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FEB - 5 1999

Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington DC 20554

February 5, 1999

Re: CC Docket No. 94-102

Dear Ms. Salas:

On February 3, 1999, Ellen Kirk, Vice President, Marketing and Strategic Planning, SnapTrack, Glenn B. Manishin of Blumenfeld & Cohen, counsel to SnapTrack, and Ruth Milkman, The Lawler Group, counsel to SnapTrack met with Thomas J. Sugrue, Chief, Wireless Telecommunications Bureau, and David Wye, WTB. In that meeting, SnapTrack made a presentation regarding issues in the wireless E-911 proceeding, CC Docket No. 94-102, using the attached material. On February 4, 1999, Ms. Kirk, Mr. Manishin, and Ms. Milkman met with Ari Fitzgerald, Legal Advisor to Chairman Kennard, and discussed issues relating to the wireless E-911 proceeding.

Sincerely,

Ruth Milkman

Attachment

No. of Copies rec'd 0+1
List A B C D E

Presentation to the FCC

October 1998

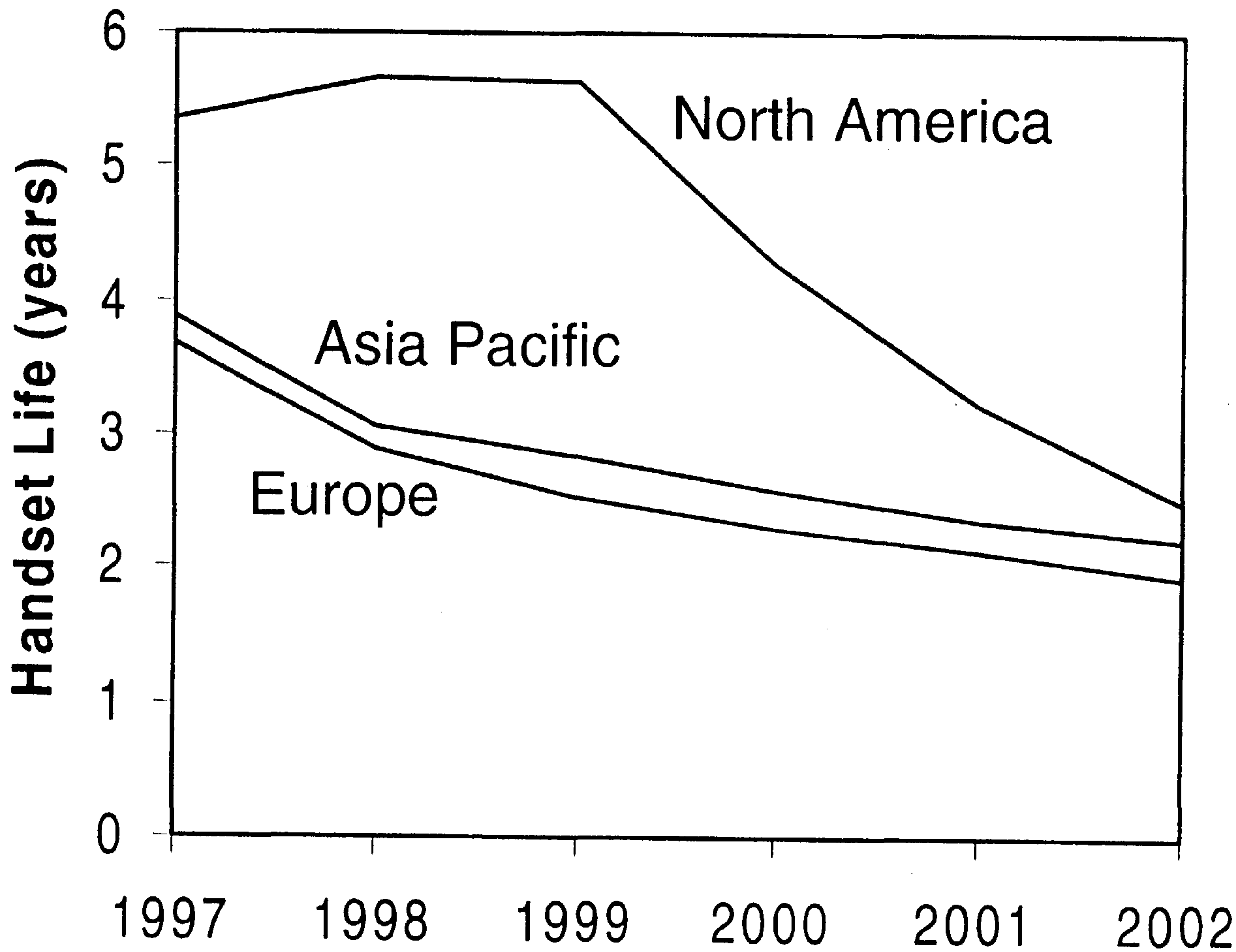
Overview

- Unambiguous guidance by the FCC regarding handset-based location solution implementation compliance is needed
- Manufacturing lead times and other timing constraints require such guidance be provided immediately to maintain viability of certain high-performance handset-based location solutions
- Timely FCC action will ensure early deployment of Phase II capability

Benefits

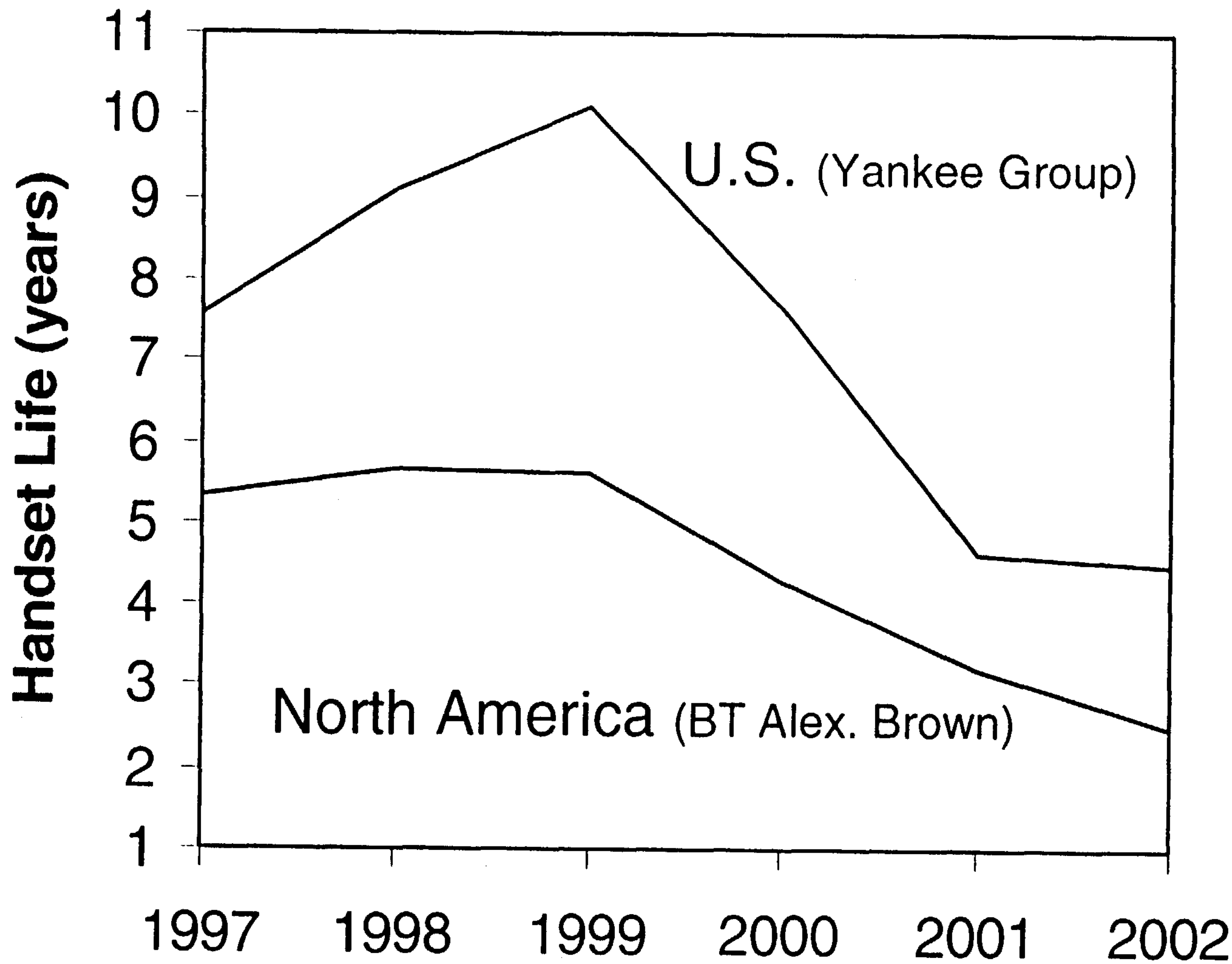
- Earlier deployment
- Improved accuracy
- Long-term higher location success rate: more people who dial 9-1-1 will be found more quickly

Average Handset Life (1)



Source: BT Alex. Brown Research

Average Handset Life (2)

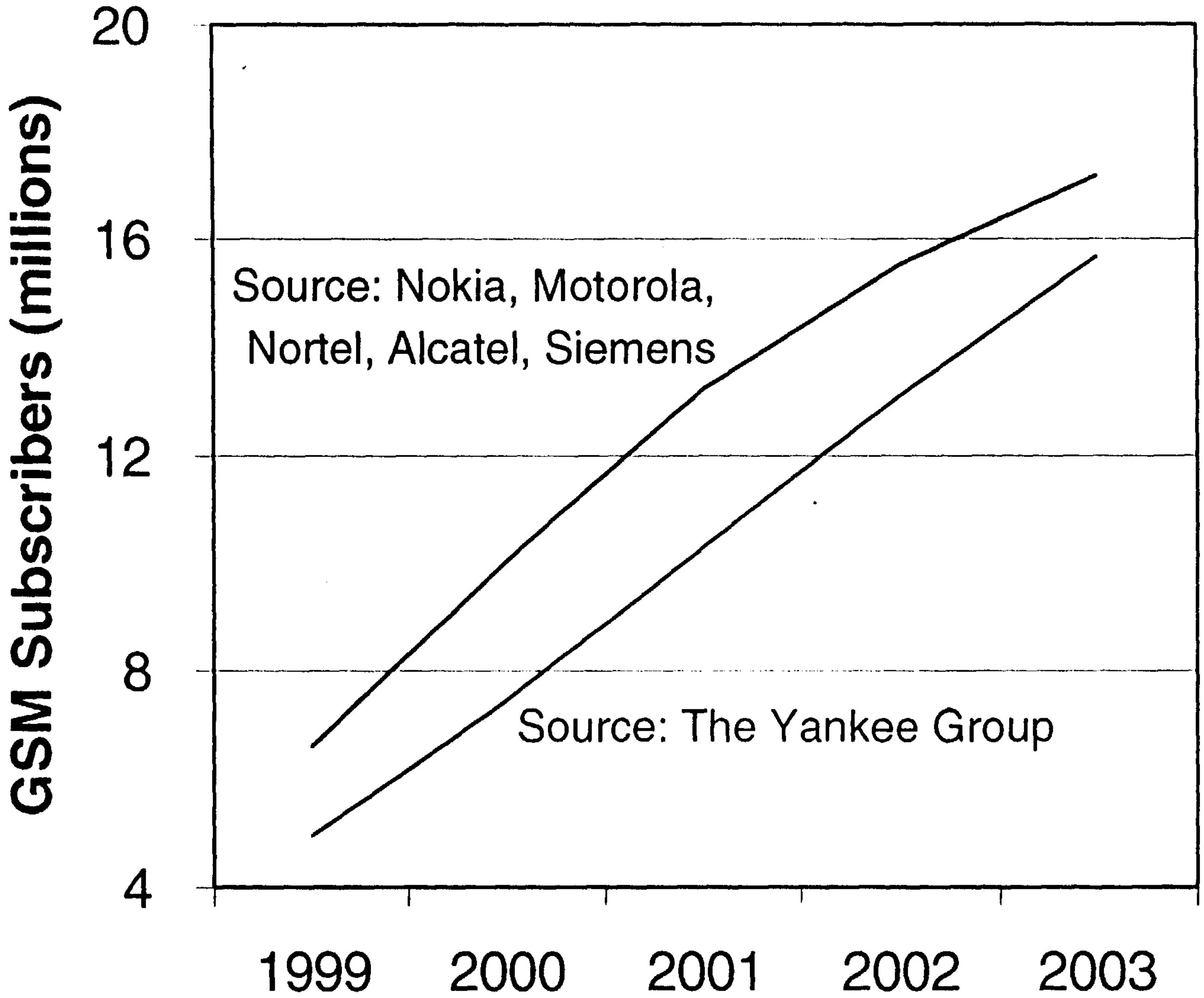


Sources: The Yankee Group, BT Alex. Brown Research

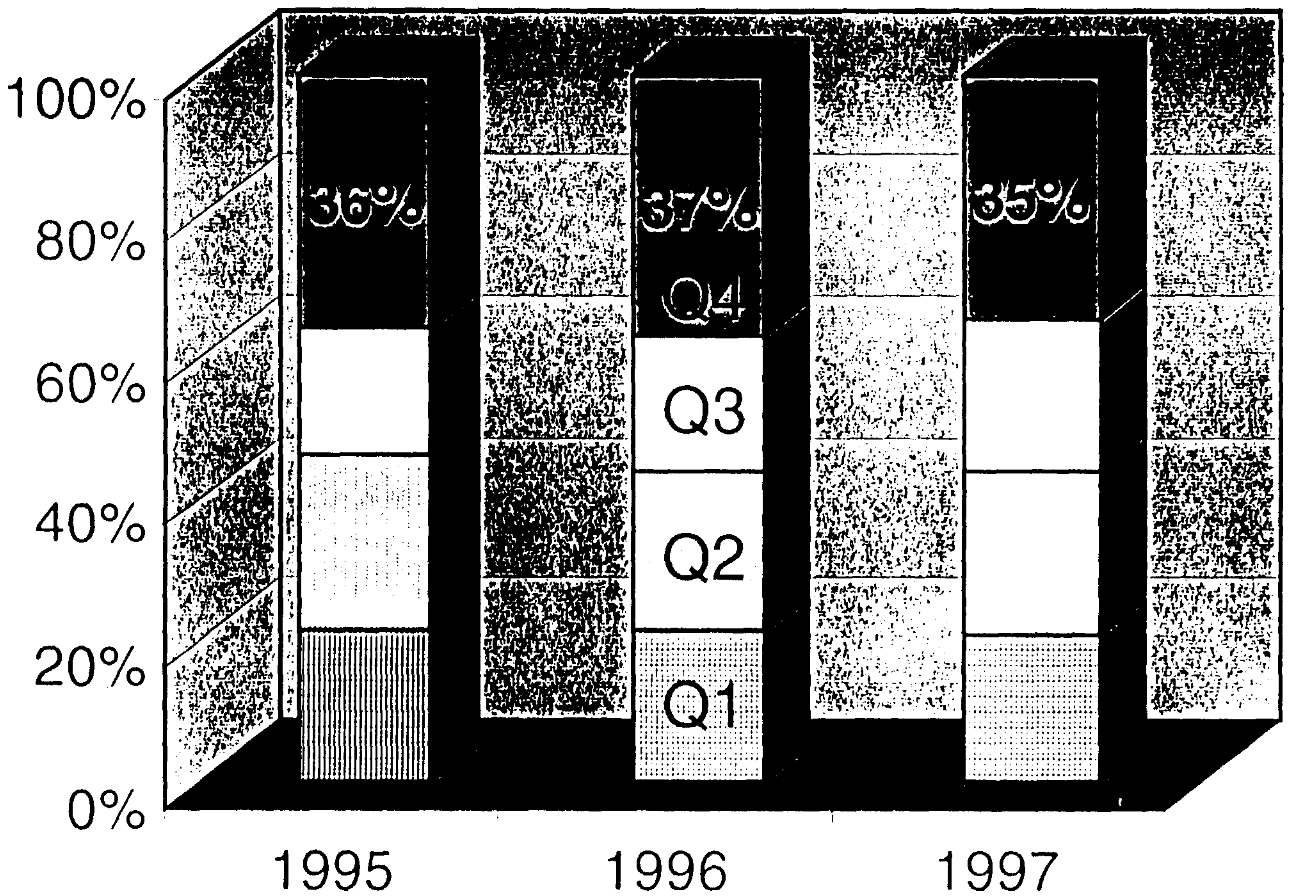
Increasing Handset Turnover

- A number of factors are contributing to the projected acceleration of handset turnover
  - network upgrades from analog to digital
  - PCS network buildout
  - an increased number of competitors leading to a requirement for feature differentiation
  - new handset manufacturers, determined to stake a claim, lowering prices and adding features

U.S. GSM Subscriber Forecasts



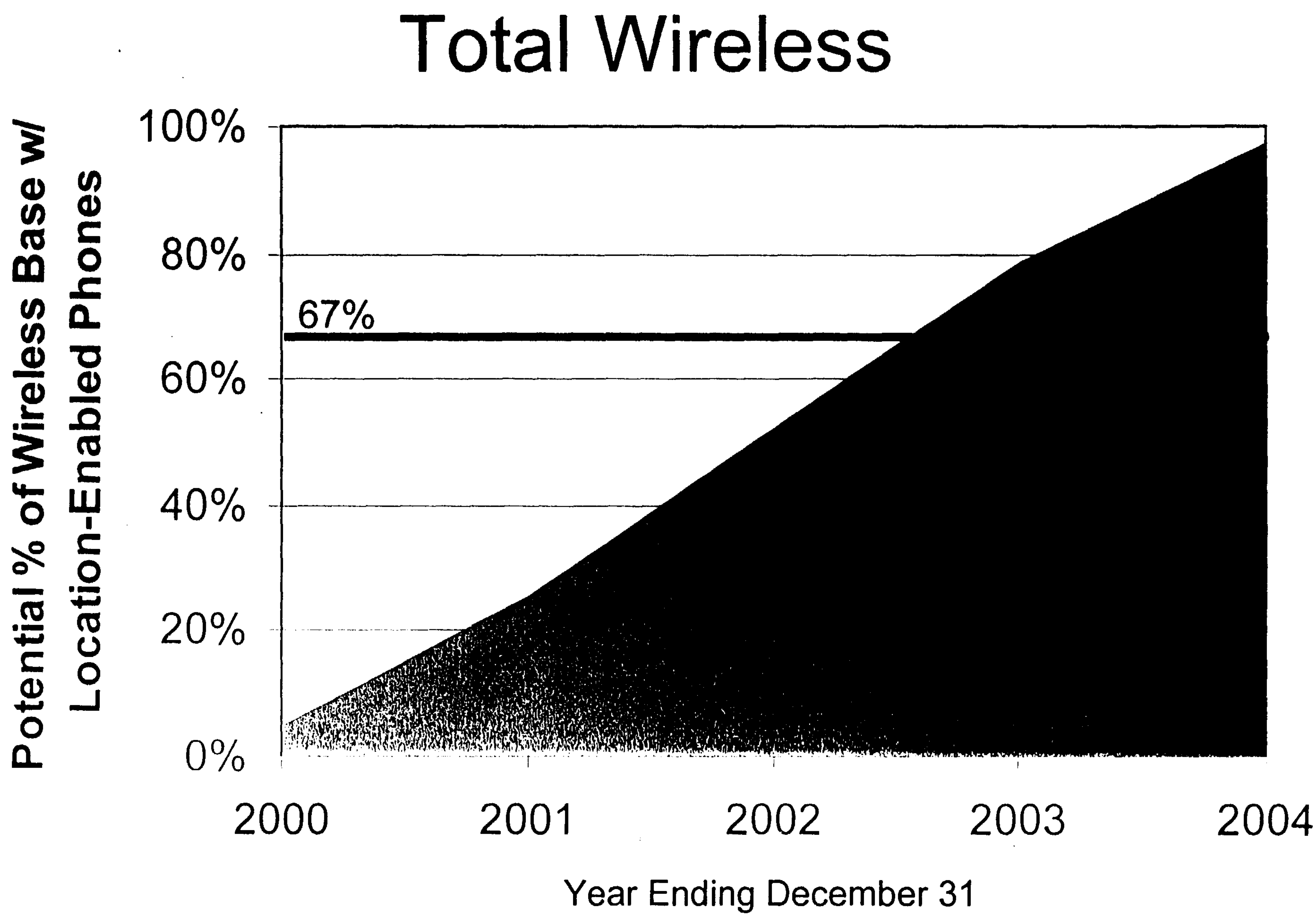
Quarterly Adds of Wireless Subs (U.S.)



Source: Donaldson, Lufkin & Jenrette

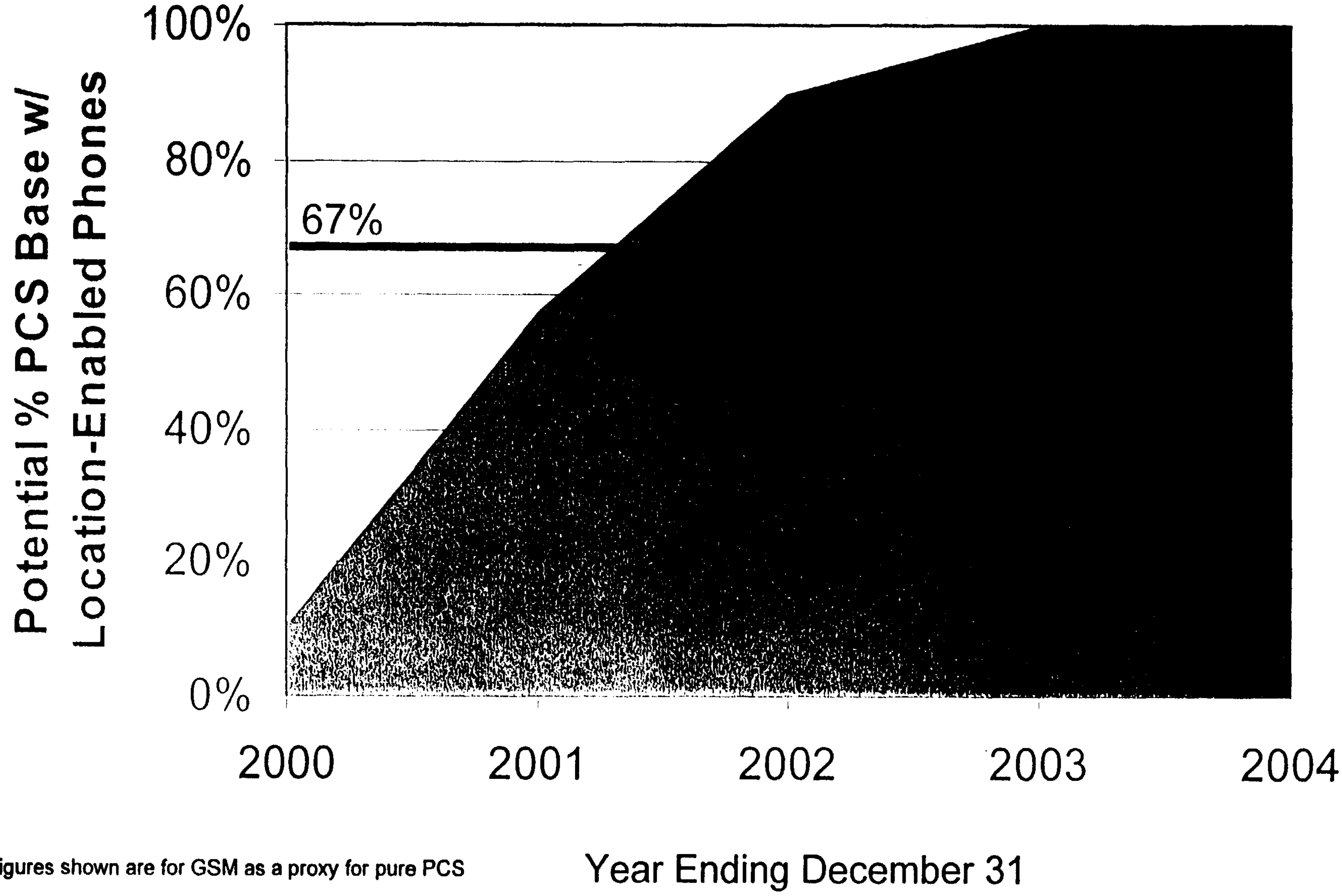
Assumptions

- High-performance location-enabled phones are offered beginning Oct. 1, 2000
- 20% of wireless phones sold in 2000 are high-performance location-enabled
- From Oct. 1, 2001, only high-performance location-enabled phones are sold
- 75% of wireless phones sold in 2001 are high-performance location-enabled
- 100% of wireless phones sold in 2002 and beyond are high-performance location-enabled



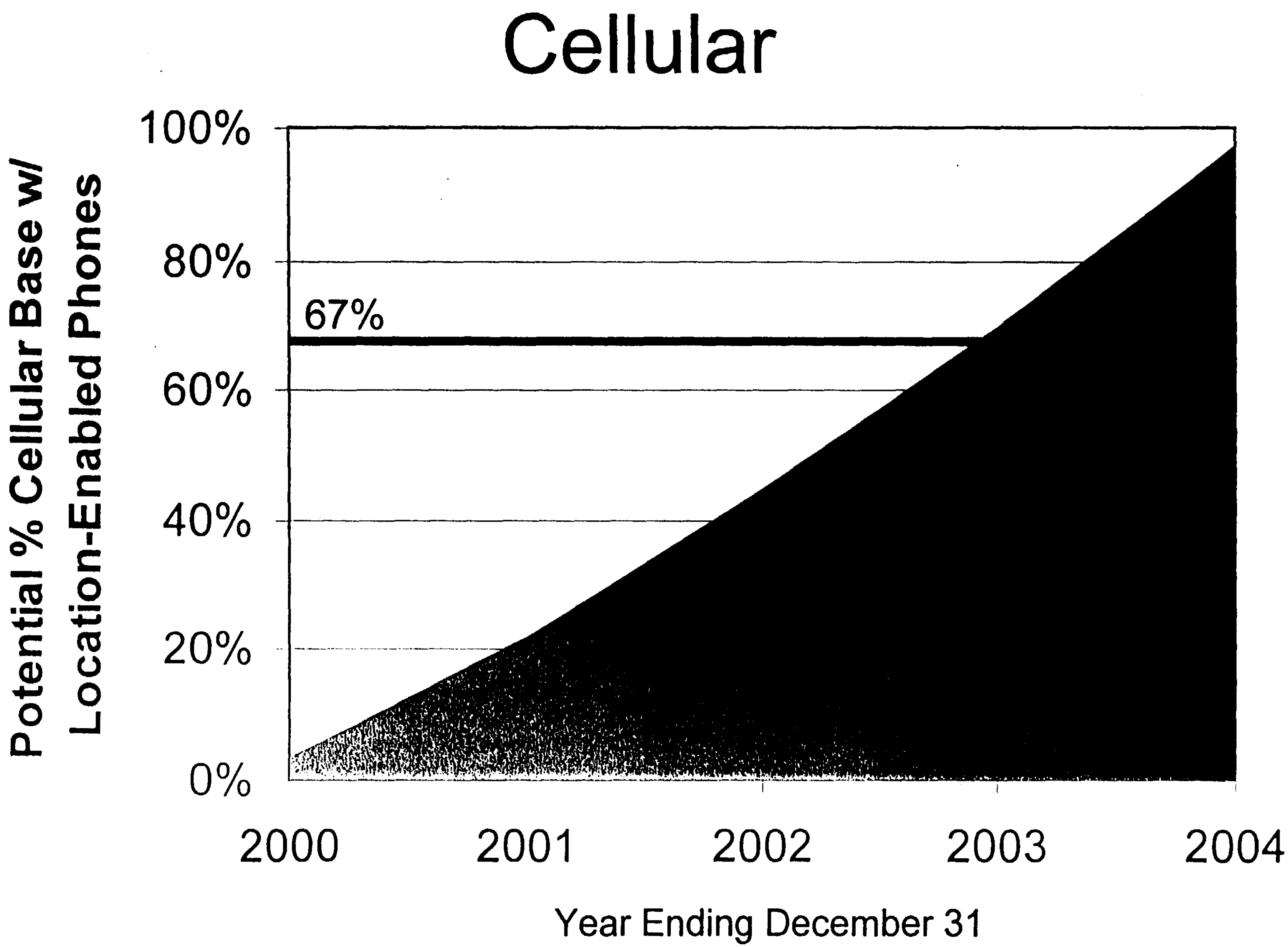
Sources: The Yankee Group, SnapTrack (2004 only)

PCS*



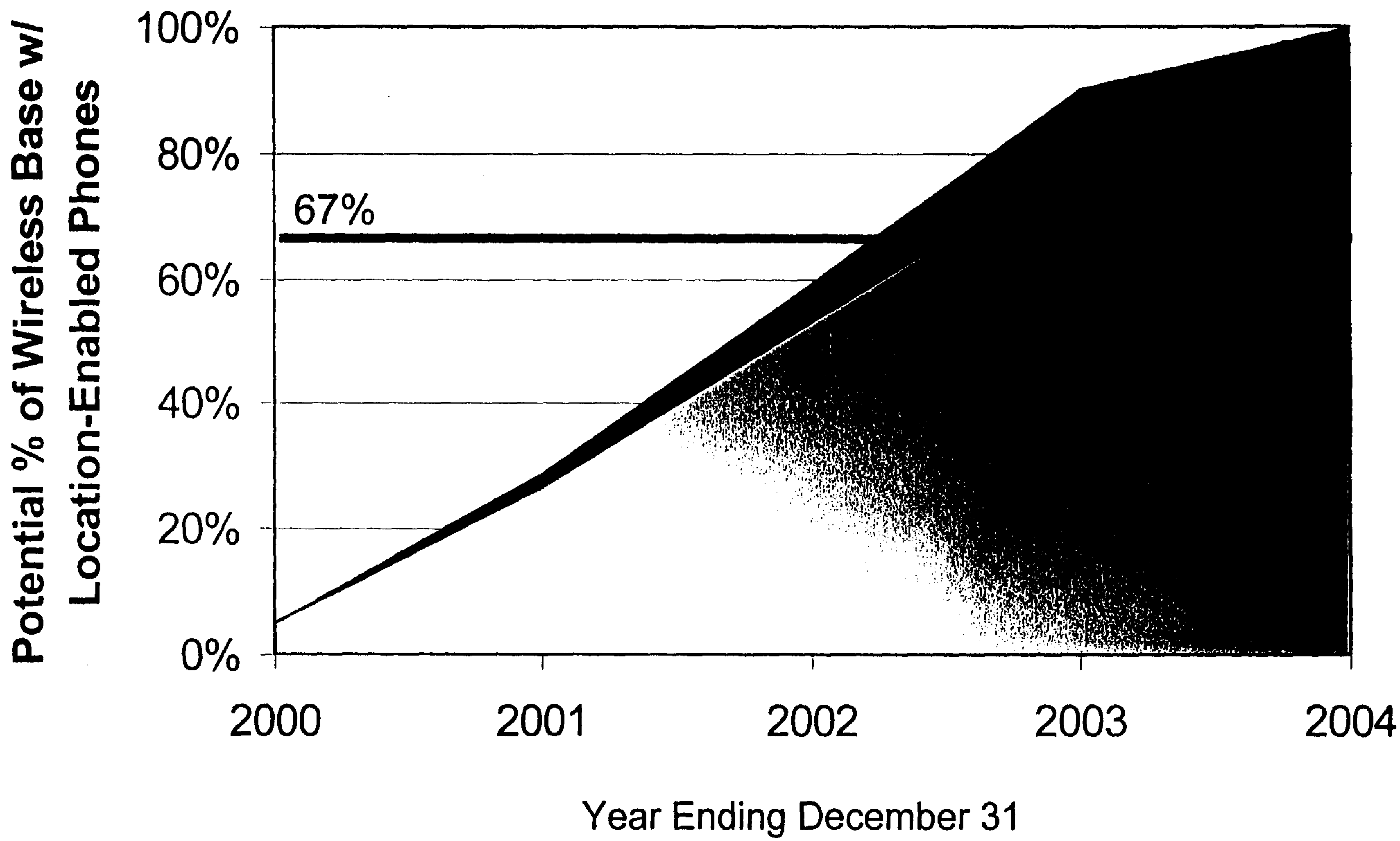
*Figures shown are for GSM as a proxy for pure PCS

Sources: The Yankee Group, SnapTrack (2004 only)



Sources: The Yankee Group, SnapTrack (2004 only)

Total Wireless - Upside



Sources: The Yankee Group, SnapTrack

Field Testing Overview

- Extensive testing in the SF Bay Area, Denver (audited), Tokyo (audited), Kyoto (audited)
- Full range of outdoor environments: freeway, suburban, deep urban canyon
- Broad cross-section of indoor environments: high-rise, commercial, residential, brick, glass/steel
- System tested at speed in vehicle with GPS antenna inside at passenger head height
- End-to-end E9-1-1 field trial
  - >650 test calls; 100% correctly routed (based on SnapTrack-determined location)
  - partnered with SignalSoft, SCC, U S WEST Wireless, two Denver-area PSAPs

SnapTrack

Summary Results: Denver Testing

Location	Garmin Results	SnapTrack Single Sample Results: Fixes	Attempts	Percent Yield	1 sigma 68.3% CEP meters	2 sigma 95% CEP meters	Max Error meters
Indoor, 2 story residence (wood frame) 3707 W 98th place, 1st floor interior hall	no fix	106	106	100%	21	35	72
Indoor, 2 story residence (wood frame) 3707 W 98th place, center of basement	no fix	33	33	100%	20	*	60
Indoor, 2 story residence (wood frame) 627 Marine, center of basement	no fix	36	37	97%	16	*	50
Indoor, 2 story office building (Brick) 2045 Broadway, 2nd floor interior hallway	no fix	110	110	100%	17	36	66
Indoor, 2 story office building (Brick) 2045 Broadway, 1st floor interior room	no fix	34	36	94%	22	*	79
Indoor, Shopping Mall Westminster Mall, Denver	no fix	27	27	100%	36	*	133
Indoor, Shopping Mall Aurora Mall, Aurora (Denver)	no fix	31	39	79%	44	*	168
Indoor, 50 story office building (Glass/Steel) 1801 California, 21st Floor 4.4 m from window	no fix	32	36	89%	84	*	231
Outdoor, urban canyon street level (mid block) Curtis street between 16th and 17th, Denver		120	120	100%	45	113	247
(Supplemental reference sites)							
Outdoor, urban canyon Parking Garage Roof		57	57	100%	18	*	47
Outdoor, open site 71st and Winchester Circle		16	16	100%	4	*	5

* Insufficient data to calculate 2 sigma value
** 5 Sample average not calculated

Altitude data collected but not tabulated

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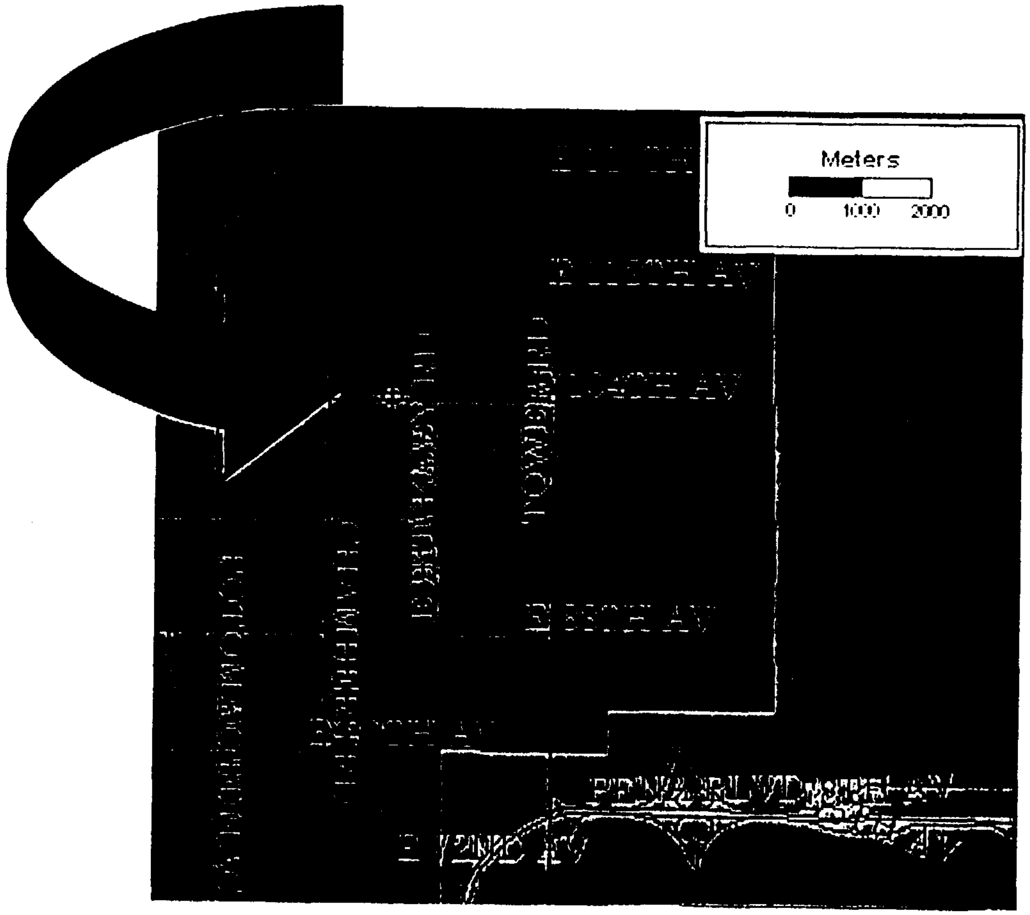
Single Cell Site Problem



Network location solutions rely on "triangles of towers" - cellular base stations are not deployed in triangles!

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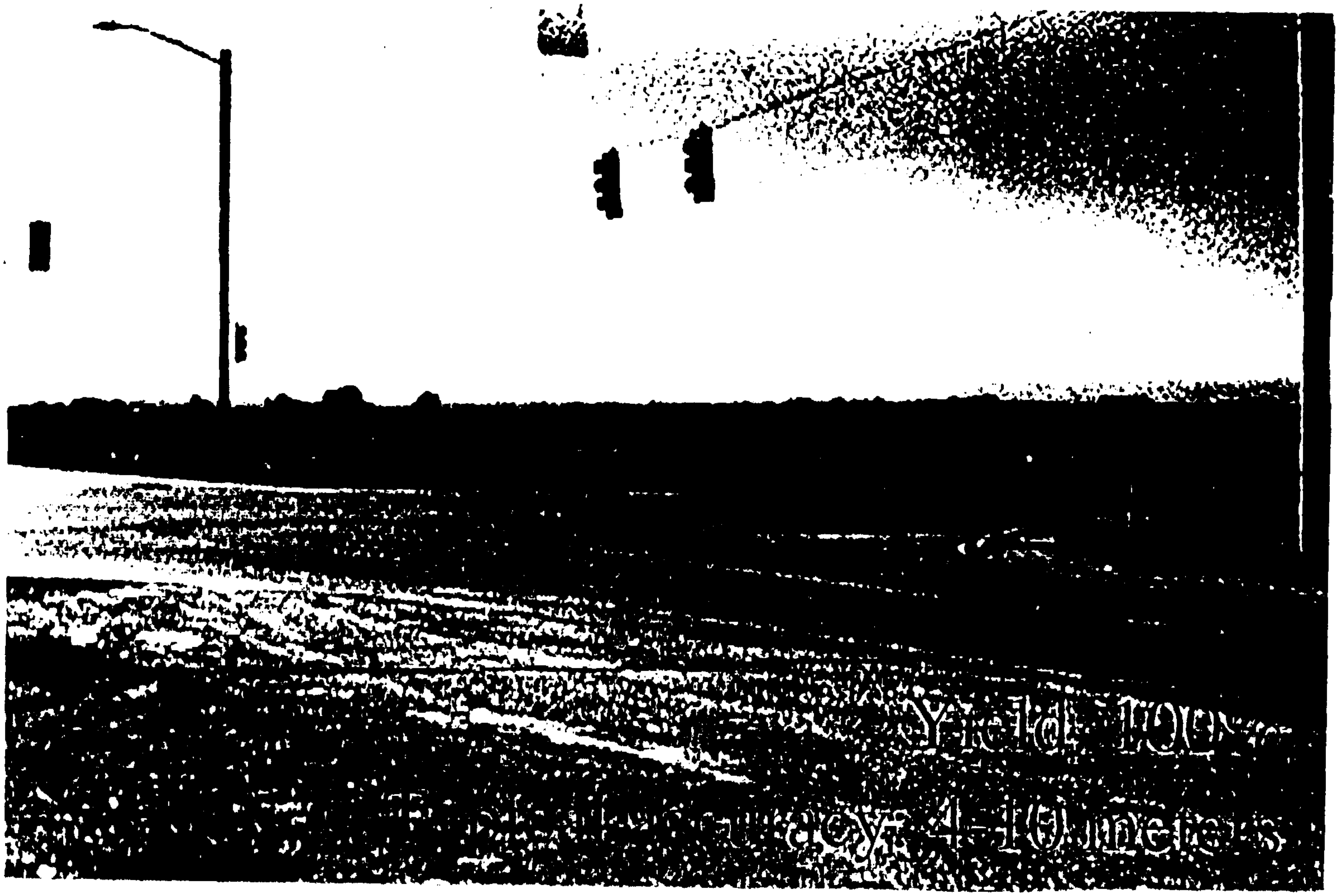
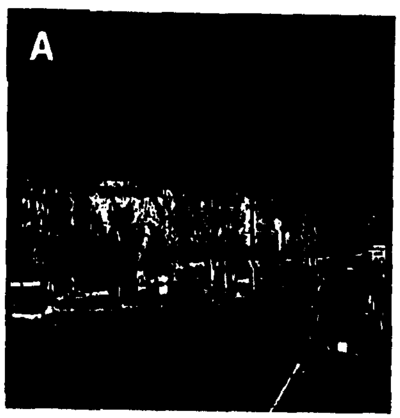
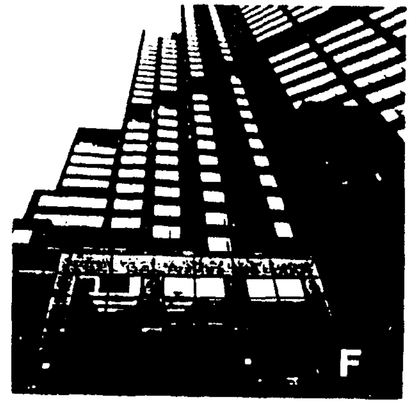
Adams County, CO (Rural)



Sensitivity & Accuracy*



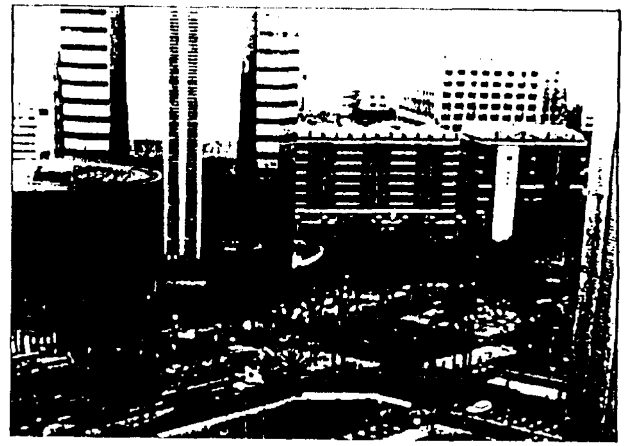


Each location is an independent fix from a cold start

Location	1-sigma (68.3%)	Yield
A. Outdoor, open site	4 meters	100%
B. Sport utility vehicle, antenna by driver's head	17 m	100%
C. 2-story residence, center of basement	20 m	100%
D. 2-story brick office bldg., 1st floor, interior room	22 m	94%
E. Urban Canyon	29 m	100%
F. 50-story glass/steel, 21st floor, 14 ft. from wall	84 m	89%

*Testing designed and audited by US WEST Wireless

SnapTrack



Japan Field Testing*

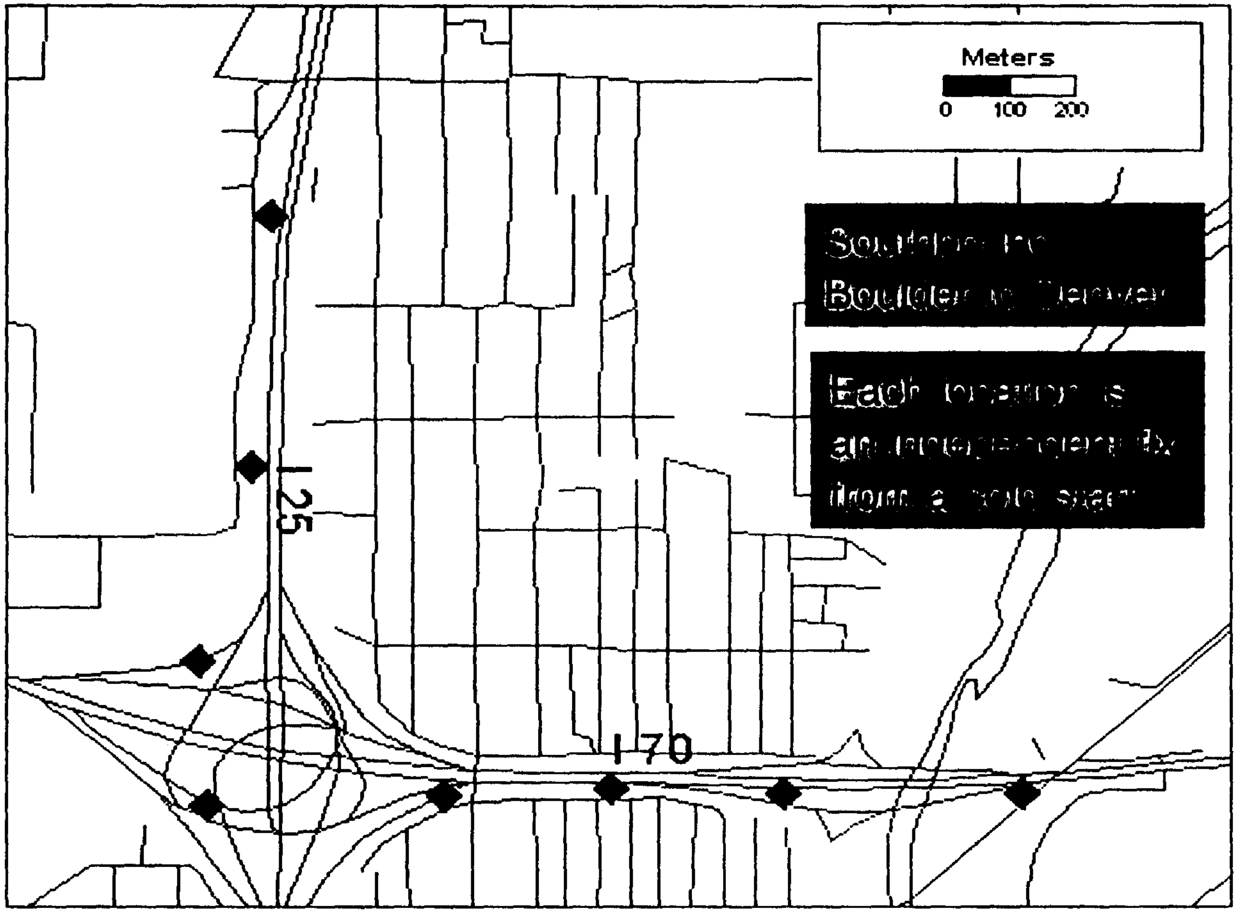
Location	5 point averaging 1-sigma (68.3%)	Yield
Outdoor, Kawasaki Dorm	4 meters	100%
Indoor, Kawasaki Dorm	12 m	100%
Shinbashi	12 m	100%
Inside Coffee Shop	20 m	100%
Ginza	18 m	100%
I-Land Street	44 m	100%

*Testing designed and audited by NTT DoCoMo

SnapTrack

Urban Highway Drive Test*

Antenna Inside Car



*Testing designed and audited by US WEST Wireless

SnapTrack

Source Data

THE YANKEE GROUP

Wireless/Mobile Communications Global

REPORT Vol. 2, No. 37—August 1998

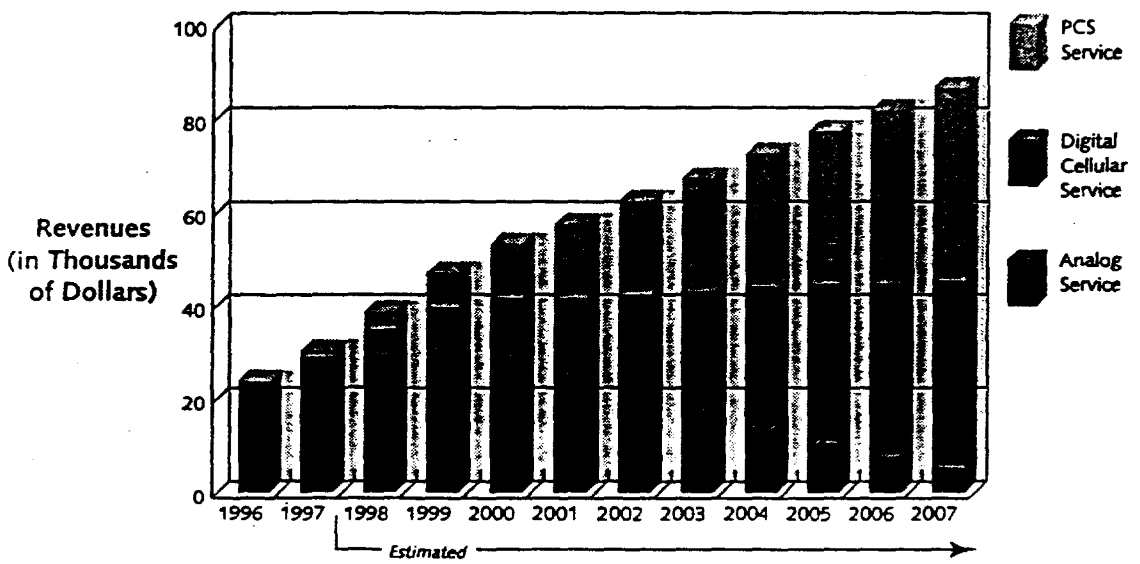
The Pricing Elasticity of Wireless: Building the Revenue Model

Executive Summary

We believe that the United States market is going through a fundamental shift in the relationship between the price charged to wireless users and their corresponding usage of wireless minutes of use (MOUs). We believe that the United States BPPM increased from $0.34 in 1991 to $0.56 in 1995 while MOUs declined from 210 in 1990 to 90 in 1995. Using the ARC method of determining the Price Elasticity Demand Coefficient, the wireless industry demonstrated a price elasticity of –1.63 during the 1991 through 1995 time period. The result of this change in the subscriber mix towards marginal MOU usage consumers resulted in a yearly decline of 8.3% for ARPU (1990–1995 CAGR) during this period.

However, with the introduction of PCS competition and the continued introduction of digital cellular services, we believe that the trend relationship between BPPM and MOUs has been reversed in the context of digital services and will ultimately be reversed in the analog segment as well, as both existing and new customers respond to increasingly favorable pricing. As a result of the first incoming minute free strategy and lower airtime rates, the average PCS BPPM has average discounts against (measured against both analog cellular and digital cellular pricing) ranging

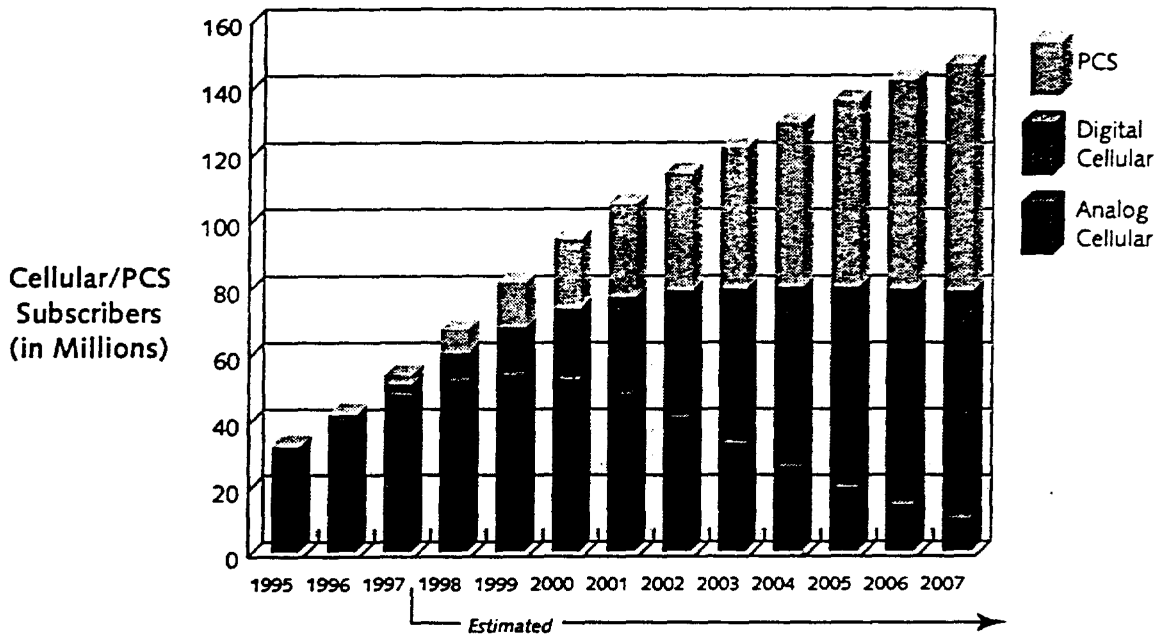
Exhibit 1
Cellular/PCS Revenue Forecast, Baseline Scenario
Source: the Yankee Group, 1998



V. Bringing it All Together: The Cellular/PCS Services Revenue Forecast, 1997–2007

Based on our APRU projections and cellular/PCS subscriber forecast, shown in Exhibit 9, we believe that revenues will grow from $24 billion in 1996 to $39 billion in 1998 and eventually to $87 billion in the year 2007. Our revenue forecast, shown in Exhibit 10, results in a 1997–2007 CAGR of 11.1%, which is slightly above our subscriber

Exhibit 9
U.S. Cellular/PCS Market Forecast
Source: the Yankee Group, 1998

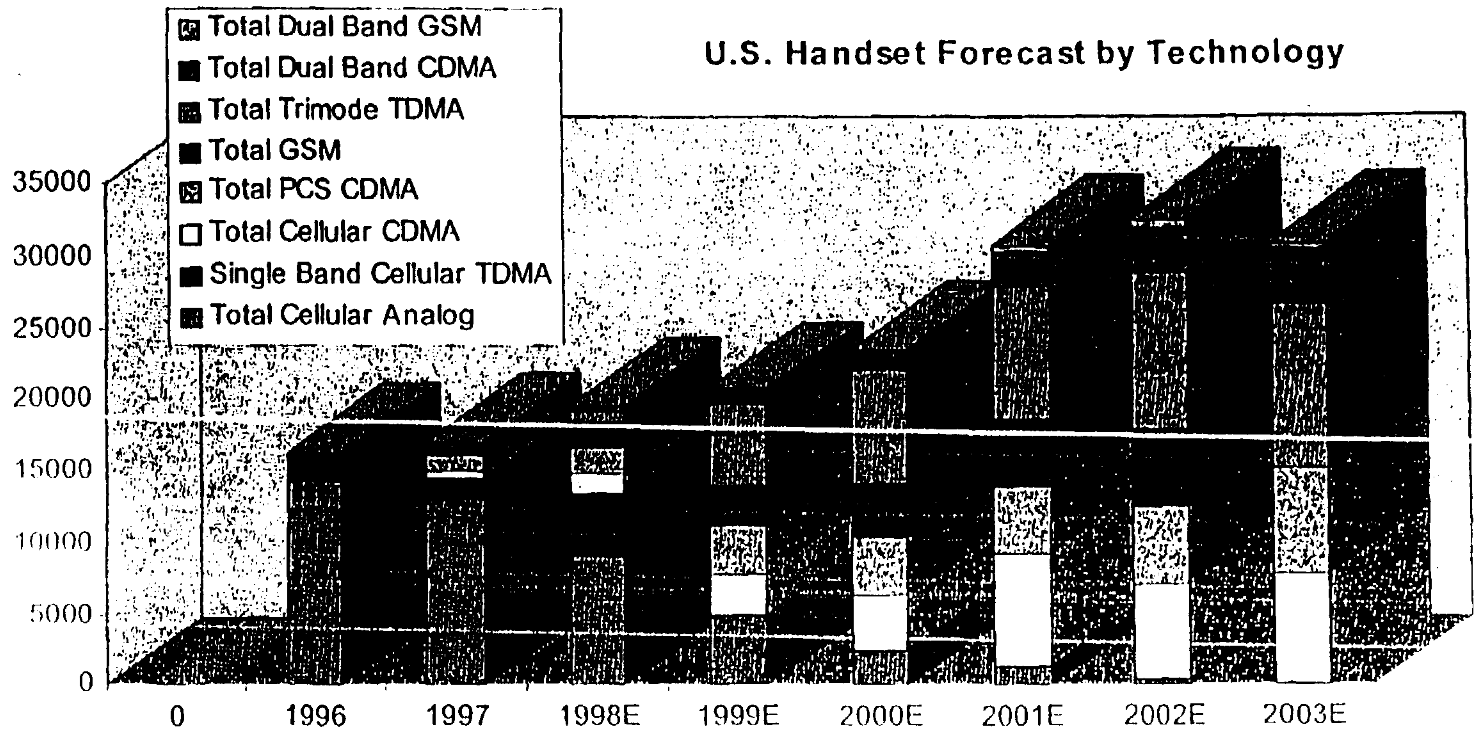


	AMPS	CDMA	PCS CDMA	Total CDMA	TDMA	PCS TDMA	Total TDMA	GSM	Total	U.S. Penetration	Growth Rate
1995	31.50	—	—	—	0.56	—	0.56	0.04	32.1	12.2%	—
1996	39.81	—	0.04	0.04	1.71	—	1.71	0.28	41.8	15.8%	30.4%
1997	47.46	0.52	1.13	1.66	2.79	0.10	2.89	1.34	53.3	20.0%	27.5%
1998	51.62	1.94	3.19	5.13	6.48	0.85	7.33	2.90	67.0	24.9%	25.5%
1999	53.26	4.59	6.62	11.21	9.74	1.90	11.64	4.98	81.1	29.9%	21.1%
2000	51.96	7.68	9.87	17.55	13.83	3.27	17.10	7.46	94.1	34.4%	16.0%
2001	47.46	11.11	13.06	24.17	18.12	4.41	22.53	10.32	104.5	37.9%	11.1%
2002	40.43	15.23	16.52	31.75	22.84	5.58	28.42	13.05	113.7	40.9%	8.8%
2003	32.82	20.02	19.83	39.85	26.53	6.70	33.23	15.67	121.6	43.4%	7.0%
2004	25.59	24.39	23.08	47.48	29.81	7.79	37.61	18.24	128.9	45.6%	6.0%
2005	19.48	28.29	26.30	54.59	31.90	8.88	40.78	20.78	135.6	47.6%	5.2%
2006	14.31	31.13	29.41	60.54	33.73	9.93	43.66	23.23	141.7	49.4%	4.5%
2007	9.94	32.94	31.93	64.87	35.68	10.78	46.46	25.23	146.5	50.6%	3.4%
1997–2007 CAGR	−14.5%	51.4%	39.6%	44.3%	29.0%	59.7%	32.0%	34.1%	10.6%	—	—

the Yankee Group Cellular/PCS Forecast

US Cellular/PCS Subscriber Forecast														
in millions	1995A	1996A	1997A	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	97-07 CAGR
AMPS	31.50	39.81	47.46	51.62	53.26	51.96	47.46	40.43	32.82	25.59	19.48	14.31	9.94	-14.5%
CDMA	-	-	0.52	1.94	4.59	7.68	11.11	15.23	20.02	24.39	28.29	31.13	32.94	51.4%
PCS CDMA	-	0.04	1.13	3.19	6.62	9.87	13.06	16.52	19.83	23.08	26.30	29.41	31.93	39.6%
Total CDMA	-	0.04	1.66	5.13	11.21	17.55	24.17	31.75	39.85	47.48	54.59	60.54	64.87	44.3%
TDMA	0.56	1.71	2.79	6.48	9.74	13.83	18.12	22.84	26.53	29.81	31.90	33.73	35.68	29.0%
PCS TDMA	-	-	0.10	0.85	1.90	3.27	4.41	5.58	6.70	7.79	8.88	9.93	10.78	59.7%
Total TDMA	0.56	1.71	2.89	7.33	11.64	17.10	22.53	28.42	33.23	37.61	40.78	43.66	46.46	32.0%
GSM	0.04	0.28	1.34	2.90	4.98	7.46	10.32	13.05	15.67	18.24	20.78	23.23	25.23	34.1%
Total	32.1	41.8	53.3	67.0	81.1	94.1	104.5	113.7	121.6	128.9	135.6	141.7	146.5	10.6%
US Penetration	12.2%	15.8%	20.0%	24.9%	29.9%	34.4%	37.9%	40.9%	43.4%	45.6%	47.6%	49.4%	50.6%	
Growth Rate		30.4%	27.5%	25.5%	21.1%	16.0%	11.1%	8.8%	7.0%	6.0%	5.2%	4.5%	3.4%	

U.S. Handset Shipment Forecast



0	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E
Total Cellular Analog	14,259	13,054	9,073	5,015	2,434	1,353	479	-
Single Band Cellular TDMA	1,794	1,396	4,330	-	-	-	-	-
Total Cellular CDMA	-	522	1,447	2,882	3,893	7,929	6,550	7,806
Total PCS CDMA	38	1,073	1,851	3,375	4,092	4,697	5,511	7,440
Total GSM	284	854	1,716	2,633	3,692	4,719	5,321	5,431
Total Trimode TDMA	-	100	748	5,829	7,981	9,238	11,115	11,497
Total Dual Band CDMA	-	22	312	842	1,179	2,428	3,060	3,751
Total Dual Band GSM	-	-	40	161	293	418	480	463
Total Shipments	16,375	17,021	19,517	20,736	23,563	30,783	32,515	30,958

1 **Numbers in thousands**

0	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E
Total Cellular Analog	14,259	13,054	9,073	5,015	2,434	1,353	479	-
Single Band Cellular TDMA	1,794	1,396	4,330	-	-	-	-	-
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Total PCS CDMA	38	1,073	1,851	3,375	4,092	4,697	5,511	7,440
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Total Dual Band CDMA	-	22	312	842	1,179	2,428	3,060	3,751
Total Dual Band GSM	-	-	40	161	293	418	480	463
Total Shipments	16,375	17,021	19,517	20,736	23,563	30,783	32,515	36,388

Numbers in Thousands	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E
CDMA	38	1,617	3,610	7,099	9,163	15,055	15,121	18,998
TDMA	1,794	1,496	5,079	5,829	7,981	9,238	11,115	11,497
GSM	284	854	1,756	2,794	3,985	5,137	5,800	5,893
Total Digital	2,117	3,967	10,444	15,721	21,129	29,430	32,036	36,388
Analog	14,259	13,054	9,073	5,015	2,434	1,353	479	-
Total	16,375	17,021	19,517	20,736	23,563	30,783	32,515	36,388

BT Alex. Brown
Research

Equity
Communications Technology

Handsets!

Rapid Growth, Explosive Innovation, Intense Competition

June 29, 1998

INDUSTRY OVERVIEW

- We expect global cellular/PCS handset unit sales to grow from 102 million in 1997 to 371 million in 2002, for a 5-year compound annual growth rate (CAGR) of 29.4%. We expect handset sales to grow from $39.6 billion in 1997 to over $76.7 billion by 2002 for a CAGR of 14% (18% for digital handsets).
- Mobile handsets, once regarded as simple devices to convert radio frequency signals into voice and vice versa, have evolved to a mass consumer electronics market characterized by rapid growth, innovation and intensifying competition.
- Competition is heating up as new spectrum is freed up and new operators enter markets. Pricing pressure is driven by carriers, which often subsidize handsets and want to cut subscriber acquisition costs, and by the arrival on the scene of dozens of new handset manufacturers that are determined to stake a claim in the market.
- Cellular/PCS networks are transitioning from analog technology to an array of digital standards such as GSM, TDMA, CDMA, and PDC.
- We have four leading handset providers under coverage: Ericsson, Inc., Motorola, Inc., Nokia Corporation and Qualcomm, Inc. Our investment rating on the shares of Ericsson and Motorola is "market perform." We rate Nokia and Qualcomm shares "buy."

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Company Name	Ticker	Analyst Stock Rating	Price	FY EPS 1998E	FY EPS 1999E	CY P/E 1998	CY P/E 1999
Ericsson, Inc.	ERICY	3	29	$0.77	$0.89	37.7x	32.6x
Motorola, Inc.	MOT	3	53 7/8	$0.72	$2.10	74.8x	25.7x
Nokia Corporation	NOK.A	2	74 9/16	$2.23	$2.32	33.4x	32.1x
Qualcomm, Inc.	QCOM	2	55 15/16	$1.56	$2.80	33.7x	NM

Net Worldwide Handset Unit Sales:

By Technology

	1995	1996	1997	1998	1999	2000	2001	2002
New subscribers								
Analog	20,913,390	14,833,662	7,020,288	1,268,904	(4,465,102)	(11,202,151)	(16,164,614)	(19,533,000)
GSM	7,291,152	19,472,000	37,186,042	43,302,194	52,153,808	56,411,116	57,136,447	60,664,083
CDMA	1,500	1,062,566	5,300,661	10,923,264	17,445,959	24,276,398	29,450,085	35,385,515
TDMA	1,172,701	1,861,191	3,829,182	8,337,544	12,481,231	18,043,064	23,325,534	26,229,873
PDC	2,739,300	10,611,800	13,558,000	12,199,968	8,751,163	4,042,852	915,209	(3,015,286)
Net new handset unit sales	32,118,043	47,841,219	66,894,173	76,031,874	86,367,059	91,571,278	94,662,662	99,731,185
Replacement rate								
Analog	6.40%	8.91%	13.51%	12.50%	9.98%	7.19%	4.86%	3.09%
GSM	6.96%	11.15%	15.17%	21.66%	26.60%	31.38%	36.02%	40.60%
CDMA	2.50%	5.00%	9.79%	14.98%	20.62%	26.87%	33.12%	37.77%
TDMA	4.99%	8.75%	15.79%	21.37%	25.85%	30.39%	34.95%	39.62%
PDC	10.00%	15.00%	22.50%	35.00%	40.00%	45.00%	50.00%	50.00%
Net handset replacement rate	6.59%	10.04%	15.27%	20.09%	23.74%	28.19%	33.35%	38.28%
Replacement sales								
Analog	4,428,268	7,489,601	12,296,854	11,540,491	8,767,629	5,509,179	2,937,857	1,263,211
GSM	859,829	3,547,412	10,465,001	24,331,194	43,740,474	69,299,826	100,127,314	137,495,781
CDMA	38	53,203	623,143	2,589,385	7,162,981	15,857,686	29,294,034	46,781,808
TDMA	86,812	314,982	1,173,449	3,369,743	7,302,363	14,068,406	24,333,706	37,974,410
PDC	330,430	2,087,415	6,181,673	13,885,924	19,370,092	23,610,637	26,691,645	25,184,003
Net replacement handset unit sales	5,705,376	13,492,614	30,740,121	55,716,737	86,343,540	128,345,734	183,384,555	248,699,211
Net handset sales								
Analog	25,341,658	22,617,705	23,829,459	18,380,344	10,085,253	6,525,348	1,724,036	1,263,211
GSM	8,150,981	23,019,412	47,651,043	67,633,389	95,894,283	125,710,942	157,263,761	198,159,864
CDMA	1,538	1,115,769	5,923,804	13,512,649	24,608,940	40,134,084	58,744,119	82,167,322
TDMA	1,259,513	2,176,173	5,002,631	11,707,287	19,783,594	32,111,470	47,659,240	64,204,283
PDC	3,069,730	12,699,215	19,739,673	26,085,892	28,121,255	27,653,489	27,606,854	25,184,003
Net handset unit sales by technology	37,823,419	61,628,275	102,146,611	137,319,561	178,493,325	232,135,333	292,998,010	370,978,682

Source: BT Alex. Brown Incorporated

Net Worldwide Handset Unit Sales:

By Region

New subscribers	1995	1996	1997	1998	1999	2000	2001	2002
North America	10,078,881	11,464,155	11,004,027	12,234,321	12,872,196	13,122,564	11,825,513	10,485,698
Europe	8,273,196	13,418,468	21,640,229	25,998,595	31,650,491	32,120,515	28,397,626	26,700,436
Asia Pacific	11,278,358	19,189,201	26,266,755	27,111,040	29,170,542	32,342,812	36,608,345	40,203,807
Latin America	1,623,529	2,366,445	6,084,540	8,207,895	9,778,366	10,254,376	12,138,204	12,719,685
Africa/Middle East	864,079	1,402,950	1,898,622	2,480,024	2,895,464	3,731,012	5,692,973	9,621,560
Net new handset unit sales	32,118,043	47,841,219	66,894,173	76,031,874	86,367,059	91,571,278	94,662,662	99,731,185
Replacement rate								
North America	5.00%	8.06%	15.20%	14.64%	15.05%	20.20%	27.73%	36.46%
Europe	8.95%	12.48%	17.03%	23.87%	29.01%	34.20%	39.34%	44.46%
Asia Pacific	7.61%	11.14%	15.75%	23.36%	27.02%	30.75%	34.63%	37.47%
Latin America	2.66%	5.22%	7.74%	11.78%	17.19%	18.62%	23.91%	30.04%
Africa/Middle East	3.98%	6.69%	7.50%	10.53%	14.85%	19.23%	23.33%	27.75%
Net handset replacement rate	6.59%	10.04%	15.27%	20.09%	23.74%	28.19%	33.35%	38.28%
Replacement sales								
North America	1,802,847	3,830,701	8,895,960	10,359,336	12,586,047	19,543,336	30,107,194	43,406,907
Europe	2,067,023	4,555,768	9,905,095	20,086,303	33,597,446	50,587,311	69,362,927	90,255,724
Asia Pacific	1,669,593	4,579,791	10,615,681	22,071,974	33,418,419	47,966,490	66,711,080	87,239,158
Latin America	106,207	332,260	963,423	2,432,389	5,230,868	7,574,989	12,631,229	19,687,465
Africa/Middle East	59,706	194,094	359,963	766,734	1,510,759	2,673,608	4,572,125	8,109,956
Net replacement handset unit sales	5,705,376	13,492,614	30,740,121	55,716,737	86,343,540	128,345,734	183,384,555	248,699,211
Net handset sales								
North America	11,881,728	15,294,856	19,899,987	22,593,657	25,458,243	39,883,311	52,575,670	66,475,443
Europe	10,340,219	18,268,678	34,746,675	48,944,743	67,384,345	84,474,454	99,180,435	118,157,679
Asia Pacific	12,947,951	23,768,992	38,193,402	51,894,119	66,235,279	83,543,583	106,065,050	132,468,441
Latin America	1,729,736	2,698,705	7,047,963	10,640,284	15,009,234	17,829,365	24,769,433	35,905,063
Africa/Middle East	923,785	1,597,044	2,258,585	3,246,757	4,406,223	6,404,620	10,407,422	17,972,055
Net handset unit sales by region	37,823,419	61,628,275	102,146,611	137,319,561	178,493,325	232,135,333	292,998,010	370,978,682

Source: BT Alex. Brown Incorporated

Technology Adoption Rates

All Technologies

Technology adoption as % of net adds	1995	1996	1997	1998	1999	2000	2001	2002
Analog	65.11%	31.01%	10.49%	1.67%	-5.17%	-12.23%	-17.08%	-19.59%
GSM	22.70%	40.70%	55.59%	56.95%	60.39%	61.60%	60.36%	60.83%
CDMA	0.00%	2.22%	7.92%	14.37%	20.20%	26.51%	31.11%	35.48%
TDMA	3.65%	3.89%	5.72%	10.97%	14.45%	19.70%	24.64%	26.30%
PDC	8.53%	22.18%	20.27%	16.05%	10.13%	4.41%	0.97%	-3.02%
Technology adoption as % of installed base								
Analog	79.91%	62.50%	45.22%	33.28%	24.15%	16.83%	11.00%	6.30%
GSM	14.26%	23.67%	34.28%	40.49%	45.22%	48.51%	50.55%	52.13%
CDMA	0.00%	0.79%	3.16%	6.23%	9.55%	12.96%	16.09%	19.06%
TDMA	2.01%	2.68%	3.69%	5.69%	7.77%	10.17%	12.66%	14.75%
PDC	3.82%	10.35%	13.65%	14.31%	13.31%	11.52%	9.71%	7.75%
Penetration rates by technology								
Analog	1.30%	1.55%	1.64%	1.63%	1.51%	1.29%	1.00%	0.66%
GSM	0.23%	0.59%	1.24%	1.98%	2.84%	3.73%	4.59%	5.48%
CDMA	0.00%	0.02%	0.11%	0.30%	0.60%	1.00%	1.46%	2.00%
TDMA	0.03%	0.07%	0.13%	0.28%	0.49%	0.78%	1.15%	1.55%
PDC	0.06%	0.26%	0.49%	0.70%	0.84%	0.89%	0.88%	0.81%
Worldwide Penetration Rate	1.63%	2.47%	3.62%	4.89%	6.27%	7.69%	9.09%	10.50%
Net new subscribers by technology								
Analog	20,913,390	14,833,662	7,020,288	1,268,904	(4,465,102)	(11,202,151)	(16,164,614)	(19,533,000)
GSM	7,291,152	19,472,000	37,186,042	43,302,194	52,153,808	56,411,116	57,136,447	60,664,083
CDMA	1,500	1,062,566	5,300,661	10,923,264	17,445,959	24,276,398	29,450,085	35,385,515
TDMA	1,172,701	1,861,191	3,829,182	8,337,544	12,481,231	18,043,064	23,325,534	26,229,873
PDC	2,739,300	10,611,800	13,558,000	12,199,968	8,751,163	4,042,852	915,209	(3,015,286)
Net new subscribers	32,118,043	47,841,219	66,894,173	76,031,874	86,367,059	91,571,278	94,662,662	99,731,185
Worldwide installed base by technology:								
Analog	69,182,275	84,015,937	91,036,225	92,305,129	87,840,027	76,637,876	60,473,262	40,940,262
GSM	12,347,213	31,819,213	69,005,255	112,307,449	164,461,257	220,872,373	278,008,821	338,672,903
CDMA	1,500	1,064,066	6,364,727	17,287,991	34,733,951	59,010,349	88,460,434	123,845,949
TDMA	1,739,037	3,600,228	7,429,410	15,766,954	28,248,185	46,291,248	69,616,782	95,846,655
PDC	3,304,300	13,916,100	27,474,100	39,674,068	48,425,231	52,468,082	53,383,291	50,368,005
Worldwide installed base:	86,574,325	134,415,544	201,309,717	277,341,591	363,708,650	455,279,929	549,942,590	649,673,776

Source: BT Alex. Brown Incorporated

Worldwide Subscriber Estimates

All Technologies

Net new subscribers - total:	1995	1996	1997	1998	1999	2000	2001	2002
North America	10,078,881	11,464,155	11,004,027	12,234,321	12,872,196	13,122,564	11,825,513	10,485,698
Europe	8,273,196	13,418,468	21,640,229	25,998,595	31,650,491	32,120,515	28,397,626	26,700,436
Asia Pacific	11,278,358	19,189,201	26,266,755	27,111,040	29,170,542	32,342,812	36,608,345	40,203,807
Latin America	1,623,529	2,366,445	6,084,540	8,207,895	9,778,366	10,254,376	12,138,204	12,719,685
Africa/Middle East	864,079	1,402,950	1,898,622	2,480,024	2,895,464	3,731,012	5,692,973	9,621,560
Net new subscribers	32,118,043	47,841,219	66,894,173	76,031,874	86,367,059	91,571,278	94,662,662	99,731,185
Worldwide installed base:								
North America	36,056,937	47,521,092	58,525,119	70,759,440	83,631,636	96,754,200	108,579,714	119,065,412
Europe	23,097,710	36,516,178	58,156,407	84,155,002	115,805,493	147,926,007	176,323,634	203,024,070
Asia Pacific	21,926,155	41,115,356	67,382,111	94,493,151	123,663,693	156,006,505	192,614,850	232,818,657
Latin America	3,995,095	6,361,540	12,446,080	20,653,975	30,432,341	40,686,716	52,824,920	65,544,604
Africa/Middle East	1,498,428	2,901,378	4,800,000	7,280,024	10,175,488	13,906,500	19,599,473	29,221,033
Worldwide subscriber installed base:	86,574,325	134,415,544	201,309,717	277,341,591	363,708,650	455,279,929	549,942,590	649,673,776

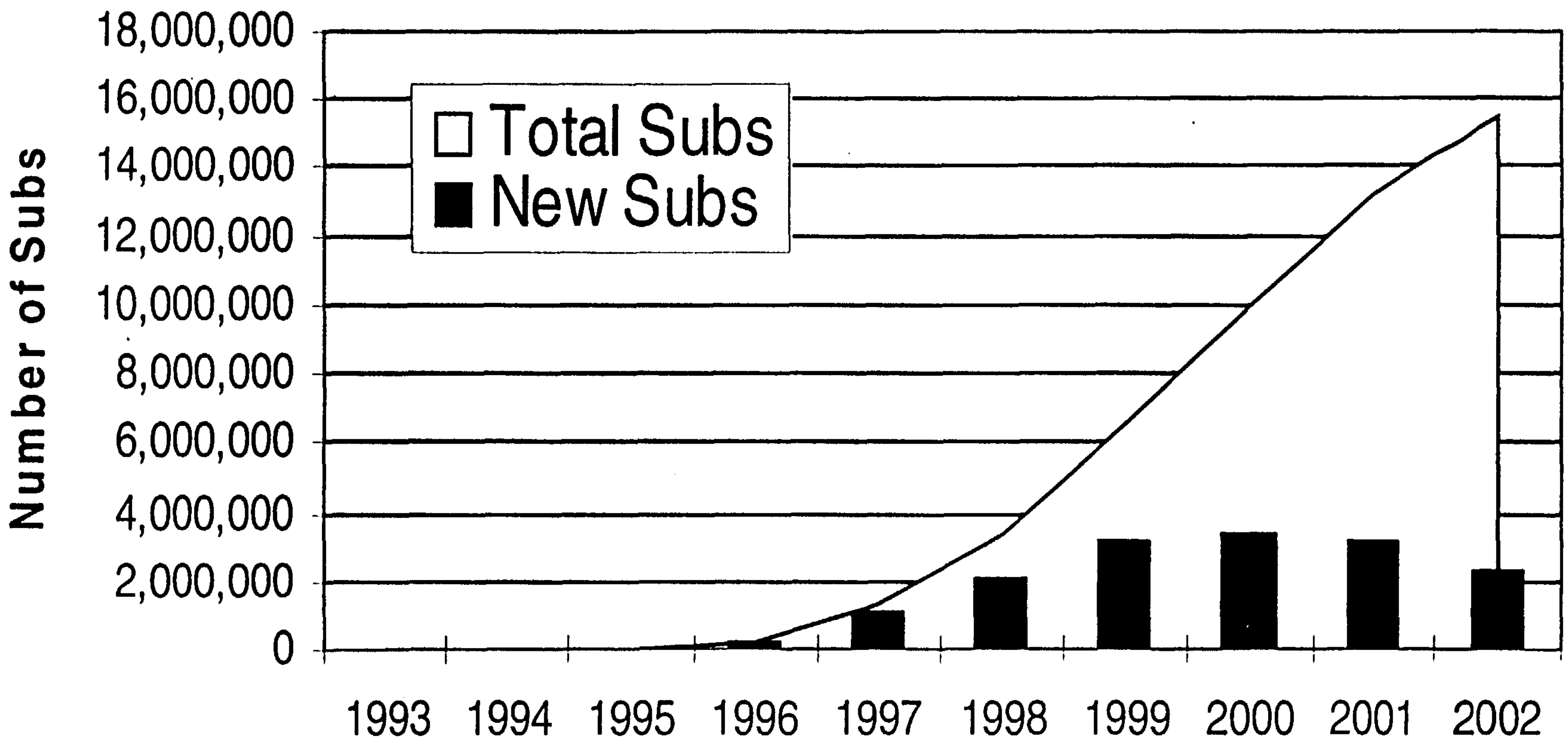
% Year to Year Change

Net new subscribers - total:	1995	1996	1997	1998	1999	2000	2001	2002
North America	16.26%	13.74%	-4.01%	11.18%	5.21%	1.95%	-9.88%	-11.33%
Europe	42.59%	62.19%	61.27%	20.14%	21.74%	1.49%	-11.59%	-5.98%
Asia Pacific	150.27%	70.14%	36.88%	3.21%	7.60%	10.87%	13.19%	9.82%
Latin America	36.80%	45.76%	157.12%	34.90%	19.13%	4.87%	18.37%	4.79%
Africa/Middle East	132.50%	62.36%	35.33%	30.62%	16.75%	28.86%	52.59%	69.01%
Net new subscribers:	56.40%	48.95%	39.83%	13.66%	13.59%	6.03%	3.38%	5.35%
Worldwide installed base:								
North America	38.80%	31.79%	23.16%	20.90%	18.19%	15.69%	12.22%	9.66%
Europe	55.81%	58.09%	59.26%	44.70%	37.61%	27.74%	19.20%	15.14%
Asia Pacific	105.92%	87.52%	63.89%	40.23%	30.87%	26.15%	23.47%	20.87%
Latin America	68.46%	59.23%	95.65%	65.95%	47.34%	33.70%	29.83%	24.08%
Africa/Middle East	136.22%	93.63%	65.44%	51.67%	39.77%	36.67%	40.94%	49.09%
Worldwide subscriber installed base:	58.98%	55.26%	49.77%	37.77%	31.14%	25.18%	20.79%	18.13%

Source: BT Alex. Brown Incorporated

Penetration Rate of E-OTD Capable Handsets

- Assume PCS1900 subscriber growth forecast as below:



The Wireless Communications Industry

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Table 2C

Cellular/PCS Industry - Quarterly Subscriber Additions

	1Q95	2Q95	3Q95	4Q95	1Q96	2Q96	3Q96	4Q96	1Q97	2Q97	3Q97	4Q97	1Q98
Independent Cellular Companies													
AirTouch Communications	172,000	243,000	285,000	238,000	228,000	278,000	258,000	540,000	258,000	284,000	283,000	582,000	221,000
American Cellular	22,219	5,005	6,960	44,043	17,160	22,846	17,807	14,488	28,449	21,023	22,412	28,188	24,819
RCE Mobile Communications Inc.	35,000	40,000	37,000	94,000	25,000	60,000	50,000	111,000	26,000	35,000	38,000	80,000	20,000
CoreComm, Inc.	16,700	13,000	9,300	8,200	12,000	11,200	11,000	9,800	7,200	9,000	8,400	14,500	15,500
Centennial Cellular Corp.	9,946	9,952	(14,884)	16,432	11,400	7,522	5,600	19,300	16,800	10,500	11,800	19,100	20,000
Comcast Cellular Corp.	35,000	50,000	30,000	55,000	35,000	47,000	(1,000)	16,000	4,000	2,000	(2,000)	17,000	7,000
Grupo Iusacell, S.A. de C.V.	7,119	315	4,930	3,114	745	(7,622)	21,783	7,799	17,821	31,013	56,260	82,123	89,618
Orange PLC	48,000	55,800	70,600	115,600	108,000	86,000	86,000	128,000	109,000	88,000	90,000	130,000	118,000
Powertel, Inc.	2,091	2,418	1,962	3,487	1,621	2,039	1,788	3,387	2,100	(25,717)	895	953	717
Price Communications	11,437	13,283	11,013	59,028	15,415	16,487	17,738	18,191	16,007	14,830	11,692	(27,739)	17,115
Rogers Cantel Mobile Comm. Inc.	26,573	20,242	44,919	163,771	75,213	62,100	63,000	119,900	48,200	44,000	29,200	63,100	12,300
360° Communications	84,850	116,443	107,214	153,261	141,252	107,320	100,199	167,661	124,526	98,250	70,806	132,617	61,469
United States Cellular Corporation	57,000	72,000	68,000	92,000	75,000	75,000	80,000	133,000	91,000	99,000	94,000	353,000	107,000
Vanguard Cellular Systems, Inc.	35,000	34,000	26,000	41,000	24,000	25,000	31,000	52,000	27,000	40,000	35,000	30,000	22,000
Vodafone Group Plc	180,000	222,000	149,000	143,000	118,000	110,000	95,000	146,000	86,000	53,000	98,000	241,000	172,000
Western Wireless	15,400	25,800	20,400	35,100	29,700	25,000	29,800	30,200	27,000	38,700	38,400	93,700	27,100
Independent Cellular Subtotal	725,344	874,240	795,952	1,161,349	811,685	847,153	750,127	1,354,939	728,803	741,816	752,572	1,594,889	780,812
Adjusted Independent Subtotal (1)	459,952	576,883	550,803	749,264	580,727	611,475	509,344	960,640	565,582	569,803	526,712	1,134,168	489,394
Regional Bell Holding Companies													
Ameritech Corporation	131,000	134,000	110,000	217,000	152,000	142,000	108,000	219,000	197,000	147,000	114,000	208,500	169,500
Bell Atlantic Corporation	180,000	224,000	229,000	383,000	219,000	247,000	232,000	356,000	224,000	241,000	189,000	292,000	127,000
BellSouth Corporation	164,140	144,318	80,216	302,922	198,408	185,176	102,000	279,000	152,000	137,000	66,000	138,000	125,000
SBC Communications Inc.	100,000	151,000	144,000	285,000	157,000	159,000	168,000	277,000	227,000	177,000	126,000	190,000	32,000
RBHC Subtotal	575,140	653,318	563,216	1,187,922	726,408	733,176	610,000	1,131,000	800,000	702,000	495,000	828,500	450,500
Independent Telephone Companies													
ALLTEL Corporation	51,938	47,618	7,654	48,590	38,864	44,237	30,397	57,096	48,522	46,359	31,086	24,465	31,201
AT&T Corp.	400,000	384,000	183,000	520,000	382,000	394,000	332,000	553,000	178,000	320,000	167,000	300,000	92,000
Century Telephone Enterprises, Inc.	11,694	17,164	11,823	28,953	16,936	18,030	12,110	26,236	11,935	18,116	31,315	140,384	6,414
GTE Corporation	161,000	213,000	106,000	227,000	83,000	149,000	150,000	356,000	260,000	137,000	140,000	182,300	46,700
Telephone and Data Systems, Inc.	57,000	72,000	68,000	92,000	75,000	75,000	80,000	133,000	91,000	99,000	94,000	353,000	107,000
Independent Telephone Subtotal	681,632	713,782	356,477	916,543	595,800	680,267	604,507	1,125,332	589,457	620,475	463,401	1,000,149	283,315
PCS Companies													
Aerial Communications Inc.	-	-	-	-	-	-	-	-	-	28,000	37,000	60,000	40,000
BellSouth Mobility DCS	-	-	-	-	-	-	12,000	39,000	29,500	25,500	20,000	15,000	26,000
Centennial Wireless	-	-	-	-	-	-	-	-	6,900	10,000	15,900	17,900	9,900
GTE Wireless	-	-	-	-	-	-	-	-	-	4,000	5,000	9,700	11,300
Omnipoint Communications Inc.	-	-	-	-	-	-	-	-	16,000	26,000	38,000	61,000	49,000
Nextel	22,600	14,400	24,000	24,000	44,100	46,900	52,000	72,300	122,600	201,500	322,200	324,100	379,800
Pacific Bell Mobile Systems	-	-	-	-	-	-	-	10,900	14,100	98,000	143,000	74,000	90,000
Powertel Inc.	-	-	-	-	-	-	-	14,892	19,994	10,385	20,795	52,691	38,161
PrimeCo Personal Communications L.P.	-	-	-	-	-	-	-	37,975	75,950	84,375	62,700	126,000	121,000
Sprint Spectrum L.P.	-	-	-	-	35,000	25,000	25,000	50,000	65,000	140,000	210,000	320,000	225,000
Western Wireless Corp.	-	-	-	-	2,300	4,100	11,200	17,900	13,500	25,400	26,600	27,600	36,000
PCS Subtotal	22,600	14,400	24,000	24,000	81,400	76,000	100,200	242,967	363,544	653,160	901,195	1,087,991	1,007,161
Total Domestic Cellular Additions (2)	1,659,724	1,873,783	1,402,496	2,761,729	1,827,935	1,949,918	1,643,851	3,083,972	1,864,039	1,793,078	1,391,113	2,609,815	1,107,209
Total Domestic Additions	1,682,324	1,888,183	1,426,496	2,785,729	1,909,335	2,025,918	1,744,051	3,326,939	2,227,583	2,446,238	2,292,308	3,697,806	2,114,370

(1) Adjusted independent subtotal includes only domestic companies: AirTouch, CoreComm, Centennial, Comcast, Powertel, Palmer, PriCellular, United States Cellular, Western Wireless and Vanguard.

(2) Total domestic subscribers are adjusted to avoid double counting of cellular subsidiaries of telephone companies.

(3) Domestic PCS companies include Aerial, APC, BellSouth Mobility, Centennial Wireless, GTE Wireless, Omnipoint, Nextel, Pacific Bell Mobile Systems, Powertel, PrimeCo, Southwestern Bell Mobile Systems, Sprint Spectrum, and Western Wireless.

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