Skywire® RL78/Kurumi Adapter User Manual

NimbeLink Corp

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1. Introduction

1.1 Product Overview

This document is the Hardware Reference Manual for the Skywire® RL78/Kurumi Adapter. The Skywire RL78/Kurumi Adapter is designed to provide robust cellular connectivity for the Renesas RL78/G13 Demonstration Kit and the Renesas Kurumi.

The Skywire Cellular Modem at the heart of this adapter connects your M2M device to the Internet of things without the costs, delays, and hassles of federal and carrier certifications.

The NimbeLink Skywire modem is available with bundled data plans from leading cellular carriers.

1.2 Orderable Part Numbers

| Orderable Device	Description	Manufacturer	Carrier	Network Type
NL-AB-RL78	Skywire RL78/Kurumi Adapter Board	NimbeLink		
NL-SW-1xRTT-V	Skywire 1xRTT Cellular Modem without data plan. 2G Modem.	NimbeLink	Verizon	CDMA 1xRTT
TG.30.8113	Primary & Diversity Cellular Antenna	Taoglas		
NL-SW-EVDO-V	Skywire EVDO Cellular Modem without Data plan. 3G Modem.	NimbeLink	Verizon	CDMA 1xRTT
MA.301.A.AB.001	3G Primary Antenna. GPS/GLONASS Antenna for Skywire EVDO*	Taoglas		

1.3 Additional Resources
- NimbeLink's Skywire2G 1xRTT Product Page
- NimbeLink's Skywire 3G CDMA/EVDO Product Page
- Telit's CE910 Hardware User Guide
- Telit's DE910 Hardware User Guide

1.4 Device Overview

Top Side

Bottom Side
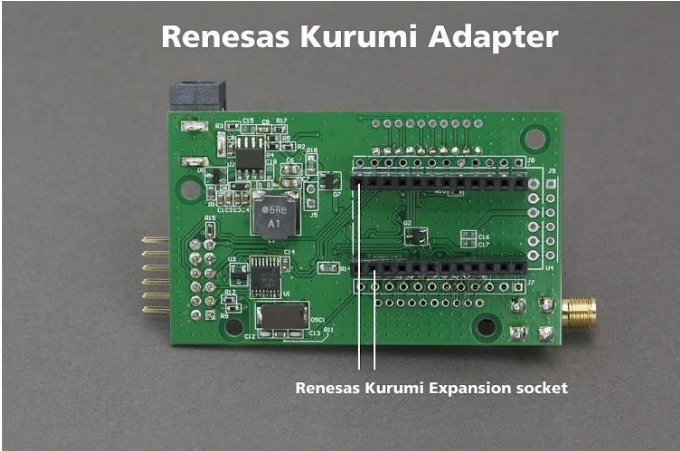
2. Technical Specifications

2.1 Electrical Specifications

2.1.1 Operating Parameters

Parameter	Value	Unit
Skywire UART Baud Rate	115200	bps
Skywire I/O Voltage	1.65-5.5	V
Skywire Power Consumption, Active Cell	750	mA
Normal	29	mA
Power Saving	1.1	mA
Skywire Input Voltage	4	V
J1 Input Voltage	5	V
PMOD Input Voltage	3.3	V
PMOD I/O Voltage	3.3	V
Kurumi Input Voltage	4	V
Temperature Range	-40 to +85°C	^{o}C
Dimensions	47 x 82 x 25	mm

2.2 Power

The Skywire RL78/Kurumi Adapter requires 5V and 3.3V inputs. Connector J1 accepts 5V input voltage and is used to supply power to the Skywire 4V Power Supply. The acceptable input Voltage range for J1 is 4.8-5.2V. Do not exceed 5.5V.

The Skywire Cellular Modem will regularly consume high amounts of current (~750 mA) from the adapters power supply. It is recommended to have 1A of available source current available for the adapter board.

2.3 Connection Descriptions

Designator	Description
SW1	Mode Selection Switch
J1	5V Power IN, Barrel Jack
J2	Skywire Breakout Header
J3	Skywire Breakout Header
J4	PMOD Connector
J5	Current Test Point
J6	Skywire Breakout Header
J7	Renesas Kurumi Breakout Header
J8	Renesas Kurumi Breakout Header
J9	Renesas Kurumi Programming Header
U4	Renesas Kurumi Socket

3. Operating Modes

3.1 RL78/G13 Demonstration Kit PMOD Adapter

3.1.1 About

The PMOD interface on the Skywire RL78-Kurumi Adapter adheres to the Digilent PMOD specifications for Type 2A (Expanded SPI) PMOD Interface with a standard twelve-pin connector.

The PMOD interface connects to the Renesas Demonstration Kit for the RL78/G13 (YRDKRL78G13) through the PMOD2 connector. The adapter's onboard SPI to UART converter provides protocol translation allowing for the demonstrations kits Type 2A (Expanded SPI) PMOD Interface to communicate with the Skywire module.

3.1.2 Block Diagram
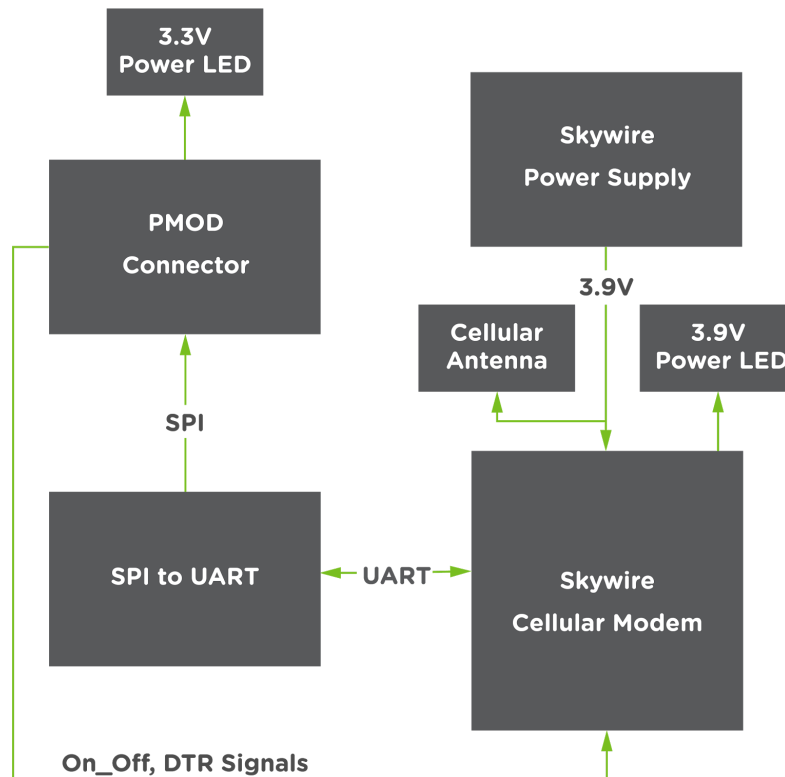
3.1.3 Switch Configuration

SW1 is used to control the configuration mode of the adapter. To configure the adapter for use with the PMOD connection do the following:

1. Remove power from J1 and the PMOD connection.

2. Place SW1.1-SW1.5 in the on position.

3. Place SW1.6 in the off position.

4. Configuration complete.

3.1.4 Connections

The Skywire RL78-Kurumi Adapter connects to the RL78/G13 through a Type 2A (Expanded SPI) PMOD Interface. The table below describes the connections.

PIN	Signal	Description
1	SS	Slave Select. Active low to enable slave device
2	MOSI	Master Out Slave In. Data from master to slave
3	MISO	Master In Slave Out. Data from slave to master
4	SCK	Serial clock. Master provides the clock to shift the data
5	GND	
6	VCC	
7	INT	Interrupt signal from slave to master, connected to the SPI to UART converter chip
8	RESET	Reset signal for master to reset SPI to UART converter
9	Skywire ON/OFF	Skywire On Off control line
10	Skywire DTR	Skywire DTR signal
11	GND	
12	VCC	

### 3.1.5 SPI to UART Chip Configurations

To configure the XR20M1170 SPI to UART interface for communication between the PMOD interface (SPI) and the Skywire Cellular Modem (UART, 115200 bps) use the configuration sequence in the table below. The SPI interface from the host processor

should be configured to SPI MODE0, most Significant bit first, and the clocking rate must be 16 MHz or lower.

Configuration Step	Register	Register Address	Value	Notes
1	LCR	0x03	0xBF	Configure LCR for EFR write
2	EFR	0x02	0x10	Configure EFR
3	LCR	0x03	0xB0	Configure LCR for Baud rate config
4	DLL	0x00	0x08	Configure baud rate for 115200 bps
5	DLM	0x01	0x00	Configure baud rate for 115200 bps
6	DLD	0x02	0x00	Configure baud rate for 115200 bps
7	MCR	0x04	0x03	Configure clock prescaler
8	LCR	0x03	0xBF	Write LCR for EFR write
9	EFR	0x02	0x00	Disable config mode
10	LCR	0x03	0x03	Reset LCR for operation mode
11	LCR	0x02	0x07	Enable and clear FIFOs

3.1.6 Board Orientation

The adapter should be connected to the RL78/G13 Demonstration kit with the Skywire modem facing towards the demonstration kit as shown below or with a right angle adaptor with the Skywire Modem facing upwards.
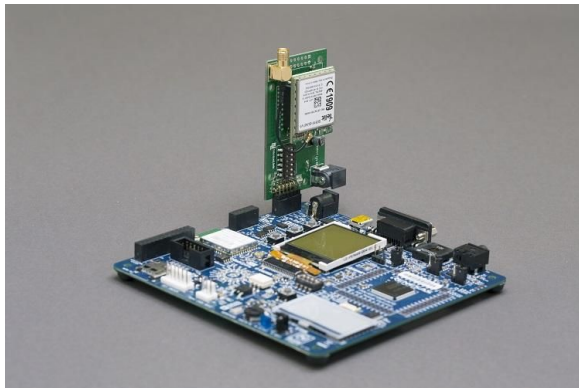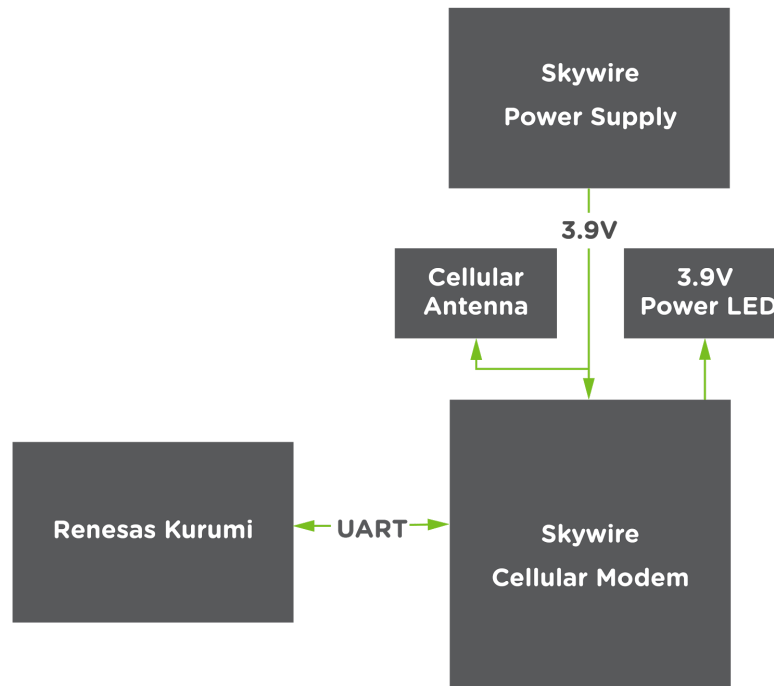

3.2 Renesas Kurumi Adapter

3.2.1 About

The Renesas Kurumi interface on the Skywire RL78-Kurumi Adapter provides a UART connection between the two boards.

3.2.2 Block Diagram

3.2.3 Switch Configuration

SW1 is used to control the configuration mode of the adapter. To configure the adapter for use with the Renesas Kurumi do the following:

1. Remove power from J1 and the PMOD connection.

2. Place SW1.1-SW1.5 in the off position.

3. Place SW1.6 in the on position.

4. Configuration complete.

3.2.4 Connections

The following table shows the connections between the NimbeLink Skywire Cellular Modem and the Renesas Kurumi.

Kurumi Pin	Signal	Description
2	Skywire DTR	Skywire Data Terminal Ready Signal
4	Skywire On Off	Skywire On/Off control line
5	Skywire CTS	Skywire Clear to Send
6	Skywire RTS	Skywire Ready to Send
7	Skywire DIN	Skywire UART data in
8	Skywire DOUT	Skywire UART data out

3.2.5 Board Orientation

The Renesas Kurumi board should be attached with the programming header aligned with the programming header breakout pins(J9) on the adapter board.