

CRS Report for Congress

Spectrum Management: Auctions

Updated September 2, 2008

Linda K. Moore
Analyst in Telecommunications and Technology Policy
Resources, Science, and Industry Division



Prepared for Members and
Committees of Congress

Spectrum Management: Auctions

Summary

Radio frequency spectrum policy issues before Congress are characterized by economic, technological and regulatory complexity. Of particular interest to policy makers are the allocation of spectrum for specific types of use (such as TV broadcasting, radio, advanced wireless services, or unlicensed) and the assignment of licenses for exclusive or shared use of specific frequencies. Today, most frequencies allocated for commercial uses are assigned through auctions, with licenses going to the highest bidder. Another important allocation of spectrum is for unlicensed use. Both commercial and non-commercial entities use unlicensed spectrum to meet a wide variety of monitoring and communications needs. Suppliers of wireless devices must meet requirements for certification to operate on frequency bands designated for unlicensed use. Examples of unlicensed use include garage door openers and Wi-Fi communications. The Federal Communications Commission (FCC) regulates licensed and unlicensed spectrum not allocated for federal use, is responsible for auctioning spectrum licenses, and can also use its authority to redistribute licenses.

Proceeds from spectrum license sales are presently attributed to general revenue in the U.S. Budget. In the 108th Congress, however, a precedent was established with the creation of a Spectrum Relocation Fund to hold proceeds from the auction of specified radio frequencies allocated to federal use; federal agencies vacating spectrum to be auctioned for commercial use are being compensated from the fund for costs of relocation. In the 109th Congress, the Deficit Reduction Act (P.L. 109-171) included provisions that placed certain auction proceeds in a Digital Television Transition and Public Safety Fund. The fund is being mainly used to assist the transition from analog television broadcasting to digital broadcasting, and for contributions to programs for public safety. Over \$7 billion of the auction proceeds were applied to deficit reduction. The funding came from the auction of spectrum (at 700 MHz) currently used for analog television broadcasting, to be vacated by February 17, 2009. The auction, Auction 73, concluded on March 18, 2008; it grossed \$19,592,420,000.

The rules for Auction 73 introduced two new business models for spectrum management and assignment that represented departures from past policy. One model designated a block of spectrum licenses for a network that could be managed to accept any suitable wireless device or software application, referred to as open access. The other model would require a shared network to accommodate both public safety and commercial users in a partnership. A national license, referred to as the D Block, was put up for auction, as part of Auction 73, with a reserve price of \$1.3 billion. The winning bidder would have been required to assume the cost and responsibility of building the network using D Block spectrum and adjacent spectrum assigned to public safety. The sole bid for the D Block was below the reserve price and consequently the D Block will be re-auctioned. The prospects for this new auction have triggered a debate about the nature of competition in the wireless industry and the need for a nationwide public safety network that may be resolved by Congress through legislation.

Contents

Background	1
Spectrum Auctions	2
Auction Rules	4
Service Rules	6
Eligibility and Payment Rules: The Impact of NextWave	6
Changes in Auction Rules	7
Spectrum License Value	7
Unlicensed Spectrum	8
Recent Congressional Actions Regarding Spectrum Auctions	8
The Balanced Budget Act of 1997	8
Auctions of Spectrum Used for Television Broadcasting	9
Auction Reform Act of 2002	9
Commercial Spectrum Enhancement Act	9
Deficit Reduction Act	10
Intelligence Reform and Terrorism Prevention Act	11
Auction of Frequencies at 700 MHz	11
Service Rules: Public Safety	12
Service Rules: Open Access	12
Band Plan, Licenses and Build-Out Requirements	12
Auction Rules	13
Auction Results	13
Conclusion	14

Spectrum Management: Auctions

Radio frequency spectrum is used for all forms of wireless communications, including cellular telephony, paging, personal communications service, radio and television broadcast, telephone radio relay, aeronautical and maritime radio navigation, and satellite command and control. Spectrum policy covers both satellite and terrestrial transmissions. The issues discussed here refer principally to spectrum management for terrestrial technologies.

Background

Radio frequency spectrum is managed primarily by regulations that set rules, for example, for permissible uses, certification of devices, requirements for public safety, and the acquisition of licenses. Spectrum is assigned primarily through licenses while some spectrum remains unlicensed and accessible to any user who meets specific requirements. The Federal Communications Commission (FCC) is responsible for overseeing licensed and unlicensed spectrum used for commercial purposes and by state and local agencies, including first responders, as well as most other radio frequencies not assigned for federal use. Although Congress has a legislative role in spectrum management, the FCC routinely takes on the responsibility of making decisions about the assignment of spectrum for different uses and sets the rules for auctions of spectrum licenses.

Two recent important auctions of spectrum licenses were for the 700 MHz band,¹ Auction 73, and the Advanced Wireless Services (AWS), designated Auction 66 or AWS-1. The auction for licenses at 700 MHz — airwaves that are or will be available because of the planned switch from analog to digital television broadcasting — ended March 18, 2008. The bids in this auction totaled over \$19.5 billion. AWS-1 was completed on September 18, 2006, with nearly \$13.9 billion in completed bids.

¹ Spectrum allocations are assigned within bands that are divided into bandwidths or channels based on assigned frequencies. Electromagnetic radio waves are usually identified by frequency, measured in cycles per second, or hertz. Standard abbreviations for measuring frequencies include kHz — kilohertz or thousands of hertz; MHz — megahertz, or millions of hertz; and GHz — gigahertz, or billions of hertz. The 700 MHz band plan (698 MHz to 806 MHz) refers to those channels that are assigned to technologies that transmit signals at speeds within or near 700 million cycles per second.

Spectrum is considered to be a natural resource² with a combination of characteristics that differentiate it from other resources. For example, spectrum is:

- **Finite.** Today's technology can only operate on certain frequencies; commercially viable frequencies are a valuable commodity.
- **Renewable.** Airwaves used to broadcast any transmission can be reused after the broadcast is completed.
- **Technology dependent.** Most natural resources can be harvested manually, albeit inefficiently. Spectrum is in the atmosphere and is usable because technology has been developed to exploit the properties of electromagnetic waves for sound, data and video transmission.
- **A national asset with international rules and regulations.** For example, most domestic uses of spectrum are assigned bands of operation through the International Telecommunications Union, an agency of the United Nations; satellites for broadcasting are governed by international treaty.
- **Administered.** To avoid interference from competing broadcast transmissions, frequency assignments are managed by recognized authorities. Administrative decisions as to how to allocate spectrum (for example, the number of channels to assign with a license) influence its commercial potential and the supply of spectrum for commercial and public use.

The development and implementation of better wireless communications technologies are critical to maximizing the efficiency of spectrum resources. Spectrum management policies ideally should take into account the impact of new technology, or — since it is difficult to predict the development paths of new technologies — allow for flexibility and accommodation in spectrum allocation. Although flexibility may be desirable in policy-making, most existing wireless technologies are inflexibly constructed to work on a limited range of specific frequencies. Relocation from one part of the spectrum to another can require costly equipment changes. Therefore, reallocation of spectrum to new uses is often expensive as well as technically and administratively difficult. Additionally, some uses of spectrum are governed by international regulations.

Spectrum Auctions

Because two or more signal transmissions over the same frequency in the same location at the same time could cause interference (a distortion of the signals), the

² The Code of Federal Regulations defines natural resources as “land, fish, wildlife, biota, air, water, ground water, drinking water supplies and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States...” (15 CFR 990, Section 990.30).

FCC, over many years, has developed and refined a system of exclusive licenses for users of specific frequencies.³ In the recent past, the FCC has granted licenses using a process known as “comparative hearings”(also known as “beauty contests”), and has used lotteries to distribute spectrum licenses. After years of debate over the idea of using competitive bidding (i.e., auctions) to assign spectrum licenses, the Omnibus Budget Reconciliation Act of 1993 (P.L. 103-66) added Section 309(j) to the Communications Act, authorizing the FCC to organize auctions to award spectrum licenses for certain wireless communications services. Additional provisions concerning auctions were included in the Balanced Budget Act of 1997, the Auction Reform Act of 2002, the Commercial Spectrum Enhancement Act, and the Deficit Reduction Act of 2005 — all discussed below. The main category of services for which licenses may be auctioned are called Commercial Mobile Radio Services (CMRS), which include Advanced Wireless Services (AWS), Personal Communications Service (PCS), cellular, and most Specialized Mobile Radio Services (SMR). With some exceptions, CMRS providers are regulated as common carriers to ensure regulatory parity among similar services that will compete against one another for subscribers.

Spectrum policy to manage frequency allocation and license assignments has evolved over the years in response to changes in technology and market demand, among other factors. Auctions are a market-driven solution to assigning licenses to use specific frequencies and are a recent innovation in spectrum management and policy. Spectrum for what is widely described as “prime” frequencies (300 MHz - 3000 MHz) is judged by many to be the most commercially desirable and is widely sought after at auction by competing interests.⁴ Several lucrative auctions have added billions to the federal treasury, applied to general revenue.

The FCC has the authority to conduct auctions only when applications are mutually exclusive (i.e., two licensees in the same frequency band would be unable to operate without causing interference with each other), and when services are primarily subscription-based. The FCC does not have authority to reclaim licenses awarded prior to the decision to permit auctions. In accordance with the Budget Enforcement Act of 1990, and provisions in the Communications Act of 1934, as amended, auction proceeds cannot be used for funding other programs.⁵ Creation of two important trust funds — the Spectrum Relocation Fund and the Digital Television and Public Safety Fund — required new language and amendments to existing law to permit some auction revenues to be applied directly to specific programs through trusts.

³ Two signals can interfere with each other even if they are not at the same exact frequency, but are close in frequency. To avoid harmful interference, the frequencies must have frequencies that are sufficiently different, known as a “minimum separation.”

⁴ Federal Communications Commission, Office of Plans and Policy, OPP Working Paper Series No. 38, “A Proposal for a Rapid Transition to Market Allocation of Spectrum,” by Evan Kwerel and John Williams, November 2002, at [http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-228552A1.pdf]. Viewed January 3, 2008.

⁵ 47 U.S.C. 309 (j) (8).

Auction Rules. The Communications Act of 1934, as amended, directs the FCC to develop a competitive bidding methodology.⁶ The FCC initially developed rules for each auction separately (with some common elements), but after several years of trial and error it has developed a set of general auction rules and procedures. While there may be special requirements for specific auctions, the following rules generally apply. As a screening mechanism, all auctions require bidders to submit applications and up-front payments prior to the auction. Most auctions are conducted in simultaneous multiple-round bidding in which the FCC accepts bids on a large set of related licenses simultaneously, using electronic communications. Bidders can bid in consecutive rounds until all bidding has stopped on all licenses. The rules the FCC sets for each auction cover many activities, such as evaluating and qualifying bidders, the bidding process, and final payment. Recent FCC decisions about auction rules that are currently controversial include setting new requirements for designated entities and using blind bidding.

Designated Entities and Entrepreneur Bidders. In some auctions, the FCC has given concessions to small businesses that include bidding credits and set-asides of licenses. These small companies are typically classed as entrepreneurs or small businesses. Entrepreneurs are defined as having annual gross revenues of less than \$125 million and total assets of less than \$500 million. Qualification as a small business includes annual revenues of no more than \$40 million, averaged over three years. The FCC originally also gave special provisions to women-owned, minority-owned, and rural telephone companies, referred to as designated entities. After a 1995 Supreme Court decision determined that government affirmative action policies must pass a “strict scrutiny” test to demonstrate past discrimination, the FCC removed minority-owned and women-owned groups from its list of businesses qualifying for bidding credits as designated entities.⁷ Many industry observers have expressed concern that some of the small businesses participating in auctions actually represent larger companies.⁸ By contracting with a larger company, some companies that bid as a designated entity or entrepreneur are alleged to have benefitted from bidding credits and other considerations granted to smaller companies while tapping the financial resources of a major wireless telecommunications company. Furthermore, a study by the Congressional Budget Office (CBO) found that a significant number of small companies that acquired spectrum licenses through preferential programs later transferred the licenses to larger companies.⁹

To avoid providing an undue advantage to designated entities, the FCC modified auction rules for the first Advanced Wireless Services auction, held in 2006.¹⁰

⁶ Communications Act of 1934, 47 U.S.C. 309 (j) (3).

⁷ *Adarand Constructors Inc., petitioner v. Federico Pena, Secretary of Transportation, et al.* Docket No. 93-1841, decided June 1995.

⁸ The issue is summarized in “Appeals Court Cautioned Not to Throw Out Auction 66,” by Jeffrey Silva, RCR Wireless News, October 23, 2006.

⁹ *Small Businesses in License Auctions for Wireless Personal Communications Services*, A CBO Paper, Congressional Budget Office, October 2005.

¹⁰ FCC, *Second Report and Order and Second Further Notice of Proposed Rule Making*, (continued...)

Notably, the FCC adopted rules to limit the transfer of designated entity benefits to any applicant or licensee with an “impermissible material relationship.” The FCC also sought to curtail “unjust enrichment payments,” by requiring that designated entities hold spectrum acquired in the AWS-1 auction for at least ten years; the rule previously set a time period of five years. The FCC found that rule modifications such as these were “necessary to ensure that every recipient of the FCC’s designated entity benefits is an entity that uses its licenses to directly provide facilities-based telecommunications services for the benefit of the public.”¹¹

Blind Bidding. Prospective bidders must meet eligibility requirements that include identifying the licenses they seek to acquire through the auction. These bidders are identified by name throughout the bidding process. Some experts in structuring spectrum auctions have proposed blind bidding so that opponents for contested licenses will not be able to identify the competitor. They argue that blind bidding would prevent collusion, for example between incumbents to keep out a new entrant, retaliatory bidding, and other practices that may skew auction results. Blind bidding was proposed during the comments period leading up to the AWS-1 auction but met resistance from the wireless industry, on the grounds that there were sufficient prospective bidders to assure competition.¹²

Media Access Project published two studies on the AWS-1 auction alleging evidence of collusive bidding and other practices that enabled incumbent wireless companies to exclude new entrants and possibly manipulate the process so that final bids were lower than might have been the case if the auction had been truly competitive.¹³ In a news report, the author of the Media Access Project papers, Dr. Gregory Rose, was quoted as saying that, under current auction rules, “I do not think it is illegal for bidders to discuss who they may want to keep out of an auction and to make arrangements to intervene.... If they did it while an auction was going on, that would be an explicit violation of the rules.” The same news article included a strong denial from one of the successful auction bidders cited in the report, T-Mobile, which was widely reported in the industry press as anxious to acquire the spectrum as part of its international strategy for 3G.¹⁴

¹⁰ (...continued)

April 25, 2006, WT Docket 05-211.

¹¹ “FCC Clarifies Certain Aspects of Its ‘Designated Entity’ Eligibility Rules Adopted in April 2006,” FCC News, June 2, 2006 at [<http://www.fcc.gov>].

¹² Public Notice, DA-06-238, January 31, 2006; comments under FCC Docket No. 6-30.

¹³ “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 January 3, 2008.

¹⁴ MAP Study Claims to See Collusion by AWS Auction Bidders,” *Communications Daily*, April 26, 2007.

From a policy perspective, the allegations, whether or not they are supported by documentation, raise some new questions about the role of auction rules in shaping the final outcome of an auction, and whether the FCC has a tendency to give more weight to the comments of the incumbents it regulates than to potential new entrants. For the auction of spectrum licenses in the 700 MHz band, the FCC established rules for blind bidding.¹⁵

Service Rules. The FCC also develops service rules for each new service for which a license will be used. Licenses are granted according to the amount of spectrum and the geographic area of coverage, known as the “band plan.” The FCC’s plan for the amount of spectrum per license, the number of licenses, and the conditions for use of the designated spectrum is developed for each new wireless service. Licenses can cover small areas, large regions, or the entire nation. Terms used for coverage areas include basic trading areas (BTAs) which correspond roughly to metropolitan areas; major trading areas (MTAs), which are combinations of BTAs dividing the United States into 51 geographic regions of similar levels of commercial activity; and regions, which are combinations of MTAs. Metropolitan statistical areas (MSAs), Cellular Market Areas (CMAs), rural service areas (RSAs), economic areas (EAs), and major economic areas (MEAs) — defined by the Department of Commerce for economic forecasts — are also used by the FCC to describe areas of coverage for some spectrum auctions. Even though licenses must be renewed periodically, it is generally understood that license winners will be able to keep the license perpetually, as long as they comply with FCC service rules.¹⁶

Eligibility and Payment Rules: The Impact of NextWave

In 1995, rules intended to favor entrepreneurs were set for Auction 5, called the PCS C-block auction, for one of the blocks of spectrum allocated for Personal Communications Service (PCS). The FCC gave bidding credits to small businesses to help them compete. Winning bidders only had to pay 10% down and the remainder could be paid over ten years at below-market interest rates. At auction in 1996, broadband C block licenses were sold for bids totaling \$13 billion. By mid-1997, however, many of the license winners (most notably NextWave Telecom Inc.) had defaulted and declared bankruptcy. The licenses were then seized by a court in bankruptcy litigation. In September 1997, the FCC offered a set of options for C-block licensees to restructure their debt (that offer was modified in March 1998). The licensees opted to maintain their bankrupt status, however, preventing the C-block spectrum from being re-auctioned. Based on its interpretation of a series of decisions in 1999 and 2000 by a U.S. Court of Appeals, the FCC cancelled the licenses that had not been paid for and re-auctioned that spectrum. The auction (Auction 35) for the defaulted licenses was completed January 26, 2001, and booked \$16.86 billion in projected revenue for the general treasury.¹⁷

¹⁵ FCC News, “FCC Revises 700 MHz Rules to Advance Interoperable Public Safety Communications and Promote Wireless Broadband Deployment,” July 31, 2007.

¹⁶ The FCC provides information on auctions at [<http://wireless.fcc.gov/auctions/>].

¹⁷ Summarized in *Associated Press Online*, “Feds Ordered to Return Wireless Licenses,” (continued...)

On June 22, 2001, the United States Court of Appeals for the District of Columbia found that the FCC did not have the legal right to take back NextWave's licenses for re-auction, and that 216 of the licenses (worth \$15.85 billion) still belonged to NextWave rather than re-auction winners such as Verizon Wireless.¹⁸ The U.S. Supreme Court agreed to hear the case, essentially weighing NextWave's right to protection under bankruptcy laws against the FCC's right to allocate spectrum. On January 27, 2003 the Supreme Court ruled in favor of NextWave, agreeing with the earlier Court of Appeals decision that the FCC did not have the authority to recover the licenses.¹⁹ Subsequently, NextWave agreed to return some of the disputed spectrum to the FCC for re-auction.²⁰

Changes in Auction Rules. To avoid future problems similar to those experienced in the auction where NextWave successfully bid on large amounts of spectrum and then defaulted, the FCC adopted streamlined auction rules for all services to be auctioned in the future.²¹ The rule changes were intended to ensure uniform procedures involving the application, payment, and certain concerns regarding designated entities (i.e., small businesses and rural telephone companies).

Spectrum License Value

Spectrum value depends on many factors, such as bandwidth, its frequencies (since signal transmission characteristics vary along different parts of the spectrum), the geographic area covered, the services permitted by FCC rules, the availability of equipment that can operate at those frequencies, the demand for services that do not interfere with other bands, the amount of alternative spectrum already available for similar services, the number of incumbents presently occupying the spectrum, and whether incumbents will remain in that spectrum or be relocated to other spectrum. Spectrum license value may be greater if adjacent bands can be aggregated to form larger blocks and if the given spectrum is not encumbered by other licensees using the same frequencies.

CBO annually scores the anticipated receipts from planned auctions of spectrum licenses and includes the revenue estimate in its annual report, *The Budget and Economic Outlook*. For fiscal years 2008-2018, CBO projected auction receipts of

¹⁷ (...continued)
January 28, 2003.

¹⁸ 254 Federal Report, 3^d Series, p 130.

¹⁹ U.S. Supreme Court, Docket No. 01-653 at [<http://www.fcc.gov/ogc/documents/opinions/2003/01-653.pdf>]. Viewed September 2, 2008.

²⁰ See FCC Report No. AUC-03-58 (Auction No. 58) at [<http://wireless.fcc.gov/auctions/>].

²¹ FCC 97-413, WT Docket 97-82, ET Docket 94-32, *Third Report and Order and Second Further NPRM* on Streamlining Auction Rules, released December 31, 1997.

\$11 billion in 2008 from the sale of TV airwaves and an additional \$2.9 billion in the period 2009-2012.²²

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. Rules regarding interference differ between licensed and unlicensed spectrum.

Recent Congressional Actions Regarding Spectrum Auctions

The Omnibus Budget Reconciliation Act amended the Communications Act of 1934 with a number of important provisions affecting the availability of spectrum licenses and authorized the FCC to organize auctions to award spectrum licenses for certain wireless communications services. Among the subsequent laws that deal with spectrum policy and auctions are the Balanced Budget Act of 1997, the Auction Reform Act of 2002, the Commercial Spectrum Enhancement Act of 2004, and the Deficit Reduction Act of 2005. The Balanced Budget Act also directed FCC actions concerning the transition to digital television, an event with significant impact on spectrum management.

The Balanced Budget Act of 1997. The Balanced Budget Act of 1997 (P.L. 105-33) contained several spectrum management provisions. It amended Section 309(j) of the Communications Act to expand and broaden the FCC's auction authority and to modify other aspects of spectrum management. Whereas previous statutes gave the FCC the authority to conduct auctions, the Balanced Budget Act required the FCC to use auctions to award ownership in mutually exclusive applications for most types of spectrum licenses. It directed the FCC to experiment with combinatorial bidding (i.e., allowing bidders to place single bids on groups of licenses simultaneously), and to establish minimum opening bids and reasonable reserve prices in future auctions unless the FCC determined that it was not in the public interest. This amendment also gave the FCC auction authority until September 30, 2007. (Extended to September 30, 2011 by Deficit Reduction Act.²³) Furthermore, the act directed the FCC to allocate spectrum for "flexible use," which means defining new services broadly so that services can change as telecommunications technology evolves.

Exempted from auctions are licenses or construction permits for

²² Congressional Budget Office, *The Budget and Economic Outlook: Fiscal Years 2008-2018*, p. 68, January 2008.

²³ P.L. 109-171, Title III, Section 3003 (b).

- (A) public safety radio services, including private internal radio services used by state and local governments and non-government entities and including emergency road services provided by not-for-profit organizations, that —
 - (i) are used to protect the safety of life, health , or property; and
 - (ii) are not made commercially available to the public;
- (B) digital television service given to existing terrestrial broadcast licensees to replace their analog television service licenses; or
- (C) noncommercial educational broadcast stations and public broadcast stations.

Examples of services exempted from auctions include utilities, railroads, metropolitan transit systems, pipelines, private ambulances, volunteer fire departments, and not-for-profit emergency road services.

The act directed the FCC to auction 120 MHz of spectrum, most of which had already been transferred by NTIA from federal to non-federal assignment and to allocate another 55 MHz located below 3 GHz for auction not later than September 2002. These deadlines were subsequently eliminated by the Auction Reform Act.

Auctions of Spectrum Used for Television Broadcasting. The Balanced Budget Act of 1997 required the FCC to conduct auctions for 78 MHz of the analog television spectrum planned to be reclaimed from television broadcasters at the completion of the transition to digital television and to allocate 24 MHz for public safety services. For administrative purpose, the FCC divided the spectrum into “Upper 700 MHz” and “Lower 700 MHz” bands. Congress instructed the FCC to hold auctions for the 700 MHz frequencies not later than 2002. The spectrum was to have been auctioned in 2002 but not reclaimed from broadcasters until 2006 or later. The act directed the FCC to grant extensions to stations with broad conditions that effectively nullified the 2006 deadline.²⁴

Auction Reform Act of 2002. Concerns about spectrum management, including spectrum used for public safety, prompted the introduction of the Auction Reform Act of 2002 (P.L. 107-195). Among the purposes of the act is the elimination of deadlines for auctions of Upper and Lower 700 MHz frequencies originally scheduled by the FCC for 2002. Specifically, the law stopped auctions in the Upper 700 MHz band that might have impacted efforts to increase the amount of spectrum available for public safety use, while requiring that some auctions in the Lower 700 MHz band take place. The law gave the FCC discretion in setting auction dates for all auctionable spectrum by eliminating deadlines established by the Balanced Budget Act of 1997.

Commercial Spectrum Enhancement Act. This act created the Spectrum Relocation Fund to provide a mechanism whereby federal agencies can recover the costs of moving from one spectrum band to another. The interest in relocating federal users — and accelerating the process by assuring reimbursement for the costs of moving — centers on valuable spectrum (relative to auction prices for comparable spectrum in the United States and other countries) now used by federal agencies, especially the Department of Defense. In particular, spectrum in bands within the

²⁴ For details, see CRS Report RL34165, *The Transition to Digital Television: Is America Ready?*, by Lennard G. Kruger.

1710-1850 MHz range is sought by wireless telecommunications companies to facilitate the implementation of next-generation wireless technologies, including high-speed mobile services (3G).²⁵ After much study, the NTIA and the FCC, aided by an Intra-Government 3G Planning Group, announced plans to provide for the transfer of spectrum in the 1710-1755 MHz range from federal agencies. Frequencies in this band would be made available to the private sector through spectrum auctions conducted by the FCC. As part of the effort, the need was identified for new legislation that would permit affected federal agencies to recover costs directly from these auction proceeds. In mid-2002, the Department of Commerce proposed the creation of a Spectrum Relocation Fund. This fund could provide a means to make it possible for federal agencies to recover relocation costs directly from auction proceeds when they are required to vacate spectrum slated for commercial auction. In effect, successful commercial bidders would be covering the costs of relocation. To accomplish the NTIA and FCC goals, the Communications Act of 1934 would need to be modified to permit the agencies direct access to auction funds. This was accomplished with the passage of the Commercial Spectrum Enhancement Act, Title II of P.L. 108-494. Following the requirements of the act, the FCC scheduled auctions for 1122 licenses at 1710 - 1755 MHz and 2110 - 2155 MHz. The auction (Auction 66) was concluded on September 18, 2006, with a gross total value of winning bids of nearly \$13.9 billion.²⁶

Congress also required the Comptroller General of the Government Accountability Office (GAO) to examine “national commercial spectrum policy as implemented by the Federal Communications Commission” and to report to Congress on its finding.²⁷ The study²⁸ concluded that auctions were generally perceived as a desirable way to allocate spectrum and recommended the extension of the FCC’s auction authority past the current expiration date of September 30, 2007. The GAO could not find evidence that market participants that had bought spectrum were at a disadvantage in competing with service providers who had been assigned spectrum. It found that the high cost of developing infrastructure was a barrier to market entry and that this cost was more significant in shaping competition and pricing decisions than the cost of spectrum. Many findings were inconclusive and the GAO recalled that in an earlier study it had recommended the creation of an independent commission to examine spectrum management.²⁹

Deficit Reduction Act. The Deficit Reduction Act of 2005 (P.L. 109-171) covered aspects of spectrum auctions for 700 MHz. The act set a definite date of February 17, 2009 for the release of spectrum at 700 MHz currently held by

²⁵ Discussed in CRS Report RS20993, *Wireless Technology and Spectrum Demand: Advanced Wireless Services*, by Linda K. Moore.

²⁶ “FCC’s Advanced Wireless Services (AWS) Spectrum Auction Concludes,” FCC News, September 18, 2006.

²⁷ P.L. 108-494, Title II, Sec. 209 (a).

²⁸ *Strong Support for Extending FCC’s Auction Authority Exists, but Little Agreement on Other Options to Improve Efficient Use of Spectrum*, December 2005, GAO-06-236.

²⁹ *Comprehensive Review of U.S. Spectrum Management with Broad Stakeholder Involvement is Needed*, January 2003, GAO-03-277.

broadcasters. Auctions by the FCC of the freed spectrum were required to begin not later than January 28, 2008 with funds deposited not later than June 30, 2008. The FCC's authority to hold auctions, which would have expired in 2007, was extended until September 30, 2011. A fund, the Digital Television Transition and Public Safety Fund, was created to receive spectrum auction proceeds and disburse designated sums to the Treasury and for other purposes. The fund and disbursements are administered by the National Telecommunications and Information Administration (NTIA). The NTIA has selectively been given the power to borrow some of the authorized funds from the Treasury, secured by the expected proceeds of the auction required by the bill. These funds can be used to implement transition programs for digital television and for some public safety projects.³⁰

Intelligence Reform and Terrorism Prevention Act. Several passages of the act (P.L. 108-458) dealt with spectrum policy. For example, Title VII, Subtitle E — Public Safety Spectrum recognized the merits of arguments for increasing the amount of spectrum at 700 MHz available for public safety and homeland security. It required the FCC, in consultation with the Secretary of Homeland Security and the NTIA, to conduct a study on the spectrum needs for public safety, including the possibility of increasing the amount of spectrum at 700 MHz.³¹ The study was submitted to Congress in late 2005.³² In it, the FCC did not make a specific recommendation for additional spectrum allocations in the short-term although it stated that it agreed that public safety “could make use of such an allocation in the long-term to provide broadband services.”³³ The FCC then initiated a rule making soliciting comments on how to take best advantage of the 24 MHz of spectrum already designated for public safety.³⁴

Auction of Frequencies at 700 MHz

The process of preparing rules for the 700 MHz Band auction 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 provided the framework for licensee business models dominated the controversy over the preparations for the auction of the 700 MHz airwaves.

³⁰ Availability of funds for digital transition, P.L. 109-171, Sec. 3005 (b); availability of funds for public safety communications, P.L. 109-459, Sec. 4; availability of funds for emergency alerts, P.L. 109-347, Sec. 606 (c); bill to make funds available for 911, S. 93 (Sen. Stevens).

³¹ P.L. 108-458, Title VII, Subtitle E, Sec. 7502 (a).

³² *Report to Congress on the Study to Assess Short-term and Long-term Needs for Allocations of Additional Portions of the Electromagnetic Spectrum for Federal, State and Local Emergency Response Providers*, Federal Communications Commission, December 19, 2005, at [http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-262865A1.pdf]. Viewed January 3, 2008.

³³ *Op. cit.* FCC, *Report to Congress* paragraph 99.

³⁴ FCC, *Eighth Notice of Proposed Rule Making*, WT Docket No. 96-86, released March 17, 2006.

Service Rules: Public Safety.³⁵ 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 1997,³⁶ and are not slated for auction. Provisions in the auction rules, however, provided 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, was put up for auction under service rules that required working with a Public Safety Licensee to build and manage a shared network. The Public Safety Licensee was assigned a single, national license for part of the 24MHz originally assigned for public safety use at the behest of Congress. The two licensees were to negotiate a Network Sharing Agreement, subject to FCC approval. The Public Safety Spectrum Trust, formed by a group of associations, was awarded the Public Safety License by the FCC.³⁷

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 access to the network, proponents of the plan argue that overall costs in such an arrangement would 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.³⁸ The FCC ruled that it would auction licenses for 22 MHz of spectrum with service rules requiring the first two criteria: open devices and open applications. These licenses are referred to as the C Block.

Band Plan, Licenses and Build-Out Requirements. The band plan for the auction reflected 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 allocated 12 MHz for local area licenses, known as Cellular Market Areas, or CMAs, creating 734 CMA licenses for auction. There were also 176 licenses offered for broader Economic Areas, or EAs, also using 12 MHz of the Lower 700 MHz band.

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 will have a short time to provide service, based on geographical or

³⁵ Service rules and other FCC requirements for a shared public safety network are discussed in CRS Report RL34054, *Public-Private Partnership for a Public Safety Network: Governance and Policy*, by Linda K. Moore.

³⁶ As required by Title III of the Balanced Budget Act of 1997 (P.L. 105-33).

³⁷ FCC, *Order*, P.S. Docket No. 06-229, November 19, 2007.

³⁸ FCC filings, WT Docket No. 96-86, by Frontline Wireless, LCC, Google, Inc., the 4G Coalition, and the Public Interest Spectrum Coalition.

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. Rules for the auction were released on October 5, 2007.³⁹ One decision in the rules was 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.⁴⁰

The FCC rules also permitted 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.

Auction Results. The auction grossed \$19,592,420,000. All of the licenses except for the D Block, intended for shared use with public safety, were successfully auctioned. The D Block received a single bid of \$472,042,000, well below the minimum price of \$1.3 billion the FCC established for that license. In the rules established for the auction, the FCC allowed for the possibility of re-auctioning the D Block with different requirements, but reserved the right to make a decision based on its determination of public interest.⁴¹ In an Order adopted and released on March 20, 2008, the FCC directed the Wireless Telecommunications Bureau not to proceed with the re-auction of the D Block because it is “in the public interest to provide

³⁹ “Auction of 700 MHz Band Licenses Scheduled for January 24, 2008,” October 5, 2007. DA-074171, AU Docket No. 07-157.

⁴⁰ “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 January 3, 2008.

⁴¹ FCC, *Second Report and Order*, WT Docket No. 96-86, August 10, 2007 release, paragraphs 306-307.

additional time to consider all options....”⁴² The FCC therefore has begun a review of its rules regarding licensing, structuring a partnership, setting service requirements, and other rules and obligations established prior to the commencement of Auction 73. It has prepared a further notice of proposed rule-making that seeks comments on identified options that might be pursued in disposing of the D Block.⁴³

Some commentators believe that the conditions placed on the licenses in the Upper 700 MHz Band diverted bidding activity to the lower part of the band, driving up the prices of these licenses. Some of the smaller companies may have been outbid in their efforts to obtain CMA licenses because of increased competition and the effect of package bidding.

Conclusion

Spectrum, a valuable resource governed by available technology, is regulated by the federal government with the primary objectives of maximizing its usefulness and efficiency, and to prevent interference among spectrum users. A key component of spectrum policy is the allocation of bands for specific uses and the assignment of frequencies within those bands. Auctions, a fairly recent innovation in frequency assignment, are regarded as a market-based mechanism for allocating spectrum. Other market-driven policies include licensing fees based on fair-market valuations of spectrum and flexibility in spectrum usage within assigned bandwidths. Today, spectrum for commercial applications is typically auctioned to the highest bidder, but many commercial users have spectrum acquired before the present-day auction process was implemented.

Auctions as a means of allocating spectrum are considered a success by many observers because of the federal revenue generated, as well as for the speed with which licenses auctioned have gone to the companies that value them the most and are most likely to put them to use. Moreover, many prefer letting businesses determine whether to invest in a new service rather than relying on the government to decide who receives a spectrum license. The FCC has concluded that auctioning of spectrum licenses has contributed to the rapid deployment of new wireless technologies, increased competition in the marketplace, and encouraged participation by small businesses.⁴⁴ However, many have questioned whether auction policy should be supplemented more aggressively with other market-driven solutions, and whether the existing auction process and administration can be improved.

Spectrum management is an exercise in reconciling divergent interests. Over time, developments in technology may significantly increase the amount of useable spectrum and consequently the ease with which a policy of equitable allocation and

⁴² FCC, *Order*, AU Docket No. 07-157, March 20, 2008 at [http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-91A1.pdf]. Viewed March 20, 2008.

⁴³ FCC, *Second Further Notice of Proposed Rulemaking*, Released May 14, 2008, PS Docket No. 06-229 at [http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-128A1.pdf].

⁴⁴ FCC 97-353, *FCC Report to Congress on Spectrum Auctions*, WT Docket No. 97-150, released October 9, 1997.

use can be crafted. For the immediate future, Congress may choose to debate and act on questions such as reforming spectrum management and allocation mechanisms. Some observers argue that a fully-developed policy should take into account issues such as international competitiveness, the communications needs of public safety agencies and the military, the role of wireless technology in economic growth, and the encouragement of new technologies that make spectrum use more efficient and more beneficial to society as a whole. The stated objective of many policy reformers is a coherent national policy that provides the proper balance for existing applications while at the same time providing opportunities for future growth and development.

Given the number of objectives in the allocation and use of spectrum, and the differing solutions for achieving them, choices made for 700 MHz could be far-reaching in setting the direction for future policy decisions.