

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Upper C-band (3.98 to 4.2 GHz))	GN Docket No. 25-59
)	

REPLY COMMENTS OF CTIA

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CTIA submits these reply comments in response to the Notice of Proposed Rulemaking (“NPRM”) issued by the Federal Communications Commission (“Commission” or “FCC”) seeking comment on making spectrum in the 3.98-4.2 GHz band (“Upper C-band”) available for new terrestrial wireless operations.¹

I. INTRODUCTION AND SUMMARY.

Whether the Upper C-band auction will repeat the massive success of the Lower C-band (3.7-3.98 GHz) auction will turn on three factors: making available the maximum amount of Upper C-band spectrum for licensed, full-power terrestrial wireless deployments; providing a clear, unwavering schedule for wireless licensees to begin their deployments in the near term following the auction; and harmonizing the Lower and Upper C-band technical rules as appropriate. The record in this proceeding demonstrates that the Commission can achieve each of these features so long as it stays the course set out by Congress. Between the law, this rulemaking, and the companion rulemaking initiated by the Federal Aviation Administration (“FAA”), all the pieces are in place for the Commission to finalize a safe but aggressive plan for transitioning the Upper C-band to its highest and best use.

¹ *Upper C-band (3.98–4.2 GHz)*, Notice of Proposed Rulemaking, FCC 25-78 (Nov. 21, 2025) (“NPRM”). Unless otherwise indicated, comments referenced herein were filed in GN Docket No. 25-59 on or before January 20, 2026.

To start, the record in this proceeding confirms what has long been known: incumbent use of the Upper C-band—primarily content distribution via Fixed Satellite Service (“FSS”)—is diminishing and can be transitioned to other platforms to the maximum extent possible. In their initial comments, SES and Eutelsat provided preliminary information confirming they can transition their incumbent content distribution services into a smaller footprint supported by additional capacity from the Ku-band. CTIA agrees that satellite licensees should lead in crafting the most effective transition solution for their services, and to the extent users of those services seek a voice in determining their preferred platform post-auction, CTIA notes this is the role that lump sum elections played in the Lower C-band transition. For its part, the Commission should continue to press FSS incumbents for a more complete understanding of future C-band satellite capacity demands and support the variety of alternatives available for meeting it, including fiber, Ku-band and other spectrum bands, and alternate distribution platforms. As the Commission considers the future of FSS in this spectrum band, it should anticipate future trends and not simply react to the past.

Continued close collaboration between federal agencies and the wireless and adjacent band aviation industry users also is critical to ensuring the Upper C-band auction is a success. On this front, substantial progress has been made. Aviation stakeholders have spent more than six years developing an industry standard for next-generation radio altimeters in the adjacent 4.2-4.4 GHz band—an effort that started long before an Upper C-band auction was on the map and is aimed primarily at addressing aviation needs. These new radio altimeters will be more resilient to radiofrequency activity below, in, and above the 4.2-4.4 GHz band and emissions generated by 5G and aeronautical services alike. While aviation stakeholders’ initial 2022 deadline for completing this work has passed, they have announced a new, “firm and durable” completion

date of March 2027,² which the FAA is seeking to accelerate to 2026. Congress, in turn, directed the FAA “to ensure that next-generation radio altimeter technology is developed, tested, certified, and installed by 2028.”³ And the FAA has launched a companion rulemaking clarifying minimum performance requirements for next-generation radio altimeters as well as proposed deadlines for installing them on aircraft, as appropriate.

The coordinated FCC and FAA proceedings, buttressed by congressional action, standards development, and cross-industry collaboration, have positioned all stakeholders for timely execution. As the Commission advances this proceeding, it should now take care to build on this backdrop by including appropriate guardrails to ensure the Upper C-band auction is successful—namely, that it is completed on schedule and provides near-term wireless access to the Upper C-band spectrum by a date certain.

All told, there is considerable progress toward a C-band auction in 2027 resulting from years of cross-industry collaboration and detailed technical work. The Commission should reject last-minute efforts by some stakeholders now seeking to encumber the proceeding with unrelated conditions designed to advance their own commercial interests. Far from promoting more efficient use of limited spectrum resources, these proposals risk delaying the Upper C-band transition, altering the value proposition of the band, and undermining the ultimate success of the congressionally mandated auction.

The Commission should forge ahead, not backwards. The record underscores the benefits of Commission action across industry sectors and with its government partners to make

² See *Advancing Industry Standards: SC-239/WG-119 Aligns to Meet Evolving Radar Altimeter Needs*, RCA (Feb. 21, 2025), <https://www.rtca.org/news/advancing-industry-standards-sc-239-wg-119-aligns-to-meet-evolving-radar-altimeter-needs/>.

³ FAA Reauthorization Act of 2024, Pub. L. No. 118–63, § 1018, 138 Stat 1025, 1397 (2024) (“2024 FAA Reauthorization Act”).

available the maximum amount of Upper C-band spectrum for licensed, full-power terrestrial wireless deployments in a timely manner. The statutory mandate to auction Upper C-band spectrum is July 2027,⁴ and both the auction and timely access to the spectrum are necessary to put the band to work for the benefit of consumers, enterprises, and the U.S. economy. To that end, a coordinated, firm timeline for transitioning Upper C-band spectrum is essential for its success.

The record also supports use of the *Emerging Technologies* framework as well as a clearinghouse and a Cost Catalog to ensure reasonable cost reimbursement that largely follows the Lower C-band (3.7-3.98 GHz) model with targeted updates to reflect lessons learned from the earlier transition incorporated. Additional steps should include further Commission oversight and accountability of both the clearinghouse and relocation coordinator to ensure that the Upper C-band transition is as efficiently managed as possible.

Finally, the Commission should adopt Lower C-band licensing, technical, and auction rules for the Upper C-band, with modifications where appropriate. Importantly, the Commission should reject calls by some commenters for technical rules, allocations, or protection frameworks that would undermine full-power terrestrial access to the band, which is critical to meet ever-growing demand for wireless broadband.

The Commission has a record in this proceeding that is ripe for action. By continuing its forward progress and interagency collaboration, near-term access to a large swath of Upper C-band spectrum is achievable and in the public interest.

⁴ One Big Beautiful Bill, Pub. L. No. 119-21, § 40002(b)(2), 139 Stat 72, 128-30 (2025).

II. THE RECORD SUPPORTS CONTINUED COMMISSION ACTION TO DRIVE THE UPPER C-BAND TRANSITION FORWARD, MAXIMIZING THE AMOUNT OF SPECTRUM FOR LICENSED TERRESTRIAL USE AND NEAR-TERM ACCESS.

A. The Record Demonstrates the Substantial Benefits of Opening Upper C-band Spectrum for Wireless Use.

Commenters agree that opening as much Upper C-band spectrum as possible, as quickly as possible, for licensed terrestrial wireless use will bring myriad benefits to consumers, enterprises, and the U.S. economy, underscoring that Congress and the Administration were correct to focus on bringing Upper C-band spectrum to market first as part of the statutory spectrum pipeline. Repurposing as much Upper C-band spectrum as possible will help meet ever-growing demand for more wireless broadband by consumers and enterprises alike, advance our national security interests, and promote U.S. leadership in wireless.⁵ Additionally, because the Upper C-band is prime mid-band spectrum, its mix of coverage and capacity makes the band especially well-suited for deployment in rural and hard-to-serve areas.⁶ And it is globally standardized, making it an “immediately actionable opportunit[y] to increase the availability of full-power, licensed spectrum suitable for wide-area mobile broadband.”⁷

With the Upper C-band auction, the Commission has an important opportunity to build on the success of Lower C-band deployments. As AT&T highlights, the adjacent Lower C-band “currently serves as a foundational building block in 5G,” with wireless providers moving quickly to deploy this spectrum and “consumers quickly reaping a wide range of benefits, from

⁵ See, e.g., AT&T Services, Inc. (“AT&T”) Comments at 2-4; Cisco Systems, Inc. (“Cisco”) Comments at 2, 6-8; Ericsson Comments at 2-3; Nokia Comments at 2-3; Qualcomm Incorporated (“Qualcomm”) Comments at 2-3; Samsung Electronics America, Inc. (“Samsung”) Comments at 2; T-Mobile USA, Inc. (“T-Mobile”) Comments at 1; Verizon Comments at 4-5.

⁶ See generally Competitive Carriers Association (“CCA”) Comments at 1.

⁷ Samsung Comments at 1.

substantial jumps in download speeds to innovative new use cases.”⁸ Expanding access to contiguous Upper C-band spectrum will extend these benefits. As an example, contiguity with the Lower C-band creates a large swath of bandwidth to support future next-generation Artificial Intelligence (“AI”)-native networks as well as near-term applications such as increasing Ultra-HD mobile video.⁹

B. Record Data Support Making As Much Spectrum As Possible Available for Licensed, Terrestrial Use.

Demand for more licensed spectrum to support 5G and beyond networks shows why it is critical to bring as much of the Upper C-band to market as possible, as soon as possible. There already is growing support across the wireless, satellite, and aviation sectors for making a substantial amount of spectrum available for licensed use, providing a strong record for the Commission as it continues to explore maximizing the Upper C-band opportunity.¹⁰

As Verizon highlights, demand for wireless data “continues to soar, with usage on pace to double every two years.”¹¹ Ericsson likewise details that mobile data traffic per active smartphone in North America is expected to nearly double between 2025 and 2031, or at a compound annual growth rate of 12 percent.¹² Globally, wireless network traffic growth is being

⁸ AT&T Comments at 3; *see also* Verizon Comments at 4-5.

⁹ *See, e.g.*, Cisco Comments at 6-9; Qualcomm Comments at 1-2; Samsung Comments at 1-2.

¹⁰ *See, e.g.*, Cisco Comments at 2; CTIA Comments at 7; Ericsson Comments at 5; Nokia Comments at 2-3; Qualcomm Comments at 1; Samsung Comments at 2; T-Mobile Comments at 3; Verizon Comments at 4-5; SES Americom, Inc. (“SES”) Comments at 16-17; The Boeing Company (“Boeing”) Comments at 11; Letter from Dorothy B. Reimold et al., Vice President, Civil Aviation, Aerospace Industries Association, et al., to Marlene H. Dortch, Secretary, FCC, GN Docket No. 25-59 (filed Oct. 2, 2025) (“Joint Aviation and Wireless Industry Ex Parte”).

¹¹ Verizon Comments at 4.

¹² Ericsson Comments at 3; *see also* AT&T Comments at 2-3; Verizon Comments at 2.

driven by 5G mobile data traffic, fixed wireless access (“FWA”), and growing adoption of augmented reality devices and generative AI applications.¹³

These facts belie claims by Open Technology Institute at New America and Public Knowledge (“OTI/PK”) that “the near-term outlook for mobile data demand is bleak.”¹⁴ OTI/PK do not disagree that data use is growing; they suggest only that the *rate* of that growth is declining. But focusing only on rate is highly misleading because it masks the critical fact that absolute data volume continues to rise year after year. To use OTI/PK’s example, Ericsson’s November 2019 Mobility Report showed total global mobile data traffic grew 68 percent between the third quarter of 2018 and the third quarter of 2019, to 38 Exabytes (“EB”) per month.¹⁵ The November 2025 Mobility Report showed that mobile data traffic grew 20 percent between the third quarter of 2024 and the third quarter of 2025, to 188 EB/month.¹⁶ While OTI/PK are correct that the relative rate of growth decreased from 2019 to 2024, the absolute amount of data usage increased nearly *five-fold* in that time. The decrease in percentage growth is merely a function of a massive increase in wireless data reflected in the baseline. In other words, the same amount of growth each year—or even an increasing amount of growth—can nonetheless produce a smaller rate of growth. Focusing only on relative growth instead of absolute growth as OTI/PK suggest would lead to flawed policy decisions and a significant underestimation of data demand. The fact remains that data demand continues to grow year after year and additional spectrum will be needed to support this continued growth, particularly as AI

¹³ Ericsson Comments at 3.

¹⁴ OTI/PK Comments at 13.

¹⁵ *Ericsson Mobility Report*, Ericsson (Nov. 2019), <https://www.ericsson.com/4ac657/assets/local/reports-papers/mobility-report/documents/2019/emr-november-2019.pdf>.

¹⁶ *Ericsson Mobility Report*, Ericsson (Nov. 2025), <https://www.ericsson.com/4aca6f/assets/local/reports-papers/mobility-report/documents/2025/ericsson-mobility-report-november-2025.pdf>.

begins to scale, with AI applications projected to drive uplink traffic 20 percent higher than it would be with existing applications.¹⁷

The data also undermine calls by some commenters for the Commission to auction only the statutory minimum of 100 megahertz.¹⁸ To the contrary, the record shows a significant amount of spectrum can and should be repurposed. For example, there is substantial record support for repurposing up to 180 megahertz of the band, with the aviation and wireless industries jointly submitting a recommendation to the Commission discussing “the opportunity to safely enable full power access for wireless operations up to 4160 MHz.”¹⁹ Additionally, SES submitted comments supporting repurposing 160 megahertz for terrestrial wireless use (in addition to a 20 megahertz guard band),²⁰ further undermining calls for the Commission to auction only the minimum amount of spectrum in the Upper C-band range.

C. The Record Highlights the Need for Near-Term Access to Upper C-band Airwaves.

As CTIA and others highlighted, the Commission’s statutory charge is to conduct an Upper C-band auction by July 2027 that encapsulates two important objectives: auction *at least* 100 megahertz, as discussed above, and ensure the spectrum is put to work in a timely manner. As AT&T notes, “[b]idders need clarity on the timeline for when they will have access to the spectrum to begin deployments.”²¹ The Commission should press ahead to repurpose and

¹⁷ *Securing the Future of U.S. Wireless Networks: The Looming Spectrum Crisis*, Accenture, at 40 (Mar. 2025), <https://api.ctia.org/wp-content/uploads/2025/03/Looming-Spectrum-Crisis-Accenture.pdf>.

¹⁸ See, e.g., ARCTEK Satellite Productions, LLC (“ARCTEK”) Comments at 1; National Association of Broadcasters (“NAB”) Comments at 2; North American Spectrum Alliance Comments at 2; Society of Broadcast Engineers, Inc. (“SBE”) Comments at 2.

¹⁹ Joint Aviation and Wireless Industry Ex Parte; see also CTIA Comments at 18; Garmin International, Inc. (“Garmin”) Comments at 7; Boeing Comments at 9; Verizon Comments at 19.

²⁰ SES Comments at 16-17.

²¹ AT&T Comments at 10.

auction as much spectrum as possible and, consistent with the statutory directive, the transition should also provide a framework for licensees to gain *access* to Upper C-band spectrum in a timely manner and in any case within two to three years following the close of the auction.

As Qualcomm states: “One of the most critical aspects of this FCC proceeding is the date of availability for deployment for the auctioned spectrum. . . . Delays in opening the spectrum for full power deployments will delay [wireless providers’] ability to meaningfully incorporate this important mid-band spectrum into their networks that have been starved of fresh spectrum resources for years.”²² Both timely auction and timely access are thus essential, as the Commission recognizes in the NPRM in finding that the Upper C-band framework must account for “the need to provide bidders with assurances of when they will be able to access the spectrum won at auction.”²³

CTIA observed in its initial comments that any investment decisions made by a potential bidder—and ultimately auction revenue overall—are tied to the bidder’s return on investment, which hinges on certainty and timely access to the airwaves won at auction.²⁴ This underscores the necessity of ensuring that the FAA’s and FCC’s timelines are aligned and timely in their respective proceedings. As the National Telecommunications and Information Administration (“NTIA”) states, “the timing and substance of the transition process for NextGen RA upgrades is critical to ensuring both aviation safety and the timely availability of Upper C-band spectrum for new wireless services.”²⁵ And, critically, the Commission’s timeline to transition Upper C-band

²² Qualcomm Comments at 4.

²³ NPRM ¶ 119.

²⁴ See CTIA Comments at 7.

²⁵ NTIA Comments at 5.

incumbents is of equal importance to access the Upper C-band—these component parts must be synchronized for a fully harmonized transition.

In its companion proceeding, the FAA is proposing a timeline that would enable Upper C-band wireless deployments between 2029 and 2032.²⁶ CTIA discusses timing issues in greater detail below. Suffice it to say, CTIA is urging the FCC and FAA to coordinate on a timeline closer to the bottom end of that range, in the 2029-2030 timeframe. Delaying beyond that timeframe is not only unnecessary, it substantially increases auction risk. First, this schedule will align access with the timing for the wireless industry’s generational upgrade to 6G, which is expected to launch commercially in that timeframe following completion of global standardization.²⁷ The wireless industry needs predictable spectrum availability to support that upgrade. Second, a more significant delay from auction to access imposes significant financial strain on auction bidders that puts the success of the Upper C-band auction at risk, as winning bidders are required to make payment to the U.S. Treasury immediately following the close of the auction, meaning billions of dollars in capital expense that could not be recouped for many years. Third, absent access to the new Upper C-band spectrum, wireless networks will not be able to meet the moment given the skyrocketing demand noted above.

To be sure, the earlier part of the FAA’s proposed timeline is achievable. As an initial matter, the next-generation radio altimeter standards have been in development since 2019, and a 2029 initial performance deadline will have had roughly a decade for completion—offering ample time for the aviation community to design, develop, certify, and install next-generation

²⁶ Requirements for Interference-Tolerant Radio Altimeter Systems, 91 Fed. Reg. 459 (Jan. 7, 2026) (“FAA NPRM”).

²⁷ See, e.g., Qualcomm, 6G FAQs, <https://www.qualcomm.com/research/6g/faqs> (last visited Feb. 16, 2026).

equipment. Additional steps have already been taken to position the aviation industry for the transition to next-generation equipment, as discussed below.²⁸ Further, the FAA itself recognizes that it has mandated equipment upgrades on considerably shorter timelines for ground proximity and terrain awareness warning systems, traffic alert and collision avoidance systems, and helicopter air ambulance installations.²⁹

The synchronized FCC and FAA rulemakings provide the necessary underpinnings for accelerating the transition of Upper C-band spectrum and ensuring near-term access. The time is now for stakeholders to provide information to both the Commission and the FAA, as appropriate, to finalize the timeline for the Upper C-band transition so that the Commission can take its next steps in this proceeding. CTIA remains committed to working with all stakeholders to prioritize aligning the timelines for transition activities and minimizing the gap between the timing of the auction and licensee access to the spectrum.

D. The Commission’s Priority Should Remain Making As Much Upper C-band Spectrum As Possible Available for Licensed, Full-Power Terrestrial Use.

Importantly, the Commission should remain laser-focused on ensuring that repurposing the Upper C-band meets the Administration’s and Congress’s expectation that reform of the band advances next-generation wireless service. As Chairman Carr emphasized in opening this rulemaking, “[b]ringing this broad segment of mid-band spectrum to market will strengthen America’s foundation for emerging 5G and 6G innovations while delivering new and affordable

²⁸ See *supra* Section IV.B.

²⁹ FAA NPRM, 91 Fed. Reg. 471-72, Tbl. 5 (discussing compliance times of one year for Ground Proximity Warning System; three years for Helicopter Terrain Awareness and Warning System (“TAWS”) and for Helicopter Air Ambulance and Traffic Alert and Collision Avoidance System (“TCAS”) for more than 30 seats; five years for TAWS; seven years for TCAS for 1-30 seats; and ten years for Automatic Dependent Surveillance-Broadcast).

broadband services to communities across the country.”³⁰ Licensees require certainty that spectrum purchased at auction will be available on an interference-free basis to serve customers.³¹

The Commission should therefore reject calls to underlay repurposed Upper C-band frequencies with new, secondary allocations that are not consistent with that need, including calls by SpaceX and others for secondary use of C-band spectrum.³² The statutory auction mandate did not include new satellite services, and these proposals are inconsistent with the goals of this proceeding. Proponents of these ideas have not undertaken any of the requisite, extensive, and time-intensive technical work that would be needed to present, and parties and the Commission to vet, the interference impacts of such proposals to co-channel and adjacent-channel users. The Commission should not slow down the substantial progress that has already been made toward meeting the Upper C-band statutory auction deadline for such incomplete ideas. SpaceX’s proposal for a shared underlay MSS allocation, with its lack of technical framework, would undermine the attractiveness of the Upper C-band at auction, diminish spectrum valuation, and risk decreasing auction participation and reducing the amount of auction revenue raised for the U.S. Treasury.³³ The Commission should also reject calls for shared access to the band,³⁴ which

³⁰ NPRM, Statement of Chairman Carr; *see also* AT&T Comments at 4; Verizon Comments at 4.

³¹ *See, e.g.*, Ericsson Comments at 9.

³² *See* Space Exploration Holdings, LLC Comments at 4, 8; *see also, e.g.*, OTI/PK Comments at 24; OQ Technology at 1.

³³ SpaceX’s proposal to underlay the Lower C-band as well is outside the scope of the proceeding and should be dismissed for that reason as well. *See* Space Exploration Holdings, LLC Comments at 4.

³⁴ *See* WISPA – The Association for Broadband Without Boundaries (“WISPA”) at 2-3 (seeking shared use on an opportunistic basis of any unused Upper C-band spectrum); *see also* Professor Monisha Ghosh et al. at 2 (seeking a CBRS-like framework for the unauctioned portion of the band).

would add unnecessary complexity and uncertainty to this critical swath of mid-band spectrum, undermining the public policy objectives of opening the band for auction.

Instead, the Commission’s focus should remain on combining the Upper and Lower C-band frequencies into a harmonized swath of spectrum that, as NTIA observes, can support “high-capacity, low-latency terrestrial wireless services and accelerat[e] the deployment of emerging technologies that rely on robust mid-band resources”³⁵ such as 5G and beyond applications. The Commission should reject requests that would hinder these benefits.

III. COMMENTERS IDENTIFY MULTIPLE PATHS TO TRANSITION UPPER C-BAND INCUMBENT OPERATIONS.

CTIA is encouraged by the comments submitted in the initial record that provide a foundation for the Commission to drive forward its proposed transition of Upper C-band incumbent operations. In particular, both SES and Eutelsat include proposals to repack incumbent content distribution services into remaining Upper C-band spectrum, with additional demand for distribution capacity potentially transitioned to the Ku-band.³⁶ SES states that it would require the construction and launch of five to seven new hybrid Ku-band satellites, depending on the amount of spectrum to be cleared, plus an additional two in-orbit spares.³⁷ Eutelsat says its transition could include a combination of advanced compression techniques, ground equipment upgrades, and procurement, launch, and operation of one or more new satellites, as well as migration of existing customers to alternative spectrum such as Ku-band or to other distribution technologies.³⁸ We also recognize that users of these services seek a voice

³⁵ NTIA Comments at 3.

³⁶ See SES Comments at 10-14; Eutelsat Comments at 9-10.

³⁷ SES Comments at 10.

³⁸ Eutelsat Communications S.A. (“Eutelsat”) Comments at 9-10, 21-22.

in determining their preferred platform post-auction,³⁹ which is the role that lump sum elections played in the Lower C-band transition.

At the same time, commenters discuss operational and administrative burdens associated with the transition;⁴⁰ high transition costs;⁴¹ technical transition complexities;⁴² the importance of maintaining service integrity;⁴³ and compensation for reasonable transition-related expenses.⁴⁴ These are important issues for decision, but they are not roadblocks to action. The Commission should drive stakeholder interests toward resolution on these and other issues, consistent with the statutory deadline and with the goals of auctioning as much full-power terrestrial-use spectrum as possible and ensuring timely access to the licensed band.

To that end, CTIA agrees with commenters that a full record on certain issues will help inform the overall Upper C-band transition.⁴⁵ Specifically, the Commission should continue to seek additional information regarding the level of demand that will remain for today's Upper C-band satellite services following the transition. Such information will provide the Commission with a better picture of future satellite capacity demands to assess the appropriate volume of

³⁹ *See, e.g.*, NCTA Comments at 13-16; North America Spectrum Alliance at 6.

⁴⁰ *See, e.g.*, America's Communications Association – ACA Connects (“ACA Connects”) Comments at 3 (noting administrative strain and staff time-commitments); PSSI Global Services, LLC et al. (“PSSI”) Comments at 9 (discussing administrative costs and overhead).

⁴¹ *See, e.g.*, ACA Connects Comments at 14-15; NAB Comments at 3-4; NCTA – The Internet & Television Association (“NCTA”) Comments at 13-17.

⁴² *See, e.g.*, Eutelsat Comments at 5; NAB Comments at 5; NCTA Comments at 13-17; SES Comments at 20.

⁴³ *See, e.g.*, ACA Connects Comments at 10-12; NAB Comments at 6; NCTA Comments at 8-10; National Public Radio, Inc. (“NPR”) Comments at 1-4; PSSI Comments at 29-32; SBE Comments at 7-9.

⁴⁴ *See, e.g.*, ACA Comments at 6-9; Eutelsat Comments at 8-13; NCTA Comments at 13-17; NPR Comments at 2, 4-5; PSSI Comments at 39; SES Comments at 19-22, 24-25; SBE Comments at 9-10.

⁴⁵ *See, e.g.*, AT&T Comments at 9-10; Comsearch Comments; NCTA Comments at 1-2; T-Mobile Comments at 1-2; Verizon Comments at 5.

satellite launches and redundancy planning.⁴⁶ CTIA also agrees that the Commission should seek additional information on advanced compression techniques for content distribution and Upper C-band earth station utilization.⁴⁷ As T-Mobile states, eliciting such information will enable the FCC to make “a data-driven decision maximizing efficient terrestrial and FSS coexistence in the Upper C-band.”⁴⁸ SES and Eutelsat also should explain further how a phased approach to the Upper C-band transition would be useful.⁴⁹ Finally, the Commission should encourage the submission of data on space and earth station operations outside the contiguous United States (“OCONUS”) (e.g., in Hawaii).⁵⁰ As AT&T states, “[n]either the Lower C-band nor the 3.45 GHz Service have been authorized OCONUS, resulting in a significant mid-band spectrum crunch in those states and territories.”⁵¹ The Commission should evaluate whether to transition some C-band spectrum in certain OCONUS areas, recognizing that variations among such areas exist.

Importantly, the Commission can obtain this information while ensuring its rulemaking process and auction procedures are not slowed down.

⁴⁶ See NCTA Comments at 2; Verizon Comments at 5; *see also* Verizon Comments at 10-11 (discussing the Commission’s findings in the *SES/Intelsat Merger Order* regarding current C-band capacity); CTIA Comments at 10-11 (same).

⁴⁷ See T-Mobile Comments at 2; Verizon Comments at 5.

⁴⁸ T-Mobile Comments at 2.

⁴⁹ See SES Comments at 17-19; Eutelsat Comments at 21-22.

⁵⁰ See AT&T Comments at 4; Verizon Comments at 7; CTIA Comments at 14-15.

⁵¹ AT&T Comments at 4.

IV. THE RECORD SHOWS THAT THE ONGOING, PARALLEL FCC AND FAA PROCESSES ARE POISED TO PROMOTE FULL-POWER UPPER C-BAND 5G DEPLOYMENTS ON A NEAR-TERM TIMELINE.

A. CTIA Agrees With Commenters That the Upper C-band Transition Is Benefitting from Continuing, Collaborative Interagency Efforts.

Commenters agree on the need for the FCC and FAA to provide certainty across stakeholder communities.⁵² With roughly 18 months remaining, the Commission and FAA are well-positioned to execute on the statutory Upper C-band auction deadline. First, the FCC and FAA issued their proposed regulations on aligned timelines, with the filing deadlines in both proceedings closing in roughly the next two weeks.⁵³ Second, the long-ongoing standards development process for next-generation radio altimeters is moving to resolution, as the FAA has indicated that it is seeking finalization of the process by June⁵⁴ and is proposing to align the RTCA standard with its final rules via a Technical Standard Order (“TSO”).⁵⁵ Even though the final standard is not yet published, the standard itself has matured such that regulators can move to timely identification and auction of spectrum. As the Co-chair of RTCA SC-239 stated, “RA development work should be able to begin once the committee establishes the validation work and should not have to wait until the standard is published.”⁵⁶

⁵² See, e.g., AT&T Comments at 9-10; Ericsson Comments at 6; Qualcomm Comments at 4; Boeing Comments at 5; Aviation Spectrum Resources, Inc. (“ASRI”) Comments at 11.

⁵³ See FAA NPRM, 91 Fed. Reg. 459. Comments on the FAA NPRM are due by March 9, 2026.

⁵⁴ FAA NPRM, 91 Fed. Reg. at 464. Even under the RTCA timeline, the Final Review and Comment (“FRAC”)/Open Consultation for the revised radio altimeter Minimum Operational Performance Standard will be complete by September 2026. See Comments of the National Telecommunications and Information Administration, GN Docket No. 25-59, at 4 (filed Aug. 4, 2025) (“NTIA NOI Comments”).

⁵⁵ FAA NPRM, 91 Fed. Reg. at 464 (“FAA will ensure that the TSOs conform to the interference tolerance mask (ITM) requirements in the final rule; any difference in the ITM of the industry standard will be corrected to conform to the FAA final rule by the implementing TSOs.”).

⁵⁶ Cross-Industry Engagement on 5G Spectrum Opportunities, FAA, at 3 (Nov. 7, 2024), <https://www.commerce.senate.gov/services/files/467B8DF2-E87F-4AE1-8E48-34821E0CDF3F>.

Moreover, the FAA has further accelerated the process by proposing the minimum performance requirements for next-generation radio altimeters and providing detailed information on the future coexistence environment, including providing the next-generation radio altimeter ITM in the FAA NPRM. Concurrently, the wireless industry achieved consensus with radio altimeter manufacturers on how much spectrum is feasible, fundamental power limits, and antenna heights, and it is driving toward technical consensus on spurious emissions limits. This information, coupled with the FCC's proposals to adopt its Lower C-band rules for the Upper C-band, provides substantial information to enable radio altimeter manufacturers and other aviation stakeholders to greatly understand the contours of the future Upper C-band 5G ecosystem.

To put it simply, aviation stakeholders have sufficient notice of what they need to build and by when; now they need only execute. Given the steps that have already been taken and the key enabling information that has already been provided, claims of misalignment between the regulatory processes or that additional delays are needed are unjustified.⁵⁷ To the contrary, regulators and industries are already benefitting from the collaboration and information that is already available, and further engagement will continue to position the transition for success.

B. A Coordinated Timeline for Enabling Timely Auction and Access to Upper C-band Spectrum is Essential and Achievable.

As Verizon notes, the NPRM appropriately focuses its attention on “the nexus between aligning radio altimeter retrofits and the need to establish a sound timeline for access to support wireless deployment.”⁵⁸ Given the collaborative efforts already underway across agencies and

⁵⁷ See, e.g., Joint Aviation Comments at 10.

⁵⁸ Verizon Comments at 20.

industries, both the statutory auction and near-term access to Upper C-band spectrum are achievable.

First, the 2027 auction timeline is achievable. As discussed, the Commission and the FAA already issued proposed notices and are well positioned to finalize their rulemakings in the first half of the year. With the radio altimeter standards development process long underway,⁵⁹ the FAA has proposed rules that it seeks to finalize in the first half of the year. Specifically, the “FAA’s anticipated timeline for publication of a final rule” is June 2026.⁶⁰ The FAA’s proposed rules are largely consistent with the work that has been undertaken by the industry standards development group, and the FAA’s final rules can be shored up through the FAA’s TSO process, as the FAA proposes.⁶¹ Neither of these steps needs to hold up finalization of a radio altimeter retrofit performance schedule or adoption of final FCC rules. The Commission is likewise well positioned to adopt a final order this year, especially given its ability to leverage Lower C-band incumbent transition and auction procedures, along with its Lower C-band service and technical rules, for the Upper C-band. Successfully completing a system of competitive bidding within the next 18 months is thus achievable.

Second, the FAA NPRM proposes that the aviation industry can complete necessary radio altimeter upgrades between 2029 and 2032 for aircraft operating under FAA rule part 91 in CONUS,⁶² and CTIA is urging adoption of a performance schedule as early as possible—in the

⁵⁹ See CTIA Comments at 15-17.

⁶⁰ FAA NPRM, 91 Fed. Reg. at 464.

⁶¹ FAA NPRM, 91 Fed. Reg. at 464.

⁶² The FAA proposes to require all radio altimeter systems on aircraft operating under FAA rule part 91 in CONUS to meet minimum performance requirements under a two-phased approach, with an initial deadline that aligns with the date the FCC authorizes wireless service in the Upper C-band. Other non-part 91 aircraft will be permitted to continue to operate, subject to operational restrictions, until their performance deadline two years after the initial performance deadline. FAA NPRM, 91 Fed. Reg. at 461.

2029-2030 range. Establishing the radio altimeter performance schedule in that timeframe now will encourage manufacturing to scale up and retrofit scheduling to commence and to facilitate auction and deployment planning.

A 2029-2030 timeframe is achievable.⁶³ As an initial matter, Congress already found that an *earlier* deadline would be achievable. In the 2024 FAA Reauthorization Act, Congress required interagency coordination, accelerated R&D efforts, grant programs, and reporting requirements “to ensure that next generation radio altimeter technology is developed, tested, certified, and installed by 2028.”⁶⁴ Additionally, because the performance standard for next-generation radio altimeters will be finalized as soon as the next few months, and the ITM for such equipment is already known, radio altimeter manufacturers can begin the process now to design and develop equipment that can be certified and installed. A near-term timeline will thus prompt manufacturer investment in scaling up radio altimeter manufacturing. Moreover, such a timeline is well within the five-and-a-half-year transition timeline on which the FCC seeks comment,⁶⁵ and it is consistent with the timeline that Eutelsat proposed in the record.⁶⁶ The Commission should continue to explore what data is needed to finalize decisions regarding the timeline and what role, if any, incentives can play in that decision.

Establishing a coordinated path forward is essential despite perceived early headwinds by some commenters. For one thing, and as discussed throughout these comments, it is critical to align the statutory timeline for auction with a reasonable transition so that the spectrum is made

⁶³ See *infra* Section II.C.

⁶⁴ 2024 FAA Reauthorization Act § 1018.

⁶⁵ See NPRM ¶ 94.

⁶⁶ See Eutelsat Comments at 20 (proposing to transition Upper C-band spectrum within three years of an FCC Order).

available in a timely manner, despite some aviation stakeholders' preliminary hesitancy around meeting the FAA's proposed timeline.⁶⁷ As discussed, RTCA started the process for developing new performance standards for next-generation radio altimeters in 2019, with an initial deadline for FRAC completion originally projected for September 2022;⁶⁸ FRAC completion is now slated for September 2026 and final publication of the minimum operational performance standard ("MOPS") is projected in March 2027.⁶⁹ Suggestions that additional time, even beyond the outer bound of the FAA's proposed 2032 timeframe, are untenable and inconsistent with the goal of enhancing equipment performance.

Additionally, given the substantial public interest benefits in deploying this spectrum, the agencies should work together to narrow the timeframe as much as possible between the auction and initial deployment. While Boeing suggests that there is Commission precedent to support allowing lengthy gaps between auction and access,⁷⁰ the auctions it cites provide no such support. To the contrary, the Lower C-band transition was 10 months from the close of bidding for Phase 1 spectrum and 34 months for Phase 2,⁷¹ and the 600 MHz incentive auction, a first-of-

⁶⁷ See Airlines for America ("A4A") Comments at 19 ("A4A's initial reaction is that a reimbursement upgrade deadline slightly longer than six years is more reasonable. Nevertheless, A4A is actively engaging with its members and the broader aviation ecosystem to determine the feasibility of the FAA's proposed timeframe of 6 years"); Lockheed Martin Comments at 7-8 ("[W]hile Lockheed Martin finds the FAA's proposed 2032 compliance timeline for Part 91 manufacturers and operators to be very ambitious, it cautions that an earlier 5G/6G deployment date is likely untenable.").

⁶⁸ See Terms of Reference, Special Committee (SC) 239, Low Range Radar Altimeter, Revision 1 (Dec. 17, 2020), <https://web.archive.org/web/20211209003009/https://www.rtca.org/wp-content/uploads/2020/12/SC-239-TOR-Rev-1-Approved-12-17-2020.pdf>.

⁶⁹ CTIA Comments at 16; NTIA NOI Comments at 4-5.

⁷⁰ See Boeing Comments at 18-19.

⁷¹ Bidding in Auction 107 concluded on February 17, 2021. Phase 1 access was granted as of December 5, 2021 (less than 10 months after bidding closed) and Phase 2 access was granted as of December 5, 2023 (less than three years after bidding closed). See *Auction of Flexible-Use Service Licenses in the 3.7–3.98 GHz Band Closes Winning Bidders Announced for Auction 107*, Public Notice, 36 FCC Rcd 4318 (2021); *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Report and Order and Order of Proposed Modification, 35 FCC Rcd 2343 (2020) ("*Lower C-band Order*"); 47 C.F.R. § 27.1412(b)(1)-(2).

its-kind framework in the world, had a phased 39-month transition, with T-Mobile announcing deployments as soon as four months after bidding concluded and two months after its first licenses were issued.⁷² These timelines hew much more closely to the earlier end of the FAA's timeline than the latter, and would be consistent with CTIA's proposal for a 2029-2030 radio altimeter performance requirement.⁷³ The Commission should thus prioritize narrowing the timeframe between auction and access, which will better ensure that the airwaves can swiftly and safely be put to use, consistent with the statutory objective for a successful, near-term auction.

Finally, CTIA encourages the Commission to further facilitate timely deployment of both Upper and Lower C-band spectrum by working with the FAA to update the Colo Void Policy to include the C-band frequencies. The FAA is evaluating the potential for adding C-band frequencies to the Colo Void Policy as part of its NPRM.⁷⁴ CTIA has previously supported this addition, which will help speed deployment in the C-band and thus the provision of expanded service that will benefit the public. CTIA agrees with WIA that the FCC should coordinate with the FAA on this issue.⁷⁵

⁷² *Incentive Auction Closing and Channel Reassignment Public Notice*, Public Notice, 32 FCC Rcd 2786 (2017); *see also* T-Mobile Press Release, T-Mobile Lights Up World's First 600 MHz LTE Network at Breakneck Pace (Aug. 16, 2017), <https://www.t-mobile.com/news/press/cheyenne-600-mhz>.

⁷³ The Lower 700 MHz auction that Boeing cites is an inapt comparison. There, incumbent broadcasters were entitled to use the spectrum for an extended period, and new 700 MHz Band licensees were allowed to deploy in the band so long as they protected the analog TV incumbents from harmful interference through the end of the DTV transition period. *See, e.g., Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59)*, Report and Order, 17 FCC Rcd 1022 (2002); *Due Diligence Announcement for the Upcoming Auction of Licenses in the Lower 700 MHz Band Scheduled for May 28, 2003*, Public Notice, 18 FCC Rcd 5079 (WTB 2003).

⁷⁴ FAA NPRM, 91 Fed. Reg. at 476.

⁷⁵ Stephen Keegan, Sr. Counsel, Government & Legal Affairs, WIA – The Wireless Infrastructure Association, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 25-59, at 4 (filed Jan. 23, 2026).

C. Available Technical Data Show That Radio Altimeters Are Becoming More Resilient and Are Improving the Coexistence Environment.

As commenters discuss, coexistence between Lower C-band 5G and radio altimeters operating in the 4.2-4.4 GHz band occurs today thanks to substantial collaboration by the wireless and aviation industries and government partners.⁷⁶ Just prior to commercial launch in the Lower C-band, calls for ground stops and nationwide prohibitions on service evolved to meaningful voluntary commitments in targeted areas and a thoughtful approach to filters to improve radio altimeter designs, resulting in Lower C-band deployments from coast to coast. Public test data likewise show that existing filters are working even better than anticipated to facilitate coexistence today—even under the most rigorous scenario employing worst-case conditions.⁷⁷ While some commenters dismiss this progress, CTIA and the wireless industry see it as firm grounding for continued advancements in equipment design that will further support coexistence in the expanded C-band environment.

The record shows as well that aviation stakeholders have benefitted from the improvements to radio altimeters' interference tolerance, with better resilience for co-channel systems (i.e., Wireless Avionics Intra-Communication, or WAIC), improved economies of scale (and thus lower costs) for next-generation equipment, and long-overdue security enhancements, as aviation regulators themselves have recognized.⁷⁸

Moreover, the data in the FAA NPRM underscore that these improvements are set to compound with next-generation radio altimeters. The ITM for next-generation equipment—

⁷⁶ See, e.g., AT&T Comments at 9; Ericsson Comments at 10-11; Nokia Comments at 5-6; Verizon Comments at 19-20.

⁷⁷ See *Radio Altimeter Test Report and Coexistence Study*, CTIA (Apr. 9, 2024), <https://api.ctia.org/wp-content/uploads/2024/06/Radio-Altimeter-Test-Report-and-Coexistence-Study-04092024.pdf>.

⁷⁸ See CTIA Comments at 16-17; Verizon Comments at 20.

which is the maximum level of interference a radio altimeter receiver can tolerate—that is incorporated in the revised RTCA MOPS and reflected in the FAA NPRM shows much improved radio altimeter performance since 2023.⁷⁹ Specifically, the data suggest that radio altimeters using the next-generation ITM can tolerate spurious emissions within the radio altimeter band that are 23 dB stronger than the level tolerated by today’s radio altimeters. The FAA confirmed that today’s RAs have a tolerance of -105 dBW/m²/MHz at the aircraft radio altimeter antenna, as noted in Table 2 of the FAA NPRM. The next-generation radio altimeters will have a tolerance of -82 dBW/m²/MHz, as defined in FAA NPRM Table 3. This is substantial, amounting to a 200x improvement in signal tolerance. Based on today’s airspace operating environment, Upper C-band base station spurious emissions in the 4.2-4.4 GHz band could be relaxed up to -25 dBm/MHz over the Lower C-band voluntary commitments (i.e., a 23 dB difference between -48 dBm/MHz and -25 dBm/MHz).

Moreover, there is record support that the ITM improvements are substantial enough to show that coexistence is achievable for Upper C-band deployments under the existing Lower C-band technical rules, and specifically a conducted power level of -13 dBm/MHz beyond the edge of the license authorization, which numerous commenters support.⁸⁰ Specifically, the record includes analysis from prior NTIA studies that radiated measurements of 5G base station power were suppressed to below -37.5 dBm/MHz within 40 megahertz of the band edge—i.e., less than 0.35% of the regulatory -13 dBm/MHz limit and well below the -25 dBm/MHz limit that the

⁷⁹ See Letter from Henry G. Hultquist, Vice President-Federal Regulatory, AT&T Services, Inc., et al. to Marlene H. Dortch, Secretary, FCC, GN Docket 18-122 (filed Mar. 31, 2023) (“Lower C-band Voluntary Commitments”).

⁸⁰ See, e.g., Ericsson Comments at 12-13; Nokia Comments at 4-5; Qualcomm Comments at 6-7; Samsung Comments at 3; AT&T Comments at 8; T-Mobile Comments at 4-5; Verizon Comments at 24-25.

revised ITM shows.⁸¹ Here, the Commission is considering repurposing up to 180 megahertz of spectrum for full-power wireless use—i.e., up to 4160 MHz; this would create at least a 40-megahertz guard band between new Upper C-band wireless operations and radio altimeter operations in the 4.2-4.4 GHz band, consistent with what NTIA used in its testing.

To drive the technical discussion forward, commenters agree that now is the time to ensure the Commission’s record is fulsome on the coexistence parameters necessary to adopt technical rules and execute on the Upper C-band auction, accounting for coexistence with next-generation radio altimeters under real-world scenarios.⁸² As NTIA states, “detailed technical data from radio altimeter manufacturers and other stakeholders. . . is essential to evaluate the performance of NextGen RAs and their ability to operate safely alongside new wireless services in adjacent spectrum bands.”⁸³ AT&T similarly discusses the need for transparency and clarity on progress toward “upgrading aircraft with next-generation radio altimeters [], projected timelines for completion, associated costs, and any other factors that may impact retrofit efforts.”⁸⁴

Currently, the record lacks this information, as aviation industry stakeholders deferred in their initial filings and committed to including additional information on these topics in their reply comments.⁸⁵ In particular, it is essential that radio altimeter manufacturers provide

⁸¹ Frank Sanders Comments at 3.

⁸² *See, e.g.*, AT&T Comments at 6-7; Ericsson Comments at 10; NTIA Comments at 7-8; Verizon Comments at 19-20.

⁸³ NTIA Comments at 4.

⁸⁴ AT&T Comments at 9.

⁸⁵ *See, e.g.*, Joint Aviation Comments at 11 (stating that “[o]ngoing work” to evaluate the implications of the ITM “is expected to result in further refinement and detail of the aviation industry’s proposals in this proceeding”); A4A Comments at 15-16, 18-19, 23 (stating that it hopes to provide fleet upgrade, timeline, and cost estimates in reply comments); Lockheed Martin Comments at 7, n.9 (anticipating that it will “have additional policy and technical comments during the reply phase of the instant proceeding”).

regulators with additional information about the modeling that is being used to determine coexistence between next-generation equipment—which will be built to the ITM that the FAA included in its rulemaking—and future Upper C-band wireless deployments. The compatibility tool that radio altimeter manufacturers have used for their modeling has thus far been a “black box,” with limited information provided to wireless stakeholders during the monthslong collaborative processes. This is especially concerning given that the FAA is now proposing to adopt nearly wholesale the same modeling inputs for its coexistence analysis. A full record on this important issue is imperative so the agencies can work together based on a common set of information to ensure that a fact-based coexistence analysis drives decisions on both the timelines and technical criteria. As both commenters and the Commission discuss, improvements to radio altimeters “will [] reinforce the successful coexistence environment” between full-power wireless operators and radio altimeters,⁸⁶ a fact that is borne out by the FAA’s own data. That understanding should serve as a baseline for regulatory decisions on this issue. CTIA urges the FCC to press for submission of such information, which will be useful in informing development of the FCC’s final transition timeline and ensuring that the FAA’s performance schedule aligns with that timetable.

D. The Wireless and Aviation Industries Have Achieved Consensus on Key Technical Details; Remaining Challenges Are Driven by the FAA’s and Radio Altimeter Manufacturers’ Worsening Coexistence Modeling.

As discussed, the ITM for next-generation radio altimeters shows that future equipment will be far more resilient than existing devices—suggesting that the next generation of radio altimeters will successfully coexist with nearby operations. Moreover, the wireless and aviation industries have reached consensus on nearly all relevant technical issues for purposes of wireless

⁸⁶ NPRM ¶ 117; *see also* Nokia Comments at 6; Qualcomm Comments at 7.

operations in Upper C-band spectrum, including full-power use of spectrum up to 4160 MHz, among other parameters. This shows meaningful progress not only in the performance of next-generation aviation equipment but also in the collaborative dialogue and collective understanding of how 5G and aviation devices can successfully operate in nearby spectrum. All that remains is consensus on the spurious emissions analysis. To date, the coexistence analysis put forth by the FAA and radio altimeter manufacturers to evaluate the expected tolerance of next-generation radio altimeters to future 5G emissions tells a different, counterintuitive, story than what the ITM would suggest. These modeling inputs, if adjusted to mirror even prior aviation modeling, would demonstrate that coexistence is achievable between next-generation equipment in the Upper C-band environment.

1. 5G and Radio Altimeter Coexistence Modeling is Muddied By Worsening Inputs That Do Not Match Aviation’s Prior Coexistence Modeling.

As a general matter, there is broad agreement on the coexistence analysis to show how next-generation radio altimeters will perform in the presence of future Upper C-band 5G signals. For months, the wireless industry and radio altimeter manufacturers have been engaged in conversations regarding these parameters, with steady progress on various modeling assumptions and alignment on a variety of factors that are consistent with testing that was conducted in prior 5G and radio altimeter coexistence analyses, including consensus for full-power commercial service in spectrum much closer to the radio altimeter band; emitter height limitations of 450 feet; and the inclusion of base station polarization loss of 3 dB.⁸⁷ As noted above, the FAA is largely incorporating these parameters into the coexistence analysis that is informing its proposed rules.

⁸⁷ See Joint Aviation and Wireless Industry Ex Parte.

However, radio altimeter manufacturers' compatibility toolkit and the FAA NPRM use weaker parameters in the Upper C-band 5G and next-generation radio altimeter coexistence analysis than have been used in prior FAA and aviation industry coexistence analyses, suggesting a challenge where none exists. Some of these variables rely on unrealistic assumptions that are inconsistent with the FAA's own rules or are belied by real-world environments. CTIA raised objections to these parameters with both the radio altimeter manufacturers and with the FAA, but to date there remains disagreement on a few key inputs to the coexistence analysis, which are highlighted below. Adjusting these modeling inputs so that they align with prior coexistence analyses and the FAA's own rules would have a meaningful and positive impact on the evaluation of how next-generation radio altimeters can operate in the future Upper C-band 5G ecosystem.

Minimum Separation Distance. The FAA proposes a spherical minimum separation distance of 35 feet. Under the FAA's rules, airplanes with one engine inoperative must maintain 35 feet of vertical clearance from obstacles; however, extending this distance to a sphere means the aircraft may be 35 feet away laterally from an obstacle, which is inconsistent with the FAA's own rules. Specifically, FAA Rule Parts 121.189, 135.379, and 135.398 require that the airplane's flight path clear all obstacles by 300 feet laterally outside the airport boundaries under one engine inoperative takeoff conditions, a non-normal flight scenario that could result in the airplane flying at a lower-than-normal height above ground.⁸⁸ It is arbitrary to rely on FAA rules for modeling vertical separation distance but then ignore the very same FAA rules for lateral

⁸⁸ 14 C.F.R. §§ 121.189(d)(1)-(2), 135.379(d)(1)-(2), 135.398(b); *see also* FAA Advisory Circular, AC 120-91A, *Airport Obstacle Analysis* (Jan. 13, 2020), https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_120-91A.pdf (noting that lateral clearance is inclusive of factors impacting the flight path).

separation distance in favor of more restrictive modeling. It is also inconsistent with the FAA's prior modeling, where a 50-foot minimum separation distance was used.⁸⁹ Using a 35-foot minimum separation distance rather than the 50-foot separation that was used in the 2023 study suggests a 3.1 dB decrease in the airspace operating environment. The wireless industry recommends defining the minimum separation distance from aircraft as a cylindrical surface with a minimum radius of 300 feet laterally away from the Upper C-band antenna face and extending 35 feet vertically above the structure to which the antenna is mounted, consistent with FAA rules.

Radio Altimeter Antenna Pattern. All prior 5G and radio altimeter coexistence studies assumed that the radio altimeter antenna pattern rolls off toward the horizon, yet the FAA NPRM and the radio altimeter manufacturers' modeling strays from prior studies by assuming maximum radio altimeter antenna gain in all instances. More specifically, in its 2023 evaluations, the FAA assumed mutual antenna coupling (inclusive of the radio altimeter antenna pattern and the base station antenna) of 10 dBi, with a base station pattern that assumed a single element pattern with a 6.4 dBi peak gain. In the NPRM, the FAA now assumes mutual antenna coupling (inclusive of the radio altimeter antenna pattern and the base station antenna pattern) of up to 29.5 dBi.⁹⁰ This results in a 19.5 dB worsening of coexistence as compared to the values that were modeled in 2023, which used a more realistic mutual antenna coupling assumption.

⁸⁹ See Airworthiness Directives; Transport and Commuter Category Airplanes, 88 Fed. Reg. 34065 (May 26, 2023) (listing the Effective Isotropic power spectral density (PSD) spurious tolerance below 400 feet as -116.5 dBm/MHz); Demonstration of Radio Altimeter Tolerant Aircraft, 88 Fed. Reg. 46055 (July 19, 2023) (defining the reference point for the PSD curves for the compliance demonstration with the AD). The difference between the PSD and the voluntary conducted emissions level of -48 dBm/MHz is 68.5 dB, which is the free space path loss corresponding to a minimum separation distance of 50 feet.

⁹⁰ The 29.5 dBi consists of a radio altimeter antenna gain of 11.5 dBi, reflected in the ITM, and the peak gain of the base station antenna applied to spurious emissions in the radio altimeter band.

Bank Angle. The FAA NPRM does not explicitly limit the bank angle of the airplane in flight as a function of height above ground, which ignores FAA rules and the risk of a wing strike on clutter or on the ground.⁹¹ The inputs used by radio altimeter manufacturers in their compatibility toolkit have changed several times over the last year, with little transparency into the rationale for the variations, and the FAA is now proposing to use the worst version of the manufacturers' assumptions. Instead, the wireless industry is encouraging aviation stakeholders to revise the coexistence modeling to use the maximum bank angle limits defined in FAA AC 120-91A, which would be consistent with the FAA's guidance. This would model steeper bank angles than those assumed in a monthslong, joint wireless and aviation industry study of 5G and radio altimeter coexistence conducted in Europe, ECC Report 362.

Combining just the assumptions of backsliding in the lateral separation distance (3.1 dB) with the worsening of the radio altimeter antenna pattern inputs (19.5 dB) entirely offsets the 23 dB of improvement that is otherwise achieved with the next-generation ITM. And yet other technical criteria have also become worse over time. Among them is the aggregation factor, which accounts for a scenario where the emissions from co-located base stations simultaneously add up at the airplane's radio altimeter antenna. Here, the FAA is proposing to use a value that is worse than that which the radio altimeter manufacturers have proposed during joint industry meetings. Additionally, the FAA NPRM does not account for cable loss even though all public radio altimeter test results from prior studies included cable loss in the measurement test setup, including AVSI testing and the 2020 RTCA Report.

⁹¹ The NPRM includes the peak RA antenna gain in the ITM. This peak gain is present regardless of the aircraft position relative to the base station antenna, a departure from prior modeling.

By making the modeling worse than prior analyses, the new coexistence case appears to negate any improvements to the ITM that otherwise exist. This would result in a poor technical and policy outcome, as it risks overburdening licensees and manufacturers with unnecessarily restrictive technical requirements that would slow robust, timely access to spectrum for 5G and future deployments. To address this, the FCC should work with the FAA to improve these discrete parameters in the coexistence modeling in order to maximize the 5G opportunity in the repurposed Upper C-band spectrum.

2. Wireless and Aviation Stakeholders are Closing in on Spurious Emissions Analyses.

While consensus has been achieved on a variety of Upper C-band technical parameters, there has yet to be a collective understanding of spurious emissions—i.e., the unwanted wireless base station energy falling into spectrum well outside of its operating band, in this case into the 4.2-4.4 GHz band. The wireless industry is evaluating how a spurious emission rule would work in the Upper C-band to bound the level of base station emissions within the 4.2-4.4 GHz band and how industry would meet such a requirement. We remain confident that we will be able to reach a rules-based framework to fully address aviation industry concerns while maximizing the 5G opportunity.

Two variables are working to achieve this end. First, as discussed, next-generation radio altimeters are expected to be substantially more resilient than the current generation of radio altimeters. Second, we have a better understanding of 5G base station antenna patterns that will be applicable for the Upper C-band. The performance of Advanced Antenna System (“AAS”) base station antennas within their operating band is well understood, and the wireless industry has extensively studied the effects of the antenna on spurious emissions falling outside of the operating band. CTIA has shared preliminary information on AAS base station antenna patterns

with aviation stakeholders that suggest that the wireless base station antenna pattern used to model spurious emissions should be the subarray pattern. CTIA is currently engaged with aviation stakeholders on this analysis, which we are continuing to fine tune. The wireless industry is committed to prioritizing this issue for resolution.

V. THE RECORD SUPPORTS USE OF EXISTING TRANSITION FRAMEWORKS, WHICH CAN BE FLEXIBLY APPLIED AND ADJUSTED AS APPROPRIATE, TO OFFER A PATH FORWARD FOR THE UPPER C-BAND TRANSITION.

A. The Record Supports Use of the *Emerging Technologies* Framework to Facilitate the Upper C-band Transition.

Commenters broadly recognize that the market-driven, court-affirmed *Emerging Technologies* framework can and should be leveraged for the Upper C-band transition, as it has proven to be reliable and flexible in its ability to support various types of spectrum repurposing efforts.⁹² As Eutelsat states, the “well-established *Emerging Technologies* precedent[] proved highly effective in the Lower C-band, ensuring incumbents could undertake a complex and costly transition with reasonable certainty of reimbursement.”⁹³ Application of the framework will require considerable additional groundwork, informed by the data collections the Commission has teed up and the lessons learned that commenters have highlighted in the underlying record.

However, the Commission should be wary of requests in the record asking the agency to declare that certain costs are presumptively reasonable or that certain entities are eligible for reimbursement. By way of example, NCTA seeks reimbursement for incumbent Upper C-band users, not just satellite operators, and it seeks reimbursement for transitional and new recurring

⁹² See, e.g., Boeing Comments at 20-23; Ericsson Comments at 9; Eutelsat Comments at 9; Lockheed Martin Comments at 14-15; LTN Global Communications, Inc. (“LTN”) Comments at 14-15; NCTA Comments at 8-9; SES Comments at 19-22; Verizon Comments at 11-13.

⁹³ Eutelsat Comments at 9.

operational costs for at least 10 years.⁹⁴ NAB similarly seeks reimbursement for increased operating expenditures that might result from a transition to alternative delivery technologies but does not include a stated end date.⁹⁵ SES seeks reimbursement for financing costs and integrated receivers/decoders as well as interest for “penalties,” with such penalties ultimately paid by new licensees who are not at fault.⁹⁶ And several commenters seek reimbursement for loss of revenue or opportunity costs that might result from the transition.⁹⁷ The Commission should reject these requests, which provide little to no clarity or certainty for prospective licensees who would ultimately bear the cost of such expenses.

The *Emerging Technologies* framework’s traditional cost reimbursement program is unsuitable and impractical to apply to the upgrade of radio altimeters. As an initial matter, reimbursable costs must be necessitated by the transition. Here, however, the altimeter upgrade effort predates the Upper C-band proceeding and is designed to improve resilience against spectrum use well beyond the Upper C-band. The radio altimeter standards development process has been underway for more than six years and in 2024 Congress mandated that next-generation radio altimeters be developed, tested, certified, and installed by 2028⁹⁸—well before Congress adopted the Working Families Tax Cut Act or the FCC launched the Upper C-band NOI, let alone adopted this Upper C-band rulemaking. These new radio altimeter standards will benefit the aviation industry in a variety of ways, including in the security, safety, and scalability of its

⁹⁴ NCTA Comments at 12-13, 16.

⁹⁵ NAB Comments at 8; *see also* North American Spectrum Alliance at 8.

⁹⁶ SES Comments at 27-28.

⁹⁷ *See, e.g.*, A4A Comments at 4; ACA Connects Comments at 3; ARCTEK Comments at 3-4; PSSI Comments at 9.

⁹⁸ 2024 FAA Reauthorization Act § 1018.

equipment and operations.⁹⁹ As discussed in CTIA’s initial comments, the International Civil Aviation Organization has observed that updating the radio altimeter standard will address many “overdue improvements,” “including better test procedures, clarification of requirements, and new necessary concepts such as cyber security.”¹⁰⁰ RTCA also has recognized that an updated standard is necessary to promote resilience to interference from co-channel aviation systems within the 4.2-4.4 GHz band.¹⁰¹ Thus the radio altimeter upgrade effort predates this proceeding, upgrades provide substantial aviation-specific benefits, and the aviation industry would be upgrading to new radio altimeters regardless of any Upper C-band transition.

Moreover, cost reimbursements would be impractical in this context. The Commission would need to determine which costs are reasonable and which are not for equipment beyond telecom infrastructure. This would be a novel, fact-intensive process for aviation equipment that could take substantial time and resources to resolve before reimbursements could be made—risking slowing down the transition process when time is of the essence to auction and deploy wireless facilities in the band.

Finally, as CTIA discussed in its initial comments, the framework for any incentive payments as a general matter should be relative to the amount of spectrum repurposed, the speed with which it is repurposed, any restrictions or limitations imposed on terrestrial wireless use of the Upper C-band, and which elements of the transition will be the driving forces in determining

⁹⁹ See *infra* Section IV.C.; see also CTIA Comments at 16-17.

¹⁰⁰ International Civil Aviation Organization, Frequency Spectrum Management Panel, Sixteenth Working Group Meeting, Status update of RCTA SC-239/EUROCAE WG-119, at 1-2 (Feb. 15-24, 2023), <https://www.icao.int/filebrowser/download/5313?fid=5313>.

¹⁰¹ Terms of Reference, Special Committee (SC) 239 Low Range Radar Altimeter, RTCA Paper No. 105-20/PMC-2012, at 2 (Apr. 17, 2020), <https://web.archive.org/web/20220120001942/https://www.rtca.org/wp-content/uploads/2020/08/SC-239-TOR-Approved-04-17-2020.pdf>.

the outer bounds of the transition schedule.¹⁰² The record on these and similar issues also underscores the importance of the Commission finalizing an updated incumbent FSS Cost Catalog of presumptively reasonable expenses prior to selection of the clearinghouse so that all parties have early clarity regarding the entities and costs that are eligible for consideration in the context of the Upper C-band transition. In any event, any accelerated timeline in the incumbent transition would not be driven by earth station operators who are not licensees and, accordingly, such entities should not be entitled to any acceleration payment as NCTA suggests.¹⁰³

B. Commenters Broadly Agree That the Upper C-band Relocation Clearinghouse Should Follow the Prior Clearinghouse Model While Leveraging Lessons Learned in the Prior Transition.

Commenters agreed that the prior Relocation Payment Clearinghouse (“RPC” or “Clearinghouse”) and Relocation Coordinator are an appropriate starting point for the Upper C-band.¹⁰⁴ In particular, the record reflects that the role of the Upper C-band clearinghouse should be the same—collecting and evaluating relocation costs, apportioning costs among new entrant licensees, distributing payments to incumbents, acting as a resolution forum for disputes, and filing oversight reports to the Commission.¹⁰⁵

At the same time, commenters documented real-world experience with Lower C-band clearing and identified improvements for the rules and policies governing clearinghouse operations for the Upper C-band. Commenters noted that the RPC costs vastly exceeded initial

¹⁰² CTIA Comments at 24-25.

¹⁰³ See NCTA Comments at 19-20.

¹⁰⁴ See, e.g., AT&T Comments at 4, 8-9; Eutelsat Comments at 16; LTN Comments at 22; SES Comments at 26-29; T-Mobile Comments at 5; Verizon Comments at 14-19.

¹⁰⁵ Eutelsat Comments at 16.

budget estimates,¹⁰⁶ that claims processing often took significantly longer than anticipated,¹⁰⁷ and that there were potentially disproportionate cost justification burdens for relatively minor claims.¹⁰⁸

CTIA supports straightforward reforms that would significantly speed processing, enhance efficiency, lower costs, and continue to guard against fraud, waste and abuse. These include: (i) implementing unambiguous deadlines for establishment of the clearinghouse, claims initiation (especially for fixed claims like lump sum payments), and claims processing;¹⁰⁹ (ii) enabling broader use of certifications and random audits for high-volume, low-value claims,¹¹⁰ as well as batch processing of certain categories of claims;¹¹¹ (iii) rapidly undertaking the work to create a robust Cost Catalog of presumptively reasonable expenses in advance of the auction that could potentially include greater use of bundled costs and lump sum elements, with the Cost Catalog developed alongside the rulemaking itself and finalized prior to selection of the clearinghouse;¹¹² (iv) requiring the clearinghouse to have and apply clear standards for

¹⁰⁶ *See, e.g.*, Verizon Comments at 15, 16 (stating the Commission should “avoid some of the cost overruns experienced in the Lower C-band reimbursement program,” “costs were excessive,” and “the Clearinghouse exceeded its entire budget by the first quarter of 2023”); *see also* CTIA Comments at 25-26.

¹⁰⁷ *See, e.g.*, Eutelsat Comments at 17; Verizon Comments at 15, 17 (noting “by the end of 2021, the Clearinghouse had approved only half of the more than 900 lump sum claims submitted” and urging the FCC to “[r]equire specific processing timeframes for the Clearinghouse to evaluate and approve or reject claims”).

¹⁰⁸ *See* SES Comments at 28.

¹⁰⁹ *See, e.g.*, Qualcomm Comments at 3; Verizon Comments at 15 (stating the Commission should “[e]stablish firm deadlines for lump sum electees to submit claims following the lump sum election” and “[r]equire incumbents seeking reasonable relocation expenses to submit claims under specific submission timelines”); SES Comments at 27-28; *see also* CTIA Comments at 26.

¹¹⁰ *See* SES Comments at 28; CTIA Comments at 26.

¹¹¹ *See* Verizon Comments at 15. The clearinghouse should also drive toward a more efficient process, for example by considering use of artificial intelligence tools to engage in more efficient batch processing.

¹¹² *See* Verizon Comments at 14; CTIA Comments at 29.

perfection of claims,¹¹³ including rejecting incomplete claims¹¹⁴ and establishing limits on the number of times a claim can be resubmitted, in order to ensure timely submission of fully documented claims—in conjunction with deadlines for claims submission after costs are incurred; (v) providing a procedural mechanism for the Clearinghouse to seek expedited guidance on discrete questions of law from the Commission;¹¹⁵ and (vi) adopting a hard cap of two percent on soft costs.¹¹⁶

With respect to soft costs, in the Lower C-band relocation the Commission adopted a “rebuttable presumption that soft costs should not exceed [two percent] of the relocation hard costs,” expecting that the RPC would “serve ‘as a watchdog over excess transactional costs.’”¹¹⁷ In reality, however, the RPC did not enforce any real showing to justify a claimant exceeding the two percent soft cost cap, instead relying on new licensees to police the process through a cumbersome appeal process. Having the clearinghouse review showings intended to overcome a “rebuttable presumption” is also vague and contributes to excess administrative costs in clearing. Instead, the Commission should adopt the policies that it utilized in microwave relocation and relocations in the 18 GHz band, where soft costs were subject to a firm two percent hard cap.¹¹⁸ As the Commission acknowledges, policies should not “encourage incumbents to view the

¹¹³ See Eutelsat Comments at 17; Verizon Comments at 15.

¹¹⁴ See Verizon Comments at 16.

¹¹⁵ See CTIA Comments at 27.

¹¹⁶ See Verizon Comments at 13.

¹¹⁷ *Lower C-band Order*, 35 FCC Rcd at 2424-25 ¶ 198.

¹¹⁸ See *Redesignation of the 17.7-19.7 GHz Frequency Band*, 15 FCC Rcd 13430, 13469, ¶ 82 & n.165) (2000) (adopting a cap of two percent of the hard costs involved); *Amendment to the Commission’s Rules Regarding a Plan for Sharing the Costs of Microwave Relocation*, 11 FCC Rcd 8825, 8848, ¶¶ 42-43 (concluding, “[t]o prevent abuses,” “incumbents should be reimbursed only for legitimate and prudent transaction expenses that are directly attributable to an involuntary relocation, subject to a cap of two percent of the ‘hard’ costs”).

relocation process as a business opportunity.”¹¹⁹ By enforcing a hard cap on soft costs that would limit administrative cost overruns and excess reimbursement, the Commission can help control the costs of relocation and increase the value of the spectrum recovered for the U.S. Treasury and the American public

CTIA also concurs with commenters’ suggestions that would improve fiscal oversight of the clearinghouse.¹²⁰ Specifically, the Commission should make clear that the clearinghouse is a fiduciary of the relocation funds it holds for clearing.¹²¹

Building on these suggestions from commenters, the Commission should take additional steps to strengthen oversight and ensure accountability for both administrators, the clearinghouse, and the relocation coordinator.¹²² First, the Commission should allow any party aggrieved by an administrator decision to appeal to the Wireless Telecommunications Bureau (“WTB”) for *de novo* review, with a fast-track timeline for prompt decisionmaking. Previously, WTB placed the burden of proof in appealing RPC decisions on the appealing party,¹²³ and the *Lower C-band Order* did not lay out a clear appeal process with respect to the Relocation Coordinator.¹²⁴ Enabling WTB to review decisions *de novo* will help to ensure proper oversight

¹¹⁹ *Lower C-band Order*, 35 FCC Rcd at 2424 ¶ 196 n.526.

¹²⁰ *See, e.g.*, SES Comments at 28; Verizon Comments at 16-17.

¹²¹ CTIA Comments at 28.

¹²² *See, e.g.*, Strategic Insights Center, Above Promotions Comments at 1-2 (filed Dec. 11, 2025).

¹²³ *See Wireless Telecommunications Bureau Announces Procedures for Appeals of Relocation Payment Clearinghouse Decisions*, Public Notice, 37 FCC Rcd 3956, 3958 (WTB 2022) (“The burden of proof lies on the appealing party to demonstrate in its appeal that the Clearinghouse decision was incorrect.”); *Expanding Flexible Use of the 3.7 to 4.2 GHz Band et al.*, Order, 38 FCC Rcd 8002, 8007 ¶ 12 (WTB 2023) (rejecting AT&T objection to burden of proof).

¹²⁴ *Lower C-band Order*, 35 FCC Rcd at 2460-61 ¶ 314 (“The Relocation Coordinator will also be responsible for receiving notice from earth station operators or other satellite customers of any disputes related to comparability of facilities, workmanship, or preservation of service during the transition and shall subsequently notify [WTB] of the dispute and provide recommendations for resolution.”) (footnote

and would align with the Commission’s approach to other administrators.¹²⁵ Second, the Commission should repeat its requirement for each administrator to report on progress at least quarterly,¹²⁶ and it should make clear that both administrators must make all pertinent information and materials in their possession available to WTB and the Office of Managing Director (“OMD”) upon request.¹²⁷ Third, the Commission should explicitly affirm that (subject to Commission oversight and review) WTB is the final decision-maker throughout the process, requiring clearinghouse contracts to attest that they will comply with the Commission’s rules and policies, including policy interpretations and orders issued by WTB or Commission based upon the forthcoming Upper C-band Order and other Commission precedents.¹²⁸ WTB should review and determine whether to approve any amendments to the Cost Catalog that the Commission develops prior to the auction, as well as final cost apportionments. Similarly, the Commission should make clear that neither Transition Plans nor Earth Station Transition Plans are final until approved by WTB. Collectively, these additional steps will ensure that the administrators

omitted); *see also* *Wireless Telecommunications Bureau Establishes a New Docket for C-Band Transition Dispute Referrals*, Public Notice, 36 FCC Rcd 7333 (WTB 2021) (creating docket for transition dispute referrals).

¹²⁵ *See, e.g.*, 47 C.F.R. § 8.212(e)(1) (stating that the Public Safety and Homeland Security Bureau reviews decisions by the Cybersecurity Labeling Administrator *de novo*); *id.* § 54.723(a) (stating that the Wireline Competition Bureau (“WCB”) reviews decisions by the Universal Service Administrative Company *de novo*); *id.* § 64.6308(e) (stating that WCB reviews token revocation decisions by the STIR/SHAKEN governance authority *de novo*).

¹²⁶ *See* SES Comments at 28; Verizon Comments at 16; *see also* *Lower C-band Order*, 35 FCC Rcd at 2450 ¶ 270 (“Each quarter, the Clearinghouse shall file progress reports in such detail as [WTB] may require.”); *id.* at 2461 ¶ 316 (“We also require the Relocation Coordinator to report on the overall status of clearing efforts [quarterly].”).

¹²⁷ *Cf. id.* at 2450 ¶ 271 (“The Clearinghouse shall provide to [WTB] and the Office of the Managing Director additional information upon request.”).

¹²⁸ *Cf.* 47 C.F.R. § 54.702(c) (stating that USAC “may not make policy, interpret unclear provisions of the statute or rules, or interpret the intent of Congress. Where the Act or the Commission’s rules are unclear, or do not address a particular situation, the Administrator shall seek guidance from the Commission.”).

effectively and dutifully assist the Commission in its implementation of the Upper C-band relocation process.

VI. LEVERAGING EXISTING PART 27 LICENSING AND TECHNICAL RULES WILL FACILITATE DEPLOYMENT ACROSS THE ENTIRE 3.7-4.2 GHZ BAND.

A. The Record Supports General Application of the Commission’s Lower C-band Rules to the Upper C-band Spectrum.

The record largely supports use of the Lower C-band licensing, technical, and auction rules for Upper C-band, with modifications where appropriate.¹²⁹ Among other things, the record supports adoption of a band plan that includes 20-megahertz sub-blocks and licenses auctioned on an unpaired, Partial Economic Area (“PEA”) basis, consistent with the Lower C-band.¹³⁰ As Nokia notes, because “20-megahertz blocks are widely supported in the equipment ecosystem,” adopting aligned rules would establish continuity across the band segments.¹³¹ Achieving continuity would in turn advance the Commission’s goals of enabling economies of scale resulting in more affordable products, rapid expansion, and meaningful deployment.¹³² Qualcomm similarly highlights that adopting consistent parameters “will allow [wireless providers] to combine Lower C-band and Upper C-band spectrum assets to deliver improved service using wider channels.”¹³³ Technical harmonization across the Lower and

¹²⁹ See, e.g., Ericsson Comments at 11-12 (stating that aligning the technical rules for the Lower and Upper C-band “should be the guiding lodestar when adopting technical and service rules for the Upper C-band.”); NTIA Comments at 7-8 (“The Commission’s proposal to harmonize the licensing requirements for the Upper and Lower C-bands . . . is the correct course to follow.”); see also AT&T Comments at 4-9; Cisco Comments at 2; CTIA Comments at 30-37; Nokia Comments at 1-2; Samsung Comments at 3-4; T-Mobile Comments at 2-6; Verizon Comments at 20-26.

¹³⁰ AT&T Comments at 5-6; Cisco Comments at 10; Nokia Comments at 4; Qualcomm Comments at 6; T-Mobile Comments at 3-4; Verizon Comments at 21-22.

¹³¹ Nokia Comments at 4.

¹³² NPRM ¶ 51.

¹³³ Qualcomm Comments at 6.

Upper C-bands will empower the industry to move quickly, deploy efficiently, and serve the American economy.

Recognizing these benefits, the Commission should not adopt smaller geographic areas, as some commenters propose.¹³⁴ PEAs have been repeatedly endorsed by the Commission as a compromise solution that enable both large and small entities to obtain access to spectrum.¹³⁵

Samsung put it succinctly, stating that 20-megahertz sub-blocks using PEAs “promotes flexible aggregation strategies and supports a wide variety of deployment models, from nationwide networks to targeted regional offerings.”¹³⁶ CTIA agrees and encourages the Commission to adopt harmonized license sizes across the Lower and Upper C-band spectrum.

The Commission also should not adopt smaller channel blocks.¹³⁷ As Cisco states, 20-megahertz blocks are “the minimal meaningful block size for enabling the next generation of

¹³⁴ See, e.g., CCA Comments at 4-5 (proposing counties or Cellular Market Areas (“CMAs”)); Rural Wireless Association, Inc. (“RWA”) Comments at 8 (proposing CMAs); WISPA Comments at 6-8 (proposing counties); Coalition of Rural Wireless Carriers Comments at 17 (proposing counties); OTI/PK Comments at 15-16 (proposing counties, if the FCC decides to auction more than 100 megahertz).

¹³⁵ See, e.g., *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8046 ¶ 82 (2016) (finding that licensing the 39 GHz band on a PEA basis “strikes the appropriate balance between facilitating access to spectrum by both large and small providers” because PEAs are smaller than other options and therefore “more realistically obtainable by smaller bidders, yet are larger than counties” which can be deemed too small); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services et al.*, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, 32 FCC Rcd 10988, 10998 ¶ 28 (2017) (adopting PEAs as the license area size for UMFUS licenses in the 24 GHz band because they “provide a balance between the larger areas that might encourage more investment, and the smaller areas . . .”); *Policies Regarding Mobile Spectrum Holdings et al.*, Report and Order, 29 FCC Rcd 6133, 6171 ¶ 77 (2014) (licensing the 600 MHz band in PEAs and finding that “PEAs permit entry by providers that contemplate offering wireless broadband service on a localized basis, yet may be aggregated by providers that plan to provide service on a larger geographic scale.”).

¹³⁶ Samsung Comments at 3.

¹³⁷ See, e.g., WISPA Comments at 6 (arguing that the Commission should auction at least two 10-megahertz blocks).

technological advancement.”¹³⁸ T-Mobile highlights the results of the Lower C-band auction, which demonstrate that “the proposed band plan supports a diversity of licensees, provides sufficient spectrum to support robust 5G deployments, and will be capable of supporting future 6G deployments.”¹³⁹ CTIA agrees with the Commission’s assessment that maintaining the 20-megahertz channel block size would “facilitate the ability of licensees in both [the Lower and Upper] portions of the band to further aggregate mid-band spectrum they need for 5G deployment and enable complementary deployments across the entire band.”¹⁴⁰ Commenters concur that the Commission should adopt Lower C-band block sizes in the Upper C-band, because doing so has been tested by past experience and is future-proof.

B. Industry Commenters Are Unified in Supporting Full-Power Use of Upper C-band Spectrum.

Commenters, including the aviation industry, support adoption of fundamental power limits consistent with the Lower C-band—i.e., 1640 Watts per megahertz EIRP in non-rural areas and 3280 Watts per megahertz EIRP in rural areas.¹⁴¹ As Garmin states, “[a]dopting such power level limits would align those technical rules ‘with those previously adopted for the adjacent Lower C-band’ and would also be aligned with the limits assumed in the FAA NPRM safety analysis for compatibility with next-generation radio altimeters up to 4160 MHz.”¹⁴² And Verizon states that “[a] harmonized approach to fixed and base station power limits here will create network efficiencies, facilitate the rapid deployment of 5G networks, and support robust

¹³⁸ Cisco Comments at 10.

¹³⁹ T-Mobile Comments at 4.

¹⁴⁰ NPRM ¶ 29.

¹⁴¹ Verizon Comments at 23; Garmin Comments at 3, 6-7; Boeing Comments at 11-12; T-Mobile Comments at 5; Ericsson Comments at 12; Nokia Comments at 5; Qualcomm Comments at 6; *see also* Samsung Comments at 3.

¹⁴² Garmin Comments at 6-7 (quoting NPRM ¶ 51).

mobile broadband services.”¹⁴³ Ericsson further comments that “[t]hese base station power levels have facilitated robust deployment of 4G LTE and 5G-NR wireless technologies, and are familiar to OEMs, wireless network operators, and other ecosystem stakeholders.”¹⁴⁴ By adopting the power levels proposed, the Commission would position the band for rapid and robust deployment, as envisioned by the statutory directive underpinning access to this band.

In contrast, the Commission should not advance calls by some commenters for low-power access to some or all of the C-band.¹⁴⁵ As discussed above and in the record, the Commission has a statutory directive to make as much of the Upper C-band as possible available for auctioned use,¹⁴⁶ and it should do so in a manner that ensures it is useful for advanced 5G and next-generation deployments.¹⁴⁷ The most productive way forward is to make the Upper C-band available as a large, contiguous swath of spectrum for full-power use.

C. Flexible Performance Requirements, Consistent with the Lower C-band Framework, Support Innovation and Technological Advancement.

Commenters agree that the Commission should adopt the flexible performance requirements that were used for the Lower C-band.¹⁴⁸ These requirements provided sufficient time for licensees to meet build-out obligations in light of the substantial transition mechanics that were necessary to gain access to the band, as well as sufficient flexibility for licensees to

¹⁴³ Verizon Comments at 23-24.

¹⁴⁴ Ericsson Comments at 12.

¹⁴⁵ OTI/PK Comments at 15-16; Lockheed Martin Comments at 17-18.

¹⁴⁶ See NPRM ¶¶ 1, 14.

¹⁴⁷ See, e.g., NTIA Comments at 2-3 (“NTIA encourages the Commission to pursue the highest feasible allocation of spectrum, recognizing the critical importance of this band for advancing next-generation connectivity across the United States. . . . [Setting proper rules] will help advance the Nation’s efforts to lead in 5G deployment and prepare for the development and introduction of future wireless technologies focused on 6G.”).

¹⁴⁸ Verizon Comments at 22; AT&T Comments at 6.

best “promote investment in and rapid deployment of new technologies and services.”¹⁴⁹ The Commission should not adopt inflexible geographic-based buildout requirements for all license holders.¹⁵⁰ Such a singular and rigid approach would be counterproductive to enabling the highest and most valuable use of the spectrum and allowing the market to respond to consumer demands and technological developments. Moreover, AT&T, like CTIA, observes that the Commission should also clarify that any timelines for satisfying performance requirements commence upon the date that the spectrum becomes available for flexible use deployments.¹⁵¹

D. The Commission Should Promote a Variety of Use Cases In the Band.

Numerous commenters agree with CTIA that the Commission should establish a 4 Watt User Equipment (“UE”) power level.¹⁵² The record shows that doing so would be consistent with the Commission’s treatment of other in-home UE, including Wi-Fi routers.¹⁵³ According to simulations conducted by Qualcomm, increasing UE power to 4 Watts would result in a 13-15 percentage point increase in coverage, 3-4x increase in uplink throughput at the cell edge, and 1.4x higher cell capacity in urban and suburban environments. As a result, this adjustment would enable providers to better support home broadband and other emerging uses.¹⁵⁴ Given

¹⁴⁹ 47 U.S.C. § 309(j)(4)(B).

¹⁵⁰ RWA Comments at 9.

¹⁵¹ AT&T Comments at 6.

¹⁵² AT&T Comments at 7-8; Qualcomm Comments at 5; Verizon Comments at 24; *see also* Cisco Comments at n.28. As CTIA and others emphasized, “User Equipment” or “UE” here does not include wireless devices intended to be operated near the body, such as smartphones. Rather, the UE at issue here is the type of equipment that is non-nomadic and not intended to be operated close to the body, such as equipment used for fixed wireless access that is subject to 47 C.F.R. § 2.1091.

¹⁵³ AT&T Comments at n.26.

¹⁵⁴ AT&T Comments at 7 (adopting a 4 Watt EIRP for mobile devices “will be particularly helpful in facilitating the use of customer premises equipment [] that supports fixed wireless use cases”); Verizon Comments at 24 (adopting the “modified limit will better encourage additional home broadband deployment to better serve Americans’ broadband needs”); Qualcomm Comments at 5 (adopting the

these benefits and the record support, the Commission should adopt a 4 Watt UE power level for the Upper C-band at minimum and, more broadly, across the 3 GHz bands.

E. The Existing OOB Limit Has Proven Successful.

Commenters also support applying the existing OOB limit to the Upper C-band.¹⁵⁵ CTIA agrees with Samsung that “[r]equiring emissions outside a licensee’s authorized frequencies to remain below a -13 dBm/MHz conducted power threshold has demonstrated its effectiveness in protecting neighboring spectrum users without imposing unnecessary constraints on network design or performance.”¹⁵⁶ Striking this reasoned balance in the Upper C-band will be critical to the band’s success.

CTIA notes NAB claims that the -13 dBm/MHz conducted OOB limit has not sufficiently protected occasional use satellite downlinks, but it offers no data in support of this assertion nor any reference to enforcement activity by the Commission.¹⁵⁷ CTIA’s members take seriously their obligations to address legitimate claims of interference. Other commenters acknowledge the existence of unregistered earth stations in the C-band today,¹⁵⁸ and as the Commission is aware, they do not have interference protection rights. There is no evidence in the record to support a more stringent OOB limit.

proposed power limit “will provide improved levels of service that are critically important for AI, XR, and other advanced applications consumers demand”).

¹⁵⁵ Qualcomm Comments at 6; T-Mobile Comments at 5; Ericsson Comments at 12; Samsung Comments at 3.

¹⁵⁶ Samsung Comments at 3.

¹⁵⁷ NAB Comments at 9.

¹⁵⁸ *See, e.g.*, ACA Connects Comments at 16 (“ACA Connects is aware of a small number of Members with earth stations that they use currently to provide video service and that are unregistered.”); North American Broadcasters Association Comments, GN Docket No. 25-59, at 6 (filed Apr. 29, 2025) (“There are many thousands of U.S. registered *and unregistered* earth station locations that rely on the Upper C-band on a daily basis.”) (emphasis added); Cunningham Communications, Inc. Comments at 7; Jackson Energy Authority Comments at 5-6.

F. The Record Supports Adoption of Protection Criteria That Align With the Lower C-Band Framework.

The record supports the Commission’s proposals to adopt existing Lower C-band protection measures for incumbent FSS earth stations, including the protection rights and obligations associated with Telemetry, Tracking, and Command operations.¹⁵⁹ CTIA agrees with Eutelsat’s assertion that the Commission should “model any further reconfiguration of the Upper C-band on the tested and approved Lower C-band transition framework,” which “balanced efficient spectrum repurposing with robust protections for incumbent operations,” among other things.¹⁶⁰

The Commission should reject requests for additional, unfounded protections. First, the Commission should reject calls to reopen the window for registering incumbent earth stations.¹⁶¹ The Commission provided ample opportunities for parties to address the accuracy of the incumbent earth station list, and lifting the freeze at this time would create uncertainty for this ongoing transition, as well as for the coexistence framework for Lower C-band licensees. Additionally, the Commission should reject Lockheed Martin’s request for new protections for its Launch and Early Operations Phase earth station similar to treatment for other earth stations in the band.¹⁶² As the Commission found in the *Lower C-band Order*, “such operations may seek authorization through the [Special Temporary Authority] process.”¹⁶³

¹⁵⁹ AT&T Comments at 8; Verizon Comments at 3, 25.

¹⁶⁰ Eutelsat Comments at ii.

¹⁶¹ ACA Connects Comments at 15-16; Cunningham Comments at 2; Jackson Energy Authority Comments at 2; NPR Comments at 5-6; North American Spectrum Alliance Comments at 8-9.

¹⁶² Lockheed Martin Comments at 18-19.

¹⁶³ *Lower C-band Order*, 35 FCC Rcd at 2480 ¶ 378.

The Commission also need not adopt new protection criteria for radio astronomy sites that operate opportunistically and on an unprotected basis in the 3.7-4.2 GHz band. These operations occur on an unallocated basis, and as such, they cannot claim protection from harmful interference. Moreover, despite suggestions otherwise, these observations may not be exclusively limited to remote areas, and there is no way of knowing if and when additional unauthorized, unallocated uses might occur. Any proposal to afford new interference protections to such observations would be inconsistent with the Commission's rules¹⁶⁴ and contrary to the public interest in promoting robust, full-power wireless operations in C-band spectrum, and should be denied.¹⁶⁵

Finally, the Commission should decline requests for a Tribal Priority Window for the Upper C-band auction.¹⁶⁶ A public auction involving all interested applicants will best ensure that the licenses are awarded consistent with the goals of Section 309(j)(3), which include the rapid deployment of new technologies; the broad dissemination of licenses; recovery of a portion of the value of the public spectrum; and ensuring that spectrum is efficiently and intensively used.¹⁶⁷ Moreover, the statutory language underlying the Upper C-band auction directs the completion of a system of competitive bidding in a tight, two-year window, the timeline for

¹⁶⁴ See generally National Radio Astronomy Observatory Comments.

¹⁶⁵ The North American Spectrum Alliance suggests sunseting Fixed Service operations in the 6 GHz band so that broadcast uplink providers can be given priority usage rights to that spectrum. See North American Spectrum Alliance Comments at 3. The FCC need not address this issue because it is beyond the scope of this proceeding.

¹⁶⁶ See generally Navajo Nation Telecommunications Regulatory Commission Comments; see also Public Knowledge *et al.* Comments at 5-14.

¹⁶⁷ 47 U.S.C. § 309(j)(3). For the same reason, the Commission should deny requests by some commenters for a rural set-aside and spectrum reserve. See generally Coalition of Rural Wireless Carriers Comments; see also WISPA Comments at 6-7.

which is already a quarter past.¹⁶⁸ As the Commission found with the AWS-3 inventory auction,¹⁶⁹ conducting a Tribal licensing window in conjunction with the Upper C-band auction could delay the spectrum from being used to provide service, contrary to the public interest mandate of prioritizing expeditious licensing. And a Tribal licensing window is not a short endeavor: after the Commission adopted a Tribal Priority Window for the 2.5 GHz band, it took half a year to issue application procedures.¹⁷⁰ With the statutory deadline for *completing* the Upper C-band auction less than a year and a half away, time is of the essence to finalize the technical and licensing rules and auction procedures for the band. The Commission should therefore decline to adopt a Tribal licensing window.

VII. CONCLUSION.

Significant progress has been made in making available the maximum amount of Upper C-band spectrum for near-term licensed, full-power terrestrial wireless deployments. CTIA encourages the Commission to continue its forward progress and interagency collaboration so that it can finalize this proceeding and ensure timely auction and access to this valuable spectrum, consistent with the public interest.

¹⁶⁸ See NPRM ¶ 14.

¹⁶⁹ See *Enhancing National Security Through the Auction of AWS-3 Spectrum Licenses et al.*, Report and Order and Second Report and Order, 40 FCC Rcd 5544, 5567-68 ¶¶ 62-63 (2025).

¹⁷⁰ See Reply Comments of CTIA, GN Docket No. 25-70 et al. (filed Apr. 14, 2025).

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