent computer memory
 FM Flight Model
 FMECA Failure Modes, Effects & Criticalities Analysis
 FPGA Field Programmable Gate Array
 FSM Flight Spare Model

G

GIDEP Government Industry Data Exchange Program
 GSE Ground Support Equipment

H

HCOR HRDL Communications Outage Recorder
 HD Hard Drive
 HDD Hard Disk Drive
 HRDL High Rate Data Link
 HRFM High Rate Frame Multiplexer
 HW Hardware

I

ICD Interface Control Document
 I/F Interface
 IRD Interface Requirements Document



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ISPR	International Space-station Payload Rack	PCI	Peripheral Component Interconnect (personal computer bus)
ISS	International Space Station	PCS	Personal Computer System
J		PDR	Preliminary Design Review
JSC	Johnson Space Center	PEHB	Payload Ethernet Hub Bridge
K		PEHG	Payload Ethernet Hub Gateway
KIP	Key Inspection Point	PFMAR	Preliminary Flight Model Acceptance Review
KSC	Kennedy Space Center	PLMDM	Payload Multiplexer De-Multiplexer
KU-Band	High rate space to ground radio link	PMC	PCI (Peripheral Component Interconnect) Mezzanine Card
L		PMP	Parts, Materials & Processes
LAN	Local Area Network	PROM	Programmable Read Only Memory
LCD	Liquid Crystal Display	PS	Power Supply
LFM	Low Fidelity Model	Q	
LRDL	Low Rate Data Link	QM	Qualification Model
M		R	
MDL	Mid-Deck Locker	RFA	Request For Approval
MGSE	Mechanical Ground Support Equipment	RFD	Request For Deviation
MIP	Mandatory Inspection Point	RFW	Request For Waiver
MMI	Man Machine Interface	RIC	Rack Interface Controller
MPLM	Multi-Purpose Logistic Module	ROD	Review Of Design
MRDL	Medium Rate Data Link	ROM	Read Only Memory
N		RX	Reception
NA	Not Applicable	S	
NASA	National Aeronautics and Space Administration	SATA	Serial Advanced Transfer Architecture (disk interface)
NCR	Non Conformance Report	S-Band	Space to ground radio link
NDI	Non Destructive Inspection	SBC	Single Board Computer
NRB	Non-conformance Review Board	SC MDM	Station Control Multiplexer De-Multiplexer
NSTS	National Space Transportation System (Shuttle)	ScS	Suitcase Simulator
O		SDD	Solid-state Disk Drive
OLED	Organic Light-Emitting Diode	SIM	Similarity Assessment
ORU	Orbital Replacement Unit	SIO	Serial Input Output
P		SOW	Statement Of Work
PA	Product Assurance	SPF	Single Point Failure
PCB	Printed Circuit Board	SRD	Software Requirements Document
		STS	Space Transportation System (Shuttle)
		SW	Software
		T	



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TBC To Be Confirmed
TBD To Be Defined
TBDCM Training & Baseline Data Collection Model
TBDCMAR TBDCM Acceptance Review
TBP To Be Provided
TCP/IP Transmission Control Protocol / Internet Protocol
TFT Thin Film Transistor
TM Telemetry
TRB Test Review Board
TRR Test Readiness Review
TRM Training Model
TX Transmission

U

UIP Utility Interface Panel
UMA Universal Mating Assembly
USB Universal Serial Bus

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1. INTRODUCTION

1.1 SCOPE

The ACOP System is intended to fly on the International Space Station (ISS) as a payload on the U.S LAB. The main objective of ACOP is to provide an ISS Internal Facility capable of supporting the external AMS-02 experiment, performing the recording of Science data. In particular, ACOP shall allow a more flexible and efficient use of ISS TM downlink, providing a temporary backup of data generated by AMS-02 and preventing, in this way, possible losses of valuable data. In addition, ACOP is the operational interface to on board crew in order to control and monitor AMS-02 inside from ISS and to permit files and SW upload into the supported payloads.

The ACOP System will be hosted in a Express Rack and will occupy a locker position.

This plan defines the test and verification activities to be performed by Carlo Gavazzi Space in order to assess design choices and to demonstrate the compliance of ACOP with the relevant functional and user requirements as defined in AD22 ACOP System Specification: sections 5.1, 5.2 , 5.3 , 5.4.3, 5.61.3 and 5.6.1.4 , 5.7 , 5.9 and 5.10. This verification plan will be followed by a Verification Control Document that will list all the requirements related to the functionality of the ACOP system, specifying the type of verification and the document where the requirement is verified (Design Report, Test Report, Inspection Report, ...)

For what concerns the interfaces (electrical, mechanical, structural, thermal) the ACOP design has a main applicable document AD1 SSP-52000-IDD-ERP (EXpedite the PProcessing of Experiments to Space Station (EXPRESS) Rack Payloads Interface Definition Document) and the AD13 SSP-52000-PVP-ERP defines the complete set of verification requirements and activities necessary to ensure compliance with AD1, it provides instructions and guidelines for creating the unique Payload Verification Plan (PVP) required by NASA to verify the compatibility, limited to the interfaces, and safety of as-built hardware and software for payloads to be placed on board the ISS inside an EXPRESS Rack. This payload specific PVP with its VRDS (Verification Requirements Definition Sheet) that clearly state the interface requirements, the verification methods and the data required, with the submittal date referred to the Launch Date, together with this document ACOP Verification Plan and the relevant future Verification Control Document completely defines the ACOP verification process

This Verification Plan is provided to ASI for approval of the proposed approach.

The verification process covers all activities necessary to assure that the design fulfils, with adequate margins, all specified and derived requirements under all specified operational and environmental conditions. The successful completion of the verification program leads to the qualification and acceptance of the design. A certificate of qualification and acceptance will formally document the completion of qualification and acceptance testing.

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1.2 OVERVIEW OF THE DOCUMENT

Section 4, after the definition of verification levels, methods and phases, contains a presentation of the ACOP verification approach, including a brief system configuration description, main assumptions and constraints, the models that shall be used to verify the ACOP functionality up to acceptance of the facility, the related main verification activities. The purpose is to give a clear picture of how the ACOP will be verified and accepted. The focus of the whole document shall be on verification by test. The tests shall be performed according to a verification schedule that shall be derived considering existing milestones and constraints.

Sections 5, 6, 7, 8 show the unit and models in more detail.

The development of the FM shall be supported by the development of analytical models for thermal design and structural design aspects. This document considers only physical models however.

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1.3 DEFINITIONS

Design Qualification

Tests and analyses intended to demonstrate that the item will function within specifications under simulated conditions more severe than those expected from ground handling, launch and orbital operations. The purpose is to discover deficiencies in design and method of manufacture and is not intended to exceed design safety margins or to introduce unrealistic modes of failure. This demonstration shall be achieved by analysis, testing, or similarity assessment.

Acceptance

Tests intended to demonstrate that hardware is acceptable for flight. It also serves as a quality control screen to detect deficiencies and normally to provide the basis for delivery of an item under the terms of a contract or agreement.

Re-Certification

The process that demonstrates that the "late exchange" items are acceptable for flight. The re-certification is a limited acceptance certification and serves also a quality control to detect deficiencies.

Functional Tests

The operation of a unit in accordance with defined operational procedures to determine that functional requirements are fulfilled.

Performance Verification

Determination by test, analysis or a combination of the two that the complete instrument or instrument unit can operate as intended in a particular mission: this includes proof that the design of the complete instrument or instrument unit has been qualified and that the particular item has been accepted as compliant to the design and ready for flight operations.

Thermal Test

A test to demonstrate the validity of the design in meeting functional goals. It also demonstrates the capability of the test item to operate satisfactorily in the environment for pressurized P/L. The test can also uncover latent defects in design, parts and workmanship.

Static Loads

Loads which acts on an instrument during the various segments of the flight profile. It consists of steady state accelerations (e.g. due to engine constant thrust or lateral wind loads) and quasi-static loads which are structure borne loads generated by the launch vehicle in the low frequency range (e.g. engine cut-off loads or wind gusts).

Random Vibration Loads

An environment induced by high-frequency acoustic noise associated with various segments of the flight profile: it manifests itself throughout the instrument in the form of directly transmitted acoustic excitation and as structure-borne random vibration excitation.

Vibration Test

This test shall demonstrate that the Instrument can withstand the launch random vibration environment.

Electromagnetic Compatibility (EMC)

The condition that prevails when various electronic devices are performing their functions according to design in a common electromagnetic environment



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2. RELEVANT DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The following documents, in the valid latest issue formally agreed with the Agency, form a part of this specification to the extent specified herein. Documents referenced in the following specifications, standards, publications and procedures are also a part of this specification and are applicable to the extent specified in the text to meet the requirements of this document.

AD	Doc. Number	Issue / Date	Rev.	Title / Applicability
1	SSP 52000-IDD-ERP	D / 6.08.03		EXpedite the PROcessing of Experiments to Space Station (EXPRESS) Rack Payloads Interface Definition Document
2	NSTS/ISS 13830	C / 01.12.1996		Implementation Procedures for Payloads System Safety Requirements – For Payloads Using the STS & ISS.
3	JSC 26493	17.02.1995		Guidelines for the preparation of payload flight safety data packages and hazard reports.
4	SSP 50004	April 1994		Ground Support Equipment Design requirements
5	SSP-52000-PDS	March 1999	B	Payload Data Set Blank Book
6	SSP 52000-EIA-ERP	February 2001	A	Express Rack Integration Agreement blank book for Express Rack payload
7	GD-PL-CGS-001	3 / 17.03.99		Product Assurance & Rams Plan
8	SSP 52000 PAH ERP	November 1997		Payload Accommodation Handbook for EXPRESS Rack
9	SSP 50184	D / February 1996		Physical Media, Physical Signaling & link-level Protocol Specification for ensuring Interoperability of High Rate Data Link Stations on the International Space Program
10	SSP 52050	D / 08.06.01		S/W Interface Control Document for ISPR ***ONLY FOR HRDL, SECTION 3.4 ***
11	ECSS-E-40	A / April 1999	13	Software Engineering Standard
12	AMS02-CAT-ICD-R04	29.08.2003	04	AMS02 Command and Telemetry Interface Control document. Section AMS-ACOP Interfaces
13	SSP 52000-PVP-ERP	Sept. 18, 2002	D	Generic Payload Verification Plan EXpedite the PROcessing of Experiments to Space Station (EXPRESS) Rack Payloads
14	NSTS 1700.7B	Rev. B Change Packet 8 / 22.08.00		Safety Policy and Requirements for Payloads using the STS
15	NSTS 1700.7B Addendum	Rev. B Change Packet 1 / 01.09.00		Safety Policy and Requirements for Payloads using the International Space Station
16	SSP 52005	Dec. 10, 1998		Payload Flight equipment requirements and guidelines for safety critical structures
17	NSTS 18798B	Change Packet 7 10.00		Interpretation of NSTS Payload Safety Requirements
18	MSFC-HDBK-527	15.11.86	E	Materials selection list for space hardware systems Materials selection list data
19	GD-PL-CGS-002	1 / 12.02.99		CADM Plan
20	GD-PL-CGS-004	2 / 07.04.03		SW Product Assurance Plan
21	GD-PL-CGS-005	2 / 09.05.03		SW CADM Plan
22	ACP-SY-CGS-001	2 Jan 05		ACOP System Specification

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2.2 REFERENCE DOCUMENT

RD	Doc. Number	Issue / Date	Rev.	Title
1	GPQ-MAN-02	1		Commercial, Aviation and Military (CAM) Equipment Evaluation Guidelines for ISS Payloads Use
2	BSSC (96)2	1 / May 96		Guide to applying the ESA software engineering standards to small software projects
3	GPQ-MAN-01	2 / December 98		Documentation Standard for ESA Microgravity Projects
4	MS-ESA-RQ-108	1 / 28 Sept. 2000		Documentation Requirements For Small And Medium Sized MSM Projects
5	PSS-05			Software Engineering Standards
6	GPQ-010	1 / May 95	A	Product Assurance Requirements for ESA Microgravity Payload. Including CN 01.
7	GPQ-010-PSA-101	1		Safety and Material Requirements for ESA Microgravity Payloads
8	GPQ-010-PSA-102	1		Reliability and Maintainability for ESA Microgravity Facilities (ISSA). Including CN 01
9	ESA PSS-01-301	2 / April 1992		De-rating requirements applicable to electronic, electrical and electro-mechanical components for ESA space systems
10	ECSS-Q-60-11A	1 / 7 Sept. 2004		De-rating and End-of-life Parameter Drifts – EEE Components

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3. ACOP SYSTEM REQUIREMENTS

Verification activity has to provide evidence of ACOP compliance with applicable requirements.

A complete Verification Matrix shall be provided as part of the Verification Control Document and shall include the identification of all the functional and user requirements as well as the identification of all verifications by Analysis and Demonstration.

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4. VERIFICATION APPROACH

4.1 VERIFICATION LEVELS

The requirements will be verified at the following levels:

- TRM (Training model) model level
- QM (Qualification Model) model level
- FM (Flight Model) model level
- FSM (Flight Spare Model) model level

Also a low fidelity model will be produced to allow early development of the ACOP ASW; it will be based on commercial boards hosted into a 19-inch crate (with fans)

The Training model is fully representative in function and performances to the FM, and shall allow the development and validation of the crew training procedure and the crew training itself (It will be finally delivered to KSC)

The Flight Spare Model will be a full replica of the Flight Model.

4.2 VERIFICATION METHODS

All Functional and User requirements will be verified by either test, analysis, inspection, review of design, or a combination of these methods. The method for each requirement is defined in the relevant specification and shall be used. The methods of verification and minimum criteria for use are defined below.

If testing is not feasible, analysis or review of design, in this order of preference, will be used. The above mentioned methods are described as follows:

- Test (T)
is actual operation of equipment under simulated conditions or the subjection of equipment to specified environments to measure responses. Testing includes measurements and demonstrations. When analysis or inspection is listed as the method of verification, testing may be used to satisfy the requirement, if preferred by the developer, if it is cost effective, and if the Agency agrees. Verification accomplished by test shall be evidenced by a test report.
- Analysis (A)
is a technical evaluation that relates equipment design and use parameters to predict actual design and operation. Analysis may be used to verify requirements, provided established techniques to be used that are adequate to yield confidence, or where testing is impractical. Included in this category is analysis of similar (SIM) items previously verified to the same criteria or more stringent criteria. Verification accomplished by analysis shall be evidenced by an analysis report.
- Review of design (ROD)
may be used when technical descriptions or engineering drawings of the flight design unambiguously show that the requirement is met.
- Inspection (I)
is a physical evaluation of equipment and associated documentation. Inspection may be used to verify construction features, drawing compliance, workmanship, and physical condition. It includes determination of physical dimensions. Verification accomplished by inspection shall be evidenced by an inspection report.

4.3 VERIFICATION PHASES

The verification phases are the following:

- **VALIDATION:**
the verification activities performed during this phase are oriented to support and justify the design choices. The data acquired will be also used to support subsequent design and verification activities
- **QUALIFICATION:**
the objective of the verification activities performed in this phase is to demonstrate that the design, implementation and manufacturing process produced hardware and software which satisfies the specification, with appropriate margin. The verification activity is performed on a qualification model item fully representative but well distinct from the flight hardware.
- **ACCEPTANCE:**
the verification activities performed during the acceptance phase are oriented to formally and contractually demonstrate that the flight items, produced in agreement with the qualified design, is free of workmanship defects. The flight product is consequently ready to be delivered

Model	TRM	QM	FM	FSM
Functional & Performance Test	X	X	X	X
EMC Test		X ¹	X ^{2,3}	
Vibration Test		X ¹	X ²	
Environmental Test (Thermal)		X ¹	X ²	
Acoustic Noise		X	X ⁴	
Note: ¹ at qualification level, ² at acceptance level, ³ only emissions TBC, ⁴ Acoustic noise measurement will performed on the FM only if QM results are marginal				

Table 4-1 Flight segment models

Table 4-1 lists the ACOP system models and the type of test that will be performed.

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Some Flight Spare (FS) boards and storage devices are foreseen by Technical Annex to the ACOP contract with ASI : the delivered models will undergo test at board or device level (TBC)

4.3.1.1 Analytical Activities

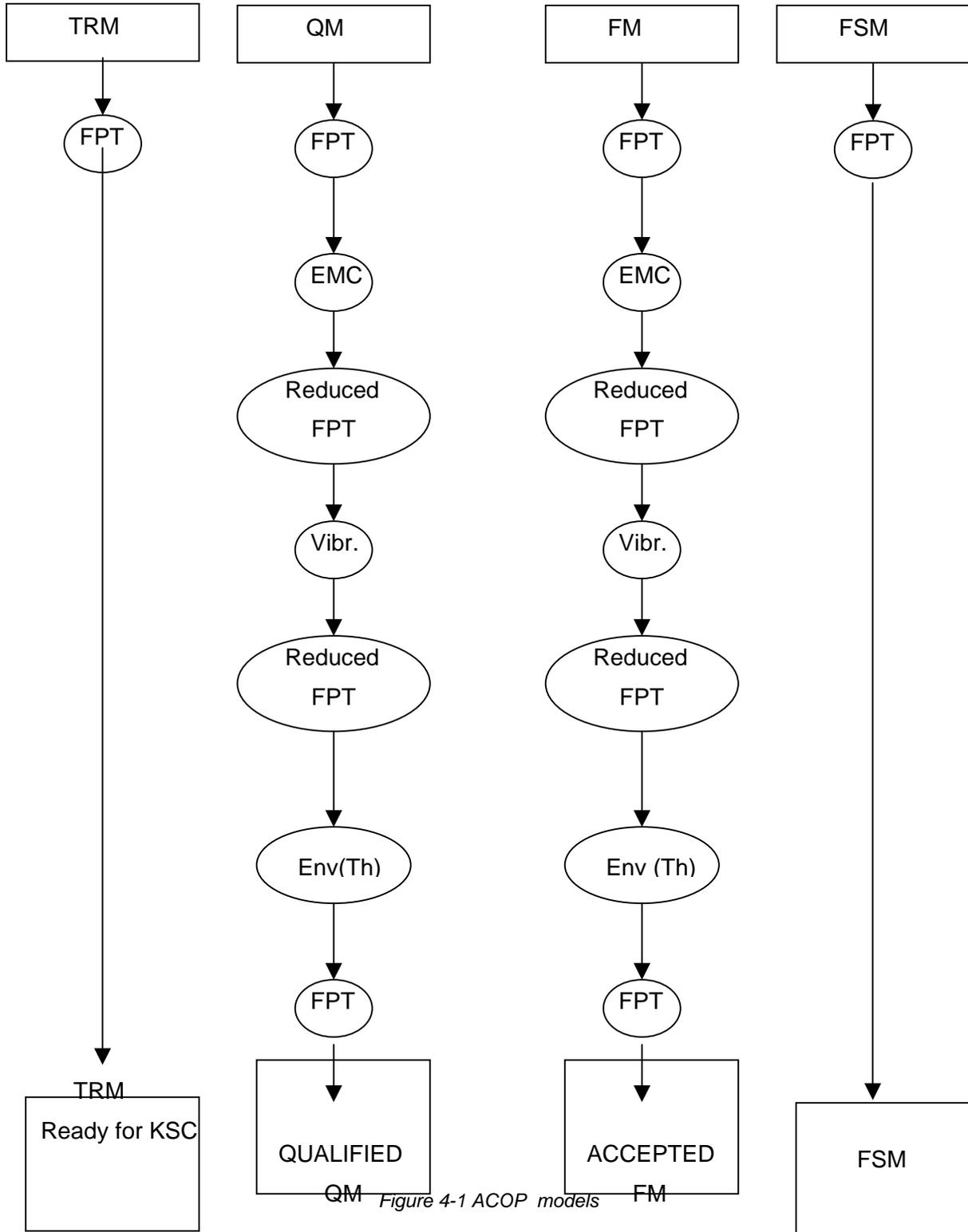
Analyses (activity with utilization of certified analytical tools/applications) will be performed at unit level for the PFM configuration.

Analyses on unit level will be performed for structural verification (Structural Analysis, Fracture Analysis) and for thermal design verification (Thermal Analysis).



4.3.2 Tests for ACOP system models

The Figure 4-1 shows the tests (nominal flow) leading to the flight hardware qualification and acceptance.



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5. DEVELOPMENT AND TRAINING MODELS AIT

5.1 ACOP TRM

5.1.1 ACOP TRM Description

The TRM is representative in functional and performance of the FM.

5.1.2 ACOP TRM Configuration

The TRM is composed as of the following sub-units:

- Locker box with all the mechanical parts**
- 1 (one) DC/DC Board**
- 1 (one) cPCI backplane**
- 1 (one) CPU board**
- 1 (one) HRDL board/function**
- 1 (one) Ethernet board/function**
- 1 (one) USB board/function**
- 1 (one) VGA board/function TBC**
- 1 (one) SATA controller board/function**
- 1 (one) Digital I/O board/function**
- 4 (four) Storage devices**
- ACOP application S/W (OBS) + Basic SW**

5.1.3 ACOP TRM AIT

The ACOP AIT will consist of the following steps:

- Assembly and check-out of custom and COTS boards,
- Assembly of the mechanical box,
- Integration HW and SW,
- Functional Test

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5.1.4 ACOP TRM Tests

5.1.4.1 ACOP TRM Acceptance Test

5.1.4.1.1 Objectives

Functional and Performance validation of the ACOP TRM.

5.1.4.1.2 Facilities

CGS TBC.

5.1.4.1.3 GSE Requirements

ACOP EGSE.

5.1.4.1.4 Test Description

The Functional and Performance tests to verify the HW and SW design.

5.1.4.1.5 Test Levels

Design Validation.

5.1.4.1.6 Success Criteria

Successful test procedure execution.

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6. ACOP QM AIT

6.1 ACOP QM

6.1.1 ACOP QM Description

The ACOP QM is fully representative in functional , performance and form of the FM.

6.1.2 ACOP QM Configuration

The ACOP QM is composed of the following sub-units:

- Locker box with all the mechanical parts**
- 1 (one) DC/DC Board**
- 1 (one) cPCI backplane**
- 1 (one) CPU board/function**
- 1 (one) HRDL board/function**
- 1 (one) Ethernet board/function**
- 1 (one) USB board/function**
- 1 (one) VGA board/function TBC**
- 1 (one) SATA controller board/function**
- 1 (one) Digital I/O board/function**
- 4 (four) Storage devices**
- ACOP application S/W (OBS) + Basic SW**

6.1.3 ACOP QM AIT

The assembly and integration of the ACOP QM is define by the design and manufacture documentation.

6.1.4 ACOP QM Tests

6.1.4.1 ACOP QM Functional and Performance Test

6.1.4.1.1 Objectives

Functional and Performances Verification.

6.1.4.1.2 Facilities

TBD.

6.1.4.1.3 GSE Requirements

ACOP EGSE.

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6.1.4.1.4 Test Description

The Functional and Performance tests shall verify the HW and SW design and check compliance with performance and functional requirements. Test Procedures shall be produced indicating the relevant test activities.

6.1.4.1.5 Test Levels

Test Procedure shall indicate the relevant functional and performance requirements to be tested.

6.1.4.1.6 Success Criteria

Successful full functional and performance test with no degradation or malfunction.

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6.1.4.2 ACOP QM Vibration Test

6.1.4.2.1 Objectives

Structural vibration, verifying the adequacy of design and manufacturing and absence of workmanship defects. Verification of the structural model (These tests shall provide first primary natural frequency and output of random vibration test of the ACOP System).

6.1.4.2.2 Facilities

Facility will be chosen.

6.1.4.2.3 GSE Requirements

MGSE will be provided by test facility contractor.

6.1.4.2.4 Test Description

The test will be performed together according to a vibration test procedure.

Before and after the execution of vibrations, a reduced set of functional set shall be performed.

6.1.4.2.5 Test Levels

Test levels will be indicated in the test procedure.

6.1.4.2.6 Success Criteria

The following success criteria shall be applied:

- First natural frequency compliance with FEM
- No damage
- No degradation of functions and performance

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6.1.4.3 ACOP QM EMC Test

6.1.4.3.1 Objectives

EMC test activity on the ACOP QM to verify the adequacy of design and manufacturing to the applicable documents. Conducted and Radiated (TBC) emission and susceptibility will be tested

6.1.4.3.2 Facilities

TBD

6.1.4.3.3 GSE Requirements

ACOP EGSE.

6.1.4.3.4 Test Description

The test will be performed together according to a EMC test procedure.

6.1.4.3.5 Test Levels

Test levels will be indicated in the test procedure.

6.1.4.3.6 Success Criteria

The following success criteria shall be applied:

- Emission inside the applicable limits
- No degradation of functions and performance during or after susceptibility tests.

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6.1.4.4 ACOP Environmental-Thermal Test

6.1.4.4.1 Objectives

The objective of this test is to verify the ACOP system for space simulated environment.

This test shall be performed on the ACOP QM to verify the compliance with the applicable requirements, in non-operative and operative temperature range limits.

6.1.4.4.2 Facilities

TBD

6.1.4.4.3 GSE Requirements

ACOP EGSE

6.1.4.4.4 Test Description

TRP shall be placed on the ACOP QM for test purpose, in number and positions defined in the Test Procedure. Other TRPs are acquired directly by the ACOP system through temperature acquisition channels. Functional and performance tests shall be executed before, during, and after the tests.

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6.1.4.5 ACOP Acoustic Test

6.1.4.5.1 Objectives

The objective of this test is to verify the ACOP system for space simulated environment.

This test shall be performed on the ACOP QM to verify the compliance with the applicable requirements concerning Continuous and Intermittent Acoustic Noise

6.1.4.5.2 Facilities

TBD

6.1.4.5.3 GSE Requirements

ACOP EGSE

6.1.4.5.4 Test Description

ACOP as any independently operated ancillary equipment item, stowed within the rack or elsewhere, and deployed on-orbit for a separate function other than that of the rack system, will individually comply with the requirements defined in AD1 as required by AD13 verification step No° ST-ER-005.

Verification shall be considered successful when the test shows that the loudest noise does not exceed the levels specified in the AD 1.

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7. ACOP FM

7.1.1 ACOP FM Description

The ACOP FM is the principal product of the ACOP project.

7.1.2 ACOP FM Configuration

The ACOP FM is composed of the following sub-units:

- ❑ **Locker box with all the mechanical parts**
- ❑ **1 (one) DC/DC Board**
- ❑ **1 (one) cPCI backplane**
- ❑ **1 (one) CPU board**
- ❑ **1 (one) HRDL board/function**
- ❑ **1 (one) Ethernet board/function**
- ❑ **1 (one) USB board/function**
- ❑ **1 (one) VGA board/function TBC**
- ❑ **1 (one) SATA controller board/function**
- ❑ **1 (one) Digital I/O board/function**
- ❑ **4 (four) Storage devices**
- ❑ **ACOP application S/W (OBS) + Basic SW**

7.1.3 ACOP FM AIT

The assembly and integration of the ACOP FM is define by the design and manufacture documentation.

7.1.4 ACOP FM Tests

7.1.4.1 ACOP FM Functional and Performance Test

7.1.4.1.1 Objectives

Functional and Performances Verification.

7.1.4.1.2 Facilities

TBD.

7.1.4.1.3 GSE Requirements

ACOP EGSE.

7.1.4.1.4 Test Description

The Functional and Performance tests shall verify the HW and SW design and check compliance with performance and functional requirements. Test Procedures shall be produced indicating the relevant test activities.

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7.1.4.1.5 Test Levels

Test Procedure shall indicate the relevant functional and performance requirements to be tested.

7.1.4.1.6 Success Criteria

Successful full functional and performance test with no degradation or malfunction.

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7.1.4.2 ACOP FM Vibration Test

7.1.4.2.1 Objectives

Structural vibration, verifying the adequacy of design and manufacturing and absence of workmanship defects. Verification of the structural model (These tests shall provide first primary natural frequency and output of random vibration test of the ACOP System).

7.1.4.2.2 Facilities

Facility will be chosen.

7.1.4.2.3 GSE Requirements

MGSE will be provided by test facility contractor.

7.1.4.2.4 Test Description

The test will be performed together according to a vibration test procedure.

Before and after the execution of vibrations, a reduced set of functional set shall be performed.

7.1.4.2.5 Test Levels

Test levels will be indicated in the test procedure.

7.1.4.2.6 Success Criteria

The following success criteria shall be applied:

- First natural frequency compliance with FEM
- No damage
- No degradation of functions and performance

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7.1.4.3 ACOP FM EMC Test

7.1.4.3.1 Objectives

EMC test activity on the ACOP FM to verify the adequacy of design and manufacturing to the applicable documents. Conducted and Radiated emission and susceptibility(TBC) will be tested

7.1.4.3.2 Facilities

TBD

7.1.4.3.3 GSE Requirements

ACOP EGSE.

7.1.4.3.4 Test Description

The test will be performed together according to a EMC test procedure.

7.1.4.3.5 Test Levels

Test levels will be indicated in the test procedure.

7.1.4.3.6 Success Criteria

The following success criteria shall be applied:

- Emission inside the applicable limits
- No degradation of functions and performance during or after susceptibility tests.

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7.1.4.4 ACOP Environmental-Thermal Test

7.1.4.4.1 Objectives

The objective of this test is to verify the ACOP system for space simulated environment.

This test shall be performed on the ACOP FM to verify the compliance with the applicable requirements, in non-operative and operative temperature range limits TBC

7.1.4.4.2 Facilities

TBD

7.1.4.4.3 GSE Requirements

ACOP EGSE

7.1.4.4.4 Test Description

TRP shall be placed on the ACOP FM for test purpose, in number and positions defined in the Test Procedure. Other TRPs are acquired directly by the ACOP system through temperature acquisition channels. Functional and performance tests shall be executed before, during, and after the tests.

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7.1.4.4.5 Test Levels

The Test levels will be defined into the Test Procedure

7.1.4.4.6 Success Criteria

Successful (partial) reduced functional tests during and after the environmental test.

No damage to hardware.

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7.1.4.5 ACOP Acoustic Test

7.1.4.5.1 Objectives

The objective of this test is to verify the ACOP system for space simulated environment.

This test shall be performed on the ACOP FM to verify the compliance with the applicable requirements concerning Continuous and Intermittent Acoustic Noise

7.1.4.5.2 Facilities

TBD

7.1.4.5.3 GSE Requirements

ACOP EGSE

7.1.4.5.4 Test Description

ACOP as any independently operated ancillary equipment item, stowed within the rack or elsewhere, and deployed on-orbit for a separate function other than that of the rack system, will individually comply with the requirements defined in AD1 as required by AD13 verification step No° ST-ER-005.

Verification shall be considered successful when the test shows that the loudest noise does not exceed the levels specified in the AD 1.

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8. ACOP FSM AIT

8.1 ACOP FSM

8.1.1 ACOP FSM Description

The ACOP FSM is fully representative in FORM, functional and performance of the FM.

8.1.2 ACOP FSM Configuration

The ACOP FSM is composed of the following sub-units:

- Locker box with all the mechanical parts**
- 1 (one) DC/DC Board**
- 1 (one) cPCI backplane**
- 1 (one) CPU board**
- 1 (one) HRDL board/function**
- 1 (one) Ethernet board/function**
- 1 (one) USB board/function**
- 1 (one) VGA board/function TBC**
- 1 (one) SATA controller board/function**
- 1 (one) Digital I/O board/function**
- 4 (four) Storage devices**
- ACOP application S/W (OBS) + Basic SW**

8.1.3 ACOP FSM AIT

The assembly and integration of the ACOP FSM is define by the design and manufacture documentation.

8.1.4 ACOP FSM Tests

8.1.4.1 ACOP FSM Functional and Performance Test

8.1.4.1.1 Objectives

Functional and Performances Verification.

8.1.4.1.2 Facilities

TBD.

8.1.4.1.3 GSE Requirements

ACOP EGSE.

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8.1.4.1.4 Test Description

The Functional and Performance tests shall verify the HW and SW design and check compliance with performance and functional requirements. Test Procedures shall be produced indicating the relevant test activities.

8.1.4.1.5 Test Levels

Test Procedure shall indicate the relevant functional and performance requirements to be tested.

8.1.4.1.6 Success Criteria

Successful full functional and performance test with no degradation or malfunction.