UM2077
User manual

SPBT3.0DPx data package

Introduction

The data package (DP) is an easy to use AT command set embedded in the SPBT3.0DPx ST Bluetooth® module series. It is a user friendly interface that implements cable replacement and supports communication with smart phones and MFI devices.

SPBT3.0DPx modules have the DP firmware with SPP, HID and IAP2 (iPOD accessory protocol) services for communication with smart phones and Apple iOS Bluetooth enabled devices.

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1 Acronyms and abbreviations

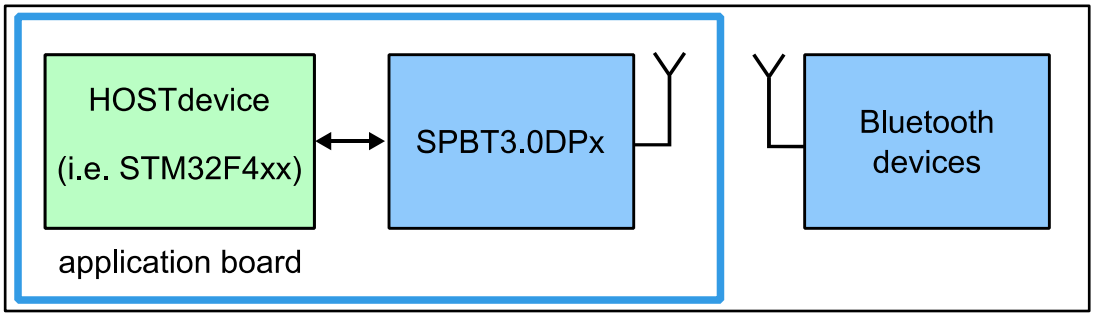
Table 1: List of acronyms

Term	Description
ASM	active status mode
ASCII	American standard code for information interchange – a standard describing encoding of characters; the use in this document is strictly US 7-bit
BD	Bluetooth device
BT	Bluetooth
DCD	modem ‘data carrier detect’ signal – indication from a modem that a connection has been made through, for example, a dial-up connection
DP	data package
DSM	deep sleep mode
DTE	Data terminal entity, e.g., a computer
DTR	modem ‘data terminal ready’ signal – indication to a modem that the data terminal is ready for connection
DUN	dial-up networking (profile)
FW	firmware
GPIO	general purpose input-output
HCI	host controller interface
HID	human interface device
HW	hardware
IAP2	iPOD accessory protocol
LAN	local area network
LMP	link manager protocol
LPO	low power oscillator
MINM	refers to the ‘man-in-the-middle’ security attack
PIN	personal identification number
SIG	Bluetooth special interest group
SPP	serial port profile
UART	universal asynchronous receiver-transmitter

2 Data package firmware interface overview

The DP firmware is a cable replacement application that provides communication between Bluetooth-enabled devices. A serial port is used to communicate with a host device through an AT command interface as shown below.

Figure 1: Communication between module and host



The AT command firmware provides:

- serial port profile (SPP) support for both client and server applications
- iPOD accessory protocol (iAP2) support for communication with Apple iOS Bluetooth-enabled devices
- Human Interface Device (HID) profile for keyboard or mouse roles. An HID connection can co-exist with SPP, or iAP2 connection
- command and bypass modes; it is possible to switch between command and bypass (data transmit/receive) modes during an active connection
- security through bonding and data encryption
- module low power modes; it is possible to switch between active status mode and deep sleep mode to reduce power consumption when the module is not connected
- BT connection mode; it is possible to set a connection to sniff mode to reduce power consumption

3 Data package command list

The following table lists all the DP commands with links to behavior, syntax, and response details.

Table 2: DP command list summary

Command	Description
AutoReconnect	Enable/disable auto-reconnect mode
AutoReconnectSetup	Set auto-reconnect configuration settings
Bond	Initiate bonding entry
BtcVersion	BT chip version
Build	Return current firmware build ID number
Bypass	Enter data bypass mode
ChangeBaud	Change host interface baud rate
ChangeDefaultBaud	Change the default host interface baud rate
Config	Return/set a configuration variable
CpTest	Test connection with MFi Co-Processor
DefaultLocalName	Change default device local name
DeleteAutoReconnect	Delete auto-reconnect configuration settings
DisableBond	Disable or deny a bonding with a specific device
Discovery	Discover and list in range device
EnableBond	Enable bonding with a specific device
EraseBondTable	Erase all the entry from the bonding table
ExitSniff	Switch device from Sniff to Normal mode
Factory	Reset factory settings
FWVersion	Return current module FW version
GetBDAddress	Read local BT address
GPIOConfig	Config GPIO as input or output
GPIORead	Read GPIO status
GPIOWrite	Set GPIO high or low
HIDConnect	Initiate a HID connection with the specified device
HIDDisconnect	Close the HID connection
HIDIntSend	Send HID report in interrupt mode
HostEvent	Enable/disable transmission of “AT-AB ..” event to host
HWVersion	Return current module HW version
iAP2AppLaunchReq	Send request to launch associated App
IAP2Connect	Initiate connection versus specified IOS device
IAP2Disconnect	Disconnect by current iOS device
LocalName	Temporally change device local name

Command	Description
PassKeyAccept	Accept MITM confirmation code
Reset	Do a master SW reset
RoleSwitch	Switch from/to master or slave role
ShowConnection	Show active data link
ShowDev	Show list of bonding table
Sniff	Switch device from Normal to Sniff mode
SPPConnect	Initiate an SPP connection with specified device
SPPDisconnect	Close SPP connection with specified device
StartFwUpdate	Start FW update procedure
UpdateInquiryScan	Allow modification of inquiry scan parameters (i.e. time)
UpdatePageScan	Allow modification of page scan parameters (i.e. time)
VarVersion	Return current version of configuration variable
Version	Return current version of AT command interface

3.1 AutoReconnect

This command enables/disables auto-reconnect mode. When enabled, the module tries to open an SPP or iAP2 connection automatically with a target device. The parameters of the auto-reconnect mode are configured with the `AutoReconnectSetup` commands.

3.1.1 Syntax

```
AT+AB AutoReconnect [enable/disable]
```

Where:

`[enable/disable]` is either:

- `enable` (or `e`) to enable the auto-reconnect mode
- `disable` (or `d`) to disable the auto-reconnect mode

3.1.2 Responses

If the request is successfully submitted, the response is:

- AT-AB AutoReconnectDone Enabled or AT-AB AutoReconnectDone Disabled

3.2 AutoReconnectSetup

This command configures the auto-reconnect parameters, which are stored in non-volatile memory.

3.2.1 Syntax

```
AT+AB AutoReconnectSetup [interval]
AT+AB AutoReconnectSetup [interval][attempts]
AT+AB AutoReconnectSetup [interval][attempts][BD Address][Type]
```

Where:

`[interval]` is the pause in seconds between attempts. Note that a page attempt is skipped if there is already a Bluetooth activity (discovery, active connection, connection setup) in progress.

`[attempts]` is the number of pages attempted to the specified device until a connection is successful. A value of 0 will not automatically page the remote device. A value of 2000 will perform unlimited pages.

`[BD Address]` is the BD address of the remote device to page and attempt to connect

`[Type]` can be:

- “SPP” to indicate an SPP connection
- “iAP2” to indicate an iAP2 connection

If parameters `[BD Address]` and `[Type]` are not specified, the module uses the last device that connected after the enabling of auto-reconnect.

3.2.2 Responses

If the request is successfully submitted, the response is:

- AT-AB AutoReconnectSetupDone

3.3 Bond

This command initiates bonding with a specified device. A personal identification number (PIN) is also required with this command. The bond table contains up to 100 devices.

The first device after the hundredth overwrites the oldest one on the list.

3.3.1 Syntax

```
AT+AB Bond [BD Addr] [PIN]
```

Where:

`[BD addr]` is the BD address of the remote device to bond with

`[PIN]` is the PIN code to use (up to 16 characters)

3.3.2 Responses

If the request is successfully submitted, the response is:

- AT-AB BondPending [Remote BD Addr]

If the operation is successful, the response is:

- AT-AB BondOk

If the operation fails, the response is:

- AT-AB BondFail

3.4 BtcVersion

This command returns the current ID of the Bluetooth controller chip.

3.4.1 Syntax

```
AT+AB BtcVersion
```

3.4.2 Responses

If the embedded BT front end controller is working properly, the response is formatted as:

- /00 <HCI_Ver> <HCI_Rev> <LMP_Ver> <Manuf_Name> <LMP_subver>

Table 3: BtcVersion parameter details

Parameter ID	Parameter detail	Size
<HCI_Ver>	HCI version	8 bit
<HCI_Rev>	HCI revision	16 bit
<LMP_Ver>	LMP ID	8 bit
<Manuf_Name>	Manufacturer name	16 bit
<LMP_subver>	LMP subversion ID	16 bit

3.5 Build

This command returns the current build ID of the application firmware.

3.5.1 Syntax

```
AT+AB Build
```

3.5.2 Responses

If the operation is successful, the response is:

- AT-AB DataPackage FW Build [date].[M.m.p]

Where:

`[date]` is the date code (yymmdd) of the application firmware

`[M.m.p]`Major FW version, `m`inor FW version and `p`oint version

3.6 Bypass

This command returns the DP FW interface to bypass mode if a connection is still available. It can be used to change a setting after a connection has been made (such as the UART baud rate). If the module does not have a connection, it responds as if the connection were down.

3.6.1 Syntax

```
AT+AB Bypass
```

3.6.2 Responses

If a connection is still available, the response is:

- AT-AB -BypassMode-

If a connection is not available or is closed from the connected device, then the module returns:

- AT-AB ConnectionDown

3.7 ChangeBaud

The host sends the ChangeBaud command to change the local UART rate to a new speed identified by the host. This setting only remains in effect during the current session until reset.

3.7.1 Syntax

```
AT+AB ChangeBaud [rate]
```

Where `[rate]` is the new baud rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 or 2000000).

3.7.2 Responses

If the change is accepted, the response is:

- AT-AB Baudrate Changed

The actual change does not occur until after the response is transmitted. The original baud rate is restored on the following reboot.

If the rate indicated is not one of the above or not usable, the system returns:

- AT-AB ERRInvalidParameter

3.8 ChangeDefaultBaud

The host sends the ChangeDefaultBaud command to change the default UART rate to a new speed identified by the host. This command overrides the default baud rate through the dynamic configuration script, so the device does not require reprogramming to update this setting and the new baud rate applies until the device is either re-programmed or another ChangeDefaultBaud command is issued.

The new baud rate does not take effect until the device is reset. To change the baud rate of the current session, use the ChangeBaud command.

3.8.1 Syntax

```
AT+AB ChangeDefaultBaud [rate]
```

Where `[rate]` is the new baud rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 or 2000000).

3.8.2 Responses

If the change is accepted, the response is:

- AT-AB Baudrate Changed

If the rate indicated is not one of the above or not usable, the system returns:

- AT-AB ERRInvalidParamter

3.9 Config

This command retrieves or sets a configuration variable.

3.9.1 Syntax

```
AT+AB Config
```

with no parameter returns a dump of the variables with corresponding values

```
AT+AB Config [variable name]
```

returns the value of the specified variable

```
AT+AB Config [variable ID]
```

returns the value of the specified variable ID

```
AT+AB Config [variable name] = [variable value]
```

sets the value of [variable name] to [variable value]

```
AT+AB Config [variable ID] = [variable value]
```

sets the value of `[variable ID]` to `[variable value]`

Refer to *Section 5: "Variable definitions"* for full details regarding configuration variables.

3.9.2 Responses

The AT+AB Config command returns a full dump of all the configuration variables.

Successful commands issued to set a specific parameter return:

- AT-AB ConfigOK

Successful commands get a specific parameter return:

- [variable ID] [variable name] = [variable value]

Incorrect or unacceptable parameters return:

- AT-AB ErrInvalidParam <param>

3.10 CpTest

The CpTest command is used to test the connection with the MFi Co-processor.

3.10.1 Syntax

```
AT+AB CpTest
```

3.10.2 Responses

If the operation is successful, the response is:

- AT-AB CP Device Version: 0x05
- AT-AB CP Firmware Version: 0x01
- AT-AB CP Authentication protocol Major version: 0x02
- AT-AB CP Authentication protocol Minor version: 0x00
- AT-AB CP Device ID: 0x00000200

If the operation is not successful, the response is:

- AT-AB CP Address Fail

3.11 DefaultLocalName

This command sets the BT Classic name of the device to the name that is reported during device discovery. By default, the DP FW interface uses “STBTC3.0 Module”. This command permanently changes the local name, unlike *Section 3.32: "LocalName "*.

3.11.1 Syntax

```
AT+AB DefaultLocalName [name]
```

Where `[name]` is the new, case sensitive, local name string (up to 20 characters). The name is assumed to be all text up to the end of the command, including spaces.

3.11.2 Responses

If the operation is successful, the response is:

- AT-AB LocalNameOk

3.12 DeleteAutoReconnect

This command deletes the auto-reconnect configuration settings.

3.12.1 Syntax

```
AT+AB DeleteAutoReconnect
```

3.12.2 Responses

If the request is successfully submitted, the response is:

- AT-AB DeleteAutoReconnectDone

3.13 DisableBond

This command prohibits new bonding with a device; it cannot be used while a connection is active.

3.13.1 Syntax

```
AT+AB DisableBond
```

3.13.2 Responses

If the operation is successful, the response is:

- AT-AB BondDisabled

3.14 Discovery

This command initiates device discovery and returns the number (maximum 10) of responses from nearby devices, followed by the Bluetooth address and name of each responding device.

Scanning lasts 10.24 s and devices are listed the same order as the scan results.

3.14.1 Syntax

```
AT+AB Discovery
```

3.14.2 Responses

When the discovery command is accepted, the response is:

- AT-AB InqPending

Once the initial inquiry is complete and discovery has started, the response is:

- AT-AB DiscoveryPending [num]

where `[num]` is the decimal number (max. 10) of devices found.

For each successful name request, the response uses the returned names thus:

- AT-AB Device [BD addr] [name]

where `[BD addr]` is in hexadecimal with the most significant byte first and `[name]` is a string in double quotes " ".

For each unsuccessful name request, the corresponding name is “Unknown”. The name request may not be successful if the connection for the request is unsuccessful.

- AT-AB Device [BD addr] "Unknown"

3.15 EnableBond

This command enables bonding with another device.

3.15.1 Syntax

```
AT+AB EnableBond
AT+AB EnableBond [BD addr]
AT+AB EnableBond [BD addr] [PIN]
AT+AB EnableBond [BD addr] [PIN] [timeout]
```

Where:

`[BD addr]` is the BD address of the remote device for which bonding is enabled. Set FFFFFFFFFFFF to allow any device.

`[PIN]` is the PIN code (up to 16 characters) used for PIN pairing; not used for simple pairing.

`[timeout]` is the duration in seconds (from 1 to 1000) in which the bond can occur. When the timer expires, the bond is disabled and the AT-AB BondDisabled event is sent to the Host.

3.15.2 Responses

If the operation is successful, the response is:

- AT-AB BondEnabled

If bonding has been initiated by a remote device, the notification is:

- AT-AB BondPending [BD addr]

where `[BD addr]` is the BD address of the remote device that initiated the bonding. If bonding has occurs, the notification is:

- AT-AB BondOk [BD addr]

where `[BD addr]` is the BD address of the remote device with successful bonding.

If bonding initiated by a remote device fails, the notification is:

- AT-AB BondFail

3.16 EraseBondTable

This command indiscriminately erases all of the bonded device entries.

3.16.1 Syntax

```
AT+AB EraseBondTable
```

3.16.2 Responses

If the operation is successful, the response is:

- AT-AB BondTableErased

3.17 ExitSniff

This command is used by DP FW to switch an SPP connection with a device from sniff mode to active mode.

3.17.1 Syntax

```
AT+AB ExitSniff [BD address]
```

Where `[BD address]` is the BD address of the device to be switched to active mode.

3.17.2 Responses

If the operation is successful, the response is:

- AT-AB ActiveMode

3.18 Factory

This command restores the factory configuration settings.

3.18.1 Syntax

```
AT+AB Factory
```

3.18.2 Responses

If the request is successfully submitted, the response is:

- AT-AB FactoryDone

3.19 FWVersion

This command returns the current DP FW version.

3.19.1 Syntax

```
AT+AB FWVersion
```

3.19.2 Responses

If the operation is successful, the response is:

- AT-AB FWVersion [M.m.p]

Where:

`[M.m.p]M`ajor FW version, `m`inor FW version and `p`oint version

3.20 GetBDAddress

This command reads the Bluetooth device address or MAC address of the local device.

3.20.1 Syntax

```
AT+AB GetBDAddress
```

3.20.2 Responses

If the operation is successful, the response is:

- AT-AB BD_ADDR = [BD address]

3.21 GPIOConfig

The GPIOConfig command is used to configure a GPIO pin to input or output.

3.21.1 Syntax

```
AT+AB GPIOConfig [GPIO Pin] [Configuration]
```

where `[GPIO Pin]` is the pin number of the desired GPIO to configure. GPIO numbering depends on the specific HW used; the valid range is:

- 1 to 14 for SPBT3.0DP1
- 1 to 8 for SPBT3.0DP2

`[Configuration]` valid values are: ‘I’ or ‘I’ for input and ‘o’ or ‘O’ for output.

3.21.2 Responses

If the operation is successful, the response is:

- AT-AB GPIOConfigDone

If an incorrect parameter is passed to the module, it returns:

- AT-AB ErrInvalidParam

3.22 GPIORead

This command reads a GPIO pin. A GPIO may be read while configured as either an input or output.

3.22.1 Syntax

```
AT+AB GPIORead [GPIO Pin]
```

where `[GPIO Pin]` is the pin number of the desired GPIO to read. GPIO numbering depends on the specific HW used; the valid range is:

- 1 to 14 for SPBT3.0DP1
- 1 to 8 for SPBT3.0DP2

3.22.2 Responses

If the operation is successful, the response is:

- AT-AB GPIOReadDone [result]

Where `[result]` is either 1 to indicate high, or 0 to indicate low.

If an incorrect parameter is passed to the module, it returns:

- AT-AB ErrInvalidParam

3.23 GPIOWrite

This command sets a GPIO pin high or low. A GPIO may only be set when configured as an output.

3.23.1 Syntax

```
AT+AB GPIOWrite [GPIO Pin] [Setting]
```

Where:

`[GPIO Pin]` is the pin number of the desired GPIO to read. GPIO numbering depends on the specific HW used.

`[Setting]` is a 1 to set a pin to high and a 0 to set a pin to low.

3.23.2 Responses

If the operation is successful, the response is:

- AT-AB GPIOWriteDone

3.24 HIDConnect

The HIDConnect command is used by DP FW to initiate a HID connection with the specified host device. The remote BD address must be specified.

3.24.1 Syntax

AT+AB HIDConnect [BD Addr]

Where [BD Addr] is the remote device's BD address to page.

3.24.2 Responses

If the connection is successful, the response is:

AT-AB HIDConnectionUp

If the connection cannot be completed, the response is:

AT-AB HIDConnectionClosed

3.25 HIDIntSend

The HIDIntSend command is used by DP FW to send HID reports to the remote hid host.

3.25.1 Syntax

AT+AB HIDIntSend [report]

Where [report] parameter is dependent upon the enabled device type.

For Keyboard device [report] is 2 two bytes hex values (4 characters). It is a simplified keyboard that does not support setting status LEDs and allow only one simultaneous key press (except modifiers):

1st byte: modifiers keys status:

Bit0 CTRL Left. Bit1 SHIFT Left. Bit2 ALT Left. Bit3 GUI Left.

Bit4 CTRL Right. Bit5 SHIFT Right. Bit6 ALT Right. Bit7 GUI Right.

Bit value: 1 key pressed. 0 key released

2nd byte: key code specified in Usage Page of USB keyboard (section 10 of document "USB HID usage tables" ver 1.12):

www.usb.org/developers/hidpage/Hut1_12v2.pdf

Example (press and release Enter key):

at+ab hidIntSend 0028

at+ab hidIntSend 0000

Example (Shift+'e'):

at+ab hidIntSend 0208

For Mouse device [report] is a 3 bytes hex values (6 characters):

1st byte: X axis movement as 2's complement. (-126, +127). Positive movement is left to right

2nd byte: Y axis movement as 2's complement. (-126, +127). Positive movement is up to down

3rd byte: buttons status. Bit0 left button. Bit1 central button. Bit2 right button.

Bit value: 1 button pressed. 0 button released

Example (Move pointer right and down by 0x10 pixels. Then left button pressed):

at+ab hidIntSend 101000

at+ab hidIntSend 000001

3.25.2 Responses

If transmission is successful, the response is

AT-AB HIDIntSent

3.26 HIDDisconnect

The HIDDisconnect command is used by DP FW to terminate a connection with the remote host device.

3.26.1 Syntax

AT+AB HIDDisconnect

3.26.2 Responses

If the connection is successful, the response is

AT-AB HIDConnectionClosed

3.27 HostEvent

This command enables or disables notification to the HOST of all the "AT-AB…" event messages. This setting remain in effect during the current session until reset.

3.27.1 Syntax

```
AT+AB HostEvent [enable/disable]
```

3.27.2 Responses

If the operation is successful, and the parameter was "enable", the response is:

- AT-AB HostEvent Enabled

If the operation is successful, and the parameter was "disable", there is noresponse.

3.28 HWVersion

This command returns the current module HW version.

3.28.1 Syntax

```
AT+AB HWVersion
```

3.28.2 Responses

If the operation is successful, the response is:

- AT-AB HWVersion [M.m]

Where:

`[M.m]`Major HW version, `m`inor HW version

3.29 iAP2AppLaunchReq

This command is used by the DP FW to send the request to the Apple device to launch the App defined with the iAPAppBundleID configuration variable. The iAP2 connection must already be established.

3.29.1 Syntax

```
AT+AB iAP2AppLaunchReq
```

3.29.2 Response

If the request is sent to the apple device, the response is

- AT-AB IAP2AppLaunchDone

If the iAP2 connection is not established, the response is:

- AT-AB ErrExecute -iAP2 not connected-

If the iAPAppBundleID configuration variable is invalid, the response is:

- AT-AB ErrExecute -Invalid iAPAppBundleID-

3.30 IAP2Connect

This command is used by DP FW to initiate a connection with the specified Apple iOS device. The remote BD address must be specified.

3.30.1 Syntax

```
AT+AB IAP2Connect [BD Addr]
```

Where `[BD Addr]` is the BD address of the iOS remote device to page.

3.30.2 Responses

If the connection is successful, the response is:

- AT-AB ConnectionUp [Remote BD Addr]
- AT-AB -iAP2-BypassMode-

If the connection cannot be completed, the response is:

- AT-AB iAP2ConnectionClosed

3.31 IAP2Disconnect

This command is used by DP FW to terminate a connection with the remote Apple iOS device.

3.31.1 Syntax

```
AT+AB IAP2Disconnect
```

3.31.2 Responses

If the connection is successful, the response is

- AT-AB iAP2ConnectionClosed

3.32 LocalName

This command is used to set the name of the device to the name that is reported during device discovery. Changing the name using this command does not permanently change the local name.

3.32.1 Syntax

```
AT+AB LocalName [name]
```

Where `[name]` is a string for the new local name (up to 20 characters). The name is all the text up to the end of the command, including spaces.

3.32.2 Responses

If the operation is successful, the response is:

- AT-AB LocalNameOk

If `[name]` is not valid (i.e., too long or empty) the following error message is returned:

- AT-AB ErrInvalidParam

3.33 PassKeyAccept

This command is used to accept the MITM confirmation code, automatically generated during the bonding phase. After setting Var55 = True, it is possible to use this command to complete the pairing.

3.33.1 Syntax

```
AT+AB PassKeyAccept [y/n]
```

Example for confirmation:

```
AT+AB PassKeyAccept y
```

Example for denying confirmation:

```
AT+AB PassKeyAccept n
```

3.33.2 Responses

If the operation is successful the module enters bypass mode and is automatically bonded or connected.

This command must be sent as a response to the AT-AB PassKeyConfirmReq [PASSKEY] (see *Section 4.1: "AT events"*) within two seconds, otherwise the module assumes:

```
AT+AB PassKeyAccept n
```

3.34 Reset

This command resets the DP FW interface; it is provided in the event that a host application wants to perform a software reset for error recovery. There is a response prior to reset in order to verify that the command was received by the DP FW interface.

3.34.1 Syntax

```
AT+AB Reset
```

3.34.2 Responses

If the operation is successful, the response is:

- AT-AB ResetPending

3.35 RoleSwitch

This command changes a link from/to a master or slave role

3.35.1 Syntax

```
AT+AB RoleSwitch [bd address]
```

Where `[bd address]` is the address of the remote device that receives the role switch.

3.35.2 Responses

If the operation is successful, the response is:

- AT-AB RoleSwitchDone [NewRole]

Where `[NewRole]` can be master or slave

3.36 ShowConnection

This command is used to display the details of active links.

3.36.1 Syntax

```
AT+AB ShowConnection
```

3.36.2 Responses

Reply format with active connection:

- Channel ID, Remote Device BD Address, Status, Profile
- 0, 4cb199dccd22, Connected, SPP

Reply without active connection:

- No Device Connected

3.37 ShowDev

This command lists the contents of the Bond Table.

3.37.1 Syntax

```
AT+AB ShowDev
```

3.37.2 Responses

This command returns the list of all the bonded devices with their BD address.

If the bonding table has no items, it returns:

- AT-AB BondTableEmpty

3.38 Sniff

This command is used by DP FW to switch the status of the current connection from active mode to sniff mode.

3.38.1 Syntax

```
AT+AB Sniff [BD address] [Sniff Interval Min] [Sniff Interval Max]
[Attempts] [Timeout]
```

Where:

[BD address] is the BD address of the connected device to be switched to sniff mode.

[Sniff Interval Min] is minimum acceptable interval between each consecutive sniff period.

[Sniff Interval Max] is maximum acceptable interval between each consecutive sniff period.

Value is given in slots from 2 to 65534. Each slot has duration of 0.625 ms. If not specified, value of configuration variable AutoSniffIntMax is used.

[Attempts] The number of master-to-slave transmission slots during which a device should listen for traffic, from 1 to 32768. If not specified value of configuration variable AutoSniffAttempts is used.

[Timeout] The amount of time before a sniff radio timeout occurs. Expressed in 1.25 ms increments. Range between 0 and 32768. If not specified value of configuration variable AutoSniffRadioTimeout is used.

3.38.2 Responses

If the operation is successful, the response is:

- AT-AB SniffMode

3.39 SPPConnect

This command initiates a connection with the specified device, specifying the remote BD address. The remote Service is optional. If not specified, the first registered SPP service is used.

3.39.1 Syntax

```
AT+AB SPPConnect [BD Addr]
```

Where `[BD Addr]` is the BD address of the remote device to page.

3.39.2 Responses

If the connection is successful, the response is:

- AT-AB ConnectionUp [BD Addr]
- AT-AB -BypassMode-

If the connection cannot be completed, the response is:

- AT-AB SPPConnectionClosed

3.40 SPPDisconnect

This command terminates a connection with the remote device.

3.40.1 Syntax

```
AT+AB SPPDisconnect
```

3.40.2 Responses

If the connection is successful, the response is:

- AT-AB SPPConnectionClosed

3.41 StartFwUpdate

This command can be issued to start the FW update procedure. It is software alternative to using the Boot pin to set the SPBT3.0DPx module in Bootloader mode.

3.41.1 Syntax

```
AT+AB StartFwUpdate
```

3.41.2 Responses

If the command execution is successful, the response is:

- AT-AB Fw Update Started

After sending the response, the module enters Bootloader mode. Refer to the firmware update procedure in the datasheet for details.

3.42 UpdateInquiryScan

The command modifies the inquiry scan parameters: mode, duration and interval.

3.42.1 Syntax

```
AT+AB UpdateInquiryScan [mode]
AT+AB UpdateInquiryScan [mode] [duration] [interval]
```

Where

`[mode]` is the discoverable mode:

- 0: non-discoverable
- 2: discoverable

`[duration]` is the scan length in slots; 18 to [interval]. The default duration is 18 slots. This parameter is optional.

`[interval]` is the period between scans in slots; 18 to 4096. The default interval is 2048 slots. This parameter is optional. This parameter is optional.

The duration of one slot is 0.625 ms.

Both optional parameters have to be included or excluded in the command. It is not possible to specify just one of the two optional parameter.

3.42.2 Responses

If the command is successful, the response is:

AT-AB InquiryScanUpdateDone

3.43 UpdatePageScan

The UpdatePageScan command is used to modify the Page scan parameters: mode, duration, and interval.

3.43.1 Syntax

```
AT+AB UpdatePageScan [mode]
AT+AB UpdatePageScan [mode] [duration] [interval]
```

where `[mode]` is the connectable mode:

- 0: non-connectable
- 1: connectable

`[duration]` is the scan length in slots from 18 to `[interval]`. The default duration is 18 slots. This parameter is optional.

`[interval]` is the period between scans in slots from 18 to 4096; the default interval is 2048 slots. This parameter is optional.

The duration of one slot is 0.625 ms.

Both optional parameters must either be included or excluded together; you cannot just specify one of the two.

3.43.2 Responses

If the command is successful, the response is:

- AT-AB PageScanUpdateDone

3.44 VarVersion

This command returns the current version of the DP configuration variable.

3.44.1 Syntax

```
AT+AB VarVersion
```

3.44.2 Responses

If the operation is successful, the response is:

```
AT-AB VarVersion [M.m]
```

Where:

`[M.m]M`ajor version and `m`inor version of the configurable variable

3.45 Version

This command returns the current version of the DP AT command interface.

3.45.1 Syntax

```
AT+AB Version
```

3.45.2 Responses

If the operation is successful, the response is:

- AT-AB DataPackage Ver [M.m]

Where:

[M.m]Major version and minor version of the AT command interface.

4 Event handling

4.1 AT events

The table below list the events that the module can send to the HOST.

Table 4: Event description details

Event	Event detail
AT-AB –CommandMode-	Module returned or entered Command Mode
AT-AB ConnectionUP [ADDR]	SPP connection has been established successfully with a device with [ADDR] address
AT-AB ConnectionDown	BT connection has been closed
AT-AB SPPConnectionClosed	SPP connection has been closed
AT-AB iAP2ConnectionClosed	iAP2 connection has been closed accessory stopped the connection accessory is out of range
AT-AB ACCSessionStarted	External accessory session has been started.
AT-AB ACCSessionStopped	External accessory session has been stopped. Possible reason: accessory stopped the connection accessory is out of range
AT-AB -BypassMode-	Module is now connected and in SPP bypass mode
AT-AB -iAP2-BypassMode-	Module is now connected and in iAP2 bypass mode
AT-AB ErrExecute	Module internal error notification
AT-AB PassKeyConfirmationReq [PASSKEY]	Module is requesting the host to confirm the validity of the indicated [PASSKEY] Host must answer as reported in *Section 3.33: "PassKeyAccept"*
AT-AB BondFail	A new association has failed to complete
AT-AB BondOk	A new association has completed successfully
AT-AB BondPending	An association process is in progress
AT-AB RemoteMode	Module entered Remote Mode
AT-AB HIDConnectionUP	HID Connection with remote host is established. HIDIntSend commands can be used
AT-AB HIDConnectionClosed	HID connection is closed

5 Variable definitions

This section lists the variables handled by the SPBT3.0DPx module to configure the correct behavior for the specific application scenario.

As already mentioned, each variable is accessible via the `AT+AB Config` command.

Variables are saved in internal non volatile memory and any changed values are loaded on system reset.

Below is an example showing a variable change to configure the UART BaudRate:

Table 5: Sample configuration sequence

Direction	Command	Note
Host TX	AT+AB Config UartBaudrate<CR+LF>	Read actual UART configuration (115200)
Module TX	var7 UartBaudrate = 115200<CR+LF>	
Host TX	at+ab config uartbaudrate=921600<CR+LF>	Change the UART bitrate to 921600
Module TX	AT-AB ConfigOK<CR+LF>	Change acknowledgment
Host TX	AT+AB Reset<CR+LF>	Reset the module. This will reload the new variable value
Module TX	AT-AB ResetPending<CR+LF>	
Host TX	AT+AB Config UartBaudrate<CR+LF>	The Host has to reconfigure the baudrate to 921600 in order to be able to communicate with the module.
Module TX	var7 UartBaudrate = 921600<CR+LF>	The new UART baud-rate has been applied

If the specified parameter is not listed, an ErrInvalidParam message is returned

Table 6: List of configuration variables

Variable ID	Variable	Description	Default
Var1	BuildVersion	BT Module build revision.	
Var3	BD_ADDR	BT Module MAC address.	
Var4	DeviceName	BT classic device name shown during connection process. Sequence is case sensitive.	ST BTC3.0 Module
Var5	StreamingSerial	Allow the configuration of the UART flow control. When set to: TRUE: flow control is disable FALSE: flow control (CTS and RTS) is enabled Note: disabling the flow control may cause data loss due to data overrun	TRUE

Variable ID	Variable	Description	Default
Var6	PIN	Code used for pairing (4 - 16 characters). Sequence is case sensitive	1234
Var7	UartBaudrate	Main UART BaudRate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 or 2000000 It should be set based on the application specific requirements. This parameter must be tuned accordingly with the CPU frequency (CpuMHz)	115200
Var8	UartParity	Main UART Parity. It may be configured as one of the following: NONE EVEN ODD	NONE
Var9	UartDataBits	Main UART DataBits per character. It may be configured as either: 8 9 The new configuration will be effective after a SW system reset or a power cycle is performed	8
Var10	UartStopBits	Main UART StopBits per character. It may be configured as either: 1 2 The new configuration will be effective after a SW system reset or a power cycle is performed	1
Var12	AutoSniff	The AutoSniff functionality when active, allow the system to turn on automatically the sniff feature when there is no data exchange on the BT link. It may be configured as either: FALSE TRUE	FALSE

Variable ID	Variable	Description	Default
Var13	AutoSniffTimeout	The inactivity timeout in seconds used for AutoSniff above. If the AutoSniff is enabled, the module will try to set the BT link in sniff mode in case there has not been any data exchange for AutoSniffTimeout seconds. Acceptable range: 1-255.	5
Var14	AutoSniffInterval	Minimum acceptable interval between each consecutive sniff period. It may be any even number between 2 and 65534. The value is expressed in 0.625 ms increments (6 = 3.75 ms).	500
Var16	HostDeepSleepEnable	Enable/Disable the Deep Sleep Mode (DSM) of the module. It may be configured as either: FALSE TRUE See *Section 6: "Module power modes"*.	FALSE
Var18	GPIO_HostWakeup	The GPIO_ HostWakeup variable allows to select the GPIO pin to be used to switch between Mode Power Modes. It may be configured as one of the following: NONE, 2, 3 (*), 7, 8 (*) See chapter “Module Power Mode” for details. See GPIO table for details.	NONE
Var25	CpuMHz	CpuMHz allows to configure the CPU clock frequency. It may be configured as: 13, 16, 26, 42, 46, 50, 64, 84 or100 Increasing the clock allows better performance with higher power consumption. Decreasing the clock reduces performance and consequently power consumption. It must be adjusted according to the application scenarios	84
Var30	COD	The variable COD allow to specify the Bluetooth class of device Up to 6 numeric characters are allowed	200404

Variable ID	Variable	Description	Default
Var32	HostEvent	All “AT-AB …” host events are sent when true.	TRUE
Var33	BondingAllowed	Enable/Disable association with other devices. It may be configured as either: FALSE: reject any association request TRUE: allow association with new devices	TRUE
Var34	PageScan	Configure the Page Scan mode It may be configured as either: FALSE: Page scan disabled. The module is not connectable. TRUE: Page scan enabled. The module is connectable.	TRUE
Var35	InquiryScan	Configure the Inquiry Scan mode. It may be configured as either: FALSE: Inquiry scan disabled. The module is not visible. TRUE: Inquiry scan enabled. The module is visible.	TRUE
Var37	UseExtLPO	Configure the external 32768Hz LPO. It may be configured as either: FALSE: internal LPO enabled TRUE: external LPO enabled Note that using the external LPO would reduce the power consumption in DSM.	FALSE
Var40	DefaultSecurity	Configure the security on incoming / outgoing connections: It may be configured as one of the following: 1: Expected: use of pairing with PIN. No "man in the middle" protection. No encryption (legacy device only) 2: Expected: No "man in the middle" protection, Encryption 3: Expected: "man in the middle" protection, Encryption, User Interaction is acceptable	2

Variable ID	Variable	Description	Default
Var41	DefaultAuth	Configure the authentication procedure based on Input/Output capabilities of the Bluetooth device. It may be configured as one of the following: 4: The device is not capable of Input Output (Pass key confirmation by host disabled) 5: The device can display and accept input (Pass key confirmation by host enable) 6: The device is only capable of a display 7: The device is a keyboard with no display	4
Var42	EnableIAP2	Enable iAP2 to support IOS devices It may be configured as either: FALSE: iAP2 support disabled TRUE: iAP2 support enabled	TRUE
Var43	AllowSniff	Configure the sniff mode. It may be configured as either: FALSE: sniff mode not supported TRUE: sniff mode is supported	FALSE
Var44	iAP2AppID	Allow to specify the application ID to be associated to the accessory Up to 50 alphanumeric characters are allowed	“com.yourcompany.yourApp”
Var51	RmtEscapeSequence	Enable remote mode: TRUE: Remote mode enabled. Remote escape sequence detection logic is enabled. FALSE: Remote mode disabled. Remote escape sequence detection logic is disabled. The remote escape sequence is “@#@$@%”	FALSE

Variable ID	Variable	Description	Default
Var55	MITMEvent	Enable/Disable the Host passkey confirmation via UART: It may be configured as either: FALSE: module will not generate the AT-AB PassKeyConfirmReq event to the host TRUE: module generates the AT-AB PassKeyConfirmReq event to the host	FALSE
Var60	AccManufacturer	Configured the accessory manufacturer identifier exposed while connecting to an iOS device. Up to 20 alphanumeric characters are allowed	“yourcompany”
Var61	AccModelNumber	Configured the accessory model identifier exposed while connecting to an iOS device. Up to 20 alphanumeric characters are allowed	“Your Model”
Var62	AccSerialNumber	Configure the accessory host device serial number exposed while connecting to an iOS device. Up to 20 alphanumeric characters are allowed	“your iAP2 SN”
Var63	EnableSPPRcv	Configure the capability of the Host to receive data that belong to the SPP profile while the module is in Command mode. It may be configured as either: FALSE: module should not send any data to the host. TRUE: module should send received data to the host. Note that if the module sends data to the Host in command mode, the following event is sent before the data: “AT-AB RecvData:”	FALSE

Variable ID	Variable	Description	Default
Var64	EnableIAP2Rcv	Configure the capability of the Host to receive data that belong to the iAP2 profile while the module is in Command mode. It may be configured as either: FALSE: module should not send any data to the host. TRUE: module should send received data to the host. Note that if the module sends data to the Host in command mode, the following event is sent before the data: “AT-AB RecvData:”	FALSE
Var65	AccFirmwareVersion	Configure the Accessory Host Device Firmware Version. Up to 20 alphanumeric characters are allowed.	“your FW version”
Var66	AccHardwareVersion	Configure the Accessory Host Device Hardware Version. Up to 20 alphanumeric characters are allowed.	“your HW version”
Var67	AccProductID	Configure the unique identifier of the product (assigned by vendor). Unsigned short value to be provide as hex format without ‘0x’ prefix (i.e. ‘abcd’).	0000
Var68	AccVersion	Configure the Software Version. Unsigned short value to be provide as hex format without ‘0x’ prefix (i.e. ‘abcd’).	0000
Var69	AccVendorID	Sets the Vendor ID. Unsigned short value to be provide as hex format without ‘0x’ prefix (i.e. ‘abcd’).	0000
Var70	AccVendorIDSource	Configure the identity of the organization that assign the vendor ID value . Unsigned short value to be provide as hex format without ‘0x’ prefix (i.e. ‘abcd’).	0000
Var72	iAP2AppBundleID	Configure IOS Application associated to the MFI accessory. Format is reverse DNS notation.	"com.yourcompany.yourApp"

Variable ID	Variable	Description	Default
Var73	CPI2CAddress	Configure the I2C address of the CP device as unsigned char hex format. Unsigned short value to be provide as hex format without '0x' prefix (i.e. 'ab').	22
Var74	EnableUARTbreak	Enable/Disable the UART break to switch from ByPass to Command mode.	FALSE
Var75	EnableEscapeSeq	Enable/disable use of the escape sequence in order to switch from Command to Bypass mode. If enabled: The escape sequence is detected The module sends AT events to the HOST in case of mode switch If disabled: The escape sequence is not detected The module does not send AT events to the HOST in case of mode switch The Escape Sequence is "^#^$^%"	TRUE
Var76	GPIO_HostModeSel	Define the GPIO module input pin that can be used by the Host to select the operating mode (Command or ByPass mode): GPIO Usage: Falling Edge: if applicable, switch from ByPass to Command Mode Rising Edge: if applicable, switch from Command to ByPass Mode See *Table 7: "SPBT3.0DP2 GPIO configuration table"* and *Table 8: "SPBT3.0DP1 GPIO configuration table"* for the list of acceptable values.	NONE

Variable ID	Variable	Description	Default
Var77	GPIO_HostModeInd	Define the GPIO module output pin used by the module to indicate to the Host the current operating mode. Acceptable values: NONE, 2, 3, 7, 8 GPIO Usage: 0: module is in Command mode 1: module is in ByPass mode See GPIO Table for details.	0
Var86	EnableSPPSrv	Enable the SPP Service. It may be configured as one of the following: FALSE: SPP service disable TRUE: SPP service enable	TRUE
Var87	iAP2TeamID	Configure the MFi Team ID associated to the App. Up to 50 alphanumeric characters are allowed	“Your Team ID”
Var88	EnableHIDKeybd	Controls enabling of HID Keyboard profile	FALSE
Var89	EnableHIDMouse	Controls enabling of HID Mouse profile	FALSE
Var91	AutoSniffIntMax	Maximum acceptable interval between each consecutive sniff period. May be any even number between 0x0002 and 0xFFFE The value is expressed in 0.625 ms increments (0x0006 = 3.75 ms).	1000
Var92	AutoSniffAttempts	The number of master-to-slave transmission slots during which a device should listen for traffic (sniff attempt). Expressed in 0.625 ms increments. Range between 0x0001 and 0x7FFF.	100
Var93	AutoSniffRadioTimeout	The amount of time before a sniff radio timeout occurs. Expressed in 1.25 ms increments. Range between 0x0000 and 0x7FFF	20

6 Module power modes

The SPBT3.0DPx module has the following power modes:

1. active status mode (ASM) (default mode)
2. deep sleep mode (DSM)

DSM mode can only be entered when there is no Bluetooth connection or discovery, pairing, or scanning activity in progress.

When the module is in DSM:

- the AT command interface is not active
- Inquiry scan (module is visible) and Page scan (module is connectable) remain active.

GPIO_4 indicates the current module power mode:

- 0: indicate that the module is in DSM mode
- 1: indicate that the module is in ASM mode

6.1 Enable deep sleep mode

To enable the DSM, the `GPIO_HostWakeUp` and `HostDeepSleepEnable` variables have to be set. Refer to the tables below for the list of GPIOs that can be used as `GPIO_HostWakeUp`.

```
/* define the module GPIO to be used by the HOST to enter /exit DSM mode */
AT+AB config GPIO_HostWakeUp = 3
/* enable the DSM mode*/
AT+AB config HostDeepSleepEnable = TRUE
```

6.2 Host forcing the module to enter DSM

To request the module to enter DSM, the HOST must force the `GPIO_HostWakeUp` pin LOW.

6.3 Host forcing the module to exit DSM

To set the module in ASM, the HOST must force the `GPIO_HostWakeUp` pin HIGH.

If the module is in DSM mode and the HOST wants to send an AT command, the module must first be switched to ASM mode.

6.4 Module exit DSM autonomously

The module automatically exits DSM if there is a Bluetooth connection or upon discovery, pairing, or scanning activity.

7 BT Connection Modes

As defined by the SIG, a Bluetooth connection can be set in either:

1. Active mode
2. Sniff mode

When a connection is established, it is in active mode by default, but it is possible to exchange data in both modes.

To reduce power consumption both the master and the salve can try to set to connection to sniff mode. Both master and slave should support sniff mode or the link will always remain in active mode.

7.1 Switch to sniff mode automatically

To automatically set a BT link to sniff mode, set the following variables thus:

```
AT+AB config AutoSniff = TRUE
AT+AB config AllowSniff = TRUE
AT+AB Config AutoSniffTimeout = 5
```

The module automatically issues a request to switch the Bluetooth link to sniff mode after `AutoSniffTimeout` seconds of inactivity.

7.2 Switch to sniff mode manually

When a connection is established, the HOST can send the “AT+AB Sniff” command to request setting the link to sniff mode.

To manually set a BT link to sniff mode, the following variable should be set:

```
AT+AB config AllowSniff = TRUE
```

7.3 Switch to active mode manually

When a connection is in sniff mode, the HOST can send the “AT+AB ExitSniff” command to switch the link to active mode.

8 Module operating modes

The module has the following operating modes:

1. Command mode: the module is ready to handle AT commands received from the HOST. This is the default mode after power on.
2. Bypass mode: the module is connected and acting as serial cable replacement. Any data received from the HOST is sent to the remote device. Any data received form the remote device is transmitted to the host.
3. Remote Mode: the module is connected and is ready to handle AT commands received from the remote device.

An operating mode switch can be requested by the HOST, by the remote device or can be autonomously initiated by the module in case of Bluetooth activity (link establishment, link closure, link drop).

The HOST request an operating mode switch by:

1. using the AT command interface (commands or EscapeSequence)
2. using the GPIO_HostModeSel GPIO
3. using the UART break

The module can notify the HOST of a mode switch by:

1. Using the AT command interface
2. Using the GPIO_HostModeInd GPIO

The remote device can request the switch to remote mode by:

1. Sending the Remote Escape Sequence

The AT command interface is the default method used. To disable usage of the escape sequence to switch from bypass to command mode, configure the following variable thus:

```
AT+AB config EnableEscapeSeq = FALSE
```

To use the GPIO method, configure the `GPIO_HostModeSel` and `GPIO_HostModeInd` variables thus:

```
AT+AB Config GPIO_HostModeSel = 2

AT+AB Config GPIO_HostModeInd = 3
```

To use the UART Break symbol method, configure the `EnableUartBreak` variable thus:

```
AT+AB Config EnableUartBreak = true
```

All the above methods can be used in a non-exclusive manner. The following sections describe how to switch between modes.

8.1 Command to bypass mode switch

A command to bypass mode switch can be:

1. initiated by the module:
   a. when a SPP or iAP2 session is opened
2. initiated by the HOST:
   a. with the “AT+AB Bypass” command
   b. with the GPIO_HostModeSel (transition from low to high)

8.2 Bypass to command mode switch

A command to bypass mode switch can be:

1. initiated by the module:
   a. when a SPP or iAP2 session is closed
2. initiated by the HOST:
   a. with the escape sequence (“^#^$^%”)
   b. with the GPIO_HostModeSel (transition from high to low)
   c. sending the UART break symbol

When requested by the HOST, the switch occurs after two seconds of inactivity; i.e., no data exchanged over UART interface. However, when the HOST is using the GPIO_HostModeSel pin (list item 2.b.) with the EnableEscapeSeq set to FALSE, the operating mode switch is immediate.

8.3 Bypass to remote mode switch

A bypass to remote mode switch can occur in the following cases:

1. The remote device sends the remote escape sequence (“@#@$@%”)

8.4 Remote to bypass mode switch

A remote to bypass mode switch can occur in the following cases:

1. The remote device sends the AT+AB ByPass command
2. The HOST sends any data to the module

9 SPBT3.0DP2 module GPIO configuration

The table below shows the functions that can be associated with each module GPIO.

Table 7: SPBT3.0DP2 GPIO configuration table

Module GPIO	Default function	Alternate function
1	Connection Status Probe 0: BT connection down 1: BT connection up	GPIO input
2	GPIO input	GPIO output HostMode_Sel Host_WakeUp
3	GPIO input	GPIO output Host_ModeInd
4	Active status probe 1: Active Status Mode Blinking: Deep Sleep Mode	GPIO input
5	I2C SDA	GPIO input GPIO output
6	I2C SCL	GPIO input GPIO output
7	GPIO input	GPIO output Host_ModeInd Host_WakeUp
8	GPIO input	GPIO output HostMode_Sel

10 SPBT3.0DP1 module GPIO configuration

The table below shows all the possible functions that can be associated to each GPIO of the module.

Table 8: SPBT3.0DP1 GPIO configuration table

Module GPIO	Default Function	Alternate Function
1	Connection Status Probe 0: BT connection down 1: BT connection up	GPIO input
2	GPIO input	GPIO output Host_ModeInd
3	GPIO input	GPIO output
4	Active status Probe 1: Active Status Mode Blinking: Deep Sleep Mode	GPIO input
5	GPIO input	GPIO output Host_WakeUp
6	GPIO input	GPIO output HostMode_Sel
7	GPIO input	GPIO output
8	GPIO input	GPIO output Host_ModeSel
9	GPIO input	GPIO output Host_ModeInd
10	GPIO input	GPIO output Host_ModeWakeUp
11	I2C SCL	GPIO input GPIO output
12	I2C SDA	GPIO input GPIO output
13	GPIO input	GPIO output
14	GPIO input	GPIO output

11 Module I/O levels

SPBT3.0DPx module is internally supplied by a voltage regulator at 1.8 V, that means the module I/O levels are referred to this voltage. When standard pins (not 5 V tolerant) are used to interface other parts of application board at different voltages compared to 1.8 V, a voltage level shifter circuit may be necessary. Refer to SPBT3.0DPx datasheet to identify standard pins.

Let's consider typical case of interfacing 3.3 V +/- 0.3 V logic circuitry.

11.1 Standard pin used as output

Output high level is limited to 1.8 V, that could be not enough to guarantee the input high level VIH of the circuit that interface the module. Based on the supply voltage used, a verification is recommended.

11.2 Standard pin used as input

The voltage must be scaled down in order to guarantee the logic levels do not to exceed the maximum values:

1.3 V < VIH < = 1.8 + 0.4 V

0 < VIL < 0.5 V

A level shifter or a resistor divider with 3.6 / 1.8 = 2 ratio can be used.

Value of resistors must be chosen compromising the maximum frequency of the input signal, and current consumption.

11.3 Reset pin

Voltage at Reset pin must be limited to 1.8 V + 0.4 V when driven by an external active output. If the external signal exceed the allowed value a solution must be implemented to limit the input voltage level.

- Use an open drain or open collector to drive the reset pin
- Use a series resistor to limit the injected current. For 3.3 V a resistor in the range of 6.8 k -10 k
- Use a resistor divider taking care that, in worst condition, V_{IH} > 2 V
- Put a Schottky diode in series to the reset line and check that the low level logic is < 0.8 V

12 Firmware upgrade

The SPBT3.0DPx modules leverage the STM32 built-in bootloader to load the new firmware. It is a three-step procedure:

- Enter bootloader mode
- Transfer the new firmware
- Exit bootloader mode

12.1 Enter bootloader mode

To enter the Bootloader mode two options are available.

Via BOOT0 pin:

- Set the BOOT0 pin to HIGH level
- Reset the module:
  - Set the RESET pin to HIGH
  - Pause
  - Set the RESET pin to LOW

Via AT Command:

- Send over module UART command “at+ab StartFwUpdate<CR><LF>”

12.2 Transfer the new firmware

The specification of the protocol used in the STM32 bootloader to download the new firmware is described in the document:

http://www.st.com/web/en/resource/technical/document/application_note/CD00264342.pdf

A reference implementation of the STM32 bootloader protocol can be found at the following link:

http://sourceforge.net/projects/stm32flash/

The STM32 Flash loader demonstrator, a Windows GUI that implement that protocol can be downloaded at the following link:

http://www.st.com/en/development-tools/flasher-stm32.html

12.3 Exit bootloader mode

To exit Bootloader mode:

- Set the BOOT0 pin to LOW or leave it floating
- Reset the module:
  - Set the RESET pin to HIGH
  - Pause
  - Set the RESET pin to LOW

12.4 Using STEVAL-BT3.0DPx

In case of STEVAL-BT3.0DPx USB dongle for Bluetooth SPBT3.0DPx module, the three steps above can be done this way:

- Enter bootloader mode:
  - Plug the USB dongle into the PC USB port

  - Insert a jumper on JP1
  - Push the SW1 reset button

If serial console available on PC, it is possible to send command:

“at+ab StartFwUpdate<CR><LF>”

In this case it is not necessary to insert a jumper on JP1.

- Transfer the new file:
  - Launch the ST Flash Loader Demonstration GUI (version has to be >= 2.7.0) http://www.st.com/en/development-tools/flasher-stm32.html
  - Program the new file with the GUI
- Exit bootloader mode:
  - Remove the jumper on JP1
  - Push the SW1 reset button

13 AT commands for regulatory testing

HCI testing commands are required to set the SPBT3.0DPx module into proper status to perform RF regulatory certification tests.

That is achieved using special AT command “AT+AB SendHCI”.

13.1 TxRx test command

This command is used to transmit or receive data packets without having a Bluetooth connection.

In TX test mode, the device will transmit packets without whitening, according to the specified parameters. This is similar to the transmitter tests in the Bluetooth Test Mode chapter of the Bluetooth Specification, but the device is master.

In RX test mode the device will put itself in a packet receive mode, where the packets are expected to arrive on a single, fixed frequency. When in TX or RX test mode, the Host can send the command again to change the parameters or to end the test mode. It is not allowed to switch on the fly between TX and RX mode, without first exiting the current scenario.

Purpose:

To verify the radio TX performance, by sending out Bluetooth packets that will be captured by a test device (e.g. spectrum analyzer).

13.2 Syntax

AT+AB SendHCI F4FC1C80808080[Test Scenario][Hopping Mode][Channel]00[Packet Type] [Payload Bytes][BD address]01[Channel Map]

Where:

[Test Scenario]: (1 byte)

- 0x01: TX pattern 0
- 0x02: TX pattern 1
- 0x03: TX pattern 1010
- 0x04: TX pattern PRBS (random)
- 0x09: TX pattern 11110000
- 0xFF: Exit Test. Note: use this value to stop a transmission before switching to a new test command

[Hopping Mode]: (1 byte)

- 0x00: single frequency
- 0x01: standard hopping - Europe
- 0x05: reduced hopping
  [Channel]: (1 byte)
- Channel: 0x00 to 0x4E (from 2402 to 2480 MHz). This is used only if Hopping Mode is set to 0x01 Single Frequency
  [Packet Type]: (1 byte)
- DH1:0x84
- DH3: 0x8B
- DH5: 0x8F
- 2DH1: 0x94
- 2DH3: 0x9A

- 2DH5: 0x9E
- 3DH1: 0xA8
- 3DH3: 0xAB
- 3DH5: 0xAF

[Payload Bytes]: (2 bytes, little endian)

- 0x00 – 0x3fd (0-1021) MUST be smaller or equal to the maximum payload of the packet type selected

For example for DM1 use 18, that is 0x12, in little endian on 2 bytes is 0x1200.

For example for DM1 use 341, that is 0x155, in little endian on 2 bytes is 0x5501.

[BD Address]: (6 bytes)

- BD_Address of the transmitting device. Not used for TX test. Use 0x000000E18000

[Channel Map]: (10 bytes, little endian)

- b0 - b79: Mask to enable transmission of each channel. Used only in case Hopping Mode is set to Reduced Hopping

b80: not used. Leave it to 0.

Examples:

to enable hopping only on the first 4 channels (from 2402 to 2405 MHz), the channel map should be 0x000000000000000000F, that in little endian is 0x0F000000000000000000.

to enable hopping only on the last 3 channels (from 2477 to 2480 MHz), the channel map should be 0x70000000000000000000, that in little endian is 0x00000000000000000070.

13.3 Responses

If the command is successful, the response is:

AT-AB CommandComplete: 0e 04 02f4fc00

13.4 TxRx_Test command examples

Command:

at+ab sendhci
F4FC1C80808080020100008F5301000000E1800001FFFFFFFFFFFFFFFFFF7F

Test Scenario: TX pattern 1

Hopping Mode: Standard Hopping - Europe, 0x01

Frequency: 0x00

Packet Type: DH5

Payload Size: 0x0153

BD Address: 0x0080E1000000

Channel_Map: 0x7FFFFFFFFFFFFFFFFFF

Response:

AT-AB CommandComplete: 0e 04 02f4fc00

Command:

at+ab sendhci
F4FC1C80808080010500008F5301000000E1800001FFFFFF00000000000000

Test Scenario: TX pattern 0

Hopping Mode: Reduced Hopping

Frequency: 0x00

Packet Type: DH5, 0x8F

Payload Size: 0x0153

BD Address: 0x0080E1000000

Channel_Map: 0x00000000000000FFFFFF

Response:

AT-AB CommandComplete: 0e 04 02f4fc00

13.5 Static TxRx test command

Using this command, the HOST is able to force the SPBT3.0DPx radio into ‘static’ transmission or ‘static’ receive mode.

In static transmission mode, the radio continuously transmits modulated “0” or “1” at the maximum power level.

In static receive mode, the radio continuously receives and demodulates data.

Syntax:

AT+AB SendHCI F8FC06 [Mode][TXRX][Channel Number][Data][Modulation Mode]

Where:

[Mode]: (1 byte)

- 0x00: Stop
- 0x01: Start

[TXRX]: (1 byte)

- 0x00: Transmission
- 0x01: Reception

[Channel Number]: (1 byte)

- 0x00 - 0x4E from 2402 MHz to 2480 MHz

[Data]: (1 byte)

- 0x00: 0 is modulated
- 0x01: 1 is modulated

[Modulation Mode]: (1 byte)

- 0x00: BR
- 0x01: BR packet in EDR
- 0x02: EDR 2 Mbps
- 0x03: EDR 3 Mbps

Response

AT-AB CommandComplete: 0e 04 02f8fc00

Command:

at+ab SendHCI F8FC050100000000

Mode: Start

TXRX: Transmission

Channel Number: 0x00

Data: 0 is modulated

Modulation Mode: BR

Response:

AT-AB CommandComplete: 0e 04 02f8fc00

14 Revision history

Table 9: Document revision history

Date	Version	Changes
15-Jun-2016	1	Initial release.
09-Mar-2017	2	Added: *Section 12: "Firmware upgrade"*, and *Section 13: "AT commands for regulatory testing"*. Updated: *Section 3: "Data package command list"* and *Section 5: "Variable definitions"*.

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