A STUDY ON THE ROLE OF SPECTRUM USAGE RIGHTS WITHIN DISPUTES

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I. INTRODUCTION

Spectrum is an undeniably valuable resource that influences the advancement of telecommunications, information and data transmission technologies, and public safety in this country every second of every day. However, unlike the physical tangibility of smart phones, cables, and satellites, the great majority of spectrum users are unaware of the physical and conceptual presence of spectrum.

Spectrum describes the range of electromagnetic frequencies that technologies, such as radios, broadcasts, satellites, and Wi-Fi devices, transmit signals over in order to send data to millions of receiving devices. For example, a radio show is transmitted as a signal over a certain electromagnetic frequency (spectrum) and a listener is able to tune her radio to the proper frequency and receive that radio show. It is important to note that in the radio example, the spectrum user is the radio show (the transmitting party).

In most situations in order to transmit over spectrum legally, one has to receive a license from the federal government, because the federal government is the only "owner" of spectrum.[1] The Federal Communications Commission (FCC), one of the governmental bodies with authority over spectrum, manages spectrum for all non-governmental spectrum users. One of the responsibilities of the FCC is to allocate and assign certain spectrum to a licensee. That license may stipulate certain technical rules; however, the user is then able to then transmit within that

[1] 47 U.S.C. § 301 ("It is the purpose of this chapter, among other things, to maintain the control of the United States over all the channels of radio transmission; and to provide for the use of such channels, but not the ownership thereof…. and no such license shall be construed to create any right, beyond the terms, conditions, and periods of the license.") While Section 301 prohibits ownership of spectrum rights, Section 204 of the Telecommunications Act of 1996, 47 U.S.C. § 309 (k), provides a high bar to deny renewal of spectrum licenses for incumbent broadcasters. This high bar for broadcasters has been recognized for generally for all incumbent spectrum users, such that denials of spectrum renewals have been mere exceptions to the norm.

spectrum space it is assigned. If the spectrum user transmits outside of its spectrum space, it may cause interference with another party's transmitting and receiving signals.

Two prevailing concepts have shaped spectrum management over time—scarcity and interference. On one hand, the government has justified its ownership and regulation of spectrum in the account of the belief that spectrum is a scarce public resource. On the other, the government has managed spectrum with the goal to eliminate potential of interference.[2] Interference is defined generally as any unwanted radio frequency signal that prevents or disrupts reception of a signal. Managing interference is a key component to spectrum management. Until recently, the government has shaped its regulatory regime around these concepts. Now, new notions, such as 'market actors,' 'spectrum flexibility,' 'property-rights,' and 'commons,' have begun influencing regulatory practices.

Interference, and even the mere possibility of interference, is one of the primary causes of disputes between parties. While the government had historically managed spectrum to minimize possible interference, as the desire for spectrum has grown, the government has allowed more and more users within the space (and therefore the fear of interference has grown). Thus, while much of the spectrum policy focuses on alleviating scarcity, several argue that more attention should be given to the role of spectrum usage rights (SURs). For example within a dispute, if each party understood its and the other parties SURs, the parties would be in the best position to negotiate, rather than devote time and money to dispute resolution within the courts or through clarifying waivers and rulemakings by the FCC.

This leads to the premise of this note: the role of spectrum usage rights and how parties have used their SURs during disputes within the spectrum space. This note creates four case

[2] "In the U.S. most commercial spectrum is packaged as licenses that grant the holder exclusive use of band for ten years. Existing licenses are typically renewed and new licenses are allocated by the Federal Communications Commission via auctions." BAE, JUNJIK ET AL., SPECTRUM MARKETS FOR WIRELESS SERVICES 1.

studies, which focus on spectrum conflicts in order to establish a better understanding of the extent of spectrum usage rights (SURs) within the licensed space.

In order to do so, this note relies on two papers written by Peter A. Tenhula and their proposition, methodology, and predictions concerning the role of SURs. Using the methodology proposed by Tenhula, this note hopes to use the data collected in order to prove that the current state of spectrum usage rights and expectations inhibit private negotiations during disputes, weaken the secondary market within the spectrum space, and stifle innovation for new entrants and new services.

The case studies explore two categories of disputes: disputes occurring during (1) the establishment of new rights and (2) the modification of existing rights.[3] Each case study summarizes the dispute and resolution process. Further, each study addresses a series of procedural questions, mainly focused on usage rights.

This note will first discuss the evolution of spectrum management in the United States. Then, it will turn to Tenhula's papers and subsequent predictions. Next, utilizing the data collected from the case studies, it will discuss Tenhula's predictions as applied to the four case studies. This note ends with suggestions on how to move forward to create a more in-depth study of SURs or ways to apply this information and create new policies or rules to establish a more efficient spectrum rights allocation system. As this country consumes more and more data over the spectrum space, it is necessary to refine procedures, such as the basic understanding of what true rights a spectrum user has.

[3] My case studies include: (1) LightSquared & Interference in Connection with Mobile Satellite Services (MSS) in L-Band; (2) The Establishment of Rules and Policies for the DARS Service & Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services; (3) Applying Secondary Market Spectrum Leasing Policies to MSS/ATC Leasing Arrangements; and (4) Qualcomm Incorporated Petition for Declaratory Ruling.

II. BACKGROUND

The slow reform of spectrum management from a strict command-and-control regime to a more flexible, property-like management can be explained by the underlying policy concerns, economic theories, and technological innovations over the past decade. Three major themes dictate this transition: (1) the vestment of spectrum ownership to the federal government in order preserve spectrum and manage interference, (2) the slow shift to a more deregulatory spectrum space to allow for greater economic and technical efficiency, and (3) the promotion of the secondary market within the spectrum space. Spectrum policy has a legacy of reactionary policies that have lingered and can be attributed to the current state of uncertainty over SURs.

A. SPECTRUM OWNERSHIP IS VESTED IN THE FEDERAL GOVERNMENT

Spectrum was traditionally viewed a scare public resource and government regulation was justified as necessary to avoid interference. [4] This notion was exacerbated by the policy goals of New Deal politicians who advocated for a strong central government and regulatory presence. As technology became increasingly accessible to more people (by the late 1920s, one third of US households owned a radio and by 1933 almost 60% of households owned a radio[5]), increased reliance and usage of spectrum magnified scarcity and interference concerns.

In 1934, Congress designed a comprehensive overhaul of spectrum management and passed the Communications Act, superseding any previous legislation regarding spectrum. Congress sought to resolve scarcity and interference concerns by vesting ownership exclusively with the

[4] In response to the unfortunate sinking of the Titanic, Congress passed the 1912 Radio Act. The rationale behind the act was that if the government did not oversee spectrum usage, interference would pollute this public resource. This fear was given life in the wake of the Titanic's sinking when reports of chaotic radio calls were said to have confused, and thus failed to rally a potential, and closer, rescue ship. The 1912 Radio Act allocated the authority to the federal government to license all radio stations (and mandated that all seagoing vessels continuously monitor distress frequencies). Radio Act of 1912, Pub. L. No. 264., 37 Stat. 302 (stating "for the purpose of preventing or minimizing interference with communication between stations in which such apparatus is operated, to facilitate radio communication…").

[5] http://www.radiostratosphere.com/zsite/behind-the-dial/radio-in-1930.html

federal government[6] and by establishing the FCC to manage spectrum licenses and allocation of private sector spectrum usage.[7] Congress allocated the co-authority over spectrum management between the executive branch for federal uses and the FCC for state and local governments and private sector use.[8] The Act established the foundation of the federal government's heavy involvement and regulation of spectrum; this governance structure described as a "command-and-control" regime.

Under the command-and-control approach, the governing body acts as the single authoritarian for resource allocation and use. As applied to the regulation of private spectrum usage, the FCC controls the processes of allocating the spectrum into blocks or bands of frequencies for specific services (i.e., broadcast, fixed, mobile); assigning licenses; dictating service rules governing the use of the allocated bands; and enforcing measures to prevent harmful inference and protect the radio environment from unintended and/or accidental radiation.

The government's exclusive ownership and heavy presence in spectrum management has left spectrum users often relying on the FCC to facilitate disputes, modify licenses, and redistribute or transfer licenses. This heavy reliance on the FCC to manage all actions in the spectrum space has been criticized for several economic and political reasons. Most famously, in 1959, Ronald H. Coase presented his now renowned "Coase Theorem" as applied to the regulation of spectrum illustrated in his paper *The Federal Communications Commission*, during which Coase argued

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[6] "Section 301 of the 1934 Communications Act announces that the federal government controls the spectrum, and that the government will permit 'the use of such channels, but not the ownership thereof, by persons for limited period of time, under licenses granted by Federal authority.'"

[7] Prior to the 1934 Act's establishment of the Federal Communications Commission, the Radio Act of 1927 had established the Federal Radio Commission and gave the commission jurisdiction to regulate spectrum. The 1927 Act provided providing that the FRC shall "assign bands of frequencies or wave lengths to various classes of stations… and determine the power which each station shall use and the time during which it may operate." Radio Act of 1927, Pub. L. No. 632, § 4(c).

[8] Communications Act of 1934, Pub. L. No. 416, ch. 652, 48 Stat. 1064 (codified as amended in scattered sections of 47 U.S.C.), § 305 ("Radio stations belonging to and operated by the United States shall not be subject to the provisions of sections 301 and 303 of this Act. All such Government stations shall use such frequencies as shall be assigned to each or to each class by the President").

that government control of spectrum was not the most economically efficient way to prevent inference.[9] Instead, he maintained, "the allocation of resources should be determined by the forces of the market rather than as a result of government decisions."[10]

Coase proposed the command-and-control regime be replaced with secondary market mechanisms, allowing for the market to most efficiently transfer spectrum to its most valuable position. He proposed for "the use of private property and the pricing system in the allocation of frequencies."[11] Coase criticized the federal practice of spectrum licensing, proposing to instead utilize property rights as a more efficient method of distributing spectrum among current and future users. He held:

> It is a commonplace of economics that almost all resources used in the economic system (and not simply radio and television frequencies) are limited in amount and scarce, in that people would like to use more than exists. Land, labor, and capital are all scarce, but this, of itself, does not call for government regulation. It is true that some mechanism has to be employed to decide who, out of the many claimants, should be allowed to use the scarce resource. But the way this is usually done in the American economic system is to employ the price mechanism, and this allocates resources to users without the need for government regulation.[12]

Specifically, Coase argued that federally managed and regulated spectrum could not be truly efficient in the absence of defined property rights. And, moreover, the role of the government should be to define the users' property rights, allowing the market to effectively allocate the spectrum to the most efficient use. While Coase's proposition lives within so many U.S. policies, regulations, and market considerations today, at the time, his proposition was met with major

[9] Ronald H. Coase, *The Federal Communications Commission,* 2 J. L. & Econ. 1-40 (1959).
[10] *Coase*. at 18.
[11] Coase, at 17.
[12] Coase, *supra* note 13 at 14.

reluctance. Commission Phillip S. Cross unabashedly opened the line of questions for Coase with: "Is this a big joke?"[13]

Coase's recommendations did not lead to the immediate spectrum reform existing today because the government's management structure did provide protection against scarcity and interference concerns when there were limited users within the space. However, with time, the regime became inadequate to address the mounting scarcity concerns, which were exacerbated by the lack of flexibility and slow transfers of spectrum licenses. Therefore, by the 1990s, the federal government began actively implementing economic theories and pursing marketplace competition in government regulations. With the increased demand on spectrum and an increased fear of interference brought on by the 'spectrum crunch,' the 1996 Telecommunications Act attempted to resolve these concerns.

B. THE 1996 TELECOMMUNICATIONS ACT ATTEMPTS TO REPLACE THE COMMAND-AND-CONTROL REGIME WITH A MORE MARKET-ORIENTED PROPERTY RIGHTS APPROACH

"The absence of a market tends to exacerbate the… sense of "spectrum scarcity."[14] This description perfectly articulates the spectrum policy concerns leading up to the 1996 Telecommunications Act.

The marketplace changed considerably since the enactment of the Communications Act: both the rise of the telecommunications industry and the emphasis on competition in the marketplace led to the 1996 Telecommunications Act, the first large-scale legislation addressing spectrum since 1934. This legislation hoped to promote new market mechanisms within FCC policy

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[13] For further discussion of Coase's influence, *see* Thomas W. Hazlett, *The Wireless Craze, the Unlimited Bandwidth Myth, the Spectrum Auction Faux Pas, and the Punchline to Ronald Coase's "Big Joke": An Essay on Airwave Allocation Policy,* 14 HARV. J.L. & TECH. 335, 343 (2001).

[14] Harvey J. Levin, *The Invisible Resource; Use and Regulation of the Radio Spectrum.* 1971 WASH. U. L. R. 711 (1971).

considerations, which was a large departure from the strict command-and-control spectrum management regime of the past, which exclusively focused on scarcity and interference concerns.

The Telecommunications Act of 1996 declared its purpose as: "To promote competition and reduce regulation in order to secure lower prices and higher quality services for American telecommunications consumers and encourage the rapid, deployment of new telecommunication technologies."[15] Notably, the legislation emphasized deregulating the telecommunications industry.

The 1996 Act established huge reforms in the regulation of the telecommunications industry; however, it did not specifically amend the ownership and leasing arrangements for spectrum, leaving the federal government the only true 'owner' of the spectrum resource. Thus, spectrum lessees were divested only 'quasi-property rights,' leaving uncertainty for both incumbents and new entrants. Departing from previous spectrum management approaches, Congress authorized the FCC to assign licenses through competitive bidding for the first time, marking a significant departure from the previous approaches to spectrum assignment. This legislation was aimed to recognize the value of increased flexibility encouraged within U.S. spectrum management and the potential value of auctions for innovation and revenue.[16] Notably, this legislation did not take a solid position on the implementation of pure property rights within the spectrum space. However, there was a clear call by some to infuse the space with distinct property-like rights to spectrum leaseholders in order to truly establish a proper secondary market.

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[15] *See* 47 U.S.C. § 201, Communications Act of 1934, as amended by the Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56.

[16] *Id*. at §§ 309(j) (1993). ("Application for license. Use of competitive bidding. If, consistent with the obligations described in paragraph (6)(E), mutually exclusive applications are accepted for any initial license or construction permit, then, except as provided in paragraph (2), the Commission shall grant the license or permit to a qualified applicant through a system of competitive bidding that meets the requirements of the subsection").

This legislation and the underlying market-driven policy considerations gave rise to the call for 'property-like' rights within the spectrum space. This would align a spectrum user more alike to an owner than a mere lessor of the space, able to sell its spectrum or sue others for trespass-like claims. The property-like rights structure allows for the market to move the spectrum to its most efficient place, remove the government from superfluous participation, and protect users from interference. However, spectrum users did not receive the full protection warranted by ownership of the spectrum they occupied. This ambiguity is especially relevant to interference disputes. For example, it was unclear who had the burden of presenting and proving the elements of harmful interference claims. Further, the failure to address the full extent that spectrum usage rights would extend codified an inherent gap in the way spectrum property rights had begun influencing policy and market decisions and the way in which spectrum rights would be treated under regulatory measures. Further, while this legislation addressed concepts of scarcity by establishing a more robust secondary markets, the Act failed to address continuing interference concerns.

While the government remains the full vested owner of spectrum, spectrum users have relied on their quasi-property rights as if those rights were akin to full property rights. This reliance on concepts of property ownership within the spectrum space has its downfalls; such that property ownership pronounces title and a bundle of rights and spectrum users have never, in fact, owned their spectrum nor held those rights. Thus, relying completely on this comparison runs up against basic differences between acting as an owner or lessor.

An alternative approach to the property rights regime – deemed the commons model - has been gained attention and some implementation. This scheme would remove any form of exclusive rights licensing to spectrum users, and instead, allow any user to operate and exploit

the spectrum simultaneously for any use (subject to basic service rules). In 1985, the FCC released the ISM band for unlicensed use.[17] This band gave rise to one of the greatest innovations of spectrum use with the invention of Wi-Fi technologies. However, many users argue that the commons space will become too cluttered and run with interference if this principle was applied to the entire spectrum space.

While by the end of the decade the government had taken active steps to reform the command-and-control regime, the pure property rights model that Coase envisioned was not realized by the 1996 Act. However, elements of both the property rights and commons models have continued to influence policy considerations, implicitly seen in the upcoming incentive auctions and the releasing of the guard bands for unlicensed use.

C. THE FCC PROMOTES THE SECONDARY MARKET BUT THE LEGACIES OF PAST REGULATORY APPROACHES HINDER ANY TRUE IMPLEMENTATION OF PROPERTY RIGHTS

While Congress did not strip spectrum ownership from the federal government in the 1996 Act, the government did begin implementing new market based approaches to its spectrum management scheme.

In 2000, the FCC released the policy statement "Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets," which held that "an effectively functioning system of secondary markets would encourage licensees to be more spectrum efficient by freely trading their rights to unused spectrum capacity, either leasing it temporarily, or on a longer-term basis, or selling their rights to unused frequencies."[18] Notably,

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[17] Encyclopedia Britannica, "Wi-Fi," available at http://www.britannica.com/EBchecked/topic/1473553/Wi-Fi.
[18] *Policy Statement*, Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets, FCC 00-401 (Released Dec. 1, 2000), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-00-401A1.pdf.

the FCC was expanding the available rights divested in spectrum lessors, such that the spectrum lessors could consider additional alternatives to the use of their spectrum (i.e., if they were not using their spectrum, they could lease the band to another party for a period of time).

Further, Chairman Powell formed the Spectrum Policy Task Force (SPTF) to evaluate existing FCC spectrum policy and to provide recommendations in regards to future practices.[19] The working groups that made up this task force provided several recommendations, including that the Commission take steps to promote a secondary market for spectrum. To do this, SPTF suggested: "removing unnecessary regulatory barriers to the development of more robust secondary markets in radio spectrum usage rights."[20] One notable result of the SPTF Report was the allocation of additional spectrum for unlicensed spectrum and authorization of spectrum leasing in a broader array of services.[21]

The Obama Administration has proven to take a fascination in spectrum policy in the United States. Drawing on the two concepts that have directed the course of spectrum policy – scarcity and interference – the Obama Administration and Congress has taken a stab at the scarcity issues. Interference, on the other hand, has remained a hidden, but domineering, beast. While the regulatory framework of spectrum once aimed at eliminating all interference, today interference issues still remain a paramount consideration of the federal government – and a major contention in conflicts between spectrum users.

In June 2010 the administration released the "Presidential Memorandum: Unleashing the Wireless Broadband Revolution." The President encouraged finding ways to use spectrum more

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[19] *Spectrum Policy Task Force Seeks Public Comment on Issues Related to Commissioner's Spectrum Policies,* Public Notice, ET Docket No. 02-135, DA 02-1311 (June 6, 2002) ("SPTF Notice").
[20] F.C.C. Spectrum Policy Task Force, Report of the Spectrum Efficiency Working Group (Nov. 15, 2002) Pg. 22, http://transition.fcc.gov/sptf/files/SEWGFinalReport_1.pdf.
[21] Spectrum Policy Task Force, One Year Later (Nov. 13, 2003), available at http://transition.fcc.gov/sptf/files/presentation-111303.pdf.

efficiently, find ways to exploit underutilized spectrum, and advance spectrum-sharing technologies.[22] Lastly, the memorandum encouraged the Secretary of Commerce (and NTIA) to collaborate with the FCC in making available 500 MHz of federal and non-federal spectrum over the next decade.[23]

In March 2012, with support from the Obama Administration, the FCC released the National Broadband Plan, which addressed the necessity of efficient spectrum use through ensuring greater transparency in allocation and through expanding incentives and mechanisms to reallocate or repurpose spectrum.[24]

Most recently, in July 2012, the President's Council of Advisors on Science and Technology (PCAST) presented a report to the President entitled "Realizing the Full Potential of Government-Held Spectrum."[25] This council articulated the role of spectrum in the success of this nation's economy.

Taking a cue from the National Broadband Plan, Congress also turned its attention to spectrum by authorizing the Commission to conduct incentive auctions.[26] If successful, the incentive auctions will free up the broadcast television spectrum for wireless broadband use (and some unlicensed use), collect potentially billions of dollars for a new nationwide, interoperable public safety network, as well as repay some of the nation's debt.

As the U.S. continues to lead the way in telecommunication services and technologies, the role of spectrum policy is integral to the nation's continued success. The transition of

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[22] *Presidential Memorandum: Unleashing the Wireless Broadband Revolution.* http://www.whitehouse.gov/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution

[23] *(Presidential Memorandum)* at Section 1(a).

[24] Connecting America: The National Broadband Plan, section 5, available at http://download.broadband.gov/plan/national-broadband-plan.pdf

[25] Realizing the Full Potential of Government-Held Spectrum, Report to the President (July 2012) *available at* http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_spectrum_report_final_july_20_2012.pdf.

[26] Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, Tit. VI, §§ 6403 et seq., 126 Stat. 225 et seq. (Feb. 22, 2012) (codified at 47 U.S.C. § 1452 et seq.). Currently, the FCC estimates it will hold the incentive auction during 2014.

command-and-control regime has left a legacy of quasi-property rights, leaving incumbents uncertain of their true spectrum usage rights and new entrants hesitant to enter the market with new technologies and services in fear of mistakenly violating another user's rights and jeopardizing their entire operation. Today, interference warranting protection by the FCC is often referred to as harmful interference; however parties have succeed in halting new entrants just with the potential of harmful interference.[27] Harmful interference is defined as "Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with [the ITU] Radio Regulations."[28] However, as this note will soon discuss, the definition and expectations surrounding harmful interference remain weak.

Today, Coasian economics and calls for deregulation have significantly influenced the current spectrum policy reform from the command-and-control regulatory structure to a more flexible, property-rights centered regime. However, the legacy of the federal government's vested ownership still plagues spectrum efficiency, especially in instances where spectrum users attempt to impose their usage rights with the same veracity as a property right. The command-and-control approach was deemed too inefficient and the 1996 market reforms failed to provide full vested rights. Reformists today call for the current spectrum rights to be clarified and strengthened in order to provide users better expectations and more opportunities to act and innovate in the market.

[27] The FCC defines harmful inference as "interference which endangers the functioning of a radio navigation service or of other safety services of seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service." 47 C.F.R. §2.1(c)(2004).
[28] 47 CFR § 2.1.

The next portion of this note turns to Peter A. Tenhula's two papers on the role of spectrum usage rights; the four case studies that review the practical applications of spectrum usage rights during interference disputes; and concludes with 'lessons learned' from the case studies overall.

III. How The Failure to Establish Concrete Procedural Spectrum Usage Rights has Continued to Plague Spectrum Disputes

The evolution of spectrum management within the United States represents the government's commitment to responding to scarcity and interference issues, often at the expense of flexibility and new market entrants and regimes. Today, while much of the focus continues to narrow on scarcity issues plaguing spectrum policy, several argue that more attention should be given to the role of spectrum usage rights, and how more defined rights and expectations would lead to decreased ambiguity within inference disputes. J. Pierre de Vries argues, "Private and public resources are being wasted in disputes about radio operation that cannot be resolved bilaterally and have been escalated to the regulator."[29] Thus, he recommends that spectrum policy makers should: (i) aim regulation at minimizing concurrent operation, not minimizing harmful interference; (ii) delegate management of interference to operators; and (iii) keep roles and stages of regulatory action distinct.[30]

Similarly, Tenhula has emphasized the importance of regulators strengthening procedural spectrum usage rights, in the form of equitable, transparent, and efficient procedural mechanisms, in order to provide a foundation for more efficient spectrum use and reduce the transaction costs associated with implementing new uses of spectrum.[31] This note will focus on spectrum usage rights in interference conflicts to prove that the current state of spectrum usage rights and

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[29] J. Pierre de Vries, "How I learned to stop worrying and love interference," Silicon Flatirons Center (Sept. 5, 2010) available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1672375.

[30] *De Vries.*

[31] Tenhula, Enforcement of Spectrum Usage Rights: Fair and Expedient Resolution of "Interference" Disputes, at 2.

expectations inhibit private negotiations during disputes, weaken the secondary market within the spectrum space, and stifle innovation on behalf of confident new entrants. Below, I will discuss Tenhula's two papers, which inspired the creation of this study and note, before addressing the case studies and findings.

A. TENHULA'S PAPERS: "A PROTOTYPE "TAXONOMY" FOR ENFOCEMENT OF SPECTRUM USAGE RIGHTS" AND "ENFORCEMENT OF SPECTRUM USAGE RIGHTS: FAIR AND EXPEDIENT RESOLUTION OF 'INTERFERENCE' DISPUTES"

Tenhula submitted the article "A Prototype "Taxonomy" for Enforcement of Spectrum Usage Rights" for the October 18, 2011, Silicon Flatirons roundtable Efficient Management: Regulation, Receivers, and Enforcement.[32] Shortly thereafter Tenhula published an extremely similar paper (presenting the very same argument, taxonomy, and predictions) with the Telecommunications Policy Research Center titled "Enforcement of Spectrum Usage Rights: Fair and Expedient Resolution of 'Interference' Disputes."[33] Within these papers, he argues:

> The emergence and evolution of new, more valuable uses of spectrum requires some flexibility for the modification of existing SURs… Equitable, transparent and efficient procedural mechanisms to adjust SURs are necessary to ensure efficient use of spectrum and reduce the transaction costs associated with advancing new, valuable uses of spectrum… Regardless of how the fuller set of rights are defined and distributed, developing an efficient way to adjudicate disputes over SURs is essential… If Coasian bargaining through private negotiations among disputing parties is generally preferred over time-consuming regulatory intervention, then equitable, transparent procedural mechanisms along with alternative institutions and venues should be readily available if and when negotiations fail or are otherwise futile. This is especially the case in a post command-and-control spectrum world that relies primarily on market-based mechanisms and flexible usage regulations in the context of both exclusive licensing and non-exclusive rights (e.g., unlicensed and light licensing approaches).

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[32] Peter A. Tenhula, A Prototype "Taxonomy" for Enforcement of Spectrum Usage Rights, Silicon Flatirons Center (Sept. 2011), available at https://docs.google.com/document/d/1OgbVgCi42a91F1hng7x9BYxUfUl9p1vTiMTTWnUc9gw/edit?hl=en_US.

[33] Tenhula, "Enforcement of Spectrum Usage Rights: Fair and Expedient Resolution of 'Interference' Disputes," Technology Policy Research Center.

Specifically, he argues clear procedural rights will aid parties in identifying burdens for pleading, proof, or remedy, and will foster delegation of interference management to the respective parties rather than the regulator.

Tenhula describes a series of questions to evaluate the procedural tracks, elements, and factors involved in resolving the dispute. Those questions are:

Category of Question	Question
Procedure	What was the procedural context: Examples: Rule making, consultation, waiver, licensing
	How long did the conflict take to resolve:
Parties	Parties in contention?
	Perceived/stated motivations
	What was the lead organization
	Which other organizations were involved
	By inference, which organizations were not involved
Decisions & Decision makers	Was the definition of "harmful interference" applied:
	Include ex post procedures or requirements in ex ante rules in anticipation of disputes
	Assign the burden of presenting/rebutting or proving/disproving the "facts" or elements surrounding harmful interference claims and defenses
	Define or redefine SURs
	Impose certain mitigation obligations or responsibilities on one or more of the parties
Technical questions	What was the band/service orientation:
	What were the technical characteristics involved:
	What were the service characteristics:
	What was the geographic scope/orientation

Finally, Tenhula predicts that applying these questions to a broad set of interference dispute cases will verify several proposed outcomes.

His proposed outcomes include:

1. There is generally no predictable or fair process for resolving complex interference disputes.
2. Even simple disputes are often subject to mysterious paths.
3. The vast majority of the disputes are eventually resolved through ex ante rulemaking procedures.

4. Resolution of such disputes take a very long time (i.e., several years).
5. The procedural rights, obligations, and burdens of proof are usually undefined or unclear, but in most cases harmful interference to incumbents is implicitly presumed and those urging coexistence (new entrants) typically bear the burden of rebutting this presumption or implementing remedial provisions to protect incumbents from interference.
6. Even under the existing definitions, no apparent and consistent elements have been articulated to make or defend against assertions of harmful interference.
7. New entrants face the most difficulties in gaining access to spectrum, being unable to survive rulemaking/licensing processes or overcome incumbent challenges based on allegations of harmful interference.
8. Incumbent spectrum users, especially Federal agencies, face their own difficulties in resolving interference issues or in changing their existing rights.
9. There is no one-size-fits-all approach to coming up with either the ex ante rights or the ex post remedies in light of the continued desire and expectation of more heterogeneity, not less, in terms of governance structures, systems and competitive providers.

Tenhula suggests that developing an effective way to adjudicate disputes over SURs is necessary to ensure efficient use of spectrum and to reduce the transaction costs associated with advancing new and valuable uses of spectrum. His papers ultimately present the proposition that more consistent data on the procedural options for resolving spectrum access or interference disputes will provide a foundation to foster more fair and expedient resolution processes. Tenhula hopes that the quantifiable study described in his papers will (1) present areas in which procedural methods for resolving spectrum access or interference disputes can be improved and (2) identify technical or legal issues that require definition or clarity.

This note constructs a study described by Tenhula's papers and applies his series of questions to four different spectrum disputes. Using the data from each case study, this note discusses the accuracy of each prediction and advances Tenhula's thesis by achieving three things: (1) to systematically analyze the case studies using Tenhula's procedural questions; (2) to provide valuable feedback on Tenhula's predictions using the data collected from the case studies; and (3) to propose a potential strategy to increase procedural efficiency during spectrum conflicts.

B. METHODOLOGY & TYPES OF DISPUTES STUDIED

Tenhula described the existence of three main categories of regulatory conflicts: (1) the establishment of new rights, (2) the modification of existing rights, and (3) enforcing existing rights. The first category, the establishment of new rights, reflects the ability of both incumbents and new entrants to expand the rights currently authorized under their license. The most obvious example of this category is when a spectrum user seeks to introduce a new service into the spectrum space and requests to modify its spectrum license.

The second category, the modification of existing rights, is particularly important to the Commission's goal of increasing spectrum competition and flexible use of spectrum. The ability to use licensed spectrum with more flexibility increases the users' ability to react to market-driven incentives (i.e., meeting new demands in the market, innovating, researching and developing new technology). To incentivize innovation and investment in the post command-and-control spectrum environment, the ability to efficiently modify rights is necessary.

The third category, the enforcement of existing rights, addresses the extent that the players involved (the disputing parties, adjudicatory actor, etc.) consider spectrum use akin to property rights and ownership. Property rights weigh strongly in favor of the owner (in contrast to the trespasser); thus studying how disputes have favored the user being trespassed—or, facing harmful interference—will offer insight to the extent of rights available to spectrum lessees.

The case studies included in this note involve disputes from category (1) the establishment of new rights and category (2) the modification of existing rights.

C. THE CASE STUDIES

This note explores the dispute and resolution process for four case studies involving disputes over the establishment of new rights and the modification of existing rights. Appendix I contains an index of the "procedural questions and answers."

CASE 1:
THE ESTABLISHMENT OF NEW RIGHTS & THEN REVOKATION OF THOSE RIGHTS FOLLWING THE GPS-LIGHT SQUARED INTERFERENCE DISPUTES

LightSquared is a private company that seeks to provide broadband connectivity throughout North America by integrating MSS/ATC service offerings in order to become a wholesaler of terrestrial wireless services. LightSquared needed to receive several rule modifications from the FCC in order to begin deploying those services within its existing licensed spectrum. During this process, several adjacent service users, mainly those users relying on GPS receivers for navigation, agriculture, and military purposes, became concerned with the possible effects of LightSquared proposed services on GPS applications. Many of the GPS receivers were built without considering the adjacent spectrum's transmissions and would therefore be ill-equipped to reject LightSquared's transmitting signals.

The FCC generally supported LightSquared's initiative because it strongly correlated with the FCC's goal to provide more broadband access throughout the nation. At one point during the conflict, LightSquared committed its network to "cover[ing] 100 percent of the U.S. population via the satellite component and ultimately over 90 percent of the population via its terrestrial component."[34] However, today, LightSquared's vision has for the most part been dismantled, but LightSquared continues to seek solutions in order to deploy its services.

[34] SkyTerra/Harbinger Order, 25 FCC Rcd at 3085, ¶ 55, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-11-133A1.pdf.

LightSquared is a Mobile Satellite Service (MSS)[35] licensee and has been providing satelighted telephony service in portions of the L-Band since 1996.[36] In December 2007, LightSquared, in agreement with Inmarsat, established a framework to utilize L-Band spectrum and provide MSS and ATC services throughout North America. In March 2010, LightSquared obtained its MSS L-band authorization. The FCC conditioned its approval of the licensing request on LightSquared "moving forward with its plan to construct its proposed integrated satellite/terrestrial 4G broadband network that would use the ATC authority to facilitate broadband service to most of the U.S. population."[37] On November 18, 2010, LightSquared applied for an ATC modification request in order to move forward in its deployment.

In January 2011, the FCC gave the conditioned approval for LightSquared to move forward with its plans to combine its existing satellite communications services with a ground based 4G-LTE network.[38] LightSquared was issued a waiver to operate in the 1525-1559 MHz and 1626.6-1660.5 MHz bands, which are adjacent to the GPS licensed Global-navigation-Satellite Serve (GNSS).[39]

In February 2012, after much vocalized concern over potentially harmful interference to the nearly located GPS devices, the FCC withdrew the waiver and effectively terminated

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[35] 47 C.F.R. § 2.1(c). The Code of Federal Regulations defines MSS as "a radiocommunication service: between mobile earth stations and one or more space stations."
[36] In the Matter of LightSquared Subsidiary LLC; Request for Modification of its Authority for an Ancillary Terrestrial Component, 2-3, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-11-133A1.pdf.
[37] (In the Matter of LightSquared Subsidiary(double check)) *Id*. at 7.
[38] In the Matter of LightSquared Subsidiary LLC; Request for Modification of its Authority for an Ancillary Terrestrial Component, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-11-133A1.pdf. ("The waiver is predicated on the specific combination of facts and circumstances before us. As such… we limit the scope of this conditional waiver to LightSquared in its use of MSS L-band spectrum."
[39] The Development of Rules Establishing Reliability Standards for Commercial Radionavigation-Satellite Service Receivers, *Request for Initiation of Proceeding* (filed Feb. 7, 2012) (docket number not yet assigned). GNSS operates in the 1559-1610 MHz band.

LightSquared's ability to deploy and operate a terrestrial network. On May 14, 2012, LightSquared filed for bankruptcy.[40]

CASE 2:
THE ESTABLISHMENT OF RULES AND POLICIES FOR THE DARS SERVICE & AMENDMENT OF PART 27 OF THE COMMISSION'S RULES TO GOVERN THE OPERATION OF WIRELESS COMMUNICATIONS SERVICES

In 2001, the FCC adopted a Report and Order that granted a special temporary authority (STA) to allow for the co-existence of SDARS and WCS licenses in the 2305-2360 MHz frequency band.[41] This rulemaking modified rules governing WCS operations and allowed the operation of mobile and portable stations. Further, new rules were adopted regarding transmitter power. At the request of SDARS and WCS licensees, the FCC refrained from adopting SDARS repeater rules to allow SDARS and WCS licensees interference issues privately. However, after several years the parties failed to come to an agreement.

The Commission adopted the new rules in an effort to establish predictability and stability of interference rights within the frequency band.

> "Over the past several years, we have provided numerous opportunities for the parties to come to an agreement that would facilitate Commission adoption of rules for both services and provide for their deployment and growth without many of the uncertainties that still exist today. Our efforts to persuade the parties to come to an agreement have been unsuccessful, however, and the time to bring close to this long-standing rulemaking has arrived."

[40] http://www.bloomberg.com/news/2012-05-14/lightsquared-failed-wireless-venture-files-for-bankruptcy.html
[41] In the Matter of Amendments of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band, Establishment of Rules and Policies for the Digital Audio Satellite Service in the 2310-2360 MHz Frequency Band, *Report and Order,* WT Docket No. 07-293, IB Docket No. 90-357 RM-8610 (5/20/2010), available at http://fjallfoss.fcc.gov/edocs_public/attachmatch/FCC-10-82A1.pdf.

CASE 3:
APPLYING SECONDARY MARKET SPECTRUM LEASING POLICIES TO MSS/ATC LEASING ARRANGEMENTS

In April 2011, the Commission released a report and order extending secondary markets leasing rules to any MSS spectrum used for terrestrial services pursuant to the Commission's Ancillary Terrestrial Component (ATC) rules.[42] Notably, MSS networks have the ability to provide communications to mobile terminals anywhere in the United States, including remote areas lacking similar telecommunication services. These services are vital to emergency services, disaster recovery, and rural support.

Prior to the rulemaking, the spectrum leasing framework for secondary markets did not extend to ATC uses of MSS spectrum. The secondary leasing framework allows certain licensees to lease some or all of the spectrum usage rights associated with their licenses to third party spectrum lessees, which could then provide a service consistent with the underlying license. The Commission contends that extending the secondary market's "spectrum manger" leasing policies will enhance the efficiency, innovation and dynamic use of spectrum, and economic opportunities.

The rulemaking requires leasing parties to submit specific information and certifications to the Commission prior to advancing on any operations. Further, the leasing arrangements are subject to additional review if public interest concerns are raised.

This rulemaking again marks a transition away from the command-and-control regime of the FCC. However, as the rulemaking indicates, the parties ability to freely act is still stifled by the imposition of several different procedural elements in the secondary leasing framework.

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[42] Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHZ and 1626.5-1660.5 MHZ, 1610-1626.6 MHZ and 2483.5-2500 MHZ and 2000-2020 mhz AND 2180-2200 mhz, *Report and Order*, ET Docket No. 10-142, (2011), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-11-57A1.pdf.

CASE 4: QUALCOMM INCORPORATED PETITION FOR DECLARATORY RULING

On January 10, 2005, Qualcomm Incorporated filed a petition with the FCC seeking a declaratory judgment on two issues: (1) that the OET-69 is an acceptable basis for demonstrating compliance with §27.60; and (2) that for the purposes of making engineering showings pursuant to §27.60(b)(I)(iii), predicted interference to not more than two percent of the population served by a TV/DTV station is *de minimis* and therefore acceptable.[43] The OET-69 is an established engineering methodology for making radio field strength predictions relating to the broadcast television service. It can be used to predict interference from transmitters located outside and inside of another station's service contour to television service. The proposed *de minimis* threshold would allow Qualcomm's subsidiary MediaFlo to more efficiently deploy a nationwide multimedia mobile network to deliver video audio and data to mobile phones. Much of the contention turned on the level (or threshold) of predicted interference acceptable and thus, the amount of predicted interference that TV/DVT stations would have to tolerate.

Parties in opposition to this adjudication included the Association for Maximum Service Television, Inc. The major concern of the petition for declaratory ruling was that OET-69 could not reliably predict interference from Qualcomm's MediaFlo service to reception of over-the-air broadcast signals.[44]

The Commission fully granted the first request. In regards to the second request, the Commission granted Qualcomm's request for a *de minimis* inference exception to §27.60 through waiver (albeit, with some minor exceptions to Qualcomm's full request). In the final order, the FCC did not use the term "harmful interference" once.

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[43] In the Matter of Qualcomm Incorporated Petition for Declaratory Ruling, 21 FCCR 11683 (10/13/06) at 5-6, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-155A1.doc.

[44] Association for Maximum Service Television, Inc., Ex parte Filing of Proposed Revisions to OET-69 for Part 27 Licenses; WT Docket No. 05-7 (March 31, 2006), available at http://apps.fcc.gov/ecfs/comment/view?id=5513483939.

VI. THE CURRENT STATE OF SPECTRUM USAGE RIGHTS AND EXPECTATIONS INHIBIT PRIVATE NEGOTIATIONS DURING DIPUTES, WEAKENS THE SECONDARY MARKET, AND STIFLES INNOVATION FOR NEW ENTRANTS AND NEW SERVICES

During the review of the case studies, several reoccurring themes presented themselves within each case study. The studies suggest spectrum usage rights do not establish the same set of rights guaranteed under the property ownership model. The dispute and resolution process illuminates the Commission's inability to entirely transition away from the command-and-control regime of the previous decades, despite the notable efforts to reform spectrum policy. Below, this note uses the results from the case studies and confirms many of Tenhula's predictions regarding the state of spectrum usage rights in conflicts.

A. PREDICTIONS CONSIDERED

1. There is generally no predictable or fair process for resolving complex interference disputes.

Verified. All four cases went through different and distinct processes during the resolution of the case, including a waiver to execute new rights (and revocation); modification of existing license for new rights through a special temporary authority (STA); modification or rights through a rulemaking; and a declaratory judgment (adjudication).

2. Even simple disputes are often subject to mysterious paths.

Verified. The LightSquared dispute exemplifies this prediction. In January 2011, the FCC quickly approved the ATC modification so that LightSquared could move forward with its deployment plans. However, by February 2012, just over a year from the original FCC waiver grant, the FCC revoked the waiver and back peddled away from its original support.

3. The vast majority of the disputes are eventually resolved through ex ante rulemaking procedures.

Verified. All four cases were resolved during ex ante rulemaking. The LightSquared operation has been halted since the most recent FCC rulemaking. The SDARS and WCS licensees attempted to resolve their conflict for years before relying on the FCC to establish its own rulemaking to resolve the dispute. Qualcomm sought to avoid litigation or future interference concerns by seeking a declaratory judgment from the FCC on their operating rights (adjudication).

A fascinating follow-up would be to contact current spectrum licensees and seek for those licensees to evaluate how they have resolved their disputes (such as via ex ante rulemakings, through private negotiations, or through litigation).

4. Resolution of such disputes take a very long time (i.e., several years).

Verified. The establishment of rules and policies for the DARS service and the amendment of Part 27 of the Commission's Rules to govern the operation of WCS took approximately 8 years. The LightSquared case is still ongoing after over two years of different procedural processes at the FCC. The cases from category 2, the modification of new rights, appear to have shorter time spans. Qualcomm's declaratory ruling took a year and 9 months. And the shortest time elapse of the case studies was the application of secondary market spectrum leasing policies to MSS/ATC leasing arrangements, which took a little under a year.

While the case studies included in this note show an average conflict lasted 39 months (or a little over three years), several of the other case studies researched reflect an even longer time span for resolution; such as, a 10 year conflict between the public safety radio services and

Nextel's commercial mobile radio services [45] and a 9 year conflict between Wireless Communications Services and SiriusXM (providing Satellite Digital Radio Services).[46]

5. The procedural rights, obligations, and burdens of proof are usually undefined or unclear, but in most cases harmful interference to incumbents is implicitly presumed and those urging coexistence (new entrants) typically bear the burden of rebutting this presumption or implementing remedial provisions to protect incumbents from interference.

Verified. This prediction is exemplified by the LightSquared case study. The potential harmful interference on the incumbent users, and more specifically, interference with the poor receivers within GPS devices, highlights the downfall of LightSquared's deployment efforts. One condition of the original waiver granted to LightSquared stated:

> [W]e [FCC] require LightSquared to help organize and fully participate in the working group… The working group shall focus on analyzing a variety of types of GPS devices for their susceptibility to overload interference from LightSquared's terrestrial network of base stations, identifying near-term technical and operational measures that can be implemented to reduce the risk of overload interference to GPS devices, and providing recommendations on steps that can be taken going forward to permit broadband wireless services to be provided in the L- Band MSS frequencies and coexist with GPS devices.[47]

Within the DARS/WCS dispute, the final Rule and Order stated that the changing of the technical rules for the SDARS repeater operations would not risk harmful interference to neighboring spectrum users, and included ex ante rules and requirements in anticipation of future disputes, such as power limits, notification requirements, compliance agreements, and equipment authorizations.

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[45] See Petition for Relief – Expedited Action Requested, WT Docket No. 02-55 (June 17, 2008). SprintNextel to FCC.

[46] Operation of Wireless Communications Services in the 2.3 GHz Band; Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, Final Rule, available at http://www.gpo.gov/fdsys/pkg/FR-2010-08-02/pdf/2010-18803.pdf; *see also*, Order on Reconsideration, In the Matter of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band; Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, at ¶8; WT Docket No. 07-293, IB Docket No. 95-91; available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db1023/FCC-12-130A1.pdf.

[47] ¶ 42, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-11-133A1.pdf.

In the final rule and order extending a secondary market leasing rules to any Mobile Satellite Services (MSS) spectrum used for terrestrial services pursuant to the Commissions Ancillary Terrestrial Component (ATC) rules, the Commission used the term "harmful interference" twelve times, mostly in the context of assuring incumbents that new services would not result in harmful interference. Burdens were assigned to the MSS licensee, as the licensee retains de facto control of the MSS spectrum (and thus is responsible for avoiding harmful interference on other users).

The Qualcomm dispute was primarily focused on the potential for predicted interference. While the term "harmful interference" was not applied; interference to incumbent broadcast television services by the 700 MHz operators was the main concern. The resulting wavier did carry some expectations on Qualcomm in implementing the de minimis threshold.

6. Even under the existing definitions, no apparent and consistent elements have been articulated to make or defend against assertions of harmful interference.

Verified. The codified definition describes harmful inference as: "interference which endangers the functioning of a radio navigation service or of other safety services of seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service."[48] However, this definition does not provide technical elements to consider in applying this definition.

The GPS community was able to bring LightSquared's deployment to a halt by claiming interference, despite the community's reliance on poor receiving devices.

In the Report and Order in the matter of Amendment of Part 27 and the rules for the DARS services, the Commission applies the statutory definition of harmful interference; however, qualified that definition in stating "the service rules we adopt today will not result in an environment where interference will never occur in any circumstance. However…we are

[48] 47 C.F.R. §2.1(c)(2004).

confident that the instances where WCS would seriously degrade or obstruct or repeatedly interrupt SDARS reception will be rare."[49] It did not recommend elements or factors for considering whether harmful interference is occurring.

In the Qualcomm dispute over predicted interference, the definition and elements of harmful interference was not even considered.

7. New entrants face the most difficulties in gaining access to spectrum, being unable to survive rulemaking/licensing processes or overcome incumbent challenges based on allegations of harmful interference.

Inconclusive. The cases used did not include any 'true' new entrants, rather only users wanting to extend their usage rights to include new services. This prediction could be verified with a series of case studies that included 'true new entrants' and whether those new entrants faced opposition or were involved in a dispute, and what type of procedures were necessary in order to practically enter into the spectrum space and deploy as a new entrant.

8. Incumbent spectrum users, especially Federal agencies, face their own difficulties in resolving interference issues or in changing their existing rights.

Inconclusive. Only the LightSquared case study included a federal user. The Department of Defense opposed LightSquared's deployment in fear of harmful interference on its devices. In this case, it appears that the incumbent Federal spectrum user was able to resolve the interference issue in its favor. And even, extend its SURs to include interference caused by poor equipment and not by poor transmission on behalf of the other user.

9. There is no one-size-fits-all approach to coming up with either the ex ante rights or the ex post remedies in light of the continued desire and expectation of more heterogeneity, not less, in terms of governance structures, systems and competitive providers.

Verified. As iterated above, each of the cases relied on different ex post remedies in resolution of their cases.

[49] Report and Order. ¶28.

B. RECOMMENDATIONS

Continuing to learn from the past policy considerations and disputes can help strengthen procedural elements within spectrum policy. While technology continues to change and evolve, establishing efficient and fair adjudicatory processes and continuing to establish procedural rights will allow for the technological issues to reign rather than burdening legal ones.[50]

It is incredibly difficult to apply general rules to the entire spectrum space that can effectively meet all the users needs and concerns. Hence, volumes of waivers and ex post procedures are requested and issued to meet the concerns of parties which the general rules do not adequately address. This process undoubtedly has overwhelmed the Commission – and has financially burdened many parties. Increasing the accessibility of information and ability to receive a fair, open, and expedient process will result in parties utilizing their own means to privately negotiate. Removing uncertainty and establishing procedural jurisprudence will help parties better understand how their rights and will likely increase negotiations without the continued involvement of the Commission in each step of the dispute.

C. FURTHER SUGGESTIONS FOR STUDY

The obvious next step in facilitating a more refined study of SURs would be to analyze the same series of questions regarding an even greater number of case studies. Further, in order to create a true empirical analysis, a future researcher could track the terminology used within the final order of each dispute and attempt to find conclusive evidence that certain terms and procedures require refining (i.e., how many times is the term "harmful interference" used within a dispute that was successful in comparison to an unsuccessful resolution).

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[50] Peter A. Tenhula, *A Prototype "Taxonomy" for Enforcement of Spectrum Usage Rights,* Draft (September 2011), 6 ("focusing on improving the procedural methods for resolving spectrum access or interference disputes may, in turn improve the substantive legal or technical issues that require definition or clarity.").

V. CONCLUSION

This study hopes to contribute to the development of data regarding disputes occurring within the spectrum space. By providing a more data-driven analysis of the procedural details involved in conflicts occurring during the establishment of new rights and the modification of existing rights, this paper sought to understand why certain resolutions have been more successful than others and why some were utter failures.

If the true goal of spectrum management is to pursue maximum efficiency, it is undeniable that spectrum users must have a clear understanding of their rights and be able to facilitate disputes and resolutions without the aid of additional parties (or with as few participating parties as possible). Therefore, if the Commission continues to provide more licenses within a frequency band (and only address scarcity concerns), more disputes will arise because of interference issues. A strong understanding of a user's spectrum rights will allow for more efficient resolution among users.

With the FCC's legacy of addressing scarcity and interference concerns within the spectrum space, it is now more important than ever to strengthen procedural spectrum usage rights as the Commission seeks to infuse spectrum management with more flexibility and new market considerations.

APPENDIX I: CASE STUDIES

CATEGORY ONE: ESTABLISHMENT OF NEW RIGHTS

The following case studies highlight cases within Category 1, disputes arising when a party seeks to establish new rights. Notably, these cases often involve new entrants and incumbent users seeking access to additional frequencies or additional service rights.

CASE 1: LIGHT SQUARED & INTERFERENCE IN CONNECTION WITH MOBILE SATELLITE SERVICES (MSS) IN L-BAND

Procedure	What was the procedural context:	Grant of waiver Revocation of waiver
	How long did the conflict take to resolve:	Ongoing 'conflict' LS sought ATC modification (Nov 2010) FCC grants ATC modification with a conditioned waiver (Jan. 2011) Revocation (Feb 2012) LS filing (Sept 2012) requesting permission to share spectrum now controlled by federal government agencies FCC published a petition for rulemaking (Nov 2012) that would give LS co-primary status within 1675-1680 MHz
Parties	Parties in contention?	LightSquared (entrant) GPS Community (incumbents)
	Perceived/stated motivations	LS: New entrant, new service - new private investment to bring broadband services to rural and less accessible regions GPS: Protect adjacent band by blocking entrance FCC: "focused on ensuring that business and consumers are able to take full advantage of economic opportunities presented by underutilized spectrum, but only when consistent with public health and safety."[51]
	What was the lead organization	FCC
	Which other organizations were involved	NTIA, GPS community, DOD, United States GPS Industry Council (USGIC)
	By inference, which	This case represents a conflict in which many

[51] Testimony by Julius Knapp, at 2, http://www.gps.gov/congress/hearings/2012-09-commerce/knapp-mindel.pdf.

	organizations were not involved	players (even those not within the adjacent bands) joined the discussion out of interest in how this new service & LS would be treated.
Decisions & Decision makers	Was the definition of "harmful interference" applied:	"The GPS-MSS conflict involves unfiltered or poorly filtered GPS legacy devices bleeding into the spectrum of neighboring users, with the result being receiver overload. Thus, the interference at issue today does not result from MSS/ACT L-band users emitting signals into the GPS spectrum."[52]
	Include ex post procedures or requirements in ex ante rules in anticipation of disputes	
	Assign the burden of presenting/rebutting or proving/disproving the "facts" or elements surrounding harmful interference claims and defenses	
	Define or redefine SURs	
	Impose certain mitigation obligations or responsibilities on one or more of the parties	January 2011 conditional waiver
Technical questions	What was the band/service orientation:	MSS/ACT L-band
	What were the technical characteristics involved:	Unfiltered and/or poorly filtered GPS legacy devices bleeding into the spectrum of neighboring users, with the result being receiver overload
	What were the service characteristics:	Satellite and terrestrial, including: (1) land-based applications; (2) maritime applications; and (3) government applications (e.g., disaster relief)[53]
	What was the geographic scope/orientation	LS provides services in North and Central America, the Caribbean, Hawaii, and costal waters.[54]

CASE 2:
THE ESTABLISHMENT OF RULES AND POLICIES FOR THE DARS SERVICE & AMENDMENT OF PART 27 OF THE COMMISSION'S RULES TO GOVERN THE OPERATION OF WIRELESS COMMUNICATIONS SERVICES

Solution		FCC granted a special temporary authority (STA) to operate SDARS terrestrial repeaters in an exclusively licensed satellite frequency band.
Procedure	What was the procedural	Approximately 8 Years

[52] (In the Matter of LightSquared Subsidiary) *Id*. at 4.
[53] In the Matter of LightSquared Subsidiary LLC; Request for Modification of its Authority for an Ancillary Terrestrial Component, 3.
[54] See http://www.skyterra.com/network/coverage-area.cfm (last visited Jan. 7, 2011).

	context:	May 2002 – May 2010
	How long did the conflict take to resolve:	In 1997, FCC adopted service rules for most aspect of SDARS operation (but not rules governing terrestrial repeater operations). On April 2, 2010, the FCC issued *WCS/SDARS Technical Rules Public Notice,* seeking comment on interference rules. Report and Order adopted on May 20, 2010.[55]
Parties	Parties in contention?	SDARS and WCS licensees
	Perceived/stated motivations	WCS licensees raised concerns regarding potential interference.
	What was the lead organization	FCC
	Which other organizations were involved	Sirius and XM (WCS licensees) SDARS licensees Several parties commented during this proceedings; including, American Mobile Radio Corporation, National Association of Broadcasters, Consumer Electornics Manufacturers Assocation, XM, Wireless Communications Association International, Inc. Full list available within report and order.[56]
	By inference, which organizations were not involved	NTIA
Decisions & Decision makers	Was the definition of "harmful interference" applied:	Yes, the R&O states that changing the technical rules will not risk harmful interference to neighboring users.
	Include ex post procedures or requirements in ex ante rules in anticipation of disputes	Yes. For example, the R&O and Second R&O include power limits, notification requirements, environmental assessments, compliance agreements, equipment authorization, and allow for petitions for reconsideration.
	Assign the burden of presenting/rebutting or proving/disproving the "facts" or elements surrounding harmful interference claims and defenses	Yes. For example, the R&O established enhanced performance requirements.
	Define or redefine SURs	Yes, in order to prepare for the co-existence of WCS and SDARS.
	Impose certain mitigation obligations or responsibilities	The R&O included build-out requirements for WCS licensees.

[55] (DARS) *Id*. at §C – Procedural History.
[56] (DARS) *Id*. at Appendix A – List of Parties Filing Pleadings.

	on one or more of the parties	
Technical questions	What was the band/service orientation:	2332.5-2345 MHz
	What were the technical characteristics involved:	Transmitting power Tension between satellite-based and terrestrial-based services
	What were the service characteristics:	Mobile broadband service, satellite radio, aeronautical mobile telemetry, and deep space network operations
	What was the geographic scope/orientation	Nationwide

CATEGORY TWO: MODIFICATION OF EXISTING RIGHTS

CASE 3:
APPLYING SECONDARY MARKET SPECTRUM LEASING POLICIES TO MSS/ATC LEASING ARRANGEMENTS

Result		A rule was made establishing (or extending) rights for new services
Procedure	What was the procedural context:	Rulemaking
	How long did the conflict take to resolve:	A little under a year MSS Rulemaking proposed on July 15, 2010. The Report and Order was adopted on April 5, 2011.
Parties	Parties in contention?	n/a
	Perceived/stated motivations	The National Broadband Plan recommended that 90 megahertz of spectrum be allocated to MSS for the purposes of terrestrial mobile broadband use.[57]
	What was the lead organization	FCC
	Which other organizations were involved	Several parties commented during the rulemaking: MSS ATC Coalition, EchoStar, AT&T, CTIA, T-Mobile, US Cellular, Verizon Wireless, CDMA Development Group, Mobile Satellite Users Association, Telecommunications Industry Association, LightSquared, DBSD, Globalstar, TerreStar, Cricket.
	By inference, which organizations were not involved	

[57] (MSS/ATC) *Id*. at pg 1.

Decisions & Decision makers	Was the definition of "harmful interference" applied:	"Harmful interference" was mentioned 12 times within the R&O. Primarily to contend that the new services would not result in harmful interference.
	Include ex post procedures or requirements in ex ante rules in anticipation of disputes	See generally Secondary Markets First Report and Order; Secondary Markets Second Report and Order; 47 C.F.R. Part 1, Subpart X ("Spectrum Leasing").[58] Notification procedures. The FCC delegated to the Wireless Telecommunication Bureau (WTB) and the International Bureau (IB) the authority to resolve implementation and administrative issues relating to notifications. [59]
	Assign the burden of presenting/rebutting or proving/disproving the "facts" or elements surrounding harmful interference claims and defenses	Yes. MSS licensee retains *de facto* control of MSS spectrum, arguably enhancing the licensee's ability to coordinate operations and avoid harmful interference. [60]
	Define or redefine SURs	Yes. For example, "under a spectrum manager leasing arrangement, the MSS licensee retains *de facto* control of the MSS spectrum at all times…"[61]
	Impose certain mitigation obligations or responsibilities on one or more of the parties	Yes, the R&O places much of the responsibility on the licensee.
Technical questions	What was the band/service orientation:	MSS/ATC
	What were the technical characteristics involved:	S-band (from 2000-2020 MHz and 2180-2200 MHz Big LEO band (from 1610-1626.5 MHz and 2483.5-2500 MHz) L-band (from 1525-1559 MHz and 1626.5-1660.5 MHz)
	What were the service characteristics:	Terrestrial wireless services Secondary markets leasing rules for terrestrial services
	What was the geographic scope/orientation	Nationwide

[58] (MSS/ATC) *Id*. at note 19.
[59] (MSS/ATC) *Id*. at note 20 – 21.
[60] *Id*. at note 17.
[61] *Id*.

CASE 4:
QUALCOMM INCORPORATED PETITION FOR DECLARATORY RULING

Result		Petition partially granted and a waiver granted
Procedure	What was the procedural context:	Adjudication[62]
	How long did the conflict take to resolve:	Approximately a year and 9 months Qualcomm filed a petition on January 10, 2005. Declaratory ruling adopted by the FCC on October 12, 2006.
Parties	Parties in contention?	Tension between 700 MHz licensees and broadcasters
	Perceived/stated motivations	After Qualcomm acquired licenses in the 700 MHz band, it sought for declaratory rulings to allow for its subsidiary MediaFlo to deploy new services in the 700 MHz band.
	What was the lead organization	FCC
	Which other organizations were involved	Qualcomm (and its subsidiary MediaFLO) Parties supporting petition[63] (largely representing the interests of 700 MHz licensees): Access Spectrum, Corr Wireless Communications, Harbor Wireless, Motorola, 700 MHz Advancement Coalition, Aloha Partners Parties opposing petition[64] (largely representing the interests of broadcasters): Association of Maximum Service Television, National Association of Broadcasters, Cox Broadcasting, Pappas Southern California License
	By inference, which organizations were not involved	NTIA
Decisions & Decision makers	Was the definition of "harmful interference" applied:	The definition "harmful interference" is not applied; however, "interference" is used throughout. More specifically, interference to broadcast television services by the 700 MHz operators.
	Include ex post procedures or requirements in ex ante rules in anticipation of disputes	n/a
	Assign the burden of presenting/rebutting or	The waiver did carry some expectations in implementing the *de minimis* threshold.

[62] In the Matter of Qualcomm Incorporated Petition for Declaratory Ruling, 21 FCCR 11683 (10/13/06) at 5-6, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-155A1.doc.
[63] Id. at footnote 26.
[64] Id. at footnote 27.

	proving/disproving the "facts" or elements surrounding harmful interference claims and defenses	
	Define or redefine SURs	No.
	Impose certain mitigation obligations or responsibilities on one or more of the parties	No.
Technical questions	What was the band/service orientation:	Lower 700 MHz band
	What were the technical characteristics involved:	Radio strength; broadcast signals
	What were the service characteristics:	DTV, multimedia cellular service
	What was the geographic scope/orientation	Nationwide

CATEGORY THREE: ENFORCING EXISTING RIGHTS

No cases under this category were thoroughly reviewed or discussed.