

FLIGHT OPERATIONS TRANSMISSION - FOT

TO: All A300, A300-600, A310, A318, A319, A320, A321, A330, A340, A350, A380, AST Operators

SUBJECT: ATA 34 – IMPACTS OF 5G TELECOMMUNICATIONS ON AIRCRAFT OPERATIONS

OUR REF.: 999.0002/22 Rev 00 dated 10-JAN-2022

CLASSIFICATION: Advice

APPLICABLE AIRCRAFT: This FOT is applicable to all Airbus Aircraft

Notice: This FOT provides flight operations advice for operational enhancements. It is left to each Operator's discretion whether to distribute this FOT, or to distribute the information contained in this FOT, to all of their applicable flight crews for information or application.

REFERENCES

Ref[1]: FOT 999.0074/21 ATA 34 - IMPACTS OF 5G TELECOMMUNICATIONS ON AIRCRAFT OPERATIONS (Issued on December 20th, 2021)

Ref[2]: FAA Airworthiness Directive AD 2021-23-12 (Issued on December 7, 2021)

Ref[3]: FAA Safety Alert for Operators SAFO 21007 (Issued on December 23, 2021)

1. PURPOSE

The purpose of this FOT is to provide additional information to Operators following the issuance of the Federal Aviation Administration (FAA) Airworthiness Directive (AD) 2021-23-12 (Ref[2]), which introduces limitations for all aircraft operating in the U.S. Airspace. It is an update to the FOT 999.0074/21 (See Ref[1]). It aims at providing additional guidance to the Operators based on identified scenarios and confirmed hypothesis.

2. DESCRIPTION

The introduction of 5G telecommunications networks across the world raises new threats. Indeed, worldwide telecommunication has allocated frequencies in mid-band from 3.4 to 4.2 GHz and 4.4 to 4.9 GHz (also known as C-band). Based on the Radio Technical Commission for Aeronautics (RTCA) Paper No. 274-20/PMC-2073, the 5G mid-band emissions have been assessed as being able to interfere with the Radio Altimeter systems, which operate in the 4.2 to 4.4 GHz.

In December 2021, the FAA published an AD (Ref[2]) to prohibit some approaches that require the use of Radio Altimeters. This restriction applies to all aircraft when in the presence of 5G C-Band wireless broadband interference as identified by NOTAM.

In December 2021, the FAA also published a Safety Alert for Operators SAFO 21007 (Ref[3]), to provide details about the risk of potential adverse effects on Radio Altimeters and the types of NOTAMs to be published (with the associated restrictions).

FLIGHT OPERATIONS TRANSMISSION - FOT

Following discussions between the Airworthiness, Authorities, Regulator and Telecommunication Operators, the 5G wireless broadband networks in the C-Band will be deployed in the USA on January 19th 2022 with limited levels around predetermined areas, notably in the vicinity of airfields.

For more details about the list of airports that will have buffer zones, refer to the following websites: <https://www.faa.gov/newsroom/faa-statement-5g> and <https://www.faa.gov/newsroom/airports-5g-buffers>

According to the FAA's AD, NOTAMs will be issued to limit the operations of:

- Instrument Landing System (ILS) Instrument Approach Procedures (IAP) SA CAT I, SA CAT II, CAT II, and CAT III
- Required Navigation Performance (RNP) Procedures with Authorization Required (AR), RNP AR IAP
- Automatic Landing operations

Based on examples of the upcoming NOTAMs, it is Airbus' understanding that regular ILS CAT 1 approaches followed by a manual landing, as well as RNP approaches (non RNP-AR), are not impacted by the limitations.

In order to restore the normal operational capabilities of Airbus products, Airbus intends to obtain from the FAA the approval of Alternative Means Of Compliance (AMOC).

3. RECENT KEY MILESTONES

Since the latest Airbus publications and webinar sessions held at the end of December 2021, Airbus worked with several organizations on the following activities:

DEC 22: Airbus submitted AMOCs based on RTCA emission levels.

From DEC 27 to JAN 3: Airbus joined the AMOC task force regrouping the FAA, other OEMs and Radio Altimeter Suppliers. The objective is to agree on a definition of the AMOC content

DEC 29: Airbus participated with other OEMs in IATA Flight Operations Group teleconference and presented the latest status for Airbus fleet

DEC 30: Meetings with OEMs, Telecommunication Operators (ATT & Verizon) and Radio Altimeter suppliers (Thales, Collins, Honeywell)

JAN 4: All Telecommunication Operators operating in C-Band agreed to temporarily delay full 5G deployment around the airfields

JAN 11: Issuance of new AMOCs (based on Radio Altimeter Part Numbers) to the FAA

In addition, Airbus has been discussing on a daily basis with other OEMs, Authorities, Radio Altimeter suppliers and Telecommunication Operators.

4. INVESTIGATION STATUS

Airbus has worked with all its Radio Altimeter suppliers to investigate the potential impact of the interference on the equipment and other aircraft systems.

Our investigations and simulations have covered emissions levels up to RTCA limits. For all Airbus programs, within these boundaries, the tests demonstrated the absence of adverse effect on the aircraft itself.

Airbus also investigated levels beyond RTCA boundaries, up to levels of approximately ten (10) times the RTCA emissions levels:

FLIGHT OPERATIONS TRANSMISSION - FOT

- On A300-600/A310/A350 and A380, 5G interference on RAs are negligible, hence the absence of cockpit effects
- On A320F/A330/A340, the effects on aircraft systems are described in paragraph 5. below.

Note: As per Airbus design, the ground spoilers and thrust reversers are not affected by 5G interference.

Further investigations of effects at higher levels of emissions are being conducted. If any new system behavior is observed, Airbus will share the information through an update of this FOT.

5. OBSERVED IMPACT ON A320F/A330/A340 SYSTEMS WITH 5G EMISSIONS BEYOND RTCA LIMITS

During the investigation performed by Airbus with emissions levels beyond RTCA limits, it has been observed that the simulated 5G interference might cause erroneous low height values computed by the Radio Altimeters and considered as valid (not rejected by the aircraft systems).

Based on those known effects, the 5G interference may have different consequences on the aircraft systems (depending on the Radio Altimeter supplier, the flight phase or the signature of the interference). Note that these effects may not necessarily occur in every case of an erroneous Radio Altimeter height indication.

Flight Instruments (PFD, HUD, Callouts)

- The RA height indication on the PFDs and HUDs may be inconsistent alongside with untimely RA callouts (unusual or untimely sequence of RA audio messages and/or indications: e.g. abrupt decrease in height or erratic sequence)
- Untimely MINIMUM callout may occur (if RADIO Decision Height is selected in the FMS)
- The AUTOLAND warning light may flash
- The Ground Reference on the PFD altitude scale may be erroneous

Auto Flight System (AFS)

- For A320Family NEO, during Take Off or Go-Around, the tail strike protection may be inoperative or operate prematurely. However the pilot retains full authority on the pitch control
- THS may freeze due to untimely activation of the Flare law: In the event of a Go-Around, the pilot may temporarily need additional sidestick input as the auto-trim function is inhibited by flare law mode
- During autoland, very small pitch oscillations may be observed in FLARE mode
- Untimely RETARD callouts may occur
- With AP engaged, LAND / FLARE / THR IDLE modes may untimely/early engage

Note: As per Airbus design, when AP is OFF the pilot retains full authority on thrust reduction (automatic engagement of RETARD mode is inhibited)

Surveillance Systems

- Untimely GPWS / TAWS alerts may occur
- Windshear detection systems (predictive and reactive) may be inoperative
- Aural TCAS alerts ("TRAFFIC" messages) may be inoperative

FLIGHT OPERATIONS TRANSMISSION - FOT

6. OPERATING RECOMMENDATIONS

- ❖ As per SOP, pilots are required to monitor and cross-check barometric and radio altitudes. Any abnormal deviation may indicate Radio Altimeter interference, notably in airports having reported a 5G C-Band NOTAM.

In the case of the above mentioned misbehavior, the flight crews must:

- › Be ready to discontinue the approach and attempt a second approach without AP/FD, or
- › Disconnect AP and FD and continue the ILS manually, or
- › Disconnect AP and FD and continue the approach using external visual references

- ❖ As per FCTM Golden Rules, take action if things do not go as expected
If the aircraft does not follow the desired vertical or lateral flight path, or the selected targets, and if the flight crew does not have sufficient time to analyze and solve the situation, the flight crew must immediately take appropriate or required actions, as follows:

The PF should change the level of automation:

- From managed guidance to selected guidance, or
- From selected guidance to manual flying.

The PM should perform the following actions in sequence:

- Communicate with the PF
- Challenge the actions of the PF, when necessary
- Take over, when necessary.

7. AIRBUS AMOC INITIATIVE

Airbus and other OEMs are working together with the Radio Altimeter suppliers to provide AMOC based on each Radio Altimeter Part Number to the FAA. AMOCs are planned to be provided to the FAA on January 11th 2022.

8. COMMUNICATION PLAN – WEBINAR WEEK 2

Airbus invites you to connect to one of the two webinars for all Operators that operate to and within the USA.

Webinar #1: Wednesday January 12th, 07:00 UTC

Copy and paste the following link in your browser:

<https://primetime.bluejeans.com/a2m/live-event/efgtwyzf>.

You may also download the BlueJeans Video Conferencing application on your mobile device, and use the Event ID to join: [efgtwyzf](https://primetime.bluejeans.com/a2m/live-event/efgtwyzf).

Webinar #2: Wednesday January 12th, 16:00 UTC

Copy and paste the following link in your browser:

<https://primetime.bluejeans.com/a2m/live-event/skyhhbgd>.

You may also download the BlueJeans Video Conferencing application on your mobile device, and use the Event ID to join: [skyhhbgd](https://primetime.bluejeans.com/a2m/live-event/skyhhbgd).

FLIGHT OPERATIONS TRANSMISSION - FOT

9. FOLLOW-UP PLAN

Airbus will issue a revision of this FOT in the case of any major update.

Airbus will also continue to communicate information related to the operational impact of 5G telecommunications via regular updates of the ISI article ref. 34.42.00048.

For any questions about the operational content of this FOT, please use [TechRequest](#) on AirbusWorld.

Best regards,

Capt. Yann LARDET
Vice President, Flight Operations Support & Training Standards

Radio Altimeter - 5G effects

Reference: 34.42.00048

Issue date: 10-DEC-2021

Last check date: 10-DEC-2021

Status: Open

A/C type/serie: A300, A300-600, A310, A318, A319, ...

ATA: 34-42

Engine manufacturer:

Supplier:

Purpose / Reason for revision: Investigation ongoing

✚ Engineering Support

Status: Open

REFERENCES

[Ref. 1] Radio Technical Commission for Aeronautics Paper No. 274-20/PMC-2073 (dated 07 October 2020)

[Ref. 2] Federal Aviation Administration Special Airworthiness Information Bulletin AIR-21-18 (dated 02 November 2021)

[Ref. 3] Federal Aviation Administration AD 2021-23-12 & AD 2021-23-13 (dated 09 December 2021)

[Ref. 4] European Union Aviation Safety Agency Position on FAA AD 2021-23-12 (dated 10 December 2021)

BACKGROUND

This In Service Information article intends to provide Operators with latest information and Airbus position with regards to the most recent publications related to the impact of 5G Interference on Radio Altimeter operations.

This article is applicable to the entire Airbus Fleet.

DESCRIPTION

The introduction of 5G telecommunications networks across the world raises new threats on flight safety.

Indeed, worldwide telecommunication has allocated frequencies on mid-band from 3.4 to 4.2 GHz and 4.4 to 4.9 GHz.

Based on the Radio Technical Commission for Aeronautics (RTCA) Paper No. 274-20/PMC-2073, the 5G mid-band emissions have been assessed as able to interfere with the radio altimeter systems which operate in the 4.2 to 4.4 GHz.

This article provides the Airbus assessment based on the hypothesis of potential interferences related to 5G base stations conceivable emissions in the 3.7 to 3.98 GHz band planned to be deployed in the United States.

ON-GOING ACTIONS

Airbus is actively participating in various forums (RTCA - Eurocae, French and European Task Forces, ICAO panels) on the impact of the potential 5G interferences and has engaged since February 2020 a 5G risk management multi-function team with the objective to ensure the continuous safe operations of airplanes by assessing potential interference between the 5G networks and aircraft systems

To support the 5G risk management multi-function team objectives, Airbus has undertaken the following actions:

- › To assess the performances of all Radio Altimeters installed on Airbus fleet in collaboration with the suppliers via testing based on (but not limited to) the hypothesis from RTCA paper No. 274-20/PMC-2073 [Ref. 1].
- › To determine the worst cases scenarios at aircraft level to detect 5G interferences (if any), and their associated effects
- › Co-chairing the new Radio Altimeter Minimum Operational Performance Standards (MOPS) ED-30/DO-155 to ensure future radio altimeter performances considering current and future radio frequencies threats.
- › To share the Airbus risk management progress and results with the FAA and the EASA
- › To monitor data and report from the fleet and to identify the root causes of any radio altimeter misbehaviors

The Airbus 5G risk management multi-function team is also continuously acting and performing complementary analysis considering:

- Any potential change on the 5G bases stations emissions hypothesis to measure the effect on the current Airbus status
- The ongoing discussions with the Airworthiness Authorities

RECOMMENDATIONS

Airbus would like to remind the Operators that consequences of Radio Frequencies Interferences on Radio Altimeters have already been assessed in the past. The effects could be categorized based on theoretical assumptions and in-service experiences.

Aircraft design and existing operational flight operations procedures actually allow to detect and cope any system misbehavior that may result from such interferences (refer to the ISI's Annexes for a non-exhaustive list of applicable procedures).

Furthermore, we would like to underline that the 5G C-band is already deployed in some geographic areas and no adverse impact was reported in service at this time.

Airbus actually concurs with the recommendations reinforced by the National Civil Aviation Authorities (like French DGAC SAFETY INFO LEAFLET N° 2021/01 dated - 5th February 2021) and Airworthiness Authorities (via FAA SAIB AIR-21-18 [Ref. 2]), and which highlight generic preventative actions already in place.

Airbus is progressing in the investigations and current results confirm that no new interim requirements on maintenance or operations are actually required at that time to demonstrate compliance to the continuous airworthiness of the Airbus aircraft.

Data and results of these investigations have been shared with Airworthiness Authorities (EASA and FAA) and discussions are still ongoing.

UPDATE 10th DECEMBER 2021

The FAA published on the 7th of December an Airworthiness Directive AD 2021-23-12 [Ref. 3] that requires Operators to incorporate some limitations in their airplane/aircraft flight manual (AFM) on or before January 4, 2022. Several approach operations requiring radio altimeter data are prohibited in the presence of 5G C-Band interference as identified by Notices to Air Missions (NOTAMs).

On the basis of the results of the risk assessment already presented to authorities, Airbus will propose to the FAA an Alternative Means Of Compliance (AMOC) to this AD with the aim of relaxing the constraints for Airbus aircraft.

Without delay, we recommend the affected Operators to include the restrictions mentioned in the FAA AD in their AFM documentation.

Please be informed that in response to the FAA's directive, the EASA published their position [Ref. 4]: for EASA, the AD 2021-23-12 is not eligible for adoption.

NEXT MILESTONES

- › FAA to respond Airbus proposal for AMOC by the end of December
- › Radio Altimeter new MOPS availability (target September 2022).

Airbus will continue to communicate information related to the impact of 5G telecommunications on the aircraft operations via regular updates of this article.

ANNEXE: OPERATIONAL CONSIDERATIONS

At this stage of the investigation, no impact on the safety of the operations had been exhibited and no particular guidance, recommendations (maintenance or operational) nor restrictions to existing instructions was considered applicable.

However, we would like to remind the Operators that some cases of Radio Altimeter signals perturbations caused by Radio Frequency Interferences (from ground military radars) overlapping the working frequency of the Radio Altimeter system have already been observed in the past.

The disturbance of the Radio Altimeter signal might then have various impacts on the aircraft systems.

The main consequent effects observable in the cockpit can be:

- Erroneous height values (variables or steady usually at lowest altitudes)
- Partial or complete loss of RA data (leading to red flag on PFD and ECAM alerts)
- Impacts on dependent systems (audio callout, autoland, TAWS, etc.)

In addition to the fault monitoring and system failure protections, the existing Standard Operating Procedures below also allow the flight crew to detect and assess those situations.

FCTM section GOLDEN RULES FOR PILOTS

The following explains each of the three actions, and the steps associated with the performance of these actions:

- *Fly*

"Fly" indicates that:

- **The Pilot Flying (PF)** must concentrate on "**flying the aircraft**" to monitor and control the pitch attitude, bank angle, airspeed, thrust, sideslip, heading, etc., in order to achieve and maintain the desired targets, vertical flight path, and lateral flight path.
- **The Pilot Monitoring (PM)** must assist the PF and must **actively monitor** flight parameters, and call out any excessive deviation. The PM's role of "actively monitoring" is very important.

Therefore, both flight crewmembers must:

- Focus and concentrate on their tasks to ensure appropriate tasksharing
- Maintain situational awareness and immediately resolve any uncertainty as a crew.

4. *Take action if things do not go as expected.*

If the aircraft does not follow the desired vertical or lateral flight path, or the selected targets, and if the flight crew does not have sufficient time to analyze and solve the situation, the flight **crew must immediately take appropriate or required actions**, as follows:

The PF should change the level of automation:

- From managed guidance to selected guidance, or
- From selected guidance to manual flying.

The PM should perform the following actions in sequence:

- Communicate with the PF
- Challenge the actions of the PF, when necessary
- Take over, when necessary.

FCOM SOP Standard Callouts

The crew must ensure that RA is alive and auto callout is operative as part of approach and landing procedures.

APPROACH AND LANDING		
EVENT	PF	PM
Approach checklist	APPROACH C/L	APPROACH C/L COMPLETE
Activation of approach Phase	ACTIVATE APPROACH PHASE	APPROACH PHASE ACTIVATED
RA alive	CHECKED	RADIO ALTIMETER ALIVE ⁽¹⁾⁽²⁾

APPROACH AND LANDING		
EVENT	PF	PM
		LANDING C/L COMPLETE
1 000 ft RA	CHECKED	ONE THOUSAND ⁽²⁾
100 ft above MDA/DH	CHECKED	ONE HUNDRED ABOVE ⁽²⁾
MDA/DH visual reference	CONTINUE	MINIMUM ⁽²⁾
MDA/DH no visual reference	GO AROUND-FLAPS	MINIMUM ⁽²⁾
		ONE HUNDRED ⁽²⁾ FIFTY ⁽²⁾
After touchdown Ground spoilers extended REV green on EWD		SPOILERS ⁽³⁾ REVERSE GREEN ⁽⁴⁾
Deceleration		DECEL ⁽⁵⁾
At 70 kt	CHECKED	SEVENTY KNOTS

⁽¹⁾ Crew awareness, crew should now keep RA in scan to landing

⁽²⁾ PM monitors pin-programmed auto callout, or announces if inoperative.

⁽³⁾ If the spoilers are not extended, call NO SPOILERS

⁽⁴⁾ If the reverse deployment is not as expected, call NO REVERSE ENGINE__ or NO REVERSE, as appropriate.

⁽⁵⁾ DECEL Callout means that the deceleration is felt by the crew, and confirmed by the speed trend on the PFD.If no positive deceleration, NO DECEL.

FCOM SOP Approach - Management of degraded guidance section

MANAGEMENT OF DEGRADED GUIDANCE

EARLY/UNTIMELY FLARE MODE ENGAGEMENT

- Perform a go around (thrust levers set to TOGA), or
- Disconnect AP, set both FDs to OFF and continue the approach using raw data or external visual references.

In association to an early/untimely FLARE mode engagement on the FMA, the following effects may occur:

- On the Primary Flight Display (PFD):
 - The RA height indication may be frozen at a positive or negative value,
 - Discrepancies between both PFDs may happen on the following indications:
 - RA heights,
 - FD orders,
 - FMA indications when both APs are engaged.
- Warnings and/or Callouts:
 - Untimely activation of the AUTOLAND warning light. *Refer to DSC-22_30-30 Autoland Warning,*
 - Untimely Terrain Awareness and Warning System (TAWS) alerts,
 - Untimely or absence of "RETARD" callout,
 - Untimely L/G GEAR NOT DOWN ECAM warning,
 - Absence or interruption of RA automatic callout (height announcement),
- On the System Display (SD): A pulsing cabin differential pressure advisory may appear on the ECAM - CAB PRESS PAGE

Note: *This ECAM advisory has no consequence on the real cabin pressure.*

Finally, we would like to take opportunity to emphasis on the recommendations below (underlined by the authorities) and that remain applicable at all time:

- *Pax should be reminded that the PED must not be in the baggage hold, but must be kept with them in the cabin, unless they are secured off.*
- *5G compatible devices in the cabin should be set to "airplane mode" or turned off*
- *For emergency communications (health emergency for instance), the crew shall only use the 3G or 4G networks.*
- *In accordance with the regulation (UE) 376/2014, any interference with the avionics system shall be reported by the crew to the Traffic Control. It is therefore important that the Traffic Control have knowledge of the potential 5G impact on the RA in order to take appropriate operational measures and inform the airport authorities if the 5G interference is suspected.*

[Survey for the Engineering Support section](#)

General Information

Potential impact:	Safety - Flight Operations				
Key information:					
Solution benefit:					
First issue date:	09-FEB-2021	Issue date:	10-DEC-2021	Last check date:	10-DEC-2021

Technical parameters

ATA:	34-42
A/C type/serie:	A300, A300-600, A310, A318, A319, A320, A321, A330, A340, A350, A380
Engine:	
Engine manufacturer:	
Fault code/ECAM warning:	
FIN:	
Part Number:	
Supplier:	

Attachments

N/A

Links

N/A

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