Realtek RTL8192E

IEEE 802.11a/b/g/n WLAN Controller with PCI-Express Interface

General Description

The Realtek RTL8192E-GR is a highly integrated MIMO (Multiple In, Multiple Out) Wireless LAN (WLAN) solution complying with the IEEE 802.11n Draft specification 2.0. It combines a MAC and 2T2R capable baseband in a single chip. When coupled with Realtek's RF IC's (RTL8256 at 2.4GHz), the RTL8192E-GR provides a complete solution for a high-performance wireless client.

The RTL8192E-GR baseband implements MIMO Orthogonal Frequency Division Multiplexing (OFDM) with two transmit and two receive paths (2T2R). Features include two spatial stream transmissions, short Guard Interval (GI) of 400ns, spatial spreading, and support for both 20MHz and 40MHz channel bandwidth. The RTL8192E-GR provides spatial stream Space-Time Block Code (STBC) to extend transmission range. As a receiver, extended range and good minimum sensitivity is achieved by having receiver diversity via 2 antennas. The RTL8192E-GR also supports explicit 'sounding packet' feedback that helps senders with beamforming capability. With two independent RF ICs, the RTL8192E-GR can perform fast roaming without link interruption.

For backward compatibility, Direct Sequence Spread Spectrum (DSSS), Complementary Code Keying (CCK) and OFDM baseband processing are included to support all IEEE 802.11a, 802.11b, 802.11g and 802.11j data rates. Differential phase shift keying modulation schemes, DBPSK and DQPSK with data scrambling capability are available, and CCK provides support for legacy data rates, with long or short preamble. The high speed FFT/IFFT paths, combined with BPSK, QPSK, 16QAM, and 64QAM modulation of the individual subcarriers, and rate compatible punctured convolutional coding with coding rate of 1/2, 2/3, 3/4, and 5/6, provide the higher data rates of 54Mbps and 300Mbps for IEEE 802.11a/g and 802.11n MIMO OFDM respectively.

The RTL8192E-GR builds in an enhanced signal detector, an adaptive frequency domain equalizer, and a soft-decision Viterbi decoder to alleviate severe multi-path effects and mutual interference in the reception of multiple streams. For better detection quality, receive diversity with Maximal-Ratio-Combine (MRC) applying up to two receive paths is implemented. Robust interference detection and suppression are provided to protect against Bluetooth, cordless phone, and microwave oven interference. Radar detection and Dynamic Frequency Selection (DFS) are supported to further protect against interference.

Receive vector diversity for multi-stream application is implemented for efficient utilization of the MIMO channel. Efficient IQ-imbalance, DC offset, phase noise, frequency offset, and timing offset compensations are provided for the radio frequency front-end. Selectable digital transmit and receive FIR filters are provided to meet transmit spectrum mask requirements and to reject adjacent channel interference, respectively.

The RTL8192E-GR supports fast receiver Automatic Gain Control (AGC) with synchronous and asynchronous control loops among antennas, antenna diversity functions, and adaptive transmit power control functions to obtain better performance in the analog portions of the transceiver.

The RTL8192E-GR MAC supports 802.11e for multimedia applications, 802.11i for security, and 802.11n for enhanced MAC protocol efficiency. Using packet aggregation techniques such as A-MPDU with BA and A-MSDU, protocol efficiency is significantly improved. Power saving mechanisms such as U-APSD, APSD, and MIMO power saving reduces power wasted during idle time, and compensates for the extra power required to transmit MIMO OFDM. The RTL8192E-GR provides simple legacy and 20MHz/40MHz co-existence mechanisms to ensure backward and network compatibility.

Features

General

- CMOS MAC and Baseband MIMO PHY Single Chip for IEEE 802.11a/b/g/n compatible WLAN
- Complete 802.11n MIMO solution coupled with RTL8256 for 2.4G solution.
- 2x2 MIMO technology for extended reception robustness and exceptional throughput
- Maximum PHY data rate up to 150Mbps using 20MHz bandwidth, 300Mbps using 40MHz bandwidth
- Compatible with 802.11n draft 2.0 specification.
- Backward compatible with 802.11a/b/g devices while operating at 802.11n data rates
- 200Mbps UDP throughput in 40MHz mode.
- 14 x 14mm 128-pin TQFP package

Host Interface

- Complies with PCI Express™ Base Specification Revision 1.1

Standards Supported

- IEEE 802.11a/b/g/n compatible WLAN
- IEEE 802.11e QoS Enhancement (WMM, WMM-SA Client mode)
- IEEE 802.11h TPC, DFS, Spectrum Measurement
- IEEE 802.11k Radio Resource Measurement
- IEEE 802.11i (WPA, WPA2). Open, shared key, and pair-wise key authentication services
- Cisco Compatible Extensions (CCX4)

MAC Features

- Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)
- Low latency immediate High-Throughput Block Acknowledgement (HT-BA)
- Long NAV for media reservation with CF-End for NAV release
- PHY-level spoofing to enhance legacy compatibility
- MIMO power saving mechanism
- Channel management and co-existence
- Multiple BSSID feature allows the RTL8192E-GR to assume multiple MAC identities when used as a wireless bridge

- Supports Wake-On-WLAN via Magic Packet and Wake-up frame
- Transmit Opportunity (TXOP) Short Inter-Frame Space (SIFS) bursting for higher multimedia bandwidth

Peripheral Interfaces

- General Purpose Input/Output (8 pins)
- 4-wire EEPROM control interface (93C46 and 93C56)
- 4-wire RF control interface (RTL8256 and RTL8258)
- Two configurable LED pins

PHY Features

- IEEE 802.11n draft 2.0 MIMO OFDM
- Two Transmit and Two Receive paths (2T2R)
- 20MHz and 40MHz bandwidth transmission
- Short Guard Interval (400ns)
- One spatial stream STBC transmission for extended coverage
- Sounding packet
- DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble
- OFDM with BPSK, QPSK, 16QAM, 64QAM, and 256QAM modulation. Convolutional Coding Rate: 1/2, 2/3, 3/4, and 5/6
- Maximum data rate 54Mbps in 802.11g, and 300Mbps in 802.11n
- OFDM receive diversity with MRC using up to 4 receive paths. Switch diversity used for DSSS/CCK.
- Hardware antenna diversity
- Selectable digital transmit and receive FIR filters
- Programmable scaling in transmitter and receiver to trade quantization noise against increased probability of clipping
- Fast receiver Automatic Gain Control (AGC)
- On-chip ADC and DAC

Applications

- Flexible dual-band MIMO (1x2/2x2/2x3) solution
- Single-band MIMO (1x2) solution