Enabling the Next Generation of WCDMA Capable Mobile Devices

RF transceiver reduces the overall cost of ownership by focusing on both the physical hardware costs and the engineering and production costs.

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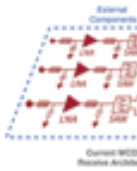
Growth of the WCDMA Market

The handset industry is expected to grow at a Compound Annual Growth Rate (CAGR) of approximately 9 percent between 2006 and 2010, which equates to an increase of more than 400 million devices. This is impressive growth for the world's largest consumer market, unless it is compared to the growth of WCDMA alone.



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The WCDMA market is expected to grow at a CAGR of between 50% and 70% in the same time frame, equating to an increase in volume of more than 450 million handsets. Although research shows that the WCDMA market is quickly accelerating, there are still barriers to the mass adoption of 3G wireless devices, including size and cost. The key to achieving this growth, and mass adoption, is to offer handsets that include the expected functionality of improved data services and coverage at a size and cost that the general market can bear.

The Challenge of Increasing Complexity

The complexity of WCDMA handsets continues to increase as more geographic regions roll out networks using different frequency bands. For example, Europe and Japan predominately utilize the IMT band (2100 MHz). In the U.S., AT&T makes use of Band II (1900 MHz) and Band V (850 MHz). There are now 10 different frequency bands that are supported by the WCDMA standard across the world with many handsets requiring concurrent operation.

RF Transceiver Designed for Multi-mode Applications

The SEQ7400 is an RF transceiver based on Sequoia Communications FullSpectra&#153 architecture, which has been designed from the ground up for multi-mode applications. The SEQ7400 reduces the overall cost of ownership by focusing on both the physical hardware costs and the less obvious engineering and production costs while addressing the size and performance demands of the market.

Receiver Path Simplification

Typically, WCDMA receivers make use of external Low Noise Amplifiers (LNAs) and external SAW filters to meet difficult noise and linearity requirements (see Figure 1). The use of both LNAs and external SAW filters results in increased board area, per band, of approximately 20 mm and $0.50 in bill of material (BOM) cost. With the increasing number of multi-band handsets being produced each year, this quickly becomes an issue of significant size and cost additions which are passed along to the consumer.

In addition to the component cost, there is also significant engineering effort and operations overhead that contributes to the increase in handset production costs. These RF-critical components require matching networks between the interface planes to maximize the performance of the overall solution. There are also placement and sourcing costs associated with any additional component that goes into the handset.

Sequoia’s approach integrates the LNAs and using a proprietary on-chip filter to remove the costly SAW filters in order to achieve the same level of performance. This approach significantly reduces the size and overall cost of the ownership of the solution, which is multiplied for multi-band applications.

Transmit Path Innovation

WCDMA is the next-generation air standard in the GSM family of technologies. It is backward compatible with both the GSM and EDGE air standards and is part of the ongoing development of cellular standards.

GSM, by unit volume, is the largest air standard in the world but is slowly transitioning to EDGE, which offers improvements in data rate and network efficiency. A majority of all chipset and transceiver suppliers have products based on one or both of these air standards and possess significant intellectual property (IP) in these areas. WCDMA is a departure from the GSM-based standards and has very different challenges. Most suppliers have met these challenges by adding a separate transmit path to support WCDMA which allows for re-use of existing technology and IP.

Designed for multi-mode applications, the SEQ7400 utilizes the same architecture for all three air standards. This provides a considerable reduction in overall die size with the removal of the second transmit chain. In current handsets, there are low band and high band GSM/EDGE power amplifiers (PA) and a WCDMA PA for each band. A single path multi-mode architecture provides future benefits as it can make use of multi-mode PAs as they become available, saving cost and board area. The second benefit of this architecture is that UTRAN-LTE and WiMAX air interface standards use OFDM modulation schemes, and the same polar architectures can be utilized to support these emerging air standards with minimal effort.

Calibration &#151 The Limiting Factor

In an industry where millions of handsets are built every day, the efficiency of the production line is critical. The extensive amount of time it takes for handsets to be calibrated and tested is a bottleneck

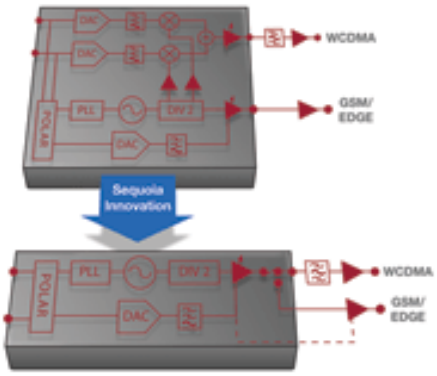

Figure 2

[2]

for factory line throughput. The calibration and test time of the handsets increases as the number of modes and frequency bands supported increases. There are different levels of calibration &#151 some can be associated with individual components and others with the entire solution.

Unlike most RF transceivers, the SEQ7400 is fully autonomous from a transceiver-level calibration standpoint. All calibrations related to the transceiver are taken care of by the device which means that the engineering effort required to integrate the solution into a platform is reduced, the overall calibration and test time is minimized and factory throughput is maximized.

Research shows that the WCDMA market is growing much faster than the overall handset market. In addition, these handsets are increasingly complex as additional frequency bands are added to support more geographic regions. In order for mass adoption of 3G devices to occur, the size and cost of WCDMA solutions must be reduced.

By combining the monolithic receiver architecture with the polar transmit path, manufacturers can reduce the overall cost of ownership by first reducing the BOM size and cost, minimizing the integration and engineering effort required, reducing the transceiver calibration burden and therefore improving the end-of-line factory throughput. These significant improvements are achieved with a unique architecture that provides the potential for further enhancements with the introduction of multi-mode power amplifiers and next-generation air standards.

About the Author

Duncan Pilgrim serves as director of product marketing for Sequoia Communications; www.sequoiacommunications.com

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