SN8000/SN8000UFL Wi-Fi Module

User Manual

Version: 1.1

November 25, 2013

Revision History

Revision	Date	Author	Change Description
1.0	11/11/13	R. Willett	Initial version
1.2	11/25/13	R. Willett	Removed SyChip logo; revised copyright notice; revised tech support information; deleted Chap. 7 "Disclaimer;" modified text in section 2.5.2, Fig. 8, Fig. 9

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1 Introduction

This user manual addresses the topics that are important for employing the SN8000/SN8000UFL Module in design, software development, regulatory certification and device manufacturing.

1.1 SN8000 Wi-Fi Module Configuration

The SN8000 Module is available in two configurations, SN8000 with on-board chip antenna and SN8000UFL with U.FL connector.

Table 1 SN8000/SN8000UFL Wi-Fi Module Configuration

Model #	P/N	Antenna Configuration
SN8000	88-00153-00	On-board chip antenna
SN8000UFL	88-00153-02	U.FL connector

1.2 Acronyms

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
SDIO	Secure Digital Input Output

1.3 Reference

[1] SN8000/SN8000UFL Wi-Fi Module Datasheet, Murata

2 Hardware Application Information

2.1 Host interfaces

2.1.1 Reference connection for SDIO host interface

Figure 1 illustrates the reference connections of the module and the host MCU using the SDIO interface.

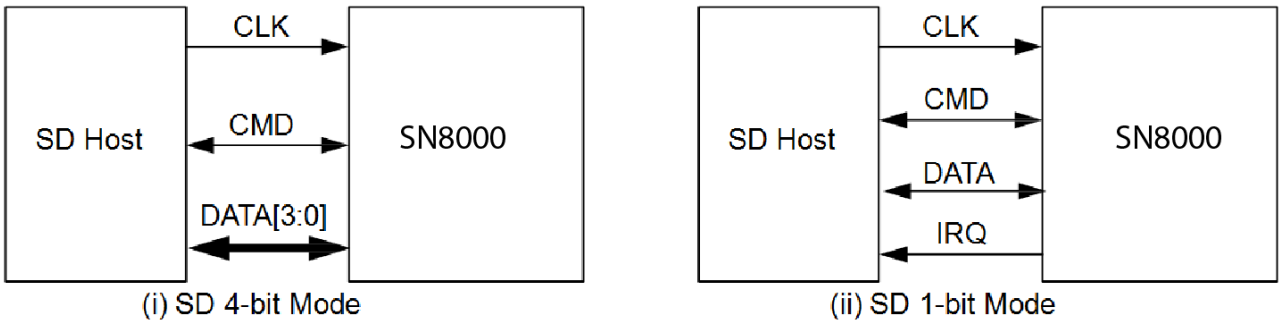


Figure 1 - SDIO Host Interface Reference Diagram

2.2 Antenna

2.2.1 Comparison of different antenna option

The table below shows the comparison of the module transmit power with different antenna configuration.

Table 2 SN8000/SN8000UFL Transmit Power Comparison with Different Antenna Options

Module	Part Number	Vendor	Gain (dBi)	Antenna Type	Connector	Module EIRP (Typical)
SN8000	On-board Chip antenna		0	Omnidirectional	None	18.5 dBm
SN8000UFL	TRF-1002	Microchip	5	Omnidirectional	U.FL	22 dBm
SN8000UFL	W1049B050	Pulse	2	Omnidirectional	U.FL	19 dBm
SN8000UFL	W3525B100	Pulse	2	Omnidirectional	U.FL	19 dBm

2.2.2 SN8000 on-board antenna characteristics

2.2.2.1 Measurement direction

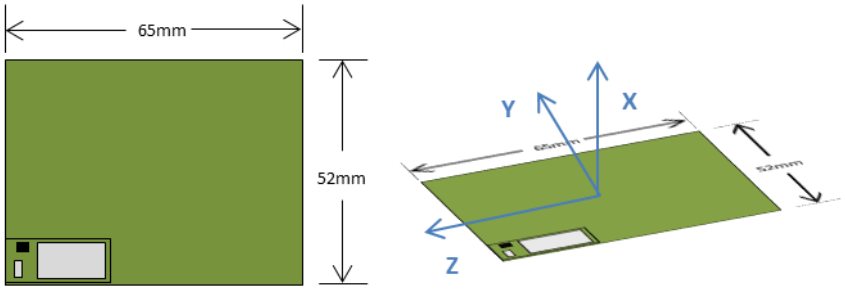
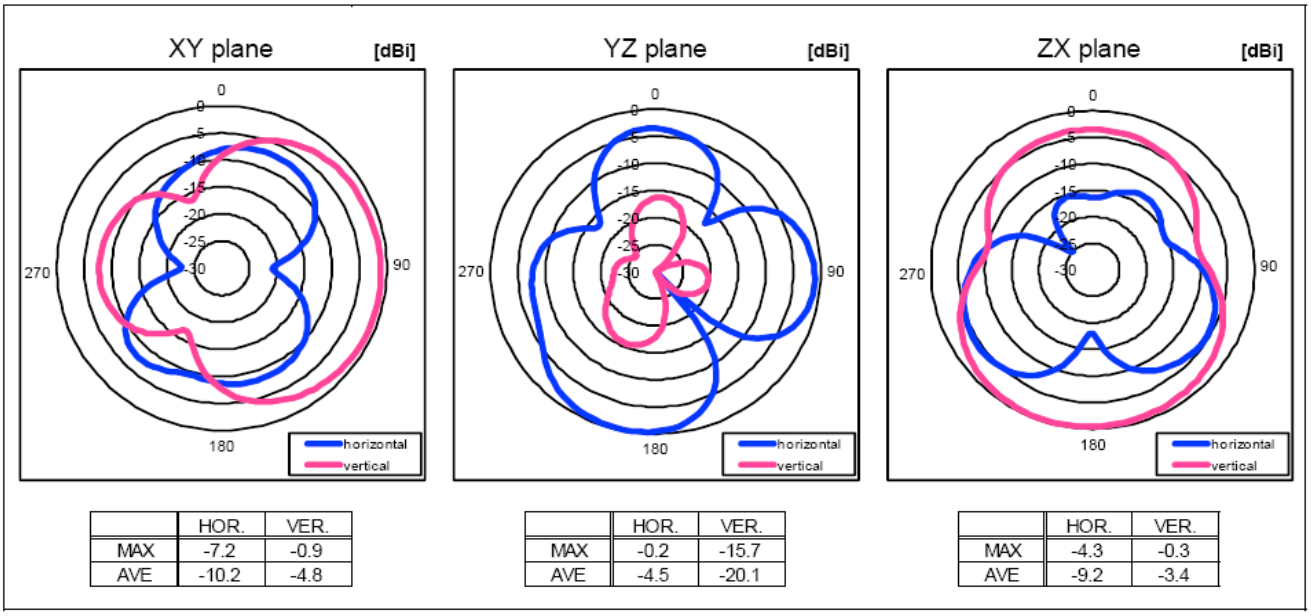


Figure 2 SN8000 on-board antenna measurement board and orientation

2.2.2.2 Radiation Pattern

The radiation pattern is measured by using the test board described in Figure 2.
The radiation pattern depends on the environment around SN8000.



	HOR.	VER.
MAX	-7.2	-0.9
AVE	-10.2	-4.8

	HOR.	VER.
MAX	-0.2	-15.7
AVE	-4.5	-20.1

	HOR.	VER.
MAX	-4.3	-0.3
AVE	-9.2	-3.4

Figure 3 SN8000 on-board antenna radiation pattern on test board

2.3 Recommended host (customer) PCB pattern

Figure 3 illustrates the recommended host circuit board land pattern.
All dimensions are in millimeters.

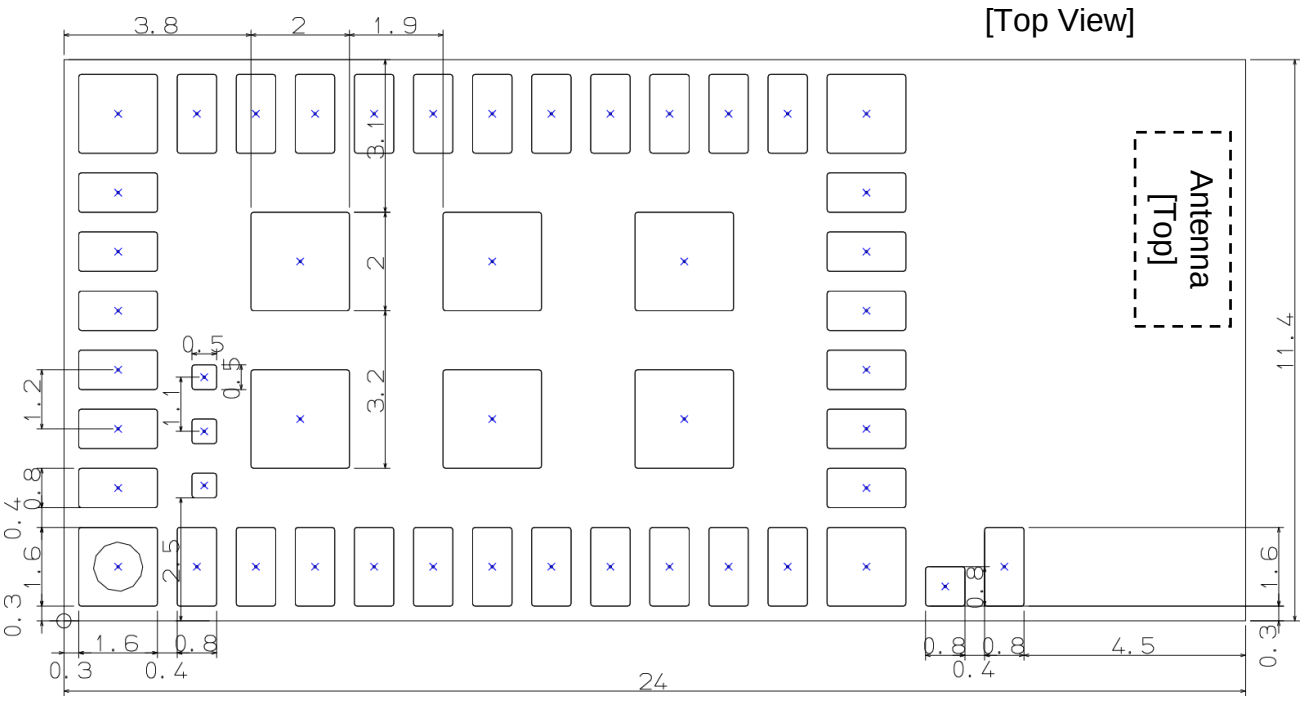


Figure 4 - Recommended Host (customer) PCB Pattern

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

The SN8000 module has an onboard antenna and requires careful host PCB alignment beneath the module to maximize the radio's RF performance. Refer to Figure 5 for the requirements.

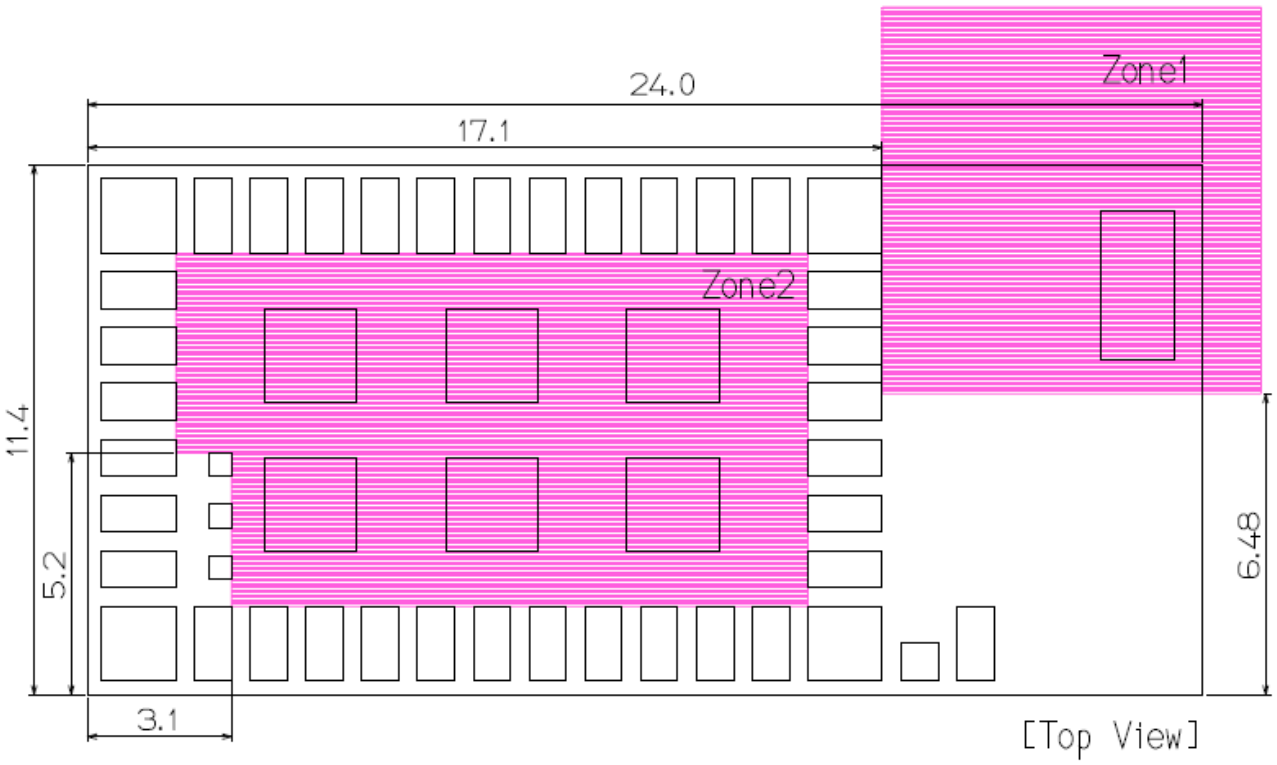


Figure 5 - Recommended Host Circuit Board Design beneath the SN8000

Notes:

1. Due to the surface mount antenna on the SN8000 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.

2.5 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.

2.5.1 SN8000 Location in the y-z plane

See Figure 2 for the definition of y-z plane.

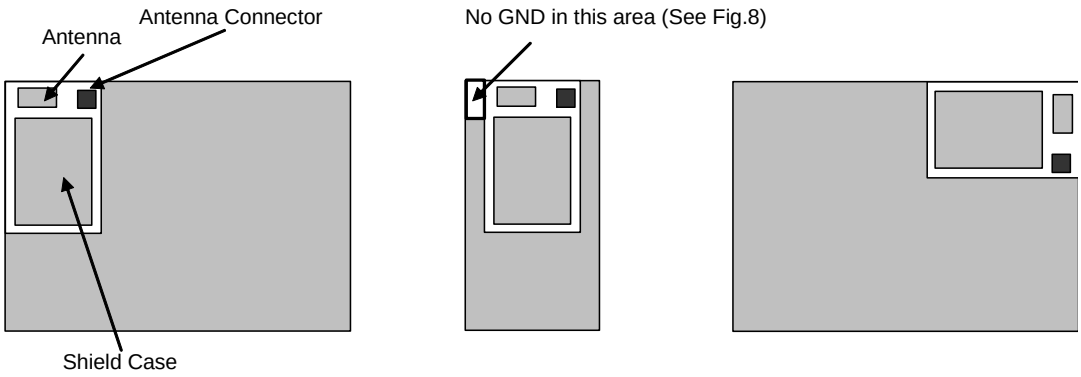


Figure 6 - Recommended Locations in the yz-plane

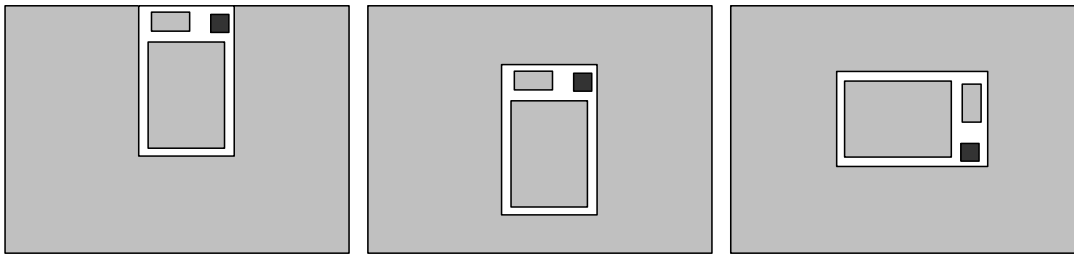


Figure 7 - Locations Not Recommended in the yz-plane

2.5.2 Host board layout surrounding SN8000

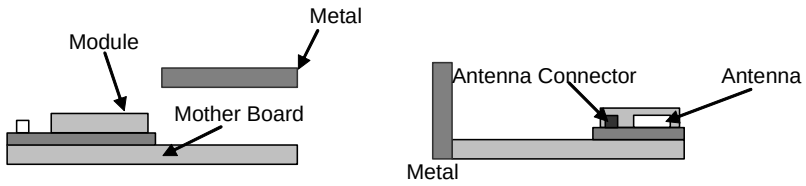


Figure 8 - Recommended layout configuration

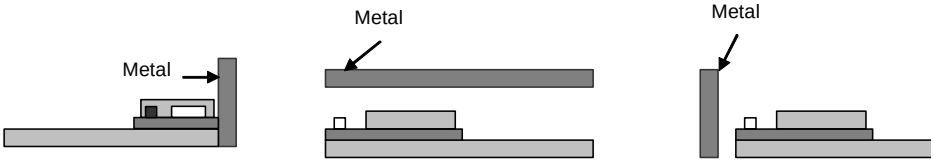


Figure 9 - Layout configuration Not Recommended

3 Software Development Information

3.1 Software Offering Options

The SN8000/SN8000UFL modules are compatible with Broadcom WICED™ SDK.

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 tool chain 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

3.2 Development Kit

To allow evaluation of the SN8000/SN8000UFL module as well as to facilitate and expedite application software development, Murata offers the SN8000/SN8000UFL Wi-Fi Module Development Kit (see TBD figure 10). The kit includes:

- An SN8000/8000UFL 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
    - WICED SDK platform patch file
    - Murata test firmware

Figure 10 SN8000/SN8000UFL Development Kit

3.3 Murata Software Update

Murata offers online software updates to customers who purchased the SN8000/SN8000UFL Development Kit. To access the document update, complete the online registration at http://www.murata-ws.com/register.htm. The SN8000/SN8000UFL Development Kit includes the required EVK Registration Code. Murata recommends that all customers who purchase the SN8000/SN8000UFL Development Kit complete the online registration immediately in order to receive the latest software offerings and application notes.

4 Assembly Information

4.1 Lead-free soldering reflow profile

When attaching the SN8000/SN8000UFL 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 3 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

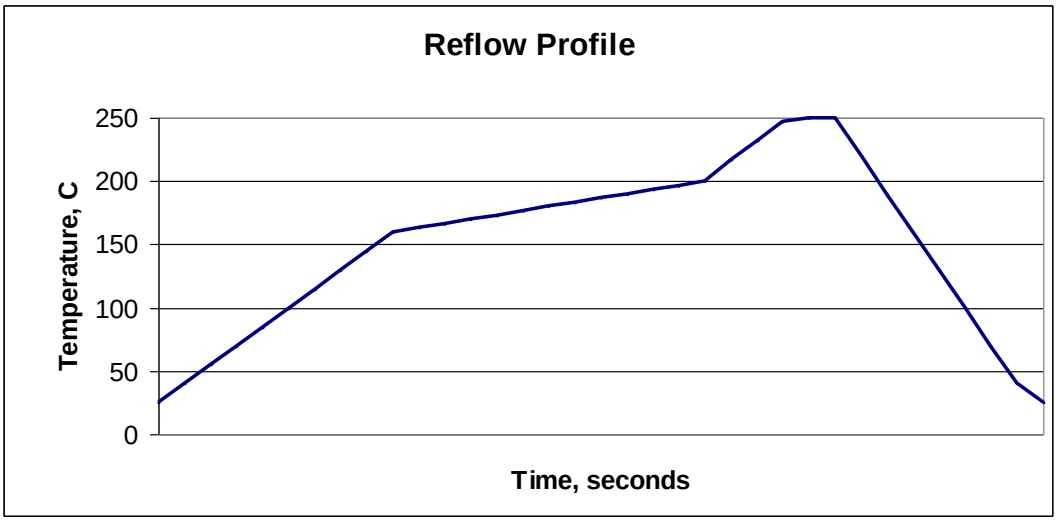


Figure 11 - Reflow Profile Pattern

5 Regulatory Information

Both SN8000 and SN8000UFL have obtained the certifications described below. ***SN8000UFL has been certified with a particular external antenna (See Table 15).***

Table 4 External Antenna to comply with regulation (Only SN8000UFL)

Part Number	Vendor	Gain (dBi)	Type	Connector	Remarks
TRF-1002	Microchip	5.0	Omnidirectional	U.FL	Necessary for FCC/IC compliance only.
W1049B050	Pulse	2.0	Omnidirectional	U.FL	Necessary for ETSI (or FCC/IC) compliance.
W3525B100	Pulse	2.0	Omnidirectional	U.FL	

5.1 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 that any changes or modifications not expressly approved by Murata may void the user's authority to operate the equipment. While an application of the SN8000 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 rockyinterference 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.

5.2 FCC Labeling Requirements

When integrating the SN8000/SN8000UFL 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 SN8000/SN8000UFL FCC identifier (FCC ID: QPU8000) as well as the notice above. The exterior

label can use wording such as “Contains Transmitter Module FCC ID: QPU8000” or “Contains FCC ID: QPU8000” although any similar wording that expresses the same meaning may be used.

5.3 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.”

5.4 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-semt/pubs/radiation/radio_guide-lignes_direct-eng.php

5.5 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-SN8000, where 4523A-SN8000 is the module’s certification number.

5.6 ESTI compliance (Europe)

This device has been tested for use in the European Union. Both SN8000 and SN8000UFL comply with the following regulation test.

ETSI EN300 328, Ver. 1.8.1
ETSI EN301.489 - 17

If this device is used in a product, the OEM has 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 Technical Support Contact

For technical support, please contact us at tech_sup@murata.com.

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Dallas, TX 75244
USA