Serverless network, Synchronization through GPS

ABSTRACT

This application note describes a synchronized wireless network in which there is no server of beacon. The synchronization of each node (clients) is made thanks to an external synchronized clock. In this application note the Pulse per Second (PPS) signal coming from GPS receiver is used as timing reference. This document describes the necessary steps to achieve a server less network.

Key Words

- Beacon Less / Server Less
- GPS Receiver
- Pulse per Second
- Synchronization input

Key Commands

- BEACON MODE
- SYNC_IN
- GP2_SIGNAL
- CHANNEL_COUNT / _DURATION

TABLE OF CONTENT:

Introduction

When a GPS receiver is used in the final product, for example wireless GPS application, it could be useful to use the precisions signal from satellite to synchronize the wireless network. This application note describes how to connect the GPS receiver to Y-Lynx wireless module to establish a wireless network without the need of beacon server.

When a time slotted protocol (TDMA) is used in wireless communication, it is necessary first to synchronize all the nodes. The beacon signal transmitted by the server is used to transmit timing information to all the nodes in the range. If a node is not in the range of the server, it can't be synchronized and so it does not allows receiving or transmitting data with other nodes. By implementing a beacon less network, this limitation is avoided and all the nodes present in the network are synchronized by default. For that a new source of synchronization is needed. The GPS signal offers this source thanks to the pulse per second signal generated by the GPS receiver itself.

The implementation of beacon less network is very simple and is step by step described below. Then, an example will illustrate a typical application using this external source of synchronization.
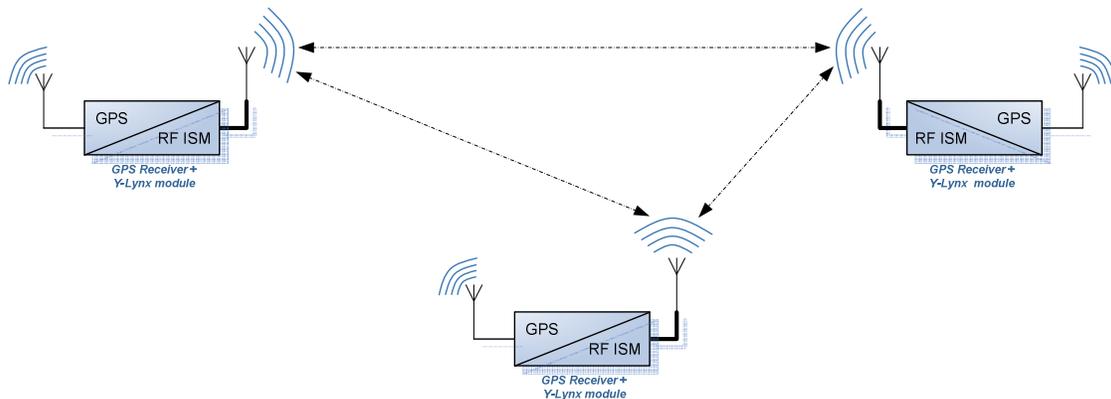
External Synchronization

SYNC_IN Mapping

To allow network synchronization based on an external signal (SYNC_IN), one of the general purposes I/Os offers by the Y-Lynx wireless module (GP1 and GP2) has to be set in input.

As soon as SYNC_IN, the external synchronization signal (Pulse per Second) is mapped on GP2 input, its rising edges are used as timing reference while its falling edge have no effect.

To map SYNC_IN on GP2, the following command has to be sent by the host to the modem:
CMD_SET_GP2_SIGNALGP2_SYNC_IN

So:
> TxD: 0x02 0xE4 0x05
> RxD: 0x01 0xE4

When GP2 is not mapped on an external signal, the wireless module synchronization relies again in the RF Beacon sent by the network server.

SYNC_IN Timing

The time between two consecutive SYNC_IN rising edges has to be greater than:
(CHANNEL_COUNT x CHANNEL_DURATION - 250µs)

For example, by default:
CHANNEL_COUNT =50
CHANNEL_DURATION = 2 (2 x 10ms)

So, the SYNC_IN rising edge period has to be greater than:
50 x 20E-3 – 250E-6 = 999.75ms

If this condition is not fulfilled, the SYNC_IN rising edge occurring too early will be ignored. This will also conduce to an unsynchronized system until next SYNC_IN rising edge occurred. During the application development, this issue can be checked by the developer by monitoring the SYNC pin (pin 12) of the wireless module which shows the synchronization status.

As the wireless communication between nodes depends on their synchronization, the timing difference of SYNC_IN rising edges has to be smaller as possible (See Figure 2). The required precision of the SYNC_IN signal as to be at least of:
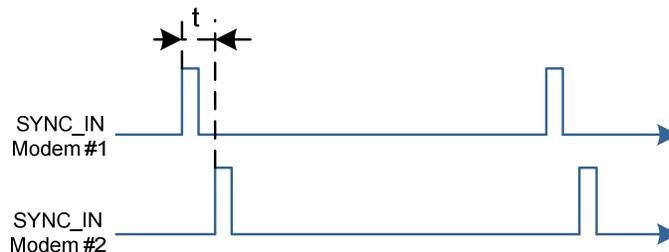> t = ± 50µs

Figure 2: SYNC_IN required precision

Application Example

When timing is respected

The following representation (Figure 3) describes the wireless module behavior when an external synchronization is applied on GP2 (SYNC_IN).

The wireless module behavior is correct when SYNC_IN rising edge minimum timing is respected.

Wireless module default parameters:
CHANNEL_COUNT = 50
CHANNEL_DURATION = 2 (2 x 10ms)

$t >= 50 \times 20E\text{-}3 - 250E\text{-}6 = 999.75ms$

Note: The channel beginnings are signaled by HOP rising edge
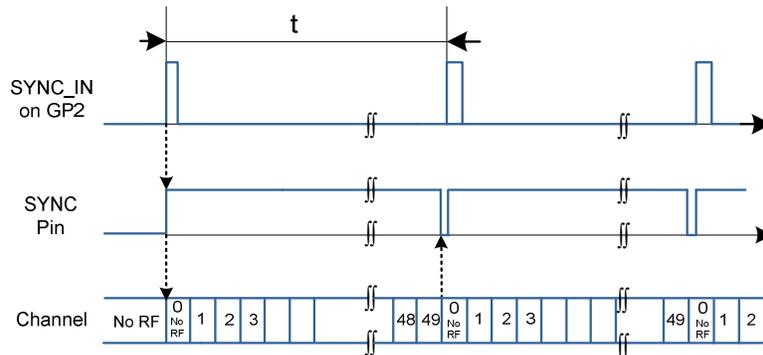

Figure 3: SYNC_IN rising edge, the timing is respected

When timing is NOT respected

The following representation (Figure 4) describes the wireless module behavior when an external synchronization is applied on GP2 (SYNC_IN).

The wireless module behavior is correct when SYNC_IN rising edge minimum timing is not respected.

Wireless module default parameters:
CHANNEL_COUNT =50
CHANNEL_DURATION = 2 (2 x 10ms)

$t <= 50 \times 20E\text{-}3 - 250E\text{-}6 = 999.75ms$

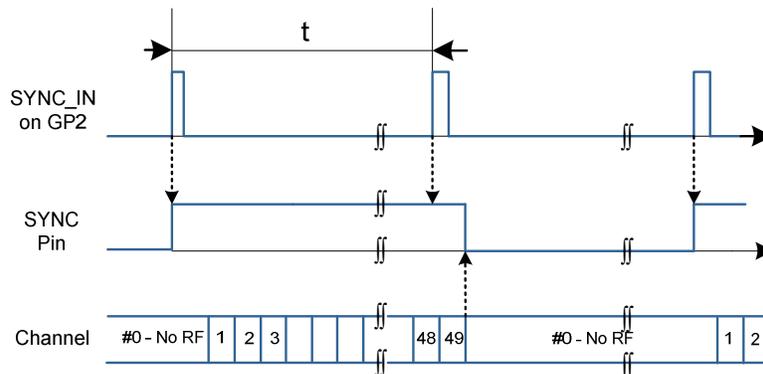*Note: The channel beginnings are signaled by HOP rising edge*

Figure 4: SYNC_IN rising edge, the timing is not respected

Additional Information

Hardware implementation

The following schematic (Figure 5) describes the typical application using an external synchronization signal
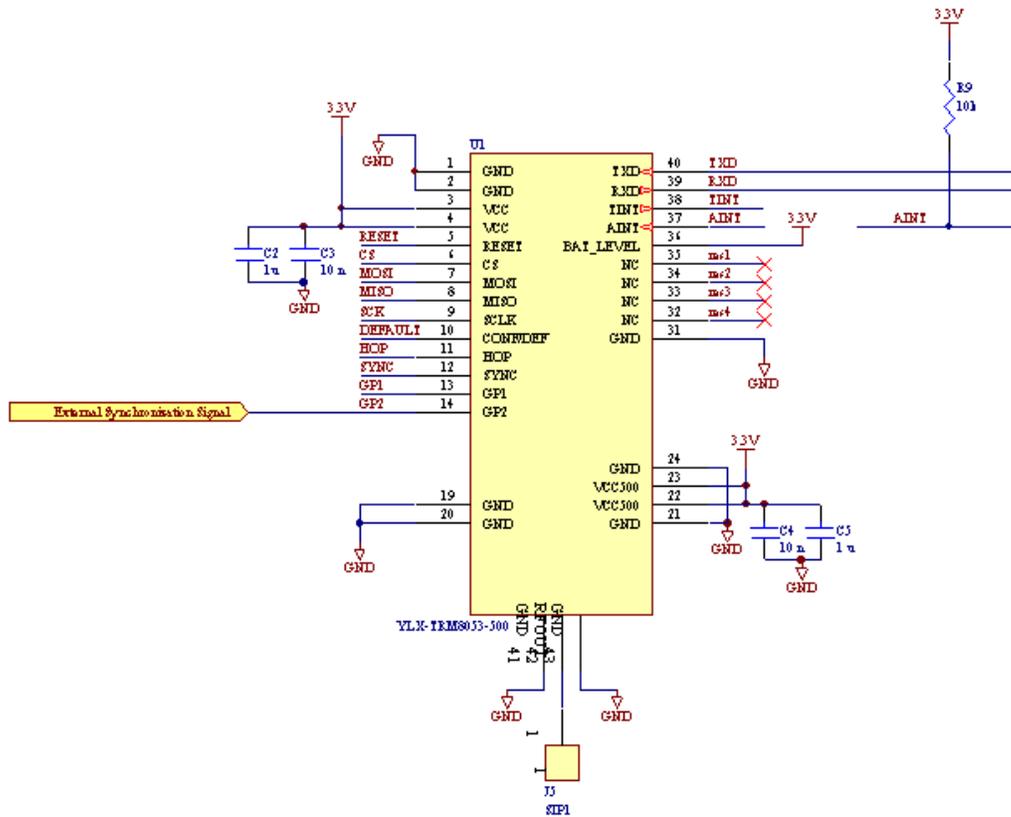

Figure 5: Typical Application

With the Radio Modem Starter Kit

It is also possible to configure and evaluate external synchronization application by using the Y-Lynx Starter Kit (Figure 6). To enable this option, select:
Application>GP2 signal mapping>GP2_SYNC_IN
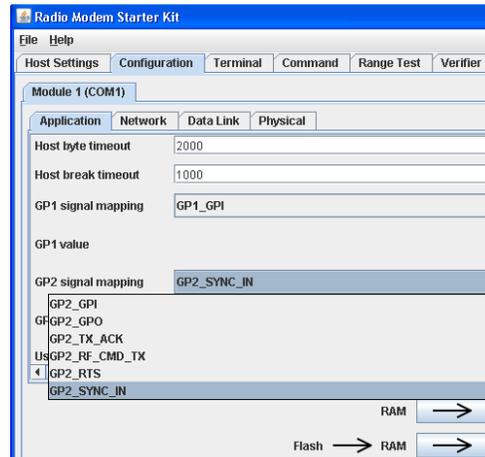
Or use the following command:
 0x02 0xE4 0x05

Figure 6: Radio Modem Starter Kit, User interface, GP2 Signal mapping

Advanced Information

Beacon Channel

The embedded protocol allow using the channel previously used by the beacon to transmit data when the network synchronization is done via an external signal (for example the PPS signal coming from a GPS receiver).

The option *Beconless network* can be used to send and receive data in the beacon channel if the entire network is synchronized via an external signal. If one module needs a RF beacon to be synchronized this option cannot be enabled.

To enabled this option, select (Figure 7)
Data Link>Beacon mode>Beaconless network

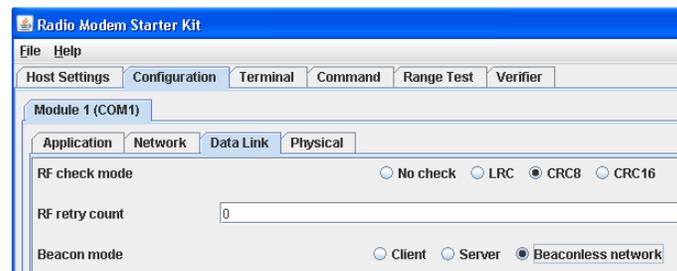Or use the following command:
 0x02 0x54 0x02

Figure 7: Radio Modem Starter Kit, User interface, Beaconless Network

Documentation History

Revision	Modifications	Date
Rev 1.0	Original version - AN005-2010.1.0	March, 2010

Contact Information

Address:

Y-Lynx Sàrl

Rue de Galilée 15
CH - 1400 YVERDON
SWITZERLAND

Phone: +41 24 423 92 05
Email: info@y-lynx.com
Web site: http://www.y-lynx.com