**Remarks of**

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**at the**

**Silicon Flatirons Telecommunications Program**
**University of Colorado at Boulder**

# "BROADBAND MIGRATION III: NEW DIRECTIONS IN WIRELESS POLICY"

**October 30, 2002**
**[as prepared for delivery]**

## I. Introduction

Good afternoon. I want to thank Professor Phil Weiser and the Silicon Flatirons Telecommunications Program for inviting me to Boulder. I can think of no better place than the foothills of the Rockies to talk about -- what else -- the broad new vistas and open spaces in spectrum policy presented by technological innovation. The mountains we must climb to achieve these opportunities are indeed steep and the climb is long and demanding – but like all accomplishments it begins with a single step. Today I would like to begin that process by setting out some of my thoughts about the next generation of spectrum policy.

Spectrum policy reform is a crucial initiative. Effective spectrum policy is essential to traditional spectrum-based services, such as mobile phones and Direct Broadcast Satellite. However, the rewards of sound spectrum policies go far beyond traditional stakeholders – they are integral parts of the long term success of FCC initiatives in Broadband, Competition Policy, Media Regulation, and Homeland Security. Ultimately, like all of our focus areas, spectrum policy must strive to maximize the unique benefits offered by spectrum-based services and devices to the American people.

## II. Spectrum Policy: At the Center of Other Policy Objectives

First, let me explain how our spectrum policy reform initiatives further the Commission's other important objectives. A little over a year ago, I outlined a 5-pronged agenda that would guide the FCC's work and our role in the "Digital Broadband Migration." That is, breakthroughs in technology will drive an exodus from existing analog platforms to digital architecture. The new networks would be more efficient and provide opportunities for an expanded array of applications and communications services for consumers. The notion of migration was that the transition would be long, and perhaps arduous, but was nonetheless essential for survival. In addressing this migration, I outlined five specific areas for Commission attention: (1) Broadband Deployment, (2) Competition Policy, (3) Re-examination of the Foundations of Media Regulation, (4) Homeland Security, and, our focus today, (5) Spectrum Policy. When we improve the way that spectrum is regulated – increasing access, availability, and efficiency – our other four initiatives are also advanced. Here are just a few potential examples:

- Broadband Deployment: Spectrum-based paths to homes and businesses hold great promise for the delivery of high speed internet. These paths ride on a variety of platforms: fixed and mobile, terrestrial and satellite, licensed and unlicensed.

- Competition Policy: Consumers are beginning to "cut the cord." Consumers, especially university students, are doing it more and more – replacing their wireline phones with mobile phones and other mobile devices for their core communications needs. Licensed wireless services have been a resounding success at introducing facilities-based local competition.

- Media Regulation/Digital Television: At its core, the DTV transition is about using the spectrum resource more efficiently and effectively. Whether it's the broadcasters of the future or new spectrum-based services in the old analog bands, digital television and spectrum policy are essential companions. Similarly, perhaps the most important developments for media consumers over the past decade has been the phenomenal growth and introduction of satellite television and radio as alternative – and spectrally-based – platforms for digital multichannel video and audio services.

- Homeland Security: Spectrum is an essential input in the continuing fight against terrorism, a force multiplier for our military and an everyday necessity for public safety officials. We must continue to work with the Administration's Homeland Defense leadership as well as the public safety and critical infrastructure communities within the FCC's jurisdiction to

ensure that adequate spectral resources are available to facilitate reliable and interoperable communications.

The common link in all of these policy areas that I have just briefly described, and of course our spectrum policies, is the growing centrality of the consumer; shifting more control to consumers to choose their communications service, their provider, their equipment, and their quality of service. Sound spectrum policy is a central component of the great digital migration for all Americans.

## III. Consumers Deserve a New Spectrum Policy Paradigm

All consumers, whether they are John and Jane Q. Public or the Boulder Police Department, deserve a new spectrum policy paradigm that is rooted in modern-day technologies and markets. We are living in a world where demand for spectrum is driven by an explosion of wireless technology and the ever-increasing popularity of wireless services.

Nevertheless, we are still living under a spectrum "management" regime that is 90 years old. It needs a hard look, and in my opinion, a new direction. Historically, I believe there have been four core assumptions underlying spectrum policy: (1) unregulated radio interference will lead to chaos; (2) spectrum is scarce; (3) government command and control of the scarce spectrum resource is the only way chaos can be avoided; and (4) the public interest centers on government choosing the highest and best use of the spectrum.

Today's environment has strained these assumptions to the breaking point. Modern technology has fundamentally changed the nature and extent of spectrum use. So the real question is, how do we fundamentally alter our spectrum policy to adapt to this reality? The good news is that while the proliferation of technology strains the old paradigm, it is also technology that will ultimately free spectrum from its former shackles.

### 1. Interference Leads to Chaos

From 1927 through to today, interference protection has always been at the core of federal regulators' spectrum mission. The Radio Act of 1927 empowered the Federal Radio Commission to address interference concerns. While interference protection remains essential to our mission, interference rules that are too strict limit users' ability to offer new services; rules that are too lax may harm

existing services. I believe the Commission should continuously examine whether there are market or technological solutions that can – in the long run – replace or supplement pure regulatory solutions to interference.

The FCC's current interference rules were typically developed based on the expected nature of a single service's technical characteristics in a given band. The rules for most services include limits on power and emissions from transmitters. Each time the old service needs to evolve with the demands of its users, the licensee has to come back to the Commission for relief from the original rules. This process is not only inefficient, it can stymie innovation.

Due to the complexity of interference issues and the RF environment, interference protection solutions may be largely technology-driven. As an illustration of the shortcomings of our current rules, I will point to a lesson I learned from my first technological mentor, the University of Colorado's own Dale Hatfield. Dale taught me that interference is not solely "caused" by transmitters, which many seem to assume – and on which our regulations are almost exclusively based. Instead, interference is often more a product of receivers; that is receivers are too dumb or too sensitive or too cheap to filter out unwanted signals. Yet, our decades-old rules have generally ignored receivers.

Not all gaps in the Commission's current interference approach are quite as obvious as the lack of receiver standards. The Commission will also be challenged to understand diverse and rapidly changing communications technologies and their interference policy impact. Emerging communications technologies are becoming more tolerant of interference through sensory and adaptive capabilities in receivers. That is, receivers can "sense" what type of noise or interference or other signals are operating on a given channel and then "adapt" so that they transmit on a clear channel that allows them to be heard. Our new policies should facilitate and support such innovative technologies that may increase spectral efficiency.

Both the complexity of the interference task -- and the remarkable ability of technology (rather than regulation) to respond to it -- are most clearly demonstrated by the recent success of unlicensed operations. According to the Consumer Electronics Association, there is already a complex variety of unlicensed devices in common use, including garage and car door openers, baby monitors, family radios, wireless headphones, and millions of wireless Internet access devices using Wi-Fi or Bluetooth technologies. Yet despite the sheer volume of devices and their disparate uses, manufacturers have developed technology that allows receivers to sift through the noise to find the desired signal.

Our mission should be to build a policy that recognizes the diverse and complex opportunities presented by changes in the role of interference in spectrum policy.

2. Scarcity

Much of the Commission's spectrum policy was driven by the assumption of acute spectral scarcity - the assumption that there is never enough for those who want it. Under this view, spectrum is so scarce that government rather than market forces must determine who gets to use the spectrum and for what. The spectrum scarcity argument shaped the Supreme Court's *Red Lion* decision, which gave the Commission broad discretion to regulate broadcast media on the premise that spectrum is a unique and scarce resource. Indeed most assumptions that underlie the current spectrum model derive from traditional broadcasting.

But just as the presumptions of *Red Lion* and similar broadcasting regulation based on scarcity have been called into doubt by the proliferation of media sources, so too must we question the continued utility of the pervasive scarcity assumption for spectrum-based services. The Commission has recently conducted a series of tests to assess actual spectrum congestion in certain locales. These tests, which were conducted by the Commission's Enforcement Bureau in cooperation with the Task Force, measured use of the spectrum at five major U.S. cities. The results showed that while some bands were heavily used, others either were not used or were used only part of the time. It appeared that these "holes" in bandwidth or time could be used to provide significant increases in communication capacity, without impacting current users, through use of new technologies. Although not dispositive, these results call into question the traditional assumptions about congestion. Indeed it appears that most of spectrum is not in use most of the time.

But even these results, if generally applicable, would be less important if it were not for the birth of new technological tools that allow the public to take advantage of available spectrum resources without diminishing other users' rights. Today's digital migration means that more and more data can be transmitted in less and less bandwidth. Not only is less bandwidth used, but innovative technologies like software defined radio and adaptive transmitters can bring additional spectrum into the pool of spectrum available for use. Scarcity will not be replaced by abundance; there will still be places and times when services are spectrum

constrained. However, scarcity need no longer be the lodestar by which we guide the spectrum ship of state.

3. Government Command and Control

While the wireless world has changed rapidly, government spectrum policy continues to be constrained by allocation and licensing systems from a bygone era. Change is inhibited by the "mother may I" phenomenon – businesses must go to the FCC for permission before they can modify their spectrum plans to respond to consumer demand.

The theory back in the 1930s was that only government could be trusted to manage this scarce resource and ensure that no one got too much of it. Unfortunately, spectrum policy is still predominantly a "command and control" process that requires government officials -- instead of spectrum users -- to determine the best use for spectrum and make value judgments about proposed -- and often over-hyped -- uses and technologies. It is an entirely reactive and too easily politicized process.

Although Congress and the Commission have actually begun shifting away from this model, the Commission still finds itself continually deciding and revisiting difficult technical questions concerning spectrum allocation, geographical coverage, system configurations, channelization, eligibility, auction exemptions, transferability, out-of-band emissions, and other technical criteria. Anyone who has been in Washington more than five minutes knows that government decision-making is measured in months and years rather than milliseconds. Even with auctions and a shift to more market-oriented policies, it is painfully obvious that we are still operating a kilobyte spectrum regulation device in a gigabyte spectrum world.

In the last twenty years, two alternative models to command and control have developed, and both have flexibility at their core. First, the "exclusive use" or quasi-property rights model, which provides exclusive, licensed rights to flexible-use frequencies, subject only to limitations on harmful interference. These rights are freely transferable. Second, the "commons" or "open access" model, which allows users to share frequencies on an unlicensed basis, with usage rights that are governed by technical standards but with no right to protection from interference. The Commission has employed both models with significant success. Licensees in mobile wireless services have enjoyed quasi-property right interests in their licensees and transformed the communications landscape as a result. In

contrast, the unlicensed bands employ a commons model and have enjoyed tremendous success as hotbeds of innovation. These successes give us some real-world experience on new and innovative alternatives to command and control, and we will undoubtedly use both models as we move forward.

4. Public Interest

The fourth and final element of traditional spectrum policy is the "public interest" standard. The phrase (or something similar), "public interest, convenience or necessity" was a part of the Radio Act of 1927 and likely came from other "utility" regulation statutes. The standard was largely a response to the interference and scarcity concerns that were created in the absence of such a discretionary standard in the 1912 Act. The "public interest, convenience and necessity" became a standard by which to judge between competing applicants for a scarce resource – and a tool for ensuring interference did not occur. The public interest under the command and control model often decided which companies or government entities would have access to the spectrum resource. At that time, spectrum was not largely a consumer resource – but rather was accessed by a relatively select few. However, Congress wisely did not create a static public interest standard for spectrum allocation and management.

Indeed, if the Commission is to do its job, the public interest must reflect the realities of the marketplace and current spectrum use. Today, I would suggest that full and complete consumer choice of wireless devices and services is the very meaning of the public interest. Certainly government telling consumers what types of services and devices they should have or own is not my view of the public's interest.

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So, how do we develop a policy that moves us from the four mainstays of traditional spectrum management into a more compelling model for this century? Since Professor Coase started the discussion on spectrum and property rights with his seminal article in 1959, we have had academic conferences, reams of economic papers, scores of academics debating the merits of FCC spectrum policy and, yet, only a modest amount of spectrum has been moved into new paradigms. That is why I established the Spectrum Policy Task Force: to lay the foundation for a new, bold approach to spectrum policy that would help us break out of the box.

IV. Spectrum Policy Reform

In June 2002, we created the Spectrum Policy Task Force to provide specific recommendations to the Commission for ways to develop a more integrated, market-oriented spectrum policy approach that provides greater certainty, minimal regulatory intervention, and greater benefits to consumers. The Task Force will assist the Commission in evaluating policies regarding interference protection, spectral efficiency, effective public safety communications, and various spectrum usage models. In the end, the Task Force's mandate is to think creatively and comprehensively about our full panoply of spectrum policies – and provide an intellectual foundation for future policy.

In only a few months, the Task Force's team of high-level, multi-disciplinary professional FCC staff – economists, engineers and attorneys – from across the Commission's Bureaus and Offices has solicited over 200 comments from the public on a wide range of questions, held four public workshops, and will soon submit its findings and recommendations. I believe that the upcoming Report will serve as a catalyst for long-needed changes in spectrum policy.

So what are some of the key steps toward reform?

1. Ad Hoc, Rigid Interference Rules Evolve to a New Paradigm for Interference Prediction and Avoidance – Interference Temperature.

The time has come to consider an entirely new paradigm for interference protection. A more forward-looking approach requires that there be a clear quantitative application of what is acceptable interference for both license holders and the devices that can cause interference. Transmitters would be required to *ensure* that the interference level – or "interference temperature" -- is not exceeded. Receivers would be required to *tolerate* an interference level.

I anticipate that the Commission will be seeking a lot of input from the technical community on these new interference concepts because this would mark a significant change. Rather than simply saying your transmitter cannot exceed a certain power, we instead would utilize receiver standards and new technologies to ensure that communication occurs without interference, and that the spectrum resource is fully utilized. So, for example, perhaps services in rural areas could utilize higher power levels because the adjacent bands are less congested therefore decreasing the need for interference protection.

During my time at the Commission, we have been forced repeatedly to reject applications for new services because the receivers of nearby services were so

poorly made that they could not tolerate the interference caused by the new service. By looking at the spectral environment more comprehensively and dynamically through the more focused measurement of interference temperature at the receiver, we better distribute the responsibilities for spectrum use and achieve greater value for American consumers.

2. Scarcity Mitigated by Access to the 4th Dimension – Time

In analyzing the current use of spectrum, the Task Force took a unique approach, looking for the first time at the *entire* spectrum, not just one band at a time. This review prompted a major insight: there is a substantial amount of "white space" out there that is not being used by anybody. The ramifications of the insight are significant. It suggests that while spectrum *scarcity* is a problem in some bands some of the time, the larger problem is spectrum *access* – how to get to and use those many areas of the spectrum that are either underutilized or not used at all.

One way the Commission can take advantage of this white space is by facilitating access in the time dimension. Since the beginning of spectrum policy, the government has "parceled" this resource in frequency and in space. We permitted use in a particular band over a particular geographic region often with an expectation of perpetual use. Like Einstein who dramatically theorized on the importance of the time dimension almost 90 years ago, the Commission now should also look at *time* as an additional dimension for spectrum policy. How well could we use this resource if our policies fostered access in frequency, space and time?

Technology has, and now hopefully FCC policy will, facilitate access to spectrum in the time dimension that will lead to more efficient use of the spectrum resource. For example, a software defined radio may allow licensees to dynamically "rent" certain spectrum bands when they are not in use by other licensees. Perhaps a mobile wireless service provider with software defined phones will lease a local business's channels during the hours the business is closed. Similarly sensory and adaptive devices may be able to ¨find¨ spectrum open space and utilize it until the licensee needs those rights for their own use. In a commercial context, secondary markets can provide a mechanism for licensees to create and provide opportunities for new services in distinct slices of time. By adding another meaningful dimension, spectrum policy can move closer to facilitating consistent availability of spectrum and further diminish the scarcity rationale for intrusive government action.

3. Command and Control Regulation Transitions to Flexibility

Historically the Commission often limited flexibility via command and control regulatory restrictions on which services licensees could provide and who could provide them. Any spectrum users that wanted to change the power of their transmitter, the nature of their service, or the size of an antenna had to come to the Commission to ask for permission, wait the corresponding period of time, and only then, if relief was granted, modify the service. Today's marketplace demands that we provide license holders with greater flexibility to respond to consumer wants, market realities and national needs without first having to ask for the FCC's permission. I believe license holders should be granted the maximum flexibility to use -- or allow others to use -- the spectrum, within technical constraints, to provide any services demanded by the public. With this flexibility, service providers can be expected to move spectrum quickly to its highest and best use.

Such flexibility should not come at the cost of clearly defined rules. The rapid pace of the markets and technology requires the Commission to continue to define clearly even the more expansive rights of flexible licenses. Without clarity, there is little certainty for the consumer, for the licensee in building business plans, or for the capital markets as to the value of the licenses. Although our licensed services – such as mobile wireless services – have thrived in the marketplace, the Commission has not maximized the public interest benefits that could be created by these licensees. For example, if the agency were to define the interference temperature in the licensed service bands, it would establish a clear watermark beyond which interference would not be permitted to rise. This certainty and stability would protect the investment-backed expectations of incumbents and their investors, while opening spectrum to innovative uses under clearly specified parameters.

4. The Public Interest in Spectrum Policy is Now More Informed by the Consumer Interest

We need a new spectrum policy that fits a new paradigm of putting the consuming public into the assessment of the spectrum public interest. This does not mean that the Commission will overlook the larger public interest goals such as national defense, public safety, and critical infrastructure. But it does mean that we should develop policies that avoid interference rules that are barriers to entry, that assume a particular proponent's business model or technology, and that take

the place of marketplace or technical solutions. Such a policy must embody what we have seen benefit the public in every other area of consumer goods and services – choice through competition, and limited, but necessary, government intervention into the marketplace to protect such interests as access to people with disabilities, public health, safety and welfare.

Spectrum policy was once an obscure abstraction for most Americans. But today Americans experience first hand the challenges of dropped cell phone calls – or limits on cable competition – or, for the early-adopters among us, interference on their wireless LANs. These are no longer abstractions – they are spectrum policy problems – interference debates, spectrum allocation decisions, and choices between licensed and unlicensed uses. The government must respond to these challenges – because the consumer impact of our failure to do so is too great to ignore – and the American people increasingly know it.

As do their leaders. On Capitol Hill, a number of members have expressed interest and advanced thoughtful proposals on spectrum reform. Similarly the Bush Administration has been an active participant in the spectrum policy dialog. At the Department of Commerce, NTIA Administrator Nancy Victory hosted a spectrum policy summit just this spring. Participants representing a broad range of interests -- government, consumers, industry and public safety - gathered to develop innovative spectrum policy recommendations. Many others are doing their own studies and holding conferences on spectrum policies: the General Accounting Office; think tanks, such as the Center for Strategic and International Studies and the CATO Institute; and universities, including my host today, the University of Colorado. And the Commission and the Task Force are at the epicenter of this national dialog. I look forward to working with anyone and everyone with good ideas on how to move spectrum policy forward.

The Task Force's work will not be merely an intellectual exercise in creative policy. Hopefully the report, and the constructive dialogue it will initiate, will provide the framework, or blueprint, for how we will approach spectrum policy in the future.

That framework is not just a long term process. It provides a significant action plan for the next quarter. In the coming months, I will:

- Direct the Task Force to produce its report for public release;

- Initiate a dialog with members of Congress on what legislative steps will assist in developing a more effective spectrum policy approach for the benefit of consumers;
- Explore ways in which the interference temperature concept, increased spectrum access and more flexible rights may enhance the public interest;
- Strive to make more spectrum available for licensed and unlicensed use;
- Recommend that the Commission at its December meeting initiate a Notice of Inquiry that builds on the Task Force's work.

## V. Conclusion

We are truly at a crossroads in the spectrum policy component of the digital migration. We must make critical decisions that balance the interests of existing spectrum users and potential new entrants to ensure that there is every opportunity and incentive to put spectrum to its highest and best use for the benefit of all consumers.

It is important to remember that at the end of the day, we're not necessarily looking for one "right" path to our destination. There is no one-size-fits-all model for spectrum policy. We may well find that there are multiple approaches to the spectrum policy peak that should be pursued in different contexts in different spectrum bands over short, medium and long-term horizons. As with any accomplishment worth achieving, the climb will likely be strenuous but the rewards at the summit are immeasurable.

Thank you.