Markets in Experimental Licenses

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Markets for experimental licenses could provide flexibility and shorter-term spectrum licenses that currently are unavailable in the current statutory framework. I propose that private firms be permitted to register with a newly established "Special Temporary Authority Facility" to conduct auctions and collect fees for experimental special temporary authority (STAs) licenses. Under a proposed "Spectrum Exchange Act of 2024," the FCC would be tasked with regulating the registrations of these firms. Price discovery from bids for experimental licenses would help regulators assess how valuable certain spectrum bands are, what uses are valuable, and enable greater use of unused spectrum in smaller time frames and smaller geographic areas. An intermediary approach would help the FCC find spectrum bands for the spectrum pipeline by allowing them to watch market participants iteratively discover valuable uses in smaller, more local areas. The facility would be driven by the demand-side, rather than rulemaking from the supply-side.

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I. Introduction

Auctions have enabled commercial users to access enormous economic value from flexible-use spectrum licenses, demonstrated by the billions of dollars spent by market participants in recent FCC auctions. Even so, federal agencies still take decades to release more spectrum because the institution is not that flexible or fast in deciding which bands to clear and reallocate, even when the bands are eventually auctioned as "flexible-use" licenses. To become more flexible, I propose an expansion of the Experimental Special Temporary Authority (STA) license program. This class of license appears to be commercially valuable as evidenced by its repeat customers. Experimental STAs are granted for time frames as short as a few days, for small geographic areas around discrete places, such as motor raceways, golf tournaments, music awards ceremonies, satellite launches, radar facilities, and wireless facilities.

The FCC has broad authority to allocate spectrum "to provide flexibility of use"[2] and has stated recently in the 3.3 GHz-3.55 GHz NPRM[3] that "the Commission considers clearing spectrum for flexible use to be a priority when it is feasible to do so."[4] The FCC also stated its view that "[s]pectrum encumbrances, on the other hand, constrain the potential of future uses of that spectrum, deter investment in the band, and undermine the public interest benefits of the relicensing process."[5]

While it has a stated commitment to flexibility, the FCC is also hampered by hold-ups of many dimensions. Flexibility is conditional, "provided such flexible use complies with international agreements, would be in the public interest, would not deter investment in communications services and systems and technological development, and would not result in harmful interference among users."[6]

In the 3.1 GHz-3.55 GHz FNPRM, the limits on flexibility become apparent in the discussion of future flexible use. As is the case with every band that is considered for auction and reallocation, the FCC must acknowledge and consider the risk of harmful interference to neighboring adjacent bands. In the frequencies down the dial, at 2.9-3.0 GHz, the NEXRAD weather radar system operated by the National Weather Service is using the band on a non-federal secondary basis, but does not raise objections or foresees interference, at least so far as no commenter has submitted a dispute in the record of risk of future interference.[7]

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[2] In the Matter of Facilitating Shared Use in the 3100-3550 MHz Band, WT Docket No. 19-348, Report & Order and FNPRM, Sept. 30, 2020, para. 23, n.62, https://docs.fcc.gov/public/attachments/FCC-20-138A1.pdf [*3.1-3.55 GHz R&O & FNPRM (2020)*] (citing 47 U.S.C. § 303(y)).
[3] In the Matter of Facilitating Shared Use in the 3.1-3.55 GHz Band, WT Docket No. 19-348, Notice of Proposed Rulemaking, 34 FCC Rcd 12662, Dec. 12, 2019, https://docs.fcc.gov/public/attachments/FCC-19-130A1.pdf [*3.1-3.55 GHz NPRM (2019)*].
[4] 3.1-3.55 GHz R&O & FNPRM (2020) at para. 22 n.59 (citing *3.1-3.55 GHz NPRM (2019)*, 34 FCC Rcd at 12665, para. 9).
[5] *Id*. at para. 22.
[6] *Id*. at para. 23, citing n.62 (47 U.S.C. § 303(y)).
[7] 3.1-3.55 GHz R&O & FNPRM (2020) at para. 31.

However, this scenario has played out in other bands where the record entered in past dockets has been disputed in future conflicts, such as the FAA band, the NOAA band, the GPS band, and more. The FCC does its best to collect public comment and engineering estimates, but as is the nature in rulemaking, as the decades pass, conditions change and interference disputes arise. If the dispute was not entered in the record in the past, who bears the burden to prove interference in the future?

This is the nature of the limitations on flexibility, in so far as the FCC is flexible to update its own rulemakings and expectations of license terms. If the rulemaking was silent at the time of the allocation on the potential interference, the license was flexible, but only until a dispute arises later.

This iterative cycle could be improved upon, however. The FCC has become more flexible over the decades in its ability to auction flexible-use licenses, and its turnaround times to find, clear, and auction new bands. The next section reviews the pace at which the FCC has been able to handle the spectrum policy challenges of engineering studies, economic review, administrative process, and the political environment.

II. Current Pipeline for Flexible-Use Licenses

The FCC has successfully auctioned flexible-use licenses in 3.45 GHz (Auction 110), 2.5 GHz (Auction 108), with more spectrum in the pipeline. To get to these outcomes, however, spectrum bands need to go through nearly 10 years of study and deliberation. For example, the groundwork for Auction 110 started in 2010, and was placed on the docket in 2019, and the auction occurred in 2023.

Finding spectrum for clearing and reallocation involves government entities, neighboring users, and political process. Legislative efforts have helped speed this process, such as the Spectrum Pipeline Act of 2015 which requires 30 MHz of spectrum to be reallocated from Federal use to non-Federal use or shared Federal and non-Federal use, or a combination thereof, by July 1, 2024.[8] The Spectrum Relocation Fund, created in 2004, allows for federal agencies to replace equipment with proceeds from reallocation auctions.[9]

Policymakers are still looking for new ways of enhancing the spectrum pipeline through legislation, creative policies, and research.

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[8] P.L. 114-74 (2015), https://www.congress.gov/114/plaws/publ74/PLAW-114publ74.pdf.

[9] P.L. 108-494 (2004), Commercial Spectrum Enhancement Act, 47 U.S.C. § 928 (allowing for federal agencies to request reimbursement for relocation costs); P.L. 112-906 (2012), Middle Class Tax Relief and Job Creation Act, 47 U.S.C, § 923(g); see generally Karen Gordon et al., "A Review of Approaches to Sharing or Relinquishing Agency-Assigned Spectrum", IDA Science & Technology Policy Institute, January 2014, at 4, https://www.ida.org/-/media/feature/publications/a/ar/a-review-of-approaches-to-sharing-or-relinquishing-agency-assigned-spectrum/p5102final.ashx [*IDA Report (2014)*].

III. New Facility for Experimental STA Licenses

One way to find more spectrum is to enhance flexible arrangements such as experimental STAs. Experimental licenses are encumbered and time-limited, however, which makes them less suitable for large-scale national networks or long-term investment. Demand for experimental STAs, as evidenced by a rather robust inflow of applications from the private sector, shows some promise that short-term usage rights have utility for wireless innovators.

By expanding the program, the FCC could run experiments with the experimental licenses. Private firms could develop the digital infrastructure needed to discover and handle transactions for short-term spectrum usage across frequency bands with various types of incumbents and terrestrial environments.

The next sections present what we already know about the demand-side for experimental STAs and what we know about the users of these experimental licenses. How much spectrum is being used by experimental licensees, who is using these licenses, how valuable are they, and how can we find more value from more unused times and spaces of spectrum?

A. Experimental STAs are Very Flexible

Flexibility has defined the experimental STA program. One scholar notes that since 2007, experimental licenses have been issued in over 74,932 frequencies, spanning nearly every band defined by the ITU spectrum table.[10] Most of these frequency bands, 58,273, or 77.8%, have been in the valuable middle bands below 3 GHz, with most requests occurring for use on the UHF band.[11]

The FCC's Experimental Radio Service (ERS) includes five categories of uses, one of which is a Special Temporary Authority license.[12] Bustamante et al. (2020) reviewed ten years of ERS licenses from 2007-2016, finding that the FCC has been able to speed up its time to issue licenses for special temporary authority from 100 days to 23 days.[13] While the Bustamante et al. (2000) paper suggests the promise of dynamic spectrum access and sharing, in fact, the evidence shows that market intermediaries may be a solution for enabling spectrum usage and pipeline discovery.

STA authorizations are limited to 6 months, while experimental licenses are allowed between 6 months and 5 years, with the majority of ERS licenses issued for 2-year terms. [14] Nearly half of

[10] *Id*. at 35.
[11] *Id*. at 38.
[12] Bustamante, Pedro, Martin Weiss, Douglas Sicker, and Marcela M. Gomez, "Federal Communications Commission's Experimental Radio Service as a Vehicle for Dynamic Spectrum Access: An Analysis of 10 Years of Experimental Licenses Data," *Data & Policy*, Vol. 2: e6 at fig.1 (2020), https://doi.org/10.1017/dap.2020.6.
[13] *Id. See also* Pedro J. Bustamante, Analysis of the Experimental Licenses of the Federal Communications Commission (FCC), 2017, http://d-scholarship.pitt.edu/30597/1/Bustamante_approved%20ETD.pdf.
[14] 3.1-3.55 GHz R&O & FNPRM (2020) at para. 21 n.57; Bustamante (2017) at 29.

the STAs issued by the FCC are for 1 month or less,[15] and only 40% of total equipment used is experimental.[16] These experimental licenses operate on a non-interference basis.[17] Most of the authorizations are within the 10 MHz and 10 GHz range.[18] Experiments are registered with the FCC and equipment specs are recorded, including the manufacturer of the transmitter, model number, and total number of units of equipment used.[19]

B. Clearing Experimental STAs for Future Auctions

In the case of experimental users in the 3.1 GHz-3.33 GHz band, the FCC cleared experimental users in order to provide a wholly unencumbered band for the commercial auction. The FCC determined that experimental use would create risk of harmful interference to new licensees in a way that would be prohibitive for a successful auction.[20] Table 1 summarizes some of the experimental users who were using the auctioned band.

Table 1. Experimental Users Cleared from 3.1 GHz-3.33 GHz

Company	Band	Description
Broadband Sports International	3.401 GHz-3.418 GHz	Video relay for RF cameras for sporting events such as PGA Tour and NASCAR
Aerial Video Systems	3.3 GHz-3.4 GHz	RF video cameras for studio in TV City Los Angeles, for Golden Globe, Grammy, Academy Awards, The Voice, Dancing with the Stars[21]
Boeing	3.1 GHz-3.55 GHz	Aviation safety testing and certification[22]
Lockheed Martin	3.1 GHz-3.55 GHz	U.S. radar manufacturers and R&D functions[23]
Raytheon	3.1 GHz-3.55 GHz	Radar testing at approximately two dozen facilities in the U.S.[24]

Source: 3.1-3.55 GHz R&O & FNPRM (2020).

[15] Bustamante (2017) at 60-61 ("With regards to the authorized time we can point out that 47% of the applications are authorized for less than 30 days (1 month). Indeed, we observe that the majority of these licenses are either authorized for less than 3 days, 10%, or less than a week, 52%.").
[16] Bustamante et al. (2020).
[17] 3.1-3.55 GHz R&O & FNPRM (2020) at para. 21 n.57 ("47 CFR §§ 5.3 (defining allowed scope of service for Experimental Radio Service operations);
5.61(a)(1) (STA authorizations limited to six months); 5.83(a)-(b) (applicant accepts license with express understanding that grant does not confer rights to conduct activity of a continuing nature and is subject to change or cancellation at any time without notice or hearing); 5.84 (operation permitted only on condition harmful interference is not caused to an established radio station; if such harmful interference occurs, the experimental licensee shall immediately cease transmissions).").
[18] Bustamante (2017) at fig.4.
[19] Bustamante (2017) at 33.
[20] 3.1-3.55 GHz R&O & FNPRM (2020) at para. 25.
[21] *Id*. at para. 16 n.52.
[22] *Id*. at para. 21 n.56.
[23] *Id*. at para. 21 n.56.
[24] *Id*. at para. 21 n.58.

C. "Spectrum Exchange Act of 2024"

New statutory authorizations will be needed in order to facilitate this expansion of the experimental STA program. A statute that enables the creation of spectrum facilities could be under a bill called the "Spectrum Exchange Act of 2024."

The "Spectrum Exchange Act of 2024" could include provisions for the building blocks needed to expand the experimental STA program to allow for auctions, fees for federal spectrum, and certification or pre-approvals for non-interference usage.

One may consider similarities between this proposal and the Spectrum Access System (SAS)/Priority Access License (PAL) sharing regime in the 3.55 GHz – 3.65 GHz (Auction 105).[25] In the Citizens Broadcast Radio Service (CBRS) band, the FCC certifies SAS Administrators for the spectrum band that perform technical functions of sensing emissions from radar transmitters.

There are important differences between the SAS/PAL model and expanding the experimental STA program. In this new proposal, spectrum exchanges and spectrum facilities would be limited to short-term STAs and would not have dynamic sensing capacity. Instead, the entities would be limited to contractual and legal functions to facilitate transactions between STAs and incumbents. Engineering disputes would happen between battles of the experts and negotiations in contracting.

Another difference between the SAS/PAL model and this one is that the new spectrum facility would accept bids across all frequency bands, not just limited to, say, a 100 MHz band in particular. While the entire spectrum dial sounds like an enormous amount of spectrum, it is quite encumbered and non-exclusive. By contrast, the 22,631 PAL licenses auctioned off in Auction 105 affords certainty and long-term usage rights to its users, which is better suited to capital investment. The STAs and experimental licenses are between 6 months and 5 years in length, which may not attract large capital investments, but could make up for that by giving market participants faster access to frequency bands that may not be available through public auction for a decade or more.

D. "Special Temporary Authority Facility"

In this proposal, private firms would be permitted to register with a "Special Temporary Authority Facility" (STAF) to run auctions and collect fees for experimental STAs in different geographic regions of the country. Between four and twelve competing firms could operate the facilities in regions of the U.S., following time zone areas, or the federal appellate court or federal reserve system areas.[26] These facilities could then be operated by companies registered as

[25] https://www.fcc.gov/35-ghz-band-overview

[26] These facilities can be registered similar to national securities exchanges, authorized by the Securities Exchange Act of 1934, Section 6.

a "National Spectrum Exchange" as defined in a "Spectrum Exchange Act." These national exchanges would have authority to coordinate with commercial and government users directly.

By allowing for bids for STAs, markets for temporary licenses could take place on federal and non-federal spectrum bands with unused capacity. Rather than ten years of study and rulemaking to get to a full auction, these smaller markets of STAs would adjust with changes in the business and technical environment. Due to the short-term and local nature of STAs, the facilities would avoid the risk of hold-up by claims of harmful interference as well. Since STAs are used on a non-interference basis, licensees have an expectation of possible interference when they seek temporary authority in federal and non-federal bands. Despite this risk of interference, demand is robust and appears to counterbalance the encumbrances on the license terms.

Price discovery from the bids would provide data on how valuable certain bands are, what uses are valuable, and could help parties with negotiating settlement amounts and damages in interference disputes in smaller time frames and smaller geographic areas. The incumbent licensee would be able to collect fees from the STA and the STA user would gain value from using the unused spectrum.

While STAs may not be suitable for building traditional nationwide networks, they may be useful for innovators who seek to deploy wireless devices that can accommodate the non-interference terms. An intermediary approach would help the FCC to become more flexible by watching market participants iteratively discover new configurations in smaller, more local areas. The facility would be driven by the demand-side, rather than rulemaking from the supply-side.

E. "Federal Spectrum Contribution Company"

One missing piece is the statutory authority for government spectrum holders to receive contribution fees for experimental use of their spectrum. The Miscellaneous Receipts Act prohibits the federal agencies from collecting revenues from spectrum assets.[27]

In order to set up auctions for experimental licenses, Congress will need to authorize the collection of fees. Rather than expecting each federal agency to manage bookkeeping, auditing, and spectrum inventories, the creation of a "Federal Spectrum Contribution Company" would need to be set up to administer transaction revenues. Each of the federal agencies could have an account with the company, which collects the fees and manages the spectrum valuation and assessments.

[27] *See generally* IDA Report (2014) ("The Miscellaneous Receipts Act mandates that 'an official or agent of the Government receiving money for the Government from any source shall deposit the money in the Treasury as soon as practicable without deduction for any charge of claim' (31 U.S.C. §3302(b)). Federal agencies are prohibited from withdrawing such money from the Treasury without a congressional appropriation and cannot supplement their budget with money obtained from other sources unless explicitly authorized by Congress. Thus, the Miscellaneous Receipts Act inhibits relinquishment and sharing of Federal spectrum by requiring specific congressional actions to take place before non-Federal users can reimburse Federal entities for reallocation-related expenses.").

Such a model would be similar to the Universal Service Administration Company, an independent not-for-profit company founded in 1998 designated by the FCC to run the $10 billion Universal Service Fund and operate with a $200 million budget to run the $10 billion Universal Service Fund. Other examples of quasi-public-private functions are Fannie Mae, the Federal National Mortgage Association, and Freddie Mac, the Federal Home Loan Mortgage Corporation (FHLMC), both publicly traded, private corporations founded by Congress and government-sponsored enterprises (GSE) founded in 1970.

The IRAC and NTIA would oversee the FSCC and retain current mandates to determine federal spectrum allocations. The FSCC would be the administrative company that processes the licenses and revenues from the special temporary authority facilities within the spectrum exchanges.

Federal spectrum officers within the agencies could be detailed to the FSCC to identify and study spectrum that is licensed for experimental use. Since the STAs are short-term and have non-interference terms, the risk of harm from interference would be low, but still a real concern for incumbents, neighbors, and licensees.

The FSCC could be funded by a handling fee on transactions and through appropriations.

F. "Certificate of Non-Interference"

One can imagine that the demand for experimental STAs could overrun the ability of the spectrum exchanges and facilities to assess whether interference might occur. This proposal would shift the burden from the supply-side to the demand-side of the market.

The bidders of the experimental license will need to obtain certificates of non-interference from the relevant adjacent users and present them to the special temporary authority facility. The experimental licensee must accept interference, according to the terms of the license, but it must also attest that it will not interfere with incumbent users. This pre-approval process would be needed and evidenced by certificates and attestations before a bidder can approach the facility with a bid for an experimental license. Based on the representations made by the parties, certificates can be signed in good faith and presented to the STAF.

In the event of catastrophic interference risk, these attestations can also include proof of insurance contracts held by the parties. These insurance policies can be filed with the facility to create a record of settlement terms in future disputes. The STAF can facilitate arbitration between parties in the event that interference creates harm that necessitates adjudication and damages.

This negotiation of interference risk would happen privately between parties before they approach the spectrum facility. The parties themselves are responsible for determining thresholds of acceptable interference at specified geographic boundaries. The parties are responsible for disclosing relevant engineering studies and representations to each other in order to gain pre-approvals for the experimental STAs.

IV. Conclusion

A market can be set up to facilitate the expansion of experimental licenses while protecting existing spectrum allocations and interference protections held by federal and non-federal incumbents. This proposal focuses on the demand-side of spectrum markets and responds with policy solutions. In the experimental STA program, licensees reveal their demand for unused spectrum. Policymakers have an opportunity to create legal structures that enable innovators to find more value from federal and non-federal spectrum.

V. References

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VI. Appendix

A. “Spectrum Exchange Act of 2024”

B. “Federal Spectrum Contribution Act of 2024”