Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)
	)
Implementation of Section 6002(b) of the	)
Omnibus Budget Reconciliation Act of	)
1993	)
	)
Annual Report and Analysis of	)
Competitive Market Conditions	)
With Respect to Commercial Mobile	)
Services	)

FOURTH REPORT

Adopted: June 10, 1999 **Released: June 24, 1999**

By the Commission;

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I. INTRODUCTION

A. Overview

In 1993 Congress created the statutory classification of Commercial Mobile Services[1] to promote the consistent regulation of mobile radio services that are similar in nature.[2] At the same time, Congress established the promotion of competition as a fundamental goal for CMRS policy formation and regulation. To measure progress toward this goal, Congress required the Federal Communications Commission ("Commission") to submit annual reports that analyze competitive conditions in the industry.[3] This report is the fourth of the Commission's annual reports on the state of CMRS competition.

This report follows the same general structure as the *Third Report*.[4] Since operators of different Commission-defined services are competing for customers against the providers of other types of services with increasing frequency, this report bases its analysis on a consumer-oriented view of wireless services by focusing on specific product categories, regardless of their regulatory classification. In some cases, this includes an analysis of offerings outside the umbrella of "services" specifically designated by the Commission as CMRS.[5] However,

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[1] Commercial Mobile Services came to be known of by the Commission as the Commercial Mobile Radio Services, or "CMRS".

[2] The Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, Title VI, § 6002(b), amending the Communications Act of 1934 ("*Communications Act*") and codified at 47 U.S.C. § 332(c) ("*1993 Budget Act*").

[3] "The Commission shall review competitive market conditions with respect to commercial mobile services and shall include in its annual report an analysis of those conditions. Such analysis shall include an identification of the number of competitors in various commercial mobile services, an analysis of whether or not there is effective competition, an analysis of whether any such competitors have dominant share of the market for such services, and a statement of whether additional providers of classes or providers in those services would be likely to enhance competition." *1993 Budget Act* codified at 47 U.S.C. § 332(c)(1)(C).

[4] Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *Third Report*, 13 FCC Rcd 19746 (1998) ("*Third Report*"). The appendixes to the *Third Report* are not published in the FCC Record (*See* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *Third Report*, FCC 98-91 (rel. Jun. 11, 1998) ("*Third Report Appendixes*")). A combined copy of the *Third Report* and the *Third Report Appendixes* may be found on the Commission's Internet site: <http://www.fcc.gov/Bureaus/Wireless/Reports/fcc98091.pdf>.

[5] For example, a number of companies provide mobile telephone, paging, and mobile data services using satellite-based networks. *See e.g.,* Section II.A.4.d.

because licensees of these other spectrum-based services often compete with CMRS providers, as well as with other providers of telecommunications services, the Commission believes that it is important to consider them in the analysis.

This report focuses on the three established wireless services that are most often associated with CMRS: mobile telephony,[6] paging/messaging,[7] and dispatch.[8] As a fourth topic, the report also discusses the growing area of mobile data services.[9] These four services are not as clearly delineated as their names imply. For example, some dispatch operators also offer mobile telephone services. In addition, many of the services discussed in the mobile data services section are actually provided by mobile telephone, paging/messaging, or dispatch operators who are leveraging those assets to enter the growing market for wireless data services. Therefore, while these product categories are used to provide structure for this wireless report, the Commission's view of operators is not limited by the categories in which this report places them.

B. Status of Competition

Several sectors of the CMRS industry have seen increased competition since the release of the *Third Report*. In the mobile telephony sector, broadband PCS and digital SMR operators have continued to aggressively deploy their networks. While these efforts have not resulted

[6] This report defines the mobile telephone segment to include cellular, broadband Personal Communications Service ("broadband PCS"), and digital Specialized Mobile Radio ("SMR") operators.

[7] This report defines the paging/messaging segment to include paging and narrowband Personal Communications Services ("narrowband PCS") operators.

[8] This report uses the term "dispatch" as a term of convenience to refer to a wide variety of services. Operators provide commercial dispatch services using a number of Commission defined services. However, due to the lack of available information, this report limits most of its discussion of the dispatch sector to operators using 800 MHz SMR, 900 MHz SMR, and 220 MHz services. It should also be noted that this report's use of the term "dispatch" includes both CMRS providers (who offer customers interconnected service) and Private Mobile Radio Service ("PMRS") providers (who do not offer customers interconnected service, but do offer non-interconnected services).

[9] The mobile wireless data industry encompasses a wide array of services ranging from data transmitted over one-way pagers to vehicle tracking from satellites to wireless Internet connections via portable computers or PDAs. Participants include both CMRS and non-CMRS providers, many of whom also offer services in the mobile telephone, paging/messaging, and dispatch sectors. However, because the sector is still evolving, the Commission believes it is appropriate to address mobile data services as a separate section.

in bringing competition to as many new markets as last year,[10] they have resulted in improved coverage and increased competition in areas where some level of competition had previously existed. The paging/messaging market continues to be highly competitive and paging carriers continue to face competition from an increasing number of operators in other wireless sectors. As stated in the *Third Report*, the completion of the 800 MHz SMR and 220 MHz spectrum auctions and the deployment of digital technology have led to a restructuring of the dispatch sector. Consequently, at this time, performing a meaningful competitive assessment would be difficult at best. Similarly, the mobile data sector remains in a developmental stage, making competitive assessments difficult. However, in the past year, the mobile data sector has seen no shortage of companies announcing plans to offer a wide variety of new products and services in the coming months and years.

C. Industry Development

During the 1990s, one of the dominant transformations in the telecommunications industry and in society in general has been the rise of wireless communications, bringing the benefits of mobility to an ever-increasing segment of the country. The information available in the year since the release of the *Third Report* shows that this trend is not abating. For example, the mobile share of the telecommunications industry continues to rise, with mobile services accounting for 14.3 percent[11] of the industry's 1997 revenues,[12] an increase over the 1996 figure of 12.2 percent of industry revenues. This increase is the result of steadily increasing subscriber penetration by mobile services. By the end of 1998, the combined domestic subscribership of the three established CMRS products mentioned above had grown to over

[10] Whenever possible, this report uses the most up to date information available to the Commission. Consequently, not all of the report's information is as of the same date. Whenever the report makes a comparison to figures from "last year" or the *Third Report*, it is referring to whatever comparable information was available at the time of the release of the *Third Report*.

[11] All of the data in this report are taken from publicly available sources. These sources include: trade associations, securities analysts, company releases, filings with the Securities and Exchange Commission, newspaper and periodical articles, and certain materials made available to the Commission that were prepared by research companies and consultants that study various aspects of the wireless industry. The accuracy of the data from these materials, however, was not independently verified by the Commission. The inclusion of these data in this report does not constitute a representation or warranty by the Commission of their accuracy or completeness.

[12] Federal Communications Commission, Common Carrier Bureau, Industry Analysis Division, *Telecommunications Industry Revenue: 1997*, Tbl. 2 (Telecommunications Industry Revenue by Service) (Nov. 1998). The figures of 1996 have changed from those reported in the *Third Report* due to changes in the reporting methodology used by the Common Carrier Bureau.

126 million units,[13] a 17 percent increase over domestic subscribership in 1997. In 1998, the CMRS industry added over 18 million new subscribers for the fourth consecutive year.[14]

Mobile Telephony. Since the release of the *Third Report*, the mobile telephony sector of CMRS experienced another year of strong growth and competitive development. In the twelve months ending December 1998, the mobile telephony sector generated over $33 billion in revenues,[15] increased subscribership from 55 million to 69.2 million,[16] and produced a national penetration rate of nearly 26 percent.[17] In addition, new entrant wireless providers[18] have continued to deploy their networks. While the new entrant network buildout and coverage has not caught up to that of cellular, there are now at least five mobile telephone operators in each of the 35 largest Basic Trading Areas[19] ("BTAs") and at least three mobile telephone providers in 97 of the 100 largest BTAs in the continental United States.[20] Finally,

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[13] It is likely that there is some amount of overlap in subscribership between these three services. This figure is the sum of the subscribership figures for mobile telephony (taken from Appendix B), paging/messaging (equaling the average of the subscribership figures cited in the Paging/Messaging section), and dispatch (taken from Appendix D).

[14] As compared with the figures from *Third Report*, FCC Rcd at 19750.

[15] *See* Appendix B, Table 1, p. B-2.

[16] *Id*.

[17] The penetration rate is calculated by dividing total subscribers by the country's total population. The 26 percent figure is based on a 1998 United States population estimate of 269.3 million. *See* Dennis Leibowitz et al, THE WIRELESS COMMUNICATIONS INDUSTRY, Donaldson, Lufkin & Jenrette, Winter 1998/1999, at 18. ("*DLJ Report*")

[18] For the purposes of this analysis, the new entrants in each mobile telephone market are defined as being either operators using broadband PCS spectrum, or Nextel Communications, Inc. ("Nextel") in the areas where it has launched its digital mobile telephone service.

[19] Basic Trading Areas ("BTAs") are Material Copyright (c) 1992 Rand McNally & Company. Rights granted pursuant to a license from Rand McNally & Company through an arrangement with the Personal Communications Industry Association. BTAs are geographic areas drawn based on the counties in which residents of a given BTA make the bulk of their shopping goods purchases. Rand McNally's BTA specification contains 487 geographic areas covering the 50 states and the District of Columbia. For its spectrum auctions, the Commission added additional BTA-like areas for: American Samoa; Guam; Northern Mariana Islands; San Juan, Puerto Rico; Mayagüez/Aguadilla-Ponce, Puerto Rico; and the United States Virgin Islands.

[20] *See* Appendix H, Map 1, at H-2. These figures assume that both cellular telephone operators have coverage in some part of all of these BTAs. This assumption is based on a Commission analysis of its cellular telephone tower database. However, this does not mean that the cellular operators necessarily have complete geographic coverage in BTAs. *See Third Report Appendixes*, at H-2.

because of growing competition in the marketplace, it appears that the average price of mobile telephone service has fallen substantially during the year since the *Third Report*, continuing the trend of the last several years.[21]

Paging/Messaging. While the paging/messaging sector has continued to grow since the release of the *Third Report*, the industry is in the process of restructuring by moving away from a "subscriber growth at any cost" strategy and toward improved financial performance. In 1998, several analysts estimated that the number of pagers in service range from 50.5 to 54.2 million units, as compared to 48.2 million in 1997.[22] Some of the effects of this focus on improving operating results can be seen by comparing subscriber growth with revenue growth. One analyst estimates that total 1998 paging revenues will increase by nearly 20 percent compared to 1997, almost double the growth rate of subscribers.[23] Paging carriers are attempting to enhance their operating results by offering advanced messaging services with narrowband PCS spectrum, as well as by offering value-added services over traditional one-way pagers.

Dispatch. The past year has seen a continuation of the trends discussed in the *Third Report*. Once again, dispatch subscribership grew by half, and Nextel Communications, Inc. ("Nextel") converted systems used for analog dispatch services to higher priced digital mobile telephony services. In addition, the Commission completed auctions of 220 MHz and the upper bands of the 800 MHz SMR spectrum which may provide new competition in the traditional dispatch market.

Mobile Data. The mobile data sector remains in a developmental stage, making competitive assessments difficult. However, in the past year, the mobile data sector has seen numerous companies announcing plans to offer a wide variety of new products and services in the coming months and years.

II. THE CMRS INDUSTRY

A. Mobile Telephony

For the purposes of this report, the mobile telephone sector includes all operators that offer commercially available interconnected mobile phone services. These operators provide access to the public switched telephone network ("PSTN") via mobile communication devices

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[21] *See* Section II.A.1.d for a detailed discussion.

[22] *See* Section II.B.

[23] Appendix C, Table 1, p. C-2.

employing radiowave technology to transmit calls. Currently, this sector is dominated by providers using three types of FCC licenses: cellular radiotelephone, broadband PCS, and SMR.[24] While all three of these FCC services were created at different times and for different purposes, they now are used to offer mobile telephone services that may be interchangeable for many users. Furthermore, while providers use different marketing techniques and different technologies to differentiate themselves to the public, they are offering essentially the same product -- mobile telephone services.

The discussion below begins with an overview of the mobile telephone market, which is divided into sections for cellular operators, broadband PCS operators, the digital SMR provider Nextel Communications, other SMR operators, resellers, and satellite providers.

1. Mobile Telephone Overview and Analysis

a. Mobile Telephone Sector Structure and Performance

In 1998, subscriber growth in the mobile telephone sector continued the trend of the past several years. As of December 1998, the market had over 69.2 million subscribers,[25] an increase of 25 percent over the 55.3 million subscribers reported in the *Third Report* for December 1997. In numerical terms, this is the largest 12-month increase in the history of the mobile telephone sector. This level of subscribership translates into nearly 26 percent of the country's population.

It is also interesting to note that the growth rate of the sector's net-new subscribers increased significantly. In 1996 and 1997, the number of new subscribers increased by less than ten percent each year. However, the 13.9 million new subscribers added in 1998 was 23 percent more than the 11.3 million subscribers added in 1997. In fact, 1998 was the first year new subscribers increased by more than 20 percent since 1994.

The financial performance of the mobile telephone sector continued to be strong. In 1998, the mobile telephone sector's annual total service revenue was over $33 billion,[26] an increase of 20.5 percent over the twelve months ending December 1997. It is also the first time in the history of the mobile telephone sector that annual service revenues exceeded $30 billion.

As the Commission found in the *Third Report*, the average monthly wireless telephone bill

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[24] As codified at 47 C.F.R. § 22.900, 47 C.F.R. § 24.200, and 47 C.F.R. § 90.601, respectively.

[25] *See* Appendix B, Table 1, p. B-2.

[26] *Id.*

has continued to decline, reflecting increasing penetration in market sectors with lower average usage and, consequently, lower monthly bills.[27] While the price plans aimed at these market segments have higher per minute rates than plans aimed at high usage customers, their lower monthly flat-rate charges do serve to expand the number of consumers who can afford to subscribe to mobile services. The average monthly bill (often referred to as average revenue per unit, or "ARPU") declined from $42.78 in December 1997 to $39.43 in December 1998.[28] However, as was reported in the *Third Report*,[29] monthly bills associated with digital mobile telephone services are higher than the market average.[30]

In terms of licenses and potential coverage, the structure of the mobile telephone industry has not changed significantly since the release of the *Third Report*. Except for movement by SBC Communications, Inc. ("SBC") and ALLTEL, Corp. ("ALLTEL"), the nation's current list of top mobile telephone operators[31] by population coverage looks similar to the list completed last year.[32] At the top are three carriers with national footprints,[33] followed by carriers with larger regional footprints, then carriers with smaller service areas or local footprints.

However, a list of the mobile telephone industry's top 25 operators by subscribership demonstrates the rising importance of non-cellular mobile telephone operators.[34] At the end of 1997, approximately seven percent of the subscribers on the top 25 list were on broadband PCS or digital SMR networks. By the end of 1998, this figure had doubled to 14 percent. In addition, at the end of 1997, there were only three pure broadband PCS or digital SMR operators in the top 25. At the end of 1998, there were six, including two in the top 10.

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[27] *Third Report*, 13 FCC Rcd at 19765.

[28] *See* Appendix B, Table 1, p. B-2.

[29] *Third Report*, 13 FCC Rcd at 19765.

[30] For example, Bell Atlantic Corp. has reported that its digital cellular subscribers are generating ARPUs of over $80 per month. Bell Atlantic Corp., *DigitalChoice/SingleRate*, (visited Mar. 30, 1999) <http://www.bellatlantic.com/invest/news/990303/sld020.htm>.

[31] *See* Appendix B, Table 3, p. B-4.

[32] *See Third Report Appendixes*, at B-5.

[33] "Footprint" is an industry term of art referring to the total geographic area in which a wireless provider can offer services.

[34] *See* Appendix B, Table 4, p. B-6.

While the non-cellular mobile telephone operators have made significant inroads into the mobile telephone sector, they are still a relatively small portion of the whole sector. According to one estimate, at the end of 1998, cellular operators had approximately 86 percent of mobile telephone subscribers, while broadband PCS had nearly ten percent and digital SMR had more than four percent.[35] However, it is important to note that there are specific geographic markets in which the non-cellular operators have achieved market share greater than the national average. For example, according to one analyst, there are more than half a dozen markets in which broadband PCS and digital SMR operators have combined market share of more than 25 percent.[36]

b. Major Operational Trends

Rise of Digital. It is possible that 1998 will become known in the mobile telephone industry as the year that digital technology began to take precedence over analog systems. During 1998, the number of customers subscribing to digital services increased by 160 percent from approximately 7.7 million to 20 million.[37] At the same time, there was only a 3.4 percent increase in the number of analog subscribers. At the end of 1998, digital subscribers made up 29 percent of the industry total, up from 14 percent at the end of 1997.

During the year, all four of the competing digital technologies[38] at least doubled their subscribership. At the end of 1998, TDMA was the most used technology, with approximately eight million subscribers.[39] Next largest was CDMA with over six million

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[35] *See DLJ Report*, at 18.

[36] *See* The Personal Communications Industry Association's Reply Comments, at Attachment A, p. 4, 1998 Biennial Regulatory Review--Spectrum Aggregation Limits for Wireless Telecommunications Carriers, WT Docket No. 98-205; Cellular Telecommunications Industry Association's Petition for Forbearance From the 45 MHz CMRS Spectrum Cap; Amendment of Parts 20 and 24 of the Commission's Rules -- Broadband PCS Competitive Bidding and the Commercial Mobile Radio Service Spectrum Cap, WT Docket No. 96-59; Implementation of Sections 3(n) and 332 of the Communications Act Regulatory Treatment of Mobile Services, GN Docket No. 93-252.

[37] *See* Appendix B, Table 5, p. B-7.

[38] The four technologies are: Code Division Multiple Access ("CDMA"), Global System Mobile Communications ("GSM"), integrated Digital Enhanced Network ("iDEN"), and Time Division Multiple Access ("TDMA"). There is also a fifth technology called Personal Access Communications System ("PACS"). 21st Century Telesis, Inc. is planning to use PACS with its C, D, and F block broadband PCS licenses. PACS is a low-power microcell technology which its proponents believe can be installed at a lower cost than the other, high-power, broadband PCS technologies. *See* 21st Century Telesis II Inc., Form 10-K, Sep. 30, 1998.

[39] *See* Appendix B, Table 5, p. B-7.

subscribers, followed by iDEN and GSM with 2.9 million and 2.7 million subscribers respectively. It is also worth noting that CDMA subscribership increased almost 360 percent during the year, compared to the 111 percent increase in TDMA subscribership. The broadband PCS operator Sprint PCS added 836,000 CDMA customers in the fourth quarter of 1998 alone.[40]

Digital-One-Rate. The most dramatic change in the mobile telephone industry since the release of the *Third Report* has been the widespread adoption of what are often referred to as "digital-one-rate" ("DOR") price plans, named after the first such plan marketed by AT&T Corp. ("AT&T"). While the details of various operators' plans differ, they generally include some combination of the following: bundles of large quantities of minutes for a fixed monthly rate that translated into at a low per-minute price; no long distance charges when used on the operator's network; no roaming charges when used on the operator's network;[41] reduced roaming charges when off the operator's network; and, in some cases, no extra roaming charges anywhere.

The first prominent DOR plan was introduced by AT&T in May 1998.[42] Under AT&T's plan, customers purchase one of three large bundles of minutes: 600 minutes for $89.99; 1,000 minutes for $119.99; or 1,400 minutes for $149.99.[43] For these prices, customers do not have long distance or roaming charges anywhere in the country, regardless of whether the calls are placed on or off AT&T's network. All calls would cost between $0.10 and $0.15 per minute, depending on the plan, regardless of where they were placed (users must pay a higher rate for any additional minutes beyond those provided with the plan). Since most roaming agreements cost operators more than $0.10 per minute, AT&T would absorb any roaming charges above that point.[44]

Since AT&T's announcement, a large number of the major mobile telephone operators, such as Sprint PCS, Bell Atlantic Corp. ("Bell Atlantic"), and AirTouch Communications, Inc. ("AirTouch"), have initiated plans of their own that are all variations on AT&T's original

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[40] *Sprint Announces Record Fourth Quarter, Yearly Results*, News Release, Sprint Corp., Feb. 2, 1999.

[41] In other words, the user's home area for phone use is expanded to include the operator's entire network.

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

[43] *Id.*

[44] Cynthia M. Motz and Robert J. Hordon, *Wireless Update: AT&T's New Digital One Rate*, Equity Research - Americas, Credit Suisse First Boston, May 11, 1998, at 1.

concept, either on a nationwide or regional basis.[45]

During the second half of 1998, consumer response to DOR plans appears to have been strong. For example, AT&T reported that it added 850,000 DOR subscribers by the end of the year[46] and continues to add 100,000 new DOR subscribers per month.[47] AT&T also reported that during the 1998, minutes-of-use by customers in its cellular license areas had increased by 29.5 percent over 1997.[48] In addition, Bell Atlantic added nearly 400,000 digital subscribers during the fourth quarter of 1998 and attributed its growth to these DOR-type plans.[49]

Wireless/Wireline Competition: Wireless Attacking the Second Line. In the past year, mobile telephone carriers, and most often broadband PCS operators, have begun to use a variety of methods to target homes with wireline-based second telephone lines. This strategy is especially prevalent among broadband PCS operators with licenses in rural or smaller urban areas. Since broadband PCS spectrum does not propagate as far as cellular spectrum, broadband PCS operators must spend more capital than cellular operators to cover the same area.[50] To contain costs, some broadband PCS operators in rural areas limit their coverage to urban centers and the roads connecting them, and impose roaming fees on users who travel outside of these areas. This coverage differential has pushed broadband PCS operators in these markets to find additional ways to promote their wireless services. Because the digital technology used by broadband PCS systems can replicate many of the features of wireline phones and analog cellular networks cannot, many broadband PCS operators in these areas are promoting their services as replacements for second telephone lines in homes or businesses.

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[45] The Yankee Group, *Year-End 1998 Wireless Industry Update: The Impact of All-Inclusive Rates*, WIRELESS/MOBILE COMMUNICATIONS GLOBAL, Report, Vol. 2, No. 46, Dec. 1998, at 8.

[46] *AT&T's Fourth Quarter Operational Profits Were $1.00 Per Share, an Increase of 45 Percent*, News Release, AT&T Corp., Jan. 25, 1999. At the end of the third quarter of 1998, AT&T reported that over two-thirds of customers signing up for the DOR plan were new subscribers to AT&T mobile telephone services. *See* AT&T Corp., AT&T EARNINGS COMMENTARY, *Third Quarter Operational Earnings Were $1.00 Per Share, Up 67%*, Jan. 25, 1999, at 6. ("*AT&T Third Quarter*")

[47] *AT&T Third Quarter*, at 6.

[48] AT&T Corp, 1998 ANNUAL REPORT (1999), at 40.

[49] *Strong Telecom and Wireless Volumes Drive Double-Digit Bell Atlantic Earnings Growth*, News Release, Bell Atlantic Corp., Jan. 27, 1999.

[50] MULTIMEDIA TELECOMMUNICATIONS ASSOCIATION, 1998 MULTIMEDIA TELECOMMUNICATIONS MARKET REVIEW AND FORECAST (1998), at 135.

One of the first broadband PCS operators to attempt this strategy was WirelessNorth, an operator with licenses in North Dakota, South Dakota, and Minnesota. According to press reports, WirelessNorth felt that the low number of POPs in its mostly rural areas meant that it could not compete with analog cellular as a strictly mobile service.[51] Instead, it introduced a price plan[52] designed to compete with wireline providers for residential second telephone lines.[53] As of November 1998, 40 percent of WirelessNorth's customers used this plan.[54] Other rural broadband PCS operators base their marketing on a similar theme. For example, Panhandle Telecommunications Systems, Inc., in Liberal, Kansas, describes its service as enhancing convenience near town, as well as providing a second line when a user is on-line with a computer.[55] In Montana, Blackfoot Communications promotes its service as "the new cordless, go-anywhere Digital PCS service."[56]

There are also examples of operators starting to combine special pricing plans with marketing plans to further appeal to the second line market. These pricing plans are similar to the DOR plans discussed above in that they have large, or unlimited bundles of minutes, but they do not have the reduced roaming and large home area features. AT&T has been running a trial for such a plan in Plano, Texas with approximately 100 participants.[57] In this trial, customers can place and receive an unlimited number of calls in Plano and Dallas for only $39.99 per month.[58] For this price, customers also receive 30 free minutes for usage outside of Plano.[59] One operator, Chase Telecommunications Holdings, Inc. ("Chase"), has taken this concept out of the trial stage and into active use. Chase has started offering unlimited local calls in

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[51] Karissa Todd, *The Road to Local Competition*, WIRELESS REVIEW, Nov. 30, 1998, *available at* 1998 WL 8999406.

[52] *See Third Report*, 13 FCC Rcd at 19777.

[53] Karissa Todd, *The Road to Local Competition*, WIRELESS REVIEW, Nov. 30, 1998, *available at* 1998 WL 8999406.

[54] *Id*.

[55] Panhandle Telecommunications Systems, Inc. , *What Is genuine PCS?* (visited Jan. 24, 1999) <http://www.ptsi.net/what_is_genuine_pcs.htm>.

[56] Blackfoot Communications, *Digital PCS Service* (visited Jan. 24, 1999) <http://www.blackfoot-telephone.com/communications/servicemain.html>.

[57] Linda J. Mutschler and Paul Wuh, *The Next Generation III*, Comment - United States - Telecommunications/Cellular, Merrill Lynch & Co., Mar. 11, 1999, at 3.

[58] *Id*.

[59] *Id*. There is also a plan which includes 300 minutes outside of Plano for $59.99 per month.

Chattanooga, Tennessee for $29.99 per month.[60] Customers using this plan cannot roam outside of Chattanooga and must use a prepaid calling card for long distance calls.

Some larger broadband PCS licensees have gone a step further by acquiring broadband PCS licenses in addition to their cellular holdings, specifically to create services that would act as an add-on to existing landline services. For example, Century Telephone Enterprises, Inc. ("Century") acquired D and E block broadband PCS licenses in areas where it already had cellular licenses. This overlap allowed it to offer two types of wireless services. Century uses the traditional cellular network for its high mobility customers.[61] For residential customers, it is using broadband PCS licenses to create a service called "The Zone Phone," which it describes as "the perfect second line."[62] To date, Century has launched this service in Grand Rapids, Kalamazoo, and Lansing, Michigan.[63] The coverage is limited to areas around each of these cities and allows customers to use the phone in their homes, neighborhoods, and around town. For a price of $39.99 per month this plan offers users 1,000 minutes of use while in these urban areas.[64] The handsets have the ability to roam on the cellular network, at a higher price, when outside of the designated Zone Phone areas.

US WEST, Inc. ("US WEST") is implementing a similar strategy. However, its new service is designed to enhance its own wireline service, while Century's is trying to compete with the wireline services of other companies. While it was selling its cellular-based operations to AirTouch, US WEST was deploying a broadband PCS-based mobile telephone service called Advanced PCS.[65] US WEST designed its network so that its wireline customers could

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[60] *Leap Wireless International Launches Cricket Service Introducing 'Comfortable Wireless' for all Users*, News Release, Leap Wireless International, Inc., Mar. 17, 1999.

[61] Nancy Gohring, *The Zone Hits Home: CenturyTel Seeks to Untether Residential Users*, TELEPHONY, Aug. 24, 1998, *available in* 1998 WL 6611643.

[62] Century Telephone Enterprises, Inc. , *What is the Zone Phone?* (visited Feb. 23, 1999) <http://www.centurytel.com/zone/html/what.htm>.

[63] Century Telephone Enterprises, Inc., *Where Can I Buy the Zone Phone?* (visited Jun. 15, 1999) <http://www.centurytel.com/zone/html/where.htm>.

[64] Century Telephone Enterprises, Inc., *What is the Zone Phone?* (visited Feb. 23, 1999) <http://www.centurytel.com/zone/html/what.htm>.

[65] US WEST first launched Advanced PCS in Denver in September of 1997. *See U S WEST Delivers First-In-The-Nation Service Giving Customers The Convenience Of Home Or Office Phone "To-Go,"* News Release, US WEST, Inc., Sep. 23, 1997.

integrate wireless service into a single package, marketing it as a "home phone to go."[66] Advanced PCS allows customers to have the same telephone number and voice mail box for both a residence and a mobile handset, and have the usage of both charged on the same bill.[67]

Consolidation. 1998 saw a continuation of the process of license consolidation in the mobile telephone sector discussed in the *Third Report*.[68] In 1998, three of 1997's top 25 operators in subscribership consolidated with other carriers.[69] Furthermore, if deals announced since the release of the *Third Report* are completed, five additional operators that were in the top 25 at the end of 1998 will be consolidated into other carriers.[70]

One of the driving forces behind many of these consolidations has been the desire of large regional carriers to enhance their ability to compete effectively with national operators like AT&T, Sprint PCS, and Nextel. As was discussed in the *Third Report*, operators with larger footprints can achieve economies of scale and increased efficiencies compared to operators with smaller footprints.[71] The need for this increased size was exacerbated in the past year by the introduction and success of AT&T's DOR plan and, in particular, its low-cost roaming feature. According to analysts, it can be significantly more expensive for regional operators

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[66] Joanna Bean, *Sprint PCS Dials Into Colorado Springs, Colo., Wireless Market*, KNIGHT-RIDDER TRIBUNE BUSINESS NEWS: THE GAZETTE, COLORADO SPRINGS, COLO., Nov. 20, 1998, *available in* 1998 WL 16349555.

[67] US WEST, Inc., *Life's Better When You're in Control* (visited Jan. 24, 1999) <http://www.uswest.com/com/customers/pcs/2home.shtml>.

[68] *See Third Report*, FCC Rcd at 19766.

[69] AirTouch's merger with US West Media Group's domestic cellular interests (*See Airtouch and MediaOne Group Complete $6 Billion Merger*, News Release, AirTouch Communications Inc., Apr. 6, 1998); ALLTEL merger with 360° Communications Co. (*See ALLTEL, 360° Complete $6 Billion Merger*, News Release, ALLTEL Corp., Jul. 1, 1998); SBC's acquisition of Southern New England Telecommunications Corp. (*See SBC Communications Completes Southern New England Telecommunications Merger*, News Release, SBC Communications Inc., Oct. 26, 1998).

[70] ALLTEL merger with Aliant Communications, Inc. (*See ALLTEL Announces Merger Agreement With Aliant Communications Inc.*, News Release, ALLTEL Corp., Dec. 18, 1998); SBC's merger with Ameritech Corp. and acquisition of Comcast Corp.'s cellular operations (*See SBC Communications and Ameritech to Merge*, News Release, SBC Communications, Inc., May 11, 1998 *and SBC Communications Announces Plans To Acquire Comcast Cellular Corporation*, News Release, SBC Communications, Inc., Jan. 20, 1999); Bell Atlantic Corp.'s merger with GTE Corp. (*See Bell Atlantic and GTE Agree To Merge*, News Release, Bell Atlantic Corp., Jul. 28, 1998); AT&T's merger with Vanguard Cellular Systems, Inc. (*See AT&T acquires Vanguard Cellular Systems*, News Release, AT&T Corp., May, 3, 1999).

[71] *See Third Report*, 13 FCC Rcd at 19766.

to provide customers with this feature than for national operators.[72] One obvious way for an operator to reduce roaming costs is by acquiring licenses covering as much of the country as possible.

In addition to the domestic consolidation activity, the year since the release of the *Third Report* has seen an increased interest by foreign companies in domestic mobile telephone carriers. This interest has taken the form of investments, mergers, and potential joint ventures. The most prominent of these actions has been Vodafone Group Plc's proposed merger with AirTouch, that, if completed, will create a company covering nearly one billion people in 23 countries.[73] Aerial Communications, Inc. was the recipient of a $200 million investment by the Finnish telecommunications company, Sonera Ltd.[74]

Prepaid. The use of prepaid billing plans has been on the rise in the mobile telephone sector. Under these plans, customers purchase a handset and a specific number of minutes. When those minutes have been used, the phone will no longer function until the customer purchases additional minutes. As was discussed in the *Third Report*, operators hope to use these plans to gain access to a whole new group of potential customers who lack the proper credit rating.[75] Operators also can use prepaid service to market to other groups like the budget conscious business and residential users and others who want to limit mobile telephone spending (*e.g.*, parents who are purchasing mobile phones for their children). Without the need for credit checks, operators can also greatly expand their distribution channels beyond their retail storefronts.

The use of prepaid plans has yet to have the dramatic effect in the overall United States market that it appears to have had in Europe.[76] However, a number of the regional broadband PCS operators have reported that prepaid users are having an increasing impact on their operations. For example, Powertel, Inc. ("Powertel") reported that at the end of 1998, almost 14 percent of its broadband PCS subscribers were using prepaid plans. Moreover, Powertel subsequently reported that at the end of the first quarter of 1999 27,000 of its 43,000 net new

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[72] Linda Runyon Mutschler and Paul Wuh, *The Impact of Digital One Rate*, Equity Research, Merrill Lynch & Co., Nov. 12, 1998, at 17.

[73] *See Vodafone and Airtouch to Merge*, News Release, Airtouch Communications, Inc., Jan. 15, 1999.

[74] *See Sonera Ltd., Completes $200 Million Investment in Aerial Communications Inc.*, News Release, Aerial Communications, Inc., Sep. 8, 1998.

[75] *See Third Report*, 13 FCC Rcd at 19775.

[76] Linda J. Mutschler and Paul Wuh, *The Next Generation III*, Comment - United States - Telecommunications/Cellular, Merrill Lynch & Co., Mar. 11, 1999, at 3.

subscribers were on prepaid plans,[77] raising its percentage of prepaid customers to 20 percent. Similarly, Aerial Communications, Inc. reported that 21 percent of its customers at the end of the first quarter of 1999 were on prepaid plans[78]

3G. International Mobile Telecommunications-2000 ("IMT-2000") is an initiative of the International Telecommunication Union ("ITU") seeking to integrate the various satellite and terrestrial wireless systems, both fixed and mobile, currently being deployed and developed under a family of standards to promote global service capabilities and interoperability after the year 2000. These systems are known as third generation or 3G systems.[79] In addition to providing the capability for higher wireless data rates by 3G systems,[80] IMT-2000 also articulates several key goals and objectives upon which potential 3G standards will be evaluated. Some of the key service objectives include: enhanced voice quality, ubiquitous coverage, service provision at a reasonable prices, increased network efficiency, new voice and data capabilities, and an orderly evolution path from second generation to 3G systems to protect investments in second generation system investments.[81]

In 1998, proposals for IMT-2000 air interfaces were submitted to the ITU. The ten terrestrial proposals were primarily based on existing TDMA and CDMA technologies, thereby facilitating evolution of second generation systems. In early 1999, based on input from the global wireless community, the ITU recommended that IMT-2000 should be developed to encompass both TDMA and CDMA. The ITU also recommended that multiple operating modes of TDMA and CDMA should be supported to allow easy evolution of second generation systems, including the three systems used in the U.S. for PCS and cellular, and to meet varying marketplace needs.

One of the important IMT-2000 issues requiring resolution was negotiations to harmonize two

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[77] *Powertel, Inc. Announces First Quarter 1999 Financial Results*, News Release, Powertel, Inc., Apr. 29, 1999.

[78] *Aerial Communications Reports Strong First Quarter Operational Improvements, Record Customer Ratings and Lower Costs*, News Release, Aerial Communications, Inc., Apr. 15, 1999.

[79] The first generation of this technology was the original analog cellular networks first deployed in the early 1980's. The second generation came in the form of the digital cellular and broadband PCS networks that operator's began to deploy in the mid-1990's.

[80] The proposed standard calls for 144 kilobits per second at mobile speeds, 384 kilobits per second at pedestrian speeds, and 2 megabits per second in fixed locations. *See* The Personal Communications Industry Association, *Market Demand Forecast for Terrestrial Third Generation (IMT-2000) Services for the Personal Communications Industry Association* (visited Apr. 28, 1999) <http://www.pcia.com/wireres/3gstudy.htm>.

[81] *Id.*

of the more prominent proposed CDMA standards, wideband CDMA and cdma2000. In March 1999, the two primary supporters behind these two proposals reached an agreement settling a dispute over intellectual property rights, making it more likely the two standards could be combined into a single, multi-mode standard.[82] In June 1999, an Operators Harmonization Group ("OHG"), consisting of major service providers from the U.S., Europe, China, Japan, Korea, Canada, and elsewhere, developed a technical framework for combining these proposals.[83] The OHG framework outlines further standards work that must be completed to enable terminals to operate in different CDMA modes efficiently. This technical work and international spectrum planning are important elements in having 3G systems provide global roaming and reduce the cost for multimode handsets. The ITU has endorsed this framework, and encouraged standards developers throughout the world to develop the necessary standards by the end of 1999. The ITU also intends to adopt its final recommendations on the radio aspects of IMT-2000 by the end of 1999.

While there are currently no 3G networks in commercial deployment, hardware manufacturers and service providers have been engaged in several trials of various 3G technologies. For example, Sprint Corp. and Northern Telecom recently performed a demonstration of cdma2000 technology[84] and LM Ericsson has reportedly been building demo systems using wideband CDMA.[85]

c. Market Entry by New Competitors

To track the progress of new operators entering mobile telephone markets, the Commission has compiled a list of Basic Trading Areas ("BTAs") with some level of coverage by new mobile telephone providers.[86] This list is based on publicly-available sources of information

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[82] *See Ericsson and Qualcomm Reach Global CDMA Resolution*, News Release, LM Ericsson and Qualcomm Inc., Mar. 25, 1999.

[83] *Wireless Operators Announce Agreement on Globally Harmonized Third- Generation (G3G) Code Division Multiple Access Standard*, News Release, Operators Harmonization Group, June 8, 1999.

[84] *See Sprint, Nortel Networks Demonstrate High-Speed Wireless Internet,* News Release, Northern Telecom Limited, Apr. 28, 1999.

[85] Jennifer B. Malapitan, *Pace-Setting 3G Wireless, Here Sooner With W-CDMA*, METROPOLITAN COMPUTER TIMES, Nov. 5, 1998, *available in* 1998 WL 20718488.

[86] For the purposes of this analysis, the new entrants are defined as being either operators using broadband PCS spectrum or Nextel in the areas where it has launched its digital SMR product. As with the *Third Report*, Nextel's digital product is included as the sole SMR competitor because the Commission does not possess any information on where other SMR operators are competing with cellular and broadband PCS operators. *See Third Report*, 13 FCC Rcd at 19768.

released by the operators such as news releases, filings made with the Securities and Exchange Commission, and coverage maps available on operators' Internet sites. Data from these sources were used because the Commission's rules do not require new entrant licensees to file buildout information with the Commission.

There are several important caveats to note when using these data. First, to be considered as having "coverage," only a portion of a BTA needs to be covered. Second, multiple operators shown in the same BTA are not necessarily providing service to the same areas. Consequently, some of the BTAs included in this analysis have only a small amount of coverage from a particular provider, possibly resulting from the buildout of a neighboring market.[87] Third, the POPs figures in this analysis include all of the POPs in a BTA with coverage. Fourth, because of the third point, this analysis overstates the total coverage in terms of both geographic areas and populations covered. Fifth, all population figures are based on the 1990 census.

Since the *Third Report*, new entrants have made significant progress in building out their networks. To date, over 335 BTAs, containing over 241 million POPs, have at least one new entrant offering service in some portion of the BTA.[88] This coverage represents more than 95 percent of the nation's total POPs. In gross terms, this increase is not a tremendous change from the level of deployment described in the *Third Report*.[89] The total number of BTAs increased by 23 percent, but most of these BTAs have smaller populations. Hence, the total POPs in the covered BTAs increased by only ten percent.

However, operators have added significantly to the levels of competition in BTAs where other new entrants already were in service. Last year, there were no BTAs with five new entrants

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[87] The Commission's buildout rules for geographic area licenses do not require operators to deploy networks such that the entire geographic area of a specific license receives coverage. For example, the construction requirements for 30 MHz broadband PCS licenses (blocks A, B, and C) state that an operator's network must serve an area containing at least one-third of the license area's population within five years of the license being granted and two-thirds of the population within ten years. *See* 47 C.F.R. § 24.203(a). Similarly, the construction requirements for 10 MHz broadband PCS licenses (blocks D, E, and F) state that an operator must cover one-quarter of a license area's population, or provide "substantial service," within five years of being licensed. *See* 47 C.F.R. § 24.203(b). The details concerning exactly which geographic areas or portions of the population should be covered to meet these requirements are left to the operators. In addition, decisions about whether to increase coverage above these requirements are left to the operators. For information on the buildout requirements for cellular licenses, *see* 47 C.F.R. § 22.946, § 22.947, § 22.949, *and* § 22.951.

[88] *See* Appendix B, Table 2A, p. B-3.

[89] *See Third Report Appendixes*, at B-4.

in service. This year, there are eight BTAs with five new entrants.[90] When the existing incumbent cellular operators are taken into account,[91] the ten million people in these BTAs may have up to seven mobile telephone operators from which they can choose, assuming all of the operators have full geographic coverage in each BTA. In addition, the number of areas with four new entrants increased from 13 BTAs, containing 25 million POPs, to 45 BTAs, containing 82 million POPs. Currently, BTAs containing approximately 74 percent of the population have at least five mobile telephone operators providing coverage in some portion of their area, up from 54 percent at the time of the *Third Report*.[92]

Driven by the desire to maximize the market of potential customers as quickly as possible, the new entrants have been concentrating their deployment efforts on the more populous geographic markets. To show this, the Commission has divided the 493 BTAs into four quartiles (groups of equal size) by their total populations.[93] Of the BTAs in the top quartile (the 123 most populated BTAs), 120 have one or more new entrants providing service (including 99 of the top 100). The second quartile (the next 123 most populated BTAs) has 101 BTAs with some coverage, and the bottom two quartiles have only 65 and 50 BTAs, respectively, with coverage. Thus, the most rural BTAs are the least likely to be experiencing competition from new entrants.

d. Price Competition

As the Commission observed in the *Third Report*, it is difficult to identify sources of information that track mobile telephone prices in a comprehensive manner.[94] However, there are a number of reports and other data available indicating that the entrance of new

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[90] The eight BTAs are Phoenix and Tucson, Arizona; Gainesville, Jacksonville, Tampa, and Lakeland, Florida; and Seattle and Bremerton, Washington.

[91] As was mentioned in the Introduction, this analysis assumes that both cellular operators have at least some coverage in all BTAs.

[92] It important to reiterate that the actual total population served by these systems is certainly lower than these total-BTA figures imply. According to one recent estimate, 57 percent of the population was covered by two or more broadband PCS operators (which is roughly equivalent to five mobile telephone operators). *See* Paul Kagan Associates, Inc., *PCS Markets and POPs*, WIRELESS MARKET STATES, Oct. 31, 1998, at 14. It is also important to note that estimates of actual coverage vary considerably. For example, the above referenced study placed the broadband PCS-based Code Division Multiple Access coverage at 179 million people. However, a more recent study by another analyst placed the same figure a much lower level, 97 million people. *See CDMA Leads PCS Availability*, News Release, The Strategis Group, Mar. 30, 1999.

[93] *See* Appendix B, Table 2B, p. B-3.

[94] *See Third Report*, 13 FCC Rcd at 19769-19770.

competitors into this market is continuing to reduce prices.[95] Because these studies use different methodologies and market samples, their findings vary and are only comparable in the broadest terms. Nevertheless, the available evidence, taken together, makes it clear that the average price for mobile telephony has continued to fall substantially since the *Third Report* in the last year, continuing the trend of the last several years.

For example, according to one study comparing mobile telephone prices in the second quarter of 1998 with the second quarter of 1997, the average price per minute decreased by 18 percent.[96] Included in this average were analog cellular price declines of 12 percent, digital cellular price declines of 23 percent and broadband PCS price declines of 18 percent.[97] A subsequent study by the same analyst tracking price changes in the 25 largest markets between the second and third quarters of 1998 indicated that prices generally continued to decline over that period.[98] The average price per minute of digital cellular plans declined by between 2.0 percent and 8.3 percent, depending on the number of minutes included with the plans.[99] Likewise, broadband PCS prices declined by between 2.9 percent and 6.9 percent.[100] At the same time, analog cellular prices were essentially unchanged, except for plans with large bundles of minutes, which increased by 5.0 percent.[101]

A report by another analyst that compared price changes between 1997 and 1998 had a slightly different view. According to this analyst, prices at lower usage levels (240 MOUs and 430 MOUs) did not change significantly between 1997 and 1998.[102] However, at the 600 MOU level, the median average price per minute declined by over 20 percent between 1997

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[95] *See Third Report*, 13 FCC Rcd at 19769-19770.

[96] *Yankee Group's Mobile Report Predicts Increased Usage, ARPU Stabilization, and Landline Displacement*, News Release, The Yankee Group, Oct. 5, 1998.

[97] *Id*.

[98] *See* The Yankee Group, *Year-End 1998 Wireless Industry Update: The Impact of All-Inclusive Rates*, WIRELESS/MOBILE COMMUNICATIONS GLOBAL, Report, Vol. 2, No. 46, Dec. 1998, at 5.

[99] *Id*.

[100] *Id*.

[101] *Id*.

[102] David A. Freedman and Gregory H. Lundberg, *Wireless Telephony: Untethered Stories & Stats - 1998 Price Declines Less Jarring than 1997's*, Equity Research - Telecommunications, Bear, Sterns & Co., Feb. 1999, at 4.

and 1998, which reflects strong competition for high-end customers.[103]

While the most aggressive price competition has been occurring at the higher levels of usage, the past year has also seen continued price declines for customers with lower levels of monthly usage. For example, according to one analyst, at the usage level of 60 MOUs per month prices for digital cellular and broadband PCS decreased by two and three percent between the second and third quarters of 1998.[104] Another analyst estimated that between 1997 and 1998, the average price at the 60 MOU usage level decreased by 11 to 15 percent.[105] One of the most visible signs of this competition is that the price per month of the entry level packages has dropped over the past few years, giving a wider segment of the population access to mobile telephone service. It is important to remember, the customers at this low usage level are still paying significantly more per minute than users at higher levels. For example, according to the first analyst mentioned in this paragraph, as of the third quarter of 1998, users at the 60 MOU level were paying two to three times more per minute than users at the 500 MOU level.[106]

A new source of price information is the cellular telephone services component of the Consumer Price Index[107] ("Cellular CPI") produced by the United States Department of Labor's Bureau of Labor Statistics ("BLS").[108] In the 13 months between the end of December 1997 and the end of January 1999, the Cellular CPI decreased by 9.1 percent, which equates to an annualized rate of 8.4 percent. In comparison, during the same period of

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[103] *Id*.

[104] *See* The Yankee Group, *Year-End 1998 Wireless Industry Update: The Impact of All-Inclusive Rates*, WIRELESS/MOBILE COMMUNICATIONS GLOBAL, Report, Vol. 2, No. 46, Dec. 1998, at 3.

[105] David A. Freedman and Gregory H. Lundberg, *Wireless Telephony: Untethered Stories & Stats - 1998 Price Declines Less Jarring than 1997's*, Equity Research - Telecommunications, Bear, Sterns & Co., Feb. 1999, at 7 and 19.

[106] *See* The Yankee Group, *Year-End 1998 Wireless Industry Update: The Impact of All-Inclusive Rates*, WIRELESS/MOBILE COMMUNICATIONS GLOBAL, Report, Vol. 2, No. 46, Dec. 1998, at 3.

[107] The Consumer Price Index ("CPI") is a measure of the average change over time in the prices paid by urban consumers for a fixed market basket of consumer goods and services. The basket of goods includes over 200 categories including items such as food and beverages, housing, apparel, transportation, medical care, recreation, education, and communications. The CPI provides a way for consumers to compare what the market basket of goods and services costs this month with what the same market basket cost a month or a year ago. Starting in December of 1998, this basket of goods included a category for cellular telephone services.

[108] All CPI figures discussed in this paragraph were taken from U.S. Department of Labor, Bureau of Labor Statistics databases found on the Bureau of Labor Statistics' Internet site <http://www.bls.gov/sahome.html>.

time, the local telephone services charges component increased by 2.2 percent, and the long distance telephone services charges component decreased by 0.1 percent. The overall consumer price index increased by 1.9 percent.

Another indication of the competitive pressures being exerted on mobile telephone prices can be seen in roaming charges. Traditionally, roaming was a very lucrative part of operators' businesses, with prices typically ranging between $0.50 and $1.00 per minute.[109] Moreover, there usually were significant roaming administration charges and fees that were assessed in addition to the per minute usage charges. However, a number of carriers are reporting that DOR plans are beginning to exert downward price pressure on their roaming rates. During 1998, carriers have reported that even though DOR plans have encouraged increased roaming, they have also led to reductions in the negotiated roaming rate charged to customers.[110] In order to remain competitive, carriers expect that they will continue to proactively renegotiate their reciprocal roaming rates between operators to reduce rates even further.[111]

e. Consumer Response

Some of the statistics reported by mobile telephone operators, such as net new subscriber growth, churn, and minutes-of-use ("MOUs"), show the effectiveness with which the new entrants are providing competition in the mobile telephone market.

Net New Subscriber Growth. Since the launch of the first broadband PCS system in November 1995, broadband PCS operators and Nextel Communications have combined to take steadily increasing portions of the industry's subscriber growth.[112] In fact, this portion has now grown to the point where the share of growth for these new entrants far exceeds their share of the industry's total population of subscribers. During their first year of operations, the new entrants acquired between four and six percent of each quarter's new mobile telephone subscribers.[113] By the third and fourth quarters of 1998, the new entrants were taking more than 45 percent of net new subscribers. Many analysts project that this trend will

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[109] Cynthia M. Motz, DON'T HANG UP ON WIRELESS, Equity Research - Americas, Credit Suisse First Boston Corp., Sep. 16, 1997, at 44.

[110] *See, e.g,* Vanguard Cellular Corp., Form 10-K, Dec. 31, 1998, at 22; United States Cellular Corp., Form 10-K, Dec. 31, 1998, at 16-17; AirTouch Communications, Inc. Form 10-K, Dec. 31, 1998, at 13; *and* Dobson Communications Corp., Form S-4, Feb. 2, 1999, at 56.

[111] *See* Airtouch Communications, Inc. Form 10-K, Dec. 31, 1998, at 13.

[112] *See* Appendix B, Table 6, p. B-8.

[113] *Id*.

continue into 1999, and that the new entrants will start taking half of the industry's net new subscribers.[114]

Churn. Churn refers to the number of customers an operator loses over a given period of time. Mobile telephone operators usually express churn in terms of average percent churn per month. For example, an operator might report churn of two percent for a given quarter. In other words, on average, the operator lost two percent of its customers in each of the quarter's three months. Thus, in this example, the operator would lose 24 percent of its customers in a single year and would turn over its entire customer base in approximately four years.[115] Given that churn measures the frequency with which subscribers switch operators, it is often used as an indicator of increasing competition.

The currently available data indicate that the recent entry into mobile telephone markets by broadband PCS and digital SMR operators has been accompanied by an increase in operators' churn levels. See Table 7 of Appendix B, which contains annual churn statistics for the four main publicly owned broadband PCS operators, a sample of cellular operators, and Nextel, the principal digital SMR operator.[116] In 1998, broadband PCS operators had churn averaging approximately 4.2 percent, which was an increase from the 3.2 percent experienced in 1997. Some operators even experienced quarters with churn as high as 5.5 percent. While cellular operators have lower churn, usually at or below 2 percent,[117] their churn levels have grown from 1.9 percent in 1996 to 2.0 percent in 1998. Historically, Nextel has kept its churn around 1.0 percent. However, its churn has risen from 1.0 percent in 1996[118] to 1.3 percent in 1997[119] to 1.8 percent in 1998.[120]

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[114] *See DLJ Report*, at 18.

[115] This assumes that each churned customer is a unique individual and that the same customers do not churn multiple times.

[116] *See* Appendix B, Table 7, p. B-9.

[117] A lower level of geographic coverage and a higher reliance on pre-paid subscribers are reasons most often given for the higher levels of churn experienced by the broadband PCS operators. *See* John M. Bensche and Briar Mewbourne, *The PCS Report - Coverage Initiated on the Personal Communications Services Industry*, Wireless Services, Lehman Brothers, Nov. 11, 1997, at 38. For example, for the fourth quarter of 1998, Omnipoint reported that its churn rate, 3.2 percent, was reduced to 2.5 percent if prepaid customers were excluded from the calculations. *Omnipoint Adds Over 100,000 Subscribers in Fourth Quarter*, News Release, Omnipoint Corp., Feb. 17, 1999.

[118] Nextel Communications, Inc., Form 10-K, Dec. 31, 1996, at 42.

[119] Nextel Communications, Inc., Form 10-K, Dec. 31, 1997, at 38.

Minutes-of-Use. One of the goals operators hoped to achieve by offering customers price plans with large bundles of low-price MOUs was to encourage increased overall usage of wireless services.[121] Since, as mentioned above, much of the most active price competition has been occurring in digital services, both cellular and broadband PCS, it has been anticipated that MOUs would increase on digital services.[122] As was reported in the *Third Report*,[123] the average number of minutes used each month by customers subscribing to digital services have in fact been at higher levels than MOUs of analog subscribers, which traditionally use about 100 minutes per month. Almost all of the broadband PCS operators are reported to have usage between 300 and 375 MOUs per month.[124] One cellular operator, Bell Atlantic, reported that in the fourth quarter of 1998 its digital cellular subscribers averaged 325 MOUs, which was three times the MOUs of its analog customers.[125] Nextel reported that in the fourth quarter of 1998 its digital SMR subscribers averaged approximately 400 MOUs.[126] Partly due to overall price decreases as well as the increased adoption of digital services, average MOUs for the industry as a whole are increasing. According to one analyst, average MOUs reached 143 per month per subscriber in 1998, an increase of 43 percent from 1996.[127]

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[120] Nextel Communications, Inc., Form 10-K, Dec. 31, 1998, at 40. Nextel's low churn has usually been attributed to its business-oriented customer base which uses the SMR-type services Nextel includes with traditional interconnected telephone service. David A. Freedman and Gregory H. Lundberg, *Nextel Communications, Inc. - Initiation of Coverage*, Equity Research, Bear Sterns, Jul. 30, 1997, at 10.

[121] *See e.g., AT&T Launches First National One-rate Wireless Service Plan*, News Release, AT&T Corp., May 7, 1998.

[122] It is also likely that some portion of the higher MOUs seen on digital plans is a result of existing high volume customers shifting over from their older, analog plans.

[123] *See Third Report*, 13 FCC Rcd at 19771.

[124] The Yankee Group, WIRELESS/MOBILE COMMUNICATIONS GLOBAL, *Year-End 1998 Wireless Industry Update: The Impact of All-Inclusive Rates*, Report, Vol. 2, No. 46, Dec. 1998, at 8.

[125] *Bell Atlantic Mobile's Growth Fueled by Popularity of Single Rate Plans*, News Release, Bell Atlantic Corp., Jan. 27, 1999.

[126] *Nextel Reports 1998 Results*, News Release, Nextel Communications, Inc., Feb. 23, 1999.

[127] *Good News for Mobile Phone Industry - Minutes of Use Are On the Uptick The Bad News - So is Churn*, News Release, The Strategis Group, Inc., Nov. 10, 1998.

f. Factors Affecting Growth and Competitive Development

(1) Coverage by Technology Type

As described above, digital technologies are quickly emerging as a driving force within the mobile telephone industry. Further, for many mobile telephone operators improving their digital footprint is a high priority. Cellular operators still have license areas that need the improved capacity and increased service offerings brought by digital technology. In addition, as was discussed in the *Third Report*, broadband PCS and digital SMR operators need to expand their footprints to increase their competitiveness with analog cellular services.[128] Consequently, one of the key factors affecting the mobile telephone industry in the coming years will continue to be the deployment of the various types of digital technologies.

To estimate the current deployment status of the four main digital mobile telephone technologies in use today (CDMA, TDMA, GSM, and iDEN), the Commission has made maps of each technology combining the coverage by all of the different mobile telephone operators.[129]

CDMA. Both cellular and broadband PCS operators use CDMA technology in their networks.[130] To date, CDMA has been launched in at least some portion of license areas[131] with approximately 208 million people, which is approximately 82 percent of the U.S. population.[132] Included in these areas is broadband PCS coverage in 210 BTAs containing 200 million people and cellular coverage in 148 MSAs and RSAs containing 145 million people.

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[128] *See Third Report*, 13 FCC Rcd at 19784.

[129] *See* Appendix H, Maps 2, 3, 4, and 5, at p. H-3 to H-6.

[130] The broadband PCS-based coverage is estimated using BTAs and the cellular-based coverage is estimated using Metropolitan Statistical Areas ("MSAs") and Rural Service Areas ("RSAs"). There are several important caveats to note when using these data. First, to be considered as having "coverage," only a portion of a license area needs to be covered. Consequently, some of the license areas included in this analysis have only a small amount of coverage from a particular provider, possibly resulting from the buildout of a neighboring market. Second, the POPs figures in this analysis include all of the POPs in a license area with coverage. Third, because of the second points, this analysis overstates the total coverage in terms of both geographic areas and populations covered. Fourth, because BTAs usually cover larger geographic areas than MSAs and RSAs, digital coverage on broadband PCS systems can appear to be greater than digital cellular coverage, when that is not necessarily the case. Fifth, all population figures are based on the 1990 census.

[131] *See* Appendix H, Map 2, p. H-3.

[132] *See* Appendix B, Table 8, p. B-10.

TDMA. Cellular and broadband PCS operators also both use TDMA technology.[133] To date, TDMA has been launched in at least some portion of license areas[134] containing approximately 191 million people, which is 76 percent of the U.S. population.[135] Included in these areas is broadband PCS coverage in 48 BTAs containing 68 million people and cellular coverage in 293 MSAs and RSAs containing over 163 million people.

GSM. In the United States, only broadband PCS operators are deploying GSM. To date, GSM has been launched in at least some portion of 231 BTAs containing 174 million people, or approximately 69 percent of the U.S. population.[136]

iDEN. The analysis of iDEN coverage is limited to the largest digital SMR provider, Nextel. While Nextel is not the only provider using iDEN,[137] it is the only one for which detailed coverage information is available. To date, Nextel has launched iDEN-based service in at least some portion of 187 BTAs, containing over 191 million people, or approximately 76 percent of the U.S. population.[138]

(2) Multi-Mode Handsets

As was discussed in the *Third Report*, handsets that are capable of using multiple technologies and multiple spectrum bands are used by digital operators to increase coverage for their customers.[139] Such handsets are most often used to allow digital customers to roam on analog cellular networks when outside their digital coverage areas. One major development since the *Third Report* is the announcements by some equipment manufacturers that they will soon start shipping a "tri-mode" CDMA handset. Similar to a TDMA-based handset used by AT&T, these CDMA handsets will allow users to access CDMA networks in broadband PCS spectrum bands, plus both analog and CDMA networks in cellular spectrum bands.[140] This handset will allow broadband PCS and cellular customers to access the

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[133] The caveats associated with the CDMA estimates are applicable to TDMA as well.

[134] *See* Appendix H, Map 3, p. H-4.

[135] *See* Appendix B, Table 8, p. B-10.

[136] *See* Appendix B, Table 8, p. B-10 *and* Appendix H, Map 4, p. H-5.

[137] *See* Traditional Dispatch Services section below, Sec. II.C.

[138] *See* Appendix B, Table 8, p. B-10 *and* Appendix H, Map 5, p. H-6.

[139] *See Third Report*, 13 FCC Rcd at 19785.

[140] *See Nokia Presents New Products at CTIA Wireless '99*, News Release, Nokia Corp., Feb. 8, 1999.

features of digital handsets when in areas covered by the other spectrum block. This handset will also allow cellular carriers that use CDMA technology to expand their network capacity by combining 10 MHz broadband PCS licenses with their existing cellular licenses.[141] On the other hand, an integrated handset allowing broadband PCS GSM customers to roam on analog cellular networks is still not available.[142]

2. Cellular Sector Analysis

During the 1970s, the Commission licensed 50 MHz of spectrum in the 800 MHz frequency band for two competing cellular systems in each market (25 MHz for each system). These licenses are divided into 305 MSAs and 428 RSAs, plus a market for service in the Gulf of Mexico, for a total of 734 geographic license areas.

a. Cellular Sector Structure and Performance

The structure of the cellular sector has not changed significantly since the release of the *Third Report*[143] in that the largest operators are mostly Bell Operating Companies ("BOCs"), inter-exchange carriers, or entities that have been spun off from one of those two (e.g., AirTouch).[144] At the end of 1998, there were two cellular carriers with more than seven million subscribers and two more with more than six million subscribers. At the end of 1997, only the two largest carriers had more than six million subscribers.

One notable trend in the performance of cellular operators is the effect broadband PCS operators have had on cellular subscriber growth. This impact is most noticeable when analyzing the growth of penetration rates of the cellular operators. In the years preceding the launch of broadband PCS and digital SMR, cellular operators usually increased their penetration rates by between one and two percentage points each year.[145] For example,

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[141] For example, last year AirTouch acquired broadband PCS E block licenses in Bakersfield, Los Angeles, and San Diego, California and Las Vegas and Reno, Nevada from Rivgam Communicators, L.L.C. *See* "Wireless Telecommunications Bureau Commercial Wireless Service Information," *Public Notice*, Report No. LB-98-44, (rel. May 29, 1998). All of these are areas where AirTouch has at least some level of ownership in one of the existing cellular licenses. *See* Appendix I.

[142] There are examples of GSM operators who use an extra adapter that permits roaming using GSM handsets. *See Powertel Launches Dual-Mode Wireless Service*, News Release, Powertel, Inc., Dec. 14, 1998.

[143] *See id.*, 13 FCC Rcd at 19779.

[144] *See* Appendix B, Table 9A, p. B-11.

[145] *See* Appendix B, Table 9B, p. B-12.

cellular operators increased their penetration rates on average by 1.55 percent and 1.68 percent in 1995 and 1996 respectively. However, in 1997, the increase in cellular operators' average penetration rates dropped by 12 percent, down to 1.48 percent. In 1998, their increase in average penetration decreased again, down to 1.23 percent.

b. Response to Competition

The efforts of cellular operators, discussed in the *Third Report*,[146] to increase their capacity and expand their service offerings by deploying digital technologies has continued during the past year. To track these digital rollouts, the Commission has compiled a list of MSAs and RSAs with some level of digital coverage by the incumbent cellular operators. These data are based on information from operators, as well as on publicly available information released by the operators such as news releases, filings made with the Securities and Exchange Commission, and coverage maps available on operators' Internet sites. This analysis found that digital cellular services are available in over 375 MSAs and RSAs, which have a combined coverage of more than 202 million POPs, or approximately 80 percent of the nation's total population.[147]

Recent reports by cellular carriers indicate that at least some of them have been successful both in gaining consumer acceptance of their digital services and in migrating a significant percentage of network usage to the digital portions of their networks, thereby relieving some of the pressures on the analog portion. For example, during 1998, AT&T, the nation's largest digital cellular operator, increased its digital subscriber total to approximately 4.35 million, an increase of 150 percent from 1.75 million at the end of 1997.[148] During 1998, SBC increased its TDMA subscribership from almost nothing to 660,000 and migrated 30 percent of the wireless minutes in its top markets to digital.[149] Bell Atlantic increased its digital subscribership six fold to 950,000 during 1998, and migrated 40 percent of busy-hour calls to

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[146] *See Third Report*, 13 FCC Rcd at 19780.

[147] *See* Appendix B, Table 8, p. B-10 *and* Appendix H, Map 6, p. H-7.

[148] AT&T increased its digital penetration rate from 29.3 percent (of 5,964,000 consolidated subscribers) to 60.5 percent (of 7,198,000 million consolidated subscribers). Both of these figures include subscribers on broadband PCS systems. *See* AT&T Corp., AT&T EARNINGS COMMENTARY, *AT&T's Fourth Quarter Operational Profits Were $1.00 Per Share, an Increase of 45 Percent*, Jan. 25, 1999, at 7.

[149] SBC Communications Inc., *Investor Briefing, SBC Delivers 19.3 Percent Earnings Growth in 1998; Grows Fourth-Quarter Earnings 20 Percent*, No. 206, Jan. 21, 1999, at 6.

digital.[150]

3. Broadband PCS Sector Analysis

Broadband PCS is similar to cellular service, except that broadband PCS systems are designed to use a digital format. The Commission set aside 120 MHz between 1850 MHz and 1990 MHz for broadband PCS.[151] This spectrum was divided into three blocks of 30 MHz each and three blocks of 10 MHz each. Two of the 30 MHz blocks are divided into 51 Major Trading Areas[152] ("MTAs"). One of the 30 MHz blocks and all of the 10 MHz blocks are divided into 493 BTAs.[153]

a. Broadband PCS Sector Structure and Performance

The broadband PCS sector is made up of one nationwide carrier, a number of other carriers that are constructing large regional networks of varying sizes, and carriers that are constructing networks more statewide or local in size. A number of these carriers are creating wireless systems based solely on their broadband PCS licenses. For example, Sprint PCS is creating a nationwide network, and Omnipoint Corp., Aerial Communications Inc., and Powertel, Inc. are building large regional systems. There are also operators, such as AT&T, SBC, and BellSouth Corp., for which broadband PCS networks are complements to their

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[150] *Strong Telecom and Wireless Volumes Drive Double-Digit Bell Atlantic Earnings Growth*, News Release, Bell Atlantic Corp., Jan. 27, 1999 *and* Bell Atlantic Corp., INVESTOR'S REFERENCE GUIDE 97 (1998), at 55.

[151] The remaining 20 MHz of spectrum for unlicensed broadband PCS is allocated for short-range communications such as a local area networks in offices. These systems operate with very low power and have a limit on the duration of transmissions.

[152] Major Trading Areas are Material Copyright (c) 1992 Rand McNally & Company. Rights granted pursuant to a license from Rand McNally & Company through an arrangement with the Personal Communications Industry Association. MTAs are combinations of two or more Basic Trading areas. Rand McNally's MTA specification contains 47 geographic areas covering the 50 states and the District of Columbia. For its spectrum auctions, the Commission added the following MTA-like areas: 1) Guam and the Northern Mariana Islands, 2) Puerto Rico and the United States Virgin Islands, and 3) American Samoa. In addition, Alaska was separated from the Seattle MTA into its own MTA-like area.

[153] In June 1998, as a result of WT Docket No. 97-82, broadband PCS C block licensees could elect to disaggregate their licenses and return 15 MHz of C block spectrum to the Commission. As a result, a number of licensees elected to disaggregate some or all of their licenses, creating new C block BTAs with seven spectrum licenses. *See* Amendment of the Commission's Rules Regarding Installment Payment Financing for Personal Communications Services (PCS) Licensees, WT Docket No. 97-82, *Second Report and Order and Further Notice of Proposed Rule Making*, 12 FCC Rcd 16436 (1997) *and* Amendment of the Commission's Rules Regarding Installment Payment Financing for Personal Communications Services (PCS) Licensees, WT Docket No. 97-82, *Order on Reconsideration of the Second Report and Order*, 13 FCC Rcd 8345 (1998).

existing cellular holdings.

The past year has been one of strong growth for broadband PCS operators. Since the *Third Report*, a dozen new operators have launched systems, including the BOC Ameritech Corp., two of AT&T's joint ventures (Triton PCS, Inc. and Telecorp PCS, Inc.), and a number of smaller carriers.[154] During 1998, operators for whom there is publicly available information increased their subscribership by 255 percent to over six million.

b. Competitive Development

Given that the broadband PCS sector remains in its early stages of development, the most important variable affecting its ability to compete in the mobile telephone market is coverage. As discussed above, the primary short-term advantage held by the incumbent cellular sector is its extensive coverage. Many potential customers, especially business users, may have been hesitant to sign up for service until broadband PCS has adequate coverage. Thus, broadband PCS operators have made expansion of their footprints a primary focus.

To date, broadband PCS service has been launched in at least some portion of 320 BTAs containing nearly 229 million POPs.[155] While 46 percent of these 320 BTAs have only one broadband PCS operator, 111 BTAs have two PCS operators, 54 BTAs have three operators, and eight BTAs now have four operators. These 173 BTAs include 75 percent of the nation's POPs.

A view of the rollout of broadband PCS by license blocks shows that most of the activity has been in the A and B blocks, with 164 and 214 BTAs launched respectively.[156] C block operators have coverage in at least some portion of 35 BTAs with over 17 million POPs.

To show where the broadband PCS operators have been concentrating their deployment efforts, this report has divided the BTAs into quartiles by their total populations.[157] Of the BTAs in the top quartile (the 123 most populated BTAs), 119 have at least one broadband PCS operator providing some coverage. The second quartile (the next 123 most populated BTAs) has 94 BTAs with some coverage, and the bottom two quartiles have only 61 and 46 BTAs, respectively, with some coverage.

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[154] *See* Appendix B, Table 10, p. B-16 *and Third Report Appendixes*, at B-16. For information about broadband PCS operators' financial statistics, *see* Appendix, B, Tables 11 and 12, p. B-17 and B-18.

[155] *See* Appendix B, Table 13A, p. B-19 *and* Appendix H, Map 7, p. H-8.

[156] *See* Appendix B, Table 13B, p. B-19.

[157] *See* Appendix B, Table 13D, p. B-20.

4. Other Competitors: Nextel Communications, Other Specialized Mobile Radio Operators, Resellers, and Satellite Operators

This section discusses several other types of operators that are competing in the mobile telephone segment: Nextel, other SMR operators, resellers, and satellite operators.

a. Nextel Communications, Inc.

For a number of years, another source of competition in mobile telephone markets has been SMR service. SMR was first established by the Commission in 1979 to provide land mobile communications on a commercial basis. While the primary use for SMR traditionally has been dispatch services,[158] SMR systems have always had the ability to offer "interconnected" service allowing access to the PSTN, but until recently have suffered from limited capacity.

Digital technologies have enabled SMR providers to become competitors in mobile telephone markets. As reported in the *Third Report*,[159] the operator most responsible for using digital technology to make SMR a mobile telephone competitor has been Nextel, with its deployment of Motorola, Inc.'s iDEN technology.[160] Nextel has combined various billings features, a near-nationwide footprint, and handsets that can be used for both interconnected service as well as traditional dispatch type services (called "Direct Connect") to create an offering targeted to business users.[161]

During the past year, Nextel has continued to develop its mobile telephone business. Nextel's network currently has coverage in more than 400 cities, including 92 of the top 100 markets.[162] Nextel has continued to add customers at the rapid pace reported in the *Third Report*, adding over 1.5 million new digital customers since the *Third Report*.[163] Nextel also continues to record the highest ARPU levels in the mobile telephone industry, reaching as

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[158] *See* Section II.C for a discussion of the dispatch market.

[159] *See Third Report*, 13 FCC Rcd at 19786-19788.

[160] The only other SMR licensee known to the Commission to be using digital technology (Southern Company offers its Southern LINC service using an iDEN network) is more focused on the traditional dispatch market. *See* Section II.C.

[161] *See* Nextel Communications, Inc., Form 10-K, Dec. 31, 1998, at 3.

[162] *Nextel Reports 1998 Results*, News Release, Nextel Communications, Inc., Feb. 23, 1999.

[163] *See Nextel Reports First Quarter Results*, News Release, Nextel Communications, Inc., Apr. 19, 1999.

high as $70 per subscriber per month.[164] In the third quarter of 1998, Nextel reported positive operating cash flow[165] for the first time for its domestic digital SMR operations.[166]

Nextel also introduced new products and services designed to keep its digital SMR service competitive with other mobile telephone services. In September 1998, Nextel began to offer Motorola's i1000 handset. This device combines all of Nextel's existing services into a handset similar to Motorola's popular StarTac cellular phone.[167] Nextel stated that this handset would allow Nextel to extend its customer base to business owners, managers, and executives.[168] In addition, Nextel followed the trend of DOR price plans discussed above by introducing its Nextel National Business Plan in January 1999.[169] The plan offers 500 or 900 digital cellular minutes, for $89.95 and $129.95, respectively, that can be used anywhere on Nextel's network with no extra charge for long distance.[170] These developments were partly responsible for the steady shift in 1998 of Nextel's MOUs away from Direct Connect minutes and toward interconnected mobile telephone minutes. In the first quarter of 1998, mobile telephone minutes accounted for 33 percent of Nextel's total MOUs.[171] By the fourth quarter of 1998, that figure rose to 45 percent.[172]

As was mentioned in the *Third Report*, Nextel's technology is incompatible with cellular and broadband PCS networks, making it impossible to roam away from Nextel's network.[173] In an effort to accelerate the expansion of its iDEN coverage, Nextel recently proposed an

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[164] *Nextel Reports 1998 Results*, News Release, Nextel Communications, Inc., Feb. 23, 1999.

[165] Operating cash flow equals earnings before interest, taxes, depreciation and amortization (often referred to as "EBITDA"). It is a commonly used measure to determine the financial performance of many wireless telecommunications operators.

[166] *Nextel Reports Third Quarter Results*, News Release, Nextel Communications, Inc., Oct. 15, 1998.

[167] *Nextel Unveils New Pocket-Sized Phone*, News Release, Nextel Communications, Inc., Sep. 8, 1998.

[168] *Id*.

[169] *Nextel Introduces National Rate Plan*, News Release, Nextel Communications, Inc., Jan. 6, 1999.

[170] *Id*.

[171] Statement made by Nextel official during Nextel's fourth quarter 1998 earnings conference call, Feb. 23, 1999.

[172] *Id*.

[173] *See Third Report*, 13 FCC Rcd at 19788.

affiliation agreement with Nextel Partners, Inc.[174] Under this agreement, Nextel Partners, Inc. agreed to build and operate iDEN-based SMR systems for Nextel.[175] This final completion of this agreement is pending approval of the license transfers.

b. Other Specialized Mobile Radio Operators

Traditionally, urban SMR operators had only a limited ability to offer mobile telephone services. This limitation has been due to a number of factors, including limited spectrum availability and the preclusion of spectrum reuse by traditional, analog high-power, single site transmitter systems employed by SMR operators.[176] In contrast, SMR operators in less spectrum-scarce, rural areas have faced fewer capacity difficulties and, consequently, have a greater ability to offer mobile telephone services.[177] For example, prior to its 1997 merger with Nextel, Pittencrieff Communications, Inc. focused on rural areas and presented its service as an alternative to cellular service.[178] As recently as 1996, SMR operators other than Nextel had several hundred thousand customers using interconnected service.[179]

c. Resellers

Resellers offer service to consumers by purchasing air time at wholesale rates from facilities-based providers and reselling it at retail prices.[180] According to a survey performed by the National Wireless Resellers Association in 1997, the resale sector had between 100 and 120

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[174] Nextel Partners, Inc., is a company created specifically to enter the mobile telephone industry by entering this affiliation agreement with Nextel. Its largest equity investors include: Nextel WIP Corp. (a wholly owned Nextel subsidiary), DLJ Merchant Banking Partners II, L.P., Eagle River Investments, L.L.C., Motorola, Inc. and Madison Dearborn Capital Partners II, L.P. *See Nextel Finalizes Agreements with Nextel Partners, Inc.*, News Release, Nextel Communications, Inc., Feb. 1, 1999.

[175] *Nextel Finalizes Agreements with Nextel Partners, Inc.*, News Release, Nextel Communications, Inc., Feb. 1, 1999.

[176] Nextel Communications, Inc., Form 10-K, Dec. 31, 1996, at 5.

[177] Pittencrieff Communications, Inc., Form 10-K, Dec. 31, 1996, at 4.

[178] *Id*.

[179] *See RCR Top 20 SMRs*, RCR RADIO COMMUNICATIONS, Feb. 10, 1997, at 14. This is the most recent Top 20 SMRs list published by RCR Radio Communications.

[180] *Interconnection and Resale Obligations Pertaining to Commercial Mobile Radio Services*, CC Docket No. 94-54, *First Report and Order*, FCC 96-263, 61 Fed. Reg. 38399 (Jul. 24, 1996), at paras. 10-11.

providers with a total of approximately two million mobile telephone subscribers.[181] In 1998, the top 20 resale providers had over 1.1 million subscribers, which was almost unchanged from 1997.[182] MCI Worldcom, Inc. is by far the largest reseller with over half of all the subscribers of the 20 largest resellers. In addition, MCI Worldcom, Inc.'s 1998 total of 565,000 customers is a slight decrease from MCI Communications Inc. and Worldcom Corp.'s combined, pre-merger total of 580,000. The remainder of the 20 largest resellers combined grew by only 4.2 percent between 1997 and 1998, well below the 24 percent growth rate for the mobile telephone industry as a whole.

d. Satellite Operators

On November 1, 1998, Iridium LLC ("Iridium") launched the first satellite-based hand-held, global satellite telephone system.[183] Iridium uses a constellation of 66 low earth-orbit satellites[184] to provide mobile telephone service from virtually any point on the globe. In urban areas, the system also offers users a cellular roaming service based on dual-mode phones that can be switched to operate with terrestrial wireless networks. Currently, Iridium's handsets can cost between $3,000 and $4,500,[185] and satellite-based calls typically cost between $3 and $6 per minute.[186]

To date, it has been reported that Iridium has experienced difficulties gaining the initial operational results for which it had planned.[187] As a result of these difficulties, Iridium

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[181] Anthony Bruno, *Resale Industry Rises to Meet Challenges of New Environment*, RCR RADIO COMMUNICATIONS REPORT, Aug. 4, 1997, at 11.

[182] *See* Appendix B, Table 15, p. B-22.

[183] *The World's First Global Satellite Telephone and Paging Company Starts Service Today*, News Release, Iridium LLC, Nov. 1, 1998.

[184] Low earth orbit satellites (often referred to as "LEOs") are satellites placed into orbits only a few hundred miles above the surface of the earth (compared to traditional geostationary satellites that orbit approximately 22,300 miles above the earth). For example, Iridium's satellites are at an altitude of approximately 780 kilometers (approximately 484 miles) and circle the Earth approximately once every 100 minutes. *See* Iridium World Communications Ltd., Form 10-K, Dec. 31, 1997, at 12.

[185] Communications Daily, *Anemic Iridium Reports Only 10,294 Customers In Quarter*, Apr. 27, 1998.

[186] Charles Bickers, *Wired Skies: Satellite Phones Will Reach Places Cellphones Can't*, FAR EASTERN ECONOMIC REVIEW, Apr. 1, 1999, *available in* 1999 WL-FEER 8674730.

[187] COMMUNICATIONS DAILY, *Iridium Seen Likely to Break First-Quarter Debt Covenants*, Feb. 25, 1999.

sought, and was granted, a 60-day extension,[188] plus a subsequent 30-day extension,[189] on covenants from creditors who hold $800 million in Iridium's debt. These covenants originally called for the company to meet specific subscriber and revenue targets by the end of March 1999.[190]

Several other satellite-based mobile telephone systems have announced plans to launch service during 1999 and 2000 to compete with Iridium. For example, Globalstar Telecommunications, Ltd. is currently planning to commence service in the third quarter of 1999,[191] and ICO Global Communications expects to launch service in 2000.[192]

B. Paging and Messaging

The paging/messaging industry continued to evolve during the year since the *Third Report*. As noted last year, many paging carriers have begun to refer to their products as "messaging services."[193] As used herein, messaging refers broadly to both traditional one-way paging services, as well as advanced services provided over narrowband PCS spectrum.[194]

Historically, paging has been a one-way wireless radio-transmission using coded radio signals to activate a device that provides an audio, visual, or tactile indicator. Over time, one-way paging services have become fairly homogeneous,[195] and competition for the service is now

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[188] Christopher Price, *Iridium Wins 60-Day Extension From Lenders*, FINANCIAL TIMES, Mar. 30, 1999, *available at* 1999 WL 3450672.

[189] *Iridium Receives 30-Day Extension From Lenders*, News Release, Iridium LLC, May 28, 1999.

[190] Christopher Price, *Iridium Wins 60-Day Extension From Lenders*, FINANCIAL TIMES, Mar. 30, 1999, *available at* 1999 WL 3450672.

[191] Globalstar Telecommunications, Ltd., Form 10-Q, Sep. 30, 1998, at 10.

[192] *ICO Reports 1998 Results*, News Release, ICO Global Communications, Feb. 17, 1999.

[193] *Third Report*, 13 FCC Rcd at 19790.

[194] The Commission auctioned regional and nationwide narrowband PCS licenses in 1994. The Commission noted that narrowband PCS can be used to provide services such as voice message paging, two-way acknowledgement paging and other data services. FCC, *FCC Auction - Regional Narrowband PCS - Fact Sheet* (visited Mar. 5, 1999) <http://www.fcc.gov/wtb/auctions/mpcs/rnp1fact.html>. Carriers often refer to such services as "advanced messaging services." SkyTel Communications Inc., Form 10-K, Dec. 31, 1998, at 1.

[195] *Third Report*, 13 FCC Rcd at 19808.

generally centered on price.[196] However, this view of the market is beginning to change. One analyst believes that the key drivers to future growth in the industry will include those service features that offer product differentiation such as advanced messaging and information services (transmitted over one-way and advanced messaging networks), as well as telemetry services.[197] The industry has also recognized this marketing shift. For example, 60 percent of the industry recently reached agreement on a set of service standards for transmitting Internet-based information to pagers.[198] The standards will permit customized information to be downloaded to customers and will allow paging providers to charge a premium for the service.[199] Carriers have also announced restructuring efforts that focus on improving financial performance rather than on increasing subscribers.[200]

This report's discussion of the paging/messaging industry begins with an analysis of the industry as a whole followed by information about specific service providers and, similar to the *Third Report*, includes information about consolidations and restructurings. The report also discusses innovative services that may contribute to the continued growth in the paging/messaging industry. The section concludes with industry projections and an assessment of competition.

1. Paging Industry Structure and Performance

In 1998, the paging industry experienced growth in both total subscribers and annual revenues.[201] Based on an analyst's 1998 estimate, 5 million new paging units (including one-

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[196] Analysts argue that paging is a commodity-based business. *See* Dennis Leibowitz, et. al., THE WIRELESS COMMUNICATIONS INDUSTRY, Donaldson, Lufkin & Jenrette, Spring 1998, at 30. A commodity is a product or service that is not highly differentiated and competition for the product or service is based on price.

[197] Jeanine Oburchay, *Wall Street Perspective*: *Is Paging a Lasting Application?*, PAGINGNOW, Dec. 10, 1998 <http://www.pagingnow.com>; *See also Wireless Messaging: A $6.6 Billion Revenue Business in 1999*, WIRELESS DATA & MESSAGING, Jan. 31, 1999, at 4. Telemetry services are discussed in Appendix G.

[198] *Wireless Messaging Industry Prepares for Information Explosion*, News Release, Paging Network, Inc., Nov. 19, 1998. Eleven companies, serving more than 60 percent of the nation's approximately 50 million paging customers approved the standards. *Id*.

[199] *Id*.; *DLJ Report*, at 38.

[200] *See Gains Too Modest To Assess Paging Industry's Shift In Marketing*, COMMUNICATIONS TODAY, Nov. 9, 1998, *available in* 1998 WL 17661712.

[201] Appendix C, Table 1, p. C-2, displays the total subscribers, annual revenues, and ARPU for the paging industry for the years 1995 through 1998. Appendix C also includes lists of public paging companies' revenues, EBITDA/operating cash flow, and EBITDA/operating cash flow margin. *See* Tables 2, 3, 4, and 5, pp. C-3

way and advanced messaging units) were to be added for a total of 53.3 million paging units, an increase of more than 10 percent over 1997.[202] In contrast, another analyst forecasts 50.5 million units in service at year-end 1998, due in part to announcements by PageMart Wireless, Inc. ("PageMart") and Paging Network, Inc. ("PageNet") that they planned to report customer losses in the fourth quarter of 1998, totalling almost one percent of the industry.[203] In fact, while PageNet previously announced it would lose 275,000 to 325,000 units in service, it actually lost 388,000 units.[204]

PageNet maintains its place as the largest U.S. paging carrier with almost 10 million subscribers. However, due to two large mergers, the second and third place carriers are much closer to PageNet's share of total subscribers.[205] Based on 53.3 million subscribers, PageNet has 18.5 percent of total industry subscribers, Arch has 13.8 percent, and Metrocall, Inc. ("Metrocall") has 10.6 percent.[206] A detailed discussion of consolidation activity is presented below.

Some of the effects of restructuring efforts can be seen by comparing the growth in total subscribers to the growth in industry revenues. Last year, one analyst forecast total 1998 paging revenues would be $6.2 billion, an increase of nearly 20 percent over 1997, almost double the growth rate of subscribers.[207] As a result of the difference in growth rates,

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through C-6 respectively.

[202] THE STRATEGIS GROUP, THE STATE OF THE US PAGING INDUSTRY: 1998 (1998), at 14. ("*Strategis Paging Report*") Paul Kagan Associates, Inc. estimates 52.3 million paging units in service at year-end 1998. Paul Kagan Associates, Inc., *Wireless Messaging: A $6.6 Billion Revenue Business in 1999*, WIRELESS DATA & MESSAGING, Jan. 31, 1999, at 4. The Yankee Group estimates 54.2 million paging units in service at year-end 1998. *PCIA Forecast*, at 5.

[203] *See DLJ Report*, at 33, 39.

[204] *PageNet Reports Quarterly and Annual Results; Company Reports Year Over Year Improvement Despite Restructuring*, News Release, Paging Network, Inc., Feb. 16, 1999; *Major Paging Carriers' Financials Take the Street by Surprise*, PAGINGNOW, Feb. 17, 1999 <http//www.pagingnow.com>.

[205] *See* Appendix C, Table 2, p. C-3.

[206] *See id.*

[207] *Strategis Paging Report*, at 30. Paul Kagan Associates, Inc. also estimates $6.2 billion in revenues in 1998. Paul Kagan Associates, Inc., *Wireless Messaging: A $6.6 Billion Revenue Business in 1999*, WIRELESS DATA & MESSAGING, Jan. 31, 1999, at 4.

estimated 1998 ARPU is $10.17 per month, up $0.60 from 1997.[208] A detailed discussion of revenue-enhancing innovative services is provided in Section II.B.3 below.

2. Operational Trends

a. Industry Consolidations

As noted above, two major consolidations have been completed since the release of the *Third Report*, along with a number of smaller mergers. Analysts argue that such consolidation is necessary and will continue[209] if paging is to survive, particularly in light of the large capital costs associated with building a narrowband PCS network. Some analysts have estimated that these capital costs are in the range of $250 to $400 million per nationwide network and have in total already exceeded $1.8 billion for narrowband networks built to date.[210]

Metrocall/AMD. In October, Metrocall acquired AT&T's Advanced Messaging Division ("AMD") and, in the process, also obtained one nationwide 50/50 KHz narrowband PCS license.[211] Including the merger with ProNet, discussed in the *Third Report*,[212] Metrocall is now the third largest paging carrier in the U.S. and serves more than 5.6 million customers.[213] In addition, as part of the agreement, AT&T will offer Metrocall's messaging services in all of its wireless stores for the next five years.[214]

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[208] *Strategis Paging Report*, at 28. In the *Third Report*, the ARPU was reported at $9.11 and was taken from estimates made by Strategis. Strategis has since revised the 1997 ARPU estimate to $9.57. *Id*.

[209] Jeanine Oburchay, *Wall Street Perspective: Is Paging a Lasting Application?*, PAGINGNOW, Dec. 10, 1998.

[210] Bill Menezes, *Paging Begins To Mature: Industry Moves To New Phase*, WIRELESS WEEK, Aug. 24, 1998, at 23; Paul Kagan Associates, Inc., *Narrowband PCS: Betting Heavily on the Future*, WIRELESS DATA & MESSAGING, Dec. 31, 1998, at 4.

[211] *See* Grant Butler, *Metrocall Completes Purchase of AT&T Advanced Messaging*, NEWSBYTES NEWS NETWORK, Oct. 5, 1998, *available in* 1998 WL 20717068. AMD's other nationwide narrowband PCS license was sold to TSR Wireless, Inc. in an unrelated transaction. *See TSR Wireless Signals Plan for Major Presence in NPCS Market*, LAND MOBILE RADIO NEWS, Aug. 28, 1998, *available in* 1998 WL 6631792.

[212] *Third Report*, 13 FCC Rcd at 19703.

[213] *See* Appendix C, Table 2, page C-3.

[214] *See* Grant Butler, *Metrocall Completes Purchase of AT&T Advanced Messaging*, NEWSBYTES NEWS NETWORK, Oct. 5, 1998, *available in* 1998 WL 20717068. Further, in January 1999, Metrocall announced that it will offer AT&T's Digital PCS and Digital One Rate offerings via its direct sales force. *See* Paul Kagan Associates, Inc., *Wireless Marketing Mentionables*, WIRELESS DATA & MESSAGING, Jan. 31, 1999, at 6.

Arch/MobileMedia. In August 1998, Arch entered negotiations to acquire MobileMedia, the fourth largest publicly-traded carrier, which would make Arch the second largest U.S. paging company with over seven million customers.[215] In the midst of the merger, MobileMedia announced plans to launch advanced messaging services by mid-year 1999, using its narrowband PCS licenses.[216] The Commission approved the merger in February 1999.[217] In April 1999, the U.S. Bankruptcy Court for the District of Delaware confirmed MobileMedia's proposed merger with Arch under its Chapter 11 bankruptcy plan of reorganization.[218] In June 1999, the acquisition was completed.[219]

Other Mergers. Aquis Communications, Inc., ("Aquis") a privately-held company, was formed to acquire Bell Atlantic Paging and subsequently merged with Paging Partners Corporation.[220] Following the acquisitions, Aquis was projected to have approximately 431,000 customers.[221] In August 1998, Vanguard acquired the operations and 70,000 customers of NationPage, which operated primarily in Pennsylvania and the upstate New York region.[222]

b. Industry Restructurings

The *Third Report* indicated that carriers were beginning to shift from a "subscriber growth-at-

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[215] *See Arch Communications and MobileMedia in Negotiations for Merger*, BUSINESS WIRE, Aug. 19, 1998.

[216] *See MobileComm Readies for NPCS Promotion*, PAGINGNOW, Feb. 25, 1999 <http://www.pagingnow.com>. MobileComm is a wholly-owned subsidiary of MobileMedia Corporation. *See id*.

[217] In the Matter of MOBILEMEDIA CORPORATION, et. al. Applicant for Authorizations and Licenses of Certain Stations in Various Services, WT Dkt. No. 97-115, *Memorandum Opinion and Order*, Rel. Feb. 5, 1999.

[218] *See Court Confirms MobileMedia's Plan of Reorganization Clearing Way for Acquisition by Arch Communications Group*, News Release, Arch Communications Group, Inc., Apr. 12, 1999.

[219] *Arch Merges With MobileMedia*, News Release, Arch Communications Group, Inc., Jun. 4, 1999.

[220] *See BAP Acquisition Corp. Announces New Company Name*, PR NEWSWIRE, Dec. 28, 1998; *See Paging Partners Officially Changes Name*, PAGINGNOW, Apr. 6, 1999 <http://www.pagingnow.com>.

[221] *See AQUIS Completes Deal for Bell Atlantic Paging*, News Release, Aquis Communications, Feb. 17, 1999.

[222] *Vanguard Cellular Acquires NationPage*, BUSINESS WIRE, Aug. 5, 1998; The *Third Report* indicated that Vanguard acquired NationPage in December 1997. However, that was merely the announcement of a definitive agreement. *Third Report*, at 19793.

any-cost" strategy to a focus on revenue growth.[223] Both PageNet and Arch, for example, have announced restructuring initiatives with accompanying layoffs and service price increases.[224] One of the most dramatic impacts of this strategy was PageNet's announcement that it lost 388,000 subscribers during the fourth quarter of 1998 due to subscriber terminations and inactive reseller accounts.[225]

3. Competitive Strategies

As was noted earlier in this section, analysts argue that, for paging to continue to experience growth, carriers will need to provide narrowband PCS services and/or information services. These services are being added or expanded in response to competition from other paging companies and other wireless sectors.

The digital technology employed by digital cellular, broadband PCS, and digital SMR providers allows two-way handsets to act as one-way pagers and advanced messaging devices.[226] Analysts believe that these carriers will continue to attract paging customers.[227] For example, a recent study by the Strategis Group states that almost one-fifth of potential turnover customers (based on a four percent churn level) are considering replacing their pagers with mobile phones.[228] However, the same study showed an unwillingness among the 25 million users of both mobile phones and pagers to abandon their pagers.[229] Analysts also are quick to delineate paging's advantages over mobile phones, such as size, price (monthly paging bills are, on average, about one-fourth of the average mobile telephone bill[230]), in-

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[223] *Third Report*, 13 FCC Rcd at 19803.

[224] *See Arch Joins the Restructuring Club*, INSIDE PAGING, Jun. 12, 1998.

[225] *PageNet Reports Quarterly and Annual Results; Company Reports Year Over Year Improvement Despite Restructuring*, News Release, Paging Network, Inc., Feb. 16, 1999; *Major Paging Carriers' Financials Take the Street by Surprise*, PAGINGNOW, Feb. 17, 1999 <http://www.pagingnow.com>.

[226] *Third Report*, 13 FCC Rcd at 19801.

[227] *See DLJ Report*, at 36.

[228] *Customer Churn Stirs Up Paging Industry*, News Release, The Strategis Group, Nov. 5, 1998.

[229] *Id*.

[230] Average monthly revenue per paging unit was estimated to be $10.17 in 1998 while the average local monthly bill for mobile telephones was estimated to be $39.43. *See* Appendix C, Table 1, p. C-2 and Appendix B, Table 1, p. B-2.

building coverage, battery life, and unobtrusiveness.[231] Other analysts believe that as broadband PCS matures, it will be able to meet paging's advantages.[232] Other carriers also provide advanced messaging services in competition with paging/messaging providers, including ARDIS Company ("ARDIS"),[233] BellSouth Wireless Data ("BWD")[234] and ReadyCom, Inc.[235] In 1998, analysts noted that once the form factor (*i.e.*, shape and size) and price of the messaging devices used by ARDIS and BWD decreases, and the distribution channels improve, the companies could provide more competition in advanced messaging.[236] Since that analysis, a device one-half the size has been introduced[237] and published prices for the messaging devices have fallen substantially.[238] In addition, PageNet and BWD recently announced that PageNet will market BWD's service.[239] American Mobile Satellite Corporation (owner of ARDIS) and SkyTel Communications, Inc. ("SkyTel") have entered a

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[231] *See DLJ Report*, at 36.

[232] *See* Bruce Felps, *Geographic Signal Strength Helps Paging Keep Its Edge*, WIRELESS WEEK, Aug. 24, 1998, at 20.

[233] Last year, Motorola sold the ARDIS Company to American Mobile Satellite Corporation which combined ARDIS' terrestrial network with the company's satellite-based network.

[234] For a further discussion of these services, *see* Section II.D.1.b.(1).

[235] ReadyCom Inc. ("ReadyCom") provides a two-way voice messaging service. ReadyCom's Responder service permits subscribers to reply, by voice, to incoming voice messages. *See ReadyCom Launches Responder Services in Raleigh/Durham, N.C.*, News Release, ReadyCom, Inc., Feb. 9, 1999. ReadyCom also offers Responder Plus which incorporates the ability to make live cellular telephone calls to as many as ten preprogrammed telephone numbers. It is marketed as a service that controls costs by limiting calling to select numbers. *See ReadyCom Develops Responder Plus Service for Cellular*, News Release, ReadyCom, Inc., Feb. 9, 1999.

[236] *See* Antony Bruno, *Growth Rates Slowing As ARPU Starts Climbing*, RCR RADIO COMMUNICATIONS REPORT, Aug. 3, 1998, *available in* 1998 WL 8226791.

[237] *See Research In Motion Unveils Next-Generation Inter@active Pager With Full Keyboard*, BUSINESS WIRE, Aug. 26, 1998.

[238] An August 1998 report indicated that the Research In Motion Inter@Active Pager cost $500. *Strategis Paging Report*, at 317. However, ARDIS and BWD currently offer the device for between $249 and $325 depending on the length of contract. BellSouth Wireless Data, *BellSouth Wireless Data - Interactive Pager Service - Promo 950* (visited Apr. 13, 1999) <http://www.bellsouthwd.com/ips/buy/promo1.html>; ARDIS, *RIM Interactive Pager* (visited Apr. 13, 1999) <http://www.ardis.com/rim.html>.

[239] *See PageNet, BellSouth Wireless Data Enter Strategic Alliance to Expand Market for Interactive Paging, Other Two-Way Services*, News Release, BellSouth Wireless Data, Mar. 10, 1999.

similar arrangement to resell each other's products.[240]

A number of satellite providers offer one-way paging and advanced messaging services. In addition to the mobile telephone services discussed above in Section II.A.4.d, Iridium launched its global paging and messaging service on November 17, 1998.[241] PageNet began offering Iridium's World Page Service in January 1999.[242] World Page Service is a one-way alphanumeric and numeric offering and when initially launched was priced at $160 per month for a twelve month contract and $500 for the paging device.[243] At the end of the first quarter of 1999, Iridium reported 2,075 satellite paging customers.[244] American Mobile Satellite Corporation ("American Mobile") and QUALCOMM Inc. ("QUALCOMM") offer advanced messaging services for trucking companies using geostationary satellite ("GEO") systems.[245] Finally, ORBCOMM Global, L.P., a little low-earth operating satellite system, also offers two-way messaging.[246]

a. Narrowband PCS

The *Third Report* noted that four carriers had launched advanced messaging services using narrowband PCS spectrum.[247] Many of these carriers continue to expand their footprints and

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[240] *See American Mobile and SkyTel Announce Strategic Alliance/Companies Agree to Pursue Joint Opportunities in Wireless Data Market*, News Release, American Mobile Satellite Corp., Apr. 7, 1999.

[241] Steve Gold, *Iridium Satellite-Based Paging/Messaging Service*, NEWSBYTES NEWS NETWORK, *available in* 1998 WL 20719014.

[242] *PageNet First to Offer Global Paging Coverage with New Service that Crosses Boundaries, Borders and Oceans*, News Release, PageNet, Jan. 27, 1999.

[243] Antony Bruno, *PageNet Turns on Iridium Satellite Paging Service*, RCR RADIO COMMUNICATIONS REPORT, Feb. 1, 1999, at 3.

[244] *Iridium Reports First Quarter Results*, News Release, Iridium LLC, Apr. 26, 1999.

[245] *See Bishop Report*, at 90. American Mobile provides guaranteed message delivery for trucking companies over its satellite network, two-way messaging to customers over its ARDIS terrestrial system, and guaranteed messaging over a combination of its terrestrial and satellite networks. *See id*. GEO satellite systems operate at 22,300 miles above the earth. *See* HARRY NEWTON, NEWTON'S TELECOM DICTIONARY (14th ed. 1998), at 322.

[246] ORBCOMM Global, L.P., Form 10-K, Dec. 31, 1998, at 4; *See also Bishop Report*, at 102. ORBCOMM's satellite constellation orbits between approximately 740 and 1000 kilometers above the Earth. ORBCOMM Global, L.P., Form 10-K, Dec. 31, 1998, at 13.

[247] *See Third Report Appendixes*, at C-8.

launch new services.[248] For example, SkyTel recently added text-to-speech capabilities over its two-way network.[249] The subscriber composes the message and SkyTel's network converts it to digitized speech introduced by the sender's name.[250] This year, SkyTel also began reselling its advanced messaging service via a "Local Partners" program to expand coverage and distribution to small- and medium-sized markets.[251] Under the agreement, ValuePage, Inc. will have the exclusive right to market SkyTel's advanced messaging services on a local basis beginning with Jackson and Vicksburg, Mississippi.[252] In addition to accessing a new group of potential customers, the agreement provides SkyTel with capital infusion from the partner for buildout in local areas.[253] In June 1999, MCI WorldCom, Inc. announced it would acquire SkyTel.[254]

CONXUS Communications, Inc. ("CONXUS") initially launched Pocketalk, its voice messaging service, in November 1997. In December 1998, CONXUS began providing Pocketext, a guaranteed messaging service, in its Pocketalk northeast markets, with the other Pocketalk markets to follow.[255] In addition to its voice messaging service launched in February 1997, PageNet launched its advanced text messaging service in the first quarter of 1999.[256]

PageMart is the newest entrant to provide services. It launched guaranteed messaging in June

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[248] *See* Appendix C, Table 6, page C-7 for lists the services and associated number of subscribers for each of the four companies; Appendix C, Table 7, page C-8, for the estimated narrowband PCS rollouts by number of launches; Appendix C, Table 8, page C-9, for the current deployment status of narrowband PCS licensees; and, Appendix H, Map 8 for the current narrowband PCS coverage of the five carriers that have launched.

[249] *See* Bruce Felps, *SkyTel Rolls Out Text-To-Voice Service*, WIRELESS WEEK, Jan. 4, 1999, at 36. For a discussion of SkyTel's telemetry services, *see* Appendix G.

[250] *See id.*

[251] *See SkyTel's "Local Partners" Program to Enhance Distribution: Company Signs First Agreement with ValuePage*, News Release, SkyTel Communications Inc., Feb. 16, 1999.

[252] *See id.*

[253] *See id.*

[254] *MCI WorldCom to Acquire SkyTel Communications*, News Release, MCI WorldCom, Inc., May 28, 1999.

[255] *See* Brad Smith, *Conxus Builds Out Data Networks*, WIRELESS NETWORK, Jan. 25, 1999, at 20.

[256] Telephone Conversation with Hugh Fagan, Director, Investor Relations, Paging Network, Inc. (Apr. 9, 1999).

1998 and now provides services in many cities throughout the country.[257] PageMart plans to add canned message response and two-way text messaging sometime in 1999.[258]

While several carriers have made significant advances in launching services using narrowband PCS spectrum, such services are still in the early stages of deployment. Analysts' projections for the total narrowband subscribers by 2002 ranges from a low of 8.4 million to a high of 24.6 million customers.[259]

b. Information Services

Based on the belief that information services will provide the product differentiation necessary to compete with other paging carriers and other sectors of the wireless industry, paging companies have spent substantial time and resources developing such offerings. For example, PageNet offers weather updates and customized sports and TV listings to its customers.[260] One of the more innovative information services that began in January 1999 was a smog alert notification service in Los Angeles provided jointly by the South Coast Air Quality Management District and several paging carriers. Depending on the outcome of the seven-month trial, it may be offered for a monthly fee of approximately $7.95.[261]

In an effort to attract non-traditional paging users, Swatch, the wristwatch maker, introduced Swatch the Beep Box, a round pager that comes in three different colors. The pager sells for $75 alone or as a $100 prepaid package of three months of service and 1,000 pages.[262] SkyTel, the marketer of the prepaid package, notes that with its advanced messaging network gaining high ARPU customers, it is targeting one-way customers in a financially-secure

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[257] *See* Antony Bruno, *PageMart Starts Two-Way Service*, RCR RADIO COMMUNICATIONS REPORT, Dec. 21, 1998, at 1.

[258] *See id*.

[259] Forecast of the Yankee Group (24.6 million). *PCIA Forecast*, at 5. Forecast of The Strategis Group (8.4 million). *Id*. at 6. Forecast of Donaldson, Lufkin & Jenrette (13 million). *DLJ Report*, at 40. Forecast of Paul Kagan Associates, Inc. (11 million). Paul Kagan Associates, Inc., *Wireless Messaging: A $6.6 Bil. Revenue Business in 1999*, WIRELESS DATA & MESSAGING, Jan. 31, 1999, at 4.

[260] *See PageNet, ESPN To Deliver Sports Info To Paging Customers*, WIRELESS TODAY, Nov. 24, 1998, *available in* 1998 WL 9345527; *See* Bruce Felps, *PageNet Subs Receive AccuWeather Forecasts*, WIRELESS WEEK, Feb. 1, 1999, at 28; *See* Brad Smith, *PageNet To Offer Custom TV Listings*, WIRELESS WEEK, Jan. 11, 1999, at 14.

[261] *See Smog Alerts To Be Issued by Pagers in Test Program*, LOS ANGELES TIMES, Nov. 18, 1998.

[262] *See Pager Gets the Swatch Treatment*, BUSINESS WIRE, Nov. 2, 1998.

manner (*i.e.*, prepaid).[263] SkyTel also offers its advanced messaging customers a variety of information services, including custom news and Bloomberg financial information.[264]

4. Competitive Assessment

In the *First*, *Second*, and *Third Reports*, the Commission concluded that the paging segment of the CMRS industry is highly competitive.[265] For a number of reasons, the Commission continues to believe that the paging/messaging industry is highly competitive. First, although concentration (based on subscriber share) has increased in the past year due to two large mergers, there are still an average of 29 paging licensees in each of the 25 largest cities in the U.S., not including resellers, and an average of 12 paging licensees in each of the 25 smallest MSAs.[266] Second, paging carriers continue to face competition from other sectors of the wireless industry. Third, customers can switch providers at low cost.[267] Fourth, while some carriers are in the midst of restructuring and raising the prices of some paging services,[268] estimated industry churn is on the rise (4.0 percent compared to 3.0 percent in 1997),[269] and one-third of those planning to switch carriers cite rising prices. There is also some evidence that at least for some classes of customers, demand is relatively more price sensitive (*i.e.*, price elastic) as evidenced by customers moving to competitors with lower prices or dropping

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[263] *See* Antony Bruno, *Prepaid Services Come To Paging Industry*, RCR RADIO COMMUNICATIONS REPORT, Sep. 21, 1998, *available in* 1998 WL 8227302.

[264] *See SkyTel Adds More Specialized Content to Information Services; Services from Datalink.net, INTERACTIVE SPORTS Enhance Level of Customization*, News Release, SkyTel Communications, Inc., Jan. 20, 1999; *See SkyTel Subscribers To Carry Bloomberg On Their Belts; Partnership Features Several Products To Get Key Financial Information To Customers on the Go*, News Release, SkyTel Communications, Inc., Dec. 16, 1998.

[265] Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *First Report*, 10 FCC Rcd at 8867-68 (1995) ("*First Report*"); Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *Second Report*, 12 FCC Rcd at 11305 (1997); *Third Report*, 13 FCC Rcd at 19804.

[266] RCR, RCR'S 1998 PAGING HANDBOOK (1998).

[267] *See Strategis Paging Report*, at 75.

[268] *See Major Paging Carrier's Financials Take the Street by Surprise*, PAGINGNOW, Feb. 17, 1999 <http://www.pagingnow.com>.

[269] *Customer Churn Stirs Up Paging Industry*, News Release, The Strategis Group, Nov. 5, 1998.

off the network entirely.[270] Finally, ARPU was at a low point last year and has increased in 1998, which is due in part, analysts believe, to the increased provision of value-added advanced messaging and information services.[271] Analysts note that such services are offered by carriers in order to differentiate their services in an increasingly competitive market.[272]

C. Traditional Dispatch

Dispatch services allow two-way, real-time, voice communications between two or more mobile units (*e.g.*, between a car and a truck) or between mobile units and fixed units (*e.g.*, between the end user's office and a truck). Typical users of dispatch services include service and delivery companies whose operations require their employees to communicate with each other on a private (one-to-one) or group (one-to-many) basis. As mentioned in the introduction, dispatch networks can also be designed to interconnect with the PSTN. Commercial dispatch carriers operate primarily in the 800 MHz, 900 MHz and 220 MHz bands.[273] Commercial dispatch service offered in the 800 MHz and 900 MHz bands is referred to by the Commission as Specialized Mobile Radio ("SMR") service.[274]

In addition to the dispatch services being provided by SMR and 220 MHz licensees, there are also many PMRS licensees using their licenses to meet their own needs for dispatch services.[275] Some of these licensees also offer commercial dispatch services to other

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[270] *See Gains Too Modest To Assess Paging Industry's Shift in Marketing*, COMMUNICATIONS TODAY, Nov. 9, 1998, *available in* 1998 WL 17661712.

[271] *New Business Climate Envelopes U.S. Paging Industry*, News Release, The Strategis Group, Aug. 5, 1998.

[272] *See Wireless Messaging Industry Prepares for Information Explosion*, News Release, PageNet, Nov. 19, 1998; *See* Jeanine Oburchay, *Wall Street Perspective: Is Paging a Lasting Application?*, PAGINGNOW, Dec. 10, 1998 <http://www.pagingnow.com>.

[273] In re Applications of Pittencrieff Communications, Inc. Transferor and Nextel Communications, Inc. Transferee For Consent to Transfer Control of Pittencrieff Communications, Inc. and its Subsidiaries, *Memorandum Opinion and Order*, 13 FCC Rcd 8935, 8949 (1997).

[274] *See* 47 C.F.R. 90.7.

[275] It is also possible that potential customers of dispatch services who are seeking more a interconnected service may also choose to purchase mobile telephone service from a cellular, broadband PCS, or digital SMR operator.

customers.[276] According to one analyst, there were approximately 15.8 million private mobile radio users in the United States as of year-end 1998.[277] However, this report will limit most of its discussion of dispatch services to commercial SMR and 220 MHz licensees.

In the following, "dispatch-only" refers to subscribers who use private or group service only, while "dispatch/interconnect" refers to subscribers who are also able to make calls to the PSTN.[278] For purposes of this report, "Dispatch" and "SMR" are used to refer to combined dispatch-only and dispatch/interconnect services in all bands.

1. Commercial Dispatch Market Structure and Performance

In 1998, the commercial dispatch industry's total subscribership increased by 48 percent from 3.1 million to 4.6 million.[279] Of the 1998 total, approximately 1.63 million were dispatch-only subscribers.[280]

The overall structure of SMR industry is more concentrated than other CMRS sectors.[281] The largest SMR operator is Nextel, with approximately 3.1 million U.S. subscribers, including over 350,000 analog-based, dispatch-only subscribers.[282] Nextel served 21 percent of all dispatch-only subscribers; Nextel's total subscribership was 68 percent of all SMR subscribers. The next largest operator was Southern Company, with 100,000 subscribers. The third largest operator was Mobex with 50,000 subscribers. Other significant operators include the Chadmoore Wireless Group, Inc. with 27,000 subscribers and Intek Global with 11,400

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[276] Commercial dispatch services are offered by PMRS licensees who can provide dispatch service to others on a for-profit basis and still be classified as PMRS as long as they are not connected to the PSTN. *See First Report*, 10 FCC Rcd at 8861-8863.

[277] The Stategis Group, Inc., "Dispatch Service in a Competitive Market," Presentation at AMTEX'98 Conference & Exposition, Nov. 13, 1998.

[278] It is important to note that operators can offer both services to customers on the same network.

[279] *See* Appendix D, Table 2, p. D-3.

[280] The Stategis Group, Inc., "Dispatch Service in a Competitive Market," Presentation at AMTEX'98 Conference & Exposition, Nov. 13, 1998. The Strategis Group estimates that 86 percent of analog subscribers and less than five percent of digital subscribers are dispatch-only.

[281] *See* Appendix D, Table 1, p. D-2.

[282] Nextel Communications, Inc., Form 10-K, Dec. 31, 1999, at 1. This figure had decreased from 583,000 at the end of 1997. *See Third Report*, at n. 277. Nextel's existing analog SMR operations focus primarily on two-way radio service. Nextel Communications, Inc., Form 10-K405, Dec. 31, 1997, at 14.

subscribers.

While revenue per subscriber for dispatch/interconnect users is much higher than dispatch-only revenue, the differential has been shrinking.[283] Between 1996 and 1998, the ARPU for dispatch-only services rose slightly, from $16.10 to $16.40. In contrast, over the same time period, the ARPU for dispatch/interconnect services decreased 22 percent from $49.40 to $38.70.

2. Major Trends and Developments

a. Analog Expansion

Even as Nextel has been successfully deploying digital technology in its networks,[284] the number of analog subscribers (excluding those served by Nextel) continues to grow.[285] While total analog subscribers in the 800 MHz band declined 6 percent in 1998, non-Nextel analog 800 MHz subscribers grew 8 percent. Other analog bands showed even more subscriber growth: analog 220 MHz grew 43 percent, and analog 450 MHz grew 273 percent. Subscriber growth in 1998 for all analog bands was 9 percent. This growth shows the continued demand for cheaper, dispatch-only service that is generally provided by analog operators.[286]

b. 220 MHz Auction

Due to a variety of factors,[287] the 220 MHz band is significantly less encumbered than the 800

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[283] *See* Appendix D, Table 3, p. D-3.

[284] Southern Company, which offers its Southern LINC service across 120,000 square miles in the Southeastern United States, is also using iDEN technology in the 800 MHz SMR band. Southern Company, *Service Territory* (visited Feb. 24, 1999) <http://www.solinc.com/serviceterr.asp>.

[285] *See* Appendix D, Table 4, p. D-3.

[286] *See* Lynette Luna, *Analog Dispatch Still a Viable Growth Business, Say Operators*, RCR, Oct. 19, 1998, at 15-16. Chadmoore Wireless Group, Inc., for example, is building a nationwide analog SMR network. According to Chadmoore COO Jan Zwaik, "We want to remain analog . . . our vision is to provide cost-effective service." Lynette Luna, *Analog Dispatch Still a Viable Growth Business, Say Operators*, RCR, Oct. 19, 1998, at 15. The capital costs per subscriber associated with digital technology are substantially higher than those for analog systems. Chadmoore Wireless Group, Inc., Form 10QSB/A, filed Nov. 25, 1998.

[287] *See* Amendment of Part 90 of the Commission's Rules To Provide for the Use of the 220-222 MHz Band by the Private Land Mobile Radio Service, *Memorandum Opinion and Order on Reconsideration*, 13 FCC Rcd 14569,14575-14579 (1998).

and 900 MHz SMR bands.[288] Furthermore, the conversion of spectrum to digital services on the 800 and 900 MHz SMR bands, and their higher monthly prices, has led to an increased demand for the less expensive dispatch services both for analog 800 and 900 MHz SMR operators, and 220 MHz operators.[289]

On October 22, 1998, the Commission completed the Phase II 220 MHz auction,[290] raising $21 million.[291] Licensees authorized in the Phase II 220 MHz Service are permitted to provide voice, data, paging and fixed communications.[292] A reauction of retained (and defaulted) licenses began on June 8, 1999.[293]

c. Upper 800 MHz Band

On December 8, 1997, the Commission completed an auction for the upper 200 channels in the 800 MHz SMR band.[294] The license holders from that auction are permitted to relocate

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[288] Caron Carlson, *FCC Prepares 220 MHz Auction*, WIRELESSWEEK, Jan. 12, 1998, at 26; Intek Diversified Corp., Form 10-K, Sep. 30, 1997, at 3. Phase I 220 MHz licensing was conducted by lotteries that awarded approximately 3,800 licenses through random selection. Federal Communications Commission, *220 MHz Fact Sheet* (last modified Jan.7, 1999) <http://www.fcc.gov/wtb/auctions/220/220fact.html>. According to Intek Global Corp., a holder of 220 MHz licenses, the number of currently commercially operational 220 MHz systems is "very small." Intek Global Corp, Form 10-K, Sept. 30, 1998, at 6.

[289] Intek Global Corp., Form 10-K, Sep. 30, 1998, at 7. "Over the last several years, however, many traditional SMR operators have been acquired by Nextel Communications, Inc. ("Nextel") and have been, or are being, converted to a national ESMR system utilizing digital technology which also provides cellular like service. That consolidation, the Company believes, has left a void in the U.S. market for those subscribers seeking traditional low cost two-way dispatch service."

[290] *See* "Phase II 220 MHz Service Auction Closes: Winning Bidders in the Auction of 908 Phase II 220 MHz Service Licenses," *Public Notice*, DA 98-2143 (rel. Oct. 23, 1998).

[291] *See* Appendix A, Tables 1 and 2, p. 2, 3, 5 for a summary of the auction design and a list of high bidders.

[292] Federal Communications Commission, *220 MHz Fact Sheet* (last modified Jan.7, 1999) <http://www.fcc.gov/wtb/auctions/220/220fact.html>.

[293] "Phase II 220 MHz Service Spectrum Auction Scheduled for June 8, 1999; Application Filing Deadline Set for May 10, 1999; Comment Sought on Reserve Prices or Minimum Opening Bids and Other Auction Procedures," *Public Notice*, DA 98-2386 (rel. Nov. 24, 1998). *See also* "Phase II 220 MHz Service Spectrum Auction; Notice and Filing Requirements for Auction of Phase II 220 MHz Service Spectrum Scheduled for June 8, 1999," *Public Notice*, DA 99-474 (rel. Mar. 8, 1999).

[294] "800 MHz SMR Auction Closes, Winning Bidders In The Auction of 525 Specialized Mobile Radio Licenses," *Public Notice*, DA 97-2583 (rel. Dec. 9, 1997).

incumbent licensees to comparable spectrum.[295] FCC rules allow a one-year voluntary negotiation period, followed by a one-year mandatory negotiation period between incumbent licensees and Economic Area (EA) licensees. Ultimately, the operators face forced relocation if the new licensee so desires. The voluntary negotiation period began on December 4, 1998.[296]

Some uncertainty regarding the 800 MHz licenses dissipated in early February 1999 when the U.S. Court of Appeals for the District of Columbia determined that the Commission was within its statutory authority to auction wireless spectrum to provide SMR services and to use its plan to relocate incumbents.[297]

d. Geotek Bankruptcy and Nextel

Geotek Communications, Inc. ("Geotek"), an SMR operator that used its own patented technology in the 900 MHz band to provide a range of telecommunications services to small- and medium-size businesses with mobile fleets of vehicles, filed for Chapter 11 bankruptcy protection on June 29, 1998.[298] Although it originally planned to reorganize, Geotek announced in October that it was shutting down its SMR operations.[299]

On February 12, 1999, Nextel announced that it planned to buy all of Geotek's 191 900 MHz licenses[300] for $150 million, pending regulatory approval.[301] Four days later, Nextel and

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[295] 47 C.F.R. §90.699.

[296] "Wireless Telecommunications Bureau Announces the Commencement of the Voluntary Negotiation Period for the Relocation of Incumbent Licensees in the 800 MHz Band," *Public Notice*, DA 98-2434 (rel. Dec. 4, 1998). The license winner must contact the incumbents by March 4, 1999 to begin negotiations.

[297] Fresno Mobile Radio, Inc. v. FCC, 165 F.3d 965 (D.C.Cir. 1999)

[298] Geotek Communications, Inc., Form 10-K, Dec. 31, 1996, at 2. In addition to traditional mobile telephone and one-to-many dispatch services, Geotek also offered a range of mobile messaging, mobile data and vehicle location services. Geotek Communications, Inc., Form 10-K, Dec. 31, 1996, at 3. As recently as January 1998, Geotek was operating in 11 markets and had 15,151 subscribers. *Geotek Reports Year End Subscriber Growth*, News Release, Geotek Communications, Inc., Feb. 5, 1998. By June 1998, however, Geotek had insufficient cash to fund operations. *Geotek to Cease Operations Later This Month*, WIRELESS TODAY, Oct. 2, 1998.

[299] *Geotek to Cease Operations Later This Month*, WIRELESS TODAY, Oct. 2, 1998.

[300] Geotek's licenses cover a potential market population of 200 million people and include a number of major metropolitan areas: Atlanta; Birmingham, Ala.; Boston; Charlotte, N.C.; Cincinnati, Ohio; Milwaukee, Wis.; New York City; Philadelphia; Portland, Ore.; Richmond, Va.; Washington, D.C.; Jacksonville and Miami, Fla.; San Antonio, Houston and Dallas, Texas; Spokane and Seattle, Wash.; and Tulsa and Oklahoma City, Okla.

Geotek received permission for the transaction from the Delaware Bankruptcy Court.[302] The following day, Nextel filed suit in the U.S. District Court for the District of Columbia to lift the consent decree limiting its holdings in the 900 MHz band.[303] On June 14, 1999, Nextel reached agreement with the Department of Justice for an out of court settlement.[304] Under the agreed terms of the settlement, which is subject to court approval, Nextel will be permitted to acquire ownership of or rights to use more than half (108 of the available 200) of the 900 MHz channels allocated for specialized mobile radio and other uses in the consent decree markets.[305]

D. Mobile Wireless Data Services

Analysts estimate that more than 70 million Americans over age sixteen log onto the Internet every day and in 1998 spent $7.8 billion via the Internet.[306] Further, worldwide sales of

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Nextel To Acquire Geotek's Licenses For $150 Million, COMMUNICATIONS TODAY, Feb. 16, 1999; Federal Communications Commission, *Final Results for All Markets (Excel Ver. 4)* (Visited Mar. 22, 1999)<http://www.fcc.gov/wtb/auctions/smr/7markets.xls>.

[301] *Nextel Requests Lift of Consent Decree to Buy Geotek's 191 900 MHz Licenses for $150 Million*, LAND MOBILE RADIO NEWS, Feb. 19, 1999. Other bidders included Mobex Communications, Chadmoore Wireless Group, Industrial Communications & Electronics Inc., Southern Co., and FleetTalk Partners. Jeffrey Silva, *Geotek Bankruptcy Sale Reset for Tuesday*, RCR RADIO COMMUNICATIONS REPORT, Feb. 15, 1999.

[302] *Nextel Requests Lift of Consent Decree to Buy Geotek's 191 900 MHz Licenses for $150 Million*, LAND MOBILE RADIO NEWS, Feb. 19, 1999.

[303] In 1995, Nextel and its supplier, Motorola Inc., signed a consent decree with the Department of Justice to obtain approval of 900 MHz license transfers from Motorola to Nextel. The consent decree limits the number of licenses each company can use in the top 14 U.S. markets. Several of the Geotek licenses fall in this category and Nextel's acquisition of the license would place it in violation of the decree. Nextel offered $100 million for Geotek licenses covering spectrum restricted by the consent decree, and $50 million for the remaining licenses. Caron Carlson, *Mobex, Nextel Spar Over DOJ Decree*, WIRELESS WEEK, Feb. 22, 1999.

[304] *Nextel to Be Freed to Utilize 900 MHz Spectrum to Expand iDEN Network*, News Release, Nextel Communications, Inc., June 14, 1999. Nextel would also need Commission approval for the license transfers.

[305] *Nextel to Be Freed to Utilize 900 MHz Spectrum to Expand iDEN Network*, News Release, Nextel Communications, Inc., June 14, 1999. The entire consent decree, and any associated restrictions on Nextel's utilization of additional 900 MHz channels in these markets, will terminate on October 30, 2000. *Id.*

[306] Brad Smith, *Wireless Wakes up To E-Commerce*, WIRELESS WEEK, Feb. 1, 1999, at 66.

handheld computing devices (sometimes referred to as personal digital assistants ("PDAs")),[307] used by many mobile users to access the Internet, grew by over 61 percent between 1997 and 1998.[308] The wireless industry is attempting to capture a portion of the revenues generated by sales of telecommunications services used to access the Internet, e-mail, and corporate intranets through mobile wireless data services.[309]

Wireless carriers are entering mobile data markets by providing new services, and equipment manufacturers have responded with a plethora of new devices.[310] For example, digital handsets range from a simple keypad phone with limited data capabilities to newer products such as QUALCOMM's pdQ "smart" phone with built-in PDA and access to the Internet.[311] In addition, several joint ventures have been announced to develop and market bundled information services and establish Internet protocol ("IP") transmission standards to facilitate communication between various types of networks and technologies. These ventures are discussed below.

This section begins with a description of mobile data providers, followed by joint ventures and industry trends and statistics.

1. Mobile Data Providers

Due to different technologies and spectrum, the mobile wireless data industry encompasses a wide array of services ranging from data transmitted over one-way pagers to vehicle tracking from satellites to wireless Internet connections via portable computers or PDAs. Participants include both CMRS and non-CMRS providers.[312] The Commission recognizes that many of the providers discussed below also offer services that were addressed in the preceding three

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[307] For example, 3Com manufactures the PalmPilot Professional. *See* 3Com Corporation, *3Com/Palm Computing - PalmPilot™ Professional Edition Organizer* (visited Feb. 19, 1999) <http://www.palm.com/products/palmpilotpro.html>.

[308] *GartnerGroup's Dataquest Says Worldwide Handheld Market Grew 61 Percent in 1998*, News Release, Dataquest Inc., Feb. 8, 1999.

[309] For a discussion of fixed wireless data services, *see* Appendices F and G.

[310] *See, e.g., HP Introduces First Color Palm-Size PC Running Microsoft Windows CE*, News Release, Hewlett-Packard Company, Feb. 1, 1999.

[311] *See* QUALCOMM Incorporated, 1998 Annual Report, at 14. The product is expected to be available in 1999. *See id.*

[312] *See* THE BISHOP COMPANY, WIRELESS DATA NETWORKS, A GUIDE TO MOBILE COMPUTING (1998), at 18. ("*Bishop Report*")

sections. However, because the industry is still evolving, the Commission believes it is appropriate to address mobile data services as a separate section. For discussion purposes, carriers providing mobile wireless data services can be grouped into four general network types: 1) paging/messaging networks, 2) voice/data networks, 3) dedicated data networks, and 4) satellite networks.[313]

As noted in the *Third Report*, the use of categories does not imply that the Commission's view of operators and services is limited by the category in which this discussion places them. Many networks are capable of providing similar services, and this report attempts to provide a broad overview of the types of services a given network may provide. As it is unlikely that consumers would be concerned about which network is used to provide mobile wireless data services, these categories have been established merely to facilitate the presentation. Furthermore, because these services are evolving in many different ways, it is not clear at this time into which market sector these services will be placed in the future.

a. Paging/Messaging Networks

As discussed in Section II.B, one-way paging companies provide a variety of subscriber information services such as e-mail, sports scores, and customized web site information. These services are ubiquitous in coverage and relatively less expensive for customers compared to some other wireless mobile data services discussed below. However, the volume and speed of the data sent are limited. Many paging carriers offer some form of information services.[314] In addition to receiving information on the screens of traditional pagers, paging subscribers can receive one-way data to download to a laptop or PDA. PageMart markets a receiver that connects to the 3Com PalmPilot.[315]

Narrowband PCS services permit higher speed transmissions of data and also allow subscribers to respond.[316] Narrowband PCS providers are also capable of providing wireless modem functions similar to packet-switching data services discussed below.[317]

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[313] Examples of the types of services provided over these networks are summarized below. For a more complete delineation of the networks and services, *see* Appendix D, Table 1, p. D-1.

[314] For a further discussion, *see* Section II.B.

[315] *See Bishop Report*, at 46-47.

[316] For a discussion of services offered by narrowband PCS providers, *see* Section II.B.3 and Appendix C, Table 8, p. C-9.

[317] *See Bishop Report*, at 50.

b. Voice/Data Networks

In addition to voice services, mobile telephone carriers provide a variety of data services over analog cellular data networks, as well as digital cellular, broadband PCS, and digital SMR networks.

(1) Analog Cellular Networks

Analog cellular carriers offer circuit-switched cellular data ("CSCD") services. CSCD service requires two computers connected continuously throughout the session. The mobile telephone connects to a modem, that transmits data via an air link to a nearby cell and through the public switched network to the other computer.[318] Providers include AirTouch, ALLTEL, and Comcast Cellular, among others.[319]

Cellular networks also provide a packet-switched data transmission service called Cellular Digital Packet Data ("CDPD") service over the existing analog network by installing certain upgrades.[320] The main difference between CDPD and CSCD is that CDPD does not require a continuous connection. Therefore, certain types of transmissions can be more efficient since CDPD does not continuously tie up the transmission path. Circuit-switched CDPD ("CS-CDPD") was developed to expand the coverage of CDPD by allowing users to access the data network wherever analog cellular voice service is available.[321] Most large cellular carriers offer CDPD.[322] While prices were originally based on the amount of data throughput, carriers have begun offering CDPD service on a flat rate basis for under $60 per month.[323] As of the end of the third quarter of 1998, CDPD was available to more than 55 percent of the

[318] *See id*, at 22.

[319] *See RCR's Top 20 Mobile Data Carriers*, RCR RADIO COMMUNICATIONS REPORT, Sep. 7, 1998, at 16.

[320] Installation of CDPD requires a special signal processor in each cell site to detect and route packet data. *Bishop Report*, at 54. *See also* HARRY NEWTON, NEWTON'S TELECOM DICTIONARY (14th ed. 1998), at 140. CDPD can also run over TDMA and CDMA networks. *Id.*

[321] *See* Shawn Steward, *A circuitous route to CDPD expansion*, CELLULAR BUSINESS, Sep. 1, 1996, *available in* 1996 WL 9781930.

[322] *See* Wireless Data Forum, *CDPD Report Card Third Quarter 1998* (visited Feb. 23, 1999) <http://www.wirelessdata.org/maps/index.asp>; *Third Report*, 13 FCC Rcd at 19811.

[323] *See Bishop Report*, at 56.

population, up slightly from 53 percent coverage at the end of the third quarter of 1997.[324]

(2) Digital Mobile Telephone Networks

Digital cellular, broadband PCS, and digital SMR mobile telephone providers are capable of providing short messaging services ("SMS"),[325] as well as circuit-switched and packet-switched data transmission.[326] SMS can be either one- or two-way text messaging provided to the mobile handset and may include e-mail as well as text Internet information.[327] Currently, most digital providers' data offerings are limited to short messaging services.[328]

Only GSM- and iDEN-based providers actively offer circuit-switched wireless data communications, permitting subscribers to send and receive e-mail, faxes, and files from their mobile phones.[329] However, it is believed that once their voice networks are built out, mobile phone providers using CDMA and TDMA technologies will also provide these services.[330] The Nokia 9000 and 9110 "smart" phones combine a GSM handset and keyboard that will send and receive faxes and e-mail using circuit-switched transmission, send and receive messages using short messaging service, and browse text web sites.[331] Ericsson recently launched the first GSM-based mobile telephone that combines a built-in modem with an infrared eye that eliminates the need for cables.[332] Omnipoint offers circuit-switched data

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[324] Wireless Data Forum, *CDPD Report Card Third Quarter 1998* (visited Feb. 23, 1999) <http://www.wirelessdata.org/maps/index.asp>; *Third Report*, 13 FCC Rcd at 19811. Appendix H, Map 9, p. H-10 shows the estimated U.S. coverage of CDPD.

[325] For example, AT&T Wireless, Sprint PCS, Omnipoint, and Nextel offer SMS.

[326] *See* footnote 321.

[327] One source indicates that some analog cellular networks have upgraded their systems to offer SMS. The networks use a digital control channel rather than an analog control channel. *See Bishop Report*, at 18.

[328] *See Bishop Report*, at 18, 36.

[329] *See id*, at 36, 83.

[330] *See id*.

[331] *See id*, at 38.

[332] *See* Gayle Bryant, *The Future in the Palm of Your Hand*, BUSINESS REVIEW WEEKLY, Dec. 7, 1998, *available in* 1998 WL 11773575.

transmission over its GSM network.[333] In addition, Southern LINC, a digital SMR provider using the iDEN network also provides circuit-switched data services.[334] While QUALCOMM produces equipment permitting data transmission over CDMA networks, no domestic CDMA providers yet offer such services.[335] Wireless digital data services that are in the testing or planning phase, such as packet-switched communications, are discussed below.

Finally, as discussed above in Section II.A.1.b, the ITU is developing recommendations for the IMT-2000 initiative which will include mobile wireless data services. It is anticipated that systems based on 3G technology will offer greatly enhanced data capabilities, and will begin to converge differing regional or national mobile systems into a radio infrastructure capable of providing those services on a global basis.[336]

c. Dedicated Data Networks

A number of wireless networks provide only data services. ARDIS, BellSouth Wireless Data, Inc. ("BWD") and Metricom, Inc. ("Metricom") use packet-switched data networks to provide a variety of wireless data services. ARDIS provides two-way data communications primarily to businesses in field services and transportation markets.[337] BWD provides services such as field sales and service through its Mobitex network, and several third-party providers package Mobitex with other software and services to provide access to e-mail, corporate intranets, and the Internet.[338] BWD began providing Internet e-mail service last year over its two-way messaging network.[339] The service permits messages up to 2700 words.[340] In addition, Palm

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[333] *See* Brad Smith, *Omnipoint Leads GSM Data Pack*, WIRELESS WEEK, Mar. 22, 1999, at 19. Omnipoint announced it would begin offering high-speed circuit-switched data at a base rate of 14.4 kbps (versus the previous 9.6 kbps) beginning April 1, 1999. *See id.*

[334] *See* Southern Company, *Southern LINC - Features* (visited Feb. 11, 1999) <http://www.solinc.com/features.asp#mobile>.

[335] *See Bishop Report*, at 40.

[336] *Id.*

[337] American Mobile Satellite Corporation, Form 10-K, Dec. 31, 1998, at 2. *See* Appendix H, Map 12, p. H-13 for American Mobile Satellite Corporation's ARDIS coverage.

[338] BellSouth, *BellSouth Wireless Data - Corporate Information* (visited Mar. 24, 1999) <http://www.bellsouthwd.com/abo/index.html>. *See also* BellSouth, *BellSouth Wireless Data - Messaging* (visited Mar. 25, 1999) <http://www.bellsouthwd.com/sol/messaging/solutions.html>. *See* Appendix H, Map 11, p. H-12 for BWD's coverage.

[339] *See* Brad Smith, *Data Finally Reaching Its Potential*, WIRELESS WEEK, Feb. 8, 1999, at 40.

Computing has announced it will provide Internet services to its Palm VII PDA using BWD's network.[341]

Metricom uses unlicensed spectrum. The company provides access to the Internet, e-mail, LANs, on-line services, and private intranets through its Ricochet service. The company is in the process of testing its upgraded network permitting data transmission speeds up to 128 Kilobits per second ("Kbps") as compared to its current network speed of 28.8 Kbps.[342] Ricochet coverage currently includes the San Francisco Bay Area; Seattle and Washington, D.C.; parts of Los Angeles and New York City; and several campuses and airports.[343] As of February 28, 1999, Metricom had 26,500 Ricochet customers.[344]

Teletrac, Inc. ("Teletrac") also uses unlicensed spectrum to provide vehicle location[345] and fleet management services in thirteen metropolitan areas.[346] Teletrac has over 2,400 commercial customers and more than 80,000 commercial and consumer units in operation.[347]

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[340] *See The Best Is Yet To Come - A Look Back at the Year in Wireless Data*, WIRELESS DATA NEWS, Dec. 9, 1998, *available in* 1998 WL 8015476.

[341] *See* Brad Smith, *Data Finally Reaching Its Potential*, WIRELESS WEEK, Feb. 8, 1999, at 40.

[342] *Metricom Deploys Industry's First 128KB Mobile Data Network*, News Release, Metricom, Inc., Mar. 16, 1999; Metricom, Inc., *Metricom Inc. Frequently Asked Questions* (visited Mar. 17, 1999) <http://www.ricochet.net/faq/faq.htm>.

[343] Metricom, Inc., Form 10-K, Dec. 31, 1998, at 2; *New York City Goes Mobile with Metricom*, News Release, Metricom, Inc., Apr. 6, 1999.

[344] Metricom, Inc., Form 10-K, Dec. 31, 1998, at 2. *See* Appendix H, Map 12, p. H-13 for Metricom's Ricochet coverage.

[345] The Commission recently completed its Location Monitoring Service ("LMS") Auction which permits license holders to utilize non-voice radio techniques to determine the location and status of mobile radio units. *See Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems, Second Report and Order*, PR Docket No. 93-61, 13 FCC Rcd 15,182 (1998). LMS auction results are provided in Appendix A, Table 4, p. A-6.

[346] Teletrac, Inc., *Corporate Information* (visited Mar. 17, 1999) <http://www.teletrac-online.com/company/htm/corpinfo.htm>; Teletrac, Inc., *Availability* (visited Mar. 17, 1999) <http://www.teletrac-online.com/products/htm/availabl.htm>.

[347] *Id.*

d. Satellite Services

A number of satellite providers offer mobile data services. The paging/messaging offerings of satellite providers were discussed above in Section II.B.3. In addition, QUALCOMM and American Mobile provide vehicle tracking services.[348] As of December 31, 1998, American Mobile had approximately 92,700 terrestrial (*i.e.,* ARDIS) and satellite data units.[349] ORBCOMM offers mobile asset tracking for trailers, containers, rail cars, heavy equipment, fishing vessels, barges and government assets.[350]

2. Joint Ventures

Some analysts believe that wireless data will serve only niches until the market addresses specific network and standards issues.[351] To begin to address issues related to proprietary networks and incompatible standards, mobile wireless data providers have announced a number of joint ventures to develop and market wireless data applications that are compatible with multiple networks and standards. Many of these joint ventures are competing against one another.[352] Three of the most prominent ventures[353] include the Wireless Access Protocol ("WAP") Forum,[354] Wireless Knowledge, LLC,[355] and Bluetooth.[356] While all of these

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[348] QUALCOMM Incorporated, Form 10-K405, Sep. 28, 1997, at 9; American Mobile Satellite Corporation, Form 10-K, Dec. 31, 1997, at 2.

[349] American Mobile Satellite Corporation, Form 10-K, Dec. 31, 1998, at 2.

[350] ORBCOMM Global, L.P., Form 10-K, Dec. 31, 1998, at 3.

[351] *See* Brad Smith, *Data Finally Reaching Its Potential*, WIRELESS WEEK, Feb. 8, 1999, at 38; *see also* Gayle Bryant, *The Future in the Palm of Your Hand*, BUSINESS REVIEW WEEKLY, Dec. 7, 1998, *available in* 1998 WL 11773575.

[352] *See The Best Is Yet To Come - A Look Back at the Year in Wireless Data*, WIRELESS DATA NEWS, Dec. 9, 1998, *available in* 1998 WL 8015476.

[353] Other ventures include announcements by Motorola Inc. and Cisco Systems Inc. to partner to provide wireless Internet access and Nextel and Netscape announcing the planned development of an Internet browser for Nextel's digital network. *See WirelessNow News Item: Recent Deals Foretell Wireless Data Success* (visited Feb. 11, 1999) <http://www.commnow.com/protectwn/a...sponse=articledetail.lasso&-search>.

[354] WAP includes over 75 percent of the handset manufacturers and carriers representing over 100 million subscribers worldwide. WAP is developing a set of standards for wireless transmission over the Internet. *See Open Wireless Internet Standard Backed by 71 Companies Worldwide*, News Release, WAP Forum, Nov. 11, 1998. The WAP Forum indicates that the specification will be vendor-neutral and network-independent and will provide worldwide wireless Internet access from handheld devices. *See id.*

initiatives have contributed to changes in the services and equipment offered by mobile wireless data providers, it is not clear, at this point, what impact these initiatives will have on market growth.[357]

3. Industry Trends and Statistics

a. Subscribers and Revenues

One analyst estimates that there were almost three million business mobile data subscribers at year-end 1998, an increase of more than 41 percent over year-end 1997.[358] Based on 1997 forecasts, revenues from business mobile data subscribers were estimated to be $535 million at year-end 1998, a 42 percent increase over year-end 1997.[359] In addition, based on a survey of ten wireless carriers, the Wireless Data Forum reports that wireless data revenues increased 63 percent in the twelve months ending June 30, 1998.[360]

b. Prices

Mobile wireless data services are highly differentiated, in part due to the specific mobile wireless services offered based on the bandwidth or transmission capacity and the geographic

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[355] WirelessKnowledge LLC, a joint venture between Microsoft and QUALCOMM was formed to offer carriers secure wireless access to data and applications on any wireless device, network, or enterprise system including CDMA, GSM, TDMA, and CDPD. *See* Brad Smith, *BT Joins Data Venture*, WIRELESS WEEK, Feb. 8, 1999, at 1. The venture introduced its first product in January 1999. *See* Antony Bruno, *WirelessKnowledge Debuts First Product*, RCR RADIO COMMUNICATIONS REPORT, Jan. 25, 1999, at 7.

[356] Ericsson, IBM, Intel, Nokia, and Toshiba announced the formation of Bluetooth, a technology specification that will permit subscribers to transmit data from wireless network to wireless network and from any location without regard to wireless phone or other equipment standards. *See* Bluetooth, *Welcome to Bluetooth Text Only_FAQ* (visited Feb. 3, 1999) <http://www.bluetooth.com/faq/index.asp>.

[357] *See* Erich Luening, *Major Move Toward Wireless Standard*, May 20, 1998 (visited Feb. 3, 1999) <http://www.news.com/News/Item/0,4,22326,00.html?owv>.

[358] The forecast by The Strategis Group (2.9 million) was completed in 1997 and there is no updated Strategis forecast available. THE STRATEGIS GROUP, THE U.S. MOBILE DATA MARKETPLACE: 1997 (1997), at 353. ("*Strategis Mobile Data Report*") In addition, The Yankee Group forecasts 2.95 million subscribers at year-end 1998. *PCIA Forecast*, at 73.

[359] The forecast by The Strategis Group was completed in 1997 and there is no updated Strategis forecast available. *Strategis Mobile Data Report*, at 353.

[360] Wireless Data Forum, *WDF: Wireless Data Market Index* (visited Feb. 2, 1999) <http://www.wirelessdata.org/index/carrier/index/asp>.

coverage of their networks.[361] Therefore, a direct comparison of prices is not particularly useful. The *Third Report* contains a table showing prices of sample e-mail and data transmissions.[362] That information has not changed substantially and continues to show a wide variation in prices depending on the technology employed,[363] although several of the technologies now offer flat-rate services.[364]

c. Subscriber and Revenue Market Share by Network

Subscriber and revenue market share breakdowns by carrier are not available. However, based on an analysis completed in 1997, one analyst estimates that as of year-end 1998 cellular and broadband PCS would have approximately 56 percent of the mobile data business subscribers, two-way messaging would have 17 percent, dedicated data networks and mobile satellite services would have 10 percent each, and SMR would have 7 percent.[365] The respective share of revenues is quite different. Mobile satellite services would have 33 percent of mobile data business revenues, dedicated data networks would have 26 percent, cellular/broadband PCS would have 20 percent, two-way messaging would have 18 percent, and SMR would have 3 percent.[366]

d. Innovation

Many carriers are attempting to enter the mobile wireless data market to provide value-added services that would differentiate their products from competitors. Around the time of CTIA's Wireless '99 Conference a number of companies many product announcements for mobile wireless data services and equipment. For example, Sprint, Lucent, US WEST, and

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[361] For additional information, *see* Appendix D, Table 1, p. D-1.

[362] *Third Report*, 13 FCC Rcd at 19813-14.

[363] *See Bishop Report*. The report indicates that there have been a couple of per transmission price changes. Geostationary prices have fallen from $10.50 to $7.15 for a sample data transfer and $3.00 to $1.20 for a sample e-mail. *Id*. at 92. Similarly, the Little Low Earth Orbiting satellite system price for a sample e-mail have fallen from $6.00 to $5.00. *Id*. at 103.

[364] *See e.g.*, *Bishop Report*, at 77.

[365] *Strategis Mobile Data Report*, at 329.

[366] *Id*.

QUALCOMM all announced Internet offerings in the near future.[367] QUALCOMM has also announced the availability of the pdQ "smart" phone with personal scheduling software and access to e-mail and the Internet by mid-1999.[368]

In addition, Ericsson began field testing its TDMA digital data and fax software and infrastructure during the first quarter of 1999. The service permits TDMA subscribers to combine a laptop computer or PDA with a digital data-capable mobile phone to provide access to the Internet, e-mail and intranets.[369]

Finally, Pacific Bell Wireless is in the process of testing a "GSM on the Net" wireless IP-based multimedia service with Ericsson,[370] and Omnipoint is testing a packet-switched platform with Ericsson.[371] In June 1999, Nextel began trialing a wireless Internet service in six cities.[372]

These announcements, along with the joint ventures indicate that the industry is attempting to expand. In addition, the IMT-2000 initiative discussed above is expected to positively impact growth. However, at this early stage, it is not clear how quickly or in which direction the market will likely evolve.

III. CONCLUSION

In the year since the release of the *Third Report*, the mobile telephone market has made steady competitive progress. There are now over two dozen broadband PCS and digital SMR operators providing competition in numerous cities across the country. As a result of these operators' activities, there are now three or more mobile telephone operators providing some

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[367] *See* Steve Rosenbush, *Wireless Phones Tap into Web Sprint Introduces Faster Service*, USA TODAY, Feb. 16, 1999, *available in* 1999 WL 6834456. Sprint plans to offer Internet access at 14.4 kbps by June 1999. Lucent will test Internet access at 144 kbps later this year, and US WEST and QUALCOMM will run a similar test in April. *See id.*

[368] *See* QUALCOMM Incorporated, 1998 Annual Report, at 14.

[369] *See Ericsson Announces Digital Data and Fax for TDMA Networks*, BUSINESS WIRE, Feb. 8, 1999.

[370] *See* Madeleine Acey, *PacBell and Ericsson Test 'GSM On The Net,'* CMP TECHWEB, Feb. 17, 1999, *available in* 1999 WL 2493490.

[371] *See* Sylvia Dennis, *Ericsson & Omnipoint To Stage First GPRS Trial in US*, NEWSBYTES NEWS NETWORK, Feb. 9, 1999, *available in* 1999 WL 5118856. Omnipoint indicates that it plans to launch packet-based services by the end of 1999. *See* Brad Smith, *Omnipoint Leads GSM Data Pack*, WIRELESS WEEK, Mar. 22, 1999, at 19.

[372] *Nextel Digital Wireless Internet Service*, ZSIGO NEWZWIRE, Apr. 27, 1999.

service in over 230 BTAs, containing over 230 million people. Furthermore, there are a minimum of five operators providing some service in each of the 35 largest BTAs. These new entrants (and incumbents) are not subject to rate and entry regulation and are being provided ever increasing regulatory flexibility to allow them to compete effectively.

While there is still considerable room for further competitive development, the effects of the progress to date are clear. For example, according to one study the average price per minute of mobile telephone service declined over 40 percent between the end of 1995 and the end of 1998. At the same time, usage of these new services remains high, with many digital customers using over 300 minutes, and as high as 400 minutes, each month. This is three times the average of analog cellular customers. While these are welcome developments, there is still much progress that remains to be made. Most operators have still been concentrating their deployment of new mobile telephone networks on more densely populated urban and suburban markets. While many of these operators are now starting to turn their attention toward smaller cities, many less populated areas are still awaiting the arrival of mobile telephone competition.

The year since the release of the *Third Report* has seen the paging/messaging sector remain a highly competitive business with numerous providers in each market. The continued competitive threats from other service providers, such as mobile telephone, mobile data and even satellite providers, have encouraged paging operators to continue to enhance and expand their product offerings with two-way messaging, voice messaging, and enhanced data services, such as e-mail and stock quotes.

Given that the dispatch sector is in the process of restructuring, caused by both Nextel's move into the mobile telephone market and the completion of the 800 MHz SMR and 220 MHz spectrum auctions, a definitive statement as to its competitive status is difficult to make in this report. Similarly, the developmental stage of the mobile data sector makes it difficult to assess its competitive status.

IV. ADMINISTRATIVE MATTERS

This Fourth Report is issued pursuant to authority contained in Section 332 (c)(1)(C) of the Communications Act of 1934, as amended, 47 U.S.C. § 322 (c)(1)(C).

It is ORDERED that the Secretary shall send copies of this Report to the appropriate committees and subcommittees of the United States House of Representatives and the United States Senate.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas
Secretary

APPENDIX A:
SPECTRUM AUCTIONS

Table of Contents

Table 1A: FCC Auctions Summary - Service Design

Auction Number and Name		Number of Licenses (1)	Geographic License Scheme (2)	Spectrum per license	Total Spectrum (in megahertz)	Service Description
1	**Nationwide Narrowband PCS**	11 (3)	Nationwide	11 blocks, 5 = 50/50 KHz, 3 = 50/12.5 KHz, 2 = 50 KHz	0.7875 MHz	Advanced paging/data
2	**Interactive Video and Data Service**	594	MSA	2 blocks of 500 kHz	1 MHz	Interactive data
3	**Regional Narrowband PCS**	30	Regional	6 blocks, 2 = 50/50 KHz, 4 = 50/12.5 KHz	0.45 MHz	Advanced paging/data
4	**A & B block Broadband PCS**	102 (4)	MTA	2 blocks of 30 MHz	60 MHz	Mobile voice and data
5/10/22	**C block Broadband PCS (5)**	493	BTA	1 block of 30 MHz or 2 blocks of 15 MHz	30 MHz	Mobile voice and data
6	**Multichannel Distribution Service**	493	BTA	Max of 13 channels of 6 MHz	78 MHz (6)	Wireless cable
7	**900 MHz Specialized Mobile Radio**	1020	MTA	20 blocks of 25 KHz	5 MHz	Mobile voice and data
8	**Digital Broadcast Service (7)**	1	Full US Coverage	500 MHz	437.5 MHz	Multichannel video
9	**Digital Broadcast Service (7)**	1	Partial US Coverage	Uses same spectrum as full coverage license	375 MHz	Multichannel video
11/22	**D, E, & F block Broadband PCS (8)**	1479	BTA	3 blocks of 10 MHz	30 MHz	Mobile voice and data
12	**Cellular Unserved**	14	MSA/RSA	2 blocks of 25 MHz	50 MHz	Mobile voice and data
13	**Interactive Video and Data Service**	981	MSA/RSA	2 blocks of 500 KHz	1 MHz	Interactive data
14	**Wireless Communications Service**	128	MEA/REAG	4 blocks, 2 = 10 MHz, 2 = 5 MHz	30 MHz	(9)
15	**Digital Audio Radio Service**	2	Full US Coverage	2 blocks of 12.5 MHz	25 MHz	Multichannel audio
16	**Upper 800 MHz Specialized Mobile Radio**	525	EA	3 blocks, 1 MHz, 3 MHz , and 6 MHz	**1**0 MHz	Mobile voice and data
17/23	**Local Multipoint Distribution Service**	986 (10)	BTA	2 blocks, 1150 MHz and 150 MHz	1300 MHz	Fixed voice, data and video
18/24	**220 MHz**	908	National, EAG, EA	13 blocks, 3 = 100 KHz, 5 = 100 KHz, 5 = 150 KHz	1.55 MHz	Voice, data, paging, fixed
19	**General Wireless Communications Service**	875	EA	5 blocks of 5 MHz	25 MHz	(11)
20	**VHF Public Coast**	42	Pub. Coast Station Areas	1 block between 350 and 500 KHz	350 to 500 kHz	Fixed and mobile
21	**Location and Monitoring Service**	528	EA	3 blocks, 2 = 6 MHz, 1 = 2.25 MHz	14.25 MHz	Mobile telemetry

Source: Federal Communications Commission

(1) This is the total number of licenses initially granted in each service. It does not take into account any partitioning and disaggregation activity. Some of these licenses have not yet been granted.
(2) MTAs = Major Trading Areas, BTAs = Basic Trading Areas, MSAs = Metropolitan Statistical Areas, RSAs = Rural Service Areas, MEAs = Major Economic Areas, REAGs = Regional Economic Area Groups.
(3) Includes one pioneer preference license.
(4) Includes three pioneer preference licenses.
(5) To date, three auctions have been completed that included C block PCS licenses, the original and two reauctions.
(6) To be precise, Multipoint Distribution Service (MDS) total spectrum should be 76 MHz because Channel 2 was originally 6 MHz only in the top 50 markets. In the rest of the markets, it was Channel 2A with 4 MHz. As noted in the MDS Auction Procedures, Terms, and Conditions: "In 1992, the 2160-2162 MHz frequency was reallocated to emerging technologies, and thus, any subsequent MDS use of these 2 MHz will be secondary."
(7) There is a total of 500 MHz of DBS downlink spectrum available. The same spectrum can be reused at each of the eight U.S. DBS orbital slots. The figures in the table are (28/32) x500 and (24/32) x500, respectively, but they each refer to portions of the same 500 MHz of spectrum.
(8) To date, two auctions have been completed that included DEF block PCS licenses, the original and one reauction.

(9) WCS is permitted to implement a wide range of services, subject to FCC engineering requirements, including fixed, mobile, radio location, and broadcasting-satellite (sound) service.
(10) Cellularvision, Inc. has been granted a pioneer preference for a portion of the 1150 MHz New York BTA, of which 850 MHz was subsequently sold to Winstar Communications, Inc.
(11) GWCS may provide any fixed or mobile communications service except Broadcast services, Radiolocation services, and Satellite services on their assigned frequency. These include but are not limited to voice, video, and data transmission, private microwave, broadcast auxiliary, and ground-to-air voice and video.

Table 1B: FCC Auctions Summary
Auction Results

	Auction Number(s) and Name	Total Winning Bids (1)	Bid Price (dollars per person per MHz)	Auction Duration Began	Ended	# Rounds	Number of Winning Bidders
1	**Nationwide Narrowband PCS**	$650,306,674	$3.10	7/25/94	7/29/94	47	6
2	**Interactive Video and Data Service**	$213,892,375	$0.85	7/28/94	7/29/94	Oral Outcry	178
3	**Regional Narrowband PCS**	$392,706,797	$3.46	10/26/94	11/8/94	105	9
4	**A & B block Broadband PCS**	$7,721,184,171	$0.52	12/5/94	3/13/95	112	18
5	**C block Broadband PCS (2)**	$10,071,708,841.50	$1.33	12/18/95	5/6/96	184	89
10		$904,607,466.75	$1.94	7/3/96	7/16/96	25	7
22		$409,936,425.00	$0.15	3/23/99	4/15/99	78	57
6	**Multichannel Distribution Service**	$216,239,603	$0.067 (3)	11/13/95	3/28/96	181	67
7	**900 MHz Specialized Mobile Radio**	$204,267,144	$0.24 (3)	12/5/95	4/15/96	168	80
8	**Digital Broadcast Service**	$682,500,000	$0.0062	1/24/96	1/25/96	19	1
9	**Digital Broadcast Service**	$52,295,000	$0.0006	1/25/96	1/26/96	25	1
11	**D, E, & F block Broadband PCS (4)**	$2,517,439,565	$0.33	8/26/96	1/14/97	276	125
22		$2,904,520	$0.10	3/23/99	4/15/99	78	6
12	**Cellular Unserved**	$1,842,533	n/a	1/13/97	1/21/97	36	10
13	**Interactive Video and Data Service**	(5)	(5)	(5)	(5)	(5)	(5)
14	**Wireless Communications Service**	$13,638,940	$0.0018	4/15/97	4/25/97	29	17
15	**Digital Audio Radio Service**	$173,234,888	$0.0274	4/1/97	4/2/97	25	2
16	**Upper 800 MHz Specialized Mobile Radio**	$96,232,060	$0.04	10/28/97	12/8/98	235	14
17	**Local Multipoint Distribution**	$578,663,029	$0.0018	2/18/98	3/25/98	127	104
23	**Service**	$45,064,450		4/27/99	5/12/99	43	40
18	**220 MHz**	$21,650,301	$0.06	9/15/98	10/22/98	173	44
24				6/8/99			
19	**General Wireless Communications Service**	(6)	(6)	(6)	(6)	(6)	(6)
20	**VHF Public Coast**	$7,459,200	$0.06 to $0.08	12/3/98	12/14/98	44	4
21	**Location and Monitoring Service**	$3,438,294	$0.001	2/23/99	3/5/99	54	4

Source: Federal Communications Commission

(1) Total Winning Bids includes high bids from the auction (net of any bidding credits) plus the price paid for any pioneer preference licenses.
(2) C block broadband PCS was auctioned in three auctions. Please note that because licenses are in more than one auction, simply summing together the figures for Total Winning Bids, Bid Price, and Number of Winning Bidders will result in over counting.
(3) Estimated to adjust for encumbered spectrum.
(4) DEF block broadband PCS was auctioned in two auctions. Please note that because licenses are in more than one auction, simply summing together the figures for Total Winning Bids, Bid Price, and Number of Winning Bidders will result in over counting.
(5) The second IVDS auction was postponed on January 29, 1997.
(6) The General Wireless Communications auction was postponed on April 24, 1998.

Table 2: 220 MHz Auction Results

Bidder Name	Licenses	POPs	Net High Bids
220 MHz Bidding Consortium	37	114,629	$728,175
Active Communications, Inc.	1	695	$1,625
AreaWide Communications Inc.	5	6,756	$31,330
Berkeley Electric Co-op, Inc.	18	11,731	$137,000
Carolina Wireless Dispatch, Inc.	10	12,431	$59,250
cellutech	2	1,051	$3,380
Com/Rad Inc.	4	1,750	$8,255
Communications Specialists, Inc.	5	7,532	$11,182
Comtran Associates Inc.	1	23,919	$36,000
DeltaCom, Inc.	6	20,588	$24,261
Dispatch & Data of Ohio, Inc.	1	4,565	$4,451
FM Communications, Inc.	1	1,530	$1,625
Garnette Communications o/o David G Boyle	2	403	$3,640
Georgia 220 MHZ Alliance, LLC	4	10,426	$16,380
Gulf Coast Electronics, Inc.	1	523	$1,625
Herbert J. Schock & Nancy J. Douglas	2	4,005	$8,128
Intek License Acquisition Corp.	181	1,058,095	$12,153,407
Intellicom Bidding Consortium	19	112,412	$417,105
KDR, INC.	18	42,896	$265,525
Knox LaRue, Sr.	3	4,273	$29,640
Longhorn Communications Incorporated	21	109,468	$390,608
Millenium 2000, Inc.	2	1,549	$24,895
Mobile Communications Service of Miami, Inc.	1	4,538	$85,150
Nancy J. Douglas	1	2,365	$19,500
Net Radio Group Communications, LLC	126	274,607	$1,124,370
Nextel 220 License Acquisition Corp.	68	58,121	$266,079
Oliver M. Collins	4	3,542	$21,710
Philip Adler	6	64,612	$397,995
Radio Comm Services Inc.	5	6,702	$175,110
Raleigh Radio-Data SMR Operating Partnership	6	5,242	$20,670
Repeater Network Spectrum Aq., Inc.	39	61,166	$377,500
Rush Network Corp.	10	14,308	$64,935
S. K. Warren Communications, Inc.	6	33,858	$354,250
Shell Offshore Services Company	14	10,561	$72,700
Sophia Licensee, Inc.	11	400,455	$3,158,545
Supreme Radio Communications, Inc.	8	4,288	$30,355
Tampa Bay Communications Inc.	1	2,068	$3,835
The Champaign Telephone Company	5	7,579	$66,450
Triangle Communications, Inc.	5	3,941	$11,775
Tuchman & Brown Investment Inc. No.2	2	4,007	$24,700
Two-Twenty Auction Company, Inc.	18	209,774	$884,455
US MobilComm, Inc.	5	28,819	$65,650
Winsome Inc.	1	1,935	$4,225
Wireless Communication Technologies Inc.	7	14,911	$62,855

Source: Federal Communications Commission

Table 3: VHF Public Coast Auction Results

Bidder Name	Licenses	POPs	Net High Bids
Data Radio Management Co., Inc.	3	4,221,966	$247,650
SMR Systems, Inc.	1	213,430	$16,900
Warren C. Havens	13	8,419,083	$390,650
WJG MariTEL Corporation	9	235,863,260	$6,804,000

Source: Federal Communications Commission

Table 4: Location and Monitoring Service Auction Results

Bidder Name	Licenses	POPs	Net High Bids
FCR, Inc.	5	n/a	$74,915
Metro-Trak, LLC	2	n/a	$446,550
Progeny LMS, LLC	230	n/a	$2,363,766
Warren C. Havens	52	n/a	$553,063

Source: Federal Communications Commission

Table 5: C, D, E, and F Block Broadband PCS License Auction

Bidder Name	Total High Bids	POPs	Net High Bids
ABC Wireless, L.L.C.	64	14,423,155	$30,211,639
Adams Telcom, Inc.	1	177,213	$700,500
Alpine PCS, Inc.	1	755,580	$3,243,000
American Wireless, L.L.C.	7	3,190,708	$7,234,163
BCN Communications, L.L.C.	3	6,470,018	$13,305,000
Beta Communications, L.L.C.	3	2,914,107	$12,933,000
BRK Wireless Company, Inc.	2	569,884	$2,205,000
C.T. Cube, Inc.	3	443,608	$1,805,400
Century Personal Access Network, Inc.	1	646,736	$881,000
CFW Communications Company	6	941,089	$745,276
Chandu Patel dba Center Point PCS	1	309,515	$453,050
Chariton Valley Communication Corporation, Inc.	3	387,503	$730,150
Cherokee PCS, Inc.	2	235,893	$1,336,266
Comcell, Inc.	1	209,339	$945,750
Comet Wireless Inc.	3	305,122	$57,394
ComScape Communications, Inc.	4	581,304	$186,305
Conestoga Wireless Company, Inc.	5	962,252	$1,150,605
ConnectBid, LLC	1	1,123,678	$1,924,566
Cook Inlet/VoiceStream PCS LLC	28	18,844,278	$192,254,957
Cross Telephone Company	2	199,181	$139,739
Denton County Electric Cooperative, Inc.	2	543,117	$3,979,000
Eliska Wireless, Inc.	2	1,600,694	$6,461,250
Elkhart Telephone Co., Inc.	1	53,960	$25,500
Entertainment Unlimited, Inc.	2	956,867	$2,613,750
Glenn W. Ishihara	9	943,327	$1,035,750
Global Telecommunications International, Inc.	1	57,684	$223,500
GW Wireless, Inc.	2	265,373	$242,250
Highland Cellular, Inc.	4	1,383,697	$1,485,893
Iowa Network Services, Inc.	1	148,331	$391,000
IT&E Overseas, Inc.	2	176,000	$74,776
Leap Wireless International, Inc.	36	11,271,377	$18,722,344
MCG PCS, Inc.	2	2,022,935	$1,846,250
Midwest Wireless Communications, L.L.C.	3	431,471	$287,300
New Mexico RSA 6-III Partnership	2	104,370	$346,500
North Alabama Cellular, LLC	4	907,319	$2,017,147
Northest Communications of Wisconsin, Inc.	5	461,505	$578,000
OPCS Three, LLC	34	18,858,695	$45,071,938
OPM Auction Co.	6	1,514,250	$4,048,550
Pegasus PCS Partners, L.P.	1	1,351,600	$4,822,000
Personal Communications Services, Inc.	1	56,981	$40,500
Pine Belt PCS, Inc.	1	324,397	$123,596
PinPoint Wireless, Inc.	1	36,618	$45,000
Pioneer Telephone Association, Inc.	1	65,059	$42,500
Redwood Wireless Corporation	7	720,097	$813,264
RTSC Communications, Inc.	2	101,705	$54,400
S & S Communications	1	79,415	$104,250
Shenandoah Mobile Company	1	128,910	$607,750
Telepak, Inc.	2	2,011,911	$6,953,000
TLA Spectrum, LLC	1	243,888	$1,602,000
Vincent D. McBride	1	113,943	$23,222
Viper Wireless, Inc.	6	4,768,737	$32,285,993
VMN Consortium	2	137,284	$40,650
West Enfield Communications, Inc.	1	165,671	$41,677
Westel, L.P.	4	550,845	$466,841
Wireless Communications Venture	3	256,264	$103,700
Wireless II, L.L.C.	2	185,359	$74,144
Zuma PCS, Inc.	5	1,862,761	$2,703,000

Source: Federal Communications Commission

Table 6: Local Multipoint Distribution Service Re-Auction

Bidder Name	Total High Bids	POPs	Net High Bids
ABS LMDS Venture	1	122,988	$127,050
Ace Link Telecommunication, Inc.	2	323,434	$651,950
Actel Corporation	4	868,656	$1,610,000
Adams Telcom, Inc.	1	177,213	$244,200
AirCom Communication Consultants, Inc.	7	841,994	$1,545,500
Airlinx, G.P.	2	328,783	$359,150
Bluegrass Telecom, L.L.C.	1	222,748	$509,000
Cloudnine Communications, Inc.	31	4,556,808	$4,148,100
Command Connect, LLC	5	1,073,405	$1,185,000
CRH Consortium	3	471,859	$744,000
Duckhorn Broadcasting, Inc.	3	219,964	$125,950
Eastern Illini Electric Cooperative	3	463,595	$721,500
EER Systems Incorporated	4	955,027	$1,758,000
Fleming-Mason Service Corporation	1	217,082	$86,450
Grand Connectivity L.L.C.	7	2,701,219	$2,674,650
Highland Cellular, Inc.	6	1,336,130	$1,289,200
HighSpeed.Com, L.L.C.	2	858,257	$1,486,650
KINI L.C.	1	143,408	$793,000
Lightspeed Communications, LP	2	3,521,846	$2,801,700
LMDS Communications Inc.	12	1,560,602	$990,550
LMDS Ventures	2	788,647	$606,100
LORALEN CORP LLC	2	471,425	$336,050
Madison County Telephone Company	1	282,187	$277,750
Mary J Kuiken	2	408,667	$305,800
McLeodUSA, Incorporated	13	2,965,367	$4,963,000
Message Express Company	2	579,925	$664,950
Miles Communications, Inc.	2	244,070	$201,300
Moline Dispatch Publishing Company, L.L.C.	2	831,770	$1,801,500
NettWork Consulting, LLC	1	215,795	$178,750
Network Wireless	2	232,364	$111,100
New Wave Networks, L.L.C.	5	577,043	$741,950
PIONEER CONSOLIDATED, INC.	1	115,066	$134,750
Rainier Cable, Inc.	2	387,538	$797,500
Sunshine LMDS Network, Inc.	4	1,395,666	$1,341,450
TLA Spectrum, LLC	13	2,542,102	$7,039,000
Totelcom of Oklahoma, Inc.	3	273,761	$224,400
Townes Telecommunications, Inc.	1	222,526	$536,000
VERSO LMDS, LLC	2	603,974	$283,800
West Carolina Rural Telephone Cooperative, Inc.	2	373,555	$353,650
Wytec, Incorporated	1	254,696	$314,050

Source: Federal Communications Commission

APPENDIX B:
MOBILE TELEPHONY

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Table 1: CTIA's Semi-Annual Mobile Telephone Industry Survey

Date	Estimated Subscribers	Total Six-Month Service Revenues (000s)	Roamer Services Revenues	Cell Sites	Employees	Cumulative Capital Investment (000s)	Average Local Monthly Bill
Jan 85	91,600	$178,085		346	1,404	$354,760	
June 85	203,600	$176,231		599	1,697	$588,751	
Dec 85	340,213	$306,197		913	2,727	$911,167	
June 86	500,000	$360,585		1,194	3,556	$1,140,163	
Dec 86	681,825	$462,467		1,531	4,334	$1,436,753	
June 87	883,778	$479,514		1,732	5,656	$1,724,348	
Dec 87	1,230,855	$672,005		2,305	7,147	$2,234,635	$96.83
June 88	1,608,697	$886,075		2,789	9,154	$2,589,589	$95.00
Dec 88	2,069,441	$1,073,473	$89,331	3,209	11,400	$3,274,105	$98.02
June 89	2,691,793	$1,406,463	$121,368	3,577	13,719	$3,675,473	$85.52
Dec 89	3,508,944	$1,934,132	$173,199	4,169	15,927	$4,480,141	$83.94
June 90	4,368,686	$2,126,362	$192,350	4,768	18,973	$5,211,765	$83.94
Dec 90	5,283,055	$2,422,458	$263,660	5,616	21,382	$6,281,596	$80.90
June 91	6,380,053	$2,653,505	$302,329	6,685	25,545	$7,429,739	$74.56
Dec 91	7,557,148	$3,055,017	$401,325	7,847	26,327	$8,671,544	$72.74
June 92	8,892,535	$3,633,285	$436,725	8,901	30,595	$9,276,139	$68.51
Dec 92	11,032,753	$4,189,441	$537,146	10,307	34,348	$11,262,070	$68.68
June 93	13,067,318	$4,819,259	$587,347	11,551	36,501	$12,775,967	$67.31
Dec 93	16,009,461	$6,072,906	$774,266	12,805	39,775	$13,946,406	$61.48
June 94	19,283,306	$6,519,030	$778,116	14,740	45,606	$16,107,920	$58.65
Dec 94	24,134,421	$7,710,890	$1,052,666	17,920	53,902	$18,938,677	$56.21
June 95	28,154,415	$8,740,352	$1,120,337	19,833	60,624	$21,709,286	$52.45
Dec 95	33,785,661	$10,331,614	$1,422,233	22,663	68,165	$24,080,466	$51.00
June 96	38,195,466	$11,194,247	$1,314,943	24,802	73,365	$26,707,046	$48.84
Dec 96	44,042,992	$12,440,724	$1,465,992	30,045	84,161	$32,573,522	$47.70
June 97	48,705,553	$13,134,551	$1,392,440	38,650	97,039	$37,454,294	$43.86
Dec 97	55,312,293	$14,351,082	$1,581,765	51,600	109,387	$46,057,911	$42.78
June 98	60,831,431	$15,286,660	$1,584,891	57,674	113,111	$50,178,812	$39.88
Dec 98	69,209,321	$17,846,515	$1,915,578	65,887	134,754	$60,542,774	$39.43

Source: *Wireless Industry Posts 'Astonishing' Subscriber Increase 13,897,028 New Subscribers in 1998*, News Release, Cellular Telecommunications Industry Association, April 1, 1999.

Tables 2A - 2B: Mobile Telephone Industry New Entrant (1) Rollout Summary

Table 2A: Estimated Mobile Telephone New Entrant (1) Rollouts by Number of Launches

Number of Providers in a BTA	Number of BTAs	POPs Contained in Those BTAs (2)	% of Total US POPs
1	116	28,100,071	11.1%
2	87	26,190,530	10.4%
3	80	95,000,108	37.6%
4	45	82,580,227	32.7%
5	8	10,000,492	4.0%
Total	336	241,871,428	95.8%

Table 2B: Estimated Mobile Telephone New Entrant (1) Rollouts by Market Size

Size of BTAs	Number of BTAs	Percent of BTAs in Quartile	POPs in Those BTAs (2)	Percent of POPs in Quartile
1st Quartile	120	97.6%	190,662,794	99.2%
2nd Quartile	101	82.1%	27,626,916	82.8%
3rd Quartile	65	52.8%	9,605,010	54.1%
4th Quartile	50	40.3%	3,976,216	42.9%

Source: Federal Communications Commission estimates based on publicly available information.

Notes:
1) For the analysis, mobile telephone new entrants are defined as broadband PCS operators plus Nextel Communications.
2) POPs from the 1990 Census.

Table 3: Mobile Telephone Industry Top 50 Operators

(In Millions)

Company	Cellular POPs (1)	ABC POPs (1)	DEF POPs (1)	Broadband POPs (2) Total	Rank	Broadband MHz-POPs (3) Total	Rank	Unduplicated Brdbnd. POPS (4) Total	Rank
AT&T	81.29	114.85	151.70	347.84	1	6,609.25	1	235.98	2
Sprint PCS		188.89	90.87	279.76	2	6,575.37	2	265.05	1
Nextel Comm.				230.00	3	2,300.00	4	230.00	3
Nextwave Telecom		111.87	53.86	165.73	4	3,894.69	3	165.73	4
Omnipoint Comm.		32.67	98.98	131.65	5	1,772.11	8	93.71	5
AirTouch Comm. (5)	64.67		21.03	85.70	6	1,827.05	6	64.67	8
SBC (6)	45.36	35.55	2.29	83.20	7	2,223.28	5	83.20	6
Western Wireless (7)	7.73	19.99	46.43	74.15	8	1,210.85	12	73.17	7
ALLTEL	35.28		32.40	67.68	9	1,206.05	13	55.63	13
GTE Mobilnet	52.32	11.08		63.40	10	1,640.33	9	61.81	9
BellSouth	38.91	7.72	13.59	60.22	11	1,340.16	11	58.64	11
Primeco		59.08		59.08	12	1,772.31	7	59.08	10
Bell Atlantic (5)	56.80			56.80	13	1,420.00	10	56.80	12
Northcoast Oper. Co.			47.86	47.86	14	478.64	19	47.86	14
Powertel	0.33	17.80	12.74	30.87	15	669.62	16	24.54	19
Ameritech (6)	22.00	8.26		30.26	16	797.76	15	30.11	15
Century Tele. Ent.	9.77		19.72	29.49	17	441.46	20	29.40	16
Aerial Comm.		27.87		27.87	18	836.14	14	27.49	17
US Cellular	25.27			25.27	19	631.67	17	25.27	18
US West		3.56	20.16	23.72	20	237.19	25	23.72	20
Aerforce			21.82	21.82	21	218.18	26	21.55	21
General Wireless	20.38			20.38	22	509.38	18	20.38	22
Comcast (6)	8.26		9.91	18.17	23	305.53	21	11.56	28
Rivgam Comm.			17.32	17.32	24	173.22	29	17.32	23
Telecorp PCS (8)		9.89	4.94	14.83	25	247.15	23	14.83	24
Cook Inlet/WW (SEC) (7)		2.98	9.83	12.81	26	142.95	32	12.81	25
Triton PCS (8)	0.91	11.01		11.92	27	242.90	24	11.92	26
Mercury PCS (PK)		2.50	9.16	11.65	28	129.03	34	11.65	27
Centennial Cellular	7.00	3.77		10.77	29	288.06	22	10.77	29
Dobson Comm. (SEC)	5.58		4.20	9.78	30	181.39	28	9.78	30
Devon Mobile (PK)		0.95	8.54	9.49	31	99.70	40	9.49	31
Urban Comm. PCS (PK)		3.47	4.42	7.89	32	148.28	31	7.89	32
21st Cent. Telesis (PK)		4.32	3.51	7.83	33	99.83	39	7.83	33
Radiofone	2.19		5.22	7.41	34	106.98	38	7.41	34
Pocket Comm.		7.33		7.33	35	109.89	37	7.33	35
Magnacom (PK)		1.77	5.47	7.23	36	81.17	43	7.23	36
McLeod, Inc.			7.15	7.15	37	71.47	46	7.15	37
Puerto Rico Telephone (9)	3.52		3.52	7.04	38	123.27	35	3.52	46
Vanguard Cellular	6.80			6.80	39	170.11	30	6.80	38
Chase Telecom		6.16		6.16	40	184.89	27	6.16	39
American Cellular	5.17			5.17	41	129.35	33	5.17	40
Clearcomm		5.12		5.12	42	76.78	45	5.12	41
Poka Lambro (PK)	0.06	1.34	3.29	4.69	43	54.58	49	4.69	42
DCC PCS (PK)			4.49	4.49	44	44.85	51	4.49	43
Texas Utilities		4.10		4.10	45	122.98	36	4.10	44
Commnet (SEC)	3.88			3.88	46	97.00	41	3.88	45
CC Puerto Rico	3.30			3.30	47	82.53	42	3.30	47
Cincinnati Bell (8)		3.20		3.20	48	63.96	48	3.20	48
Price Comm.	3.18			3.18	49	79.39	44	3.18	49
Rural Cellular	2.36	0.59		2.95	50	70.71	47	2.95	50

Notes:
(1) All of the operators' POPs equal their total net POPs. Net POPs are calculated for each individual license by multiplying that license's population by the operator's percentage ownership of the license.
(2) Broadband POPs are the sum of cellular, ABC block PCS, and DEF block PCS POPs.
(3) Broadband MHz-POPs equals cellular POPs multiplied by 25 MHz plus AB block PCS POPs multiplied by 30 MHz plus C block PCS POPs multipled by either 15 MHz or 30 MHz plus DEF block PCS POPs multiplied by 10 MHz.
(4) Unduplicated POPs adjusts Broadband POPs to account for a licensee having multiple licenses in the same geographic area.
(5) PrimeCo is owned by AirTouch (50%), Bell Atlantic (50%).
(6) SBC Communications has announced plans to merge with both Ameritech and Comcast.
(7) Cook Inlet Western is a joint venture in which Western Wireless owns 49.9%.
(8) Telecorp, Triton PCS and Cincinnati Bell have entered into joint ventures with AT&T
(9) Acquired by GTE.

Sources: Unless otherwise noted, Dennis Leibowitz et al, THE WIRELESS COMMUNICATIONS INDUSTRY, Donaldson, Lufkin & Jenrette, Winter 1998/1999, at 100-173.
PK - Paul Kagan Associates, Inc., *Tops in Wireless POPs*, WIRELESS MARKET STATS, Aug. 25, 1997, at 8-9. These figures have been adjusted for the June 1998 C block elections.
SEC - Filings made with the Securities and Exchange Commission.
Nextel Broadband POPs - Paul Kagan Associates, Inc., *Tops in Wireless POPs*, WIRELESS MARKET STATS, Aug. 25, 1997, at 8.
Nextel Broadband MHz-POPs - Calculated assuming an average of 10 MHz across all licenses. *See* John M. Bensche & Briar Mewbourne, *Nextel Communications: Initiating Coverage*, Wireless Services, Lehman Brothers, Sep. 3, 1997, at 8.

Table 4: Top 25 Mobile Telephone Operators by Subscribers
(in thousands)

	Year-End 1997				Year-End 1998			
	Operator	Cellular	PCS	Total	Operator	Cellular	PCS	Total
1	AT&T (2)	5,931	88	6,019	AirTouch	7,915	0	7,915
2	SBC	5,068	365	5,433	AT&T (2)	6,635	563	7,198
3	Bell Atlantic	5,356	0	5,356	SBC	5,924	846	6,770
4	BellSouth	4,900	141	5,041	Bell Atlantic	6,201	0	6,201
5	GTE	4,487	(1)	4,487	BellSouth	4,575	326	4,901
6	AirTouch	4,309	0	4,309	GTE	4,817	(1)	4,817
7	Ameritech	3,177	0	3,177	ALLTEL	4,009	(1)	4,009
8	360 Communications	2,583	0	2,583	Ameritech	3,577	(1)	3,577
9	US West Media Group	2,374	0	2,374	Nextel	0	0	2,790
10	US Cellular	1,710	0	1,710	Sprint PCS	0	2,590	2,590
11	Nextel	0	0	1,271	US Cellular	2,183	0	2,183
12	ALLTEL	941	0	941	Western Wireless	660	322	983
13	Sprint PCS	0	883	883	PrimeCo	0	902	902
14	Comcast	783	0	783	Comcast	815	0	815
15	Western Wireless	520	129	649	Vanguard Cellular	664	0	664
16	Vanguard Cellular	645	0	645	Century Tele. Ent.	624	0	624
17	Century Tele. Ent.	570	0	570	Centennial Cellular	286	99	385
18	SNET	457	0	457	Price Communications	382	0	382
19	PrimeCo	0	387	387	Omnipoint	0	376	376
20	Price Communications	310	0	310	CommNet Cellular	359	0	359
21	Commnet Cellular	290	0	290	Dobson Comm.	347	0	347
22	Centennial Cellular	218	51	269	American Cellular	334	0	334
23	American Cellular	244	0	250	Powertel	29	295	324
24	CCPR	196	0	196	Aerial Comm.	0	312	312
25	Aliant Communications	183	0	183	Aliant Comm.	303	0	303

Sources: Publicly available company documents such as operators' news releases and filings made with the Securities and Exchange Commission.

Notes:

1) Indicates that the operator has broadband PCS based systems but does not report those subscribers separately.
2) AT&T's PCS subscriber total is the average of estimates made by Merrill Lynch, SalomonSmith Barney, Toronto-Dominion, and Paul Kagan Associates.

Table 5: Estimated U.S Digital Mobile Telephone Subscribers

Technology	1997 Subscribers	1998 Subscribers	Percent Change
GSM Subs	1,200,000	2,700,000	125%
TDMA Subs	3,800,000	8,000,000	111%
CDMA Subs	1,400,000	6,400,000	357%
iDEN Subs	1,300,000	2,900,000	123%
Total Digital Subs	7,700,000	20,000,000	160%
Percent of Total	14%	29%	107.6%
Analog Cellular Subs	47,600,000	49,200,000	3%
Percent of Total	86%	71%	-17%
Total Mobile Phone Subs	55,300,000	69,200,000	25%

Sources:
CDMA: 1997 – CDMA Development Group, *Survival of the Fittest*, (visited Feb. 11, 1999) <http://www.cdg.org/magazines/spectrum/us.html>. 1998 – *cdmaOne Subscribers reach Almost 23 Million Globally; All Regions Showing Substantial Growth*, New Release, CDMA Development Group, Feb. 8, 1999. The figures for both years were reported for North America as a whole. They were adjusted for the United States by removing the publicly available CDMA subscriber totals of BCE Mobile Communications, Inc. and Clearnet Communications, Inc.

TDMA: 1997 – *Universal Wireless Communications Consortium (UWCC) Announces Over 100 Percent Worldwide Subscriber Growth for TDMA in 1998*, News Release, Universal Wireless Communications Consortium, Apr. 6, 1999. 1998 – Email from Universal Wireless Communications Consortium personnel, Feb. 15, 1999. The figures for both years were reported for North America as a whole. They were adjusted for the United States by removing the publicly available TDMA subscriber totals of Rogers Cantel Mobile Communications, Inc.

GSM: 1997 – *GSM Customers to Hit 100 Million Mark in 1998*, News Release, GSM MoU Association, Feb. 18, 1998. 1998 – *GSM Continues Record Growth in North America; Customers Top 3 Million in United States & Canada*, News Release, North American GSM Alliance L.L.C., Feb. 8, 1999. The figures for both years were reported for North America as a whole. They were adjusted for the United States by removing the publicly available GSM subscriber totals of Microcell Telecommunications, Inc.

iDEN: The iDEN figures are the combined digital SMR subscriber totals for Nextel and Southern Company ("Southern"). Southern's 1997 figure is estimated and the 1998 figure is as of November 1998. Nextel: *Nextel Reports 1998 Results*, News Release, Nextel Communications, Inc., Feb. 23, 1999. Southern: *Southern LINC Hits 100,000th Customer Milestone*, News Release, Southern Company, Nov. 5, 1998.

Total Mobile Telephone Subs: Appendix B, Table 1, p. B-2.

Table 6: Quarterly Mobile Telephone Subscriber Growth

	95Q4	96Q1	96Q2	96Q3	96Q4	97Q1	97Q2	97Q3	97Q4	98Q1	98Q2	98Q3	98Q4
Cellular													
AirTouch (6)	2,262	2,392	2,550	3,072	3,403	3,550	3,745	3,901	4,309	4,560	7,290	7,461	7,915
AT&T (1)	3,950	4,232	4,539	4,784	5,204	5,325	5,542	5,747	5,931	6,023	6,233	6,417	6,635
Bell Atlantic	3,356	3,575	3,822	4,054	4,410	4,634	4,875	5,064	5,356	5,483	5,707	5,914	6,201
SBC (3)	3,659	3,807	3,961	4,125	4,398	4,623	4,781	4,890	5,068	5,090	5,188	5,234	5,924
GTE	3,011	3,094	3,243	3,393	3,749	4,009	4,151	4,286	4,487	4,545	4,631	4,685	4,817
BellSouth (3)	3,559	3,791	4,018	4,142	4,460	4,645	4,836	4,860	4,900	5,027	5,222	5,399	4,575
ALLTEL	625	663	708	738	795	844	890	921	941	977	1,010	3,863	4,009
Ameritech	1,891	2,043	2,185	2,293	2,512	2,709	2,856	2,970	3,177	3,345	3,462	3,576	3,600
US Cellular	710	785	860	940	1,073	1,164	1,263	1,357	1,710	1,817	1,922	2,018	2,183
Comcast	665	705	746	745	762	766	768	766	783	790	799	810	815
Vanguard (3) (4)	381	405	430	461	513	540	580	615	645	667	692	678	664
Western Wireless	210	239	264	290	324	351	390	426	520	547	583	620	660
Century Tele. Ent. (5)	290	307	325	337	368	380	398	430	570	576	584	592	624
Price Comm.	212	227	244	262	280	311	326	337	310	327	347	364	382
Commnet	168	181	195	211	230	244	257	275	290	307	320	336	359
Dobson Comm.	27	30	30	32	34	79	96	85	100	110	151	163	347
American Cellular	73	89	110	126	140	169	191	214	244	264	286	305	335
Aliant Comm.	110	118	126	133	147	154	161	170	183	271	281	290	303
CCPR	116	128	139	150	159	167	176	182	196	212	234	265	302
Centennial	116	128	135	141	160	177	187	199	218	238	253	268	286
Rural Cellular (4)	27	31	36	39	45	48	77	80	85	87	92	176	187
Powertel	39	40	42	44	48	50	24	25	26	27	28	28	29
360 Comm.	1,502	1,643	1,750	1,851	2,156	2,281	2,379	2,450	2,583	2,644	2,733	0	0
US West MG	1,339	1,437	1,557	1,664	1,873	1,984	2,073	2,200	2,374	2,424	0	0	0
Sygnet Wireless	45	48	51	54	107	114	121	130	143	148	157	167	0
	28,340	30,137	32,066	34,082	37,350	39,317	41,144	42,580	45,148	46,506	48,206	49,629	51,151
		1,798	1,929	1,655	3,268	1,967	1,827	1,435	2,481	1,358	1,700	1,381	2,118
Broadband PCS													
Sprint PCS (2)					1	46	116	281	890	1,110	1,370	1,750	2,590
PrimeCo					37	114	195	260	388	508	598	707	902
SBC Comm.					10	27	137	287	365	446	568	670	846
AT&T							1	22	88	136	251	392	563
Omnipoint						16	42	80	141	190	255	274	376
BellSouth				12	51	81	106	126	141	167	205	249	326
Western Wireless		2	6	18	36	49	74	101	129	165	213	265	322
Aerial Comm.							28	65	125	165	204	231	312
Powertel					15	35	45	66	119	157	181	229	295
US West									15	28	54	104	185
Centennial						7	17	33	51	61	70	86	99
Cincinnati Bell											14	25	56
Intelos												7	12
Rural Cellular													5
Chase Telecomm.													4
APC/Sprint	32	60	90	118	158	181	201	225	0	0	0	0	0
Total	32	62	96	147	308	555	962	1,546	2,451	3,132	3,982	4,987	6,892
Net Adds	32	31	34	51	161	247	408	583	905	681	850	1,005	1,905
Digital SMR													
Nextel Subs	85	129	176	228	300	423	624	947	1,271	1,642	2,042	2,417	2,790
Nextel Net Adds		44	47	52	72	123	202	322	324	371	401	375	373
Tot Net Adds		1,872	2,010	1,758	3,501	2,336	2,437	2,341	3,711	2,410	2,951	2,761	4,396
PCS/Nextel %		4.0%	4.0%	5.8%	6.7%	15.8%	25.0%	38.7%	33.1%	43.6%	42.4%	50.0%	51.8%
Cellular %		96.0%	96.0%	94.2%	93.3%	84.2%	75.0%	61.3%	66.9%	56.4%	57.6%	50.0%	48.2%

Sources: Except as noted, publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.

Notes:
1) AT&T's broadband PCS subscriber totals are the average of estimates made by Merrill Lynch, SalomonSmith Barney, Toronto-Dominion, and Paul Kagan Associates.
2) APC/Sprint and Sprint PCS subscriber totals prior to 1998 are based on the average of estimates made by: SalomonSmith Barney, Paul Kagan Associates, Inc., and Merrill Lynch.
3) Adjustments to the cellular net adds in the fourth quarter of 1998 were made for system divestitures by Vanguard Cellular, the restructuring of BellSouth's subscribership reduction caused by the restructuring of its joint ventures with AT&T, and SBC Communications' acquisition of Southern New England Telecommunications.
4) Adjustments to the cellular net adds in the third quarter of 1998 were made for system divestitures by Vanguard Cellular and system acquisitions by Rural Cellular.
5) Adjustments to the cellular net adds in the fourth quarter of 1997 were made for Century Telephone Enterprises' acquisition of Pacific Telecom.
6) Adjustments to the cellular net adds in the third quarter of 1996 were made for system acquisitions by AirTouch.

Table 7: Mobile Telephone Industry Subscriber Churn

	1996	1997	1998
Cellular			
ALLTEL	1.95%	2.04%	2.12%
American Cellular	1.60%	1.80%	1.80%
Bell Atlantic	1.80%	1.73%	1.85%
Century Tele. Ent.	2.37%	2.31%	2.23%
Dobson Comm.	1.83%	1.89%	2.00%
Powertel	1.60%	1.60%	1.90%
Price Comm.	1.84%	1.87%	1.91%
Rural Cellular	1.30%	1.60%	1.50%
US Cellular	1.90%	1.90%	1.90%
Vanguard Cellular	2.20%	2.20%	2.00%
Weighted Average	1.89%	1.89%	1.95%
Broadband PCS			
Powertel		3.70%	4.10%
Omnipoint (1) (2)		2.70%	4.50%
Aerial Comm. (2)		3.40%	5.50%
Western Wireless (2)		3.00%	2.40%
Centennial (3)		2.60%	4.60%
Weighted Average		3.20%	4.20%
Digital SMR			
Nextel	1.00%	1.30%	1.80%

Source: Publicly available company documents such as news releases and filings made with the Securities and Exchange Commission or

Note:
(1) Excluding 30 day returns (prepaid customers).
(2) Source: *See* Tomas J. Lee, *1Q99 Quarterly Preview*, Equity Research United States, SalomonSmith Barney, Inc., Apr. 14, 1999 and Tomas J. Lee, *Mobile Metrics – Fall 1998*, Equity Research United States, SalomonSmith Barney, Inc., Sep. 21, 1998.
(3) Centennial's figures are for the 12 months ending in May of each year.

Table 8: Mobile Telephone Digital Coverage

Technology	Band	Number of License Areas	POPs in Those License Areas (3)	% of Total POPs
CDMA	Broadband PCS (1)	210	199,804,727	79.1%
	Digital Cellular (2)	148	145,292,249	57.5%
	Combined Total	-	208,497,555	82.4%
TDMA	Broadband PCS (1)	48	68,400,640	27.1%
	Digital Cellular (2)	293	163,531,737	64.7%
	Combined Total	-	191,625,143	75.8%
GSM	Broadband PCS (1)	231	174,533,734	69.1%
iDEN	Digital SMR (1)	187	191,547,195	75.8%

Source: Federal Communications Commission estimates based on publicly available information.
Notes:
(1) The license areas used for broadband PCS and digital SMR are BTAs.
(2) The license areas used for digital cellular are MSAs and RSAs.
(3) The POPs are from the 1990 census.

Tables 9A - 9E: Cellular Industry Financial Summary

Table 9A:
Cellular Operator Year-End Subscribership - 1995 to 1998 (1)

	1995	Percent Change	1996	Percent Change	1997	Percent Change	1998	Percent Change
AirTouch (2)	3,601,000	45.0%	5,276,000	50.4%	6,683,000	26.6%	7,915,000	18.4%
AT&T (3)	3,950,000	41.1%	5,204,000	31.7%	6,019,000	15.7%	7,198,000	19.6%
Bell Atlantic	3,356,000	43.4%	4,410,000	31.4%	5,356,000	21.5%	6,201,000	15.8%
SBC (4)	3,982,000	22.3%	4,790,000	20.2%	5,525,000	15.2%	5,924,000	7.2%
GTE (3)	3,011,000	28.7%	3,749,000	24.5%	4,487,000	19.7%	4,817,000	7.4%
BellSouth	3,558,662	30.1%	4,460,000	25.3%	4,900,000	9.9%	4,575,000	-6.6%
ALLTEL (3) (5)	2,126,299	33.3%	2,951,548	27.3%	3,523,839	18.4%	4,008,660	13.8%
Ameritech (3)	1,891,000	45.6%	2,512,000	32.8%	3,177,000	26.5%	3,577,000	12.6%
US Cellular	710,000	68.6%	1,073,000	51.1%	1,710,000	59.4%	2,183,000	27.7%
Comcast	665,000	32.7%	762,000	14.6%	783,000	2.8%	829,000	5.9%
Vanguard Cellular	381,000	55.5%	513,000	34.6%	645,000	25.7%	664,000	2.9%
Western Wireless	209,500	85.7%	324,200	54.7%	520,000	60.4%	660,400	27.0%
Century Tele. Ent.	290,075	37.0%	368,233	26.9%	569,983	54.8%	624,119	9.5%
Price Comm.	211,985	80.8%	279,816	32.0%	309,606	10.6%	381,977	23.4%
Commnet Cellular	168,465	46.6%	229,879	36.5%	289,841	26.1%	358,665	23.7%
Dobson Comm.	71,279	23.9%	140,880	28.9%	243,027	191.8%	347,306	42.9%
American Cellular	73,000	322.0%	139,800	91.5%	243,700	74.3%	334,500	37.3%
Aliant Comm.	109,708	309.7%	146,702	34.5%	182,987	24.6%	302,740	65.4%
Cellular Comm. PR	115,500	69.1%	159,300	37.9%	196,400	23.3%	301,000	53.3%
Centennial Cellular (6)	135,000	20.0%	187,000	38.5%	268,600	43.6%	285,900	6.4%
Rural Cellular	26,764	53.8%	45,094	68.5%	84,600	87.6%	186,892	120.9%
Powertel	38,582	34.8%	47,617	23.4%	25,848	-45.7%	28,989	12.2%
Total	28,681,819	39.3%	37,769,069	31.7%	45,743,431	21.1%	51,704,148	13.0%

Source: Publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.

Notes:
(1) Unless otherwise noted all figures are consolidated domestic subscribers. Unless notes, no corrections have been made for mergers and acquisitions.
(2) On April 6, 1998, AirTouch completed its acquisition of US West Media Group's wireless properties. The AirTouch figures for 1995, 1996, and 1997 include the US West subscribers.
(3) 1997 and/or 1998 figures include subscribers on broadband PCS systems.
(4) On October 26, 1998, SBC merged with Southern New England Telecommunications. The SBC figures for 1995, 1996, and 1997 include the Southern New England Telecommunications subscribers.
(5) On July 1, 1998, 360 Communications and ALLTEL merged. The ALLTEL figures for 1995, 1996, and 1997 include the 360 Communications subscribers.
(6) Centennial Cellular's figures are as of November 30 of each year.

Table 9B:
Cellular Operator Year-End Subscriber Penetration - 1994 to 1998

	1994	1995	1996	1997	1998
Airtouch (1)	4.38%	6.22%	8.29%	10.48%	11.72%
Aliant Comm.	7.50%	10.00%	13.20%	16.30%	17.70%
ALLTEL (2)	5.50%	7.60%	9.10%	10.70%	12.00%
American Cellular	1.00%	2.00%	3.60%	5.30%	6.84%
Ameritech (3)	4.93%	7.17%	9.53%	12.09%	13.59%
Bell Atlantic	4.20%	6.00%	7.80%	9.40%	10.80%
BellSouth	5.50%	7.13%	8.90%	10.20%	11.90%
CCPR	2.00%	3.40%	4.10%	5.10%	7.80%
Centennial Cellular (4)	1.97%	2.08%	2.52%	3.39%	4.59%
Century Tele. Ent.	3.33%	4.22%	5.19%	6.30%	6.90%
Comcast	6.80%	8.50%	9.30%	9.50%	10.20%
Commnet Cellular	2.53%	3.59%	5.15%	6.35%	7.82%
Dobson Comm. (5)	4.78%	5.75%	4.81%	6.05%	6.80%
GTE	4.80%	6.30%	7.80%	9.10%	9.70%
Price Comm.	4.58%	6.41%	7.45%	9.40%	11.57%
Rural Cellular	2.90%	4.50%	7.50%	7.60%	8.00%
SBC (6)	7.20%	8.70%	10.50%	11.50%	12.30%
US Cellular	1.98%	3.18%	4.94%	7.11%	8.84%
Vanguard Cellular	3.65%	5.34%	6.77%	8.51%	9.81%
Western Wireless	2.20%	3.60%	5.40%	6.97%	8.69%
Average	5.3%	6.8%	8.5%	10.0%	11.2%
Percent Change		29.5%	24.7%	17.4%	12.3%
Net Growth		1.55%	1.68%	1.48%	1.23%
Percent Change			8.6%	-12.2%	-16.8%

Source: Publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.

Notes:
(1) The AirTouch figures for 1994-1997 are pro forma figures estimated to include the US West Media Group's operations.
(2) The ALLTEL figures for 1994-1997 are pro forma figures estimated to include 360 Communications' operations.
(3) Ameritech's 1994 and 1995 figures are calculated using its 1996 POPs.
(4) The Centennial Cellular figures are for May of each year.
(5) The Dobson Communications figures for 1994-1997 are pro forma figures estimated to include Sygnet Wireless' operations.
(6) The SBC figures for 1994-1997 are pro forma figures estimated to include Southern New England Telecommunications' operations.

Table 9C:
Cellular Operator Annual Revenues - 1995 to 1998
(in millions) (1)

	1995	Percent Change	1996	Percent Change	1997	Percent Change	1998	Percent Change
AirTouch (2)	$2,292.300	35.6%	$2,965.200	29.4%	$3,516.000	18.6%	$3,831.000	9.0%
AT&T (3)	n/a	n/a	$4,238.000	n/a	$4,642.000	9.5%	$5,007.000	7.9%
Bell Atlantic	$2,092.100	28.6%	$2,651.300	26.7%	$3,097.900	16.8%	$3,481.300	12.4%
SBC (4) (5) (10)	$2,408.000	30.1%	$3,137.000	20.7%	$3,697.000	17.9%	$4,185.000	13.2%
GTE (4) (5)	$2,019.000	31.2%	$2,634.000	16.2%	$2,922.000	10.9%	$3,070.000	5.1%
BellSouth	$1,888.259	28.9%	$2,312.289	22.5%	$2,520.101	9.0%	$2,632.932	4.5%
ALLTEL (4) (6)	$1,232.515	34.9%	$1,544.500	25.3%	$1,838.500	19.0%	$2,137.200	16.2%
Ameritech (4) (7)	$1,074.240	22.1%	$1,342.530	25.0%	$1,759.780	31.1%	$1,886.940	7.2%
US Cellular	$492.395	48.1%	$707.820	43.8%	$876.965	23.9%	$1,162.467	32.6%
Comcast	$374.880	31.0%	$426.053	13.7%	$444.946	4.4%	$455.199	2.3%
Vanguard Cellular	$236.071	40.5%	$302.054	28.0%	$374.518	24.0%	$421.706	12.6%
Western Wireless	$146.555	132.2%	$221.307	51.0%	$302.848	36.8%	$416.620	37.6%
Century Tele. Ent.	$197.494	33.6%	$250.243	26.7%	$307.742	23.0%	$407.749	32.5%
Price Comm.	$104.906	52.1%	$159.743	52.3%	$185.449	16.1%	$197.329	6.4%
Commnet Cellular	$113.084	40.1%	$148.517	31.3%	$183.705	23.7%	$205.271	11.7%
Dobson Comm. (9)	$44.260	32.4%	$71.735	62.1%	$152.348	112.4%	$240.303	57.7%
American Cellular	$41.504	696.8%	$112.616	171.3%	$181.000	60.7%	$246.157	36.0%
Aliant Comm.	$34.121	217.7%	$63.696	86.7%	$76.710	20.4%	$119.067	55.2%
Cellular Comm. PR	$108.668	61.9%	$133.818	23.1%	$148.494	11.0%	$180.198	21.4%
Centennial Cellular (8)	$101.057	46.0%	$125.286	24.0%	$169.123	35.0%	$206.053	21.8%
Rural Cellular	$20.327	29.6%	$30.461	49.9%	$47.591	56.2%	$87.720	84.3%
Powertel	$29.312	34.7%	$34.652	18.2%	$22.918	-33.9%	$19.610	-14.4%
Total (11)	$15,051.048	32.8%	$23,612.820	28.7%	$27,467.638	16.3%	$30,596.821	11.4%

Source: Publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.

Notes:
(1) Unless otherwise noted, all figures are for consolidated domestic holdings. Unless noted, no corrections have been made for mergers and acquisitions.
(2) The AirTouch figures are pro forma figures estimated to include the US West Media Group's operations.
(3) AT&T's figures are for what it refers to as "core" wireless services which it describes as being primarily cellular operations and excludes: broadband PCS systems, wireless data, two-way messaging, and fixed wireless systems. Some analysts use this figure as a proxy for AT&T's cellular operations.
(4) Includes revenues from broadband PCS operations.
(5) Figures for periods prior to 1996 include service revenues only. The percent change between 1995 and 1996 was calculated using only service revenues.
(6) The ALLTEL figures are pro forma figures estimated to include 360 Communications' operations.
(7) Ameritech's figures are calculated using the numbers it reported for its cellular and paging unit's percentage of its total revenues.
(8) The Centennial Cellular figures are for the twelve months ending in November of each year.
(9) The Dobson Communications figures are pro forma figures estimated to include Sygnet Wireless' operations.
(10) The SBC figures are pro forma figures estimated to include Southern New England Telecommunications' operations.
(11) The percentage increase for the total revenue figures are calculated using only the operators for whom data was available for all four years

Table 9D:
Cellular Operator Annual Operating Cash Flow - 1995 to 1998
(in millions) (1)

	1995	Percent Change	1996	Percent Change	1997	Percent Change	1998	Percent Change
AirTouch (2)	$849.200	34.8%	$1,176.400	38.5%	$1,535.000	30.5%	$1,716.000	11.8%
AT&T (3)	n/a	n/a	$1,496.000	n/a	$1,654.000	n/a	$1,563.000	-5.5%
Bell Atlantic	$655.000	80.4%	$873.700	33.4%	$1,158.700	32.6%	$1,349.800	16.5%
SBC (4) (8)	n/a	n/a	$1,143.000	n/a	$1,087.000	-4.9%	$1,399.000	28.7%
GTE (4)	$742.000	36.6%	$880.000	14.0%	$865.000	-1.7%	$1,104.000	27.6%
BellSouth	$823.618	30.4%	$1,004.111	21.9%	$1,156.728	15.2%	$1,187.643	2.7%
ALLTEL (4)	$436.482	45.7%	$587.009	34.5%	$719.366	22.5%	$895.718	24.5%
Ameritech	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
US Cellular	$132.213	59.6%	$196.205	48.4%	$261.922	33.5%	$382.854	46.2%
Comcast	$133.300	21.8%	$154.001	15.5%	$170.038	10.4%	$174.950	2.9%
Vanguard Cellular	$68.028	89.3%	$102.563	50.8%	$123.145	20.1%	$151.494	23.0%
Western Wireless	$28.929	1276.3%	$60.289	108.4%	$103.875	72.3%	$155.682	49.9%
Century Tele. Ent.	$82.436	56.4%	$101.487	23.1%	$129.208	27.3%	$192.582	49.0%
Price Comm.	$41.586	67.0%	$66.190	59.2%	$80.980	22.3%	$88.595	9.4%
Commnet Cellular	$30.627	95.5%	$52.846	72.5%	$74.821	41.6%	$88.140	17.8%
Dobson Comm. (7)	$15.279	44.9%	$27.424	79.5%	$66.622	142.9%	$96.348	44.6%
American Cellular	$9.347	-366.9%	$38.470	311.6%	$69.233	80.0%	$118.760	71.5%
Aliant Comm.	$13.763	217.1%	$27.216	97.7%	$35.404	30.1%	$60.590	71.1%
Cellular Comm. PR	$26.678	92.2%	$37.419	40.3%	$44.185	18.1%	$69.797	58.0%
Centennial Cellular (6)	$46.286	104.2%	$58.588	26.6%	$77.400	32.1%	$104.359	34.8%
Rural Cellular	$5.740	58.9%	$8.779	53.0%	$19.860	126.2%	$39.357	98.2%
Powertel	$11.992	55.3%	$16.461	37.3%	$9.434	-42.7%	$10.019	6.2%
Total (9)	$4,152.504	45.7%	$8,108.158	31.7%	$9,441.921	16.4%	$10,948.688	16.0%

Source: Publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.

Notes:
(1) Unless otherwise noted, all figures are for consolidated domestic holdings. Unless noted, no corrections have been made for mergers and acquisitions.
(2) The AirTouch figures are pro forma figures estimated to include the US West Media Group's operations.
(3) AT&T's figures are for what it refers to as "core" wireless services which it describes as being primarily cellular operations and excludes: broadband PCS systems, wireless data, two-way messaging, and fixed wireless systems. Some analysts use this figure as a proxy for AT&T's cellular operations.
(4) Includes cash flows from broadband PCS operations.
(5) The ALLTEL figures are pro forma figures estimated to include 360 Communications' operations.
(6) The Centennial Cellular figures are for the twelve months ending in November of each year.
(7) The Dobson Communications figures are pro forma figures estimated to include Sygnet Wireless' operations.
(8) The SBC figures are pro forma figures estimated to include Southern New England Telecommunications' operations.
(9) The percentage increase for the total cash flow figures are calculated using only the operators for whom data was available for all four years

Table 9E:
Cellular Operator Annual Operating Cash Flow Margin - 1995 to 1998 (1)

	1995	Percent Change	1996	Percent Change	1997	Percent Change	1998	Percent Change
AirTouch (2)	37.0%	-0.6%	39.7%	7.1%	43.7%	10.0%	44.8%	2.6%
AT&T (3)	n/a	n/a	35.3%	n/a	35.6%	0.9%	31.2%	-12.4%
Bell Atlantic	31.3%	40.3%	33.0%	5.3%	37.4%	13.5%	38.8%	3.7%
SBC (4) (8)	n/a	n/a	36.4%	n/a	29.4%	-19.3%	33.4%	13.7%
GTE (4)	36.8%	4.2%	33.4%	-9.1%	29.6%	-11.4%	36.0%	21.5%
BellSouth	43.6%	1.2%	43.4%	-0.4%	45.9%	5.7%	45.1%	-1.7%
ALLTEL (4) (5)	35.4%	8.1%	38.0%	7.3%	39.1%	3.0%	41.9%	7.1%
Ameritech	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
US Cellular	26.9%	7.7%	27.7%	3.2%	29.9%	7.7%	32.9%	10.3%
Comcast	35.6%	-7.0%	36.1%	1.7%	38.2%	5.7%	38.4%	0.6%
Vanguard Cellular	28.8%	34.7%	34.0%	17.8%	32.9%	-3.2%	35.9%	9.3%
Western Wireless	19.7%	492.6%	27.2%	38.0%	34.3%	25.9%	37.4%	8.9%
Century Tele. Ent.	41.7%	17.1%	40.6%	-2.8%	42.0%	3.5%	47.2%	12.5%
Price Comm.	39.6%	9.8%	41.4%	4.5%	43.7%	5.4%	44.9%	2.8%
Commnet Cellular	27.1%	39.6%	35.6%	31.4%	40.7%	14.5%	42.9%	5.4%
Dobson Comm. (7)	34.5%	9.5%	38.2%	10.7%	43.7%	14.4%	40.1%	-8.3%
American Cellular	22.5%	-133.5%	34.2%	51.7%	38.3%	12.0%	48.2%	26.1%
Aliant Comm.	40.3%	-0.2%	42.7%	5.9%	46.2%	8.0%	50.9%	10.3%
Cellular Comm. PR	24.6%	18.8%	28.0%	13.9%	29.8%	6.4%	38.7%	30.2%
Centennial Cellular (6)	45.8%	39.9%	46.8%	2.1%	45.8%	-2.1%	50.6%	10.7%
Rural Cellular	28.2%	22.7%	28.8%	2.1%	41.7%	44.8%	44.9%	7.5%
Powertel	40.9%	15.3%	47.5%	16.1%	41.2%	-13.3%	51.1%	24.1%
Total (9)	35.9%	8.4%	36.7%	2.3%	38.6%	5.1%	40.9%	6.1%

Source: Publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.

Notes:
(1) Unless otherwise noted, all figures are for consolidated domestic holdings. Unless noted, no corrections have been made for mergers and acquisitions.
(2) The AirTouch figures are pro forma figures estimated to include the US West Media Group's operations.
(3) AT&T's figures are for what it refers to as "core" wireless services which it describes as being primarily cellular operations and excludes: broadband PCS systems, wireless data, two-way messaging, and fixed wireless systems. Some analysts use this figure as a proxy for AT&T's cellular operations.
(4) Includes cash flows from broadband PCS operations.
(5) The ALLTEL figures are pro forma figures estimated to include 360 Communications' operations.
(6) The Centennial Cellular figures are for the twelve months ending in November of each year.
(7) The Dobson Communications figures are pro forma figures estimated to include Sygnet Wireless' operations.
(8) The SBC figures are pro forma figures estimated to include Southern New England Telecommunications' operations.
(9) The percentage increase for the total cash flow margin figures are calculated using only the operators for whom data was available for all four years.

Table 10: Broadband PCS Industry Growth

Operator	Technology Choice	Launch Date	Subscibers 12/31/95	Subscibers 12/31/96	Subscibers 12/31/97	Subscibers 12/31/98
APC/Sprint (1)	GSM	11/15/95	31,667	158,333	-	-
Western Wireless	GSM	2/28/96		35,500	128,600	322,400
BellSouth	GSM\TDMA	7/18/96		51,000	141,000	326,000
Powertel	GSM	10/15/96		14,892	118,757	295,295
SBC Communications (2)	GSM\TDMA	10/29/96		10,000	365,000	846,000
PrimeCo	CDMA	11/13/96		38,000	387,000	902,000
Omnipoint	GSM	11/14/96		n/a	141,000	375,500
Centennial Cellular (3)	CDMA	12/12/96		16,900	50,700	98,700
Sprint PCS (1) (4)	CDMA	12/16/96		1,333	890,000	2,590,000
GTE (5)	CDMA	2/18/97			n/a	n/a
Aerial Communications	GSM	3/27/97			125,000	311,900
Airadigm	GSM	5/3/97			n/a	n/a
AT&T (6)	TDMA	6/5/97			88,000	562,688
Horizon PCS (7)	CDMA	8/29/97			n/a	n/a
US West Communications	CDMA	9/23/97			15,000	185,000
WirelessNorth	CDMA	10/1/97			n/a	n/a
Third Kentucky Cellular (8)	GSM	10/7/97			n/a	n/a
Intelos	CDMA	10/9/97			n/a	12,000
NPI Wireless	GSM	10/13/97			n/a	n/a
US Unwired (7)	CDMA	Nov-97			n/a	n/a
PCS One (9)	GSM	11/17/97			n/a	16,000
DIGIPH PCS	GSM	1/22/98				n/a
Poka Lambro	CDMA	Jan-98				n/a
Southeast Telephone	GSM	2/8/98				n/a
ALLTEL	CDMA	2/23/98				n/a
3 Rivers Wireless	CDMA	3/30/98				n/a
Hargrey Wireless	CDMA	4/1/98				n/a
Blackfoot Communications	CDMA	4/8/98				n/a
Rural Cellular (10)	GSM	4/21/98				5,129
Conestoga Enterprises	GSM	5/1/98				n/a
Cincinnati Bell (11)	TDMA	5/5/98				56,000
Via Wireless (7)	CDMA	7/15/98				n/a
Ameritech (5)	CDMA	7/21/98				n/a
Lifecom	CDMA	8/10/98				n/a
Century Telephone Enterprises	TDMA	8/12/98				n/a
Panhandle Telecomm. Systems	GSM	9/22/98				n/a
Chase Telecommunications	CDMA	9/23/98				3,500
AlaskaDigitel	CDMA	10/26/98				n/a
Iowa Wireless Services (12)	GSM	11/6/98				n/a
Amica Wireless	CDMA	12/14/98				n/a
Cellular South	TDMA	1/20/99				-
Triton PCS (11)	TDMA	1/26/99				-
Telecorp (11)	TDMA	2/4/99				-
Southwest PCS (7)	CDMA	3/22/99				-
Industar	TDMA	4/1/99				-
South Central (Utah) Comm.	CDMA	4/1/99				-
PinPoint Communications	GSM	2Q99				-
Pyxis Communications	CDMA	April 99				-
Roseville Communications	CDMA	6/11/99				-

Sources:
- Except as noted below, all subscriber figures come from operators' news releases and filings made with the Securities and Exchange Commission.

Notes:
(1) APC/Sprint and Sprint PCS subscriber totals prior to 1998 are based on the average of estimates made by: Salomon Smith Barney, Paul Kagan Associates, Inc., and Merrill Lynch.
(2) SBC Communication's information includes the PCS operations added with the acquisition of Pacific Telesis. SBC launched its lone existing broadband PCS license in Tulsa on 5/22/97.
(3) Centennial Cellular's subscriber figures are as of November 30 of each year.
(4) Sprint PCS acquired APC/Sprint Spectrum on January 6, 1998. APC/Sprint Spectrum's 4th quarter 1997 subscribers are included with Sprint PCS.

(5) GTE and Ameritech report their broadband PCS subscribers with their existing cellular operations.
(6) AT&T does not report its broadband PCS subscribers separately. The subscriber totals here are the average of estimates made by Merrill Lynch, SalomonSmith Barney, Toronto-Dominion, and Paul Kagan Associates.
(7) Entered in affiliation agreements with Sprint PCS.
(8) Operates under the name Wireless 2000.
(9) PCS One is a joint venture between D&E Communications and Omnipoint.
(10) Rural Cellular controls 51% of Wireless Alliance LLC, a joint venture between it and Aerial Communications.
(11) Joint Venture with AT&T.
(12) Joint Venture with Western Wireless.

Table 11: Broadband PCS Capital Expenditures: 1995 - 1998

Operator	1995	1996	1997	1998	Cumulative Capital Ex	Covered POPs 12/31/98 (thous.)	Cell Sites in Service 12/31/98
Aerial (1)	$297.551	$242.270	$387.718	$96.950	$1,024.489	27,500	1,180
AT&T (2)	n/a	$1,088.000	$1,338.000	$522.000	$2,948.000	n/a	n/a
Centennial (3)	$0.219	$15.478	$50.056	$57.108	$137.522	3,839	125
Conestoga Enterprises (4)	$0.000	$0.000	$7.246	$20.848	$28.094	402	70
Omnipoint (5)	$14.844	$164.116	$435.167	$560.864	$1,174.991	46,000	2,800
Powertel	$0.000	$224.647	$289.594	$204.990	$719.231	15,600	1,409
Rural Cellular (6)	$0.000	$0.000	$8.801	$13.300	$22.101	708	53
Sprint PCS	$31.806	$1,419.216	$2,278.300	$2,903.600	$6,632.922	170,000	9,000
Western Wireless	$16.891	$234.362	$264.432	$206.503	$722.188	16,121	n/a

Sources: Publicly available information such as operators' news releases and filings made with the Securities and Exchange Commission.

Notes:
(1) Aerial's figures include non-cash transactions.
(2) AT&T's figures are for what it refers to as "new" wireless services which include: broadband PCS systems, wireless data, two-way messaging, and fixed wireless systems. Some analysts use this figure as a proxy for AT&T's broadband PCS operations.
(3) Centennial's years are the 12 months ending in May. The cumulative figure includes 14.661 million for the six months ending November 1998. Its "covered" POPs are the entire population of Puerto Rico.
(4) Conestoga's figures includes some paging expenditures and its covered POPs include all of the Reading, Sunbury, and Williamsport BTAs.
(5) Omnipoint's covered POPs represents the population to which it was marketing service as of 12/31/98.
(6) Rural Cellular is a joint venture with Aerial Communications. Its covered POPs are the entire population of its broadband PCS service area.

Table 12: Broadband PCS Income Data: 1995 - 1998

Operator	Statistic	1996	Percent Change	1997	Percent Change	1998	Percent Change
Aerial	Revenue			$55.952	-	$155.154	177.3%
	EBITDA			($177.611)	-	($196.584)	10.7%
	EBITDA Margin			-317.4%	-	-126.7%	-60.1%
AT&T (1)	Revenue			$26.000	-	$399.000	1434.6%
	EBITDA			($426.000)	-	($343.000)	-19.5%
	EBITDA Margin			-1638.5%	-	-86.0%	-94.8%
Centennial	Revenue			$26.163	-	$86.059	228.9%
	EBITDA			($4.139)	-	$32.826	-893.1%
	EBITDA Margin			-15.8%	-	38.1%	-341.1%
Omnipoint	Revenue	$0.531	-	$42.377	-	$167.753	295.9%
	EBITDA	($48.941)	-	($145.924)	-	($282.528)	93.6%
	EBITDA Margin	-	-	-344.3%	-	-168.4%	-51.1%
PCS One (3)	Revenue			$0.179	-	$5.208	2813.3%
	EBITDA			($1.777)	-	($11.562)	550.5%
	EBITDA Margin			-994.3%	-	-222.0%	-77.7%
Powertel (2)	Revenue	$4.473	-	$55.998	-	$155.826	178.3%
	EBITDA	($23.728)	-	($95.253)	-	($114.601)	20.3%
	EBITDA Margin	-530.5%	-	-170.1%	-	-73.5%	-56.8%
PrimeCo	Revenue	$12.000	-	$208.000	-	$509.000	144.7%
	EBITDA	n/a	-	($341.300)	-	($214.100)	-37.3%
	EBITDA Margin		-	-164.1%	-	-42.1%	-74.4%
Sprint PCS (4)	Revenue	$4.175	-	$400.800	-	$1,225.400	375.0%
	EBITDA	($346.278)	-	($1,324.500)	-	($1,600.600)	47.9%
	EBITDA Margin	-	-	-330.5%	-	-130.6%	-68.9%
Western Wireless	Revenue	$17.539	-	$77.730	343.2%	$167.962	116.1%
	EBITDA	($67.434)	-	($130.066)	92.9%	($120.877)	-7.1%
	EBITDA Margin	-384.5%	-	-167.3%	-56.5%	-72.0%	-57.0%

Sources: Publicly available information such as operators' news releases and filings made with the Securities and Exchange Commission.

Notes:

(1) AT&T's figures are for what it refers to as "new" wireless services which include: broadband PCS systems, wireless data, two-way messaging, and fixed wireless systems. Some analysts use this figure as a proxy for AT&T's broadband PCS operations.

(2) Powertel's 1996 figures are for the 4th quarter only.

(3) PCS One is a joint venture between D&E Communications and Omnipoint.

(4) Sprint PCS's 1997 and 1998 figures are pro forma to include all of the operations of the various partnerships that make up Sprint PCS, including APC-Sprint Spectrum in the Washington, DC MTA. The 1996 figures only reflect operations on the non-pioneers preference licenses launched late in the year.

Tables 13A - 13D: Broadband PCS Rollout Summary

Table 13A: Estimated Broadband PCS Rollouts by Number of Providers in a BTA

Number of Providers in a BTA	Number of BTAs	POPs in Those BTAs (1)	% of Total US POPs
1	147	39,410,133	15.6%
2	111	103,084,989	40.8%
3	54	76,224,527	30.2%
4	8	10,000,492	4.0%
Total	320	228,720,141	90.6%

Table 13B: Estimated Broadband PCS Rollouts by Technology

Technology	Number of BTAs	POPs in Those BTAs (1)	% of Total US POPs
CDMA (2)	210	199,804,727	79.1%
GSM	231	174,533,734	69.1%
TDMA	48	68,400,640	27.1%

Table 13C: Estimated Broadband PCS Rollouts by Service Block

Service Block	Number of BTAs (3)	POPs in Those BTAs (1)	% of Total US POPs
A	164	180,526,325	71.5%
B	214	199,141,939	78.9%
C (4)	35	17,028,852	6.7%
D	86	90,827,413	36.0%
E	56	52,918,097	21.0%
F	40	28,418,339	11.3%

Table 13D: Estimated Broadband PCS Rollouts by Number of Providers in a BTA

Size of BTAs	Number of BTAs	Percent of BTAs in Quartile	POPs in Those BTAs (1)	Percent of POPs in Quartile
1st Quartile	119	96.7%	190,047,430	98.9%
2nd Quartile	94	76.4%	25,991,595	77.9%
3rd Quartile	61	49.6%	9,043,626	50.9%
4th Quartile	46	37.1%	3,637,490	39.3%

Notes:
1) POPs from 1990 Census.
2) The CDMA coverage includes Sprint PCS' CDMA overlay in the Washington, DC and Baltimore, MD BTAs of the APC/Sprint Spectrum GSM-based network.
3) There are several BTAs where a single operator controls multiple license blocks. This analysis assumes that they are all in use (except for AT&T's DEF block licenses). This was not done in the *Third Report*, making the numbers from Table 13C not comparable with the equivalent table in the *Third Report*.
4) A number of licensee returned their C block licenses as a part of the June 1998 elections and switched to using licenses owned by Sprint PCS in the A or B blocks.

Table 14: Potential New Broadband PCS Competition in the 20 Most Populated BTAs

(As of 3/23/99)

BTA	BTA Name	Total Broadband PCS License Blocks	Operators in Service	Licenses Controled by Those Operators	Remaining Unlaunched Licenses	Licenses Involved in Bankruptcy Litigation	Licenses in 1999 Broadband PCS Auction	Licenses With Announced Plans for Fixed Services (4)	Remaining Potential Near-Term Mobile Telephone Competitors (5)	**Number of Those Operators with Publicly Announced Equipment Contracts (6)**
321	New York, NY	6	2	3	3	1	0	1	1	**0**
262	Los Angeles, CA (1)	6	2	3	3	1	0	1	1	**0**
78	Chicago, IL	6	3	4	2	1	1	0	0	**0**
404	San Francisco, CA (2)	6	2	2	4	2	0	1	1	**0**
346	Philadelphia, PA (3)	7	3	3	4	1	1	0	2	**0**
112	Detroit, MI	6	3	4	2	1	1	0	0	**0**
101	Dallas, TX	6	2	2	4	1	1	2	0	**0**
51	Boston, MA	6	3	4	2	1	0	0	1	**0**
461	Washington, DC	6	2	2	4	1	0	0	3	**1**
196	Houston, TX	6	3	3	3	1	0	1	1	**1**
293	Miami, FL	6	3	4	2	1	0	1	0	**0**
24	Atlanta, GA	6	3	3	3	2	0	0	1	**1**
84	Cleveland, OH	6	3	3	3	1	0	0	2	**1**
298	Minneapolis, MN	6	3	3	3	1	0	1	1	**0**
394	St Louis, MO	6	2	2	4	1	1	0	2	**2**
413	Seattle, WA	6	4	4	2	1	0	1	0	**0**
350	Pittsburgh, PA	6	2	2	4	1	0	1	2	**0**
402	San Diego, CA (1)	6	2	3	3	1	0	1	1	**0**
29	Baltimore, MD	6	2	2	4	1	0	0	3	**1**
347	Phoenix, AZ	6	4	5	1	0	1	0	0	**0**

Source: Federal Communications Commission estimates based on publicly available information.

Notes:

(1) In Los Angeles and San Diego, the E block broadband PCS license has been acquired by one of the cellular operators in that area, AirTouch, and are included in the "Licenses Owned by Those Operators" column.

(2) According to a recent analyst report, Western Wireless' San Francisco BTA license in unfunded. *See* Thomas J. Lee and Peter E. de Boer, *VoiceStream Wireless*, Equity Research: United States Wireless Services, Salomon Smith Barney, Inc., May 24, 1999, at 8.

(3) The C block license for the Philadelphia BTA was disaggregated. See "Wireless Telecommunications Bureau Announces Broadband Personal Communications Services (PCS) C Block Unconditional Elections," *Public Notice*, DA 98-1340 (rel. Jul. 2, 1998).

(4) These are licenses on which AT&T has stated it plans to deploy its fixed wireless service, called "Project Angel" (see Appendix F for a discussion).

(5) While there have been a few exceptions, most broadband PCS operators have taken a minimum of 12 months to launch their networks after being granted their licenses. Therefore, this analysis assumes it unlikely that any license not currently in the hands of an operator will be in active use prior to the end of 1999.

(6) It is possible that some operators have entered into contracts with equipment vendors without the Commission's knowledge. In addition, the contracts known to the Commission might not apply to the licenses in this analysis.

Table 15: Top 20 Mobile Telephone Resellers: 1997 and 1998

1997		1998	
Operator	**Resale Subscribers**	**Operator**	**Resale Subscribers**
MCI Communications	450,000	MCI Worldcom	565,000
WorldCom Wireless	130,000	Progressive Concepts	76,000
Progressive Concepts	76,000	Prime Matrix Wireless	72,000
Connecticut Telephone	65,100	Connecticut Telephone	70,000
CellNet Communications	60,000	CellNet Communications	65,000
Prime Matrix Wireless Comm.	52,000	Select Wireless	40,000
NW Communications	51,104	DCN Wireless/Robo Wireless	39,414
Phase 2 Cellular	46,000	Discount Cellular Inc.	24,831
DCN Wireless/Robo Wireless	38,655	Cellular Plus Systems	22,000
Select Wireless	35,000	Marathon Communications	21,000
Cellular Plus Systems	20,000	Phase 2 Cellular	20,000
Cellnet Telecommunications	16,500	Cellnet of Ohio Inc.	17,500
One Source Communications	15,000	SkyNet	15,677
SkyNet	12,456	CoreComm	15,031
Marathon Communications	10,000	The Mobile Phone Co.	13,000
The Mobile Phone Co.	9,600	One Source Communications	11,500
Cellular Dynamics	9,500	Pacific Cellular	10,200
Worldwide Mobilcom	8,000	Cellular Dynamics	10,000
Cortelco Puerto Rico	7,400	Car Phones Express	10,000
San Diego Wireless Comm.	6,100	San Diego Wireless Comm.	8,100
	1,118,415		1,126,253
	40.2%		50.2%

Sources:
1997: *RCR Top 20 Wireless Resellers*, RCR RADIO COMMUNICATIONS, Dec. 28, 1998, at S7.
1998: *RCR Top 20 Wireless Resellers*, RCR RADIO COMMUNICATIONS, Jan. 11, 1999, at 16.

APPENDIX C:
PAGING/MESSAGING

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Table 1: 1995 – 1998 Paging Industry Numbers

	Paging Units	Percent growth	Revenues	Percent growth	Average Monthly Revenue Per Unit
1995	34,500,000	31.86%	$3,814,000,000	17.97%	$10.51
1996	42,100,000	22.03%	$4,467,000,000	17.12%	$9.79
1997	48,200,000	14.49%	$5,181,000,000	15.98%	$9.57
1998	53,300,000	10.58%	$6,196,000,000	19.59%	$10.17

Sources:

(1) THE STRATEGIS GROUP, THE STATE OF THE US PAGING INDUSTRY: 1998 (1998), at 14, 28, 34. ("*Strategis Paging Report*")

Table 2: 1995 – 1998 Number of Paging Units by Publicly-Held Company

Company	1995	growth	1996	growth	1997	growth	1998 (1)
PageNet	6,737,907	26.92%	8,551,574	19.33%	10,204,743	-3.33%	9,864,908
Metrocall (2)	944,013	126.94%	2,142,351	88.15%	4,030,836	40.41%	5,659,550
Arch	2,006,000	64.26%	3,295,000	18.06%	3,890,000	9.92%	4,276,000
MobileMedia	4,145,696	6.13%	4,400,000	-22.73%	3,400,000	-8.82%	3,100,000
AirTouch	2,338,000	21.90%	2,850,000	8.81%	3,101,000	10.35%	3,422,000
PageMart	1,240,024	49.31%	1,851,445	35.75%	2,513,337	4.19%	2,618,527
ProNet	856,302	48.42%	1,270,954	n/a	n/a	n/a	n/a
Ameritech	745,000	53.02%	1,140,000	31.58%	1,500,000	2.80%	1,542,000
AT&T	983,668	18.21%	1,162,843	11.82%	1,300,341	n/a	n/a
SkyTel (3)	830,800	9.21%	907,300	20.90%	1,096,900	29.62%	1,421,800
American Paging (4)	784,500	-0.91%	777,400	4.33%	811,100	n/a	n/a
Preferred Networks	153,901	135.53%	362,481	25.47%	454,795	15.50%	525,274
Teletouch (5)	68,500	185.40%	195,500	64.25%	321,100	8.91%	349,700
Paging Partners	59,000	40.68%	83,000	81.93%	151,000	n/a	181,000

Sources:

- Information is based on publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.
- Includes both traditional one-way as well as advanced messaging units.

Notes:

(1) Based on Fall 1998 data, the following privately-held firms would be ranked above by paging units: TSR Wireless, LLC (largest privately-held at seventh – 2.4 million customers), SourceOne Wireless Inc. (between Preferred Networks and Teletouch – 450,000 customers), and Network Services LLC, Bell Atlantic (now part of Aquis Communications), and Southern Net Association of Paging (all between Teletouch and Paging Partners).
(2) Metrocall's 1997 pagers in service include ProNet. Metrocall's 1998 numbers include AT&T.
(3) SkyTel's pagers in service does not include fixed telemetry units.
(4) American Paging was merged with TSR Wireless, LLC, a privately-held company.
(5) Teletouch files its SEC Form 10-KSB on a fiscal year ended May 31.

Table 3: 1995 – 1998 Revenues by Publicly-Held Company (000s) (1)

Company	1995	growth	1996	growth	1997	growth	1998
PageNet (2)	$646,022	27.32%	$822,487	16.84%	$960,976	8.85%	$1,046,027
Metrocall (3)	$110,859	35.27%	$149,957	92.96%	$289,364	60.60%	$464,724
Arch	$162,590	103.81%	$331,370	19.76%	$396,841	4.23%	$413,635
MobileMedia (4)	$252,996	153.25%	$640,710	-17.69%	$527,392	-14.73%	$449,681
AirTouch (2)	$265,000	29.43%	$343,000	7.58%	$369,000	13.55%	$419,000
PageMart (2)	$159,191	39.20%	$221,592	25.36%	$277,778	12.19%	$311,652
ProNet	$60,704	60.03%	$97,144	n/a	n/a	n/a	n/a
Ameritech (5)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AT&T (5)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
SkyTel (6)	$235,870	40.01%	$330,239	14.27%	$377,366	28.87%	$486,304
American Paging	$107,150	-2.77%	$104,187	-9.38%	$94,413	n/a	n/a
Preferred Networks	$7,353	81.56%	$13,350	169.52%	$35,981	8.74%	$39,126
Teletouch (7)	$8,674	265.75%	$31,725	30.46%	$41,389	9.11%	$45,159
Paging Partners	$5,474	26.23%	$6,910	31.24%	$9,069	n/a	$9,902

Sources:
- Information is based on publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.

Notes:

(1)Revenues include service, rents, maintenance, and equipment revenues.
(2) PageNet (beginning in 1996), AirTouch (all years), and PageMart (all years) include results from international operations.
(3) Metrocall's revenues include the results of operations of acquired companies from their acquisition dates. Metrocall, Form 10-K, Dec. 31, 1998, at 18.
(4) MobileMedia did not file an SEC Form 10-K for the years ended December 31, 1996 through December 31, 1998. The 1996 through 1998 amounts in the table above are from MobileMedia's March 1, 1999 SEC Form 8-K. The amounts are unaudited.
(5) AT&T and Ameritech do not separately report paging operations in their SEC Form 10-Ks.
(6) SkyTel's numbers include the revenues associated with fixed telemetry services.
(7) Teletouch files its SEC Form 10-KSB on a fiscal year ended May 31.

Table 4: 1995 – 1998 EBITDA/Operating Cash Flow by Publicly-Held Company (000s) (1)

Company	1995	growth	1996	growth	1997	growth	1998
PageNet (2)	$201,131	27.70%	$256,837	20.52%	$309,550	7.56%	$332,939
Metrocall (3)	$27,771	17.93%	$32,751	115.17%	$70,469	77.34%	$124,969
Arch	$47,186	124.22%	$105,801	23.19%	$130,332	8.64%	$141,587
MobileMedia (4)	$61,771	68.99%	$104,386	-23.54%	$79,816	42.40%	$113,658
AirTouch (2)	$74,600	17.69%	$87,800	23.01%	$108,000	13.89%	$123,000
PageMart (2)	($10,076)	-185.58%	$8,623	216.14%	$27,261	68.26%	$45,870
ProNet	$15,144	38.27%	$20,939	n/a	n/a	n/a	n/a
Ameritech (5)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AT&T (5)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
SkyTel (6)	$331	3761.03%	$12,780	447.93%	$70,026	85.96%	$130,218
American Paging	$15,695	-118.15%	($2,849)	n/a	($3,267)	n/a	n/a
Preferred Networks	($2,153)	n/a	($8,600)	n/a	($11,336)	n/a	($6,533)
Teletouch (7)	$1,720	442.85%	$9,337	32.83%	$12,402	15.43%	$14,316
Paging Partners	($1,555)	n/a	($1,500)	n/a	($47)	n/a	$578

Sources:
- Information is based on publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.

Notes:

(1) EBITDA is the company's earnings before interest, taxes, depreciation and amortization and is a standard measure of financial performance.
(2) PageNet (beginning in 1996), AirTouch (all years), and PageMart (all years) include results from international operations.
(3) Metrocall's EBITDA numbers include the results of operations of acquired companies from their acquisition dates. Metrocall, Form 10-K, Dec. 31, 1998, at 18.
(4) MobileMedia did not file an SEC Form 10-K for the years ended December 31, 1996 through December 31, 1998. The 1996 through 1998 amounts in the table above are from MobileMedia's March 1, 1999 SEC Form 8-K. The amounts are unaudited.
(5) Ameritech and AT&T do not separately report paging operations in their SEC Form 10-Ks.
(6) SkyTel's numbers include the EBITDA associated with fixed telemetry services.
(7) Teletouch files its SEC Form 10-KSB on a fiscal year ended May 31.

Table 5: 1995 – 1998 EBITDA/Operating Cash Flow Margin (1)

Company	1995	growth	1996	growth	1997	growth	1998
PageNet	31.13%	0.30%	31.23%	3.15%	32.21%	-1.19%	31.83%
Metrocall	25.05%	-12.82%	21.84%	11.51%	24.35%	10.42%	26.89%
Arch	29.02%	10.02%	31.93%	2.86%	32.84%	4.22%	34.23%
MobileMedia	24.42%	-33.27%	16.29%	-7.11%	15.13%	67.01%	25.28%
AirTouch	28.15%	-9.07%	25.60%	14.34%	29.27%	0.30%	29.36%
PageMart	-6.33%	-161.48%	3.89%	152.20%	9.81%	49.97%	14.72%
ProNet	24.95%	-13.60%	21.55%	n/a	n/a	n/a	n/a
Ameritech	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AT&T	n/a	n/a	n/a	n/a	n/a	n/a	n/a
SkyTel	0.14%	2657.70%	3.87%	379.51%	18.56%	44.30%	26.78%
American Paging	14.65%	-118.67%	-2.73%	n/a	-3.46%	n/a	n/a
Preferred Networks	-29.28%	n/a	-64.42%	n/a	-31.51%	n/a	-16.70%
Teletouch	19.83%	48.42%	29.43%	1.81%	29.96%	5.80%	31.70%
Paging Partners	-28.41%	n/a	-21.71%	n/a	-0.52%	n/a	n/a

Notes:

(1) EBITDA margin, or cash flow margin, equals the company's EBITDA divided by its total revenue. It is used as a measure of a company's efficiency and profitability.

Table 6: Narrowband PCS Services and Subscribers

Service	Subscribers (1)
SkyTel SkyWord Plus (guaranteed)	300,600
SkyTel SkyWriter (two-way)	116,400
PageNet VoiceNow	4,248
CONXUS (Pocketalk and Pocketext)	87,000
PageMart Guaranteed Messaging	775

Sources:

- Company information is based on publicly available company documents such as news releases and filings made with the Securities and Exchange Commission.
- Antony Bruno, *Conxus Refocuses Amid Layoffs*, RCR RADIO COMMUNICATIONS REPORT, Mar. 29, 1999, at 1, 42.
- *Strategis Paging Report*, at 241.

Notes:

(1) SkyTel's and PageMart's numbers are from year-end 1998, PageNet's number is from mid-1998, and CONXUS' number was reported in March 1999.

Table 7: Estimated Narrowband PCS Rollouts by Number of Launches (1)

Number of Narrowband PCS Operators with Coverage in a BTA	Number of BTAs	POPs in Those BTAs (2)	Percent of Total U.S. POPs
4	22	80,600,988	31.9%
3	154	110,855,261	43.9%
2	104	32,837,376	13.0%
1	99	15,348,685	6.1%
Total	379	239,642,310	94.9%

Notes:

(1) There are several important caveats to note when using these data. First, to be considered as having "coverage" only a portion of a BTA territory needs to be covered. This means that some of the BTAs included in this summary have only a small amount of coverage, possibly resulting from the buildout of a neighboring market. Second, because of the size of some of the BTAs in the Western U.S., the maps included in this report overstate actual coverage. Third, multiple operators shown in the same market are not necessarily providing service to the same areas. Fourth, the POPs figures used in this analysis include all of the POPs in a BTA with coverage. This results in an overstatement of the total number of POPs actually covered.

(2) POPs from the 1990 census.

Table 8: Narrowband PCS Deployment

Carrier	Deployment
SkyTel	Two-way (September 1995) and guaranteed messaging (April 1997) covering approximately 80 percent of the U.S. population.
PageNet	Reselling SkyTel services. Voice messaging (February 1997) operational in 4 markets. Launched advanced text messaging network in first quarter 1999.
CONXUS	Voice messaging (November 1997) operational in 13 major metropolitan areas. Launched text messaging in December 1998. In process of launching text messaging in existing voice messaging markets.
PageMart	Reselling SkyTel services. Launched guaranteed messaging in June 1998 covering more than 70 percent of the U.S. population. Launching of two-way announced for 1999.
Metrocall	Reselling SkyTel services. Recently formed alliance with PageMart to resell its services and then construct own network sharing capital and expenses with PageMart. Obtained one nationwide license through AT&T acquisition.
TSR Wireless, LLC	Reselling SkyTel and CONXUS services. Merged with American Paging and gained regional licenses. Also purchased one nationwide license from AT&T. Has completed network in Southern California and Nevada and is field testing the system. Signed agreement with PageMart to begin reselling its services throughout rest of country in third quarter of 1999.
MobileMedia	Reselling SkyTel and CONXUS services. Launching of advanced messaging announced for mid-year 1999.
AirTouch Paging	Reselling SkyTel services. Recently formed alliance with PageMart to resell its services by mid-1999 and then construct own network sharing capital and expenses with Metrocall and PageMart.
Benbow PCS (Arch)	Arch owns 49.9 percent of Benbow, owner of one nationwide license. Arch is reselling SkyTel and CONXUS services. Arch is in the process of merging with MobileMedia who also owns several licenses.
InstaPage Network, LTD	Operating in Puerto Rico.
Ameritech	Reselling SkyTel services.

Sources:

- *Third Report Appendixes*, Appendix C, Table 6, p. C-8.
- Publicly-available company documents such as news releases and filings made with the Securities and Exchange Commission.
- *TSR Wireless Signals Plans for Major Presence in Narrowband PCS Market*, LAND MOBILE RADIO NEWS, Aug. 28, 1998, *available in* 1998 WL 6631792.
- *Metrocall, PageMart Join on Narrowband PCS Buildout Effort*, RCR RADIO COMMUNICATIONS REPORT, Nov. 2, 1998, at 23.
- *TSR Tries its Hand at Two-Way in Florida*, INSIDE PAGING, Aug. 6, 1998.
- *Mtel Signs Reseller Agreements with 20 Carriers*, LAND MOBILE RADIO NEWS, Feb. 28, 1997, *available in* 1998 WL 8474293.
- *Strategy Analytics' Outlook on Paging Conservative*, RCR RADIO COMMUNICATIONS REPORT, Mar. 30, 1998, *available in* 1998 WL 8225762.
- *AirTouch Paging and PageMart Wireless Form Narrowband PCS Strategic Alliance; AirTouch to Offer ReFLEX 25 Advanced Messaging Services by Middle of Year*, Press Release, PageMart Wireless, Inc., Mar. 30, 1999.
- Telephone Conversation with Hugh Fagan, Director, Investor Relations, Paging Network, Inc., (Apr. 9, 1999).
- *TSR Builds ReFLEX 25 Network*, WIRELESS WEEK, May 3, 1999, at 24.
- *TSR Wireless Signs Two-Way Deal With PageMart Wireless*, Press Release, TSR Wireless LLC, Jun. 8, 1999.

APPENDIX D:
DISPATCH SERVICES

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Table 1: 1998 SMR OPERATORS

Rank (1)	SMR Provider	Total Subscribers	Analog Subscribers
1	Nextel (2)	3,143,900	354,000
2	Southern Co.(1)	100,000	N/A
3	Mobex (1)	50,000	N/A
N/A	Chadmoore Wireless Group, Inc.(3)	27,000	27,000
N/A	Intek Global Corp. (4)	11,400	N/A
N/A	21st Century Wireless	N/A	N/A
N/A	Industrial Communications & Electronics, Inc.	N/A	N/A
N/A	Fleet Talk, Inc	N/A	N/A

(1) Jeffrey Silva, *Nextel Sues To Lift Decree; Bankruptcy Judge Approves Geotek Spectrum Sale*, RCR, Feb. 22, 1999.
(2) Nextel Communications, Inc., Form 10-K, Dec. 31, 1999, at 1.
(3) *Chadmoore Wireles Group Gets Credit Approval for $21 Million; Capital to Complete Buildout*, News Release, Chadmoore Wireless Group, Inc., Jan. 8, 1999.
(4) Intek Global Corp., 10-Q, Feb. 12, 1999.

Table 2: SMR SUBSCRIBERS (millions)

	Analog	Digital	Total
1996	1.86	.35	2.2
1997	1.79	1.35	3.1
1998	1.73	2.92	4.6

Source:
- The Stategis Group, Inc., "Dispatch Service in a Competitive Market," Presentation at AMTEX'98 Conference & Exposition, Nov. 13, 1998.

Table 3: SMR AVERAGE REVENUE PER UNIT

	Dispatch-Only	Dispatch / Interconnect
1996	$16.10	$49.40
1997	$16.30	$40.50
1998	$16.40	$38.70

Source:
- The Stategis Group, Inc., "Dispatch Service in a Competitive Market," Presentation at AMTEX'98 Conference & Exposition, Nov. 13, 1998.

Table 4: ANALOG SMR SUBSCRIBER GROWTH

Band	Growth
800 MHz	-6%
800 MHz (excluding Nextel)	8%
900 MHz	2%
450 MHz	273%
220 MHz	43%
All Analog bands	**9%**

Source:
- The Stategis Group, Inc., "Dispatch Service in a Competitive Market," Presentation at AMTEX'98 Conference & Exposition, Nov. 13, 1998.

APPENDIX E:
MOBILE WIRELESS DATA

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Table 1: Mobile Wireless Data Networks

Network	Spectrum Used	Primary Target Markets (1)	Coverage	Speed
Paging	35-36, 43-44, 152-159, 454-460, and 929-931 MHz.	One-way messaging.	Nationwide.	512-6400 bps.
Narrowband PCS	901-902, 930-931, 940-941 MHz.	Two-way messaging.	Coverage is provided by SkyTel, CONXUS, PageMart, and PageNet. Potential coverage is nationwide.	6400-25600 bps.
Circuit-Switched Cellular Data ("CSCD")	800 MHz.	Facsimiles, file transfer, Internet.	Potential coverage is same as analog voice cellular. (3)	1200-9600 bps up to 14400 under optimal.
Cellular Digital Packet Data ("CDPD")	800 MHz.	Two-way messaging, transaction-based applications (*I.e.,* credit card authorization), database query, dispatch/field service.	Built out to approximately 55 percent of U.S. POPs. *See* Appendix I, Map 9. Potential coverage is the same as analog voice cellular.	4800-12000 bps.
Digital Cellular/PCS/SMR Networks	800, 900 and 1900 MHz.	One- and two-way messaging, file transfer, Internet.	Coverage is limited to a few companies. Potential coverage is nationwide.	9600-14400 bps.
ARDIS	800 MHz.	Two-way messaging, data services to field services and transportation markets.	427 of the largest U.S. cities. *See* Appendix I, Map 10.	1200-9600 bps.
BellSouth Wireless Data	900 MHz.	Two-way messaging, dispatch/field service, database query, Internet.	Covers 92 percent of U.S. POPs. *See* Appendix I, Map 11.	4800 bps.
Metricom	902-928 MHz and 2.4 GHz - unlicensed, 2.3 GHz - licensed.	Two-way messaging, file transfer, Internet, access to LANs, intranets.	In four areas, several airports and university campuses. *See* Appendix I, Map 12.	9400-28800 bps. Planning to launch at 128000 bps.
Teletrac	902-928 MHz - unlicensed.	Vehicle location, fleet management.	Operating in 13 metropolitan areas.	2400 bps.

Sources:
- Publicly-available company documents such as news releases and filings made with the Securities and Exchange Commission.
- Jeanine Oburchay & Brian Park, CELLNET DATA SYSTEMS, INC., Bear, Stearns & Co. Inc., Feb. 5, 1999, at 24. ("Oburchay & Park")
- THE BISHOP COMPANY, WIRELESS DATA NETWORKS, A GUIDE TO MOBILE COMPUTING (1998
- AT&T WIRELESS SERVICES, CDPD, DIGITAL CELLULAR AND PCS NETWORKS (1997).
- THE STRATEGIS GROUP, THE U.S. MOBILE DATA MARKETPLACE: 1997 (1997), at 124.
- *TSR to Resell PockeTalk*, RCR RADIO COMMUNICATIONS REPORT, Sep. 7, 1998, *available in* 1998 WL 8227110.
- *TSR Wireless Makes Bid for MobileMedia; Arch's Acquisition Thrown Into Question*, LAND MOBILE RADIO NEWS, Apr. 2, 1999, *available in* 1999 WL 6446879.
- *Arch Enters into Definitive Agreement with CONXUS to Be Carrier of Its Mobile Voice Messaging Services*; PR NEWSWIRE, Dec. 11, 1996.

Notes:
(1) In this context, messaging refers generally to paging, e-mail, and data such as specific Internet content (*e.g.*, stock quotes, sports scores, etc.).
(2) Capacity refers to the amount of data that can be economically handled by the network. *Bishop Report*, at 115.
(3) *See Third Report Appendixes*, Appendix H, Map 1, p. H-2.

APPENDIX F:
FIXED VOICE AND DATA SERVICES

As Congress and the Commission have looked for new ways to promote competition in the telecommunications industry, it has become clear that wireless licensees providing fixed wireless services have the potential to create facilities-based competition in numerous industries beyond the traditional mobile markets. While spectrum classified as CMRS is being utilized in this manner,[1] non-CMRS spectrum, including Multipoint Multichannel Distribution Service ("MMDS"), 3.5 GHz, Digital Electronic Message Service ("DEMS"), Local Multipoint Distribution Service ("LMDS"), and 39 GHz, are also being used.

In this section, the Commission reviews the state of competition provided by fixed wireless operators for voice and data services in both residential and business markets. For discussion purposes, the operators are trifurcated by spectrum bands - cellular/broadband PCS, 2 GHz to 4 GHz, and Upperband spectrum. The Commission also examines some of the challenges these operators face, as well as some of their strengths.

A. Fixed Wireless Access

In a fixed wireless access system, a provider attaches a radio transmitter to a customer's premises that communicates with a central antenna site. This antenna site acts as the gateway into the PSTN or the Internet. This technology functions as a replacement for the "last mile" of copper wire that has traditionally provided individual customers with telecommunications services, thus allowing a wireless provider to compete with a traditional wireline service provider. The "last mile" is also referred to as the "local loop;" thus, fixed wireless access is often referred to as "Wireless Local Loop" or "WLL" for short.[2]

B. Service Providers

1. Cellular (800 MHz) / Broadband PCS (1900 MHz)

One analyst predicts that, worldwide, WLL systems using cellular/broadband PCS spectrum will have the greatest number of WLL subscribers in the future, growing from an estimated

[1] "Licensees of cellular systems may use alternative cellular technologies and/or provide fixed services on a co-primary basis with their mobile offerings, including personal communications services . . . on the spectrum within their assigned channel block." 47 CFR § 22.902(d).

[2] The terminology of fixed wireless technology is still being developed, and operators and equipment manufacturers often use generic terms in a proprietary way. AT&T, for example, refers to its fixed wireless technology as "Fixed Wireless Service." Nortel refers to its technology as "Fixed Wireless Access."

5.8 million in 2001 to 22 million in 2005.[3] In the United States, the current WLL in these bands is still in an early stage of development, is currently targeted at low-use/residential subscribers, and is secondary to the mobile products of service providers.

Centennial Cellular Corp. ("Centennial") - Centennial has been operating a WLL system in Puerto Rico since 1997 using its broadband PCS spectrum.[4] Centennial offers both mobile and fixed services from the same platform. Centennial was serving 14,200 "HomePhone" customers as of November 30, 1998.[5] The HomePhone unit looks and functions like a conventional telephone and supports call waiting, conference calling, call transfer, voice mail, one-touch redial, and other features.[6] HomePhone service costs $29.95 per month for 250 off-peak minutes and 30 peak minutes.[7] This rate is for fixed use only: subscribers incur additional charges if they use the phone as a mobile unit.[8] The phone can either be leased or purchased.[9] All calls within Puerto Rico are local and incoming calls are free.[10]

Western Wireless Co.("WWC") - WWC is operating fixed wireless systems in Nevada and North Dakota using its cellular licenses. Under an agreement reached between Nevada Bell, the Nevada Public Service Commission, and WWC to expand basic telephone service to a previously unserved region, WWC provides dialtone service to two small rural communities,

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[3] WIRELESSNOW, Sep. 16, 1998, citing Global Wireless Local Loop Markets: 1998, THE STRATEGIS GROUP (1998).

[4] *Bringing Local Loop to Puerto Rico*, WIRELESS BUSINESS & TECHNOLOGY, Jan. 1998, at 27.

[5] Centennial Cellular Corp., Form S-4, Mar. 3, 1999, at 6. These numbers include Centennial's product aimed at business customers, known as "BusinessPhone." *See* Centennial de Puerto Rico, *Centennial's Wireless System: Benefits & Advantages of Centennial's Wireless Products & Services* (visited Feb. 27, 1999) <http://www.centennialpr.net/wireless.htm>.

[6] In addition to an AC power adapter, the phone comes with a 12-volt DC power pack that can be used during power outages or, for example, when the customer wants to take the phone outside. Centennial de Puerto Rico, *Centennial Scores a First with CDMA Fixed Wireless Phones* (visited Feb. 26, 1999) <http://www.qualcomm.com/cdma/bulletin/centennial.html>

[7] *Un Telefone Que Se Activa Con Solo Enchufarlo*, Promotional Flyer, Centennial de Puerto Rico, Mar. 3, 1999. Additional minutes cost extra. There is also a plan costing $39.95 per month, which includes 500 off-peak minutes and 90 peak minutes. *Id.*

[8] *Un Telefone Que Se Activa Con Solo Enchufarlo*, Promotional Flyer, Centennial de Puerto Rico, Mar. 3, 1999.

[9] *Id.* There is a $69.95 activation charge if you lease the phone. The unit costs $299. *Id.*

[10] *Bringing Local Loop to Puerto Rico*, WIRELESS BUSINESS & TECHNOLOGY, Jan. 1998, at 27. Centennial does not charge for incoming calls because it is compensated by Puerto Rico Telephone Co., the local LEC, for connecting them.

Antelope Valley and Reece, using its cellular infrastructure.[11] Operating basically as a subcontractor to Nevada Bell, WWC provides service at the regular tariffed wireline local rate to the 50 residents of the region.[12] Users connect to the PSTN by way of a laptop-sized unit provided by WWC. The unit is basically a cellular phone with a phone jack.[13]

In the small town of Regent, North Dakota, WWC set up a similar network, but as a CLEC and without support from the state.[14] Inaugurated on January 7, 1999,[15] it was turned off four days later by Consolidated Telephone Cooperative ("CTC"), the ILEC for the area.[16] CTC, through which WWC connected to the PSTN, disconnected WWC's customers, claiming that WWC's interconnection agreement permitted "cellular calls and not . . . competitive local exchange service."[17] After a phone conference with the North Dakota Public Service Commission and the Federal Communications Commission, CTC agreed to reconnect WWC's customers.[18] As of February 8, 1999, WWC had signed up 40 customers, 20 percent of the

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[11] According to the WWC, it was able to bring service to the region with approximately $100,000 worth of infrastructure improvements. WWC claims it would have cost over $1 million to provide wired service to the approximately 50 customers in the region. *Western Wireless Seeks Universal Service Fund Subsidies for Rural Operations*, PCS WEEK, Jul. 22, 1998.

[12] *Western Wireless Seeks Universal Service Fund Subsidies for Rural Operations*, PCS WEEK, Jul. 22, 1998. Nevada Bell makes up the difference between the tariffed rate and WWC's cellular rates. Conversation with Christopher Johnson, Manager, Regulatory Affairs, Western Wireless Corp., Mar. 18, 1999.

[13] The prototype unit, made by Telular Corp., costs approximately $500, but is expected to be about half that price in mass production. Sound quality and data rates are those of WWC's AMPS-based cellular system in that area. Conversation with Christopher Johnson, Manager, Regulatory Affairs, Western Wireless Corp., Mar. 18, 1999.

[14] Western Wireless spent $350,000 building a cell site near town and leased 2,000 phone numbers from the local telephone company for $320 per month. Bryan Gruley, *Battle Lines: As Phone Wars Move to Rural Towns, Tactics Are Growing Rougher; Fighting for Clients, Cash from Subsidies, Upstart Finds Its Main Cable Cut; 'Not the 900-Pound Gorilla,'* THE WALL STREET JOURNAL, Feb. 10, 1999 ("*Gruley*").

[15] North Dakota Governor Edward Shafer and Western Wireless CEO John Stanton placed the inaugural calls on Regent's new system to North Dakota Senator Byron Dorgan and Federal Communications Commission Chairman William Kennard. Regent, ND is the home town of Sen. Dorgan. WIRELESSNOW, Jan. 8, 1999. WWC picked Regent because Sen. Dorgan, addressing an industry conference two years ago, challenged Mr. Stanton to demonstrate that he could provide competition in Regent and thereby show that wireless technology can provide competition anywhere. *Gruley*.

[16] *Incumbent Shuts Down Competitive Wireless LEC: Service Is 'Unauthorized,'* COMMUNICATIONS DAILY, Jan. 12, 1999.

[17] *Id.*

[18] *ND LEC Cuts Western Wireless Service*, WIRELESSNOW, Jan. 18, 1999 <http://www.commnow.com/>. However, litigation in this case continues. *See, e.g.*, Expedited Motion for Preliminary Injunctive Relief of Western Wireless Corp., Western Wireless Corp. v. Consolidated Telephone Cooperative, Case No. PU-1564-99-

town's 268 residents.[19] WWC's fixed local loop service is priced at $14.99 per month versus $16.00 for CTC[20] and the local calling area includes 15 communities versus two communities for CTC.[21]

AT&T - In February 1997, AT&T announced the development of a "revolutionary fixed wireless technology," code-named "Project Angel."[22] The system, operating on AT&T's broadband PCS spectrum, was to provide subscriber households with two phone lines and the capability for high-speed Internet access at 128 kbps.[23] After running field trials of the system in Chicago in late 1997,[24] AT&T put the project on hold, reportedly because of concern over high implementation costs.[25] In February 1999, AT&T announced that it would resume tests of Project Angel.[26] In May, the company began offering free fixed wireless service in Dallas a part of its testing of the system.[27] AT&T plans to introduce local commercial voice and data services in select cities by 2000.[28]

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17 (N.D. P.S.C. filed Jan. 15, 1999); Complaint of Western Wireless Corp., Western Wireless Corp. v. Consolidated Telephone Cooperative (FCC filed Jan. 29, 1999).

[19] CTIA Notebook, COMMUNICATIONS DAILY, Feb. 9, 1999.

[20] *Gruley*.

[21] CTIA Notebook, COMMUNICATIONS DAILY, Feb. 9, 1999. WWC CEO John Stanton claims that WWC provides service at a fraction of the $200 monthly per subscriber subsidy covered by the Universal Service Fund. *Id.*

[22] *AT&T's Breakthrough Wireless Technology New Alternative for Local Service*, News Release, AT&T Corp., Feb. 25, 1997.

[23] The new system was designed to connect a consumer's home to an AT&T digital switching center via a neighborhood antenna mounted on a utility pole or other structure. A single antenna could serve up to 2,000 homes. The only new equipment required on the customer's house is a transceiver about the size of a pizza box that can be mounted on the side or back of a house. *Id.*

[24] *Fixed Wireless Service: Questions & Answers*, AT&T Corp. Promotional Brochure, May 1997.

[25] Peter Elstrom, *AT&T's Wireless Path to Local Service: "Project Angel" Will Back Up Ma Bell's Cable Forays*, BUSINESS WEEK, Dec. 28, 1998.

[26] *Cell Phones, PDAs Merge*, PCS WEEK, Feb. 15, 1999.

[27] *Dallas Tapped for Project Angel Fixed Wireless Trial*, WIRELESSNOW, May 20, 1999.

[28] *Cell Phones, PDAs Merge*, PCS WEEK, Feb. 15, 1999. There are other trials as well. For example, in October 1998, Pioneer Holdings, LLC, owned by Long Line Limited, MCI, and Northwest Iowa Power Cooperative (NIPCO), joined two other companies in launching a fixed wireless access trial to 25 customers outside of Hayward, IA. Karissa Todd, *The Road to Local Competition,* WIRELESS REVIEW, Nov. 30, 1998. *See also*, Pioneer Holdings, LLC, *Projects* (visited Feb 28, 1999)

2. 2 GHz to 4 GHz

Commercial and trial services in these bands, primarily by wireless cable licensees, target both business and residential customers.

a. Wireless Cable

MMDS licensees, also referred to as "wireless cable" operators,[29] originally purchased licenses in the 2 GHz spectrum band to provide television programming to residential customers. However, many MMDS operators found it difficult to compete with cable in this market due to the high capital costs of building out wireless cable systems[30] and the lower channel capacities of MMDS relative to those of wireline cable and direct-to-home satellite companies.[31] These difficulties resulted in low subscriber numbers and financial strain for several MMDS companies.[32] However, as an innovative business opportunity, many wireless cable companies have begun to focus on offering high-speed Internet access[33] and telephony

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<http://www.pioneerholdiings.com/site/new/projects.html>.

[29] Multichannel Video Programming Distributors ("MVPD") that use microwave frequencies in the multichannel multipoint distribution service ("MMDS"), multipoint distribution service ("MDS"), and instructional television fixed service ("ITFS") to transmit video programming to subscribers equipped with special rooftop antennas are typically referred to as MMDS or wireless cable systems. *See* Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming, *Third Annual Report*, 12 FCC Rcd 4358, 4386 n. 152 (1997).

[30] *Heartland Wireless and Wireless One Dropping Video Focus*, COMMUNICATIONS DAILY, Mar. 22, 1999 ("*COMM. DAILY 3/22/99*").

[31] *See* Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming, *Fifth Annual Report*, FCC 98-335 (rel. Dec. 23, 1998), at ¶ 82. The maximum capacity of analog MMDS is 33 channels, while 62 percent of all cable television subscribers received at least 54 channels in October 1998. *See Id.*, at ¶¶ 19-21, 82.

[32] In April 1998, Standard & Poor's lowered its debt rating on all wireless cable companies to CCC+ or lower, stating that analog wireless was not a viable competitor to cable. *S&P Says Analog Wireless Cable Isn't Viable, Downgrades Industry*, COMMUNICATIONS DAILY, Apr. 17, 1998. On July 30, 1998, CAI Wireless Systems, Inc. declared bankruptcy. CAI Wireless Systems, Inc., Form 8-K, Aug. 4, 1998. On October 7, 1998, Heartland Wireless Systems, Inc. declared bankruptcy. *S&P Says Analog Wireless Cable Isn't Viable, Downgrades Industry*, COMMUNICATIONS DAILY, Apr. 17, 1998.

[33] *See* Table 1 at F-16 for a summary of Internet access offerings by wireless cable operators. *Heartland's Bankruptcy May Set Back 2-Way Wireless Internet*, COMMUNICATIONS DAILY, Oct. 9, 1998; *Wireless Cable Told to Focus on Wholesaling, Internet*, COMMUNICATIONS DAILY, Oct. 27, 1998; *MMDS Companies Realign Their Interests; Announce Cooperation on Flexible 2-Way Use of Their Spectrum*, News Release, Heartland Wireless Communications, Inc., Dec. 3, 1998.

instead of television programming, and have shown early success in these endeavors.[34]

The Commission's September 1998 order authorizing wireless cable operators to offer two-way services cleared the way for another major competitor to enter the broadband services market.[35] The Commission's Order established a framework for allowing MMDS operators to offer, quickly and easily, two-way high-speed Internet access service, as well as other two-way services, such as telephony, video conferencing, and distance learning.[36] Prior to the Order, MMDS operators sought waivers from the Commission to provide Internet access and used a telephone line modem for the upstream connection.

In March 1999, Wireless One, Inc. ("Wireless One") and Heartland Wireless Systems, Inc. (which changed its name to Nucentrix on April 1, 1999) announced that they would emerge from bankruptcy with business plans focused on offering high-speed Internet access mainly to small businesses and home offices.[37] The companies stated they would not expand their video operations, but would continue operating their existing systems through partnerships with direct-to-home satellite companies.[38] Later that month, MCI WorldCom invested $200 million in four wireless cable companies including Wireless One, CAI Wireless Systems, Inc. ("CAI Wireless"), People's Choice TV Corp., and CS Wireless Systems, Inc.[39] Industry observers speculated that the investment would become a core part of MCI WorldCom's strategy for offering high-speed Internet access to consumers.[40] In April 1999, MCI WorldCom acquired the remaining equity of CAI Wireless. During that same month, Sprint acquired People's

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[34] *See* Wireless Communications Association International Comments, at 21, Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming, CS Docket No. 98-102 (Jul. 31, 1998).

[35] *See* Amendment of Parts 1, 21, and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmission, *Report and Order*, FCC 98-231 (rel. Sep. 25, 1998).

[36] *See* Mike Farrell, *Wireless Ops Hope Two-Way Ruling Helps*, MULTICHANNEL NEWS, Sep. 28, 1998, at 3, 32 ("*Farrell*"); Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming, *Fifth Annual Report*, FCC 98-335 (rel. Dec. 23, 1998).

[37] *COMM. DAILY 3/22/99*.

[38] *COMM. DAILY 3/22/99*.

[39] Rebecca Blumenstein and Nicole Harris, *MCI WorldCom Purchases the Debt of Group of Wireless-Cable Concerns*, THE WALL STREET JOURNAL, Mar. 30, 1999; MCI WorldCom's Wireless Cable Plans Seen Widening Broadband Options, COMMUNICATIONS DIALY, Mar. 31, 1999.

[40] *Id.*

Choice TV Corp. and American Telecasting.[41] Almost all MMDS operators have stated that they plan to offer more data and telephony services in 1999.[42]

In addition to the traditional wireless cable operators, there are several wireless cable licensees who were not previously video programming distributors, but instead provide Internet access. These entities tend to be start-up companies using MMDS or low-power television licenses. For example, IJNT International (formerly InterJetNet, Inc.) was founded in 1997 and now offers wireless Internet access in six cities.[43] SkyLynx Communications, Inc., operating at 2.4 GHz, was formed in 1996 and offers two-way, high-speed, advanced data services in Florida and California.[44] The company is focusing on small to medium sized businesses and Multiple Dwelling Units, such as apartment buildings and condominiums, in second-tier cities.[45]

b. Other Providers

CFW Communications ("CFW")- CFW conducted a wireless local loop trial in 1998 using its MMDS spectrum. It was able to broadcast from a central cell site to terminals up to 30 miles away and obtained two-way voice capabilities with the quality of a landline connection. CFW is considering building a WLL for commercial purposes.[46]

Salt River Pima-Maricopa Reservation - On December 11, 1998, Arizona Senator McCain placed the inaugural call on an experimental fixed wireless system located on the Salt River Pima-Maricopa Reservation, a 56,000-acre Indian reservation near Scottsdale, AZ.[47] The system, using Nortel's "Proximity I" Fixed Wireless Access technology, operates at 3.5 GHz

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[41] Nicole Harris, *Sprint to Purchase Wireless-Cable Firm American Telecasting for $167.8 Million*, THE WALL STREET JOURNAL, Apr. 28, 1999.

[42] *MMDS Industry Facts*, PRIVATE CABLE & WIRELESS CABLE, Dec. 1998, at 13.

[43] IJNT International/UrJet InterNet, *UrJet Internet* (visited Jun. 14, 1999) <http://www.urjet.net/urjet.taf>.

[44] *SkyLynx Communications, Inc. Announces Commencement of Trading,* News Release, SkyLynx Communications, Inc., Jul. 30, 1998; SkyLynx Communications, Inc., *Wireless Markets* (visited Jun. 14, 1999) <http://www.skylynx.com>.

[45] *SkyLynx Communications Enters Sarasota Wireless Market*, News Release, SkyLynx Communications, Inc., Dec. 16, 1998; SkyLynx Communications, Inc., *Welcome to SkyLynx* (visited Feb. 23, 1999) <http://www.skylynx.com/home.html>.

[46] Marcia Martinek, *Rural Regional & Remunerative*, WIRELESS REVIEW, Feb. 1, 1999.

[47] Carol Sowers, *High-Tech Phones for Tribe Salt River Reservation 1st to Use Small Dish*, THE ARIZONA REPUBLIC, Dec. 12, 1998 ("*Sowers*").

and connects to users through a pizza-sized dish.[48] Attached to the exterior of a building, the dish receives signals from a central 163-foot tall transmitter.[49] The new system has been installed in about 100 homes on the reservation of 6,000 people.[50] Monthly service for the system costs about $13 and long distance calls are 10 cents a minute.[51] The service includes call waiting, voice mail, and three-way calling.[52] Antenna installation costs $60 and takes about two hours.[53]

3. Upperbands (24 to 39 GHz)

The largest commercial deployment of fixed wireless systems has occurred in the "upperbands" of the spectrum, in the 24 GHz (DEMS), 28 GHz (LMDS), and 39 GHz ranges.[54] The most significant operators in these bands, Teligent, Inc. ("Teligent") and WinStar Communications, Inc. ("WinStar"), are concentrating on business customers. However, the recently auctioned LMDS spectrum may create more residential services.[55]

a. 24 GHz (DEMS)

Teligent - Teligent provides a bundle of broadband fixed wireless telecom services to small and medium sized businesses using its 24 GHz licenses.[56] Teligent has also made significant strides in its business since the writing of the *Third Report*. As of June 1999, the company

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[48] David Trinkwon, Director - Market development, Fixed Wireless Access, Nortel Networks, *New Fixed Wireless Access Solutions . . . Now "Alive" in the USA*, Presentation to NARUC, Orlando, Florida, Nov. 6, 1998.

[49] *Sowers*.

[50] *Id.* The service is operated by a tribal telecommunications division, Saddleback Communications, and its subcontractor, Mountain Telecommunications, Inc. David Trinkwon, Director - Market Development, Fixed Wireless Access, Nortel Networks, *New Fixed Wireless Access Solutions . . . Now "Alive" in the USA*, Presentation to NARUC, Orlando, Florida, Nov. 6, 1998.

[51] *Sowers*.

[52] *Id.*

[53] *Id.*

[54] DEMS spans 24.25 - 25.25 GHz; LMDS spans 27.5 - 31.3 GHz; 39 GHz spans 38.6 - 40.0 GHz. 39 GHz is often referred to as 38 GHz. *See* Table 2 at F-18 for a summary of current service offerings by upperband operators.

[55] Jeff Bounds, *Uncertain Future: Will the Market Accept LMDS? Bosch, Others Gamble on New Technology*, DALLAS BUSINESS JOURNAL, Jul. 3, 1998.

[56] Teligent, Inc., *New! Local Private Line Keeps Your Business Connected* (visited Feb. 27, 1999) <http://www.teligent.com>.

had entered 28 markets covering 83 million people and plans to enter 12 additional markets by the end of 1999.[57] Teligent's licenses cover 74 markets nationwide and the company plans to enter all these markets by the end of 2001.[58] By the end of 1998, the company had secured access rights to nearly 2,400 buildings and had installed 13 Nortel DMS switches.[59]

b. 28 GHz (LMDS)

A Local Multipoint Distribution Service system is capable of offering subscribers a variety of one- and two-way broadband services, such as video programming distribution, video teleconferencing, and wireless local loop telephony, as well as Internet access and other high speed data transmission services. Because of its multi-purpose applications, LMDS has the potential to become a major competitor to local exchange carriers and cable television providers, although it appears that LMDS operators plan to concentrate on voice and data services.[60] There is currently only one operational, commercial LMDS provider: SPEEDUS.COM, Inc. (formerly Cellularvision USA). SPEEDUS.COM offers high-speed Internet access, up to 48 Mbps downstream, to business and residential users in Manhattan, Brooklyn, and Queens, NY.

The Commission completed an LMDS auction in March 1998.[61] LMDS licensees plan to offer a mix of the fixed wireless services mentioned above, especially high-speed Internet access and other data services.[62] While many are waiting for the technological standards and specifications to be set and for the LMDS technology to mature,[63] some licensees have taken the first steps in building their networks. Some have signed contracts with equipment

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[57] *Teligent Brings More Bandwidth at Lower Cost to Seattle Small and Mid-Sized Businesses,* News Release, Teligent, Inc., Jun. 8, 1999. *See* Appendix H, Map 13 at H-13.

[58] *Teligent Reports Third Quarter Financial Results, Completes Launch of First 15 Markets,* News Release, Teligent, Inc., Nov. 11, 1998.

[59] *Teligent Reports 1998 Financial Results, Sets Operating Benchmarks for 1999,* News Release, Teligent, Inc., Mar. 1, 1999; *Teligent Reports Third Quarter Financial Results, Completes Launch of First 15 Markets,* News Release, Teligent, Inc., Nov. 11, 1998.

[60] *See, e.g.,* Ken Freed, *NextLink Slowly Positions for Big Wireless Play*, INTERACTIVE WEEK, Feb. 15, 1999.

[61] *See* Appendix A, Tables 1 and 2 for summaries of the auction's design and outcome and *Third Report Appendixes*, at A-6 for a list of high bidders.

[62] *See WinStar Wins 15 LMDS Licenses in FCC Auction,* News Release, WinStar Communications, Inc., Mar. 26, 1998; Jeannine Aversa, *Licenses for Wireless Service Auctioned*, THE WASHINGTON POST, Mar. 26, 1998, at C3.

[63] Cathy Stephens, *Jumpstarting LMDS*, PRIVATE CABLE & WIRELESS CABLE, Oct. 1998, at 18.

manufacturers, run trials of their networks, and/or have announced plans for service offerings.[64] Most of these licensees are either established telecommunications companies that plan to expand their networks and enhance their service offerings or business ventures of utility companies that want to bring advanced services to rural areas not served by fiber. In October 1998, nine percent of LMDS licensees stated they planned to deploy their networks within a year and 50 percent plan to offer services in the next three to five years.[65] LMDS operators are expected to offer their services mainly to small and medium sized businesses.[66] Analysts predict that nine percent of broadband users will access the Internet via LMDS in 2003[67] and that LMDS revenues will total $241 million in 1999 and over $6 billion by 2007.[68] The Commission has scheduled an auction of additional LMDS licenses for April 27, 1999.[69]

In one of the major developments since the close of the first LMDS auction, Nextlink Communications, Inc. ("Nextlink") a CLEC currently operating 25 fiber networks in 15 states and the District of Columbia,[70] announced two major acquisitions. In January 1999, Nextlink announced its acquisition of WNP Communications, Inc. ("WNP") and completed the acquisition in April 1999.[71] WNP was the largest bidder in the LMDS auction, having acquired 40 licenses covering 114 million POPs. In addition, Nextlink announced an agreement with Nextel to purchase Nextel's interest in LMDS licensee Nextband Communications, LLC ("Nextband"). Nextlink and Nextel each own 50 percent of Nextband, which purchased 42 licenses in the LMDS auction. This aquisition will make Nextlink the sole owner of Nextband. When the two deals are completed, Nextlink will own spectrum

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[64] *See* Table 3 at F-19 for a summary of current activity by recent LMDS auction winners.

[65] Cathy Stephens, *Jumpstarting LMDS*, PRIVATE CABLE & WIRELESS CABLE, Oct. 1998, at 18.

[66] Cathy Stephens, *Weighing the LMDS Architecture Options*, Private Cable & Wireless Cable, Jan. 1999, at 32 (quoting Phil Goetz, the chief architect for Lucent's broadband fixed wireless products); *Q&A with Thomas H. Jones of WNP Communications*, PRIVATE CABLE & WIRELESS CABLE, Nov. 1998, at 50.

[67] *Internet Industry Facts*, PRIVATE CABLE & WIRELESS CABLE, Dec. 1998, at 16.

[68] *LMDS Industry Facts*, PRIVATE CABLE & WIRELESS CABLE, Dec. 1998, at 11.

[69] "Auction of Local Multipoint Distribution Service Spectrum, Auction Notice and Filing Requirements for 168 Local Multipoint Distribution Service Licenses Scheduled for April 27, 1999, Minimum Opening Bids and Other Procedural Issues," *Public Notice*, DA 99-266 (rel. Jan. 29, 1999).

[70] Nextlink Communications, Inc., *Cities We Serve* (visited Jun. 14, 1999) <http://www.nextlink.com/usmap.html>.

[71] *NEXTLINK Communications To Acquire WNP Communications for $695 Million*, News Release, Nextlink Communications, Inc., Jan. 14, 1999. On March 30, 1999, the FCC approved the assignment of WNP's licenses to Nextlink. "Wireless Telecommunications Bureau Public Safety and Private Wireless Division Grants Consent to Assign Authorizations of WNP Cmmunications, Inc. and PCO Aquisition Corp.," *Public Notice*, DA 99-610 (rel. Mar. 30, 1999); *Nextlink Closes WNP Acquisition; Becomes Largest Holder of Fixed Wireless Spectrum in North America,* News Release, Nextlink Communications, Inc., Apr. 27, 1999.

covering all of the top 30 U.S. markets, most of which it plans to enter by the end of 1999.[72] The company plans to use the spectrum as a complement to its fiber networks.[73] In June 1999, Nextlink also purchased two million shares of SPEEDUS.COM, Inc.[74]

c. 39 GHz

WinStar - WinStar uses its 28 GHz and 39 GHz licenses to provide a package of WLL services, which it collectively calls "Wireless Fiber." WinStar sells local, long distance, high speed data, Internet access, and information services to business customers and resells its networks to other telecommunications carriers.[75] WinStar has grown significantly since the writing of the *Third Report*. The company now offers wireless CLEC services in the top 30 markets in the United States[76] and had 380,000 lines in service as of March 31, 1999.[77] WinStar plans to compete in 40 markets by the end of 1999 and states that it has the financial capabilities to enter 50 cities in the U.S. and another 50 around the world.[78]

WinStar adopted a strategy of not only connecting individual businesses but entire buildings to its network by contracting with owners of corporate real estate. WinStar had obtained access rights to more than 4,800 commercial buildings nationwide by March 1999[79] and has plans to obtain access to a total of 8,000 buildings by the end of 1999. These access rights enable WinStar to provide a building's tenants with a wide range of telecommunications

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[72] *See* Appendix H, Map 14 at H-14.

[73] *McCaw's Big-Picture Strategy Comes into Clearer Focus as Nextel Chief Consolidates Domestic LMDS Holdings*, PCS WEEK, Jan. 27, 1999; *McCaw Aims to Consolidate Domestic LMDS Spectrum Holdings*, COMMUNICATIONS TODAY, Jan. 15, 1999.

[74] SPEEDUS.COM, Inc., *SPEEDUS.COM, Inc. and Nextlink Sign $40 Million Pact, Nextlink Agrees to Purchase Two Million Shares at $10 Per Share*, News Release, SPEEDUS.COM, Inc., June 14, 1999.

[75] These other carriers include CLECs, Competitive Access Providers ("CAPs"), inter-exchange carriers ("IXCs"), LECs, and Internet Service Providers ("ISPs").

[76] Winstar Communications, Inc., *Business Services* (visited Feb. 27, 1999) <http://www.winstar.com/indexBuisServ.htm>. *See* Appendix H, Map 15 at H-15.

[77] *WinStar Reports On-Net Building Penetration Jumps to 14 Percent*, News Release, WinStar Communications, Inc., May 12, 1999.

[78] *$2 Billion Winstar / Lucent Strategic Agreement to Expand Winstar's Broadband Network*, News Release, WinStar Communications, Inc., Oct. 22, 1998. In April 1998, WinStar purchased a 15 percent stake in Advanced Radio Telecom. *WinStar to Purchase 14.9% of Advanced Radio Telecom Corp.*, BUSINESS WIRE, Apr. 27, 1998.

[79] *Winstar Reports First Quarter Results*, News Release, WinStar Communications, Inc., May 12, 1999.

services.[80]

Advanced Radio Telecom, Inc. ("ART") - ART uses its 39 GHz licenses, as well as frame relay and ATM technology, to offer high-speed Internet access and other Internet services.[81] ART began offering these services to business customers in Seattle, WA in September 1998, and in Portland, OR and Phoenix, AZ in December 1998.[82] At the end of 1998, ART had access to 155 buildings, offered full network connectivity to 85 buildings, and had received 142 customer orders. In June 1999, Qwest Communications International Inc. purchased a 19 percent stake in ART. ART claims the investment will help the company fulfill its goal of building broadband wireless high-speed networks in 40 of the top 50 metropolitan areas over the next two years. ART plans to provide a full array of communications services including Internet access, Internet services, data transmission, fax, video conferencing, electronic commerce, and voice over IP.[83] ART has stated that its spectrum licenses combined with Qwest's 18,500-mile fiber network will allow ART to reach more than 50 percent of U.S. businesses.[84]

ART's nationwide 38 GHz licenses cover 49 of the top 50 and 90 of the top 100 U.S. markets. In total, the licenses cover 210 markets with a population of over 186 million.[85] In June 1998, ART purchased 23 additional 39 GHz licenses from Columbia Capital Corp. that cover 22 million POPs in 13 markets.[86]

AT&T - Although AT&T owns 39 GHz licenses, there is little public information concerning

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[80] *Winstar Achieves Access Rights to More Than 4,200 Commercial Buildings Nationwide*, News Release, WinStar Communications, Inc., Dec. 17, 1998.

[81] Advanced Radio Telecom, Inc., *Technical Information* (visited Mar. 1, 1999) <http://www.art-net.net/technical/tech.htm>. Internet services include web hosting and e-commerce.

[82] *See* Appendix I, Map 16 at I-16.

[83] *Advanced Radio Telecom Corp. Announces Operating Results for Fourth Quarter 1998*, News Release, Advanced Radio Telecom, Inc., Jan. 12, 1999; *Advanced Radio Telecom Launches Internet Services in Portland*, News Release, Advanced Radio Telecom, Inc., Dec. 21, 1998; *Advanced Radio Telecom Corp. Announces Operating Results for Fourth Quarter 1998*, News Release, Advanced Radio Telecom, Inc., Jan. 12, 1999; Advanced Radio Telecom, Inc., *Who We Are* (visited Mar. 1, 1999) <http://www.art-net.net/about/who.htm>.

[84] *Qwest Communications and Investor Group Commit $251 Million to Advanced Radio Telecom To Expand Its High-Speed Local Wireless Network*, News Release, Advanced Radio Telecom Corp, June 1, 1999.

[85] *Advanced Radio Telecom Corp. Announces Operating Results for Fourth Quarter 1998*, News Release, Advanced Radio Telecom, Inc., Jan. 12, 1999.

[86] Telephony, COMMUNICATIONS DAILY, Jun. 4, 1998.

how the company is using them.[87] AT&T obtained the licenses through its acquisition of Teleport Communications Group, Inc. ("TCG"), completed in July 1998.[88] At that time, TCG, now AT&T's business local services unit,[89] was the largest fiber-based CLEC in the United States and had obtained the licenses through its acquisition of Biztel Communications, Inc. in 1996. TCG primarily used its digital, fiber optic networks to deliver services, but would rely on its 39 GHz spectrum to connect customers to its fiber networks, to provide temporary installation when its fiber networks were down, and to provide stand-alone facilities where the company did not have fiber networks.[90] AT&T has said it plans to expand TCG's wireless local loop bypass business.[91]

C. Competitive Analysis

1. Strengths

In addition to providing new competition in existing markets, fixed wireless systems have the potential to provide new services and expand capacity into areas considered too expensive to enter using available wireline technologies. WLLs afford new entrants in a market direct access to an individual customer's building, limiting the reliance on LECs.

Lower Network Deployment Costs - Fixed wireless operators claim that their networks have a significantly lower cost structure than wireline systems for two primary reasons.[92] First, wireless networks are free of the installation and maintenance costs incurred with wires. Second, unlike a wireline network in which an entire market must be wired before initiating service, the capital expenditures of a wireless network can be incrementally incurred as more customers are added. Because of this lower cost structure, operators have been able to charge significantly lower prices than wireline competitors for business services. Teligent, for example, offers its subscribers a flat monthly rate which is up to a 30 percent discount

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[87] *See* Appendix I, Map 17 at I-17.

[88] *AT&T Completes TCG Merger; TCG Now Core of AT&T Local Services Network Unit*, News Release, AT&T Corp., Jul. 23, 1998.

[89] Teleport Communications Group, Inc., *TCG Home Page* (visited Mar. 1, 1999) <http://www.tcg.com>.

[90] Teleport Communications Group, Inc., Form 10-K405, Dec. 31, 1996, at 10.

[91] Bill Menezes, *MCI WorldCom Discovers Fixed Wireless*, WIRELESS WEEK, Feb. 8, 1999, at 25.

[92] According to a WinStar, it can cost up to 85 percent less to provide phone service through the air than through a fiber network. Suzanne King, *Gaining a Foothold*, KANSAS CITY BUSINESS JOURNAL, Nov. 13, 1998.

compared to wireline providers.[93]

High Capacity of Upperbands- Upperband licensees have large blocks of spectrum at their disposal, permitting high-capacity services, such as video conferencing and super-high-speed Internet access. Winstar claims to offer 200 Mbps speeds on its multipoint systems, 1500 times faster than an ISDN line (128 Kbps).[94] This capacity also permits providers to offer packages of local, long-distance, and Internet services.

Underserved Markets - There are a number of market segments with low penetration by existing broadband wireline systems. For example, only a small percentage of office buildings have broadband access.[95] Fixed wireless operators can act as strategic partners with wireline CLECs who wish to extend their fiber networks more cheaply to such buildings. Many small and medium sized businesses, too low volume for expensive fiber connections, are also potential customers.[96] In addition, wireless access has the potential to improve competition and broadband services for residential customers in both urban and rural markets.[97]

2. Challenges

Along with the competitive advantages described above, fixed wireless providers face a

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[93] To qualify for the maximum discount, customers switch their existing service -- local, long distance or Internet -- and sign up with Teligent for a minimum of one year. Teligent averages several representative bills from the customer's current carriers and deducts up to 30 percent. That figure becomes the customer's new flat monthly rate. Local and Internet service are unlimited. If customers wish to increase their long distance usage over current levels, they can purchase more service at what the company believes are attractive prices. *Teligent Introduces Revolutionary, Lower-Cost Communications Services In New Orleans*, News Release, Teligent, Inc., Feb. 25, 1999.

[94] *See Ex Parte* presentation materials of Winstar Communications, Inc., CC Docket No. 96-98; CS Docket 95-184; CCBPol 97-9; CC Docket 98-146; IB Docket No: 97-95 (FCC filed Nov. 20, 1998).

[95] Estimates of this large market vary. Teligent estimates that fiber networks today reach only 3 percent of the 750,000 office buildings in the U.S. (although the company conditions that that 3 percent actually reaches 35 percent of "fiber-addressable businesses"). Nancy Gohring, *Wireless Networks: Broadband Wireless Operators Build Their Case*, TELEPHONY, Jul. 6, 1998. Roberta Woods, director of Wireless Market Research at Pioneer Consulting, claims that 99 percent of the estimated 4.6 million commercial buildings in the United States are not served by fiber. Charles Mason, *LMDS: Huge Niche Technology*, AMERICA'S NETWORK, Sep. 1, 1998.

[96] WinStar believes small and medium sized businesses constitute 60 percent of all businesses in the United States and represent a market opportunity in excess of $30 billion per year. Winstar Communications, Inc., Form 10-K, Dec. 31, 1997, at 6.

[97] Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, *Report*, CC Docket No. 98-146 (rel. Feb. 2, 1999), at ¶¶ 45-46.

number of challenges in establishing service. The challenges mentioned below are in addition to those faced by all CLECs such as obtaining interconnection agreements.[98]

Access Barrier Issues - Fixed wireless providers have noted a number of barriers to access to customers' premises. Such barriers include roof rights as well as related inside building facilities and inside wiring. Fixed wireless providers need rooftop access on apartment and office buildings to place their transmitting and receiving antennas. Providers also need access to inside conduits and physical pathways from the building owner. In addition, providers require access to the building's inside wiring and riser cables to connect to the customer's telephone system.

Obtaining access can represent a long and tedious process, as individual contracts must be negotiated. Moreover, WinStar, Teligent, and others have claimed that certain building owners and managers have started to charge excessive fees, not based on a reasonable cost for access to roof and inside facilities, but as an opportunity to gather revenues. Such prices are discriminatory, they claim, as established incumbent LECs and cable providers are not asked to pay such fees.[99]

State and Local Government Right-of-Way Requirements - Certain state and local governments have started to assess right-of-way franchise requirements and right-of-way fees on broadband fixed wireless licensees.[100] Wireless carriers argue that because they do not use the public rights-of-way, they should be exempt from franchise requirements.[101] WinStar believes the effect of such actions will delay and possibly prohibit the provision of competitive local exchange service by new wireless entrants.

Universal Service Funding - Wireline local exchange carriers offer residential service discounted by the receipt of universal service funds. In order to receive funding, a fixed

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[98] As for all CLECs, the successful negotiation of these agreements on favorable terms is essential to the success of WLL. In addition, in the near term, providers of WLL will still need to rely on LECs for many of the unbundled network elements required to provide telephone service (*e.g.*, switching and operator services). As fixed wireless access providers expand their operations and begin to take customers from incumbent LECs, disputes such as the one between Western Wireless and Consolidated Telephone (see above) may become more common.

[99] *See* WinStar Communications, Inc.'s Comments at 5; Teligent, Inc.'s Comments at 6-8, filed in response to "Common Carrier Bureau Seeks Recommendations on Commission Actions Critical to the Promotion of Efficient Local Exchange Competition," *Public Notice*, 12 FCC Rcd 10,343 (1997).

[100] WinStar argues it should not have to pay rights of way fees because its network is deployed on rooftops, which are private property, rather than the public rights-of way. *See id.*

[101] In July 1998, a federal district court ordered the city of Dallas to halt imposition of franchise fees or linking payment of right-of-way charges with certifying new wireless carriers, saying such actions exceed regulatory limits under state and federal law. *U.S. Judge Rejects Dallas Bid to Impose Fees on Wireless Carriers*, COMMUNICATIONS DAILY, Jul. 8, 1998.

wireless operator, like all carriers, has to be designated an "Eligible Telecommunications Carrier" ("ETC") by the state in which it plans to operate.[102] Some wireless providers consider some of these state rules as discriminating unfairly against them.[103]

Technical Issues - The propagation and technical characteristics of upperband frequencies present two major challenges. First, high frequency signals behave much more like visible light than cellular or PCS signals when obstacles such as terrain, buildings, and vegetation are encountered. These signals require line-of-sight between transmitter and receiver in order for a prospective customer to receive an adequate signal. To increase coverage, operators must increase the height of cell antennas or move cells closer together. Second, high frequency signals are easily scattered and absorbed by rain. An afternoon thunderburst, for example, can significantly reduce the effective range of an upperband system. Raising transmitter power output during these events helps reduce signal fading.

[102] 47 U.S.C. 214(e)(2).

[103] Western Wireless Corp., Petition for Preemption, Pursuant to Section 253 of the Communications Act, of Kansas Statutes and Rules that Discriminate Against New Entrants, Jul. 20, 1998, at n. 18.

TABLE 1: INTERNET ACCESS OFFERINGS BY MMDS LICENSEES

Wireless Cable Operators			
Company	**Location**	**Launch Date**	**Downstream Speed**
American Telecasting (acquired by Sprint)	Colorado Springs, CO	Sep. 1997	750 kbps downstream, telephone return path
	Denver, CO; Portland, OR	Feb. 1998	750 kbps downstream, telephone return path
	Eugene, OR; Seattle, WA	Trial Demonstration 1998	Two-way
CAI Wireless Systems, Inc. (acquired by MCI WorldCom)	Washington, DC	N/A	Up to 27 Mbps downstream, telephone return path
CFW Communications	Charlottesville, VA	Sep. 1997	Up to 27 Mbps downstream, telephone return path
CS Wireless Systems, Inc.	Dallas/Fort Worth, TX	Nov. 1997	Up to 4 Mbps downstream; telephone, ISDN, or T-1 return path
Nucentrix (formerly Heartland Wireless Systems, Inc.)	Sherman, TX	Jun. 1998	768 kbps (one and two-way)
MagnaVision Corp.	New York, NY	Successful 6-month trial completed	1.5 Mbps or greater downstream
People's Choice TV Corp. (acquired by Sprint)	Detroit, MI	Oct. 1997	Up to 36 Mbps downstream, telephone or ISDN return path
	Phoenix, AZ	Mar. 1998	Same
Sioux Valley Wireless	Sioux Falls, SD	Dec. 1997	Up to 10 Mbps downstream, telephone or ISDN return path
Wireless One, Inc.	Jackson, MS	1998	MDS spectrum downstream, WCS return path
	Baton Rouge, LA	1998	Same
	Memphis, TN	Dec. 1998	Same

Other Providers			
Company	**Location**	**Launch Date**	**Downstream Speed**
Cache Valley AIRNET	Cache Valley, UT	N/A	Up to 10 Mbps downstream, telephone or ISDN return path
DirectNet	South Florida	Aug. 1997	1-2 Mbps downstream, telephone return path
IJNT International (formerly InterJetNet)	Salt Lake City, UT	Aug. 1997	Up to 10 Mbps (one and two-way)
	Beaumont, TX	Sep. 1997	Same
	Houston, TX	N/A	Same
	Orange County, CA	Dec. 1998	Same
	San Francisco Bay Area, CA	Dec. 1998	Same
	Provo-Orem, UT	Apr. 1999	Same
Le Groupe Videotron/Wavepath	San Francisco, CA	Dec. 1998	384 kbps (two-way)
Metro.Net	Northern California	N/A	Up to 10 Mbps downstream, telephone or ISDN return path
SkyLynx Communications, Inc.	Tampa, FL	4th Q 1998	Up to 30 Mbps downstream, up to 11 Mbps upsteam
	Fresno, CA	N/A	Same
UltimateCom, LLC	Atlanta, GA	Mar. 1998	N/A , telephone return path
	Denver, CO	N/A	3 Mbps (two-way)

TABLE 2: UPPERBAND FIXED WIRELESS OPERATORS

Company	Spectrum	Rollout Areas	Subscribers	Services
WinStar	28 and 38 GHz	Top 30 markets in the U.S.	380,000 lines in service	Voice, high speed data, Internet access, and information services
Teligent	24 GHz	28 markets nationwide	Access rights to 2,400 buildings	Voice, high speed data, Internet access, and information services
ART	38 GHz	Seattle, WA Portland, OR Phoenix, AZ	Access rights to 155 buildings	High-speed Internet access and Internet services
AT&T (Biztel/TCG)	38 GHz			TCG used as back-up and extension of fiber network; AT&T use unclear.
SpeedUs.com (formerly Cellularvision)	28 GHz (LMDS)	New York City Metro Area	2,000	Internet access (up to 48 Mbps downstream, telephone return path)

TABLE 3: RECENT LMDS AUCTION WINNERS

Company	POPs	Major License Areas	Announced Plans
Nextlink Communications, Inc.	50.8 million (A) 35.8 million (B)	most major U.S. cities	Acquired licenses of WNP and Nextband; plans to offer LMDS commercially as a complement to its CLEC fiber networks by end of 1999
WinStar	14.7 million (A) 2.3 million (B)	San Francisco, New Orleans, Salt Lake City, Norfolk, Orlando, other parts of California	Use of LMDS in conjunction with its 38 GHz spectrum to extend its reach to other cities
Touch America, Inc.	2.1 million (A) 2.1 million (B)	parts of Montana, Wyoming, Utah, Colorado, Idaho, North Dakota, Washington, Minnesota	Begin LMDS buildout in Helena and Billings, MT; use spectrum to link 30 cities to its 10,000 mile fiber network; and equipment contract with Nortel
BTA Associates	3.0 million (A) 675,000 (B)	Colorado	Begin offering LMDS services by the end of 1999
Liberty Cellular, Inc.	1.0 million (A) 1.0 million (B)	throughout Kansas	Begin offering LMDS service by late 1999; equipment contract with Nortel
US Unwired	1.8 million (A) 325,000 (B)	Louisiana, eastern Texas	Use of LMDS licenses to expand and complement its existing CLEC network and services
Virginia Tech Foundation, Inc.	1.5 million (A)	Southwest Virginia	Began LMDS deployment in Blacksburg, VA in May 1999; equipment donated by Wavtrace.
Home Telephone Company, Inc.	624,000 (A)	Charleston, SC	Begin deploying network in mid-1999; equipment contract with Newbridge Networks
Tri-Corner Telecommuni-cations, Inc.	163,000 (A and B)	Durango, CO, Farmington, NM	Begin offering LMDS services by the end of 1999

(A) indicates BTA A Block which consists of 1,150 MHz
(B) indicates BTA B Block which consists of 150 MHz

APPENDIX G:
FIXED TELEMETRY SERVICES

Some companies can now use fixed wireless technology to monitor their remote equipment from a central location, such as utility companies monitoring residential meters. Traditionally, company employees had to travel to each device and record measurements manually. However, wireless sensor devices installed in each remote piece of equipment can now transmit measurements back to a company's central office or headquarters, eliminating the need for time-consuming travel. Customers of such companies can even monitor or make changes to the equipment themselves from a remote location using the wireless sensor devices. This new technology is called fixed wireless telemetry.[1] The uses of fixed wireless telemetry include the monitoring of gas, electric, and water utility meters (often referred to as automatic meter reading ("AMR") devices), HVAC systems, gas and oil pipelines, vending machines, alarm systems, parking meters, streetlights, smoke/fire detectors, personal computer printers, factory process systems, photo copiers, and railway and other transportation systems.

Fixed wireless telemetry is similar to mobile data wireless services in that both involve the transmission and measurement of data from equipment in a remote location. The only difference is that with fixed wireless telemetry, the objects that contain the wireless sensors, such as utility meters or vending machines, are stationary.

A. Current Market Structure

The fixed wireless telemetry market has grown since the publication of the *Third Report*, largely due to continued deregulation in various segments of the utility industry. In the past few years, many states have shifted their utility rate setting policies away from asset-based rate-of-return systems to performance-based systems that calculate rates on factors such as costs, efficiency, and quality of service. The provision of fixed wireless telemetry services has assisted utilities in promoting these factors.[2]

1. Non-CMRS Providers

Both non-CMRS and CMRS providers are players in the telemetry market. The two major non-CMRS providers are Itron, Inc. ("Itron") and CellNet Data Systems, Inc. ("CellNet"). Itron is the leader in the AMR telemetry market. As of December 31, 1998, Itron had shipped 13.5 million AMR units, a 22 percent increase from the previous year, to 403

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[1] Telemetry is the transmission and measurement of data from a remote source.

[2] Jeanine Oburchay & Brian Park, CELLNET DATA SYSTEMS, INC., Bear, Stearns & Co. Inc., Feb. 5, 1999, at 8 ("*Oburchay & Park*").

utilities.[3] CellNet's installed telemetry base has doubled since the writing of the *Third Report* from one to two million units.[4] As of February 1999, the company had connected two million telemetry devices[5] and was adding an average of 100,000 devices each month.[6] CellNet has a total of 4.8 million devices under contract[7] and a Memorandum of Understanding for an additional 312,000 devices with utilities that have 7.5 million meters in their service territories.[8] When CellNet's wide area networks under contract are fully built out, the company will cover more than 35 million POPs.[9] CellNet currently has operational networks in six metropolitan areas,[10] but has licenses to offer service in 58 of the top 60 MSAs.[11] In addition to serving utilities, the company provides remote monitoring for photocopying machines, vending machines, and home security systems.[12] It is planning to branch further into the non-energy telemetry markets as it grows.[13] Whisper Communications, Inc. ("Whisper") is a third provider of fixed wireless telemetry services to utility companies. In December 1997, Whisper was awarded a contract to connect 1.1 million electric and gas meters to wireless AMR networks.[14]

2. CMRS Providers

Certain CMRS providers have continued to branch into the fixed wireless telemetry market. The major players include SkyTel, PageMart, American Mobile, Metricom, and Aeris

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[3] *Itron Announces Fourth Quarter and Year-End Results*, News Release, Itron, Inc., Feb. 3, 1999.

[4] *More Than Two Million Devices Now Online in CellNet Data Systems Wireless Networks*, PR NEWSWIRE, Feb. 16, 1999 ("*PR NEWSWIRE 2/16/99*"); *CellNet Data Systems Announces 1997 Fourth-Quarter and Year-End Results*, News Release, CellNet Data Systems, Inc., Feb. 9, 1998.

[5] *PR NEWSWIRE 2/16/99*.

[6] CellNet Data Systems, Inc., *Integrated Wireless* (visited Feb. 17, 1999) <http://www.cellnet.com/Home/welcome.html>.

[7] *Oburchay & Park*, at 1.

[8] *PR NEWSWIRE 2/16/99*.

[9] *Id.*

[10] Kansas City, St. Louis, Minneapolis-St. Paul, Seattle, Indianapolis, and the San Francisco Bay Area.

[11] *Oburchay & Park*, at 6.

[12] *PR NEWSWIRE 2/16/99*.

[13] *Oburchay & Park*, at 16.

[14] Whisper Communications, Inc., *About Whisper* (visited Feb. 19, 1999) <http://www.whisper.com/about.htm>.

Communications, Inc. ("Aeris").

SkyTel uses its narrowband PCS network to provide fixed wireless telemetry services.[15] SkyTel had 104,500 devices under contract at the end of 1998; however, only 6,700 of these units were in service at that time.[16] SkyTel secured a 6-year contract with Enron to supply at least 69,000 AMR units to an integrated natural gas and electric company for residential use.[17] SkyTel also has a contract to provide 20,000 fixed wireless telemetry units to Barringer Instruments, Skywire Corporation, the Williams Companies, and XP Systems.[18]

PageMart also uses its narrowband PCS licenses to offer fixed wireless telemetry services. It currently has contracts to provide telemetry services for environmental control systems,[19] photocopying and imaging systems,[20] and home security systems.[21] PageMart plans to have its telemetry networks fully operational by mid-1999.[22]

American Mobile acquired ARDIS in April 1998 and uses ARDIS's wireless data licenses to provide fixed, as well as mobile, telemetry services. For example, American Mobile provides AMR service to Enron's commercial and industrial customers.[23] Enron not only monitors electricity use by its customers using American Mobile's network, but also allows its corporate customers to monitor electricity use in their own regional offices from remote locations.[24] American Mobile and Enron will bring at least 55,000 meters on-line by July

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[15] *Oburchay & Park*, at 23.

[16] *SkyTel Earns Positive Net Income in 4Q98*, News Release, SkyTel Communications, Inc., Feb. 17, 1999.

[17] *Id.*; *Mtel and Enron Energy Services Announce Major Service Agreement*, News Release, SkyTel Communications, Inc., Dec. 15, 1997; *Oburchay & Park*, at 23.

[18] *Mtel Signs Contracts for 20,000 Fixed Wireless Units*, News Release, SkyTel Communications, Inc., Sep. 9, 1997.

[19] *PageMart Wireless Announces Strategic Alliance with Pentech to Provide Telemetry Solutions for the Environmental Control Industry*, News Release, PageMart Wireless, Inc., Sep. 15, 1998.

[20] *PageMart Wireless Reports Fourth Quarter Results; Narrowband PCS Network Launched Nationwide*, PR NEWSWIRE, Feb. 4, 1999.

[21] *PageMart Wireless Forms Strategic Alliance with ITI to Provide Telemetry Solutions for Home Security Industry*, News Release, PageMart Wireless, Inc., Sep. 15, 1998.

[22] Antony Bruno, *PageMart Starts Two-Way Service*, RCR RADIO COMMUNICATIONS REPORT, Dec. 21, 1998.

[23] *Oburchay & Park*, at 23; Tony Kontzer, *Electricity Meter Reading Joins Digital Era*, INVESTOR'S BUSINESS DAILY, Jul. 6, 1998.

[24] Tony Kontzer, *Electricity Meter Reading Joins Digital Era*, INVESTOR'S BUSINESS DAILY, Jul. 6, 1998.

2001.[25]

Metricom, the producer of Richochet, uses spread-spectrum radios in the unlicensed 902-928 MHz band of radio spectrum to offer a fixed wireless telemetry service called UtiliNet to utility companies.[26]

Aeris offers a telemetry product with fixed and mobile capabilities called MicroBurst that uses the control channel infrastructure of cellular networks.[27] Aeris offers MicroBurst by partnering with cellular carriers, which in turn offer it to their end users (including Bell Atlantic, Ameritech, U.S. Cellular, and AirTouch).[28] These agreements give Aeris a footprint that covers 80 percent of the cellular licenses areas in the United States and 200 million POPs in North America.

Another company, Cellemetry LLC ("Cellemetry"), offers telemetry services using the underutilized portions of cellular telephone networks to send short data messages.[29] Forty cellular carriers offer Cellemetry in their license areas, including BellSouth, which owns 40 percent of Cellemetry.[30] With these agreements, Cellemetry covers 82 percent of the cellular license areas in the U.S., which cover 80 percent of the U.S. population, and has the highest number of deployed telemetry units connected to cellular networks.

In addition to Cellemetry, BellSouth offers telemetry services to systems that must transmit larger amounts of data, such as commercial alarm systems and vending machine monitoring systems, through BellSouth Wireless, previously RAM Mobile Data. This network covers 93 percent of the business population in the U.S. BellSouth plans to double the number of base stations it uses for its telemetry operations from May 1998 to May 2000.[31]

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[25] *Id.*

[26] Metricom, Inc., *Products and Services* (visited Feb. 22, 1999) <http://www.ricochet.net/products/corp.htm>; Metricom, Inc., *Welcome to UtiliNet* (visited Feb. 22, 1999) <http://www.metricom.com/products/industrial/utilinet.html>.

[27] *AirTouch to Offer Aeris MicroBurst for Short-Burst Data Applications; Aeris Nears Completion of National Footprint*, BUSINESS WIRE, Feb. 8, 1999.

[28] *Id.*

[29] Cellemetry LLC, *Technical Overview* (visited Feb. 22, 1999) <http://209.86.119.56/html/techoverview.html>.

[30] *Recent Agreements Give Company "Largest Cellular Data Services Network in World,"* News Release, Cellemetry LLC, Jan. 11, 1999.

[31] Nancy Gohring, *Telemetry Takes the Lead: Small-Volume Wireless Data May Be First to Make a Profit*, TELEPHONY, May 11, 1998.

B. Potential Growth

There is still great potential for the fixed wireless telemetry industry and many segments of the market remain untapped.[32] An analyst from the Yankee Group stated, "We believe that telemetry will grow significantly over the next five years, making a noticeable impact on the $200 billion deregulating energy industry and other industries. The value of telemetry, though virtually unrecognized today, is increasing as it becomes technologically feasible and cost-effective. Its possibilities are vast."[33]

Only two percent of the more than 270 million utility meters in the United States have been telemetrized.[34] The Strategis Group believes 37 percent of those will be connected to fixed wireless networks within the next five years, with the majority being electric or gas meters in hard-to-reach rural areas.[35] One analyst has stated that there is an "opportunity for 130 million [non-utility] remote monitoring sites nationwide" in addition to the millions of potential utility sites.[36] Another analyst has predicted that telemetry systems using Motorola's ReFLEX technology (a technology also used for narrowband PCS applications) will have 11 million units in service by the end of 2001 and 40 million by the end of 2005.[37] And CellNet itself admits that is has hardly scratched the surface of the market, stating that its two million deployed telemetry devices represent only one-half of one percent of the potential U.S. utility metering market.[38]

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[32] *Yankee Group Predicts Telemetry Growth*, PAGINGNOW, Jan. 8, 1999; CellNet Data Systems, Inc., *What the Media and Analysts Are Saying about CellNet* (visited Feb. 17, 1999) <http://www.cellnet.com/News/mediaMain.html>.

[33] *Yankee Group Predicts Telemetry Growth*, PAGINGNOW, Jan. 8, 1999.

[34] Whisper Communications, Inc., *About Whisper* (visited Feb. 20, 1999) <http://www.whisper.com/about.htm>.

[35] Nancy Gohring, *Telemetry Takes the Lead: Small-Volume Wireless Data May Be First to Make a Profit*, TELEPHONY, May 11, 1998.

[36] *Oburchay & Park*, at 1, 17.

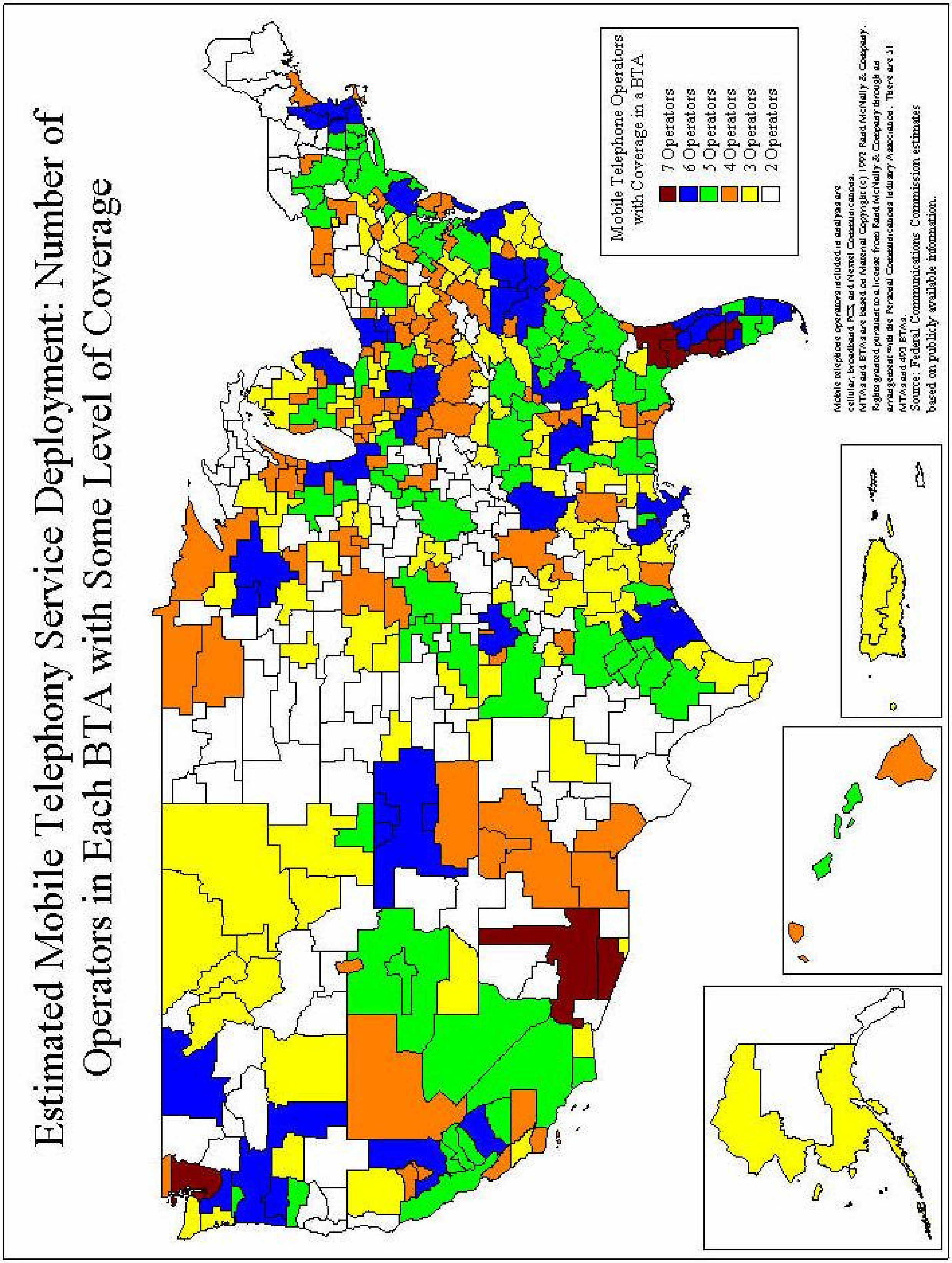
[37] *DRC Projects Telemetry Applications for ReFLEX*, PAGINGNOW, Feb. 17, 1999 (quoting Brian Cotton, an industry business manager for wireless communications and telecommunications transmission practices for Frost & Sullivan).

[38] CellNet Data Systems, Inc., *Integrated Wireless* (visited Feb. 17, 1999) <http://www.cellnet.com/Home/welcome.html>.

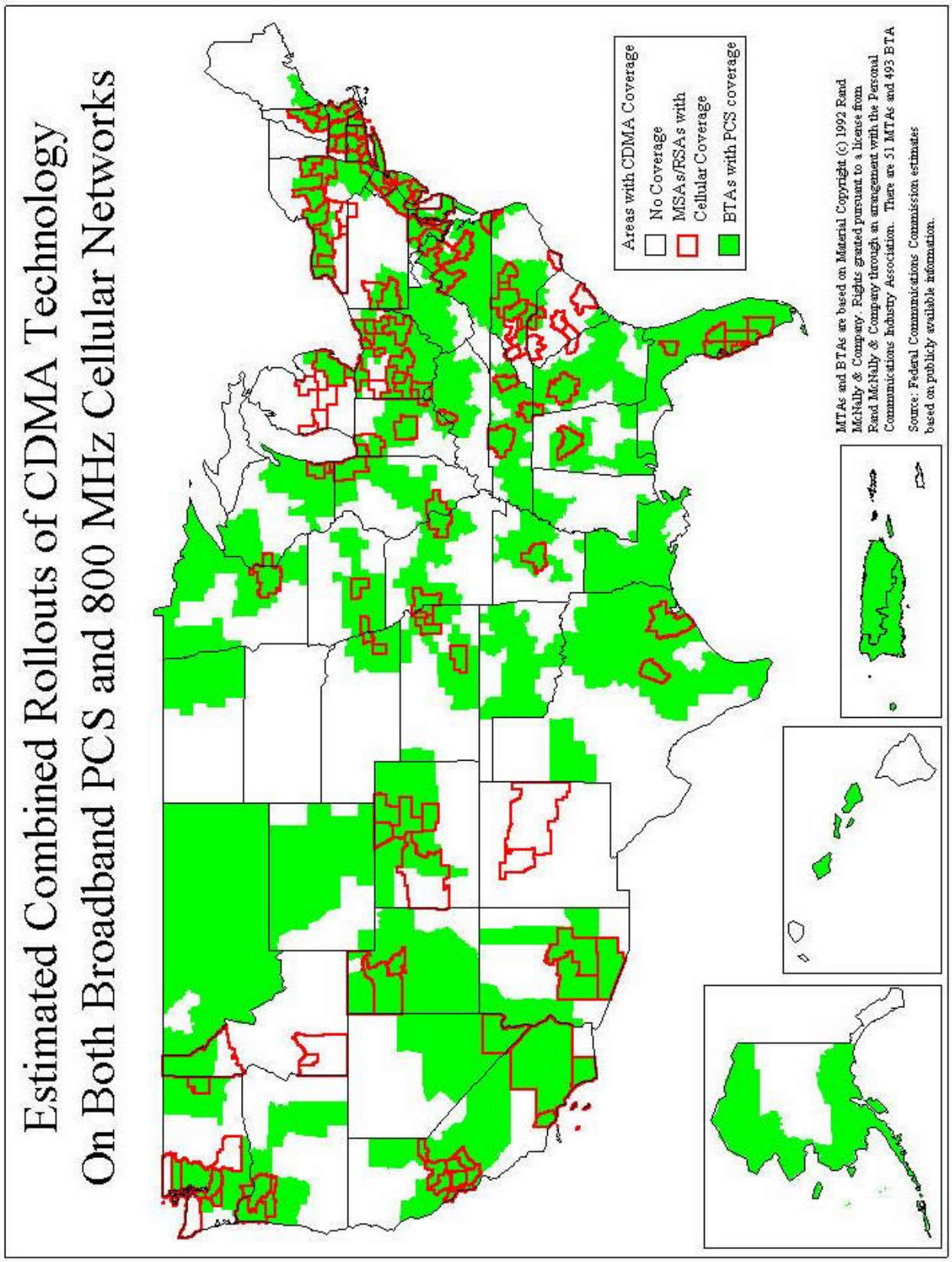
APPENDIX H:
MAPS

Table of Contents

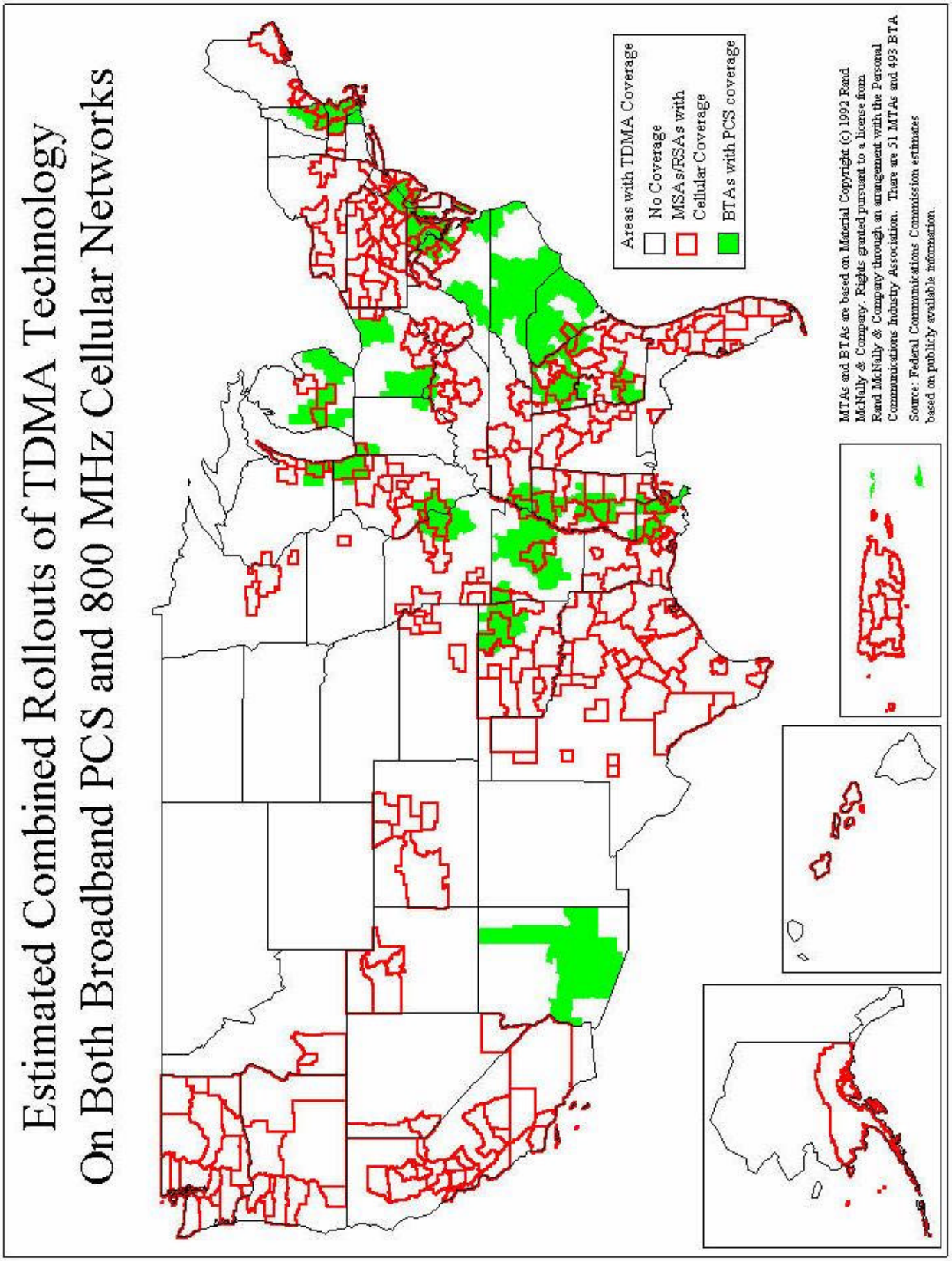
Map 1


Estimated Mobile Telephony Service Deployment: Number of Operators in Each BTA with Some Level of Coverage
Mobile Telephone Operators with Coverage in a BTA
7 Operators
6 Operators
5 Operators
4 Operators
3 Operators
2 Operators
Mobile telephone operators included in analysis are cellular, broadband PCS, and Nextel Communications.
MTAs and BTAs are based on Material Copyright (c) 1992 Rand McNally & Company. Rights granted pursuant to a license from Rand McNally & Company through an arrangement with the Personal Communications Industry Association. There are 51 MTAs and 493 BTAs.
Source: Federal Communications Commission estimates based on publicly available information.

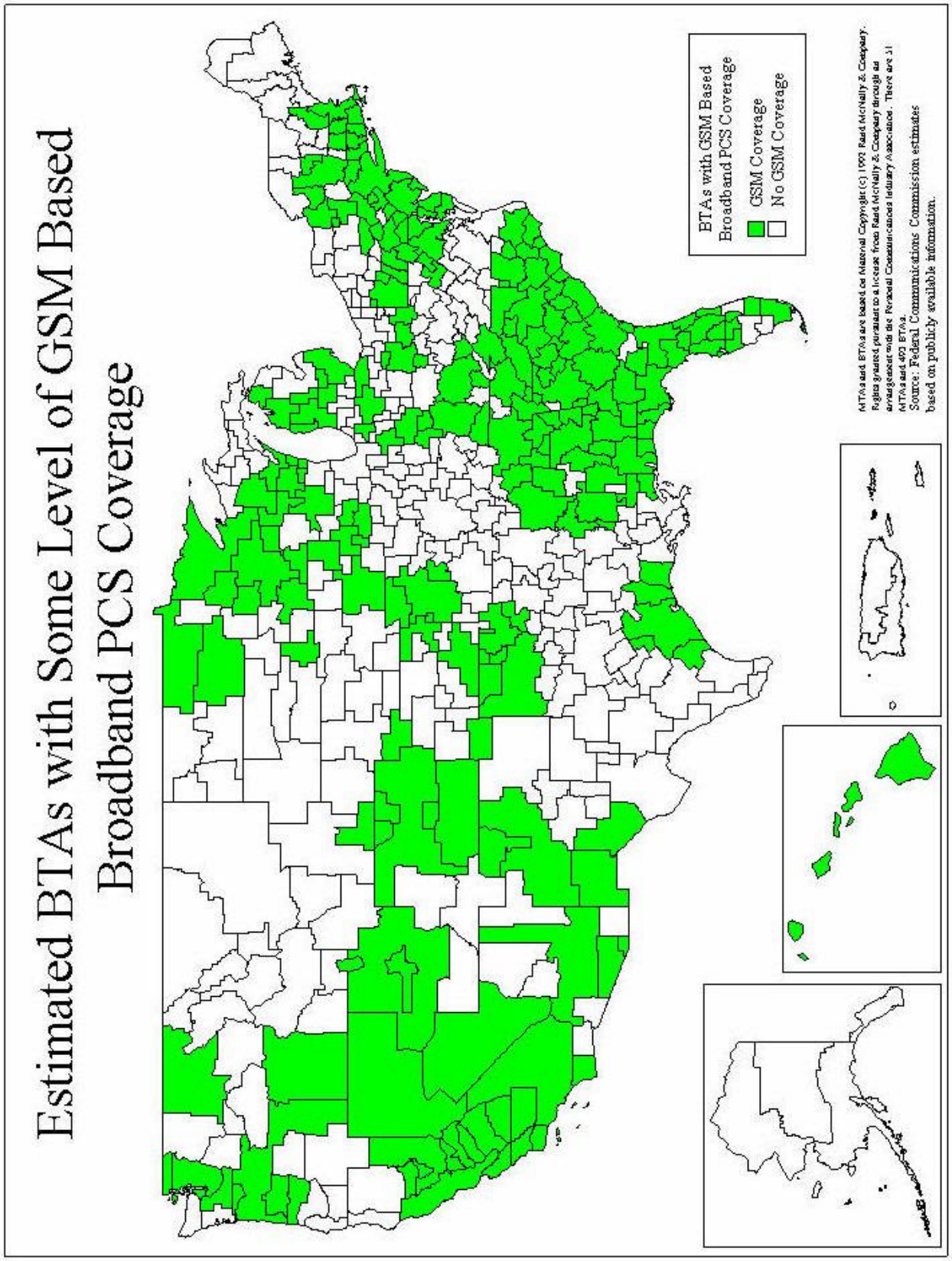
Map 2


Estimated Combined Rollouts of CDMA Technology
On Both Broadband PCS and 800 MHz Cellular Networks
Areas with CDMA Coverage
No Coverage
MSAs/RSAs with Cellular Coverage
BTAs with PCS coverage
MTAs and BTAs are based on Material Copyright (c) 1992 Rand McNally & Company. Rights granted pursuant to a license from Rand McNally & Company through an arrangement with the Personal Communications Industry Association. There are 51 MTAs and 493 BTA
Source: Federal Communications Commission estimates based on publicly available information.

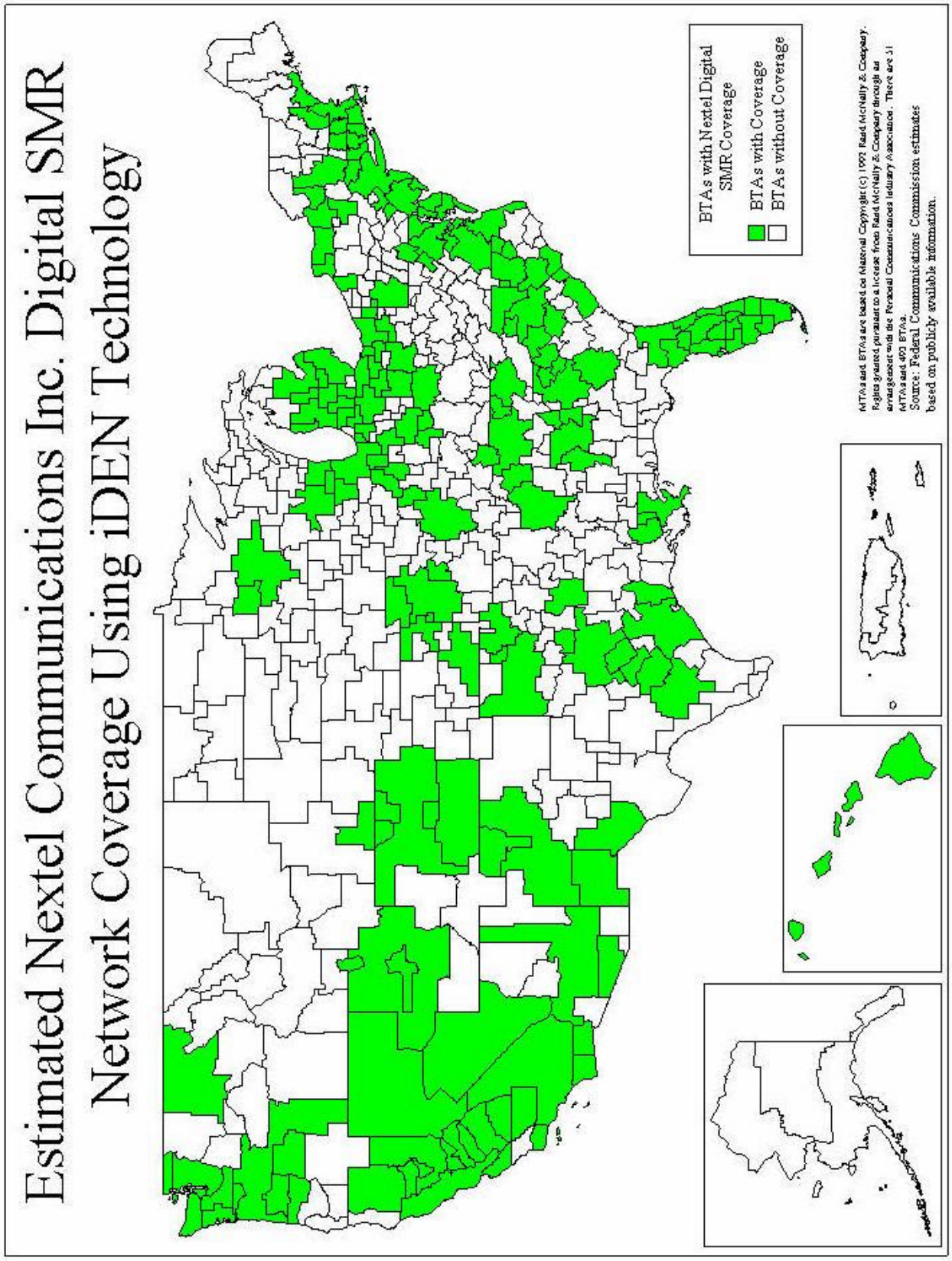
Map 3


Estimated Combined Rollouts of TDMA Technology
On Both Broadband PCS and 800 MHz Cellular Networks
Areas with TDMA Coverage
No Coverage
MSAs/RSAs with Cellular Coverage
BTAs with PCS coverage
MTAs and BTAs are based on Material Copyright (c) 1992 Rand McNally & Company. Rights granted pursuant to a license from Rand McNally & Company through an arrangement with the Personal Communications Industry Association. There are 51 MTAs and 493 BTA.
Source: Federal Communications Commission estimates based on publicly available information.

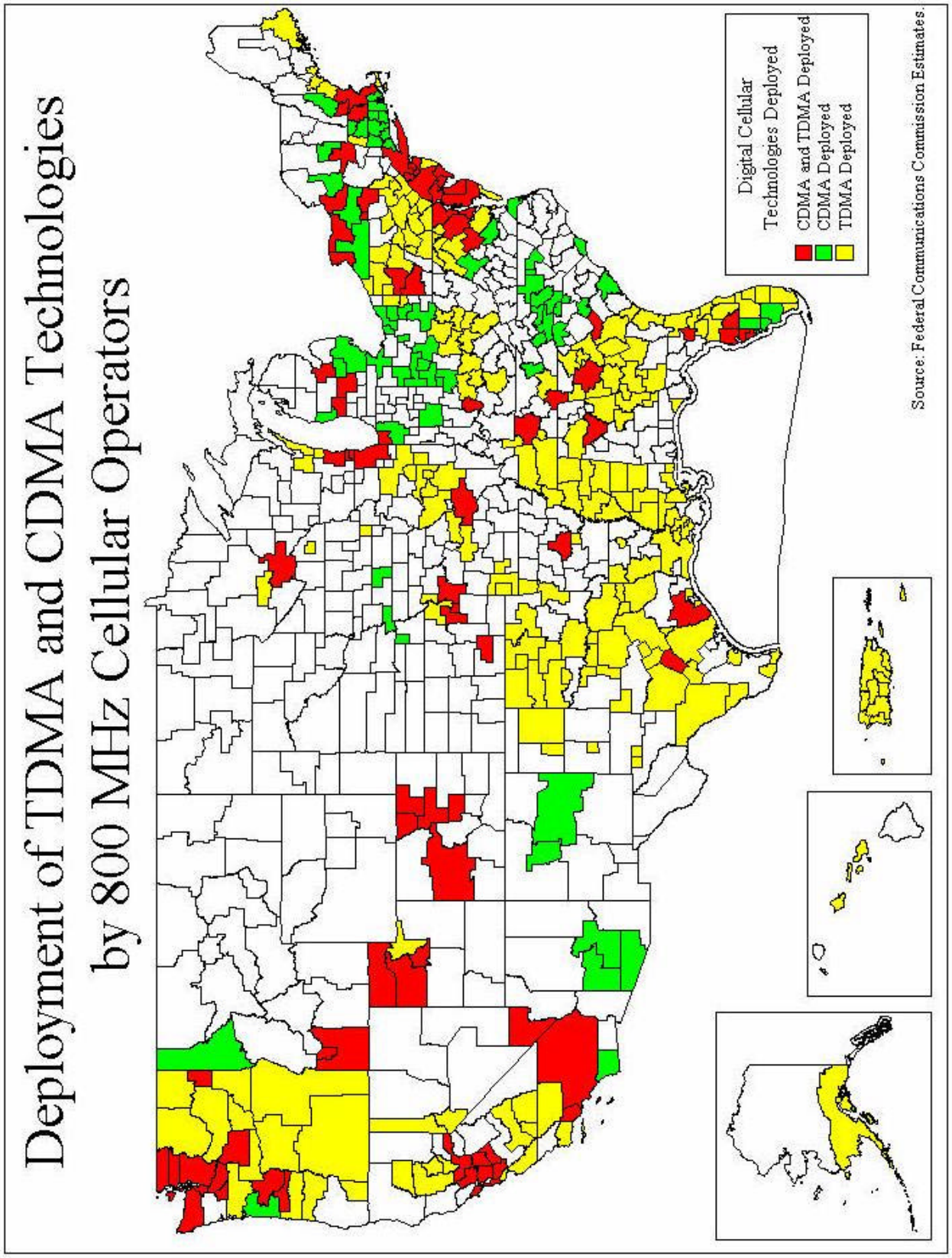
Map 4


Estimated BTAs with Some Level of GSM Based Broadband PCS Coverage
BTAs with GSM Based Broadband PCS Coverage
GSM Coverage
No GSM Coverage
MTAs and BTAs are based on Material Copyright(c) 1992 Rand McNally & Company. Rights granted pursuant to a license from Rand McNally & Company through an arrangement with the Personal Communications Industry Association. There are 51 MTAs and 493 BTAs.
Source: Federal Communications Commission estimates based on publicly available information.

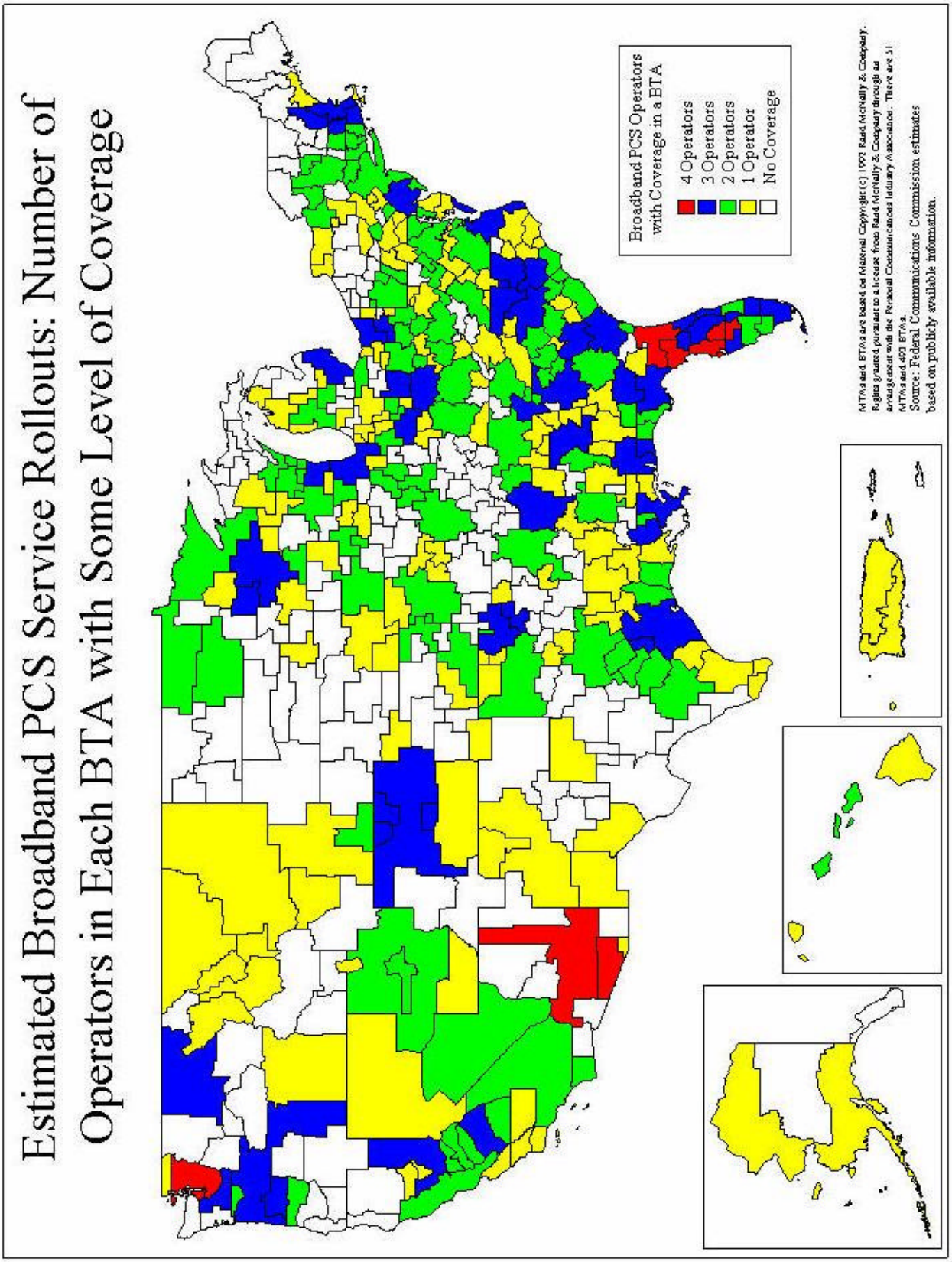
Map 5


Estimated Nextel Communications Inc. Digital SMR
Network Coverage Using iDEN Technology
BTAs with Nextel Digital SMR Coverage
BTAs with Coverage
BTAs without Coverage
MTAs and BTAs are based on Material Copyright(C) 1992 Rand McNally & Company. Rights granted pursuant to a license from Rand McNally & Company through an arrangement with the Personal Communications Industry Association. There are 51 MTAs and 493 BTAs.
Source: Federal Communications Commission estimates based on publicly available information.

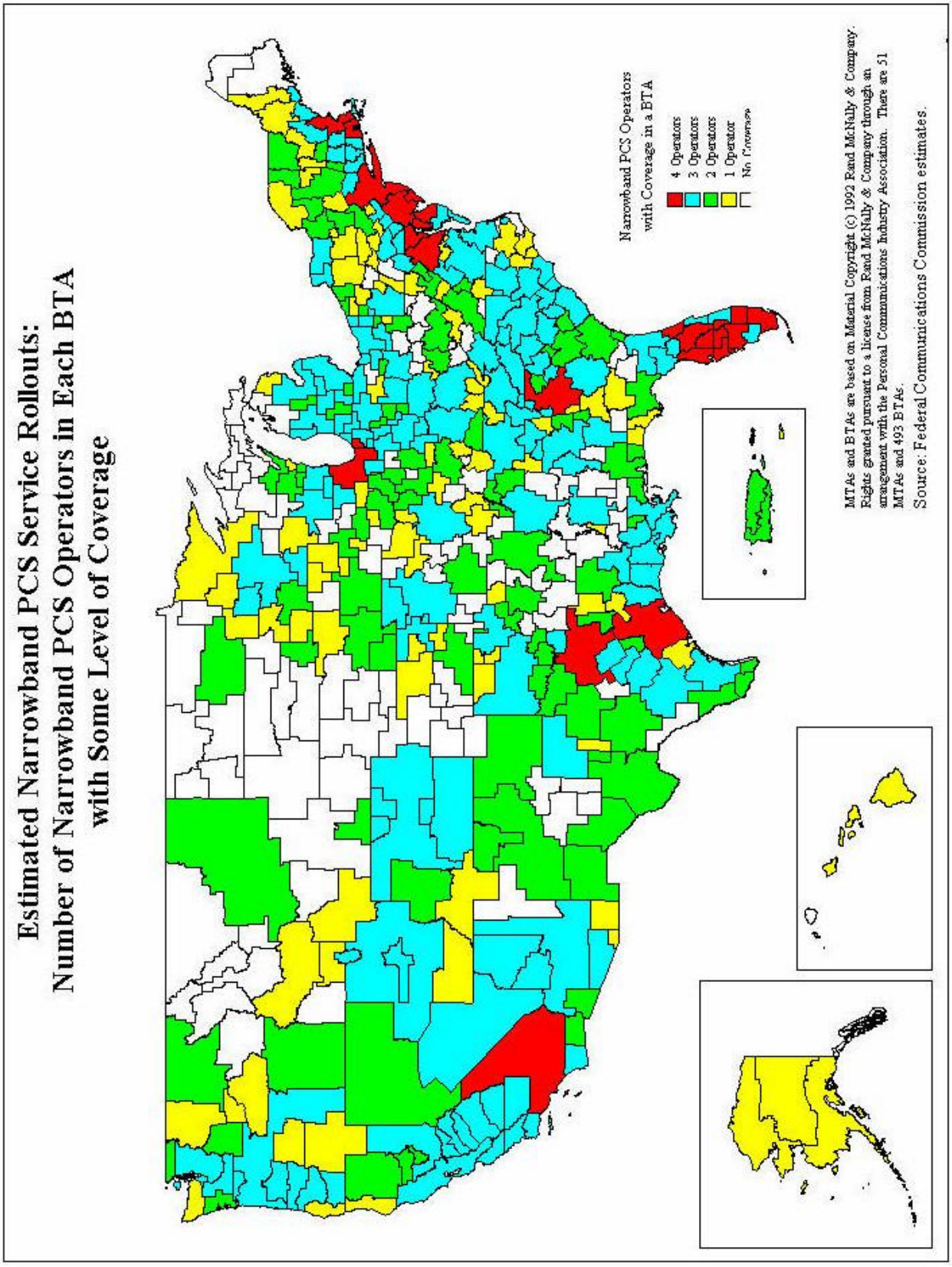
Map 6


Deployment of TDMA and CDMA Technologies
by 800 MHz Cellular Operators
Digital Cellular Technologies Deployed
CDMA and TDMA Deployed
CDMA Deployed
TDMA Deployed
Source: Federal Communications Commission Estimates.

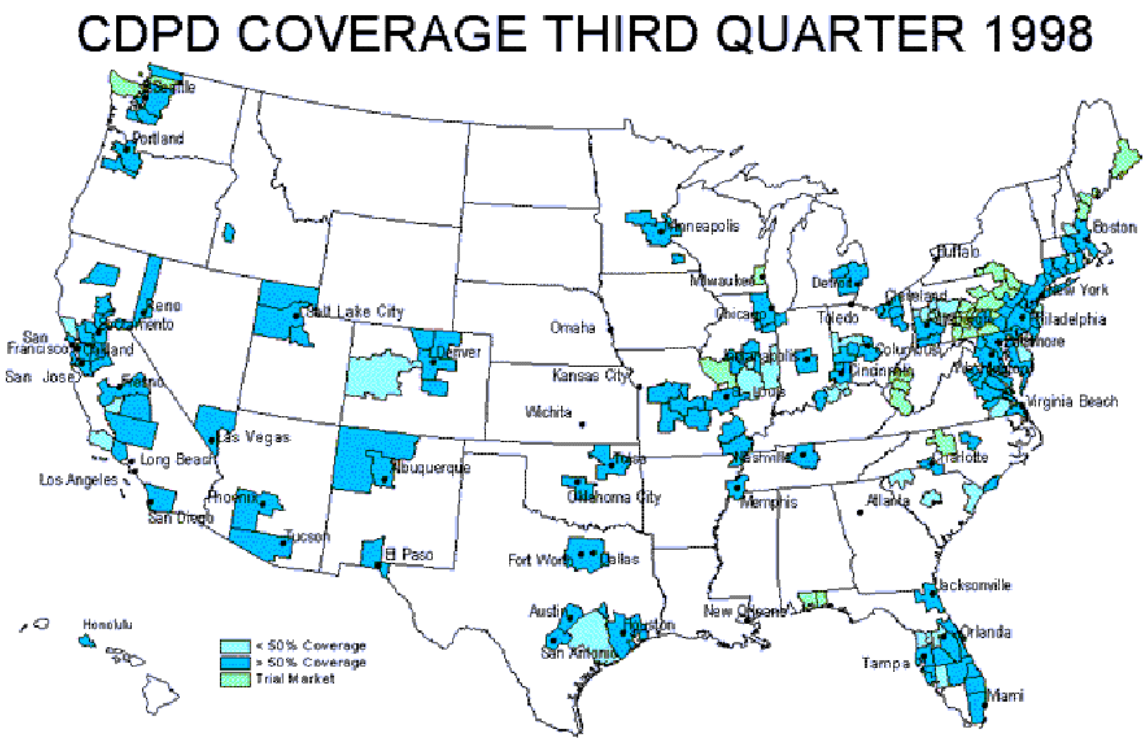
Map 7


Estimated Broadband PCS Service Rollouts: Number of Operators in Each BTA with Some Level of Coverage
Broadband PCS Operators with Coverage in a BTA
4 Operators
3 Operators
2 Operators
1 Operator
No Coverage
MTAs and BTAs are based on Material Copyright (c) 1992 Rand McNally & Company. Rights granted pursuant to a license from Rand McNally & Company through an arrangement with the Personal Communications Industry Association. There are 51 MTAs and 493 BTAs.
Source: Federal Communications Commission estimates based on publicly available information.

Map 8

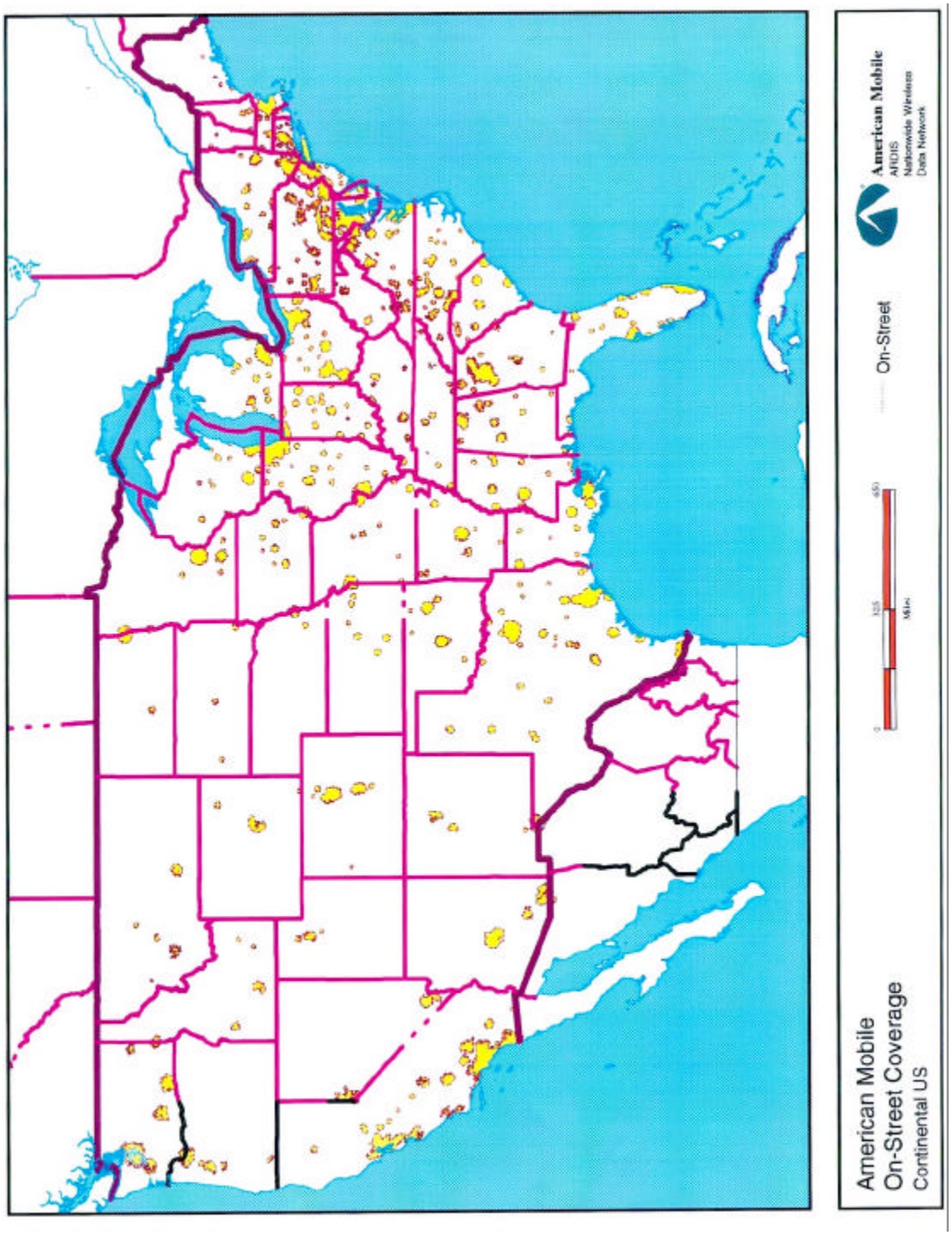

Estimated Narrowband PCS Service Rollouts:
Number of Narrowband PCS Operators in Each BTA
with Some Level of Coverage
Narrowband PCS Operators
with Coverage in a BTA
4 Operators
3 Operators
2 Operators
1 Operator
No Coverage
MTAs and BTAs are based on Material Copyright (c) 1992 Rand McNally & Company.
Rights granted pursuant to a license from Rand McNally & Company through an
arrangement with the Personal Communications Industry Association. There are 51
MTAs and 493 BTAs.
Source: Federal Communications Commission estimates.

Map 9



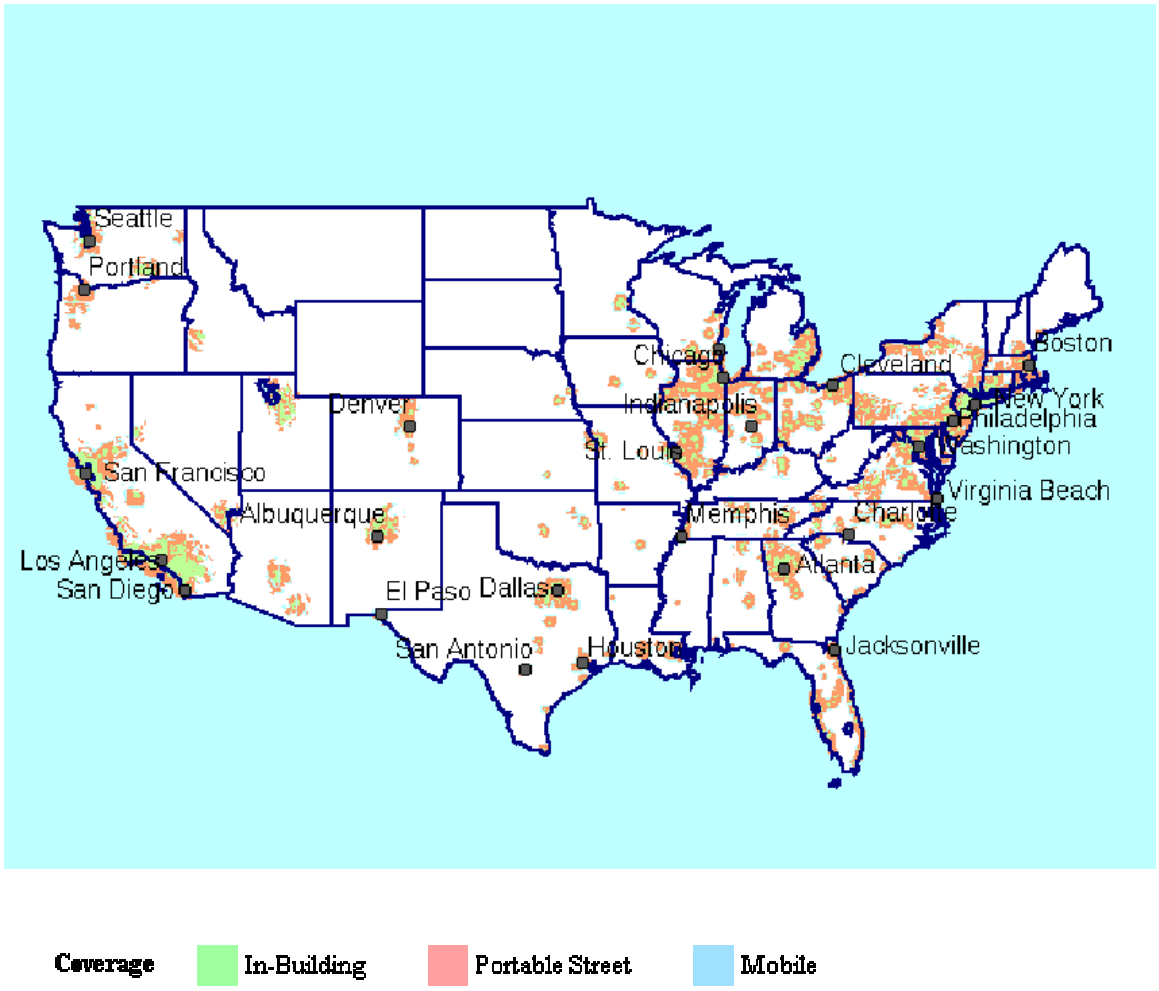
Source: *WDF: Coverage Maps* (visited Feb. 23, 1999) http://www.wirelessdata.org/maps/index.asp.

Map 10
ARDIS Coverage



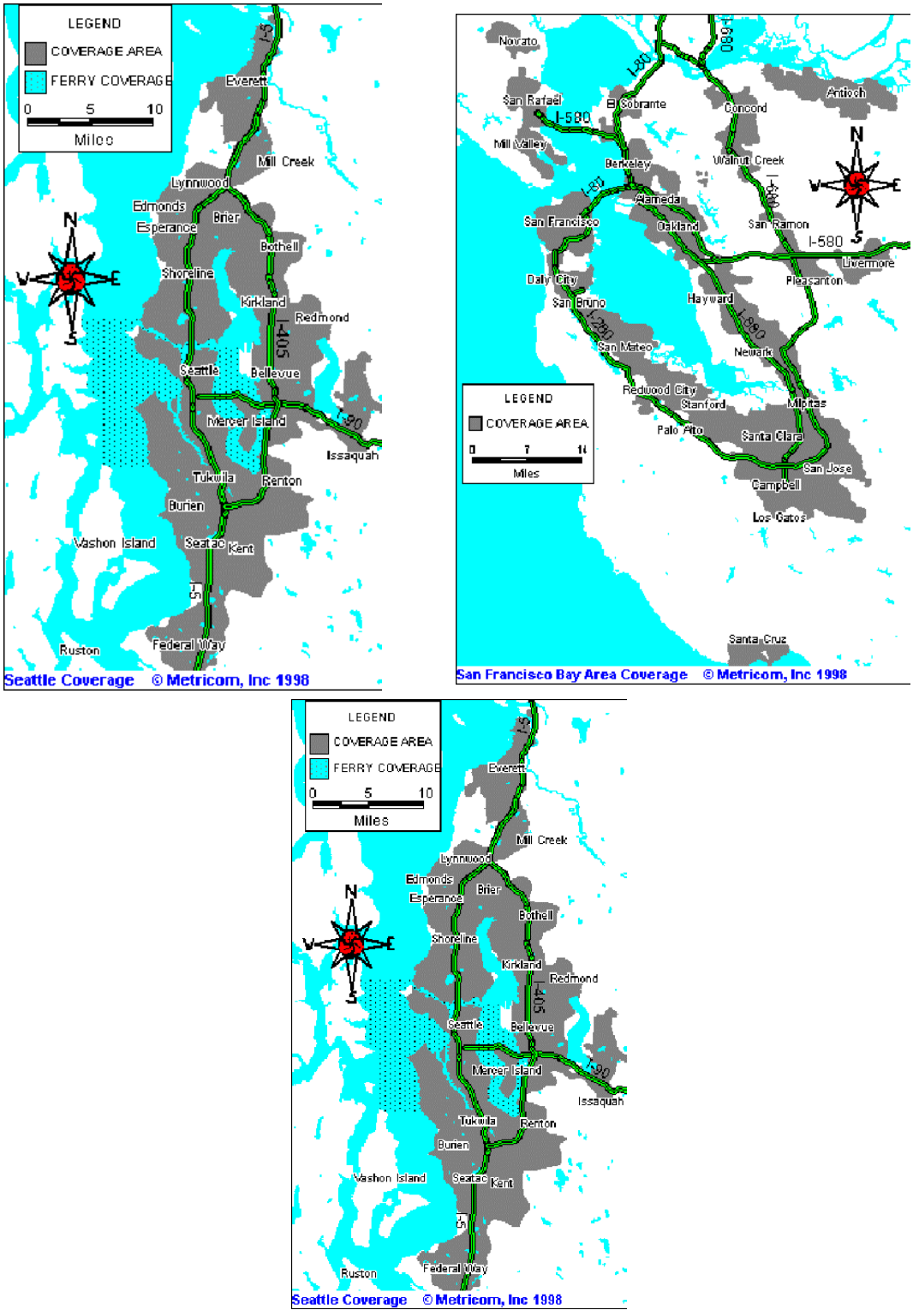
Source: American Mobile Satellite Company (ARDIS Company). The company also has coverage in Alaska and Hawaii.

Map 11
BellSouth Wireless Data Coverage



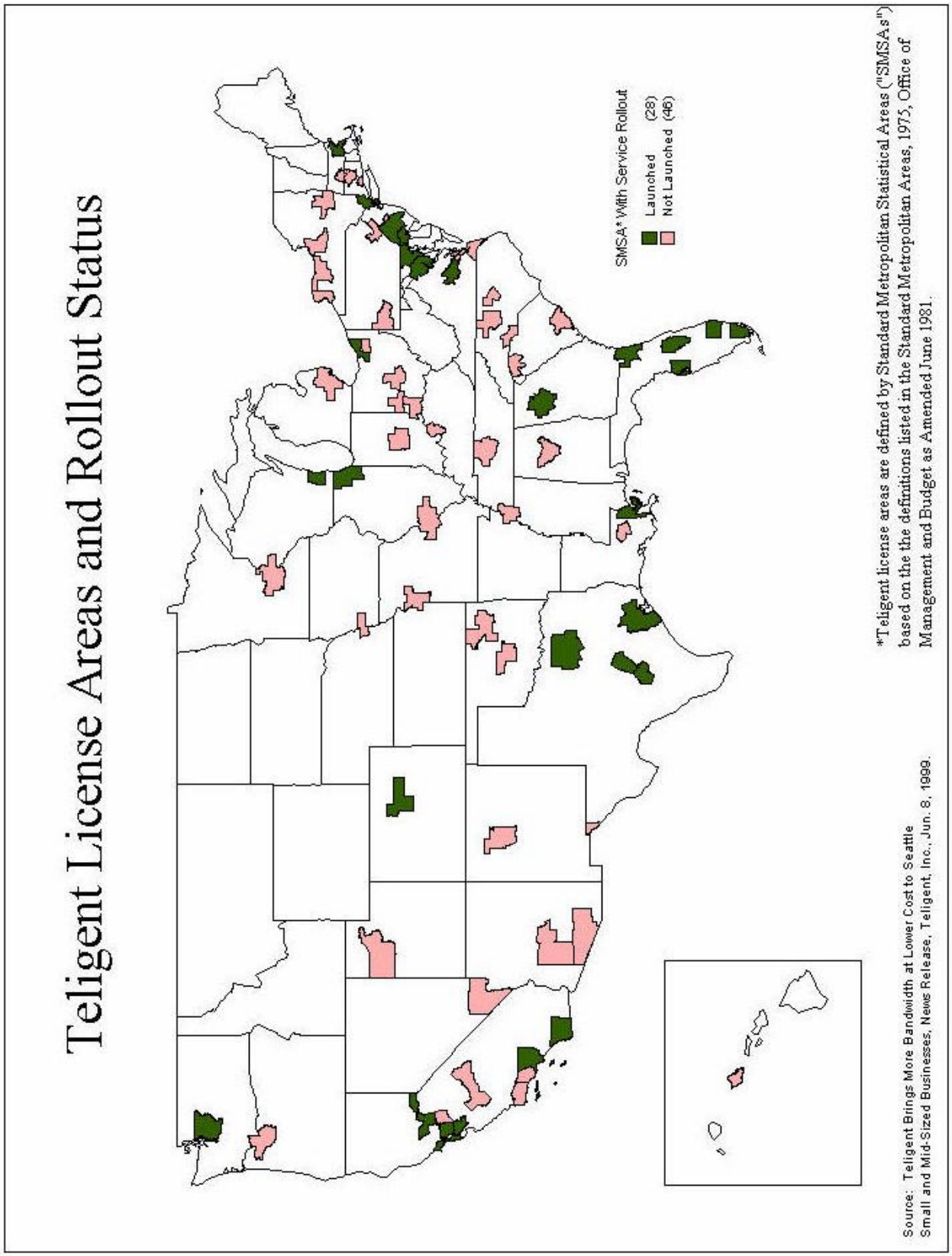
Source: *BellSouth Wireless Data – Mobitex Coverage* (visited Feb. 23, 1998) <http://www.bellsouthwd.com/covapp/>.

Map 12
Metricom Ricochet Coverage



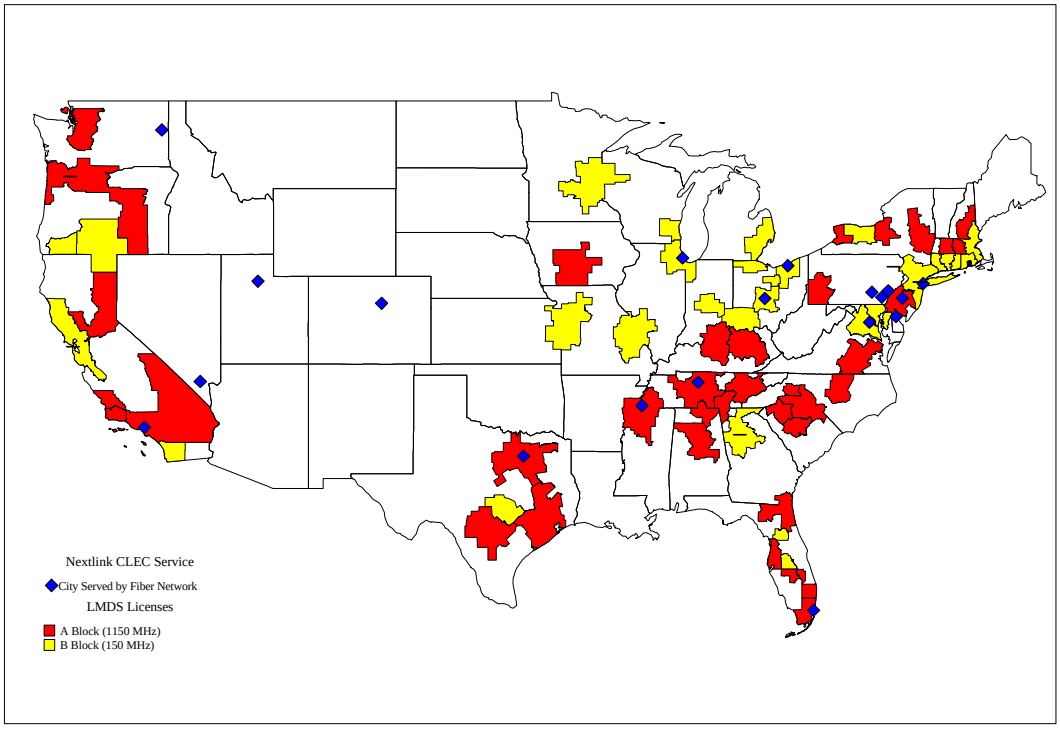
Source: *Ricochet Coverage Areas and Maps* (visited Feb. 23, 1999) http://www.metricom.com/coverage/index.html

Map 13

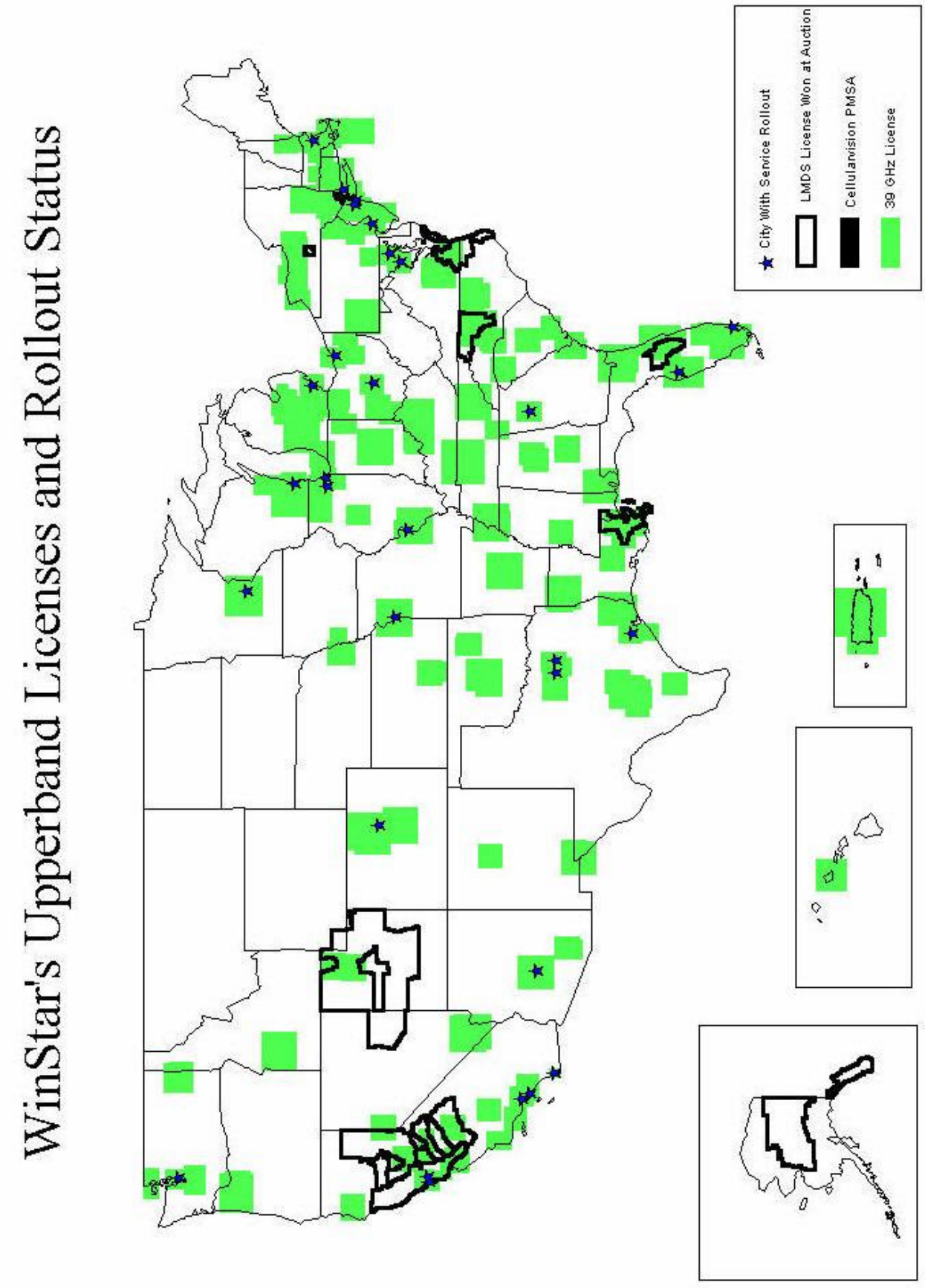

Teligent License Areas and Rollout Status
SMSA* With Service Rollout
Launched (28)
Not Launched (46)
*Teligent license areas are defined by Standard Metropolitan Statistical Areas ("SMSAs") based on the the definitions listed in the Standard Metropolitan Areas, 1975, Office of Management and Budget as Amended June 1981.
Source: Teligent Brings More Bandwidth at Lower Cost to Seattle Small and Mid-Sized Businesses, News Release, Teligent, Inc., Jun. 8, 1999.

Map 14

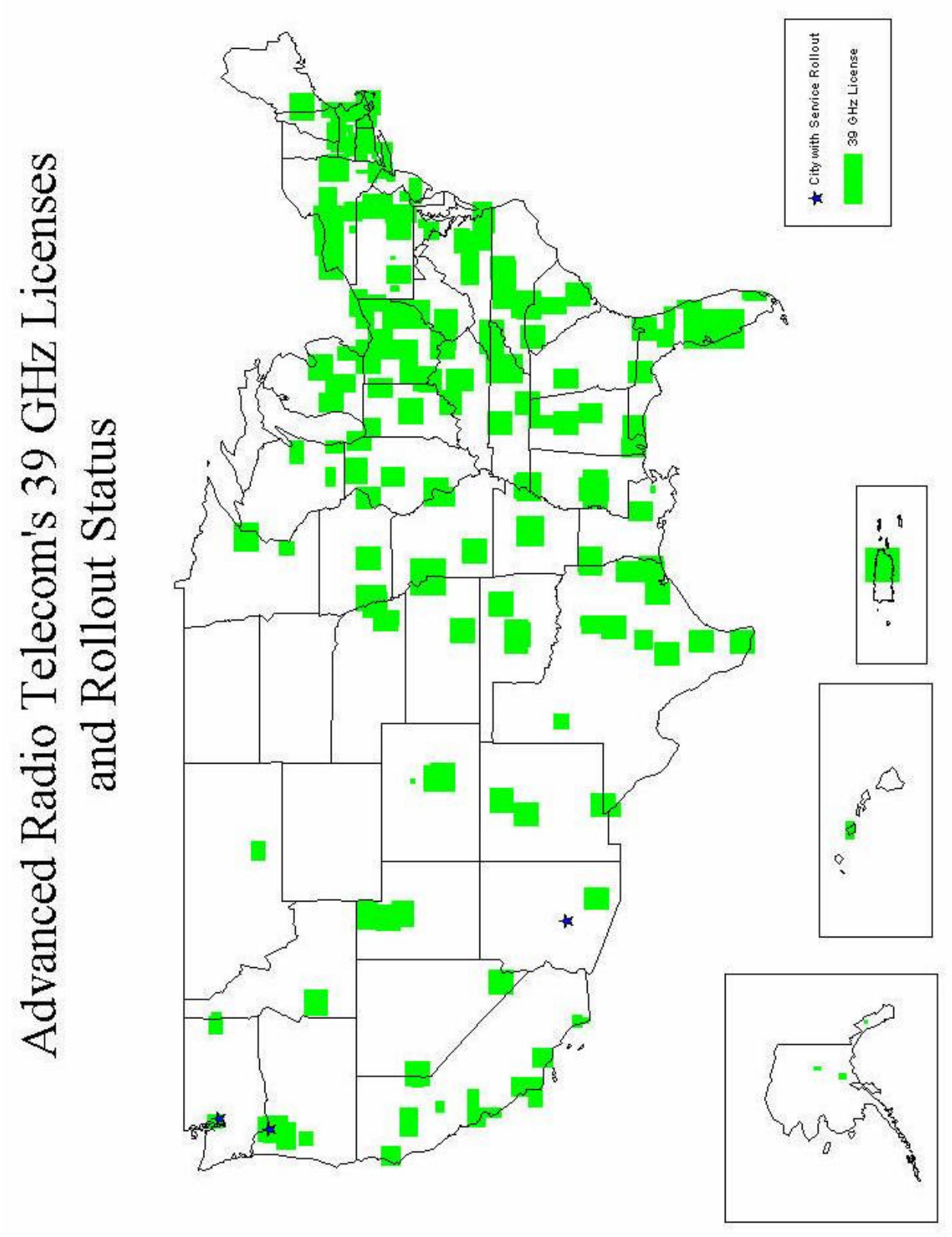
Nextlink Coverage Area
(Combined WNP and Nextband License Areas)



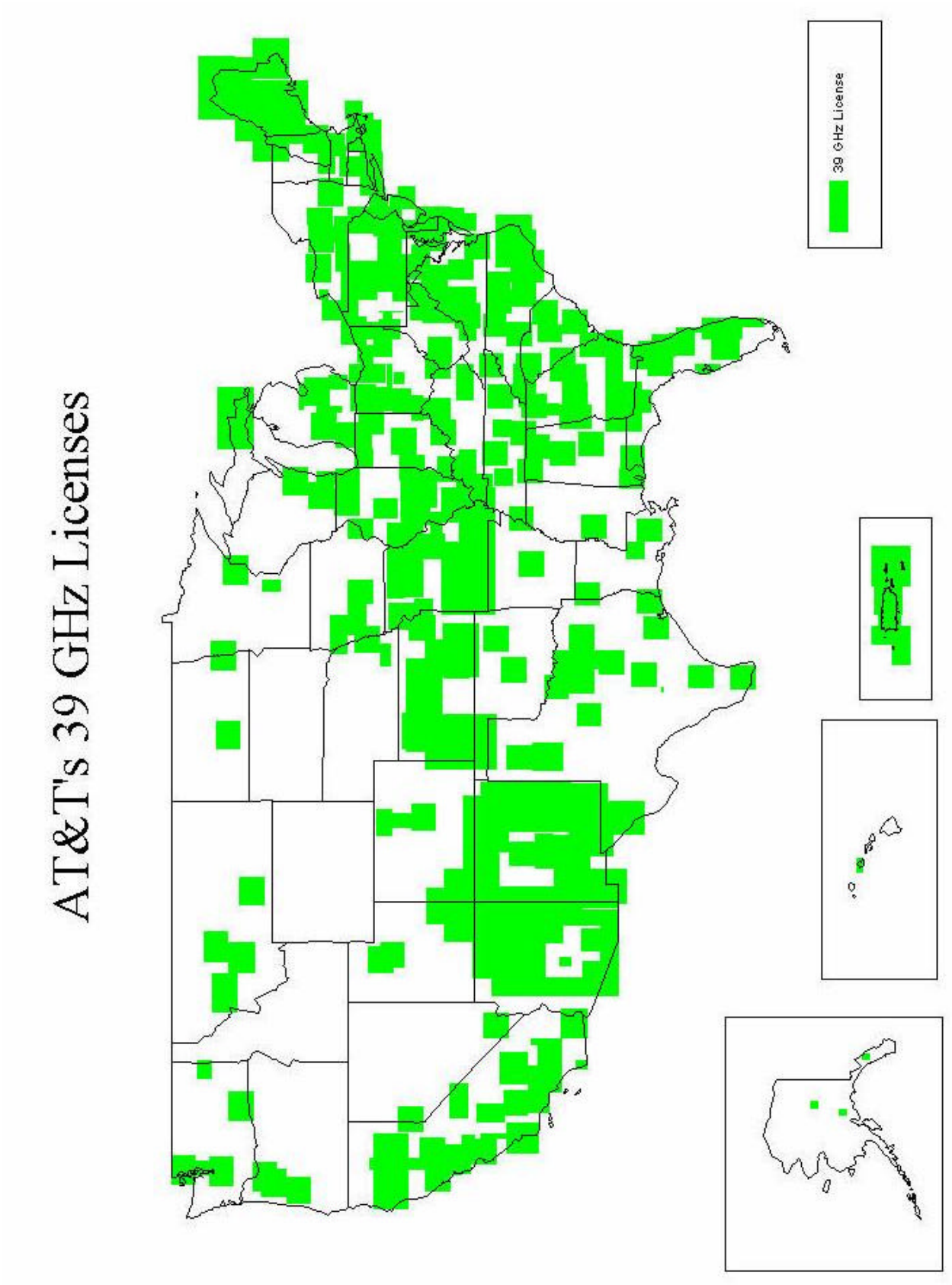
Map 15


WinStar's Upperband Licenses and Rollout Status
City With Service Rollout
LMDS License Won at Auction
Cellularvision PMSA
39 GHz License

Map 16


Advanced Radio Telecom's 39 GHz Licenses
and Rollout Status
City with Service Rollout
39 GHz License

Map 17



APPENDIX I:
CELLULAR LICENSE OWNERSHIP

Below are the cellular licenses owned by a selection of mobile telephone operators. This information was gathered from either public sources, such as filings with the Securities and Exchange Commission and operators' World Wide Web sites, or through contacts with the operators themselves. Some of this information may no longer be accurate due to mergers, acquisitions, and exchanges, some of which are noted. When available, the following information is provided for each license:

MSA/RSA Name: The market name for a license.
MSA/RSA Number: The market's number. Markets 1 through 306 are Metropolitan Statistical Areas ("MSAs"). Markets 308 through 724 are Rural Service Areas ("RSAs"). Market 307 is for the Gulf of Mexico.
Frequency Block: For each market, there are two 25 MHz licenses. They are referred to as A block (or non-wireline) and B block (or wireline).
Submarket: For various reasons, the licenses for some markets have been further subdivided (refered to as either Submarkets 1, 2, 3, etc. or A, B, C, etc).
As of Date: The date on which a license was owned by an operator. Unless the operator provided a specific "as of date," the date was assumed to be: the period for which a filing was made with the Securities and Exchange Commission, the date a World Wide Web site was visited, the date a list was provided by an operator, or the date an acquisition or exchange was completed.
% Owned: Percentage of license the operator claimed to control.
POPs: The population covered by license as reported by the operator. POPs reported by different operators can be for different time periods and from different sources. Multiple operators can report different POPs for the same license area.
Net POPs: Equals POPs multiplied by the percentage ownership.

AirTouch Communications

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Los Angeles-Long Beach/Anaheim-Santa Ana-Garden Grove/Riverside-San Bernardino-Ontario, CA	2	B	1	82.30%	12/31/98	15,116,000	12,440,468
Detroit/Ann Arbor, MI	5	A	1	100.00%	12/31/98	4,654,000	4,654,000
San Francisco-Oakland, CA	7	A	1	47.00%	12/31/98	3,989,000	1,874,830
Dallas-Forth Worth, TX	9	A	1	17.00%	6/30/98	4,610,000	783,700
Minneapolis-St. Paul, MN-WI	15	B	1	100.00%	12/31/98	2,703,000	2,703,000
Cleveland, OH	16	A	1	100.00%	12/31/98	1,829,000	1,829,000
Atlanta, GA	17	A	1	100.00%	12/31/98	3,405,000	3,405,000
San Diego, CA	18	B	1	100.00%	12/31/98	2,758,000	2,758,000
Denver-Boulder, CO	19	B	1	100.00%	12/31/98	2,219,000	2,219,000
Seattle-Everett, WA	20	B	1	99.13%	12/31/98	2,219,000	2,199,695
Cincinnati, OH-KY-IN	23	A	1	100.00%	12/31/98	1,535,000	1,535,000
Kansas City, MO-KS	24	A	1	50.00%	12/31/98	1,564,000	782,000
Phoenix, AZ	26	B	1	100.00%	12/31/98	2,693,000	2,693,000
San Jose, CA	27	A	1	47.00%	12/31/98	1,636,000	768,920
Portland, OR-WA	30	B	1	100.00%	12/31/98	1,701,000	1,701,000
Columbus, OH	31	A	1	100.00%	6/30/98	1,349,000	1,349,000
Sacramento, CA	35	B	1	49.88%	12/31/98	1,528,000	762,166
Salt Lake City-Ogden, UT	39	B	1	100.00%	6/30/98	1,305,000	1,305,000
Dayton, OH	40	A	1	100.00%	6/30/98	843,000	843,000
Toledo, OH-MI	48	A	1	100.00%	6/30/98	797,000	797,000
Akron, OH	52	A	1	100.00%	6/30/98	695,000	695,000
Grand Rapids, MI	64	A	1	100.00%	6/30/98	768,000	768,000
Omaha, NE-IA	65	A	1	93.75%	6/30/98	644,000	603,750
Flint, MI	68	A	1	100.00%	6/30/98	512,000	512,000
Oxnard-Simi Valley-Ventura, CA	73	B	1	82.30%	6/30/98	741,000	609,843
Fresno, CA	74	B	1	1.10%	6/30/98	800,000	8,800
Tuscon, AZ	77	B	1	100.00%	6/30/98	834,000	834,000
Lansing-East Lansing, MI	78	A	1	100.00%	6/30/98	505,000	505,000
Tacoma, WA	82	B	1	99.13%	6/30/98	680,000	674,084
Albuquerque, NM	86	B	1	100.00%	6/30/98	634,000	634,000
Canton, OH	87	A	1	100.00%	6/30/98	409,000	409,000
Wichita, KS	89	A	1	100.00%	6/30/98	481,000	481,000
Las Vegas, NV	93	B	1	27.79%	6/30/98	1,178,000	327,366
Saginaw-Bay City-Midland, MI	94	A	1	100.00%	6/30/98	402,000	402,000
Bakersfield, CA	97	B	1	1.10%	6/30/98	655,000	7,205
Des Moines, IA	102	B	1	76.00%	6/30/98	439,000	333,640
Stockton, CA	107	B	1	49.88%	6/30/98	556,000	277,333
Spokane, WA	109	B	1	100.00%	6/30/98	426,000	426,000
Vallejo-Fairfield-Napa, CA	111	A	1	50.00%	6/30/98	508,000	254,000
Colorado Springs, CO	117	B	1	100.00%	6/30/98	537,000	537,000

Santa Rosa-Petaluma, CA	123	A	1	40.18%	6/30/98	442,000	177,596
Santa Barbara-Santa Maria-Lompoc, CA	124	B	1	10.00%	6/30/98	401,000	40,100
Salinas-Seaside-Monterey, CA	126	A	1	42.96%	6/30/98	344,000	147,782
Eugene-Springfield, OR	135	B	1	100.00%	6/30/98	315,000	315,000
Lorain-Elyria, OH	136	A	1	100.00%	6/30/98	287,000	287,000
Duluth, MN-WI	141	B	1	83.66%	6/30/98	238,000	199,111
Modesto, CA	142	B	1	49.88%	6/30/98	437,000	217,976
Hamilton-Middletown, OH	145	A	1	99.60%	6/30/98	330,000	328,680
Salem, OR	148	B	1	100.00%	6/30/98	334,000	334,000
Visalia-Tulare-Porterville, CA	150	B	1	1.10%	6/30/98	373,000	4,103
Lima, OH	158	A	1	100.00%	6/30/98	221,000	221,000
Provo-Orem, UT	159	B	1	100.00%	6/30/98	327,000	327,000
Reno, NV	171	B	1	49.88%	6/30/98	319,000	159,117
Springfield, IL	176	B	1	12.65%	6/30/98	202,000	25,553
Topeka, KS	179	A	1	78.01%	6/30/98	203,000	158,360
Springfield, OH	180	A	1	89.23%	6/30/98	186,000	165,968
Muskegon, MI	181	A	1	79.41%	6/30/98	195,000	154,850
Boise City, ID	190	B	1	100.00%	6/30/98	281,000	281,000
Champaign-Urbana-Rantoul, IL	196	B	1	12.65%	6/30/98	157,000	19,861
Fort Collins-Loveland, CO	210	B	1	100.00%	6/30/98	241,000	241,000
Bremerton, WA	212	B	1	99.13%	6/30/98	242,000	239,895
Chico	215	B	1	49.88%	6/30/98	207,000	103,252
Fargo-Moorehead, ND-MN	221	B	1	100.00%	6/30/98	170,000	170,000
Decatur, IL	230	B	1	12.65%	6/30/98	113,000	14,295
Mansfield, OH	231	A	1	100.00%	6/30/98	129,000	129,000
Athens, GA	234	A	1	86.84%	6/30/98	179,000	155,444
Olympia, WA	242	B	1	100.00%	6/30/98	207,000	207,000
Greeley, CO	243	B	1	100.00%	6/30/98	160,000	160,000
Bloomington-Normal, IL	250	B	1	12.65%	6/30/98	145,000	18,343
Redding, CA	254	B	1	48.43%	6/30/98	169,000	81,847
Bellingham, WA	270	B	1	100.00%	6/30/98	161,000	161,000
Yuba City, CA	274	B	1	49.88%	6/30/98	147,000	73,324
St. Joseph, MO	275	A	1	43.50%	6/30/98	97,000	42,195
Grand Forks, ND-MN	276	B	1	100.00%	6/30/98	104,000	104,000
Casper, WY	299	B	1	100.00%	6/30/98	66,000	66,000
Lawrence, KS	301	A	1	50.00%	6/30/98	95,000	47,500
Arizona 1 - Mohave	318	B	1	33.33%	6/30/98	139,000	46,329
Arizona 2 - Coconino	319	B	1	100.00%	6/30/98	273,000	273,000
Arizona 3 - Navajo	320	B	1	100.00%	6/30/98	170,000	170,000
Arizona 4 - Yuma	321	B	1	100.00%	6/30/98	161,000	161,000
Arizona 6 - Graham	323	B	2	100.00%	6/30/98	209,000	209,000
California 1 - Del Norte	336	B	1	5.60%	6/30/98	216,000	12,096
California 2 - Modoc	337	B	1	25.00%	6/30/98	61,000	15,250
California 5 - San Luis Obispo	340	B	1	10.00%	6/30/98	238,000	23,800
California 8 - Tehama	343	B	1	49.88%	6/30/98	103,000	51,376
California 10 - Sierra	345	B	1	49.88%	6/30/98	96,000	47,885
Colorado 3 - Garfield	350	B	1	100.00%	6/30/98	303,000	303,000
Georgia 3 - Chattooga	373	A	1	100.00%	6/30/98	210,000	210,000
Georgia 4 - Jasper	374	A	1	100.00%	6/30/98	126,000	126,000
Idaho 1 - Boundary	388	B	1	75.00%	6/30/98	263,000	197,250
Idaho 2 - Idaho	389	B	1	50.00%	6/30/98	75,000	37,500
Idaho 3 - Lemhi	390	B	1	66.67%	6/30/98	18,000	12,001
Idaho 4 - Elmore	391	B	1	100.00%	6/30/98	155,000	155,000
Idaho 5 - Butte	392	B	2	100.00%	6/30/98	164,000	164,000
Illinois 2 - Bureau	395	B	3	2.53%	6/30/98	259,000	6,553
Illinois 4 - Adams	397	B	1	0.13%	6/30/98	218,000	283
Illinois 5 - Mason	398	B	2	12.65%	6/30/98	96,000	12,144
Illinois 6 - Montgomery	399	B	1	7.72%	6/30/98	203,000	15,672
Illinois 7 - Vermilion	400	B	1	7.72%	6/30/98	241,000	18,605
Iowa 1 - Mills	412	B	1	7.62%	6/30/98	64,000	4,877
Iowa 2 - Union	413	B	1	50.00%	6/30/98	49,000	24,500
Iowa 7 - Audubon	418	B	1	14.29%	6/30/98	55,000	7,860
Iowa 10 - Humbolt	421	B	1	27.46%	6/30/98	178,000	48,879
Minnesota 4 - Lake	485	B	1	100.00%	6/30/98	15,000	15,000
Nevada 2 - Lander	544	B	1	50.00%	6/30/98	55,000	27,500
Nevada 3 - Storey	545	B	1	49.88%	6/30/98	124,000	61,851
Nevada 4 - Mineral	546	B	1	50.00%	6/30/98	34,000	17,000
Nevada 5 - White Pine	547	B	1	100.00%	6/30/98	14,000	14,000
New Mexico 1 - San Juan	553	B	1	100.00%	6/30/98	265,000	265,000
New Mexico 4 - Santa Fe	556	B	2	100.00%	6/30/98	278,000	278,000
North Dakota 3 - Barnes	582	B	1	15.41%	6/30/98	91,000	14,023
Ohio 3 - Ashtabula	587	A	1	100.00%	6/30/98	104,000	104,000
Ohio 4 - Mercer	588	A	1	100.00%	6/30/98	230,000	230,000
Ohio 6 - Morrow	590	A	1	100.00%	6/30/98	466,000	466,000
Ohio 8 - Clinton	592	A	1	100.00%	6/30/98	182,000	182,000
Oregon 1 - Clatsop	606	B	1	100.00%	6/30/98	189,000	189,000
Oregon 4 - Lincoln	609	B	1	100.00%	6/30/98	233,000	233,000
Utah 1 - Box Elder	673	B	1	100.00%	6/30/98	125,000	125,000
Utah 2 - Morgan	674	B	1	66.67%	6/30/98	48,000	32,002
Washington 1 - Clallam	693	B	1	99.13%	6/30/98	282,000	279,547

Washington 2 - Okanogan	694	B	1	100.00%	6/30/98	135,000	135,000
Washington 3 - Ferry	695	B	1	100.00%	6/30/98	61,000	61,000
Washington 4 - Grays Harbor	696	B	1	37.50%	6/30/98	123,000	46,125
Wyoming 4 - Niobrara	721	B	1	100.00%	6/30/98	137,000	137,000
Wyoming 5 - Converse	722	B	1	100.00%	6/30/98	12,000	12,000

Aliant Communications

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Omaha, NE-IA	65	B	1	100.00%	1/1/99	634,489	634,489
Lincoln, NE	172	B	1	100.00%	12/31/98	231,114	231,114
Iowa 1 - Mills	412	B	1	9.20%	12/31/98	62,364	5,737
Nebraska 1 - Sioux	533	B	1	100.00%	12/31/98		
Nebraska 2 - Cherry	534	B	1	100.00%	12/31/98		
Nebraska 3 - Knox	535	B	1	100.00%	12/31/98		
Nebraska 4 - Grant	536	B	1	100.00%	12/31/98		
Nebraska 5 - Boone	537	B	1	100.00%	12/31/98		
Nebraska 6 - Keith	538	B	1	100.00%	12/31/98		
Nebraska 7 - Hall	539	B	1	100.00%	12/31/98		
Nebraska 8 - Chase	540	B	1	100.00%	12/31/98		
Nebraska 9 – Adams	541	B	1	100.00%	12/31/98		
Nebraska 10 – Cass	542	B	1	100.00%	12/31/98		

Notes: On December 18, 1998, Aliant Communications has announced its intention to merge with ALLTEL.

ALLTEL

MSA/RSA Name	MSA/RSA Number	Frequency Block	Sub Market	% Owned	As of Date	POPs	Net POPs
New York, NY-NJ/Nassau-Suffolk, NY/Newark, Jersey City and Paterson-Clifton-Passaic, NJ	1	B	1	10.0000%	12/31/98	15,104,441	1,510,444
Chicago, IL	3	B	1	5.0000%	12/31/98	7,603,156	380,158
Houston, TX	10	B	1	11.1100%	12/31/98	3,977,290	441,877
St. Louis, MO-IL	11	B	1	2.0000%	12/31/98	2,464,311	49,286
Pittsburgh, PA	13	B	1	1.9300%	12/31/98	2,088,938	40,317
Cleveland, OH	16	B	1	3.5000%	12/31/98	1,841,736	64,461
Cincinnati, OH-KY-IN	23	B	1	1.2016%	12/31/98	1,516,955	18,228
Kansas City, MO-KS	24	B	1	19.0000%	12/31/98	1,523,475	289,460
Columbus, OH	31	B	1	1.2016%	12/31/98	1,313,279	15,780
Hartford-New Britain-Bristol, CT	32	B	1	0.1485%	12/31/98	1,112,760	1,652
Rochester, NY	34	B	1	15.0000%	12/31/98	1,037,866	155,680
Dayton, OH	40	B	1	1.2016%	12/31/98	850,238	10,216
Bridgeport-Stamford-Norwalk-Danbury, CT	42	B	1	0.1485%	12/31/98	830,330	1,233
Norfolk-Virginia Beach-Portsmouth, VA/NC	43	A	1	100.0000%	12/31/98	1,048,228	1,048,228
Greensboro-Winston-Salem-High Point, NC	47	B	1	80.5817%	12/31/98	983,707	792,688
Toledo, OH-MI	48	B	1	85.1000%	12/31/98	653,698	556,297
New Haven-West Haven-Waterbury-Meriden, CT	49	B	1	0.1485%	12/31/98	791,830	1,176
Akron, OH	52	B	1	3.5000%	12/31/98	683,997	23,940
Syracuse, NY	53	B	1	45.0000%	12/31/98	673,310	302,990
Gary-Hammond-East Chicago, IN	54	B	1	5.0000%	12/31/98	625,006	31,250
Northeast Pennsylvania, PA	56	B	1	78.9800%	12/31/98	659,594	520,947
Allentown-Bethlehem-Easton, PA-NJ	58	B	1	20.7700%	12/31/98	714,126	148,324
Richmond, VA	59	A	1	50.0000%	Jan-99	802,859	401,430
Charlotte-Gastonia, NC	61	B	1	100.0000%	12/31/98	865,754	865,754
New Brunswick-Perth Amboy-Sayreville, NJ	62	B	1	10.0000%	12/31/98	701,446	70,145
Springfield-Chicopee-Holyoke, MA	63	B	1	0.1485%	12/31/98	591,653	879
Youngstown-Warren, OH	66	B	1	96.8630%	12/31/98	491,908	476,477
Greenville-Spartanburg, SC	67	B	1	89.1700%	12/31/98	686,113	611,807
Long Branch-Asbury Park, NJ	70	B	1	10.0000%	12/31/98	589,068	58,907
Raleigh-Durham, NC	71	B	1	92.0228%	12/31/98	827,723	761,694
Austin, TX	75	B	1	0.8200%	12/31/98	940,500	7,712
Harrisburg, PA	84	B	1	100.0000%	12/31/98	499,994	499,994
Johnson City-Kingsport-Bristol, TN-VA	85	B	1	100.0000%	12/31/98	386,589	386,589
Canton, OH	87	B	1	3.5000%	12/31/98	405,596	14,196
Chattanooga, TN-GA	88	B	1	8.1200%	12/31/98	454,735	36,924
Wichita, KS	89	B	1	40.0000%	12/31/98	481,811	192,724
Charleston-North Charleston, SC	90	B	1	75.0000%	12/31/98	526,281	394,711
Little Rock-North Little Rock, AR	92	B	1	64.0000%	12/31/98	547,406	350,340
Las Vegas, NV	93	B	1	72.2061%	12/31/98	1,018,224	735,220
Columbia, SC	95	B	1	53.6000%	12/31/98	497,046	266,417
Fort Wayne, IN	96	B	1	25.0000%	12/31/98	437,208	109,302
York, PA	99	B	1	100.0000%	12/31/98	450,097	450,097
Beaumont-Port Arthur, TX	101	B	1	11.1100%	12/31/98	376,781	41,860
Peoria, IL	103	B	1	100.0000%	12/31/98	344,465	344,465
Newport News-Hampton, VA	104	A	1	100.0000%	12/31/98	480,498	480,498
Lancaster, PA	105	B	1	100.0000%	12/31/98	449,868	449,868

Jackson, MS	106	B	1	26.7460%	12/31/98	418,523	111,938
Augusta, GA/SC	108	B	1	100.0000%	12/31/98	440,003	440,003
Huntington-Ashland, WV/KY/OH	110	B	1	100.0000%	12/31/98	317,680	317,680
Reading, PA	118	B	1	10.0000%	12/31/98	351,468	35,147
South Bend-Mishawaka, IN	129	B	1	100.0000%	12/31/98	303,760	303,760
Erie, PA	130	B	1	3.5000%	12/31/98	281,760	9,862
Lorain-Elyria, OH	136	B	1	3.5000%	12/31/98	282,160	9,876
Melbourne-Titusville-Palm Bay, FL	137	B	1	25.0000%	12/31/98	459,621	114,905
Montgomery, AL	139	B	1	100.0000%	12/31/98	319,623	319,623
Charleston, WV	140	B	1	100.0000%	12/31/98	256,504	256,504
Johnstown, PA	143	B	1	100.0000%	12/31/98	238,787	238,787
Daytona Beach, FL	146	B	1	25.0000%	12/31/98	413,373	103,343
Fayetteville, NC	149	B	1	92.0228%	12/31/98	291,322	268,083
New London-Norwich, CT	154	B	1	0.1485%	12/31/98	248,221	369
Savannah, GA	155	B	1	100.0000%	12/31/98	282,837	282,837
Lima, OH	158	B	1	85.1000%	12/31/98	221,480	188,479
Killeen-Temple, TX	160	B	1	100.0000%	12/31/98	300,940	300,940
Springfield, MO	163	B	1	100.0000%	12/31/98	272,218	272,218
Fort Smith, AK-OK	165	B	1	100.0000%	12/31/98	234,418	234,418
Hickory, NC	166	B	1	100.0000%	12/31/98	237,102	237,102
Tallahassee, FL	168	B	1	100.0000%	12/31/98	278,223	278,223
Galveston-Texas City, TX	170	B	1	11.1100%	12/31/98	241,736	26,857
Wheeling, WV-OH	178	B	1	100.0000%	12/31/98	157,197	157,197
Fayetteville-Springdale, AK	182	B	1	89.9000%	12/31/98	255,554	229,743
Gainesville, FL	192	B	1	100.0000%	12/31/98	220,689	220,689
Waco, TX	194	B	1	100.0000%	12/31/98	200,740	200,740
Cedar Rapids, IA	195	B	1	100.0000%	12/31/98	180,058	180,058
Steubenville-Weirton, OH-WV	199	B	1	100.0000%	12/31/98	139,291	139,291
Parkersburg-Marietta, OH-WV	200	B	1	100.0000%	12/31/98	158,115	158,115
Waterloo-Cedar Falls, IA	201	B	1	88.5417%	12/31/98	146,645	129,842
Lynchburg, VA	203	B	1	100.0000%	12/31/98	158,437	158,437
Longview-Marshall, TX	206	B	1	60.0000%	12/31/98	169,960	101,976
Wilmington, NC	218	B	1	100.0000%	12/31/98	202,394	202,394
Elkhart-Goshen, IN	223	B	1	100.0000%	12/31/98	167,253	167,253
Altoona, PA	225	B	1	100.0000%	12/31/98	132,079	132,079
Anderson, SC	227	B	1	89.1700%	12/31/98	155,628	138,773
Mansfield, OH	231	B	1	100.0000%	12/31/98	128,300	128,300
Petersburg-Colonial Heights-Hopewell, VA	235	A	1	79.0783%	12/31/98	136,960	108,306
Tyler, TX	237	B	1	60.0000%	12/31/98	162,194	97,316
Sharon, PA	238	B	1	96.8630%	12/31/98	122,370	118,531
Ocala, FL	245	B	1	100.0000%	12/31/98	229,539	229,539
Dothan, AL	246	B	1	100.0000%	4/1/99	133,618	133,618
Williamsport, PA	251	B	1	100.0000%	12/31/98	121,493	121,493
Charlottesville, VA	256	B	1	100.0000%	12/31/98	102,516	102,516
Jacksonville, NC	258	B	1	100.0000%	12/31/98	145,653	145,653
State College, PA	259	B	1	100.0000%	12/31/98	131,792	131,792
Albany, GA	261	B	1	100.0000%	12/31/98	118,751	118,751
Danville, VA	262	B	1	100.0000%	12/31/98	110,259	110,259
Florence, SC	264	B	1	53.6000%	12/31/98	123,586	66,242
Fort Walton Beach, FL	265	B	1	100.0000%	12/31/98	167,808	167,808
Kankakee, IL	273	B	1	5.0000%	12/31/98	103,307	5,165
St. Joseph, MO	275	B	1	49.0000%	12/31/98	98,084	48,061
Burlington, NC	280	B	1	92.0228%	12/31/98	115,453	106,243
Panama City, FL	283	B	1	100.0000%	12/31/98	145,363	145,363
Dubuque, IA	286	B	1	85.0000%	12/31/98	88,756	75,443
Iowa City, IA	296	B	1	100.0000%	12/31/98	101,682	101,682
Lawrence, KS	301	B	1	19.0000%	12/31/98	90,776	17,247
Aurora-Elgin, IL	303	B	1	5.0000%	12/31/98	46,062	2,303
Joliet, IL	304	B	1	5.0000%	12/31/98	35,562	1,778
Alabama 4 - Bibb	310	B	1	100.0000%	12/31/98	140,259	140,259
Alabama 5 - Cleburne	311	B	2	100.0000%	12/31/98	51,598	51,598
Alabama 6 - Washington	312	B	1	100.0000%	12/31/98	121,283	121,283
Alabama 7 - Butler	313	B	1	100.0000%	12/31/98	170,120	170,120
Alabama 8 - Lee	314	B	1	100.0000%	12/31/98	76,554	76,554
Arkansas 1 - Madison	324	B	1	51.0000%	12/31/98	35,882	18,300
Arkansas 1 - Madison	324	B	2	51.0000%	12/31/98	39,771	20,283
Arkansas 2 - Marion	325	B	2	51.0000%	12/31/98	7,508	3,829
Arkansas 4 - Clay	327	B	1	55.4500%	12/31/98	200,169	110,994
Arkansas 5 - Cross	328	B	1	55.4500%	12/31/98	118,707	65,823
Arkansas 6 - Cleburne	329	B	1	55.4500%	12/31/98	101,780	56,437
Arkansas 7 - Pope	330	B	1	55.4500%	12/31/98	114,094	63,265
Arkansas 8 - Franklin	331	B	1	51.0000%	12/31/98	68,337	34,852
Arkansas 9 – Polk	332	B	1	100.0000%	12/31/98	65,663	65,663
Arkansas 10 – Garland	333	B	1	55.4500%	12/31/98	157,561	87,368
California 2 – Modoc	337	B	1	25.0000%	12/31/98	58,937	14,734
Colorado 6 - San Miguel	353	A	1	100.0000%	3/31/99	71,851	71,851
Connecticut 1 – Litchfield	357	B	1	0.1485%	12/31/98	180,107	267
Connecticut 2 – Windham	358	B	1	0.1485%	12/31/98	104,079	155
Florida 4 – Citrus	363	B	2	25.0000%	12/31/98	182,132	45,533
Florida 4 – Citrus	363	B	3	100.0000%	12/31/98	34,001	34,001

Florida 5 – Putnam	364	B	1	25.0000%	12/31/98	41,775	10,444
Florida 5 – Putnam	364	B	2	100.0000%	12/31/98	70,046	70,046
Florida 6 – Dixie	365	B	1	100.0000%	12/31/98	54,691	54,691
Florida 7 – Hamilton	366	B	1	100.0000%	12/31/98	101,744	101,744
Florida 8 – Jefferson	367	B	2	100.0000%	12/31/98	5,899	5,899
Florida 8 – Jefferson	367	B	1	100.0000%	12/31/98	46,924	46,924
Florida 9 – Calhoun	368	B	1	100.0000%	12/31/98	40,388	40,388
Florida 10 – Walton	369	B	1	100.0000%	12/31/98	112,525	112,525
Georgia 1 – Whitfield	371	B	1	25.5400%	12/31/98	219,686	56,108
Georgia 2 – Dawson	372	B	1	38.7000%	12/31/98	153,232	59,301
Georgia 2 – Dawson	372	B	2	35.0000%	12/31/98	97,149	34,002
Georgia 4 – Jasper	374	B	3	35.0000%	12/31/98	63,512	22,229
Georgia 7 – Hancock	377	B	2	100.0000%	12/31/98	93,219	93,219
Georgia 8 – Warren	378	B	1	33.3300%	12/31/98	156,741	52,242
Georgia 9 – Marion	379	B	2	50.0000%	12/31/98	20,874	10,437
Georgia 9 – Marion	379	B	3	100.0000%	12/31/98	22,672	22,672
Georgia 10 – Bleckley	380	B	1	100.0000%	12/31/98	88,202	88,202
Georgia 10 – Bleckley	380	B	2	50.0000%	12/31/98	42,112	21,056
Georgia 11 – Toombs	381	B	1	100.0000%	12/31/98	152,942	152,942
Georgia 12 – Liberty	382	B	1	41.6600%	12/31/98	215,390	89,731
Georgia 13 – Early	383	B	1	100.0000%	12/31/98	146,111	146,111
Georgia 14 – Worth	384	B	1	50.0000%	12/31/98	247,291	123,646
Illinois 2 – Bureau	395	B	2	40.0000%	12/31/98	257,293	102,917
Illinois 3 – Mercer	396	B	1	18.1375%	12/31/98	203,087	36,835
Illinois 5 - Mason	398	B	1	100.0000%	12/31/98	47,717	47,717
Indiana 2 - Kosciusko	404	B	1	75.0000%	12/31/98	171,812	128,859
Indiana 3 - Huntington	405	B	1	20.0000%	12/31/98	146,081	29,216
Iowa 1 - Mills	412	B	1				
Iowa 5 - Jackson	416	B	1	7.1400%	12/31/98	8,349	596
Iowa 14 - Kossuth	425	B	1	5.5600%	12/31/98	107,028	5,951
Iowa 15 - Dickinson	426	B	1	6.6700%	12/31/98	83,766	5,587
Iowa 16 - Lyon	427	B	1	8.3300%	12/31/98	104,124	8,674
Massachusetts 1 - Franklin	470	B	1	0.1485%	12/31/98	70,685	105
Mississippi 3 - Bolivar	495	B	2	26.7460%	12/31/98	30,788	8,235
Mississippi 4 - Yalobusha	496	B	2	26.7460%	12/31/98	34,914	9,338
Mississippi 5 - Washington	497	B	2	26.7460%	12/31/98	49,553	13,253
Mississippi 6 - Montgomery	498	B	1	26.7460%	12/31/98	30,651	8,198
Mississippi 7 - Leake	499	B	1	26.7460%	12/31/98	179,227	47,936
Mississippi 8 - Claiborne	500	B	2	26.7460%	12/31/98	11,396	3,048
Mississippi 9 - Copiah	501	B	1	26.7460%	12/31/98	80,205	21,452
Mississippi 10 - Smith	502	B	2	26.7460%	12/31/98	50,139	13,410
Missouri 1 - Atchison	504	B	1	31.2200%	12/31/98	42,617	13,305
Missouri 2 - Harrison	505	B	1	50.0000%	12/31/98	34,132	17,066
Missouri 3 - Schuyler	506	B	1	100.0000%	12/31/98	55,377	55,377
Missouri 4 - De Kalb	507	B	1	47.5000%	12/31/98	69,073	32,810
Missouri 8 - Callaway	511	B	1	30.0000%	12/31/98	102,474	30,742
Missouri 9 - Bates	512	B	1	19.6000%	12/31/98	77,297	15,150
Missouri 9 - Bates	512	B	2	100.0000%	12/31/98	21,569	21,569
Missouri 10 - Benton	513	B	1	100.0000%	12/31/98	95,397	95,397
Missouri 13 - Washington	516	B	1	2.0000%	12/31/98	91,168	1,823
Missouri 14 - Barton	517	B	1	85.7000%	12/31/98	101,839	87,276
Missouri 15 - Stone	518	B	1	71.0000%	12/31/98	115,898	82,288
Missouri 16 - Laclede	519	B	1	100.0000%	12/31/98	96,830	96,830
Missouri 18 - Perry	521	B	1	2.0000%	12/31/98	118,497	2,370
Missouri 19 - Stoddard	522	B	1	2.0000%	12/31/98	199,276	3,986
Nevada 2 - Lander	544	B	1	50.0000%	12/31/98	51,005	25,503
Nevada 4 - Mineral	546	B	1	50.0000%	12/31/98	30,242	15,121
New Mexico 1 - San Juan	553	A	1	100.0000%	12/31/98	257,276	257,276
New Mexico 2 - Colfax	554	A	1	100.0000%	12/31/98	23,796	23,796
New Mexico 4 - Santa Fe	556	A	1	100.0000%	12/31/98	263,381	263,381
New Mexico 5 - Grant	557	A	1	100.0000%	12/31/98	59,226	59,226
North Carolina 2 - Yancey	566	B	2	100.0000%	12/31/98	74,023	74,023
North Carolina 4 - Henderson	568	B	2	50.0000%	12/31/98	57,607	28,804
North Carolina 4 - Henderson	568	B	3	100.0000%	12/31/98	89,982	89,982
North Carolina 5 - Anson	569	B	1	50.0000%	12/31/98	92,847	46,424
North Carolina 5 - Anson	569	B	2	100.0000%	12/31/98	35,403	35,403
North Carolina 6 - Chatham	570	B	1	100.0000%	12/31/98	157,106	157,106
North Carolina 7 - Rockingham	571	B	1	100.0000%	12/31/98	195,408	195,408
North Carolina 7 - Rockingham	571	B	2	100.0000%	12/31/98	88,022	88,022
North Carolina 8 - Northampton	572	B	1	100.0000%	12/31/98	287,499	287,499
North Carolina 9 - Camden	573	B	1	100.0000%	12/31/98	119,126	119,126
North Carolina 10 - Harnett	574	B	1	100.0000%	12/31/98	281,768	281,768
North Carolina 11 - Hoke	575	B	1	100.0000%	12/31/98	223,100	223,100
North Carolina 12 - Sampson	576	B	1	100.0000%	12/31/98	128,210	128,210
North Carolina 13 - Greene	577	B	1	100.0000%	12/31/98	239,785	239,785
North Carolina 14 - Pitt	578	B	1	100.0000%	12/31/98	240,647	240,647
North Carolina 15 - Cabarrus	579	B	1	100.0000%	12/31/98	133,724	133,724
North Carolina 15 - Cabarrus	579	B	2	50.0000%	12/31/98	285,316	142,658
Ohio 1 - Williams	585	B	1	100.0000%	12/31/98	127,464	127,464
Ohio 2 - Sandusky	586	B	1	67.4710%	12/31/98	206,475	139,311

Ohio 5 - Hancock	589	B	1	68.3491%	12/31/98	235,219	160,770
Ohio 6 - Morrow	590	B	1	82.4742%	12/31/98	450,273	371,359
Ohio 7 - Tuscarawas	591	B	2	100.0000%	12/31/98	254,938	254,938
Ohio 10 - Perry	594	B	2	100.0000%	12/31/98	174,251	174,251
Ohio 11 - Columbiana	595	B	1	100.0000%	12/31/98	112,518	112,518
Oklahoma 4 - Nowata	599	B	1	77.8800%	12/31/98	90,489	70,473
Pennsylvania 1 - Crawford	612	B	1	80.0000%	12/31/98	197,624	158,099
Pennsylvania 3 - Potter	614	B	1	100.0000%	12/31/98	96,845	96,845
Pennsylvania 3 - Potter	614	B	2	61.5300%	12/31/98	96,845	59,589
Pennsylvania 4 - Bradford	615	B	1	100.0000%	12/31/98	98,349	98,349
Pennsylvania 4 - Bradford	615	B	2	50.0000%	12/31/98	98,349	49,175
Pennsylvania 5 - Wayne	616	B	1	40.0000%	12/31/98	82,527	33,011
Pennsylvania 6 - Lawrence	617	B	1	57.1300%	12/31/98	379,808	216,984
Pennsylvania 8 - Union	619	B	1	100.0000%	12/31/98	406,342	406,342
Pennsylvania 10 - Bedford	621	B	1	100.0000%	12/31/98	142,030	142,030
Pennsylvania 11 – Huntingdon	622	B	1	100.0000%	12/31/98	21,776	21,776
Pennsylvania 12 – Lebanon	623	B	1	100.0000%	12/31/98	117,171	117,171
South Carolina 1 – Oconee	625	B	1	100.0000%	12/31/98	61,928	61,928
South Carolina 2 – Laurens	626	B	1	50.0000%	12/31/98	227,027	113,514
South Carolina 3 – Cherokee	627	B	1	50.0000%	12/31/98	134,070	67,035
South Carolina 4 – Chesterfield	628	B	1	50.0000%	12/31/98	212,463	106,232
South Carolina 5 – Georgetown	629	B	1	50.0000%	12/31/98	243,529	121,765
South Carolina 6 – Clarendon	630	B	1	50.0000%	12/31/98	195,183	97,592
South Carolina 7 – Calhoun	631	B	1	50.0000%	12/31/98	152,787	76,394
South Carolina 8 – Hampton	632	B	1	50.0000%	12/31/98	173,664	86,832
South Carolina 9 – Lancaster	633	B	1	50.0000%	12/31/98	201,482	100,741
Tennessee 4 – Hamblen	646	B	1	100.0000%	12/31/98	161,143	161,143
Tennessee 8 – Johnson	650	B	1	100.0000%	12/31/98	16,452	16,452
Texas 7 – Fanni	658	B	1	25.0000%	12/31/98	358,771	89,693
Texas 7 – Fanni	658	B	2	97.5000%	12/31/98	44,358	43,249
Texas 8 – Gaines	659	B	1	14.2860%	12/31/98	49,845	7,121
Texas 8 – Gaines	659	B	2	14.2860%	12/31/98	48,879	6,983
Texas 9 – Runnels	660	B	1	15.3800%	12/31/98	33,232	5,111
Texas 9 – Runnels	660	B	3	100.0000%	12/31/98	57,473	57,473
Texas 9 – Runnels	660	B	4	15.3800%	12/31/98	29,397	4,521
Texas 10 – Navarro	661	B	1	25.0000%	12/31/98	40,493	10,123
Texas 10 – Navarro	661	B	2	100.0000%	12/31/98	155,064	155,064
Texas 10 – Navarro	661	B	3	25.0000%	12/31/98	29,720	7,430
Texas 10 – Navarro	661	B	4	100.0000%	12/31/98	77,811	77,811
Texas 11 – Cherokee	662	B	1	18.0000%	12/31/98	173,226	31,181
Texas 11 – Cherokee	662	B	2	46.0000%	12/31/98	107,932	49,649
Texas 15 – Concho	666	B	1	100.0000%	12/31/98	90,377	90,377
Texas 16 – Burleson	667	B	1	9.6000%	12/31/98	322,312	30,942
Texas 17 – Newton	668	B	1	17.0210%	12/31/98	246,993	42,041
Utah 6 – Piute	678	B	1	20.0000%	12/31/98	27,914	5,583
Virginia 1 – Lee	681	B	1	100.0000%	12/31/98	145,678	145,678
Virginia 2 – Tazewell	682	B	1	71.2600%	12/31/98	136,224	97,073
Virginia 4 – Bedford	684	B	2	100.0000%	12/31/98	110,603	110,603
Virginia 6 – Highland	686	B	2	100.0000%	12/31/98	13,578	13,578
Virginia 7 – Buckingham	687	B	2	100.0000%	12/31/98	43,678	43,678
Virginia 8 – Amelia	688	A	1	100.0000%	12/31/98	83,244	83,244
Virginia 9 – Greensville	689	A	1	100.0000%	12/31/98	87,605	87,605
Virginia 10 – Frederick	690	B	2	33.0000%	12/31/98	233,327	76,998
Virginia 11 – Madison	691	B	2	100.0000%	12/31/98	42,970	42,970
West Virginia 6 – Lincoln	706	B	1	100.0000%	12/31/98	185,822	185,822

Note: On December 18, 1998, ALLTEL has announced its intention to merge with Aliant Communications.

Amercan Cellular

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Duluth, MN-WI	141	A	1	100.00%	12/31/98	238,000	238,000
Orange County, NY	144	A	1	100.00%	12/31/98	328,000	328,000
Poughkeepsie, NY	151	A	1	95.60%	12/31/98	273,000	260,988
Eau Claire, WI	232	A	1	96.00%	12/31/98	145,000	139,200
Wausau, WI	263	A	1	95.90%	12/31/98	124,000	118,916
Laredo, TX	281	B	1	44.50%	12/31/98	192,000	85,440
Illinois 4 - Adams	397	A	1	44.50%	12/31/98	218,000	97,010
Illinois 6 - Montgomery	399	A	1	44.50%	12/31/98	203,000	90,335
Kentucky 4 - Spencer	446	A	1	100.00%	12/31/98	259,000	259,000
Kentucky 5 - Barren	447	A	1	100.00%	12/31/98	161,000	161,000
Kentucky 6 - Madison	448	A	1	100.00%	12/31/98	270,000	270,000
Kentucky 8 - Mason	450	A	1	100.00%	12/31/98	120,000	120,000
Michigan 1 - Gogebic	472	A	1	100.00%	12/31/98	207,000	207,000
Minnesota 2 - Lake of the Woods	483	A	2	100.00%	12/31/98	39,000	39,000
Minnesota 3 - Koochiching	484	A	1	100.00%	12/31/98	61,000	61,000
Minnesota 4 - Lake	485	A	1	100.00%	12/31/98	15,000	15,000

Minnesota 5 - Wilkin	486	A	1	100.00%	12/31/98	209,000	209,000
Minnesota 6 - Hubbard	487	A	1	100.00%	12/31/98	233,000	233,000
New York 5 - Otsego	563	A	1	100.00%	12/31/98	376,000	376,000
New York 6 - Columbia	564	A	1	100.00%	12/31/98	113,000	113,000
Ohio 7 - Tuscarawas	591	A	1	100.00%	12/31/98	260,000	260,000
Ohio 10 - Perry	594	A	1	100.00%	12/31/98	64,000	64,000
Pennsylvania 9 - Greene	620	A	1	100.00%	12/31/98	187,000	187,000
Tennessee 4 - Hamblen	646	A	1	100.00%	12/31/98	274,000	274,000
West Virginia 2 - Wetzel	702	A	1	100.00%	12/31/98	79,000	79,000
West Virginia 3 - Monongalia	703	A	1	100.00%	12/31/98	272,000	272,000
Wisconsin 1 - Burnett	708	A	1	100.00%	12/31/98	114,000	114,000
Wisconsin 2 - Bayfield	709	A	1	100.00%	12/31/98	87,000	87,000
Wisconsin 3 - Vilas	710	A	1	100.00%	12/31/98	146,000	146,000
Wisconsin 4 - Marinette	711	A	1	100.00%	12/31/98	122,000	122,000
Wisconsin 5 - Pierce	712	A	1	100.00%	12/31/98	83,000	83,000
Wisconsin 6 - Trempealeau	713	A	2	100.00%	12/31/98	33,000	33,000

Ameritech

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Chicago, IL	3	B	1	95.00%	12/31/98	7,737,000	7,350,150
Detroit/Ann Arbor, MI	5	B	1	95.42%	12/31/98	4,654,000	4,440,986
St. Louis, MO-IL	11	A	1	85.00%	12/31/98	2,505,000	2,129,250
Milwaukee, WI	21	B	1	79.08%	12/31/98	1,462,000	1,156,077
Cincinnati, OH-KY-IN	23	B	1	52.79%	12/31/98	1,535,000	810,373
Columbus, OH	31	B	1	52.79%	12/31/98	1,349,000	712,178
Dayton, OH	40	B	1	52.79%	12/31/98	843,000	445,045
Gary-Hammond-East Chicago, IN	54	B	1	95.00%	12/31/98	628,000	596,600
Flint, MI	68	B	1	95.42%	12/31/98	512,000	488,566
Madison, WI	113	B	1	64.68%	12/31/98	412,000	266,486
Hamilton-Middletown, OH	145	B	1	52.79%	12/31/98	330,000	174,217
Springfield, IL	176	B	1	60.00%	12/31/98	202,000	121,200
Springfield, OH	180	B	1	52.79%	12/31/98	186,000	98,195
Racine, WI	189	B	1	79.08%	12/31/98	187,000	147,870
Champaign-Urbana-Rantoul, IL	196	B	1	60.00%	12/31/98	157,000	94,200
Janesville-Beloit, WI	216	B	1	64.68%	12/31/98	151,000	97,668
Decatur, IL	230	B	1	60.00%	12/31/98	113,000	67,800
Kenosha, WI	244	B	1	79.08%	12/31/98	146,000	115,450
Bloomington-Normal, IL	250	B	1	60.00%	12/31/98	145,000	87,000
Kankakee, IL	273	B	1	95.00%	12/31/98	105,000	99,750
Sheboygan, WI	277	B	1	79.08%	12/31/98	111,000	87,773
Columbia, MO	278	A	1	100.00%	12/31/98	131,000	131,000
Aurora-Elgin, IL	303	B	1	95.00%	12/31/98	51,000	48,450
Joliet, IL	304	B	1	95.00%	12/31/98	37,000	35,150
Hawaii 1 - Kauai	385	A	1	100.00%	12/31/98	58,000	58,000
Illinois 2 - Bureau	395	B	3	31.80%	12/31/98	258,000	82,044
Illinois 5 - Mason	398	B	2	60.00%	12/31/98	97,000	58,200
Illinois 6 - Montgomery	399	B	1	36.82%	12/31/98	202,000	74,368
Illinois 7 - Vermilion	400	B	1	36.82%	12/31/98	240,000	88,358
Indiana 1 - Newton	403	B	2	95.00%	12/31/98	58,000	55,100
Kentucky 7 - Trimble	449	B	2	52.79%	12/31/98	178,000	93,972
Missouri 7 - Saline	510	A	1	100.00%	12/31/98	173,000	173,000
Missouri 8 - Callaway	511	A	1	100.00%	12/31/98	107,000	107,000
Missouri 10 - Benton	513	A	1	100.00%	12/31/98	104,000	104,000
Missouri 12 - Maries	515	A	1	100.00%	12/31/98	121,000	121,000
Missouri 18 - Perry	521	A	1	100.00%	12/31/98	122,000	122,000
Missouri 19 - Stoddard	522	A	1	100.00%	12/31/98	201,000	201,000
Ohio 4 - Mercer	588	B	1	52.79%	12/31/98	230,000	121,424
Ohio 7 - Tuscarawas	591	B	1	52.79%	12/31/98	91,000	48,042
Ohio 8 - Clinton	592	B	1	52.79%	12/31/98	182,000	96,083
Ohio 10 - Perry	594	B	1	52.79%	12/31/98	51,000	26,924
Wisconsin 9 - Columbia	716	B	1	71.88%	12/31/98	132,000	94,879
Wisconsin 9 - Columbia	716	B	2	71.88%	12/31/98	132,000	94,879

Note: Ameritech has announced its intention to merge with SBC Communications.

AT&T

MSA/RSA Name	MSA/RSA Number	Frequency Block	Submarket	Percentage	As of Date	POPs	Net POPs
New York, NY-NJ/Nassau-Suffolk, NY/Newark, Jersey City and Paterson-Clifton-Passaic, NJ	1	A	1	98.33%	4/13/98	15,127,968	14,875,331
Los Angeles-Long Beach/Anaheim-Santa Ana-Garden	2	A	1	50.00%	4/13/98	15,144,272	7,572,136

Grove/Riverside-San Bernardino-Ontario, CA							
San Francisco-Oakland, CA	7	A	1	50.00%	4/13/98	3,947,398	1,973,699
Dallas-Forth Worth, TX	9	A	1	83.01%	4/13/98	4,472,988	3,713,027
Houston, TX	10	A	1	85.00%	4/13/98	4,055,538	3,447,207
St. Louis, MO-IL	11	A	1	15.00%	4/13/98		
Miami-Fort Lauderdale-Hollywood, FL	12	A	1	100.00%	4/13/98	3,628,484	3,628,484
Pittsburgh, PA	13	A	1	82.15%	4/13/98	2,086,082	1,713,716
Minneapolis-St. Paul, MN-WI	15	A	1	100.00%	4/13/98	2,661,422	2,661,422
Denver-Boulder, CO	19	A	1	100.00%	4/13/98	2,176,569	2,176,569
Seattle-Everett, WA	20	A	1	100.00%	4/13/98	2,861,282	2,861,282
Tampa-St. Petersburg, FL	22	A	1	100.00%	4/13/98	2,080,532	2,080,532
Kansas City, MO-KS	24	A	1	50.00%	4/13/98	1,539,305	769,653
Buffalo, NY	25	A	1	25.00%	4/13/98		
San Jose, CA	27	A	1	50.00%	4/13/98	1,610,673	805,337
Portland, OR-WA	30	A	1	100.00%	4/13/98	1,652,397	1,652,397
San Antonio, TX	33	A	1	100.00%	4/13/98	1,483,755	1,483,755
Sacramento, CA	35	A	1	100.00%	4/13/98	1,494,384	1,494,384
Salt Lake City-Ogden, UT	39	A	1	100.00%	4/13/98	1,276,327	1,276,327
Oklahoma City, OK	45	A	1	100.00%	4/13/98	1,007,677	1,007,677
Jacksonville, FL	51	A	1	100.00%	4/13/98	1,029,590	1,029,590
Northeast Pennsylvania, PA	56	A	1	100.00%	12/31/98	653,817	653,817
Tulsa, OK	57	A	1	100.00%	4/13/98	798,851	798,851
Allentown-Bethlehem-Easton, PA-NJ	58	A	1	100.00%	12/31/98	713,438	713,438
Orlando, FL	60	A	1	100.00%	4/13/98	1,252,484	1,252,484
West Palm Beach-Boca Raton, FL	72	A	1	100.00%	4/13/98	1,011,309	1,011,309
Oxnard-Simi Valley-Ventura, CA	73	A	1	100.00%	4/13/98	730,935	730,935
Fresno, CA	74	A	1	100.00%	4/13/98	772,867	772,867
Austin, TX	75	A	1	100.00%	4/13/98	967,099	967,099
Tacoma, WA	82	A	1	100.00%	4/13/98	Part of Seattle	
Harrisburg, PA	84	A	1	100.00%	12/31/98	499,402	499,402
Las Vegas, NV	93	A	1	100.00%	4/13/98	1,064,941	1,064,941
Columbia, SC	95	A	1	2.63%	4/13/98	485,000	12,756
York, PA	99	A	1	100.00%	12/31/98	456,861	456,861
Shreveport, Louisiana	100	A	1	100.00%	4/13/98	379,247	379,247
Lancaster, PA	105	A	1	100.00%	12/31/98	453,348	453,348
Stockton, CA	107	A	1	100.00%	4/13/98	544,075	544,075
Spokane, WA	109	A	1	94.12%	4/13/98	416,774	392,268
Huntington-Ashland, WV/KY/OH	110	A	1	100.00%	12/31/98	316,929	316,929
Vallejo-Fairfield-Napa, CA	111	A	1	50.00%	4/13/98	502,304	251,152
Lakeland-Winter Haven, FL	114	A	1	100.00%	4/13/98	443,966	443,966
Colorado Springs, CO	117	A	1	100.00%	4/13/98	508,412	508,412
Reading, PA	118	A	1	100.00%	12/31/98	353,650	353,650
Binghamton, NY	122	A	1	100.00%	12/31/98	293,703	293,703
Santa Rosa-Petaluma, CA	123	A	1	50.18%	4/13/98	426,564	214,050
Santa Barbara-Santa Maria-Lompoc, CA	124	A	1	89.19%	4/13/98	390,160	347,984
Salinas-Seaside-Monterey, CA	126	A	1	52.36%	4/13/98	351,640	184,119
Eugene-Springfield, OR	135	A	1	100.00%	4/13/98	308,960	308,960
Melbourne-Titusville-Palm Bay, FL	137	A	1	93.69%	4/13/98	469,103	439,503
Charleston, WV	140	A	1	100.00%	12/31/98	254,889	254,889
Modesto, CA	142	A	1	100.00%	4/13/98	429,438	429,438
Johnstown, PA	143	A	1	100.00%	4/13/98	238,214	238,214
Daytona Beach, FL	146	A	1	100.00%	4/13/98	419,894	419,894
Salem, OR	148	A	1	94.94%	4/13/98	323,642	307,266
Visalia-Tulare-Porterville, CA	150	A	1	95.00%	4/13/98	364,952	346,704
Portland, ME	152	A	1	100.00%	12/31/98	288,136	288,136
Portsmouth-Dover-Rochester, NH-ME	156	A	1	100.00%	12/31/98	280,193	280,193
Provo-Orem, UT	159	A	1	93.47%	4/13/98	308,807	288,642
Killeen-Temple, TX	160	A	1	100.00%	4/13/98	308,640	308,640
Springfield, MO	163	A	1	100.00%	4/13/98	277,329	277,329
Sarasota, FL	167	A	1	92.03%	4/13/98	300,801	276,827
Galveston-Texas City, TX	170	A	1	8.25%	4/13/98	245,748	20,274
Reno, NV	171	A	1	91.75%	4/13/98	301,242	276,390
Wheeling, WV-OH	178	A	1	95.32%	4/13/98	156,633	149,303
Topeka, KS	179	A	1	10.49%	4/13/98	202,000	21,190
Muskegon, MI	181	A	1	7.91%	4/13/98	186,000	14,713
Anchorage, AK	187	A	1	89.44%	4/13/98	269,385	240,938
Boise City, ID	190	A	1	91.99%	4/13/98	267,646	246,208
Yakima, WA	191	A	1	93.58%	4/13/98	219,706	205,601
Waco, TX	194	A	1	100.00%	4/13/98	202,704	202,704
St. Cloud, MN	198	A	1	71.79%	4/13/98	217,255	155,967
Steubenville-Weirton, OH-WV	199	A	1	100.00%	4/13/98	138,605	138,605
Parkersburg-Marietta, OH-WV	200	A	1	100.00%	12/31/98	157,364	157,364
Longview-Marshall, TX	206	A	1	100.00%	4/13/98	171,167	171,167
Fort Pierce, FL	208	A	1	100.00%	4/13/98	293,833	293,833
Fort Collins-Loveland, CO	210	A	1	91.74%	4/13/98	229,480	210,525
Bradenton, FL	211	A	1	93.52%	4/13/98	233,592	218,455
Bremerton, WA	212	A	1	97.53%	4/13/98	237,146	231,288
Pittsfield, MA	213	A	1	22.41%	4/13/98	136,000	30,478
Richland-Kennewick-Pasco, WA	214	A	1	100.00%	4/13/98	185,835	185,835
Chico	215	A	1	100.00%	4/13/98	198,881	198,881

Monroe, LA	219	A	1	100.00%	4/13/98	148,701	148,701
Altoona, PA	225	A	1	100.00%	12/31/98	131,287	131,287
Anderson, SC	227	A	1	7.00%	4/13/98		
Medford, OR	229	A	1	92.23%	4/13/98	172,554	159,147
Wichita Falls, TX	233	A	1	98.99%	4/13/98	135,516	134,147
Athens, GA	234	A	1	7.14%	4/13/98	174,000	12,424
Tyler, TX	237	A	1	97.00%	4/13/98	446,853	433,447
Joplin, MO	239	A	1	100.00%	4/13/98	146,143	146,143
Texarkana, TX - Texarkana, AR	240	A	1	89.71%	4/13/98	137,437	123,295
Olympia, WA	242	A	1	93.16%	4/13/98	203,177	189,280
Greeley, CO	243	A	1	90.62%	4/13/98	152,271	137,988
Ocala, FL	245	A	1	90.46%	4/13/98	235,121	212,690
Williamsport, PA	251	A	1	100.00%	12/31/98	118,681	118,681
Redding, CA	254	A	1	92.87%	4/13/98	167,120	155,204
State College, PA	259	A	1	100.00%	12/31/98	131,962	131,962
Lawton, OK	260	A	1	100.00%	4/13/98	120,911	120,911
Bellingham, WA	270	A	1	92.78%	4/13/98	156,184	144,908
Yuba City, CA	274	A	1	96.01%	4/13/98	144,226	138,471
St. Joseph, MO	275	A	1	47.50%	4/13/98	98,093	46,594
Elmira, NY	284	A	1	100.00%	12/31/98	92,820	92,820
Las Cruces, NM	285	A	1	15.92%	4/13/98	156,000	24,835
Bryan-College Station, TX	287	A	1	100.00%	4/13/98	135,791	135,791
Rochester, MN	288	A	1	86.32%	4/13/98	116,384	100,463
Sherman-Denison, TX	292	A	1	100.00%	4/13/98	98,783	98,783
Lawrence, KS	301	A	1	50.00%	4/13/98	92,266	46,133
Alaska 2 - Bethel	316	A	1	100.00%	4/13/98	160,805	160,805
California 3 - Alpine	338	A	1	100.00%	4/13/98	147,005	147,005
California 8 - Tehama	343	A	1	100.00%	4/13/98	99,782	99,782
California 12 - Kings	347	A	1	100.00%	4/13/98	117,010	117,010
Colorado 3 - Garfield	350	A	1	100.00%	4/13/98	287,867	287,867
Connecticut 1 - Litchfield	357	A	1	100.00%	4/13/98	181,002	181,002
Florida 2 - Glades	361	A	2	100.00%	4/13/98	129,572	129,572
Florida 4 - Citrus	363	A	1	85.00%	4/13/98	457,379	388,772
Florida 5 - Putnam	364	A	2	100.00%	4/13/98	43,911	43,911
Hawaii 2 - Maui	386	A	1	100.00%	4/13/98	120,233	120,233
Idaho 4 - Elmore	391	A	1	100.00%	4/13/98	146,783	146,783
Louisiana 1 - Claiborne	454	A	1	25.00%	4/13/98		
Louisiana 2 - Morehouse	455	A	A	100.00%	4/13/98	24,122	24,122
Louisiana 3 - De Soto	456	A	2	100.00%	4/13/98	34,769	34,769
Maine 4 - Washington	466	A	1	100.00%	12/31/98	86,052	86,052
Minnesota 6 - Hubbard	487	A	2	100.00%	4/13/98	39,265	39,265
Missouri 14 - Barton	517	A	1	100.00%	4/13/98	103,186	103,186
Nevada 3 - Storey	545	A	1	100.00%	4/13/98	114,489	114,489
New Jersey 1 - Hunterdon	550	A	1	100.00%	4/13/98	119,793	119,793
Ohio 9 - Ross	593	A	1	100.00%	12/31/98	248,993	248,993
Ohio 10 - Perry	594	A	2	100.00%	12/31/98	112,256	112,256
Oklahoma 3 - Grant	598	A	1	100.00%	4/13/98	206,616	206,616
Oklahoma 5 - Roger Mills	600	A	1	100.00%	4/13/98	59,108	59,108
Oregon 1 - Clatsop	606	A	1	83.30%	1999		
Oregon 2 - Hood River	607	A	1	89.72%	4/13/98	101,353	90,934
Pennsylvania 5 - Wayne	616	A	1	100.00%	12/31/98	84,292	84,292
Pennsylvania 8 - Union	619	A	1	100.00%	12/31/98	408,709	408,709
Pennsylvania 10 - Bedford	621	A	2	100.00%	12/31/98	141,875	141,875
Pennsylvania 11 - Huntingdon	622	A	1	100.00%	12/31/98	113,933	113,933
Pennsylvania 12 - Lebanon	623	A		100.00%	12/31/98	117,361	117,361
Texas 6 - Jack	657	A	1	100.00%	4/13/98	81,670	81,670
Texas 11 - Cherokee	662	A	1	97.00%	4/13/98	Part of MSA 237	
Texas 17 - Newton	668	A	1	100.00%	4/13/98	251,096	251,096
Utah 1 - Box Elder	673	A	1	100.00%	4/13/98	121,080	121,080
Washington 1 - Clallam	693	A	1	100.00%	4/13/98	274,984	274,984
Washington 5 - Kittitas	697	A	1	100.00%	4/13/98	124,561	124,561
Washington 6 - Pacific	698	A	1	100.00%	4/13/98	184,079	184,079
Washington 7 - Skamania	699	A	1	89.72%	4/13/98	Part of RSA 699	
West Virginia 1 - Mason	701	A	1	100.00%	12/31/98	77,008	77,008
West Virginia 6 - Lincoln	706	A	1	100.00%	12/31/98	182,128	182,128

Bell Atlantic

MSA/RSA Name	MSA/RSA Number	Frequency Block	Submarket	Percentage	As of Date	POPs	Net POPs
New York, NY-NJ/Nassau-Suffolk, NY/Newark, Jersey City and Paterson-Clifton-Passaic, NJ	1	B	1	90.00%	12/31/98	15,071,691	13,564,522
Philadelphia, PA	4	B	1	100.00%	12/31/98	4,898,782	4,898,782
Boston-Lowell-Brockton-Lawrence-Haverhill, MA-NH	6	B	1	100.00%	12/31/98	4,020,940	4,020,940
Washington, DC-MD-VA	8	B	1	64.73%	12/31/98	3,828,917	2,478,458
Pittsburgh, PA	13	B	1	92.80%	12/31/98	2,109,397	1,957,520
Baltimore, MD	14	B	1	100.00%	12/31/98	2,430,902	2,430,902
Buffalo, NY	25	B	1	100.00%	12/31/98	1,200,575	1,200,575
Phoenix, AZ	26	A	1	100.00%	12/31/98	2,299,070	2,299,070
Hartford-New Britain-Bristol, CT	32	A	1	100.00%	12/31/98	1,120,611	1,120,611
Rochester, NY	34	B	1	85.00%	12/31/98	1,036,870	881,340
Providence-Warwick-Pawtucket, RI	38	B	1	100.00%	12/31/98	913,054	913,054
Bridgeport-Stamford-Norwalk-Danbury, CT	42	A	1	100.00%	12/31/98	830,029	830,029
Albany-Schenectady-Troy, NY	44	B	1	100.00%	12/31/98	850,116	850,116
New Haven-West Haven-Waterbury-Meriden, CT	49	A	1	100.00%	12/31/98	799,201	799,201
Syracuse, NY	53	B	1	55.00%	12/31/98	679,244	373,584
Worchester-Fitchburg-Leominster, MA	55	B	1	100.00%	12/31/98	713,060	713,060
Northeast Pennsylvania, PA	56	B	1	4.99%	12/31/98	658,055	32,837
Allentown-Bethlehem-Easton, PA-NJ	58	B	1	53.11%	12/31/98	711,153	377,693
Charlotte-Gastonia, NC	61	A	1	100.00%	12/31/98	835,117	835,117
New Brunswick-Perth Amboy-Sayreville, NJ	62	B	1	90.00%	12/31/98	696,418	626,776
Springfield-Chicopee-Holyoke, MA	63	A	1	100.00%	12/31/98	600,868	600,868
Greenville-Spartanburg, SC	67	A	1	100.00%	12/31/98	671,390	671,390
Wilmington, DE-NJ-MD	69	B	1	100.00%	12/31/98	606,553	606,553
Long Branch-Asbury Park, NJ	70	B	1	90.00%	12/31/98	577,631	519,868
New Bedford-Fall River, MA	76	B	1	100.00%	12/31/98	509,950	509,950
Tuscon, AZ	77	A	1	100.00%	12/31/98	715,020	715,020
El Paso, TX	81	A	1	100.00%	12/31/98	659,135	659,135
Albuquerque, NM	86	A	1	100.00%	12/31/98	589,617	589,617
Columbia, SC	95	A	1	97.37%	12/31/98	484,530	471,787
Utica-Rome, NY	115	B	1	100.00%	12/31/98	320,456	320,456
Reading, PA	118	B	1	100.00%	12/31/98	348,587	348,587
Trenton, NJ	121	B	1	100.00%	12/31/98	330,145	330,145
Binghamton, NY	122	B	1	65.00%	12/31/98	309,066	200,893
Manchester-Nashua, NH	133	B	1	100.00%	12/31/98	345,844	345,844
Atlantic City, NJ	134	B	1	100.00%	12/31/98	332,964	332,964
Orange County, NY	144	B	1	70.00%	12/31/98	323,402	226,381
Poughkeepsie, NY	151	B	1	70.00%	12/31/98	266,165	186,316
Portland, ME	152	B	1	33.00%	12/31/98	279,318	92,175
New London-Norwich, CT	154	A	1	100.00%	12/31/98	243,199	243,199
Hickory, NC	166	A	1	100.00%	12/31/98	232,598	232,598
Asheville, NC	183	A	1	100.00%	12/31/98	202,480	202,480
Pittsfield, MA	213	A	1	70.92%	12/31/98	135,708	96,244
Anderson, SC	227	A	1	97.00%	12/31/98	150,183	145,678
Vineland-Millville-Bridgeton, NJ	228	B	1	100.00%	12/31/98	139,258	139,258
Burlington, VT	248	B	1	100.00%	12/31/98	142,144	142,144
Glens Falls, NY	266	B	1	100.00%	12/31/98	126,116	126,116
Lewiston-Auburn, ME	279	B	1	33.33%	12/31/98	102,593	34,194
Elmira, NY	284	B	1	100.00%	12/31/98	95,467	95,467
Las Cruces, NM	285	A	1	76.28%	12/31/98	155,980	118,982
Arizona 2 - Coconino	319	A	1	100.00%	12/31/98	232,920	232,920
Arizona 5 - Gila	322	A	1	100.00%	12/31/98	169,958	169,958
Connecticut 2 - Windham	358	A	1	100.00%	12/31/98	103,675	103,675
Delaware 1 - Kent	359	B	1	100.00%	12/31/98	244,170	244,170
Georgia 2 - Dawson	372	A	1	100.00%	12/31/98	274,665	274,665
Maryland 2 - Kent	468	B	1	100.00%	12/31/98	429,336	429,336
Maryland 3 - Frederick	469	B	1	100.00%	12/31/98	166,690	166,690
Massachusetts 2 - Barnstable	471	B	1	100.00%	12/31/98	210,782	210,782
New Hampshire 2 - Carroll	549	B	1	100.00%	12/31/98	207,522	207,522
New Jersey 1 - Hunterdon	550	B	1	100.00%	12/31/98	115,526	115,526
New Jersey 2 - Ocean	551	B	1	100.00%	12/31/98	443,631	443,631
New Jersey 3 - Sussex	552	B	1	100.00%	12/31/98	138,169	138,169
New York 1 - Jefferson	559	B	1	40.00%	12/31/98	259,667	103,867
New York 2 - Franklin	560	B	1	42.90%	12/31/98	232,884	99,907
New York 3 - Chautauqua	561	B	1	45.00%	12/31/98	488,231	219,704
New York 4 - Yates	562	B	1	77.00%	12/31/98	358,656	276,165
New York 5 - Otsego	563	B	1	100.00%	12/31/98	386,986	386,986
New York 6 - Columbia	564	B	1	33.33%	12/31/98	110,993	36,994
North Carolina 1 - Cherokee	565	A	1	100.00%	12/31/98	175,760	175,760
North Carolina 2 - Yancey	566	A	1	100.00%	12/31/98	157,357	157,357
North Carolina 4 - Henderson	568	A	1	100.00%	12/31/98	328,239	328,239
North Carolina 5 - Anson	569	A	1	100.00%	12/31/98	127,304	127,304
Pennsylvania 2 - McKean	613	B	1	100.00%	12/31/98	88,731	88,731
Pennsylvania 3 - Potter	614	B	2	38.46%	12/31/98	59,023	22,700

Pennsylvania 4 - Bradford	615	B	2	50.00%	12/31/98	68,417	34,209
Pennsylvania 6 - Lawrence	617	B	2	51.13%	12/31/98	158,835	81,212
Pennsylvania 7 - Jefferson	618	B	1	100.00%	12/31/98	216,539	216,539
Pennsylvania 9 - Greene	620	B	1	100.00%	12/31/98	186,732	186,732
Pennsylvania 11 - Huntingdon	622	B	2	100.00%	12/31/98	90,612	90,612
Rhode Island 1 - Newport	624	B	1	100.00%	12/31/98	86,308	86,308
South Carolina 1 - Oconee	625	A	1	100.00%	12/31/98	60,008	60,008
South Carolina 2 - Laurens	626	A	1	100.00%	12/31/98	222,802	222,802
South Carolina 3 - Cherokee	627	A	1	100.00%	12/31/98	132,126	132,126
South Carolina 8 - Hampton	632	A	1	100.00%	12/31/98	166,689	166,689
South Carolina 9 - Lancaster	633	A	1	100.00%	12/31/98	196,915	196,915
Vermont 1 - Franklin	679	B	1	100.00%	12/31/98	207,380	207,380
Vermont 2 - Addison	680	B	1	100.00%	12/31/98	123,738	123,738
Virginia 1 - Lee	681	A	1	100.00%	12/31/98	147,303	147,303
Virginia 2 - Tazewell	682	B	1	4.99%	12/31/98	135,926	6,783
Virginia 10 - Frederick	690	B	1	64.73%	12/31/98	51,091	33,071
Virginia 11 - Madison	691	B	3	64.73%	12/31/98	69,561	45,027
Virginia 12 - Caroline	692	B	2	64.73%	12/31/98	70,451	45,603
West Virginia 1 - Mason	701	B	1	100.00%	12/31/98	74,235	74,235
West Virginia 2 - Wetzel	702	B	1	100.00%	12/31/98	78,651	78,651

Note: Bell Atlantic has announced its intention to merge with GTE.

BellSouth

MSA/RSA Name	MSA/RSA Number	Frequency Block	Submarket	Percentage	As of Date	POPs	Net POPs
Los Angeles-Long Beach/Anaheim-Santa Ana-Garden Grove/Riverside-San Bernardino-Ontario, CA	2	A	1	44.39%	12/31/98	14,766,508	6,554,853
Houston, TX	10	A	1	44.39%	12/31/98	3,919,171	1,739,720
Miami-Fort Lauderdale-Hollywood, FL	12	B	1	100.00%	12/31/98	3,451,832	3,451,832
Pittsburgh, PA	13	B	1	3.60%	12/31/98	2,093,893	75,380
Atlanta, GA	17	B	1	100.00%	12/31/98	3,111,400	3,111,400
Indianapolis, IN	28	A	1	100.00%	12/31/98	1,347,064	1,347,064
New Orleans, LA	29	B	1	100.00%	12/31/98	1,180,852	1,180,852
Memphis, TN-AR-MS	36	B	1	93.86%	12/31/98	1,040,653	976,757
Louisville, KY-IN	37	B	1	100.00%	12/31/98	933,817	933,817
Birmingham, AL	41	B	1	100.00%	12/31/98	908,231	908,231
Nashville-Davidson, TN	46	B	1	100.00%	12/31/98	1,090,914	1,090,914
Honolulu, HI	50	A	1	100.00%	12/31/98	879,935	879,935
Jacksonville, FL	51	B	1	85.76%	12/31/98	1,013,136	868,865
Gary-Hammond-East Chicago, IN	54	A	1	33.33%	12/31/98	624,435	208,124
Richmond, VA	59	A	1	49.90%	Jan-99	800,217	399,308
Orlando, FL	60	B	1	75.46%	12/31/98	1,213,893	916,004
West Palm Beach-Boca Raton, FL	72	B	1	100.00%	12/31/98	973,453	973,453
Baton Rouge, LA	80	B	1	100.00%	12/31/98	565,377	565,377
Mobile, AL	83	A	1	98.68%	12/31/98	520,267	513,399
Chattanooga, TN-GA	88	B	1	62.70%	12/31/98	452,330	283,611
Columbia, SC	95	B	1	46.42%	12/31/98	490,535	227,706
Bakersfield, CA	97	A	1	100.00%	12/31/98	616,649	616,649
Shreveport, Louisiana	100	B	1	9.00%	12/31/98	379,525	34,157
Jackson, MS	106	B	1	73.26%	12/31/98	416,072	304,814
Lexington-Fayette, KY	116	B	1	100.00%	12/31/98	373,639	373,639
Evansville, IN/KY	119	A	1	100.00%	12/31/98	413,018	413,018
Huntsville, AL	120	B	1	100.00%	12/31/98	399,660	399,660
Melbourne-Titusville-Palm Bay, FL	137	B	1	75.46%	12/31/98	454,028	342,610
Macon-Warner Robins, GA	138	B	1	100.00%	12/31/98	311,666	311,666
Daytona Beach, FL	146	B	1	75.46%	12/31/98	409,706	309,164
Galveston-Texas City, TX	170	A	1	38.77%	12/31/98	238,669	92,532
Lafayette, LA	174	B	1	51.00%	12/31/98	225,660	115,087
Terre Haute, IN	185	A	1	92.85%	12/31/98	169,996	157,841
Clarksville-Hopkinsville, TN/KY	209	B	1	100.00%	12/31/98	191,450	191,450
Anderson, IN	217	A	1	100.00%	12/31/98	133,357	133,357
Monroe, LA	219	B	1	9.00%	12/31/98	147,395	13,266
Tuscaloosa, AL	222	B	1	100.00%	12/31/98	158,936	158,936
Florence, AL	226	B	1	100.00%	12/31/98	136,816	136,816
Athens, GA	234	B	1	100.00%	12/31/98	168,719	168,719
Muncie, IN	236	A	1	93.10%	12/31/98	119,906	111,632
Lafayette, IN	247	A	1	100.00%	12/31/98	136,256	136,256
Anniston, AL	249	B	1	100.00%	12/31/98	117,434	117,434
Florence, SC	264	B	1	46.42%	12/31/98	122,979	57,087
Kokomo, IN	271	A	1	9.04%	12/31/98	99,933	9,034
Gadsden, AL	272	B	1	100.00%	12/31/98	100,691	100,691
Bloomington, IN	282	A	1	94.18%	12/31/98	115,207	108,502
Owensboro, KY	293	A	1	100.00%	12/31/98	90,844	90,844
Alabama 1 - Franklin	307	B	1	100.00%	12/31/98	55,130	55,130
Alabama 1 - Franklin	307	B	2	80.00%	12/31/98	53,152	42,522
Alabama 1 - Franklin	307	B	5	100.00%	12/31/98	63,040	63,040

Alabama 2 - Jackson	308	B	1	100.00%	12/31/98	25,249	25,249
Alabama 3 - Lamar	309	B	1	100.00%	12/31/98	97,841	97,841
Alabama 5 - Cleburne	311	B	1	100.00%	12/31/98	123,370	123,370
Alabama 6 - Washington	312	A	1	100.00%	12/31/98	120,839	120,839
Florida 1 - Collier	360	B	2	100.00%	12/31/98	30,503	30,503
Florida 2 - Glades	361	B	2	71.50%	12/31/98	128,685	92,010
Florida 2 - Glades	361	B	3	100.00%	12/31/98	8,152	8,152
Florida 4 - Citrus	363	B	2	75.46%	12/31/98	177,430	133,889
Florida 5 - Putnam	364	B	1	75.46%	12/31/98	33,734	25,456
Florida 5 - Putnam	364	B	3	85.76%	12/31/98	38,240	32,795
Florida 11 - Monroe	370	B	1	100.00%	12/31/98	83,152	83,152
Georgia 1 - Whitfield	371	B	1	74.46%	12/31/98	216,855	161,470
Georgia 2 - Dawson	372	B	1	61.23%	12/31/98	148,548	90,956
Georgia 2 - Dawson	372	B	2	35.00%	12/31/98	100,370	35,130
Georgia 2 - Dawson	372	B	3	100.00%	12/31/98	33,337	33,337
Georgia 3 - Chattooga	373	B	1	75.00%	12/31/98	204,631	153,473
Georgia 4 - Jasper	374	B	1	100.00%	12/31/98	60,717	60,717
Georgia 4 - Jasper	374	B	3	35.00%	12/31/98	41,161	14,406
Georgia 5 - Haralson	375	B	1	100.00%	12/31/98	106,045	106,045
Georgia 6 - Spalding	376	B	4	100.00%	12/31/98	13,910	13,910
Georgia 6 - Spalding	376	B	5	100.00%	12/31/98	77,383	77,383
Georgia 7 - Hancock	377	B	1	100.00%	12/31/98	51,030	51,030
Indiana 5 - Warren	407	A	1	100.00%	12/31/98	121,577	121,577
Indiana 7 - Owen	409	A	1	100.00%	12/31/98	224,480	224,480
Indiana 9 - Decatur	411	A	1	100.00%	12/31/98	145,042	145,042
Kentucky 1 - Fulton	443	A	1	100.00%	12/31/98	189,322	189,322
Kentucky 2 - Union	444	A	1	100.00%	12/31/98	128,548	128,548
Kentucky 3 - Meade	445	A	1	100.00%	12/31/98	333,075	333,075
Kentucky 6 - Madison	448	B	2	100.00%	12/31/98	139,956	139,956
Kentucky 7 - Trimble	449	B	1	100.00%	12/31/98	57,693	57,693
Kentucky 7 - Trimble	449	B	3	100.00%	12/31/98	75,139	75,139
Kentucky 8 - Mason	450	B	1	100.00%	12/31/98	118,733	118,733
Kentucky 9 - Elliott	451	A	1	100.00%	12/31/98	204,050	204,050
Kentucky 10 - Powell	452	A	1	100.00%	12/31/98	153,883	153,883
Kentucky 11 - Clay	453	A	1	100.00%	12/31/98	170,670	170,670
Louisiana 1 - Claiborne	454	B	1	9.00%	12/31/98	114,680	10,321
Louisiana 2 - Morehouse	455	B	1	9.00%	12/31/98	116,255	10,463
Louisiana 3 - De Soto	456	B	2	9.00%	12/31/98	90,417	8,138
Louisiana 5 - Beauregard	458	B	2	35.00%	12/31/98	273,836	95,843
Louisiana 6 - Iberville	459	B	1	35.00%	12/31/98	151,018	52,856
Louisiana 6 - Iberville	459	B	2	51.00%	12/31/98	31,441	16,035
Louisiana 7 - West Feliciana	460	B	1	66.70%	12/31/98	179,528	119,745
Louisiana 8 - St. James	461	B	1	50.00%	12/31/98	110,979	55,490
Louisiana 9 - Plaquemines	462	B	1	100.00%	12/31/98	257,713	257,713
Mississippi 1 - Tunica	493	B	1	93.87%	12/31/98	62,176	58,365
Mississippi 2 - Benton	494	B	1	100.00%	12/31/98	242,751	242,751
Mississippi 3 - Bolivar	495	B	2	73.26%	12/31/98	30,704	22,494
Mississippi 4 - Yalobusha	496	B	1	100.00%	12/31/98	71,079	71,079
Mississippi 4 - Yalobusha	496	B	2	73.26%	12/31/98	34,314	25,138
Mississippi 5 - Washington	497	B	2	73.26%	12/31/98	47,590	34,864
Mississippi 6 - Montgomery	498	B	1	73.26%	12/31/98	31,342	22,961
Mississippi 7 - Leake	499	B	1	73.26%	12/31/98	178,303	130,625
Mississippi 8 - Claiborne	500	B	2	73.26%	12/31/98	11,467	8,401
Mississippi 9 - Copiah	501	B	1	73.26%	12/31/98	79,574	58,296
Mississippi 10 - Smith	502	B	2	73.26%	12/31/98	50,097	36,701
Tennessee 1 - Lake	643	B	1	93.87%	12/31/98	85,915	80,648
Tennessee 1 - Lake	643	B	4	100.00%	12/31/98	48,353	48,353
Tennessee 5 - Fayette	647	B	1	93.87%	12/31/98	165,324	155,190
Tennessee 5 - Fayette	647	B	2	100.00%	12/31/98	86,499	86,499
Tennessee 5 - Fayette	647	B	3	100.00%	12/31/98	87,137	87,137
Tennessee 6 - Giles	648	B	1	100.00%	12/31/98	159,041	159,041
Tennessee 7 - Bledsoe	649	B	1	100.00%	12/31/98	97,137	97,137
Tennessee 7 - Bledsoe	649	B	2	100.00%	12/31/98	10,447	10,447
Tennessee 9 - Maury	651	B	1	100.00%	12/31/98	66,205	66,205

Cellular Communications of Puerto Rico

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
San Juan-Caguas, PR	91	A	1	100.00%	12/31/98	2,124,891	2,124,891
Ponce, PR	147	A	1	100.00%	12/31/98	261,585	261,585
Mayaguez, PR	169	A	1	100.00%	12/31/98	227,941	227,941
Arecibo, PR	202	A	1	100.00%	12/31/98	195,843	195,843
Aguadilla, PR	204	A	1	99.01%	12/31/98	180,687	178,898
Puerto Rico 1 - Rincon	723	A	1	100.00%	12/31/98	13,726	13,726
Puerto Rico 2 - Adjuntas	724	A	1	100.00%	12/31/98	276,517	276,517
Puerto Rico 3 - Ciales	725	A	1	100.00%	12/31/98	126,052	126,052
Puerto Rico 4 - Aibonito	726	A	1	100.00%	12/31/98	295,140	295,140
Puerto Rico 6 - Vieques	728	A	1	100.00%	12/31/98	8,975	8,975

Puerto Rico 7 - Culebra	729	A	1	100.00%	12/31/98	1,598	1,598
Virgin Islands 1 - St.Thomas Island	730	A	1	100.00%	12/31/98	51,670	51,670
Virgin Islands 2 - St. Croix Island	731	A	1	100.00%	12/31/98	50,139	50,139

Note: Cellular Communications of Puerto Rico has announced its intention to merge with SBC Communications.

Centennial Cellular

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
San Francisco-Oakland, CA	7	B	1	2.87%	7/31/98	3,686,600	105,805
San Jose, CA	27	B	1	2.87%	7/31/98	1,497,600	42,981
Sacramento, CA	35	B	1	23.47%	7/31/98	1,355,100	318,042
Fort Wayne, IN	96	A	1	100.00%	7/31/98	420,900	420,900
Beaumont-Port Arthur, TX	101	A	1	100.00%	7/31/98	361,200	361,200
Stockton, CA	107	B	1	23.47%	7/31/98	480,600	112,797
Vallejo-Fairfield-Napa, CA	111	B	1	2.87%	7/31/98	451,200	12,949
Santa Rosa-Petaluma, CA	123	B	1	2.87%	7/31/98	388,200	11,141
Salinas-Seaside-Monterey, CA	126	B	1	2.87%	7/31/98	355,700	10,209
South Bend-Mishawaka, IN	129	A	1	100.00%	7/31/98	289,200	289,200
Kalamazoo, MI	132	A	1	100.00%	7/31/98	293,500	293,500
Modesto, CA	142	B	1	23.47%	7/31/98	370,600	86,980
Reno, NV	171	B	1	23.47%	7/31/98	254,700	59,778
Lafayette, LA	174	A	1	94.50%	7/31/98	209,000	197,505
Santa Cruz, CA	175	B	1	2.87%	7/31/98	229,700	6,592
Battle Creek, MI	177	A	1	100.00%	7/31/98	186,000	186,000
Benton Harbor, MI	193	A	1	100.00%	7/31/98	161,400	161,400
Lake Charles, LA	197	A	1	25.10%	7/31/98	168,100	42,193
Alexandria, LA	205	A	1	93.20%	7/31/98	149,000	138,868
Jackson, MI	207	A	1	92.00%	7/31/98	149,800	137,816
Chico	215	B	1	23.47%	7/31/98	182,100	42,739
Elkhart-Goshen, IN	223	A	1	91.70%	7/31/98	156,200	143,235
Redding, CA	254	B	1	23.47%	7/31/98	147,000	34,501
Yuba City, CA	274	B	1	23.47%	7/31/98	122,600	28,774
Arizona 4 - Yuma	321	A	1	100.00%	7/31/98	120,700	120,700
California 1 - Del Norte	336	B	1	6.88%	7/31/98	199,200	13,705
California 2 - Modoc	337	B	1	25.00%	7/31/98	57,000	14,250
California 7 - Imperial	342	A	1	100.00%	7/31/98	109,300	109,300
California 8 - Tehama	343	B	1	23.47%	7/31/98	90,700	21,287
California 10 - Sierra	345	B	1	23.47%	7/31/98	81,800	19,198
Indiana 1 - Newton	403	A	1	100.00%	7/31/98	204,200	204,200
Indiana 2 - Kosciusko	404	A	1	100.00%	7/31/98	160,000	160,000
Indiana 3 - Huntington	405	A	1	100.00%	7/31/98	145,200	145,200
Indiana 4 - Miami	406	A	1	100.00%	7/31/98	179,000	179,000
Indiana 6 - Randolph	408	A	1	100.00%	7/31/98	217,900	217,900
Louisiana 2 - Morehouse	455	A	1	100.00%	7/31/98	92,200	92,200
Louisiana 3 - De Soto	456	A	1	100.00%	7/31/98	121,300	121,300
Louisiana 4 - Caldwell	457	A	1	100.00%	7/31/98	71,600	71,600
Louisiana 5 - Beauregard	458	A	1	100.00%	7/31/98	372,500	372,500
Louisiana 6 - Iberville	459	A	1	100.00%	7/31/98	131,000	131,000
Louisiana 7 - West Feliciana	460	A	1	100.00%	7/31/98	170,900	170,900
Michigan 6 - Roscommon	477	A	1	100.00%	7/31/98	130,400	130,400
Michigan 7 - Newaygo	478	A	1	100.00%	7/31/98	220,200	220,200
Michigan 9 - Cass	480	A	1	85.70%	7/31/98	288,000	246,816
Mississippi 8 - Claiborne	500	A	1	100.00%	7/31/98	153,900	153,900
Mississippi 9 - Copiah	501	A	1	100.00%	7/31/98	118,000	118,000
Nevada 3 - Storey	545	B	1	23.47%	7/31/98	90,600	21,264
Ohio 1 - Williams	585	A	1	100.00%	7/31/98	125,900	125,900
Pennsylvania 6 - Lawrence	617	B	1	14.29%	7/31/98	363,400	51,930

Century Telephone Enterprises

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Detroit/Ann Arbor, MI	5	B	1	3.20%	12/31/98	4,761,992	152,384
Dallas-Forth Worth, TX	9	B	1	0.50%	12/31/98	4,630,120	23,151
Milwaukee, WI	21	B	1	17.96%	12/31/98	1,972,973	354,346
Grand Rapids, MI	64	B	1	97.00%	12/31/98	770,152	747,047
Flint, MI	68	B	1	3.20%	12/31/98	511,788	16,377
Austin, TX	75	B	1	35.00%	12/31/98	1,016,912	355,919
Lansing-East Lansing, MI	78	B	1	97.00%	12/31/98	512,390	497,018
Little Rock-North Little Rock, AR	92	B	1	36.00%	12/31/98	555,272	199,898
Saginaw-Bay City-Midland, MI	94	B	1	91.70%	12/31/98	404,426	370,859
Shreveport, Louisiana	100	B	1	87.00%	12/31/98	379,370	330,052
Jackson, MS	106	A	1	89.58%	12/31/98	426,583	382,133
Madison, WI	113	B	1	9.78%	12/31/98	702,398	68,695

Appleton-Oskosh-Neenah, WI	125	B	1	98.85%	12/31/98	500,164	494,412
McAllen-Edinburg-Mission, TX	128	A	1	69.50%	12/31/98	525,734	365,385
Kalamazoo, MI	132	B	1	97.00%	12/31/98	308,144	298,900
Brownsville-Harlingen, TX	162	A	1	78.74%	12/31/98	329,824	259,703
Biloxi-Gulfport, MS	173	A	1	96.45%	12/31/98	232,431	224,180
Lafayette, LA	174	B	1	49.00%	12/31/98	262,964	128,852
Battle Creek, MI	177	B	1	97.00%	12/31/98	195,400	189,538
Muskegon, MI	181	B	1	97.00%	12/31/98	191,712	185,961
Benton Harbor, MI	193	B	1	97.00%	12/31/98	161,753	156,900
Alexandria, LA	205	B	1	100.00%	12/31/98	143,311	143,311
Jackson, MI	207	B	1	97.00%	12/31/98	156,316	151,627
Monroe, LA	219	B	1	87.00%	12/31/98	147,570	128,386
Eau Claire, WI	232	B	1	55.50%	12/31/98	143,664	79,734
Texarkana, TX - Texarkana, AR	240	B	1	89.00%	12/31/98	137,764	122,610
Pascagoula, MS	252	A	1	89.22%	12/31/98	130,979	116,859
Rochester, MN	288	B	1	2.93%	12/31/98	113,844	3,336
La Crosse, WI	290	B	1	95.00%	12/31/98	102,768	97,630
Pine Bluff, AK	291	B	1	100.00%	12/31/98	81,588	81,588
Sherman-Denison, TX	292	B	1	0.50%	12/31/98	102,618	513
Alaska 1 - Wade Hampton	315	A	1	100.00%	12/31/98	85,056	85,056
Alaska 3 - Haines	317	B	1	100.00%	12/31/98	74,712	74,712
Arkansas 2 - Marion	325	B	1	82.00%	12/31/98	87,646	71,870
Arkansas 3 - Sharp	326	B	1	82.00%	12/31/98	103,724	85,054
Arkansas 11 - Hempstead	334	B	1	89.00%	12/31/98	66,228	58,943
Arkansas 12 - Ouachita	335	B	1	80.00%	12/31/98	185,325	148,260
Louisiana 1 - Claiborne	454	B	1	87.00%	12/31/98	112,083	97,512
Louisiana 2 - Morehouse	455	B	1	87.00%	12/31/98	115,624	100,593
Louisiana 3 - De Soto	456	B	2	87.00%	12/31/98	96,231	83,721
Louisiana 4 - Caldwell	457	B	1	100.00%	12/31/98	72,615	72,615
Michigan 1 - Gogebic	472	B	1	100.00%	12/31/98	196,408	196,408
Michigan 2 - Alger	473	B	1	100.00%	12/31/98	113,772	113,772
Michigan 3 - Emmet	474	B	1	42.84%	12/31/98	164,586	70,509
Michigan 4 - Cheboygan	475	B	1	100.00%	12/31/98	135,657	135,657
Michigan 5 - Manistee	476	B	1	42.84%	12/31/98	161,584	69,223
Michigan 6 - Roscommon	477	B	1	98.00%	12/31/98	142,356	139,509
Michigan 7 - Newaygo	478	B	1	56.07%	12/31/98	244,148	136,894
Michigan 8 - Allegan	479	B	1	97.00%	12/31/98	101,746	98,694
Michigan 9 - Cass	480	B	1	43.38%	12/31/98	301,227	130,672
Michigan 10 - Tuscola	481	B	1	26.00%	12/31/98	137,398	35,723
Minnesota 7 - Chippewa	488	B	1	2.93%	12/31/98	172,206	5,046
Minnesota 8 - Lac qui Parle	489	B	1	2.93%	12/31/98	67,467	1,977
Minnesota 9 - Pipestone	490	B	1	2.93%	12/31/98	134,073	3,928
Minnesota 10 - Le Sueur	491	B	1	2.93%	12/31/98	230,077	6,741
Minnesota 11 - Goodhue	492	B	1	2.93%	12/31/98	205,949	6,034
Mississippi 2 - Benton	494	A	1	100.00%	12/31/98	249,231	249,231
Mississippi 5 - Washington	497	A	1	-	12/31/98	159,176	
Mississippi 6 - Montgomery	498	A	1	100.00%	12/31/98	183,177	183,177
Mississippi 7 - Leake	499	A	1	100.00%	12/31/98	181,661	181,661
Texas 7 - Fanni	658	B	6	89.00%	12/31/98	58,013	51,632
Texas 16 - Burleson	667	B	1	9.60%	12/31/98	334,056	32,069
Washington 5 - Kittitas	697	B	1	8.47%	12/31/98	60,311	5,108
Washington 8 - Whitman	700	B	1	7.36%	12/31/98	137,237	10,101
Wisconsin 1 - Burnett	708	B	1	42.21%	12/31/98	112,351	47,423
Wisconsin 2 - Bayfield	709	B	1	99.00%	12/31/98	86,024	85,164
Wisconsin 3 - Vilas	710	B	1	42.86%	12/31/98	142,332	61,003
Wisconsin 4 - Marinette	711	B	1	25.00%	12/31/98	119,763	29,941
Wisconsin 5 - Pierce	712	B	1	-	12/31/98	95,903	
Wisconsin 6 - Trempealeau	713	B	1	57.14%	12/31/98	116,145	66,365
Wisconsin 7 - Wood	714	B	1	22.70%	12/31/98	291,168	66,095
Wisconsin 8 - Vernon	715	B	1	84.00%	12/31/98	236,525	198,681
Wisconsin 10 - Door	717	B	1	22.50%	12/31/98	129,404	29,116

CFW Communications

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Virginia 5 - Bath	685	B	1	22.00%	12/31/98		
Virginia 6 - Highland	686	B	1	84.00%	12/31/98	200,000	168,000

Comcast

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Philadelphia, PA	4	A	1	100.00%	12/31/98	4,886,800	4,886,800
New Brunswick-Perth Amboy-Sayreville, NJ	62	A	1	100.00%	12/31/98	708,600	708,600
Wilmington, DE-NJ-MD	69	A	1	100.00%	12/31/98	626,400	626,400
Long Branch-Asbury Park, NJ	70	A	1	100.00%	12/31/98	597,900	597,900

Trenton, NJ	121	A	1	87.20%	12/31/98	289,000	252,008
Atlantic City, NJ	134	A	1	97.40%	12/31/98	326,800	318,303
Vineland-Millville-Bridgeton, NJ	228	A	1	94.60%	12/31/98	133,500	126,291
Aurora-Elgin, IL	303	A	1	83.40%	12/31/98	39,700	33,110
Joliet, IL	304	A	1	85.30%	12/31/98	30,500	26,017
Delaware 1 - Kent	359	A	1	50.00%	12/31/98	262,000	131,000
New Jersey 2 - Ocean	551	A	1	100.00%	12/31/98	494,000	494,000

Note: Comcast has announced it intention to sell its cellular operations to SBC Communications.

CommNet Cellular

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Duluth, MN-WI	141	B	1	16.34%	2/10/99	240,234	39,254
Portland, ME	152	B	1	11.11%	2/10/99	284,147	31,569
Terre Haute, IN	185	B	1	16.67%	2/10/99	170,755	28,465
Pueblo, CO	241	B	1	73.99%	2/10/99	133,797	98,996
Sioux City, IA-NE	253	B	1	74.50%	2/10/99	136,731	101,865
Sioux Falls, SD	267	B	1	100.00%	2/10/99	142,073	142,073
Billings, MT	268	B	1	91.63%	2/10/99	129,371	118,543
Lewiston-Auburn, ME	279	B	1	11.11%	2/10/99	103,721	11,523
Rapid City, SD	289	B	1	100.00%	2/10/99	110,926	110,926
Great Falls, MT	297	B	1	91.63%	2/10/99	82,324	75,433
Bismarck, ND	298	B	1	51.00%	2/10/99	91,892	46,865
Colorado 1 - Moffat	348	A	1	100.00%	2/10/99	48,029	48,029
Colorado 2 - Logan	349	B	1	61.75%	2/10/99	66,939	41,335
Colorado 4 - Park	351	B	1	61.75%	2/10/99	78,325	48,366
Colorado 5 - Elbert	352	B	1	66.00%	2/10/99	36,101	23,827
Colorado 6 - San Miguel	353	B	1	100.00%	2/10/99	76,122	76,122
Colorado 7 - Saguache	354	B	1	69.40%	2/10/99	49,823	34,577
Colorado 8 - Kiowa	355	B	1	49.00%	2/10/99	46,379	22,726
Colorado 9 - Costilla	356	B	1	49.00%	2/10/99	25,782	12,633
Idaho 2 - Idaho	389	B	1	50.00%	2/10/99	71,284	35,642
Idaho 3 - Lemhi	390	B	1	33.33%	2/10/99	17,602	5,867
Idaho 5 - Butte	392	B	1	100.00%	2/10/99	144,672	144,672
Idaho 6 - Clark	393	B	1	91.64%	2/10/99	300,443	275,326
Iowa 4 - Muscatine	415	B	1	10.11%	2/10/99	155,178	15,688
Iowa 5 - Jackson	416	B	1	78.57%	2/10/99	109,023	85,659
Iowa 6 - Iowa	417	B	1	100.00%	2/10/99	156,442	156,442
Iowa 8 - Monona	419	B	1	44.92%	2/10/99	54,811	24,621
Iowa 9 - Ida	420	A	1	100.00%	2/10/99	63,038	63,038
Iowa 13 - Mitchell	424	B	1	50.00%	2/10/99	66,643	33,322
Iowa 14 - Kossuth	425	B	1	13.28%	2/10/99	110,868	14,723
Iowa 15 - Dickinson	426	B	1	49.14%	2/10/99	83,090	40,830
Iowa 16 - Lyon	427	B	1	49.17%	2/10/99	102,942	50,617
Kansas 1 - Cheyenne	428	B	1	4.11%	2/10/99	27,741	1,140
Kansas 2 - Norton	429	B	1	4.11%	2/10/99	30,523	1,254
Kansas 3 - Jewell	430	B	1	4.11%	2/10/99	53,026	2,179
Kansas 4 - Marshall	431	B	1	4.11%	2/10/99	137,928	5,669
Kansas 5 - Brown	432	B	1	4.11%	2/10/99	32,861	1,351
Kansas 6 - Wallace	433	B	1	4.11%	2/10/99	20,123	827
Kansas 7 - Trego	434	B	1	4.11%	2/10/99	80,524	3,310
Kansas 8 - Ellsworth	435	B	1	4.11%	2/10/99	131,254	5,395
Kansas 9 - Morris	436	B	1	4.11%	2/10/99	58,858	2,419
Kansas 10 - Franklin	437	B	1	4.11%	2/10/99	109,008	4,480
Kansas 11 - Hamilton	438	B	1	4.11%	2/10/99	84,143	3,458
Kansas 12 - Hodgeman	439	B	1	4.11%	2/10/99	43,831	1,801
Kansas 13 - Edwards	440	B	1	4.11%	2/10/99	29,677	1,220
Kansas 14 - Reno	441	B	1	4.11%	2/10/99	175,260	7,203
Kansas 15 - Elk	442	A	1	4.11%	2/10/99	155,007	6,371
Missouri 9 - Bates	512	B	1	14.70%	2/10/99	35,343	5,195
Montana 1 - Lincoln	523	B	1	91.63%	2/10/99	66,810	61,218
Montana 1 - Lincoln	523	B	2	91.63%	2/10/99	82,182	75,303
Montana 2 - Toole	524	B	1	91.63%	2/10/99	32,203	29,508
Montana 4 - Daniels	526	B	1	91.63%	2/10/99	9,897	9,069
Montana 5 - Mineral	527	B	1	91.63%	2/10/99	197,567	181,031
Montana 6 - Deer Lodge	528	B	1	91.63%	2/10/99	65,707	60,207
Montana 7 - Fergus	529	B	1	91.63%	2/10/99	23,502	21,535
Montana 8 - Beaverhead	530	B	1	91.63%	2/10/99	91,862	84,173
Montana 9 - Carbon	531	B	1	91.63%	2/10/99	35,676	32,690
Montana 10 - Prairie	532	B	1	91.63%	2/10/99	13,526	12,394
New Mexico 1 - San Juan	553	B	2	58.36%	2/10/99	117,311	68,463
New Mexico 3 - Catron	555	B	1	12.25%	2/10/99	89,939	11,018
New Mexico 5 - Grant	557	B	1	16.33%	2/10/99	59,835	9,771
North Dakota 1 - Divide	580	B	1	53.36%	2/10/99	105,910	56,514
North Dakota 2 - Bottineau	581	B	1	65.06%	2/10/99	59,961	39,011
North Dakota 3 - Barnes	582	B	1	41.45%	2/10/99	90,709	37,599

North Dakota 4 - McKenzie	583	B	1	49.00%	2/10/99	58,607	28,717
North Dakota 5 - Kidder	584	B	1	61.75%	2/10/99	46,240	28,553
South Dakota 1 - Harding	634	B	1	100.00%	2/10/99	33,484	33,484
South Dakota 2 - Corson	635	B	1	100.00%	2/10/99	18,830	18,830
South Dakota 3 - McPherson	636	B	1	100.00%	2/10/99	53,417	53,417
South Dakota 5 - Custer	638	B	1	100.00%	2/10/99	17,205	17,205
South Dakota 5 - Custer	638	B	2	100.00%	2/10/99	15,882	15,882
South Dakota 6 - Haakon	639	B	1	100.00%	2/10/99	46,573	46,573
South Dakota 6 - Haakon	639	B	2	100.00%	2/10/99	1,511	1,511
South Dakota 7 - Sully	640	B	1	88.16%	2/10/99	60,553	53,384
South Dakota 8 - Kingsbury	641	B	1	100.00%	2/10/99	79,882	79,882
South Dakota 9 - Hanson	642	B	1	100.00%	2/10/99	104,802	104,802
Utah 3 - Juab	675	B	1	100.00%	2/10/99	59,833	59,833
Utah 4 - Beaver	676	B	1	100.00%	2/10/99	116,678	116,678
Utah 5 - Carbon	677	B	3	100.00%	2/10/99	41,233	41,233
Utah 6 - Piute	678	B	1	80.00%	2/10/99	27,499	21,999
Wyoming 1 - Park	718	B	1	66.00%	2/10/99	52,841	34,875
Wyoming 2 - Sheridan	719	B	1	100.00%	2/10/99	76,569	76,569
Wyoming 3 - Lincoln	720	A	1	100.00%	2/10/99	146,254	146,254

Convergys

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Cincinnati, OH-KY-IN	23	B	1	45.00%	12/31/98		
Columbus, OH	31	B	1	45.00%	12/31/98		
Dayton, OH	40	B	1	45.00%	12/31/98		
Hamilton-Middletown, OH	145	B	1	45.00%	12/31/98		
Springfield, OH	180	B	1	45.00%	12/31/98		
Kentucky 7 - Trimble	449	B	2	45.00%	12/31/98		
Ohio 4 - Mercer	588	B	1	45.00%	12/31/98		
Ohio 7 - Tuscarawas	591	B	1	45.00%	12/31/98		
Ohio 8 - Clinton	592	B	1	45.00%	12/31/98		
Ohio 10 - Perry	594	B	1	45.00%	12/31/98		

Note: On December 31, 1998, Cinicnnati Bell spun off Convergys and included in the new company its 45% interest in a limited partnership which operates the cellular licenses listed above.

Dobson Communications

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Youngstown-Warren, OH	66	A	1	100.00%	12/31/98	491,900	491,900
Erie, PA	130	A	1	100.00%	12/31/98	280,600	280,600
Santa Cruz, CA	175	A	1	86.90%	12/31/98	245,600	213,426
Sharon, PA	238	A	1	100.00%	12/31/98	122,100	122,100
Hagerstown, MD	257	A	1	100.00%	12/31/98	127,800	127,800
Cumberland, MD-WV	269	A	1	100.00%	12/31/98	68,000	68,000
Enid, OK	302	A	1	100.00%	12/31/98	57,600	57,600
Arizona 5 – Gila	322	B	1	75.00%	12/31/98	202,100	151,575
California 4 – Madera	339	A	1	100.00%	12/31/98	377,300	377,300
California 7 – Imperial	342	B	1	100.00%	12/31/98	149,300	149,300
Kansas 5 – Brown	432	A	1	100.00%	12/31/98	118,200	118,200
Maryland 2 – Kent	468	A	1	100.00%	12/31/98	453,700	453,700
Maryland 3 – Frederick	469	A	1	100.00%	12/31/98	184,200	184,200
Missouri 1 – Atchison	504	A	1	100.00%	12/31/98	42,600	42,600
Missouri 4 - De Kalb	507	A	1	100.00%	12/31/98	68,800	68,800
Missouri 5 – Linn	508	A	2	100.00%	12/31/98	14,200	14,200
New York 3 – Chautauqua	561	A	1	100.00%	12/31/98	480,000	480,000
Ohio 2 – Sandusky	586	A	1	100.00%	12/31/98	262,100	262,100
Ohio 11 – Columbiana	595	A	1	100.00%	12/31/98	111,700	111,700
Oklahoma 2 – Harper	597	A	1	100.00%	12/31/98	48,800	48,800
Oklahoma 3 – Grant	598	B	1	5.00%	12/31/98	205,600	10,280
Oklahoma 5 - Roger Mills	600	B	1	64.40%	12/31/98	32,500	20,930
Oklahoma 7 – Beckham	602	B	1	64.40%	12/31/98	115,700	74,511
Pennsylvania 1 – Crawford	612	A	1	100.00%	12/31/98	197,200	197,200
Pennsylvania 2 – McKean	613	A	2	100.00%	12/31/98	89,400	89,400
Pennsylvania 6 – Lawrence	617	A	1	100.00%	12/31/98	376,400	376,400
Pennsylvania 7 – Jefferson	618	A	1	100.00%	12/31/98	217,100	217,100
Pennsylvania 10 – Bedford	621	A	1	100.00%	12/31/98	49,500	49,500
Texas 2 – Hansford	653	B	1	61.00%	12/31/98	89,700	54,717
Texas 16 – Burleson	667	A	1	100.00%	12/31/98	334,000	334,000

GTE

MSA/RSA Name	MSA/RSA Number	Frequency Block	Submarket	Percentage	As of Date	POPs	Net POPs
San Francisco-Oakland, CA	7	B	1	97.10%	12/31/98	3,897,013	3,784,000
Houston, TX	10	B	1	83.60%	12/31/98	4,040,670	3,378,000
Cleveland, OH	16	B	1	96.50%	12/31/98	1,850,777	1,786,000
San Diego, CA	18	A	1	100.00%	12/31/98	2,681,000	2,681,000
Tampa-St. Petersburg, FL	22	B	1	100.00%	12/31/98	2,091,000	2,091,000
San Jose, CA	27	B	1	97.10%	12/31/98	1,618,950	1,572,000
Indianapolis, IN	28	B	1	94.80%	12/31/98	1,372,363	1,301,000
Memphis, TN-AR-MS	36	A	1	100.00%	12/31/98	1,028,000	1,028,000
Louisville, KY-IN	37	A	1	100.00%	12/31/98	940,000	940,000
Birmingham, AL	41	A	1	100.00%	12/31/98	927,000	927,000
Norfolk-Virginia Beach-Portsmouth, VA/NC	43	B	1	100.00%	12/31/98	1,039,000	1,039,000
Nashville-Davidson, TN	46	A	1	100.00%	12/31/98	1,114,000	1,114,000
Greensboro-Winston-Salem-High Point, NC	47	A	1	100.00%	12/31/98	1,004,000	1,004,000
Honolulu, HI	50	B	1	100.00%	12/31/98	875,000	875,000
Jacksonville, FL	51	B	1		1998		
Akron, OH	52	B	1	96.50%	12/31/98	682,902	659,000
Richmond, VA	59	B	1	100.00%	12/31/98	811,000	811,000
Raleigh-Durham, NC	71	A	1	100.00%	12/31/98	858,000	858,000
Fresno, CA	74	B	1	97.00%	12/31/98	761,856	739,000
Austin, TX	75	B	1	61.70%	12/31/98	987,034	609,000
Knoxville, TN	79	A	1	94.10%	12/31/98	555,792	523,000
El Paso, TX	81	B	1	100.00%	12/31/98	695,000	695,000
Mobile, AL	83	B	1	100.00%	12/31/98	523,000	523,000
Johnson City-Kingsport-Bristol, TN-VA	85	A	1	100.00%	12/31/98	441,000	441,000
Canton, OH	87	B	1	96.50%	12/31/98	404,145	390,000
Chattanooga, TN-GA	88	A	1	100.00%	12/31/98	459,000	459,000
Charleston-North Charleston, SC	90	A	1	100.00%	12/31/98	492,000	492,000
Fort Wayne, IN	96	B	1	65.00%	12/31/98	427,692	278,000
Bakersfield, CA	97	B	1	97.00%	12/31/98	629,897	611,000
Davenport-Rock Island-Moline, IA/IL	98	B	1	100.00%	12/31/98	358,000	358,000
Beaumont-Port Arthur, TX	101	B	1	83.60%	12/31/98	375,598	314,000
Newport News-Hampton, VA	104	B	1	100.00%	12/31/98	473,000	473,000
Vallejo-Fairfield-Napa, CA	111	B	1	97.10%	12/31/98	486,097	472,000
Lakeland-Winter Haven, FL	114	B	1	100.00%	12/31/98	445,000	445,000
Lexington-Fayette, KY	116	A	1	100.00%	12/31/98	380,000	380,000
Evansville, IN/KY	119	B	1	100.00%	12/31/98	322,000	322,000
Huntsville, AL	120	A	1	100.00%	12/31/98	414,000	414,000
Santa Rosa-Petaluma, CA	123	B	1	97.10%	12/31/98	426,365	414,000
Santa Barbara-Santa Maria-Lompoc, CA	124	B	1	90.00%	12/31/98	387,778	349,000
Salinas-Seaside-Monterey, CA	126	B	1	97.10%	12/31/98	340,886	331,000
Pensacola, FL	127	B	1	100.00%	12/31/98	391,000	391,000
Erie, PA	130	B	1	96.50%	12/31/98	280,829	271,000
Rockford, IL	131	B	1	59.60%	12/31/98	303,691	181,000
Lorain-Elyria, OH	136	B	1	96.50%	12/31/98	281,865	272,000
Fayetteville, NC	149	A	1	99.50%	12/31/98	285,427	284,000
Visalia-Tulare-Porterville, CA	150	B	1	97.00%	12/31/98	353,608	343,000
Roanoke, VA	157	B	1	100.00%	12/31/98	234,000	234,000
Fort Myers, FL Counties - Lee	164	B	1	100.00%	12/31/98	385,000	385,000
Sarasota, FL	167	B	1	100.00%	12/31/98	299,000	299,000
Galveston-Texas City, TX	170	B	1	83.60%	12/31/98	242,823	203,000
Santa Cruz, CA	175	B	1	97.10%	12/31/98	239,959	233,000
Terre Haute, IN	185	B	1	76.30%	12/31/98	170,380	130,000
Clarksville-Hopkinsville, TN/KY	209	A	1	100.00%	12/31/98	189,000	189,000
Bradenton, FL	211	B	1	100.00%	12/31/98	235,000	235,000
Anderson, IN	217	B	1	94.80%	12/31/98	132,911	126,000
Tuscaloosa, AL	222	A	1	93.50%	12/31/98	160,428	150,000
Florence, AL	226	A	1	93.10%	12/31/98	137,487	128,000
Petersburg-Colonial Heights-Hopewell, VA	235	B	1	100.00%	12/31/98	147,000	147,000
Muncie, IN	236	B	1	94.80%	12/31/98	118,143	112,000
Lafayette, IN	247	B	1	94.80%	12/31/98	139,241	132,000
Anniston, AL	249	A	1	100.00%	12/31/98	114,000	114,000
Danville, VA	262	A	1	95.80%	12/31/98	108,559	104,000
Florence, SC	264	A	1	100.00%	12/31/98	124,000	124,000
Kokomo, IN	271	B	1	94.80%	12/31/98	101,266	96,000
Gadsden, AL	272	A	1	90.00%	12/31/98	102,222	92,000
Burlington, NC	280	A	1	100.00%	12/31/98	117,000	117,000
Bloomington, IN	282	B	1	94.80%	12/31/98	117,089	111,000
Las Cruces, NM	285	B	1	100.00%	12/31/98	167,000	167,000
Bryan-College Station, TX	287	B	1	100.00%	12/31/98	133,000	133,000
Sherman-Denison, TX	292	B	1		1998		
Owensboro, KY	293	B	1	100.00%	12/31/98	91,000	91,000
Victoria, TX	300	B	1	100.00%	12/31/98	82,000	82,000
Alabama 1 - Franklin	307	A	1		Oct-98		
Alabama 1 - Franklin	307	A	2		Oct-98		

Alabama 1 - Franklin	307	A	3		Oct-98		
Alabama 2 - Jackson	308	A	1	100.00%	Oct-98	128,000	128,000
Alabama 5 - Cleburne	311	A	1		Oct-98		
Alabama 5 - Cleburne	311	A	2		Oct-98		
California 4 - Madera	339	B	1		Oct-98		
California 5 - San Luis Obispo	340	B	1	90.00%	Oct-98	217,778	196,000
California 6 - Mono	341	B	1	100.00%	Oct-98	28,000	28,000
California 9 - Mendocino	344	B	1	100.00%	Oct-98	141,000	141,000
California 12 - Kings	347	B	1	97.00%	Oct-98	110,309	107,000
Florida 1 - Collier	360	B	1	61.60%	Oct-98	191,558	118,000
Florida 2 - Glades	361	B	1	100.00%	Oct-98	83,000	83,000
Florida 3 - Hardee	362	B	1	100.00%	Oct-98	175,000	175,000
Florida 4 - Citrus	363	B	1	100.00%	Oct-98	228,000	228,000
Florida 11 - Monroe	370	B	2	100.00%	Oct-98	81,000	81,000
Hawaii 1 - Kauai	385	B	1	100.00%	Oct-98	58,000	58,000
Hawaii 2 - Maui	386	B	1	100.00%	Oct-98	115,000	115,000
Hawaii 3 - Hawaii	387	B	1	100.00%	Oct-98	140,000	140,000
Illinois 1 - Jo Daviess	394	B	1	91.50%	Oct-98	315,847	289,000
Illinois 2 - Bureau	395	B	1		9/8/97		
Illinois 3 - Mercer	396	B	1		9/8/97		
Illinois 8 - Washington	401	B	1		9/8/97		
Illinois 9 - Clay	402	B	1		9/8/97		
Indiana 1 - Newton	403	B	1		Oct-98		
Indiana 3 - Huntington	405	B	1		Oct-98		
Indiana 6 - Randolph	408	B	1		Oct-98		
Indiana 7 - Owen	409	B	1		Oct-98		
Indiana 8 - Brown	410	B	1		Oct-98		
Indiana 9 - Decatur	411	B	1		Oct-98		
Iowa 4 - Muscatine	415	B	1		Oct-98		
Iowa 5 - Jackson	416	B	1		Oct-98		
Kentucky 1 - Fulton	443	B	1		Oct-98		
Kentucky 2 - Union	444	B	1	100.00%	Oct-98	128,000	128,000
Kentucky 7 - Trimble	449	A	1	100.00%	Oct-98	166,000	166,000
New Mexico 3 - Catron	555	B	1		Oct-98		
New Mexico 5 - Grant	557	B	1		Oct-98		
New Mexico 6 - Lincoln	558	B	1	71.40%	Oct-98	61,625	44,000
North Carolina 15 - Cabarrus	579	A	1		Oct-98		
Ohio 2 - Sandusky	586	B	2	100.00%	Oct-98	24,000	24,000
Ohio 3 - Ashtabula	587	B	1		Oct-98		0
South Carolina 6 - Clarendon	630	A	1	100.00%	Oct-98	194,000	194,000
South Carolina 7 - Calhoun	631	A	1		Oct-98		
Tennessee 1 - Lake	643	A	1	100.00%	Oct-98	297,000	297,000
Tennessee 2 - Cannon	644	A	1	100.00%	Oct-98	159,000	159,000
Tennessee 3 - Macon	645	A	1	100.00%	Oct-98	330,000	330,000
Tennessee 5 - Fayette	647	A	1	100.00%	Oct-98	336,000	336,000
Tennessee 6 - Giles	648	A	1	100.00%	Oct-98	157,000	157,000
Tennessee 7 - Bledsoe	649	A	1	100.00%	Oct-98	248,000	248,000
Tennessee 9 - Maury	651	A	1	100.00%	Oct-98	68,000	68,000
Texas 10 - Navarro	661	B	3	75.00%	Oct-98	29,333	22,000
Texas 11 - Cherokee	662	B	1		Oct-98		
Texas 16 - Burleson	667	B	1		Oct-98		
Texas 17 - Newton	668	B	1		Oct-98		
Texas 20 - Wilson	671	B	2		1998		
Texas 21 - Chambers	672	B	1	75.00%	Oct-98	21,333	16,000
Virginia 3 - Giles	683	B	1	51.00%	Oct-98	182,353	93,000
Virginia 4 - Bedford	684	B	1	51.00%	Oct-98	66,667	34,000
Virginia 5 - Bath	685	B	1	77.00%	Oct-98	63,636	49,000
Virginia 7 - Buckingham	687	B	1	100.00%	Oct-98	39,000	39,000
Virginia 8 - Amelia	688	B	1	95.00%	Oct-98	84,211	80,000
Virginia 9 - Greensville	689	B	1	95.00%	Oct-98	87,368	83,000
Virginia 11 - Madison	691	B	1	95.00%	Oct-98	111,579	106,000
Virginia 12 - Caroline	692	B	1	95.00%	Oct-98	33,684	32,000
Wisconsin 8 – Vernon	715	B	1		1998		

Note: The licenses listed with as of dates of October 1998 are ones for which GTE has applied to transfer to Bell Atlantic as a part of their proposed merger. GTE also owns minority stakes in other MSA and RSA licenses.

Hector Communications

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Rochester, MN	288	B	1	10.00%	12/31/98		
Minnesota 7 - Chippewa	488	B	1	10.00%	12/31/98		
Minnesota 8 - Lac qui Parle	489	B	1	10.00%	12/31/98		
Minnesota 9 - Pipestone	490	B	1	10.00%	12/31/98		
Minnesota 10 - Le Sueur	491	B	1	10.00%	12/31/98		
Minnesota 11 - Goodhue	492	B	1	10.00%	12/31/98		

North Dakota 3 - Barnes	582	B	1	1.60%	12/31/98	92,000	1,472

Hickory Tech

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Minnesota 10 - Le Sueur	491	A	1	100.00%	12/31/98	230,000	230,000

New Ulm Telecom

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Rochester, MN	288	B	1	7.90%	12/31/98		
Minnesota 7 - Chippewa	488	B	1	7.90%	12/31/98		
Minnesota 8 - Lac qui Parle	489	B	1	7.90%	12/31/98		
Minnesota 9 - Pipestone	490	B	1	7.90%	12/31/98		
Minnesota 10 - Le Sueur	491	B	1	7.90%	12/31/98		
Minnesota 11 - Goodhue	492	B	1	7.90%	12/31/98		

Price Communucations

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Augusta, GA/SC	108	A	1	100.00%	3/31/99	440,864	440,864
Macon-Warner Robins, GA	138	A	1	99.20%	3/31/99	318,227	315,681
Montgomery, AL	139	A	1	94.60%	3/31/99	320,687	297,598
Columbus, GA-AL	153	A	1	98.90%	3/31/99	250,845	213,720
Savannah, GA	155	A	1	98.50%	3/31/99	288,736	284,405
Dothan, AL	246	A	1	95.00%	3/31/99	133,618	126,403
Albany, GA	261	A	1	96.80%	3/31/99	117,984	102,056
Panama City, FL	283	A	1	92.00%	3/31/99	149,953	117,563
Alabama 8 - Lee	314	A	1	100.00%	3/31/99	173,677	173,677
Georgia 6 - Spalding	376	A	1	96.30%	3/31/99	203,899	196,355
Georgia 7 - Hancock	377	A	1	100.00%	3/31/99	135,121	135,121
Georgia 8 - Warren	378	A	1	100.00%	3/31/99	157,912	157,912
Georgia 9 - Marion	379	A	1	100.00%	3/31/99	118,111	118,111
Georgia 10 - Bleckley	380	A	1	100.00%	3/31/99	151,827	151,827
Georgia 12 - Liberty	382	A	1	100.00%	3/31/99	215,935	215,935
Georgia 13 - Early	383	A	1	100.00%	3/31/99	148,361	128,332

Puerto Rico Telephone

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
San Juan-Caguas, PR	91	B	1				
Ponce, PR	147	B	1				
Mayaguez, PR	169	B	1				
Arecibo, PR	202	B	1				
Aguadilla, PR	204	B	1				
Puerto Rico 1 – Rincon	723	B	1				
Puerto Rico 2 – Adjuntas	724	B	1				
Puerto Rico 3 – Ciales	725	B	1				
Puerto Rico 4 – Aibonito	726	B	1				
Puerto Rico 5 – Ceiba	727	B	1				
Puerto Rico 6 – Vieques	728	B	1				
Puerto Rico 7 – Culebra	729	B	1				

Note: GTE is in the process of completing a transaction that will give it control of Puerto Rico Telephone and it cellular telephone licenses.

Roseville Communications

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Sacramento, CA	35	B	1	23.50%	12/31/98		
Stockton, CA	107	B	1	23.50%	12/31/98		
Modesto, CA	142	B	1	23.50%	12/31/98		
Reno, NV	171	B	1	23.50%	12/31/98		
Chico	215	B	1	23.50%	12/31/98		
Yuba City, CA	274	B	1	23.50%	12/31/98		
California 8 - Tehama	343	B	1	23.50%	12/31/98		

California 10 – Sierra	345	B	1	23.50%	12/31/98

Rural Cellular

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Bangor, ME	224	B	1	100.00%	12/31/98	143,000	143,000
Burlington, VT	248	A	1	100.00%	12/31/98	148,000	148,000
Maine 1 – Oxford	463	B	1	100.00%	12/31/98	83,000	83,000
Maine 2 – Somerset	464	B	1	100.00%	12/31/98	148,000	148,000
Maine 3 – Kennebec	465	B	1	100.00%	12/31/98	221,000	221,000
Massachusetts 1 - Franklin	470	A	1	100.00%	12/31/98	71,000	71,000
Minnesota 1 - Kittson	482	B	1	100.00%	12/31/98	50,000	50,000
Minnesota 2 - Lake of the Woods	483	B	1	100.00%	12/31/98	64,000	64,000
Minnesota 3 - Koochiching	484	B	1	100.00%	12/31/98	59,000	59,000
Minnesota 5 - Wilkin	486	B	1	100.00%	12/31/98	206,000	206,000
Minnesota 6 - Hubbard	487	B	1	100.00%	12/31/98	257,000	257,000
New Hampshire 1 - Coos	548	A	1	100.00%	12/31/98	223,000	223,000
New York 2 - Franklin	560	A	1	100.00%	12/31/98	226,000	226,000
South Dakota 4 - Marshall	637	B	1	100.00%	12/31/98	69,000	69,000
Vermont 1 – Franklin	679	A	1	100.00%	12/31/98	210,000	210,000
Vermont 2 – Addison	680	A	1	100.00%	12/31/98	232,000	232,000

SBC Communications

MSA/RSA Name	MSA/RSA Number	Frequency Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Chicago, IL	3	A	1	100.00%	12/31/98	7,261,000	7,261,000
Boston-Lowell-Brockton-Lawrence-Haverhill, MA-NH	6	A	1	100.00%	12/31/98	4,030,000	4,030,000
Washington, DC-MD-VA	8	A	1	90.00%	12/31/98	3,661,000	3,294,900
Dallas-Forth Worth, TX	9	B	1	82.50%	12/31/98	3,949,000	3,257,925
St. Louis, MO-IL	11	B	1	98.00%	12/31/98	2,424,000	2,375,520
Baltimore, MD	14	A	1	90.00%	12/31/98	2,348,000	2,113,200
Kansas City, MO-KS	24	B	1	81.00%	12/31/98	1,447,000	1,172,070
Buffalo, NY	25	A	1	75.00%	12/31/98	1,189,000	891,750
Hartford-New Britain-Bristol, CT	32	B	1	99.50%	12/31/98	1,124,000	1,118,380
San Antonio, TX	33	B	1	70.00%	12/31/98	1,302,000	911,400
Rochester, NY	34	A	1	100.00%	12/31/98	1,002,000	1,002,000
Providence-Warwick-Pawtucket, RI	38	A	1	100.00%	12/31/98	916,000	916,000
Bridgeport-Stamford-Norwalk-Danbury, CT	42	B	1	99.50%	12/31/98	828,000	823,860
Albany-Schenectady-Troy, NY	44	A	1	100.00%	12/31/98	830,000	830,000
Oklahoma City, OK	45	B	1	62.00%	12/31/98	930,000	576,600
New Haven-West Haven-Waterbury-Meriden, CT	49	B	1	99.50%	12/31/98	804,000	799,980
Syracuse, NY	53	A	1	100.00%	12/31/98	660,000	660,000
Gary-Hammond-East Chicago, IN	54	A	1	66.70%	12/31/98	604,000	402,868
Worchester-Fitchburg-Leominster, MA	55	A	1	95.30%	12/31/98	710,000	676,630
Springfield-Chicopee-Holyoke, MA	63	B	1	99.50%	12/31/98	603,000	599,985
New Bedford-Fall River, MA	76	A	1	100.00%	12/31/98	506,000	506,000
Wichita, KS	89	B	1	60.00%	12/31/98	454,000	272,400
Little Rock-North Little Rock, AR	92	A	1	100.00%	12/31/98	513,000	513,000
Corpus Christi, TX	112	B	1	100.00%	12/31/98	350,000	350,000
Utica-Rome, NY	115	A	1	100.00%	12/31/98	317,000	317,000
McAllen-Edinburg-Mission, TX	128	B	1	77.50%	12/31/98	383,000	296,825
New London-Norwich, CT	154	B	1	99.50%	12/31/98	255,000	253,725
Lubbock, TX Counties - Lubbock	161	B	1	71.00%	12/31/98	223,000	158,330
Brownsville-Harlingen, TX	162	B	1	77.50%	12/31/98	260,000	201,500
Fort Smith, AK-OK	165	A	1	100.00%	12/31/98	219,000	219,000
Springfield, IL	176	A	1	96.70%	12/31/98	190,000	183,730
Topeka, KS	179	B	1	77.00%	12/31/98	192,000	147,840
Fayetteville-Springdale, AK	182	A	1	100.00%	12/31/98	211,000	211,000
Amarillo, TX	188	B	1	71.00%	12/31/98	187,000	132,770
Champaign-Urbana-Rantoul, IL	196	A	1	98.30%	12/31/98	173,000	170,059
Pittsfield, MA	213	B	1	99.50%	12/31/98	140,000	139,300
Abilene, TX	220	B	1	71.00%	12/31/98	148,000	105,080
Decatur, IL	230	A	1	99.00%	12/31/98	117,000	115,830
Bloomington-Normal, IL	250	A	1	96.00%	12/31/98	129,000	123,840
Odessa, TX	255	B	1	71.00%	12/31/98	119,000	84,490
Glens Falls, NY	266	A	1	100.00%	12/31/98	119,000	119,000
St. Joseph, MO	275	B	1	51.00%	12/31/98	98,000	49,980
Laredo, TX	281	B	1	55.50%	12/31/98	133,000	73,815
Pine Bluff, AK	291	A	1	49.13%	12/31/98	85,000	41,761
Sherman-Denison, TX	292	B	1	82.50%	12/31/98	95,000	78,375
Midland, TX	295	B	1	71.00%	12/31/98	107,000	75,970
Lawrence, KS	301	B	1	81.00%	12/31/98	82,000	66,420
Arkansas 1 - Madison	324	A	1	50.00%	12/31/98	66,000	33,000
Arkansas 2 - Marion	325	A	1	50.00%	12/31/98	82,000	41,000
Arkansas 3 - Sharp	326	A	1	50.00%	12/31/98	98,000	49,000

Arkansas 4 - Clay	327	A	1	50.00%	12/31/98	201,000	100,500
Arkansas 5 - Cross	328	A	1	50.00%	12/31/98	123,000	61,500
Arkansas 6 - Cleburne	329	A	1	50.00%	12/31/98	93,000	46,500
Arkansas 7 - Pope	330	A	1	50.00%	12/31/98	105,000	52,500
Arkansas 8 - Franklin	331	A	1	50.00%	12/31/98	64,000	32,000
Arkansas 10 - Garland	333	A	1	50.00%	12/31/98	145,000	72,500
Arkansas 12 - Ouachita	335	A	1	50.00%	12/31/98	191,000	95,500
Connecticut 1 - Litchfield	357	B	1	99.50%	12/31/98	174,000	173,130
Connecticut 2 - Windham	358	B	1	99.50%	12/31/98	103,000	102,485
Illinois 2 - Bureau	395	A	1	100.00%	12/31/98	252,000	252,000
Illinois 4 - Adams	397	A	1	55.50%	12/31/98	203,000	112,665
Illinois 5 - Mason	398	A	1	100.00%	12/31/98	93,000	93,000
Illinois 6 - Montgomery	399	A	1	55.50%	12/31/98	197,000	109,335
Kansas 5 - Brown	432	B	2	100.00%	12/31/98	89,000	89,000
Massachusetts 1 - Franklin	470	B	1	99.50%	12/31/98	70,000	69,650
Massachusetts 2 - Barnstable	471	A	1	100.00%	12/31/98	204,000	204,000
Missouri 8 - Callaway	511	B	1	60.00%	12/31/98	93,000	55,800
Missouri 9 - Bates	512	B	1	50.40%	12/31/98	54,000	27,216
Missouri 11 - Moniteau	514	B	1	50.00%	12/31/98	138,000	69,000
Missouri 12 - Maries	515	B	1	50.00%	12/31/98	117,000	58,500
Missouri 13 - Washington	516	B	1	98.00%	12/31/98	84,000	82,320
Missouri 17 - Shannon	520	B	1	98.00%	12/31/98	56,000	54,880
Missouri 18 - Perry	521	B	1	98.00%	12/31/98	112,000	109,760
Missouri 19 - Stoddard	522	B	1	98.00%	12/31/98	197,000	193,060
New York 1 - Jefferson	559	A	1	100.00%	12/31/98	250,000	250,000
New York 4 - Yates	562	A	1	100.00%	12/31/98	352,000	352,000
Oklahoma 3 - Grant	598	B	1	74.00%	12/31/98	200,000	148,000
Oklahoma 9 - Garvin	604	B	1	60.00%	12/31/98	195,000	117,000
Rhode Island 1 - Newport	624	A	1	100.00%	12/31/98	87,000	87,000
Texas 6 - Jack	657	B	1	49.50%	12/31/98	80,000	39,600
Texas 7 - Fanni	658	B	1	50.00%	12/31/98	123,000	61,500
Texas 9 - Runnels	660	B	1	35.60%	12/31/98	46,000	16,376
Texas 9 - Runnels	660	B	4	84.60%	12/31/98	48,000	40,608
Texas 10 - Navarro	661	B	1	75.00%	12/31/98	136,000	102,000
Texas 18 - Edwards	669	B	1	34.00%	12/31/98	185,000	62,900
Texas 19 - Atascosa	670	B	1	33.30%	12/31/98	203,000	67,599
Texas 20 - Wilson	671	B	1	50.00%	12/31/98	86,000	43,000
Virginia 10 - Frederick	690	A	1	90.00%	12/31/98	215,000	193,500
Virginia 11 - Madison	691	A	1	90.00%	12/31/98	219,000	197,100
Virginia 12 - Caroline	692	A	1	90.00%	12/31/98	165,000	148,500
West Virginia 4 - Grant	704	A	1	90.00%	12/31/98	153,000	137,700

Notes: SBC has announced its intention to merge with Ameritech and Cellular Communications of Puerto Rico, as well as acquire the cellular operations of Comcast.

Shenandoah Telecommunications

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Virginia 10 - Frederick	690	B	2	66.00%	12/31/98		

Triton PCS

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
South Carolina 5 - Georgetown	629	A	1	100.00%	12/31/98		

Unites States Cellular

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Los Angeles-Long Beach/Anaheim-Santa Ana-Garden Grove/Riverside-San Bernardino-Ontario, CA	2	B	1	5.50%	12/31/98	15,795,000	868,725
Milwaukee, WI	21	A	1	100.00%	12/31/98	1,452,000	1,452,000
Oklahoma City, OK	45	B	1	14.60%	12/31/98	1,010,000	147,460
Tulsa, OK	57	B	1	55.06%	12/31/98	804,000	442,682
Oxnard-Simi Valley-Ventura, CA	73	B	1	5.50%	12/31/98	With MSA 1	
Knoxville, TN	79	B	1	96.03%	12/31/98	560,000	537,768
Davenport-Rock Island-Moline, IA/IL	98	A	1	97.37%	12/31/98	357,000	347,611
Des Moines, IA	102	A	1	100.00%	12/31/98	434,000	434,000
Peoria, IL	103	A	1	100.00%	12/31/98	347,000	347,000
Corpus Christi, TX	112	A	1	100.00%	12/31/98	392,000	392,000
Madison, WI	113	A	1	92.50%	12/31/98	399,000	369,075
Appleton-Oskosh-Neenah, WI	125	A	1	100.00%	12/31/98	345,000	345,000

McAllen-Edinburg-Mission, TX	128	A	1	26.20%	12/31/98	526,000	137,812
Rockford, IL	131	A	1	100.00%	12/31/98	306,000	306,000
Manchester-Nashua, NH	133	A	1	92.70%	12/31/98	360,000	333,720
Portland, ME	152	B	1	49.00%	12/31/97	288,000	141,120
Portsmouth-Dover-Rochester, NH-ME	156	B	1	40.00%	12/31/98	282,000	112,800
Roanoke, VA	157	A	1	100.00%	12/31/98	234,000	234,000
Tallahassee, FL	168	A	1	100.00%	12/31/98	285,000	285,000
Asheville, NC	183	B	1	100.00%	12/31/98	214,000	214,000
Green Bay, WI	186	A	1	99.01%	12/31/98	216,000	213,862
Racine, WI	189	A	1	89.82%	12/31/98	185,000	166,167
Yakima, WA	191	B	1	58.54%	12/31/98	222,000	129,959
Gainesville, FL	192	A	1	100.00%	12/31/98	225,000	225,000
Cedar Rapids, IA	195	A	1	96.00%	12/31/98	181,000	173,760
Waterloo-Cedar Falls, IA	201	A	1	93.03%	12/31/98	145,000	134,894
Lynchburg, VA	203	A	1	100.00%	12/31/98	160,000	160,000
Fort Pierce, FL	208	B	1	100.00%	12/31/98	297,000	297,000
Richland-Kennewick-Pasco, WA	214	B	1	100.00%	12/31/98	187,000	187,000
Janesville-Beloit, WI	216	A	1	92.43%	12/31/98	152,000	140,494
Wilmington, NC	218	A	1	96.51%	12/31/98	217,000	209,427
Bangor, ME	224	A	1	91.88%	12/31/98	144,000	132,307
Medford, OR	229	B	1	100.00%	12/31/98	174,000	174,000
Wichita Falls, TX	233	B	1	70.45%	12/31/98	140,000	98,630
Joplin, MO	239	B	1	100.00%	12/31/98	149,000	149,000
Kenosha, WI	244	A	1	99.32%	12/31/98	144,000	143,021
Charlottesville, VA	256	A	1	95.37%	12/31/98	148,000	141,148
Hagerstown, MD	257	B	1	100.00%	12/31/98	128,000	128,000
Jacksonville, NC	258	A	1	96.48%	12/31/98	145,000	139,896
Lawton, OK	260	B	1	70.45%	12/31/98	110,000	77,495
Wausau, WI	263	B	1	71.76%	12/31/98	122,000	87,547
Cumberland, MD-WV	269	B	1	100.00%	12/31/98	100,000	100,000
Sheboygan, WI	277	A	1	86.76%	12/31/98	111,000	96,304
Columbia, MO	278	B	1	100.00%	12/31/98	130,000	130,000
Lewiston-Auburn, ME	279	A	1	83.63%	12/31/98	100,000	83,630
Laredo, TX	281	A	1	93.74%	12/31/98	188,000	1762,31
Dubuque, IA	286	A	1	95.51%	12/31/98	88,000	84,049
La Crosse, WI	290	A	1	95.11%	12/31/98	103,000	97,963
Iowa City, IA	296	A	1	100.00%	12/31/98	102,000	102,000
Victoria, TX	300	A	1	100.00%	12/31/98	83,000	83,000
Alton-Granite City, IL	305	B	1	100.00%	12/31/98	21,000	21,000
California 1 - Del Norte	336	A	1	100.00%	12/31/98	209,000	209,000
California 2 - Modoc	337	A	1	100.00%	12/31/98	63,000	63,000
California 9 - Mendocino	344	A	1	100.00%	12/31/98	140,000	140,000
Florida 5 - Putnam	364	A	1	100.00%	12/31/98	71,000	71,000
Florida 6 - Dixie	365	A	1	100.00%	12/31/98	58,000	58,000
Florida 8 - Jefferson	367	A	1	100.00%	12/31/98	50,000	50,000
Florida 9 - Calhoun	368	A	1	100.00%	12/31/98	43,000	43,000
Florida 10 - Walton	369	A	1	100.00%	12/31/98	121,000	121,000
Georgia 11 - Toombs	381	A	1	100.00%	12/31/98	156,000	156,000
Georgia 14 - Worth	384	A	1	100.00%	12/31/98	256,000	256,000
Hawaii 3 - Hawaii	387	A	1	100.00%	12/31/98	141,000	141,000
Idaho 5 - Butte	392	A	1	100.00%	12/31/98	168,000	168,000
Idaho 6 - Clark	393	A	1	100.00%	12/31/98	295,000	295,000
Illinois 1 - Jo Daviess	394	A	1	100.00%	12/31/98	320,000	320,000
Illinois 3 - Mercer	396	A	1	100.00%	12/31/98	202,000	202,000
Illinois 4 - Adams	397	B	2	100.00%	12/31/98	214,000	214,000
Indiana 4 - Miami	406	B	1	28.57%	12/31/98	178,000	50,855
Indiana 5 - Warren	407	B	1	33.33%	12/31/98	124,000	41,329
Iowa 1 - Mills	412	A	1	100.00%	12/31/98	62,000	62,000
Iowa 2 - Union	413	A	1	100.00%	12/31/98	50,000	50,000
Iowa 3 - Monroe	414	A	1	49.00%	12/31/98	90,000	44,100
Iowa 4 - Muscatine	415	A	1	100.00%	12/31/98	154,000	154,000
Iowa 5 - Jackson	416	A	1	100.00%	12/31/98	108,000	108,000
Iowa 6 - Iowa	417	A	1	100.00%	12/31/98	156,000	156,000
Iowa 7 - Audubon	418	A	1	100.00%	12/31/98	55,000	55,000
Iowa 9 - Ida	420	B	1	16.67%	12/31/98	63,000	10,502
Iowa 10 - Humbolt	421	A	1	100.00%	12/31/98	180,000	180,000
Iowa 11 - Hardin	422	A	1	100.00%	12/31/98	113,000	113,000
Iowa 12 - Winneshiek	423	A	1	24.50%	12/31/98	115,000	28,175
Iowa 13 - Mitchell	424	A	1	100.00%	12/31/98	66,000	66,000
Iowa 14 - Kossuth	425	A	1	100.00%	12/31/98	107,000	107,000
Iowa 16 - Lyon	427	A	1	100.00%	12/31/98	103,000	103,000
Kansas 15 - Elk	442	B	1	75.00%	12/31/98	154,000	115,500
Maine 1 - Oxford	463	A	1	100.00%	12/31/98	83,000	83,000
Maine 2 - Somerset	464	A	1	100.00%	12/31/98	146,000	146,000
Maine 3 - Kennebec	465	A	1	100.00%	12/31/98	221,000	221,000
Maine 4 - Washington	466	B	1	100.00%	12/31/98	86,000	86,000
Maryland 1 - Garrett	467	B	1	100.00%	12/31/98	29,000	29,000
Missouri 3 - Schuyler	506	A	1	100.00%	12/31/98	56,000	56,000
Missouri 5 - Linn	508	A	1	100.00%	12/31/98	54,000	54,000
Missouri 6 - Marion	509	B	1	100.00%	12/31/98	85,000	85,000

Missouri 11 - Moniteau	514	A	1	100.00%	12/31/98	151,000	151,000
Missouri 13 - Washington	516	A	1	100.00%	12/31/98	95,000	95,000
Missouri 15 - Stone	518	A	1	100.00%	12/31/98	122,000	122,000
Missouri 16 - Laclede	519	A	1	100.00%	12/31/98	102,000	102,000
Missouri 17 - Shannon	520	A	1	100.00%	12/31/98	56,000	56,000
New Hampshire 1 - Coos	548	B	1	100.00%	12/31/98	225,000	225,000
New Hampshire 2 - Carroll	549	A	1	100.00%	12/31/98	218,000	218,000
New York 1 - Jefferson	559	B	1	60.00%	12/31/98	255,000	153,000
North Carolina 2 - Yancey	566	B	3	100.00%	12/31/98	31,000	31,000
North Carolina 3 - Ashe	567	A	1	100.00%	12/31/98	163,000	163,000
North Carolina 4 - Henderson	568	B	1	100.00%	12/31/98	196,000	196,000
North Carolina 6 - Chatham	570	A	1	81.20%	12/31/98	165,000	133,980
North Carolina 7 - Rockingham	571	A	1	100.00%	12/31/98	293,000	293,000
North Carolina 8 - Northampton	572	A	1	100.00%	12/31/98	294,000	294,000
North Carolina 9 - Camden	573	A	1	100.00%	12/31/98	120,000	120,000
North Carolina 10 - Harnett	574	A	1	100.00%	12/31/98	299,000	299,000
North Carolina 11 - Hoke	575	A	1	100.00%	12/31/98	228,000	228,000
North Carolina 12 - Sampson	576	A	1	100.00%	12/31/98	134,000	134,000
North Carolina 13 - Greene	577	A	1	100.00%	12/31/98	248,000	248,000
North Carolina 14 - Pitt	578	A	1	100.00%	12/31/98	244,000	244,000
Ohio 9 - Ross	593	B	1	49.00%	12/31/98	250,000	122,500
Oklahoma 4 - Nowata	599	B	2	55.06%	12/31/98	102,000	56,161
Oklahoma 6 - Seminole	601	A	1	55.06%	12/31/98	219,000	120,581
Oklahoma 7 - Beckham	602	B	2	70.45%	12/31/98	10,000	7,045
Oklahoma 8 - Jackson	603	B	1	70.45%	12/31/98	97,000	68,337
Oklahoma 9 - Garvin	604	A	1	100.00%	12/31/98	204,000	204,000
Oklahoma 10 - Haskell	605	A	1	100.00%	12/31/98	84,000	84,000
Oregon 2 - Hood River	607	B	1	65.55%	12/31/98	75,000	49,163
Oregon 3 - Umatilla	608	B	1	76.39%	12/31/98	152,000	116,113
Oregon 5 - Coos	610	A	1	100.00%	12/31/98	261,000	261,000
Oregon 6 - Crook	611	B	1	100.00%	12/31/98	199,000	199,000
Pennsylvania 10 - Bedford	621	B	2	100.00%	12/31/98	49,000	49,000
South Carolina 4 - Chesterfield	628	A	1	100.00%	12/31/98	215,000	215,000
Tennessee 3 - Macon	645	B	1	16.67%	12/31/98	347,000	57,845
Tennessee 4 - Hamblen	646	B	2	100.00%	12/31/98	136,000	136,000
Tennessee 7 - Bledsoe	649	B	3	96.03%	12/31/98	152,000	145,966
Texas 4 - Briscoe	655	B	2	70.45%	12/31/98	12,000	8,454
Texas 5 - Hardeman	656	B	1	70.45%	12/31/98	37,000	26,067
Texas 18 - Edwards	669	A	1	100.00%	12/31/98	227,000	227,000
Texas 19 - Atascosa	670	A	1	100.00%	12/31/98	266,000	266,000
Texas 20 - Wilson	671	A	1	100.00%	12/31/98	150,000	150,000
Vermont 2 - Addison	680	B	2	100.00%	12/31/98	107,000	107,000
Virginia 2 - Tazewell	682	A	1	100.00%	12/31/98	83,000	83,000
Virginia 3 - Giles	683	A	1	100.00%	12/31/98	202,000	202,000
Virginia 4 - Bedford	684	A	1	100.00%	12/31/98	177,000	177,000
Virginia 5 - Bath	685	A	1	100.00%	12/31/98	61,000	61,000
Virginia 7 - Buckingham	687	A	1	100.00%	12/31/98	92,000	92,000
Washington 4 - Grays Harbor	696	A	1	100.00%	12/31/98	120,000	120,000
Washington 5 - Kittitas	697	B	1	85.20%	12/31/98	72,000	61,344
Washington 6 - Pacific	698	B	1	100.00%	12/31/98	186,000	186,000
Washington 7 - Skamania	699	B	1	65.55%	12/31/98	29,000	19,010
West Virginia 3 - Monongalia	703	B	1	100.00%	12/31/98	267,000	267,000
West Virginia 4 - Grant	704	B	1	100.00%	12/31/98	172,000	172,000
West Virginia 5 - Tucker	705	B	1	100.00%	12/31/98	131,000	131,000
West Virginia 7 - Raleigh	707	B	1	100.00%	12/31/98	253,000	253,000
Wisconsin 5 - Pierce	712	A	1	100.00%	12/31/98	14,000	14,000
Wisconsin 6 - Trempealeau	713	A	1	100.00%	12/31/98	83,000	83,000
Wisconsin 7 - Wood	714	A	1	100.00%	12/31/98	291,000	291,000
Wisconsin 8 - Vernon	715	A	1	100.00%	12/31/98	237,000	237,000
Wisconsin 9 - Columbia	716	A	1	100.00%	12/31/98	387,000	387,000
Wisconsin 10 - Door	717	A	1	100.00%	12/31/98	129,000	129,000

Western Wireless

MSA/RSA Name	MSA/RSA Number	Freq. Block	Sub Market	% Owned	As of Date	POPs	Net POPs
Lubbock, TX Counties - Lubbock	161	A	1	100.00%	12/31/98	234,000	234,000
Lincoln, NE	172	A	1	100.00%	12/31/98	236,000	236,000
Abilene, TX	220	A	1	100.00%	12/31/98	153,000	153,000
Fargo-Moorehead, ND-MN	221	A	1	100.00%	12/31/98	167,000	167,000
Pueblo, CO	241	A	1	100.00%	12/31/98	134,000	134,000
Sioux City, IA-NE	253	A	1	100.00%	12/31/98	123,000	123,000
Odessa, TX	255	A	1	96.00%	12/31/98	123,000	118,080
Sioux Falls, SD	267	A	1	99.00%	12/31/98	142,000	140,580
Billings, MT	268	A	1	98.00%	12/31/98	125,000	122,500
Grand Forks, ND-MN	276	A	1	100.00%	12/31/98	102,000	102,000
Rapid City, SD	289	A	1	100.00%	12/31/98	109,000	109,000
San Angelo, TX	294	A	1	100.00%	12/31/98	104,000	104,000
Midland, TX	295	A	1	96.00%	12/31/98	117,000	112,320

Great Falls, MT	297	A	1	100.00%	12/31/98	80,000	80,000
Bismarck, ND	298	A	1	100.00%	12/31/98	91,000	91,000
Casper, WY	299	A	1	100.00%	12/31/98	63,000	63,000
California 6 - Mono	341	A	1	100.00%	12/31/98	29,000	29,000
Colorado 4 - Park	351	A	1	100.00%	12/31/98	89,000	89,000
Colorado 5 - Elbert	352	A	1	100.00%	12/31/98	34,000	34,000
Colorado 7 - Saguache	354	A	1	100.00%	12/31/98	50,000	50,000
Colorado 8 - Kiowa	355	A	1	100.00%	12/31/98	46,000	46,000
Colorado 9 - Costilla	356	A	1	100.00%	12/31/98	30,000	30,000
Idaho 2 - Idaho	389	A	1	100.00%	12/31/98	78,000	78,000
Iowa 8 - Monona	419	A	1	100.00%	12/31/98	54,000	54,000
Kansas 3 - Jewell	430	A	1	100.00%	12/31/98	52,000	52,000
Kansas 4 - Marshall	431	A	1	100.00%	12/31/98	123,000	123,000
Kansas 8 - Ellsworth	435	A	1	100.00%	12/31/98	129,000	129,000
Kansas 9 - Morris	436	A	1	100.00%	12/31/98	58,000	58,000
Kansas 10 - Franklin	437	A	1	100.00%	12/31/98	111,000	111,000
Kansas 14 - Reno	441	A	1	100.00%	12/31/98	173,000	173,000
Minnesota 1 - Kittson	482	A	1	100.00%	12/31/98	50,000	50,000
Minnesota 2 - Lake of the Woods	483	A	1	100.00%	12/31/98	26,000	26,000
Minnesota 7 - Chippewa	488	A	1	100.00%	12/31/98	173,000	173,000
Minnesota 8 - Lac qui Parle	489	A	1	100.00%	12/31/98	67,000	67,000
Minnesota 9 - Pipestone	490	A	1	100.00%	12/31/98	134,000	134,000
Missouri 9 - Bates	512	A	1	100.00%	12/31/98	79,000	79,000
Montana 1 - Lincoln	523	A	1	100.00%	12/31/98	151,000	151,000
Montana 2 - Toole	524	A	1	100.00%	12/31/98	37,000	37,000
Montana 3 - Phillips	525	A	1	100.00%	12/31/98	14,000	14,000
Montana 4 - Daniels	526	A	1	100.00%	12/31/98	39,000	39,000
Montana 5 - Mineral	527	A	1	100.00%	12/31/98	190,000	190,000
Montana 6 - Deer Lodge	528	A	1	100.00%	12/31/98	64,000	64,000
Montana 7 - Fergus	529	A	1	100.00%	12/31/98	30,000	30,000
Montana 8 - Beaverhead	530	A	1	100.00%	12/31/98	93,000	93,000
Montana 9 - Carbon	531	A	1	100.00%	12/31/98	32,000	32,000
Montana 10 - Prairie	532	A	1	100.00%	12/31/98	20,000	20,000
Nebraska 2 - Cherry	534	A	1	100.00%	12/31/98	30,000	30,000
Nebraska 3 - Knox	535	A	1	100.00%	12/31/98	116,000	116,000
Nebraska 4 - Grant	536	A	1	100.00%	12/31/98	35,000	35,000
Nebraska 5 - Boone	537	A	1	100.00%	12/31/98	148,000	148,000
Nebraska 6 - Keith	538	A	1	100.00%	12/31/98	110,000	110,000
Nebraska 7 - Hall	539	A	1	100.00%	12/31/98	92,000	92,000
Nebraska 8 - Chase	540	A	1	100.00%	12/31/98	58,000	58,000
Nebraska 9 - Adams	541	A	1	100.00%	12/31/98	80,000	80,000
Nebraska 10 - Cass	542	A	1	100.00%	12/31/98	87,000	87,000
Nevada 1 - Humboldt	543	A	1	100.00%	12/31/98	46,000	46,000
Nevada 2 - Lander	544	A	1	100.00%	12/31/98	57,000	57,000
Nevada 4 - Mineral	546	A	1	100.00%	12/31/98	36,000	36,000
Nevada 5 - White Pine	547	A	1	100.00%	12/31/98	15,000	15,000
New Mexico 6 - Lincoln	558	A	1	100.00%	12/31/98	245,000	245,000
North Dakota 1 - Divide	580	A	1	100.00%	12/31/98	104,000	104,000
North Dakota 2 - Bottineau	581	A	1	100.00%	12/31/98	59,000	59,000
North Dakota 4 - McKenzie	583	A	1	100.00%	12/31/98	64,000	64,000
North Dakota 5 - Kidder	584	A	1	100.00%	12/31/98	47,000	47,000
Oklahoma 1 - Cimarron	596	A	1	100.00%	2/4/99	27,000	27,000
Oklahoma 7 - Beckham	602	A	1	100.00%	12/31/98	127,000	127,000
Oklahoma 8 - Jackson	603	A	1	100.00%	12/31/98	96,000	96,000
South Dakota 1 - Harding	634	A	1	100.00%	12/31/98	37,000	37,000
South Dakota 2 - Corson	635	A	1	100.00%	12/31/98	23,000	23,000
South Dakota 3 - McPherson	636	A	1	100.00%	12/31/98	53,000	53,000
South Dakota 4 - Marshall	637	A	1	100.00%	12/31/98	69,000	69,000
South Dakota 5 - Custer	638	A	1	100.00%	2/1/99	27,000	27,000
South Dakota 6 - Haakon	639	A	1	100.00%	12/31/98	41,000	41,000
South Dakota 7 - Sully	640	A	1	100.00%	12/31/98	66,000	66,000
South Dakota 8 - Kingsbury	641	A	1	100.00%	12/31/98	74,000	74,000
South Dakota 9 - Hanson	642	A	1	100.00%	12/31/98	100,000	100,000
Texas 1 - Dallam	652	A	1	100.00%	12/31/98	57,000	57,000
Texas 2 - Hansford	653	A	1	100.00%	12/31/98	90,000	90,000
Texas 3 - Parmer	654	A	1	100.00%	12/31/98	141,000	141,000
Texas 4 - Briscoe	655	A	1	100.00%	12/31/98	42,000	42,000
Texas 5 - Hardeman	656	A	1	100.00%	12/31/98	76,000	76,000
Texas 8 - Gaines	659	A	1	100.00%	12/31/98	136,000	136,000
Texas 12 - Hudspeth	663	A	1	100.00%	12/31/98	27,000	27,000
Texas 13 - Reeves	664	A	1	100.00%	12/31/98	32,000	32,000
Texas 14 - Loving	665	A	1	100.00%	12/31/98	46,000	46,000
Utah 3 - Juab	675	A	1	100.00%	12/31/98	59,000	59,000
Utah 4 - Beaver	676	A	1	100.00%	12/31/98	120,000	120,000
Utah 6 - Piute	678	A	1	100.00%	12/31/98	27,000	27,000
Wyoming 2 - Sheridan	719	A	1	100.00%	12/31/98	76,000	76,000
Wyoming 4 - Niobrara	721	A	1	100.00%	2/4/99	134,000	134,000
Wyoming 5 - Converse	722	A	1	100.00%	12/31/98	12,000	12,000