



MLink Ultra User's Guide

Revision – Draft

Apr 1, 2021

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1 Legal Disclaimer and Conditions of Use

This document contains information for the MLink Ultra Transceiver and accompanying accessories (“Product”) and is provided “as is”. The purpose of providing such information is to enable a Product Developer to understand the Product and how to integrate it into a wireless data solution. Reasonable effort has been made to make the information in this document reliable and consistent with specifications, test measurements and other information. However, Aurora Wireless Networks Inc. and its affiliated companies, directors, officers, employees, agents, trustees or consultants (“Aurora Wireless Networks Inc”) assume no responsibility for any typographical, technical, content or other inaccuracies in this document. Aurora Wireless Networks Inc reserves the right in its sole discretion and without notice to you to change Product specifications and materials and/or revise this document or withdraw it at any time. The Product Developer assumes the full risk of using the Product specifications and any other information provided.

Your use of the information contained in this Guide is restricted to the development activity authorized under the agreement(s) between you and Aurora Wireless Networks Inc, and is otherwise subject to all applicable terms and conditions of such agreement(s), including without limitation software license, warranty, conditions of use and confidentiality provisions.



2 Revision History

Revision	Date	Description
Draft	Apr 1, 2021	Initial release

3 Abbreviations

Abbreviation	Description
A/D	Analog to Digital
ATTN	Attenuator
Aux	Auxiliary
BSL	Boot Strap Loader
CLK	Clock
CS (nCS)	Chip Select (not Chip Select)
CTS	Clear to Send
EN	Enable
FCC	Federal Communications Commissions
GPIO	General Purpose Input/Output Digital
HCR	Hardware Configuration Resistor
I2C	Inter-Integrated Circuit
IC	Industry Canada
IRQ	Interrupt Request
LNA	Low Noise Amplifier
MOSI	Master Out Slave In
MISO	Master In Slave Out
PA	Power Amplifier
PCB	Printed Circuit Board
PWM	Pulse Width Modulated
RBW	Resolution Bandwidth
RF	Radio Frequency
RST (nRST)	Reset (not Reset)
RTC	Real Time Clock
RTS	Request to Send
Rx	Receive
RxD	Receive Data
SCK	Serial Clock
SDA	Serial Data
SPI	Serial Peripheral Interface
SW	Software
TBC	To Be Confirmed
TBD	To Be Determined
TRP	Total Radiated Power
Tx	Transmit
TxD	Transmit Data
TDD	Time Division Duplex
UART	Universal Asynchronous Receiver/Transmitter

4 Reference Documents

1. MLink Ultra Block Diagrams – Draft, Mar 29, 2021
2. Schematics (MLink Ultra – Rev 2.pdf MLink Ultra – Rev 2.pdf)

3. Bill of Materials (BOM, AWN, Ultra, Rev 2, Mar 22, 2021.BOM)

5 Product Overview

MLink Ultra (AMU900) is the next generation of **MLink 900**. It is an ultra energy and cost efficient, long range wireless network. Available as a module, development platform or a fully customized product. Perfect for a wide range of applications, this highly versatile platform enables rapid design, development, and deployment of your next generation products.

6 Features

Ultra Low Energy: Up to **10 years** or more from AA batteries or even directly from the sun.

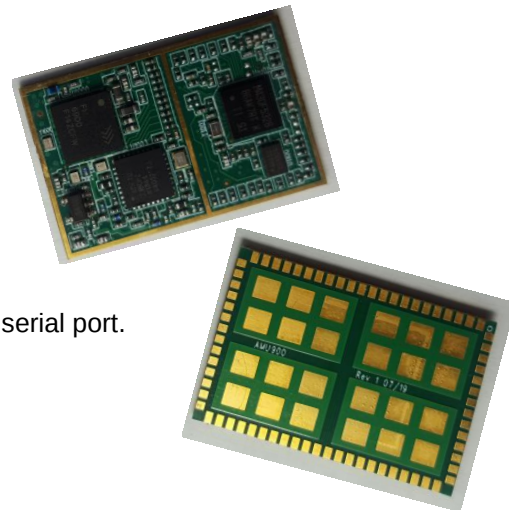
Impressive Range: Up to **10 km** or more using high efficiency integral antennas.

Design Flexibility: Build your application right on the MLink platform or communicate through the embedded serial port.

Direct support for a variety of peripherals:

- GPS
- Displays, accelerometers
- Industrial sensors, audio alerts

Intrinsically safe options available.



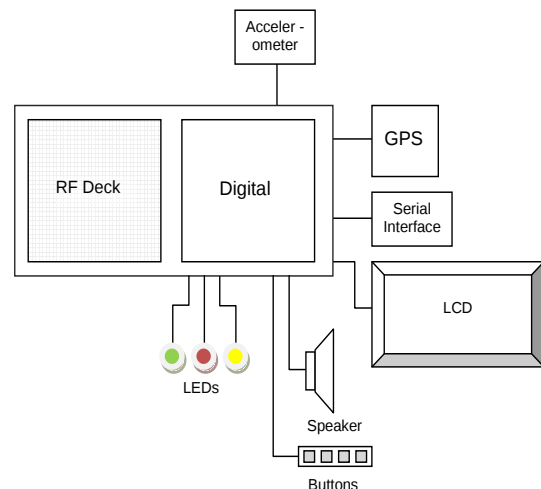
7 Specifications

7.1 Physical

- Size 18.03 x 27.43 x 3.05 mm

7.2 Electrical

- Frequency Range 902 – 928 MHz (US/Can)
- Output Power up to +29 dBm (US/Can)
- Effective Radiated Sensitivity better than -120 dBm (1.2 kbps at 10^{-3} BER)
- Access Method TDD - FHSS
- DC Supply Voltage 2.2 to 3.6 Vdc (Main)
2.2 to 4.2 Vdc (PA)
- Energy Consumption (typical @ 38.4 kbps)
 - TX < 20 mJ
 - RX < 0.5 mJ
 - Standby (/s) < 100 μ W



7.3 Data Rates

- Dynamically adaptable from 1.2 – 76.8 kbps

7.4 Interfaces

- RF
 - 50 Ω
- Digital/Base Band
 - ADC, PWM, GPIO, I2C, SPI, UART

7.5 Firmware

- Real Time Operating System
- Embedded, autonomous protocol
- Up to 64 kB Flash and 4 kB RAM available for customer applications

7.6 Environmental

- Operating Temperature -40 to +85 C
- Storage Temperature -40 to +85 C
- Operating Relative Humidity 0 to 90% non-condensing

8 Regulatory Certification

8.1 United States (FCC)

MLink Ultra modules meets Part 15 of the FCC rules and regulations. Compliance with the labeling requirements, FCC notices is required. In order to comply with FCC Certification requirements, the Original Equipment Manufacturer (OEM) must fulfill the following requirements.

1. The system integrator must place an exterior label on the outside of the final product housing the MLink Ultra module. Figure 8.1.1.1 below shows the contents that must be included in this label.
2. MLink Ultra modules may only be used with the antenna that has been tested and approved for use with the module.
3. NOTE: THE AURORA WIRELESS NETWORKS INC IS NOT RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

8.1.1 Labeling Requirements

The OEM must make sure that FCC labeling requirements are met. This includes a clearly visible exterior label on the outside of the final product housing that displays the contents shown in Figure 8.1.1.1 below.

Manufacturer's name Brand name or Trade Name	
Contains MLink Ultra	FCC ID: 2AZEH-AMU900 IC ID: 27118-AMU900
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.	

Figure 8.1.1.1 – FCC Label

8.1.2 FCC Notices

WARNING: The MLink Ultra modules have been tested by the FCC for use with other products without further certification (as per FCC Section 2.1091). Changes or modifications to this device not expressly approved by Aurora Wireless Networks Inc could void the user's authority to operate the equipment.

NOTICE: OEM's must verify the final end product complies with unintentional radiators (FCC Section 15.107 and 15.109) before providing a declaration of conformity for their final product to Part 15 of the FCC Rules.

NOTICE: The MLink Ultra modules have been certified for mobile and fixed radio applications. If the module will be used for portable applications, the device must undergo SAR testing.

RF Exposure WARNING: This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTICE: The preceding statement must be included as a CAUTION statement in OEM product manuals in order to alert users of FCC RF Exposure compliance.

8.2 Canada (IC)

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.

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 (e.i.r.p.) 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.

This radio transmitter Model: AMU900, IC: 27118–AMU900 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 Model: AMU900, IC: 27118 – AMU900 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.

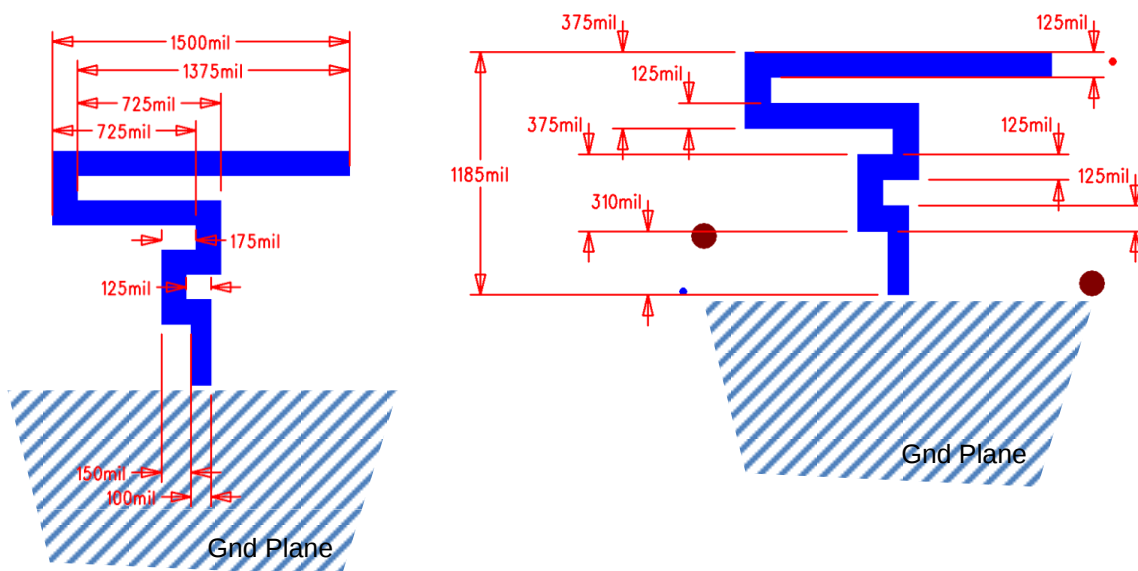
8.3 Approved Antennas

MLink Ultra modules are approved for mobile and fixed applications. FCC & IC requires that for mobile applications the antenna be mounted a minimum of 20 cm from users, as captured in section 8.1.2 above.

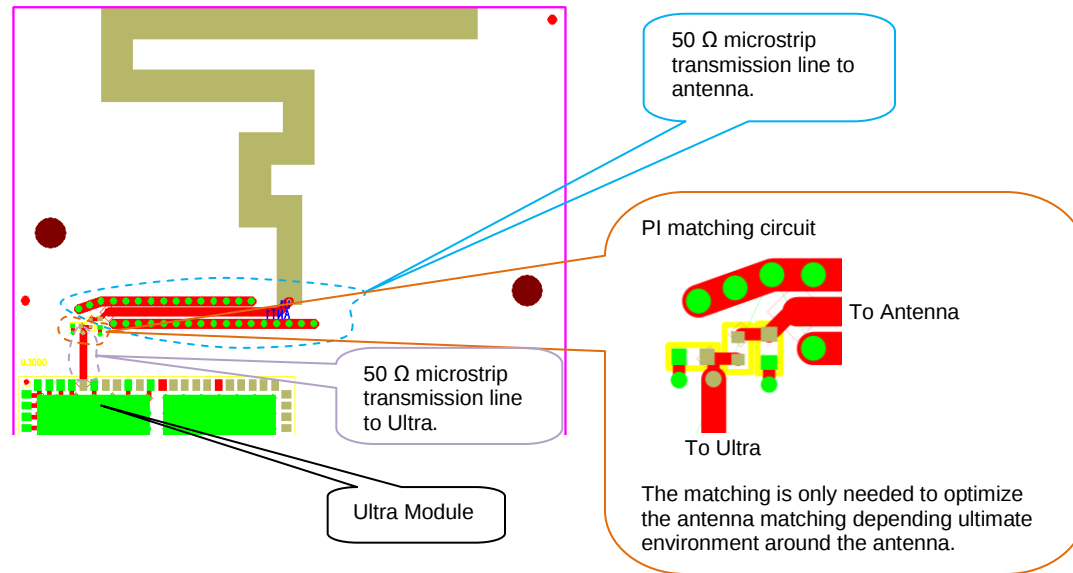
MLink Ultra modules has been approved for use with both an integral PCB antenna and recommended external antenna.

8.3.1 Integral PCB Antenna

MLink Ultra modules has been approved for use with both an integral PCB antenna structure as capture below.



The PCB antenna is connected to a 50 Ω microstrip transmission line and lumped element matching circuit as shown below.



8.3.2 External Antenna

Mlink Ultra modules have been approved for use with an external Yagi antenna captured below including a 1.2 dB min cable loss. External antenna types with the same or **lower** maximum gain are permitted for use with MLink Ultra. Professional installation is required for the external antenna.

Manufacturer	Part Number	Type	Gain	Application	Min Separation
MaxStream Inc or Laird Technologies	A09-Y8NF or PC904	4 Element Yagi	4.8 dBd ¹	Mobile and Fixed	20 cm

Note 1: Including 1.2 dB min cable loss as captured below:

- 5 ft min of RG-174 (27.9 dB/100 ft @ 900 MHz)
- 7 ft min of RG-58/RG-8X (20.1 dB/100 ft @ 900 MHz)
- 16 ft min of RG-213/LMR240 (7.7 dB/100 ft @ 900 MHz)
- 32 ft min of LMR-400 (3.9 dB/100 ft @ 900 MHz)

Part Number	A09-Y8NF
Photo	
Specific Freq. (MHz)	896-980
Gain (dBd)	6 ²
Maximum Power Input (Watts)	200
Product Narrative	4 element, 6 dB gain yagi. 1 piece unit construction with elements welded to boom. Feed system is enclosed in potted PVC radome for weatherability.
Type	4-Element Yagi
General Freq. (MHz)	896-980
Bandwidth @ Rated VSWR (MHz)	84
Gain (dBi)	8.15 ³
H. Beamwidth	105 Deg.
Vert. Beamwidth	65 Deg.
Front to Back Ratio (dB)	16 dB
VSWR	1.5:1
Polarization	Vert./Horiz.
Lightning Prot.	DC Ground
Size (HxWxD")	12"
Weight	0.68

Note 2: With 1.2 dB min cable loss (as captured below) for 4.8 dBd total.

Note 3: With 1.2 dB min cable loss (as captured below) for 7 dBi total.

- 5 ft min of RG-174 (27.9 dB/100 ft @ 900 MHz)
- 7 ft min of RG-58/RG-8X (20.1 dB/100 ft @ 900 MHz)
- 16 ft min of RG-213/LMR240 (7.7 dB/100 ft @ 900 MHz)
- 32 ft min of LMR-400 (3.9 dB/100 ft @ 900 MHz)

9 Integration Instructions

MLink Ultra is designed for use in countless wireless applications requiring long range communications with low energy consumption. To ensure that the final product complies with the all of the regulatory requirements for the Modular Grant the following integration instructions should be followed. MLink is limited to OEM installation ONLY. The OEM integrator is



responsible for ensuring that the end-user has no manual instructions to remove or install the module.

9.1 Mounting

MLink Ultra is a surface mount device which is installed on the OEM PCB along with other components. The mechanical drawing below captures the external dimensions of the MLink Ultra module.

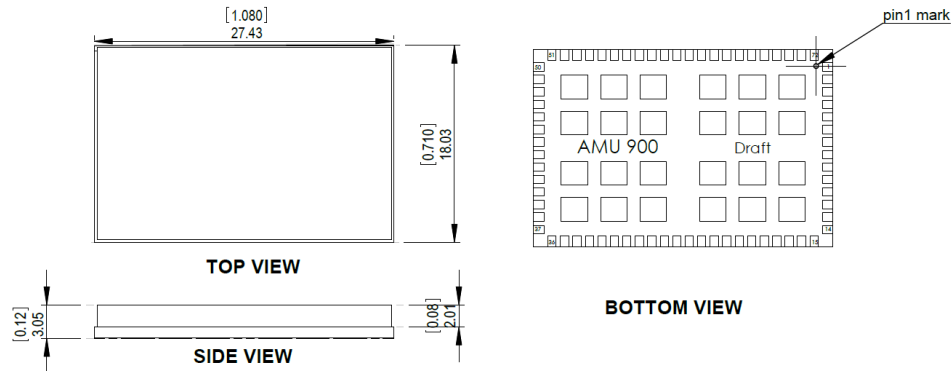


Figure 9.1.1 – MLink Ultra Mechanical Drawing

The recommended footprint is shown in the figure below.

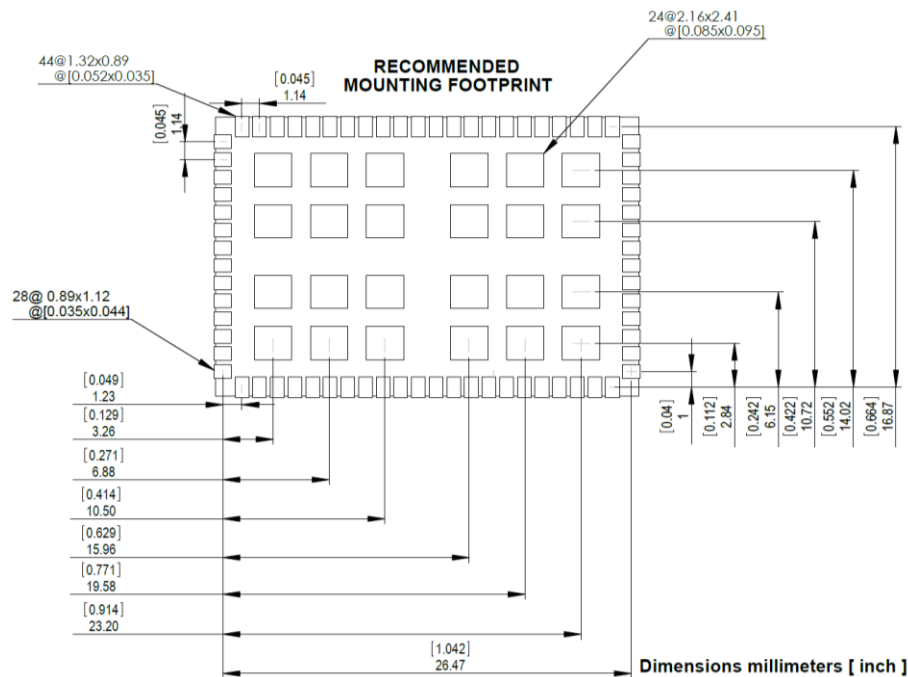
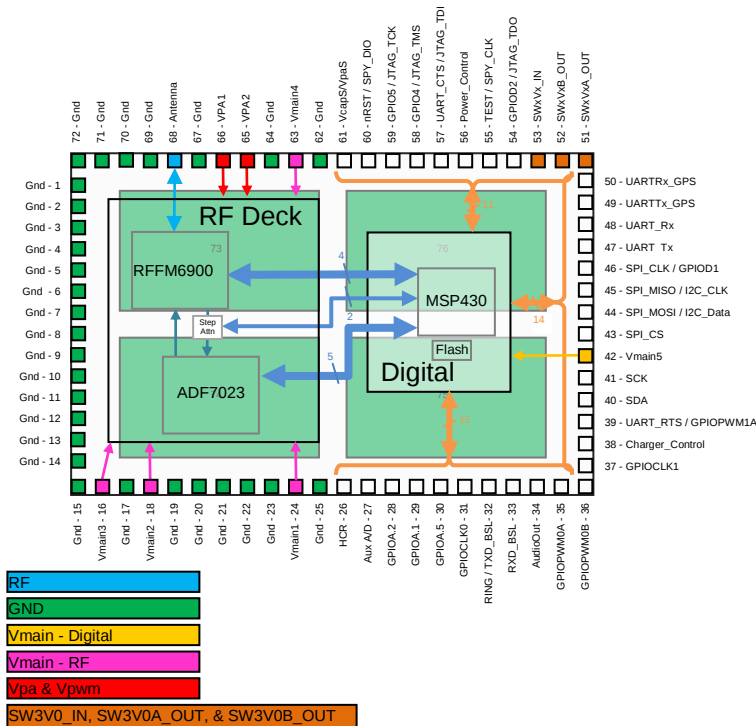


Figure 9.1.2 – Recommended MLink Ultra Footprint

Minimal circuitry is required to support MLink Ultra and therefore the PCB can be a simple 2 layer FR4 board with ground plane ($> 1350 \text{ mm}^2$) on the bottom opposite layer to the MLink Ultra module for heat dissipation.

9.2 Interfaces

The figure below captures the interface lines to MLink Ultra



Key interface pins shown below. The MLink Ultra datasheet (Ref 4) provides detailed information for all interface pins.

Pin #	Name	Description
16, 18, 24, 63	Vmain3, Vmain2, Vmain1, Vmain4, Vmain5 (input)	Power Supplies - Various analog and digital supplies 2.2 – 3.6 V 3 V typ
65, 66	VPA2, VPA1 (input)	Power Supplies - RF PA supplies 2.2 – 4.2 V 3 V typ
1-15, 17, 19-23, 25, 62, 64, 67, 69-72, 32	Gnd (bi-directional)	Ground Low impedance ground connection for MLink power supply, digital and analog signals.
68	Antenna	RF 900 MHz RF TX and RX signal 50 ohms impedance
49, 50	UARTTX_GPS, UARTRX_GPS	Digital Serial interface to GPS peripheral module.

Pin #	Name	Description
	(bi-directional)	
39, 47, 48, 57	UART_RTS, UART_Tx, UART_Rx, UART_CTS (bi-directional)	Digital • MLink serial interface. Use to communicate via the MLink Modem Interface
43-46	SPI_CS, SPI_MOSI, SPI_MISO, SPI_CLK (bi-directional)	Digital • SPI to peripheral modules
27-30, 34-37, 54, 58, 59	Aux A/D, GPIOA.2, GPIOA.1, GPIOA.5, GPIOCLK0, AudioOut, GPIOPWM0A, GPIOPWM0B, GPIOCLK1, GPIOD2, GPIO4, GPIO5 (bi-directional)	Digital/Analog • General purpose digital and analog I/O which is firmware configurable – for example for use with LED, Buttons, voltage measurement, etc

For additional information please contact Aurora Wireless Networks at 403-777-9988 or support@aurorawirelessnetworks.com.