

# European Aviation Safety Agency

## European Technical Standard Order

**Subject:** FUNCTIONAL ETSO EQUIPMENT USING AN ETSO-2C153-AUTHORISED IMA PLATFORM OR MODULE

### 1 - Applicability

This ETSO standard is applicable to any equipment presented for an ETSO authorisation to a functional<sup>1</sup> ETSO standard, where the equipment implements one (or several) ETSO-2C153-authorized IMA platforms/modules for which the applicant seeks compliance credit from these ETSO authorisations to demonstrate compliance with a functional ETSO.

Note: This ETSO standard is also applicable to any equipment for which an applicant is seeking an ETSO authorisation of a functional ETSO standard where the applicant performs additional development on an already authorised ETSO-C214 'open' class article and intends to take compliance credit from this authorisation to demonstrate compliance with further functional ETSO standards.

This ETSO standard provides the requirements which functional ETSO equipment using an ETSO-2C153-authorized IMA platform or module or integrating further an ETSO-C214-authorized article that is designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

EUROCAE ED-124 and RTCA DO-297 recognise incremental IMA system approval by introducing intermediate acceptance steps. ETSO-2C153 authorisation is the first step in the ETSO IMA authorisation process. This ETSO-C214 standard is an intermediate step to authorise functional ETSO equipment (F-ETSO equipment)<sup>2</sup> implementing an ETSO-2C153-authorized IMA platform or IMA module, when the applicant is seeking compliance credit from these preceding authorisations to demonstrate compliance with a functional ETSO standard. This ETSO standard defines the requirements and delta activities that shall be performed for the authorisation of the integrated F-ETSO equipment.

Note: This ETSO standard does not define the minimum operational performance specifications of the defined function; these are defined by the individual 'functional'<sup>1</sup> ETSO standard, with which the applicant may elect to comply (refer to CS-ETSO Subpart A, Section 2.5).

<sup>1</sup> Functional ETSO standard: any ETSO standard of CS-ETSO describing an aircraft function, i.e. typically the majority of all ETSO standards except ETSO-2C153 and this ETSO-C214.

<sup>2</sup> 'F-ETSO equipment' is the integrated equipment for which the applicant is seeking an ETSO standard approval, using ETSO-2C153 platform(s)/module(s).

## 2 - Procedures

### 2.1 - General

The applicable procedures are detailed in CS-ETSO Subpart A.

### 2.2 - Specific

#### 2.2.1 - Access to the information of the selected ETSO-2C153 platforms/modules

The applicant is responsible for establishing the necessary communication channels with the ETSO-2C153 holder company.

The applicant shall have access to all necessary design data as a 'user' of the ETSO-2C153 platform (for instance, the declaration of design performance, user guide/manual per ETSO-2C153 Appendix 3, installation manual, environmental qualification plans/reports, etc.).

The applicant's organisation shall establish a communication means to obtain timely notifications of design changes, open problem reports (at least the ones impacting the usage of the platform), occurrence reports and airworthiness directives (ADs) that affect or relate to the ETSO-2C153 platforms/modules.

#### 2.2.2 - Assessment of design changes

The applicant shall perform a change impact analysis on ETSO-2C153 platform design evolutions on the functional ETSO equipment, and shall perform the necessary development life cycle activities that are impacted by the ETSO-2C153 changes.

Note: The functional ETSO holder is responsible for assessing the classification of the changes to the F-ETSO equipment as minor or major as per Part 21.A.611 and for providing the necessary associated justification.

Change management processes shall be compliant with AMC 20-170 Section 5.4.

#### 2.2.3 - Assessment and reporting of open problem reports (OPRs)

The management, analysis and classification of OPRs shall be performed by the applicant following the objectives of AMC 20-170 Section 5.5, for which objective a) of that section is adapted to the F-ETSO context as follows:

- a) *The reporting of open problem reports (OPRs) between the different ETSO-2C153 platforms/modules and the F-ETSO equipment shall be established and assessed by the F-ETSO applicant.*

## 3 - Technical conditions

### 3.1 - Basic

#### 3.1.1 - Minimum performance standard

This section provides the minimum performance standard requirements for the process of further development of equipment using an ETSO-2C153-authorized platform(s)/module(s) for which a functional ETSO authorisation (defined as the F-ETSO equipment) is sought.

The process requirements will cover the environmental qualification, the hardware development assurance, software development assurance and finally the integration of these developed items into the F-ETSO equipment to demonstrate compliance for the intended function, using the credit of the authorised ETSO-2C153 platform(s)/module(s).

### Definition of classes

This ETSO is an incremental step between ETSO-2C153 and complete IMA systems certified during an aircraft type certification. Depending on the future evolution of the F-ETSO equipment, two classes have been defined:

- ‘open’ class, and
- ‘closed’ class.

‘Open’ class refers to an ETSO article that has been integrated taking into account the provisions for future evolution (\*) of the ETSO article but restricted to an IMA context. That means that there are still shared resources available after the integration of all the functions of the F-ETSO article, and that the performance and usage constraints of the remaining resources have been characterised.

‘Closed’ class refers to ETSO articles that have been integrated and where no evolution (\*) has been anticipated, with all IMA-related activities considered closed. The performance of the remaining resources is not characterised. An F-ETSO ‘closed’ class article no longer offers the capability for IMA development. Design changes may still be performed in accordance with the Part-21 provisions, as for other ETSO articles.

*(\*) The term ‘evolution’ in these sentences refers to further development of functions using the remaining resources of the IMA, and without affecting the performance of the already authorised F-ETSO function.*

Class	Minimum performance standard
‘Open’	Section 3 of this document and Appendix 1
‘Closed’	Section 3 of this document

#### 3.1.1.1 - Use of ‘ETSO-2C153’-authorised platforms/modules

##### Identification of the ETSO-2C153 platforms/modules used

- (a) The applicant shall clearly define the ETSO-2C153 platforms/modules used in the design and the associated ETSO-2C153 authorisation credit that is intended to be used for the F-ETSO equipment compliance demonstration.
- (b) The ETSO approval and the part number of the ETSO-2C153 platforms/modules used shall be clearly referenced in the ETSO certification programme. The ETSO approval and the part number, including the issue/minor revisions of the ETSO-2C153 platforms/modules used, shall be clearly referenced in the declaration of design and performance (DDP).
- (c) Any resources/functions included in the ETSO-2C153 platforms/modules but unused in the current F-ETSO equipment shall be clearly identified in the ETSO certification programme or any related software/hardware plans.

- (d) The applicant shall identify and quantify the usage (used and unused features) of the ETSO-2C153 platform resources, including the usage of its health monitoring and fault management resources.

Proper use of the ETSO-2C153 platform(s)/module(s)

- (e) The applicant shall demonstrate the proper use of the ETSO-2C153 platform(s)/module(s), including compliance with the ETSO-2C153 platform integration requirements/user requirements and with the requirements for the correct use of platform safety features. In particular, the applicant shall demonstrate that the use, the partitioning, the configuration of the resources and the installation of the items are performed on the ETSO-2C153 platform/modules in compliance with the ETSO-2C153 user manual, installation manual or equivalent data (as documented per ETSO-2C153 Appendix 3). This also includes the deactivation or disabling of unused ETSO-2C153 functions/modules, when available, or the means to ensure that the intended function is performed without any interference from unused ETSO-2C153 functions/modules.

### **3.1.1.2 - Equipment/hardware/software development**

The ETSO certification programme shall describe the F-ETSO equipment and its structural breakdown. This shall include the use and integration of the ETSO-2C153-authorized platform(s)/module(s) within the F-ETSO equipment. The F-ETSO equipment certification programme shall introduce the planning, the organisation, the division of tasks and the development, validation, integration, and verification activities conducted on the F-ETSO article, including the tool environment used for those activities.

Considerations regarding the content of this ETSO certification programme and guidance can be found in ED-124 Chapter 4.4.3, referring to 'IMA system certification plans'.

In particular, the ETSO certification programme shall indicate the structure of the life cycle data that will support the compliance demonstration with the ETSO requirements.

#### **Non-ETSO functions**

Any non-ETSO function embedded in the equipment shall be developed and integrated in conformance to the requirements of this section, in order to be able to demonstrate that it does not interfere with the ETSO functions.

Any non-ETSO functions embedded in the equipment shall be clearly identified as non-ETSO functions in the ETSO certification programme.

#### **3.1.1.2.1 - Hardware development**

- (a) The applicant shall clearly define the additional hardware part that will be developed and integrated with the ETSO-2C153 platforms/modules that are used.
- (b) The development of the hardware shall be compliant with CS-ETSO Subpart A Section 2.3.

#### **3.1.1.2.2 - Software/application development**

- (a) The applicant shall clearly define the software applications that will be developed and integrated with the ETSO-2C153 platforms/modules that are used and with any possible additional hardware.
- (b) The development of hosted applications shall be compliant with CS-ETSO Subpart A Section 2.2.
- (c) The development of the hosted applications executing on an ETSO-2C153 platform shall comply with the Task 2 objectives defined in ED-124/DO-297 Table A-2 and Chapter 4.3.1, except Objective 4.3.1.d, and with the following adaptation for Objective 4.3.1.a, where the ED-124/DO-297 text is replaced by:

Objective 4.3.1.a:

‘Demonstrate that each application performs its intended function and satisfies the related ETSO standard and Subpart A Section 2.2 requirements and the F-ETSO article requirements while properly utilising the appropriate platform resources and interfacing with other modules and/or applications.’

Particularly it shall be demonstrated that the hosted application on the ETSO-2C153 platform/module complies with the user requirements provided by the ETSO-2C153 provider (see the CS-ETSO/ETSO-2C153 standard — Appendix 3).

- (d) Any non-ETSO application embedded in the ETSO article shall be developed in conformance to the above requirements (b) and (c) in order to be able to demonstrate that it does not interfere with the ETSO functions.

The associated life cycle data to demonstrate the above requirements shall be produced and organised to support the functional ETSO system integration objectives, and to show that the applications are executing correctly within the platform and module requirements and limitations.

Even though the objectives for the development of hosted applications remain applicable, when relevant, some activities/life cycle data might be combined with F-ETSO equipment activities/data (next section).

### 3.1.1.2.3 - Equipment integration process

There are several levels of integration that are possible for functional ETSO equipment using ETSO-2C153-authorized platforms/modules, of which some examples are listed below:

- the integration of software applications on an ETSO-2C153 platform;
- the integration of several ETSO-2C153 modules to build an integrated equipment and its software applications; and
- the integration of additional hardware simultaneously with software applications, together with an ETSO-2C153 platform/module or additional hardware, into an ETSO-2C153 rack platform (class RH).

#### General objective

- (a) The applicant shall perform the integration of the ETSO-2C153 platform(s) and modules used with any additional hardware and the hosted software applications. These integration

activities have to be compliant with the ED-124/DO-297 Task 3 objectives defined in ED-124/DO-297

Table A-3 and Chapter 4.4.1, except Objective 4.4.1.a, and with the following adaptation for Objective 4.4.1.d where the ED-124/DO-297 text is replaced by:

*Objective 4.4.1.d:*

*'Demonstrate compliance with the applicable functional ETSO standards and related MOPS.'*

Note: Even though the integration activities have their own objectives, when relevant, some activities/data might be combined with some activities/life cycle data of the development of the hosted applications (see Section 3.1.1.2.2).

### **Health monitoring and fault management**

- (b) The applicant shall describe how the ETSO-2C153 health monitoring and fault management resources are used and integrated with the other platform/modules/application features, resulting in the health monitoring and fault management of the functional ETSO equipment.

In particular:

Principles and mechanisms shall be defined in order to allow the consistent sharing of fault management data between ETSO-2C153 module/platform resources and the functions of the ETSO article.

Recovery mechanisms shall be defined to ensure the continuity of the functions of the ETSO article when needed.

Guidance on health monitoring and fault management can be found in ED-124 Chapters 3.6.1 to 3.6.7.

Guidance about health monitoring and fault management at the platform and application levels respectively can also be found in ED-124 Chapters 3.1.1.b.5 and 3.1.2.d.

### **Configuration data/parameter data items**

- (c) AMC 20-170 Section 5.2 shall be followed.

### **Use of tools and tool qualification**

- (d) AMC 20-170 Section 5.3 shall be followed.

### **3.1.1.2.4 - Safety assessment**

The safety assessment of the F-ETSO equipment shall consider the possible failures in the ETSO-2C153 platform/modules used in the equipment that are described by the platform provider in their failure modes and effect analysis and the safety assessment of the F-ETSO equipment. If any assumptions have been made at the ETSO-2C153 platform/modules level, they shall be validated by the F-ETSO safety assessment process.

Note: If additional hardware is added to an ETSO-2C153 platform/module, it shall also be considered in the safety assessment.

### **3.1.2 - Environmental standard**

The applicant shall demonstrate the compliance of the integrated F-ETSO equipment with the environmental requirements identified in CS-ETSO Subpart A paragraph 2.1.

If the applicant intends to reuse evidence from an earlier demonstration of compliance achieved by the ETSO-2C153 platform/module, an assessment of the achieved performance shall be performed so as to identify any gaps between the earlier qualification of the ETSO-2C153 platform/module and the intended F-ETSO environment, in compliance with the requirements of Subpart A Section 2.1. The qualification test plan of the F-ETSO shall clearly identify any additional qualification activities and any tests that need to be (re)performed considering the impact of the integration of several hardware platforms/modules, as well as the possible differences between the intended environment of the F-ETSO equipment and the environment for which the ETSO-2C153 platform/modules were qualified.

### **3.1.3 – Software**

See Section 3.1.1.2.2 of this ETSO standard.

### **3.1.4 – Airborne electronic hardware**

See Section 3.1.1.2.1 of this ETSO standard.

## **3.2 - Specific**

The installation manual shall include all the data necessary for the proper installation and use of the F-ETSO equipment.

The installation manual shall document a means to ensure the compatibility between the authorised ETSO-2C153 platform/module and the authorised F-ETSO article. In particular, the installation manual shall provide compatibility and mixability information between the IMA ETSO-2C153 platform/module and the F-ETSO hosted application(s).

### **3.2.1 Failure condition classification**

See CS-ETSO Subpart A paragraph 2.4.

The failure condition classification that is appropriate for the ETSO article will not be driven by this ETSO standard, but driven by the intended aircraft function and the minimum classification indicated in the functional ETSO standard with which the ETSO article is intended to comply.

## **4 - Marking**

### **4.1 - General**

See CS-ETSO Subpart A paragraph 1.2.

### **4.2 - Specific**

The applicant shall mark the ETSO article with ETSO-C214 and the selected class of the equipment:

- ETSO-C214 'Open', or
- ETSO-C214 'Closed'.

The applicant shall maintain the original ETSO marking of the ETSO-2C153 platform and modules used in the F-ETSO equipment. When the technique of electronic marking was used, this electronic marking shall remain available, even after having developed additional software.

#### **5 - Availability of referenced document**

See CS-ETSO Subpart A paragraph 3.



## Appendix 1 for 'open' class IMA equipment

This Appendix is applicable to 'open' class IMA equipment.

### 1 - IMA resources of 'open' class equipment

When the C214-ETSO article is of 'open' class, the F-ETSO applicant needs to properly characterise and document the resulting platform resources and partitioning features for the next user.

Three main cases of 'open' equipment are distinguished in order to adapt the requirements to the development specificities of the F-ETSO article as follows:

- a) When the applicant uses only one ETSO-2C153 platform and does not augment its resources, as illustrated below:

Shared resources of the F-ETSO equipment



...then the applicant shall describe the use of the original ETSO-2C153 platform with regard to the ETSO-2C153 Appendix 3 data (such as the user guide) and describe the remaining resources with respect to that Appendix 3 data so that it is clear which shared resources remain available for future incremental development by an independent user or aircraft manufacturer. In particular, the resources that are used and allocated shall be described and quantified.

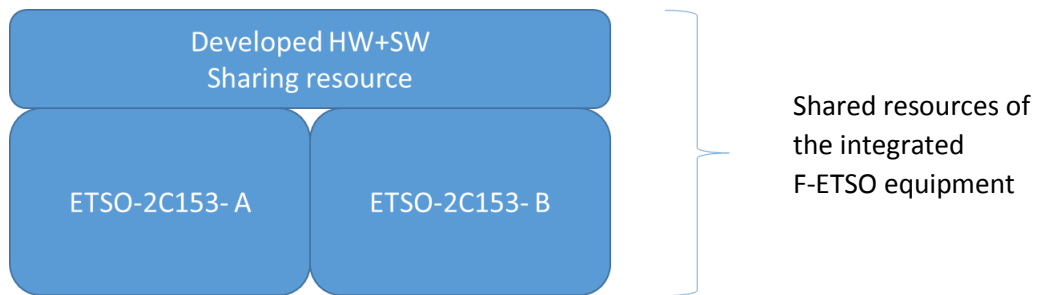
- b) When the F-ETSO equipment integrates multiple ETSO-2C153-authorized resources without augmenting the IMA sharing capability, as illustrated below:

Shared resources of the F-ETSO equipment



...the F-ETSO applicant shall characterise the resulting platform using the individual characterisation of the ETSO-2C153 platform and document the resulting ETSO-C214 'open' platform in compliance with ETSO-2C153 Appendix 3.

- c) When the F-ETSO equipment augments the IMA sharing resources with additional development (hardware and/or software), as illustrated below:



...the F-ETSO equipment development shall comply with ETSO-2C153 Appendix 2 and the related classes and document the augmented 'open' platform C214 in compliance with ETSO-2C153 Appendix 3.

The applicant can use the Appendix 3 ETSO-2C153 data of the ETSO-2C153 platform/modules that are used and augment or amend them to elaborate the ETSO-C214 'open' platform user data, in compliance with ETSO-2C153 Appendix 3.

Within the characterisation effort of resources, the applicant should in particular document the instructions for configuration of the ETSO-C214 article so that the next user can ensure the integrity and continuity of the system configuration, and ensure that the resource allocation, partitioning, and health monitoring would not be impaired when integrating the ETSOA article.

## **2 - Continuous health monitoring capability**

As a user of an ETSO-2C153 platform/modules, the F-ETSO applicant should pay particular attention to ensuring that there is a continuous health monitoring capability. Health monitoring features provided in an 'open' class platform shall be continuously maintained and characterised throughout the integration process, and the health monitoring capability shall be made available for any potential further incremental development.