



AMW004 Data Sheet

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Contact

Email: info@ack.me

Web: <http://ack.me>
<http://ackmenetworks.com>

About this Data Sheet

This document provides information on the AMW004 802.11b/g/n WICED module from ACKme Networks. Specifications for the module I/O and peripherals are taken from the [SAM4S Series](#) data sheet from Atmel Corporation. Specifications for the WLAN subsystem were compiled from measured data unless otherwise noted.

Organization

This data sheet is organized into the following sections:

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AMW004 Data Sheet

2.4GHz IEEE 802.11b/g/n WICED™ Module

Features

- Self-contained low-power Wi-Fi networking module with onboard microcontroller and antenna.
- Integrated SPI-serial flash for software upgrades
- Works seamlessly with Broadcom WICED Development System.

Wi-Fi

- Broadcom BCM43362 single band 2.4GHz IEEE 802.11b/g/n 1x1 Wi-Fi transceiver
- Includes support for all Wi-Fi security modes including Open, WEP, WPA, and WPA2-PSK

Microprocessor

- Atmel AT91SAM4S16C ARM 32-bit Cortex™-M4 CPU, with a 2kB cache at up to 120MHz.
- Integrated 1MB Flash memory and 128kB SRAM
- Clock, reset & supply management including 32kHz RTC, high-precision 8/12MHz RC oscillator, PoR, brownout detector and watchdog
- Up to 22 Peripheral DMA controller channels
- Ultra Low Power sleep, wait and backup modes
- 128-bit unique ID

Interfaces*

- A/D converters: 10 channel input, 12-bit resolution, 1Msps with gain control and auto calibration
- D/A converter: 1 channel x 12-bit, 1Msps
- UART: 2 x 4-wire, 2 x 2-wire up to 7.5Mbit/s
- SPI: 1 x SPI master/slave up to 120Mbit/s
- I²C: 2 x I²C interfaces (SMBus/PMBus)
- I²S: 1 x I²S / Synchronous Serial Controller
- GPIO: Up to 29 GPIOs (overlaid with peripherals)
- USB: 1 x USB2.0 full-speed device controller with dedicated DMA, on-chip full-speed PHY
- Timers: 2 x 3-Channel 16-bit Timer/Counter with IC/OC/PWM capability, quadrature decoder logic and additional 4-Channel 16-bit PWM
- Wake-up : 12 External wake inputs and RTC/RTT wake for ultra-low power operation
- External Wi-Fi antenna option
- JTAG/SWD debug interface

**Some interfaces share module pins*

Operational & Radio

- Single operating voltage : 3.3V (typical)
- Operational Temperature Range: -30°C to +85°C
- Size : 1.25" x 0.70" x 0.11" (31.8 x 17.8 x 2.7mm)
- Weight : 0.07oz (2g)
- Current consumption @ 25°C
 - Backup : 1.85µA, <300µs wakeup
 - Wait : 28µA, <100µs wakeup, RAM retention
 - Wi-Fi Powersave : 0.77mA
 - Active receive : 6.9mA @ 1Mbit/s
 - Active transmit : 12.5mA @ 1Mbit/s
- Maximum RF transmit power
 - 802.11b/g : +18.5 dBm
 - 802.11n : +13.5 dBm
- Minimum Receive sensitivity
 - 802.11b/g : -94 dBm
 - 802.11n : -86 dBm
- Sustained TCP throughput : >20Mbit/s

Applications

- Industrial, M2M and Home Automation
 - Environmental monitoring
 - Energy monitoring
 - Wireless sensing, remote data logging
 - HVAC, power, light, & thermostat control
 - Appliance control
- Security
 - Cameras, Doors/Window monitoring
 - Alarms, Smoke Detectors
 - Door and entry control
- Health & Fitness
 - Fitness Equipment
 - Home health monitoring eg. weight scales
- Consumer
 - Audio, Toys, Robots

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1 General Description

The AMW004 module from ACKme Networks combines a SAM4S microcontroller with a BCM43362 Wi-Fi device and on-board antenna to provide an advanced stand-alone Wi-Fi and networking solution.

An integrated module avoids difficult RF layout and enables designers to rapidly embed Wi-Fi and secure networking functionality into virtually any device.

Custom applications may be developed for the module using the Broadcom WICED Software Development Kit. Alternately, the ACKme Networks WiConnect serial-to-Wi-Fi application may be used to fast-track module integration into end products.

With dimensions of just 0.7 x 1.25 inches and a wide temperature range, the module is suitable for integration into most embedded applications.

The Wi-Fi device from Broadcom includes an integrated RF transmit power amplifier and provides superior Wi-Fi performance and full compatibility with all 2.4GHz 802.11b/g/n Wi-Fi networks. An external antenna option provides additional performance and flexibility if required.

The SAM4S microprocessor from Atmel is based on a high-performance ARM® Cortex™-M4 32-bit RISC core operating at a frequency up to 120MHz. The SAM4S incorporates high-speed embedded memory including 1MB Flash memory and 128kB SRAM, and an extensive range of enhanced I/Os and peripherals.

The AMW004 module connects a large number of SAM4S pins to capitalize on the extensive SAM4S I/O and peripheral interfaces. The module supports the following list of interfaces, and provides additional interface combinations by leveraging SAM4S I/O multiplexing and alternate function capabilities.

- 10 x 12-bit A/D converters
- 1 x 12-bit D/A converters
- 1 x 4-Wire USART interface
- 1 x 4-Wire, 2 x 2-Wire UART interfaces
- 1 x SPI master/slave bus
- 2 x I2C interfaces
- 1 x I2S interface
- 1 x USB full-speed device interface
- 12 x edge/level sensitive wake inputs

The module may be powered by a single 3.3V power supply. A separate power supply pin for the Wi-Fi subsystem is provided to minimize power supply noise coupling into the WLAN subsystem, and to enable additional control for power sensitive applications.

Power consumption in various states is determined by the power consumption of the SAM4S microprocessor and BCM43362 Wi-Fi chip. The power supply to the Wi-Fi chip and radio subsystem may be externally knife-switched under software control to achieve minimum power consumption in an ultra-low power backup state described in the SAM4S datasheet.

The microprocessor may be woken from low power states by connecting any of 12 different module pins, or by other methods including an internal RTC/RTT timer or supply monitor as described in the SAM4S datasheet.

The module incorporates a 32.768kHz crystal to maintain an accurate real time clock. A 32kHz clock output is available on a dedicated module pin in both active and SAM4S powerdown modes. The 32kHz clock output may be used to drive the clock input of other system devices. This avoids the need for an additional crystal thereby minimizing total system cost.

Application debugging with a software debugger such as gdb is enabled with a standard JTAG (or Serial Wire Debug) interface.

The module has FCC modular approval for use in the United States, and CE approval for use in Europe and other countries.

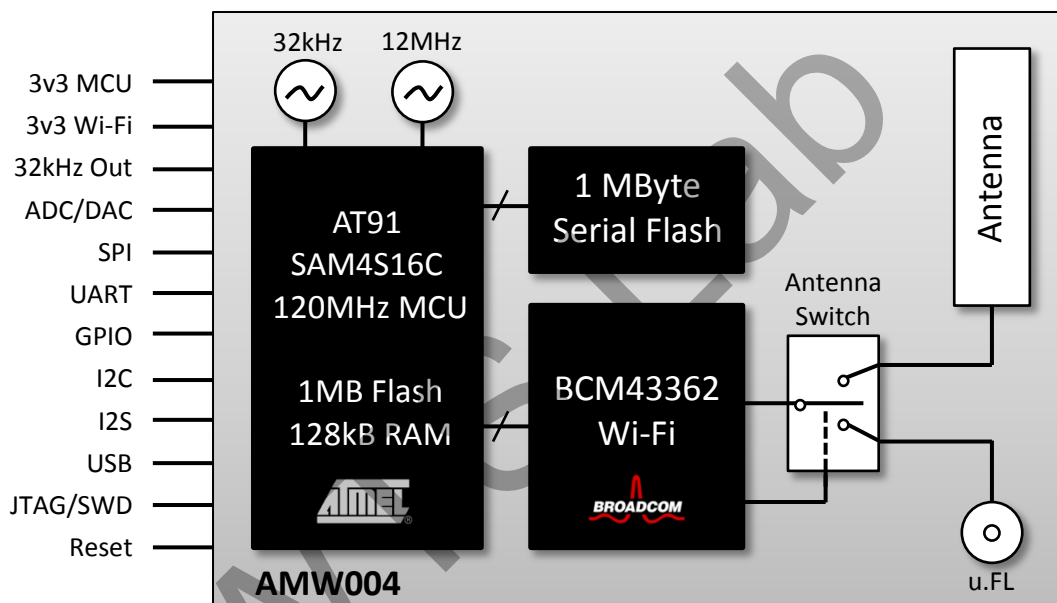
2 Block Diagram

Figure 1 is a block diagram of the AMW004 module. The main components of the module are an AT91SAM4S16C microprocessor and BCM43362 Wi-Fi System-in-Package (SiP) module. The SAM4S ARM processor and peripherals are driven by a 12MHz crystal, the integrated RTC is driven by a 32.768kHz crystal. An integrated 1MByte serial flash chip may be used to store additional applications, user data or firmware images as part of an over the air (OTA) update process.

A dedicated power supply input to the WLAN subsystem is controlled by an application running on the SAM4S, enabling the module to achieve minimum power consumption when the Wi-Fi networking interface is not required.

The module includes an antenna diversity switch. The switch enables static or dynamic selection of the on-board antenna or an external antenna plugged to the u.FL connector.

Figure 1. AMW004 Architecture



3 Electrical Specifications

3.1 Absolute Maximum Ratings

CAUTION! The absolute maximum ratings in Table 1 and Table 2 indicate levels where permanent damage to the device can occur, even if these limits are exceeded for only a brief duration. Functional operation is not guaranteed under these conditions. Operation at absolute maximum conditions for extended periods can adversely affect long-term reliability of the device.

The values in Table 1 reflect absolute maximum ratings from the respective ATSAM4S16C and BCM43362 datasheets.

Table 1. Absolute Maximum Voltage Ratings

Symbol	Ratings	Min	Max	Unit
VDD_3V3	External power supply voltage to MCU subsystem	-0.3	4.0	V
VDD_3V3_WIFI	External power supply voltage to WLAN subsystem	-0.5	6.0	
V _{in}	Input voltage on any other MCU pin	-0.3	4.0	

Table 2. Absolute Maximum Environmental Ratings

Characteristic	Note	Min	Max	Unit
Storage Temperature	–	-40	+125	°C
Relative Humidity	Non-condensing	–	65	%

3.2 Recommended Operating Conditions

Functional operation is not guaranteed outside the limits shown in Table 3 and Table 4, and operation outside these limits for extended periods can adversely affect long-term reliability of the device.

3.2.1 DC Operating Conditions

Table 3. Recommended DC Operating Conditions

Symbol	Ratings	Min	Typ	Max	Unit
VDD_3V3	External power supply voltage to MCU subsystem	1.62	3.3	3.6	V
VDD_3V3_WIFI	External power supply voltage to WLAN subsystem	2.3	3.3	3.6	

Note: VDD_3V3 and VDD_3V3_WIFI must be at the same voltage when using the Wi-Fi.

3.2.2 Environmental Conditions

Table 4. Recommended Environmental Conditions

Characteristic	Note	Min	Max	Unit
Ambient Temperature	Limited by WLAN chip specification	-30	+85	°C

Characteristic	Note	Min	Max	Unit
Relative Humidity	Non-condensing	–	85	%

3.3 Power Consumption

Table 5. Power consumption

Operational State	Note	Typ ¹	Max ¹	Max ¹	Unit
			T _A = 25°C	T _A = 85°C	
Backup	SAM4S Backup Mode, Wi-Fi powered off	1.85	1.85	12.42	µA
Wait ³	SAM4S Wait Mode, Wi-Fi powered off	32.2	32.2	590	µA
Sleep	SAM4S Sleep Mode, Wi-Fi powered off	–	6.89	–	mA
Wi-Fi Powersave ^{2,3}	SAM4S Wait mode, Wi-Fi in powersave	0.77	–	–	mA
Active Receive ^{2,3,4}	SAM4S Wait mode, Wi-Fi active receive	6.9	–	–	mA
Active Transmit ^{2,3,5}	SAM4S Wait mode, Wi-Fi active transmit	12.5	–	–	mA
Wi-Fi Tx Test Mode ⁶	SAM4S Active mode, Wi-Fi active transmit	–	349	–	mA

Notes:

1. Total combined current consumed by all power supplies: VDD_3V3, VDD_3V3_WIFI.
2. 802.11 beacon Interval = 102.4ms, DTIM=3, Beacon Duration = 1ms @ 1Mbps.
3. SAM4S Wait Mode with 10µs wakeup latency
4. Average current receiving 1Mbit/s UDP at 802.11n MCS7
5. Average current transmitting 1Mbit/s UDP at 802.11n MCS7
6. Wi-Fi Transmitting at +18.5dBm CCK 11Mbit/s with maximum duty cycle

3.4 32kHz Crystal

Table 6. 32kHz Crystal Specifications

Operational State	Note	Min	Typ	Max	Unit
Frequency		–	32768	–	Hz
Frequency Tolerance		–	20	–	ppm
Frequency Ageing	Measured @25°C ±3°C	-3	–	3	ppm

Notes:

1. Reproduced from manufacturers datasheet.

4 WLAN RF Specifications

The AMW004 WLAN radio specifications are derived from the Broadcom BCM43362 WLAN radio specifications.

Unless otherwise stated, the specifications in this section apply when the operating conditions are within the limits specified in Section 3.2, Recommended Operating Conditions. Functional operation outside these limits is not guaranteed.

All specifications are measured by connecting directly to the u.FL connector.

4.1 Summary WLAN Specifications

Table 7. Summary WLAN Specifications

Feature Supported	Description
WLAN Standard	IEEE 802.11b/g/n 1x1 SISO
Frequency Band	2.400 GHz – 2.484 GHz
WLAN Channels	Channels 1 – 14
Data Rates	802.11b (1, 2, 5.5, 11 Mbps) 802.11g (6, 9, 12, 24, 36, 48, 54 Mbps) 802.11n (HT20 MCS0-MCS7)
Maximum Receive level @ 2.4GHz	-2.5 dBm @ 1, 2 Mbps (8% PER, 1024 octets) -8.5 dBm @ 5.5, 11 Mbps (8% PER, 1024 Octets) -12 dBm @ 6-54 Mbps (10% PER, 1000 Octets)
Maximum RF Tx Output Power	+18.5 dBm @ 802.11b (EVM < -9 dB) +13.5 dBm @ 802.11n MCS7 (EVM < -28 dB)
Carrier Frequency Accuracy	±20 ppm (26MHz crystal with ±10 ppm @ 25C)

4.2 WLAN Receiver Specifications

Table 8. WLAN Receiver Performance Specifications

Parameter	Condition/Notes	Min	Typical	Max	Unit
Frequency Range	–	2400	–	2500	MHz
Operating Temperature ¹	–	-30	–	+85	°C
Receive Sensitivity ² (8% PER for 1024 octet PSDU) at u.FL connector	1 Mbps DSSS	–	-94	-91	dBm
	11 Mbps CCK	–	-87	-83	
Receive Sensitivity ² (10% PER for 1000 octet PSDU) at u.FL connector ¹	6 Mbps OFDM	–	-86	-81	dBm
	54 Mbps OFDM	–	-73	-69	

Parameter	Condition/Notes	Min	Typical	Max	Unit
Receive Sensitivity ² (10% PER for 4096 octet PSDU) at u.FL connector. Defined for default parameters: GF, 800ns GI, and non-STBC	65 Mbps MCS0, HT20	-	-86	-81	dBm
	65 Mbps MCS7, HT20	-	-70	-65	
Max. Receive Level @ 2.4GHz	@ 1, 2 Mbps (8% PER, 1024 octets)	-2	-	-	dBm
	@ 5.5, 11 Mbps (8% PER, 1024 Octets)	-8	-	-	
	@ 6-54 Mbps (10% PER, 1000 Octets)	-11.5	-	-	

Notes:

1. Operation below -20°C and above +65°C with parameter derating per Note 2
2. Derate receive sensitivity by 1.5dB for operation between temperatures of -30°C to -20°C and 65°C to 85°C

4.3 WLAN Transmitter Specifications

Table 9. WLAN Transmitter Performance Specifications

Parameter	Condition/Notes	Min	Typical	Max	Unit	
Frequency Range	-	2400	-	2500	MHz	
Operating Temperature ¹	-	-30	-	+85	°C	
Transmit power ² measured at u.FL connector for highest power level setting at 25°C, VDD-3V3_RF_IN=3.3V with spectral mask and EVM compliance	EVM does NOT exceed :					
	1 Mbps DSSS	-11 dB	+15.5	+17	+18.5	dBm
	11 Mbps CCK	-11 dB	+15.5	+17	+18.5	
	6 Mbps OFDM	-22 dB	+12.5	+14	+15.5	
	54 Mbps OFDM	-25 dB	+12.5	+14	+15.5	
	MCS0, HT20	-22 dB	+10.5	+12	+13.5	
MCS7, HT20	-28 dB	+10.5	+12	+13.5		

Notes:

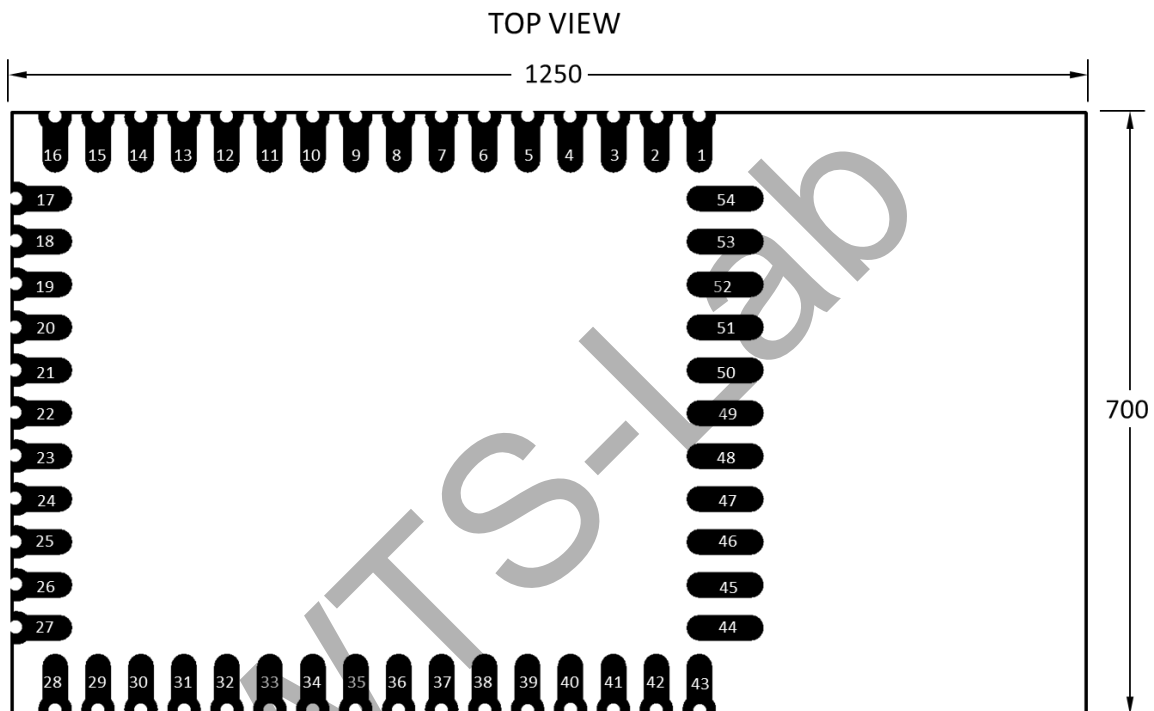
1. Operation below -20°C and above +65°C with parameter derating per Note 2
2. Derate transmit power by 1.5dB for operation between temperatures of -30°C to -20°C and 65°C to 85°C

5 Pinout and Signal Descriptions

5.1 Pinout

A top view of the AMW004 pinout is depicted in Figure 2. All dimensions are in thousands of an inch. A recommended footprint is provided in Section 6.1.

Figure 2. AMW004 Pinout (TOP View – Pins NOT visible from top!)



5.2 Pin Description

Table 10. AMW004 Pin Definitions

Pin	Name	Type ¹	SAM4S I/O ²	Primary Function	Alternate & Other Function(s)
1	GND	S	GND	Ground	-
2	VDD_3V3_WIFI	S	-	3.3V WLAN power supply	-
3	JTAG_TDI	I/O	PB4	JTAG TDI	GPIO, I2C_TWD1
4	JTAG_TDO	I/O	PB5	JTAG TDO	GPIO, I2C_TWCK1, TRACESWO
5	JTAG_TMS	I/O	PB6	JTAG TMS	GPIO, SWDIO

Pin	Name	Type ¹	SAM4S I/O ²	Primary Function	Alternate & Other Function(s)
6	JTAG_TCK	I/O	PB7	JTAG TCK	GPIO, SWCLK
7	GPIO_0	I/O	PB14	GPIO	SPI_NPCS1, PWM_H3, DAC1
8	GPIO_1	I/O	PB10	GPIO	USB_DDM
9	GPIO_2	I/O	PB11	GPIO	USB_DDP
10	OSC_32K_OUT	O	PB13	OSC_32K_OUT	-
11	GPIO_3	I/O	PB2	GPIO	UART_RXD1, SPI_NPCS2, AD6, WKUP12
12	GPIO_4	I/O	PB3	GPIO	UART_TXD1, AD7, PCK2
13	GPIO_5	I/O	PA0	GPIO	PWM_H0, WKUP0
14	GPIO_6	I/O	PA1	GPIO	PWM_H1, WKUP1
15	GPIO_7	I/O	PA17	GPIO	SSC_TD, PWM_H3, AD0, PCK1
16	GND	S	GND	Ground	-
17	GPIO_8	I/O	PA18	GPIO	SSC_RD, AD1, PCK2
18	GPIO_9	I/O	PA19	GPIO	SSC_RK, PWM_L0, AD2, WKUP9
19	GPIO_10	I/O	PA15	GPIO	SSC_TF, PWM_L3, TIOA1, WKUP14
20	GPIO_11	I/O	PA16	GPIO	SSC_TK, PWM_L2, TIOB1, WKUP15
21	GPIO_12	I/O	PA20	GPIO	SSC_RF, PWM_L1, AD3, WKUP10
22	GND	S	GND	Ground	-
23	GPIO_13	I/O	PA21	GPIO	USART_RXD1, AD8, PCK1
24	GPIO_14	I/O	PA22	GPIO	USART_TXD1, SPI_NPCS3, AD9
25	MCU_ERASE	I	MCU_ERASE	MCU_ERASE	-
26	GPIO_15	I/O	PA24	GPIO	USART_RTS1, PWM_H1
27	GPIO_16	6I/O	PA25	GPIO	USART_CTS1, PWM_H2
28	GND	S	GND	Ground	-
29	VDD_3V3	S	VDDIN, VDDIO, ADVREF	3.3V MCU power supply input	-
30	GPIO_17	I/O	PA14	GPIO	SPI_SPCK, PWM_H3, WKUP8
31	GPIO_18	I/O	PA13	GPIO	SPI_MOSI, PWM_H2
32	GPIO_19	I/O	PA12	GPIO	SPI_MISO, PWM_H1
33	GPIO_20	I/O	PA11	GPIO	SPI_NPCS0, PWM_H0, WKUP7

Pin	Name	Type ¹	SAM4S I/O ²	Primary Function	Alternate & Other Function(s)
34	GPIO_21	I/O	PC13	GPIO	AD10, PWM_L0
35	GPIO_22	I/O	PC12	GPIO	AD12
36	GPIO_23	I/O	PA10	GPIO	UART_TXD0, SPI_NPCS2
37	GPIO_24	I/O	PA9	GPIO	UART_RXD0, SPI_NPCS1, WKUP6, PWM_FIO
38	GPIO_25	I/O	PA6	GPIO	USART_TXD0, PCK0
39	GPIO_26	I/O	PA5	GPIO	USART_RXD0, SPI_NPCS3, WKUP4
40	RESET_L	I	NRST	System Reset	-
41	GPIO_27	I/O	PA4	GPIO	I2C_TWCK0, WKUP3, TCLK0
42	GPIO_28	I/O	PA3	GPIO	I2C_TWD0, SPI_NPCS3
43-54	GND	S	-	Ground	-

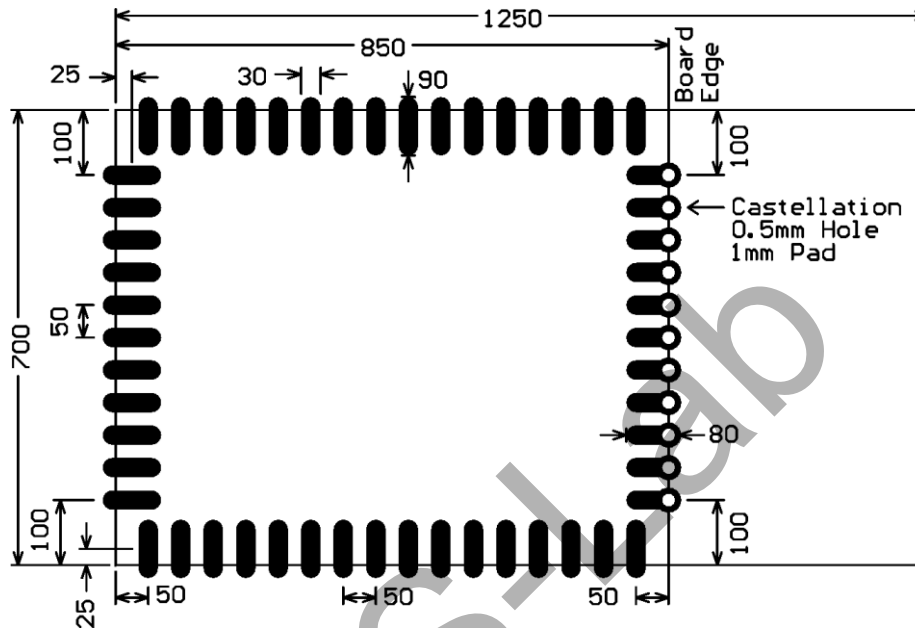
Notes:

1. I = Input, O = Output, S = Supply
2. All pins are connected directly to the [AT91SAM4S16C](#) as noted in the column titled **SAM4S I/O** unless otherwise indicated.

6 Design Guidelines

6.1 Recommended PCB Footprint

Figure 3. AMW004 Recommended Footprint (Top)



All dimensions are in thousands of an inch unless otherwise marked. The addition of castellations on the periphery of the module carrier board directly beneath the end of the module nearest the antenna (as depicted in Figure 3) are strongly recommended.

6.2 Routing Recommendations

When designing a carrier board, the addition of ground fill directly underneath the AMW004 module, rather than signal or power traces, is recommended. If traces must be routed directly beneath the module, avoid routing directly under test pads or under the end of the module close to the antenna. Failure to comply with these recommendations may result in degraded performance of WLAN functionality.

6.3 Soldering Information

TBA

6.4 Module Photograph

Figure 4. AMW004 Photograph (Top)



6.5 Application Examples

This section provides circuit examples demonstrating how to configure the module to meet various application requirements.

6.5.1 Power Supply

The module requires at least 10 μ F of bulk capacitance between VDD_3V3 pin 29 and ground and between VDD_3V3_WIFI pin 2 and ground. The WLAN radio performance may be significantly degraded if ground Pins 44-54 near the antenna are not connected to a solid ground.

For applications that do not require separate control of the WLAN power supply, the VDD_3V3 and VDD_3V3_WIFI power supply pins may be connected together as shown in .

Alternately, for applications that require finer control over power consumption, the VDD_3V3_WIFI supply can be dynamically driven. This is achieved using a separate regulator, or with a P-channel MOSFET as shown in . The WIFI_EN gate enable signal may be connected to any available GPIO on the module and controlled by software to power on or off the WLAN subsystem as required.

Figure 5. Common Power Supply

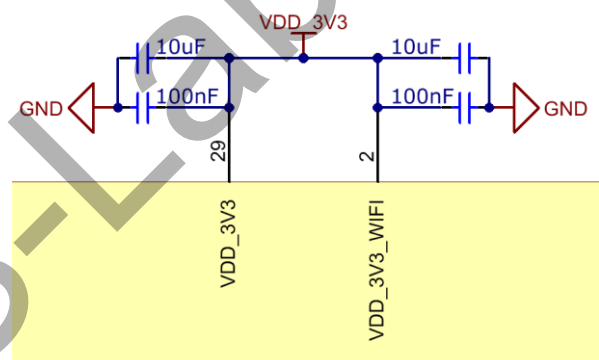
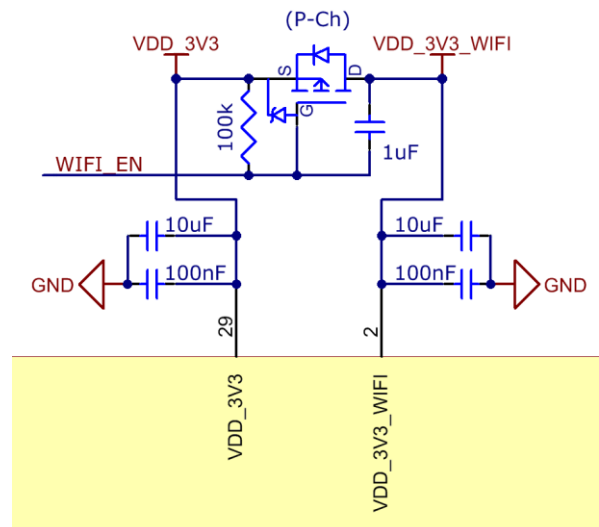


Figure 6. Gated WLAN Power Supply

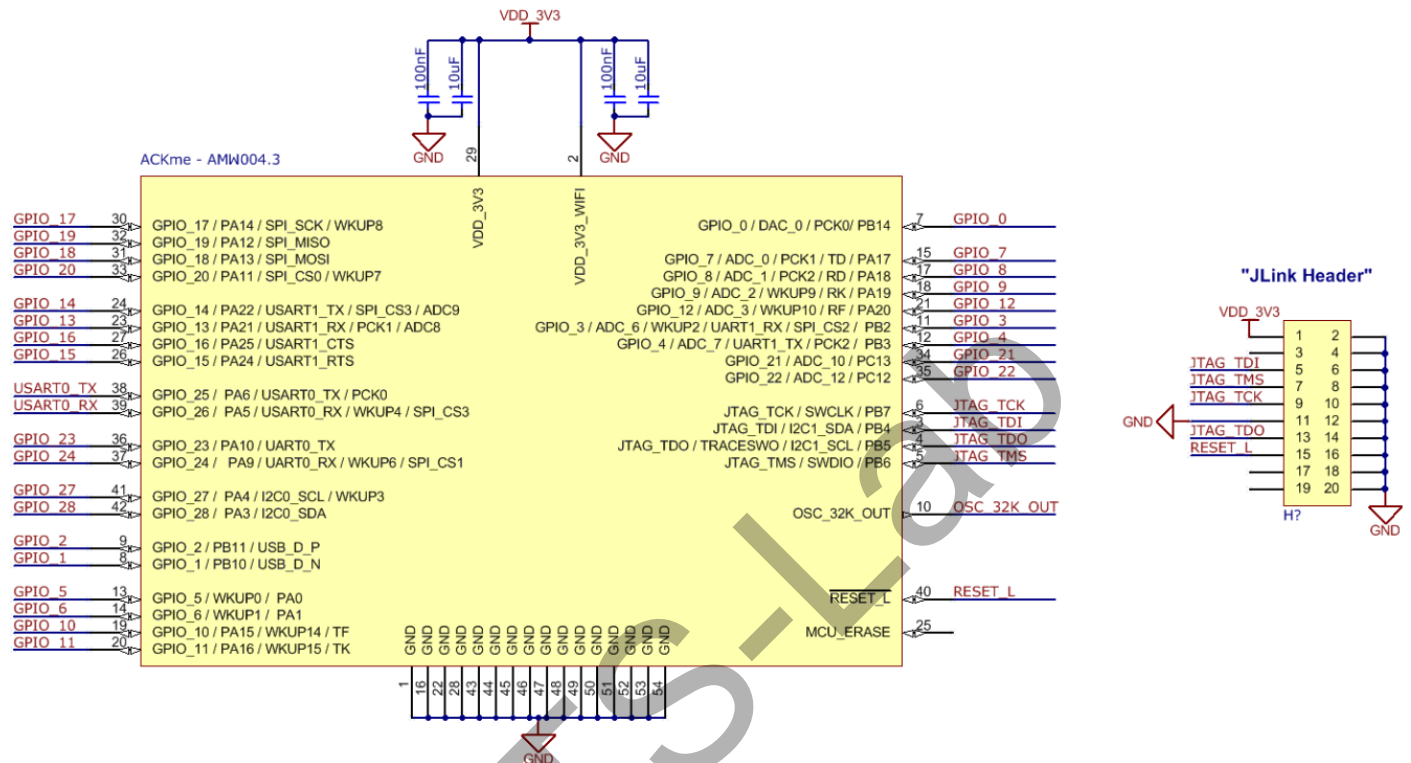


6.5.2 Programming and Debug

The module may be programmed using the WICED SDK by connecting power and a JTAG JLINK header as shown

in Figure 7. JTAG adapters from Olimex, Segger or others may be used as described in the WICED SDK documentation.

Figure 7. Connecting the AMW004 Module for Programming and Debug

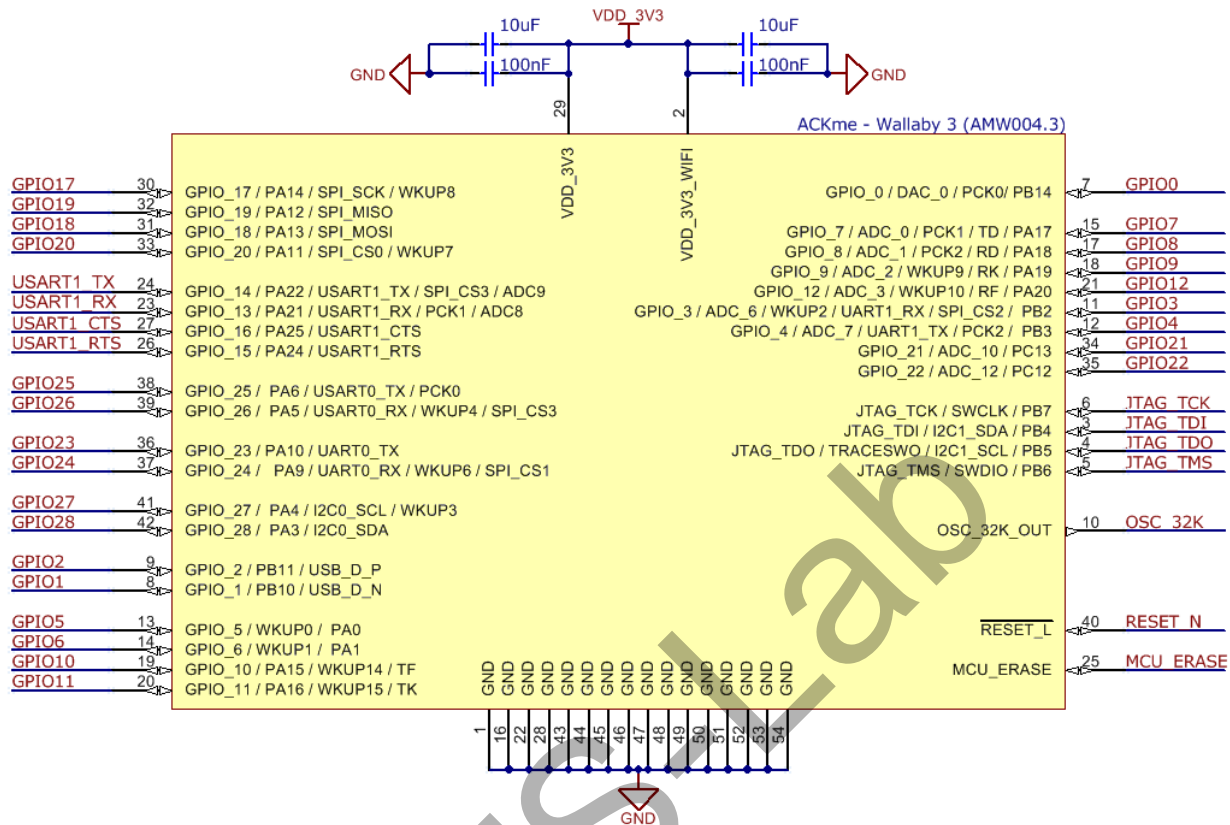


6.5.3 Operation using WiConnect

The AMW004 module is pre-installed with WiConnect, ACKme Networks feature-rich and reliable serial Wi-Fi networking application with easy-to-use commands.

The module only requires power and a connection to a serial interface such as UART or SPI. A host processor connects to pins 23/24 (or 38/39) as shown in Figure 8 if the USART1 (or USART0) serial interface is used.

Figure 8. Using the AMW004 Module with WiConnect and a UART serial interface



7 Regulatory Certification

The AMW004 module has been certified for operation in various regulatory domains. This section outlines certification information specific to the following countries and regions:

- United States
- Canada
- Europe
- Australia
- New Zealand

Should you require regulatory certification for the AMW004 module in a country or region not listed, please contact your local ACKme Networks sales office or create a support request via our website at <http://ack.me>.

7.1 United States

The ACKme Networks AMW004 module has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Sub-part C “Intentional Radiators” modular approval in accordance with Part 15.212 Modular Transmitter approval. Modular approval allows the end user to integrate the AMW004 module into a finished product without obtaining subsequent and separate FCC approvals for intentional radiation, provided no changes or modifications are made to the module circuitry. Changes or modifications could void the user’s authority to operate the equipment. The end user must comply with all of the instructions provided by the Grantee which indicate installation and/or operating conditions necessary for compliance.

The finished product is required to comply with all applicable FCC equipment authorization, regulations, requirements, and equipment functions not associated with the transmitter module portion. For example, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15 Sub-part B “Unintentional Radiators”), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for non-transmitter functions on the transmitter module (i.e. Verification, or Declaration of Conformity) (e.g., transmitter modules may also contain digital logic functions) as appropriate.

7.1.1 Labeling and User Information Requirements

The AMW004 module has been labelled with a unique FCC ID number, and if the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording as follows:

Contains FCC ID: 2ABPY-61F8D
 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.

The user manual for the product should include the following 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.

Additional information on labeling and user information requirements for Part 15 devices can be found in KDB Publication 784748 available at the FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB) at the following website: <https://apps.fcc.gov/oetcf/kdb/index.cfm>

7.1.2 RF Exposure

All transmitters regulated by FCC must comply with RF exposure requirements. OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, provides assistance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to Radio Frequency (RF) fields adopted by the Federal Communications Commission (FCC). The bulletin offers guidelines and suggestions for evaluating compliance.

If appropriate, compliance with exposure guidelines for mobile and unlicensed devices can be accomplished by the use of warning labels and by providing users with information concerning minimum separation distances from transmitting structures and proper installation of antennas.

The following statement must be included as a CAUTION statement in manuals and OEM products to alert users of FCC RF exposure compliance:

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter

If the AMW004 module is used in a portable application (i.e., the antenna is less than 20 cm from persons during operation), the integrator is responsible for performing Specific Absorption Rate (SAR) testing in accordance with FCC rules 2.1091.

7.1.3 External Antenna

Modular approval in the United States is permitted with the use of the integrated antenna ONLY. If an external antenna is used with the AMW004 module, additional testing of the end product is needed to meet FCC requirements.

7.1.4 Further Information

Additional information regarding FCC certification and use of the AMW004 module in the United States is available from the following sources.

- Federal Communications Commission (FCC) <http://www.fcc.gov.au>
- FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB) <http://apps.fcc.gov/oetcf/kdb/index.cfm>

7.2 Canada

The AMW004 module has been certified for use in Canada under Industry Canada (IC) Radio Standards Specification (RSS) RSS-210 and RSSGen. Modular approval permits the installation of a module in a host device without the need to recertify the device.

7.2.1 Labeling and User Information Requirements

Labeling Requirements for the Host Device (from Section 3.2.1, RSS-Gen, Issue 3, December 2010): The host device shall be properly labeled to identify the module within the host device.

The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labeled to display the Industry Canada certification number of the module, preceded by the words “Contains transmitter module”, or the word “Contains”, or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: 11685A-61F8D

User Manual Notice for License-Exempt Radio Apparatus (from Section 7.1.3 RSS-Gen, Issue 3, December 2010): User manuals for license-exempt radio appa-

ratus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both:

This device complies with Industry Canada license-exempt RSS standard(s). 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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Transmitter Antenna Notification (from Section 7.1.2 RSS-Gen, Issue 3, December 2010): User manuals for transmitters shall display the following notice in a conspicuous location:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

The above notice may be affixed to the device instead of displayed in the user manual.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi) and required impedance for each.

7.2.2 External Antenna Types

Transmitter Antenna (from Section 7.1.2 RSS-Gen, Issue 3, December 2010):

The AMW004 module can only be operated with the on-board antenna with which it was approved without additional testing.

If an external antenna is used with the AMW004 module, additional testing of the end product is needed to meet IC requirements as described in the previous section.

7.2.3 Further Information

Additional information may be obtained from the Industry Canada website at <http://www.ic.gc.ca>

7.3 Europe

The AMW004 module is an R&TTE Directive assessed radio module that is CE marked and has been manufactured and tested with the intention of being integrated into a final product.

The AMW004 module has been tested to R&TTE Directive 1999/5/EC Essential Requirements for Health and Safety Article 3.1(a), Electromagnetic Compatibility (EMC) Article 3.1(b), and Radio Article 3.2 and the results are summarized in Table 11. A Notified Body Opinion has also been issued. All AMW004 test reports are available on the ACKme Networks website at <http://ack.me>.

The R&TTE Compliance Association provides guidance on modular devices in the document titled Technical Guidance Note 01 available on the website at http://www.rtteca.com/html/download_area.htm.

NOTE: To maintain conformance to the testing listed in _____, the module shall be installed in accordance with the installation instructions in this data sheet and shall not be modified.

When integrating a radio module into a completed product the integrator becomes the manufacturer of the final product and is therefore responsible for demonstrating compliance of the final product with the essential requirements of the R&TTE Directive.

7.3.1 Labeling and User Information Requirements

The label on the final product which contains the AMW004 module must follow CE marking requirements. The R&TTE Compliance Association Technical Guidance Note 01 provides guidance on final product CE marking

7.3.1 External Antenna Requirements

From R&TTE Compliance Association document Technical Guidance Note 01:

Provided the integrator installing an assessed radio module with an integral or specific antenna and installed in conformance with the radio module manufacturer's installation instructions requires no further evaluation under Article 3.2 of the R&TTE Directive and does not require further involvement of an R&TTE Directive Notified Body for the final product. [Section 2.2.4]

The European Compliance Testing listed in Table 11 was performed using the AMW004 on-board antenna.

7.3.2 Further Information

A document that can be used as a starting point in understanding the use of Short Range Devices (SRD) in Europe is the European Radio Communications Committee (ERC) Recommendation 70-03 E, which can be downloaded from the European Radio Communications Office (ERO) at: <http://www.ero.dk>.

Further information may be obtained from the following websites:

- Radio and Telecommunications Terminal Equipment (R&TTE)
http://ec.europa.eu/enterprise/rtte/index_en.htm
- European Conference of Postal and Telecommunications Administrations (CEPT)
<http://www.cept.org>
- European Telecommunications Standards Institute (ETSI)
<http://www.etsi.org>
- European Radio Communications Office (ERO)
<http://www.ero.dk>
- The Radio and Telecommunications Terminal Equipment Compliance Association (R&TTE CA)
<http://www.rtteca.com/>

Table 11. European Compliance Testing

Certification	Standard	Article	Laboratory	Report Number	Date
Safety	EN 60950-1:2006+A11:2009+A1:2010	3.1(a)	Worldwide Testing Services (Taiwan)	<TBD>	<TBD>
Health	EN 50371:2002-03			<TBD>	<TBD>
EMC	EN 301 489-1 v1.81 (2008-04)	3.1(b)		<TBD>	<TBD>
	EN301 489-17 v2.1.1 (2009-05)			<TBD>	<TBD>
Radio	EN 300 328 v1.7.1 (2006-10)	3.2	<TBD>	<TBD>	
Notified Body Opinion	<MARK TBD>		Eurofins	<TBD>	<TBD>

7.4 Australia

Australian radio regulations do not provide a modular approval policy similar to the United States (FCC) and Canada (IC). However, AMW004 module test reports may be used in part to demonstrate compliance in accordance with ACMA Radio communications “Short Range Devices” Standard 2004 which references Australia/New Zealand industry standard AS/NZS-4268:2008. AMW004 RF transmitter test reports may be used as part of the product certification and compliance folder. For further information regarding the availability of RF test reports, please contact ACKme Networks via our website at <http://ack.me>.

7.4.1 External Antenna Requirements

The compliance test reports provided in Table 11 were performed using the AMW004 on-board antenna. If an external antenna is used with the AMW004 module, additional testing of the end product is needed to meet Australian regulatory requirements.

7.4.2 Further Information

Additional information may be obtained from the Australian Communications and Media Authority website at <http://www.acma.gov.au>.

7.5 New Zealand

New Zealand radio regulations do not provide a modular approval policy similar to the United States (FCC) and Canada (IC). However, AMW004 module test reports may be used in part to demonstrate compliance

with the New Zealand “General User Radio License for Short Range Devices”. New Zealand Radio communications (Radio Standards) Notice 2010 references Australia/New Zealand industry standard AS/NZS-4268:2008. AMW004 RF transmitter test reports may be used as part of the product certification and compliance folder. For further information regarding the availability of RF test reports, please contact ACKme Networks via our website at <http://ack.me>.

7.5.1 External Antenna Requirements

The compliance test reports provided in Table 11 were performed using the AMW004 on-board antenna. If an external antenna is used with the AMW004 module, additional testing of the end product is needed to meet New Zealand regulatory requirements.

7.5.2 Further Information

Additional information may be obtained from the New Zealand Radio Spectrum Ministry of Economic Development website at <http://www.rsm.govt.nz>.

8 Packaging, Handling & Storage, RoHS

8.1 Packaging

The AMW004 module is shipped in a moisture resistant sealed bag. The shelf life of the sealed bag is 12 months at 40°C and <90% Relative Humidity (RH). Please refer to the bag seal date.

8.2 Handling & Storage



CAUTION **MSL3 Sensitive Device!**

The AMW004 module is a moisture sensitive device rated at Moisture Sensitive Level 3 (MSL3) per **IPC/JEDEC J-STD-20**.

After opening the moisture sealed storage bag, modules that will be subjected to reflow solder or other high temperature processes must be:

1. mounted to a circuit board within 168 hours at factory conditions ($\leq 30^{\circ}\text{C}$ and <60% RH)

OR

2. continuously stored per **IPC/JEDEC J-STD-033**

Modules that have been exposed to moisture and environmental conditions exceeding packaging and storage conditions **MUST** be baked before mounting according to **IPC/JEDEC J-STD-033**.

Failure to meet packaging and storage conditions will result in irreparable damage to modules during solder reflow.

8.3 RoHS Directive

The AMW004 module is produced according to the RoHS (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment) directive and complies with the directive.

9 Revision History & Glossary

9.1 Revision History

Table 12: Document Revision History

Revision	Date	Change Description
AN-DSM4-100D2	Jul 8, 2013	Draft release
AN-DSM4-100D3	Aug 15, 2013	Added RF measurement values
AN-DSM4-100D4	Sep 11, 2013	Updated pinout and added serial flash and 32k crystal
ADS-MW004-100D6	Nov 16, 2013	Added preliminary power consumption measurements, formatting
ADS-MW004-100D7	Nov 18, 2013	Clarification of Tx/Rx operation temperature specifications
ADS-MW004-100D8	Mar 4, 2014	Added packaging & certification information, added 32k crystal spec

9.2 Glossary

In most cases, acronyms and abbreviations are defined on first use. A comprehensive list of acronyms and other terms used in ACKme Networks documents are provided on the ACKme Networks website at <http://ack.me/FAQs/Glossary>.

10 References

Throughout this data sheet, references to other documents are listed. The following documents provide additional material:

1. [ATSAM4S16C Data Sheet](#)
Rev. D
Atmel Corporation, July 2012
2. [IEEE 802.11 Standard – 2012](#)
Institute of Electrical and Electronics Engineers.
<http://standards.ieee.org>

WTS-Lab

WTS-Lab

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ACKme Networks

US Headquarters:	Australian Office:
2 North Santa Cruz Ave	Level 21, Tower 2
Suite #207	201 Sussex St
Los Gatos CA 95030	Sydney NSW 2000

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Contact: +1 (408) 402 5708
e-mail: info@ack.me
<http://ack.me>
<http://ackmenetworks.com>