

Skywire™ 2G 1xRTT Embedded Cellular Modem Datasheet

NimbeLink Corp

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1. Introduction

1.1 Orderable Part Numbers

| Orderable Device | Operating Temperature | Carrier | Network Type |
|------------------|-----------------------|---------|--------------|
| NL-SW-1xRTT-V | -40 to +85°C | Verizon | CDMA 1xRTT |
| NL-SW-1xRTT-A | -40 to +85°C | AERIS | CDMA 1xRTT |

1.2 Additional Resources

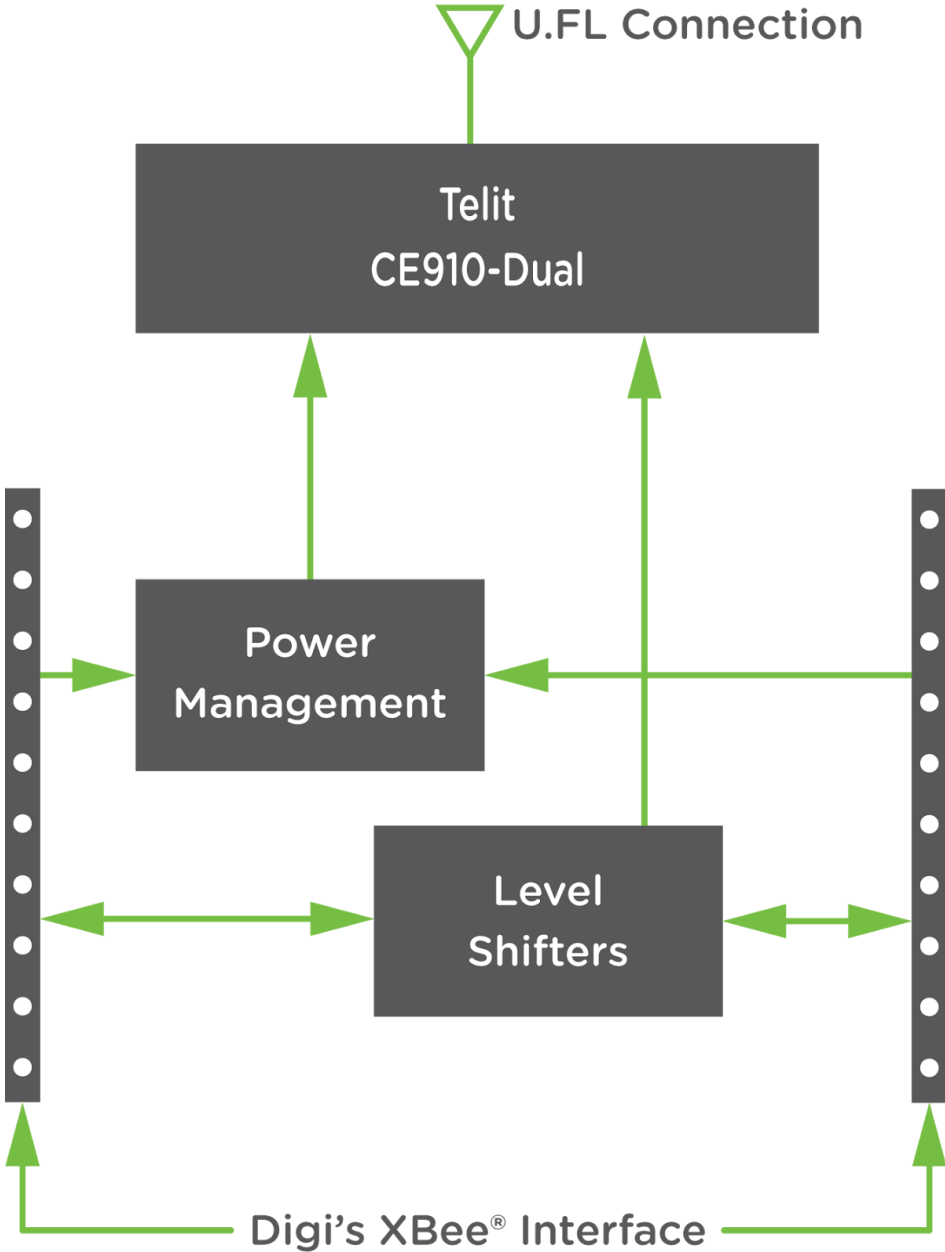
The following documents or documentation resources are referenced within this document.

- [Telit's CE910 Hardware User Guide](#)

1.3 Product Overview

Add robust cellular connectivity to your M2M devices without the cost, delay, and hassle of federal and carrier certifications. Extensive experience in designing and building embedded product solutions makes the NimbeLink Skywire™ embedded cellular modem the smallest on the market. It complies with the popular XBEE® interface standard and supports 1xRTT communication, minimizing costs of hardware and network access. The module is designed for volume production and is intended for OEMs to embed into end equipment designs.

1.4 Block Diagram



2. Technical Specifications

2.1 Electrical Specifications

2.1.1 Absolute Maximum Ratings

| Parameter | Signal | Maximum Rating |
|-----------------------|--------|----------------|
| Main Power Supply | VCC | 4.3V |
| I/O Voltage Reference | VREF | 5.5V |

2.1.2 Recommended Ratings & Module Pin out

2.1.2.1 Connectors J1 and J2

| Pin | Name | Direction | Description | Min | Typical | Max | If not used |
|-----|-----------|-----------|--|-------------------------|---------|-----------------------------------|--|
| 1 | VCC | Input | Main Power supply | 3.5V | 3.9V | 4.3V | Must be implemented |
| 2 | DOUT | Output | UART data out, I/O level tied to VREF | VOL: GND to 0.55V | | VOH: VREF x 0.67 to VREF | Must be implemented if USB not used, No connection |
| 3 | DIN | Input | UART data in, I/O level tied to VREF | VIL: GND to 0.15V | | VIH: VREF-0.4 V to VREF | Must be implemented if USB not used, No connection |
| 4 | GND | Input | Ground Pin | | 0 | | Must be implemented |
| 5 | RESET_nIN | Input | Controls HW_SHUTDOWN input on Telit CE910-DUAL, tie low for 800mS to activate. Internally pulled up to VCC with 57k resistor. Drive with open collector output. Assert only in an emergency as the module will not gracefully exit the cellular network when asserted. | | VREF | | No connection |
| 6 | VUSB | Input | Supply for USB interface | 4.4V | 5V | 5V | No connection |
| 7 | USB_D+ | I/O | USB differential Data + signal | | | | No connection |
| 8 | USB_D- | I/O | USB differential Data - signal | | | | No connection |
| 9 | DTR | Input | Modem Data Terminal Ready input | VIL: GND to 0.15V | | VIH: VREF-0.4 V to VREF | Tie to GND |
| 10 | GND | Input | Ground Pin | | 0 | | Must be implemented |
| 11 | GND | Input | Ground Pin | | 0 | | Must be implemented |
| 12 | CTS | Output | Modem Clear to Send hardware flow control output | VOL: GND to 0.55V | | VOH: VREF x 0.67 to VREF | No connection |

| | | | | | | | |
|----|-----------|--------|---|----------------------|--------------|----------------------------|----------------------|
| 13 | ON/nSLEEP | Output | Signal drives the onboard LED indicating network status. OFF = Device OFF, Fast blink = Searching for Network & Not Registered, Slow Blink = Registered with full service, Permanently on = call is active. See Telit CE910-DUAL manual for additional information. | 0 | | 1.8V | No connection |
| 14 | VREF | Input | Voltage reference for offboard I/O signals. This signal drives the input voltage side of an onboard buffer which converts all external I/O voltage from VREF range to 1.8V range to drive the onboard Telit CE910-DUAL modem module. | 1.65V | 1.8V or 3.3V | 5.5V | Must be implemented |
| 15 | GND | Input | Ground Pin | | 0 | | Must be implemented |
| 16 | RTS | Input | Modem Request to Send hardware flow control input | VIL: GND to 0.15V | | VIH: VREF-0.4 V to VREF | Tie to GND |
| 17 | DIO3 | I/O | Programmable GPIO_03 on Telit CE910-DUAL module | 0 | | 1.8V | No connection |
| 18 | DIO2 | I/O | Programmable GPIO_02 on Telit CE910-DUAL module | 0 | | 1.8V | No connection |
| 19 | ADC1 | Input | ADC_IN1 input on Telit CE910-DUAL module (12bit resolution, <1mV, input resistance 1Mohm) | 0 | | 1.8V | No connection |
| 20 | ON_OFF | Input | Modem On/Off signal. Assert low for at least 1 second and then release to activate start sequence. Drive with open collector output. Internally pulled up to internal I/O rail with 200k pull up. Do not use any external pull ups. Note: If you want modem to turn on automatically when power is applied, permanently tie this signal to GND. | 0 | | 1.8V | Must be implemented. |

2.2 Mechanical Specifications

2.2.1 Mechanical Characteristics

| Parameter | Typical | Unit |
|--|----------------------|--------|
| Dimensions (excluding pin height, for solder to board applications) | 29.0 x 33.60 x 6.63 | mm |
| Dimensions (including pin height, for board to board connector applications) | 29.0 x 33.60 x 10.73 | mm |
| Weight | x | Grams |
| Connector Insertion/Removal | hundreds | Cycles |

2.2.2 Mating Connectors

| Connector Designator | Manufacture | Populated on Module | Recommended Mate | Mate Manufacture |
|----------------------|-------------|---------------------|---|-----------------------------|
| J1, J2 | 3M | 951110-2530-AR-PR | 950510-6102-AR | 3M |
| | | | Acceptable alternate: NPPN101BFCN-RC | Sullins Connector Solutions |
| X1 | Hirose | U.FL-R-SMT(10) | CAB.011 | Taoglas |

2.2.3 Device Placement

⚠ Make sure the Skywire™ is installed in the correct orientation; failure to do so will damage the device and void the warranty.

2.3 Environmental Specifications

| Parameter | Min | Typical | Max | Unit | Note |
|-----------------------|-----|---------|-----|------|----------------|
| Operating Temperature | -40 | 25 | +85 | °C | |
| Storage Temperature | -40 | 25 | +85 | °C | |
| Operating Humidity | 20 | | 90 | % | Non-condensing |

3. Important Design Considerations

3.1 ON_OFF Signal

To conserve power, the Telit CE910-DUAL does not automatically start up when power is applied. The baseboard design must supply a means to assert the ON_OFF signal for the specified time (1 second < hold time < 2 seconds) to start-up the module. To make module automatically start when power is applied, tie ON/OFF signal to GND permanently. See Telit Hardware User Guide for additional details regarding the ON_OFF signal.

3.2 Power Supply Requirements

The module will regularly consume high amounts of current on the Main Power Supply (VCC), up to 750mA during active transmits and receives. The baseboard power supply should be designed to support peak currents up to 1 Amp. A 100uF capacitor should be placed near the VCC pin on the module to ensure ample energy is available, with a low inductance path to the VCC pin. For example power supply designs, there are multiple references available. See the NimbeLink Skywire™ Development Kit schematic for a switching regulator example, or reference the Telit Hardware User Guide which has an example of both Linear and Switching regulator designs.

3.3 Network Connection Status LED

The ON/nSLEEP signal on pin 13 drives the on-board LED indicating network status. By default, the 1xRTT module has this setting disabled. Use the following commands to enable and save this feature.

First, configure the GPIO for alternate function:

```
AT#GPIO = 1,0,2
```

The modem should respond with:

```
OK
```

Next, set the desired LED behavior with this command:

```
AT#SLED=2,10,10
```

The modem should respond with:

```
OK
```

Finally, commit the changes to non-volatile memory so the setting will persist across power down/power up:

```
AT#SLEDSAV
```

The modem should respond with:

```
OK
```


| LED Status | Network Status Indication |
|-----------------|--|
| Permanently OFF | Device OFF or setting disabled (see above) |
| Fast Blinking | Searching for Network & Not Registered |
| Slow Blinking | Registered with full service |
| Permanently ON | Call is active |

4. Mounting Guidelines

The Skywire™ embedded cellular modem supports multiple connection methods, the two primary methods are board to board connectors and soldering directly to the baseboard.

4.1 Board to Board connectors approach

The XBEE® form factor calls for two, 10 pin, 2mm pitch female receptacles.

There are many connector manufactures that can be used; below is one readily available product:

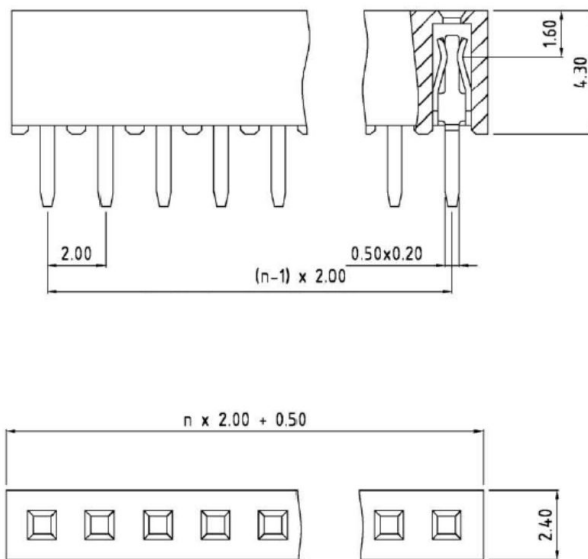
Manufacture: 3M

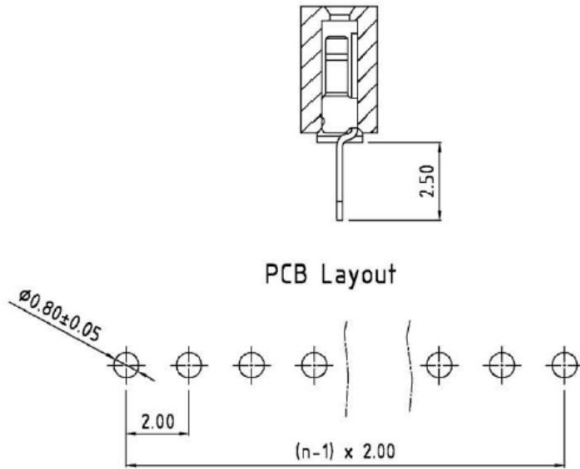
Alternate: Sullins Connector Solutions

Part Number: 950510-6102-AR

Alternate P/N: NPPN101BFCN-RC

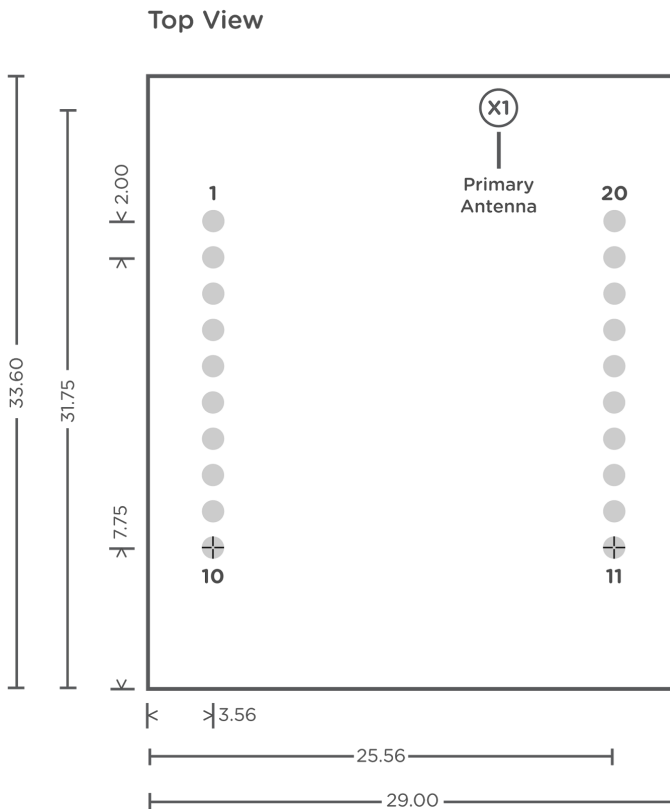
Typical part drawing and footprint information:





4.2 Solder to Board connection approach

The module can be soldered directly to a PCB. The PCB should be designed with two rows of ten, 0.8mm plated thru holes spaced 2mm apart. The two rows should be 22mm apart. See drawing for recommended footprint. Measurements are in millimeters.



5. Antenna Considerations

5.1 Antenna Requirements

Designers should review latest CE910 Hardware User Guide to ensure the information is up to date.

| Parameter | Signal |
|-----------------------------|---------------------|
| Type | 800/1900Mhz Primary |
| Bandwidth in CDMA BC0 | 70Mhz |
| Bandwidth in CDMA BC1 | 140Mhz |
| Max Gain in CDMA BC0 | 5.12dBi |
| Max Gain in CDMA BC1 | 6.12dBi |
| Impedence | 50 Ohm |
| Input Power (Average Power) | >24.5dBm |
| VSWR recommended | <2:1 |

5.2 Recommended Antennas

| Type | Manufacturer | Part Number |
|---------|----------------------|-----------------|
| Primary | Taoglas ¹ | TG.30.8113 |
| Primary | MobileMark | PSKN3-900/1900S |

Note 1: U.FL to SMA adapter required.

For applications not using the recommended antennas developers will need to ensure that the selected antenna(s) must meet the following gain requirements:

| Frequency | Max Gain (dBi) |
|---------------|----------------|
| 700 MHz Band | 10.41 dBi |
| 1700 MHz Band | 6.5 dBi |

6. Certifications

6.1 Carrier Specific

NL-SW-1xRTT

Verizon OD Certified

6.2 Geography Specific

Federal Communications Commission (FCC47) part 22, 24

Complies with FCC47 Part 15 Class B Radiated and Conducted Emissions

7. Federal Regulatory Licensing

7.1 Export Control Classification Number (ECCN)

ECCNs are five character alpha-numeric 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.

NL-SW-LTE-1xRTT (and all Skywire Modems): 5A992.a

7.2 Harmonized Tariff Schedule Code

HTS Code: 8517.62.0010

8. End Product Labeling Requirements

Device Uses Approved Radio: NL-SW-1xRTT

Contains FCC ID: RI7CE910-DUAL and IC ID: 5131A-CE910DUAL

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 interferences, and (2) this device must accept any interference received, including interference that may cause undesired operation.