WLAN6060 Embedded Module
Application Notes

09/27/2002
(Preliminary)

Confidential Information

WLAN6060 Embedded Module Document Revision Control

Revision	Date	Author	Engineering Approval	Marketing Approval	Operation Approval	Mark
Preliminary	09/27/2002	PG	KS	AM	RC	

WLAN6060 Product Series

Product	**Footprint**	**I/O to Host**	**I/O to RF**	**Antenna**
WLAN6060BB Embedded Module	BGA/SMT	CF/PCMCIA	Coaxial Connector	External antenna required
WLAN6060EB Embedded Module	60 pin interboard connector	CF/PCMCIA	Coaxial Connector	External antenna required
WLAN6060SD Network Interface Card	SDIO	SDIO	Internal	No external antenna required

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1. Introduction

SyChip Inc introduces the world smallest embedded Wireless LAN modules with the size of 25.0x22.5x3.0mm^3 (WLAN6060BB) and 25.0x25.0x4.5 mm^3 (WLAN6060EB). The module incorporates the popular wireless Ethernet standard, 802.11b. It supports BSS (Basic Service Set) and IBSS (Independent Basic Service Set) operation under DCF (Distributed Coordination Function), and operation under the optional PCF (Point Coordination Function). The module provides data rate of up 11Mbps.

Through dynamic throughput management, the WLAN6060BB(EB) can adjust its transmit/receive speed to 1, 2, 5.5, or 11Mbps. This technique ensures that the module is performing at the optimal transmission rate for the range signal strength while consuming minimum power.

With the form factor of 25.0x22.5x3.0mm^3 (WLAN6060BB) and 25.0x25.0x4.5 mm^3(WLAN6060EB), the modules enable next generation PDAs, Cellular Phones, and Ultra-thin notebooks to access the Internet, transfer streaming video or audio, images or large files from a WLAN-enabled environment.

Key Advantages:

- World smallest WLAN(802.11b) modules with miniature size of 25.0x22.5x3.0mm^3 (WLAN6060BB) and 25.0x25.0x4.5 mm^3(WLAN6060EB)
- Firmware implements the full IEEE 802.11b Wireless LAN MAC protocol.
- Internal WEP64/128 bit engine.
- Programmable data rate: 1, 2, 5.5 and 11 Mbps.
- Support short preamble.
- Wi-Fi certifed

2. Architecture

Block Diagram

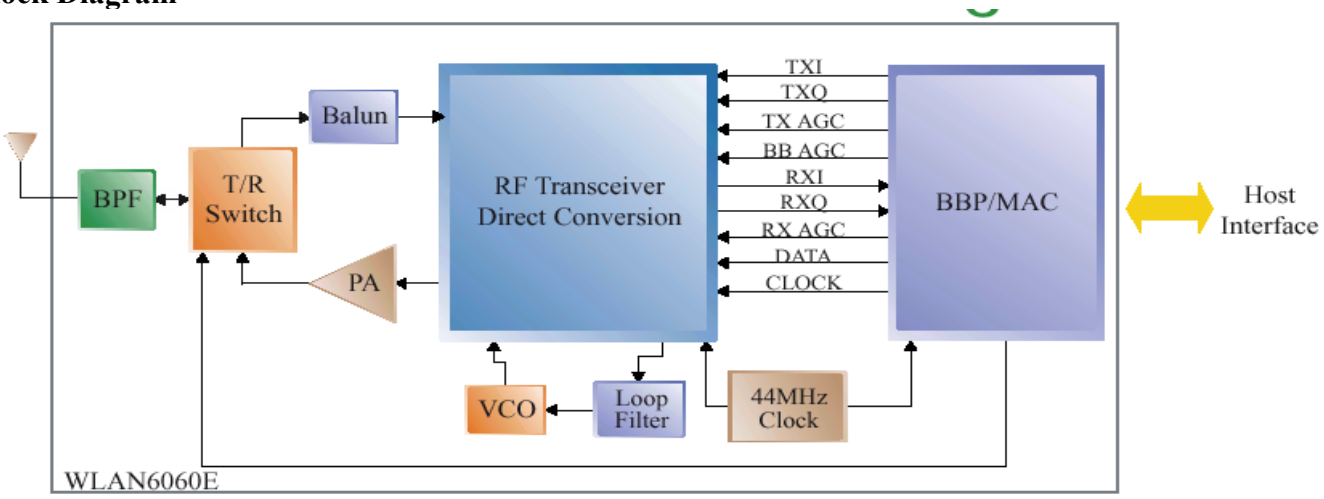


Figure 1. WLAN6060BB(EB) Block Diagram

The design is robust. Utilizing separate chips for the Radio, Base band, and VCO functions enables SyChip to deliver a reliable, consistent product.

The RF Transceiver integrated circuit includes an LNA, transmit pre-amplifier, quadrature up/down converter, synthesizer, low pass filter, and RX amplifier. It utilizes Direct Conversion technology, eliminating the need for intermediate-frequency mixer(s), amplifier and filter components.

The versatile design of the WLAN6060BB(EB) enables programming of the RF channel frequency from 2.4 GHz to 2.5 GHz in steps of 1 MHz. This covers all of the RF channels frequencies specified in 802.11b standard.

The Baseband Processor is a highly integrated Baseband/MAC . The host interface supports PCMCIA, and CF card applications.

3. Functional Description

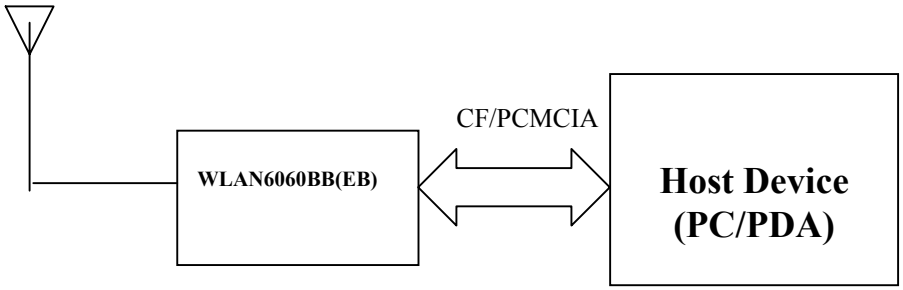


Figure 2. WLAN6060BB(EB) Functional Interface Diagram

WLAN6060BB(EB) is a complete WLAN(802.11b) system and only an external antenna needs to be implemented as a standalone unit or as a plug-and-play module in different applications.

The RF function provides programming of the RF channel frequency from 2.4 GHz to 2.5 GHz in steps of 1 MHz. This covers all of the RF channels frequencies specified in 802.11b standard.

The RF channel frequency for transmission and reception is stable with 25kHz of its final value, 0.75ms after reprogramming or switching from sleep mode to receive mode.

WLAN6060BB(EB) delivers the wireless connection with data rates of 1Mbps, 2Mbps, 5.5Mbps, and 11Mbps in various environments. A control circuit within the module selects the data rate and power level ensuring optimum performance at the lowest possible power levels at all times.

WLAN6060BB(EB) supports 802.11 WEP 64/128 bit security standard. Future versions will support LEAP and 802.1x.

WLAN6060BB(EB) currently supports Windows 2000/NT/XP and Win CE3.0 Operating System. Future versions will include Win CE.NET and Palm OS.

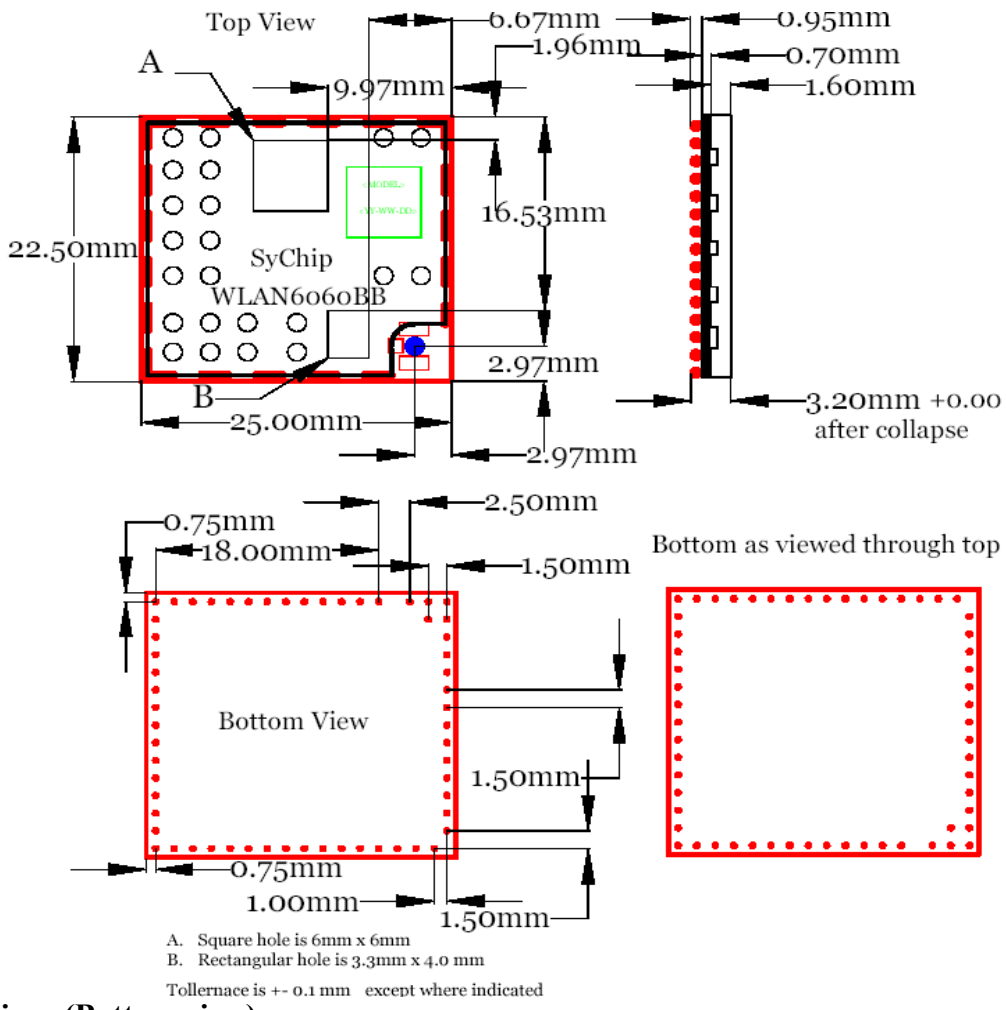
4. Specifications

DC Electrical Specifications					
Parameter	Condition	Min	Typical	Max	Units
Supply Voltage(Vcc)		3.0	3.3	3.6	V
Current (Receiving)	3.3V		TBD		mA
Current (Transmitting)	Pout = 12.5dBm @3.3V		TBD		mA
Current (Standby)	3.3V		TBD		mA
Current (Sleep)	3.3V		TBD		µA
Logic high input		0.7Vcc			V
Logic low input				0.3Vcc	V
Logic high output		Vcc – 0.2			V
Logic low output			0.1	0.2	V
Operating Temperature		-30		+70	°C
Storage Temperature		-40		+85	°C
I/O Interface	CF/PCMCIA				
RX/TX Specifications					
Physical Layer Data Rate			1		Mbps
			2		Mbps
			5.5		Mbps
			11		Mbps
Frequency Range		2400		2500	MHz
Step Size			1		MHz
Output Power	3.3V, 25°C	12.5			dBm
Transmit Spectral Mask	1st Side-lobe, 3.3V	-30			dBc
Transmit Spectral Mask	2nd Side-lobe, 3.3V	-50			dB
Sensitivity	1Mbps, FER 8%, 3.3V	-80*	-90		dBm
	2Mbps, FER 8%, 3.3V	-80*	-88		dBm
	5.5Mbps, FER 8%, 3.3V	-76*	-87		dBm
	11Mbps, FER 8%, 3.3V	-76*	-83		dBm

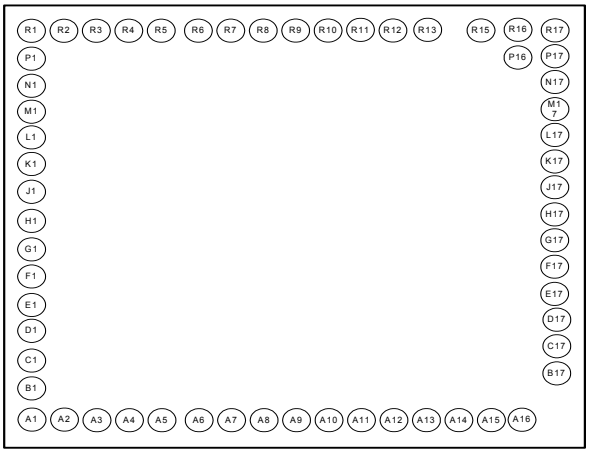
* IEEE802.11 compliant

Dimension

a) BGA version WLAN6060BB



Pin Definitions (Bottom view)

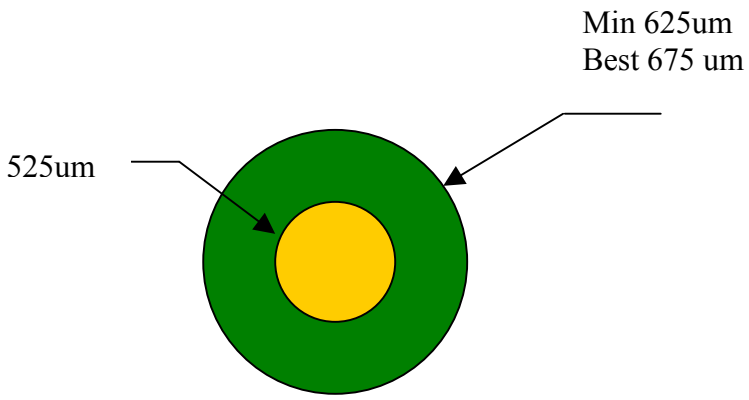


Pin Number	Pin Name	Description
R4	HD0	PC Card data bus
R5	HD1	PC Card data bus
R6	HD2	PC Card data bus
R7	HD3	PC Card data bus
R8	HD4	PC Card data bus
R9	HD5	PC Card data bus
R10	HD6	PC Card data bus
R11	HD7	PC Card data bus
R12	HD8	PC Card data bus
K17	HD9	PC Card data bus
J17	HD10	PC Card data bus
H17	HD11	PC Card data bus
G17	HD12	PC Card data bus
F17	HD13	PC Card data bus
E17	HD14	PC Card data bus
D17	HD15	PC Card data bus
A7	HA0	PC Card address bus
A8	HA1	PC Card address bus
A9	HA2	PC Card address bus
A10	HA3	PC Card address bus
A11	HA4	PC Card address bus
A13	HA5	PC Card address bus
A14	HA6	PC Card address bus
A15	HA7	PC Card address bus
B17	HA8	PC Card address bus
C17	HA9	PC Card address bus
A5	HCE1_N	PC Card select, low byte
A4	HCE2_N	PC Card select, high byte
A3	HOE_N	PC Card output enable
A2	HIORD_N	PC Card I/O space read strobe
C1	HIOWR_N	PC Card I/O space write strobe
D1	HWE_N	PC Card memory attribute space write enable
E1	HIREQ_N	PC Card interrupt request
L1	RESET_N	Hardware reset. Self-asserted by internal pull-up at power-on. Clock signal CLKIN or XTALIN must be available before negation of reset. Value of MD[15:0] copied to MDIR[15:0] and various control register bits on the first MCLK following release of Reset.
F1	HWAIT_N	Host wait, asserted to indicate data transfer not completed and to force host bus wait states.
H1	HIMPACK_N	PC Card I/O decode confirmation
J1	HREG_N	PC Card attribute space select
K1	HSTSCHG_N	PC Card status change
B1	LED	LED Input
A1	GND	Ground
A6	GND	Ground
A12	GND	Ground
A16	GND	Ground
L17	GND	Ground
G1	GND	Ground
N17	GND	Ground
M17	GND	Ground
R16	GND	Ground

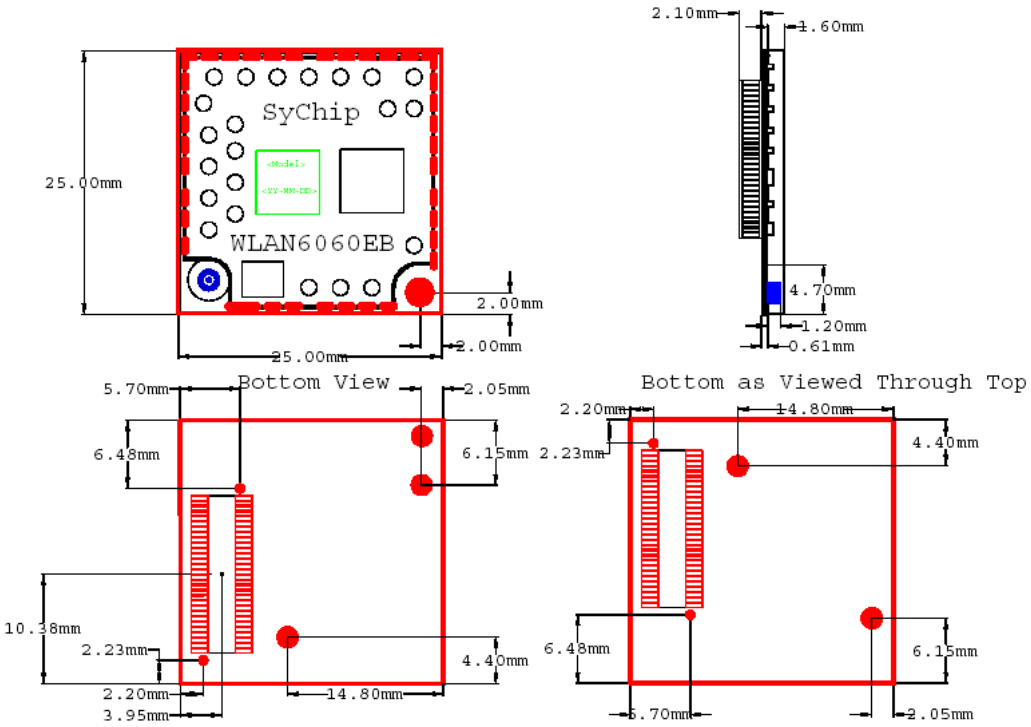
R17	GND	Ground
P16	GND	Ground
P17	GND	Ground
M1	GND	Ground
N1	GND	Ground
R3	GND	Ground
R13	GND	Ground
R15	GND	Ground
P1	VCC	Power Input (3.3V)
R1	VCC	Power Input (3.3V)
R2	VCC	Power Input (3.3V)

Suggested PCB PAD for WLAN6060BB module

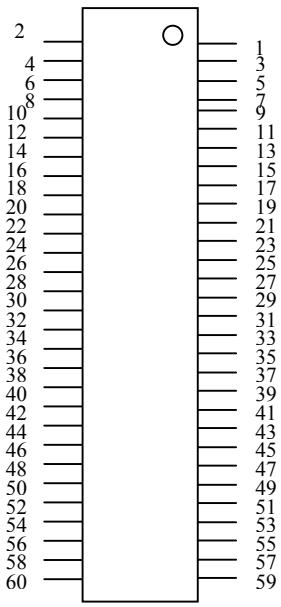
1. Solder mask defined PAD.
2. Copper pad: Min 625 um, best 675 um
3. Solder mask opening: 525 um
4. For Solder Mask:
    a. Very thin (Taiyo PSR4000)
    b. No solder mask undercut
5. Solder mask registration tolerance: 50um maximum



b) 60-pin connector version WLAN6060EB



Pin Definitions



Pin Number	Pin Name	Description
1	GND	Ground
2	GND	Ground
3	HD3	PC Card data bus
4	HD11	PC Card data bus
5	HD4	PC Card data bus
6	HD12	PC Card data bus
7	HD5	PC Card data bus
8	HD13	PC Card data bus
9	HD6	PC Card data bus
10	HD14	PC Card data bus
11	HD7	PC Card data bus
12	HD15	PC Card data bus
13	HCE1_N	PC Card select, low byte
14	HCE2_N	PC Card select, high byte
15	NC	Not Connected
16	GND	Ground
17	HOE_N	PC Card output enable
18	HIORD_N	PC Card I/O space read strobe
19	HA9	PC Card address bus
20	HIOWR_N	PC Card I/O space write strobe
21	HA8	PC Card address bus
22	HWE_N	PC Card memory attribute space write enable
23	HA7	PC Card address bus
24	HIREQ_N	PC Card interrupt request
25	VCC	Power Input (3.3V)
26	VCC	Power Input (3.3V)
27	HA6	PC Card address bus
28	NC	Not Connected
29	HA5	PC Card address bus
30	NC	Not Connected
31	HA4	PC Card address bus
32	RESET_N	Hardware reset. Self-asserted by internal pull-up at power-on. Clock signal CLKIN or XTALIN must be available before negation of reset. Value of MD[15:0] copied to MDIR[15:0] and various control register bits on the first MCLK following release of Reset.
33	HA3	PC Card address bus
34	HWAIT_N	Host wait, asserted to indicate data transfer not completed and to force host bus wait states.
35	HA2	PC Card address bus
36	HINPACK_N	PC Card I/O decode confirmation
37	HA1	PC Card address bus
38	HREG_N	PC Card attribute space select
39	HA0	PC Card address bus
40	NC	Not Connected
41	HD0	PC Card data bus
42	HSTSCHG_N	PC Card status change
43	HD1	PC Card data bus
44	HD8	PC Card data bus
45	HD2	PC Card data bus
46	HD9	PC Card data bus
47	GND	Ground
48	HD10	PC Card data bus
49	GND	Ground
50	GND	Ground
51	GND	Ground
52	GND	Ground

53	GND	Ground
54	GND	Ground
55	NC	Not Connected
56	NC	Not Connected
57	NC	Not Connected
58	NC	Not Connected
59	NC	Not Connected
60	NC	Not Connected

5. Test Setup

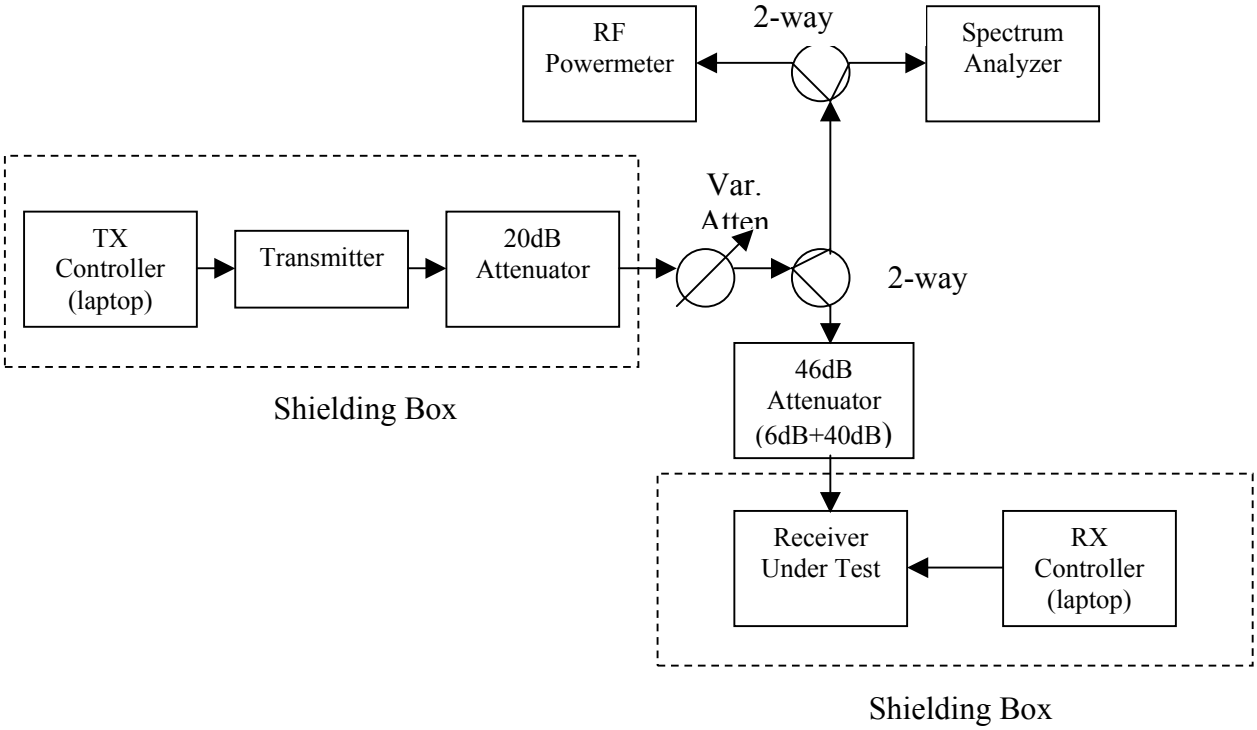
This test setup is for the following key specifications test of the receiver and transmitter of the WLAN6060BB(EB) module:

- Receiver sensitivity
- Output Power
- Spectrum mask

Equipment Required

1. Reference WLAN6060 PCMCIA WLAN transmitter (used as a DSSS source)
2. Shielded Boxes with copper finger stock on lid, -- 2 required: one to enclose TX controller and transmitter and one to enclose RX controller and receiver
3. Laptop computers – 2
4. RF Power meter with sensitive sensor head, (-70~+20dBm power range, HP438A with 8484 sensor or equivalent)
5. Variable attenuator, 50Ohm, 6~60dB
6. 2-way precision, 50Ohm power splitters, 2
7. 6dB, 50 Ohm, precision attenuator, DC-6GHz, with SMA connectors.
8. 40dB, 50 Ohm, precision attenuator, DC-6GHz, with SMA connectors.
9. 10dB, 50 Ohm, precision attenuator, DC-6GHz.
10. Spectrum Analyzer(HP8593E or equivalent).
11. Various lengths of low loss 50 Ohm coax cables terminated in male SMA connectors
12. Window based SyChip LANEVAL software to generate transmitter packets and display the receiver Packet Error Rate.
13. Window based SyChip WLAN Test Utility(SWTU) software for providing a convenient continuous transmit mode enabling accurate power measurement.

Test System



Receiver Test Procedure

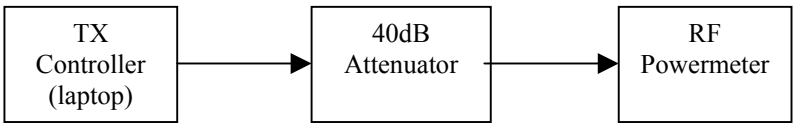
Sensitivity

1. Connect the equipment as shown in the Test Setup using low loss coax cables. Make sure that all connections are adequately connected.
2. Ensure that the power meter has recently been zeroed and that the correct calibration constants have been entered.
3. On the transmitter controller Laptop, note that the NDIS driver icon appears in the System Tray on the desktop. Double click on this icon and note that the Wireless LAN Configuration Utility opens. Left click on the Configuration tab and select either the **AdHoc** or **Pseudo IBSS** mode(depending on driver version). Select the Channel and Data Rate. Click on **Apply** and note that the NDIS icon color is green.
4. Using the LANEVAL software on the Transmit Controller Laptop, turn on the transmitter by left clicking the mouse on the **Start Tx** button. Note that the Transmit Data window opens. The transmitter will start and data transmission will begin. Allow the transmitter to warm up for 3 minutes to stabilize its power output.
5. Place a cover over the transmitter shielded box such that the unit is completely covered on all sides. Add a weight to the center of the cover to ensure adequate pressure sealing the cover to the Finger Stock.
6. Set the Variable Attenuator to minimum attenuation.
7. On the Receiver Controller Laptop, repeat step 3.

8. On the receiver Controller Laptop, start the LANEVAL software. In the opening menu, left click on **Start Rx.** Note that the Receive Data window opens. In this Menu, left click on **Start Rx.** Note that the displays in the Current column are indicating data. The Percent Packet Error Rate (PER%) should indicate at or very close to 0% (i.e., perfect packet transfers).
9. Place the cover on the Receiver. Close as much of the top opening as possible, leaving only just enough of the Laptop exposed to enable reading its screen. Alternately, for convenience, you may connect a remote monitor and a remote keyboard to the Laptop thereby permitting the Receiver box to be completely shielded. In this case, it is prudent to place Ferrite Decoupling Sleeves around each of the connecting cables on these devices to prevent RF signals from propagating through this path. Locate these sleeves inside the box near where the cables exit the box.
10. Slowly increase the attenuation by rotating the Variable Attenuator counterclockwise (CCW) until the PER increases to approximately 8%. NOTE: Because of the sophisticated correlator used in PRISM, PER normally degrades extremely rapidly, once the sensitivity threshold is reached. It is therefore not usually possible to achieve exactly an 8% PER. Rather, try to average the PER around this 8% value.
11. Turn the Transmitter off by clicking on the **STOP Tx** button.
12. Start the PTU software by double clicking on its icon on the desktop.
13. Select the proper associated driver from the list appearing on the screen. After a short delay, the MAC Address and Baseband Processor type should appear. If you are not sure of the correct driver, click on the PCMCIA icon in the System Tray on the Desktop and note the name displayed. NOTE: The button for the operating channel is colored green. Click on this channel. Notice that a border appears around the button.
14. Click on the **Continuous Tx** button. Notice that its color turns to red. The Transmitter is now operating with no packet gaps, enabling accurate reading of the power. **Note:** You will not receive packets while in Continuous Transmit mode.
15. Observe the Power meter reading. The Receiver Sensitivity may be easily calculated by subtracting 40dB from the power reading. Example: If a Power meter indicates –43dBm, the Receiver Sensitivity is –83dBm.
16. Turn off the Transmitter by clicking on the **Continuous Tx** button. The color should revert back to gray.

Transmitter Test Procedure

Output Power



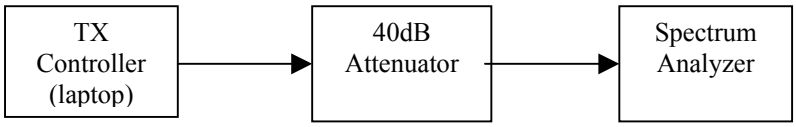
Output Power Level Test setup

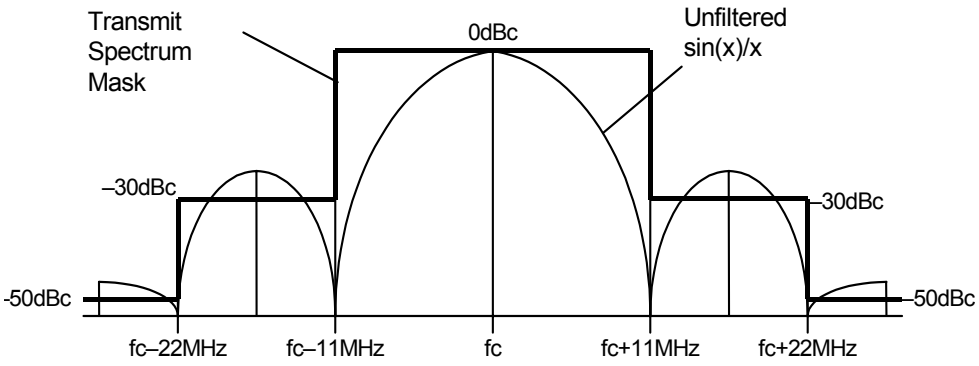
1. Connect the equipment as shown in the Test Setup using low loss coax cables. Make sure that all connections are adequately connected.

2. Ensure that the power meter has recently been zeroed and that the correct calibration constants have been entered.
3. Start the PTU software by double clicking on its icon on the desktop.
4. Select the proper associated driver from the list appearing on the screen. After a short delay, the MAC Address and Baseband Processor type should appear. If you are not sure of the correct driver, click on the PCMCIA icon in the System Tray on the Desktop and note the name displayed.
5. Click on the channel to be tested. Notice that a border appears around the button.
6. Click on the **Continuous Tx** button. Notice that its color turns to red.
7. Observe the Power meter reading. This reading plus 40dB is the Power output level in that particular channel.
8. Repeat 5~7 of above to complete all channels tests.
9. Turn off the Transmitter by clicking on the **Continuous Tx** button. The color should revert back to gray.

Spectrum Mask

1. Connect the equipment as shown in the Test Setup using low loss coax cables. Make sure that all connections are adequately connected.
2. Ensure that the power meter has recently been zeroed and that the correct calibration constants have been entered.
3. Set the Spectrum Analyzer frequency from 2.4GHz to 2.4GHz. Set VB300KHz and 100MHz respectively.
4. Start the PTU software by double clicking on its icon on the desktop.
5. Select the proper associated driver from the list appearing on the screen. After a short delay, the MAC Address and Baseband Processor type should appear. If you are not sure of the correct driver, click on the PCMCIA icon in the System Tray on the Desktop and note the name displayed.
6. Click on the channel to be tested. Notice that a border appears around the button.
7. Click on the **Continuous Tx** button. Notice that its color turns to red.
8. Observe the curve on the Spectrum Analyzer. Set Average. Marker the Maximum point around the center frequency.
9. Move the marker to the first sidelob between 11MHz to 22MHz away from the center frequency. The measured value difference between the markers is the first sidelob rejection.
10. Move marker to second sidelob beyond 22MHz from the center frequency. The measured value difference between the markers in center frequency and the second sidelob is the second sidelob rejection.
11. Repeat 6~10 of above to complete all channels tests.
12. Turn off the Transmitter by clicking on the **Continuous Tx** button. The color should revert back to gray.





Spectrum Mask Test

6. Technical Support

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