

**Testimony of Thomas Stroup  
Chief Executive Officer, Shared Spectrum Company  
before the  
House Energy and Commerce  
Subcommittee on Communications, Technology and the Internet**

**December 15, 2009**

Good morning, Chairman Boucher, Ranking Member Stearns, and members of the Subcommittee. Thank you for this opportunity to testify on the pending spectrum inventory and spectrum relocation bills. My testimony this morning will focus on two main points: First, in order to gain better knowledge of how and if valuable spectrum resources are being used effectively and efficiently, regulatory and legislative efforts to develop a comprehensive inventory and spectrum database must include data on actual spectrum utilization or occupancy. Second, until such a database is compiled, publicly available and fully analyzed, we caution against jumping to any conclusions as to what's next for particular frequency bands – whether such next steps would be the potential reallocation for broadband services, designating more bands for unlicensed devices or some other regulatory actions – because ongoing technological developments present spectrum access alternatives that have not existed until now.

Before getting into the heart of my testimony this morning, I would first like to provide the subcommittee some information about my background and a brief introduction to Shared Spectrum Company. I have been involved in the wireless industry for over 25 years, going back to the days when cellular telephone licenses were subject to comparative hearings at the FCC. In the early 90s, I was President of the Personal Communications Industry Association (PCIA) which helped the nascent wireless industry win the reallocation of fixed microwave spectrum for

new Personal Communications Services (PCS). Then, I founded and ran a company called Columbia Spectrum Management to facilitate and negotiate the relocation of microwave incumbents in the PCS bands on behalf of the new auction winners. I am also a co-Founder and the CEO of CSM Wireless, which holds mobile wireless licenses in six markets, and served on the board of the Virginia Center for Innovative Technology. Since March of this year, I have been the CEO of Shared Spectrum Company or “SSC”.

SSC is a small technology company located in Vienna, Virginia and founded by Dr. Mark McHenry in 2000. After leaving the Defense Advanced Research Agency (DARPA), Dr. McHenry began conducting spectrum occupancy studies in order to document the untapped potential of many unused frequency bands. These studies indicated that less than a third of the allocated radio spectrum was being used at any given time. While the studies showed that the utilization of each band varies, Dr. McHenry discovered that a significant amount of wireless spectrum should be available for more robust wireless applications and secondary users; that is if technology and regulations allowed such users to safely access the vacant bandwidth. So, Dr. McHenry and SSC pioneered innovative dynamic spectrum access (DSA) technology, which takes advantage of the empty spectrum capacity by dynamically adapting to the spectral environment and changing transmission or reception parameters on the fly. This allows for more efficient wireless communications for new commercial and non-commercial wireless systems without causing harmful interference to or requiring the dislocation of legacy systems using the same bands.

The company developed DSA over the past nine years for several military projects – building prototype devices, developing software and conducting field tests. This technology is now being deployed in several military radio systems and we are exploring several commercial

applications including new, cost-effective rural wireless broadband systems that can access preferred, lower frequencies.

At the same time DSA was being developed and tested, the regulatory environment at the FCC was evolving favorably to support DSA-enabled “smart” or “cognitive” radios through flexible service rules, secondary market policies and lower entry barriers in many licensed and unlicensed bands, including the so-called TV “white spaces.” Similarly, the federal frequency management regulations of the National Telecommunications and Information Administration (NTIA) now enable systems using cognitive radio or software defined radio technologies in any radiocommunications service so long as they operate in accordance with the applicable restrictions governing those services. NTIA’s 2008 Federal Strategic Spectrum Plan also acknowledged that Federal spectrum requirements necessitate a new, evolutionary model for spectrum management that will provide the means to meet the increasing demand of Federal users through dynamic spectrum access to bandwidth – wherever required, whenever required. More recently, NTIA Director Larry Strickling told a Department of Defense Spectrum Symposium that NTIA has “high hopes for dynamic spectrum access and related innovations to make spectrum use as efficient as possible and to solve the challenges presented when different users and different devices are trying to operate in the same frequency band.”<sup>1</sup> Finally, we are also very pleased to see the Obama Administration’s commitment “to supporting research that will foster the next wave of innovation in information and communications technologies such as ‘cognitive radio’ that allows for the efficient sharing of spectrum . . . .”<sup>2</sup>

---

<sup>1</sup> Remarks of Asst. Sec’y of Commerce, Lawrence Strickling, at the 2009 DOD Spectrum Symposium (Arlington, VA, Oct. 14, 2009) (As Prepared for Delivery).

<sup>2</sup> Executive Office of the President, National Economic Council and Office of Science and Technology Policy, “A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs” (Sept. 2009).

\* \* \* \* \*

As has been pointed out already throughout the hearing, the demand for spectrum across all sectors and markets is substantially increasing. The existing supply, to the extent it is even known, is constrained by outmoded access restrictions, inflexibility and artificial barriers. SSC agrees that the necessary first step in confronting the spectrum dilemma, as recognized by the foresight of the sponsors and co-sponsors of H.R. 3125, is to conduct a comprehensive survey of the nation's spectrum resources. We are, therefore, pleased to support, and encourage expedited enactment of, the Radio Spectrum Inventory Act.

The spectrum inventory bill would provide expanded authority and guidance to the FCC and NTIA to work together to create and maintain an accurate, comprehensive database of spectrum allocations, assignments and utilization. Consolidating the available allocation and assignment data from the various NTIA and Commission repositories into a single, unified portal or database will go a long way toward a better understanding of spectrum. As recognized in the bill, it is also important to supplement this allocation and assignment data with information regarding the actual use of the airwaves. Virtually every service to which spectrum is allocated can show a legitimate need for the spectrum, and most incumbents will argue that they make "efficient" or "effective" use of those allocations. Thus, compiling a database of spectrum assignments will be interesting, but that alone will fail to show how much, or even if, the spectrum is actually being utilized.

As I mentioned previously, Dr. McHenry and SSC have been conducting spectrum utilization studies for several years. Attached to my testimony are exhibits that list SSC's public studies to date, most of which were funded by the National Science Foundation, and some sample results of measurements taken from SSC's rooftop spectrum observatory in Northern

Virginia during the Presidential inauguration activities in January 2009. Allow me highlight some of the results from this data.

The plots from the analysis of the inauguration data, as a general matter, show the relative intensity of use over several days across several public safety bands. While there are parts of the 800 MHz band containing public safety and other land mobile users that are used intensively (Exhibit B, Figures 1 and 2), other band segments show little or no use (Exhibit B, Figures 3-10).

Similar observations can be made from spectrum occupancy measurements taken from a rooftop overlooking New York City as it was hosting the Republican National Convention in September 2004. During an event where larger than normal levels of radio traffic would be expected, the measured occupancy levels varied from less than one percent in the 1240-1300 MHz Aeronautical RADAR band to 77 percent in some of the TV bands. The average spectrum usage based on these measurements was only 13 percent.

Another NSF-funded study in an area of presumed high level of spectrum use was conducted in Chicago in November 2005 at the Illinois Institute of Technology. The spectrum occupancy was similar to that identified in New York, where only the TV, cellular and PCS bands showed use in excess of 40 percent and the average use appeared to be a little more than 17 percent. These measurements were taken during a normal work week where a high level of activity was expected.

These reports have been available for public scrutiny for years and continue to be cited by various organizations to highlight the dramatic underutilization of this important resource. SSC has conducted similar studies in less populated areas, and none show anywhere close to the level of occupancy shown in these urban studies. Thus, to summarize Dr. McHenry's earlier

findings, in densely populated areas, on average, less than 20 percent of the spectrum is being used.

The FCC's Enforcement Bureau, NTIA's Boulder Lab and NSF-supported academic institutions have conducted similar spectrum measurement studies over the years with interesting results. This data could be incorporated into the spectrum inventory immediately. Based on SSC's unique experience in conducting spectrum occupancy studies, we offer the following additional suggestions.

For purposes of supplementing the consolidated spectrum database, SSC suggests that the Commission and NTIA could – in faithfully implementing the Radio Spectrum Inventory Act or under their existing authority – sponsor or conduct an initial series of spectrum occupancy studies at a diverse set of 10 to 20 fixed locations, augmented by mobile data collections, in urban and rural areas over several days or weeks. Depending on available agency and other financial resources, some or all of this effort could be contracted out to independent third parties or conducted through NSF or the National Academy of Sciences. These studies would assess the full range of spectral, temporal, spatial, and related issues and variables. Bands with low occupancy and large spectrum holes (time and frequency) can be checked against the consolidated assignment database (including the predicted transmission patterns for known fixed transmitters) to determine if the signals should have been detectable if they were present.

Long-term spectrum observatories could also be set up by the Commission, NTIA, universities and other parties at a variety of locations around the country to provide a steady source of usage data that will validate earlier results, observe trends in spectral usage over longer periods (years), identify usage patterns and anomalies, and confirm the positions of spectral holes in time and space. Like air pollution monitoring stations that feed data to the EPA's Air

Quality System repository of ambient air quality data or various river and stream monitoring facilities across the country that track water flow and pollutant information, spectrum observatories could be a useful spectrum resource management tool.

We also believe that the analysis of the inventory information along with any data on the actual use of spectrum must take into account the purpose for which a spectrum band in question has been originally allocated and the manner in which the particular spectrum band is expected to be used. For example, in some bands, it may be appropriate to look at average spectrum utilization over a given period of time or over a certain geographic area. For other bands, utilization could be based on peak usage levels, especially during times of emergency. However, based on SSC's experience, up to 85 percent of the spectrum (or more) will likely be found to be totally unoccupied with both a peak and average utilization near or at zero.

\* \* \* \* \*

The incredible value of a comprehensive spectrum inventory and database has been well articulated by the other witnesses today, many commenters in the FCC's broadband and wireless innovation proceedings<sup>3</sup> as well as highly credible academics and think tanks.<sup>4</sup> However, until such a database is compiled and available, SSC cautions against any presupposition as to what's next for a particular band, whether it be potential reallocation for broadband services, designating more bands for unlicensed devices or some other regulatory actions. Once this information is made more easily accessible to the public, incumbents and entrepreneurs, a wide range of eager spectrum-constrained innovators can identify potentially available spectrum and

---

<sup>3</sup>See Record in GN Docket Nos. 09-51 and 09-157, *In the Matter of National Broadband Plan and Fostering Innovation and Investment in the Wireless Communications Market*.

<sup>4</sup> See Simon Wilkie, *ICT: The 21st Century Transitional Initiative*, Aspen Institute Communications and Society Program, Jan. 7, 2009, at 6-8 & 36; Philip J. Weiser, *The Untapped Promise of Wireless Spectrum*, Brookings Institution Discussion Paper 2008-08, July 2008, at 12-18.

deploy new approaches to sharing spectrum or partnering with existing licensees. On the other hand, to assume that the next step following the initial inventory would be a traditional reallocation proceeding would amount to a plan for years and years of fighting among entrenched interests that have no notion or incentive to have their existing spectrum rights diminished, no matter how well those rights are exercised or utilized. This is based on my personal experience where it took six years for the spectrum to be reallocated, and that looked like the “fast track” compared to most reallocation efforts that typically have dragged on for ten years or more.

As the Subcommittee considers both of the pieces of legislation that are the subject of this hearing, we believe that it is also important to recognize that new technologies such as dynamic spectrum access, cognitive radios and smart antennas enable more efficient use of existing spectrum allocations and can create new opportunities for sharing spectrum with existing services in underutilized bands. Another potential positive result of a reliable spectrum inventory, and without the need for further regulatory action, would be the use of the spectrum data to facilitate more vibrant secondary market leasing activity. For example, to promote the development of broadband service in rural markets, spectrum holders may be more encouraged to post to the database or through a spectrum broker the terms under which they would make spectrum available for lease.

Accordingly, SSC suggests that the overwhelming interest in finding additional spectrum for wireless broadband services is more likely to be accommodated in a timely manner if a flexible spectrum access framework is established that includes DSA-enabled sharing with government and non-government incumbents. Such a framework would focus on “multi-purposing” legacy bands with flexible overlay rights (and responsibilities) because traditional

“repurposing” or “reclaiming” bands that involve relocating incumbents would be too difficult, too costly, too time consuming and, in light of new technology, unnecessary. Indeed, this is similar to what occurred when the PCS bands were made available in 1995. The licenses that were auctioned were subject to a non-interference requirement with the existing microwave incumbents. While most of those old licensees ultimately were relocated to new systems on other frequencies, the advances made in DSA and cognitive radio technology now provide the ability to co-exist with legacy systems that was not available at that time.

\* \* \* \* \*

Thank you, again, for this opportunity to testify today. I look forward to addressing your questions and concerns.