

EASA Proposed CM-ES-001 Issue 01 – Certification of Power Supply Systems for Portable Electronic Devices - Comment Response Document

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
1	Air France DOA EASA.21J.027	3.1.1.3.	8	<p>It is mentioned that the Electrical Load Analysis (ELA) should be undertaken taking into account the maximum loading that may be utilized from the PSS.</p> <p>Usually, according to TC holder specifications, the loading conditions used for the ELA calculation do not represent the real “physical” maximum load available from the PSS, but only a percentage for different flight phases according to “duty cycle” rules. e.g. : for B777 aircraft, the ELA is based only on 20% of PSS maximum load during cruise.</p> <p>In addition, current in-seat PSS are often combined with seat motion system (same in-seat electrical supply). What respective loading should be considered ?</p>	<p>The electrical maximum loading conditions should be clarified.</p> <p>If the “duty cycle” rules are acceptable, the percentage to be used and the flight phases to be considered should be defined.</p> <p>The loading conditions for combined PSS with other system(s) should be defined.</p>	Yes	No	Partially Accepted	<p>This Certification Memorandum is applicable to all TC and STC holders. The ELA for PSS could follow the principles established by the TC Holder ELA. The Certification Memorandum has been modified accordingly.</p> <p>New wording: “The agreed TC holder ELA could be referred to as additional guidelines.”</p> <p>This Certification Memorandum is only addressing the certification aspects of PSS for PED and the ELA aspects related to this system. The seat motion system is out of its scope.</p>
2	Air France DOA EASA.21J.027	3.1.1.4.	8	<p>It is mentioned that the mean of deactivation should be provided as a minimum for the cabin crew and an additional switch main also be provided in the flight deck.</p> <p>However, FAA ADs (EASA adopted) for B737/747/767 request that flight crew must be able to turn off electrical power to IFE and other non-essential passenger cabin systems through a switch in the flight compartment during non-normal or emergency situations (AD nr 2009-12-06, 2009-15-12 and 2008-23-15)</p>	<p>The location of the “primary” deactivation mean required must be clarified (in cabin or in flight deck ?).</p>	Yes	No	Partially Accepted	<p>The intent of the requirement is to have a single switch that allows the crew to completely disconnect the entire PSS for PED system from the aircraft electrical system, regardless of its location, in the flight deck or in the cabin crew.</p> <p>Paragraph is reworded as follows:</p> <p>“A clearly labelled and conspicuous means (on/off switch) for deactivating the <u>entire</u> PSS for PED should be provided in the cabin or the flight deck. as a minimum for the cabin crew. Cabin configurations may require the provision of more than one switch in the cabin. An additional switch may also be provided in the flight deck.”</p>
3	Air France DOA EASA.21J.027	3.1.1.6.	9	<p>It is mentioned that the EMC evaluation of the PSS for PED should be accomplish for all foreseeable operating and standby conditions for conducted and radiated EMI.</p> <p>The wording “standby conditions” is ambiguous.</p> <p>Are the functional tests according to the functional test section of the Aircraft Maintenance Manual (AMM) good enough to check the conducted and radiated EMI ?</p> <p>The aircraft systems to be tested are not defined.</p> <p>The required conditions to perform ground or/and flight EMI tests are not mentioned.</p>	<p>The EMC evaluation to be performed should be segregated; on the one hand for the conducted EMI and on the other hand for the radiated EMI.</p> <p>Differences between “operating” and “standby” conditions should be clarified.</p> <p>The aircraft systems to be tested must be defined as well as the conditions to do these tests. e.g. : engine(s) running or not.</p> <p>The test method(s) should be indicated (functional tests using AMM or spectrum analysis ?)</p> <p>The condition to perform flight EMI test should be indicated.</p> <p>Example(s) of EMI test plan should be helpful.</p>	Yes	No	Not Accepted	<p>The intent of the Certification Memorandum is not to give a precise definition of the test. It is the responsibility of the applicant to perform what they think necessary to demonstrate no interferences between the new system installed and the other aeroplane systems.</p> <p>The aircraft systems to be tested are all electrical units or systems essential to safe aeroplane operation, as defined in CS 25.1353(a) and 25.1431(d).</p> <p>At least a Ground Test should be performed.</p>
4	Air France DOA EASA.21J.027	3.1.1.6.	9	<p>It is mentioned that “representative PED loads” should be used the check the conducted and radiated EMI.</p> <p>The wording “representative PED loads” is ambiguous and can be understood in different ways. => Are resistive tools (with adjustable voltage and power) acceptable? => Are bulbs acceptable? => Are real PEDs acceptable (one/several Makes-models)?</p>	<p>It should be clarified what is a “representative PED load”.</p> <p>If tools are acceptable, a minimum standard or specification to comply with should be defined.</p>	Yes	No	Not Accepted	<p>Representative PED loads means loads that are foreseen to be connected to the PSS, they could be real loads if known or any other kind of load that can be justified to be representative of what is going to be connected.</p>

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5	Air France DOA EASA.21J.027	3.1.1.6.	9	<p>It is mentioned, as a minimum, the following load cases should be considered : => No loads, one load, several loads, all loads.</p> <p>For "one load" and "several loads" cases, the test conditions can be implemented in many ways.</p> <p>Must "one load case" be tested at each power supply output? (one by one ?)</p> <p>How many (several) power supply output must be tested and in which aircraft areas?</p> <p>For "several loads case" the power conditions are not mentioned.</p>	<p>The "one load" and "several loads" cases should be clarified and quantified.</p> <p>For "several loads case", the number of minimum installed power supply output to be tested must be indicated. e.g. : percentage or number of output power supply per area, per class or per seat Model installed.</p> <p>For "several loads case" the power conditions (min/max) should be indicated.</p>	Yes	No	Not Accepted	Refer to comment 3.
6	Air France DOA EASA.21J.027	3.1.1.6.	9	<p>It is mentioned that the tests with "representative PEDs loads" <u>should be followed</u> by tests to check the conducted interference from the PEDs in the range of 30-100 MHz with the intended PEDs connected to the PSS.</p> <p>Does it mean that for all kind of PSS installation, a specific conducted EMI test should always be done after a "first one" done with "representative PEDs loads"?</p> <p>The wording "intended PEDs" is ambiguous. Does it mean that "real PEDs" have to be used for the conducted EMI test?</p> <p>Regarding the frequency range, does it mean that only aircraft systems operating in this range have to be tested? (HF, VHF, Marker beacon, VOR/LOC)</p>	<p>The required conditions to perform the conducted EMI test should be clarified.</p> <p>The following data should, at least, be mentioned : => PED load type (tools or real PEDs?), => test method, => frequency increments.</p>	Yes	No	Partially Accepted	<p>The intent of this test has been clarified in accordance with other similar comments done to this section.</p> <p>This additional test is now recommended, but not required for certification.</p> <p>New wording: "This may be followed by tests with the intended PEDs connected to the PSS for PED to check the conducted interference from the PED in the range of 30-100 MHz, but it is not required for certification."</p> <p>Intended PEDs means the PEDs that are foreseen to be normally connected.</p> <p>In accordance with CS 25. 1353(a) and 25.1431(d), the test objective is to demonstrate that the new system will not affect the operation of other electrical units or systems essential to safe aeroplane operation, therefore all these systems need to be tested.</p> <p>Refer also to comments 3, 6, 16, 32, 33, 41, 42 and 45.</p>
7	Air France DOA EASA.21J.027	3.1.1.8.	9	<p>It is mentioned that all components associated with the PSS should meet applicable flammability requirements according to CS 25.869</p> <p>The RTCA DO-160 also includes "Fire, Flammability" requirements (section nr 26).</p> <p>For PSS components, does compliance with this section can substantiate CS 25.869?</p>	<p>The possible links (or not) between CS 25.869 and DO-160 section 26 requirements should be indicated</p>	Yes	No	Noted	<p>For EWIS related to PSS for PED, CS 25.869 (a)(3) refers to 25.1713. The associated AMC defines the test to be performed on EWIS.</p> <p>For other equipment, such as the inverter/converters, appropriate qualification of the equipment should be performed depending on the installation location of the equipment in the aeroplane.</p>
8	Air France DOA EASA.21J.027	3.1.2.3.	11	<p>It is mentioned that a mean for the automatic deactivation of the PSS should be provided in the event of rapid decompression to remove power from all components containing high voltage circuit.</p> <p>In the TGM 25/10 and the FAA memo ANM-01-111-165 the high voltage is defined as being a voltage over 110 V AC 60Hz.</p> <p>No value is mentioned in the proposed memo.</p>	<p>The value of the high voltage should be mentioned to avoid interpretations.</p>	Yes	No	Noted	<p>All sections under 3.1.2 are applicable to High Voltage Alternating Current (AC) Systems, which are already defined in 3.1.2 as 110 V AC 60 Hz, 230 V AC 50 Hz.</p> <p>No change is considered necessary to be included in the Certification Memorandum.</p>

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9	Air France DOA EASA.21J.027	3.1.4.	12	<p>It is mentioned that the restrictions of use for each phase of flight must be included in the appropriate operations/training manuals.</p> <p>Currently this restriction is mentioned in the basic limitation section of the Airbus fleets Aircraft Flight Manual (AFM) but not in Boeing fleets ones.</p> <p>Is there an different approach between FAA and EASA regarding this topic?</p>	<p>It should be mentioned in which manual this restriction (limitation?) must be included (AFM, FCOM or CCOM/FAM?).</p> <p>Note : FCOM : Flight Crew Operating Manual CCOM : Cabin Crew Operating Manual (Airbus designation) FAM : Flight Attendant Manual (Boeing designation)</p>	Yes	No	Partially Accepted	<p>Although not stated in the Certification Memorandum, it is normal practice within EASA to have this limitation included in the AFM. The appropriate crew action should appear in the required manual (FCOM if it is an action to be performed by the flight crew, in the CCOM or FAM if to be performed by cabin crew). Such an approach has been different from the FAA one.</p> <p>See also comment 13 on further discussion about AFM.</p>
10	AMAC Aerospace (Switzerland) AG	3.1.2.2.	7	<p>I saw one mistake in paragraph „3.1.2.2. Fault Protection“ (relevant portion copied below):</p> <p>Note: Fault current is defined as a current that flows from one conductor to ground or to another conductor owing to an abnormal connection (including an arc) between the two.</p> <p>Differential protection is a technique for protection from short circuits.</p> <p>A GFI in general can only detect currents which return back to the power source on a non usual way, bypassing the GFI. Usually this happens via a protective earth conductor (PE), in an A/C this is usually the A/C structure, or a dedicated PE conductor back to the Inverter.</p> <p>A direct short circuit, between the live (P) and Neutral (N) lines protected by the same GFI, cannot be detected, as the currents coming from the source and returning back into the source through the GFI are equal, but opposite, as is the case during normal operation. Short circuits also with the presence of a GFI must be handled by a CB.</p>	<p>I guess the best way to correct the sentence is something similar to the following:</p> <p>Note: Fault current is defined as a current that flows from one conductor to ground or to another conductor not protected by the same GFI, owing to an abnormal connection (including an arc) between the two.</p> <p>Differential protection is a technique for protection from short circuits towards ground</p>	---	---	Partially Accepted	<p>Whilst the comment is understood, it is not seen as a mistake in the definitions, but more due to the fact that they are too general when referring to personal protection.</p> <p>In the context of this Certification Memorandum, fault current would be the electric current not balanced between the energized conductor and the return neutral conductor. Such an imbalance may indicate current leakage through the body of a person who is grounded and accidentally touching the energized part of the circuit.</p> <p>The note including definitions has been removed from the Certification Memorandum to avoid confusion.</p>
11	Lufthansa Technik Office of Airworthiness	1.1	4	<p>This memorandum is applicable for all locations where outlets could be installed. Since nowhere restrictions are mentioned that outlets inside stowage compartments are prohibited, please advise if installation there are combined with additional requirements.</p>		---	---	Noted	<p>This Certification Memorandum is general for all electrical outlets, regardless of their location, but some provisions may need to be adopted in certain cases.</p> <p>In case of installation inside stowage compartment, EASA has developed a specific Special Condition which addresses additional requirements relative to smoke and fire aspects.</p>
12	Lufthansa Technik Office of Airworthiness	3.1.1.4.	8	<p>EASA requests that the master power switch should be clearly labelled to prevent crew confusion and unintentional reactivation of the system. Together with the requirement of the possibility of immediate disconnection of all outlets – typically in case of failure – is it sufficient to use the Commercial Cut-Off Switch (Airbus) or Cabin Utility Switch (Boeing) as a master switch to fulfil this item? A labelling regarding PSS would not be added for this kind of switches. Procedures regarding deactivation of this system will be implemented in the applicable manuals.</p>		---	---	Noted	<p>The Commercial Cut-Off switch (Airbus) or Cabin Utility Switch (Boeing) are acceptable to be used as the single switch, no additional labelling is necessary if the switch is clear and easy to be identified. The intent of this requirement is that it is easy for the crew to completely disconnect the whole system in case of failure with a single action, and that it is easy to find the appropriate switch for such an action.</p> <p>No change to the Certification Memorandum is necessary.</p>

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13	Lufthansa Technik Office of Airworthiness	3.1.1.4.	8	EASA requests that the system should be deactivated during critical flight phases. During the EMI surveys it will be verified, that the system including connected PED's does not interfere with any other system. This includes all flight and landing phases. OPS requirements defines that PED's have to be switched off and stored during TTL so that the PSS itself (without PED's) would be activated during TTL only. Thus, it is excluded that possible interference are higher than tested during the surveys. Hence this item should be able to be compensated by sufficient EMI tests.		---	---	Partially Accepted	After further review we agree this is an operational consideration, unless this appears as a limitation in the certification exercise. The Certification Memorandum has been modified accordingly by replacing the sentence "The PSS for PED should be deactivated during critical phases of flight: i.e. take-off and landing" by "The AFM should identify any phases of flight in which the PSS for PED should be deactivated".
14	Lufthansa Technik Office of Airworthiness	3.1.1.5.	8	EASA requests "in use" lights for all outlets where PED's are connected. The intent of this requirement in the former papers like TGM/25/10 was to give the cabin crew the opportunity to verify, specially at dimmed cabin, which outlets are in use to avoid injuries of passengers through overheated PED's in case of obscured and connected devices. Since nearly all PED's are also powered by batteries so that, if the PED's are obscured and not connected, this will not be visible for the cabin crew. Therewith no significantly difference between this two configurations are given. Thus, indication lights do not generate an additional safety feature and should not be required. Independent of the exposition above special installations offers the option through their location of the outlet to ensure a free and unrestricted view to the outlets (e.g. medical outlets, outlets in galley areas or for hair dryers in lavatories). Especially for such installations where outlets could not be easily obscured "in use" lights does not increases the safety and are therefore inapplicable.		---	---	Noted	The Certification Memorandum currently states: "A means of indication should be provided to enable the cabin crew to identify which outlets are in use". A means of indication may be also that, due to the location of the outlet, it is clearly visible if some PED is connected to it, and it is not possible to be obscured by anything else (for example, outlets installed in a wall). EASA has already accepted similar cases to the ones mentioned by Lufthansa Technik in the comment. No change in the Certification Memorandum is considered necessary.
15	Lufthansa Technik Office of Airworthiness	3.1.1.6.	9	EASA defines the applicable sections for the equipment qualification as follows: RTCA DO-160 section 4 through 9, 11 and 15 through 22 as far as applicable as an acceptable means of demonstrating compliance. EASA is asked to adapt the listed section to the sections which are applicable for typical designs where all components are installed inside the pressurized area zone or in the cabin. E.g. sections like Section 11 "Fluids Susceptibility" are obviously not applicable. Other subsections like the decompression test are already mentioned in separate items of this memorandum. Especially for electrical power inverter a qualification according TSO-C73 should also be acceptable.		---	---	Not Accepted	We have realized this reference to the system tests according to RTCA DO-160 should not be in the EMI section, as it covers more tests than only electromagnetics ones, therefore we have added a note at the end of the section including it, however all the mentioned sections of RTCA are kept, the applicability of them will depend on each particular installation. New wording at the end of section 3.1.1.6: "Note 2: System testing should be accomplished in accordance with appropriate chapters of EUROCAE ED-14/RTCA DO-160 at its applicable issue (see Sections 4 through 9, 11, and 15 through 22, as applicable to a particular design)." For electrical power inverter, compliance with TSO-C73 instead of performing qualification test as per RTCA DO-160 is not considered enough, TSO-C73 is an old document that refers to obsolete standards.

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16	Lufthansa Technik Office of Airworthiness	3.1.1.6.	9	In former EASA-projects it has been offered in the EPS CRI for the Electromagnetic compatibility evaluation that "Known worst case loads at worst case locations should be tested. In the absence of a more rational analysis, the following cases should be considered:" LHT asks to implement this option and therefore replace "As a minimum, the following cases should be considered:" with the former wording above.		---	---	Accepted	<p>As a result of comments 16, 32, 33, 41, 42 and 45 the paragraph has been reworded as follows:</p> <p>" (...) Testing for conducted emissions should include 150 kHz to at least 30 MHz as depicted in Section 21 of document EUROCAE ED-14/RTCA DO-160.</p> <p>Electromagnetic compatibility (EMC) evaluation of the PSS for PED should be accomplished for all foreseeable operating and standby conditions.</p> <p>Representative PED loads should be used to check the conducted and radiated electromagnetic interference (EMI) from the PSS whilst under load conditions.</p> <p>Known worst case loads at worst case locations should be tested. In the absence of a more rational analysis, the following cases should be considered:</p> <ul style="list-style-type: none"> • No load; • One load: minimum, maximum power delivered by the PSS for PED; • Several loads connected; • All loads connected: minimum, maximum power delivered by the PSS for PED <p>This may be followed by tests with the intended PEDs connected to the PSS for PED to check the conducted interference from the PED in the range of 30-100 MHz, but it is not required for certification. Additional testing using validated modelling techniques can also be used.</p> <p>Note 1: It is not expected that the PED perform to the category 'H' level of radiated emissions (reference EUROCAE ED-14/RTCA DO-160 Section 21). However, the PSS should filter undesirable conducted emissions generated by the PED or by the PSS for PED itself and prevent the propagation of any unwanted RF into other aeroplane systems.</p> <p>Note 2: System testing should be accomplished in accordance with appropriate chapters of EUROCAE ED-14/RTCA DO-160 at its applicable issue (see Sections 4 through 9, 11, and 15 through 22, as applicable to a particular design).</p>
17	Lufthansa Technik Office of Airworthiness	3.1.1.7.	9	Neither CS25.601 nor CS25.1309 requires a permanent deactivation in case of detected overheat. Both paragraphs requests installation of only reliable parts and limit the installation of components to parts which would not reduce the safety or performance of the aircraft. Nowhere is defined that this has to be ensured by an automatic shutdown without automatically recoverability. Why EASA requests a manually resetting?		---	---	Not Accepted	<p>The overheat protection mentioned in the Certification Memorandum refers to an overheat situation caused by an electrical fault, in this case the system should not be able to be automatically reset in flight because the condition that caused the overheat may have not been resolved. But it can be manually reset by a crew member.</p> <p>Any deviation to this principle should be discussed in a case by case basis.</p>

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18	Lufthansa Technik Office of Airworthiness	3.1.1.7.	9	EASA states that an overheat protection should be included. In the middle of the paragraph this requirement has been relativised through "However, if this feature is included". Please clarify the intent of this item.		---	---	Accepted	Including an overheat protection is a recommendation, not a requirement, but in case this protection is included, it should not be automatically resettable. The wording has been changed to be clearer: "However, if this feature is included, it should not be automatically resettable."
19	Lufthansa Technik Office of Airworthiness	3.1.1.8.	9	EASA is requested to define the applicable flammability requirements more precisely. The mentioned paragraph CS 25.869 references to the paragraphs 25.831(c) and 25.863. Both paragraphs do not include special flammability requirements. 25.0831(c) only defines that the defined concentrations of harmful or hazardous concentration of gases or vapours should not be exceeded.		---	---	Noted	Refer to comment 7
20	Lufthansa Technik Office of Airworthiness	3.1.1.9.	9	EASA wants to limit the outlet power to 200W for typically used PED's. In the Introduction part EASA describes that these requirements should be applicable for all PSS outlets independently from their installation location. As examples of PED's laptops and hair dryers are mentioned. Since hair dryers would not be possible to operate at power limited outlet, the general restriction regarding power limitation is not helpful. Equivalent installations are given in the galley area. The option to discuss with EASA which outlets could be exempt from this limitation is not worthwhile, since the workload on EASA and applicant side will be increased. LHT could not notice any advantage from the power limitation. The safety related requirements are independent from the power limitation. Therefore LHT suggest restricting the power limitation, if anywhere necessary, to all outlets which could be reached by passengers normally seating at certified seats and easily obscured. For all other outlets a power limitation should not be necessary. EASA requests additional design features for unlimited outlets. Please advise which design features, additional to the features mentioned in this memorandum, are meant.		---	---	Not Accepted	The intention of this paragraph is that any installation/modification of an PSS for PED including outlets with power above 200watts should be submitted to EASA. In the TGM 25-10 the power was limited to 100watt, as this power was more than enough at the time of the TGM was issued to power laptop computers, as the TGM only covered ISPSS. The intention of the power limitation is to control the types of devices that can be powered by the PSS or PED. Taking into account the current demand for typical PEDs nowadays the limit has been revised to 200watt. However, this Certification Memorandum is covering not only the ISPSS, but also any other PSS for PED installed in the aircraft, even those to which high power consumers will be connected to. The use of this kind of equipment, such as hair dryers, could pose a safety threat to the passengers, due to shock, and the risk of fire may also increase. Therefore, to address these specific cases when high power consuming equipment is expected to be connected (for Executive Power Systems, medical equipment, etc.) the applicant should submit a proposal to the EASA including a rationale as the need for the increased power requirements and the additional design features that will minimize the possibility of adverse effects on essential or critical aeroplane systems and shock hazards to persons.
21	Lufthansa Technik Office of Airworthiness	3.1.1.11.	10	A review of the installation instead of the mentioned installation drawings acc. Part 21A31 should be sufficient.		---	---	Partially Accepted	Installation drawings should be available, in accordance with Part 21A31, but are not necessarily to be provided to EASA. Refer also to comment 47 New wording: "All data necessary to define the design, including installation drawings and wiring diagrams should be available, in accordance with Annex Part 21A.31 to Commission Regulation (EC) No 1702/2003."
22	Lufthansa Technik Office of Airworthiness	3.1.2.2.	11	In this item it should be sufficient to mention the EN-norm. The advantage would be that if the norm will be revised, an adoption of this item does not become necessary. Therefore formulations like "Activation time in the event of a differential fault should be equivalent to characteristics as defined in EN 61008-1." would be helpful.		---	---	Not Accepted	Refer also to comment 40. The reference to EN 61008-1 has been eliminated, and to be in line with the values used in other applications approved by EASA, the time limit has been changed to 30ms.

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23	Lufthansa Technik Office of Airworthiness	3.1.2.2.	11	This paragraph defines that "features for monitoring the health of the fault detection circuits" are required. Instead of permanent monitoring a frequently manual test of the GFI by pressing the test button of the GFI should be sufficient (MPD Task).		---	---	Noted.	The Certification Memorandum does not ask for a continuous monitoring of the GFI. A manual test of the GFI could be acceptable if it is in accordance with the safety requirements CS 25.1360 and 25.1309.
24	Lufthansa Technik Office of Airworthiness	3.1.2.3.	11	EASA requests that components which containing high voltage circuits should be deactivated or tested according RTCA DO-160. In section 4.6.2 ("Decompression Test") of DO-160 is not clearly defined where high voltage begins. EASA has defined 110V and 230V as high voltage. Contrastingly in the respective standards high voltage is defined above 1 kV, low voltage below 1 kV. For voltages in the 110V and 230 V region no arcing can seriously expected. EASA is requested to clarify the term "high voltage" in this context.		---	---	Not Accepted	As defined in Section 3.1.2, high voltage is 110 V AC 60 Hz, 230 V AC 50 Hz. EASA experience is that arcing is possible at these voltage levels under rapid decompression situations.
25	Lufthansa Technik Office of Airworthiness	3.1.4.	12	This item is an operational requirement. During a STC process the applicant has to show compliance with the applicable regulation e.g. defined in the Type Certificate. OPS-requirements depend on the registration of the aircraft and should therewith not be part of the compliance finding process for a STC.		---	---	Partially Accepted	As noted, these are operational considerations to be considered additionally to the certification points presented in the other sections of the Certification Memorandum. Additionally, points a) to d) require inputs from the TC/STC holder.
26	Embraer	3.1.1.1.	7	The CM states that the PSS for PED installation should both minimize the possibility of insertion of conductive objects, as well as mitigate the resultant hazard of such an event. Minimization or mitigation of the hazard should be sufficient to address the issue and would maintain harmonization with the FAA standard in FAA Memorandum ANM-01-111-165.	Embraer recommends that the second sentence of the third paragraph be revised to read " Otherwise an applicant should show that a design means is in place to mitigate the resultant hazard."	---	---	Accepted	Wording has been changed as suggested.
27	Embraer	3.1.1.1.	7	The requirements of the fourth paragraph are ambiguous, and repeat the objectives many of the more tangible design requirements in other sections. In addition, the requirement to "eliminate" shock risk is technically not feasible and is not in keeping with other paragraphs which call for the risk to be minimized (example in the third paragraph of Section 3.1.1.9).	Embraer recommends that this paragraph be deleted.	---	---	Partially Accepted	Wording has been changed as follows to make it in line with CS 25.1360: the risk should be "minimized" instead of "eliminated". New wording: "Occupants should be protected against the hazards of electrical shock. Applicants should submit substantiation of non-hazards to passengers for all proposed voltages. Substantiation should include system requirements which eliminate minimize the risk of shock."
28	Embraer	3.1.1.4.	8	The second paragraph of this section specifies that a deactivation switch for the PSS for PED should be provided as a minimum to the cabin crew. This requirement is not necessarily appropriate for business aircraft that can operate without cabin crew, as well as conflicting with the first paragraph of this section that specifies operation by a "crew member" (which includes flight crew or cabin crew).	Embraer recommends that the first sentence of the second paragraph of this section be revised to say "... should be provided as a minimum for the flight crew or cabin crew."	---	---	Accepted	Refer to comment 2
29	Embraer	3.1.1.4.	8	The last paragraph of this section is more appropriately addressed as an operational issue, which is already covered in Section 3.1.4.	We recommend that this paragraph be deleted from Section 3.1.1.4.	---	---	Not Accepted	Refer to comment 13
30	Embraer	3.1.1.6.	9	The requirement to consider electrostatic discharge damage to RF filters should not include external sources such as lightning.	The memo should be revised as written in the FAA memorandum to say "... the effect of human-generated electrostatic discharge ..."	---	---	Accepted	Wording has been changed as suggested.

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31	Embraer	3.1.1.6.	9	The reference in the third paragraph to the "latest issue" of EUROCAE ED-14/RTCA DO-160 should be removed. Prior qualification of PSS for PED equipment to an earlier standard should still be allowed as it is for other equipment.		---	---	Accepted	Refer also to comment 15. New wording: "System testing should be accomplished in accordance with appropriate chapters of EUROCAE ED-14/RTCA DO-160 at its latest applicable issue (see Sections 4 through 9, 11, and 15 through 22, as applicable to a particular design)."
32	Embraer	3.1.1.6.	9	The requirement in the sixth paragraph should be modified as in the FAA memorandum to make clear that the test with intended PEDs is not required for certification. It is not practical, nor necessary, for a manufacturer/modifier to conduct tests for all potential PEDs. Operation of PEDs is the responsibility of the operator.		---	---	Accepted	Wording has been changed to clarify that this additional testing is recommended but not required for certification. New wording: This may be followed by tests with the intended PEDs connected to the PSS for PED to check the conducted interference from the PED in the range of 30-100 MHz, but it is not required for certification.
33	Embraer	3.1.1.6.	9	In addition the requirement for conducted interference testing of the PEDs up to 100 MHz exceeds the requirements of EUROCAE ED-14/DO-160 applicable to installed equipment, which is limited to 30 MHz.	This sentence should be changed to be compatible with the airborne equipment standards.	---	---	Partially Accepted	Refer to comment 32.
34	Embraer	3.1.1.7.	9	From the third sentence in this section ("However, if this feature is included ..."), Embraer concludes that overheat protection means are encouraged, but an option as in the FAA memorandum. It would be easier to understand if the first sentence were revised to say " EASA recommends that the system components should include an overheat protection."		---	---	Partially Accepted	Refer to comment 18.
35	Embraer	3.1.1.11.	10	Subject 1: The last sentence of the third paragraph of this section would be more correct if it read " ... it should be further noted that any ETSO approval compliance with any applicable ETSO for a seat ..." It is possible to include to address installation aspects under an ETSO approval, but merely complying with the standards of the ETSO is not sufficient.		---	---	Accepted	The suggested wording has been incorporated in the Memorandum.
36	Embraer	3.1.1.11.	10	Subject 2: To maintain the harmonization with FAA memorandum, Embraer believes EASA should keep the possibility to route 230VAC voltage power supplies wires within standard AC aeroplane wiring looms, without spacers or equivalent separation in order to keep a minimum distance between the wires. It will be impractical to maintain separation in many business aircraft because of the small size of the fuselage and cabin.		---	---	Not Accepted	For clarity purposes the order of the sentences has been changed, the new wording is as follows: <ul style="list-style-type: none"> • Where PSS for PED EWIS is routed with standard aeroplane wiring looms, spacers or equivalent separation should be used to keep a minimum distance in accordance with the SWPM of the aeroplane. • In the absence of more specific guidelines from the SWPM of the aeroplane, 230V AC voltage power supplies wires should not be routed within standard aeroplane wiring looms." The new wording tries to clarify that all the PSS for PED wiring should be separated from the standard aeroplane wires; when routed in the same looms, by use of spacers or equivalent separation. However, in case of 230V AC wires, the recommendation is to route the wires in different looms than the standard ones, unless other provisions exist in the SWPM of the aeroplane.

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37	Embraer	3.1.2.2.	11	To maintain clear harmonization with the FAA memorandum, Embraer recommends that the first sentence in the first paragraph be revised to say "To prevent personnel injury it is recommended that suitable means of protection such as differential protection and/or galvanic isolation (isolation transformer) should be provided to minimize ...".		---	---	Not Accepted	The current wording of the Certification Memorandum has a similar meaning.
38	Airbus SAS	3.1.1.5.	8	Airbus proposes to clarify the first sentence of Section 3.1.1.5 to take future design solutions into account. In future, USB ports are envisaged for PED power supplies. USB power ports provide a maximum of 5 A at 5 V DC, resulting in 25 W.	Airbus proposes to change the first sentence to read (additional text underlined): "A means of indication should be provided to enable the cabin crew to identify which outlets are in use <u>except for low power DC outlets up to 25 VA.</u> "	Yes	Yes	Partially Accepted	New wording: "A means of indication should be provided to enable the cabin crew to identify which outlets are in use <u>except for USB outlets</u> ".
39	Airbus SAS	3.1.1.6.	9	Airbus proposes to make a differentiation between power supply buses for PEDs used for equipment essential for continued safe flight and landing and those used for commercial equipment.	Airbus proposes to change the second sentence on page 9/13 to read (additional text underlined): " <u>If affected aeroplane equipment, which could be degraded, are essential parts of systems required for safe flight and landing</u> , periodic maintenance should be undertaken to establish the effectiveness of the filters in service."	Yes	Yes	Not Accepted	In accordance with section 3.1.1.2, the PSS for PED should be connected to non-essential bus bars.
40	Airbus SAS	3.1.2.2.	11	Airbus checked EN-61008-1 referred to in Section 3.1.2.2. , 3 rd sentence, 2 nd bullet. In EN-61008-1 we did not find the required activation time of 100 msec in the event of a differential fault. Further, we consider the combination of fault current 30 mA with activation time 100 msec potentially critical when used in aircraft standard power supply systems.	Airbus proposes to introduce an activation time of <u>30 msec</u> in the event of a differential faults. If 100 msec shall be kept, Airbus requests to introduce explanatory text into the CM.	Yes	Yes	Accepted	To be in line with the values used in other applications approved by EASA, the time limit has been changed to 30ms.
41	Dassault Aviation France	3.1.1.6.	9	The reference to "Performing tests per EUROCAE ED-14/RTCA DO-160 at its latest issue" is sufficient. The given details in CM do not bring any complementary clarification and are not justified in this text.	Delete in CM the technical details which are defined in ED or RTCA: ... Testing for conducted emissions should include 150 kHz to at least 30 MHz as depicted in Section 21 of document EUROCAE ED-14/RTCA DO-160. Additionally, the conducted emissions portion of the testing should be continued up to 100 MHz (levels as specified in Section 21 of EUROCAE ED-14/RTCA DO-160) to ensure no radio frequency (RF) coupling paths exist which may channel signals upstream of the PSS.... Note 1: It is not expected that the PED perform to the category 'H' level of radiated emissions (reference EUROCAE ED-14/RTCA DO-160 Section 21). However, the PSS should filter undesirable conducted emissions generated by the PED or by the PSS for PED itself and prevent the propagation of any unwanted RF into other aeroplane systems.	Suggestion	Objection	Not Accepted	The frequency range between 30 and 100MHz is not included in the ED or RTCA. This is an additional test to ensure there is no radio frequency coupling path that may channel signals upstream of the PSS. This additional test is a recommendation, and it is not required for certification. For final wording on this section refer also to comments 6, 16, 32, 33, 41, 42 and 45.

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42	Dassault Aviation France	3.1.1.6.	9	<p>For electromagnetic compatibility (EMC) evaluation, representative PED loads are required to check the conducted and radiated electromagnetic interference (EMI) from the PSS.</p> <p>CM text asks for too many cases to be considered for evaluation without real interest: the demonstrated most constraining case would be sufficient for evaluation.</p> <p>The following "tests with the intended PEDs connected to the PSS for PED" has to be performed per ED-14/RTCA DO-160 according only to section 15 through 22, as applicable and determined for each design.</p>	<p>Replace: "As a minimum, the following cases should be considered:</p> <ul style="list-style-type: none"> - No load; - One load: minimum, maximum power delivered by the PSS for PED; - Several loads connected; - All loads connected: minimum, maximum power delivered by the PSS for PED" <p>By: The most constraining load case will be demonstrated.</p> <p>Delete the mentioned range 30-100 Mhz</p> <p>This should be followed by tests with the intended PEDs connected to the PSS for PED to check the conducted interference from the PED in the range of 30-100 MHz. To check for conducted interference known worst case loads at worst case locations should be tested. Additional testing using validated modelling techniques can also be used.</p>	Suggestion	Objection	Partially Accepted	<p>As a result of comments 6, 16, 32, 33, 41, 42 and 45 the paragraph has been reworded as follows:</p> <p>" (...) Testing for conducted emissions should include 150 kHz to at least 30 MHz as depicted in Section 21 of document EUROCAE ED-14/RTCA DO-160.</p> <p>Electromagnetic compatibility (EMC) evaluation of the PSS for PED should be accomplished for all foreseeable operating and standby conditions.</p> <p>Representative PED loads should be used to check the conducted and radiated electromagnetic interference (EMI) from the PSS whilst under load conditions.</p> <p>Known worst case loads at worst case locations should be tested. In the absence of a more rational analysis, the following cases should be considered:</p> <ul style="list-style-type: none"> • No load; • One load: minimum, maximum power delivered by the PSS for PED; • Several loads connected; • All loads connected: minimum, maximum power delivered by the PSS for PED <p>This may be followed by tests with the intended PEDs connected to the PSS for PED to check the conducted interference from the PED in the range of 30-100 MHz, but it is not required for certification. Additional testing using validated modelling techniques can also be used.</p> <p>Note 1: It is not expected that the PED perform to the category 'H' level of radiated emissions (reference EUROCAE ED-14/RTCA DO-160 Section 21). However, the PSS should filter undesirable conducted emissions generated by the PED or by the PSS for PED itself and prevent the propagation of any unwanted RF into other aeroplane systems.</p> <p>Note 2: System testing should be accomplished in accordance with appropriate chapters of EUROCAE ED-14/RTCA DO-160 at its applicable issue (see Sections 4 through 9, 11, and 15 through 22, as applicable to a particular design).</p>
43	Dassault Aviation France	3.1.1.7.	9	<p>Text should precise at which level the overheat protection is asked for:</p> <ul style="list-style-type: none"> - At each Outlet level or - At the level of the alternative power supply 		Suggestion	---	Not Accepted	<p>The overheat protection is to be implemented at system level. Generally the protection is implemented at the converter/inverter level.</p>

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44	CAA UK	3.1.1.5.	8	<p>Requirement reference shown as CS 25.1301, whereas CS 25.1309b and 25.1322 would be more appropriate to the paragraph that refers to crew mitigation of hazards and flight deck indication.</p> <p>Justification: because the requirement refers to crew mitigation of hazards and flight deck indication, the relevant requirements for this are those suggested rather than 25.1301 as currently stated.</p>	<p>Proposed Text (if applicable): 3.1.1.5 Systems Status Indication (Ref. CS 25.1309(b), CS 25.1322)</p>	---	---	Partially Accepted	<p>This section refers to PSS or PED system status indication during its normal operation, therefore reference to CS 25.1301 is maintained.</p> <p>Reference to CS25.1322 has been added, however applicability of 25.1309b is not considered appropriate.</p>
45	CAA UK	3.1.1.6.	9	<p>There has been some duplication of the material taken from the JAA and FAA papers into this section. The second paragraph on page 9 that refers to tests per EUROCAE ED-14/RTCA DO-160.... refers to tests from 150kHz to 30MHz . A second sentence states that test should be continued up to 100MHz. This is a duplication of the text two paragraphs down and implies that the additional tests "should" be done. In fact, the additional tests are optional and "may" follow the basic tests covering the configurations defined by the bulleted list. The change in text to that presented within the FAA paper implies a different "requirement" which is not thought to be the intent here.</p> <p>Justification: In order to harmonise the EASA position with all existing papers, the first mention of the "up to 100MHz test should be removed. The second mention of the up to 100MHz tests, after the bullet should be retained as an additional test that "may" follow the basic tests.</p>	<p>Proposed Text (if applicable):</p> <p>Testing for conducted emissions should include 150 kHz to at least 30 MHz as depicted in Section 21 of document EUROCAE ED-14/RTCA DO- 160. Additionally, the conducted emissions portion of the testing should be continued up to 100 MHz (levels as specified in Section 21 of EUROCAE ED-14/RTCA DO-160) to ensure no radio frequency (RF) coupling paths exist which may channel signals upstream of the PSS.</p> <p>...</p> <p>As a minimum, the following cases should be considered:</p> <ul style="list-style-type: none"> · No load; · One load: minimum, maximum power delivered by the PSS for PED; · Several loads connected; · All loads connected: minimum, maximum power delivered by the PSS for PED <p>This should may be followed by tests with the intended PEDs connected to the PSS for PED to check the conducted interference from the PED in the range of 30-100 MHz. To check for conducted interference known worst case loads at worst case locations should be tested. Additional testing using validated modelling techniques can also be used.</p>	---	---	Partially Accepted	<p>As a result of comments 6, 16, 32, 33, 41, 42 and 45 the paragraph has been reworded as follows:</p> <p>" (...) Testing for conducted emissions should include 150 kHz to at least 30 MHz as depicted in Section 21 of document EUROCAE ED-14/RTCA DO-160.</p> <p>Electromagnetic compatibility (EMC) evaluation of the PSS for PED should be accomplished for all foreseeable operating and standby conditions.</p> <p>Representative PED loads should be used to check the conducted and radiated electromagnetic interference (EMI) from the PSS whilst under load conditions.</p> <p>Known worst case loads at worst case locations should be tested. In the absence of a more rational analysis, the following cases should be considered:</p> <ul style="list-style-type: none"> • No load; • One load: minimum, maximum power delivered by the PSS for PED; • Several loads connected; • All loads connected: minimum, maximum power delivered by the PSS for PED <p>This may be followed by tests with the intended PEDs connected to the PSS for PED to check the conducted interference from the PED in the range of 30-100 MHz, but it is not required for certification. Additional testing using validated modelling techniques can also be used.</p> <p>Note 1: It is not expected that the PED perform to the category 'H' level of radiated emissions (reference EUROCAE ED-14/RTCA DO-160 Section 21). However, the PSS should filter undesirable conducted emissions generated by the PED or by the PSS for PED itself and prevent the propagation of any unwanted RF into other aeroplane systems.</p> <p>Note 2: System testing should be accomplished in accordance with appropriate chapters of EUROCAE ED-14/RTCA DO-160 at its applicable issue (see Sections 4 through 9, 11, and 15 through 22, as applicable to a particular design).</p>

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46	CAA UK	3.1.1.10.	10	<p>The proposed paragraph needs to re-align with the criticality and probability criteria of 25.1309 to enable correct application of this task. To state that the safety assessment should be conducted such that any likely failure condition would not reduce aeroplane safety nor endanger the occupants is a good holistic approach, but cannot be aligned with the defined safety assessment process as defined in AMC to 25.1309. It should also be noted that the safety assessment will not prevent failure conditions causing this condition, it can only verify that the "design" has accomplished this; it is the design/development that prevents inappropriate safety hazards, verified by SSA. The words "likely" and "reduce" in the first sentence need revising. A revised text is proposed to re-align the approach with demonstrating compliance with 25.1309(b) and 25.1709</p> <p>Justification: The wording has been subtly changed from that presented within the FAA paper to the extent that the intent appears to have changed. It is important to remember that italicised text in the FAA paper is "requirement" derived text, so the guidance should align with that presented, as there is a technically harmonised approach. The FAA requires the safety assessment to be addressed for any catastrophic and hazardous failure condition; the proposed EASA memo applies to all "likely failure conditions" which is not a criticality nor probability classification in so far as 25.1309 is applied.</p>	<p>Proposed Text (if applicable): Appropriate qualitative and/or quantitative failure analyses of each installed power supply system for PED should be conducted such that any likely probable failure condition would not reduce adversely affect aeroplane safety nor endanger the occupants. to demonstrate that the probability of any system failure shall be no more probable than that allowed by the safety criteria of CS 25.1309(b) , and a qualitative assessment of installed EWIS shall be conducted if any associated hazards are catastrophic or hazardous.</p>	---	---	Partially Accepted	<p>Reference to the applicable requirements is included.</p> <p>New wording: "Appropriate qualitative and/or quantitative failure analyses of each installed power supply system for PED should be conducted to demonstrate compliance with CS 25.1309(b) and CS 25.1709"</p>
47	CAA UK	3.1.1.11.	10	<p>Third bullet in paragraph states that Installation drawings should be provided in accordance with 21A.31. It isn't clear why only the installation drawings have been identified against this requirement; it would be expected that all data/drawings defining the aircraft change configuration should be provided, e.g. wiring diagrams. The reference should be changed to refer to all data; mention of the installation drawings could be retained as an example.</p> <p>Justification: 21A.31 refers to all data not just installation drawings.</p>	<p>Proposed Text (if applicable):</p> <ul style="list-style-type: none"> • All data necessary to define the design, including installation drawings and wiring diagrams, should be provided in accordance with Annex Part 21A.31 to Commission Regulation (EC) No 1702/2003. 	---	---	Accepted	<p>Refers also to comment 21.</p> <p>New wording: "All data necessary to define the design, including installation drawings and wiring diagrams should be available, in accordance with Annex Part 21A.31 to Commission Regulation (EC) No 1702/2003."</p>
48	CAA UK	3.1.1.11.	10	<p>Fourth bullet is presented as a single sentence rather than two sentences. The result of this is that interpretation of the text is more difficult. The text should be split into two sentences as shown.</p> <p>Justification: Text as presented is difficult to understand. The sentence should be split into two sentences as found within the FAA policy memorandum.</p>	<p>Proposed Text (if applicable): In the absence of more specific guidelines from the SWPM of the aeroplane, 230V AC voltage power supplies wires should not be routed within standard aeroplane wiring looms. where PSS for PED EWIS is routed with standard aeroplane wiring looms, spacers or equivalent separation should be used to keep a minimum distance in accordance with the SWPM of the aeroplane.</p>	---	---	Partially Accepted	<p>Refer to comment 36.</p>

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49	CAA UK	3.1.3.	11	<p>The EPS CRI, from which this text was derived, refers to the possible installation of showers, and the precautions to be taken in the installation of power outlets within their vicinity. The original text refers to any shower rather than the shower, as there might be more than one. The text should therefore reflect the possibility of more than one shower... rather than "only one"</p> <p>Justification: The text should cater for the possibility of more than one shower being installed; some aircraft design changes have added more than one shower room.</p>	<p>Proposed Text (if applicable):</p> <ul style="list-style-type: none"> • The Any shower cubicle should be closed up to the ceiling. • No outlets are allowed inside any of the shower cubicles. • The power outlets should not be placed within the encompassing radius of 0,6m at the of any shower cubicle door. 	---	---	Accepted	Wording incorporated as suggested.

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50	CAA UK	3.1.4.	12	<p>The text covering operational considerations might benefit from some additional clarification (second paragraph) clarification in para c), and additional material within para g) from the original TGM. Additional text identifying some airlines' concern over PEDs batteries being charged might be warranted to explain the need for the warnings regarding loss of PSS at any time.</p> <p>Justification: Clarification, see proposed text.</p>	<p>Proposed Text (if applicable):</p> <p>The responsibility of establishing the suitability of use of a Portable Electronic Device on an aeroplane model remains with the aeroplane operator as required by the currently applicable EU OPS 1.110 Portable Electronic Devices.</p> <p>When crew actions are needed to implement a chosen method of compliance, they instructions should be included in the appropriate operations/training manuals, together with at least the following minimum technical data and operational information, necessary to enable such actions:</p> <ul style="list-style-type: none"> a) Description of the system; b) Instructions for the activation/deactivation of the PSS, e.g. system control switches and passenger controls; c) Identification of the restrictions on use for each phase of flight (such as if the PSS for PED should be deactivated during critical phases of flight: i.e. take-off and landing.); d) Monitoring passenger use of system by cabin crew; <p>In addition, it is recommended that the following operation factors be considered and reviewed with the appropriate personnel. This list should include, but it is not limited to, the following:</p> <ul style="list-style-type: none"> e) Flight deck and cabin crew communication/coordination; if applicable; f) Hazards e.g. trip hazards, overheating of passenger devices because of being covered by pillows, blankets, etc; g) Information to passengers, detailing PEDs that can be used and instructions on use of the system, its limitations, hazards and operation of any airline supplied equipment. If the airlines prohibits the charging of PED internal batteries through the PSS for PEDs, the airline should consider informing the occupants such as, safety precautions and warning that power may be disconnected at any time if necessary without notice; h) Identification of malfunction of system and/or individual units and corrective action. 	---	---	Partially Accepted	<p>In the second paragraph, "they" refers to the crew actions, not to the instructions.</p> <p>In point c) "such as if" has been incorporated.</p> <p>Additional information to be included in point g) makes the information to be provided too specific.</p>