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UNLICENSED SHARING OF BROADCAST SPECTRUM

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Introduction

Each day, between the hours of waking, working, and sleeping, we unconsciously interact with an incredible variety of unlicensed devices. From controlling the garage door and monitoring the baby, to microwaving breakfast and speaking on a cordless phone, to keyless entry to a workplace and turning off the television via remote control, our interactions with unlicensed devices have become second nature. And each day, whether most of us realize it or not, we go to bed not having to pay a cent to anyone for the right to do these things.

What makes all of these conveniences possible? Simple, light-handed regulations that permit the unlicensed sharing of a small portion of the spectrum by multiple users at low power, subject to only technical restrictions. The benefits of this freedom to innovate within the unlicensed bands are seen daily in the numerous devices and conveniences we take for granted. Additional unlicensed spectrum would create opportunities for greater competition, more affordable high-speed Internet access, new wireless services, and ultimately, increased access by the public to a common asset.

Unlicensed Notice of Inquiry

On December 20, 2003, the Federal Communications Commission released a Notice of Inquiry¹ in the matter of allocating additional spectrum above 3GHz and below 900MHz for general unlicensed use. While opening up additional unlicensed spectrum above 3GHz is beneficial, the physical characteristics of spectrum below one gigahertz offer the unique ability to penetrate foliage, walls, and other natural obstacles faced by radio signals.² These frequencies have increased economic value derived from their beneficial technical characteristics. Therefore, the means by which unlicensed devices are given the opportunity to utilize unused broadcast spectrum will be the focus of this Issue Brief.

At the heart of the inquiry was a call for comment on the ability of unlicensed devices to operate in a secondary fashion to licensed high-power services in the broadcast bands. In response, a broad range of individuals, incumbent licensees, public interest groups, and technology companies filed over one hundred comments and reply comments.

Overwhelmingly, however, the majority of responses leaned toward an incumbent “not in my backyard” argument (also known as the “NIMBY Syndrome”). In other words, while the bulk of the Commenters expressed general support for opening up more spectrum to unlicensed use, their support was predicated on the assumption that their spectrum would remain untouched. The logical consequence of this NIMBY Syndrome is that every frequency band, once assigned to a licensed service, should remain so, leaving no spectrum capacity for unlicensed use.

During the past three years, the rapid deployment of unlicensed wireless devices has become one of the few examples of growth and profitability in the telecom sector. While most of the equipment deployed has utilized frequencies above one gigahertz, more requests have been made for access to lower frequencies due to propagation characteristics that offer greater flexibility. Yet, rather than give these unlicensed devices more spectrum breathing room, the FCC has decided that they would rather risk suffocating this nascent industry.

Unfortunately for incumbents, the demand for spectrum continues to explode. Something, or rather someone, has to give. Due to the command and control allocation regime currently in place, even though the vast majority of spectrum in the broadcast bands is grossly underutilized, it has been impossible for new, novel, and more efficient users to gain access rights.

* This issue brief summarizes Comments and Reply Comments submitted to FCC ET Docket No. 02-380 by J.H. Snider, New America Foundation, with Harold Feld, Media Access Project. Max Vilimpoc is a Research Associate with the New America Foundation's Spectrum Policy Program. J. H. Snider is a Senior Research Fellow with the New America Foundation's Spectrum Policy Program.

The New America Foundation, in formal comments to the FCC, proposes three methods of allocating unlicensed access to the broadcast spectrum:

1. **Dedicated** unlicensed access would allocate a band of frequencies solely on a shared basis to devices operating without interference protection. An example of dedicated unlicensed use is the 2.4 GHz band, where Wi-Fi, Bluetooth, and other unlicensed services are booming. Currently, over 90% of the spectrum used by TV channels 52-69 are guard bands, or “white space” not assigned to full power TV stations. Since these are due under current law to be returned to the public, they should be allocated for shared access and become unlicensed after the digital television transition.
2. **Shared** unlicensed access would allow unlicensed devices to operate alongside licensed services. An example of shared use is garage door openers, , which share spectrum with the United States Air Force. A low power unlicensed underlay could be allocated across all broadcast bands.
3. **Opportunistic** unlicensed access would give unlicensed devices the right to use so-called “white space” where licensed services do not fully utilize the information-carrying capacity of their spectrum allocations. Emerging smart radio technologies incorporating sharing protocols can be used by unlicensed devices without harmful interference to incumbent services.

By creating distinctions in unlicensed access types, spectrum regulators would have greater flexibility and legal granularity to allocate multiple simultaneous users within a set of frequencies. The benefits of this approach would enable users to use spectrum to its fullest capacity, while lowering the costs of spectrum access by mitigating its artificial scarcity. Given its limited length, this Issue Brief will focus solely on advocating a strategy for achieving dedicated unlicensed access to the unused portions of the broadcast band. (For more details, please consult New America’s Comments and Reply Comments³.)

Channels 52-69: A Vast Wasteland

To demonstrate the immediate availability of broadcast band spectrum above channel 52, a tally was made of licensed television stations operating in the 210 Designated Market Areas.⁴ Figure 1 illustrates the low spectrum utilization rate of the Lower and Upper 700 MHz bands. The column labeled “By Allocation (%)” shows the percentage of stations operating on a particular channel (across all 210 market areas) and is not affected by the size of the population within those markets. The column labeled “By Population (%)” shows the percentage of viewing households out of the total number of viewing households (from all 210 market areas) that can receive a particular channel. By its nature, this second column weights television coverage depending on the size of the market. These utilization numbers indicate that there is a roughly 1 in 14 chance of a high-powered station allocated on one of channels 52-69 in a viewing area, and a 1 in 5 chance that the station actually exists based on population coverage.

High Power Broadcast Spectrum Utilization Rate		
Channel	By Allocation (%)	By Viewing Households (%)
52	10.95	28.73
53	11.90	28.08
54	9.05	19.03
55	11.90	20.60
56	12.86	32.58
57	12.86	24.96
58	11.90	19.99
59	9.05	20.62
60	3.33	15.60
61	6.19	23.96
62	5.24	20.45
63	1.90	3.71
64	3.81	7.52
65	3.33	12.73
66	5.24	18.60
67	4.29	15.31
68	4.76	21.14
69	1.90	5.14
Average	7.25	18.82

Figure 1. Channels 52-69: A Vast Wasteland

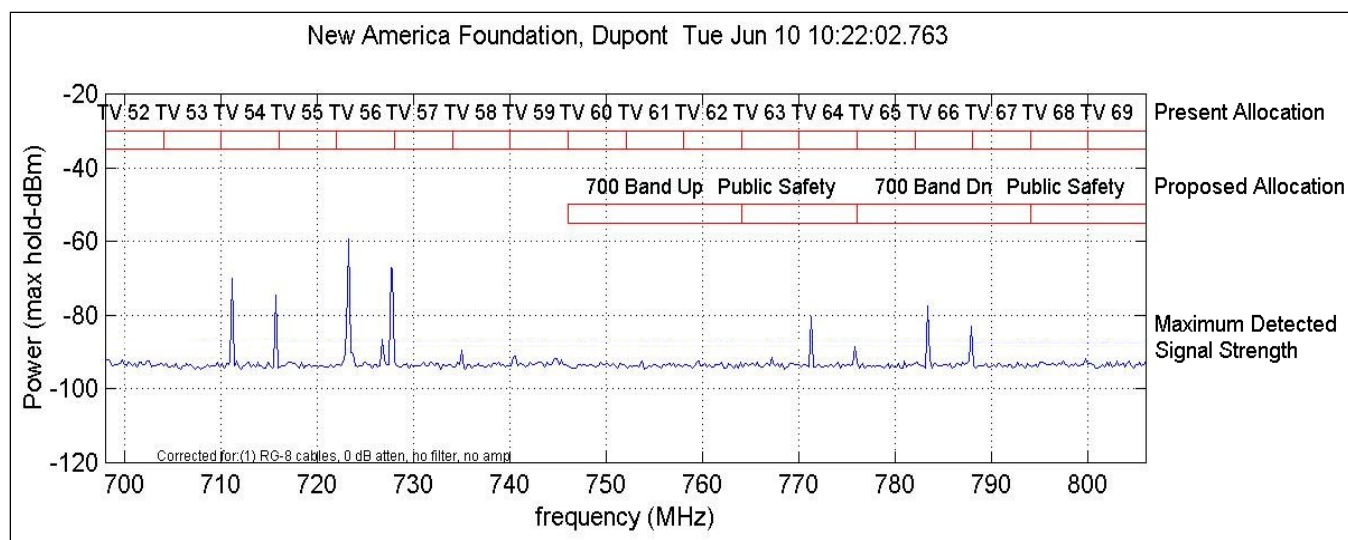


Figure 2. Whitespace Measurements of Channels 52 to 69.

Experimental Support

To demonstrate the emptiness of the broadcast band spectrum from channel 52 to 69, New America in concert with the Shared Spectrum Company took direct measurements of the spectrum within the vicinity of the Foundation's Dupont Circle headquarters. Figure 2 shows the maximum signal strengths received over a two-hour monitoring period. It is evident that only 4 channels are active out of 18, and only one of these channels barely meets the minimum standard for protection from interference (the FCC-defined Grade B service contour). Put simply, the 108 MHz of spectrum allocated to television channels 52-69 is measurably underutilized and could very easily be put to better use by many other services.

Turn Whitespace into Dedicated Unlicensed Bands

A number of transitional steps will be necessary to allow for the gradual introduction of unlicensed devices on unused broadcast frequencies. The first step would allow unlicensed devices to operate on the guard bands and unassigned channels in the bands associated with TV channels 52-69. Since these channels have been designated for relocation early in the DTV transition, and since there are very few allocated stations, a significant amount of spectrum would be available for immediate sharing.

As the band is vacated by current licensed users, unlicensed devices would then be granted the full frequency range for dedicated unlicensed use while remaining cognizant of and avoiding interference to the public safety operations in the Upper 700 MHz band. Finally, as the DTV transition enters its final stages, former analog guard bands in the range of channels 2-51 (excluding Channel 37), could be made available for unlicensed use. However, even before the end

of the DTV transition, an effort should be made to allow greater opportunistic use of unused broadcast spectrum.

There is nothing new about the appropriation of broadcast spectrum for low-powered, limited-range use by production studios; the above proposals merely extend this easement to the public. Low-powered wireless microphones operating in unused broadcast spectrum are produced by established companies such as Shure⁵ and Audio-Technica and used at sports venues, churches, and thousands of other locations.

In addition, content and television producers use tools known as Wireless Assist Video Devices to coordinate scenes being shot by film crews. WAVDs are allowed to operate as broadcast auxiliary devices on unused spectrum provided they do not interfere with nearby television receivers. Since these devices operate on the broadcast band today with little incident, there is strong reason to doubt the assertion made by the National Association of Broadcasters that allowing unlicensed use would necessarily cause harmful interference to broadcast receivers⁶.

Conclusion

In summary, additional unlicensed spectrum, particularly in frequencies below one gigahertz, would offer a unique opportunity for innovators to capitalize on significant advances in digital modulation and coding technologies. Additional technologies such as better radio receivers, cognitive radio, diversity antennas, and many others will ultimately allow even more users to share spectrum. As demonstrated by the evidence above, the spectrum is readily available and is merely waiting for the proper occupants.

Endnotes

¹ Federal Communications Commission Notice of Inquiry, “In the Matter of Additional Spectrum for Unlicensed Devices Below 900MHz and in the 3GHz Band”, ET Docket No. 02-380, December 20, 2002.

² See J. H. Snider, *The Explanation to the Citizen’s Guide to the Airwaves*, Washington, DC: New America Foundation, May 2003.

³ See Comments and Reply Comments of the New America Foundation filed jointly with the Consumers Union, Consumer Federation of America, Media Access Project, Center for Digital Democracy, Public Knowledge, and the Benton Foundation in ET Docket No. 02-380, April 17, 2003 and May 16, 2003.

⁴ See 100000 Watts: US Radio and TV Directory, <http://www.100000watts.com/>

⁵ See Comments of Shure, Inc. in ET Docket No. 01-75, August 7, 2001.

⁶ See Comments of the National Association of Broadcasters, ET Docket No. 02-380, April 17, 2003.