Certification Authorities for Transport Airplanes (CATA)

CATA Worklist Item (CWI) FAA-03 – CNS Guidance Harmonization

Date Raised:	12-July-2017	Updated: 29 October 2019	Status:	Open	
Subject:	Communication, Navigation, and Surveillance (CNS) Guidance Harmonization				
Related Issue(s): (Identify Discussion Paper number, if any)	CATA Action Item 2	017-12, raised during the 17 Ma	ay meeting ir	n Renton.	

Description of Issue(s):

(Give a brief background of issue(s)

NextGen avionics technologies have complex and evolving standards. Although equipment standards (i.e., ED-/DO- documents) as well as TSO/ETSO equipment requirements are generally harmonized, the installation guidance may not be.

Background:

The FAA developed a NextGen Avionics Guidance Summary table to assist FAA ACOs in certification of NextGen technologies. The FAA proposed, and the CATA accepted during the May 17 CATA meeting, a proposal to form a quadrilateral SME group to evaluate the FAA summary table with the aim of identifying differences in the listed guidance and the impact of those differences on applicants seeking certification with multiple authorities. Where differences are identified, the SME group will evaluate the potential impact of those differences on installation-level certification of the associated technologies, and seek either harmonization, or clear definition of enveloped requirements to support global acceptance.

Proposed Prioritization:

(Per CATA Technical Issues List Prioritization schema, SME proposes along with authority CATA members)

Question	Answer
1. Is there an active working group related to this issue?	No. Working groups for equipment standards only (i.e., ED-/DO- documents used in the development of TSO/ETSO equipment requirements). None for the installation issues addressed by this CWI.
2. In which documents are there deviations amongst the authorities?	Installation guidance (i.e., AMCs/ACs)
3. Was this issue raised by or at the CMT?	No
4. What is the level of impact on projects in the future (i.e. minor, major, critical)?	Major/Critical
5. How many authorities does the issue impact?	Will depend on each authority's initiatives (i.e., SESAR) or other operational goals.
6. What is the approximate technical complexity of the issue (i.e. low, medium, high)?	High

Recommendation:

(SME proposes expected resolution of the issue)

The targeted outcome of this activity is to update the FAA summary table noted in the Background section to include associated CMT partner authority requirements and harmonization status. From this reference point the SME team will identify appropriate harmonization tasks, if any, and ultimately document in a suitable vehicle (to be proposed by the SME team) the enveloped set of requirements necessary to support global acceptance.

(Using CATA criteria for determination of technical issues)

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As noted in the Background section the CATA accepted this tasking at the May 2017 meeting.

Interim CATA Position:

(Explain agreement, dissent or conclusion on this CWI)

Release of the entire avionics technology guidance summary, including the completed Surveillance portion with added "Enveloped Requirements to Comply with all Authorities" completed. The summary table is appended directly to this CWI form.

This action represents an interim step toward closure of the CWI. Additional interim releases will be considered by the CATA as the Navigation, Communication, and other components of the analysis are completed.

САТА	Name	Signature	Date
Representative		_	
ANAC	Marcelo Leite Daniel Pessoa	/s/	03.01.2020
EASA	Colin Hancock Mathilde Labatut	/s/	09.12.2019
FAA	Tom Groves	/s/	04.12.2019
TCCA	Canh Nham	/s/	04.12.2019

Interim Release of CWI:

Final CATA Position:

(Explain agreement, dissent or conclusion on this CWI)

OPEN

Enabler	Description	Guidance		Notes
		ANAC	IS № 91-005, IAC-3508-91-0895 and FAA AC 91-85A	
DV01	Ability to fly more fuel efficient flight	EASA	CS-ACNS — BOOK 1 — Subpart E, Section 2	
RVSM levels an	levels and on more user preferred	FAA	AC 91-85A (operational)	
	routings	TCCA	AC 700-039 (operational)	
		ANAC	FAA AC 20-138D Cha 2 / ANAC IS Nº 91-001 (operational)	
Required Navigation		ANAO	CS-ACNS issue 2 Subpart C (Note: AMC 20-12 is obsolete with publication of CS-ACNS	
Performance (RNP) 10 (also		EASA	issue 2)	
called RNAV 10 in ICAO PBN Manual)	Reduced oceanic separation	FAA	AC 20-138D Chg 2 / AC 90-105A & "RNP 10 Through Data Collection" (operational)	Order 8400.12C cancelled May 2016. Guidance incorporated into AC 90-105A and Online Booklet, RNP 10 through Data Collection.
,		TCCA	FAA Order 8400.12C	
		ANAC	FAA AC 20-138D Chg. 2 / ANAC IS Nº 91-001 (operational)	
Basic Area Navigation	Implementation of Basic RNAV	EASA	CS-ACNS issue 2 Subpart C (Note: AMC 20-4A is obsolete with publication of CS-ACNS issue 2)	
(B-RNAV) (RNAV 5)	designated Airspace	FAA	AC 20-138D Chg 2 / AC 90-96A (operational)	European operations only, but addressed in AC 20-138D Chg 2 / AC 90-96A.
	o .	TCCA	AC 700-015 (operational) / FAA AC 90-96A (operational) / FASA AMC 20-4A	
		ANAC	EAA AC 20-138D Chg. 2 / ANAC IS Nº 91-001 (operational)	
	Enables more efficient routes and	FASA	CS-ACNS issue 2 Subpart C	
RNAV 1, RNAV 2	procedures	FAA	$\Delta C = 20-138D Char = 2 / AC = 90-100A (operational)$	
	P	TCCA	AC 700-019 (operational)	
		ANAC	EAA AC 20.138D Chg. 2 / ANAC IS Nº 01.001 (operational)	
	Further reduced oceanic separation	ANAC	CS ACNS issue 2 Subpart C	
RNP 4	(in conjunction with Future Air	EASA		Order 8400.32 especified May 2016. Cuidance incorrected into AC 00.10EA
	Navigation System (FANS 1/A)	FAA	AC 20-138D Chg 2 / AC 90-105A (operational)	Order 8400.33 cancelled May 2016. Guidance incorporated into AC 90-105A.
		TCCA	AC 700-006 (operational)	
		ANAC	FAA AC 20-138D Chg. 2 / ANAC IS Nº 91-001 (operational)	
RNP 2	Reduced continental separation	EASA	CS-ACNS issue 2 Subpart C	
		FAA	FAA AC 20-138D Chg. 2 / AC 90-105A (operational)	
		TCCA	AC 700-038 (operational)	Enroute Continental
		ANAC	FAA AC 20-138D Chg. 2 / ANAC IS Nº 91-001 (operational)	
		EASA	CS-ACNS issue 2 Subpart C (Note: JAA TGL-10 is obsolete with publication of CS-ACNS	
	RNP routes for connectivity	LAGA	issue 2)	
RNP 1 between the ter	between the en route structure and terminal airspace	FAA	AC 20-138D Chg 2 / AC 90-105A & AC 90-96A (operational)	P-RNAV for European operations (addressed in AC 90-96A). RNP 1 addressed in AC 20- 138D Chg 2 / AC 90-105A. RNP 1 aircraft with P-RNAV approval based on GPS capability meet the functional requirements for RNP 1 operations.
		TCCA	AC 700-025 (operational) / FAA AC 90-96A	
		ANAC	FAA AC 20-138D Chg. 2 / ANAC IS Nº 91-001 (operational)	
RNP-APCH	Better access to runways that are not equipped with precision	EASA	CS-ACNS issue 2 Subpart C (Note: AMC 20-27A is obsolete with publication of CS- ACNS issue 2)	
	approach and landing systems	FAA	FAA AC 20-138D Chg. 2 / AC 90-105A (operational)	
		TCCA	AC 700-023 (operational) / EASA AMC 20-27	
	Improves access to airports in	ANAC	FAA AC 20-138D Chg. 2 / ANAC IS № 91-001 (operational)	
RNP Authorization	reduced visibility with an approach that can curve to the runway:	EASA	CS-ACNS issue 2 Subpart C (Note: AMC 20-26 is obsolete with publication of CS-ACNS issue 2)	
Required (AR) Approaches	improves procedures to separate	FAA	AC 20-138D Chg 2 / AC 90-101A (operational)	
	traffic flows	TCCA	AC 700-024 (operational)	
		ANAC	FAA AC 20-138D Chg. 2 / ANAC IS Nº 91-001 (operational)	
Advanced RNP	Enables more accurate and	FASA	CS-ACNS issue 2 Subpart C	
	predictable flight paths for	FAA	AC 20-138D Cbg 2 TSO-C115d / AC 90-105A (operational)	Includes RF Leas
	enhanced safety and efficiency	TCCA	ICAO Document 9613 PBN Manual	
Vortical Bath Conrol for	Stabilized approach to belo	EASA		
Non-Precision Approaches	eliminate CEIT	EASA	AC 120 108 (operational)	
Non-1 recision Approaches		TCCA		
		ANAC		
		EASA		

Navigation	r			
Enabler	Description	Guidance		Notes
		FAA		
FMS Baro-VNAV Temperature Compensation (below 0 deg C or below ISA)	Ensures obstacle and terrain clearance during approach with temperatures below 0 deg C or below ISA	TCCA	AC 500-020, RTCA DO-236 / AC 700-028 (operational)	AC 500-020 - 4.1 New/Updated FMS Designs Incorporating Barometric VNAV Approach Capability (1) New or updated FMS designs shall provide a means for an aircraft to fly the true vertical path angle for final approach segment, as defined in the resident navigation database, in below ISA temperature conditions. The FMS equipment shall also provide the capability to temperature compensate all waypoints from the Initial Approach Fix to the Missed Approach Holding Point (known as the Missed Approach Holding Waypoint for RNAV procedures) inclusive, as coded in the navigation database. The FMS shall also provide a means for determining a temperature compensated MDA/DA, when the MDA/DA is entered by the pilot. (2) Temperature compensation may be applied for airport temperatures "below ISA" or "below 0°C". The latter has been included to be consistent with the existing Nav Canada operational procedures as described in CAP GEN.
		ANAC	FAA AC 20-138D Chg. 2 / ANAC IS № 91-001 (operational)	
		EASA	CS-ACNS issue 2 Subpart C (Note: AMC 20-27A is obsolete with publication of CS- ACNS issue 2)	CS-ACNS Subpart C resulting from NPA 2018-02
Vertical Navigation (VNAV) Enables defined climb ar paths	Enables defined climb and descent paths	FAA	AC 20-138D Chg 2 / AC 90-105A (operational)	AC 20-138D, paragraph 11-1.b, provides guidance for newly installed Baro-VNAV systems incorporating automated temperature compensation for all segments in the approach procedure, including the missed approach holding waypoint. Newly installed Baro-VNAV systems not incorporating automated temperature compensation require an evaluation of procedures for manual altitude corrections, effect on crew workload and protections from erroneous altitude entries to show compliance with §§ 25.1301, 25.1302 and 25.1523.
		TCCA		
		ANAC	FAA AC 20-138D Chg 2	
Localizer Performance with	Improved access to many airports	EASA	CS-ACNS issue 2 Subpart C (Note: AMC 20-28 is obsolete with publication of CS-ACNS issue 2)	CS-ACNS Subpart C resulting from NPA 2018-02
Vertical Guidance (LPV)	in reduced visibility with an approach aligned to the runway	FAA	AC 20-138D Chg 2 / AC 90-107 (operational)	FAA should be notified about any project related to applicants requesting to use DO-178C Level C flight management system (FMS) software for hazardous operations (e.g., localizer performance with vertical guidance (LPV) capability).
		TCCA	EASA AMC 20-28	
Trajectory Operations		ANAC	FAA AC 20-138D Chg 2	
	Enhances PBN capabilities	EASA	TBD	
		FAA	AC 20-138D Chg 2, TSO-C115d	
		TCCA		
Alternative Regitier		ANAC	ТВД	
Navigation and Timing	Provides GNSS-independent APNT	EASA	TBD	
(APNT)	capability	FAA	TBD	
(0.00)		TCCA		

Surveillance							
Enabler	Description	Guidance		Notes	Enveloped Requirements to Comply with all Authorities		
Mode S - Elementary		ANAC	FAA AC 20-151C		Follow CS-ACNS - Subpart D - Section 2		
Surveillance	Enables improved air traffic	EASA	CS-ACNS - Subpart D - Section 2, ETSO-C112d	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment).	NOTE: The FAA will remove from AC 20-151C reference to JAA TGL 13		
(ELS) (European Mandate)	surveinance	FAA	AC 20-151C	AC references JAA TGL 13 Rev. 1/CS-ACINS	(addressed in CS-ACNS) at the next opportunity. The FAA accepts the		
		ANAC	EAA AC 20 161C		guidance noted above.		
		FASA	CS-ACNS - Subpart D - Section 3 ETSO-C112d	Mandated by ELLNo 1207/2011 1028/2014 (amendment) & 2017/386 (amendment)	Follow CS-ACNS - Subpart D - Section S Supplemented with AC 20-151C		
Made O. Falsanad		LAGA	CorAcito - Subpart D - Section 3, E130-C1120	Mandated by EO NO 1207/2011, 1020/2014 (amendment), & 2017/300 (amendment).	Vertical Intention Register		
Mode S - Enhanced	Enables improved air traffic				NOTE: The EAA will remove from AC 20-151C reference to AMC 20-13		
(EHS) (European Mandate)	surveillance	FAA			(addressed in CS-ACNS) at the next opportunity. The EAA accents the		
			AC 20 151C	AC references AMC 20 12/CS ACNS	guidance noted above.		
		TCCA	AC 20-151C	AC TELETETICES AIVIC 20-15/C3-ACINS			
		TOOA			Follow AMC 20-24		
					-Does not provide the means to comply with EASA ELLNo. 1207/2011		
		ANAC			1028/2014 (amendment). & 2017/386 (amendment) or FAA 14 CFR		
					91.225 & 91.227.		
Automatic Dependent	Enhanced ATS in Non Rodar Areas	EAGA	AMC 20 24 ETSO 201125 (ED 72B)				
(ADS-B) in Non-Radar	using ADS-B Surveillance	LAGA	AMIC 20-24, E130-201120 (ED-736)	Does not provide the means to comply with the rules set forth in the EU No 1207/2011,			
Areas (NRA)				1028/2014 (amendment), & 2017/386 (amendment).			
		FAA					
		T001					
		ICCA			To comply with all authorities		
				An IP is no longer required with release of FAA AC 20-165B. ADS-B Out is not mandatory in Brazilian aircoace yet. There is an offenore region (Pio de Janeiro) where there is a	Install 1000 FS ADS-B Out data link		
		ANAC	NAC FAA AC 20-165B	implemented ground infrastructure to allow the ADS-B use for space control purposes. After	-GNSS based position source with FTSO/TSO-129a (SA-aware) as a		
				November 08th 2018 only aircrafts equipped with ADS-B out will be allowed to fly within	minimum (for FAA operations TSO-C129/C196 GPS units covered by		
				such airspace.	FAA exemption 12555 with AEM limitation if SA-unaware).		
				Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment).	-The same position source for navigation, should be used for ADS-B or		
		EASA	CS-ACNS - Subpart D - Section 4, ETSO-C1666/ETSO-C112d	FAA AC 20-165A quidance	standalone ETSO/TSO-C145c/C146c (or later), RTCA DO-229D (or later)		
				Mandated by 14 CER 91.225 & 91.227	operational class 1, 2, or 3 GNSS receiver connected to the		
					transponder.		
			Reference: https://www.faa.gov/nextgen/equipadsb/installation/equipment/ for FAA	-Installation should include antenna diversity.			
			approved v2 ADS-B Out avionics.	-Include all parameters and meet all minumum values as specified in			
				For FAA operations only: TSO-C129 and TSO-C196 GPS receivers are covered by FAA	"Values to Comply with All Authorities," ref. the App. A-ADS-B Out		
				Exemption 12555. For the use of Selective Availability (SA) unaware (unaware of the current	Parameters Tab.		
		FAA	AC 20-165B / AC 90-114A Chg 1 (operational), TSO-C166b/TSO-C154c, Policy Memos	status of SA (deactivated)) GPS units in ADS-B Out installations, which requires use of the	-Continuity with probability of remote or Ref. EASA Deviation to CS		
			AIR100-15-140-DM30 & AIR100-15-140-DM37, Policy Memo AFS-360_2016-03-02 & Order N 8000 363, Policy Memo AIR100 15 130 PM10, & Policy Memo, AIR 100 14 130	ADS-B Service Availability Prediction Tool (pre-flight availability verification tool that	ACNS.D.ADSB.105 to not meet a 'remote' quantitative probability		
			GM27	predicts the ability of an aircraft to meet the requirements of 14 CFR 91.227(c)(1)(i) and (iii)	requirement (1E-5/FH) if the installation meets the requirements of EU		
				that ADS-B operations are not commenced or continued unless satellite availability for the	No 1207/2011 by having a continuity equal to or less than 2E-4/FH and		
				route has been confirmed using the FAA SAPT tool.	the equipment supporting the ADS-B functionality is DAL C (meets		
					remote qualitative probability).		
					-Meet test and evaluation criteria inc. flight test (as required) per AC		
					20-165B Chapter 4.		
ADS-R Out	Enables improved air traffic			ADS-B is not being mandated in Canada in the near term. It is acknowledged that ADS-B	-Meet continuing airworthiness requirements per AC 20-165B Chapter		
AD3-B Out	processing			technology will supplement the current ground-based radar surveillance system and may	2.3. Most the more demanding criteria (either CS ACNS or AC 20 165P)		
	1					eventually replace it to some extent, however, the intent of not mandating the ADS-B system	ref. red requirements in Ann. B-ADS-B Out Guidance Comp. Tab which
				is to allow owners and operators to volunteer their participation in a surveillance system	includes a comparison of the two guidance documents		
				where NAV CANADA will offer ADS-B and to benefit from its advantages.			
				All aircraft that emit position information using a 1090 MHz extended squitter (1090ES) may			
				be provided surveillance separation services, provided they meet the airworthiness			
				compliance requirements defined in: 1 EASA AMC 20-24: or			
				2. EASA CS ACNS: or			
				3. FAA 14 CFR 91.227 or AC 20-165A (or replacement); or			
			AC 700-000 (operational) / EAA AC 20-1658 / EASA AMC 20-24 & CS ACNS / AID	4. Configuration standards reflected in Appendix XI of Civil Aviation Order 20.18 of the Civil			
		TCCA	CANADA (ICAO) Part 2 Enroute (ENR) Section 1.6.3	Aviation Safety Authority of Australia.			
				ADS-B Out systems that are unable to meet the above requirements must disable ADS-B			
				transmission unless:			
				1. the aircraft always transmits a value of 0 (zero) for one or more of the position quality			
				Indicators (NUCP, NIC, NAC or SIL); or 2. the operator has received an exemption from NAV CANADA			
				This is essentially what TCCA will certify to and depends somewhat on how extensively the			
				applicant wants the system certified. For strictly North American operations it will likely just			
				probably be a combination of FAA and EASA.			
				·····			

Surveillance Description Guidance Notes Enveloped Requirements to Comply with all Authorities Enabler ANAC TBD - Designed to function with the following avionics: EASA -RTCA DO-260B (EUROCAE ED-102A) MOPS for 1090 MHz Extended FAA Squitter ADS-B, Class A1: 125 W with two antennas (top antenna Nav Canada is a partner on the Aerion Space Based ADS-B system using ADS-B receivers on Iridium satellites to provide global ADS-B coverage.. required for satellite coverage). Note – Almost all commercial aircraft equipage is ≥ 200 W. System accommodates other existing and future ADS-B message standards: DO-260 (Link Version 0), DO-260A (Link Version 1), and DO-260C (under development). Enables global air traffic -Not designed to support 978 MHz Universal Access Transceiver (UAT). Space-based ADS-B Out surveillance and automation (Proposal in Canada) Include all parameters as specified in "Values to processing Comply with All Authorities," ref. the App. A-ADS-B Out Parameters TBD TCCA Tab. ANAC FAA AC 20-172B Follow AC 20-172B EASA TBD, ETSO-C195b ADS-B In isn't covered by EPAS 2018-2022. If an aircraft installation includes ADS-B In without ADS-B Out, the airplane won't be able to ADS-B In - Airborne/Ground receive ADS-R or TIS-B data. The airplane will only be able to get direct ADS-B traffic (air-tr air) via 1090 MHz link and FIS-B data, because they won't be able to broadcast (via ADS-B Cockpit Display of Traffic Improves awareness of other traffic FAA AC 20-172B, TSO-C195b / 90-114A Chg 1 (operational) Information (CDTI) Out) their ADS-B In capability (FAA only provides TIS-B and ADS-R to aircraft that indicate they are ADS-B In capable). The only time the aircraft may receive TIS-B and ADS-R is if they are close to an ADS-B Out aircraft and can "borrow" their ADS-R/TIS-B data. TCCA FAA AC 20-172B ANAC FAA AC 20-172B Follow AC 20-172B ADS-B In - In-Trail Improves oceanic in-trail EASA TBD, ETSO-C195b ADS-B In isn't covered by EPAS 2018-2022 Procedure (ITP) climb/descent FAA AC 20-172B, TSO-C195b / 90-114A Chg 1 (operational) TCCA FAA AC 20-172B Where alerts are integrated, the recommendations from FAA AC 20-172B have been Follow AC 20-172B FAA AC 20-172B ANAC Displays and alerts crew to ollowed. ADS-B In - ADS-B Traffic airborne conflicts independent of FASA TBD, ETSO-C195b ADS-B In isn't covered by EPAS 2018-2022 Traffic Alert and Collision Advisory System (ATAS) FAA AC 20-172B, TSO-C195b / 90-114A Chg 1 (operational) Avoidance System (TCAS) TCCA FAA AC 20-172B TBD Follow Future AC 20-172C (TBD) Provides higher performance along ANAC track guidance, control, indications, EASA TBD ADS-B In isn't covered by EPAS 2018-2022 ADS-B In - Flight-deck and alerts for enroute and termina or ADS-B In - Interval Management applications, an issue paper should be initiated to Interval Management (FIM) FAA AC 20-172C (TBD) operations (single stablish the method of compliance. runway/coincident routes) TCCA rovides guidance information fo ANAC TBD Follow Future AC 20-172C (TBD) aircraft participating in paired EASA ADS-B In isn't covered by EPAS 2018-2022. TBD ADS-B In – Advancedapproaches to closely spaced For ADS-B In - Interval Management applications, an issue paper should be initiated to Interval Management (A-IM) parallel runways and crossing and FAA AC 20-172C (TBD) stablish the method of compliance. converging runways (non-TCCA ncident routes). Incorporate

The Certification Authorities for Transport Airplanes (CATA) quadrilateral group developed this spreadsheet as a working tool to assist in identification of certification guidance harmonization opportunities for avionics technologies. The CATA recognize the value of this spreadsheet to industry, since it provides a single-source

ummary of certification guidance. The spreadsheet provides a current view of related guidance materials for the listed technologies, provided to industry as a convenience. Industry should always verify the accuracy and applicability of the referenced materials, since they may change over time.

Communication				
Enabler	Description	Guidance		Notes
	Increase to the number of available	ANAC		
Voice Channel Spacing	communication channels by	EASA	CS-ACNS – Subpart B – Section 1	ICAO Annex 10, Volume III, Part 2 (up to Amendment No 85). Mandated by IR (EU) 1079/2012.
Mandate)	splitting the VHF band from 25 kHz	FAA		
,	to 8.33 kHz spacing	TCCA	CS-ACNS – Subpart B – Section 1	
		ANAC	EAA AC 20-150B	
Satellite Voice	Provides voice communication for	FASA	ETSO-C132a ETSO-C159c	
Communications	oceanic and remote operations	FAA	AC 20-150B	
		TCCA	FAA AC 20-150B	
		ANAC	FAA AC 20-140C	
		EASA	CS-ACNS – Subpart B – Section 2. ETSO-C160a	Mandated by IR (EU) No 29/2009 and 2015/310, Ref. EPAS 2018-2022 - RMT.0524
ATN B1 with VDL Mode 2 (European Mandate)	Provides for domestic data link clearances in European airspace	FAA	AC 20-140C, TSO-C160a, Policy Memo AIR-6B0-17-6B0-DM281 / AC 90-117 (operational)	For the VDL M2 sub-network designator, equipment approved under a previous TSOA (i.e., TSO-C160a (or TSO-C160 with TSO-C160a multi-frequency capabilities) may receive the associated designator.
		TCCA	FAA AC 20-140B	
		ANAC	FAA AC 20-140C	An IP is no longer required with release of FAA AC 20-140C.
		EASA	FAA AC 20-140C	
FANS 1/A+ FANS 1/A+ FANS 1/A+ FANS 1/A+ Surveillance transfer of communications in North At airspace	Provides for domestic and oceanic			For the SATCOM (Classic Aero & SBD) and VDL M2 sub-network designators, equipment approved under a previous TSOA (i.e., TSO-C132a or earlier revision, TSO-C159c or earlier revision, TSO-C160a (or TSO-C160 with TSO-C160a multi-frequency capabilities), as applicable) may receive the associated designator. TSO-C132a, TSO-C159c, and TSO-C160a for the SATCOM and VDR equipment classify
	data link clearances and surveillance transfer of communications in North Atlantic airspace	FAA	AC 20-140C, TSO-C132a, TSO-C159c, TSO-C160a, Policy Memo AIR-6B0-17-6B0- DM281 / AC 90-117 (operational)	the failure of the function as a minor failure condition. However, AC 20-140C specifies that the integrated data comm. system must detect the corruption of a data message and mitigate the undetected corruption of a data message with a DAL commensurate to a major hazard (i.e. Level C). Per AC 20-140C no automation for flight plan modification is still acceptable, however, if the aircraft does not include automation (i.e. functional integration) then the applicant will need to demonstrate compliance with both 14 CFR 25.771(a) and 14 CFR 25.1523. However, note that the US intends to allow only FANS 1/A+ (with automation) to operate in the US NAS (Reference AC 90-117 Data Link Communications).
		TCCA		
	Data link system meeting various	ANAC	FAA AC 20-140C	
Multiple Data Link	Multiple Data Link	EASA	CS-ACNS – Subpart B – Section 2 (ACNS.B.DLS.B1.015) covers ATN B1 & FANS 1/A+	
Capabilities (Multiple Stack) F	ATN B1 & B2, ATN B1 & B2 &	FAA	AC 20-140C	
	FANS 1/A+, B2 & FANS 1/A+)	TCCA		
Baseline 2		ANAC	FAA AC 20-140C	
		EASA	EUROCAE standards ED-228A and ED-229A	RMT.0524 is developing material for CS-ACNS
	Provides clearances, terminal information, and Initial Trajectory Operations	FAA	AC 20-140C, TSO-C160a, Policy Memo AIR-6B0-17-6B0-DM281 / AC 90-117 (operational)	For the VDL M2 sub-network designator, equipment approved under a previous TSOA (i.e., TSO-C160a (or TSO-C160 with TSO-C160a multi-frequency capabilities) may receive the associated designator. For B2 data link communication systems that do not support Dynamic RNP or Interval Management services, an issue paper should be initiated to establish the method of
				compliance.
		TCCA		
		ANAC	FAA AC 20-160A	
		EASA		

Communication				
Enabler	Description	Guidance		Notes
Data Link Recording	Provides guidance for compliance with airworthiness standards for onboard recording of CPDLC	FAA	AC 20-160A	A CVR update for recording of data link communications is required for any newly installed data link system (AC 20-160A/TSO-C177a (or earlier revision)/14 CFR 25.1457 at Amdt. 25- 124) unless the date of manufacture for the aircraft and the date of CPDLC design approval (e.g., FANS 1/A) for the make, model, and series of that aircraft is before the effective date of the data link recording rule then data link recording is not required for the life of the aircraft.
		TCCA		

Low visibility Operatio	115			
Enabler	Description	Guidance		Notes
		ANAC	AC 25-11B	ANAC IP has been issued to provide a harmonized guidance for ILS approach CAT II considering FAA AC 20-129A and EASA CS-AWO.
Head-Up Display	Reduces minimums at qualifying	EASA	CS-AWO, AMC 25-11 (CS-25 Amdt 17) / Future CS-AWO Issue 2	Ref. NPA 2018-06
System (ILS)	runways	FAA	AC 25-11B Apdx F, AC 20-191 (TBD), TSO-C210 / AC 120-118, Order 8400.13E (operational)	AC 20-191/120-118 will replace AC 120-28D/120-29A which currently includes guidance for CAT I/II/III and low visibility T/O airworthiness and operational criteria.
		TCCA	FAA AC 25-11B / EASA AMC 25-11	
	Uses enhanced flight visibility to continue approach below	ANAC	FAA AC 20-167A	
	minimums	EASA	TBD (CRI) / Future CS-AWO Issue 2	AMC 25-11 (CS-25 Amdt 17) does not provide operational credit. Ref. NPA 2018-06
Enhanced Flight Vision System (EFVS) (for landing)	Expand operational use of EFVS (for landing)	FAA	AC 20-167A / AC 90-106A (operational)	AC 20-167A includes guidance for EVS, CVS, SVS, EFVS (EVS does not require a HUD and does not provide operational credit; EFVS requires a HUD and provides operational credit). With the amendment (25-144) to 14 CFR 25.773 (adding paragraph (e)) effective 3/21/2017, the special conditions for EVS/EFVS are no longer necessary. EEVS using a beed worm display. (HWD) would require a MOC IP.
		TCCA	AC 20-167A / AC 90-106A	
		ANAC	FAA AC 20-185	
Omethodia Mistan Ordanas	Installation guidance for use of SVGS for decision altitudes as low as 150 ft	EASA	TBD / Future CS-AWO Issue 2	Ref. NPA 2018-06
System (SVGS)		FAA	AC 20-185A (TBD)	With the amendment (25-144) to 14 CFR 25.773 (adding paragraph (e)) effective 3/21/2017, the special conditions for SVS/SVGS are no longer necessary.
		TCCA	TBD (In progress)	
Ground-Based Augmentation System (GBAS) Landing System (GLS) II/III	Provides autoland in very low visibility	ANAC	AC 20-138D, TBD	DECEA, that is responsible for the Bazilian airspace control, has been developing and implementing a GBAS station at Galeao Airport in Rio de Janeiro. The GBAS station is working, however, some challenges (ionospheric threat) prevents full use for approach purposes. This is the only GBAS facility in Brazil.
		EASA	TBD / Future CS-AWO Issue 2	Development of the requirements for the use of GBAS augmented GNSS to support CAT <i>I</i> / <i>I</i> / <i>I</i> / <i>I</i> / <i>I</i> operations (EPAS 2018-2022 - RMT.0682 - Implementation of the regulatory needs of the SESAR common projects). CS-AWO Issue 2 resulting from NPA 2018-06
		FAA	AC 20-138D, AC 20-138E (TBD), AC 20-191 (TBD) / AC 120-118 (operational)	For CAT I/II/III GLS autoland, rollout and/or takeoff an issue paper should be initiated to establish the method of compliance (MOC). AC 20-138D Change 2 provides the guidance for CAT I GLS approach. An issue paper is needed to establish the MOC for CAT II/III GLS approaches. Guidance for CAT II/III will be incorporated into AC 20-191 & 120-118. Guidance for CAT I will be in AC 20-138E.
		TCCA		

Flight Deck Enhancements				
Enabler	Description	Guidance		Notes
		ANAC	FAA AC 20-173 (Airworthiness) IS 91-002 (Operational)	
	Allows electronic access to paper	EASA	AMC 20-25	Opinion 10/2017 - Transposition of provisions on electronic flight bag from ICAO Annex 6
Electronic Flight Bag Inclus	products and other applications. Inclusion is based on intended function.	FAA	AC 20-173 / AC 120-76D (TBD) (operational)	An IP for Class 3 EFB projects is no longer required. The guidance is covered in AC 20-173/120- 76D. Note that an IP for Class 2 EFB provision projects is no longer required if the power disconnect switch is located away from the EFB/PED or cradle.
		TCCA	AC 700-020 (operational)	
		ANAC	FAA AC 20-149B, FAA AC 25-11B Apdx G	
	Provides weather and aeronautical	EASA	AMC 25-11 Chapter 7, ETSO-C157b, ETSO-C154c	
FIS-B	information in the cockpit for	FAA	AC 20-149B, AC 25-11B Apdx G, TSO-C157b, TSO-C154c	
enhanced situation awareness flight conditions	enhanced situation awareness of flight conditions	TCCA	FAA AC 20-149B	
		ANAC	FAA AC 20-167A	
	Displays a synthetic vision image of the external scene topography to the flight crew	EASA	Future CS-AWO Issue 2	Ref. NPA 2018-06
Synthetic Vision Systems		FAA	AC 20-167A / Future AC 20-185A (TBD - will contain all SVS/SVGS guidance. SVS guidance currently published in AC 20-167A will be moved to AC 20-185A)	With the amendment (25-144) to 14 CFR 25.773 (adding paragraph (e)) effective 3/21/2017, the special conditions for SVS/SVGS are no longer necessary.
		TCCA	FAA AC 20-167	
		ANAC	AC 20-177	
Airborne Access to System	Provide flight crews with access to	EASA	N/A	
Wide Information	Management (SWIM) over non	FAA	AC 20-177, TSO-C207a	
Management (AAtS)	aeronautical frequency band.	TCCA		
Alah ama Oshilalar		ANAC	TBD	
Airborne Collision Avoidance System (ACAS-X)	Improves airborne collision	EASA	TBD	
	nuisance alerts	FAA	TBD	
		TCCA		

Parameter	Values to Comply with All Authorities	To Comply with EASA Only	To Comply with TCCA Only*	To Comply with FAA or ANAC Only	
Length and width of the aircraft	R	R	0	R	
Latitude and longitude	R	R	R	R	
Barometric pressure altitude	R	R	R	R	
Velocity	R	R	0	R	
TCAS II or ACAS is installed & operating in a mode that					
can generate resolution advisories	R	R	0	R	
If a resolution advisory is in effect when an operable					
TCAS II or ACAS is installed	R	R	0	R	
Mode 3/A transponder code	R	R	0	R	
Aircraft Identification (the aircraft's call sign)	R	R	R	R	
An emergency, radio, communication failure, or					
unlawful interference indication	R	R	R	R	
"IDENT" indication (SPI)	R	R	R	R	
Assigned ICAO 24-bit address	R	R	R	R	
Emitter category	R	R	0	R	
ADS-B In capability	R	0	0	R	
Geometric altitude	R	R	0	R	
Navigation Accuracy Category for Position (NAC _P)	R ≥ 8	R ≥ 7	R	R ≥ 8	
Navigation Accuracy Category for Velocity (NAC _v)	R ≥ 1	R ≥ 1	0	R≥1	
Navigation Integrity Category (NIC)	R ≥ 7	R ≥ 6	R	R ≥ 7	
System Design Assurance (SDA)	R ≥ 2	R ≥ 2	0	R ≥ 2	
Source Integrity Level (SIL)	R = 3	R = 3	R	R = 3	
Version number	R =2	R =2	R	R =2	
Geometric Vertical Accuracy (GVA)	R	R	0	0	
Vertical rate	R (if available)	R (if available)	0	0	
GNSS antenna offset	R	R	0	0	
Selected altitude	R (if available)	R (if available)	0	0	
Barometric pressure setting	R (if available)	R (if available)	0	0	
Selected heading	0	0	0	0	
R=Required/O=Optional					
				l	
*Nav Canada accepts EASA AMC 20-24 non-radar area ADS-8 minimum requirements. ADS-8 Out is not mandated, but those aircraft so equipped can be better served in the current, ground-based ADS-B coverage					
area (Hudson Bay, Northeast and Oceanic near Greenland).					

CS-ACNS - BOOK 2 - Subpart D - Section 4 - 1090 MHz Extended Squitter ADS-B Out	AC 20-165B - Airworthiness Approval of Automatic Dependent Surveillance - Broadcast Out Systems
GM1 ACNS.D.ADSB.001 Applicability	1.1.2 Intent of This AC.
With respect to 1090 MHz ES ADS-B Out installations, the material in this section is to a large degree in line with the corresponding FAA AC	This AC is primarily intended for installations compliant with the aircraft requirements of Title 14 of the Code of Federal Regulations 14 CFR
20-165A [also applies to AC 20-165B] material. Differences between the two documents are listed in Appendix J . This guidance may be of	91.225 and § 91.227. Airworthiness compliance will be evaluated based on the applicable intended function rule (such as §§ 23.1301,
use when showing of compliance with both documents is required.	25.1301, 27.1301, or 29.1301) recognizing that the intended function is to meet the equipment requirements in §§ 91.225 and 91.227. It is
The requirements of CS ACNS.D.ADSB fully cover (and exceed) the requirements of AMC 20-24 (Certification Considerations for the	possible to receive airworthiness approval for your ADS-B OUT system with a different intended function; however, we strongly discourage
Enhanced ATS in Non-Radar Areas using ADS-B Surveillance (ADS-B-NRA) Application via 1090 MHz Extended Squitter). Therefore, aircraft	this type of installation unless it is in accordance with the criteria for ADS-B OUT in foreign non-radar airspace (for example, Approved
that comply with CS ACNS.D.ADSB also comply with AMC 20-24 but not vice versa.	Means of Compliance (AMC) 20-24, Certification Considerations for the Enhanced ATS in Non-Radar Areas using ADS-B Surveillance (ADS-B
The approval of on-board systems receiving and processing ADS-B messages in support of air-to-air applications is outside the scope of	NRA) Application via 1090 MHZ Extended Squitter). Applicants using this AC to install ADS-B systems that are not compliant with §§ 91.225
Subpart D section 4.	and 91.227 must follow all aspects of this AC or propose alternate means, as appropriate, to the Federal Aviation Administration (FAA).
Note: In accordance with EU Regulation No 1207/2011, aircraft having a maximum take off mass greater than 5 700 kg or a maximum	1.5.1 (Scope) This AC only addresses the installation of ADS-B OUT systems. Installation guidance for ADS-B IN can be found in the latest
cruising true airspeed greater than 128.6 m/s (250 knots) and operating flights as general air traffic in accordance with instrument flight	version of AC 20-172, Airworthiness Approval for ADS-B In Systems and Applications. Installation guidance for Flight Information Services -
rules in the airspace within the ICAO EUR and AFI regions where EU Member States are responsible for the provision of air traffic services	Broadcast (FIS-B) can be found in the latest version of AC 20-149, Installation Guidance for Domestic Flight Information Services -
are to be compliant with CS ACNS Book 1 Subpart D section 4.	Broadcast
AMC1 ACNS.D.ADSB.010 ADS-B Out system approval	4.1.1 (Ground Test) System Interface Testing.
Equipment Qualification	Verify the installed ADS-B equipment meets its intended function and transmits the appropriate information from each of the interfaced
For equipment qualification, refer to AMC1 ACNS.D.ADSB.030 through to AMC1 ACNS.D.ADSB.090.	systems (including the position source, barometric altitude source, heading source, TCAS II, pilot interface, etc). Coordinate with local ATC
The ADS-B Out functionality should be demonstrated by ground testing, using ramp test equipment where appropriate, that verifies during	before broadcasting over the air to prevent being a source of interference to ATC or ADS-B IN equipped aircraft in the area. For example,
nominal system operation, the correctness of the aircraft derived surveillance data contained in the ADS-B messages, and the functioning	transmitting airborne position reports with simulated airborne altitudes while on the surface will produce false targets for the ATC
of system monitoring tools/fault detectors including any ADS-B self-test features.	surveillance systems or airborne ADS-B IN equipped aircraft.
	4.1.3 (Ground Test) Rule Compliance.
	Ensure the ADS-B system meets the requirements of § 91.227.
	4.1.8 (Ground Test) Self Test.
	Evaluate the ADS-B self-test features (if provided) and failure mode annunciations to ensure the pilot is able to determine whether the
	system is functioning properly.
AMC1 ACNS.D.ADSB.020(a-b) ADS-B Out data parameters	4.1.3.2 (Ground Test) Parameters.
During ADS-B Out system installation testing, all the parameters that are broadcast should be demonstrated to be correct for each	Per § 91.227(d), ensure the following parameters are properly populated and transmitted.
installed ADS-B transmit unit, i.e. the transmitted data should be in line with the respective source data.	4.1.3.2.1 The length and width of the aircraft;
	4.1.3.2.2 An indication of the aircraft's latitude and longitude;
	4.1.3.2.3 An indication of the aircraft's barometric pressure altitude;
	4.1.3.2.4 An indication of the aircraft's velocity;
	4.1.3.2.5 An indication if TCAS II or ACAS is installed and operating in a mode that can generate resolution advisory alerts;
	4.1.3.2.6 If an operable TCAS II or ACAS is installed, an indication if a resolution advisory is in effect;
	4.1.3.2.7 An indication of the Mode 3/A transponder code specified by ATC;
	4.1.3.2.8 An indication of the aircraft's call sign that is submitted on the flight plan, or the aircraft's registration number, except when the
	pilot has not filed a flight plan, has not requested ATC services, and is using a TSO-C154c self-assigned temporary 24-bit address [CS only
	recongnizes 1090 ES for the ADS-B Out data link);
	4.1.3.2.9 An indication if the flightcrew has identified an emergency, radio communication failure, or unlawful interference;
	4.1.3.2.10 An indication of the aircraft's "IDEN I' to AIC;
	4.1.3.2.11 An indication of the arcrait assigned iCAO 24-bit address, except when the pilot has not need a hight pilot, has not requested
	All services, and is using a 150-c154c self-assigned temporary 24-bit address [CS only recongnizes 1050 ES for the ADS-B Out adda link];
	4.1.3.2.12 An indication of the anciar semitter category,
	1.1.3.2.1 An indication of the act of in Aboo in capability is instance (not required by Co),
	4.1.3.2.15 An indication of the Navigation Accuracy Category for Position (NAC.)
	4.1.3.2.16 An indication of the Angistion Accuracy Category for Velocity (MAC.)
	1.1.2.17 An indication of the Navigation Letterity (Steeper (NUC))
	A 13.2.12 An indication of the System Design Assurance (SNA) and
	1.1.3.2.10 An indication of the System Design Associate (SDA), and
	Activities with indication of the position integrity level (arc).

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), a guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation,	nd Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.
AMC1 ACNS.D.ADSB.020(a-b) ADS-B Out data parameters (cont.) The Emitter Category, Aircraft Length and Width and GPS Antenna Offset parameters might be either configured as a fixed value during ADS-B Out system installation, or provided via a variable data interface. In both cases [AC 20-165B specifies that these parameters be set at installation], during installation, the respective settings should be verified to be correctly set.	 3.2.3.2 (Installation)Aircraft Length and Width. This parameter must be configured during installation 3.2.3.4 (Installation) Emitter Category. Set emitter category per manufacturer instructions 3.8.4.1 (Installation) GNSS Antenna Offset and Position Offset Applied (POA). Although not required to comply with § 91.227 <i>[Required by CS]</i>, it is highly encouraged for ADS-B equipment manufacturers to provide instructions to installers for setting this parameter and for installers to configure the offset during installation.
	Additional Guidance not Addressed in CS-ACNS
	4.1.3.4 (Ground Test) Barometric Altitude Accuracy. Validate that the barometric altitude transmitted from the ADS-B system is accurate to within 125 feet. If the aircraft has a transponder installed, you must also validate that the ADS-B barometric altitude matches the transponder barometric altitude.
AMC1 ACNS.D.ADSB.020(a-b) ADS-B Out data parameters (cont.) The ADS-B Horizontal Position System Design Assurance (SDA) parameter indicates the probability of an ADS-B Out system malfunction causing false or misleading position information or position quality metrics to be transmitted. SDA may be pre-set at installation for systems that do not utilise multiple position sources with different design assurance levels, otherwise the system should be capable of adjusting the SDA broadcast parameter to match the position source being employed at the time of transmission. ADS-B transmit equipment that is compliant with AMC1 ACNS.D.ADSB.030 and that is directly connected to a position source compliant with AMC1 ACNS.D.ADSB.070 may set the SDA to 'two' without further analysis.	 3.1.2 (Installation) System Safety Assessment. The ADS-B System Design Assurance (SDA) parameter indicates the probability of an ADS-B system malfunction causing false or misleading position information or position quality metrics to be transmitted. SDA may be preset at installation for systems that do not use multiple position sources with different design assurance levels; otherwise the system must be capable of adjusting the SDA broadcast parameter to match the position source being employed at the time of transmission. 3.1.2.1 (Installation) Compliant Architecture. 3.1.2.1 (Installation) ADS-B equipment that meets the minimum performance requirements of TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link] and is directly connected to a position source meeting the minimum performance requirements of any revision of the following TSOs may set the SDA = 2 without further analysis: - TSO-C129 [TSO-C129 a is the minimum in CS-ACNS], Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS); - TSO-C145, Airborne Navigation Sensors Using The Global Positioning System (GPS) Augmented By The Satellite Based Augmentation System (SBAS); - TSO-C146, Stand-Alone Airborne Navigation Equipment Using the Global Positioning System Equipment using Aircraft-Based Augmentation.
AMC1 ACNS.D.ADSB.020(a-b) ADS-B Out data parameters (cont.) For more complex ADS-B installations, a system safety assessment is required to set the SDA. Basically, the lowest design assurance level of one system in the horizontal position data transmission chain should define the SDA value. Additional guidance material on the required surveillance data parameters are provided in Appendix H Part 1 and Part 2. Appendix H Part 6 provides matrices of the so-called BDS register fields as used by the 1090 ES ADS-B transmit unit to broadcast the ADS-B Out parameters. These matrices detail the ADS-B Out data requirements at data field level for general understanding and in support of integration testing, as appropriate. If installations transmit ADS-B Out data that do not meet some requirements of the Subpart D Section 4, the respective data should only be transmitted with a 'zero' quality indication (if a quality indication is defined in the ADS-B Out transmit system).	 3.1.2.1.2 (Installation) For installations in aircraft with more complex system architectures, a system safety assessment, as described below, is required to set the SDA. Installations of uncertified ADS-B systems must set SDA = 0 with the following exception: experimental category aircraft, including experimental light-sport aircraft (E-LSA) (Part 91 aircraft), may install unapproved equipment and set the SDA in accordance with the equipment manufacturer's installation manual, provided the equipment has a statement of compliance to the performance requirements of § 91.227), from the equipment manufacturer(s). 3.1.2.2.1 (Installation) ADS-B systems using position sources not listed in section 3.1.2.1 or systems with intermediary devices such as data concentrators must accomplish a system safety assessment and set the SDA according to the results of the assessment. Systems integrated through a highly integrated data bus architecture must complete the system safety assessment. The system safety assessment must demonstrate that the installed system meets all TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link] requirements to set the SDA = 2 or 3. This can be accomplished using the methods, for example, as described in— - AC 25.1309-1(), System Design and Analysis; - ASE 1.309-1(), System Safety Analysis and Assessment for Part 23 Airplanes; - SAE International (SAE) Aerospace Recommended Practice (ARP) 4761, Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment; or - SAE ARP 4754A, Guidelines for Development of Civil Aircraft and Systems. 3.1.2.2.2 (Installation) If the system contains different design assurance levels for hardware and software, the worst-case design assurance level should be used. For example, if the hardware assurance level is C, and the software assurance level is B, the SDA would indicate the system has been qualified commensurate with a Major failur
	Additional Guidance not Addressed in CS-ACNS

	3.1.2.3 (Installation) Existing Equipment Design Assurance. The aircraft installation may make use of some equipment certified for use with an existing transponder system. There is no intent for this safety assessment to drive the replacement of existing altimetry, flightcrew controls, heading instruments, or antennas. In contrast, the position source installation must be compliant with the guidance in this AC, including design assurance considerations.
AMC1 ACNS.D.ADSB.025(a) Provision of data — Approved sources (a) See AMC1 ACNS.D.ADSB.070-090 for details on the approval of the respective data sources. (b) For transmission of optional data items, the following provisions should be considered: (1) Airspeed In case of a loss of GNSS horizontal velocity data, the ADS-B transmit unit normally switches to broadcast airspeed information (using subtypes 3 and 4 of register 09 ₁₆). Therefore, if airspeed data is provided to the ADS-B transmit unit, it should be provided by an approved airspeed source that is providing data intended for use by the flight crew. An air data computer meeting the minimum performance requirements of holding an EASA equipment authorisation in accordance with ETSO-C106 (JTSO-C106) is an acceptable source. (2) Heading In case of a loss GNSS ground track and if heading is provided to the ADS-B transmit unit, the heading source should hold an EASA equipment authorisation in accordance with ETSO-C5e (JTSO-C5e) or any revision of ETSO-C6d (JTSO-C6d). (3) Other Data Parameters The Intent Change Flag should be set as appropriate to indicate the availability of information in the Mode S registers 40 ₁₆ to 42 ₁₆ .	A.2.2 (Parameters) Airspeed. Optionally, true airspeed or indicated airspeed may be transmitted. The airspeed source should be approved to output airspeed data. An air data computer meeting the minimum performance requirements of TSO-C106 is one acceptable source. Do not interface an airspeed source to the ADS-B that has not been approved for cockpit display. 3.5 (Installation) Heading Source. 3.5.1 (Installation) Equipment Eligibility. For installations that integrate heading on the airport surface, the heading source must meet the minimum performance requirements of any revision of TSO-C5, Direction Instrument, Non-Magnetic (Gyroscopically Stabilized), or any revision of TSO-C6, Direction Instrument, Magnetic (Gyroscopically Stabilized). The equipment must have the appropriate installation and airworthiness approval. 3.11.1 (Installation - Foreign Airspace Requirements) Optional Parameters [<i>Required by CS if available and in a suitable format</i>]. If operations are planned in a country that requires parameters not mandated in the United States, such as selected heading and selected altitude, follow the ADS-B equipment mundfacturer's installation guidance to interface those parameters. 3.2.3.3 (Installation) ADS-B IN Capability. This parameter must [<i>Not required by CS</i>] be configured to indicate if the aircraft has an ADS-B IN system installed, and can process ADS-B
If available, Selected Heading information should come from approved data sources. The 1090 ES IN capability field should be set correctly.	messages to support at least one ADS-B IN application. For ease of installation, the parameter does not have to indicate the operational status of the ADS-B IN system. If the aircraft has both 1090ES ADS-B IN and UAT ADS-B IN systems installed, both the 1090ES ADS-B IN and UAT ADS-B IN capability should be set accordingly. A.2.1 (Parameters) ADS-B IN Capability. Two messages indicate the ADS-B IN status of the aircraft. The 1090 ADS-B IN message indicates if the aircraft has the ability to receive 1090ES ADS-B messages installed. The UAT ADS-B IN message indicates if the aircraft has the ability to receive UAT ADS-B IN capability is important because TIS-B and ADS-R services are provided specific to an aircraft's position relative to other aircraft. The FAA may only provide complete TIS-B and ADS-R services to aircraft that indicate they are ADS-B IN capable. ADS-B IN capability is required to be transmitted by § 91.227 [<i>Not required by CS</i>].
AMC1 ACNS.D.ADSB.025(c) Provision of data – Data quality indication and associated data Data quality indications for the horizontal position containment bound (NIC) and horizontal position accuracy bound (NACp) should be provided to the ADS-B transmit unit together with the corresponding horizontal position information within the same data set. Data quality indications for the horizontal position source integrity level (SIL) and system design assurance level (SDA) may be preset at installation. Systems that utilise multiple GNSS-based position sources with different design assurance levels or source integrity levels, should be capable of adjusting the SDA and SIL quality indications to match the position source that is employed at the time of transmission. The horizontal velocity accuracy bound (NACv) and vertical geometric altitude accuracy bound (GVA) should be dynamically provided to the ADS-B transmit unit together with the corresponding velocity and geometric altitude information within the same data set. However, NACv and GVA may be also preset at installation. For further guidance on the ADS-B data quality indicators, refer to AMC1 ACNS.D.ADSB.070(a).	 3.1.2 (Installation) System Safety Assessment. SDA may be preset at installation for systems that do not use multiple position sources with different design assurance levels; otherwise the system must be capable of adjusting the SDA broadcast parameter to match the position source being employed at the time of transmission. 3.3.3.3 (Installation) Source Integrity Level (SIL). SIL is typically a static (unchanging) value and may be set at the time of installation if a single type of position source is integrated with the ADS-B system. 3.3.3.7 (Installation) Navigation Accuracy Category for Velocity (NAC_v). Set the NAC_v based on design data provided by the position source. 3.3.3.9 (Installation) Geometric Vertical Accuracy (GVA). Set the GVA based on design data provided by the position source manufacturer
AMC1 ACNS.D.ADSB.030 ADS-B Transmit unit installation To be approved, the ADS-B transmit unit installation To be approved, the ADS-B transmit unit should hold an EASA equipment authorisation in accordance with ETSO-C166b and ETSO-C112d, including any additional requirements as required to comply with the provision of the AMC's to Subpart D section 4 (e.g. On-the-ground status determination and maximum NIC encoding). Where such additional requirements apply, it is expected that the ADS-B transmit unit manufacturer supplies compliance information through a Declaration of Design and Performance (DDP), or an equivalent document The broadcast of Selected Altitude and Barometric Pressure Setting are optional for equipment meeting ETSO-C166b and equipment should implement this optional functionality if available and in a suitable format [<i>Not required by § 91.227</i>]. If using earlier versions of ETSO-C112(), it should to be demonstrated that all applicable requirements from EUROCAE ED-102A have been implemented. This can be achieved by a positive deviation of compliance to previous versions of EUROCAE ED-73 that have been documented in the Declaration of Design and Performance (DDP).	3.2.1 (Installation - ADS-B Equipment) Equipment Eligibility. ADS-B equipment must meet the performance requirements specified in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link]. A compliant installation must meet the requirements in § 91.227. To deviate from any rule requirements, you must obtain a deviation approval from the FAA, in accordance with § 91.225(c) and § 91.227(f). Under those provisions, as specified in 14 CFR 21.618, this requires showing that factors or design features provide an equivalent level of safety that compensates for the standards from which a deviation is requested. 3.11.1 (Installation - Foreign Airspace Requirements) Optional Parameters [Required by CS if available and in a suitable format]. If operations are planned in a country that requires parameters not mandated in the United States, such as selected heading and selected altitude [incl. Barometric Pressure Setting], follow the ADS-B equipment manufacturer's installation guidance to interface those parameters.
	Additional Guidance not Addressed in CS.ACNS

	3.2.2.1 UAT Systems With Mode S Transponders [CS only recongnizes 1090 ES for the ADS-B Out data link]. Do not install a UAT ADS-B OUT system with the capability to transmit a random 24-bit address in an aircraft that also has a Mode S transponder unless the random 24-bit feature is disabled. The ATC automation system would interpret the different 24-bit addresses as two separate aircraft, and alert controllers to a conflict that does not actually exist. 3.2.2.2. Mixed Transmit/Receive Classifications. TSO-C156b and TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link] allow Class A transmit-only and Class A receive-only equipment configurations. There are no restrictions for installing a certain class of receive equipment with a different class of transmit equipment. For example, a Class A3 transmit-only unit can be used in the same aircraft with a Class A1 receive-only unit. It is also acceptable to have a TSO-C166b transmitter and a TSO-C154c receiver and vice versa [CS only recongnizes 1090 ES for the ADS-B Out data link] . 3.2.2.3. Stand-Alone 1090ES Transmitters. RTCA/DO-260B, section 2.2.2.2, only allows Class A0 and B0 1090ES transmitters because they are not compliant with § 91.227.
AMC1 ACNS.D.ADSB.040 Antenna Diversity [CS requires antenna diversity, AC 20-165 allows single bottom-mounted antenna] . The 1090 ES data protocol includes a bit to indicate, at any time, if only one or both antennas (if installed) are functional. The corresponding parameter for the Single Antenna bit is contained in register 65 ₁₆ (message element bit '30') and should be set to the appropriate value. Note 1: For detailed guidance on the required antenna diversity as a function of aircraft maximum cruising true airspeed capability, refer to AMC1 ACNS.D.ELS.065 [CS requires antenna diversity, AC 20-165 allows single bottom-mounted antenna] . Note 2: For further guidance on antenna installations, see CS ACNS.D.ELS.060, CS ACNS.D.ELS.065, AMC1 ACNS.D.ELS.060 and AMC1 ACNS.D.ELS.065.	[CS requires antenna diversity, AC 20-165 allows single bottom-mounted antenna] 3.8.4.5 (Installation) Single Antenna Bit. For aircraft using a single antenna, this parameter should be set to one, "True". A.2.26 (Parameters) Single Antenna Bit. This parameter indicates if the ADS-B equipment is transmitting through a single antenna.
AMC1 ACNS.D.ADSB.055 Simultaneous operation of ADS-B transmit units Manual switching between transmitters is considered acceptable. Note: The requirement applies to ADS-B transmit units broadcasting on the same data link. It does not preclude simultaneous operation of dual link installations.	3.2.2.4 (Installation) Multiple ADS-B OUT Systems. If the aircraft has the ability to operate a 1090ES and a UAT ADS-B OUT system at the same time, the systems must have a single point of entry for the emergency code, IDENT, and Mode 3/A code. Neither system may use the anonymity (random address) feature. If dual ADS- B OUT systems of the same link are installed (for example, to increase dispatch reliability), the installation must preclude operation of both systems simultaneouslyNote: Installation of dual 1090ES and UAT ADS-B IN capability is acceptable and encouraged. Also, dual systems must be the same version level; that is, if the 1090ES system meets the requirements of RTCA/DO-260B (version 2), the UAT system must meet the requirements of RTCA/DO-282B (version 2). Note: Installation of dual 1090ES and UAT ADS-B IN capability is acceptable and encouraged. Refer to AC 20-172() for ADS-B IN installation guidance.
AMC1 ACNS.D.ADSB.060 On-the-ground status Determination For aircraft with retractable landing gear, the on-the-ground status determination is typically provided through a landing gear weight-on- wheels switch. For aircraft that have fixed-gear, the ADS-B Out system should be able to determine the air-ground status of the aircraft using other means. Installations that provide a means to automatically determine on-the-ground status based on input from other aircraft sensors are acceptable if they are demonstrated to accurately detect the status. Otherwise, ground status validation algorithms should be implemented, using speed thresholds that match the typical aircraft's rotation speed as closely as possible. It is noted that for the validation of a directly determined on-the-ground status that is not validated outside the ADS-B transmit function, validation against the aircraft's typical rotation speed (rather than a fixed value of 50 m/s (100 knots)) might not have been tested in accordance with ETSO-C166b. If that is the case, it is expected that the ADS-B transmit unit manufacturer supplies compliance information through a Declaration of Design and Performance (DDP), or an equivalent document. Detailed guidance material is provided in Appendix I.	3.10.2 (Installation) Air-Ground Status. For aircraft with retractable landing gear, the air-ground status determination is typically provided through a landing gear weight-on- wheels (WOW) switch. For aircraft that have fixed gear, the ADS-B system must still be able to determine the air-ground status of the aircraft. Installations that provide a means to automatically determine air-ground status based on inputs from other aircraft sensors may be acceptable if they can be demonstrated to accurately detect the status. For example, air-ground status may be derived from WOW switch and GPS velocity; or GPS velocity, an airport database, and geometric altitude; or GPS velocity and airspeed. These algorithms should be tested and validated during the installation approval.
	Additional Cuidance not Addressed in CEACNE

	3.10.3 (Installation) Mode S Transponder Inhibit. TSO-C112d and TSO-C112e, Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment, requires Mode S transponders to inhibit the reply to Mode A/C/S all-call and Mode S-only all-call interrogations on the surface. Mode S transponders with ADS-B functionality will now remain "ON" during surface operations; thus it is imperative that you ensure the transponder interface to the air-ground status is installed correctly and that the transponder does not reply to Mode A/C/S all-call or Mode S-only all-call interrogations on the surface. Note: In deploying Airport Surface Detection Equipment version X (ASDE-X) at various airports, we have found transponder installations that have been improperly wired and therefore inappropriately respond to ATC and TCAS interrogations while on the airport surface.
AMC1 ACNE D ADED 070. Herizental Decition and Velocity Data Services	2.2.1 (Installation Devition Source) Equipment Elizibility
 (a) GNSS Standards (1) Basic GNSS System Approval To be approved, the horizontal position and velocity data source should hold an EASA equipment authorisation in accordance with either ETSO-C129a, or ETSO-C145/ETSO-C146, including the additional qualification requirements as specified in paragraph (2) below. (2) Additional GNSS Receiver Qualification Requirements In order to fully address the standard associated with ADS-B Out, an ETSO authorisation alone may not be sufficient to ensure ADS-B compatibility. The position and velocity source should also comply with the following requirements (i) to (vi). It is expected that compliance with these requirements is demonstrated by the equipment manufacturer and documented in the Declaration of Design and Performance (DDP), or an equivalent document. Detailed guidance material on the qualification requirements is provided in Appendix H Part 5. 	591.227 is performance based and does not require any specific position source [CS requires GNSS position source with TSO-C129a, or TSO-C145/ETSO-C146 approval]. The existing navigation equipment and airworthiness standards should be used; however, they must be augmented to address the unique issues associated with ADS-B. A TSO authorization alone is not sufficient to ensure ADS-B compatibility. The position source must also comply with the performance requirements in 4.5.6 Appendix B of this AC. Compliance with the 4.5.6 Appendix B requirements may be documented in the position source manufacturer's installation instructions. Note: Not all GNSS position sources will provide the same availability. Refer to 4.5.6 Appendix B for more information on GNSS availability. The FAA recommends TSO-C146 or TSO-C146 position sources that meet the 4.5.6 Appendix B requirements to maximize availability and ensure access to the airspace identified in § 91.225 after January 1, 2020.
	Additional Guidance not Addressed in CS-ACNS
	Additional Guidance not Addressed in CS-ACNS 3.3.2.6 (Installation) GPS/UAT Time Mark Synchronization [CS only recongnizes 1090 ES for the ADS-B Out data link]. When integrating a UAT with an external GPS, the design of the hardware time mark must be interoperable. Some GPS synchronize the leading edge of the time mark to the UTC second. Other GPS allow the time mark pulse to be asynchronous to the UTC second, then record the time of the leading edge in the digital data along with the position solution. The UAT equipment must support the GPS time mark design. If the UAT equipment and GPS do not share a common time mark design, the UAT equipment will not be properly synchronized with the ground system and other aircraft.
AMC1 ACNS D ADSR 070 Horizontal Position and Velocity Data Sources (cont.)	Additional Guidance not Addressed in CS-ACNS 3.3.2.6 (Installation) GPS/UAT Time Mark Synchronization [CS only recongnizes 1090 ES for the ADS-B Out data link]. When integrating a UAT with an external GPS, the design of the hardware time mark must be interoperable. Some GPS synchronize the leading edge of the time mark to the UTC second. Other GPS allow the time mark pulse to be asynchronous to the UTC second, then record the time of the leading edge in the digital data along with the position solution. The UAT equipment must support the GPS time mark design. If the UAT equipment and GPS do not share a common time mark design, the UAT equipment will not be properly synchronized with the ground system and other aircraft.

AMC1 ACNS.D.ADSB.070 Horizontal Position and Velocity Data Sources (cont.)	B.4.1 (Position Source Qualification - GNSS) Position.
	GNSS position sources must provide a latitude and longitude output
	B.4.1.2 (Position Source Qualification - GNSS) TSO-C129a.
	Additional means of compliance for this TSO require GNSS manufacturers to substantiate that the latitude/longitude is output and
	referenced to WGS-84 coordinate system.
	B.4.2 (Position Source Qualification - GNSS) Position Source Latency.
	GNSS position source manufacturers must provide position source latency information.
	B.4.4 (Position Source Qualification - GNSS) Horizontal Position Integrity.
	GNSS position sources must have a horizontal position integrity (such as HIL or HPL) output qualified during the system's TSOA or design
	approval to determine NIC.
	B.4.6 (Position Source Qualification - GNSS) Integrity Fault Alerts.
	GNSS position source manufacturers must provide design data on the maximum time the position source can take to indicate an integrity
	fault. If the fault indication is mode specific, data on all modes must be included. It is recommended that the indication of an integrity
	fault be provided within 8 seconds [10 sec. requirement, but AC recommends 8 sec.] across all modes.
	B.4.8. (Position Source Qualification - GNSS) Horizontal Position Accuracy.
	GNSS position sources should provide an HFOM output that was demonstrated during the position source's design approval or during an
	installation approval.
AMC1 ACNS.D.ADSB.070 (cont.)	B.3.8 (Position Source Qualification - General) Velocity Accuracy.
(vii) The horizontal velocity accuracy output should have been qualified. If a dynamic horizontal velocity accuracy output is not provided,	The position source should have a velocity accuracy output that was qualified in conjunction with the system's TSOA or design approval.
the transmitted horizontal velocity accuracy should be based on a worst case accuracy. If a dynamic horizontal velocity accuracy output is	Instead of a dynamic output, the position source manufacturer may demonstrate a worst case velocity accuracy that can be assumed
provided, the source should have been qualified for this quality indication accordingly as per Appendix H Part 5 paragraph 4.	based on testing. A test for GNSS position sources is contained in the latest revision of AC 20-138, appendix 4. The position source
In addition, a means should be provided to establish the condition when the horizontal velocity track angle accuracy exceeds plus/minus	manufacturer may propose a test method for non-GNSS sources [CS requires GNSS-based position sources (GNSS/IRS systems are
'eight' degrees as per Appendix H Part 5 paragraph 4.	recognized as acceptable)] or an alternate test for GNSS sources during the TSOA or design approval.
(3) Interface Interoperability Aspects	3.3.2.2 (Installation) Position Source and ADS-B Equipment Interface.
It should be verified that the position and velocity information (including their respective quality indicators) received from the source are	Unless the ADS-B equipment manufacturer has analyzed the interface between the position source and the ADS-B equipment you are
correctly interpreted by the ADS-B equipment.	installing, and specifically listed the position source in the ADS-B equipment's installation manual, you must provide an analysis of the
(i) Horizontal Position Integrity Containment Bound	interface between the position source and the ADS-B equipment that demonstrates the position, velocity, position accuracy, position
Some approved horizontal position sources may incorrectly output horizontal position integrity containment bounds of less than 75	integrity, and velocity accuracy information taken from the position source is properly interpreted by the ADS-B equipment. When
meters. In such cases, it is accepted that the transmit unit limits the NIC value to 'eight'.	installing modifications to a position source, the installer must determine and test those portions of the ADS-B system that are impacted
It is expected that the ADS-B transmit unit manufacturer supplies compliance information through a Declaration of Design and	by the modification and ensure the ADS-B system is not adversely impacted.
Performance (DDP), or an equivalent document.	Note: This analysis will require engineering design data from the ADS-B equipment manufacturer and/or the position source
(ii) Horizontal Velocity Format	manufacturer.
The position and velocity source manufacturer should provide information describing how the horizontal velocity information is output	B.3.2 (Position Source Qualification - General) Horizontal Velocity.
(i.e. in a ground speed/track angle format versus north/east velocity format) and the protocols used.	The position source must output north/south and east/west velocities. We recommend the position source also output the velocity in a
(4) Data Quality Indicator Testing	ground speed and track angle format.
By design and under nominal GNSS satellite constellation conditions, an ADS-B Out system that is compliant with CS ACNS.D.ADSB.070	B.4.11 (Position Source Qualification - GNSS) Horizontal Velocity.
should meet the required values of the horizontal position NIC, NACp, SIL and horizontal velocity NACv quality indicators (refer to	The position source must output north/south and east/west velocities. It is recommended the position source also output the velocity in a
Appendix H Part 3 Table 20).	ground speed and track angle format.

AMC1 ACNS.D.ADSB.070 (cont.)	3.3.2.1 (Installation) Installation Guidance.
(b) Installation Guidance	The position source must be installed in accordance with the applicable guidance. New GNSS position sources must be installed in
The GNSS based position sources should be installed in accordance with FAA AC 20-138B (or later).	accordance with AC 20-138(), Airworthiness Approval of Positioning and Navigation Systems.
Note: EASA is developing GNSS installation guidance, once published, should be used instead of the FAA material [Update to CS-ACNS	3.3.2.3 Secondary Position Source.
Subpart C upon release] .	There is no requirement to have a secondary position source input. However, if you interface a secondary position source to the ADS-B
(c) Multiple Position and Velocity Data Sources	system, it must meet the requirements in 4.5.6 Appendix B of this AC.
(1) Multiple Source Approval	Note: If a position source is unable to provide § 91.227 accuracy and integrity values, it will not qualify the aircraft to operate in airspace
Any position and velocity source that is interfaced to the ADS-B transmit unit, should meet the requirements of CS ACNS.D.ADSB.070.	defined by § 91.225 after January 1, 2020.
(2) Source Priority	3.3.2.4 Position Source Selection.
If multiple horizontal position data sources are interfaced with the ADS-B transmit unit, priority should be given to the source that provide:	If multiple position sources (such as MMR/GPS, IRS/INS/ADIRU [CS requires GNSS-based position sources (GNSS/IRS systems are
the best ADS-B performance with respect to the horizontal position integrity containment bound (NIC).	recognized as acceptable)] or GPS1 & GPS2) are interfaced to the ADS-B equipment, source selection can be accomplished manually by
A change of the selection between sources should only take place when the not selected source has exceeded the NIC performance of the	the pilot, automatically by the aircraft's navigation system, or by the ADS-B equipment. We discourage automatic selection of the ADS-B
selected source for several seconds.	position source based solely on the navigation source in use because operational requirements sometimes dictate a navigation source that
(d) Interconnecting Avionics	may not provide the best ADS-B performance. If the ADS-B equipment accomplishes the position source selection, it should do so in
Interconnecting avionics between a horizontal position and velocity data source and the ADS-B transmit unit are not recommended.	accordance with TSO-C166b or TSO-C154c. If multiple sources are interfaced to the ADS-B system, there should be a means for the
If installed, interconnecting avionics should:	flightcrew to readily determine which source is selected. Describing how this selection is performed in the AFM is one acceptable means
(1) not output horizontal position and velocity data that has been blended with data from other sources;	of compliance.
(2) use GNSS horizontal velocity data to extrapolate the horizontal position data if extrapolation is deployed; and	Note: TSO-C166b and TSO-C154c require the ADS-B equipment to use a single position source for the latitude, longitude, horizontal
(3) maintain full source resolution of the horizontal position and velocity data.	velocity, accuracy metrics, and integrity.
Interconnecting avionics that do not comply with the above may dilute the horizontal position accuracy achieved with GNSS-based	C.3.1 (Latency Analysis) Position Source to ADS-B Interface.
sources, with detrimental effects on the usability of the ADS-B Out system.	Directly connecting the position source to the ADS-B equipment is the preferred method of installation.
Note: closely coupled GPS/IRS systems are not considered as interconnecting avionics	C.4.1 (Latency Analysis) Recommendations for Reducing Latency.
	Directly connect the position source to the ADS-B equipment.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS -
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters,	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply:	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3);	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3); (2) Mode A Code: CS ACNS.D.ELS.(a)(1);	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3); (2) Mode A Code: CS ACNS.D.ELS.(a)(1); (3) SPI: CS ACNS.D.ELS.(a)(2);	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3); (2) Mode A Code: CS ACNS.D.ELS.(a)(1); (3) SPI: CS ACNS.D.ELS.(a)(2); (4) Emergency Mode/Status: CS ACNS.D.ELS.(a)(1);	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3); (2) Mode A Code: CS ACNS.D.ELS.(a)(1); (3) SPI: CS ACNS.D.ELS.(a)(2); (4) Emergency Mode/Status: CS ACNS.D.ELS.(a)(1); (5) Pressure Altitude: CS ACNS.D.ELS.025;	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3); (2) Mode A Code: CS ACNS.D.ELS.(a)(1); (3) SPI: CS ACNS.D.ELS.(a)(2); (4) Emergency Mode/Status: CS ACNS.D.ELS.(a)(1); (5) Pressure Altitude: CS ACNS.D.ELS.(a)(1); (6) MCP/FCU Selected Altitude: : AMC1 ACNS.D.EHS. (c)(1);	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3); (2) Mode A Code: CS ACNS.D.ELS.(a)(1); (3) SPI: CS ACNS.D.ELS.(a)(2); (4) Emergency Mode/Status: CS ACNS.D.ELS.(a)(1); (5) Pressure Altitude: CS ACNS.D.ELS.(a)(1); (6) MCP/FCU Selected Altitude: : AMC1 ACNS.D.EHS. (c)(1); (7) Barometric Pressure Setting:AMC1 ACNS.D.EHS.;	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3); (2) Mode A Code: CS ACNS.D.ELS.(a)(1); (3) SPI: CS ACNS.D.ELS.(a)(2); (4) Emergency Mode/Status: CS ACNS.D.ELS.(a)(1); (5) Pressure Altitude: CS ACNS.D.ELS.(a)(1); (6) MCP/FCU Selected Altitude: : AMC1 ACNS.D.EHS. (c)(1); (7) Barometric Pressure Setting:AMC1 ACNS.D.EHS.; (8) ACAS Operational/Resolution Advisory: AMC1 ACNS.D.ELS.015; and	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
 AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3); (2) Mode A Code: CS ACNS.D.ELS.(a)(1); (3) SPI: CS ACNS.D.ELS.(a)(2); (4) Emergency Mode/Status: CS ACNS.D.ELS.(a)(1); (5) Pressure Altitude: CS ACNS.D.ELS.(a)(1); (6) MCP/FCU Selected Altitude: : AMC1 ACNS.D.EHS. (c)(1); (7) Barometric Pressure Setting:AMC1 ACNS.D.ELS.(1); and (9) ICAO 24 bit Address: CS ACNS.D.ELS.(0). 	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
 AMC1 ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (a) General Requirements For the requirements and general guidance on the data sources providing the Mode S Elementary and Enhanced surveillance parameters, the following references to CS ACNS.D.ELS and CS ACNS.D.EHS apply: (1) Aircraft Identification: CS ACNS.D.ELS.(a)(3); (2) Mode A Code: CS ACNS.D.ELS.(a)(1); (3) SPI: CS ACNS.D.ELS.(a)(2); (4) Emergency Mode/Status: CS ACNS.D.ELS.(a)(1); (5) Pressure Altitude: CS ACNS.D.ELS.(a)(1); (6) MCP/FCU Selected Altitude: : AMC1 ACNS.D.EHS. (c)(1); (7) Barometric Pressure Setting:AMC1 ACNS.D.ELS.(1); (8) ACAS Operational/Resolution Advisory: AMC1 ACNS.D.ELS.(0); and (9) ICAO 24 bit Address: CS ACNS.D.ELS.(050. (b) Emergency Status 	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For ELS, follow CS-ACNS - Subpart D - Section 2. For EHS, follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Appendix F (for populating) and B.21 (for testing) Vertical Intention Register. Parameters common to ADS-B mandates are addressed in Appendix H below.
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AMC1 ACNS.D.ADSB.080 (cont.) (d) Vertical Rate The Vertical Rate information should come from the most accurate and steady source. In order to ensure that minimum performance requirements are met for Vertical Rate information, the following source prioritisation should be applied: - Hybrid Vertical Rate Source: the information may be taken from a hybrid system which filters barometric vertical rate with an inertial reference unit (IRU) vertical rate and GNSS vertical rate, provided the accuracy of the vertical rate output is at least as good as barometric vertical rate sources (e.g. ETSO-C106). - Blended Vertical Rate Source: the information may be taken from a blended system which filters IRU vertical rate and barometric vertical rate, provided the accuracy of the vertical rate output t is at least as good as barometric vertical rate sources (e.g. ETSO-C106). - Barometric Vertical Rate Source: the information may be taken from an air data computer (ADC) holding an EASA equipment authorisation in accordance with ETSO-C106 or a vertical velocity instrument holding an EASA equipment authorisation in accordance with applicable revisions of ETSO-C8(). - GNSS Vertical Rate Source: GNSS vertical velocity equipment which have not been qualified in accordance with CS-ACNS.D.ADSB.070 should not be interfaced with the ADS-B transmit unit.	[Vertical rate is not required by § 91.227 (optional)]. 3.9.1 (Installation) Equipment Eligibility. Unlike position accuracy, vertical velocity accuracy is not transmitted in ADS-B messages. Thus it is important that vertical velocity sources integrated into the ADS-B system meet minimum performance requirements at installation. Use the following guidance: 3.9.1.1 (Installation) Hybrid Vertical Rate Source. Vertical rate may be taken from a hybrid system that filters barometric vertical rate with an Inertial Reference Unit (IRU) vertical rate and GNSS vertical rate, provided the hybrid system was tested and approved to provide a vertical rate output with an accuracy that is at least as good as barometric vertical rate sources (such as TSO-C106). Hybrid vertical rate could come from a Flight Management System (FMS), Air Data and Inertial Reference System (ADIRS), or IRU. ADS-B equipment should transmit hybrid vertical rate solutions as barometric vertical rates. 3.9.1.2 (Installation) Blended Vertical Rate Source. Vertical rate may be taken from a blended system that filters IRU vertical rate and barometric vertical rate, provided the blended system with an accuracy that is at least as good as barometric vertical rate sources (such as TSO-C106). Blended vertical rate could come from an FMS, ADIRS, or IRU. ADS-B equipment should transmit blended vertical rate sources (such as TSO-C106). Blended vertical rate could come from an FMS, ADIRS, or IRU. ADS-B equipment should transmit blended vertical rate solutions as barometric vertical rates. 3.9.1.1.3 (Installation) Barometric Vertical Rate Source. Barometric vertical rate may be taken from an air data computer meeting the minimum performance requirements of any revision of TSO-C106 or a vertical rate may be taken from an ariad computer meeting the minimum performance requirements of applicable revisions of TSO-C8, Vertical Velocity Instrument (Installation) Beometric vertical rate may be taken from any revi
Vertical Rate from an inertial sensor that is not blended with barometric altitude should not be transmitted. Neither should ADS-B transmit units derive a barometric altitude rate by sampling barometric altitude measurements. The source bit for vertical rate (1090 ES register 0916, message bit '36') should be coded as barometric when utilising barometric rate from an air data computer, or when using a blended or hybrid vertical rate. The source bit for vertical rate should only be coded as geometric when using vertical rate from a GNSS source. Note: due to differences in the respective transmit formats, the above source prioritisation differs in some parts with the guidance applicable to Mode S Enhanced Surveillance as provided in AMC1 ACNS.D.EHS.015. For general guidance on Vertical Rate data sources, refer to Appendix H , Part 1, Definition 14.	 3.9.1.5 (Installation) Inertial Vertical Rate Source. Vertical velocity from an inertial sensor that is not blended with barometric altitude should not be transmitted from the ADS-B system. 3.9.1.6 (Installation) Barometric Altitude Source. ADS-B systems should not derive a barometric altitude rate by sampling barometric altitude measurements. This could lead to misleading vertical velocity information. If barometric vertical rate is not available, use geometric vertical rate. 3.9.2 (Installation) Installation Guidance. The vertical rate field can be populated with either barometric vertical rate or geometric vertical rate. There is no requirement to interface multiple vertical rate sources: 1. Hybrid vertical rate or blended vertical rate. 2. Barometric vertical rate. 3.9.3.2 (Installation) Vertical Rate Source. The source bit for vertical rate should be coded as barometric when using barometric rate from an air data computer, or when using a blended or hybrid vertical rate. The source bit for vertical rate should be coded as geometric when using vertical rate from a GNSS source.
AMC1 ACNS.D.ADSB.080 (cont.) (e) Selected Altitude (and related Modes) With respect to the various status and mode fields contained in register 62 ₁₆ (subtype 1), the respective provisions of AMC1 ACNS.D.EHS. (c)(1) apply to the Selected Altitude Type, Status of MCP/FCU Mode Bits, VNAV Mode Engaged, Altitude Hold Mode, and Approach Mode information. The population of the additional Autopilot Engaged and LNAV Mode Engaged fields status bits are optional but should be populated where the data is available.	[Selected altitude is not required by § 91.227 (optional)] 3.11.1 (Installation - Foreign Airspace Requirements) Optional Parameters. If operations are planned in a country that requires parameters not mandated in the United States, such as selected heading and selected altitude, follow the ADS-B equipment manufacturer's installation guidance to interface those parameters

AMC1 ACNS.D.ADSB.085 Geometric Altitude	[GVA is not required by § 91.227 (optional)]
(a) Geometric Altitude data source	B.4.15 (Position Source Qualification - GNSS)
The position source should output a vertical position accuracy metric to support the encoding of the Geometric Altitude GVA quality	The GNSS should output vertical position accuracyif vertical position accuracy is output, it must have been qualified during design
indicator.	approval of the position source.
GNSS position sources should provide the geometric altitude accuracy through the vertical figure of merit (VFOM). If that is the case, the	3.3.3.9 (Installation) Geometric Vertical Accuracy (GVA).
vertical position source accuracy output by a GNSS receiver should have been qualified as per Appendix H Part 5 paragraph 5.	Set the GVA based on design data provided by the position source manufacturer. GNSS position sources may provide the geometric
If the position source does not output a qualified vertical accuracy metric, the GVA parameter should be set to 'zero'.	altitude accuracy through the Vertical Figure of Merit (VFOM). If the position source does not output a qualified vertical accuracy metric,
For general guidance on the GVA encoding, refer to Definition 20 in Appendix H of Subpart D.	the GVA parameter should be set to "0".
(b) Geometric Altitude Reference	3.3.3.8 (Installation) Geometric Altitude.
A GNSS position source compliant with CS ACNS.D.ADSB.070 provides Geometric Altitude, in its native format, as geocentric height above	Ensure the geometric altitude provided by the position source is based on Height-Above-Ellipsoid (HAE) instead of Height-Above-Geoid
the earth's ellipsoid shape. Height Above Ellipsoid (HAE) is described by the WGS-84 format.	(HAG). Do not interface a position source that provides HAG or Mean Sea Level (MSL) altitude to the ADS-B equipment unless the ADS-B
Another altitude reference is described by the earth's geoid, a surface on which the gravitational potential is constant and which	equipment has the ability to determine the difference between an HAG and HAE input, and the ADS-B equipment has demonstrated
approximates the (local) mean levels of all the earth's seas. The difference between the mathematically idealised smooth ellipsoid and	during design approval that it can properly convert HAG to HAE using the same model as the position source. It would also be acceptable
irregular geoid surfaces varies between +106m to -85m across the earth. The related Mean Sea Level (MSL) altitude is then established as	to demonstrate that the error due to conversion of HAG to HAE does not cause the GVA to be exceeded.
the sum of the HAE altitude and those local differences (using look-up tables). MSL is sometimes also referred to as Height-Above-Geoid	B.3.10 (Position Source Qualification - General) Geometric Altitude.
(HAG).	The position source must have a geometric altitude output. The geometric altitude must be referenced to the WGS-84 ellipsoid.
A position source that only provides HAG or MSL altitude (ARINC label 076) but not HAE (ARINC label 370) should not be interfaced to the	B.4.9 (Position Source Qualification - GNSS) Geometric Altitude.
ADS-B transmit unit unless the ADS-B transmit unit can properly convert HAG/MSL to HAE, using the same HAG/MSL model as the position	All GNSS position sources must output a geometric altitude. Geometric altitude for ADS-B purposes is the height above the WGS-84
source (typically NATO STANAG Appendix 6). This should be based on position source installation instructions that specify a deterministic	ellipsoid (that is, it is not MSL). We recommend that the GNSS position source output geometric altitude as
method to perform conversion to HAE, and be demonstrated during ADS-B transmit unit design approval. It is expected that the respective	Height-Above-Ellipsoid (HAE). Some GNSS position sources provide Height-Above-Geoid (HAG) instead of HAE. The position source
compliance information is supplied by the position and velocity source, and ADS-B transmit unit manufacturers through a Declaration of	manufacturer must provide data on whether the position source outputs HAE or HAG.
Design and Performance (DDP) or an equivalent document.	
AMC1 ACNS.D.ADSB.085 (cont.)	
Note: Horizontal position sources compliant with Class 3 equipment approved under ETSO-C145c/C146c are required to output HAE	
altitude. The requirement has been implemented from revision C of RTCA/DO-229 onwards.	
(c) Geometric Altitude Accuracy Quality Indicator Testing	
If a qualified vertical accuracy metric is available, under nominal GNSS satellite constellation and visibility conditions, the transmitted GVA	
value should be a minimum of 'one'.	
AMCI ACNS.D.ADSB.090(a) Flight Deck Interface	3.3.2.5 (Installation) Position Source.
(a) installations	The ADS-B position source does not need to be the same position source used for navigation. It is acceptable for a GNSS position source to
(1) Data Transmission and Display Consistency	be embedded in the ADS-B equipment and provide position information to the ADS-B system without providing any navigation information
The data transmitted by the active ADS-B transmit unit with the data displayed to the night crew should be consistent [AC 20-165B allows]	to other onboard systems. ICS requires using a compliant GNSS sensor connected to the transponder and the navigation equipment (i.e.
the position source for ADS-B to be different than the position source used for navigation j.	transponder and navigation equipment receive the same data from the GNSS source) or installation of a standalone GNSS receiver
Note: The horizontal position data displayed to the flight crew might be based on data from more than the position source than that used	connected (only) to the transponder provided the GNSS receiver is approved to ETSO-C145c or C146c (or later ETSO amenaments).
TOT AUS-B transmissions.	Note: Operational Class 1, 2, or 3 of RTCA D0-2290 for later), satisfy the criterial. As addressed in 4.5.6 Appendix B of this AC, an
	integrated GNSS position source should still meet the requirements of ISO-C145(), ISO-C146(), or ISO-C196().

AMC1 ACNS.D.ADSB.090(a) (cont.)	3.7.3.2 (Installation) Emergency Status.
(2) Single Point of Flight Crew Entry	Refer to section 3.7.3.5 of this AC for information on single point of entry of the emergency status.
Installations that do not provide a single point of flight crew entry for the transponder and the ADS-B transmit unit should be evaluated to	3.7.3.3 (Installation) IDENT.
ensure that dual entry of the Mode A code, SPI, and emergency status does not lead to the transmission by the active ADS-B transmit uni	Refer to section 3.7.3.5 of this AC for information on single point of entry of the IDENT.
of inconsistent data, particularly when communicating an aircraft emergency.	3.7.3.4 (Installation) Mode 3/A Code.
	Refer to section 3.7.3.5 of this AC for information on single point of entry of the Mode 3/A code.
	3.7.3.5 (Installation) Single Point of Entry.
	Aircraft equipped with a separate transponder and ADS-B system should provide the pilot a single point of entry into both systems for the
	Mode 3/A code, IDENT, and emergency status. If ADS-B equipment sets the emergency status, IDENT, or Mode 3/A code based on entry
	of these parameters into a separate transponder, the STC/TC needs to identify the appropriate transponder interfaces. Experience in the
	FAA's Alaska CAPSTONE program demonstrated that operator mitigations to prevent differing codes from being entered in the
	transponder and ADS-B system were ineffective and resulted in numerous false and misleading proximity alerts for ATC. Additionally,
	there are workload and safety concerns of requiring the pilot to enter the Mode 3/A code. IDENT, and emergency codes multiple times.
	Thus, if you do not provide a single point of entry for the mode 3/A code. IDENT, and emergency code, you must accomplish a human
	factors evaluation and an additional system safety assessment as follows:
	3.7.3.5.1 (Installation) Human Factors Evaluation.
	Installations not providing a single point of entry must accomplish an evaluation of the pilot interface controls to ensure the design
	minimizes the optential for entry errors by the flightcrew, and enables the flightcrew to detect and correct errors that do occur. Evaluate
	the system interface design to ensure dual entry of the emergency status. IDENT, and Mode 3/A code does not introduce significant
	additional workload narticularly when communicating an aircraft emergency. Refer to section 4.1.5.4 of this AC for additional information
	on the luman factors evaluation
AMC1 ACNS.D.ADSB.090 (cont.)	3.7.3.5.2 (Installation) System Safety Assessment.
	Transmission of false or misleading information is considered to be a major failure effect and may not occur at a rate greater than 1x10-5
	per flight hour for ADS-B systems. Installations not providing a single point of entry must accomplish a safety assessment that
	demonstrates that the probability of the transponder and ADS-B system ever transmitting differing Mode 3/A codes is less than 1x10-5 per
	flight hour. The analysis must consider the potential of all pilot errors.
	4.1.5.4 (Ground Test) Pilot Interface Errors.
	Installations not providing a single point of entry for the ADS-B and transponder for the Mode 3/A code, IDENT, and emergency status
	must accomplish an evaluation of the pilot interface controls to determine that they are designed to minimize entry errors by the
	flightcrew, and enable the flightcrew to detect and correct errors that do occur. System interface design must also be evaluated to ensure
	dual entry of the Mode 3/A code, IDENT, and emergency status does not introduce significant additional workload, and that the controls
	are acceptable for data entry, accuracy, and error rates, particularly when communicating an aircraft emergency. Evaluations should
	consider pilot-detected and undetected error rates, pilot workload, and training times. Refer to section 3.7.3.5 of this AC for additional
	information on transponder and ADS-B system single point of entry.
AMC1 ACNS.D.ADSB.090(a) (cont.)	3.7.2.2. (Installation) Turning Off ADS-B.
(b) ADS-B Off Switch	14 CFR 91.225 and § 91.227 requires that all aircraft equipped with ADS-B OUT operate with the equipment turned on at all times. There
If control is provided to enable or disable the ADS-B transmit unit, then the status of the active ADS-B transmit unit should clearly be	are no requirements to disable ADS-B broadcasts at the request of ATC. When ADS-B functionality resides in the Mode S transponder, it is
indicated to the flight crew from their normal seated position.	acceptable to disable the ADS-B transmissions by disabling the transponder (that is, "Standby" or "Off"). If this architecture is used,
The respective controls should be located such that inadvertent disabling is prevented.	specify the impact in the flight manual or pilot's guide (for example, loss of ADS-B, transponder, and TCAS functionality). Locate the ADS-B
	on/off controls to prevent inadvertent actuation.

AMC1 ACNS.D.ADSB.090(b) Flight Deck Interface	3.7.2.1 (Installation) System Status.
ADS-B device or function failures, should be indicated in amber or in accordance with the flight deck annunciation philosophy, without	The installation must have a method to display system operational status to the flightcrewThe following two failure annunciations must
undue delay, i.e. a response time within the order of one second.	be included in the initial airworthiness certification (that is, STC or TC) type design data for the ADS-B OUT equipment, and should be
ADS-B device or function failures may be indicated independently of each other; however, detailed operating instructions should be	consistent with the overall flightdeck design philosophy for surveillance equipment. These failure conditions are advisory only and do not
developed to describe the means to interpret indications.	constitute a caution or warning condition. For legacy Mode C installations that are adding a UAT device, the following two failure
The ADS-B device or function failure indication should not be confused with an ACAS or Mode S system failure annunciations.	annunciations are optional [CS only recongnizes 1090 ES for the ADS-B Out data link] .
In case of an ADS-B function failure, it is expected that the transponder should continue to support the ACAS, Mode A/C and Mode S	3.7.2.1.1 (Installation) ADS-B Device Failure.
functions.	If the ADS-B equipment is unable to transmit ADS-B messages, the system should provide an appropriate annunciation to the flightcrew.
The proper indications of the ADS-B Out system failures should be tested.	3.7.2.1.2 (Installation) ADS-B Function Failure.
	The ADS-B system depends on a position source to provide the data to populate the ADS-B messages and reports. If the position source or
	its interface with the ADS-B equipment fails, the ADS-B system will not be able to broadcast the required ADS-B data. In this case, the ADS-
	B equipment has not failed, but it cannot perform its function due to a failure to receive the position source data. The ADS-B system
	should distinguish between a position source or interface failure and an ADS-B equipment failure. The installer must provide
	documentation, in the applicable flight manual, or flight manual supplement, that explains how to differentiate between annunciation of
	an equipment failure and a function failure if the failure annunciations are not independent. The ADS-B function failure must not cause a
	TCAS II system failure.
	Note: Certain advanced ADS-B IN applications may require flightcrew knowledge of own-ship ADS-B OUT operational status. Refer to AC
	20-172() for guidance regarding ADS-B IN installations [ADS-B In isn't covered by EPAS 2018].
	Additional Guidance not Addressed in CS ACNS
	Additional Guidance of Addresses in CS-ACKS
	5.91.252 (installation) monymetry (actual per only recomprised about 150-c154c equipment to transmit a self-assigned (randomized) temporary 24
	a bit address and no call sign. No such provision is provided for TSO-C166b equipment. After lanuary 1 2020, and in the airspace identified
	in § 91.225, the UAT anonymous 24-bit address feature may only be used when the operator has not filed a flight blan and is not
	requesting ATC services. The UAT call sign may also be omitted, but only when the anonymous 24-bit address is chosen. We do not
	recommend integrating the anonymity features, as the operator will not be eligible to receive ATC services, may not be able to benefit
	from enhanced ADS-B search and rescue capabilities, and may impact ADS-B IN situational awareness benefits. The following
	considerations must be included in the ADS-B system design when installing equipment capable of using the anonymity feature:
	3.7.2.3.1 (Installation) [CS only recongnizes 1090 ES for the ADS-B Out data link] When the ADS-B equipment is initially powered-on, the
	24-bit address must default to the aircraft's assigned ICAO 24-bit address.
	3.7.2.3.2 (Installation) [CS only recongnizes 1090 ES for the ADS-B Out data link] When the ADS-B equipment is initially powered-on, the
	call sign may not be blank (Not Available per RTCA/DO-282()). At initial power-on, it is acceptable for the call sign to revert to a non-blank
	call sign that existed before the ADS-B equipment being powered off, or to the aircraft registration number.
	3.7.2.3.3 (Installation) [Cs only recongnizes 1090 ES for the ADS-B Out data link] The ADS-B equipment can only allow an anonymous 24-
	bit address selection if the Mode 3/A code is set to "1200".
	3.7.2.3.4 (instaliation) [CS only recongnizes 1090 ES for the ADS-B Out data link] The ADS-B equipment may only allow selection of the
	anonymous 24-bit address via a dedicated pilot interface. The ADS-B OUT equipment may not automatically set an anonymous 24-bit
	address or set a blank (Not Available per RTCA/DO-282()) call sign based solely on pilot selection of the 1200 Mode 3/A code.
	2 7 2 2 5 (Jostallation) JCC and accompanies 1000 EE for the ADE B Out date light The ADE B OUT equipment must extend in the discharge
	5.7.2.3.3 (installation) [CS only reconginizes 1090 cs for the ADS-B Out data link] The ADS-B OUT equipment must automatically disable the anonymity feature if any Mode 3/A code other than 1200 is selected. The 2/A bit address must automatically construct to the allocation is incredited.
	assigned ICAO 24-bit address. If the call of was blank the call cline must automatically revert to the alternation purpose
	assigned to be 24 on address. In the can sign was brank, the can sign must durbinationly revent to the anti-rait registration number.
	3.7.2.3.6 (Installation) ICS only recommizes 1090 FS for the ADS-B Out data link! Describe the effects of selecting the approximity features
	in the flight manual or pilot's guide. Effects include the inability to receive Instrument Flight Rule (IFR) or Visual Flight Rule (VFR)
	separation services, potential loss of enhanced search and rescue benefits, and potential negative impacts to ADS-B IN annications.
	and because where a part of the part of th

AMC1 ACNS.D.ADSB.110 Horizontal Position and Velocity Data Refresh	B.3.11 (Position Source Qualification - General) Update Rate.
For systems with a 1 Hertz computation rate, the output of position and velocity data can vary between 0.8 seconds and 1.2 seconds.	The position source must output a new position at least once per second. Faster position update rates reduce latency of the transmitted
Note Faster position update rates reduce the latency of the transmitted position and velocity information and are therefore encouraged.	position and are encouraged.
	B.4.10 (Position Source Qualification - GNSS) Update Rate.
	The position source must output a new position at a minimum of once per second. Faster position update rates reduce latency of the
	transmitted position and are encouraged.
	C.4.1.3 (Recommendations for Reducing Latency) Use a position source that provides position updates at greater than 1 Hz.
	Additional Guidance not Addressed in CS-ACNS
	B.4.10.1 (Position Source Qualification - GNSS) TSO-C129 [TSO-C129a is the minimum in CS-ACNS].
	Means of compliance for TSO-C129 are described in RTCA/DO-208 change 1, section 2.1.11 for displays. This requirement is modified by
	ISO-C129 section (a)(3)(v) for navigation data used for display in Class A equipment. Class B and Class C equipment are modified by sections (b)(b) how the section (a)(5)(b) how the section of the section of the section (a)(5)(b) how the section (b) how the section
	sections (a)(4)(V) and section (a)(5)(V) respectively.
	B.4.10.2 (Position source Qualification - Giss) ISO-C1234. Manas of compliance for TOC (2120 are described in BTCA/DO 200 change 1, costion 2,1,11 for displays. This convisionment is modified by
	The choice cation (a)(2)(a) for cavitation data used for displaying (lass A and lass B and Class C and internet as modified by
	rso-cl2a, sector (a)(3)(y) or negotively certions (a)(4)(y) or an (a)(5)(y) respectively
	R 4 10 3 (Position Source Qualification - GNSS) TSO-C145/146 Rev a Class 1
	Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.1.
	B.4.10.4 (Position Source Qualification - GNSS) TSO-C145/146 Rev a Class 2.
	Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.1 and 2.1.5.8.1.
	B.4.10.5 (Position Source Qualification - GNSS) TSO-C145/146 Rev b/c/d Class 1.
	Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.1.
	B.4.10.6 (Position Source Qualification - GNSS) TSO-C145/146 Rev b/c/d Class 2/3.
	Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.1 and 2.1.5.8.1.
	B.4.10.7 (Position Source Qualification - GNSS) TSO-C196/196a.
	Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.1
AMCI ACNS.D.ADSB.115 and 120 Horizontal Position and Velocity Total and Uncompensated Latency	D.1.31 (Definition) Total Latency.
(a) Time of Applicability	The total time between when the position is measured by the position source (GNSS TOM for GNSS systems) and when the position is
With respect to the latency requirements in CS ACNS.D.ADSB.115 and CS ACNS.D.ADSB.120, the initial time of applicability (IIOA) is the	transmitted from the aircraft (ADS-B time of transmission) [CS IL measurement is from the TOA, whereas, § 91.227 IL measurement is
time of values of the position of velocity solution, hence, the latency between the time of signal in space measurement (TOW) and this	promitie Form (data sin data data of a secondary).
time of values is excluded in on the local latency budget [IS 12 medsurement is from the TOA, whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement is from the TOA (whereas, y 31.227 12 medsurement))	Later via laterially relatively relatively relatively more than the notificing is marked by the notificing source to when it is transmitted by the ADS-B
The transmit time of applicability (TTOA) equals the initial time of applicability plus the amount of compensated latency (CL) as valid at the	Laterity is defined as the determined where where the position is inclusion of the position source of where its transmission and a source of the position of the source of the transmission of the transmissio
time at which the ADS-B transmit unit broadcasts the position (or velocity) information (TOT).	equipment [=
(b) Compliance Demonstration	C.4.8.1 (Latency Analysis) Time of Measurement (TOM).
Total latency (TL) is the difference between time of transmission (TOT) and initial time of applicability (ITOA) <i>JCS TL measurement is from</i>	The latency analysis starts at the position source TOM ICS TL measurement is from the TOA, whereas, § 91.227 TL measurement is from
the TOA, whereas, § 91.227 TL measurement is from the TOM (adds an additional 0.5 seconds)] . The analysis of total latency includes	the TOM (adds an additional 0.5 seconds)]. The position source TOM for GNSS sources is the time when the last GNSS signal used to
the maximum asynchronous delay caused by the time difference of position (or velocity) updates arriving at the ADS-B transmit unit and of	determine the position arrives at the aircraft GNSS antenna. TOM for an inertial position source or a GNSS-aided inertial position source is
transmitting the information. It is noted that for ADS-B transmit units compliant with AMC1 ACNS.D.ADSB.030, this asynchronous delay	the time of the last accelerometer measurement. TOM for an RNAV system using multiple DME signals would be the time the last DME
can be up to 1.1 second [includes 0.1 seconds UL of ADS-B equipment].	signal arrives at the aircraft's DME antenna [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)].
	Note: To demonstrate compliance with § 91.227, you must calculate latency from the position source TOM. Do not calculate latency from
	the position source time of applicability, as defined in RTCA/DO-260B with corrigendum 1 and RTCA/DO-282B with corrigendum 1 [CS TL
	measurement is from the TOA, whereas, § 91.227 TL measurement is from the TOM (adds an additional 0.5 seconds)] .
	C.4.8.2 (Latency Analysis) Transmit Time of Applicability.
	The transmit time is the time when the ADS-B system broadcasts the position. The transmitted position's time of applicability for
	synchronized systems is the appropriate UIC epoch. The transmitted position's time of applicability for unsynchronized systems is the
	Jactual time the AUS-b equipment begins transmission of the message that contains the position.
	recter, synchronized ADS-b systems randomized by ine position it anisitission adound the UTC epoch to avoid interference WITD other ADS-B transmitters. This readomization should not be included in the latence analysis.
	a anshitters. This randomization should not be included in the latency dilaliysis.

A nor non-balled the rest of t	
	Total latency analysis must include the maximum asynchronous delay caused by position updates arriving at the ADS-B equipment out-of- synch with when the ADS-B system transmits the position. This delay is a factor of the position source update rate rather than the ADS-B equipment transmission rate. For example, a 1 Hz position source could provide a position update immediately after an ADS-B position transmission. This position would be extrapolated, up to 1 second, until the next position update arrives from the position source. Thus, a 1 Hz position source can introduce 1 second of total latency. This 1 second must be included in the total latency calculation. C4.3 (Latency Analysis) Mean Latency vs. Maximum Latency. In instances where the latency is variable, use the worst-case latency under fault-free conditions in the analysis. Variable latency, for example, can occur due to variance in loading of a data concentrator or the asynchronous nature of a GNSS to ADS-B interface. As the applicant, you must propose to the FAA how to deal with variable latencies introduced by intermediary devices such as data concentrators.
AMC1 ACNS.D.ADSB.115 and 120 Horizontal Position and Velocity Total and Uncompensated Latency (cont). Uncompensated latency (UL, or more generically a latency compensation error) is the difference between total latency (TL) and amount of compensated latency (CL) thereof. Therefore, uncompensated latency determines the transmit time of applicability (TTOA). The GNSS time mark if provided to the transmit system, can be used by the ADS-B transmit unit to reduce uncompensated latency. It is possible for compensation algorithms to overcompensate for the effects of latency, also as a result of the desired attempt to account for latency external to the ADS-B transmit unit. This might lead to transmitting a position that is out in front of the actual aircraft position rather than behind the actual aircraft position. This is acceptable as long as the transmitted position is not further ahead than 0.2 s (200 ms). The various latency related parameters are summarised in Figure 1	 D.1.32 (Definition) Uncompensated Latency. Any latency in the ADS-B system that is not compensated through extrapolation. Uncompensated latency can be represented as the difference between the time of applicability of the broadcast position and the actual time of transmission. C.4.7 (Latency Analysis) UTC Epoch Synchronization. The position transmitted from the ADS-B equipment may be aligned with a UTC epoch. TSO-C154c requires UAT systems to extrapolate the position to the 1.0 second or 0.2 second UTC epoch. TSO-C166b allows 1090ES systems to extrapolate to the 0.2 second UTC epoch or transmit asynchronously. To synchronize the position output with the UTC epoch, the position source needs to provide a time mark. The ADS-B equipment uses this time mark to extrapolate the position to the UTC epoch. Typically the time mark will be from a GNSS position source. Implementation of the time synchronization in the 1090ES systems will help minimize uncompensated latency. C.4.5 (Latency Analysis) Overcompensating. It is possible for compensation algorithms to "overcompensate" for the effects of latency, essentially transmitting a position that is out in front of the actual aircraft position rather than behind the actual aircraft position. This type of system is acceptable as long as the transmitted provide a civice and functional devices and the actual aircraft position.
Figure 1: Latency Parameters t AMC1 ACNS.D.ADSB.115 and 120 (cont.)	transmitted position is no further ahead than 200 ms, (refer to RTCA/DO-260B, appendix U). 4.1.2 (Ground Test) System Latency.
Latency should be addressed through analysis rather than testing. Total and uncompensated latency information should be generated by the respective manufacturers of the position source, ADS-B transmit unit and any interconnecting avionics and should be included as part of the latency analysis. The latency analysis should determine the latency applicable to each component of the ADS-B Out system. The total of all of the individual component latencies should be established as the sum of their maximum latencies. ADS-B Out systems whereby the transmit equipment compliant with AMC1 ACNS.D.ADSB.030 is directly connected to a position source compliant with AMC1 ACNS.D.ADSB.070, should meet the total latency and uncompensated latency requirements without further analysis. For other ADS-B Out systems, the applicant should perform a detailed position and velocity latency analysis. This includes systems where ADS-B Out system components are interfaced through a highly integrated architecture. For detailed guidance on horizontal position and velocity source latency qualification, refer to Appendix H Part 5. It is expected that this compliance information is supplied by the position and velocity source manufacturer through a Declaration of Design and Performance (DDP) or an equivalent document.	Latency is addressed through analysis rather than testing. Refer to section 3.1.3 and 4.5.6 Appendix C of this AC. C.2 (Latency Analysis) Analysis. Accomplish the analysis by determining the applicable latencies for each component and totaling all of the individual component latencies. You must include all sources of position latency, including but not limited to: the position source, intermediary devices between the position source and ADS-B equipment, and ADS-B equipment. Use the following guidelines to determine latency for each component. C.2.2 (Latency Analysis) Intermediary Device. Intermediary devices are typically data concentrators. The latency information should be generated by the intermediary device manufacturer and presented as part of the latency analysis. If the intermediary device latency is variable, use the worst-case latency. C.2.3 (Latency Analysis) ADS-B Equipment. Use the TSO-C166b and TSO-C154c [<i>CS only recongnizes 1090 ES for the ADS-B Out data link</i>] latency standards for the latency analysis or use the actual latency information generated by the PAS-B equipment manufacturer. TSO-C166b and TSO-C154c require the uncompensated latency of the ADS-B equipment to be less than 100 ms. C.3.2 (Latency Analysis) Position Source to ADS-B Interface. Directly connecting the position Source to the ADS-B equipment is the preferred method of installation. Alternately, if this architecture is not used, we recommend that any latency introduced between the position source output and the ADS-B equipment input be less than 100 ms (refer to RTCA/DO-260B, appendix U). C.3.3 (Latency Analysis) ADS-B Equipment The latency requirements for the ADS-B equipment are included in TSO-C156b and TSO-C154c [<i>CS only recongnizes 1090 ES for the ADS</i> -B out <i>data link</i>] are required by 591.227. C.4.1.1 (Recommendations for Reducing Latency) Directly connect the position source to the ADS-B equipment.

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), and Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent,					
guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/reg	gulation, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.				
AMC1 ACNS.D.ADSB.115 and 120 (cont.)	 3.1.3 (Installation) Position Latency. Latency is the difference between the time when a measurement is taken to determine the aircraft's geometric position and the time when the aircraft's ADS-B equipment transmits that position measurement [CS TL measurement is from the TOA, whereas, § 91.227 TL measurement is from the TOA (adds an additional 0.5 seconds)]. Limiting the latency in ADS-B systems minimizes the errors in the reported position. TSO-C166b and TSO-C154c ADS-B equipment compensate for latency by extrapolating the position based on velocity information. All applicants must demonstrate compliance with the latency requirements in section 3.1.3.1. This can be done by equipping with a compliant architecture such as the one listed in section 3.1.3.2 or performing an analysis such as the one detailed in section 3.1.3.3. Latency terms are further defined in 4.5.6 Appendix C of this AC. Note 1: To demonstrate compliance with § 91.227, you must calculate latency from the position source time of measurement (TOM). Do not calculate latency from the position source time of applicability, as defined in RTCA, Inc. (RTCA) document (DO)-260B, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B), with corrigendum 1, and RTCA/DO-282B, Minimum Operational Performance Standards for Universal Access Transceiver (UAT) Automatic Dependent Surveillance – Broadcast, for the TOA, whereas, § 91.227 TL measurement is from the TOM (adds an additional 0.5 seconds)]. 				
AMC1 ACNS.D.ADSB.115 and 120 (cont.)	 3.1.3.1 (Installation) Position Latency Requirements. There are two position latency requirements associated with ADS-B OUT: 1. Total latency. Total latency is defined as the difference between the time when the position is measured and when the position is transmitted from the aircraft. To meet § 91.227, the total latency must be less than or equal to 2.0 seconds [CS latency measurement is from the TOA (total 1.5 sec. requirement)]. 2. Uncompensated latency. Uncompensated latency is the difference between the time of applicability for the transmitted position and the actual time the position is transmitted from the ADS-B system. To meet § 91.227, the uncompensated latency must be less than or equal to 0.6 seconds. The aircraft must compensate for any latency greater than 0.6 seconds but must not overcompensate (that is, lead the aircraft position) by more than 0.2 seconds. Note: RTCA Special Committee 186, which developed the ADS-B OUT minimum operational performance standards, recommendation is to support future ADS-B IN applications. The § 91.227 latency requirements support ATC separation services and the initial basic ADS-B IN applications. However, we encourage you to minimize uncompensated latency as much as possible in your installation. Recommendations for minimizing latency are included in 4.5.6 Appendix C of this AC. 3.1.3.2 (Installation) Compliant Architecture. ADS-B systems that directly connect a position source meeting the minimum performance requirements of any revision of TSO-C145, TSO-C146, or TSO-C196 with ADS-B equipment meeting the minimum performance requirements of any revision of TSO-C145, TSO-C146, or TSO-C196 with ADS-B equipment meeting the minimum performance requirements of any revision of TSO-C145, TSO-C146, or TSO-C196 with ADS-B equipment meeting the minimum performance requirements of any revision of TSO-C145, TSO-C146, or TSO-C196 with ADS-B equipment meeting the minimum performance requirements of any rev				

AMC1 ACNS.D.ADSB.115 and 120 (cont.)	3.1.4 (Installation) Integrity Metric Latency.
(c) ADS-B Quality Indicator Change Latency	There is an allowance for Global Navigation Satellite System (GNSS) position sources to delay the update of the integrity containment
The ADS-B Quality Indicator change latency requirements are driven by the maximum time to alert for the indication of a data integrity	radius while attempting to detect and exclude faulted satellites. § 91.227 allows up to 12 seconds for the ADS-B system to transmit a
failure with respect to exceeding integrity containment bound (CS ACNS.D.ADSB.070 and related AMC guidance).	change in the Navigation Integrity Category (NIC). This 12-second allowance is available for any position source, not just GNSS position
For detailed guidance on time to alert qualification, refer to Appendix H Part 5.	sources. The 12 seconds includes both the time for the position source to detect the fault and time for the ADS-B system to transmit the
	fault indication. The requirement to indicate a change in NIC applies to the time between when a faulted position is first transmitted and
	when the updated NIC is transmitted indicating the fault. The total time to update the NIC is based on the cumulative effect of (1) the
	position source fault detection and exclusion time, and (2) the worst-case asynchronous transmission difference between when the
	faulted position is transmitted and when the NIC indicating the fault is transmitted.
	3.1.4.1 (Installation) Compliant Architecture.
	ADS-B equipment meeting the minimum performance requirements of TSO-C166b or TSO-C154c that is directly connected to a position
	source meeting the minimum performance requirements of any revision of TSO-C145, TSO-C146, or TSO-C196 will typically meet the
	integrity latency requirements. For these systems you only need to demonstrate, through analysis, that a non-isolated GNSS satellite fault
	detected by the position source is properly passed to the ADS-B equipment and that the ADS-B equipment indicates an invalid position by
	transmitting the position integrity and accuracy metrics equal to zero.
	Note: ARINC Characteristic 743A-5, GNSS Sensor, allows flexibility in how information is transferred during a GNSS satellite fault; thus, it is
	necessary to ensure a non-isolated satellite failure results in the ADS-B indicating an invalid position.
	Integrity Metric Latency Analysis.
	3.1.4.2 (Installation) if you are installing an AUS-B system without a compliant architecture, like the one described above, you must
	accomplish a latency analysis to demonstrate the ADS-B system meets the integrity metric latency requirements. The latency analysis
	should include the maximum time for a position source to indicate an integrity fault, any delay added by an intermediary device such as a data concentrator, and the delay added by the ADS B equipment.
	data concentrator, and the delay added by the ADS-B equipment.
AMC1 ACNS D ADSR 115 and 120 (cont.)	C 4.4 (Latency Analysis) Compensating for Interface Latency in Linsynchronized Systems
(d) Horizontal Position Latency Compensation	It is acceptable to install ADS-B equipment that components the for latency that occurs outside of the ADS-B equipment, even if the position
The ADS-B transmit unit may compensate for horizontal position latency incurred outside the ADS-B transmit unit (see sub-paragraph 2	source and ADS-B equipment are not time synchronized. Establishing the proper corrections for external latency is problematic because
above). If such is implemented, a verifiable estimation of the delay between the time of applicability of the position measurement, and the	the TSO-C166b equipment may be interfaced to numerous different aircraft architectures. These architectures could include different
provision of that measurement to the ADS-B transmit unit data interface should be performed.	position sources, with different latencies, as well as different data concentrators with different delays. To interface unsynchronized ADS-B
	equipment that compensates for external latencies, the ADS-B equipment manufacturer must provide a list of the acceptable equipment
	and the acceptable architectures. Typically this type of ADS-B equipment will only be installed in closely-integrated architectures. You
	may not attempt to integrate ADS-B equipment that compensates for external latencies unless the ADS-B equipment manufacturer has
	expressly documented the installation architecture and design data is available for each component. The total amount of time that can be
	used for compensation is still limited by the requirement to limit total latency to within
	2.0 seconds.
	Additional Suidance and Addressed in SEACNE
	Automotion domaine not Addressed in CSACHS 3.1.5 (Installation) System Design Assurance (SDA) and Source Integrity Level (SIL) Latency.
	§ 91.227 requires broadcasting changes in the SDA or SIL within 10 seconds. Changes in the SDA or SIL will typically occur when all
	position sources are lost, or when a secondary position source is integrated into an ADS-B system and that secondary position source has a
	different SDA or SIL than the primary position source. If you integrate multiple position sources with different SDAs or SILs. demonstrate
	during ground testing that a change in position source results in an updated SDA and SIL within 10 seconds. If integrating an ADS-B
	transmitter with a noncompliant GPS, the SDA and SIL must be set to "0".
	C.4.6 (Latency Analysis) Extrapolation During Loss of Position Data.
	TSO-C166b equipment compliant with RTCA/DO-260B, sections 2.2.3.2.3.7.4 and 2.2.3.2.3.8.4, allows extrapolation of the position for up
	to 2 seconds when the position data is not available from the position source. This allowance is in case position data is lost for a single
	sample, and it does not have to be considered in the total latency calculation, provided it is a non-normal condition. If the position data is
	lost, several position updates could exceed the latency requirement, but the position would then be invalidated within 2 seconds, pursuant
	to TSO-C166b.
	C.4.9 (Latency Analysis) Minor Changes to Position Source Type Design.
	If the ADS-B installation relies on position source latency performance, versus a TSO latency standard, the ADS-B system installer must
	update the ICA for the position source with a process that ensures continued airworthiness of the ADS-B system following design changes
	to the position source

C.5 (Latency Analysis) Latency Analysis Example. This example uses a GNSS meeting the minimum performance requirements of TSO-C145 (any revision) directly connected to TSO-C166b ADS-B equipment. This installation is a T = 0 installation; thus it is unsynchronized. The example in Table C-1 is considered a compliant architecture. Note 1: ADS-B equipment compensated latency is bounded by the asynchronous nature of the position source delivery and ADS-B system transmission. Thus ADS-B equipment compensated latency is included in the asynchronous delay row. Note 2: The latency between the position source TOM and the position source time of applicability is required to be compensated by all revisions of TSO-C145, TSO-C146, and TSO-C196. Table C-1. Latency Analysis Example Uncompensated Compensated Item Total Latency Notes Latency Latency Position Source ≤ 200 ms ≤ 500 ms ≤ 700 ms Directly Position Source to 0 ADS-B Interface connected ADS-B Equipment < 100 ms Note 1 < 100 ms 1 Hz position Asynchronous Delay 0 \leq 1.0 second < 1.0 second source Total \leq 1.8 second $\leq 300 \text{ ms}$ \leq 1.5 second Appendix G - Example of Flight Manual Supplement for ADS-B Out 2.2 (AFM) Aircraft Flight Manual The installed ADS-B out system is fully compliant with the requirements of CS ACNS.D.ADSB (1090 MHz Extended Squitter ADS-B Out). A Include ADS-B OUT operating limitations, normal operating procedures, and a system description in the Airplane Flight Manual (AFM), detailed description of the system operation can be found in the ______, P/N ____, , Rev. ____ or Rotorcraft Flight Manual (RFM), AFM Supplement (AFMS), or RFM Supplement (RFMS). The flight manual must also state that the installation meets the requirements of § 91.227. This can be accomplished by adding the following statement to the General or Normal subsequent revisions. LIMITATIONS Procedures section of the flight manual: None The installed ADS-B OUT system has been shown to meet the equipment requirements of 14 CFR 91.227. EMERGENCY PROCEDURES 2.2.1 (AFM) Operating Limitations. No change to Approved Aircraft Flight Manual The flight manual should describe any operating limitations necessary for safe operation because of design, installation, or operating NORMAL/ ABNORMAL PROCEDURES characteristics. Normal/Abnormal operating procedures are described in the , P/N , Rev. or subsequent 2.2.2 (AFM)Operating Procedures. Describe normal and non-normal operating procedures for the system in the flight manual. revisions. The procedure to change Aircraft Identification in flight is described in 2.2.3 (AFM) System Description. PERFORMANCE Describe the ADS-B OUT system and the interface with other systems on the aircraft in the flight manual... No change to Approved Aircraft Flight Manual Additional Guidance not Addressed in CS-ACNS 2.2.2.1 (AFM) Describe any actions expected of the pilot. 2.2.2.2 Describe how to enter the Mode 3/A code, Flight ID, operate the IDENT function, and activate or deactivate emergency status. If the ADS-B system and transponder do not have a single point of entry for the Mode 3/A code, IDENT, and emergency status, the flight manual procedures must ensure conflicting information is not transmitted from the ADS-B system and transponder. 2.2.2.3 (AFM) Describe any ADS-B OUT displays and provide instructions to the pilot on how to respond to any error conditions. 2.2.2.4 (AFM) Describe how the ADS-B OUT system can be disabled, if there is an ability to disable the ADS-B OUT system. Also, describe the means through which the pilot can detect that the system has been disabled. The flight manual must address the effects of turning off the ADS-B OUT system, including the effects on the transponder and TCAS II if disabling the ADS-B OUT system also disables the transponder or the TCAS II.

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), and Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, guidance/requirements in black are additional info, that does not conflict, but is not specified in the other guidance document/regulation, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets. 2.2.2.5 (AFM) Include guidance in the flight manual on when to enable the ADS-B OUT system. The ADS-B OUT system must be enabled (turned ON) during all phases of flight operation including airport surface movement operations. ADS-B IN surface applications and ATC surface surveillance will use ADS-B OUT broadcasts; thus, it is important for aircraft ADS-B OUT systems to continue to transmit on the airport surface. If the ADS-B OUT function is embedded in a Mode S transponder, the flight manual, checklists, and any operator procedures manuals must be updated accordingly with ADS-B OUT operations guidance. Note: Historically, transponders have been turned on by the flightcrew when entering the runway for takeoff and turned off or to standby when exiting the runway after landing. When ADS-B is integrated into a Mode S transponder, the existing guidance for transponder operation must be updated to ensure the ADS-B system is operating during airport surface movement operations. 2.2.3 (AFM) System Description. ...If multiple position sources are interfaced to the ADS-B transmitter, describe the source selection mechanism and any related indications. Appendix H - Part 1 – ADS-B Out Data Parameters (AMC ACNS.D.ADSB.020(a)) Part 1 of this Appendix provides guidance to the aircraft integrator on the minimum ADS-B Out surveillance data requirements (Table 5 3.1.6 (Installation) Populating Message Elements. and associated Definitions). § 91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91.225. All parameters transmitted by the ADS-B system must conform to the standards in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS-B In addition, guidance is given for the overall understanding of the ADS-B Out system, in support of equipment configuration and ADS-B Out data parameter testing, as appropriate. This includes the presentation of data encodings related to the so-called BDS registers (Table 4), as *Out data link]* and may not contain false or misleading information. extracted from ED-102A. The content of the various BDS registers are loaded into the 56-bit ADS-B message (ME) field of the Mode S A.1 (Parameters) Purpose. Downlink Format 17 (DF17, bits 33-88), in line with their respective transmission rates. This appendix provides a description of the message elements that may be contained in an ADS-B OUT message. Table 5 below makes reference to the BDS registers that contain the various ADS-B Out data parameters. When Table 5 states Same source as for Mode S replies, reference is made to the requirement that the content of ADS-B broadcasts and Mode S replies that carry the same information need to come from the same source (CS ACNS.D.ADSB.025(b)). The reference to the BDS registers is provided in order to facilitate a detailed understanding and traceability of ADS-B Out requirements at ADS-B transmit unit level, also in support of integration testing, as appropriate. The relationship between the BDS registers and the ADS-B message Type Codes (first 5 bits in the 56-bit ADS-B message field) is thereby as shown in Table 4. The Type Code is used to differentiate between ADS-B message types (i.e. BDS registers). In addition, for Airborne and Surface Position Messages, the Type Code is used to encode the horizontal position integrity containment bounds (NIC). The Subtype Code is used to further differentiate between ADS-B messages of a certain type (e.g. Operational Status Message). A number of service bulleting have been issued to rectify some observed deficiencies and have already been addressed by the equipment manufacturers. Therefore, the installed transponders should have all published corrective transponder equipment service bulletins (SB) relating to the correct operation of the ADS-B functionality embodied. 3.1.6 (Installation) Populating Message Elements. Table 4: BDS Register Overview § 91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91.225. All parameters Type transmitted by the ADS-B system must conform to the standards in TSO-C166b or TSO-C154c and may not contain false or misleading **BDS Register** Subtype Code Code(s) information 0, 9-18, 20-2 0516 - Airborne Position Message n/a 0616 - Surface Position Message 0, 5-8 n/a 0816 - Aircraft Identification and Category Message 1, 2, 3 or 4 n/a 0916 - Airborne Velocity Message 1+2 19 Velocity over Ground (Normal/Supersonic) 6116 - Aircraft Status Message 28 1 Emergency Status and Mode A Code 6116 - Aircraft Status Message 28 2 ACAS RA Broadcast 6216 - Target State and Status Message 29 1 6516 - Aircraft Operational Status Message 31 0 While Airborne 6516 - Aircraft Operational Status Message 31 1 On the Surface Note: Although BDS registers 0716 and 0A16 are not conveying ADS-B data items their implementation is needed to complement the ADS-B protocol Table 5: Minimum ADS-B Out Surveillance Data Transmission Requirements (Parameter/Requirements/BDS Register/Remarks)

 Aircraft Identification/See Definition 1/08₁₆/Same source as for Mode S replies Definition 1: Aircraft Identification Data Sources Aircraft Identification is provided to the ADS-B transmit unit so that the information is identical to the filed ICAO flight plan. This information may be provided from, amongst others: A flight management system; or A pilot control panel; or For aircraft, which always operate with the same aircraft identification (e.g. using registration as the aircraft identification), it may be programmed into equipment at installation. In case no ICAO flight plan is filed, the Aircraft Registration is provided to the ADS-B transmit unit. 	3.7.3.1 (Installation) Call Sign/Flight ID. The assigned aircraft registration number must [change to should] be set as the call sign/flight ID during installation. Procedures for dynamically selecting a call sign must be included in the flight manual or pilot's guide if the ADS-B equipment provides a means to input a radio telephony call sign. If pilot-selectable, the call sign/flight ID should be readily apparent to the flightcrew. When the aircraft system is powered on, the call sign/flight ID must be filled. At initial power-on it is acceptable for the call sign/flight ID to revert to a previously set call sign that existed before the system being powered off, or to the aircraft registration number. Refer to section 3.7.2.3 of this AC for information on use of the anonymity feature. Note: The preset call sign/flight ID will have to be updated if the aircraft's registration number changes. A.2.4 (Parameters) Call Sign/Flight ID. The term "aircraft call sign" is the radiotelephony call sign assigned to an aircraft for voice communications purposes. (This term is sometimes used interchangeably with "flight identification" or "flight ID"). For general aviation aircraft, the aircraft call sign is normally the national registration number; for airline and commuter aircraft, the call sign is usually comprised of the company identification and flight number (and therefore not linked to a particular airframe) and, for the military, it usually consists of numbers and code words with special significance for the operation conducted. The call sign or aircraft registration number is required to be transmitted by § 91.227 except when using the TSO-C154c anonymity feature [CS only recongnizes 1090 ES for the ADS-B Out data link] .
 Mode A Code/See Definition 2/61₁₆/Same source as for Mode S replies Broadcast suppressed for conspicuity code '1000' Definition 2: Mode A Code Refer to AMC1 ACNS.D.ELS.015 for general guidance. When the ADS-B transmit unit receives a Mode A Code containing the Mode S conspicuity code (1000), the broadcast of Mode A code information is stopped. Note: The broadcast of the Mode A Code is provided as a transitional feature, e.g. to aid operation of legacy ATC automation systems that use Mode A Code for Flight Plan correlation. Entry of the Mode A Code of 1000 will disable the transmission of the Mode A Code, and, hence, reduce the overall 1090 ES transmission rate. 	 3.7.3.4 (Installation) Mode 3/A Code. The installation must provide a means for the pilot to enter the Mode 3/A code. A.2.19 (Parameters) Mode 3/A Code. Currently ATC automation relies on the Mode 3/A code to identify aircraft under radar surveillance and correlate the target to a flight plan. The mode 3/A code is a four digit number ranging from 0000 to 7777. Secondary Surveillance Radars (SSR) and ADS-B will concurrently provide surveillance, so the Mode 3/A code is included in the ADS-B OUT message and is required to be transmitted by § 91.227. Note: ADS-B systems will not transmit the Mode 3/A code if the Mode 3/A code is set to 1000.
3. ICAO 24-bit aircraft address/Transmit ICAO 24-bit aircraft address/All BDS (AA field of DF17, bits 9-32)/Unique ICAO 24 bit aircraft address needs to be assigned by the responsible authority	 3.2.3.1 (Installation) International Civil Aviation Organization (ICAO) 24-Bit Address. You must set the ICAO 24-bit address during installation in accordance with the ADS-B equipment manufacturer's instructions. For U.S. civil aircraft, the ICAO 24-bit address is currently established as a function of the aircraft's registration or "N" number. You can determine the appropriate address for U.S. registered aircraft on the following FAA website: http://registry.faa.gov/aircraftinquiry/. Use of a random 24-bit address is discussed further in section 3.7.2.3 of this AC. Note 1: The ICAO 24-bit address is also used by the Mode S transponder. For the addition of ADS-B (1090ES) in an existing Mode S transponder installation, verify that the ICAO 24-bit address decodes to the current aircraft registration number. Note 2: The ICAO 24-bit address will have to be updated if the aircraft's registration number changes. Note 3: Installation instructions may require inputting the 24-bit address as an Octal, Decimal, or Hexadecimal number (that is, 506043310ctal = 10684633Decimal = A308D9Hex). Ensure you use the correct base number when configuring the ADS-B system. 4.1.7 (Ground Test) ICAO 24-bit Address. For U.S. civil aircraft, demonstrate that the 24-bit address transmitted by the system correlates to the aircraft registration number. If the system has a separate Mode S transponder and ADS-B system transmit the same correct ICAO 24-bit address. For non-U.S. registered aircraft, verify that the ICAO 24-bit address assigned to an aircraft by the responsible State authority. A.2.14 (Parameters) ICAO 24-bit address assigned to an aircraft during the registration process. ICAO 24-bit addresses are defined blocks of addresses assigned for participating countries or states worldwide. In the United States, civil aircraft are assigned an address from an encoding scheme based on the aircraft registration number ("N" number). Addit

guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation,	and appendix i) and AC 20-1656 (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same of consistent, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.
 4.a. Airborne Horizontal Position – Latitude and Longitude/See Definition 3/05₁₆ Definition 3: Horizontal Position Information The Mode S Extended Squitter position format uses the Compact Position Reporting (CPR) algorithm to encode latitude and longitude efficiently into messages. The resulting messages are compact in the sense that several higher order bits which are normally constant for long periods of time, are not transmitted in every message. The CPR technique enables a receiving system to unambiguously determine the location of the aircraft, and, hence, reconstruct the original information provided by the source. If required for integration testing purposes, detailed guidance on the CPR algorithm is provided in ED-102A/DO-260B. A horizontal position data source provides position information for both the airborne and surface horizontal position data formats (i.e. registers 05₁₆ or 06₁₆, respectively), accordingly encoded by the ADS-B transmit unit depending on the aircraft airborne/surface state. 	 3.3.3.1 (Installation) Latitude and Longitude. The ADS-B equipment must set the latitude and longitude based on the real-time position information provided by the position source. A.2.17 (Parameters) Latitude and Longitude. These parameters are derived from the position source and provide a geometric based position. Reference all geometric position elements broadcast from the ADS-B unit to the WGS-84 ellipsoid. Latitude and longitude are required to be transmitted by § 91.227. A.2.24 (Parameters) Position. These parameters are derived from the position source and provide a geometric based position. Reference all geometric position elements broadcast from the ADS-B unit to the WGS-84 ellipsoid. Latitude and longitude is required to be transmitted by § 91.227.
 4.b. Airborne Horizontal Position Quality: NIC/See Definition 4 and 5/05₁₆ Type Codes/Incl. NIC Supplements A (65₁₆) and B (05₁₆) 4.c. Horizontal Position Quality: NACp/See Definition 4 and 6/62₁₆ and 65₁₆/ 4.d. Horizontal Position Quality: SIL/See Definition 4 and 7/62₁₆ and 65₁₆/(ncl. SIL Supplement. 4.e. Horizontal Position Quality: SDA/See Definition 4 and 8/65₁₆ Definition 4: Horizontal Position Quality – NIC and NACp The encoding of the NIC and NACp horizontal position quality indicators should be directly derived from the corresponding integrity and accuracy information as being reported by the selected horizontal position source (refer also to CS ACNS.D.ADSB.025(c)). In case a measurement integrity failure has been indicated by the selected horizontal position source (e.g. bit 11 of ARINC label 130 for ARINC 743A compliant sources), both the NIC and NACp quality indicators will be set to invalid (zero), regardless of the indicated integrity containment bound (e.g. HPL). 	
 4.b. Airborne Horizontal Position Quality: NIC/See Definition 4 and 5/05₁₆ Type Codes/Incl. NIC Supplements A (65₁₆) and B (05₁₆)Definition 5: Airborne NIC Value NIC is reported so that surveillance applications, such as by ATC or other aircraft, may determine whether the reported horizontal position has an acceptable level of measurement integrity for the intended use. (Note that the NIC parameter is closely associated with the SIL quality metric.) The NIC (and SIL) values are associated with a possible failure condition of the position measurement function and the detection thereof. For most ADS-B applications, the NIC (and SIL) values are the key horizontal position quality metrics on which the horizontal position data is determined to be of sufficient quality for its intended use. The NIC value is encoded on the respective horizontal position integrity containment radius as provided by the source. The NIC values, including the NIC Supplements values, are encoded for airborne position messages as follows (Rc is the horizontal position integrity containment bound, typically HPL/HIL for GNSS systems): 	3.3.3.5 (Installation) Navigation Integrity Category (NIC). The ADS-B equipment must set the NIC based on the real-time integrity metric provided by the position source. When interfacing GNSS position sources, the NIC should be based on the HPL or HIL. However, although HPL values significantly smaller than 0.1 nautical mile (nm) can be output from single-frequency GNSS sources, the HPL may not actually achieve the reported level of protection as there are error contributions that are no longer considered negligible. You should review the position source design data to determine if all error sources are taken into consideration, or if the position source limits the HPL output, when computing an unaugmented Receiver Autonomous Integrity Monitoring (RAIM) based HPL. This applies to all TSO-C129() and TSO-C196() position sources, and to TSO-C145() and TSO-C146() position sources when operating in unaugmented modes. Where the HPL is based on RAIM. This may apply to some position source does not account for all errors or accomplish the appropriate HPL limiting, you must ensure you interface the position source to ADS-B equipment that limits the NIC ≤ 8. Refer to section 4.5.6Appendix B, of this AC for additional information regarding HPL considerations. A.2.22 (Parameters) Navigation Integrity Category (NIC). The NIC parameter specifies a position integrity containment radius. NIC is reported so surveillance applications, such as ATC or other aircraft, may determine whether the reported geometric position has an acceptable level of integrity for the intended use. The NIC parameter is closely associated with the SIL. While NIC specifies the integrity containment radius, SIL specifies the probability of the actual position lying outside that containment radius without indication. ADS-B systems should drive the NIC from an approved position source's integrity output, such as the HPL from the GNSS. A minimum NIC value of "7" must be transmitted [CS requires a minimum NIC of "6"] by § 91.227.

ADS-B Out Guidance Como: Includes a comparison of FASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), and Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in g re the nsistent

Table 6: Airborne NIC Encoding				Table A-3. NIC Values						
					NIC	Containment Radius				
		Airborne			0	Unknown				
NIC		Airborne	NIC Su	pplement		1	RC < 37.04 km (20.0 nm)			
Value	Radius of Containment (R _c)	Position	C	odes		2	RC < 14.816 km ($8.0 nm$)			
		TYPE Code	Α	В		3	RC < 7.408 km (4.0 nm)			
	R- unknown or	0.19.05				4	RC < 3.704 km (2.0 nm)			
0	$R_c \ge 37\ 040\ m\ (20\ NM)$	22	0	0		5	RC < 1.852 km (1.0 nm)			
1	R _c < 37 040 m (20 NM)	17	0	0		6 Sup A=1 Sup B=1	RC < 1111.2 m (0.6 nm)		T-LL D.1 MCT	
2	$B_c < 14.816 \text{ m} (8 \text{ NM})$	16	0	0		6 Sup A=0 Sup B=0	RC < 926 m (0.5 nm)		Table D.S. AIC Encoding	
3	$B_{c} < 7.408 \text{ m} (4 \text{ NM})$	16	1	1		6 Sup A=0 Sup B=1	RC < 555.6 m (0.3 nm)	Value	Radius of Containment	
4	$P_{\rm e} < 3.704 {\rm m} (2. {\rm NM})$	15	-	-		7	RC 370.4 m (0.2 nm)	1	$R_c < 37.04 \text{ km}$ (20.0 nm)	
5	$P_{-} < 1.852 \text{ m} (1 \text{ NM})$	14	0	0		8	RC < 185.2 m (0.1 nm)	2	R _C ≤ 14.816 km (8.0 nm)	
5	$R_{\rm C} < 1.052 {\rm m} (1.000)$	14	0			9	RC < 75 m	3	$R_C \le 7.408 \text{ km}$ (4.0 nm)	
	$R_{\rm c} < 1111.2 \text{ m} (0.6 \text{ NM})$	13	1			10	RC < 25 m	4	$R_{C} \le 3.704 \text{ km}$ (2.0 nm)	
6	R _c < 926 m (0.5 NM)	13	0	0		11	RC < 7.5 m	5	$R_C \le 1.852 \text{ km}$ (1.0 nm)	
	R _c < 555.6 m (0.3 NM)	13	0	1				6	$R_C \le 1.111 \text{ km} = (0.0 \text{ nm})$ $R_C \le 0.05 \text{ nm}$	
7	R _c < 370.4 m (0.2 NM)	12	0	0				6	$R_{c} \le 555.6m$ (0.3 nm)	
8	R _c < 185.2 m (0.1 NM)	11	0	0				7	R _C < 370.4 m (0.2 nm)	
9	R _c < 75 m	11	1	1					$R_{C} \le 185.2 \text{ m}$ (0.1 nm)	
10	R _c < 25 m	10 or 21	0	0				9	R _C < 75 m	
11	R _c < 7.5 m	9 or 20	0	0				10	R _C < 25 m	
ninimum NIC values required for the ADS-B-RAD application can be found in Table 20, in Part 3 of Appendix A. They are met								11	Kc < /.3 m	
rizontal pos Position Qu	ition source requirements defined in CS ality: NACp/See Definition 4 and 6/62 ₁₆	ACNS.D.ADSB. and 65 ₁₆ /	070.			3.3.3.6 (Installation) N	avigation Accuracy Category for Po	osition (N	IAC _p).	
Ср					A 1 4 10 10 10 10	The ADS-B equipment	must set the NAC _P based on the re	eal-time !	95-percent accuracy metric provided by the position source. When	
the 95 % ra	dial accuracy of the aircraft's horizontal	position inform	hation (latiti	Ide and longiti	e) derived from the position	interfacing GNSS source	tes, the NAC _P should be based on a	qualifie	d Horizontal Figure of Merit (HFOM).	
position m	peasurement function the NACn value d	lescribes the no	minal perfo	rmance of the	leasurement function in	A.2.20 (Parameters) N	avigation Accuracy Category for Po	osition (N	IAC _P).	
ntal positio	n accuracy as provided by the source.		in a perio			avionics The ADS-B e	e accuracy of the aircraft's norizon auinment derives a NAC, value fro	tal positi m the no	on information (latitude and longitude) transmitted from the aircraft sition source's accuracy output, such as the HEOM from the GNSS.	CS The
lue is encoded as follows:						NAC _o specifies with 95	percent probability that the report	ted infor	mation is correct within an associated allowance. A minimum NAC.	valu
						of "8" must be transm	itted to operate in airspace define	d in § 91.	227 ICS requires a minimum NAC of "7"]. Table A-1 provides the	
						applicable NAC _P values				
ז						D.1.18 (Definition) Nav	rigation Accuracy Category for Pos	ition (NA	C _P).	
ι						Used to indicate, with	95 percent certainty, the accuracy	of the a	ircraft reported horizontal position. Table D-1 provides a list of poss	ible
						NAC _P values. A NAC _P C	of 8 or greater is required [CS requ	ires a mi	nimum NAC _P of "7] by § 91.227.	

	Table 7: NACp Encoding			Table A-1. NA	C _P Values			
Coding	95% Horizontal Accuracy Bound		NAG	P Horizontal Accura	cy Bound		1	
0	EPU ≥ 18 520 m (≥10 NM)		0	$EPU \ge 18.52 \text{ km}$ $EPU \le 18.52 \text{ km}$	(10nm) (10nm)		-	
1	EPU < 18 520 m (10 NM)		2	EPU < 7.408 km	(4nm)]	
2	EPU < 7 408 m (4 NM)		3	EPU < 3.704 km	(2nm)		_	
3	EPU < 3 704 m (2 NM)		4	EPU < 1852 m	(1nm)		-	
4	EPU < 1852 m (1 NM)		5	EPU < 926 m	(0.5nm) (0.3nm)		Table D-1. NAC _P Encoding	
5	EPU < 926 m (0.5 NM)		7	EPU < 185.2 m	(0.1nm)	Value	Horizontal Accuracy Bound (Estimated Position Uncertainty)	
6	EPU < 555.6 m (0.3 NM)		8	EPU < 92.6 m	(0.05nm)	0	EPU≥18.52 km (10.0 nm) EPU≤18.52 km (10.0 nm)	
-			9	EPU < 30 m		2	EPU < 7.408 km (4.0 nm)	
7	EPU < 185.2 m (0.1 NM)		10	EPU < 10 m		3	$EPU \le 3.704 \text{ km}$ (2.0 nm) $EPU \le 1.852 \text{ m}$ (1.0 nm)	
8	EPU < 92.6 m (0.05 NM)		11	$EPU \le 3 m$		5	EPU < 926 m (0.5 nm)	
9	EPU < 30 m					6	EPU < 555.6 m (0.3 nm)	
10	EPU < 10 m					8	EPU < 185.2 m (0.1 nm) EPU < 92.6 m (0.05 nm)	
10						9	EPU < 30 m	
11	EPU < 3 m					10	EPU < 10 m	
						11	EPU < 3 m	
. Horizontal Posi	ition Quality: SIL/See Definition 4 and $7/62_{16}$ and 65_{16} /Incl. SIL Supplement.	3	3.3.3.3)	InstallationSource Integrit	y Level (SIL).			
finition 7: SIL			SIL is b	ased solely on the position	source's prob	ability of exce	eeding the reported integrity value and should be set based on de	
e encoding of the	e norizontal position source integrity level (SIL) is based on the probability of the inment defined by the NIC, without alerting, assuming no avionics faults. The SIL	value is set as follows:	A.2.27 (P	arameter) Source Integrity	Level (SIL).	ii		
			The SIL fi	eld defines the probability	of the reporte	d horizontal	position exceeding the radius of containment defined by the NIC,	
		alerting,	assuming no avionics faults	s A SIL value	of "3" must	be transmitted to operate in airspace defined in § 91.225. Table		
		outlines	he SIL values.					
			Note 1: The probability of an avionics fault causing the reported horizontal position to exceed the radius of containment defined by the					
		4	NIC, with	out aierting, is covered by be SIL probability can be d	the SDA parar ofined as oith	neter. er ner semple	or per-bour as defined in the SIL supplement (SILSLIPP)	
			0.1.25 (D	efinition) Source Integrity	Level (SIL).	- per sample	or per nour as defined in the sit supprement (sitsOFF).	
		т	The prob	ability of the reported hori	zontal positio	n exceeding t	he radius of containment defined by the NIC without alerting, ass	
		a	avionics has no faults. Table D-4 provides a list of possible SIL values. A SIL of 3 is required by § 91 227					

Table 8: SIL Encoding			Table A-4.	SIL Values, Probability of Exceeding the NIC Containment Radius
SIL value	Probability of Exceeding the NIC		SIL Value	Probability of exceeding the NIC containment radius
			0	> 1x10 ⁻³ Per-hour or Sample or Unknown
0	Unknown or $> 1 \times 10^{-3}$ per flight hour or per sample		1	$\leq 1 \times 10^{-3}$ Per-hour or Sample
1	< 1 × 10 ⁻³		2	$\leq 1 \times 10^{-5}$ Per-hour or Sample
-	per flight hour or per sample		3	$\leq 1 \times 10^{-7}$ Per-hour or Sample
2	\leq 1 $ imes$ 10 ⁻⁵ per flight hour or per sample			Table D-4. SIL Encoding
3	≤ 1 × 10 ⁻⁷		Value	Probability
	per flight hour or per sample		0	$> 1 \mathrm{x} 10^{-3}$ or unknown
			1	$\leq 1 \mathrm{x} 10^{-3}$
			2	$\leq 1 \mathrm{x} 10^{-5}$
			3	$\leq 1 \mathrm{x} 10^{-7}$
Whereas SIL assumes that Whereas SIL assumes that For horizontal position so alerting is based on a per be set to 'one'. The SIL encoding is the sa	inte required for the AUS-B-RAD application can be found in Table 20, in P sition source requirements defined in CS ACNS.D.ADSB.070 (see also relat there are no system integrity failures, the SIL should consider the effects urces compliant with CS ACNS.D.ADSB.070, the probability of exceeding a hour rate. Hence, the SIL Supplement should be set to 'zero'. If based on p me for airborne position messages and surface position messages.	A AMC guidance). ed AMC guidance). of a faulted signal-in-space. SUC radius of containment without er sample, the SIL Supplement would S G G C A T A	A.2.27 (Parameters) Source Vithough the SIL assumes t pace (SIS), if a SIS is used i lote 2: The SIL probability I.3.3.4 (Installation) Source IILSUPP is based on wheth ample basis and should be SNSS position source comp (2196 may preset SILSUPP t A.2.28 (Parameters) Source the SILSUPP defines wheth A-5.	Integrity Level (SL). here are no unannunciated faults in the avionics system, the SIL must consider the effects of a faulted Signal-I by the position source. can be defined as either per sample or per-hour as defined in the SIL supplement (SILSUPP). e Integrity Level Supplement (SILSUPP). er the position source probability of exceeding the reported integrity value is calculated on a per-hour or per- set based on design data from the position source equipment manufacturer. ADS-B systems interfaced with oliant with any revision of TSO-C129 [TSO-C129a is the minimum in CS-ACNS], TSO-C145, TSO-C146, or TSO- o "ZERO," as GNSS position sources use a per-hour basis for integrity. e Integrity Level Supplement (SILSUPP). er the reported SIL probability is based on a per-hour probability or a per-sample probability as defined in Tai
				Table A-5. Source Integrity Level Supplement
			SIL Supplement	Basis for SIL Probability
			0	Probability of exceeding NIC containment radius is based on per-hour.
		l	1	Probability of exceeding NIC containment radius is based on per-sample.

4.e. Horizontal Position Quality: SDA/See Definition 4 and 8/65 ₁₆	A.2.29 (Parameters) System Design Assurance (SDA).
Definition 8: SDA	The SDA parameter defines the failure condition that the ADS-B system is designed to support as defined in Table A-5. The supported
The encoding of the system design assurance level (SDA) is based on the failure condition that the entire ADS-B Out system, with respect	failure condition will indicate the probability of an ADS-B system malfunction causing false or misleading position information or position
to the horizontal position data and associated quality indicators, is designed to support.	quality metrics to be transmitted. This should include the probability of exceeding the containment radius without annunciation. Because
The SDA value is encoded as follows:	the installer of ADS-B OUT equipment does not know how the broadcast data will be used, the installer cannot complete a Functional
	Hazard Assessment (FHA) evaluating the use of the broadcast data. The SDA provides a surrogate for such a FHA by identifying the
	potential impact of an erroneous position report caused by an equipment malfunction. The definitions and probabilities associated with
	the supported failure effect are defined in AC 25.1309-1, AC 23.1309-1(), and AC 29-2 (Changes 1-3 incorporated). The SDA includes the
	position source, ADS-B equipment, and any intermediary devices that process the position data. § 91.227 requires an SDA of 2 or 3 as
	defined in Table A-6.
	D.1.26 (Definition) System Design Assurance (SDA).
	The failure condition that the position transmission chain is designed to support. Table D-5 provides a list of possible SDA values. An SDA

Table 9: SDA Encoding						
SDA value	Software & Hardware Design Assurance Level (see Note 1)	Corresponding System Integrity Level (see Note 2)				
0	N/A	> 1X10 ⁻³ per flight hour or unknown (No Safety Effect)				
1	D	≤ 1×10 ⁻³ per flight hour (Probable)				
2	с	≤ 1×10 ⁻⁵ per flight hour (Remote)				
3	В	≤ 1X10 ⁻⁷ per flight hour (Extremely Remote)				

		Table A-6. System Design Assurance	
SDA Value	Supported Failure Condition Note 2	Probability of Failure Causing Transmission of False or Misleading Information Note 3,4	Software & Hardware Design Assurance Level Note 1,3
0	Unknown/ No safety effect	> 1x10 ⁻³ Per-hour or Unknown	N/A
1	Minor	$\leq 1 \times 10^{-3}$ Per-hour	D
2	Major	$\leq 1 \times 10^{-5}$ Per-hour	С
3	Hazardous	$\leq 1 \times 10^{-7}$ Per-hour	В

Table D-5. SDA Encoding

Value	Probability of Undetected Fault Causing the Transmission of False or Misleading Information
0	> 1x10 ⁻³ or unknown
1	$\leq 1 x 10^{-3}$
2	$\leq 1 \times 10^{-5}$
3	$\leq 1 \times 10^{-7}$

Note 1: Software Design Assurance per EUROCAE ED-12C (RTCA DO-178C). Airborne Electronic Hardware Design Assurance per EUROCAE ED-80 (RTCA DO-254).

Note 2: In line with the ADS-B-RAD requirements, the minimum value required for the horizontal position source is SDA=2 (). The SDA encoding is the same for airborne position messages and surface position messages.

Note 1: Software design assurance pursuant to RTCA/DO-178C, Software Considerations in Airborne Systems and Equipment Certification, or equivalent. Airborne electronic hardware design assurance pursuant to RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware, or equivalent.

Note 2: Supported failure classification defined in AC 25.1309-1(), AC 23.1309-1(), and AC 29-2().

of 2 or greater is required by § 91.227. Refer to A.2.29 for more information

Note 3: Because the broadcast position can be used by any ADS-B IN equipped aircraft or by ATC, the provisions in AC 23.1309-1() that allow reduction in failure probabilities and design assurance level for aircraft under 6,000 pounds do not apply for the ADS-B OUT system. Note 4: Includes probability of transmitting false or misleading latitude, longitude, or associated position accuracy and integrity metrics.

5. Pre Defini Refer	essure Altitude/See ition 9: Pressure Alt to AMC1 ACNS.D.E	Definition 9/05 ₁₆ , titude Data Source ELS.015 for guidan	/Same source as for Mode S replies. Data associated with es .ce.	'NICbaro' integrity indicator .	3.4.3.2 (Installation) Barometric Altitude Integrity Code (NIC _{BARO}). You should verify the type of altitude source installed in the aircraft and interface the altitude system per the ADS-B equipment manufacturer's instructions. For aircraft with an approved, non-Gillham altitude source, NIC _{BARO} should be preset at installation to "ONE". For aircraft with a Gillham altitude source without an automatic cross-check, NIC _{BARO} must be preset at installation to "ZERO". For aircraft that dynamically cross-check a Gillham altitude source with a second altitude source, the NIC _{BARO} must be set based on the result of this			
The A	DS-B NICbaro quali	ty indicator is end	coded as follows:					
		Tab	ole 10: NICbaro Encoding		cross-check. We recommend that ADS-B installations use non-Gillham altitude encoders to reduce the potential for altitude errors.			
	Coding 0	The barom that has n	Meaning etric altitude is based on a Gillha not been cross-checked against a e altitude.	m coded input nother source	This parameter indicates the aircraft's barometric pressure altitude referenced to standard sea level pressure of 29.92 inches of mercury or 1013.2 hectopascals. The barometric pressure altitude is required to be transmitted by § 91.227 . A.2.23 (Parmeters) NIC _{BARO} NIC _{BARO} indicates if pressure altitude is provided by a single Gillham encoder or another more robust altitude source. Because of the			
	1	The barom input that of pressure based on a	hetric altitude is either based on a has been cross-checked against a e altitude and verified as being co a non-Gillham coded source.	Gillham code nother source nsistent, or is	potential for an undetected error in a Gillham encoding, many Gillham installations are cross-checked against a second altitude source. NIC _{BARO} annotates the status of this cross-check. D.1.6 (Definition) Barometric Altitude Integrity Code (NIC _{BARO}). Indicates if pressure altitude is provided by a single Gillham encoder or another, more robust altitude source. Because of the potential fo an undetected error in a Gillham encoding, many Gillham installations are cross-checked against a second altitude source. NIC _{BARO}			
6 Spe	cial Position Identif	ication/Setting as	per ED-73E §2.5/05 ₁₆ /Same source as for Mode S replies		3.7.3.3 (Installation) IDENT.			
					The installation must provide a means for the pilot ot enter the IDENT feature. A.2.16 (Parameters) IDENT. IDENT is a flag manually set by the pilot at the request of ATC in ATCRBS, Mode S, and ADS-B messages. The pilot manually enables the IDENT state, which highlights their aircraft on the controller's screen. IDENT is required to be transmitted by § 91.227.			
7.a. E (wher Defini The p other	mergency Status/S re defined for SSR) ition 10: Emergency rovision of the Eme emergency conditi	ee Definition 10/6 y Status ergency Status val ons defined in 61	51 ₁₆ (subtype 1)/Same source as for Mode S replies ues that do not have a corresponding Mode A Code value ₁₆ , is optional. This applies to the decimal values 2, 3, 6 ar	e (see CS ACNS.D.ELS.) denoting the Id 7 in Table 11.	3.7.3.2 (Installation) Emergency Status. The installation must provide a means for the pilot to enter the emergency status of the aircraft. Although TSO-C166b and TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link] identify multiple emergency codes, only the codes for general emergency, no communications, and unlawful interference are required to be available for broadcast. It is acceptable to base the ADS-B emergency status on the emergency status code input into the transponder (that is, Mode 3/A codes 7500, 7600, and 7700). A.2.5 (Parameters) Emergency Status.			
		Table 11: E	mergency Status Encoding		This parameter alerts ATC that the aircraft is experiencing emergency conditions and indicates the type of emergency. Applicable			
	Coding (Binary)	(Decimal)	Meaning		to potential danger to the aircraft so it can take appropriate action. Emergency status is required to be transmitted by § 91.227.			
	000	0	No Emergency					
	001	1	General Emergency					
	010	2	Lifeguard/medical Emergency					
	011	3	Minimum Fuel					
	100	4	No Communications					
	101	5	Unlawful Interference					
	110	6	Downed Aircraft					
	111	7	Reserved					
7.b. F	mergency Indicatio	n/Setting as per F	D-73E \$2 5/05/Same source as for Mode S replies					

8. 1090 ES Version Number/To be set to 2 for ED-102A/DO-260B systems/65 ₁₆ /Value is fixed at the time the ADS-B transmit unit is						A.2.34 Version Number.					
manufactured					The applicable TSO Minimum Operational Performance Standard (MOPS) level is communicated through the version number, which is						
					fixed at the time the ADS-B equipment is manufactured. Version 2 applies to ADS-B equipment that meets MOPS documents RTCA					/DO-	
					260B with corrigendum 1 or RTCA/DO-282B with corrigendum 1 [CS only recongnizes 1090 ES for the ADS-B Out data link] . ADS-B						
						equipment outputting version 2 or higher is required by § 91.227.					
9.a. Airborne Horizontal Velocity (Ground Speed) - east/west and north/south/See Definition 11/09 ₁₆ (subtypes 1 and 2)/Same source as						B.3.2 (Position Source Qualification - General) Horizontal Velocity.					
for SSR EHS replies						The position source must output north/south and east/west velocities. We recommend the position source also output the velocity in a					
14. Movement (surface ground speed)/See Definitions 11 and 12/0616/NACv: same as for airborne ground velocity (see 9b)						ground speed and track angle format.					
Definition 11: Horizontal Velocity (Ground Velocity)						3.3.3.2 (Installation) Horizontal Velocity.					
The horizontal velocity provides the rate at which an aircraft changes its horizontal position with a clearly stated direction.						The ADS-B equipment must set the horizontal velocity based on the real-time velocity information provided by the position source. The					
Velocity data sources provide ground velocity vector information for both the airborne and surface velocity data transmit formats,						ADS-B equipment must transmit a north/south and an east/west velocity while airborne, and a combination of ground speed and ground					
allowing for the transmission of east/west and north/south velocity information (0916), or velocity scalar (0616, movement) and possibly						track or heading while on the surface. Ensure the position source provides horizontal velocity in both formats or ensure the ADS-B					
ground track information2 (061c), respectively. In case of a failure of the provision of ground velocity data, the ADS-B transmit unit will						equipment can properly convert between formats. We recommend transmitting heading instead of ground track while on the surface.					
broadcast airspeed (and heading) information instead (using subtypes 3 or 4 of register 09						Refer to section 3.5.3 of this AC for additional information on interfacing heading.					
oroadcast anspect (and neading) mormation instead (daing subtypes 5 of 4 or register 0516.					A.2.13 (Parameters) Horizontal Velocity.						
					The horizontal velocity provides the rate at which an aircraft changes its horizontal position with a clearly stated direction. Horizontal						
					velocity is provided with the north/south velocity and the east/west velocity parameters while airborne. Horizontal velocity is provided b						
					a combination of the ground speed and heading or ground track while on the surface. TSO-C166b and TSO-C154c [CS only recongnizes						
					1090 ES for the ADS-B Out data link] require that the north/south velocity, east/west velocity, ground speed, and ground track come						
					from the same source as the position. Heading information may come from a separate source. Horizontal velocity is required to be						
					transmitted by § 91.227.						
					A.2.10 (Parameters) Ground Speed.						
						This parameter is also derived from the position sensor and provides ATC with the aircraft's speed over the ground. This parameter is					
						reported in the surface position message.					
9.b. Horizontal Velocity Quality: NACv/See Definition 12/0916 (airborne) and 6516 (subtype 1 surface)						3.3.3.7 (Installation) Navigation Accuracy Category for Velocity (NACv).					
14. Movement (surface ground speed)/See Definitions 11 and 12/06. /NACV: same as for airborne ground velocity (see 9h)						Set the NACv based on design data provided by the position source manufacturer. The NACV may be updated dynamically from the					
Definition 12: Horizontal Velocity Quality Indicator NACy						position source, or set statically based on qualification of the position source.					
The NACK is an estimate of the accuracy of the horizontal geometric velocity data.						A.2.21 (Parameters) Navigation Accuracy Category for Velocity (NAC $_{\rm V}$).					
The NACY value is encoded as follows:						The NAC _v is an estimate of the accuracy of the horizontal geometric velocity output. The coding of "ZERO," indicating that the accuracy is					
The NACY encoding is the same for airborne position messages and surface position messages.						unknown or either equal to or worse than 10 meters per second (m/s), is of little value to ADS-B applications. There is no vertical rate					
Table 12: NACv Encoding					accuracy metric. A NAC _V of greater than or equal to "1" is required by § 91.227 . Table A-2 provides the applicable NIC <i>[typo]</i> values. D.1.19 (Definition) Navigational Accuracy Category for Velocity (NACV).						
	Navigation Accuracy Category for Velocity				NACV values. A NACV of 1 or greater is required by \$ 91.227.						
NACU											
NACV											
									Table A-2. NAC _V		
	Co	ding	Horizontal Velocity			, i i i i i i i i i i i i i i i i i i i	Value	Valority Ace	uracy Bound (Estimated Valocity Uncertainty)	1	
			Error (95%)			-	- O	velocity Acc	> 10 m/s or unbrown	1	
	(Binary)	(Decimal)				ł	1		< 10 m/s		
					1	-	1		< TO IIVS	-	
	000	0	Unknown or <u>></u> 10 m/s				2		< 3 m/s	-	
						I	3		< 1 m/s	4	
	001	1	< 10 m/s			I	4		< 0.3 m/s		
			Table D-2. NAC _V								
	010	2	< 3 m/s		Value	Velocity Accuracy Bound (Esti	imated Velocity	Uncertainty)			
	010	2	< 5 m/s		0	> 10 m/s or	unknown				
	011	2	< 1 m/s		1	< 10	m/s				
	011	3	< 1 111/5			- 10	n/s				
	100					< 31	n (n				
	100	4	< 0.3 m/s		3	<1 n	LU S				
	L				4	< 0.3	m/s				
10. Emitter Category/See Definition 13/08 ₁₆	3.2.3.4 (Installation) Emitter Category.										
--	---										
Definition 13: Emitter Category	Set emitter category per manufacturer instructions. Table 1 below provides guidance on setting the emitter category that is appropriate										
Emitter Category settings describe the size and performance of an aircraft, primarily expressed with respect to its maximum take-off	for the type of aircraft it is being install on.										
weight.	A.2.6 (Parameters) Emitter Category.										
The Emitter Category value is encoded as follows:	The emitter category provides an indication of the aircraft's size and performance capabilities. Emitter categories are defined in TSO-										
The ADS-B Emitter Category Sets A, B, C or D are identified by the Message Format TYPE Codes 4, 3, 2, and 1 respectively.	C166b and TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link]. Emitter category is designed primarily to provide										
Note 1: A coding of '0' within an Emitter Category Set is not allowed.	information on the wake turbulence that an aircraft produces. Emitter category is required to be transmitted by § 91.227.										
Note 2: The Emitter Category codes 1 to 5 in category set A are intended to advise other aircraft of the transmitting aircraft's wake vortex											

Table 13: Emitter Category Encoding									
AD	S-B Emitter Category Set "A"	ADS-B Emitter Category Set "B							
Coding	Meaning	Coding	Meaning						
0	No ADS-B Emitter Category Information	0	No ADS-B Emitter Category Information						
1	Light (< 7 031 kg (15 500 lbs))	1	Glider / Sailplane						
2	Small (7 031 to 34 019 kg (15 500 to 75 000 lbs))	2	Lighter-than-Air						
3	Large (34 019 to 136 078 kg (75 000 to 300 000 lbs))	3	Parachutist / Skydiver						
4	High-Vortex Large (aircraft such as B-757)	4	Ultralight / hang-glider / paraglider						
5	Heavy (> 136 078 kg (300 000 lbs))	5	Reserved						
6	High Performance (> 49 m/s ² (5g) acceleration and > 205 m/s (400 knots))	6	Unmanned Aerial Vehicle						
7	Rotorcraft	7	Space / Trans-atmospheric vehicle						

category code should be used.

characteristics, and not necessarily the transmitting aircraft's actual maximum take-off weight. In case of doubt, the next higher aircraft

ADS	5-B Emitter Category Set "C"	ADS-B Emitter Category Set "D"		
Coding	Meaning	Coding	Meaning	
0	No ADS-B Emitter Category Information	0	No ADS-B Emitter Category Information	
1	Surface Vehicle - Emergency Vehicle	1 - 7	Reserved	
2	Surface Vehicle - Service Vehicle			
3	Point Obstacle (includes tethered balloons)			
4	Cluster Obstacle			
5	Line Obstacle			
6 - 7	Reserved			

	Table 1. Emitter Category
Emitter Category	Description
No Emitter Category	Do not use this emitter category. If no emitter category fits your installation, seek guidance from the FAA as appropriate.
Light Airplane < 15,500 lbs	Any airplane with a maximum takeoff weight less than 15,500 pounds. This includes very light aircraft (light-sport aircraft) that do not meet the requirements of 14 CFR 103.1.
Small Airplane ≥ 15,500 to < 75,000 lbs	Any airplane with a maximum takeoff weight greater than or equal to15,500 pounds but less than 75,000 pounds.
Large Airplane ≥ 75,000 to < 300,000 lbs	Any airplane with a maximum takeoff weight greater than or equal to 75,000 pounds but less than 300,000 pounds that does not qualify for the high vortex category.
Large Airplane With High Vortex	Any airplane with a maximum takeoff weight greater than or equal to 75,000 pounds but less than 300,000 pounds that has been determined to generate a high wake vortex. Currently, the Boeing 757 is the only example.
Heavy ≥ 300,000 lbs	Any airplane with a maximum takeoff weight equal to or above 300,000 pounds.
High Performance > 5 G and > 400 TAS	Any airplane, regardless of weight, that can maneuver in excess of 5 G's and maintain true airspeed above 400 knots.
Rotorcraft	Any rotorcraft, regardless of weight.
Glider / Sailplane	Any glider or sailplane, regardless of weight.
Lighter Than Air	Any lighter-than-air (airship or balloon), regardless of weight.
Parachute / Sky Diver	For use by parachute / sky divers.
Ultralight Vehicle	A vehicle that meets the requirements of 14 CFR 103.1.Light sport aircraft should not use the ultralight emitter category unless they meet 14 CFR 103.1.
UAV	Any unmanned aerial vehicle or system regardless of weight.
Space/Trans-atmospheric Vehicle	For use by space/trans-atmospheric vehicles.
No ADS-B Emitter Category Information	Do not use this emitter category. Refer to category 0 above.
Surface Vehicle— Emergency Vehicle	For use by surface emergency vehicles.
Surface Vehicle— Service Vehicle	For use by surface vehicles.
Point Obstacle (Includes Tethered Balloons)	For use by point obstacles to include tethered Balloons.
Cluster Obstacle	For use by cluster obstacles.
Line Obstacle	For use by line obstacles.

11. Vertical Ra	te/See Definition 14/0916 (s	subtypes 1 and 2)/	Selected sour	ce is indicated	d in 0916 source indication)	3.9 (Installation) Vertical Rate Source.
Definition 14:	Vertical Rate					We recommend that the ADS-B system output the vertical rate field when available [Vertical Rate is not required by § 91.227 (optional)].
Vertical Rate i	s either the barometric or ge	eometric rate at w	hich the aircra	aft is climbing	or descending, measured in feet per minute. The	The vertical rate may come from a barometric air data computer, a GNSS source, or a system that filters barometric and geometric vertical
vertical rate is	typically generated by an ai	r data computer o	or GNSS position	on source, or e	equipment which blends barometric vertical rate	rates. Vertical rate will typically come from a position source or an air-data computer. This section addresses this unique parameter, and
with inertial ve	ertical rate and/or GNSS ver	tical rate.				augments section 3.3 and 3.4 of this AC, as applicable.
As the geomet	tric vertical rate can be read	ily derived from th	ne ADS-B Out p	position sourc	e, it is classified as a minimum requirement rather	3.9.3.1 (Installation) Vertical Rate.
than an (effec	tively Mode S Enhanced Surv	veillance) conditio	nal requireme	nt [CS require	es Vertical Rate parameter].	Interface vertical rate from one or more of the sources listed in section 3.9.1 above. Ensure the source provides vertical rate in feet per
						minute, or ensure the ADS-B equipment can recognize the vertical rate basis and convert the vertical rate to feet per minute.
						A.2.33 (Parameters) Vertical Rate.
						The vertical rate is the barometric or geometric rate at which the aircraft is climbing or descending, measured in feet per minute. The
						vertical rate is typically generated by an air data computer or GNSS position source, or equipment that blends barometric vertical rate
						with inertial vertical rate and/or GNSS vertical rate.
12.a. Surface I	Horizontal Position - Latitude	e and Longitude/So	ource see AM	C ACNS.D.ADS	5B.070 See Definition 3/06 ₁₆ /Quality indicators	
NACp. SIL. SDA	A: same encodings as for airb	porne horizontal p	osition.		, 10, . ,	
12.a. Surface I	Horizontal Position - Latitude	e and Longitude/Se	ource see AM	C ACNS.D.ADS	SB.070 See Definition 3/0616/Quality indicators	
NACp, SIL, SDA	A: same encodings as for airb	porne horizontal p	osition.			
Definition 15:	Surface NIC Value					
The Surface N	IC value, including the NIC Su	upplement A and (C values, is en	coded as follo	ws:	
	Table 14: Surfa	ace NIC Encod	lina			
			Surface			
NIC Value	Radius of Containment	Surface	NIC Supplement			
	(R _c)	TYPE Code	A	C		
0	R _c unknown	0, 8	0	0		
	R _c < 1 111.2 m (0.6 NM)	8	0	1		
6	R _c < 555.6 m	8	1	0		
	(0.3 NM)		÷.	, in the second		
7	R _c < 370.4 m (0.2 NM)	8	1	1		
8	R _c < 185.2 m (0.1 NM)	7	0	0		
9	R _c < 75m	7	1	0		
10	R _c < 25m	6	0	0		
11	R _c < 7.5m	5	0	0		

13. Heading, Ground Track/See Definition 16/0616/Heading preferred source	3.3.3.2 (Installation) Horizontal Velocity.
Definition 16: Surface Heading/Ground Track	The ADS-B equipment must seta combination of ground speed and ground track or heading while on the surface. We recommend
Aircraft Heading indicates the direction in which the nose of the aircraft is pointing. It should be used as the primary source and be	transmitting heading instead of ground track while on the surface. Refer to section 3.5.3 of this AC for additional information on
expressed (in ME bit 54 in 65_{16}) as either true north ('0', preferred) or magnetic north ('1').	interfacing heading.
If an approved heading source is not available (or failed during operation), the Ground Track angle information from the selected ground	3.3.3.10 (Installation) Ground Track Angle.
velocity data source will be used instead by the ADS-B transmit unit for the determination of the direction of the horizontal velocity vector If the position source ground track is used and inaccurate below a certain ground speed, and the position source does not inhibit output of the ground track at these slower speeds, the installer should ensure that the ADS-B transmit unit has the capability to invalidate the ground track when the GNSS ground speed falls below a threshold specified by the position source manufacturer (e.g. 3.6 m/s (7 knots)).	For installations that do not have heading information available, ground track from the position source must be transmitted while on the surface. Many position sources will provide accurate ground track information, but the ground track may only be accurate above certain ground speeds. If the position source ground track is inaccurate below a certain ground speed and the position source does not inhibit output of the ground track at these slower speeds, the installer should ensure the ADS-B equipment has the capability to invalidate the ground track when the GNSS ground speed falls below 7 knots. Erroneous ground track readings could be misleading for ATC surface operations and ADS-B IN applications. If the position source itself inhibits output of ground track at slower speeds where the ground track would be inaccurate, the installer may interface the position source ground track to the ADS-B equipment without any restrictions. 3.5.2.2 (Installation) Interfacing heading is not required, but is highly encouraged if the aircraft has an approved heading source. 3.5.3 Configuration of Associated Parameters. When the aircraft is on the surface, the ADS-B system is required to transmit either heading or ground track; however, we recommend transmitting heading if a source of heading information is available and valid. True heading is preferred, but magnetic heading is acceptable. Ensure the heading type (true or magnetic) interfaced to the ADS-B equipment matches the heading type transmitted from the ADS-B equipment. 3.5.2.1 The heading does not need to come from the same source as the position and velocity.
13. Heading, Ground Track/See Definition 16/06 ₁₆ /Heading preferred source Definition 16: Surface Heading/Ground Track (cont.)	A.2.11 (Parameters) Ground Track Angle. The ground track angle is the direction of the horizontal velocity vector over the ground. Ground track or heading is required to be
	transmitted while on the ground to transmit complete velocity information.
	A.2.12 (Parameters) Heading.
	Heading indicates the direction in which the nose of the aircraft is pointing. There is no heading accuracy metric. Heading or ground track
	is required to be transmitted while on the ground to transmit complete velocity information.
	A.2.13 (Parameters) Horizontal Velocity.
	Horizontal velocity is provided by a combination of the ground speed and neading of ground track while on the surface.
15. Length & width of aircraft/See Definition 17/6516 (subtype 1)	3.2.3.2 (Installation) Aircraft Length and Width.
Definition 17: Aircraft Length and Width	This parameter must be configured during installation. Do not set the length and width parameter to a value of "0," as the length and
Aircraft Length and Width settings describe the aircraft dimensions by the width and length of a rectangle that is aligned parallel to the	width code is required by § 91.227. The length and width code chosen should be the smallest value that encompasses the entire aircraft
aircraft's heading. The aircraft's length is to be measured along its axis of symmetry (i.e. from nose to tail). The aircraft's width is to be	and any fixed objects. For fixed-wing aircraft, this may be the nose, or other fixed object forward of the nose, such as a pitot probe. For
measured from wing-tip to wing-tip.	rotorcraft, this may be the most forward, aft and lateral point the rotor blades sweep or some other fixed object such as a refueling boom.
The Aircraft Length and Width values are encoded as shown in Table 15 to be less than or equal to a respective upper bound length and	See (refer to figure 2 below).
width as expressed in the two right-side columns. The Length and Width Codes are based on a combined encoding of the actual length and width Codes are based on a combined encoding of the actual length and width Codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encoding of the actual length and width codes are based on a combined encode	1 A.2.18 (Parameters) Length and Width of Aircraft.
what whereby the largest respective upper bound prevails. If the Aircraft or Venicle is longer than 85 meters, or wher than 90 meters,	Insparameter provides ALC and other aircraft with quick reference to the aircraft's dimensions while on the surface. Aircraft length and with the surface is the theorem that have 0.1 202
nen decimal Andraity venice Lengin/ widh code 15 is used.	which is required to be transmitted by § 91.227.
Example: a powered giver with an overall length of 24 meters and wingspan of 50 meters would, normally, have a length code of '001'.	
nowever/142.41431, since the wingspan exceeds 34 meters, it does not quality for either what subcategory of length category four. In the second second a length category four and with such as a size of the would be assigned a length category four and with code of 1/0 and with such as the second second second second as a size of the second secon	
meters and width less than 52 meters.	



ADS-B (guidance 16. GPS Definiti GPS An Both a I the nos The acc The late	DS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), idance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation 5. GPS Antenna Offset/See Definition 18/65 ₁₆ (subtype 1) /Lateral and longitudinal efinition 18: GPS Antenna Offset (lateral and longitudinal) PS Antenna Offset information provides the position offset of the GNSS antenna used for the provision of horizontal position informatic oth a lateral distance of the GPS Antenna (from the longitudinal axis of the aircraft) and a longitudinal distance of the GPS Antenna (fror ne nose of the aircraft) are provided. ne accuracy of the information should be better than 2 meters, consistent with the data resolution. ne lateral and longitudinal GPS Antenna Offset values are encoded as follows:								nd Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets. A.2.9.1 (Parameters) The GNSS antenna offset indicates the longitudinal distance between the most forward part of the aircraft and the GNSS antenna, and the lateral distance between the longitudinal center line of the aircraft and the GNSS antenna. Also, refer to section 3.8.4.1 – 3.8.4.3 and Figure 3 of this AC. GNSS Antenna Offset and Position Offset Applied (POA). 3.8.4.1 (Installation) Although not required to comply with § 91.227 [CS requires GPS Antenna Offset parameter], it is highly encouraged for ADS-B equipment manufacturers to provide instructions to installers for setting this parameter and for installers to configure the offset during installation. The GNSS antenna offset information will be extremely valuable for surface ATC surveillance and future ADS-B IN surface situational awareness and surface collision alerting applications. 3.8.4.2 (Installation) If the ADS-B equipment is interfaced to multiple GNSS position sources that use GNSS antennas in different locations on the aircraft. the installation must have provisions to ensure the appropriate GNSS antenna offset is being transmitted when the ADS-B
									equipment switches from one position source to another.
		Table	e 16: La	iteral A	xis GPS Antenna C	offset Encoding			
		۱۸۱ (Mess)	E ' Bit age Bit)		Upper Bo GPS Anto	ound of the enna Offset			
		33 (65)	34 (66)	35 (67)	Along Lateral (Pitch) Axis				
		0 = left	Enco	ding	1	Axis			
		1 = right	Bit 1	Bit 0	Direction	(meters)			
			0	0		NO DATA	1		
		0	0	1	LEFT	2			
			1	0		4			
		L	1	1		6			
					2				
		1	1	0	RIGHT	4			
			1	1		6	1		
	Supplement Maximum d the distance The No Dat represented	tary Notes distance left o e is greater ti ta case is in d by encoding	or right han 6 m dicated 1 of 100	of aircr eters, t by enc as abo	aft longitudinal (roll) hen the encoding sh oding of 000 as abo re.	axis is 6 meters or 19. Juld be set to 6 meters. Sive, while the ZERO of	685 feet. If fset case is		
	information, i.e. +/- 1 meter.								

	Tab	le 17:	Longit	udinal	Axis GP	S Antenna Offset Encoding			
	'ME' Bit Upper Bound of the (Message Bit) GPS Antenna Offset			Upper Bound of the GPS Antenna Offset]				
36 37 38 39 40 (68) (69) (70) (71) (72) Encoding		Along Longitudinal (Roll) Axis Aft From Aircraft Nose							
	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	(meters)			
	0	0	0	0	0	NO DATA			
	0	0	0	0	1	Position Offset Applied by Sensor (see also Notes)			
	0	0	0	1	0	2			
	0	0	0	1	1	4			
	0	0	1	0	0	6			
	*	*	*	*	*	***			
	1	1	1	1	1	60			
If the distance is greater than 60 meters, the encoding should be set to 60 meters. Position Offset Applied by the Sensor applies to future cases where the antenna offset is compensated by the horizontal position source to the centre of the rectangle describing the aircraft's length and width (refer to Definition 17). The encoding of the values from decimal '2' (only bit 1 one set to '1') to '31' (all five bits set to '1') is as follows: encoded binary value = offset [m]) / 2 + 1 (e.g. an offset of 4 meters leads to a binary value of (4/2 + 1 = 3), i.e. Bits 0-1 equal '1' and Bits 2-4 equal '0').							na offset is scribing the re bits set to neters leads		
									Additional Guidance not Addressed in CS-ACNS
									3.8.4.3 (Installation) The POA setting of the GNSS antenna indicates if the broadcast position of the vehicle is referenced to either a) the aircraft's ADS-B position reference point, or b) the lateral distance from centerline and longitudinal distance from the most forward part of the aircraft, (reference 4.5.6 B.4.1). Note: Either the transmitted position should be adjusted to the reference point described in paragraph 3.8.4.4 OR the GNSS antenna offsets should be provided. It is not required to do both.
									3.8.4.4 (Installation) The ADS-B position reference point is the center of the rectangle used to describe the length and width of the aircraft in the length and width code. Refer to section 3.2.3.2 and figure 2 of this AC. For a more detailed description of POA, refer to RTCA/DO- 338, Minimum Aviation System Performance Standards (MASPS) for ADS-B Traffic Surveillance Systems and Applications (ATSSA), section 3.2.4.1.
									A.2.9.2 (Installation) The POA setting of the GNSS antenna offset indicates that the broadcast position is referenced to the aircraft's ADS-B position reference point versus the GNSS antenna location. Also, refer to section 3.8.4.1 - 3.8.4.3 and Figure 3 of this AC. For further details about POA, refer to RTCA/DO-338, section 3.2.4.1.

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), and Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets. Figure 3. Position Offset Reported Length (using next higher value) Center of leading edge ADS-B reference point Center of defining rectangle (center of solid box) of Length Width code "box" Antenna lateral offset ed Width (using next higher \bigcirc Position of GNSS antenna Antenna longitudinal offset 17.a. Geometric Altitude/See Definition 19/09₁₆ (05₁₆) 3.3.3.8 (Installation) Geometric Altitude. Ensure the geometric altitude provided by the position source is based on Height-Above-Ellipsoid (HAE) instead of Height-Above-Geoid Definiton 19: Geometric Altitude (HAG). Do not interface a position source that provides HAG or Mean Sea Level (MSL) altitude to the ADS-B equipment unless the ADS-B The geometric altitude is a measure of the aircraft's height above a geometric reference and is provided by a GNSS-based position source. equipment has the ability to determine the difference between an HAG and HAE input, and the ADS-B equipment has demonstrated Both within 05₁₆ and 09₁₆, Geometric Altitude is provided as height above ellipsoid (HAE) in accordance with the WGS 84 coordinate system (AMC1 ACNS.D.ADSB.085(b)). during design approval that it can properly convert HAG to HAE using the same model as the position source. It would also be acceptable to demonstrate that the error due to conversion of HAG to HAE does not cause the GVA to be exceeded. A.2.7 (Parameters) Geometric Altitude. The geometric altitude is a measure of altitude provided by a satellite-based position service and is not affected by atmospheric pressure. Geometric altitude is only available with a GNSS position source. Geometric altitude for ADS-B purposes is the height above the World Geodetic System 1984 (WGS-84) ellipsoid (HAE). Geometric altitude is required to be transmitted by § 91.227. 17.b. Geometric Altitude Quality: GVA/See Definition 20/6516 (subtype 0) [GVA is not required by § 91.227 (optional)] Definition 20: Geometric altitude guality indicator information (GVA) 3.3.3.9 (Installation) Geometric Vertical Accuracy (GVA). The GVA parameter expresses the actual performance of the geometric altitude data source as valid at the time of applicability of the Set the GVA based on design data provided by the position source manufacturer. GNSS position sources may provide the geometric altitude accuracy through the Vertical Figure of Merit (VFOM). If the position source does not output a qualified vertical accuracy metric, measurement. The GVA value is encoded as follows: the GVA parameter should be set to "0". A.2.8 (Parameters) Geometric Vertical Accuracy (GVA). Table 18: GVA Encoding The GVA indicates the 95-percent accuracy of the reported vertical position (geometric altitude) within an associated allowance. GVA Encoding 95% Accuracy (decimal) (meters) Unknown or > 150 meters 0 1 ≤ 150 meters 2 45 meters 3 Reserved Additional Guidance not Addressed in CS-ACNS

					A.2.15 (Parameters) IFR Capability. This parameter existed in TSO-C166a and TSO-C154b compliant equipment, but was removed from TSO-C166b and TSO-C154c equipment [Remove from AC 20-165B].	
						A.2.25 (Parameters) Receiving ATC Services. This parameter is a bit set in the ADS-B system of an aircraft indicating that the Mode A code is not set to "1200". This parameter existed in TSO-C166a and TSO-C154b compliant equipment, but was removed from TSO-C166b and TSO-C154c equipment [<i>Remove from AC 20-</i> 165B].
						A.2.32 (Parameters) Trajectory Change Report Capability. This information is permanently set to "zero" in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link] equipment. No installation interface is required. Trajectory change reports are reserved for future use.
Annondiv	H Port 2 - ADS B Out Surveille	anco Data Paramotors (AMC		(h))		
Table 19	elow makes reference to the BI	OS register(s) that contain th	e various ADS-B Out	surveillance data para	meters, When Table 19	3.1.6 (Installation) Populating Message Elements.
states Same source as for Mode S replies, reference is made to the requirement that the content of ADS-B broadcasts and Mode S replies that carry the same information and need to come from the same source (CS ACNS.D.ADSB.025(b)). Guidance on the content of the various BDS registers and their relationship with the ADS-B message Type Codes is provided in Table 4 in part 1 of Appendix A.						 § 91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91.225. All parameters transmitted by the ADS-B system must conform to the standards in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link] and may not contain false or misleading information. A.1 (Parameters) Purpose. This appendix provides a description of the message elements that may be contained in an ADS-B OUT message.
	Table 19: ADS-B-ADD	Surveillance Data Tra	nsmission Requi	rements	1	
Item	Parameter	Requirements	BDS Register	Remarks	-	
1	Selected Altitude	See Definition 21	62 ₁₆			
2	Barometric Pressure Setting	See Definition 21.	62 ₁₆	Same source as		
3a	ACAS Operational	.	62 ₁₆ and 65 ₁₆	replies		
Зb	Resolution Advisory (RA)	See Definition 22.	61 ₁₆ (subtype 2)			
Refer to A	MC1 ACNS.D.EHS. (c) (1 and (c) 22: ACAS Operational /Resolution s populated from ACAS II system ed (refer to ADS-B transmit unit	(3) for detailed guidance. on Advisory (RA) Refer to AN ns if installed on the aircraft. manufacturer instructions).	IC1 ACNS.D.ELS.015 Both parameters sho	(f) for detailed guidanc	ie. ' if an ACAS II system is	 3.11.1 (Installation - Foreign Airspace Requirements) Optional Parameters [CS requires Selected Altitude/Barometric Pressure Setting parameters when available and in a suitable format]. If operations are planned in a country that requires parameters not mandated in the United States, such as selected heading and selected altitude, follow the ADS-B equipment manufacturer's installation guidance to interface those parameters. 3.6.1 (Installation) Equipment Eligibility. TCAS II systems should comply with TSO-C119a, Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II, or subsequent version, and be installed in accordance with AC 20-131A, Airworthiness Approval of Traffic Alert and Collision Avoidance Systems (TCAS II) and Mode S Transponders, or any revision of AC 20-151, Airworthiness Approval of Traffic Alert and Collision Avoidance Systems (TCAS II), Versions 7.0 and 7.1 and Associated Mode S Transponders, as applicable. No ADS-B interface is available or required for TCAS I systems. Note: Many aircraft will be equipped with a Mode S transponder with ADS-B functionality and a TCAS II. The Mode S transponder is considered to be a component of the TCAS II system and also a component of the ADS-B system. 3.6.2.1 (Installation) TCAS II Interface. TCAS II is not a required part of the ADS-B system; however, if TCAS II is installed on your aircraft, the equipment must be integrated so the "TCAS installed and operational. This parameter must interface with the TCAS II system if a TCAS II system is installed on your aircraft. This parameter should be preset to "ZERO" if a TCAS II is not installed in your aircraft or if a TCAS II. System is installed on your aircraft. This parameter will already be provided to the Mode S transponder from the TCAS II system if a TCAS II system is installed on your aircraft. This parameter will already be provided to the Mode S transponder from the TCAS II. TCAS II system is installed on you
						installed.

Definitio	n 22 (cont.)			A.2.30 (Parameters) TCAS Installed and Operational.		
				This parameter indicates whether the aircraft is fitted with a TCAS II and if the TCAS II is turned on and operating in a mode that can		
				generate resolution advisory alerts. The TCAS installed and operational parameter is required to be transmitted by § 91.227.		
				A.2.31 (Parameters) TCAS Traffic Status.		
				This parameter indicates if a TCAS II equipped aircraft is currently generating a TCAS resolution advisory. The TCAS traffic status		
				parameter is required to be transmitted by § 91.227 if the aircraft is TCAS II equipped.		
				Additional Guidance not Addressed in CS-ACNS		
				3.6.2.2 (Installation) TCAS II Hybrid Surveillance.		
			If an ADS-B IN system is installed in an aircraft equipped with a TCAS II hybrid surveillance system compliant with RTCA/DO-300(),			
				Minimum Operational Performance Standards (MOPS) for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance, the		
				TCAS II will use ADS-B IN position data to reduce the interrogation rates of low-threat intruders. The information transmitted by ADS-B		
				OUT systems installed in accordance with the guidance in this AC is suitable for use by TCAS II hybrid surveillance. Refer to AC 20-151() for		
				more information on hybrid surveillance.		
				3.6.2.3 (Installation) TCAS Messages.		
				The ADS-B transmission of the "TCAS operational" or "TCAS Resolution Advisory (RA) active" messages does not increase the hazard level		
				of the ADS-B equipment defined in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link].		
Append	ix H - Part 3 – ADS-B Out Minimum Horizonta	I Position and Velocity Data Requirements				
Table 20	provides a summary of the minimum horizon	tal position data requirements as specified in the defining	ADS-B-RAD Safety and	D.1.18 (Definitions) Navigation Accuracy Category for Position (NAC _p).		
Perform	ance Requirements/Interoperability documen	.t (ED-161).		A NAC _P of 8 or greater is required by § 91.227 [CS requires NAC $_P$ of 7 or greater].		
Note 1:	The requirement of NACp<=0.1NM in support	of 3NM separation is based on the arguments produced in	n Annex B to ED-161 (ADS-	A.2.20 (Parameters) Navigation Accuracy Category for Position (NAC _P).		
B-RAD S	afety and Performance Requirements/Interop	erability Requirements Document).	10 5 10 1 1 1 1 1	A minimum NAC _P value of "8" must be transmitted to operate in airspace defined in § 91.227 [CS requires a minimum NAC _P value of 7].		
Note 2:	The SDA encoding of '2' (10-5/fight-hour) appl	ies to individual components of the ADS-B Out system, i.e.	10-5/fight-hour for the	A.2.22 (Parameters) Navigation Integrity Category (NIC).		
ADS-B tr	ansmit unit and 10-5/flight-hour for the horizon	ontal position and velocity source.		A minimum NIC value of "7" must be transmitted to operate in airspace defined in § 91.225 [CS requires a minimum NIC value of 6].		
Note 3:	ADS-B transmit units interfaced with a GNSS p	osition source that is compliant with CS ACNS.D.ADSB.070	and the related AMC	D.1.20 (Definition) Navigation Integrity Category (NIC).		
guidance	e) should preset the SIL Supplement to 'zero'.			A NIC of 7 or greater is required by § 91.227 [CS requires NIC of 6 or greater] .		
				A.2.27 (Parameters) Source Integrity Level (SIL)		
	Table 20: Minimum Horizontal Posi	tion and Velocity Data Quality Requirements		A SIL value of "3" must be transmitted to operate in airspace defined in § 91.225.		
				D.1.2.5 (Definition) Source Integrity Level (SIL)		
	Quality Parameter	Requirement		A SIL of 3 is required by § 91.227.		
	Position Accuracy (NACp)	NACp<=185.2 m (0.1NM) (i.e. NACp>=7) for		A.2.29 (Parameters) System Design Assurance (SDA).		
		both 3 NM and 5 NM separation		The SDA parameter defines the failure condition that the ADS-B system is designed to support as defined in Table A-5The SDA includes		
	Position Integrity Containment	3 NM Sep: NIC<=1 111.2 m (0.6 NM) (i.e.		the position source, ADS-B equipment, and any intermediary devices that process the position data§ 91.227 requires an SDA of 2 or 3 as		
	Radius (NIC)	NIC>=6)		defined in Table A-6		
		5 NM Sep: NIC<=1 852 m (1 NM) (i.e.		D.1.26 (Definition) System Design Assurance (SDA).		
		NIC>=5)		An SDA of 2 or greater is required by § 91.227.		
	Source Integrity Level (SIL)	SIL=3: 10 ⁻⁷ /flight-hour		A.2.21 (Parameters) Navigation Accuracy Category for Velocity (NAC _v).		
	System Design Assurance (SDA)	SDA=2: 10 ⁻⁵ /flight-hour - allowable probability		A NAC _v of greater than or equal to "1" is required by § 91.227.		
		level REMOTE		D.1.19 (Definition) Navigational Accuracy Category for Velocity (NAC _v).		
		(MAJOR failure condition, LEVEL C software and		A NAC _v of 1 or greater is required by § 91.227.		
		design assurance level)				
	Velocity Accuracy (NACv)	NACv<=10 m/s (i.e. NACv>=1)				

Note 4: If set as fixed value, NACv should be always 'one'. For quality indications that are dynamically provided by the velocity source, NACv should be 'one' or 'two'. There is currently no established guidance on establishing a NACv performance of 'three' or better.	3.3.3.4 (Installation) Source Integrity Level Supplement (SILSUPP). ADS-B systems interfaced with a GNSS position source compliant with any revision of TSO-C129 [TSO-C129a is the minimum in CS- ACNS], TSO-C145, TSO-C146, or TSO-C196 may preset SILSUPP to "ZERO," as GNSS position sources use a per-hour basis for integrity. 3.3.3.7.1 (Installation) A NAC _v = 1 (< 10 m/s) may be permanently set at installation for GNSS equipment passing the tests identified in 4.5.6 Appendix B of this AC, or may be set dynamically from velocity accuracy output of a position source qualified in accordance with the guidance in 4.5.6 Appendix B. 3.3.7.2 (Installation) A NAC _v = 2 (< 3 m/s) must be set dynamically from velocity accuracy output of a position source qualified in accordance with the 4.5.6 Appendix B guidance. Do not permanently pre-set a NACV = 2 at installation, even if the position source has passed the tests identified in 4.5.6 Appendix B. 3.3.7.3 (Installation) A NAC _v = 3 or NACV = 4 should not be set based on GNSS velocity accuracy unless you can demonstrate to the FAA that the velocity accuracy actually meets the requirement.
This should be verified through appropriate tests, as follows. With respect to NIC and NACp testing, the ADS-B Out system installer should check for satellite shielding and masking effects if the stated performance is not achieved. (a) Airborne & Surface NIC: During testing under nominal GNSS satellite constellation and visibility conditions, the transmitted NIC value should be a minimum of 'six' [§ 91.227 requires a minimum NIC value of 7]. (b) NACp: During testing under nominal GNSS satellite constellation and visibility conditions, the transmitted NACp value should be a minimum of 'six' [S 91.227 requires a minimum operational requirement is a NAC p of 7, however, during testing under nominal GNSS satellite constellation and visibility conditions, a NAC p of 8 is expected. Tests which produce a NAC p of 7 indicate an issue with the test environment]. In order to validate the correctness of the transmitted horizontal position, the aircraft should be positioned on a known location. (c) SIL: SIL is typically a static (unchanging) value and may be set at the time of installation if a single type of position source is integrated with the ADS-B transmit unit. SIL should be set based on design data from the position source equipment manufacturer. Installations which derive SIL from GNSS position sources compliant with CS ACNS.D.ADSB.070 should set the SIL to 'three'. ADS-B transmit units interfaced with a GNSS position source that is compliant with CS ACNS.D.ADSB.070 (and the related AMC guidance) should pre-set the SIL Supplement to 'zero'.	 4.1.3.1 Accuracy and Integrity Performance. Ensure the installed system meets its stated accuracy and integrity performance under expected operating conditions. We recommend that you accomplish a GNSS performance prediction for the applicable time of your test to ensure the ADS-B system meets the predicted performance. In absence of predicted GNSS performance, demonstrate that you meet all § 91.227(c)(1) requirements as listed in Table 2. 4.1.3.2.17 An indication of the Navigation Integrity Category 4.1.3.3 Position Accuracy. Position the aircraft on a surveyed location and validate the position transmitted from the ADS-B system. Ensure the position transmitted is within the allotted NAC_P accuracy limit. For example, if the aircraft reports a NACP = 8, the ADS-B position should be within 92.6 meters, 0.05 nm. If the aircraft reports a NACP = 10, the ADS-B position accuracy is smaller or equal to the resolution of the test equipment, it is acceptable to use plus or minus one Least Significant Bit as the pass/fail criteria. Source Integrity Level (SIL). 3.3.3.3 SIL is typically a static (unchanging) value and may be set at the time of installation if a single type of position source is integrated with the ADS-B system. SIL is based solely on the position source's probability of exceeding the reported integrity value and should be set based on design data from the position source equipment manufacturer. Installations that derive SIL form GNSS position sources that are compliant with any revision of TSO-C129 [TSO-C129 as the minimum in CS-ACNS], TSO-C145, or TSO-C146, or TSO-C196 and output Horizontal Uncertainty Level (HLL) should set the SIL = 3 because HPL and HIL are based on a probability of 110-7 per-hour. Do not base NIC or SIL on Horizontal Uncertainty Level (HUL) information. If integrating with a noncompliant GPS, SIL must be set to "0". 3.3.3.4 Source Integrity Level Supplement (SILSUPP). ADS-B systems interfac

(d) NACv: If set as fixed value, NACv should be always 'one'. For quality indications that are dynamically provided by the velocity source, NACv should be 'one' or 'two'.	$3.3.3.7.1 \text{ A NAC}_{v} = 1$ (< 10 m/s) may be permanently set at installation for GNSS equipment passing the tests identified in 4.5.6 Appendix B of this AC, or may be set dynamically from velocity accuracy output of a position source qualified in accordance with the guidance in 4.5.6 Appendix B.
It is noted that there is currently no established guidance on establishing a NACv performance of 'three' or better.	Table 2. Accuracy and Integrity Requirements $NIC \ge 7$ $Rc < 370.4 m (0.2 mm)$ $NAC_V \ge 1$ $s = 100.5 mm)$ $NAC_V \ge 2$ $s = 110.7 mm)$ $NAC_V \ge 2 = 110.7 mm)$ $NAC_V \ge 2 = 110.7 mm)$ $NAC_V \ge 2 = 100.7 mm)$ $NAC_V \ge 1 \le 100.7 mm)$ $NAC_V \ge 1 \le 100.7 mm)$ $NAC_V \ge 2 \le 110.7 mm)$ $SDA \ge 2 \le 1110^{-7} mm$ $SDA \ge 2 \le 110^{-5} mm$
Appendix H - Part 4 – ADS-B Out Integrity and Continuity Requirements	
Lts ACNS.D.ADSB.100 and CS ACNS.D.ADSB.105 summarise, per data parameter, the integrity and continuity probability levels applicable to	3.1.2.2.2 (Installation) Note: Although the direct effects to your aircraft of an ADS-B failure may be minor, the ADS-B OUT information will be the ADS-B OUT information will be the ADS-B OUT information will be added and a second se
the ADS-B UIL system.	De used by other ADS-BIN equipped aircraft and by AIC. Thus, the provisions in AC 23.1309-11 [typo 25.1309-1 [add other part midnaed] that allow reduction in failure are habilities and decime assurance level for allower funders for and the analytic table ADS
In the first place, the ADS-BOULSYSTEM instance in the anciart needs to deriver data that satisfy the ADS-B-AD and other domain system	Buildance), that allow reduction in failure probabilities and design assurance reversor and rait under 6,000 pounds do not apply to the Abs-
safety and perioritatice requirements in the with section 3.4 of the ADS-64AD safety and renormalice requirements/interoperability	B 3 9 (Installation) Design Assurance
As for the number of framing the ADS-R-RAD operational safety assessment the ADS-R-RAD airborne domain only comprises the	Because the broadcast nosition can be used by any ADS-B IN equipped aircraft or by ATC the provisions in AC 23 1309-10 [typo 25,1309-
horizontal position data source and the ADS-B transmit unit. including the interconnecting avionics, the data sources providing surveillance	1 (add other part guidance)) that allow reduction in failure probabilities and design assurance level for aircraft under 6.000 pounds do not
information other than horizontal position and velocity are assumed to operate as within today's SSR environment. Hence, in line with CS	apply for the ADS-B OUT system. The overall probability of a position source malfunction causing a position to be output that exceeds the
ACNS.D.ADSB.080, the related Mode S Elementary and Enhanced Surveillance requirements apply.	output integrity radius must be less than 1x10-5 per-hour.
It is noted that the respective Mode S Elementary and Enhanced Surveillance requirements have to be understood within their given	
context, in particular taking into account applicable procedural mitigation means (e.g. as currently performed by means of the ICAO	
required controller-pilot verification procedure for pressure altitude reporting).	
The ADS-B Out data parameters other than the ones addressed in the preceding paragraphs, need to satisfy comparable ADS-B-RAD	
requirements.	
The specified integrity levels are required to adequately protect against the corruption of ADS-B Out surveillance data causing false or	

misleading information to be transmitted.

Although the direct effects to an aircraft of an ADS-B Out failure may be minor, the ADS-B Out information will be used by ATC and other ADS-B equipped aircraft, thus provisions that would allow for a reduction in failure probabilities and design assurance level, do not apply to the ADS-B Out system.

Additional Guidance not Addressed in CS-ACNS

B.3.15 (Position Source Qualification - General) Availability. § 91.225 and § 91.227 do not define an availability requirement; however, it is a significant operational factor when selecting the position source (refer to Table B-2, Estimated GNSS Availabilities (Minimum Threshold Constellation), below). B.4.3.1 (Position Source Qualification - GNSS - Availability) Analysis has shown the following estimated availability for TSO GPS receivers using a 2-degree antenna mask angle (refer to Table B-2), assuming the minimum threshold GPS satellite constellation. The Minimum Threshold Constellation is the probability of slots filled with healthy satellites. For Table B-1, the FAA uses the modified interagency forum on operational requirements (IFOR) constellation probabilities that provides a conservative estimate of predicted GNSS availability. The modified IFOR probabilities are not guaranteed by the U.S. Air Force, but are intended to be consistent with the Global Positioning System Standard Positioning Service Performance Standard, revision 4, dated September 2008. Modified IFOR threshold constellation state probabilities based on this performance standard (a 0.99999-percent probability of 20 healthy satellites or satellite pairs in expanded slot configuration) are shown in Table B-1.

	probabilities	s based on this performance star on) are shown in Table B-1	tandard, revision 4, dated Se ndard (a 0.99999-percent pro	bability of 20 healthy satellites or	satellite pairs in expanded slot
		Table B-1. Modifie	d IFOR Threshold Constell	tion State Probabilities	
		Number of Healthy Satellites	Probability That Exactly a Given Number of Satellite Are Healthy	Probability That at Least a Given Number of Satellites Are Healthy	
		24	0.72%	0.72%	
		23	0.17%	0.89%	
		22	0.064%	0.954%	
		21	0.026%	0.98%	
		20	0.01999%	0.99999%	
		19	0.000005%	0.999995%	
		18	0.000005%	1.0000%	
	ADS-B, INCL operator GN select an AE GPS service will conside will also cor standard AT	VSS receivers and Wide Area Multilat VSS receivers and the health of ti DS-B positioning source that prov availability determination syster r the operator's GNSS equipage isider the status of existing back To is authorized to apply along th Table B-2. Estimated	teration, to mitigate the impi- he constellation. Backup sur vides the necessary availabilit in to assist operators in deter and the GPS constellation the up surveillance capability alo le operator's defined route o d GNSS Availabilities (N	to of loss of GNSs performance du reillance will not be available in all y for their route of flight. The FAA mining surveillance availability for t is predicted to be available at th ng with the required positioning pe flight.	airspace, and operators should plans to implement a preflight ADS-B before flight. This tool e planned flight time. The tool erformance for the separation ation)
		Positioning Service (Receive	er Standard) Pred	icted Availability (ADS-B Cor	npliance)
		GPS (TSO-C129) (SA On)		≥ 89.0%	
		GPS (TSO-C196) (SA Off)		\geq 99.0%	
		GPS/SBAS (TSO-C145/TSC	D-C146)	≥ 99.9%	
Appendix H - Part 5 – GNSS Position and Velocity Source Qualification	APPENDIX	B. IDENTIFYING AND QUALIFYIN	G ADS-B POSITION SOURCE	;	

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), a guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation,	and Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.
This part 5 of Appendix H provides guidance to GNSS equipment manufacturers on how to establish a qualification for these ADS-B specific requirements, i.e. beyond the demonstration of compliance to ETSO requirements. In the following, as appropriate, reference is made to the respective: ETSO material: ETSO-C129a (JTSO-C129a), ETSO-C196a, ETSO-C145()/146() EUROCAE/RTCA MOPS material: ED-72A, DO-208, DO-229D, DO-316 as well as DO-235B; and FAA AC material (AC 20-138C). Note: ETSO-C145 refers to RTCA DO-229A, ETSO-C146 refers to RTCA DO-229B, ETSO-C145c/146c refers to RTCA DO-229D, and ETSO- C145()/146() refers to any of those revisions. In addition to the ETSO minimum requirements, the requirements of this part need to be demonstrated unless this has been demonstrated as a declared non-ETSO function. It is expected that the required compliance demonstration is supplied by the position and velocity source manufacturer through a Declaration of Design and Performance (DDP), or an equivalent document.	 B.1 (Position Source Qualification) Purpose. This appendix defines the minimum requirements for position sources interfaced to ADS-B systems. The appendix also defines appropriate position source qualification methods when the existing GNSS TSOs do not contain specific requirements or test procedures. The position source manufacturer should provide design data where appropriate, preferably in the GNSS equipment installation manual, so the installer can properly interface the position source to the ADS-B system. Position source suppliers must ensure any supplied data is incorporated into the article design, and changes to any documented characteristics result in a change to the part number. B.2 (Position Source Qualification) Organization. This appendix includes general guidance that applies to all position sources, as well as GNSS-specific guidance. The appendix also provides high-level requirements for tightly-coupled GNSS/IRU position sources and non-GNSS position sources (<i>CS requires GNSS-hased position sources (GNSS/IRS systems are recognized as acceptable[]</i>. Unless otherwise specified, all references in this AC to TSO-C129 [<i>TSO-C129 is the minimum in CS-ACNS]</i>, TSO-C145, TSO-C146, and TSO-C196 refer to any revision of the TSO. B.4. (Position Source Qualification - GNSS) GNSS Position sources. Compliance to the applicable TSOs for GNSS position sources does not guarantee that the unit is suitable as an ADS-B position source. The information in this section describes an acceptable means to demonstrate compliance with ADS-B requirements not addressed by GNSS TSOs when using GNSS position sources for ADS-B.
 (a) Horizontal Position Integrity (HPL) Horizontal Position Integrity — AMC1 ACNS.D.ADSB.070(a).1.2(a) Applicability: ETSO-C129a (JTSO-C129a) GNSS equipment manufacturers should provide substantiation data showing that the equipment outputs latitude and longitude information that is referenced to the WGS-84 coordinate system. GNSS equipment manufacturers should provide substantiation data showing that the equipment outputs a 10-7/hr Horizontal Protection Limit (HPL, or equivalent) based on the RAIM algorithm meeting the ETSO-C129a (JTSO-C129a) Class A1, A2, B1, B2, C1, or C2 RAIM requirements. 	 B.4.1 (Position Source Qualification - GNSS) Position. GNSS position sources must provide a latitude and longitude output. Requirements and test procedures in TSO-C129 [TSO-C129a is the minimum in CS-ACNS] /145/146/196 are sufficient and GNSS equipment with TSOA for the aforementioned TSOs require no additional qualification for the position output. Some GNSS position outputs are referenced to the center of navigation of the aircraft. Manufacturers should document under what conditions the position is output in this manner. Installers must configure the ADS-B installation to account for any position offset from the surveillance reference point or GNSS antenna position as applicable. Note: The intent is to output position, velocity, and HFOM in a consistent manner for time of applicability (refer to RTCA/DO-229D, Minimum Operational Performance Standards for Global Positioning System/Wide Area Augmentation System Airborne Equipment, sections 2.1.2.6 and 2.1.2.6.2). B.4.12 (Position Source Qualification - GNSS - Position) TSO-C129a. The requirements outlined for 2D accuracy in section (a)(3)(xvi) of TSO-C129a do not ensure full compliance for the GNSS unit. Additional means of compliance for this TSO require GNSS manufacturers to substantiate that the latitude/longitude is output and referenced to WGS-84 coordinate system.
	Additional Guidance not Addressed in CS-ACNS
	B.4.1.1 (Position Source Qualification - GNSS - Position) TSO-C129 [TSO-C129a is the minimum in CS-ACNS]. The requirements outlined for 2D accuracy in section (a)(3)(xvi) of TSO-C129 do not ensure full compliance for the GNSS unit. Additional means of compliance for this TSO require GNSS manufacturers to substantiate that the latitude/longitude is output and referenced to WGS-84 coordinate system.
	B.4.1.3 (Position Source Qualification - GNSS - Position) TSO-C145/146 Rev a Class 1.
	Internation Source Qualification - GNSS - Position) TSQ-C145/146 Rev a Class 2/3
	Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.4.8 and 2.1.5.8.
	B.4.1.5 (Position Source Qualification - GNSS - Position) TSO-C145/146 Rev b/c/d Class 1.
	Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.
	B.4.1.6 (Position Source Qualification - GNSS - Position) TSO-C145/146 Rev b/c/d Class 2/3.
	Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.4.8 and 2.1.5.8.
	B.4.1.7 (Position Source Qualification - GNSS - Position) ISO-C196/1968. Means of compliance for this TSO are defined in RTCA/DO-316. Minimum Operational Derformance Standards for Clobal Positioning
	System/Aircraft Based Augmentation System, section 2.1.2.6.

The position source must have a horizontal position integrity output qualified during the system's TSOA or design approval. This integrity output should describe the radius of a circle in the horizontal plane, with its cent position integrity under fault-free avoincis conditions. Position source must have a horizontal position with at least 99999 percent probability under fault-free avoincis conditions. Position source must have a solution integrity output qualified during the system's TSOA or design approval. Position source must have a solution integrity output of a 99.9999 percent probability to a 99.9999 percent probability (such as a tightly-coupled inertial/GMSS system after the loss of GNSS) can still be installed; howere, to they will not equipment [CS requires GNSS-based position source (SNSS/RS systems are recognized as acceptable]]. Additionally, if the change of probability is due to a change in position source funds are recognized as acceptable]]. Additionally, if the change of probability is due to a change in position source as any of indicination - GNSS Horizontal Position Integrity. GNSS position source must have a horizontal position integrity (such as HL or HPL) output qualified during the system's TSOA or design approval to determine NIC. B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity TSO-C129a. The requirements outline for Class A, B, and C equipment provide horizontal and agorithms under RTCA/DO-208 change 1, section 2.2.1.13. However, there is no requirement to computer or output HPL. To proverly comply with the ADS-Change 1, section 2.2.2.1.3. However, there is no requirements a output HPL. To provely comply with the ADS-Change 1, section 2.2.2.3. Subject 50 and acceparis an aprileor for this 2 a 2.0-provely comply with th
output should describe the radius of a circle in the horizontal plane, with its precent probability under fault-free avionics conditions. Position sources that degrade from a 99.9999 percent probability coal 99.9999 percent probability (such as a tight)-coupled inertial/GNSS system after the loss of GNSS) can still be installed; however, they will not meet § 91.227 following the degradation. In this case, the position source must have a way of indicating the change to the ADS-B equipment [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)]. Additionally, if the change of probability is due to a change in position source, the new position source must meet all of the requirements in this appendix. B.4.4 (Position Source Qualification - GNSS) Horizontal Position Integrity. GNSS position sources must have a horizontal position integrity (HPL) (cont.) B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity (HPL) (cont.) B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity through RAIM algorithms under RTCA/DO-208 change 1, section 2.2.1.13. However, there is no requirements to to appendix and the ADS-B requirements, additional means of compliance for this TSO requirement using the last-squares (a) Horizontal Position Integrity (HPL) (cont.) B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity through RAIM algorithms under RTCA/DO-208 change 1, section 2.2.1.13. However, there is no requirements to appendix and the topser provide horizontal reports to properly comply with the ADS-B requirements, additional means of compliance for this TSO requirements acceptabe as an HPL. To properly comply with the ADS-B requirements, addi
assured to contain the indicated horizontal position with at least 99.99999 percent probability under fault-free avionics conditions. Position sources that degrade from a 99.99999 percent probability (such as a tightly-coupled inertial/GNS: system after the loss of GNSS) can still be installed; however, they vill not meet § 91.227 following the degradation. In this case, the position source must have a way of indicating the change to the ADS-enquires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)]. Additionally, if the change of probability is due to a change in position source, the new position source must meet all of the requirements in this appendix. B.4.4 (Position Source Qualification - GNSS) Horizontal Position Integrity. (a) Horizontal Position Integrity (HPL) (cont.) B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C129a. The requirements NULL B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity) through RAIM algorithms under RTCA/DO-208 change 1, section 2.5.1.3. However, there is To compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value for compains angainst the alarm limit. Equipment using the least-squares
Position sources that degrade from a 99.99999 percent probability to a 99.999 percent probability (such as a tightly-coupled inertial/GNSS system after the loss of GNS5) can still be installed, however, they will not nequipment § 91.227 following the degradation. In this case, the position source must have a way of indicating the change of probability is due to a change in position sources (GNS5/IRS systems are recognized as acceptable)]. Additionally, if the change of probability is due to a change in position source, the new position source must meet all of the requirements in this appendix. B.4.4 (Position Source Qualification - GNS5 Horizontal Position integrity. GNSS position source Qualification - GNS5 - Horizontal Position integrity (such as HL or HPL) output qualified during the system's TSOA or design approval to determine NIC. B.4.4.2 (Position Source Qualification - GNS5 - Horizontal Position Integrity) TSO-C129a. The requirements outlined for Class A, B, and C equipment to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC/DO-208 change 1, section 2.5.2.5 using this protection level value is acceptable as an HPL if the equipment performs the test in RTCA/DO-208 change 1, section 2.5.2.5 using this protection level value is acceptable as an HPL if the equipment test est-squares
system after the loss of GNSS) can still be installed; however, they will not meet § 91.227 following the degradation. In this case, the position source must have a way of indicating the change to the ADS-B equipment [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)]. Additionally, if the change of probability is due to a change in position source, the new position source must meet all of the requirements in this appendix. 8.4.4 (Position Source Qualification - GNSS) Horizontal Position Integrity. GNSS position sources must have a horizontal position integrity (such as HIL or HPL) output qualified during the system's TSOA or design approval to determine NIC. (a) Horizontal Position Integrity (HPL) (cont.) B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C129a. The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second time to alert. This ACC POC 208 change 1, section 2.5.2.5 using this protection level value is acceptable as an HPL if the equipment performs the test in TGA/DO 208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm limit. Equipment using the least-squares
position source must have a way of indicating the change to the ADS-B equipment [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable]]. Additionally, if the change of probability is due to a change in position source, the new position source must meet all of the requirements in this appendix. B.4.4 (Position Source Qualification - GNSS) Horizontal Position Integrity. GNSS position sources must have a horizontal position Integrity (such as HIL or HPL) output qualified during the system's TSOA or design approval to determine NIC. (a) Horizontal Position Integrity (HPL) (cont.) B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C129a. The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. The protection level value is acceptable as an HPL if the equipment performs the test in RTCA/DO 208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm limit. Equipment using the least-squares
systems are recognized as acceptable]]. Additionally, if the change of probability is due to a change in position source, the new position source must meet all of the requirements in this appendix. B.4.4 (Position Source Qualification - GNSS) Horizontal Position Integrity. GNSS position sources must have a horizontal Position integrity (such as HIL or HPL) output qualified during the system's TSOA or design approval to determine NIC. (a) Horizontal Position Integrity (HPL) (cont.) B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C129a. The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS multifacturers to provide substantiation data showing that the equipment outputs a 1.40-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. This AC acceptable as an HPL if the equipment performs the test in RTCA/DO 208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm limit. Equipment using the least-squares
source must meet all of the requirements in this appendix. B.4.4 (Position Source Qualification - GNSS) Horizontal Position Integrity. GNSS position sources must have a horizontal position integrity (such as HIL or HPL) output qualified during the system's TSOA or design approval to determine NIC. (a) Horizontal Position Integrity (HPL) (cont.) B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C129a. The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value is acceptable as an HPL if the equipment performs the test in RTCA/DO 208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm limit. Equipment using the least-squares
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(a) Horizontal Position Integrity (HPL) (cont.) B.4.4.2 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C129a. The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value is acceptable as an HPL if the equipment performs the test in RTCA/DO 208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm limit. Equipment using the least-squares
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change 1, section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of complance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value for comparison bagainst the alarm limit. Equipment using the least-squares
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208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm limit. Equipment using the least-squares
residual RAIM method recommended in RTCA/DO-208 change 1, appendix F provides an acceptable HPL.
B.3.6 (Position Source Qualification - General) Position Integrity (Probability).
The position source manufacturer must provide information describing the basis for the probability of exceeding the horizontal integrity
containment radius. This basis must indicate the probability of exceeding the integrity containment radius as well as the sampling
duration (per-hour or per-sample).
B.4.5 (Position Source Qualification - GNSS) Position Integrity (Probability).
GNSS position source manufacturers must provide information describing the basis for the probability of exceeding the horizontal integrity
containment radius.
Additional Guidance not Addressed in CS-ACNS
B.4.4.1 (Position Source Qualification - GNS5 - Horizontal Position Integrity) ISO-C129 [ISO-C129 as the minimum in CS-ACNS].
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The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B results of the computed of the Computed System (GPS) and the computed System (GPS).
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the
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The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value is acceptable as an HPL if the equipment using the least-squares residual RAIM method recommended in RTCA/DO-208 change 1, appendix F provides an acceptable HPL. B.4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements are be found in the STCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements are be found in BTCA/DO-229C sections 2.1.2.1.1.1.1.1
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value is acceptable as an HPL if the equipment performs the test in RTCA/DC 208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm limit. Equipment using the least-squares residual RAIM method recommended in RTCA/DO-208 change 1, appendix F provides an acceptable HPL. B.4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, section 2.1.1.3.1. PA 4.4 (Position Source Qualification - GNSS – Morizontal Position Integrity) TSO-C145/146 Rev a Class 1.
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value is acceptable as an HPL if the equipment using the least-squares residual RAIM method recommended in RTCA/DO-208 change 1, appendix F provides an acceptable HPL. B.4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.1.3.1. B.4.4.4 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.2.2 and 2.1.5.2.2 A summary.
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Arborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirements or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSs manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value is acceptable as an HPL if the equipment using the least-squares residual RAIM method recommended in RTCA/DO-208 change 1, appendix F provides an acceptable. B.4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirements or compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equirements, additional means of compliance for this TSO require devices an HPL if the equipment using the least. This AC recommends an 8-second time to alert. The protection level value is acceptable as an HPL if the equipment using the least-squares residual RAIM method recommended in RTCA/DO-208 change 1, apendix F provides an acceptable HPL. B.4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, section 2.1.1.13.1. B.4.4.4 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, section 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, section 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2.
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value for comparison against the alarm limit. Equipment using the least-squares residual RAIM method recommended in RTCA/DO-208 change 1, appendix F provides an acceptable HPL. B.4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/DO-208 change 1, Minium Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.1.3. However, there is no requirement to compute or output PL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/nr HPL based on the RAIM algorithm at least compatible as an HPL if the equipment performs the test in RTCA/DO 208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm limit. Equipment using the least-squares residual RAIM method recommended in RTCA/DO-208 change 1, appendix F provides an acceptable HPL. B 4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A s
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/D0-208 change 1, Minimum Operational Performance Standards for Airborne to compute HPL. To properly compily with the ADS-B System (GPS), section 2.2.1.13. Requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends and second time to alert. The protection level value is acceptable as an HPL if the equipment provides ubstantiation data showing that the equipment protection level value is acceptable as an arPL if the equipment provides as a RCA/DO-208 change 1, appendix F provides an acceptable HPL. B 4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.1.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.
The requirements outlined for Class A, B, and C equipment provide horizontal integrity througation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requiremental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requiremental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requiremental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirements and Horizon exposure output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second the tota is acceptable as an HPL if the equipment using the least-squares residual RAIM method recommended in RTCA/DO-208 change 1, appendix P provides an acceptable HPL. B.4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.3.2.2. A summary of the latter
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through NAM algorithms under RTCA/DO-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.113. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1.40-7/hr HPL based on the RMM algorithm at least once per some data the other. This AC recommends an 8-second time to alert. The protection level value is acceptable as an HPL if the equipment performs the test in RTCA/DO-208 (208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm line. Equipment using the least-squares residual RAIM method recommended in RTCA/DO-228C, section 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, 2.1.4.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229D, sections 2.1.2.6, 2.1.2.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229D, sections 2.1.2.6, 2.1.2.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229D, sections 2.1.2
The requirements outlined for Class A, B, and C equipment provide horizontal integrity through RAIM algorithms under RTCA/D0-208 change 1, Minimum Operational Performance Standards for Airborne Supplement J using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirement to compute the L To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. The protection level value is acceptable as an HPL if the equipment using the least-squares residual RAIM method recommended in RTCA/D0-208 change 1, appendix F provides unstantiation data showing that the equipment outputs a 1.x10-7/hr HPL based on the RAIM algorithm sunder start support to the second time to alert. This AC recommends an 8-second time to alert. This SO recention is NS or Class 1. B.4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-Cl45/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/D0-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/D0-229C, section 2.1.1.3.1. B.4.4.4 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-Cl45/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/D0-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/D0-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/D0-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/D0-229C, sections 2.1.2.6, 2.1.2.2
The requirements outlined for Class A, B, and C equipment provide hortzontal integrity through RAM Algorithus under RTCX/D0-208 change 1, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GFS), section 2.2.1.3. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirement system (GFS), section 2.2.1.3. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirement system (GFS), section 2.2.1.3. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirement system (GFS), section 2.2.1.3. However, there is no requirement to compute or second that to alext. This AC recommends an 8-second time to alext. The protection level value is acceptable as an HPL if the equipment performs the test in RTCA/DO 208 change 1, section 2.5.2.5 using this protection level value is an acceptable HPL. section 2.5.2.6 using this protection level value is acceptable as an HPL if the equipment using the least-squares residual RAIM method recommended in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements. Source Qualification - GNS - Horizontal Position Integrity) TSO-Clasf/I46 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.2.2, and 2.1.5.2.2. A summary of the latter requirements can be found in RTCA/DO-229C, sections 2.1.1.1.3.1. B.4.4.4 (Position Source Qualifi
The requirements outlined for Class A, B, and C equipment provide horizontal Integrity through RAIM algorithms under RTCx/D0-208 change 1, Minimum Operational Performance Standards for Alzborne Supplemental Navigation Equipment Using Global Positioning System (GPS), section 2.2.1.13. However, there is no requirement to compute or output HPL. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufactures to provide substantiation data showing that the equipment outputs a 110-7/hr HPL based on the RMA lagorithms under also once presend that meets a Hower the estimation of the substantiation data showing that the equipment outputs a 110-7/hr HPL based on the RMA lagorithms under also receive estimation that also miler. This AC recommends an 8-second time to alert. The protection level value for comparison against the substantiation data showing the test in RTCx/DOC 208 change 1, section 2.5.2.5 using this protection level value for comparison against the alarm limit. Equipment using the least-squares residual RAIM method recommended in RTCA/DO-208 change 1, appendix F provides an acceptable HPL. B.4.4.3 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-2292, sections 2.1.1.26, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be found in RTCA/DO-2292, section 2.1.1.1.3.1. B.4.4.4 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-2292, section 2.1.1.3.1. B.4.4.5 (Position Source Qualification - GNSS - Horizontal Position Integrity) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-2290, sections 2.1.2.6, 2.1.2.2.2, and 2.1.3.2.2. A summary of the latter requirements can be

	B.4.5.1 (Position Source Qualification - GNSS - Position Integrity Probability) TSO-C129 [TSO-C129a is the minimum in CS-ACNS].
	Means of compliance for TSO-C129 are defined in RTCA/DO-208 change 1, section 2.2.1.13.1, referring to table 2-1.
	B.4.5.2 (Position Source Qualification - GNSS - Position Integrity Probability) TSO-C129a.
	Means of compliance for TSO-C129a are defined in RTCA/DO-208 change 1, section 2.2.1.13.1, referring to table 2-1.
	B.4.5.7 (Position Source Qualification - GNSS - Position Integrity Probability) TSO-C196/196a.
	Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.2.2.2. For additional guidance on an acceptable scaling
	method, GNSS manufacturers can refer to RTCA/DO-316, appendix U, section 4.
(a) Horizontal Position Integrity (HPL) (cont.)	B.4.5.3 (Position Source Qualification - GNSS - Position Integrity Probability) TSO-C145/146 Rev a Class 1.
Applicability: ETSO-C145()/146()	Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.2.2.1 for Satellite-Based Augmentation System (SBAS) based
SBAS equipment certified under any revision of ETSO-C145 or ETSO-C146 is required to have several modes of operation depending on the	integrity. This requirement references appendix J, section J.2.1, defining position integrity. (Integrity probability is for HPLSBAS only). For
availability of augmentation. For example, when operating in an augmented mode intended for LPV approach guidance, the position	additional guidance on an acceptable scaling method, GNSS manufacturers can refer to RTCA/DO-229C, appendix U, section 4. FDE
source may determine HPL based on a lateral error versus a horizontal error and an exposure time based on the duration of the approach	requirements can be found in section 2.1.2.2.2.2.2.
versus flight hour (refer to Appendix J to RTCA DO229D for details).	B.4.5.4 (Position Source Qualification - GNSS - Position Integrity Probability) TSO-C145/146 Rev a Class 2/3.
If the position source outputs the HPL on lateral error and approach exposure time, it is possible that the ADS-B transmit function would	Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.2.2.1 for SBAS-based integrity. This requirement references
need to inflate the HPL by 3% in approach modes to ensure the integrity is appropriately bounded.	appendix J, section J.2.1, defining position integrity. (Integrity probability is for HPLSBAS only). For additional guidance on an acceptable
GNSS equipment manufacturers should provide information data to determine if the integrity output needs to be scaled (i.e., by applying	scaling method, GNSS manufacturers can refer to RTCA/DO-229C, appendix U, section 4. FDE requirements can be found in section
an inflation factor). The same considerations apply to GBAS differentially-corrected position sources when in approach mode.	2.1.2.2.2.2.2.
	B.4.5.5 (Position Source Qualification - GNSS - Position Integrity Probability) TSO-C145/146 Rev b/c/d Class 1.
	Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.2.2.1 for SBAS-based integrity. This requirement references
	to appendix J, section J.3.1, defining position integrity. (Integrity probability is for HPLSBAS only). For additional guidance on an
	acceptable scaling method, GNSS manufacturers can refer to
	RTCA/DO-229D appendix U, section 4. FDE requirements can be found in section 2.1.2.2.2.2.
	B.4.5.6 (Position Source Qualification - GNSS - Position Integrity Probability) TSO-C145/146 Rev b/c/d Class 2/3.
	Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.2.2.1 for SBAS-based integrity. Appendix J, section J.3.1
	provides a background definition for position integrity. (Integrity probability is for HPLSBAS only). For additional guidance on an
	acceptable scaling method. GNSS manufacturers can refer to
	RTCA/DO-229D, appendix U, section 4, FDE requirements can be found in section 2.1.2.2.2.2.
(a) Horizontal Position Integrity (HPI) (cont.)	B.4.17 (Position Source Qualification - GNSS) Approach Mode Integrity
	SRAS equipment certified under any revision of TSO-C145 or TSO-C146 is required to have several modes of operation depending on the
	availability of augmentation. For example, when operating in an augmented mode intended for LPV approach guidance, the position
	source may determine HPL based on a lateral error versus a borizontal error and an exposure time based on the duration of the approach
	versus flight hour (refer to RTCA/DO-229D, angendix I). If the position source outputs the HPI on lateral error and approach exposure
	time, it is nossible that the ADS-B transmitter would need to inflate the HPI by 3 percent in approach modes to ensure the intervity is
	appropriately bounded. GBAS equipment is required to comply with the GNS or SBAS requirements for the output of nosition data. This
	is an integration issue between the GPS and ADS-B transmitter. The obsition source manufacturer must provide information to the system
	integration is determine if the integrity output pade to be scaled (that is, by analyzing an inflation factor). Although we do not address the
	interface of a GRAS differentiative organized position source in the AC it will have similar considerations in approach modes as CRAS
	interface of a GDAS differentially corrected position source in this Ac, it will have similar considerations in approach modes as GDAS.
	Additional Guidance not Addressed in CS ACNS
	Additional Guidance for Addression in Co-Acto
	D.A.T.1 (Fusion source quantization - Gives - Approach house integrity) 150-C125 [150-C125] is the minimum in CSACH5].
	A 17.2 (Pacition Source Qualification - CNSS - Anarcasch Mode Integrity) TSO (1292
	Diversity (restored solution source) and the solution of the solution mode integrity (solution) sources and the solution of th
	Intersteric appreciate to the FSC estimates and the scalar statement of the scalar statement of the scalar scalar statement of the scalar scalar scalar statement of the scalar sca
	None of compliance (gammadium - Grass - Approach Model integrity) 150-0149, 140 Rev a Class I.
	Intents of compliance for fills 150 die definieu in ALCA 2022/250, Settloffs 2.1.1.1.5.1.dff 2.1.5.2.2.
	D.4.1/14 (Position Source Qualification - GNSS - Approach Mode Integrity) ISU-CL49/140 Rev a Class 2/3.
	precais or compliance for first is 0 are defined in RTCA/DU-229C, sections 2.1.1.13.1, 2.1.3.2, 2.1.4.2.2, and 2.1.5.2.2.
	B.4.1/3 (Position source Qualification - GNSS - Approach Mode Integrity) ISU-C145/146 Rev D//d Class 1.
	Invients of compliance for this 150 are defined in KTCA/DO-229D, sections 2.1.1.13.1 and 2.1.3.2.2.
	DAAT C (Devision Council Council Annual Marked Later with) TCO CAAT (AAC Devis 1/2) (100 - 2/2)
	B.4.17.6 (Position Source Qualification - GNSS - Approach Mode Integrity) TSO-C145/146 Rev b/c/d Class 2/3.

	B.4.17.7 (Position Source Qualification - GNSS - Approach Mode Integrity) TSO-C196/196a.
	This is not applicable to this TSO as no HPL scaling is applied.
Integrity Fault – Time to Alert — AMC ACNS.D.ADSB.070(a).1.2(b) Applicability: ETSO-C129a (ITSO-C129a) For the horizontal position sources compliant with AMC ACNS.D.ADSB.070, it should to be demonstrated, that a non-isolated GNSS satellite fault detected by the position source is properly passed to the ADS-B transmit unit within the allowable time to alert of 10 seconds, at any time. With reference to the mode dependent time to alert in Table 3-5 of EUROCAE ED-72A section 3.2.1 (Table 2-1 of RTCA DO-208 Section 2.2.1.13.1), GNSS equipment manufacturers should provide information describing the equipment integrity fault output latency, along with interface instructions and/or any limitations for meeting the 10-second latency requirement of AMC1 ACNS.D.ADSB.070(a).1.2(b). Note 1: The latency of reporting nominal ADS-B Quality Indicator changes, such as in response to changing GNSS satellite constellations or due to switching between position sources, is bounded by CS ACNS.D.ADSB.070(a).1.2(c) as well. Note 2: ED-72A allows a provision to extend the Time to Alarm up to 30 seconds during en route phases of flight while for terminal and Non-Precision Approach the 10-second limit is applicable. For ADS-B Out, a time to alert of 10 seconds applies to any phases of flight.	 B.3.5.2 (Position Source Qualification - General - Horizontal Position Integrity) Validity Limit. If the integrity value of the output cannot be trusted beyond a certain limit, indicate this limitation in the design documentation. B.3.5.3 (Position Source Qualification - General - Horizontal Position Integrity) Integrity Fault. The position source must be able to identify, and output, an indication of an integrity fault. This indication should occur within 8 seconds of output of an erroneous position. The position source manufacturer must provide information on how this integrity fault is output. B.4.4.2 (Position Source Qualification - GNSS - Position Source Latency) TSO-C129a. To properly comply with the ADS-B requirements, additional means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing that the equipment outputs a 1x10-7/hr HPL based on the RAIM algorithm at least once per second that meets a 10-second time to alert. This AC recommends an 8-second time to alert. B.4.6 (Position Source Qualification - GNSS) Integrity Fault Alerts. GNSS position source manufacturers must provide design data on the maximum time the position source can take to indicate an integrity fault. If the fault indication is mode specific, data on all modes must be included. It is recommended that the indication of an integrity fault be provided within 8 seconds all modes. All revisions of TSO-C145, TSO-C146, and TSO-C196 GNSS equipment meet this requirement. No revisions of TSO-C129 GNSS equipment meet this requirement without meeting further qualifications outlined below. TSO-C129a. Receivers compliant with ARINC Characteristic 743A-5, GNSS Sensor, dated May 2009, represent the condition where a satellite fault has been detected but the receiver was unable to exclude the faulted satellite by setting bit 11 of label 130. This bit must be integrited the of the fault of the position invalid regardless of the ind
	B.3.5. (Position Source Qualification - General) Position Integrity (Horizontal). Additionally, if the change of probability is due to a change in position source, the new position source must meet all of the requirements in this appendix.
Integrity Fault – Time to Alert — AMC ACNS.D.ADSB.070(a).1.2(b) (cont.) Applicability: ETSO-C129a (ITSO-C129a)	B.4.6.2 (Position Source Qualification - GNSS - Integrity Fault Alerts) TSO-C129a. The requirements in RTCA/DO-208 change 1, section 2.2.1.13.1 cover the time to alarm for different phases of flight. To properly comply with the overall 12-second integrity fault output for ADS-B <i>[includes both the time for the position source to detect the fault and time for</i> <i>the ADS-B system to transmit the fault indication]</i> , additional means of compliance for TSO-C129a require GNSS manufacturers to provide information in the installation instructions describing the equipment integrity fault latency output with interface instructions and/or limitations for meeting the 12-second allocation set by this AC <i>[includes both the time for the position source to detect the fault and time for the ADS-B system to transmit the fault indication]</i> .
	B.4.6.1 (Position Source Qualification - GNSS - Integrity Fault Alerts) TSO-C129 [TSO-C129a is the minimum in CS-ACNS]. The requirements in RTCA/DO-208 change 1, section 2.2.1.13.1 cover the time to alarm for different phases of flight. To properly comply with the overall 12-second integrity fault output for ADS-B, additional means of compliance for TSO-C129 require GNSS manufacturers to provide information in the installation instructions describing the equipment integrity fault latency output with interface instructions and/or limitations for meeting the 12-second allocation set by § 91.227.
	 B.4.6.3 (Position Source Qualification - GNSS - Integrity Fault Alerts) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.1.13 and 2.1.2.2.2.2.1 through 2.1.2.2.2.4. B.4.6.4 (Position Source Qualification - GNSS - Integrity Fault Alerts) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.1.13, 2.1.2.2.2.1 through 2.1.2.2.2.4, and 2.1.4.2.2.2.1
	B.4.6.6 (Position Source Qualification - GNSS - Integrity Fault Alerts) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.1.13 and 2.1.2.2.2.2.1 through 2.1.2.2.2.4. B.4.6.6 (Position Source Qualification - GNSS - Integrity Fault Alerts) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.1.13, 2.1.2.2.2.1 through 2.1.2.2.2.4. and 2.1.4.2.2.2.1
	through 2.1.4.2.2.2.3. B.4.6.7 (Position Source Qualification - GNSS - Integrity Fault Alerts) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, sections 2.1.1.11 and 2.1.2.2.2.1 through 2.1.2.2.2.4.

Mode Output — AMC1 ACNS.D.ADSB.070(a).1.3	
	B.3.5.1 (Position Source Qualification - General - Horizontal Position Integrity) Mode.
Applicability: ETSO-C129a (JTSO-C129a), ETSO-C196a, ETSO-C145()/146()	If interpretation of the integrity output of the position source can change due to a change in the position source mode, the position source
GNSS equipment manufacturers should provide instructions describing any equipment modes affecting the interpretation of horizontal	must have a way of communicating that change of mode to the ADS-B equipment. Additionally, the position source manufacturer should
position integrity output and how the position source outputs the mode indication.	provide a description of the modes and a description of how the position source outputs the mode indication.
As the minimum horizontal position integrity containment bound provided by non-augmented, as well as some specific augmented GNSS	B.4.16 (Position Source Qualification - GNSS) Mode Output
source, equipment is limited to 0.1 NM by design, the GNSS equipment manufacturer should present substantiation data whether the HPI	If interpretation of the integrity output of the position source can change due to a change in the position source mode, the position source
output is limited or not, and provide proper instructions for the ADS-B Out system integration. If the GNSS source equipment does not	must have a way of communicating that change of mode to the ADS-B equipment. Additionally, the position source manufacturer should
limit the HPL, although it should do so by design, the ADS-B transmit unit limits the encoded NIC value to be equal to or less than 'eight'.	provide a description of the modes and a description of how the position source outputs the mode indication.
	B.4.16.1 (Position Source Qualification - GNSS - Mode Output) TSO-C129 [TSO-C129a is the minimum in CS-ACNS].
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if
	affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits,
	section paragraph B.4.7, of this appendix).
	B.4.16.2 (Position Source Qualification - GNSS - Mode Output) TSO-C129a.
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if
	affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits,
	paragraph B.4.7, of this appendix).
	B.4.16.3 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev a Class 1.
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if
	affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits,
	paragraph B.4.7, of this appendix).
	B.4.16.4 (Position Source Qualification - GNSS - Mode Output)TSO-C145/146 Rev a Class 2.
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if
	affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits,
	paragraph B.4.7, of this appendix).
Mode Output - AMCLACNS D ADSP 070(a) 1.2 (cont.)	P. 4.16.5 (Pacition Source Qualification SNIS) Made Quatrut) DSQ C145/146 Pau b/c/d Class 1
Mode Output America Activity (a).1.3 (cont.)	Magne of compliance for this TSO require GNSS manufactures to provide installation instructions describing the modes available (if
	means or compliance or this resortion of the second and the second
	ancerna B A 7 of this approximation integrity output, and now the position source outputs the mode indication (refer to rotation integrity tands), narragraph B A 7 of this approximation
	B 4 16 6 (Position Source Qualification - GNSS - Mode Qutnut) TSQ-C145/146 Rev b/c/d Class 2/3
	B4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if
	B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits.
	Belagion Device, of this appendix). B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7. of this appendix).
	B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Qutput) TSO-C196/196a.
	Belagraph D-477, of this appendix). B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if
	B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits,
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix).
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position fource Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits.
	B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly smaller than 0.1 nm can be output from single-frequency GNSS sources, if the HPL value was computed using RAIM, it may not actually
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly smaller than 0.1 nm can be output from single-frequency GNSS sources, if the HPL value was computed using RAIM, it may not actually achieve the reported level of protection as there are error contributions that are no longer negligible and should be taken into
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly smaller than 0.1 nm can be output from single-frequency GNSS sources, if the HPL value was computed using RAIM, it may not actually achieve the reported level of protection as there are error contributions that are no longer negligible and should be taken into consideration. Such error sources specifically include correlation of ionospheric errors across satellites, tropospheric delay compensation
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly smaller than 0.1 nm can be output from single-frequency GNSS sources, if the HPL value was computed using RAIM, it may not actually achieve the reported level of protection as there are error contributions that are no longer negligible and should be taken into consideration. Such error sources specifically include correlation of ionospheric errors satellites, tropospheric delay compensation errors, multipath, and receiver noise errors. This issue is not uniqu
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly smaller than 0.1 nm can be output from single-frequency GNSS sources, if the HPL value was computed using RAIM, it may not actually achieve the reported level of protection as there are error contributions that are no longer negligible and should be taken into consideration. Such error sources specifically include correlation of ionospheric errors across satellites, tropospheric delay compensation errors, multipath, and receiver noise errors. This issue is not u
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly smaller than 0.1 nm can be output from single-frequency GNSS sources, if the HPL value was computed using RAIM, it may not actually achieve the reported level of protection as there are error contributions that are no longer negligible and should be taken into consideration. Such error sources specifically include correlation of inospheric errors across satellites, tropospheric delay compensation errors, multipath, and receiver noise errors. This issue is not un
	 B.4.16. (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly smaller than 0.1 nm can be output from single-frequency GNSS sources, if the HPL value was computed using RAIM, it may not actually achieve the reported level of protection as there are error contributions that are no longer negligible and should be taken into consideration. Such error sources specifically include correlation of ionospheric errors across satellites, tropospheric delay compensation errors, multipath, and receiver noise errors. This issue is not unique to unaugmented GPS position sources, as all revisions of TSO-C145 and TSO-C146 GNSS position sources also calculate integrity based on RAIM when Satellite-Based Augmentation System (SBAS) integrity is not used. Even when using SBAS augmentation, the integrity calculation is not required to account for these err
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly smaller than 0.1 nm can be output from single-frequency GNSS sources, if the HPL value was computed using RAIM, it may not actually achieve the reported level of protection as there are error contributions that are no longer negligible and should be taken into consideration. Such error sources specifically include correlation of ionospheric errors across satellites, tropospheric delay compensation errors, multipath, and receiver noise errors. This issue is not unique to unaugmented GPS position sources, as all revisions of TSO-C145 and TSO-C146 GNSS position sources also calculate integrity calculation is not required to account for these error sources except when in LNAV/VNAV or LPV/LP approach modes. ADS-B capable position sources must provide design information to the i
	 B.4.16.6 (Position Source Qualification - GNSS - Mode Output) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.16.7 (Position Source Qualification - GNSS - Mode Output) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing the modes available (if affecting interpretation of integrity output) and how the position source outputs the mode indication (refer to Position Integrity Limits, paragraph B.4.7, of this appendix). B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. B.4.7 (Position Source Qualification - GNSS) Position Integrity Limits. This requirement was previously called Integrity Validity Limit. Single-frequency RAIM-based HPL computations have been designed to support navigation applications and provide an appropriate error bound down to approximately 0.1 nm. Although HPL values significantly smaller than 0.1 nm can be output from single-frequency GNSS sources, if the HPL value was computed using RAIM, it may not actually achieve the reported level of protection as there are error contributions that are no longer negligible and should be taken into consideration. Such error sources specifically include correlation of ionospheric errors across satellites, tropospheric delay compensation errors, multipath, and receiver noise errors. This issue is not unique to unaugmented GPS position sources, as all revisions of TSO-C145 and TSO-C146 GNSS position sources also calculate integrity based on RAIM when Satellite-Based Augmentation System (SBAS) integrity is not used. Even when using SB

Mode Output — AMC1 ACNS.D.ADSB.070(a).1.3 (cont.)	 B.4.7.1 (Position Source Qualification - GNSS - Position Integrity Limits) Whether a TSO-C129 or TSO-C196 position source limits the HPL output to greater than 75 meters. If the position source does not limit its HPL output, the position source manufacturer should provide guidance to the ADS-B system installer to ensure the ADS-B equipment limits the NIC to ≤ 8. Although single-frequency RAIM-based HPL values are only accurate down to approximately 0.1 nm, for ADS-B purposes, the position source only need limit the HPL to greater than 75 meters, because an HPL greater than 75 meters ensures the ADS-B equipment will only set a NIC of ≤ 8. B.4.7.1.1 (Position Source Qualification - GNSS - Position Integrity Limits) TSO-C129 <i>[TSO-C129a is the minimum in CS-ACNS]</i>. Means of compliance for this TSO require GNSS manufacturers to present substantiation data whether HPL is limited or not, and provide B.4.7.1.2 (Position Source Qualification - GNSS - Position Integrity Limits) TSO-C129a. Means of compliance for this TSO require GNSS manufacturers to present substantiation data whether HPL is limited or not, and provide
	proper installation instructions for the ADS-B integration. B.4.7.1.3 (Position Source Qualification - GNSS - Position Integrity Limits) TSO-C196/196a. Means of compliance for this TSO require GNSS manufacturers to present substantiation data whether HPL is limited or not, and provide proper installation instructions for the ADS-B integration. B.4.7.2 (Position Source Qualification - GNSS - Position Integrity Limits) Whether a TSO-C145 or TSO-C146 position source limits the HPL in non-SBAS augmented modes to greater than 75 meters. If the position source does not limit the HPL output in non-augmented modes, the position source manufacturer should provide guidance to the ADS-B system installer to ensure the ADS-B equipment limits the NIC to ≤ 8 in non-augmented modes. The position source manufacturer should also provide instructions on how to determine the position source mode if appropriate. B.4.7.2.1 (Position Source Qualification - GNSS - Position Integrity Limits) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO require GNSS manufacturers to present substantiation data whether HPL is limited or not, and provide proper installation instructions for the ADS-B integration.
Mode Output — AMC1 ACNS.D.ADSB.070(a).1.3 (cont.)	 B.4.7.2.2 (Position Source Qualification - GNSS - Position Integrity Limits) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO require GNSS manufacturers to present substantiation data whether HPL is limited or not, and provide proper installation instructions for the ADS-B integration. Installations intending to support NIC ≥ 9 must use LNAV/VNAV or LPV/LP approach requirements (RTCA/DO-229C, section 2.1) at the time of HPL output, in accordance with TSO-C145/C146 Rev a, but the enroute through LNAV K-Factor (6.18 vs. 6) must be applied (refer to RTCA/DO-229C, appendix J, section 2.1 and appendix U, section 4). Either the GNSS source equipment sets the K-Factor for HPL, or the ADS-B equipment applies proper scaling. The GNSS manufacturer must present substantiation data on which K-Factor is used and provide proper installation instructions for the ADS-B integration. B.4.7.2.3 (Position Source Qualification - GNSS - Position Integrity Limits) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO require GNSS manufacturers to present substantiation data whether HPL is limited or not, and provide proper installation instructions for the ADS-B integration. B.4.7.2.4 (Position Source Qualification - GNSS - Position Integrity Limits) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide substantiation data whether HPL is limited or not, and provide proper installation instructions for the ADS-B integration. Installations intending to support NIC ≥ 9 must use LNAV/VNAV or LPV/LP approach requirements (RTCA/DO-229D, section 2.1) at the time of HPL output, in accordance with TSO-C145/C146 Rev b/c, but the enroute through LNAV K-Factor (6.18 vs. 6) must be applied (refer to RTCA/DO-229D appendix J, section 3.1) and appendix U, section 4). Either the GNSS source equipment sets the K-Factor for HPL, or the ADS B equipment applies proper scaling. The GNSS manufacturer must present substantiation

 B.4.4 (Position Accuracy (HFOM) — AMC ACKS D. ADS8.070(a).1.2(d) Applicable, PTSO-2139, ETSO-CL439, and ETSO-CL46 B.4.4 (Position Source Qualification - General) Position Accuracy (Horizontal). B.4.4 (Position Source Qualification - General) Position Accuracy (Horizontal). B.4.4 (Position Source Qualification - General) Position Accuracy, (Horizontal). B.4.4 (Position Source Qualification - General) Position Accuracy. B.4.3 (Position Source Qualification - General) Position Accuracy. B.4.4 (Position Source Qualification - General) Position Accuracy. B.4.3 (Position Source Qualification - General) Position Accuracy. B.4.3 (Position Source Qualification - General) Position Accuracy. B.4.4 (Position Source Qualification - General) Position Accuracy. B.4.3 (Position Source Qualification - General) Position Accuracy. B.4.3 (Position Source Qualification - General) Position Accuracy. B.4.3 (Position Source Qualification - General Position Accuracy) TSO-CL45/L46 Rev a Class 1. Means of complanes for this coregeneral Position Accuracy) TSO-CL45/L46 Rev a Class 1. Means		
Applicability: FISO C129s, ETSO C145, and ETSO C146 Note 1: Compliance with RTC4/DO-229D required by FTSO-C145-C1EG-CTSO-C126/C16 may be acceptable by applications of a positive deviation. Note 2: If the following: reference is made in the qualification tests described in DO-229D, the equivalent material in DO-316 gaperas. Note 2: If the following: reference is made in the qualification tests described in DO-229D, the equivalent material in DO-316 gaperas. Note 2: If the following: reference is made in the qualification tests described in DO-229D, the equivalent material in DO-316 gaperas. Note 2: If the following: reference is made in the qualification tests described in DO-229D, the equivalent material in DO-316 gaperas. Note: The intermotion of the complete and output and its associated If/OM accuracy metric is accorded to be applied: (1) The horizontal position accuracy output and its associated If/OM accuracy metric is no estification and the collabel environtal position accuracy output requirement, however, all equipment mathematically equivalent linear combination of range measurements). There is no restriction on the choice of the weight matrix VB requirement as output to be considered and DS complete and DS	(b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D.ADSB.070(a).1.2(d)	B.3.4 (Position Source Qualification - General) Position Accuracy (Horizontal).
Net 2: Compliance with RTC4/D0-2290 is required by ETSO-C145/c146. ETSO-C145/c146 may be acceptable by applications of a minute describe the radius of a crice in the horizontal pane, with its center being at the true position with a case of the true of the true position with a case of the minimum in C5-ACMS. The case of the true position with a case of the minimum in C5-ACMS. The case of the true position with a case of the true position with the case of the true position with the case of the true position with the case of the true position with true case. The case of the true position with true case of the true position with true case of the true position with true case. The case of the true position with true case of the true position with true case. The true case of the true position with true case of the true position with true case. The true position with true case of the true position with true case. The true position with true case of the true position with true case. The true case of the true position with true case. The true position with true case of the true position with true case. The true case of the true position with true case. The true case of the true position with true case. The true case of the true position with true case. The true case of the true position with true case. The true case of the true position with true case. The true case of the true position with true case. The true case of the true position	Applicability: ETSO-C129a, ETSO-C145, and ETSO-C146	The position source must have a horizontal position accuracy output, and the output must have been qualified during the system's TSOA
positive deviation. Note 2: If in the fundaming reference is made in the quilification tests described in DO-2390, the equivalent material in OO-316 applies well. Gives equipment manufacturers should provide substantiation data showing the equipment computes and output NFOM. The following criteria for an acceptable informatial position accuracy. We deviation of DO-2390 Appendix 1 (or any mathematically equivalent linear combination of range measurements). There is no restriction on the choice of the weight matrix were mathematically equivalent linear combination of range measurements). There is no restriction on the choice of the weight matrix were mathematically equivalent linear combination of range measurements). There is no restriction on the choice of the weight matrix were weight matrix were in the second balance of the second and the s	Note 1: Compliance with RTCA/DO-229D is required by ETSO-C145c-C146c. ETSO-C145/-C146 may be acceptable by applications of a	or design approval. This output must describe the radius of a circle in the horizontal plane, with its center being at the true position that
Note 2: If in the following, reference is made in the qualification tests described in DO-2309, the equivalent material in DO-318 applies? B.4.8 (Position Source Qualification - GNSS) Horizontal Position Accuracy. GNSS equipment manufacturers should provide substantiation data showing the equipment computes and output SPO. (The for intervent in	positive deviation.	describes the region assured to contain the indicated horizontal position with at least 95 percent probability under fault-free conditions.
well. GNSS equipment manufacturers should provide substantiation data showing the equipment computes and outputs HFOM. The following criteria for an acceptable horizontal position output and its associated HFOM accuracy metric are recommended to be applied: (1) The horizontal position output due faculated using the persent less storais no storais solution of 0-2290 Appendix 1, 100 and persent or equal to the ones listed in DO 2290 Appendix 1, 100 (2) The horizontal position accuracy should be test-dated using the procedure of DO-2290 Section 32.6.3. The dD used to to consist and position fource should position accuracy on the equipment to mathematically equivalent linear combination of ange measurements). There is no restriction on the choice of the weight matrix W and greater or equal to the ones listed in DO 2290 Appendix 1, 101 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and greater or equal to the ones listed in DO 2290 Appendix 1, 102 and compliance for this SO require GNSS manufacturers to provide substantiation data showing the equipment computes and outputs HFOM. Test is and appendix 4, section 4-11 for an acceptable HFOM test. B 4.8.3 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO C145/146 Rev a Class 1, and compliance for this SO arequire GNSS manufacturers to provide subs	Note 2: If in the following, reference is made in the qualification tests described in DO-229D, the equivalent material in DO-316 applies as	B.4.8 (Position Source Qualification - GNSS) Horizontal Position Accuracy.
GNES equipment manufacturers should provide substantiation data showing the equipment computes and output HPOL Mearcaray metric are recommended to be applied: (1) The horizontal position output should be calculated using the general less squares position solution of DO-2290 Appendix 1.10 cm an mathematically quarket linear combination of rage measurements. There is no estitution on the choice of the weight matrix W (2) The horizontal position output should be calculated using the general less squares position of DO-2290 Appendix 1, when the equipment uses SRAS-provided integrity, and HFOM in a consistent of DO-2290 Appendix 1, when the equipment uses SRAS-provided integrity, and the exploration accuracy (HFOM) in the set of the station approval. GNSS - Horizontal Position Accuracy (TSO-C128), as the main in CSA-CSOI, and graster or equal to the onsist lead in DO-2290 Appendix 1, when the equipment uses SRAS-provided integrity, a fixed sign of 33.3 m is considered a sufficient over-hound when using FDF-provided integrity, FO equipment that uses SRAS-provided integrity, testing only in the highest mode attainable for its declared Operational Classes perified in the test State screamed in CPD-2015 Concept and the set of the CONST manufacturers to provide substantiation data showing the equipment computes and output SHOM. Second and the set of the state of t	well.	GNSS position sources should provide an HFOM output that was demonstrated during the position source's design approval or during an
criteria for an acceptable horizontal position output and its associated HFOM accuracy metric are recommended to be applied. (1) The horizontal position output and its associated HFOM accuracy metric are recommended to be applied. (2) The horizontal position output and its associated HFOM accuracy metric are recommended to be applied. (2) The horizontal position accuracy welcity, and HFOM accuracy and	GNSS equipment manufacturers should provide substantiation data showing the equipment computes and outputs HFOM. The following	installation approval. GNSS certified under TSO-C145b/c, TSO-C146b/c/d, or all revisions of TSO-C196 are required to provide the HFOM
 (1) The horizontal position output should be calculated using the general least squares position solution of D0-2200 Appendix 11 or any mathematcally equivalent linear combination of range measurements). There is on restriction on the choice of the weight mark W. Including non-weight displays should be greater or equal to the ones listed in D0-220 Appendix i. Non the equipment cases SDAS-provided integrity. The inclust is to output to be considered an ADS- 8 compliant position source. Note: The intent is to output to be considered an ADS-8 compliant position source. Note: The intent is to output to be considered an ADS-8 compliant position source. Note: The intent is to output to position, valuely be stead using the procedure of D0-220 Appendix i. If or an acceptable integrity is settion 2.2.8.2.3. The oil used to compute the using the arccuracy ISO-C129 [TSO-C129a list to main integrity and greater or equal to the ones listed in D0-220 Appendix i. If or an acceptable integrity, testing only in the highest mode attainable for its declared Operational Class a specified in the test itser list acceptable. (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D.ADS8.070(a).1.2(d) (cont.) (cont) (cont)<!--</th--><th>criteria for an acceptable horizontal position output and its associated HFOM accuracy metric are recommended to be applied:</th><th>output. TSO-C129, TSO-C145a, and TSO-C146a do not contain a horizontal position accuracy output requirement; however, all equipment</th>	criteria for an acceptable horizontal position output and its associated HFOM accuracy metric are recommended to be applied:	output. TSO-C129, TSO-C145a, and TSO-C146a do not contain a horizontal position accuracy output requirement; however, all equipment
mathematically equivalent linear combination of range measurements). There is no restriction on the choice of the weight matrix W Note: The intent is to output position, velocity, and HFOM in a consistent manner for time of applicability (refer to RTCA/D0-229D, including non-weighted solutions). (2) The horizontal position accuracy should be tested using the procedure of DO-229D Section 2.5.8.3. The oil used to compute the equipment does not use SBAS-provided integrity. The equipment the uses SBAS-provided integrity, the equipment the uses SBAS-provided integrity. A fixed sigma of 33.3 m is considered a sufficient over-bound when using FDE-provided integrity. For equipment the uses SBAS-provided integrity, testing only in the highest mode attainable for its declared Operational Class as specified in the test itself is acceptable. Note: The intent is to output position, velocity, and HFOM in a consistent manner for time of applicability (refer to RTCA/DO-229D, intent uses the equipment the uses SBAS-provided integrity. For equipment that uses SBAS-provided integrity, testing only in the highest mode attainable for its declared Operational Class as specified in the test itself is acceptable. 8.4.8.1 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO require GNS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D.ADSS.B070(a).1.2(d) (cont.) B.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO require GNS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test.	(1) The horizontal position output should be calculated using the general least squares position solution of DO-229D Appendix J.1 (or any	must provide a HFOM output to be considered an ADS-B compliant position source.
Including non-weighted solutions; the use of the LIX4V/NAV, IP, LPV approach weight (wi = 1/o/2) is optional. (2) The horizontal position accuracy should be stead using the procedure of D0-2290 Section 2.5.8. The oil used to compute the variance d2major should be greater or equal to the ones listed in D0-2290 Appendix 1 when the equipment uses SBAS-provided integrity. A fixed sigma of 33.3 m is considered a sufficient over-bound when using FDE-provided integrity. For equipment that uses SBAS-provided integrity, testing only in the highest mode attainable for its declared Operational Class specified in the test its fis is acceptable. (b) Horizontal Position Accuracy (HFOM) — AMC ACNS. D.ADSB.070(a) 1.2(d) (cont.) (3) The accuracy metric should be greater or equal to 1.96 sprit(2/2est + 42north) or 2.45 dmajor where dmajor, deast, and dnorth are computed using the same of employed during the horizontal accuracy test procedure. General certification substantiation accuracy (b) Horizontal Position Accuracy (HFOM) — AMC ACNS. D.ADSB.070(a) 1.2(d) (cont.) (3) The accuracy metric should be greater or equal to 1.96 sprit(2/2est + 42north) or 2.45 dmajor where dmajor, deast, and dnorth are computed using the same of employed during the horizontal accuracy test procedure. General certification substantiation data that the substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. 8.4.8.2 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 2/3. Meetrics were rounded to 2 decimal places; there is no intention to prohibit the use of a more accuracy emteris in substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. (varying from 95 % to approximately 98 5 % for the horizontal position solution (or mathematically equivalent (varying from 95 % to approximately 98 5 % for the horizontal position solution (or mathematically equivalent (varying from	mathematically equivalent linear combination of range measurements). There is no restriction on the choice of the weight matrix W	Note: The intent is to output position, velocity, and HFOM in a consistent manner for time of applicability (refer to RTCA/DO-229D,
 (2) The horizontal position accuracy should be treated using the procedure of DO-229D Section 2.5.8.3. The 012 used to compute the variance 2mails should be treated or equal to the ones listed to mose 158ted in DO-229D Section 2.5.8.3. The 012 used to compute the quagment uses SBAS-provided integrity. A fixed sigma of 33.3 m is considered a sufficient over-bound when using FDE-provided integrity. A fixed sigma of 33.3 m is considered a sufficient over-bound when using FDE-provided integrity. A fixed sigma of 33.3 m is considered a sufficient over-bound when using FDE-provided integrity. Testing only in the highest mode attainable for its declared Operational Class a specified in the test itself is acceptable. (b) Horizontal Position Accuracy (HFOM) — AMC ACNS D.ADSB.070(a).1.2(d) (cont.) (c) Horizontal Position Accuracy (HFOM) — AMC ACNS D.ADSB.070(a).1.2(d) (cont.) (d) Horizontal Position Accuracy (HFOM) — AMC ACNS D.ADSB.070(a).1.2(d) (cont.) (e) Horizontal Position Accuracy (HFOM) — AMC ACNS D.ADSB.070(a).1.2(d) (cont.) (e) Horizontal Position Accuracy (HFOM) — AMC ACNS D.ADSB.070(a).1.2(d) (cont.) (f) Horizontal Position Accuracy (HFOM) — AMC ACNS D.DADSB.070(a).1.2(d) (cont.) (g) The accuracy metric should be greater or equal to 1.96 sqrt(d2east + d2north) or 2.45 dmajor where dmajor, deast, and dnorth are equipment tests this requirement is sufficient; no specific test is required. Note 1: The scaling factors for the horizontal accuracy (HFOM Hest. (a) The accuracy metric subculto provide a unistration data that the equipment tiss effection in the standard metrics used to provide a minimum of 95 % containment is equired to a provide a distribution with a sigma of 35.4 and gone characy accuracy metric subculto provide a minimum of 95 % containment in the position daccuracy of the scalared on the test described in AC 20-138(), appendix 4, section A-11 for an acceptable HFOM test. <li< th=""><th>including non-weighted solutions; the use of the LNAV/VNAV, LP, LPV approach weight (wi = 1/σi2) is optional.</th><th>sections 2.1.2.6 and 2.1.2.6.2).</th></li<>	including non-weighted solutions; the use of the LNAV/VNAV, LP, LPV approach weight (wi = 1/σi2) is optional.	sections 2.1.2.6 and 2.1.2.6.2).
variance d2major should be greater or equal to the ones listed in D0-2290 Appendix J when the equipment computes SBAS-provided integrity, a fixed sigma of 33.3 m is considered a sufficient over-bound when using FDE-provided integrity. For equipment that uses SBAS-provided integrity, testing only in the highest mode attainable for its declared Operational Class as specified in the test itself is acceptable. (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D.ADS8.070(a).1.2(d) (cont.) (c) Horizontal Position Accuracy (HFOM) = AMC ACNS.D.ADS8.070(a).1.2(d) (cont.) (c) Horizontal Position Accuracy (HFOM) = AMC ACNS.D.ADS8.070(a).1.2(d) (cont.) (c) Horizontal	(2) The horizontal position accuracy should be tested using the procedure of DO-229D Section 2.5.8.3. The oi2 used to compute the	B.4.8.1 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C129 [TSO-C129a is the minimum in CS-ACNS].
and greater or equal to the ones listed as an acceptable means for FDE-provided integrity. A fixed sigms of a 33 m is considered a sufficient over-bound when using PDE-provide integrity. A fixed sigms of 33.3 m is considered a sufficient over-bound when using PDE-provide integrity. For equipment that uses SBAS-provided integrity, testing only in the highest mode attainable for its declared Operational Class a specified in the test liself is acceptable. B.4.8.2 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing the equipment does computed using the same of employed during the horizontal accuracy test procedure. General certification substantiation data the horizontal accuracy test procedure. General certification substantiation data the horizontal accuracy test procedure. General certification substantiation data the horizontal accuracy test procedure. General certification substantiation data the same of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM. Refer to the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. (1) The accuracy metric ishould be greater or equal to 1.56 strit(22est + d2north) or 2.45 dmajor where dmajor, dest, and dnorth equipment meets this requirement is sufficient, no specific test is required. Note 1: The scaling factors for the horizontal position accuracy test procedure. General certification substantiation acturacy test procedure. General certification substantiation data the sead on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. (b) Horizontal Position accuracy test procedure. General certification substin indicur	variance d2major should be greater or equal to the ones listed in DO-229D Appendix J when the equipment uses SBAS-provided integrity	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing the equipment computes and
equipment does not use SBAS-provided integrity. A fixed sigma of 33.3 m is considered a sufficient over-bound when using PDE-provided integrity. For equipment that uses SBAS-provided integrity, testing only in the highest mode attainable for its declared Operational Class as specified in the test itself is acceptable. 8.4.8.2 (Position Source Qualification - GMSS - Horizontal Position Accuracy) TSO-C129a. (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D ADS8.070(a) 1.2(d) (cont.) 8.4.8.3 (Position Source Qualification - GMSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO require GMSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D ADS8.070(a) 1.2(d) (cont.) 8.4.8.3 (Position Source Qualification - GMSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO require GMSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. requirement meets this requirement is sufficient, no specific test is required. Note 1: The scaling factors for the horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 95 % containment. Ba.8.4 (Position Source Qualification - GMSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO require GMSS manufacturers to provide a minimum of 95 % containment. Ba.8.4 (Position Source Qualification - GMSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO require GMSS - Hor	and greater or equal to the ones listed as an acceptable means for FDE-provided integrity in section DO-229D 2.1.2.2.2.2 when the	outputs HFOM. Refer to the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test.
integrity, For equipment that uses SBAS-provided integrity, testing only in the highest mode attainable for its declared Operational Class as Means of compliance for this T50 require GNSS manufacturers to provide substantiation data showing the equipment computes and outputs HFOM. Refer to the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D. ADSB.070(a) 1.2(d) (cont.) B.4.8.3 (Position Source Qualification - GNSS - Horizontal Position Accuracy) T50-C145/146 Rev a Class 1. Means of compliance for this T50 require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. B.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) T50-C145/146 Rev a Class 1. Means of compliance for this T50 require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. B.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) T50-C145/146 Rev a Class 2/3. Means of compliance for this T50 require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. B.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) T50-C145/146 Rev b/c/d Class 1. Means of compliance for this TS0 require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. B.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) T50-C145/146 Rev	equipment does not use SBAS-provided integrity. A fixed sigma of 33.3 m is considered a sufficient over-bound when using FDE-provided	B.4.8.2 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C129a.
specified in the test itself is acceptable. (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D.ADSB.070(a).1.2(d) (cont.) (a) The accuracy metric should be greater or equal to 1.96 sqrt(d2east + d2north) or 2.45 dmajor where dmajor, deast, and dnorth are computed using the same oi employed during the horizontal accuracy test procedure. General certification substantiation data that the requipment meets this requirement is sufficient; no specific test is required. Note 1: The scaling factors for the horizontal position accuracy. metrics were rounded to 2 decimal places; there is no intention to prohibit the use of a more accurate number. Note 2: The horizontal position accuracy metric slisted above are the standard metrics used to provide a minimum of 95 % containmet in the position almetrics used to provide a minimum of 95 % containment in the position of metric acuracy metric that can be mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable. Set approximately 98.5 % containment in the position domain under the Gaussian assumption is also acceptable. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). 8.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). 8.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). 8.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix	integrity. For equipment that uses SBAS-provided integrity, testing only in the highest mode attainable for its declared Operational Class as	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing the equipment computes and
 (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D.ADS8.070(a).1.2(d) (cont.) (a) The accuracy metric should be greater or equal to 1.96 synt(d2east + d2north) or 2.45 dmajor where dmajor, deast, and dnorth are computed using the same or iemployed during the horizontal accuracy test procedure. General certification substantiation data that the equipment meets this requirement is sufficient; no specific test is required. Note 1: The scaling factors for the horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 55 % containment. Note 2: The horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 55 % containment. Note 2: The horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 55 % containment. Note 2: The horizontal position accuracy metrics listed above are the standard metrics used to provide a sumption that a Gaussian distribution with a sigma of over > bounds the error of the range measurements. The use of a general least squares position error. Any accuracy metric that can be mathematically demonstrated to provide a minimum of 55 % containment in the position error. Any accuracy metric that can be mathematically demonstrated to provide a minimum of 55 % containment in the position domain under the Gaussian assumption is also acceptable. B.4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-222D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-22D). B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-22DD, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-22D). B.4.8.7 (Position Source Qualificat	specified in the test itself is acceptable.	outputs HFOM. Refer to the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test.
(b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D. ADS8.070(a).1.2(d) (cont.) 8.4.8.3 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this (a) Horizontal Position Accuracy (HFOM) — AMC ACNS.D. ADS8.070(a).1.2(d) (cont.) 8.4.8.3 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D. ADS8.070(a).1.2(d) (cont.) 8.4.8.3 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. 8.4.8.3 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. 8.4.8.3 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. 8.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). Rathema		
(b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D.ADS8.070(a).1.2(d) (cont.) 8.4.8.3 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this (b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D.ADS8.070(a).1.2(d) (cont.) 8.4.8.3 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this (c) Horizontal Position Accuracy metric should be greater or equal to 1.96 sqrt(d2east + d2north) or 2.45 dmajor where dmajor, deast, and dnorth are computed using the same oi employed during the horizontal accuracy test procedure. General certification substantiation data that the equipment meets this requirement is sufficient; no specific test is required. Note 1: The scaling factors for the horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 95 % containment. 8.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 2/3. (varying from 95 % to approximately 98.5 % for the horizontal metrics) under the assumption that a Gaussian distribution with a sigma of owner- bounds the error of the range measurements. The use of a general least squares position solution (or mathematically equivalent) 8.4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable. 8.4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO aredefined in RTCA/DO-229D, section 2.1.2.6 (al		
 (b) Horzontal Position Accuracy (HPOM) — ANC ACNS.D. ADSB.07(a):1.2(a) (cont.) (cont.) (cont.)<!--</th--><th></th><th></th>		
(3) The accuracy metric should be greater or equal to 1.96 sqrt(d2east + d2north) or 2.45 dmajor where dmajor, deast, and dnorth are computed using the same of employed during the horizontal accuracy test procedure. General certification substantiation data that the equipment meets this requirement is sufficient; no specific test is required. Note 1: The scaling factors for the horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 95 % containment (varying from 95 % to approximately 98.5 % for the horizontal metrics) under the assumption that a Gaussian distribution with a sigma of or e-bounds the error of the range measurements. The use of a general least squares position solution (or mathematically equivalent results in a joint Gaussian distribution for the components (North, East, Up) of the position error. Any accuracy metric that can be mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable. 8.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). 8.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-230, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). 8.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-230, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). 8.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/	(b) Horizontal Position Accuracy (HFOM) — AMC ACNS.D.ADSB.070(a).1.2(d) (cont.)	B.4.8.3 (Position Source Qualification - GNS5 - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 1. Means of compliance for this
computed using the same of employed during the horizontal accuracy test procedure. General certification substantiation data that the equipment meets this requirement is sufficient; no specific test is required. Note 1: The scaling factors for the horizontal position accuracy metrics were rounded to 2 decimal places; there is no intention to prohibit the use of a more accurate number.an acceptable HFOM test.Note 2: The horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 95 % containment in tesults in a joint Gaussian distribution for the components (North, East, Up) of the position error. Any accuracy metric that can be mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is alsoB.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D).B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D).B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-216, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D).B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-316)	(3) The accuracy metric should be greater or equal to 1.96 sqrt(d2east + d2north) or 2.45 dmajor where dmajor, deast, and dnorth are	TSO require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for
 Equipment meets this requirement is sufficient; no specific test is required. Note 1: The scaling factors for the horizontal position accuracy B.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO required Note 1: The scaling factors to the horizontal metrics used to provide a minimum of 95 % containment in the position solution (or mathematically equivalent) is also B.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 2/3. B.4.8.5 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. B.4.8.5 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. B.4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. B.4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. B.4.8.7 (Position Source Qualification - GNSS -	computed using the same of employed during the horizontal accuracy test procedure. General certification substantiation data that the	an acceptable HFOM test.
metrics were rounded to 2 decimal places; there is no intention to prohibit the use of a more accurate number. Note 2: The horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 95 % containment (varying from 95 % to approximately 98.5 % for the horizontal metrics) under the assumption that a Gaussian distribution with a sigma of a or events the error of the range measurements. The use of a general least squares position solution (or mathematically equivalent) methematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable. Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(), appendix 4, section A4-11 for an acceptable HFOM test. B-4.8.5 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). B-4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-316).	equipment meets this requirement is sufficient; no specific test is required. Note 1: The scaling factors for the horizontal position accuracy	B.4.8.4 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev a Class 2/3.
Note 2: The horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 95 % containment (varying from 95 % to approximately 98.5 % for the horizontal metrics) under the assumption that a Gaussian distribution with a sigma of gi over- bounds the error of the range measurements. The use of a general least squares position solution (or mathematically equivalent) results in a joint Gaussian distribution for the components (North, East, Up) of the position error. Any accuracy metric that can be mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable. B4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-316).	metrics were rounded to 2 decimal places; there is no intention to prohibit the use of a more accurate number.	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the test described in AC 20-138(),
(varying from 95 % to approximately 98.3% for the horizontal metrics) under the assumption that a Gaussian distribution with a sigma of or over- bounds the error of the range measurements. The use of a general least squares position solution (or mathematically equivalent) results in a joint Gaussian distribution for the components (North, East, Up) of the position error. Any accuracy metric that can be mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable.	Note 2: The horizontal position accuracy metrics listed above are the standard metrics used to provide a minimum of 95 % containment	appendix 4, section A4-11 for an acceptable HFOM test.
or over-bounds the error of the range measurements. The use of a general least squares position solution (or mathematically equivalent) Means of compliance for this ISO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of results in a joint Gaussian distribution for the components (North, East, Up) of the position error. Any accuracy metric that can be mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable. Means of compliance for this ISO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). B.4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-316).	(varying from 95 % to approximately 98.5 % for the horizontal metrics) under the assumption that a Gaussian distribution with a sigma of	B.4.8.5 (Position Source Qualification - GNSS - Horizontal Position Accuracy) ISO-C145/146 Rev b/c/d Class 1.
results in a joint Gaussian distribution for the components (North, East, Up) of the position error. Any accuracy metric that can be mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable. B.4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-216)	or over- bounds the error of the range measurements. The use of a general least squares position solution (or mathematically equivalent)	Means of compliance for this ISO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of
mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable. B.4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) ISO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-316)	results in a joint Gaussian distribution for the components (North, East, Up) of the position error. Any accuracy metric that can be	
Acceptable. Means or compliance for this ISO are defined in RTCA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-229D). B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-210	mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also	B.4.8.6 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3.
RTCA/DD-229D). B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of BTCA/DO-216)	ассертаріе.	Means or compliance for this ISO are defined in RICA/DO-229D, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of
B.4.8.7 (Position Source Qualification - GNSS - Horizontal Position Accuracy) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of BTCA/DO-316)		
Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of RTCA/DO-316		8.4.8.7 (Position Source Qualification - GNS5 - Horizontal Position Accuracy) ISO-C196/1968.
		Means or compliance for this ISU are defined in KILA/UU-316, section 2.1.2.6 (also refer to section 1.7.1 and appendix H of or A/OO 214)

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation,	and Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.
Horizontal Position Latency — AMC1 ACNS.D.ADSB.070(a).1.2(e)	D.1.12 (Definition) GNSS Time of Applicability.
Time of Measurement to Time of Applicability	The time when the position output from the GNSS sensor is applicable.
Applicability: ETSO-C129a (JTSO-C129a)	D.1.13 (Definition) GNSS Time of Measurement (TOM).
The intent of this qualification is to ensure that position and related quality indicator information are related to the same time of	The time when the last GNSS signal used to determine the position arrives at the aircraft GNSS antenna.
applicability in a consistent manner.	B.3.13 (Position Source Qualification - General) Positon, Velocity, and Accuracy Time of Applicability.
Based on the particular receiver design, GNSS equipment manufacturers should use a manufacturer-defined test, and/or analysis to	For each position output by the source, a velocity, horizontal position accuracy metric, and horizontal velocity accuracy metric must also
determine the latency between the time satellite measurements are collated for processing and the time the equipment calculates a	be output. All measurements and metrics must have the same time of applicability. A horizontal position integrity metric must also be
filtered (impulse response) position solution. The equipment should meet a 500-millisecond time of measurement to time of applicability	output, but its time of applicability may lag the position. Refer to TSO-C145, TSO-C146, or TSO-C196 for additional information on the
requirement and account for the impulse response of the position solution.	integrity time to alert.
Note: Whilst CS ACNS.D.ADSB does not establish requirements on the time of measurement, the above qualification has been	B.4.13 (Position Source Qualification - GNSS) Time of Applicability.
incorporated to ensure consistency with FAA AC 20-165A [CS latency measurement is from the TOA, whereas, § 91.227 latency	The GNSS equipment must output a time of applicability.
measurement is from the TOM (adds an additional 0.5 seconds)] .	Note: The intent is to output position, velocity, and HFOM with a consistent time of applicability (refer to RTCA/DO-229D, sections 2.1.2.6
	and 2.1.2.6.2).
	B.4.13.2 (Position Source Qualification - GNSS - TOA) TSO-C129a.
	Means of compliance for this ISO require GNSS manufacturers to use a manufacturer-defined test and/or analysis to determine the
	latency between the time satellite measurements are collated for processing and the time the equipment calculates a filtered (impulse
	response) position solution. The equipment must meet a SUU-millisecond TOM-to-time-or-applicability requirement and account for the
	Impulse response of the position solution.
	C.3.1 (Latency Analysis) Position Source.
	we recommend using position sources where the latency of the position, velocity, and position accuracy metrics are less than of edual to
	So in setween the position row and the position time of applications (LS and that the position is output in loss than 200 ms offset he
	deterty measurement is from the row (adds on dualitointic) seconds), and the position is obtained the resonance and a second of the row (adds on dualitointic) seconds), and the position is obtained and additional and additional and the position is obtained and additional and the row (adds of the row (adds of the row (adds of the row (add))).
	with a second quidance/CS-ACNSI
	Note: All revisions of TSO-C145, TSO-C146, and TSO-C196 equipment meet these recommendations
	C 4 1 2 (Latency Analysis - Recommendations for Reducing Latency) Lise a SO-C145 TSO-C146 or TSO-C196 position source (any
	Additional Guidance not Addressed in CS-ACNS
	B.4.13.1 (Position Source Qualification - GNSS - TOA) TSO-C129 [TSO-C129a is the minimum in CS-ACNS].
	Means of compliance for this TSO require GNSS manufacturers to use a manufacturer-defined test and/or analysis to determine the
	latency between the time satellite measurements are collated for processing and the time the equipment calculates a filtered (impulse
	response) position solution. For example; the receiver does not make observations at a single moment in time but instead staggers them,
	perhaps to reduce throughput. In that case, the observations would need to be extrapolated to a common moment. There are many
	extrapolation methods but some use filtering that may induce latency. This would need to be addressed in the latency analysis. Since
	there are filters involved, measuring the impulse response may be one way or observing this delay. Furthermore, as another example; a
	receiver uses a Costas filter that has a specific bandwidth as part of the tracking loop. I hat bandwidth constrains the speed at which a
	aynamic maneuver wiii propagate through the tracking loop and thus to the resulting position. Again, measuring the impulse response of
	the Costa loop would provide insight into deray that would be observed when instance, bearing this in mind, the equipment must meet a EQC millioreand TOM to time of applicability requiring and applicative would be used in the response of the precision solution.
	sou-minisecond row-to-time-or-applicability requirement and account for the impuse response of the position solution.
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1.
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C sections 2.1.2.6 and 2.1.2.6.2.
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C sections 2.1.2.6 and 2.1.2.6.2. B.4.13.4 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 2/3.
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C sections 2.1.2.6 and 2.1.2.6.2. B.4.13.4 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 2/3.
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C sections 2.1.2.6 and 2.1.2.6.2. B.4.13.4 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2. B.4.13.5 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2. B.4.13.5 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2.
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C sections 2.1.2.6 and 2.1.2.6.2. B.4.13.4 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2. B.4.13.5 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.5 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1.
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C sections 2.1.2.6 and 2.1.2.6.2. B.4.13.4 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2. B.4.13.5 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 2/3.
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C sections 2.1.2.6 and 2.1.2.6.2. B.4.13.4 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2. B.4.13.5 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2 B.4.13.7 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2 B.4.13.7 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C sections 2.1.2.6 and 2.1.2.6.2. B.4.13.4 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2. B.4.13.5 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2 B.4.13.7 (Position Source Qualification - GNSS - TOA) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-236 sections 2.1.2.6, 2.1.2.6.2 B.4.13.7 (Position Source Qualification - GNSS - TOA) TSO-C196/196a.
	B.4.13.3 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C sections 2.1.2.6 and 2.1.2.6.2. B.4.13.4 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6, 2.1.2.6.2, and 2.1.5.8.2. B.4.13.5 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6 and 2.1.2.6.2. B.4.13.6 (Position Source Qualification - GNSS - TOA) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6, and 2.1.5.8.2 B.4.13.7 (Position Source Qualification - GNSS - TOA) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, sections 2.1.2.6 and 2.1.2.6.2.

Time of Applicability to Time of Output	C.2.1 (Latency Analysis) Position Source Latency Considerations.
Applicability: ETSO-C129a (JTSO-C129a)	In general, the latency information should be generated by the position source manufacturer and presented as part of the latency analysis.
The GNSS equipment manufacturer should document the position source latency from time of applicability to time of position output [CS	The latency measurement should begin at the TOM [CS latency measurement is from the TOA, whereas, § 91.227 latency measurement
latency measurement is from the TOA, whereas, § 91.227 latency measurement is from the TOM (adds an additional 0.5 seconds)]. If	is from the TOM (adds an additional 0.5 seconds)] and end when the position is output from the position source.
this latency exceeds 0.4 seconds [Clarification - 200ms for the GNSS receiver output and 200ms for getting the information to the	B.3.12 (Position Source Qualification - General) Position Source Latency.
transponder interface consistent with AC 20-1651. It may not support the 1.5-second total ADS-B transmission latency at the aircraft leve	The position source manufacturer must provide position source latency information. Specifically, the manufacturer must provide the
(refer also to AMC1 ACNS.D.ADSB.115) /CS latency measurement is from the TOA (total 1.5 sec. requirement), whereas, § 91.227 latency	amount of position source total latency and uncompensated latency. Because the latency requirements are based on the entire ADS-B
measurement is from the TOM (adds an additional 0.5 seconds - total 2 sec. requirement)].	OUT system, and not just the position source, the following position source latency targets are only guidelines. Position source
	uncompensated latency should be less than 200 ms, compensated latency should be less than 500 ms, and total latency should be less
	than 700 ms (ronsistent with the TSO with an additional 200ms to get the information to the transnonder consistent with 0.9 second
	auidance / [S-ACNS]
	Note 1: System latency requirements are described in section 3.1.3 and Annendiy C of this AC
	Note 1: Optimizerity requirements are declared in Section SEC and Appendix Contrasted.
	A 2 Decision Source Qualification (GNS) Pacifico Source Latency
	B.H.Z. (Fostion source qualification - Girss) Fostion Source Latercy.
	24.2.1 (Decision Source Auroliticities inductive position source latency information.
	B.4.2.1 (Position Source Qualification - GNSS - Position Source Latericity) ISO-CL29 is the minimum in CS-ACMSJ.
	Means of compliance for this 150 require GNSS manufacturers to document the position source latency from time of measurement (10M)
	to time of position output, in this latency exceeds 0.5 seconds Clarify Internet Seconds to get the information to the transponder],
	It may not support the z-second ADS-B transmission latency at the articlat level.
	B.4.2.2 (Position Source Qualification - GNSS - Position Source Latency) ISU-CL29a.
	Means of compliance for this ISO require GNSS manufacturers to document the position source latency from IOM to time of position
	output [CS latency measurement is from the IOA, whereas, § 91.227 latency measurement is from the IOM (adds an additional 0.5
	seconds]]. If this latency exceeds 0.9 seconds [Clarification - includes 200ms to get the information to the transponder], it may not
	support the 2-second ADS-B transmission latency [CS latency measurement is from the TOA (total 1.5 sec. requirement), whereas, §
	91.227 latency measurement is from the TOM (adds an additional 0.5 seconds - total 2 sec. requirement)] at the aircraft level.
	Additional Guidance not Addressed in CS-ACNS
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 and 2.1.5.8.2.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.1.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in the latency analysis or use actual latency information generated by the GNSS manufacturer to determine the position source maximum total latency and uncompensated latency. If the GNSS equipment is classified as Class 3 pursuant to any
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C146 GNSS. Use the TSO latency standards in th
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in th
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	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C146/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C146/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO la
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in the latency analysis or use actual latency information generated by the GNSS manufacturer to determine the position source maximum total latency and uncompensated latency. If the GNSS equipment is classified as Class 3 pursuant to any revision of TSO-C145
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in the latency and uncompensated latency. If the GNSS equipment is classified as Class 3 pursuant to any revision of TSO-C145, there are tighter latency standards for the LPV modes. If the Class 3 standard is implemented across all modes, the tighter latency numbers may be us
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2 C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C149 GNSS. Use the TSO latency standards in the latency analysis or use actual latency information generated by the GNSS manufacturer to determine the position source maximum total latency and uncompensated latency. If the GNSS equipment is classified as Class 3 pursuant to any revision of TSO-C129 GNSS.
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in the latency analysis or use actual latency information generated by the GNSS manufacturer to determine the position source maximum total latency and uncompensated latency. If the GNSS equipment is classified as Class 3 pursuant to any revision of TSO-C145, there are tighter latency stand
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-329D, section 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C149/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in the latency analysis or use actual latency information generated by the GNSS manufacturer to determine the position source maximum total latency atomates for the LPV modes. If the Class 3 standard is implemented across all modes, the tighter latency numbers may be used;
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-210, section 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in the latency and uncompensated latency. If the GNSS equipment is classified as Class 3 pursuant to any revision of TSO-C145, there are tighter latency standards for the LPV modes. If the Class 3 standard is implemented across all modes, the tighter latency num
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-2196 (Source 2.1.2.6.2) C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in the latency and uncompensated latency. If the GNSS equipment is classified as Class 3 pursuant to any revision of TSO-C145, there are tighter latency and ands for the LPV modes. If the Class 3 standard is implemented across all modes, the tig
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2 and 2.1.5.8.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6.2 B.4.2.6 (Position Source Rulaing the Intercy analysis or use actual latency information generated by the GNSS manufacturer to determine the position source maximum total latency analysis or use actual latency information generated by the GNSS manufacturer to determine the position source maximum total latency standards for the LPV modes. If the Class 3 st
	Additional Guidance not Addressed in CS-ACNS B.4.2.3 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6.2. B.4.2.4 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229C, sections 2.1.2.6.2 and 2.1.5.8.2. B.4.2.5 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6.2. B.4.2.6 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2. B.4.2.7 (Position Source Qualification - GNSS - Position Source Latency) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.2.6.2. C.2.1.1 (Latency Analysis) TSO-C145, TSO-C146, and TSO-C196 GNSS. Use the TSO latency standards in the latency analysis or use actual latency information generated by the GNSS manufacturer to determine the position source maximum total latency analysis or the L2PV modes. If the Class 3 standard is implemented across all modes, the tighter latency numbers may b

	C.2.1.4 Other Position Sources [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)].
	Total and uncompensated latency information should be generated by the position source manufacturer and included as part of the
	latency analysis.
Time Mark	B.3.14 (Position Source Qualification - General) Time Mark.
Applicability: ETSO-C129a (JTSO-C129a), ETSO-C196a, ETSO-C145()/C146()	Position sources should output a time mark identifying the Coordinated Universal Time (UTC) time of applicability of the position. The
If the use of the time mark to reduce latency is implemented in the ADS-B Out system, GNSS equipment manufacturers should provide	time mark can be used by the ADS-B equipment to reduce uncompensated latency.
installation instructions describing how the time mark relates to the time of applicability of the position, velocity, and related quality	B.4.19 (Position Source Qualification - GNSS) Time Mark.
indicator information.	GNSS position sources should output a UTC time mark identifying time of applicability with the successive position outputThe time mark
	can be used by the ADS-B equipment to reduce uncompensated latency.
	C.4.1.4 (Latency Analysis - Recommendations for Reducing Latency) Use the GNSS time mark in TSO-C166b systems to reduce position
	source and intermediary device uncompensated latency. (Use of the GNSS time mark is required by TSO-C154c [CS only recongnizes
	1090 ES for the ADS-B Out data link])
	B.4.19.2 (Position Source Qualification - GNSS - Time Mark) TSO-C129a.
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing how the time mark relates to
	the position, velocity, FOM, and time of applicability.
	B.4.19.3 (Position Source Qualification - GNSS - Time Mark) TSO-C145/146 Rev a Class 1.
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing how the time mark relates to
	the position, velocity, FOM, and time of applicability.
	B.4.19.4 (Position Source Qualification - GNSS - Time Mark) TSO-C145/146 Rev a Class 2/3.
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing how the time mark relates to
	the position, velocity, FOM, and time of applicability.
	B.4.19.5 (Position Source Qualification - GNSS - Time Mark) TSO-C145/146 Rev b/c/d Class 1.
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing how the time mark relates to
	the position, velocity, FOM, and time of applicability.
	B.4.19.6 (Position Source Qualification - GNSS - Time Mark) TSO-C145/146 Rev b/c/d Class 2/3.
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing how the time mark relates to
	the position, velocity, FOM, and time of applicability.
	B.4.19.7 (Position Source Qualification - GNSS - Time Mark) TSO-C196/196a.
	Means of compliance for this TSO require GNSS manufacturers to provide installation instructions describing how the time mark relates to
	the position, velocity, FOM, and time of applicability.
	Additional Guidance not Addressed in CS-ACNS
	B.4.11 (Position Source Qualification - GNSS - Horizontal Velocity) The position source must output north/south and east/west velocities.
	It is recommended the position source also output the velocity in a ground speed and track angle format.
	Note: The intent is to output position, velocity, and quality metrics in a consistent manner for time of applicability (refer to RTCA/DO-229D,
	sections 2.1.2.6 and 2.1.2.6.2).
	B.4.11.1.1 (Position Source Qualification - GNSS - Horizontal Velocity) ISO-C129 [ISO-C129a is the minimum in CS-ACNS].
	Means of compliance for this TSO require GNSS manufacturers to perform the velocity test in AC 20-138(), appendix 4 and provide
	information substantiating the data is output.
	B.4.11.1.2 (Position Source Qualification - GNSS - Horizontal Velocity) TSO-C129a.
	Means of compliance for this TSO require GNSS manufacturers to perform the velocity test in AC 20-138(), appendix 4 and provide
	information substantiating the data is output.
	B.4.11.1.3 (Position Source Qualification - GNSS - Horizontal Velocity) ISO-C145/146 Rev a Class 1.
	Means of compliance for this TSO are defined in RTCA/DO-229C, section 2.1.2.6 along with the test defined in AC 20-138(), appendix 4.
	P. 4.4.4.4.4. (Decision Course Overlife entropy CNCC, University) (decish) TCO C445 (446 Device Clear 2/2
	B.4.11.1.4 (Position Source Qualification - GNSS - Horizontal velocity) ISU-C145/146 KeV a Class 2/3.
	means of compliance for this roo are defined in KTCAyDO-222C, section 2.1.2.6 along with the test defined in AC 20-138(), appendix 4.
	R 4 11 1 5 (Position Source Qualification - GNSS - Horizontal Velocity) TSQ-C145/146 Rev h/c/d Class 1
	Mapro formaliance for this CO are defined in BTCA/DO.2000 sertion 2.1.2.6. The TSO requirement is only to output velocity, but there
	is no accuracy requirement. Satisfying this IDSR requirement means the GNSS manufacturer must also comply with the horizontal
	velocity accuracy requirements and tests described in AC 20-138(), appendix 4.

	B.4.11.1.6 (Position Source Qualification - GNSS - Horizontal Velocity) TSO-C145/146 Rev b/c/d Class 2/3.
	Means of compliance for this TSO are defined in RTCA/DO-229D, section 2.1.2.6. The TSO requirement is only to output velocity, but there
	is no accuracy requirement. Satisfying this ADS-B requirement means the GNSS manufacturer must also comply with the horizontal
	velocity accuracy requirements and tests described in AC 20-138(), appendix 4.
	B.4.11.1.7 (Position Source Qualification - GNSS - Horizontal Velocity) TSO-C196/196a.
	Means of compliance for this TSO are defined in RTCA/DO-316, section 2.1.2.6. The TSO requirement is only to output velocity, but there
	is no accuracy requirement. Satisfying this ADS-B requirement means the GNSS manufacturer must also comply with the horizontal
	velocity accuracy requirements and tests described in AC 20-138(), appendix 4.
	Note: The velocity test found in AC 20-138() is also defined in section 2.3.6.4 of RTCA/DO-316.
(d) Horizontal Velocity Accuracy — AMC1 ACNS.D.ADSB.070(a).1.2(f)	B.4.14 (Position Source Qualification - GNSS) Velocity Accuracy.
Environmental Noise Test Conditions:	The GNSS position source manufacturer must provide design data to assist the installer in setting the NAC _v . Scaling the reported GNSS
Applicability: ETSO-C129a, ETSO-C145()/C146() (JTSO-C145/C146)	position accuracy (HFOM and VFOM) is not an acceptable means to determine NAC
For equipment that was not required to meet the environmental noise standard prescribed by DO-235B, the velocity tests in AC 20-138B,	B 4 14 5 (Position Source Qualification - GNSS - Velocity Accuracy) TSQ-C129a
Appendix 4 use environmental noise test conditions that may cause the equipment to stop functioning, i.e. to lose satellite acquisition and	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the NAC =1 and NACV = 2 test as
tracking capability that causes the equipment to stop outputting velocity. Whilst this contributes to an ADS-B availability issue for	$r_{\rm ext}$ and $r_{\rm ext}$ a
operators, this loss of function will not prevent the equipment from being used as an ADS-B velocity input, provided:	appropriate and document the NACV in the installation instituctions for the ZOS integration. Neter to $Ac 20150()$ appendix 4, section A4-
(1) the equipment does not output misleading velocity information at or after the onset of the triggering interference levels; and	20(5) for additional guidance relative to using the holse environment in KTCA/DO-255() for the velocity tests.
Note: A method to accomplish this is first running the test at the higher noise level to ensure there is no misleading velocity information at	
loss of function before running the complete test at the lower noise level	
(2) the equipment manufacturer should state that the equipment meets the noise requirements in DO-235B	
If the advance conditions are met the velocity tests in Annendix 4 of ΔC 20-1388 (see below for NACy=1 and NACy=2 cases) can be run using	
an interference level that does not cause the equinent to lose acquisition and tracking	
ADS-B Out system installations intending to support NACy = 1:	B.4.14.1 (Position Source Qualification - GNSS - Velocity Accuracy) NACV = 1.
Annlicability: FTSO-C129a (ITSO-C129a) FTSO-C1496a FTSO-C145()/146()	Ear installations intending to support NACV = 1 the GNSS manufacturer must perform the velocity tests in AC 20-138D appendix 4 section
The GNSS equipment manufacturer should before the velocity tests in Appendix 4 of $4C$ 20-1388 associated with NACy = 1 to	$\Delta 4.1$ through $\Delta 4.3$ associated with $\Delta CV = 1$. The GNSS manufacturer must indicate that the equipment satisfies the requirements for
substantiate the equipment memory subjects in the closely case in ppendix is the 2020 associated in the construction of the	NACV = 1 in the installation instructions for the ADS-R integration
The GNSS equipment manufacturer should indicate that the equipment satisfies the requirements for NAC $y = 1$ in the instructions for the	R 4 14 2 (Position Source Qualification - GNSS - Velocity Accuracy) NACV = 2
ANS-R Integration	Explosition intending to support NACV = 2 the GNSS manufacturer must perform the velocity tests in AC 20-138D appendix 4
ADS P Out system installations intending to support NACy = 2:	For instantions interlined to support twee -2 , the dynamic and the function in the velocity tests in A 20 -300, appendix 4, excitons A 1 through A 1 occident with NACV - 1 and NACV - 2. The GNS manufactures must present substantiation data that the
Abstraction instantations interaction appoint the -2 .	sections A+1 in ough A+5 associated with NACV = 1 and NACV = 2. The dross manufacturer must present substantiation data that the organisment drossing organism with REGMA and VEGMA (refer to AC 20.1290), appendix 4, continer AA 5, and AA 9) and that the argument
Applicability, close-closed (130-closed), close-close, close-closed, the optimized in the strength of the content of the conte	equipment dynamically outputs in only and violity (see to AC 200136), appendix 4, sections A+3 and A+3) and that the equipment v_{i} sections A+3 and A+3) and that the equipment
The GNDS equipment manufacturer should substantiate that the equipment dynamically outputs Proviv and Vroiviv and perform the	velocity and accuracy outputs have passed the velocity tests associated with MACV = 1 and MACV = 2. The GNDS manufacturer must
velocity tests in AC 20-138C Appendix 4 associated with NACV = 1 and NACV = 2 to Substantiate the equipment's velocity output.	indicate that the equipment satisfies the requirements for NACV = 2 in the installation instructions for the ADS-B integration.
The GNSS equipment manufacturer should indicate that the equipment satisfies the requirements for NACV = 2 in the instructions for ADS-	B.4.14.3 (Position Source Qualification - GNSS - velocity Accuracy) $NAC_V = 3$ or 4.
B Out system integration.	No standard for performance has been developed to support NACV = 3 or NACV = 4. A NACV = 3 or NACV = 4 should not be set based on
	GNSS velocity accuracy unless you can demonstrate to the FAA that the error contributions have been adequately modeled to meet those
	levels of performance.
	B.4.14.4 (Position Source Qualification - GNSS - Velocity Accuracy) TSO-C129 [TSO-C129a is the minimum in CS-ACNS] .
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the NACV = 1 and NACV = 2 test as
	appropriate and document the NACV in the installation instructions for the ADS-B integration. Refer to AC 20-138(), appendix 4, section
	A4-2d(3) for additional guidance relative to using the noise environment in RTCA/DO-235B for the velocity tests.
	B.4.14.5 (Position Source Qualification - GNSS - Velocity Accuracy) TSO-C129a.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the NACV =1 and NACV = 2 test as
	appropriate and document the NACV in the installation instructions for the ADS-B integration. Refer to AC 20-138() appendix 4, section A4-
	2d(3) for additional guidance relative to using the noise environment in RTCA/DO-235() for the velocity tests.

ADS-B Out system installations intending to support NACv = 1: (cont.)	B.4.14.6 (Position Source Qualification - GNSS - Velocity Accuracy) TSO-C145/146 Rev a Class 1.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the NACV = 1 and NACV = 2 test as
	appropriate and document the NACV in the installation instructions for the ADS-B integration.
	B.4.14.7 (Position Source Qualification - GNSS - Velocity Accuracy) TSO-C145/146 Rev a Class 2/3.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the NACV =1 and NACV = 2 test as
	appropriate and document the NACV in the installation instructions for the ADS-B integration.
	B.4.14.8 (Position Source Qualification - GNSS - Velocity Accuracy) TSO-C145/146 Rev b/c/d Class 1.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the NACV = 1 and NACV = 2 test as
	appropriate and document the NACV in the installation instructions for the ADS-B integration.
	B.4.14.9 (Position Source Qualification - GNSS - Velocity Accuracy) TSO-C145/146 Rev b/c/d Class 2/3.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the NACV = 1 and NACV = 2 test as
	appropriate and document the NACV in the installation instructions for the ADS-B integration.
	B.4.14.10 (Position Source Qualification - GNSS - Velocity Accuracy) TSO-C196/196a
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data based on the NACV = 1 and NACV = 2 test as
	appropriate and document the NACV in the installation instructions for the ADS-B integration.
	Additional Guidance not Addressed in CS-ACNS
	B.4.12 (Position Source Qualification - GNSS) Ground Speed.
	It is recommended that the position source output ground speed. GNSS manufacturers choosing to output ground speed may snow
	compliance as described below for the appropriate ISO.
	B.4.12.1 (Position Source Qualification - GNSS - Ground Speed) ISU-CL29 (ISU-CL29 as it for minimum in CS-ACNS).
	Means of compliance for this ISO require GNSS manufacturers to provide mormation in the installation instructions describing now the indestruction structure is a considered according to the provide mormation in the installation instructions describing now the
	Velocity is output (that is, in a ground spectroninat versus north/east velocity normat) and the protocols used.
	B-4.12.2 (Fostion source quantization - Gross - Ground speed) 150-C12.24.
	velocity is output (that is in a ground speed format varius porth (act velocity format) and the protocols used
	R 4 12 3 (Position Source Qualification - GNSS - Ground Speed ToD-C145/146 Rev a Class 1
	The Gamma equipment requirements outlined in $RTCA/DO-229C$ section 2.2.1.4.10 for the display resolution of ground speed are
	insufficient to show ADS-B compliance. A recommendation for
	GNSS manufacturers on label 103 and label 112 can be found in RTCA/DO-229D, appendix H. Additional means of compliance for TSO-
	C145/146 Rev a Class 1 require GNSS manufacturers to provide information in the installation instructions describing how the velocity is
	output (that is, in a ground speed format versus north/east velocity format) and the protocols used.
	B.4.12.4 (Position Source Qualification - GNSS - Ground Speed) TSO-C145/146 Rev a Class 2/3.
	The Gamma equipment requirements outlined in RTCA/DO-229C, section 2.2.1.4.10 for the display resolution of ground speed are
	insufficient to show ADS-B compliance. A recommendation for
	GNSS manufacturers on label 103 and label 112 can be found in
	RTCA/DO-229D, appendix H. Additional means of compliance for TSO-C145/146 Rev a Class 2/3 require GNSS manufacturers to provide
	information in the installation instructions describing how the velocity is output (that is, in a ground speed format versus north/east
	velocity format) and the protocols used.
	B.4.12.5 (Position Source Qualification - GNSS - Ground Speed) TSO-C145/146 Rev b/c/d Class 1.
	Gamma-1 equipment requirements outlined in RTCA/DO-229D,
	section 2.2.1.4.10 for the display resolution of ground speed are insufficient to show ADS-B compliance. A recommendation for GNSS
	manufacturers on label 103 and label 112 can be found in
	RTCA/DO-229D, appendix H. Additional means of compliance for TSO-C145/146 Rev b/c/d Class 1 require GNSS manufacturers to provide
	information in the installation instructions describing how the velocity is output (that is, in a ground speed format versus north/east
	verocity romatij and the protocols USe0. Di 4.4.2.6 (Docision Severo Qualification _CNSC_Crowned Encody TSO_C145/146 Row k/c/d Class 3/2
	p.4.12.0 (Fusition source Qualification - GNSS - Ground Speed) 150-C145/146 Kev D/C/d Class 2/3.
	Variante 2 and variation 2 of 14 40 for the display receiving a forward speed are insufficient to show APS P compliance. A
	recomposition for GNES manufactures on label 102 and label 112 can be found.
	recommendation for Gross manufacturers on laber 125 and laber 121 and le round
	in more yes table, appendix it. Additional means or compliance for 130-140 rev 0/04 class 2/3 require onso illialidatule's to provide information in the installation instructions describing how the velocity is output (that is in a ground speed formativersus
	north/east velocity format) and the protocols used

	B.4.12.7 (Position Source Qualification - GNSS - Ground Speed) TSO-C196/196a.
	Means of compliance for this TSO require GNSS manufacturers to provide information in the installation instructions describing how the
	velocity is output (that is, in a ground speed format versus north/east velocity format) and the protocols used. A recommendation for
	Gives manufacturers on laber 103 and laber 112 can be round in RTCA/DO-316, appendix H.
Track Angle Validity:	B.4.18 (Position Source Qualification - GNSS) Track Angle Validity.
Applicability: ETSO-C129a (JTSO-C129a), ETSO-C196a, ETSO-C145()/146()	GNSS position sources can provide a track angle; however, the GNSS track angle may become invalid below a certain velocity. Optimally,
Using test and/or analysis for substantiation data, GNSS manufacturers should provide instructions for the ADS-B Out system integrator	the position source should either invalidate or remove the track angle when it is no longer valid. If the position source does not invalidate
indicating when the track angle 95 % accuracy, when derived from north/east velocity, exceeds plus/minus 'eight' degrees. It is acceptable	the track angle or remove the track angle when it is potentially invalid, the position source manufacturer must provide information on
for the instructions to state that the track angle does not meet the required accuracy below a specified speed.	velocity limitations for GNSS track angle.
Note 1: Track Angle Validity is only an issue at taxiing speeds. Thereby, only along-track acceleration (0.58g) and jerk (0.25g/sec) are	Note: The interference levels used to demonstrate velocity accuracy compliance can be used for track angle validity as well.
assumed to apply.	B.4.18.1 (Position Source Qualification - GNSS - Track Angle Validity) TSO-C129 [TSO-C129a is the minimum in CS-ACNS].
Note 2: Use should be made of the test environment specified in Appendix 4 of AC 20-138B. The interference levels used to demonstrate	Means of compliance for TSO-C129 require GNSS manufacturers
velocity accuracy compliance can be used for true track angle validity testing as well.	to use the test environment and guidance defined in AC 20-138(), appendix 4, section 4-12. It is recommended that manufacturers use
	RTCA/DO-229D, appendix H for outputting track angle (ARINC 743 all revisions, label 103) for those using ARINC 429 characteristics.
	B.4.18.2 (Position Source Qualification - GNSS - Track Angle Validity) TSO-C129a.
	Means of compliance for ISO-C129a require GNSS manufacturers
	to use the test environment and guidance defined in AC 20-138(), appendix 4, section 4-12. It is recommended that manufacturers use
	RTCA/D0-223D, appendix n for outputting track angle (AKINC 743 all revisions, label 103) for those using AKINC 429 characteristics.
	D.4. Jo.5 (FOSIIIO) SOULCE QUAIILICATION - GISS - Hack Alige Valuary) ISO-C145/140 Nev a Class 1. Maans of compliance for TSO-C145/146 Bev a Class 1 radius
	α can be compared to 150 C140 440 keV and α cass in equation (GMSS manufacturers to use the test environment and guidance defined in ΔC 20-138() annendiv A section 4-12. It is recommended that
	manufacturers use RTCA/DO-229C, appendix H for outputting track angle (ARINC 743 all revisions, label 103) for those using ARINC 429
	characteristics.
	B.4.18.4 (Position Source Qualification - GNSS - Track Angle Validity) TSO-C145/146 Rev a Class 2/3.
	Means of compliance for TSO-C145/146 Rev a Class 2/3 require GNSS manufacturers to use the test environment and guidance defined in
	AC 20-138(), appendix 4, section 4-12. It is recommended that manufacturers use RTCA/DO-229C, appendix H for outputting track angle
	(ARINC 743 all revisions, label 103) for those using ARINC 429 characteristics.
Track Angle Validity: (cont.)	B.4.18.5 (Position Source Qualification - GNSS - Track Angle Validity) TSO-C145/146 Rev b/c/d Class 1.
Applicability: ETSO-C129a (ITSO-C129a), ETSO-C145 ()/146()	Means of compliance for TSO-C145/146 Rev b/c/d Class 1 require GNSS manufacturers to use the test environment and guidance defined
Using test and/or analysis for substantiation data, GNSS manufacturers should provide instructions for the ADS-B OUT system integrator	In AC 20-138(), appendix 4, section 4-12. It is recommended that manufacturers use RTCA/DO-229D, appendix H for outputting track
Indicating when the track angle 55 % accuracy, when derived from northylast velocity, exceeds pusyminus eight degrees. It is acceptable for the instructions to state that the track angle does not meet the required sources the holdway associated end	angle (AKINC / 43 all revisions, label 103) for those using AKINC 429 characteristics.
Note 1: Track Angle Validity is only an issue at taxing energy. Thereby, only along track are aspectice used and int (0.25g/sec) are	D.4. Job. (POSITION DURING QUAINLATION - GNOS - Hack Artigle Validity) 150-C145/140 Rev D/C/U Class Z/S. Means of compliance for this FSD requires GNSs manufacturers to use the test environment and midance defined in AC 20-138/L anneadix.
assumed to analy	A section 4.12. It is recommended that manifacturers use BTC 4/00-2290, annendiv H for outputting track angle (ABIV) 743 all revisions
Note 2: Use should be made of the test environment specified in Appendix 4 of AC 20-1388. The interference levels used to demonstrate	a) section 4 is in the resonance of the main maintenance of the main of the 2000, appendix in the outpercent of the main maintenance of the main of the 2000, appendix in the outpercent of the maintenance
velocity accuracy compliance can be used for true track angle validity testing as well.	B.4.18.7 (Position Source Qualification - GNSS - Track Angle Validity) TSO-C196/196a.
	Means of compliance for this TSO require GNSS manufacturers, using test or analysis to use the test environment and guidance defined in
	AC 20-138(), appendix 4 section 4-12. It is recommended that manufacturers use RTCA/DO-316, appendix H for outputting track angle
	(ARINC 743 all revisions, label 103) for those using ARINC 429 characteristics.
	Additional Guidance not Addressed in CS-ACNS
	B.3.10 (Position Source Qualification - General) Geometric Altitude.
	The position source must have a geometric altitude output. The geometric altitude must be referenced to the WGS-84 ellipsoid.
	15.4.3 (POSition Source Qualinication - GNSS) Geometric Altitude.
	Air once position sources must output a geometric altitude, deometric altitude for Abs-8 purposes is the neighf above the WGS-84 official (basis) is a table). We recommend that the GNS position source output scenario altitude of
	pempara (inde is) is in the map. We recommend that the ensarpointed to the dupling geometric altitude as Haight-bhowe-Ellinosid (HAF). Some GNSS notition sources provide Height-bhowe-Genid (HAG) instead of HAF. The position source
	manifacturer must novide data on whether the notions source surfault HAF or HAG
	R4.9.1 (Position Source Qualification - GNSS - Geometric Altitude) TSQ-C129 ITSQ-C129a is the minimum in CS-ACNSI
	Means of compliance for this TSO require GNSS manufacturers to provide data to substantiate the output of HAE. The data produced to
	substantiate vertical position accuracy pursuant to the test described in AC 20-138(), appendix 4, section A4-10 is sufficient. For GPS
	equipment that outputs other altitude measures, the installation instructions must specify a deterministic method to perform conversion
	to HAE.

	B.4.9.2 (Position Source Qualification - GNSS - Geometric Altitude) TSO-C129a.
	Means of compliance for this TSO require GNSS manufacturers to provide data to substantiate the output of HAE. The data produced to
	substantiate vertical position accuracy pursuant to the test described in AC 20-138(), appendix 4, section A4-10 is sufficient. For GPS
	equipment that outputs other altitude measures, the installation instructions must specify a deterministic method to perform conversion
	to HAE.
	B.4.9.3 (Position Source Qualification - GNSS - Geometric Altitude) TSO-C145/146 Rev a Class 1.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing the equipment outputs HAF. The
	data produced to substantiate vertical position accuracy nursuant to the test described in $\Delta C 20.138()$ appendix 4 section $\Delta 4.10$ is
	and a produce to substantiate vertical position accuracy pursuant to the test described in Ac 20-150(), appendix 4, section A+ 10 is
	sumcrem.
	5.4.3.4 (Position source Quannation - Gross - Geometric Antique) 100-0143 (140 nev a Class 27.5.
	For class 2 equipment, the means of compliance for this ISO require GNSS manufacturers to provide substantiation data showing the
	equipment outputs HAE. The data produced to substantiate vertical position accuracy pursuant to the test described in AC 20-138(),
	appendix 4, section A4-10 is sufficient. Class 3 equipment complies with the ADS-B geometric altitude requirement pursuant to RTCA/DO-
	229C, section 2.1.5.8.
	B.4.9.5 (Position Source Qualification - GNSS - Geometric Altitude) TSO-C145/146 Rev b/c/d Class 1.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing the equipment outputs HAE. The
	data produced to substantiate vertical position accuracy pursuant to the test described in AC 20-138(), appendix 4, section A4-10 is
	sufficient.
	B.4.9.6 (Position Source Qualification - GNSS - Geometric Altitude) TSO-C145/146 Rev b/c/d Class 2/3.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing the equipment outputs HAE. The
	data produced to substantiate vertical position accuracy pursuant to the test described in AC 20-138(), appendix 4, section A4-10 is
	sufficient.
	B.4.9.7 (Position Source Qualification - GNSS - Geometric Altitude) TSO-C196/196a.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data showing the equipment outputs HAE. The
	data produced to substantiate vertical position accuracy pursuant to the test described in AC 20-138(). appendix 4. section A4-10 is
	sufficient.
(e) Geometric Altitude Accuracy (VFOM) — AMC ACNS.D.ADSB.085	B.3.3 (Position Source Qualification - General) Position Accuracy (Vertical)
Applicability: ETSO-C129a (JTSO-C129a), ETSO-C196a, ETSO-C145()/146()	The position source should output a vertical position accuracy metric. The vertical position accuracy metric must have been qualified
GNSS equipment manufacturers should provide substantiation data showing if and how the equipment computes and outputs VEOM. If	during the system's TSOA or design approval. This output must describe the vertical position accuracy with 95 percent probability under
VEOM is output the following criteria for an accentable HAE-referenced geometric altitude output and its associated VEOM accuracy	fault-free conditions
metric are recommended to be applied.	8.4.15 (Position Source Qualification - GNSS) Vertical Position Accuracy
(1) The HAE output should be calculated using the general least squares notition solution of DO-229D Appendix I 1 (or any mathematically	The GNSS should output vertical position accuracy. The vertical accuracy should specify a 95-percent probability bound on the reported
(r) The third output shadow as a state of the generation of the state of the state of the work that the state of the state	we tied a position of the control of
equivalent militat combination of the LNAV($N(A) \neq D$), mere is not execution of the choice of the weight matrix w including non- weighted equivalent the use of the LNAV($N(A) \neq D$). The execution of the choice of the weight matrix w including non-	vertical position. No revisions of 130-0125 of 130-0125 in the vertical actual dy of integrity requirements, and 130-0145 / 140 only has vertical position. No revisions of 130-0125 of 130-0125 make vertical actual dy of integrity requirements is continuously output the
weighted solutions, the use of the LNAV/VNAV, Lr , Lr v approach weight ($W = 1/02$) is optional.	vertical accuracy requirements for certain approach modes. Note of the Gross Joss have a requirement to continuously output the
(2) The final actuality should be tested using the procedure of DO-2220 Section 2.5.6.5. The ord used to compute the variance do 2 should be tested using the procedure of DO-2220 Section 2.5.6.5. The ord used to compute the variance do 2 should be tested using the procedure of DO-2220 Section 2.5.6.5.	vertical position accuracy data. In vertical position accuracy is output, it must have been qualified during design approval of the position
be greater of equal to the ones listed in DO-2239 Appendix 1 when the equiphient uses SBAS-provided integrity and greater of equal to	
the ones listed as an acceptable means for FDE-provided integrity in section 2.1.2.2.2.2 when the equipment does not use SBAS-provided	B.4.15.1 Position Source Qualification - Gives - Vertical Position Accuracy (150-C129 Inso-C129 as the minimum in C-ACINS).
integrity. A fixed sigma of 33.3 m is considered a sufficient over-bound when using FDE-provided integrity. For equipment that uses SAS-	Means of compliance for this ISO require GNSS manufacturers to provide substantiation data along with the VFOM output based on the
provided integrity, testing only in the highest mode attainable for its declared Operational Class as specified in the test itself is acceptable.	test described in AC 20-138(), appendix 4, section A4-10.
(3) The accuracy metric should be greater or equal to 1.96 dU where dU is computed using the same of employed during the HAE accuracy	B.4.15.2 (Position Source Qualification - GNSS - Vertical Position Accuracy) TSO-C129a.
test procedure. General certification substantiation data that the equipment meets this requirement is sufficient; no specific test is	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data along with the VFOM output based on the
required.	test described in AC 20-138(), appendix 4, section A4-10.
	B.4.15.2 (Position Source Qualification - GNSS - Vertical Position Accuracy) TSO-C145/146 Rev a Class 1.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data along with the VFOM output based on the
	test described in AC 20-138(), appendix 4, section A4-10.
	B.4.15.3 (Position Source Qualification - GNSS - Vertical Position Accuracy) TSO-C145/146 Rev a Class 2.
	Means of compliance for this TSO require GNSS manufacturers to provide substantiation data along with the VFOM output based on the
	test described in AC 20-138(), appendix 4, section A4-10.

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), a guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation,	and Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.
 (e) Geometric Altitude Accuracy (VFOM) — AMC ACNS.D.ADSB.085 (cont.) For GPS equipment that outputs altitude references other than HAE whilst the overall ADS-B Out System meets AMC1 ACNS.D.ADSB.085(b), an equivalent data accuracy should be demonstrated. Note 1: The scaling factors for the vertical position accuracy metrics were rounded to 2 decimal places; there is no intention to prohibit the use of a more accurate number. Note 2: The vertical position accuracy metrics listed above are the standard metrics used to provide a minimum of 95 % containment (varying from 95 % to approximately 98.5 % for the vertical metrics) under the assumption that a Gaussian distribution with a sigma of oi over- bounds the error of the range measurements. The use of a general least squares position solution (or mathematically equivalent) results in a single Gaussian distribution for the components (North, East, Up) of the position error. Any accuracy metric that can be mathematically demonstrated to provide a minimum 95 % containment in the position domain under the Gaussian assumption is also acceptable. 	 B.4.15.4 (Position Source Qualification - GNSS - Vertical Position Accuracy) TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO require GNSS manufacturers to provide substantiation data along with the VFOM output based on the test described in AC 20-138(), appendix 4, section A4-10. B.4.15.5 (Position Source Qualification - GNSS - Vertical Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide substantiation data along with the VFOM output based on the test described in AC 20-138(), appendix 4, section A4-10. B.4.15.6 (Position Source Qualification - GNSS - Vertical Position Accuracy) TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO require GNSS manufacturers to provide substantiation data along with the VFOM output based on the test described in AC 20-138(), appendix 4, section A4-10. B.4.15.6 (Position Source Qualification - GNSS manufacturers to provide substantiation data along with the VFOM output based on the test described in AC 20-138(), appendix 4, section A4-10.
	Additional Guidance not Addressed in CS-ACNS
	B.3.7 SIS Error Detection. The position source should provide a means to detect a SIS error when the system uses a SIS. The probability of missed detection for a faulty SIS should be less than 1x10-3. GNSS equipment provides the appropriate SIS error detection. B.4.2 O SIS Error Detection
	The position source should provide a means to detect a SIS error when the system uses a SIS. The probability of missed detection for a faulty SIS should be less than 1x10-3. GNSS equipment provides the appropriate SIS error detection.
	 B.4.20.1 TSO-C129. Means of compliance for this TSO are defined in RTCA/DO-208 change 1, section 2.2.1.13.1, referring to Table 2-1 (refer to Table 2-1, note D). However, TSO-C129 equipment has no requirement for pseudorange step detection. This requires GNSS manufacturers to provide substantiation data documenting that their RAIM algorithm includes pseudorange step detection pursuant to TSO-C129a, section (a)(3)(xv)5.
	B.4.20.2 TSO-C129a. Means of compliance for this TSO are defined in RTCA/DO-208, change 1, section 2.2.1.13.1, referring to Table 2-1 (refer to Table 2-1, note D) and TSO-C129a, section (a)(3)(xv)5.
	B.4.20.3 TSO-C145/146 Rev a Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.1.3 and 2.1.1.5 for SBAS, section 2.1.1.2 for GPS health message, and section 2.1.2.2.2.2 for FDE. Note: The SBAS SIS includes health monitoring/fault information, which is why these general signal processing requirements are included.
	B.4.20.4 TSO-C145/146 Rev a Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.1.3 and 2.1.1.5 for SBAS, section 2.1.1.2 for GPS health message, and section 2.1.2.2.2.2 for FDE. Note: The SBAS SIS includes health monitoring/fault information, which is why these general signal processing requirements are included.
	B.4.20.5 TSO-C145/146 Rev b/c/d Class 1. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.1.3 and 2.1.1.5 for SBAS, section 2.1.1.2 for GPS health message, and section 2.1.2.2.2.2 for FDE. Note: The SBAS SIS includes health monitoring/fault information, which is why these general signal processing requirements are included.
	B.4.20.6 TSO-C145/146 Rev b/c/d Class 2/3. Means of compliance for this TSO are defined in RTCA/DO-229D, sections 2.1.1.3 and 2.1.1.5 for SBAS, section 2.1.1.2 for GPS health message, and section 2.1.2.2.2.2 for FDE. Note: The SBAS SIS includes health monitoring/fault information, which is why these general signal processing requirements are included.
	B.4.20.7 TSO-C196/196a. Means of compliance for this TSO are defined in RTCA/DO-316, sections 2.1.1.2, 2.1.1.3, and 2.1.2.2.2.2.
	B.5 Tightly-Coupled GNSS/IRS Position Sources [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] This section provides high-level guidance on the issues that will need to be addressed to qualify a tightly-coupled Global Navigation Satellite System/Inertial Reference System (GNSS/IRS) for use in an ADS-B system. You must propose to the FAA the method to approve a tightly-coupled GNSS/IRS for use in an ADS-B system.

B.5.1 Tightly-Coupled GNSS/IRS Outputs [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)].
The tightly-coupled GNSS/IRS outputs must meet the requirements, including validation, of either RTCA/DO-229(), appendix R, or
RTCA/DO-316, appendix R.
B.5.2 Horizontal Velocity Accuracy [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)].
The ADS-B system must address the horizontal velocity accuracy.
B.5.3 GNSS Performance [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)].
The GNSS sensor should meet the minimum performance requirements for any revision of TSO-C129, TSO-C145, TSO-C146, or TSO-C196.
Additionally, the GNSS sensor should meet all applicable GNSS requirements of this appendix as applicable.
B.5.4 GNSS Installatation [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)].
Install the GNSS sensor(s) in accordance with AC 20-138().
B.5.5 NIC Containment Radius [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)].
§ 91.227 requires a SIL = 3, which means the probability of exceeding the NIC containment radius should be less than 1x10-7 per hour or
per sample. The
tightly-coupled GNSS/IRS system should transmit the integrity quality metric on a per-hour basis. After loss of GNSS or GNSS RAIM, the
hybrid system should report the integrity containment radius of 1x10-7 probability on a per-sample basis rather than on a per-hour basis.
Doing so would allow the GNSS/IRS system to transmit at a probability of 1x10-7 for a longer period of time.
B.5.5.1 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] RTCA/DO-229D, appendix R,
section 2.1 requires tightly-coupled systems to meet two integrity limits. The integrity limit for the faulted satellite case is 1x10-7. The
integrity limit for fault-free (rare normal) case is 1x10-5. RTCA/DO-229D, appendix R, section 2.1.1 acknowledges that in tightly integrated
systems, inertial coasting may cause the rare normal limit to be dominant over the limit for the faulted conditions in times of poor satellite
coverage. If the HPL output from the tightly-coupled position source changes from the fault detection 1x10-7 basis to the fault free 1x10-5
basis, the position source needs to indicate this change to the ADS-B equipment. We recommend the position source use a 1x10-7
integrity basis in all modes.
B.5.5.2 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] If the integrity containment
probability output of the tightly-coupled GNSS/IRS position source changes from per-hour to per sample following a loss of GNSS or a loss
of GNSS RAIM, the position source must indicate this change to the ADS-B equipment (that is, SILSUPP).
B.5.5.3 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] If the tightly-coupled GNSS/IRS
scales the inertial integrity from 1x10-5 to 1x10-7, the scaling must have been demonstrated during design approval of the position source.
If the inertial basis is per-sample and is scaled to per-hour, this scaling must have been demonstrated during the position source design
approval.
B.5.6 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] GNSS Integrity Performance in the
Hight Manual.
If a tightly-coupled GNSS/IRS position source is intended to be used as an ADS-B position source after the loss of GNSS, include integrity
coasting performance in the flight manual. Specifically address the following:
D 5 C 1 (C maximum CNCC land a sitian source (CNCC //DC mattern and mattern and the state high state in a site of the state of the stat
B.5.6.1 [Cs requires GNS5-based position sources (GNS5) in systems are recognized as acceptable). It inertial coasting will meet § 91.227 inequality of the share position sources (GNS5) in systems are recognized as acceptable).
requirements, such as WACP \rightarrow 5, With \rightarrow 7, Sic \rightarrow 5, and SiAP \rightarrow 2.
loss of GNS for which inertial costing is evented to meet the 81 227 requirements. The estimate check the head accurate meet
minimum 6.01.227 requirements inst hefere the loss of GNSS or GNSS PAIM. This estimate will be belouted assume the system met
manaction (1912) requirements just before the loss of GNSS MAINI. This estimate will be negrate operators in developing a manaction of the operators in developing and the operators in develo
Realistic enable that the system can meet
3 51.227 requirements during predicted object durations.
The EAA does not how of any currently available point. Specific and a survey that can meet the performance residence of 6.91.227
However, you may wish to integrate a backing ADS and DIT canability in the event of face of CASS. Such a backing is not control of the de
not expert any ATC operational advantages for systems that provide a non-GNSS backup unless that backup capability most the
ner concernent of a 91 277. This section provides histolay and an on the issues that will head to be addressed to qualify a
performance requirements or 3 04221. This acculation provides ingenerate applicance on the issues that will be due to be double seed to be
use the guidance below and monose to the FAA the method to approve a pon-FINS motion source for use in an DS-R system
are the parameter balance balance and propose to the method to approve a new crisp position source for use in an Abba b system
8.6.1.1.ICS requires GNSS-based nosition sources (GNSS/IRS systems are recognized as acceptable)] The DMF/DMF Area Navigation
[INAV] system must meet the minimum performance requirements of TSO-C66c. Distance Measuring Equipment (DME) Operating within
the Radio Frequency Rape of 960-1215 Merahertz
the name requerted numbers and the medianer the

	B.6.1.2 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] There are no industry standards for
	use of a DME/DME system to determine position integrity or velocity accuracy. You must propose a method to derive these parameters.
	B.6.1.3 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] The DME/DME system must only
	use DME facilities listed in the Airport/Facility Directory (A/FD).
	B.6.1.4 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] The DME/DME system must only use
	operational DME facilities.
	The system must exclude non-operational facilities by checking the identification. Operational mitigations, such as manually excluding
	(blackballing) DME stations or any action that requires pilot action or monitoring of the DME/DME system, are not permissible for ADS-B
	qualified position sources.
	B.6.1.5 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] Reasonableness Checks.
	The DME/DME system must incorporate reasonableness checking. Refer to AC 90-100(), U.S. Terminal and En Route Area Navigation
	(RNAV) Operations, for additional information on reasonableness checks.
	B.6.2 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] VOR/DME.
	ADS-B position sources may not use Very High Frequency Omnidirectional Range (VOR) information. Do not interface any position solution
	that uses VOR information as the performance of the VOR cannot be assumed throughout the region in which the signal is received.
	B.6.3.1 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] The GNSS equipment or DME
	equipment must meet the requirements in this appendix.
	B.6.3.2 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] Loosely coupled INS/IRU equipment
	must meet 14 CFR part 121, appendix G.
	B.6.3.3 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] The loosely coupled INS/IRU position
	source must provide all of the required position source outputs listed in this appendix. Qualify the outputs during installation approval of
	the ADS-B system; refer to section B.3 of this appendix. Velocity accuracy may be qualified and set statically. Update the position
	accuracy and position integrity metrics dynamically.
	B.6.3.4 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] § 91.227 requires a SIL = 3, which
	means the probability of exceeding the NIC containment radius should be less than 1x10-7 per hour or per sample. A GNSS/IRS that
	continues to provide the integrity containment radius based on a 1x10-7 probability after loss of GNSS or GNSS RAIM is preferred.
	Potential errors, caused by GNSS updating before the loss of GNSS, must continue to be bounded.
	B.6.3.4.1 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] If the integrity containment
	probability output of a loosely coupled
	GNSS/IRS position source changes from 1x10-7 to 1x10-5 following a loss of GNSS or a loss of GNSS RAIM, the position source must relay
	this change to the ADS-B equipment. The overall system time to transmit a change in SIL must be 10 seconds or less.
	B.6.3.4.2 [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)] If the integrity containment
	probability output of a loosely coupled GNSS/IRS position source changes from per-hour to per-sample following a loss of GNSS or a loss of
	GNSS RAIM, the position source must relay this change to the ADS-B equipment.
	B.7 Future Position Sources [CS requires GNSS-based position sources (GNSS/IRS systems are recognized as acceptable)].
	It is expected that future position sources such as dual frequency GPS and GPS/Galileo sources will be acceptable position sources for ADS-
	B and meet the performance requirements of § 91.227. Future revisions of this AC will address new position source technology when it
	becomes available.
Appendix H - Part 6 - Compliance Matrix BDS Register Fields	

ADS-B Ou guidance/	: Guidance Cor requirements	np: Includes a comparison of EAS, in black are additional info. that d	A CS-ACNS (ii oes not conf	ncl. BOOK1/BOOK 2 – Subpart D – Section 4, App lict, but is not specified in the other guidance doo	endix H (Part 1-6), a sument/regulation, a	nd Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.
This part of the popul Omitted in Reference with Part Within the approved (requirem In addition 'Capability	of Appendix H I ation of the 10 the tables are to ADS-B Out 1 of this Apper requirements sources. 'O' ex- ent is mandato to the 1090 E (CA)' field, als	ists compliance matrices of the Bi 90 ES data fields with data from a e fields containing the subtype coo item numbers is made in line with dix. (Req't) column, 'M' expresses a r presses an optional requirement, ory provided that the condition ex S data fields (as specified by the r o conveyed within downlink form	DS register fii pproved sou des (for these h Part 1 of th mandatory re 'NA' express pressed in th espective 'M iat DF 17, sho	elds transmitted by the 1090 ES ADS-B transmit u rces (CS ACNS.D.ADSB.025(a) applies). e, refer to Part 1 of this Appendix) and reserved f is Appendix respectively. Reference to Definition equirement, i.e. the respective fields are populate ses non-applicability and 'C' expresses a condition te remark column is met). E' Bits conveyed within the downlink format DF : puld be populated for all below registers as follow	init, with respect to ields. s is made in line ed with data from nal requirement L7), the 3-bit L7:	3.1.6 (Installation) Populating Message Elements. § 91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91.225. All parameters transmitted by the ADS-B system must conform to the standards in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link] and may not contain false or misleading information.
_						
	DF 17 bits	Field	Req't	Remark		
	6-8	Capability	М	Refer to ICAO Annex 10, Volume IV, section 3.1.2.5.2.2.1.		
		Register 05 ₁₆ – A	irborne P	osition Message		3.1.6 (Installation) Populating Message Elements.
						§ 91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91.225. All parameters
	ME Bits	Field	Req't	Remark		transmitted by the ADS-B system must conform to the standards in ISO-C166b or ISO-C154c [CS only recongnizes 1090 ES for the ADS-B Out data link] and may not contain false or misleading information.
	6-7	Surveillance Status	М	= '0', no condition information = '1', Item 7a, Definition 10 = '2', Mode A code change = '3', Item 6		
	8	NIC Supplement-B	М	Item 4b, Definition 4 and 5		
	9-20	Altitude	М	Item 5, Definition 9		
	21	Time (T)	М	"GNSS time mark coupled" (`0' no, `1' yes), Item 4a, Definition 3		
	22	CPR Format (F)	М	Compact Position Reporting (CPR) format type ('0' even, '1' odd) , Item 4a, Definition 3		
	23-39	CPR Encoded Latitude	М	Item 4a Definition 3		
	40-56	CPR Encoded Longitude	М			
		Register 06 ₁₆ – S	Surface Po	sition Message		3.1.6 (Installation) Populating Message Elements. § 91 227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91 225. All parameters
	ME Bits	Field	Req't	Remark		transmitted by the ADS-B system must conform to the standards in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS-B
	6-12	Movement	м	Item 14, Definitions 11 and 12		Out data link] and may not contain false or misleading information.
	13	Heading/Ground Track Status	м	Item 13, Definition 15		
	14-20	Heading/Ground Track	М			
	21	Time (T)	м	`GNSS time mark coupled' (`0' no, `1' yes), Item 4a, Definition 3		
	22	CPR Format (F)	м	Compact Position Reporting (CPR) format type ('0' even, '1' odd) , Item 4a, Definition 3		
	23-39	CPR Encoded Latitude	М	Item 4a Definition 3		
	40-56	CPR Encoded Longitude	М			

Register 08 ₁₆ - Aircraft Identification and Category Message			on and Category Message	3.1.6 (Installation) Populating Message Elements. § 91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91.225. All paramet transmitted by the ADS-B system must conform to the standards in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the AL			
ME Bits	Field	Req't	Remark	Remark Out data link] and may not contain false or misleading information.			
6-8	ADS-B Emitter Category	М	Item 10, Definition 13				
9-56	Identification Characters #1-#8	М	6 bits per character, Item 1, Definition 1				
jister 09	16 - Airborne Velocity Mes Norm	sage - Ve al/Supers	elocity over Ground (Subtypes 1and sonic)	2, \$1.6 (Installation) Populating Message Elements. \$91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by \$91.225. All parameters transmitted by the ADS-B system must conform to the standards in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the A Out data link] and may not contain false or misleading information.			
ME Bits	Field	Req't	Remark				
6-8	Subtype	М	'0' normal, '1' supersonic				
9	Intent Change Flag	0	Mode S protocol support, indication of new information in GICB registers 40 ₁₆ to 42 ₁₆				
11-13	NACv	М	Item 9b, Definition 12				
14	E/W Direction Bit	М					
15-24	E/W Velocity	М	Itom 0a, Definition 11				
25	N/S Direction Bit	М					
26-35	N/S Velocity	М					
36	Vertical Rate Source	М					
37	Vertical Rate Sign	М	Item 11, Definition 14				
38-46	Vertical Rate	М					
49	Difference from Barometric Altitude Sign	М	Item 17a Definition 19				
50-56	Difference from	М					

Regist	er 09 ₁₆ - Airborne Velocity Norma	Message I/Superso	- Airspeed (Subtypes 3 and 4, onic)	3.1.6 (Installation) Populating Message Elements. § 91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91.225. All parameter transmitted by the ADS-B system must conform to the standards in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the ADS Out data link] and may not contain false or misleading information
ME Bits	Field	Req't	Remark	
6-8	Subtype	М	`0' normal, `1' supersonic	
9	Intent Change Flag	0	Mode S protocol support, indication of new information in GICB registers 40 ₁₆ to 42 ₁₆	
11-13	NACv	0	Item 9b, Definition 12	
14	Heading Status Bit	0		
15-24	Heading	0	There On Definition 44	
25	Airspeed Type	0	Item 9a, Definition 11	
26-35	Airspeed	0		
36	Vertical Rate Source	М		
37	Vertical Rate Sign	М	Item 11, Definition 14	
38-46	Vertical Rate	М		
49	Difference from Barometric Altitude Sign	М	Itom 17a Definition 10	
50-56	Difference from Barometric Altitude	М	item 17a, Dennition 19	
Register	61 ₁₆ - Aircraft Status Mess	age - Em	ergency Status and Mode A Code	3.1.6 (Installation) Populating Message Elements. § 91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91.225. All parame
ME Bits	Field	Req't	Remark	transmitted by the ADS-B system must conform to the standards in TSO-C166b or TSO-C154c [CS only recongnizes 1090 ES for the
6-8	Subtype	М	=`1'	Out data link/ and may not contain false or misleading information.
9-11	Emergency/Priority Status	М	Mandatory codes: '0', '1', '4' and '5', Item 7a, Definition 10	
12-24	Mode A Code	М	Item 2, Definition 2	
)agistar 61 - Aircraft Sta	tue Mace	are - ACAS DA Broadcast	3.1.6 (Installation) Populating Message Elements.
NE 0.		D //		§ 91.227 lists parameters that must be populated (that is, not a null value) for operation in airspace defined by § 91.225. All parameters
ME Bits	Field	Req't	Remark	Utarismitted by the ADS-B system must conform to the standards in ISU-C1666 or ISU-C154c [LS only recongnizes 1090 ES for the AL
5-8	Subtype	М	='2'	
9-22	Active Resolution Advisories	М		
23-26	RACs Record	М	4	
27	RA Terminated	М	Item 20b, Definition 22	
28	Multiple Threat Encounter	М	I	
29-30	Threat Type Indicator	М		
31-56	Threat Identity Data	М		

	Register 62 ₁₆ - Targ	et State a	and Status Message	3.1.6 (Installation) Populating Message Elements.
				s 91.227 lists parameters that must be populated (that is, not a null value) for operation in anspace defined by 9.1.225. All parameters
ME Bits	Field	Req't	Remark	Uniformation of the standards in 150-c1566 of 150-c1566
6-7	Subtype	м	= `1'	
8	SIL Supplement	м	Item 4d, Definition 4 and 7	
9	Selected Altitude Type	С		
10-20	MCP/FCU Selected Altitude or FMS Selected Altitude	с	Where available in a suitable format Item 18, Definition 21	
21-29	Barometric Pressure Setting	С	Where available in a suitable format Minus 800 millibars.	
30	Selected Heading Status	0		
31	Selected Heading Sign	0	not required by Commission Regulation (EU) No 1207/2011	
32-39	Selected Heading	0	Regulation (EO) No 1207/2011	
40-43	Navigation Accuracy Category Position (NAC _P)	м	Item 4c, Definition 4 and 6	
44	Navigation Integrity Category Baro	м	Item 5, Definition 9	
45-46	Source Integrity Level	м	Item 4d, Definition 4 and 7	
47	Status of MCP/FCU Mode Bits	м		
48	Autopilot Engaged	0		
49	VNAV Mode Engaged	0	Item 18, Definition 21	
50	Altitude Hold Mode	0]	
52	Approach Mode	0	<u> </u>	
53	TCAS Operational	м	Item 20a, Definition 22	
54	LNAV Mode Engaged	0	Item 18, Definition 21	
-				-

Pegi	ster 65 Aircraft Operat	tional Sta	tus Massaga - While Airborne
negi.	Ancial operation	cional sta	and the stage while subothe
ME Bits	Field	Req't	Remark
6-8	Subtype	м	= '0' (Airborne)
9-10	Airborne Capability Class Subtype	м	= `0,0'
11	TCAS Operational	м	Item 20a, Definition 22
12	1090 ES IN	0	not required by EU Regulation No 1207/2011
15	Air Referenced Velocity Report Capability	м	 '0', if aircraft is not capable of sending Airborne Velocity, Subtype 3 or 4 '1', if yes
16	Target State Report Capability	м	= `1'
17-18	Trajectory Change Report Capability	м	= `0'
19	UAT IN	0	not required by EU Regulation No 1207/2011
25-26	Airborne Operational Mode Subtype	м	= `0,0'
27	TCAS RA Active	м	Item 20b, Definition 22
28	IDENT Switch Active	М	Item 6
30	Single Antenna Flag	м	= `0', see CS-ACNS.D.ADSB.040
31-32	System Design Assurance	м	Item 4e, Definition 4 & 8
41-43	MOPS Version Number	м	= `2'
44	NIC Supplement-A	м	Item 4b, Definition 4 & 5
45-48	NACP	м	Item 4c, Definition 4 & 6
49-50	GVA	м	Item 17b, Definition 20
51-52	Source Integrity Level	м	Item 4d, Definition 4 & 7
53	NICBaro	м	Item 5, Definition 9
54	Horizontal Reference Direction (HRD)	0	'0' true north, '1' magnetic north (Airborne Velocity, subtype 3 & 4)
55	SIL Supplement	м	Item 4d, Definition 4 & 7

ME Bits	Field	Req't	Remark	s 21.227 hists parameters that make be populated (that is, not a minimum value) for operation an appace defined by 31.227. All
6-8	Subtype	м	= `1' (Surface)	u anismitete up une ADD-5 system music contorni to the stahdards in ISO-C1660 of ISO-C154C [CS only recongnizes 1090 E5].
9-10	Surface Capability Class Subtype	м	= `0,0'	
12	1090 ES IN	0	not required by Commission Regulation (EU) No 1207/2011	
15	B2 Low	NA	not applicable (targeting at class B2 equipment, e.g. ground vehicles)	
16	UAT IN	0	not required by Commission Regulation (EU) No 1207/2011	
17-19	NACv	м	Item 9b, Definition 12	
20	NIC Supplement C	м	Item 12b, Definition 15	
21-24	Length/Width Codes	м	Item 15, Definition 17	
25-26	Surface Operational Mode Subtype	м	= `0,0'	
27	TCAS RA Active	м	Item 20b, Definition 22	
28	IDENT Switch Active	м	Item 6	
30	Single Antenna Flag	м	= '0', see CS ACNS.D.ADSB.040	
31-32	System Design Assurance	м	Item 4e, Definition 4 and 8	
33-40	GPS Antenna Offset	м	Item 16, Definition 18	
41-43	MOPS Version Number	м	= `2'	
44	NIC Supplement-A	м	Item 12b, Definition 15	
45-48	NAC _P	м	Item 4c, Definition 4 and 6	
51-52	Source Integrity Level	м	Item 4d, Definition 4 and 7	
53	Track Angle/Heading	м	Item 9a, Definition 11	
54	Horizontal Reference Direction (HRD)	м	'0' true north, '1' magnetic north Item 13, Definition 15	
55	SIL Supplement	м	Item 4d, Definition 4 and 7	

ADS-B Out Guidance Comp: includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-b), a guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation, a	na Appendix I) and AC 20-1656 (Incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.
The ADS-B Out system installer should verify that the air-ground status inputs (or algorithms) are functioning properly and that the ADS-B	4.1.10 (Ground Test) Air-Ground Status.
Out system transmits the appropriate airborne messages or surface messages based on the On-the-ground status. This can be	Verify that the air-ground inputs (or algorithms) are functioning properly and that the ADS-B system transmits the appropriate airborne
accomplished with simulated inputs to the appropriate sensors or accomplished in conjunction with the flight test.	messages or surface messages based on the air-ground status. This can be accomplished with simulated inputs to the appropriate sensors
The following tests provide guidance to the aircraft integrator for the verification of the ADS-B Out system installation, as appropriate.	or accomplished in conjunction with the flight test. Rotorcraft may consider hover taxi as in the air.
Separate cases are presented depending on the need to validate the status within the ADS-B transmit unit.	
(a) Directly determined On-the-ground status being validated outside the ADS-B transmit function:	
Modern aircraft with integrated avionics suites commonly contain sophisticated algorithms for determining the On-the-ground status	
based on multiple aircraft sensors. These algorithms are customised to the airframe and designed to overcome individual sensor failures.	
These algorithms are an acceptable means to determine the On-the-ground status and do not require additional validation.	
(b) Validation of directly determined On-the-ground status not being validated outside the ADS-B transmit function:	
If ground speed or airspeed is larger than the aeroplane's typical rotation speed, then the On-the-ground status is (changed to) airborne	
and the aircorne position message is broadcast irrespective of the directly determined On-the-ground status (i.e. as indicated to the ADS-B	
transmit function).	
(c) Indirectly determined On-the-ground status validation within the ADS-B transmit unit: If an aircraft is not equipped with a means, such	
as a weight-on-whees switch, to determine whether it is alroome of on the ground, then the following tests should be performed to	
determine whether to broadcast the Airborne or Surface Position Messages.	
(1) If the all clarks fadio height (Ari) parameter is available, and Aris is shared by the formation of the	
The available, and the dot of the Abar erest and ST man ST may clock include an ereat of backasts and acceptation message.	
in an arece parameters are obtained, the occusion to broadcast the Amborne of Sundee Fostion messages is accentinically the together the	
(2) If radio beight (RH) is not available, and if the aircraft's ground speed (GS) and airspeed (AS) are available, and GS-26 m/s (50 knots)	
and AS-26 m/s (50 knots), then that aircraft broadcasts the surface position message.	
Otherwise, the aircraft broadcasts the Airborne Position Message.	
On-the-ground status Test and Validation Guidance for Helicopters, Lighter-than-Air Vehicles and Fixed-under-Carriage Aeroplanes	
Installations intended for this category that are unable to provide a compliant direct or indirect ground status detection function, should	
only broadcast the Airborne Position Message. In addition, the "CA" capability field in downlink format DF 17 should be set accordingly.	
CS-ACNS - BOOK 1 - Subpart D - Section 4 — 1090 MHz Extended Squitter ADS-B	
GENERAL	
CS ACNS.D.ADSB.001 Applicability	§ 91.227 Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment performance requirements.
(See GM1 ACNS.D.ADSB.001)	
This section provides standards for 1090 MHz Extended Squitter (ES) ADS-B Out installations.	
SYSTEM FUNCTIONAL REQUIREMENTS	
CS ACNS.D.ADSB.010 ADS-B Out system approval	
(See AMC1 ACNS.D.ADSB.010)	
The equipment contributing to the ADS-B Out function is approved.	
ADS-B OUT DATA	
CS ACNS.D.ADSB.020 ADS-B Out Data Parameters (See AMC1 ACNS.D.ADSB.020(a-b))	§ 91.227(d) Minimum Broadcast Message Element Set for ADS-B Out. Each aircraft must broadcast the following information, as defined in
--	--
(a) The ADS-B Out system provides the following minimum set of data parameters:	TSO-C166b or TSO-C154c. The pilot must enter information for message elements listed in paragraphs (d)(7) through (d)(10) of this section
(1) Aircraft Identification;	during the appropriate phase of flight.
(2) Mode A Code;	(1) The length and width of the aircraft;
(3) ICAO 24-bit aircraft address;	(2) An indication of the aircraft's latitude and longitude;
(4a) Airborne Horizontal Position — Latitude and Longitude;	(3) An indication of the aircraft's barometric pressure altitude;
(4b) Airborne Navigation Integrity Category: NIC;	(4) An indication of the aircraft's velocity;
(4c) Airborne/Surface Navigation Accuracy Category for Position: NACp;	(5) An indication if TCAS II or ACAS is installed and operating in a mode that can generate resolution advisory alerts;
(4d) Airborne/Surface Source Integrity Level: SIL;	(6) If an operable TCAS II or ACAS is installed, an indication if a resolution advisory is in effect;
(4e) Airborne/Surface System Design Assurance: SDA;	(7) An indication of the Mode 3/A transponder code specified by ATC;
(5) Pressure Altitude (incl. NICbaro);	(8) An indication of the aircraft's call sign that is submitted on the flight plan, or the aircraft's registration number, except when the pilot
(6) Special Position Identification (SPI);	has not filed a flight plan, has not requested ATC services, and is using a TSO-C154c self-assigned temporary 24-bit address;
(7a) Emergency Status;	(9) An indication if the flightcrew has identified an emergency, radio communication failure, or unlawful interference;
(7b) Emergency Indication;	(10) An indication of the aircraft's "IDENT" to ATC;
(8) 1090 ES Version Number;	(11) An indication of the aircraft assigned ICAO 24-bit address, except when the pilot has not filed a flight plan, has not requested ATC
(9a) Airborne velocity over Ground — (East/West and North/South);	services, and is using a TSO-C154c self-assigned temporary 24-bit address;
(9b) Airborne/Surface Navigation Accuracy Category for Velocity: NACv;	(12) An indication of the aircraft's emitter category;
(10) Emitter Category;	(13) An indication of whether an ADS-B In capability is installed [not required by CS (optional)];
(11) Vertical Rate [not required by 91.227 (optional)] ;	(14) An indication of the aircraft's geometric altitude;
(12a) Surface Horizontal Position — Latitude and Longitude;	(15) An indication of the Navigation Accuracy Category for Position (NACP);
(12b) Surface Navigation Integrity Category: NIC;	(16) An indication of the Navigation Accuracy Category for Velocity (NACV);
(13) Surface Ground Track;	(17) An indication of the Navigation Integrity Category (NIC);
(14) Movement (surface ground speed);	(18) An indication of the System Design Assurance (SDA); and
(15) Length/width of Aircraft;	(19) An indication of the Source Integrity Level (SIL).
(16) GPS Antenna Longitudinal Offset [not required by 91.227 (optional)] ;	
(17a) Geometric Altitude; and	
(17b) Geometric Altitude Quality: GVA [not required by 91.227 (optional)] .	
(b) Where available in a suitable format, the ADS-B Out system provides the following data parameters:	
(1) Selected Altitude [not required by 91.227 (optional)];	
(2) Barometric Pressure Setting [not required by 91.227 (optional)]; and	
(3) ACAS Resolution Advisory.	
CS ACNS D ADSP 025 Provision of Data (See AMC1 ACNS D ADSP 025/a)(a)	
C3 ALI data provided by the ADS-B Out system comer from approved sources	
(a) An data product by the ADS B out system originates from the same data source as used in the transponder replies to Mode S	
(b) The data transmitted by the ADDD but system originates from the same data source as used in the transponder replies to mode a	
(c) When a data quality indication is required, it is provided to the ADS-R transmit unit together with the associated data parameter and it	
(c) when a dealer matching in required, it is promotion to the range of annihilation of the measurement	
Ans. It Ranswitt i Nitt	
CS 4CNS D ADSR 030 ADS-R Transmit Unit Annroval (See AMC1 4CNS D 4DSR)	
The ADS-B transmit unit is approved and it is integrated in the Mode S transponder	
CS ACNS D ADSR 035 ICAO 24-bit Aircraft address	AC 20-165 4 1 7 ICAO 24-Rit Address
The ICAO 24 bit aircraft address is implemented as specified in CS ACNS D ELS 055	For non-LLS, registered aircraft verify that the ICAO 24-bit address is the address assigned to the aircraft by the responsible State
The ICAO 24-bit direction during a difference of the competent authority is correctly implemented on each transponder. The ICAO 24 -bit direction during a difference of the competent authority is correctly implemented on each transponder.	authority
The hole 14 bit while up to a diversity (See AMC1 a CNS D ADSR 040) (CS requires antenna diversity AC 20-165 allows sinale bottom-	AC 20-1558 3.8.1 Antenna Location and Number Required ICS requires antenna diversity. AC 20-155 allows single bottom-mounted
Contention and and and and any loce name interview above of the requires unterime and any more to too anows angle bottom	ne po 1953, Sol i vinenna zodalon ana ramoch reganza po reganza anemna aversky, re zo zos anono single potoni mounce antenna i
The ADS a transmit unit employs antenna diversity under the same conditions as specified in CS ACNS D ELS 065	The aircraft ADS-B antenna is an important part of the overall ADS-B Quit system because antenna systems are major contributors to the
Aircraft with a maximum certified take-off mass in excess of \$700 ka or a maximum cruician true airspeed canobility under International	system link performance. The location and number of antennas required for the airborne ADS-B QUIT system is a function of the
Standard Atmosphere (ISA) conditions: b) mexcess of 130 m/s (250 k nots) operates with an antenna diversity installation (FS requires	equipment class of the selected broadcast link (UAT or 1090FS). Single bottom-mounted antenna (TSO-C156A and TSO-C154A 415 and R15
antenna diversity (aircraft applicability equivalent to EU No 1207/2011 for ADS-B Out equipage). AC 20-165 allows single bottom-	classes) installations are allowed /CS requires antenna diversity. AC 20-165 allows sinale bottom-mounted antenna!
mounted antennal.	······································

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), a guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation, a	nd Appendix I) and AC 20-1 Ind guidance/requirement:	165B (incl. Appendix A-D)/	91.227. Guidance/requinnce or requirements. Clar	rements in green are the sa ification has been provided	ne or consistent, in brackets.
CS ACNS.D.ADSB.045 Antenna installation The antenna is installed as specified in CS ACNS.D.ELS.060. (a) The installed antenna(s) has (have) a resulting radiation pattern which is (are) vertically polarised, omnidirectional in the horizontal plane, and has (have) sufficient vertical beam width to ensure proper system operation during normal aircraft manoeuvres. (b) Antenna(s) is/are located such that the effect on the far field radiation pattern(s) by the aircraft structure are minimised.					
CS ACNS.D.ADSB.050 Transmit power The ADS-B transmit unit has a peak transmit power as specified in CS ACNS.D.ELS.010(c);(d). (c) The peak pulse power available at the antenna end of the transmission line of the transponder is more than 125 W (21 dBW) and not more than 500 W (27 dBW) for aircraft that operate at altitudes exceeding 4 570 m (15 000 ft) or with a maximum cruising speed exceeding 90 m/s (175 knots). (d) The peak pulse power available at the antenna end of the transmission line of the transponder is more than 70 W (18.5 dBW) and not more than 500 W (27 dBW) for aircraft operating at or below 4 570 m (15 000 ft) with a maximum cruising airspeed of 90 m/s (175 knots) or less.	AC 20-165B, 3.8.1 Antenn For the UAT link, 16 wat data link]. For the 1090E § 91.227(b) 1090 MHz ES (1) Aircraft operating in Cl A1, A1S [CS requires ante Squitter Automatic Deper the Radio Frequency of 10 (2) Aircraft operating in ai antenna and output powe (i) Class A1, A1S [CS requir (ii) Class A1H, A1S, A2, A3, Surveillance-Broadcast (A link].	a Location and Number Re tts minimum transmit powe ES link, 125 watts minimum and UAT Broadcast Links and lass A airspace must have e enna diversity], A2, A3, B15 ndent Surveillance-Broadca 900 Megahertz (MHz). irspace designated for ADS- er requirements of either: ires antenna diversity], A2, b15, or B1 equipment as c DS-B) Equipment Operating	quired. er at the antenna output i transmit power at the ar nd Power Requirements quipment installed that n is (CS requires antenna di st (ADS-B) and Traffic Info -B Out, but outside of Class , A3, B1S (CS requires ant lefined in TSO-C154c, Uni g on the Frequency of 978	is required [CS only recongn itenna output is required.	izes 1090 ES for the ADS-B Out er output requirements of Class is defined in TSO-C166b, Extended (TIS-B) Equipment Operating on ipment installed that meets the fined in TSO-C166b; or IAT) Automatic Dependent 1090 ES for the ADS-B Out data
		Table 3. Minimum and Tested Transmitter Class A1 A15 B1 B15 A2 A3	Maximum Transmitted F Minimum Power 21.0 dBW 21.0 dBW 21.0 dBW 21.0 dBW 21.0 dBW 21.0 dBW 23.0 dBW	Auximum Power 27.0 dBW	
	Additional Guidance not a 3.8.2 (Installation) Equipm ADS-B antennas must mee 3.8.3.1 (Installation) Using When using an existing an antenna installation does	Addressed in CS-ACNS nent Eligibility. et requirements defined in g an Existing Antenna. ntenna system, if the install not have to be reevaluated	the ADS-B equipment ma ation does not modify the I.	anufacturer's installation ma	nual. 3, or output specifications, the
	3.8.3.2 (Installation) Insta	Illing a New Shared Transpo	onder/ADS-B Antenna.		
	Follow the transponder an 3.8.3.3 (Installation) Instal If the UAT system is instal following guidance:	ntenna installation guidanc Illing a New Stand-Alone UA Iled in an aircraft without a	e in AC 20-151(). AT ADS-B Antenna <i>[CS onl</i> transponder or the instal	y recongnizes 1090 ES for th lation will not use the existi	he ADS-B Out data link] . ng transponder antenna, use the
	3.8.3.3.1 (Installation) Ant Mount antennas as near a horizontal plane. 3.8.3.3.2 (Installation) Ant The spacing between the provide a minimum of 20 wave stubs, 20 dB of isola antenna is other than a co	tenna Location [CS only rec as practical to the centerlin tenna Distance From Other UAT antenna and any trans dB of isolation between thi tition is obtained by providir onventional stub, the minin	ongnizes 1090 ES for the e of the fuselage and loca Antennas [CS only recon sponder (Mode S or Air Tr e two antennas. If both a ng a spacing of at least 20 hum spacing must be dete	ADS-B Out data link]. ite them in a position to mir gnizes 1090 ES for the ADS- affic Control Radar Beacon: ntennas are conventional o inches between the centers ermined such that 20 dB or i	imize obstruction in the B Out data link] . System (ATCRBS)) antenna must mni-directional matched quarter- is of the two antennas. If either more of isolation is achieved.

	2.9.2.2.2 (Installation) Transmit Down ICC only recommises 1000 EC for the ADC P. Out data link!
	Transmit power will be verified during ground test.
	3.8.3.3.4 (Installation) Structural Analysis (CS only recongnizes 1090 ES for the ADS-B Out data link1 .
	You may need to submit a structural analysis of new antenna installation to show compliance with the applicable regulations.
	3.8.3.4 (Installation) Antenna Diplexers [CS only recongnizes 1090 ES for the ADS-B Out data link].
	Diplexers manufactured in accordance with TSO-C154b or TSO-C154c may be installed so UAT ADS-B equipment and a transponder may
	share the same antenna. The TSO-C154b and TSO-C154c diplexer installation instructions are required to have a limitation that ensures
	insertion of the diplexer does not exceed the maximum cable attenuation allowance between the transponder and antenna.
	3.8.3.5 (Installation) Single Antenna [CS only recongnizes 1090 ES for the ADS-B Out data link] .
	Single antenna systems must use a bottom-mounted antenna.
	3.8.5 (Installation) Mutual Suppression.
	Follow the ADS-B equipment manufacturer's guidance on interfacing the ADS-B OUT equipment to the mutual suppression bus.
CS ACNS D ADSR 055 Simultaneous operation of ADS-R transmit units (See AMC1 ACNS D ADSR)	AC 20-1658 3.2.2.4.15 dual ADS-B OUT systems of the same link are installed (for example, to increase dispatch reliability), the installation
If more than one ADS-B transmit unit is installed simultaneous operation of the transmit systems is prevented	The 20 100 (3.2.2.4) the data AD 3 both systems of the same mixture instance (for example, to increase dispatch renability), the instanation must need to be a same to be a sa
C & C & D & D & D & D & D & D & D & D &	AC 20.1658 3.10 2 dir-Ground Status
(a) The on-the-ground status is determined and validated by the ADS-B Out system	For aircraft with retarctable landing gear, the air-ground status determination is tynically provided through a landing gear, weight-on-
(b) The on-the-ground status is not set by a manual action.	wheels (WOW) switch. For aircraft that have fixed gear, the ADS-B system must still be able to determine the air-ground status of the
	aircraft Installations that provide a means to automatically determine air-ground status based on inputs from other aircraft sensors may
	be acceptable if they can be demonstrated to accurately detect the status. For example, air-ground status may be derived from WOW
	switch and GPS velocity: or GPS velocity, an airport database, and geometric altitude; or GPS velocity and airspeed. These algorithms
	should be tested and validated during the installation approval.
	Note 1: We recommend that any automatic air-ground determination be more robust than just a simple comparison of ground speed to a
	single threshold value. Field experience has shown that this method can lead to false air-ground status.
	Note 2: Manual selection of the air-ground status is not acceptable.
	Note 3: Rotorcraft may require unique logic for providing an accurate air-ground state. A reliable method to determine the air-ground
	state should consider training requirements. Rotorcraft may consider hover taxi as in the air.
	4.1.10 Air-Ground Status.
	Verify that the air-ground inputs (or algorithms) are functioning properly and that the ADS-B system transmits the appropriate airborne
	messages or surface messages based on the air-ground status. This can be accomplished with simulated inputs to the appropriate sensors
	or accomplished in conjunction with the flight test. Rotorcraft may consider hover taxi as in the air.
HORIZONTAL POSITION AND VELOCITY DATA SOURCES	
CS ACNS.D.ADSB.070 Horizontal Position and Velocity Data Sources (See AMC1 ACNS.D.ADSB.)	
(a) The horizontal position is derived from GNSS data [AC 20-165 allows for non-GNSS position sources if requirements are met].	
(b) The GNSS receiver based horizontal position and velocity data source is approved and performs, as a minimum, horizontal position	
receiver autonomous integrity monitoring (RAIM) and fault detection and exclusion (FDE).	
(c) Horizontal velocity data stems from the same source as horizontal position data.	
CS ACNS.D.ADSB.080 Data Sources as defined by Mode S Elementary and Enhanced Surveillance (See AMC1 ACNS D ADSB 080)	Mandated by EU No 1207/2011, 1028/2014 (amendment), & 2017/386 (amendment) in European Airspace. For FLS, follow CS-ACNS -
The data source requirements as defined for in section 2 and 3 of this subpart, are applicable.	Subpart D - Section 2. For EHS. follow CS-ACNS - Subpart D - Section 3 supplemented with AC 20-151C Section 2.3.10 & Annendix F (for
	populatinal and B.21 (for testinal Vertical Internation Register.
CS ACNS.D.ADSB.085 Geometric Altitude (See AMC1 ACNS.D.ADSB.)	AC 20-165B, B.3.10 Geometric Altitude.
(a) Geometric Altitude is provided by the horizontal position and velocity source (see CS ACNS.D.ADSB.070).	The position source must have a geometric altitude output. The geometric altitude must be referenced to the WGS-84 ellipsoid.
(b) Geometric Altitude is transmitted as height above WGS-84 ellipsoid.	
FLIGHT DECK CONTROL AND INDICATION CAPABILITIES	

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), and Appendix I) and AC 20-165B (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent,				
guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation	, and guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.			
CS ACNS.D.ADSB.090 Flight deck interface (See AMC1 ACNS.D.ADSB.090(a) and AMC1 ACNS.D.ADSB.090(b)) (a) The control and display of surveillance data items is as per CS ACNS.D.ELS.030.	AC 20-1658, 3.7.2.1 System Status. The installation must have a method to display system operational status to the flightcrew, and should be consistent with the overall			
(a) A means is provided :	flightdeck design philosophy. The system must display flightcrew inputs such as Mode 3/A code, emergency codes, IDENT, and call sign. If			
(1) to select Mode A Code, including emergency indicators;	an existing transponder is used to input Mode 3/A codes, emergency codes, and IDENT into the ADS-B system, the current transponder			
(2) to initiate the IDENT (SPI) feature;	control interface is sufficient. The following two failure annunciations must be included in the initial airworthiness certification (that is,			
(3) for an aircraft identification to be inserted by the flight crew if the aircraft uses variable aircraft identification;	SIC or IC) type design data for the ADS-B OUT equipment, and should be consistent with the overall hightdeck design philosophy for			
(4) to notify the flight crew when the transmission of pressure altitude information has been inhibited, if a means to inhibit the transmission of pressure altitude is previded;	Surveinance equipment. These failure conditions are devisory only and do not constitute a calculor of warning condition. For legacy Mode			
(anismission of pressure diriculters is provided)	Constantions that are adding a OAT device, the following two failure annunclations are optional [CS only reconginzes 1050 ES for the ADS-			
(b) to select the runnpointer to the standary of Ore Commonly,	3 7 2 1 1 ADS-R Device Failure			
to indicate the non-operational status of janute of the transporter system without under any and without the need jor jugite erew action:	If the ADS-B equipment is unable to transmit ADS-B messages, the system should provide an appropriate annunciation to the flightcrew.			
(7) to display the selected Mode A code to the flight crew;	3.7.2.1.2 ADS-B Function Failure.			
(8) to display the aircraft identification to the flight crew; and	The ADS-B system depends on a position source to provide the data to populate the ADS-B messages and reports. If the position source or			
(b) Input which is not intended to be operated in flight, is not readily accessible to the flight crew.	its interface with the ADS-B equipment fails, the ADS-B system will not be able to broadcast the required ADS-B data. In this case, the ADS-			
(b) A means is provided to indicate the non-operational status or failure of the ADS-B Out system without undue delay.	B equipment has not failed, but it cannot perform its function due to a failure to receive the position source data. The ADS-B system			
	should distinguish between a position source or interface failure and an ADS-B equipment failure. The installer must provide			
	documentation, in the applicable flight manual, or flight manual supplement, that explains how to differentiate between annunciation of			
	an equipment failure and a function failure if the failure annunciations are not independent. The ADS-B function failure must not cause a			
	TCAS II system failure			
	Turning Off ADS-B.			
	14 CFR 91.225 and 9 91.227 requires that all all craft equipped with ADS-B OUT operate with the equipment turned on at all times. Inere			
	are no requirements to usable ADS-b bloadcasts at the request of ATC. When ADS-b functionality results in the words S an applications by disable to disable the ADS-b bloadcasts at the request of ATC. When ADS-b functionality results in the words S an applications by disable to a scantable to disable the ADS-b bloadcasts at the request of ATC. When ADS-b functionality results in the words S and S are applied by the transmission by disable to a scantable to disable the ADS-b bloadcasts at the request of ATC.			
	acceptable to usable the AD-6 transmissions by usabiling the transported (that is, standay of Ori) in this at cilicate the acceptable to specify the impact in the flight manual or infort's guide (for example, loss of AD-S, B transmoder, and TCAS functionality). Locate the AD-S			
	and off controls to prevent inadvertent actuation.			
SYSTEM PERFORMANCE REQUIREMENTS				
CS ACNS.D.ADSB.100 Integrity	AC 20-1658, 3.7.3.5.2 System Safety Assessment.			
(a) the ADS-B OUT system integrity is designed commensurate with a major failure condition for the transmission of the following parameters:	Transmission of taise or misleading information is considered to be a major failure effect and may not occur at a rate greater than 1x10-5 new flight how for ADR a cytemet.			
parameters.	per ingin nou nor AD>-6 systems AC 20.1558 B 3 Q Hba position source must support a major or greater failure effect			
(1) Lithout Around Horizontal Position — Latitude and Longitude:	Ac 20-1030, B.3.9 The position source must support a major of greater failure effect			
(2) Airborne Navigation Integrity Category: NIC:				
(4) Airborne/Surface Navigation Accuracy Category for Position: NACp;				
(5) Airborne/Surface Source Integrity Level: SIL;				
(6) Airborne/Surface System Design Assurance: SDA;				
(7) 1090 ES Version Number;				
(8) Airborne velocity over Ground — East/West and North/South;				
(9) Airborne/Surface Navigation Accuracy Category for Velocity: NACv;				
(10) Emitter Category;				
(11) Surface Horizontal Position — Latitude and Longitude;				
(12) Surface Navigation Integrity Category: NIC; (12) Surface Crawind Tradiu				
(13) Surface Ground Track;				
(15) Length/width of Aircraft				
(16) GPS Antenna Offset <i>Inot required by</i> 91.227 (ontional)]				
(17) Geometric Altitude:				
[19] Comparis Altitude Quality: GVA Inst required by 91 222 (antional)]				
(10) Geometric Attitude Quality. GVA not required by 51.227 (optional)				
(b) The ADS-B Out system integrity is designed commensurate with a 'minor' failure condition for the transmission of other data				

ADS-B Out Guidance Comp: Includes a comparison of EASA CS-ACNS (incl. BOOK1/BOOK 2 – Subpart D – Section 4, Appendix H (Part 1-6), a guidance/requirements in black are additional info. that does not conflict, but is not specified in the other guidance document/regulation,	nd Appendix I) and AC 20-1658 (incl. Appendix A-D)/ § 91.227. Guidance/requirements in green are the same or consistent, nd guidance/requirements in red are different guidance or requirements. Clarification has been provided in brackets.
CS ACNS.D.ADSB.105 Continuity (a) The ADS-B Out system continuity is designed to an allowable qualitative probability of 'remote' [§ 91.227 doesn't specify a continuity <i>requirement</i>]. Ref. EASA Deviation to CS ACNS.D.ADSB.105 to not meet a 'remote' quantitative probability requirement (1E-5/FH) if the installation	[§ 91.227 doesn't specify a continuity requirement].
meets the requirements of EU No 1207/2011 by having a continuity equal to or less than 2E-4/FH and the equipment supporting the ADS-functionality is DAL C (meets remote qualitative or chability)	
INVICENTIAL POSITION AND VELOCITE DATA KET KEST KATE AND DATE KING INC.	8 91 227(a)(2) The aircraft must transmit its position and valacity at loast once pay second while airbarne or while moving on the airpart
A horizontal position and velocity source calculates position and velocity data with a rate of at least 1 Hertz.	surface.
CS ACNS.D.ADSB.115 Horizontal Position and Velocity Total Latency (See AMC1 ACNS.D.ADSB.115 and 120)	§ 91.227(e)(1) The aircraft must transmit its geometric position no later than 2.0 seconds from the time of measurement of the position to
Measured from the time of applicability within the source, the total latency of the horizontal position and horizontal velocity data	the time of transmission.
introduced by the ADS-B Out system does not exceed 1.5 second.	[Although TL requirements appear different, they are consistent with each other. CS TL measurement is from the TOA, whereas, §
[Although TL requirements appear different, they are consistent with each other. CS TL measurement is from the TOA, whereas, § 91.227TL measurement is from the TOM (adds an additional 0.5 seconds)]	91.227 TL measurement is from the TOM (adds an additional 0.5 seconds)]
CS ACNS.D.ADSB.120 Horizontal Position Uncompensated Latency (See AMC1 ACNS.D.ADSB.115 and 120)	§ 91.227(e)(2) Within the 2.0 total latency allocation, a maximum of 0.6 seconds can be uncompensated latency. The aircraft must
The uncompensated latency of the horizontal position data introduced by the ADS-B Out System does not exceed 0.6 second.	compensate for any latency above 0.6 seconds up to the maximum 2.0 seconds total by extrapolating the geometric position to the time of message transmission.
	AC 20-165, C.4.2 Latency Applicability.
	The 2.0 second total latency requirement [CS latency measurement is from the TOA (total 1.5 sec. requirement), whereas, § 91.227
	latency measurement is from the TOM (adds an additional 0.5 seconds - total 2 sec. requirement)] applies to the aircraft position
	(latitude and longitude), velocity, and the velocity accuracy metric (NAC _v). The 0.6 second uncompensated latency requirement only
	applies to the aircraft position (latitude and longitude).
	Additional Guidance not Addressed in CS-ACNS
	CHAPTER 2. THE APPROVAL PROCESS AND NECESSARY DOCUMENTATION
	CHAPTER 2. THE APPROVAL PROCESS AND NECESSARY DOCUMENTATION 2.1.2 The ADS-B OUT System.
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2.3.4.2 ADS-B Source System Components. Although the installer may not have access to the specific source system ICA to incorporate changes into those specific documents, the installer must do an analysis of the source systems to determine what maintenance actions on those source systems would require a functional test of the ADS-B system to verify that the system is operating properly. In particular, those systems providing a dedicated input to the ADS-B system that cannot be verified by other means should be tested as part of the ADS-B system as a whole. Once the installer identifies those actions, they must provide recommended language for the operator to include in their ICA. If the installer determines that removal and replacement of the Global Positioning System (GPS) receiver requires a full functional check of the ADS-B system because the GPS input to the ADS-B cannot be verified by other means, its instructions to the operator should indicate this. For example: Modify the R&R ICA instructions in your GPS maintenance manual to include the following statement: "Removal and replacement of the GPS receiver also requires a full functional check of the ADS-B system per MM XX-XX-XX, Pg xxx. Make a logbook entry for accomplishment of this test".
2.3.4.2 Design Changes to Interfacing Components. Ensuring continued airworthiness of the ADS-B system following upgrades of interfacing components could be problematic if the installer of the ADS-B system is unaware of design changes to interfacing components, or if the installer of the updated interfacing component is unaware of a potential impact to the ADS-B system. To avoid this problem, the ADS-B system installer must update the ICA for each interfacing system with a process that ensures continued airworthiness of the ADS-B system following design changes to the interfacing component.
UTIANTER 3. ADS-B UUT STSTEINI INSTALLATION GUIDANCE
3.1.1 Environmental Qualification. Ensure the environmental qualification of the installed equipment is appropriate for the aircraft in accordance with AC 21-16G, RTCA Document DO-160 versions D, E, F, and G, "Environmental Conditions and Test Procedures for Airborne Equipment".
ICHAPTER 4. TEST AND EVALUATION
4.1 Electromagnetic Interface (EMI)/Electro Magnetic Compatibility (EMC) Testing. Provide an EMI/EMC test plan that demonstrates compliance with 14 CFR 23.1431(a) and (b), 25.1353(a) and (b), 25.1431(a) and (c), 27.1301, 27.1309, 29.1353(a) and (b), and 29.1431(a) and (b) as appropriate. Accomplish EMI/EMC testing to ensure the ADS-B equipment does not provide an interference source on other installed systems on the aircraft. Additionally, ensure equipment already installed in the aircraft does not interfere with the ADS-B system. If the STC or TC only involves a software change to an existing approved Mode S transponder installation, and the software update will not affect the systems response to EMI, you do not need to accomplish EMI testing again.
 4.1.4 Electromagnetic Interface (EMI)/Electro Magnetic Compatibility (EMC) Testing. Provide an EMI/EMC test plan that demonstrates compliance with 14 CFR 23.1431(a) and (b), 25.1353(a) and (b), 25.1431(a) and (c), 27.1300, 29.1353(a) and (b), and 29.1431(a) and (b) as appropriate. Accomplish EMI/EMC testing to ensure the ADS-B equipment does not provide an interference source on other installed systems on the aircraft. Additionally, ensure equipment already installed in the aircraft does not interfere with the ADS-B system. If the STC or TC only involves a software change to an existing approved Mode S transponder installation, and the software update will not affect the systems response to EMI, you do not need to accomplish EMI testing again. 4.1.5 Human Machine Interface. Evaluate the flightcrew interface for the ADS-B OUT system, including the human-system interface and system behavior. The ADS-B OUT system must be compatible with the overall flightdeck design characteristics (such as access to controls, sunlight readability, night lighting, etc.) as well as the aircraft environment (such as vibrations).
 4.1.4 Electromagnetic Interface (EMI)/Electro Magnetic Compatibility (EMC) Testing. Provide an EMI/EMC test plan that demonstrates compliance with 14 CFR 23.1431(a) and (b), 25.1353(a) and (b), 25.1431(a) and (c), 27.1301, 27.1309, 29.1353(a) and (b), and 29.1431(a) and (b) as appropriate. Accomplish EMI/EMC testing to ensure the ADS-B equipment does not provide an interference source on other installed systems on the aircraft. Additionally, ensure equipment already installed in the aircraft does not interfere with the ADS-B system. If the STC or TC only involves a software change to an existing approved Mode S transponder installation, and the software update will not affect the systems response to EMI, you do not need to accomplish EMI testing again. 4.1.5 Human Machine Interface. Evaluate the flightcrew interface for the ADS-B OUT system, including the human-system interface and system behavior. The ADS-B OUT system must be compatible with the overall flightdeck design characteristics (such as access to controls, sunlight readability, night lighting, etc.) as well as the aircraft environment (such as vibrations). 4.1.5.1 Information Display. Evaluate the ADS-B OUT system to ensure displayed information is easily and clearly discernible, and has enough luminance, size, and visual contrast for the pilots to see and interpret it. Ensure the pilots have a clear, unobstructed, and undistorted view of the displayed information elements. Ensure information elements are distinct and permit the pilots to determine the source of the information elements are distinct and permit the pilots to determine the source of the information elements in foressary, when there are multiple sources of the same kind of information.

4.1.5.3 Annunciations and Alerts.				
Evaluate all ADS-B annunciations and alerts to ensure they are clear and unambiguous, and provide attention-getting and saliency			on-getting and saliency	
appropriate to the type of alert. Compliance with AC 25.1322-1, Flightcrew Alerting; AC 27.1322 (in AC 27-1B, Certification of Nor			1B, Certification of Normal	
Category Rotorcraft); and AC 29.1322 (in AC 29-2C, Certification of Transport Category Rotorcraft) should be considered when eval				e considered when evaluating
ADS-B annunciations and alerts. The colors yellow/amber and red should be restricted to cautions and warnings, respectively. Ev				rnings, respectively. Evaluate
the annunciations and indications to ensure they are operationally relevant and limited to minimize the adverse effects on flightcr				verse effects on flightcrew
workload. When an annunciation is provided for the status or mode of a system, it is recommended that the annunciation indicat				he annunciation indicate the
actual state of the system, and not just the position of a switch.				
4.1.5.5 Lighting.				
Evaluate all foreseeable conditions relative to lighting, including failure modes such as lighting and power system failure, and day and r				ystem failure, and day and night
operations.				
4.1.6 Transponder Regress	ion Testing.			
At a minimum, use the pro	cedures outlined in AC 43-6	6(), Altitude Reporting E	quipment and Transponder Sy	stem Maintenance and
Inspection Practices, to val	idate that the transponder	is operating normally fo	blowing the ADS-B installation	. Use the procedures outlined
in AC 20-151() for ADS-B sy	stems that include installat	tion of a new or modifie	d Mode S transponder. If you	are installing a new air-ground
status capability for the AD	S-B system and this function	onality is also interfaced	to the transponder, you must	ensure replies to the Mode A/C
and ATCRBS/Mode S all-ca	Il interrogations are inhibite	ed on the ground.		·····, ····, ····,
4.1.7 ICAO 24-Bit Address.	-8			
For U.S. civil aircraft, demo	onstrate that the 24-bit add	lress transmitted by the	system correlates to the aircr	aft registration number. If the
system has a senarate Mor	de S transponder and UAT A	ADS-B system installed (ensure both the transponder.	and ADS-B system transmit the
system has a separate vioue's transponder and UAT AUS-B system installed, ensure both the transponder and AUS-B system transmit				he address assigned to the
same currect ICAO 24-bit address. For non-U.S. registered aircraft, verify that the ICAO 24-bit address is the address assigned to the aircraft but the responsible State authority.				
A 1 9 Position Source Esilure				
4.1.3 Prostion source failure. Demostrate that a failure or loss of the position source results in an indication to the operator of an ADS P function failure. If a				S function failure If a
perioristrate that a failure or loss of the position source results in an indication to the operator of an ADS-B function failure. If a				the change from the primary
secondary position source is interfaced to the ADS-B equipment, ensure it meets all guidance in this AC. If the change from the prim			accomplished within 10	
seconds.				accomplished within 10
4.1.11 Transmit Power.				
Transmit nower testing mu	ist be accomplished if a new	w antenna has been inst	alled an existing antenna has	been relocated a diplever has
been installed into an existing antenna system, or the output specifications on the transponder have changed. Perform the following				ed Perform the following
testing to validate transmit nower.			ed. Terform the following	
LESUING to valuate transmit power:			ctionality doos not require	
transmit nowor tosting unl	oss a now antonna has hoo	n installed the antenna	location has changed or the	output specifications on the
transmit power testing un		in instance, the antenna	location has changed, or the	output specifications on the
transponder nave changed.				
Vorify that the neak pulse	nower at the antenna and	of the transmission line	mosts the minimum and may	imum nowor lovels summarized
in Table 2, considering the	tost oquinmont antonna ar	or the transmission line i	the measurement in each a	undrant of the antonna nattorn
(forward aft loft right)	test equipment antenna ga	ani anu patri loss. Repea	it the measurement in each q	dadrant of the antenna pattern
(IOI waru, ait, ieit, light).				
Table 3. Minimum and Maximum Transmitted Power From TSO-C166b				
	T (1T) (C1	DC' D		
	Tested Transmitter Class	Minimum Power	Maximum Power	
	Al	21.0 dBW	27.0 dBW	
	A1S	21.0 dBW	27.0 dBW	
	B1	21.0 dBW	27.0 dBW	
	B1S	21.0 dBW	27.0 dBW	
	A2	21.0 dBW	27.0 dBW	
	A3	23.0 dBW	27.0 dBW	
		2010 02011	2110 0211	

4.1.11.2 UAT Transmitte	er [CS only recongnizes 1	090 ES for the ADS-B Out d	lata link] .	
Verify that the peak puls	se power at the antenna	end of the transmission line	e meets the minimum and maxi	imum power levels summarized
in Table 4, considering th	he test equipment anter	na gain and path loss. Repe	eat the measurement in each qu	uadrant of the antenna pattern
(forward, aft, left, right).				
	Table 4. Minimur	n and Maximum Transmitt	ted Power From TSO-C154c	
	Tested Transmitter Cl	ass Minimum Power	Maximum Power	
	A1H	12.0 dBW	16.0 dBW	
	A1S	12.0 dBW	16.0 dBW	
	B1	12.0 dBW	16.0 dBW	
	BIS	12.0 dBW	16.0 dBW	•
	A2	12.0 dBW	16.0 dBW	
	A2	12.0 dBW	10.0 dBW	
	A5	20.0 dBW	24.0 dBW	J
4.1.12 TCAS.				
If a TCAS II system is inst	talled on the aircraft, en	sure the proper messages a	re transmitted by the ADS-B sys	stem when the TCAS II is on and
operating in a mode that	t can provide RAs. No T	CAS II system regression tes	sting beyond the ground interfac	ce testing covered in this
section is required.				
4.1.13 Transponder All-c	call Inhibit.			
When ADS-B functionali	ty resides in a Mode S tr	ansponder, conduct a test c	demonstrating that replies to M	ode A/C/S all-call and Mode S-
only all-call interrogation	ns are inhibited on the g	round. Also demonstrate th	hat replies to discrete interrogat	tions are not inhibited.
4.1.14 Mode 3/A Code a	and Emergency Code.			
Demonstrate that the co	orrect Mode 3/A code ar	d IDENT is transmitted. Do	not transmit the 7500, 7600, o	r 7700 emergency codes over
the air during ground or flight testing. If testing emergency codes is desired, contact the local ATC facility and coordinate testing to				
prevent a nuisance eme	rgency response.			
4.2 Flight Test [CS-ACNS	i doesn't require a flight	test] .		
 This section provides inf	ormation on flight testin	g ADS-B systems.		
4.2.1 Electromagnetic Ir	nterference [CS-ACNS d	esn't require a flight test]		
During all phases of fligh	nt, survey the flight deck	EMI to determine that the	ADS-B OUT equipment is not a s	source of objectionable
conducted or radiated in	nterference to previously	installed systems or equip	ment, and that operation of the	ADS-B OUT equipment is not
adversely affected by co	onducted or radiated inte	rference from previously in	nstalled systems and equipment	
4.2.2 Other System Perf	ormance ICS-ACNS does	n't require a flight test].		
Demonstrate the proper	r performance of any pre	viously installed aircraft sys	stems that required changes as	a result of the ADS-B
installation in accordance	ce with the applicable po	licy. This can be accomplish	hed with standard regression te	st procedures for the other
installed systems, and do	oes not require a unique	test for ADS-B.		
4.2.3 User Interface [CS-	-ACNS doesn't require a	flight test] .		
Exercise all user inputs.	If separate user inputs a	re required for the transpo	nder and ADS-B systems, evalua	ate the flight manual
procedures for ensuring	the same Mode 3/A coo	le, IDENT, and emergency c	odes are transmitted from both	n systems.
4.3 Flight Test With FAA	Ground System [CS-ACN	IS doesn't require a flight t	test].	
Perform a flight test to s	show that the installed sy	stem performs properly wi	ith the FAA ground system. The	e test will verify that the FAA
ground system properly	receives the aircraft's A	DS-B broadcast messages, t	here are no dropouts, and the i	nformation transmitted is
complete and correct. C	Currently the only metho	d available to accomplish th	he flight test is to fly within ADS	-B service coverage and
accomplish a post-flight	analysis of the data rece	ived from the FAA. This tes	st is intended to evaluate the de	esign interface for the position
source and the ADS-B ec	quipment.	destant second at the me	To an To an I have been store	resident for the state of the state of
Note 1: This flight test is	intended to complete a	design approval under an S	or TC application; it is not in	tended for the alteration of
Individual aircraft.	adard process for resure	ting flight toot outhorization	a thoro are no unique flight toot	t outborization requirements fo
ADS-B flight tests	idard process for reques	ung night test authorization	n, there are no unique filght test	caucionization requirements to
4.3.1 Preflight Coordinat	tion (CS-ACNS doesn't re	auire a fliaht testl .		
4.3.1.1 Data Retrieval IC	CS-ACNS doesn't require	a flight test] .		
Flight test data can be re	equested for two distinct	types of flight testing, open	rational checkout of a previousl	ly certified system, and testing
of a first-of-kind ADS-B s	system.			

 4.3.1.1.1. Previously Certified Systems [CS-ACNS doesn't require a flight test]. In the context of this AC, a previously certified system is an ADS-B system that holds a Type Certificate, Supplemental Type Certificate or is listed on an Approved Model Listing. Aircraft owners may request a flight test compliance report to verify a previously approved ADS-B system has been installed and configured correctly. Interested parties can email 9-AWA-AFS-300-ADSB-AvionicsCheck@faa.gov and request an ADS-B Aircraft Operation Compliance Report (ACR). When requesting an ACR, include aircraft registration number ("N" number), location, date, and approximate local time of flight. All requests should be made after the test flight has taken place. 4.3.1.1.2 First-of-Kind Systems [CS-ACNS doesn't require a flight test]. System integration teams may request flight test data for first-of-kind ADS-B systems. First-of-kind systems are those that are part of a TC, STC, or Approved Model List (AML) effort. At least 48 hours before the flight, holy test flight by emailing 9-avs-air-130fIttest@FAA.gov that you require data to support first-of-kind testing of a new ADS-B system. Contacting the FAA before a test flight test request sheet. When contacting the FAA for flight test data, it is recommended you carbon copy any certifying officials you may be working with within the Aircraft
Certification Office, Military Certification Office, Flight Standards District Office, or Flight Inspection District Office. Flight test data can usually be provided to the requester within 48 hours. An analysis report may take up to 30 days if it is determined necessary.
4.3.1.2 ATC Coordination [CS-ACNS doesn't require a flight test]. There is no ADS-B specific requirement to coordinate the flight test in advance with ATC. Follow normal flight test procedures for coordinating with ATC.
4.3.2 Flight Test Profile [CS-ACNS doesn't require a flight test]. This profile is intended to be flown on all ADS-B system approvals. The profile need not be flown exactly, and variances for ATC clearances and vectors are acceptable. The flight test should be at least 1 hour long. If the profile is completed in less than 1 hour, continue the flight until enough data is collected. The flight test may not be performed using the random UAT 24-bit address feature, since the 24-bit address is a key field in retrieving the ATC flight profile data. The profile discussed in section 4.3.2.3 through 4.3.4.6 below may be flown in any order.
4.3.2.1 Location of Flight [CS-ACNS doesn't require a flight test]. The flight may be accomplished in any airspace that has FAA ADS-B ground station coverage. As of December 1, 2015 the ADS-B ground network is completely deployed across the continental United States, Hawaii, Puerto Rico, and Guam. The ADS-B ground network has been installed in Alaska but does not cover the entire state. Refer to the following website for information on existing ADS-B coverage in the National Airspace System (NAS): http://www.faa.gov/nextgen/programs/adsb/coverageMap
4.3.2.2 Distance From Ground Station [CS-ACNS doesn't require a flight test] . This flight profile does not specify the distance the aircraft must be from an ADS-B ground station. Transmit power is evaluated through ground testing instead of demonstrating a minimum air-to-ground reception distance.
4.3.2.3 Altitude [CS-ACNS doesn't require a flight test] . Fly the aircraft at multiple altitudes throughout the flight within ADS-B coverage. There is no maximum or minimum altitude required for the flight test.
4.3.2.4 Turns [CS-ACNS doesn't require a flight test] . Verify the ADS-B system performs properly during turning maneuvers. During the flight, place the aircraft in various normal configurations such as takeoff, approach, landing, and cruise configuration if appropriate for the airframe. During the flight, perform at least two left and two right 360-degree turns. Table 5 below provides the suggested altitude, speed, and bank angle at which these turns should be made. The intent of this test is to ensure the ADS-B system operates properly over the normal flight regimes of the aircraft under test. Variations on altitude, speed, and bank angle are acceptable as long as the intent of the test is met.

		Table 5	. Turns	
		Part 23	Aircraft	
	Configuration	Altitude Range (in feet AGL)	Speed Range	Bank Angle
	Takeoff	3000-5000	1.4 Vs	30°
	Approach or Landin	ng 2000-7000	1.4 Vs	30°
	Cruise	7000-10000	1.5 V _S to 1.8 V _S	30°
		Part 25	Aircraft	
	Configuration	Altitude Range	Speed Range	Bank Angle
	Takeoff	3000-5000	V ₂ + 20 kts	30°
	Approach or Landin	ng 2000-7000	V _{APP} + 20 kts	30°
	Cruise	7000-10000	$1.5 V_S$ to $1.8 V_S$	30°
		Part 27 I	otorcraft	
	Configuration	Altitude Range	Speed Range	Bank Angle
	Landing	1000-3000	V _Y + 10 kts	30°
	Cruise	2000-5000	0.8 V _{NE} or 0.8 V _H	30°
		Part 29 I	otorcraft	
	Configuration	Altitude Pange	Speed Range	Bank Angle
		Annuae Range	Speed Range	Dunieringie
	Landing	1000-3000	V _Y + 10 kts	30°
4.3.2.5 Climi	Landing Cruise bs/Descents [CS-ACNS does	1000-3000 2000-10000 sn't require a flight test]	Vy + 10 kts 0.8 V _{NE} or 0.8 V _H	30° 30°
4.3.2.5 Climi Verify the AI made during descents sho regime of th	Landing Cruise bs/Descents [CS-ACNS does DS-B system performs prop g the test flight. Table 7 pro ould be at least one minute ne aircraft under test. Varia	Annual Range 1000-3000 2000-10000 sin't require a flight test] enly during climbs and de vides a suggested airspe in length. The intent of tions on climb and desce	$V_{\rm Y} + 10 \text{ kts}$ $0.8 V_{\rm NE} \text{ or } 0.8 V_{\rm H}$ scents. Table 6 provied at which descents his test is to ensure the rates are acceptable	30° 30° 30° des a suggested airspeed should be made during the e ADS-B system operate: e as long as the intent of
4.3.2.5 Climi Verify the Al made during descents sho regime of th	Landing Cruise DS-B system performs prop g the test flight. Table 7 pro ould be at least one minute he aircraft under test. Varia	Annual Range 1000-3000 2000-10000 and t require a flight test] erly during climbs and de avoides a suggested airspection length. The intent of tions on climb and descee Table 6. Climbal Clim	$V_{\rm Y} + 10 \text{ kts}$ $0.8 V_{\rm NE} \text{ or } 0.8 V_{\rm H}$ scents. Table 6 provi ed at which descents his test is to ensure t int rates are acceptab	30° 30° des a suggested airspeed should be made during th the ADS-B system operate: e as long as the intent of
4.3.2.5 Clim Verify the Al made during descents sho regime of th	Landing Cruise DS-Descents [CS-ACNS does DS-B system performs prop g the test flight. Table 7 pro ould be at least one minute te aircraft under test. Varia	Anitude Range 1000-3000 2000-10000 an't require a flight test] erly during climbs and de vides a suggested airspe in length. The intent of tions on climb and desce Table 6. Cli 3 Aircraft Part 25 Aircr	$V_{\rm Y} + 10 \text{ kts}$ $0.8 V_{\rm NE} \text{ or } 0.8 V_{\rm H}$ scents. Table 6 provided at which descents his test is to ensure that rates are acceptable and Speeds aft Part 27 Rotorcraft	30° 30° </td
4.3.2.5 Clim Verify the Al made during descents sho regime of th	Landing Cruise DS-Descents [CS-ACNS does DS-B system performs prop g the test flight. Table 7 pro ould be at least one minute te aircraft under test. Varia	Annual Parage 1000-3000 2000-10000 sn't require a flight test] erly during climbs and de vides a suggested airspe in length. The intent of tions on climb and desce Table 6. Cli 3 Aircraft Part 25 Aircr VFE - 10 kts	Speed Kange $V_Y + 10 \text{ kts}$ $0.8 V_{NE} \text{ or } 0.8 V_H$ scents. Table 6 provided at which descents his test is to ensure that rates are acceptab mb Speeds aff Part 27 Rotorcraft V_Y	30° 4000 400 <
4.3.2.5 Clim Verify the Al made during descents sho regime of th	Landing Cruise bs/Descents [CS-ACNS doess DS-B system performs prop g the test flight. Table 7 pro ould be at least one minute ie aircraft under test. Varia Configuration Part 2 Take off V _Y Cruise V _H	Initial Particular 1000-3000 2000-10000 sm't require a flight test] erly during climbs and devides a suggested airspein length. The intent of tions on climb and descent Table 6. Climbs 3 Aircraft Part 25 Aircrit VFE - 10 kts Vmo - 10 kts	$\begin{tabular}{ c c c c } \hline & V_{\rm Y} + 10 \ {\rm kts} \\ \hline & 0.8 \ V_{\rm NE} \ {\rm or} \ 0.8 \ V_{\rm H} \\ \hline & 0.8 \ V_{\rm NE} \ {\rm or} \ 0.8 \ V_{\rm H} \\ \hline & {\rm scents.} \ Table 6 \ {\rm provided} \ {\rm scents} \ {\rm tabular} \ {\rm tab$	30° 4000 400 <
4.3.2.5 Clim Verify the AI made during descents sho regime of th	Landing Cruise bs/Descents [CS-ACNS does DS-B system performs prop g the test flight. Table 7 pro- ould be at least one minute teacraft under test. Varia Configuration Part 2 Take off V _Y Cruise V _H	Initial Particular 1000-3000 2000-10000 san't require a flight test] erly during climbs and de vides a suggested airspein in length. The intent of tions on climb and descent Table 6. Climb 3 Aircraft Part 25 Aircrit VFE - 10 kts VMO - 10 kts Table 7. Desc	Vr + 10 kts 0.8 V _{NE} or 0.8 V _H scents. Table 6 provided at which descents his test is to ensure that rates are acceptable mb Speeds aff Part 27 Rotorcraft VY 0.8 V _{NE} or 0.8 V ent Speeds	Join Tright 30° 30° 30° 30° des a suggested airspeed should be made during the ne ADS-B system operates e as long as the intent of If Part 29 Rotorcraft VY H 0.8 V _{NE} or 0.8 V _H
4.3.2.5 Clim Verify the AI made during descents sho regime of th	Landing Cruise bs/Descents [CS-ACNS does DS-B system performs prop g the test flight. Table 7 pro ould be at least one minute teae aircraft under test. Varia Configuration Part 2 Configuration Part 2	Animule Range 1000-3000 2000-10000 sn't require a flight test] erly during climbs and de vides a suggested airspe in length. The intent of tions on climb and desce Table 6. Cli 3 Aircraft Part 25 Aircr 3 Aircraft Part 25 Aircr 3 Aircraft Part 25 Aircr	$\begin{tabular}{ c c c c } \hline & V_{Y} + 10 \ kts \\ \hline & 0.8 \ V_{NE} \ or \ 0.8 \ V_{H} \\ \hline & 0.8 \ V_{NE} \ or \ 0.8 \ V_{H} \\ \hline & constraints \ constraint$	30° 4 Part 29 Rotorcraft 1 Part 29 Rotorcraft
4.3.2.5 Clim Verify the AI made during descents sho regime of th	Landing Cruise bs/Descents [CS-ACNS does DS-B system performs prop g the test flight. Table 7 pro ould be at least one minute teast one minute configuration Part 2 Take off Vr Cruise VH Configuration Part 2 Cruise VNE -	Initial Part 25 Aircr	$\begin{tabular}{ c c c c } \hline & V_{Y} + 10 \ kts \\ \hline & 0.8 \ V_{NE} \ or 0.8 \ V_{H} \\ \hline & 0.8 \ V_{NE} \ or 0.8 \ V_{H} \\ \hline & d \ at \ which \ descents \\ his test is to ensure the ensure that the ensure t$	30° 30° 30° 30° 30° 30° des a suggested airspeed should be made during the ADS-B system operates e as long as the intent of ft Part 29 Rotorcraft VY H 0.8 V _{NE} or 0.8 V _H ft Part 29 Rotorcraft gt 0.8 V _{NE} or 0.8 V _H
4.3.2.5 Climi Verify the AI made during descents sho regime of th	Landing Cruise bs/Descents [CS-ACNS does DS-B system performs prop g the test flight. Table 7 pro ould be at least one minute teast one minute configuration Part 2 Take off Vr Cruise VH Configuration Part 2 Cruise VH	Initial Part 25 Aircr Aircraft Part 25 Aircr Ioo Aircraft Part 25 Aircr Ioo Ioo Vie Ioo	Speed Kange $V_Y + 10 \text{ kts}$ $0.8 V_{NE} \text{ or } 0.8 V_H$ scents. Table 6 provided at which descents this test is to ensure the trates are acceptable mb Speeds aft Part 27 Rotorcra V_Y $0.8 V_{NE}$ or $0.8 V_H$ ent Speeds aft Part 27 Rotorcra V_Y $0.8 V_{NE}$ or $0.8 V_H$ other Speeds aft Part 27 Rotorcra $V_Y + 10 \text{ kts}$	30° des a suggested airspeed should be made during the ADS-B system operates e as long as the intent of ft Part 29 Rotorcraft VY H 0.8 V _{NE} or 0.8 V _H VY + 10 kts

4.3.3 Post-Flight Data Analysis [CS-ACNS doesn't require a flight test]. You must accomplish a post-flight data analysis to ensure the aircraft is transmitting accurate ADS-B information. Ensure all data associated with the track is consistent, such as position, 24-bit address, velocity, flight ID, barometric altitude, Mode 3/A code, emitter category, and geometric altitude. The post-flight data analysis should also reveal if there were any unexpected data dropouts that might be caused by intermittent wiring interfaces or interface incompatibility. The flight test does not require the use of a truth source to accomplish post-flight data analysis; however, the FAA will provide radar data when available to help analyze the flight track. At a				
minimum, analyze the following areas:				
4.3.3.1 Rule Compliance [CS-ACNS doesn't require a flight test] . Review the data from the FAA ground system for the flight to ensure the installed system meets its stated accuracy and integrity performance under flight conditions. We recommend that you accomplish a GNSS performance prediction for the applicable time of yo test and ensure the ADS-B system meets the predicted performance. Due to the design of existing GNSS receivers and typical GPS constellation configurations, there will be time periods when unaugmented GNSS solutions drop below the NIC and NACP performance required by the rule. Such outages usually do not occur for more than 20 minutes, and many are of much shorter durations. If the integrity and accuracy of an existing GNSS installation does not meet the rule requirements during the test flight, the applicant should show that poor performance was caused by the constellation during the period of time that the flight occurred. If that cannot be established as the cause of the poor performance, there may be a problem with the position sensor installation that needs to be investigated and resolved. Resolution of this type of issue will probably require the involvement of the position source manufacturer. There may also be short periods where position messages transmit NIC = 0, velocity messages transmit NACV = 0, and status messages transmit NACP = 0, SIL = 0. These can be caused by antenna shadowing and switching effects, and do not indicate an installation proble if they are infrequent and of short duration. All such outages must be less than 5 seconds in duration to avoid operational impacts. This condition occurs more often than once every 1000 position transmissions when averaging all outages over the flight duration. If this condition occurs more often during the flight test, the applicant must establish root cause and provide a solution before granting installation approval. Demonstrate that you meet all § 91.227(c)(1) accuracy and integrity requirements, listed in Table 8, during flight.				
Table 8. Accuracy and Integrity Requirements During Flight				
Ensure NIC \geq 7 throughout the flight. Rc <370.4 m (0.2 nm)				
Ensure NAC _P \ge 8 throughout the flight. EPU <92.6 m (0.05 nm)				
Ensure $NAC_V \ge 1$ throughout the flight. $\le 10 \text{ m/s}$				
Ensure SIL = 3 throughout the flight $\leq 1 \times 10^{-7}$				
Ensure SDA ≥ 2 throughout the flight $\le 1 \times 10^{-5}$				
4.3.3.2 Position Accuracy/Integrity [CS-ACNS doesn't require a flight test] . Compare the track received by the FAA ground system with the actual flight track. There is no specific tolerance for this test; rather, the applicant must show there are no gross position errors, track offsets or discontinuities, or other obvious anomalies.				
4.3.3.4 Velocity Accuracy [CS-ACINS doesn't require a flight test]. Compare the velocity received by the FAA ADS-B ground system with the actual velocities flown. There is no specific tolerance for this test; rather, you must show that they compare reasonably, and that there are no gross velocity errors.				
4.3.3.4 Geometric Altitude Accuracy [CS-ACNS doesn't require a flight test] . Compare the geometric altitude received by the FAA ground system with the geometric altitude flown. There is no specific tolerance for this test; rather, you must show that they compare reasonably, and that there are no gross geometric altitude errors.				
4.3.3.5 Barometric Pressure Altitude Accuracy [CS-ACNS doesn't require a flight test]. Compare the barometric pressure altitude received by the FAA ground system with the actual barometric pressure altitude flown. There is no specific tolerance for this test; rather, you must show that they compare reasonably, and that there are no gross barometric pressu altitude errors.				

 4.3.3.6 Validity Checks [CS-ACNS doesn't require a flight test]. The FAA plans to use radar, multilateration, and UAT passive ranging as independent validity checks for ADS-B. The validity check will indicate "valid" when the independent check is able to validate the ADS-B position, "invalid" when it determines the ADS-B position is out of tolerance, and "unknown" if it is unable to accomplish the validity check. If a validity or enhanced validity status is provided in the flight test data, you must show that it never indicates "invalid". Note: Validity checks are planned to ensure the ADS-B position is within 0.56 nm in terminal airspace and 1.9 nm in en-route airspace. Enhanced validity checks are planned to ensure the ADS-B position is within 0.2 nm within approximately 15 nm of terminal radars and close proximity to airports with Airport Surface Detection Equipment, Model X (ASDE-X) systems.
4.4 International Flight Test Options [CS-ACNS doesn't require a flight test] . If the aircraft is being flight tested outside of the United States, it is acceptable to perform the flight test against another Air Navigation Service Provider's (ANSP) ground system. Other ANSP's ground systems must be fully operational and appropriately qualified to provide ATC separation services. Other ANSP ground systems must also be able to provide all parameters required by § 91.227. You will have to work with the foreign ANSP to retrieve the necessary data.
4.5 Subsequent Flight Test Data Reuse [CS-ACNS doesn't require a flight test]. The flight test guidelines in section 4.3 of this AC apply to initial TC/STC applications. Flight test data from a similar installation, covered under a previous TC/STC, may be used instead of a new flight test if the following conditions can be confirmed through the documentation of the previous STC:
4.5.1 Position Source Equipment [CS-ACNS doesn't require a flight test]. The position source must be identical to that of the other Amended Type Certificate (ATC), TC, or STC documentation. Equipment families that use the same baseline design may make a case for equivalence.
4.5.2 ADS-B Equipment [CS-ACNS doesn't require a flight test]. The ADS-B equipment must be identical to that of the other ATC/TC/STC documentation. Equipment families that use the same baseline design may make a case for equivalence.
4.5.3 System Interface [CS-ACNS doesn't require a flight test] . A direct interface must be used between the position source and the ADS-B equipment, and that interface must be identical to that of the previous ATC/TC/STC. Aircraft with data concentrators will have to re-accomplish the flight test, even if the equipment is identical.
4.5.4 Air-Data Interface [CS-ACNS doesn't require a flight test]. The air-data interface to the ADS-B equipment must be identical to that of the previous ATC/TC/STC. The actual air-data source may be different equipment; only the interface to the ADS-B equipment needs to be identical. However, if the air-data source is different, more extensive ground testing should be accomplished, to include a dynamic test where the air-data source has simulated inputs from sea level to the maximum certified operating altitude of the aircraft. Care should be taken to ensure broadcast of simulated altitude information does not cause interference with ATC or ADS-B IN applications.
4.5.5 Heading Interface [CS-ACNS doesn't require a flight test]. The heading interface to the ADS-B equipment (if applicable) must be identical to that of the previous ATC/TC/STC. The heading source may be different; only the interface to the ADS-B equipment needs to be identical. If the heading source is different, testing should be accomplished, to include positioning the aircraft at multiple headings on the surface to verify heading accuracy.
4.5.6 TCAS Interface [CS-ACNS doesn't require a flight test]. The TCAS Interface to the ADS-B equipment must be identical to that of the previous ATC/TC/STC. The TCAS equipment may be different; only the interface to the ADS-B equipment needs to be identical.