AirPrime HL7802

Hardware Integration Guide

SIERRA WIRELESS®

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Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless product are used in a normal manner with a well-constructed network, the Sierra Wireless product should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless product, or for failure of the Sierra Wireless product to transmit or receive such data.

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Revision History

Revision number	Release date	Changes
1	June 2020	Creation

Contents

>> 1: Introduction

The AirPrime HL7802 is an industrial-grade LGA 86-pad module that provides data connectivity on LTE and 2G networks. The module also provides GNSS functionality.

1.1 Accessories

A hardware development kit is available for AirPrime HL78 series modules. The kit contains hardware components for evaluating and developing with the module, including:
- Development board
- Cables
- Antennas (Additional antennas may be required to support all bands)
- Other accessories

2: Power

2.1 Power Supply

The host provides power to the AirPrime HL7802 through multiple power and ground pins. The host must provide safe and continuous power at all times; the module does not have an independent power supply, or protection circuits to guard against electrical issues.

For detailed pinout and voltage / current requirements of this module, see the AirPrime HL7802 Product Technical Specification.

2.2 Module Power Modes

Table 2-1 summarizes the AirPrime HL7802 module's power modes.

Table 2-1: Supported Power Modes

Power Mode	Description	Wake-up Events[a]
OFF	Module is off (no power to the system)	Apply power
Running	Module is powered RF power is on only during Rx/Tx activity	n/a
Sleep	Basic low power mode Possible modem state—Stack OFF, DRX, eDRX, PSM, No service	• UART1_DTR signal transition to active • WAKE_UP signal transition to active
Lite Hibernate	Intermediate low power mode Possible modem state—Stack OFF, eDRX, PSM, No service	• UART1_DTR signal transition to active • WAKE_UP signal transition to active
Hibernate	Lowest power mode Possible modem state—Stack OFF, eDRX, PSM	• WAKE_UP signal transition to active

a. Subject to device configuration.

3: RF Specifications

3.1 Supported Bands

The AirPrime HL7802 operates on the frequency bands listed below:

Table 3-1: LTE Frequency Band Support

RF Band	Transmit (Tx) Band (MHz)	Receive (Rx) Band (MHz)	Cat-M1	Cat-NB1
B1	1920–1980	2110–2170	Y	Y
B2	1850–1910	1930–1990	Y	Y
B3	1710–1785	1805–1880	Y	Y
B4	1710–1755	2110–2155	Y	Y
B5	824–849	869–894	Y	Y
B8	880–915	925–960	Y	Y
B9	1749.9–1784.9	1844.9–1879.9	See [a]	See [a]
B10	1710–1770	2110–2170	See [a]	See [a]
B12	699–716	729–746	Y	Y
B13	777–787	746–756	Y	Y
B18	815–830	860–875	Y	Y
B19	830–845	875–890	Y	Y
B20	832–862	791–821	Y	Y
B25	1850–1915	1930–1995	Y	Y
B26	814–849	859–894	Y	Y
B27	807–824	852–869	Y	See [a]
B28	703–748	758–803	Y	Y
B66	1710–1780	2110–2200	Y	Y

a. Will be supported in a future release.

Table 3-2: GPRS / EDGE Frequency Band Support

RF Band	Transmit Band (TX)	Receive Band (Rx)
GSM 850	824–849	869–894
E-GSM 900	880–915	925–960
DCS 1800	1710–1785	1805–1880
PCS 1900	1850–1910	1930–1990

Table 3-3: GNSS Frequency Band Support

Band	Frequencies (MHz)
GPS L1	1575.42 ± 20
GLONASS L1 FDMA	1597.5–1605.8

3.2 Conducted Tx Power

Table 3-4: Conducted Tx Max Output Power Tolerances — LTE[a]

RF Band	Min	Typ	Max	Units	Notes
All bands	21.5	23	24.5	dBm	Power Class 3

a. Normal operation conditions (25°C)

Table 3-5: Conducted Tx Max Output Power Tolerances — 2G[a,b]

RF Band	Min	Typ	Max	Units	Notes
GSM 850	31.5	32.5	33.5	dBm	GMSK mode (Class 4; 2 W, 33 dBm)
E-GSM 900	31.5	32.5	33.5	dBm	GMSK mode (Class 4; 2 W, 33 dBm)
DCS 1800	28.5	29.5	30.5	dBm	GMSK mode (Class 1; 1 W, 30 dBm)
PCS 1900	28.5	29.5	30.5	dBm	GMSK mode (Class 1; 1 W, 30 dBm)

a. Stated power tolerances satisfy 3GPP TS 51.010-1 requirements for normal (25°C) and Class A (extreme) conditions.
b. Stated power tolerances for input voltage of 3.7V.

4: General Design Recommendations

This section describes general design recommendations for the AirPrime HL7802 module.

Note: This is a non-exhaustive list of suggested design guidelines. The developer is responsible for deciding whether to implement these guidelines.

4.1 Host Application Board PCB

For details pertaining to PCB design requirements and industrial assembly of the AirPrime HL7802 module on host applications, refer to Airprime HL78xx Customer Process Guidelines, available at http://source.sierrawireless.com.

4.2 Power Supply

When designing the power supply, make sure that VBATT/VBATT_PA meet the requirements listed in the AirPrime HL7802 Product Technical Specification, available at http://source.sierrawireless.com.

The AirPrime HL7802 should not be supplied with voltage over 4.35V, even temporarily or however briefly.

If the system's main board power supply unit is unstable or supplied with voltage over 4.35V, even in the case of transient voltage presence on the circuit, the module's power amplifier may be severely damaged.

To avoid such issues, add a voltage limiter to the module's power supply lines so that VBATT and VBATT_PA signal pads will never receive a voltage surge over 4.35V. The voltage limiter can be as simple as a Zener diode.

4.3 Antenna

Sierra Wireless strongly recommends working with an antenna manufacturer either to develop an antenna adapted to the application, or to adapt an existing solution to the application.

4.4 ESD Guidlines

4.4.1 ESD Guidelines for USIM

Decoupling capacitors must be added according to the drawings below as close as possible to the USIM connectors on UIM1_CLK, UIM1_RST, UIM1_VCC, UIM1_DATA and UIM1_DET signals to avoid EMC issues and to comply with the requirements of ETSI and 3GPP standards covering the USIM electrical interface.

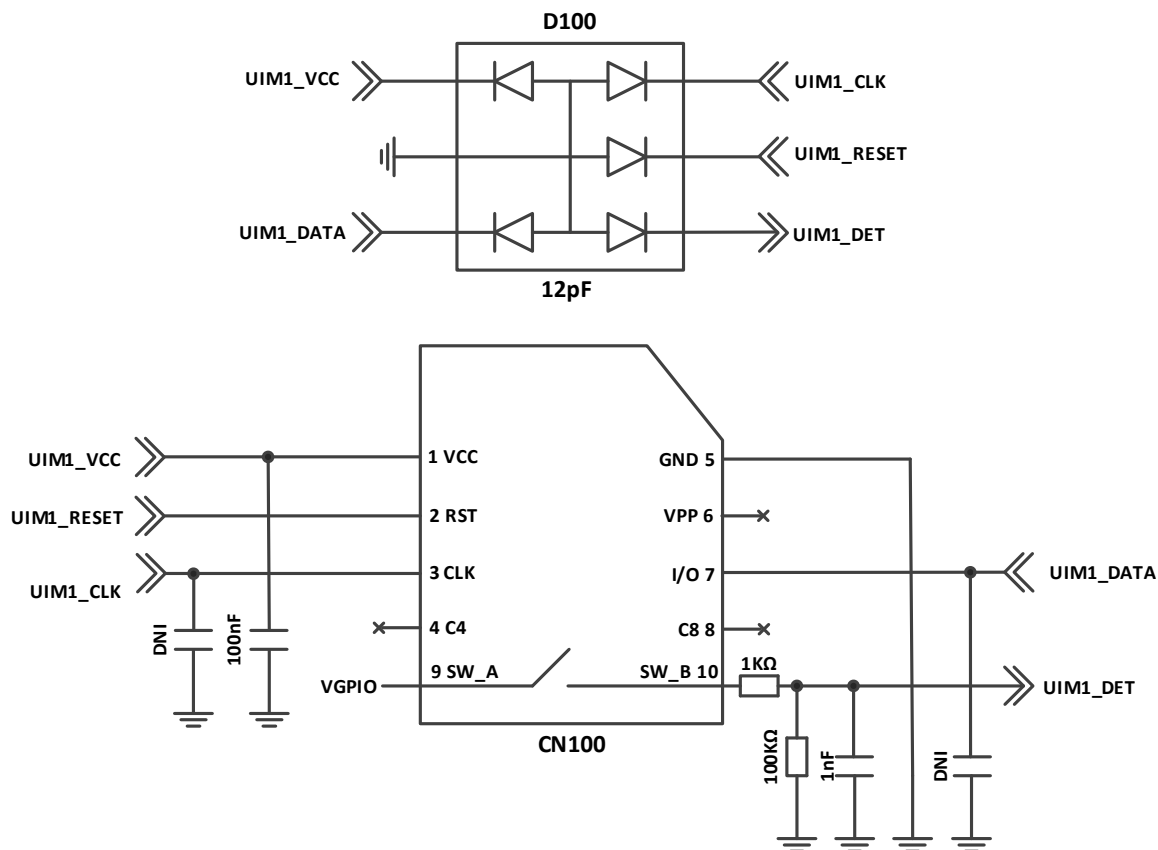A typical schematic including USIM detection is provided below.

Figure 4-1: EMC and ESD Components Close to the USIM

Sierra Wireless recommends using diode ESDALC6V1-5P6 ESD for D100.

4.4.2 ESD Guidelines for USB (TBC)

When the USB interface is externally accessible, it is required to have ESD protection on the USB_VBUS, USB_D+ and USB_D- signals.
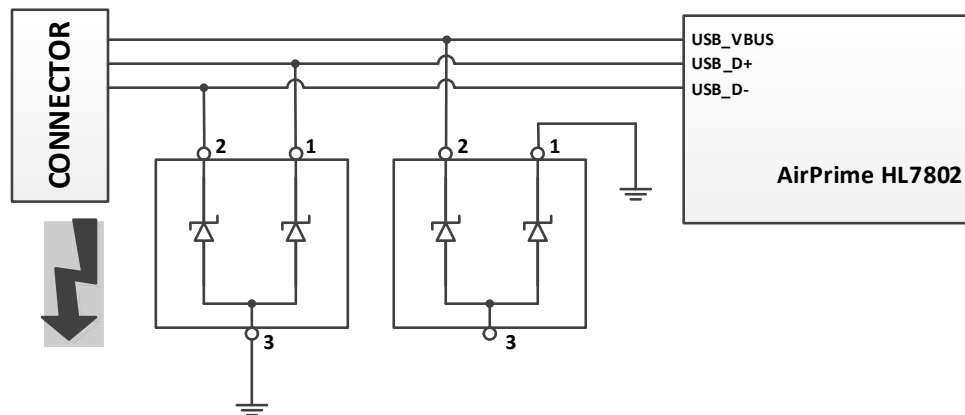
Figure 4-2: ESD Protection for USB

Note: It is not recommended to have an ESD diode with feedback path from USB_VBUS to either USB_D+ or USB_D-.

Sierra Wireless recommends using ESD diode RCLAMP0503N or ESD5V3U2U-03LRH.

5: Regulatory Compliance and Industry Certifications

5.1 Important Compliance Information for North American Users

The AirPrime HL7802 module has been granted modular approval for mobile applications. Integrators may use the AirPrime HL7802 module in their end products without additional FCC/IC (Industry Canada) certification if they meet the following conditions. Otherwise, additional FCC/IC approvals must be obtained.

1. The end product must use the RF trace design approved with the AirPrime HL7802 module. The Gerber file of the trace design can be obtained from Sierra Wireless upon request.

2. At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.

3. To comply with FCC/IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed the limits stipulated in Table 5-1.

Table 5-1: AirPrime HL7802 Antenna Gain Specifications

Device	Technology	Band	Frequency (MHz)	Maximum antenna gain (dBi)	
				Standalone	Collocated
AirPrime HL7802	LTE	B2	1850–1910	8	6
		B4	1710–1755	6	6
		B5	824–849	6	4
		B12	699–716	6	3
		B13	777–787	6	3
		B25	1850–1915	6	6
		B26	814–849	6	4
		B66	1710–1780	6	6
	GPRS/EDGE	GPRS G850	824–849	3	1
		GPRS G1900	1850–1910	3	3

4. The AirPrime HL7802 module may transmit simultaneously with other collocated radio transmitters within a host device, provided the following conditions are met:
   - Each collocated radio transmitter has been certified by FCC/IC for mobile application.
   - At least 20 cm separation distance between the antennas of the collocated transmitters and the user's body must be maintained at all times.

- · ·The radiated power of a collocated transmitter must not exceed the EIRP limit stipulated in Table 5-2.

Table 5-2: Collocated Radio Transmitter Specifications

Device	Technology	Frequency (MHz)	EIRP Limit (dBm)
Collocated transmitters[a]	WLAN 2.4 GHz	2400–2500	30
	WLAN 5 GHz	5150–5850	30
	BT	2400–2500	16
	WiGig	58320–62640	25

a. Valid collocated transmitter combinations: WLAN+BT; WiGig+BT. (WLAN+WiGig+BT is not permitted.)

5. A label must be affixed to the outside of the end product into which the AirPrime HL7802 module is incorporated, with a statement similar to the following:
   - **This device contains FCC ID: N7NHL7802 / IC:2417C-HL7802.**

6. A user manual with the end product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC/IC RF exposure guidelines.

The end product with an embedded AirPrime HL7802 module may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

Note: If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093 and IC RSS-102.

6: Terms and Abbreviations

Table 6-1: Terms and Abbreviations

Abbreviation	Definition
CLK	Clock
DRX	Discontinuous Reception
EDGE	Enhanced Data rates for GSM Evolution
eDRX	Extended DRX
ESD	Electro-Static Discharges
ETSI	European Telecommunications Standards Institute
FDMA	Frequency-division multiple access
GLONASS	Global Navigation Satellite System
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
LTE	Long-Term Evolution
PCB	Printed Circuit Board
PSM	Power Save Mode
RST	Reset
UART	Universal Asynchronous Receiver-Transmitter
UIM	User Identity Module
USB	Universal Serial Bus
USIM	UMTS Subscriber Identity Module
VBATT VBATT_PA	Main Supply Voltage from Battery or DC Adapter