For Immediate Release: 11/29/2011

Contact: Mark Cooper
301-384-2204

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.
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:**


**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).


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

Applications

<table>
<thead>
<tr>
<th>Spectrum Set Aside for Shared Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>.130, .144, 6.780, 13.560, 900 MHz</td>
</tr>
<tr>
<td>RFID</td>
</tr>
<tr>
<td>Supply Chain Management</td>
</tr>
<tr>
<td>Medial Applications People Tracking, security</td>
</tr>
<tr>
<td>Manufacturing Parts Retail, active shelves Transport Payment Warehouse Inventory Livestock Tracking Timing</td>
</tr>
<tr>
<td>27.120, 40.680 MHz</td>
</tr>
<tr>
<td>900 MHz</td>
</tr>
<tr>
<td>2.4 GHz</td>
</tr>
<tr>
<td>802.11 /Wi-Fi Broadband Access WLANs Home Commercial Educational Healthcare Industrial Governmental 802.15.1/Bluetooth Mobile Phone Connectivity PC Networking Output/input Replacing Wires Gaming Marketing &amp; Promotion Industrial Network Bridge Medical Wireless Devices</td>
</tr>
<tr>
<td>5 GHz</td>
</tr>
<tr>
<td>802.16/WiMax Microwave Point-to-Point Transport &amp; Road Traffic Telematics 802.11 /Wi-Fi CORDLESS PHONES</td>
</tr>
<tr>
<td>24.125 GHz</td>
</tr>
<tr>
<td>Movement Detection</td>
</tr>
<tr>
<td>60 GHz</td>
</tr>
<tr>
<td>Wireless HD /WiGig, Home Entertainment Data Networking Wireless Docking Sensing, Industrial, Scientific &amp; Medical</td>
</tr>
</tbody>
</table>

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

![Graph showing number of cell sites (000) over time](image)

Carriers have avoided constructing 130,000 cell sites, resulting in annual cost savings of more than $25 billion.

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

**EXCLUSIVE LICENSED**

<table>
<thead>
<tr>
<th>Standards Released</th>
<th>UNLICENSED SHARED USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2G – GSM 1993</td>
<td>IEEE 802.11-1997: WLAN standard originally 1 Mbit/s and 2 Mbit/s, 2.4 GHz RF and infrared (IR) standard (1997),</td>
</tr>
<tr>
<td>2.75G- GSM+EDGE</td>
<td>IEEE 802.11a: 54 Mbit/s, 5 GHz standard (1999)</td>
</tr>
<tr>
<td>3G – CDMA 2000</td>
<td>IEEE 802.11b: Enhancements to 802.11 to support 5.5 and 11 Mbit/s (1999)</td>
</tr>
<tr>
<td>3G – 1x EV-DO Rev A</td>
<td>IEEE 802.11c: Bridge operation procedures; included in the IEEE 802.1D (2001)</td>
</tr>
<tr>
<td>3G – WCDMA</td>
<td>IEEE 802.11d: International (country-to-country) roaming extensions (2001)</td>
</tr>
<tr>
<td>3.5g – HSPDA</td>
<td>IEEE 802.11e: Enhancements: QoS, including packet bursting (2005)</td>
</tr>
<tr>
<td>WIMAX – IEEE 802.16</td>
<td>IEEE 802.11g: 54 Mbit/s, 2.4 GHz standard (backwards compatible with b) (2003)</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11k: Radio resource measurement enhancements (2008)</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11r: Higher throughput improvements using MIMO</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11s: Fast BSS transition (FT) (2008)</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11v: Protected Management Frames (September 2009)</td>
</tr>
</tbody>
</table>
Network Technologies

<table>
<thead>
<tr>
<th>Introduced</th>
<th>1991</th>
<th>1988</th>
</tr>
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<tbody>
<tr>
<td>Digital Spread Encoding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spread Spectrum</td>
<td>1995</td>
<td>1988</td>
</tr>
<tr>
<td>OFDM</td>
<td>2006</td>
<td>2001</td>
</tr>
<tr>
<td>MIMO/Adaptive</td>
<td>2008</td>
<td>2004</td>
</tr>
<tr>
<td>Beamforming</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Applications: Radical
- Precise global positioning
- Precise urban positioning
- Wide area networks
- Real-time location
- Satellite based
- Local area networks/wireless broadband
- Communications
- 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

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

Devices

Major Handset Launched

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

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


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EXHIBIT 7:

Making more high-quality spectrum available for shared use has great potential consumer benefits.

Capacity (Mbs/second)

Legend:
- 802.11 in 2.4 MHz
- 802.11 in 5 GHz
- 802.11 in 500Mhz to 1 GHz
- Fixed 802.11 or WiMax

Potential gains with access to high-quality spectrum

Range in Meters

Increase Coverage of extended regular broadband

Provide Broadband in rural areas

Extend HD Broadband

Sources:

These estimates are a representation of the general gain in capacity and reach 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:

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