

CRS Report for Congress

Spectrum Management: Auctions

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



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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 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 currently allocated to federal use; federal agencies vacating spectrum to be auctioned for commercial use will be compensated from the fund for costs of relocation. In the 109th Congress, the Deficit Reduction Act (P.L. 109-171) included provisions that will hold certain auction proceeds in a Digital Television Transition and Public Safety Fund. The fund mainly would assist the transition from analog television broadcasting to digital broadcasting, and would contribute to programs for public safety. Over \$7 billion would go toward deficit reduction. The funds are to come from the auction of spectrum currently used for analog television broadcasting, to be vacated by February 17, 2009. The auction is to begin not later than January 28, 2008.

The FCC is considering the rules it will set for the upcoming auction of the old TV channels. Issues that have been raised in the discussion over how best to allocate this spectrum include the creation of national licenses with open access for wireless devices, the treatment of designated entities — with references to NextWave — blind bidding, how much spectrum is needed for public safety communications, and proposals to provide spectrum for shared use between public safety and the private sector. In particular, proposals put forth by Cyren Call, Frontline, and the FCC have sparked an ongoing public debate about the “highest and best use” for the spectrum currently designated for auction by the Deficit Reduction Act.

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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.

Key Policy Issues for the 110th Congress

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. The most recent major auction of spectrum for Advanced Wireless Services (AWS), designated Auction 66 or AWS-1, was completed on September 18, 2006.¹ The AWS-1 auction attracted nearly \$13.9 billion in completed bids. The next major auction, perhaps the last competitive auction for a substantial amount of spectrum for decades to come, is for licenses at 700 MHz,² for channels that are or will be available because of the planned switch from analog to digital television broadcasting.³ The Deficit

¹ “FCC’s Advanced Wireless Services (AWS) Spectrum Auction Concludes,” FCC News, September 18, 2006.

² 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.

³ For a more detailed discussion of the auction, see CRS Report RL33838, *Emergency Communications: Policy Options at a Crossroads*, by Linda K. Moore.

Reduction Act requires that bidding in this auction commence no later than January 28, 2008.⁴

As the FCC moves forward with plans for the 700 MHz auction, its actions are being closely observed by Congress.⁵ Among the decisions that the FCC must make that are of interest to Congress are geographical coverage of licenses; auction rules that assure fair access for small business; rules governing designated entities; requirements for network build out; support for public safety communications; and band plans that could favor one technology over another.

Background

Spectrum is considered to be a natural resource⁶ 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

⁴ P.L. 109-171, Sec. 3003 (a) (2).

⁵ For example, hearings in both the Senate and House, such as "The Present and Future of Public Safety Communications," February 8, 2007, Senate, Committee on Commerce, Science, and Transportation; "Digital Future of the United States: Part III: Spectrum Opportunities and the Future of Wireless," April 19, 2007, and "Wireless Innovation and Consumer protection," July 11, 2007, both held by House of Representatives, Committee on Energy and Commerce, Subcommittee on Telecommunications and the Internet.

⁶ 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).

(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 Administration

The Federal Communications Commission manages all non-federal spectrum, including that used by state and local governments. Among other responsibilities, the FCC supervises spectrum auctions. The National Telecommunications and Information Administration (NTIA) manages all spectrum used by the federal government, including the Department of Defense (DOD). The NTIA — part of the Department of Commerce — also serves as the principal adviser to the executive branch on domestic and international telecommunications issues. The Department of State represents the United States at international meetings to negotiate treaties for spectrum use. The NTIA and the FCC work together to coordinate spectrum policy.

Beginning in 2003, President George W. Bush has issued several memoranda to establish and guide a national Spectrum Policy Initiative, lead by the Secretary of the Department of Commerce. As required by the President, the Secretary submitted a plan to implement recommendations previously provided by the Federal Government Spectrum Task Force. The planning process is being guided by the NTIA, which has established seven projects dealing with aspects of spectrum policy.⁷ One of the projects has as its goal to “Improve Long-term Planning and Promote Use of Market-based Economic Mechanisms in Spectrum;” this group is examining auctions and other means of deriving revenue from spectrum resources as part of its broader analysis of effective spectrum management.

Some have suggested that the commercial policies followed by the FCC to conduct auctions are not compatible with the management of spectrum for non-commercial use. It has been proposed that the NTIA take over the management of frequencies used by public safety agencies, critical infrastructure industries, and other non-federal entities where the use of wireless communications is essential to

⁷ *Spectrum Management for the 21st Century; plan to implement recommendations of the President’s policy initiative*, U.S. Department of Commerce, posted March 14, 2006, at [<http://www.ntia.doc.gov/osmhome/reports/ImplementationPlan2006.pdf>]. Viewed April 26, 2007.

protecting life and property. This action, it is argued, would enable the NTIA to work more closely with the Department of Defense, federal departments such as Homeland Security, and local and state agencies to develop band plans for emergency communications. Although this does not change the role of congressional jurisdiction, many believe such a move could streamline the coordination of public policy for interoperable communications and other goals Congress has set for improving emergency preparedness and response.

Spectrum Auctions

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. The auction process assigns a monetary value to spectrum through competitive bidding.

Many economic models for providing the “highest and best use” for spectrum exist and have been tried, both in the United States and worldwide. 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.⁸ Several lucrative auctions have added billions to the federal treasury, applied to general revenue.

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 FCC, over many years, has developed and refined a system of exclusive licenses for users of specific frequencies.⁹ 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 (47 U.S.C. 927) 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 (SMR) and Mobile Satellite Services (MSS). With some exceptions, CMRS providers are

⁸ 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,” November 2002 [http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-228552A1.pdf]. Viewed April 26, 2007.

⁹ 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.”

regulated as common carriers to ensure regulatory parity among similar services that will compete against one another for subscribers.

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.¹⁰ 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 auction revenues to be applied directly to specific programs through trusts.

Auction Rules. The Communications Act of 1934, as amended, directs the FCC to develop a competitive bidding methodology.¹¹ 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 rejecting 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.¹² Many industry observers have expressed concern that some of the small businesses participating in auctions actually

¹⁰ 47 U.S.C. 309 (j) (8).

¹¹ Communications Act of 1934, 47 U.S.C. 309 (j) (3).

¹² *Adarand Constructors Inc., petitioner v. Federico Pena, Secretary of Transportation, et al.* Docket No. 93-1841, decided June 1995.

represent larger companies.¹³ By contracting with a larger company to lease or sell to it spectrum access successfully acquired through bidding as a designated entity or entrepreneur, some companies 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.¹⁴

To avoid providing an undue advantage to designated entities, the FCC modified auction rules for the Advanced Wireless Services auction, held in 2006, that is funding the Spectrum Relocation Fund.¹⁵ 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.”¹⁶ Although the FCC awarded bidding credits to some of the 128 bidders authorized to participate in the AWS-1 auction, it did not in this auction set aside a block of licenses exclusively for bids from entrepreneurs or designated entities. The FCC’s change in the treatment of designated entities is being challenged in court.¹⁷

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

¹³ The issue is summarized in “Appeals Court Cautioned Not to Throw Out Auction 66,” by Jeffrey Silva, RCR Wireless News, October 23, 2006.

¹⁴ *Small Businesses in License Auctions for Wireless Personal Communications Services*, A CBO Paper, Congressional Budget Office, October 2005.

¹⁵ FCC, *Second Report and Order and Second Further Notice of Proposed Rule Making*, April 25, 2006, WT Docket 05-211.

¹⁶ “FCC Clarifies Certain Aspects of Its ‘Designated Entity’ Eligibility Rules Adopted in April 2006,” FCC News, June 2, 2006 at [<http://www.fcc.gov>].

¹⁷ Wireless News, Communications Daily, April 13, 2006. Excerpt: “The 3rd U.S. Appeals Court, Philadelphia, is expected to hold long-delayed oral arguments in late May in a case filed by Council Tree, Bethel Native Corp. and the Minority Media & Telecom Council against the FCC, seeking to overturn the 2006 advanced wireless services auction.”

but met resistance from the wireless industry, on the grounds that there were sufficient prospective bidders to assure competition.¹⁸

Media Access Project has 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.¹⁹ 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 includes 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.²⁰

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.

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), 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

¹⁸ Public Notice, DA-06-238, January 31, 2006; comments under FCC Docket No. 6-30.

¹⁹ “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 April 26, 2007.

²⁰ MAP Study Claims to See Collusion by AWS Auction Bidders,” *Communications Daily*, April 26, 2007.

generally understood that license winners will be able to keep the license perpetually, as long as they comply with FCC service rules.²¹

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.²²

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.²³ 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.²⁴ Subsequently, NextWave agreed to return some of the disputed spectrum to the FCC for re-auction in January 2005.²⁵

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.²⁶ The rule changes were intended to ensure

²¹ The FCC provides information on auctions at [<http://wireless.fcc.gov/auctions/>].

²² Summarized in *Associated Press Online*, "Feds Ordered to Return Wireless Licenses," January 28, 2003.

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

²⁴ U.S. Supreme Court, Docket No. 01-653 at [<http://www.supremecourtus.gov/docket/01-653.htm>]. Viewed April 26, 2007.

²⁵ See FCC Report No. AUC-03-58 (Auction No. 58) at [<http://wireless.fcc.gov/auctions/>].

²⁶ FCC 97-413, WT Docket 97-82, ET Docket 94-32, *Third Report and Order and Second* (continued...)

uniform procedures involving the application, payment, and certain concerns regarding designated entities (i.e., small businesses and rural telephone companies). For example, in many cases the FCC specifies a minimum opening bid prior to an auction, and provides more time prior to the auction for potential bidders to develop business plans, assess market conditions, and evaluate the availability of equipment.

The FCC has also modified some wireless service rules to help new spectrum licensees maximize the value from their licenses. Changes include allowing licensees to partition licenses for greater efficiency, sharing regions among licensees, and expediting the relocation of incumbent microwave licensees from the spectrum purchased in the PCS auctions.

Spectrum Value

Spectrum value depends on many factors, such as the amount of spectrum, 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 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 spectrum auctions, and includes the revenue estimate in its annual report, *The Budget and Economic Outlook*. CBO projects auction receipts of \$28 billion in the period 2007-2011.²⁷

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.

Some advocates for unlicensed spectrum would like to see spectrum set aside in the 700 MHz band, where channels will be released by television broadcasters as they move from analog to digital transmission. An alternative proposal for providing

²⁶ (...continued)

Further NPRM on Streamlining Auction Rules, released December 31, 1997.

²⁷ Congressional Budget Office, *The Budget and Economic Outlook: Fiscal Years 2008-2017*, p. 82, January 2007.

unlicensed spectrum as part of the DTV transition is to designate so-called “white spaces” among the new digital TV channels. Beginning in May 2004, the FCC requested comment on proposals for considering the use of spectrum in television broadcast bands (Docket No. 04-186). On September 11, 2006 the FCC announced that it would move forward with the docket and laid out a timetable for completing the process so that devices could be developed and ready for retail sales by February 2009.²⁸ As part of its review for further rule making, the FCC is seeking comment on the possibility of designating all or some of the spectrum in the white spaces for licensed use,²⁹ which would be auctioned. Rules regarding interference differ between licensed and unlicensed spectrum.

Recent Congressional Actions Regarding Spectrum Auctions

Congress uses its oversight authority of the FCC to correct the agency’s course or to steer it in new directions. Notable 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 directs 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 (47 U.S.C. 153) 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.³⁰) 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

- (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;

²⁸ FCC, *First Report and Order and Further Notice of Proposed Rule Making*, ET Docket No. 04-186, released October 18, 2006.

²⁹ *Ibid.*, paragraphs 3, 24, 26 and others.

³⁰ P.L. 109-171, Title III, Section 3003 (b).

- (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.³¹

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 gives 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 1710-1850 MHz range is sought by wireless telecommunications companies to facilitate the implementation of next-generation wireless technologies, including

³¹ For details, see CRS Report RL31260, *Digital Television: An Overview*, by Lennard G. Kruger.

high-speed mobile services (3G).³² 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.³³

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.³⁴ The study³⁵ 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.³⁶

Deficit Reduction Act. The Deficit Reduction Act of 2005 (P.L. 109-171) covers 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 broadcasters. Auctions by the FCC of the freed spectrum are required to begin not later than January 28, 2008 with funds deposited not later than June 30, 2008. The

³² Discussed in CRS Report RS20993, *Wireless Technology and Spectrum Demand: Advanced Wireless Services*, by Linda K. Moore.

³³ “FCC’s Advanced Wireless Services (AWS) Spectrum Auction Concludes,” FCC News, September 18, 2006.

³⁴ P.L. 108-494, Title II, Sec. 209 (a).

³⁵ *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.

³⁶ *Comprehensive Review of U.S. Spectrum Management with Broad Stakeholder Involvement is Needed*, January 2003, GAO-03-277.

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 to be 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.³⁷

Intelligence Reform and Terrorism Prevention Act. Several passages of the act (P.L. 108-458) deal 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.³⁸ The study was submitted to Congress in late 2005.³⁹ 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.”⁴⁰ 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.⁴¹

Broadband Trust Proposal by Cyren Call. With over 1000 responses by December 2006, the FCC request drew many comments from the public safety community and commercial wireless interests. One petition that attracted attention was from a company called Cyren Call Communications Corporation requesting the reallocation of 30 MHz (half of the 60MHz currently designated for auction for commercial use by the Deficit Reduction Act)⁴² to a “Public Safety Broadband

³⁷ 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).

³⁸ P.L. 108-458, Title VII, Subtitle E, Sec. 7502 (a).

³⁹ *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 April 26, 2007.

⁴⁰ *op. cit.* FCC, *Report to Congress* paragraph 99.

⁴¹ FCC, *Eighth Notice of Proposed Rule Making*, WT Docket No. 96-86, released March 17, 2006.

⁴² P.L. 109-171, Sec. 3003.

Trust.”⁴³ According to the proposal, the trust would lease capacity not used by public safety to commercial operators that would provide the network infrastructure. The FCC denied Cyren Call’s petition, citing, among other reasons, the Congressional mandate to auction the spectrum Cyren Call proposed to use.⁴⁴ There continues to be pressure from the public safety community and others for the assignment of additional spectrum at 700 MHz for public safety use.⁴⁵

Auction of Frequencies at 700 MHz

Rules for the 700 MHz auction that will decide the coverage of the licenses are being actively debated. Among rules under consideration are: rebanding the 700 MHz licenses held by public safety to increase capacity for broadband; the geographic areas covered by licenses; creating licenses for rural areas; requirements for building out networks; the number of years a license must be held by its winning bidder before it can be leased or sold to another party; the role of designated entities and other preferential bidding categories; the possibility of sharing some spectrum at 700 MHz between public safety and commercial users; and the creation of an open access license. The debate about open access is many-faceted. Advocates of open access insist that this means “open devices, open applications, open services, and open networks.”⁴⁶ An open network would allow customers to choose their own wireless devices without committing to a service plan from a single provider.

Rebanding and Relocating Spectrum for Public Safety

In considering a rebanding of the 24MHz at 700 MHz for public safety, the FCC is recognizing the shift in wireless technology that has occurred since the band plan was first studied a decade ago. Advances in technology have made it possible to transmit data-rich communications to radios and cell phones with applications that were not imagined when the 700 MHz band plan was originally developed. The FCC also recently initiated a program to protect public safety users from interference that required a rebanding of their channels at 800 MHz. Public safety and commercial users are in the process of relocating under this plan. In both cases, the FCC made or proposes to make spectrum available to commercial users without going through the auction process.

700 MHz: Public Safety and Commercial Operations. In December 2006, the FCC issued a new Notice of Proposed Rulemaking (NPRM) that proposed to turn over management of the 24MHz of spectrum designated for public safety to a not-for-profit group that would, among other responsibilities, hold a national

⁴³ For links to a summary of the proposal, filings with the FCC, and other information, see [<http://www.cyrencall.com>]. Viewed April 26, 2007.

⁴⁴ FCC, *Order*, RM No. 11348 released November 3, 2006.

⁴⁵ For example, statement of Association for Public-Safety Communications Officials, at [http://www.apointl.com/government/positions/APCO_position_statements.htm#Additi onal700]. Viewed April 26, 2007.

⁴⁶ Ex Parte, Joint Filing of Technology Sector Organizations and Public Interest Organizations Concerning Open Access, July 18, 2007. WT Docket # 96-86 *et al.*

license that would support public safety with a broadband wireless backbone.⁴⁷ In the NPRM, the FCC states that it is responding to “an opportunity to put in place a regulatory framework that would ensure the availability of effective spectrum in the 700 MHz band for interoperable, public safety use.”⁴⁸ To achieve this, the FCC is presenting a “plan that we believe may best promote the rapid deployment of a nationwide, interoperable broadband public safety network . . . [with] a centralized and national approach to maximize public safety access. . . .”⁴⁹

In the NPRM, the FCC states its case for how the proposal meets objectives for “public safety communications in the twenty-first century”⁵⁰ and provides some information about the selection of a national licensee and the licensee’s obligations. The FCC proposes that the licensee should meet criteria such as not-for-profit status, experience with public safety frequency coordination, and the ability to directly represent all public safety interests. Responsibilities would include the design and implementation, build-out, and maintenance of a national network, the coordination of eligibility for access for public safety, and the leasing of capacity to commercial users.⁵¹ The licensee would be able to charge fees for the use of its services, such as access to the network, to both public safety and commercial users.⁵²

The NPRM also seeks comments on secondary operations by commercial users on the remaining 12 MHz of spectrum assigned by Congress for public safety use. Currently the FCC permits public safety licensees to lease spectrum assigned to them only for use by other public safety entities. The FCC uses the NPRM to propose exempting the new, national public safety licensee from limitations it imposes on existing public safety entities.⁵³

Public safety’s demand for spectrum fluctuates from modest during routine operations to high during times of crisis. Many would agree that sharing frequencies and access to networks with commercial operations makes sense. The FCC is proposing to share spectrum by halving public safety’s allotment of exclusive spectrum from 24MHz to 12MHz in the 700 MHz band. Alternative solutions for spectrum sharing could be achieved through relocation in other bands or by designating other 700 MHz frequencies for shared use.

800 MHz: Public Safety and Sprint Nextel. In mid-2005, wireless communications managers commenced the process of moving selected public safety radio channels to new frequencies, part of a three-year plan to mitigate persistent problems with interference to their radio communications. The interference usually

⁴⁷ FCC, *Ninth Notice of Proposed Rulemaking*, Docket No. WT 96-86, released December 20, 2006.

⁴⁸ *Ibid.*, paragraph 2.

⁴⁹ *Ibid.*, paragraph 3.

⁵⁰ *Ibid.*, paragraph 11.

⁵¹ *Ibid.*, paragraph 27.

⁵² *Ibid.*, paragraphs 28 - 30.

⁵³ *Ibid.*, paragraph 45.

takes the form of dropped calls or dead spaces with radio transmissions — primarily to or from first responders — in some frequencies in the 800 MHz band. The majority of documented incidents of interference were attributed to the network operated by Nextel Communications, Inc. (now Sprint Nextel). As part of an agreement originally made between Nextel and the Federal Communications Commission, some public safety wireless users will be moved to new frequencies, with the wireless company paying all or part of the cost. In return for these expenditures, and reflecting the value of spectrum that Sprint Nextel will be relinquishing, the FCC assigned 10 MHz of new spectrum to the wireless company.

The FCC announced on July 8, 2004 that it had agreed upon a rebanding plan to consolidate public safety frequencies and those used by some other operators, such as utilities, in the lower part of the 800 MHz band, while moving some of the 800 MHz channels acquired by Nextel, and some other commercial users, to the higher end of the band. This rebanding is expected to eliminate interference caused by the close proximity and interleaving of commercial and public safety channels. The decision reached by the FCC in general supports a rebanding plan first proposed by Nextel in 2001. After months of negotiations, clarifications and technical corrections, a modified plan was accepted on February 7, 2005.⁵⁴ The conversion process is scheduled to be completed by June 26, 2008, within three years of the official start date set by the FCC.

Key points of the plan are

- Move channels designated for interoperability to the lower end of the band, close to the planned public safety band at 700 MHz.
- Require public safety systems to relocate to channels at 809-815 MHz and 854-860 MHz.
- Require certain business and industrial users to relocate to channels at 809-815 MHz and 854-860 MHz.
- Require Enhanced Specialized Mobile Radio users, “ESMR,” to relocate to 817-824 MHz and 862-869 MHz.
- Require Nextel to give up some of its licenses at 800 MHz and all of its licenses at 700 MHz.
- Modify Nextel’s licenses to provide the right to operate at 1910-1915 MHz and 1990-1995 MHz, “conditioned on Nextel fulfilling certain obligations specified in the Commission’s decision.”
- Value the 1.9 GHz spectrum rights to be assigned to Nextel at almost \$4.9 billion, less the cost of relocating incumbent users in those channels.
- Credit Nextel the value of the spectrum rights it is relinquishing at 700 MHz and 800 MHz plus the “actual costs” to Nextel in relocating “all incumbents in the 800 MHz band.”
- Require Nextel to make an “anti-windfall payment” to the Treasury at the conclusion of the relocation process that will equal the

⁵⁴ “Nextel Accepts FCC 800 MHz Interference Solution,” FCC News, February 7, 2005 at [<http://www.fcc.com>].

difference between the \$4.9 billion valuation and the cumulative credits.

- Require Nextel to provide public safety users at 800 MHz and incumbent users at 1.9 GHz with “comparable facilities.”
- Require Nextel to establish escrow accounts and a letter of credit in the amount of \$2.5 billion, to “ensure that the band reconfiguration process will be completed.”
- Provide an independent “Transition Administrator” to authorize disbursements, “subject to *de novo* Commission review.”⁵⁵

As delays mount for the three-year program, there are many critics of the rebanding effort, especially as regards progress in working with public safety users and the reimbursement of costs.⁵⁶

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.⁵⁷ 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.

⁵⁵ FCC order at [http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-168A1.pdf]. Viewed April 26, 2007.

⁵⁶ See CRS Report RL32408, *Spectrum Policy: Public Safety and Wireless Communications*, by Linda K. Moore.

⁵⁷ FCC 97-353, *FCC Report to Congress on Spectrum Auctions*, WT Docket No. 97-150, released October 9, 1997.

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 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.