

Wireless Device Applications of Optoelectronics

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Thoughtful Analysis, Actionable Information

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**Optoelectronics Industry
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Wireless Device Applications of Optoelectronics

1 Market Background

Portable wireless devices such as mobile phones are a large and growing applications market for optoelectronic components and modules. In 2006, one billion mobile phones were sold. Wireless connectivity is being added to many portable products such as portable media players, handheld games, and cameras that are also large markets for optoelectronic components and modules. Wireless connectivity and consumers' desires for mobile applications will continue to drive the optoelectronics market. Optoelectronics enable many of the key features in today's wireless devices. These features include low power consumption, high reliability, ruggedness, compact size, and low cost. The optoelectronic components and modules in wireless device applications include: image sensor chips and camera modules; light emitting diodes (LED) for keyboard illumination, back-lighting and camera flash; sensors for ambient light detection; and of course displays of several types. The optoelectronics content of high end smart phones can reach up to 30% of the total hardware bill of materials cost in 2007. The high manufacturing volumes of many wireless devices help drive down optoelectronic component and module costs leading to attractive products that are highly valued by consumers. Wireless device manufacturers routinely use optoelectronics to differentiate their products (see Figure 1) in the competitive global marketplace.



Figure 1: Wireless Device (Nokia N95) with Extensive Optoelectronics Content

Source: Nokia

The mobile phone of Figure 1 illustrates how current wireless devices employ sophisticated optoelectronics to yield converged products with high functionality. The Nokia N95 mobile phone of Figure 1 was introduced in 2006 and incorporates a 5.0 megapixel main camera with auto focus and macro mode. The device records video clips at 640 x 480 color pixels, and includes a 352 x 288 pixel common intermediate format (CIF) front side camera for video calling and self portraits, LED Flash, 2.6 inch quarter video graphics ar-

ray (QVGA) 240 x 320 pixel thin film transistor-liquid crystal display (TFT-LCD), and an ambient light detector to control display backlight illumination. In addition to the extensive complement of optoelectronic components, the device incorporates Wi-Fi networking, Bluetooth connectivity, GPS navigation, USB 2.0 serial interface, mobile radios including eGSM 900/1800/1900, WCDMA 2100/HSDPA, music player, video player, FM radio, and email. This capability is presented in a converged device that is representative of the generic handheld device size of 100 mm x 50 mm x 20 mm (actual dimensions 99 mm x 53 mm x 21 mm). This high end smart phone is available in early 2007 unlocked for less than \$700 without a mobile carrier service contract.

The migration of wireless connectivity into products with substantial optoelectronic content is further illustrated in Figure 2. This Nikon digital camera with Wi-Fi wireless connectivity is an example of a trend that will increase rapidly. Consumers seek wireless connectivity in their personal information devices to provide immediacy for prompt sharing of digital content directly and by email. Consumers also desire more convenient uploading of digital content to their computers and mass storage system.



Figure 2: Consumer Digital Camera (Nikon COOLPIX S7c) with Wi-Fi Wireless Connectivity

Source: Nikon

Wireless connectivity is also being applied to the large and growing portable media player (PMP) market. Figure 3 shows the Sandisk Sansa Connect PMP that incorporates a 2.2 inch QVGA (320 x 240 pixels) color TFT display. The Connect provides wireless Wi-Fi connectivity to download music and photos, and for internet radio. As the market advances, wireless connectivity will continue to migrate into a wider range of product categories at decreased price points.

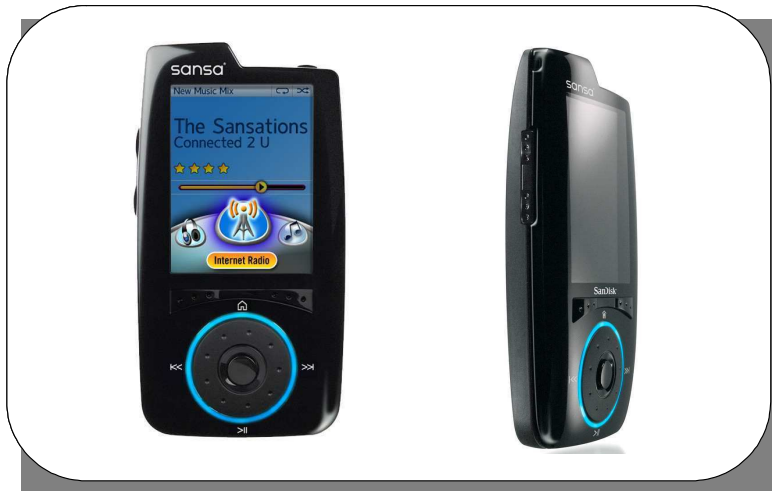


Figure 3: Portable Media Player (Sandisk Sansa Connect) with Wi-Fi Wireless Connectivity
 Source: Sandisk

The market for wireless devices has been steadily growing worldwide. Figure 4 shows the global number of mobile phone subscribers. There has been steady growth in worldwide wireless subscribers and growth is forecast to continue. However, wireless subscriber growth in Europe and the U.S. is saturating. For example, wireless penetration in the U.S. reached 72.4 % in 2006. In 2006 wireless penetration was more than 100% in Western Europe and 88% for Europe as a whole. Subscriber growth in the rest of the world continues to grow resulting in steady growth in the total number of worldwide subscribers. Wireless subscriber growth in 2006 greater than 20 percent was observed in Middle East/Africa and Latin America, and Asia/Pacific grew 18.4 percent. After 2008 worldwide subscriber growth slows. The compound annual growth in wireless subscribers worldwide is 4.6% between 2010 and 2017. The Asia/Pacific region is the fastest growing during 2010-2017 with a compound annual growth rate (CAGR) of 6.7%.

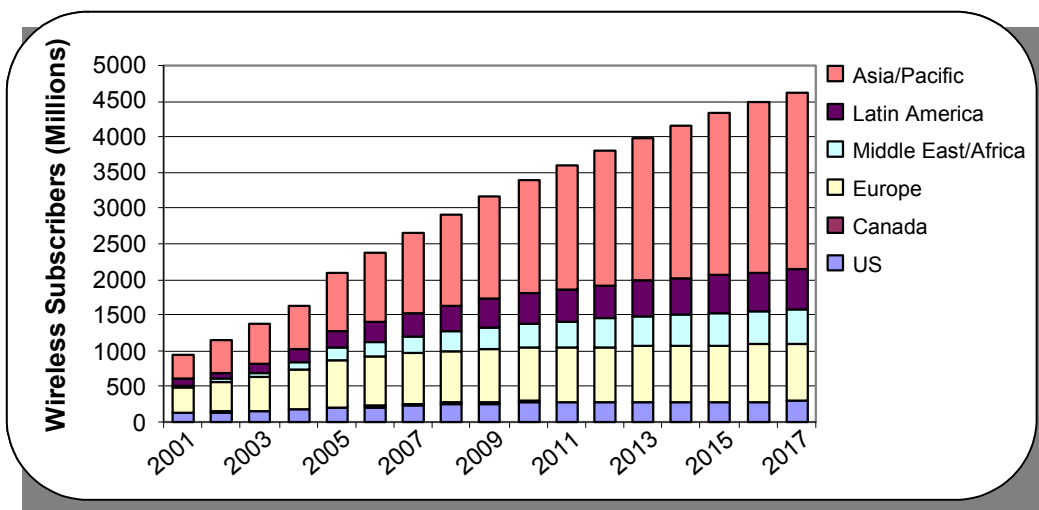


Figure 4: Forecast Worldwide Wireless Subscriber Growth, 2001-2017
 Sources: TIA, OIDA