

SN820X Wi-Fi Network Controller Module Family

User Manual

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Revision History

Revision	Date	Author	Change Description
1.0	09/30/13	R. Willett	Initial version
1.1	11/6/2013	R. Willett	Revised Table 1; added Acronyms and References on page 5; revised Figures 1 and 2; revised Figure 11

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1 Introduction

This user manual addresses the topics that are important for employing the SN820X Module in design, software development, regulatory certification and device manufacturing.

1.1 SN820X Wi-Fi Network Controller Module Family

The SN820X Module Family is a portfolio of low power, self-contained, embedded wireless module solutions that address the connectivity demands of M2M applications. These products integrate a micro-controller, a Wi-Fi BB/MAC/RF IC, an RF front end and two clocks into small form factor modules. The module family includes 2 different micro-controller options as shown below. The modules can also be purchased with either a standard on-board chip antenna or a U.FL connector where remote antenna flexibility is required.

Model #	P/N	Built-in STM	RAM Size	Flash Size
SN8200	88-00151-00	ARM Cortex M3	96KB	768KB
SN8200UFL	88-00151-02	ARM Cortex M3	96KB	768KB
SN8205	88-00158-00	ARM Cortex M3	128KB	1024KB
SN8205UFL	88-00158-02	ARM Cortex M3	128KB	1024KB

Table 1 - SN820X Wi-Fi Network Controller Module Family Configuration Comparison

1.2 Acronyms

ADC	Analog to Digital Converter
DAC	Digital to Analog Converter
GPIO	General-Purpose Input-Output
I2C	Intelligent Interface Controller
I2S	Integrated Interchip Sound
ISM	Industrial, Scientific and Medical
MAC	Medium Access Control
MSL	Moisture Sensitivity Level
PER	Packet Error Rate
ROHS	Restriction of Hazardous Substances
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver-Transmitter

1.3 References

- [1] STM32F103RF Data Sheet, ST Microelectronics
- [2] STM32F205RG Data Sheet, ST Microelectronics
- [3] SN820X Wi-Fi Network Controller Module Family Data Sheet, Murata
- [4] AN_SN8200_002 SN820X Firmware Downloading Application Note, Murata

2 Hardware Application Information

2.1 External digital interfaces

2.1.1 Reference connection for UART host interface

Figure 1 illustrates the connections between the module and the host MCU using the UART interface. A level shifter may be needed if the host UART interface level does not match with the module interface.

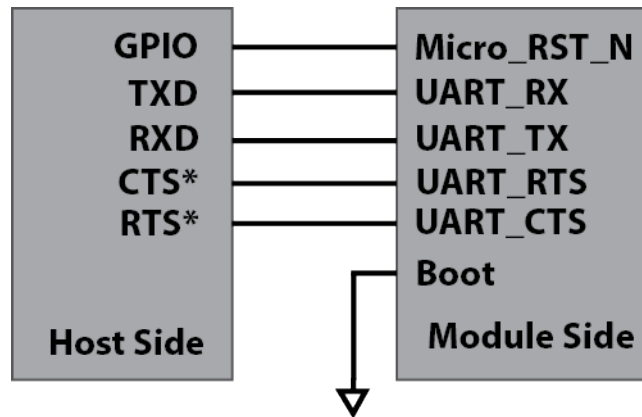


Figure 1 - UART Host Interface Reference Diagram

*Note: The CTS and RTS pins are optional and only needed for hardware flow control

2.1.2 Reference connection for the SPI host interface

Figure 2 illustrates the connections between the module and the host MCU using the SPI interface.

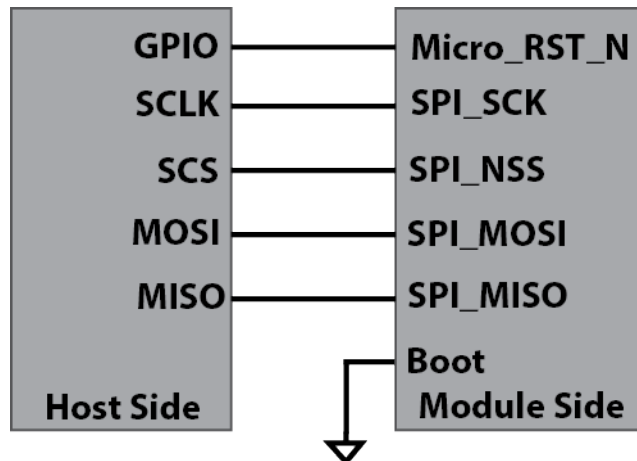


Figure 2 - SPI Host Interface Reference Diagram

*Note: The ALRT Interrupt to the Host is an optional signal.

2.2 Recommended host (customer) PCB pattern

Figure 3 illustrates the recommended host circuit board land pattern.

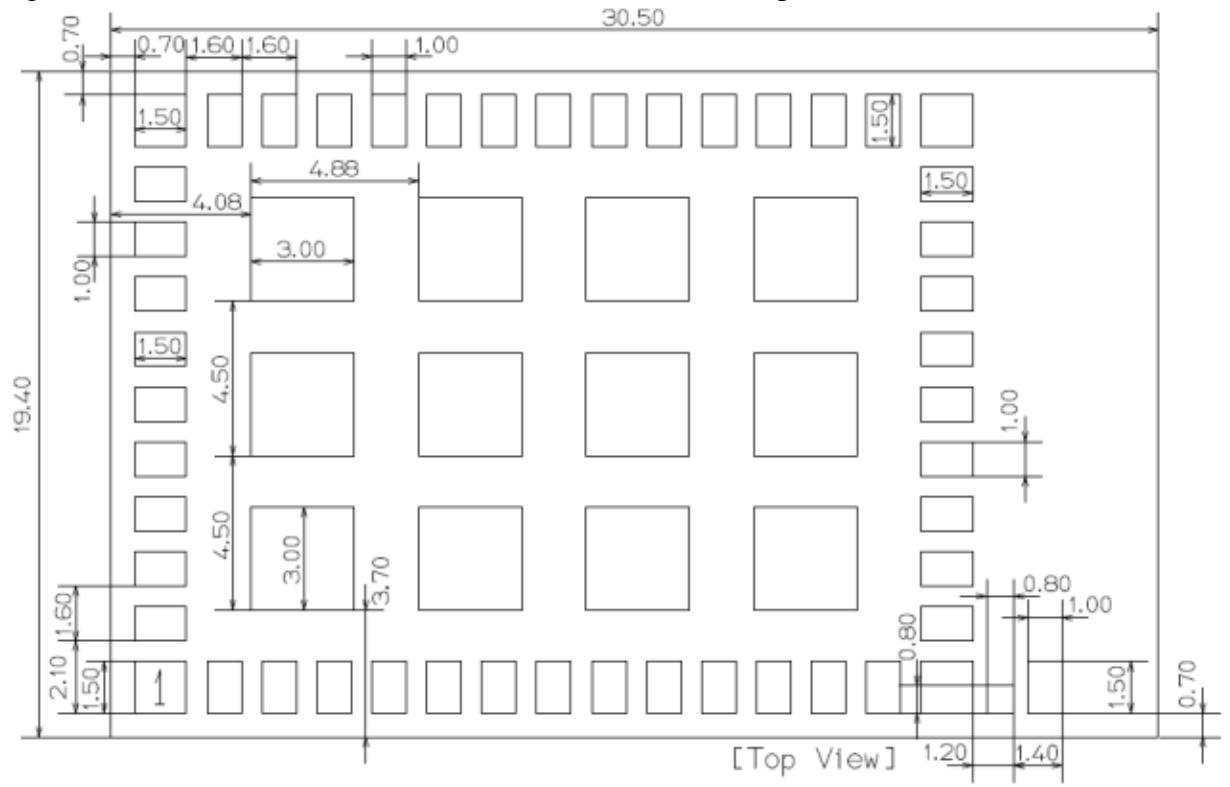


Figure 3 - Recommended Host (customer) PCB Pattern

2.3 Host PCB layout recommendations for on-board chip antenna version

The SN820X module has an onboard antenna and requires careful host PCB alignment beneath the module to maximize the radio's RF performance. Refer to Figure 4 for the requirements.

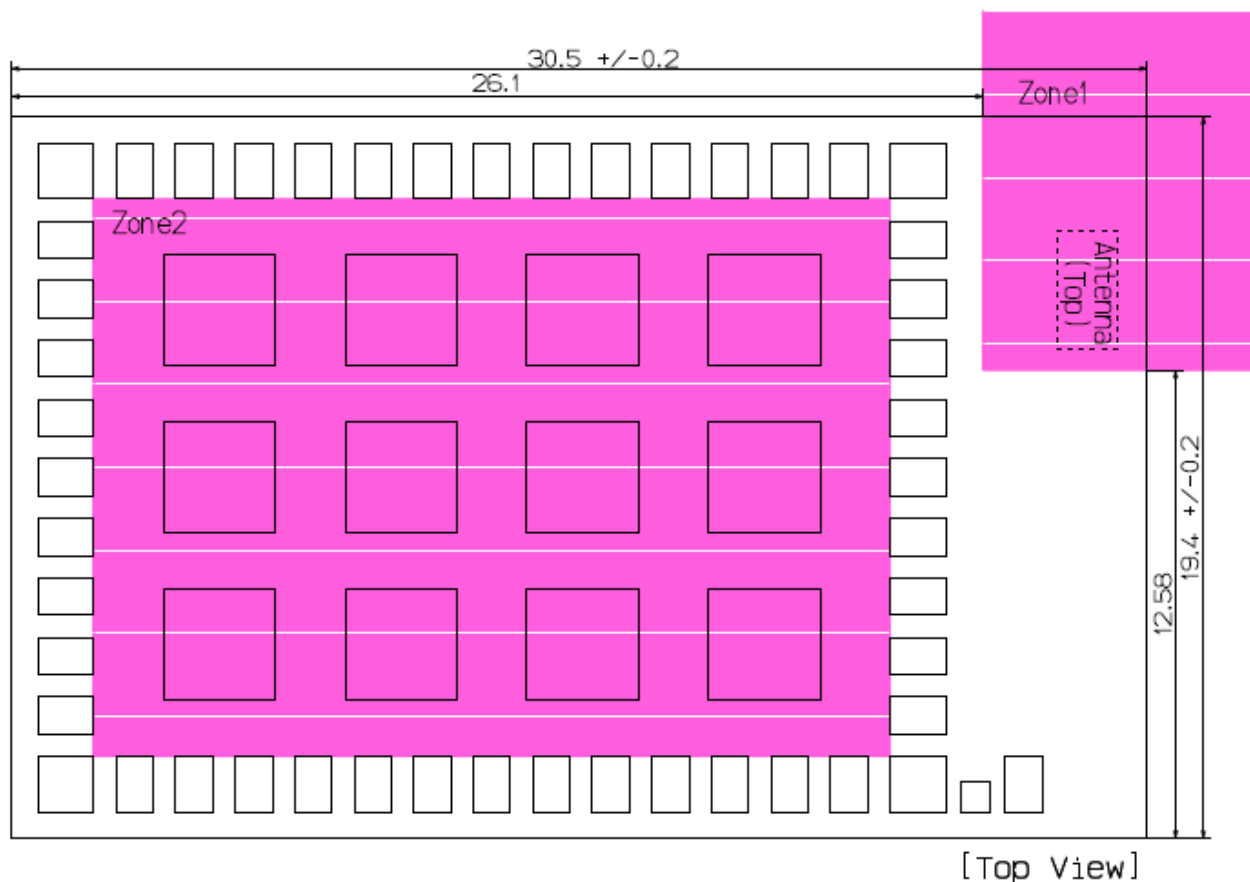


Figure 4 - Recommended Host Circuit Board Design beneath the SN820X

Notes:

1. Due to the surface mount antenna on the SN820X module, the area in 'Zone1' on all layers of the customer circuit board should be free of any metal objects. Specifically, there should be no ground plane, traces or metal shield case.
2. The area in 'Zone2' on the top layer of the customer circuit board should have ground only with no signal traces.

2.4 Module Location for on-board chip antenna version

For optimum EIRP (Effectively Isotropically Radiated Power), use the recommended module location on your host circuit board.

2.4.1 SN820X Location in the x-y plane

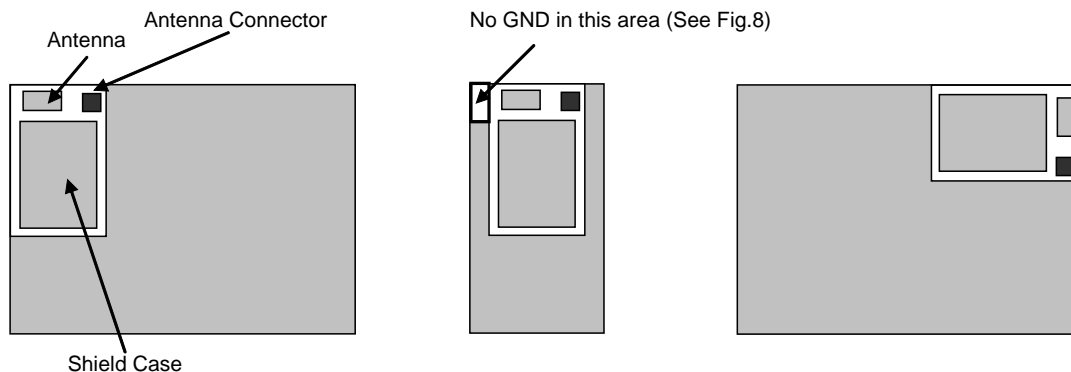


Figure 5 - Recommended Locations in the xy-plane

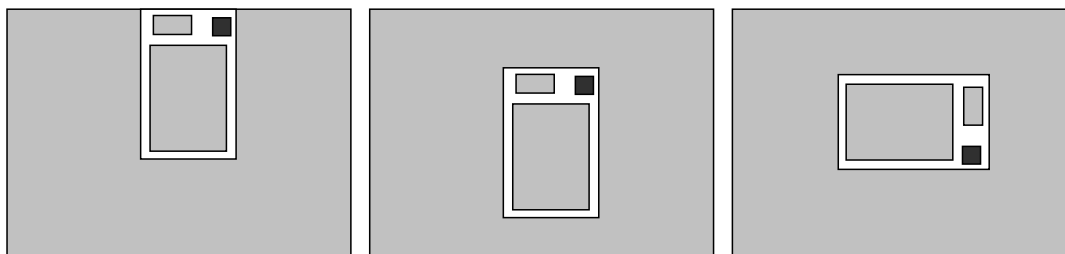


Figure 6 - Locations Not Recommended in the xy-plane

2.4.2 SN820X Location in the z-plane

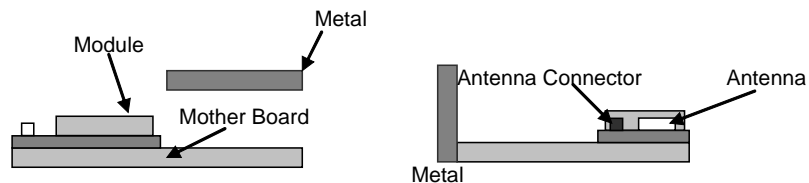


Figure 7 - Recommended Locations In z Plane

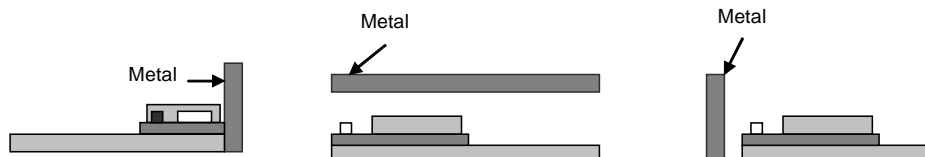


Figure 8 - Locations Not Recommended in xy-plane

3 Software Development Information

3.1 Software Offering Options

The SN820X offers two software options: the open source Broadcom WICED™ SDK and the Murata software package.

3.1.1 WICED SDK

WICED™ is a Broadcom development system that vastly reduces the effort required to add wireless connectivity to embedded devices. The SDK enables developers to quickly create network connected applications targeted for low-resource microcontrollers.

The WICED™ SDK includes:

- An open source build system and toolchain based on GNU make.
- A GUI IDE based on the Eclipse CDT that seamlessly integrates with a programmer and a single-step, thread-aware, debugger based on OpenOCD and gdb.
- A complete software stack that includes advanced security and networking features such as SSL/TLS, IPv4/IPv6 networking, and mDNS/Bonjour.
- Production ready example applications.

To use WICED™ SDK, follow these steps:

1. Contact modules@murata.com to get patch files that will match the module hardware with the WICED™ SDK, and
2. Register at Broadcom WICED™ website at: <http://www.broadcom.com/products/wiced/wifi/> to get the SDK installation package

3.1.2 Murata Software Package

Based on the Broadcom WICED™ solution, Murata offers a pre-built firmware/software package that makes host integration, wireless and peripheral control easier and reduces the amount of firmware programming required.

The Murata Simple Network Interface Controller (SNIC) protocol supports socket interface on both UART and SPI to host.

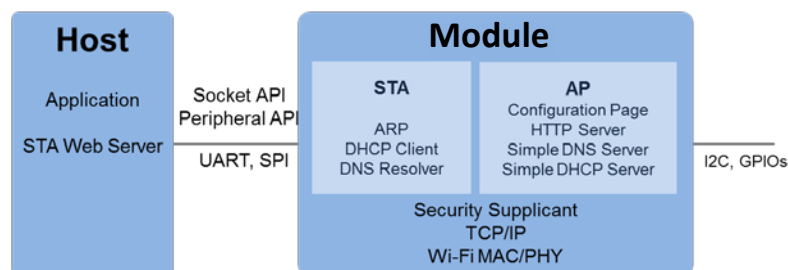


Figure 9 - SN820X SNIC Software Architecture Diagram

Murata's EZ Web Wizzard™ (EWW) software supports easy, custom web-based control to reduce cost on an additional host microcontroller.

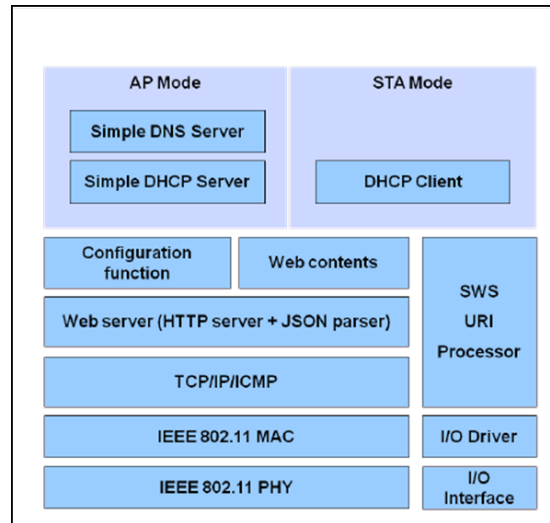


Figure 10 - SN820X EZ Web Wizzard Software Architecture Diagram

- Controls I/O interfaces through HTML, JavaScript and JSON
- Supports UART, I2C and GPIOs
- Supports wireless network configuration, JSON parser, HTTP server, TCP/IP network stack, and WiFi driver
- Enables creation of wireless IP-capable nodes

To access the software package, please purchase the Murata SN820X Development Kit.

3.2 Development Kit

To allow evaluation of the SN820x module as well as to facilitate and expedite application software development, Murata offers the SN820X Wi-Fi Network Controller Development Kit + ([see figure 11](#)). The kit includes:

- An SN820X Evaluation Board
- A mini USB cable
- A reference external antenna (for U.FL version only)
- A Quick Start Guide
- A CD containing the following:
 - EVK User Guide
 - Software User Guide
 - Software Interface Specification
 - Sample Source Code
 - Sample Application User Guide
 - USB PC Drivers
 - Murata Software Configuration and Development PC Tool



Figure 11 - Typical SN8200 Development Kit

3.3 Murata Software Update

Murata offers online software updates to customers who purchased the SN820X Development Kit. To access the software update, complete the online registration at <http://www.murata-ws.com/register.htm>. The SN820X Development Kit includes the required EVK Registration Code. Murata strongly recommends that all customers who purchase the SN820X Development Kit complete the online registration immediately in order to receive the latest software offerings and application notes.

4 Module Software Downloading

Because no single firmware can meet the requirements of all customers, Murata has several options that make the SN820X module family adaptable to many applications. This is why the modules are delivered with no application firmware pre-installed.

Finalize the firmware image, and then download the firmware to the module. For more details, please see reference [4].

5 Assembly Information

5.1 Lead-free soldering reflow profile

When attaching the SN820X module to its host PCB, use the recommended lead-free soldering reflow profile shown in the table & graph below.

The module is designed to withstand two reflows. Opposite side reflow is prohibited due to the weight of the module.

Table 2 - Reflow Profile Recommendation

Ramp up rate	3° C/second max
Maximum time maintained above 217° C	120 seconds
Peak temperature	250° C
Maximum time within 5° C of peak temperature	20 seconds
Ramp down rate	6° C/second max

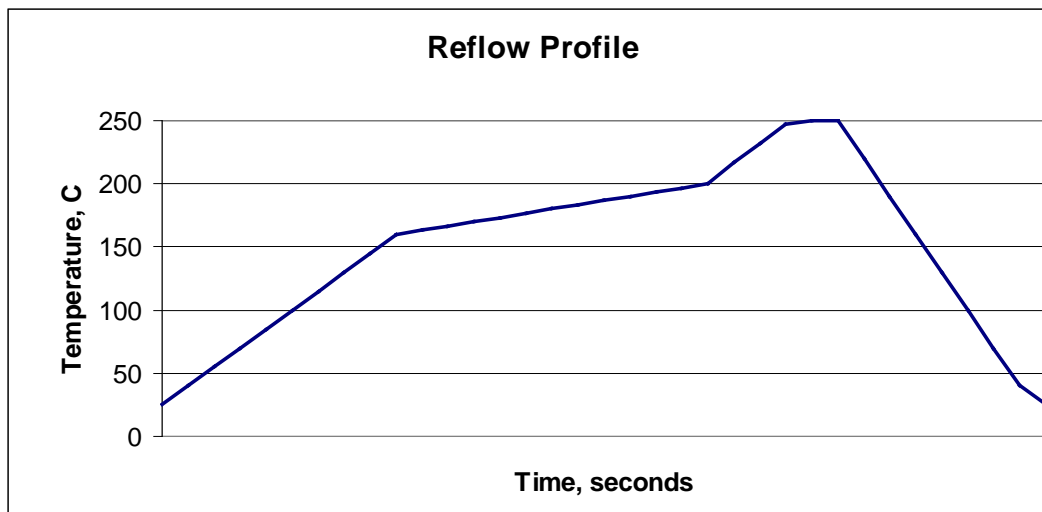


Figure 12 - Reflow Profile Pattern

6 Regulatory Information

The SN820X module family has obtained the certifications described below. **The antennas listed in the table below are approved for use with the UFL versions.**

Part Number	Vendor	Gain (dBi)	Type	Connector	Remarks
TRF-1002	Microchip	5.0	Omnidirectional	U.FL	For FCC/IC compliance
W1049B050	Pulse	2.0	Omnidirectional	U.FL	For FCC/IC and ETSI compliance

6.1 FCC Notice (USA)

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 FCC requires the OEM to be notified of any changes or modifications. Changes or modifications not expressly approved by SyChip, LLC could void the user's authority to operate the equipment. While an application of the SN820X module in a product is not required to obtain a new FCC authorization for the module, this does not preclude the possibility that some other form of authorization or testing may be required for that end product.

This device, using the integrated antenna, has been tested to comply with FCC CFR Part 15. The device meets the requirements for modular transmitter approval as detailed in the FCC public notice DA00.1407.

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, or consult the dealer or an experienced radio/TV technician for help.

6.2 FCC Labeling Requirements

When integrating the SN820X into a product, the FCC labeling requirements must be met. This includes a clearly visible label on the outside of the finished product specifying the SN820X FCC identifier (FCC ID: QPU8200) as well as the notice above. The exterior label can use wording such

as “Contains Transmitter Module FCC ID: QPU8200” or “Contains FCC ID: QPU8200” although any similar wording that expresses the same meaning may be used.

6.3 RF Exposure

This module has been certified for remote and base radio applications and is not intended to be operated within 20 cm of the body. If the module will be used for portable applications, the device must undergo SAR testing.

The following statement must be included as a CAUTION statement in manuals for the products to alert users on FCC RF exposure compliance:

“WARNING: To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operations at closer distances than this are not recommended.”

6.4 FCC Notices

IMPORTANT: The SN820X Wi-Fi Module has been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not expressly approved RFM could void the user's authority to operate the equipment.

IMPORTANT: OEMs must test final product to comply with unintentional radiators (FCC section 15.107 & 15.109) before declaring compliance of their final product to Part 15 of the FCC Rules.

6.5 IC Notice (Canada)

The term “IC” before the certification/registration number only signifies that the Industry Canada technical specifications were met.

Le terme “IC” devant le numéro de certification /d’enregistrement signifie seulement que les spécifications techniques Industrie Canada ont été respectées.

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.

Cet appareil est conforme avec Industrie Canada RSS standard exempts de licence (s). Son utilisation est soumise à Les deux conditions suivantes: (1) cet appareil ne peut pas provoquer d'interférences et (2) cet appareil doit accepter Toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement du dispositif.

This device complies with Health Canada’s Safety Code 6 / IC RSS-210. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada’s requirement. Information can be obtained at: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php

Cet appareil est conforme avec Santé Canada Code de sécurité 6 / IC RSS-210. Le programme d'installation de cet appareil doit s'assurer que les rayonnements RF n'est pas émis au-delà de l'exigence de Santé Canada. Les informations peuvent être obtenues: http://www.hc-sc.gc.ca/ewh-smt/pubs/radiation/radio_guide-lignes_direct-eng.php

6.6 IC Labeling Requirements

The host device should 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: 4523A-SN8200, where 4523A-SN8200 is the module's certification number.

6.7 CE Notice (Europe)

This device has been tested and certified for use in the European Union.

If this device is used in a product, the OEM has the responsibility to verify compliance of the final product to the EU standards. A Declaration of Conformity must be issued and kept on file as described in Annex II of the Radio and Telecommunications Terminal Equipment Directive.

6.8 CE Labeling Requirements

The ‘CE’ mark must be placed on the OEM product per the labeling requirements of the Directive. Given that the operating frequency band is not harmonized by a few European countries, the restriction or alert sign must be placed alongside the ‘CE’ mark as shown below. As of the date of this document, only France has a restriction. The restriction is that, if the radio is operated outdoors in the 2450-2483.5 MHz band, the power must be limited to 10 mW instead of 100 mW. The OEM must account for this and the product must have the alert mark. It does not require country notifications, however.



7 Technical Support Contact

For technical support, contact tech_sup@murata.com.

SyChip, LLC
4441 Sigma Road
Dallas, TX 75244
USA

Note: SyChip LLC is a subsidiary of Murata Electronics, North America

8 Disclaimer

Please read this notice before using the SN820X, SN820XUFL, SN8205, or SN8205UFL product.

1. Please note that the only warranty that SyChip LLC (“SyChip”) provides regarding the products is its conformance to the specifications provided herein. Accordingly, SyChip shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification.

SYCHIP HEREBY DISCLAIMS ALL OTHER WARRANTIES REGARDING THE PRODUCTS, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, THAT THEY ARE DEFECT-FREE, OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. YOU AGREE TO INDEMNIFY AND DEFEND SYCHIP AND ITS AFFILIATES AGAINST ALL CLAIMS, DAMAGES, COSTS AND EXPENSES THAT MAY BE INCURRED, INCLUDING WITHOUT LIMITATION, ATTORNEY FEES AND COSTS, DUE TO THE USE OF PRODUCTS.

2. The product is designed and manufactured for general applications, and not for any particular application, so testing and use of the product shall be conducted at your own risk and responsibility. Specifically, please observe the following:

- i) Please conduct validation and verification of the products in actual condition of mounting and operating environment before commercial shipment of the equipment.
- ii) Please pay attention to minimize any mechanical vibration or shock, not to drop the product or a substrate that contains the product during transportation.
- iii) Since the application of static electricity or overvoltage may cause a defect in the product or deterioration of its reliability, caution must be taken against exposure to any static electricity generated by electrified items such as work benches, soldering irons, tools, carrying containers, etc.
- iv) Caution shall be taken to avoid overstress to the product during and after the soldering process.
- v) Since the applied soldering method may deteriorate the reliability, thorough evaluation is recommended.
- vi) In case the product is to be used in equipment or electric circuit that requires high safety or reliability function or performance, sufficient reliability evaluation checks for safety shall be performed before commercial shipment and moreover, due consideration to install a protective circuit is strongly recommended at customer's design stage. Please provide an appropriate fail-safe function on your product to prevent any damages that may be caused by the abnormal function or the failure of our product.

Notwithstanding the foregoing, the product shall not be used in any application listed below which requires especially high reliability for the prevention of such defect as may directly cause damage to the third party's life, body or property.

- Aircraft equipment
- Aerospace equipment
- Undersea equipment
- Power plant control equipment
- Medical equipment
- Transportation equipment (vehicles, trains, ships, etc.)
- Traffic signal equipment
- Disaster prevention / crime prevention equipment
- Application of similar complexity and/or reliability requirements to the applications listed in the above.

3. SyChip's warranty as provided in Clause 1 above that the products comply with descriptions expressly specified in the specifications shall be effective for a period of six (6) months from the date of delivery. SyChip shall not be liable for any defects that occur in dry packed products that are installed more than six (6) months after shipment.

SyChip's liability under this warranty shall be limited to products that are returned during the warranty period to the address designated by SyChip and that are determined by SyChip not to conform to such warranty. If SyChip elects to repair or replace such products, SyChip shall have reasonable time to repair such products or provide replacements. Repaired products shall be warranted for the remainder of the original warranty period. Replaced products shall be warranted for a new full warranty period.

For avoidance of doubt, SyChip shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than SyChip including improper installation or testing, or for any products that have been altered or modified in any way by an entity other than SyChip. Moreover, SyChip shall not be liable for any defects that result from your or third party's design, specifications or instructions for such products.

4. Testing and other quality control techniques are used to the extent SyChip deems necessary. Unless mandated by government requirements, SyChip does not necessarily test all parameters of each product.

5. End of Life - Please note that we may discontinue the manufacture of products, due to reasons such as, but not limited to, end of supply of materials and/or components from our suppliers.