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# Public Safety, Interoperability and the Transition to Digital Television

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## Summary

Plans for the use of spectrum intended for wireless emergency communications and interoperability are enmeshed in the technical requirements and complex economic and policy issues that surround the planned transition to digital television (DTV) in the United States. The Balanced Budget Act of 1997 requires the Federal Communications Commission (FCC) to allocate 24 MHz of spectrum at 700 MHz to public safety, without providing a hard deadline for the transfer. The channels designated for public safety are among those currently held by TV broadcasters.

The 9/11 Commission Report recommends that "Congress should support pending legislation which provides for the expedited and increased assignment of radio spectrum for public safety purposes." This was a reference to H.R. 1425 (Representative Harman) — the Homeland Emergency Response Operations Act, or HERO Act — which would have required the FCC to "take all actions necessary to complete assignments" for these channels so that operations could begin no later than January 1, 2007, in line with the deadline originally envisioned for the completion of the transition to DTV for all affected channels. After the appearance of the Report, several bills resembling H.R. 1425 were introduced in the 108th Congress. Steps to release the spectrum were included in both the key House (H.R. 10) and Senate (S.2845) versions of the bills proposed to respond to the 9/11 Commission. The Senate version included language that would have released the needed channels by the end of 2007. The House version and the final Intelligence Reform and Terrorism Protection Act of 2004 expressed the preference that the transition to digital television be considered in its entirety so as not to disadvantage the estimated 75 broadcasting stations that would have been affected almost immediately under the Senate version. Language in the Act conveys the sense of Congress that the first session of the 109th Congress must act to establish a comprehensive approach to the timely return of spectrum and that any delay in doing this will delay planning by the public safety sector. There is also provision for a study that could provide the foundation for achieving significant improvements in public safety communications.

This report summarizes issues relevant to the clearing of the frequencies, or channels, designated for public safety.

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# Public Safety, Interoperability and the Transition to Digital Television

## Background

Public safety agencies include the nation's first responders (such as firefighters, police officers, and ambulance services) and a number of local, state, federal — and sometimes regional — authorities. Communications, often wireless, are vital to these agencies' effectiveness and to the safety of their members and the public. Wireless technology requires radio frequency capacity in order to function. Many public safety wireless communications programs suffer from funding difficulties and technical limitations due largely to the evolution of the market and technology for public safety communications and to the constraints of spectrum allocation (radio frequency assignments). There is a perceived need for timely resolution of problems that the public safety sector finds increasingly critical, such as reducing commercial transmission interference to emergency calls, implementing high-speed services, using Wi-Fi[1] technologies to deliver data, providing interoperability, increasing standardization and expanding spectrum capacity.

The key agencies for spectrum management are the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA). Among other responsibilities, the FCC supervises spectrum for non-federal public safety agency communications. The NTIA — part of the Department of Commerce — administers spectrum used by federal entities. The lead program for fostering interoperability is SAFECOM, part of the Department of Homeland Security. SAFECOM has absorbed the Public Safety Wireless Network (PSWN) Program, previously operated jointly by the Departments of Justice and Treasury. PSWN was created to respond to recommendations made by the Public Safety Wireless Advisory Committee (PSWAC)[2] regarding the improvement of public safety communications over wireless networks. PSWN operated as an advocate for spectrum management policies that would improve wireless network capacity and capability for public safety. SAFECOM, however, has no authority over spectrum management decisions.

## Interoperability and the 9/11 Commission Report

Interoperability, also referred to as compatibility or connectivity, allows different systems to readily contact each other and provides needed redundancy. A significant barrier to achieving interoperability is the lack of sufficient spectrum on

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[1] Wi-Fi, for wireless fidelity, provides Internet access from web-enabled devices through wireless local area networks, or "hotspots."

[2] "Final Report of the Public Safety Wireless Advisory Committee," September 11, 1996.

similar radio frequencies. Spectrum allocations for public safety are fragmented at many different frequencies. Existing wireless technology is designed to work within specified frequency ranges. Communications equipment must be specially built to handle multiple frequency ranges, thereby limiting interoperability, adding to the cost, and affecting operations in various ways. Insufficient capability for interoperable communications for first responders and for other public safety response units has been identified by many, including the 9/11 Commission, as a serious problem in any effective response to a terrorist attack or other major disaster. The 9/11 Commission, in one of its recommendations, linked the need for spectrum with the need to improve connectivity.[3] The FCC has designated 2.5 MHz of spectrum in the public safety channels at 700 MHz for interoperability. Most public safety organizations recommend an increase in the amount of spectrum for public safety use at 700 MHz as a way to maximize interoperability and operating efficiency.

## Spectrum for Public Safety Use

Many public safety officials believe that additional spectrum needs to be assigned for public safety use — and not exclusively for first responders.[4] In addition to providing spectrum for other types of users, the spectrum available for public safety needs to support high-speed transmissions capable of quickly sending data (such as photographs, floor plans and live video). This requires providing frequencies with greater bandwidth to enable wireless broadband and new-generation technologies. Most frequency assignments for first responders are narrowband and most are located below 512 MHz.[5] Commonly-used frequencies are VHF or UHF.[6] Problems for users in the lower frequencies are primarily congestion and a dependency on out-dated, analog equipment. Many newer systems use frequencies

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[3] The National Commission on Terrorist Attacks Upon the United States, *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States*, Official Government Edition, Washington, D.C. 2004, p. 397. This recommendation is discussed in CRS Report RL32594, *Public Safety Communications: Policy, Proposals, Legislation and Progress.*

[4] In 1997 amendments to the Communications Act of 1934 , Congress defined public safety services as "services — (A) the sole or principal purpose of which is to protect the safety of life, health or property; (B) that are provided (i) by State or local government entities; or (ii) by nongovernmental organizations that are authorized by a governmental entity whose primary mission is the provision of such services ; and (C) that are not made commercially available to the public by the provider." Some believe that critical infrastructure industry workers should be specifically included in this definition. Utility company technicians, for example, often arrive at a fire in tandem with fire fighters, to shut off electricity and gas.

[5] Radio frequency spectrum is measured in hertz. Radio frequency is the portion of electromagnetic spectrum that carries radio waves. The distance an energy wave takes to complete one cycle is its wavelength. Frequency is the number of wavelengths measured at a given point per unit of time, in cycles per second, or hertz (Hz). Typical designations are: kHz — kilohertz or thousands of hertz; MHz — megahertz, or millions of hertz; and GHz — gigahertz, or billions of hertz.

[6] Very High Frequency (VHF) and Ultra High Frequency (UHF) are transmitted in three bands in the United States — low VHF, high VHF, and UHF.

in the 800 MHz range. Problems in the 800 MHz range are created by interference from commercial wireless transmissions and insufficient bandwidth for advanced applications such as image transfer. To reduce interference to public safety, the FCC has proposed a spectrum relocation plan that would place public safety channels together at the lower end of the 800 MHz band and might increase the amount of spectrum available to first responders.[7] Radio frequencies have been designated for state and local public safety use in the 700 MHz range but there are no allocations specifically for federal use at 700 MHz. The FCC has coordinated with the NTIA for federal access to public safety spectrum but additional spectrum would have to be allocated by Congress for federal agencies to have comparable access and interoperability at 700 MHz. Also, the bandwidth assignments are judged by most experts to be too narrow for broadband services.

Although, cumulatively, the amount of radio frequencies designated for non-federal public safety totals over 90 MHz,[8] the characteristics of these frequencies are dis-similar, requiring different technological solutions. The fragmentation of spectrum assignments for public safety is a significant barrier to achieving interoperability in the future and, in the past, has been the source of many of the technical problems that plague public safety communications, such as out-of-date equipment, proprietary solutions, congestion and interference. The immediate barrier to achieving radio communications interoperability is — simply put — that UHF and VHF frequencies cannot connect directly with each other; and older, analog equipment widely used below 512 MHz cannot connect with newer digital equipment at 800 MHz. None of the frequency assignments can, using current technology, support wide-area communications relying on high-speed, data-rich transmissions.

## Freeing Spectrum at 700 MHz

In 1997, responding to the request from the public safety community for more spectrum, Congress passed legislation[9] that included providing some of the needed frequencies. Congress mandated that channels used to broadcast analog television were to be cleared and spectrum at 700 MHz was to be reallocated for wireless communications, including public safety. To meet the instructions of Congress, the FCC assigned the frequencies 764-776 MHz and 794-806 MHz, in channels 63-64 and 68-69 respectively, for public safety use. At the behest of many public safety organizations, the FCC designated 2.5 MHz of this allocation specifically for

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[7] This plan is discussed in CRS Report RL32408, *Spectrum Policy: Public Safety and Wireless Communications Interference.*

[8] Estimated at approximately 97 MHz in Testimony of Michael K. Powell, Chairman, Federal Communications Commission, at Hearing of Senate Committee on Commerce, Science and Transportation, "Spectrum for Public Safety Users," September 8, 2004. The NTIA has apparently not supplied a similar estimate of frequencies assigned to federal agencies that are or can be accessed for public safety purposes.

[9] Balanced Budget Act of 1997, P.L.105-33, Title III.

interoperability. Channels 60-62 and 65-67[10] were identified for auction for commercial wireless use. The FCC created the Public Safety National Coordinating Committee to develop recommendations for standards to be used for equipment and systems tuned to the designated channels in the upper 700 MHz band. By 2003, the bulk of standards work for voice communications was completed and public safety agencies were able to test prototype equipment in areas where the designated frequencies are not in use for analog television broadcasts.

**TV Broadcasters Occupy Needed Spectrum.** The general uncertainty about 700 MHz spectrum availability is seen by many as an obstacle to implementation of public safety communications on the frequencies for which advanced levels of standards, systems interoperability, and performance can be expected.[11] As noted by the FCC, "the major urban areas where the need for additional public safety spectrum is most acute are some of the same areas in which this band is most encumbered by broadcast stations."[12] The FCC attempted to work with the broadcasting industry and wireless carriers on a "market-driven" approach for voluntary clearing of the 700 MHz channels designated for auction or assigned to public safety agencies. The FCC showed a willingness to relax some technical requirements in order to facilitate voluntary band clearing that relied on channel swapping.[13] Proposals that might lead to freeing television spectrum through channel swapping for commercial wireless use could be similarly applied to freeing spectrum for public safety wireless communications. Proposals regarding policy or requests for action — for example by some broadcasting companies, Motorola, Inc. and New York State — claim that, with some modification to the rules, the freeing of public safety channels can be achieved *by date certain* with minimal loss of television reception for over-the-air broadcasts.[14] In testimony before Congress in September 2004, representatives from Motorola, Inc. reaffirmed the conviction that a timely clearing of public safety channels could be achieved, estimating that 75 television broadcasting stations would be affected.[15]

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[10] 746-764 MHz and 776-794 MHz, respectively.

[11] For example, National Task Force on Interoperability, "Why Can't We Talk," February 2003.

[12] FCC, *Report to Congress in the Matter of Auction Reform Act of 2002*, released June 19, 2003 (FCC 03-138).

[13] An outline of the band-vacating plan proposed by a coalition of broadcasters, the Spectrum Clearing Alliance, was submitted to the FCC on March 16, 2001 (Comments, Docket No. 99-168.) Comments can be found by going to the FCC Electronic Comment Filing System (ECFS) on the FCC website [http://www.fcc.gov]. In ECFS, click "Search for Filed Comments," insert the docket number in the box marked "Proceeding," and search the file.

[14] Comments and petitions filed for Proceeding 03-15 by New York State, Office for Technology, Statewide Wireless Network, April 21, 2003 and White Paper, "700 MHz TV Clearing, Its Impact on TV Viewership and Options for Accelerating Public Safety Access," Motorola, Inc., February 2, 2004, [http://motorola.com/cgiss/docs/700mhz_whitepaper.pdf]. (Viewed August 18, 2004.)

[15] Testimony of Gary Grube, Chief Technology Officer, Motorola, Inc. at Hearing of Senate Committee on Commerce, Science and Transportation, "Spectrum for Public Safety Users," September 8, 2004.

**Auction Reform Act of 2002.** A number of proposals and counter-proposals for vacating commercial spectrum at 700 MHz had been presented to the FCC, with discussions continuing until the passage of P.L. 107-195 in June 2002. Known as the Auction Reform Act of 2002 (H.R. 4560), the new law delayed some of the planned auctions and set various constraints on the authority of the FCC to arrange for voluntary band clearing and channel swapping. Because of FCC rules regarding interference and spacing, clearing some channels of television broadcasting for wireless use can also require clearing adjacent channels. The Auction Reform Act, however, limits the FCC in its ability to waive interference standards and rules about spacing if this results in "any degradation" of television broadcasting. These limitations are intended to assure full access to free broadcasts for the television-viewing public. Although the act exempts public safety channels from some requirements, only the four designated channels (63-64; 68-69) are specifically mentioned in the exclusion. Mandated band-clearing is prohibited by the act and voluntary band-clearing that uses channel swapping is potentially hampered by limits on interference and location set by the act. The FCC has stated that if using channels 63-64 and 68-69 for public safety creates interference in adjacent channels beyond what the Auction Reform Act allows, then communications in the public safety channels must be curtailed or prohibited.[16] In testimony before Congress in September 2004, FCC Chairman Michael Powell stated, "If Congress determines that the pressing needs of public safety require an earlier transition deadline for certain channels, the Commission stands ready to implement such a plan."[17] He suggested several provisions Congress might wish to include in such a mandate, including specifying the FCC's authority to act to clear channels adjacent to public safety for technical reasons. In the same testimony, he also explained the FCC preference for a deadline of 2009 for opening 700 MHz spectrum to new users, including public safety.

**Expediting the Transition to Digital TV.**[18] In the Balanced Budget Act of 1997, Congress established 85% as the threshold for the percentage of households, by market, that must be able to receive digital signals in order for the FCC to end the licenses for analog, over-the-air broadcasting. In this scenario, the 15% that lacked digital equipment would, presumably, quickly lose access to all television programs. A proposal by the FCC Media Bureau Chief, Kenneth Ferree — known as the "Ferree Plan" — would count DTV sets, digital-to-analog converters, and cable or satellite set-top boxes that can either down-convert or pass-through a broadcaster's digital signal in establishing whether the 85% threshold had been reached. This and related actions would make it possible for the FCC to begin reclaiming spectrum from broadcasters as early as January 2009. FCC Chairman Michael Powell requested that the Media Bureau seek public comment about the impact of ending analog broadcasting to the approximate 15% of viewers who might be adversely affected by transition plans for DTV; the response to-date has been mixed. A Senate hearing on

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[16] FCC, *Report to Congress in the Matter of Auction Reform Act of 2002*, released June 19, 2003 (FCC 03-138).

[17] Powell, Hearing, September 8, 2004.

[18] This report focuses on spectrum issues. For more information on DTV, see CRS Report RL31260, *Digital Televison: An Overview*, by Lennard G. Kruger.

September 8, 2004 explored some of the options for clearing 700 MHz channels, including modifying the Ferree Plan, or providing a subsidy to expedite the clearing of 700 MHz channels, including reimbursing consumers who purchase converter boxes that would allow analog sets to receive DTV broadcasts.[19] In the interim, the FCC is taking concrete steps to facilitate the eventual move to DTV with a number of technical requirements.[20]

## Proposals for Increasing Spectrum for Public Safety

The number of radio frequencies available for interoperable communications capability can significantly impact first responder communications, and the range of these frequencies can significantly impact the cost of equipment. Public safety officials and planners are among those calling on Congress to allocate 30 MHz of additional spectrum at 700 MHz to increase the efficiency of public safety communications. The Spectrum Coalition for Public Safety has circulated proposed legislation that would allocate additional spectrum at 700 MHz for use by state and local first responders, critical infrastructure industries and federal public safety agencies.[21] Public safety communications equipment manufacturers are among those that believe significant economies of scale might be achieved if similar equipment on compatible spectrum is provided to a large block of like users. As public safety users migrate to 700 MHz, the need for costly equipment that patches together incompatible systems and frequencies will be reduced. Consolidation of public safety users in the 800 MHz might provide similar economies over time.

Among the concerns of the proponents of providing additional spectrum are insufficient number of channels to support interoperability with federal agencies and insufficient bandwidth for federal, state and local agencies to transmit data at high speeds (broadband). The need for greater spectral capacity will grow with the number of participants in interoperable systems and the amounts of information being shared on these systems. Bottlenecks in communications are a problem that is already manifest among federal computer networks and landline transmissions, and many believe it will worsen as more information is pushed through. As emergency response units become more mobile, demand for time-critical, wireless communications capacity will also increase. New technologies that improve communications capacity are being introduced almost continuously, but the need to provide suitable spectrum for a full range of voice and data communications will persist.

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[19] Hearing of Senate Committee on Commerce, Science and Transportation, "Spectrum for Public Safety Users," September 8, 2004

[20] "FCC Takes Next Steps To Promote Digital TV Transition," August 4, 2004, and "DTV Channel Election Information and Deadlines," October 7, 2004, FCC News at [http://www.fcc.gov].

[21] Spectrum Coalition for Public Safety at [http://www.spectrumcoalition.org].

## Spectrum Policy and Public Safety in the 109th Congress

Title VII, Subtitle E — Public Safety Spectrum of the Intelligence Reform and Terrorism Protection Act of 2004 recognizes the merits of the arguments for increasing the amount of spectrum at 700 MHz available for public safety and homeland security. It requires 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 [Sec. 7502 (a)]. The same section of the ACT also instructs the Secretary of Homeland Security to lead a study to "assess strategies that may be used to meet public safety telecommunications needs." [Sec. 7502 (b)]. The strategies study is to address the need for nationwide interoperable communications networks, the capacity of public safety to use wireless broadband applications, and the communications capabilities of "all emergency response providers. . . ." The use of "commercial wireless technologies to the greatest extent possible" is to be considered. Both the FCC and the Homeland Security studies are to be submitted by year-end 2005.

Studies and other measures regarding interoperable communications are also addressed in the Act. Title VII, Subtitle D - Homeland Security requires the Secretary of Homeland Security to establish a program to enhance public safety interoperable communications [Sec. 7303 (a)]. Among the responsibilities of the program are the development of a "comprehensive national approach to achieving public safety interoperable communications." Several of the specific requirements for the study overlap those detailed in Subtitle E, Sec. 7502. Subtitle D requirements that are closely connected to spectrum use include: information on the life cycle and technical requirements of existing infrastructure [Sec.7303 ( a) (1) (D) (i)]; and the need for international, cross-border interoperability [Sec.7303 ( a) (1) (D) (ii)]. The Secretary is to report to Congress on plans for voluntary standards for interoperable communications and a schedule of milestones for the program; the statutory deadline for this report is 120 days from enactment, in April 2005. Authorizations for this program cover fiscal years 2005 through 2009 (Sec. 7303 (a) (2) (3). Another section in Subtitle D addresses communications support for urban and other high risk areas specifically (Sec.7303, ''Sec. 510). There is also provision to establish pilot projects in high threat urban areas or regions that might serve as a national model for a strategic plan. Specifically the purpose of the pilots is to establish the basis for a regional strategic plan that would foster interagency communications (Sec. 7304).

The Intelligence Reform and Terrorism Protection Act of 2004 conveys the sense of Congress that the first session of the 109th Congress must act to establish a comprehensive approach to the timely return of spectrum [Title VII, Subtitle E, Sec. 7501 (b) (1)] and that any delay in doing this will delay planning by the public safety sector. [Title VII, Subtitle E, Sec. 7501 (b) (2]. The Act, therefore, proposes or requires a number of actions regarding public safety interoperability and spectrum use within a specified time:

- Sense of Congress that it must pass legislation that resolves spectrum release as part of the transition to digital television; first session. (Sec. 7501.)

- Requirement for a study on spectrum for public safety and homeland security; December 2005. (Sec. 7502.)

- Requirement for a study on strategies to meet interoperable communications needs; December 2005. (Sec. 7502.)

- Requirement to establish program to enhance public safety interoperable communications; report on program, April 2005.(Sec. 7303.)

- Establishment by the President of a mechanism for coordinating cross-border interoperability issues with Canada and Mexico; June 2006. (Sec. 7303.)

- Requirement to establish at least two pilot projects in high threat or urban areas for interagency communications; March 2005.(Sec. 7303, Sec.''510.)

- Reports on interagency communications pilots; interim, June 2005; final June 2006. (Sec. 7304.)

- Provision of funds for authorized program for interoperable communications; fiscal years 2005 through 2009.