Certification Memorandum

Guidance to Certify an Aircraft as PED tolerant

EASA CM No.: CM-ES-003 Issue 02 issued 21st May 2024

Regulatory requirement(s): **CS 23.1309(b)(1), CS 25.1309(a)(1), CS 27.1309(a), CS 29.1309(a)**
CS 25.1353(a)
CS 23.1431(a), CS 25.1431(a), CS 29.1431(a)
CS 23.1529, CS 25.1529, CS 27.1529, CS 29.1529

In accordance with the EASA Certification Memorandum procedural guideline, the European Aviation Safety Agency proposes to issue an EASA Certification Memorandum (CM) on the subject identified above.
All interested persons may send their comments, referencing the EASA Proposed CM Number above, to the e-mail address specified in the "Remarks" section, prior to the indicated closing date for consultation.

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EASA Certification Memoranda are living documents into which either additional criteria or additional issues can be incorporated as soon as a need is identified by EASA.

Log of issues

Issue	Issue date	Change description
001	23.08.2017	First issue.
002	21.05.2024	Editorial update of references to industry standards, which have been updated to address 5G and WiFi 6e wireless technologies.

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1. Introduction

1.1. Purpose and scope

The purpose of this Certification Memorandum is to provide specific guidance on the certification of an aircraft to be tolerant to the electromagnetic emissions of Portable Electronic Devices (PEDs). Wireless communication standards with low power emissions as defined in EUROCAE ED-130B / RTCA DO-363A section 6.2.2 do not need to be analysed for back door coupling, as these low power emissions are not considered a risk to the safe operation of an aircraft. Front door coupling assessment is only needed if it is intended to allow operation of PEDs in low visibility approach operation.

Commission Regulation (EU) No 965/2012 and the relevant amendments require Part CAT, Part NCC and Part SPO operators to demonstrate that any PED use on-board is safe and does not affect adversely the performance of the aircraft systems and equipment. For Part NCO the pilot in command is responsible to permit the use of any PED on board.

The EASA published the Part-CAT AMC/GM and Part-NCC AMC/GM, this material offers guidance and defines different scenarios for the operator to determine whether it is safe to permit the use of PEDs on board. Some of these scenarios refer to an aircraft which is certified as PED tolerant. This Certification Memorandum aims at defining the specific guidelines to certify an aircraft as PED tolerant.

Additionally, the EUROCAE Working Group 99 (WG-99) and RTCA Special Committee 234 (SC-234) have recently updated the existing material, providing recommendations to demonstrate tolerance to RF from intentionally transmitting PEDs following existing practices for aircraft system high intensity radiated field (HIRF) protection. The intention of this Certification Memorandum is to recognize this new approach as acceptable means of compliance for the demonstration of an aircraft as PED tolerant.

This Certification Memorandum is applicable to aircraft certified to CS-23, CS-27, CS-29 and CS-25.

The certification guidance included in this Certification Memorandum to demonstrate an aircraft as tolerant to the electromagnetic hazards created by PEDs, may also be used by the operators to show compliance with the operational provisions referred above.

1.2. References

It is intended that the following reference materials be used in conjunction with this Certification Memorandum:

Reference	Title	Code	Issue	Date
23.1309(b)(1) 23.2500(b) 25.1309(a)(1) 27.1309(a) 29.1309(a)	Equipment, systems and installations / General requirements on systems and equipment functions	CS-23 CS-23 CS-25 CS-27 CS-29	1 to 4 5 and up 5 and up 1 and up 1 and up	12/02/2009 31/03/2017 05/09/2008 30/11/2007 30/11/2007
25.1353(a)	Electrical equipment and installations	CS-25	5 and up	05/09/2008
23.1431(a) 23.2510 25.1431(a) 29.1431(a)	Electronic equipment / Equipment, systems, and installations	CS-23 CS-23 CS-25 CS-29	1 to 4 5 and up 5 and up 1 and up	12/02/2009 31/03/2017 05/09/2008 30/11/2007

Reference	Title	Code	Issue	Date
23.1529 23.2625 25.1529 27.1529 29.1529	Instructions for continued airworthiness	CS-23 CS-23 CS-25 CS-27 CS-29	1 to 4 5 and up 5 and up 1 and up 1 and up	12/02/2009 31/03/2017 05/09/2008 30/11/2007 30/11/2007
Regulation 965/2012	Commission Regulation (EU) No 965/2012			05/10/2012
Part-CAT AMC-GM - Issue 2 - Amendment 1 (Annex to Decision 2014-029-R)	AMC1 CAT.GEN.MPA.140 Portable electronic devices	Part-CAT AMC-GM	Issue 2 Amendment 1	24/09/2014
Part-NCC AMC- GM - Amendment 1 (Annex to ED Decision 2014-030-R)	AMC1 NCC.GEN.130 Portable electronic devices	PART-NCC AMC-GM	Amendment 1	24/09/2014
Part 21	Annex 1 to Commission Regulation (EU) No 748/2012	Part 21	---	03/08/2012
EUROCAE ED-130A / RTCA DO-363	Guidance for the Use of Portable Electronic Devices (PEDs) on Board Aircraft	ED-130 / DO-363	B / A	23/06/2022
EUROCAE ED-239 / RTCA DO-307A	Aircraft Design and Certification for Portable Electronic Device (PED) Tolerance	ED-239 / DO-307	A / B	23/06/2022
RTCA DO-294C	Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDS) on Aircraft	DO-294	C	16/12/2008

The applicable requirements and provisions listed above are based on the up-to-date CS standards. Different standards and amendments may apply depending on retained Type Certification Basis (i.e. previous JARs). These lay out the regulatory basis for the certification of an aircraft as PED tolerant.

1.3. Abbreviations

AFM	Aircraft Flight Manual
CAT	Commercial Air Transport

CS	Certification Specification
EASA	European Union Aviation Safety Agency
EIRP	Equivalent Isotropic Radiated Power
EMC	Electromagnetic Compatibility
EMH	Electromagnetic Hazards
EMI	Electromagnetic Interference
EUROCAE	European Organisation for Civil Aviation Equipment
ICA	Instructions for Continued Airworthiness
MEF	Multiple Equipment Factor
NCC	Non-commercial air operations with complex motor-powered aircraft
OPH	Pilot Operating Handbook
PED	Portable Electronic Device
RF	Radio Frequency
RTCA	Radio Technical Commission for Aeronautics
STC	Supplemental Type Certificate
TC	Type Certificate
T-PED	Transmitting Portable Electronic Device
WLAN	Wireless Local Area Network

2. Background

EASA reviewed the Portable Electronic Device (PED) policy, with the publication of the ED Decisions 2014/029/R and 2014/030/R, recognizing the wide proliferation of PEDs and the wish of passengers to use them everywhere and at any time. These provisions refer to different scenarios for permitting the use of PEDs by the operator, some of these scenarios refer to an aircraft which is certified as PED tolerant.

This Certification Memorandum is issued to provide the applicant with acceptable means of compliance to demonstrate that an aircraft is tolerant to the electromagnetic emissions of PEDs.

PEDs are any kind of electronic devices brought on board the aircraft by crew members, passengers or as part of the cargo, and that are not included in the approved aircraft configuration. The use of PEDs on board the aircraft, either by crew members and passengers or included in the cargo, presents a source of uncontrolled electromagnetic emissions with potential risk of adverse interference effects to aircraft systems.

PEDs fall into two main categories: non-intentional transmitters and intentional transmitters (T-PEDs).

The electromagnetic hazard created by the PEDs that are operating on-board the aircraft can be defined as:

1. Front door coupling is the possible disturbance to an aircraft system as received by the antenna of the system and mainly in the frequency band used by the system.

2. Back door coupling is the possible disturbance of aircraft systems by electromagnetic fields generated by transmitters. Back door coupling requirements are in line with HIRF certification requirements.

To be able to allow the use of PEDs within an aircraft, it is necessary to demonstrate that the aircraft and its systems are compatible with the RF emissions generated by the intentional and non-intentional transmissions of PEDs.

The applicant for certification of installed wireless RF systems that communicate with portable wireless RF transmitters and receivers, which will not become part of the aircraft configuration, should provide evidence of approved data that shows the airplane has demonstrated transmitting PED tolerance.

It is also the responsibility of the certification applicant to demonstrate that the installed system does not interfere with the other aircraft systems. EMI demonstration for electrical equipment installation is out of the scope of this CM.

3. EASA Certification Policy

3.1. Certification of an Aircraft as PED tolerant

The following EASA policy is intended to provide means of compliance for the applicant that intends to demonstrate an aircraft's compatibility with PED emissions within the cabin, cargo hold and/or flight deck.

It remains the operator's responsibility to allow the use of PED on board aircraft in accordance with his procedures, which are supervised by the responsible National Aviation Authority (NAA).

3.1.1. Certification Plan

The applicant should prepare a certification plan that will explain how PED tolerance will be shown to allow safe use of PEDs under prescribed conditions.

The plan may follow the guidance provided in EUROCAE ED-130 B/ RTCA DO-363A or EUROCAE ED-239A /RTCA DO-307B. The referenced documents describe a process involving analyses and measurements that determines the character of an interference environment, and the susceptibility (or tolerance) of specific aircraft and its equipment.

Any mitigating actions, including necessary AFM procedures, should be developed as necessary to declare an aircraft PED tolerant.

3.1.2. Safety Objectives

To comply with the certification requirements the applicant should address the safety issues associated with the widespread use of PEDs in the aircraft.

The applicant should demonstrate that the use of PEDs does not adversely affect the correct operation of equipment and systems that have failure modes that are classified as Major, Hazardous or Catastrophic, as well as the Cockpit Voice Recorder (CVR) and Flight Data Recorder (FDR).

For front-door coupling, assessment is only needed if PED operation is intended in low-visibility approach.

The failure classification should be derived from a system safety analysis performed for the aircraft.

3.1.3. RF and EMI Assessment at aircraft level

The applicant should perform a detailed RF and EMI assessment that defines the character of the total RF environment in the aircraft, which now includes conditions comprising the operation of multiple PEDs, and the vulnerability of aircraft systems to interference.

This assessment should consider intentional transmissions and their potential effect on aircraft equipment and wiring through direct illumination (back door coupling), unintended spurious emissions within the aircraft RF receiver bands (front door coupling) and intentional emissions in the vicinity of frequency bands of aircraft radio receivers, like the case of Radio Altimeters (front door coupling).

1. To address back door coupling aircraft systems susceptibility acceptable means of compliance are:
    - EUROCAE ED-239A /RTCA DO-307B Section 3 or,
    - EUROCAE ED-130B / RTCA DO-363A Section 6.

    The recommendations in the guidance material to address back door coupling closely follow existing practices for aircraft system high intensity radiated fields (HIRF) protection, therefore consideration of the existing HIRF certification of the aircraft is helpful to address the back-door coupling effects.

    Wireless communication standards defined as low power technologies as per EUROCAE ED-130B / RTCA DO-363A Section 6.2.2 do not need to be analysed for backdoor coupling, as these low power emissions are considered not to affect aircraft systems.
2. To address front door coupling susceptibility, acceptable means of compliance are:
    - EUROCAE ED-239A / RTCA DO-307B Section 4, Appendix C and Appendix D or,
    - EUROCAE ED-130B / RTCA DO-363A Section 5.

Previous versions of EUROCAE ED-130, RTCA DO-307 and RTCA DO-294C do not include guidance to evaluate the effects of emissions from 5G PED on the Radio Altimeter. Initial revisions of EUROCAE ED-130, RTCA DO-307 contain requirements that are even more stringent than the ones contained in later revisions and that are currently accepted for back door tolerance demonstration. These earlier revisions can still be accepted as means of compliance only in case potential interference from 5G PED emissions to on board radio altimeter doesn't need to be assessed for a specific application. In order to prevent potential misuse of these standards, EASA recommends the use of the documents at the latest revision that are pointed out in the paragraphs above.

Depending on the intention of the certification exercise, different scenarios are possible:

No.	Certification Objective	Back door coupling assessment	Front door coupling assessment	Correspondence with operational scenarios in Annex to ED Decision 2014/029/R
1	Certification of an aircraft as PED tolerant (for all technologies)	Needed (Note 1)	Needed	1
2	Certification of the installation of a wireless communication system to be used in all flight phases	Needed (Note 2)	Needed	3
3	Certification of the installation of a wireless communication system to be used in all flight phases except low visibility approach operation	Needed (Note 2)	N/A (Note 3)	6

No.	Certification Objective	Back door coupling assessment	Front door coupling assessment	Correspondence with operational scenarios in Annex to ED Decision 2014/029/R
4	PEDs will be allowed to be used only with transmitting capabilities disabled, i.e. no wireless transmission capabilities are allowed in any flight phase	N/A	Needed	5

Note 1: When the intention is to certify an aircraft as PED tolerant, account should be taken of all possible PED transmission standards which are likely to exist within the PEDs that can be brought on-board the aircraft.

Note 2: When the intention is to certify the installation of a system that controls the intentional transmissions of the PEDs, i.e. a picocell for mobiles telephones or a Wi-Fi router; the RF and EMI assessment should take into account as a minimum the PED transmissions standards that will be controlled by the installed system.

Note 3: A front door coupling susceptibility assessment is necessary when the intention is to allow gate-to-gate operation of the PEDs, i.e. including low visibility approach operation. The assessment may be differed to the operator.

3.1.4. Aircraft Flight Manual Limitations

Restrictions arising from the EMI assessment should be documented in the aircraft flight manual (AFM) or Pilot Operating Handbook (OPH). They may be linked to different aircraft zones where EMI testing has not been successfully conducted and where PED use should be prohibited, or to particular transmission technologies covered.

When back door PED tolerance has only been demonstrated for certain transmission technologies (scenarios 2 and 3 in section 3.1.3), the AFM should include a clear statement of the technologies that have been addressed.

When front door PED tolerance has not been demonstrated (scenario 3 in section 3.1.3), the AFM should include a clear statement that PED allowance during low visibility approach is not covered by aircraft certification.

When no back door PED tolerance assessment has been performed (scenario 4 in section 3.1.3), the AFM should include a clear statement that PEDs transmitting capabilities assessment is not performed as part of the aircraft certification.

3.1.5. Instructions for Continued Airworthiness

The applicant should maintain ICA documentation in accordance with CS 23.1529, 25.1529, 27.1529 or 29.1529.

In order to sustain the aircraft PED tolerance, any design changes introduced to the aircraft should consider any impact that this might have on the RF and EMI assessment that has been undertaken.

The outcome of the RF and EMI assessment performed is valid only for the approved configuration of the aircraft as tested or for which the analysis was performed against. Altering the aircraft in any way from the approved configuration could invalidate the results, making the aircraft no longer PED tolerant.

Any modifications to an aircraft that is certified PED tolerant should be assessed to confirm if the PED tolerance is maintained or if there are limitations. Any instructions for sustaining aircraft PED tolerance should be specified in the instructions for continuous airworthiness document.

Guidance on sustaining aircraft PED tolerance can be found in EUROCAE ED-130B / RTCA DO-363A section 7 or EUROCAE ED-239A / RTCA DO-307B section 5.7.

3.1.6. Design data

The data to be submitted by the applicant to support the granting of approval should address the subjects of this Certification Memorandum.

For non-HIRF or only partially HIRF approved aircraft, the applicant should list all of the evaluated aircraft systems and equipment for which PED tolerance has been demonstrated.

The list should comprise all Hazardous and Major systems including CVR and FDR shown to be PED tolerant, and a list of all equipment part numbers performing Catastrophic functions. In addition the list should also identify the type of PED technologies that have been assessed, if a technology specific demonstration was made. The list can also be in the format of a Non-PED tolerant Equipment list.

The equipment list should be utilized for follow-on installations and anticipate additional aircraft equipment configurations to determine the need for additional assessment or testing.

3.1.7. Other regulatory requirements

In addition to airworthiness approval, the applicant should be aware of other specific issues that are associated with the scope of this demonstration. Specific test and development license(s) will need to be obtained to permit transmissions at designated T-PED frequencies, prior to conducting any ground and flight testing activities.

Safety precautions from RF emissions for personnel conducting all tests should be taken.

Licenses for generating the necessary RF fields and modulations for the required tests should be obtained from the relevant communications regulator.

Testing instructions should take into account emission restrictions imposed by spectrum usage licences.

3.2. Who this Certification Memorandum affects

The guidelines in the Certification Memorandum are applicable to all TC and STC applicants who intend to demonstrate an aircraft as PED tolerant or are installing a wireless communication system that will connect with PEDs.

4. Remarks

1. For any question concerning the technical content of this EASA Certification Memorandum, please contact:

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