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CRS Report for Congress

Spectrum Use and the Transition to Digital TV

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Summary

The United States, like most of the world, is moving to replace current television technology with a new, technically superior format generally referred to as digital television (DTV). As part of this transition, Congress has acted to move television broadcasters out of radio spectrum currently used for the old, analog technology. The vacated radio frequencies are now scheduled for release in accordance with provisions of the Deficit Reduction Act of 2005 (P.L. 109-171), which sets a February 2009 date for the release of the spectrum. Auctions for commercial uses of the spectrum are to be scheduled no later than January 28, 2008. About $10 billion of the auction proceeds has been designated for specific purposes by the act.

On July 31, 2007, the Federal Communications Commission (FCC) announced the rules for the auction of airwaves now used for analog TV broadcasting. Because the decisions the FCC makes in setting up an auction of spectrum licenses can shape the bidding process and the eventual outcome of the auction, the FCC typically finds itself under pressure to set requirements that favor specific interests or policy goals. The preparations for the upcoming auction have been particularly fraught with controversy. The propagation characteristics of the spectrum are such that it is considered ideal for wireless broadband. For this and other reasons, control of this spectrum is sought not only by the incumbent wireless companies wishing to expand their capacity but also by companies eager to apply next-generation technologies for new business models. The auction rules introduce two innovative business models for spectrum management and assignment that represent departures from past policy. One model requires a shared network to accommodate both public safety and commercial users in a partnership. The other innovative model designates spectrum licenses for a network that could be managed to accept any suitable wireless device. The decisions the FCC has made for this auction — and by extension for spectrum policy — have framed a new debate about access to the airwaves, the nature of competition in the wireless industry, and wireless access to the Internet.

Deficit Reduction Act

Broadcasters are currently transmitting analog TV signals using radio frequency channels that will be vacated as they switch to digital broadcast technology. The Deficit Reduction Act of 2005 (P.L. 109-171, Title III) requires broadcasters to end analog broadcasting by February 17, 2009, freeing the spectrum — usually referred to as the 700 MHz band[1] — for other uses. Some of the channels have been assigned for public safety communications; licenses for a few channels have been auctioned; and the remaining licenses are slated for auction no later than January 2008. The Congressional Budget Office (CBO) has assigned a value of about $12.5 billion for the auction;[2] many industry estimates are significantly higher. Funds from the auction will initially be deposited in a fund created for that purpose, the Digital Television Transition and Public Safety Fund.

The National Telecommunications and Information Administration (NTIA) is responsible for managing the fund and for disbursements, which total approximately $10 billion. The Deficit Reduction Act allocates $7.363 billion of auction proceeds toward closing the budget deficit, to be paid to the U.S. Treasury on September 30, 2009. Nine programs authorized by the act to receive auction funds are: a program that would expend up to $1,500 million on coupons for households toward the purchase of TV set top boxes that can convert digital broadcast signals for display on analog sets; a grant program of up to $1,000 million for public safety agencies to deploy systems on 700 MHz spectrum they will receive as part of the transition; payments of up to $30 million toward the cost of temporary digital transmission equipment for broadcasters serving the Metropolitan New York area; payments of up to $10 million to help low-power television stations convert full-power broadcast signals from digital to analog; a program funded up to $65 million to reimburse low-power television stations in rural areas for upgrading equipment; up to $106 million to implement a unified national alert system and $50 million for a tsunami warning and coastal vulnerability program; contributions totaling no more than $43.5 million for a national 911 improvement program; and up to $30 million in support of the Essential Air Service Program. For some of these programs, the NTIA is authorized to borrow money from the Treasury, to be repaid from auction proceeds.

Spectrum License Allocation and Auction

One of the first steps the FCC takes in preparing for an auction is to develop a band plan that allocates the spectrum for specific purposes (for example, high-speed transmission, which requires bandwidth of at least 10 MHz per license) and to decide the number of licenses and the geographic coverage for each license (for example, 200

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[1] Radio frequency spectrum is measured by the frequency of cycles per second, or hertz (Hz). Standard abbreviations for measuring frequencies include kHz — kilohertz or thousands of hertz; MHz — megahertz. For example, the 700 MHz band includes radio frequencies from 698-806 MHz and refers to those channels that are designated for technologies that transmit signals at speeds within or near 700 million cycles per second.

[2] Congressional Budget Office Cost Estimate, S. 1932, Deficit Reduction Act of 2005, January 27, 2006, p. 22. At [http://www.cbo.gov/showdoc.cfm?index=7028&sequence=0].

licenses for metropolitan areas).[3] These decisions begin the process of shaping the auction: the size of the bandwidth has an impact on the type of service it can be used for, and the geographic coverage of licenses can be used to encourage, for example, small companies seeking a local license or large companies seeking to expand their national coverage by acquiring a regional or national license. The FCC also establishes criteria for participation in the auction, for example, requiring documentation of financial resources. It also draws up service rules, which are a statement of the regulator's expectations for how the license will be used. Service rules usually include a timetable for putting the license to use, that is, the rules impose deadlines for the license-holder to build out a network so that a specified number of people or areas are served. The FCC makes its proposed plans known through a series of notices, which are made available for public comment, before announcing its decision about the auction in a final Report and Order. The rules for the auction of licenses in the 700 MHz band are in a Second Report and Order adopted July 31, 2007.[4] Key points are summarized below.[5]

The 700 MHz Auction. The process of preparing rules for the 700 MHz Band auction (designated Auction #31) attracted more debate than usual for a number of reasons. One reason for interest in the spectrum is that the airwaves used for TV have good propagation qualities, able to travel far and to penetrate building walls easily. The proposals for service rules that will provide the framework for licensee business models have dominated the controversy over the preparations for the auction of the 700 MHz airwaves. Some observers have called this the "100-year auction," because the decisions about its service rules could have a significant impact on spectrum management and the wireless industry for decades to come.

Service Rules: Public Safety. Public safety groups have been assigned 24 MHz of spectrum in the 700 MHz band that will become fully available once broadcasters have vacated the band. The licenses for this spectrum were assigned for public safety use by Congressional mandate, in 1997,[6] and are not slated for auction. Provisions in the auction rules, however, provide for a new, interoperable communications network for public safety users to be shared with commercial users. A national license for 10 MHz, designated as Upper Block D, will be auctioned under service rules that will require working with a Public Safety Licensee to build and manage a shared network. The Public Safety Licensee will be assigned a single, national license for half of the 24MHz assigned for public safety use. The two licensees will be required to work together under a Network Sharing Agreement that they will negotiate, subject to FCC approval.

A partnership would give some public safety agencies access to private-sector capital and expertise to build the network; there is currently no federal plan to assist in building a nationwide, interoperable network. Although public safety users would be charged for

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[3] The different area descriptions used by the FCC in allocating licenses are discussed in CRS Report RL31764, *Spectrum Management: Auctions*.

[4] WT Docket # 96-86. The written record of the decision will be released in August 2007.

[5] Source: FCC News, "FCC Revises 700 MHz Rules to Advance Interoperable Public Safety Communications and Promote Wireless Broadband Deployment," July 31, 2007.

[6] As required by Title III of the Balanced Budget Act of 1997 (P.L. 105-33).

access to the network, proponents of the plan argue that overall costs will be less than if the network were purely for public safety, because of greater economies of scale.

Service Rules: Open Access. Several companies associated with Silicon Valley and Internet ventures petitioned the FCC to set aside a block of spectrum as a national license that would be used for open access, which was defined as open devices, open applications, open services, and open networks.[7] The FCC has ruled that it will auction licenses for 22 MHz of spectrum with service rules requiring the first two criteria: open devices and open applications. There will be 12 regional licenses that will require winning bidders to allow their customers to choose their own handsets and download programs of their choice, subject to reasonable conditions needed to protect the network from harm. If these licenses are not sold, subject to a minimum price, the licenses will be put on the block a second time, without the open platform requirement.

Proponents of wholesaling argue that only an open network that anyone can use — not just subscribers of one wireless company — can provide consumer choice. If successful, an open network would allow customers to choose their own wireless devices without committing to a service plan from a single provider. Such a model challenges the business plans of the large wireless companies, the incumbents, that rely on contracts for a specific wireless device to tie their customers to them. Not only do service contracts between consumers and wireless companies limit the customer's choice of wireless devices, but also, carriers are increasingly blocking access to certain services. This contract-driven business model is often referred to as a walled garden. A wholesale network could provide more market opportunities for new wireless devices, especially wireless devices that could provide unrestricted access to the Internet.

Wireless incumbents, in particular, have challenged the concepts of open access and wholesaling. They, and others, claim that the unproven nature of a wholesale business model makes it risky and that therefore the auctionable licenses would be devalued. They argue that imposing requirements that would create a wholesale network introduces an extra level of regulatory oversight, covering such areas as handset compatibility, applications standards, market access regulation, and interconnection rules.[8]

Band Plan, Licenses and Build-Out Requirements. The band plan for the auction reflects several changes to the plan originally proposed by the FCC. The changes make it possible to create licenses for 62 MHz of spectrum at 700 MHz instead of 60 MHz. In the Lower 700 MHz band, the FCC has allocated 12 MHz for local area licenses, known as Cellular Market Areas, or CMAs. There will be 734 CMA licenses for auction. There will also be 176 licenses offered for broader Economic Areas, or EAs, also using 12 MHz of the Lower 700 MHz band. Some commentators believe that the conditions placed on the licenses in the Upper 700 MHz Band will divert bidding activity to the lower part of the band, possibly driving up the prices of these licenses. In this case, some of the smaller companies may be outbid in their efforts to obtain CMA licenses.

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[7] Filings, WT Docket # 96-86, by Frontline Wireless, LCC, Google, Inc., the 4G Coalition, and the Public Interest Spectrum Coalition.

[8] Filings, WT Docket # 96-86, by CTIA-The Wireless Association, AT&T, and others.

All of the commercial licenses have what the FCC describes as "stringent" performance requirements, in particular for what are referred to as build-out rules. Winning bidders in the upcoming auctions will have a short time to provide service, based on geographical or population parameters, or risk forfeiting licenses. For example, the CMA and EA licensees in the Lower 700 MHz band must cover at least 35% of the geographic area within four years and 70% of the area by the end of ten years, the term of the license. The regional license-holders in the Upper 700 MHz band must have built a network that will reach 40% of the population in their license area within four years, and 75% by the end of the license term. Failure to meet these interim guidelines will result in a reduction of the license term, from ten to eight years, accelerating the build-out schedule. Licensees that fail to meet the final deadline will forfeit that part of the license that has not met build-out requirements. The FCC will reclaim the spectrum and make it available to others.

Auction Rules. Full rules for the auction will be published at a later date, but the FCC has announced some of them. One decision is to use "blind bidding." Recent auctions have had open bidding, where all participants knew not only the amounts of competing bids but also the names of their competitors. With anonymity, bidders will not be able to cooperate to exclude a third-party, which allegedly occurred during the AWS-1 auction.[9]

The FCC has also said that it will permit package bidding, also known as combinatorial bidding. In a package auction, bidders may make a single bid for a group of licenses, instead of competing for each license individually. Package bidding is believed to favor new entrants and larger companies by allowing them to acquire licenses for the coverage that meets their business needs in a manner that is more efficient and less risky. In attempting to acquire, for example, national coverage, by winning many auction licenses, a bidder risks winning some of the licenses, but not enough of the licenses to support its business plan. A successful package bid eliminates a number of licenses from the general bidding process, reducing the supply of licenses open for bids from small players that are seeking only one or two licenses.

The Origin of Spectrum Auctions

The Omnibus Budget Reconciliation Act of 1993 (P.L. 103-66) amended the Communications Act of 1934 with a number of important provisions affecting the availability of spectrum licenses. The Licensing Improvement section[10] of the act laid out the general requirements for the FCC to establish a competitive bidding methodology and consider, in the process, objectives such as the development and rapid deployment of new

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[9] "Tacit Collusion in the AWS-1 Auction: The Signaling Problem" and "How Incumbents Blocked New Entrants in the AWS-1 Auction: Lessons for the Future," by Gregory Rose, Economic Research Services, for Media Access Project, April 20, 2007. Press release at [http://www.mediaaccess.org/press/MAP%20Press%20Release%204-23-07.pdf]; reports at [http://www.mediaaccess.org/filings/Rose_How_Incumbents_Blocked.pdf] and at [http://www.mediaaccess.org/filings/Rose_Tacit_Collusion.pdf]. Viewed August 1, 2007.

[10] P.L. 103-66 Title III, Subtitle C, Chapter 1.

technologies.[11] The law prohibited the FCC from making spectrum allocations decisions based "solely or predominately on the expectation of Federal revenues...."[12] The Emerging Telecommunications Technologies section[13] directed the NTIA to identify not less than 200 MHz of auctionable radio frequencies used by the federal government that could be transferred to the commercial sector.[14] The FCC was directed to allocate and assign these released frequencies over a period of at least 10 years, and to reserve a significant portion of the frequencies for allocation after the ten-year time span.[15] Similar to the requirements for competitive bidding, the FCC was instructed to ensure the availability of frequencies for new technologies and services, and also the availability of frequencies to stimulate the development of wireless technologies.[16] The FCC was further required to address "the feasibility of reallocating portions of the spectrum from current commercial and other non-federal uses to provide for more efficient use of spectrum" and for "innovation and marketplace developments that may affect the relative efficiencies of different spectrum allocations."[17] The Advanced Wireless Services (AWS-1) auction that was concluded in September 2006 is one result of spectrum reassignment as required in this section.[18] Subsequent modifications of the Communications Act have not substantively changed the above-noted provisions regarding spectrum allocation.[19] It appears that, in 1993, Congress foresaw that inclusive policies for access to airwaves would have to take into account developments in technology and cultural changes that were, at the time, glimpsed but not fully imagined.

Unlicensed Spectrum

Unlicensed spectrum is not sold to the highest bidder and used for the services chosen by the license-holder but is instead accessible to anyone using wireless equipment certified by the FCC for those frequencies. Among the advantages of unlicensed spectrum is the opportunity to test new technology directly with consumers instead of going through spectrum license-holders. One of the disadvantages of unlicensed spectrum is the possibility of interference among the transmissions of the various users, both within the assigned bandwidth and with other bandwidths. The FCC, in a separate proceeding, is considering the assignment of "white space" channels for unlicensed use. White space refers to the empty channels that serve as buffers between the new digital TV channels.[20]

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[11] 47 U.S.C. § 308 (j), especially (1), (3), and (4).

[12] 47 U.S.C. § 308 (j) (7) (A).

[13] P.L. 103-66 Title III, Subtitle C, Chapter 2.

[14] 47 U.S.C. § 923 (b) (1).

[15] 47 U.S.C. § 925 (b) (1).

[16] 47 U.S.C. § 925 (b) (2).

[17] 47 U.S.C. § 925 (b) (3).

[18] Discussed in CRS Report RS21508, *Spectrum Management and Special Funds*.

[19] See United States Code Annotated, Title 47, sections as footnoted, WEST Group , 2001 and the 2007 Cumulative Annual Pocket Part.

[20] White space is discussed in CRS Report RS20993, *Advanced Wireless Services and Spectrum Demand*.