Skywire® Raspberry Pi Adapter Data Sheet

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1. Introduction

1.1 Overview

This document is the data sheet for the Skywire Raspberry Pi Adapter. Throughout the document the Skywire Raspberry Pi Adapter will often be referred to as "the adapter", although it may be referred to by its full name.

The NimbeLink Skywire modem is available with bundled data plans from leading cellular carriers. Visit go.nimbelink.com for cellular data plan details.

The Skywire cellular modem, antennas, and power supply are sold separately.

Make sure you check the Nimbelink's Skywire Raspberry Pi Adapter's product page for the most up to date information.

1.2 Product Description

The Skywire Raspberry Pi Adapter allows Raspberry Pis to gain easy access to the Internet of Things (IoT) via any of the Skywire plug-in cellular modems. The Raspberry Pi is a low-cost, community-supported development platform that allows quick, easy application development. It accepts plug-in boards called "hats" or "adapters" that allow a wide variety of expanded capabilities. The Skywire Raspberry Pi Adapter supports any of NimbeLink's end-device certified Skywire plug-in cellular modems with optional bundled, no-contract cellular plans. In addition to cellular connectivity the adapter offers:

- A 5V Power Supply input via a 2.1mm DC barrel Jack
- Compatibility with the Raspberry Pi 3B and the Raspberry Pi Compute Module 3 I/O Board
- Two Grove sensor interfaces for unlimited sensor flexibility

Fast, easy prototyping made possible by the Skywire Raspberry Pi Adapter.

1.3 Orderable Parts

Orderable Part Number	Description	Carrier	Technology
NL-AB-RPI	Skywire Raspberry Pi Development Kit		
NL-SW-LTE-SVZM20-ES	Skywire, 4G LTE CAT M1, Verizon	Verizon	4G LTE
NL-SW-LTE-GELS3-C	Skywire, 4G LTE CAT 1, Verizon	Verizon	4G LTE
NL-SW-LTE-WM14-B	Skywire, 4G LTE CAT 1, AT&T, T-Mobile	AT&T, T-Mobile	4G LTE
NL-SW-LTE-TSVG	Skywire, 4G LTE CAT 3, w/ GNSS, Verizon	Verizon	4G LTE
NL-SW-LTE-TNAG-B	Skywire, 4G LTE CAT 3, w/ GNSS, AT&T, T-Mobile	AT&T, T-Mobile	4G LTE
NL-SW-LTE-S7588-T	Skywire, 4G LTE CAT 4, AT&T, T-Mobile	Verizon	4G LTE
NL-SW-LTE-S7588-V	Skywire, 4G LTE CAT 4, Verizon	AT&T, T-Mobile	4G LTE
TG.08.0113	Monopole Cellular Antenna		
TG.30.8113	Dipole Cellular Antenna		

1.4 Additional Resources
- Nimbelink's Skywire Raspberry Pi Development Kit Product Page

2. Technical Specifications

2.1 Block Diagram

5VDC Barrel Jack

Grove Connectors

4V Regulator

SMA

USB

Skywire

SMA

40 Pin RPI Connector
60 Pin RPI Compute Module 3 I/O Board Connector
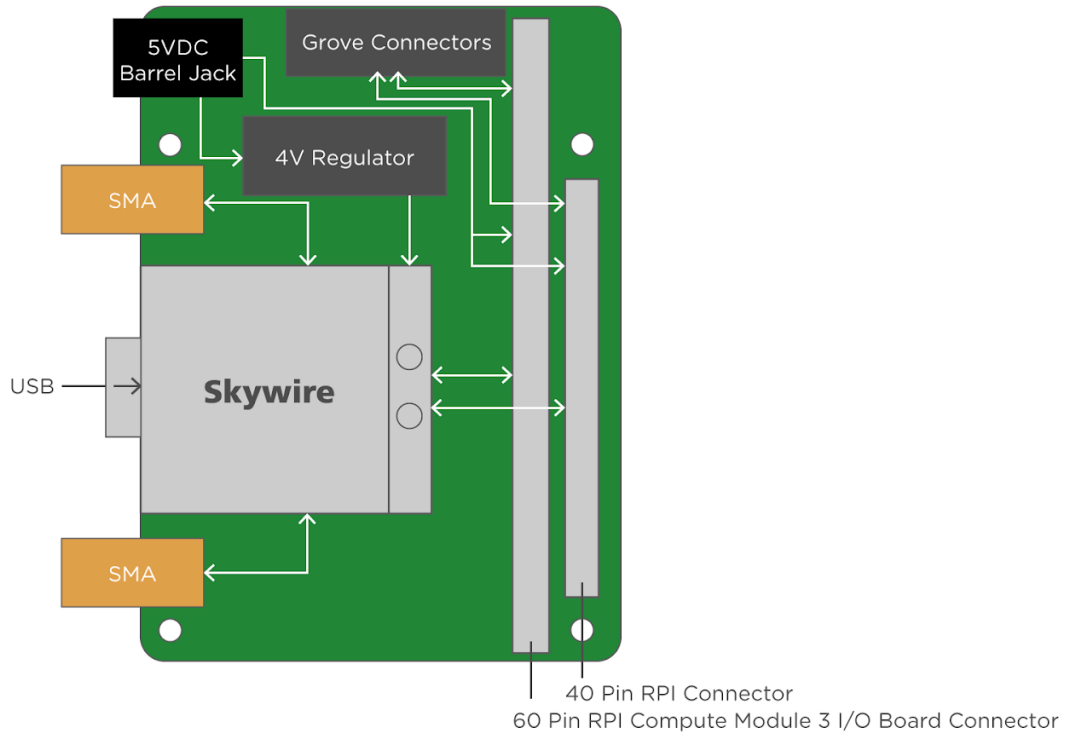
2.2 Pinout

The adapter can use up to 20 GPIO in addition to the GND and VCC connections on the J8 and J11 headers.

| Connector	Direction	RPI GPIO Name	Connection	Notes
J8-3/J11-1	Input	GPIO02	J10 Grove I2C SDA	See Note 1
J8-5/J11-3	I/O	GPIO03	J10 Grove I2C SCL	See Note 1
J8-7/J11-4	Output	GPIO04	4V Regulator Enable	
J8-29/J11-11	I/O	GPIO05	J9 Grove GPIO5	See Note 1
J8-31/J11-13	I/O	GPIO06	J9 Grove GPIO6	See Note 1
J8-26/J11-15	Input	GPIO07	EEPROM WP	
J8-32/J11-25	Input	GPIO12	Skywire ON/Sleep	
J8-33/J11-27	I/O	GPIO13	Skywire ADC	
J8-8/J11-29	Output	GPIO14	Skywire DIN	
J8-10/J11-31	Input	GPIO15	Skywire DOUT	
J8-36/J11-33	Input	GPIO16	Skywire CTS	
J8-11/J11-35	Output	GPIO17	Skywire RTS	
J8-12/J11-37	Output	GPIO18	4V Regulator PG	
J8-15/J11-45	I/O	GPIO22	Skywire DIO2	See Note 1, 2
J8-16/J11-47	I/O	GPIO23	Skywire DIO3	See Note 1, 2
J8-18/J11-49	Input	GPIO24	Skywire ON-OFF	
J8-22/J11-51	Input	GPIO25	Skywire Reset	
J8-13/J11-55	Input	GPIO27	Skywire DTR	
J8-28/J11-3	Input	ID_SC	I2C ID SCL	
J8-27/J11-1	I/O	ID_SD	I2C ID SDA	

*Note 1: Not configured by Device Tree Overlay (DTO)
*Note 2: Not connected by default, optional 0 ohm jumper can be connected to use the signal.

2.3 Mechanical Specifications

Mechanical Specifications	
Parameter	Value
Mechanical Size	65.9x78x23.4mm
PCB Layers	4
PCB Thickness	1.6mm
RoHS	Yes
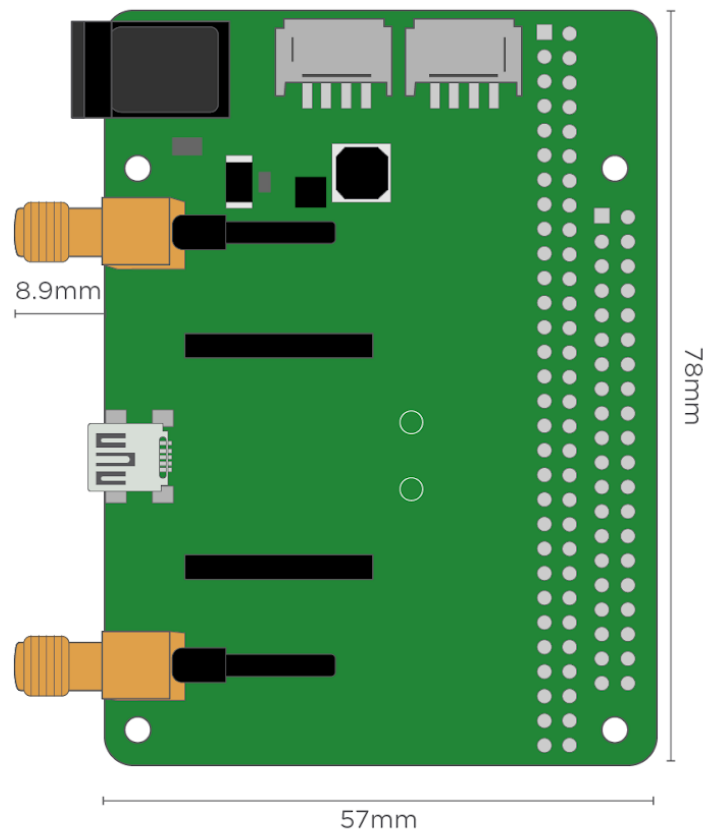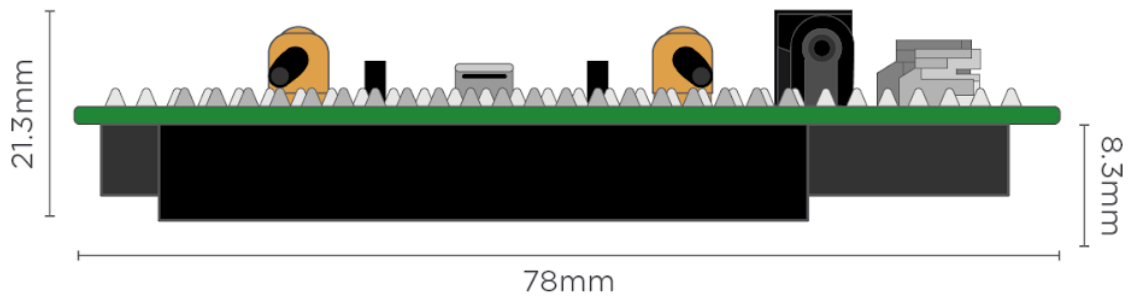
2.4 Electrical Specifications

Electrical Specifications				
Parameter	Min	Typ	Max	Unit
J5 Input Voltage	4.9	5	5.1	V
J5 Current Requirements		0.8	3.3	A
Skywire Current Requirements*		0.3	2	A
Raspberry Pi Current Requirements		0.4	1.3	A

*Skywire current requirements will vary between different modem models. Modems will use more current in low signal conditions (poor RF reception).

2.5 Power Requirements

The adapter requires a +5VDC input to J5 in order to power the Skywire Modem. The adapter can not be back powered by the Raspberry Pi, but the +5VDC input from J5 can power any attached Raspberry Pi.

Nimbelink recommends using a +5VDC 3A supply, such as CUI's SWI18-5-N-P6, to ensure enough current is available for the Skywire and the Raspberry Pi during high current loads.

2.6 Raspberry Pi Compatibility

NimbeLink's Skywire Raspberry Pi Development Kit has been designed to be drop in compatible with the following Raspberry Pi models:

-   Raspberry Pi 3 Model B
-   Raspberry Pi Compute Module 3 I/O Board.

2.7 Antenna Specifications

For optimum performance, a dipole antenna, such as a Taoglas TG.30.8113 antenna, is recommended.

2.8 Features

Nimbelink's Skywire Raspberry Pi Adapter is designed to be a low cost, adaptable cellular gateway for the Raspberry Pi development platforms. The adapter enables diverse connectivity options by including a Skywire Cellular Modem socket for cellular/GPS connections, allowing users to use any of Nimbelink's 2G, 3G, or 4G Skywire modems.

2.8.1 Skywire Cellular Modem

The hat's Skywire socket allows for the Skywire cellular modem to communicate with the Raspberry Pi development kit over UART or through a USB connection. The Skywire's 20-pin form factor allows for compatibility across all of the Skywire product line and interchangeability between 2G, 3G, and 4G cellular technologies.

2.8.2 Grove Connectors

There are two Grove Connectors onboard the adapter that allow users to attach additional digital Grove sensors. Grove connector J9 connects to GPIO5/GPIO6 to provide two GPIO's and connector J10 connects to the Raspberry Pi's I2C pins. The adapter's DTO does not load pin configurations for J15 or J16, but many distributions will automatically configure I2C1 at boot.

NOTE: Applications using the Grove connectors on NL-AB-RPI adapter board with PCB revision 1001430 REV A are affected by Errata 1001468.

2.8.3 EEPROM

The adapter has an onboard EEPROM containing the adapter device tree overlay(DTO) information that is attached to the ID I2C lines. By default the EEPROM has write protection enabled to protect the EEPROM from data corruption, but if users need to modify the EEPROM they can control the WP pin using GPIO7. The EEPROM is configured by default to use I2C2 address 0x50.
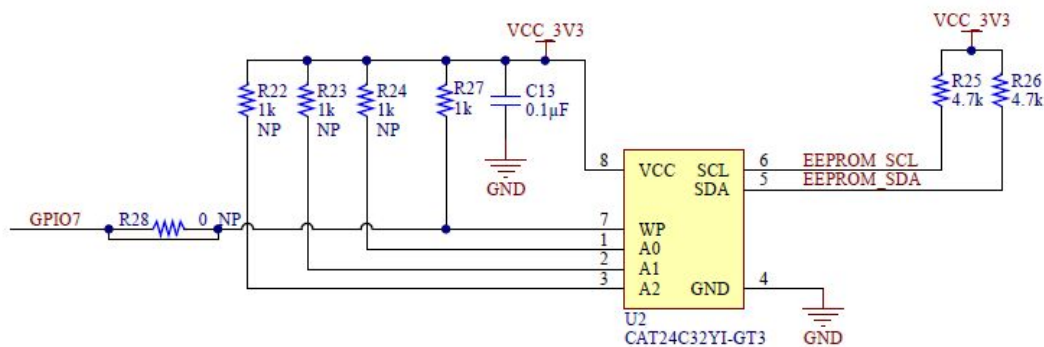
2.8.4 Device Tree Overlay

The adapters onboard EEPROM contains information that will automatically configure the Raspberry Pi's device tree to enable the adapters required pins. The device tree will automatically configure the following:

Pin	Configuration	Use	I/O	Initialized Value	Comments
GPIO04	Input	Sky_PWR_EN	I	Default	See Note 3
GPIO07	Input	EEPROM_WP	I	Default	See Note 3
GPIO14	ALT0	UART TXD	O	Default	
GPIO15	ALT0	UART RXD	I	Default	
GPIO16	ALT3	UART CTS	I	Default	
GPIO17	ALT3	UART RTS	O	Default	
GPIO18	Input	Sky_PWR_PG	I	Default	See Note 3
GPIO24	Input	Sky_On_Off	I	Default	See Note 3
GPIO25	Output	Sky_Reset	O	Down	
GPIO27	Output	Sky_DTR	O	Down	

*Note 3: This signal is configured as an input to allow the default hardware pullup/pulldowns on the adapter to drive the signal. If users wish to manipulate these signals they will need to initialize the pin to their prefered settings.