

GPS in the GSM Handset

When Will It Become Mainstream?



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Are location-based services and integration of GNSS technology into GSM mobile phones always going to be the killer application of the future, or will they actually happen someday soon? Two researchers heavily involved in this sector draw on recent market studies to support their answer to this question.

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Use of GPS and its related location-based services (LBS) applications in the mobile handset is an experience that predominantly has only included CDMA mobile phone subscribers. Mainstream adoption of GPS in the GSM mobile phone has always seemed to be a year away. But 2007 may be the year that GPS finally arrives in the GSM world, while 25 percent of wideband CDMA (WCDMA) handsets are expected to offer GPS by 2009.

Four important reasons support our belief that GPS will become popular in the GSM handset next year. The first factor inducing vendors to include GPS is regulatory, that is, the mandates for automatic location of emergency callers in the various regions. The second is competitive: CDMA carriers who have had GPS integrated in their handsets since 2002 have been turning on LBS offerings over the past year.

A third factor is economic: carriers continue to look for ways to increase average return per user (ARPU) for data sent

over their networks and to recoup some of their high licensing costs for 3G spectrum. Finally, there is consumers' need for portable navigation and other applications driven by location awareness capabilities in the network.

All these drivers — as well as increased accuracy requirements and the fact that existing network-based positioning technologies do not work as well for upcoming 3G and WCDMA cellular standards — are pushing GPS ICs into the handset.

Regional Variations

Of course, the importance of these market drivers varies by geographic region, depending upon a number of factors (See **Figure 1**). In North America, (the largest current market for GPS chipsets in mobile handsets), the Federal Communications Commission's E-911 mandate has made the regulatory factor particularly important, while the competitive factor is also high due to the presence of the CDMA carriers with GPS capabilities already in their handsets.

The economic drive is less important to North American telecom companies because carriers here have only recently

begun formulating their strategies for LBS-based applications. And, although consumers are starting to show enthusiasm for navigational tools, demand is not as strong in a region where roads are relatively well marked, addresses are uniform, and maps are widely available.

In Europe the regulatory push is less important because E-112 (the European Union's counterpart to E-911) is a soft mandate, and governments are letting operators decide the best way to implement emergency calling. The competitive factor is also less critical due to the absence of CDMA.

The economic factor is important in Europe, however, because carriers are continually looking for ways to recoup their large investments in 3G licenses, and they believe LBS is the next frontier for increasing data ARPU. As for consumer demand, portable navigation devices such as those made by TomTom, Garmin, and Navman are hot-selling items in Europe, which has the largest portable navigation device (PND) market globally.

Lastly, in the Far East, the competitive, economic, and consumer demand factors all play a strong role in pushing GPS into the handset.

The World of CDMA

For several years, Qualcomm has included GPS capabilities in all its CDMA chipsets; so, nearly every CDMA handset on the market today includes GPS functionality. Japan and South Korea have many GPS-enabled handsets.

In 2004, SiRF Technology signed a major agreement with SK Telecom in South Korea to use SiRF's GPS solutions in its CDMA handsets. Global Locate and Freescale are also major players in this market.

LBS will be the primary driver in cellular handsets of the near future, with the result that these devices will be the major growth area for GPS. Nearly all North American CDMA handsets of the last few years have GPS receivers, but due to technological limitations only a handful of models have demonstrated the ability to use those receivers for commercial LBS purposes.

The main take-away here is that, at least in North America, few truly GPS-useful CDMA devices are available. Most (though not all) Japanese and Korean CDMA models do not suffer from this limitation. Most iDEN phones offered by carrier Nextel are also GPS-enabled.

The World of GSM . . .

Where CDMA and GSM networks share markets, the result has been pressure on GSM-based carriers to incorporate GPS

hardware into their handsets. The story is similar wherever competitive CDMA networks exist, such as in the Far East.

Over the course of the next year and beyond, GPS looks set to play an increasingly important role in non-CDMA markets. The appearance of GPS in GSM handsets will become more pervasive in 2008, while 2007 will be a year of requests for quotations (RFQs) from carriers, technology evaluations, infrastructure upgrades for LBS, network trials, and so on. The

inflection point or "hockey stick" turn upward for large-scale integration of GPS ICs into the handset is closer to 2010.

Asian original design manufacturers (ODMs) have begun to develop GSM/GPRS/EDGE and, most importantly, WCDMA

handsets that incorporate GPS technology. Top-tier handset vendors are also exploring GPS in GSM handsets.

GSM operators have the advantage of being able to monitor the experience of LBS applications on the CDMA and Nextel iDEN platforms, and then choose to offer only the applications that have been successful.

According to ABI Research's Mobile Devices Online Database, 58 different types of GSM handsets that incorporate GPS ICs are currently on the market. This only represents approximately four percent of all new models of GSM mobile handsets available in the marketplace.

Eight main vendors offer GPS ICs for the GSM handset: Atmel/u-blox, eRide, Global Locate, GloNav, Nemerix, SiRF, Texas Instruments, and u-Nav. SiRF was the first to get into the handset platform when Nextel integrated its chipset into iDEN phones in late 2003.

SiRF remains the market leader by far, and the rest of the vendors listed here only total 10 percent market share. But we expect that some of them will soon be nipping at SiRF's heels.

The average selling price (ASP) for GPS ICs in 2006 is US\$4, which is why GPS will see traction initially only in the smartphone and advanced handset tiers. The ASP needs to drop to

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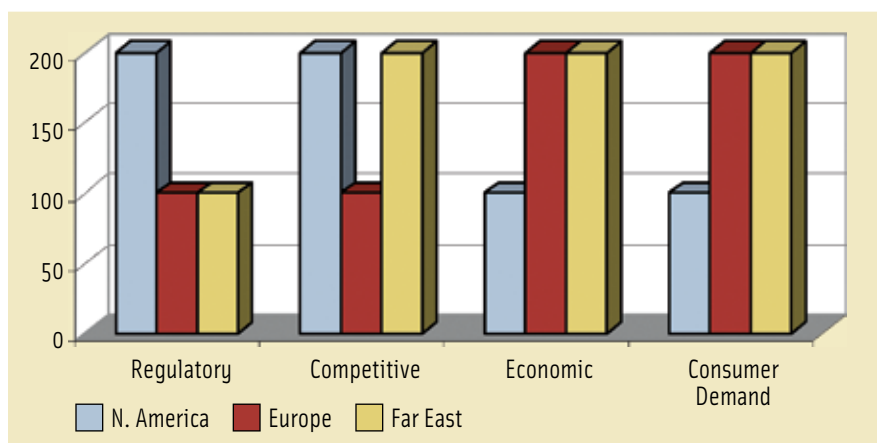


FIGURE 1 Handset manufacturers' reasons for including GPS in the mobile phone, by region. Source: ABI Research industry study.

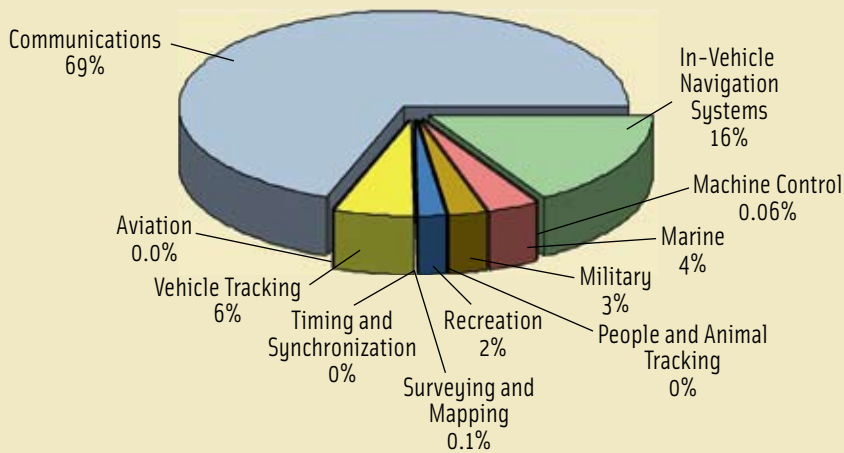
GNSS Receiver Shipments Share by End Use
World: 2011

FIGURE 2 Estimated proportion of GNSS receiver shipments (unit volume) by market segment in 2011. (ABI Research projections.)

below \$4 in order to increase penetration in the advanced tiers, and will need to go below \$2 in order to engage with the mass market lower tiers. We expect an aggressive level of competition to develop between GPS IC manufacturers, as the smaller vendors vie to gain market share through competitive pricing.

... and Beyond

In a chicken-or-egg dynamic, until GPS silicon pricing falls into the \$2 range, similar to that of Bluetooth, GPS will not be added to WCDMA handsets on a widespread basis in the absence of operator demand. But GPS silicon prices will not fall until economies of scale are achieved, and this will only occur when they are widely integrated into WCDMA handsets.

However, the need to comply with regulatory mandates such as E911 and E112 may provide a way out of this bind. GPS is the most obvious and effective way to deal with this. Therefore, in order to meet regulatory requirements, operators are likely to require GPS in their WCDMA handsets, creating an opening for widespread integration of GPS, driving down GPS silicon pricing, and increasing opportunities to create GPS-enabled LBS in non-CDMA markets.

Final Thoughts

The long-awaited arrival of GPS in mobile telephone handsets in general, and GSM phones in particular, is still subject to decisions by key players as well as marketplace dynamics and consumer preferences. Figure 2 shows ABI Research's projections by market segment for worldwide GNSS receiver sales in 2011 (on a predicted annual total of 302 million units).

Semiconductor Vendors. For semiconductor vendors, the key take-away is that by 2007 they need to integrate to single chip GPS solutions in order to reduce cost. The ASP needs to go below \$4 in order to get into 100 percent of high tier phones, and below \$2 to get into mass market handsets.

At the same time performance must not be allowed to suffer because GPS performance is already minimal, and lacking in urban canyons and indoors. This might mean that the RF section needs to be in a high-performance technology such as SiGe (rather than CMOS), at least for the short term.

Handset Manufacturers. If they want to implement GPS in advanced GSM handsets by 2007, then handset manufacturers now need to be evaluating price, performance, and form factor of the wares from the different chipset vendors. They have to ensure that the chipset interfaces correctly to the existing hardware in the handset — such as the modem and the applications processor, that the software is integrated with the rest of the handset software, that

the right LBS applications are loaded in, that the GPS engine passes along the position coordinates in the right format to the applications layers, and that the A-GPS data is transferred correctly between itself and the cellular network.

Operators. GSM operators need to ensure that their handset partners plan to include GPS functionality in some of their advanced tier handsets. Considering it can take close to a year to design and test a new function such as GPS in a mobile phone, operators should be in their final stages of discussions on GPS hardware architecture, performance parameters such as time-to-first-fix (TTFF), RF sensitivity when stationary and when in motion, and the chipset power consumption. They should also be performing trade-off analyses of GPS chipset architecture versus cost.

Acknowledgement

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