This document is scheduled to be published in the Federal Register on 01/11/2023 and available online at **federalregister.gov/d/2023-00420**, and on **govinfo.gov**

[4910-13-P]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. FAA-2022-1647; Project Identifier AD-2022-01379-T]

RIN 2120-AA64

Airworthiness Directives; Transport and Commuter Category Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: The FAA proposes to supersede Airworthiness Directive 2021-23-12, which applies to all transport and commuter category airplanes equipped with a radio (also known as radar) altimeter. AD 2021-23-12 requires revising the limitations section of the existing airplane/aircraft flight manual to incorporate limitations prohibiting certain operations requiring radio altimeter data when in the presence of 5G C-Band interference as identified by Notices to Air Missions. Since the FAA issued AD 2021-23-12, the FAA determined that additional limitations are needed due to the continued deployment of new 5G C-Band base stations whose signals are expected to cover most of the contiguous United States at transmission frequencies between 3.7-3.98 GHz. This proposed AD would require revising the limitations section of the existing airplane/aircraft flight manual to incorporate limitations prohibiting certain operations requiring radio altimeter data, due to the presence of 5G C-Band interference. This proposed AD would also require modifying certain airplanes to allow safe operations in the United States 5G C-Band radio frequency environment. The FAA is issuing this AD to address the unsafe condition on these products.

DATES: The FAA must receive comments on this proposed AD by [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: You may send comments, using the procedures found in 14 CFR 11.43 and 11.45, by any of the following methods:

• Federal eRulemaking Portal: Go to regulations.gov. Follow the instructions for submitting comments.

• Fax: 202-493-2251.

• Mail: U.S. Department of Transportation, Docket Operations, M-30, West Building Ground Floor, Room W12-140, 1200 New Jersey Avenue SE, Washington, DC 20590.

• Hand Delivery: Deliver to Mail address above between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

AD Docket: You may examine the AD docket at regulations.gov under Docket No. FAA-2022-1647; or in person at Docket Operations between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The AD docket contains this NPRM, any comments received, and other information. The street address for Docket Operations is listed above.

FOR FURTHER INFORMATION CONTACT: Brett Portwood, Continued Operational Safety Technical Advisor, COS Program Management Section, Operational Safety Branch, FAA, 3960 Paramount Boulevard, Lakewood, CA 90712-4137; phone: 817-222-5390; email: operationalsafety@faa.gov.

SUPPLEMENTARY INFORMATION:

Comments Invited

The FAA invites you to send any written relevant data, views, or arguments about this proposal. Send your comments to an address listed under ADDRESSES. Include "Docket No. FAA-2022-1647; Project Identifier AD-2022-01379-T" at the beginning of your comments. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. The FAA

will consider all comments received by the closing date and may amend the proposal because of those comments.

Except for Confidential Business Information (CBI) as described in the following paragraph, and other information as described in 14 CFR 11.35, the FAA will post all comments received, without change, to regulations.gov, including any personal information you provide. The agency will also post a report summarizing each substantive verbal contact received about this proposed AD.

Confidential Business Information

CBI is commercial or financial information that is both customarily and actually treated as private by its owner. Under the Freedom of Information Act (FOIA) (5 U.S.C. 552), CBI is exempt from public disclosure. If your comments responsive to this NPRM contain commercial or financial information that is customarily treated as private, that you actually treat as private, and that is relevant or responsive to this NPRM, it is important that you clearly designate the submitted comments as CBI. Please mark each page of your submission containing CBI as "PROPIN." The FAA will treat such marked submissions as confidential under the FOIA, and they will not be placed in the public docket of this NPRM. Submissions containing CBI should be sent to Brett Portwood, Continued Operational Safety Technical Advisor, COS Program Management Section, Operational Safety Branch, FAA, 3960 Paramount Boulevard, Lakewood, CA 90712-4137; phone: 817-222-5390; email: operationalsafety@faa.gov. Any commentary that the FAA receives that is not specifically designated as CBI will be placed in the public docket for this rulemaking.

Background

The FAA issued Airworthiness Directive (AD) 2021-23-12, Amendment 39-21810 (86 FR 69984, December 9, 2021) (AD 2021-23-12), for all transport and commuter category airplanes equipped with a radio altimeter. AD 2021-23-12 was

prompted by a determination that radio altimeters cannot be relied upon to perform their intended function if they experience interference from wireless broadband operations in the 3.7-3.98 GHz frequency band (5G C-Band). AD 2021-23-12 requires revising the limitations section of the existing airplane/aircraft flight manual (AFM) to incorporate limitations prohibiting certain operations requiring radio altimeter data when in the presence of 5G C-Band interference as identified by Notices to Air Missions (NOTAMs). The agency issued AD 2021-23-12 because radio altimeter anomalies that are undetected by the automation or pilot, particularly close to the ground (e.g. landing flare), could lead to loss of continued safe flight and landing.

Actions Since AD 2021-23-12

Airplane Capability and Alterations: Since issuing AD 2021-23-12, the FAA has reviewed data from dozens of alternative method of compliance (AMOC) requests, demonstrating that these radio altimeters can be relied upon to perform their intended function when operating beyond a certain protection radius around 5G C-Band transmitters. The iterative AMOC process allowed the FAA to gain insight into 5G C-Band transmission impacts to runway safety zones[1] in a progressively more sophisticated manner. At first, the FAA made conservative assumptions about the potential for impact on radio altimeters from 5G C-Band transmissions and applied them to all airport environments. During the FAA's initial analyses of AMOC requests, the FAA looked to protect against 5G C-Band interference during the most critical phases of flight (takeoffs and landings) by protecting a 2-nautical mile circle around the ends of runways. After some time and an improved understanding of the C-Band signals and their effects on specific radio altimeters, the FAA was able to reduce the protected area around the ends of runways and instead define a rectangular airspace area to protect around runways. The

[1] Runway safety zones are those areas around a runway where radio altimeters on transport and commuter category airplanes must function accurately and reliably during critical phases of flight where radio altimeter interference is most likely to result in a catastrophic accident.

rectangular area was further refined into a trapezoidal area, which allowed for geographically expanded 5G C-Band transmissions that would not affect radio altimeter functions within the area. The FAA is now able to assess the 5G C-Band transmissions' impact to aviation operations in a specific area, taking into account the particularities of the signal and the airport environment. This assessment process is the Signal in Space (SiS) analysis. It includes a 3-dimensional model for the runway safety zone and considers base station heights and terrain around the airport.

The AMOC process also provided data about the varying levels of interference tolerance for a majority of radio altimeters on the market, allowing the FAA to understand the overall susceptibility to interference of the existing fleet of transport airplanes. In addition, the FAA learned about the aircraft alterations that can be accomplished quickly to improve a radio altimeter's tolerance to transmissions in adjacent or nearby spectrum bands. Now that the FAA better understands the performance of specific radio altimeters and the means to make them more tolerant of transmissions in adjacent or nearby spectrum bands, the FAA is proposing the updated corrective action presented in this proposed AD.

5G Compatibility: AMOCs allowing operations otherwise prohibited by AD 2021-23-12 were based on voluntary operational mitigations undertaken by AT&T and Verizon, 5G C-Band licensees. The FAA, AT&T, and Verizon have collaborated extensively to ensure 5G C-Band radio frequency transmissions and aircraft operations can safely co-exist. In early January 2022, the FAA progressively tailored runway protection zones around airports to envelop only the airspace areas where critical phases of flight occur. The FAA has worked with AT&T and Verizon to improve the precision of the FAA's interference analyses used during the AMOC process. In turn, AT&T and Verizon coordinated their

deployment around 5G C-Band mitigated airports (5G CMAs),[2] including in some cases reducing emission power around airports and committing to antenna pointing angles in the vertical plane to limit the potential for interference within the tailored runway safety zones. This collaborative work has allowed safe transport and commuter airplane operations to continue in the short term.

Update to Safety Determination: The FAA's initial determination that radio altimeters cannot be relied upon to perform their intended function if they experience interference from wireless broadband operations in the 5G C-Band remains unchanged. Therefore, this proposed AD would continue prohibiting the use of the same operations identified in the original AD (AD 2021-23-12) except for the prohibition of Required Navigation Performance with Authorization Required (RNP AR) Instrument Approach Procedures (IAP). After further analysis, the FAA has determined that 5G C-Band interference does not create an unsafe condition for an airplane conducting RNP AR IAPs because RNP AR operations do not rely on direct radio altimeter inputs to determine arrival at altitude minimums or the flight path of the airplane. Therefore, this proposed AD would no longer prohibit RNP AR IAPs.

The FAA has also gained a better understanding of 5G C-Band interference beyond its effect on the operations prohibited by AD 2021-23-12. Since 5G C-band deployment began, the FAA has solicited reports of radio altimeter anomalies from aircraft pilots and operators.[3] The FAA has received over 420 reports of radio altimeter anomalies occurring within a known location of a 5G C-Band deployment. Approximately 315 of these reports were determined to not be related to 5G C-Band

---

[2] For purposes of this proposed AD, a "5G C-Band mitigated airport" is an airport at which AT&T and Verizon have agreed to voluntarily limit their 5G deployment at the request of the FAA. The FAA will provide a list of these airports in the United States through the FAA Domestic Notice system. More information about Domestic Notices can be found on the FAA website at https://www.faa.gov/air_traffic/publications/domesticnotices/dom1_foreword.html.

[3] Special Airworthiness Information Bulletin AIR-21-18R1 and subsequent revisions encouraged pilots to submit detailed reports of radio altimeter anomalies using the Radio Altimeter Anomaly Reporting Form available on the FAA website at www.faa.gov/air_traffic/nas/RADALT_reports/.

interference and were resolved through normal continued operational safety procedures. But for roughly 100 of the anomaly reports occurring within NOTAM areas, the FAA has excluded other potential causes for the anomaly, but could not rule out 5G C-Band interference as the potential source of the radio altimeter anomalies. These approximately 100 incidents included various flight deck effects such as erroneous Terrain Awareness and Warning System (TAWS) warnings, erroneous Traffic Collision Avoidance System (TCAS) warnings, erroneous landing gear warnings, and the erroneous display of radio altimeter data. Although these flight deck effects are less severe than the hazards associated with low-visibility landings, the FAA is concerned that to the extent 5G C-Band operations contributed to such events, the effects will occur more frequently as telecommunication companies continue to deploy 5G C-Band services throughout the country. The FAA has assessed the cumulative effects of increasing numbers of erroneous warnings across the fleet of transport and commuter airplanes. Although they may seem minor in isolation such that some may consider them a mere nuisance, these warnings have safety implications over time. The erroneous warnings increase flightcrew workload as they try to ascertain the validity of the warning. Repeated determinations that the warning occurred in error will lead to flightcrew desensitization to warnings from these safety systems.[4] In other words, as the flightcrew becomes more desensitized to erroneous warnings, they are less likely to react to an accurate warning, negating the safety benefits of the warning altogether and likely leading to a catastrophic incident.

---

[4] FAA research on nuisance alerts in the air traffic control (ATC) environment has shown that nuisance alerts can desensitize people toward the alert and lead to slower responses to real alerts. When people experience frequent false or low-urgency alerts, they tend to respond less quickly and less accurately to real and high-urgency alerts. Further, when there is a high incidence of nuisance alerts, people may suppress the alert before determining its actual status or may no longer treat the alert as mandatory. In both cases, overall alarm compliance decreases and they may stop responding to every alert. See *Nuisance Alerts in Operational ATC Environments: Classification and Frequencies*, Friedman-Berg, Allendoerfer, and Pai (2008). A copy of this paper can be found on the FAA website at https://hf.tc.faa.gov/publications/2008-nuisance-alerts-in-operational-atc-environments/full_text.pdf.

AD 2021-23-12 does not mitigate the hazards associated with erroneous system warnings, focusing instead on the potentially more severe hazards associated with certain low visibility operations. Additionally, AD 2021-23-12 does not address other operations near airports, such as Category I instrument landing system (ILS) or visual flight rule (VFR) approaches. Therefore, the FAA has determined that additional corrective action is required to address this unsafe condition and proposes to supersede AD 2021-23-12.

Why New Corrective Action is Needed: In addition to the hazards due to the cumulative effects of nuisance warnings described earlier, the FAA expects an increase in the number of 5G C-Band base stations around airports in the national airspace system (NAS) and expects these stations to transmit in the entire 5G C-Band frequency band (from 3.7 to 3.98 GHz). Since the FAA issued AD 2021-23-12, which focused solely on the airport environment, 5G C-Band base stations have increasingly begun transmission in other areas of the country. Whereas 5G transmissions were initially limited to 3.7 to 3.8 GHz, these transmissions have also begun to expand to 3.8 to 3.98 GHz, and the FAA expects deployment at the higher end of the frequency range to expand after July 1, 2023.[5] These higher frequencies are nearer to the spectrum allocation where radio altimeters operate (4.2 to 4.4 GHz), which means that the potential for interference to radio altimeters from in-band and spurious[6] emissions may be more likely. In addition, the FAA expects approximately 19 additional telecommunication companies in addition to AT&T and Verizon will begin transmitting in the C-Band at some point after June 2023.[7] As the 21 telecommunication companies authorized to transmit 5G C-Band continue to expand transmissions throughout the country, using NOTAMs to identify affected areas and assessing proposed AMOCs will become untenable. NOTAMs are

---

[5] FCC licenses authorized 5G transmissions from 3.7 to 3.98 GHz.

[6] The tolerance to 5G spurious emissions is the level of aggregate interference in the radio altimeter band below which the installed radio altimeter system will meet its performance standards and perform its intended function.

[7] The additional 19 telecommunications companies will have access to the FCC-licensed spectrum after current users vacate use of the frequencies.

temporary means of disseminating information until the information can be publicized by other means. Given 5G C-Band signals are not expected to be temporary and that 5G signals will cover the contiguous U.S., NOTAMs are no longer the best means of communicating the location of the 5G C-Band environment. In addition, given the information gleaned over the past year, the FAA is now able to identify the conditions under which radio altimeters can be relied on to perform their intended function in the presence of a 5G C-Band environment. Therefore, case-by-case AMOC approvals that allow performing certain operations otherwise prohibited by an AD are no longer the most efficient way for airplane operators to show that their radio altimeters perform their intended function in the 5G C-Band environment.

Determination of Airplane Radio Altimeter Tolerance Requirements: The FAA is proposing interference tolerance requirements for radio altimeters that can be used across the affected fleet. Airplanes meeting these proposed minimum performance levels would be allowed to use the prohibited operations at the airports identified by an FAA Domestic Notice[8] after July 1, 2023. Airplanes operating under 14 CFR part 121 would also be required to have a radio altimeter that meets the proposed minimum performance standards (i.e., tolerance requirements) on or before February 1, 2024.

The FAA determined the proposed interference tolerance requirements by using the fuller understanding of specific radio altimeter capabilities the FAA gained during the AMOC process. This process revealed the radio altimeter modifications that would not require a substantial system redesign, allowing aircraft operators to readily replace radio altimeters or install filters that allowed the aircraft to operate safely in a mitigated 5G environment.

[8] Domestic Notices publish special notices or notices containing graphics pertaining to almost every aspect of aviation, such as military training areas, large scale sporting events, air show information, Special Management Programs (STMPs), and airport-specific information.

The interference tolerance requirements are represented by a power spectral density (PSD) curve. The PSD curve, as depicted in figure 1 to paragraph (g)(2) of this proposed AD, represents the height over the ground and received power from a 5G C-Band emitter, at or below which the radio altimeter is expected to function reliably, measured in decibels per megahertz. These measurements are limited to the 5G CMAs that will be listed in an FAA Domestic Notice. For purposes of this proposed AD, a "radio altimeter tolerant airplane" (also known within industry as a Group 4 airplane) is one for which the radio altimeter, as installed, demonstrates tolerance to radio altimeter interference at or above PSD curve threshold specified in figure 1 to paragraph (g)(2) of this proposed AD. A radio altimeter tolerant airplane also demonstrates tolerance to a spurious emission level of -48 dBm/MHz in the 4200-4400 MHz radio altimeter band. For purposes of this proposed AD, a "non-radio altimeter tolerant airplane" (also known in industry as a Group 1, 2, or 3 airplane) is one for which the radio altimeter, as installed, does not demonstrate those tolerances. Some radio altimeters may already demonstrate tolerance to the 5G C-Band emissions without modification. Some may need to install filters between the radio altimeter and antenna to increase a radio altimeter's tolerance. For others, the addition of a filter will not be sufficient to address interference susceptibility; therefore, the radio altimeter will need to be replaced with an upgraded radio altimeter. The FAA has determined that radio altimeter tolerant airplanes will not experience the unsafe condition at any airport identified by the FAA as a 5G CMA in an FAA Domestic Notice.

Areas of Operation: Over the past year, the FAA and the aviation industry, using data voluntarily provided by AT&T and Verizon, have identified maximum power levels for 5G C-Band transmissions that would permit safe aircraft operations. These power levels were identified using a SiS analysis that considers factors specific to an airport. That is, the SiS analysis considers specific 5G C-Band base station data to predict the 5G signal

characteristics in the runway safety zone. The base station data includes 5G C-Band tower or antenna locations, fundamental transmission power levels, and antenna height. Using this analysis, the FAA has found that airplanes meeting the proposed standards as represented by the PSD curve can safely perform the prohibited operations specified in this proposed AD at 5G CMAs. These operations are safe for radio altimeter tolerant airplanes to perform at these airports as long as telecommunication companies transmit at parameters under the current voluntary agreements with the FAA and FCC.

Compatibility with 5G C-Band Providers: The FAA has determined that any 5G C-Band provider that maintains the mitigated actions will not have an effect on the safety of transport and commuter airplanes with radio altimeters that meet the interference tolerance requirements at 5G CMAs. The FAA will assess the effects of any changes to transmission parameters at 5G CMAs to determine whether they would result in a hazard to air navigation. If the transmission changes negatively affect the safe operation of a radio altimeter tolerant airplane at that airport, the FAA will remove that airport from the 5G CMAs list.

Therefore, the FAA has determined that an unsafe condition exists when performing certain operations in the presence of 5G C-Band transmissions affecting the proper function of radio altimeters. For that reason, operators would be required to revise their existing AFM to prohibit these operations unless operating a radio altimeter tolerant airplane at a 5G CMA. This proposed requirement would take effect on July 1, 2023.

In addition, the FAA proposes to prohibit operations under part 121 in the U.S. after February 1, 2024, unless such operations are conducted with a radio altimeter tolerant airplane. As explained earlier, the FAA expects erroneous system warnings due to a malfunctioning radio altimeter to lead to flightcrew becoming desensitized to system warnings. Such desensitization negates the safety benefits of the warning itself and can lead to a catastrophic event. To minimize the number of erroneous system messages and

the unsafe condition they produce, the FAA is proposing to require all airplanes operating under part 121 meet the PSD performance curve to operate in the contiguous U.S. after February 1, 2024. This is the date the FAA has determined to be as soon as reasonably practical, consistent with FAA policy.[9] Non-radio altimeter tolerant airplanes can operate under part 121 subject to the revised AFM limitations until February 1, 2024, without meeting the radio altimeter performance requirements proposed in this AD. If this AD is finalized as proposed, after February 1, 2024, airplanes operating under part 121 must meet the radio altimeter tolerant requirements specified in figure 1 to paragraph (g)(2) of this proposed AD.

FAA's Determination

The FAA is issuing this NPRM after determining that the unsafe condition described previously is likely to exist or develop on other products of the same type design.

Proposed AD Requirements in this NPRM

This proposed AD would maintain the requirements of AD 2021-23-12, except for the limitation pertaining to RNP AR IAPs by requiring, before further flight, revising the existing AFM to incorporate limitations prohibiting the following operations in the presence of 5G C-Band wireless broadband interference as identified by NOTAM (NOTAMs will be issued to state the specific airports where the radio altimeter is unreliable due to the presence of 5G C-Band wireless broadband interference). Alternatively, operators may incorporate the AFM revision required by paragraph (g) of AD 2021-23-12.

- Instrument Landing System (ILS) Instrument Approach Procedures (IAP) SA CAT I, SA CAT II, CAT II, and CAT III

[9] PS-ANM-25-05, *Risk Assessment Methodology for Transport Category Airplanes*, available at drs.faa.gov/browse/excelExternalWindow/4E5AE8707164674A862579510061F96B.0001.

- Automatic Landing operations
- Manual Flight Control Guidance System operations to landing/head-up display (HUD) to touchdown operation
- Use of Enhanced Flight Vision System (EFVS) to touchdown under 14 CFR 91.176(a).

On or before June 30, 2023, this proposed AD would also require revising the existing AFM to incorporate limitations prohibiting these same operations at all airports for non-radio altimeter tolerant airplanes. For radio altimeter tolerant airplanes, the prohibited operations would be allowed at 5G CMAs as identified in an FAA Domestic Notice.

On or before February 1, 2024, this proposed AD would require that airplanes operating under Part 121 be modified from a non-radio altimeter tolerant airplane to a radio altimeter tolerant airplane.

Interim Action

The FAA considers that this AD, if adopted as proposed, would be an interim action. Once the Technical Standard Order (TSO) standard for radio altimeters is established, which will follow the existing international technical consensus on the establishment of the minimum operational performance standards (MOPS), the FAA anticipates that the MOPS will be incorporated into the TSO. The FAA also anticipates that aircraft incorporating equipment approved under the new Radio Altimeter TSO will be able to operate in both 5G CMAs and non-5G CMAs with no 5G C-Band-related AFM limitations. Once a new radio altimeter TSO is developed, approved, and available, the FAA might consider additional rulemaking.

Costs of Compliance

The FAA is requesting comments on this evaluation of costs and benefits for the proposed airworthiness directive. If adopted as proposed, this AD would affect

approximately 7,993 airplanes of U.S. registry, all of which would require two AFM revisions. In Special Airworthiness Information Bulletin AIR-21-18R2, the FAA requested radio altimeter retrofit plans, timelines, and completion information from the aviation industry. The FAA did not receive comprehensive data, but based on the limited information the agency did receive, the FAA extrapolated impacts across industry. Based on that information, the FAA roughly estimates that almost 7,000 airplanes on the U.S. registry are already equipped or are being retrofitted to address radio altimeter interference tolerance before publication of this AD, or are not operated under 14 CFR Part 121, and thus would only require AFM revisions to comply with this AD as proposed. Based on information received, some operators will comply with the proposed modification by replacing the radio altimeter and others by installing an externally mounted filter. The FAA estimates that approximately 180 airplanes would require radio altimeter replacement and 820 airplanes would require addition of radio altimeter filters to comply with the proposed modification requirement. As such, the FAA estimates the following costs to comply with this proposed AD, for a total cost of compliance of up to $26,049,810:

Estimated costs

Action	Labor cost	Parts cost	Cost per product	Cost on U.S. operators
AFM revision for all airplanes	1 work-hour X $85 per hour = $85	$0	$85	$679,405 for 7,993 affected airplanes
AFM revision (radio altimeter tolerant specific limitations)	1 work-hour X $85 per hour = $85	$0	$85	$679,405 for 7,993 affected airplanes
Modification (radio altimeter replacement option)			Up to $80,000 (includes parts and labor)	Up to $14,400,000 for 180 affected airplanes

Action	Labor cost	Parts cost	Cost per product	Cost on U.S. operators
Modification (filter addition option)	12 work-hours X $85 per hour = $1,020 per filter	$4,000 per filter	$5,020 per filter	Up to $10,291,000 for 820 affected airplanes with 2 or 3 filters per airplane

The benefits of the proposed AD would include the value of reducing aviation accident risks that are mitigated by TAWS, TCAS, and airborne windshear warning and flight guidance systems (windshear systems), all of which rely on proper performance of radio altimeters to perform their intended function. TAWS, TCAS, and windshear systems are examples of safety-enhancing systems required for operation under 14 CFR Part 121. The FAA required these systems to address hazards which have caused accidents and fatalities during commercial air transportation in the United States. This proposed AD would maintain the same level of safety afforded by these and other safety systems before the use of the C-Band by 5G broadband networks. This proposed AD would also minimize erroneous system messages and the unsafe condition they produce.

Authority for this Rulemaking

Title 49 of the United States Code specifies the FAA's authority to issue rules on aviation safety. Subtitle I, section 106, describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the Agency's authority.

The FAA is issuing this rulemaking under the authority described in Subtitle VII, Part A, Subpart III, Section 44701: General requirements. Under that section, Congress charges the FAA with promoting safe flight of civil aircraft in air commerce by prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce. This regulation is within the scope of that authority

because it addresses an unsafe condition that is likely to exist or develop on products identified in this rulemaking action.

Regulatory Findings

The FAA has determined that this proposed AD would not have federalism implications under Executive Order 13132. This proposed AD would not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government.

For the reasons discussed above, I certify that the proposed regulation:

(1) Is not a "significant regulatory action" under Executive Order 12866, and

(2) Would not affect intrastate aviation in Alaska.

Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) of 1980, Public Law 96–354, 94 Stat. 1164 (5 U.S.C. 601–612), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (Pub. L. 104–121, 110 Stat. 857, Mar. 29, 1996) and the Small Business Jobs Act of 2010 (Pub. L. 111–240, 124 Stat. 2504 Sept. 27, 2010), requires Federal agencies to consider the effects of the regulatory action on small business and other small entities and to minimize any significant economic impact. The term "small entities" comprises small businesses and not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and governmental jurisdictions with populations of less than 50,000.

The FAA is publishing this Initial Regulatory Flexibility Analysis (IRFA) to aid the public in commenting on the potential impacts to small entities from this proposal. The FAA invites interested parties to submit data and information regarding the potential economic impact that would result from the proposal. The FAA will consider comments

when making a determination or when completing a Final Regulatory Flexibility Assessment. An IRFA contains the following:

(1) A description of the reasons why the action by the agency is being considered;

(2) A succinct statement of the objective of, and legal basis for, the proposed rule;

(3) A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply;

(4) A description of the projected reporting, recordkeeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;

(5) An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap, or conflict with the proposed rule; and

(6) A description of any significant alternatives to the proposed rule which accomplish the stated objectives of applicable statutes and which minimize any significant economic impact of the proposed rule on small entities.

Reasons the Action is Being Considered

AD 2021-23-12 requires revising the limitations section of the existing AFM to incorporate limitations prohibiting certain operations requiring radio altimeter data when in the presence of 5G C-Band interference as identified by NOTAMs. Since the FAA issued AD 2021-23-12, the FAA determined that more restrictive limitations are needed due to the continued deployment of new 5G C-Band base stations whose signals are expected to cover most of the contiguous United States at transmission frequencies between 3.7-3.98 GHz. This proposed AD would address the unsafe condition resulting from the continued deployment of 5G C-Band transmissions and their interference to radio altimeters.

Objectives of the Proposed Rule

This proposed AD would require revising the limitations section of the existing AFM to incorporate limitations prohibiting certain operations requiring radio altimeter data, due to the presence of 5G C-Band interference. This proposed AD would also require modifying certain airplanes to allow safe operations in the United States 5G C-Band-radio frequency environment.

Description and Estimate of the Number of Small Entities

The FAA used the definition of small entities in the RFA for this analysis. The RFA defines small entities as small businesses, small governmental jurisdictions, or small organizations. In 5 U.S.C. 601(3), the RFA defines "small business" to have the same meaning as "small business concern" under section 3 of the Small Business Act. The Small Business Act authorizes the Small Business Administration (SBA) to define "small business" by issuing regulations.

The SBA established size standards for various types of economic activities, or industries, under the North American Industry Classification System (NAICS).[10] These size standards generally define small businesses based on the number of employees or annual receipts. The following table shows the SBA size standards for certificate holders as an example. Note that the SBA definition of a small business applies to the parent company and all affiliates as a single entity.

Small Business Size Standards: Air Transportation

NAICS Code	Description	SBA Size Standard
481111	Scheduled Passenger Air Transportation	1,500 employees
481112	Scheduled Freight Air Transportation	1,500 employees
481211	Nonscheduled Chartered Passenger Air Transportation	1,500 employees
481212	Nonscheduled Chartered Freight Air Transportation	1,500 employees

[10] Small Business Administration (SBA) Table of Size Standards. Effective December 19, 2022. https://www.sba.gov/document/support--table-size-standards.

Small Business Size Standards: Air Transportation

NAICS Code	Description	SBA Size Standard
481219	Other Nonscheduled Air Transportation	$25 million

Certificate holders affected by the proposed AD are those authorized to conduct operations under 14 CFR part 121. To identify small entities, the FAA reviewed readily available data sources (e.g., company web sites) and data available to the FAA through its certificate oversight functions to determine whether the certificate holder meets the applicable size standard. The following table provides a summary of the estimated number of small entities to which this proposed AD would apply.

Estimated Number of Small Entities

Category	Number of Entities	Number Small Entities	Percent Small Entities
Major	6	0	0%
National	15	7	47%
Passenger and Cargo Charter	12	8	67%
Regional	15	7	47%
Specialty Cargo	14	9	64%
Total	**62**	**31**	**50%**

Projected Reporting, Recordkeeping, and Other Compliance Requirements

No new recordkeeping or reporting requirements are associated with the proposed AD. Small entity compliance with the proposed AD would entail incorporation of AFM revisions at an approximate cost of $170 per airplane. As discussed previously, the FAA estimates that the majority of airplanes operated by small entities will already be equipped in a manner that complies with the proposed requirements of this AD. Given the relatively small aircraft fleet sizes for small entity airlines, the FAA anticipates that a small number of airplanes would need to have radio altimeter filters installed (at an approximate cost of $5,020 per filter), and a smaller number of airplanes will require a radio altimeter replacement (at an approximate cost of up to $80,000 per airplane). These costs represent a small percentage of the overall cost of owning and operating a transport category airplane, and to the extent that small entities provide more unique services or serve markets with less competition, these entities might be able to pass on these small incremental costs of AD compliance in the form of price increases.

All Federal Rules That May Duplicate, Overlap, or Conflict

There are no relevant Federal rules that may duplicate, overlap, or conflict with the proposed AD.

Significant Alternatives Considered

This AD specifies the only feasible alternatives identified for mitigating the unsafe condition. If a less burdensome method for mitigating the unsafe condition is identified, the FAA will consider proposed alternative methods of compliance, if requested, using the procedures found in 14 CFR 39.19.

List of Subjects in 14 CFR Part 39

Air transportation, Aircraft, Aviation safety, Incorporation by reference, Safety.

The Proposed Amendment

Accordingly, under the authority delegated to me by the Administrator, the FAA proposes to amend 14 CFR part 39 as follows:

PART 39 - AIRWORTHINESS DIRECTIVES

1. The authority citation for part 39 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701.

§ 39.13 [Amended]

2. The FAA amends § 39.13 by:

a. Removing Airworthiness Directive (AD) 2021-23-12, Amendment 39-21810 (86 FR 69984, December 9, 2021), and

b. Adding the following new AD:

Transport and Commuter Category Airplanes: Docket No. FAA-2022-1647; Project Identifier AD-2022-01379-T.

(a) Comments Due Date

The FAA must receive comments on this airworthiness directive (AD) action by [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

(b) Affected ADs

This AD replaces AD 2021-23-12, Amendment 39-21810 (86 FR 69984, December 9, 2021) (AD 2021-23-12).

(c) Applicability

This AD applies to all transport and commuter category airplanes equipped with a radio (also known as radar) altimeter. These radio altimeters are installed on various transport and commuter category airplanes including, but not limited to, the airplanes for which the design approval holder is identified in paragraphs (c)(1) through (19) of this AD.

(1) The Boeing Company

(2) Airbus SAS

(3) Bombardier Inc.

(4) Embraer S.A.

(5) Gulfstream Aerospace Corporation

(6) Gulfstream Aerospace LP

(7) Textron Aviation Inc.

(8) Pilatus Aircraft Limited

(9) Fokker Services B.V.

(10) Saab AB, Support and Services

(11) DeHavilland Aircraft of Canada Limited

(12) Airbus Canada Limited Partnership

(13) ATR-GIE Avions de Transport Régional

(14) Yaborã Indústria Aeronáutica S.A.

(15) MHI RJ Aviation ULC

(16) BAE Systems (Operations) Limited

(17) Lockheed Martin Corporation/Lockheed Martin Aeronautics Company

(18) Viking Air Limited

(19) Dassault Aviation

(d) Subject

Air Transport Association (ATA) of America Code 31, Indicating/Recording System; 34, Navigation.

(e) Unsafe Condition

This AD was prompted by determination that radio altimeters cannot be relied upon to perform their intended function if they experience interference from wireless broadband operations in the 3.7-3.98 GHz frequency band (5G C-Band). The FAA is issuing this AD because radio altimeter anomalies that are undetected by the automation or pilot, particularly close to the ground (e.g. landing flare), could lead to loss of continued safe flight and landing. Additionally, radio altimeter anomalies could lead to increased flightcrew workload and flightcrew desensitization to warnings.

(f) Compliance

Comply with this AD within the compliance times specified, unless already done.

(g) Definitions

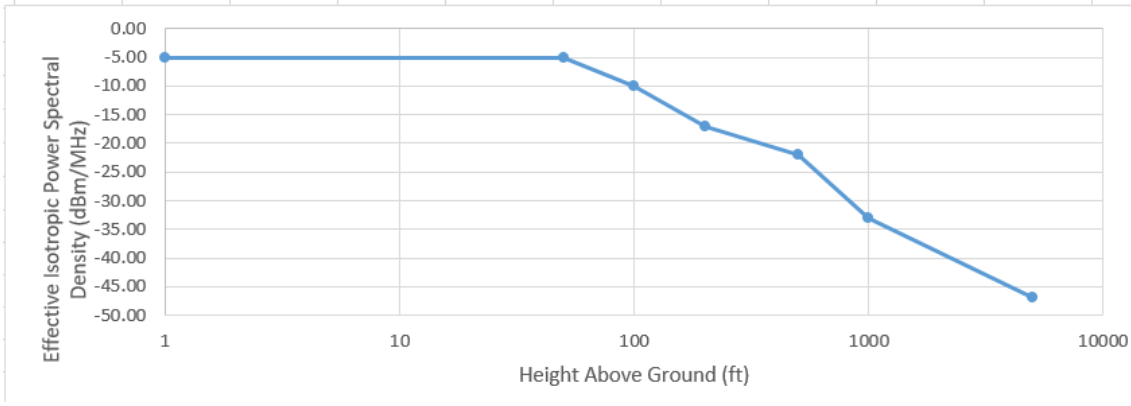
(1) For purposes of this AD, a "5G C-Band mitigated airport" (5G CMA) is an airport at which the telecommunications companies have agreed to voluntarily limit their 5G deployment at the request of the FAA, as identified by an FAA Domestic Notice.

(2) For purposes of this AD, a "radio altimeter tolerant airplane" is one for which the radio altimeter, as installed, demonstrates the tolerances specified in paragraphs (g)(2)(i) and (ii) of this AD, using a method approved by the FAA.

(i) Tolerance to radio altimeter interference at or above the power spectral density (PSD) curve threshold specified in figure 1 to paragraph (g)(2) of this AD.

(ii) Tolerance to an aggregate base station conducted spurious emission level of -48 dBm/MHz in the 4200-4400 MHz radio altimeter band.

Figure 1 to paragraph (g)(2) – *Effective Power Spectral Density*



Height above ground (ft)	Effective Isotropic PSD (dBm/MHz)
Aircraft on the ground	-5
50	-5
100	-10
200	-17
500	-22
1000	-33
5000	-47

(3) For purposes of this AD, a "non-radio altimeter tolerant airplane" is one for which the radio altimeter, as installed, does not demonstrate the tolerances specified in paragraphs (g)(2)(i) and (ii) of this AD.

(h) Airplane/Aircraft Flight Manual (AFM) Revision for All Airplanes

Before further flight: Revise the Limitations Section of the existing AFM by incorporating the limitations specified in figure 2 to paragraph (h) of this AD. This may be done by inserting a copy of figure 2 to paragraph (h) of this AD into the existing AFM. If an operator has complied with paragraph (g) of AD 2021-23-12, that action satisfies the requirements of this paragraph.

Figure 2 to paragraph (h) – *AFM Revision*

(Required by AD 20-**-**)**

Radio Altimeter Flight Restrictions

When operating in U.S. airspace, the following operations requiring radio altimeter are prohibited in the presence of 5G C-Band wireless broadband interference as identified by NOTAM (NOTAMs will be issued to state the specific airports where the radio altimeter is unreliable due to the presence of 5G C-Band wireless broadband interference):

- Instrument Landing System (ILS) Instrument Approach Procedures (IAP) SA CAT I, SA CAT II, CAT II, and CAT III
- Automatic Landing operations
- Manual Flight Control Guidance System operations to landing/head-up display (HUD) to touchdown operation
- Use of Enhanced Flight Vision System (EFVS) to touchdown under 14 CFR 91.176(a)

(i) AFM Revision for Non-Radio Altimeter Tolerant Airplanes

For non-radio altimeter tolerant airplanes, do the actions specified in paragraphs (i)(1) and (2) of this AD.

(1) On or before June 30, 2023, revise the Limitations Section of the existing AFM by incorporating the limitations specified in figure 3 to paragraph (i) of this AD. This may be done by inserting a copy of figure 3 to paragraph (i) of this AD into the existing AFM. Incorporating the AFM revision required by this paragraph terminates the AFM revision required by paragraph (h) of this AD.

(2) Before further flight after incorporating the limitations specified in figure 3 to paragraph (i) of this AD, remove the AFM revision required by paragraph (h) of this AD.

Figure 3 to paragraph (i) – *AFM Revision for Non-Radio Altimeter Tolerant Airplanes*

(Required by AD 20-**-**)**

Radio Altimeter Flight Restrictions

Due to the presence of 5G C-Band wireless broadband interference, when operating in the contiguous U.S. airspace, the following operations requiring radio altimeter are prohibited:

- Instrument Landing System (ILS) Instrument Approach Procedures (IAP) SA CAT I, SA CAT II, CAT II, and CAT III
- Automatic Landing operations
- Manual Flight Control Guidance System operations to landing/head-up display (HUD) to touchdown operation
- Use of Enhanced Flight Vision System (EFVS) to touchdown under 14 CFR 91.176(a).

(j) AFM Revision for Radio Altimeter Tolerant Airplanes

For radio altimeter tolerant airplanes, do the actions specified in paragraphs (j)(1) and (2) of this AD.

(1) On or before June 30, 2023, revise the Limitations Section of the existing AFM by incorporating the limitations specified in figure 4 to paragraph (j) of this AD. This may be done by inserting a copy of figure 4 to paragraph (j) of this AD into the existing AFM. Incorporating the AFM revision required by this paragraph terminates the AFM revision required by paragraph (h) of this AD.

(2) Before further flight after incorporating the limitations specified in figure 4 to paragraph (j) of this AD, remove the AFM revision required by paragraph (h) of this AD.

Figure 4 to paragraph (j) – *AFM Revision for Radio Altimeter Tolerant airplanes*

(Required by AD 20-**-**-**)**

Radio Altimeter Flight Restrictions

Due to the presence of 5G C-Band wireless broadband interference, when operating in the contiguous U.S. airspace, the following operations requiring radio altimeter are prohibited unless operating at a 5G C-Band mitigated airport as identified in an FAA *Domestic Notice*:

- Instrument Landing System (ILS) Instrument Approach Procedures (IAP) SA CAT I, SA CAT II, CAT II, and CAT III
- Automatic Landing operations
- Manual Flight Control Guidance System operations to landing/head-up display (HUD) to touchdown operation
- Use of Enhanced Flight Vision System (EFVS) to touchdown under 14 CFR 91.176(a).

(k) Modification

(1) For non-radio altimeter tolerant airplanes operating under 14 CFR part 121: On or before February 1, 2024, modify each airplane to a radio altimeter tolerant airplane and accomplish the actions specified in paragraphs (k)(i) and (ii) of this AD.

(i) Revise the Limitations Section of the existing AFM by incorporating the limitations specified in figure 4 to paragraph (j) of this AD. This may be done by inserting a copy of figure 4 to paragraph (j) of this AD into the existing AFM.

(ii) Remove the AFM revision required by paragraph (i) of this AD.

(2) For non-radio altimeter tolerant airplanes not operating under part 121, accomplishing the modification and AFM revision specified in paragraph (k)(1) of this AD is optional.

(l) Alternative Methods of Compliance (AMOCs)

(1) The Manager, Operational Safety Branch, FAA, has the authority to approve AMOCs for this AD, if requested using the procedures found in 14 CFR 39.19. In accordance with 14 CFR 39.19, send your request to your principal inspector or responsible Flight Standards Office, as appropriate. If sending information directly to the manager of the Operational Safety Branch, send it to the attention of the person identified in paragraph (m) of this AD. Information may be emailed to: AMOC@faa.gov.

(2) Before using any approved AMOC, notify your appropriate principal inspector, or lacking a principal inspector, the manager of the responsible Flight Standards Office.

(3) AMOCs approved for AD 2021-23-12 are approved as AMOCs for the requirements specified in paragraph (h) of this AD.

(m) Related Information

For more information about this AD, contact Brett Portwood, Continued Operational Safety Technical Advisor, COS Program Management Section, Operational Safety Branch, FAA, 3960 Paramount Boulevard, Lakewood, CA 90712-4137; phone: 817-222-5390; email: operationalsafety@faa.gov.

(n) Material Incorporated by Reference

None.

Issued on January 6, 2023.

Gaetano A. Sciortino, Acting Director,
Compliance & Airworthiness Division,
Aircraft Certification Service.

[FR Doc. 2023-00420 Filed: 1/9/2023 8:45 am; Publication Date: 1/11/2023]