ORIGINAL

BEFORE THE
Federal Communications Commission
WASHINGTON, DC 20554

In the Matter of	)	
	)	
U S WEST Wireless, L.L.C.	)	CC Docket No. 94-102
	)	DA 98-2631
Petition for Waiver of Section 20.18(e) of the Commission's Rules	)	
	)	
	)	

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To: Chief, Wireless Telecommunications Bureau

PETITION FOR WAIVER OF SECTION 20.18(e)
OF THE COMMISSION'S RULES

U S WEST WIRELESS, L.L.C

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February 4, 1999

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To: Chief, Wireless Telecommunications Bureau

PETITION FOR WAIVER OF SECTION 20.18(e)
OF THE COMMISSION'S RULES

U S WEST Wireless, L.L.C. ("U S WEST") hereby petitions the Bureau for a waiver of Section 20.18(e) of the Commission's rules, which requires commercial mobile radio service ("CMRS") licensees to provide public safety answering points ("PSAPs") the location of 911 calls by longitude and latitude within a radius of 125 meters, no later than October 1, 2001.[1] If granted, the waiver would permit U S WEST and other CMRS carriers to phase in solutions to the Enhanced 911 ("E911") Phase II Automatic Location Identification ("ALI") requirements contained in Section 20.18(e).[2] The waiver is necessary to allow CMRS licensees time to analyze and explore more fully the feasibility

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1 47 C.F.R. § 20.18(e).

2 The Bureau has indicated that if a carrier demonstrates that a waiver of Section 20.18(e) is warranted, it may be appropriate to grant a waiver of general applicability to all carriers subject to Section 20.18(e). *Public Notice* at 5. U S WEST supports this approach.

of competing ALI solutions to Section 20.18(e) and to ensure that the rule is "technologically and competitively neutral."[3]

On December 24, 1998, the Wireless Telecommunications Bureau ("Bureau") encouraged parties to request such waivers.[4] The Bureau indicated that the grant of waivers would provide requesting carriers with the *option* of choosing a network, handset, or hybrid solution to the Phase II ALI requirements and would *not* obligate the requesting carriers to utilize a handset-based solution.[5] Accordingly, should U S WEST's waiver request be granted, it expressly reserves the right to implement the solution it deems most viable and appropriate for the provision of Phase II ALI.

INTRODUCTION AND SUMMARY

In 1996, the Commission adopted rules to ensure the availability of 911 services via wireless handsets.[6] Because of the transient nature of wireless phones, the Commission also required CMRS licensee to provide the location of 911 callers to PSAPs. Section 20.18 requires the provision of this information in two phases. Pursuant to Phase

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3 *See Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems,* CC Docket No. 94-102, *Memorandum Opinion and Order*, 12 F.C.C.R. 22665, 22725 (1997) ("*E911 MO&O*").

4 *Wireless Telecommunications Bureau Outlines Guidelines For Wireless E911 Rule Waivers For Handset Based Approaches To Phase II Automatic Location Identification Requirements*, CC Docket No. 94-102, *Public Notice*, DA 98-2631 (December 24, 1998).

5 *Public Notice* at 5.

6 *Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems,* CC Docket No. 94-102, *First Report and Order and Further Notice of Proposed Rulemaking*, 11 F.C.C.R. 18676, 18712 (1996) ("*E911 Report and Order*"); *E911 MO&O*, 12 F.C.C.R. at 22726.

I, which became effective on April 1, 1998, CMRS licensees are required to provide PSAPs with the location of the cell site receiving a 911 call, if certain conditions are met.[7] Phase II, in turn, requires CMRS licensees to provide PSAPs with the location of 911 calls by longitude and latitude within a radius of 125 meters using root mean square ("RMS") techniques.[8] The Commission has clarified that Phase II requires carriers to have the "capability to identify the latitude and longitude of a mobile unit making a 911 call, within a radius of no more than 125 meters in 67 percent of all cases."[9] CMRS licensees must be capable of providing this Phase II information no later than October 1, 2001.[10]

The Commission recognized that there was technological uncertainty regarding the provision of Phase II ALI and therefore adopted general performance criteria, rather than extensive technical standards, so as to permit "various technologies to be used in the provision of Phase II ALI."[11] The Commission expressly stated that it did not intend to

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7 47 C.F.R. § 20.18(d). The Phase I and Phase II ALI requirements are applicable only if (i) the administrator of the designated PSAP has requested the information, (ii) the PSAP is capable of using the information, and (iii) a mechanism for recovering the costs of implementing an ALI system has been established. 47 C.F.R. § 20.18(f).

8 47 C.F.R. § 20.18(e).

9 *E911 Report and Order*, 11 F.C.C.R. at ¶ 18712; *E911 MO&O*, 12 F.C.C.R. at 22726.

10 47 C.F.R. § 20.18(e).

11 Letter from Daniel B. Phythyon, Chief, Wireless Telecommunications Bureau, FCC, to Pamela J. Riley, Vice President — Federal Regulatory, AirTouch Communications at 1 (October 23, 1998) (citing *E911 Report and Order*, 11 F.C.C.R. at 18714).

apply the Phase II implementation deadline in a way that "would hamper the development and deployment" of systems that exceed the accuracy and reliability standards established for Phase II.[12]

U S WEST and other carriers have conducted preliminary tests to determine the accuracy and reliability of incorporating Global Positioning Satellite ("GPS") technology into handsets for the provision of Phase II ALI. These tests indicate that a handset-based solution to the Commission's Phase II ALI requirements may be possible, and that such solutions may provide better accuracy than required by the rules. The tests have not involved commercially available handsets, however, and standards still must be finalized. Additional tests of prototype handsets designed specifically for commercial use will be necessary to gauge the accuracy and feasibility of handset solutions. Thereafter, manufacture and deployment efforts would be required, again if feasibility is determined.

The Bureau has itself acknowledged that, with respect to potential handset solutions, it "may not be possible or economically feasible for carriers to provide ALI for the embedded base of handsets . . . on the date set by the current Commission rules."[13] The Bureau thus expressed a willingness to consider (i) waivers requesting phased-in implementation, or (ii) application of the Phase II requirements only to new phones.[14]

U S WEST supports the Bureau's decision to consider waivers of Section 20.18(e) that may facilitate the further development and deployment of handset-based solutions to

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12 *E911 MO&O*, 12 F.C.C.R. at 22725.

13 *Public Notice* at 2.

14 *Id.* at 2-3.

the Phase II ALI requirements and serve the public interest. In this filing, U S WEST supplies information regarding the current status of handset-based solutions and requests a waiver of the Commission's rules that would deem U S WEST and other CMRS carriers in compliance with the rule if they offer to subscribers handsets that exceed the current Phase II ALI requirements prior to the October 1, 2001 implementation deadline.

I. STATUS OF HANDSET-BASED SOLUTIONS FOR THE PROVISION OF PHASE II ALI

A. Preliminary Trials Conducted By U S WEST Indicate That Handset-Based Solutions May Provide ALI That Exceeds The Standards Contained In Section 20.18(e)

During the week of February 23, 1998, U S WEST participated in field tests in Denver, Colorado with SnapTrack, Inc.[15] and two PSAPs to determine the potential for handset-based solutions to the Phase II ALI requirements. Because no manufacturer currently produces ALI-capable handsets, handsets were retrofitted with enhanced GPS technology for the tests. The tests were conducted in a variety of terrains — urban, suburban, rural, and mountainous — and within a variety of building structures — wood, brick, two-story residences, and tall office buildings.

By using specially designed handsets, location information was obtained in areas where ordinary GPS would not work — such as building interiors. The tests also indicated that handset-based solutions may be capable of providing ALI that exceeds the accuracy and reliability criteria established by Section 20.18(e). Sample tests results follow:

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15 SnapTrack has developed a potential handset-based solution to the Commission's Phase II ALI requirements.

- Callers located within two story buildings, both wood and brick, were located within 22 meters 68.3 percent of the time;
- Callers located in unobstructed areas were located within 4 meters 68.3 percent of the time; and
- Callers located at street level between buildings — an "urban canyon" — were located within 45 meters 68.3 percent of the time.[16]

Although these preliminary tests indicate that handset solutions may provide ALI that exceeds the standards set forth in Section 20.18(e), the tests also demonstrated some limitations. For example, the handsets tested were incapable of providing reliable location information (*i.e.*, within 125 meters) for calls initiated from deep within the interior of tall office buildings and similar structures. ALI vendors are actively working to overcome these problems and further testing will be necessary to determine the reliability in these areas. Further, as noted, the testing was performed with specially designed handsets — and not commercial products. Again, these preliminary results are promising but additional significant efforts will be required before feasibility is established.

Other wireless carriers have conducted tests with similar results. In King County, Washington, for example, three wireless carriers conducted a five-month field test of

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[16] SnapTrack, Inc. Ex Parte, Summary Results: Denver Testing (October 30, 1998). The Commission's rules specify that RMS should be used to determine reliability, but a number of parties have disputed the merits of the RMS measure. *See* Ericsson Inc. Ex Parte at 4-10 (March 20, 1998). The accuracy of the Denver tests was determined using Circular Error Probability ("CEP"). For a detailed discussion of the merits of CEP versus RMS, *see* Ericsson Inc. Ex Parte at 4-10 (March 20, 1998).

specially designed handsets capable of supplying location information.[17] These tests were conducted in urban, rural, suburban, and mountainous locations and the handsets were capable of suppling ALI within 125 meters "100% of the time" pursuant to the FCC's RMS accuracy measure.[18] According to the King County E-911 Program Office, the tests were able to locate callers within 40 feet 80 percent of the time.[19] These tests indicated that:

- PSAPs could "pinpoint" the location of callers with specially designed handsets within urban canyons;[20]
- It was possible to distinguish between calls made from highways and secondary roads running parallel to each other using specially designed handsets; and
- PSAPs could accurately track the location of moving vehicles armed with ALI-capable handsets.

To confirm, although these preliminary tests indicate that handsets utilizing GPS may provide more precise location information than required by the FCC's rules, further testing and activities are required to determine the accuracy and commercial viability of ALI-enabled handsets. Until these efforts are complete, U S WEST will be unable to commit to a Phase II compliance solution. Despite this, the Commission should waive its

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17 The tests were conducted between June 1 and October 1, 1998. Integrated Data Communications, Ex Parte at 3-4 (December 30, 1998) ("IDC Ex Parte").

18 IDC Ex Parte at 3-4.

19 Letter from Marlys R. Davis, E-911 Program Manager for King County, Washington, to Nancy Boocker, FCC Wireless Bureau, at 2 (December 30, 1998) ("Davis Letter").

20 *Id.*

rule to permit exploration of these issues and a prompt phased-in deployment of handset solutions if feasibility is established.

B. ALI-Capable Handsets Should Be Commercially Available Prior To October 1, 2001

The commercial availability of ALI-capable handsets is dependent on the finalization of industry standards, among other things. The Telecommunications Industry Association is attempting to finalize standards early in 1999.[21] Other standards groups are working with similar timeframes.

U S WEST has been informed by three vendors that ALI-capable handsets should be commercially available in advance of the Phase II implementation deadline — possibly as early as the fourth quarter of 2000. It appears that a number of other vendors are actively working on such handsets.[22] Based on these projections, ALI-capable handsets should be available in advance of the Phase II implementation deadline.

If strict compliance with Section 20.18(e) is required, however, handset solutions will not be possible. Read literally, Section 20.18(e) requires carriers to supply ALI accurate within 125 meters for 67 percent of calls no later than October 1, 2001. Thus, carriers would be required to replace sufficient handsets with ALI-capable handsets to ensure that these criteria can be met. Assuming that replacement handsets cost approximately a couple hundred dollars each, it would cost the CMRS industry billions of

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21 Letter from Phil Brown, Chair, Working Group I, TR-45.5 Subcommittee, to Kim Chang, Vice Chair Working Group II, TR-45.5 Subcommittee at 1 (November 18, 1998) (Attachment 1).

22 *See* SnapTrack Press Release at 1 (September 23, 1998) (Attachment 2).

dollars to replace these handsets. These replacement costs would make handset solutions cost prohibitive and this solution would have no prospect of success.

Instead, the better approach would be for the Commission to permit Phase II ALI to be phased in, provided the technology chosen for the provision of ALI will provide location information that exceeds the standards set forth in Section 20.18(e). This approach would still permit the rapid introduction of Phase II compliant handsets into the marketplace.

The replacement rate associated with handsets indicates that two-thirds of all wireless subscribers should have ALI-capable handsets four to five years after the handsets become commercially available. In this regard, it has been estimated that somewhere between 15-22 percent of existing handsets will be replaced this year, with the replacement rate increasing in subsequent years.[23] These replacement rates have led to projections that more than 95 percent of wireless subscribers will own ALI-enabled phones by the end of 2004.[24]

Moreover, replacement rates are likely to increase if new phones contain features desirable to consumers. Many consumers are already trading in older analog phones for digital phones capable of providing new features. In this regard, it appears that consumers

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23 *See* BT Alex. Brown, *Handsets! Rapid Growth, Explosive Innovation, Intense Competition* (June 29, 1998) (Attachment 3); *Mobile Family Segment To Churn $4 Billion, Study Says*, Newsbytes (August 21, 1998) (citing 22 percent replacement rate); *Briefs*, Mobile Phone News (August 18, 1997) (citing 17 percent replacement rate).

24 *See* SnapTrack Ex Parte (October 30, 1998).

desire both emergency and non-emergency location information.[25] Location technology is currently being deployed in automobiles, for example, and sold as advanced navigation or roadside assistance services.[26] Thus, it appears likely that handset replacement rates will increase over the next few years, as new features are made available.

Accordingly, the Commission should allow the replacement rate of existing handsets to establish the rate of Phase II ALI implementation. Such an approach would allow handset solutions to be considered as a compliance option and would be consistent with the implementation of safety features in other industries.[27]

C. If A Carrier Utilizes A Handset-Based Solution To The Phase II ALI Requirements, Location Information Still Will Accompany 911 Calls Placed By Roamers

The Commission's ultimate goal is to ensure that all wireless subscribers have access to Phase II ALI, even when they roam on other networks. U S WEST recognizes that some roamers will not have access to Phase II ALI under a handset solution, but believes that the problem is a small one.

All roamers with ALI-capable handsets will receive Phase II ALI. The only roamer "problem" will occur when a roamer does not have an ALI-capable phone *and* roams on a network that has deployed a handset solution to the provision of Phase II ALI.

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25 Tendler Cellular, Inc. Ex Parte at 3-4 (October 14, 1997); Cambridge Positioning Systems Ex Parte at 3; TruePosition Ex Parte, Wireless E911 Survey, at 3 (September 16, 1997).

26 KSI, Inc. Ex Parte (July 13, 1995).

27 For example, when the government decided to mandate the deployment of airbags in automobiles, it did not require manufacturers to retrofit existing automobiles with this safety feature. *See* Zoltar Ex Parte Reply to Comments at 4 (October 28, 1997).

While vendors and the wireless industry are attempting to address this problem, it should be noted that these roamers will still receive Phase I ALI. Moreover, the number of roamers without ALI-capable handsets should decline rapidly in the next few years, given the projected replacement rate of existing handsets. Efforts are still underway to solve the roamer problem. To the extent the problem cannot be solved at the time of initial implementation, it is estimated that only small numbers of callers will not have access to Phase II ALI, with that number decreasing significantly over the next few years.

II. WAIVER SHOWING

Pursuant to Sections 1.3 and 24.819 of the Commission's rules, a waiver is appropriate if:

(1) The underlying purpose of the rule(s) would not be served and a waiver would serve the public interest;

(2) Application of the rule(s) would be inequitable, unduly burdensome, or contrary to the public interest;[28] or

(3) Good cause for waiving the rule can be demonstrated.[29]

As discussed herein, adherence to the Phase II implementation deadline for handset-based solutions is inconsistent with the underlying purpose of Section 20.18(e) and would be contrary to the public interest. If a handset solution is deemed feasible, a waiver grant would permit U S WEST and other CMRS carriers to phase in compliance with Phase II ALI requirements if they make ALI handsets available prior to the implementation deadline. CMRS licensees thus would be given the option of choosing among

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[28] 47 C.F.R. § 24.819(a).

[29] 47 C.F.R. § 1.3.

different technological solutions to Section 20.18(e) and the rule would be applied in a "technologically and competitively neutral" manner.[30]

CONCLUSION

For the foregoing reasons, the Commission should grant an industry wide waiver that would deem CMRS licensees in compliance with the Phase II implementation deadline if ALI-capable handsets which exceed Phase II requirements are offered for sale prior to October 1, 2001.

Respectfully submitted,

U S WEST WIRELESS, L.L.C

By: Jeffry Brueggeman

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February 4, 1999

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30 *See E911 MO&O*, 12 F.C.C.R. at 22725.

Attachment 1

TR45.5.2/98.11.18. 05

TELECOMMUNICATIONS INDUSTRY ASSOCIATION

COMMITTEE CORRESPONDENCE

Please reply to:

Phil Brown
Chair, Working Group I
TR-45.5 Subcommittee

November 18, 1998

Kim Chang
Vice-Chair, Working Group II
TR-45.5 Subcommittee

Dear Kim,

WG-I has reviewed your correspondence to us dated October 23, 1998 regarding Position Location Signaling. Answers to the two questions posed by WG-II are contained below.

1. *Should the location measurement data transmitted between the Position Determination Entity (PDE) and the mobile station be vendor-specific, or should it be explicitly defined in the standard?*

   It should be explicitly defined in the standard. The service provider membership of WG-I is unanimous in its desire to have a standardized interoperable approach, in order to avoid a scenario in which multiple PDE implementations are required in the network. Specifically, there is a need to ensure availability of a minimum core set of position measurement data that will meet FCC E-911 Phase II requirements.

2. *...considering the lack of resources and the time it would take to harmonize multiple proposals received by the group (WG-II), it is likely that the work will not be completed by December, 1998.*

   The important milestone date for the (U.S.) service providers is October, 2000, which is one year prior to the effective date for the FCC's E-911 Phase II requirements. By this time it is felt that the process of seeding the population of CDMA mobile stations with location-enabled units must be underway. Working backward from that date suggests that a standard must be published at least one year prior to allow for

(This correspondence represents "working papers." Therefore, the contents cannot be viewed as reflecting the corporate policies or the views of the Telecommunications Industry Association or of any company. The Association, the companies and individuals involved, take no responsibility in the application of contents of this document.)

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Representing the telecommunications industry
in association with the Electronic Industries Association

product development, and that baseline text should be agreed upon several months prior to that to allow for V&V and the ballot process. Thus, the membership of WG-I feels baseline text for the standardized interoperable approach must be complete by the end of the February, 1999 meeting.

Please contact me if you have any questions or comments.

Sincerely,

Phil Brown
Chair, TIA TR-45.5.1

cc: Prakash Panjwani – Chair, WG-II TG-3

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Attachment 2

SnapTrack

IMMEDIATE RELEASE

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SNAPTRACK TEST GROUP MOVES ADVANCED WIRELESS LOCATION SYSTEM TO NEXT STAGE OF COMMERCIAL DEVELOPMENT

Wireless-aided GPS System Closer to Market Availability

SAN JOSE, Calif., Sept. 23, 1998 – SnapTrack, inventors of the world's first wireless-aided GPS technology for handset-based location, today announced at PCS '98 that 16 wireless firms are proceeding with prototype integrated handset development for the commercial market. Trials for SnapTrack-enabled phones are scheduled to begin in the first quarter of 1999, with widespread availability planned by the end of that year.

Carrier members of the SnapTrack CDMA Test Group (STCTG) include AirTouch Communications, Ameritech Cellular, Bell Mobility, GTE Wireless, PrimeCo Personal Communications, Sprint PCS, and U S WEST Wireless. Participating manufacturers include Denso, Fujitsu, Hyundai, LGIC, Motorola, Nokia, and Samsung on the handset side, and Texas Instruments (TI) and VLSI on the chipset side.

Established in April, the STCTG focuses on integrating Code Division Multiple Access (CDMA) transmission technology with the SnapTrack system. From a wireless network, independent of air-interface, the SnapTrack system captures information such as approximate handset location, timing, and frequency to use for precise location determination.

(more)

"This forum has devoted a great deal of energy to evaluating the implementation and connectivity issues surrounding wireless location determination. By moving forward with prototype development, we believe we can demonstrate rapid implementation of wireless location technology," said Steve Poizner, SnapTrack president. "With accuracy and sensitivity unmatched by any other solution, SnapTrack is changing the way people think about wireless location."

This announcement comes on the heels of last month's multimillion-dollar licensing agreement with NTT DoCoMo, Japan's largest wireless carrier. DoCoMo plans to deploy location-based services using SnapTrack technology on its PDC network in the second quarter of 1999. The deal brings together NTT's world-class expertise in developing cutting-edge wireless services and SnapTrack's innovative location technology to offer Japanese consumers the most advanced personal navigation system in the world via a variety of wireless devices. Last month, SnapTrack also announced a strategic investment by the venture capital fund established by TI, the world's leading provider of digital signal processors (DSPs).

Prototype development of handsets integrated with SnapTrack's DSP-based software follows a successful battery of field trials conducted in Denver earlier this year. The findings, released in August, show SnapTrack's technology yields a consistently high level of accuracy in locating callers and allowing the information to be routed to a third party. Sensitivity and accuracy testing resulted in measurements ranging from four meters inside a car on rural roads, to less than 85 meters inside a 50-story high rise on the 21st floor. Reliable location fixes were generated 89 percent of the time in the high rise, 94% of the time within the interior of a masonry office building, and 100% of the time in the other environments tested.

(more)

The FCC mandate requiring delivery of location information with wireless 9-1-1 calls has catalyzed the development of this innovative technology, which also enables carriers to generate revenue from value-added location services, including roadside assistance, traffic information, mobile yellow pages, efficient dispatch, asset tracking, and location-sensitive billing. The Denver field trials proved SnapTrack's wireless location system exceeds the FCC accuracy requirements for wireless E9-1-1, providing the high precision required to support location-based services. SnapTrack can pinpoint callers within feet of their actual location, even in buildings and cars, where conventional GPS does not operate effectively, if at all. SnapTrack technology allows callers to be found automatically in an emergency, while the *Location on Demand* privacy feature permits location calculation only after user authorization.

ABOUT SNAPTRACK

San Jose, Calif.-based SnapTrack™, Inc., was founded in 1995 to enhance economically the safety and productivity of people and assets when they are mobile. The company's goal is to leverage existing assets to develop high-performance wireless location determination technology. SnapTrack's patented cellular-aided GPS technology offers accurate, high-speed location of a wireless caller anytime, anywhere. SnapTrack's Web site is located at www.snaptrack.com.

###

Attachment 3

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

CERTIFICATE OF SERVICE

I, Jo-Ann G. Monroe, hereby certify that on this 4th day of February 1999, copies of the foregoing were served on the following by hand:

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