incumbent operators from exercising market power, either collectively or unilaterally, even in highly concentrated markets.[140] The ease or difficulty of entry generally depends on the nature and significance of entry barriers. Barriers to entry in the mobile telecommunications market may include first-mover advantages, large sunk costs, and access to spectrum.[141]

1. Spectrum Allocation and Assignment

68. Government control of spectrum allocation and assignment has the potential to create a significant barrier to entry into markets for mobile communications services by limiting the amount of spectrum allocated to CMRS and by requiring carriers to obtain a government-issued license in order to use such spectrum for the provision of CMRS.[142] However, the Commission has helped to reduce any potential entry-limiting effects of government-controlled spectrum allocation and assignment through various policies. First, as discussed in greater detail below, the amount of spectrum available for the provision of CMRS has been increased. For example, the allocation of 120 MHz of spectrum to broadband PCS ended the cellular duopoly by facilitating the entry of new mobile telephone service providers. Second, the Commission has progressively implemented a more flexible, market-oriented model of spectrum allocation and assignment for spectrum used to provide commercial mobile services. For example, initially spectrum policy restricted the use of cellular spectrum to analog service and limited the number of cellular entrants to two in each local market. In contrast, as detailed below, current policy affords licensees greater flexibility to decide what services to offer and what technologies to deploy on cellular spectrum, as well as other spectrum used for the provision of CMRS, and allows market forces to play a greater role in determining the number of entrants in each local market for mobile telephone service. Finally, subject to the Commission's approval, CMRS licensees are allowed to buy and sell licenses, in whole or in part, on the secondary market. As noted in the *Ninth Report*, beginning in 2003 the Commission also allowed CMRS licensees to lease all or a portion of their spectrum usage rights for any length of time within the license term, and over any geographic area encompassed by the license.[143] The effect of this flexible, market-oriented spectrum model has been to help reduce any entry barriers that may arise from government regulation of spectrum.

a. Cellular, Broadband PCS, and SMR

69. Currently, mobile telephone operators primarily use three types of spectrum licenses to provide mobile voice and, in most cases, mobile data services: cellular, broadband PCS, and SMR.[144] This information is provided as a basis for understanding the formation of the current industry structure.

70. Cellular – The Commission began licensing commercial cellular providers in 1982 and completed licensing the majority of operators by 1991. The Commission divided the United States and its possessions into 734 cellular market areas ("CMAs"), including 305 Metropolitan Statistical Areas

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[140] *See DOJ/FTC Guidelines* at §3.0; *see also* Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization* (3rd ed., Addison, Wellsley, Longman, Inc., 1999), at 77.

[141] *See Spectrum Cap Order*, 16 FCC Rcd at 22688-91, ¶¶ 39-43.

[142] *See, e.g.*, Thomas W. Hazlett, *The Wireless Craze, The Unlimited Bandwidth Myth, The Spectrum Auction Faux Pas, and the Punchline to Ronald Coase's "Big Joke"*, Working Paper 01-01, AEI-Brookings Joint Center for Regulatory Studies, Jan. 2001; *Spectrum Framework Review: Implementation Plan*, Consultation Document, Office of Communications, Jan. 13, 2005, at 77 and 81-82.

[143] *Ninth Report*, at 20631.

[144] *See* Appendix B, Table 1 and Maps 11-14, *infra*, for descriptions and maps of various geographical licensing schemes employed by the Commission.

("MSAs"), 428 Rural Statistical Areas ("RSAs") and a market for the Gulf of Mexico.[145] Two cellular systems were licensed in each market area. The Commission designated 50 megahertz of spectrum in the 800 MHz frequency band for the two competing cellular systems in each market (25 megahertz for each system). Initially, cellular systems offered service using analog technology, but today most of the service offered using cellular spectrum is digital.[146]

71. Broadband PCS – Broadband PCS is similar to cellular service, except that broadband PCS systems operate in different spectrum bands and have been designed from the beginning to use a digital format. Broadband PCS licenses have been assigned through auction, beginning in 1995.[147] The Commission has set aside the spectrum between 1850 MHz and 1990 MHz for broadband PCS. This spectrum includes 120 megahertz used for mobile telephone services, divided originally into three blocks of 30 megahertz each (blocks A, B, and C) and three blocks of 10 megahertz each (blocks D, E, and F).[148] Two of the 30 megahertz blocks (A and B blocks) are assigned on the basis of 51 Major Trading Areas ("MTAs").[149] One of the 30 megahertz blocks (C block) and all three of the 10 megahertz blocks are assigned on the basis of 493 BTAs.[150]

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[145] Under the original cellular licensing rules, one of the two cellular channel blocks in each market (the B block) was awarded to a local wireline carrier, while the other block (the A block) was awarded competitively to a carrier other than a local wireline incumbent. After awarding the first 7 MSA licenses pursuant to comparative hearing rules, the Commission adopted rules in 1984 and 1986 to award the remaining cellular MSA and RSA licenses through lotteries. By 1991, lotteries had been held for every MSA and RSA, and licenses were awarded to the lottery winners in most instances. In some RSA markets, however, the initial lottery winner was disqualified from receiving the license because of a successful petition to deny or other Commission action. Implementation of Competitive Bidding Rules to License Certain Rural Service Areas, *Report and Order*, 17 FCC Rcd 1960, 1961-1962 (2002). In 1997, the Commission auctioned cellular spectrum in areas unbuilt by the original cellular licensees. *See* FCC, *Auction 12: Cellular Unserved* (visited Apr. 12, 2002) <http://wireless.fcc.gov/auctions/12/>. In 2002, the Commission auctioned three RSA licenses where the initial lottery winner had been disqualified. *See* FCC, *Auction 45: Cellular RSA* (visited Jun. 7, 2002) <http://wireless.fcc.gov/auctions/45/>.

[146] *See* section VI.B.1, Subscriber Growth, *infra*.

[147] The first auction was for two license blocks of 30 megahertz each. FCC Grants 99 Licenses For Broadband Personal Communications Services In Major Trading Areas, *News Release*, FCC, Jun. 23, 1995. The Commission has had five additional broadband PCS auctions. *See* FCC, *Auctions Home* (visited Apr. 29, 2003) <http://wireless.fcc.gov/auctions/>. Three licenses were also awarded as part of a pioneer preference program in 1994. Three Pioneer Preference PCS Applications Granted, *News Release*, FCC, Dec. 14, 1994.

[148] The Commission's broadband PCS allocation includes 20 megahertz of spectrum at 1910 MHz - 1930 MHz for unlicensed broadband PCS.

[149] Major Trading Areas are Material Copyright (c) 1992 Rand McNally & Company. Rights granted pursuant to license from Rand McNally & Company through an arrangement with the Federal Communications Commission. Rand McNally's MTA specification contains 47 geographic areas covering the 50 states and the District of Columbia. For its spectrum auctions, the Commission has added three MTA-like areas: Guam and the Northern Mariana Islands, Puerto Rico and the U.S. Virgin Islands, and American Samoa. In addition, Alaska was separated from the Seattle MTA into its own MTA-like area. MTAs are combinations of two or more BTAs. *See* note 24 for a description of BTAs.

[150] In June 1998, broadband PCS C block licensees were permitted to elect to disaggregate their licenses and return 15 megahertz of C block spectrum to the Commission. As a result, a number of licensees elected to disaggregate some or all of their licenses, creating some BTAs with seven broadband PCS spectrum licenses. *See* Amendment of the Commission's Rules Regarding Installment Payment Financing for Personal Communications Services (PCS) Licensees, *Second Report and Order and Further Notice of Proposed Rule Making*, 12 FCC Rcd 16436 (1997); Amendment of the Commission's Rules Regarding Installment Payment Financing for Personal Communications Services (PCS) Licensees, *Order on Reconsideration of the Second Report and Order*, 13 FCC Rcd 8345 (1998). In (continued....)

72. The most recent broadband PCS auction (Auction No. 58) was completed in the past year. On February 15, 2005, the Commission completed the auction of 242 broadband PCS licenses comprising CMRS spectrum that had been offered previously in other auctions but was returned to the Commission as a result of license cancellation or termination.[151] In that auction, 24 bidders won 217 licenses, raising (in net high bids) a total of more than $2.0 billion.

73. SMR - The Commission first established SMR in 1979 to provide for land mobile communications on a commercial basis. The Commission initially licensed spectrum in the 800 and 900 MHz bands for this service, in non-contiguous bands, on a site-by-site basis.[152] The Commission has since licensed additional SMR spectrum through auctions.[153] In total, the Commission has licensed 19 megahertz of SMR spectrum, plus an additional 7.5 megahertz of spectrum that is available for SMR as well as other services.[154] While Commission policy permits flexible use of this spectrum, including the provision of paging, dispatch, mobile voice, mobile data, facsimile, or combinations of these services,[155] the primary use for SMR traditionally has been trunked dispatch services.[156] Dispatch differs from

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August 2000, the Commission decided to reconfigure each 30 megahertz C block license available for auction, beginning with Auction No. 35, into three 10 megahertz licenses. Amendment of the Commission's Rules Regarding Installment Payment Financing for Personal Communications Services (PCS) Licensees, *Sixth Report and Order and Order on Reconsideration*, 15 FCC Rcd 16266, 16267 (2000).

[151] Broadband PCS Spectrum Auction Closes, *Public Notice*, 20 FCC Rcd 3703 (2005). Some of the spectrum to be re-auctioned was returned as a result of the settlement agreement between the FCC and NextWave. *See Ninth Report*, at 20630.

[152] The "900 MHz" SMR band refers to spectrum allocated in the 896-901 and 935-940 MHz bands; the "800 MHz" band refers to spectrum allocated in the 806-824 and 851-869 MHz bands. *See* 47 C.F.R. § 90.603; *see also* 47 C.F.R. § 90.7 (defining "specialized mobile radio system").

[153] The Commission has held multiple auctions for SMR licenses. FCC, *FCC Auctions* (visited Mar. 7, 2002) <http://wireless.fcc.gov/auctions/>.

[154] There are five megahertz in the 900 MHz band (200 paired channels x 12.5 kHz/channel). *See* 47 C.F.R. § 90.617, Table 4B. There are 21.5 megahertz in the 800 MHz band: 14 megahertz in the 800 SMR Service (280 paired channels x 25 kHz/channel) and 7.5 megahertz in the 800 MHz General Category (150 paired channels x 25 kHz/channel). *See* 47 C.F.R. § 90.615, Table 1 (SMR General Category) and 47 C.F.R. § 90.617, Table 4A (SMR Service). In 2000, the Commission amended its rules to allow Business and Industrial/Land Transportation licensees in the 800 MHz band to use their spectrum for CMRS operations under certain conditions. Implementation of Sections 309(j) and 337 of the Communications Act of 1934 as Amended Promotion of Spectrum Efficient Technologies on Certain Part 90 Frequencies; Establishment of Public Service Radio Pool in the Private Mobile Frequencies Below 800 MHz; Petition for Rule Making of The American Mobile Telecommunications Association, *Report and Order and Further Notice of Proposed Rule Making*, 15 FCC Rcd 22709, 22760-61 (2000). This could make up to five megahertz of additional spectrum available for digital SMR providers: 2.5 megahertz in the Industrial/Land Transportation Category (50 paired channels x 25 kHz/channel) and 2.5 megahertz in the Business Category (50 paired channels x 25 kHz/channel). *See* 47 C.F.R. § 90.617, Tables 2A and 3A. As discussed below in Section III.E.1.b, *infra*, the configuration of the 800 MHz band is changing as a result of a new band plan adopted by the Commission.

[155] Principles for Reallocation of Spectrum to Encourage the Development of Telecommunications Technologies for the New Millennium, *Policy Statement*, 14 FCC Rcd 19868 (1999); *see also* Applications of Various Subsidiaries and Affiliates of Geotek Communications, Inc., Debtor-In-Possession, Assignors, and Wilmington Trust Company or Hughes Electric Corporation, Assignees, For Consent to Assignment of 900 MHz Specialized Mobile Radio Licenses, *Memorandum Opinion and Order*, 15 FCC Rcd 790, 802 (2000).

[156] Dispatch services allow two-way, real-time, voice communications between fixed units and mobile units (*e.g.*, between a taxicab dispatch office and a taxi) or between two or more mobile units (*e.g.*, between a car and a truck). *See Fifth Report*, at 17727-17728, for a detailed discussion. A number of providers continue to provide both (continued....)

mobile voice communications offered by PCS and cellular carriers in that it allows both one-to-one and one-to-many communication (including real-time conferencing with groups), and it generally does not operate through interconnection with the public switched telephone network.[157] SMR systems have also had the ability to offer interconnected service, but until the development of digital technologies, analog SMR systems had limited capacity to provide mobile telephone services. In recent years, however, the nature of SMR service has evolved significantly. SMR providers such as Nextel and SouthernLINC Wireless, a unit of energy concern Southern Company, have used digital technologies to increase spectral efficiency and to become more significant competitors in mobile telephony, while also providing dispatch functionality as a part of their service offerings.[158] Furthermore, in apparent response to the dispatch functionality of SMR services, some cellular and broadband PCS carriers have begun to offer push-to-talk functionality on their networks, including Verizon Wireless, Sprint PCS, and ALLTEL.[159] SMR spectrum is also used for certain data-only networks.[160]

74. Available Licenses and Spectrum Aggregation – In every geographical area of the country, the Commission initially authorized up to eight different mobile telephone licenses (two cellular and six broadband PCS), not including additional digital SMR licenses.[161] Moreover, under Commission rules, broadband PCS, cellular, and auctioned SMR licensees may, with Commission approval, disaggregate (divide the spectrum into smaller amounts of bandwidth) or partition (divide the license into smaller geographical areas) their licenses, or both, to other entities.[162] Many licensees hold more than one license in a particular market. While no longer in operation, the Commission's CMRS spectrum cap molded the current distribution of spectrum licenses. Under the spectrum cap, no entity could control more than 45 megahertz of cellular, broadband PCS, and SMR[163] spectrum in an MSA, or more than 55 megahertz in an RSA.[164] In November 2001, however, the Commission raised the spectrum cap to 55

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commercial and private dispatch services at 800 MHz, 900 MHz, 220 MHz, 217-219 MHz, and 450-470 MHz. *See* Applications of Motorola, Inc.; Motorola SMR, Inc.; and Motorola Communications and Electronics, Inc. - Assignors; and FCI 900, Inc., Assignee, For Consent to Assignment of 900 MHz Specialized Mobile Radio Licenses, *Order*, 16 FCC Rcd 8451 (2001) ("*Motorola Order*"). Dispatch and SMR are often used interchangeably, although SMR refers to specific spectrum ranges.

[157] *See* The Strategis Group, *The State of the SMR Industry: Nextel and Dispatch Communications*, Sept. 2000, at 57; The Strategis Group, *U.S. Dispatch Markets*, Jan. 2000, at 1. *See also Motorola Order*, at 8457.

[158] According to Nextel, "[We are] referred to as an 'SMR provider' . . ., although [our] services compete directly with and are regulated virtually identically to those of cellular and PCS providers." Nextel, Automatic and Manual Roaming Obligations Pertaining to Commercial Mobile Radio Services, WT Docket No. 00-193, *Comments*, at note 4 (filed Jan. 5, 2001). However, in comparison with cellular and broadband PCS providers, digital SMR providers are more focused on the business than the individual consumer market. *See, e.g.*, Nextel Communications, Inc., SEC Form 10-Q, Nov. 14, 2000, at 16.

[159] *Ninth Report*, at 20634.

[160] *See* Section IV.B.1.e, Data-Only Networks and Technology Deployment, *infra*.

[161] Some areas may have fewer than eight active licenses because certain auction winners or licensees have defaulted on payments to the Commission, because some licensees did not meet their buildout requirements, some licensees returned their licenses, or some licenses remained unsold in an auction.

[162] 47 C.F.R. § 24.714 (PCS); 47 C.F.R. § 22.948 (cellular); 47 C.F.R. §§ 90.813 and 90.911 (auctioned SMR). As a result of partitioning and disaggregation, there often are more than eight cellular and broadband PCS licenses in a market.

[163] No more than 10 megahertz of SMR spectrum was attributable to an entity under the cap. 47 C.F.R. § 20.6(b).

[164] 47 C.F.R. § 20.6(a).

megahertz in all markets, and decided to eliminate the restriction entirely effective January 1, 2003.[165]

b. 800 MHz Band Reconfiguration and 1.9 GHz Spectrum Exchange

75. On July 8, 2004, the Commission adopted a new band plan for the 800 MHz band to resolve the problem of interference to public safety radio systems operating in the band from CMRS providers operating systems on channels in close proximity to those utilized by public safety entities.[166] The new band plan addresses the root cause of the interference problem by separating generally incompatible technologies, with the costs of relocating 800 MHz incumbents to be paid by Nextel. To accomplish the reconfiguration, the Commission will require Nextel to give up rights to certain of its licenses in the 800 MHz band and all of its licenses in the 700 MHz band. In exchange, the Commission will modify Nextel's licenses to provide the right to operate on two five-MHz blocks in the 1.9 GHz band – specifically 1910-1915 MHz and 1990-1995 MHz – conditioned on Nextel fulfilling certain obligations specified in the Commission's decision. As a new entrant in the 1.9 GHz band, Nextel is also obligated to fund the transition of incumbent users to comparable facilities. The Commission determined that the overall value of the 1.9 GHz spectrum is $4.8 billion, less the cost of relocating incumbent users. In addition, the Commission decided to credit to Nextel the value of the spectrum rights that Nextel will relinquish and the actual costs Nextel incurs to relocate all incumbents in the 800 MHz band. To the extent that the total of these combined credits is less than the assessed value of the 1.9 GHz spectrum rights, Nextel will make an anti-windfall payment equal to the difference to the United States Department of the Treasury at the conclusion of the relocation process.

c. Narrowband Spectrum

76. In addition to the spectrum that mobile telephone carriers use to offer both voice and data CMRS services, two additional spectrum bands – paging and narrowband PCS – are used by licensees to offer CMRS services that consist only of data communications. Spectrum designated for commercial messaging/paging is spread across several non-contiguous bands: 35-36 MHz, 43-44 MHz, 152-159 MHz, 454-460 MHz, and 929-932 MHz.[167] Each license consists of between 20 and 50 kilohertz.[168] The Commission first allocated spectrum for paging in 1949 and licensed the spectrum on a site-by-site basis through the mid-1990s.[169] In 2000 the Commission began auctioning additional paging licenses on a geographic area basis using EAs and MEAs.[170] The Commission completed its third paging auction on May 28, 2003.[171]

77. Narrowband PCS spectrum is located in the 901-902 MHz, 930-931 MHz, and 940-941

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[165] *Spectrum Cap Order*, at 22669. The increase to 55 megahertz took effect February 13, 2002. *See* 67 Fed. Reg. 1626 (Jan. 14, 2002). All license transfers are still subject to review by the Commission to determine whether they are in the public interest. *Spectrum Cap Order*, at 22670-22671.

[166] FCC Adopts Solution to Interference Problem Faced by 800 MHz Public Safety Radio Systems, *News Release*, Federal Communications Commission, Jul. 8, 2004.

[167] FCC, *Paging (Lower) Bandplan*, <http://wireless.fcc.gov/auctions/data/bandplans/pagingLwrband.pdf>; FCC, *929 and 931 MHz Paging Bandplan*, <http://wireless.fcc.gov/auctions/data/bandplans/auc26bnd.pdf>.

[168] *Id.*

[169] Revision of Part 22 and Part 90 of the Commission's Rules to Facilitate Future Development of Paging Systems, Implementation of Section 309(j) of the Communications Act – Competitive Bidding, *Notice of Proposed Rulemaking*, 11 FCC Rcd 3108, 3109-3110 (1996).

[170] *See* 929 and 931 MHz Paging Auction Closes, *Public Notice*, DA 00-508 (rel. Mar. 6, 2000); *Seventh Report*, at 13050-13051.

[171] Lower and Upper Paging Bands Auction Closes, *Public Notice*, DA 03-1836 (rel. May 30, 2003).

MHz bands and allows licensees to offer an array of two-way data services such as text messaging.[172] The Commission first auctioned narrowband PCS spectrum in 1994.[173] Licenses consisted of between 50 and 100 kilohertz each and were offered on both a nationwide and regional basis.[174] The Commission completed its most recent auctions of narrowband PCS licenses in September 2003.[175]

d. 700 MHz Bands

78. As discussed in the *Eighth Report,* the 700 MHz spectrum is being reclaimed from u broadcast services in connection with the transition of the analog television service to digital television. The reclamation of television spectrum has been addressed in two parts, primarily as a result of different statutory requirements applicable to the two bands and differing degrees of incumbency in the two bands.[177] These two bands are the 698-746 MHz (known as the "Lower 700 MHz") band and the 746-806 MHz (or "Upper 700 MHz") band. The Upper 700 MHz Band is currently used by TV stations on Channels 60-69 and comprises 60 megahertz, while the Lower 700 MHz Band, which is used by TV stations on Channels 52-59, comprises 48 megahertz of spectrum.[178]

79. Seventy-eight megahertz of the total 108 megahertz of Upper and Lower 700 MHz spectrum will generally be open to a broad range of flexible uses.[179] Pursuant to statutory mandate, licenses for this spectrum will be assigned through competitive bidding.[180] These bands have many permissible uses: winning bidders may use the spectrum for fixed, mobile (including mobile wireless commercial services), and broadcast services.[181] The Commission expects that many of the new

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[172] Implementation of Section 309(j) of the Communications Act – Competitive Bidding Narrowband PCS, PP Docket No. 93-253, *Third Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, 10 FCC Rcd 175 (1994).

[173] Announcing the High Bidders in the Auction of Ten Nationwide Narrowband PCS Licenses; Winning Bids Total $617,006,674, *Public Notice*, PNWL 94-4 (Aug. 2, 1994).

[174] *Id.*; Announcing the High Bidders in the Auction of 30 Regional Narrowband PCS Licenses; Winning Bids Total $490,901,787, *Public Notice,* PNWL 94-27 (rel. Nov. 9, 1994).

[175] Regional Narrowband PCS Spectrum Auction Closes, *Public Notice*, DA 03-3006 (rel. Oct. 1, 2003); Narrowband PCS Spectrum Auction Closes, *Public Notice*, DA 03-3012 (rel. Oct. 2, 2003). *See, also, Ninth Report*, at 20636-20637.

[176] *See Eighth Report*, at 14798-14799.

[177] Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59), GN Docket No. 01-74, *Notice of Proposed Rulemaking*, 16 FCC Rcd 7278, 7282 (2001).

[178] The Commission has allocated 24 megahertz of the Upper 700 MHz band for use by public safety entities, pursuant to Section 337(a) of the Communications Act. 47 U.S.C. § 337(a).

[179] *See* Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59), GN Docket No. 01-74, *Report and Order*, 17 FCC Rcd 1022 (2002) ("*Lower 700 MHz Report and Order*"); Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, WT Docket No. 99-168, *Third Report and Order*, 16 FCC Rcd 2703 (2001); Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, WT Docket No. 99-168, *Second Memorandum Opinion and Order*, 16 FCC Rcd 1239 (2001); Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, WT Docket No. 99-168, *Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, 15 FCC Rcd 20845 (2000); Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, WT Docket No. 99-168, *Second Report and Order*, 15 FCC Rcd 5299 (2000) ("*Upper 700 MHz Second Report and Order*").

[180] *See Lower 700 MHz Report and Order*, at 1024; *Upper 700 MHz Second Report and Order*, at 5301-2.

[181] *Id.*

technologies to be developed and deployed in this band will support advanced wireless applications.[182] However, much of the Upper and Lower 700 MHz spectrum is currently encumbered by television broadcasters, and may remain so until the end of period when broadcasters convert from analog to digital transmission systems.[183] That period is defined by statute.[184] Nevertheless, there may be some portions of these bands that are not so encumbered and are available for immediate use by winning bidders.

80. The Balanced Budget Act of 1997 and subsequent legislation initially directed the Commission to license these reclaimed spectrum bands well in advance of the end of the DTV transition period.[185] However, the Auction Reform Act of 2002 eliminated these statutory deadlines[186] and provided the Commission with discretion to "determine the timing of and deadlines for the conduct of competitive bidding under [Section 309(j) of the Communications Act of 1934, as amended], including the timing of, and deadlines for, qualifying for bidding; conducting auctions; collecting, depositing, and reporting revenues; and completing licensing processes and assigning licenses."[187] The Auction Reform Act further ordered the Commission to delay the A, B, and E block portion of Auction No. 44 (Lower 700 MHz) and the entire Auction No. 31 (Upper 700 MHz), yet it also directed the Commission to proceed with an auction of the Lower 700 MHz C and D blocks starting "no earlier than August 19, 2002, and no later than September 19, 2002."[188] On September 18, 2002, the initial auction of Lower 700 MHz C and D block licenses (Auction No. 44) closed, raising $88.7 million in net bids.[189] Subsequent auctions of licenses in these bands (Auction Nos. 49 and 60) in 2003 and 2005 resulted in winning bids for all of the licenses that remained held by the Commission after Auction No. 44 and raised additional net bids of over $57 million.[190]

81. As required by the Auction Reform Act, the Commission prepared a report announcing when it intends to reschedule the remaining 700 MHz band auctions, and submitted the report to Congress on June 19, 2003.[191]

e. Advanced Wireless Services

82. U.S. mobile carriers have the flexibility to deploy advanced wireless technologies, including those commonly called Third Generation or "3G," that allow them to offer high-speed mobile data services using their existing CMRS spectrum.[192] To further the goal of promoting the deployment of

[182] *Lower 700 MHz Report and Order*, at 1032.

[183] *Id.*, at 1028.

[184] *See* 47 U.S.C. § 309(j)(14)(A)-(B).

[185] Balanced Budget Act of 1997, Pub. L. No. 105-33, 111 Stat. 251 § 3003 (1997) (adding new Section 309(j)(14) to the Communications Act of 1934, as amended); § 3007 (uncodified; reproduced at 47 U.S.C. § 309(j) note 3); Consolidated Appropriations Act, 2000, Pub. L. No. 106-113, 113 Stat. 2502, App. E, § 213, 145 Cong. Rec. H12493-94 (Nov. 17, 1999) ("Consolidated Appropriations Act"); 47 U.S.C. § 309(j)(14)(C)(ii).

[186] Auction Reform Act of 2002, Pub. L. No. 107-195, 116 Stat. 715 ("*Auction Reform Act*").

[187] 47 U.S.C. § 309(j)(15), as added by the *Auction Reform Act*.

[188] 47 U.S.C. § 309(j)(15)(C)(iii), as enacted by the *Auction Reform Act*.

[189] Lower 700 MHz Band Auction Closes, *Public Notice*, DA 02-2323 (rel. Sept. 20, 2002).. *See, also, Ninth Report*, at 20638.

[190] Lower 700 MHz Band Auction Closes, *Public Notice*, DA 03-1978 (rel. June 18, 2003); Auction of Lower 700 MHz Band Licenses Closes, *Public Notice*, DA 05-2239 (rel. Aug. 5, 2005).

[191] Auction Reform Act of 2002, *Report To Congress*, FCC 03-138 (rel. Jun. 19, 2003).

[192] 47 C.F.R §§ 20.901(a) and 24.3.

advanced services, the Commission has made efforts to allocate and license additional spectrum suitable for offering advanced wireless services (AWS).[193] As noted in the *Eighth Report*, in 2002 the Commission, together with the National Telecommunications and Information Administration ("NTIA"), allocated 90 megahertz of spectrum in the 1710-1755 and 2110-2155 MHz bands that can be used to offer advanced wireless services, including 3G services.[194] In 2004, the Commission allocated an additional twenty megahertz of spectrum in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz bands, and sought comment on service rules for fixed and mobile services, including AWS, in these bands.[195]

83. In November 2003, in WT Docket No. 02-353, the Commission released a *Report and Order* adopting service rules for licensed fixed and mobile services, including advanced wireless services, for the 90 megahertz of spectrum at 1710-1755 and 2110-2155 MHz.[196] These service rules include application, licensing, operating and technical rules, and competitive bidding provisions. The Commission determined that this spectrum could be used for any wireless service that is consistent with the spectrum's fixed and mobile allocations and to license this spectrum under the Commission's flexible, market-oriented Part 27 rules.[197] In order to meet a variety of needs, including the needs of both large and small service providers, the Commission adopted a band plan for this spectrum employing paired spectrum blocks and Economic Areas (EAs), Regional Economic Areas (REAGs) and Rural Service Areas/Metropolitan Statistical Areas (RSA/MSA) licensing areas. The band plan also permits spectrum to be easily aggregated.

84. The Commission also decided not to impose ownership restrictions (other than those contained in Section 310 of the Communications Act), spectrum aggregation limits, eligibility restrictions, or interim performance requirements. The Commission did determine to limit the lower band (*i.e.*, 1710-1755 MHz band) to mobile transmissions and the upper band (*i.e.*, 2110-2155 MHz band) to base transmissions and established rules to protect co-channel and adjacent channel operations from interference. The Commission also determined to assign licenses for this spectrum using the Commission's Part 1 competitive bidding rules and award bidding credits of 15 percent for small businesses and 25 percent for very small businesses.[198]

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[193] Advanced Wireless Services (AWS) is the collective term we use for new and innovative fixed and mobile terrestrial wireless applications using bandwidth that is sufficient for the provision of a variety of applications, including those using voice and data (such as internet browsing, message services, and full-motion video) content.

[194] *Eighth Report*, at 14801. The Commercial Spectrum Enhancement Act, signed into law on December 23, 2004, establishes a Spectrum Relocation Fund to reimburse federal agencies operating on certain frequencies that have been reallocated to non-federal use, including the 1710-1755 MHz band, for the cost of relocating their operations. *See* Commercial Spectrum Enhancement Act, Pub. L. No. 108-494, 118 Stat. 3986, Title II (2004).

[195] Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems, ET Docket No. 00-258, *Sixth Report and Order, Third Memorandum Opinion and Order and Fifth Memorandum Opinion and Order*, 19 FCC Rcd 20720 (2004); Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands; Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, WT Docket No. 04-356; WT Docket No. 02-353, *Notice of Proposed Rulemaking*, 19 FCC Rcd 19263 (2004) (*AWS-2 Service Rules NPRM*).

[196] Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, WT Docket No. 02-353, *Report and Order*, 18 FCC Rcd 25162 (2003); *Order on Reconsideration*, FCC 05-149 (rel. Aug. 15, 2005).

[197] 47 C.F.R. Part 27.

[198] In the recently issued Order on Reconsideration involving the AWS band, the Commission has indicated that it plans to examine, in a future proceeding, certain aspects of its rules pertaining to a designated entity's eligibility for (continued....)

85. *The AWS-2 Service Rules NPRM*, released in September 2004, sought comment on issues specific to the1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz bands, and also offered some tentative conclusions consistent with existing AWS service rules, such as allowing flexible use of this spectrum and licensing this spectrum under Part 27 of the Commission's rules. The *NPRM* also sought comment on how best to control in-band and adjacent-band interference. Further, the *NPRM* proposed that the Commission conduct any auction of this spectrum in conformity with the general competitive bidding rules set forth in Part 1 of the Commission's rules and that it use the same small business size standards and associated bidding credits as adopted for broadband PCS and the other 90 megahertz of AWS spectrum.[199]

f. Broadband Radio Service

86. In July 2004, the Commission transformed the rules and policies governing the Multipoint Distribution Service (MDS) and the Instructional Television Fixed Service (ITFS) in the 2500-2690 MHz band by providing licensees with greater flexibility and establishing a more functional band plan.[200] As one part of this action, the Commission renamed the MDS service the "Broadband Radio Service" (BRS) and renamed the ITFS service the Educational Broadband Service (EBS).

87. The Commission took several steps to restructure the 2495-2690 MHz band and facilitate more efficient use of the spectrum. First, the Commission created a new band plan for the 2495-2690 MHz band that eliminated the use of interleaved channels by MDS and ITFS licensees and created distinct band segments for high power operations, such as one-way video transmission, and low power operations, such as two-way fixed and mobile broadband applications. By grouping high and low power users into separate portions of the band, the new band plan reduces the likelihood of interference caused by incompatible uses and creates incentives for the development of low-power, cellularized broadband operations, which were inhibited by the prior band plan. Second, the Commission expanded the original MDS-ITFS band by adding to it five megahertz of additional spectrum from below 2500 MHz, which will provide room for the future relocation of MDS Channels 1 and 2, which are presently located in the 2.1 GHz band.

88. In addition, the Commission provided licensees with the flexibility to employ the technologies of their choice in the band and to lease spectrum under the Commission's secondary market spectrum leasing policies and procedures. The Commission also implemented geographic area licensing for all licensees in the band, which will allow increased flexibility while reducing administrative burdens on both licensees and the Commission.

89. Finally, the Commission established a mechanism for transition from the existing band configuration to the new band plan. BRS and EBS providers will have a three-year period during which they may propose transition plans for relocating existing facilities of all other licensees within the same

(Continued from previous page) ———————————
bidding credits. *See* Service Rules for Advanced Wireless Services In the 1.7 GHz and 2.1 GHz Bands, *Order On Reconsideration*, FCC 05-149 (rel. Aug. 15, 2005), at ¶41.

[199] AWS-2 Service Rules NPRM, 19 FCC Rcd 19263.

[200] Amendment of Parts 1, 21, 73, 74, and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational, and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands, WT Docket No. 03-66, *Report and Order and Further Notice of Proposed Rulemaking*, 19 FCC Rcd 14165 (2004). The rules for this band were initially established in 1963 but have evolved significantly since that time. In October 2002, three organizations representing MDS and ITFS providers – the Wireless Communications Association International, the National ITFS Association, and the Catholic Television Network (collectively, the Coalition) – submitted a proposal to the FCC requesting that it substantially change the rules governing this band. In April 2003, the FCC released a Notice of Proposed Rulemaking seeking comment on the Coalition proposal and on other ways to foster efficient and effective use of this spectrum.

Major Economic Area (MEA) to new spectrum assignments in the revised band plan. Plan proponents must notify all licensees in the MEA and file their plans with the Commission. The Commission sought comment on alternative transition options for markets in which no transition plan is proposed, including offering new licenses at auction and modifying existing licenses while offering existing licensees tradable instruments that they could use to bid for new licenses.

90. The changes made to the 2495-2690 MHz band should enable BRS/EBS providers to use this spectrum in a more technologically and economically efficient manner. The goal of the new rules is to facilitate the growth of new and innovative wireless technologies and services, including wireless broadband services that have the potential to compete with cable and DSL broadband providers and to extend broadband service to rural and underserved areas.

2. Other Potential Barriers to Entry

91. There are three other types of entry barriers, each of which captures separate dimensions of the difficulty of entering an industry.[201] The first type consists of the impediment to entry erected by advertising expenditures. Unlike tangible capital, advertising can neither be resold nor otherwise transferred to prospective buyers; such expenditures are irrecoverable or sunk. While the incumbent has already incurred the sunk costs, the entrant has not. Therefore, the entrant has higher incremental cost and incremental risk associated with its decision to enter. The second type of entry barrier arises from economies of scale, which allow firms to lower the cost per unit of producing and distributing a product as the volume of output expands. The more extensive economies of scale are, the larger is the minimum efficient scale relative to the size of the market, meaning a nascent firm risks depressing market price by producing at optimal scale. The alternative is to produce at less than minimum cost. Either way, expected profitability is lowered, and entry is dissuaded. The third type of entry barrier, and closely related to the second, is the inability of new firms to borrow sums sufficient to finance efficient start-ups. The inability to borrow sufficiently increases with the larger absolute capital requirement needed to realize minimum cost, erecting a staunch entry barrier.

92. All three types of entry barriers have the potential to afford incumbent carriers first-mover advantages over latecomers. We believe it is probable that the three types of entry barriers are high in mobile telephone service. Telecommunications has historically been an industry characterized by large investments in network infrastructure and vast scale economies, suggesting the scale economy and capital requirement barriers are both high. Increasing advertising expenditures by mobile telephone carriers as they seek to brand their products suggests that the product differentiation barrier in mobile telephone service is similarly high. As documented below in Section IV.B.4 on carrier rivalry with respect to advertising and marketing, total advertising expenditures by the five nationwide operators alone approached $4 billion in 2004, though advertising expenditures per subscriber fell in 2004 after rising from 2001 to 2003.[202] On the other hand, as noted in the *Ninth Report*, CTIA has interpreted the recent subscriber growth achieved by non-cellular entrants such as T-Mobile and Nextel as evidence that first-mover advantages may no longer be relevant to the mobile telephone industry.[203]

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[201] *See* William J. Baumol and Robert D. Willig, *Fixed Cost, Sunk Cost, Entry Barriers and Sustainability of Monopoly*, QUARTERLY JOURNAL OF ECONOMICS, Vol. 96, Aug. 1981, at 406-431; Joe S. Bain, *Barriers to New Competition*, 1956, at 55; William S. Comanor and Thomas A. Wilson, *Advertising Market Structure and Performance*, THE REVIEW OF ECONOMICS AND STATISTICS, V. 49, Nov. 1967, at 425.

[202] Section IV.B.4, Advertising and Marketing, *infra*.

[203] *Ninth Report*, at 20641.

F. Rural Markets

1. Geographical Comparisons: Urban vs. Rural

93. Since the release of the *Sixth Report*,[204] the Commission has attempted to obtain a better understanding of the state of competition below the national level, and particularly in rural areas.[205] The Commission does not have a statutory definition of what constitutes a rural area.[206] The Commission has used RSAs as a proxy for rural areas for certain purposes, such as the former cellular cross-interest rule and the former CMRS spectrum cap, stating that "other market designations used by the Commission for CMRS, such as [EAs], combine urbanized and rural areas, while MSAs and RSAs are defined expressly to distinguish between rural and urban areas."[207] In its Report and Order concerning deployment of wireless services in rural areas, the Commission adopted a "baseline" definition of rural as a county with a population density of 100 persons or fewer per square mile.[208] For this reason, we adopt this same definition to analyze service availability in rural areas for this report.[209]

2. Rural Competition

94. In comparing competitive entry in counties with population densities of 100 persons per square mile or less to those with densities greater than 100 persons per square mile, we find that the less densely populated counties have an average of 3.7 mobile competitors, while the more densely populated counties have an average of 5.5 competitors. The number of competitors in the less densely populated counties is unchanged from the *Ninth Report*, but the average number of competitors in the more densely

[204] *Sixth Report*, at 13350.

[205] The Commission held a public forum in February 2002 to discuss, among other things, CMRS competition issues in rural areas. In 2003, the Commission released a *Notice of Proposed Rulemaking* in 2003 to examine ways to promote the rapid and efficient deployment of spectrum-based services in rural areas. Facilitating the Provision of Spectrum-Based Service to Rural Areas and Promoting Opportunities for Rural Telephone Companies to Provide Spectrum-Based Services, *Notice of Proposed Rulemaking*, 18 FCC Rcd 20802 (2003) ("*Rural NPRM*"). In addition, the *Eighth CMRS NOI* included questions on a range of rural wireless issues.

[206] The federal government has multiple ways of defining rural, reflecting the multiple purposes for which the definitions are used. *Eighth Report*, at 14834; *Rural NPRM*, at 20808-11. Similarly, in its *Ninth CMRS NOI*, the Commission asked for comments on how the Commission should define "rural areas" for purposes of the *Ninth Report*. *Ninth CMRS NOI*, at 5615-5616.

[207] Biennial Regulatory Review, Spectrum Aggregation Limits for Wireless Telecommunications Carriers, *Report and Order*, 15 FCC Rcd 9219, 9256 at note 203 (1999).

[208] Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies To Provide Spectrum-Based Services, *Report and Order*, 19 FCC Rcd. 19078, at 19087-19088 (2004) ("We recognize, however, that the application of a single, comprehensive definition for 'rural area' may not be appropriate for all purposes. . .Rather than establish the 100 persons per square mile or less designation as a uniform definition to be applied in all cases, we instead believe that it is more appropriate to treat this definition as a presumption that will apply for current or future Commission wireless radio service rules, policies and analyses for which the term 'rural area' has not been expressly defined. By doing so, we maintain continuity with respect to existing definitions of 'rural' that have been tailored to apply to specific policies, while also providing a practical guideline.").

[209] We note that this definition was supported by many of the commenters responding to the *Ninth Report NOI*. *See Ninth Report*, note 266, at 20642. In the *Eighth Report*, the Commission analyzed service availability in rural areas using three different proxy definitions, and similar results were obtained for each definition. *Eighth Report*, at 14835-37.

populated counties has declined 7 percent from 5.9 competitors.[210]

3. Conclusion

95. Based on our rollout analysis information provided by commenters, we conclude that CMRS providers are competing effectively in rural areas.[211] While it appears that, on average, a smaller number of operators are serving rural areas than urban areas, this structural difference is not, by itself, a sufficient basis for concluding that CMRS competition is not effective in rural areas. To the contrary, market structure is only a starting point for a broader analysis of the status of competition based on the totality of circumstances, including the pattern of carrier conduct, consumer behavior, and market performance as discussed more fully below. Despite the smaller number of mobile operators in rural areas as compared to urban areas, there is no evidence in the record to indicate that this structural difference has enabled carriers in rural areas to raise prices above competitive levels or to alter other terms and conditions of service to the detriment of rural consumers. In addition, data and statements presented by commenters on the *Tenth CMRS PN* support the conclusion that there is effective competition with respect to CMRS in rural areas.[212]

IV. CARRIER CONDUCT IN THE MOBILE TELECOMMUNICATIONS MARKET

96. A concentrated market, in conjunction with significant entry barriers, may lessen competition in the market for commercial mobile services in two distinct ways. First, it may increase the likelihood that a group of competing carriers will successfully engage in coordinated interaction aimed at raising prices and lowering output. Second, it may enable an individual carrier to profitably raise price and lower output unilaterally. However, neither coordinated interaction nor unilateral action to lessen competition is a necessary consequence of market concentration and entry barriers. For example, unilateral or coordinated action to lessen competition may be thwarted or undermined by the presence of one or more maverick carriers who have the ability and incentive to expand sales by undercutting the prices of rivals, offering innovative service packages and engaging in aggressive advertising and promotional campaigns.[213] The analysis of carrier conduct thus focuses on whether incumbent carriers, given the prevailing market structure, engage in intense price and non-price rivalry or instead behave in a friendly manner.

A. Price Rivalry

1. Developments in Mobile Telephone Pricing Plans

97. The continued rollout of differentiated pricing plans also indicates a competitive marketplace. In the mobile telephone sector, we observe independent pricing behavior, in the form of continued experimentation with varying pricing levels and structures, for varying service packages, with

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[210] *Ninth Report*, at 20643.

[211] *See, e.g.*, CTIA Comments, at 15-16 ("the wireless industry has a tremendous and unprecedented track record in rapidly bringing high-quality, affordable telecommunications services to consumers located in rural areas"); T-Mobile Reply Comments, at 6 ("T-Mobile and other wireless providers have demonstrated in recent Commission proceedings that there is significant wireless competition in rural areas").

[212] *See, e.g.*, CTIA Comments, at 21 ("in 2004, the Bureau of Labor Statistics found that 50.5% of rural households have wireless service, versus 53.5% of urban households") (Data *cited in* Joseph S. Kramer, *et al.*, "The Myths and Realities of Universal Service: Revisiting the Justification for the Current Subsidy Structure," PFF, January 2005, at 17 and 121).

[213] An example is when AT&T introduced its digital-one-rate plan in May 1998, which was the first plan to include a large quantity of monthly minutes at a fixed rate and no long distance charges when used on the operator's network. *See Fourth Report*, at 10155, and *Fifth Report*, at 17677-78.

various handsets and policies on handset pricing.[214] AT&T Wireless's Digital One Rate plan, introduced in May 1998, is one notable example of an independent pricing action that altered the market to the benefit of consumers.[215] Today all of the nationwide operators offer some version of a national rate pricing plan in which customers can purchase a bucket of minutes to use on a nationwide or nearly nationwide network without incurring roaming or long-distance charges.

98. Since 2003, U.S. providers have stepped up efforts to take on more customers through "family plan" packages.[216] In family plan offerings, subscribers sign up for two lines and then have the option of adding additional lines at reduced prices. The lines share the available minutes on the plan jointly. All the nationwide carriers now offer family plans, with the initial two lines usually costing at least $60 a month, and each additional line costing an extra $10 to $20.[217] One report explained the attractiveness of such plans to carriers: "Family plans were designed to add new customers cheaply by encouraging people to give phones to their children or older relatives as carriers race to sign up the remaining roughly 40 percent of the population that do not already have cellphones. These plans tend to bring in less revenue per user than single accounts but the hope is that whole families are less inclined than individuals to switch to rival services and that children will stay loyal to the operator as they get older."[218]

2. Prepaid Service

99. In the United States, most mobile telephone subscribers pay their phone bills after they have incurred charges (known as postpaid service). Prepaid service, in contrast, requires customers to pay for a fixed amount of minutes prior to making calls. Although prepaid plans are considered a good way to increase penetration rates, they typically produce lower ARPUs and higher churn rates in comparison to postpaid service.[219] For these reasons, the industry generally has not heavily promoted prepaid offerings in the past.[220] However, the pool of unsubscribed customers qualified for postpaid plans[221] has declined to the point where prepaid offerings, which do not require credit checks, seem more attractive to

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[214] We also note that early termination fees are a widespread phenomenon in the marketplace. The Commission has initiated two separate proceedings on this matter. *See* "Wireless Telecommunications Bureau Seeks Comment on Petition for Declaratory Ruling Filed by CTIA Regarding Whether Early Termination Fees are 'Rates Charged' Within 47 U.S.C. Section 332(c)(3)(A)," *Public Notice*, 20 FCC Rcd 9100 (2005); "Wireless Telecommunications Bureau Seeks Comment on Petition for Declaratory Ruling Filed by SunCom, and Opposition and Cross-Petition for Declaratory Ruling Filed by Debra Edwards, Seeking Determination of Whether State Law Claims Regarding Early Termination Fees are Subject to Preemption Under 47 U.S.C. Section 332(c)(3)(A)," *Public Notice*, 20 FCC Rcd 9103 (2005).

[215] *See AT&T Launches First National One-Rate Wireless Service Plan*, News Release, AT&T Corp., May 7, 1998.

[216] *Family Plans Reflect Slowing Cell Growth*, REUTERS, Mar. 27, 2005.

[217] Phil Cusick and Richard Choe, *Wireless Growth: It's a Family Affair*, Bear Stearns, Equity Research, Jan. 26, 2005, at 4.

[218] *Family Plans Reflect Slowing Cell Growth*, REUTERS, Mar. 27, 2005.

[219] *Diamond in the Rough*, at 5. But prepaid subscribers have lower levels of bad debt, are cheaper to acquire, and pay more on a per-minute basis than postpaid subscribers. *Id.*, at 5. "Prepaid offerings will almost certainly have a detrimental effect on key wireless metrics such as ARPU, churn and MOUs. Ultimately, however, if prepaid service can add to profitability and free cash flow and generate a respectable return on investment, it is worth pursuing." *Id.*, at 6.

[220] *Pay First*; Yuki Noguchi, *The Push Behind Prepaid*, WASHINGTON POST, June 2, 2005, at D01 ("*The Push Behind Prepaid*").

[221] Only about 58 percent of the US population has prime credit. *Diamond in the Rough*, at 4.

carriers.[222] In response, some carriers have introduced new prepaid plans, or entire brands.[223] In some cases, they are tailoring their offerings to suit segments of the market that do not want or cannot get a traditional cellular plan, particularly the youth market.[224] One survey found that 39 percent of teen cell phone users use prepaid plans.[225]

100. The result of these efforts has been a significant rise in the percentage of wireless users who subscribe to prepaid plans. Analysts estimate the prepaid base to represent between 8 and 11 percent of U.S. subscribers at the end of 2004,[226] a substantial increase from the figure of 6 percent reported here for the last two years.[227] Among the nationwide carriers, T-Mobile had 11.4 percent of its subscribers on prepaid plans, Cingular Wireless had 7 percent, and Verizon Wireless had 5.5 percent.[228] Nextel offers prepaid plans through its subsidiary brand, Boost Mobile; Sprint PCS does not offer prepaid plans itself, but partners with third-party resellers to market prepaid offerings.[229]

3. Mobile Data Pricing

101. As noted in the *Ninth Report*, handset-based mobile data applications such as text messaging, multimedia messaging services, ringtones, and games are marketed to consumers primarily as an add-on to mobile voice service.[230] During the past year carriers continued to experiment with a mix of different methods for pricing such handset-based mobile data services, including pricing based on kilobytes consumed, a flat rate for each use or download of an application ("pay-as-you-go"), volume discounts on packages or bundles of an application, and unlimited use pricing.[231] Use of these pricing options varies by type of application as well as by provider, with providers frequently offering customers a choice of pricing options for a particular application. In addition to allowing customers to purchase particular applications on a stand-alone or *a la carte* basis, carriers also offer bundled offerings that include various types and combinations of mobile data services. As in the past, mobile data pricing continues to be characterized by considerable complexity due to the diversity of pricing options.[232]

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[222] *Pay First.* However, not all carriers find prepaid that attractive. According to Verizon Wireless, "we want our customers to be postpaid...It's a better business proposition." *Id.*

[223] *See* Section III.B.2, Resale/MVNO Providers, *supra*. According to one analyst, "each of the major carriers has recently launched or re-launched its prepaid service, which is another move to increase penetration of lower income brackets at the expense of ARPU and margins." Simon Flannery and Vance Edelson, *Wireless Carriers Susceptible to Slowing Industry Growth*, Morgan Stanley, Equity Research, May 25, 2005, at 2.

[224] *Pay First. See, also, The Push Behind Prepaid* ("In the next year, companies plan introductions of a slew of services offering some form of prepaid service").

[225] COMMUNICATIONS DAILY, Aug. 13, 2004, at 10 (citing a Coinstar Teen Poll).

[226] John Byrne, *Kagan Wireless Projections 2004-2014*, KAGAN WIRELESS MARKET STATS, May 27, 2005, at 3 (10.8 percent); *Diamond in the Rough*, at 4 (10 percent); Jason Armstrong, *et al., Shades of Grey in Prepaid*, Goldman Sachs, Equity Research, Apr. 12, 2005, at 1 (8 percent).

[227] *Ninth Report*, at 20654; *Eighth Report*, at 14830.

[228] David Janazzo *et al., US Wireless Matrix 4Q04*, Merrill Lynch, Equity Research, Mar. 4, 2005, at 17 ("*US Wireless Matrix 4Q04*").

[229] *See* Section III.B.2, Resale/MVNO Providers, *supra*.

[230] *Ninth Report*, at 20645.

[231] *Id*, at 20646.

[232] *Id. See, also*, Sandeep Junnarkar, *A Dizzying Array of Options for Using the Web on Cellphones*, NEW YORK TIMES, June 23, 2005 ("*Options for Using the Web on Cellphones*").

102. Communications data services such as text messaging, photo messaging, and other multimedia messaging services tend to be priced in similar ways. All the nationwide carriers allow customers to send and receive text messages on a pay-as-you-go basis for a flat rate per message sent or received, and in addition they typically offer customers the option of purchasing text messaging packages for a fee that affords customers a lower unit price per message as compared with the flat pay-as-you-go rate.[233] Similarly, Cingular and T-Mobile offer photo messaging on both a pay-as-you-go basis and in discounted packages, albeit at higher rates per message as compared with text messaging.[234] Other carriers also offer unlimited text messaging or photo messaging for a flat monthly fee.[235] In addition to *a la carte* offerings, some carriers include various packages and combinations of text and multimedia messaging services as part of a bundled offering with a monthly mobile Internet access service plan and other mobile data services.[236]

103. As indicated in the *Ninth Report* carriers have tended to move away from kilobyte-based pricing of handset-based mobile data applications in favor of other pricing methods.[237] However, some carriers continue to use kilobyte-based pricing for downloadable applications such as ringtones, graphics, and games. For example, Cingular and Sprint charge customers for the kilobytes consumed to download a game or ringtone.[238] The kilobyte-based charge is on top of a one-time fee to download a game or ringtone and use it for an unlimited period. Other carriers, such as T-Mobile, typically charge just a one-time fee to purchase a ringtone or game.[239] Some carriers offer other pricing options for downloadable applications. For example, in addition to a one-time fee for unlimited use of a game, Verizon Wireless offers customers the option of paying a lower fee for a monthly subscription to the game.[240]

104. Aside from handset-based applications, carriers offer monthly mobile Internet access service packages for data users who access the Internet through laptops or Personal Digital Assistants ("PDAs"). The nationwide carriers continue to price mobile Internet access service packages in two

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[233] Cingular Wireless, *Media and Services* (visited May 26, 2005) <www.cingular.com>; Sprint, *Sprint PCS Vision* (visited May 26, 2005) <www.sprintpcs.com>; T-Mobile USA, *Services & Features* (visited May 26, 2005) <www.t-mobile.com>; Verizon Wireless, *Get It Now* (visited May 26, 2005) <www.verizonwireless.com>; Nextel, *Services* (visited June 16, 2005) <www.nextel.com>. Some carriers provide more specific information about pricing structures on their web sites than others. In cases where carrier web sites were less informative, phone calls to customer service representatives provided the basis for statements about the data pricing methods used by certain carriers.

[234] Cingular Wireless, *Media and Services* (visited May 26, 2005) <www.cingular.com>; T-Mobile USA, *Services & Features* (visited May 26, 2005).

[235] Sprint, *Sprint PCS Vision* (visited May 26, 2005) <www.sprintpcs.com>; Nextel, *Services* (visited June 16, 2005) <www.nextel.com>.

[236] Cingular Wireless, *Media and Services* (visited May 26, 2005) <www.cingular.com>; Sprint, *Sprint PCS Vision* (visited May 26, 2005) <www.sprintpcs.com>; Nextel, *Services* (visited June 16, 2005) <www.nextel.com>. *See also, Options for Using the Web on Cellphones.*

[237] *Ninth Report*, at 20646. *See, also*, Options for Using the Web on Cellphones.

[238] Cingular Wireless, *Media and Services* (visited May 26, 2005) <www.cingular.com>; Sprint, *Sprint PCS Vision* (visited May 26, 2005) <www.sprintpcs.com>. *See also, Options for Using the Web on Cellphones* (noting that Cingular Wireless, in contrast to other carriers, offers metered wireless data plans that price usage based on the number of megabytes downloaded).

[239] T-Mobile USA, *Services & Features* (visited May 26, 2005) <www.t-mobile.com>.

[240] Verizon Wireless, *Get It Now* (visited May 26, 2005) <www.verizonwireless.com>.

principal ways: based on the amount of megabytes consumed each month, or unlimited use pricing.[241] As noted in the Ninth Report, under the megabyte-based pricing scheme, the monthly rate per package increases with the amount of megabytes included in the package, but the volume discounts provided by larger packages result in a progressively lower price per megabyte.[242]

B. Non-Price Rivalry

105. Service providers in the mobile telecommunications market also compete on non-price characteristics such as coverage, quality of service, and ancillary services. Non-price competition is a response to consumer preferences and demand. Indicators of non-price rivalry include advertising and marketing, capital expenditures, technology deployment and upgrades, and the provision of ancillary services.

1. Technology Deployment and Upgrades

a. Overview

106. The subject of technology deployment and upgrades by U.S. mobile telecommunications carriers is properly analyzed under the heading of carrier conduct because of the Commission's market-based approach to managing spectrum for commercial mobile voice and data services. In particular, the Commission's policies allow mobile telecommunications carriers the freedom to choose among the various standards for second-generation and more advanced network technologies that are identified and described below. In contrast, the European Community mandated a single harmonized standard for second-generation mobile telecommunications services, and has also adopted a single standard for third-generation services.[243] Thanks to the flexibility afforded by the Commission's market-based approach, different U.S. carriers have chosen a variety of different technologies and associated technology migration paths, and competition among multiple incompatible standards has emerged as an important dimension of non-price rivalry in the U.S. mobile telecommunications market and a distinctive feature of the U.S. mobile industry model.

107. Theory and evidence suggest that allowing the use of multiple standards may have several pro-competitive advantages over standardization of wireless network technologies. Since the types of services tend to differ across technologies, use of multiple standards may result in greater product variety and greater differentiation of services offered by carriers using different technologies.[244] Diversified and heterogeneous services make it more difficult for carriers to coordinate their behavior so as to restrict competition with regard to pricing. Other potential pro-competitive advantages of multiple standards include greater technological competition and greater price competition between operators using different technologies.[245] In particular, competition between carriers using competing incompatible

[241] Cingular Wireless, *Data Connect* (visited June 16, 2005) <www.cingular.com>; Sprint, *Wireless Data* (visited June 16, 2005) <www.sprintpcs.com>; T-Mobile, *Internet Rate Plans* (visited June 16, 2005) <www.t-mobile.com>; Nextel, Data Access (visited June 16, 2005) <www.nextel.com>; Verizon Wireless, *Wireless Internet BroadbandAccess* (visited June 17, 2005) <www.verizonwireless.com>.

[242] *Ninth Report*, at 20648.

[243] Neil Gandal, David Salant, and Leonard Waverman, *Standards in Wireless Telephone Networks*, TELECOMMUNICATIONS POLICY, Vol. 27, 2003 ("*Standards in Wireless Telephone Networks*"). The authors note that, although the European Community backed away from mandating a single standard for third-generation services, the absence of a mandate has had little practical effect as all European mobile operators have opted for the same standard and migration path. *Id.*, at 330.

[244] *Id.*, at 329-330.

[245] *Id.*

technologies tends to put pressure on carriers to achieve sufficiently high adoption of their technology in order to ensure it survives the "standards war."[246] The pressure to fill their networks may lead carriers to enact price cuts and handset subsidies.[247] Finally, the adoption of a particular standard may enable one carrier, or a subset of carriers, to gain a temporary competitive advantage over rival carriers, which may also tend to undermine the incentive and the ability of carriers to coordinate their conduct in such a way as to restrict competition.

108. The following analysis of technology deployment and upgrades is divided into four parts. As background to examining the particular technological choices made by different carriers, Section IV.B.1.b provides an introduction to cellular network design and technology and identifies and describes the major digital technologies and associated migration paths. Section IV.B.1.c examines the specific technological choices made by mobile carriers that use the same spectrum bands, network design and technologies to offer both voice and data services. Section IV.B.1.d examines the impact of these choices on coverage by technology type. Finally, Section IV.B.1.e examines the technology deployment decisions of carriers with regard to data-only networks and services.

b. Background on Network Design and Technology

109. Cellular, PCS, and digital SMR networks use the same basic design. All use a series of low-power transmitters to serve relatively small areas ("cells"), and reuse spectrum to maximize efficiency.[248] In the past, cellular and SMR networks used an analog technology, while PCS networks were designed from the start to use a digital format. Digital technology provides better sound quality and increased spectral efficiency than analog technology. From a customer's perspective, digital service in the cellular band or SMR bands is virtually identical to digital service in the PCS band. Digital technology is now dominant in the mobile telephone sector, with approximately 97 percent of all wireless subscribers using digital service.[249]

110. The four main digital technologies used in the United States are: Code Division Multiple Access ("CDMA"), Global System for Mobile Communications ("GSM"), integrated Digital Enhanced Network ("iDEN"), and Time Division Multiple Access ("TDMA"). These four technologies are commonly referred to as Second Generation, or "2G," because they succeeded the first generation of analog cellular technology, Advanced Mobile Phone Systems ("AMPS").[250] As discussed in the *Seventh Report*, in light of industry developments this report no longer distinguishes between TDMA and GSM networks in its analysis of digital coverage, but considers the two as one migration path towards more

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[246] Carl Shapiro and Hal R. Varian, *Information Rules*, Harvard Business School Press, 1999, at 261-296; Simon Flannery *et al.*, *3G Economics a Cause for Concern*, Morgan Stanley, Equity Research, Feb. 1, 2005, at 11 ("*3G Economics a Cause for Concern*").

[247] *3G Economics a Cause for Concern*, at 10-11.

[248] PCS, digital SMR, and cellular networks are all "cellular" systems since all divide service regions into many small areas called "cells." Cells can be as small as an individual building or as large as 20 miles across. Each cell serves as a base station for mobile users to obtain connection to the fixed network and is equipped with its own radio transmitters/receivers and associated antennas. Service regions are divided into cells so that individual radio frequencies may be reused in different cells ("frequency reuse"), in order to enhance frequency efficiency. When a person makes a call on a wireless phone, the connection is made to the nearest base station, which connects with the local wireline phone network or another wireless operator. When a person is using a wireless phone and approaches the boundary of one cell, the wireless network senses that the signal is becoming weak and automatically hands off the call to the base station in the next cell. *See Sixth Report*, at 13361, note 55.

[249] *See* SectionVI.B.1, Subscriber Growth, *infra*.

[250] *See* note 260, *infra*, for a discussion of the cellular analog requirement and its sunset.

advanced digital capabilities. The large U.S. carriers intend to phase out TDMA in the foreseeable future; however, we recognize that TDMA as currently deployed will continue to be used by millions of subscribers for a number of years.[251]

111. Beyond the 2G digital technologies, mobile telephone carriers have been deploying next-generation network technologies[252] that allow them to offer mobile data services at higher data transfer speeds and, in some cases, to increase voice capacity.[253] For TDMA/GSM carriers, the first step in the migration to next-generation network technologies is General Packet Radio Service ("GPRS" or "GSM GPRS"), a packet-based data-only network upgrade that allows for faster data rates by aggregating up to eight 14.4 kbps channels.[254] Beyond GPRS, most U.S. TDMA/GSM carriers have begun to deploy Enhanced Data Rates for GSM Evolution ("EDGE") technology, which offers average data speeds of 100-130 kbps. Wideband CDMA ("WCDMA," also known as Universal Mobile Telecommunications System, or "UMTS") is the next migration step for GSM carriers beyond EDGE and allows maximum data transfer speeds of up to 2 Mbps and average user speeds of 220-320 kbps.[255] Finally, deployment of WCDMA with HSDPA (High Speed Data Packet Access) technology will allow average download speeds of 400-700 kbps with burst rates of up to several Mbps.[256]

112. Many CDMA carriers have upgraded their networks to CDMA2000 1xRTT (also referred to as "CDMA2000 1X" or "1xRTT") , a technology that doubles voice capacity and delivers peak data rates of 307 kbps in mobile environments and typical speeds of 40-70 kbps.[257] The next step in the CDMA migration beyond 1xRTT is CDMA2000 1xEV-DO (evolution-data only, "EV-DO"), which allows maximum data throughput speeds of 2.4 Mbps.[258] The more advanced technologies on the CDMA migration path are backwards compatible, whereas WCDMA is incompatible with GSM and TDMA.[259]

c. Technology Choices and Upgrades of Mobile Telephone Carriers

113. Of the five nationwide mobile telephone operators, Cingular, and T-Mobile use TDMA/GSM as their 2G digital technology, Sprint PCS and Verizon Wireless use CDMA, and Nextel

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[251] *See, for example,* Cingular Wireless, SEC Form 10-K, filed Mar. 7, 2005, at 70 (stating that "we [will] continue to sell and market TDMA services for the foreseeable future."). *See, also, Seventh Report*, at 13011.

[252] For purposes of this report, all of the network technologies beyond 2G that carriers have deployed, as well as those that they plan to deploy in the future, are generally referred to as "next-generation network technologies." The International Telecommunication Union ("ITU") has defined 3G network technologies as those that can offer maximum data transfer speeds of 2 megabits per second ("Mbps") from a fixed location, 384 kbps at pedestrian speeds, and 144 kbps at traveling speeds of 100 kilometers per hour. *See Fifth Report*, at 17695. There is ambiguity among other industry players, however, as to which network technologies constitute 3G and which constitute interim technologies, often labeled "2.5G." *See Seventh Report*, at 12990 and 13038. Therefore, this report uses a more general label to describe all of the technologies beyond 2G.

[253] *See* Section IV.B.1.c, Technology Choices and Upgrades of Mobile Telephone Carriers, *infra.*

[254] *See Seventh Report*, at 12990. This upgrade is also labeled GSM/GPRS because many TDMA/GSM carriers are upgrading their TDMA markets with GSM and GPRS simultaneously.

[255] *Wireless Broadband Access Task Force Report*, at 25.

[256] *Id.*.

[257] *See Seventh Report*, at 12990; *Ninth Report*, at 20650.

[258] *Id.*

[259] *Standards in Wireless Telephone Networks*, at 328.

uses iDEN.[260] All five nationwide mobile carriers, together with other U.S. mobile carriers, have continued to deploy next-generation network technologies over the past year.

114. Verizon Wireless has deployed 1xRTT technology throughout "virtually all" of its network.[261] In addition, since October 2003, Verizon has launched EV-DO technology in 31 major U.S. cities, covering over 75 million people.[262] With the EV-DO service, subscribers can access the Internet while mobile via a wireless modem card connected to a laptop computer or PDA, or they can download a range of multimedia content and advanced applications on certain mobile handset models.[263] Furthermore, when EV-DO subscribers travel to other parts of the country where EV-DO networks have not been deployed, they can seamlessly roam on and access Verizon's 1xRTT network because the more advanced technologies on the CDMA migration path are backwards compatible.[264] Verizon plans to expand its EV-DO coverage to a total of 150 million people by the end of 2005.[265] Verizon reports that its EV-DO delivers average user speeds of 400-700 kbps.[266] Other notable EV-DO deployments include launches by Alltel in Akron and Cleveland, OH, and by Midwest Wireless in Olmsted County, MN.[267]

115. Sprint, the other nationwide CDMA carrier, has deployed 1xRTT across its entire network footprint and began rolling out EV-DO technology in July 2005.[268] Sprint initially deployed its EV-DO network to business districts and major airports in 34 U.S. cities. The company plans to expand its EV-DO network to 143 million people by the end of 2005, and to offer EV-DO-based services on a variety of devices in 60 metropolitan areas by early 2006.[269] As discussed in the *Ninth Report*, the company announced in June 2004 its plans to deploy EV-DO technology over its network during 2005, rather than wait for 1xEV-DV technology to become commercially available.[270] Sprint's change in strategy with regard to deployment of technologies on the CDMA migration path can be seen as a

[260] In addition, all operators using cellular spectrum must deploy AMPS, an analog technology, throughout the part of their networks using cellular spectrum. *See* 47 C.F.R. §§ 22.901, 22.933. In 2002, the Commission decided to eliminate the requirement after a five-year transition period. Year 2000 Biennial Regulatory Review – Amendment of Part 22 of The Commission's Rules to Modify or Eliminate Outdated Rules Affecting The Cellular Radiotelephone Service and Other Commercial Mobile Radio Services, *Report and Order*, 17 FCC Rcd 18401, 18414 (2002).

[261] Verizon Wireless, SEC Form 10-K, filed Mar. 14, 2005, at 3.

[262] *On-Demand in the Palm of Your Hand: Verizon Wireless Launches "VCAST" – Nation's First and Only Consumer 3G Multimedia Service*, Press Release, Verizon Wireless, Jan. 7, 2005; *Verizon Wireless Launches High-Speed Wireless Broadband Network in Tallahassee, Florida Area*, Press Release, Verizon Wireless, Feb. 28, 2005; *Verizon Wireless Extends Rollout of 3G Network in St. Louis, Missouri*, Press Release, Verizon Wireless, June 3, 2005.

[263] *Wireless Broadband Access Task Force Report*, at 25.

[264] *See Ninth Report*, at 20652.

[265] *Wireless Broadband Access Task Force Report*, at 25.

[266] *Verizon Wireless Extends Rollout of 3G Network in St. Louis, Missouri*, Press Release, Verizon Wireless, June 3, 2005.

[267] Sue Marek, *Smaller Operators Mull 3G Upgrade*, WIRELESS WEEK, Apr. 15, 2005; Susan Rush, *Midwest Wireless Brings EV-DO to Minnesota*, WIRELESS WEEK, Apr. 21, 2005.

[268] *See Ninth Report*, at 20652; *Sprint Begins Launch of EV-DO Wireless High-Speed Data Service*, Press Release, Sprint, July 7, 2005.

[269] *Sprint Begins Launch of EV-DO Wireless High-Speed Data Service*, Press Release, Sprint, July 7, 2005.

[270] *See Ninth Report*, at 20653.

competitive response to Verizon's EV-DO offering, and thus provides a clear-cut example of intense non-price rivalry.[271]

116. Prior to its merger with Cingular in October 2004, AT&T Wireless had deployed EDGE technology across its entire GSM/GPRS network footprint, covering approximately 215 million people.[272] AT&T Wireless had also launched UMTS (or WCDMA) networks in six U.S. cities: Seattle, San Francisco, Phoenix, Detroit, San Diego, and Dallas.[273] After the completion of its acquisition of AT&T Wireless, Cingular incorporated the former AT&T Wireless GSM/GPRS/EDGE and UMTS networks into its GSM/GPRS network footprint.[274] In addition, Cingular announced in November 2004 that it plans to deploy UMTS with HSDPA technology in 15-20 major U.S. markets by the end of 2005.[275] It has been reported that this upgrade as an effort to compete with Verizon Wireless's EV-DO network, which offers speeds similar to or slightly below HSDPA and faster than UMTS.[276]

d. Coverage by Technology Type

117. To date, 285 million people, or 99.8 percent of the total U.S. population, live in counties where operators offer digital mobile telephone service, using CDMA, TDMA/GSM, or iDEN (including their respective next generation technologies), or some combination of the three.[277] These counties make up 89 percent of the total land area of the United States. To estimate the current levels of deployment of the three main digital mobile telephone technologies individually, we have prepared maps of each technology, which combine the network coverage of all of the relevant operators.[278] We have also prepared maps showing the extent of next generation network technology deployment.[279]

118. CDMA has been launched in at least some portion of counties containing 280 million people, or roughly 98 percent of the U.S. population, while TDMA/GSM has been launched in at least some portion of counties containing 278 million people, or 97 percent of the U.S. population.[280] To date, digital SMR operators have launched iDEN-based service in at least some portion of counties containing over 262 million people, or approximately 92 percent of the U.S. population.[281]

119. CDMA 1xRTT and/or 1xEVDO has been launched in at least some portion of counties

[271] *Id.*

[272] *See Ninth Report*, at 20651.

[273] *Id.*

[274] As of the end of 2004, Cingular had deployed GSM/GPRS technology across its entire network footprint and 65% of its subscriber base was equipped with GSM/GPRS devices. Cingular Wireless LLC, SEC Form 10-K, filed Mar. 7, 2005, at 8. Just prior to its merger with AT&T Wireless, Cingular had deployed across EDGE technology to two-thirds of its covered network POPs. Cingular Wireless LLC, SEC Form 10-Q, filed Aug. 5, 2004, at 23.

[275] Mike Dano, *Cingular Wireless Takes Worldwide HSDPA Lead with DoCoMo Delay*, RCR WIRELESS NEWS, May 16, 2005, at 1.

[276] *Id.*

[277] Broadband PCS-based and digital SMR-based coverage are estimated using counties, and cellular-based coverage is estimated using CMAs. The caveats mentioned in Section II.B, Sources of Information, and in Section II.C.1, Number of Mobile Telephone Competitors, *supra*, apply to this analysis as well.

[278] *See* Appendix B, Maps 5-8, *infra*.

[279] *See* Appendix B, Map 9, *infra*.

[280] *See* Appendix A, Table 7, *infra*.

[281] *Id.*

containing 278 million people, or roughly 97 percent of the U.S. population, while GPRS, EDGE, and/or UMTS has been launched in at least some portion of counties containing 267 million people, or about 94 percent of the U.S. population.[282]

e. Data-Only Networks and Technology Deployment

120. In addition to the networks discussed above, which mobile telephone carriers use to offer both voice and data services, mobile carriers operate a number of other types of networks in order to provide IP-based broadband, as well as narrowband, data-only commercial mobile services.

121. As mentioned above, since August 2004, Clearwire has launched mobile broadband service in twelve U.S. cities and plans to roll out service to four additional markets in the near future.[283] To offer the service, Clearwire is using OFDM technology developed and manufactured by its equipment subsidiary, NextNet Wireless, and spectrum in the 2.5 GHz BRS/EBS band. Because it allows signals to pass through buildings and trees, OFDM technology enables carriers to offer wireless broadband services without a direct line-of-sight between the transmitter and the receiver.[284] Using OFDM technology, Clearwire has eliminated the need for customers to attach an antenna to their rooftop, as is required for most fixed broadband services, and instead allows its subscribers to access the Internet with "plug-and-play" modem devices connected to a personal or laptop computer at downstream speeds ranging from 512 kbps to 1.5 Mbps.[285] Customers can transport these devices to other locations where a network signal is available and in some cases use them while traveling at high speeds.[286] OFDM-based wireless broadband services also typically eliminate the need for a carrier to send technicians to install equipment at the end user's house or building.

122. In October 2004, Clearwire announced a partnership with Intel in which Clearwire will deploy equipment based on the 802.16 WiMax standard, of which Intel has been a major proponent and developer.[287] WiMax equipment also uses OFDM technology; however, because the equipment will be standardized, it will be interoperable across networks and is expected to be less expensive than proprietary standards.[288] Once the 802.16e standard has been finalized, NextNet plans to manufacture end-user equipment that will include 802.16e chipsets manufactured by Intel. The 802.16e version of WiMax will allow wireless broadband services to be offered on a wide-area mobile, rather than a fixed, basis.[289]

123. As mentioned in the *Ninth Report*, Nextel launched a trial wireless broadband service in

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[282] *See* Appendix B, Map 9, *infra*.

[283] *See* Section III.B.3, *supra*; *Wireless Broadband Access Task Force Report*, at 23; Clearwire, *Now Serving/Coming Soon* (visited June 3, 2005) <http://www.clearwire.com>. In addition to Clearwire, several small wireless broadband providers operating in the BRS/EBS band have begun to roll out non-line-of-sight OFDM equipment, some of which is manufactured by NextNet Wireless, to their customers. See Section III.B.3, *supra*.

[284] *Wireless Broadband Access Task Force Report*, at 19-20.

[285] Clearwire, *Service Plans* (visited June 3, 2005) <http://www.clearwire.com>.

[286] "Delivering the Future of Broadband Wireless Today," Presentation by Guy Kelnhofer, President and CEO, NextNet Wireless, submitted at the Wireless Broadband Forum, May 19, 2004, Federal Communications Commission, Washington, DC.

[287] *Wireless Broadband Access Task Force Report*, at 23.

[288] *Id.*, at 19-20; Melanie Reynolds, *Getting a Fix on WiMax*, ELECTRONICS WEEKLY, Feb. 23, 2005; Mark Boslet, *Curtain Rises for WiMax Broadband*, DOW JONES NEWSWIRES, Feb. 2, 2005.

[289] *Wireless Broadband Access Task Force Report*, at 23.

the Raleigh-Durham, N.C. market in February 2004 and began offering the service on a commercial basis in April 2004.[290] The service used Flash-OFDM (orthogonal frequency division multiplexing) technology developed by Flarion Technologies to provide typical download speeds of 950 kbps to 1.5 Mbps, with burst rates of up to 3.0 Mbps.[291] Customers could purchase either a wireless modem for a personal computer or a wireless modem card to use with a laptop computer. In February 2005, however, shortly after announcing its proposed merger with Sprint, Nextel stated that it would end its Flarion service in Raleigh in June 2005. In January 2005, Sprint joined the WiMAX Forum, and analysts speculate that the new, merged company will use its BRS spectrum to deploy WiMAX instead of or in addition to Flash-OFDM technology.[292]

124. Among the narrowband data-only providers, several carriers use paging spectrum to operate networks that offer traditional one-way paging services.[293] Some paging carriers also operate data networks using narrowband PCS spectrum, which allow them to offer two-way messaging services. Narrowband PCS carriers use the ReFLEX technology protocol, which can transmit data at speeds ranging from 3.2 to 25 kbps.[294] USA Mobility, the largest U.S. paging company formed from the merger of Metrocall and WebLink Wireless in November 2004, offers both traditional paging services and two-way messaging services. The company's narrowband PCS network uses ReFLEX technology developed by Motorola and covers 90 percent of the U.S. population.[295]

125. Two other carriers, Cingular Wireless and Motient Corp. ("Motient"), operate two-way data networks using the 900 MHz SMR and 800 MHz SMR spectrum bands, respectively. Cingular Wireless's network, known as the Mobitex, is a packet-switched radio technology that provides always-on, two-way messaging and data delivery and covers 93 percent of the urban business population in the U.S.[296] The Motient (formerly ARDIS) network includes more than 2,200 base stations and provides coverage in 400 U.S. cities covering 90 percent of the U.S. business population.[297] These networks have provided a variety of mobile data services to personal digital assistants ("PDAs") and other handheld devices, including Blackberry devices made by Research in Motion (RIM). However, over the past year, RIM discontinued the production of the non-voice Blackberry devices that operate on these networks.[298]

126. As discussed in the *Ninth Report*, Space Data is using narrowband PCS spectrum in the 900 MHz band and balloon-borne platforms, called SkySitesTM, to roll out a commercial telemetry service.299 Although national weather services have been using balloon systems to transmit atmospheric

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[290] *See Ninth Report*, at 20653; *Wireless Broadband Access Task Force Report*, at 27.

[291] *Id.*

[292] *Wireless Broadband Access Task Force Report*, at 27.

[293] *See* Section III.A, Services and Product Market Definition, and Section III.B.3, Data-Only Providers, *supra*, for a discussion of traditional paging services and paging carriers.

[294] *See Ninth Report*, at 20654.

[295] USA Mobility, *About USA Mobility – Quick Corporate Fact Sheet* (visited June 3, 2005) <http://www.usamobility.com/about/facts.htm>.

[296] *See Ninth Report*, at 20655.

[297] *See Ninth Report*, at 20655; eAccess Solutions, Inc., *DataTAC Network Coverage* (visited June 3, 2005) <http://www.eaccess.com/wireless_tech/datatac.htm>.

[298] RIM, *Blackberry Wireless Devices* (visited June 3, 2005) <http://www.rim.net/products/handhelds/index.shtml>; Motient Corp, SEC Form 10-K, filed Mar. 31, 2005, at 4.

[299] *See Ninth Report*, at 20655. *See also* Section III.B.3, Data-Only Providers, *supra*.

data to ground-based weather stations for decades, Space Data is the first to make commercial use of this platform.300 In April 2004, Space Data launched its network in West Texas to provide wireless telemetry services to oil and gas companies, and has since expanded its network to cover all of Texas, Louisiana, and Oklahoma, as well as portions of New Mexico, Arizona, California, and the Gulf of Mexico.301

2. Capital Expenditures

127. Capital expenditures, alternatively called "capital spending" or abbreviated to "capex," are funds spent during a particular period to acquire or improve long-term assets such as property, plant, or equipment.[302] In the mobile telephone industry, capex consists primarily of spending to expand and improve the geographic coverage of networks, increase the capacity of existing networks so they can serve more customers, and improve the capabilities of networks (by allowing higher data transmission speeds, for example).[303] One analyst estimated that the wireless industry spent roughly $22 billion on capex in 2004, an increase of 12 percent from the $19 billion spent in 2003, reversing a two-year trend of declining wireless capex.[304] One analyst has argued that capex spent to expand coverage is now mostly over and that future capex will be spent largely on technological upgrades and capacity needs.[305]

3. Roaming

128. All mobile calling plans specify a calling area – such as a particular metropolitan area, a state, a region, the carrier's entire network, or the entire United States – within which the subscriber can make a call without incurring additional charges. When a subscriber exits this area, or "roams," he or she may incur additional charges for each minute of use. Sometimes these roaming charges go directly to the subscriber's carrier, and sometimes the charges are used to pay a carrier other than the subscriber's, on whose network the subscriber was roaming.[306] This source of revenue is particularly important to many rural and smaller carriers.[307] However, roaming revenues are under pressure as roaming rates have declined and nationwide carriers continue to expand into smaller communities.[308]

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[300] *See Ninth Report*, at 20655.

[301] *Space Data Corporation Launches New Wireless Telemetry Service in West Texas Oil and Gas Fields*, Press Release, Space Data Corporation, Apr. 14, 2004; *Space Data's SkySite® Network Takes Off Over South-Central U.S.*, Press Release, Space Data Corporation, Oct. 19, 2004.

[302] CNNMoney, *Money 101 Glossary* (visited Mar. 20, 2003) <http://money.cnn.com/services/glossary/c.html.>. There are differing opinions on what constitutes capital spending versus non-capital spending.

[303] *Eighth Report*, at 14818.

[304] *US Wireless Matrix 4Q04*, at 38; *Ninth Report*, at 20656. While this report is retrospective, the Commission plans to examine in next year's report the possible impact of Hurricane Katrina on CMRS-related capital expenditures.

[305] *Ninth Report*, at 20656. *See, also, Wireless 411*, at 68.

[306] The fees that a carrier collects from non-subscribers using its network are called "outcollect" fees, and the fees that a carrier pays for its subscribers to roam on other networks are called "incollect" fees. Margo McCall, *Roaming Feeds Regional Carriers*, WIRELESS WEEK, Mar. 26, 2001, at 23.

[307] *See Wireless 411*, at 40 (Table 19: Roaming Revenues as a Percentage of Total Service Revenues).

[308] Matt Richtel, *Where Only the Antelope Roam*, NEW YORK TIMES, Nov. 6, 2004. According to John Stanton, the chief executive of Western Wireless, the per-minute roaming charge that national carriers pay to regional companies has dropped to 16 cents a minute, on average, from as high as $1 in the 1990's. Matt Richtel, *Where Only the Antelope Roam*, NEW YORK TIMES, Nov. 6, 2004. *See, also, Wireless 411*, at 33 ("Regional operators have (continued....)

129. CTIA reported that roaming revenues for the mobile telephone industry increased over the past year, from $3.8 billion in 2003 to $4.2 billion in 2004, reversing the trend of the last few years.[309] However, the contribution of roaming revenues to total service revenues continued its decline, from 4.3 percent reported in 2003 to 4.1 percent in 2004, and down from over 10 percent five years ago.[310]

4. Advertising and Marketing

130. Firms may engage in advertising and marketing either to inform consumers of available products or services or to increase sales by changing consumer preferences. Mobile telecommunications service is an "experience good,"[311] and in general, advertising for an experience good tends to be persuasive rather than informational in nature.

131. As a group, the five nationwide operators spent a total of $3.9 billion on advertising in 2004, up 9 percent from 2003, and up 24 percent from 2002.[312] Advertising expenditures - including television, radio, newspaper, magazine, and outdoor spending - were roughly 4.5 percent of wireless service revenues.[313] The $3.9 billion figure places wireless services among the highest-spending industry groups.[314] The top three network TV advertisers in 2004 were Sprint PCS, Verizon Wireless, and Cingular, ahead of McDonald's, Wendy's and Burger King.[315] Advertising expenditures per subscriber fell in 2004, which one analyst attributes to the growth of the wireless subscriber base.[316]

5. Quality of Service

132. As U.S. mobile penetration moves closer to the saturation point, competitive pressure to attract new customers and retain existing customers has resulted in concerted efforts by carriers to improve service quality.[317] As in years past, network investment remains a key element of carriers' strategies for improving service quality. Section IV.B.1 above of this report, as well as similar sections in previous reports, detail the digital and next-generation upgrades that carriers have been making to improve the coverage, capacity, and capabilities of their networks, while Section IV.B.2 provides an estimate of total spending by wireless carriers on network expansion and improvements.[318] By increasing

(Continued from previous page) ———————————
generally seen annual declines in roaming revenues, as growth in roaming minutes has been more than offset by declines in roaming rates").

[309] *See* Appendix A, Table 1, *infra*.

[310] *Id.*

[311] An experience good is a product or service that the customer must consume before determining its quality. *See* Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization* (3rd ed., Addison, Wellsley, Longman, Inc., 1999), at 484.

[312] Simon Flannery, *et al.*, *Wireless Carrier Advertising Remains Intense*, Morgan Stanley, Equity Research, May 18, 2005, at 2.

[313] *Id.*, at 3.

[314] *Id.*, at 2.

[315] *Id.*, at 2.

[316] *Id.*, at 4 ("Of course, advertising also serves to retain existing subscribers, not just to bring in new gross adds. Since it is generally harder to bring in a new sub than to keep an old one, we would expect ad expense per subscriber to trend down as subscriber bases grow, as has been the case.")

[317] The Associated Press, *Sprint Looks to Fix Customer Problems*, NEW YORK TIMES, Mar. 10, 2005 ("*Sprint Looks to Fix Customer Problems*").

[318] *See Ninth Report*, at 20657.

network coverage and call handling capacity and improving network performance and capabilities, carriers' investments in network deployment and upgrades have the potential to result in service quality improvements that are perceptible to consumers, such as better voice quality, higher call-completion rates, fewer dropped calls and deadzones, additional calling features, more rapid data transmission, and advanced data applications. As noted in the *Ninth Report*, one of the principal ways carriers have improved network coverage and quality is by increasing the number of cell sites.[319] In addition, carriers have been deploying micro-cell sites, or antennas that provide coverage in highly localized areas, to improve coverage in locations such as tunnels, airports, and certain neighborhoods.[320] Some carriers have also used devices that amplify cellular signals, called repeaters, to improve indoor coverage in office buildings, shopping malls, and convention centers.[321]

133. Carriers can increase capacity and thereby improve service quality not only by investing in their networks, but also by acquiring additional spectrum. As detailed in Sections III.D and III.E.1 above, carriers have added to their spectrum holdings through the Commission's spectrum auctions, the purchase of licenses in the secondary market, and mergers and acquisitions. Cingular's acquisition of AT&T Wireless is a key example of this strategy. The two carriers argued that by combining their spectrum holdings and network infrastructure, the merged company would achieve an increase in capacity that would enable it to offer service with better voice and data quality, fewer dropped calls, and lower blocking rates, especially during peak call hours.[322] However, while Cingular continues to maintain that the merger will ultimately improve coverage, it has emphasized that the promised benefits will not be fully realized until the integration of the two carriers' networks is completed in June 2006.[323]

134. In addition to investing in network infrastructure and spectrum, carriers continue to pursue marketing strategies designed to differentiate their service from rival offerings with regard to consumer perceptions of service quality. Previous reports cited Verizon Wireless's "Can You Hear Me Now?" advertising campaign as an example of an attempt at such brand differentiation based on superior network coverage, reliability and voice quality.[324] Analysts continue to single out Verizon Wireless as being mainly differentiated from its rivals by its network quality.[325] A recent survey of wireless subscribers found that 40 percent of Verizon Wireless customers indicated that network quality was their main reason for choosing Verizon.[326] As indicated in the *Eighth Report*, brand differentiation works in tandem with quality-enhancing network investment to create a competitive advantage in attracting and retaining subscribers.[327]

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[319] *Id.*, at 20657-20658.

[320] Li Yuan, *Why You Still Can't Hear Me Now*, WALL STREET JOURNAL, May 25, 2005, at D1 ("*Why You Still Can't Hear Me Now*").

[321] *Id.*

[322] *Cingular-AT&T Wireless Order*, at 21601.

[323] *Why You Still Can't Hear Me Now*; Li Yuan and Jesse Drucker, *How Cellular Services Rank On Complaints*, WALL STREET JOURNAL, Mar. 29, 2005, p. D1.

[324] *See Eighth Report*, at 14825.

[325] Simon Flannery *et al.*, *1Q05 Trend Tracker: The Telecom Conundrum*, Morgan Stanley, Equity Research, June 8, 2005, at 24 ("*1Q05 Trend Tracker*"); *Ninth Report*, at 20658.

[326] Phil Cusick and Richard Choe, *Characteristics of Wireless Subscribers and Non-Users*, Bear Stearns, Equity Research, Feb. 2005, at 25.

[327] *See Eighth Report*, at 14824-14825.

135. T-Mobile introduced a new strategy for differentiating its service with regard to network quality in the past year. T-Mobile is the first national carrier to add an interactive "Personal Coverage Check" feature to its Web site that enables customers to check the quality of network coverage where they live and work before they purchase service.[328] T-Mobile's computerized mapping tool allows users to search on any street address or intersection in the United States and get a rating of the signal strength at that location and in the surrounding area. For each search, T-Mobile provides a color-coded map with eleven shades of coverage ranging from "none" to "great." According to T-Mobile, the top rating means that calls are rarely dropped.[329] T-Mobile has also made its new interactive maps available on computers in its stores, with signs urging customers to "put our coverage to the test before you sign up."[330] In contrast, although all carriers provide national or regional coverage maps to customers that show the cities where they provide some level of service, these coverage maps generally provide only a broad overview of a carrier's coverage.[331] Most carriers do not provide details about the quality of service in specific neighborhoods except when customers request such information from sales representatives.[332]

136. According to analysts, by providing potential customers with more accurate information and assurances about service quality, the new tool may help T-Mobile differentiate its service from those of its rivals.[333] In addition, it may enable T-Mobile to reduce churn and customer complaints by discouraging customers who live or work in areas with poor reception from signing up. T-Mobile's innovation may also put competitive pressure on other carriers to provide additional information about possible geographic variations in the quality of their network coverage. For example, Cingular offers an interactive mapping tool in its stores that enables customers to estimate the likelihood of coverage inside a building or a vehicle at a specific location, and the company has indicated that it intends to add the service to its Web site later in 2005.[334]

137. Carriers are also actively competing to attract and retain customers based on other dimensions of customer service. An example is cellphone repair and replacement. Sprint is rolling out an in-store repair service for customers who need to get their cellphones fixed.[335] Sprint planned to have repair shops in more than half of its 800 retail locations across the country by the middle of March 2005.[336] Some rival carriers, including Cingular Wireless and T-Mobile, have decided not to provide repair services in their stores, but instead let customers with malfunctioning cellphones call a toll-free number and have a replacement phone sent to them overnight.[337]

138. Consumer satisfaction surveys afford one means of gauging the effects of carrier

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[328] David Kesmodel, *T-Mobile Offers More Details On Coverage to Ease Concerns*, WALL STREET JOURNAL, Apr. 27, 2005 ("*T-Mobile Offers More Details On Coverage*").

[329] *Id.* More specifically, the top rating means that customers have a 95 percent chance of making a call without it being dropped. *Id.*

[330] *Id.*

[331] *Id. See, also*, Jeff Gelles, *Consumers Get Less Static on Cellular Coverage*, PHILADELPHIA INQUIRER, May 2, 2005 ("*Consumers Get Less Static on Cellular Coverage*").

[332] *T-Mobile Offers More Details On Coverage.*

[333] *Id.*

[334] *Id.*

[335] *Sprint Looks to Fix Customer Problems.*

[336] *Id.*

[337] *Id.*