

# IPC/WLB-PG

Document Ordercode: DOC/IPC\_WLBPGE

<b>Revision</b>	<b>Date</b>	<b>Author</b>	<b>Modification</b>
1.0	24.11.2016	F. Liechti	First release
1.1	02.06.2017	S. Mutter	Added Notes for overload behavior of mPCIe Module Adapted current consumption of mPCIe Modules and added Notes
1.2	14.01.2022	S. Mutter	Increased maximal LNA supply current to 50mA

## Contents

<b>1</b>	<b>Introduction</b>	<b>4</b>
1.1	General Remarks	4
1.2	Contents of this Documentation	4
1.3	Additional Products and Documents	4
1.3.1	Hardware Products	4
1.3.2	Software Products	4
1.3.3	Documents	4
1.4	Items delivered	5
1.5	Installation	5
1.6	Safety Recommendations and Warnings	5
1.7	Electro Static Discharge	6
1.8	Life Cycle Information	6
1.8.1	Transportation and Storage	6
1.8.2	Assembly and Installation	6
1.8.3	Operation	6
1.8.4	Maintenance and Repair	6
1.8.5	Disposal	6
1.8.6	Warranty	6
1.8.7	RoHS	7
1.8.8	WEEE	7
<b>2</b>	<b>Product Description</b>	<b>7</b>
2.1	Features	7
2.1.1	Variants	8
2.2	Operating Modes	8
<b>3</b>	<b>Hardware Description</b>	<b>8</b>
3.1	Overview	8
3.2	Host device Interface	9
3.3	USB Hub	9
3.4	GPS	9
3.4.1	Auxiliary GPS Interface	10
3.4.2	Dead Reckoning	10
3.4.3	Dead Reckoning Sensor orientation	10
3.4.4	GPS Auxiliary Connector	10
3.5	mPCIe Socket	11
3.6	SIM Card	13
3.6.1	Solderable eSIM Card	13
3.7	Board Controller and SIM switch	14
<b>4</b>	<b>Programming Information</b>	<b>15</b>
4.1	Overview	15
4.2	USB Hub	15
4.3	GPS	15
4.3.1	Driver Requirement	15
4.3.2	GPS Programming interface	15

4.4	PCI Express Mini Card Socket	15
4.5	Board Controller and SIM switch	16
4.6	Remarks on programming Board Controller	16
4.7	Syslogic IPC/WLB Library	16
4.7.1	Remarks on Windows API	16
4.7.2	General Remarks on API	16
4.7.3	SIM Card Change	17
<b>5</b>	<b>Technical Data</b>	<b>18</b>
5.1	General Electrical Data	18
5.2	Mechanical Data	20
5.3	EMI / EMC Specification	20
<b>6</b>	<b>Product Revision History</b>	<b>21</b>
6.1	Hardware	21
<b>7</b>	<b>Manufacturer Information</b>	<b>22</b>
7.1	Contact	22
7.1.1	RMA Service	22

## List of Tables

Tab. 1	USB Connector P200	9
Tab. 2	General Absolute Maximum Ratings	18
Tab. 3	General Recommended Operating Conditions	18
Tab. 4	General Electrical Characteristics	18
Tab. 5	General Switching Characteristics	20
Tab. 6	Hardware Revision State	21

## List of Figures

Fig. 1	Block Diagram	7
Fig. 2	Board Layout	8
Fig. 2	Dead Reckoning Sensor Orientations	10
Fig. 3	Board dimensions	20

## 1 Introduction

### 1.1 General Remarks

The content and presentation of this document has been carefully checked. No responsibility is accepted for any errors or omissions in the documentation.

Note that the documentation for the products is constantly revised and improved. The right to change this documentation at any time without notice is therefore reserved.

Syslogic is grateful for any help referring to errors or for suggestions for improvements.

### 1.2 Contents of this Documentation

This document addresses to system integrators, programmers and instructed installation and maintenance personal working with the IPC/WLB\_PG system. It provides all information needed to configure, setup and program the board. For complete information also the documentation of the main device and communications and I/O boards must be consulted. As the IPC/WLBPG board may be delivered in various versions with optional hardware blocks the standard version (IPC/WLB\_PG-A101E) is described here, which includes most of the hardware.

### 1.3 Additional Products and Documents

#### 1.3.1 Hardware Products

The following hardware products are useful together with the IPC/WLB\_PG board:

- User Manual IPC/SL8 and IPC/ML8 (DOC/IPC\_SL8-E)
- User Manual IPC/RSL8 (DOC/IPC\_RSL8-E)
- User Manual IPC/SL71 (DOC/COMPACT71-SLE)
- User Manual IPC/ML71 (DOC/COMPACT71-MLE)
- Other User Manual according to hardware used.

#### 1.3.2 Software Products

The following software products are useful together with the COMPACT base board:

- User Manual Debian 7 (IPC/DEBINAN-7AE)
- User Manual Debian 8 (IPC/DEBIAN8-8A-64)
- User Manual Windows 7 for IPC71 (DOC/WINESTD7-71A)
- User Manual Windows 7 for IPC8 (DOC/WINESTD7-8A)
- Other User Manual according to operating system used.

#### 1.3.3 Documents

The following documents are **required** for correct operation of the IPC/WLB\_PG board:

- [1]: U-Blox Neo M8U Datasheet ([UBX-15015679](#))
- [2]: U-Blox Neo M8U Protocol Specification ([UBX-13003221](#))
- [3]: U-Blox white paper UDR ([UBX-16000376](#))
- [4]: Microchip MCP2210 Datasheet ([DS22288A](#))

## 1.4 Items delivered

The IPC/WLB\_PG board is delivered without any additional hardware. Select the required additional parts from the table below.

Part	Description	Remarks
CAB/DM4DM4-15B	USB Connection cable to Datamate 4Pin, 15cm	Host connection
CAB/IPEXSMA-15A	Ipex u.FL to SMA adapter cable	
CAB/IPEXSMA-RP-15A	Ipex u.FL to SMA-RP adapter cable	Required to fulfil FCC requirements for LTE/Wifi
CAB/IPEXQMA-15A	Ipex u.FL to QMA adapter cable	
CPN/LTEMPE-1A	LTE/HSPA+/GSM Module	

Tab. 1 Additional Parts

## 1.5 Installation

The IPC/WLB\_PG must be installed into the host device. Refer to the corresponding documentation of your industrial or embedded computer.

### Important Note

Before applying power to the IPC/WLB\_PG system the separately ordered host device must be correctly configured and mounted (please consult User Documentation of the selected product).

### Important Note

For best thermal performance the device needs to be installed connecting directly to the case of the host device.

## 1.6 Safety Recommendations and Warnings

The products are intended for measurement, control and communications applications in industrial environments. The products must be assembled and installed by specially trained people. The strict observation of the assembly and installation guidelines is mandatory.

The use of the products in systems in which the life or health of persons is directly dependent (e.g. life support systems, patient monitoring systems, etc.) is not allowed.

The use of the products in potentially explosive atmospheres requires additional external protection circuitry which is not provided with the products.

The device is designed to be used in combination with an LTE/UMTS/GPRS/GSM device. These devices require a minimum distance between antennas and places people stay.

### Important Note

Respect required minimum distance of the LTE/UMTS/GPRS/GSM modem to places people stay.

Depending on the application the host device may require to fulfil EMI Class B. Details are available from CENELEC or the local notified body.

### Important Note

Check EMI requirement before using the device.

In case of uncertainty or of believed errors in the documentation please immediately contact the manufacturer (address see chapter 7). Do not use or install the products if you are in doubt. In any case of misuse of the products, the user is solely liable for the consequences.

IPC/WLB-PG: user documentation

DOC/IPC\_WLBPGE; V1.2

Ensure that the power supply is disconnected from the device before working on the device (connecting interfaces, replacing flash cards, batteries, opening the enclosure, etc.).

Please read the safety instructions of the power supply before installing/connecting the device.

## **1.7 Electro Static Discharge**

Electronic boards are sensitive to Electro-Static Discharge (ESD). Please ensure that the product is handled with care and only in a ESD protected environment. Otherwise proper operation is not guaranteed.

## **1.8 Life Cycle Information**

### **1.8.1 Transportation and Storage**

During transportation and storage, the products must be in their original packing. The original packing contains an antistatic bag and shock-absorbing material. It is recommended, to keep the original packing in case of return of the product to the factory for repair. Note that the packing is recyclable.

### **1.8.2 Assembly and Installation**

Observe the EMI-precautions against static discharge. Carefully read the assembly and installation documentation of the host device before unpacking the products. Make sure that you have all the necessary items ready (including all the small parts).

### **1.8.3 Operation**

The operating environment must guarantee the environmental parameters (temperature, power supply, etc.) specified in the technical specification section of the IPC/WLB\_PG manual.

The main functionality of the IPC/WLB\_PG is defined by the application programs running on the host device. The application programs are not part of the delivery by Syslogic but are defined, developed and tested by the customer or a system-integrator for each specific application. Refer to the respective documentation for more information.

### **1.8.4 Maintenance and Repair**

In the rare case of a module hardware-failure or malfunction, the complete system should be exchanged. The faulty system must be returned to the factory for repair.

For best maintenance and repair service it is recommended to use the Syslogic RMA Service. Refer to Chapter 7.1.1 .

Please use whenever possible the original packing for return of the product (EMI and mechanical protection).

### **1.8.5 Disposal**

At the end of the lifespan the IPC/WLB\_PG products must be properly disposed. IPC/WLB\_PG products contain a multitude of elements and must be disposed like computer parts.

### **1.8.6 Warranty**

Our products are covered by a world-wide manufacturer's warranty. The warranty period starts at the delivery time from our official distributor to the customer. The duration of the warranty period is specified in the respective product catalogs and the offers. All products carry a date code and a serial number for identification. The manufacturing data and deliveries are registered in a high level Quality Management System.

The warranty covers material and manufacturing defects. All products must be returned via the official distributor to the factory for repair or replacement. The warranty expires immediately if the products are damaged of operation outside of the specified recommended operating conditions. The warranty also expires if the date code or job number listed on the product is altered or rendered unintelligible. The warranty does not include damage due to errors in firmware or software delivered with the products.

For best warranty service it is recommended to use the Syslogic RMA Service. Refer to Chapter 7.1.1 .

### 1.8.7 RoHS

The product IPC/WLB\_PG designed and produced according to the Restriction of Hazardous Substances (RoHS) Directive (2002/95/EC).

### 1.8.8 WEEE

The products of the IPC/WLB\_PG family are not designed ready for operation for the end-user and are not intended for consumer applications. Therefore, the Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) is not applicable. But users should still dispose the product properly at the end of life.

## 2 Product Description

The IPC/WLB\_PG is an expansion board to Syslogic IPC/SL8, IPC/ML8 and IPC/RSL8 the following features.

- One USB connection for supply and data to the host system.
- Onboard USB hub to connect all devices on the board.
- GPS with Dead Reckoning (u-Blox Neo M8U)
  - Ipex u.FL antenna interface for active external antenna
  - Update rate up to 20Hz
  - Horizontal Position Accuracy up to 2.5m
  - Time to first Fit (Cold Start) down to 26s
  - Supporting GPS, GLONASS, BeiDou and Galileo
- PCIExpress Mini Card Socket (USB and SIM Interface only) intended for LTE/GPRS/GSM modem and other modules.
- Two Micro SIM sockets with SIM controller
- Board controller allows basic configuration of the board

### 2.1 Features

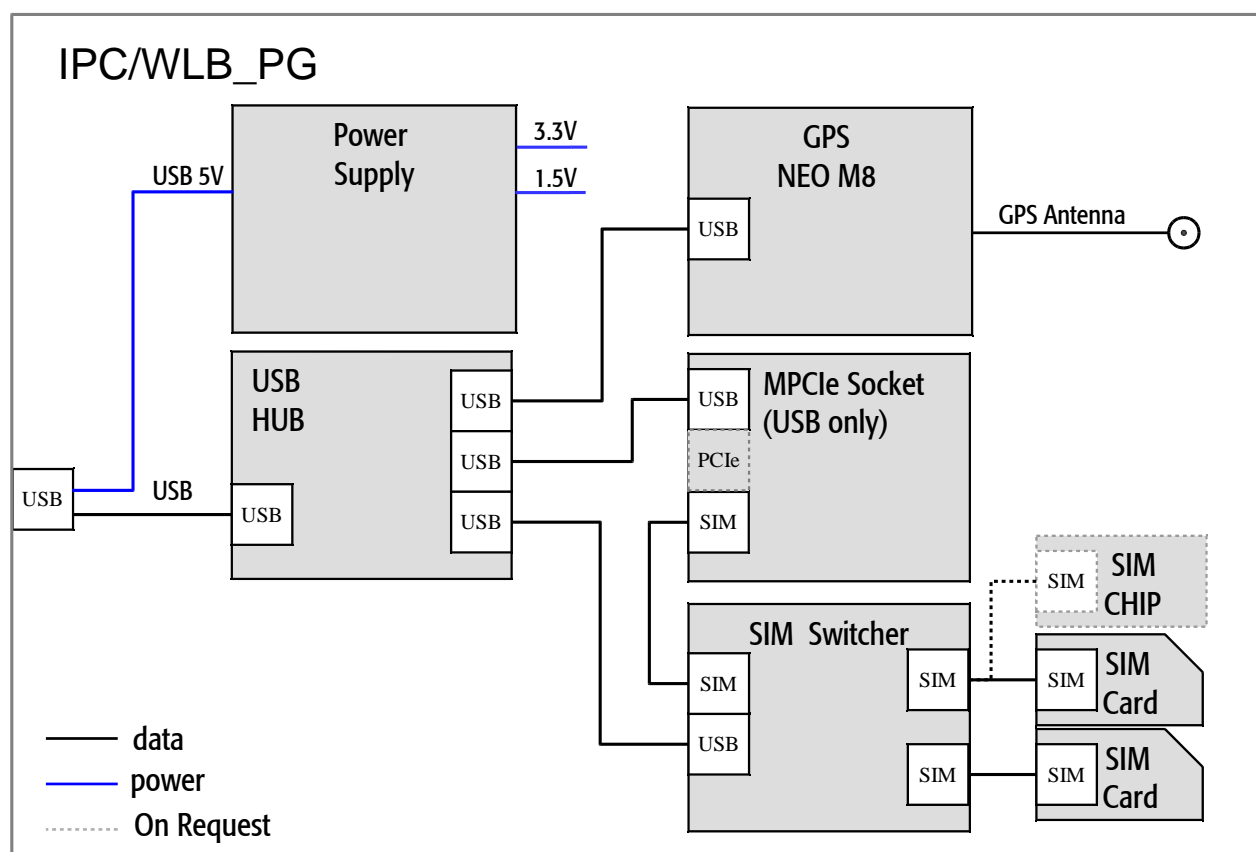


Fig. 1 Block Diagram

### 2.1.1 Variants

Product	USB Hub	mPCIe socket	GPS	SIM1	SIM2	Sim Controller	Conformal Coating
IPC/WLB-PG-101E	Yes	Yes	with DR	Micro SIM	Micro SIM	Yes	No
IPC/WLB-PG-101EC	Yes	Yes	with DR	Micro SIM	Micro SIM	Yes	YES

Tab. 2 Product Variants

## 2.2 Operating Modes

The IPC/WLB allows to use all features at the same time. Additionally, there are the following possibilities to disable features:

- Turn off Power of mPCIe Socket
- Turn off GPS
- Disable WAN interface (if supported by the Modem)

## 3 Hardware Description

### 3.1 Overview

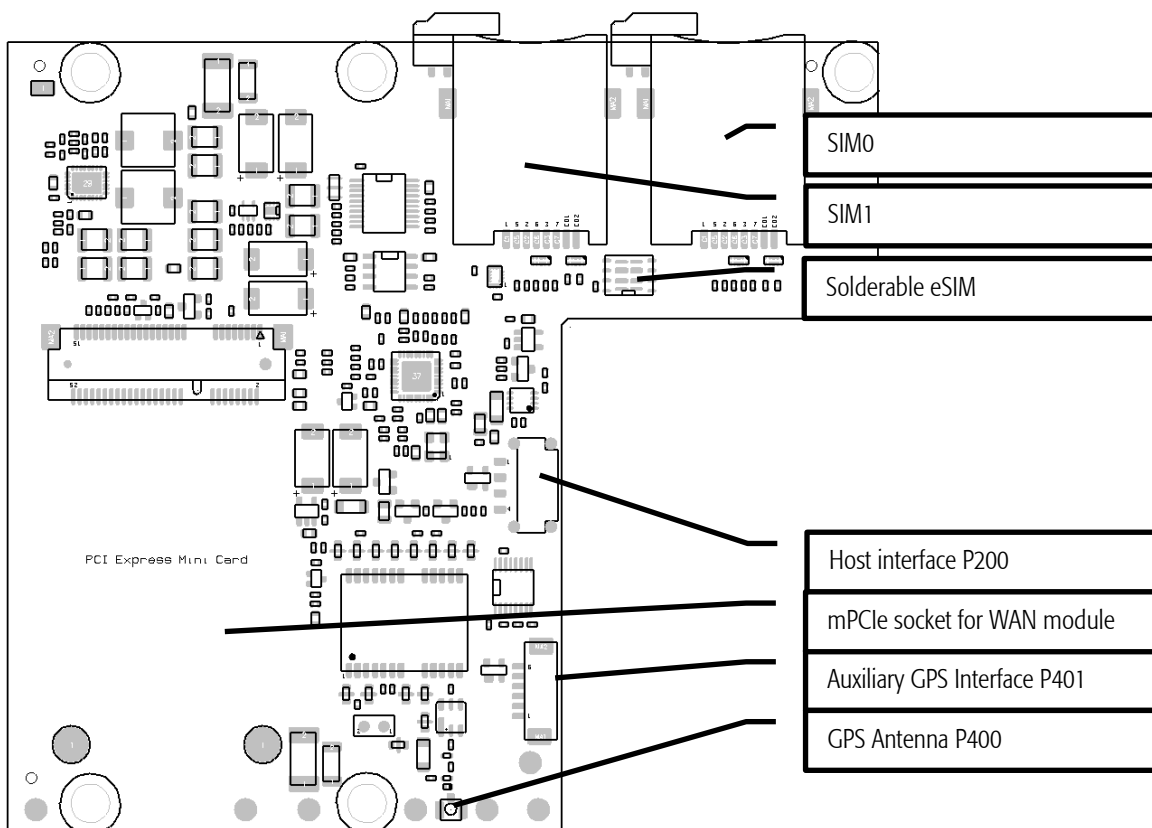


Fig. 2 Board Layout



## 3.2 Host device Interface

IPC/WLB\_PG devices are intended to be connected to an USB connector.

<b>Host USB Connector P200</b>	
<b>Connector</b>	
Connector Type Assembled	Harwin M80-8360445
Mating Connector Type	M80-8990405
<b>Pin description</b>	
Pin 1	USB Supply Voltage 5V
Pin 2	USB Data -
Pin 3	USB Data +
Pin 4	USB Ground

Tab. 1 USB Connector P200

### Important Note

Make sure the host device is able to provide enough energy. If using WAN modules inserted into the PCIeExpress Mini Card socket current consumption may exceed 0.5A. Check the technical data for exact values.

Make sure using good cables to minimize voltage drop.

Remark: if no or not well matched antenna is connected to WAN module, the current consumption may increase significantly.

## 3.3 USB Hub

The USB Hub used is a Microchip USB2513Bi three port hub.

The hub turns on the downstream devices as soon as the it is enumerated.

For some variants the USB Hub is not installed.

## 3.4 GPS

The positioning functionality is provided using a u-Blox NEO-M8U. Refer to the data sheet [1] and protocol specification [2] for detailed hardware and programming information.

Using GPS requires an external active antenna. The performance of the GPS is depending on the quality and position of the antenna.

The IPC/WLB\_PG provides backup supply voltage to the GPS for approximately 10 minute. This is intended to shorten time to first fix during reboot or reset of the host device. In combination with dead reckoning it may be advisable to supply backup power using the auxiliary interface P402

<b>GPS antenna connector (P400)</b>	
<b>Connector</b>	<b>Description</b>
Connector Type Assembled	Hirose U.FL-R-SMT-1
Mating Connector Type	Any U.FL Cable Connector
LNA Supply Voltage	3.3V+/-10% with internal 100ohm series resistor
LNA maximum Supply current	50mA
Required frequency range	1575MHz GPS 1598 ... 1606MHz Glonass 1561MHz BeiDou 1560MHz ... 1591MHz Galileo
Required antenna impedance	50Ohms
Required antenna ESD Rating	4kV contact discharge, 8kV air discharge
<b>Pin description</b>	
Pin 1	Antenna
Shield	GND

Tab. 3 GPS antenna interface

### 3.4.1 Auxiliary GPS Interface

This auxiliary interface to the GPS module provides the following features and signals:

- Auxiliary backup power to extend the backup supply
- RS232 interface to the GPS Module
- Wheel tick and direction signal if supported by the GPS Module (refer to u-Blox NEO M8U Datasheet [1])

### 3.4.2 Dead Reckoning

Dead Reckoning allows accurate positioning even in areas where satellite coverage is not accurate. Refer to u-Blox M8U Datasheet [1], N8U protocol specification [2] and white paper on UDR [3].

Before Dead Reckoning may be used the internal sensors need to be calibrated and the calibration needs to be saved on the NVM on the module. Dead Reckoning before the first GNSS fix requires that the RTC has been enabled and powered since the previous fix. Apply backup voltage to the GPS auxiliary connector P401

### 3.4.3 Dead Reckoning Sensor orientation

Dead Reckoning uses acceleration and rotation sensor. The Axis of the sensors are orientated as followed:

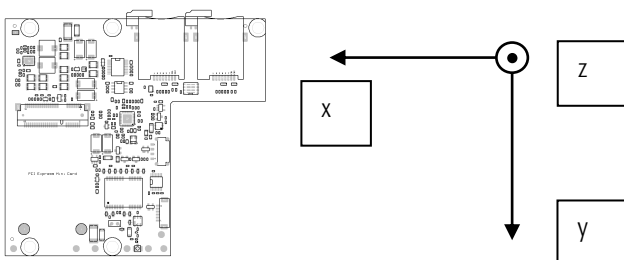


Fig. 3 Dead Reckoning Sensor Orientations

### 3.4.4 GPS Auxiliary Connector

The GPS Auxiliary Connector provides interface for RTC backup supply of the GPS module, odometer inputs and a RS232 two wire interface connected to the GPS module.

<b>GPS Aux Connector (P401)</b>	
<b>Connector</b>	<b>Description</b>
Connector Type Assembled	Molex 53261-0671 (Picoblade 6pin)
Mating Connector Type	Any mating Picoblade 6 Pin connector
<b>Pin description</b>	
Pin 1	GND
Pin 2	Backup supply voltage
Pin 3	TXD (RS232)
Pin 4	RXD (RS232)
Pin 5	Wheel tick signal connected to GPS pin 15
Pin 6	Direction signal connected to GPS pin 4

Tab. 4 GPS auxiliary interface

### 3.5 mPCIe Socket

The IPC/WLB\_PG provides a socket for PCI Express Mini Card (full size) with USB and SIM interface intended to be used with a LTE/GPRS/GSM modem.

Remarks on PCI Express Mini Card interface

- Use M2 Screws to fix the PCI Express Mini Card.
- 1.5V supply is available on request only.
- Power supply may be turned off.
- PCI Express Mini Card WWAN Signal is available on the board controller.
- PCI Express Mini Card WAN Disable Signal may be set using the board controller.

#### **Important Note**

IPC/WLB\_PG socket does not provide a PCI Express interface.

#### **Important Note**

Maximum component height on bottom side of PCI Express Mini Card on bottom side: 1.35mm max.

#### **Important Note**

Power consumption of WAN modules depend on the quality of the antenna connected. If no antenna or a badly matched antenna is connected power consumption may exceed the capabilities of the local power supplies as well as the host supply capacity.

### Important Note

Power consumption of a LTE/GPRS/GSM modem when used in GSM Mode only and with bad connectivity can lead to high currents. This can lead to “over-current condition” kernel messages on the corresponding USB port. If the used USB port has an over-current protection, the IPC/WLB\_PG will get disconnected and then registers itself newly with a new ID. The user application should deal with this reconnection and take care, that the device does not try to connect itself multiple times in GSM mode, when the connection stays bad. If the device is connected to a USB port without over-current protection, the kernel messages can be ignored and the device will not disconnect itself. This behavior has been seen with the MPCI-L210-02S-00 Modul of uBlox.

<b>mPCIe Connector (P500)</b>					
<b>Connector</b>			<b>Description</b>		
Connector Type Assembled			Molex 53261-0671 (Picoblade 6pin)		
Mating Connector Type			Any mating Picoblade 6 Pin connector		
<b>Pin description</b>					
<b>Pin</b>	<b>Function</b>	<b>IPC/WLB Feature</b>	<b>Pin</b>	<b>Function</b>	<b>IPC/WLB Feature</b>
Pin 1	WAKE_N	NC	Pin 2	+3.3Vaux	3.3V
Pin 3	COEX1	NC	Pin 4	GND	GND
Pin 5	COEX2	NC	Pin 6	1.5V	NC/1.5V
Pin 7	CLKREQ#	NC	Pin 8	UIM_PWR	UIM_PWR
Pin 9	GND	GND	Pin 10	UIM_DATA	UIM_DATA
Pin 11	REFCLK-	NC	Pin 12	UIM_CLK	UIM_CLK
Pin 13	REFCLK+	NC	Pin 14	UIM_RESET	UIM_RESET
Pin 15	GND	GND	Pin 16	UIM_VPP	NC
Pin 17	UIM_C8	NC	Pin 18	GND	GND
Pin 19	UIM_C4	NC	Pin 20	W_DISABLE#	DISABLE WAN
Pin 21	GND	GND	Pin 22	PERST#	Reset
Pin 23	PERn0	NC	Pin 24	+3.3Vaux	3.3V
Pin 25	PERp0	NC	Pin 26	GND	GND
Pin 27	GND	GND	Pin 28	1.5V	NC/1.5V
Pin 29	GND	GND	Pin 30	SMB_CLK	Pull UP
Pin 31	PETn0	NC	Pin 32	SMB_DATA	Pull UP
Pin 33	PETp0	NC	Pin 34	GND	GND
Pin 35	GND	GND	Pin 36	USB_D-	USB-
Pin 37	GND	GND	Pin 38	USB_D+	USB+
Pin 39	+3.3Vaux	3.3V	Pin 40	GND	GND
Pin 41	+3.3Vaux	3.3V	Pin 42	LED_WWAN#	LED_WWAN
Pin 43	GND	GND	Pin 44	LED_WLAN#	NC
Pin 45	Reserved	NC	Pin 46	LED_WPAN#	NC
Pin 47	Reserved	NC	Pin 48	+1.5V	NC
Pin 49	Reserved	NC	Pin 50	GND	GND
Pin 51	Reserved	NC	Pin 52	+3.3Vaux	3.3V

Tab. 5 Mini PCI Express card connector pinout

Remark: 1.5V Supply is available on request only.

### 3.6 SIM Card

IPC/WLB\_PG device is equipped with two MINI SIM card holder. Either one of them is connected to the mPCIe Socket, the other one is disabled.

To install a SIM card do the following steps:

1. Open the lock by sliding it to the right if closed.
2. Insert the card
3. Close the lock again by sliding it to the left.

To unmount a SIM card do the following steps:

1. Open the lock by sliding it to the right
2. Push the SIM card and release. The SIM card will be pushed out.
3. Remove the SIM card.

#### Important Note

It is recommended observing the state of the lock. This prevents the SIM from falling out during operation. The state of the lock may be controlled using the board controller. Refer to chapter 3.6.1 .

<b>SIM Card Holder (P600: SIM0, P601: SIM1)</b>	
<b>Connector</b>	<b>Description</b>
SIM Format	Mini SIM, ID-0000, Plug-In UICC
SIM Size	25mm x 15mm
SIM Detection	Available
SIM Lock	Available
<b>Pin description</b>	
C1	Supply Voltage
C2	Reset
C3	Clock
C4	NC
C5	GND
C6	Connected to Supply Voltage (C1)
C7	DATA
C8	NC

Tab. 6 SIM Card Interface

#### Important Note

Select operating temperature range of inserted SIM card properly. Ambient temperature of the inserted card is higher than the ambient temperature of the device.

#### 3.6.1 Solderable eSIM Card

On request SIM1 may be equipped as an solder able Embedded SIM Chip with case MFF1 or MFF2 instead of the card holder. For further detail contact manufacture (see chapter 7).

### 3.7 Board Controller and SIM switch

The Board Controller is implemented using a Microchip MCP2210 USB HID to SPI Interface. The SPI Interface is not used. All accessible features are implemented as GPIOs described in Tab. 7.

The device allows reading and writing the GPIOs as well as setting default values. Additionally, it offers 256Bytes of EEPROM.

The MCP2210 is a USB HID Device. For most operating System it is not required to install special driver. The device may be accessed directly using operating system interfaces.

Board Controller		Description				
Identification	ID					
USB Device ID	0x04D8					
USB Vendor ID	0x00DE					
GPIO	Signal	Dir	Default	Description		
GPIO 0	SIM_SEL	Out	0	Selects SIM Card.	0: SIM 0	1: SIM1
GPIO 1	WAN_DISABLE	Out	0	Enables airplane mode of mPCIe Module (disable WAN connection)	0: disabled	1: enabled
GPIO 2	WAN_POWER	Out	1	Enable mPCIe module power	0: power off	1: power on,
GPIO 3	GPS_POWER	Out	1	Enable GPS power	0: power off	1: power on
GPIO 4	SIM0 Detect	In		Detects if SIM0 is inserted	0: no SIM	1: SIM inseted
GPIO 5	SIM0 Lock	In		Lock of SIM0 is closed	0: open	1: closed
GPIO 6	WAN_LED	In		LED WWAN	0: active	1: passive
GPIO 7	SIM1 Detect	In		Detects if SIM1 is inserted	0: no SIM	1: SIM inseted
GPIO 8	SIM1 Lock	In		Lock of SIM1 is closed	0: open	1: closed

Tab. 7 GPIO Configuration

## 4 Programming Information

### 4.1 Overview

The IPC/WLB\_PG bus powered USB Device with different USB devices according to the following table:

Board Controller				
Device		USB VID	USB PID	Remark
USB HUB		0x0bb3	0x2513	
Port 1	GPS	0x1546	0x01a8	
Port 2	Modem			Defined by inserted Modem
Port 3	Board controller	0x04d8	0x00de	

Tab. 8 USB Device Information

### 4.2 USB Hub

The USB Hub used is a Microchip USB2513Bi three port hub. For most operating system no special drivers.

### 4.3 GPS

#### 4.3.1 Driver Requirement

The GPS module is implemented as a CDC-ACM device. For operating systems that support CDC-ACM devices (Windows 10, Debian) no driver installation is required. If using older Windows operating system install driver for NEO-M8U available from u-Box website.

If using Windows Embedded Standard 7 the following packages need to be installed:

- Compaq USB Modem Driver (Standard 7 Package Reference) winemb-inf-mdmcpq
- All depending packages of winemb-inf-mdmcpq

Refer to Windows 7 Embedded user manual.

#### 4.3.2 GPS Programming interface

The GPS module starts sending navigation messages right after initialization without any commands.

The GPS module accepts NMEA and UBX protocol. For detailed programming information refer to u-Blox M8 Receiver Description Protocol Specification [2].

### 4.4 PCI Express Mini Card Socket

For programming information of the modem installed in the PCI Express Mini Card socket refer to its datasheet and documentation.

#### Important Note

Power consumption of a LTE/GPRS/GSM modem when used in GSM Mode only and with bad connectivity can lead to high currents. This can lead to "over-current condition" kernel messages on the corresponding USB port. If the used USB port has an over-current protection, the IPC/WLB\_PG will get disconnected and then registers itself newly with a new ID. The user application should deal with this reconnection and take care, that the device does not try to connect itself multiple times in GSM mode, when the connection stays bad. If the device is connected to a USB port without over-current protection, the kernel messages can be ignored and the device will not disconnect itself. This behavior has been seen with the MPC1-L210-02S-00 Modul of uBlox.

## 4.5 Board Controller and SIM switch

The board controller is implemented using a Microchip MCP2210 device. For complete programming information refer to MCP2210 datasheet [4].

The device is implemented as a USB HID generic device. For most operating systems no additional driver is required.

## 4.6 Remarks on programming Board Controller

For normal operation only the following commands are used:

Command (1 <sup>st</sup> Byte)	Name	Description	Remark
0x30	Set (VM) GPIO Current Pin Value	set GPIO Value	Make sure to write valid data to all GPIOs
0x31	Get (VM) GPIO Current Pin Value	get GPIO Value	

Tab. 9 Most frequent used USB-HID Commands

The module is configured by factory according to Tab. 7. Make sure not to change direction to avoid unwanted behavior.

## 4.7 Syslogic IPC/WLB Library

Syslogic provides a demo software as well as a API to control the IPC/WLB-PG device. The API and the demo software is available for Debian and Windows on request.

### 4.7.1 Remarks on Windows API

The Windows library is based on the hidapi by Alan Ott.

Demo software is developed using Microsoft Visual Studio 2013.

- If creating a new program do the following configuration:
  - Compiler settings: Add folder “..\hidapi” to include directories
  - Linker Setting: Add “..\windows\Debug” or “..\windows\Release” to additional library directories
  - Linker Setting: add hidapi.lib to additional dependencies
  - Add hidapi as a project dependency to your application
- If sending telegrams using `wlb_procCMD` make sure to add a byte with value 0 to the start of your message. Refer to `hid_read` documentation.

### 4.7.2 General Remarks on API

`ipcWLBpg_lib` offers the following simplified API to control the board controller.

Function call	Description
<code>ipcWLB_connect</code>	Call this function to connect to the board controller prior to any other access
<code>ipcWLB_getInfo</code>	Call this function to load data about the connected device to a variable of the type <code>wlb_device</code>
<code>ipcWLB_printDeviceInfo</code>	Prints the content of the a <code>wlb_device</code> variable to standard output.
<code>ipcWLB_getGPIO</code>	Returns the current state of all GPIOs. Mask them by using <code>GPIO_*</code> constants
<code>ipcWLB_setGPIO</code>	Writes GPIO according to the Value and the mask. If mask bit is 1 the corresponding GPIO will be written according to the corresponding bit of value If mask bit is 0 the corresponding GPIO will not be changed
<code>ipcWLB_printGPIO</code>	Will print GPIO to readable format to standard output.
<code>ipcWLB_close</code>	Call this function before closing the application

Tab. 10 API Function calls.

If using `ipcWLB_getGPIO` or `ipcWLB_setGPIO` use the following constants:



Function call	Value	Default	Description
GPIO_SIM_SEL	0x0001	0	Set SIM Card selection
GPIO_WAN_DISABLE	0x0002	0	Set to 1 do configure Airplane mode of WAN module
GPIO_WAN_PWR	0x0004	1	Turns WAN Power on
GPIO_GPS_PWR	0x0008	1	Turns GPS Power on
GPIO_CARD1_DET	0x0010	-	Check if SIM 1 is inserted
GPIO_LATCH1_DET	0x0020	-	Check if SIM 1 latch is closed
GPIO_WAN_LED	0x0040	-	WAN LED, feature depending on WAN module inserted
GPIO_CARD2_DET	0x0080	-	Check if SIM 2 is inserted
GPIO_LATCH2_DET	0x0100	-	Check if SIM 2 latch is closed

Tab. 11 API constants

### 4.7.3 SIM Card Change

To change the active SIM card during operation the following procedure is recommended. Command example work for u-Blox MPC1 modules.

- Check if WAN module is connected to home network. Send AT+CREG? To WAN Module using CDC-ACM Serial interface.
- If WAN is not in home network:
  - Make sure the not active SIM Card is inserted. Use API command ipcWLB\_getGPIO.
  - Deregister from network by sending "AT+CFUN=4" to WAN Module.
  - Change SIM Interface using USB HID interface of ipc/WLB-PG ipcWLB\_setGPIO(GPIO\_SIM\_SEL, GPIO\_SIM\_SEL)
  - Reset WAN module using AT+CFUN=16 or AT+CFUN=1,1.

Commands may vary depending on WAN module used.

## 5 Technical Data

### 5.1 General Electrical Data

#### Important Note

Do not operate the IPC/WLB-PG board outside of the recommended operating conditions. Otherwise lifetime and performance will degrade. Operating the board outside of the absolute maximum ratings may damage the hardware.

#### Absolute Maximum Ratings (over free air temperature range)

Parameter	Symbol	min	nom	max	Unit
internal power supply voltage	Vcc	-0.5		5.5	Vdc
isolation logic to chassis (AC, 60s, 500m a.s.l., Ta=25°C)			none		Vrms
creepage distance logic to chassis and PCB boarder		1.0			mm
storage temperature range	Tst	-40		85	°C

Tab. 2 General Absolute Maximum Ratings

#### Recommended Operating Conditions

Parameter	Symbol	min	nom	max	Unit
USB Supply Voltage	Vcc	4.5	5.00	5.5	Vdc
operating free-air temperature range	Ta	-40		85	°C

Tab. 3 General Recommended Operating Conditions

#### Electrical Characteristics (over recommended operating range, unless otherwise noted)

Parameter	Symbol	min	typ	max	Unit
USB current consumption	Icc			1000	mA
Peak USB current consumption (check Manual of mPCIe Board)	Iccpeak			2500	mA
WAN module supply voltage	VccMPCle	3.0	3.3	3.6	V
WAN module supply current 3.3V (average)	IccMPCle			1100	mA
WAN module supply current 3.3V (peak)	IccMPCleP			2750	mA
WAN module supply current 1.5V (if available)				500	mA
Backup supply voltage (P401)	Vbckp	1.8		5.0	V
Backup supply current (P401)	Ibckp		15		uA

Tab. 4 General Electrical Characteristics

### **Important Note**

Current consumption of the IPC/WLB-PG including a WAN may vary from 100mA to 1000mA. The host system must be able to provide the current specified.

The current consumption is highly dependent on the selected protocol, channel and output power. It can go up to 2500 mA or even more depending on the chosen mPCIe Modul and its peak current.

Not sufficient power supply might cause the harmonic distortion.

## Switching Characteristics (nominal conditions)

Parameter	Symbol	min	nom	max
Board controller frequency	fclk		12.000	MHz
USB Hub Clock	Fclk		24.000	MHz

Tab. 5 General Switching Characteristics

## 5.2 Mechanical Data

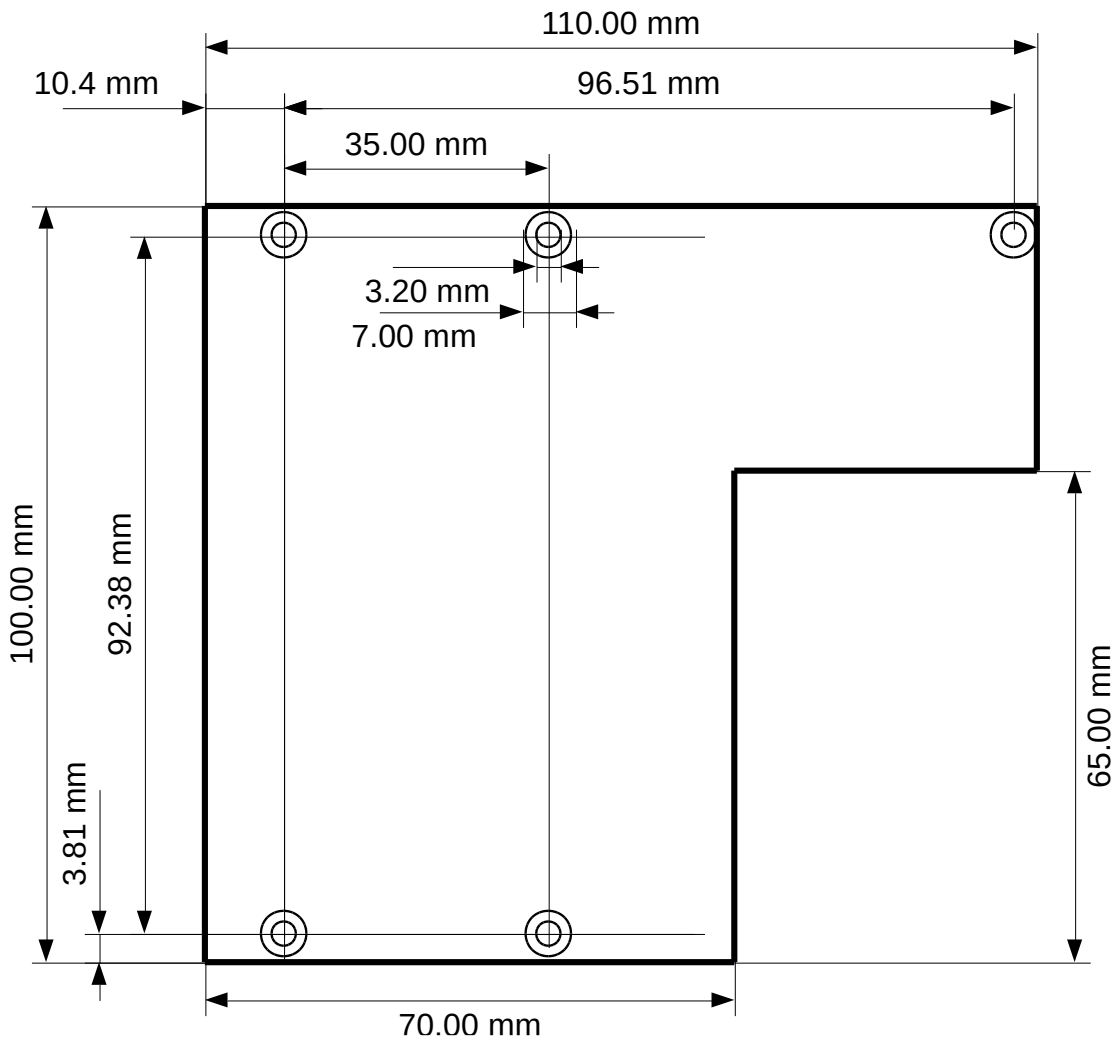


Fig. 4 Board dimensions

## 5.3 EMI / EMC Specification

The IPC/WLB-PG board fulfils the following standards:

- EN55032 Electromagnetic compatibility of multimedia equipment - Emission requirements
- EN50035 Electromagnetic compatibility of multimedia equipment - Immunity requirements
- EN301489-1 Electromagnetic compatibility and Radio spectrum Matters (ERM);  
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

## 6 Product Revision History

### 6.1 Hardware

This paragraph lists the different hardware revisions of the IPC/WLB-PG delivered beginning with the first production lot. Note that prototyping boards (Revision < 1.0) are not included and must be returned to factory for upgrade or replacement. All information listed in this document relies on definitive state hardware. Therefore this information may be incompatible with the prototyping board hardware.

#### Important Note

This document always covers the newest product revision listed in Tab. 12. Please contact the manufacturers technical support for upgrade options.

Board Identification (see product label)	Product Revision	Remarks
IPC/WLB-PG-101E	#1.0	First series

Tab. 6 Hardware Revision State

## **7 Manufacturer Information**

### **7.1 Contact**

Our distributors and system integrators will gladly give you any information about our products and their use. If you want to contact the manufacturer directly, please send a fax or email message containing a short description of your application and your request to the following address or use one of the information or technical support request forms on our internet homepage:

Syslogic Datentechnik AG  
Taefernstrasse 28  
CH-5405 Baden-Daettwil/Switzerland

e-mail: [support@syslogic.com](mailto:support@syslogic.com)

Web: [www.syslogic.com](http://www.syslogic.com)

T: +41 56 200 90 50

F: +41 56 200 90 40

#### **7.1.1 RMA Service**

Syslogic offers a Return Material Authorization process to simplify handling of devices that needs to be returned to the manufacturer. Please follow the instructions on our web page: [www.syslogic.com/rma](http://www.syslogic.com/rma) to get best service.