European Aviation Safety Agency

Comment-Response Document 2014-16

High-Intensity Radiated Fields (HIRF) and lightning

CRD TO NPA 2014-16 — RMT.0223 (MDM.024) — 15.7.2015

EXECUTIVE SUMMARY

This Comment-Response Document (CRD) contains the comments received on the Notice of Proposed Amendment (NPA) 2014-16 (published on 25 June 2014) and the responses provided thereto by EASA.

In response to the comments received, changes have been made to the final text of:

— CS 23.1306(a)(2)
— CS 23.1308(a)(2)
— CS 25/27/29.1316(a)(2)
— CS 25.1316(b)
— CS 25/27/29.1317(a)(2)
— AMC 20-136
— AMC 20-158

Applicability		Process map	
Affected regulations and decisions:	CS-23, CS-25, CS-27, CS-29, AMC-20	Concept Paper:	No
		Terms of Reference:	10.2.2012
		Rulemaking group:	No
Affected stakeholders:	Applicants for Type Certificates (TC)/ Supplemental Type Certificates (STC) (or changes thereto)	RIA type:	Light
		Technical consultation during NPA drafting:	No
		Publication date of the NPA:	25.6.2014
Driver/origin:	Safety; regulatory coordination	Duration of NPA consultation:	3 months
		Review group:	No
Reference:	JAA INT POLs 23/1, 23/3, 25/2, 25/4, 27&29/1	Focussed consultation:	No
		Publication date of the Decision:	in parallel with this CRD

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1. Procedural information

1.1. The rule development procedure

The European Aviation Safety Agency (hereinafter referred to as the 'Agency') developed this Comment-Response Document (CRD) in line with Regulation (EC) No 216/2008[1] (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure[2].

This rulemaking activity is included in the Agency's 4-year Rulemaking Programme under RMT.0223 (MDM.024)[3]. The scope and timescale of the task were defined in the related Terms of Reference (see process map on the title page).

The draft CSs and AMC-20 have been developed by the Agency. All interested parties were consulted through NPA 2014-16[4], which was published on 25 June 2014. 28 comments were received from interested parties, including industry and national aviation authorities.

The text of this CRD has been developed by the Agency.

The process map on the title page contains the major milestones of this rulemaking activity.

1.2. The structure of this CRD and related documents

This CRD provides a summary of the comments and responses as well as the full set of individual comments and responses thereto received to NPA 2014-16.

1.3. The next steps in the procedure

The Agency will publish the individual Decisions for each CS and AMC-20 containing the final text.

1 Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1).

2 The Agency is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as the 'Rulemaking Procedure'. See Management Board Decision concerning the procedure to be applied by the Agency for the issuing of Opinions, Certification Specifications and Guidance Material (Rulemaking Procedure), EASA MB Decision No 01-2012 of 13 March 2012.

3 RMT.0223 (MDM.024) 'HIRF' was combined with RMT.0224 (MDM.025) 'Lightning' prior to its launch.

4 See NPA-2014-16.

2. Summary of comments and responses

28 comments were received from 14 commentators on NPA 2014-16.

Responses to the comments can be summarised as follows:

	Accepted	Partially accepted	Noted	Not accepted	Total
Number of Comments	6	3	11	8	28
%	21 %	11 %	39 %	29 %	100 %

Those 'Noted' were largely supportive of the proposals. In some comments, examples were requested to help in understanding the text. However, the Agency considered this unnecessary as examples are already provided in the referenced industry standards.

One comment questioned a difference between CS 23.1308(a)(2) and the corresponding FAR paragraph. The Agency partially accepted the comment, adding some clarification to the text. The Agency also considered that an equivalent change to CS 23.1306 was valid.

Three comments highlighted the need to review the proposals for CS-23 in light of the General Aviation Road Map and rulemaking task RMT.0498 (Reorganisation of Part 23 and CS-23). This was always the Agency's intention (see Note on page 7 of NPA 2014-16). The outcome of this review will be included in the future Decision related to CS-23.

3. CRD table of comments, responses and resulting text

In responding to comments, a standard terminology has been applied to attest the Agency's position. This terminology is as follows:

(a) **Accepted** — The Agency agrees with the comment and any proposed amendment is wholly transferred to the revised text.

(b) **Partially accepted** — The Agency either agrees partially with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.

(c) **Noted** — The Agency acknowledges the comment but no change to the existing text is considered necessary.

(d) **Not accepted** — The comment or proposed amendment is not shared by the Agency.

(General Comments)	-

comment	*2* comment by: *CAA-NL* Please be advised that the Netherlands has no comments and supports this NPA.
response	*Noted*

comment	*4* comment by: *Austro Control* Austro Control appreciates the proposed intention to include Lightning and HIRF requirements to the airworthiness codes. Due to the fact that not only large aircraft would be vulnerable to lightning strikes and HIRF environments and for the purpose of communality with regulations issued by the FAA, Austro Control would fully support Option 3 "Amend CS-23, CS-25, CS-27, CS-29 and AMC-20" with the following comment: Austro Control experienced during several projects with different kind of aircraft types (CS-25 and CS-23) that the applicant proposed ED14()/DO-160() single unit testing as sole means of showing of compliance in accordance with HIRF requirements for Level A Display system. Statements from applicants included that the DO-160()/ED14 testing of the single unit of a system reflects the aircraft installation situation to the maximum intent possible. Pursuant to 6.d.9.e.(9), we would recommend to make this item more clear. Examples have been shown to help to understand the background. One possible example could be that a Level A display system ED-14() HIRF test should include the displays, any symbol-generators (if foreseen), the equipment required for the Level A functions (such as air data, altitude, attitude, …) and those required for other functions (NAV, GPS, FMS…) tested at once during the ED-14() HIRF test. Clarification could reduce project hours caused by discussions and we expect that several aircraft types will be retrofitted with displays due to increased reliability of these systems compared to the mechanical instruments and the fact that such displays might have the potential to support possible future operational requirements as well as "nice to have" features. Best regards

	Franz Graser
response	*Noted* Clarity is already provided in Figure 1 (page 55), which clearly shows the routes to HIRF compliance. If testing is to performed, then the integrated system test of Step 5 must be performed. This can be augmented by the equipment test of Step 4, but this is optional. Examples are provided in ED-107A.

comment	*5* comment by: *Airbus Helicopters* Airbus Helicopters supports the contents of this NPA.
response	*Noted*

comment	*6* comment by: *Luftfahrt-Bundesamt* We welcome the organizational consolidation accompanied by the harmonization between EASA and FAA.
response	*Noted*

comment	*7* comment by: *Swiss International Airlines / Bruno Pfister* Swiss Intl Air Lines Ltd takes note of NPA 204-16 without further comments
response	*Noted*

comment	*18* comment by: *DGAC France* DGAC France feels like it is benefic to have requirements linked to HIRF and lightning directly included in the certification specifications. It is more readable and obvious for the postulant to know what will be applicable for his/her project. Nevertheless, it will be essential to review the proposed requirements for CS-23 in light of the general aviation roadmap and also rulemaking task RMT.0498 (Reorganisation of Part 23 and CS-23) as stated in note page 7, especially for the lower end of the future Part23 aircraft category.
response	*Noted* The output from this rulemaking task for CS-23 will be coordinated with the ongoing GA Road Map activities.

comment	*19* comment by: *René Meier, Europe Air Sports* Europe Air Sports, European Powered Flying Union and Aero-Club of Switzerland pepared common comments on NPA 2014-16. The three organisations thank the Agency for the preparation of this NPA, a highly technical paper which will affect our operations only indirectly, the "CS" being basic documents for manufacturers.

	Efforts were concentrated on CS-23 and CS-27 proposals, CS-25 and CS-29 products being a little bit out of our scope, our community mostly flying aircraft of the lighter end of the fixed-wing- or the rotary wing species. The team preparing our comments was not aware of any incident or accident caused by HIRF/lightning involving aircraft below 2730 kg MTOM, the team sees increased future risks and, therefore, asks for a risk-based approach to solutions appropriate to General Aviation's needs.
response	*Noted* The output from this rulemaking task for CS-23 will be coordinated with the ongoing GA Road Map activities.

comment	*27* comment by: *René Meier, Europe Air Sports* Personal remark: Flight International, edition 23-29 September 2014, page 43, published an article presenting Billy Martin, director Wichita State University's electromagnetic effects laboratory. I read there: "Electronics can be susceptible to various electromagnetic environment threats, such as lightning, HIRF and even portable electronic devices. All electronics are susceptible in some manner at some power level..." After reading Billy Martin's text I have this question: Would it not be fruitful to integrate portable electonic devices in the work leading later to a CRD and an Opinion? Rationale: Many different portable electronic devices, various types of electronic flight bags are used on-board of aircraft of all types. I quickly checked NPA 2014-14 Personal Electronic Devices II. Connected with cargo tracking devices I found the HIRF topic, but nowhere I found the combination "HIRF and lightning".
response	*Not accepted* NPA 2014-14 is proposing an operational rule which affects different rules and is being pursued as a separate rulemaking task.

comment	*28* comment by: *EUROCONTROL* **General comment by EUROCONTROL** EUROCONTROL is not in a position to make comments concerning a possible excessive aggregated level of radiation, including at and around airports, as it has no visibility on non-aviation sources of radiation. Cross-checking whether or not typical peak field strengths of installed ground systems are compatible with the Tables provided in the document could be useful. However, this would also require on the field knowledge and measurement since here we are looking for the aggregated radiation. EUROCONTROL has no detailed knowledge on the high intensity field values that can be expected at or around airports and, therefore, cannot validate the content of Tables from an aviation perspective with a view to confirming whether or not the magnetic radiation at the main airports is below the various V/m values

	given for the field strength. It can be added that, in the case these values were too stringent, manufacturers, ANSPs and Airport Operators would possibly have an issue.
response	*Noted* An explanation of how the HIRF environment was established can be found in ED-107A, Section 3.

2. Explanatory Note - 2.1. Overview of the issues to be addressed p. 6

comment	*8* comment by: *Evektor* Paragraph 15, second bullet states that: "*No significant differences were found.*" (between 20-158 and 20-158A). Evektor find information in missing paragraph (2) (AC 20-158A, page 21, chapter *g. Step 7 — Aircraft Assessment Decision*) as important.
response	*Accepted* Text has been added in AMC 20-158 for harmonisation.

comment	*11* comment by: *Garmin International* Section 2.1 #16 Current text: … for Level B/C systems the Agency and FAA refer to different revisions of ED-14G/DO-160G due to the different time of their respective regulation. This results in different HIRF environments being applied during the equipment tests. Applicants should be aware of this difference and ensure testing is performed to meet the more stringent requirements. Currently under the FAA, the AC21-16G section 7(f) allows use of DO-160E that allows existing equipment qualified to these levels to meet Level B and C requirements for HIRF. Test methods from DO-160E and DO-160G both can be considered worst-case depending on the cable impedance. When the cable bundle is low impedance, the test current can be achieved at lower forward power during the DO-160G method than the DO-160E method. In this case the DO-160E method would result in higher current induced on the bundle. For high impedance cable, both the DO-160E and DO-160G method might not achieve the test current; however, the DO-160G method requires an increase in forward power up to 6dB to try and achieve the test current. Note that anyone taking credit from DO160E will be using Cat R, whose current level is also higher above 40MHz than the HIRF Test Level 1. Given the lower criticality, the DO160E method should be considered equivalent and align/harmonize with the AC21-16G to allow consistent certification approaches, and greater harmonization which is one of the objectives of this NPA, ref section 2.2 #3. Proposed text: … for Level B/C systems the Agency and FAA refer to different revisions of ED-14G/DO-160G due to the different time of their respective regulation. This results in different HIRF environments being applied during the equipment tests. Applicants should be aware of this difference and should use the latest ED-14G/DO-160G when possible; however, DO160E also will be considered acceptable and ensure testing is performed to meet the more stringent

	requirements.
response	*Not accepted* The referenced version of the document should be used. Any use of alternatives will be subject to Agency agreement.

comment	*22* comment by: *DGAC France* Efforts must be made to harmonize requirements beetwen EASA and FAA in order to ease import and export of aircraft.
response	*Noted* Where possible, every effort has been made to enhance harmonisation. However, this does not mean blind acceptance of text; therefore, differences may occur where the Agency has judged that FAA text is inappropriate or inadequate, or that further clarification is needed to avoid any misunderstanding.

2. Explanatory Note - 2.4. Overview of the proposed amendments p. 7-8

comment	*12* comment by: *Garmin International* Section 2.4 Current text: Note: … *1) contain requirements based on proportionate performance, complexity and type of operation;* Today a part 23 Class I aircraft is required to meet the same requirement as the largest aircraft type under part 25 for both HIRF and lightning. There does not seem to be any "proportionate" consideration under HIRF and lightning that is applied in other areas of certification such as software/AEH for part 23 aircraft. Therefore, Garmin requests that EASA consider this in defining requirements for part 23 aircraft. For HIRF/lightning, Garmin would like to see a similar reduction in certification rigor that is currently practiced with software/AEH (e.g. DAL) for the low end of part 23 aircraft. Garmin believes that the use of technology to increase situational awareness greatly improves safety for these classes of aircraft and the cost and schedule impact of meeting the same requirements as part 25 hinders the ability to deploy systems that potentially could enhance safety.
response	*Noted* As noted in the NPA, the outcome of this activity will be subject to further review against the objectives of the GA Road Map. It should be noted that the certification levels applied relate directly to the environmental hazards likely to be encountered in operation. The level of safety applied is related to the criticality of installed systems. Proportionality is embedded in these rules as the number and criticality of systems is likely to reduce in the lower weight categories of aircraft.

3. Proposed amendments - CS-23 - CS 23.1306 p. 9

comment	*13* comment by: *Garmin International* Section 3.1 ***EASA Proposal 2: Create CS 23.1308 as follows:*** (a)(2) the system automatically recovers normal operation of that function, in a timely manner, after the aeroplane is exposed to HIRF environment I, as described in Appendix K; and **Current FAA Rule:** (a)(2) The system automatically recovers normal operation of that function, in a timely manner, after the airplane is exposed to HIRF environment I, as described in appendix J to this part, *unless the system's recovery conflicts with other operational or functional requirements of the system;* and The red text in the FAA rule does not exist in the EASA rule. This missing text has been included in past EASA CRIs. Garmin believes this should be retained in the EASA rule. This provides harmonization with FAA which is one of the objectives of this NPA, ref section 2.2 #3. This comment also applies to the Parts 25, 27, and 29 regulations.
response	*Partially accepted* The Agency's concern with the deleted text was that the 'other operational or functional requirements of the system' was not related to any level of criticality. It could, therefore, be interpreted that automatic recovery of a critical function could be suppressed if it interfered with a non-critical function, which is obviously undesirable. However, it is also recognised that automatic recovery of a critical function may, in some circumstances where a back-up system is available, create an unsafe condition if it were to interfere with another critical function. The missing text is, therefore, reinserted but with further clarification added. Furthermore, the rationale is equally applicable to lightning, so the same clause is added to CS 23.1306.
comment	*23* comment by: *Piaggio Aero Industries* With reference to proposed 23.1306 (a), keeping in mind the definition of "adverse effect" stated in relevant AMC ("*Adverse Effect. A lightning effect resulting in system failure, malfunction, or misleading information to a degree that is unacceptable for the specific aircraft function or system addressed in the system lightning protection regulations"),* we understand that during lightning an impact on the function (performed by one or more equipmeny) may occur, as long as it is not unacceptable. As an example, loosing availability of an engine parameter for a short period (e.g. 0.5 sec) would be acceptable, provided the same parameter is available to the crew without any action ("automatically recover") after the lightning. We suggest clarifying this, possibly adding some examples in the AMC/GM. With reference to proposed 23.1306(b), we understand that a pilot action is acceptable to

recover normal operation following lightning (since there is no mention to "automatic recover"). We suggest replacing "function recovers normal operation" with "function can be restored to normal operation, automatically or following emergency/abnormal procedures, in a timely manner"….
We also suggest adding a list (or some examples) of procedures that are not acceptable (such as using CB to remove and reapply power to a system, or similar), and other that can be acceptable.

We also suggest adding in the AMC a definition of "Malfunction" and "misleading information" (from page 28, we understand that definition from AC 23-1309 should apply)

response

Not accepted

Examples are provided in related industry standards (e.g. ARP 5415A, ARP 5416A/ED-105, ARP 5577/ED-113).

Proposed changes to CS 23.1306(b) are a means of compliance against an objective rule. The list of examples would also be prescriptive.

'Malfunction' and 'Misleading Information' are terms which are already widely used.

resulting text

CS 23.1306 Electrical and electronic system lightning protection
(a)(2) the system automatically recovers normal operation of that function in a timely manner after the aeroplane is exposed to lightning, unless the system's recovery conflicts with operational or functional requirements of the system that would prevent continued safe flight and landing of the aeroplane.
...

CS 23.1308 High-Intensity Radiated Fields (HIRF) protection
(a)(2) the system automatically recovers normal operation of that function, in a timely manner, after the aeroplane is exposed to HIRF environment I, as described in Appendix K, unless the system's recovery conflicts with operational or functional requirements of the system that would prevent continued safe flight and landing of the aeroplane; and
...
(Similar changes to CS-25, CS-27 and CS-29)

3. Proposed amendments - CS-23 - CS 23.1308 p. 9-10

comment

24 comment by: *Piaggio Aero Industries*

With reference to proposed 23.1308 (a), keeping in mind the definition of "adverse effect" reported in relevant AMC ("***Adverse Effect:*** *HIRF effect that results in system failure, malfunction, or misleading information to a degree that is unacceptable for the specific aircraft function or system addressed in the HIRF regulations. A determination of whether a system or function is adversely affected should consider the HIRF effect in relation to the overall aircraft and its operation"),* we understand that during/after exposition to HIRF, an impact on the function may occur, as long as it is not unacceptable. As an example, impact on an engine parameter for a short period could be acceptable, provided the same parameter is recovered without any action ("automatically recover") after exposition to

	HIRF. We suggest to clarify this, possibly adding some examples in the AMC/GM. With reference to 23.1308 (b) and (c), we understand that an impact on function may occur, as long as it is not unacceptable. Using of procedures to be accomplished by flight crew can be envisaged to restore normal operations of the affected function
response	*Not accepted* Examples are provided in related industry standards (e.g. ED-107). Proposed changes to CS 23.1308(a) are a means of compliance against an objective rule. The list of examples would also be prescriptive.

3. Proposed amendments - CS-23 - CS 23.1309 p. 10

comment	*1* comment by: *THALES AVIONICS* Page 10 Reference : §3.1 Proposal 4 Current NPA text : 18-40GHz levels described Thales Concern & Rationale for action : Today, HIRF tests are stopped at 18GHz. Mandatory expansion to 40 GHz may be burdensome with no added value for many equipment. Action & rewording proposal : 18-40GHz testing should be required as an option. Indicate that 18-40GHz testing iis as an option for equipment unless explicitely necessary.
response	*Not accepted* AMC 20-158 paragraph 9.c (Step 3 – System assessment decision) clearly states that testing above 18 GHz is not required if data and design analysis show that the integrated system test results satisfy the pass criteria from 12 GHz to 18 GHz.

3. Proposed amendments - CS-25 - CS 25.1316 p. 12-13

comment	*14* comment by: *Garmin International* Section 3.1 (b) ***Proposal 5: Amend CS 25.1316 by deleting the existing text and replacing with the following:*** (b) Each electrical and electronic system that performs a function, for which failure would reduce the capability of the aeroplane or the ability of the flight crew to respond to an adverse operating condition, must be designed and installed so that the function is recovered in a timely manner after the aeroplane is exposed to lightning. **Current FAA Rule:** (b) Each electrical and electronic system that performs a function, for which failure would

	reduce the capability of the airplane or the ability of the flightcrew to respond to an adverse operating condition, must be designed and installed so that the function *recovers normal operation* in a timely manner after the airplane is exposed to lightning. The red text difference does not exist in the Parts 27, and 29 rules. Recommend CS 25.1316 (b) read the same as CS 27/29.1316 (b).
response	*Accepted*

3. Proposed amendments - CS-25 - CS 25.1317 p. 13

comment	*15* comment by: *Garmin International* ***Proposal 6: Create CS 25.1317 as follows:*** (a)(2) The system automatically recovers normal operation of that function, in a timely manner, after the aeroplane is exposed to HIRF environment I, as described in Appendix R; and **Current FAA Rule:** (a)(2) The system automatically recovers normal operation of that function, in a timely manner, after the airplane is exposed to HIRF environment I, as described in appendix L to this part, *unless the system's recovery conflicts with other operational or functional requirements of the system*; and The red text in the FAA rule does not exist in the EASA rule. This missing text has been included in past EASA CRIs. Garmin believes this should be retained in the EASA rule. This provides harmonization with FAA also which is one of the objectives of this NPA, ref section 2.2 #3.
response	*Partially accepted* The Agency's concern with the deleted text was that the 'other operational or functional requirements of the system' was not related to any level of criticality. It could, therefore, be interpreted that automatic recovery of a critical function could be suppressed if it interfered with a non-critical function, which is obviously undesirable. However, it is also recognised that automatic recovery of a critical function may, in some circumstances where a back-up system is available, create an unsafe condition if it were to interfere with another critical function. The missing text is, therefore, reinserted, but with further clarification added. Furthermore, the rationale is equally applicable to lightning, so the same clause is added to CS 25.1316.

3. Proposed amendments - AMC-20 - AMC 20-136 p. 23-42

comment	*16* comment by: *Garmin International*

	AMC 20-136 Section 8.f The section refers to ED-14**G**. These should be referred to without version. Previous versions are also acceptable. Comment applies throughout the rest of the document.
response	*Not accepted* The referenced version of the document should be used. The use of alternatives will be subject to the Agency's agreement.

comment	*17* comment by: *Garmin International* AMC 20-136, Table 3, row Level 3 The sentence "Examples of such areas are avionics bays not enclosed by bulkheads, cockpit areas, and locations with large apertures (that is, doors without electromagnetic interference (EMI) gaskets, windows, access panels, and so on)." should be joined together rather than being separate paragraphs.
response	*Accepted*

comment	*21* comment by: *René Meier, Europe Air Sports* Appendix 1: Definitions and Acronyms: Continued Safe Flight and Landing page 41/80 Fifth sentence: "For CS-23 aeroplanes, it is not necessary to land at an airport." Please replace "airport" with "aerodrome". Or, even better, change the whole sentence and write "For CS-23 aeroplanes a landing on any field considered suitable by the pilot-in-command is acceptable." For CS-25 or large aeroplanes "airport" is the correct term. Rationale: The term "airport" implies a large installation, "aerodrome" is the more general term. Then: Our alternative proposal reflects clearer what a pilot-in-command has to do.
response	*Not accepted* The Agency believes that, when read in context, the intent of the original text is clear.

comment	*25* comment by: *Piaggio Aero Industries* With reference to page 31, table 2, first row, We suggest adding the means of protection, as follow: Describe systems' installation, including unusual or unique features, and adopted means of protection;
response	*Not accepted* Means of protection should be described as part of the system's installation.

3. Proposed amendments - AMC-20 - AMC 20-158 p. 43-74

comment	*3* comment by: *UK CAA*

Page No: 65

Paragraph No: Proposal 19, paragraph 10, Steps to Level Band C and D System HIRF Compliance. d. Step 4 – Equipment Test (1)

Comment: Compliance for Level B and C systems can be accomplished using ED-14G Section 20 Category RR testing. However, the text identifies that only the alternative modulation for radiated susceptibility can be used to provide compliance. Within ED-14E, two methods were presented, and it was the alternative modulation variation of that test that could be used. However, at issue F, ED 14 removed the "other" test method leaving only the test that was accepted (as the alternative) but it is now the only test method and not an alternative. This has been carried over to ED-14G and thus the reference to the test as the alternative methodology is redundant as there is only one method presented.

Reference can now be made to the test for Category RR without needing to refer to modulations.

Justification: Referring to accepted test method as the Category RR test using the Alternative modulation is likely to cause confusion because the accepted method is the only method presented in issue G of ED-14.

Proposed Text: Delete the text as shown below:

"ED-14G, Section 20 laboratory test procedures should be used, using equipment test levels defined in the regulations. The test levels used depend on whether the system is categorized as level B or C. Equipment HIRF test level 1 or 2, as applicable, should be used for level B systems. ED-14G Section 20, Category RR (using the alternative modulation for radiated susceptibility), satisfies the requirements of equipment HIRF test level 1."

response *Accepted*

comment *9* comment by: *Evektor*

AMC 20-158, page 60, chapter *g. Step 7 – Aircraft Assessment Decision* does not contain following text from AC 20-158A (page 21- *g. Step 7 — Aircraft Assessment Decision*):
"(2) Integrated display systems include the display equipment, control panels, and the sensors that provide information to the displays. In some systems, the sensors also provide information to level A systems that are not displays. For example, if the sensors also provide information to Level A flight controls, you must use actual transfer functions and attenuation when demonstrating compliance for these sensors and the flight controls."

response *Accepted*

Text has been added in AMC 20-158 for harmonisation.

comment *10* comment by: *AIRBUS*

the comment is related to chapter 6.b.2 Safety assessment page 48-49

Proposal:

Add the following before the last sentence in paragraph 6.b.(2) to read:

"The safety assessment should consider the common cause effects of HIRF, particularly for highly integrated systems and systems with redundant elements"

Rational:

Airbus proposes to highlight the specificity of HIRF, that has to considered as a common cause of failure to several systems.

In addition, the AMC 20-158 will be harmonised with FAA AC 20-158A

response *Accepted*

comment *26* comment by: *Piaggio Aero Industries*

Page 48, first line: There is a reference to AC 23-1309-1D (present issue is -1E, as also stated at page 44). Is that a typo?
We also suggest adding in the AMC a definition of "Malfunction" and "misleading information" (we understand that definition from AC 23-1309E should apply)

response *Partially accepted*

Typo accepted.
'Malfunction' and 'Misleading Information' are terms which are widely used.

resulting text

AMC 20-158
6.b.2 **Safety assessment.** A safety assessment related to HIRF must be performed to establish and classify the equipment or system failure condition. **Table 1** provides the corresponding failure condition classification and system HIRF certification level for the appropriate HIRF regulations. The failure condition classifications and terms used in this AMC are similar to those used in AC 23.1309-1E and AMC 25.1309, as applicable. Only those systems identified as performing or contributing to functions whose failure would result in catastrophic, hazardous, or major failure conditions are subject to HIRF regulations. Based on the failure condition classification established by the safety assessment, the systems should be assigned appropriate HIRF certification levels, as shown in **Table 1**. The safety assessment should consider the common cause effects of HIRF, particularly for highly integrated systems and systems with redundant elements. Further guidance on performing the safety assessment can be found in AC 23.1309-1D, AMC 25.1309, ED-79A, and SAE ARP 4761.

4. RIA - 4.5. Comparison and conclusion p. 79

comment *20* comment by: *René Meier, Europe Air Sports*

We agree with your conclusion.

Rationale:
Considering progress and innovation experienced during the last few years as regards airframes, avionics, displays, and engine controls, it is obvious that action is required. Also

	for our community "Option 3" is the preferred one, it is perfectly in line with the harmonisation we are looking for, especially when we think of RMT.0498, the rulemaking task bringing maximum harmonisation with FAA in hopefully few years from now.
response	*Noted*