Skywire Nano Global 4G LTE-M Embedded Cellular Modem Datasheet

NimbeLink Corp.

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Table of Contents

1. Introduction

1.1 Scope

This document serves as the hardware datasheet for the NL-SWN-LTE-NRF9160 Skywire Nano modem.

1.2 Contact Information

NimbeLink's goal is to make integrating Skywire modems into end-user applications as easy as possible. Please send any feedback, documentation requests, or technical support questions to NimbeLink's product support team at:

product.support@nimbelink.com

For purchasing information, please visit the "Part Ordering Information" section on the modem's product page:

https://nimbelink.com/products/4g-lte-m-global-nano/

Any additional sales questions or requests for quotation can be directed to NimbeLink's sales team at:

sales@nimbelink.com

1.3 Orderable Part Numbers

Orderable Device	Operating Temperature	4G LTE-M Bands	4G LTE NBIoT Bands
NL-SWN-LTE-NRF9160	-40˚C to +85˚C	B1, B2, B3, B4, B5, B8, B12, B13, B14, B17, B18, B19, B20, B25, B26, B28, B66	B1, B2, B3, B4, B5, B8, B12, B13, B17, B19, B20, B25, B26, B28, B66

1.4 Additional Resources

- Skywire Nano NL-SWN-LTE-NRF9160 Embedded Modem Product Page
- Skywire Nano NL-SWN-LTE-NRF9160 AT Command Manual
- Skywire Nano NL-SWN-LTE-NRF9160 Application Notes
- Skywire Nano NL-SWN-LTE-NRF9160 Mechanical Model (STEP)
- Skywire Nano Dev Kit User Manual

2. Product Description

2.1 Device Information

The NL-SWN-LTE-NRF9160 Skywire Nano is an embedded cellular modem with an integrated Arm® Cortex®-M33 CPU that includes 256 KB of RAM and 1 MB of flash. The modem provides low-power LTE and GPS connectivity, and is compatible with most global LTE-M and NB-IoT cellular networks.

The Skywire Nano has many useful serial and analog peripherals integrated into the modem, including: UART, SPI, I²C, PWM and a 14-bit ADC with up to eight input channels. The modem offers 31 GPIO pins with support for flexible peripheral mapping, simplifying the development process for system designers.

Featuring a 23 mm x 16.5 mm form factor, the Skywire Nano is an ideal solution for designers seeking ultra low-power LTE connectivity and a robust Arm® Cortex®-M33 CPU in a small, cost-effective package.

2.2 Feature Brief

The table below contains a list of noteworthy device features and specifications:

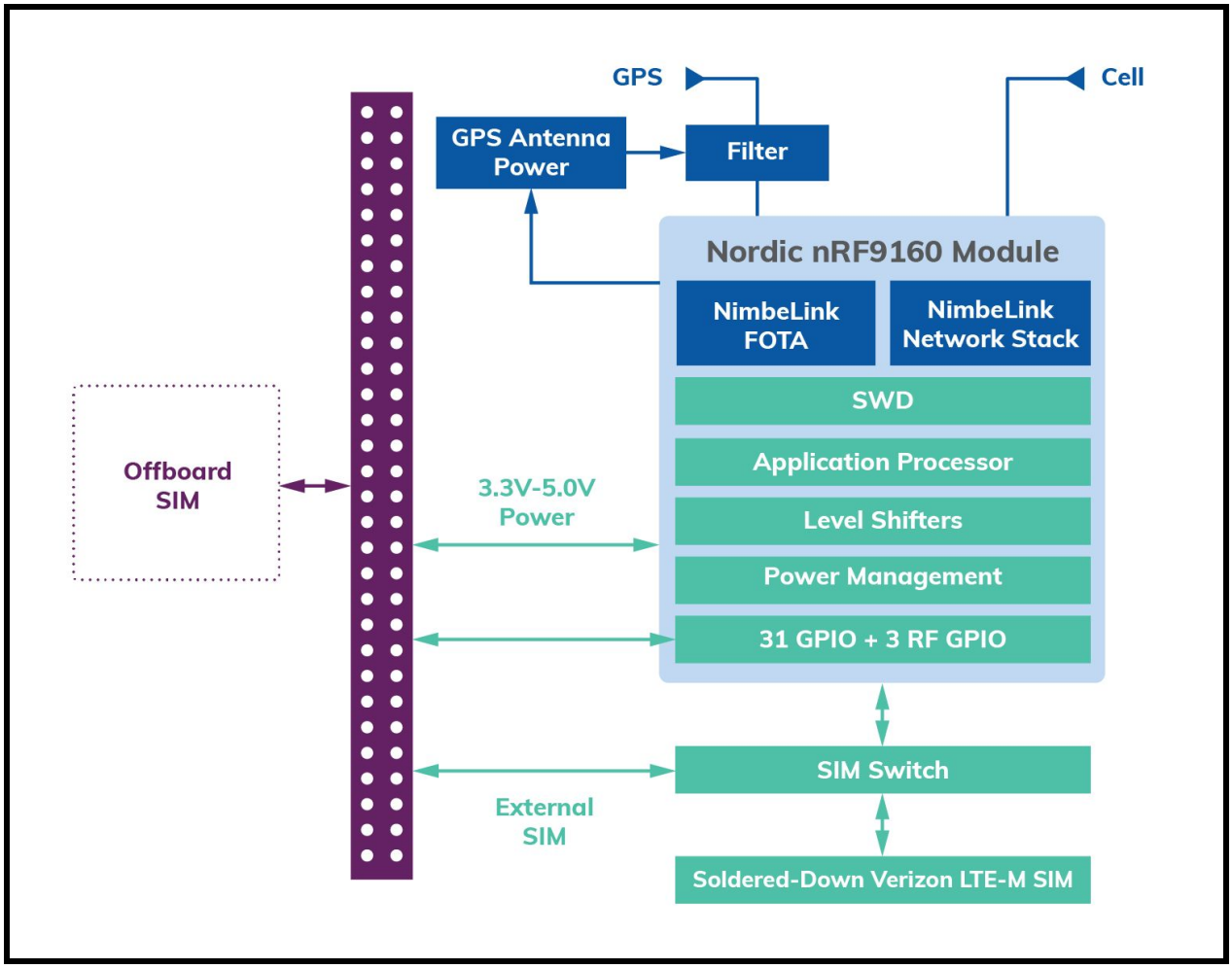
Feature / Specification	Description
Application Processor	**CPU:** 64 MHz Arm® Cortex®-M33
RAM and Flash	**RAM:** 256 KB **Flash**: 1 MB
Application Processor Peripherals	**Serial Peripherals:** 4 x SPI, 4 x UART, 4 x Two Wire Interface (TWI), I²C, I²S **Analog Peripherals:** PDM, PWM, 8/10/12-bit ADC with 8 input channels and 200 kHz sampling rate (up to 14-bit resolution when oversampling) **Timers:** 3 x Timers, 2 x RTC Watchdog Timers
I/O Pins	**GPIO:** 31 x GPIO with flexible mapping for peripherals, 3 x 1.8V referenced GPIO for implementing dynamic antenna tuning or extra I/O
Internet Protocols	**Transport Layer Protocols:** TCP/UDP, TLS/DTLS

Feature / Specification	Description
Cellular Capabilities	**Cellular Technologies:** LTE-M, LTE CAT-NB1, and LTE CAT-NB2 **Internet Protocols:** IPv4, IPv6 **SMS:** PDU and Text Mode **Low Power Modes:** PSM, eDRX **Operating Frequency Range:** 699 MHz to 1980 MHz **Cellular Operation Mode:** HD-FDD **RF Output Power:** -40 dBm to +23 dBm
LTE-M Specifications	**LTE-M Bands:** B1, B2, B3, B4, B5, B8, B12, B13, B14, B17, B18, B19, B20, B25, B26, B28, B66 **Low Band RX Sensitivity:** -108 dBm **Midband Rx Sensitivity:** -107 dBm **Uplink Speed:** 375 Kbps **Downlink Speed:** 300 Kbps
LTE CAT-NB1 and LTE CAT-NB2 Specifications	**LTE CAT-NB1 and LTE CAT-NB2 Bands:** B1, B2, B3, B4, B5, B8, B12, B13, B17, B19, B20, B25, B26, B28, B66 **RX Sensitivity:** -114 dBm **Uplink Speed:** 70 Kbps **Downlink Speed:** 32 Kbps
SIM Specification	**Soldered-Down SIM:** Verizon LTE-M eSIM integrated into the modem **External Sim Interface:** Support for an external SIM interface
Cellular Certifications	**PTCRB:** In Progress **AT&T:** In Progress **Verizon ODI:** In Progress **GCF:** In Progress

Feature / Specification	Description
GPS Specifications	**GPS Band:** GPS L1 C/A **GPS Center Frequency:** 1575.42 MHz **Sensitivity, Cold Start:** -142 dBm **Sensitivity, Hot Start:** -145 dBm **Sensitivity, Tracking:** -151 dBm **Cold Start TTFF:** TBD **Hot Start TTFF:** TBD
Power Supply Inputs	**Supply Voltage (VCC):** 3.3V to 5.0V **Typical Value:** 3.3V or 5V **GPIO Reference Voltage (VCC_GPIO):** 1.8V to 3.6V **Typical Value:** 1.8V or 3.3V
Typical Power Consumption	**TBD**
Physical Characteristics	**Dimensions (unmated):** 0.906" x 0.650" x 0.157" (23.00 mm x 16.5 mm x 4 mm) **Dimensions (mated):** 0.906" x 0.650" x 0.172" (23.00 mm x 16.50 mm x 4.36 mm) **Mass:** 2 grams (approx.)
Environmental Conditions	**Operating / Storage Temperature Range:** -40 ˚C to 85 ˚C **Humidity Range:** 20 %RH to 90 %RH

2.3 Block Diagram

The figure below depicts the block diagram of the NL-SWN-LTE-NRF9160:



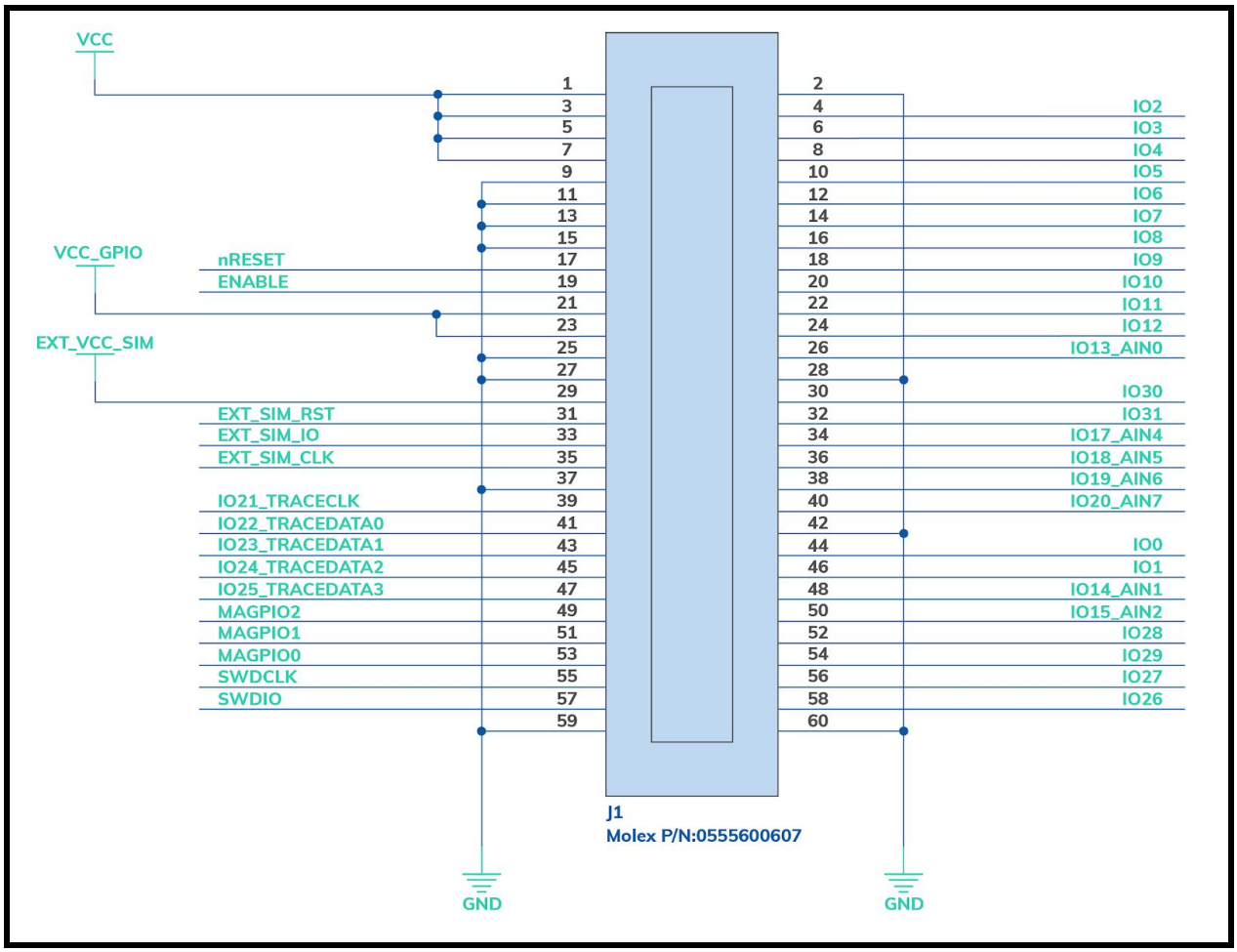
3. Device Specifications

3.1 Device Connectors

3.1.1 60-pin Connector (J1)

The Skywire Nano interface utilizes a single 60-pin Molex connector to mate the modem to a baseboard. The female side of the mating connector pair is populated on the Skywire Nano (Molex P/N: 0547220604).

The male side of the mating connector pair (Molex P/N: 0555600607) is placed on the baseboard that is interfacing with the modem. The male connector must be used by all system designers, and the pinout depicted below must be adhered to strictly and completely on all baseboards:

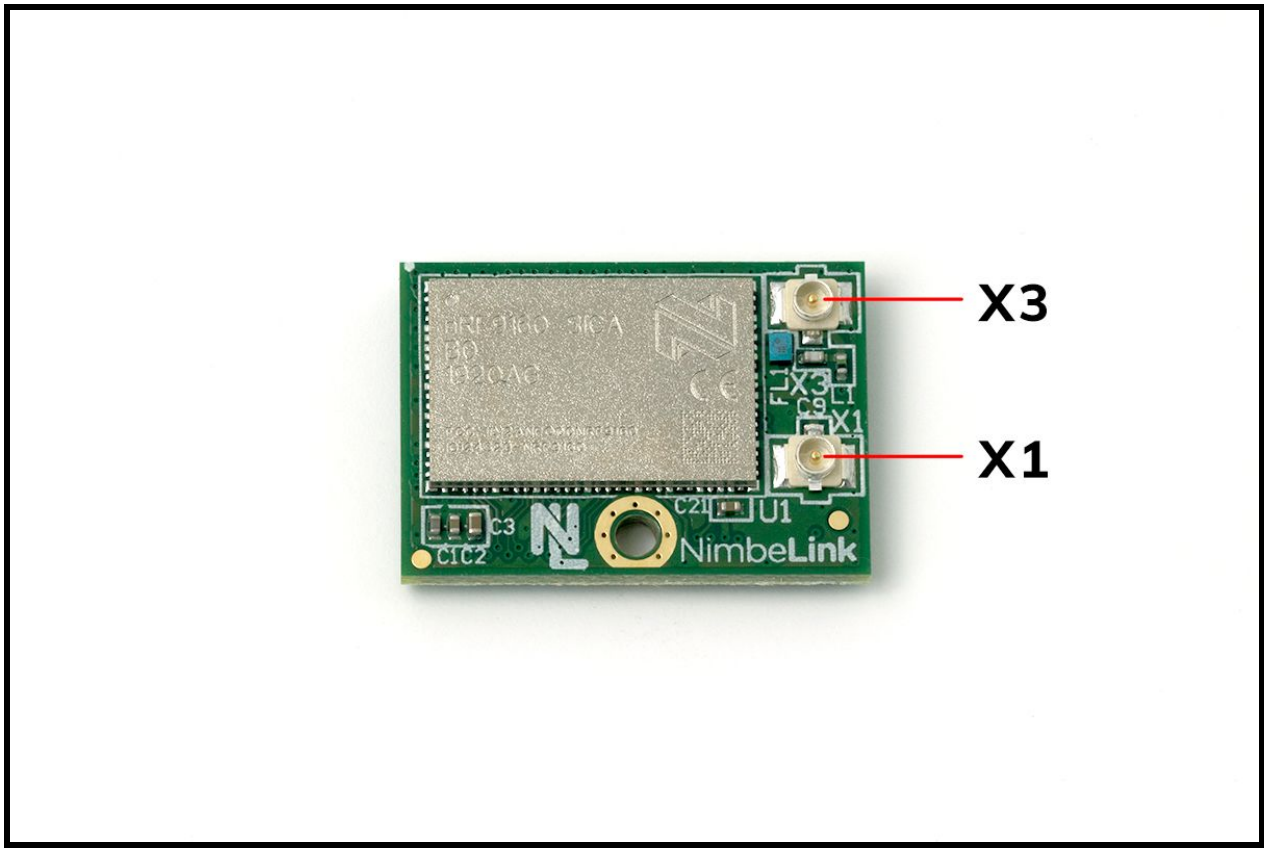


3.1.2 U.FL Antenna Ports

The modem has two U.FL connectors, X1 and X3, that are used to connect to external antennas for the cellular interface, and the GPS interface, respectively.

Connector Designator	Description	Location
X1	Cellular Antenna Connection	Top Side
X3	GPS Antenna Connection	

The image below depicts the location of each of the above antenna ports on the Skywire Nano:



3.2 Electrical Specifications

Section 3.2 contains relevant electrical specifications for the modem and each pin on the 60-pin connector, J1.

3.2.1 Absolute Maximum and Minimum Ratings

To avoid potential damage to the modem, ensure that all voltages applied to the modem pins do not fall outside of the ranges specified by the maximum and minimum ratings:

Pin Type	Modem Pin(s)		Min. Rating	Max. Rating
Ground Input	GND			0V
Power Supply Input	VCC		-0.3V	5.5V
I/O Reference Voltage Input	VCC_GPIO		-0.3V	3.9V
nRESET Signal	nRESET		-0.3V	VCC_GPIO + 0.3V
1V8 Referenced I/O	MAGPIO2, MAGPIO1, MAGPIO0		-0.3V	1.9 V
VCC_GPIO Referenced I/O	All other input and I/O pins.	VCC_GPIO ≤ 3.6V	-0.3 V	VCC_GPIO + 0.3V
		VCC_GPIO > 3.6V	-0.3V	3.9V

3.2.2 Pin Types

The table below contains a legend for the abbreviations used for the pin types throughout this datasheet:

I/O Type	Description
PI	Power Input
PO	Power Output
AI	Analog Input
DI	Digital Input
DO	Digital Output
IO	Digital Input/Output

3.2.3 Recommended Operating Conditions

The following tables contain recommended operating conditions for every pin on connector J1.

3.2.3.1 Power Input Pins

The Skywire Nano has 12 ground pins, 4 VCC pins, and 2 VCC_GPIO pins that must be connected to the baseboard.

Pin #	Name	Type	Notes	Min.	Typ.	Max.
2, 9, 11, 13, 15, 25, 27, 28, 37, 42, 59, 60	GND	PI	Ground Pins		0V	
1, 3, 5, 7	VCC	PI	Main Power Supply Pins	3.3V	3.3V or 5.0V	5.0V
21, 23	VCC_GPIO	PI	Modem IO Voltage Input Pins	1.8V	1.8V or 3.3V	3.6V

3.2.3.2 ENABLE and nRESET Pins

The Skywire Nano has an ENABLE pin and an nRESET pin that control the power-on and reset functionality of the modem. These pins must be connected to the baseboard.

Pin #	Name	Type	Notes	Min.	Typ.	Max.
17	nRESET	DI	Must be driven with an open-drain output. Never drive high. Pulled up to 2.2V on the cellular module.	**VIL:** 0V to 0.4V		
19	ENABLE	DI	Tie to VCC with a 10k resistor to enable modem.	**VIL:** 0V to 0.4V	VCC	**VIH:** 1.2V to VCC

3.2.3.3 SWD Interface Pins

The Skywire Nano has an SWD interface that is used to program and debug the integrated application processor. These pins must be connected to the baseboard.

Pin #	Name	Type	Notes	Min.	Typ.	Max.
55	SWDCLK	DI	SWD interface clock signal. Internally pulled up.	**VIL:** 0V to 0.3 * VCC_GPIO		**VIH:** 0.7 * VCC_GPIO to VCC_GPIO
57	SWDIO	IO	SWD I/O pin. Internally pulled-up.	**VIL:** 0V to 0.3 * VCC_GPIO **VOL:** 0V to 0.4V		**VIH:** 0.7 * VCC_GPIO to VCC_GPIO **VOH:** VCC_GPIO - 0.4 V to VCC_GPIO

3.2.3.4 External SIM Interface Pins

The Skywire Nano features a soldered-down Verizon SIM on the modem, as well as an external SIM interface. NimbeLink recommends connecting these pins to a SIM card slot or another soldered-down SIM on the baseboard, but it is not required.

Pin #	Name	Type	Notes	Min.	Typ.	Max.
29	EXT_VCC_SIM	PO	External SIM Supply Voltage Pin	1.65V	1.8V	1.95V
31	EXT_SIM_RST	DO	External SIM reset signal. 1.8V referenced.	**VOL:** 0V to 0.27V		**VOH:** 1.26V to 1.8V
33	EXT_SIM_IO	IO	External SIM interface IO signal. 1.8V referenced.	**VOL, VIL:** 0V to 0.27V		**VOH, VIH:** 1.26V to 1.8V
35	EXT_SIM_CLK	DO	External SIM clock output. 1.8V ref'd.	**VOL:** 0V to 0.27V		**VOH:** 1.26V to 1.8V

3.2.3.5 Analog Input Pins

The Skywire Nano has 7 analog input pins available for use. These pins can also be used as digital I/O.

Pin #	Name	Type	Notes	Min.	Typ.	Max.
26	IO13_AIN0	AI, IO	Analog input pin 0 or digital I/O.	0V		VCC_GPIO
48	IO14_AIN1	AI, IO	Analog input pin 1 or digital I/O.			
49	IO15_AIN2	AI, IO	Analog input pin 2 or digital I/O.			
34	IO17_AIN4	AI, IO	Analog input pin 4 or digital I/O.			
36	IO18_AIN5	AI, IO	Analog input pin 5 or digital I/O.			
38	IO19_AIN6	AI, IO	Analog input pin 6 or digital I/O.			
40	IO20_AIN7	AI, IO	Analog input pin 7 or digital I/O.			

3.2.3.6 Trace and Debug Pins

The Skywire Nano has a serial debug and trace interface that allows the user to debug code running on the modem's Arm® Cortex®-M33 application processor. These pins can also be used as digital I/O.

Pin #	Name	Type	Notes	Min.	Typ.	Max.
39	IO21_TRACECLK	IO	Trace bus clock or digital I/O.	**VIL:** 0V to 0.3 * VCC_GPIO **VOL:** 0V to 0.4V		**VIH:** 0.7 * VCC_GPIO to VCC_GPIO **VOH:** VCC_GPIO - 0.4 V to VCC_GPIO
41	IO22_TRACEDATA0	IO	Trace bus data 0 or digital I/O.			
43	IO23_TRACEDATA1	IO	Trace bus data 1 or digital I/O.			
45	IO24_TRACEDATA2	IO	Trace bus data 2 or digital I/O.			
47	IO25_TRACEDATA3	IO	Trace bus data 3 or digital I/O.			

3.2.3.7 RF GPIO Pins

The Skywire Nano has three 1.8V referenced pins that can be used to drive external antenna tuning circuitry such as RF switches. These pins can also be used as additional 1.8V GPIO pins.

Pin #	Name	Type	Notes	Min.	Typ.	Max.
49	MAGPIO2	IO	RF GPIO 2 or digital I/O. Fixed 1.8V reference.	**VIL:** 0V to 0.54V **VOL:** 0V to 0.4V		**VIH:** 1.26V to 1.8V **VOH:** 1.7V to 1.9V
51	MAGPIO1	IO	RF GPIO 1 or digital I/O. Fixed 1.8V reference.			
53	MAGPIO0	IO	RF GPIO 0 or digital I/O. Fixed 1.8V reference.			

3.2.3.8 Digital I/O Pins

The Skywire Nano has 31 digital I/O pins with the following electrical specifications:

Pin #	Type	Notes	Min.	Typ.	Max.
4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 30, 32, 34, 36, 38, 39, 40, 41, 43, 44, 45, 46 47, 48, 50, 52, 54, 56, 58	IO	Digital I/O pins. Some pins may have alternate functions (i.e. analog input pins)	**VIL:** 0V to 0.3 * VCC_GPIO **VOL:** 0V to 0.4V		**VIH:** 0.7 * VCC_GPIO to VCC_GPIO **VOH:** VCC_GPIO - 0.4 V to VCC_GPIO

The table below lists each digital I/O pin available for use on the modem:

Note: *The analog input pins and the trace and debug pins were mentioned previously in Section 3.2.3.5 and Section 3.2.3.6, respectively. These pins are listed a second time in the table below because their secondary function is digital I/O.*

Pin #	Name	Type	Description
44	IO0	IO	Digital IO #0.
46	IO1	IO	Digital IO #1.
4	IO2	IO	Digital IO #2.
6	IO3	IO	Digital IO #3.
8	IO4	IO	Digital IO #4.
10	IO5	IO	Digital IO #5.
12	IO6	IO	Digital IO #6.
14	IO7	IO	Digital IO #7.
16	IO8	IO	Digital IO #8.
18	IO9	IO	Digital IO #9.
20	IO10	IO	Digital IO #10.
22	IO11	IO	Digital IO #11.
24	IO12	IO	Digital IO #12.
26	IO13_AIN0	AI, IO	Analog input #0, or digital IO #13.

Pin #	Name	Type	Description
48	IO14_AIN1	AI, IO	Analog input #1, or digital IO #14.
50	IO15_AIN2	AI, IO	Analog input #2, or digital IO #15.
34	IO17_AIN4	AI, IO	Analog input #4, or digital IO #17.
36	IO18_AIN5	AI, IO	Analog input #5, or digital IO #18.
38	IO19_AIN6	AI, IO	Analog input #6, or digital IO #19.
40	IO20_AIN7	AI, IO	Analog input #7, or digital IO #20.
39	IO21_TRACECLK	IO	AP debug trace clock, or digital IO #21.
41	IO22_TRACEDATA0	IO	AP debug trace data #0, or digital IO #22.
43	IO23_TRACEDATA1	IO	AP debug trace data #1, or digital IO #23.
45	IO24_TRACEDATA2	IO	AP debug trace data #2, or digital IO #24.
47	IO25_TRACEDATA3	IO	AP debug trace data #3, or digital IO #25.
58	IO26	IO	Digital IO #26.
56	IO27	IO	Digital IO #27.
52	IO28	IO	Digital IO #28.
54	IO29	IO	Digital IO #29.
30	IO30	IO	Digital IO #30.
32	IO31	IO	Digital IO #31.

3.3 Cellular and GPS Specifications

3.3.1 Available Technologies and Bands

Cellular Technology	Bands
LTE CAT-M1	B1, B2, B3, B4, B5, B8, B12, B13, B14, B17, B18, B19, B20, B25, B26, B28, B66
LTE CAT-NB1, LTE CAT-NB2	B1, B2, B3, B4, B5, B8, B12, B13, B17, B19, B20, B25, B26, B28, B66
GPS	L1 C/A (1575.42 MHz)

3.3.2 LTE CAT-M1 Specifications

Parameter	Description	Min.	Typ.	Max.
Operating Frequency	Modem operating frequency range.	699 MHz		1980 MHz
Output Power	RF output power.	-40 dBm	23 dBm	23 dBm
Output Power Accuracy	Accuracy of reported output power.			±2 dBm
Low Band RX Sensitivity	CAT-M1 RX sensitivity at low band.		-108 dBm	
Midband Rx Sensitivity	CAT-M1 RX sensitivity at midband.		-107 dBm	
Uplink Speed	CAT-M1 upload speed.			375 Kbps
Downlink Speed	CAT-M1 download speed.			300 Kbps

3.3.3 LTE CAT-NB1 and LTE CAT-NB2 Specifications

Parameter	Description	Min.	Typ.	Max.
Operating Frequency	Modem operating frequency range.	699 MHz		1980 MHz
Output Power	RF output power.	-40 dBm	23 dBm	23 dBm
Output Power Accuracy	Accuracy of reported output power.			±2 dBm
RX Sensitivity	CAT-NB1 / CAT-NB2 RX sensitivity.		-114 dBm	
Uplink Speed	CAT-M1 upload speed.			70 Kbps
Downlink Speed	CAT-M1 download speed.			32 Kbps

3.3.4 GPS Specifications

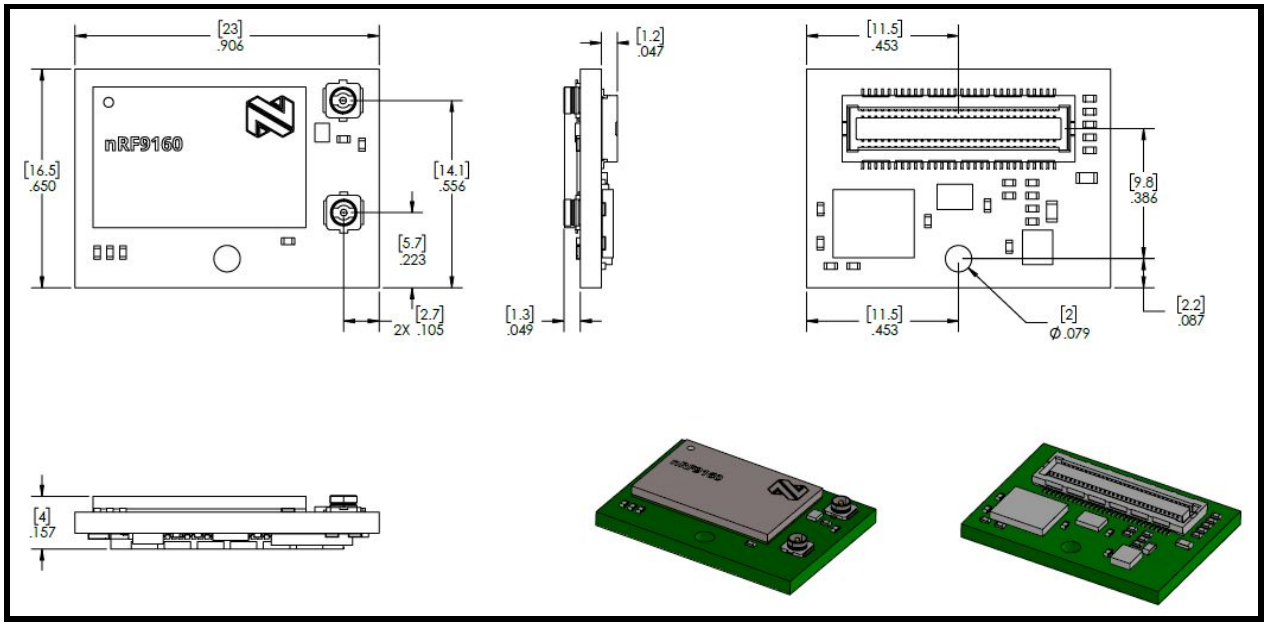
Parameter	Description	Min.	Typ.	Max.
Operating Frequency	GPS L1 C/A center frequency.		1575.42 MHz	
Sensitivity, Cold Start	RX sensitivity for cold start.		-142 dBm	
Sensitivity, Hot Start	RX sensitivity for hot start.		-145 dBm	
Sensitivity, Tracking	RX sensitivity while tracking.		-151 dBm	
TTFF, cold	Cold start, clear LOS to sky, typical conditions		TBD	
TTFF, hot	Hot start, clear LOS to sky, typical conditions		TBD	
Periodic Accuracy	Periodic tracking position accuracy		TBD	
Continuous Accuracy	Continuous tracking position accuracy		TBD	

3.4 Mechanical Specifications

3.4.1 Modem Mechanical Characteristics

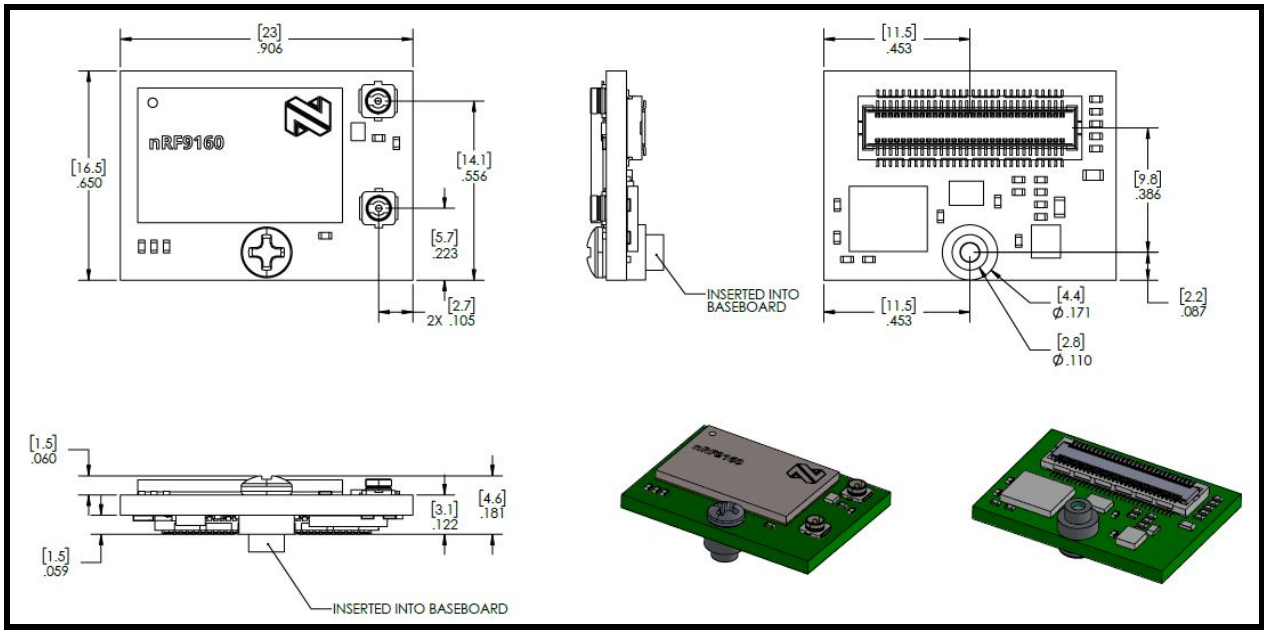
Parameter	Description	Min.	Typ.	Max.
Dimensions, Unmated	Modem dimensions, connector J1 not mated with baseboard.	0.906" x 0.650" x 0.157" 23.00 mm x 16.500 mm x 4.00 mm		
Dimensions, Mated	Modem dimensions, connector J1 mated to baseboard.	0.906" x 0.650" x0 .181" 23.00 mm x 16.50 mm x 4.6 mm		
Mass	Mass of the modem in grams.		2 grams	
J1 Insertions/Removals	Number of mating cycles until possible connector failure.		10	
X1/X3 Insertion/Removals	Number of mating cycles until possible connector failure.	30	hundreds	

3.4.2 Mechanical Drawing (Modem Unmated)



Note: *Dimensions are inches and [mm].*

3.4.3 Mechanical Drawing (Modem Mated to Baseboard)



Note: *Dimensions are inches and [mm].*

3.4.4 Mating Connectors

The table below contains each connector on the modem as well as a recommended mating connector:

Connector Designator	Populated on Modem	Manufacturer	Recommended Mate	Manufacturer
J1	0547220604	Molex	555600607*	Molex
X1, X3	U.FL-R-SMT-1(10)	Hirose	CAB.011	Taoglas

**The use of a Molex 555600607 as the mating connector is strictly required for the Skywire Nano.*

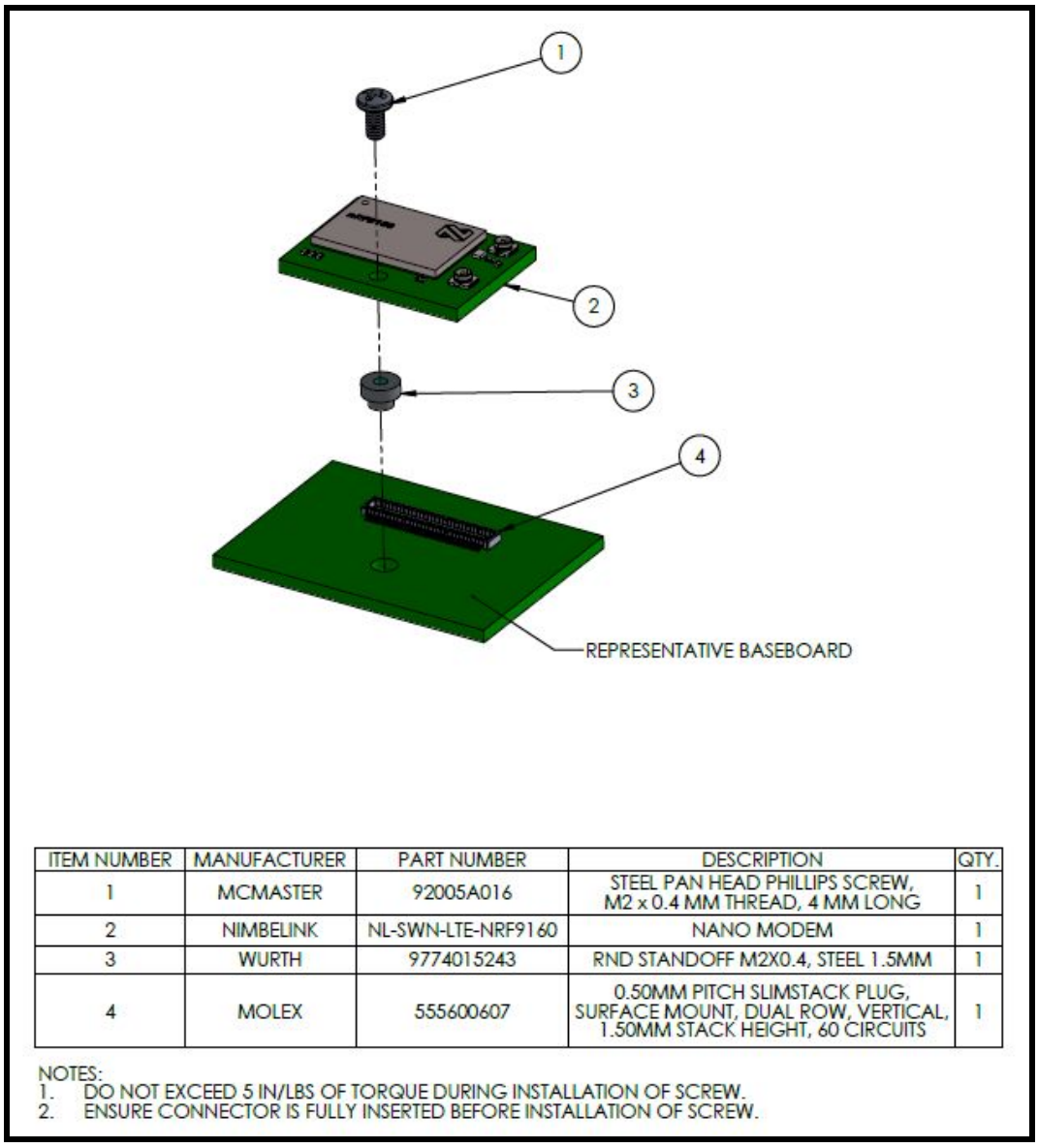
3.4.5 Mating Considerations

The use of a spacer and a mounting screw is required in order to provide mechanical stability and retention to the modem when it is attached to a baseboard. The spacer must be soldered to the baseboard, and does not ship with the modem.

Description	Manufacturer	Manufacturer P/N	Notes
M2 Threaded Steel Spacer, 1.5mm length	Würth Elektronik	9774015243	The exact spacer P/N must be used to ensure proper mating.
M2 Hex Screw, 4mm length	McMaster-Carr	91292A004	These part numbers are recommended mounting screws. Equivalent alternatives may also be acceptable.
M2 Phillips Screw, 4mm length	McMaster-Carr	92005A016	

3.4.6 Modem Assembly Diagram

The image below depicts the assembly diagram for the Skywire Nano:



ITEM NUMBER	MANUFACTURER	PART NUMBER	DESCRIPTION	QTY.
1	MCMASTER	92005A016	STEEL PAN HEAD PHILLIPS SCREW, M2 x 0.4 MM THREAD, 4 MM LONG	1
2	NIMBELINK	NL-SWN-LTE-NRF9160	NANO MODEM	1
3	WURTH	9774015243	RND STANDOFF M2X0.4, STEEL 1.5MM	1
4	MOLEX	555600607	0.50MM PITCH SLIMSTACK PLUG, SURFACE MOUNT, DUAL ROW, VERTICAL, 1.50MM STACK HEIGHT, 60 CIRCUITS	1

NOTES:
1. DO NOT EXCEED 5 IN/LBS OF TORQUE DURING INSTALLATION OF SCREW.
2. ENSURE CONNECTOR IS FULLY INSERTED BEFORE INSTALLATION OF SCREW.

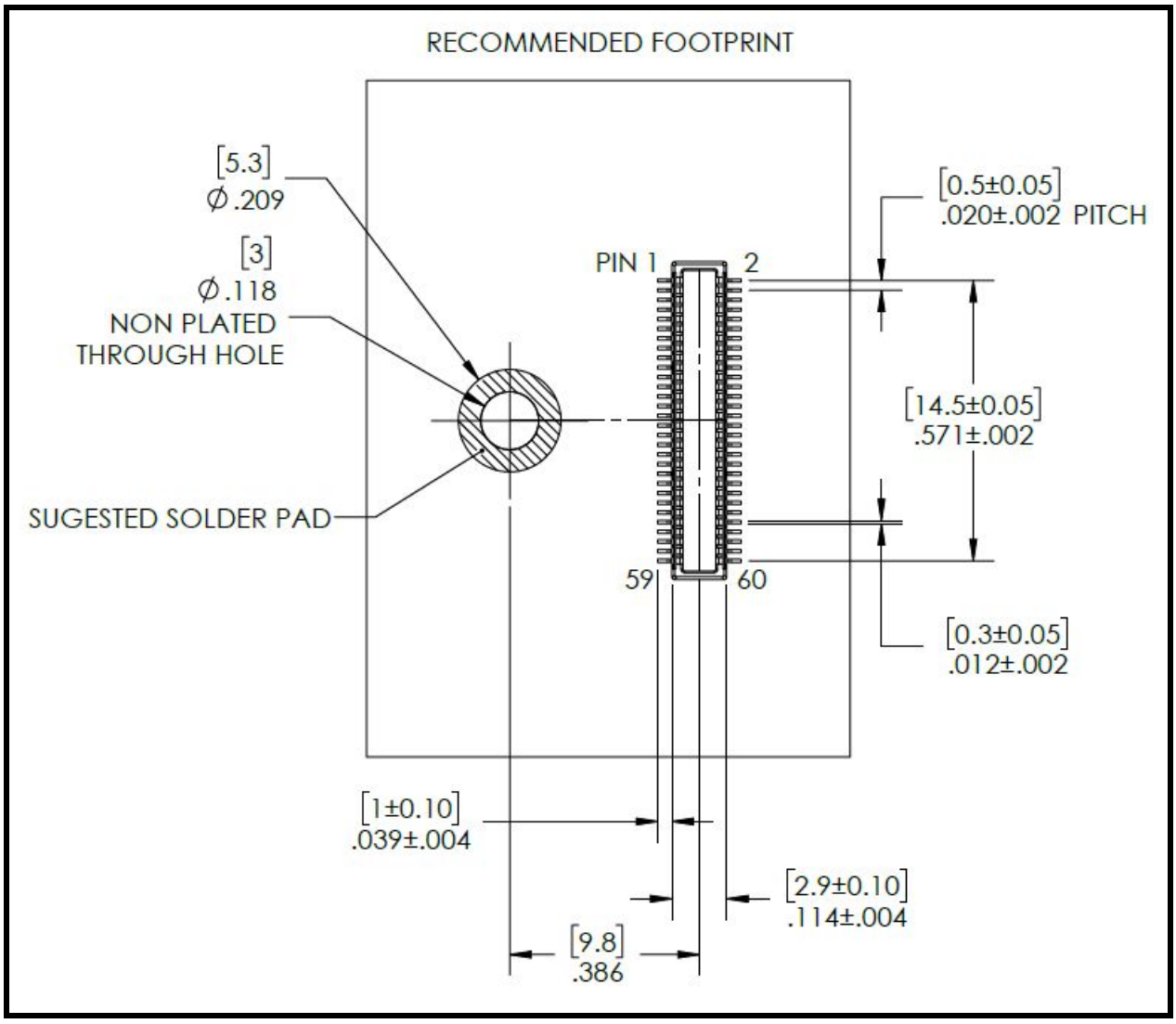
To attach the modem to a baseboard, first the round spacer should be soldered into the baseboard, then mate the modem with the baseboard connector. Ensure that the two connectors are parallel with each other before applying insertion force.

After the modem is properly seated in the baseboard connector, drive a mounting screw through the top side of the modem and into the baseboard spacer. The screw should be tightened to a maximum of 5 in/lb. Do not overtighten the mounting screw.

3.5 Recommended PCB Footprint

The image below depicts the recommended footprint for the Skywire Nano.

Note: *Components placed under the Skywire Nano should be no taller than 0.010 inches (0.250 mm) tall.*



Note: *Dimensions are inches and [mm].*

3.6 Environmental Specifications

Parameter	Description	Min.	Typ.	Max.
Operating Temperature	Operating temperature range.	-40 ˚C	25 ˚C	85 ˚C
Storage Temperature	Storage temperature range.	-40 ˚C	25 ˚C	85 ˚C
Operating Humidity	Non-condensing operating humidity range.	20 %RH		90 %RH

4. Regulatory information

4.1 Cellular Certifications

PTCRB: In Progress , **AT&T:** In Progress , **Verizon ODI:** In Progress , **GCF:** In Progress

4.2 Export Control Classification Number (ECCN)

ECCNs are five character alphanumeric designations used on the Commerce Control List (CCL) to identify dual-use items for export control purposes. An ECCN categorizes items based on the nature of the product, i.e. type of commodity, software, or technology and its respective technical parameters.

ECCN for All Skywire Modems: 5A992.c

4.3 Harmonized Tariff Schedule Code

HTS Code: 8517.62.0010

4.4 RoHS Compliance

The NL-SWN-LTE-NRF9160 complies with the RoHS (Restriction of Hazardous Substances) directive of the European Union, EU Directive 2011/65/EU.

4.5 Interference Statement

This device complies with Part 15 of the FCC Rules and Industry Canada licence-exempt RSS standards. Operation is subject to the following two conditions: (1) This device may not cause harmful interferences, and (2) this device must accept any interference received, including interference that may cause undesired operation.

4.6 FCC & IC Compliance

If the modem's antenna is located farther than 20cm from the human body and there are no adjacent transmitters, the FCC and IC approvals of the modem's Nordic nRF9160 cellular module can be reused by the end product.

If the modem's antenna is mounted closer than 20cm from the human body, or if there are adjacent transmitters, additional FCC/IC testing may be required for the end device.

NL-SWN-LTE-NRF9160 modems make use of the FCC ID and Industry Canada ID (IC ID) of the on-board Nordic nRF9160 cellular module:

Orderable Device	FCC ID	IC ID
NL-SWN-LTE-NRF9160	2ANPO00NRF9160	24529-NRF9160

The FCC certificate is available at the following link by searching for the FCCID listed above:

https://www.fcc.gov/oet/ea/fccid

The IC ID certificate is available at the following link by searching for the IC ID listed above:

https://sms-sgs.ic.gc.ca/equipmentSearch/searchRadioEquipments?execution=e1s1&lang=en

4.7 Wireless Notice

In order to comply with FCC and IC radiation exposure limits for an uncontrolled environment alongside carrier specific certifications, the antennas cannot exceed the maximum gain levels listed here:

Cellular Band	Center Frequency	Technology	Max. Antenna Gain
Band 2	1900 MHz	LTE CAT-M1 and LTE NB1/NB2	9.0 dBi
Band 4	1700 MHz		6.0 dBi
Band 5	850 MHz		7.1 dBi
Band 12	700 MHz		6.6 dBi
Band 13	700 MHz		6.9 dBi
Band 17	700 MHz		6.6 dBi
Band 25	1900 MHz		9.0 dBi
Band 26	850 MHz		7.0 dBi
Band 66	1700 MHz		6.0 dBi
Band 14	700 MHz	LTE CAT-M1 Only	6.9 dBi

4.8 End-Product Labeling Requirements

End products utilizing NL-SWN-NRF9160 modems must be labeled with the following information:

Device Uses Approved Radio: NL-SWN-LTE-NRF9160

Contains FCC ID: 2ANPO00NRF9160

Contains IC ID: 24529-NRF9160

This device complies with Part 15 of the FCC Rules and Industry Canada licence-exempt RSS standards. Operation is subject to the following two conditions: (1) This device may not cause harmful interferences, and (2) this device must accept any interference received, including interference that may cause undesired operation.

5. Document Version Information

Revision	Author	Description	Date
1	SDR	Initial document release.	02/05/20