Product Technical Specification

AirPrime HL6528RDx

SIERRA WIRELESS

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1. Introduction

The HL6528RDx series of embedded modules were created to improve, expand and enhance the design of the existing HL6528x.

This document defines the high level product features and illustrates the interfaces for the AirPrime HL6528RDx, and covers the hardware aspects of the product series, including electrical and mechanical.

Redesigned variants covered in this document are:

- HL6528RD
- HL6528RD-G
- HL6528RD-2.8V
- HL6528RD-G2.8V

The AirPrime HL6528RD and HL6528RD-G modules are 1.8V IO modules as defined in section **Error! Reference source not found. Error! Reference source not found.**. 2.8V IO variants are also available, and defined throughout this document as HL6528RD-2.8V and HL6528RD-G2.8V. HL6528RDx denotes applicability to all four variants.

The AirPrime HL6528RDx belongs to the AirPrime HL Series from Essential Connectivity Module family. This is an industrial-grade quad-band GSM/GPRS Embedded Wireless Module, designed for the automotive market and any other market with similar quality and life-time support requirements. The following table enumerates the frequencies supported by the HL6528RDx module.

Table 1.   Supported Frequencies

RF Band	Transmit band (Tx)	Receive band (Rx)	Maximum Output Power
GSM 850	824 to 849 MHz	869 to 894 MHz	2 Watts GSM and GPRS
E-GSM 900	880 to 915 MHz	925 to 960 MHz	2 Watts GSM and GPRS
DCS 1800	1710 to 1785 MHz	1805 to 1880 MHz	1 Watt GSM and GPRS
PCS 1900	1850 to 1910 MHz	1930 to 1990 MHz	1 Watt GSM and GPRS

This module supports a large variety of interfaces such as Analog and Digital Audio, as well as Dual UIM Single Standby to provide customers with the highest level of flexibility in implementing high-end solutions. In addition, both AirPrime HL6528RD-G and HL6528RD-G2.8V modules also embed a high-performance GNSS receiver.

1.1.   Common Flexible Form Factor (CF³)

The AirPrime HL6528RDx module belongs to the Common Flexible Form Factor (CF³) family of modules. This family consists of a series of WWAN modules that share the same mechanical dimensions (same width and length with varying thicknesses) and footprint. The CF³ form factor provides a unique solution to a series of problems faced commonly in the WWAN module space as it:

- Accommodates multiple radio technologies (from 2G to LTE advanced) and band groupings
- Supports bit-pipe (Essential Module Series) and value add (Smart Module Series) solutions
- Offers electrical and functional compatibility
- Provides Direct Mount as well as Socketability depending on customer needs

1.2.   Physical Dimensions

The AirPrime HL6528RDx modules are compact, robust, fully shielded modules with the following dimensions:

- Length: 23 mm
- Width: 22 mm
- Thickness: 2.50 mm (including the label)
- Weight : 2.25g (TBC)

Note: Dimensions specified above are typical values.

1.3.   General Features

The table below summarizes the AirPrime HL6528RDx module features.

Table 2.   AirPrime HL6528RDx Features

Feature	Description
GSM Output Power	• Class 4 (2 W) for GSM 850 and E-GSM 900 • Class 1 (1 W) for DCS 1800 and PCS 1900
GPRS	• Quad-band GSM 850/E-GSM 900/DCS 1800/PCS 1900 • GPRS Multi-slot class 10 • R99 support • PBCCH support • Coding schemes: CS1 to CS4
Audio Interface	• Analog and Digital interfaces • Supports Full Rate (FR), Enhanced Full Rate (EFR), Half Rate (HR) and Adaptive Multi Rate (AMR) • Noise reduction and echo cancellation • DTMF generation
UIM Interface	• Dual UIM Single Standby support • 1.8V/3.0V support for UIM1 and UIM2 • Supports UIM application tool kit with proactive UIM commands
Application Interface	• Full set of AT commands for GSM/GPRS including GSM 07.07 and 07.05 AT command sets • Comprehensive set of dedicated AT commands for M2M applications
SMS	• SMS class 0,1 and 2 • SMS MT, MO • SMS storage into UIM card or Flash memory • Concatenation of MT SMS
Supplementary Services	• Call Forwarding • Call Barring • Multiparty Service • Call Waiting • Call Hold • USSD • Automatic answer

Feature	Description
RTC	Real Time Clock (RTC) with calendar and alarm
Temperature Sensor	• Temperature monitoring • Alarms

1.4. GNSS Features

The table below summarizes the GNSS capabilities of the AirPrime HL6528RD-G and HL6528RD-G2.8V modules.

Table 3.   GNSS Capabilities

Feature	Description
GPS	L1 band (CDMA 1575.42 MHz)
GLONASS	L1 Band (FDMA 1602MHz)
SBAS (TBC)	WAAS, EGNOS, MSAS, GAGAN, QZSS
Channels	52
Antenna	Passive or active antenna support
Assistance data	Server-generated Extended Ephemeris

1.5. Interfaces

The AirPrime HL6528RD and HL6528RD-2.8V modules provide the following interfaces and peripheral connectivity:

- 1x – Backup Battery Interface
- 2x – 1.8V/3V UIM
- 1x – USB 1.1
- 8x – GPIOs, 4 of which have multiplexes
- 1x – 8-wire UART
- 1x – Active Low PWR_ON_N
- 1x – Active Low RESET_IN_N
- 2x – ADC
- 2x – System Clock Out
- 1x – Analog Audio Interface (Differential input/output)
- 1x – Digital Audio
- 1x – I²C
- 1x – Debug Interface
- 1x – JTAG Interface
- 1x – GSM Antenna
- 1x – 2G TX Burst Indicator

In addition to the interfaces above, the AirPrime HL6528RD-G and HL6528RD-G2.8V modules also provide the following interfaces and peripheral connectivity:

- GPS Antenna
- External LNA Enable/Disable
- Pulse Per Second

1.6.   Connection Interface

The AirPrime HL6528RDx module is an LGA form factor device. All electrical and mechanical connections are made through the 146 pads Land Grid Array (LGA) on the bottom side PCB.
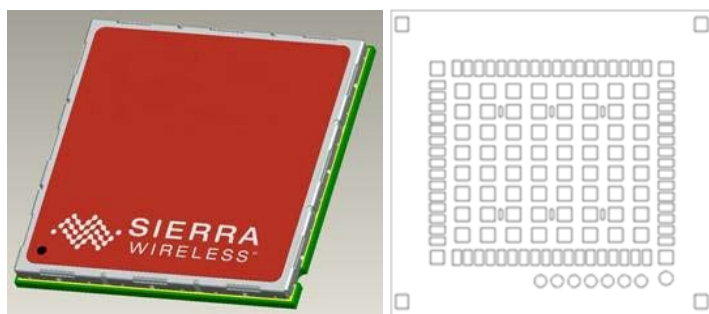
Figure 1.   AirPrime HL6528RDx Module Mechanical Overview

The 146 pads have the following distribution

- 66 inner signal pads, 1x0.5mm, pitch 0.8mm
- 1 reference test point (Ground), 1.0mm diameter
- 7 test point (JTAG), 0.8mm diameter, 1.20mm pitch
- 64 inner ground pads, 1.0x1.0mm, pitch 1.825mm/1.475mm
- 4 inner corner ground pads, 1x1mm
- 4 outer corner ground pads, 1x0.9mm

1.7.   ESD

Refer to the following table for ESD Specifications.

Note: Information specified in the following table is preliminary and subject to change.

Table 4.   ESD Specifications

Category	Connection	Specification
Operational	RF ports	IEC-61000-4-2 — Level (Electrostatic Discharge Immunity Test) ESD protection is highly recommended at the point where the antenna (main and GPS) contacts are exposed.
Non-operational	Host connector interface	Unless otherwise specified: • JESD22-A114 +/- 1500V Human Body Model • JESD22-A115 +/- 150V Machine Model • JESD22-C101C +/- 500V Charged Device Model

Category	Connection	Specification
Signals	SIM connector	ESD protection is highly recommended at the point where the USIM contacts are exposed, and for any other signals that would be subjected to ESD by the user.
	Other host signals	

1.8. Environmental and Certifications

1.8.1. Environmental Specifications

The environmental specification for both operating and storage conditions are defined in the table below.

Table 5.   AirPrime HL6528RDx Module Environmental Specifications

Conditions	Range
Operating Class A	-30°C to +70°C
Operating Class B	-40°C to +85°C
Storage	-40°C to +90°C

Class A is defined as the operating temperature ranges that the device:

- Shall exhibit normal function during and after environmental exposure.
- Shall meet the minimum requirements of 3GPP or appropriate wireless standards.

Class B is defined as the operating temperature ranges that the device:

- Shall remain fully functional during and after environmental exposure
- Shall exhibit the ability to establish a voice, SMS or DATA call (emergency call) at all times even when one or more environmental constraint exceeds the specified tolerance.
- Unless otherwise stated, full performance should return to normal after the excessive constraint(s) have been removed.

1.8.2. Regulatory

The AirPrime HL6528RDx module is compliant with the following regulations: R&TTE directive, FCC, IC, ANATEL and NCC.

1.8.3. RoHS Directive Compliant

The AirPrime HL6528RDx module is compliant with RoHS Directive 2011/65/EU which sets limits for the use of certain restricted hazardous substances. This directive states that "from 1st July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)".

1.8.4.   Disposing of the Product

This electronic product is subject to the EU Directive 2012/19/EU for Waste Electrical and Electronic Equipment (WEEE). As such, this product must not be disposed of at a municipal waste collection point. Please refer to local regulations for directions on how to dispose of this product in an environmental friendly manner.

1.9.   References

[1]   AirPrime HL Series Customer Process Guidelines

Reference Number: 4114330

[2]   AirPrime HL6528RDx AT Commands Interface Guide

Reference Number: 4117743

[3]   AirPrime HL Series Development Kit User Guide

Reference Number: 4114877

2. Detailed Interface Specifications

Note: *If not specified, all electrical values are given for VBATT=3.7V and an operating temperature of 25°C.*

If needed, the AirPrime HL6528RDx module can support two different voltages for VBATT and VBATT_PA power inputs. However, using the same power supply for both signals is recommended.

2.1. Power Supply

The AirPrime HL6528RDx module is supplied through the VBATT signal with the following characteristics.

Table 6. Power Supply

	Minimum	Typical	Maximum
VBATT voltage (V)	3.35[1]	3.7	4.3
VBATT_PA voltage (V) Full Specification	3.35[1]	3.7	4.3
VBATT_PA voltage (V) Extended Range[2]	2.8[2]	3.7	4.3

1   This value has to be guaranteed during the burst

2   No guarantee of 3GPP performances over extended range

2.2. Current Consumption

The following table lists the current consumption of the AirPrime HL6528RDx module at different conditions.

Note: *Typical values are defined for VBATT/VBATT_PA at 3.7V and 25°C, for 50Ω impedance at all RF ports. Maximum values are provided for VSWR 3:1 with worst conditions among supported ranges of voltage and temperature.*

Table 7. Current Consumption

Parameters		Typical	Maximum
Off mode (HL6528RD and HL6528RD-2.8V) (µA)		200	TBD
Off mode (HL6528RD-G and HL6528RD-G2.8V) (µA)		TBD	TBD
GSM Sleep mode (average, mA) Single UIM operation	DRX2	1.7	TBD
	DRX5	TBD	TBD
	DRX9	1.3	TBD
GSM Sleep mode (average, mA) Dual UIM operation	DRX2	TBD	TBD
	DRX5	TBD	TBD
	DRX9	TBD	TBD
GSM in communication mode (average, mA)	E-GSM 900 / GSM 850 (PCL=5)	220	TBD
	DCS 1800 / PCS 1900 (PCL=0)	150	TBD
GPRS (2 TX, 3 RX) (average, mA)	E-GSM 900 / GSM 850 (PCL=5)	330	TBD
	DCS 1800 / PCS 1900 (PCL=0)	230	TBD

Parameters		Typical	Maximum
Peak Current consumption (peak, A)	E-GSM 900 / GSM 850	1.5	TBD
	DCS 1800 / PCS 1900	0.9	TBD
GNSS Acquisition[1] (average, mA) GSM registered on network	Max value[3]	TBD	TBD
	Min value[4]	TBD	TBD
GNSS Acquisition[1] (average, mA) GSM in Flight mode	Max value[3]	TBD	TBD
	Min value[4]	TBD	TBD
GNSS Navigation (1Hz)[1] (average, mA) GSM registered on network	Max value[3]	TBD	TBD
	Min value[4]	TBD	TBD
GNSS Navigation (1Hz)[1] (average, mA) GSM in Flight mode	Max value[3]	TBD	TBD
	Min value[4]	TBD	TBD
GNSS Hibernate mode[2] (average, mA) GSM registered on network	Max value[3]	TBD	TBD
	Min value[4]	TBD	TBD

1   Maximum SVs in view, signal level @-130dBm, high gain configuration

2   Hot start conditions are maintained in Hibernate mode

3   Baseband is running (or no sleep mode allowed) in max value condition. Refer to document [2] AirPrime HL6528RDx AT Commands Interface Guide for sleep mode description.

4   Baseband is in sleep mode in min value condition. Refer to document [2] AirPrime HL6528RDx AT Commands Interface Guide for sleep mode description.

Table 8.   Current Consumption per Power Supply (VBATT / VBATT_PA)

Parameters			Typical	Maximum
VBATT_PA	Peak current (A) GPRS communication mode, 2TX	E-GSM 900 / GSM 850 (PCL=5)	TBD	TBD
		DCS 1800/ PCS 1900 (PCL=0)	TBD	TBD
	Peak current (A) GSM communication mode, 1TX	E-GSM 900 / GSM 850 (PCL=5)	TBD	TBD
		DCS 1800/ PCS 1900 (PCL=0)	TBD	TBD
	Average current (mA) GSM communication mode, 1TX	E-GSM 900 / GSM 850 (PCL=5)	TBD	TBD
		DCS 1800/ PCS 1900 (PCL=0)	TBD	TBD
VBATT (HL6528RD and HL6528RD-2.8V)	Peak current (A) GPRS communication mode, 2TX	E-GSM 900 / GSM 850 (PCL=5)	TBD	TBD
		DCS 1800/ PCS 1900 (PCL=0)	TBD	TBD
	Peak current (A) GSM communication mode, 1TX	E-GSM 900 / GSM 850 (PCL=5)	TBD	TBD
		DCS 1800/ PCS 1900 (PCL=0)	TBD	TBD
	Average current (mA) GSM communication mode, 1TX	E-GSM 900 / GSM 850 (PCL=5)	TBD	TBD
		DCS 1800/ PCS 1900 (PCL=0)	TBD	TBD

Parameters			Typical	Maximum
VBATT (HL6528RD-G and HL6528RD-G2.8V)	Peak current (A) GPRS communication mode, 2TX GNSS Navigation mode	E-GSM 900 / GSM 850 (PCL=5)	TBD	TBD
		DCS 1800/ PCS 1900 (PCL=0)	TBD	TBD
	Peak current (A) GSM communication mode, 1TX GNSS Navigation mode	E-GSM 900 / GSM 850 (PCL=5)	TBD	TBD
		DCS 1800/ PCS 1900 (PCL=0)	TBD	TBD
	Average current (mA) GSM communication mode, 1TX GNSS Navigation mode	E-GSM 900 / GSM 850 (PCL=5)	TBD	TBD
		DCS 1800/ PCS 1900 (PCL=0)	TBD	TBD

2.3.   VGPIO

The VGPIO output can be used to:

- Pull-up signals such as I/Os
- Supply the digital transistors driving LEDs

The VGPIO output is available when the AirPrime HL6528RDx module is switched ON.

Caution: *VGPIO is only on when RESET_IN_N and PWR_ON_N are both at low level.*

Table 9.   VGPIO Electrical Characteristics

Parameter	HL6528RD, HL6528RD-G			HL6528RD-2.8V, HL6528RD-G2.8V			Remarks
	Min	Typ	Max	Min	Typ	Max	
Voltage level (V)	1.70	1.80	1.90	2.7	2.80	2.95	Both active mode and sleep mode
Current capability active mode (mA)	-	-	50	-	-	50	
Current capability sleep mode (mA)	-	-	3 (TBC)	-	-	3 (TBC)	
Line regulation (mV/V)	-	-	50 (TBC)	-	-	50 (TBC)	Iout = MAX
Rise Time(ns)	-	-	6 (TBC)	-	-	6 (TBC)	Test load capacitor = 30 pF

2.4.   BAT_RTC

The AirPrime HL6528RDx module provides an input/output to connect a Real Time Clock power supply.

This pad is used as a back-up power supply for the internal Real Time Clock. The RTC is supported when VBATT is available but a back-up power supply is needed to save date and hour when VBATT is switched off.

If VBATT is available, the back-up battery can be charged by the internal 2.8 V power supply regulator.

Table 10.   BAT_RTC Electrical Characteristics

Parameter	Minimum	Typical	Maximum
Input voltage (V)	2.0	2.8	3.15
Input current consumption (µA)	-	2.5	56
Output voltage (V)	2.82	2.8	3.18
Max charging current (@VBATT=3.6V) (mA)	-	0.6	-

Note: If unused, it is recommended to add a common 10 µF capacitor to BAT_RTC.

2.5.   UIM Interface

The AirPrime HL6528RDx has two physical UIM interfaces – one main UIM interface (UIM1), and a second UIM interface (UIM2) reserved for Dual UIM Single Standby option.

Both UIM interface allow control of a 1.8V/3V UIM and are fully compliant with GSM 11.11 recommendations related to UIM functions.

The five signals used by the UIMx interface are as follows:

- UIMx_VCC: power supply
- UIMx_CLK: clock
- UIMx_DATA: I/O port
- UIMx_RESET: reset
- UIMx_DET: UIM detection (optional)

Table 11.   Electrical Characteristics of UIMx

Parameter	Min	Typ	Max	Remarks
UIMx Interface Voltage (V) (VCC, CLK, DATA, RESET)	2.7	3.0	3.15	The appropriate output voltage is auto detected and selected by software
	1.65	1.80	1.95	
UIMx_VCC Current (mA)	-	-	10	Max output current in sleep mode = 3 mA
UIMx_VCC Line Regulation (mV/V)	-	-	50	At Iout_Max
UIMx_VCC Power-up Setting Time (µs) from power down	-	10	-	
Logic 1 of UIMx_DET (V)	2.4	-	-	For HL6528RD-2.8V and HL6528RD-G2.8V
	1.4	-	-	For HL6528RD and HL6528RD-G
Logic 0 of UIMx_DET (V)	-	-	0.4	For HL6528RD-2.8V and HL6528RD-G2.8V
	-	-	0.4	For HL6528RD and HL6528RD-G
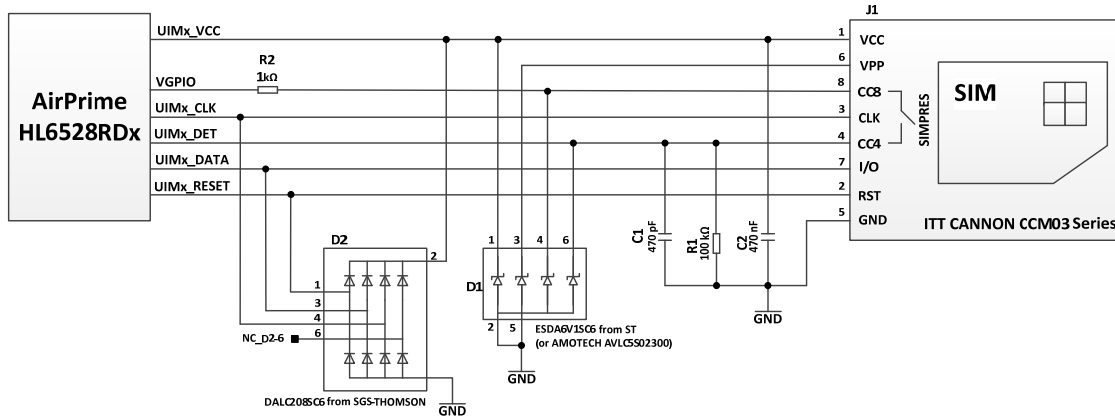
Figure 2.   UIMx Implementation Example

2.5.1.   UIMx_DET

UIMx_DET is used to detect and notify the application about the insertion and removal of a UIM device in the UIM socket connected to the UIM interface (UIM1 or UIM2). When a UIM is inserted, the state of UIMx_DET transitions from logic 0 to logic 1. Inversely, when a UIM is removed, the state of UIM1_DET transitions from logic 1 to logic 0.

The GPIO used for UIM1_DET is GPIO3, and the GPIO used for UIM2_DET is GPIO4.

2.6.   USB Interface

The AirPrime HL6528RDx has one USB interface.

USB_VBUS is used for USB connection detection purposes. For details, refer to document [2] AirPrime HL6528RDx AT Commands Interface Guide.

Table 12.   USB Pad Description

Pad #	Signal Name	I/O	Function
12	USB_D-	I/O	USB data negative
13	USB_D+	I/O	USB data position
16	USB_VBUS	I	USB VBUS

Table 13.   USB_VBUS Electrical Characteristics

Parameter	Minimum	Typical	Maximum	Unit
Input voltage	4.75	5.0	5.25	V
Input current consumption	-	1	-	mA

2.7.   Electrical Information for Digital I/O

The AirPrime HL6528RDx supports four groups of digital interfaces with varying current drain limits.

Table 14 Digital I/O Electrical Characteristics – Input/Output Voltage provides the input and output voltage values of the digital interfaces, while the succeeding tables provides the input and output current per digital IO group. Digital IO groups are as follows:

- Group 1:
  - GPIO2
  - GPIO6
  - GPIO7
  - GPIO8
  - PPS
  - EXT_LNA_EN
- Group 2:
  - UART1
- Group 3:
  - GPIO3
  - GPIO4
  - I²C
- Group 4:
  - PCM
  - DEBUG_TX

Table 14.   Digital I/O Electrical Characteristics – Input/Output Voltage

Parameter	HL6528RD, HL6528RD-G			HL6528RD-2.8V, HL6528RD-G2.8V		
	Min	Typ	Max	Min	Typ	Max
Input Voltage-High (V)	1.6		2.1	2.6		3.1
Input Voltage-Low (V)			0.15			0.15
Output Voltage-High (V)	1.206		2.1	1.87		3.1
Output Voltage-Low (V)			0.4			0.4

Table 15.   Digital I/O Electrical Characteristics – Group 1 Input/Output Current

Parameter	HL6528RD, HL6528RD-G			HL6528RD-2.8V, HL6528RD-G2.8V			Notes
	Min	Typ	Max	Min	Typ	Max	
Input Current-High(µA)	-22.5		12.5	-2			Current consumption
Input Current-Low(µA)	-82.5		-6.1			2	Current consumption
DC Output Current-High (mA)			16			0.02	
DC Output Current-Low (mA)	-16			-1			

Table 16.   Digital I/O Electrical Characteristics – Group 2 Input/Output Current

Parameter	HL6528RD, HL6528RD-G			HL6528RD-2.8V, HL6528RD-G2.8V			Notes
	Min	Typ	Max	Min	Typ	Max	
Input Current-High(µA)	-22.5		12.5	-22.5		12.5	Current consumption
Input Current-Low(µA)	-82.5		-6.1	-82.5		-6.1	Current consumption
DC Output Current-High (mA)			1.5			16	
DC Output Current-Low (mA)	-1.5			-16			

Table 17.   Digital I/O Electrical Characteristics – Group 3 Input/Output Current

Parameter	HL6528RD, HL6528RD-G			HL6528RD-2.8V, HL6528RD-G2.8V			Notes
	Min	Typ	Max	Min	Typ	Max	
Input Current-High(µA)	-2			-22.5		12.5	Current consumption
Input Current-Low(µA)			2	-82.5		-6.1	Current consumption
DC Output Current-High (mA)			0.02			16	
DC Output Current-Low (mA)	-1			-16			

Table 18.   Digital I/O Electrical Characteristics – Group 4 Input/Output Current

Parameter	HL6528RD, HL6528RD-G			HL6528RD-2.8V, HL6528RD-G2.8V			Notes
	Min	Typ	Max	Min	Typ	Max	
Input Current-High(µA)	-22.5		12.5	-22.5		12.5	Current consumption
Input Current-Low(µA)	-82.5		-6.1	-82.5		-6.1	Current consumption
DC Output Current-High (mA)			16			16	
DC Output Current-Low (mA)	-16			-16			

Note: The PCM interface only supports 2.8V even with 1.8V configuration.
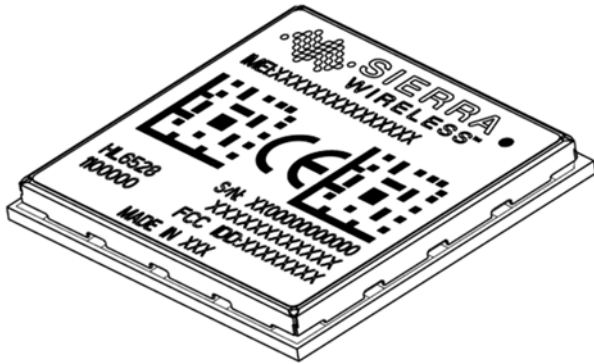
3.   Mechanical Drawings

Figure 3.   AirPrime HL6528RDx (angular view)
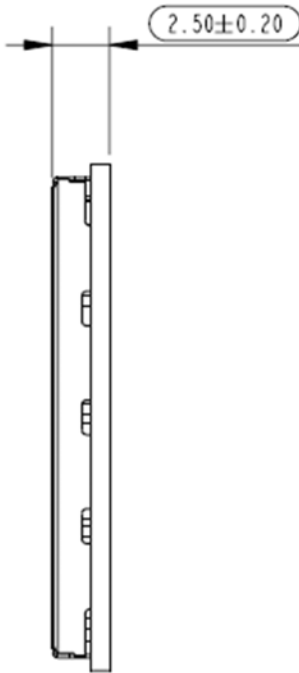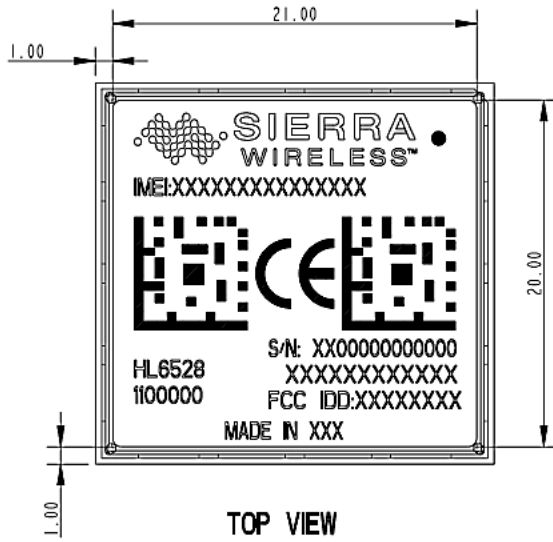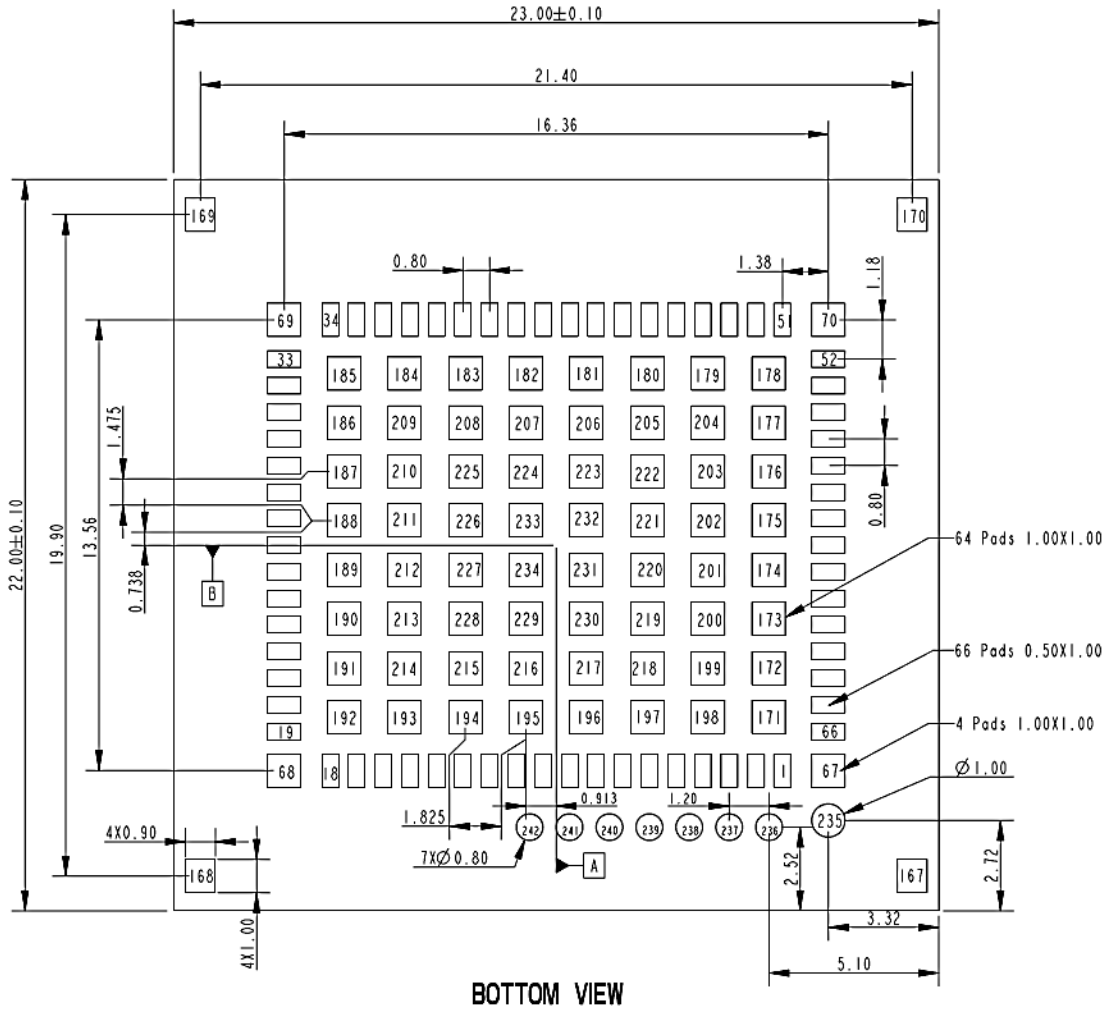

Figure 4.   AirPrime HL6528RDx (side view)

Figure 5.   AirPrime HL6528RDx Module (top view)

Figure 6.   AirPrime HL6528RDx Module (bottom view with dimensions)

4. Regulatory Legal Information

4.1. Label

The AirPrime HL6528RDx module is labeled with its own FCC ID on the shield side. Each HL6528RDx variant has its own FCC ID as listed in the table below.

Table 19.   AirPrime HL6528RDx FCC IDs

Model Name	FCC ID
HL6528RD	N7NHL6528RD
HL6528RD-G	N7NHL6528RDG
HL6528RD-2.8V	N7NHL6528RD28V
HL6528RD-G2.8V	N7NHL6528RDG28V

When the module is installed in a customer's product, the FCC ID label on the module will not be visible. To avoid this case, an exterior label must be stuck on the surface of the customer's product to indicate the FCC ID of the enclosed module. This label can use wording such as the following: "Contains Transmitter module FCC ID: <FCC ID as listed in Table 19 AirPrime HL6528RDx FCC IDs>" or "Contains FCC ID: <FCC ID as listed in Table 19 AirPrime HL6528RDx FCC IDs>".

4.2. FCC Regulations

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 interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

4.3.   RF Exposure Information

This Modular Approval is limited to OEM installation for mobile and fixed applications only. The antenna installation and operating configurations of this transmitter, including any applicable source-based time-averaging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of §2.1091.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons, must not be collocated or operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.

The end user has no manual instructions to remove or install the device and a separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

According to the MPE RF explore report, maximum antenna gain allowed for use with this device is 3.1 dBi for GSM 850 and 2 dBi for PCS 1900.

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily removed. Otherwise, a second label must be placed on the outside of the final device that contains the following text: —Contains FCC ID: <FCC ID as listed in Table 19 AirPrime HL6528RDx FCC IDs>

4.4.   IC Regulations

IC Radiation Exposure Statement:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'entrainer des comportements non-desirés

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p) is not more than necessary for successful communication.

Labeling Requirements for the Host Device (from Section 7.2, RSS RSP-100 issue 10, November 2014): The host device shall be properly labeled to identify the module within the host device. The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labeled to display the Industry Canada certification number of the module, preceded by the words — Contains transmitter moduleǁ, or the word — Containsǁ, or similar wording expressing the same meaning, as follows: Contains transmitter module IC: <IC as listed below>.

Table 20.   AirPrime HL6528RDx IC

Model Name	IC
HL6528RD	2417C-HL6528RD
HL6528RD-G	2417C-HL6528RDG
HL6528RD-2.8V	2417C-HL6528RD28V
HL6528RD-G2.8V	2417C-HL6528RDG28

This device complies with IC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the IC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.

Cet appareil est conforme aux limites d'exposition aux rayonnements de la IC CNR-102 définies pour un environnement non contrôlé. Afin d'éviter la possibilité de dépasser les limites d'exposition aux fréquences radio de la IC CNR-102, la proximité humaine à l'antenne ne doit pas être inférieure à 20 cm (8 pouces) pendant le fonctionnement normal.

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

4.5.   CE

The minimum distance between the user and/or any bystander and the radiating structure of the transmitter is 20cm.

Assessment of compliance of the product with the requirements relating to the Radio and Telecommunication Terminal Equipment Directive (EC Directive 1999/5/EC) was performed by Telefication BV (Notified Body No.0560)

CE 0560

5. Terms and Abbreviations

Abbreviation	Definition
ADC	Analog to Digital Converter
AGC	Automatic Gain Control
AT	Attention (prefix for modem commands)
AVL	Automatic Vehicle Location
CCB	Customer Carrier Board
CDMA	Code Division Multiple Access
CF3	Common Flexible Form Factor
CLK	Clock
CODEC	Coder Decoder
CPU	Central Processing Unit
DAC	Digital to Analog Converter
DTR	Data Terminal Ready
EGNOS	European Geostationary Navigation Overlay Service
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EN	Enable
ESD	Electrostatic Discharges
ETSI	European Telecommunications Standards Institute
FDMA	Frequency-division multiple access
GAGAN	GPS aided geo augmented navigation
GLONASS	Global Navigation Satellite System
GND	Ground
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
Hi Z	High impedance (Z)
IC	Integrated Circuit
IMEI	International Mobile Equipment Identification
I/O	Input / Output
LED	Light Emitting Diode
LNA	Low Noise Amplifier
MAX	Maximum
MIN	Minimum
MSAS	Multi-functional Satellite Augmentation System
N/A	Not Applicable
PA	Power Amplifier
PC	Personal Computer
PCB	Printed Circuit Board
PCL	Power Control Level
PLL	Phase Lock Loop

Abbreviation	Definition
PWM	Pulse Width Modulation
QZSS	Quasi-Zenith Satellite System
RF	Radio Frequency
RFI	Radio Frequency Interference
RMS	Root Mean Square
RST	Reset
RTC	Real Time Clock
RX	Receive
SCL	Serial Clock
SDA	Serial Data
SIM	Subscriber Identification Module
SMD	Surface Mounted Device/Design
SPI	Serial Peripheral Interface
SV	Satellite Vehicle
SW	Software
PSRAM	Pseudo Static RAM
TBC	To Be Confirmed
TBD	To Be Defined
TP	Test Point
TTS	Text To Speech
TX	Transmit
TYP	Typical
UART	Universal Asynchronous Receiver-Transmitter
UICC	Universal Integrated Circuit Card
USB	Universal Serial Bus
UIM	User Identity Module
VBATT	Main Supply Voltage from Battery or DC adapter
VSWR	Voltage Standing Wave Ratio
WAAS	Wide Area Augmentation System