



ASR-2KL Data Sheet

Modified: 14 February 2019

Afero Part Number: D-LIT-00002-00

Revision History

REVISION	DATE	AUTHOR	CHANGE DESCRIPTION
0.5	09/01/2016	DA	Initial draft
0.6	10/13/2016	RSB	ASR-2KL specific tweaks
0.7	11/29/2016	RSB	Add RF test data, relax input voltage requirement
0.9	1/13/2017	RSB/DK	RF data now reflects FCC settings, measured power numbers, cleanup
0.95	2/17/2017	BB	Added mechanical characteristics and Bluetooth power level
1.0	3/6/2017	CDV	Added Afero Part Number
1.1	3/8/2017	BB	Added Wireless LAN Module Specification
1.2	6/30/2017	BB	Added Ordering Information
1.3	7/19/2017	BB	Added part number
1.4	8/7/2017	SB	Modified average power consumption specification
2.0	2/14/2019	SB	Genericized the part number in section 1.1; changed VCC minimum voltage level to 4.75V in section 3.2; added ordering details to section 6.1.

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1. Introduction

ASR-2KL is a Wi-Fi and Bluetooth® low energy module. It enables ultra-low power connectivity for data communication. The product integrates a Wi-Fi/Bluetooth radio, RF front-end, a microcontroller running the Afero custom firmware, security IC, and crystal into a small package. This is an ideal solution for Internet of Things (IoT) applications.

1.1 About Afero

Afero builds integrated hardware, software, and cloud services for IoT connectivity and data analytics. The Afero turnkey platform incorporates a secure wireless module, scalable cloud services, and a range of development tools that enable companies and developers to quickly prototype and build connected devices.

The Afero platform is vertically integrated, giving developers a solution that combines security and connectivity at the three key touch points for all connected devices:

- Product (embedded secure radio module)
- Mobile (app-level monitoring and control)
- Cloud (web API)

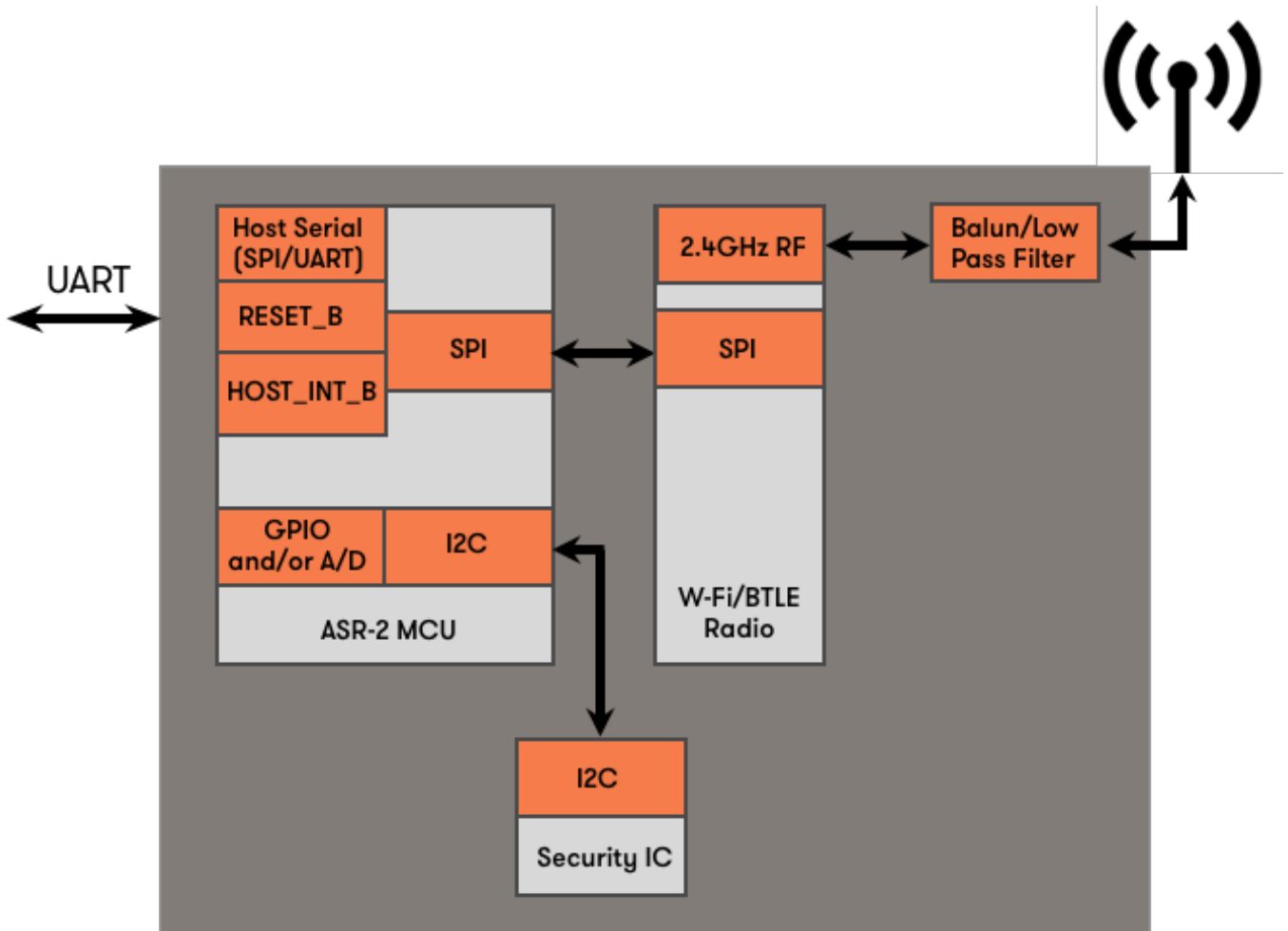
This vertical integration accelerates the creation of connected devices by minimizing the investment normally required for software development and testing -- while ensuring a secure and scalable solution.

The Afero Secure Radio module (ASR-2KL, P/N A-FGS-00004-xx) comes programmed with authentication, encryption, and connection management software, ensuring a reliable connection to the Afero Cloud. The Afero mobile application, available for both Android and iOS phones, allows users to manage their smart devices and services from their phone. Afero Dynamic Hub Technology further extends users' control over their devices by providing a secure network that connects wirelessly to the Afero Cloud using LTE.

1.2 Features

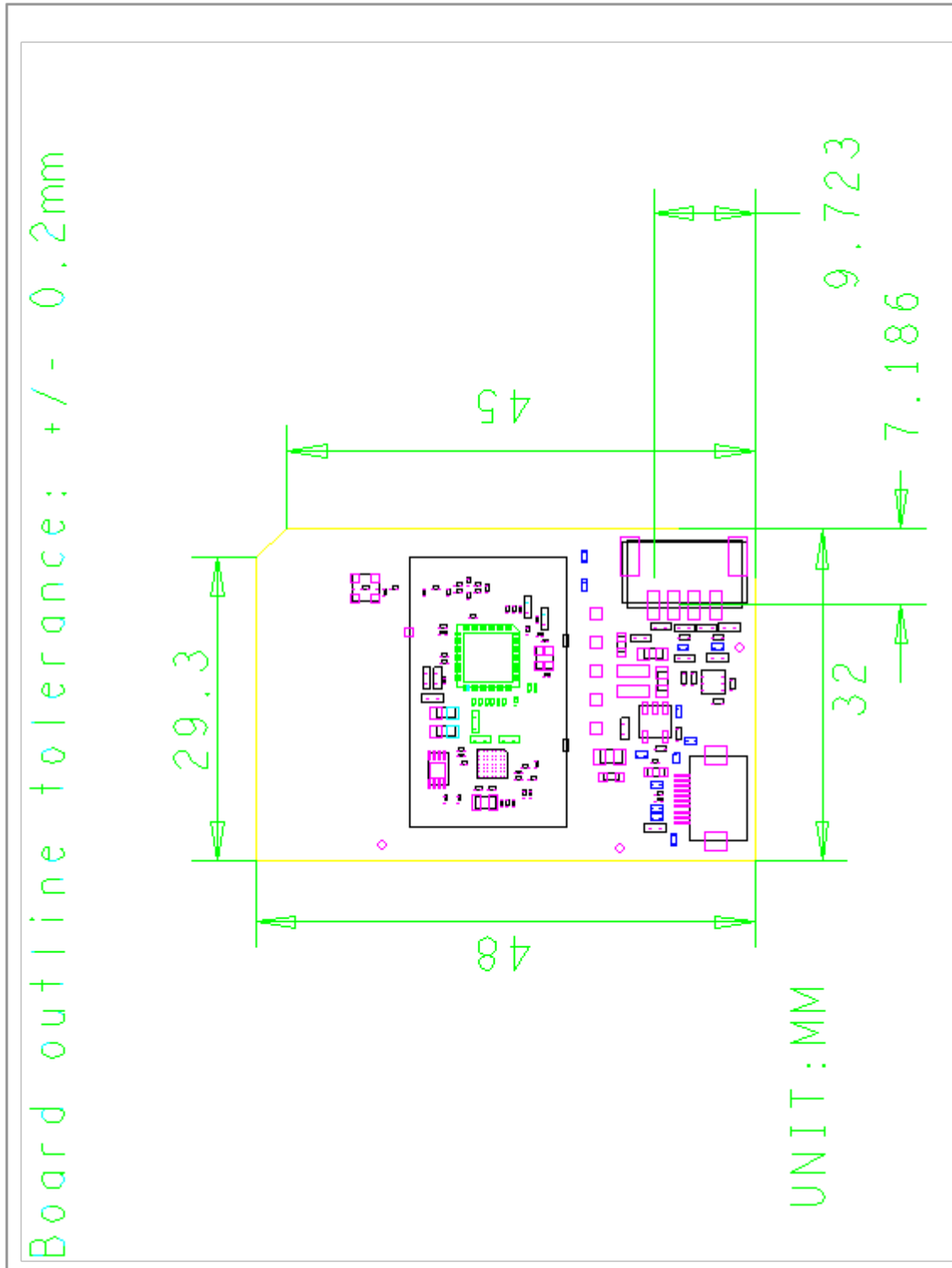
- Model name: Afero Secure Radio Module
- Afero model number: ASR-2KL
- WLAN type: 802.11 b/g/n 1x1
- WLAN radio frequencies: 2.4GHz
- Number of WLAN antennas: One (1)
- WLAN antenna configuration: Microstrip Monopole antenna
- WLAN encryption: 64-bit WEP, 128-bit WEP, WPA-PSK, WPA2-PSK
- Bluetooth radio: Bluetooth® low energy wireless technology (4.0)
- Number of Bluetooth antennas: One (1) shared with WLAN
- Bluetooth antenna configuration: Shared with WLAN
- Bluetooth power level: 5dBm
- Maximum transmit power: 16 dBm
- Receive sensitivity: -79.5 dBm
- Power consumption: <500 mW (average)
- Security features: Cryptographic co-processor with secure, hardware-based key storage
- Host interface: UART, 5V TTL
- Interface pins: N/A
- Certifications: Bluetooth Sig
- Compliance: FCC/IC
- Dimensions: 48 mm x 32 mm x 4.5mm (L x W x H)
- Weight (Earth ABL): 10g
- Package: Connectorized module
- Power (VCC): 5VDC +10/-5%, 12VDC +/- 10%
- Operating temperature: 0 - +70C
- Storage temperature: -20 - +85C
- Operating humidity: 10-85% RH, non-condensing
- Storage humidity: 0-90% RH, non-condensing

1.3 Block Diagram



2. Mechanical Specification

2.1 Mechanical Drawing



2.2 Mechanical Characteristics

ITEM	TEST CONDITIONS
Assembly	No defects of wiring, soldering and assembling
Appearance	No dirt, rust, corrosion, or foreign material
Mass	10g +/- 5g

3. DC Electrical Specification

3.1 Absolute Maximum Rating

DESCRIPTION	MIN	MAX	UNIT
VCC	-0.3	+14.0	V
VIO (UART)	-0.3	Lesser of VCC+.3V and 5.8V	V

3.2 Recommended Operating Conditions

PARAMETER	MIN	MAX	UNIT
Operating Temperature Range	0	70	°C
VCC	4.75	13.2	V
VIO (UART)	4.5	5.5	V

3.3 Standard Test Conditions

Ambient Conditions: 25C +/- 5C, 65%RH +/- 10%

Power Supply: VCC 12V +/- 5% or 5V +/- 5%

3.4 Typical Current Consumption

Measurements taken from 12 VDC power supply.

CURRENT CONSUMPTION	MIN	TYP	MAX	UNIT
TX Off		41.2		mA
TX Mode (1Mbps 11b)		107.8		mA
TX Mode (11Mbps 11b)		97		mA
TX Mode (6Mbps 11g)		100		mA
TX Mode (54Mbps 11g)		78		mA
TX Mode (MCS0 11n)		104		mA
TX Mode (MCS7 11n)		64		mA
RX Mode		40		mA
Typical Usage (LG RAC operation)		30		mA

3.5 UART Specification

UART signaling is CMOS @ 5V.

3.6 Pin Description

PIN #	PIN NAME	I/O	PIN DESCRIPTION
1	VCC		Power In 5.0V +10/-5% or 12.0V +/-10%
2	RX	I	UART RX
3	TX	O	UART TX
4	GND		Ground

4. RF Specification

Conditions: 25°C, V_{CC}=12V, Parameters measured at RF connector.

4.1 Wireless LAN Module Specifications

WIRELESS LAN MODULE SPECIFICATIONS	
Model	ASR-2KL
Frequency Range	2400MHz to 2483MHz
Output Power (Max)	IEEE 802.11b: 20dBm IEEE 802.11g: 17dBm IEEE 802.11n: 17dBm

4.2 RF Characteristics for IEEE802.11b

11Mbps mode unless otherwise specified.

ITEMS	CONTENTS			
Specification	IEEE802.11b			
Mode	DSSS/CCK			
Channel frequency	2400 - 2483 MHz			
Data rate	1, 2, 5.5, 11Mbps			
TX CHARACTERISTICS	MIN	TYP	MAX	UNIT
Total Radiated Power level		15	20	dBm
Spectrum mask				
1 st side lobes (to fc ±11 MHz)	-37	-36	-35	dBr
2 nd side lobes (to fc ±22MHz)	-55	-54.5	-52	dBr
Modulation Accuracy (EVM)	-19	-20	-21	dB
Frequency tolerance	-12	-11.5	-11	ppm
RX CHARACTERISTICS	MIN	TYP	MAX	UNIT
Minimum input level sens. (TIS, PER ≤ 8%)		-79.5		dBm
Maximum input level (PER ≤ 8%)	-10	5		dBm

4.3 RF Characteristics for IEEE802.11g

54Mbps mode unless otherwise specified.

ITEMS	CONTENTS			
Specification	IEEE802.11g			
Mode	OFDM			
Channel frequency	2400 - 2483MHz			
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps			
TX CHARACTERISTICS	MIN	TYP	MAX	UNIT
Total Radiated Power level	10	15	17	dBm
Spectrum mask				
at fc \pm 11 MHz	-31	-26.5	-22	dBr
to fc \pm 20MHz	-38	-34	-30	dBr
to fc \geq \pm 30MHz	-51	-46.5	-42	dBr
Constellation Error (EVM)	-16	-21	-26	dB
Frequency tolerance	4.7	4.85	5	ppm
Chip clock frequency tolerance	4	5.25	6.5	ppm
RX CHARACTERISTICS	MIN	TYP	MAX	UNIT
Minimum input level sens. (TIS, PER \leq 10%)		-72.0		dBm
Maximum input level (PER \leq 10%)	-10	-3		dBm

4.4 RF Characteristics for IEEE802.11n

MCS7 mode unless otherwise specified.

ITEMS	CONTENTS			
Specification	IEEE802.11n - 2.4GHz			
Mode	OFDM			
Channel frequency	2400 - 2483MHz			
Data rate	6.5, 13, 19.5, 26, 39, 52, 58.5, 65Mbps			
TX CHARACTERISTICS	MIN	TYP	MAX	UNIT
Total Radiated Power level	10	15	17	dBm
Spectrum mask (HT20)				
at $f_c \pm 11$ MHz	-30	-26	-22	dBr
to $f_c \pm 20$ MHz	-40	-35	-30	dBr
to $f_c \geq \pm 30$ MHz	-53	-48	-43	dBr
Constellation Error (EVM)	-16	-22	-30	dB
Frequency tolerance	4.3	4.65	5	ppm
Chip clock frequency tolerance	3	4.5	6	ppm
RX CHARACTERISTICS	MIN	TYP	MAX	UNIT
Minimum input level sens. (TIS, PER \leq 10%)		-70.3		dBm
Maximum input level (PER \leq 10%)	-10	-3		dBm

5. Environmental Specification

5.1 Absolute Maximum Rating

DESCRIPTION	MIN	MAX	UNIT
Storage temperature	-20	85	°C
Storage humidity	0	90	%RH
Operating temperature	0	70	°C
Operating humidity	10	85	%RH

5.2 Recommended Operating Conditions

PARAMETER	MIN	MAX	UNIT
Operating Temperature Range	0	70	°C

6. Ordering Information

6.1 ASR-2KL (Generic)

There are two different part numbers for ASR-2KL that can be ordered; the part numbers correspond to the two possible connector types. Customers must integrate the corresponding mating connector into their wiring harness to connect with the ASR-2KL module.

PART NUMBER	CONNECTOR TYPE	CONNECTOR PART NUMBER	MATING CONNECTOR
A-FGS-00004-G0	YeonHo 4 Pin, 2mm	SMW200-H04J	SMH200-04
A-FGS-00004-G1	JST 4 Pin, 2mm	BM04B-PASS-TFT(LF)(SN)	PAP-04V-S

**Afero reserves the right to make changes to the specifications
and functionality of this product.**