

SWB-A52H Manual

Atheros AR6003X WLAN Solution

Samsung Electro-Mechanics

Summary

This manual presents the general information and user guide of SWB-A52H IEEE 802.11a/b/g/n Wireless LAN.

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1 General Description

1.1 Functional Description

SWB-A52H is the RF module that integrates Wireless LAN (WLAN). This embedded module is optimized for WLAN enabled handheld mobile devices.

1.2 Features

- IEEE Std 802.11a/b/g, 802.11n(1x1), HT=20/40 (HT=40, 5GHz ONLY)
- WiFi direct support for 2.4GHz only
- Includes all the baseband and radio functionality, from host interface up to antenna, needs only external antenna
- Small dimensions (9.0 x 9.5 x 1.2 mm) with an LGA – 64pin peripheral footprint
- Cellular coexistence supported
- Host interfaces: SDIO, GSPI for WLAN.
- RoHS compliant
- MSL3

1.2.1 Radio Transceiver

- Frequency of Operation: 2412 – 2472 MHz,
5180 – 5320 MHz, 5500 – 5700 MHz, 5745 – 5825 MHz
- Fully compliant with IEEE 802.11a/b/g, 802.11n 1x1
- Receiver sensitivity (< 8% PER) at 11 Mbit/sec data rate: -90dBm
- Receiver sensitivity (< 10% PER) at 54 Mbit/sec data rate: -75dBm @ 11g
- Receiver sensitivity (< 10% PER) at 54 Mbit/sec data rate: -74 dBm @ 11a
- Receiver sensitivity (< 10% PER) at HT20, MCS7, 2.4GHz : -72dBm
- Receiver sensitivity (< 10% PER) at HT20, MCS7, 5GHz : -71 dBm
- Blocking filter for suppression of CDMA, GSM, PCS and WCDMA interfering signals
- Transmitter output power in 802.11b mode at 1~11Mbps: 13dBm
- Transmitter output power in 802.11g mode at 6~54Mbps: 13dBm
- Transmitter output power in 802.11a mode at 6~54Mbps: 13dBm
- Transmitter output power in 802.11n mode at HT20, 2.4GHz, MCS0~MCS7: 13dBm
- Transmitter output power in 802.11n mode at HT20, 5GHz, MCS0~MCS6: 13dBm
- Transmitter output power in 802.11n mode at HT40, 5GHz, MCS0~MCS5/MCS6: 13dBm/12dBm

1.2.2 Applications

- Smart phone/feature phones with embedded WLAN connectivity

- Tablet PC with embedded WLAN connectivity
- Personal digital assistants (PDA)
- SDIO WLAN Network Interface Cards (NIC)
- Voice over IP (VoIP) cordless phones
- Mobile gaming devices
- Portable media players (PMP) including networked MP3 player
- Networked digital camera and photo frames
- Digital media adapter and receiver
- Networked TV, set-top box, DVD recorder, personal video recorder (PVR), media drive, and other consumer electronics appliances

2 Electrical Characteristics

2.1 DC Characteristics

2.1.1 Absolute Maximum Ratings

Symbol(Domain)	Parameter	Max Rating	Unit
WLAN			
VREG	Digital 1.8V supply	-0.3 to 2.5	V
AVDD18	Analog 1.8V supply	-0.3 to 2.5	V
DVDD_SDIO	SDIO I/O supply	-0.3 to 4.0	V
DVDD_SOC1	GPIO I/O supply	-0.3 to 4.0	V
DVDD_SOC2	GPIO I/O supply	-0.3 to 4.0	V
VDD33	3.3V supply	-0.3 to 4.0	V
VBATT	External PA supply	-0.3 to 4.8	V
PAREG_BASE	PAREG input	-0.3 to 4.0	V

2.1.2 Recommended Operating Conditions

Symbol(Domain)	Parameter	Min.	Nom	Max	Unit
WLAN					
VREG	Digital 1.8V supply	1.71	1.8	1.89	V
AVDD18	Analog 1.8V supply	1.71	1.8	1.89	V
DVDD_SDIO	SDIO I/O supply	1.71		3.46	V
DVDD_SOC1	GPIO0 I/O supply	1.71		3.46	V
DVDD_SOC2	GPIO1 I/O supply	1.71		3.46	V
VDD33	3.3V supply	3.14	3.3	3.46	V
VBATT	External PA supply	3.14	3.3	4.2	V
PAREG_BASE	PAREG input	3.14	3.3	3.46	V

3 RF Specifications

All measurements are made under nominal supply voltage and room temperature conditions.

3.1 Receiver RF Specifications for 2.4GHz

Parameter	Conditions	Min.	Nom.	Max.	Unit
Minimum receiver sensitivity in 802.11b mode					
1Mbps	PER<8%, Packet size= 1024bytes			-80	dBm
2Mbps				-80*	dBm
5.5Mbps				-76	dBm
11Mbps			-90	-76*	dBm
Minimum receiver sensitivity in 802.11g mode					
6Mbps	PER<10%, Packet size= 1000bytes			-82*	dBm
9Mbps				-81*	dBm
12Mbps				-79*	dBm
18Mbps				-77*	dBm
24Mbps				-74*	dBm
36Mbps				-70*	dBm
48Mbps				-66*	dBm
54Mbps			-75	-65*	dBm
Minimum receiver sensitivity in 802.11n mode					
HT20, MCS7, 1stream, 1Tx, 1Rx	PER<10%		-72	-64*	dBm
Maximum input signal level					
802.11b mode	PER<8%	-10*			dBm
802.11g mode	PER<10%	-20*			dBm
802.11n mode	PER<10%	-20*			dBm

"*" indicates IEEE 802.11 standard specifications

3.2 Receiver RF Specifications for 5GHz

Parameter	Conditions	Min.	Nom.	Max.	Unit
Minimum receiver sensitivity in 802.11a mode					
6Mbps	PER<10%, Packet size= 1000bytes			-82*	dBm
9Mbps				-81*	dBm
12Mbps				-79*	dBm
18Mbps				-77*	dBm
24Mbps				-74*	dBm
36Mbps				-70*	dBm
48Mbps				-66*	dBm
54Mbps			-74		-65*
Minimum receiver sensitivity in 802.11n mode					
HT20, MCS7, 1stream, 1Tx, 1Rx	PER<10%		-71	-64*	dBm
Maximum input signal level					
802.11a mode	PER<10%	-30*			dBm
802.11n mode	PER<10%	-30*			dBm

"*" indicates IEEE 802.11 standard specifications

3.3 Transmitter RF Specifications for 2.4GHz

Parameter	Conditions	Min.	Nom.	Max.	Unit
Linear output power in 802.11b mode					
Output power@1~11Mbps	As specified in IEEE802.11	10	13	15	dBm
Linear output power in 802.11g mode					
Output power@6~36Mbps	As specified in IEEE802.11	10	13	15	dBm
Output power@48Mbps		10	13	15	dBm
Output power@54Mbps		10	13	15	dBm
Linear output power in 802.11n mode					
Output power@HT20,MCS0 ~ MCS7		10	13	15	dBm
Transmit spectrum mask					
Margin to 802.11b spectrum mask	Maximum output power	0			dBr
Margin to 802.11g spectrum mask		0			dBr
Margin to 802.11n spectrum mask		0			dBr
Transmit modulation accuracy in 802.11b mode					
1Mbps	As specified in IEEE802.11b	-		35	%
2Mbps		-		35	%
5.5Mbps		-		35	%
11Mbps		-		35	%
Transmit modulation accuracy in 802.11g mode					
6Mbps	Mandatory	-		-5	dB
9Mbps	Option	-		-8	dB
12Mbps	Mandatory	-		-10	dB
18Mbps	Option	-		-13	dB
24Mbps	Mandatory	-		-16	dB
36Mbps	Option	-		-19	dB
48Mbps	Option	-		-22	dB
54Mbps	Option	-	-29	-25	dB
Transmit modulation accuracy in 802.11n mode					
HT20, MCS0~MCS6					dB
HT20,MCS7			-31*	-28	dB
Transmit power-on and power-down ramp time in 802.11b mode					
Transmit power-on ramp time from 10% to 90% output power				2	usec
Transmit power-down ramp time from 90% to 10% output power				2	usec

* The method of full-packet estimation is applied.

3.4 Transmitter RF Specifications for 5GHz

Parameter	Conditions	Min.	Nom.	Max.	Unit
Linear output power in 802.11a mode					
Output power@6~36Mbps	As specified in IEEE802.11	10	13	16	dBm
Output power@48Mbps		10	13	16	dBm
Output power@54Mbps		10	13	16	dBm
Linear output power in 802.11n mode					
Output power@HT20,MCS0 ~ MCS6		10	13	16	dBm
Output power@HT20,MCS7*		7	10	13	dBm
Output power@HT40,MCS0 ~ MCS5		10	13	16	dBm
Output power@HT40,MCS6		9	12	15	dBm
Output power@HT40,MCS7*		6	9	12	dBm
Transmit spectrum mask					
Margin to 802.11a spectrum mask	Maximum output power	0			dBr
Margin to 802.11n spectrum mask		0			dBr
Transmit modulation accuracy in 802.11a mode					
6Mbps	Mandatory	-		-5	dB
9Mbps	Option	-		-8	dB
12Mbps	Mandatory	-		-10	dB
18Mbps	Option	-		-13	dB
24Mbps	Mandatory	-		-16	dB
36Mbps	Option	-		-19	dB
48Mbps	Option	-		-22	dB
54Mbps	Option	-	-29	-25	dB
Transmit modulation accuracy in 802.11n mode					
HT20,MCS0~MCS5					dB
HT20,MCS6			-29	-25	dB

<Notice> By enabling Full packet Estimation and changing Bias setting, AR6003X & SWB-A51H can pass -28dB EVM target on MCS7. (The detailed information is furnished by QCA.)

4 Additional Information

4.1 Host Interface Configurations

4.1.1 WLAN Mode setting

HMODE0	Configuration
High (DVDD_SOC2)	SDIO Mode
GND	GSPI Mode

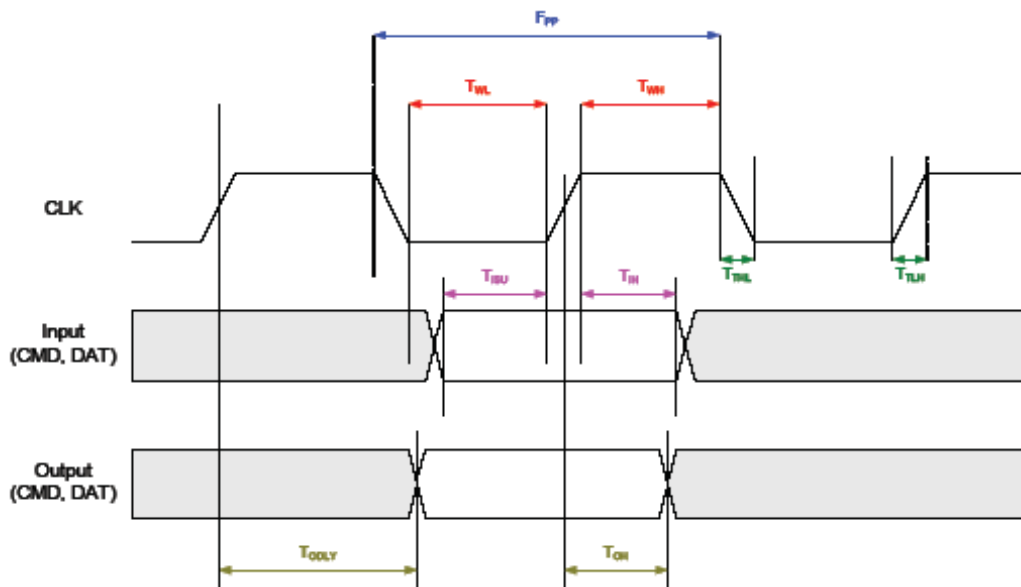


Figure 4-1 SDIO 2.0 timing

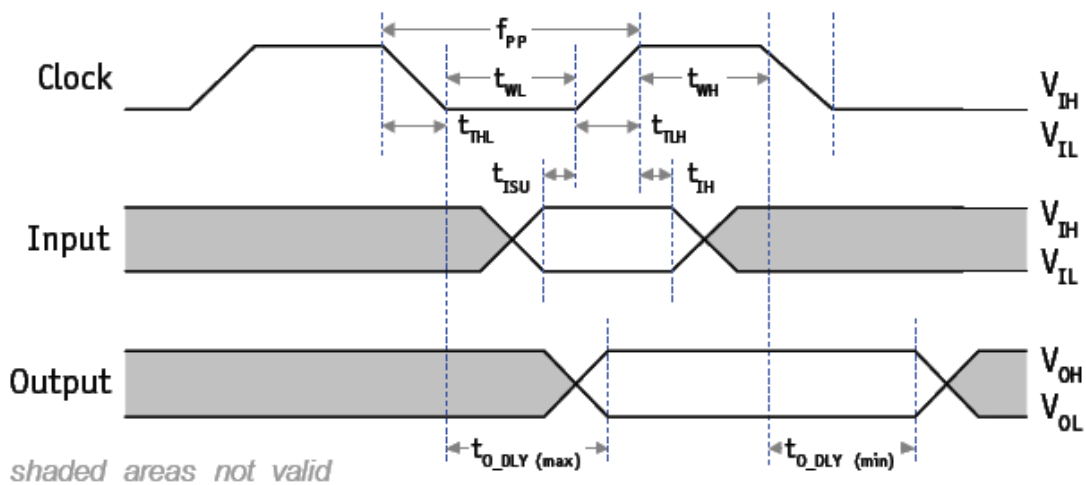


Figure 4-2 GSPI timing

SDIO Timing Constraints

Parameter	Description	Min.	Max.	Unit	Note
f_{PP}	Clock frequency data transfer mode	0	50	MHz	$40\text{pF} \geq C_L$
t_{WL}	Clock low time	7	-	ns	$40\text{pF} \geq C_L$
t_{WH}	Clock high time	7	-	ns	$40\text{pF} \geq C_L$
t_{TLH}	Clock rise time	-	10	ns	$40\text{pF} \geq C_L$
t_{THL}	Clock fall time	-	10	ns	$40\text{pF} \geq C_L$
t_{ISU}	Input setup time	6	-	ns	$40\text{pF} \geq C_L$
t_{IH}	Input hold time	2	-	ns	$40\text{pF} \geq C_L$
t_{OH}	Output hold time	2.5	-	ns	$40\text{pF} \geq C_L$
$t_{O_DLY}(\text{min})$	Output delay time during data transfer mode	0	14	ns	$40\text{pF} \geq C_L$

GSPI Timing Constraints

Parameter	Description	Min.	Max.	Unit	Note
f_{PP}	Clock frequency	0	48	MHz	
t_{WL}	Clock low time	8.3	-	ns	
t_{WH}	Clock high time	8.3	-	ns	
t_{TLH}	Clock rise time	-	2	ns	
t_{THL}	Clock fall time	-	2	ns	
t_{ISU}	Input setup time	5	-	ns	
t_{IH}	Input hold time	5	-	ns	
t_{O_DLY}	Output delay	0	5	ns	

4.2 Reference and Sleep Clock

4.2.1 Optional External 32KHz Input Clock

The 32KHz clock is used in low-power modes such as IEEE power-save and sleep.

The SWB-A51H does not require an external 32KHz clock. By default, the SWB-A51H will utilize its internal 32KHz clock. If the end application has a more accurate 32KHz clock, then it can be supplied externally via the WIFI_CLK_32K pin. The WIFI_CLK_32K input clock timing and voltage requirements are shown below.

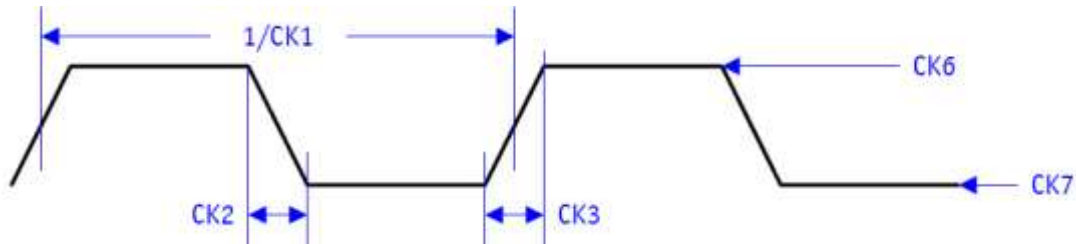


Figure 4-5 WIFI_CLK_32K pin Input clock timing

Symbol	Description	Min.	Nom.	Max.	Unit
CK1	Frequency	-	32.768	-	kHz
CK2	Fall Time	1	-	100	ns
CK3	Rise Time	1	-	100	ns
CK4	Duty Cycle (High-to-Low Ratio)	15	-	85	%
CK5	Frequency Stability	-50	-	50	ppm
CK6	Input High Voltage				V
CK7	Input Low Voltage				V

4.2.2 Reference Clock for WLAN

WIFI_XTALI and WIFI_XTALO are the pins used for the reference clock. The reference clock is the primary clock source for the SWB-A51H. SWB-A51H supports 26MHz by default frequency.

and it can support 19.2/24/26/38.4/40/52MHz reference clock.

Reference clock source may come from either an external crystal or oscillator/TCXO source.

Three hardware solutions are used for the reference clock

- External crystal option

<Note> SEMCO recommend the below Crystal (CL=15PF) or equivalent

ITTI : 14340159-26.000MHz

SEMCO : SQ3D02600Y2JBA, SQBD02600Y2QCG, SQ2D02600Y2JCG,

HOSONIC : E1AB26.0000F15G11

NDK : EXS00A-CS04255 (NX2520_26MHz)

HARMONY : X3S026000BF1S

KDS : ZK05956

- External reference clock option (i.e. XO, VCXO, or VCTCXO)
- Host reference drive option

External Crystal Requirements

Parameter	Min.	Nom.	Max.	Unit
Frequency	-	26	-	MHz
Frequency Stability	-20	-	20	ppm
Effective series resistance (ESR)		-	100	Ohm
Capacitance (CL)				pF

The external reference clock option or host reference drive option voltage requirements are shown below.

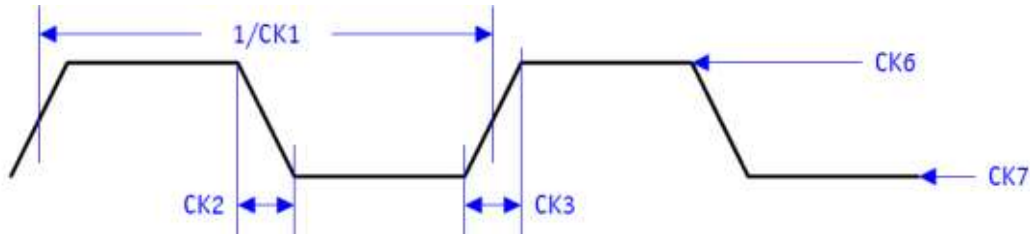


Figure 4-6 External reference clock option or Host reference drive option

Symbol	Description	Min.	Nom.	Max.	Unit
CK2	Fall Time	-	-	0.1*Period	ns
CK3	Rise Time	-	-	0.1*Period	ns
CK4	Duty Cycle (High-to-Low Ratio)	40	-	60	%
CK5	Frequency Stability	-20	-	20	ppm
CK6	Input High Voltage	0.75		3.46	V
CK7	Input Low Voltage				V

When using a TCXO, the clock signal is input at the WIFI_XTALO pin and must be AC-coupled using a 10nF capacitor. The WIFI_XTALI pin must be tied to GND when using a TCXO

FCC Notice

- Host device of the approved module shall be marked with the following item:

Contains Transmitter Module FCC ID: E2XSWB-A52H or **Contains FCC ID: E2XSWB-A52H**

5.15- 5.25 GHz band is restricted to indoor operations only.

Compliance with FCC requirement 15.407(c)

Data transmission is always initiated by software, which is then passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinues transmission in case of either absence of information to transmit or operational failure.

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

- **Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

When installing it in a mobile equipment

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. This equipment has very low levels of RF energy that it is deemed to comply without

maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated keeping the radiator at least 20cm or more away from person's body (excluding extremities: hands, wrists, feet and ankles).