LMX9820A Bluetooth Serial Port Module - Quick Setup Guide

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Introduction

The National Semiconductor® LMX9820A Bluetooth[™] Serial Port module is a highly integrated radio, baseband controller and memory device implemented on an FR4 substrate. 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.

LMX9820A 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 (v1.1) stack including profiles and command interface. This firmware features point-to-point and pointto- multipoint link management supporting data rates up to the theoretical maximum over RFComm of 704 kbps. The internal memory supports up to three active Bluetooth data links and on active SCO link.

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

This document is based on:

Table 0-1.

Item	Version
Hardware	LMX9820ASM
Firmware	V6.00 and later
Actual Firmware Release in production	V6.21

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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 Evalboard. The inbuilt command and event interpreter generates an easy to read log of the UART traffic between the application and the LMX9820A.

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.

Simply Blue Commander Version: 1.3.0.3	_ []	×
Eile Definitions Configuration About		
Command Directory Transport Layer log		
Br: Event: SimplyBlue Ready, SW Version: 0621.		
Brack BAW): 00		
🗄 🛅 SPP Link Establishment		
🗄 💼 Audio Link Establishment		
🗄 💼 DefaultConnections		
🗄 💼 Low Power Modes		
🕀 💼 Wake-up functionality		
🕀 🧰 SPP Port Configuration		
🗄 🛄 Local Bluetooth Settings		
🗄 💼 Local SDB Configuration		
E-Cal Hardware Commands		ы
Send string		
Send Calc checksum and length Save bytes as command Generate break		
	11	
	1	
		۲
UART COM1 115200Bps		1

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 Evaluationboard 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 taskbar 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. It is not necessary to drive the LMX9820A.



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".



2.0 Setup descriptions

The LMX9820A 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.

2.1 CABLE REPLACEMENT WITH LMX9820A WAITING FOR INCOMING CONNECTION

By default the LMX9820A 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 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 as 'passive' waiting device.

2.1.1 Connect Hyperterminal to LMX9820A

Since the LMX9820A 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 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 Evaluation Kit.

2.1.1.2 Create new connection

Create a new connection by typing a connection name like "SBDemo LMX9820A".



Figure 2-1. Create New Connection in Hyperterminal

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2.1.1.3 Choose correct comport

Since Hyperterminal is physically talking to a serial port, please choose the serial port the LMX9820A Evaluation Board is connected to, eg. 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
<u>QK</u> Cancel

Figure 2-2. Choose correct comport

2.1.1.4 Choose comport settings

Choose the correct comport settings for your LMX9820A 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 Evaluationboard is configured by the ISEL Pins. For 115.200kbit/s the setting needs to be ISEL1=0, ISEL2=1.

COM2 Properties	? ×
Port Settings	
	_
Bits per second: 115200	
Data bits: 8	
Parity: None	
Stop bits: 1	
Elow control: Hardware	
<u>R</u> estore Default	s
OK Cancel <u>A</u> r	oply

Figure 2-3. Choose comport settings

2.1.1.5 Reset the LMX9820A Evaluation Board

Once the correct speed is chosen "Hyperterminal" should connect to the selected comport. Afterwards a hardware reset of the LMX9820A Evaluationboard should cause a response as shown in Figure 2-4. The cryptic characters are specific hexvalues 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 communcation between "Hyperterminal" and the LMX9820A Evaluationboard is confirmed.

SBDemo LMX9820A - I jile <u>E</u> dit <u>V</u> iew <u>C</u> all <u>T</u> ra		nal					_0
.							
₿i% ± ö0621♥_							
							Þ
onnected 0:02:35	Auto detect	115200 8-N-1	SCROLL	CAPS	NUM	Capture	Print echo

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

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

Since the LMX9820A 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 is within in the task-bar 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 Evalutation board should appear as "Serial Port Device".



Figure 2-5. Result of Inquiry procedure

2.1.2.2 Service Discovery - Get Services of the LMX9820A

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".



Figure 2-6. Service Discovery result

2.1.2.3 Establish Link to the LMX9820A

To finally connect to the LMX9820A Evalboard, double click on the "Serial Port" Icon if "Serial Port Device" has been selected. This will start the connection establishment process.



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.

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

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



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

2.1.2.4 Enter PIN for LMX9820A By default the LMX9820A 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 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 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 (SMB data only) File View My Bluetooth My Services Tools Help IVE IVE
Serial Por Device
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 should indicate a message similar to Figure 2-11. The cryptic data show again an event reported by the LMX9820A command interface. The data comply to a specific packet format which are not readable in ASCII.

SBDemo LMX9820)A - HyperTermir	nal					_ D ×
	Transfer Help						
02 3 -	0 🎦 🖆						
0X¶0♥_							
							-
Ī							
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 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	
<u>l</u> con:	
🂫 📚 🥸 🧐	>
OK Cano	cel

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			<u>? ×</u>
🧞 SBDemo	USBDongle		
Enter details for	the phone numb	er that you (want to dial:
Country/region:	Germany (49)		7
Area code:	89		
Phone number:			
Connect using:	COM4		▼
	0	K	Cancel
Figure 2.	13. Choose c	orrect CO	MPort



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 (see Section 2.1.1.4 on page 8).

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ide

COM4 Properties	<u>? ×</u>
Port Settings	
	- I
Bits per second: 115200	
Data bits: 8	
Parity: None	
Stop bits: 1	
Flow control: Hardware	
<u>R</u> estore Defaults	
OK Cancel App	ly

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 switches automatically to "Transparent Mode" after beeing 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.

🍓 SBDemo LMX9820/	A - HyperTerminal	_ _ N
File Edit View Call	Transfer Help	
<u>□</u>	Send File Receive File Capture Text Send Text File Capture to Printer	_ _
		v Þ
Sends a file to the remote	e system	16
	Figure 2-15. Choose "Send File" with Hypertermina	1

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

Send File				? ×
Folder: H:\		\mathbf{k}		
Filename:				
H:\LMX9820ASM_	ds_0.7.pdf			Browse
Protocol:				
Zmodem				-
	<u>S</u> end		<u>C</u> lose	Cancel

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 fil	e send for SBDemo LMX9820A	
Sending:	H:\LMX9820ASM_ds_0.7.pdf	
Last event:	Sending	Files: 1 of 1
Status:	Sending	Retries: 0
File:	11	33K of 603K
Elapsed:	00:00:03 Remaining; 00:00:53	Throughput: 10900 cps
		Cancel cps/bps

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

2.2 INITIATE A LINK WITH LMX9820A USING SIMPLY BLUE COMMANDER

The LMX9820A command interface offers full bluetooth capabilities. The Simply Blue Commander software gives an easy to use interface to send commands to the LMX9820A 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 Evaluation kit is connected to.

Once the program is up and running, press the RESET button on the evaluation kit. This will cause the LMX9820A to reboot and bring up the "LMX9820 Ready" Event, followed by the firmware version.

Simply Blue Commander Version: 1.3.0.3	
File Definitions Configuration About	
Command Directory	
🕞 🛅 Device Discovery 🥼 👘 🤁 👘 🗛 👘 🔁	
Bx(RAW): 00	
🗄 💼 SPP Link Establishment	
🗄 💼 🗀 Audio Link Establishment	
🗄 💼 DefaultConnections	
🗄 💼 Low Power Modes	
🗄 💼 🚰 Wake-up functionality	
🗄 💼 SPP Port Configuration	
🗄 💼 Local Bluetooth Settings	
🗄 💼 Local SDB Configuration	
🗄 💼 Local Hardware Commands	
Send string	
Send Calc checksum and length Save bytes as command Generate break	
HEX/ASCII input:	
	I
	►
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.

🔀 Simply Blue Commander 🛛 Version: 1.3.0.3	<u>- ×</u>
File Definitions Configuration About Command Directory Change UART speed: 115200 Change UART Settings: 01 01 TestMode: Bluetooth DUT TestMode: DH1,Channel 16,PRBS RfTestMode: Stop TX Restore factory settings Restore factory settings Restore factory settings Fireware Upgrade	
Send string	
Send Calc checksum and length Save bytes as command Generate break	
HEX/ASCII input:	
02 52 26 00 00 78 03 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	II
	II
	Þ
UART COM1 115200Bps	

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.

Simply Blue Commander Version: 1.3.0.3 File Definitions Configuration About Command Directory Device Discovery GIAC Inc. inc. Benote Name Request Benote Name Request SDAP Client SDAP Client SPP Link Establishment DefaultConnections Low Power Modes Wake-up functionality SPP Port Configuration	Transport Layer log 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
Send string Send Calc checksum and length HEX/ASCII input:	Save bytes as command Generate break
02 52 00 03 00 55 0A 00 00 03 I I I I I	
I R I I I U I I I I I I I I	
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 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.

😥 Simply Blue Commander 🛛 Version: 1.3.0.3	
File Definitions Configuration About	
Command Directory	Transport Layer log
Device Discovery GIAC Inquiry LIAC Inquiry SDAP Clie SDAP Clie DefaultConnections Low Power Modes Wake-up functionality SPP Port Configuration	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
Send string	
Send Calc checksum and length	Save bytes as command Generate break
HEX/ASCII input:	·
02 52 02 06 00 5A FF FF FF FF FF FF 03	
I R I I I Z ÿ ÿ ÿ ÿ ÿ ij I	
UART COM2 115200Bps	

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 inidicates 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.

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lf a	bluetooth	device	wants	to	connect	to	the	serial	port	service	of	another	device,	it	first	has	to	ask	for	this	specific
RF	COMM port	t. IThis																			

Simply Blue Commander Version: 1.3.0.3	
File Definitions Configuration About	
Command Directory	Transport Layer log
Device Discovery GIAC Inquiry GIAC Inquiry DefaultC Inquiry DefaultConnections DefaultConnections Low Power Modes Wake-up functionality SPP Port Configuration	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
Send string Send Calc checksum and length	Save bytes as command Generate break
HEX/ASCII input:	
02 52 02 06 00 50 01 58 14 17 00 08 03 1	
UART COM2 115200Bps	

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

2.2.3.2.3 Press "Send"

To finally send the command to the LMX9820A, just press the "Send" button. The LMX9820A will respond to the request by the appropriate "Remote Device Name" Event, including the status and the devicename. 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.

Simply Blue Commander Version: 1.3.0.3	<u>- 0 ×</u>
File Definitions Configuration About	
Command Directory Transport Layer log	
Bevice D Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008, DeviceName: D GIAC G	CDL38.
Send string	
Seng Calc checksum and length Save bytes as command Generate break	
HEX/ASCII input:	
02 52 02 06 00 5A 01 58 14 17 00 08 03 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1
	1 1 1
UART COM2 115200Bps	

Figure 2-23. Remote Name Request Reponse

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 eg. a modemdriver 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.

+	<u> </u>	Devico SDAP SDAP SI	Olier AP AP AP AP	cove ht Fann Servi Servi Attrib	e <mark>et</mark> ce Bro ce Bro ce Sea ute Re	wse arch ques	Pub		R× T× R× T× R× T× R×	c Eve c Eve c Eve c Eve c Eve c Eve c Eve c Eve c Eve c Eve	ent: F ent: T ent: T ent: S ent: S d: Re ent: F	Remo emote nquiry Devic quiry, Simply eset Resto	te Do Dev y, Sta e Fo Leng Blue	rice N atus: I und, I jth: Q Rea ictory	lame 30 3dAc A, Ni dy, S Sett	, Bd/ Idr: (umR W V ings,	Addr:)158 espo 'ersio	015 1417 nce n: 0	5814 7000 s: 00 621.	1700 8, Di	008 evid	ceCl				
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-	nd s					nt	Þ	-	•																	•
-		SPP L		stabl			▶ (sum	- and	I len,	gth		Gave	byte:	s as c	omm	and			Ge	nera	te b	reak	;			•
Se HE>	S (/AS	SPP L tring end	ink E	stabl	ishmer Calc c	l					·	Save	byte:	asc	omm	and			Ge	nera	te b	reak				•
Se HE>	S (/AS	SPP L tring end	ink E	stabl	ishmer Calc c	l					·	Gave	byte:	s as c	omm	and			Gei	nera	te b	reak	:	1	1	•

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.

File Definitions Configuration About Command Directory Image: Device Discovery Image: SDAP Client Image: SDAP Connect Image: SDAP Service Browse SPF Image: SDAP Service Browse Public Image: SDAP Service Search Image: SDAP Disconnect Image: SDAP Discon	
SDAP Service Browse Pub SDAP Service Search SDAP Attribute Request SDAP Disconnect SPP Link Establishment Send string	
	Þ
HEX/ASCII input:	
	I I
	I I
UART COM2 115200Bps	

Figure 2-25. Replace payload by bluetooth

LMX9820A Bluetooth Serial Port Module - Quick Setup Guide

2.2.4.1.3 Press "Send"

To finally send the command to the LMX9820A, just press the "Send" button. The LMX9820A 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.



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.

File				ns		ngui	racio	n	۹bo			-																		
				ctor	·						_	_	ansp : Eive				-					_		_		_		_		
+ +		SD SD SD SD De	AP SD SD SD SD SD P Li	e Dis Clier IAP IAP IAP IAP IAP IAP	nt Con Serv Serv Attril Disc Stat	nect vice vice bute bute	Brow Brow Sea Rec ect men	vse î rch ques	5			Tx: Rx Tx: Rx Tx: Rx Rx Tx: Rx	: Eve : Eve : Eve : Eve : Eve : Eve	d: S ent: ent: d: R ent: ent: d: Ir ent:	ervia SDA DAF Ren emo Inqu Dev guir Sim	ce B AP C Co note D vice D y, Lo plyB	row: Conn Devid Devid Stati Four engti	se, E ect, B /ice /ice Nus: (nd, F h: Q	Brow Sta IdAc Nar Iamo DO BdA A, N	vse I itus: ddr: me, B e, B ddr: lumf	Grou 00 015 Stat 1Ad 015 Resp	up II 814 us: I dr: 0 5814): 0 170 00, 1 158 170 ces:	111 008 3dA(141 008, 00,	ddr: 700(, De	0150 08 vice	B1 41 Clas	1700	108,	
		end				Ca	lc cł	neck	.sun	n ar	id le	ength		Sa	avel	byte	sas	con	nma	nd			Ge	nera	ate b	oreak	;			
HE>				ut: 00	89	01	11	03			1							1	1			1				1	1			-
		<u> </u>				•			•											-	-	+	-	-	-			+	÷	+
1	R	5	I	<u> </u>	<u> </u>	1	1	I	I	1	<u> </u>	1	<u> </u>	1	1	I	1	1	1	1	1	1	1	1	1	1	1	1	<u> </u>	
•																														▶
IAR	ΤC	OM2	2 1	152	00B	ps																								
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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.



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.

Bit Client SDAP Client Bit Client SPP Link Establishment Bit Client Rx: Event: Service Browse, Status: 00, Browse Group ID: 0210, Service Bit Client Rx: Event: Service Browse, Browse Group ID: 0111 Bit Client Rx: Event: SDAP Connect, Status: 00 Bit Client Rx: Event: SDAP Connect, Status: 00 Bit Client Tx: Cmd: SDAP Connect, Status: 00 Tx: Cmd: SDAP Connect, BdAddr: 015814170008	Set Link Supervision Timeou	Try Cond. Designed Designed Names, Data day, 01E014170000	
BX: Event: Service Browse, Status: 00, Browse Group ID: 0210, Service 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: 01581	4170008,
■ Bx: Event: SDAP Disconnect, Status: 00	E - Client E - Client Establishment	Tx: Cmd: SDAP Disconnect Rx: Event: Service Browse, Status: 00, Browse Group ID: 021	10, Servir

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, 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.

Guide	
d d	Simply Blue Commander Version: 1.3.0.3
Setup	File Definitions Configuration About
Se	Command Directory Transport Layer log
Quick	End Device Discovery A Rx: Event: SDAP Disconnect, Status: 00 Tx: Cmd: SDAP Disconnect
ni	By: Event: Service Browse, Status: 00, Browse Group ID: 0210, Service
a	Tx: Cmd: Service Browse, Browse Group ID: 0111
	Establish SPP Connection Rx: Event: SDAP Connect, Status: 00
In	Get Link Supervision Timeout 🛛 🛛 🕅 Rx: Event: Remote Device Name, Status: 00, BdAddr: 015814170008,
Module	Example 2 Set Link, Supervision Timeout Tx: Cmd: Remote Device Name, BdAddr: 015814170008
₹ S	Enter Transparent Mode, Loc Rx: Event: Inquiry, Status: 00 Exter Transparent Mode, Loc Rx: Event: Device Found, BdAddr: 015814170008, DeviceClass: 0401
Port	Release Link LocalPort=01 Tx: Cmd: Inquiry, Length: 0A, NumResponces: 00, Mode: 00
Serial	Send string
Se	Send Calc checksum and length Save bytes as command Generate break
ţ	
Bluetooth	HEX/ASCII input:
let	
3lu	
320	UART COM2 115200Bps
X9820A	Figure 2.20 Adopting the "Establish CDD Connection" Commond

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.

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 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 needs to be used (0000).

Enter B	uetooth Passkey	/	×
? *	relationship for fut	needs a Bluetooth Passkey to create Paired ure connections. Please use the same evice and on the remote device: Serial Port Device 08:00:17:13:17:77	OK Cancel



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.

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I.

Bluetool	th Service Authorization	x
đ	Bluetooth device "Serial Port Device" is attempting to access Bluetooth Serial Port A service. Click Yes to allow this device to access this service.	Yes No
·	Iways allow this device to access this service. a Left: 15 s	



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.

8	5im	ply	Blu	e C	omr	nar	ıde	r V	'ers	ion	1.3	3.0.3	3															_		x
File -Co +	D mma C	and I De ^r SD, SPI	Dire vice AP I P Li	etor Dis Clier nk E	icovi nt Estab	ery olishi	mer	ıt	Abo	ut		Rx: Rx: Rx:	Eve Eve Eve	ent l ent l	Port Link Esta	: Esl ablis	tus (ablis n Lir	shea 1k, S	1, St Stati	atus us: 0	: 00 0, L), B(.oca	iAdo al Po	dr: 0 ort: 0	158 1	1417	s: 80 7000	18, L	oca	
			Se Ge Se En Re	nd D t Lin t Lin ter T) ata: nk Su nk Su iran:	Te: uper uper spare	st, L visio visio ent l	necti .ocal on Ti on Ti Mod IPort	Port meo meo e, Lo	ut ut,		Tx: Rx: Tx: Rx: Tx:	Cma E ve Cma E ve Cma	1: SI ent: 5 1: Se ent: 5 1: SI	DAF Servie SDA DAF	P Dis vice ce B AP C P Co	con Brow row: onn	nec wse se, l ect, E	t Sta Srov Sta dAc	vse (itus: ddr: me, !	00 Groi 00 015 Stal	, Bro up II 814 tus:	D: 0 170 00,	111 008	ddr:	015	0210 5814]	5.
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JAR	T CO	DM2	: 1	152	:00Bj	ps																								

Figure 2-34. Successful link establishment from the LMX9820A

2.2.6 Create Hyperterminal connection for incoming virtual serial port

Once the LMX9820A 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.

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".



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.

Connect To
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
OK Cancel

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 (see Section 2.1.1.4 on page 8).

COM6 Properties	? ×
Port Settings	
	_
Bits per second: 115200 ▼	
Data bits: 8	
Parity: None	
Stop bits: 1	
Elow control: Hardware	
<u>R</u> estore Defaults	5
OK Cancel Ap	ply



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 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.

Simply Blue Commander Version: 1.3.0.3	
File Definitions Configuration About	
Command Directory Transport Layer log	
 Device Discovery SDAP Client SDAP Client SPP Link Establishment Establish SPP Connection Send Data: Test, LocalPort=C Get Link Supervision Timeout Set Link Supervision Timeout Enter Transparent Mode, Loc Release Link LocalPort=01 Release Link LocalPort=01 Send Data: Test, LocalPort=01 Send Data: Send Data:	
Send string	
Send Calc checksum and length Save bytes as command Generate break	
HEX/ASCII input:	
02 52 0A 08 00 64 01 01 58 14 17 00 08 02 03 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1
	1 1
UART COM2 115200Bps	

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

2.2.8 Send Data by using "Send Data"

After actively estabilishing a link the LMX9820A 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.

	Blue	Comr	nan	ider	٧e	rsio	n: 1	.3.0.	3														_	
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.⊕ <mark>⊡</mark> Do			ery				-			ent: Se d: Seni										54	6573	374		
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	-	olish Sl				,				ent: Inc ent: Inc														
		Dalh					٦J			ent: Inc														
		link 5t	•							ent: Inc ent: Inc														
		.ink Su	•					Bx:	: Eve	ent: Ind	omir	īg D	ata,	Loc	al Po	ort: O	11, F	lece	eive	d D	lata:	65		
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HEX/ASCI 02 52 OP		0 68	01	04	00 5	4 6	5 7	3 74	03	1 1	1	T	T	I	1	1	1	1	T	I	I	1	1	I
I B I	1 1	h	I	I	I T	е	s	t	T	1.1	T	T	T	T	T	I	T	T	T	T	T	T	I	T
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🇞 SBD)emo l	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd				_		×
🇞 SBD)emo l	USBD	ong	oerte	ermina ncom	al wi ing ·	ndo - Hy	ow of	the	USBI	-						mar	nd				_		×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd				_		×
File E)emo l	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd						×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd				-		×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd				-		×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd				_		×
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File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd						×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd						×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd						×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd						×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd						×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd						×
File E	Demo l idit Vi	USBD	ong	oerte	ermina ncom	al wi ing · He	ndo - Hy	ow of	the	USBI	-						mar	nd						×
File E	Demo l	USBD ew (ong		ermina ncom	al wi	ndo - Hy elp	yper	the	USBI	Dong	Je a		rser	ndinç			NUM	1		aptur		Prir	

2.2.9 Switching to transparent mode on the LMX9820A

If only one link is established, so no differentiation between different links is necessary, the LMX9820A 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".



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 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.

🏀 SBDemo USBDongle in	coming - Hype	rTerminal					_ 🗆)	×
File Edit View Call Tra								_
			k					л
Test®R≭h⊍♦Tes	st♥							
							_	4
								-
Connected 0:05:36	Auto detect 1	15200 8-N-1	SCROLL	CAPS	NUM	Capture	Print echo	

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

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.

Command Directory	😥 Sim	ply	Blu	e Co	omr	nar	nder	r V	/ers	ion	: 1.:	3.0.	3															_		×
Device Discovery SDAP Client SDAP Client SPP Link Establishment Establish SPP Connection Send Data: Test, LocalPort Get Link Supervision Timeout Set Link Supervision Timeout Enter Transparent Mode, Local Release Link LocalPort=01 Release Link LocalPort=01 Send string Calc checksum and length Save bytes as command Generate break Get String Calc checksum and length Save bytes as command Generate break	File D	efini	ition	is (Conf	figur	ratio	n	АЬо	ut																				
SDAP Client Tx: Cmd: Send Data, Local Port: 01, Payload Data: 54657374 SPP Link Establishment Fx: Event: Transparent Mode, Status: 00, Local Port: 01 Send Data: Test, LocalPort=C Fx: Event: Send Data, Local Port: 01, Payload Data: 54657374 Send Data: Test, LocalPort=C Fx: Event: Send Data, Local Port: 01, Payload Data: 54657374 Send Data: Test, LocalPort=C Fx: Event: Send Data, Local Port: 01, Payload Data: 54657374 Set Link Supervision Timeout Fx: Event: Incoming Data, Local Port: 01, Received Data: 34 Set Link Supervision Timeout Fx: Event: Incoming Data, Local Port: 01, Received Data: 32 Rx: Event: Incoming Data, Local Port: 01, Received Data: 32 Rx: Event: Incoming Data, Local Port: 01, Received Data: 32 Rx: Event: Incoming Data, Local Port: 01, Received Data: 32 Rx: Event: Incoming Data, Local Port: 01, Received Data: 32 Rx: Event: Incoming Data, Local Port: 01, Received Data: 32 Rx: Event: Incoming Data, Local Port: 01, Received Data: 34 Rx: Event: Incoming Data, Local Port: 01, Received Data: 32 Rx: Event: Incoming Data, Local Port: 01, Received Data: 32 Rx: Event: Incoming Data, Local Port: 01, Received Data: 34 Rx: Event: Incoming Data, Local Port: 01, Received Data: 34 Rx: Event: Incoming Data, Local Port: 01, Received Data: 34 Rx: Event: Incoming Data, Local Port: 01	Comm	and l	Dire	ctory	y							-Tra	ansp	ort	Laye	r log	,													
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Figure 2-43. Send "Teststring" over the transparent UART link

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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.

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

2.2.10 "Generate BREAK" to leave "Transparent Mode"

Since the LMX9820A 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.

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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.

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LMX9820A Bluetooth Serial Port Module - Quick Setup Guide

LMX9820A Bluetooth Serial Port Module - Quick Setup Guide

3.0 Bibliography

- 3.1 LMX9820A SOFTWARE USERS GUIDE VERSION 1.6.1, NATIONAL SEMICONDUCTOR
- 3.2 SIMPLY BLUE COMMANDER USERS GUIDE VERSION 1.3, NATIONAL SEMICONDUCTOR

4.0 Revision History

Table 4-1. Revision History											
Revision # (PDF Date) Revisions / Comments											
1.0 Initial Release											

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