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WM-BN-BM-26_A User Manual

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Wireless Product Business Group / Wireless module & Development Division

1 Introduction

This document provides general guidance to OEMs for the integration of WLAN 802.11b/g/n with BT4.1 + HS on the system platform. This document also describes the interfaces between WLAN/BT devices and power circuits for supporting appropriate system reference clock and power supplies from the system point of view. Figure 1 shows the system block diagram of WM-BN-BM-26_A Evaluation Kit.

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2 PCB Layout Guideline

DC power

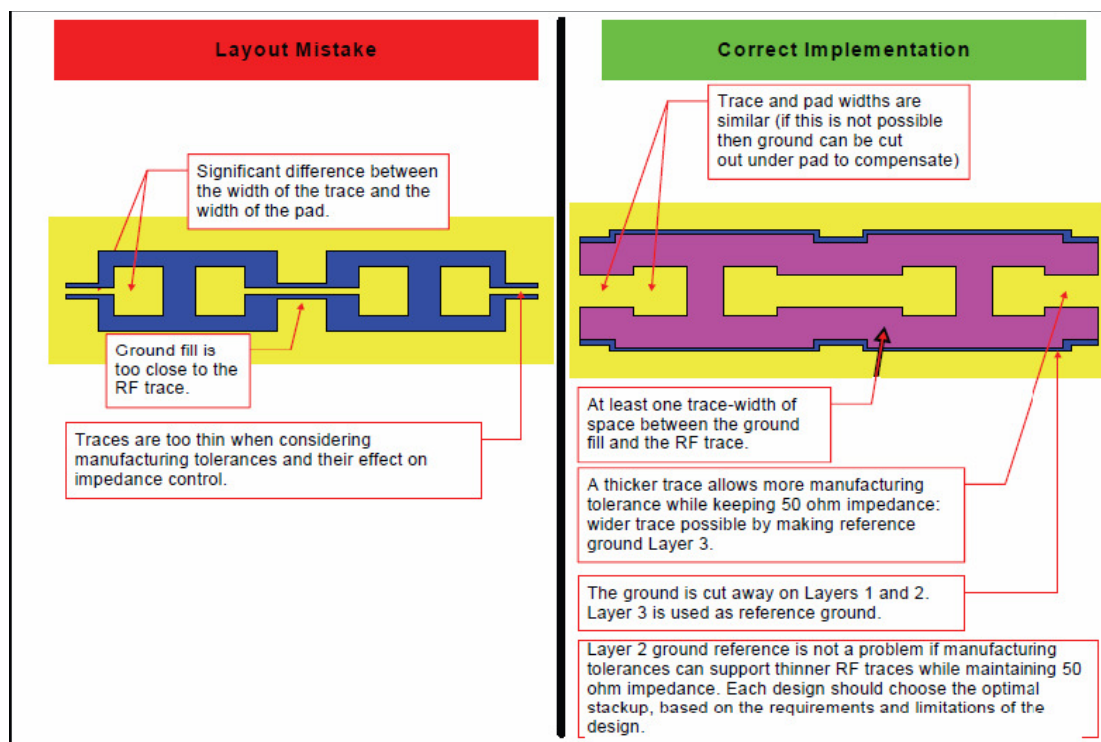
- Use wide traces for power supply lines. Know the maximum currents being carried on each power supply trace, and make the trace widths proportionate to the current (especially for long trace lengths). Where possible, fill large areas with copper to distribute the highest currents. These measures minimize IR drops, line inductance, and switching transients.
 - Use several plated via holes to connect power supply traces between layers. The number of vias used should be proportional to the current being routed.
 - Avoid loops in the supply distribution traces. Current-carrying loops are essentially antennas radiating electromagnetic fields that may corrupt transceiver performance or cause regulatory electromagnetic interference (EMI) test failures
- Capacitor for power line, please close to module pin out
 - Isolate the supplies trace with ground
 - Spread out the LDO supply lines to reduce coupling

RF

General guidelines for routing RF signals of WLAN Antenna port

RF signals require controlled-impedance lines to minimize mismatch losses and efficiently transfer energy from source to load. The line impedance depends upon several variables — trace width and thickness, co-planar ground spacing, height of dielectric material between the trace and ground plane(s), and dielectric constant of the PCB material. Given the PCB material selected, the geometry of the micro-strip, strip-line, or co-planar grounded waveguide (CGW) elements must be designed properly to provide the desired 50-Ω impedance. Design of micro-strip, strip-line, and CGW elements is well documented and supported in many microwave software applications

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Additional RF-specific PCB design guidelines include:

- Keep the RF traces on the component sides (top or bottom layer) using micro-strip or CGW techniques where possible.
- Screen these traces to avoid electromagnetic interference.
- Use internal layers with strip-line techniques if necessary.
- Maintain continuous ground below micro-strip traces, beside CGW traces, and above and below strip-line traces.
- Keep traces short and direct, to minimize loss and undesired coupling.
- Front-end losses increase the system noise figure — keep traces before the first gain stage as short as possible and use low-loss capacitors and inductors.
- Clear internal layer (or layers) of metal. This improves micro-strip, CGW, and strip-line geometries, allowing wider traces.
- Fill the areas along both sides of traces with ground to improve isolation, but provide adequate clearance to minimize co-planar capacitance and leakage. These ground-filled areas are integral to CGW designs.
- Use several ground vias along both sides of the signal traces to connect RF ground-fill areas to the internal RF ground plane.
- Avoid crossing RF traces if possible.
- Ground of RF trace it is better to use it's own ground on top layer.

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Clock

LPO_32K(32.768 KHz) is clock need isolated by ground to avoid noise. Both supply variation and module external clock of signals onto this radio reference must be avoided. The clock signal trace, into the module, must be protected against corruption, by other clocks, power supply transients, and digital noise. These signals must be routed carefully using techniques similar to micro-strip and strip-line to maintain high isolation and signal purity.

Recommended orient the components to keep the clock signal lines from host as short and direct as possible.

Recommended to add more GND vias near the CLK routing to minimize noise coupling from other circuit

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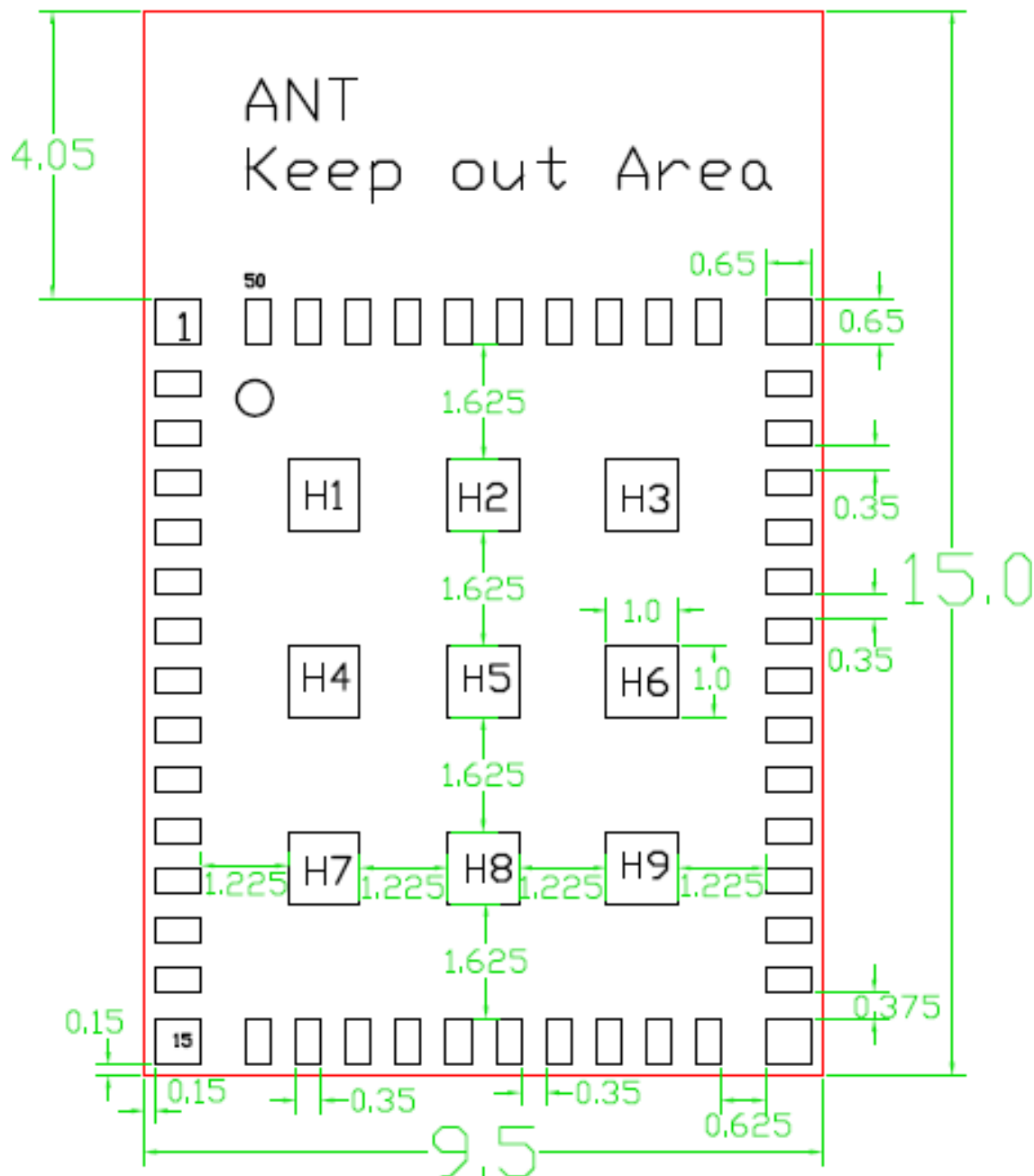
3 Reference Circuit

Note:

1. It's highly recommended that keeping the top layer of the module mounting area as ground plane
2. Avoid routing trace go through the module underneath

Module Interconnection

4 Module Footprint Recommendation



(Top View)

5 Pin Definition Description

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Pin#	Pin Name	Type	Description
RF Port			
3	WLAN_BT_ANT	I/O	WLAN/BT Transmit/Receive Antenna Port
WLAN SDIO Interface (level referred by VDDIO)			
8	WL_SDIO_CLK	I	SDIO Bus clock input
12	WL_SDIO_D0	I/O	SDIO Bus data line 0
10	WL_SDIO_D2	I/O	SDIO Bus data line 2
11	WL_SDIO_CMD	I/O	SDIO Bus command line
14	WL_SDIO_D1	I/O	SDIO Bus data line 1
13	WL_SDIO_D3	I/O	SDIO Bus data line 3
Bluetooth UART Interface (level referred by VDDIO)			
33	BT_UART_CTS_N	I	Bluetooth UART clear-to-send. Active-low clear-to-send signal for the HCI UART interface.
35	BT_UART_RXD	I	Bluetooth UART serial input. Serial data input for the HCI UART Interface.
32	BT_UART_RTS_N	O	Bluetooth UART request-to-send. Active-low request-to-send signal for the HCI UART interface.
34	BT_UART_TXD	O	Bluetooth UART serial output. Serial data output for the HCI UART Interface.
Bluetooth PCM Interface (level referred by VDDIO)			
28	BT_PCM_CLK	I/O	PCM clock can be master (output) or slave (input).
31	BT_PCM_IN	I	PCM data input.
29	BT_PCM_SYNC	I/O	PCM sync signal can be master (output) or slave (input).
30	BT_PCM_OUT	O	PCM data output.
Reference Clock			
25	LPO_IN	I	External sleep clock input (32.768 kHz)
GPIO and Control Signal (level referred by VDDIO)			
17	WL_GPIO_1	I/O	This pin can be programmed by software to be a GPIO
6	WL_GPIO_2	I/O	This pin can be programmed by software to be a GPIO
16	WL_HOST_WAKE (WL_GPIO_0)	I/O	This pin can be programmed by software to be a GPIO or a WLAN_HOST_WAKE output indicating that host

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Pin#	Pin Name	Type	Description
			wake-up should be performed.
38	BT_HOST_WAKE	O	Bluetooth HOST_WAKE
37	BT_DEV_WAKE	I	Bluetooth DEV_WAKE
24	BT_REG_ON	I	Used by PMU to power up or power down the internal BCM43438 regulators used by the BT/FM section. This pin has an internal 200kOhm pull-down resistor that is enabled by default. It can be disabled through programming.
18	WL_REG_ON	I	Used by PMU to power up or power down the internal BCM43438 regulators used by the WLAN section. This pin has an internal 200kOhm pull-down resistor that is enabled by default. It can be disabled through programming.
Power Supplies			
21	VBAT	I	Battery supply input
22	VBAT	I	Battery supply input
19	VDDIO	I	Digital I/O supply input
Ground			
1	GND	-	Ground
2	GND	-	Ground
4	GND	-	Ground
5	GND	-	Ground
7	GND	-	Ground
9	GND	-	Ground
15	GND	-	Ground
20	GND	-	Ground
23	GND	-	Ground
26	GND	-	Ground
27	GND	-	Ground
36	GND	-	Ground
39	GND	-	Ground
40	GND	-	Ground
41~50	GND	-	Ground

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Pin#	Pin Name	Type	Description
H1~H9	GND	-	Ground

Host interface SDIO/gSPI mode selection

6 SDIO/gSPI function

PIN number 8、10、11、12、13 and 14 as SDIO/SPI interface. The WM-BN-BM-26_A WLAN section supports SDIO version 2.0 for both 1-bit(25Mbps) and 4-bit modes (100Mbps), as well as high speed 4-bit mode (25MHz clocks – 200Mbps). It has the ability to map the interrupt signal on a GPIO pin.

Besides, WM-BN-BM-26_A also provide gSPI interface, please see the WLAN GPIO signals and strapping options.

The default setting is SDIO interface and WL_SDIO_D2 needs to pull high.

SDIO Pins Status Description

4 bit mode			
Pin#	Symbol	I/O	Description
8	SDIO_CLK	I	SDIO Input Clock from Host (up to 50 MHz), external loader capacitor is optional
11	SDIO_CMD	I/O	SDIO Command Line, external pull-up resistor needed(10-100K ohm)

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12	SDIO_DATA_0	I/O	SDIO Data line 0, external pull-up resistor needed(10-100K ohm)
14	SDIO_DATA_1	I/O	SDIO Data line 1 or interrupt, external pull-up resistor needed (10-100K ohm)
10	SDIO_DATA_2	I/O	SDIO Data line 2, external pull-up resistor needed(10-100K ohm)
13	SDIO_DATA_3	I/O	SDIO Data line 3, external pull-up resistor needed(10-100K ohm)
1 bit mode			
Pin#	Symbol	I/O	Description
8	SDIO_CLK	I	SDIO Input Clock from Host (up to 50 MHz), external loader capacitor is optional
11	SDIO_CMD	I/O	SDIO Command Line, external pull-up resistor needed(10-100K ohm)
12	SDIO_DATA	I/O	SDIO Data line, external pull-up resistor needed(10-100K ohm)
14	SDIO_IRQ	I/O	IRQ interrupt, external pull-up resistor needed(10-100K ohm)
10	N/C	I/O	Not used
13	N/C	I/O	Not used

SPI Signals Default Status

The SPI interface (slave mode) is multiplexed with SDIO lines, and behaves similarly to the SDIO interface on functionality, register, and addressing level. The below table describes the SPI slave mode pins.

SPI Slave Mode Pins Description

Pin#	Symbol	SPI Type	SPI Mode	Description
8	SDIO_CLK	I	SPI_CLK	SPI Serial Clock, Output from master; can range to 50 MHz
11	SDIO_CMD	I	SPI_DI	Master Output, Slave Input Output from master
12	SDIO_DATA_0	O	SPI_DO	Master Input, Slave Output from slave
14	SDIO_DATA_1	O	SPI_IRQ	SPI Interrupt from WIFI chip to Host
10	SDIO_DATA_2	O	N/C	Not used
13	SDIO_DATA_3	I	SPI_CS	Slave Select Output from master

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7 WLAN Function SW Setup

Follow driver installation procedure steps to install the USI_WM_BN_BM_26_A module driver on your PC (OS: Ubuntu 12.04 / Linux 3.2.0-24).

- 1 Open a Terminal window.
- 2 Make a wifi folder on /home/xxx/Desktop

```
root@xxx:/home/xxx/Desktop# mkdir wifi
```

- 3 copy **dhd**, **dhd.ko**, **sdio-g-mfgtest-seqcmds.bin**, **wl** and **bcm943438wlpth_usi_bm26a.txt** files to /home/xxx/Desktop/wifi folder.

```
root@xxx:/home/xxx/cp dhd /home/xxx/Desktop
root@xxx:/home/xxx/cp dhd.ko /home/xxx/Desktop
root@xxx:/home/xxx/cp sdio-g-mfgtest-seqcmds.bin /home/xxx/Desktop
root@xxx:/home/xxx/cp wl /home/xxx/Desktop
root@xxx:/home/xxx/cp bcm943438wlpth_usi_bm26a.txt /home/xxx/Desktop
```

- 4 Change the wl file to be a executable file.

```
root@xxx:/home/xxx/Desktop/wifi# chmod 777 wl
```

- 5 Power supply to WM-BN-BM-26_A EVB then insert the SDIO interface to the SD slot of PC, and keyin “dmesg” to check the card detect status.

```
root@xxx:/home/xxx/Desktop/wifi# dmesg
```

if the card detect successful, it will show below message.

```
[ 451.631779] mmc0: queuing unknown CIS tuple 0x80 (3 bytes)
[ 451.634078] mmc0: queuing unknown CIS tuple 0x80 (3 bytes)
[ 451.638264] mmc0: queuing unknown CIS tuple 0x80 (7 bytes)
[ 451.644839] mmc0: queuing unknown CIS tuple 0x80 (11 bytes)
[ 451.781131] mmc0: new high speed SDIO card at address 0001
```

if no above message display, please check the EVB or PC SD slot status.

- 6 Please execute the below command to bring-up WiFi function,

```
root@xxx:/home/xxx/Desktop/wifi# insmod dhd.ko "firmware_path=sdio-g-mfgtest-
```

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```
seqcmds.bin nvram_path=bcm943438wlpth_usi_bm26a.txt"
```

7 If bring-up WiFi successful, you will see the below message by dmesg cmd,

```
[ 459.514234] dhd_module_init in
[ 459.514241] no wifi platform data, skip
[ 459.514234] dhd_module_init in
[ 459.514241] no wifi platform data, skip
[ 459.515120] F1 signature read @0x18000000=0x1541a9a6
[ 459.518891] F1 signature OK, socitype:0x1 chip:0xa9a6 rev:0x1 pkg:0x4
[ 459.520388] DHD: dongle ram size is set to 524288(orig 524288) at 0x0
[ 459.520677] dhd_attach(): thread:dhd_watchdog_thread:8d2 started
[ 459.520743] dhd_attach(): thread:dhd_dpc:8d3 started
[ 459.520748] dhd_deferred_work_init: work queue initialized
[ 459.590966] dhdsdio_write_vars: Download, Upload and compare of NVRAM succeeded.
[ 459.642979] dhd_bus_init: enable 0x06, ready 0x06 (waited 0us)
[ 459.650556] dhd_wlfc_init(): successfully enabled bdcv2 tlv signaling, 79
[ 459.651148] dhd_wlfc_init(): wlfc_mode=0x0, ret=-23
[ 459.651152] Dongle Host Driver, version 1.201.34 (r491657)
[ 459.651154] Compiled in /usr/src/4356/open-src/src on Dec 2 2014 at 05:55:13
[ 459.651652] Register interface [eth1] MAC: 44:39:c4:11:cc:eb
```

8 Use WL tool to check the wifi function if works.

```
root@xxx:/home/xxx/Desktop/wifi# ./wl ver
7.45 RC46.0
wl0: May 28 2015 00:59:58 version 7.45.46 (r559555 WLTEST) FWID 01-b3cad1aa
```

9 Once you see logs like as 8.8, then you can start to do WiFi function test by Tx/Rx command.

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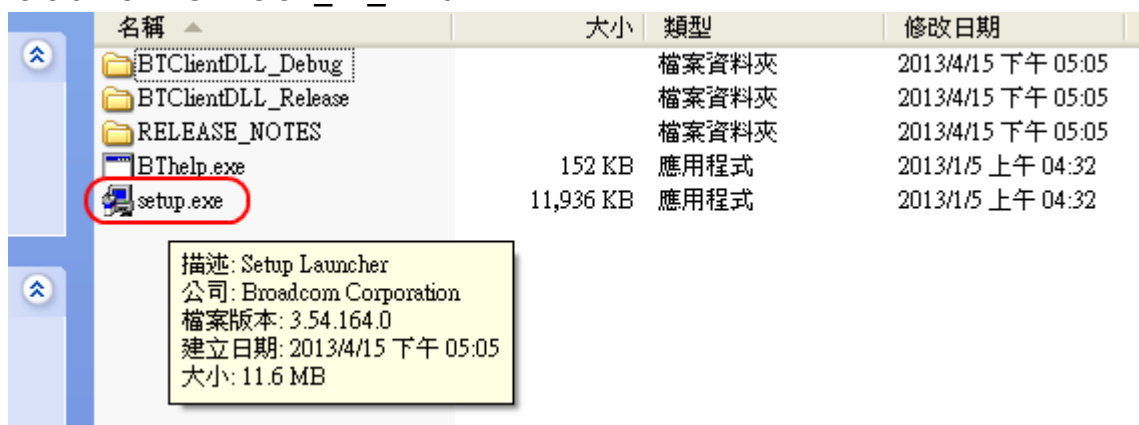
8 BT Function SW Setup

Follow driver installation procedure steps to install the USI_WM_BN_BM_26_A module driver on your PC (OS: XP).

- 1 Please install ActivePerl software into your PC,
the version is ActivePerl-5.8.4.810-MSWin32-x86.msi



- 2 Please install BRCM MyBluetool into your PC,
the version is BLUETOOL_MI_1.7.0.2



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3 Please place 4 files on the same folder, those file as below, HCICommander.exe
BCM4343A1_001.002.009.0033.0084_ORC_USI_WM-BN-BM-26_A_CL2.hcd

1_Download_firmware.bat.

2_Enable_DUT.bat

4 It is use UART interface to enable BlueTouth function, so we use a use-to serial
RS-232 cable to download BT firmware on WM-BN-BM-26_A EVB.

5 Please execute 1_Download_firmware.bat file to download firmware.

```

15:42:16.484 GetHCIEvent() read 6 bytes. [e:4:1:4c:fc:0:0:0]
15:42:16.484 HCIUSWriteRAM wrote 5 bytes
15:42:16.484 Calling SendHCICCommand(4c:fc:05:46:65:0d:00)
15:42:16.484 BTTransport_t::SendHCICCommand wrote 9 bytes
15:42:16.484 GetHCIEvent() read 6 bytes. [e:4:1:4c:fc:0:0:0]
15:42:16.484 HCIUSWriteRAM wrote 5 bytes
15:42:16.484 Calling SendHCICCommand(4c:fc:06:44:65:0d:00)
15:42:16.484 BTTransport_t::SendHCICCommand wrote 10 bytes
15:42:16.484 GetHCIEvent() read 6 bytes. [e:4:1:4c:fc:0:0:0]
15:42:16.484 HCIUSWriteRAM wrote 6 bytes
15:42:16.484 Calling SendHCICCommand(4c:fc:ff:a4:63:0d:00)
15:42:16.500 BTTransport_t::SendHCICCommand wrote 259 bytes
15:42:16.515 GetHCIEvent() read 6 bytes. [e:4:1:4c:fc:0:0:0]
15:42:16.515 HCIUSWriteRAM wrote 255 bytes
15:42:16.515 Calling SendHCICCommand(4c:fc:a9:9f:64:0d:00)
15:42:16.515 BTTransport_t::SendHCICCommand wrote 173 bytes
15:42:16.531 GetHCIEvent() read 6 bytes. [e:4:1:4c:fc:0:0:0]
15:42:16.531 HCIUSWriteRAM wrote 169 bytes
15:42:16.531 Calling SendHCICCommand(4c:fc:05:a0:63:0d:00)
15:42:16.531 BTTransport_t::SendHCICCommand wrote 9 bytes
15:42:16.531 GetHCIEvent() read 6 bytes. [e:4:1:4c:fc:0:0:0]
15:42:16.531 HCIUSWriteRAM wrote 5 bytes
15:42:16.531 Calling SendHCICCommand(4c:fc:05:9f:63:0d:00)
15:42:16.531 BTTransport_t::SendHCICCommand wrote 9 bytes
15:42:16.531 GetHCIEvent() read 6 bytes. [e:4:1:4c:fc:0:0:0]
15:42:16.531 HCIUSWriteRAM wrote 5 bytes
15:42:16.531 Calling SendHCICCommand(4c:fc:07:9c:63:0d:00)
15:42:16.531 BTTransport_t::SendHCICCommand wrote 11 bytes
15:42:16.531 GetHCIEvent() read 6 bytes. [e:4:1:4c:fc:0:0:0]
15:42:16.531 HCIUSWriteRAM wrote 7 bytes
15:42:16.531 HCI_WRITE_RAM commands done
15:42:16.531 Sending HCI_LAUNCH_RAM command
15:42:16.531 BTTransport_t::SendHCICCommand wrote 8 bytes
15:42:16.531 GetHCIEvent() read 6 bytes. [e:4:1:4c:fc:0:0:0]
15:42:16.531 BRCM2045CFG2RAMmain() END, config data downloaded successfully
15:42:16.734 sent HCI_RESET #1
15:42:16.734 GetHCIEvent() read 6 bytes. [e:4:1:3:c:0:0:0]
15:42:16.734 read back HCI_RESET command complete event
15:42:16.734 OK response from HCI_RESETS, returning
15:42:16.734 << Download patch RAM successful >>

D:\JSI-Module-Spec\BroadCom Series\WM_BN_BM_26_A\03_SWDesign_Package\06_WiFi_BT
TestMode_Tool_Win\bcm43438bt>

```

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6 Please execute 2_Enable_DUT.bat file to set BT enter DUT mode.

```

>>
15:43:57.578
15:43:57.578      Broadcom PC HCICommander Utility v1.5, All right reserved.
15:43:57.578      < Used for HTC only >.
15:43:57.578 <=====
15:43:57.578 <<
15:43:57.687 ParseInputParams: HCICommander.exe com3 enble_dut.hci
15:43:57.687 BRCMHCICommander will send HCI commands
15:43:57.687 Exe path:D:\USI-Module-Spec\BroadCom Series\WM_BN_BM_26_A\03_SWDes
15:43:57.687 ign_Package\06_WiFi_BT_TestMode_Tool_Win\bcm43438bt\
15:43:57.734 Open: com3 OK!
15:43:57.734 SetCommState OK
15:43:57.734 SetCommTimeouts OK
15:43:57.734 Extra sleep 500 ms for PC COM to be ready...
15:43:57.734 Sleep <0.500 sec> .....

15:43:58.250 Load input script file: D:\USI-Module-Spec\BroadCom Series\WM_BN_B
15:43:58.250 M_26_A\03_SWDesign_Package\06_WiFi_BT_TestMode_Tool_Win\bcm43438bt\enble_dut.hci

15:43:58.250 No output log file
15:43:58.250 [>]01 05 0c 03 02 00 02
15:43:58.250 Write[7]: show first 5 bytes:0x1, 0x5, 0xc, 0x3, 0x2
15:43:58.250 Written: OK
15:43:58.250 Expected read data length:0x4
15:43:58.250 GetHCIEvent() read 3 bytes. [e:4:1:0:0:0:0]
15:43:58.250 Read 4 bytes back, show first 5 bytes:0x4, 0xe, 0x4, 0x1, 0x0
15:43:58.250 [>]01 1a 0c 01 03
15:43:58.250 Write[5]: show first 5 bytes:0x1, 0x1a, 0xc, 0x1, 0x3
15:43:58.250 Written: OK
15:43:58.250 Expected read data length:0x4
15:43:58.250 GetHCIEvent() read 3 bytes. [c:0:4:0:0:0:0]
15:43:58.250 Read 4 bytes back, show first 5 bytes:0x4, 0xc, 0x0, 0x4, 0x0
15:43:58.250 [>]01 03 18 00
15:43:58.250 Write[4]: show first 5 bytes:0x1, 0x3, 0x18, 0x0, 0x0
15:43:58.250 Written: OK
15:43:58.250 Expected read data length:0x4
15:43:58.250 GetHCIEvent() read 3 bytes. [4:1:1a:0:0:0:0]
15:43:58.250 Read 4 bytes back, show first 5 bytes:0x4, 0x4, 0x1, 0x1a, 0x0
15:43:58.250
15:43:58.250 << Sending HCI commands successfully >>

D:\USI-Module-Spec\BroadCom Series\WM_BN_BM_26_A\03_SWDesign_Package\06_WiFi_BT_
TestMode_Tool_Win\bcm43438bt>

```

7 If successful, you can use Anritsu MT8852 or R&S CBT to do BT RF performance test.

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Class B: (Section 15.105)

FEDERAL COMMUNICATIONS 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 or more 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.

(Section 15.21)

CAUTION:

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

(Section 15.19)(a)(3)

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.

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RF Exposure Information (SAR)

This device meets the government's requirements for exposure to radio waves. This device is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the U.S. Government.

The exposure standard employs a unit of measurement known as the Specific Absorption Rate, or SAR. The SAR limit set by the FCC is 1.6 W/kg. Tests for SAR are conducted using standard operating positions accepted by the FCC with the EUT transmitting at the specified power level in different channels.

The highest SAR value for the device as reported to the FCC is **0.4 W/kg** when placed next to the body.

End Product Labeling

The final end product must be labeled in a visible area with the following: "Contains FCC ID: 2AAD3JA0D0J0"

Information for the OEMs and Integrators

The following statement must be included with all versions of this document supplied to an OEM or integrator, but should not be distributed to the end user.

- 1) This device is intended for OEM integrators only.
- 2) Please see the full Grant of Equipment document for other restrictions.

To ensure RF exposure compliance the antenna(s) used with 802.11b/g/n+BT 4.1 Module must be provide a minimum separation distance of 5mm from all persons, in all operating modes and orientations of the host platform,
The antenna separation distance applies to both horizontal and vertical orientation of the antenna when installed in the host system.