Envara 's EN303: World's First Highly Integrated, Multi-Mode IEEE 802.11a+b+g Single RF Chip

The Wireless LAN (WLAN) market is growing rapidly as business and home consumers alike take increasing advantage of the power to access data, images and video wherever it's most useful and convenient. However, with numerous standards operating in very different frequency bands, effective solutions must operate in all wireless networking environments. In addition, the allocated spectrum, particularly in the unlicensed 5-GHz band, varies worldwide, a factor that must be taken into account to design WLAN systems that can operate anywhere. Therefore, market leading WLAN solutions will offer multi-mode interoperability with transparent worldwide usage, enabling the user to access wireless networks anywhere without any second thought or action.

Envara's EN303 is a single highly-integrated RF chip capable of operating in both the 2.4-GHz and 5-GHz WLAN frequency bands, that is an integral part of Envara's WiND502 IEEE 802.11a+b+g chipset solution. The EN303 supports complementary code keying (CCK) modulation for compatibility with IEEE 802.11b and orthogonal frequency division multiplexing (OFDM) at both 5 GHz and 2.4 GHz, for compatibility with IEEE 802.11a and the current draft of IEEE 802.11g. IEEE 802.11g proposes higher data rates in the 2.4 GHz frequency band via OFDM modulation. As a result, the EN303 is interoperable in the WLAN environment of any of the dominant wireless networking standards ensuring that compatibility with legacy WLAN networks, and mixed network environments are invisible to the user and a non-issue for the network owner.

The frequency allocation of the IEEE 802.11a standard in the "unlicensed" 5-GHz band is constantly evolving. In particular, the Japanese government is currently proposing an additional 4 RF channels in the 4.9 to 5.0-GHz band and a further 3 channels in the 5.03 to 5.09-GHz band for this standard. This change could significantly increase the available channels for 5-GHz WLAN in Japan, and create yet another difficulty for WLAN chipmakers by requiring them to enable access to this lower-frequency band. The EN303 design is future-proofed against evolutions and changes in allocated spectrum worldwide by its ability to operate in any of the worldwide 5-GHz spectrum definitions and to use dynamic frequency selection (DFS) for automatic radio channel selection. More specifically, the EN303 is capable of operating from 4.9 to 5.8 GHz, and in all internationally-allocated 2.4-GHz bands, ensuring transparent usage worldwide for any equipment using this technology.

The highly integrated EN303 integrates all the necessary components onto a single chip rather than employing multiple components with the associated increases in bill-of-materials (BOM) costs, size of design, power consumption, and manufacturing complexity. The EN303 chip includes all necessary voltage-controlled oscillators (VCOs), frequency synthesizers, and low noise amplifiers (LNAs), representing all the functionality required to implement multi-band WLAN radio, with the exception of passive components and power amplifier functionality. The chip has an extremely small die size that combined with low BOM costs and multi-mode interoperability enables high yield, low-cost manufacture of WLAN network interface cards (NICs) and Access Points (APs) for a multitude of WLAN applications and environments. The following figure provides a basic schematic of the EN303, revealing the high level of component and functional integration in the design.

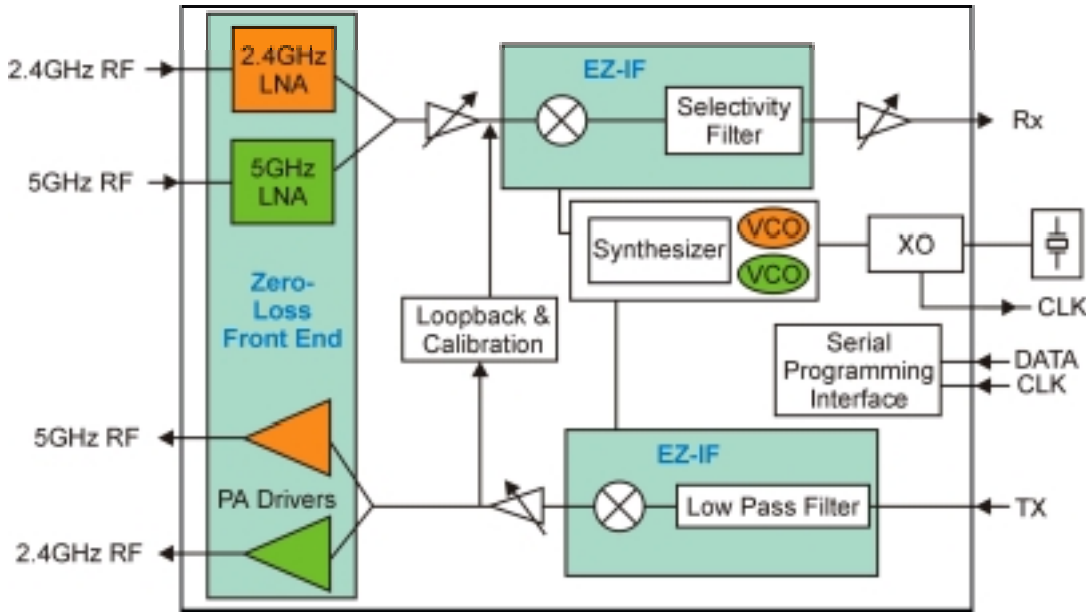

Fig.: EN303 Functional Schematic

The radio signal is down- or up-converted in the EN303 using Envara's patent-pending EZ-IF (Enhanced Zero-IF) technology, which is a means of performing direct-conversion to and from 2.4 GHz or 5 GHz. Direct-conversion reduces costs by requiring fewer building blocks in the chip and eliminating additional external components. Converting a signal to and from RF is typically performed in two ("up" or "down") steps and requires additional external components such as IF filters. Envara's EZ-IF technology implements direct-conversion without sacrificing radio performance, meeting all of the technical challenges associated with this method such as I&Q balancing, dc-offset removal, and adjacent-channel rejection. As a result several external-filtering components are eliminated, reducing die size and BOM costs, while increasing the function and utility of the EN303 chip.

The EN303 also features the patent-pending Zero-Loss Front-End RF design, that significantly reduces the costs and increases the receiver sensitivity of WLAN systems based on the WiND502 WLAN chipset solution. Zero-Loss Front-End refers to the elimination of off-chip RF switches and related front-end components in the system design by including that functionality, in a highly integrated fashion, directly in the chip design without introducing signal loss. This approach further reduces power consumption and BOM costs by removing 2 RF switches from the design. It also enhances receiver sensitivity by 3 dB as each of the two RF switches removed typically introduces a 1.5-dB signal loss.

The EN303 includes a self-calibration function designed to improve WLAN system transmission and reception quality, while simplifying the radio design. The self-calibration circuitry enables the chip to self-calibrate at power-on. By communicating this calibration data to the OFDM modem the EN303 enables the OFDM modem to digitally modify the OFDM signal – according to the reverse distortion of the RF chip – to obtain better overall WLAN system performance with simplified RF design. Furthermore, this self-calibration functionality significantly reduces the calibration

time of WLAN cards during production, further helping OEMs to reduce WLAN systems costs.

The EN303 is fabricated using IBM's stable, well-characterized SiGe process to ensure quality and yield. As a result, using the EN303 provides a critical asset for OEM customers in competitive markets as it accelerates their time to market with production-proven silicon and yields. The overall performance of the EN303 engineering samples, and of each of their individual building blocks, is over their respective specifications in such a way that guarantees high production yield after accounting for production process tolerances.

The EN303, an integral part of Envara's WiND502 multi-mode IEEE 802.11a+b+g WLAN chipset solution, is packaged in a 56-pin leadless package, and is currently sampling to selected alpha partners. Envara engineers are developing hardware reference designs and software drivers for WiND502-based WLAN solutions in parallel with silicon development to ensure that the function of each is optimized and to minimize the time to market for OEM customers. After sampling to our alpha partners, WiND502 multi-mode IEEE 802.11a+b+g engineering samples, reference designs and software drivers will be generally released for production in the beginning of Q1 2003.

Summary

The EN303 WLAN chip is a highly-integrated WLAN solution that offers multi-mode interoperability over wide frequency bands, enabling transparent use anywhere in the world in any wireless networking environment. It has been designed focusing on ensuring low BOM costs and rapid time to market for OEM customers to ensure their critical needs are optimized along with performance. A short list of the primary features and advantages offered by the EN303 include:

- Multi-mode operation for IEEE 802.11a+b+g in the 2.4-GHz and 5-GHz bands *in a single chip*.
- Transparent use worldwide in any internationally-allocated frequency spectrum for these WLAN standards, including the proposed new Japanese 5GHz bands.
- High level of integration enables a single chip solution for reduced BOM costs and manufacturing complexity.
- Small die size that increases yield-per-wafer and reduces cost.
- Patent-pending EZ-IF design for direct-frequency conversion with extremely good performance.
- Patent-pending Zero Loss Front End design to reduce system costs and increase receiver sensitivity by 3dB.
- Self-calibration feature to minimize WLAN system testing time during production.
- High yield using IBM's well-characterized SiGe process.

Overall, the EN303 is a remarkable feat of RF design and technology, blending patent-pending technology with exceptional design to create a low-power, low-cost multi-mode IEEE 802.11a+b+g WLAN system capable of transparently operating worldwide.