Clearance Record
DOCUMENT COMMENT LOG

Originating Office:	Document Description:	Project Lead:	Reviewing Office:	Date of Review:
AIR-130	TSO-C145d/C204 Consolidated Public Comments	Kevin Bridges		

Comment Number	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
1. Thales Avionics		We concur with this new approach of certifying sub assembly. Nevertheless as EU industrial, we are keen to have a harmonized approach between FAA and EASA on this topic in order to keep a level playing field.		FAA and EASA to harmonize their position on this subject.	**Accepted.** EASA is aware of these draft TSOs, but the FAA cannot guarantee EASA will adopt an ETSO version. However, the FAA has not received an indication that EASA disagrees with the proposal. The FAA will continue discussions with EASA to resolve any harmonization issues.
2. Thales Avionics	TSO C204, §5	To be consistent with TSO C145d, paragraph 5.j (instead of 5.e) should be excluded from the data submitted to the civil aviation authority	-	Replace “5.e” by “5.j”	**Accepted.**
3. Thales Avionics	TSO C145d Appendix 1, page 3 §3.2.(c)	Remove ”described in paragraph 3.1.” at the end of the sentence. The pass/fail criteria for this test are not described in §3.1	-	Remove ” described in paragraph 3.1.”	**Partially Accepted.** The sentence was changed as follows to more accurately reference the appropriate paragraphs:

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					Section 2.5.2.4.2 defines the pass/fail criteria *for the test case described in paragraph 3.1(b)(3).*
4. Thales Avionics	TSO C145d Appendix 1, page 3, §4(a)	Refer for clarity the tables from DO-229D Change 1 applicable to class beta equipment: Table 2-14, Table 2-16 and Table 2-18	-	Add references to Tables 2-14, 2-16 and 2-18 from DO-229D Change 1	**Accepted.**
5. Thales Avionics	TSO C145d Appendix 1, page 3 §4(d)	Refer to DO-160G instead of DO-160E		Replace DO-160E by DO-160G	**Partially Accepted.** The TSO template language in paragraph 3.d allows applicants to use DO-160E as specified by the MOPS, or, to use another appropriate standard (such as a later revision). The appendix 1 paragraph includes a reference to paragraph 3.d as follows: RTCA/DO-160E section 16 relates to aircraft power supply *(refer to TSO paragraph 3.d for environmental qualification requirements).*

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6. CMC	C145 / Page 3 / Para. 3.e.(1)	Requires compliance to DO-178C. However using DO-178B per AC 20-155C, the software will be declared as DO-178B compliant not DO-178C. Such use of DO-178B must not require a deviation from the TSO.	Note 2 implies that software must meet DO-178C and be declared as such which is not the guidance of the AC.	Update Note 2: Applicants should refer to AC 20-115C for other acceptable means of software development using legacy software or software development methods.	**Partially Accepted.** The FAA is currently resolving the TSO template language for DO-178B versus revision 'C'. The current policy is to reference revision 'B' until the template language issue is settled. Note 2 has been deleted and all references to DO-178C are changed to revision 'B'.
7. CMC	C145 / Page 5 / Para. 5.a.(7)(b)	As written, a TSO-C144 active antenna appears excluded. Also use consistent wording with 5.a.(7)(a) as done in C204.	DO-229D Change 1 Section 2.1.1.10 Note 1 and AC 20-138C Table 2 allow such an active antenna for Class 1.	Include TSO-C144 active antenna in referenced TSO list. Replace "is installed" with "can satisfy the requirements of RTCA/DO-229D, Change 1".	**Not Accepted.** The language is the same as TSO-C145c except that the single paragraph is divided into two for easier reading. Nothing prevents an applicant from using a TSO-C144 active antenna as a manufacturer-specified antenna per 5.a(7)(a) and AC 20-138 (latest revision).

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8. CMC	C204 / Page 2/ Para. 3.b. (1), (2), and (3)	TSO-C145c and draft d both refer to "position data"; the same wording should be retained in the new card TSO.	Consistent wording to avoid implication of a change in requirements.	Use "position" instead of PVT.	**Accepted.**
9. CMC	C204 / Page 2 / Para. 3.e.	Requires compliance to DO-178C. However using DO-178B per AC 20-155C, the software will be declared as DO-178B compliant not DO-178C. Such use of DO-178B must not require a deviation from the TSO.	Note 2 implies that software must meet DO-178C and be declared as such which is not the guidance of the AC.	Update Note 2: Applicants should refer to AC 20-115C for other acceptable means of software development using legacy software or software development methods.	**Partially Accepted.** The FAA is currently resolving the TSO template language for DO-178B versus revision 'C'. The current policy is to reference revision 'B' until the template language issue is settled. Note 2 was deleted and all references to DO-178C are changed to revision 'B'.
10. CMC	C204 / Page 2 / Para. 3.e.	Sentence states "... according to <u>either</u> …" which implies an alternative when none is provided	Typo.	Delete "either".	**Accepted.**
11. CMC	C204 / Page 3 / Para. 3.g. and h.	It would be convenient to retain the same paragraph numbering as in TSO-C145d	Consistency with TSO-C145d	Reorder the two paragraphs.	**Accepted.**

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12. CMC	C204 / Page 3 / Para 5.	Incorrect reference to 5.e)	See text of 5. j.	Refer to 5. j.	**Accepted.**
13. CMC	C204 / Page 5 / Para. 5.a.(6)(b)	As written, a TSO-C144 active antenna appears excluded.	DO-229D Change 1 Section 2.1.1.10 Note 1 and AC 20-138C Table 2 allow such an active antenna for Class 1.	Include TSO-C144 active antenna in referenced TSO list.	**Not Accepted.** The language is the same as TSO-C145c except that the single paragraph is divided into two for easier reading. TSO-C204 is consistent with TSO-C145c/d and nothing prevents an applicant from using a TSO-C144 active antenna as a manufacturer-specified antenna per 5.a(6)(a) and AC 20-138 (latest revision).
14. CMC	C204 / Page 7 / Para. 6.i	Numbering sequence: no para. h.	Sequential numbering.	Change to i to h	**Accepted.**

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15. Garmin	TSO-C145d Page 1, par 2.a	Section 2.a allows only 18 months after the effective 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.	**Not Accepted.** This is the standard template language and time frame for TSOs.
16. Garmin	TSO-C145d Page 2, par. 3.b	Includes the statement: **(1)** Failure of the function defined in paragraph **3.a** resulting in misleading information for en route, terminal, approach lateral navigation (LNAV), and approach LNAV/vertical navigation (VNAV) position data is a *Major* failure condition, **(2)** Failure of the	It is reasonable to clarify the wording to ensure aircraft level analysis is the driver for determining failure classifications. EASA has recognized this using the following wording in ED Decision 2010/010/R 14/12/2010 Annex I Subpart A – General 2.4 Failure condition classification: "Develop the system to, at	We recommend that no failure classification/DAL requirement be included in the TSO as this requires an aircraft level system assessment. Or add the following general guidance: "The design assurance for the functions defined in paragraph 3.b of this TSO must be commensurate with the failure conditions listed	**Not Accepted.** This is consistent with the TSO template language and all previous TSO-C145 revisions.

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		function defined in paragraph **3.a** resulting in misleading information for localizer performance without vertical guidance (LP), and approach localizer performance with vertical guidance (LPV) position data is a *Hazardous* failure condition, and **(3)** Loss of the function defined in paragraph **3.a** for en route through LP/LPV position data is a *Major* failure condition. **(4)** Design the system to at least these failure condition classifications consistent with the operational capability. Wording needs to change to recognize the fact that failure condition classification is ultimately determined by aircraft level analysis.	least, the design assurance level equal to the failure condition classifications provided in the ETSO. Development to a lower Design Assurance Level may be justified for certain cases and accepted during the ETSO process but will lead to installation restrictions."	even if the installation assesses the equipment failure to have a lesser safety effect."	

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17. Garmin	TSO-C145d Page 2, par 3.b.(2)	TSO paragraph 3.b.(2) states: "Failure of the function defined in paragraph **3.a** resulting in misleading information for localizer performance without vertical guidance (LP), and approach localizer performance with vertical guidance (LPV) position data is a *Hazardous* failure condition, and" The LP operation is not identified as an approach operation.	LP is an approach operation and should be identified as such for consistency with LPV.	Suggest adding the word "approach" before the text "localizer performance without vertical guidance" in paragraph 3.b.(2).	**Accepted.**
18. Garmin	TSO-C145d Page 3, par 3.e	Section 3.e "Software Qualification" requires compliance with DO-178C.	AC 20-115C allows DO-178B to be used to show compliance for the software aspects of airborne systems. The "Note 2" should be elevated to a requirement to explicitly allow DO-178B as allowed in AC 20-115C. Elevating this note to requirement would allow applicants to use standards other than DO-178C (as	An additional statement should be added to allow use of 178B or 178C as appropriate. Remove "Note 2", keep item (1) under 3.e as is, and add an item (2) under 3.e: "Applicants with legacy software may use RTCA/DO-178B rather than RTCA/DO-178C, if such use is in accordance with	**Partially Accepted.** The FAA is currently resolving the TSO template language for DO-178B versus revision 'C'. The current policy is to reference revision 'B' until the template language issue is settled. Note 2 was deleted and all references to DO-178C are changed to revision 'B'.

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			allowed by AC 20-115C) without the need to send deviations to the FAA. This change will reduce burden on both the FAA and the applicants in reviewing menial DO-178B deviations as DO-178B could be used without need for a deviation, which aligns with the intent of "Note 2". This would be particularly relevant for equipment that has been granted TSOA to a previous revision of TSO-C145.	AC 20-115C ."	
19. Garmin	TSO-C145d Page 3, par 3.e.(2)	Paragraph 3.e.(2) states that applicants using a TSO-C204 CCA functional sensor can use TSO-C204 as substantiation for the software qualification. The wording of this section should change to state that software resident in the appliance needs to be developed in accordance with RTCA/DO-178C or RTCA/DO178B if it can	It is possible (perhaps likely) that the outputs from the TSO-C204 CCA are processed by software resident in the appliance but external to the CCA. The current wording of the TSO paragraph does not appear to require software resident in the appliance but external to the TSO-C204 CCA to be developed in accordance with RTCA/DO-178.	Clarify text of paragraph 3.e.(2) to require that any appliance software that can potentially introduce failures or cause loss of function for any function defined in this TSO be developed in accordance with RTCA/DO-178C or RTCA/DO-178B.	**Not Accepted.** There is no requirement to use a TSO-C204 CCA functional sensor. However, if an applicant does use one, then paragraph 3.e.(2) allows credit for the software development in the TSO-C204 sensor. The end-use applicant is responsible for all other aspects of the TSO-C145d application not covered by

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		potentially introduce failures or cause loss of function for any function defined in this TSO.	If the appliance software can introduce failures or cause loss of function, then it also needs to be developed in accordance with RTCA/DO-178.		virtue of the C204 TSOA.
20. Garmin	TSO-C145d Page 4, par 3. f	Section 3.f requires development according to DO-254 for all Design Assurance Levels.	AC 20-152 paragraph 1.b provides guidance that in all cases where the AEH DAL is Minor or lower DO-254 is not required.	Adjust the Electronic Hardware Qualification guidance as defined in AC 20-152 paragraph 1.b, which provides guidance that where the complex AEH DAL is Minor DO-254 compliance is not required.	**Not Accepted.** This is the standard template language and is consistent with previous TSO revisions. AC guidance can be applied as appropriate, but the lowest TSO-C145d failure condition per paragraph 3.b is major.
21. Garmin	TSO-C145d Page 4, par 3.f.(2)	Paragraph 3.f.(2) states that applicants using a TSO-C204 CCA functional sensor can use TSO-C204 as substantiation for the complex custom airborne electronic hardware (AEH) qualification. The wording of this section should change to state that complex custom AEH resident in the appliance needs to be developed in accordance with	It is possible (perhaps likely) that the outputs from the TSO-C204 CCA are processed by complex custom AEH resident in the appliance but external to the CCA. The current wording of the TSO paragraph does not appear to require complex custom AEH resident in the appliance but external to the TSO-C204 CCA to be developed in accordance with RTCA/DO-254.	Clarify text of paragraph 3.f.(2) to require that any appliance complex custom AEH that can potentially introduce failures or cause loss of function for any function defined in this TSO be developed in accordance with RTCA/DO-254.	**Not Accepted.** There is no requirement to use a TSO-C204 CCA functional sensor. However, if an applicant does use one, then paragraph 3.e.(2) allows credit for the software development in the TSO-C204 sensor. The end-use applicant is responsible for all other aspects of the TSO-C145d application not covered by virtue of the C204 TSOA.

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		RTCA/DO-254 if it can potentially introduce failures or cause loss of function for any function defined in this TSO.	If the appliance complex custom AEH can introduce failures or cause loss of function, then it also needs to be developed in accordance with RTCA/DO-254.		
22. Garmin	TSO-C145d Page 4, par 4.b.(2)	Paragraph 4.b.(2) states: Each subassembly of the article that you determined may be interchangeable. This language is confusing.	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.	**Not Accepted.** This is the standard template language.
23. Garmin	TSO-C145d Page 4, par 4.e	Includes the statement: At least one major component must be permanently and legibly marked with the operational equipment class (for example, Class 2) as defined in RTCA/DO-229D, Change 1, Section 1.4.2. The Order 8150.1C TSO template does not include the "applicable equipment class(es)" phrase.	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 par 7-4.e.(4).(b) "See Inst Mnl for Addtl TSO	Remove par 4.e from the TSO. Add a new paragraph under 5.a requiring the equipment class(es) to be included in the "Manual(s)".	**Not Accepted.** This language is carried forward from the previous TSO revision because it is still applicable. The equipment classes are a unique item to this TSO that was not anticipated by Order 8150.1C.

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			approvals and/or markings.").		
24. Garmin	TSO-C145d Page 6, par 5.c.	A PSAC, SW configuration index (SCID), and SW accomplishment summary (SAS) should be required for any software resident in the appliance but external to the TSO-C204 CCA that can potentially introduce failures or cause loss of function for any function defined in this TSO. Such software should be developed in accordance RTCA/DO-178C or RTCA/DO-178B.	As mentioned above, some software in the appliance but external to the TSO-C204 CCA may be needed to meet the TSO requirements. This software must be developed in accordance with RTCA/DO-178C or RTCA/DO-178B and a PSAC, SCID, and SAS should be provided for these software items.	Add text to paragraph 5.c. stating that a PSAC, SCID, and SAS are required for any software items in the appliance that need to be developed in accordance with RTCA/DO-178C or RTCA/DO-178B.	**Not Accepted.** This paragraph is for the applicant that <u>does not</u> choose to use a TSO-C204 CCA. Applicants that don't use C204 must develop a PSAC just as they normally would when making application for a sensor under TSO-C145. Applicants choosing to use a C204 CCA sensor get full software credit by virtue of the C204 TSOA and only have to develop data not credited to C204 for their C145d application.
25. Garmin	TSO-C145d Page 6, par 5.d	A PHAC, hardware verification plan, top-level drawing, and hardware accomplishment summary should be required for any complex custom airborne electronic hardware (AEH)	As mentioned above, some complex custom AEH in the appliance but external to the TSO-C204 CCA may be needed to meet the TSO requirements. This hardware must be developed in	Add text to paragraph 5.d. stating that a PHAC, hardware verification plan, top-level drawing, and hardware accomplishment summary are required for any complex custom AEH	**Not Accepted.** This paragraph is for the applicant that <u>does not</u> choose to use a TSO-C204 CCA. Applicants that don't use C204 must develop a PHAC just as

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		resident in the appliance but external to the TSO-C204 CCA that can potentially introduce failures or cause loss of function for any function defined in this TSO. Such complex custom AEH should be developed in accordance RTCA/DO-254.	accordance with RTCA/DO-254 and a PHAC, hardware verification plan, top-level drawing, and hardware accomplishment summary should be provided for these software items.	in the appliance that needs to be developed in accordance with RTCA/DO-254.	they normally would when making application for a sensor under TSO-C145. Applicants choosing to use a C204 CCA sensor get full hardware credit by virtue of the C204 TSOA and only have to develop data not credited to C204 for their C145d application.
26. Garmin	TSO-C145d Page 6, par 5.g.	This paragraph requires listing the "If the software qualification limits eligibility of the equipment to certain aircraft types, identify the qualification level, and that the equipment is not eligible for all aircraft types." in the installation manual which can be misleading to the installer and is inconsistent with the process of determining failure condition classification and requirements at the aircraft level.	Failure condition classification is determined by system safety assessment at the aircraft level and can vary based on installation. By providing a failure condition classification and limitations at the appliance level this creates an impression that the safety analysis for these functions is complete for an entire aircraft type. Additionally, TSO paragraphs 5.a.(4)(a) and 5.a.(4)(b) already require the Manual(s)to contain the software and AEH design assurance levels that an	Remove the requirement to list "software qualification limits" in the Manual(s).	**Not Accepted.** This is verbatim from paragraph 5.g in the previous revision. It applies <u>if</u> an applicant chooses to use the lower software DAL per the AC for Part 23 airplanes. Paragraph 5.g makes no statement about the installation manual. The applicant can choose to not use lower DAL in which case paragraph 5.g does not apply.

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			installer needs to determine whether the equipment can support the aircraft level failure condition classification.		
27. Garmin	TSO-C145d Page 7, par 5.i	TSO paragraph 5.i and its subparagraphs define required information to be supplied to the ACO for a non-TSO function. This guidance is inconsistent with Order 8110.4C CHG 4.	TSO paragraph 5.i indicates that "you must … include the following information with your TSO application" but the TSO 5.i subparagraphs which specify the required information to be supplied to the ACO for a non-TSO function are inconsistent with the Order 8110.4C CHG 4 paragraph 6-9.b.(3) "Manufacturer Data Submittal" requirements. For example, TSO paragraphs 5.i.(5) and 5.i.(6) require submittal of "Results of test/analysis" while Order 8110.4C CHG 4 paragraph 6-9.b.(3) requires submittal of "proposed test procedures"; while both sets of guidance use the word "test", otherwise there is no similarity.	Adjust the wording in the TSO (template) to be consistent with the 8110.4C CHG 4 intent.	**Not Accepted.** This is the template language for non-TSO functions. We will explore better ways to explain the difference between performance better than what is required by the TSO, and a function completely unrelated to the TSO.

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28. Garmin	TSO-C145d Page 7, par 5.i	TSO paragraph 5.i and its subparagraphs include definition of non-TSO functions. This guidance is inconsistent with Order 8110.4C CHG 4.	TSO paragraph 5.i 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 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.i "performance" definition, the 11 watt transmitter has a non-TSO 1 watt capability. The	Adjust the wording in the TSO (template) to be consistent with the 8110.4C CHG 4 intent.	**Not Accepted.** This is the template language. The comment demonstrates a fundamental misunderstanding between performance better than what is required by TSO and a function completely unrelated to the TSO.

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			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.		
29. Garmin	TSO-C145d Page 8, par 6.g	This requirement should also apply to software resident in the appliance but external to the TSO-C204 CCA that can potentially introduce failures or cause loss of function for any function defined in this TSO.	As mentioned above, some software in the appliance but external to the TSO-C204 CCA may be needed to meet the TSO requirements. This software must be developed in accordance with RTCA/DO-178C or RTCA/DO-178B and the appropriate documentation should be available for review by the responsible ACO.	Modify paragraph 6.g to state that the appropriate RTCA/DO-178C or RTCA/DO-178B documentation should be available for all software in the appliance that is not covered under TSO-C204.	**Not Accepted.** This paragraph is for the applicant that <u>does not</u> choose to use a TSO-C204 CCA. Applicants that don't use C204 must develop the software just as they normally would when making application for a sensor under TSO-C145. Applicants choosing to use a C204 CCA sensor get full software credit by virtue of the C204 TSOA and only have to develop data not credited to C204 for their C145d application.
30. Garmin	TSO-C145d Page 8, par 6.h	This requirement should also apply to complex custom airborne electronic hardware (AEH) resident in the appliance but external to the TSO-C204 CCA that	As mentioned above, some complex custom AEH in the appliance but external to the TSO-C204 CCA may be needed to meet the TSO requirements. This complex	Modify paragraph 6.h to state that the appropriate RTCA/DO-254 documentation should be available for all complex custom AEH in the	**Not Accepted.** This paragraph is for the applicant that <u>does not</u> choose to use a TSO-C204 CCA. Applicants that don't use C204 must

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		can potentially introduce failures or cause loss of function for any function defined in this TSO.	custom AEH must be developed in accordance with RTCA/DO-254 and the appropriate documentation should be available for review by the responsible ACO.	appliance that is not covered under TSO-C204.	develop the hardware just as they normally would when making application for a sensor under TSO-C145. Applicants choosing to use a C204 CCA sensor get full hardware credit by virtue of the C204 TSOA and only have to develop data not credited to C204 for their C145d application.
31. Garmin	TSO-C145d Page 8, 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.i.(1) through 5.i.(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	Adjust the wording in the TSO (template) to be consistent with the 8110.4C CHG 4 intent.	**Not Accepted.** The additional items are necessary due to the unique nature of the TSO compared to what is generically envisioned by the template.

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			includes a non-TSO function.		
32. Garmin	TSO-C204 Page 2, par. 3.b	Includes the statement: **1)** Failure of the function defined in paragraph **3.a** resulting in misleading information for en route, terminal, approach lateral navigation (LNAV), and approach LNAV/vertical navigation (VNAV) PVT data is a *Major* failure condition, **(2)** Failure of the function defined in paragraph **3.a** resulting in misleading information for localizer performance without vertical guidance (LP), and approach localizer performance with vertical guidance (LPV) PVT data is a *Hazardous* failure condition, and **(3)** Loss of the function defined in	It is reasonable to clarify the wording to ensure aircraft level analysis is the driver for determining failure classifications. EASA has recognized this using the following wording in ED Decision 2010/010/R 14/12/2010 Annex I Subpart A – General 2.4 Failure condition classification: "Develop the system to, at least, the design assurance level equal to the failure condition classifications provided in the ETSO. Development to a lower Design Assurance Level may be justified for certain cases and accepted during the ETSO process but will lead to installation restrictions."	We recommend that no failure classification/DAL requirement be included in the TSO as this requires an aircraft level system assessment. Or add the following general guidance: "The design assurance for the functions defined in paragraph 3.b of this TSO must be commensurate with the failure conditions listed even if the installation assesses the equipment failure to have a lesser safety effect."	**Not Accepted.** This is consistent with the TSO template language and TSO-C145d.

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		paragraph **3.a** for en route through approach LP/LPV PVT data is a *Major* failure condition. **(4)** Develop the system to, at least, the design assurance level equal to these failure condition classifications. Wording needs to change to recognize the fact that failure condition classification is ultimately determined by aircraft level analysis.			
33. Garmin	TSO-C204 Page 2, par 3.e	Section 3.e "Software Qualification" requires compliance with DO-178C.	AC 20-115C allows DO-178B to be used to show compliance for the software aspects of airborne systems. The "Note 2" should be elevated to a requirement to explicitly allow DO-178B as allowed in AC 20-115C. Elevating this note to requirement would allow applicants to use standards other than DO-178C (as allowed by AC 20-115C) without the need to send	An additional statement should be added to allow use of 178B or 178C as appropriate. Remove "Note 2", keep item (1) under 3.e as is, and add an item (2) under 3.e: "Applicants with legacy software may use RTCA/DO-178B rather than RTCA/DO-178C, if such use is in accordance with AC 20-115C ."	**Partially Accepted.** The FAA is currently resolving the TSO template language for DO-178B versus revision 'C'. The current policy is to reference revision 'B' until the template language issue is settled. Note 2 was deleted and all references to DO-178C are changed to revision 'B'.

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			deviations to the FAA. This change will reduce burden on both the FAA and the applicants in reviewing menial DO-178B deviations as DO-178B could be used without need for a deviation, which aligns with the intent of "Note 2".		
34. Garmin	TSO-C204 Page 2, par 3. f	Section 3.f requires development according to DO-254 for all Design Assurance Levels.	AC 20-152 paragraph 1.b provides guidance that in all cases where the AEH DAL is Minor or lower DO-254 is not required.	Adjust the Electronic Hardware Qualification guidance as defined in AC 20-152 paragraph 1.b, which provides guidance that where the complex AEH DAL is Minor DO-254 compliance is not required.	**Not Accepted.** This is the standard template language and is consistent with previous TSO revisions. AC guidance can be applied as appropriate, but the lowest TSO-C145d failure condition per paragraph 3.b is major.
35. Garmin	TSO-C204 Page 3, par 4.b.(2)	Paragraph 4.b.(2) states: Each subassembly of the article that you determined may be interchangeable. This language is confusing.	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.	**Not Accepted.** This is the standard template language.

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36. Garmin	TSO-C204 Page 3, par 4.e	Includes the statement: The SBAS CCA functional sensor must be permanently and legibly marked with the operational equipment class (for example, Class 2) as defined in RTCA/DO-229D, Change 1, Section 1.4.2. The Order 8150.1C TSO template does not include the "applicable equipment class(es)" phrase.	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 par 7-4.e.(4).(b) "See Inst Mnl for Addtl TSO approvals and/or markings.").	Remove par 4.e from the TSO. Add a new paragraph under 5.a requiring the equipment class(es) to be included in the "Manual(s)".	**Not Accepted.** This language is carried forward from the previous TSO revision because it is still applicable. The equipment classes are a unique item to this TSO that was not anticipated by Order 8150.1C.
37. Garmin	TSO-C204 Page 5, par 5.g.	This paragraph requires listing the "If the software qualification limits eligibility of the equipment to certain aircraft types, identify the qualification level, and that the equipment is not eligible for all aircraft types." in the installation manual which can be misleading to the installer and is inconsistent with the process of	Failure condition classification is determined by system safety assessment at the aircraft level and can vary based on installation. By providing a failure condition classification and limitations at the appliance level this creates an impression that the safety analysis for these functions is complete for an entire aircraft type.	Remove the requirement to list "software qualification limits" in the Manual(s).	**Not Accepted.** This is verbatim from paragraph 5.q in the previous revision. It applies <u>if</u> an applicant chooses to use the lower software DAL per the AC for Part 23 airplanes. Paragraph 5.g makes no statement about the installation manual. The applicant can choose to not use lower DAL in

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		determining failure condition classification and requirements at the aircraft level.	Additionally, TSO paragraphs 5.a.(4)(a) and 5.a.(4)(b) already require the Manual(s)to contain the software and AEH design assurance levels that an installer needs to determine whether the equipment can support the aircraft level failure condition classification.		which case paragraph 5.g does not apply.
38. Garmin	TSO-C204 Page 5, par 5.i	TSO paragraph 5.i and its subparagraphs define required information to be supplied to the ACO for a non-TSO function. This guidance is inconsistent with Order 8110.4C CHG 4.	TSO paragraph 5.i indicates that "you must … include the following information with your TSO application" but the TSO 5.i subparagraphs which specify the required information to be supplied to the ACO for a non-TSO function are inconsistent with the Order 8110.4C CHG 4 paragraph 6-9.b.(3) "Manufacturer Data Submittal" requirements. For example, TSO paragraphs 5.i.(5) and 5.i.(6) require submittal of "Results of test/analysis" while Order 8110.4C CHG 4 paragraph 6-9.b.(3) requires submittal	Adjust the wording in the TSO (template) to be consistent with the 8110.4C CHG 4 intent.	**Not Accepted.** This is the template language for non-TSO functions.

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			of "proposed test procedures"; while both sets of guidance use the word "test", otherwise there is no similarity.		
39. Garmin	TSO-C204 Page 5, par 5.i	TSO paragraph 5.i and its subparagraphs include definition of non-TSO functions. This guidance is inconsistent with Order 8110.4C CHG 4.	TSO paragraph 5.i 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 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	Adjust the wording in the TSO (template) to be consistent with the 8110.4C CHG 4 intent.	**Not Accepted.** This is the template language. We will explore better ways to explain the difference between performance better than what is required by the TSO, and a function completely unrelated to the TSO.

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			called out under the TSO; consequently, by the paragraph 5.i "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.		
40. Garmin	TSO-C204 Page 6, par 6.i	TSO paragraph numbering 6.g skips to 6.i.	Numbering error.	Renumber the bullet 6.i to become 6.h.	**Accepted.**
41. Garmin	TSO-C204 Page 7, par 7	TSO paragraph 7 requires furnishing data in paragraphs 5.a, 5.b and 5.f through 5.h to "one entity (such as an operator or repair station)". This is inconsistent with the intent of TSO-C204 as stated in paragraph 1.	TSO-C204 states in paragraph 1. "TSO-C204 is intended as a means for end-use equipment manufacturers incorporating the SBAS CCA functional sensor to streamline their TSO-C145d application for a Class Beta position/velocity/time (PVT) sensor by using the TSO'd SBAS CCA for partial certification credit." As this	Reword paragraph 7 to ensure consistency with the users identified in paragraph 1.	**Not Accepted.** This TSO is unique and all the items listed are necessary for the end-use manufacturer to apply for TSO-C145d.

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			TSO is intended as a means for “end-use equipment manufacturers” there is no need to require sending the data identified in paragraph 7 to “one entity (such as an operator or repair station)”.		
42. Garmin	TSO-C204 Page 7, par 7	TSO-C204 paragraph 7excludes paragraph 7.b from the 8150.1C TSO template.	Excluding paragraph 7.b seems inconsistent with the need to submit the supporting Non-TSO data in paragraphs 5.i.(1) through 5.i.(4) to the FAA. If there are Non-TSO functions, it seems like the “end-use equipment manufacturers” should receive the supporting Non-TSO data.	Add paragraph 7.b from the 8150.1C TSO template if paragraph 7 is re-scoped to only require furnishing data to “end-use equipment manufacturers”.	**Accepted.**