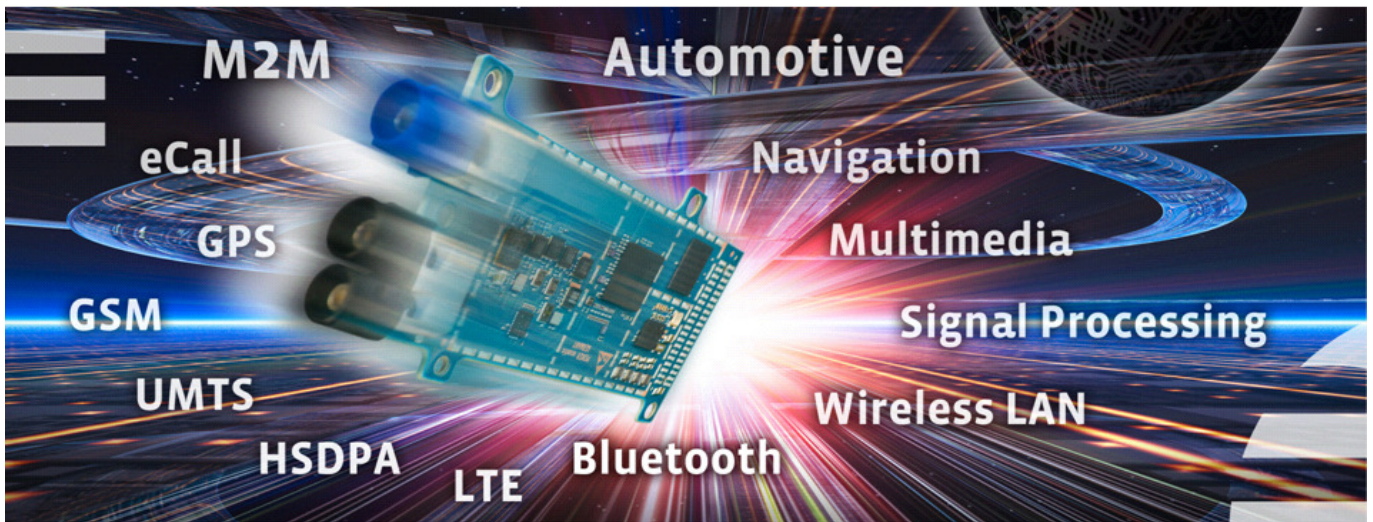


User manual NAD-MDM6200



Peiker product #: 2189-082-112-00 (V1082-x13) HW0811

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Status: Approved

History:

Date	Revision	Name	Comment
05.02.11	Rev 0.0	ChZi	Initial document
08-08-2011	Rev 0.1	Gleich / Herold	Document Review
17-08-2011	Rev 0.2	Hofmann	Document Review
18-08-2011	Rev 0.3	Herold / Hofmann	Document Review; Warning Statement included
06-10-2011	Rev. 0.4	Herold	IC Canada Conformance statement Review

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1 Introduction

1.1 Scope

This document give an overview electrical and functional detail fort he peiker NAD.

1.2 Audience

Informations for integrate the module in other applications.

1.3 Contact information, Support

Peiker
Max-Planck Street 32
D-61381 Friedrichsdorf
<http://www.peiker.de>
info@peiker.de

1.4 Related Documents

None.

2 Overview

2.1 Product Variants

The NAD-MDM6200 ist available in 3 variants:

Peiker product #	WCDMA FDD bands
2189-082-112-00 (V1082-112) HW0811	BC1, BC8 (EU configuration)
2189-082-114-00 (V1082-114) HW0811	BC1 (China configuration)
2189-082-115-00 (V1082-x13) HW0811	BC2, BC5 (US2 configuration)

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

2.3 Features

- GSM/GPRS/EDGE Quad band (850, 900, 1800,1900)
- HSUPA up to 5.76 Mbps
- HSDPA up to 14.4 Mbps
- WCDMA up to 384kbps uplink/downlink
- DTM
- eCall inband nodem

Power Classes

- Class 4 (33dBm, 2W) Lo bands 850, 900 GSMK
- Class 1 (30dBm, 1W) Hi bands 1800, 1900 GSMK
- Class E2 Lo bands 850, 900 8PSK (EDGE)
- Class E2 Hi bands 1800, 1900 8PSK (EDGE)
- PS GPRS/EDGE Multi slot class 12 (4Dn/4Up/5Sum max.)
- CS Multi slot class 1 (1Dn/1Up)
- DTM Multi slot class 11 (4Dn/3Up/5Sum max.)

2.4 Approvals

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

3 Overview

3.1 Dimension, Mechanical Drawings

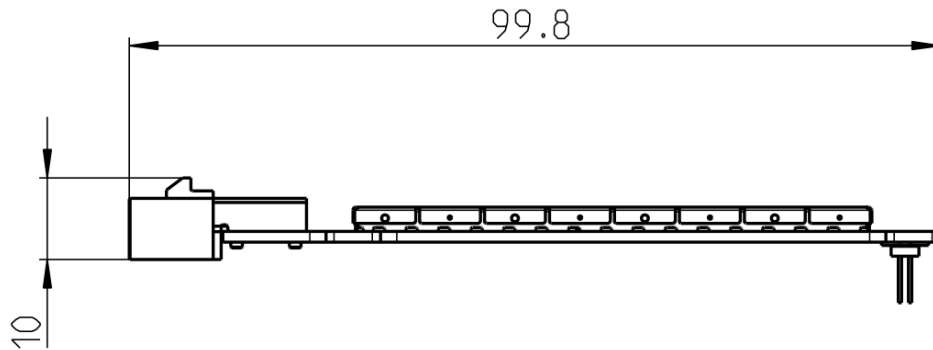


Figure 1 V1082-x13 Mechanical Dimensions.

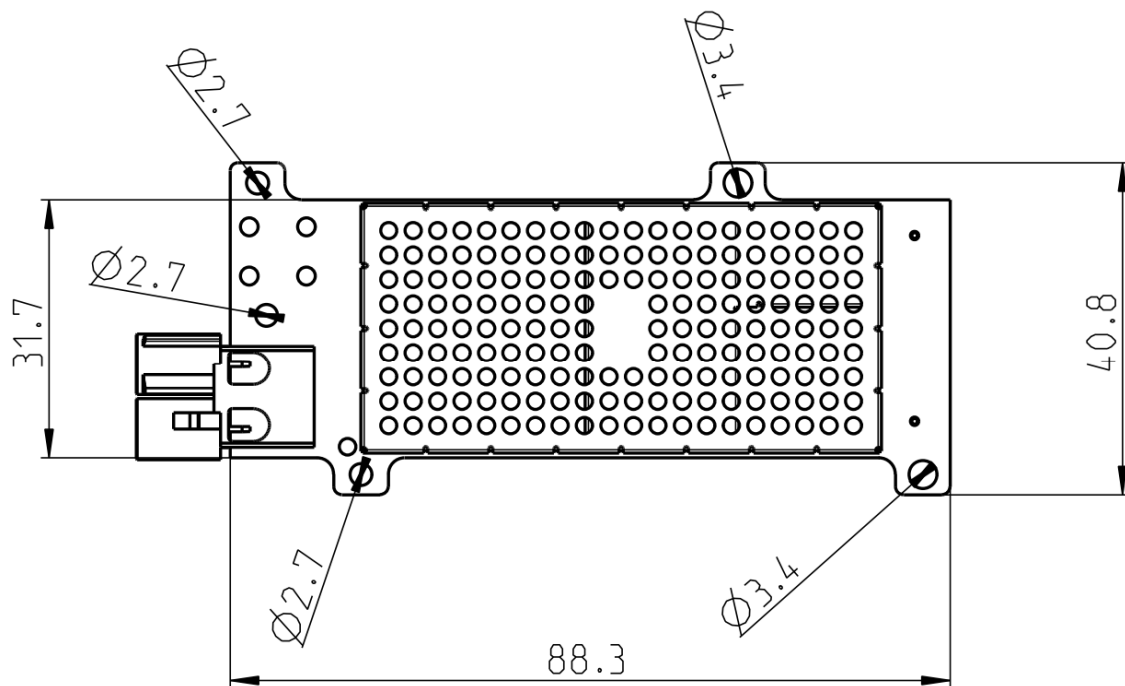


Figure 2 V1082-x13 Mechanical Dimensions (Top View).

3.2 Block Diagram

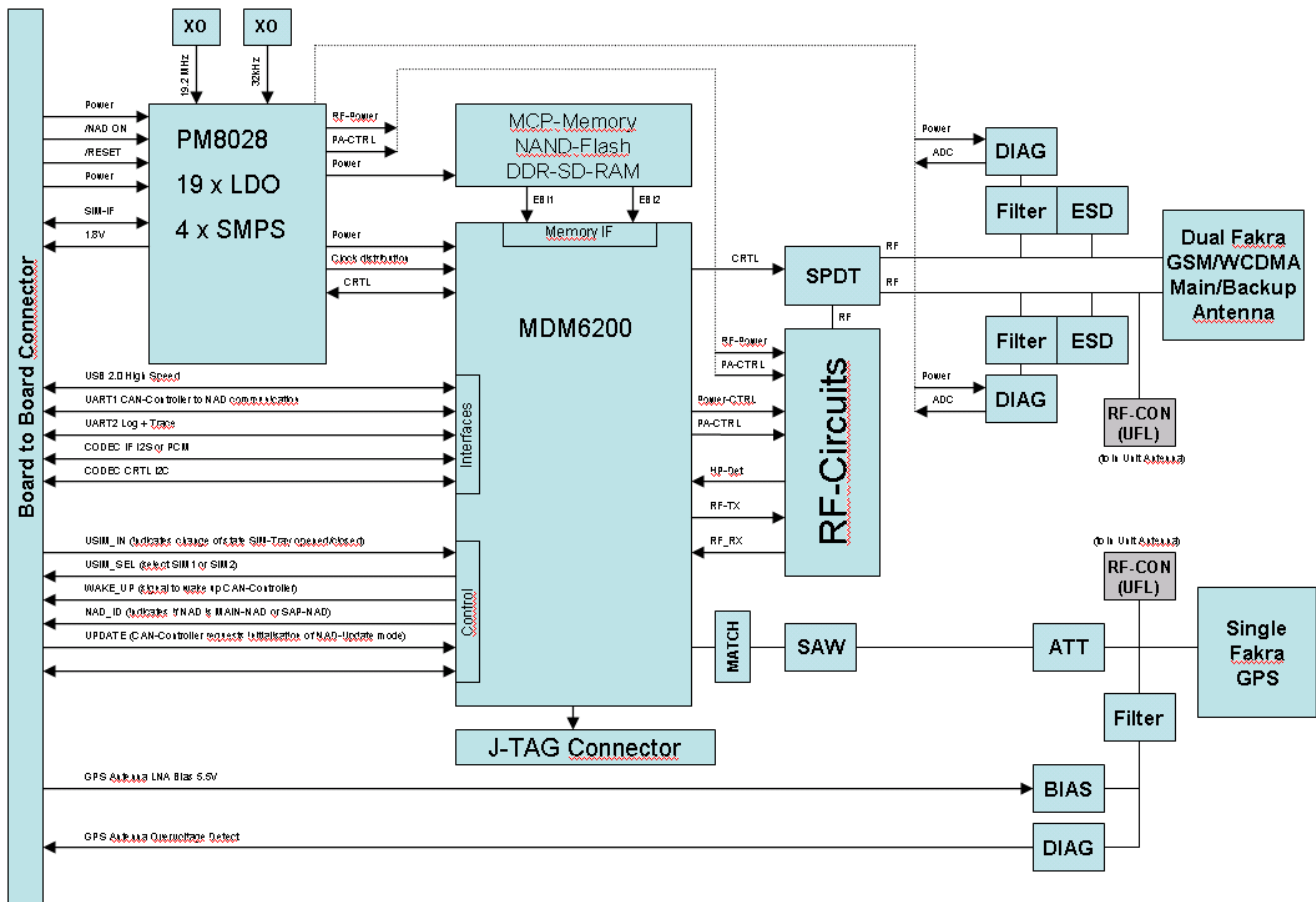


Figure 3 V1082-x13 Block Diagram.

3.3 HW Features

- Qualcomm chipset MDM6200 (RF + Base band) + PM8028 (Power management)
- ARM11 Core up to 480 MHz
- 2 DSP for modem and application DSP
- MCP Memory (1Gb NAND Flash x16, 512Mb Mobile DDR SDRAM x16)
- 19.2MHz clock reference
- SPDT switch for main and backup antenna operation
- Onboard antenna diagnostic
- Heavy duty baseband and antenna connector
- Dedicated heat sink area under power amplifier section
- Prepared for GPS/Glonass operation, GPS antenna biasing and diagnostics

3.4 Connectors

3.4.1 Base Band Connector

The NAD has a 40pin (2x20) connector with 1.27mm pitch. The connector is designed to stitch through the main board PCB. To allow variable mounting scenarios the 40pin connect can be populated on the top or the bottom side of NAD PCB. Default location is the PCB bottom side.

3.4.1 Antenna Connectors

To support the usage of a main and backup antenna, the NAD has an automotive dual FAKRA RF-Connector (SMB male) populated.

The NAD board is prepared for the population of another single FAKRA RF- RF- Connector (SMB male) to connect a GPS/GLONASS active antenne for simultaneous GPS/GLONASS operation

3.5 Interfaces (40pin Connector)

3.5.1 USB

The NAD has one USB2.0 OTG high speed (480MBit) compliant interface including the phy.
The IF consists of 4 signals:

USB_DP
USB_DM
USB_VBUS
USB_GND

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 NAD PCB.

3.5.2 SIM Interface

The NADs SIM interface is compatible to 1.8V and 3V SIM Cards, the nessecary voltage and level shifting is handle by 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 MBit, so HW designers should take care of the length and routing of the SIM IF to prevent potential EMC problems.

3.5.3 KPD_POWER

The signal is used switch on the NAD-Module.

KPD_POWER is pulled against VPH_Power on the NAD internally.

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

3.5.4 Reset

The signal is used to reset the NAD the NAD-Module.

RES_IN is pulled against VPH_Power on the NAD internally.

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

3.5.5 Reference Voltage Output (VREG_MSME 1.8V)

VREG_MSME is the reference voltage corresponding to the GPIOs/GSBI interfaces of NAD.

VREG_MSME can be used to source interface circuits like level shifters which are connected to the GPIOs/GSBIs of the NAD. The current on VREG_MSME shall not exceed 30mA.

When using VREG_MSME it is recommended to decouple the signal with a combination of 1uF and 22pF directly at the baseband connector.

3.5.6 GPIOs

21 GPIOs are available on NAD baseband connector. The reference voltage is of the GPIOs is 1.8V. The GPIOs can be used with flexible input and out configurations, such input with pull up or pull down, various pull up/down drive strength can be programmed interrupt functionality is possible. Also output push/pull or output with pull/down can be configured. For details please refer to latest chipset device specification document 80_VR001-1.

Some the GPIOs are part of the 5 available GSBIs (General Serial Bus Interface).

GPIOs and GSBIs share the same output pins and may not available when used in an GSBI configuration, see chapter GSBIs.

GPIOs not belonging to a GSBI bundle:

GPIO9,14,17,69,73

GPIOs belonging to a GSBI bundle:

GPIO30,31,32,33,34,35,36,37,38,39,40,41,42,43,46,47

3.5.7 GSBIs

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

Available signals on GSBI bundles:

GSBI0: GSBI0_2, GSBI0_3 (GPIO_30,31)
 GSBI1: GSBI1_0, GSBI1_1, GSBI1_2, GSBI1_3 (GPIO_32,33,34,35)
 GSBI2: GSBI2_0, GSBI2_1, GSBI2_2, GSBI2_3 (GPIO_36,37,38,39)
 GSBI3: GSBI3_0, GSBI3_1, GSBI3_2, GSBI3_3 (GPIO_40,41,42,43)
 GSBI4: GSBI4_2, GSBI4_3 (GPIO_46,47)

Generally the functions of a GSBI are:

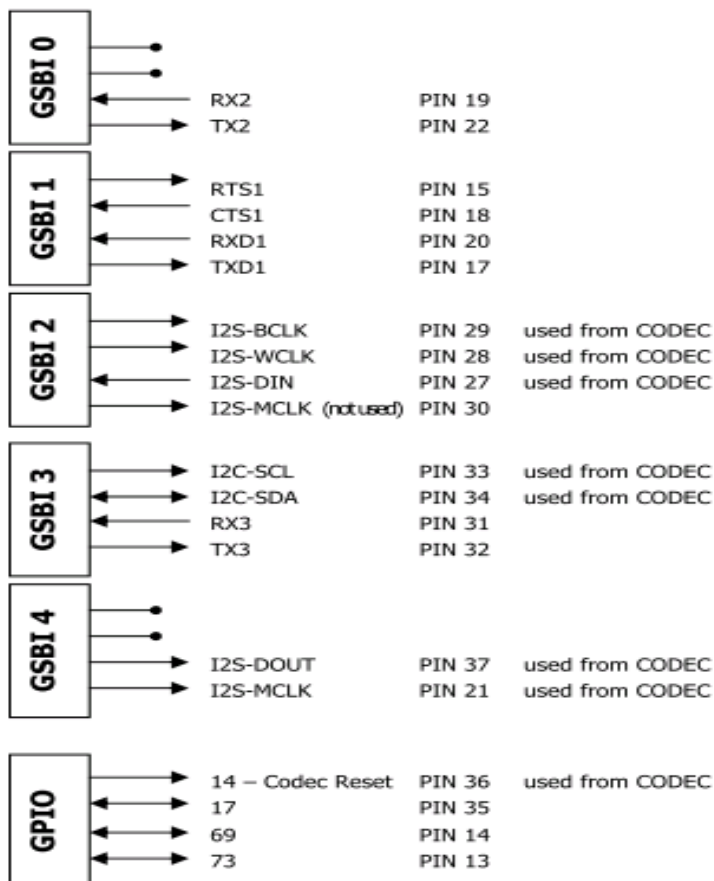
UART, UIM, I2C, I2S, SPI, PCM, RTS, CTS, GPIO

For details and possible combinations an GSBI please refer to latest chipset device specification document 80_VR001-1.

An example of a possible configuration with I2S audio codec, I2C audio codec control and and 2 UARTS is shown below.

For details also refer to V1102 schematics.

GSBI-Belegung NAD auf LP1190-X (MDM6200)



3.5.8 Baseband Connector Pinning

Pin	Signal	Direction related to NAD	Parameter	Comment
2	GND	Input Power		Power GND
1	VPH_PWR	Input Power	3.8V / 2A peak	Main power
4	GND	Input Power		Power GND
3	VPH_PWR	Input Power	3.8V / 2A peak	Main power
6	GND	Input Power		Power GND
5	VPH_PWR	Input Power	3.8V / 2A peak	Main power
8	VREG_MSME	Output Power	1,8V / 30mA	Output power to TCB mainboard for sourcing levelshifters
7	KPD_POWER	IN / active low	pull down with o.C.	NAD switch on input
10	USIM_CLK	OUT	2.85V / 1.8V	SIM-Card clock
9	USIM_RST	OUT	2.85V / 1.8V	SIM-Card reset
12	USIM_DATA	I/O	2.85V / 1.8V	SIM-Card data, requires a pull up to VREG_USIM @ destination platform
11	VREG_USIM	Output Power	2.85V / 1.8V / 150mA	Output power to SIM-Card
14	GPIO_69	I/O	1.8V	GPIO
13	GPIO_73	I/O	1.8V	GPIO
16	RES_IN	IN	pull down with o.C	force a reset condition to NAD
15	GPIO_32_GSBI1_0	I/O	1.8V	GPIO or GSBI
18	GPIO_33_GSBI1_1	I/O	1.8V	GPIO or GSBI
17	GPIO_35_GSBI1_3	I/O	1.8V	GPIO or GSBI
20	GPIO_34_GSBI1_2	I/O	1.8V	GPIO or GSBI
19	GPIO_30_GSBI0_2	I/O	1.8V	GPIO or GSBI
22	GPIO31_GSBI_0_3	I/O	1.8V	GPIO or GSBI
21	GPIO_47_	OUT	1.8V	GPIO or GSBI
24	USB_VBUS	Input Power	5V / 5mA	High-Speed USB Device for communication
23	USB_DP	IN/OUT	USB-Level 3.3V	High-Speed USB Device for communication
26	GND_USB	Power		High-Speed USB Device for communication
25	USB_DM	IN/OUT	USB-Level 3.3V	High-Speed USB Device for communication
28	GPIO_37_GSBI_2_1	I/O	1.8V	GPIO or GSBI
27	GPIO_38_GSBI_2_2	I/O	1.8V	GPIO or GSBI
30	GPIO_39_GSBI_2_3	I/O	1.8V	GPIO or GSBI
29	GPIO_36_GSBI_2_0	I/O	1.8V	GPIO or GSBI
32	GPIO_43_GSBI_3_3	I/O	1.8V	GPIO or GSBI
31	GPIO_42_GSBI_3_2	I/O	1.8V	GPIO or GSBI
34	GPIO_41_GSBI_3_1	I/O	1.8V	GPIO or GSBI
33	GPIO_40_GSBI_3_0	I/O	1.8V	GPIO or GSBI
36	GPIO_14	I/O	1.8V	GPIO
35	GPIO_17	I/O	1.8V	GPIO
38	GPIO_9	I/O	1.8V	GPIO
37	GPIO_46_GSBI_4_2	I/O	1.8V	GPIO or GSBI
40	EXT_5V5	Input Power	5,5V / 100mA	Power for inside GPS-Antenna LNA
39	GPS_ANT_OVERVOLT	OUT / active low	Open Collector	Detection of GPS-Antenna short against vehicle battery (8-18V)

3.5.7 GPS related Pins

Pin 39 GPS_ANT_OVERVOLTAGE and Pin 40 EXT_5V5 are reserved for future use of the internal GPS of the NAD.

The pins should be grounded when not used in the design.

3.5.7 Antenna Diagnostics

The NAD is capable to monitor the connection status of both antennas (MAIN and BACKUP)

To monitor the connection status, antennas with internal DC coupled 10k resistors to GND must be used.

The diagnose is performed by NAD SW using 2 ADCs.

The following connection states of the antenna can be monitored:

- Antenna short against GND
- Antenna short against Vbatt (+12V)
- Antenna connected
- Antenna not connected

3.5.7 Antenna Switching

The NAD is equipped with two antenna connectors. A main and a backup antenna can be connected to the antenna ports. To switchover between the antennas a SPDT RF-Switch is populated on NAD. The switch can be performed by SW toggling 2 internal GPIOs on NAD. At the moment the main antenna is switched on by default. The main antenna is mapped to the SMB connector close to the outer dimension of the NAD.

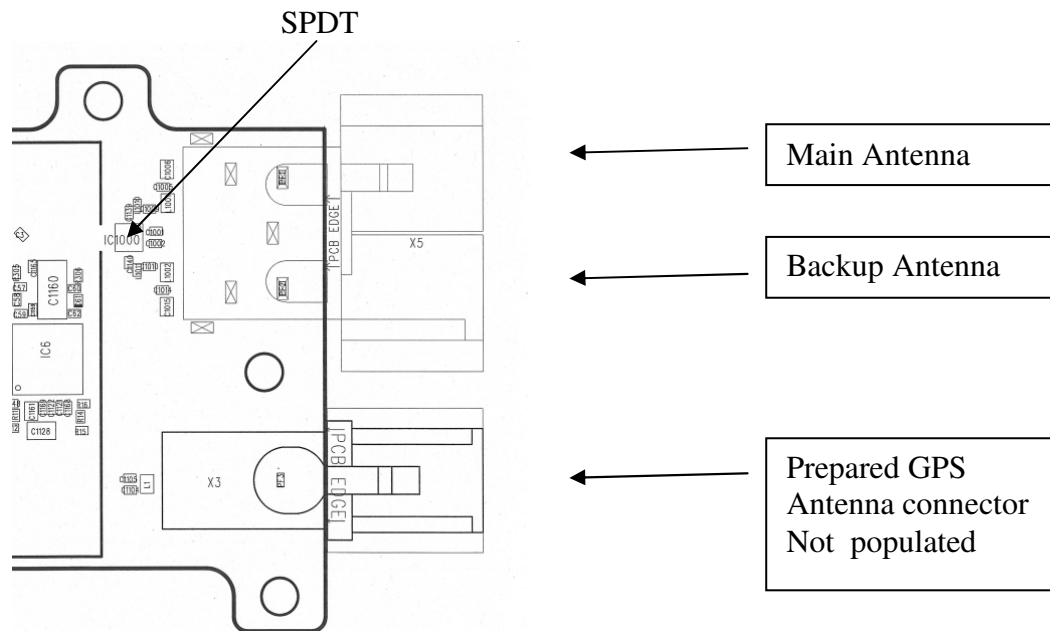


Figure 4 V1082-x13 Antenna Connectors.

3.6 Supply Voltage

The external supply voltage is applied to NAD by 6 Pins on the base band connector.

PINs 1,3,5 for VPH_PWR

PINs 2,4,5 for the corresponding GND

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

Absolute maximum supply voltage	3.4V ~ 4.2V
Nominal supply voltage	3.8V
Recommended supply voltage	3.7V ~ 3.9V
Voltage drop @ GSM power burst (33dBm)	<100mV

During Hi RF Power GSM bursts the power amplifier can draw peak currents > 2Amps at VPH_PWR. The voltage drop during the GSM burst shall not exceed 100mV (measured at C5 on the NAD module)

3.7 Power Consumption

T_A = +25°C, VPH_PWR = 3.8V

		Output Power max. (typ. 23dBm)	Output Power 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	

3.8 Transmitter

Tbd.

3.9 Receiver

Tbd.

3.10 Enviromental Specification

3.10.1 Temperature Range

Range		
Operating temp. range	-20°C ... +65°C	3GPP spec. conform
Operating temp. range	-25°C ... +85°C ^{Note 1}	Operational Performance might slightly 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

For the NAD V1082-x13 there is an evaluation board available.

Features :

- On board 12V DC power supply or 3,8V DC direct connected (i.e. unbuffered).
- USB port type B
- SIM card tray
- 40 pin header connected to the systemconnector of the NAD
- 3 GSPI Port connected to DB9 or pin header. Can be configured as UART od SDIO or SPDIF to connect audio codecs

Using the evaluation board with on board 3.8V regulator

- Connect 11 .. 14V DC to power connector 1) (use delivered cable)
- Power on the board with switch 2).

Using the evaluation board with an external power supply

- Remove Jumper 3)
- Switch 2) to off condition
- Connect external supply V+ 3.6 .. 4.0V DC to connector 4) (nominal 3.8V DC)
- Connector 4): Pin1: GND
Pin2: Sense GND
Pin3: Sense V+
Pin4: V+

Note: Make sure that the external power supply is not generating spikes or hazards higher than 4.2V. NAD Module gets damaged when spikes or hazards above 4.2V are applied

RF Connector

- For RF measurements use main antenna connector 5)

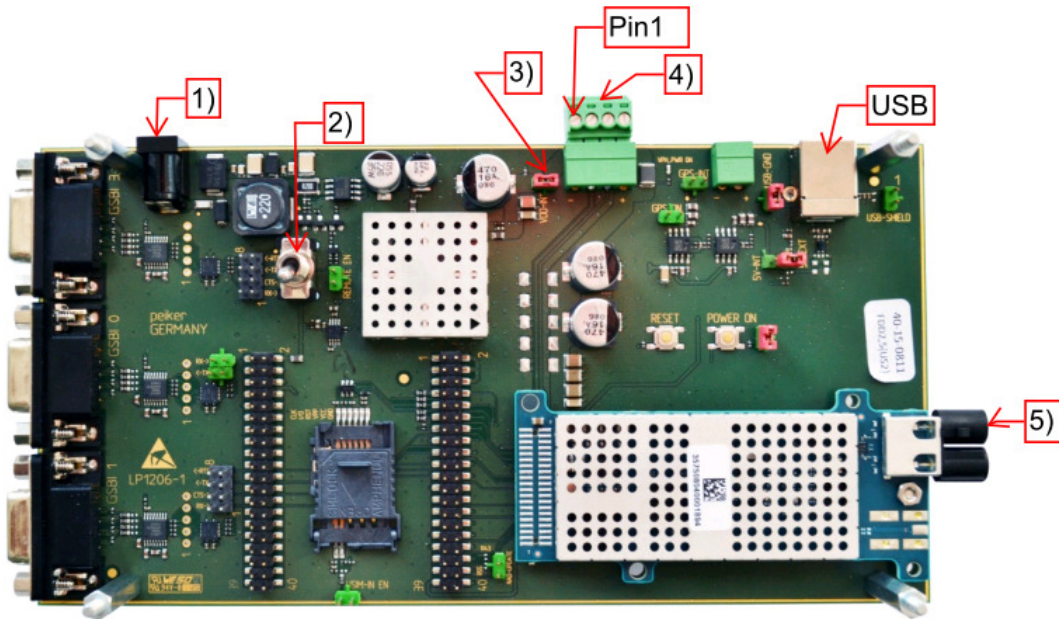


Figure 5 Evaluation Kit for V1082-x13.

5 AT Command interface

The modules supports standart AT command as listed below.

Commands are compliant to

3GPP TS 27.007 .

3GPP 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	
AT+CCWA	Call waiting	
AT+CHLD	Call related supplementary services	
AT+CUSD	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	

Command	Description	Comment
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

Tbd.

7 List of Acronyms

3GPP	3 rd Generation Partnership Project
ADC	Analog Digital Converter
ADN	Abbrieviated 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 Pachet 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 Warning Statements

FCC

NOTE: 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.

(c) The provisions of paragraphs (a) and (b) of this section do not apply to digital devices exempted from the technical standards under the provisions of § 15.103.

(d) For systems incorporating several digital devices, the statement shown in paragraph (a) or (b) of this section needs to be contained only in the instruction manual for the main control unit.

(e) In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

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

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

IC Canada

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

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

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.

Modifications

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 the equipment.