
Wireless RS232

ABSTRACT

The purpose of this application note is to achieve a wireless communication between two PCs by replacing the RS232 cable with Y-Lynx radio modem.

The easiest way is to use the Y-Lynx Radio Modem Starter Kit (RMSK), to configure but also to transmit and receive data.

This simple point to point communication application will be extended to more than 2

devices. At the end a MESH network will be achieved.

Since wireless module from Y-Lynx embeds radio communication protocol and digital functionalities, it is suitable for solutions using the internal resources of the product.

Key Words

- Wireless RS232
- Point to point
- MESH Network
- Config/Default Mode

Key Commands

- BEACON_MODE
- RF_ADDRESS
- HOST_DATA_MODE
- SEND_DATA
- RECEIVED_DATA

INTRODUCTION	2
POINT TO POINT WIRELESS LINK	2
COMPLEX TOPOLOGY	4
IN CONFIG MODE	7
CONCLUSION	10
DOCUMENTATION HISTORY	11
CONTACT INFORMATION.....	11

Introduction

Most of board peripherals are connected using the RS232 standard. This standard has existed since the 1960s and is easily implemented using embedded systems hardware.

The wireless protocol to transfer data from one RS232 to another one is already embedded in the Y-Lynx wireless module. To develop a simple point to point communication, the user

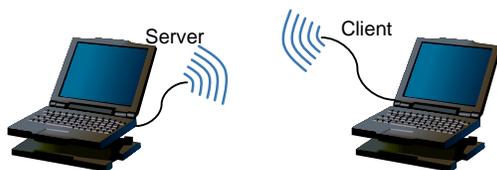
will have to configure the wireless modules by modifying few settings thanks to the Y-Lynx Radio Modem Starter Kit.

The next step will be to extend the wireless RS232 communication to more than two devices by modifying the default configuration of each module.

Point to Point Wireless link

Overview

The embedded wireless communication protocol developed by Y-Lynx is based on the Server/Client architecture. Data can be transmitted from one RS232 COM port to another one, by using Y-Lynx radio modules; one has to be set as Server and the other as Client. This operation synchronizes all the nodes present in the network. In a point to point communication only one Server and one Client are present in the network.



As the Y-Lynx wireless modems are programmed with the same default parameters and with a Client configuration, the aim will be to modify the configuration of one of these modules by setting it in Server mode.

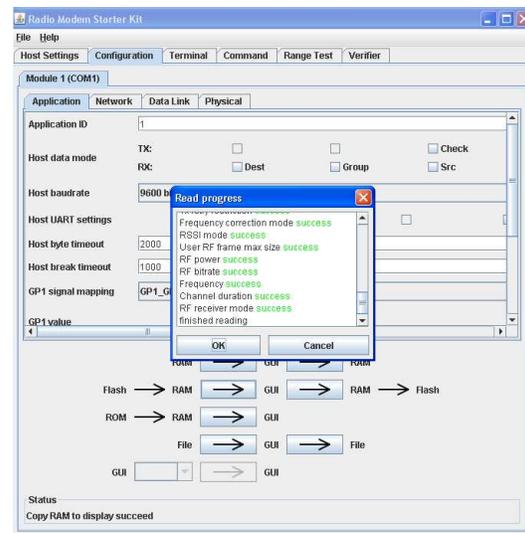
Hardware and software Configuration

The simplest way to achieve this modification is to use the Y-Lynx Radio Modem Starter Kit.

First of all, plug the modules into the 40 pins connector, select the desired power source and communication port, to begin let's first use the RS232 COM port. Before powering-up the board, verify that Mode 2 has been selected (Mode Select slide switch) to achieve a Default Reset. For more information on RMSK

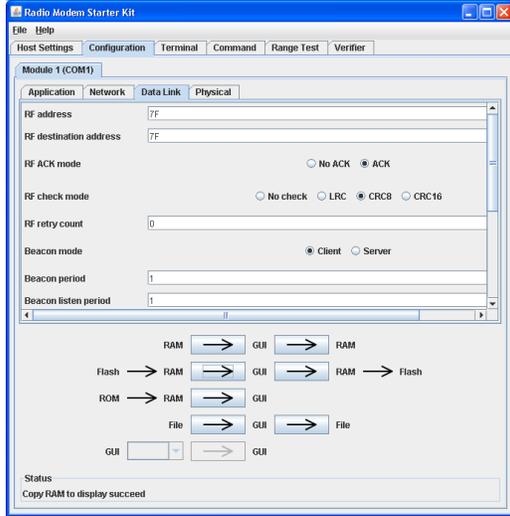
assembling please refer to the RMSK User's Guide.

The second step concerns the operation of the RMSK Graphic User Interface. To obtain the default parameters programmed in each module apply the steps described in the RMSK User's Guide until obtaining the ROM configuration of the two nodes (note: Mode Select slide switch has to be set in position 2).



At this stage the two modems are connected to the two PCs, and the configuration of each modem has been downloaded to the GUI.

To configure one module has Server, select the *Configuration* page and then the *Data Link* sub-window.



On the *Data Link* page few parameters can be configured. Three of them depend on the addressing process: RF address, RF destination address and Beacon mode. To implement a simple point to point communication, only the Beacon mode has to be modified. The sender address and the receiver address don't need to be modified and have the same default value, 0x7F. This will not cause any concern since the final application is a point to point communication.

By selecting Server for the Beacon mode option on one module, the Sync LEDs light-up on both RMSK platforms. To return to Data mode, the Mode Select slide switch has to be set in position 1. One connection has been established between a Server and a Client, the data can be transferred from one node to the other.

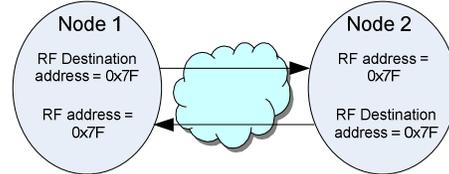
Data transfer

To transfer data wirelessly, select *Terminal* page on both Graphic User Interface. In the Data to send field one GUI, enter your data and click on the *Send* button. The message will appear in green in the log window and in red in the receiver log window. The same operation can be done with the other Graphic User Interface.

A wireless communication has been achieved from one RS232 COM port to another RS232 COM port.

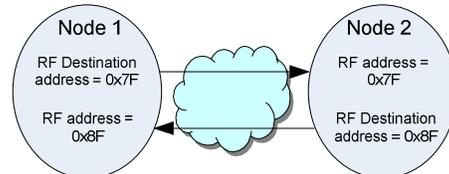
Address Modification

The wireless communication uses the same default RF address for the node 1 and for the node 2 (0x7F). The used addresses can be checked on the *Data Link* page of the Graphic User Interface (RF address and RF destination address).



Data link parameters		
	RF Address	RF Destination address
Node 1	0x7F	0x7F
Node 2	0x7F	0x7F

By modifying the RF address of one node and the RF destination address on the other node, a wireless communication will occur between two different nodes with different addresses. In the example below, the node 1 is configured with the address 0x8F and the node 2 with the default address 0x7F.



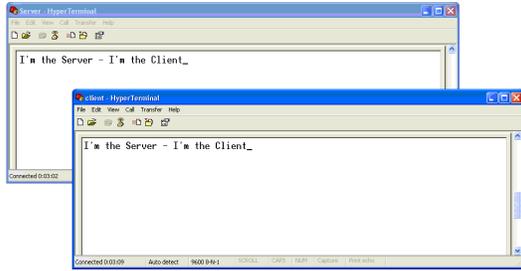
Data link parameters		
	RF Address	RF Destination address
Node 1	0x8F	0x7F
Node 2	0x7F	0x8F

With the Hyper Terminal

The nodes have been configured through the Radio Modem Starter Kit; it is now possible to use Microsoft ® Hyper Terminal to communicate from one node to the other.

Click on Host Settings to free the communication port used by the RMSK. Open two Hyper Terminal connections and verify that the port settings are correct and correspond to the same settings used by the RMSK. The echo typed characters can be enabled by selecting File>Properties then Settings>ASCII Setup> Echo typed characters locally.

Then on one Hyper Terminal window, type your message. For example: "I'm the Server". On the second Hyper Terminal window, the client can response "I'm the Client".



How does it work?

The wireless modem embeds a powerful communication controller, the LibIC5305, which offer two modes of behavior. The first one is the DATA mode where data present at the modem input (UART or SPI) is transferred to the air. The second is the CONFIG mode where data present at the input are considered as commands and not as data. For more information about the CONFIG/DEFAULT mode, please refer to the YLX-TRM datasheet or to the RMSK-TRM User's Guide.

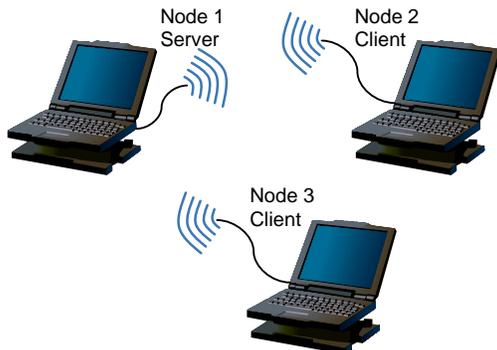
In DATA mode (pin CONFIG/DEFAULT connected to VCC), the command, HOST_DATA_MODE allows to configure the wireless transfer at the emission and at the reception. The Bit 2, Destination address, is used at the emission to add the destination address to the wireless transferred data. If the Bit 2 is not enabled, the communication controller uses the RF destination address set in the RF destination address parameter.

The addressing system used above is often used for point to point communication where as the addresses are fixed. The advantage of this addressing system is to limit the overhead between the Host (microcontroller) and the Radio modem by avoiding the transfer of the destination address.

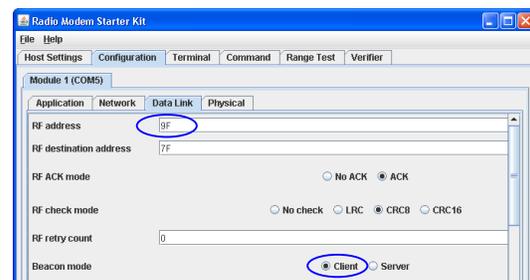
When the network topology is more complex than a point to point communication, like a star network, the addressing system described as above is not efficient. When the destination has to be modified, the host has to modify the RF destination address by using the SET_RF_DEST_ADDRESS command. To avoid unnecessary communications between the host and the wireless module, the embedded communication controller offers dedicated functionalities to complex topology network.

COMPLEX TOPOLOGY

A communication will be achieved based on a point to point communication described above. A node 3 will be added in the network with the address 0x9F.



Launch a new RMSK Graphic User Interface, select the right COM port and load the ROM memory to the GUI. Then on the *Data Link* page modify the RF address to 0x9F and verify that the *Beacon mode* is set as Client



As demonstrated during the point to point communication example, the addressing system using the RF destination address parameters is not suitable for point to multipoint communication.

A specific command embedded in the communication controller resolve this issue. The Bit2 [Dest] of the HOST_DATA_MODE command is used to prefix the data with the RF Destination address.

Host data mode command

In transmitter mode, Host data command determines which information must be sent from the host to the radio modem as prefix.

The parameters in transmit mode are the following:

- Bit 5: Check, redundancy check
- Bit 4: Retry, number of retry
- Bit 3: Tx Power, transmit output power
- Bit 2: Tx Destination, destination address
- Bit 1: Tx Group, used if destination address is multicast
- Bit 0: Tx Channel, channel ID

In receiver mode Host data mode command determines which information must be sent from the radio modem to the host for payload extracting.

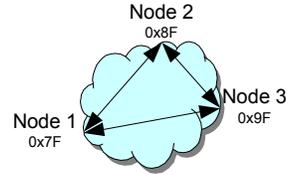
The parameters in receive mode are the following:

- Bit 7: Rx Destination; destination address
- Bit 6: Rx Group; destination group
- Bit 5: Rx Source; address of the transmitter
- Bit 4: Rx_Retry; retry value
- Bit 3: Channel ID where the RF reception has been made
- Bit 2: Rx_RSSI; RSSI output
- Bit 1: Frequency Error Indicator
- Bit 0: Rx_Size, length of the following payload (c.f. LAST_FRAME_INFO)

For more information on the HOST_DATA_MODE command please refer to LibIC5305 Reference Guide available on the Y-Lynx web site: www.y-lynx.com

Network Configuration

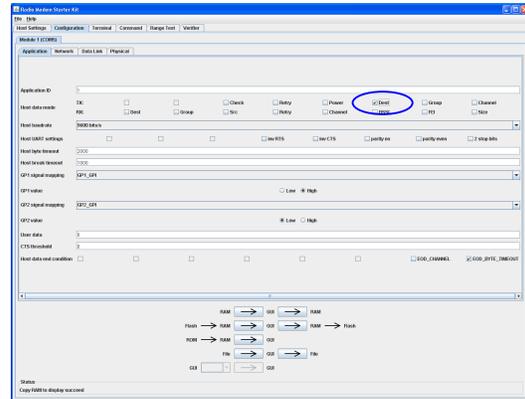
Launch three RMSK GUIs and verify the RF address parameter to avoid conflicts. For example set the node 1 as Server and the two others as Client.



	Node 1	Node 2	Node 3
RF Address	0x7F	0x8F	0x9F
Type	Server	Client	Client

By enabling the Host data Mode Tx Bit2 [Dest], the RF destination address will be added by the Host to the transferred data frame. In consequence, the RF Destination address parameter will not be taken into account during the data packet processing.

For the three nodes, select the *Application* page and enable the *Dest* option on the *Host Data Mode TX* command.



Up-load the modifications to the communication controller by clicking on: GUI->RAM or GUI->RAM->Flash.

Then return in Data mode by setting the Mode Select slide switch to position 1.

Data transfer

To transfer data wirelessly, select *Terminal* page on the three Graphic User Interfaces. Then in the *Data to send* field enter first the

destination address in hexadecimal followed by the data and click on *Send* button. The message is automatically transferred to the air, and received by the corresponding node.

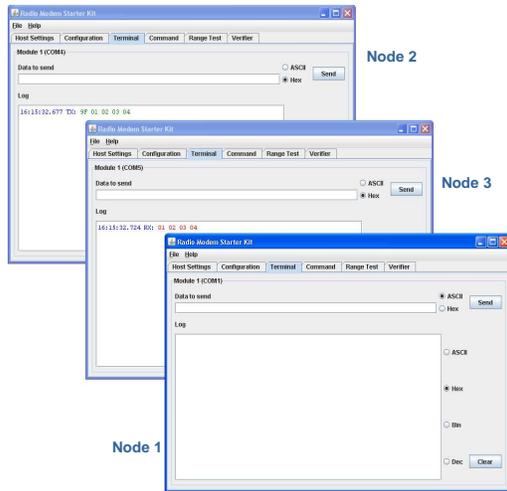
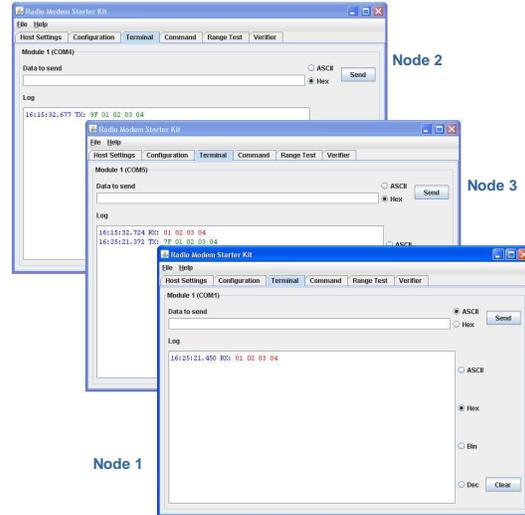
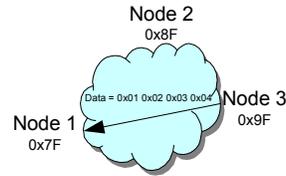
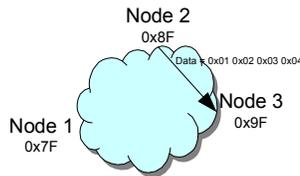
For example, the following message is sent by Node 2 to Node 3:

0x9F 0x01 0x02 0x03 0x04

Where:

RF Destination address: 0x9F

Message: 0x01 0x02 0x03 0x04



The message transferred by Node 3 (in green in Node 3 log window) has been received by Node 1 (in red in Node 1 log window).

As described above, when the bit2 of the Host Data Mode Tx parameter is enabled, the communication controller uses the first byte as RF destination address and the following bytes are considered as data.

This addressing system is very useful when the RF destination address is not fixed.

In the log window of Node 2, the message 0x9F 0x01 0x02 0x03 0x04 has been sent over the air. In the log window of Node 3 the message 0x01 0x02 0x03 0x04 has been received and in the log window of Node 1 no message has been received.

The same message can be transferred from Node 3 to Node 1:

0x7F 0x01 0x02 0x03 0x04

In this case:

RF Destination address: 0x7F

Message: 0x01 0x02 0x03 0x04

Received Data Indicator

With Host data mode RX, the receiver node can obtain additional information about the received RF frame.

On the three GUI, verify that each node has a unique address and one of them is set as a Server:

	Node 1	Node 2	Node 3
RF Address	0x7F	0x8F	0x9F
Type	Server	Client	Client

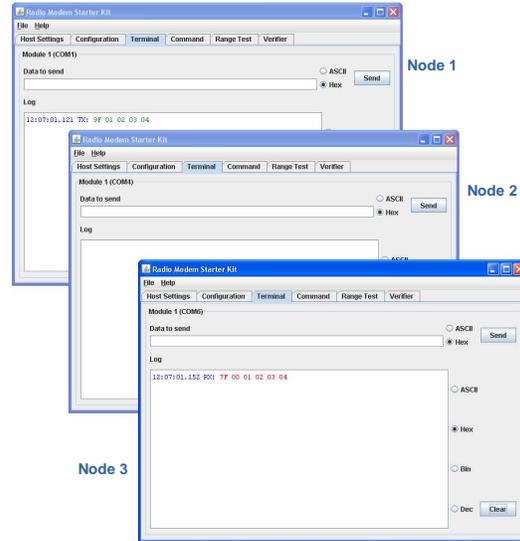
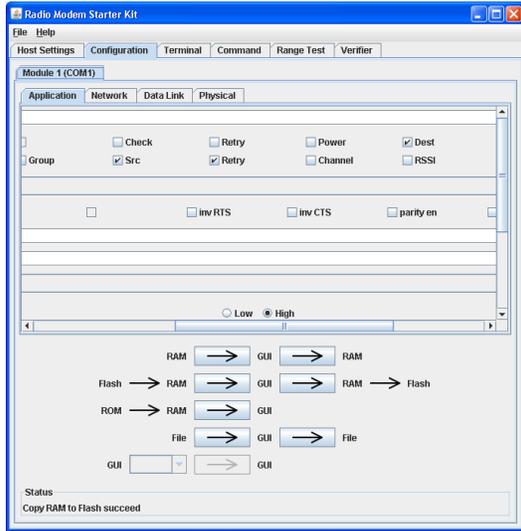
In the Host Data Mode Rx parameter select:

- Src : Sender Address
- and
- Retry: Number of retry

In the Host Data Mode TX Parameter select:

- Dest: Destination address

Then load the configuration and return to Data mode (Mode Select slide switch in position 1)



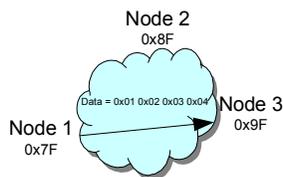
On the log file of Node 3, the following message will have been forwarded by the communication controller to the host 3.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
0x7F	0x00	0x01	0x02	0x03	0x04

On the terminal page of Node 1 (0x7F) enter the following frame:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
0x9F	0x01	0x02	0x03	0x04

The message (0x01 0x02 0x03 0x04) will be sent to the address 0x9F (Node 3).



Then click on Send button.

Where:

- 0x7F: Sender Address (node 1)
- 0x00: Number of retry (no retry used)
- 0x01 0x02 0x03 0x04: Data

Thanks to Host Data Mode parameter, the receiver node is able to obtain information about the message routing source and the channel quality.

These commands are very useful when the network topology is more complex with repeater and where radio communications are critical.

In CONFIG mode

The wireless communications described above are using the Data mode. It is also possible to transfer data when the wireless modem is set in Config mode.

The Config mode is generally used to configure the modem parameters, so that the data that are transferred from the host to the modem are considered as configuration

parameters and are not transferred to the air. Nevertheless it is possible to transmit wirelessly data to another node by using specific commands already included in the communication controller.

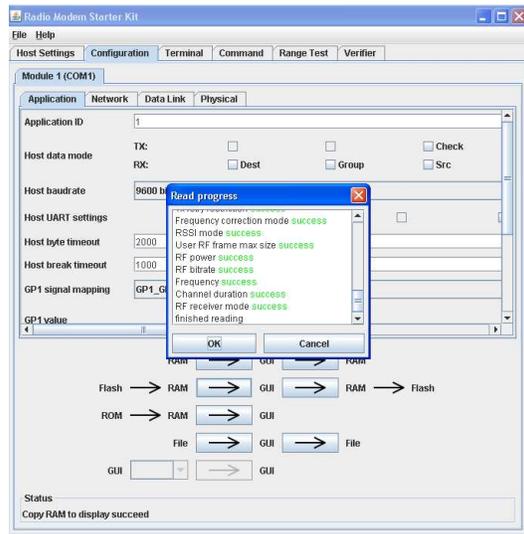
A specific command used to transfer data in Config mode is:

- SEND_DATA

The SEND_DATA command is used to inform the modem that the following data have to be transmitted over the air. For more information, please refer to the LibC5305 Reference Guide.

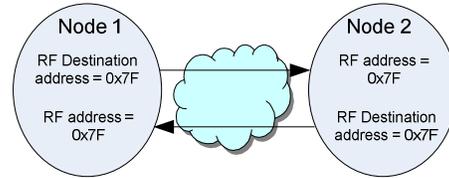
Send Data Command

As for the point to point communication in Data mode, connect the two wireless modems on two RMSK boards, launch the GUI application and load the ROM parameters in the GUI. Then keep the Config mode active (*Mode Select* slide switch in position 2).



Select one node as Server and load the configuration to flash.

As the Bit2 [Dest] of the Host Data Mode Tx parameter is not enabled, the data are transmitted to the RF destination address set in the according parameter. The default RF address of the wireless modules (0x7F) will be used to achieve a point to point communication as described above with the Data mode.



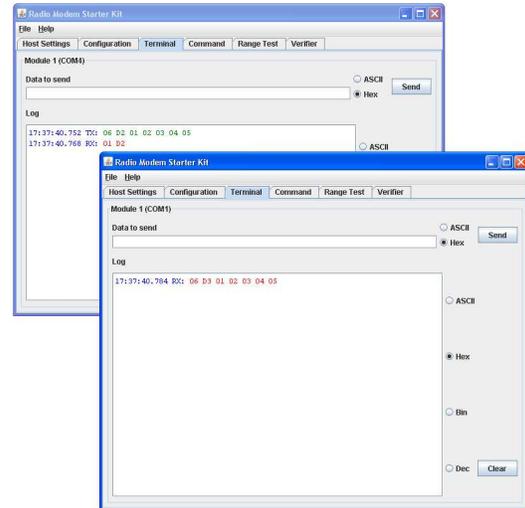
So to send data wirelessly, the command SEND_DATA can be used directly. The format of this command is the following:

	Byte 1	Byte 2	Byte
From host to the module	Length	0xD2	DATA

The length corresponds to the command ID (0xD2) plus the number of data byte. For example, to transmit the following frame: 0x01 0x02 0x03 0x04 0x05, the host sends to the wireless modem the following frame.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x06	0xD2	0x01	0x02	0x03	0x04	0x05

Select the *Terminal* page on both Graphic User Interfaces. In one GUI, enter the frame described above and click on *Send* button.



The following frame has been received by destination node: 0x06 0xD3 0x01 0x02 0x03 0x04 0x05.

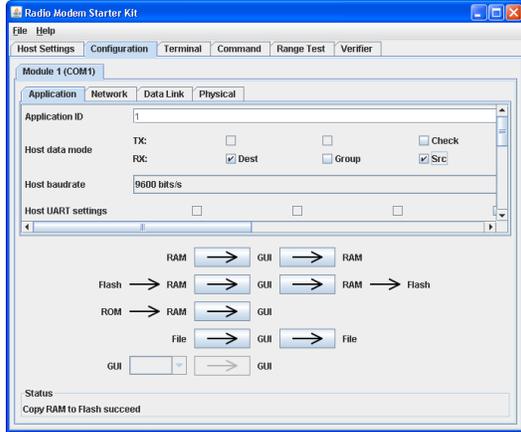
- Where:
- 0x06: Length of the frame
 - 0xD3: Received frame indicator
 - 0x01 0x02 0x03 0x04 0x05: Data

Note: 0x01 0xD2 received by the transmitter corresponds to the command acknowledgment.

Received Data Indicator

On the receiver node, select Configuration>Application this will determine which information will be sent to the host from the communication controller.

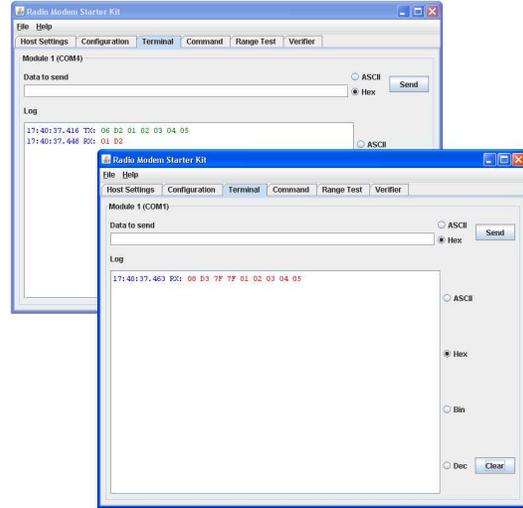
In the example below, the Destination address (used to make the difference with a broadcast message) has been selected as well as the Source (sender address).



After having up-dated the new parameters to the Flash memory by clicking on GUI>RAM or on GUI->RAM->Flash to save parameters in the Flash memory, select the terminal page on both GUI. In the sender Terminal page, enter the frame described below and click on Send button.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x06	0xD2	0X01	0X02	0X03	0X04	0X05

The command acknowledgment is confirmed by the message 0x01 0xD2.



The received frame is composed of:

Byte 1	Byte 2	Byte 3	Byte 4
0x08	0xD3	0X7F	0X7F

Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
0X01	0X02	0X03	0X04	0X05

Where:

- 0x08: Length of the frame
- 0xD3: Received frame indicator
- 0x7F*: Destination address (Receiver)
- 0x7F*: Source Address (Sender)
- 0x01 0x02 0x03 0x04 0x05: Data

*by default the sender address and the receiver address is the same and equal to 0x7F.

Conclusion

The Y-Lynx wireless modems are suitable for cables replacement without developing an interface layer.

Thanks to the embedded communication controller, a simple point to point communication as well as a complex MESH network can be easily achieved. Dedicated commands have been added specifically for routing mechanism, channel quality estimation

and other indicators (not presented in this document).

In addition all the settings of each node can be saved in the Flash memory of the communication controller thereby eliminating any modems parameterization. When the network structure is fixed, the modem settings can be done at the Y-Lynx factory and allows using the wireless modem directly in any kind of applications.

Documentation History

Revision	Modifications	Date
Rev 1.0	Original version - AN0830-002.1.0	July, 2008

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