

FCC FACT SHEET^{*}
Amendment of Part 90 of the Commission's Rules
Sixth Further Notice of Proposed Rulemaking - WP Docket No. 07-100

Background: The 4940-4990 MHz (4.9 GHz) band is 50 megahertz of spectrum allocated for fixed and mobile services and designated for public safety use. In 2002, the Commission envisioned that the band would support new broadband applications such as high-speed digital technologies and wireless local area networks (WLANs) for incident scene management, dispatch operations, and vehicular/personal communications. And yet, the development of the 4.9 GHz band to date appears to have fallen short of its potential. In June 2012, the Commission issued a Fifth Further Notice of Proposed Rulemaking to develop a record on several 4.9 GHz band issues, including potential band plan changes and expanding license eligibility beyond public safety entities.

What the Sixth Further Notice of Proposed Rulemaking Would Do:

- Propose to expand the channel aggregation bandwidth limit to 40 megahertz.
- Propose to allow public safety aeronautical mobile and robotic use on 5 megahertz of spectrum.
- Propose to require applicants for new stations and licensees seeking modifications to submit to frequency coordination administered by FCC-certified frequency coordinators.
- Propose to maintain the Universal Licensing System to serve as the frequency coordination database and modify the 4.9 GHz band application form to capture additional data.
- Propose to require existing licensees with point-to-point, point-to-multipoint, base, and mobile stations to seek licenses for such stations in the database so their operations can be protected during future coordination.
- Propose to restart the filing process for regional plans.
- Propose to accord primary status for point-to-point and point-to-multipoint links that carry or support narrowband traffic on five 1-megahertz channels.
- Propose to raise the minimum antenna gain for point-to-point transmitting antennas to 26 dBi to allow for more directional transmissions and larger antennas.
- Propose to revise the construction notification deadlines from 18 months after license grant to 12 months.
- Propose to grandfather existing licensees and their installed systems.
- Seek comment on alternative eligibility for entities such as Critical Infrastructure Industries.
- Seek comment on leasing, spectrum sharing approaches, and alternative uses.

* This document is being released as part of a “permit-but-disclose” proceeding. Any presentations or views on the subject expressed to the Commission or its staff, including by email, must be filed in WP Docket No. 07-100, which may be accessed via the Electronic Comment Filing System (<https://www.fcc.gov/ecfs/>). Before filing, participants should familiarize themselves with the Commission's *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. *See* 47 CFR § 1.1200 *et seq.*

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)
)
Amendment of Part 90 of the Commission’s Rules) WP Docket No. 07-100

SIXTH FURTHER NOTICE OF PROPOSED RULEMAKING*

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* This document has been circulated for tentative consideration by the Commission at its March 22, 2018 open meeting. The issues referenced in this document and the Commission’s ultimate resolutions of those issues remain under consideration and subject to change. This document does not constitute any official action by the Commission. However, the Chairman has determined that, in the interest of promoting the public’s ability to understand the nature and scope of issues under consideration by the Commission, the public interest would be served by making this document publicly available. The Commission’s ex parte rules apply and presentations are subject to “permit-but-disclose” ex parte rules. See, e.g., 47 CFR §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission’s ex parte rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission’s meeting. See 47 CFR §§ 1.1200(a), 1.1203.

I. INTRODUCTION

1. The Commission has allocated and designated 50 megahertz of spectrum in the 4.9 GHz band (4940-4990 MHz) to public safety.¹ Although nearly 90,000 public safety entities are eligible under our rules to obtain licenses in the band,² there were only 2,442 licenses in use in 2012 and only 3,174 licenses in use nearly six years later in 2018.³ With no more than 3.5% of potential licensees using the band, we remain concerned that, as the Commission stated in 2012, the band has “fallen short of its potential.”⁴

2. Public safety entities have offered several reasons why the band has seen less use than expected. One reason cited is the difficulty of acquiring equipment and the cost of deployment. According to the Association of Public-Safety Communications Officials International’s (APCO) 4.9 GHz Task Force Report (APCO Report), “the public safety user community remains small relative to the greater consumer marketplace,” which “has historically resulted in a limited vendor ecosystem, specialized devices, and higher costs.”⁵ We also believe that a lack of available equipment for mobile applications has impeded widespread use of the band by public safety. The National Public Safety Telecommunications Council (NPSTC) has argued that interference concerns have also suppressed use of the 4.9 GHz band. In its 4.9 GHz NPSTC Plan Recommendations Final Report (NPSTC Plan), NPSTC notes that because the Commission’s current rules “allow geographically based licensing with little documentation on system design and transmitter location,” public safety “contemplating new service in this band cannot determine if other agencies in their area might cause harmful interference today or in the future.”⁶

3. In this Sixth Further Notice of Proposed Rulemaking (*Sixth Further Notice*), we seek comment on several alternatives to stimulate expanded use of and investment in the 4.9 GHz band, drawing on comments in the record as well as the NPSTC Plan submitted in 2013 and the APCO Report submitted in 2015. Our goal is to ensure that public safety continues to have priority in the band while opening up the band to additional uses that will facilitate increased usage, including more prominent mobile use, and encourage a more robust market for equipment and greater innovation, while protecting primary users from harmful interference. We believe that with an appropriate sharing mechanism in place, which we discuss in further detail below, our proposed approach will promote more opportunistic use of the 4.9 GHz band without compromising the integrity and security of public safety operations.

¹ See *4.9 GHz Band Transferred from Federal Government Use*, WT Docket No. 00-32, Second Report and Order and Further Notice of Proposed Rulemaking, 17 FCC Rcd 3955 (2002).

² See U.S. Census Bureau, Statistical Abstract of the United States: 2012, Section 8, at 267, Table 428; See also 47 CFR §§ 90.523(a), 90.1203(a) (providing eligibility for governmental entities to hold licenses in the 4.9 GHz band).

³ Compare *Amendment of Part 90 of the Commission’s Rules; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band; Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150, Fourth Report and Order and Fifth Further Notice of Proposed Rulemaking, 27 FCC Rcd 6577, 6584 n. 49 (2012) (*Fifth Further Notice*), with <http://wireless2.fcc.gov/UlsApp/UlsSearch/searchAdvanced.jsp>; search parameters: Radio Service = PA – Public Safety 4940-4990 MHz Band; Authorization Type = Regular; Status = Active (last visited Jan. 26, 2018).

⁴ *Fifth Further Notice*, 27 FCC Rcd at 6584, para. 16.

⁵ APCO International 4.9 GHz Task Force Report, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150, at 12 (dated Sept. 28, 2015) (APCO Report).

⁶ NPSTC 4.9 GHz NPSTC Plan Recommendations Final Report, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150, at 1 (dated Oct. 24, 2013) (NPSTC Plan).

II. BACKGROUND

4. In June 2012, the Commission released the *Fifth Further Notice* in which it sought comment on rule changes intended to establish frequency coordination procedures for 4.9 GHz operations and to encourage spectrum efficiency and greater use of the 4.9 GHz band.⁷ It sought comment on how 4.9 GHz licensees currently use this spectrum, what applications and uses are best suited for the band, and what are the most cost-effective ways to improve accessibility to the band while minimizing adverse impact on incumbent operations.⁸ The Commission sought views on alternative frequency coordination proposals for 4.9 GHz licensees.⁹ The Commission also sought comment on specific proposals regarding expanded eligibility for critical infrastructure industry (CII) entities, for commercial entities on a secondary basis, subject to a shutdown feature, and for the First Responder Network Authority (FirstNet).¹⁰ The Commission also sought comment about the impact of the Middle Class Tax Relief and Job Creation Act of 2012 (Spectrum Act) on broadband uses of the 4.9 GHz band by public safety entities.¹¹ Finally, the Commission sought comment on whether to allow aeronautical mobile use in the 4.9 GHz band.¹²

5. The responsive comments to the *Fifth Further Notice* illustrate the wide variety of existing systems operating in the 4.9 GHz band and underscore the importance of developing rules that promote flexible use and maximize spectrum efficiency.¹³ Since the *Fifth Further Notice* the Commission has continued to build the record on the 4.9 GHz band. In October 2013, NPSTC submitted detailed recommendations in the NPSTC Plan, and the Public Safety and Homeland Security Bureau (Bureau) released a *Public Notice* seeking comment on the proposals in the NPSTC Plan.¹⁴ In September 2015, the APCO Report provided additional recommendations on how to increase public safety use of the band, reduce equipment costs, and drive investment in up-to-date technology in the band.¹⁵

⁷ *Fifth Further Notice*, 27 FCC Rcd at 6582 para. 10. The Commission received 31 comments and 5 reply comments in response to the *Fifth Further Notice*. The commenters are listed in Appendix A.

⁸ See *Fifth Further Notice* at 6584 para. 17.

⁹ *Fifth Further Notice* at 6585-92 paras. 19-41.

¹⁰ See *Fifth Further Notice* at 6592-93 para. 43, 6594-95 para. 47.

¹¹ See *Fifth Further Notice* at 6584 para. 17; see Pub. L. No. 112-96, 126 Stat. 156 (2012).

¹² See *Fifth Further Notice* at 6600 para. 61.

¹³ Current licensees use the band for: citywide deployment of 2.4 GHz/4.9 GHz wireless broadband internet access network (APCO Report at 4); fixed point-to-point (P-P) links and point-to-multipoint (P-MP) hubs to manage and monitor traffic and road conditions (AASHTO Comments at 7-9); mesh networks in support of security video and public safety operations and a P-MP network for voice and data communications (King County Comments at 1-2 and APCO Report at 4); WLANs (Port Angeles Comments at 1-2, APCO Report at 4, City of New York Comments to NPSTC Plan at 3); links for video and data backhaul that support security camera networks (Chicago Comments at 2, City of New York Comments to NPSTC Plan at 1-2); P-P and P-MP to connect and supply public safety answering points (PSAPs), fire departments, and law enforcement agencies with mission-critical voice and data (Grundy ETSB Comments at 3); base stations along commuter rail lines to support real-time incident video transmission, support police, and operate Positive Train Control systems (Denver RTD Comments at 3); deployable systems to support operations addressing wildfires (NPSTC Comments at 5); and emergency call boxes (NYCTA Comments to the NPSTC Plan at 5).

¹⁴ *Public Safety and Homeland Security Bureau Seeks Comment on National Public Safety Telecommunications Council's 4.9 GHz NPSTC Plan Recommendations Final Report*, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150, Public Notice, 28 FCC Rcd 14865 (PSHSB 2013). The Commission received 11 comments and 6 reply comments in response to the NPSTC Plan. The commenters are listed in Appendix A.

¹⁵ APCO Report.

III. SIXTH FURTHER NOTICE OF PROPOSED RULEMAKING

6. Taking into consideration the record in response to the *Fifth Further Notice*, comments on the NPSTC Plan, the APCO Report, and more recent *ex parte* filings,¹⁶ we now propose a limited set of rules for the 4.9 GHz band to promote more flexible and intensive use of this public safety spectrum while preventing interference. Our goals are (a) to support the needs of public safety while opening the band to other compatible uses, (b) to maximize spectral efficiency and usage, (c) to promote a common equipment ecosystem that will drive down equipment costs and stimulate investment through economies of scale, (d) to encourage innovation, and (e) to ensure that secondary users do not cause interference to primary users.

7. In this *Sixth Further Notice*, we review the major issues previously identified in the *Fifth Further Notice*; in the NPSTC Plan and the APCO Report and in comments on both of these evaluations; and in subsequent *ex parte* proposals. We then propose and seek comment on specific rules and policies intended to address each issue, and seek comment on and solicit alternative proposals.

A. Band Plan

8. In the *Fifth Further Notice*, the Commission sought comment on the current 4.9 GHz band plan, which divides the band into ten one-megahertz channels (Channels 1–5 and 14–18) and eight five-megahertz channels (Channels 6–13), and limits channel aggregation bandwidth to 20 megahertz.¹⁷ The NPSTC Plan proposes to keep this channelization, but recommends aggregating Channels 1–5 into a single 5 megahertz channel designated for air-to-ground communications and robotic use¹⁸ and proposes to reduce the current channel aggregation limit from 20 to 10 megahertz.¹⁹ The APCO Report proposes no band plan changes but calls for relaxing the 20 megahertz channel aggregation limit, arguing that this would enable the band to accommodate 40 megahertz products that are currently available only outside the U.S.,²⁰ which relaxation could “create a better business case for manufacturers,” and would “provide more options for rural deployments.”²¹

9. *Discussion.* Most commenters express support for the NPSTC band plan proposal.²² Based in part on the NPSTC band plan, we propose to retain the existing channelization plan for the band,

¹⁶ See, e.g., Letter from Presidential Partner Consulting to Marlene H. Dortch, Secretary, Federal Communications Commission, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150 (dated Mar. 5, 2016) (PPC *ex parte*); Letter from Kurt Schaubach, Chief Technology Officer, Federated Wireless, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150 (dated May 18, 2016) (Federated Wireless *ex parte*); Letter from Ralph A. Haller, Chairman, NPSTC, to Marlene H. Dortch, Secretary, Federal Communications Commission, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150 (dated July 8, 2016) (NPSTC *ex parte*); Letter from Stephen Comstock, Director, Tax and Accounting Policy, American Petroleum Institute, to Marlene H. Dortch, Secretary, Federal Communications Commission, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150 (dated Aug. 5, 2016).

¹⁷ *Fifth Further Notice* at 6597 para. 53.

¹⁸ NPSTC Plan at 6. NPSTC notes that the term “air-to-ground” includes ground to air communications. *Id.* at 8 note 11. We infer the same when we use interchangeably either “air-to-ground” or “aeronautical mobile.”

¹⁹ NPSTC Plan at 6, 12; see 47 CFR § 90.1213(a)-(b).

²⁰ APCO Report at 13. 40 megahertz products are not available in the US because of the 20 megahertz limit on channel aggregation in the Commission’s current rules. See 47 CFR § 90.1213(a)-(b).

²¹ APCO Report at 13. Relaxing the 20 megahertz aggregation to permit a 40 megahertz channel “should be possible with proper frequency coordination and would be quite useful especially in rural areas that have little or no use of the band. This would support public safety needs for cameras and data intensive applications that require more bandwidth.” *Id.*

²² See APCO Comments to the NPSTC Plan at 2, the Forestry Conservation Communications Association, International Municipal Signal Association, and International Association of Fire Chiefs (FCCA/IAFC/IMSA)

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but we seek comment below on more flexible aggregation limits, and in Section B, we propose to modify the 4.9 GHz band plan by aggregating Channels 1 - 5 to form a five-megahertz bandwidth channel for aeronautical mobile and robotic use. Although current geographic licenses authorize use of the entire 50 megahertz by all qualified services, we envision that under our revised rules we would grant licenses for specific uses that would authorize specific channels. We are concerned that the current geographic licensing model does not provide sufficient information on specific channel usage to facilitate effective frequency coordination, which we propose below for the 4.9 GHz band.²³ For example, we seek comment on licensing base stations and hot spots site-by-site rather than blanket geographic licensing, and licensing these stations and mobiles for a specific channel or channels instead of the entire band, to the extent that channel use is static. Does 4.9 GHz equipment dynamically change channels as needed throughout the band to avoid interference? We seek comment on these proposals.

10. We further propose to expand the existing channel aggregation bandwidth limit to 40 megahertz and seek comment on that proposal, which could provide more options of the type advocated in the APCO Report, such as new rural deployments, and may enable public-safety access to 5G technologies.²⁴ We seek comment on this proposal. We are concerned that narrowing the limit to 10 megahertz as proposed in the NPSTC Plan would constrain flexibility and discourage use of innovative broadband technologies.²⁵ We nonetheless propose to allow Regional Planning Committees (RPCs) to submit plans to limit aggregations to 20 megahertz.²⁶ We solicit alternative band plan suggestions or modifications to the above. For example, should we permanently aggregate Channels 6-9 and 10-13 to form two 20-megahertz channels? We seek comment about the relative costs and benefits of wider channels. Are wider channels needed to drive innovation of equipment in the band, or are the current aggregation limits sufficient?

11. We agree with commenters that any reconfiguration or repurposing of the 4.9 GHz band should not force incumbent licensees to modify, abandon, or replace existing 4.9 GHz facilities, which would impose technical, operational, and financial burdens on those incumbents.²⁷ Therefore, we propose to grandfather all incumbent users as of the date any final rules become effective.²⁸ As we discuss below in Section D, we further propose that those incumbent licensees whose authorizations currently encompass the entire 4.9 GHz band must certify the channels they actually use when they input their transmitter and receiver parameters into the Commission's Universal Licensing System (ULS) database. Only those channels for which operating parameters have been supplied would receive protection. We seek comment on this approach, under which all new primary and secondary users of the band will be

Comments to the NPSTC Plan at 2, Region 13 Comments to the NPSTC Plan at 1, API Comments to the NPSTC Plan at 6, EWA Comments to the NPSTC Plan at 3, UTC Comments to the NPSTC Plan at 6-7. A few commenters argue that a more dynamic spectrum sharing framework would lead to increased use of the band by new technologies that enable real-time spectrum sharing and interference management. *See Federated Wireless ex parte*, *PPC ex parte*. We discuss options for shared use of this band *infra* in Section III.K.

²³ *See infra* Section III.C.

²⁴ *See* APCO Report at 13; *see also* UTC Comments at 12 (“30 MHz wide channels ... will support OC3 capacity traffic”).

²⁵ *See* King County and the City of Seattle Comments to the NPSTC Plan at 5, Region 8 Comments to the NPSTC Plan at 6; City of New York Comments to the NPSTC Plan at 8.

²⁶ UTC Comments at 12 (“30 MHz wide channels ... will support OC3 capacity traffic”), APCO Report at 13.

²⁷ *See* Region 8 Comments to the NPSTC Plan at 6, City of New York Comments to the NPSTC Plan at 8, King County/Seattle Comments to the NPSTC Plan at 6, Vislink, Inc. (Vislink) Reply Comments to the NPSTC Plan at 1. *See also* SSC Comments to the NPSTC Plan at 3-4 (opposing “static” allocation of channels to any one service as an inefficient use of spectrum).

²⁸ *See* Vislink Reply Comments to the NPSTC Plan at 1 (“[a] grandfather clause may be necessary to protect existing users.”).

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required to coordinate around and protect incumbent users. We also seek comment on whether a temporary licensing freeze before the release date of a report and order in this proceeding and lasting until the effective date of the final rules would be necessary to prevent the filing of applications for systems that are incompatible with the modified band plan.

B. Aeronautical Mobile and Robotic Use

12. In the *Fifth Further Notice*, the Commission sought comment on whether to lift the general prohibition on aeronautical mobile operations in the 4.9 GHz band.²⁹ The Commission proposed to revise Section 90.1205(c) to permit aeronautical mobile operation in the band on a secondary, non-interference basis to 4.9 GHz terrestrial services and subject to demonstrating interference protection to radio astronomy (RAS) operations.³⁰ The Commission sought comment on whether to impose restrictions or conditions on aeronautical mobile use, such as an altitude limit of 1500 feet above ground.³¹

13. Eight parties filed comments to the *Fifth Further Notice* in support of allowing aeronautical mobile operations under such conditions.³² The National Academy of Sciences Committee on Radio Frequencies (CORF), an organization representing RAS observatories, requests the following conditions: (1) make the aeronautical use secondary to terrestrial services, including RAS; (2) limit the altitude of use of this band to 1500 feet above the altitude of the observatory and limit operation to greater than 50 miles from observatories; (3) require aeronautical mobile applicants within 50 miles of protected observatories to demonstrate that the former will protect the latter from interference; and (4) require applicants within 50 miles of protected observatories to certify that they have served a copy of their application on such observatories.³³ AASHTO recommends that air-to-ground operations that employ omnidirectional antennas should be limited to low power, while operations using steerable directional antennas that minimize interference to terrestrial users could employ higher power.³⁴ FCCA/IAFC/IMSA recommend a maximum altitude of “500 feet above ground for direct, non-directional air-to-ground video feeds,” a maximum bandwidth of five megahertz for a video feed, and a requirement that “aircraft providing video feeds to fixed remote receive sites must use steerable antennas and be limited to 1500 feet above ground level.”³⁵

14. The NPSTC Plan recommends aggregating Channels 1-5 into a five-megahertz channel to be used for air-to-ground communications and robotic communications.³⁶ The NPSTC Plan would permit transmissions at altitudes up to 400 feet above ground level, and at higher altitudes if the licensee has a waiver.³⁷ The proposal would require aeronautical mobile operations with an area of operation less

²⁹ *Fifth Further Notice* at 6600 para. 61. See 47 CFR §§ 2.106, 90.1205(c).

³⁰ RAS observations may be made in the band 4950-4990 MHz, which overlaps 40 megahertz of the 4.9 GHz band. See 47 CFR § 2.106 note US385.

³¹ *Fifth Further Notice* at 6601 para. 62.

³² AASHTO Comments at 14, FCCA/IAFC/IMSA Comments at 15-16, Grundy ETSB Comments at 9, Region 54 Comments at 9, NPSTC Comments at 11, Port Angeles Comments at 5, CORF Comments at 1-8, CSS Comments at 1.

³³ CORF Comments at 1-2. See also Grundy ETSB Comments at 9, Region 54 Comments at 9 concurring with 1500-foot altitude limit.

³⁴ AASHTO Comments at 14.

³⁵ FCCA/IAFC/IMSA Comments at 15.

³⁶ NPSTC Plan at 6. See supporting comments FCCA/IMSA/IAFC Comments to the NPSTC Plan at 2, LA County Comments to the NPSTC Plan at 1-2, Vislink Reply Comments to the NPSTC Plan at 2.

³⁷ NPSTC Plan at 8 (also opposing operations above 1500 feet because of the wide area of potential interference).

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than 80.5 km from listed RAS sites to obtain concurrence from the affected RAS site.³⁸ NPSTC proposes licensing robotic operations on Channels 1-5 on a shared basis with air-to-ground operations,³⁹ not allowing Channels 1-5 to be used for point-to-point (P-P)⁴⁰ communications, and migrating existing users to other channels.⁴¹ APCO also supports these proposals, noting that “modification of the existing rules, using the guidelines proposed in the NPSTC recommendations, would allow use of the 4.9 GHz band for air to ground communications, would add to the available public safety portfolio, and would assist with increasing public safety use of the spectrum.”⁴² APCO also supports “following the proposal contained in the NPSTC report with regard to robotic operations to allow for use of 4.9 GHz spectrum on a controlled and limited basis for robotic applications.”⁴³

15. *Discussion.* We propose to designate Channels 1-5 as aeronautical mobile channels in the 4.9 GHz band. The proposed channel selection provides spectral separation from RAS operations in the 4950-4990 MHz band. As NPSTC notes, the 4.9 GHz band is an ideal short range band with the bandwidth required to transmit video from air to ground. Moreover, many law enforcement agencies operate helicopters and planes using video cameras and so could benefit from this rule change.⁴⁴

16. We also propose to designate Channels 1-5 for robotic use. Although law enforcement has been using robots for several years, these devices currently operate on an unlicensed basis and are unprotected from interference.⁴⁵ Modifying our rules to allow robotic operations could thus improve public safety. We seek comment on the relative costs and benefits of adding robotic use to this band. Is interference likely to be a problem for public safety robots? We propose to limit aerial transmitted information to video payload and to prohibit use of the 4.9 GHz band for aircraft (including unmanned aircraft systems) command and control. We seek comment on these proposals and also request commenting parties to address whether similar restrictions on payload and command and control frequencies should be imposed on robotic uses.

17. One of the potential cost of these rules would be that, for other than grandfathered licensees, the public safety use of Channels 1-5 would be limited to aeronautical mobile and robotic operations. We seek comment on the extent to which limiting the flexibility of spectrum use in this manner imposes costs by, *e.g.*, creating cumbersome regulatory obstacles to repurposing the spectrum for alternative public safety needs that may become more pressing as circumstances change. Are there any countervailing benefits in establishing these proposed use restrictions? We also seek comment on the potential benefits of the proposed rule apart from such restrictions. Such benefits, which may be significant, would include that aeronautical mobile functionality would provide to first responders, who could use Channels 1-5 to transmit airborne video of emergency scenes such as wildfires, vehicle pursuits, and other events to assist in response and recovery efforts. A benefit of using these channels for robotic operations would be to enhance first responder safety by allowing users to send remote controlled, camera-equipped mobile devices into potentially dangerous situations. We seek comment on the magnitude of these and any other relative costs and benefits.

18. Because we decline to propose mandatory relocation of incumbent terrestrial users on

³⁸ NPSTC Plan at 8. *See* 47 CFR § 2.106 footnote US385.

³⁹ NPSTC Plan at 9.

⁴⁰ A point-to-point connection refers to a communications connection between two nodes or endpoints.

⁴¹ NPSTC Plan at 9.

⁴² APCO Report at 11.

⁴³ APCO Report at 11.

⁴⁴ NPSTC Plan at 8.

⁴⁵ NPSTC Plan at 8.

Channels 1-5,⁴⁶ we therefore propose to require aeronautical mobile and robotic operations to be frequency coordinated around incumbent terrestrial users of Channels 1-5, consistent with the frequency coordination procedures proposed in Section III.C below, including RPC review.⁴⁷ We seek comment on the relative costs and benefits of this coordination requirement. Once aeronautical mobile and robotic operations are licensed, we propose to grant them co-primary status on Channels 1-5. Therefore, during an incident or emergency requiring such use, they would be able to operate on an equal basis with terrestrial users, around which they have already been coordinated, presenting a minimal risk of interference. To prevent future terrestrial licensing in the 4940-4945 MHz segment, we propose to revise Section 90.1207 so terrestrial-based licenses are only available in the 4945-4990 MHz segment rather than the entire band. We seek comment on the relative costs and benefits of these proposals and alternative approaches.

19. While we propose to allow manned aeronautical use of Channels 1-5, we believe it would be premature at this time to permit unmanned aerial systems (UAS) to transmit in the 4.9 GHz band. The Federal Aviation Administration's (FAA) Part 107 rules limit small UAS operations to 400 feet altitude above ground, require visual line of sight aircraft operation, prohibit operations over people, and prohibit operation in certain airspace, among other restrictions.⁴⁸ The FAA's UAS altitude limit is well below our proposal of 1500 feet above ground, and the other restrictions may present impediments to effective public safety use of UAS. Moreover, the Commission has not yet issued service rules for UAS operations in any specific spectrum band.⁴⁹ Nevertheless, we seek comment on the potential for the 4.9 GHz band to support possible future UAS payload operations.

20. We propose to establish a maximum altitude limit of 1500 feet (457 meters) above ground level (AGL) for manned airborne operations on Channels 1-5.⁵⁰ We believe this limit allows greater flexibility than NPSTC's proposal of 400 feet and is consistent with the altitude limit adopted for air-to-ground communications in the 700 MHz narrowband spectrum.⁵¹ However, because FAA rules require fixed-wing aircraft to maintain certain clearances around structures,⁵² we propose to allow fixed-wing aircraft to transmit at altitudes exceeding 1500 feet AGL, but only to avoid obstructions, and then only in the immediate area of the obstruction. We seek comment on the terrestrial interference potential

⁴⁶ RPC8 notes that there are existing operations in the current band plan in the Region, including channels 1-5. Region 8 Comments to the NPSTC Plan at 7.

⁴⁷ The Commission will coordinate these applications with NTIA in accordance with our established procedures under the Memorandum of Understanding between the FCC and NTIA.

⁴⁸ See 14 CFR §§ 107.51(b), 107.31, 107.39, 107.41.

⁴⁹ The Commission's current rules provide for hobbyist and unlicensed UAS uses. See 47 CFR Part 95 Subpart C.

⁵⁰ FAA rules and state and local ordinances on aviation would take precedence over our proposed altitude transmission limits.

⁵¹ See *Proposed Amendments to the Service Rules Governing Public Safety Narrowband Operations in the 769-775/799-805 MHz Bands*, PS Docket No. 13-87; *National Public Safety Telecommunications Council Petition for Rulemaking on Aircraft Voice Operations at 700 MHz*, RM-11433; *National Public Safety Telecommunications Council Petition for Rulemaking to Revise 700 MHz Narrowband Channel Plan*, RM-11433; *Region 24 700 MHz Regional Planning Committee Petition for Rulemaking*, WT Docket No. 96-86, PS Docket No. 06-229; *State of Louisiana Petition for Rulemaking*, RM-11577; Report and Order, 29 FCC Rcd 13283, 13291 para. 18 (2014) (*700 MHz Report and Order*).

⁵² 14 CFR § 91.119. "Except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes: ... (b) *Over congested areas*. Over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft. (c) *Over other than congested areas*. An altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure." 14 CFR § 91.119(b)-(c).

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and coverage of fixed-wing aircraft compared to the interference potential and coverage of helicopters, and whether any restrictions or prohibitions should apply to either group of aircraft.

21. We propose to allow air-to-ground and robotic transmissions only from low power devices as defined in Section 90.1215 of our rules⁵³, which limits maximum conducted output power to 14 dBm per 5 megahertz bandwidth and use of a directional antenna to confine radiation to the direction of the associated receiving antenna.⁵⁴ We seek comment on this proposed power limit, as well as on other techniques to minimize interference. For example, AASHTO and LA County propose to allow use of higher powered steerable directional antennas for air-to-ground communications,⁵⁵ while Vislink contends that some air-ground communications will require omnidirectional antennas.⁵⁶ We seek comment on the current state of aerial steerable directional antenna technology and the associated cost of such equipment.

22. To minimize the impact of 4.9 GHz aeronautical and robotic operations on the important work being done by RAS observatories,⁵⁷ we propose that aeronautical mobile and robotic operations, as with all other 4.9 GHz band operations, make every effort to protect the RAS observatories listed in our rules.⁵⁸ We propose that aeronautical mobile use shall generally be prohibited within 80.5 kilometers from a listed RAS site.⁵⁹ Public safety entities seeking authorization for aeronautical mobile operations fewer than 80.5 kilometers from a listed RAS site would be required to submit a waiver request and notify and obtain concurrence from the affected observatory. Next, we propose to apply the L emission mask to aeronautical mobile devices on Channels 1-5, which will provide attenuation of 40 dB at 4950 MHz and above⁶⁰ to minimize emissions into RAS. We do not propose to require robotic operations to maintain 80.5 km spacing to RAS sites. Robotic operations are transient and, because of their lower antenna elevations relative to airborne operations, do not pose an equivalent interference issue. Moreover, RAS sites are typically located in remote areas where robotic operations are unlikely to take place. We seek comment on our conclusion concerning the interference potential of robotic operations to RAS operations

⁵³ 47 CFR § 90.1215.

⁵⁴ 47 CFR § 90.1215(b). For low power devices, if transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. *Id.*

⁵⁵ AASHTO Comments at 14, LA County Comments to the NPSTC Plan at 1-2. We address more on directional antennas in the Section III.H *infra*.

⁵⁶ Vislink Reply Comments to the NPSTC Plan at 2 (arguing that certain scenarios may only be viable with omnidirectional antennas, including the seamless integration of airborne nodes into mesh networks).

⁵⁷ “Radio astronomy observations in the 4.9 GHz band are extremely useful in studying brightness distributions of objects such as ionized hydrogen clouds surrounding young stars, remnants of supernovae which mark the cataclysmic end of stars, and ejecta traveling at nearly the speed of light from black holes in the nuclei of galaxies. Such observations allow scientists to construct detailed maps of such phenomena, to understand their structures and dynamics, and to derive physical parameters from the sources, such as their total masses. Observations of radio emissions from neutron stars and black holes are particularly sensitive to interference due to variability, and one cannot just re-observe such phenomena at a later time.” CORF Comments at 4.

⁵⁸ 47 CFR § 2.106, footnote US385.

⁵⁹ A transmission at an altitude of 1,500 feet travels 47.5 miles by line-of-sight assuming a spherical earth, so CORF supports a 50-mile (80.5-kilometer) minimum distance between observatories and aircraft operating at 1500 feet. *See* CORF Comments at 6-7, NPSTC Plan at 8. The coordinates for the RAS observatories are listed in footnote US385 or footnote US131, except for the Allen Telescope Array, which is located at 40° 49' 01" North latitude, 121° 28' 12" West longitude. *See* 47 CFR § 2.106 footnotes US131 and US385.

⁶⁰ 47 CFR § 90.210(1)(6).

(continued....)

and on any burdens that these proposed RAS protection rules would impose, including the burden placed on small entities.

23. Next, we propose to amend Section 2.106 of the Commission's rules to remove the prohibition on aeronautical mobile service use from the 4940-4950 MHz band in the non-Federal Table of Frequency Allocations, *i.e.*, we propose to reallocate the lower 10 megahertz segment of the 4940-4990 MHz band from the "mobile except aeronautical mobile" service to the "mobile" service. This action would parallel the International Table and provide the Commission with additional flexibility with regard to the future use of the mobile service.⁶¹ We request comment on this proposal.

24. Finally, we remind commenters that the United States has border agreements with Canada and Mexico for the 4.9 GHz band that limit potential air-ground operations in border areas. In the Canada Agreement, the Commission agrees not to authorize aeronautical mobile stations within 160 kilometers of the border area without the written consent of Innovation, Science and Economic Development Canada (ISED).⁶² In the Mexico Agreement, for stations operated in aircraft, power flux density shall not exceed -114 dBW/m² in any 1 MHz bandwidth at or beyond the common border.⁶³ Thus, any rules we may adopt authorizing aeronautical use will be subject to these restrictions in border areas. However, we retain the option of seeking future revision of these cross-border agreements through appropriate international channels. The limits arising from these international agreements would continue to apply to all licensees in the 4.9 GHz band, including aeronautical and robotic uses.

C. Coordination

25. Our rules currently require 4.9 GHz licensees to "cooperate in the selection and use of channels in order to reduce interference and make the most effective use of the authorized facilities,"⁶⁴ but do not require prior frequency coordination. We note that current 4.9 GHz band licenses authorize use of the entire band and are geographic rather than site-based. Thus, they allow licensees to deploy base stations, mobile units, and temporary fixed stations anywhere within the licensee's jurisdiction using any part of the spectrum band by informally coordinating with other uses, and without having to obtain prior clearance from the Commission.⁶⁵ In the 2009 *Further Notice* in this proceeding, the Commission expressed concern that informal self-coordination "may not ensure that applicants for primary permanent fixed stations offer sufficient protection to other primary permanent fixed stations and other co-primary users."⁶⁶ Accordingly, the Commission proposed a notice-and-response coordination procedure conducted among applicants and licensees similar to the procedure used for point-to-point (P-P)

⁶¹ In the International Table of Frequency Allocations, the 4800-4990 MHz band is allocated to the fixed and mobile services on a primary basis, and to the radio astronomy service on a secondary basis, in all Regions. International footnote 5.442 states, *inter alia*, that the allocation of the mobile service in the 4950-4990 MHz band is restricted to the mobile, except aeronautical mobile, service. See 47 CFR § 2.106.

⁶² See Arrangement L, Sharing Agreement Between the Department of Industry of Canada and the Federal Communications Commission of the United States of America Concerning the Use of the Frequency Band 4940-4990 MHz by the Mobile and Fixed Services Along the Canada-United States Border, May 10, 2013 at 2, available at http://transition.fcc.gov/ib/sand/agree/files/can-nb/Arrangement_L.pdf.

⁶³ Protocol Between the Department of State of the United States of America and the Secretariat of Communications and Transportation of the United Mexican States Concerning the Use of the 4940-4990 MHz Band for Terrestrial Non-Broadcasting Radiocommunication Services Along the Common Border, Dec 1, 2009 at 6, Appendix I, available at <http://www.state.gov/documents/organization/186969.pdf>.

⁶⁴ 47 CFR § 90.1209(b).

⁶⁵ See 47 CFR § 90.1207.

⁶⁶ See *Amendment of Part 90 of the Commission's Rules*, WP Docket No. 07-100, Report and Order and Further Notice of Proposed Rulemaking, 24 FCC Rcd 4298, 4317 para. 44 (2009).

microwave applications under Part 101 of the Commission's rules.⁶⁷ However, in the *Fifth Further Notice*, the Commission acknowledged the views of the majority of commenters that notice-and-response coordination "may not be appropriate for this band because [it] would add a level of uncertainty and complexity to the coordination process,"⁶⁸ and sought comment on requiring 4.9 GHz applications to be submitted to a third party such as a certified public safety frequency coordinator or an RPC.⁶⁹ Most commenters to the *Fifth Further Notice* supported certified frequency coordination for the 4.9 GHz band,⁷⁰ although a few commenters argued that the *status quo* of self-coordination is working.⁷¹

26. NPSTC's Plan proposes that 4.9 GHz applications be coordinated by a certified public safety frequency coordinator.⁷² APCO supports NPSTC's recommendation because "many public safety users and manufacturers choose not to invest in the 4.9 GHz band because it is not coordinated."⁷³ Specifically, APCO reports that "the current jurisdictional licensing model is viewed within the public safety community as too similar to an unlicensed structure to provide the degree of confidence needed for mission critical communications, including sensitive transmissions."⁷⁴ APCO asserts that "new frequency coordination procedures designed to improve usage, performance, and interference protection would encourage public safety entities that have been reluctant in the past to begin utilizing the 4.9 GHz Band."⁷⁵

27. *Discussion.* We propose to require certified frequency coordination for licensing in the 4.9 GHz band. Given that our goal is to encourage a wide variety of uses of the 4.9 GHz band, we agree with NPSTC, APCO, and the majority of commenters that neither self-coordination nor a notice-and-response coordination procedure is likely to be sufficient to ensure interference protection to primary users in a mixed use environment. We seek comment on this view. We do not propose to require incumbent 4.9 GHz licensees to submit to frequency coordination for their existing operations. Rather, as noted above, we propose to grandfather incumbent operations provided that they file certain technical information on P-P, point-to-multipoint (P-MP), base, and mobile operations in our licensing database as discussed *infra* in Section D.

28. We propose that, subject to qualification criteria, Public Safety Pool frequency coordinators which the Commission has certified to coordinate in other Part 90 spectrum bands should be eligible to coordinate applications in the 4.9 GHz band. We seek comment on whether to limit 4.9 GHz band coordination to public safety coordinators or whether to allow coordination by non-public safety coordinators as well.⁷⁶ To ensure that coordinators are qualified to address band-specific coordination issues, we propose to require all frequency coordinators seeking to coordinate in the 4.9 GHz band to

⁶⁷ See *id.* at 4317 para. 45. See also 47 CFR §§ 90.1209(b), 101.103(d).

⁶⁸ *Fifth Further Notice* at 6587 para. 24.

⁶⁹ *Fifth Further Notice* at 6590-91 para. 34-36.

⁷⁰ AASHTO Comments at 6, APCO Comments at 2, Denver RTD Comments at 6, FCCA/IMSA/IAFC Comments at 6, LA County Comments at 1-2, NPSTC Comments at 5, Port Angeles Comments at 3, EWA Reply at 6, GRE Comments at 6, NPPD Comments at 2, MSI Comments at 2.

⁷¹ Chicago Comments at 4, EMR Comments at 3, Mobile County Comments at 1.

⁷² NPSTC Plan at 12.

⁷³ APCO Report at 10.

⁷⁴ APCO Report at 10.

⁷⁵ APCO Report at 10.

⁷⁶ EWA Reply Comments at 6; API Comments to the NPSTC Plan at 4-5. See also Letter from Elizabeth R. Sachs, Lukas, Nace, Gutierrez & Sachs, LLP (representing EWA), to Marlene H. Dortch, Secretary, Federal Communications Commission, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150 (dated Oct. 19, 2015).

submit a qualification showing, which would include a coordination plan and a showing of expertise specifically for the 4.9 GHz band. We further propose to direct the Public Safety and Homeland Security Bureau to certify coordinators for the band. We seek comment on these proposals, including whether a qualification showing would place a burden on small entities. Current public safety frequency coordinator fees for frequency pair/site combinations range from \$60 to \$315 depending on the frequency band.⁷⁷ We seek comment on the relative costs and benefits of frequency coordination.

29. The NPSTC Plan proposed that frequency coordinators would send each application to the applicant's home RPC for a five-business day review.⁷⁸ We believe this particular proposal is burdensome on RPCs and redundant with the frequency coordinator's function and invite comment on this tentative conclusion. However, NPSTC also proposed that any application where the power flux density (PFD) into an adjacent region border exceeds -109 dBW/m² would be flagged to be sent to the adjacent RPC to review. We believe this proposal may help prevent interference between regions, so we propose to adopt it. We seek comment on whether this PFD is an appropriate threshold, how PFD should be calculated and predicted, and how a PFD dispute would be resolved. We seek comment on what bandwidth reference should apply to this proposed PFD limit, *e.g.*, is a 5 megahertz bandwidth appropriate?

30. Finally, we seek comment on whether waiving frequency coordination for certain technology could serve as incentive for manufacturers and licensees to use such technology in the 4.9 GHz band without creating harmful interference. Should we exempt certain short term uses from frequency coordination, such as public safety robotic uses or ad hoc mobile networks? If so, how could such users minimize interference potential to existing operations in the same areas?

D. Database and Existing Licensees

31. In the *Fifth Further Notice*, the Commission noted that ULS does not contain information specifying receiver location for 4.9 GHz band P-P or P-MP links, geographically licensed base station coordinates, antenna gain, output power, and antenna height.⁷⁹ Because a frequency coordinator lacking this information would have difficulty protecting incumbent primary fixed links and base stations from interference from new operations, the *Fifth Further Notice* proposed to require all current 4.9 GHz licensees to register the technical parameters of their permanent fixed P-P, P-MP, and base-to-mobile stations, including permanent fixed receivers when applicable, into a coordination database to ensure that primary operations receive proper interference protection.⁸⁰ The Commission "tentatively concluded that the most cost-effective option is for the Commission to create and maintain a 4.9 GHz registration database that is modeled after an existing database," such as the millimeter wave band registration database in ULS.⁸¹ The Commission also sought comment on whether to use a third party database such as the Computer-Assisted Pre-Coordination Resource and Database (CAPRAD) or a dynamic database

⁷⁷ <http://www.apcointl.org/spectrum-management/frequency-coordination/fees.html>, http://www.imsasafety.org/IMSA/Frequency_Coordination/IMSA/IMSA_Frequency_Coordination/IMSA_Frequency_Coordination.aspx, http://www.fcca-usa.org/frequency_coordination_fee_schedule.php, http://aashto.radiosoft.com/Pages/downloads/AASHTO_fees_2016.05.01.pdf.

⁷⁸ NPSTC Plan at 12.

⁷⁹ *Fifth Further Notice* at 27 FCC Rcd 6588 para. 27. The current 4.9 GHz license format is geographic in nature except for permanent fixed point-to-point and point-to-multipoint stations, where permanent fixed transmitters are authorized on an individual basis. A licensee has authority to operate base stations, mobile units, and temporary fixed stations anywhere within the jurisdiction of the license. See 47 CFR §§ 90.1207(a), (b), (c). Thus, data for base stations and fixed receivers are not currently stored in ULS.

⁸⁰ *Fifth Further Notice* at 6588 para. 27.

⁸¹ *Fifth Further Notice* at 27 FCC Rcd 6590 para. 33.

similar to the Television White Space (WS) database.⁸²

32. Commenters generally agree that the 4.9 GHz band is hampered by lack of a reliable database that provides technical information about current licensee deployments.⁸³ The APCO Report concludes that wider use of the 4.9 GHz band is inhibited by “blanket geographical licensing for fixed and mobile operations on any channel across the band,”⁸⁴ And therefore proposes that “all fixed locations be identified and licensed for a specific channel or channels.”⁸⁵ The NPSTC Plan proposes that incumbent licensees be required to “relicense using the proposed frequency coordination process and appropriate ULS schedules” within one year from when ULS is ready to accept applications using the new process.⁸⁶ It also proposes that incumbent licensees that do not conform to the new band plan (including any region-specific variations) must modify their licenses within five years of the adoption of new rules.⁸⁷

33. The NPSTC Plan recommends using ULS to compile the information needed for coordination because “ULS is already funded” and “data required for coordination is already collected by ULS in the application process.”⁸⁸ NPSTC opposes using a private database that would “require the applicants to fund the entire cost of capturing, storing, and making data available to coordinators.”⁸⁹ However, other commenters suggest establishing a geo-location database similar to the WS database, so that commercial and unlicensed users could use the 4.9 GHz band on a secondary basis.⁹⁰

34. *Discussion.* Our rules specify that 4.9 GHz licensees encountering or causing harmful interference are expected to cooperate and resolve the problem by mutually satisfactory arrangements.⁹¹ Based on the record in this proceeding, we believe that concerns from public safety users of this band regarding resolution of interference issues in the 4.9 GHz band would be addressed if more complete technical information is available to all affected parties. Therefore, we propose to require incumbent licensees and new applicants to provide technical information that will enhance frequency coordination and help mitigate the possibility of interference, while permitting more new users, thereby promoting more efficient use of spectrum that has long been underutilized. We solicit alternative suggestions that

⁸² *Fifth Further Notice* at 27 FCC Rcd 6590 para. 33.

⁸³ NPSTC Plan at 9-10 (lack of specific data regarding how a licensee uses the 4.9 GHz band in an entire geographic area “hinders use by others.”); AASHTO Comments at 13 (“Capturing the elements detailed in [47 CFR] §101.21(e) for point-to-point installations and for point-to-multipoint installations is crucial to the coordination process and the resolution of harmful interference reports.”); APCO Comments at 5 (“Without that information, frequency coordinators will not be able to assign frequencies to new users with confidence that interference will not occur.”); NRPC Comments at 6; GRE Comments at 4-5.

⁸⁴ APCO Report at 10.

⁸⁵ APCO Report at 10.

⁸⁶ NPSTC Plan at 10.

⁸⁷ NPSTC Plan at 10.

⁸⁸ NPSTC Plan at 9. Although as noted above, *see supra* paragraph 30, ULS does not currently contain data relating to 4.9 GHz base stations and receivers, NPSTC proposes that the Commission could modify both its current information collections and ULS to compile the information needed for coordination in this band. NPSTC notes that ULS already captures types of data that could facilitate coordination in the Part 101 and other Part 90 services, and thus NPSTC states, “we believe the current ULS system is set up to gather and store the information needed to coordinate 4.9 GHz applications.” *Id.*

⁸⁹ NPSTC Plan at 9.

⁹⁰ We discuss potential secondary use of the 4.9 GHz band *infra* in Section III.K. Carlson Comments at 2-5, AICC Comments at 5, Spectrum Bridge Comments at 7-18, SSC Comments at 4-5, SSC Comments to the NPSTC Plan at 8, WISPA Comments at 7-8.

⁹¹ 47 CFR § 90.1209(b).

would achieve these goals.

35. We believe ULS provides the most efficient and cost-effective means to facilitate certified frequency coordination in the 4.9 GHz band because it is both flexible and easily accessible to frequency coordinators, incumbent licensees, applicants, and other interested parties.⁹² While the Commission relies on private databases in other select spectrum bands, ULS is already set up for licensing in the 4.9 GHz band, and the Commission can use existing form schedules to capture P-P, P-MP, fixed receiver, base station, and mobile station data. Accordingly, we propose to add the 4.9 GHz band to the microwave schedule for P-P, P-MP, and fixed receiver stations.⁹³ We also propose to uncouple base and mobile stations from geographic licenses and instead require that base and mobile technical parameters be entered on the existing location and technical data schedules.⁹⁴ Thus, we propose to maintain ULS as the comprehensive licensing database for the 4.9 GHz band, which frequency coordinators will use to base their coordination. This proposal would not affect or restrict frequency coordinators' use of their own internal databases, which draw licensing data from ULS on a regular basis.⁹⁵ We propose to modify ULS as necessary to accept the necessary licensing data, prepare application instructions, and release a public notice to announce when ULS is ready to accept such applications. Regarding the burdens associated with the Commission's application for radio service authorization, the Commission has estimated that "each response to this collection of information will take on average 1.25 hours."⁹⁶ The estimate "includes the time to read the instructions, look through existing records, gather and maintain required data, and actually complete and review the form or response."⁹⁷ We seek comment on whether these time and cost burdens are accurate, and on the number of entities (incumbents and new entrants) likely to be subject to this requirement. We also seek comment on how best to measure the benefits emanating from this filing requirement in order to determine whether its benefits exceed its relative costs. For example, what is the cost of resolving current and potential interference problems in the absence of such a filing requirement? We seek comment on this proposal, and on the feasibility of alternative database solutions.

36. We propose to set a one-year timetable, starting on the release date of the ULS public notice described above, for incumbent licensees to provide data, as recommended in the NPSTC Plan. We propose to establish an application process for existing licensees with geographic licenses to identify P-P, P-MP, fixed receivers, base stations, and mobiles that are not licensed site-by-site. Under this process, incumbent licensees would file one or more applications, and update or delete the existing

⁹² See AASHTO Comments at 13-18, APCO Comments at 5; APCO Comments to the NPSTC Plan at 2; FCCA/IMSA/IAFC Comments at 10, FCCA/IAFC/IMSA Comments to the NPSTC Plan at 2; Grundy ETSB Comments at 4; Region 54 Comments at 4; NPSTC Comments at 5, NRPC Comments at 6, API/ENTELEEC/NRECA Comments at 10; EWA Reply at 4; GRE Comments at 4-5; NPPD Comments at 3; Southern Comments at 8-10; UTC Comments at 16-17; AICC Comments at 5; Region 8 Comments to the NPSTC Plan at 7-8; Region 13 Comments to the NPSTC Plan at 2, Region 24 Comments to the NPSTC Plan at 2, K. Raghunandan Comments to the NPSTC Plan at 3; CSS Comments at 2.

⁹³ We would ask users to apply for separate microwave (MW) licenses for P-P, P-MP, and fixed receivers using Form FCC 601 Schedule I. Information collected would include transmitter and receiver antenna coordinates, azimuth (direction), polarization, beamwidth, physical dimensions, gain, and height above ground, as well as transmit details such as power, channel, emission.

⁹⁴ We would ask users to license their base and mobile stations using Form FCC 601 Schedules D and H. Base and mobile information would include details such as coordinates (base), height above average terrain (base), number of units (mobile), mobile area of operation, power, channels, and emissions.

⁹⁵ ULS database downloads are available at <http://wireless.fcc.gov/uls/index.htm?job=transaction&page=daily>.

⁹⁶ See FCC Form 601 at 1, available at <https://www.fcc.gov/file/11910/download>. The form has OMB control number 3060-0798.

⁹⁷ *Id.*

(continued....)

licenses as necessary to eliminate redundancy following a Public Notice announcing that ULS is ready to accept such applications. There would be no fee for the application process since only public safety eligible entities are currently authorized in the band, and the Commission does not charge application fees for public safety entities. We seek comment on this proposal.

37. AASHTO suggests that incumbent licensees should be required to submit to frequency coordination either when their licenses are set for renewal or within one calendar year of the Commission's adoption of coordination requirements.⁹⁸ We disagree because the purpose of the application process is to collect missing incumbent data so that fixed operations would be visible in the database. Although a richer database will better aid future coordinations, coordination of incumbents is not necessary to accomplish this goal and would impose unnecessary cost. Accordingly, for this incumbent application process, we propose to grant NYCTA's request to waive frequency coordination requirements for one year following the effective date of those rules.⁹⁹ However, we propose that after the one-year deadline, an application from an incumbent licensee to supply the required database information would be treated as any other application for a new license or modification, *i.e.*, it would require frequency coordination. We seek comment about whether the status of a license should become secondary if the incumbent licensee does not meet the one-year deadline.

38. Finally, we decline to propose that incumbent licensees modify their licenses to conform to the new proposed rules and band plan.¹⁰⁰ We agree with commenters such as Region 8 and King County/Seattle that such action would be unduly burdensome and inequitable to incumbent licensees, which already use the band for mission critical public safety operations.¹⁰¹ Instead, we propose to grandfather existing licensees from having to make any technical modifications to conform to the new rules and band plan, other than providing more sufficient data as we discussed above, as of the effective date of new rules adopted in this proceeding. However, applications from incumbent licensees submitted more than one year after the new rules are in effect would be subject to the new proposed rules and band plan.

E. Regional Planning

39. Section 90.1211(a) of the Commission's rules provides that each RPC region may submit a plan with guidelines to be used for sharing spectrum in the 4.9 GHz band.¹⁰² The rules list elements to be included in regional plans and provide instructions for the plan's modification.¹⁰³ Although the Commission originally set a deadline for all RPCs to submit 4.9 GHz regional plans, it subsequently decided to make plan submission voluntary and stayed the deadline.¹⁰⁴ To date, only 10 out of 55 RPC

⁹⁸ AASHTO Comments at 12-13.

⁹⁹ NYCTA Reply to the NPSTC Plan at 7.

¹⁰⁰ For example, we would not require incumbent licensees to vacate the proposed aeronautical mobile and robotic band segment, 4940-4945 MHz (*see infra* Section III.B); or to upgrade their antennas to a minimum gain of 26 dBi (*see infra* Section III.H).

¹⁰¹ Region 8 Comments to the NPSTC Plan at 4-8, King County/Seattle Comments to the NPSTC Plan at 6-7.

¹⁰² 47 CFR § 90.1211(a).

¹⁰³ 47 CFR § 90.1211(b), (c).

¹⁰⁴ *See The 4.9 GHz Band Transferred from Federal Government Use*, WT Docket No. 00-32, Memorandum Opinion and Order, 19 FCC Rcd 22325, 22331-32 paras. 17-20 (2004) (*4.9 GHz MO&O*); *The 4.9 GHz Band Transferred from Federal Government Use*, WT Docket No. 00-32, Memorandum Opinion and Order and Third Report and Order, 18 FCC Rcd 9152, 9169 para. 42 (2003) (*4.9 GHz Third Report and Order*); *The 4.9 GHz Band Transferred from Federal Government Use*, WT Docket No. 00-32, Order, 19 FCC Rcd 15270 (2004) (*Stay Order*).

(continued....)

regions have submitted 4.9 GHz regional plans.¹⁰⁵ In the *Fifth Further Notice*, the Commission sought comment on whether it should lift the stay and amend Section 90.1211 to require Regional Plans to cover permanent fixed links and base stations, as well as mobile and temporary fixed links.¹⁰⁶

40. NPSTC's Plan states that "a single national plan for 4.9 GHz will meet most regions' needs," but "some regions will need some different parameters to better meet needs of users in their regions."¹⁰⁷ NPSTC proposes to allow RPCs to file amended regional plans specific to 4.9 GHz to reflect regional considerations, including a required showing of need, within 120 days after the Commission adopts new rules for the band.¹⁰⁸ Several commenters support RPC involvement in the 4.9 GHz band.¹⁰⁹

41. *Discussion.* We believe that RPCs should play an integral role in shaping use of the 4.9 GHz band through regional planning. In this connection, we propose to afford RPCs the flexibility to file new and amended regional plans for Commission review and approval to reflect their region-specific needs or considerations as supported by a showing of need.¹¹⁰ Alternately, RPCs would have the option to default to the national rules without regional variation by taking no action. We seek comment on this proposal, and on how to implement regional variations.

42. NPSTC recommends that RPCs be able to make region-specific changes in the following four areas: (i) enabling additional channel aggregation; (ii) incorporating an additional channel designated for specialized use; (iii) placing limits on the use of P-P links in urban areas or imposing more stringent antenna requirements or other technical parameters to allow greater channel reuse; and (iv) in rural areas, allowing higher radiated power for longer path lengths and non-line of sight paths.¹¹¹ We tentatively disagree with the NPSTC Plan's proposals for item (i) because we propose to allow 40 megahertz channel aggregation, and for item (iv) because we believe that the upper effective isotropically radiated power (EIRP) limits should be codified in our rules rather than left to the discretion of the RPCs.¹¹² We propose to allow regional plans to be submitted for Commission approval that include variations for items (ii) and (iii) as well as for polarization.¹¹³ In lieu of item (i), we propose to allow RPCs to limit aggregations to 20 megahertz as discussed above. We also propose to limit the ability of RPCs to restrict non-public safety licensing eligibility to a greater degree than is provided in the

¹⁰⁵ See WT Docket No. 00-32. Regions that have submitted plans include Regions 12 (Idaho), 41 (Utah), 8 (New York City Metropolitan Area), 16 (Kansas), 24 (Missouri), 39 (Tennessee), 6 (Northern California), 5 (Southern California), 11 (Hawaii), and 19 (New England).

¹⁰⁶ *Fifth Further Notice* at 6591-92 paras. 39, 41. 47 CFR § 90.1211(b)(4) requires regional plans to incorporate a description of coordination procedures for temporary fixed and mobile operations. The rule omits permanent fixed links and base stations.

¹⁰⁷ NPSTC Plan at 12-13.

¹⁰⁸ NPSTC Plan at 13.

¹⁰⁹ See FCCA/IAFC/IMSA Comments to the NPSTC Plan at 3, Region 8 Comments to the NPSTC Plan at 9, Region 13 Comments to the NPSTC Plan at 1, Region 24 Comments to the NPSTC Plan at 1, Vislink Reply Comments to the NPSTC Plan at 1, and City of New York Reply Comments to the NPSTC Plan at 8 (but also opposing NPSTC's proposal for a national plan).

¹¹⁰ See FCCA/IAFC/IMSA Comments to the NPSTC Plan at 3, Region 13 Comments to the NPSTC Plan at 1, Region 24 Comments to the NPSTC Plan at 1-2, Vislink Reply Comments to the NPSTC Plan at 1, King County/Seattle Comments to the NPSTC Plan at 7.

¹¹¹ NPSTC Plan at 13.

¹¹² We discuss EIRP in greater detail in Section III.H below.

¹¹³ We discuss polarization in Section III.I *infra*.

Commission's rules.¹¹⁴ In general, we believe that providing these areas in which a regional plan can deviate from the national plan, combined with the overall flexibility of the band plan we propose, will enable regions to meet most needs of their users without threatening investments in existing deployments. Because we cannot foresee all areas in which RPCs may need flexibility, we propose to allow RPCs to request changes outside these areas pursuant to a waiver request. We are mindful that regional variations add a challenge to frequency coordination, but we believe that frequency coordinators have the tools to keep track of these variations.¹¹⁵ We seek comment on relative costs and benefits arising from this approach, which would not change the status of regional plans as optional.

43. We seek comment on when RPCs should be required to submit regional plans. Comments on this issue were mixed, with suggested deadlines of 180 days, 240 days, and 12 months after final rules are effective.¹¹⁶ Considering the resource constraints on RPCs, we propose a deadline of six months after the effective date of final rules for each RPC to notify the Commission either that it intends to file a regional plan or that the region will default to the general rules, and a deadline of one year after rules adopted in this proceeding become effective for the filing of regional plans. Prior to Commission acceptance of any regional plan, we propose to allow new applications for 4.9 GHz licenses to be filed consistent with updated general rules. These licenses would be grandfathered for the duration of the license period. We would lift the current stay on Section 90.1211(a) once the proposed rule modification becomes effective. We propose to continue to accept regional plans and amendments after the one-year deadline for the benefit of those RPCs that lack the resources to file timely regional plans or are not yet formed,¹¹⁷ but the purpose of the deadline is to provide a goal to commence licensing based on regional plan considerations. The Public Safety and Homeland Security Bureau would place any submitted regional plans on public notice for comment. With regard to Plan Amendments, we seek comment on establishing a streamlined process for staff review of such modifications, including defining "major" and "minor" plan modifications as defined by Section 90.527(b) of the rules.¹¹⁸ We seek comment on these proposals and solicit alternative suggestions, especially from the individual RPCs. We seek comment on any burdens that the regional plan filing deadline may place on small entities.

44. Finally, we decline the NPSTC Plan's recommendation to permanently waive the existing requirement to obtain concurrence from adjacent regions for plan amendments.¹¹⁹ The NPSTC Plan makes no mention of the existing adjacent region coordination requirement for initial regional plans,¹²⁰ and we do not see why regional plan amendments should not also be subject to adjacent region review. This adjacent region review process for plan amendments has worked in the 700 MHz and 800 MHz bands,¹²¹ and we do not believe the process which is currently in place is unduly burdensome on RPCs for the 4.9 GHz band. We seek comment on whether adjacent region review requirements would place undue

¹¹⁴ See Ex Parte Letter from Elizabeth Sachs, Esq. on behalf of Enterprise Wireless Alliance to Marlene H. Dortch, Secretary, Federal Communications Commission, WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150 (dated Jul. 9, 2014) at 3.

¹¹⁵ Frequency coordinators face variations by region in the 769-775 MHz and 799-805 MHz public safety narrowband channels.

¹¹⁶ Grundy ETSB Comments at 6 (12 months); Region 54 Comments at 6 (12 months); GRE Comments at 7 (12 months with annual updates); Region 13 Comments to the NPSTC Plan at 1 (240 days); Region 24 Comments to the NPSTC Plan at 1-2 (180 days).

¹¹⁷ Licensees in those regions would abide by the general rules of 47 CFR Part 90, Subpart Y until the Commission approves any subsequent regional plans.

¹¹⁸ 47 CFR § 90.527(b).

¹¹⁹ See 47 CFR § 90.1211(c).

¹²⁰ 47 CFR § 90.1211(b)(3).

¹²¹ See 47 CFR § 90.527(b).

burdens on small entities.

F. Technical Standards

45. In the *Fifth Further Notice*, the Commission sought comment on whether to adopt technical standards for 4.9 GHz band equipment.¹²² While acknowledging that the Commission previously had declined to mandate such a technical standard, the Commission sought comment on using IEEE 802.11 as a potential standard solution, given the standard's worldwide availability and flexibility in supporting various applications.¹²³ Some commenters to the *Fifth Further Notice* assert that mandatory technical standards would inhibit technological development in the band,¹²⁴ restrict local flexibility and control, and render existing equipment obsolete.¹²⁵ Other commenters contend that standards would promote national interoperability and lend certainty to the marketplace for 4.9 GHz equipment.¹²⁶ A number of these commenters express specific support for an 802.11-based standard.¹²⁷

46. *Discussion.* Since the Commission adopted service rules for the 4.9 GHz band in 2003, the 4.9 GHz band has not fostered a market for diverse technology or inexpensive equipment, which in turn has led to underutilization and a slow influx of users. In general, the Commission has favored technology-neutral rules and has avoided adoption of mandatory standards, a model that has worked in many spectrum bands. However, the record in this proceeding suggests that some public safety users may desire greater certainty regarding technical standards to stimulate investment in the band. While we tentatively conclude that we should not adopt mandatory technical standards for the 4.9 GHz band and seek comment on this view, we seek comment on how to encourage voluntary implementation of technical standards for equipment in the band that can provide certainty for public safety users while also providing appropriate incentives for manufacturers to develop innovative and cost-effective equipment that will encourage interoperability, discourage fragmentation, and reduce equipment costs through higher economies of scale. Would a voluntary industry standard/framework that would not be promulgated in our rules be appropriate and preferable to incorporating such a standard (or any other) in our rules? Are there industry standards available in the 4.9 GHz band, and if not, what is the likelihood that applicable standards could be extended to the 4.9 GHz band? What would be the relative cost and benefit of different voluntary standards for high-power and low-power systems?

G. Point-to-Point and Point-to-Multipoint

47. Until 2009, permanent fixed P-P and P-MP stations in the 4.9 GHz band were secondary to base, mobile, and temporary fixed operations.¹²⁸ In 2009, the Commission permitted licensing of permanent fixed P-P and P-MP stations that deliver broadband services on a primary basis, while those stations that deliver narrowband traffic remain secondary to other operations in the 4.9 GHz band.¹²⁹ In the *Fifth Further Notice*, the Commission sought comment on whether to license all permanent fixed P-P stations on a primary basis, regardless of whether they support broadband or narrowband traffic, or

¹²² *Fifth Further Notice*, 27 FCC Rcd at 6601-2 para. 64.

¹²³ *Fifth Further Notice*, 27 FCC Rcd at 6602 para. 65.

¹²⁴ Mobile County Comments at 3, Southern Comments at 11, Cambium Comments at 3, MSI Comments at 7, GRE Comments at 16.

¹²⁵ EMR Comments at 7, Denver RTD Comments at 8.

¹²⁶ King County Comments at 5, AICC Comments at 4.

¹²⁷ King County Comments at 5, Grundy ETSB Comments at 10, Region 54 Comments at 10, Port Angeles Comments at 6, NRPC Comments at 10. However, *see* Cambium Comments at 5 (“The IEEE 802.11 standard is poorly suited to applications in fixed outdoor PTP and PMP networks.” Further, “Time division duplex (TDD) ... synchronization is not supported by IEEE 802.11.”).

¹²⁸ *See* 47 CFR § 90.1207(d) (2008).

¹²⁹ *See Report and Order*, 24 FCC Rcd at 4303 para. 9; 47 CFR § 90.1207(d).

(continued....)

whether permanent fixed P-MP stations not delivering broadband service should remain secondary.¹³⁰

48. *Discussion.* Secondary status requires the user to accept the risk of interference and to cease operation if it causes interference to a primary licensee. The supporting commenters persuade us that primary status for P-P and P-MP links that carry or support narrowband traffic would resolve this risk and increase usage of the 4.9 GHz band because it would give potential users confidence to invest in the band.¹³¹ Given the divided comment record on primary status for narrowband P-P and P-MP links,¹³² we propose to allow licensees to use individual 1-MHz bandwidth Channels 14-18 for permanent fixed P-P and P-MP operations on a primary basis, while existing permanent fixed P-P and P-MP operations on individual 1-MHz bandwidth Channels 1-5 would remain secondary, with no such further licensing allowed on those channels due to the proposed aeronautical mobile and robotic designation. We seek comment on this proposal, including its relative costs and benefits. Under the status quo, any competing public safety organization in dense urban areas could obtain secondary licenses for P-P and P-MP links on channels 14-18 with no obligation to protect each other from interference. Accordingly, one potential cost of a proposal to license these links on a primary basis is that it could increase the difficulty of competing public safety organizations in dense urban areas to obtain primary licenses for base, mobile, and temporary fixed operations in channels 14-18 because primary users are entitled to interference protection and cannot be licensed with overlapping channel assignments and areas of operation as secondary use may allow. How likely is this to occur, and what would be the cost of a work-around?

49. The NPSTC Plan recommends that applications for P-P licenses include a showing as to the need for the bandwidth requested, to address the potential of P-P links to cause interference.¹³³ At this time, we do not propose to impose such a requirement, which no other commenter has suggested, because the record does not contain objective benchmarks for correlating various uses with bandwidth needs. We have found that no evidence of P-P interference in the record, and we invite commenters to submit any such evidence. Further, we believe that technical rule changes we propose below in Section III.H may reduce interference potential by producing more directional P-P links. We seek comment on our view and on these concerns.

50. Next, in order to limit “temporary” links to truly temporary uses, we propose to adopt the NPSTC Plan’s recommendation that temporary P-P links may only be operated for thirty days maximum over a given path in a one-year period.¹³⁴ Any application for longer operation would require a showing why longer duration is needed and how the link is supporting public safety protection of life and property. We seek comment on whether the number of days should be reduced or increased and the reasons therefor. We seek comment on the relative costs and benefits of the limitation proposed here, as well as any alternate proposals. We solicit alternative suggestions and solicit comment on burdens that a timeframe limitation on temporary P-P links would place on small entities.

51. Finally, we decline to consider a request from the comment record that the band be used

¹³⁰ *Fifth Further Notice* at 6594 para. 46.

¹³¹ See AASHTO Comments at 14 (“fixed, terrestrial mesh networks should have primary status”); Grundy ETSB Comments at 7; Region 54 Comments at 6; NPPD Comments at 3; GRE Comments at 13 (“SCADA traffic .. may be a very suitable and desirable application for fixed operation on a narrowband channel.”); UTC Comments at 10-12; Region 13 Comments to the NPSTC Plan at 2, Region 24 Comments to the NPSTC Plan at 2.

¹³² See Region 35 Comments at 2; Southern Comments at 10 (“The 4.9 GHz band is ideal for broadband applications, and other bands are available for narrowband ...”); Region 8 Comments to the NPSTC Plan at 6.

¹³³ NPSTC Plan at 7.

¹³⁴ NPSTC Plan at 7. Under current rules, there is no operational time limit within the one-year timeframe of temporary fixed stations. 47 CFR § 90.1207(c).

only for fixed uses.¹³⁵ The band supports substantial mobile use,¹³⁶ and it would be contrary to the public interest to force such operations to relocate from the 4.9 GHz band or cease operation. We believe that with the regional planning process combined with frequency coordination, the goal of increased density of fixed link deployment can occur with rule changes regardless of mobile presence. We seek comment on this tentative conclusion.

H. Power Limits

52. The 4.9 GHz rules contain power output limits that depend on the channel bandwidth for both low power and high power transmitters.¹³⁷ High power P-P and P-MP links may use directional antennas with gains greater than 9 dBi and up to 26 dBi with no reduction in conducted output power, but if antennas with a gain of more than 26 dBi are used, the maximum conducted output power and peak power spectral density must be reduced by the amount in decibels that the directional gain exceeds 26 dBi.¹³⁸ The Commission imposed the antenna gain rule “in order to avoid interference from fixed operations to mobile operations.”¹³⁹

53. In the *Fifth Further Notice*, the Commission sought recommendations for an effective radiated power (ERP) limit for high power, permanent and temporary fixed transmitters, and whether to impose a maximum ERP limit on point-to-point links.¹⁴⁰ Going forward, we will discuss radiated power levels in the 4.9 GHz band in terms of EIRP, rather than ERP, because antenna gains in the 4.9 GHz band rules are conventionally specified in terms of gain relative to an isotropic reference (dBi).¹⁴¹ To make point-to-point use in the band more efficient, the Commission also sought comment on whether it should establish a different minimum gain for P-P transmitting antennas and, if so, what value of gain would be appropriate and what power reduction, if any, should be required.¹⁴²

54. The NPSTC Plan does not address ERP limits, but it notes that Section 101.143 of the Commission’s rules specifies a formula for reducing the maximum EIRP for short path lengths and proposes “that the frequency coordinators use a similar reduction in maximum EIRP for short path lengths with formulas developed based on transmit powers allowed in this band.”¹⁴³ The NPSTC Plan further recommends that for P-P links an antenna with a minimum gain of 26 dBi, a maximum of 5.5 degree beamwidth and a minimum 25 dB front-to-back ratio be required.¹⁴⁴ The NPSTC Plan also

¹³⁵ API/ ENTELEC/NRECA Comments at 11 (“if mobile operations were discontinued in the band, tighter radiation patterns from fixed links will serve to reduce congestion and allow for increased density of deployment.”).

¹³⁶ See *supra* note 13.

¹³⁷ See 47 CFR § 90.1215(a)(1). High power devices are limited to a peak power spectral density of 21 dBm per one MHz. See 47 CFR § 90.1215(a)(2).

¹³⁸ 47 CFR §§ 90.1215(a)(2); 90.1207(d).

¹³⁹ *4.9 GHz Third Report and Order*, 18 FCC Rcd at 9175 para. 57.

¹⁴⁰ *Fifth Further Notice* at 6599 para. 58.

¹⁴¹ See 47 CFR § 90.1215. EIRP = ERP + 2.15 dB. See Federal Communications Commission, Office of Engineering and Technology, Laboratory Division Public Draft Review, “Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System” at 3, available at <https://apps.fcc.gov/eas/comments/GetPublishedDocument.html?id=204&tn=255011> (last visited Jan. 26, 2018). “[F]or ERP, the antenna gain is expressed relative to an ideal half-wave dipole antenna.” *Id.* at 2. ERP is not ideal for the 4.9 GHz band because the NPSTC Plan at 7 and the APCO Report at 13 refer to antenna size by “diameter,” inferring that parabolic antennas, not half-wave dipole antennas, are used in the 4.9 GHz band for P-P links.

¹⁴² *Fifth Further Notice* at 6599 para. 58.

¹⁴³ NPSTC Plan at 7. See 47 CFR §§ 101.113(a), 101.143; see also FCCA/IAFC/IMSA Comments at 12 in support.

¹⁴⁴ NPSTC Plan at 7. See also FCCA/IAFC/IMSA Comments at 12 endorsing 26 dBi minimum antenna gain.

(continued....)

recommends that frequency coordinators be allowed to impose tighter specifications for the antenna if that allows assignment of a channel that otherwise would cause interference.¹⁴⁵ NPSTC states that equipment using “multiple modulation rates and /or MIMO [multiple-input and multiple-output] antenna technologies” is inefficient and proposes that “they normally not be allowed in the band.”¹⁴⁶ NPSTC recommends that requests for higher EIRP levels only be granted under waiver and receive full coordination so that both frequency coordinators and RPCs can comment.¹⁴⁷

55. The APCO Report argues for “increasing the size of the antennas supporting 4.9 GHz operations.”¹⁴⁸ APCO states that “larger directional antennas (i.e. 4’ diameter and above) have more discriminatory “off-path” antenna patterns and FB (Front-to-Back) ratios which allow the coordinator to assign frequencies closer together and permit more systems to co-exist, interference-free, within a given frequency band.”¹⁴⁹ APCO also contends that “there are cases where a larger antenna may allow the coordinator to assign a frequency to a system where a smaller antenna may not have an efficient enough antenna pattern.”¹⁵⁰

56. *Discussion.* We propose to allow P-P transmitting antennas to operate with a minimum directional gain of 26 dBi, maximum 5.5 degree beamwidth and minimum 25 dB front-to-back ratio. Antenna physical size, or area, is related to antenna gain.¹⁵¹ Although the rules do not contain restrictions on physical antenna size, we believe this proposal will enable users to deploy larger directional antennas, as recommended in the APCO Report, and to produce narrower beam widths and more directional P-P links, which should enable co-channel users in congested areas to place links closer together and achieve greater frequency reuse. Moreover, the higher gain would increase the EIRP so that P-P links can cover longer distances, which could save users the expense of deploying multiple, low EIRP links. Further, the record indicates that several low cost antennas that meet these requirements are already available.¹⁵² We seek comment on the relative costs and benefits of this proposal. We invite commenters to provide additional information about these antennas and associated costs in the record and we seek comment on the levels of directional antenna gains that licensees are using today. We also seek comment about burdens that a change to the antenna gain rules would place on small entities, notwithstanding that we propose to grandfather existing P-P and P-MP installations from having to replace antennas.

57. We seek comment on whether the rules should contain a maximum EIRP limit for directional links. Although the NPSTC Plan proposes no maximum EIRP, three commenters suggest power levels equivalent to maximum EIRP levels of 65.15 dBm for P-P and 55.15 dBm for P-MP to “promote the use of the band for longer range communications . . . , particularly in rural areas.”¹⁵³

¹⁴⁵ NPSTC Plan at 7.

¹⁴⁶ NPSTC Plan at 7.

¹⁴⁷ NPSTC Plan at 7-8.

¹⁴⁸ APCO Report at 13.

¹⁴⁹ APCO Report at 13.

¹⁵⁰ APCO Report at 13.

¹⁵¹ Bernard E. Keiser, *Broadband Coding, Modulation, and Transmission Engineering* 179, 192 (Bernard E. Keiser 1998). “A Complete expression for antenna gain must include an efficiency factor η . Then if A_t is the physical area of the antenna’s reflector, $g_t = 4\pi\eta A_t/\lambda^2$. Typical values for η are 0.5 to 0.7.” *Id.* at 192. “ g_t [is the] antenna on-axis gain [and] λ = wavelength, m.” *Id.* at 179.

¹⁵² NPSTC Plan at 7.

¹⁵³ See GRE Comments at 15; NPPD Comments at 3; UTC Comments at 12 (proposing maximum ERP of 63 dBm for P-P and 53 dBm for P-MP. EIRP = ERP + 2.15 dB. So, the maximum EIRPs would be 65.15 dBm for P-P and 55.15 dBm for P-MP). We also note that the high power maximum conducted output power for a 20-megahertz

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Accordingly, we seek comment on these EIRP limits. Since we noted above that the upper power limits need to be codified in the rules, we seek comment on whether these proposed power limits are adequate to meet the needs of regions whose users would deploy links with long path lengths in rural areas. We also seek comment on whether such an increase in maximum power levels for directional links creates any additional interference concerns and how it might affect the ability to coordinate additional links. Similarly, what effect might such an increase have on the ability for continued mobile operations in the band? We seek comment on whether emission mask M is sufficient, or whether a tighter emission mask should be imposed for these higher power operations.¹⁵⁴ We seek further comment on other power suggestions in the record and how they would fit with the above proposals.¹⁵⁵

58. Finally, we decline to propose restrictions on multiple modulation rates and MIMO antenna technologies as proposed by the NPSTC Plan.¹⁵⁶ We agree with the City of New York that “Multiple Input Multiple Output (MIMO) technology is a key element of both the 802.11n standard and LTE standards. Rather than being less spectrally efficient, it is more so as it provides for increased throughput and range.”¹⁵⁷ Similarly, multiple modulation rates are more spectrally efficient and offer licenses additional flexibility in the planning and operation of their systems.

I. Polarization

59. The *Fifth Further Notice* sought comment on requiring P-P links to use a specific polarization, e.g., horizontal or vertical, to reduce potential interference to other links or to portable or mobile devices.¹⁵⁸ The Commission sought comment on the costs of changing an antenna’s polarization and whether polarization diversity would increase throughput.¹⁵⁹

60. *Discussion.* Given the mixed comment record,¹⁶⁰ we decline to propose any polarization requirements in our rules. However, we still believe that polarization can be a tool to increase density of P-P links in a given area and to address cases of actual interference between two or more P-P links. We note that side-by-side co-channel P-P links with orthogonal (opposite) polarizations could operate with minimized interference because each receive antenna would reject signals of the opposite polarization. We are also encouraged that dual polarization together with polarization multiplexing can increase capacity in a P-P link, as Cambium suggests.¹⁶¹ As discussed above, we propose to allow regional plans submitted for Commission review pursuant to Section 90.1211 to propose any polarization schemes for new applications within their regions as necessary to maximize frequency reuse, manage interference, and increase throughput. As part of the application frequency coordination process, frequency coordinators

channel is 33 dBm. See 47 CFR § 90.1215(a)(1). At this output power, an antenna gain of 32.15 dBi would give an EIRP of 65.15 dBm as sought by GRE, NPPD, and UTC.

¹⁵⁴ See 47 CFR § 90.210(m).

¹⁵⁵ See Region 35 Comments at 2 and API/ ENTELEC/NRECA Comments at 11 (unlimited ERP for fixed links); AASHTO Comments at 14 (“Hot Spots ... [should] be power limited to confine their operations within communications zones with a maximum radius of 1000 meters.”); WISPA Comments at 9 (recommending the 1-watt output power limit of 47 CFR § 15.407(a)(3), which applies to U-NII operations in the 5725-5850 MHz band).

¹⁵⁶ NPSTC Plan at 7.

¹⁵⁷ City of New York Reply to the NPSTC Plan at 8.

¹⁵⁸ *Fifth Further Notice* at 6599-6600 para. 59.

¹⁵⁹ *Id.*

¹⁶⁰ See GRE Comments at 16 and Region 35 Comments at 2 in support of the Commission’s proposals; see Southern Comments at 11, Grundy ETSB Comments at 9, Region 54 Comments at 9, and Cambium Comments at 2 in opposition.

¹⁶¹ Cambium Comments at 2 (“dual polarization ... allow[s] for higher overall capacity within congested areas, and ... deployment of non-line-of-sight links with high availability in rural or other less congested areas.”).

(continued....)

would be able to recommend a particular polarization for a proposed P-P link in those regions. We seek comment on this proposal.

J. Deployment Reports, Construction Deadlines

61. The *Fifth Further Notice* sought comment on whether to require 4.9 GHz licensees to file periodic deployment reports to better inform the Commission about usage of the band.¹⁶² The Commission indicated that reports could include information such as status of equipment development and purchase, including number of devices and users; site development, including use of existing towers; deployments and upgrades (commencement and completion), including site information and location; and applications in development or in use.¹⁶³ The Commission also sought comment on reporting frequency.¹⁶⁴

62. *Discussion.* Although a deployment report requirement had some support in the record,¹⁶⁵ we agree with the opposing comments regarding burdens on licensees¹⁶⁶ and decline to propose requiring deployment reports. In addition to imposing a burden, such reports would be superfluous given our database proposal discussed above,¹⁶⁷ in which existing licensees would file certain additional information on their operating parameters.

63. However, we propose to establish a one-year construction deadline for all 4.9 GHz licensees, with a corresponding construction reporting requirement.¹⁶⁸ The current rules impose an 18-month construction deadline only on fixed P-P stations that are licensed on a site-by-site basis, and no construction deadline for base and temporary fixed stations.¹⁶⁹ We believe that shortening the construction period to one year for all 4.9 GHz licenses will lead to more timely use of the spectrum and reduce the possibility of spectrum warehousing.¹⁷⁰ Accordingly, we propose to require all 4.9 GHz geographic licensees to place at least one base or temporary fixed station in operation within 12 months of license grant and file a standard construction notification with the Commission. We also propose to reduce the construction period for fixed point-to-point stations from 18 months to 12 months. These proposed rule changes will also harmonize the construction deadlines for the 4.9 GHz band with the deadlines of Section 90.155, which is the analogous rule for the majority of Part 90 radio services.¹⁷¹ We note that we have received no objections to this construction deadline change. We seek comment on these proposals, on their relative costs and benefits, on the burdens that the proposed construction deadline would place on small entities, and on alternative solutions that would achieve the same goal.

¹⁶² *Fifth Further Notice* at 6603 para. 68.

¹⁶³ *Id.*

¹⁶⁴ *Id.*

¹⁶⁵ See NRPC Comments at 10, Region 35 Comments at 2, Grundy ETSB Comments at 11, Region 54 Comments at 10.

¹⁶⁶ See FCCA/IAFC/IMSA Comments at 17, Mobile County Comments at 12, MSI Comments at 3-4, NPSTC Comments at 12.

¹⁶⁷ See MSI Comments at 3-4. See also *supra* para. 36.

¹⁶⁸ See NPSTC Comments at 12. See also Region 35 Comments at 2 (deployment reports “could be something similar to filing a [FCC Form 601] schedule K [notification of construction]”).

¹⁶⁹ 47 CFR § 90.1209(d).

¹⁷⁰ Generally, the Commission issues a 4.9 GHz band license for the geographic area encompassing the legal jurisdiction of the licensee. See 47 CFR § 90.1207(a). We refer to such license holders as geographic licensees.

¹⁷¹ 47 CFR § 90.155.

K. Eligibility, Shared Use, and Other Alternatives

64. Currently, only entities providing public safety services are eligible for licenses in the 4.9 GHz band.¹⁷² Non-public safety entities—including CII entities—may use the 4.9 GHz spectrum by entering into sharing agreements with eligible public safety licensees, but only for “operations in support of public safety.”¹⁷³ In light of the limited use of the band to date by public safety, the *Fifth Further Notice* sought comment on whether expanding eligibility to non-public safety users might lead to increased use and reduction in equipment costs that would benefit public safety.¹⁷⁴ Specifically, the Commission sought comment on whether CII entities should be eligible to hold primary 4.9 GHz licenses, thus removing the requirement for a sharing agreement, and also whether the band should be opened to commercial users on a secondary or non-interfering basis subject to a shutdown mechanism to enable priority access by public safety entities.¹⁷⁵ In response to the *Fifth Further Notice*, the NPSTC Plan proposed to extend primary 4.9 GHz eligibility to CII. More recently, other *ex parte* filers have recommended various secondary spectrum sharing approaches combined with maintaining priority status for public safety in the 4.9 GHz band.¹⁷⁶

65. In this *Sixth Further Notice*, we seek to further discuss these alternative eligibility and spectrum sharing approaches and other alternatives for the band. We seek comment on four specific alternatives outlined below, and on whether the four alternatives or elements thereof could be combined. We also solicit comment on any other sharing approaches that would meet the Commission’s goals for the band.

1. Extending Eligibility to CII

66. The NPSTC Plan proposes to expand eligibility to afford CII co-primary status with public safety in the 4.9 GHz band and allow CII entities immediate access to two five-megahertz channels (Channels 6 and 7).¹⁷⁷ On the remaining channels in the band, NPSTC proposes to preserve public safety’s licensing priority for three years, but would allow CII to seek access on a notice basis.¹⁷⁸ Under the proposed notice procedure, a CII entity’s application to use unoccupied channels would be put on public notice, and any public safety entity in the same geographic area as the CII entity’s planned system would have 30 days to file an application for the same channels, in which case the public safety applicant would prevail. This notice process would expire after three years after the Commission’s rules become effective, at which point public safety and CII would have equal access to all channels in the band on a first-come, first-served basis with no required notice.¹⁷⁹

67. The majority of commenters responding to both the *Fifth Further Notice* and the NPSTC Plan support expanding 4.9 GHz band eligibility to CII entities.¹⁸⁰ APCO and FCCA/IAFC/IMSA assert

¹⁷² 47 CFR § 90.1203(a). The question of FirstNet’s status as an entity eligible for a 4.9 GHz band license is still pending. See *Fifth Further Notice*, 27 FCC Rcd at 6596-6597 paras. 50-51.

¹⁷³ 47 CFR § 90.1203(b).

¹⁷⁴ *Fifth Further Notice*, at 27 FCC Rcd 6592 para. 43.

¹⁷⁵ *Fifth Further Notice*, at 27 FCC Rcd 6593 para. 43.

¹⁷⁶ See APCO Report, Federated Wireless *ex parte*, PPC *ex parte*.

¹⁷⁷ NPSTC Plan at 6, 10-11.

¹⁷⁸ NPSTC Plan at 11.

¹⁷⁹ NPSTC Plan at 11.

¹⁸⁰ See APCO Comments at 3-4, AASHTO Comments at 6, King County Comments at 3, NPSTC Comments at 9, Region 35 Comments at 2, Wyoming Comments at 1, API/ENTELEC/NRECA Comments at 6-7, EEI Comments at 2-7, EEI Reply at 2-3, EWA Comments at 4-5, GRE Comments at 3, NPPD Comments at 3, Southern Comments at 4-8, UTC Comments at 1, AICC Reply at 1-3, SSC Comments at 4, Cambium Comments at 1, and MSI Comments at 1. See also FCCA/IAFC/IMSA Comments to NPSTC Plan at 3, API Comments to NPSTC Plan at 3, EWA

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that CII eligibility would enhance interoperability between utilities and public safety agencies during and immediately following major emergencies,¹⁸¹ although APCO cautions that CII use should be “carefully monitored to ensure that public safety needs are considered in every potential conflicting filing.”¹⁸² The Utilities Telecom Council (UTC) states that CII primary eligibility “could provide capacity and coverage for smart grid and other applications ... [and] would promote investment in and more effective use of the spectrum.”¹⁸³

68. Some public safety commenters oppose direct licensing of CII entities and advocate retaining the requirement that CII entities may only use the 4.9 GHz band pursuant to sharing agreements with public safety licensees.¹⁸⁴ In response, Southern Company contends that “the current eligibility rules for the 4.9 GHz band do not correlate with marketplace or political realities,” because CII entities are “understandably reluctant to enter agreements whereby their investment in infrastructure, and their use of a vital communications resource, could be rendered worthless at any time, including when that resource is needed most.”¹⁸⁵

69. Some commenters advocate expanding CII eligibility to include additional categories of potential users. The Enterprise Wireless Alliance (EWA) proposes extending 4.9 GHz band eligibility to “all private internal systems” that “have defined areas of operation not necessarily focused on population centers, often conducted in a campus-type environment that can be coordinated with public safety usage.”¹⁸⁶ The Alarm Industry Communications Committee (AICC) argues that alarm companies should have primary access to the 4.9 GHz band in order to allow them “to more efficiently and rapidly gather and forward to PSAPs information about emergencies.”¹⁸⁷

70. *Discussion.* We seek comment on whether offering CII co-primary status with public safety is likely to create incentives for increased investment in the 4.9 GHz band. The Commission has recognized that railroad, power, and petroleum entities use radio communications “as a critical tool for responding to emergencies that could impact hundreds or even thousands of people.”¹⁸⁸ Extending eligibility to CII could encourage collaborative investment by public safety and CII users of the 4.9 GHz

Comments to NPSTC Plan at 4-5, UTC Comments to NPSTC Plan, Shared Spectrum Company (SSC) Comments to NPSTC Plan, Vislink Reply Comments to NPSTC Plan.

¹⁸¹ APCO Comments at 3-4 (limited CII use of the 4.9 GHz band would be beneficial to safety-related operations), FCCA/IAFC/IMSA Comments to NPSTC Plan at 3.

¹⁸² APCO Report at 14.

¹⁸³ UTC Comments at 5.

¹⁸⁴ LA County Comments at 2 and Port Angeles Comments at 4 (both arguing that CII eligibility would diminish the ability of public safety systems to use the full spectrum capacity), Chicago Comments at 3, Denver RTD Comments at 7, EMR Comments at 7, Mobile County Comments at 2, Region 8 Comments to NPSTC Plan at 6-8. *See also* NYCTA Comments to NPSTC Plan at 3.

¹⁸⁵ Southern Company Comments at 3.

¹⁸⁶ EWA Comments at 4. *See also* EWA Comments to NPSTC Plan at 4-5.

¹⁸⁷ AICC Reply Comments at 2-3.

¹⁸⁸ “Although the primary function of [railroad, power, and petroleum entities] is not necessarily to provide safety services, the nature of their day-to-day operations provides little or no margin for error and in emergencies they can take on an almost quasi-public safety function. Any failure in their ability to communicate by radio could have severe consequences on the public welfare ... utility companies need to possess the ability to coordinate critical activities during or following storms or other natural disasters that disrupt the delivery of vital services to the public such as provision of electric, gas, and water supplies.” *Replacement of Part 90 by Part 88 to Revise the Private Land Mobile Radio Services and Modify the Policies Governing Them*, PR Docket No. 92-235, Second Report and Order, 12 FCC Rcd 14307, 14328-9 para. 41 (1997).

(continued....)

band to improve response to emergencies that affect both public safety and critical infrastructure. We seek comment on this approach, including its potential relative costs and benefits.

71. We also seek comment on whether eligibility for CII entities should be conditioned on using the band to provide “public safety services” as that term is defined in Section 337(f)(1)(A) of the Communications Act of 1934, as amended.¹⁸⁹ For example, API requests that CII entities be permitted to use the band for any purpose, not just in support of public safety.¹⁹⁰ Would eliminating the requirement that the band be used for “public safety services” by CII users increase use of the band, lowering equipment costs and facilitating the other benefits of CII access to the band? Or would it unduly increase congestion? Considering the public safety focus of the 4.9 GHz band, should we limit CII use of the 4.9 GHz band to communications related to the protection of life, safety, and property, as opposed to general business purposes?¹⁹¹ If we maintain the requirement, how should the Commission ensure compliance by CII users (and what are the costs of doing so)? Given public safety’s relatively modest use of 4.9 GHz spectrum to date, we think there is sufficient remaining spectrum in the band to accommodate both expanded use by public safety and CII co-primary use. Stated otherwise, we think the benefits of co-primary use of the band by both CII and public safety can be realized at slight or no cost to public safety. We seek comment on this characterization. Is there reason to elevate public safety communications in the band over other uses? If so, would preferential algorithms built into equipment ensure priority of public safety communications? How would that priority be achieved? Would such priority be sufficient to ensure that public safety traffic would not be interfered with? We seek comment on affording public safety priority over other users and how priority would be achieved.

72. If we grant co-primary eligibility to CII entities without the need for a sharing agreement with a public safety entity, we seek comment on NPSTC’s proposal to provide CII immediate, co-primary access to Channels 6 and 7 during the first three years, to establish a notice procedure for CII access to the remainder of the band during the three-year period, and to open up the entire band to CII thereafter. Should we consider alternative access arrangements, such as providing CII immediate access to Channels 12 and 13, which could be coupled with access to narrowband Channels 14-18 to create 15 megahertz of contiguous spectrum for CII to access on a co-primary basis?¹⁹² Should we exclude Channels 1-5 from CII eligibility in light of our proposal to dedicate this segment to public safety aeronautical mobile and robotic use? We seek comment on these options and solicit any alternative suggestions.

73. We in turn seek comment on extending 4.9 GHz band co-primary eligibility to all private internal systems, as EWA requests. Would doing so be consistent with our core goal of supporting critical public safety needs? Similarly, we seek comment on extending primary eligibility to alarm companies as advocated by AICC. Does the fact that the Commission’s recent review of ULS in another proceeding suggesting that certain frequencies designated for central alarm operations may be underutilized affect how we should approach this request?¹⁹³ Finally, we note that the Commission’s

¹⁸⁹ 47 U.S.C. § 337(f)(1)(A); *see* 47 CFR § 90.523(b)(2).

¹⁹⁰ API Comments to NPSTC Plan at 3.

¹⁹¹ *See State of Ohio/FirstEnergy Corp.*, Order, 31 FCC Rcd 8758 (PSHSB 2016) (electric utility authorized to use 700 MHz public safety spectrum for public safety purposes that include communications related to power outage restoration, emergency notifications necessary to the safety of employees and the public and protection of property, and energization, de-energization, or reconfiguration of electric transmission lines).

¹⁹² *See supra* Section III.G for further discussion.

¹⁹³ *See Amendment of Part 90 of the Commission’s Rules to Improve Access to Private Land Mobile Radio Spectrum; Land Mobile Communications Council Petition for Rulemaking Regarding Interim Eligibility for 800 MHz Expansion Band and Guard Band Frequencies; Petition for Rulemaking Regarding Conditional Licensing Authority Above 470 MHz*; WP Docket No. 16-261, RM-11719, RM-11722, Notice of Proposed Rulemaking, 31 FCC Rcd 9431, 9435-6 paras. 12-14 (2016) (proposing to make certain frequencies in the 460-470 MHz band that are designated for central station alarm operations available for other PLMR uses because the Commission’s review of ULS suggested that these frequencies are underutilized). “The need of central stations for these frequencies

(continued....)

general approach to making spectrum available in recent years has leaned toward flexible use rather than allocations to specific industries. We seek comment on how granting CII entities eligibility for co-primary status is consistent with this approach. We also ask how CII entities' need for co-primary use of this band can be differentiated from the needs of other critical and safety-related industries that may seek access to this band in the future.

2. Leasing

74. In the 2003 *4.9 GHz Third Report and Order*, the Commission allowed non-public safety entities engaged in providing public safety-related services to be licensed in the 4.9 GHz band to support public safety operations.¹⁹⁴ In 2004, the Commission permitted public safety licensees with "exclusive spectrum rights"¹⁹⁵ to lease their spectrum to other public safety entities eligible for such a license authorization and to entities providing communications in support of public safety operations.¹⁹⁶ Based on the record at that time, the Commission declined to permit public safety licensees to lease 4.9 GHz spectrum for commercial or non-public safety operations.¹⁹⁷ Specifically, the Commission noted that commenters expressed concern that such leasing could face statutory barriers or result in abuse without the implementation of regulatory safeguards.¹⁹⁸ In the *Secondary Markets Order*, the Commission also noted that allowing such leasing could be premature given the then-nascent state of "interruptible use" technology that would enable public safety licenses to immediately reclaim the use of any leased spectrum for public safety emergencies.¹⁹⁹

75. *Discussion.* In this *Sixth Further Notice*, we seek to establish new licensing and service rules for the 4.9 GHz band that will spur investment and innovation while furthering public safety use of the band. We seek comment on whether these objectives could be facilitated by expanding the leasing alternatives available to public safety in the band. In particular, should we remove the current limitation and allow public safety licensees that have obtained exclusive spectrum rights in the 4.9 GHz band to lease spectrum capacity to CII or to commercial entities generally? Would such expanded leasing flexibility stimulate investment in equipment and networks that would benefit public safety and further our objectives for increased use of the band? Would such leasing opportunities present public safety entities with new potential revenue streams that could be used to increase investment in NG911 operations or to purchase new 4.9 GHz equipment? What rule changes, if any, would best facilitate bringing the economies of scope and scale that come with commercial use of a band to this public safety spectrum? How would a leasing alternative lead to increased use of the band compared to the current environment, where non-public safety entities can to enter into sharing agreements with public safety

appears to have diminished since this spectrum was set aside for their use over 40 years ago, which may be attributable to advancements in services and technologies that can be used to complete the communications path between the location of the alarm and the alarm services' central office, such as cellular telephone, satellite communication services, and the Internet." *Id.* at 9435-6 para. 12.

¹⁹⁴ *4.9 GHz Third Report and Order*, 18 FCC Rcd 9152, 9158-59 paras. 15-16 (adopting 47 CFR § 90.1203).

¹⁹⁵ To the extent that licensees are sharing spectrum, they are not permitted to enter into spectrum leasing arrangements with other entities.

¹⁹⁶ *Promoting Efficient Use of Spectrum Through the Elimination of Barriers to the Development of Secondary Markets*, Second Report and Order, 19 FCC Rcd 17503, 17529-31 paras. 53-56 (2004) (*Secondary Markets Order*). See 47 CFR § 1.9048 ("Licensees in the Public Safety Radio Services (see part 90, subpart B and § 90.311(a)(1)(i) of this chapter) may enter into spectrum leasing arrangements with other public safety entities eligible for such a license authorization as well as with entities providing communications in support of public safety operations (see § 90.523(b) of this chapter).").

¹⁹⁷ *Secondary Markets Order*, 19 FCC Rcd at 1729 paras. 53-54.

¹⁹⁸ *Secondary Markets Order*, 19 FCC Rcd at 1730-31 para. 56 and n.133.

¹⁹⁹ *Secondary Markets Order*, 19 FCC Rcd at 1730-31 para. 56.

(continued....)

licensees? What are the relative costs and benefits of expanding leasing alternatives?

76. We also seek comment on how best to ensure that public safety would retain priority access to 4.9 GHz spectrum in any commercial leasing framework. As noted above, the Commission cited a dearth of technology in 2004 that would support “interruptible” spectrum leasing. In light of the significant technological advances that have occurred since then, does technology now exist that would enable public safety to interrupt other spectrum users and reclaim leased spectrum capacity in emergencies? Should non-public safety entities that lease spectrum capacity have primary status because they entered agreements with specific public safety licensees? If so, how would public safety priority function?

77. As noted above, in the *Secondary Markets Order* the Commission cited to comments expressing concern that the Communication Act might be a barrier to allowing public safety entities to lease spectrum that had been designated for public safety for non-public safety operations.²⁰⁰ Those comments suggested that because Section 337 of the Communications Act of 1934 defines “public safety services” as services that “are not made commercially available to the public by the provider,”²⁰¹ the Commission could be limited in its ability to allow non-public safety services on bands designated for public safety services. However, Section 337’s proscription on commercial operations is expressly limited to 24 megahertz of spectrum in the 700 MHz band,²⁰² and there is no equivalent statutory limitation on the 4.9 GHz band.²⁰³ Section 90.1203 of our rules, which governs eligibility for 4.9 GHz licenses, incorporates the requirements and conditions set forth in Section 90.523 of our rules, which in turn implements Section 337 of the Act,²⁰⁴ and provides that applications in this band are limited to operations in support of public safety.²⁰⁵ The Commission tentatively concludes that it has authority to modify Section 90.1203 to allow public safety licensees to enter into leases for non-public safety or commercial uses in the 4.9 GHz band. We seek comment on this tentative conclusion. Are there any other potential jurisdictional barriers to adopting the rules proposed here?

78. If we authorize expanded leasing by public safety in the 4.9 GHz band, should there be conditions or limitations on use of leased spectrum or expenditure of leasing revenues to safeguard against potential abuse? For example, should use of leased spectrum be limited to communications in support of public safety or should all communications be allowed regardless of whether they have a public safety nexus? Can or should we require public safety licensees that receive leasing revenues to invest such revenues solely for public safety purposes, *e.g.*, for procurement of public safety equipment or maintenance and operational costs of the network? Would such a requirement be consistent with the Miscellaneous Receipts Act?²⁰⁶ Are there provisions of state or local law relating to use of funds by local public safety entities that the Commission should take into consideration here? How would compliance with such a requirement be audited and enforced?

79. We seek comment on the relative costs and benefits of a commercial-leasing options vis-à-vis the CII co-primary option discussed above. Which option would bring the greatest innovation to the 4.9 GHz band? Which option would best facilitate the introduction of new, lower cost equipment? Which option would best empower public safety users—the case-by-case leasing to commercial entities where public safety users must sign off on each use or the ability of CII users to gain co-primary access to

²⁰⁰ *Secondary Markets Order*, 19 FCC Rcd at 1730-31 para. 56.

²⁰¹ 47 U.S.C. § 337(f)(1)(C).

²⁰² 47 U.S.C. § 337(a).

²⁰³ See Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, 107 Stat. 312 (giving Commission authority to allocate the 4.9 GHz band and to propose regulations governing its use).

²⁰⁴ 47 CFR §§ 90.1203(a), 90.523.

²⁰⁵ 47 CFR § 90.1203(b).

²⁰⁶ 31 U.S.C. § 3302(b); see Nextel, B-303413 (2004).

the spectrum without further public safety input? In short, which of these options would best serve our goals in increasing shared use of this band at the lowest cost? As noted above, given public safety's relatively modest use of 4.9 GHz spectrum to date, we think that allowing leasing would not impose any cost on public safety. Stated otherwise, we think the benefits of allowing more efficient spectrum use through leasing can be realized at no cost to public safety. We note that there are potential revenue streams from leasing, further supporting our judgement that allowing leasing would be produce benefits that exceed relative costs. We seek comment on this characterization.

3. Two-Tiered Sharing on a Secondary Basis

80. In the *Fifth Further Notice*, the Commission sought comment on whether to open 4.9 GHz band eligibility to commercial users on a secondary or non-interfering basis, while ensuring priority access for public safety entities by means of a sharing mechanism, such as dynamic access control based on a database similar to that used for TV white spaces devices.²⁰⁷ In response, some commenters support extending eligibility to commercial entities on a secondary basis.²⁰⁸ Carlson, AICC, Spectrum Bridge, SSC, and WISPA suggest that adopting an intelligent, dynamic database system as the sharing mechanism could allow non-public safety to use the 4.9 GHz band on a secondary basis.²⁰⁹ The APCO Report recommends that the Commission consider “build[ing] upon the ‘white space’ model and apply[ing] it to the 4.9 GHz arena to spur development by increasing the potential customer base, including within the CII segment.”²¹⁰ APCO recommends that the Commission study “[a]n innovative approach that incorporates essential features such as frequency coordination, with newer spectrum management tools that could expand the user base while preserving reliable access for public safety.”²¹¹

81. However, many public safety commenters oppose opening the band to commercial users, even on a secondary basis.²¹² These commenters express concern that because public safety generally requires greater lead time than commercial entities to secure funding to construct communications systems, commercial operations could foreclose public safety use and increase the risk of interference and congestion. Commenters also express skepticism about the feasibility of a using a dynamic database as a sharing mechanism. FCCA/IMSA/IAFC argue that “white space-style databases are not appropriate for the 4.9 GHz band” because they rely on equipment that employs geo-location or similar technologies, and “requiring 4.9 GHz devices to incorporate geo-location or similar capabilities will unnecessarily impede the development of equipment for the band.”²¹³ Southern similarly “does not believe the database paradigm used for TV White Spaces ... devices would be appropriate for the 4.9 GHz band,” citing the risk to public safety that could be caused by “loss of critical communications service due to database

²⁰⁷ *Fifth Further Notice* at 6593 para. 43.

²⁰⁸ Wyoming Comments at 1, AICC Comments at 3, Carlson Comments at 3, Spectrum Bridge Comments at 13, and WISPA Comments at 5.

²⁰⁹ Carlson Comments at 2-5, AICC Comments at 5, Spectrum Bridge Comments at 7-18, SSC Comments at 4-5, SSC Comments to the NPSTC Plan at 8 (noting that an intelligent database and dynamic spectrum access radios could manage the allocation of frequencies to public safety users on a primary basis and to CII users on a secondary basis), WISPA Comments at 7-8.

²¹⁰ APCO Report at 14-15.

²¹¹ APCO Report at 15.

²¹² Chicago Comments at 3, Denver RTD Comments at 5-7 (“[t]here are other established options [besides the 4.9 GHz band] for point-to-point applications for non-public safety users,” citing the 6 GHz and 11 GHz bands under Part 101 of the Commission’s rules and the unlicensed 5.8 GHz band), EMR Comments at 6, FCCA/IMSA/IAFC Comments at 14, Mobile County Comments at 2, Port Angeles Comments at 4, Region 35 Comments at 2, EWA Comments at 2-3, GRE Comments at 12, UTC Comments at 14, Cambium Comments at 6, MSI Comments at 5.

²¹³ FCCA/IMSA/IAFC Comments at 10.

errors, malfunctions of the coordination system, or loss of connectivity with the database.”²¹⁴

82. *Discussion.* As a third option, we seek comment on the feasibility of a two-tiered sharing approach, in which Tier 1 would consist of primary licensees in the band (including all incumbent users), while Tier 2 would allow other non-public safety users to access the band on a secondary basis, with safeguards to ensure priority and interference protection for Tier 1 operations. We seek comment on potential mechanisms that could facilitate two-tiered sharing in the 4.9 GHz band while protecting primary users.

83. For example, could we implement Tier 2 secondary access to the 4.9 GHz band using frequency coordination and licensing procedures similar to those we are proposing for primary licensing? The public safety community has long relied on frequency coordination in other spectrum bands to protect mission-critical communications from interference. While this system has worked well in other bands, frequency coordination in the 4.9 GHz band would typically take place before deployment and does not take into account the dynamically changing environment of real-time spectrum usage. We seek comment on whether a frequency coordination approach to Tier 2 secondary use would provide sufficient flexibility to support dynamic spectrum use while protecting Tier 1 users. Would real-time coordination be feasible if we required Tier 2 users to provide digital identification and/or geo-location so that Tier 1 users could readily identify potential sources of interference to their systems? We seek comment on relative costs and benefits that a digital ID and/or geolocation requirement on Tier 2 users would have, especially for Tier 2 small businesses.

84. We also seek comment on the feasibility of developing an automated database system to enable dynamic Tier 2 secondary use of the 4.9 GHz band while protecting Tier 1 operations.²¹⁵ We acknowledge the concerns raised by commenters that “white-spaces” databases previously developed for commercial bands might not provide sufficient assurance of real-time protection for mission-critical public safety operations. We seek comment on what capabilities an automated system would need to support the public safety requirements of the 4.9 GHz band. What would it cost to design, build, and operate such a system, and who should be responsible for such costs? What information would Tier 1 and Tier 2 users need to enter and update in the database to facilitate dynamic spectrum sharing? What would be the cost and burden of providing such information? How would an automated system communicate with users’ devices to help minimize interference and facilitate registration, coordination, and dynamic access? What capabilities would be required to identify potentially interfering Tier 2 users in real time and to direct them to move to a non-interfering channel or to shut down? We seek comment on these issues and on alternative models for spectrum sharing that would achieve these goals. Beyond the upfront cost of designing, building and operating the automated database system, and recurring database maintenance costs—both necessary to enable dynamic Tier 2 secondary use—such dynamic spectrum sharing would appear to impose few costs on public safety because it would retain primary access to the spectrum as needed. These costs would be the costs of entering and updating information to the automated database. We seek comment on whether the benefits to secondary users would outweigh the upfront, recurring, and database entry relative costs, and any other appreciable costs that we may not have taken into account.

4. Other Alternatives

85. Finally, we request comment on other alternatives, such as redesignating the 4.9 GHz band, wholly or partially, to support commercial wireless use. Are the bases for the Commission’s decision in 2002 to allocate the entire band for public safety purposes still valid, or does the public interest now call for a change? For example, would the public interest be best served if this spectrum

²¹⁴ Southern Comments at 10.

²¹⁵ See, e.g., Carlson Comments at 2-5, AICC Comments at 5, Spectrum Bridge Comments at 7-18, SSC Comments at 4-5, SSC Comments to the NPSTC Plan at 8 (noting that an intelligent database and dynamic spectrum access radios could manage the allocation of frequencies to public safety users on a primary basis and to CII users on a secondary basis), WISPA Comments at 7-8.

could be used for commercial applications, such as 5G, or would it be better to strike a balance between public safety and commercial uses? What are the relative costs and benefits of a commercial use of this spectrum as weighed against the band plan we propose above or the sharing use alternatives on which we seek comment? If only a portion of the band were to be redesignated, how should the band be divided between public safety and commercial use? If any or all of the spectrum is redesignated for commercial wireless purposes, should the Commission consider auctioning the redesignated spectrum, making licenses available on a first-come, first-served basis, or authorizing the spectrum for unlicensed use under Part 15 of the Rules? If the Commission allows commercial use in all or part of the 4.9 GHz band, should it allow both mobile and fixed use? When considering whether to designate all or part of the band for commercial users, should the Commission consider designating the entire band in markets where there are no existing public safety 4.9 GHz facilities? In markets where there are public safety incumbents, should public safety use be limited to those incumbents or should a specified amount of the 4.9 GHz band be reserved for public safety use? If the Commission divides the band into commercial and public safety segments, would it need to establish guard bands or would in-band and out-of-band emission limits suffice to guard against harmful interference? Commenters should address how the loss of opportunities for public safety spectrum use in the 4.9 GHz band might affect congestion in other bands currently allocated for public safety use.

86. In the event that the Commission redesignates any of the spectrum in the 4.9 GHz band, how should the Commission treat existing public safety systems operating in the band? Should public safety systems simply be grandfathered on their current frequencies? If so, should it be based on the frequencies licensed or those actually deployed and used? If the band is divided into public safety and commercial segments, should public safety licensees be required to relocate their facilities into the public safety segment? In the event the Commission elects to designate the entire band for commercial use, is there alternative spectrum to which existing public safety 4.9 GHz licensees can be relocated? If so, who should pay the relocation cost, *e.g.*, if the Commission decides to auction the redesignated spectrum? Should auction proceeds be used to pay public safety's cost to relocate its systems? We seek comment on the relative costs and benefits of all of these options.

IV. PROCEDURAL MATTERS

87. *Ex Parte Presentations.*—The proceeding shall be treated as a “permit-but-disclose” proceeding in accordance with the Commission’s *ex parte* rules.²¹⁶ Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter’s written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b). In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.*, .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission’s *ex*

²¹⁶ 47 CFR §§ 1.1200 *et seq.*

parte rules.

88. *Comment Filing Procedures.*—Pursuant to sections 1.415 and 1.419 of the Commission’s rules, 47 CFR §§ 1.415, 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission’s Electronic Comment Filing System (ECFS). *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998). **Commenters should refer to WP Docket No. 07-100 when filing in response to this Sixth Further Notice of Proposed Rulemaking.**

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: <http://apps.fcc.gov/ecfs/>.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number.

Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission’s Secretary, Office of the Secretary, Federal Communications Commission.

- All hand-delivered or messenger-delivered paper filings for the Commission’s Secretary must deliver the filings to FCC Headquarters at 445 12th St., SW, Room TW-A325, Washington, DC 20554. The filing hours at this location are 8:00 a.m. to 7:00 p.m. Filers must make sure that all hand deliveries are held together with rubber bands or fasteners. Filers must dispose of any envelopes before entering the building.
- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.
- U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12th Street, SW, Washington DC 20554.

89. *Accessible Formats.*—To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (TTY).

90. *Regulatory Flexibility Analysis.*—As required by the Regulatory Flexibility Act of 1980, *see* 5 U.S.C. § 603, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities of the policies and rules addressed in this document. IRFA is set forth in Appendix C. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines as comments filed in response to this *Sixth Further Notice of Proposed Rulemaking* as set forth herein, and they should have a separate and distinct heading designating them as responses to the IRFA. The Commission’s Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of the *Sixth Further Notice of Proposed Rulemaking*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).²¹⁷

91. *Initial Paperwork Reduction Act Analysis.*—This *Sixth Further Notice of Proposed Rulemaking* contains proposed new and modified information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and the Office of Management and Budget (OMB) to comment on the information collection requirements contained in this document, as required by the Paperwork Reduction Act of 1995 (PRA).²¹⁸ Public and agency comments are due 60 days after publication of this document in the Federal Register. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4), we seek

²¹⁷ *See* 5 U.S.C. § 603(a).

²¹⁸ *See* Paperwork Reduction Act of 1995, Public Law 104-13.

specific comment on how we might “further reduce the information collection burden for small business concerns with fewer than 25 employees.” The Commission will submit the *Sixth Further Notice of Proposed Rulemaking* to the Office of Management and Budget for review under Section 3507(d) of the PRA.

92. We specifically seek comment on the time and cost burdens to meet the license modification proposal in the *Sixth Further Notice of Proposed Rulemaking* and whether there are ways of minimizing the costs burdens associated with the license modification process. For the Commission’s current application for radio service authorization, the Commission has estimated that “each response to this collection of information will take on average 1.25 hours.”²¹⁹ The estimate “includes the time to read the instructions, look through existing records, gather and maintain required data, and actually complete and review the form or response.”²²⁰ We seek comment on whether these time and cost burdens are accurate to meet the proposed modifications to the application.

93. For further information, contact Mr. Thomas Eng, Policy and Licensing Division, Public Safety and Homeland Security Bureau, (202) 418-0019 or TTY (202) 418-7233; or via e-mail at Thomas.Eng@fcc.gov.

V. ORDERING CLAUSES

94. Accordingly, IT IS ORDERED, pursuant to sections 1, 4(i), 4(j), 4(o), 301, 303(b), 303(g), 303(r), 316, 332, and 403 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 154(o), 301, 303(b), 303(g), 303(r), 316, 332, and 403, that this *Sixth Further Notice of Proposed Rulemaking* is HEREBY ADOPTED.

95. IT IS FURTHER ORDERED that the Commission’s Consumer and Governmental Affairs Bureau, Reference Center, SHALL SEND a copy of this *Sixth Further Notice of Proposed Rulemaking*, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

²¹⁹ See FCC Form 601 at 1, available at <http://transition.fcc.gov/Forms/Form601/601.html>. The form has OMB control number 3060-0798.

²²⁰ *Id.*

APPENDIX A**List of Commenters**Comments to the *Fifth Further Notice*

Alarm Industry Communications Committee (AICC)
American Association of State Highway and Transportation Officials (AASHTO)
American Petroleum Institute, The Energy Telecommunications and Electrical Association, and The National Rural Electric Cooperative Association (API/ ENTELEC/NRECA)
Association of Public-Safety Communications-Officials, International, Inc. (APCO)
Carlson Wireless Technologies, Inc. (Carlson)
Cambium Networks Ltd. (Cambium)
City of Chicago (Chicago)
City of Port Angeles, Washington (Port Angeles)
Consolidated Spectrum Services (CSS)
County of Los Angeles, California (LA County)
Denver Regional Transportation District (Denver RTD)
Edison Electric Institute (EEI)
EMR Consulting, Inc. (EMR)
Enterprise Wireless Alliance (EWA)
Forestry Conservation Communications Association, International Municipal Signal Association, and International Association of Fire Chiefs (FCCA/IAFC/IMSA)
Great River Energy (GRE)
Grundy County Emergency Telephone System Board (Grundy ETSB)
King County, Washington (King County)
Mobile County Public Works (Mobile County)
Motorola Solutions, Inc. (MSI)
National Academy of Sciences Committee on Radio Frequencies (CORF)
National Public Safety Telecommunications Council (NPSTC)
National Regional Planning Council (NRPC)
Nebraska Public Power District (NPPD)
Region 35 700 MHz Regional Planning Committee (Region 35)
Region 54 700 MHz Regional Planning Committee (Region 54)
Shared Spectrum Company (SSC)
Southern Company Services, Inc. (Southern)
Spectrum Bridge, Inc. (Spectrum Bridge)
Utilities Telecom Council (UTC)
Wyoming Public Safety Communications Commission – Spectrum Work Group (Wyoming PSCC)

Reply Comments to the *Fifth Further Notice*

AICC
EEI
EWA
Region 5 700 MHz Regional Planning Committee (Region 5)
Wireless Internet Service Providers Association (WISPA)

Comments to the NPSTC Plan

APCO
API
EWA

FCCA/IMSA/IAFC
LA County
K. Raghunandan
Region 8 (Anthony Melia)
Region 13 (William Carter)
Region 24 (Stephen Devine)
Shared Spectrum Company (SSC)
UTC

Reply Comments to the NPSTC Plan

City of New York
King County, Washington and the City of Seattle, Washington (King County/Seattle)
EWA
New York City Transit Authority (NYCTA)
UTC
Vislink, Inc.

Ex Parte Filings

NPSTC 4.9 GHz National Plan Recommendations Final Report (Oct. 24, 2013)
EWA Ex Parte Letter (Jul. 9, 2014)
APCO 4.9 GHz Task Force Report (Sept. 28, 2015)
EWA Ex Parte Letter (Oct. 19, 2015)
Presidential Partners Consulting Letter (Mar. 5, 2016)
UTC, NPSTC, EWA Ex Parte (Apr. 13, 2016)
NPSTC Letter (Response to Presidential Partners Consulting) (Apr. 21, 2016)
Federated Wireless, Inc. Ex Parte (May 18, 2016)
APCO Letter (Response to Federated Wireless) (Jun. 1, 2016)
NPSTC Letter (Response to Federated Wireless) (Jul. 8, 2016)
API Letter (Supporting NPSTC Plan) (Aug. 5, 2016)
UTC Ex Partes (covering three meetings) (Jan. 13-17, 2017)
EWA Ex Parte (Apr. 17, 2017)
API Ex Parte (Apr. 21, 2017)
UTC Ex Partes (covering three meetings) (Jul. 14-21, 2017)

APPENDIX B

Proposed Rules

For the reasons discussed in the preamble, the Federal Communications Commission proposes to amend 47 C.F.R. Parts 0, 2, and 90 as follows:

PART 0 – COMMISSION ORGANIZATION

1. The authority citation for Part 0 continues to read as follows:

AUTHORITY: Sec. 5, 48 Stat. 1068, as amended; 47 U.S.C. 155, 225, unless otherwise noted.

2. Section 0.392 is amended by adding paragraph (k) to read as follows:

§ 0.392 Authority Delegated.

* * * * *

(k) Certifies frequency coordinators; considers petitions seeking review of coordinator actions; and engages in oversight of coordinator actions and practices.

PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

3. The authority citation for Part 2 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, 336.

4. Section 2.106, the Table of Frequency Allocations, is amended by revising page 41 to read as follows:

§ 2.106 Table of Frequency Allocations.

* * * * *

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
(See previous page)	3500-3700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.433	3500-3600 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.433A Radiolocation 5.433	3500-3550 RADIOLOCATION G59 AERONAUTICAL RADIONAVIGATION (ground-based) G110	3500-3550 Radiolocation	Private Land Mobile (90)
3600-4200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile		3600-3700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.433	3550-3650 RADIOLOCATION G59 AERONAUTICAL RADIONAVIGATION (ground-based) G110	3550-3600 FIXED MOBILE except aeronautical mobile US105 US433	Citizens Broadband (96)
			US105 US107 US245 US433	3600-3650 FIXED FIXED-SATELLITE (space-to-Earth) US107 US245 MOBILE except aeronautical mobile US105 US433	Satellite Communications (25) Citizens Broadband (96)
		5.435	3650-3700	3650-3700 FIXED FIXED-SATELLITE (space-to-Earth) NG169 NG185 MOBILE except aeronautical mobile US109 US349	
	3700-4200 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile		3700-4200	3700-4200 FIXED FIXED-SATELLITE (space-to-Earth) NG180	Satellite Communications (25) Fixed Microwave (101)
4200-4400 AERONAUTICAL RADIONAVIGATION 5.438			4200-4400 AERONAUTICAL RADIONAVIGATION		Aviation (87)
5.439 5.440			5.440 US261		
4400-4500 FIXED MOBILE 5.440A			4400-4940 FIXED MOBILE	4400-4500	
4500-4800 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 MOBILE 5.440A				4500-4800 FIXED-SATELLITE (space-to-Earth) 5.441 US245	
4800-4990 FIXED MOBILE 5.440A 5.442 Radio astronomy			US113 US245 US342	4800-4940 US113 US342	
			4940-4990	4940-4950 FIXED MOBILE	Public Safety Land Mobile (90Y)
				4950-4990 FIXED MOBILE except aeronautical mobile	
5.149 5.339 5.443			5.339 US342 US385 G122	5.339 US342 US385	
4990-5000 FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY Space research (passive) 5.149			4990-5000 RADIO ASTRONOMY US74 Space research (passive) US246		

PART 90 –PRIVATE LAND MOBILE RADIO SERVICES

5. The authority citation for Part 90 continues to read as follows:

AUTHORITY: Sections 4(i), 11, 303(g), 303(r), and 332(c)(7) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 161, 303(g), 303(r), and 332(c)(7), and Title VI of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, 126 Stat. 156.

6. Section 90.175 is amended by removing paragraph (j)(22) and adding paragraph (k).

§ 90.175 Frequency coordinator requirements.

* * * * *

(j) * * *

(22) [Removed]

(k) *For frequencies in the 4940-4990 MHz band:* See § 90.1209 of this chapter for further information.

7. Section 90.1205 is amended by revising paragraph (c) to read as follows:

§ 90.1205 Permissible operations.

* * * * *

(c) Aeronautical mobile and robotic station operations are permitted subject to § 90.1219.

8. Section 90.1207 is amended by revising paragraphs (a) through (d) and adding paragraph (e) to read as follows.

§ 90.1207 Licensing.

(a) A 4945-4990 MHz band geographic license gives the licensee authority to operate temporary (1 year or less) fixed stations on any authorized channel in this band within its licensed area of operation. See §90.1213. A 4945-4990 MHz band license will be issued for the geographic area encompassing the legal jurisdiction of the licensee or, in case of a nongovernmental organization, the legal jurisdiction of the state or local governmental entity supporting the nongovernmental organization.

(1) A temporary fixed station is required to be individually licensed if:

(i) International agreements require coordination;

(ii) Submission of an environmental assessment is required under §1.1307 of this chapter; or

(iii) The station would affect areas identified in §1.924 of this chapter.

(2) Any antenna structure that requires notification to the Federal Aviation Administration (FAA) must be registered with the Commission prior to construction under §17.4 of this chapter.

(b) Subject to §90.1209, base stations and mobile units (including portable and handheld units) in the 4945-4990 MHz band are required to be licensed on a site-by-site basis. All existing licensees that operate such stations shall seek licenses for such stations in the Commission's Universal Licensing System database by filing new or modification applications within one year after the Public Safety and Homeland Security Bureau and the Wireless Telecommunications Bureau announce by public notice that the database is ready to accept such applications. Any antenna structure that requires notification to the Federal Aviation Administration (FAA) must be registered with the Commission prior to construction under §17.4 of this chapter.

(c) Permanent fixed point-to-point transmitters and receivers, permanent fixed point-to-multipoint transmitters and fixed receivers in the 4945-4990 MHz band must be licensed individually on a site-by-site basis. All existing licensees that operate such stations shall seek individual licenses for such stations in the Commission's Universal Licensing System database by filing new applications within one year after the Public Safety and Homeland Security Bureau and the Wireless Telecommunications Bureau announce by public notice that the database is ready to accept such applications. Primary permanent fixed point-to-point and point-to-multipoint transmitters must use directional antennas with gains equal to or greater than 26 dBi. All such stations in the 4945-4990 MHz band are accorded primary status.

(d) A 4940-4945 MHz license gives the licensee authority to operate aeronautical mobile or robotic stations subject to § 90.1219 on any authorized channel in this band within its licensed area of operation. *See* § 90.1213. Geographic area licenses and individually licensed stations issued before the effective date of this rule that use spectrum overlapping or within the 4940-4945 MHz band segment are grandfathered.

(e) Existing 4940-4990 MHz band licenses as of the effective date of this rule are grandfathered from revisions to Section 90.1215(a)(2).

9. Section 90.1209 is revised to read as follows:

§ 90.1209 Policies governing the use of the 4940–4990 MHz band.

* * * * *

(b) Eligible applications will be processed on a first come first served priority basis. Each application for a new frequency assignment or for a change in existing facilities must include a showing of frequency coordination. A database of licenses is available at <http://wireless.fcc.gov/uls>. Frequency coordinators and potential applicants should examine this database before seeking station authorization, and make every effort to ensure that their fixed and base stations operate at a location, and with technical parameters, that will minimize the potential to cause and receive interference. Licensees of stations suffering or causing harmful interference are expected to cooperate and resolve this problem by mutually satisfactory arrangements. If licensees are unable to do so, frequency coordinators may adjudicate such matters and recommend solutions to the Commission. The Commission may impose restrictions including specifying the transmitter power, antenna height, or area or hours of operation of the stations concerned. Within one day of making a frequency recommendation, the lead frequency coordinator must send a copy of the application to other certified frequency coordinators. Concurrently, the lead frequency coordinator must send a copy of the application to the adjacent 700 MHz Regional Planning Committee where the signal at the region border

exceeds $-109 \text{ dBW/m}^2/5\text{MHz}$.

(c) Licensees will make every practical effort to protect radio astronomy operations as specified in § 2.106, footnote US385 of this chapter.

(d) Licensees of base or temporary fixed stations must place at least one such station in operation within twelve (12) months of the license grant date, or the license cancels automatically as of the expiration of such twelve-month period, without specific Commission action. Fixed point-to-point and point-to-multipoint stations which are licensed on a site-by-site basis must be placed in operation within twelve (12) months of the grant date or the authorization for that station cancels automatically as of the expiration of such twelve-month period, without specific Commission action.

(e) Temporary fixed point-to-point stations may only be operated for thirty days maximum over a given path over a one-year time frame.

10. Section 90.1211 is revised to read as follows:

§ 90.1211 Regional plan.

(a) To facilitate the shared use of the 4.9 GHz band, each region may submit a plan on guidelines to be used for sharing the spectrum within the region.

(b) Such plans must incorporate the following common elements:

(1) Identification of the document as a plan for sharing the 4.9 GHz band with the region specified along with the names, business addresses, business telephone numbers and organizational affiliations of the chairperson(s) and all members of the planning committee.

(2) A summary of the major elements of the plan and an explanation of how all eligible entities within the region were given an opportunity to participate in the planning process and to have their positions heard and considered fairly.

(3) An explanation of how the plan was coordinated with adjacent regions.

(4) A description of the coordination procedures for permanent fixed point-to-point and point-to-multipoint stations, base stations, temporary fixed stations, and mobile operations. The procedures shall include, but are not limited to, mechanisms for incident management protocols, interference avoidance, and interoperability.

(c) Regional plans may vary from the band plan in the following areas:

(1) Limit channel aggregation to 20 megahertz bandwidth.

(2) Designate one or more channels for specialized use.

(3) Place limits on the use of point-to-point links in urban areas or impose more stringent limits on antenna gain, maximum conducted output power, power spectral density, or other technical parameters of point-to-point systems relative to the limits of § 90.1215.

(4) Require polarization for point-to-point links.

(d) Regional plans may be modified by submitting a written request, signed by the regional planning committee, to the Chief, Public Safety and Homeland Security Bureau. The request must contain the full text of the modification, and a certification that all eligible entities had a chance to participate in discussions concerning the modification and that any changes have been coordinated with adjacent regions.

11. Section 90.1213 is amended by revising paragraphs (a) and (b) to read as follows:

§ 90.1213 Band plan.

(a) Upon the effective date of this rule, Channel numbers 1 through 5 are aggregated for a channel bandwidth of 5 MHz and may be subsequently licensed for use only in accordance with § 90.1219 of this chapter; any existing operations on these channels prior to the effective date of this rule are grandfathered. Channel numbers 6 through 13 are 5 MHz bandwidth channels and Channel numbers 14 through 18 are 1 MHz bandwidth channels. The following channel center frequencies are permitted to be aggregated for channel bandwidths of 5, 10, 15 or 20 MHz as described in paragraph (b) of this section. Channel numbers 14 through 18 should be used for narrow bandwidth operations and should be used in aggregations only if all other 5 MHz channels are blocked.

Center Frequency (MHz)	Bandwidth (MHz)	Channel Nos.
4942.5	5	1-5
4947.5	5	6
4952.5	5	7
4957.5	5	8
4962.5	5	9
4967.5	5	10
4972.5	5	11
4977.5	5	12
4982.5	5	13
4985.5	1	14
4986.5	1	15
4987.5	1	16
4988.5	1	17
4989.5	1	18

* * *

(b) The following tables list center frequencies to be licensed for aggregated channels only. A license may contain any combination of bandwidths from aggregated channels provided that the bandwidths do not overlap. The bandwidth edges (lower and upper frequencies) are provided to aid in planning.

(1) 5 MHz bandwidth aggregation:

Center Frequency (MHz)	Channel Nos. Employed	Lower Frequency (MHz)	Upper Frequency (MHz)
4942.5	1 to 5*	4940	4945
4947.5	6	4945	4950
4952.5	7	4950	4955

4957.5	8	4955	4960
4962.5	9	4960	4965
4967.5	10	4965	4970
4972.5	11	4970	4975
4977.5	12	4975	4980
4982.5	13	4980	4985
4987.5	14 to 18**	4985	4990

* Licensees for these channels granted after the effective date of this rule may use these channels only in accordance with § 90.1219 of this chapter.

**Licensees should avoid using these channels in aggregations unless all other channels are blocked.

(2) 10 MHz bandwidth aggregation:

Center Frequency (MHz)	Channel Nos. Employed	Lower Frequency (MHz)	Upper Frequency (MHz)
4950	6 & 7	4945	4955
4955	7 & 8	4950	4960
4960	8 & 9	4955	4965
4965	9 & 10	4960	4970
4970	10 & 11	4965	4975
4975	11 & 12	4970	4980
4980	12 & 13	4975	4985
4985	13 to 18*	4980	4990

*Licensees should avoid using these channels in aggregations unless all other channels are blocked.

(3) 15 MHz bandwidth aggregation:

Center Frequency (MHz)	Channel Nos. Employed	Lower Frequency (MHz)	Upper Frequency (MHz)
4952.5	6 to 8	4945	4960
4957.5	7 to 9	4950	4965
4962.5	8 to 10	4955	4970
4967.5	9 to 11	4960	4975
4972.5	10 to 12	4965	4980
4977.5	11 to 13	4970	4985
4982.5	12 to 18*	4975	4990

*Licensees should avoid using these channels in aggregations unless all other channels are blocked.

(4) 20 MHz bandwidth aggregation:

Center Frequency (MHz)	Channel Nos. Employed	Lower Frequency (MHz)	Upper Frequency (MHz)
4955	6 to 9	4945	4965
4960	7 to 10	4950	4970
4965	8 to 11	4955	4975
4970	9 to 12	4960	4980

4975	10 to 13	4965	4985
4980	11 to 18*	4970	4990

*Licensees should avoid using these channels in aggregations unless all other channels are blocked.

(5) 30 MHz bandwidth aggregation:

Center Frequency (MHz)	Channel Nos. Employed	Lower Frequency (MHz)	Upper Frequency (MHz)
4960	6 to 11	4945	4975
4965	7 to 12	4950	4980
4970	8 to 13	4955	4985
4975	9 to 18*	4960	4990

*Licensees should avoid using these channels in aggregations unless all other channels are blocked.

(6) 40 MHz bandwidth aggregation:

Center Frequency (MHz)	Channel Nos. Employed	Lower Frequency (MHz)	Upper Frequency (MHz)
4965	6 to 13	4945	4985
4970	7 to 18*	4950	4990

*Licensees should avoid using these channels in aggregations unless all other channels are blocked.

12. Section 90.1215 is amended by revising paragraph (a)(2) to read as follows:

§ 90.1215 Power limits.

* * *

(a) * * *

(1) * * *

(2) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point transmitting antennas (both fixed and temporary-fixed rapid deployment) shall operate with minimum directional gain of 26 dBi, maximum 5.5 degree beamwidth and 25 dB front-to-back ratio. For point-to-point systems, the maximum effective isotropically radiated power (EIRP) is 65.15 dBm. High power point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain exceeding 26 dBi. For point-to-multipoint systems, the maximum EIRP is 55.15 dBm. Frequency coordinators may recommend reduction to the EIRP on a case-by-case basis, through reduction of the maximum conducted output power, spectral density, and/or antenna gain. Further, under § 90.1211(c)(3)-(4), Regional Planning Committees may recommend alternate lower

limits to the allowed antenna gain, maximum conducted output power, or power spectral density of point-to-point systems.

* * * * *

13. Section 90.1219 is created to read as follows:

§ 90.1219 Aeronautical mobile and robotic operation.

Entities eligible pursuant to § 90.1203(a) may conduct manned aeronautical mobile and robotic terrestrial operations on Channels 1 through 5 (4940-4945 MHz) to transmit video payload on a primary basis to terrestrial services under the following restrictions.

(a) Airborne use of these channels is limited to aircraft flying at or below 457 meters (1500 feet) above ground level. Fixed wing aircraft may use these channels at altitudes exceeding 457 meters above ground level as necessary to comply with 14 CFR § 91.119(b)-(c).

(b) Licensees may use only low power devices as defined by § 90.1215 that use Emission Mask L as defined by § 90.210(l) for aeronautical mobile use.

(c) Licensees may use only low power devices as defined by § 90.1215 for robotic applications.

(d) The applicant shall provide a description of proposed operation to demonstrate that the proposed aeronautical mobile operations protect radio astronomy operations and terrestrial services from interference.

(e) Aeronautical mobile and robotic applications must be approved in writing by the 700 MHz Regional Planning Committee or the National Regional Planning Council as part of the frequency coordination Regional Planning Committee review process before the coordinator can submit the application to the Commission.

(f) Aeronautical mobile operations are prohibited within 80.5 kilometers (50 miles) of radio astronomy sites listed in § 2.106 US385 or US131. The coordinates to be used for the Allen Telescope Array are 40° 49' 01" North latitude, 121° 28' 12" West longitude. An applicant for aeronautical mobile use whose geographic boundaries fall within 80.5 kilometers of any of these radio astronomy sites may request a waiver, but shall certify that it has served a copy of the application on affected radio astronomy observatories.

(g) The Commission has the discretion to impose special conditions and operating restrictions on individual licenses as necessary to reduce risk of interference to radio astronomy operations and terrestrial services.

(h) Transmissions in the 4940-4990 MHz band to or from unmanned aerial systems are prohibited.

APPENDIX C

INITIAL REGULATORY FLEXIBILITY ANALYSIS

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),

2. ¹ the Commission has prepared this Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies and rules proposed in this *Sixth Further Notice of Proposed Rulemaking (Sixth Further Notice)*. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments on the *Sixth Further Notice* provided in Section IV of the item. The Commission will send a copy of the *Sixth Further Notice*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).² In addition, the *Sixth Further Notice* and IRFA (or summaries thereof) will be published in the Federal Register.³

A. Need for, and Objectives of, the Proposed Rules

3. We are issuing a *Sixth Further Notice* to propose rule changes to encourage greater use and improved spectrum efficiency of the 4940-4990 MHz (4.9 GHz) band. We seek to implement changes to our policies and regulations that promote optimal use, innovation, and investment. In 2002, the Commission envisioned that the band would support new broadband applications such as high-speed digital technologies and wireless local area networks (WLANs) for incident scene management, dispatch operations, and vehicular/personal communications. Notwithstanding the Commission's action to accord primary status to broadband permanent fixed point-to-point links in 2009, the development of the 4.9 GHz band to date appears to have fallen short of its potential. The *Fifth Further Notice of Proposed Rulemaking* in this proceeding enabled the Commission to develop a record on several issues, including 4.9 GHz coordination, eligibility, licensing, band plan, power and antenna gain, aeronautical mobile use, and standards.⁴

4. The *Sixth Further Notice* proposes to:

- Expand the channel aggregation bandwidth limit to 40 megahertz.
- Allow public safety aeronautical mobile and robotic use on channels 1-5.
- Require applicants for new stations and licensees seeking modification to submit to frequency coordination administered by the FCC-certified frequency coordinators.
- Maintain the Universal Licensing System (ULS) to serve as the frequency coordination database and modify the 4.9 GHz band application form to capture additional data.
- Require existing licensees with base, mobile, point-to-point (P-P), and point-to-multipoint (P-MP) stations license such stations in the database so their operations can be protected during future coordination.
- Restart the filing process for regional plans.
- Accord primary status for P-P and P-MP links that carry or support narrowband traffic on channels 14-18.

¹ See 5 U.S.C. § 603. The RFA, see 5 U.S.C. §§ 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

² See 5 U.S.C. § 603(a).

³ *Id.*

⁴ Fifth Further Notice of Proposed Rulemaking, 27 FCC Rcd 6577, 6584 n. 49 (2012).

- Raise the minimum antenna gain for P-P transmitting antennas to 26 dBi.
- Revise the construction notification deadlines to 12 months after license grant.
- Grandfather existing licensees and their installed systems.

B. Legal Basis

5. Interest parties may find authority for the actions proposed in this *Sixth Further Notice* in sections 1, 4(i), 4(j), 4(o), 301, 303(b), 303(g), 303(r), 316, 332, and 403 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 154(o), 301, 303(b), 303(g), 303(r), 316, 332, and 403.

C. Description and Estimate of the Number of Small Entities to Which Rules Will Apply

6. The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the proposed rules, if adopted.⁵ The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”⁶ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.⁷ A “small business concern” is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (“SBA”).⁸

7. *Small Businesses, Small Organizations, Small Governmental Jurisdictions.*⁹ Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three broad groups of small entities that could be directly affected herein.¹⁰ First, while there are industry specific size standards for small businesses that are used in the regulatory flexibility analysis, according to data from the SBA’s Office of Advocacy, in general a small business is an independent business having fewer than 500 employees.¹¹ These types of small businesses represent 99.9% of all businesses in the United States which translates to 28.8 million businesses.¹²

8. Next, the type of small entity described as a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”¹³

⁵ 5 U.S.C. § 603(b)(3).

⁶ 5 U.S.C. § 601(6).

⁷ 5 U.S.C. § 601(3) (incorporating by reference the definition of “small-business concern” in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

⁸ 15 U.S.C. § 632.

⁹ See 47 CFR §§ 90.1203, 90.523. Governmental jurisdictions are eligible to hold public safety licenses in the 4.9 GHz band.

¹⁰ See 5 U.S.C. § 601(3)-(6).

¹¹ See SBA, Office of Advocacy, “Frequently Asked Questions, Question 1 – What is a small business?” https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016)

¹² See SBA, Office of Advocacy, “Frequently Asked Questions, Question 2- How many small business are there in the U.S.?” https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

¹³ 5 U.S.C. § 601(4).

Nationwide, as of Aug. 2016, there were approximately 356,494 small organizations based on registration and tax data filed by nonprofits with the Internal Revenue Service (IRS).¹⁴

9. Finally, the small entity described as a “small governmental jurisdiction” is defined generally as “governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”¹⁵ U.S. Census Bureau data from the 2012 Census of Governments¹⁶ indicates that there were 90,056 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.¹⁷ Of this number there were 37,132 General purpose governments (county¹⁸, municipal and town or township¹⁹) with populations of less than 50,000 and 12,184 Special purpose governments (independent school districts²⁰ and special districts²¹) with populations of less than 50,000. The 2012 U.S. Census Bureau data for most types of governments in the local government category shows that the majority of these governments have

¹⁴ Data from the Urban Institute, National Center for Charitable Statistics (NCCS) reporting on nonprofit organizations registered with the IRS was used to estimate the number of small organizations. Reports generated using the NCCS online database indicated that as of August 2016 there were 356,494 registered nonprofits with total revenues of less than \$100,000. Of this number 326,897 entities filed tax returns with 65,113 registered nonprofits reporting total revenues of \$50,000 or less on the IRS Form 990-N for Small Exempt Organizations and 261,784 nonprofits reporting total revenues of \$100,000 or less on some other version of the IRS Form 990 within 24 months of the August 2016 data release date. See <http://nccs.urban.org/sites/all/nccs-archive/html/tablewiz/tw.php> where the report showing this data can be generated by selecting the following data fields: Report: “The Number and Finances of All Registered 501(c) Nonprofits”; Show: “Registered Nonprofits”; By: “Total Revenue Level (years 1995, Aug to 2016, Aug)”; and For: “2016, Aug” then selecting “Show Results”. INDEPENDENT SECTOR, THE NEW NONPROFIT ALMANAC & DESK REFERENCE (2010).

¹⁵ 5 U.S.C. § 601(5).

¹⁶ See 13 U.S.C. § 161. The Census of Government is conducted every five (5) years compiling data for years ending with “2” and “7”. See also Program Description Census of Government <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadate.xhtml?lang=en&type=program&id=program.en.CO.G#>.

¹⁷ See U.S. Census Bureau, 2012 Census of Governments, Local Governments by Type and State: 2012 - United States-States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG02.US01>. Local governmental jurisdictions are classified in two categories - General purpose governments (county, municipal and town or township) and Special purpose governments (special districts and independent school districts). U.S. Census Bureau, Statistical Abstract of the United States: 2012 at 267, Table 428 (2011), <http://www2.census.gov/library/publications/2011/compendia/statab/131ed/2012-statab.pdf> (citing data from 2007).

¹⁸ See U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01>. There were 2,114 county governments with populations less than 50,000.

¹⁹ See U.S. Census Bureau, 2012 Census of Governments, Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States - States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01>. There were 18,811 municipal and 16,207 town and township governments with populations less than 50,000.

²⁰ See U.S. Census Bureau, 2012 Census of Governments, Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01>. There were 12,184 independent school districts with enrollment populations less than 50,000.

²¹ See U.S. Census Bureau, 2012 Census of Governments, Special District Governments by Function and State: 2012 - United States-States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG09.US01>. [The U.S. Census Bureau data did not provide a population breakout for special district governments.](#)

(continued....)

populations of less than 50,000.²² Based on this data we estimate that at least 49,316 local government jurisdictions fall in the category of “small governmental jurisdictions.”²³

10. *Private Land Mobile Radio Licensees.* Private land mobile radio (PLMR) systems serve an essential role in a vast range of industrial, business, land transportation, and public safety activities. Companies of all sizes operating in all U.S. business categories use these radios. Because of the vast array of PLMR users, the Commission has not developed a small business size standard specifically applicable to PLMR users. The closest applicable SBA category is Wireless Telecommunications Carriers (except Satellite) which encompasses business entities engaged in *radiotelephone communications*. The appropriate size standard for this category under SBA rules is that such a business is small if it has 1,500 or fewer employees.²⁴ For this industry, U.S. Census data for 2012 shows that there were 967 firms that operated for the entire year.²⁵ Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or more.²⁶ Thus under this category and the associated size standard, the Commission estimates that the majority of PLMR licensees are small entities.

11. According to the Commission’s records, a total of approximately 400,622 licenses comprise PLMR users.²⁷ Of this number there are a total of 3,174 PLMR licenses in the 4.9 GHz band.²⁸ The Commission does not require PLMR licensees to disclose information about number of employees, and does not have information that could be used to determine how many PLMR licensees constitute small entities under this definition. The Commission however believes that a substantial number of PLMR licensees may be small entities despite the lack of specific information.

12. *Frequency Coordinators.* Neither the Commission nor the SBA has developed a small business size standard specifically applicable to spectrum frequency coordinators.²⁹ The closest applicable SBA category is Business Associations which comprises establishments primarily engaged in

²² See U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States–States - <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01>; Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States–States - <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01>; and Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States–States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01>. While U.S. Census Bureau data did not provide a population breakout for special district governments, if the population of less than 50,000 for this category of local government is consistent with the other types of local governments the majority of the 38, 266 special district governments have populations of less than 50,000.

²³ *Id.*

²⁴ See 13 CFR § 121.201, NAICS code 517210.

²⁵ U.S. Census Bureau, 2012 Economic Census of the United States, Table EC1251SSSZ5, Information: Subject Series, “Establishment and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210”. https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517210.

²⁶ *Id.* Available census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with “1000 employees or more.”

²⁷ This figure was derived from Commission licensing records as of September 19, 2016. Licensing numbers change on a daily basis. This does not indicate the number of licensees, as licensees may hold multiple licenses. There is no information currently available about the number of PLMR licensees that have fewer than 1,500 employees.

²⁸ Based on an FCC Universal Licensing System search of January 26, 2018. Search parameters: Radio Service = PA – Public Safety 4940-4990 MHz Band; Authorization Type = Regular; Status = Active.

²⁹ The Commission’s records indicate that there are currently 13 frequency coordinators that would be affected by this rulemaking. See <https://www.fcc.gov/wireless/wireless-services/industrial-business/industrial-business-licensing#block-menu-block-4> (last visited Jan. 26, 2018).

promoting the business interests of their members.³⁰ The SBA has developed a small business size standard for “Business Associations,” which consists of all such firms with gross annual receipts of \$7.5 million or less.³¹ For this category, U.S. Census Bureau data for 2012 shows that there were 14,996 firms that operated for the entire year.³² Of these firms, a total of 14,229 had gross annual receipts of less than \$5 million and 396 firms had gross annual receipts of \$5 million to \$9,999,999.³³

13. There are 13 entities certified to perform frequency coordination functions under Part 90 of the Commission’s rules.³⁴ According to U. S. Census Bureau data approximately 95% of business associations have gross annual receipts of \$7.5 million or less and would be classified as small entities. The Business Associations category is very broad however, and does not include specific figures for firms that are engaged in frequency coordination. Thus, the Commission is unable to ascertain exactly how many of the frequency coordinators are classified as small entities under the SBA size standard.³⁵ Therefore, for purposes of this IRFA under the associated SBA size standard, the Commission estimates that a majority of the 13 FCC-certified frequency coordinators are small.

14. *Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.* This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment.³⁶ Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment.³⁷ The SBA has established a size standard for this industry of 1,250 employees or less.³⁸ U.S. Census data for 2012 show that 841 establishments operated in this industry in that year.³⁹

³⁰ See U.S. Census Bureau, 2012 NAICS Definitions, NAICS Code “813910, “Business Associations”, <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.813910>. See also, e.g., Replacement of Part 90 by Part 88 to Revise the Private Land Mobile Radio Services and Modify the Policies Governing Them, PR Docket 92-235, *Second Report and Order*, 12 FCC Rcd 14307, 14353 (1997).

³¹ 13 CFR § 121.201, NAICS Code 813910.

³² U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1281SSSZ4, Other Services (Except Public Administration): Subject Series - Estab and Firm Size: Receipts/Revenue Size of Firms for the United States: 2012, NAICS code 813910, https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/81SSSZ4/naics~813910.

³³ *Id.* Available census data does not provide a more precise estimate of the number of firms that have receipts of \$7.5 million or less. The data provided accounts for firms with receipts of less than \$5 million or between \$5 million and \$9,999,999.

³⁴ The Commission’s records indicate that there are currently 13 frequency coordinators that would be affected by this rulemaking. See <https://www.fcc.gov/general/public-safety-frequency-coordinators>; and <https://www.fcc.gov/wireless/wireless-services/industrial-business/industrial-business-licensing> (last visited Jan. 26, 2018).

³⁵ 13 C.F.R § 121.201.

³⁶ The NAICS Code for this service is 334220. 13 C.F.R 121.201. See also U.S. Census Bureau, 2012 NAICS Definitions, “334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing” <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.334220#>.

³⁷ *Id.*

³⁸ 13 CFR § 121.201, NAICS Code 334220.

³⁹ U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1231SG2, Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2012, NAICS Code 334220, https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/31SG2/naics~334220.

Of that number, 828 establishments operated with fewer than 1,000 employees, 7 establishments operated with between 1,000 and 2,499 employees and 6 establishments operated with 2,500 or more employees.⁴⁰ Based on this data, we conclude that a majority of manufacturers in this industry are small.

15. *Wireless Telecommunications Carriers (except Satellite)*. This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular services, paging services, wireless internet access, and wireless video services.⁴¹ The appropriate size standard under SBA rules is that such a business is small if it has 1,500 or fewer employees.⁴² For this industry, Census data for 2012 show that there were 967 firms that operated for the entire year.⁴³ Of this total, 955 firms had fewer than 1,000 employees and 12 had employment of 1,000 employees or more.⁴⁴ Thus under this category and the associated size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities.

16. The Commission's own data—available in its Universal Licensing System—indicate that, as of October 25, 2016, there are 280 Cellular licensees that will be affected by our actions today.⁴⁵ The Commission does not know how many of these licensees are small, as the Commission does not collect that information for these types of entities. Similarly, according to internally developed Commission data, 413 carriers reported that they were engaged in the provision of wireless telephony, including cellular service, Personal Communications Service (PCS), and Specialized Mobile Radio (SMR) services.⁴⁶ Of this total, an estimated 261 have 1,500 or fewer employees.⁴⁷ Thus, using available data, we estimate that the majority of wireless firms can be considered small.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

17. The *Sixth Further Notice* proposal to permit aeronautical mobile operation would impose a one-time information collection requirement on applicants for such operation. The information collected would include a description of proposed operation to demonstrate that the proposed aeronautical mobile operations protect radio astronomy (RAS) operations and 4.9 GHz terrestrial services from interference. Applicants would submit their applications to their frequency coordinator and their

⁴⁰*Id.*

⁴¹ NAICS Code 517210. See <https://www.census.gov/eos/www/naics/>. NAICS Code 517210. See <https://www.census.gov/eos/www/naics/>. U.S. Census Bureau, 2012 NAICS Definitions, “517210 Wireless Telecommunications Carriers (Except Satellite),” See <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.517210>.

⁴² 13 CFR § 121.201, NAICS code 517210.

⁴³ U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ5, Information: Subject Series: Estab and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210 (rel. Jan. 8, 2016). https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517210.

⁴⁴ *Id.* Available census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with “1000 employees or more.”

⁴⁵ See <http://wireless.fcc.gov/uls>. For the purposes of this IRFA, consistent with Commission practice for wireless services, the Commission estimates the number of licensees based on the number of unique FCC Registration Numbers.

⁴⁶ *Trends in Telephone Service*, at tbl. 5.3. *Trends in Telephone Service*, at tbl. 5.3. *Trends in Telephone Service*, at tbl. 5.3. See Federal Communications Commission, Wireline Competition Bureau, Industry Analysis and Technology Division, *Trends in Telephone Service* at Table 5.3 (Sept. 2010) (*Trends in Telephone Service*), https://apps.fcc.gov/edocs_public/attachmatch/DOC-301823A1.pdf.

⁴⁷ See *id.*

respective regional planning committee or the National Association of Regional Planning Committees for coordination. If the applicant's geographic boundaries fall within 80.5 kilometers of the edge of the proposed aeronautical operation, the collected information also would include a waiver request and a certification that the applicant has served a copy of the application to all affected RAS observatories listed in the Table of Frequency Allocations, 47 CFR § 2.106 footnote US385. This information collection is technical in nature and may incur costs associated with compensating engineering or technical staff or consultants. The purpose of this proposed information collection requirement is to ensure that the proposed aeronautical mobile operations protect RAS operations and 4.9 GHz terrestrial services from interference, and to make affected RAS observatories aware of the proposed aeronautical use so that they can identify the source of any actual interference that may occur.

18. The *Sixth Further Notice* proposal to require base and mobile stations, permanent fixed point-to-point transmitters and receivers, and permanent fixed point-to-multipoint transmitters and receivers in the 4940-4990 MHz band to be licensed individually on a site-by-site basis for coordination purposes would impose a one-time information collection requirement on existing 4.9 GHz band licensees. The information collected would include transmitter station technical parameters such as coordinates, antenna height, and antenna gain. Collected information also would include permanent fixed receiver locations in the case of point-to-point and directional point-to-multipoint links. The information would be collected on Form 601 in the Commission's Universal Licensing System database. We expect there to be no application fee associated with this information collection for public safety entities because they are exempt from application fees pursuant to 47 CFR § 1.1116(b). Engineering or technical skills would be necessary to comply with this information collection. The purpose of this proposed information collection requirement is to make this information available to frequency coordinators to ensure that these operations are protected from interference. The *Sixth Further Notice* proposes a one-year deadline for licensees to complete this information collection after final rules in this proceeding become effective. Before the deadline, the Commission would waive frequency coordination requirements. After one year, the information collection would be subject to frequency coordination requirements, including frequency coordination fees. We seek comment on whether small entities should have a lengthier deadline, and what showing the Commission should require from licensees to attest that they qualify as small entities. Should the Commission require small entities to file attestations by the one-year deadline, or accept attestations after the deadline at the time they eventually complete the information collection?

19. The *Sixth Further Notice* proposal to require regional planning committees to file regional plans within one year of the effective date of the final rule applies only to RPCs that opt to file regional plans. The purpose of these proposals is to motivate regional planning committees to devise plans to facilitate shared use of the 4.9 GHz band. Regional plans may contain licensee compliance requirements including: smaller channel aggregation limits; limitations on channel usage for specialized use; limits on use of point-to-point links in urban areas or more stringent limits on antenna gain, maximum conducted output power, power spectral density, or other technical parameters of point-to-point systems relative to Section 90.1215(a); and polarization for point-to-point links. Regional planning committees may opt not to file a plan, in which case the Commission assume that licensees will comply with the standard channel plan.

20. The *Sixth Further Notice* proposal to require a minimum antenna gain of 26 dBi, a maximum 5.5-degree beamwidth, and 25 dB front-to-back ratio for high power point-to-point transmitters is intended to produce narrower beamwidths, which can allow greater reuse of spectrum by allowing a greater density of co-channel point-to-point links within a given geographic area. To comply with this proposed rule, new entrant small entities would be required to use antennas that meet the proposed specifications on high power point-to-point transmitters. We propose to grandfather existing licensees from this requirement. We seek comment on whether the proposed requirement would be burdensome on small entities.

21. Currently, licensees of base or temporary fixed stations have no time limit to place such stations in operation, and licensees of fixed point-to-point stations have a deadline of eighteen (18)

months to place such stations in operation.⁴⁸ The proposal to require licensees of base stations and temporary fixed stations to place at least one such station in operation within twelve (12) months of the license grant date, along with the proposal to require licensees of fixed point-to-point stations and fixed point-to-multipoint stations to place all such stations in operation within twelve months of license grant date, are intended to ensure timely deployment and usage of the 4.9 GHz spectrum and reduce spectrum warehousing where licensed channels lies fallow. To comply with this proposed rules, small entity licensees must file notice(s) of construction with the Commission using the Universal Licensing System (<http://wireless.fcc.gov/uls>) by the 12-month deadline. We seek comment on whether a more lenient deadline(s) should apply to small business entities.

E. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

22. The RFA requires an agency to describe any significant alternatives that it has considered in developing its approach, which may include the following four alternatives (among others): “(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities.”⁴⁹

23. The *Sixth Further Notice* proposal to require information collection of certain operations may impose economic impact on small entities. We considered an exemption from coverage of the proposed rule, or any part thereof, for such small entities. However, such an exemption would frustrate the purpose of the proposed rules, which is to make certain information available to frequency coordinators to ensure that primary status licensees operations are protected from interference before it occurs. An exemption of the rule would mean that certain information about small entity licensees would not show up in the frequency coordination database, and thus, the frequency coordinator would not be able to make informed frequency coordination decisions regarding new users. As a result, the small entity licensee could experience actual harmful interference from new users of the 4.9 GHz band and would have to attempt to identify the source of the interference and mutually resolve the interference. Actual harmful interference can be difficult and costly to resolve in a timely manner.

24. We are aware that small entities may have fewer resources to meet the proposed one-year timetable of the information collection proposal. Therefore, we are considering a more lenient deadline for small entities to comply with the information collection proposal, and we seek comment on an appropriate timetable.

25. The *Sixth Further Notice* proposes to require a minimum antenna gain of 26 dBi, a maximum 5.5-degree beamwidth, and 25 dB front-to-back ratio for high power point-to-point transmitters. If adopted the proposal would require small entities to replace their antennas. Therefore in an effort to minimize this impact, The *Sixth Further Notice* proposes the grandfathering of existing point-to-point and point-to-multipoint installations from having to replace antennas, and we seek comment on whether this adequately minimizes economic impact on small entities. We decline to allow an exemption for small entities as an alternative because a vast majority of licensees are small entities,⁵⁰ and the proposed rule would serve little purpose by applying only to a relative few number of licensees.

26. The *Sixth Further Notice* proposal to limit temporary fixed point-to-point station operations to thirty days maximum over a given path over a one-year time frame is intended to limit use of temporary links to emergency situations so that other uses of the band can be maximized. We

⁴⁸ 47 CFR § 90.1209(d).

⁴⁹ 5 U.S.C. § 603(c)(1) – (4).

⁵⁰ Most public safety licensees are governmental jurisdictions. As we mentioned in Section C above, 88,761 out of a total of 89,476 governmental jurisdictions are considered small.

considered the alternative of allowing temporary fixed links to operate without limitation in the one-year timeframe, but such operations can preclude other uses of the band such as permanent fixed stations, which are primary in most cases. We therefore seek comment on other ways to minimize the significant economic impact of this proposal on small entities.

F. Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rules

27. None.