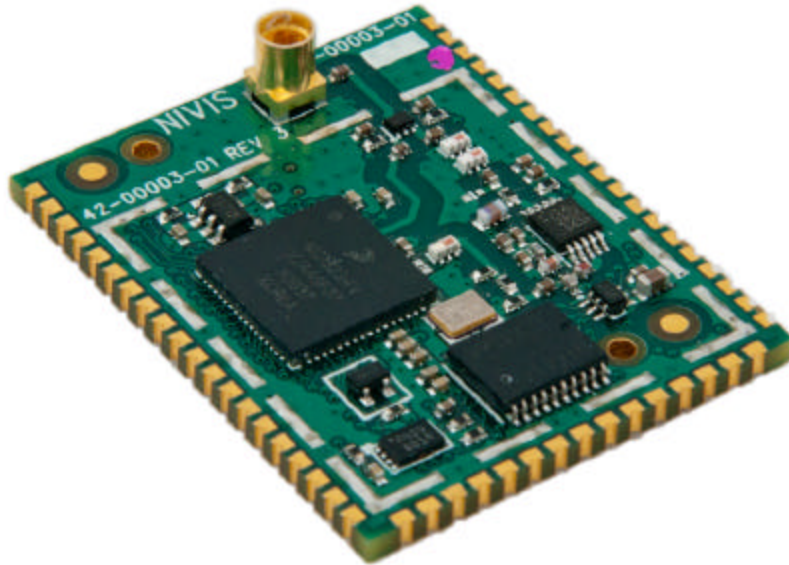




VersaNode 310-I Hardware Integration Application Note

Version 3.0

Date: May 24, 2013

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1. Purpose and Audience

The purpose of this document is to define the VN310-I radio's connectivity options. It also aims to provide the necessary data to achieve hardware integration of the VN310-I with a customer's external application processor.

An external processing entity can communicate with the VN310-I using either a UART interface (utilizing UART2) or an SPI interface. The UART1 port is dedicated to serial firmware download.

By definition the VN310-I is essentially a small radio module, approximately 1.1"W x 1.4"L, which is pre-loaded with the Nivis ISA100.11a communications stack. The small form factor enables the radio to be used in a variety of applications. The VN310-I and the VN310-H are identical from a hardware perspective and differ only by the pre-loaded factory firmware.

2. Interface Summary

Figure 1 presents the physical location of the pins on the VN310-I, and Table 1 presents the VN310-I pin descriptions.

Note: For minimum battery consumption, all unused GPIOs should be left unconnected.

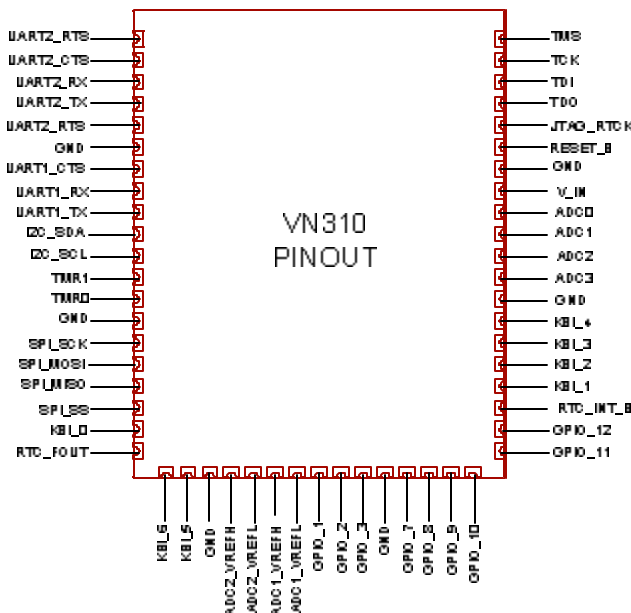


Figure 1. VN310-I Pinout

Table 1. VN310-I Pin Definitions

No.	Name	Description	Type	Dir	Comments
1	UART2-CTS	UART2 Clear to Send	DIG	I	Standard UART communication with flow control. Connect this to UART-RTS of application processor.
2	UART2-RTS	UART2 Request to Send	DIG	O	Standard UART communication with flow control. Connect this to UART-CTS of application processor.
3	UART2-RXD	UART2 Receive Data	DIG	I	Standard UART communication with flow control. Connect this to UART-TXD of application processor.
4	UART2-TXD	UART2 Transmit Data	DIG	O	Standard UART communication with flow control. Connect this UART-RXD of application processor.
5	UART1-RTS	UART1 Request to Send	DIG	I	Not Used
6	GND	Ground	N/A	N/A	
7	UART1-CTS	UART1 Clear to Send	DIG	O	Not Used
8	UART1-RXD	UART1 Receive Data	DIG	I	Standard UART communication. Used for upgrading the firmware of the VN310-I. TTL<-> RS232 level shifters should be employed when connecting to RS232 port.
9	UART1-TXD	UART1 Transmit Data	DIG	O	Standard UART communication. Used for upgrading the firmware of the VN220. TTL<-> RS232 level shifters should be employed when connecting to RS232 port.
10	I2C-SDA	I2C bus DATA	DIG	I/O	Not Used
11	I2C-SCL	I2C bus CLOCK	DIG	I/O	Not Used
12	TMR1	Timer 1 I/O	DIG	O	READY signal used to wake up the application processor.
13	TMR0	Timer 0 I/O	DIG	I/O	Not Used
14	GND	Ground	N/A	N/A	
15	SPI-SCK	SPI Clock	DIG	O	Standard SPI Communication
16	SPI-MOSI	SPI Data Out	DIG	O	Standard SPI Communication
17	SPI-MISO	SPI Data In	DIG	I	Standard SPI Communication
18	SPI-SS	SPI Slave Select	DIG	O	Standard SPI Communication
19	KBIO	RTC clock out enable / Keyboard interface pin 0	DIG	O	Not Used

No.	Name	Description	Type	Dir	Comments
20	RTC-FOUT	32768Hz RTC clock out	DIG	O	Not Used
21	KBI6	Keyboard interface pin 6	DIG	I	Used for Wakeup & Status (Provisioning) button. Holding this pin low for 10 seconds causes the radio to return to the factory defaults state and scan for a provisioning device.
22	KBI5	Keyboard interface pin 5	DIG	I/O	Not Used
23	GND	Ground	N/A	N/A	
24	ADC2-VREFH	ADC2 reference, high pin	Analog	I	Set ADC2-VREFH to Low and ADC2-VREFL to High and power the VN220 for a few seconds to erase the flash. After erasing the flash, set the ADC2-VREFH to High and ADC2-VREFL to Low. WARNING: this operation will erase the Nivis Bootloader and all manufacturing and non-volatile data!
25	ADC2-VREFL	ADC2 reference, low pin	Analog	I	See the comments for ADC2-VREFH.
26	ADC1-VREFH	ADC1 reference, high pin	Analog	I	Not Used
27	ADC1-VREFL	ADC1 reference, low pin	Analog	I	Not Used
28	GPIO1	GPIO	DIG	O	Used for output gain control.
29	GPIO2	GPIO	DIG	O	Used for output gain control.
30	GPIO3	GPIO	DIG	O	Used for output gain control.
31	GND	Ground	N/A	N/A	
32	GPIO7	GPIO	DIG	I/O	Not Used
33	GPIO8	GPIO	DIG	I/O	Not Used
34	GPIO9	GPIO	DIG	I/O	Not Used
35	GPIO10	GPIO	DIG	I/O	Not Used
36	GPIO11	GPIO	DIG	I/O	Not Used
37	GPIO12	GPIO	DIG	I/O	Not Used
38	RTC-INT-B	RTC wake-up interrupt / Keyboard interface pin 7	DIG	O	Not Used
39	KBI1	Keyboard interface pin 1	DIG	I	Used as boot switch in order to boot different firmware images based on the position of the switch (future functionality). At present, this pin should be held HIGH.

No.	Name	Description	Type	Dir	Comments
40	KBI2	Keyboard interface pin 2	DIG	I/O	Not Used
41	KBI3	Keyboard interface pin 3	DIG	I/O	Not Used
42	KBI4	Keyboard interface pin 4	DIG	I	WKU signal. Used by the application processor to wake up the VN210 processor.
43	GND	Ground	N/A	N/A	
44	ADC3	ADC pin 3	Analog	I	Not Used
45	ADC2	ADC pin 2	Analog	I	Not Used
46	ADC1	ADC pin 1	Analog	I	Not Used
47	ADC0	ADC pin 0	Analog	I	Reserved for future functionality. At present this pin should be held HIGH.
48	Vin	Supply Voltage	N/A	I	See Note.
49	GND	Ground	N/A	N/A	
50	RESET	RESET pin	DIG	I	Reset pin of the VN310-I. LOW to reset and HIGH to run.
51	JTAG-RTCK	JTAG Return Clock	DIG	O	Standard JTAG interface.
52	JTAG-TDO	JTAG Test Data Output	DIG	O	Standard JTAG interface
53	JTAG-TDI	JTAG Test Data Input	DIG	I	Standard JTAG interface
54	JTAG-TCK	JTAG Test Data Input	DIG	I	Standard JTAG interface
55	JTAG-TMS	JTAG Test Mode Select	DIG	I	Standard JTAG interface

Note: In the default configuration, the radio is powered directly from an external power source. The external power source must be tightly regulated, (3.0V +/- 2%) since it affects regulatory compliance. Failure to use a tightly regulated power source will invalidate regulatory compliance. Note that in this default configuration, R29, R32, R33, C48, C49, are populated. LDO U13 is not populated. If the user requires on-board regulation for the radio, then U13 (PN: MCP1802T-3002I-OT) must be populated, and R29 must be depopulated. Contact Nivis engineering for more information.

3. Serial and SPI Interfacing with VN310-I

The following figures indicate the correct UART and SPI pin connectivity between the VN310-I and an external application processor.

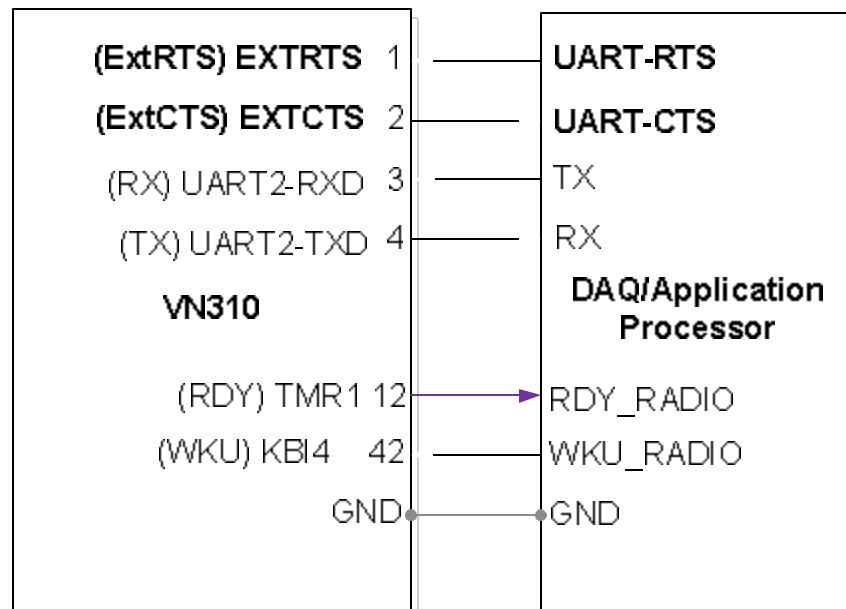


Figure 2. Interfacing with the VN310-I using UART Based Communication

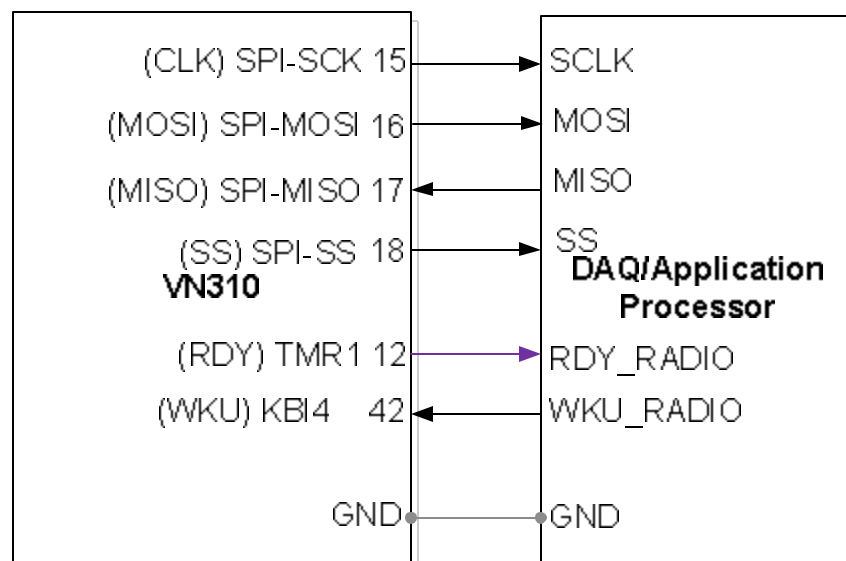


Figure 3. Interfacing with the VN310-I using SPI Based Communication

Connect the RDY pin only if the full wakeup communication mode is desired.

For additional information, please consult the document entitled

08-00011-01_Nivis_ISA100.11a_FULL_API_Integration_Manual.pdf

or

08-00014-01_Nivis_ISA100.11a_SIMPLE_API_Integration_Manual.pdf.

4. VN310-I Power Supply Considerations

4.1 Key Specifications

Table 2. Key Specifications

Parameter	Min	Typ	Max	Units	Comment
Supply Voltage (3V regulated supply)	2.94	3.0	3.06	V	
Voltage on any digital I/O	-0.3	Vcc	Vcc + .02 V	V	
RF Output Level	0	+10	+17	dBm	Output power at antenna connector
Storage Temp Range (Max)	-40		+85	°C	
Operating Temp Range (Max)	-40		+85	°C	

4.2 Electrical Characteristics

Table 3. Electrical Characteristics

Parameter	Min	Typ	Max	Units	Comments
Voltage on analog pins	0	3.0	Vcc	V	
Voltage supply noise			200	mVpp	50Hz – 15MHz
Peak current			124	mA	TX mode, maximum output power
Operating relative humidity	10		90	%RH	Non condensing
Transmit current			67	mA	At 10 dBm
			124	mA	At 17 dBm
Receive current ¹⁾		21	27	mA	
Hibernate current ²⁾		15		µA	
Output High-level Voltage (IOH = 5 mA) (All digital outputs)	80% Vcc		Vcc	V	

Output Low Voltage (IOL = -5 mA) (All digital outputs)	0	20% Vcc	V
Input Low Voltage (All digital inputs)	0	30% Vcc	V
Input High-level Voltage (all digital inputs)	70% Vcc	Vcc	V
Input hysteresis (all digital inputs)	0.06 Vcc		V

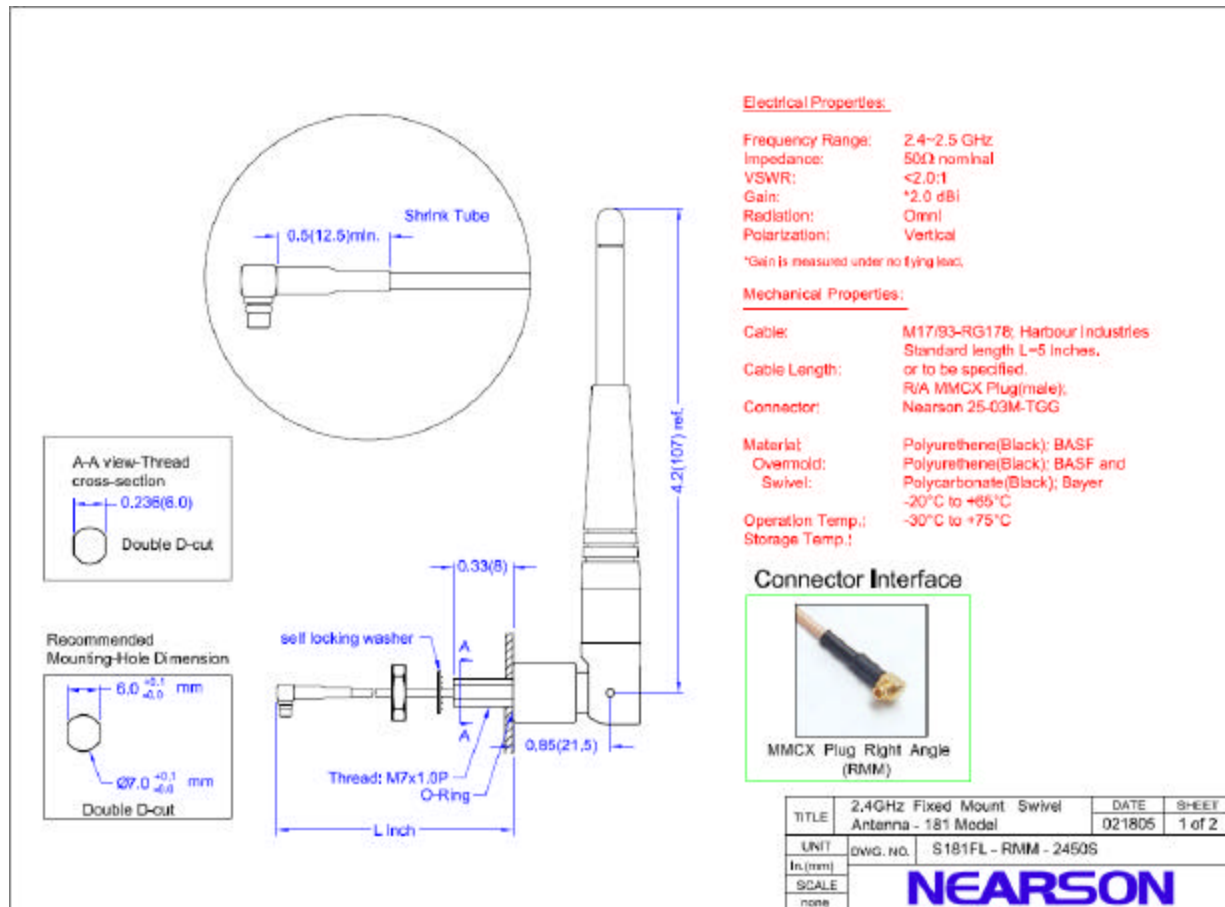
Notes:

- 1) All RAM active, Reference oscillator on (24 MHz) at 1.2 VDC, Radio RX on (receiving data), Reference clock available to all peripherals, ADC1 available but inactive, CPU on at 2 MHz (DCD).
- 2) External 32 kHz crystal oscillator on, CPU off (stop mode), wake-up from RTI timer or external request, Radio off, ADCs not available.

For additional information please consult the VersaNode 310 datasheet.

4.3 External antenna specifications and installation requirements

Antenna Specification



Antenna Installation requirements-The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

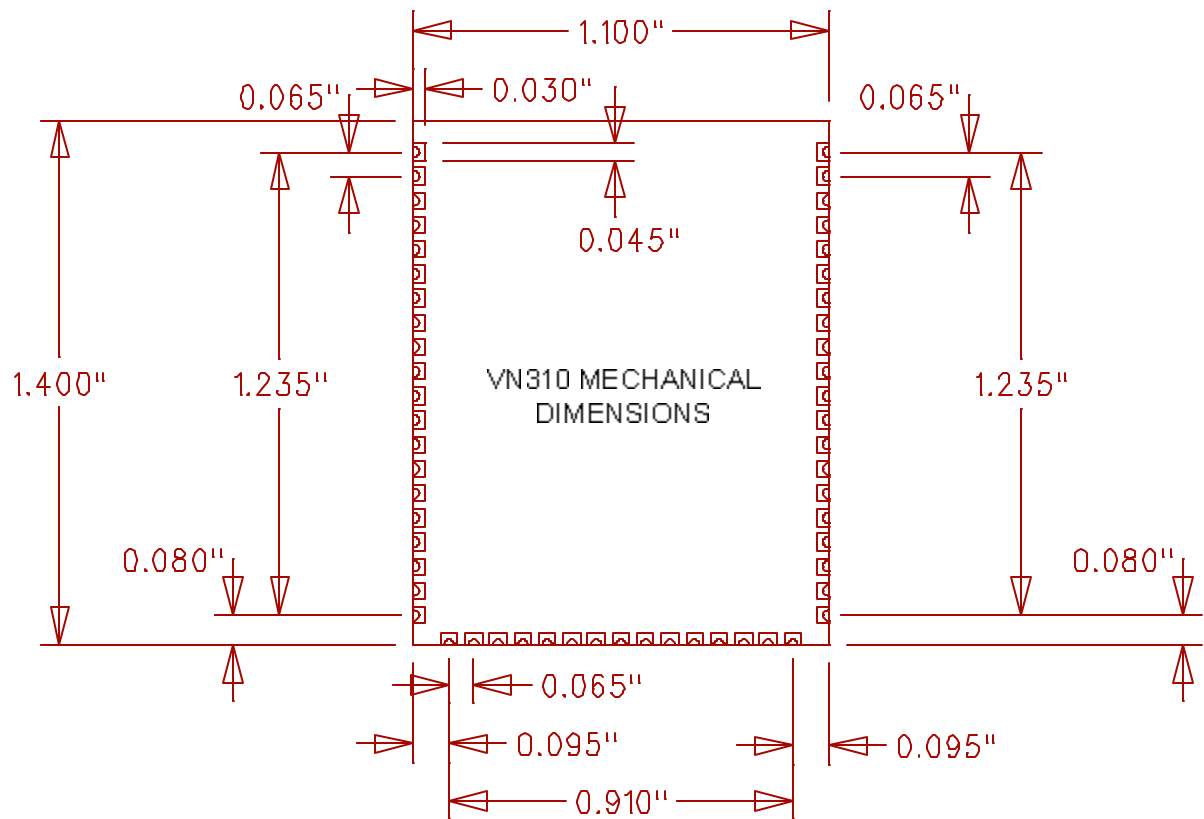
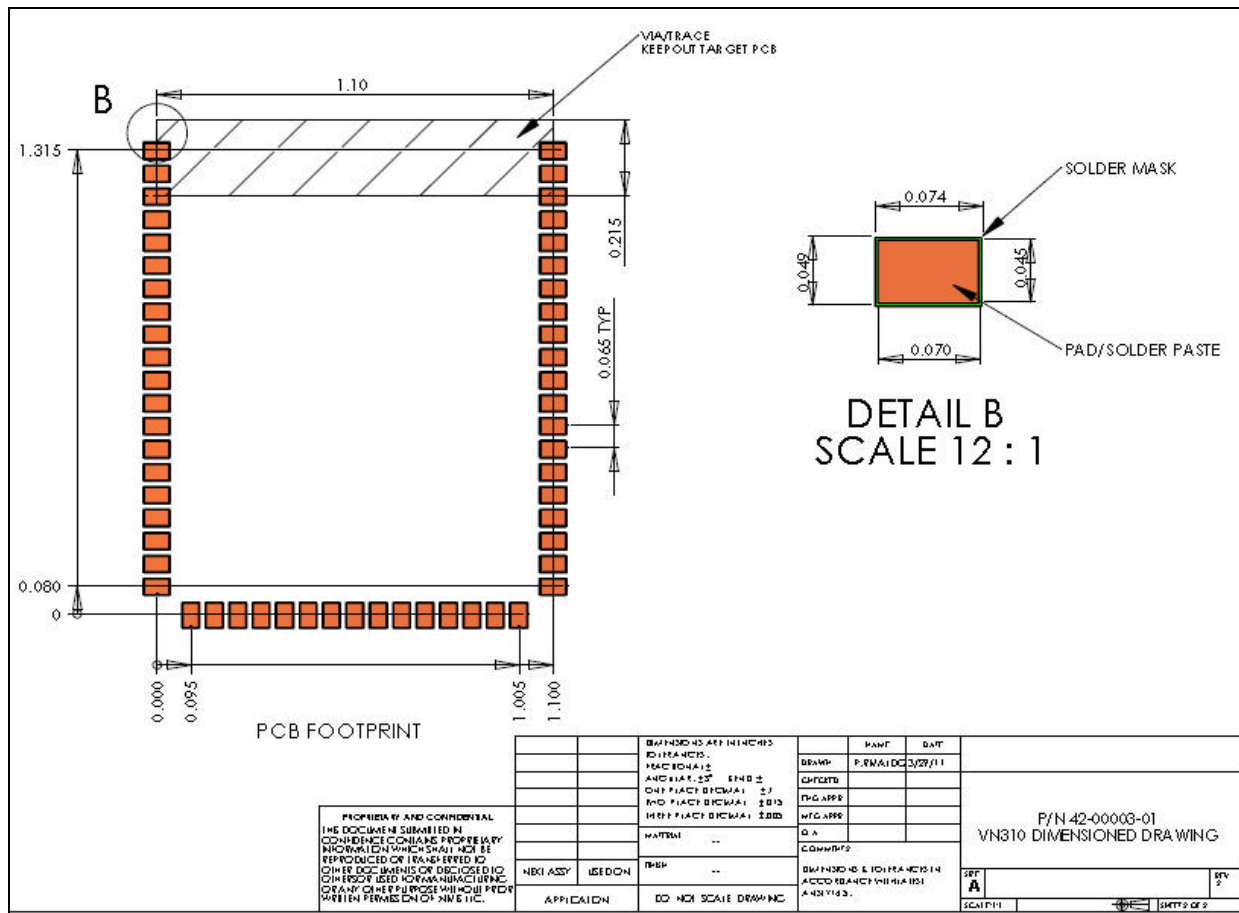


Figure 5. Outline Drawing





6. Regulatory Labeling and Notices

FCC Notice-

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.

Note: 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.*
- Consult the dealer or an experienced radio/TV technician for help.*

IC RSS-210/RSS-Gen Notices-

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.

L'opération est soumise aux 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 de l'appareil.

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.

Sous la réglementation d'Industrie Canada, ce transmetteur radio ne peut fonctionner en utilisant une antenne d'un type et un maximum (ou moins) gain approuvées pour l'émetteur par Industrie Canada. Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis de manière que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pas ce qui est nécessaire pour une communication réussie.

This radio transmitter 6546A-VN3104034R5 has been approved by Industry Canada to operate with the antenna types listed above 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.

Cet émetteur de radio 6546A-VN3104034R5 a été approuvé par Industrie Canada pour fonctionner avec les types d'antennes énumérées ci-dessus avec le gain maximal admissible et impédance d'antenne requise pour chaque type d'antenne indiqué. Types d'antennes ne figurent pas dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdites pour l'utilisation avec cet appareil.