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# Product Technical Specification

## AirPrime HL8548 and HL8548-G

PRELIMINARY



**SIERRA**  
WIRELESS

4114663  
1.0  
October 16, 2013

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PRELIMINARY



# Contents

|   |           |
|---|-----------|
| <b>1. INTRODUCTION .....</b>                      | <b>9</b>  |
| 1.1. Common Flexible Form Factor (CF3).....       | 9         |
| 1.2. Physical Dimensions .....                    | 10        |
| 1.3. General Features.....                        | 10        |
| 1.4. GNSS Features .....                          | 13        |
| 1.5. Architecture .....                           | 13        |
| 1.6. Interfaces.....                              | 14        |
| 1.7. Connection Interface .....                   | 14        |
| 1.8. ESD .....                                    | 15        |
| 1.9. Environmental & Certifications .....         | 15        |
| 1.9.1. Environmental Specifications .....         | 15        |
| 1.9.2. Regulatory .....                           | 16        |
| 1.9.3. RoHS Directive Compliant .....             | 17        |
| 1.9.4. Disposing of the Product .....             | 17        |
| 1.9.5. References .....                           | 17        |
| <b>2. PAD DEFINITION .....</b>                    | <b>18</b> |
| <b>3. DETAILED INTERFACE SPECIFICATIONS .....</b> | <b>22</b> |
| 3.1. Power Supply .....                           | 22        |
| 3.2. Power Consumption .....                      | 22        |
| 3.3. VGPI0 .....                                  | 23        |
| 3.4. BAT_RTC .....                                | 24        |
| 3.5. SIM Interface .....                          | 24        |
| 3.6. USB .....                                    | 25        |
| 3.7. Electrical Information for Digital I/O ..... | 25        |
| 3.8. General Purpose Input/Output (GPIO) .....    | 25        |
| 3.9. Main Serial Link (UART1).....                | 26        |
| 3.10. POWER ON Signal (PWR_ON) .....              | 27        |
| 3.11. Reset Signal (RESET).....                   | 27        |
| 3.12. ADC .....                                   | 28        |
| 3.13. PWM .....                                   | 28        |
| 3.14. Clock Interface.....                        | 28        |
| 3.15. PCM.....                                    | 28        |
| 3.16. I <sup>2</sup> C Interface.....             | 30        |
| 3.17. HSIC .....                                  | 30        |
| 3.18. Debug Interfaces .....                      | 30        |
| 3.18.1. Debug Port .....                          | 30        |
| 3.18.2. JTAG .....                                | 30        |

|           |                                       |           |
|-----------|---------------------------------------|-----------|
| 3.19.     | PPS (HL8548-G Only) .....             | 31        |
| 3.20.     | EXT_LNA_GPS_EN (HL8548-G only) .....  | 31        |
| 3.21.     | RF Interface .....                    | 31        |
| 3.21.1.   | RF Connection .....                   | 31        |
| 3.21.2.   | RF Performances .....                 | 32        |
| 3.21.3.   | TX Burst Indicator (2G_TX_ON) .....   | 32        |
| 3.22.     | GNSS Interface .....                  | 33        |
| <b>4.</b> | <b>DESIGN GUIDELINES .....</b>        | <b>34</b> |
| 4.1.      | Power-Up Sequence .....               | 34        |
| 4.2.      | Module Switch-Off .....               | 34        |
| 4.3.      | Sleep Mode Management .....           | 34        |
| 4.4.      | ESD Guidelines for SIM Card .....     | 35        |
| 4.5.      | Radio Integration .....               | 36        |
| <b>5.</b> | <b>X-RAY EXPOSURE .....</b>           | <b>37</b> |
| <b>6.</b> | <b>FCC/IC LEGAL INFORMATION .....</b> | <b>38</b> |
| 6.1.      | Label .....                           | 38        |
| 6.2.      | FCC Regulations .....                 | 38        |
| 6.3.      | RF Exposure Information .....         | 38        |
| 6.4.      | IC Regulations .....                  | 39        |
| <b>7.</b> | <b>TERMS AND ABBREVIATIONS .....</b>  | <b>40</b> |



## List of Figures

|           |  |    |
|-----------|--|----|
| Figure 1. | AirPrime HL8548 and HL8548-G Architecture Overview (TBC) ..... | 13 |
| Figure 2. | AirPrime HL8548 and HL8548-G Mechanical Overview .....         | 14 |
| Figure 3. | PCM Timing Waveform (TBC).....                                 | 29 |
| Figure 4. | 2G_TX_ON State during TX Burst .....                           | 33 |
| Figure 5. | EMC and ESD Components Close to the SIM.....                   | 35 |
| Figure 6. | Serial Resistors for Long SIM Bus Lines.....                   | 35 |
| Figure 7. | Antenna Connection .....                                       | 36 |
| Figure 8. | GNSS Application with Active Antenna.....                      | 36 |

PRELIMINARY



## >> | List of Tables

|           |   |    |
|-----------|---|----|
| Table 1.  | Supported Bands/Connectivity .....                              | 9  |
| Table 2.  | AirPrime HL8548 and HL8548-G Features .....                     | 10 |
| Table 3.  | GNSS Capabilities .....   | 13 |
| Table 4.  | ESD Specifications .....  | 15 |
| Table 5.  | AirPrime HL8548 and HL8548-G Environmental Specifications ..... | 15 |
| Table 6.  | Regulation Compliance .....                                     | 16 |
| Table 7.  | Pad Definition .....  | 18 |
| Table 8.  | Power Supply .....  | 22 |
| Table 9.  | Power Consumption .....   | 22 |
| Table 10. | VGPIO Electrical Characteristics .....                          | 23 |
| Table 11. | BAT_RTC Electrical Characteristics .....                        | 24 |
| Table 12. | Electrical Characteristics of UIM1 .....                        | 24 |
| Table 13. | Digital I/O Electrical Characteristics .....                    | 25 |
| Table 14. | UART1 Pin Description .....                                     | 26 |
| Table 15. | PWR_ON Electrical Characteristics .....                         | 27 |
| Table 16. | RESET Electrical Characteristics .....                          | 27 |
| Table 17. | ADC Electrical Characteristics .....                            | 28 |
| Table 18. | Digital Audio Interface Electrical Characteristics .....        | 29 |
| Table 19. | I <sup>2</sup> C Pin Description .....                          | 30 |
| Table 20. | SW Trace Pin Description .....                                  | 30 |
| Table 21. | JTAG Pin Description .....                                      | 30 |
| Table 22. | PPS Electrical Characteristics .....                            | 31 |
| Table 23. | RF Connection .....   | 31 |
| Table 24. | RF Performance .....  | 32 |
| Table 25. | Burst Indicator States .....                                    | 32 |
| Table 26. | TX Burst Characteristics .....                                  | 32 |
| Table 27. | GNSS Interface Specifications .....                             | 33 |

# 1. Introduction

This document is the Product Technical Specification for the AirPrime HL8548 and HL8548-G Embedded Modules. It defines the high level product features and illustrates the interfaces for these features. This document is intended to cover the hardware aspects of the product series, including electrical and mechanical.

The AirPrime HL8548 and HL8548-G belong to the AirPrime HL Series from Essential Connectivity Module family. These are industrial grade Embedded Wireless Modules that provides voice and data connectivity on GPRS, EDGE, WCDMA, HSDPA and HSUPA networks (as listed in Table 1 Supported Bands/Connectivity). On top of this, the HL8548-G also provides GNSS functionality. These modules are designed for the industry and automotive markets and any market with similar quality and life-time support requirements.

The HL8548 and HL8548-G support a large variety of interface like Digital Audio and Dual SIM Single Standby to provide customers with the highest level of flexibility in implementing high-end solutions.

Table 1. Supported Bands/Connectivity

| RF Band   | Transmit band (Tx) | Receive band (Rx)    | Maximum Output Power         |
|-----------|--------------------|----------------------|------------------------------|
| UMTS B1   | 1922 to 1978 MHz   | 2112 to 2168 MHz     | 23 dBm (+/- 2dBm) Class 3bis |
| UMTS B2   | 1852 to 1908 MHz   | 1932 to 1988 MHz     | 23 dBm (+/- 2dBm) Class 3bis |
| UMTS B5   | 826 to 847 MHz     | 871 to 892 MHz       | 23 dBm (+/- 2dBm) Class 3bis |
| UMTS B6   | 832 to 838 MHz     | 877 to 883 MHz       | 23 dBm (+/- 2dBm) Class 3bis |
| UMTS B8   | 882 to 913 MHz     | 927 to 958 MHz       | 23 dBm (+/- 2dBm) Class 3bis |
| GSM 850   | 824 to 849 MHz     | 869 to 894 MHz       | 2 Watts GSM, GPRS and EDGE   |
| E-GSM 900 | 880 to 915 MHz     | 925 to 960 MHz       | 2 Watts GSM, GPRS and EDGE   |
| DCS 1800  | 1710 to 1785 MHz   | 1805 to 1880 MHz     | 1 Watt GSM, GPRS and EDGE    |
| PCS 1900  | 1850 to 1910 MHz   | 1930 to 1990 MHz     | 1 Watt GSM, GPRS and EDGE    |
| GPS       | --                 | 1575.42 ± 20 MHz     | --                           |
| GLONASS   | --                 | 1597.5 to 1605.8 MHz | --                           |

## 1.1. Common Flexible Form Factor (CF<sup>3</sup>)

The AirPrime HL8548 and HL8548-G are Common Flexible Form Factor (CF<sup>3</sup>) modules.

Common Flexible Form Factor (CF<sup>3</sup>) represents a family of WWAN modules that share the same mechanical dimensions (width and length with varying thicknesses) as well as a standardized footprint but can accommodate multiple radio technologies. The modules will have a “common” form factor across generations of products and for different radio technologies. All modules belonging to this family can be both solder-down as well as connectorized.

The CF<sup>3</sup> form factor provides a solution to a set of problems faced commonly in the WWAN module space:

- Accommodate any radio technology and band grouping
- Supports bit-pipe & value add
- Offers electrical and functional compatibility across generations and radio technologies
- Competitive size in 2G and leading edge in 4G
- Solderable as well as socketable
- Enables Configure to Order/Build to Order

## 1.2. Physical Dimensions

The AirPrime HL8548 and HL8548-G modules are compact, robust, fully shielded modules with the following dimensions:

- Length: 23 mm
- Width: 22 mm
- Thickness: 2.5mm

*Note: Dimensions specified above are typical values.*

## 1.3. General Features

The table below summarizes the AirPrime HL8548 and HL8548-G features.

Table 2. AirPrime HL8548 and HL8548-G Features

| Feature         | Description   |
|-----------------|---|
| Physical        | <ul style="list-style-type: none"> <li>• Small form factor (146-pin solderable LGA pad) – 23mm x 22mm x 2.5mm (nominal)</li> <li>• Complete body shielding</li> <li>• RF connection pads – RF primary and GNSS interface</li> <li>• Baseband signals connection</li> </ul>  |
| Electrical      | Single or double supply voltage (VBATT and VBATT_PA) – 3.2V – 4.5V  |
| RF              | <ul style="list-style-type: none"> <li>• Quad-band GSM / GPRS / EDGE (850 MHz, 900 MHz, 1800 MHz, 1900 MHz)</li> <li>• Penta-band UMTS WCDMA FDD (850 MHz(B5/B6), 900MHz(B8), 1900 MHz(B2), 2100MHz(B1))</li> <li>• GPS (1575.42 MHz), GLONASS (1602MHz)</li> </ul>   |
| Audio interface | <ul style="list-style-type: none"> <li>• Digital interface (ONLY)</li> <li>• Supports Enhanced Full Rate (EFR), Full Rate (FR), Half Rate (HR), and both Narrow-Band and Wide-band Adaptive Multirate (AMR-NB and AMR-WB) vocoders</li> <li>• MO and MT calling</li> <li>• Echo cancellation and noise reduction</li> <li>• Emergency calls (112, 110, 911, etc.)</li> <li>• Incoming call notification</li> <li>• DTMF generation</li> </ul> |
| SIM interface   | <ul style="list-style-type: none"> <li>• Dual SIM Single Standby with fast network switching capability</li> <li>• 1.8V/3V support</li> <li>• SIM extraction / hot plug detection</li> <li>• SIM/USIM support</li> <li>• Conforms with ETSI UICC Specifications.</li> <li>• Supports SIM application tool kit with proactive SIM commands</li> </ul>  |

| Feature               | Description  |
|-----------------------|--|
| Application interface | <ul style="list-style-type: none"> <li>• NDIS NIC interface support (Windows XP, Windows 7, Windows 8, Windows CE, Linux)</li> <li>• Multiple non-multiplexed USB channel support</li> <li>• Dial-up networking</li> <li>• USB selective suspend to maximize power savings</li> <li>• CMUX multiplexing over UART</li> <li>• AT command interface – 3GPP 27.007 standard, plus proprietary extended AT commands</li> </ul>   |
| Protocol Stack        | <p>Dual-mode UMTS (WCDMA) / HSDPA / HSUPA / EDGE / GPRS / GSM operation</p> <ul style="list-style-type: none"> <li>• GSM/GPRS/EDGE <ul style="list-style-type: none"> <li>▪ GPRS/EDGE – Class 33 (296 kbits downlink and 236.8 kbits uplink)</li> <li>▪ CSD (Circuit-switched data bearers)</li> <li>▪ Release 4 GERAN Feature Package 1</li> <li>▪ SAIC / DARP Phase 2</li> <li>▪ Latency Reduction</li> <li>▪ Repeated FACCH and Repeated SACCH</li> <li>▪ A-GPS support</li> <li>▪ GPRS ROHC</li> <li>▪ Enhanced Operator Name String (EONS)</li> <li>▪ Enhanced Network Selection (ENS)</li> </ul> </li> <li>• WCDMA <ul style="list-style-type: none"> <li>▪ 3GPP WCDMA FDD Multimode Type II UE Protocol Stack</li> <li>▪ Configurable for data classes up to 384 kBit/s</li> <li>▪ Inter-RAT Handover and Cell Reselection</li> <li>▪ Supports two types of Compressed Mode</li> <li>▪ Network Assisted Cell Change from UTRAN to GERAN and GERAN to UTRAN</li> <li>▪ A-GPS support</li> <li>▪ CSD (Circuit-switched data bearers) over WCDMA (transparent/non transparent up to 64 kBit/s; Support for Video Telephony)</li> </ul> </li> <li>• HSDPA (High Speed Downlink Packet Access) <ul style="list-style-type: none"> <li>▪ Compliant with 3GPP Release 5</li> <li>▪ HSDPA Category 8 data rate – 7.2 Mbps (peak rate)</li> <li>▪ IPv6 support</li> </ul> </li> <li>• HSUPA (High Speed Uplink Packet Access) <ul style="list-style-type: none"> <li>▪ Compliant with 3GPP Release 6</li> <li>▪ HSUPA Category 6 data rate - 5.76 Mbps (peak rate)</li> <li>▪ Robust Header Compression (RoHC)</li> <li>▪ Fractional DPCH</li> </ul> </li> </ul> |
| SMS                   | <ul style="list-style-type: none"> <li>• SMS MO and MT</li> <li>• CS and PS support</li> <li>• SMS saving to SIM card or ME storage</li> <li>• SMS reading from SIM card or ME storage</li> <li>• SMS sorting</li> <li>• SMS concatenation</li> <li>• SMS Status Report</li> <li>• SMS replacement support</li> <li>• SMS storing rules (support of AT+CNMI, AT+CNMA)</li> </ul>   |

| Feature                | Description  |
|------------------------|--|
| Supplementary Services | <ul style="list-style-type: none"> <li>• Call Barring</li> <li>• Call Forwarding</li> <li>• Call Hold</li> <li>• Caller ID</li> <li>• Call Waiting</li> <li>• Multi-party service</li> <li>• USSD</li> <li>• Automatic answer</li> </ul>   |
| GNSS*                  | <p>Provides:</p> <ul style="list-style-type: none"> <li>• Standalone GNSS functionality</li> <li>• GPS and GLONASS support</li> <li>• A-GPS features</li> <li>• NMEA support</li> </ul> <hr/> <p><i>Note:</i> GNSS specifications are preliminary targets that are subject to change without notice. Actual GNSS functionality is dependent on the firmware version, and on module configuration.</p>  |
| Connectivity           | <ul style="list-style-type: none"> <li>• Multiple (up to 20) cellular packet data profiles</li> <li>• Sleep mode for minimum idle power draw</li> <li>• Automatic GPRS attach at power-up</li> <li>• GPRS detach</li> <li>• Mobile-originated PDP context activation / deactivation</li> <li>• Support QoS profile <ul style="list-style-type: none"> <li>▪ Release 97 – Precedence Class, Reliability Class, Delay Class, Peak Throughput, Mean Throughput</li> <li>▪ Release 99 QoS negotiation – Background, Interactive, and Streaming</li> </ul> </li> <li>• Static and Dynamic IP address. The network may assign a fixed IP address or dynamically assign one using DHCP (Dynamic Host Configuration Protocol).</li> <li>• Supports PAP and CHAP authentication protocols</li> <li>• PDP context type (IPv4, IPv6, IPv4v6). IP Packet Data Protocol context</li> <li>• RFC1144 TCP/IP header compression</li> <li>• Interaction with existing GSM services (MO/MT SMS voice calls) while: <ul style="list-style-type: none"> <li>▪ GPRS is attached, or</li> <li>▪ In a GPRS data session (class B GPRS suspend / resume procedures)</li> </ul> </li> </ul> |
| Environmental          | <p>Operating temperature ranges (industrial grade):</p> <ul style="list-style-type: none"> <li>• Class A: -30°C to +70°C</li> <li>• Class B: -40°C to +85°C</li> </ul>   |
| RTC                    | Real Time Clock (RTC) with calendar and alarm  |
| Temperature Sensor     | <ul style="list-style-type: none"> <li>• Temperature monitoring</li> <li>• Alarms</li> </ul>   |

\* Only available on the AirPrime HL8548-G.

# 1.4. GNSS Features

The table below summarizes the AirPrime HL8528-G GNSS capabilities.

Table 3. GNSS Capabilities

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

# 1.5. Architecture

The figure below presents an overview of the AirPrime HL8548 and HL8548-G internal architecture and external interfaces.

*Note: Dotted parts are only supported on the AirPrime HL8548-G.*

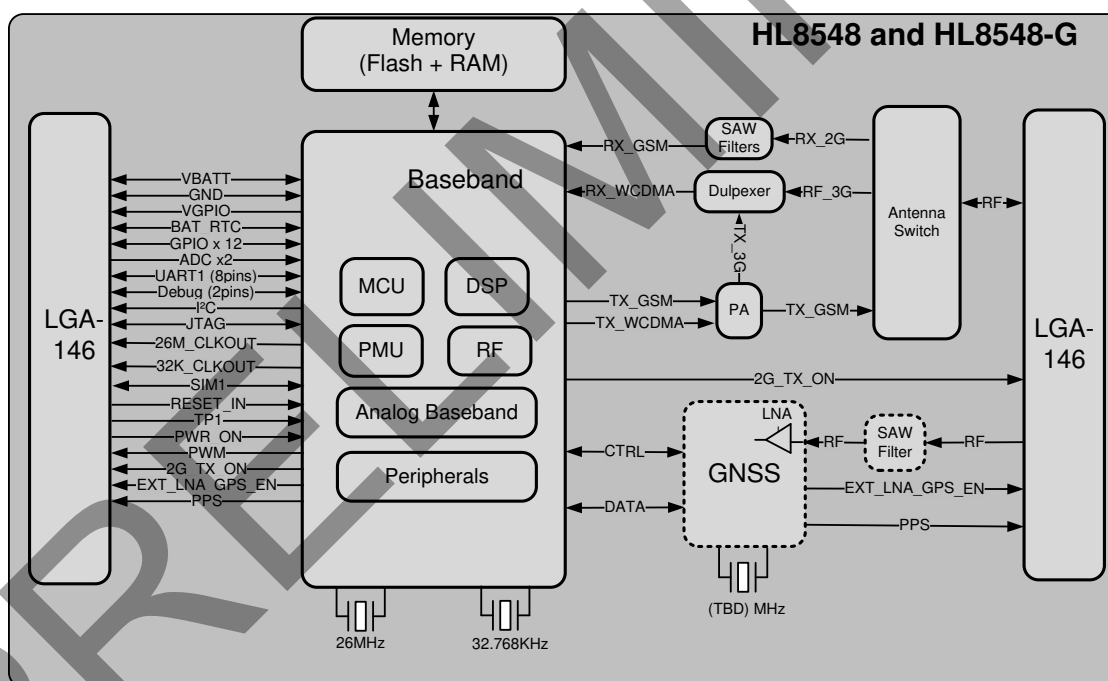


Figure 1. AirPrime HL8548 and HL8548-G Architecture Overview (TBC)



## 1.6. Interfaces

The AirPrime HL8548 and HL8548-G module provides the following interfaces and peripheral connectivity:

- 1 8-pins UART
- 1 I<sup>2</sup>C
- 1 HSIC
- Active Low RESET
- USB 2.0
- 1 Backup Battery Interface
- 2 System Clock Out
- Active Low POWER ON
- 1 1.8V/3V SIM
- 1 Digital Audio
- 2 ADC
- 1 JTAG Interface
- 2 PWM
- 12 GPIOs with 4 multiplexes
- 2G TX Burst Indicator
- GSM Antenna

In addition, the AirPrime HL8548-G module provides the following additional interfaces and peripheral connectivity:

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

## 1.7. Connection Interface

The AirPrime HL8548 and HL8548-G module is an LGA form factor device. All electrical and mechanical connections are made through the 146 Land Grid Array (LGA) pads on the bottom side of the PCB.

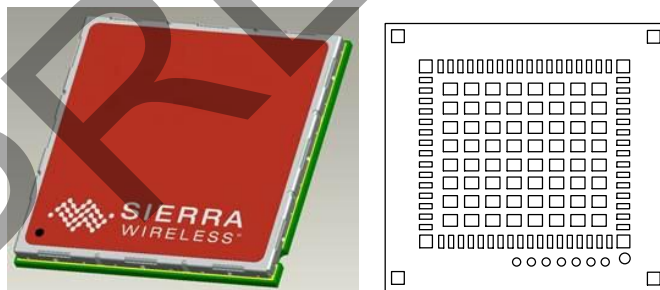


Figure 2. AirPrime HL8548 and HL8548-G Mechanical Overview

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

## 1.8. 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)  |
| Non-operational | Host connector interface | Unless otherwise specified: <ul style="list-style-type: none"> <li>• JESD22-A114 +/- 2kV Human Body Model</li> <li>• JESD22-A115 +/- 200V Machine Model</li> <li>• JESD22-C101C +/- 500V Charged Device Model</li> </ul> |
| 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       |  |

## 1.9. Environmental & Certifications

### 1.9.1. Environmental Specifications

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

**Table 5. AirPrime HL8548 and HL8548-G Environmental Specifications**

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

## 1.9.2. Regulatory

The AirPrime HL8548 and HL8548-G are both compliant with the following regulations:

- R&TTE directive 1999/5EC
- Japan JRF/JPA
- FCC
- IC

These compliances will be reflected on the AirPrime HL8548 and HL8548-G labels when applicable.

Table 6. Regulation Compliance

| Document     | Current Version   | Title   |
|--------------|-------------------|---|
| NAPRD.03     | v5.18 or later    | Overview of PCS Type certification review board (PTCRB) Mobile Equipment Type Certification and IMEI control  |
| GCF-CC       | v3.51.1 or later  | GCF Conformance Certification Criteria  |
| TS 51.010-1  | V10.0.0 (2012-03) | 3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification  |
| TS 51.010-2  | V10.0.0 (2012-03) | 3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Mobile Station (MS) conformance specification; Part 2: Protocol Implementation Conformance Statement (PICS) proforma specification   |
| EN 301511    | V9.0.2 (2003-03)  | Global System for Mobile Communications (GSM); Harmonized EN for Mobile Stations in the GSM 900 and GSM 1800 Bands Covering Essential Requirements Under Article 3.2 of the R&TTE Directive (1999/5/EC)   |
| EN 301489-1  | V1.9.2 (2011-09)  | Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements  |
| EN 301489-3  | V1.4.1 (2002-08)  | Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz  |
| EN 301489-7  | V1.3.1 (2005-11)  | Electromagnetic Compatibility and Radio Spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) Standard for Radio Equipment and Services; Part 7: Specific Conditions for Mobile and Portable Radio and Ancillary Equipment of Digital Cellular Radio Telecommunications Systems (GSM and DCS) |
| EN 60950-1   | NA                | IEC 60950-1:2005/A1:2009<br>EN 60950-1:2006/A11:2009/A1:2010/A12:2011/AC :2011<br>Information technology equipment – safety- and general requirements   |
| EN 300440-1  | v1.6.1 (2012-08)  | Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range;<br>Part 1: Technical characteristics and test methods   |
| EN 300440-2  | V1.4.1 (2012-08)  | Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range;<br>Part 2: Harmonized EN under article 3.2 of the R&TTE Directive   |
| FCC Part 15B | NA                | Subpart B - Radio frequency devices subpart B – Unintentional Radiators   |

| Document       | Current Version | Title  |
|----------------|-----------------|--|
| FCC Part 22H   | NA              | Cellular Radiotelephone Service; Subpart H: Cellular Radiotelephone Service                                      |
| FCC Part 24E   | NA              | Personal Communications Service; Subpart E: Broadband PCS.   |
| RSS-132        | Issue 2:2005    | Cellular telephones employing new technologies operating in the 824-849 MHz and 869-894 MHz bands.               |
| RSS-133        | Issue 5:2009    | 2 GHz personal communications services   |
| AS/ACIF S042.1 | 2008            | Requirements for connection to an air interface of a telecommunications network<br>Part 1; General               |
| AS/ACIF S042.3 | 2005            | Requirements for connection to an air interface of a Telecommunications Network - Part 3: GSM Customer Equipment |
| AS/NZS 60950.1 | 2011            | Safety of information technology equipment (IEC 60950-1, Ed.2.0: 2005, MOD)                                      |
| SRRC           | NA              | State Radio Regulation Center - China Type Approval  |

### 1.9.3. RoHS Directive Compliant

The AirPrime HL8548 and HL8548-G 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)”.

### 1.9.4. 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.



### 1.9.5. References

- [1] AirPrime HL Series Customer Process Guidelines  
Reference Number: 4114330
- [2] AirPrime HL6 and HL8 Series AT Commands Interface Guide  
Reference Number: 4114680

## 2. Pad Definition

Table 7. Pad Definition

| Pin # | Signal Name     | Function  | I/O | Active Low/ High | Power Supply Domain | Recommendation for Unused Pins |
|-------|-----------------|---|-----|------------------|---------------------|--------------------------------|
| 1     | GPIO1 / I2C_CLK | General purpose input/output/I <sup>2</sup> C Clock | I/O |                  | 1.8V                | Left Open                      |
| 2     | UART1_RI        | UART1 Ring indicator                                | O   |                  | 1.8V                | Left Open                      |
| 3     | UART1_RTS       | UART1 Request to send                               | I   | L                | 1.8V                | Connect to UART1_CTS           |
| 4     | UART1_CTS       | UART1 Clear to send                                 | O   | L                | 1.8V                | Connect to UART1_RTS           |
| 5     | UART1_TX        | UART1 Transmit data                                 | I   |                  | 1.8V                | Mandatory connection           |
| 6     | UART1_RX        | UART1 Receive data                                  | O   |                  | 1.8V                | Mandatory connection           |
| 7     | UART1_DTR       | UART1 Data terminal ready                           | I   | L                | 1.8V                | Connect to UART1_DSR           |
| 8     | UART1_DCD       | UART1 Data carrier detect/                          | O   | L                | 1.8V                | Left Open                      |
| 9     | UART1_DSR       | UART1 Data set ready                                | O   | L                | 1.8V                | Connect to UART1_DTR           |
| 10    | GPIO2           | General purpose input/output                        | I/O |                  | 1.8V                | Left Open                      |
| 11    | RESET_IN        | Input reset signal                                  | I   | L                | 1.8V                | Left Open                      |
| 12    | USB_D-          | USB Data Negative (Low / Full Speed)                | I/O |                  | 3.3V                | Left Open                      |
|       |                 | USB Data Negative (High Speed)                      |     |                  | 0.38V               |                                |
| 13    | USB_D+          | USB Data Positive (Low / Full Speed)                | I/O |                  | 3.3V                | Left Open                      |
|       |                 | USB Data Positive (High Speed)                      |     |                  | 0.38V               |                                |
| 14    | HSIC_DATA       | High Speed Inter-Chip Data                          | I/O |                  | 1.2V                | Left Open                      |
| 15    | HSIC_STRB       | High Speed Inter-Chip Strobe                        | I/O |                  | 1.2V                | Left Open                      |
| 16    | USB_VBUS        | USB VBUS  | I   |                  | 5V                  | Left Open                      |
| 17    | NC              | Not Connected (Reserved for future use)             |     |                  |                     | Left Open                      |
| 18    | NC              | Not Connected (Reserved for future use)             |     |                  |                     | Left Open                      |

| Pin # | Signal Name    | Function                                | I/O | Active Low/High | Power Supply Domain | Recommendation for Unused Pins |
|-------|----------------|---|-----|-----------------|---------------------|--------------------------------|
| 19    | NC             | Not Connected (Reserved for future use) |     |                 |                     | Left Open                      |
| 20    | NC             | Not Connected (Reserved for future use) |     |                 |                     | Left Open                      |
| 21    | BAT_RTC        | Power supply for RTC backup             | I/O |                 | 1.8V                | Left Open                      |
| 22    | 26M_CLKOUT     | 26MHz System Clock Output               | O   |                 | 1.8V                | Left Open                      |
| 23    | 32K_CLKOUT     | 32.768kHz System Clock Output           | O   |                 | 1.8V                | Left Open                      |
| 24    | ADC1           | Analog to digital conversion            | I   |                 | 1.2V                | Left Open (TBC)                |
| 25    | ADC0           | Analog to digital conversion            | I   |                 | 1.2V                | Left Open (TBC)                |
| 26    | UIM1_VCC       | 1.8V/3V SIM1 Power supply               | O   |                 | 1.8V/3V             | Mandatory connection           |
| 27    | UIM1_CLK       | 1.8V/3V SIM1 Clock                      | O   |                 | 1.8V/3V             | Mandatory connection           |
| 28    | UIM1_DATA      | 1.8V/3V SIM1 Data                       | I/O |                 | 1.8V/3V             | Mandatory connection           |
| 29    | UIM1_RESET     | 1.8V/3V SIM1 Reset                      | O   | L               | 1.8V/3V             | Mandatory connection           |
| 30    | NC             | Not Connected (Reserved for future use) |     |                 |                     | Left Open                      |
| 31    | NC             | Not Connected (Reserved for future use) |     |                 |                     | Left Open                      |
| 32    | NC             | Not Connected (Reserved for future use) |     |                 |                     | Left Open                      |
| 33    | PCM_OUT        | PCM data out                            | O   |                 | 1.8V                | Left Open                      |
| 34    | PCM_IN         | PCM data in                             | I   |                 | 1.8V                | Left Open                      |
| 35    | PCM_SYNC       | PCM sync out                            | I/O |                 | 1.8V                | Left Open                      |
| 36    | PCM_CLK        | PCM clock                               | I/O |                 | 1.8V                | Left Open                      |
| 37    | GND            | Ground                                  | 0V  |                 | 0V                  | Mandatory connection           |
| 38    | RF_GPS         | RF GNSS Input                           |     |                 |                     | Mandatory connection           |
| 39    | GND            | Ground                                  | 0V  |                 | 0V                  | Mandatory connection           |
| 40    | GPIO7          | General purpose input/output            | I/O |                 | 1.8V                | Left Open                      |
| 41    | GPIO8          | General purpose input/output            | I/O |                 | 1.8V                | Left Open                      |
| 42    | PPS            | GNSS Pulse Per Second                   | O   |                 | 1.8V                | Left Open                      |
| 43    | EXT_LNA_GPS_EN | External GNSS LNA enable                | O   | H               | 1.8V                | Left Open                      |



| Pin # | Signal Name      | Function  | I/O | Active Low/High | Power Supply Domain                    | Recommendation for Unused Pins |
|-------|------------------|---|-----|-----------------|--|--------------------------------|
| 44    | DEBUG_TX         | Debug transmit data                                     | I/O |                 | 1.8V                                   | Left Open                      |
| 45    | VGPIO            | GPIO voltage output                                     | O   |                 | 1.8V                                   | Left Open                      |
| 46    | GPIO6            | General purpose input/output                            | I/O |                 | 1.8V                                   | Left Open                      |
| 47    | TP1              | Test Point 1<br>0 - Download Mode<br>Open - Normal Mode | I   | L               | 1.8V                                   | Left Open                      |
| 48    | GND              | Ground  |     |                 | 0V                                     | Mandatory connection           |
| 49    | RF_MAIN          | RF GSM Input/output                                     |     |                 |  | Mandatory connection           |
| 50    | GND              | Ground  |     |                 | 0V                                     | Mandatory connection           |
| 51    | DEBUG_RX         | Debug receive data                                      | I/O |                 | 1.8V                                   | Left Open                      |
| 52    | GPIO10           | General purpose input/output                            | I/O |                 | 1.8V                                   | Left Open                      |
| 53    | GPIO11           | General purpose input/output                            | I/O |                 | 1.8V                                   | Left Open                      |
| 54    | GPIO15           | General purpose input/output                            | I/O |                 | 1.8V                                   | Left Open                      |
| 55    | NC1              | Reserved for future use                                 |     |                 |  | Left Open                      |
| 56    | NC2              | Reserved for future use                                 |     |                 |  | Left Open                      |
| 57    | PWM1             | Pulse Width Modulation                                  | O   |                 | 1.8V                                   | Left Open                      |
| 58    | PWM2 / GPIO12    | Pulse Width Modulation/General purpose input/output     | I/O |                 | 1.8V                                   | Left Open                      |
| 59    | PWR_ON           | Active Low Power On control signal                      | I   | L               | 1.8V                                   | Mandatory connection           |
| 60    | 2G_TX_ON         | 2G TX burst indicator                                   | O   | H               | 1.8V                                   | Left Open                      |
| 61    | VBATT_PA         | Power supply  | I   |                 | 3.2V (min)<br>3.7V (typ)<br>4.5V (max) | Mandatory connection           |
| 62    | VBATT_PA         | Power supply  | I   |                 | 3.2V (min)<br>3.7V (typ)<br>4.5V (max) | Mandatory connection           |
| 63    | VBATT            | Power supply  | I   |                 | 3.2V (min)<br>3.7V (typ)<br>4.5V (max) | Mandatory connection           |
| 64    | GPIO3 / UIM1_DET | General purpose input/output/UIM1 Detection             | I/O | H               | 1.8V                                   | Left Open                      |
| 65    | GPIO4            | General purpose input/output                            | I/O | H               | 1.8V                                   | Left Open                      |

| Pin #    | Signal Name  | Function   | I/O | Active Low/High | Power Supply Domain | Recommendation for Unused Pins |
|----------|--|--|-----|-----------------|---------------------|--------------------------------|
| 66       | GPIO5 / I2C_SDA  | General purpose input/output/I <sup>2</sup> C Data | I/O |                 | 1.8V                | Left Open                      |
| 67-70    | GND  | Ground   | GND |                 | 0V                  |                                |
| 71 - 166 | <i>Note: These pins are not available on the AirPrime HL8548 and HL8548-G modules.</i> |  |     |                 |                     |                                |
| 167-234  | GND  | Ground   | GND |                 | 0V                  |                                |
| 235      | GND  | Ground   | GND |                 | 0V                  |                                |
| 236      | JTAG_RESET   | JTAG RESET   | I   | L               | 1.8V                | Left Open                      |
| 237      | JTAG_TCK   | JTAG Test Clock                                    | I   |                 | 1.8V                | Left Open                      |
| 238      | JTAG_TDO   | JTAG Test Data Output                              | O   |                 | 1.8V                | Left Open                      |
| 239      | JTAG_TMS   | JTAG Test Mode Select                              | I   |                 | 1.8V                | Left Open                      |
| 240      | JTAG_TRST  | JTAG Test Reset                                    | I   | L               | 1.8V                | Left Open                      |
| 241      | JTAG_TDI   | JTAG Test Data Input                               | I   |                 | 1.8V                | Left Open                      |
| 242      | JTAG_RTCK  | JTAG Returned Test Clock                           | O   |                 | 1.8V                | Left Open                      |

## 3. Detailed Interface Specifications

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

For standard applications, VBATT and VBATT\_PA must be tied externally to the same power supply. For some specific applications, AirPrime HL8548 and HL8548-G module supports separate VBATT and VBATT\_PA connection if requirements below are fulfilled.

### 3.1. Power Supply

The AirPrime HL8548 and HL8548-G module is supplied through the VBATT signal with the following characteristics.

Table 8. Power Supply

| Supply                                  | Minimum          | Typical | Maximum |
|---|------------------|---------|---------|
| VBATT voltage (V)                       | 3.2 <sup>1</sup> | 3.7     | 4.5     |
| VBATT_PA voltage (V) Full Specification | 3.2 <sup>1</sup> | 3.7     | 4.5     |

<sup>1</sup> This value has to be guaranteed during the burst

### 3.2. Power Consumption

The following table lists the power consumption of the AirPrime HL8548 and HL8548-G at three different temperatures (-40°C, 25°C and 85°C).

Table 9. Power Consumption

| Parameter  |            | -40°C | 25°C  |     | +85°C |
|--|------------|-------|-------|-----|-------|
|  |            | Typ   | Typ   | Max | Typ   |
| Off mode   |            |       | 40 µA |     |       |
| Sleep mode - GSM DRX2<br>(registered to the network)   | GSM900     |       | TBD   |     |       |
|  | DCS1800    |       | TBD   |     |       |
|  | GSM850     |       | TBD   |     |       |
|  | PCS1900    |       | TBD   |     |       |
| Sleep mode - GSM DRX9<br>(registered to the network)   | GSM900     |       | TBD   |     |       |
|  | DCS1800    |       | TBD   |     |       |
|  | GSM850     |       | TBD   |     |       |
|  | PCS1900    |       | TBD   |     |       |
| Sleep mode - WCDMA DRX6<br>(registered to the network) | Band 1     |       | TBD   |     |       |
|  | Band 2     |       | TBD   |     |       |
|  | Band 5 / 6 |       | TBD   |     |       |
|  | Band 8     |       | TBD   |     |       |

| Parameter  |                         | -40°C | 25°C   |       | +85°C |
|--|-------------------------|-------|--------|-------|-------|
|  |                         | Typ   | Typ    | Max   | Typ   |
| Sleep mode - WCDMA DRX9<br>(registered to the network) | Band 1                  |       | TBD    |       |       |
|  | Band 2                  |       | TBD    |       |       |
|  | Band 5 / 6              |       | TBD    |       |       |
|  | Band 8                  |       | TBD    |       |       |
| GNSS active mode (@GSM DRX5)                           |                         |       | TBD    |       |       |
| WCDMA in communication<br>mode (Voice Call)            | Band 1                  |       | TBD    |       |       |
|  | Band 2                  |       | TBD    |       |       |
|  | Band 5 / 6              |       | TBD    |       |       |
|  | Band 8                  |       | TBD    |       |       |
| WCDMA in communication<br>mode (HSDPA)                 | Band 1                  |       | TBD    |       |       |
|  | Band 2                  |       | TBD    |       |       |
|  | Band 5 / 6              |       | TBD    |       |       |
|  | Band 8                  |       | TBD    |       |       |
| WCDMA in communication<br>mode (HSUPA)                 | Band 1                  |       | TBD    |       |       |
|  | Band 2                  |       | TBD    |       |       |
|  | Band 5 / 6              |       | TBD    |       |       |
|  | Band 8                  |       | TBD    |       |       |
| GSM in communication mode                              | GSM900 / GSM850 (PCL=5) |       | 220 mA |       |       |
|  | DCS / PCS (PCL=0)       |       | 160 mA |       |       |
| GSM in communication mode                              | GSM900 / GSM850 (PCL=5) |       | 220 mA |       |       |
|  | DCS / PCS (PCL=0)       |       | 160 mA |       |       |
| GPRS (2 TX,3 RX)                                       | GSM900 / GSM850 (PCL=5) |       | 360 mA |       |       |
|  | DCS / PCS (PCL=0)       |       | 240 mA |       |       |
| Current consumption during a<br>burst                  | GSM900 / GSM850         |       | 1.50 A | 1.8A  |       |
|  | DCS / PCS               |       | 0.8 A  | 1.0 A |       |

### 3.3. VGPIO

The VGPIO output can be used to:

- Pull-up signals such as I/Os
- Supply the digital transistors driving LEDs
- Act as a voltage reference for the ADC interfaces, ADC0 and ADC1

The VGPIO output is available when the AirPrime HL8548 AND HL8548-G module is switched ON.

Table 10. VGPIO Electrical Characteristics

| Parameter               | Min | Typ | Max          | Remarks                                      |
|-------------------------|-----|-----|--------------|--|
| Voltage level (V)       | 1.7 | 1.8 | 1.9          | Both active mode and sleep mode              |
| Current capability (mA) | -   | -   | 450<br>(TBC) | Power Management support up to 500mA output. |

| Parameter     | Min | Typ | Max | Remarks               |
|---------------|-----|-----|-----|-----------------------|
| Rise Time(ms) | -   | -   | 1.5 | Start-Up time from 0V |

### 3.4. BAT\_RTC

The AirPrime HL8548 and HL8548-G module provides an input/output to connect a Real Time Clock power supply.

This pin 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 1.8V power supply regulator.

Table 11. BAT\_RTC Electrical Characteristics

| Parameter                          | Minimum | Typical   | Maximum | Unit |
|------------------------------------|---------|-----------|---------|------|
| Input voltage                      | -       | 1.8       | -       | V    |
| Input current consumption          | -       | 2.5 (TBC) | -       | μA   |
| Output voltage                     | -5%     | 1.8       | +5%     | V    |
| Max charging current (@VBATT=3.7V) | -       | 25        | -       | mA   |

### 3.5. SIM Interface

The AirPrime HL8548 and HL8548-G has one physical SIM interface, UIM1, which has optional support for dual SIM application with an external SIM switch. For further information, refer to document [2] AirPrime HL6 and HL8 Series AT Commands Interface Guide for software support.

The UIM1 interface allows control of a 1.8V/3V SIM and is fully compliant with GSM 11.11 recommendations concerning SIM functions.

The four signals used by this interface are as follows:

- UIM1\_VCC: power supply
- UIM1\_CLK: clock
- UIM1\_DATA: I/O port
- UIM1\_RST: reset
- UIM1\_DET: SIM detection

Table 12. Electrical Characteristics of UIM1

| Parameter   | Min  | Typ  | Max  | Remarks   |
|---|------|------|------|---|
| UIM1 Interface Voltage (V)<br>(VCC,CLK,IO,RST)      | 2.7  | 3.0  | 3.15 | The appropriate output voltage is auto detected and selected by software. |
|   | 1.65 | 1.80 | 1.95 |   |
| UIM1 Detect   | 1.33 | 1.80 | 2.1  | High active   |
| UIM1_VCC Current (mA)                               | -    | -    | 10   | Max output current in sleep mode = 3 mA                                   |
| UIM1_VCC Line Regulation (mV/V)                     | -    | -    | 50   | At Iout_Max   |
| UIM1_VCC Power-up Setting Time (us) from power down | -    | 10   | -    |   |

## 3.6. USB

The AirPrime HL8548 and HL8548-G have one USB interface.

(Other content TBC)

## 3.7. Electrical Information for Digital I/O

Table 13 Digital I/O Electrical Characteristics enumerates the electrical characteristics of the following digital interfaces:

- UART
- PCM
- GPIO
- I<sup>2</sup>C
- JTAG
- RESET
- PWM

Table 13. Digital I/O Electrical Characteristics

| Parameter                    | 1.8V Configuration |     |      | Remarks                                  |
|------------------------------|--------------------|-----|------|--|
|                              | Min                | Typ | Max  |  |
| Input Current-High( $\mu$ A) | -                  | -   | 125  | (TBD)                                    |
| Input Current-Low( $\mu$ A)  | -                  | -   | 125  | (TBD)                                    |
| DC Output Current-High (mA)  | -                  | -   | 5    | Pin driving a "1" with output set at "0" |
| DC Output Current-Low (mA)   | -5                 | -   | -    | Pin driving a "0" with output set at "1" |
| Input Voltage-High(V)        | 1.33               | -   | 2.1  |  |
| Input Voltage-Low(V)         | -                  | -   | 0.34 |  |
| Output Voltage-High(V)       | 1.5                | -   | 1.9  |  |
| Output Voltage-Low(V)        | -                  | -   | 0.2  |  |

## 3.8. General Purpose Input/Output (GPIO)

The AirPrime HL8548 and HL8548-G modules provide 12 GPIOs, 4 of which have multiplexes.

| Pin Number | Signal Name | Multiplex | I/O | Power Supply Domain |
|------------|-------------|-----------|-----|---------------------|
| 1          | GPIO1       | I2C_CLK   | I/O | 1.8V                |
| 10         | GPIO2       |           | I/O | 1.8V                |
| 40         | GPIO7       |           | I/O | 1.8V                |
| 41         | GPIO8       |           | I/O | 1.8V                |
| 46         | GPIO6       |           | I/O | 1.8V                |
| 52         | GPIO10      |           | I/O | 1.8V                |
| 53         | GPIO11      |           | I/O | 1.8V                |
| 54         | GPIO15      |           | I/O | 1.8V                |