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SKYEMODULE NOVA DATASHEET

PRELIMINARY

VERSION 031014



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1 Introduction

1.1 Getting Started

Operating your SkyeModule Nova begins with finding a method to connect to a host. The SkyeModule itself does not operate without direction (commands) from a host. The host can be in the form of a PC or, more typically, an embedded microcontroller. This document explains the physical and electrical characteristics of the module, so you can understand how to integrate the Nova into a finished product.

For **initial demonstration** of the module, **SkyeWare v4 software** is available on the media that came with the developer/evaluation kit or available for download at support.skyetek.com. Open this software on your windows PC and it will be recognized when you connect through USB or RS232 (with developer kit interface board). The software demonstrates features like selecting tags, reading and writing. It also has a powerful command builder that lets you format, send and receive any command to and from the reader. More about SkyeWare can be found in the SkyeWare User Guide. See the Additional Reading section below.

The **next step** after demonstrating the module's functionality is **developing your own communication with the module**. This can be achieved with simple code on a microcontroller or using the SkyeTek API on a PC. Once connected to a host through one of the four host interfaces, the reader to host communication is formatted with a full featured protocol called SkyeTek Protocol v3. In order to make learning commands and formatting easy, we have developed a series of application notes with examples to get you started. The application notes start with basic tag and reader commands and become very detailed for tags with special features. Read more about the protocol and commands in section 13, Communicating with the Module and then move on to the Additional Reading in section 1.3.

1.2 Why a SkyeTek Module?

Many customers may wonder, "What value does a module add over an RFID transceiver chip?"

RFID transceiver chips may seem simple, but they actually require significant engineering time and capital investment to integrate. Transceiver chips contain up to 50 registers for configuration and functionality. In addition, communicating over air protocols such as ISO18000-6C is complex, described in nearly 150 pages of cryptic procedures. For example, just selecting a tag requires a minimum of 6 and up to 100 over air interactions with multiple tags present. SkyeTek has also optimized the complex RF chain to give the best performance and efficiency possible. **SkyeTek modules mask the complexities of RFID from the user and pack functionality into just a few commands.**

SkyeTek's core set of commands allow the user to read and write to tags with a single command, regardless of the tag type. The module is also field upgradable, so you can use the latest security algorithms and tag features as they are released. Power regulation and filtering for the radio are handled in the Nova, so you can supply voltage directly from an unregulated source like a battery. Finally, the Nova will be modularly approved by the FCC and CE, so you can bypass expensive radio testing at a certified test lab and avoid potential schedule delays due to failures.

Using a SkyeTek module will greatly reduce time to market and upfront development costs. Allow SkyeTek to take the burden of developing an RF system so you can focus your energy on your core products.

1.3 Additional Reading

[SkyeTek Protocol v3 Reader Commands](#) – Application note with descriptions and examples of the reader commands: read/write system, read/write default system, load defaults, and reset

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1.4 Revision History

Revision	Author	Change
031014	Josh Peifer	Initial draft.

Table 1-1: Revision History

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2 Definition of Terms

3DES	Triple Data Encryption Standard
AES	Advanced Encryption Standard
API	Application Programming Interface
DES	Data Encryption Standard
GPIO	General Purpose Input/Output
HID	Human Interface Device
I ² C	Inter-integrated Circuit
LSB	Least Significant Bit
MSB	Most Significant Bit
NC	No Connect
RoHS	Reduction of Hazardous Substances
SPI	Serial Peripheral Interface
SSEL	Slave Select
STP V3	SkyeTek Protocol Version 3
TTL	Transistor-transistor Logic

3 Ordering Information

3.1 Nova Standard Part Numbers

Part Number	Host Interface	Baud Rate	Description
SM-NV-00	USB (HID)	12Mbps	Mini PCI express connector

Table 3-1: Nova Standard Part Numbers

NOTE – The Nova will always communicate via USB, when a USB host is connected.

3.2 Part Number Details

The Nova part number is constructed according to the SkyeTek part number specification below:

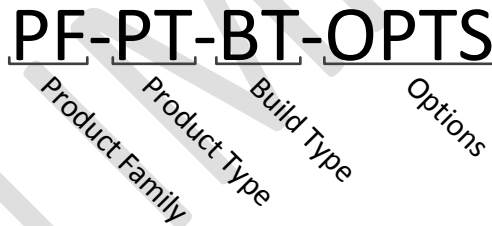


Figure 3-1: SkyeTek Part Number Format

Code	Options	Description
Product Family	SM = SkyeModule	Highest level product family code.
Product Type	NV = NOVA	Specifies the specific part type.
Build Type		Specifies hardware form factor.
Options	Blank = Standard	This field is left for special customer part numbers or standard variations such I2C for I2C as the default host interface. Consult the SkyeTek sales team for custom orders.

Table 3-2: Part Number Details

3.3 How to Buy

SkyeTek products are distributed through a worldwide distribution network as well as directly through SkyeTek. For more information on how to purchase SkyeTek products in your area, please visit the [How To Buy](#) page on the SkyeTek website at www.skyetek.com/howtobuy.

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4 SkyeModule Nova Overview

4.1 Description

The SkyeModule™ Nova marks the next generation of SkyeTek UHF reader modules. The Nova is an ultra-small, 2 port, 500mW EPC Class 1 Gen 2 reader/writer module. A cutting edge ARM Cortex microcontroller, latest UHF transceiver technology and cutting edge adaptive antenna tuning coupled with the reader's intelligent operating system make this module the most powerful and feature rich UHF reader module of its size. Manufactured in accordance with ISO 9001 and ISO 13485, quality is a top priority for all SkyeTek modules.



Figure 4-1: SM-NV-00

4.2 Block Diagram

[PICTURE]

Figure 4-2: SkyeModule Nova Block Diagram

4.3 Features

- Selects, Reads and writes to transponders based on EPC Global Class 1 Gen 2v2 (ISO 18000-6C)
- Return Signal Strength Indicator (RSSI)
- 2 antenna ports, each capable of 500mW output power
- Adaptive Antenna Tuning
- Mini PCIe half card form factor
- Wide and efficient power supply with input from 2.0 – 5.5V
- Deep sleep mode current down to 10uA
- Easy migration to and from the M7/M9/M10
- Supported host interfaces include USB, TTL level RS232, SPI, I2C
- Modularly certified (coming soon)

4.4 Applications

- Mobile Computing
- Inventory and Asset Management
 - Retail Inventory
 - In Transit Inventory
- Access Control

4.5 Agency Approvals

- RoHS 2
- FCC Modular – Seeking approval
- CE Mark – Seeking approval
- Manufactured according to ISO9001 and ISO13485

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5 Mechanical Specifications

Dimensions: 25 mm x 30 mm = 750 mm²
Height: 5 mm

[PICTURE]

Figure 5-1: SM-NV Mechanical Drawing

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6 Pinning Information

6.1 Connector Descriptions

The SM-NV-00 is the standard version of the Nova module and use the 52 pin Mini PCIe connector. In production, customers can connect a host to the module in one of three ways:

Connector Type	Description	Ref Des	Man.	Man. P/N	Mating Connector
52 pin Mini PCIe	Host interface connector	J3	Molex	N/A	0679101002

Table 6-1: SkyeModule Nova Connector Specification

Custom connectors and antenna configurations can be ordered with a minimum order quantity. Please contact a SkyeTek sales representative or local reseller to discuss ordering options. For more information on how to purchase SkyeTek products in your area, please visit the [How To Buy](http://SkyeTek.com/HowToBuy) page on the SkyeTek website at SkyeTek.com/HowToBuy.

6.2 Host Interface Connector Pin Mapping

The SkyeModule Nova host connector is a 52-pin Mini PCI Express edge connector. The pin numbers are located as illustrated in Figure 6-1 below. The pin mappings and descriptions are shown in Table 6-2. Note that all unconnected pins should be left floating.

[PICTURE]

Figure 6-1: Host Interface Connector Pin Numbering

Pin	Name	Description	I/O	Pin	Name	Description	I/O
1	NC	Not Connected	N/A	2	VIN	Input Power Supply	Input
3	NC	Not Connected	N/A	4	GND	Ground	Input
5	NC	Not Connected	N/A	6	NC	Not Connected	N/A
7	NC	Not Connected	N/A	8	MISO	SPI Master In, Slave Out	Output
9	GND	Ground	Input	10	MOSI	SPI Master Out, Slave In	Input
11	NC	Not Connected	N/A	12	SCK	SPI Clock IN	Input
13	NC	Not Connected	N/A	14	SSEL	SPI Slave Select	Input
15	GND	Ground	Input	16	NC	Not Connected	N/A
17	NC	Not Connected	N/A	18	GND	Ground	Input
19	NC	Not Connected	N/A	20	Deep Sleep	Active Low Deep Sleep	Input
21	GND	Ground	Input	22	Reset	Active Low Reset	Input
23	NC	Not Connected	N/A	24	VIN	Input Power Supply	Input
25	NC	Not Connected	N/A	26	GND	Ground	Input
27	GND	Ground	Input	28	NC	Not Connected	N/A
29	GND	Ground	Input	30	SCL	I2C Clock	Input
31	NC	Not Connected	N/A	32	SDA	I2C Data	I/O
33	NC	Not Connected	N/A	34	GND	Ground	Input
35	GND	Ground	Input	36	D-	USB D minus	I/O
37	GND	Ground	Input	38	D +	USB D Plus	I/O
39	VIN	Input Power Supply	Input	40	GND	Ground	Input
41	VIN	Input Power Supply	Input	42	GPIO0	General Purpose I/O 0	I/O
43	GND	Ground	Input	44	GPIO1	General Purpose I/O 1	I/O
45	GPIO3	General Purpose I/O 3	I/O	46	GPIO2	General Purpose I/O 2	I/O
47	NC	Not Connected	N/A	48	NC	Not Connected	N/A
49	RXD	UART Receive	Input	50	GND	Ground	Input
51	TXD	UART Transmit	Output	52	VIN	Input Power Supply	Input

Table 6-2: SkyeModule Nova Pin Descriptions

6.3 Using the GPIO Pins

You can use the User Port Direction and User Port Value system parameters to address the GPIO pins to set the user port direction (input or output) and the user port value (high or low). For more information, see the following:

- “User Port Direction” in section 14.3.9
- “User Port Value” in section 14.3.10

NOTE – GPIO3 is used as a data ready pin when in SPI or I²C mode. GPIO3 cannot be used as GPIO when using these interfaces.

7 Environmental Specifications

7.1 Electrostatic Precautions



CAUTION – Failure to take proper electrostatic precautions may result in damage to or failure of your SkyeModule Nova.

The SkyeModule Nova contains static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- Wear a static grounding strap when handling electronic control components.
- Keep all plastic, vinyl, and styrofoam (except antistatic versions) away from printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.

7.2 General Ratings and Operating Conditions

Specification	Rating
Temperature range	Temperature is 25 degrees Celsius unless otherwise noted
Operating	-20 to +70 degrees C
Storage	-40 to +125 degrees C
Humidity	
Operating, continuous storage	10-90 percent (non-condensing)
Transient storage (<24 hours)	5-95 percent maximum (non-condensing)
ESD protection	< 1kV (ESD HBM 15500 Ω , 100pF) —or— 100V (ESD MM 0.75uH, 200pF)

Table 7-1: Environmental Ratings/Operating Conditions

8 Electrical Specifications

This chapter discusses the electrical specifications of the SkyeModule Nova. Unless otherwise noted, the following assumptions apply to these specifications:

- Temperature is 25 degrees Celsius.
- Frequency is 915 MHz.
- Supply voltage (VCC) is 5 V.

8.1 Electrical Characteristics

Specification	Min	Typ	Max	Units/Notes
RF Characteristics				
Frequency ranges (Direct output)		860-960		MHz
Transmission Parameters				
Transmit Power		500		mW
Optimum PA Load Impedance		50		Ohms
Logic Inputs				
High state input voltage	2.3		5.0	V
Low state input voltage	0		1	V
Input Current (IINH/IINL)			10	nA
Logic Outputs				
Output High Voltage (VOH)	2.8	3.3	3.6	V
Output Low Voltage (VOL)			0.4	V
Output Current (IINH/IINL)			4	mA
Power Supplies				
Voltage Supply	2.0		5.5	V
Idle Current @ 5V Supply		150		mA
Continuous Transmit Current @ 5V Supply		500		mA
Low Power Software Sleep Mode Current @ 5V Supply		10		mA
Deep Sleep Mode Current @ 5V Supply		5		uA

Table 8-1: SkyeModule Nova Electrical Specifications

8.2 Absolute Maximum Ratings

Specification	Rating
V _{SUPPLY} to GND	7.0 V
Digital I/O voltage to GND	5.5 V

Table 8-2: Absolute Maximum Ratings

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9 Performance Specifications

9.1 Range Specifications

The range measurements below should be used as a guideline and not a guarantee. Environment can play a major role on tag range performance. Be sure to avoid any conductor in or near the field, as eddy currents can significantly reduce energy transfer between the reader antenna and the tag.

Specification	Min	Typ	Max	Units/Notes
Select Tag Range (6dBi Broad Band Antenna)				
Avery Dennison Label, Monza 3 Chip		6	10	m

Figure 9-1: Range Specifications

WARNING: Read ranges are not guaranteed and are subject to change without warning due to tag silicon or inlay variations.

10 Radio Specifications

10.1 Agency Approvals

As part of a host system, the SkyeModule Nova will not interfere with the overall system's compliance with agency requirements for emissions and susceptibility, including:

- United States: Seeking FCC 15.247 modular approval
- Europe: Seeking EN302-208, EN301-489, EN 61000-4-3
- RoHS

10.2 Frequency Band

The Nova operates in the 860-960MHz band. Allowed frequency bands and channels are subject to regional regulatory standards. Operating frequency of the Nova is software adjustable.

10.3 Tag Protocols

The SkyeModule Nova supports at least the basic tag commands (select, read, and write) for EPC Class 1 Gen 2 (ISO 18000-6C) compliant tags. For the most current listing of supported tags and features, see the [SkyeModule Nova Tag Support List](#).

11 Host Interface Specifications

The SkyeModule Nova supports the following microcontroller host interfaces for easy integration into existing systems:

- USB (Overrides other interfaces when connected)
- TTL Serial
- SPI
- I²C

The SkyeModule Nova and the host interface board support TTL Serial and USB communications. The host interface board provides a USB connector and a TTL to RS-232 level converter for the TTL Serial host interface. The Host Interface system parameter determines which host interface is used to communication with the host. Each interface is software selectable and only one host interface is active at a time, however, USB may always be connected and overrides the current interface. The host interface is selected based on the power-up default value and can be changed at run time. The SkyeModule Nova operates under host control using SkyeTek Protocol v3 sent over one of the host interfaces described in this chapter.

The following sections describe the power and host communication connections for the SkyeModule Nova. The SkyeTek Protocol and commands are described further in section 13, Communicating with the Module.

11.1 USB 2.0

As a USB device, the host detects the SkyeModule Nova as an HID device. The SkyeModule Nova uses a standard HID driver but is not a certified USB device. The SkyeModule Nova supports both standard and high speed USB hosts and enumerates correctly on both Windows and UNIX platforms. The USB interface is typically only used for demonstration as a USB host controller is not usually available for in embedded systems. To communicate with the reader in USB mode, either SkyeTek demonstration software or the SkyeTek APIs can be used. See the SkyeTek support site for the latest software and API downloads at support.skyetek.com.

Figure 11-1 shows an example of a circuit to permit USB communications without using the host interface board.

[PICTURE]

Figure 11-1: USB Connection Diagram

NOTE – If powered by USB, the USB host must be capable of supplying the USB standard high power device, 500mA at 5V.
