LMX98xx Bluetooth Serial Port Modules - Quick Setup Guide

National Semiconductor
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Introduction

The National Semiconductor® Simply Blue modules are highly integrated radio, baseband controller and memory devices. All hardware and firmware is included to provide a complete solution from antenna through the complete lower and upper layers of the Bluetooth stack, up to the application including the Generic Access Profile (GAP), the Service Discovery Application Profile (SDAP), and the Serial Port Profile (SPP). The module includes a configurable service database to fulfil service requests for additional profiles on the host.

The LMX9820A/LMX9830 is optimized to handle the data and link management processing requirements of a Bluetooth node. The firmware supplied within this device offers a complete Bluetooth stack including profiles and command interface. This firmware features point-to-point and point-to-multipoint link management supporting data rates up to the theoretical maximum over RFComm of 704 kbps. The internal memory supports up to 7 active Bluetooth data links and 1 active SCO link.

This document will give a quick introduction into different usage scenarios of the LMX9820A/LMX9830 Simply Blue Module. The guide refers to the deliverables you have received with the LMX9820ADEVKIT, LMX9820ADONGLE, LMX9830DEVKIT or LMX9830DONGLE.

This document is based on:

Table 0-1. Version Information

Item	Version	
Hardware	LMX9820ASM	LMX9830
Firmware	V6.00 and later	V1.06 or later
Actual Firmware Release in production	V6.21	V2.10

Table of Contents

1.0 Installation

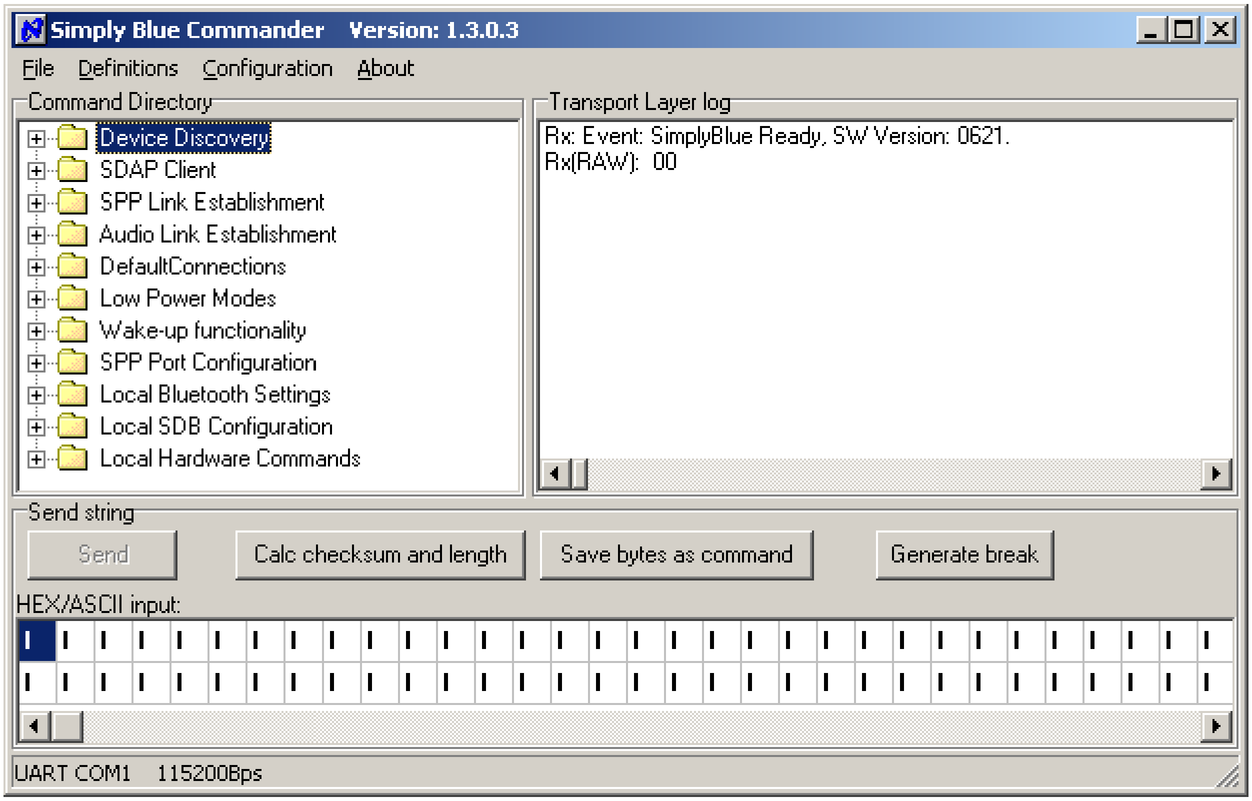
1.1 INSTALL SIMPLY BLUE COMMANDER

The Simply Blue Commander is an easy to use application which enables you to send single commands to the LMX9820A/ LMX9830 Evalboard. The built-in command and event interpreter generates an easy to read log of the UART traffic between the application and the LMX9820A/LMX9830.

For the installation of the program please refer to the “Simply Blue Commander User Guide”.

After installation please make sure the connection between PC and Board is set up and working.

The screen should come up like shown in Figure 1-1.



```
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Rx(RAW):  00
```

UART COM1   115200Bps

Figure 1-1. Simply Blue Commander

1.2 INSTALL IVT BLUETOOTH STACK

In case you do not have any other bluetooth device for testing, each LMX9820A/LMX9830 Evaluation board includes one ABE USB Dongle. This dongle is a standard Bluetooth USB dongle based on National’s standard HCI products LMX9814 or LMX5452.

In order to be able to work with a HCI based dongle, a host stack (windows stack) has to be installed on your PC. The dongle is shipped with the IVT windows stack.

Please insert the CD delivered with the ABE USB Dongle and follow the instructions of the setup. After the installation please plug the dongle into an available USB port. The PC should detect the dongle and install the necessary drivers.

Afterwards the stack is ready and should show up as the picture below. The task bar should include a blue/white colored bluetooth sign.

NOTE: The IVT Stack is only necessary in combination with the ABE Bluetooth USB Dongle. which can be used as counterpart for the LMX9820A/LMX9830. It is not necessary to drive the LMX9820A/LMX9830.

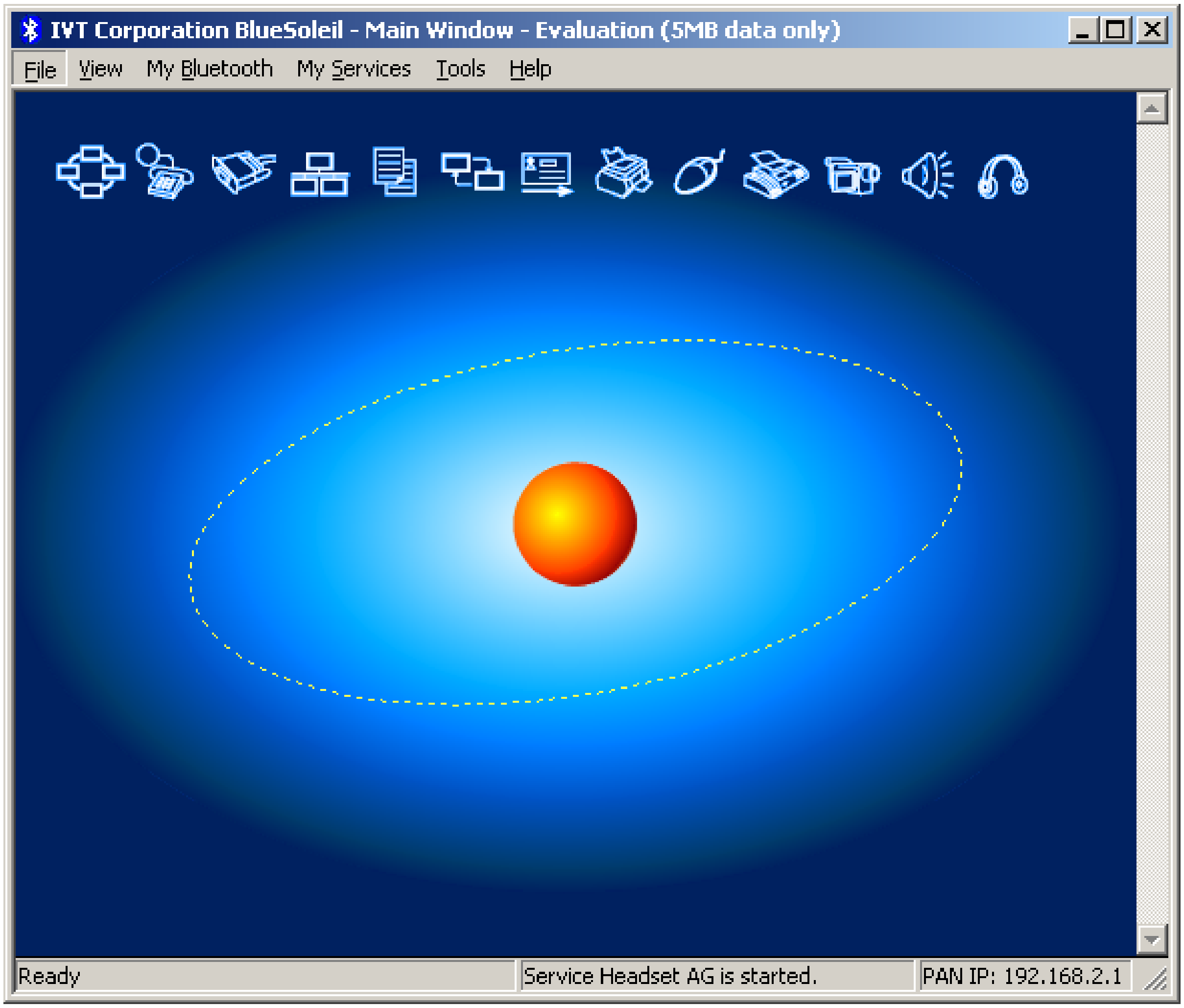

IVT Corporation BlueSoleil - Main Window - Evaluation (5MB data only)
File
View
My Bluetooth
My Services
Tools
Help
Ready
Service Headset AG is started.
PAN IP: 192.168.2.1

Figure 1-2. IVT Stack Startwindow

1.3 SETTING UP HYPERTERMINAL

Simple serial port data transfers can be done by using a standard serial port terminal program like the Microsoft Hyperterminal. The program is part of Windows 2000/XP.

Some of the demonstrations later on are based on hyperterminal. For this, please make sure Hyperterminal or a similar terminal program is available on the system.

You'll find hyperterminal within the Windows environment within the Start Menu under “Start/All Programs/Accessories/ Communication”. Please see Figure 1-3 where to find “Hyperterminal”.

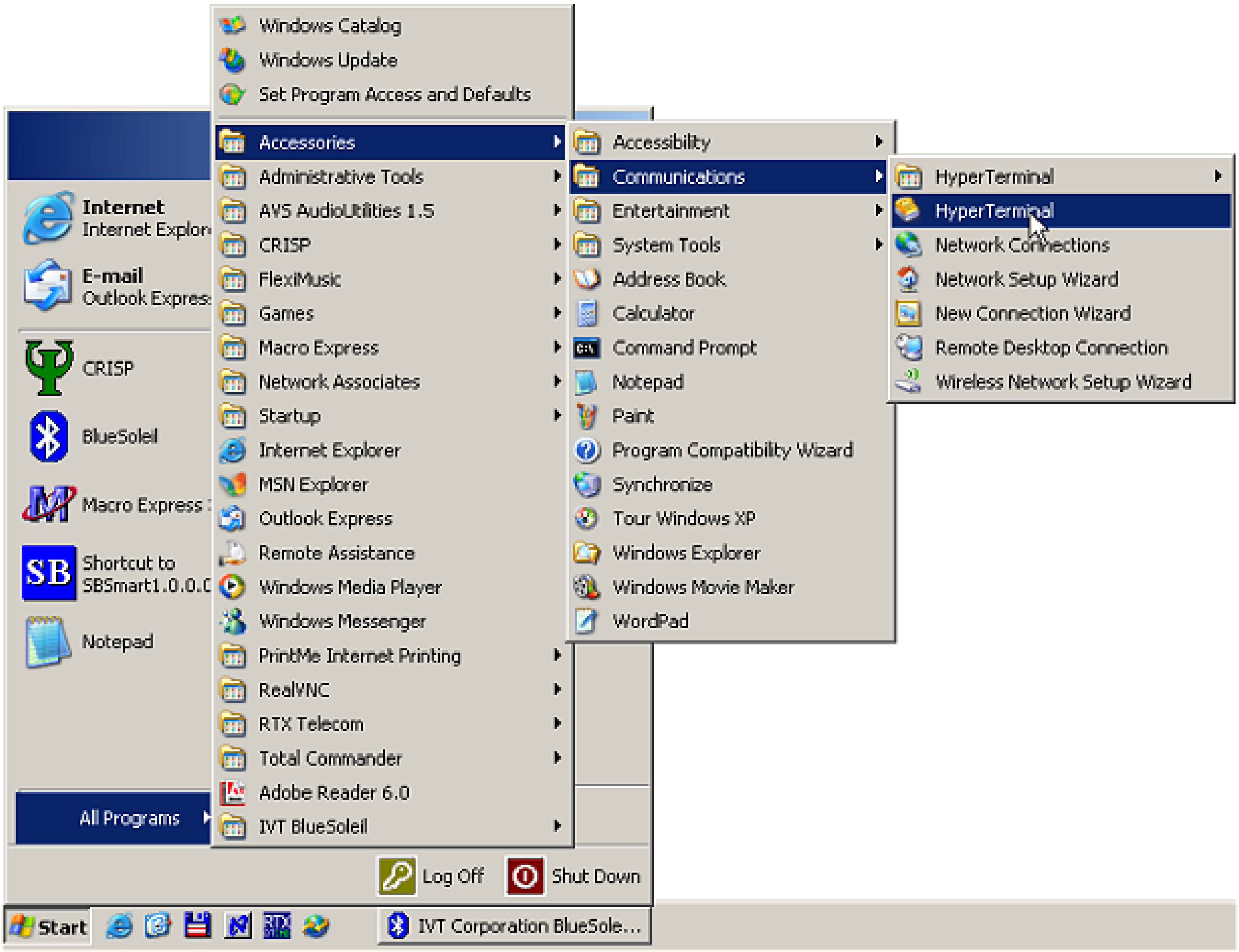


Figure 1-3. Check availability of Hyperterminal

2.0 Setup descriptions

The LMX9820A/LMX9830 is a full bluetooth node, by default configured to listen for incoming links. The command interface also offers to ability to configure the device and actively setup links.

The following examples shall give an quick introduction into the different functionalities of the LMX9820A/LMX9830.

2.1 CABLE REPLACEMENT WITH LMX9820A/LMX9830 WAITING FOR INCOMING CONNECTION

By default the LMX9820A/LMX9830 is configured to be visible (discoverable) and connectable for other devices. The service database offers one “Serial Port Profile” (SPP) service called “COM1”.
In case the LMX9820A/LMX9830 is connected by a remote device it will indicate the incoming link by a short event on the UART and then switch to transparent meaning it will not try to interpret incoming data on the UART directly to the bluetooth interface. Incoming data on the bluetooth interface are directly routed to the UART interface without framing them into Simply Blue specific packets.

The demo is based on using Hyperterminal on both sides to create a simple serial port connection between two devices using the USB dongle as connecting device and LMX9820A/LMX9830 as ‘passive’ waiting device.

2.1.1 Connect Hyperterminal to LMX9820A/LMX9830

Since the LMX9820A/LMX9830 is waiting for an incoming automatically no specific action has been taken on this side. In order to monitor the incoming data on the UART any terminal program able to talk to a serial port can be used. This example uses the Hyperterminal application.

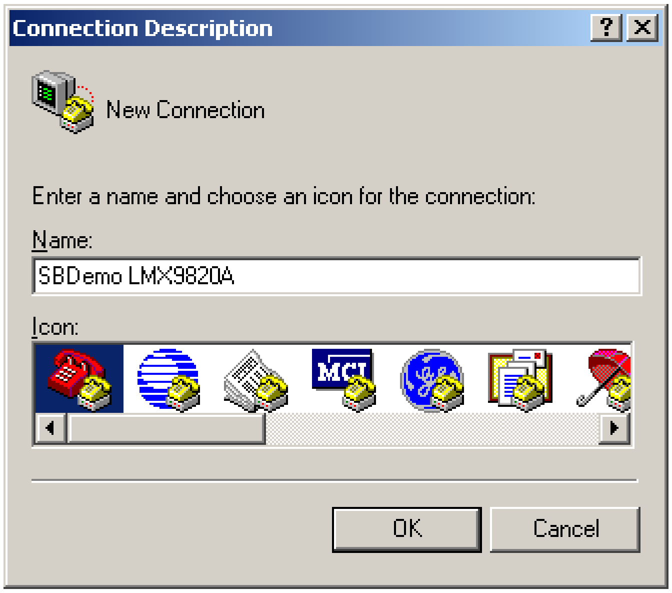
The following steps should be followed to connect “Hyperterminal” to the LMX9820A/LMX9830 Evaluation Board.

2.1.1.1 Start Hyperterminal

Start Hyperterminal as described in Section 1.3. Please make sure no other application (e.g. Simply Blue Commander) is using the same port as the LMX9820A/LMX9830 Evaluation Kit.

2.1.1.2 Create new connection

Create a new connection by typing a connection name like “SBDemo LMX9820A”.

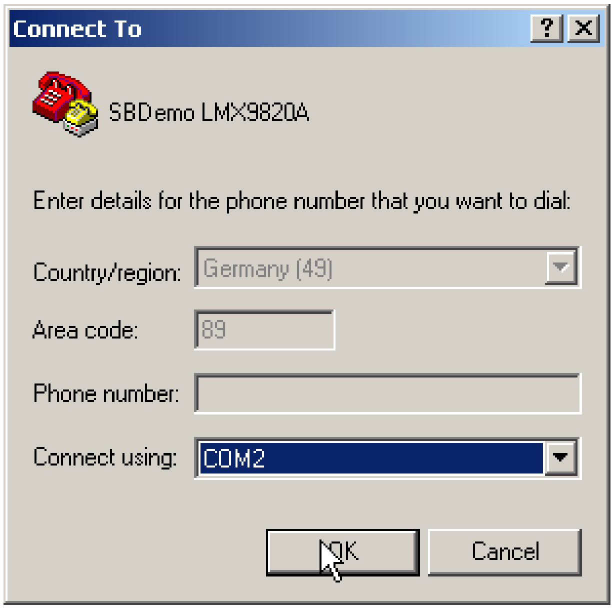


Enter a name and choose an icon for the connection:
Name:
SBDemo LMX9820A

Figure 2-1. Create New Connection in Hyperterminal

2.1.1.3 Choose correct comport

Since Hyperterminal is physically talking to a serial port, please choose the serial port the LMX9820A/LMX9830 Evaluation Board is connected to, e.g. COM2 of your PC.


Connect To

SBDemo LMX9820A

Enter details for the phone number that you want to dial:

Country/region: Germany (49)

Area code: 89

Phone number:

Connect using: COM2

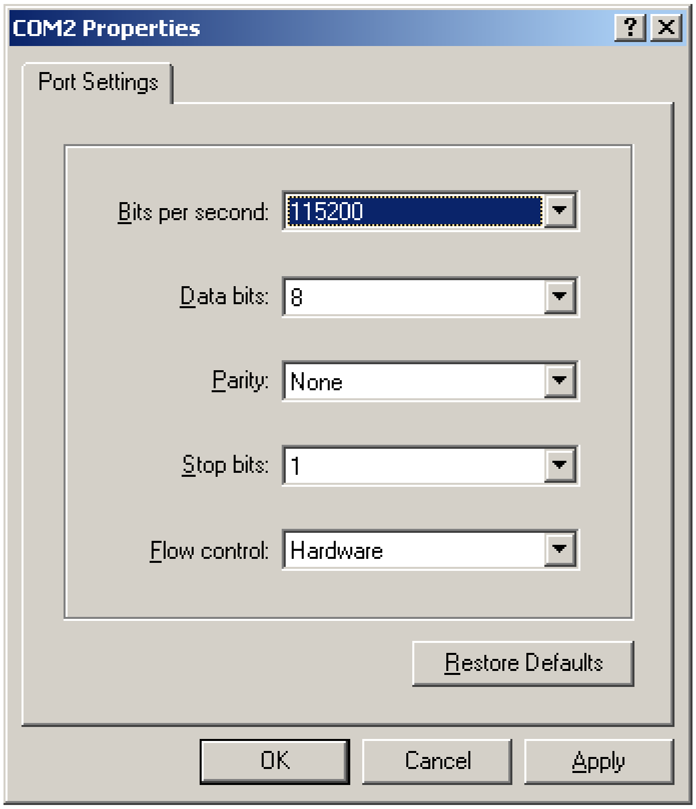
Figure 2-2. Choose correct comport

2.1.1.4 Choose comport settings

Choose the correct comport settings for your LMX9820A/LMX9830 Evaluation board. By default the board is configured to 115.200kbit/s, No Parity, 1 Stopbit. Please make sure Hardware Flow Control is selected in the dialog.

The UART speed of the LMX9820A Evaluation board is configured by the ISEL Pins for LMX9820A. For 115.200kbit/s the setting needs to be ISEL1=0, ISEL2=1.

The LMX9830 UART settings is done by configuring pins OP3, OP4 and OP5. The setting for 115.2kbit/s is OP3=1, OP4=1 and OP5=0



COM2 Properties

Port Settings

Bits per second: 115200

Data bits: 8

Parity: None

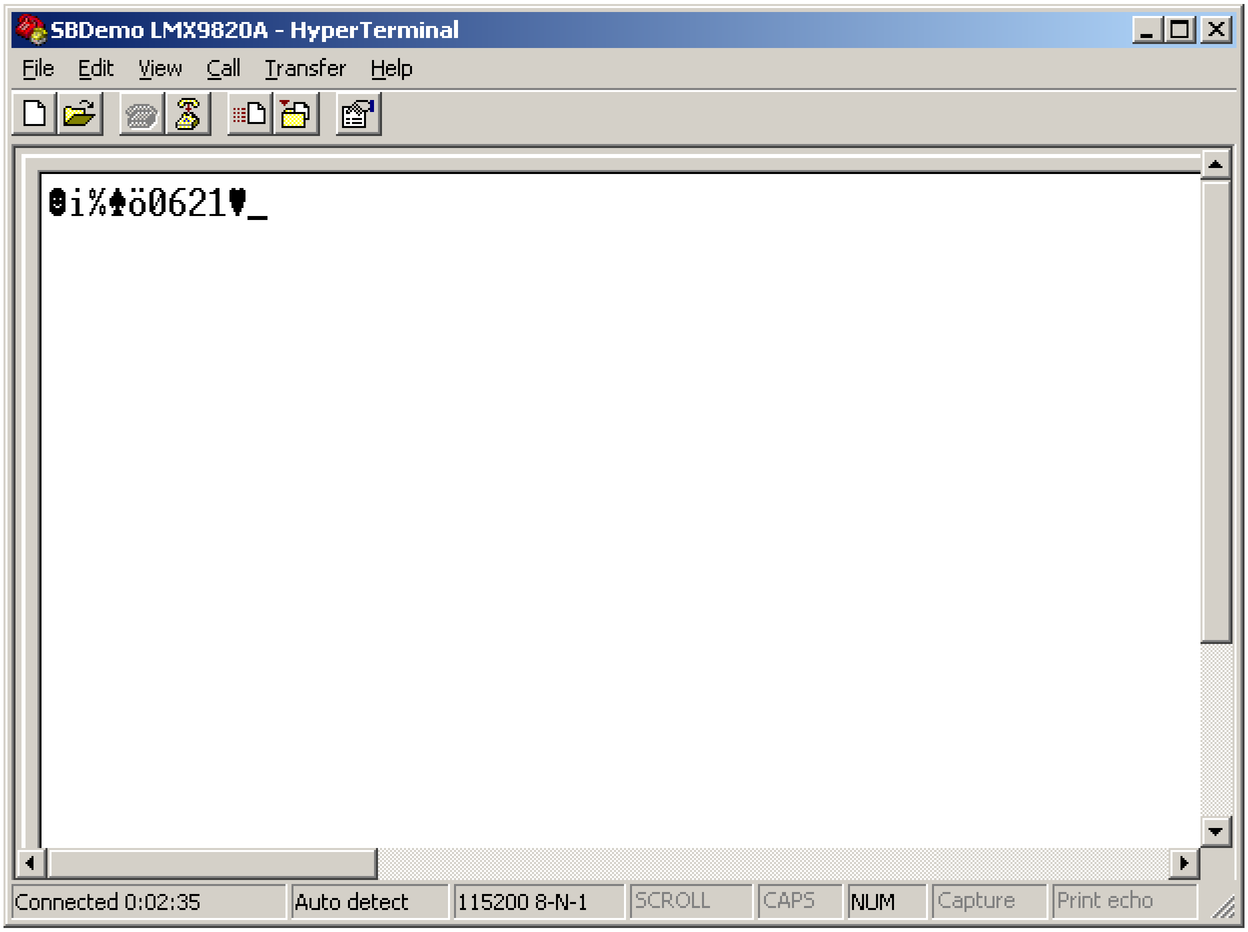
Stop bits: 1

Flow control: Hardware

Figure 2-3. Choose comport settings

2.1.1.5 Reset the LMX9820A/LMX9830 Evaluation Board

Once the correct speed is chosen “Hyperterminal” should connect to the selected comport. Afterwards a hardware reset of the LMX9820A/LMX9830 Evaluation board should cause a response as shown in Figure 2-4. The cryptic characters are specific hex values which are part of the Simply Blue interface event. The “0621” indicates the firmware version. which might be different to your board. Please refer to [1] for a detailed description of this event.
If this event is received the communication between “Hyperterminal” and the LMX9820A/LMX9830 Evaluation board is confirmed.



SBDemo LMX9820A - HyperTerminal
File Edit View Call Transfer Help
SCROLL
CAPS
NUM
Capture
Print echo

```
☻i%♠ö0621♥_
```

Connected 0:02:35 | Auto detect | 115200 8-N-1

Figure 2-4. Firmware Response after Reset

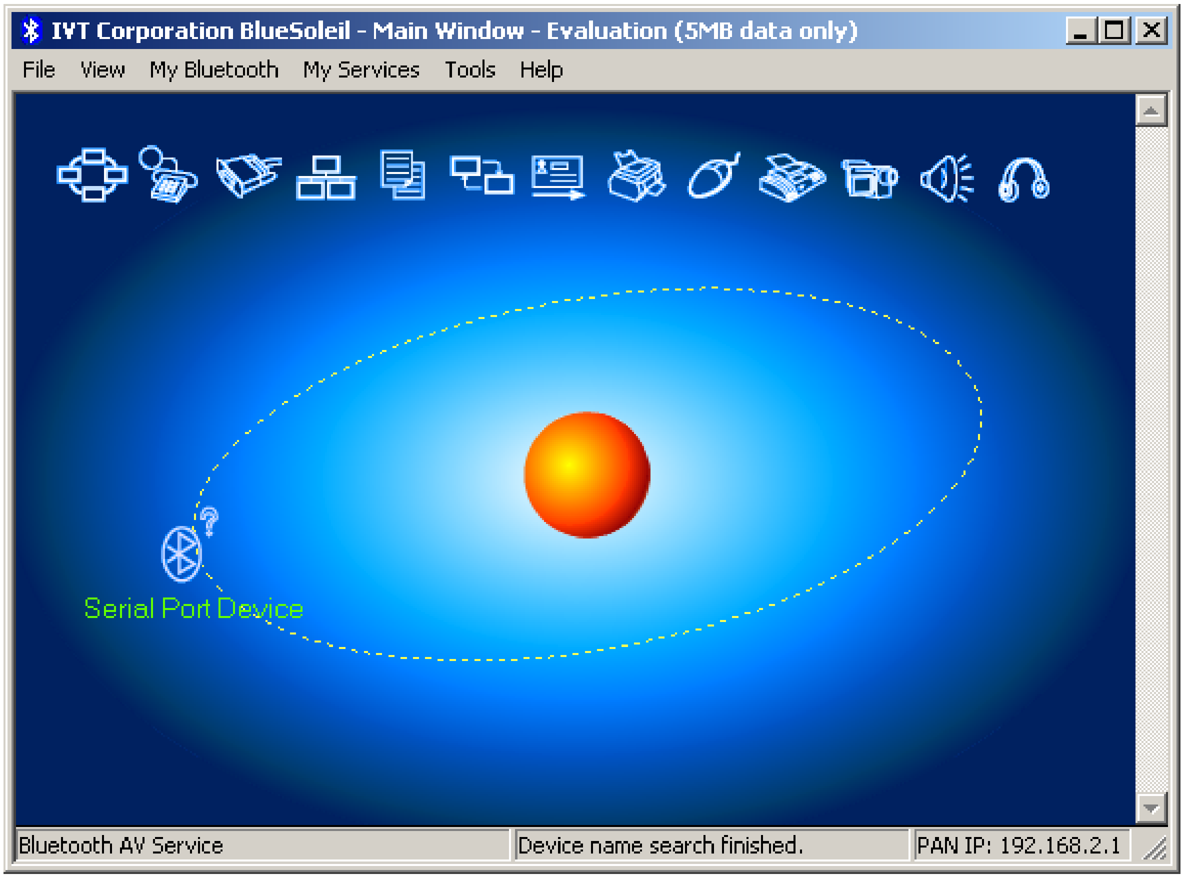
IMPORTANT: Please do not close the Hyperterminal window during the whole demonstration procedure.

2.1.2 Establish Link to the LMX9820A/LMX9830 from the ABE Bluetooth USB Dongle

Since the LMX9820A/LMX9830 by default connectable and discoverable, it can be connected from any other bluetooth device. To establish the link from the ABE USB Dongle, the IVT Stack needs to be started. Therefore please start the “Bluesoleil” application. You should see the screen as demonstrated in Figure 1-2 on page 4. The Bluetooth icon within in the taskbar needs to be blue and white. In case the background is grey instead of blue, the USB dongle has not been installed correctly.

2.1.2.1 Start Inquiry - Search for devices in range

The first to be done is to search for the devices in range. To do so, please click on the yellow “sun” in the middle of the window, which initiates the Bluetooth “Inquiry”. The LMX9820A/LMX9830 Evaluation board should appear as “Serial Port Device”.



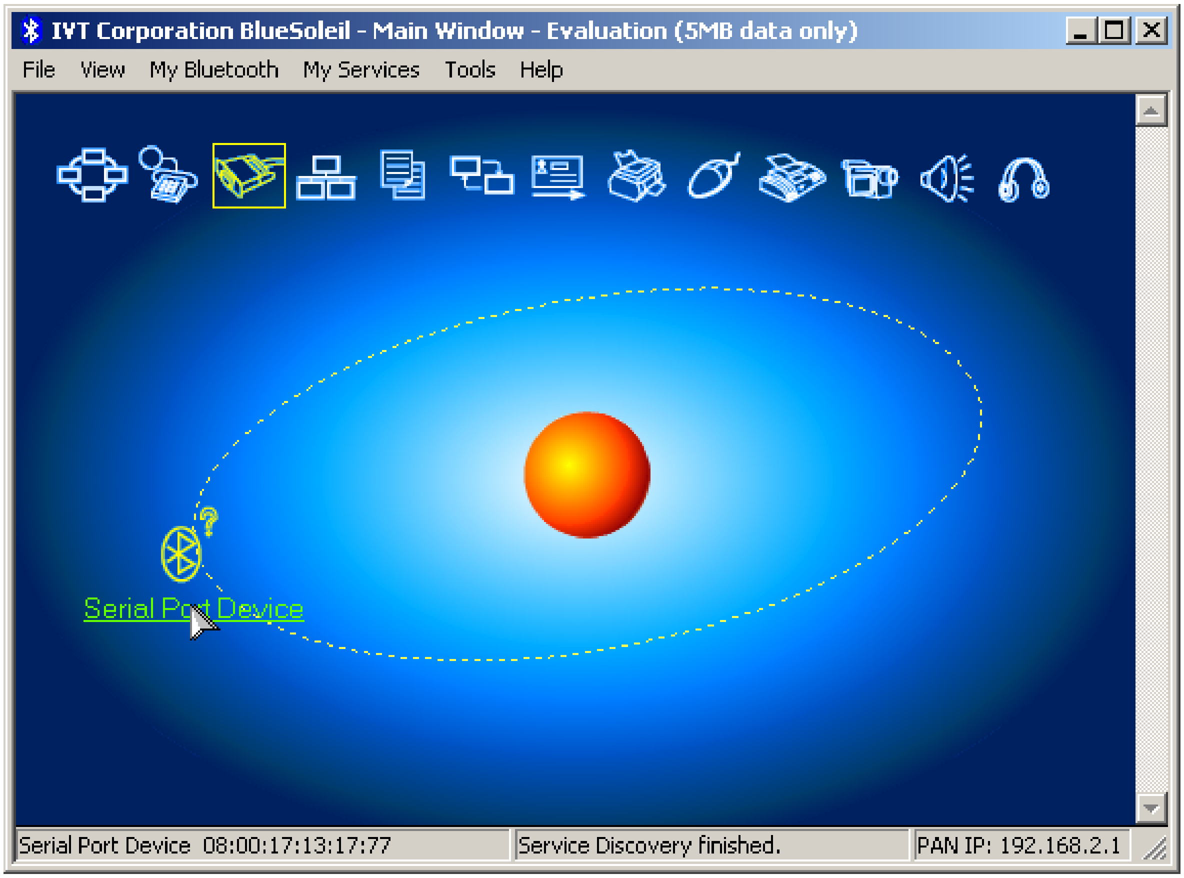
IVT Corporation BlueSoleil - Main Window - Evaluation (5MB data only)

Bluetooth AV Service | Device name search finished. | PAN IP: 192.168.2.1

Figure 2-5. Result of Inquiry procedure

2.1.2.2 Service Discovery - Get Services of the LMX9820A/LMX9830

Once the “Serial Port Device” is detected, double click on the icon or the name of the device to start the service discovery on this device. If successful, the stack will indicate the available services by surrounding the specific icons with rectangles. The service discovery should result in the screen as shown in Figure 2-6, indicating a “Serial Port service”.


IVT Corporation BlueSoleil - Main Window - Evaluation (5MB data only)
File
View
My Bluetooth
My Services
Tools
Help
Serial Port Device

Serial Port Device 08:00:17:13:17:77

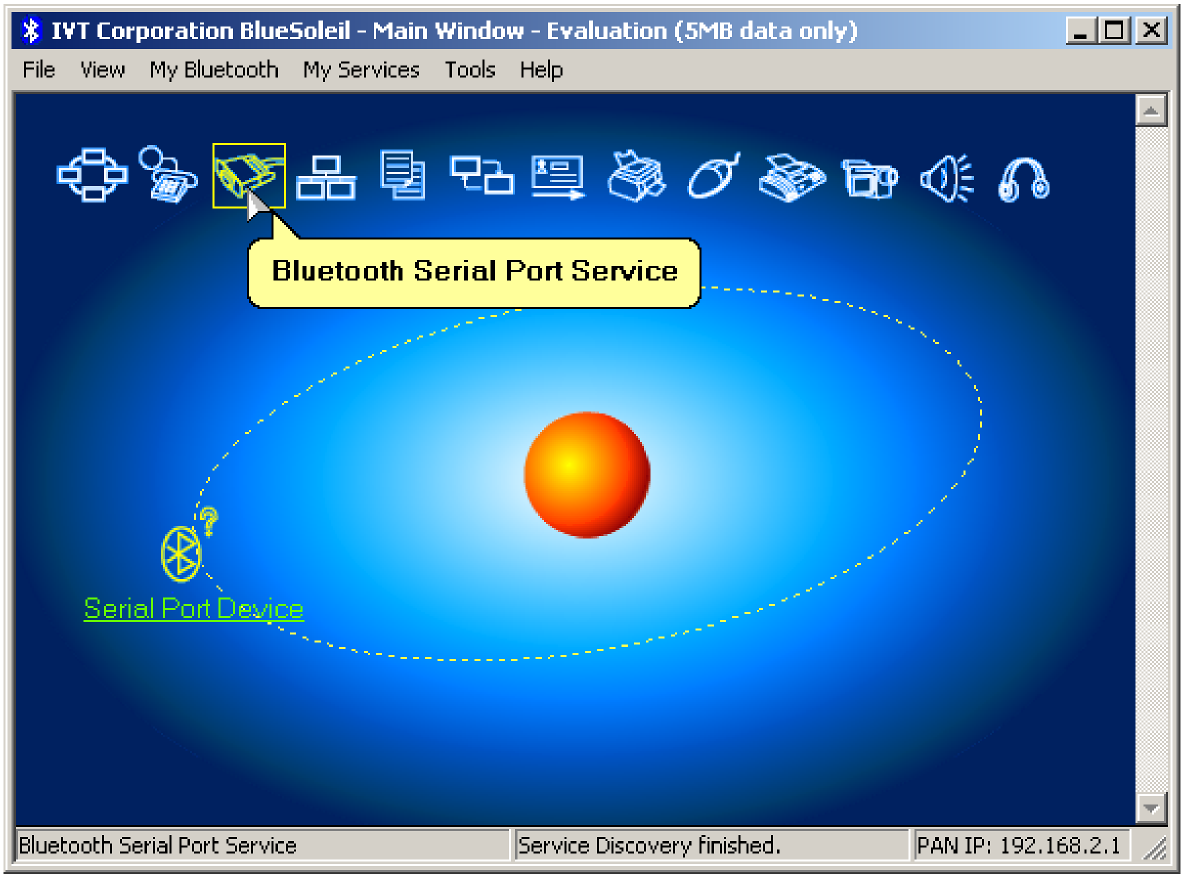
Service Discovery finished.

PAN IP: 192.168.2.1

Figure 2-6. Service Discovery result

2.1.2.3 Establish Link to the LMX9820A/LMX9830

To finally connect to the LMX9820A/LMX9830 Evaluation board, double click on the “Serial Port” Icon if “Serial Port Device” has been selected. This will start the connection establishment process.



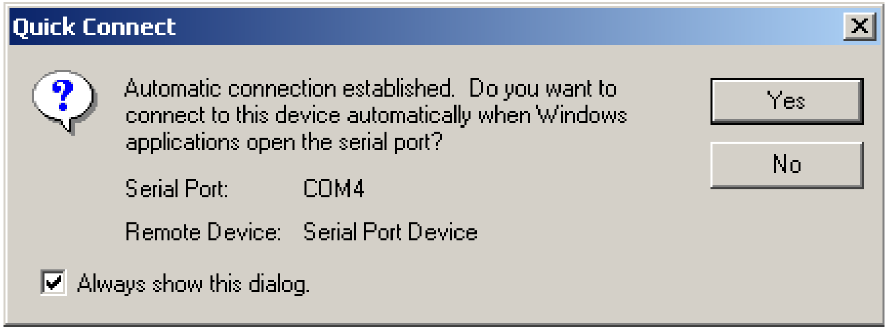
IVT Corporation BlueSoleil - Main Window - Evaluation (5MB data only)
File View My Bluetooth My Services Tools Help
Bluetooth Serial Port Service
Serial Port Device
Bluetooth Serial Port Service
Service Discovery finished.
PAN IP: 192.168.2.1

Figure 2-7. Connect to the bluetooth serial port

As result the stack will report the virtual serial port, which will be used for this serial port connection. In this example "COM4" will be used. This means, any data sent to this COMPort will be sent over the bluetooth link to the LMX9820A/ LMX9830.

If the dialog is answered with Yes, the stack will automatically open the bluetooth link to the LMX9820A/LMX9830 as soon as any application opens "COM4".

Please confirm with "Yes" if that's desired. Otherwise the assignment of COM4 to the LMX9820A/LMX9830 will be temporary.



Quick Connect

Automatic connection established. Do you want to connect to this device automatically when Windows applications open the serial port?

Serial Port: COM4

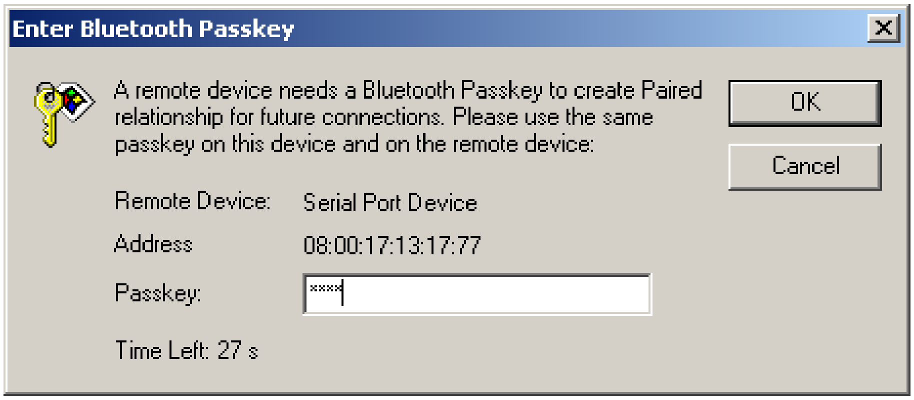
Remote Device: Serial Port Device

☑ Always show this dialog.

Figure 2-8. Virtual Serial Port used for this connection

2.1.2.4 Enter PIN for LMX9820A/LMX9830

By default the LMX9820A/LMX9830 asks for a PIN if the local SPP service is connected from a remote device. Therefore the following dialog will appear from the IVT Stack. Please type “0000”, which is the default PIN stored in the LMX9820A/LMX9830 and press OK.



Enter Bluetooth Passkey

A remote device needs a Bluetooth Passkey to create Paired relationship for future connections. Please use the same passkey on this device and on the remote device:

Remote Device: Serial Port Device

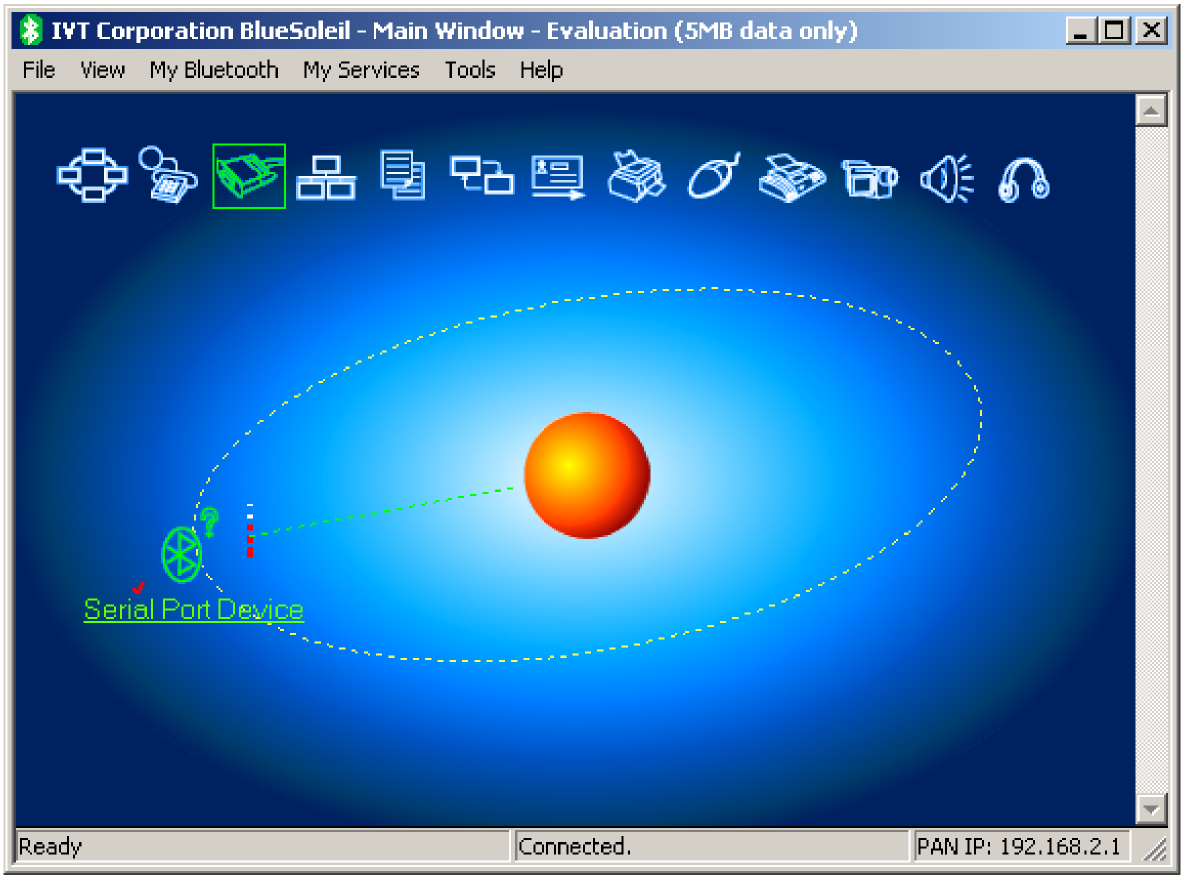
Address 08:00:17:13:17:77

Passkey: ****

Time Left: 27 s

Figure 2-9. Enter PIN for LMX9820A/LMX9830

Afterwards the Link between the two devices is established. The IVT Stack indicates the link by showing a line between the “sun” and the “Serial Port Device” icon.

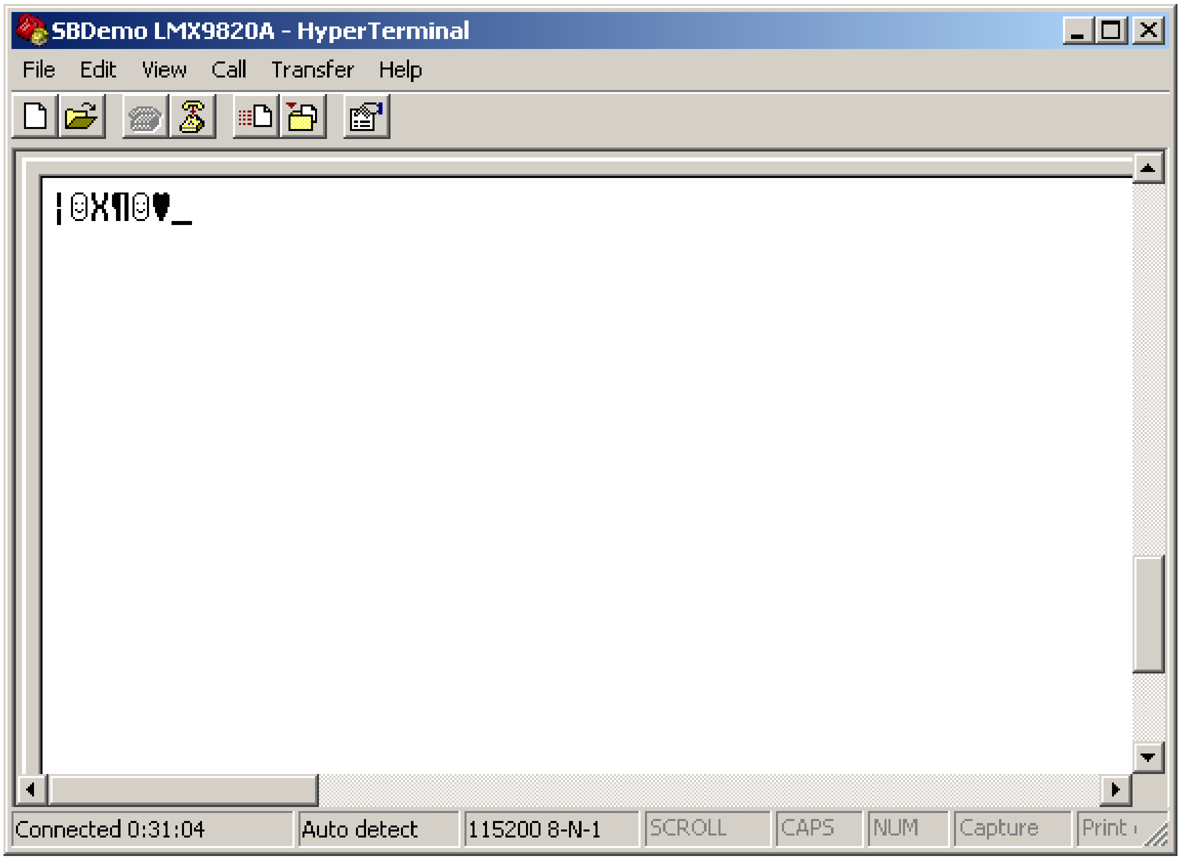


IVT Corporation BlueSoleil - Main Window - Evaluation (5MB data only)

Ready | Connected. | PAN IP: 192.168.2.1

Figure 2-10. Bluetooth Connection Established

Once the link is established, the Hyperterminal window of the LMX9820A/LMX9830 should indicate a message similar to Figure 2-11. The cryptic data show again an event reported by the LMX9820A/LMX9830 command interface. The data comply to a specific packet format which are not readable in ASCII.



```
¦☺X¶☺♥_
```

```
Connected 0:31:04   Auto detect   115200 8-N-1   SCROLL   CAPS   NUM   Capture   Print
```

Figure 2-11. Incoming Link Established in Hyperterminal

2.1.3 Open Hyperterminal session on the virtual serial port

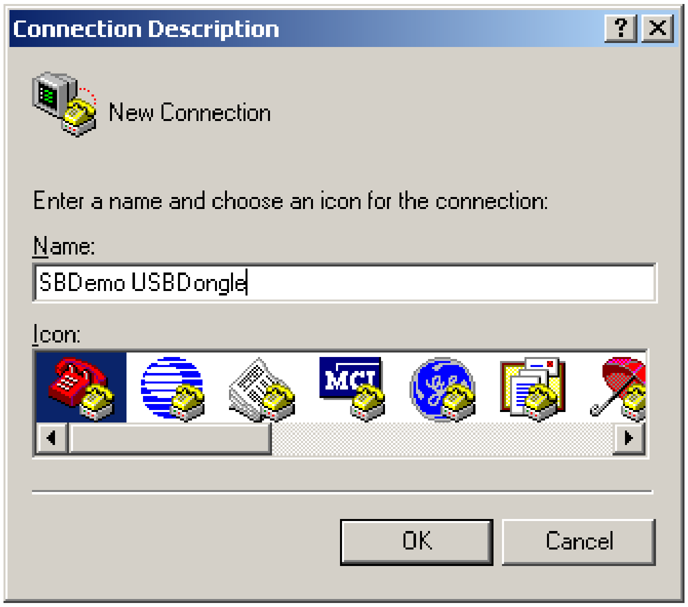
in order to exchange data now between the LMX9820A/LMX9830 and the USB Dongle/IVT stack, another terminal window can be used. For this, create another Hyperterminal connection, directly connected to the COMPort reported in Section 2.1.2.3 on page 11.

2.1.3.1 Start Hyperterminal

Start Hyperterminal as described in Section 1.3 on page 4.

2.1.3.2 Create new connection

Create a new connection by typing a connection name like “SBDemo USBDongle”.



Connection Description

New Connection

Enter a name and choose an icon for the connection:

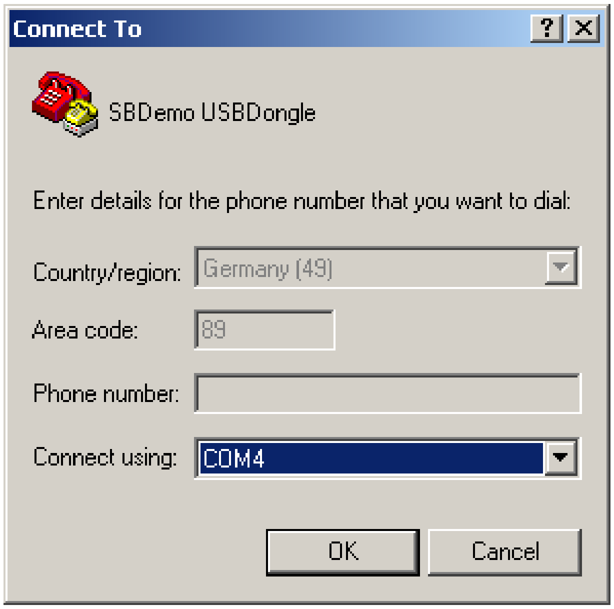
Name: SBDemo USBDongle

Icon:

Figure 2-12. Create New Connection

2.1.3.3 Choose correct Comport

In order to talk to virtual serial port of the stack, choose the COMPort reported by the stack as described in Section 2.1.2.3, Figure 2-8 on page 12. In this example “COM4” needs to be used.



Connect To

SBDemo USBDongle

Enter details for the phone number that you want to dial:

Country/region: Germany (49)

Area code: 89

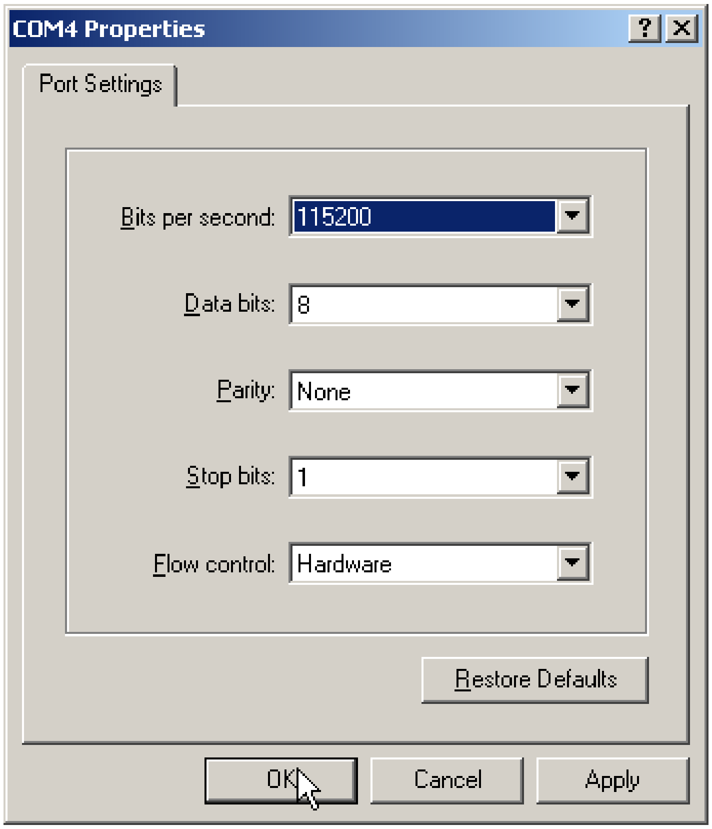
Phone number:

Connect using: COM4

Figure 2-13. Choose correct COMPort

2.1.3.4 Select correct comport settings

The comport settings for the virtual serial port should be the same as chosen for the LMX9820A/LMX9830 (see Section 2.1.1.4 on page 8).



Bits per second: 115200

Data bits: 8

Parity: None

Stop bits: 1

Flow control: Hardware

Figure 2-14. Select correct comport settings

Afterwards the Hyperterminal window comes up and should be connected to the selected COMPort.

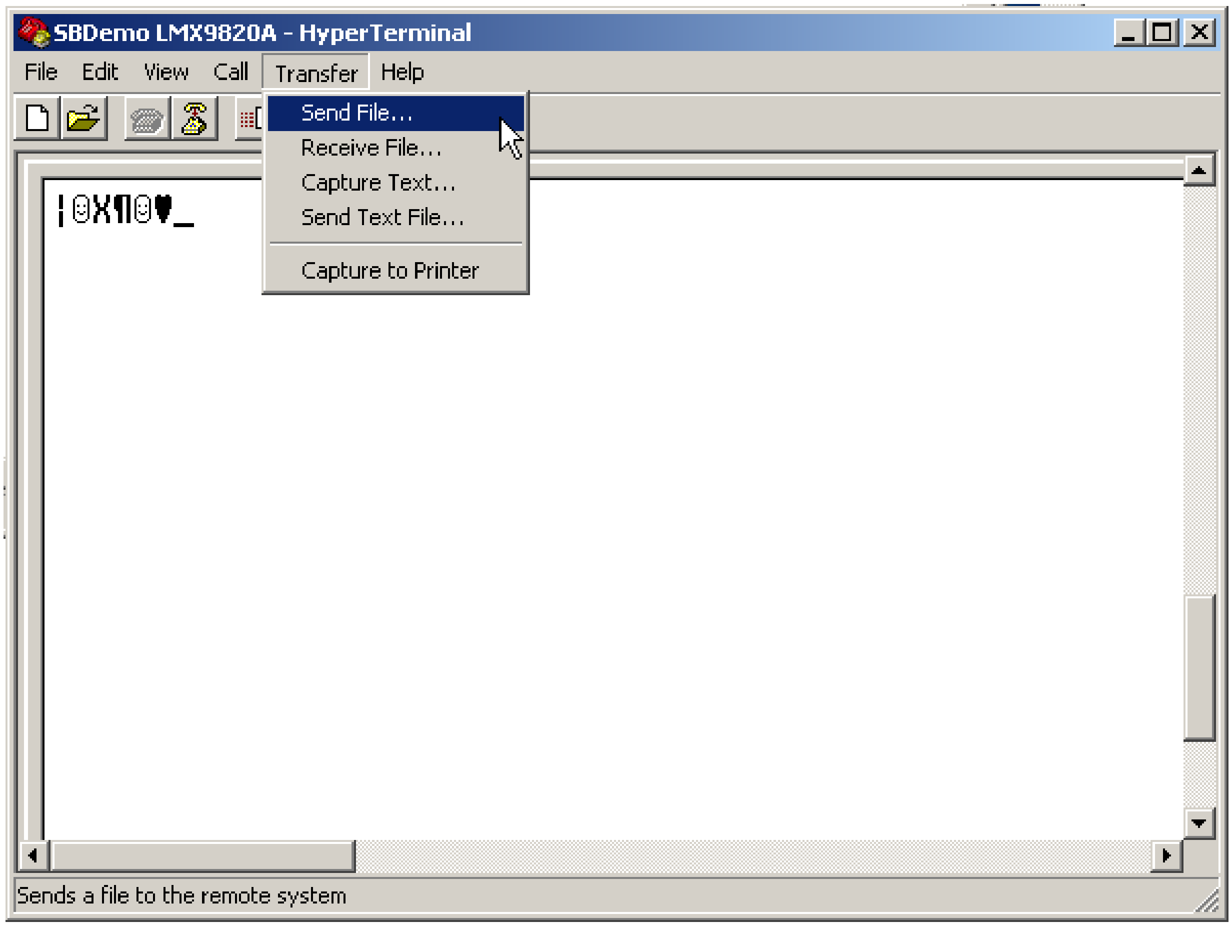
2.1.4 Use Hyperterminal for simple chat

Once both Hyperterminal windows are opened, each character typed or data sent will be transferred to the other device and will show up in the other Hyperterminal. Since the LMX9820A/LMX9830 switches automatically to “Transparent Mode” after being connected from outside, any character sent to it will be forwarded to the bluetooth device connected to it.

2.1.5 Transfer a file with ZModem

Hyperterminal can also be used to send a file to the other side.

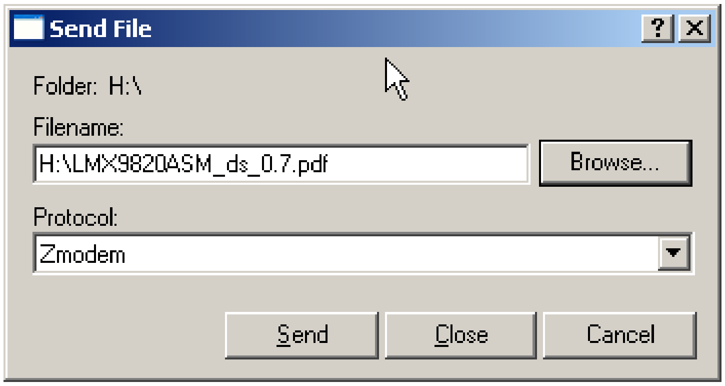
To do so, please select “Transfer/Send File” from the menu.



Sends a file to the remote system

Figure 2-15. Choose “Send File...” with Hyperterminal

Afterwards please select the file you want to send, choose “Zmodem” in the Protocol section and press “Send”.



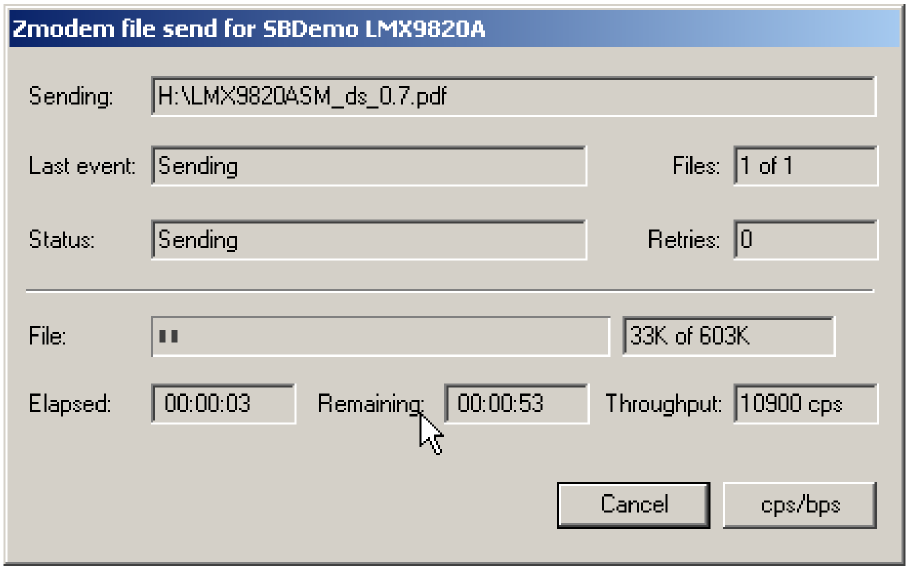
Folder: H:\

Filename: H:\LMX9820ASM_ds_0.7.pdf

Protocol: Zmodem

Figure 2-16. Choose File and protocol

Once done, receiving and transmitting Hypterterminal show the progress of the transmission, together with the average speed of the link.



Zmodem file send for SBDemo LMX9820A

Sending: H:\LMX9820ASM_ds_0.7.pdf

Last event: Sending

Files: 1 of 1

Status: Sending

Retries: 0

File: 33K of 603K

Elapsed: 00:00:03

Remaining: 00:00:53

Throughput: 10900 cps

Figure 2-17. Progress window for sending a file with ZModem

2.2 INITIATE A LINK WITH LMX9820A/LMX9830 USING SIMPLY BLUE COMMANDER

The LMX9820A/LMX9830 command interface offers full bluetooth capabilities. The Simply Blue Commander software gives an easy to use interface to send commands to the LMX9820A/LMX9830 and interprets incoming events.

Please see also [2] for a detailed description on the usage of Simply Blue Commander.

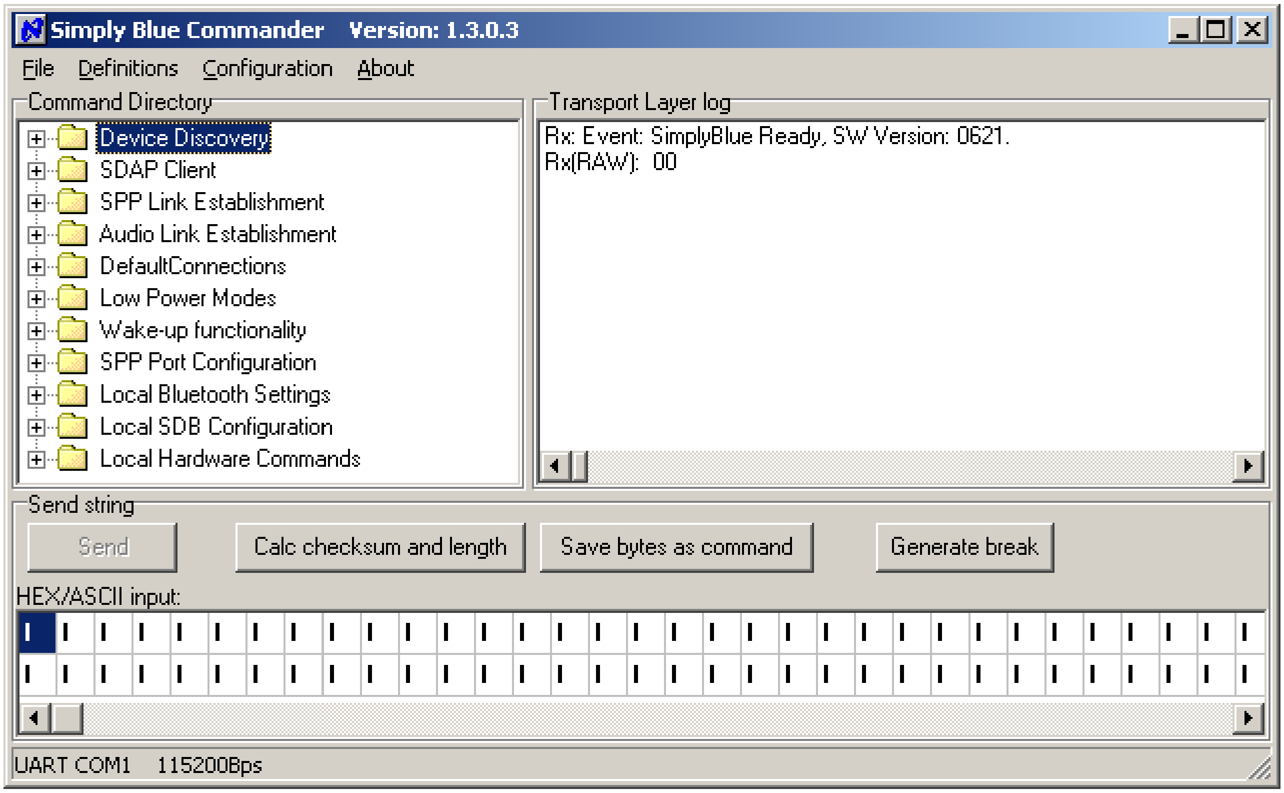
The following demonstration shows how to use Simply Blue Commander to establish a standard Serial Port Profile (SPP) Link to another device. The counterpart of the link will be the ABE USB Dongle, controlled by the IVT Stack.

Please make sure the devices are connected to the PC and the IVT stack at the PC detected the USB Dongle correctly.

2.2.1 Start Simply Blue Commander

Start Simply Blue Commander as described in Section 1.1 on page 3. Please make sure no other device is using the Comport the LMX9820A/LMX9830 Evaluation board is connected to.

Once the program is up and running, press the RESET button on the Evaluation board. This will cause the LMX9820A/LMX9830 to reboot and bring up the “SimplyBlue Ready” Event, followed by the firmware version.



```
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Rx(RAW):  00
```

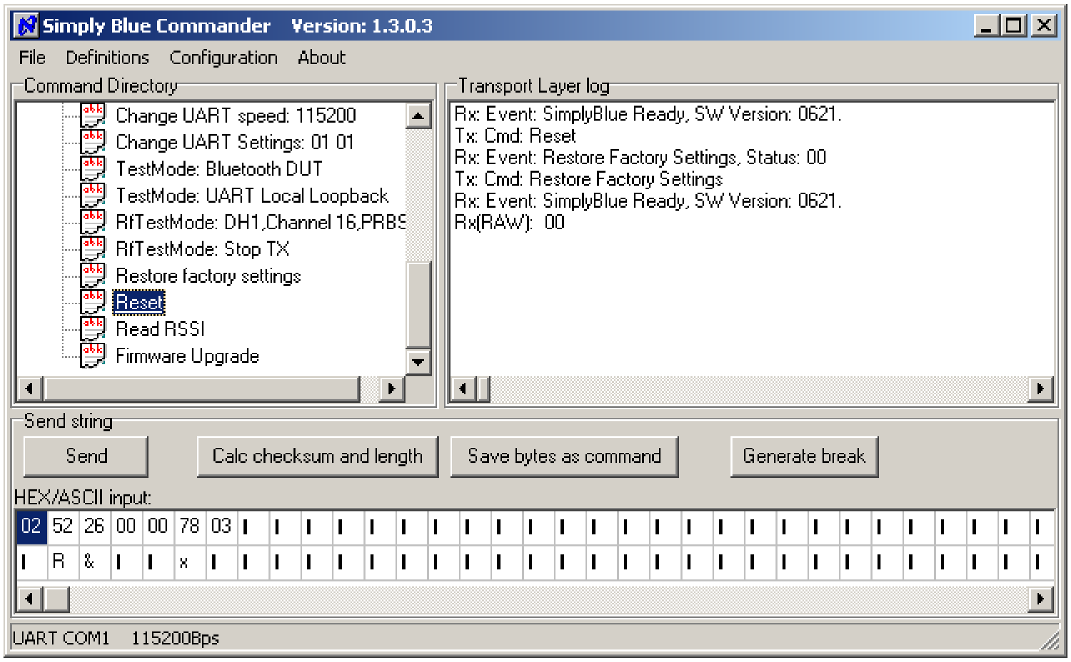
UART COM1 115200Bps

Figure 2-18. Simply Blue Commander Start Window

2.2.2 Send “Restore to factory settings” and “Reset”

To make sure all settings are reset to expected values, the “Restore to factory settings” can be used before first initialization. This is not required for general use, it is just necessary for this demo to make sure all parameters are set as expected.

To do so, open the “Local Hardware Commands” Folder within the Command Directory and double-click on “Restore to Factory Settings”. Afterwards double-click on “Reset”, which will complete the activation of the settings.



Change UART speed: 115200
Change UART Settings: 01 01
TestMode: Bluetooth DUT
TestMode: UART Local Loopback
RfTestMode: DH1,Channel 16,PRBS
RfTestMode: Stop TX
Restore factory settings
Reset
Read RSSI
Firmware Upgrade

```
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Tx: Cmd: Reset
Rx: Event: Restore Factory Settings, Status: 00
Tx: Cmd: Restore Factory Settings
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Rx(RAW): 00
```

```
02 52 26 00 00 78 03
   R  &        x
```

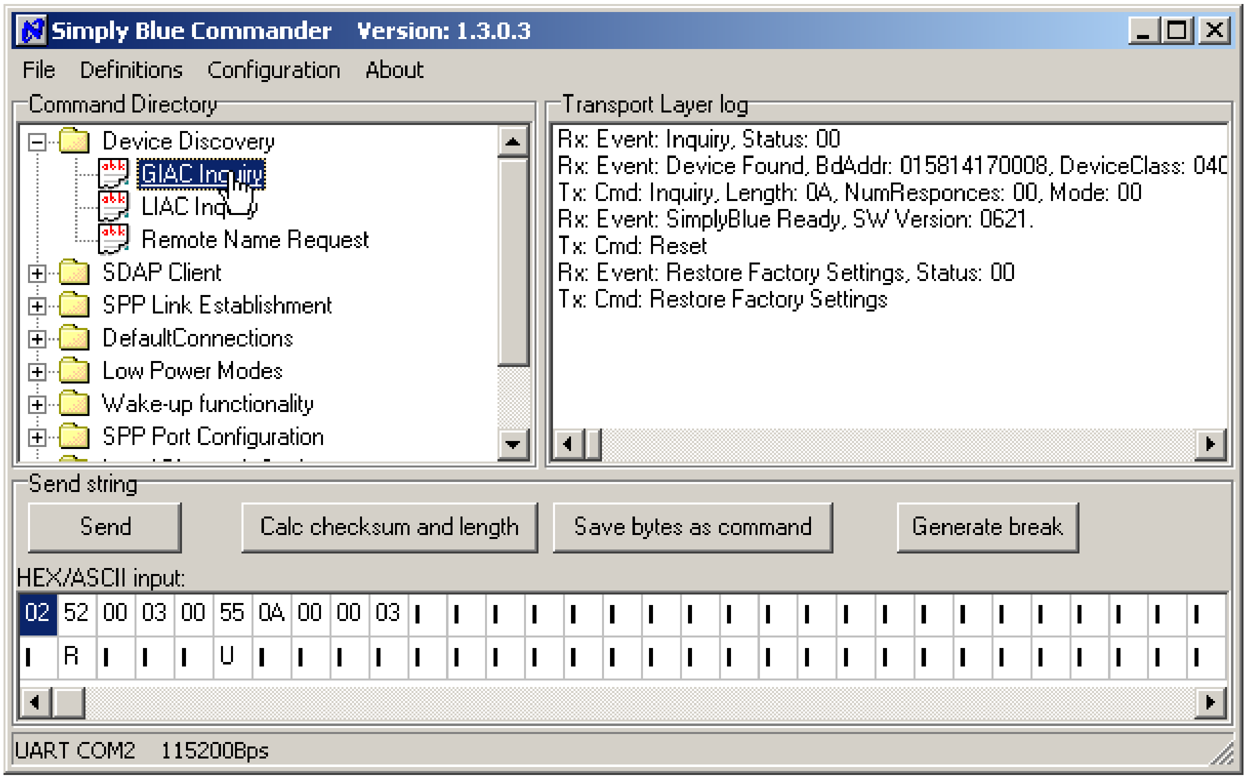
Figure 2-19. Restore to factory settings

2.2.3 Find remote device

To be able to connect to another device the connecting device needs to know the Bluetooth Device Address and the Remote RFComm Port to connect to.

2.2.3.1 Device Discovery - Send “GIAC Inquiry”

The first step therefore is to start the “Inquiry” Process. This process can be started using the “GIAC Inquiry” Command in the “Device Discovery” section of the Command Directory. On “GIAC Inquiry” (General Inquiry Access Code Inquiry) the device will show any device scanning in normal mode. “LIAC” (Limited Inquiry Access Code) will search for devices in the “Limited Inquiry scan mode” which is only used in special applications.



```
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 040
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Tx: Cmd: Reset
Rx: Event: Restore Factory Settings, Status: 00
Tx: Cmd: Restore Factory Settings
```

02	52	00	03	00	55	0A	00	00	03
	R				U				

UART COM2 115200Bps

Figure 2-20. General Inquiry to get the bluetooth address of a remote device

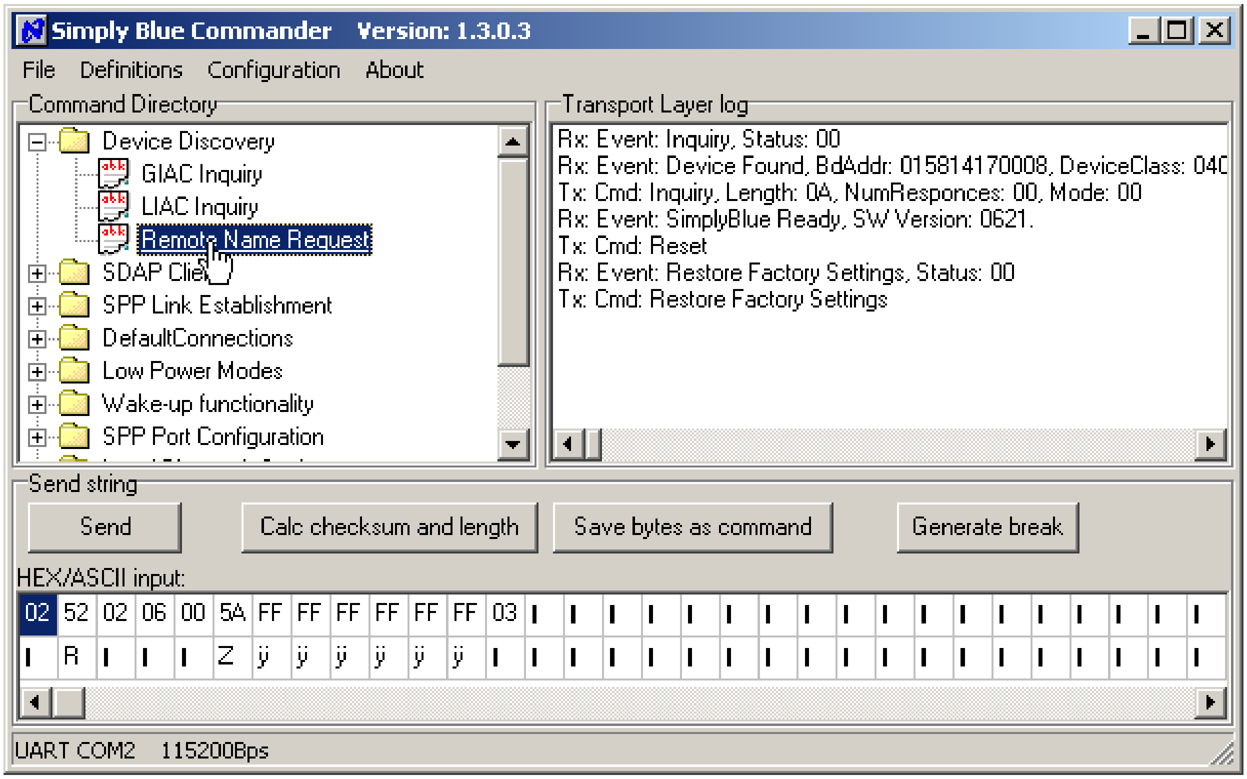
2.2.3.2 Get remote name (optional)

In case more than one device has been found, each of the devices can be asked for it's "Friendly Name". As seen in Section 2.1.2.1 on page 10, the LMX9820A/LMX9830 by default appeared as "Serial Port Device". To get the remote name of the device in our example, the device needs to be contacted and asked for it's name.

The name request is initiated by the "Remote Name Request" Command within the Command Directory. Since the command needs to be modified for each specific device, the following procedure needs to be followed for each device.

2.2.3.2.1 Single Click "Remote Name Request"

By single clicking the Remote Name Request Command, the "HEX/ASCII input" line is updated with the complete hex string to be sent to the LMX9820A/LMX9830.



```
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 040
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Tx: Cmd: Reset
Rx: Event: Restore Factory Settings, Status: 00
Tx: Cmd: Restore Factory Settings
```

```
02 52 02 06 00 5A FF FF FF FF FF FF 03
   R        Z  ÿ  ÿ  ÿ  ÿ  ÿ  ÿ
```

Figure 2-21. Activate Remote Name Request

2.2.3.2.2 Replace payload by device bluetooth address

After activating the command in the command directory, the HEX/ASCII input now shows the complete structure of the command. Each command is built out of a 6-byte header, the payload and a 1-byte delimiter. The payload of the command by default is filled with FF as placeholder for the remote bluetooth device address.

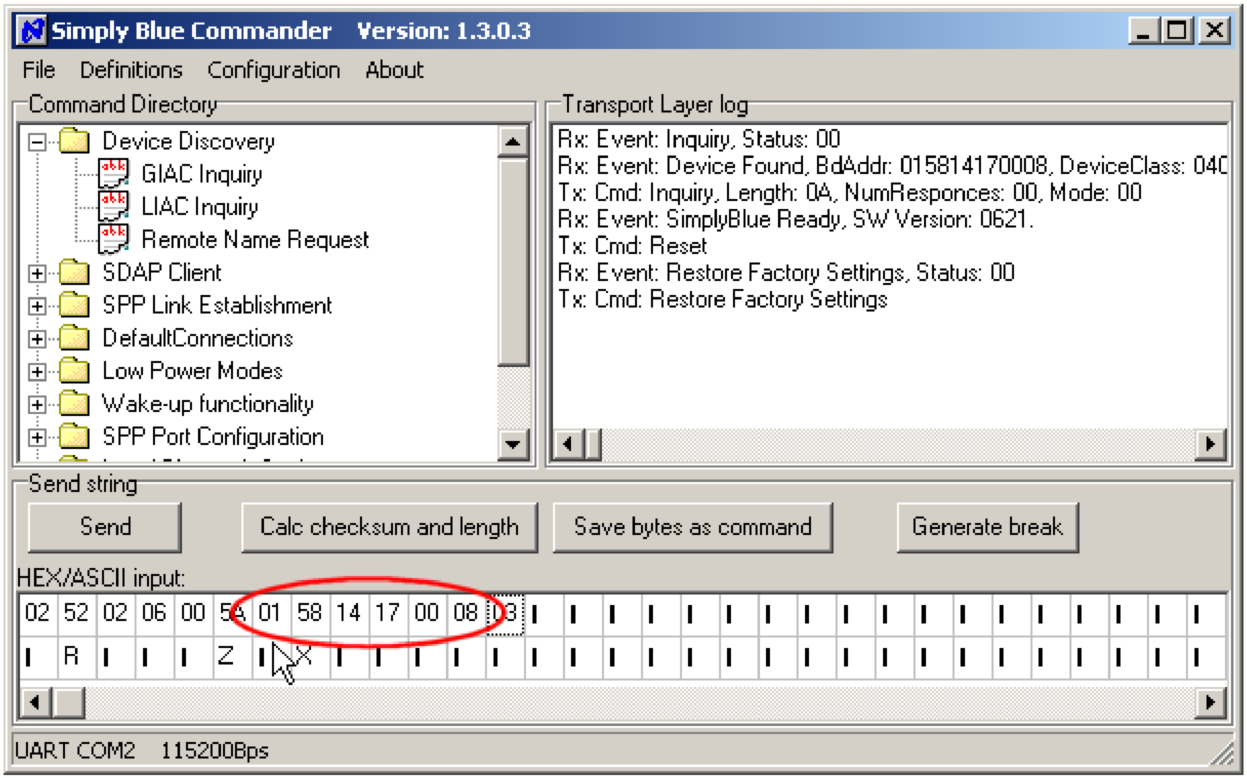
To initiate the remote name request, the bluetooth device address from the previous inquiry result needs to be filled in. The address can be found within Transport Layer log, reported as

"RX:Event: Device Found, BdAddr: **015814170008**, Device Class: 040112"

In this example the inquiry just indicates one device with address 015814170008.

To complete the request this address has to be filled into the HEX/ASCII input link, by replacing the FFs with this address. See Figure 2-22 on page 23 as an example.

If a bluetooth device wants to connect to the serial port service of another device, it first has to ask for this specific RFCOMM port. This



```
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 040
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Tx: Cmd: Reset
Rx: Event: Restore Factory Settings, Status: 00
Tx: Cmd: Restore Factory Settings
```

HEX/ASCII input:

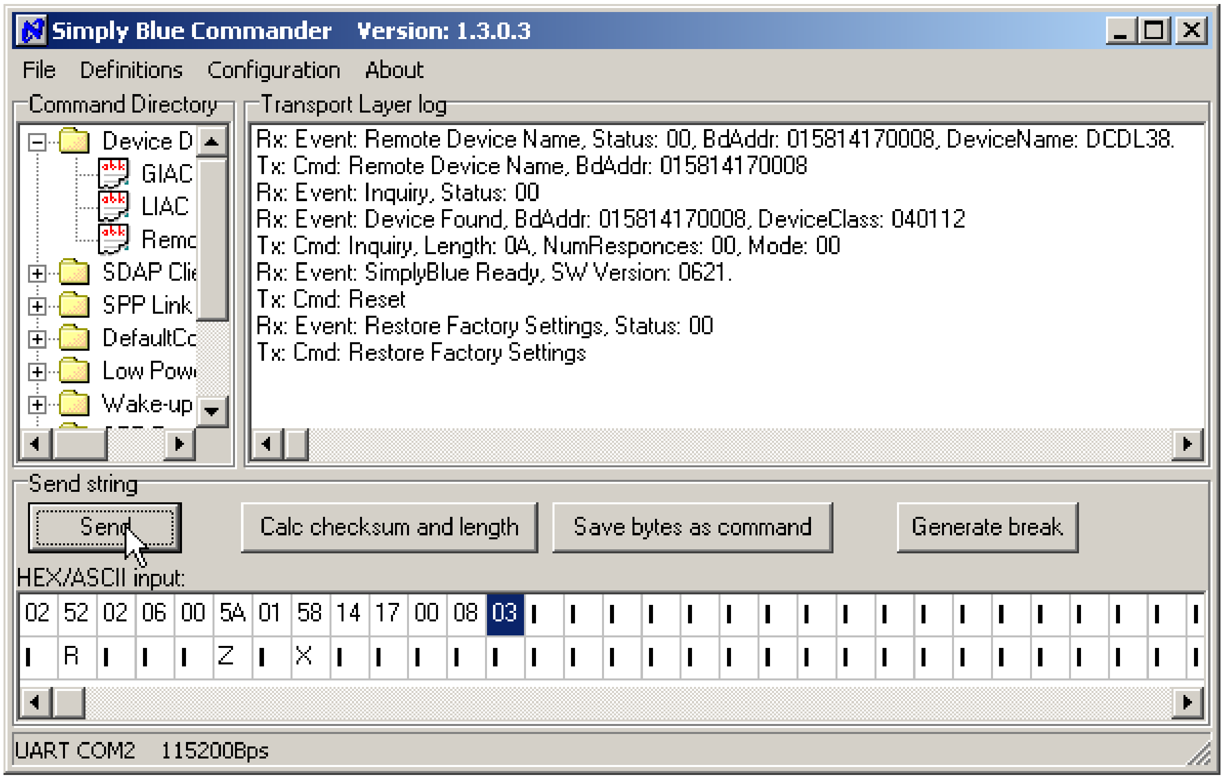
```
02 52 02 06 00 5A 01 58 14 17 00 08 03
   R           Z     X
```

UART COM2 115200Bps

Figure 2-22. Fill in the Bluetooth address of the found device

2.2.3.2.3 Press “Send”

To finally send the command to the LMX9820A/LMX9830, just press the “Send” button. The LMX9820A/LMX9830 will respond to the request by the appropriate “Remote Device Name” Event, including the status and the device name. In this example the name “DCDL38” has been detected. In case the status is different from 0x00, the physical connection establishment might have been failed. In that just try again until the status 00 is reported.



```
Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008, DeviceName: DCDL38.
Tx: Cmd: Remote Device Name, BdAddr: 015814170008
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 040112
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Tx: Cmd: Reset
Rx: Event: Restore Factory Settings, Status: 00
Tx: Cmd: Restore Factory Settings
```

HEX/ASCII input: 02 52 02 06 00 5A 01 58 14 17 00 08 03

Figure 2-23. Remote Name Request Response

2.2.4 Get remote RFComm Port for SPP

A serial port profile communication between two devices is based on the “RFCOMM” layer. This layer basically offers a virtual serial port environment to the application. Each SPP based service like “Serial Port” or “Dial Up Networking” is registered to a specific RFCOMM port, like e.g. a modem driver on a PC is using a specific COMport.

This comport assignment is stored within the so called “Service Database” of each device.

If a device wants to create a link to the “Serial Port” service of another device, it has to know the RFComm Port for this service on the other device. Afterwards a link will be established from a Local Port to the appropriate Remote Port.

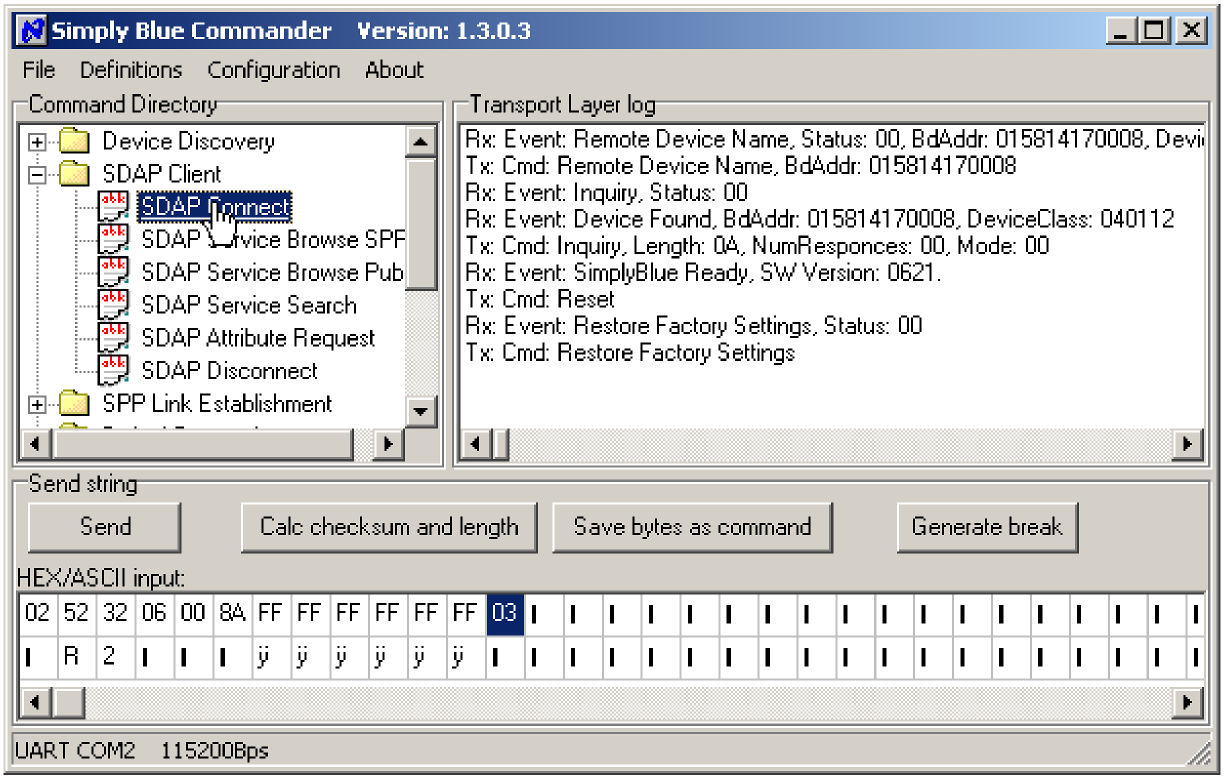
The RFCOMM Port of a service on the remote device can be found by using a SDAP Request.

2.2.4.1 Create SDAP Connection

To browse for service first a SDAP connection has to be established. For this the “SDAP Connect” Command can be used. Since the command needs to be modified for the correct bluetooth address, the same procedure as for the Remote Name Request needs to be used.

2.2.4.1.1 Single Click “SDAP Connect” in the Command Directory

By a single click of the command in the directory, the hex string for the command appears in the “HEX/ASCII input:” line.



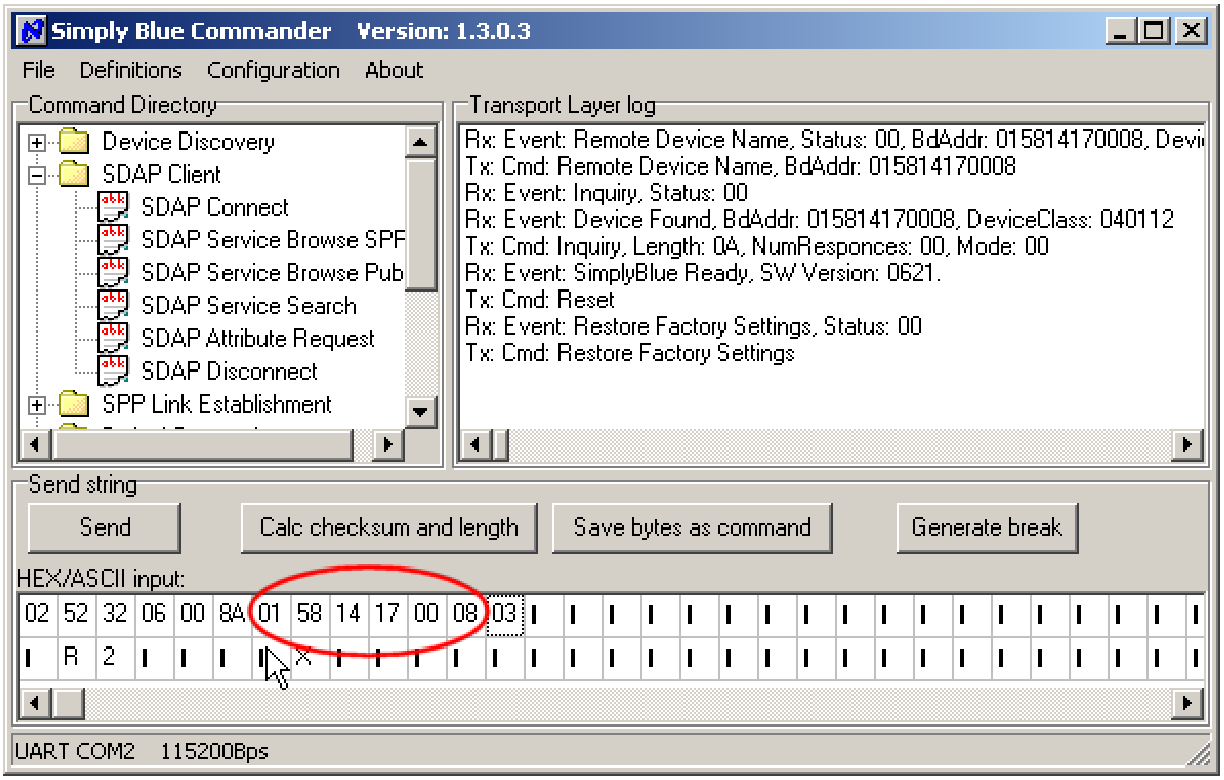
```
Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008, Devi
Tx: Cmd: Remote Device Name, BdAddr: 015814170008
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 040112
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Tx: Cmd: Reset
Rx: Event: Restore Factory Settings, Status: 00
Tx: Cmd: Restore Factory Settings
```

```
02 52 32 06 00 8A FF FF FF FF FF FF 03
   R  2              ÿ  ÿ  ÿ  ÿ  ÿ  ÿ
```

Figure 2-24. Activate "SDAP Connect"

2.2.4.1.2 Replace payload by device bluetooth address

The example SDAP Connect command has FF values as placeholders for the device address. These FFs have to be replaced by the address of the device to be contacted.



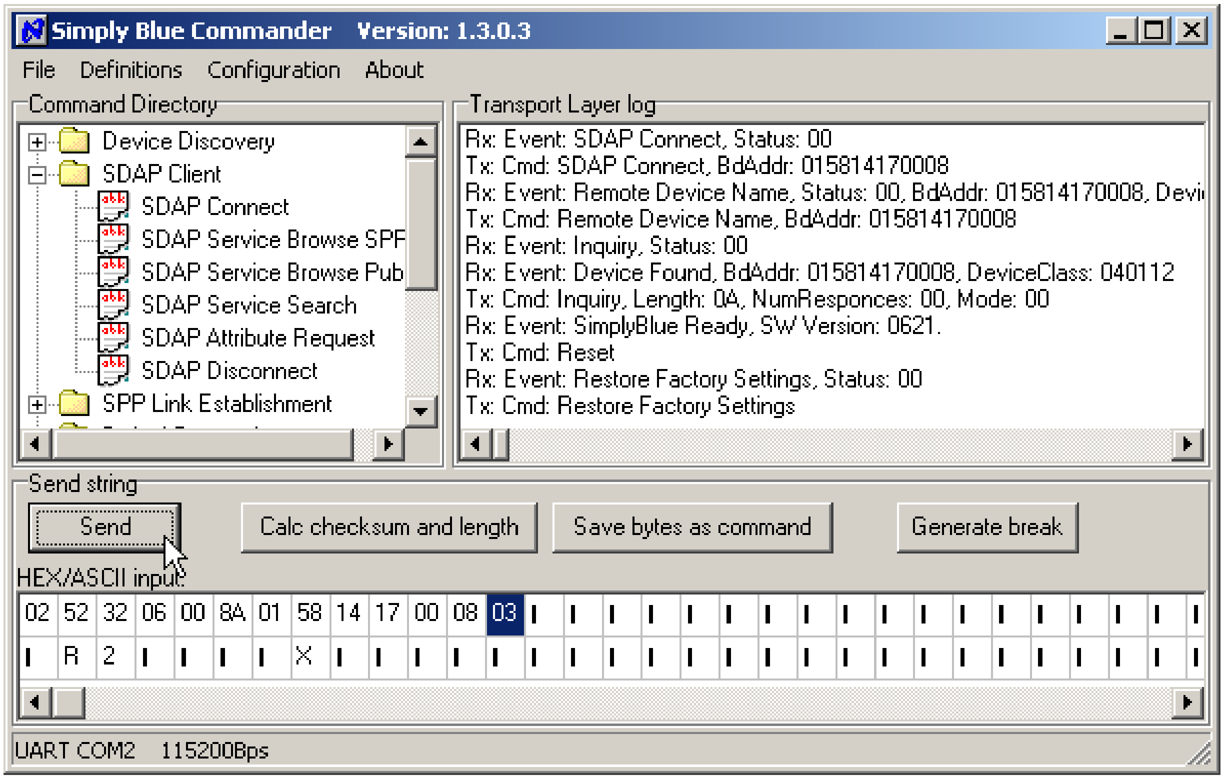
```
Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008, Devi
Tx: Cmd: Remote Device Name, BdAddr: 015814170008
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 040112
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Tx: Cmd: Reset
Rx: Event: Restore Factory Settings, Status: 00
Tx: Cmd: Restore Factory Settings
```

```
02 52 32 06 00 8A 01 58 14 17 00 08 03
   R  2              X
```

Figure 2-25. Replace payload by bluetooth

2.2.4.1.3 Press “Send”

To finally send the command to the LMX9820A/LMX9830, just press the “Send” button. The LMX9820A/LMX9830 will confirm the connection establishment including the status. In case the status is 0x00 the connection establishment was successful. Otherwise please retry until the connection is confirm as success.



```
Rx: Event: SDAP Connect, Status: 00
Tx: Cmd: SDAP Connect, BdAddr: 015814170008
Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008, Devi
Tx: Cmd: Remote Device Name, BdAddr: 015814170008
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 040112
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Tx: Cmd: Reset
Rx: Event: Restore Factory Settings, Status: 00
Tx: Cmd: Restore Factory Settings
```

02	52	32	06	00	8A	01	58	14	17	00	08	03
ı	R	2	ı	ı	ı	ı	X	ı	ı	ı	ı	ı

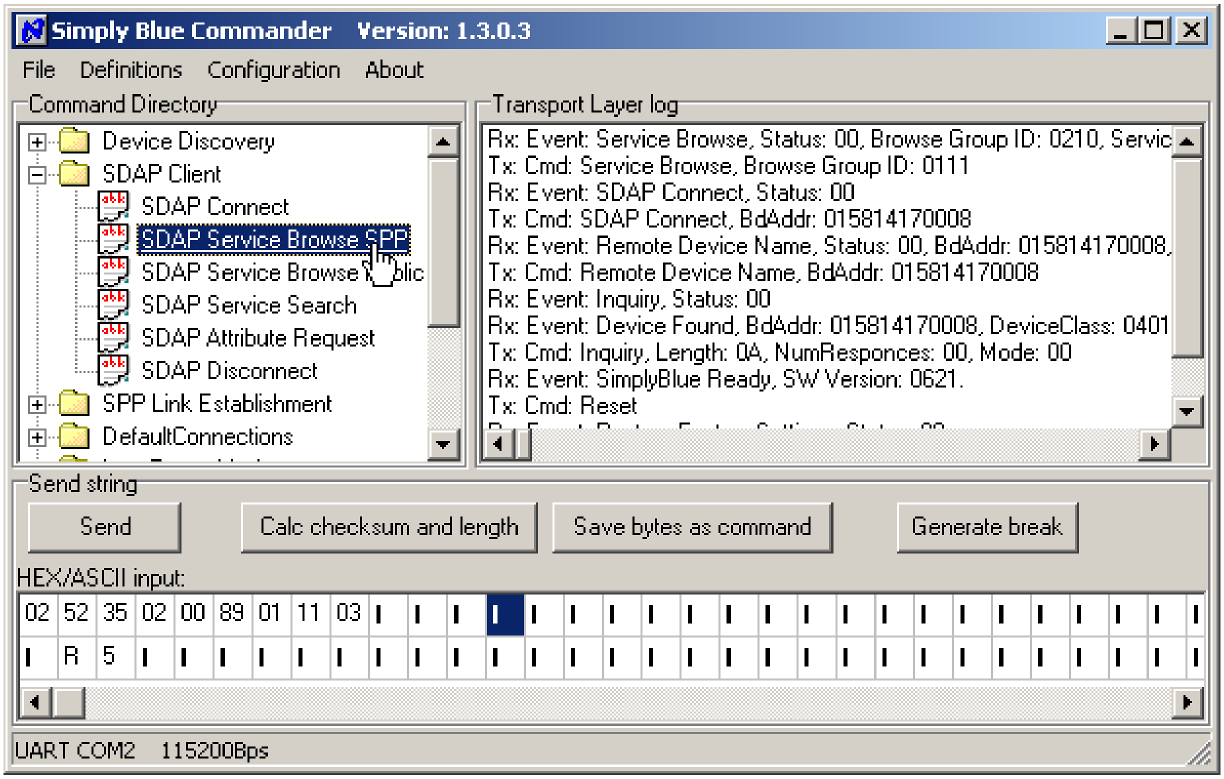
UART COM2 115200Bps

Figure 2-26. Press “Send” to release the command

2.2.4.2 Browse for the SPP Service

Once the SDAP Connection is established, the remote database can be asked for the requested service. The prepared “SDAP Service Browse SPP” Command can be used directly to browse for the service by double clicking the command in the command directory.

This request searches specifically for a SPP entry. Please refer to [1] for details on the command.



```
Rx: Event: Service Browse, Status: 00, Browse Group ID: 0210, Servic
Tx: Cmd: Service Browse, Browse Group ID: 0111
Rx: Event: SDAP Connect, Status: 00
Tx: Cmd: SDAP Connect, BdAddr: 015814170008
Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008,
Tx: Cmd: Remote Device Name, BdAddr: 015814170008
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 0401
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
Rx: Event: SimplyBlue Ready, SW Version: 0621.
Tx: Cmd: Reset
```

```
02 52 35 02 00 89 01 11 03
   R  5
```

UART COM2 115200Bps

Figure 2-27. Send SDAP Service Browse for SPP

The response to this requests includes the status and, in case a valid service has been found, the port number and the name of the requested service. The full response of the device in the example looks like this

Rx: Event: Service Browse, Status: 00, Browse Group ID: 0210, Service ID: 0111, PortNo: 02, Service Name: Serial Port A., Browse Group ID: 0210, Service ID: 0111, PortNo: 03, Service Name: Serial Port B.

The event shows, that the remote device offer 2 Serial Port services:

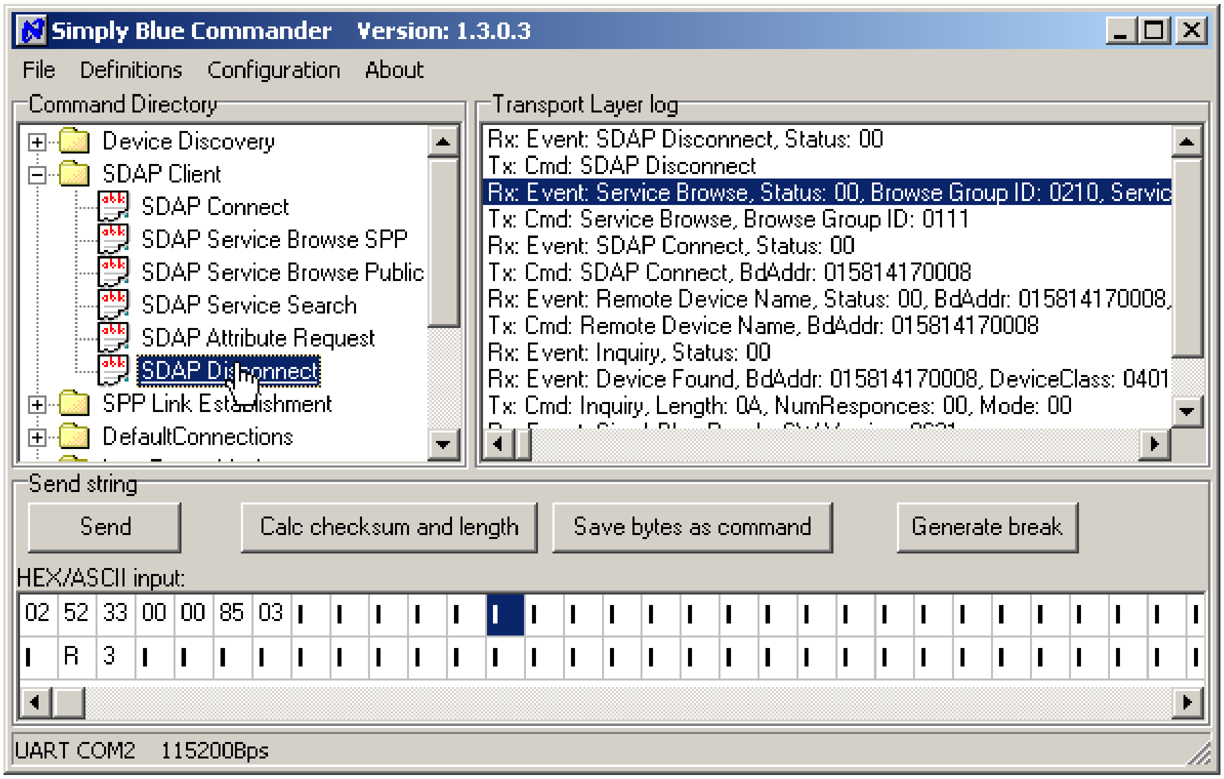
- Service 1:
  — RFCOMM Port: “0x02”
  — Service Name: “Serial Port A”

- Service 2:
  — RFCOMM Port: “0x03”
  — Service Name: “Serial Port B”

For a Serial Port connection, one of those ports can be used.

2.2.4.3 Close SDAP Connection

After the successful Service browse, the SDAP connection needs to be closed again. The prepared SDAP Disconnect commands needs no modification and can be used directly.



```
Rx: Event: SDAP Disconnect, Status: 00
Tx: Cmd: SDAP Disconnect
Rx: Event: Service Browse, Status: 00, Browse Group ID: 0210, Servic
Tx: Cmd: Service Browse, Browse Group ID: 0111
Rx: Event: SDAP Connect, Status: 00
Tx: Cmd: SDAP Connect, BdAddr: 015814170008
Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008,
Tx: Cmd: Remote Device Name, BdAddr: 015814170008
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 0401
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
```

HEX/ASCII input:

```
02 52 33 00 00 85 03
    R  3
```

Figure 2-28. SDAP Disconnect Request

2.2.5 Establish SPP Link

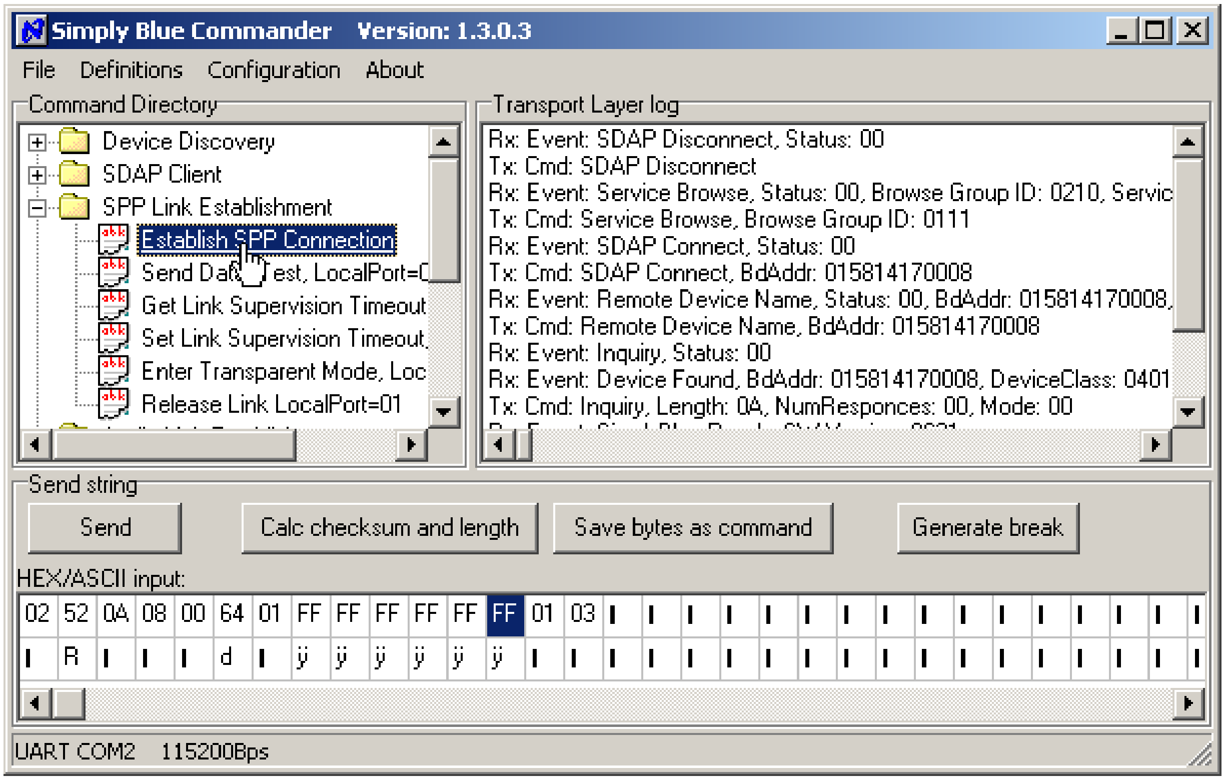
Finally, if the bluetooth address (BD_Addr) and the remote RFComm port to be addressed are known, an SPP Link can be established to the device.

NOTE: The steps explained in Section 2.2.3.1 to Section 2.2.4.3 are only necessary in case the remote device is not known yet.

2.2.5.1 Select “Establish SPP Link”

The main command to establish a link to another device is “Establish SPP Link”, to be found in the “SPP Link Establishment” section of the command directory.

Select the command to get the HEX string in the “HEX/ASCII input” line.



```
Rx: Event: SDAP Disconnect, Status: 00
Tx: Cmd: SDAP Disconnect
Rx: Event: Service Browse, Status: 00, Browse Group ID: 0210, Servic
Tx: Cmd: Service Browse, Browse Group ID: 0111
Rx: Event: SDAP Connect, Status: 00
Tx: Cmd: SDAP Connect, BdAddr: 015814170008
Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008,
Tx: Cmd: Remote Device Name, BdAddr: 015814170008
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 0401
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
```

```
02 52 0A 08 00 64 01 FF FF FF FF FF FF 01 03
   R           d     ÿ  ÿ  ÿ  ÿ  ÿ  ÿ
```

UART COM2 115200Bps

Figure 2-29. Select “Establish SPP Link”

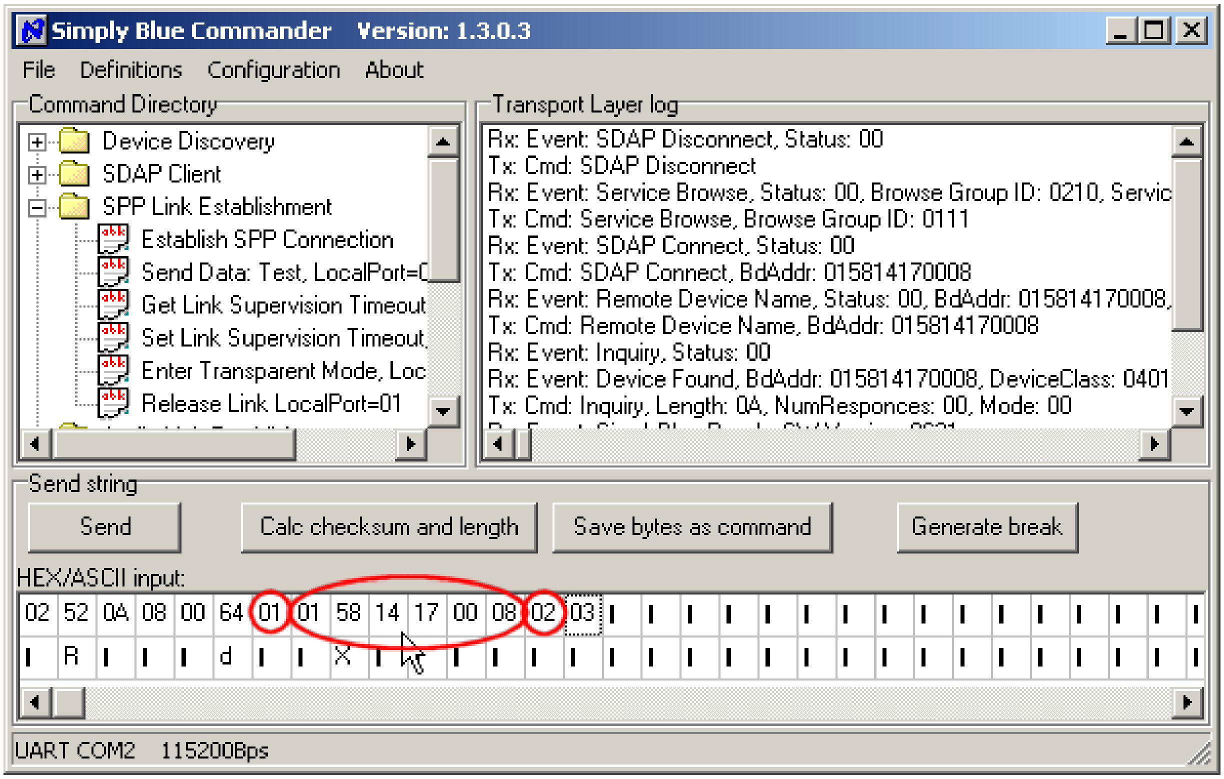
2.2.5.2 Adapt Link Establishment parameters

The “Establish SPP Connection” command includes 3 parameters in the payload, which have to be adapted to successfully establish a link.

As usual the first 6-bytes of the command are the packet header. The payload of the command in the example consists of

- The Local RFCOMM Port (1 byte)
  - — This is the local RFCOMM port of the LMX9820A/LMX9830, which will be assigned to this link. Each data sent to this port after link establishment will be sent to this remote bluetooth device.
- The BD_Addr of the remote device (6 bytes)
  - — In able to connect to the correct device, its BD_Addr has to be filled in (same as used for SDAP, found by Inquiry)
- The Remote RFCOMM Port (1 byte)
  - — The remote RFCOMM port is the comport assigned to the Serial port service, as found by the SDAP Service Browse (see Section 2.2.4.2). In this case Port 02 shall be used.

There in this example the payload has to be filled with 01 01 58 14 17 00 08 02.



```
Rx: Event: SDAP Disconnect, Status: 00
Tx: Cmd: SDAP Disconnect
Rx: Event: Service Browse, Status: 00, Browse Group ID: 0210, Servic
Tx: Cmd: Service Browse, Browse Group ID: 0111
Rx: Event: SDAP Connect, Status: 00
Tx: Cmd: SDAP Connect, BdAddr: 015814170008
Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008,
Tx: Cmd: Remote Device Name, BdAddr: 015814170008
Rx: Event: Inquiry, Status: 00
Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 0401
Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
```

```
02 52 0A 08 00 64 01 01 58 14 17 00 08 02 03
   R           d           X
```

Figure 2-30. Adapting the “Establish SPP Connection” Command

2.2.5.3 Press “Send” to connect

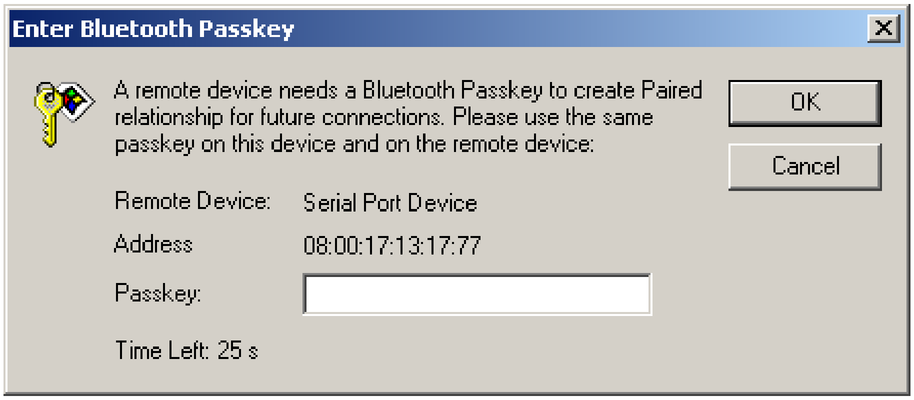
By pressing “Send” the command will be sent to the LMX9820A/LMX9830.

The Link Establishment is first confirmed by the event

Rx: Event: Establish Link, Status: 00, Local Port: 01

which just indicates that the command has been received successfully and the LMX9820A/LMX9830 is starting to process the request. If status is different from 00 then please check again the parameters you’ve entered within the command.

The IVT stack of the USB Dongle will probably alert to the user that another device tries to request the service and will ask for the PinCode. For this the default pincode of the LMX9820A/LMX9830 needs to be used (0000).



A remote device needs a Bluetooth Passkey to create Paired relationship for future connections. Please use the same passkey on this device and on the remote device:

Remote Device: Serial Port Device

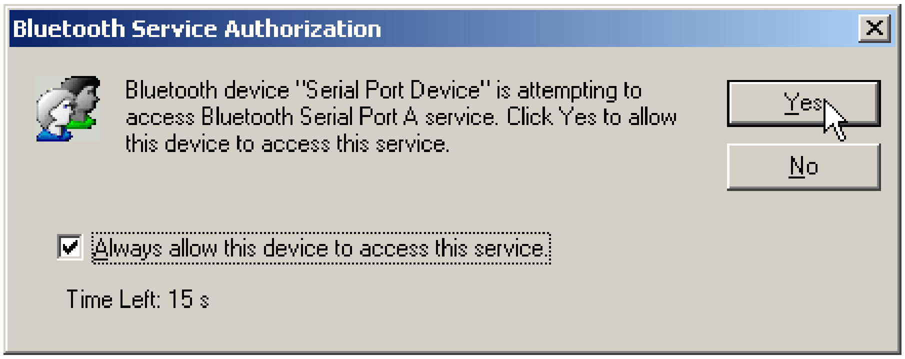
Address 08:00:17:13:17:77

Passkey:

Time Left: 25 s

Figure 2-31. Pincode request on the IVT Stack for the incoming connection

In case the Pincode has been entered correctly, the stack asks if again on application level if the device is allowed to access the Serial Port Service. The question should be answered with Yes. To avoid this message in the future, the checkbox can be checked as well.



Bluetooth device "Serial Port Device" is attempting to access Bluetooth Serial Port A service. Click Yes to allow this device to access this service.

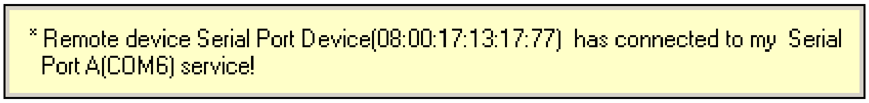
☑ Always allow this device to access this service.

Time Left: 15 s

Figure 2-32. Incoming device requesting access to a local service

Finally the stack reports virtual serial port which can be used to send and receive data for the connected device. This port can now be used by applications like hyperterminal.

NOTE: The IVT stack and most other windows stacks assign different virtual ports for incoming and outgoing connections.



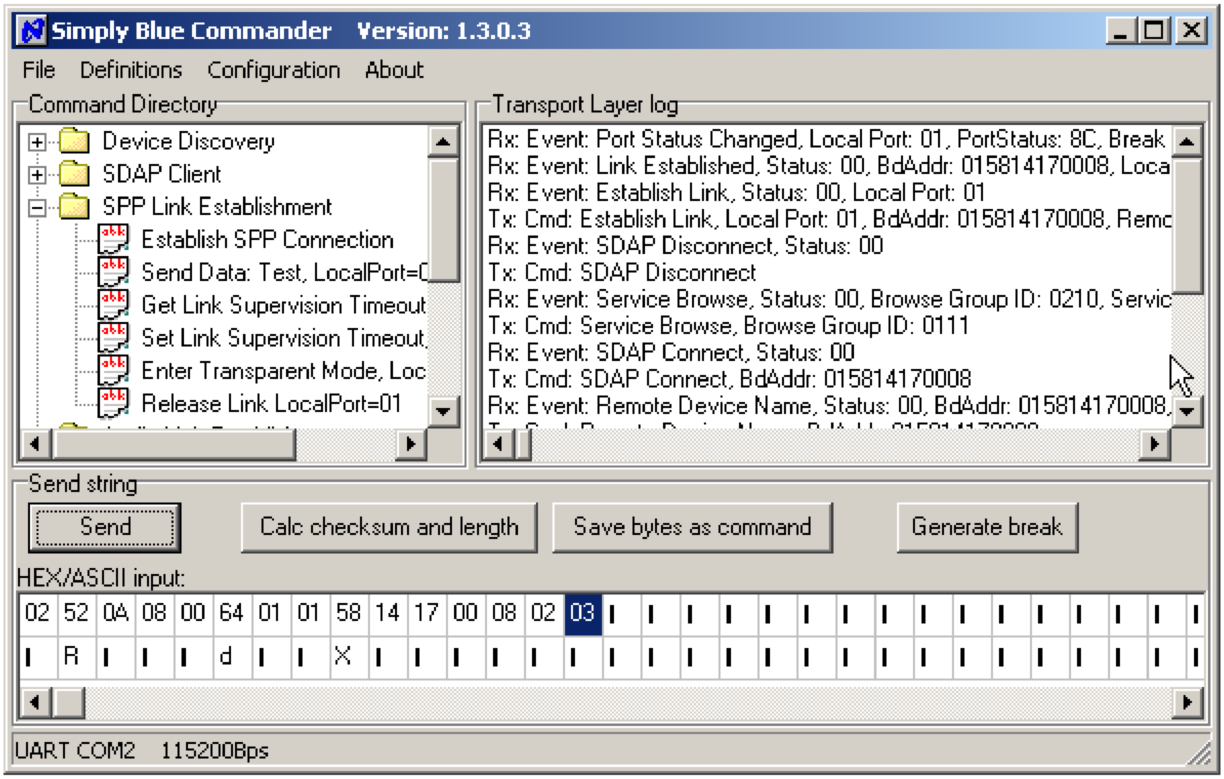
* Remote device Serial Port Device(08:00:17:13:17:77) has connected to my Serial Port A(COM6) service!

Figure 2-33. Virtual Serial Port for the incoming link

Having a final look at the “Simply Blue Commander” it shows the event

Rx: Event: Link Established, Status: 00, BdAddr: 015814170008, Local Port: 01, Remote Port Number: 02

with status 00, which indicates the successful link establishment. In case this event reports status 0x03, the link establishment most likely timed out or failed to another reason. The link establishment command should be resent.



```
Rx: Event: Port Status Changed, Local Port: 01, PortStatus: 8C, Break
Rx: Event: Link Established, Status: 00, BdAddr: 015814170008, Loca
Rx: Event: Establish Link, Status: 00, Local Port: 01
Tx: Cmd: Establish Link, Local Port: 01, BdAddr: 015814170008, Remo
Rx: Event: SDAP Disconnect, Status: 00
Tx: Cmd: SDAP Disconnect
Rx: Event: Service Browse, Status: 00, Browse Group ID: 0210, Servic
Tx: Cmd: Service Browse, Browse Group ID: 0111
Rx: Event: SDAP Connect, Status: 00
Tx: Cmd: SDAP Connect, BdAddr: 015814170008
Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008,
```

```
02 52 0A 08 00 64 01 01 58 14 17 00 08 02 03
|  R  |  |  |  d  |  |  X  |  |  |  |  |  |
```

UART COM2 115200Bps

Figure 2-34. Successful link establishment from the LMX9820A/LMX9830

2.2.6 Create Hyperterminal connection for incoming virtual serial port

Once the LMX9820A/LMX9830 connects to the Windows Stack of the USB Dongle, the windows stack will assign a virtual serial port to this link as seen in Section 2.2.5.3 on page 30.

This means, any data sent to this virtual serial port will be sent to the LMX9820A/LMX9830.

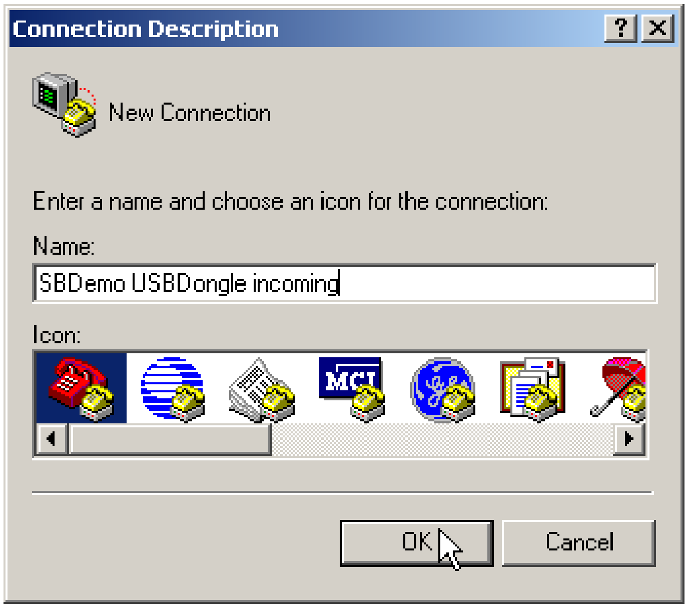
Since we need an application to do this, a Hyperterminal connection needs to be created.

2.2.6.1 Open Hyperterminal Start Hyperterminal

Start Hyperterminal as described in Section 1.3 on page 4.

2.2.6.2 Create new connection

Create a new connection by typing a connection name like “SBDemo USBDongle incoming”.



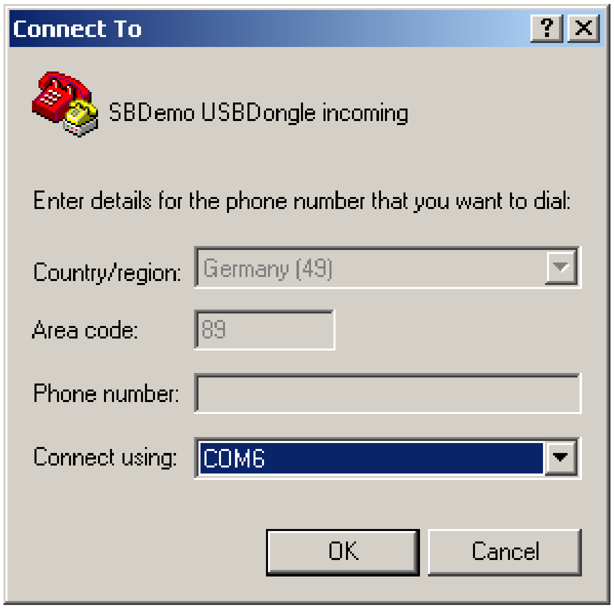
Enter a name and choose an icon for the connection:

Name: SBDemo USBDongle incoming

Figure 2-35. Create new connection

2.2.6.3 Choose correct Comport

In order to talk to virtual serial port of the stack, choose the COMPort reported by the stack as described in Section 2.2.5.3 on page 30, Figure 2-33 In this example “COM6” needs to be used.



SBDemo USBDongle incoming

Enter details for the phone number that you want to dial:

Country/region: Germany (49)

Area code: 89

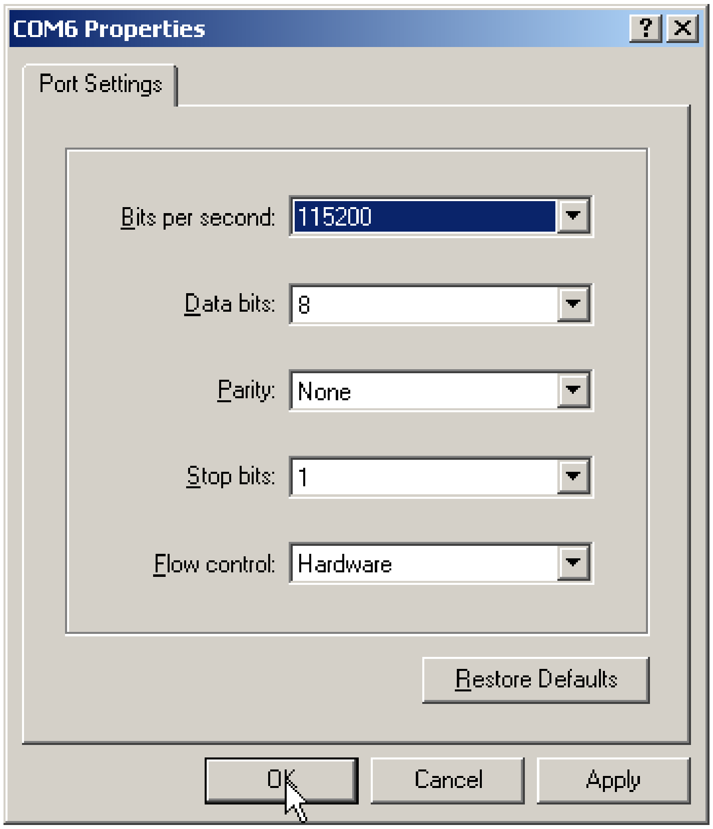
Phone number:

Connect using: COM6

Figure 2-36. Choose correct comport

2.2.6.4 Select correct comport settings

The comport settings for the virtual serial port should be the same as chosen for the LMX9820A/LMX9830 (see Section 2.1.1.4 on page 8).



Bits per second: 115200

Data bits: 8

Parity: None

Stop bits: 1

Flow control: Hardware

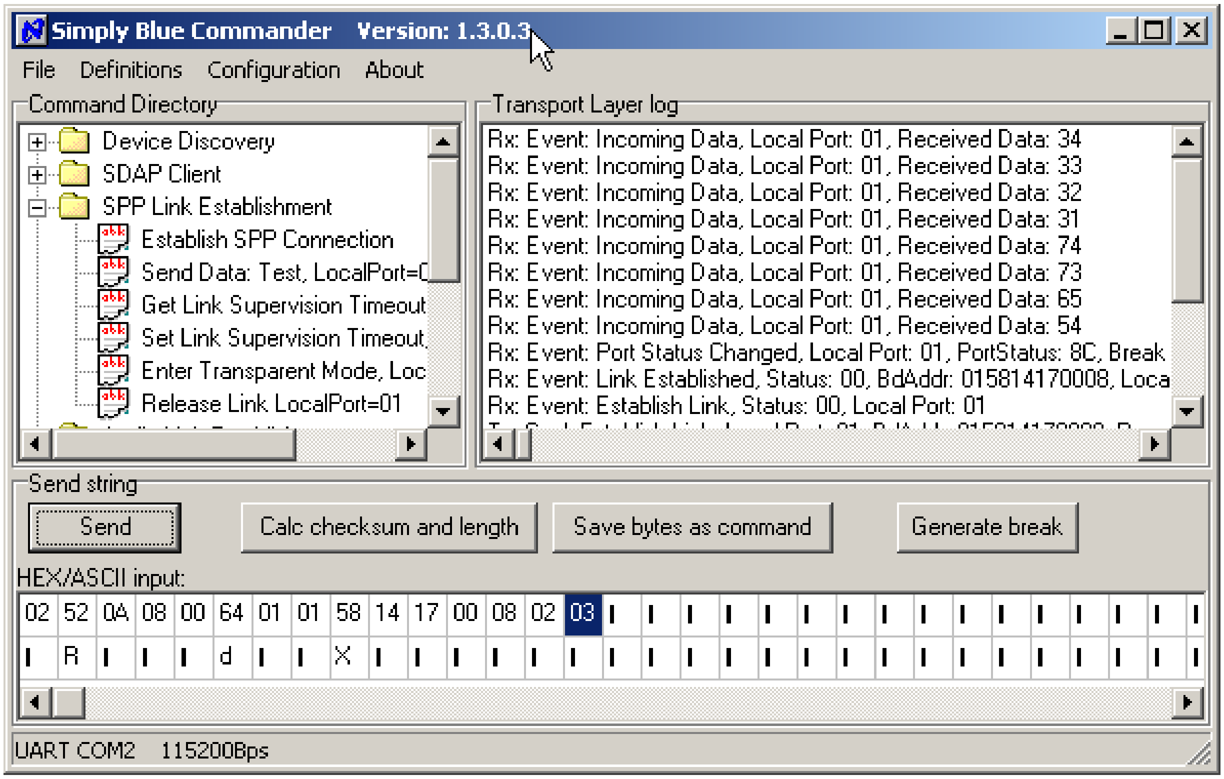
Figure 2-37. Select correct comport settings

Afterwards the Hyperterminal window comes up and should be connected to the selected COMPort.

2.2.7 Receiving Data in Simply Blue Commander

Once the Hyperterminal shows “Connected” any key typed in that window will appear as incoming data in the Simply Blue Commander. See Figure 2-38 as example for the events sent for the Text “test1234”. The test is displayed in hex.

Since the LMX9820A/LMX9830 is still in command mode, meaning, it still is trying to interpret incoming UART data, it indicates incoming data on the bluetooth link with the “Incoming Data” event on the UART.



```
Rx: Event: Incoming Data, Local Port: 01, Received Data: 34
Rx: Event: Incoming Data, Local Port: 01, Received Data: 33
Rx: Event: Incoming Data, Local Port: 01, Received Data: 32
Rx: Event: Incoming Data, Local Port: 01, Received Data: 31
Rx: Event: Incoming Data, Local Port: 01, Received Data: 74
Rx: Event: Incoming Data, Local Port: 01, Received Data: 73
Rx: Event: Incoming Data, Local Port: 01, Received Data: 65
Rx: Event: Incoming Data, Local Port: 01, Received Data: 54
Rx: Event: Port Status Changed, Local Port: 01, PortStatus: 8C, Break
Rx: Event: Link Established, Status: 00, BdAddr: 015814170008, Loca
Rx: Event: Establish Link, Status: 00, Local Port: 01
```

```
02 52 0A 08 00 64 01 01 58 14 17 00 08 02 03
    R           d        X
```

Figure 2-38. Incoming Data at LMX9820A/LMX9830 in command mode

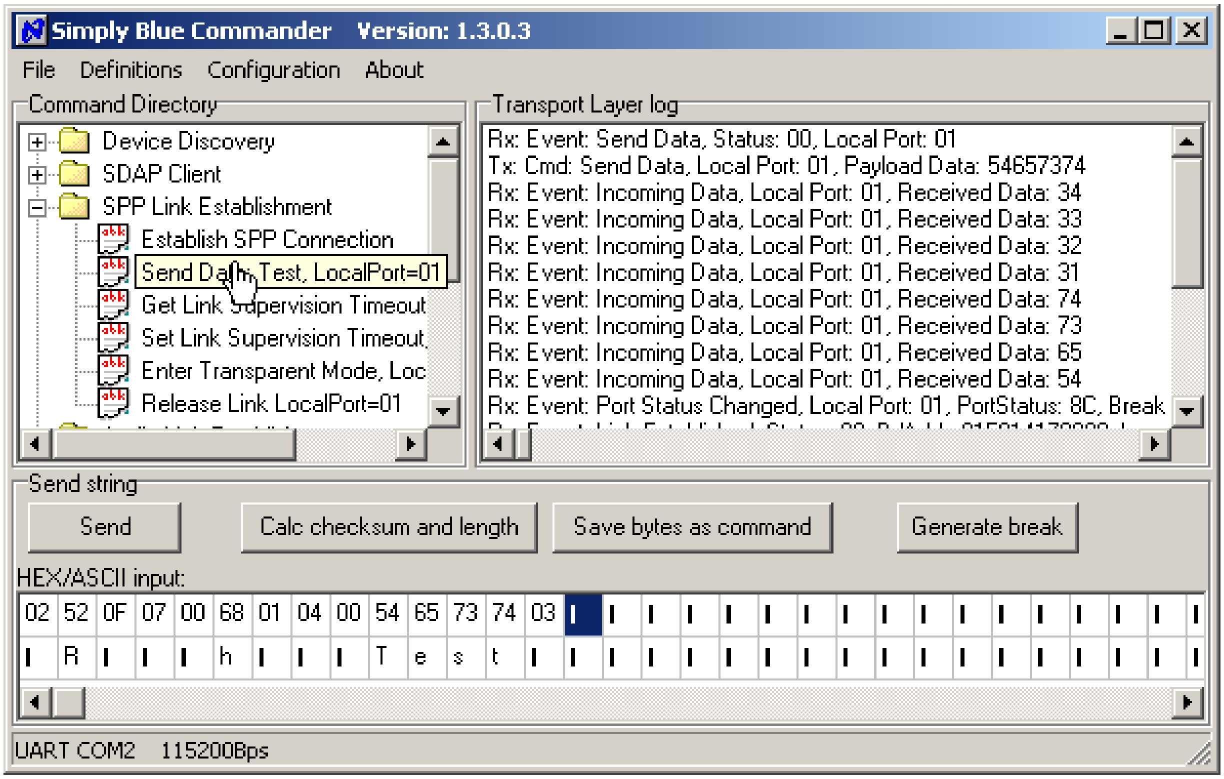
2.2.8 Send Data by using “Send Data”

After actively establishing a link the LMX9820A/LMX9830 will stay in command mode for either a second link or other configurations. Therefore any data to be sent to the other device have to be sent via the “Send Data” command. The command is formed out of the 6-byte header and the payload. The payload consists of

- Local RFCOMM Port (1 byte)
  — The port, to which the package has to be sent to. The port defines the bluetooth link the data have to be forwarded to. In this example the link has been established on port 01.
- Datalength (2 bytes)
  — Length of the data to be sent
- Data (‘Datalength’ bytes)
  — Data to be sent (maximum 330bytes)

The prepared command “Send Data:Test, Local Port=01” in the command directory sends the data “Test” to the remote device.

NOTE: in multiple link setups this command needs be used to differentiate between different connections.

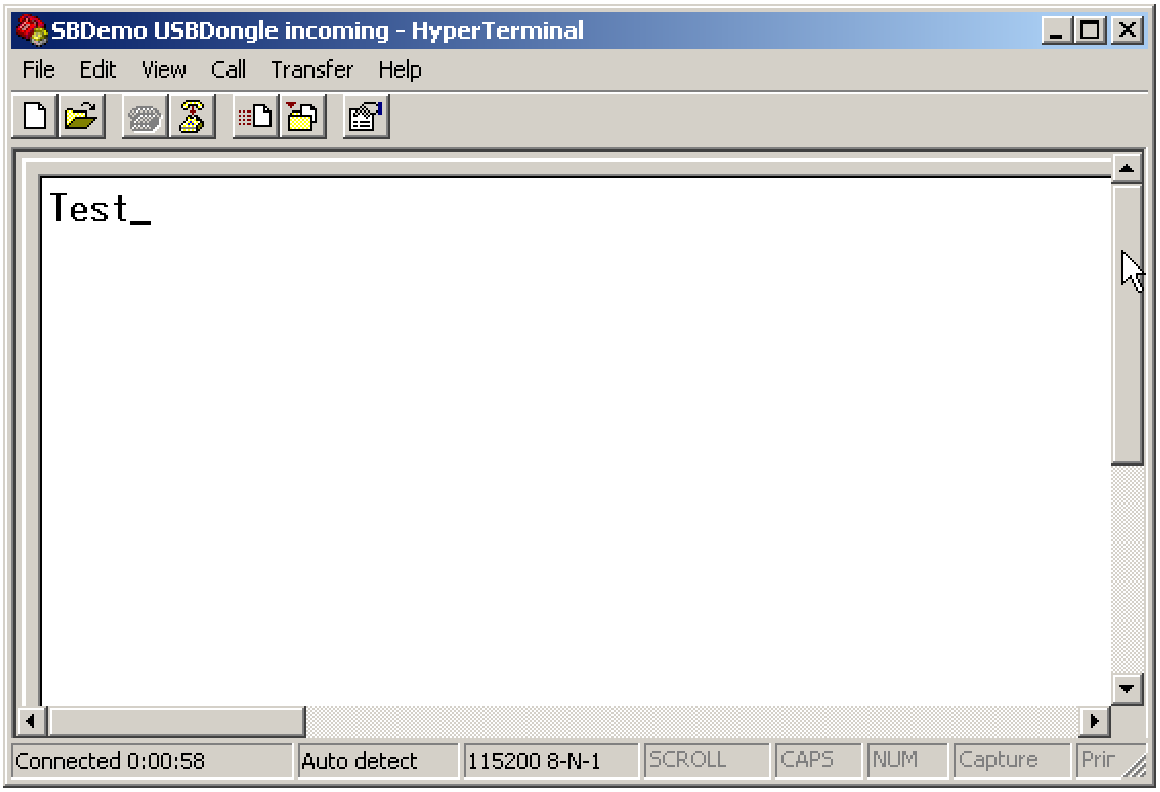


```
Rx: Event: Send Data, Status: 00, Local Port: 01
Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374
Rx: Event: Incoming Data, Local Port: 01, Received Data: 34
Rx: Event: Incoming Data, Local Port: 01, Received Data: 33
Rx: Event: Incoming Data, Local Port: 01, Received Data: 32
Rx: Event: Incoming Data, Local Port: 01, Received Data: 31
Rx: Event: Incoming Data, Local Port: 01, Received Data: 74
Rx: Event: Incoming Data, Local Port: 01, Received Data: 73
Rx: Event: Incoming Data, Local Port: 01, Received Data: 65
Rx: Event: Incoming Data, Local Port: 01, Received Data: 54
Rx: Event: Port Status Changed, Local Port: 01, PortStatus: 8C, Break
```

```
02 52 0F 07 00 68 01 04 00 54 65 73 74 03
   R           h           T  e  s  t
```

Figure 2-39. Send Data by using “Send Data” command

The data will appear in the Hyperterminal window of the USB Dongle after sending.



```
Test_
```

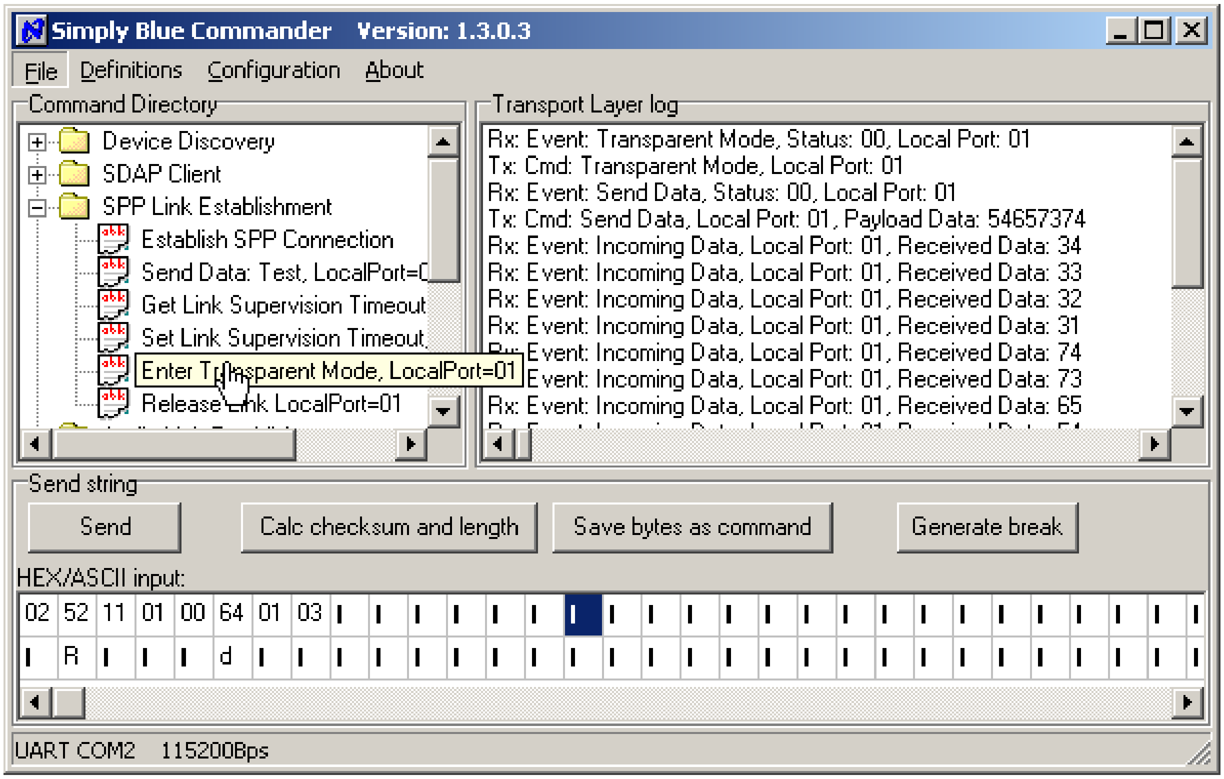
Connected 0:00:58 | Auto detect | 115200 8-N-1

Figure 2-40. Hyperterminal receiving the data sent by the LMX9820A/LMX9830

2.2.9 Switching to transparent mode on the LMX9820A/LMX9830

If only one link is established, so no differentiation between different links is necessary, the LMX9820A/LMX9830 allows to switch the UART interface to “transparent”. This means, incoming data will not be parsed to be a valid command, instead, all incoming data will be sent to the remote device directly.

Transparent Mode on the local port 1 can be reached by sending the prepared command in the “Command Directory”.

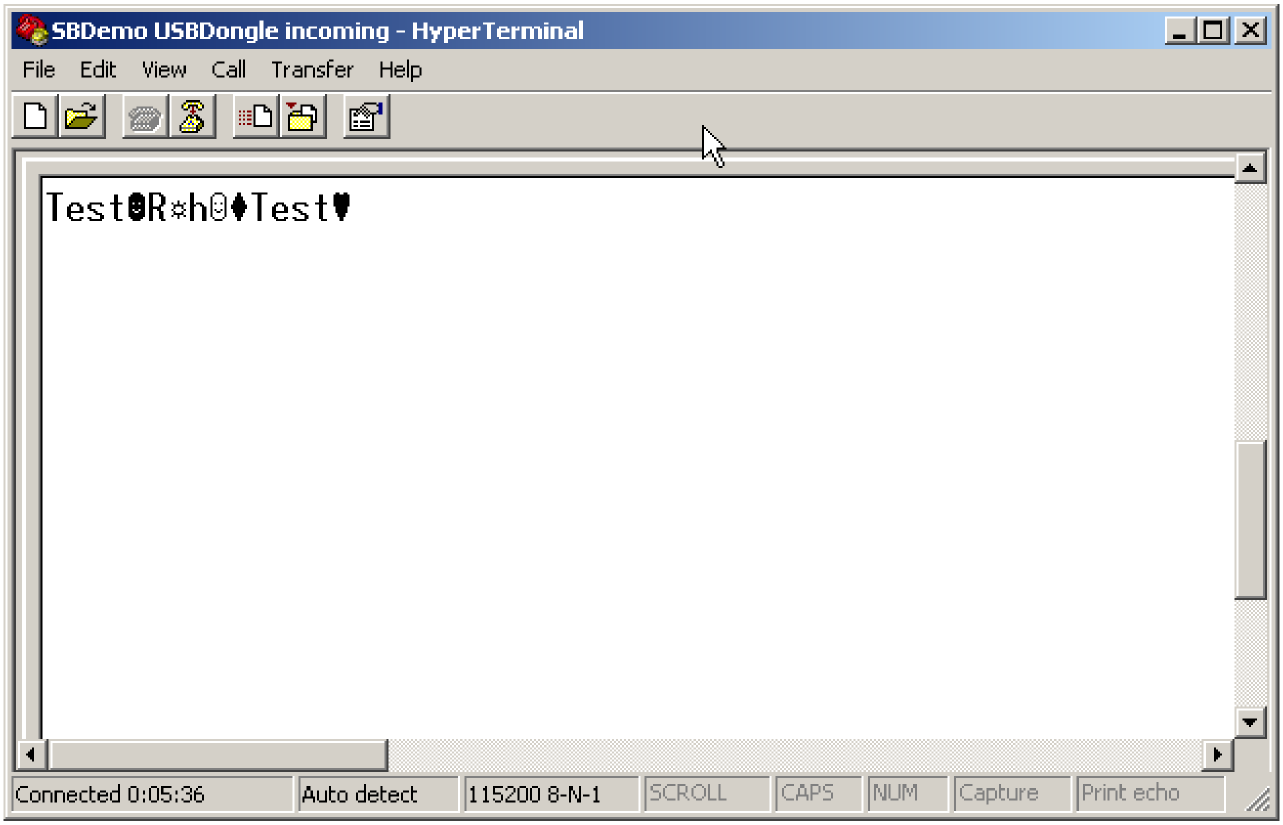


```
Rx: Event: Transparent Mode, Status: 00, Local Port: 01
Tx: Cmd: Transparent Mode, Local Port: 01
Rx: Event: Send Data, Status: 00, Local Port: 01
Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374
Rx: Event: Incoming Data, Local Port: 01, Received Data: 34
Rx: Event: Incoming Data, Local Port: 01, Received Data: 33
Rx: Event: Incoming Data, Local Port: 01, Received Data: 32
Rx: Event: Incoming Data, Local Port: 01, Received Data: 31
Rx: Event: Incoming Data, Local Port: 01, Received Data: 74
    Event: Incoming Data, Local Port: 01, Received Data: 73
Rx: Event: Incoming Data, Local Port: 01, Received Data: 65
```

Figure 2-41. Switch to “Transparent Mode” on the UART

Afterwards, all data will be sent directly to the other side. This can be simulated by sending “Send Data: Test, LocalPort=01” again. The LMX9820A/LMX9830 will now send the complete packet to the other device, not just the “Test” string.

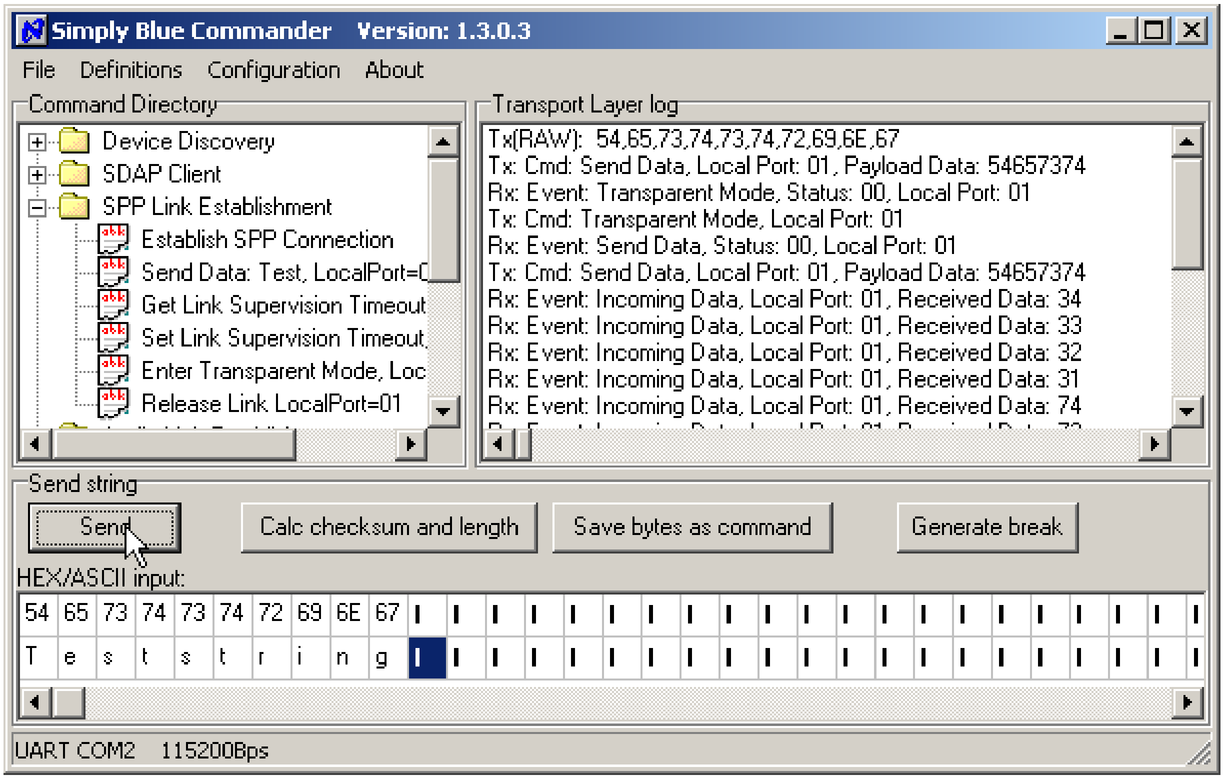
This can be seen at the cryptic characters within the Hyperterminal window.



```
Test☻R☼h☺♦Test♥
```

Figure 2-42. Hyperterminal receiving the complete package from the LMX9820A/LMX9830

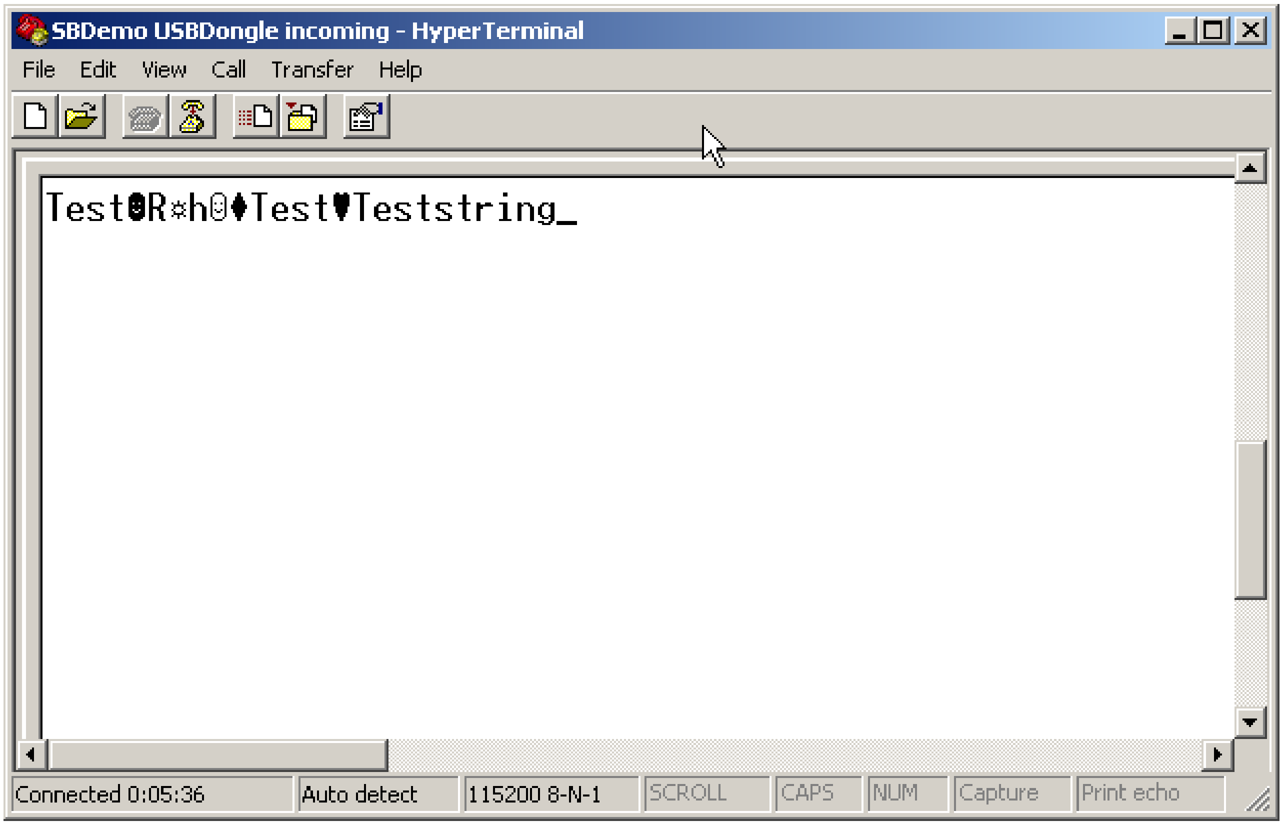
In Simply Blue Commander any data can now be sent without using the “Send Data” command. For this just type a string in the “HEX/ASCII input” line and press “Send”. The whole string will be sent.



```
Tx(RAW): 54,65,73,74,73,74,72,69,6E,67
Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374
Rx: Event: Transparent Mode, Status: 00, Local Port: 01
Tx: Cmd: Transparent Mode, Local Port: 01
Rx: Event: Send Data, Status: 00, Local Port: 01
Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374
Rx: Event: Incoming Data, Local Port: 01, Received Data: 34
Rx: Event: Incoming Data, Local Port: 01, Received Data: 33
Rx: Event: Incoming Data, Local Port: 01, Received Data: 32
Rx: Event: Incoming Data, Local Port: 01, Received Data: 31
Rx: Event: Incoming Data, Local Port: 01, Received Data: 74
```

54	65	73	74	73	74	72	69	6E	67
T	e	s	t	s	t	r	i	n	g

Figure 2-43. Send “Teststring” over the transparent UART link

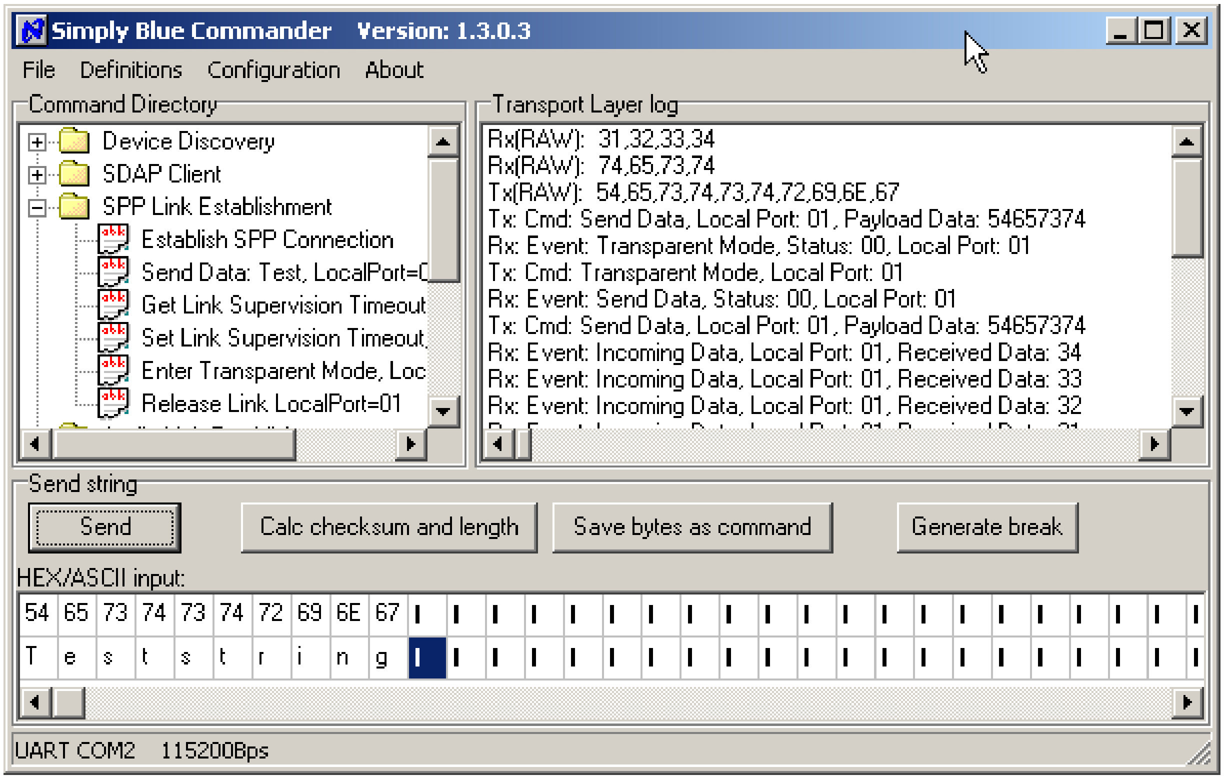


```
Test☻R☼h☺♦Test♥Teststring_
```

Connected 0:05:36 | Auto detect | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo

Figure 2-44. Receiving the RAW Datastring

In case, any key is pressed within the Hyperterminal window now, the incoming data will be shown in RAW format within the Simply Blue Commander. The following screenshot shows the message in Simply Blue Commander in case “test” and “1234” have been sent.



```
Rx(RAW):  31,32,33,34
Rx(RAW):  74,65,73,74
Tx(RAW):  54,65,73,74,73,74,72,69,6E,67
Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374
Rx: Event: Transparent Mode, Status: 00, Local Port: 01
Tx: Cmd: Transparent Mode, Local Port: 01
Rx: Event: Send Data, Status: 00, Local Port: 01
Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374
Rx: Event: Incoming Data, Local Port: 01, Received Data: 34
Rx: Event: Incoming Data, Local Port: 01, Received Data: 33
Rx: Event: Incoming Data, Local Port: 01, Received Data: 32
```

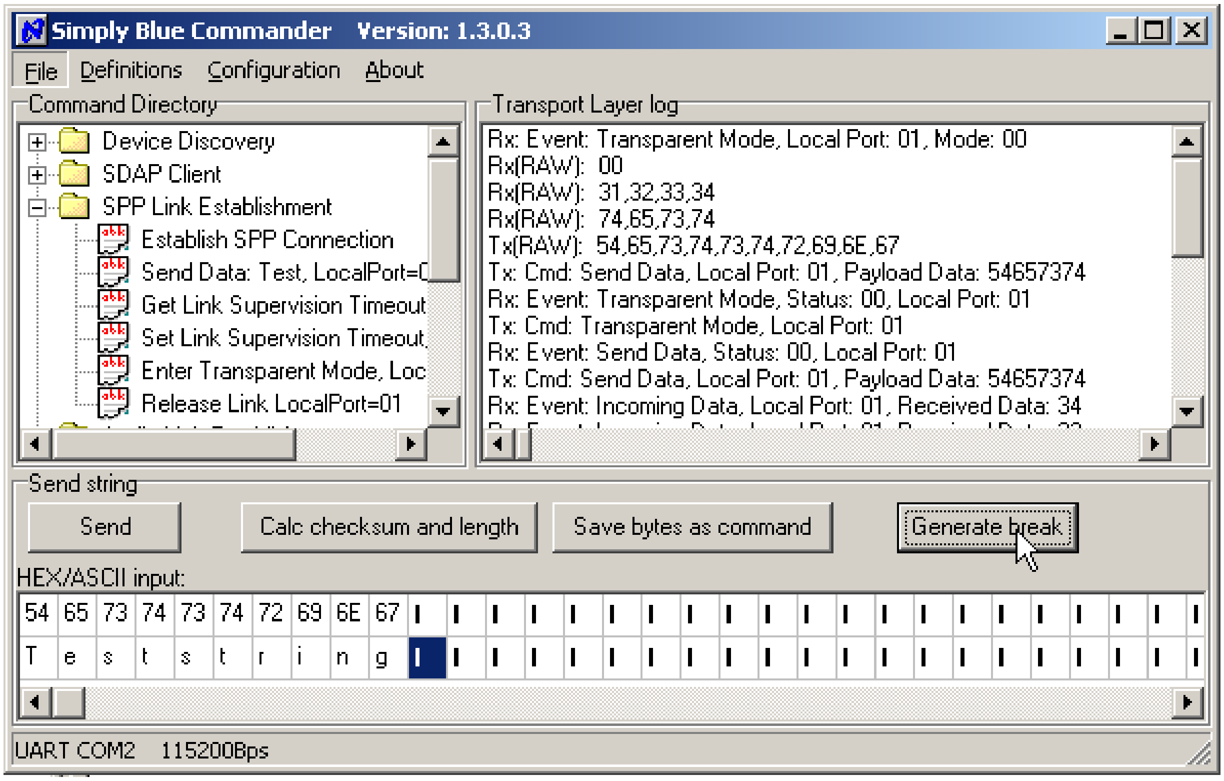
54	65	73	74	73	74	72	69	6E	67	
T	e	s	t	s	t	r	i	n	g	

UART COM2 115200Bps

Figure 2-45. Incoming data in Simply Blue commander with LMX9820A/LMX9830 in transparent mode

2.2.10 “Generate BREAK” to leave “Transparent Mode”

Since the LMX9820A/LMX9830 does not listen to any commands in transparent mode, the UART Break needs to be used to leave this mode. The BREAK is initiated by clicking on the button “Generate break”. Afterwards, data have to be sent again by using the “Send Data” command. Incoming data will be indicated with the “Incoming data” Event.



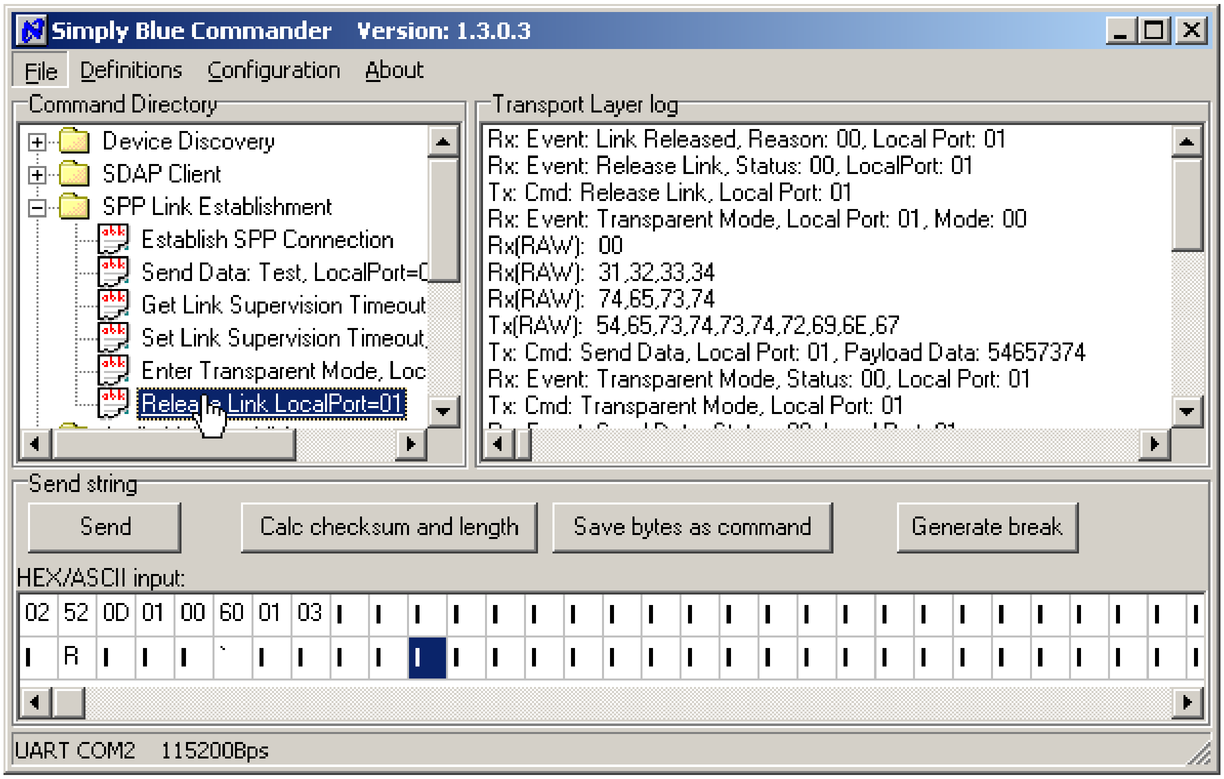
```
Rx: Event: Transparent Mode, Local Port: 01, Mode: 00
Rx(RAW): 00
Rx(RAW): 31,32,33,34
Rx(RAW): 74,65,73,74
Tx(RAW): 54,65,73,74,73,74,72,69,6E,67
Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374
Rx: Event: Transparent Mode, Status: 00, Local Port: 01
Tx: Cmd: Transparent Mode, Local Port: 01
Rx: Event: Send Data, Status: 00, Local Port: 01
Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374
Rx: Event: Incoming Data, Local Port: 01, Received Data: 34
```

```
54 65 73 74 73 74 72 69 6E 67
T  e  s  t  s  t  r  i  n  g
```

Figure 2-46. Leaving transparent with UART Break

2.2.11 Release Link

Finally the link can be released by using the prepared “Release Link LocalPort=01” command.



```
Rx: Event: Link Released, Reason: 00, Local Port: 01
Rx: Event: Release Link, Status: 00, LocalPort: 01
Tx: Cmd: Release Link, Local Port: 01
Rx: Event: Transparent Mode, Local Port: 01, Mode: 00
Rx(RAW): 00
Rx(RAW): 31,32,33,34
Rx(RAW): 74,65,73,74
Tx(RAW): 54,65,73,74,73,74,72,69,6E,67
Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374
Rx: Event: Transparent Mode, Status: 00, Local Port: 01
Tx: Cmd: Transparent Mode, Local Port: 01
```

```
02 52 0D 01 00 60 01 03
   R           `
```

Figure 2-47. Releasing the link by the LMX9820A/LMX9830

3.0 Bibliography

3.1 LMX9820A SOFTWARE USERS GUIDE, NATIONAL SEMICONDUCTOR

3.2 SIMPLY BLUE COMMANDER USERS GUIDE VERSION 1.3, NATIONAL SEMICONDUCTOR

3.3 LMX9830 SOFTWARE USERS GUIDE, NATIONAL SEMICONDUCTOR

4.0 Revision History

.

Table 4-1. Revision History

Revision # (PDF Date)	Revisions / Comments
1.0	Initial Release

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National Semiconductor
Corporation
Americas
Email:
new.feedback@nsc.com

National Semiconductor
Europe
Fax: +49 (0) 180-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 69 9508 6208
English Tel: +44 (0) 870 24 0 2171
Français Tel: +33 (0) 1 41 91 87 90

National Semiconductor
Asia Pacific Customer
Response Group
Tel: 65-2544466
Fax: 65-2504466
Email: ap.support@nsc.com

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