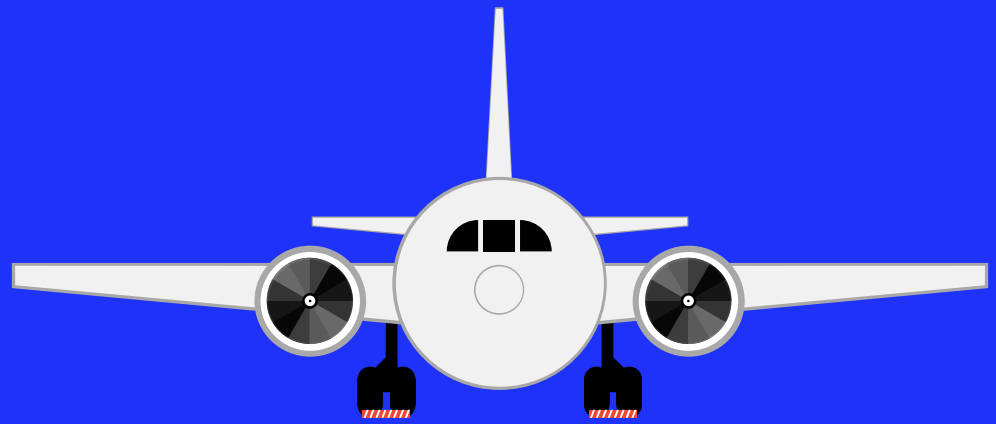
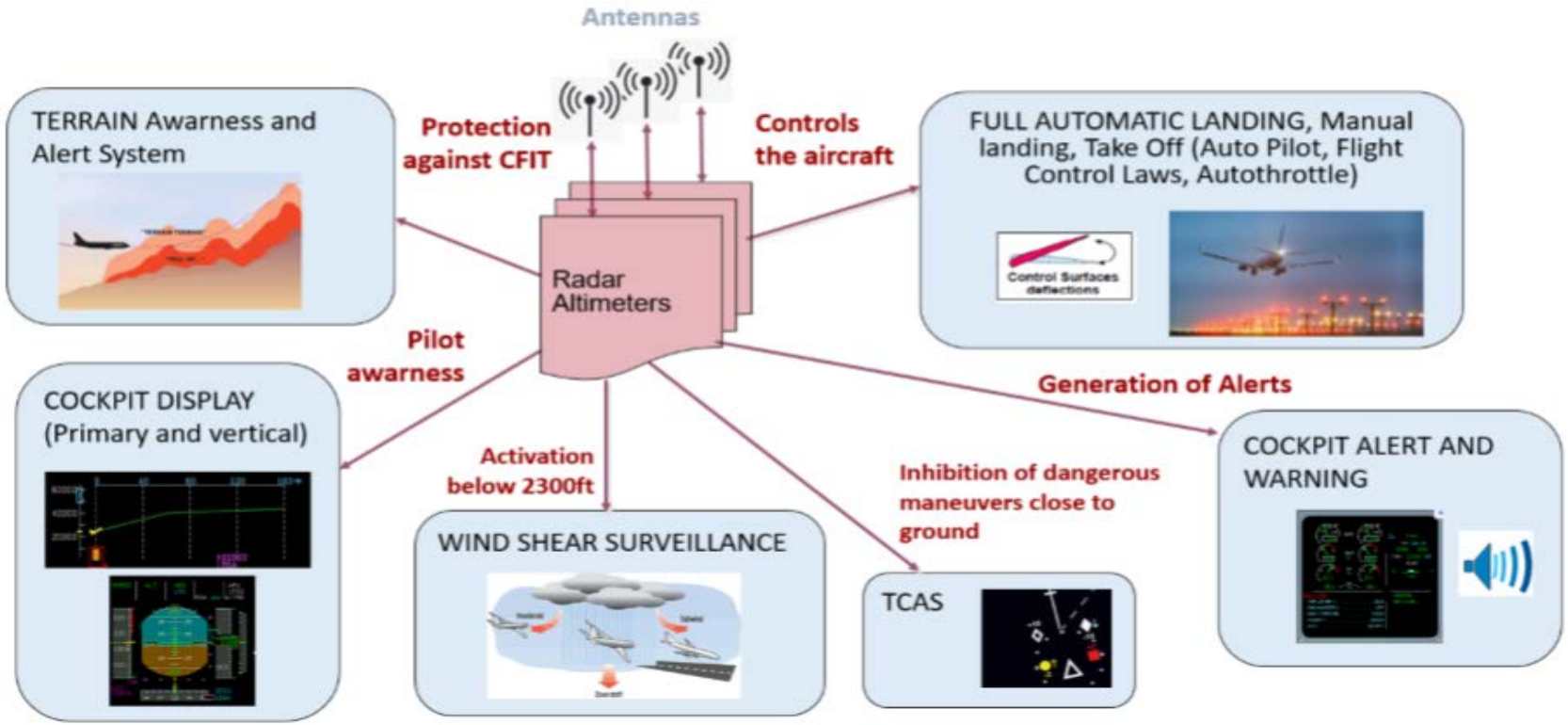
Chapter 2 -Potential impacts of 5G on Radio Altimeters during aircraft operations

19 December 2022

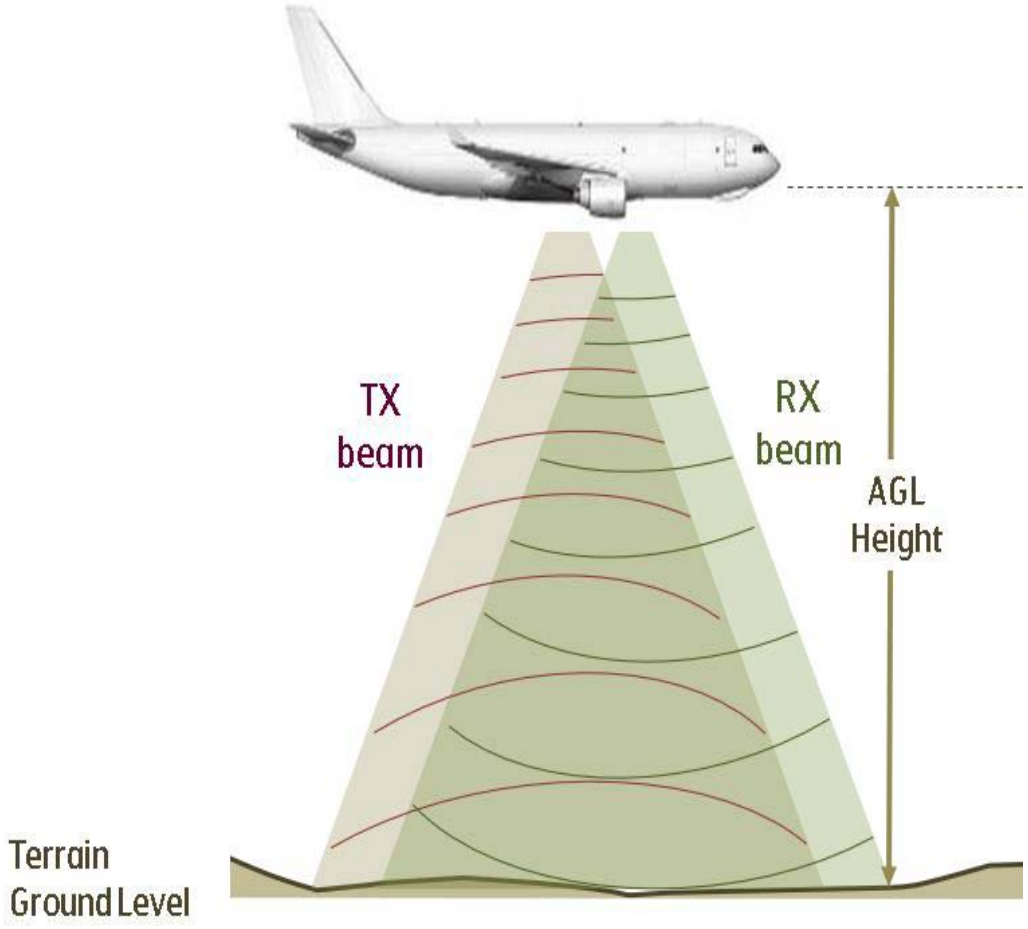


Introduction

- The band 4 200-4 400 MHz is allocated to the aeronautical radionavigation service (ARNS) and is reserved for **radio altimeters installed onboard aircraft by ITU Radio Regulations Art. 5 – Frequency Allocations, footnote No. 5.438.**
- The only sensor onboard the aircraft capable of providing a direct measurement of the clearance height above the terrain and any obstacles,
- Has crucial role in providing situational awareness to flight crew



Radio altimeters characteristics



- 3 Identical Radio altimeter systems on a single aircraft operate simultaneously and independently from one another.
- Technical characteristics can be found in Recommendation ITU-R M.20593
- RAs are included in the minimum equipment list on aircraft
- Designed at Assurance Level (DAL) of A
- Two types of radar waveform modulation methods : FMCW and Pulsed modulation

Technical Concern- Radio Altimeter standard

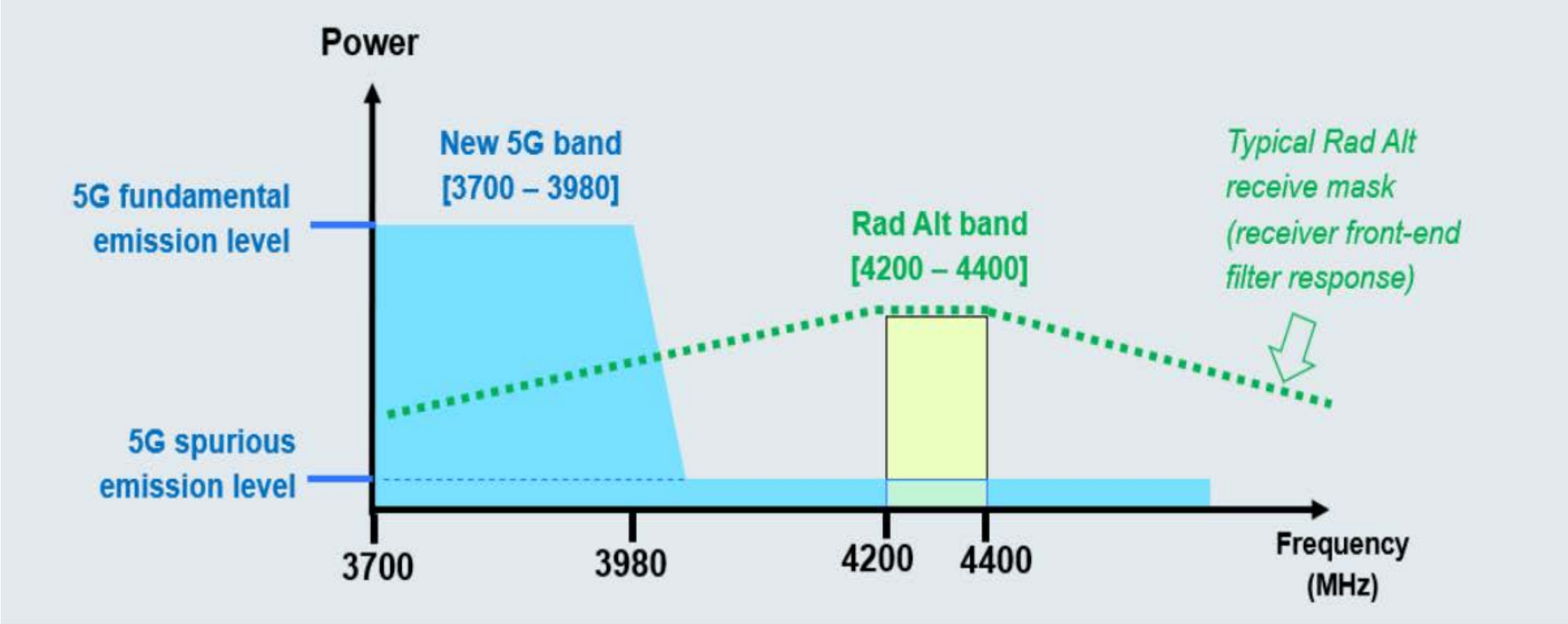
2.2 TRANSMITTER OPERATING FREQUENCY

The transmitter of the radio altimeter shall be operated within a frequency band allocated for the operation of airborne radio altimeters as provided in the International Telecommunications Union regulations. The spurious radiation characteristics shall also comply with these regulations. The equipment designer should note that national requirements may be more stringent than the I.T.U. regulations.

A standard set in the 1980s

- Developed before “telecom boom” and existence of 3G/4G/5G/6G…
- Few if any requirements to ensure spectrum compatibility with adjacent/nearby spectrum users.
- Current radio altimeters are complied with national regulations; however, the national regulations may not be suitable for current competing needs and spectrum environment.

Technical Concern



Potential operational impacts of 5G on Aircraft and Crew

- Loss of Situational Awareness
- Controlled Flight into Terrain (CFIT)
- used as a safety-critical navigation sensor by the **Automatic Flight Guidance and Control Systems**
- List of operational impact;
  - Undetected Erroneous Altitude/Flare phase- Catastrophic failure
  - Undetected Erroneous Altitude/all phases of flight –Catastrophic failure
  - Unanticipated NCD -Approach, Landing, Takeoff- Hazardous ,Severe major

Thank you