RTL8192EEBT

RTL8192EE+RTL8761AU

Combo Module User's Manual

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USING THIS DOCUMENT

This document is intended for the software engineer's reference and provides detailed programming information.

Though every effort has been made to ensure that this document is current and accurate, more information may have become available subsequent to the production of this guide.

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1. General Description

The Realtek RTL8192EE is a highly integrated single-chip MIMO (Multiple In, Multiple Out) Wireless LAN (WLAN) solution for the wireless high throughput 802.11n specification. It combines a MAC, a 2T2R capable baseband, and RF in a single chip. The RTL8192EE provides a complete solution for a high throughput performance wireless client.

The RTL8192EE baseband implements Multiple Input, Multiple Output (MIMO) Orthogonal Frequency Division Multiplexing (OFDM) with 2 transmit and 2 receive paths (2T2R) and is compatible with the IEEE 802.11n specification. Features include two spatial streams transmission, short Guard Interval (GI) of 400ns, spatial spreading, and transmission over 20MHz and 40MHz bandwidth. The RTL8192EE provides a spatial stream Space-Time Block Code (STBC) and Low Density Parity Check (LDPC) encoding and decoding to extend the range of transmission. At the receiver, extended range and good minimum sensitivity is achieved by having receiver diversity up to two antennas. As the recipient, the RTL8192EE also supports explicit sounding packet feedback that helps senders with beamforming capability. With two independent RF blocks, the RTL8192EE can perform fast roaming without link interruption.

For legacy compatibility, Direct Sequence Spread Spectrum (DSSS), Complementary Code Keying (CCK) and OFDM baseband processing are included to support all IEEE 802.11b and 802.11g data rates. Differential phase shift keying modulation schemes, DBPSK and DQPSK with data scrambling capability, are available along with complementary code keying to provide data rates of 1, 2, 5.5 and 11Mbps 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, provides the maximum data rate of 54Mbps and 300Mbps for IEEE 802.11g and 802.11n MIMO OFDM respectively.

The RTL8192EE 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 2 receive paths are implemented. Robust interference detection and suppression are provided to protect against Bluetooth, cordless phone, and microwave oven interference. Receive vector diversity for multi-stream application is implemented for efficient utilization of MIMO channels. Efficient IQ-imbalance, DC offset, phase noise, frequency offset, and timing offset compensations are provided for radio frequency front-end impairments. Selectable digital transmit and receive FIR filters are provided to meet transmit spectrum mask requirements and to reject adjacent channel interference, respectively.

The RTL8192EE 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 the better performance in the analog portions of the transceiver.

The RTL8192EE 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 Legacy Power Save, U-APSD, and MIMO power saving reduce the power wasted during idle time, and compensate for the extra power required to transmit MIMO OFDM. The RTL8192EE provides simple legacy and 20MHz/40MHz co-existence mechanisms to ensure backward and network compatibility.

The Realtek RTL8761AU is a highly integrated single-chip Bluetooth 2.1/3.0/4.0 controller, USB interface. It combines BT Protocol Stack (LM, LL, and LE), BT Baseband, modem, and BT RF in a single chip.

The RTL8761AU Bluetooth controller complies with Bluetooth core specification v4.0, and supports dual mode (BR/EDR + AMP + Low Energy Controllers). It is compatible with previous versions, including v2.1 + EDR and v3.0 + HS. For BR/EDR, it supports scatternet topology and allows four active links in slave mode, and seven active links in master mode. For Low Energy, it supports multiple states and allows eight active links in master mode. The links in BR/EDR and LE can be active simultaneously.

2. Functional Specifications

Standards	***WiFi:*** IEEE 802.11b, IEEE 802.11g, Draft IEEE 802.11n, IEEE 802.11d, IEEE 802.11e, IEEE 802.11h, IEEE 802.11i ***BT:*** V2.1+EDR/BT v3.0/BT v3.0+HS/BT v4.0
Bus Interface	***WiFi:*** PCI Express ***BT:*** USB
Form Factor	NGFF 、minicard
Data Rate	**802.11b:** 11, 5.5, 2, 1 Mbps; **802.11g:** 54, 48, 36, 24, 18, 12, 9, 6 Mbps **802.11n:** MCS 0 to 15 for HT20MHz; MCS 0 to 15 for HT40MHz **BT:** 1 Mbps for Basic Rate 2,3 Mbps for Enhanced Data Rate ,6,9,12,18,24,36,48,54 Mbps for High Speed
Media Access Control	***WiFi:*** CSMA/CA with ACK ***BT:*** AFH, Time Division
Modulation Techniques	***802.11b***: CCK, DQPSK, DBPSK ***802.11g***: 64 QAM, 16 QAM, QPSK, BPSK ***802.11n***: 64 QAM, 16 QAM, QPSK, BPSK ***BT***: 8DPSK, π/4 DQPSK, GFSK
Network Architecture	***WiFi***: Ad-hoc mode (Peer-to-Peer) Infrastructure mode ***BT***: Pico Net Scatter Net

Operating Channel	***WiFi 2.4GHz:*** 11: (Ch. 1-11) – United States 13: (Ch. 1-13) – Europe 14: (Ch. 1-14) – Japan ***BT 2.4GHz:*** Ch. 0 ~78
Frequency Range	2.400GHz ~ 2.4835 GHz
Security	***WiFi*** : WPA, WPA-PSK, WPA2, WPA2-PSK, WEP 64bit & 128bit, IEEE 802.11x, IEEE 802.11i ***BT:*** Simple Paring
Operating Voltage	3.3 V ±9% I/O supply voltage

4. Warning

4.5.1 Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTE:
FCC Radiation Exposure Statement:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 0.5cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

IEEE 802.11b or 802.11g operation of this product in the U.S.A. is firmware-limited to channels 1 through 11.

This device is intended only for OEM integrators under the following conditions:
1) The antenna must be installed such that 0.5 cm is maintained between the antenna and users.

2) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: This device and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures. Refering to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without C2P.
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End Product Labeling
This transmitter module is authorized only for use in device where the antenna may be installed such that 0.5 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID: TX2RTL8192EEBT”.

Manual Information To the End User
The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.
The end user manual shall include all required regulatory information/warning as show in this manual.

4.5.2 Industry Canada Statement

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions:
1) this device may not cause interference and
2) this device must accept any interference, including interference that may cause undesired operation of the device

French translation:
Ce dispositif est conforme à la norme CNR-210 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

This device has been designed to operate with an antenna having a maximum gain of 3.5dBi.
Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the EIRP is not more than required for successful communication.

French translation:
Ce dispositif a été conçu pour fonctionner avec une antenne ayant un gain maximum de 3.5 dBi. Une antenne à gain plus élevé est strictement interdite par les règlements d'Industrie Canada. L'impédance d'antenne requise est de 50 ohms.
Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peutfonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pourl'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectriqueà l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que lapuissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire àl'établissement d'une communication satisfaisante.

IMPORTANT NOTE:
IC Radiation Exposure Statement:
This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 0.5cm between the radiator & your body.

French translation:

NOTE IMPORTANTE: (Pour l'utilisation de dispositifs mobiles)
Déclaration d'exposition aux radiations:
Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 0.5 cm de distance entre la source de rayonnement et votre corps.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 0.5 cm is maintained between the antenna and users, and

2) For all products market in Canada, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

CAN ICES-3 (B)/NMB-3(B)

French translation :

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

1) L'antenne doit être installée de telle sorte qu'une distance de 0.5 cm est respectée entre l'antenne et les utilisateurs, et

2) Pour tous les produits vendus au Canada, OEM doit limiter les fréquences de fonctionnement CH1 à CH11 pour bandes de fréquences 2.4G grâce aux outils de microprogrammation fournis. OEM ne doit pas fournir d'outil ou d'informations à l'utilisateur final en ce qui concerne le changement de réglementation de domaine.

Tant que les 3 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE: This device and its antenna(s) must not be co-located with any other transmitters except in accordance with IC multi-transmitter product procedures. Refering to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without reassessment permissive change.

French translation:

NOTE IMPORTANTE: Cet appareil et son antenne (s) ne doit pas être co-localisés ou fonctionnement en association avec une autre antenne ou transmetteur.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 0.5 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains IC: 6317A-RTL8192EEBT”.

French translation:

Plaque signalétique du produit final
Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 0.5cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 6317A-RTL8192EEBT ".

Manual Information To The End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

French translation:

Manuel d'information à l'utilisateur final
L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module. Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

4.5.3 NCC 警語

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

本模組於取得認證後將依規定於模組本體標示審合格籤。
系統廠商應於平台上標示「本產品內含射頻模組： XXXyyyLPDzzzz-x (NCC ID) 」字樣。

4.5.4 Japan Statement

Host system must be labeled with "Contains MIC ID:xxxxxx “ , MIC ID displayed on label.

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Total Antenna List

No.	Brand	Ant. Type	Con. Type	Peak Gain (dBi)	Model No.
1	LYNwave	PIFA	IPEX MHF4	TX1: 3.5	TX1: ALA110-222050-300011
2	LYNwave	PIFA	IPEX	TX1: 3.5	TX1: ALA110-222050-300010
3	JOYMAX	DIPOLE	IPEX	TX1: 3.0	TX1: TWF-614XMPXX-500
4	Well Green	PIFA	IPEX	TX1: 0.85 TX2: 0.44	TX1: SKW10WMPB01+A TX2: SKW10WMPB02+A
5	Well Green	PIFA	IPEX	TX1: 0.42 TX2: -0.13	TX1: SK65EWMPB01+A TX2: SK650WMPB02+A
6	JESS-LINK	PIFA	IPEX	TX1: 2.72 TX2: 0.07	TX1: DC33001AD00 TX2: DC33001AD00
7	HIGH-TEK	PIFA	IPEX	TX1: -0.93 TX2: 0.87	TX1: DC33001AC00 TX2: DC33001AC00
8	Luxshared	PIFA	IPEX	TX1: -0.28 TX2: 0.59	TX1: L01RF023-YT-R (WLAN Main) TX2: L01RF029-YT-R (WLAN Aux)
9	Luxshared	PIFA	IPEX	TX1: 2.08 TX2: 0.14	TX1: L01RF019-DT-R (31-502717) TX2: L01RF021-DT-R (31-502716)
10	Well Green	PIFA	IPEX	TX1: 0.55 TX2: 1.36	TX1: SKAEUWMPB01+B TX2: SKAEUWMPB01+B
11	Well Green	PIFA	IPEX	TX1: 0.82 TX2: -2.23	TX1: SKA91WMPB02+A TX2: SKA91WMPB01+A
12	Wgt	PIFA	IPEX	TX1: 2.14 TX2: 1.92	TX1: W550EU WM-1 TX2: W550EU WM-2
13	Acon	PIFA	IPEX	TX1: -0.63 TX2: -3.39	TX1: APP6P-700781 TX2: APP6P-700782
14	Acon	PIFA	IPEX	TX1: -0.13 TX2: -0.23	TX1: ATM6P-70100 TX2: ATM6P-70200
15	WNC	PIFA	IPEX	TX1: -0.58 TX2: -1.48	TX1: DQ6G15G5800 TX2: DQ6G15G5700
16	Zhan Yun	PIFA	IPEX	TX1: -0.70 TX2: -1.20	TX1: DQ60QTLI200 TX2: DQ60QTLI201
17	WNC	PIFA	IPEX	TX1: 1.15 TX2: 0.59	TX1: 81.EKG15.G30 TX2: 81.EKG15.G29
18	YAGEO	PIFA	IPEX	TX1: 0.59 TX2: 0.90	TX1: CAN4313LC0613WLA3 TX2: CAN4313LC0613WLA4
19	WNC	PIFA	IPEX	TX1: 0.18 TX2: 0.60	TX1: 81.EKG15.G38 TX2: 81.EKG15.G37
20	JESS-LINK	PIFA	IPEX	TX1: 1.89 TX2: 1.56	TX1: PANT11A00008-1 TX2: PANT11A00009-1

No.	Brand	Ant. Type	Con. Type	Peak Gain (dBi)	Model No.
21	Foxconn	PIFA	IPEX	TX1: 0.21 TX2: 0.60	TX1: WDAN-T1RH1 TX2: WDAN-T1RH2
22	Well Green	PIFA	IPEX	TX1: 0.21 TX2: -0.75	TX1: SKX71WMPB01+B TX2: SK370WMPB01+B
23	Luxshared	PIFA	IPEX	TX1: -0.6 TX2: -0.29	TX1: L01RF008-R TX2: L01RF009-R
24	Well Green	PIFA	IPEX	TX1: 0.72 TX2: 0.49	TX1: SKW25WMPB01+A TX2: SKW25WMPB01+A
25	Well Green	PIFA	IPEX	TX1: -0.17 TX2: -2.24	TX1: SK549WMPB01+A TX2: SK549WMPB02+A
26	Wgt	PIFA	IPEX	TX1: 1.7 TX2: 2.53	TX1: W350ETQ WM-1 TX2: W350ETQ WM-2
27	Well Green	PIFA	IPEX	TX1: -1.93 TX2: -1.28	TX1: SKW54WMPB01+C TX2: SKW34WMPB02+A
28	Joinsoon	PIFA	IPEX	TX1: 2.6 TX2: 0.53	TX1: IA-120266 TX2: IA-120267
29	WNC	PIFA	IPEX	TX1: 0.24 TX2: -0.58	TX1: 25.90AH8.001 TX2: 25.90AH7.001
30	Wieson	PIFA	IPEX	TX1: 1.28 TX2: 0.34	TX1: 25.90AH8.011 TX2: 25.90AH7.011
31	Yageo	PIFA	IPEX	TX1: -0.27 TX2: -0.88	TX1: 25.90AH8.021 TX2: 25.90AH7.021
32	Yageo	PIFA	IPEX	TX1: -0.11 TX2: -0.68	TX1: 25.90AJB.001 TX2: 25.90AJC.001
33	Yageo	PIFA	IPEX	TX1: -1.32 TX2: -1.14	TX1: 25.90AJB.001 TX2: 25.90AJC.001
34	Yageo	PIFA	IPEX	TX1: 2.74 TX2: 0.63	TX1: 25.90ALR.001 TX2: 25.90ALQ.001
35	WNC	PIFA	IPEX	TX1: -0.61 TX2: 1.91	TX1: 25.90AAL.001 TX2: 25.90AAK.001
36	TE Connectivity	PIFA	IPEX	TX1: 1.29 TX2: 0.04	TX1: 25.90AAL.011 TX2: 25.90AAK.011
37	Amphenol	PIFA	IPEX MHF4	TX1: -1.73 TX2: -1.65	TX1: 0C50890 TX2: 0C50888
38	Amphenol	PIFA	IPEX MHF4	TX1: -1.54 TX2: -0.53	TX1: C-3942-16-000-48 TX2: C-3941-16-000-48

No.	Brand	Ant. Type	Con. Type	Peak Gain (dBi)	Model No.
39	Luxshare	PIFA	IPEX MHF4	TX1: -0.47 TX2: -0.25	TX1: LA22LN718-1N-3F TX2: LA22LN719-1N-3F
40	YAGEO	PIFA	IPEX MHF4	TX1: 1.80 TX2: 1.19	TX1: CAN4313LL0727WLA1 TX2: CAN4313LL0727WLA2
41	Amphenol	PIFA	IPEX MHF4	TX1: -1.69 TX2: 0.41	TX1: LX3965-16-000-C TX2: LX3964-16-000-C
42	Luxshare-ICT	PIFA	IPEX MHF4	TX1: -0.61 TX2: 1.82	TX1: DC330016W00 TX2: DC330016W10
43	HIGH-TEK	PIFA	IPEX	TX1: -2.20 TX2: -2.20	TX1: 25.90ALR.011 TX2: 25.90ALQ.011
44	HIGH-TEK	PIFA	IPEX	TX1: -0.70 TX2: -0.60	TX1: 25.90AJB.011 TX2: 25.90AJC.011
45	HIGH-TEK	PIFA	IPEX	TX1: -0.42 TX2: 1.59	TX1: 25.90AJB.011 TX2: 25.90AJC.011