

NINA-B1 series

Throughput measurements

Application Note

Abstract

This application note provides throughput measurements for NINA-B1 series with u-blox connectivity software.



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This document applies to the following products:

Product name	Type number	u-blox connectivity software version	PCN reference
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	NINA-B111-03B-00	4.0.0	N/A
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1 Introduction

This Application Note provides Bluetooth® low energy throughput measurements for different device-to-device combinations for NINA-B1 series with u-blox connectivity software (from software version 3.0.0 onwards) in different configurations of LE data packet length extension (DLE), Long ATT MTU size (MTU) and from software version 4.0.0 physical layer (PHY). The measurements are done with the u-blox Low Energy Serial Port Service.

For more information regarding u-blox Serial Port Service (SPS) data transfer, see *u-blox Low Energy Serial Port Service Protocol Specification [2]*. For further information regarding the AT commands toolbox, see *Bluetooth serial port adapter toolbox – Getting started [3]*.

Measurements have been performed with selected combinations of devices listed below:

- NINA-B1 series
- ODIN-W2 series
- OBS421 series
- Android device
- iOS device

2 Test setup

- Use *s-center evaluation software [4]* and *AT command toolbox data pump tool [3]* for configuration and testing.
- Configure two Bluetooth LE devices (Device A and Device B) to connect to each other using the configuration settings described in each row of the throughput results tables. The baud rate is set to the highest supported (AT+UMRS=1000000,1,8,1,1,1 for NINA-B1). The LL PDU payload size (Data Length Extension feature) is changed with the MTU size and is set to be 4 bytes larger than the MTU size. Configure NINA-B1 LL PDU setting by AT+UBTLECFG=26,x where x should be set to 1 for NINA-B1 to accept and negotiate an MTU size of 247 bytes and x should be set to 2 for NINA-B1 to only accept an MTU size of 23 bytes.
- Configure the minimum and maximum connection interval for NINA-B1 using AT+UBTLECFG=4,x and AT+UBTLECFG=5,x respectively, where x is the connection interval in 1.25 ms units.
- The physical layer (PHY) can be configured to 2 Mbps in NINA-B1 v4.0.0. The following AT command settings should be used to accept and request a PHY of 2 Mbps: AT+UBTLECFG=27,2, AT+UBTLECFG=28,2 and AT+UBTLEPHYR=[conn_handle],2,2 where conn_handle is the connection handle that identifies the connection.
- Simplex: Send continuous data from Device A to Device B during 60 seconds and calculate the mean throughput during this period.
- Duplex: Send continuous data from Device A to Device B and from Device B to Device A during 60 seconds and calculate the mean throughput of the data from Device A to Device B during this period.
- If nothing else is stated, the measurements are done with SPS flow control enabled.

3 Throughput results for NINA-B1 Software v3.0.1

3.1 Software versions

ODIN-W2 v4.0.0

OBS421 v5.3.2

Android v7.0 with u-blox BLE app

iOS v10.3.2 with u-blox BLE app

3.2 NINA-B1 (Central) - NINA-B1 (Peripheral)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
NINA-B1 (central)	NINA-B1(peripheral)	6,6	23	Simplex	190 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	6,6	23	Simplex	190 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	6,6	23	Duplex	131 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	6,6	23	Duplex	131 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	24,40	247	Simplex	729 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	24,40	247	Simplex	729 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	24,40	247	Duplex	400 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	24,40	247	Duplex	400 kbit/s

3.3 ODIN-W2 (Central) – NINA-B1 (Peripheral)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
ODIN-W2 (central)	NINA-B1 (peripheral)	6,6	23	Simplex	82 kbit/s
NINA-B1 (peripheral)	ODIN-W2 (central)	6,6	23	Simplex	31 kbit/s
ODIN-W2 (central)	NINA-B1 (peripheral)	6,6	23	Duplex	74 kbit/s
NINA-B1 (peripheral)	ODIN-W2 (central)	6,6	23	Duplex	16 kbit/s

3.4 ODIN-W2 (Peripheral) – NINA-B1 (Central)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
NINA-B1 (central)	ODIN-W2 (peripheral)	6,6	23	Simplex	22 kbit/s
ODIN-W2 (peripheral)	NINA-B1(central)	6,6	23	Simplex	41 kbit/s
NINA-B1 (central)	ODIN-W2 (peripheral)	6,6	23	Duplex	9 kbit/s
ODIN-W2 (peripheral)	NINA-B1(central)	6,6	23	Duplex	36 kbit/s

3.5 OBS421 (Central) – NINA-B1 (Peripheral)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
OBS421 (central)	NINA-B1 (peripheral)	6,40	23	Simplex	85 kbit/s
NINA-B1 (peripheral)	OBS421 (central)	6,40	23	Simplex	55 kbit/s
OBS421 (central)	NINA-B1 (peripheral)	6,40	23	Duplex	72 kbit/s
NINA-B1 (peripheral)	OBS421 (central)	6,40	23	Duplex	36 kbit/s

3.6 Android device (Central) – NINA-B1 (Peripheral)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
Galaxy S8 (central)	NINA-B1 (peripheral)	12,12	23	Simplex	40 kbit/s
NINA-B1 (peripheral)	Galaxy S8 (central)	12,12	23	Simplex	76 kbit/s
Galaxy S8 (central)	NINA-B1 (peripheral)	12,12	23	Duplex	38 kbit/s
Galaxy S8 (central)	NINA-B1 (peripheral)	39,39	247	Simplex	470 kbit/s
NINA-B1 (peripheral)	Galaxy S8 (central)	39,39	247	Simplex	685 kbit/s
NINA-B1 (peripheral)	Galaxy S8 (central)	39,39	247	Duplex	319 kbit/s

3.7 iOS Device (Central) – NINA-B1 (Peripheral)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
iPhone 7 (central)	NINA-B1 (peripheral)	24,24	247	Simplex	194 kbit/s
NINA-B1 (peripheral)	iPhone 7 (central)	24,24	247	Simplex	182 kbit/s
iPhone 7 (central)	NINA-B1 (peripheral)	24,24	247	Duplex	68 kbit/s
NINA-B1 (peripheral)	iPhone 7 (central)	24,24	247	Duplex	74 kbit/s



Preliminary tests of iPhone 7 with iOS 11 beta 2 shows a throughput of ~350 kbps.

4 Throughput results for NINA-B1 Software v4.0.0

4.1 Software versions

ODIN-W2 v4.0.0

OBS421 v5.3.2

Android v7.0 with u-blox BLE app

iOS v11.0 with u-blox BLE app

4.2 NINA-B1 (Central) - NINA-B1 (Peripheral)

Device A	Device B	PHY	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
NINA-B1 (central)	NINA-B1(peripheral)	1 Mbps	6,6	23	Simplex	191 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	1 Mbps	6,6	23	Simplex	191 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	1 Mbps	6,6	23	Duplex	131 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	1 Mbps	6,6	23	Duplex	131 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	1 Mbps	24,40	247	Simplex	730 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	1 Mbps	24,40	247	Simplex	730 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	1 Mbps	24,40	247	Duplex	394 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	1 Mbps	24,40	247	Duplex	394 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	2 Mbps	6,6	23	Simplex	264 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	2 Mbps	6,6	23	Simplex	265 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	2 Mbps	6,6	23	Duplex	164 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	2 Mbps	6,6	23	Duplex	164 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	2 Mbps	6,6	247	Simplex	780 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	2 Mbps	6,6	247	Simplex	780 kbit/s
NINA-B1 (central)	NINA-B1(peripheral)	2 Mbps	24,40	247	Duplex	764 kbit/s
NINA-B1 (peripheral)	NINA-B1(central)	2 Mbps	24,40	247	Duplex	764 kbit/s

4.3 ODIN-W2 (Central) – NINA-B1 (Peripheral)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
ODIN-W2 (central)	NINA-B1 (peripheral)	6,6	23	Simplex	82 kbit/s
NINA-B1 (peripheral)	ODIN-W2 (central)	6,6	23	Simplex	31 kbit/s
ODIN-W2 (central)	NINA-B1 (peripheral)	6,6	23	Duplex	74 kbit/s
NINA-B1 (peripheral)	ODIN-W2 (central)	6,6	23	Duplex	17 kbit/s

4.4 ODIN-W2 (Peripheral) – NINA-B1 (Central)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
NINA-B1 (central)	ODIN-W2 (peripheral)	6,6	23	Simplex	22 kbit/s
ODIN-W2 (peripheral)	NINA-B1(central)	6,6	23	Simplex	42 kbit/s
NINA-B1 (central)	ODIN-W2 (peripheral)	6,6	23	Duplex	10 kbit/s
ODIN-W2 (peripheral)	NINA-B1(central)	6,6	23	Duplex	36 kbit/s

4.5 OBS421 (Central) – NINA-B1 (Peripheral)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
OBS421 (central)	NINA-B1 (peripheral)	6,40	23	Simplex	85 kbit/s
NINA-B1 (peripheral)	OBS421 (central)	6,40	23	Simplex	56 kbit/s
OBS421 (central)	NINA-B1 (peripheral)	6,40	23	Duplex	72 kbit/s
NINA-B1 (peripheral)	OBS421 (central)	6,40	23	Duplex	36 kbit/s

4.6 Android device (Central) – NINA-B1 (Peripheral)

Device A	Device B	PHY	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
Galaxy S8 (central)	NINA-B1 (peripheral)	1 Mbps	6,40	23	Simplex	32 kbit/s
NINA-B1 (peripheral)	Galaxy S8 (central)	1 Mbps	6,40	23	Simplex	54 kbit/s
Galaxy S8 (central)	NINA-B1 (peripheral)	1 Mbps	6,40	23	Duplex	32 kbit/s
Galaxy S8 (central)	NINA-B1 (peripheral)	1 Mbps	6,40	247	Simplex	395 kbit/s
NINA-B1 (peripheral)	Galaxy S8 (central)	1 Mbps	6,40	247	Simplex	614 kbit/s
Galaxy S8 (central)	NINA-B1 (peripheral)	2 Mbps	6,40	23	Simplex	33 kbit/s
NINA-B1 (peripheral)	Galaxy S8 (central)	2 Mbps	6,40	23	Simplex	55 kbit/s
Galaxy S8 (central)	NINA-B1 (peripheral)	2 Mbps	6,40	23	Duplex	33 kbit/s
Galaxy S8 (central)	NINA-B1 (peripheral)	2 Mbps	6,6	247	Simplex	486 kbit/s
NINA-B1 (peripheral)	Galaxy S8 (central)	2 Mbps	6,6	247	Simplex	589 kbit/s

4.7 iOS Device (Central) – NINA-B1 (Peripheral)

Device A	Device B	Connection interval min, max (x * 1.25 ms)	MTU (bytes)	Dataflow	Throughput
iPhone 7 (central)	NINA-B1 (peripheral)	6,40	23	Simplex	43 kbit/s
NINA-B1 (peripheral)	iPhone 7 (central)	6,40	23	Simplex	40 kbit/s
iPhone 7 (central)	NINA-B1 (peripheral)	6,40	23	Duplex	25 kbit/s
NINA-B1 (peripheral)	iPhone 7 (central)	6,40	23	Duplex	25 kbit/s
iPhone 7 (central)	NINA-B1 (peripheral)	12,12	247	Simplex	378 kbit/s
NINA-B1 (peripheral)	iPhone 7 (central)	12,12	247	Simplex	357 kbit/s
iPhone 7 (central)	NINA-B1 (peripheral)	40,320	247	Duplex	126 kbit/s
NINA-B1 (peripheral)	iPhone 7 (central)	40,320	247	Duplex	146 kbit/s

Appendix

A Glossary

Name	Definition
ATT	Attribute Protocol
LE	Low Energy
LL	Link Layer
MTU	Maximum Transmission Unit
PDU	Protocol Data Unit
PHY	Physical Layer
SPS	Serial Port Service
UART	Universal Asynchronous Receiver-Transmitter serial interface

Table 1: Explanation of abbreviations used

Related documents

- [1] u-blox Short Range Modules AT Commands Manual, document number UBX-14044127
- [2] NINA-B1 series Protocol Specification, document number UBX-16011192
- [3] Bluetooth serial port adapter toolbox – Getting started, document number UBX-15012587
- [4] s-center Evaluation software - <https://www.u-blox.com/en/product/s-center>



For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (<http://www.u-blox.com>).

Revision history

Revision	Date	Name	Comments
R01	30-Jun-2017	tvon, kgom	Initial release.
R02	24-Apr-2018	apet, kgom	Included support and throughput results for NINA-B1 software version 4.0.0. Added the AT commands for configuration.

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