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National Spectrum Strategy
37 GHz Spectrum Sharing Report

Prepared by the Department of Defense and the
National Telecommunications and Information Administration

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EXECUTIVE SUMMARY

Overview

As directed by the 2023 National Spectrum Strategy (NSS), the Department of Defense (DoD) and National Telecommunications and Information Administration (NTIA) evaluated a co-equal sharing framework to allow Federal and non-Federal users to deploy systems in the 37.0-37.6 GHz (Lower 37 GHz) band. The scope of this report is limited to sharing between Federal and non-Federal operations. The report assumes that the Federal Communications Commission (FCC) will establish site-based authorizations for non-Federal licensees, but the report does not attempt to address how the FCC will regulate sharing between and among non-Federal systems.

- Building on prior collaborative efforts of NTIA, DoD, and the FCC, the findings reflect coordination across a range of government and industry stakeholders.
- The recommendations for a sharing framework take advantage of the physical characteristics of this band, which is well-suited for short-range and line-of-sight wireless applications.
- The report recognizes the need for flexible access tailored to both Federal and non-Federal user requirements to foster technological advances and policy innovation.

Background

With limited incumbent uses, the band presents a “clean slate” for developing a new model for co-primary Federal and non-Federal access. Specifically, this spectrum supports the creation of very narrow, directed beams and limited propagation for ground communications, making robust forms of sharing possible.

- U.S. policymakers have long recognized the unique sharing opportunities of the Lower 37 GHz band, as well as the need to protect Federal sites, including 15 military sites, five National Aeronautics and Space Administration receiving earth station operations and two National Science Foundation sites.
- In coordination with NTIA, the FCC in 2016 adopted an Order that concluded that non-Federal fixed and mobile applications can share 37-38.6 GHz with DoD operations. The Order made the Lower 37 GHz band available for co-primary sharing, with both Federal and non-Federal users accessing the band by registering sites through a coordination mechanism.
- In 2019, the FCC established service rules addressing Federal sites for a 2020 auction in the 37 GHz band, with sharing rules for 37.0-37.6 GHz to be addressed at a later date. Among other things, the decision added one Federal site to the list of protected Federal sites in the 37 GHz band and limited future DoD access to the 37.6-38.6 GHz (Upper 37 GHz) band unless the Department could demonstrate that its operations cannot be accommodated in the Lower 37 GHz band.
- To enable an innovative sharing approach for the Lower 37 GHz band, the FCC, NTIA and DoD began discussions in 2020 on the details of a coordination mechanism. These discussions resulted in a draft sharing framework, based on first-in user rights.
- Following the release of the NSS Implementation Plan, the FCC released a 2024 Public Notice, that sought information on sharing issues in the Lower 37 GHz band, including how to accommodate various use cases through a coordination mechanism between Federal and non-Federal operators.

Use Cases

Expected uses of the Lower 37 GHz band include data-intensive applications, such as high speed, low latency 5G services. Wireless operators view this spectrum as well-suited for providing additional bandwidth, for example during large events through indoor distributed antenna deployments. Industry also sees value in the band for addressing increased demand for mobile network capacity by offloading traffic from other bands.

- Potential use cases include fixed wireless access; high-capacity backhaul; cable supplement for Internet of things (IoT) networks and augmented reality applications; and mobile or private networks that support industrial IoT, smart factories and other high-bandwidth indoor communications applications.
- Federal users, including DoD, may leverage some of this same technology, including as part of potential additional adaptations to meet mission requirements (e.g., hardening).
- Although not being proposed for any specific frequency allocation at this time, DoD is evaluating additional use cases to meet military missions, including: (1) Unmanned Systems to provide terrestrial or maritime to aeronautical mobile and potentially space to aeronautical mobile (maritime, terrestrial) unmanned systems; and (2) Wireless Power Transfer to provide a variety of capabilities currently in development by military research labs to deliver power to wireless communication systems, mobile vehicles, surface and subsurface vehicles, and other potential uses cases.

Recommendations

Based on the foregoing, we make the following recommendations for sharing between Federal and non-Federal users:

- **Coordination Framework:** To coordinate shared access between Federal and non-Federal users, NTIA and DoD support the use of the two-phase procedures described in the FCC Public Notice. The first phase would use simple propagation models to determine whether there are overlapping contours and permit operations to proceed in the absence of any overlap. The second phase would apply in the event of overlap between a proposed site registration and an existing site already registered in the database and would require the parties to exchange more detailed data and attempt to coordinate their operations. We expect the second phase of coordination will proceed quickly; if there is a dispute between the parties, the matter would be referred to NTIA and the FCC for resolution. This coordination framework described in the Public Notice would provide a “floor” to establish initial sharing rules. We support the potential evolution of the database to more dynamic mechanisms based on demonstrated need and available technology.
- **Priority Access (37.0-37.2 GHz):** DoD would retain 200 megahertz of priority access (37.0-37.2 GHz). Non-Federal entities would be permitted to access the lower 200 megahertz, with the understanding their operations may be preempted by DoD. If the contours of an existing or planned DoD system overlap with those of a deployed commercial system in the lower 200 megahertz, DoD would reserve the right to provide notice (through NTIA and the FCC) to the commercial operator that it must cease or reduce its operations to eliminate the overlap, unless the non-Federal entity is able to otherwise coordinate to the satisfaction of DoD.
- **Co-equal Access (37.2-37.6 GHz):** Sharing in this part of the band would be on a co-equal basis between Federal and non-Federal users. Because DoD and other Federal operations are likely to be a “second-in” use based on their longer acquisition timelines and technology development lifecycles,

we support a build-out requirement for Federal users of at least 24 months from when they enter a site into the coordination portal.

- **Adjacent Band Protection:** A critical issue is the need to protect operations in the adjacent 36-37 GHz band. Earth Observations from environmental satellites that use this spectrum serve in a variety of purposes, including water and precipitation detection, and are leveraged extensively by DoD. NTIA recommends an administrative change to update the U.S. footnotes to reflect a resolution from the World Radiocommunication Conference in 2019, which was designed to address the interference risk to passive space-based sensors below 37 GHz that may accompany expanded fixed and mobile wireless deployments above 37 GHz.

Conclusion

The Lower 37 GHz band presents a unique opportunity to advance what the NSS describes as the “potential expanded governmental and non-governmental use for an array of advanced, next-generation applications and services.” An initial coordination framework based on “first-in” user rights that protects “second in” access will advance the long-standing vision for this co-primary band of co-equal access for Federal and non-Federal users. Further, this innovative sharing framework can be made possible by ensuring that adjacent band protections for passive space-based sensors are addressed in accordance with the recommendations to address the interference risk of new deployments of in the Lower 37 GHz band. We look forward to the next steps in implementing coexistence measures that advance a range of sharing innovations for this spectrum.

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I. INTRODUCTION

This report provides recommendations and findings to expand Federal and non-Federal access in the 37.0-37.6 gigahertz (GHz) spectrum band (Lower 37 GHz band) for innovative advanced wireless uses, consistent with the National Spectrum Strategy (NSS) and the NSS Implementation Plan (I-Plan).¹ The Lower 37 GHz band presents a unique opportunity for advancing military missions and fostering technology and policy innovation for sharing between Federal and non-Federal users. With co-primary allocations for both Federal and non-Federal systems, the band shows promise for expanding government and commercial deployments alike.²

The NSS identified the Lower 37 GHz band as one of five spectrum ranges for in-depth study. The NSS directed a study to advance “a co-equal, shared-use framework allowing Federal and non-Federal users to deploy operations” in the 37.0-37.6 GHz band.³ This report builds on collaboration between the National Telecommunications and Information Administration (NTIA), the Department of Defense (DoD) and the Federal Communications Commission (FCC) that occurred in 2020-2021. The I-Plan designates DoD, in coordination with NTIA and the FCC, as the lead for finalizing the study plan and project schedule and completing the study. The I-Plan also directs DoD and NTIA to complete the final report by November 2024 in coordination with the Interagency Spectrum Advisory Council (ISAC).⁴ An FCC Public Notice, released on August 9, 2024, sought information on sharing issues in the Lower 37 GHz band.⁵

A. Methodology

To better understand the requirements necessary to support co-equal sharing in the Lower 37 GHz band, we coordinated with various stakeholders, including DoD subject-matter experts, other Federal spectrum users, the FCC, and the commercial wireless industry. Key DoD stakeholders whose expertise contributed to these findings include the Military Departments, the DoD Chief Information Officer, Joint Staff, Office of the Under Secretary of Defense for Research & Engineering, and the Defense Information Systems Agency. Insights from the DoD 5G and Future Generation Cross Functional Team provided important context relative to warfighter requirements to innovate for 5G and beyond. Since the release of the NSS I-Plan in March 2024, DoD informal outreach to the Defense Industrial Base (DIB) on the state of advanced wireless technology and commercial deployment plans also informed these findings. We also received input from the Interdepartment Radio Advisory Committee (IRAC) and the newly formed ISAC.

U.S. policymakers have recognized the unique sharing opportunity of this spectrum range. A 2016 FCC Report and Order (R&O) and Further Notice of Proposed Rulemaking (FNPRM) described a

¹ See NTIA, National Spectrum Strategy at 3, 6-7 (November 13, 2023), https://www.ntia.gov/sites/default/files/publications/national_spectrum_strategy_final.pdf (“NSS”) and NTIA, National Spectrum Strategy Implementation Plan (“I-Plan”) at A-12, (March 12, 2024), <https://www.ntia.gov/sites/default/files/publications/national-spectrum-strategy-implementation-plan.pdf> (“I-Plan”).

² See NTIA, “Lower 37 GHz – Stakeholder Engagement Update,” July 10, 2024, <https://www.ntia.gov/other-publication/2024/lower-37-ghz-stakeholder-engagement-update>.

³ See NTIA, NSS at 3, 6-7 (2023) and NTIA, I-Plan at A-12 (2024).

⁴ See NTIA, NSS I-Plan at A-12, (2024).

⁵ See FCC, *Information Sought on Sharing in the Lower 37 GHz Band in Connection with the National Spectrum Strategy Implementation Plan*, Public Notice, WT Docket No. 24-243, released August 9, 2024 (“FCC Public Notice”).

“new paradigm for Federal and non-Federal sharing in the 37 GHz band, with the goal of fully developing a powerful new model for efficiently sharing high-frequency spectrum [that] can be applied to other such bands in the future.”⁶ In general, the Lower 37 GHz band has the potential to meet several short range/line-of-sight use cases.

The Lower 37 GHz band is part of the 37-38.6 GHz spectrum range, all of which is allocated to the fixed and mobile services on a primary basis for Federal and non-Federal use.⁷ Portions of the 37-38.6 GHz band are also allocated to the Space Research Service (SRS) (space-to-Earth) on a primary basis for Federal use (37-38 GHz) and to the Fixed-Satellite Service (FSS) (space-to-Earth) on a primary basis for non-Federal use. Use of the FSS downlink allocation is subject to the soft-segmentation plan in the FCC’s V-Band Second Report and Order.⁸ In addition, the 37-38.6 GHz band is adjacent to the 36-37 GHz band, where passive sensors in the Earth Exploration Satellite Service (EESS) and SRS are located.⁹

Federal Table	Non-Federal Table	FCC Rule Part
37-38 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (space-to-Earth)	37-37.5 FIXED MOBILE except aeronautical mobile US 151	Upper Microwave Flexible Use (30)
	37.5-38 FIXED FIXED-SATELLITE (space-to-Earth) NG63 MOBILE except aeronautical mobile US151	Satellite Communications (25) Upper Microwave Flexible Use (30)
38-38.6 FIXED MOBILE 38.6-39.5	38-39.5 FIXED FIXED-SATELLITE (space-to-Earth) NG63 MOBILE NG175	

Figure 1 – Excerpt of Table of Frequency Allocations, U.S. Table

⁶ See FCC, *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8057-8060 at para. 2 (2016) (“First R&O”).

⁷ See U.S. Table of Frequency Allocations, 47 CFR. § 2.106.

⁸ See 47 CFR § 2.106; FCC, *Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations*, Second Report and Order, 18 FCC Rcd 25428, 25438 at para. 24 (2003).

⁹ See First R&O at para. 103.

B. Historical Context

The following historical background provides a chronological summary of the interests and outcomes of wireless operations in the Lower 37 GHz band.

Regulatory consideration of the potential uses of this band for wireless innovation dates to 2004, when the FCC sought comment on fixed and point-to-point multipoint service rules in the 37 GHz and 42 GHz bands, including the possibility of allowing “mobile use in the future, if and when the technology develops.”¹⁰ (Unlike the 37 GHz spectrum range, the 42 GHz band has only a non-Federal spectrum allocation.) The following year, industry commenters told the Commission it was not in the public interest to license these bands because the supply of millimeter wave (mmW) spectrum exceeded the demand.¹¹

2004: NTIA in 2004 identified 14 military sites in the 37-38.6 GHz band that required protection throughout the entire band.¹² NTIA also identified the National Aeronautics and Space Administration’s (NASA’s) receiving earth stations in the SRS in the 37-38 GHz band: Goldstone, California; Guam, Pacific Ocean; Merritt Island, Florida; Wallops Island, Virginia; and White Sands, New Mexico. Further, NTIA identified Green Bank, Virginia; and Socorro, New Mexico National Science Foundation (NSF) sites to support their Very Long Baseline Interferometry earth station operations.

NTIA identified in 2019 an additional military site for protection, which was a small coordination zone around Edwards Air Force Base (AFB) to the south of Federal facilities in China Lake, California.¹³ In addition, NTIA sought the conversion into a single area of four overlapping coordination zones listed in the Table of Allocations under the China Lake site. The intent was to protect DoD’s operations in the China Lake coordination area and nearby Edwards AFB, without impacting Upper 37 GHz licensees’ access to relevant population centers in California. NTIA recommended that coordination with the Federal operations be conducted via the IRAC process.

¹⁰ See FCC, *Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands; Implementation of Section 309(j) of the Communications Act – Competitive Bidding, 37.0-38.6 GHz and 38.6-40.0 GHz Bands*, ET Docket No. 95-183 and PP Docket No. 93-253, Third Notice of Proposed Rulemaking, 19 FCC Rcd 8232, 8242 ¶ 25 (2004).

¹¹ See, e.g., Reply Comments of First Avenue Networks, Inc., ET Docket No. 95-183, et al., at 1 (filed Jan. 3, 2005); Reply Comments of Winstar Communications, LLC (“Winstar”), ET Docket No. 95-183, et al., at 4 (filed Jan. 3, 2005); Reply Comments of Fixed Wireless Communications Coalition, ET Docket No. 95-183, et al., at 2 (filed Jan. 3, 2005). The adjacent 38.6-40 GHz band had been made available for licensing on a Rectangular Service Area (RSA) basis since the 1990s, and that band was auctioned on a Partial Economic Area basis in 2000. See Amendment of the Commission's Rules Regarding the 37.0 - 38.6 GHz and 38.6 - 40 GHz Bands, Report and Order and Second Notice of Proposed Rulemaking, ET Docket No. 95-183, 12 FCC Rcd 18600 (1997); 39 GHz Band Auction Closes, *Public Notice*, 15 FCC Rcd 13648 (WTB 2000).

¹² See Letter from Fredrick R. Wentland, Associate Administrator, Office of Spectrum Management, NTIA, March 24, 2004, to Mr. Edmond J. Thomas, Chief, Office of Engineering and Technology, FCC.

¹³ See Letter from David J. Redl, Assistant Secretary for Communications and Information, Department of Commerce to Ajit Pai, Chairman, FCC (filed Apr. 11, 2019) at 4.

<i>Location</i>	<i>Agency</i>
<i>China Lake, CA</i>	Navy
<i>San Diego, CA</i>	Navy
<i>Nanakuli, HI</i>	Navy
<i>Fishers Island, NY</i>	Navy
<i>Saint Croix, VI</i>	Navy
<i>Fort Irwin, CA</i>	Army
<i>Fort Carson, CO</i>	Army
<i>Fort Hood, TX</i>	Army
<i>Fort Bliss, TX</i>	Army
<i>Yuma Proving Ground, AZ</i>	Army
<i>Fort Huachuca, AZ</i>	Army
<i>White Sands Missile Range, NM</i>	Army
<i>Edwards Air Force Base, CA</i>	Air Force
<i>Moody Air Force Base, GA</i>	Air Force
<i>Hurlburt Air Force Base, FL</i>	Air Force

Figure 2 – 15 Protected Military Sites

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mmW bands, including the creation of a “new paradigm for Federal and non-Federal sharing in the 37 GHz band.” The First *Spectrum Frontiers* Report and Order (First R&O) concluded that non-Federal fixed and mobile operations can share the 37-38.6 GHz band with DoD operations.¹⁹ The FCC made the Lower 37 GHz band available for coordinated co-primary sharing between Federal

In 2006, NTIA sent a follow-up letter to the FCC, reiterating the need to protect NASA, NSF, and military operations from non-Federal terrestrial and FSS operations in 37-38 band.¹⁵ NTIA recommended that because of potential interference from airborne systems, the aeronautical mobile service allocation should be deleted from the 37-38 GHz band.

2014: By 2014, the state of wireless technology had evolved. The FCC launched a regulatory proceeding to examine the potential provision of mobile radio services in the mmW spectrum.¹⁶ In a 2014 Notice of Inquiry (NOI), the FCC noted that until then, the prevailing assumption was that mobile service in spectrum at higher frequencies was infeasible “because radio waves at those frequencies travel in straight lines and could provide only line-of-sight service. Also, the propagation and atmospheric absorption characteristics of higher frequency bands significantly reduce the coverage of individual base stations and require a very expensive network to achieve a reasonable extent of aggregate coverage.”¹⁷ Leading wireless equipment manufacturers began developing ways to provide non-line-of-sight services in higher spectrum bands with increased range.

The NOI sought comment on the suitability of the 37 GHz and 42 GHz bands for advanced mobile services, noting that the FCC and NTIA would work together to ensure that in the 37 GHz range “federal operations are protected” while maximizing the use of the band for commercial operations.¹⁸

2016: In 2016, the FCC, in coordination with NTIA, took further steps to promote technological advances in the

¹⁴ See 47 CFR § 30.205 (b) Federal Coordination Requirements (Note, Fort Hood was renamed Fort Cavazos on May 9, 2023; *Hurlburt Air Force Base, FL* refers to Hurlburt Field, part of Eglin AFB).

¹⁵ See Letter from Fredrick R. Wentland, Associate Administrator, Office of Spectrum Management, NTIA, September 13, 2006, to Mr. Julius Knapp, Chief, Office of Engineering and Technology, FCC.

¹⁶ See FCC, *In the Matter of Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Notice of Inquiry, 29 FCC Rcd 13020, 13021 at para. 2 (2014) (“Notice of Inquiry”).

¹⁷ See Notice of Inquiry at para. 5.

¹⁸ See Notice of Inquiry at para. 68.

¹⁹ See FCC, *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, 8057 at para. 149 (2016) (“First R&O”).

and non-Federal fixed and mobile users, determining both sets of operators would access the band by registering individual sites through a coordination mechanism to be developed through government and industry collaboration. (Of note: The FCC made the Upper 37 GHz band, 37.6-38.6 GHz, available on a licensed geographic basis, with protected Federal sites, via an auction which concluded in 2020.)

In the Lower 37 GHz band, the First R&O designated non-Federal users as authorized by rule with Federal and non-Federal users accessing the band through a coordination mechanism. The FCC explained that it “envision[ed] this segment serving as a proving ground for Federal and non-Federal sharing in the mmW bands, as a way to facilitate expanded Federal use in the band, an opportunity to facilitate lower-cost access to mmW bands, and a means for all providers to gain additional capacity where and when it is needed.”²⁰ For the entire 37-38.6 GHz range, the Order designated coordination zones for the Federal sites identified by NTIA.²¹

2018: In 2018, the FCC affirmed the co-primary sharing framework for the Lower 37 GHz band and sought comment on the details of that approach, including a third-party coordinator or a coordination model similar to that used in Part 101 point-to-point bands.²² A Third Further Notice of Proposed Rulemaking (Third FNPRM), which accompanied the *Spectrum Frontiers* Third Report and Order, recognized the importance of the Lower 37 GHz band to future Federal operations, stating the FCC would “work in partnership with NTIA, DoD, and other Federal agencies to develop a sharing approach that allows for robust Federal and non-Federal use in this band.”²³ The FCC sought comment on accommodating coordination zones for future Federal operations at a limited number of additional sites.²⁴ The *Spectrum Frontiers* Fourth Report and Order (Fourth R&O) set a course for the auction of the Upper 37 GHz band, among other bands.²⁵

2019: To continue efforts to make access to millimeter wave spectrum available, the FCC adopted a coordination process in 2019 for the Upper 37 GHz band (37.6-38.6 GHz) to accommodate future military use beyond protected DoD sites when access to the Lower 37 GHz band cannot be accommodated.²⁶ The *Spectrum Frontiers* Fifth Report and Order (Fifth R&O) addressed protection of specific Federal sites in the Upper 37 GHz band, with the sharing framework for the Lower 37 GHz band to be determined at a later date.²⁷ FCC rules require equipment in these bands

²⁰ See First R&O at para. 113.

²¹ See First R&O at para. 116.

²² See FCC, *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, 33 FCC Rcd 5576 at para. 28 (2018). (“Third FNPRM.”)

²³ See Third FNPRM at para. 62.

²⁴ See Third FNPRM at para. 74.

²⁵ See *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Fourth Report and Order, 33 FCC Rcd 12168 (2018) (Fourth R&O). Bidding for the auction of the Upper 37 GHz band (37.6-38.6 GHz), 39 GHz band (38.6-40 GHz), and 47 GHz (47.2-48.2 GHz) band began in December 2019 and concluded in March 2020 (Auction 103). See also *Incentive Auction of Upper Microwave Flexible Use Service Licenses in the Upper 37 GHz, 39 GHz, and 47 GHz Bands for Next-Generation Wireless Services Closes*, Public Notice, 35 FCC Rcd 2015 (Mar. 12, 2020).

²⁶ See FCC, *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Fifth Report and Order, (2019) (“Fifth R&O”).

²⁷ See Fifth R&O at para. 17n.48 (stating that the FCC was “continuing discussions with the Department of Defense on how to effectuate usage of the Lower 37 GHz band, and the Commission intends to take steps towards specifying rules for sharing the band within three months, including exploring whether giving priority access to military use of the 37.0-37.2 GHz band would facilitate usage of the Lower 37 GHz band”).

be capable of operating across the 37-40 GHz range, which is expected to drive equipment availability with respect to the overall technological ecosystem for the 37 GHz and 39 GHz bands. Licensees in the Upper 37 GHz band must demonstrate buildout at license renewal; licenses have 10-year terms (i.e., 2030 timeframe.)²⁸

The Fifth R&O established a process to allow DoD to access the Upper 37 GHz band to accommodate the military's needs while protecting the interests of non-Federal licensees in the Upper 37 GHz spectrum band. DoD may submit requests for access to the Upper 37 GHz band "for specific additional military bases and ranges, for the purpose of defense applications or national security. Such requests must include a justification regarding why the proposed operations could not be accommodated in the Lower 37 GHz band."²⁹



Figure 3 – Six protected military sites under Part 30 (China Lake, Fort Irwin, Edwards AFB, San Diego, Calif.; Yuma Proving Ground, Fort Huachuca, Ariz.)

²⁸ Initial authorizations will have a term not to exceed 10 years from the date of initial issuance or renewal. (See 47 CFR § 30.103).

²⁹ See Fifth R&O at para. 16.

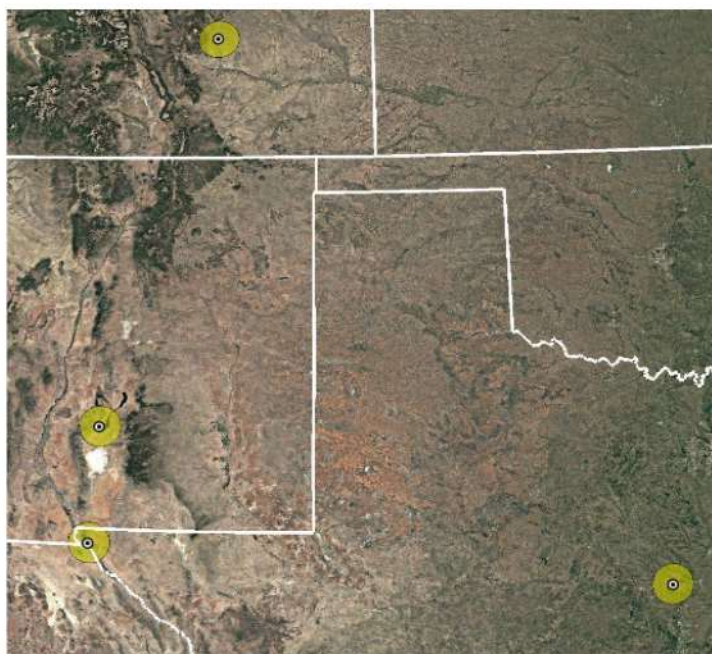


Figure 4 – Four protected military sites under Part 30 (Fort Carson, Colo.; Fort Hood and Fort Bliss, Texas; White Sands Missile Range, N.M.)

When such requests are made, FCC staff will review them, in consultation with affected licensees, NTIA and DoD, to determine whether “the request for access can be accommodated without creating a significant risk of harmful interference to current or planned deployments by potentially affected non-Federal licensees.”³⁰ The FCC based this decision on several factors, including an expectation that DoD requests are likely to be relatively rare, since the Commission anticipated that most such operations can be accommodated in the Lower 37 GHz band.³¹ Further, military use, when it cannot be accommodated in the Lower 37 GHz band, is likely to be limited to military bases and ranges, for the purpose of defense applications or national security. The technical characteristics of systems in this spectrum are marked by high path losses and use of advanced antennas and adaptive power control, which can be utilized to mitigate impact on licensees’ operations.

C. Recent Developments

2020: In 2020, the FCC, NTIA and DoD began discussions on a possible coordination mechanism that would bring to fruition the innovative co-equal sharing framework envisioned for the Lower 37 GHz band.³² These discussions resulted in the development of a strawman sharing framework, based on first-in user rights. This work is the basis for the two-phase coordination framework described in the FCC Public Notice and its appendices.

³⁰ See Fifth R&O at para. 16.

³¹ See Fifth R&O at para. 16.

³² See NSS at 7 and FCC Public Notice at 2.

2023: In 2023, the FCC adopted a 42-42.5 GHz Notice of Proposed Rulemaking (42 GHz NPRM), including options to combine a sharing framework for both the 42 GHz and 37-37.6 GHz bands.³³ The FCC sought comment on “potential synergies” while adopting similar sharing approaches for both bands.³⁴ The 42 GHz NPRM cited suggestions by several commenters that the FCC should base sharing rules for the Lower 37 GHz band with those adopted for the 70/80/90 GHz bands. In response to the 42 GHz NPRM, several commenters stressed the need for a simple sharing framework based on the 70/80/90 GHz coordination rules.³⁵ Others stressed the need for low barriers of entry to the Lower 37 GHz band, referencing a previously submitted sharing proposal to the FCC modeled, in part, on the 70/80/90 GHz coordination rules.³⁶

Also in 2023, prior to its release of the NSS, NTIA opened a public comment period in March 2023 for inputs on several issues, including potential bands for further study. Several responses proposed the identification of the Lower 37 GHz band for study, including a sharing approach that leverages Dynamic Spectrum Management System (DSMS) capabilities.³⁷ Commenters also emphasized the near-term sharing opportunity represented by this spectrum, noting that a database-enabled sharing regime in this band would allow wireless carriers to expand multi-gigabit wireless connectivity while coexisting with Federal operations.³⁸

2024: In 2024, the FCC adopted a Public Notice to develop the record for the Lower 37 GHz band with the goal of informing this report.³⁹ The Public Notice sought additional information on potential uses, including the feasibility of Aeronautical Mobile Service (AMS) in the band.⁴⁰ The Public Notice proposes a two-phase coordination framework to allow new applicants to coordinate with Federal and non-Federal incumbents.⁴¹ The Public Notice also contemplates that the lower 200 megahertz band segment (i.e., 37.0-37.2 GHz) “would be subject to priority use by DoD and

³³ See FCC, *Shared Use of the 42-42.5 GHz Band*, Notice of Proposed Rulemaking, 38 FCC Rcd 6362 (2023) (“42 GHz NPRM”).

³⁴ See 42 GHz NPRM at para. 23.

³⁵ See Comments of NCTA – The Internet & Television Association, WT Docket No. 23-158 and GN Docket No. 14-177 (filed September 29, 2023) at 5.

³⁶ See Comments of Charter Communications, WT Docket No. 23-158 and GN Docket No. 14-177 (filed August 30, 2023) at 7. See also Comments of WISPA – Broadband Without Boundaries, WT Docket No. 23-158 and GN Docket No. 14-177 (filed August 30, 2023) at 11 (“While WISPA proposes using an AFC, the general concept of coordination within a nationwide license is akin to other Part 101 services, specifically for the 70/80/90 GHz bands, and it is conceivable that going forward those bands can migrate to automated coordination as well.”) See also comments of T-Mobile (filed August 30, 2023) at 1 (the FCC “should implement the nationwide non-exclusive licensing framework currently used in the 70/80/90 GHz bands, with a few modifications to ensure that the spectrum will be used efficiently and may be deployed for variety of advanced communications services.”).

³⁷ See Comments of Federated Wireless, “Development of a National Spectrum Strategy,” NTIA Docket Number: 230308-0068, April 17, 2023.

³⁸ See Comments of Charter Communications (filed April 17, 2023), NTIA Docket Number: 230308-0068 (“The FCC and NTIA have been reviewing this band for years, so it is well-positioned to quickly be made available for shared commercial and federal use. This band can provide the high-speed, low-latency services that are being developed for 5G and beyond. A simple licensing regime for the Lower 37 GHz band – modeled on the FCC’s approach in the 70/80/90 GHz bands – would allow commercial operators to use a database to coordinate multiple users, and enable licensed, non-exclusive use of the spectrum without many costly operational obligations.”).

³⁹ See FCC Public Notice.

⁴⁰ *Id.* at 2.

⁴¹ *Id.* at 2-3.

military agency departments.”⁴² The majority of comments filed in response to the FCC’s Public Notice generally support the proposed two-phase coordination framework.

The following section provides an overview of potential use cases for the Lower 37 GHz band, including use cases tied to specific DoD mission needs, and a recommended way forward to enable robust forms of coordinated sharing between Federal and non-Federal users in this spectrum.

D. Potential Use Cases

The Public Notice inquired about a variety of potential use cases for the Lower 37 GHz band, including AMS, fixed wireless broadband, point-to-point links, Internet of Things networks, device-to-device operations, augmented reality applications, smart cities, smart grids, and as part of private networks. However, the FCC anticipates that operations will initially be limited to point-to-point and point-to-multipoint operations while other use cases continue to develop.⁴³ Commenters generally agreed with the FCC’s description of the expected use cases. For example, Charter Communications and Starry are using the Lower 37 GHz band on an experimental basis to develop new technologies and models around wireless offloading and fixed wireless broadband, “demonstrating the significant potential for meeting market needs for high-capacity licensed millimeter wave spectrum.”⁴⁴

Commenters view the Lower 37 GHz band as well-suited to deliver high speed, low latency multigigabit and 5G services over short and medium distances, such as real-time augmented reality-powered data sharing for innovations in smart cities, schools, offices, homes, libraries, hospitals, factories, and autos.⁴⁵ The band’s ability to support concentrated deployments over small geographic areas advances sharing.⁴⁶ Commercial uses cover a variety of data-intensive applications, ranging from home internet to wireless backhaul.⁴⁷ Non-Federal wireless operators who were winning bidders of 37.6-38.6 GHz licenses at auction described using this spectrum for additional bandwidth for stadiums and arenas during large events through distributed antenna deployments indoors.⁴⁸ The cable industry, which generally did not participate in the Upper 37 GHz auction, also views the Lower 37 GHz band as poised to address the increased demand for mobile network capacity “by allowing providers to offload traffic from other bands to this high-

⁴² *Id.* at 4.

⁴³ See FCC Public Notice at 2.

⁴⁴ See Joint Comments Of Charter Communications, Inc., Federated Wireless, Inc., Open Technology Institute At New America, Qualcomm Incorporated, Starry, Inc., and WISPA (“Joint Comments”), WT Docket No. 24-243, at 3.

⁴⁵ See Comments of NCTA – The Internet and Television Association, WT Docket No. 24-243, at 1.

⁴⁶ See Comments of AT&T Services, Inc., WT Docket No. 24-243, at 2.

⁴⁷ See Comments of Starry, Inc., WT Docket No. 24-243, at 2 (filed September 9, 2024) (“The combination of power and available bandwidth makes the band well-situated to serve myriad commercial uses, including fixed wireless broadband and mobile broadband.”) See Joint Comments, at 3 (“Millimeter wave spectrum is particularly useful for high bandwidth applications over short or medium distances. This includes mobile applications that perform well in dense areas and fixed broadband applications that support gigabit speeds to end users; internet-of-things applications, like video, that require high bandwidth; mobile or fixed broadband backhaul or mobile broadband fronthaul; and myriad other uses that will evolve over time.”).

⁴⁸ See Comments of Verizon, Inc. WT Docket No. 24-243, at 3 (“Verizon also uses millimeter-wave spectrum to support distributed antenna system deployments indoors. For example, concertgoers and attendees of other events who want to livestream video, post pictures, and upload other content online to share their experiences are often able to do so because of the capacity gains afforded by large channels of millimeter-wave spectrum Verizon has deployed in large event venues.”).

capacity spectrum.”⁴⁹ Under this scenario, Lower 37 GHz channels would serve as secondary carriers for mobile broadband service by deploying radios in the band alongside Citizens Broadband Radio Service (CBRS) base stations in the 3.5 GHz spectrum band.⁵⁰

Based on responses to the FCC’s Public Notice, DoD’s engagement with the DIB and prior comments filed at the FCC and NTIA on this matter, potential Federal use cases include those described above as well as some potential additional cases that DoD is exploring.

The Lower 37 GHz band enables diversity to DoD’s 5G Strategy by providing high-bandwidth, low-latency connectivity for mission-critical applications.⁵¹ This spectrum offers large bandwidth and high data rates, making it suitable for applications such as real-time video streaming, remote control of unmanned vehicles, and high-speed data transfer for point-to-point, base-to-mobile and point-to-multipoint scenarios. The band can potentially improve commercial infrastructure at military installations, offering directionality used to secure DoD’s unique capabilities such as Port/Flight Line network communications. In addition, this band permits the deployment of private 5G networks that can provide resilient communications, real-time situational awareness, and enhanced command and control capabilities in expeditionary and tactical environments.

There is currently research and experimentation with respect to capabilities in this band which address DoD requirements and are exclusively designed for DoD missions; in the future this research may include:

- **Use Case 1 – Unmanned Systems:** DoD is interested in evaluating unmanned systems to provide terrestrial or maritime to aeronautical mobile and potentially space to aeronautical mobile (maritime, terrestrial) unmanned systems in the 37-37.2 GHz band. This spectrum can provide unmanned systems with high bandwidth data for force protection video, communications, lifesaving medical supplies, logistics, sensor power restoration, undersea, and maritime capabilities. For initial terrestrial use cases, operations are anticipated up to 800 feet and a 0-to-5-kilometer radius, with an expectation that requirements and technological capabilities may evolve over time.
- **Use Case 2 – Wireless Power Transfer (WPT):** DoD is interested in evaluating WPT in 37-37.2 GHz to provide a variety of capabilities currently in development by our research labs to deliver untethered power to and through unmanned systems, wireless communication systems, underwater vehicles, electric vehicles, sensor recharging, satellite-to-aircraft, space-to-moon, and several other potential uses cases. DoD is interested in collaboration with Industry on WPT equipment development, which would operate within the confines of the military priority band. WPT is a technology which allows electrical energy to be transmitted point-to-point from a power source to a receiver without the need for physical wires. It is

⁴⁹ *Id.* at 5.

⁵⁰ *Id.* at 5 (“As a result, when CBRS connections are constrained by smaller bandwidths, end-user devices could establish connections with the radios in the Lower 37 GHz band. The band’s extra-wide channels would boost peak data transfer speeds and improve the performance of applications that require high sustained throughput or reliably fast round-trip packet transfers.”).

⁵¹ See Department of Defense 5G Strategy, May 2020 at 3 (“DoD must develop and employ new concepts of operation that use the ubiquitous connectivity that 5G capabilities offer to increase the effectiveness, resilience, speed, and lethality of our Forces.”)

also known as wireless power transmission, wireless energy]transmission, or electromagnetic power transfer. WPT to vehicles has the potential to benefit DoD in many ways as this technology resolves battery drainage challenges from mobile vehicle radios, provides tighter beamwidths, is more cost effective and may offer better safety standards than the current power transfer in higher frequency bands. In addition to offering significant time/cost savings to delivering power to distant/hard to reach nodes, wireless power has several economic and commercial market benefits for space, unmanned, maritime, multi-domain operations, electric, and autonomous vehicles.

This report does not recommend any new allocations to support these use cases. Instead, the expectation is that experimentation with these use cases, and potentially others, would proceed using standard procedures for experimental operations. Depending on the success of those efforts and any necessary showing of compatibility with other operations under existing allocations, at some point in the future it might be appropriate to propose additional service(s) be added to the Federal Table of Frequency Allocations.

II. WAY FORWARD

Based on the foregoing, we make the following findings and recommendations:

A. Additional Protected Federal Sites

DoD continues to evaluate the list of protected military sites under Part 30 to ensure that the list reflects current and emerging mission requirements. An example of future bases and installations for which DoD may need additional protections if user needs cannot be accommodated in the Lower 37 GHz band in the future are sites that focus on 5G prototyping and experimentation. Examples of sites that may merit further study for this purpose in the future are listed in the table below and range from the U.S. Marine Corps 5G range (Twentynine Palms, California) to the Naval Postgraduate School (NPS) (Monterey, California).

<i>Location</i>	<i>Agency</i>	<i>Coordination area (Decimal degrees)</i>	<i>Related efforts</i>
<i>Monterey, CA</i>	Navy	10-kilometer radius centered on latitude 36.594667 and longitude - 121.878491.	Prototypes and Experiments, system development, test and evaluation
<i>Camp Roberts, CA</i>	Navy	40-kilometer radius centered on latitude 35.798567 and longitude - 120.743580.	Prototypes and Experiments, system development, test and evaluation, military exercises
<i>Norfolk, VA</i>	Navy	40-kilometer radius centered on latitude 36.943220 and longitude - 76.318851.	Prototypes and Experiments, system development, test and evaluation
<i>Twentynine Palms, CA</i>	USMC	30-kilometer radius centered on latitude 34.237642 and longitude - 116.063496.	Prototypes and Experiments, system development, test and evaluation, military exercises

Figure 5 – Examples of DoD Sites for 5G Experimentation

B. Adopt a Two-Phase Coordination Process

The Public Notice asked for comment on the use of a coordination process for the Lower 37 GHz band that would leverage existing Part 101 coordination procedures with two phases, with the first phase using propagation models to determine access, and a second phase that would require parties to coordinate, in the event of overlap between a proposed site registration and an existing site that is already registered in the database.⁵² Under Part 101, non-Federal licensees may use the 70/80/90

⁵² See FCC Public Notice, Appendix A: Draft Lower 37 GHz Phase 1 Coordination Zone Contour Methodology and Appendix B: Draft Lower 37 GHz Phase 2 Coordination Methodology. The Public Notice noted that in 2018, the FCC “sought comment on utilizing a third-party coordinator or alternatively, implementing a coordination model similar to that used in Part 101 point-to-point bands.”

GHz bands for any point-to-point, non-broadcast service.⁵³ (The 70/80/90 bands refer to the 71–76 GHz, 81–86 GHz, 92–94 GHz, and 94.1–95 GHz.) Like the Lower 37 GHz band, these bands are allocated on a co-primary basis for Federal and non-Federal use.⁵⁴ The FCC in 2003 adopted service rules for non-Federal use of the 70/80/90 GHz bands through a two-step, non-exclusive licensing regime.⁵⁵ If a proposed link does not interfere with existing Federal operations, it is given a “green light;” if it may interfere with existing Federal operations, then it is given a “yellow light,” indicating that the licensee must file a registration application with the FCC for coordination of the proposed link with NTIA.⁵⁶ The “green light” / “yellow light” system is designed to protect the sensitive nature of the locations of military installations.

To facilitate sharing of the band, we support the two-phase process for coordinating between Federal and non-Federal systems. New operations in the Lower 37 GHz band would be subject to coordination with Federal and non-Federal incumbents before a new site can be authorized.

In Phase One, the coordination portal would draw a protected contour around each existing site and an interfering contour for the proposed new site based on its technical parameters, including transmitter details such as location (latitude and longitude), equivalent isotropic radiated power, antenna height, and antenna azimuth angle. NTIA’s database would be queried, and if there is no contour overlap between the proposed new site and existing operations, Phase One coordination results in a “green light” and the site can be registered. If the proposed site’s contour does result in overlap, the result of Phase One coordination is a “yellow light”, and Phase Two coordination is triggered.

In Phase Two, an applicant would engage with NTIA, which would coordinate with incumbent and/or priority operators, to discuss whether and how the proposed site could coexist within the defined contour. The result of this phase could be the proposal of additional interference mitigation techniques, such as antenna directivity, polarization, or shielding to provide solutions in specific situations without requiring a one-size-fits-all approach.

To facilitate coordination, Federal and non-Federal operators would generally be required to provide technical information about their operations. We assume that the technical details of proposed non-Federal sites would be publicly available in the Universal Licensing System (ULS) or some other FCC database. NTIA would maintain the technical details of Federal sites provided by Federal operators. Operational security (OPSEC) measures would be put in place to protect information about certain sensitive, or classified Federal systems that cannot be shared publicly; in some cases, this may limit what information NTIA can share with non-Federal operators.⁵⁷ As part

⁵³ See 47 CFR § 101.1507.

⁵⁴ See 47 CFR § 2.106. In the 70 GHz and 80 GHz bands, Fixed, Mobile, and Broadcasting services must not cause harmful interference to, nor claim protection from, Federal Fixed-Satellite Service operations located at 28 military installations. Further, in 80 GHz, 92–94 GHz and 94.1–95 GHz, licensees proposing to register links located near 18 radio astronomy observatories must coordinate their proposed links with those observatories. The 94–94.1 GHz frequencies are allocated for Federal use for Earth Exploration Satellite (active), Radiolocation, and Space Research (active) and for non-Federal use for Radiolocation.

⁵⁵ See *Allocations and Service Rules for 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, Report and Order, 18 FCC Rcd 23318 at para. 5 (2003) (70/80/90 GHz Report and Order).

⁵⁶ See 47 CFR § 101.1523(b)(3), (c).

⁵⁷ Associated infrastructure, including cleared personnel, will be necessary to analyze requests at varying levels of classification.

of continued work, we will work with the FCC and relevant Federal agencies to refine the processes around protecting OPSEC requirements identified by Federal agencies, to enable us to best protect national security and public safety while providing maximum transparency and spectrum efficiency.

The public record developed in response to the FCC's Public Notice is largely supportive of this overall approach. Many commenters support the two-phase coordination proposal outlined in the Public Notice.⁵⁸ Some commenters suggest that the coordination process should include a shot clock for moving from Phase One to Phase Two and advocate for a clearly-defined dispute resolution process.⁵⁹ We do not believe a shot clock is needed for Phase One, inasmuch as we expect the determination of whether there are overlapping contours between an incumbent system and a potential new entrant will be essentially automatic once the new entrant submits its data. In cases where a Phase Two coordination is requested, we are prepared to support a requirement for the parties to submit information within 30 working days, assuming no OPSEC issues, and would expect the parties to meet within another 90 days to discuss the extent the additional information facilitates sharing.

Commenters also indicated a desire for transparency in the Phase Two coordination, and every effort will be made to reveal the details behind coordination decisions to potential entrants while ensuring Federal user security requirements are met. The 70/80/90 GHz approach serves as a starting point for a successful framework. One noted drawback of the approach is that when entrants receive a "yellow light," which would be akin to entering the Phase Two process in the DoD proposed framework for the Lower 37 GHz band, NTIA cannot provide feedback as to how much the coexistence margin is exceeded. This is to protect the location data of U.S. Government (USG) assets, but leaves the entrant with very little information in which to modify their deployment proposal such that it would receive a "green light." As part of continued work, we will investigate the amount of information sharing or obfuscation necessary to protect USG assets while providing maximum transparency and ensuring efficiency in the utilization of spectrum resources while still protecting USG assets. DoD will also investigate how best to provide feedback to non-Federal users to take advantage of mitigation techniques such as antenna directivity, polarization, frequency selection, shielding, site selection, and transmitter power control.

As noted below, 37 GHz spectrum sharing is not funded through the Spectrum Relocation Fund (SRF), which has implications for the timelines and available resources to engage in Phase Two analysis and negotiations. We anticipate that Federal and non-Federal users (or non-Federal and non-Federal users) will make every effort to analyze requests and coordinate with applicants in a timely manner. This is why we recommend an initial 90-day timeline for Phase Two analysis and negotiations. If after good-faith negotiations and 90 days has passed, either party may choose to escalate to dispute resolution.

⁵⁸ See Comments of Comsearch, a Commscope Company, WT Docket No. 24-243 at 2 (filed Sept. 9, 2024); Comments of Micronet Communications Inc., WT Docket No. 24-243 at 1 (filed Sept. 9, 2024); Comments of Starry, Inc., WT Docket No. 24-243 at 7-8 (filed Sept. 9, 2024); Comments of INCOMPAS, WT Docket No. 24-243 at 5 (filed Sept. 9, 2024); Comments of Ericsson, WT Docket No. 24-243 at 3 (filed Sept. 9, 2024); Comments of NCTA, WT Docket No. 24-243 at 5 (filed Sept. 9, 2024); Comments of Charter Communications, Inc. *et al.*, WT Docket No. 24-243 at 4 (filed Sept. 9, 2024).

⁵⁹ See, e.g., Comments of Verizon, WT Docket No. 24-243 at 5 (filed Sept. 9, 2024); Comments of CTIA, WT Docket No. 24-243 at 7-8 (filed Sept. 9, 2024); Verizon Comments at 4; Ericsson Comments at 2; Verizon Comments at 5.

Until there is more experience with the issues that may arise, we recommend at this time a dispute resolution process that consists of a referral to the FCC and NTIA by one or both parties. In general, we expect that if a dispute arises between a Federal entity and a non-Federal user during Phase Two, either the Federal entity or the non-Federal user may request that NTIA and FCC establish a process to resolve the dispute. With respect to the resolution of any disputes that may arise, NTIA and the FCC will meet simultaneously with representatives of the Federal entity and the non-Federal user to review the technical data and discuss the dispute. NTIA and the FCC will initiate the dispute resolution process within 30 days after a Federal entity's or a non-Federal user's written request for assistance from NTIA and the FCC. The time period for review starts after NTIA and the FCC have received requested technical data from the Federal entity and non-Federal user.

NTIA will implement the database for coordination between Federal and non-Federal systems, as it does now for the 70/80/90 GHz coordination portal. Comsearch and NCTA argue that a third party, not NTIA, should maintain the coordination database for Federal operators.⁶⁰ However, NTIA already has access to information about Federal systems and is best situated to maintain this database. Our expectation is that the resources for establishing and operating the coordination portal will be manageable, but as additional experience is gained, that expectation may need to be revisited. Unlike other spectrum sharing coordination portals that have been developed based on recent auctions (e.g., Advanced Wireless Services-3, CBRS, 3.45 GHz), 37 GHz does not present an opportunity to request SRF funds to resource the development and operations of a portal and the associated coordination.

Some commenters support an approach that uses a DSMS that would be developed by a multistakeholder group.⁶¹ We are not convinced that such an approach can be developed and implemented as quickly as the approach outlined above. We support the potential evolution of the initial database approach to one involving more dynamic mechanisms, such as a DSMS, based on demonstrated need and available technology, but initial deployment of a low-overhead approach such as that used in the 70/80/90 GHz band will provide an opportunity to ascertain what Federal and non-Federal user requirements are for the coordination database and how they can best be met.

Several commenters emphasized the importance of a common licensing and spectrum management framework for both the Lower 37 GHz band and 42 GHz (42-42.5 GHz).⁶² We take no position on this issue as long as it does not purport to affect the flexibility of Federal operations to use the Lower 37 GHz band without using the 42 GHz band.

⁶⁰ See Comsearch Comments at 3; NCTA Comments at 8.

⁶¹ See Joint Comments, WT Docket 24-243, at 6. See also Comments of the Dynamic Spectrum Alliance, WT Docket No. 24-243 at 5 ("Rather than the proposed nationwide licensing framework with first-come first-served rights that relies on manual coordination, which could lead to spectrum warehousing in the absence of build-out requirements and could create barriers to entry for smaller operators and users, the DSA recommends that the Commission adopt a license-by-rule approach akin to the General Authorized Access (GAA) tier in CBRS.").

⁶² See Joint Comments, WT Docket No. 24-243, at 3. Also see Comments of Federated Wireless, WT Docket 24-243 at 2 ("A common approach will facilitate access to 1100 MHz of spectrum by both consumer-oriented and private wireless operators to support the delivery of a wide range of fixed and mobile wireless broadband services.").

C. Provide Priority Access for Military Operations in the Lower 200 Megahertz

The FCC's Public Notice asked, consistent with the 2018 FNPRM, about the lower 200 megahertz of the band being subject to priority use by DoD and military agency departments "to ensure that spectrum is available for military deployments, which may be on a longer timescale than commercial deployments."⁶³ Several commenters noted that under priority access rules, non-Federal access should be permissible for commercial operations subject to certain conditions.

- NCTA described a sharing framework under which 200 megahertz of DoD priority access would not be necessary using TDD sync and 200-meter standoff distances, which are derived from calculations dependent on 3GPP-like system characteristics. NCTA cautioned against any framework which would limit non-Federal access to the 200 megahertz of Federal priority spectrum when not in use by a Federal system.
- Verizon stated that non-Federal operations should be allowed in the 37.0-37.2 GHz segment "subject to future federal operations" and priority access should not be interpreted as exclusive access. Verizon supports the proposals in the Public Notice that priority access includes as a condition on non-Federal site registrations in the 37.0-37.2 GHz band "that the licensee must modify or potentially cease operations in the future if those operations conflict with later military deployments and that these non-federal operations will not be protected from harmful interference from subsequent military deployments."⁶⁴
- Ericsson advised that in the 37.0-37.2 GHz portion of the band, the coordination framework should permit Federal operators to have a priority for outdoor registrations only; "indoor registrations should be available to non-federal operators on a first-come, first-served basis, subject to reasonable protections for outdoor use."⁶⁵

Priority access is critical to provide an opportunity for DoD to pursue and ultimately deploy technology innovation in all facets. Since the FCC began considering service rules for the Lower 37 GHz band, priority access for Federal users has been contemplated.⁶⁶ The Public Notice references this long-standing history "to ensure that spectrum is available for military deployments which may be on a longer timescale than commercial deployments." The co-primary allocation for Federal and non-Federal applies throughout the entire 37.0-38.6 GHz range. As noted above, limitations on DoD's access to the 37.6-38.6 GHz frequency range, which has already been auctioned for commercial use, underscores the need for the Lower 37 GHz band sharing framework to enable meaningful military access, including as part of a priority access segment.

To implement priority access, non-Federal operators could register sites in the lower 200 megahertz immediately, subject to future pre-emption by military operations. The non-Federal operator would operate on a Non-Interference Basis (NIB) to prospective DoD operations until military users require access. Non-Federal users can request access to the lower 200 megahertz, with the understanding that their operations may be preempted by DoD. If Phase One contours overlap with a deployed commercial system in the lower 200 MHz, DoD would work with NTIA to invoke priority access. Within a set period (i.e., 30 days), DoD would work in good faith with the

⁶³ See FCC Public Notice, WT Docket No. 24-243, at 4.

⁶⁴ See Comments of Verizon, Inc., WT Docket No. 24-243 at 6-7.

⁶⁵ See Comments of Ericsson, WT Docket No. 24-243 at 7.

⁶⁶ See Fifth R&O, GN Docket No. 14-177, Final Rule (2019) at n.2.

commercial operator to resolve the interference concerns. If DoD concerns cannot be mitigated in this period, DoD would have priority access to the lower 200 megahertz in the desired location. Upon notification that DoD is beginning construction of its facilities, the commercial operator would cease any overlapping operations. DoD and NTIA would support a limited period of compliance for non-Federal incumbents upon such notification (i.e., 30 days from receipt of notice to stop transmitting.)

The NSS recognizes a unique opportunity for advancements in the Lower 37 GHz band and describes it for “potential expanded governmental and non-governmental use for an array of advanced, next-generation applications and services.” The NSS I-Plan Strategic Objective 1.1(b) identifies “NTIA, working through the IRAC, will update both the relevant guidance and the procedures for NTIA review of agency spectrum requirements to help ensure that spectrum access will meet new requirements,” which further declares innovation and NTIA’s forward thinking of future Federal Agency requirements. As discussed above, DoD is evaluating the potential use of this spectrum for a variety of innovative services. In addition to aeronautical and WPT, it is looking at various space and moon-based services. DoD will initially pursue evaluation of these innovative use cases under experimental authorizations or special temporary authorizations. A study would also evaluate the additional service rules for 37.0-37.2 GHz to inform a potential future request for a change to the Table of Frequency Allocations. DoD is interested in collaborating with industry on all of these efforts.

D. Provide Co-equal Federal and Non-Federal Access to the Upper 400 Megahertz

Although the Lower 37 GHz band is ideal for co-primary, co-equal sharing, DoD and other Federal operations are likely to be a “second-in” use based on their longer acquisition timelines for military systems in general and the longer technology development lifecycles for any unique systems. The FCC’s Public Notice recognized the general risk, “particularly in larger markets, that future entrants (both federal and non-federal) may be precluded from accessing the band if the band is fully licensed in the initial licensing phase.” We therefore seek to ensure that government operations are not “locked out” by early deployments of commercial technologies. We appreciate the examples cited by the Public Notice (e.g., “applicants could be limited to a single 100-megahertz channel per site, which would ensure that multiple operators could access the band;” or “to establish accelerated buildout deadlines (e.g., 60 or 90 days) for registrations issued during the initial phase.”)

We take no position on the maximum spectrum that any one licensee can hold in any given area. We do, however, support a disparity in build-out requirements between Federal and non-Federal operations in order to account for Congressional appropriations and acquisitions timelines that are typical of Federal operations. NTIA intends to target Federal operations to complete construction and begin operations within 24 months of clearing a proposed site through the coordination process.

E. Protect Adjacent Band Protection in Accordance with ITU Recommendations

A critical issue is the need to protect operations in the adjacent 36-37 GHz band. Earth observations from environmental satellites serve a variety of purposes, including water and precipitation detection, and are leveraged extensively by DoD for mission execution, operational planning, and resource protection. Additionally, DoD shares environmental monitoring data with

our Federal and international partners and works closely with the scientific community to assess impacts to passive band sensing.

The 36-37 GHz space-based passive sensor collects data to support:

- **Ocean Surface Vector Winds:** Used for resource protection, evacuation, and ship maneuver operations
- **Cloud Liquid Water:** Used for DoD Numerical Weather Prediction/Data Assimilation (NWP/DA) for both quality control and to assign uncertainty in “All-sky” assimilation of cloudy radiance
- **Precipitation Rate:** Used for operational weather assessment. Precipitation rate is an indication of soil moisture and ground condition that is needed for Army off-road mobility and land operations
- **Snow Depth:** Used for flood estimates, river gap crossing, and ground maneuvers
- **Tropical Cyclone Intensity:** Resource protection, evacuation, and ship maneuvers
- **Sea Ice Characterization:** Operational risk and safety for Arctic submarine and surface operations
- **Imagery of 37 GHz data** for tropical cyclone forecast and warning
- **Numerical Weather Prediction (NWP)** model directly assimilates 30 GHz data

Passive sensor observations in the 36-37 GHz band specifically support the U.S. Navy (USN)’s current and future battlespace awareness to assess impacts to afloat and coastal/littoral ship routing and mission operations, aircraft and flight operations, and overall resource protection of assigned assets and facilities. The Joint Typhoon Warning Center relies on these specific satellite observations as their primary means to assess tropical cyclones in data sparse ocean areas to assess impacts to DoD operations. Finally, the associated surface characteristic observations feed USG land information system models used by the U.S. Army for global trafficability forecasting as well as the USN and U.S. Air Force atmospheric and oceanographic models and forecast efforts used by every DoD warfighter daily for operations and resource protection.

DoD systems in the band include the Defense Meteorological Satellite Program (DMSP), whose mission is to collect and disseminate global, high-resolution visible and thermal cloud cover imagery, and other critical air, land, sea, and space environment data to DoD forces and the intelligence community. DMSP data is also furnished to the civilian community through the Department of Commerce. In addition, the Weather Satellite Follow-on is a Low-Earth Orbit microwave imaging system developed and delivered by the United States Space Force’s Space Systems Command. This program is designed to provide U.S. and Allied warfighters with essential weather data, including the measurement of ocean surface wind speed and direction, ice thickness, snow depth, soil moisture, and local spacecraft Energetic Charged Particle environment. NASA also has operations that rely on the 36-37 band, including the Global Precipitation Measurement (GPM) Mission, which is an important science satellite mission that operates passive sensors to measure Earth’s rain and snowfall and the INvestigation of Convective UpdraftS (INCUS) (planned for 2026). In the 36-37 GHz band, NASA missions also rely on data from EESS operations operated by other administrations, with examples from the Japanese Aerospace Exploration Agency

(Global Change Observation Mission – Water; the Copernicus Imaging Microwave Radiometer (CIMR) constellation of 3 satellites planned for 2028; and Global Observing SATellite for Greenhouse gases and Water cycle planned for later this year. European Space Agency operations include the Copernicus Polar Ice and Snow Topography Altimeter planned for 2027 and the Sentinel-3 series. Further, beyond these specific examples, additional EESS (passive) systems operate in this band sponsored by other administrations.

In 2016, the Commission, with the support of NTIA, adopted an out-of-band emission limit that it concluded would “keep emissions from an UMFUS [Upper Microwave Flexible Use Service] device into the 36-37 GHz band well below the -10 dBW level specified by footnote US550A,” noting that the -10 dBW power limit “was adopted to protect passive sensors in the 36-37 GHz band in accordance with ITU Resolution 752 (WRC-07).”⁶⁷ Under FCC Part 30.203, operations are limited to -13 dBm/MHz, which expands to -13 dBW/GHz. Subsequently, in order to accommodate and account for terrestrial International Mobile Telecommunications (IMT) in the band, WRC-19, with support from the United States, adopted Resolution 243 (WRC-19), summarized in Table 1 below.⁶⁸ Resolution 243 recommends an OOB limit of -30dB(W/GHz) and requires no more than -43dBW across any one megahertz and no more than -23dBW across the full one gigahertz.

Currently, the FCC’s rules (Part 30.203) limit out of band emissions below 37 GHz to -13 dBm/MHz. Referencing WRC-19 Agenda Item (AI) 1.13, this does not align with the levels recommended in Rec. ITU-R RS.2017. Protection to the levels of Rec. ITU-R RS.2017 is essential, considering the anticipated higher density deployment of fixed and mobile services that will result from the development of a sharing framework in the Lower 37 GHz Band.

NTIA recommends an administrative change to update the U.S. footnotes to reflect the WRC-19 Resolution 243, Table 1 (shown below as **Figure 6**).

TABLE 1

Frequency band for the EESS (passive)	Frequency band for IMT stations	Unwanted emission mean power for IMT stations*	Recommended limits for IMT stations*
36-37 GHz	37-40.5 GHz	-43 dB(W/MHz) and -23dB(W/GHz) within the frequency band 36-37 GHz	-30dB(W/GHz)
* The unwanted emission power level is considered in terms of total radiated power (TRP). The TRP is to be understood here as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere.			

Figure 6 – WRC-19, Resolution 243 Table 1

⁶⁷ See First R&O at para. 156.

⁶⁸ Terrestrial component of International Mobile Telecommunications in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz, Resolution 243, WRC-19.

Proposed footnote based on the interpretation of the Resolution 243 emission limits:

USXXX To protect stations in the Earth exploration-satellite service (passive), IMT stations operating in the range 37-40 GHz, shall not exceed total radiated power (TRP) of -23 dBW in the 36-37 GHz band and -43 dBW within any 1 MHz of the 36-37 GHz band. The TRP is defined as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere.

Proposed inclusion of international footnote to communicate Res 243 recommendations:

5.550B The frequency band 37-43.5 GHz, or portions thereof, is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Because of the potential deployment of FSS earth stations within the frequency range 37.5-42.5 GHz and high-density applications in the fixed-satellite service in the frequency bands 39.5-40 GHz in Region 1, 40-40.5 GHz in all Regions and 40.5-42 GHz in Region 2 (see, No. 5.516B), administrations should further take into account potential constraints to IMT in these frequency bands, as appropriate. Resolution 243 (WRC-19) applies.

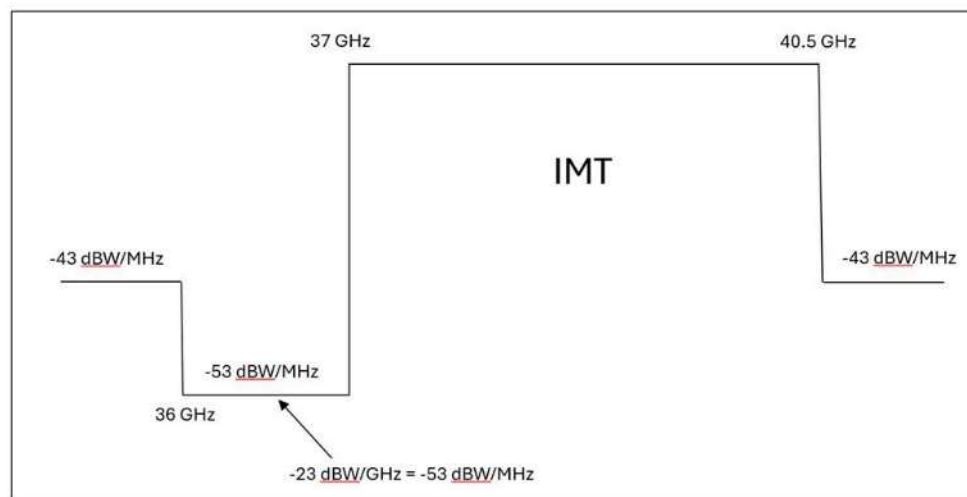


Figure 7 – One Example of an Out of Band Emission Mask Consistent with ITU Resolution 243

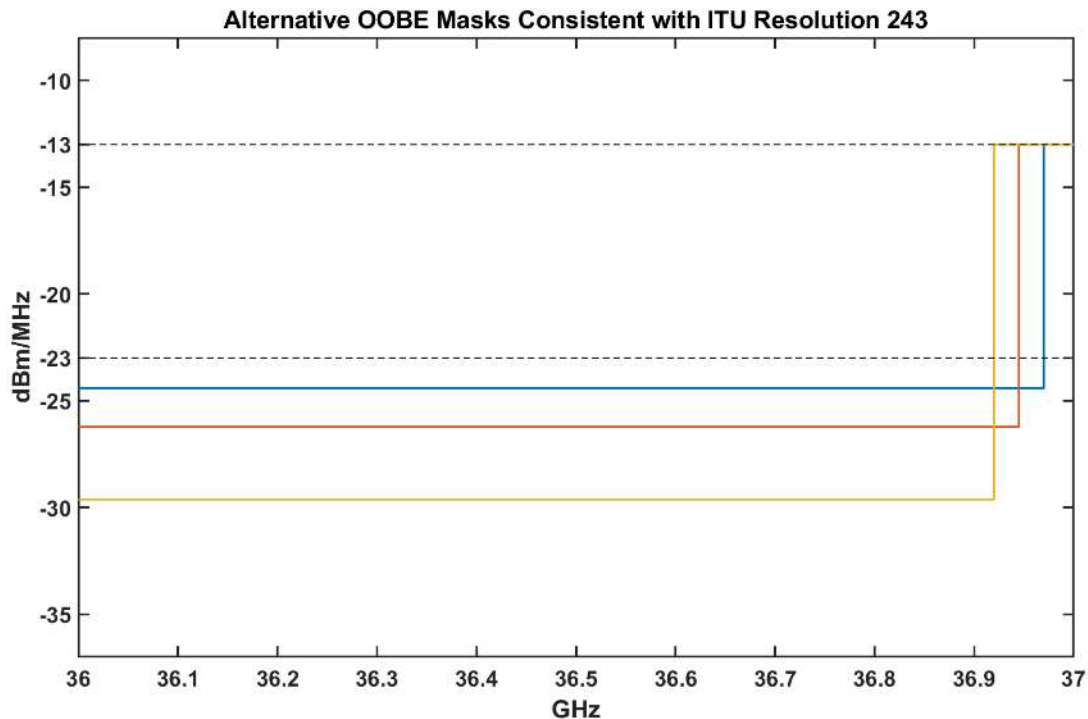


Figure 8 – Additional Out of Band Emission Masks Consistent with ITU Resolution 243

Total Radiated Power (TRP) is the only acceptable way to measure compliance with these emission limits.⁶⁹ Modern millimeter-wave systems have active beamforming networks that are integrated into the antenna array, making conductive testing not feasible due to the lack of physical space for measurement ports. A standard approach is important in estimating impacts to passive band sensing measurements. Noting that all passive sensor bands contribute to the overall accuracy of meteorological and space weather forecasting products and real-time situational awareness, it is recommended an evaluation of existing passive band protection is assessed based upon Rec. ITU-R RS.2017.⁷⁰

The FCC Public Notice asked for comment regarding adjacent band protection to update FCC part 30.203 out-of-band emission (OOBE) criteria originally based on ITU Res 752 (WRC-07) to align with out-of-band emission limits consist with ITU Res 243 (WRC-19) for protecting 36-37 GHz Earth Exploration Satellite (passive) and Space Research (passive) primary services.⁷¹ Some potential users of Lower 37 GHz opposed revising the OOBE limits for the 37 GHz band, arguing that revising the limit could make existing equipment unusable.⁷² These comments,

⁶⁹ This aligns with the measurement methodology based on the American Geophysical Union, American Meteorological Society and National Weather Association comments to FCC's Emission Limits in the 25.25-27.5 GHz Band, ET Docket No. 21-186/GN Docket No. 14-177.

⁷⁰ Since passive band data is combined across other passive band data to improve the accuracy of meteorological and space weather products it is important to look forward into ensuring the other passive bands are protected in line with Rec. ITU-R RS.2017.

⁷¹ See FCC Public Notice, WT Docket No. 24-243.

⁷² See Comments of CTIA, WT Docket No. 24-243 at 2, 4-6; Comments of NCTA, WT Docket No. 24-243 at 17-18; Comments of Ericsson, WT Docket No. 24-243 at 5; Comments of Verizon, WT Docket No. 24-243 at 6-7.

however, fail to provide information regarding the actual characteristics of the existing equipment, including any measurements of their actual OOB or the roll-off of their emissions over varying frequency ranges; the cost of modifying the equipment if necessary; and any evidence that the limits adopted at WRC-19 are not needed to protect the nearby passive services. We would expect that in any follow-on FCC rulemaking interested industry stakeholders will provide such details.

In contrast to the industry comments, the National Academy of Sciences' Committee on Radio Frequencies (CORF) stressed the importance of protecting the adjacent 36-37 GHz Earth Exploration Satellite Service band.⁷³ CORF assessed that the current OOB limits defined in Part 30.203 are barely sufficient to offer protection from a single 37 GHz transmitter within the entire footprint of a typical EESS (passive) sensor and urged immediate adoption of more stringent limits proposed in ITU Res 243 (WRC-19). CORF explained the natural thermal emissions being observed by microwave and millimeter wave remote sensing instruments are exceedingly weak, so interference thresholds are much lower than those for active communication systems. While active systems operate at signal-to-noise ratios, remote sensing receivers must measure changes in noise temperature of 0.1K or less. Because Earth remote sensing systems are total power radiometers, they have no way of distinguishing between natural thermal emissions these systems are designed to detect and in-band interference from artificial transmitters, unless the artificial signals rise to a level that causes a statistically or physically recognizable unnatural emission level. It is the lower level "insidious interference" that introduces unknown measurement bias into the remote sensing data. ITU-R RS.2017 establishes interference levels at which the consequences of this bias are at a tolerable level.⁷⁴ Moreover, should an application emerge for the Lower 37 GHz band that would involve an average number of active transmitters exceeding 10 per 100 km², CORF urged the Commission to consider other measures, such as further reduced OOB limits or restriction to indoor operation, to ensure continued protection of the EESS (passive) observations in the 36-37 GHz band.

It is notable that DoD's support for locating its 200 megahertz of priority spectrum at the low end of the band and its acceptance of the WRC-19 OOB limits, demonstrates its commitment to protecting the passive services in the adjacent band and its recognition of the importance of those services.

Before there is any widespread deployment of facilities in the Lower 37 GHz band, it is critical that the concerns raised above be fully addressed.

⁷³ See Comments of National Academy of Sciences' Committee on Radio Frequencies, WT Docket No. 24-243 (filed 27 Sep 2024).

⁷⁴ See ITU-R RS.2017 at https://www.itu.int/dms_pubrec/itu-r/rec/rs/R-REC-RS.2017-0-201208-I!!PDF-E.pdf.

III. CONCLUSION

The Lower 37 GHz band presents a unique opportunity to advance what the NSS describes as the “potential expanded governmental and non-governmental use for an array of advanced, next-generation applications and services.” A simple coordination framework to facilitate sharing based on “first-in” user rights that protects “second in” access will advance the long-standing vision for this co-primary band of co-equal access for Federal and non-Federal users. Further, this innovative sharing framework can be made possible by ensuring that adjacent band protections for passive space-based sensors are addressed in accordance with the recommendations to address the interference risk of new deployments of in the Lower 37 GHz band. We look forward to the next steps in implementing coexistence measures that advance a range of sharing innovations for this spectrum.

Appendix A - Glossary of Terms

3GPP	3rd Generation Partnership Project
CBRS	Citizens Broadband Radio Service
dBm	Decibel milliwatts
dBW	Decibel Watts
DIB	Defense Industrial Base
DoD	Department of Defense
DMSP	Defense Meteorological Satellite Program
DSMS	Dynamic Spectrum Management System
EES	Earth Exploration Satellite Service
FCC	Federal Communications Commission
FNPRM	Further Notice of Proposed Rulemaking
GAA	General Authorized Access
GHz	Gigahertz
IMT	International Mobile Telecommunications
I-Plan	Implementation Plan
IRAC	Interdepartment Radio Advisory Committee
ISAC	Interagency Spectrum Advisory Council
ITU	International Telecommunication Union
ITU-R	ITU Radiocommunication Sector
Lower 37 GHz Band	37.0-37.6 GHz
MHz	Megahertz
mmW	Millimeter Wave
NASA	National Aeronautics and Space Administration
NCTA	The Internet & Television Association
NOI	Notice of Inquiry
NPRM	Notice of Proposed Rulemaking
NSF	National Science Foundation
NSS	National Spectrum Strategy

37 GHz Band	37.0-38.6 GHz
NTIA	National Telecommunications and Information Administration
OBE	Out-of-Band Emission
OPSEC	Operational Security
R&O	Report and Order
SRF	Spectrum Relocation Fund
SRS	Space Research Service
TDD	Time Division Duplex
TRW	Total Radiated Power
UMFUS	Upper Microwave Flexible Use Service
Upper 37 GHz Band	37.6-38.6 GHz
USG	United States Government
USN	United States Navy
WPT	Wireless Power Transfer
WRC	World Radiocommunication Conference