

AN4127 Application note

Demonstration board for Bluetooth[®] module class 2 SBT2632C2A.AT2

Introduction

This document describes the STEVAL-SPBT3ATV3 demonstration board (dongle) for the Bluetooth $^{\tiny (\!R\!)}$ class 2 SPBT2632C2A.AT2 module.

The dongle includes the module under evaluation, an RF antenna, and a USB connector.

The USB connector is used to connect the dongle with a PC, to access the Bluetooth module and to supply the dongle.

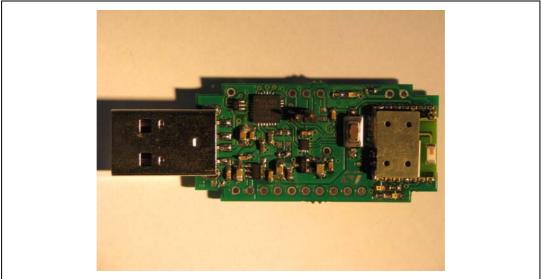
The STEVAL-SPBT3ATV3 is an easy solution to test and operate with the SPBT2632C2A.AT2 module and familiarize the user with the embedded FW which enables the creation of a Bluetooth link with simple AT commands. The AT command list is detailed in the UM1547 user manual.

This document introduces the main technical characteristics of the dongle and includes a quick start guide to get started with the STEVAL-SPBT3ATV3.

Dongle features:

- Based on V3.0 Bluetooth class 2 module, SPBT2632C2A.AT2
- USB interface and power supply
- Supported reprogrammability via USB interface
- Reset button
- Antenna onboard
- RoHS compliant

Figure 1. STEVAL-SPBT3ATV3 dongle



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1 Demonstration board usage limitation

The dongle based on the SPBT2632C2A.AT2 module is not qualified; it is a pure demonstration tool only for evaluation purposes and not a product in itself.

2 Recommended operating conditions

Symbol Unit Condition Min. Тур. Max. Parameter -40 °C < T < 85 °C 5 ۷ Vdd 4.5 5.5 Board supply voltage °C Тор Operating case temperature range -40 +85

Table 1. Recommended operating conditions



3 Dongle layout

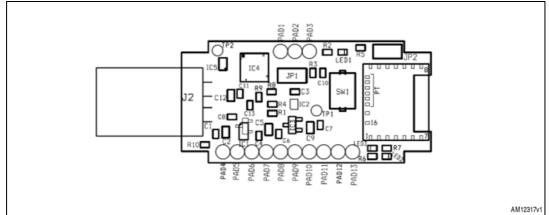
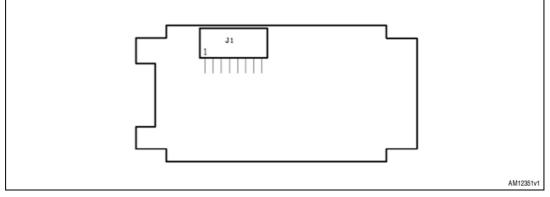


Figure 2. Dongle component layout, front side







4 I/O connections

4.1 PAD description

Other than the USB plug, some pads are also available. In fact PAD1 to PAD13 make the SPBT2632C2A.AT2 pins available to the user.

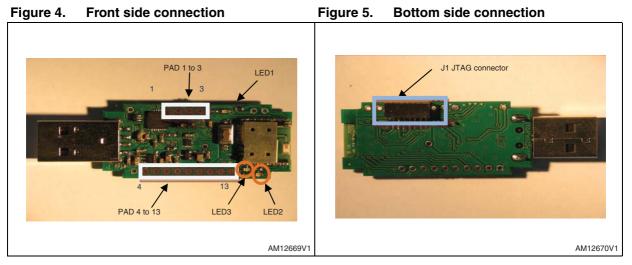


Table 2 gives a description of these pads.

		Description
	1	BOOT0 - Boot pin used for firmware downloading - used for testing purposes
	2	3.3 V (module – LED1 is connected to this PAD)
	3	RESETN - reset - connected in parallel to onboard reset switch
4 GND		
	5	+5 V (USB)
	6	LPO (external 32.768 kHz frequency input to allow deep sleep and sniff mode Bluetooth module functional states)
PAD	7	GPIO07 – general purpose I/O
	8	GPIO01 – general purpose I/O $^{(1)}$ (LED2 is connected to this GPIO)
	9	GPIO02 – general purpose I/O ⁽¹⁾
	10	GPIO03 – general purpose I/O ⁽¹⁾
	11	GPIO04 – general purpose I/O ⁽¹⁾ (LED3 is connected to this GPIO)
	12	GPIO06 – general purpose I/O ⁽¹⁾
	13	GPIO05 – general purpose I/O

Table 2.Pad connections



		Description
	1	JTRST
	2	JTDO
	3	JTCK
JTAG	4	JTMS
JIAG	5	JTDI
	6	nRESET (max. voltage 2.5 V)
	7	+ 3.3 V
	8	GND

 Table 2.
 Pad connections (continued)

1. Default configuration - a different configuration may be chosen (see the SPBT2632C2A.AT2 datasheet).

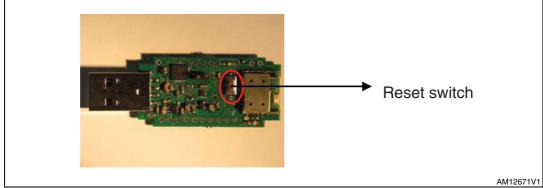
4.2 Reset switch

A reset switch SW1 is present on the dongle. When SW1 is pushed, SPBT2632C2A.AT2 is forced to reset.

The following prompt is displayed on the screen:

- AT-AB CommandMode
- AT-AB BDAddress xxxxxxxxxxx





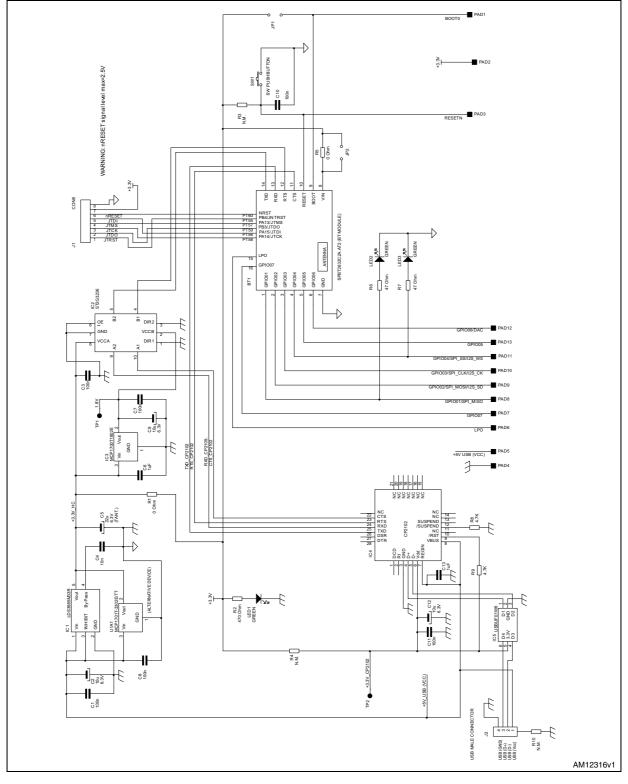


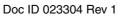
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5 Dongle schematic







6 Getting started

6.1 Dongle installation

The Bluetooth SPBT2632C2.AT2 module and the related dongle do not need any Bluetooth driver on the host processor. However, before using a new USB device the user must install it on their PC.

If the USB driver is not present on the PC, it is necessary to apply a simple installation procedure as follows:

• Step 1:

Simply plug the STEVAL-SPBT3ATV3 into any available USB port. The computer responds with the following two messages:

Figure 8. USB drive installation first and second step



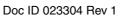
Step 2:

Next, a "Found New Hardware Wizard" installation window opens. Select 'Yes, this time only' to locate the drivers from the $Microsoft^{(R)}$ website.

Figure 9. Wizard installation first step

Welcome to the Found New	
Hardware Wizard	
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission). <u>Read our privacy policy</u>	
Can Windows connect to Windows Update to search for software?	
Yes, now and givery time I connect a device No. not this time	
Click Next to continue.	
	Windows will search for current and updated software by looking on your computer, on the hardware installation (D), or on the Windows Update Web site (with your permission). Read our privator policy Can Windows connect to Windows Update to search for software?

Click 'Next' to install automatically.





Found New Hardware Wizard	
This wizard helps you install software for: CP2102 USB to UART Bridge Controller	
If your hardware came with an installation CD or floppy disk, insett it now.	
What do you want the wizard to do?	
Click Next to continue.	

Figure 10. Wizard installation second step

The STEVAL-SPBT3ATV3 USB to UART controller and virtual COM port driver is now installed.

• Step 3:

The "Found New Hardware Wizard" now opens again in order to install the USB device driver.

Select 'Yes, this time only' to locate the drivers from the Microsoft website.

Figure 11. Wizard installation third step

	Welcome to the Found New Hardware Wizard Windows will search for current and updated software by	
	looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission). Read our privacy policy	
	Can Windows connect to Windows Update to search for software?	
	© <u>Yes</u> , this time only ○ Yes, now and gvery time I connect a device ○ No, not this time	
	Click Next to continue.	

The following message appears:







• Step 4:

Open the Windows[®] device manager application to verify correct installation, and see which COM port has been assigned to the STEVAL-SPBT3ATV3 Bluetooth serial device. The STEVAL-SPBT3ATV3 is usually assigned the same virtual COM port each time it is inserted (unless there are other virtual COM devices altering port assignments).

Two device drivers for the STEVAL-SPBT3ATV3 Bluetooth device should be seen here.

Figure 13. Windows device manager

The CP2102 chip provides the function of using standard UART serial communications from the computer via the universal serial bus, and interfaces directly to the Bluetooth module inside the STEVAL-SPBT3ATV3 Bluetooth serial adapter. If USB driver wizard installation fails, follow *Appendix A: USB driver installation* installation procedure.

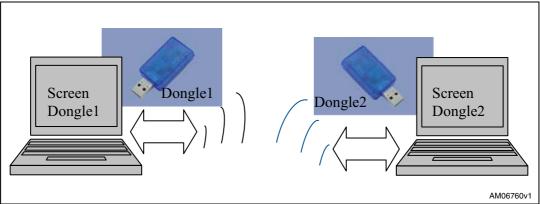
6.2 Setup and connect

The purpose of this section is to describe all the necessary steps to establish a connection between two Bluetooth STEVAL-SPBT3ATV3 dongles realizing a serial line/cable replacement application.

Two PCs and two STEVAL-SPBT3ATV3 boards are needed to perform the connection.



Figure 14. Basic setup



(Please refer to the UM1547 user manual for the listing and meaning of the AT commands.)

6.2.1 Startup

Two dongles are needed to perform the connection.

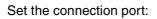
Each dongle has its own BD address. Suppose 0080e1f00001 for dongle1 and 0080e1f00002 for dongle2.

Each dongle has the following factory default:

- UART: 115200 baud rate, no parity, 1 stop bit, 8 data bits
- Local name: "Amp'ed UP!"
- Class of device: misc. device
- Profile: SPP (serial port profile)
- Service name: "AMP-SPP"
- Deep sleep: disabled
- Page and inquiry scan: 1.28s interval, 11ms duration
- Security: disabled
- Bonding PIN: "1234"
- Bonding allowed: always enabled
- Plug each dongle into the PC using the USB connector
- Open the HyperTerminal program on both PCs and create a new connection "AT Command".



Connection Description ? 🔀	
New Connection Enter a name and choose an icon for the connection: Name:	
AT Command	
OK Cancel	AM06761v





Connect To	Imand
Enter details for	the phone number that you want to dial:
Arga code: Phone number:	1
Cognect using:	COM18
	AM06762v1

and configure it:

Figure	17.	Port	parameters
--------	-----	------	------------

COM18 Properties			
Port Setting:			
Bits per secon	t 115200	×	
<u>D</u> ata bit	8	×	
Park	None 🗸	×	
<u>S</u> top bit	۲ <mark>۱</mark>		
Elow contro	t None 🗸		
	<u>R</u> estore Defa	faults	
	OK Cancel	Apply AM06763v1	

with the following parameters:

- Select the proper COM line (COM1, COM2.....)
- Set baud rate = 115000 (default baud rate of SPBT2632C2.AT2 module)
- Set data bits = 8
- Set stop bits = 1
- Set parity = none
- Set flow control = none

From the menu file set the AT command connection properties:

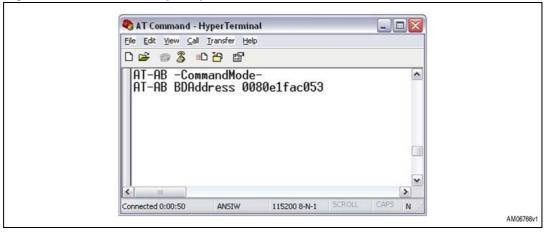
Figure 18. Connection properties setup

Connect To Settings	ASCII Setup
Function, arrow, and ctrl keys act as	
	ASCII Sending
Backspace key sends	Send line ends with line feeds
⊙ <u>C</u> trl+H ○ <u>D</u> el ○ Ctrl+ <u>H</u> , Space, Ctrl+H	Echo typed characters locally
Emulation:	Line delay: 1 milliseconds.
ANSIW Terminal Setup	Character delay: 1 milliseconds.
Terminal Sector	
Tel <u>n</u> et terminal ID: VT100	ASCII Receiving
Backscroll buffer lines: 500	Append line feeds to incoming line ends
Play sound when connecting or disconnecting	Eorce incoming data to 7-bit ASCII
	Vrap lines that exceed terminal width
Input Translation ASCII Setup	
	OK Cancel

The dongle is ready to use:

- Press the reset switch on the dongle
- On the screen, the prompt followed by the module Bluetooth address should appear:

Figure 19. AT command prompt



"AT-AB -CommandMode -"

"AT-AB BDAddress xxxxxxxxxxxxxx

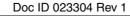
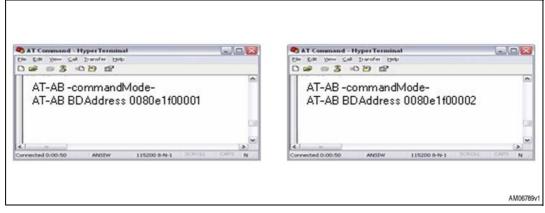




Figure 20. BDAddress dongle1, dongle2



From now on the user can operate the dongle using the AT commands.

6.2.2 Inquiry and available services

Before establishing a connection, the dongle must know which Bluetooth devices are present and which services are offered. Each module has its own address which identifies the module itself in the network. The BD address can be found during the discovery phase.

If the BD address of the Bluetooth device the user wants to connect to is known, the inquiry procedure can be omitted.

- Discovery:
 - AT+AB discovery

This command returns the number of responses of nearby devices and then the individual responses with the BD address, and device name. The number of devices returned is limited to 10.

Inquiry is performed with an interval of 10.24 seconds.

The devices are reported in the same order as the original inquiry results.

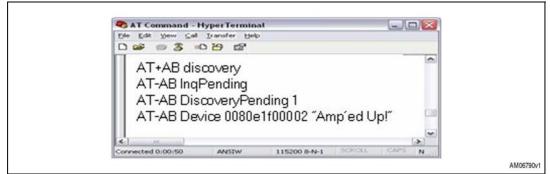
For each name or service name request that is successful, the response uses the returned names in the following format:

- AT-AB device [BD addr] [name]
- AT-AB device [BD addr] Unknown

As a consequence of a discovery command issued by dongle1, the following lines are displayed:



Figure 21. Discovery dongle1



Note: In the case of 1 device found.

Service:

To verify, at the same time, which kind of service is available, use the command:

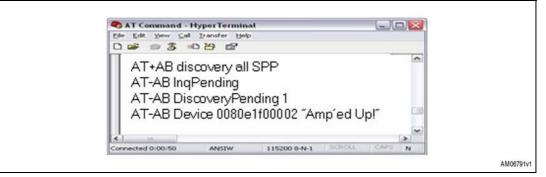
AT+AB discovery [CoD] [profile]

Response is:

AT-AB device [BD addr] [name]

As a consequence of a discovery command for SPP service issued by dongle1, the following appears on the screen:

Figure 22. Service dongle1



Note: In the case of 1 device found.

Bonding:

Bonding is used when an application needs to pair with another remote device. Devices must be enabled to bond, with this aim, the EnableBond command is used. The BD address, PIN and timeout parameters are optional.

AT+AB EnableBond

If the operation is successful, the response is:

AT-AB BondEnabled

To bond devices the "bond command" is used where the device address and the identification number (PIN) is specified.

The command is:

AT+AB bond [BD addr] [Pin]



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If the request is successfully submitted, the response is:

- AT-AB BondPending [BD addr]
- If the operation is successful, the response is:
 - AT-AB BondOk

If it fails:

AT-AB BondFail

In this case, dongle1 is requesting a bonding with dongle2.

Figure 23. Bonding dongle1, dongle2

🗞 AT Command - HyperTerminal 📃	🗖 🔯 🖣 AT Command - HyperTerminal	
Ele Edit Yew Gall Iransfer Help	Ele Edit View Gall Iransfer Help	
C 📽 👘 💲 🗠 🎖 📾	D 📽 🐲 🐉 📫 🔂 🗃	
AT-AB -commandMode- AT-AB 0080e1f00001 AT+AB EnableBond AT-AB EnableBondOk AT-AB bond 0080e1f00002 1234	AT-AB -commandMode- AT-AB BDAddress 0080e1f00002 AT+AB EnableBond AT-AB EnableBondOk	
AT-AB BondPending AT-AB BondOk 0080e1f00002	AT-AB BondPending AT-AB BondOk 0080e1f00001	
	×	~
1	and the second s	
Connected 0:00:50 ANSIW 115200 0-N-1 SCROLL CAP Failure due to different PIN	Connected 0:00:50 ANSTW 115200 B-N-1 50	ROLL CAPS N
Connected 0:00:50 ANSTW 115200 8-N-1 5070L CAP Failure due to different PIN	N Connected 0:00:50 ANSTW 115200 0-N-1 50	and a second
Connected 0:00:50 ANSTW 115200 8-N-1 507CU CAP Failure due to different PIN	N Connected 0:00:50 ANSTW 115200 0-N-1 50	CROLL CAPS N
Connected 0:00:50 ANSTW 115200 8-N-1 507CL CAP Failure due to different PIN	N Connected 0:00:50 ANSTW 115200 0-N-1 % Image: Connected 0:00:50 ANSTW 115200 0-N-1 %	CROLL CAPS N
Connected 0:00:50 ANSTW 115200 8-N-1 50P.01 CAP Failure due to different PIN AT Command - HyperTerminat The Edit Yew Call Transfer Yeap	N Connected 0:00:50 ANSTW 115200 8-N-1 S	CROLL CAPS N
Connected 0:00:50 ANSW 115200 8-N-1 SCROLL CAP Failure due to different PIN AT command - HyperTerminat Ce 24 yew Cel Insufer Beb Ce 25 Cel Insufer Beb Ce 26 Yew AT+AB EnableBond AT-AB EnableBondOk AT+AB bond 0080e1f00002 7777 AT-AB BondPending	N Connected 0:00:50 ANSTW 115200 8-N-1 %	CROLL CAPS N

Connection:

Once the dongle knows the device present and the service offered, the command to set up connection is:

AT+AB SPPconnect [BD Addr] [Service]

If the connection is successful, the response is:

- AT-AB ConnectionUp
- AT-AB -BypassMode-

At this point the connection is established. The dongles can send and receive data. In this case, dongle1 knows the address of dongle2, and wants to connect to dongle2:



AT+AB SPPconnectionUp AT-AB ConnectionUp AT-AB ConnectionUp AT-AB -BypassModeweitw 115200 84-1 000 N



Now the two dongles are connected to one another and in -BypassMode-.

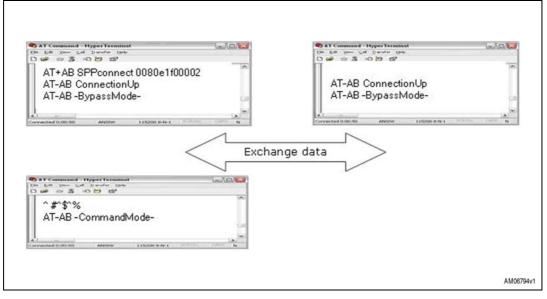
In other words, everything typed on a terminal is transferred to the other via the Bluetooth link and vice versa. In -BypassMode- the dongle doesn't answer the commands.

If, for example, the user needs to change some parameters of a dongle, it's necessary to switch to -CommandMode-, giving the "escape command".

The escape command is a special sequence of characters followed by at least two seconds of inactivity on the serial port.

The escape command sequence is: $^{\#^{\infty}}$.

Figure 25. Escape dongle1, dongle2



As can be noted, the escape command given to dongle1 doesn't affect dongle2 which remains in -BypassMode-.

Connection between the two dongles is still active; to return to the "exchange data" situation, dongle1 must be re-configured in -BypassMode- with the command "Bypass".



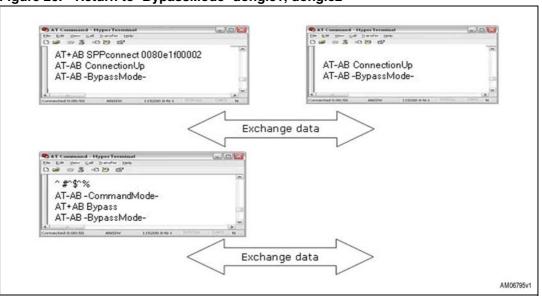


Figure 26. Return to -BypassMode- dongle1, dongle2

Now the two dongles can exchange data again.

Disconnection:

The SPPDisconnect command is used to terminate a connection with the remote device.

AT+AB SPPDisconnect

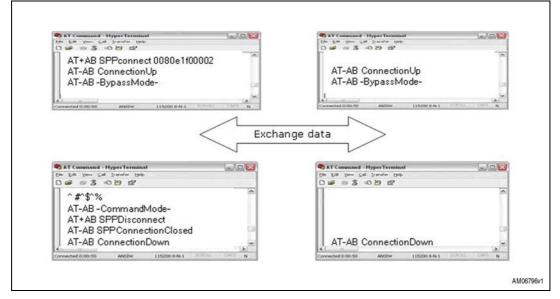
If the disconnection is successful, the response is:

AT-AB SPPConnectionClosed

SPPDisconnect is a command; it is recognized and accepted by the dongle only if the dongle is in -CommandMode-.

If the dongle is in -BypassMode-, send the "escape command" before giving the disconnection command.

Figure 27. Disconnection dongle1, dongle2



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Information related to successful disconnection is displayed on both screens.

• Smart cable setup:

The smart cable setup command is used to enable and configure a SmartCable device.

A device BD address is specified with which to automatically establish a connection, replacing the need for AT connection commands.

It is stored in the non-volatile memory.

The command is:

AT+AB SmartCableSetup [BD Addr] [Attempts] [Interval]

If the command is successful, the response is:

- AT-AB SmartCableConfigDone

In this case, suppose an automatic connection of dongle1 to dongle2 at power-on is needed, with the possibility to retry for 5 times with an interval of 1 sec between each retry.

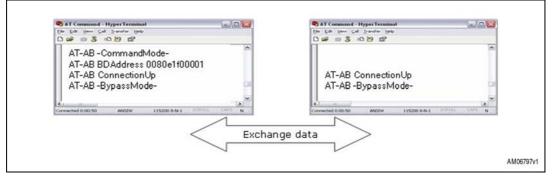
The command is:

AT+AB SmartCableSetup 0080e1f00002 5 1

This command is stored inside the non-volatile memory and executed at power-on.

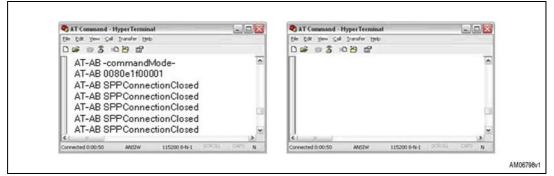
In case dongle2 is already powered:

Figure 28. Smart cable dongle1, dongle2



If dongle2 is not powered or not available, dongle1 automatically retries 5 times.

Figure 29. Automatic retrial dongle1



If dongle2 is present, dongle1 automatically connects. If dongle2 is unplugged, connection fails. However, connection is automatically restored if dongle2 is again plugged in during the interval of retrial assigned to dongle1.

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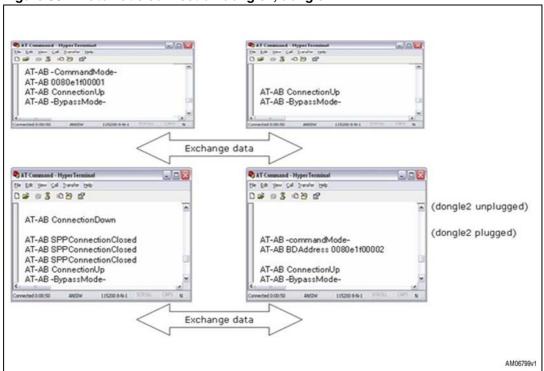


Figure 30. Automatic connection dongle1, dongle2

• Delete smart cable setup:

The command to remove the SmartCableSetup is:

AT+AB DeleteSmartCable

If the operation is successful, the answer is:

AT-AB DeleteSmartCableDone

To give the command the dongle must be in; -CommandMode-.

Erase bond table:

The erase bond table command must be used to clear all the bonded device entries:

AT+AB EraseBondTable

If the operation is successful, the answer is:

AT-AB BondTableErased

6.2.3 Command and answer syntax

The syntax of the commands is fixed and cannot be changed, the prefix for each command is AT+AB.

Each command has an answer which is preceded by the prefix AT-AB; this identifier can be changed by means of the AT+AB config command.

If it is necessary to change the prefix of the answer from AT-AB to ">>" on dongle1, the steps to follow are shown in *Figure 31*:



Figure 31.	Change syntax dongle1
------------	-----------------------

Ele Edt Yew Call Transfer Help
D 📽 👳 💲 🗚 🛱
AT+AB Version- AT-AB abserial Ver 1.1 AT+AB config ATReply=>> AT+AB Version >> abserial Ver 1.1

Note: Change reply prefix.

6.2.4 GPIO and LED

The SPBT2632C2A.AT2 has several pins which can be configured as GPIOs (GPIO01 to GPIO07).

If GPIO function is selected, GPIO direction (input/output) and GPIO level can be chosen by means of the AT commands.

GPIO must be configured for output or input using the proper command:

- AT+AB GPIOConfig [GPIO Pin] I for input
- AT+AB GPIOConfig [GPIO Pin] O for output

Once configured, the GPIO port can be read or written with the commands:

- AT+AB GPIOWrite [GPIO Pin] 1 write 1
- AT+AB GPIOWrite [GPIO Pin] 0 write 0
- AT+AB GPIORead [GPIO Pin] read

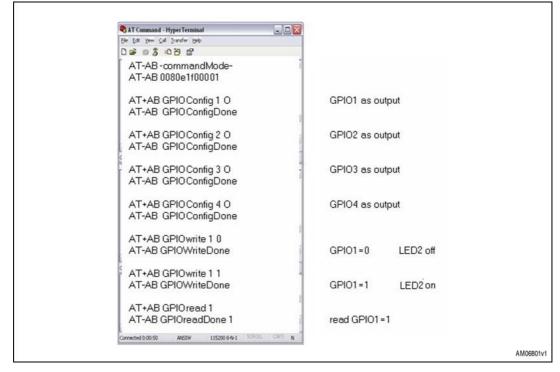
On the dongle there are 2 LEDs connected to GPIOs: LED2 connected to GPIO01 and LED3 to GPIO004.

Each LED can be switched on/off by driving the corresponding GPIO with the proper AT command.



Example:







Appendix A USB driver installation

If USB driver wizard installation fails, the dongle can be installed using the driver available on the silicon lab website at

www.silabs.com/support/pages/support.aspx?ProductFamily=USB+to+UART&PartNumber =cp2102.

Insert the dongle into a USB port on the PC, follow the steps described in *Section 6.1* of this document.

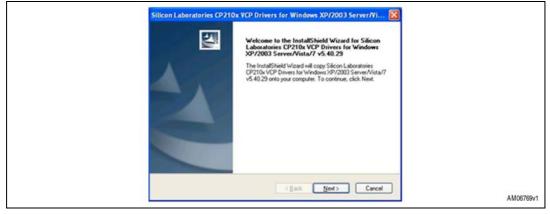


Figure 33. USB driver installation launch

Figure 34. License agreement

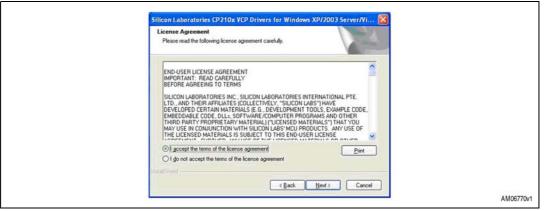




Figure 35. Wizard installation 1

Choose Destination Location	
Select folder where setup will install files.	
Setup will install Silicon Laboratories CP210x VCP Drivers for Windows XP/2003 Server/Vista/7 v5.40.29 in the following folder.	
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.	
Destination Folder c:\\MCU\CP210x\Windows_XP_S2K3_Viste_7 Browse	
InstatSheld	

Figure 36. Wizard installation 2

Ready to Install the Program The wizard is ready to begin installation.		4
Click Install to begin the installation.		
If you want to review or change any of your ins the wizard.	tallation settings, click Back. Click Cancel to	exit
N MARKANI -		
InstatiSheld	< Back Install Cance	ы

Figure 37. Wizard installation 3

Silicon Laboratories Silicon Laboratories CP	210x USB to UART Bridge		Succe	55
Installation Location:		Driver Version 5.4.29		Installation completed successfu
C:\Program Files\Silabs\MC	J\CP210×\			ОК
Change Install Location	Install	Cancel	1	(



	InstallShield Wizard Complete	
	The InstallShield Woard has successfully copied the Silicon Laboratories CP210x VCP Drivers for Windows 39/2003 ServerVisita7 V5 45 v2 10 your had wine. The driver installer listed below thould be executed in order to install drivers or update an existing driver.	
	Launch the CP210x VCP Driver Installes	
	Click Finish to complete the Silicon Laboratories CP210x VCP Drivers for Windows XP/2003 Server/Vista/7 v5.40.23 setup.	
	cBack Finish Carcel	

Figure 38. Wizard installation terminated



Hardy	bleting the Found New ware Wizard uf has finished intalling the tothnare foc
	ed nas Insched mitualing the Lichn-se fut. Silicon Labs CP210x USB to UART Bridge
Click Fini	ish to close the wizard.
	Cancel
	AM06775v

The USB driver installation is now complete.



7 Revision history

Table 3.Document revision history

Date	Revision	Changes
21-Jun-2012	1	Initial release.



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