UM1008
User manual

Demonstration kit for the ST7570 power line modem with graphical user interface

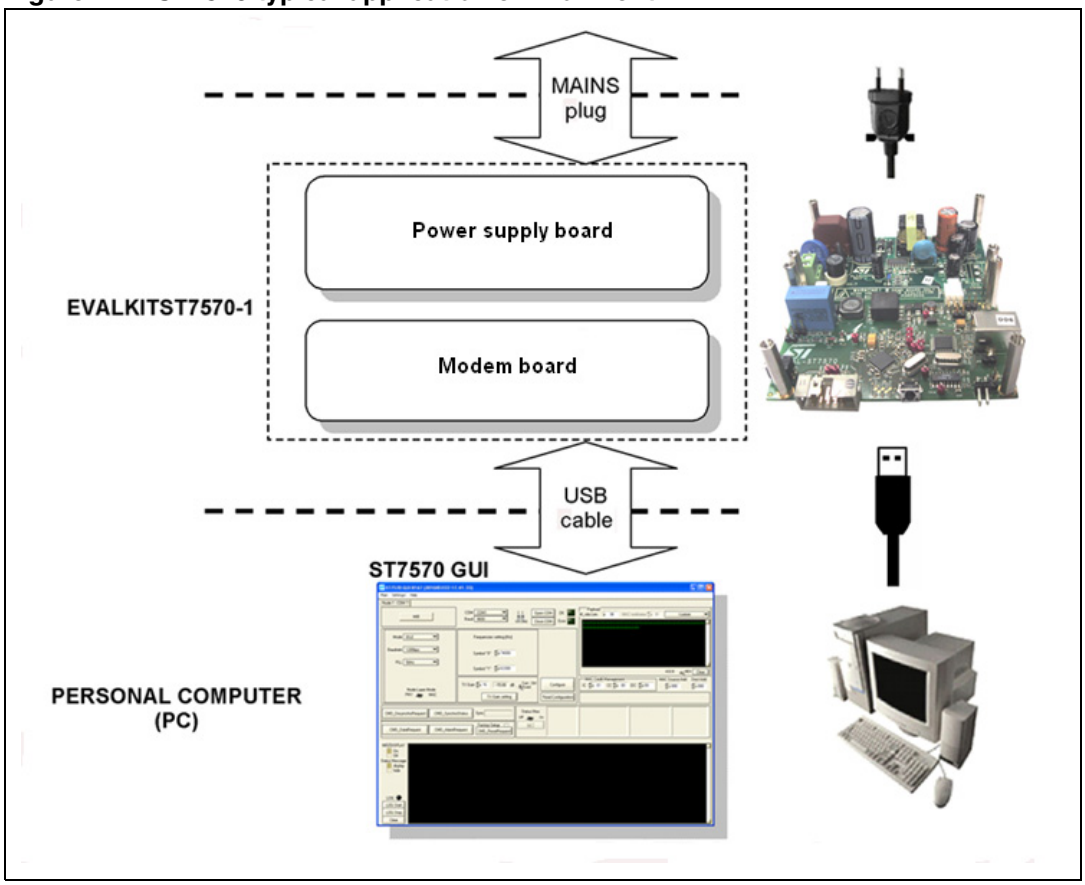
Introduction

The ST7570 GUI is a software tool that allows interfacing with one or more STMicroelectronics™ power line modem (PLM) demonstration boards with a personal computer (PC). Only PLM demonstration boards equipped with the ST7570 device are supported.

The ST7570 GUI gives the user complete control of the ST7570 device, having access to all its registers and functions, as described in [2].

The typical application environment (shown in *Figure 1*) consists of an ST7570 GUI running on a PC and communicating through a USB connection with a PLM demonstration kit equipped with the ST7570 product, such as the EVALKITST7570-1 (consisting of a modem board and a power supply board).

Figure 1. ST7570 typical application environment



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1 Document conventions

The following abbreviations are used:

Table 1. List of abbreviations

Abbreviation	Description
PRE	Preamble
SSD	Start of Subframe Delimitation
MIB	Management Information Base
PGA	Programmable Gain Amplifier
ZC	Zero-crossing
PHY	Physical Layer
MAC	Medium Access Layer
DA	Destination Address
SA	Source Address
NS	Number of Subframes
FCS	Frame Check Sequence
CRC	Cyclic Redundancy Check
M_sdu	MAC service data unit
M_pdu	MAC protocol data unit
IC	Initial Credit
CC	Current Credit
DC	Delta Credit
TIC	Inter-character Timeout
FIMA	First Initiator MAC Address
LIMA	Last Initiator MAC Address
RC	Repeater call procedure
IS	Intelligent Synchronization procedure

2 Connection procedure

In order to connect EVALKITST7570-1 to the PC, the user must follow the instructions below:

1. Connect the board to the PC using a USB cable.
2. Plug a power cable into the board AC power plug.
3. Plug the power cable into the power socket.
4. As soon as the board is powered, the power LEDs switch on.

USB/UART adapter driver installation

The USB communication between the EVALKITST7570-1 and the PC is managed through an onboard USB to UART adapter. This device needs the installation of the correct device software driver on the PC.

Assuming that the device drivers are not yet installed, follow the instructions below:

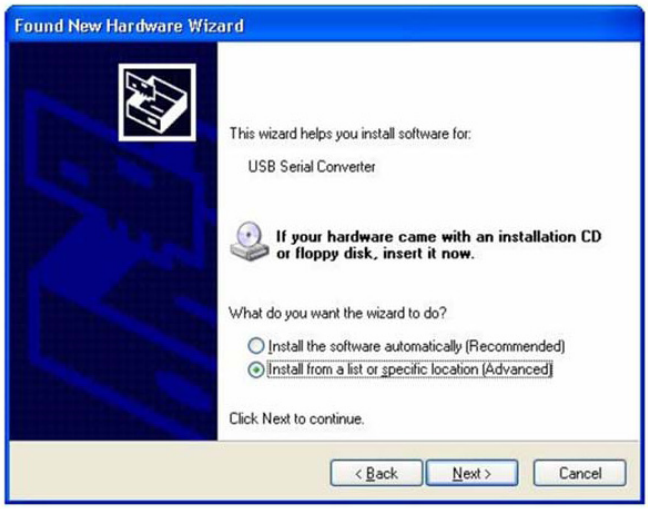
1. Download the latest available Virtual COM Port (VCP) drivers from the FTDI web site (www.ftdichip.com) and unzip them to a location on the host PC.
2. Connect the EVALKITST7570-1 to a spare USB port on the host PC. The screen shown in *Figure 2* is displayed. Select “No, not this time” from the options available and then click “Next” to proceed with the installation.

Figure 2. Hardware update wizard screen



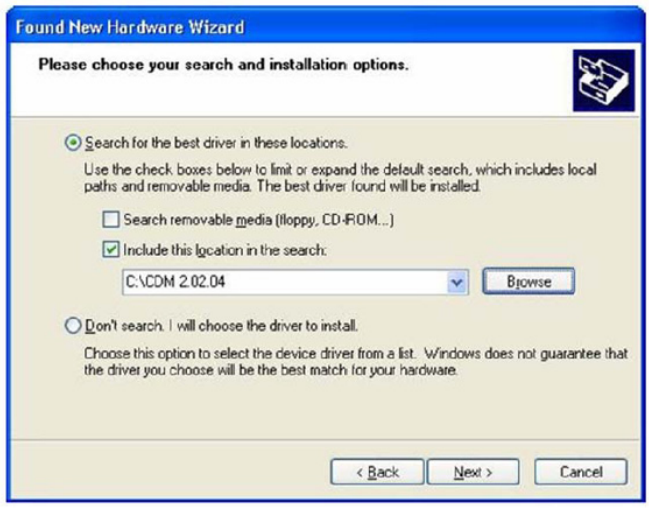
3. Select “Install from a list or specific location (Advanced)”, as shown in *Figure 3* below and then click “Next”.

Figure 3. New hardware update wizard



4. Select “Search for the best driver in these locations” and enter the file path in the combo-box (“C:\CDM 2.02.04", in the example shown in *Figure 4*) or browse to it by clicking “Browse”. Once the file path has been entered in the box, click “Next” to proceed.

Figure 4. Found new hardware update wizard



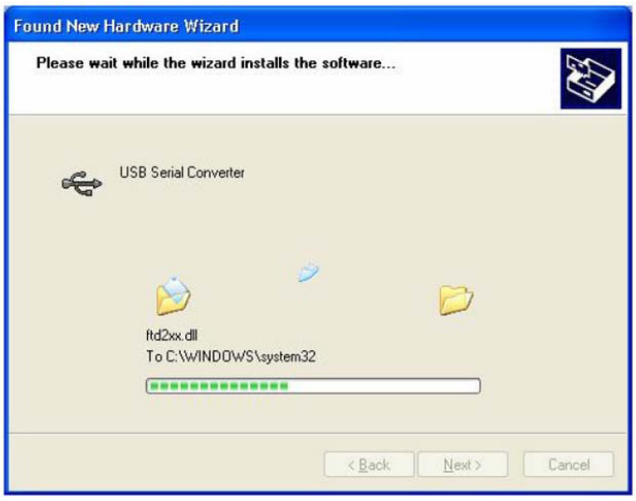
5. If Windows® XP is configured to warn when unsigned (non-WHQL certified) drivers are about to be installed, the message dialogue shown in *Figure 5* is displayed, unless installing a Microsoft® WHQL certified driver. Click on “Continue Anyway” to continue with the installation. If Windows XP is configured to ignore file signature warnings, no message appears.

Figure 5. Hardware installation



6. The screen shown in *Figure 6* is displayed as Windows XP copies the required driver files.

Figure 6. Software installation



7. A message should then appear indicating that the installation was successful (*Figure 7*). Click “Finish” to complete the installation for the first port of the device.

Figure 7. Completing the found new hardware update wizard



Once the driver installation is complete a new “USB serial port” device is installed on the host PC.

3 GUI installation

3.1 System requirements

A personal computer (PC) including:

- Windows NT/2000/XP operating system
- A hard disk with at least 15 MBytes of free space to install the GUI
- One or more USB 1.1 ports

3.2 Installing the software

Follow the instructions below to install the ST7570 GUI software.

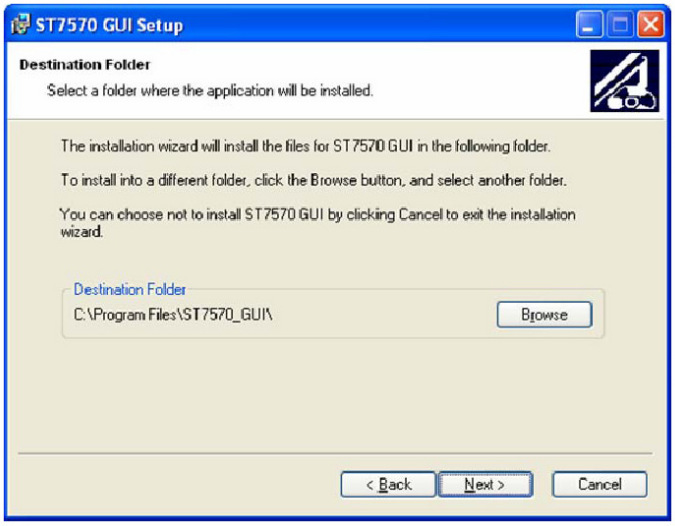
1. Extract the contents of the archive in a new directory.
2. Launch “setup.exe” to start the install procedure.
3. Press the “Next” button (*Figure 8*).

Figure 8. ST7570 GUI installation wizard



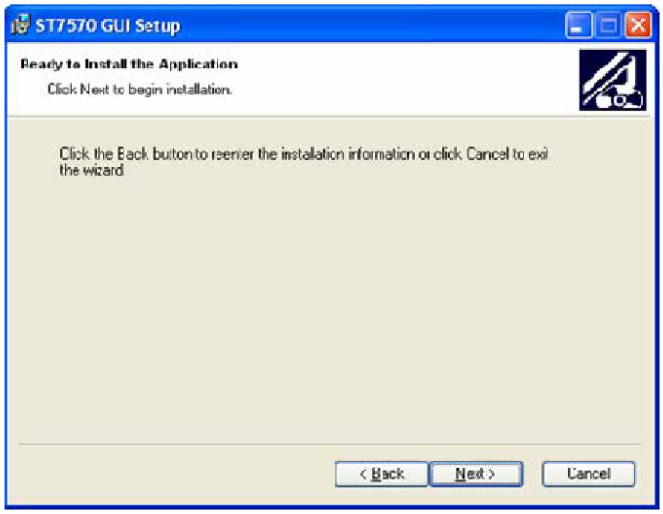
4. Choose an installation path (the default path is suggested) and press the “Next” button (*Figure 9*).

Figure 9. ST7570 GUI setup



5. Press the “Next” button to start the installation (*Figure 10*).

Figure 10. Application installation



6. Once installation has completed, press the “Finish” button to complete the process (*Figure 11*).

Figure 11. Application installed



4 Getting started

4.1 Introduction

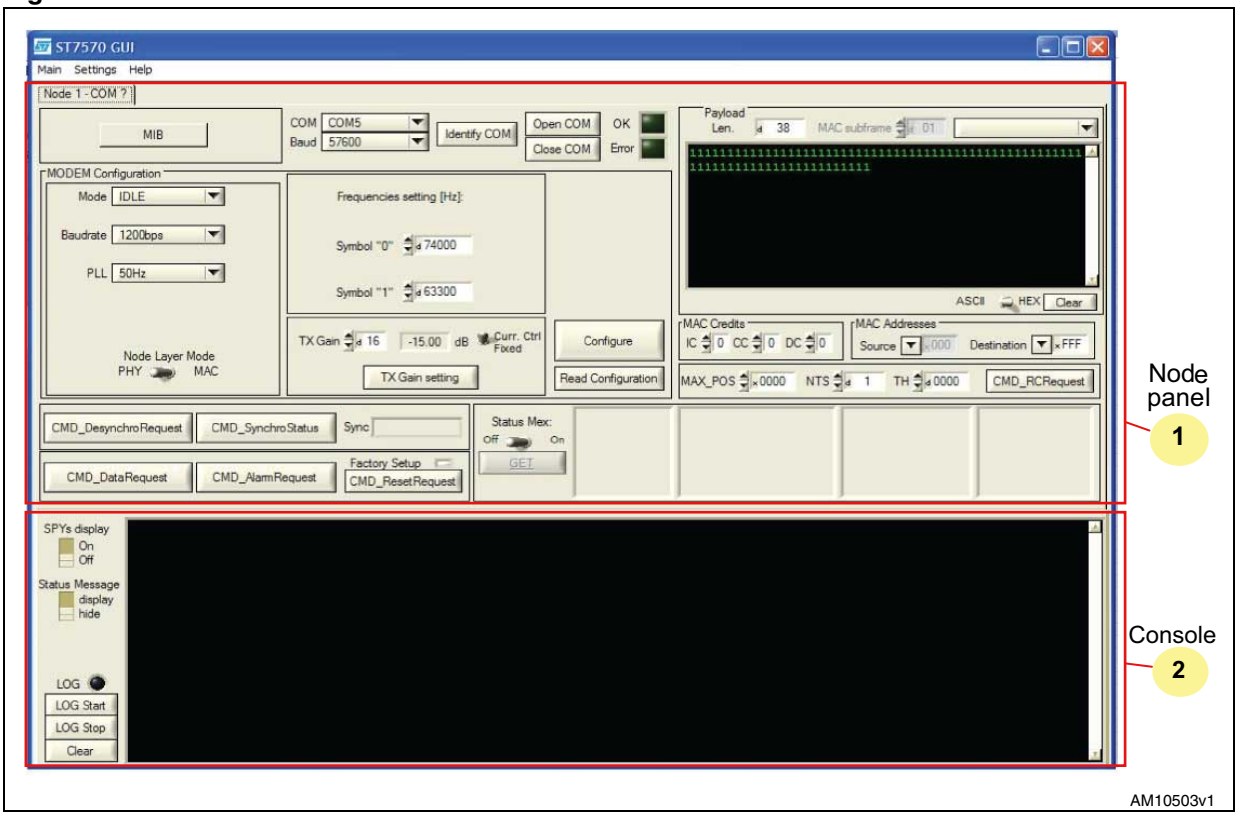
The ST7570 GUI gives the user complete control of the ST7570 device, with full access to all the settings and functions described in [1.]. The GUI can be used to:

- Establish a connection to the ST7570 modem
- Configure the ST7570 and manage all its settings
- Perform any transmission and reception of data and alarms over the power line

Figure 12 shows the main window of the ST7570 GUI. The panel is divided into two sections:

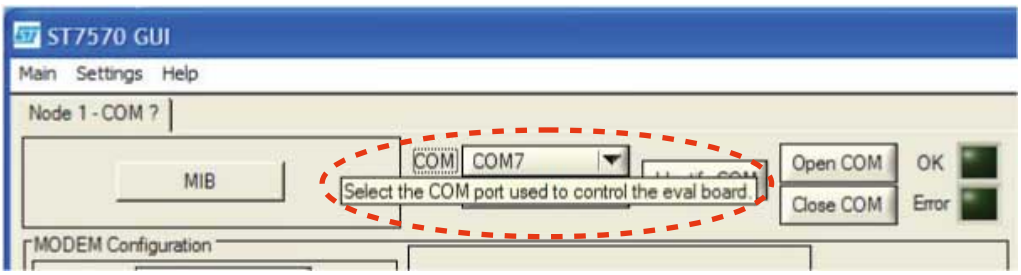
1. Node panel: used to control an ST7570 node. In case of multiple nodes connected to the GUI, the user can switch between the panels through the node panel tabs.
2. Console: box displaying where all the messages exchanged with the node are displayed. In the case of multiple nodes, this panel is common to all the nodes.

Figure 12. ST7570 GUI main window



Almost all graphical interface objects and relative controls show their tooltips, when the user hovers the cursor over this item: these tooltips give information about the meaning and the use of the controls and parameters.

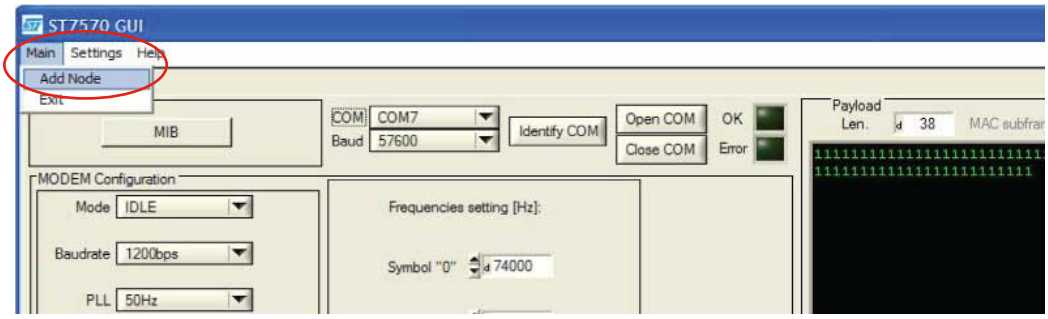
Figure 13. ST7570 GUI tooltip example



4.2 Adding other nodes

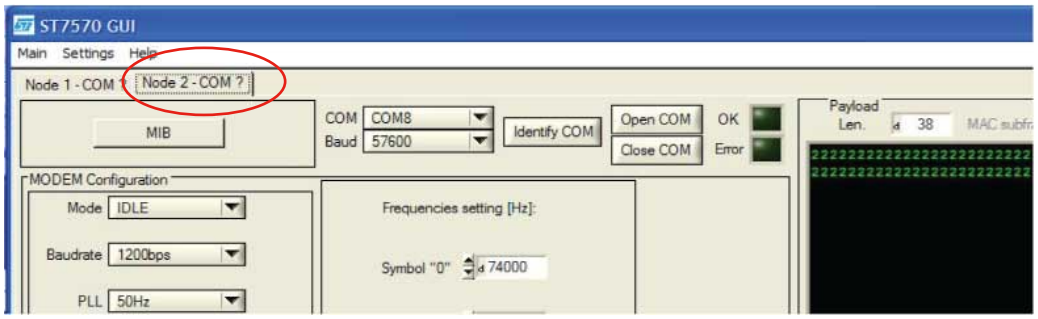
By default, the GUI shows only one node tab in the panel (“Node 1" in *Figure 12*). Nevertheless, a single instance of the ST7570 GUI can control more nodes if needed. To add a new node, left-click on the “Main” menu and then select the menu item “Add node” (*Figure 14*).

Figure 14. “Add node” procedure to add a new node



As a result, a new panel tab appears (with tab “Node 2" in *Figure 15*).

Figure 15. The new node has been added - (panel Node 2) is now available

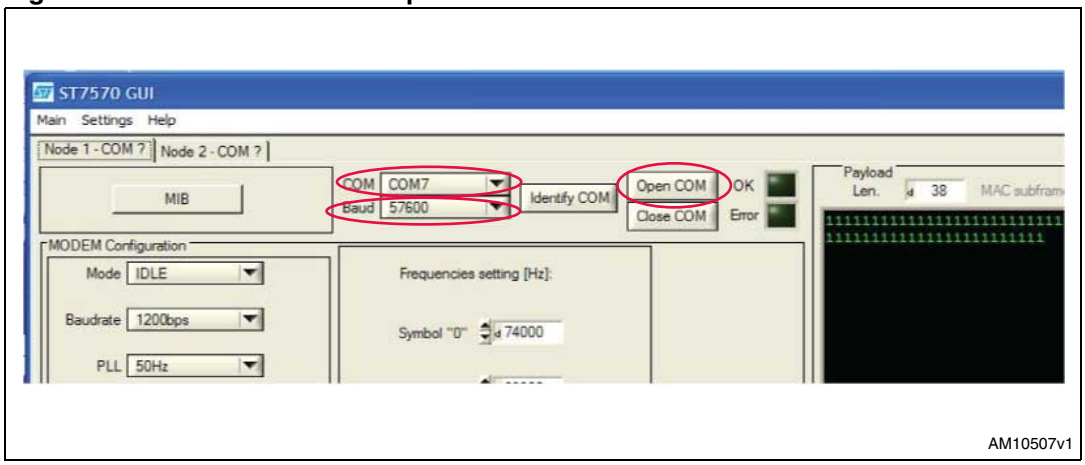


4.3 Opening the COM

To establish communication with the ST7570 demonstration board:

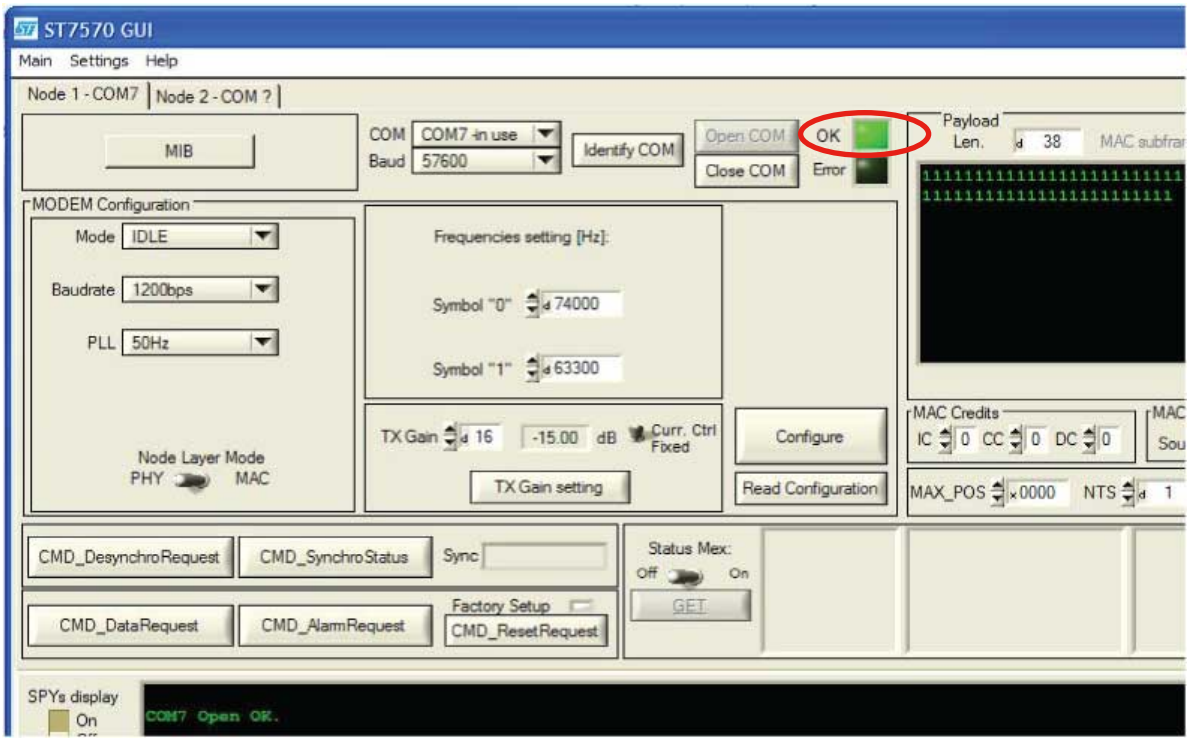
1. Automatically identify or manually select the COM port number associated to the board
2. Select the desired baud rate. Note that modem boards come with a factory default baud rate equal to 57600 bps.

Figure 16. Modem connection procedure



If the connection is properly established, the light switches to green and a positive notification is displayed on the console:

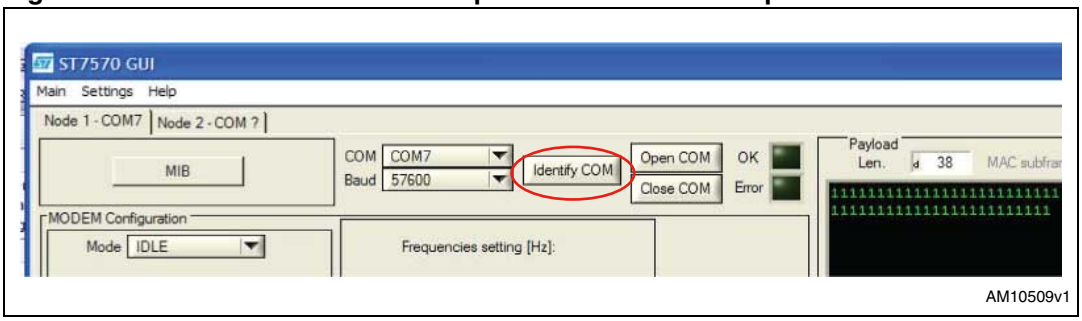
Figure 17. Modem connection success



Automatic COM port number detection

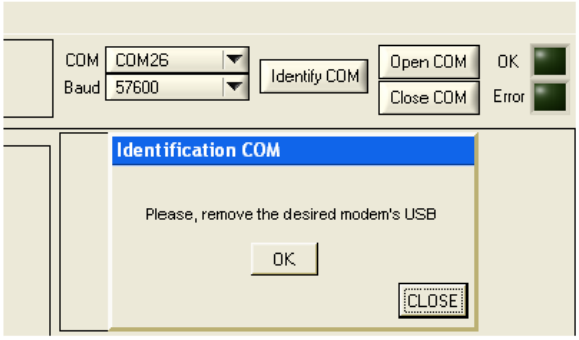
This guided procedure allows the user to simply identify the COM port number related to the board they would like to connect with. As indicated in *Figure 18*, the “Identify COM” button in the node panel must be pressed:

Figure 18. Start the automatic COM port number detection procedure



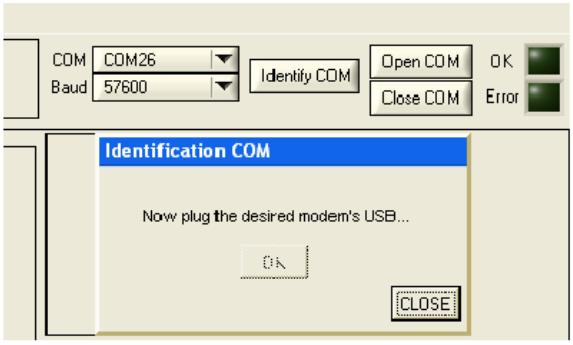
First of all, the procedure invites the user to remove the desired modem's USB cable:

Figure 19. Automatic COM port number detection procedure: step 1



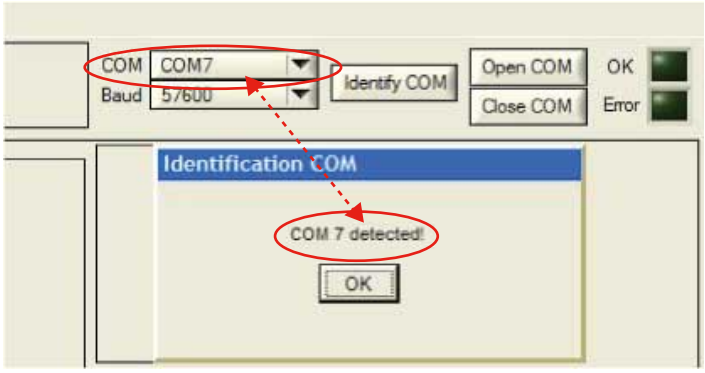
Then the user should plug in the USB cable:

Figure 20. Automatic COM port number detection procedure: step 2



The automatic procedure stops communicating the detected COM number and sets this value in the relative control:

Figure 21. Automatic COM port number detection procedure: final step



5 Services

5.1 Basic modem configuration

At power-on, the modem is in IDLE state (refer to [2.]).

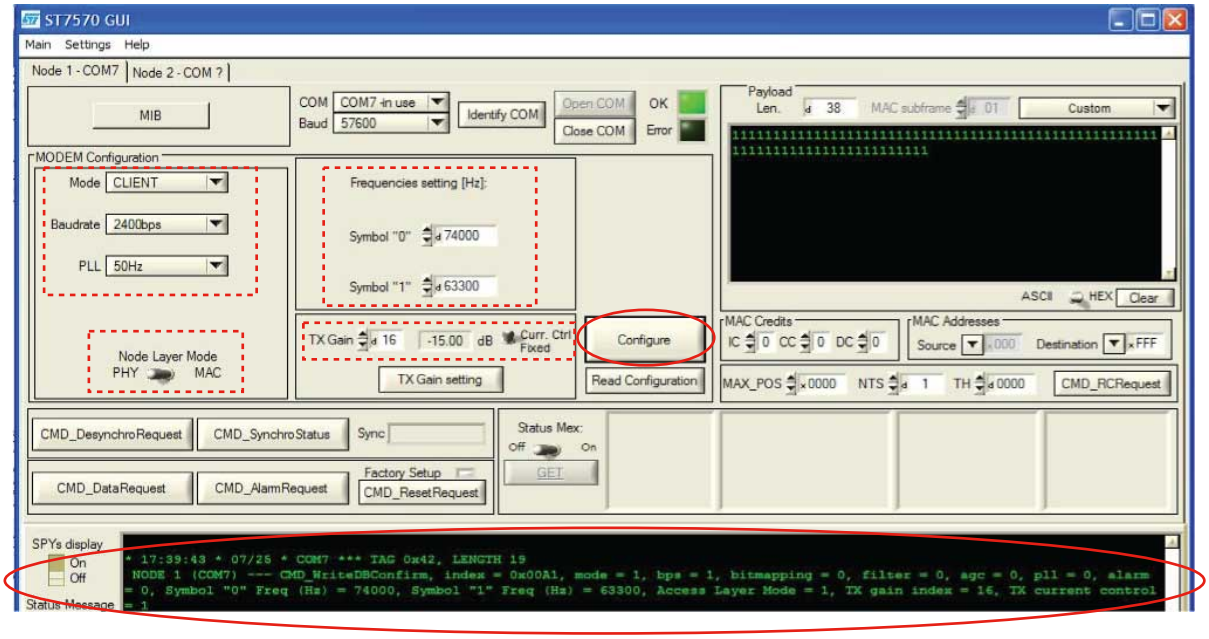
In order to perform communication on the power line, the modem must be configured through the “Configure” button.

This command groups all the basic operating settings of the modem, as resumed in MIB 0x00A1 object (“PLC Configuration”):

- Operating mode
- Bit rate
- Mains frequency
- Transmission gain
- Channel frequencies
- Access layer mode
- Current control

A confirmation (positive or negative) appears on the console notifying that either the configuration required has been successfully set or an error has occurred (*Figure 22*).

Figure 22. Modem configuration



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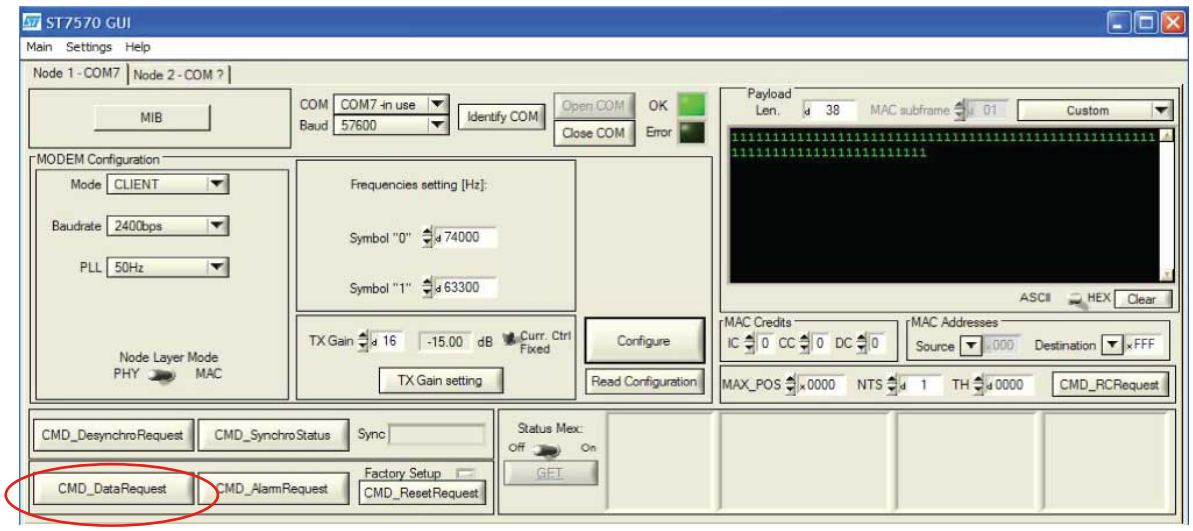
In PHY operating mode, these are all the configuration settings needed to perform transmission and reception on the power line.

5.2 PHY layer communication

In order to perform power line communication between two modems:

1. Open two COM ports, as described in *Section 5.3*.
2. Configure the modems, as described in *Section 6.1* (first node as PHY client, second node as PHY server).
3. Customize (if desired) the payload to be transmitted.
4. Press the CMD_DataRequest button.

Figure 23. PHY power line transmission

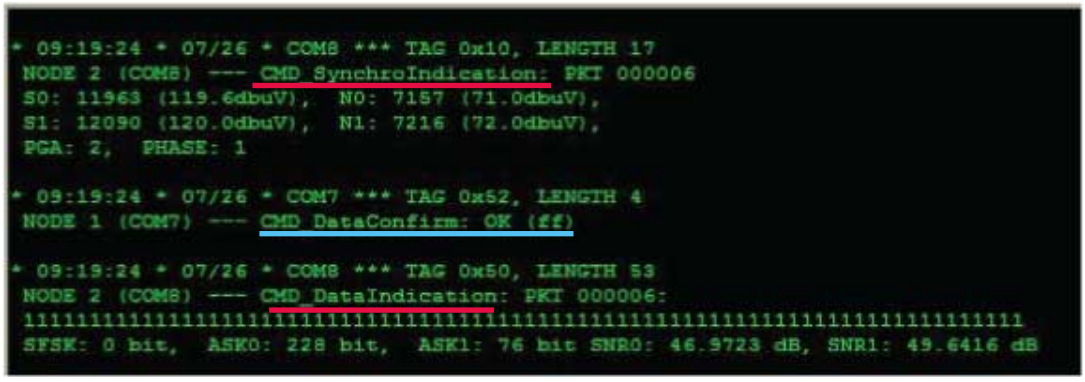


AM10512v1

If the communication is correctly performed, the console displays the successful Data Confirm notification in the client side and the Synchro and Data Indication notifications in the server side.

5. This basic communication test has the same steps as the test described in [2.].

Figure 24. Communication notifications



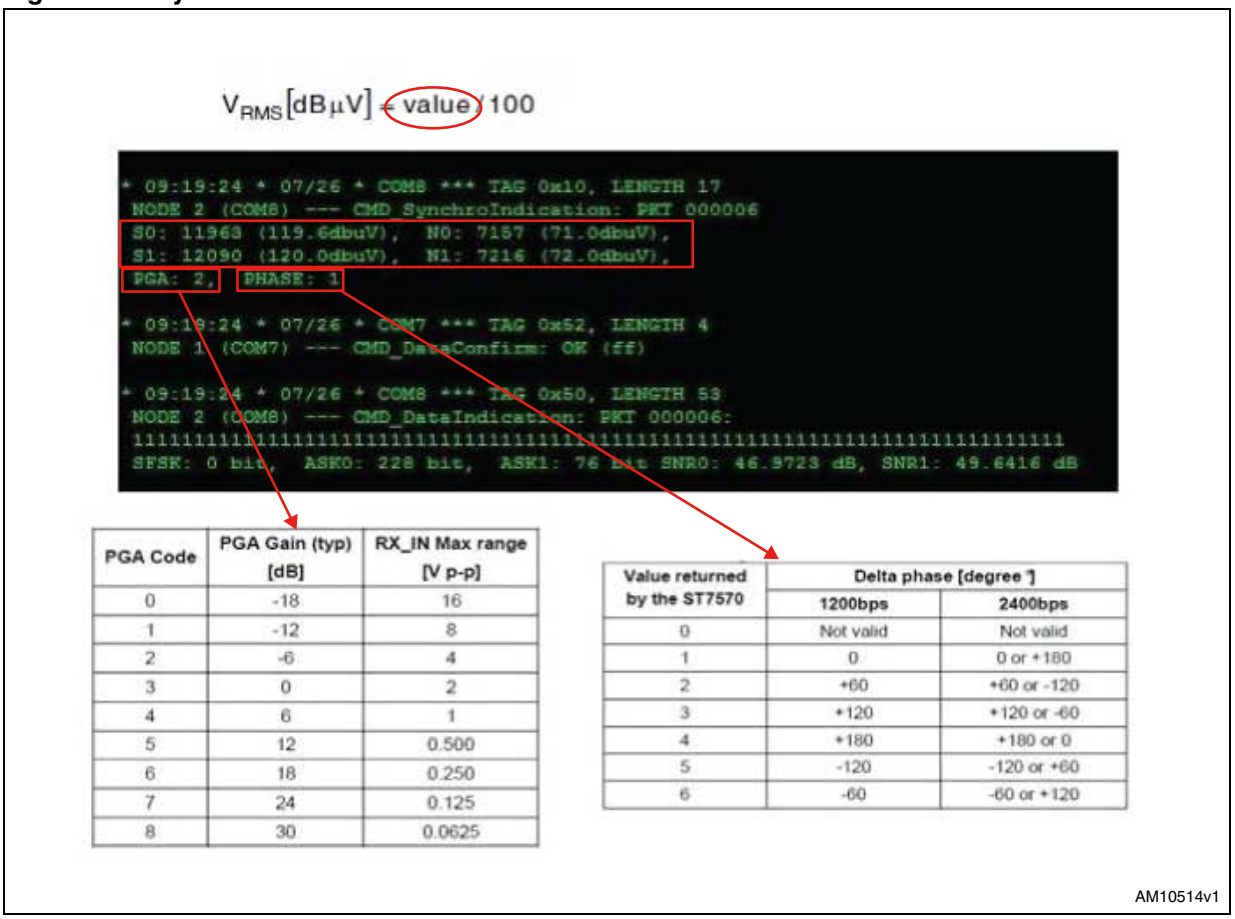
AM10513v1

5.2.1 Synchro indication information

As soon as a valid PRE+SSD has been received by the ST7570, the GUI displays a CMD_SynchroIndication notification in the console box with the related information regarding signal and noise levels, electrical phase and embedded PGA code.

Figure 25 presents the graphical format of the Synchro Indication notification, and it shows how to decode the values displayed of signal and noise levels, electrical phase and PGA code.

Figure 25. Synchro Indication information



PGA Code	PGA Gain (typ) [dB]	RX_IN Max range [V p-p]
0	-18	16
1	-12	8
2	-6	4
3	0	2
4	6	1
5	12	0.500
6	18	0.250
7	24	0.125
8	30	0.0625

Value returned by the ST7570	Delta phase [degree °]	
	1200bps	2400bps
0	Not valid	Not valid
1	0	0 or +180
2	+60	+60 or -120
3	+120	+120 or -60
4	+180	+180 or 0
5	-120	-120 or +60
6	-60	-60 or +120

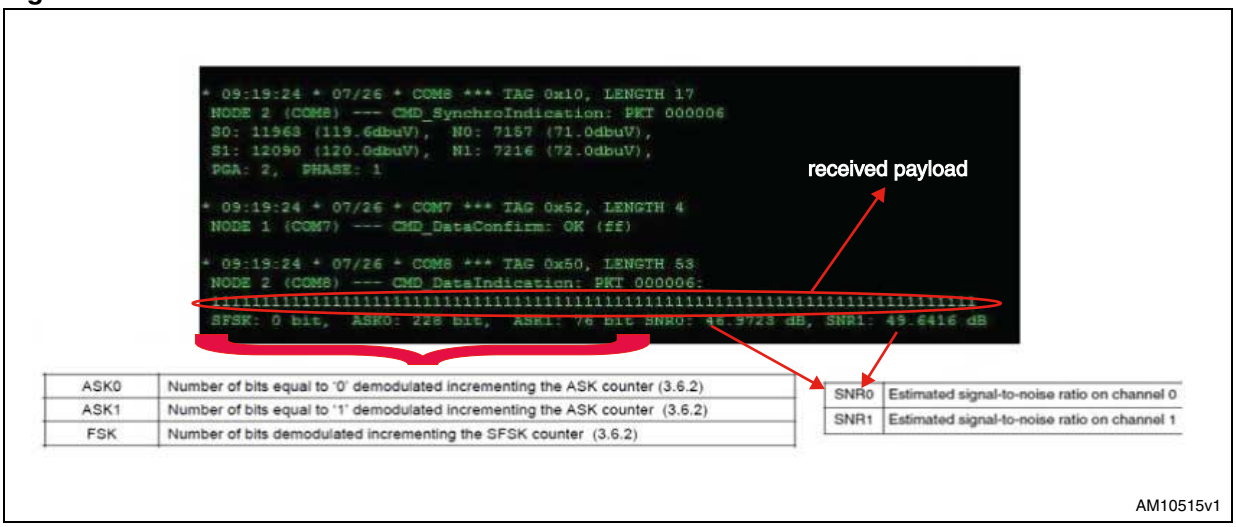
AM10514v1

5.2.2 PHY data indication information

In PHY mode, the Data Indication exchanged from ST7570 to the PC host gives information about the payload of the received frame, the levels of signal and noise estimated during frame reception, and some statistical information about the demodulation procedure.

Figure 26 shows how the ST7570 GUI presents the PHY Data Indication.

Figure 26. Data indication information



5.2.3 Synchronization management

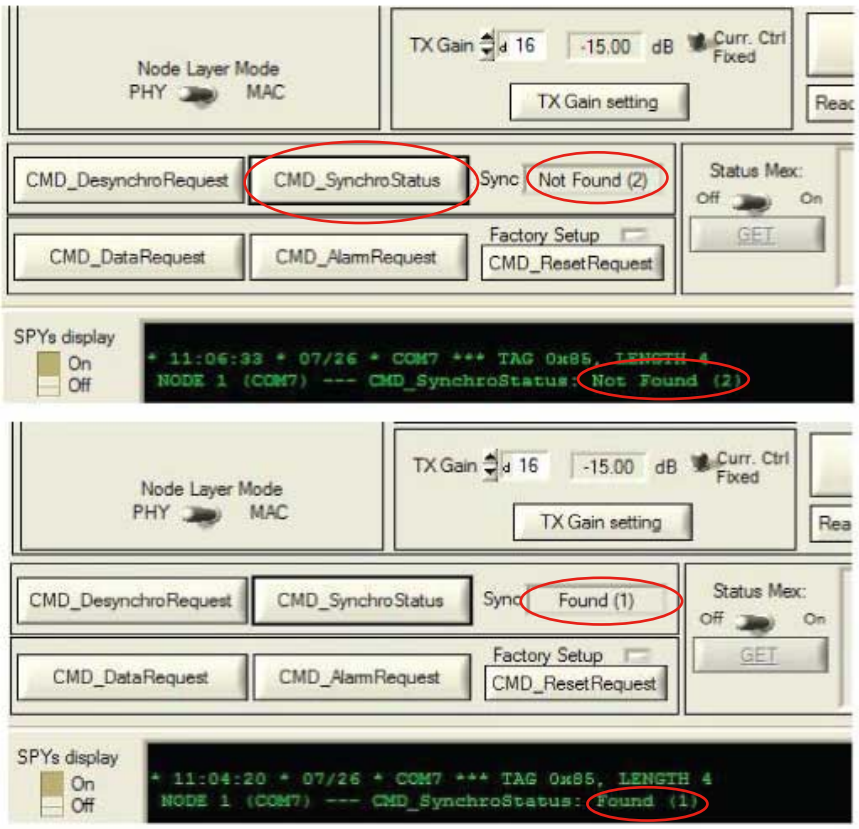
A client modem acquires the timeslot synchronization as soon as a frame is either transmitted or received; a server node is not allowed to transmit if not synchronized, and synchronization can be achieved through a valid reception only.

CMD_SynchroStatus

In the Node tab, the CMD_SynchroStatus button can be used to know the synchronization status of the modem, as it implements the CMD_SyncroStatus command [2.].

Both console and “Sync” box show the modem status: Found(1) or NotFound(2) are the possible answers, as in *Figure 27*.

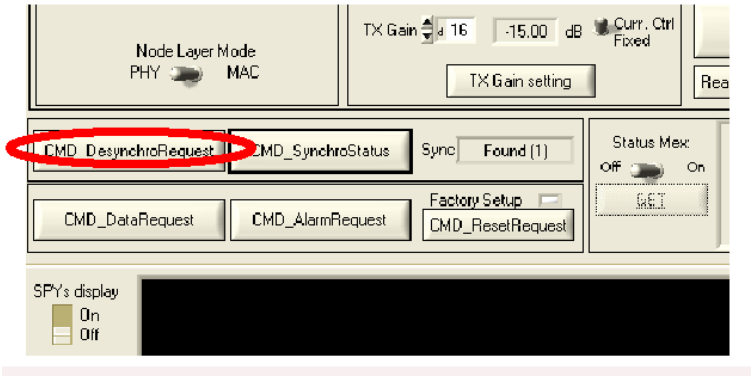
Figure 27. Synchronization status information



CMD_DesynchroRequest

It is possible to force a rejection of the synchronization through the dedicated command CMD_DesynchroRequest. When pressed, the CMD_DesynchroRequest button in the node tab allows this request to be sent. The execution of this command does not generate any answer notification and, therefore, the console does not show any message.

Figure 28. Synchronization reject request command

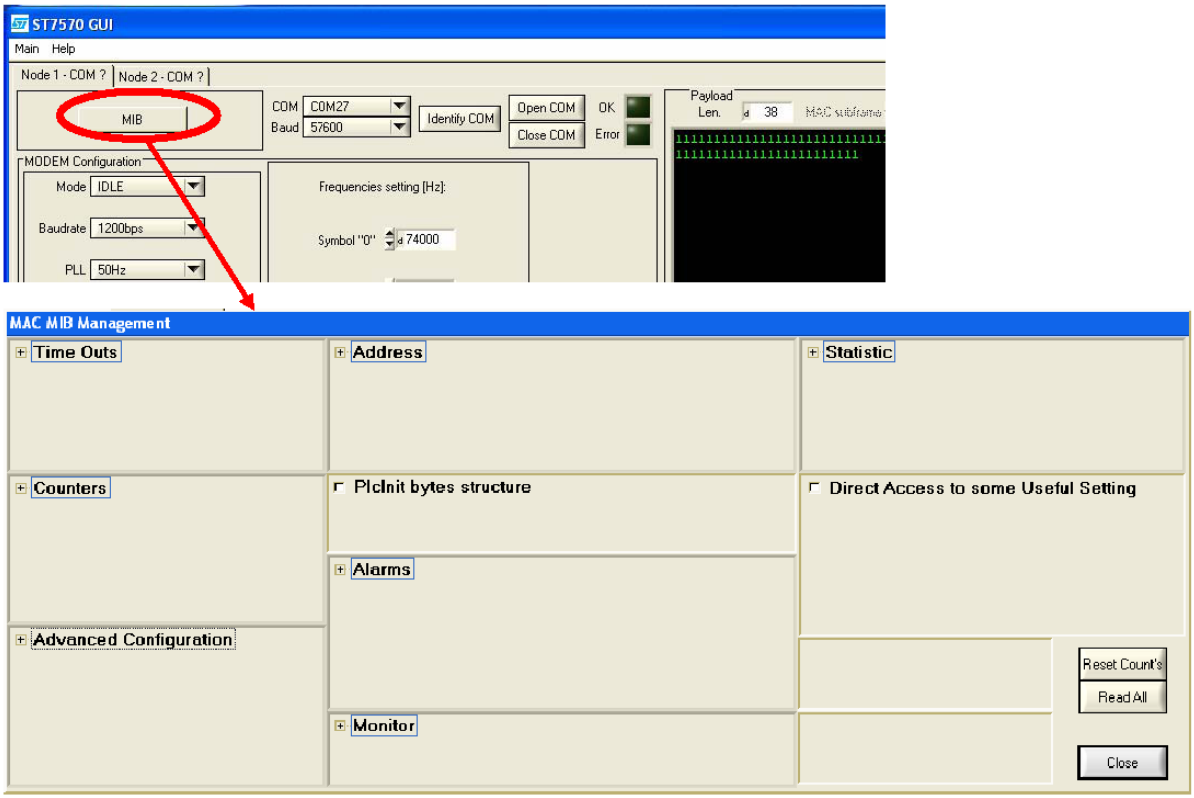


5.3 MIB operations

In addition to basic modem configuration, explained in *Section 6.1*, as described in the IEC61334-5-1 standard, there are several other parameters that influence modem behavior when configured as MAC; all these parameters belong to the MIB and are accessible through MIB write and read operations.

Figure 29 shows the panel that appears once the “MIB” button in the node panel is pressed.

Figure 29. MIB parameter panel default appearance

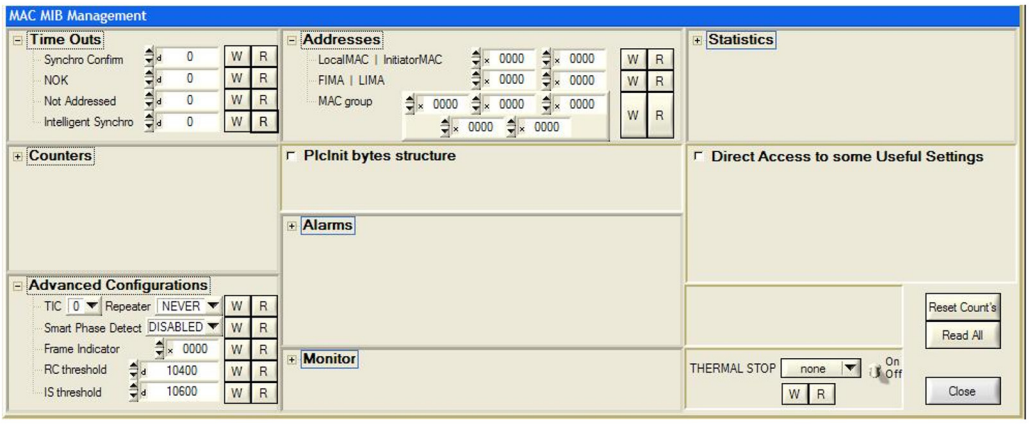


The MIB parameters allowing basic operations at MAC layer are:

1. Addresses: Local MAC address, Initiator MAC address, FIMA and LIMA, and MAC group addresses.
2. Timeout: Time Out Synchro Confirm[sec], Not OK[sec], Not Addressed[min] and Intelligent Synchronization[min].
3. Repeater settings: (for server only).

Figure 29 shows their position in the “MIB” panel.

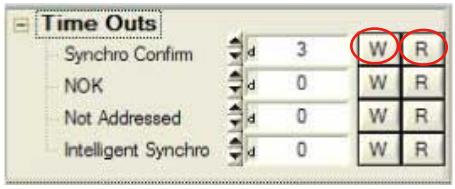
Figure 30. MAC layer configuration parameters



The MIB panel allows to write and read all the MIB objects listed and described in [2.]. The object name used in the label is the same as in [2.] and the object index is shown on the tooltip.

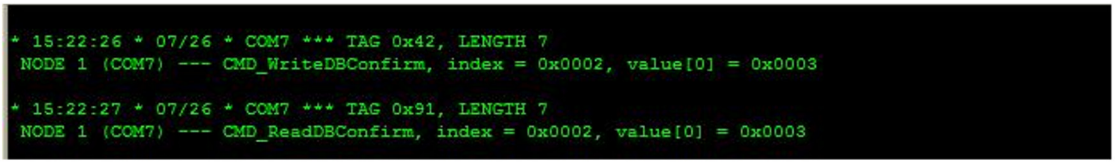
For all MIB objects, the “W” button close to the corresponding box name allows to write the value set in the box in the ST7570 registers. On the other hand, the “R” button reports the current value stored in the ST7570 registers and it is displayed in the corresponding box name.

Figure 31. MIB object writing and reading



The GUI console displays the result of both operations, as in *Figure 32*:

Figure 32. MIB object writing and reading: console messages



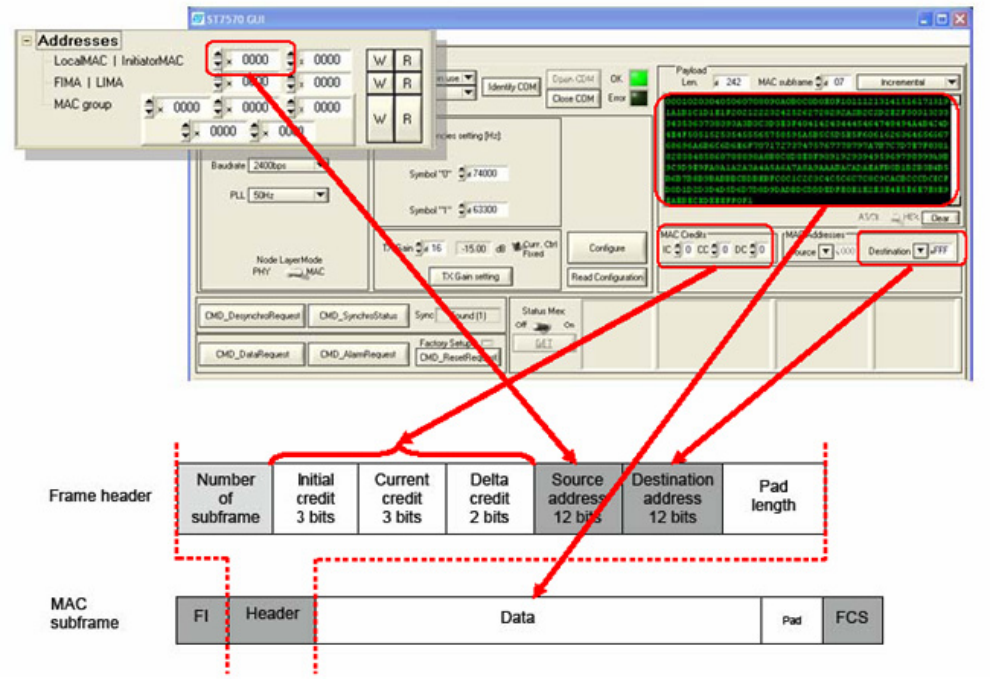
5.4 MAC layer communication

In order to perform communication in MAC mode, follow the steps listed in *Section 6.2* making sure the operating mode is set to MAC instead of PHY.

5.4.1 MAC frame transmission

As described in [*3.*],the standard MAC frame is made up of several parameters that can be set directly in the GUI, as shown in *Figure 33*. When the CMD_DataRequest button is pressed (i.e. the user is requesting a packet transmission), the ST7570 GUI software sends a proper command to the modem with the parameters values.

Figure 33. MAC layer frame composition



If the communication is correctly performed, the console displays the successful Data Confirm notification in the client side and the Synchro Found and Data Indication notifications in the server side.

Figure 34. MAC communication notifications

```
* 15:27:08 * 07/26 * COM8 *** TAG 0x10, LENGTH 18
 NODE 2 (COM8) --- CMD_SynchroIndication_Found (0x01),
 S0: 11967 (119.0dbuV),  N0: 7090 (70.0dbuV),
 S1: 12091 (120.0dbuV),  N1: 7090 (70.0dbuV),
 PGA: 2,  PHASE: 6

* 15:27:08 * 07/26 * COM7 *** TAG 0x52, LENGTH 4
 NODE 1 (COM7) --- CMD_DataConfirm: OK (ff)

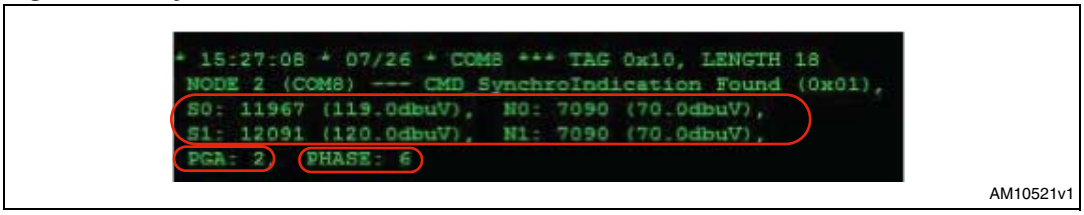
* 15:27:08 * 07/26 * COM8 *** TAG 0x50, LENGTH 34
 NODE 2 (COM8) --- CMD_DataIndication: DA: 0xfff, SA: 0xc00, IC: 0, CC: 0, DC: 0, PL: 0, (length: 26)
 M_sdu: 11111111111111111111111111111111111111111111111111111111
```

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5.4.2 Synchro indication found information

All the additional information provided in this notification has the same meaning as in the PHY layer and is explained in *Section 6.2.1*.

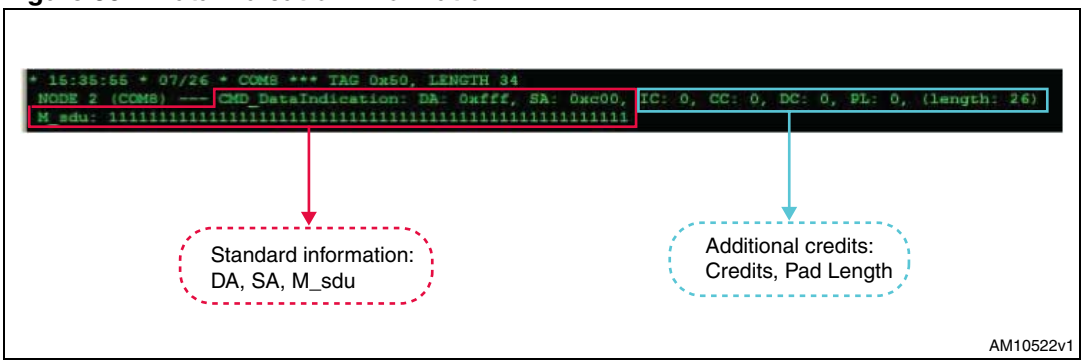
Figure 35. Synchro indication found information



5.4.3 MAC data indication information

This notification contains standard information (specified in IEC61334-5-1) and additional information about the frame credits and the eventual padding.

Figure 36. Data indication information

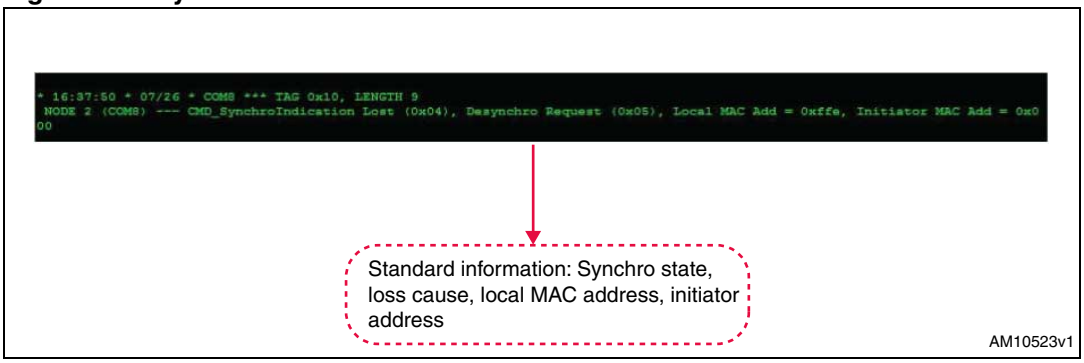


5.4.4 Synchronization management notification

Figure 37 shows an example of the synchronization lost notification.

All the related fields are coded in accordance with [*2.*].

Figure 37. Synchro indication lost information

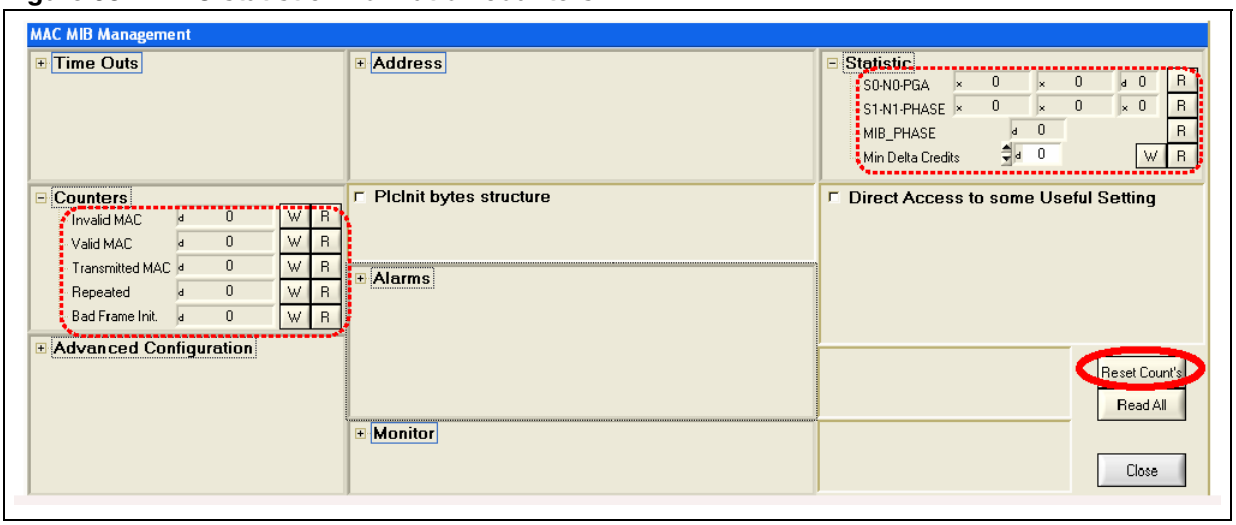


5.4.5 Statistic information

Several MIB variables (accessible through indexed MIB write and read operations) allow a complete analysis of the communicating behavior and performance of the modem set in MAC mode.

The writing operation on these statistic variables causes a reset to default values and the Reset Count's button resets all the counter values.

Figure 38. MAC statistic information counters

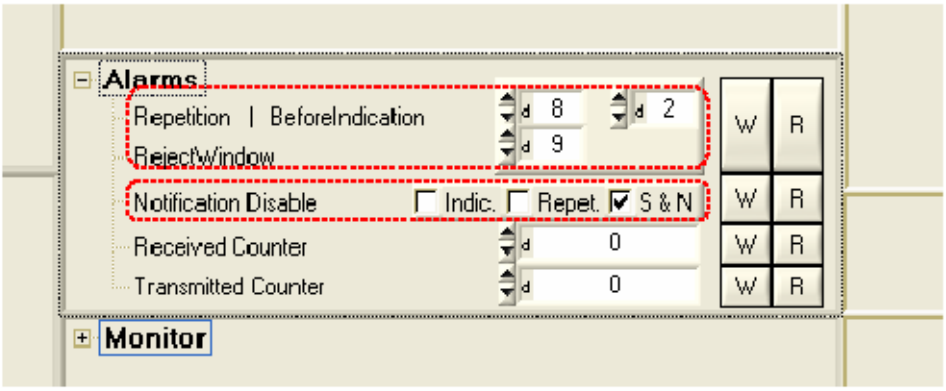


5.5 Alarm services

Once synchronized, the node can transmit, receive, and repeat alarms according to the settings stored in the following MIB objects:

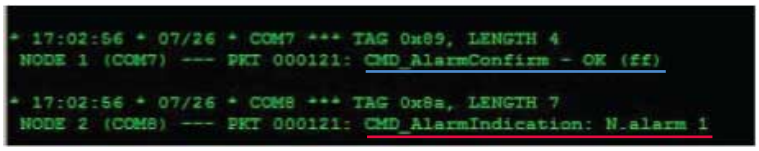
1. Alarm Repetition number, Alarm Before Indication number, Alarm Reject Window number: MIB object 0085h in [2.].
2. Disable Alarm Indication, Disable Alarm Repetition, Disable Alarm SN Indication: MIB object 0086h in [2.].

Figure 39. Alarm service settings



In case of alarm transmission, the console displays the successful Alarm Confirm notification in the client side and the Alarm Indication notification with the total number of received alarms in the server side.

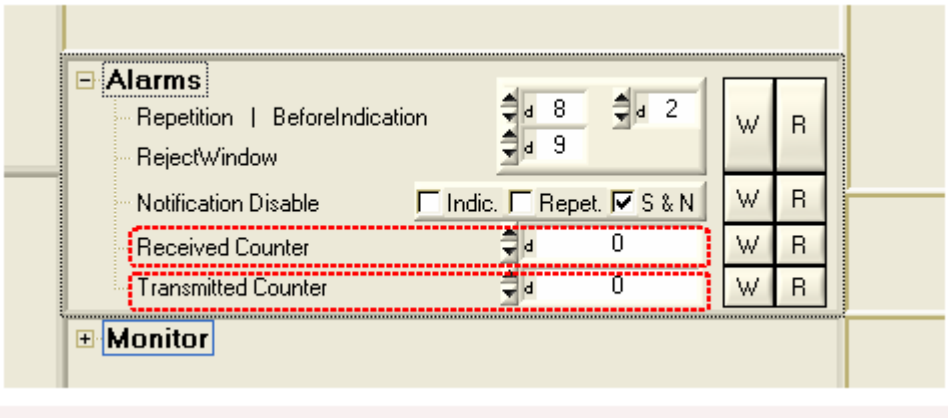
Figure 40. Alarm service notifications



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Through MIB alarm counters (MIB object 0083h, 0084h in [2.]), it is also possible to know the total number of transmitted and received alarms (these values depend on the alarm setting):

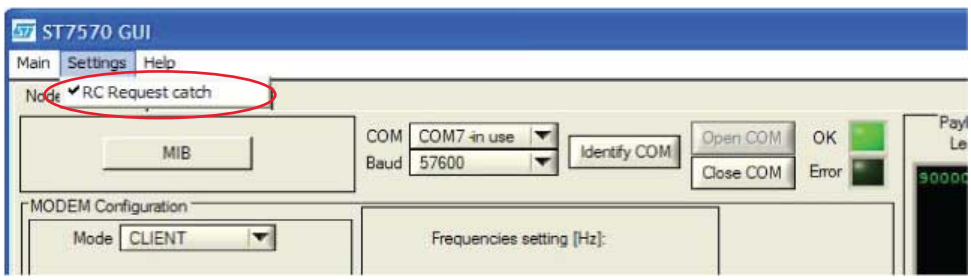
Figure 41. Alarm counters controls



5.6 Repeater Call

The ST7570 GUI allows the user to manage the Repeater Call for both MAC Client and Server nodes. In order to activate the automatic recognition of the Repeater Call procedure, the “RC Request Catch” setting must be ticked as in *Figure 42*.

Figure 42. RC request catch setting



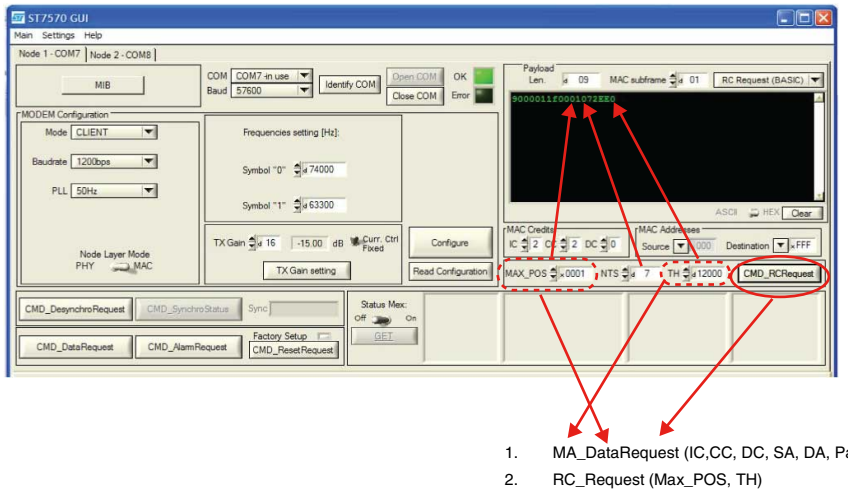
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5.6.1 Repeater Call for client nodes

The Repeater Call service is started by a Client node in accordance with the details presented in [2]. By pressing the CMD_RC Request button with the parameters presented in *Figure 43* properly filled, the GUI performs both operations:

- send a MAC data request command to the connected modem following the upper protocol layer specifications for Data Payload; the Payload window automatically switches to the RC Request (BASIC) item; the data transmission takes into account the credit parameters expressed in the GUI (the IC parameter must be greater than 0 so that the modem can accept the RC Request)
- send an RC Request to the modem while powerline transmission is in progress to respect the RC mechanism, with the TX_POS, RC_THRESHOLD parameters expressed in the GUI.

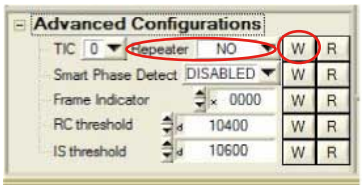
Figure 43. Repeater Call request for client



5.6.2 Repeater Call for server nodes

In order to activate the Repeater Call service for server nodes, the MIB object 000Bh (repeater settings) must be written to either a “No” or “Yes” value through the referred ring menu from the MIB panel, as in *Figure 44*.

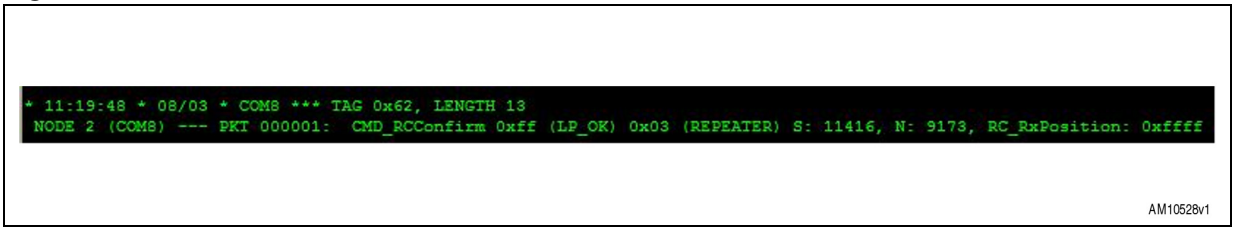
Figure 44. Repeater settings for server node



After a valid reception of a MAC frame properly filled to announce the Repeater Call mechanism (as the one sent by the Client in *Section 5.6.1*), if the Server receives an RC

pattern during the next timeslot, the GUI console displays the RC Confirm with all its parameters:

Figure 45. RC confirm for server node



6 References

1. STMicroelectronics, ST7570; *S-FSK power line networking system-on-chip*, datasheet
2. STMicroelectronics, UM0934; *FSK, PSK Multi-Mode Power Line Networking System On Chip*, user manual
3. International Electrotechnical Commission (IEC), IEC 61334-5-1 ed2.0, www.iec.ch

7 Revision history

Table 2. Document revision history

Date	Revision	Changes
22-Nov-2010	1	Initial release.
04-Nov-2011	2	– Modified: *Table 1* – Changed: *Figure 12*, *13*, *14*, *15*, *16*, *17*, *18*, *21*, *22*, *23*, *24*, *25*, *26*, *27*, *30*, *31*, *32*, *34*, *35*, *36*, *37* and *40* – Added: *Section 5.6*

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