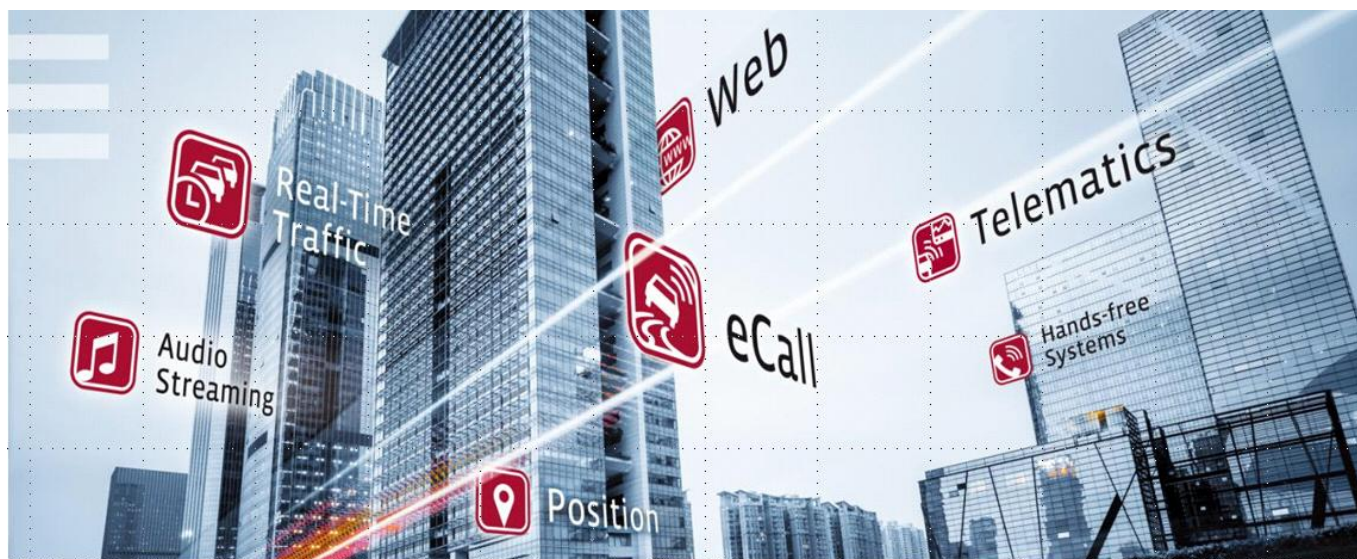


# User manual

## LTE-NAD V1140-xxx



Peiker product ID: 2189-140-xxx-00 (V1140-xxx)

Revision: 0.10  
Date: August 2014

Status: Draft

## History:

| <b>Date</b> | <b>Revision</b> | <b>Name</b> | <b>Comment</b>  |
|-------------|-----------------|-------------|---|
| 15.09.2013  | 0.5             | wlo         | Initial document  |
| 13.12.2013  | 0.6             | phse        | Some additions to sections 2.1 and 3.3<br>Some corrections to section 2.2, Figure 4 updated |
| 16.12.2013  | 0.7             | phse        | Some additions to section 8   |
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| 17.06.2014  | 0.9             | phse        | Updated Max Antenna Gain Values in section 8.3  |
| 24.06.2014  | 0.9.1           | wlo         | Added FW update and WIN7 driver installation  |
| 31.07.2014  | 0.10            | phse        | Added FCC labeling requirements of V1140-100  |
| 08.08.2014  | 0.11            | phse        | Modifications/additions to sections 8.1, 8.1.1 and 8.2                                      |
|             |                 |             |   |
|             |                 |             |   |

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# 1 Introduction

## **1.1 Scope**

This document gives an overview about electrical, mechanical and functional detail of the peiker LTE-NAD v1140-xxx.

## **1.2 Audience**

Information to integrate the module in other applications.

## **1.3 Contact information, Support**

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Germany

<http://www.peiker.de>  
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## **1.4 Related Documents**

None.

## 2 Overview

### 2.1 Product Variants

The LTE-NAD is available in multiple product variants:

| <b>Peiker product #</b>     | <b>Module configuration</b>       |
|-----------------------------|-----------------------------------|
| 2189-140-100-00 (V1140-100) | LTE EU configuration              |
| 2189-140-101-00 (V1140-101) | LTE North America configuration   |
| 2189-140-103-00 (V1140-103) | 2G/3G EU/RoW configuration        |
| 2189-140-104-00 (V1140-104) | LTE Asia Pacific configuration    |
| 2189-140-105-00 (V1140-105) | 2G/3G North America configuration |
| 2189-140-106-00 (V1140-106) | 2G/3G China configuration         |

All variants include Quad band GSM/GPRS/EDGE (850, 900, 1800, 1900 MHz)

#### **V1140-100**

|             |             |
|-------------|-------------|
| LTE Bands   | B3, B7, B20 |
| WCDMA Bands | FDD1, FDD8  |

#### **V1140-101**

|             |                 |
|-------------|-----------------|
| LTE Bands   | B2, B4, B5, B17 |
| WCDMA Bands | FDD2, FDD5      |

#### **V1140-103**

|             |                              |
|-------------|------------------------------|
| LTE Bands   | No LTE support               |
| WCDMA Bands | FDD1, FDD2, FDD5, FDD6, FDD8 |

#### **V1140-104**

|             |                        |
|-------------|------------------------|
| LTE Bands   | B1, B3, B5, B7, B19    |
| WCDMA Bands | FDD1, FDD5, FDD6, FDD8 |

#### **V1140-105**

|             |                |
|-------------|----------------|
| LTE Bands   | No LTE support |
| WCDMA Bands | FDD2, FDD5     |

#### **V1140-106**

|             |                |
|-------------|----------------|
| LTE Bands   | No LTE support |
| WCDMA Bands | FDD1           |

## 2.2 Features

### Features

- Same footprint and pin-out for all modules
- Voice and data calls are supported in all modules
- GSM (R99, GPRS and EDGE) for all modules
- WCDMA (R99, R5 HSDPA, R6 HSUPA and R7 HSPA+) for all modules
- WCDMA (R8 DC-HSPA+) for all modules except for V1140-101 and V1140-105
- LTE (Rel.9 Cat3 FDD) for LTE capable modules
- DTM/eDTM
- eCall inband modem
- Standalone GPS, GLONASS, AGPS (MS-Assisted and MS-Based)

### Data rates

- GSM: DL/UL – 14.4kbps / 14.4kbps  
GPRS: Multislot class 12, DL/UL – 85.6kbps / 42.8kbps  
EDGE: Multislot class 12, DL/UL – 236.8kbps / 118.4kbps
- WCDMA: DL/UL up to 384kbps  
HSPA+:
  - Category 24 in DL using 64 QAM and Dual-Cell; Up to 42 Mbps – Not supported by V1140-101 and V1140-105
  - Category 14 in DL using 64 QAM; Up to 21 Mbps
  - Category 6 in UL using 16 QAM; Up to 5.76 Mbps
- LTE-FDD Category 3: Up to 100 Mbps in DL, up to 50 Mbps in UL

### Power Classes

- LTE: All supported bands, Power Class 3
- WCDMA: All supported bands, Power Class 3
- EDGE: 850 MHz / 900 MHz / 1800 MHz / 1900MHz, Power Class E2
- GSM / GPRS: 850 MHz / 900MHz, Power Class 4
- GSM / GPRS: 1800 MHz / 1900MHz, Power Class 1

### Dimension and Weight

- Dimensions: 31mm x 46mm x 4mm
- Weight < 10 grams

## 2.3 Approvals

- R&TTE directive
- CE, GCF
- FCC, IC, PTCRB
- AT&T

## 3 Overview

### 3.1 HW Features

- Qualcomm SoC (system on chip)
  - o LTE capable modules V1140-100, V1140-101 and V1140-104  
MDM9215 Baseband / PMIC8018 Power management / WTR1605L
  - o Non-LTE modules V1140-103, V1140-105 and V1140-106  
MDM8215 Baseband / PMIC8018 Power management / WTR1605
- Cortex A5 Core up to 550 MHz
- 3 DSPs for modem and low power audio sub systems
- RPM Resource and power manager
- 2Gb NAND Flash x16,
- 2Gb Low Power Mobile DDR SDRAM x32
- 19.2MHz clock reference
- Dedicated heat sink in center area underneath the PCB
- GPS/GLONASS operation, GPS antenna biasing and diagnostics

### 3.2 Connectors

#### 3.2.1 Module Signal and RF Connectors

The LTE-NAD has 172 signal pins (2xAA and 2xBB) connector pads with 1.0mm pitch. The signal pads are located close to the board edges.

There are three antenna pads, each collocated by RF GND connectors

- Main transmit and receive antenna – pin LGA\_PRX\_ANT
- Diversity antenna for WCDMA respective MIMO antenna for LTE – pin LGA\_DRX\_ANT\_IN
- GNSS antenna for both GPS and GLONASS – pin LGA\_GPS\_DRX\_ANT

#### 3.2.2 Ground and Heat Dissipation Connectors

To support the usage of module under complicated thermal conditions, there are a number of large grounded pads in the center of PCB. These pads are dedicated ground pads to transfer heat dissipation to a carrier board.

This should be especially considered by customer designs. A reference design showing landing patterns and PCB stack-up is available on request.

### 3.3 Main Interfaces

#### 3.3.1 USB

The NAD has one USB2.0 OTG high speed (480MBit) compliant interface including the PHY. The IF consists of 5 signals:



- USB\_D\_P: USB Data Plus signal
- USB\_D\_M: USB Data Minus signal
- USB\_ID: Master/Slave Configuration<sup>1</sup>
- USB\_VBUS: USB Voltage Supply
- VREG\_USB3\_3V075 USB Voltage Output

A dynamic reconfiguration between USB-Host or USB-Device is not foreseen, the NAD can be configured to USB-Host or USB-Device by the insertion of a resistor on the USB\_ID line.

### 3.3.2 SIM Interface

The NADs SIM interface is compatible to 1.8V and 3V SIM Cards, the necessary voltage and level shifting is handle by LTE-NAD automatically. The IF consists of the following signals:

VREG\_USIM  
USIM\_CLK  
USIM\_DATA  
USIM\_RESET

The data speed on the SIM IF is up to 4 Mbps, so HW designers should take care of the length and routing of the SIM IF to prevent potential EMC problems.

### 3.3.3 Power on

The signal PON\_N is used switch on the NAD-Module. PON\_N is pulled against VMAIN on the LTE-NAD internally.

Due to this fact it is recommended to pull this input against GND using an open collector or open drain output only.

### 3.3.4 Reset

EXT\_RESIN\_N is used to reset the LTE-NAD-Module, see table of LTE-NAD signal pins. There are further reset signals available, please check .

RES\_IN is pulled against VMAIN power on the LTE-NAD internally. Therefore, it is recommended to pull this input against GND using an open collector or open drain output only.

### 3.3.5 GPIOs

---

<sup>1</sup> The LTE-NAD is configured in the slave mode. For other configuration of the USB – Interface please contact peiker acustic GmbH & Co.KG.

There are 51 GPIOs on the LTE-NAD module available. Most of them are part of the 5 GSBI s provided in next chapter. They are used for different interfaces (see Table 1 and the following chapters). For allocation of GPIOs/GSBI s to different configurations please contact peiker acustics GmbH & Co.KG

GPIOs and GSBI s share the same output pins and may not available when used as GSBI configuration.

The following GPIOs are not belonging to a GSBI bundle:

GPIO 47, 72, 82, 25, 28, 26, 27, 84, 80, 21, 23, 22, 24, 20, 1, 78, 79, 85, 86, 69, 0, 77, 65, 61, 68, 51, 54, 73, 48, 49, 53.

The following GPIOs are belonging to a GSBI bundle:

GPIO 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 29, 30.

### 3.3.6 GSBI s

Each GSBI (General Serial Bus Interface) consists of a bundle of 4 GPIOs. 5 GSBI are available. The reference voltage is of the GSBI s is 1.8V.

Available signals on GSBI bundles at the board to board connector:

- GSBI1: GSBI1\_0, GSBI1\_1, GSBI1\_2, GSBI1\_3 (GPIO\_29, 30, 2, 3)
- GSBI2: GSBI2\_0, GSBI2\_1, GSBI2\_2, GSBI2\_3 (GPIO\_4, 5, 6, 7)
- GSBI3: GSBI3\_0, GSBI3\_1, GSBI3\_2, GSBI3\_3 (GPIO\_8, 9, 10, 11)
- GSBI4: GSBI4\_0, GSBI4\_1, GSBI4\_2, GSBI4\_3 (GPIO\_12, 13, 14, 15)
- GSBI5: GSBI5\_0, GSBI5\_1, GSBI5\_2, GSBI5\_3 (GPIO\_16, 17, 18, 19)

For the standard configuration of the GSBI s see the following **Fehler! Verweisquelle konnte nicht gefunden werden.** 3.

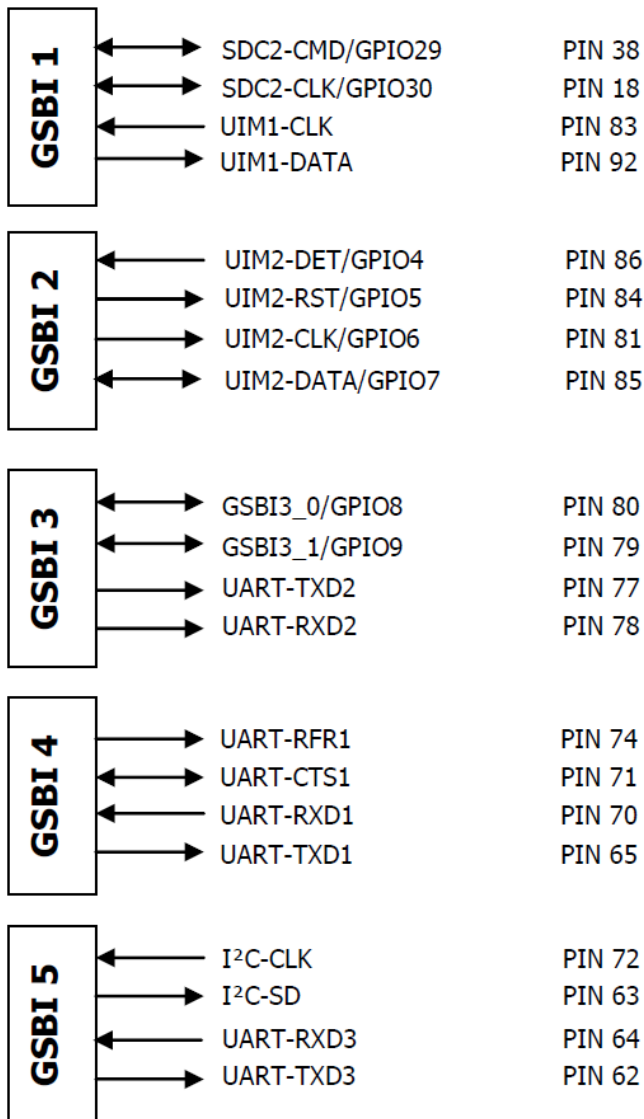


Figure 1 V1140-xxx General Serial Bus Interface GSBI interface configuration

### 3.3.7 Module Pin-out

Table 1 Module Pin-out

| PIN    | Signal      | Direction related to LTE-NAD | Comment                            |
|--------|-------------|------------------------------|------------------------------------|
| 1      | GND         | Input Power                  | Main ground connection, Corner pad |
| 2 – 22 | GND         | Input Power                  | Main ground connection             |
| 23     | GPIO47      | Input                        | WDOG_DISABLE                       |
| 24     | JTAG_TDI    | Input                        | JTAG Interface                     |
| 25     | JTAG_TDO    | Output                       | JTAG Interface                     |
| 26     | GPIO_72     | IN/OUT                       |                                    |
| 27     | JTAGTMS     | Input                        | JTAG Interface                     |
| 28     | JTAG_TRST_N | Input                        | JTAG Interface                     |

| <b>PIN</b> | <b>Signal</b>     | <b>Direction related to LTE-NAD</b> | <b>Comment</b>                            |
|------------|-------------------|-------------------------------------|---|
| 29         | JTAG_RTCK         | Output                              | JTAG Interface                            |
| 30         | GND               | Input Power                         | Main ground connection                    |
| 31         | JTAG_TCK          | Input                               | JTAG Interface                            |
| 32         | JTAG_RESOUT_N     | Input                               | JTAG Interface                            |
| 33         | GPIO82            | Output                              | NAD – Runnig, Controll signal             |
| 34         | JTAG_PS_HOLD      | Input                               | JTAG Interface                            |
| 35         | EXT_RESIN_N       | Input                               | Input Reset for LTE-NAD module            |
| 36         | GND               | Input Power                         | Main ground connection                    |
| 37         | RESOUT_N          | Output                              | Output Reset                              |
| 38         | GPIO29_SDC2_CMD   | IN/OUT                              | SD Card CMD                               |
| 39         | GPIO25_SDC2_D0    | IN/OUT                              | SD Card Data 0                            |
| 40         | GPIO28_SDC2_D3    | IN/OUT                              | SD Card Data 3                            |
| 41         | GPIO30_SDC2_CLK   | Output                              | SD Card Clock                             |
| 42         | GND               | Input Power                         | Main ground connection                    |
| 43         | GPIO26_SDC2_D1    | IN/OUT                              | SD Card Data 1                            |
| 44         | GPIO27_SDC2_D2    | IN/OUT                              | SD Card Data 2                            |
| 45         | PM_GPIO4          | IN/OUT                              |   |
| 46         | GPIO84            | Output                              | Reset of the Codec                        |
| 47         | GND               | Input Power                         | Main ground connection                    |
| 48         | SDC1_CMD          | IN/OUT                              | SD Card CMD                               |
| 49         | SDC1_DATA0        | IN/OUT                              | SD Card Data 0                            |
| 50         | SDC1_DATA3        | IN/OUT                              | SD Card Data 3                            |
| 51         | SDC1_CLK          | Output                              | SD Card Clock                             |
| 52         | GPIO80_SDC1_DET_N | IN/OUT                              |   |
| 53         | GND               | Input Power                         | Main ground connection, Corner pad        |
| 54         | SDC1_DATA2        | IN/OUT                              | SD Card Data 2                            |
| 55         | SDC1_DATA1        | IN/OUT                              | SD Card Data 1                            |
| 56         | GPIO21_I2S_WS     | Output                              | I <sup>2</sup> S - Word Select            |
| 57         | GPIO23_I2S_DOUT   | Output                              | I <sup>2</sup> S – Data Output            |
| 58         | GPIO22_I2S_DIN    | Input                               | I <sup>2</sup> S - Data Input             |
| 59         | GPIO24_I2S_MCLK   | Output                              | I <sup>2</sup> S - Master Clock           |
| 60         | GND               | Input Power                         | Main ground connection                    |
| 61         | GPIO20_I2S_CLK    | Output                              | I <sup>2</sup> S - Clock                  |
| 62         | GPIO19_GSBI5_3    | Output                              | 2 – Pin – UART TXD 3                      |
| 63         | GPIO17_GSBI5_1    | IN/OUT                              | I <sup>2</sup> C – Serial Data            |
| 64         | GPIO18_GSBI5_2    | Input                               | 2 – Pin – UART RXD 3                      |
| 65         | GPIO15_GSBI4_3    | Output                              | 4 – Pin – UART TXD 1                      |
| 66         | GND               | Input Power                         | Main ground connection                    |
| 67         | USB_D_P           | IN/OUT                              | High – Speed USB Device for communication |
| 68         | USB_D_M           | IN/OUT                              | High – Speed USB Device for communication |
| 69         | GND               | Input Power                         | Main ground connection                    |
| 70         | GPIO14_GSBI4_2    | Input                               | 4 – Pin – UART RXD 1                      |

| <b>PIN</b> | <b>Signal</b>         | <b>Direction related to LTE-NAD</b> | <b>Comment</b>                            |
|------------|-----------------------|-------------------------------------|---|
| 71         | GPIO13_GSBI4_1        | Input                               | 4 – Pin – UART Clear To Send 1            |
| 72         | GPIO16_GSBI5_0        | Output                              | PC - Clock                                |
| 73         | USB_ID                | Input                               |   |
| 74         | GPIO12_GSBI4_0        | Output                              | 4 – Pin – UART Ready For Receive 1        |
| 75         | GND                   | Input Power                         | Main ground connection                    |
| 76         | USB_VBUS              | Input                               | High – Speed USB Device for communication |
| 77         | GPIO11_GSBI3_3        | Output                              | 2 – Pin – UART TXD 2                      |
| 78         | GPIO10_GSBI3_2        | Input                               | 2 – Pin – UART RXD 2                      |
| 79         | GPIO9_GSBI3_1         | IN/OUT                              |   |
| 80         | GPIO8_GSBI3_0         | IN/OUT                              |   |
| 81         | GPIO6_UIM2_CLK        | IN/OUT                              |   |
| 82         | GND                   | Input Power                         | Main ground connection                    |
| 83         | GPIO2_UIM1_CLK        | Output                              | SIM Card - Clock                          |
| 84         | GPIO5_UIM2_RST        | IN/OUT                              |   |
| 85         | GPIO7_UIM2_DATA       | IN/OUT                              |   |
| 86         | GPIO4_UIM2_DET        | IN/OUT                              |   |
| 87         | GND                   | Input Power                         | Main ground connection, Corner pad        |
| 88         | HSIC_DATA             | IN/OUT                              | Connection to Ethernet Controller         |
| 89         | GND                   | Input Power                         | Main ground connection                    |
| 90         | HSIC_STROBE           | IN/OUT                              | Connection to Ethernet Controller         |
| 91         | GND                   | Input Power                         | Main ground connection                    |
| 92         | GPIO3_UIM1_DATA       | Output                              | SIM Card – Data 1                         |
| 93         | GPIO1_UIM1_RST        | Output                              | SIM Card – Reset 1                        |
| 94         | GPIO78                | IN/OUT                              |   |
| 95         | GPIO79_HSIC_RDY       | Output                              | Reset of Ethernet Controller              |
| 96         | GPIO85                | Output                              | Time synchronization                      |
| 97         | GPIO86_GPS_EXT_LNA_EN | IN/OUT                              |   |
| 98         | GND                   | Input Power                         | Main ground connection                    |
| 99         | VREG_USB3_3V075       | Output Power                        | Output Power to USB                       |
| 100        | GND                   | Input Power                         | Main ground connection                    |
| 101        | VREG_MSME_1V8         | Output Power                        | Output Power                              |
| 102        | GND                   | Input Power                         | Main ground connection                    |
| 103        | VREG_UIM2             | Output Power                        | Output Power to SIM Card 2                |
| 104        | VREG_SDC1_2V95        | Output Power                        | Output Power to SD Card 1                 |
| 105        | GND                   | Input Power                         | Main ground connection                    |
| 106        | VREG_UIM1             | Output Power                        | Output Power to SIM Card 1                |
| 107        | GND                   | Input Power                         | Main ground connection                    |
| 108        | GND                   | Input Power                         | Main ground connection                    |
| 109        | VMAIN                 | Input Power                         | Main power                                |
| 110        | VMAIN                 | Input Power                         | Main power                                |
| 111        | VMAIN                 | Input Power                         | Main power                                |
| 112        | VMAIN                 | Input Power                         | Main power                                |

| <b>PIN</b>   | <b>Signal</b>   | <b>Direction related to LTE-NAD</b> | <b>Comment</b>                          |
|--------------|-----------------|-------------------------------------|---|
| 113          | GND             | Input Power                         | Main ground connection                  |
| 114          | GND             | Input Power                         | Main ground connection                  |
| 115          | PON             | Input                               | Power On                                |
| 116          | HW-REV-RESISTOR | Output                              |   |
| 117          | PM_GPIO3        | IN/OUT                              |   |
| 118          | GND             | Input Power                         | Main ground connection                  |
| 119          | PM_MPP5         | Input                               | PM – ADC – channel                      |
| 120          | PM_MPP1         | Input                               | PM – ADC – channel                      |
| 121          | GND             | Input Power                         | Main ground connection                  |
| 122          | GPIO69          | Output                              | Switch between main and back up antenna |
| 123          | GPIO0_UIM1_DET  | Input                               | SIM Card – Detection 1                  |
| 124          | GPIO77          | Output                              | Reset signal of SDC2                    |
| 125          | GPIO65          | Output                              | NAD – Wake up                           |
| 126          | GPIO61          | Input                               | NAD – Update                            |
| 127          | PON_N           | Input                               | Power On                                |
| 128          | GND             | Input Power                         | Main ground connection                  |
| 129          | GPIO68          | Output                              | PS-3V8-Hold                             |
| 130          | GPIO51          | Input                               | BOOT_CONFIG3                            |
| 131          | GPIO54          | Input                               | BOOT_CONFIG0                            |
| 132          | GND             | Input Power                         | Main ground connection                  |
| 133          | PM_MPP2         | Input                               | PM – ADC - channel                      |
| 134          | PM_GPIO2        | IN/OUT                              |   |
| 135          | PM_GPIO1        | IN/OUT                              |   |
| 136          | PM_GPIO6        | IN/OUT                              |   |
| 137          | GND             | Input Power                         | Main ground connection                  |
| 138          | GPIO73          | IN/OUT                              |   |
| 139          | GND             | Input Power                         | Main ground connection, Corner pad      |
| 140          | GPIO48          | Input                               | BOOT_CONFIG6                            |
| 141          | GPIO49          | Input                               | BOOT_CONFIG5                            |
| 142          | GPIO53          | Input                               | BOOT_CONFIG1                            |
| 143 –<br>152 | GND             | Input Power                         | Main ground connection                  |
| 153          | LGA_PRX_ANT     |                                     | Connection to the antenna switch        |
| 154 –<br>160 | GND             | Input Power                         | Main ground connection                  |
| 161          | LGA_GPS_DRX_ANT |                                     | Connection to the antenna connector     |
| 162 –<br>164 | GND             | Input Power                         | Main ground connection                  |
| 165          | LGA_DRX_ANT_IN  | Input                               | Connection to the antenna switch        |
| 166          | LGA_DRX_ANT_OUT |                                     |   |
| 167 –<br>172 | GND             | Input Power                         | Main ground connection                  |

Note: Pins should be grounded when not used in design.

### 3.4 Supply Voltage

The external supply voltage is applied to LTE-NAD by 8 Pins on modules signal connectors.

PINs 109, 110, 111, 112 for VMAIN

PINs 107, 108, 113, 114 for the corresponding GND

Please note that there are further main ground connection that should be connected to ensure proper NAD function.

$T_A = -40^{\circ}\text{C} \dots +85^{\circ}\text{C}$

|  |             |
|--|-------------|
| Absolute minimum/maximum supply voltages | 3.6V ~ 4.0V |
| Nominal supply voltage                   | 3.8V        |
| Recommended supply voltage               | 3.8V        |
| Voltage drop @ GSM power burst (33dBm)   | <100mV      |

During Hi RF Power GSM bursts the power amplifier can draw peak currents > 2Amps at VMAIN. The voltage drop during the GSM burst shall not exceed 100mV.

### 3.5 Power Consumption

$T_A = +25^{\circ}\text{C}$ , VPH\_PWR =3.8V

|                       |         | Output Power          | Output Power       |
|-----------------------|---------|-----------------------|--------------------|
|                       |         | max. (typ. 23dBm)     | 0 dBm              |
| Voice call WCDMA BC1  |         | ~530mA                | ~145mA             |
| Voice call WCDMA BC2  |         | ~570mA                | ~145mA             |
| Voice call WCDMA BC5  |         | ~630mA                | ~140mA             |
| Voice call WCDMA BC8  |         | ~580mA                | ~140mA             |
|                       |         | PCL 5 (typ. 32.5 dBm) | PCL 19 (typ. 5dBm) |
| Voice call GSM850     |         | ~260mA                | ~65mA              |
| Voice call GSM900     |         | ~270mA                | ~65mA              |
|                       |         | PCL 0 (typ.30.5dBm)   | PCL 15 (typ.0dBm)  |
| Voice call GSM1800    |         | ~165mA                | ~65mA              |
| Voice call GSM1900    |         | ~165mA                | ~65mA              |
| Standby current GSM   | DRX = 5 | Tbd mA                |                    |
| Standby current WCDMA | DRX = 7 | Tbd mA                |                    |
| Standby current LTE   | DRX = 7 |                       |                    |

|                   |  | <b>Output Power</b> | <b>Output Power</b> |
|-------------------|--|---------------------|---------------------|
| LTE data call B3  |  |                     |                     |
| LTE data call B7  |  |                     |                     |
| LTE data call B20 |  |                     |                     |

### **3.6 Transmitter**

Tbd.

### **3.7 Receiver**

Tbd.

## **3.8 Environmental Specification**

### **3.8.1 Temperature Range**

| Range                 |                                   |  |
|-----------------------|-----------------------------------|--|
| Operating temp. range | -20°C ... +65°C                   | 3GPP spec. conform   |
| Operating temp. range | -40°C ... +85°C <sup>Note 1</sup> | Operational<br>Performance might slightly<br>deviate from 3GPP spec. |
| Storage temp. range   | -40°C ... +85°C                   |  |

Note 1: Due to temperature specification of the chipset, the temperature of the power manager and the temperature of the modem chip shall not exceed +85°C.



## 4 Evaluation Kit

### 4.1 Overview

For the NAD V1140-xxx, there is an evaluation board available.

Features:

- On board 12V DC power supply (alternatively 3,8V DC direct connected, unbuffered).
- USB port type B
- SIM card tray
- 20 pin JTAG header for debugging
- 2 UART ports connected to DB9
- CODEC supported by I2S and I2C interfaces

### Using the evaluation board with an external power supply

By default the module can be supplied by a switching regulator at 12V DC input voltage or by the module VCC at 3.8V.

3.8V supply should be able to deliver 3.5A max. Sense contacts are for supplies which support the corresponding feature.

### Using the evaluation board with on board 3.8V regulator

For use at 3.8V simply disconnect the 12V supply and plug on 3.8V.

**Note: Make sure that the external power supply is not generating spikes or hazards higher than 4.0V. LTE-NAD Module gets damaged when spikes or hazards above 4.0V are applied**

### RF Connector

- For RF measurements use main antenna connector

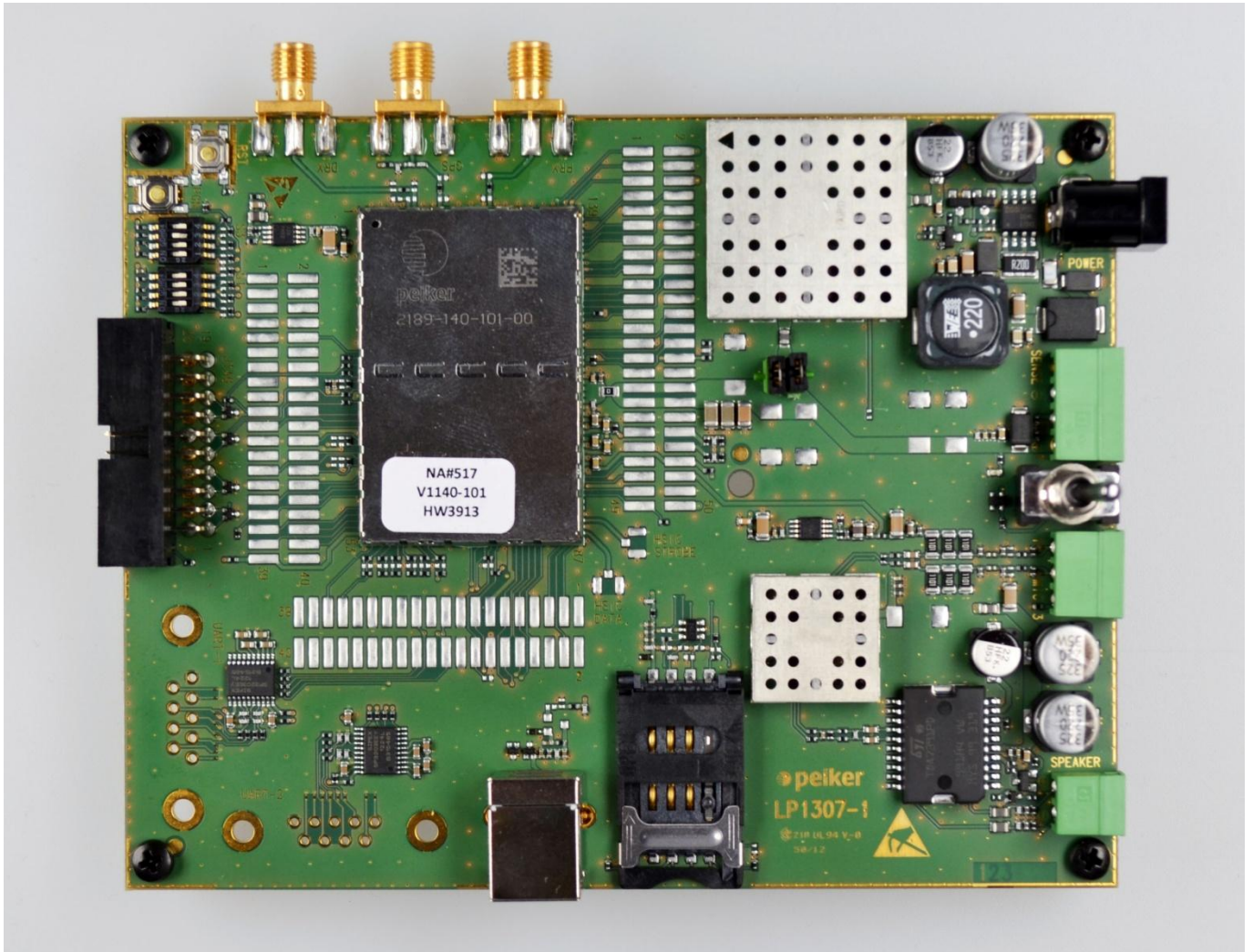


Figure 2 Evaluation Kit for V1140-xxx.

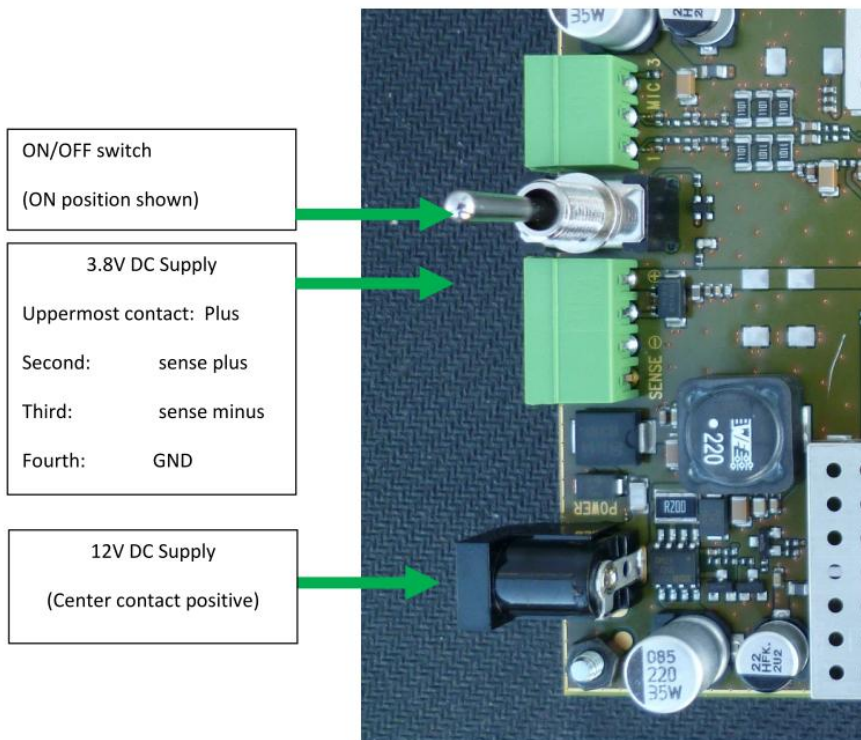


Figure 3 Power supply for Evaluation Kit for V1140-xxx.

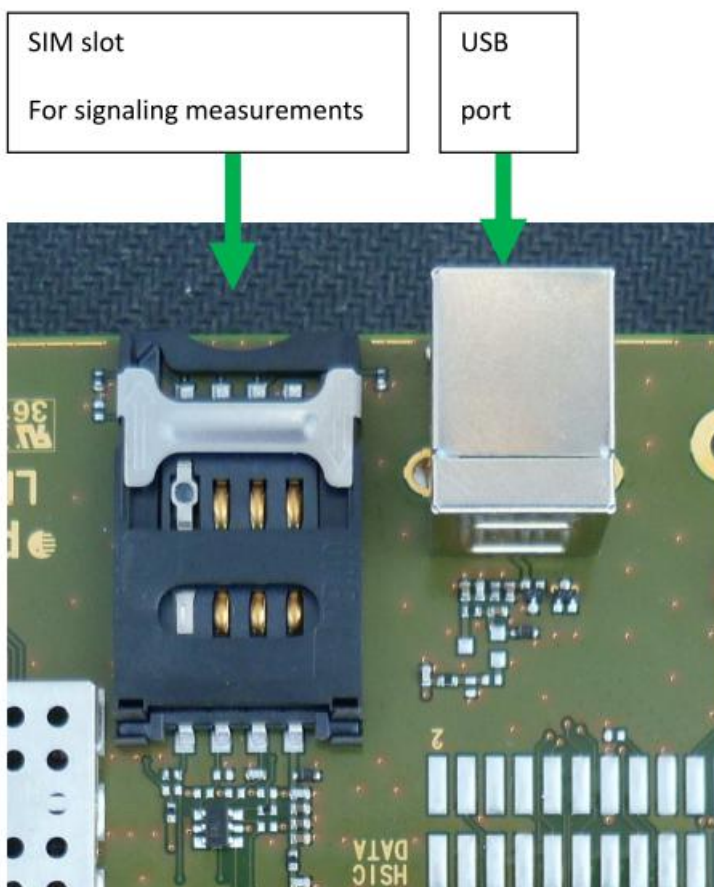


Figure 4 SIM card and USB interfaces for Evaluation Kit for V1140-xxx.



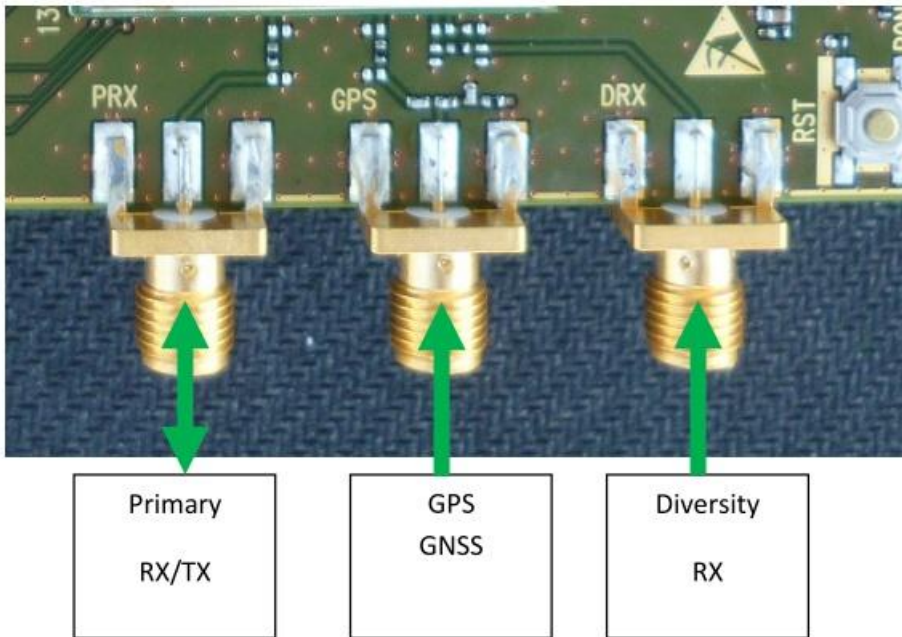


Figure 5 RF interfaces for Evaluation Kit for V1140-xxx.

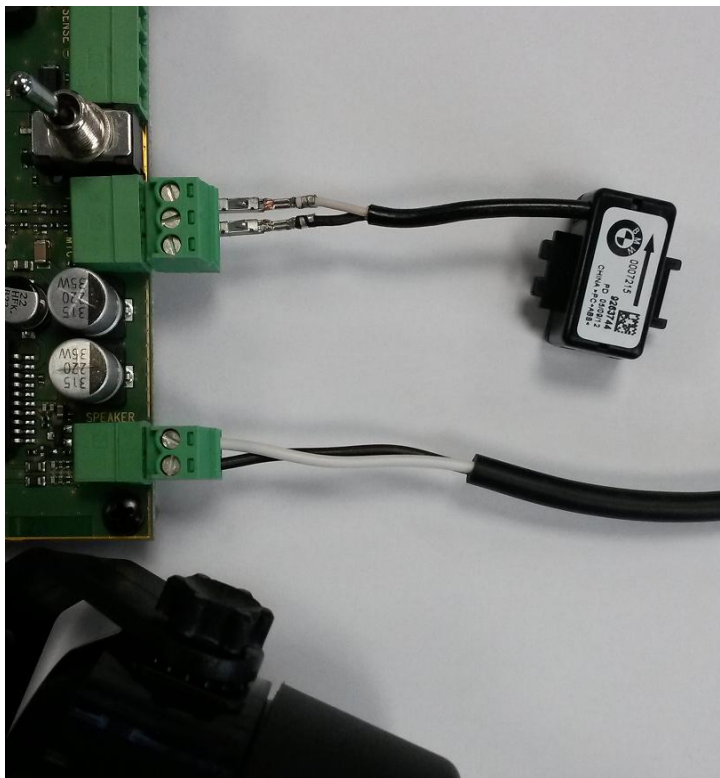


Figure 6 Loudspeaker and microphone interfaces for Evaluation Kit for V1140-101.

## 4.2 Firmware Update

For Firmware (FW) update the Windows software tool *swupd.exe* is available. To run a FW update following preconditions should be fulfilled:

- Evaluation board is power-on and connected to laptop or PC
- Qualcomm HS-USB Diagnostics 9025 Driver, version 2.0.9.1d or higher, is installed
- Virtual COM port of Qualcomm HS-USB Diagnostics 9025 is identified

**Note:** Please ensure to have a backup of your module configuration file

### 4.2.1 Identify Qualcomm Diagnostics Port Number

Please use the Windows Device Manager to identify virtual COM port number

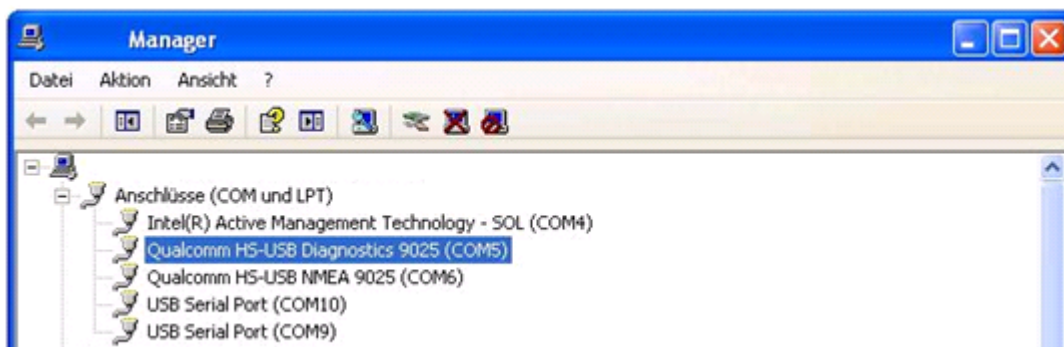


Figure 7 Identify Virtual COM port number of Qualcomm HS-USB Diagnostics 9025 using Windows Device Manager – in provided example COM5

### 4.2.2 Install and Run FW Executable

There is no dedicated software installation required. Please copy all files received with FW update to folder of your choice and ensure that all components are available

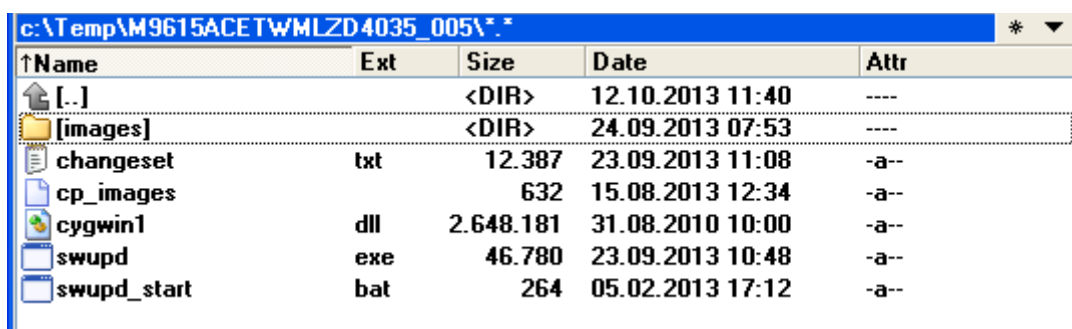


Figure 8 Components of FW update tool

**Important:** Before starting FW update ensure to have backup QCN file of your evaluation board.

To start update process please run the batch file *swupd\_start.bat* and enter Virtual COM port number identified in previous step.

```

C:\WINDOWS\system32\cmd.exe
Enter COM port for Qualcomm HS-USB Diagnostics 9002: 5
Changed desired Comport to /dev/com5
Changed download mode to USB
Changed download source directory to .\images\
12:29:27 : SW Update Utility Version 3.2.3 for LTE9615 06-Dec-2012
Copyright(C) 2009-2012 Peiker acoustic GmbH & Co KG. All rights reserved
Any use without prior permission is prohibited!

12:29:27 : Start Download process
12:29:27 : Synchronizing with NAD...
12:29:29 : NAD is in known SBL2 Download Mode

12:29:29 : Downloading Flash programmer...
12:29:29 : Connection with regular Bootloader. Download Flash Programmer
cygwin warning:
MS-DOS style path detected: .\images\NPRG9x15.hex
Preferred POSIX equivalent is: ../images/NPRG9x15.hex
CYGWIN environment variable option "nodosfilewarning" turns off this warning.
Consult the user's guide for more details about POSIX paths:
  http://cygwin.com/cygwin-ug-net/using.html#using-pathnames
12:29:30 : Go command to start FLP execution

12:29:30 : Close USB connection, wait for USB bringup

12:29:31 : Re-Opened USB connection

12:29:31 : Start Download SBL1...
12:29:31 : End Download SBL1...
12:29:31 : Start Download SBL2...
12:29:32 : End Download SBL2...
12:29:32 : Start Download RPM...
12:29:32 : End Download RPM...
12:29:32 : Start Download APPSBL...
12:29:32 : End Download APPSBL...
12:29:32 : Start Download DSP1...
12:29:35 : End Download DSP1...
12:29:35 : Start Download DSP2...
12:30:08 : End Download DSP2...
12:30:08 : Start Download DSP3...
12:30:15 : End Download DSP3...
12:30:15 : Start Download Linux boot loader...
12:30:18 : End Download Linux boot loader...
12:30:18 : Start Download Linux root file system...
12:30:38 : End Download Linux root file system...
12:30:38 : Start Download Linux user file system...
12:31:55 : End Download Linux user file system...
12:31:55 : Download completed Successfully!

Sending Reset command, expecting Reset Ack...

12:31:55 : Endtime:
Drücken Sie eine beliebige Taste . . .
  
```

Figure 9 Complete FW update

A complete FW update will take about 2:30 minutes. Please note that there are other options to run FW update. To learn more please run *swupd.exe /h*.

### 4.2.3 Known Issues

Sometimes a timeout occurs. Please simply re-run the batch file in that case.

Please inform us if you experience problems updating the FW on Evaluation Board.

Please check if access to Qualcomm HS-USB Diagnostics port is blocked by other program.

## 4.3 Windows 7 Driver Installation

### 4.3.1 Driver installation

The released 64-bit Windows 7 USB host driver package is Qualcomm's HK11-NA430-7\_1.00.22 or higher revision, where 7\_1.00.22 is the revision number.

Driver can be obtained from Qualcomm. Following the license conditions, peiker is not allowed to distribute this driver.

Note: There could be certificates to be installed.

### 4.3.2 Available interfaces

The interfaces provided in Fig. 9 in Windows Device Manager will appear once

- the USB driver is installed properly,
- the USB cable connects EvalBoard and computer, and
- the Evaluation Board is powered-up.

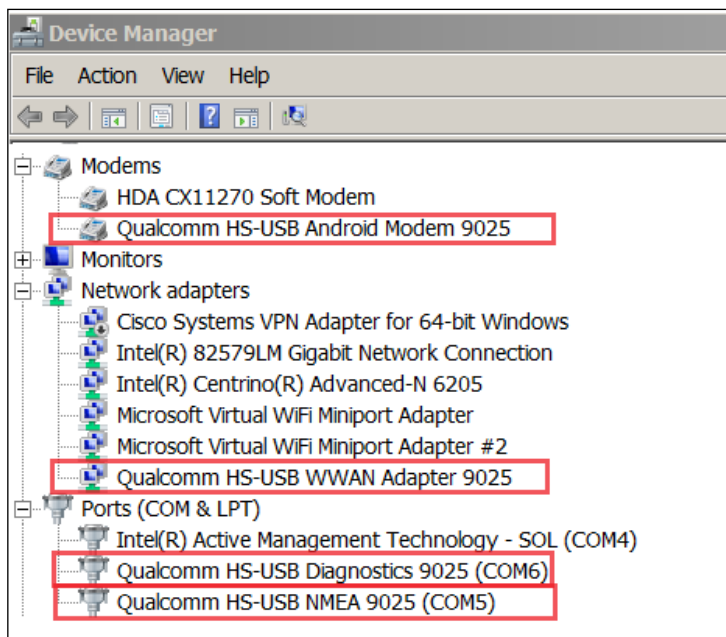


Figure 10 Interfaces provided by Evaluation Board for OS Windows 7

In following chapters provide some information on how these interfaces could be used.

### 4.3.3 AT Command interface and PPP Dial-up Modem connection

AT commands are used to control to some extent the modem. To send AT commands to the Modem such tools as PuTTY or similar are used.

To setup PuTTY the virtual COM port can be read from Modem property information – right click in Device Manager the Modem string and select “Properties”. The assigned virtual COM port is shown in “Modem” dialog box, see in Figure 11 – Port COM7.

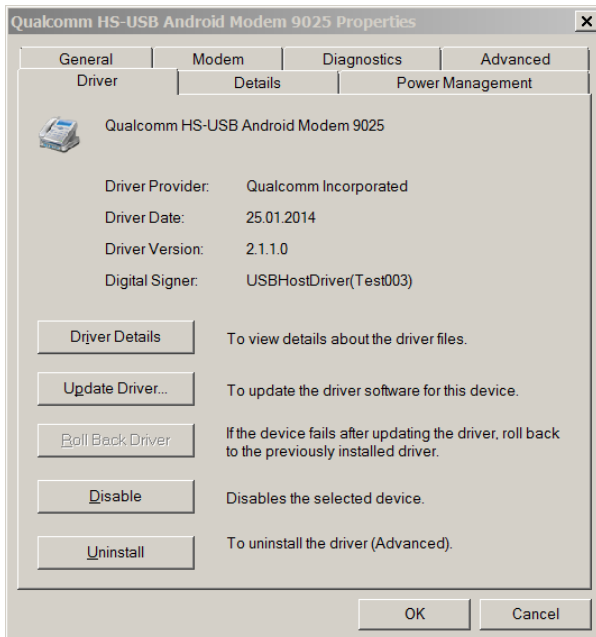


Figure 11 Modem Property dialog box

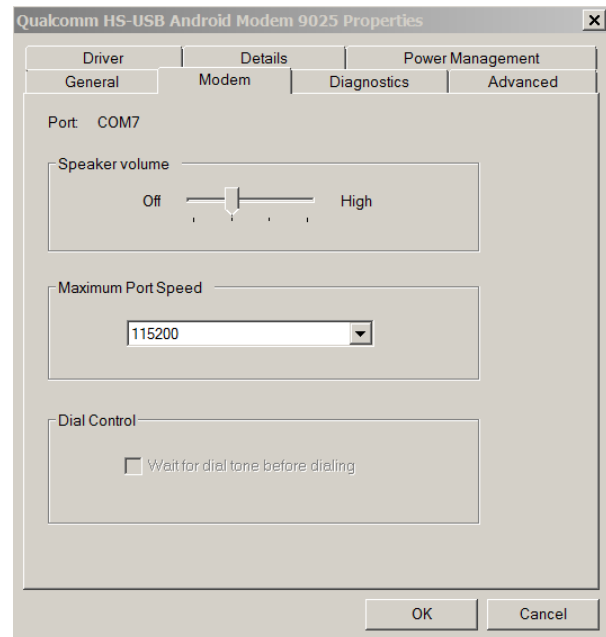


Figure 12 Virtual COM port and modem settings

Furthermore, it is recommended to add the APN string in Modem property box as shown in Figure 12. Alternatively, the APN string can be set by AT command `AT+CGDCONT=1,"IP","web.vodafone.de"` (Note: The latter is the special APN valid for Vodafone Germany only). Please check with your Provider the correct APN string.

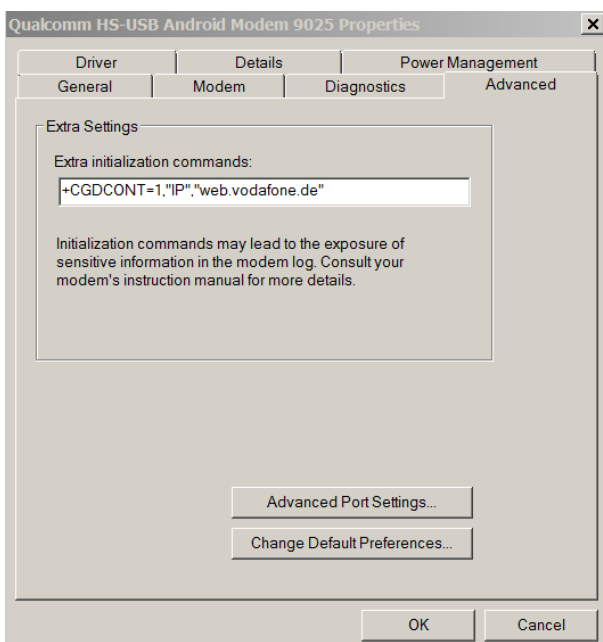


Figure 13 Enter the APN delivered by your MNO in Modem Property dialog



Select in “Network and Sharing Center” of “Control Panel” the option “Set Up a Connection or Network” and enter here the “Connect to the Internet” option. Follow the instructions to setup a new dial-up connection.

Once the connection is setup, the Dial-up Connection is available under Network Connections. Using the Windows context menu, the connection maybe activated or deactivated.

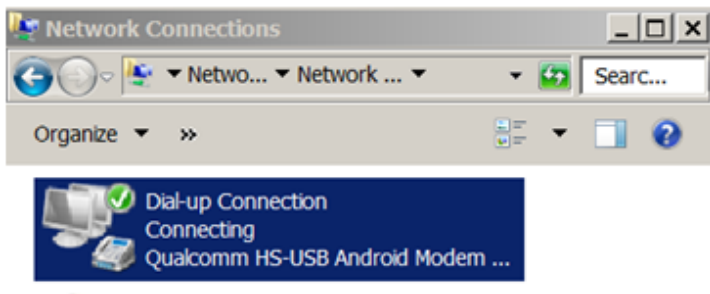


Figure 14 Dial-up Connection is available under Network Connections.

Note: Prior to use this connection, a valid APN for your Mobile Network Operator must be entered, see explanation above.

LTE-NAD AT command set is provided in chapter [5 AT Command interface](#)

#### 4.3.4 RmNet NDIS connection as Network Interface Card



Figure 15 The USB driver provides a NIC (Network Interface Card).

Currently according to Qualcomm proprietary information on x86, x64/AMD64, and ARM (Win8 only, for WoA/WoS) architectures following NDIS versions are supported (Source: Qualcomm Solution 00007808):

- NDIS 5.1: Windows XP, Server 2003, CE
- NDIS 5.2: Windows Server 2003 SP2
- NDIS 6.0: Windows Vista
- NDIS 6.1: Windows Vista SP1, Server 2008
- NDIS 6.20: Windows 7, Server 2008 R2

Note: If NIC connection is not available please check with your Service Engineer if NV# 3534 is properly set.

Note: Especially for LTE the NIC interface provides much more data throughput as the PPP Dial-up Modem connection.

#### 4.3.5 Diagnostics interface

The Diagnostics Interface can be used with special Qualcomm Tools that are matter of dedicated license agreement with Qualcomm. Therefore, there is no additional information provided in this document.

Note: Diagnostics Port is used for Firmware Updates as explained in chapter [Firmware Update](#)

#### 4.3.6 NMEA GNSS interface

The virtual NMEA COM port provides NMEA information, delivered by build-in GNSS receiver of LTE-NAD Module.

LTE-NAD provides GPS and GLONASS location information. Please contact peiker for GALILEO support.

## 5 AT Command Set

The modules supports standard AT command as listed below. Commands are compliant to 3GPP TS 27.007 and TS 27.005

| Command | Description  | Comment  |
|---------|--|--|
| AT+CMGF | Message Format   |  |
| AT+CSCA | Service Centre Address                                 |  |
| AT+CMGS | Send Message   |  |
| AT+CGMI | Manufacturer Identification                            |  |
| AT+CGMM | Request model identification                           |  |
| AT+CGMR | Request revision identification                        |  |
| AT+CGSN | Request product serial number                          |  |
| AT+CIMI | Request international mobile subscriber identification |  |
| AT+CMOD | Call mode  | Only one Parameter is supported by the device. |
| AT+CHUP | Hang up call   |  |
| ATD     | Initiate a CS or PS call or supplementary service      |  |
| ATA     | Answer incoming CS call command                        |  |
| ATH     | Hangup CS call command                                 |  |
| AT+CBST | Select bearer service type                             |  |
| AT+CEER | Extended error report                                  |  |
| AT+CVHU | Voice hangup control                                   |  |
| AT+CREG | Network registration                                   |  |
| AT+COPS | PLMN selection   |  |
| AT+CLCK | Facility lock  |  |
| AT+CPWD | Change password  |  |
| AT+CLIP | Calling line identification presentation               |  |
| AT+CLIR | Calling line identification restriction                |  |

| Command    | Description  | Comment  |
|------------|--|--|
| AT+CCWA    | Call waiting   |  |
| AT+CHLD    | Call related supplementary services                        |  |
| AT+CUUSD   | Unstructured supplementary service data                    |  |
| AT+CLCC    | List current calls   |  |
| AT+CPOL    | Preferred PLMN list  |  |
| AT+CPAS    | Phone active status  |  |
| AT+CFUN    | Set phone functionality                                    |  |
| AT+CPIN    | Enter PIN  |  |
| AT+CSQ     | Signal quality   |  |
| AT+CMER    | Mobile termination event reporting                         |  |
| AT+CSIM    | Generic SIM access   |  |
| AT+CRSM    | Restricted SIM access                                      |  |
| AT+CMEE    | Report mobile termination error                            |  |
| AT+CGDCONT | Define PDP context   |  |
| AT+CGEQREQ | Request 3G quality of service profile                      |  |
| AT+CGATT   | PS attach or detach  |  |
| AT+CGACT   | PDP context activate or deactivate                         |  |
| AT+CGPADDR | Show PDP address   |  |
| AT+CGSMS   | Select service for MO SMS messages                         |  |
| ATE        | Character Echo ON/OFF                                      |  |
|            |  |  |
| AT+CSMS    | Check Message Service support                              |  |
| AT+CSMP    | Set Text Mode Parameters                                   |  |
| AT+CSDH    | Show Text Mode Parameters                                  |  |
| AT+CSCB    | Select Cell Broadcast Message Types                        |  |
| AT+CSAS    | Save Settings  | Only one Parameter is supported by the device. |
| AT+CRES    | Restore Settings   | Only one Parameter is supported by the device. |
| AT+CMGL    | List messages  |  |
| AT+CNMA    | New message acknowledgement                                |  |
| AT+CMGC    | Send Command   |  |
| AT+CMMS    | More Messages to Send                                      |  |
| AT+ATV     | DCE response format  |  |
| AT+ATX     | Result code selection and call progress monitoring control |  |
| AT+CNMI    | New Message Indications to TE                              |  |
| AT+CPMS    | Preferred Message Storage                                  |  |
| AT+CMGW    | Write Message to Memory                                    |  |
| AT+CMSS    | Send Message from Storage                                  |  |
| AT+CMGD    | Delete Messages  |  |
| AT+CNUM    | Get MSISDN   |  |
| AT+CPBS    | Select phonebook memory storage                            |  |
| AT+CPBR    | Read phonebook entries                                     |  |
| AT+CPBW    | Writephonebook entry                                       |  |

## **6 Safety Recommendations according to EN60950-1**

This device must be supplied by a limited power source according to EN 60950-1.  
The clearance and creepage distances required by the end product must be withheld when the module is installed.  
The cooling of the end product shall not negatively be influenced by the installation of the module.

## 7 List of Acronyms

|       |   |
|-------|---|
| 3GPP  | 3 rd Generation Partnership Project             |
| ADC   | Analog Digital Converter                        |
| ADN   | Abbreviated Dialing Number                      |
| A-GPS | Assisted GPS                                    |
| AMR   | Adaptive Multi Rate                             |
| AT    | Attention Command                               |
| AWS   | Advanced Wireless Services                      |
| BER   | Bit Error Rate                                  |
| CLIP  | Calling Line Identification Presentation        |
| CLIR  | Calling Line Identification Restriction         |
| CSD   | Circuit Switch Data                             |
| DARP  | Downlink Advanced Receiver Performance          |
| DTMF  | Dual Tone Multi Frequency                       |
| FDN   | Fixed Dialing Number                            |
| FTP   | File Transfer Protocol                          |
| GSM   | Global System for Mobile communication          |
| GPIO  | General Purpose Input Output                    |
| GPRS  | General Packet Radio Service                    |
| GPS   | Global Positioning System                       |
| HSPA  | High Speed Uplink Packet Access                 |
| HW    | Hardware  |
| LED   | Led Emitting Diode                              |
| MO    | Mobile Originated                               |
| MT    | Mobile Terminated                               |
| OEM   | Original Equipment Manufacturer                 |
| PCB   | Printed Circuit Board                           |
| PCM   | Pulse Code Modulation                           |
| PDU   | Protocol Data Unit                              |
| PIN   | Personal Identification Number                  |
| RF    | Radio Frequency                                 |
| RoHs  | Restriction of Hazardous Substances             |
| UART  | Universal Asynchronous Receiver and Transmitter |
| USB   | Universal Serial Bus                            |
| USIM  | Universal Subscriber Identity Module            |
| UMTS  | Universal Mobile Telecommunications System      |
| WCDMA | Wideband Code Division Multiple Access          |
|       |   |
|       |   |
|       |   |

## 8 Regulatory Certifications

In the context of sections 8.1 and 8.1.1, the terms "equipment" and "device" refer equally to either V1140-100, V1140-101, V1140-103 or V1140-105.

In the context of section 8.2, the terms "apparatus", "device" and "appareil" refer equally to either V1140-101, V1140-103 or V1140-105.

### 8.1 USA (FCC)

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- (1) The device may not cause harmful interference, and
- (2) The device must accept any interference received, including interference that may cause undesired operation.

#### 8.1.1 FCC Warnings and Notices

**WARNING:** The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by peiker acoustic GmbH & Co. KG could void the user's authority to operate this equipment.

**NOTICE:** This equipment 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 generates, uses, and 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:

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

## 8.2 Canada (IC)

- This Class b digital apparatus comply with Canadian ICES-003.
  - *Cet appareil numérique de la classe b est conforme à la norme NMB-003 du Canada.*
- 
- This device complies to Industry Canada license-exempt RSS standard(s). 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.
  - *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'en compromettre le fonctionnement.*

## 8.3 OEM Responsibilities

### Antenna

- The antenna gain, including cable loss and based on the capabilities of the module's transmitter mounted on the PCBs specified in the related FCC filings, must not exceed 1,47dBd at 700 MHz & 850 MHz, 6dBi at 1700 MHz , 3.01dBi at 1900 MHz and 9,21 dBi at 2600 MHz for satisfying FCC RF exposure compliance.
- The antenna gain, including cable loss and based on the capabilities of the module's transmitter in a stand-alone configuration, must not exceed 0,77dBd at 700 MHz & 850 MHz, 5dBi at 1700 MHz, 2.01dBi at 1900 MHz and 8,01 dBi at 2600 MHz for satisfying FCC RF exposure compliance.
- The systems antenna(s) must be installed such that 20 cm is maintained between the antenna(s) and the body of the user or nearby persons.
- This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. The preceding statement must be included as a Caution statement in OEM product manuals in order to alert users of FCC RF Exposure compliance.

## Power Regulation

- The host equipment must provide power regulation circuitry to ensure that the module is supplied with stable 3.8VDC.

## FCC Labeling

- The V1140-100 module is labeled with its own FCC ID Number. If the FCC ID is not visible when the V1140-100 module is installed inside another device, then the host device must contain the FCC ID number with the statement such as the following: "Contains Transmitter Module FCC ID: QWY-V1140-100" or "Contains FCC ID: QWY-V1140-100"
- The V1140-101 module is labeled with its own FCC ID Number. If the FCC ID is not visible when the V1140-101 module is installed inside another device, then the host device must contain the FCC ID number with the statement such as the following: "Contains Transmitter Module FCC ID: QWY-V1140-101" or "Contains FCC ID: QWY-V1140-101"
- The V1140-103 module is labeled with its own FCC ID Number. If the FCC ID is not visible when the V1140-103 module is installed inside another device, then the host device must contain the FCC ID number with the statement such as the following: "Contains Transmitter Module FCC ID: QWY-V1140-103" or "Contains FCC ID: QWY-V1140-103"
- The V1140-105 module is labeled with its own FCC ID Number. If the FCC ID is not visible when the V1140-105 module is installed inside another device, then the host device must contain the FCC ID number with the statement such as the following: "Contains Transmitter Module FCC ID: QWY-V1140-105" or "Contains FCC ID: QWY-V1140-105"

## IC Labeling

- The V1140-101 module is labeled with its own IC ID Number. If the IC ID is not visible when the V1140-101 module is installed inside another device, then the host device must contain the IC ID number with the statement such as the following: "Contains Transmitter Module IC: 6588A-V1140101" or "Contains IC: 6588A-V1140101".
- The V1140-103 module is labeled with its own IC ID Number. If the IC ID is not visible when the V1140-103 module is installed inside another device, then the host device must contain the IC ID number with the statement such as the following: "Contains Transmitter Module IC: 6588A-V1140103" or "Contains IC: 6588A-V1140103".
- The V1140-105 module is labeled with its own IC ID Number. If the IC ID is not visible when the V1140-105 module is installed inside another device, then the host device must contain the IC ID number with the statement such as the



following: "Contains Transmitter Module IC: 6588A-V1140105" or "Contains IC: 6588A-V1140105".