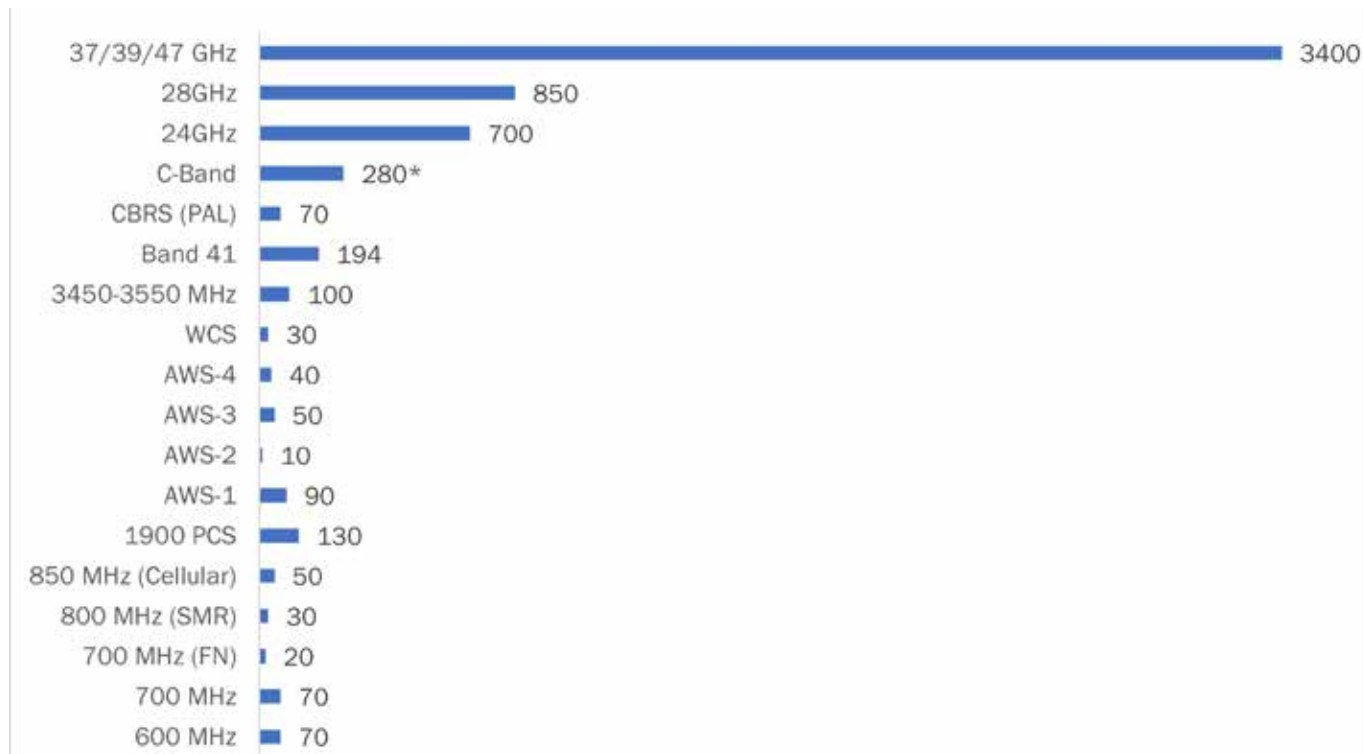


An aerial, top-down view of a white commercial airplane on a tarmac. The aircraft is oriented diagonally from the top right towards the bottom left. A prominent red engine is visible on the right side of the fuselage. Yellow ground markings are visible on the grey asphalt surface. The lighting creates a dark shadow of the plane on the ground.

Mid-Band Spectrum and the Co-Existence with Radio Altimeters



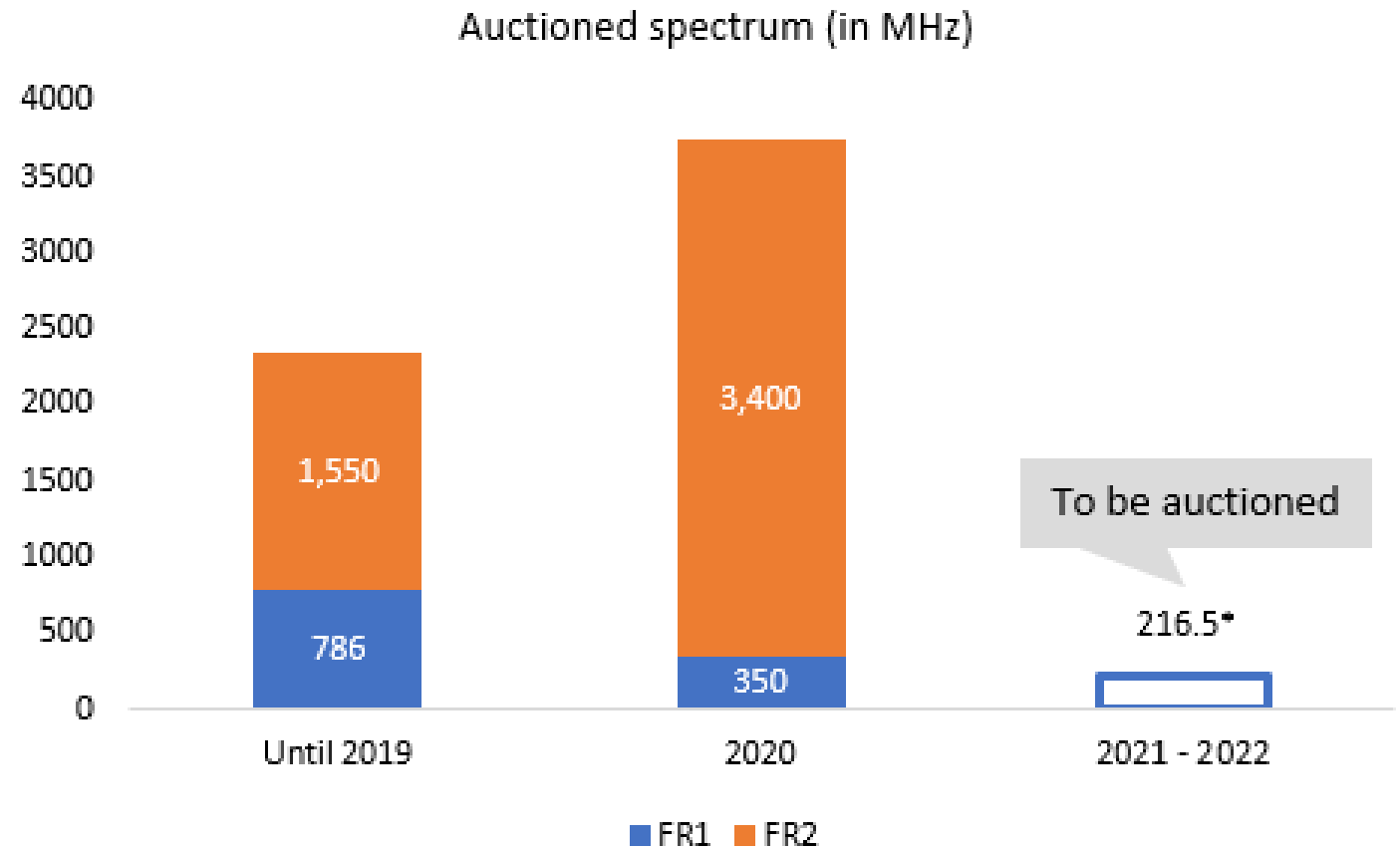
Available Spectrum in 2022 – United States



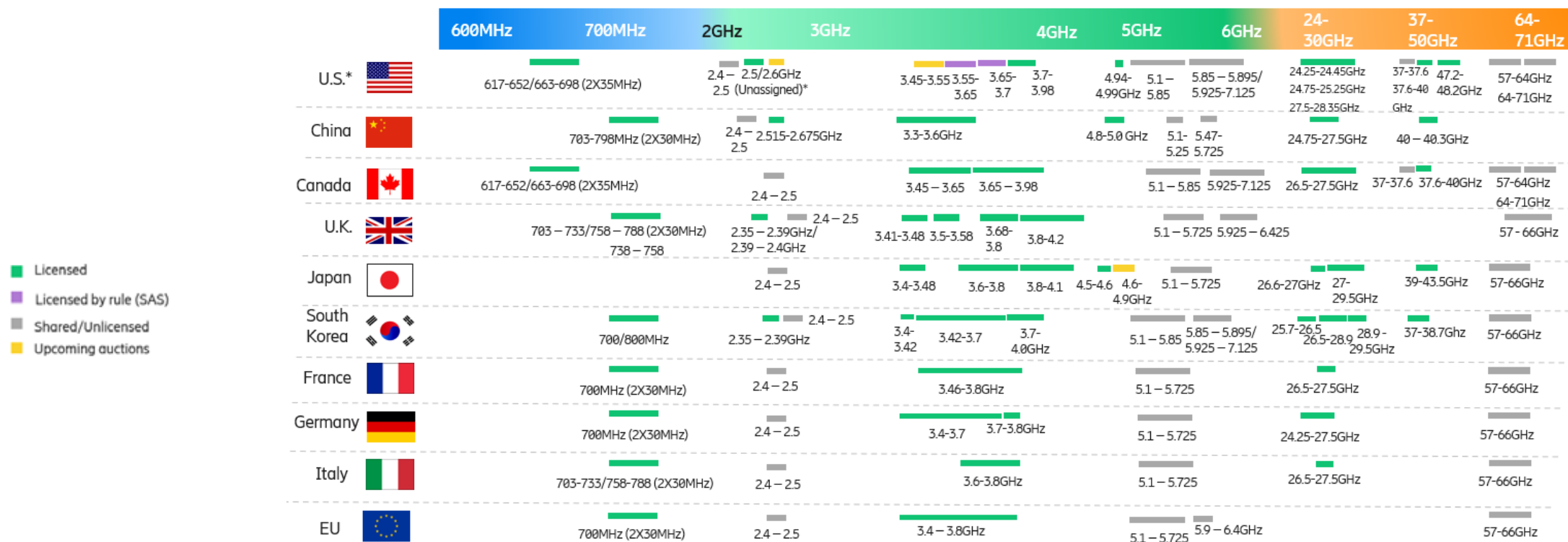
Spectrum Use in North America

Spectrum Type	USA	Canada	Mexico
Low-band - FDD	600 MHz, 700 MHz, 800 MHz SMR, 850 MHz	600 MHz, 700 MHz, 800 MHz SMR, 850 MHz	700 MHz, 800 MHz, 850 MHz
Mid-band - FDD	1900 PCS, AWS, 2300 WCS	1900 PCS, AWS, 2300 WCS, 2.5 GHz	1900 PCS, AWS, 2.5 GHz
Mid-band - TDD	2500 MHz, 3.5 GHz	2500 MHz, 3500 MHz	2500 MHz, 3400 – 3600 MHz (FWA)
High-band - TDD	24 GHz, 28 GHz, 37 GHz, 39 GHz, 47 GHz		

Auctioned Spectrum in the US to date



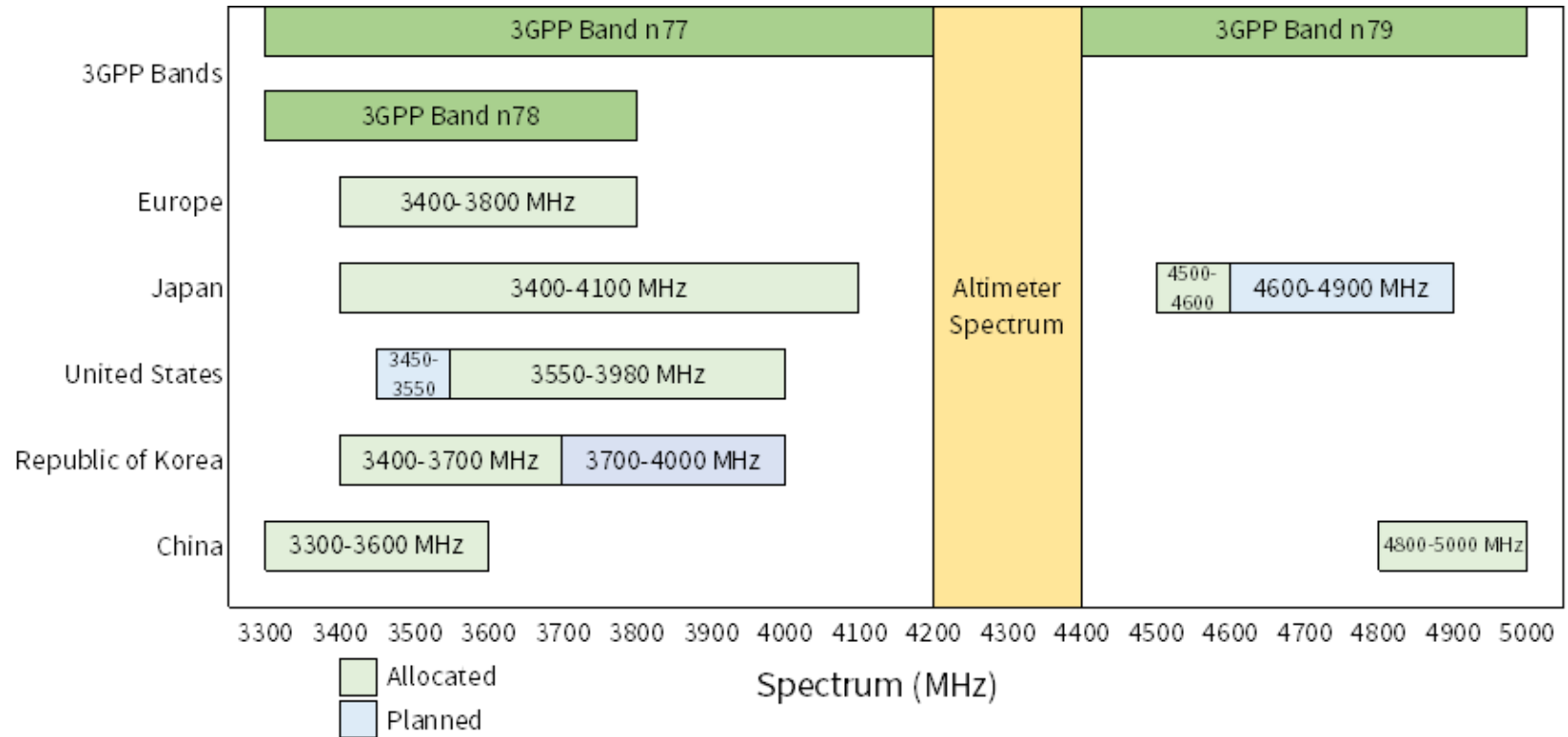
Global outlook on licensed & unlicensed spectrum (low, mid, high bands)



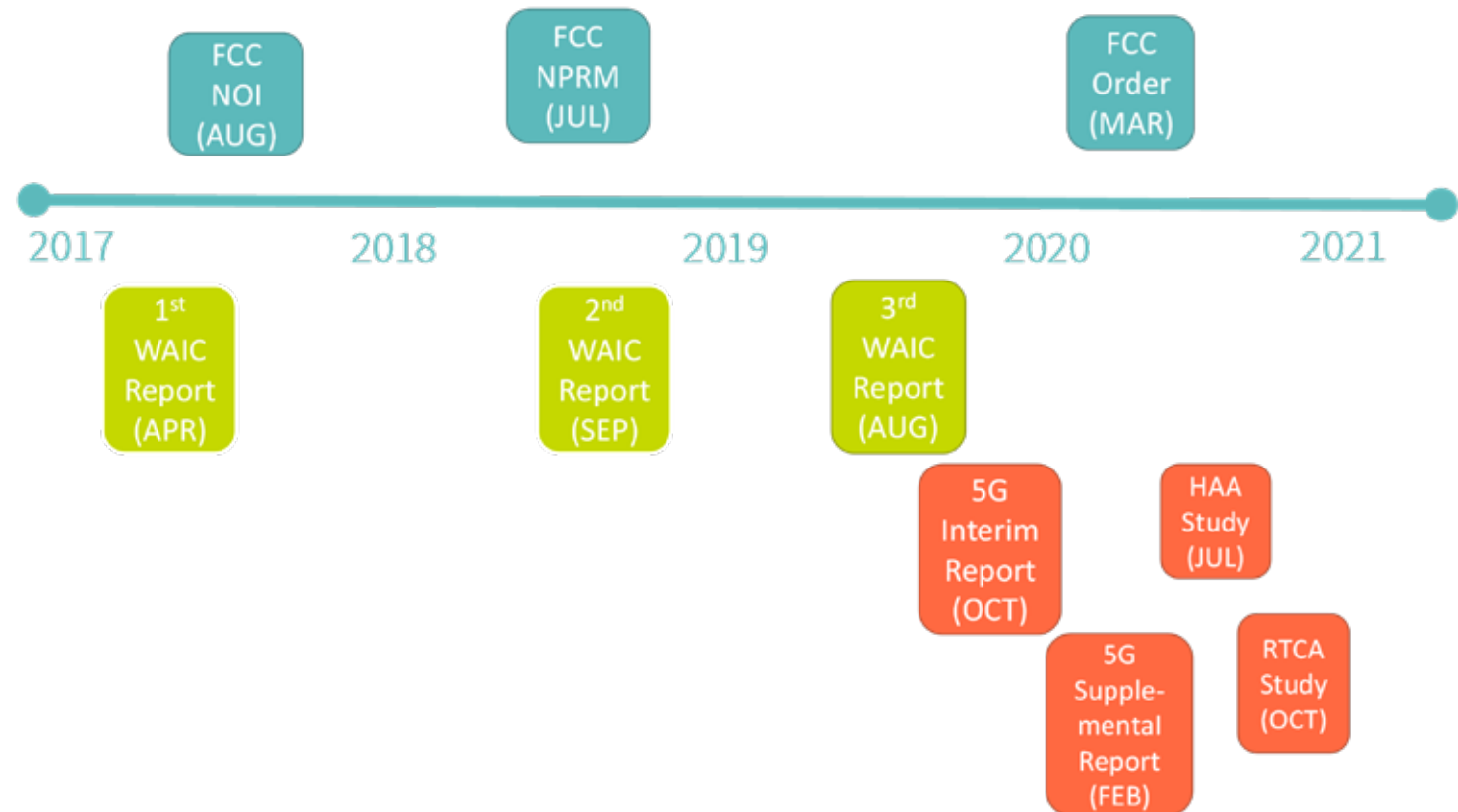
- Licensed
- Licensed by rule (SAS)
- Shared/Unlicensed
- Upcoming auctions



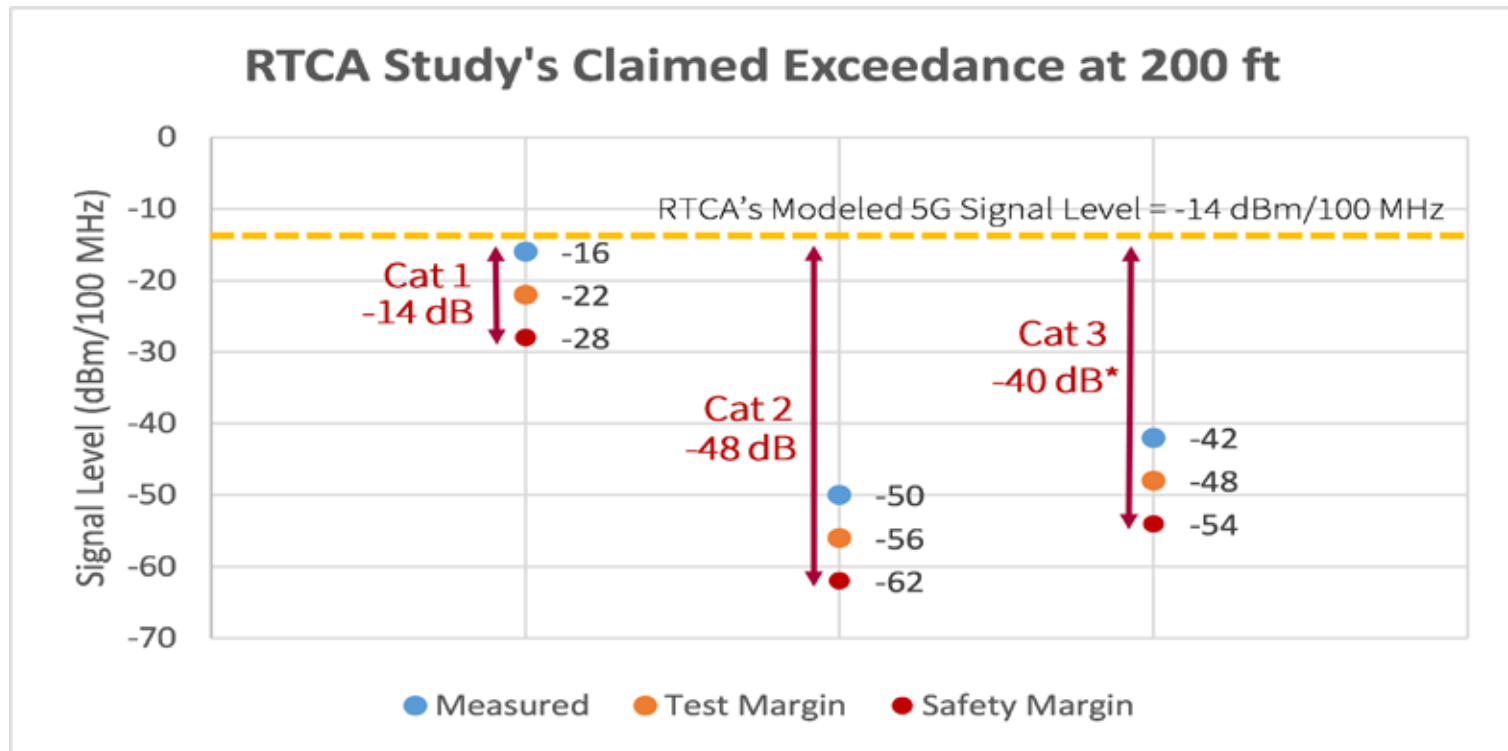
3GPP Bands and Spectrum Allocations Near the Altimeter Band



FCC and Aviation's Studies Timeline

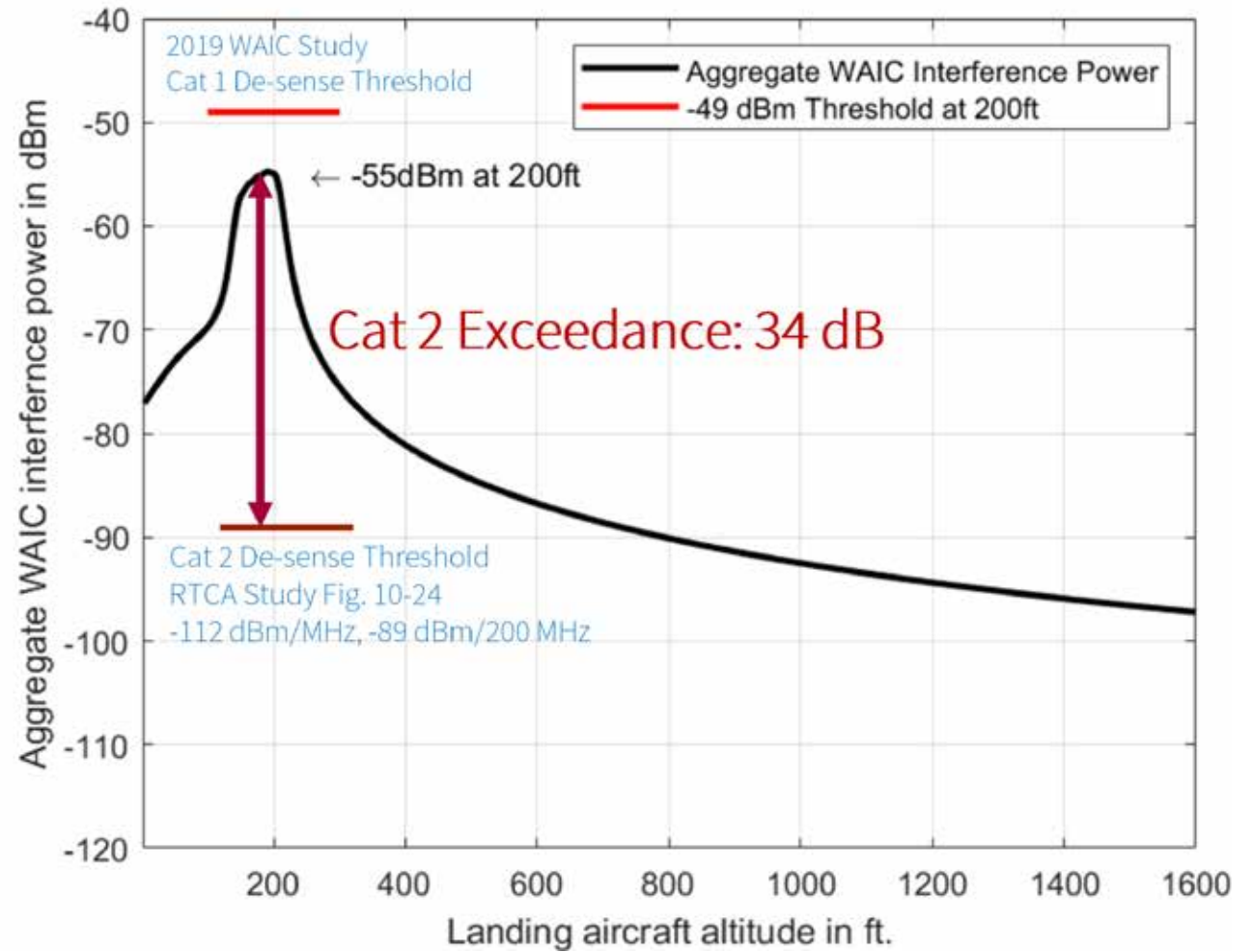


RTCA Study's Claimed Exceedance at 200 ft

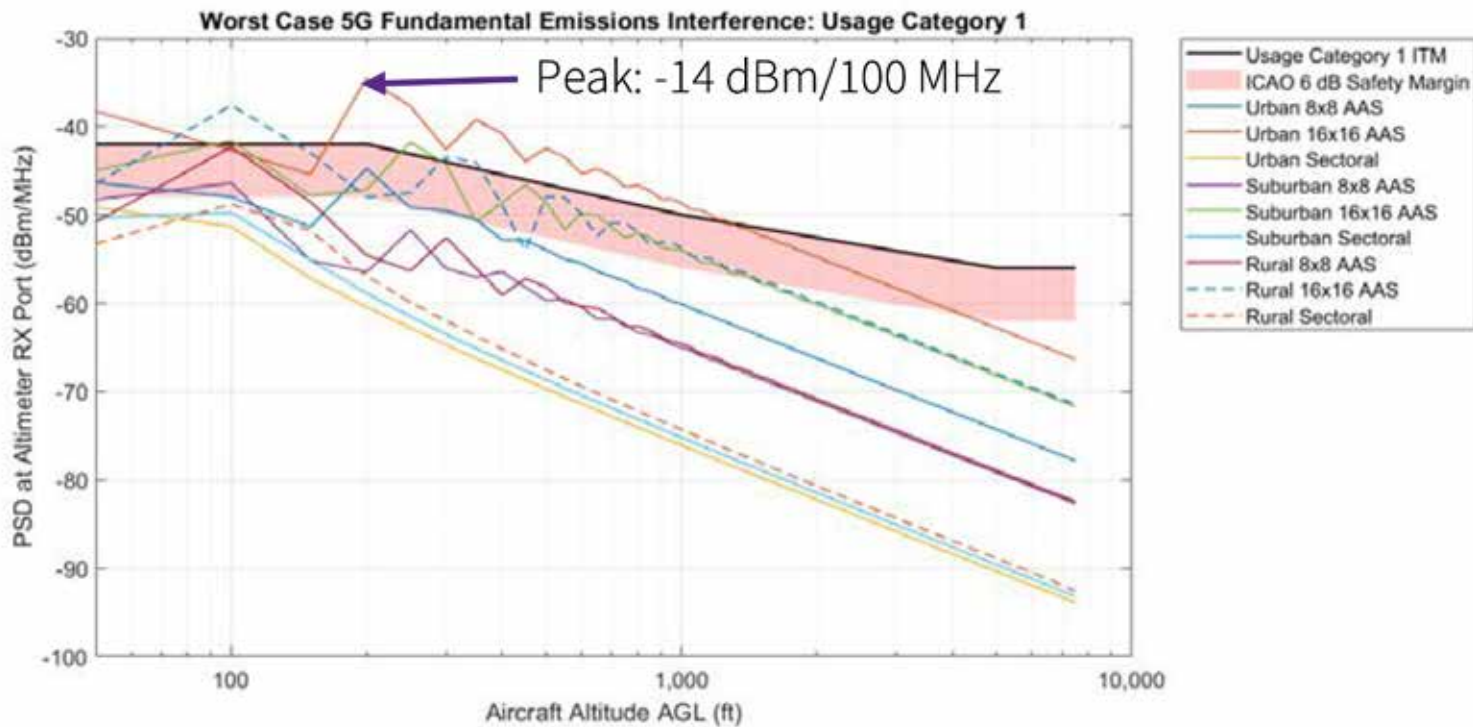


*Cat. 3's highest claimed exceedance of 45 dB was at 2,000 ft. Cat. 3 at 200 ft had a claimed exceedance of 40 dB.

WAIC Performance for the Worst Category 2 Altimeter



Worst Case 5G Emissions



Airport Scenarios

Scenario	Landing Aircraft	Go-around	Glideslope Approach
Aircraft Altitude (ft)	50	200	200
Aircraft Location	Runway Threshold	Runway Threshold	Not at airport
Terrain Type	Smooth	Smooth	Potentially rough
Loop Loss (dB)	54	70	90
Other RA Interference	23 db less	AVSI level	40 dB less

FAA Altitude Accuracy Requirements

System Type	Height Range	Accuracy of electrical data output	Accuracy displayed to the crew
Automatic Landing (ED-30 Table 1)	3 to 100 feet	+/- 3 feet	+/- 5 feet
	100 to 500 feet	+/- 3%	+/- 5%
	500 feet to the maximum of the scale	+/- 5%	+/- 7%
Ground Proximity Warning (ED-30 Table 2)	3 to 100 feet	+/- 5 feet	Not stated
	Above 100 feet	+/- 5%	

AVSI Pass/Fail Criteria

Criteria	Pass/Fail Threshold
Mean height error	>0.5%
98% of all heigh measurements	Within 2%
Height reading label	NCD (Non-Computed Data)

Altimeter Manufacturer Tolerances

Manufacturer	Altimeter Model	Accuracy of electrical data output	Accuracy displayed to the crew
Collins	ALT-50A	+/-2 ft or 2%	0 to 500: +/-5% Above 500: +/-7%
Honeywell	KRA-405B	0 to 500: +/-3 ft or 3% 500 to 2500: +/-5%	0 to 500: +/-5% 500 to 2500: +/-7%
Bendix	ALA-51A	0 to 500: +/-2 ft or 2% 500 to 2500: +/-5%	Not stated
Bendix King	KRA 10	Not stated	0 to 100: +/-5 ft 100 to 500: +/-5% >500: +/-7%
Bonzer	Mark 10	40 to 100: +/-5 ft 100 to 2500: +/-5%	Not stated
Thales	ERT-530	+/-5% over rough terrain	Not stated



Thank you

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