

**Combined Public
DOCUMENT COMMENT LOG**

Originating Office: AIR-132	Document Description: Division Review PROPOSED TSO-C159b	Project Lead/Reviewer Dave Robinson	Reviewing Office: Public-Industry Review	Date of Review: 10 July-10 August 2014
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Commenter	Page & Paragraph	Comment	Reason for Comment	Suggested Change	Comment Resolution
1. Garmin	Page 1, Paragraph 2.a	Section 2.a allows only 18 months after the publication date of this new TSO revision for all products in development against the previous revision to be completed and receive approval against the previous revision.	18 months is a relatively short grace period for products where development cycles can easily exceed 2 years.	Products being developed against the previous TSO revision should be allowed 24 months from the new TSO revision release to finish all qualification and approvals against the previous TSO revision the product was designed and developed against. Garmin appreciates the recent TSO template change to allow 18 months over the previous 6 months, but we believe 24 months is more in line with industry standard development cycles of 2 to 3 years.	Non concur, language is per template.
2. Garmin	Page 1, Paragraph 3	Paragraph 3 states that: NGSS equipment identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements in RTCA, Inc. document RTCA/DO-262B, <i>Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS)</i> , dated	Typical TSO wording specifically limits the scope of the paragraph to include only new models that claim TSO-C159b. Additionally, in a recent discussion on another TSO, FAA AIR-120 indicated that test sections are not part of the minimum functional and performance requirements that the equipment must meet in order to provide the intended function defined in paragraph 3.a of this TSO. In other words, TSO deviations do not need to be obtained in cases where the tests are not conducted precisely in	Suggest changing to: New models of NGSS equipment that claim this TSO and are identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements in Sections 2.1 and 2.2 of RTCA, Inc. document RTCA/DO-262B, <i>Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS)</i> , dated June 17, 2014.	Non concur, language is per template.

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		June 17, 2014.	accordance with the procedures defined within the MPS test section although the intent of the test must be followed and any modifications to the test must be validated.		
3. Garmin	Page 2-3, Paragraph 3.a	Table 3-2 heading "Requirements" is inconsistent with Table 3-1 heading "Requirement".	Looks like a typo.	Change Table 3-2 heading to "Requirement".	Concur, change made.
4. Garmin	Page 2-3, Paragraph 3.a	Table 3-1 and Table 3-2 Requirements column refer to Appendix E Sections 2.2.1.1.X that do not exist in DO-262B as numbered sections.	<p>Incorrect references. It appears that the intention of DO-262B Appendix E was to include sections 2.2.1.1.1 to 2.2.1.1.11 as it refers to these sections in paragraph 2.2.1.1.</p> <p>If Table 3-2 keeps the references to 2.2.1.1.X, then all of the "X" values should be reduced by 1 to keep the subparagraph numbered logically. The range would be 2.2.1.1.4 to 2.2.1.1.11 instead of the shown 2.2.1.1.5 to 2.2.1.1.12.</p>	Update all references to Appendix E Section 2.2.1.1.	Non concur, all references line up as described in TSO.
5. Garmin	Page 2, Paragraph 3.a, Table 3-1, Row 1	<p>This section states:</p> <p>The AES1 cannot support voice calling</p> <p>This statement is confusing when read along with the AES2 description.</p>	The reader must have knowledge of Table 4-1 to see that the AES1 system refers to an Iridium "SBD only" LRU. Without this knowledge, the AES1 categorization is otherwise indistinguishable from a more capable Iridium LBT.	Make the descriptions of AES1 and AES2 more distinct such that it is clear to the reader that the descriptions are not referring to the same type of transceiver. Consider stating that AES1 is an SBD-only transceiver while AES2 is capable of multiple services.	Concur, change made. This paragraph establishes the intended function of the equipment which is used to help determine the safety criticality.
6. Garmin	Page 3, Paragraph 3.b	<p>This section states:</p> <p>The NGSS will support both data and voice communications</p> <p>This is ambiguous due to the use of the term "will."</p>	The term "will" does not imply either a requirement or permission.	If the NGSS must support both data and voice communications, change "will" to "shall." If support for both functions is optional, change "will" to "may."	Partial concur, This paragraph is not intended to establish additional equipment requirements such as shall, must, should is not applicable.

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7. Garmin	Page 4, Paragraph 3.c	The minor failure condition defined in paragraph 3.c is not consistent with the major failure condition identified in DO-262B section 2.2.3.10.	<p>DO-262B section 2.2.3.10 identifies undetected corruption (including spoofing) of FANS messages as a major failure condition and requires a security analysis be performed using RTCA DO-326.</p> <p>SC-216 has made substantial changes in the drafting of DO-326A, which will be published by mid-August. The references to DO-326 and the processes it defines are no longer accurate and need to be revisited to determine the context in which they still apply.</p> <p>FAA Policy Statement PS-AIR-21.16-02 contains specific exclusions for types of systems that need to be considered for a security analysis. Any changes to the TSO regarding security requirements should take the content of this policy statement in to consideration.</p> <p>The applicability of security requirements is in flux. As noted in the scope statement of DO-326A:</p> <p>“...and is intended to be used ... in the context of part 25 for Transport Category Aircraft which include an approved passenger seating configuration of more than 19 passenger seats. This guidance is not intended for CFR parts 23, 27, 29, 33.28, and 35.15, normal, utility, acrobatic, and commuter</p>	<p>Draft material for the TSO that overrides all DO-326 references in DO-262B with references to DO-326A.</p> <p>Specifically note that overall FAA policy for various functions will govern the need for a security analysis, so it may not be applicable depending on the combination of functions supported by the system.</p> <p>The new TSO material must take the limitations imposed by the DO-326A scope and FAA PS-AIR-21.16-02 into account and be consistent with both.</p>	<p>Partially Concur. While we will not use the exact language suggested by the commenter, we agree with the rationale for the comment and will meet the intent of the suggested change as follows: 1) Add language to Paragraph 3 removing the requirement for the equipment to meet Section 2.2.3.10, Information Security, of Normative Appendix D or E (as applicable) of RTCA/DO-262B. 2) Add- note under Paragraph 3. ‘There are no MPS security requirements for the NGSS equipment. However, a security risk assessment may be required at the time of installation, and, if needed, security controls may be implemented in connected aircraft systems or addressed by flight crew procedures’.</p>

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			<p>category airplanes, normal category rotorcraft, transport category rotorcraft, engines, and propellers”</p> <p>Any security requirements should keep this scope limitation in mind as well.</p>		
8. Garmin	Page 4, Paragraph. 3.c	<p>Includes the statement:</p> <p>Develop the system to, at least, the design assurance level equal to this failure condition classification.</p> <p>Wording needs to change to allow failure condition to be determined at the aircraft level.</p>	<p>This statement implies the failure condition classification of an appliance is determined by the TSO regardless of mitigations employed to meet aircraft level safety requirements such as redundant appliances/systems. Unless the DAL cannot be affected by the installation, the aircraft System Safety Assessment should determine the failure classification and by extension, the design assurance level (DAL) requirement. The aircraft FHA/SSA ultimately determines the DAL requirement for a particular installation. Specifying the DAL at the appliance level without the benefit of the specific aircraft level FHA/SSA means that in some cases the DAL will undoubtedly be higher and more costly than necessary. This will have a chilling effect on the installation of new, safety enhancing technologies since the cost will be greater than necessary. It is possible to build and certify a TSOA appliance that cannot be approved for installation in one or more aircraft types because it does not have the required DAL. Similarly, just because the</p>	<p>Suggest changing to the following wording:</p> <p>Develop the system to, at least, the design assurance level required by the anticipated installation for the functionality defined in paragraph 3b.</p>	Non concur, language is per template.

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			<p>appliance meets a TSO DAL does not mean it can be approved for installation. We recommend that no failure classification/DAL requirement be included in a TSO when the installation can affect or mitigate the hazard level and therefore consideration should be given to revising paragraph 3.c in this TSO to the general guidance in the Recommendation column.</p>		
9. Garmin	Page 4, Paragraph. 3.e	<p>Includes the statement:</p> <p>Demonstrate the required performance under the test conditions specified in the Normative Appendix D/E, section 2.3, of RTCA/DO-262B, <i>Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems(NGSS)</i>, dated June 17, 2014 using standard environmental conditions and test procedures appropriate for airborne equipment.</p> <p>Wording needs to change to allow other Environmental standards as appropriate.</p>	<p>The environmental Qualification Paragraph does not specifically allow different standard environmental condition and test procedure than RTCA/DO-160G. All other new TSOs allow this.</p>	<p>Add the standard Environmental Qualification statement:</p> <p>A different standard environmental condition and test procedure other than RTCA/DO-160G, <i>Environmental Conditions and Test Procedures for Airborne Equipment</i>, dated December 8, 2010, may be used, provided the standard is appropriate.</p>	<p>Partial concur, the stated language was missing from draft template. Appropriate language was added to the document.</p>
10. Garmin	Page 4, Paragraph. 3.e, Note	<p>The note erroneously references paragraph 3.g</p>	<p>The reference should be to paragraph 3.h, the Deviation paragraph.</p>	<p>Change the note in paragraph 3.e to reference paragraph 3.h</p>	<p>Concur, change made.</p>

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11. Garmin	Page 4, Paragraph 3.f	Reference to paragraph 3.c is not bold	Formatting	Make reference bold	Concur, change made.
12. Garmin	Page 4, Paragraph 3.g	Paragraph heading is not underlined	Formatting	Underline heading Electronic Hardware Qualification	Concur, change made.
13. Garmin	Page 4, Paragraph 3.g	The sentence regarding failure condition classifications is referred to paragraph 3.b which is Functionality	Incorrect reference	Change reference to paragraph 3.c Failure Condition Classifications	Concur, change made.
14. Garmin	Page 5, Paragraph 4.b	<p>Includes the statement:</p> <p>Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, the TSO number, class and subclass identification:</p> <p>The Order 8150.1C TSO template does not include the "equipment class and subclass" phrase.</p>	Garmin is routinely granted deviations from TSO requirements to mark the "applicable equipment class(es)" as the equipment does not have sufficient space to include this as well as all other required markings (e.g., multiple TSOs and SW level, etc. that appear in other TSOs). This deviation is granted through use of a marking similar to the example in Order 8150.1C ¶ 7-4.e.(4).(b) "See Inst Mnl for Addtl TSO approvals and/or markings."	<p>Remove "class and subclass identification" from paragraph 4.b.</p> <p>Additionally, relocate paragraph 4.b(3) to under 5.a to support a new paragraph under 5.a requiring the equipment class and subclass to be included in the "Manual(s)".</p>	Non concur, the language in paragraph clearly states" Installation procedures and limitations sufficient to ensure that the NGSS equipment class and subclass components when installed according to the Original Equipment Manufacturers (OEM's) installation manual or operational procedures, still meets this TSO's requirements for NGSS equipment. 4.d allows for electronic part marking in lieu of physical marking.
15. Garmin	Page 5, Paragraph 4.b.(2)	<p>Paragraph 4.b.(2) states:</p> <p>Each subassembly of the article that you determined may be interchangeable.</p>	The language for this requirement is confusing. This could mean that a stuffed printed circuit board needs the TSO number.	Suggest removing the statement or if removing causes problems, work with industry to establish wording that is better understood.	Non concur, language is per template.

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		This language is confusing.			
16. Garmin	Page 7, Paragraph 5.a.5	<p>Includes the statement:</p> <p>A summary of the test conditions used for environmental qualifications for each component of the article. For example, a form as described in RTCA/DO-160G, <i>Environmental Conditions and Test Procedures for Airborne Equipment, DO-262B, section 2.3.</i></p> <p>The above reference runs together DO-160G and DO-262B, section 2.3 “Equipment Performance – Environmental Conditions”. So the reference intention is unclear.</p>	Clarification of reference.	Remove the “DO-262B, section 2.3” text and replace with “Appendix A” to show the correct DO-160 reference.	Concur, draft update to latest template.
17. Garmin	Page 8, par 5.e	TSO paragraph 5.e and its subparagraphs include definition of non-TSO functions and the data to be submitted to the ACO for non-TSO functions. This guidance is inconsistent with Order 8110.4C CHG 4.	TSO paragraph 5.e states “Identify functionality or performance contained in the article not evaluated under paragraph 3 of this TSO (that is, non-TSO functions).” Use of the term “performance” in the definition of a non-TSO function is inconsistent with the Order 8110.4C CHG 4 paragraph 6-9.b.(1) and 6-9.b.(3)(a) guidance regarding how to define a non-TSO function. The issue is non-TSO should not be defined as “performance”. It will create difficulty if these criteria are	Adjust the wording in the TSO (and template) to be consistent with the 8110.4C CHG 4 intent.	Non concur, language is per template. FAA is working to resolve inconsistencies with 8110.4 and 8150.1.

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			<p>used. For example, if a TSO requires a minimum 10 watt transmitter and a company makes equipment that is robust at 11 watts, the performance exceeding the TSO is not called out under the TSO; consequently, by the paragraph 5.e “performance” definition, the 11 watt transmitter has a non-TSO 1 watt capability. The distinction of a “function that can be accomplished outside the TSO box” as is specified in Order 8110.4C CHG 4 paragraph 6-9 is critical to making non-TSO function work long term.</p>		
18. Garmin	Page 9, Paragraph 6.g	Reference to paragraph 3.f is not bold	Formatting	Make reference bold	Concur, change made.
19. Garmin	Page 10, par 7.b	TSO paragraph 7.b contains wording that is inconsistent with Order 8110.4C CHG 4.	TSO paragraph 7.b includes additional guidance about what furnished data should be provided to an operator or repair station when the equipment includes a non-TSO function. The problematic guidance states “include one copy of the data in paragraphs 5.e.(1) through 5.e.(4).” This guidance is inconsistent with Order 8110.4C CHG 4. Order 8110.4C CHG 4 paragraph 6-9.b.(6) defines the FAA-industry agreed data that must be provided to an installer when equipment includes a non-TSO function.	Adjust the wording in the TSO (and template) to be consistent with the 8110.4C CHG 4 intent.	Non concur, language is per template. FAA is working to resolve inconsistencies with 8110.4 and 8150.1.

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<p>Greg Wales Technical Specialist (Civil)</p> <p>20. Thales UK</p>	<p>Page 2, Table 3-1:</p>	<p>AES4, Requirement stated as “Appendix E, Section 2.2.1.1.1”. In fact Appendix E section 2.1.1 has not been given numbered sub-sections, Similar for AES6 and AES7.</p>		<p>So it should really be “Appendix E, Section 2.1.1, AES4 Definition and Requirements”.</p>	<p>Non concur, DO-262B, section 2.2.1.1.1 AES4 Definition and Requirements, page E-31 does exist. Section 2.1.1 provides for the design and manufacture of the equipment shall provide for an installation that does not impair the airworthiness of the aircraft.</p>
<p>21. Greg Wales Technical Specialist (Civil)</p> <p>Thales UK</p>	<p>Page 3, Table 3-2:</p>	<p>It would be useful to repeat row 2 on this page (column headings).</p>			<p>Concur, change made to column heading.</p>
<p>22. Greg Wales Technical Specialist (Civil)</p> <p>Thales UK</p>	<p>Page 3, Table 3-2:</p>	<p>For rows 6MA through DF. Again Appendix E section 2.1.1 has not be given numbered sections, so the quoted sections 2.2.1.1.5 through 2.2.1.1.12 do not exist. Should be replaced by, for example for 6MA: “Appendix E, Section 2.2.1, 6MA Definition and Requirements”.</p>			<p>Non concur, see Appendix E, Section 2.2.1.1.5-2.2.2.2.12, I believe the reviewer is referring to Appendix D on this comment</p>

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<p>23. Greg Wales Technical Specialist (Civil)</p> <p>Thales UK</p>	<p>Page 6, Table 4-1:</p>	<p>Table has been split between pages 5 and 6; it would be useful to repeat the first two rows at the top of page 6 to see the column headings.</p>			<p>Concur, change made to column heading.</p>
<p>24. Friedhelm RUNGE Avionics Systems Section Manager European Aviation Safety Agency</p>  <p>Tel.: +49 221 89990-4084 - Mobile: +49 171 9785563 Postal: Postfach 10 12 53, 50452 Cologne, Germany 21. An agency of the European Union</p>		<p>The FAA is proposing the TSO-C159 update with the title “Next Generation Satellite Systems (NGSS) Equipment”.</p> <p>We in EASA had a little problem with the title as it refers to a next generation without specifying what this next generation would be. We had modified the title in the ETSO-C159a to: Avionics Supporting Next Generation Satellite Systems (NGSS) = Airborne Iridium Satellite Transceiver for Voice or Data.</p> <p>In the new RTCA/DO-262B an appendix addressing as well INMARSAT technology has been added.</p> <p>I assume it may be important to reference to the NextGEN program but it is important as well to describe the content of a</p>			<p>Comment acknowledged, no change made. NGSS is considered generic, consistent, and concise. The FAA does not wish to publish a TSO to a specific manufacture, so to reference to a generic named title is more appropriate.</p>

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		<p>TSO/ETSO properly and in an easy to understand way in the title. Unfortunately the current title does not give this clear picture to me. What do you think about the following proposal: Airborne INMARSAT or IRIDIUM Satellite Transceiver for Voice or Data?</p> <p>Best regards</p> <p>Friedhelm</p>			
25. Embraer	Page 4, paragraph 3.g.	In regards to failure condition classification, paragraph 3.g should reference paragraph 3.c, instead of 3.b.	Typographical error. Failure condition classification is defined on paragraph 3.c, not on 3.b.	<p>The text passage: <i>“g. Electronic Hardware Qualification. If the article includes complex custom airborne electronic hardware, develop the component according to RTCA, Inc. document RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware, dated April 19, 2000, to at least the design assurance level consistent with the failure condition classification defined in paragraph 3.b of this TSO.”</i> should be changed to: <i>“g. Electronic Hardware Qualification. If the article</i> </p>	Concur, change made.

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				<p><i>includes complex custom airborne electronic hardware, develop the</i></p> <p>Commenter</p> <p>Page & Paragraph</p> <p>Comment Reason for Comment Suggested Change Comment Resolution</p> <p><i>component according to RTCA, Inc. document RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware, dated April 19, 2000, to at least the design assurance level consistent with the failure condition classification defined in paragraph 3.cb of this TSO.”</i></p>	