



**UGWDR82NUH50  
UGWDR82NUH50A  
UGWDR82NUH50-UN1**

**802.11b/g/n WiFi USB Radio Dongle**

**Issue Date: 16-OCT-2009  
Revision: 1.0**

## REVISION HISTORY

Rev. No.	History	Issue Date	Remarks
0.1	Draft	July, 09, 2009	First Draft; Author: Allen Cabreros (acabreros@unigen.com)
0.91	Draft	July, 20, 2009	Mechanical Dimensions added
1.0	Release	Oct, 16, 2009	Ordering information details added; FCC/CE regulatory ID's added

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## PRODUCT INTRODUCTION

The Unigen UGWDR82NUH50A USB dongle supports the IEEE 802.11b/g/n radio technology. The IEEE 802.11 Wireless Ethernet standards known as WLAN and are currently the most popular, short range, unlicensed radio technology for transferring large amounts of data within a short range and period of time reliably. With reliable transmissions, protocol stack and with use of the OSI model this USB wireless device can achieve over-the-air data throughput of up to 300Mbps downstream and 150Mbps upstream. The San Gabriel radio module family utilizes multi stream 1x2 MIMO antennas to achieve high throughput in a small form factor. WLAN is a radio technology

## FEATURES AND BENEFITS

- USB bus powered dongle
- USB2.0 interfaces
- Compliant to IEEE 802.11b/g radio standards
- Compatible with 802.11n draft 2.0 specification
- Compatible with 802.11n final 1.0 specification
- 1 x 2 MIMO technology for extended reception robustness and exceptional throughput
- 2 Printed Antennas or 2 U.FL TX/RX ports (optioned by P/N)
- 150Mbps receive PHY rate and 75Mbps transmit PHY rate using 20MHz bandwidth
- 300Mbps receive PHY rate and 150Mbps transmit PHY rate using 40MHz bandwidth
- Backward compatible with 802.11b/g devices while operating at 802.11n data rates
- Two configurable LEDS
- Embedded LDOs, EEPROM and crystals
- Rohs compliance
- Ready for embedded OS such as Windows CE and Linux

## STANDARDS SUPPORTED

- IEEE 802.11b/g/n compatible WLAN
- IEEE 802.11e QoS Enhancement (WMM)
- IEEE 802.11h TPC, Spectrum 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 RTL8191SU to assume multiple MAC identities when used as a wireless bridge
- Transmit Opportunity (TXOP) Short Inter-Frame Space (SIFS) bursting for higher multimedia bandwidth

## PHY FEATURES

- IEEE 802.11n draft 2.0 MIMO OFDM
- One Transmit and Two Receive paths (1T2R)
- 20MHz and 40MHz bandwidth transmission
- Short Guard Interval (400ns)
- DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble
- OFDM with BPSK, QPSK, 16QAM, and 64QAM modulation. Convolution 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 2 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)

## PRODUCT DESCRIPTION

### UGWDR82NUH50A USB dongle

The UGWDR82NUH50A USB dongle features the Realtek RTL8191SU which integrates IEEE 802.11 b/g/n RF transceiver, baseband and MAC layer. The USB dongle supports the 1TX/2RX MIMO antenna technology to support 300Mbps downstream and 150Mbps upstream PHY rates. The USB dongle is a self powered USB device utilizing the 5V power source supplied by VBUS. A host controller is required to support the full 802.11 protocol and driver. Embedded Linux and WinCE driver support is available.

### Realtek RTL8191SU IC

The Realtek RTL8191SU-GR is a highly integrated MIMO (Multiple In, Multiple Out) Wireless LAN (WLAN) USB 2.0 network interface controller complying with the IEEE 802.11n Draft specification 2.0 and IEEE 802.11n Final specification 1.0. It combines a MAC, 1T2R capable baseband and RF in a single chip, the RTL8191SU-GR provides a complete solution for a high-performance wireless client.

The RTL8191SU-GR baseband implements MIMO Orthogonal Frequency Division Multiplexing (OFDM) with one transmit and two receive paths (1T2R). Features include one spatial stream transmissions, short Guard Interval (GI) of 400ns, spatial spreading, and support for both 20MHz and 40MHz channel bandwidth. The RTL8191SU-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.

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, 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 802.11g and 802.11n MIMO OFDM respectively.



The RTL8191SU-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.

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 RTL8191SU-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 RTL8191SU-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 RTL8191SU-GR provides simple legacy and 20MHz/40MHz co-existence mechanisms to ensure backward and network compatibility.

## FUNCTIONAL BLOCK DIAGRAM

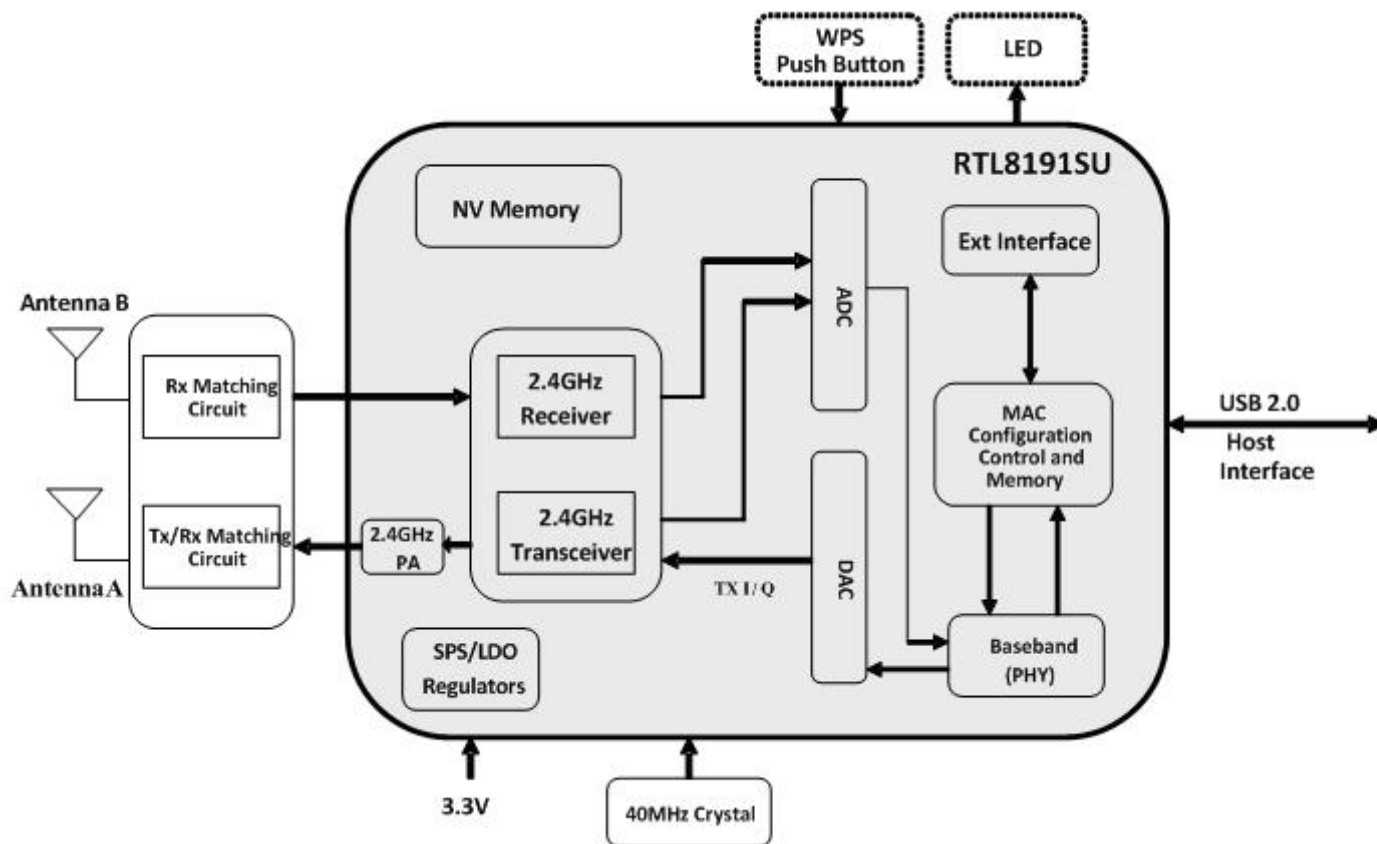


Figure 1: Module Block Diagram

## TEMPERATURE LIMIT RATINGS

**Table 1: Temperature Limit Ratings**

Parameter	Minimum	Maximum	Units
Storage Temperature	-55	+125	°C
Ambient Operating Temperature	0	70	°C
Junction Temperature	0	125	°C

## POWER CONSUMPTION CHARACTERISTICS

**Table 2: Power Consumption Characteristics**

Condition	Specifications @5V	Units
Associated and Idle (w/o power save mode)	168	mA
Associated and Idle (w/ power save mode)	38.2	mA
Unassociated and Idle (w/o power save mode)	154	mA
Unassociated and Idle (w/ power save mode)	37.5	mA
Packet TX	205	mA
Packet RX	198	mA
TX throughput: 106Mbps (MCS15@40MHz)	131	mA
RX throughput: 142Mbps (MCS15@40MHz)	190	mA
TX throughput: 103Mbps (MCS7@40MHz)	130	mA
RX throughput: 90Mbps (MCS7@40MHz)	190	mA
TX throughput: 48Mbps (MCS15@20MHz)	124	mA
RX throughput: 84Mbps (MCS15@20MHz)	175	mA
TX throughput: 48Mbps (MCS7@20MHz)	125	mA
RX throughput: 48Mbps (MCS7@0MHz)	173	mA
Radio Off	37.5	mA
Dongle Disabled	1.45	mA
Suspend	1.41	mA

## RF CHARACTERISTICS

Table 3: RF Characteristics

Parameter	Conditions	Specifications	Units
RF channel support		2412, 2417, 2422, 2427, 2432, 2437, 2442, 2447, 2452, 2457, 2462, 2467, 2472, 2482	MHz
RF output power	802.11b 11Mbps	17	dBm
	802.11g 54Mbps	15	dBm
	802.11n MCS7	13	dBm
Receiver sensitivity	802.11b	-84	dBm
	802.11g (1R)	-73	
	802.11n (2R)	-71 (MCS 7 HT20) -68 (MCS 15_HT20) -68 (MCS 7 HT40) -65 (MCS 15_HT40)	dBm
Frequency offset		$\pm 25$	ppm
Transmit Spectrum Mask		Conform to IEEE 802.11b/g Spectrum Mask	

## MECHANICAL DRAWINGS

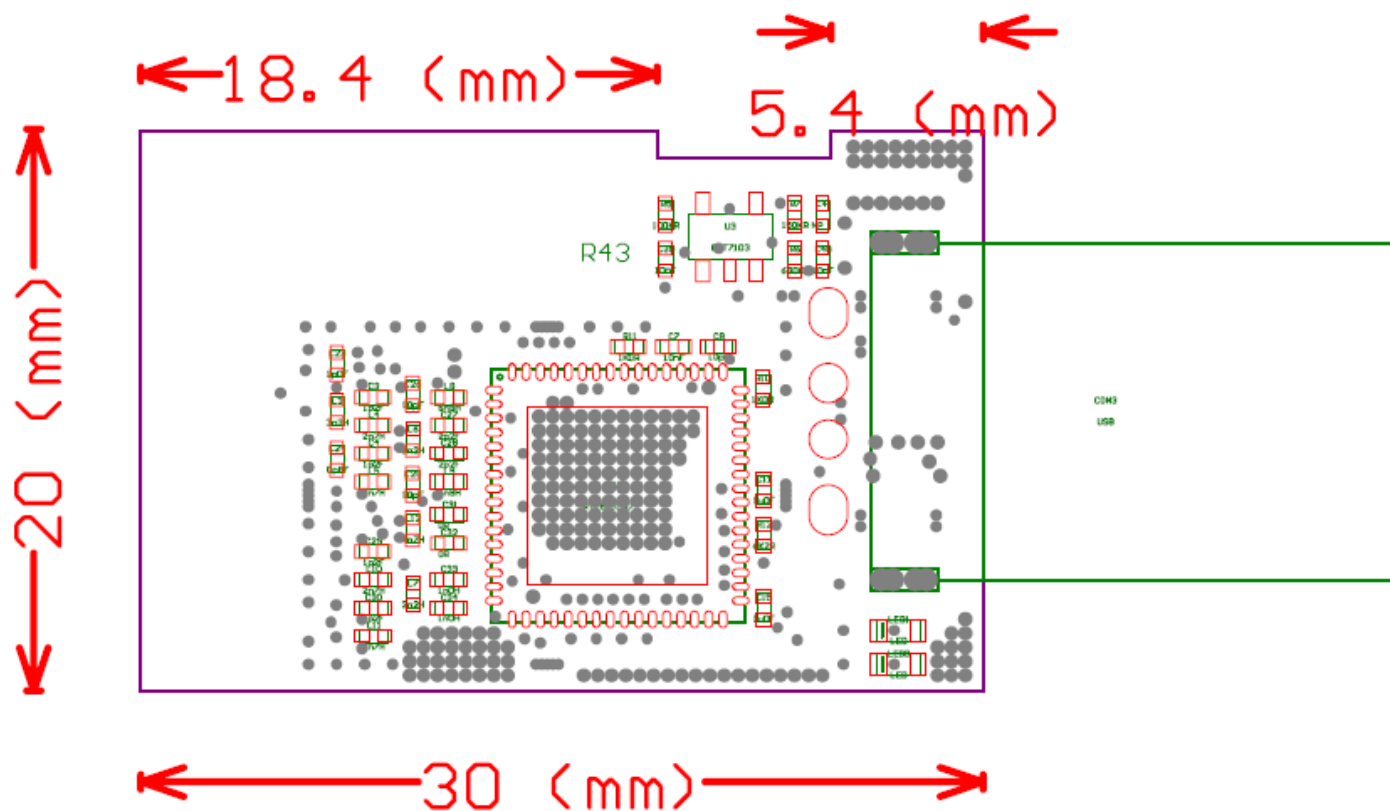
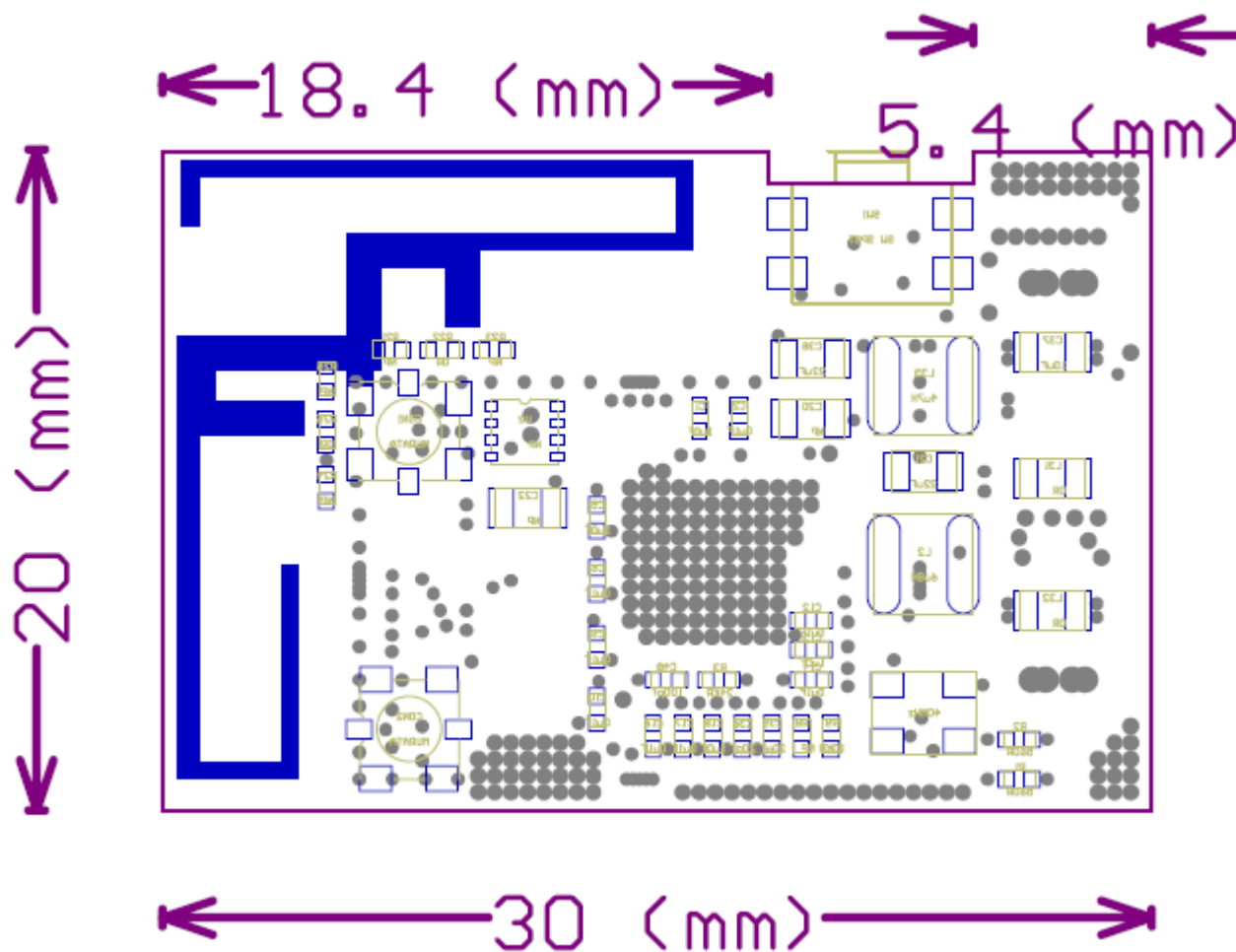
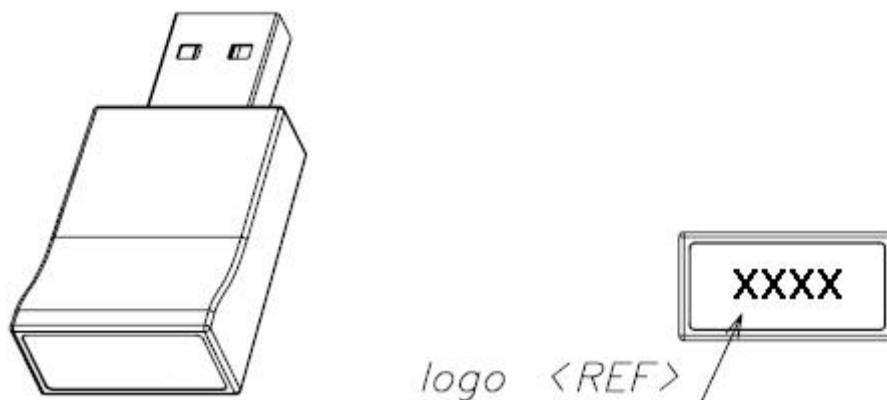


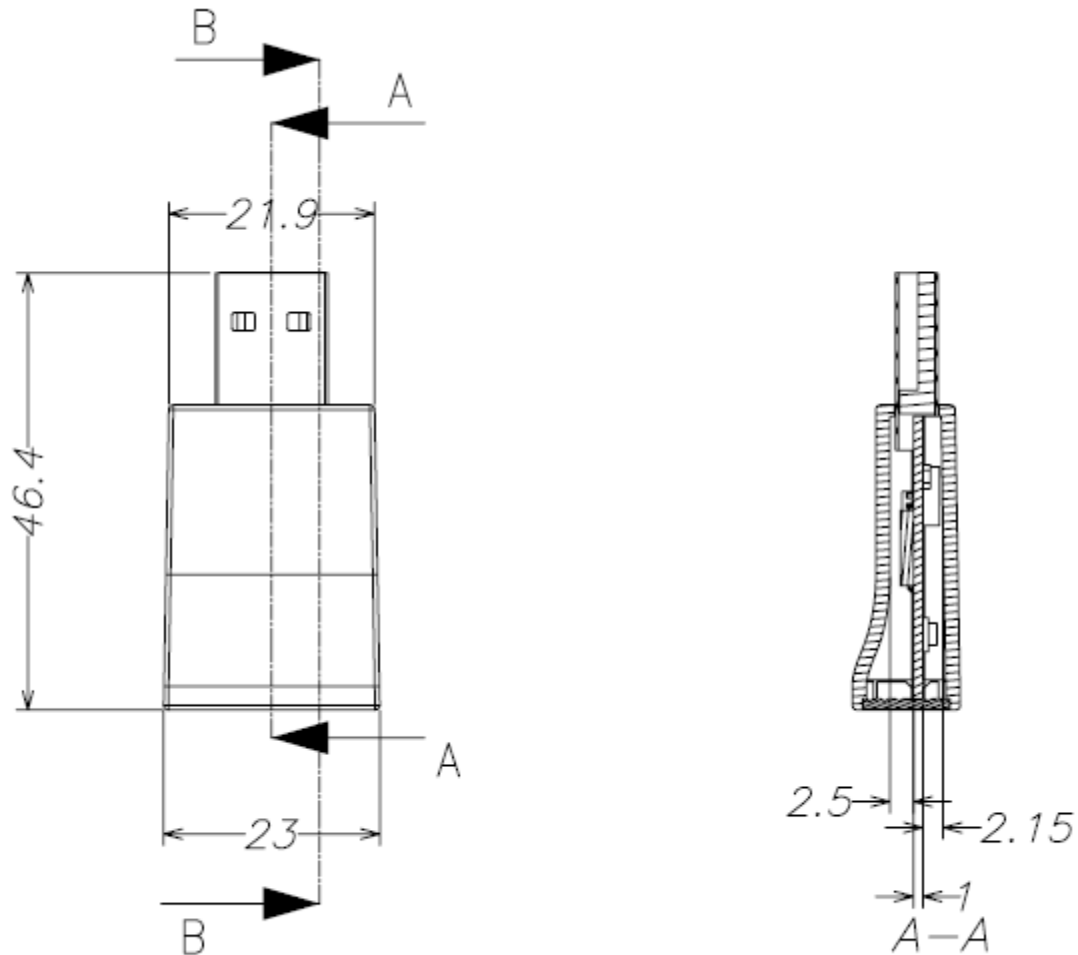
Figure 2: Mechanical Dimensions (Top)



### Figure 3: Mechanical Dimensions (Bottom)

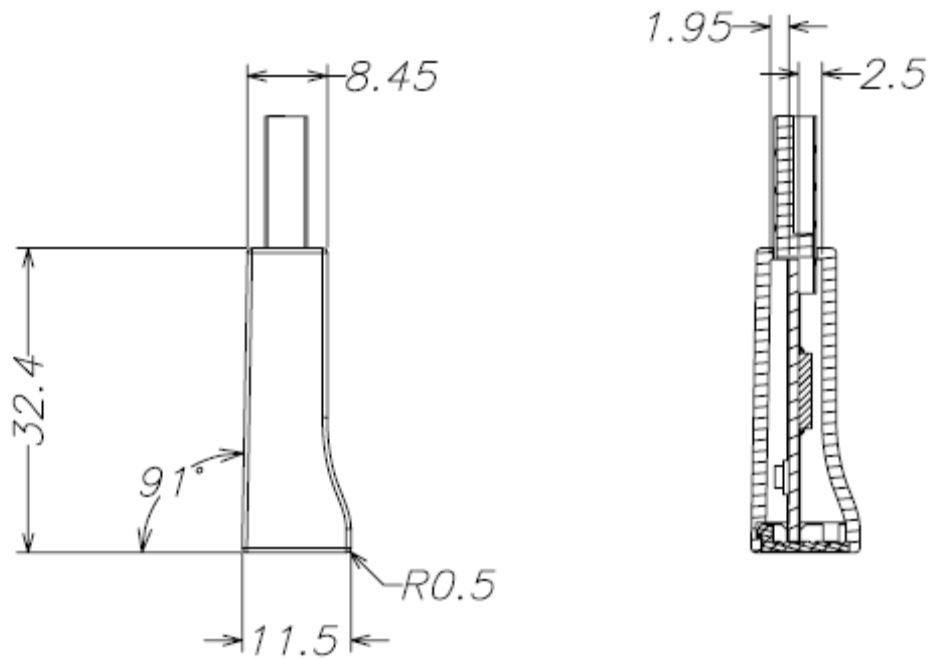


**Figure 4: Mechanical Enclosure 1**



**Figure 5: Mechanical Enclosure 2**





**Figure 6: Mechanical Enclosure 3**

## AGENCY CERTIFICATIONS

### Device Certification

FCC ID – R8KUGWDR82

IC: 5125-UGWDR82

### FCC Modular Certification

FCC ID – R8KUGWDR82M

IC: 5125-UGWDR82M

## ORDERING INFORMATION

### UGWDR82NUH50-UN1

- Clamshell packaging
- Mechanical housing
- Super bright White LED's
- FCC **DEVICE** certification
- Printed embedded antennas

### UGWDR82NUH50A

- RF shield over the RF section of the board
- FCC **MODULAR** certification
- Printed embedded antennas
- No mechanical housing or packaging
- Push button switch for WPS security
- Green LED's

### UGWDR82NUH50

- RF shield over the RF section of the board
- FCC **MODULAR** certification
- Comes with coaxial connector antennas
- No mechanical housing or packaging
- Push button switch for WPS security
- Green LED's

## CONTACT INFORMATION

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