

ARM-Nano Development Guide

N1LD-N4LP, N4LD, N8LP, N8LD, N8LoRa



USER GUIDE V1.2



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1 Introduction

This document describes how to use the ARM-Nano Evaluation kit (ARM-Nano EV).

We strongly recommend for the user to read thoroughly the User Guide of the ARM-Nano prior to start working on the device.

The ARM-Nano is a family of modules sharing the same form factor and ideally suited for today's high performance ISM band RF applications.

The ARM-Nano Evaluation kit is divided into two parts, a mother card and a daughter card, allowing users to test all modules of the ARM-Nano family.

The ARM-Nano Evaluation kit is an excellent tool to help users to test every aspect of the radio. When the ARM-Nano Evaluation is supplied by battery, users can test the radio range between a Master and a Slave without using PC. It has been design to enable quick and easy testing of the PER performances.

2 Evaluation Kit Contents :

The ARM-Nano EV consists of:

- 2 x Mother cards
- 2 x Daughter cards
- 2 x ½ wavedipoleantennas
- 2 x Mini USB cables



ARM-Nano Development Guide

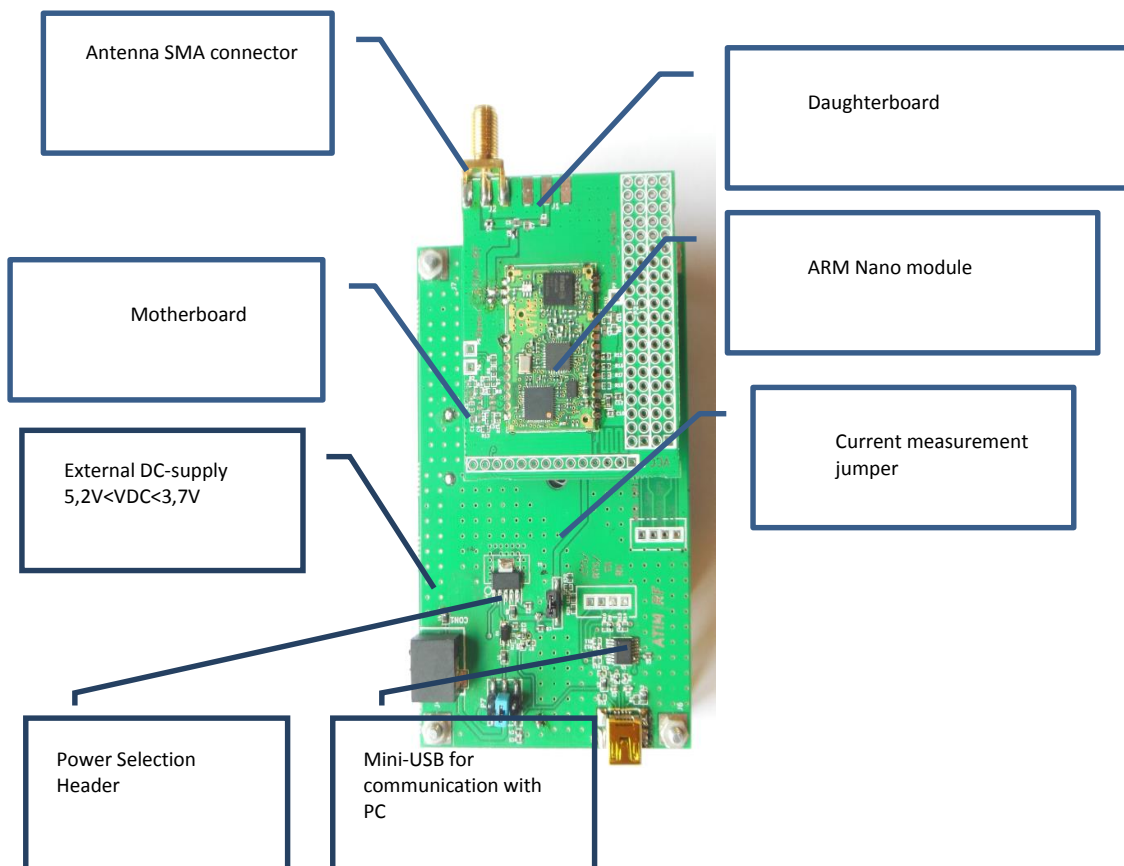


N1LD-N4LP, N4LD, N8LP, N8LD, N8LoRa

3 Ordering information

- N1LD-SDK1 N1LD Smart Development Kit (169MHz 27dBm)
- N4LP-SDK1 N4L9 Smart Development Kit (433MHz 10dBm)
- N4LD-SDK1 N4LD Smart Development Kit (407-470MHz 29dBm)
- N8LP-SDK1 N8LP Smart Development Kit (868MHz 14dBm)
- N8LD-SDK1 N8LD Smart Development Kit (868MHz 27dBm)
- N8LoRa-SDK1 N8LoRa Smart Development Kit (868MHz 20dBm)

4 Description



ARM-Nano Development Guide

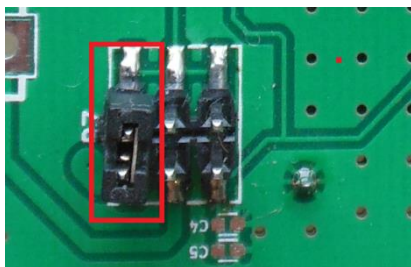


N1LD-N4LP, N4LD, N8LP, N8LD, N8LoRa

5 Power Sources

5.1 Battery Power

The ARM-Nano EV includes a battery holder for three 1.5V AA batteries on the reverse side of the PCB.

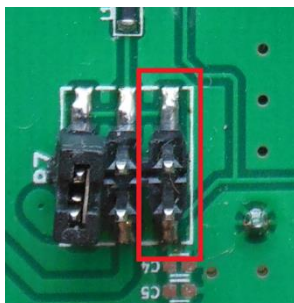


Normal AA batteries can be used and the onboard regulator supplies 3.3V to the board. The power source selection jumpers should short circuit pin 1-2 ("BATT").

The maximum current consumption is limited by the regulator to 1500 mA.

Jumper settings to power ARM-Nano EV via battery power.

5.2 USB Power



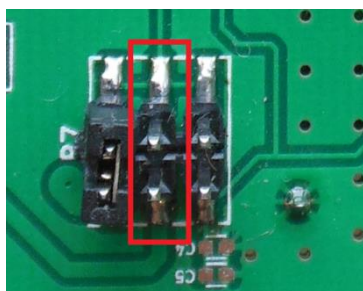
When the ARM-Nano EV is connected to a PC via a USB cable, it can draw power from the USB bus. The onboard voltage regulator supplies approximately 3.3V to the board. The power source selection jumpers should short circuit pin 3-4 ("USB") of header.

The maximum current consumption is limited by the regulator to 100 mA.

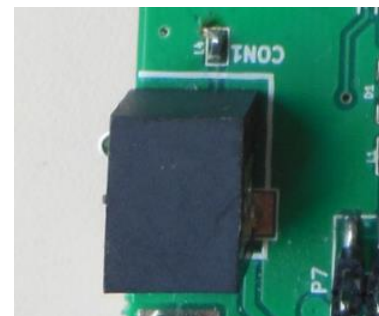
Jumper settings to power ARM-Nano EV via the USB cable.

5.3 External Power Supply

The ARM-Nano EV has a connector for powering the board using an external power supply (<5.2VDC)



The power source selection jumpers should short circuit pin 5-6 of header.



ARM-Nano Development Guide



N1LD-N4LP, N4LD, N8LP, N8LD, N8LoRa

5.4 ARM Nano LED



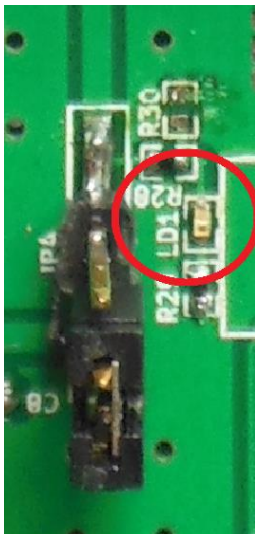
OFF Power is turned off

ON Power is turned on

BLINKING: communication mode.

When the LED blinks, that means that the transceiver has succeeded to send a message in Tx mode or has succeeded to receive a message.

5.5 SUPPLY LED:



OFF Power is turned off

ON Power is turned on



6 Communication mode

Any type of terminal can be used.

Nano Modules are RTU modules ready for transmission and reception operations at first power-up without any configuration. It starts in communication mode allowing to directly sends and receive data. The default UART configuration is set to 19200bps, 8 data bits, 1 stop bit and no parity. By default, the module listens permanently the RF interface and the UART port.

- When an incoming frame is from the RF interface, the data payload of the frame is transmitted on the UART port.
- When an incoming data is detected on the UART port, it is sent to the RF interface.

UART interface

There is no specific protocol to respect for data transmission and reception. Each byte sent on the UART port is reported on the RF interface and vice versa.

7 Radio interface

The data coming from the UART interface are accumulated in an internal fifo in the module and then encapsulated in an RF frame. The maximum amount of data that can be transferred into a single radio packet can reach 1024 Bytes.

The packet length is adapted automatically as a function of the length of the frame. The RF protocol creates some delays at each new packet. The RF protocols encapsulate the data payload with the following elements:

- Preamble
- Synchro words
- Header (Long or Short)
- Payload
- Postamble (CRC optional)

ARM-Nano Development Guide



N1LD-N4LP, N4LD, N8LP, N8LD, N8LoRa

8 Command Mode

The UART connection is, on 19200bps format basis , 8 bytes of data, no parity, 1 stop byte, without flow control.

The memorization of the parameters is immediate and applies after reset, ON / OFF, ATR, ATQ. For a hot configuration (without writing in EEPROM), it is necessary to use the ATH then ATI commands to make the reset with the new parameters.

Command	Fonction
+++	Start AT commands
ATQ + ENTER	Quit AT commands
ATR + ENTER	MCU reset
ATI + ENTER	MCU reset
ATS'XXX' + ENTER	Read EEPROM of the register SXXX. XXX decimal value
ATS'XXX'='YY' + ENTER	Write EEPROM of the register SXXX. XXX decimal value , YY hexadecimal value
ATH'XXX' + ENTER	Read RAM of the register HXXX. XXX decimal value
ATH'XXX'='YY' + ENTER	Write RAM of the register HXXX. XXX decimal value, YY hexadecimal value
ATF + ENTER	Reset to factory mode
ATV + ENTER	Modem version
ATL + ENTER	List of ATS registers

9 Test Mode

Test Mode detailed here allows the user to verify the performance of Nano modules based on desired radio parameters.

The AT CMD has been developed to facilitate tests. One can estimate that there are 3 main test modes. Users can invent other tests using AT CMD to adapt it to their needs.

TX / RX Mode: This test checks the level of the receiver of the frame sent. For the reception, it is advisable to use the ATT02 order. As to the issue, you can use either the command ATT00 (prerecorded frame), or any frame is transmitted in the communication mode.

Scan Mode: This mode allows check the level of any received signal using ATT02 order.

Ping-Pong Mode: This mode allows measuring the PER. When using a terminal, it is possible to know the signal level received by the SLAVE and MASTER.

It is also possible to use this mode to test the radio range of the system without using a PC. Simply register a module in MASTER and SLAVE another. LED communication of slave module blinks when the signal is received correctly. For this mode, it is strongly recommended to use batteries to power the card and get away from the PC. Because the latter may affect the sensitivity of the receiver by their spurious radiation.



ARM-Nano Development Guide

N1LD-N4LP, N4LD, N8LP, N8LD, N8LoRa

9.1 TX/RX mode

9.1.1 TX mode

There are 2 solutions to send messages:

1st Solution:

In the CMD MODE, use ATT00.

A message with a counter index will be sent every second. When the frame is sent, the communication diode blinks.

To exit the Test Mode, press the key “a”.

2nd solution:

In the communication mode, type any message. If using terminal such as “serial killer 2.0” one can send periodic frames.

When the frame is sent, the communication diode blinks.

9.1.2 Rx Mode

In the CMD MODE, use ATT02 to read the message and the RSSI.

To exit the Test Mode, press the key “a”.

Example of aRx Mode

```
Received/Sent data
ARM-N8 - WELCOME IN SETUP MODE -
ATS002=00
S002=00
ATS003=00
S003=00
ATR
ARM-N8 RESTART
ARM-N8 - WELCOME IN MODE -
ATT02
Modem is in continuous Rx
Hello The world !!! | Status RSSI:-32dBm
Hello The world !!! | Status RSSI:-33dBm
Hello The world !!! | Status RSSI:-33dBm
Hello The world !!! | Status RSSI:-32dBm
Hello The world !!! | Status RSSI:-33dBm
Hello The world !!! | Status RSSI:-33dBm
```

When the frame is corrected received, the communication diode blinks.



ARM-Nano Development Guide

N1LD-N4LP, N4LD, N8LP, N8LD, N8LoRa

9.1.3 SCAN Mode

The scan mode allows measuring the RSSI of any signal. It indicates whether the channel is busy or not.

```
Received/Sent data
Channel:0000 RSSI:-125dBm > Frame:NO
Channel:0000 RSSI:-125dBm > Frame:NO
Channel:0000 RSSI:-123dBm > Frame:NO
Channel:0000 RSSI:-123dBm > Frame:NO
Channel:0000 RSSI:-125dBm > Frame:NO
Channel:0000 RSSI:-123dBm > Frame:NO
Channel:0000 RSSI:-123dBm > Frame:NO
Channel:0000 RSSI:-120dBm > Frame:NO
Channel:0000 RSSI:-123dBm > Frame:NO
Channel:0000 RSSI:-122dBm > Frame:NO
Channel:0000 RSSI:-122dBm > Frame:NO
Channel:0000 RSSI:-123dBm > Frame:NO
Channel:0000 RSSI:-123dBm > Frame:NO
Channel:0000 RSSI:-30dBm > Frame:NO
Channel:0000 RSSI:-123dBm > Frame:NO
Channel:0000 RSSI:-122dBm > Frame:NO
Channel:0000 RSSI:-123dBm > Frame:NO
```

9.1.4 Ping-Pong Mode :

This mode allows to measure the PER (packet error rate).

The master module sends a message with a counter index, and waits for an answer from the slave module. The slave module receives the message and repeats the message. If the master module has an answer, the received message is compared to the sent message to know if there are errors. In the answer, there is other information such as: RSSI of the Master and the Slave modules, the power and the PER.

```
Received/Sent data
Pout: YES
> Fra: PER=error frame number / total frame number -38dBm/-32dBm PER:0000/02FE
BER:0

> Frame:02FF Local @:00 Remote @:FF Channel:01BC
Pout:14dBm Repeater:NO CRC:YES
> Frame:02FF YES 65ms RSSI:-39dBm/-32dBm PER:0000/02FF
BER:0000/07A8

> Frame:0300 Local @:00 Remote @:FF Channel:01BC
Pout:14dBm Repeater:NO CRC:YES
> Frame:0300 YES 65ms RSSI:-41dBm/-33dBm PER:0000/0300
BER:0000/0800

> Frame:0301 Local @:00 Remote @:FF Channel:01BC
Pout:14dBm Repeater:NO CRC:YES
> Frame:0301 YES 65ms RSSI:-37dBm/-33dBm PER:0000/0301
BER:0000/0858
```

ARM-Nano Development Guide



N1LD-N4LP, N4LD, N8LP, N8LD, N8LoRa

Example:

Module 1 is set up in Master module:

```
+++          Enter in CMD Mode
ATT00       The module is set up in Master mode.
```

To initialize the counter, you must press the space bar. And to stop the test, press the a button

Module 2 is set up in Slave module:

```
+++          Enter in CMD Mode
ATT01       The module is set up in Master mode.
```

It is also possible to test the radio range without a PC using this mode PING PONG. Simply declare each module as master or slave using default AT S000. The LED flashes to inform if communication message when the message is received. Boot up each module, it will automatically default configuration. You will find below a detailed PING PONG method for measuring the radio range to 869.525MHz example.

Module in Master mode

```
Received Sent | Enter in CMD MODE
ARM-N8 - WELCOME IN SETUP MODE -
ATS003=02
S003=02          Channel setup: 020A (869.525MHz)
ATS002=0A
S002=0A
ATS008=01
S008=01          Datate select:1,2kbps
ATS000=00
S000=00          Master mode by default
AIR
ARM-N8 RESTARTING
Entering in ping-pong mode
> Frame:0001 Local @:00 Remote @: :020A
Pout:27dBm Repeater:NO CRC:YES
> Frame:0001 YES 1221ms RSSI:-29dBm/-27dBm PER:0000/0001
BER:0000/0058
> Frame:0002 Local @:00 Remote @:FF Channel:020A
Pout:27dBm Repeater:NO CRC:YES
> Frame:0002 YES 1214ms RSSI:-29dBm/-27dBm PER:0000/0002
BER:0000/00B0
> Frame:0003 Local @:00 Remote @:FF Channel:020A
Pout:27dBm Repeater:NO CRC:YES
> Frame:0003 YES 1215ms RSSI:-30dBm/-27dBm PER:0000/0003
BER:0000/0108
> Frame:0004 Local @:00 Remote @:FF Channel:020A
Pout:27dBm Repeater:NO CRC:YES
> Frame:0004 lost PER:0001/0004 BER:0000/0108
Test mode stopped
```

Module in Slave mode

```
+++          Enter in CMD MODE
ARM-N8 - WELCOME IN SETUP MODE -
ATS003=02
S003=02          Channel setup: 020A (869.525MHz)
ATS002=0A
S002=0A
ATS008=01
S008=01          Datate select:1,2kbps
ATS000=01
S000=01          Slave mode by default
AIR
ARM-N8 RESTARTING
Entering in ping-pong mode
> Frame:0000 YES RSSI:-27dBm/0dBm
PER:0001/0000 BER:0000/0058
> Frame:0001 Local @:00 Remote @:FF
Channel:020A Pout:27dBm Repeater:NO CRC:YES
> Frame:0001 YES RSSI:-27dBm/-29dBm
PER:0002/0001 BER:0000/00B0
> Frame:0002 Local @:00 Remote @:FF
Channel:020A Pout:27dBm Repeater:NO CRC:YES
> Frame:0002 YES RSSI:-27dBm/-29dBm
PER:0003/0002 BER:0000/0108
> Frame:0003 Local @:00 Remote @:FF
Channel:020A Pout:27dBm Repeater:NO CRC:YES
> Frame:0003 YES RSSI:-28dBm/-30dBm
PER:0004/0003 BER:0000/0160
> Frame:0004 Local @:00 Remote @:FF
Channel:020A Pout:27dBm Repeater:NO CRC:YES
```

ARM-Nano Development Guide



N1LD-N4LP, N4LD, N8LP, N8LD, N8LoRa

