

[Airbus Amber]

Not Technical

Radio Altimeter & 5G Issue

NACC/CAR/SAM Preparatory Workshop to ITU
World Radiocommunication Conference 2023
(WRC-23)

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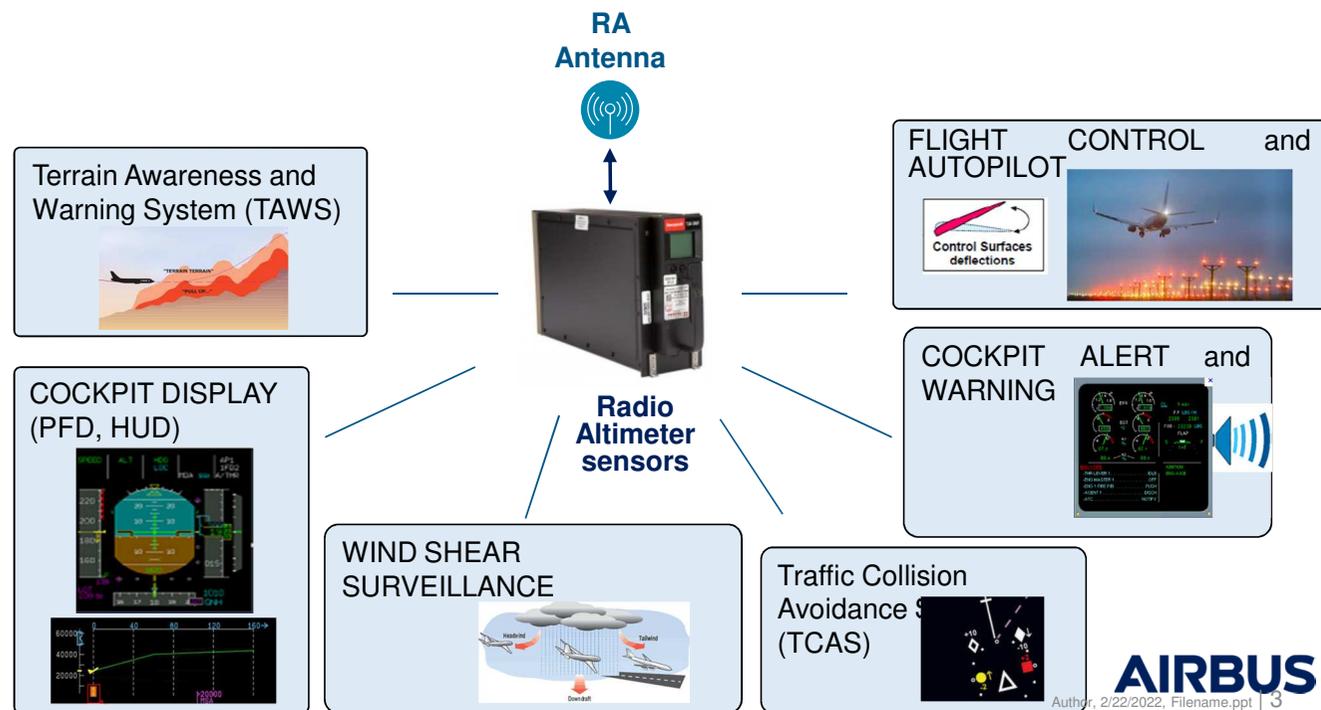
Agenda & Acknowledgements

- The Problem & Impacts
- 5G and Radio Altimeter Band
- Context & Technical concern
- AMOC process V1, V2 & V3
- Conclusion & Way Forward

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The Problem and Impacts

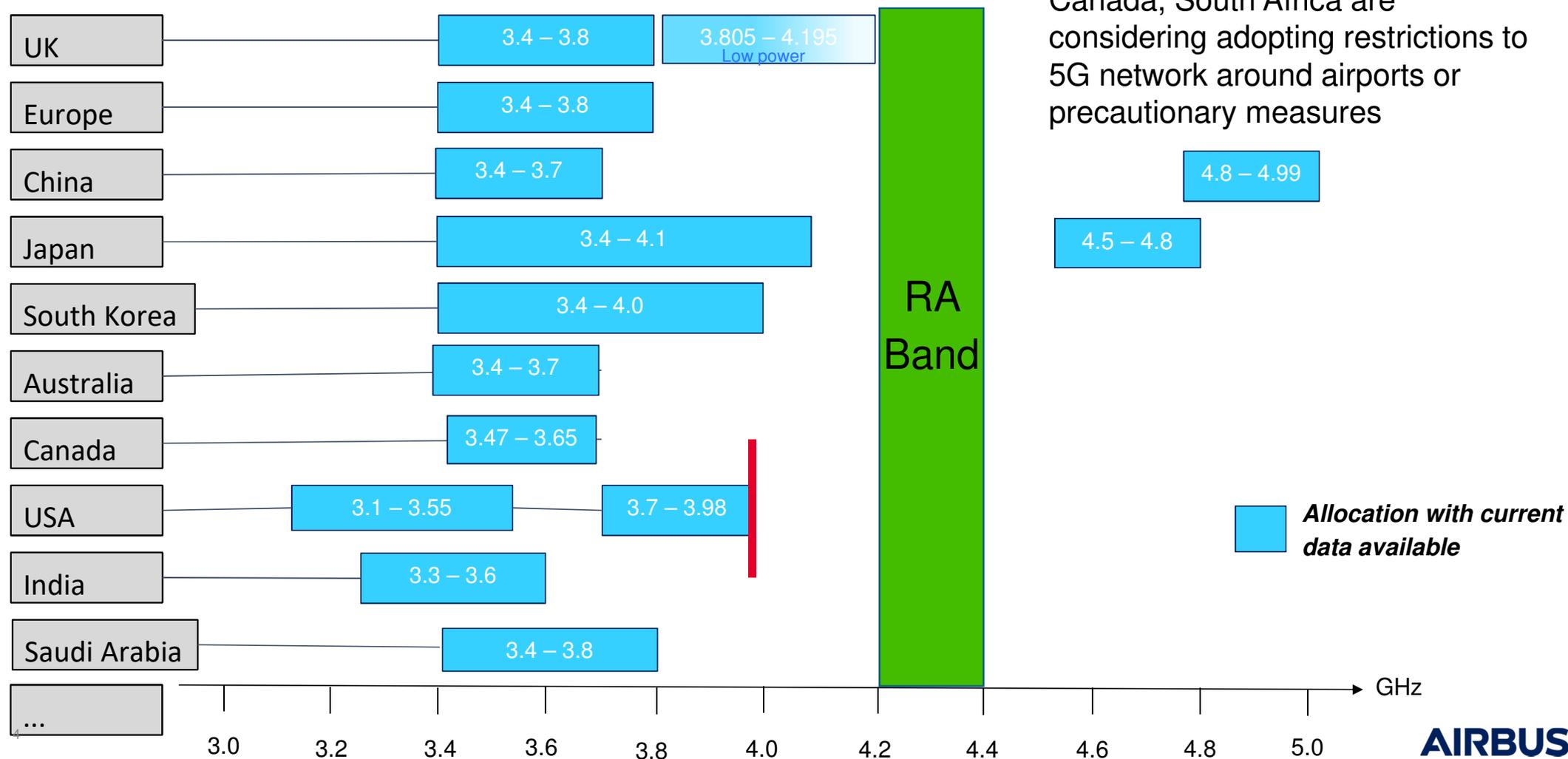
- Governments all over the world are considering (or have considered) allowing 5G cellular systems to operate in parts of the frequency ranges 3.4 - 4.2 GHz and 4.4 - 4.9 GHz (adjacent to the band used by radio altimeters from 4.2 - 4.4 GHz.)
- Based on the Radio Technical Commission for Aeronautics (RTCA) Paper No. 274-20/PMC-2073, the 5G mid-band emissions may interfere with the Radio Altimeters.
- Impacted aircraft potentially include commercial aircraft, military aircraft, helicopters and larger GA & UAS aircraft with radio altimeters
- Some altimeters appear to be vulnerable to high power cellular systems.
- New Radio Altimeter standards are being developed to sustain planned 5G environment.
- The level of the problem is different depending on the platform.



5G and Radio Altimeter band

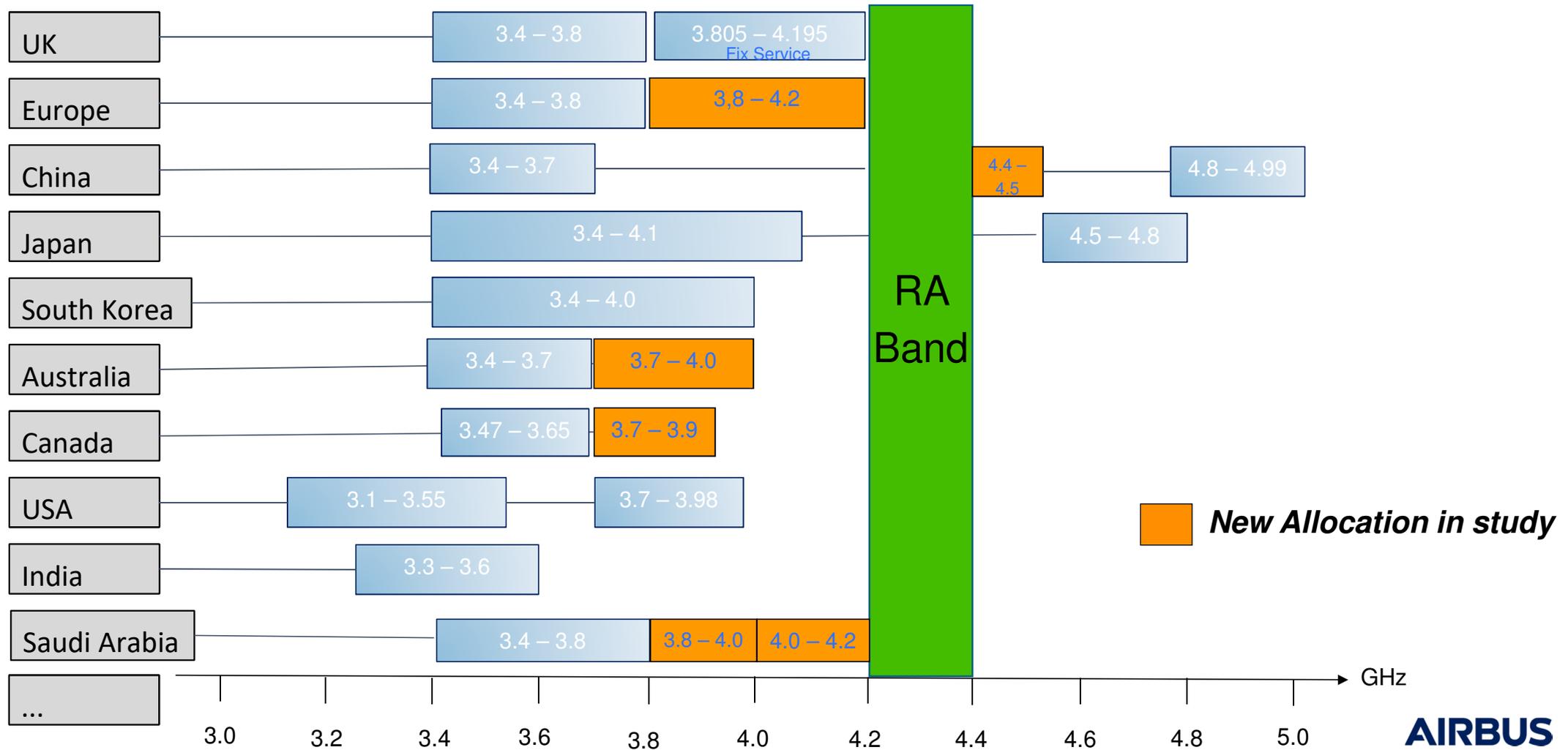
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Snapshot of 5G roll-out in **mid-band spectrum (C Band)**



Future 5G roll-out in study

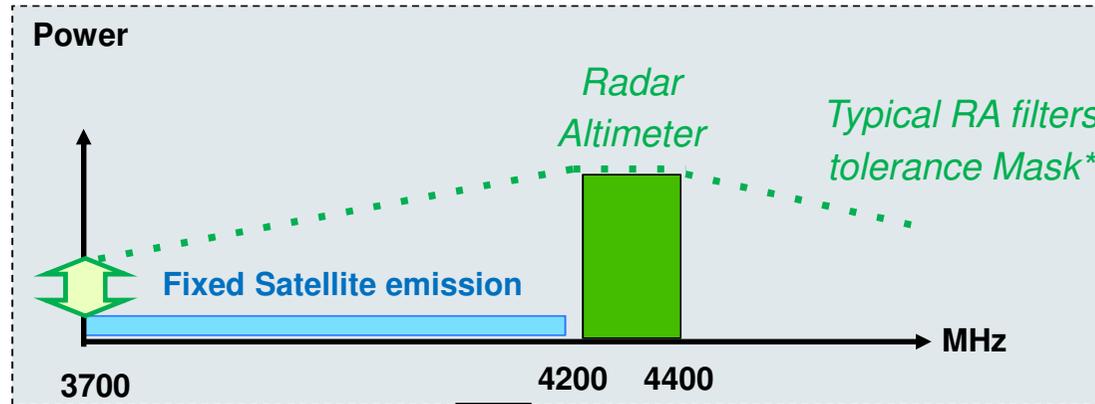
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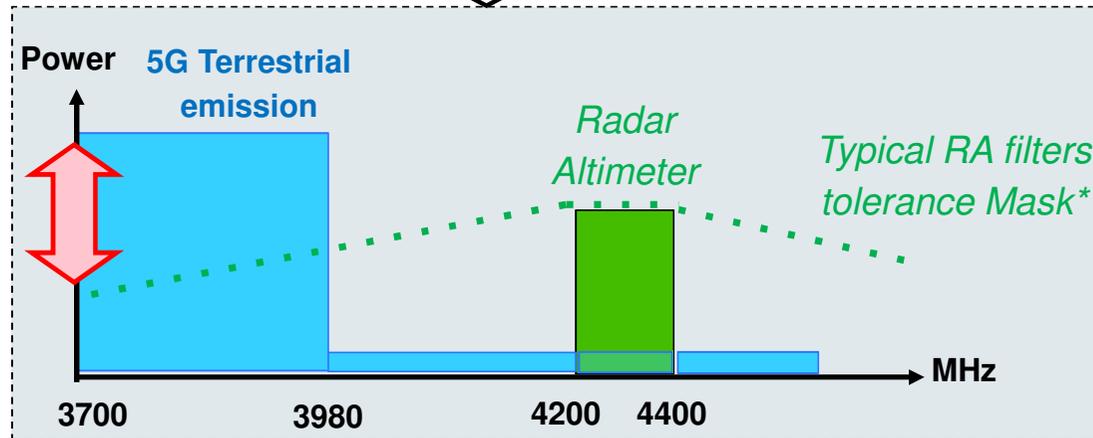
Context and Technical concern

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Fundamental Satellite signals are filtered by RA



Fundamental Terrestrial 5G energy not filtered by all RA models

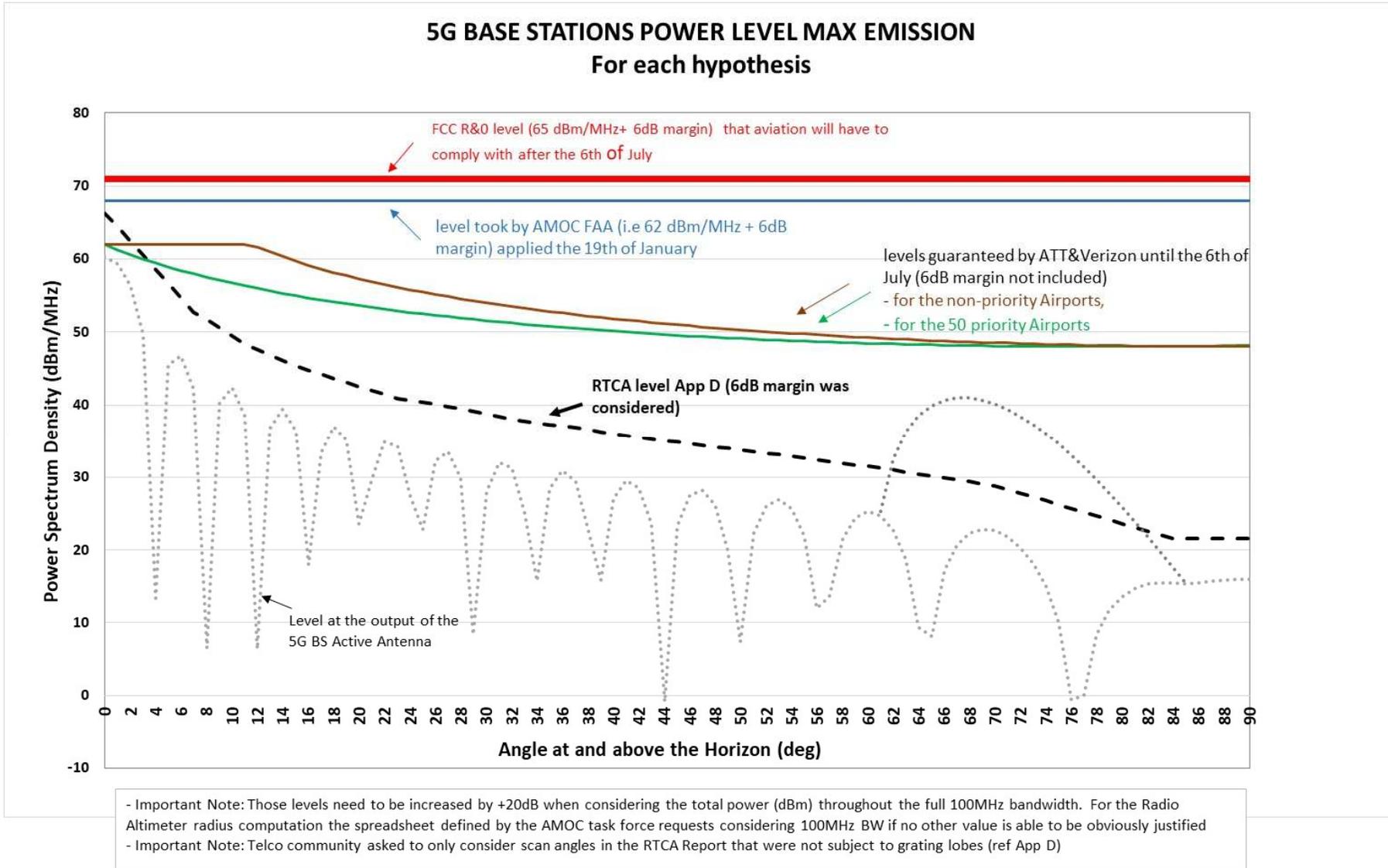


*To ease understanding:
Not to scale and not
representative to current
filters

Air Transport RA receivers have not been designed to support such level of terrestrial interferences in its adjacent band (previously allocated to Fixed Satellites Services) even though they are fully compliant with applicable regulations

Context and Technical concern

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AMOC Process

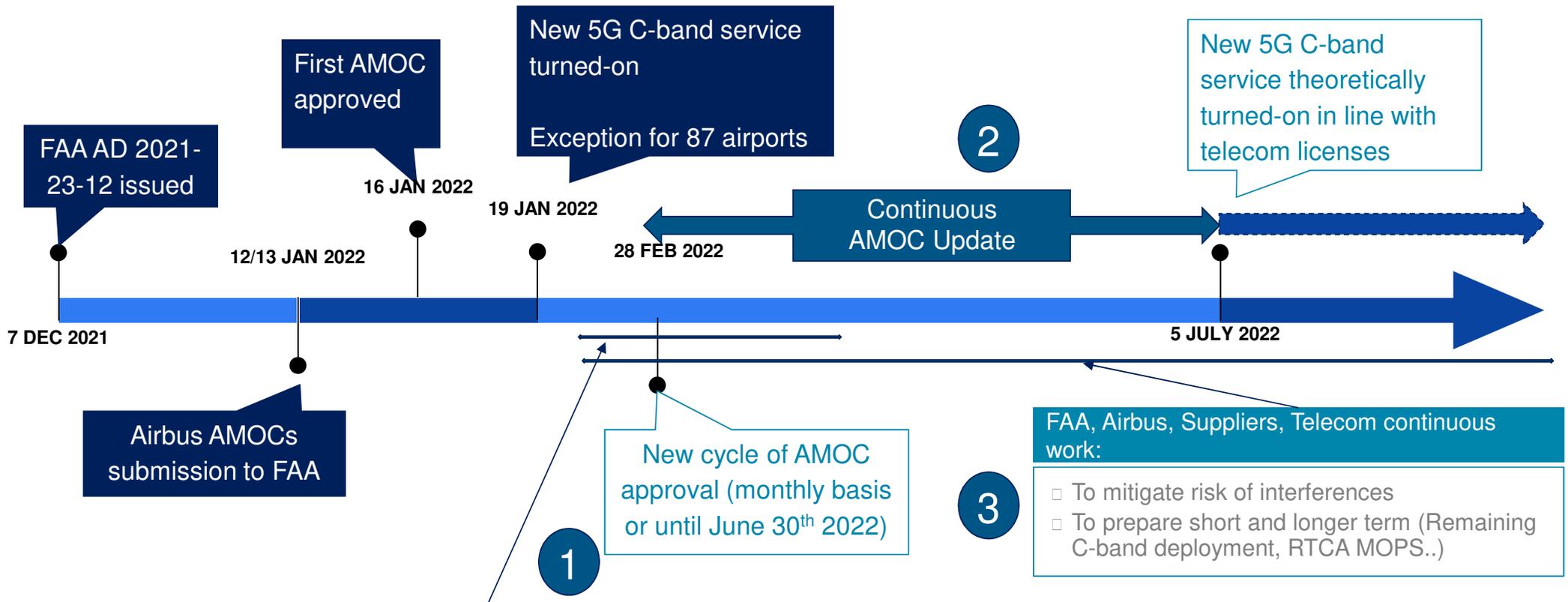
- AD 2021-23-13 Issued December 7, 2021 with an effective date January 4, 2022
- prohibits certain types of approaches in areas of 5G C-band interference as identified by NOTAMs
- AMOC process refers to Radio Altimeter performance metrics based on standardized test parameters to define a protection radius per RA without interferences

- Aircraft Manufacturers have submitted AMOCs based on:
 - Level taken by FAA (62 dBm/MHz + 6 dB)
 - Each RA suppliers technical parameters defined to compute the minimum radius
 - FAA tool (including all 5G NOTAMs) evaluate Airplanes/RA combination eligible for an AMOC approval per runway based on radius and base station locations

- Airports/Runways clearance is then provided by the FAA
- An AMOC Approval per Airport/Runways is composed of :
 - An introduction Letter stating the RA Supplier/associated Part Number(s) combined with associated aircraft types, for which the AMOC is applicable. This Letter mentions an expiry Date.
 - An appendix providing a 5G Cleared Airport/Runways List for given RA Part Number(s) and Aircraft type(s)

AMOC Process in force in the United States

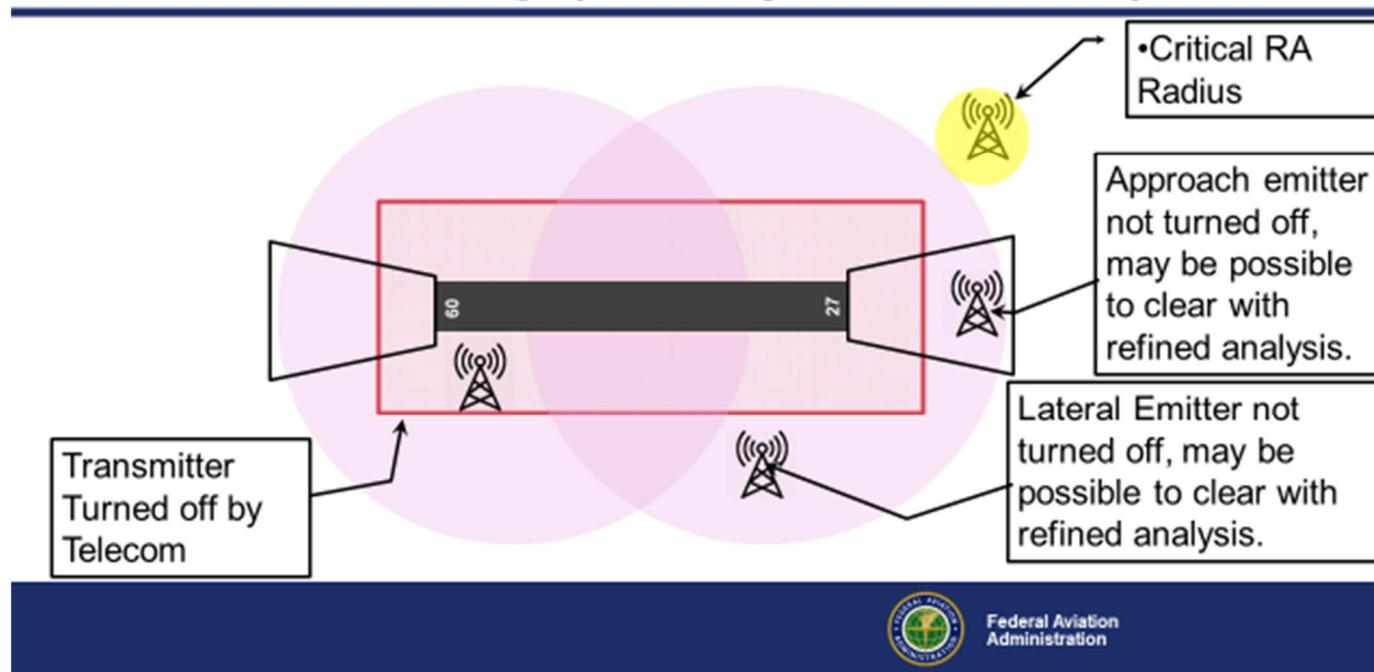
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AMOC Task Force (FAA, Airframers, RA Suppliers, Telecom operators) has validated the new “AMOC V3”, renamed “Variable Radius Method” by FAA, planned to be used Early March.

FAA protection surfaces as per January 19th 2022 (AMOC V1)

Jan 19 Geometry (2D only with Circles)



FAA protection surfaces as per end January 2022 (with AMOC V2)

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Fixed Radius Method

AMOC V2

AMOC FAA: 62 dBm/MHz + 6dB margin

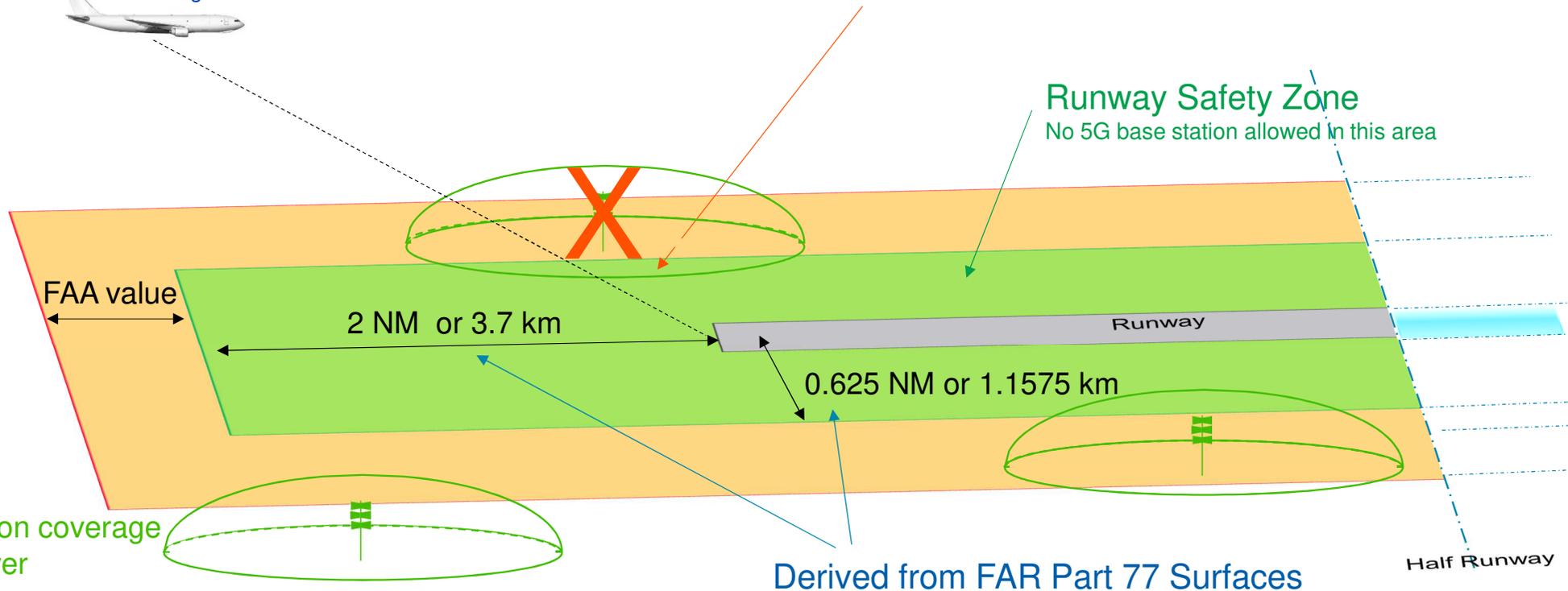


Performance Buffer

5G base station in this zone and radiating in the exclusion zone shall be turned off

Runway Safety Zone

No 5G base station allowed in this area



FAA protection surfaces as per end January 2022 (with AMOC V3)

Variable Radius Method AMOC V3

AMOC FAA: 62 dBm/MHz + 6dB margin

Realistic parametric model

- RA sensitivity characteristics
- RA antenna pattern
- Terrain elevation
- Base station altitude

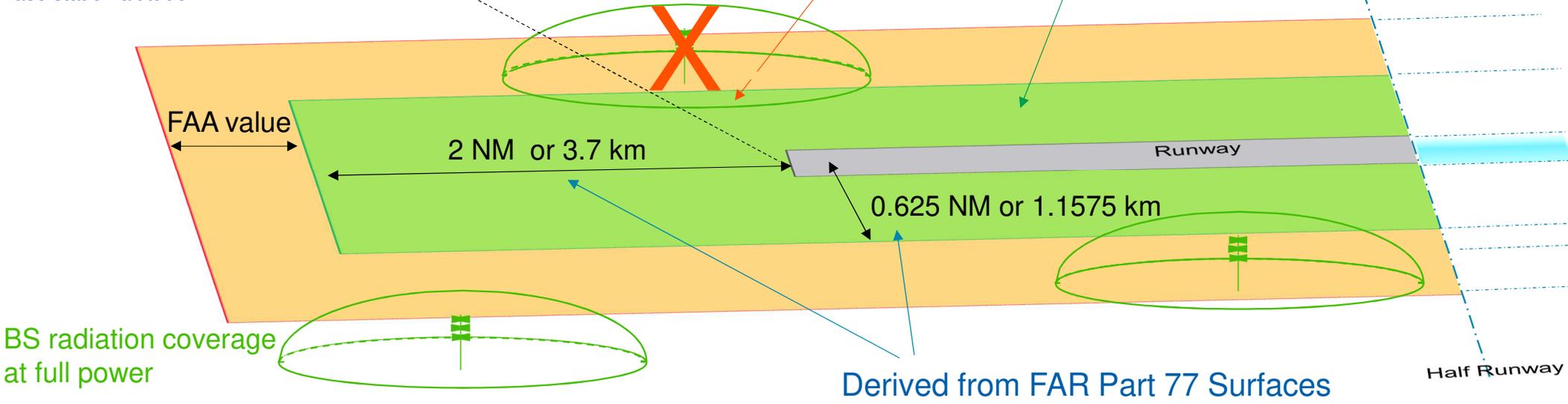


Performance Buffer

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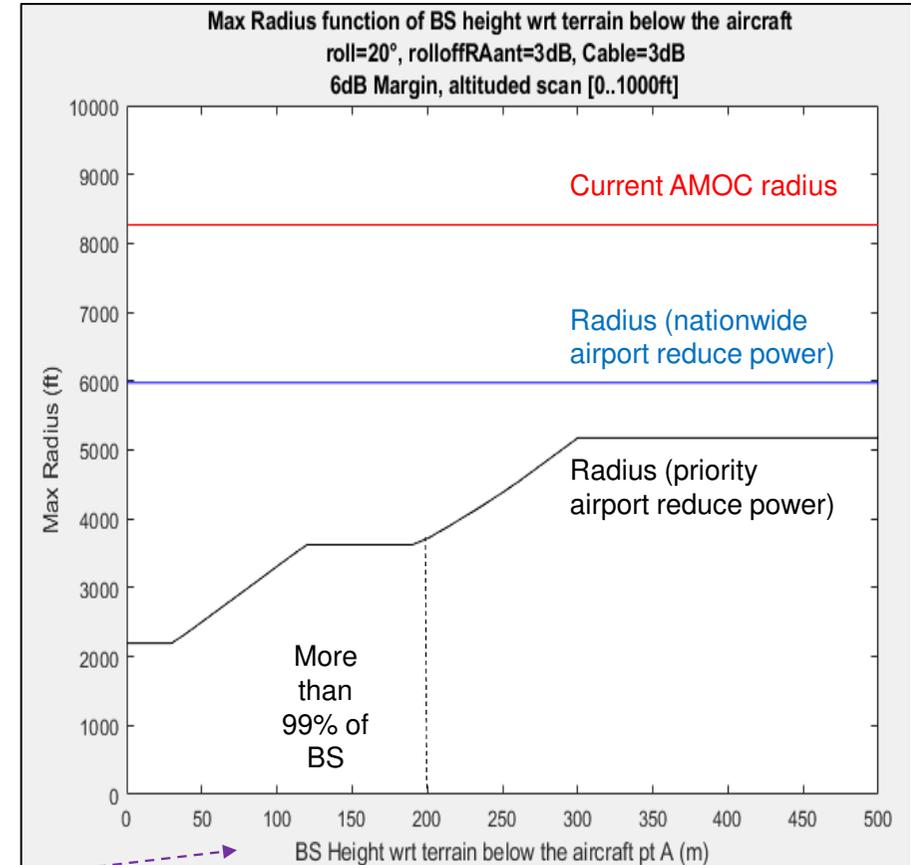
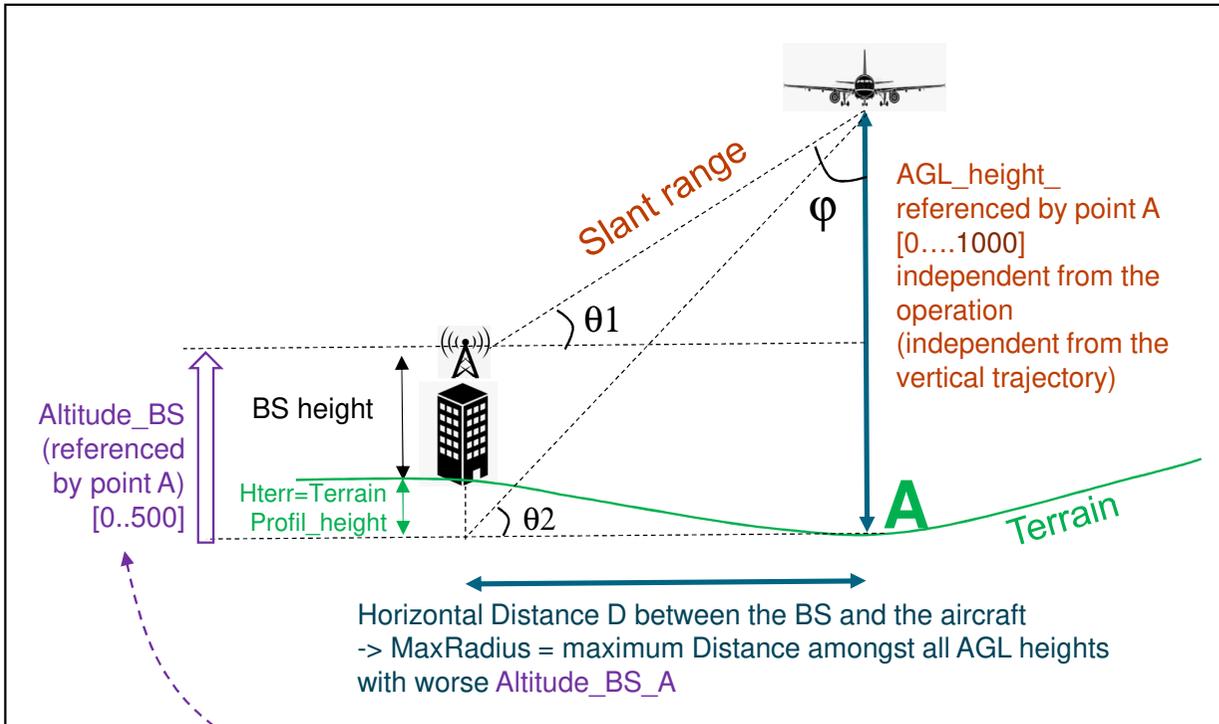


AMOC V3 "Variable Radius Method" will clear more runways whatever Aircraft/RA couple

AMOC V3 “Variable Radius Method”

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- AGL_height_A at the referenced point A [0....1000 ft]
- Horizontal Distance D between the BS and the aircraft [0...max]
- Altitude_BS_A (referenced by point A) [0..500 ft]



Applicable for every RA
Only applicable to fixed wing a/c

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Conclusion & Way forward 1

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- The deployment of new 5G telecommunications networks across the world may introduce new threats towards the aviation sector and flight safety.
- Aircraft Manufacturers & Radio Altimeter Suppliers have actively contributed, as part of an industry taskforce led by the RTCA, to assess the worldwide impact of these potential 5G interferences, with the objective to ensure the continued safe operation of flight.
- Aircraft Manufacturers & Radio Altimeter Suppliers developing new standards via RTCA/EUROCAE for a new RA MOPS planned to be available as of today in December 2022.
 - In addition to European countries and the United States, it is necessary to assess this risk for other countries & regions
- Aircraft Manufacturers objective in assessing and addressing potential interference between 5G networks and aircraft systems, is to ensure the continuous safe operations of airplanes.
- Aircraft Manufacturers will support future 5G deployment and usage for aviation thanks to close collaboration between Aviation & Telecom Industries.
- Aircraft Manufacturers will continue to provide updates to our airline customers and work with airworthiness authorities.

Take all practicable and necessary measures to ensure that mid-band 5G unwanted emissions will not cause harmful interference to Radio Altimeters

Conclusion & Way forward 2

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- Aircraft Manufacturers & Radio Altimeter Suppliers rely upon recommendation 5/5 from ICAO HLCC 2021

Recommendation 5/5 — Mitigating the risk of 5G implementation to safety-critical radio altimeter functions

That States:

- a) consider, as a priority, public and aviation safety when deciding how to enable cellular broadband/5G services;
- b) consult with aviation safety regulators, subject matter experts and airspace users, to provide all necessary considerations and regulatory measures to ensure that incumbent aviation systems and services are free from harmful interference; and

That ICAO:

- c) continue coordinated aviation efforts, particularly at the International Telecommunication Union (ITU), to protect radio frequency spectrum used by aeronautical safety systems.

Take all practicable and necessary measures to ensure that mid-band 5G unwanted emissions will not cause harmful interference to Radio Altimeters and improve transparent data sharing between Telecom Operators & Manufacturers and Aviation Industry to safely co-exist in the future

Thank you

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