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***STUDY FINDS CONSUMER BENEFITS OF UNLICENSED SPECTRUM EXCEED \$50B
PER YEAR***

CFA to Congress: More High-Quality Spectrum Needed for Shared and Innovative Use

Washington, DC, November 29, 2011 -- The Consumer Federation of America sent the following letter to the House Subcommittee on Communications and Technology in advance of the December 1st House of Representatives Commerce Subcommittee mark-up of legislation regarding future spectrum policy.

Dear Chairman Walden, Ranking Member Eshoo and Members of the Subcommittee:

The most important and immediate goal of spectrum policy reform is to ensure that the mobile communications sector, which lies at the center of the digital economy, continues to develop in an innovative, user and consumer-friendly, manner, so that it can continue to spur economic growth, investment and job creation.

Our analysis of *The Consumer Benefits of Expanding Shared Use of the Public Airwaves*, which we are releasing today (www.consumerfed.org/pdfs/Consumer-Benefits-of-Shared-Use-Spectrum.pdf) demonstrates that spectrum made available for shared use without a license (unlicensed spectrum), has played a central and critical role in growth of wireless broadband data service. In fact, the shared use model has performed as well as, if not better than, the exclusive licensed model, even though unlicensed spectrum was considered to be “junk” by commercial operators. Using unlicensed technologies like Wi-Fi and Bluetooth, consumers receive higher quality service at lower prices.

- Consumers “extend” broadband service to their mobile devices at home and directly access hundreds of thousands of public and private hot spots across the U.S. This adds over \$25 billion per year in value to broadband service.
- The efficient use of shared spectrum allows cellular wireless providers to “offload” more than one-third of their data traffic, dramatically reducing the number of cell sites they have to build and operate. This lowers the cost of service by at least another \$25 billion per year.
- Intensive intra-firm communications, remote metering and monitoring, tagging of assets and goods, pay and go billing, and a host of others machine-to-machine applications, all of which rely on shared use spectrum, save businesses tens of billions of dollars per year.

Policymakers must ensure that the shared use model continues to expand by making available additional, high quality spectrum on an unlicensed basis. Making spectrum available for shared use is likely to reduce the deficit in the short and long term.

- In the short term, the wireless companies will bid up the price for spectrum, if less is available at auction.
- In the long-term, because shared uses will create more economic value the increase in commerce will also indirectly generate additional tax revenues.

Proposals to auction all high-quality spectrum made available by clearing current users (like broadcasters) that would markedly curtail unlicensed access will have the effect of strangling the shared use model.

- The cost of wireless broadband service will be higher and value lower, resulting in less economic activity, fewer jobs and less federal revenue.
- In particular, the large incumbent wireless providers like AT&T and Verizon are likely to prevail in any auction: in the last two auctions, the top four wireless companies bought up over four-fifths of the spectrum made available.
- If all spectrum that is cleared is auctioned, little will be left over for innovative and dynamic shared use.

Legislation to increase the spectrum for wireless communications should ensure that high quality spectrum is made available for shared use and give the FCC the authority to determine how much should be made available to promote the continued consumer-friendly, innovation-friendly development of this vital sector.

The Consumer Federation of America is an association of nearly 300 nonprofit consumer organizations that was established in 1968 to advance the consumer interest through research, advocacy, and education.

**THE CONSUMER BENEFITS OF EXPANDING SHARED USE OF
UNLICENSED RADIO SPECTRUM:
LIBERATING LONG-TERM SPECTRUM POLICY FROM SHORT-TERM THINKING**

**Mark Cooper
Senior Adjunct Fellow, Silicon Flatirons,
Director of Research, Consumer Federation of America
New America Foundation, November 18, 2011**

- 1. Economic theory predicts that removing barriers to entry in the market for radio spectrum usage improves the static and dynamic efficiency of utilization of this scarce resource.**

In particular, theory suggests that removing the spectrum barrier to entry by allowing unlicensed access will:

- Decentralize decision making;
- Deconcentrate investment;
- Improve spectral efficiency;
- Allow user innovations;
- Promote end-user focus;
- Capture externalities; and
- Lower transaction costs.
- Unlicensed use also enriches the wireless ecology because it creates a diversity of ownership models, which in turn increases value, enhances innovativeness, promotes resilience, and supports pluralism.

- 2. Economic reality shows that shared use of the public airwaves has lowered consumer costs by billions of dollars and increased consumer value by a similarly large amount.**

The unlicensed model has equaled or exceeded the exclusive licensed model, on which cellular service providers primarily rely, on all the key measures of economic output performance:

- Use (Exhibit 1);
- Value (Exhibit 2);
- Applications (Exhibit 3);
- Efficiency (Exhibit 4); and
- Innovation (Exhibit 5).

- 3. The economic value created and innovations developed by using unlicensed spectrum have been achieved even though shared use has been confined to relatively small slivers of low-quality spectrum.**

- Shared use has been virtually shut out of access to the most attractive spectrum, which lies in frequencies in the 500 MHz to 1 GHz range (Exhibit 6).
- The FCC's decision to allow shared use of the TV "White Spaces" is threatened by some legislative proposals to auction all high-quality spectrum.

If policymakers create more space for unlicensed uses in higher-quality spectrum, the best is yet to come because expanded shared use will allow carriers and other service providers multiple new opportunities (Exhibit 7), including

- A greater ability to carry traffic offloaded from cellular networks;
- Increased coverage of Wi-Fi and similar technologies;
- Expansion of rural broadband deployment; and
- Support for many more business services.

4. Auctioning spectrum without making more unlicensed spectrum available will undermine the future success of the shared use model by starving it of a critical input and/or imposing conditions that undermine its core value.

Large incumbent telecommunications companies have gobbled up spectrum by mergers and acquisition and through auctions to such an extent that the top four firms control over four-fifths of the spectrum potentially useful for wireless broadband (Exhibit 8).

The large incumbents dominate auctions because they

- Have deep pockets;
- Possess communications infrastructure;
- Concentrate demand and decision making; and
- Have a strong incentive to bid — suppressing competition.

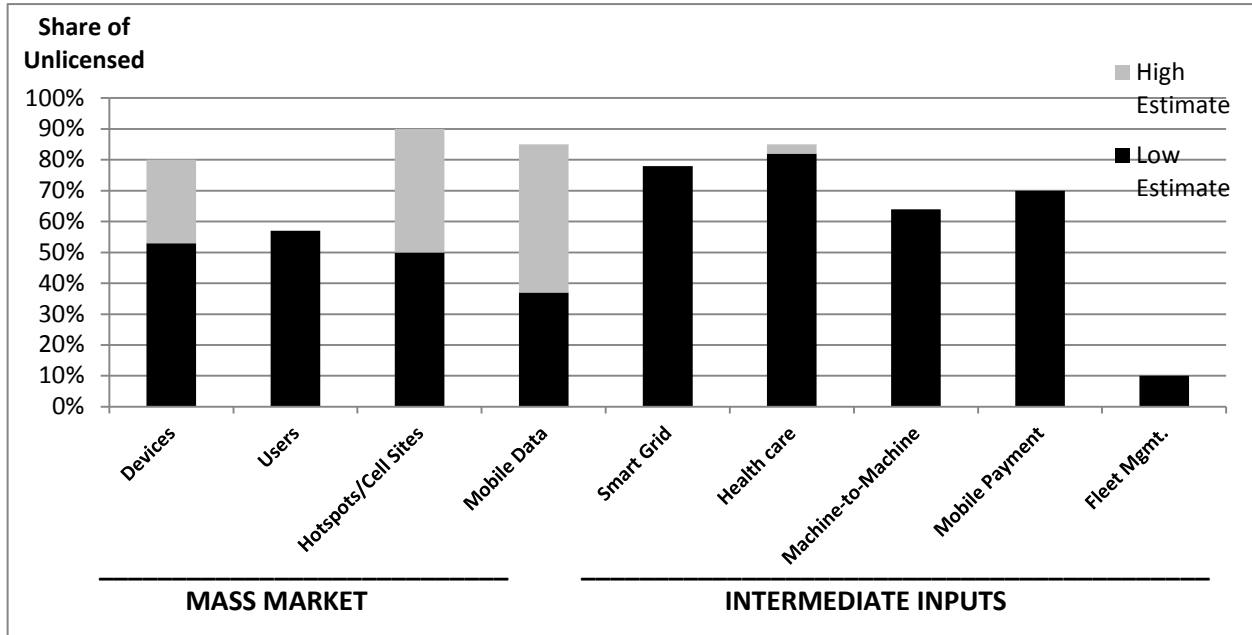
Auctions will result in little, if any, additional spectrum being made available for shared use because exclusive licensees won't share on terms and conditions that allow the shared use model to thrive, while users of shared spectrum are at a severe disadvantage in auctions.

- Many of the beneficiaries of shared use are unknown. While we can predict that there will be economic benefit associated with unlicensed spectrum, it is difficult to identify in advance precisely what form that benefit will take.
- Firms that supply shared use devices and applications generally have less access to capital than the massive telecommunications bidders at auction.
- Because device and applications developers are not telecommunications companies, access to spectrum is likely not necessary to their core business models.
- They are also likely to lack expertise in negotiating the processes of an FCC auction.

5. Making high-quality spectrum available for shared use will increase federal revenues and reduce the deficit.

- First, if the supply of spectrum for exclusive licenses is reduced, cellular providers will bid up the price of the spectrum that is auctioned. Given that the cellular service providers have declared a "spectrum crisis," it would be reasonable to assume that they will bid up the price substantially.
- Second, the expansion of economic activity associated with the spectrum made available for shared use not only generates tax revenues, but it also does so at a higher tax rate than exclusive licenses because the purchase price of the spectrum is not claimed as a business expense.

**EXHIBIT 1:
IN 2011, UNLICENSED SPECTRUM PLAYS A PROMINENT PART IN WIRELESS DATA ACTIVITY**



Sources and Notes:

Devices: The low estimate counts dual mode devices as both cellular and Wi-Fi; high figure compares Wi-Fi-enabled devices to cellular subscribers. Nick Flaherty, "Consumer Wi-Fi Drives Global Growth," *The Embedded Blog*, May 28, 2010; Peter King, "Digital Home Wi-Fi Enabled Devices: Global Market Forecast and Outlook," July 2007; Industry Analysis and Technology Division, *Internet Access Services: Status as of December 2010*, Federal Communications Commission, October 2011. Nick Flaherty, "Consumer Wi-Fi Drives Global Growth: Wi-Fi chip shipment to surpass 770 million in 2010, up 33%," *The Embedded Blog*, May 26, 2010; Richard Thanki, *The Economic Value Generated by Current And Future Allocations of Unlicensed Spectrum*, Perspective, 2009). The underlying data in many cases is InStat.

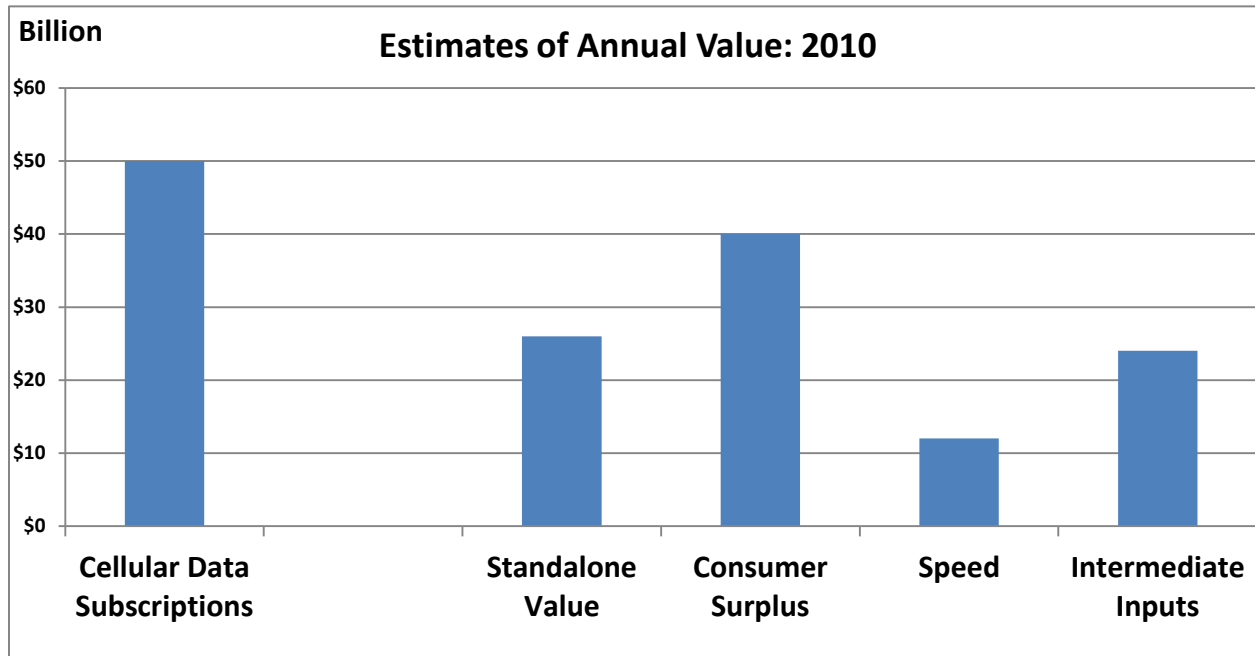
Users: Assumes 110 million users of unlicensed spectrum based on Pew Internet and American Life Data (*Americans and their Cell Phones*, August 15, 2011; *35% of American Adults Own a Smartphone*, July 11, 2011; *Half of Adult Cell Phone Owners have Apps on Their Phones*, November 2, 2011; *Spring Change Assessment Survey Data*). ComScore, *Digital Omnivores: How Tablets, Smartphones and Connected Devices Are Changing U.S. Digital Media Consumption Habits*, October 2011, puts the figure for Wi-Fi users at 116 million. CTIA, *Semi-Annual Survey*, 2011, puts cellular subscriptions at 327.5 million in mid-2011.

Hot spots: 400,000 total public and private hotspots (derived from Wireless Broadband Alliance, *Global Developments in Public WiFi*, 2011) compared to 256,500 cell sites (CTIA, *Semi-Annual Survey*, 2011).

Mobile data: ComScore, *Digital Omnivores: How Tablets, Smartphones and Connected Devices are Changing U.S. Digital Media Consumption Habits*, October 2011 (putting the figure at 37%). Adding in business uses pushes the total to over 80%. "Cost of Adding Network Capacity: More Spectrum or New Sites? Could there be Other Alternatives," *Wirelesse2e*, May 17, 2001.

Intermediate Inputs: Yochai Benkler, *Unlicensed Wireless vs. Licensed Spectrum: Evidence from Market Adoption*, 2011. Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum*, Perspective, 2009, provides dollar estimates for health care and tagging in the retail sector.

**EXHIBIT 2:
THE USE OF UNLICENSED SPECTRUM ACCOUNTS FOR A SIGNIFICANT PART OF THE
TOTAL VALUE OF WIRELESS BROADBAND SERVICE**



Sources and Notes:

Cellular data estimated as \$50/month for 84,000 million subscribers year-end 2010 Industry Analysis and Technology Division, *Internet Access Services: Status as of December 2010*, Federal Communications Commission, October 2011.

Wi-Fi standalone value is calculated as 110 million users are \$20 per month value based on charges for standalone Wi-Fi services (as advertised in web sites of Boingo, AT&T, T-Mobile). Most cellular providers bundle Wi-Fi with cellular broadband subscriptions.

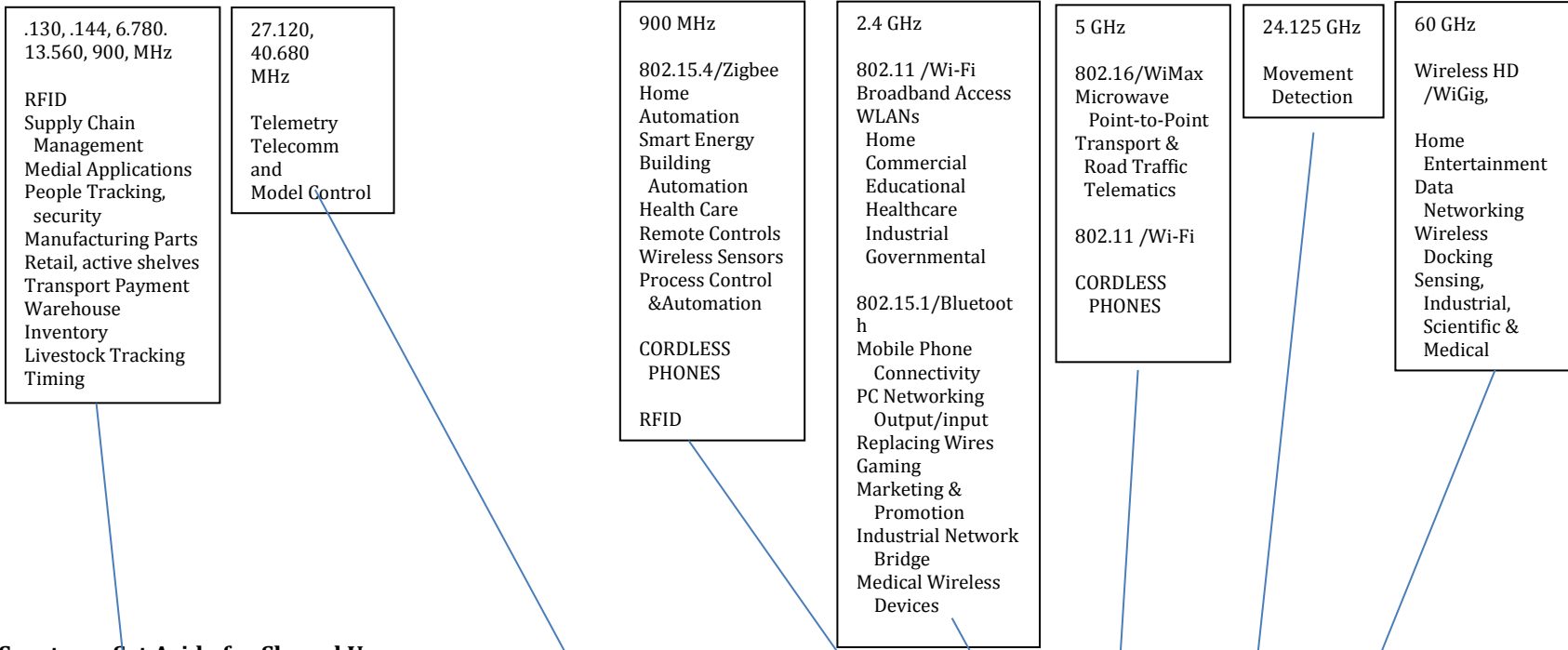
Consumer surplus is from Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum*, Perspective, 2009 (adjusting his 30% scenario for the current level of broadband subscribers).

Speed is from, Paul Milgrom, Jonathan Levin and Assaf Eilat, *The Case for Unlicensed Spectrum*, October 12, 2011).

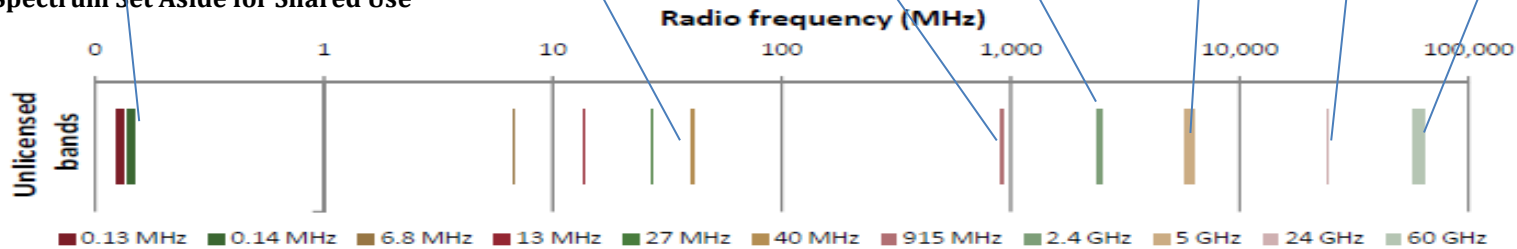
Intermediate Inputs from Richard Thanki, *The Economic Value Generated by Current And Future Allocations of Unlicensed Spectrum*, Perspective, 2009 and Yochai Benkler, *Unlicensed Wireless vs. Licensed Spectrum: Evidence from Market Adoption*, 2011.

**EXHIBIT 3:
RELYING ON VERY LITTLE SPECTRUM, UNLICENSED USE HAS ENABLED A WIDE RANGE OF APPLICATIONS**

Applications

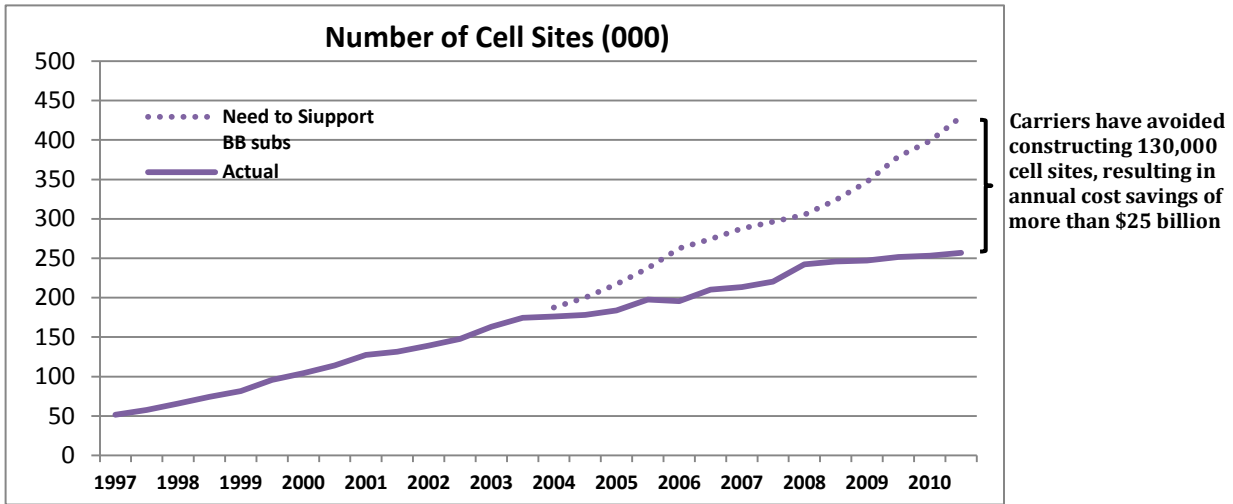


Spectrum Set Aside for Shared Use



Source: Richard Thanki, *The Economic Value Generated by Current And Future Allocations of Unlicensed Spectrum*, Perspective, 2009.

**EXHIBIT 4:
UNLICENSED USE ENABLES EFFICIENCY IN WIRELESS DATA SERVICE BECAUSE
OFFLOADING CELLULAR TRAFFIC DRAMATICALLY REDUCES THE NUMBER OF CELL SITES NEEDED**



Notes and Sources:

130,000 cell sites derived by using capacity needed for a voice and data subscriber at 1.8 times the need for a voice-only subscriber based on the suburban estimate of Ryan Hallahan and Jon M. Peha, *Quantifying the Cost of a Nationwide Broadband Public Safety Network*, Carnegie Mellon University, Research Showcase, September 1, 2008. Richard Dineen, *The Capacity Crunch: What Can Mobile Telecoms Operators do as "Moore's Law Mobile" Breaks Down?* HSBC, December 8, 2009, estimates increases in cell density necessary to keep up with data traffic growth showing a deficit, without offloading by 2011. The rate of growth of broadband subscriptions exceeds his assumed growth by 50 percent. His projected increase in cell density needed to keep up for 2011 (23%) and 2012 (27%) without offloading imply the need for 127,000 to 136,000 more cells.

Capital expenditures are estimated at \$500,000 per cell site (Ryan Hallahan and Jon M. Peha, *Quantifying the Cost of a Nationwide Broadband Public Safety Network*, Carnegie Mellon University, Research Showcase, September 1, 2008 and Federal Communications Commission, *Mobile Broadband: The Benefits of Additional Spectrum*, OBI Technical Paper No. 6). The annual capital recovery factor is assumed to be 20%. Operating expenses are assumed to be 20% of capex ((Ryan Hallahan and Jon M. Peha, *Quantifying the Cost of a Nationwide Broadband Public Safety Network*, Carnegie Mellon University, Research Showcase, September 1, 2008). Therefore, annual savings = 130,000 * \$500,000 * .4 = \$26 billion. The large number of sites needed would likely increase the cost per site significantly, which means the estimate of \$25 billion is a low figure.

**EXHIBIT 5:
INNOVATION IN SHARED USE SPECTRUM EQUALS OR EXCEEDS THE EXCLUSIVE LICENSED SECTOR**

<u>EXCLUSIVE LICENSED</u>	<u>UNLICENSED SHARED USE</u>
<u>Standards Released</u>	
2G – GSM 1993	IEEE 802.11-1997: WLAN standard originally 1 Mbit/s and 2 Mbit/s, 2.4 GHz RF and infrared (IR) standard (1997),
2.75G- GSM+EDGE	IEEE 802.11a: 54 Mbit/s, 5 GHz standard (1999)
3G – CDMA 2000	IEEE 802.11b: Enhancements to 802.11 to support 5.5 and 11 Mbit/s (1999)
3G – 1x EV-DO Rev A	IEEE 802.11c: Bridge operation procedures; included in the IEEE 802.1D (2001)
3G – WCDMA	IEEE 802.11d: International (country-to-country) roaming extensions (2001)
3.5g – HSPDA	IEEE 802.11e: Enhancements: QoS, including packet bursting (2005)
WiMAX – IEEE 802.16	IEEE 802.11g: 54 Mbit/s, 2.4 GHz standard (backwards compatible with b) (2003)
4G – LTE	IEEE 802.11h: Spectrum Managed 802.11a (5 GHz), European compatibility (2004)
	IEEE 802.11i: Enhanced security (2004)
	IEEE 802.11j: Extensions for Japan (2004)
	IEEE 802.11k: Radio resource measurement enhancements (2008)
	IEEE 802.11n: Higher throughput improvements using MIMO
	IEEE 802.11r: Fast BSS transition (FT) (2008)
	IEEE 802.11w: Protected Management Frames (September 2009)
	IEEE 802.11y: 3650–3700 MHz Operation in the U.S. (2008)

EXCLUSIVE LICENSED

Network Technologies

Introduced

Digital Spread Encoding	1991
Spread Spectrum	1995
OFDM	2006
MIMO/Adaptive Beamforming	2008

Applications: Radical

Precise global positioning

Wide area networks
Satellite based
Communications

Incremental

Mobile TV
Services, texting, picture
messaging, video calling,
secure mail
Data over broadcast
Networks (subtitling &
video text)

Devices

Major Handset Launched

6/29/07 AT&T Apple iPhone
11/19/07 VZW LG Voyager
4/1/08 Sprint Samsung Instinct
7/10/08 Apple iPhone 3G
7/11/08 AT&T HSDPA iPhone 3G
9/23/08 T-Mobile Android G1
10/21/08 AT&T Samsung Epix
11/4/08 AT&T Blackberry Bold
11/20/08 Sprint HTC Touch Diamond
11/21/08 VZW Blackberry Storm
2/24/09 AT&T Matrix Pro
2/26/09 VZW LG Versa
3/2/09 Sprint Palm Pre
4/1/09 MetroPCS Samsung Finesse
7/13/09 VZW & Sprint Blackberry Tour
9/21/09 Cellular South HTC Hero (Android)
EOY 2009 LG Watch Phone

Sources:

Gerald R. Faulhaber and David J. Farber,
*Innovation in the Wireless Ecosystem: A
Customer-Centric Framework (2009)* for
exclusive license standards and major
handset launches; Wikipedia for 802.11
standards,

Richard Thanki, *The Economic Value Generated by
Current and Future Allocations of Unlicensed
Spectrum, Perspective, 2009, pp. 37-39* for
network deployment and applications.

Wi-Fi Alliance, Wi-Fi Certified Products,
http://www.wi-fi.org/certified_products.php
for Wi-Fi-enabled devices

UNLICENSED SHARED USE

1988
1988
2001
2004

Precise urban positioning
Real-time location
Local area networks/wireless broadband
Novel wireless connectivity (critical device monitoring, monitoring
and control in adverse environments)
Automatic building control
Wireless sensor networks

Personal area networks/Cable replacement (computer mice, keyboards,
printers, head sets, headphones)
Contactless payment
Supply chain improvement
Consumer electronics (Wi-Fi radio, STBs)
Identification (RFID - Humans, Animals, Goods)
Remote controls

Major Types of Certified Wi-Fi-enabled Devices: (Hundreds of companies/Thousands of Devices)

Networking Equipment - Access Point/Router

Access Point for Home or Small Office (Wireless Router)
Enterprise Access Point, Switch/Controller or Router
Mobile AP

Networking Equipment - Gateway

Cable, DSL or Other Broadband Gateway
(Integrated Home Access Device)

Consumer Electronics - Cameras

Digital Still, Portable Video, Networked Web

Consumer Electronics - Audio Devices

Digital Audio - Stationary (speakers, receiver, MP3 player)
Digital Audio - Portable (MP3 player)

Consumer Electronics - Video Devices

Set Top Box, Media Extender, Media Server
Display Device (eg. television, monitor, picture frame)

Consumer Electronics - Gaming Devices

Game Console or Game Console Adapter
Gaming Device - Portable

Consumer Electronics - Storage and Servers

Media Server or Media Adapter
Network Storage Device (networked hard drive)

PCs and Computing Devices - Adapter Cards

External, Internal Wi-Fi Adapter Card

PCs and Computing Devices - Computers and PDAs

Laptop Computer, Ultra-mobile PC, PDA

PCs and Computing Devices - Printers

Printer or Print Server (includes scanner and fax)

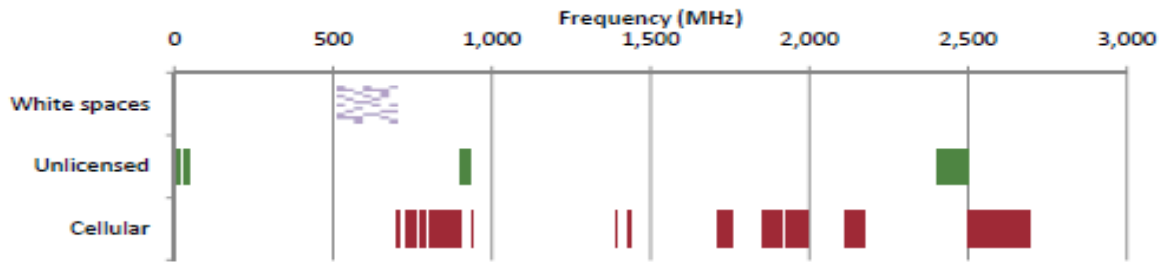
Voice-Capable Devices - Phones

Phone, dual-mode (Wi-Fi and cellular)
Phone, single-mode (Wi-Fi only)
Smartphone, dual-mode (Wi-Fi and cellular)
Smartphone, single-mode (Wi-Fi only)

Other

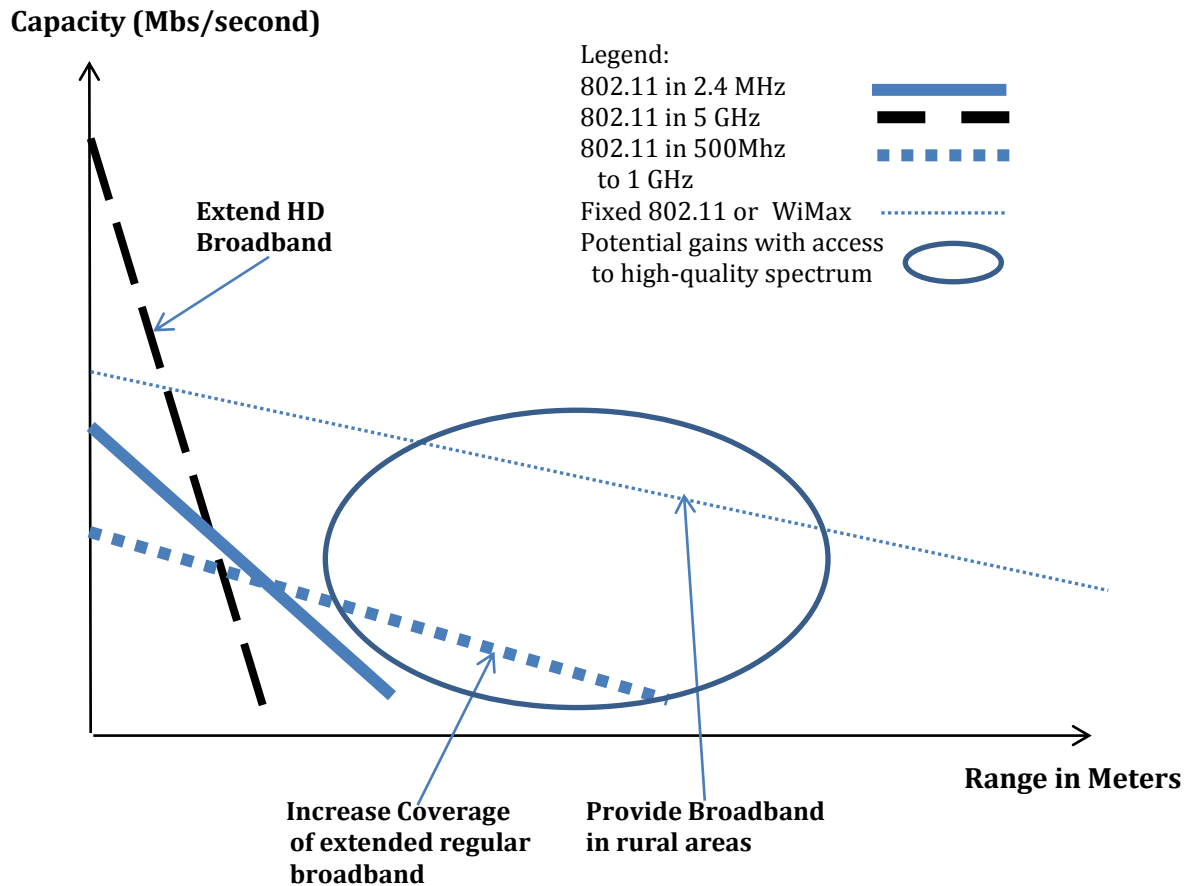
Barcode Scanner

**EXHIBIT 6:
BELOW 1 GHz, THERE IS VERY LITTLE SPECTRUM WHERE UNLICENSED USE IS PERMITTED AND THE AUCTION PROCESS COULD ELIMINATE THE ABILITY TO USE WHITE SPACES FOR SHARED USE**



Sources: Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum*, Perspective, 2009;

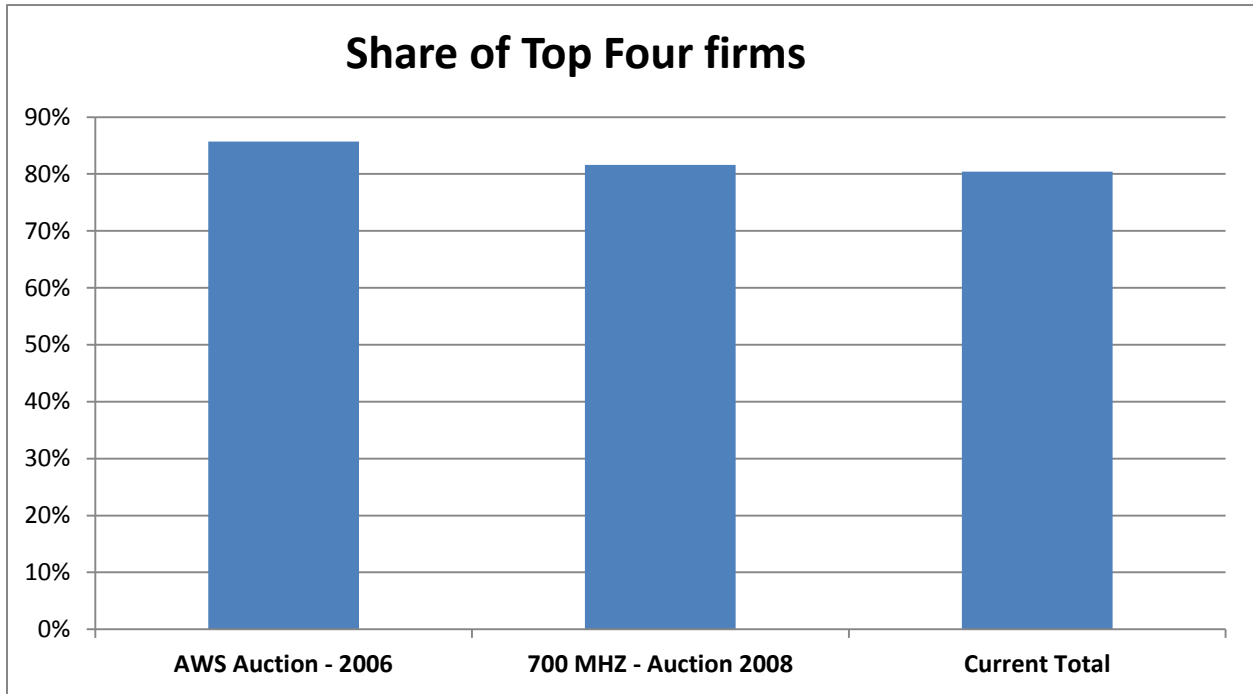
**EXHIBIT 7:
MAKING MORE HIGH-QUALITY SPECTRUM AVAILABLE FOR SHARED USE
HAS GREAT POTENTIAL CONSUMER BENEFITS**



Sources:

These estimates are a representation of the general gain in capacity and reach based on Based on Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum*, Perspective, 2009 and Dirk Grunwald, *How New Technologies Can Turn a Spectrum Crisis Into a Spectrum Opportunity*, February 2011. The precise degree to which the range and capacity are increased depends on the amount of spectrum made available.

EXHIBIT 8
LICENSED SPECTRUM FOR BROADBAND IS HIGHLY CONCENTRATED AND
RECENT AUCTIONS HAVE ALLOWED LARGE FIRMS TO INCREASE THEIR DOMINANCE



Source and Notes:

Top 4 firms are Sprint-Clearwire (Joint Venture), AT&T, Verizon, and T-Mobile. Current shares are from Federal Communications Commission, *Fifteenth Report In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993 Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 10-133, June 27, 2011.

Auction shares are from FCC Auction Database, year shown is the completion date.

Total spectrum available for broadband is from Coleman Bazelon, Charles L. Jackson, and Giulia McHenry, "An Engineering and Economic Analysis of the Prospects of Reallocating Radio Spectrum from the Broadcast Band through the Use of Voluntary Incentive Auctions," *Telecommunications Policy Research Conference*, September 19, 2011, Table 4 based on Potential Supply.