Bluetooth® Classic BT 3.0 modules
A Comprehensive User Guide

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Outline

- Section 1. Blue Modules overview
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- Section 2. Hardware Features
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  - SPBT2632C1A
  - STEVAL-SPBTxATVx
- Section 3. Software Features
  - SW Architecture, AT Commands and Configuration Variables
  - UART Configuration
  - GPIOs Configuration
  - Basic Procedures
  - SmartCable
  - Remote Mode
  - Multipoint
  - Power Modes
  - Security
  - Communication with Smart Phones
  - COD setting
  - Upgrading Firmware

Section 1
Blue Modules overview

Blue Modules characteristics (1/3)

Key features	SPBT2632C2A.AT2 	SPBT2632C1A.AT2 
Core devices	STM32 ARM-Cortex-M3 MCU + STLC2690 *Bluetooth* IC	STM32 ARM-Cortex-M3 MCU + STLC2690 *Bluetooth* IC
Class	Class 2, typ output 0dBm	Class 1, typ output 10dBm
Bluetooth standard	*Bluetooth* 3.0	*Bluetooth* 3.0
SPP and AT2 command	✓	✓
Antenna and shield	✓	✓
Low power mode	with external LPO (Low Power Oscillator)	✓
Pin count	16	24
Form factor	Micro-sized : 11.6 x 13.5 mm	Small : 15 x 27 mm
Supply voltage range	2.1 ÷ 3.6 V	2.1 ÷ 3.6 V
Voltage regulator	✓	✓
Clock integrated	✓	✓
WLAN coexistence	✓	✓
Operating temperature	-40 ÷ 85 ºC	-40 ÷ 85 ºC

Blue Modules characteristics (2/3)

Key features	SPBT2632C2A.AT2 	SPBT2632C1A.AT2 
High Speed CPU Mode 32 MHz	Average values	
ACL data 115 KBaud UART at max throughput (Master)	23 mA	23 mA
ACL data 115 KBaud UART at max throughput (Slave)	27.5 mA	27.5 mA
Connection, no data traffic, Master	9.1 mA	9.1 mA
Connection, no data traffic, Slave	11.2 mA	11.2 mA
Connection 375 ms sniff with LPO (Low Power Oscillator)	490 µA*	490 µA
Page/inquiry scan, without deep sleep	9.5 mA	9.5 mA
Page/inquiry scan, with deep sleep, no LPO	2.7 mA	-
Page/inquiry scan, with deep sleep and LPO	520 µA*	520 µA
Standby, without deep sleep	8.6 mA	8.6 mA
Standby with deep sleep, no LPO	1.7 mA	-
Standby with deep sleep and LPO	70 µA*	60 µA

* With external clock

Blue Modules characteristics (3/3)

Key features	SPBT2632C2A.AT2 	SPBT2632C1A.AT2 
Pin counting		
Reset (NRST) pin	✓	✓
Boot pin	✓	✓
4 pins for UART interface (TX, RX, CTS, RTS)	✓	✓
6x bottom pins JTAG interface (JTDI, JTDO, JTMS, JTCK, JTRST, NRST)	✓	✓
GPIOs	7 and LPO input	16
GPIO High Level	2.1 V	2.1 V
Interfaces		
High speed UART	✓	✓
I^2C only for Apple code processor interface	✓	✓
RF characteristics		
Antenna Load	50 Ω	50 Ω
Sensitivity Level (BER < 0.001 with DH5)	-86 dBm	-90 dBm
Maximum Output Power (50 Ω load)	0 dBm	+10 dBm

Blue Modules - Certifications

- **Blue Modules are CE and Bluetooth® certified.**
- **Radio type compliant for US, Canada and Japan**

	BQB qualified design	CE Statement of opinion*	FCC and IC	Japan Type Certification
SPBT2632C1A.AT2	QD ID: **B019224** Product type: End Product TGP Version: Core 3.0 Core Spec Version: 3.0 Product Description: Bluetooth Module, spec V3.0	**0447-ARAM00002** Measurements in accordance with: EN 300 328 V 1.7.1 (2006-10) EN 301 489-17 V 2.1.1 (2009) EN 60950-1:2006 +A11:2009+A1:2010 CE 0051 ⓘ	FCC ID: **X3ZBTMOD3** IC: **8828A-MOD3** In accordance with FCC part 15, the SPBT2632C1A.AT2 is listed above as a modular transmitter device	Work in Progress
SPBT2632C2A.AT2	QD ID: **B019224** Product type: End Product TGP Version: Core 3.0 Core Spec Version: 3.0 Product Description: Bluetooth Module, spec V3.0	**0448-ARAM00003** Measurements n accordance with : EN 300 328 V 1.7.1 (2006-10) EN 301 489-17 V 2.1.1 (2009) EN 60950-1:2006 +A11:2009+A1:2010 CE 0051 ⓘ	FCC ID: **X3ZBTMOD5** IC: **8828A-MOD4** In accordance with FCC part 15, the SPBT2632C2A.AT2 is listed above as a modular transmitter device	Radio type ID: **006-000095** SPBT2632C2A.AT2 **is** certified as Type Approval in conformity with Chapter 38-24-1 of Japan Radio Law

* Reports available on request

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Bluetooth™

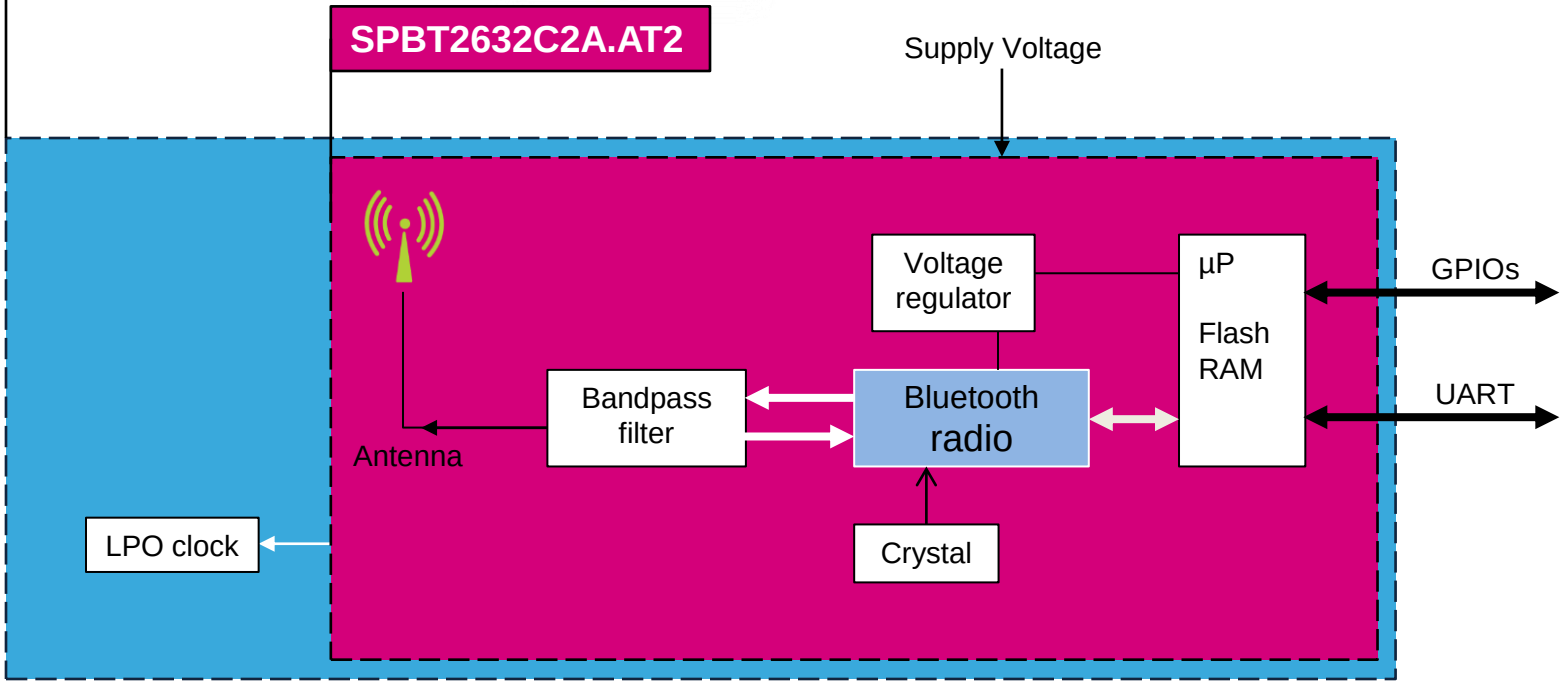
Blue Modules hardware architecture

TX Power: +10 dBm.
RX Sensitivity: -90 dBm
Size: 15 x 27 mm

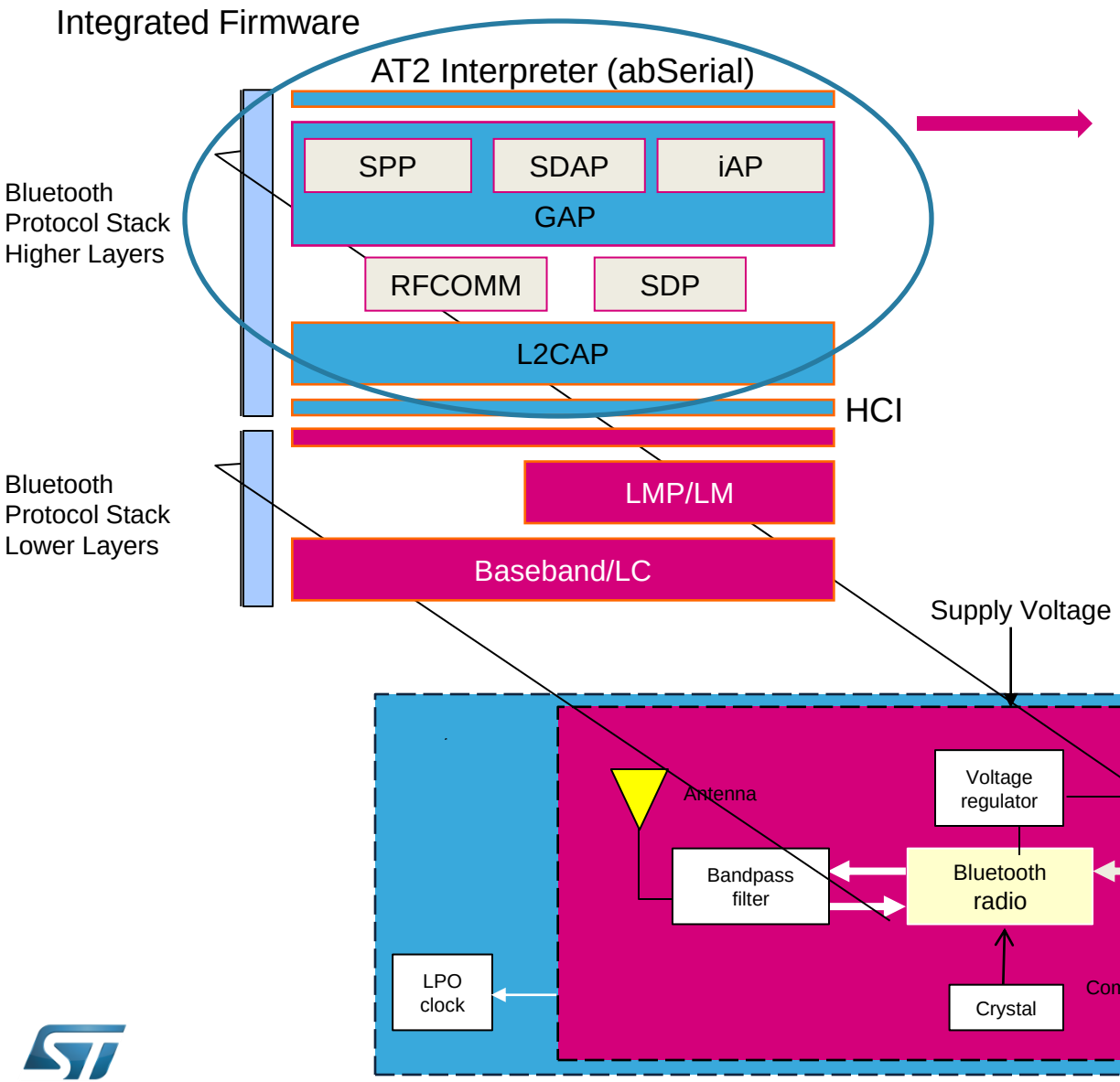
SPBT2632C1A.AT2

TX Power: +0 dBm.
RX Sensitivity: - 86 dBm
Size: 11.6 x 13.5 mm

SPBT2632C2A.AT2



Blue Modules firmware architecture



Generic Access Profile (GAP)

- Discovers and connects to other devices
- Security (authentication)
- idle mode procedure: inquiry
- linking, paging, connection

Service Discovery Profile (SDP)

- Locates/describes services from/to other devices

Serial Port Profile (SPP)

- Emulates legacy serial communication
- Cable replacement

iPod Accessory Protocol (iAP)

- Supports communication with Apple iOS Bluetooth enabled device*

AT Command Layer

The Blue Modules Firmware integrates a layer of AT-like commands (abSerial) on top of the Bluetooth stack. They have a very simple syntax and allow Firmware configuration and Bluetooth connection management

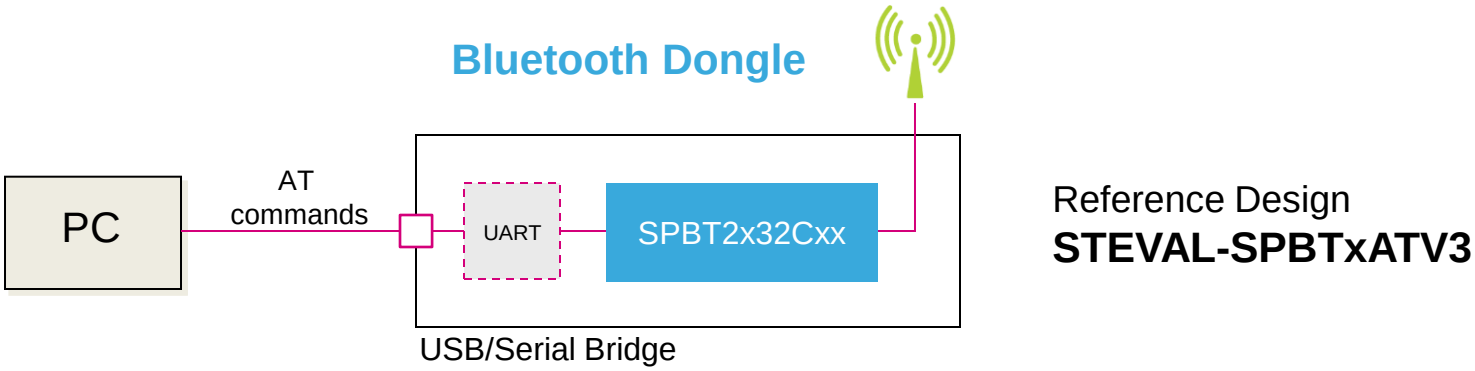
Blue Modules part number

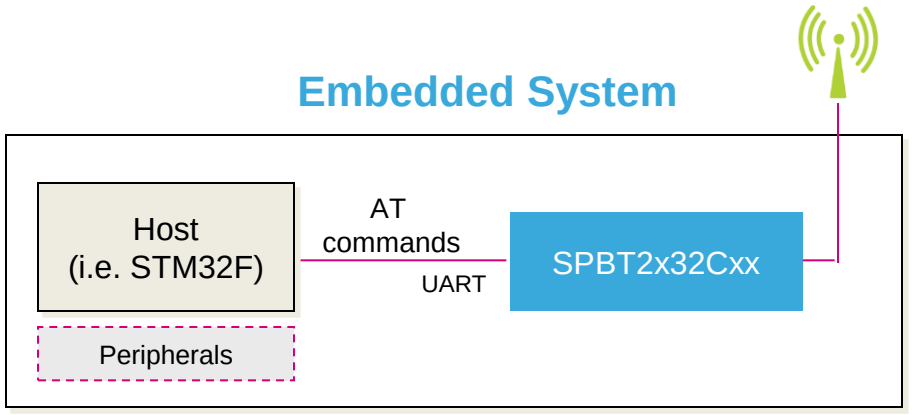
SPBT2632C2A.AT 2 (Class 2 profile, enhanced FW)
SPBT2632C1A.AT 2 (Class 1 profile, enhanced FW)

Key features	AT2 command
Bluetooth version	3.0
Point-to-point communication	✓
Multipoint communication	✓
Remote commands	✓
Sniff mode	✓
Profiles	
SPP	✓
iAP	✓
Smart Phone support	
Android	✓
iPhone	✓

Integration Modes

Connect the Blue Modules with your favorite host processor via the UART interface



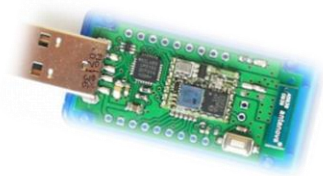


Support tools

Order codes

Order code	Description
SPBT2632C2A.AT2	Bluetooth V3.0, Class2, antenna, AT2 command Firmware
SPBT2632C1A.AT2	Bluetooth V3.0, Class1, antenna, AT2 command Firmware

Evaluation boards



Order code	Description
STEVAL-SPBT3ATV3	USB dongle, evaluation board for SPBT2632C2A.AT2
STEVAL-SPBT4ATV3	USB dongle, evaluation board for SPBT2632C1A.AT2

Other tools

Technical Documentation
Datasheets
Application note
AT command user manual

Promotional Documentation
Marketing presentation on www.st.com
Product briefcase on MyST

Technical support
Contact us @ onlinesupport@st.com

Section 2
Hardware Features

SPBT2632C2A
Hardware Features

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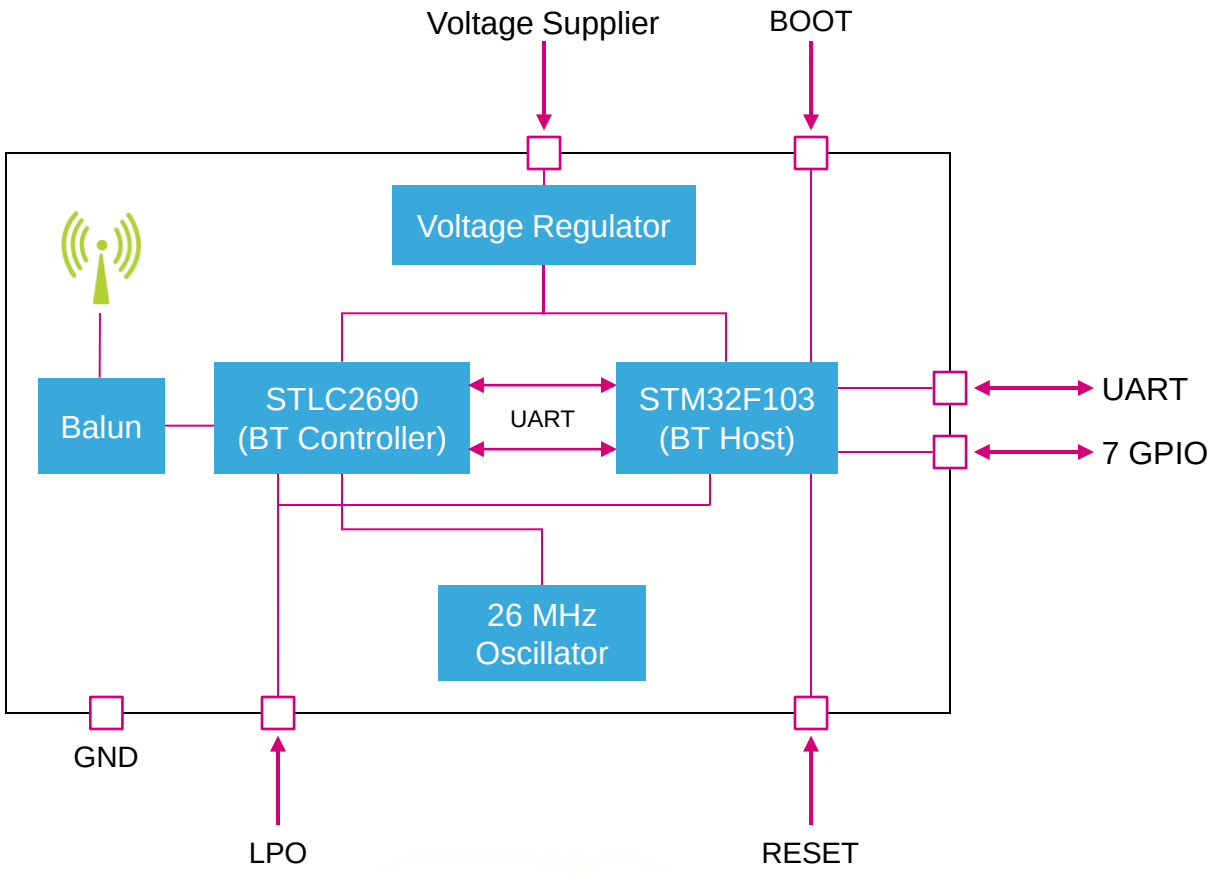
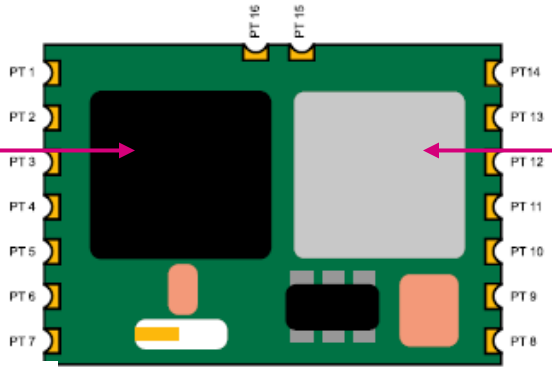
SPBT2632C2A Hardware Features

- Bluetooth 3.0 Compliant
- Integrated Chip Antenna
- Max Output Power transmission:
  - 0 dBm
- Small form factor:
  - 11.5 x 13.5 mm
- External Communication interfaces:
  - UART
  - 7 GPIO
  - LPO
- 3.3V single supply voltage, integrated voltage regulator
- Integrated 26 MHz quartz oscillator
- Operating temperature range:
  - -40º ~ +85 ºC

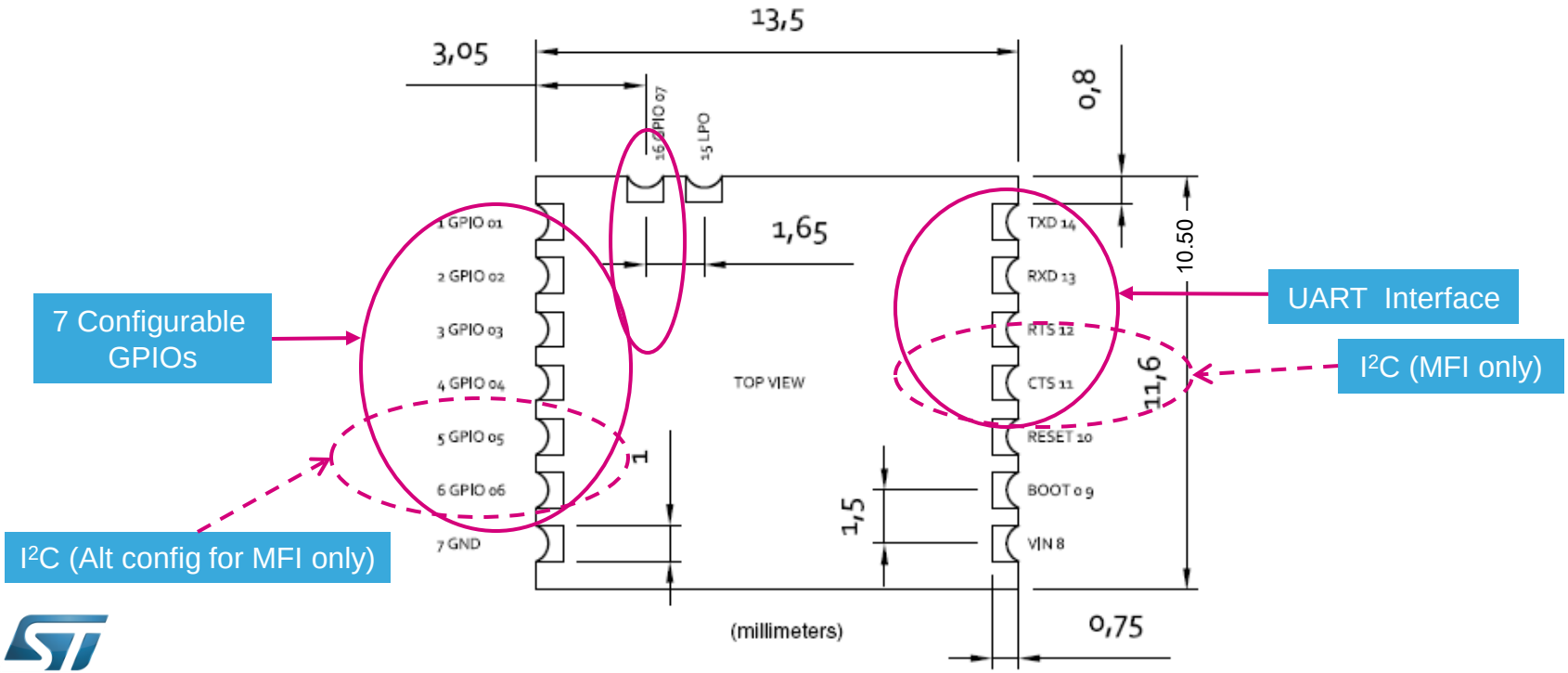


SPBT2632C2A Pinout

STLC2690
(package WFBGA48)



STM32F103
(package BGA64)



SPBT2632C2A Characterization Figures

Parameter	Conditions	Min	Typ	Max	Unit
Supply Voltage, Vin	---	+2.1	+2.5	+3.6	V
Operating Temperature Range	---	-40	---	+85	°C
Signal Pin Voltage	---	---	+2.1	---	V
Radio Rec. Sensitivity Level	BER < 0.001 with DH5	---	-86	---	dBm
Radio Transmitter Output Power	50 Ω Load	---	0	---	dBm

Power Consumption. High Speed CPU Mode: 32 MHz	Average	Unit
ACL data 115 KBaud UART at Max throughput (Master)	23	mA
ACL data 115 KBaud UART at Max throughput (Slave)	27.5	mA
Connection, no data traffic, Master	9.1	mA
Connection, no data traffic, Slave	11.2	mA
Connection 375 ms sniff (external LPO required)	490	µA
Standby, (page/inquiry scan), without deep sleep	8.6 (9.5)	mA
Standby, (page/inquiry scan), with deep sleep, no external LPO	1.7 (2.7)	mA
Standby, (page/inquiry scan), with deep sleep, with external LPO	70 (520)	µA

SPBT2632C2A Characterization with External Low Power Oscillator (1/2)

- **LPO: Low Power Oscillator**
  (32.768kHz External clock, Tolerance: ±150ppm)

- LPO is connected to the CPU and Radio IC.

- LPO standard of Radio IC (V_{DD} = 1.8V) is:
  - Duty cycle: min 40%, max 60%
  - Low level Input Voltage (V_{IL}): Min = 0, Max = 0.5V
  - High level Input Voltage (V_{IH}): Min = 1.2V, Max = 1.8V

- On the other hand, CPU STM32F103 (V_{DD} = 2.1V) is:
  - Duty cycle: Min 30%, Max 70%
  - Low level Input Voltage (V_{IL}): Min = V_{SS}, Max = 0.3 V_{DD}
  - High level Input Voltage (V_{IH}): Min = 0.7V_{DD}, Max = V_{DD}

SPBT2632C2A Characterization with External Low Power Oscillator (2/2)

- CPU power supply is supplied from the 2.1V LDO in the module. Therefore, 0.7 * V_{DD} = 0.7 * 2.1 = 1.47 V (V_{IH} Min) next, V_{IH} is dominated by the MCU side.

- Specification of LPO that satisfies the standards of both:
  - Duty cycle: Min 40%, Max 60%
  - Low level Input Voltage (V_{IL}): Min = 0, Max = 0.5V
  - High level Input Voltage (V_{IH}): Min = 1.47V, Max = 1.8V

- **LPO operation check method**:
  Put to Sniff mode, connected by state without communication for 10 minutes (Sniff mode), if it is maintained, it becomes the LPO judgment OK

SPBT2632C1A
Hardware Features

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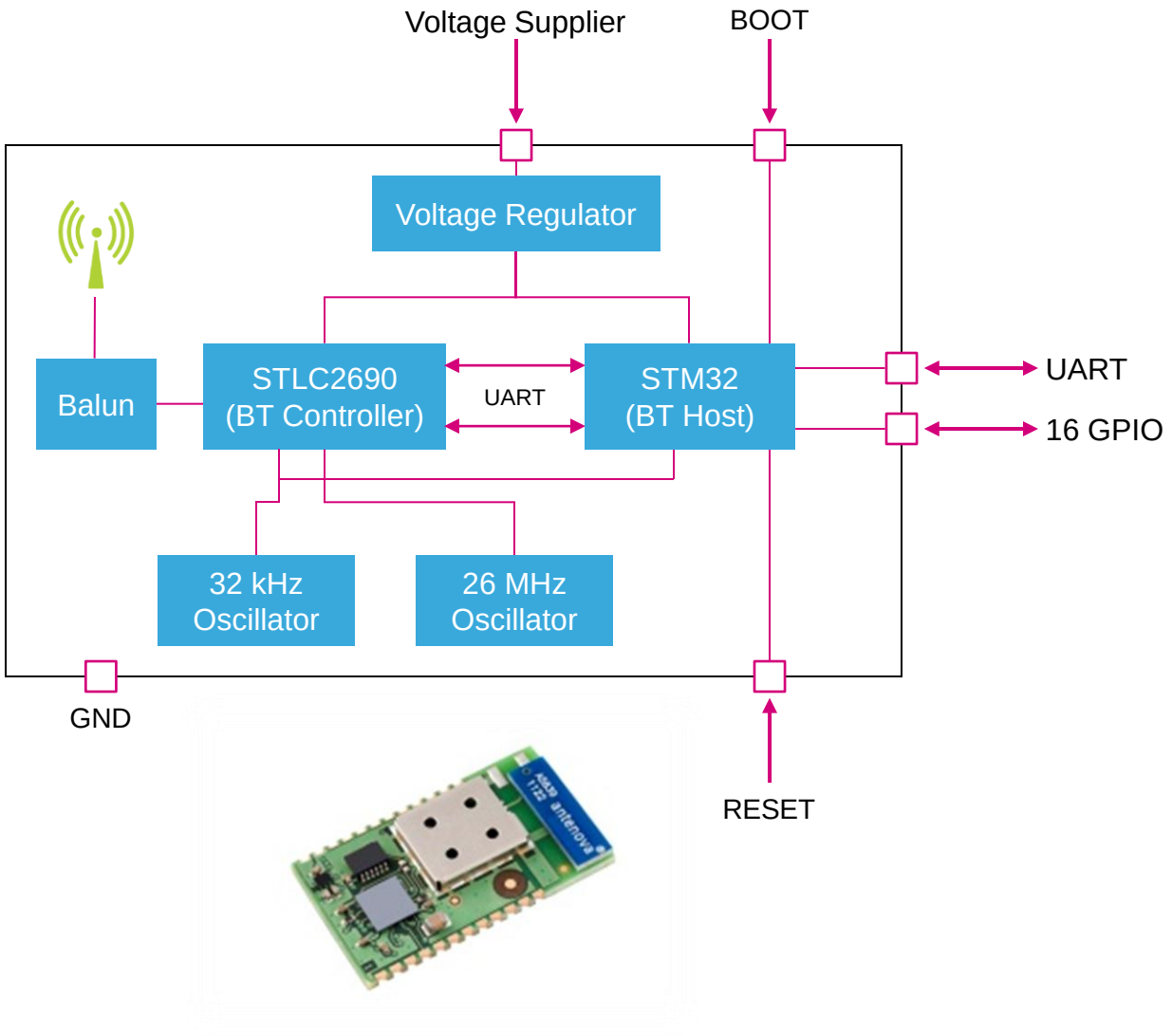
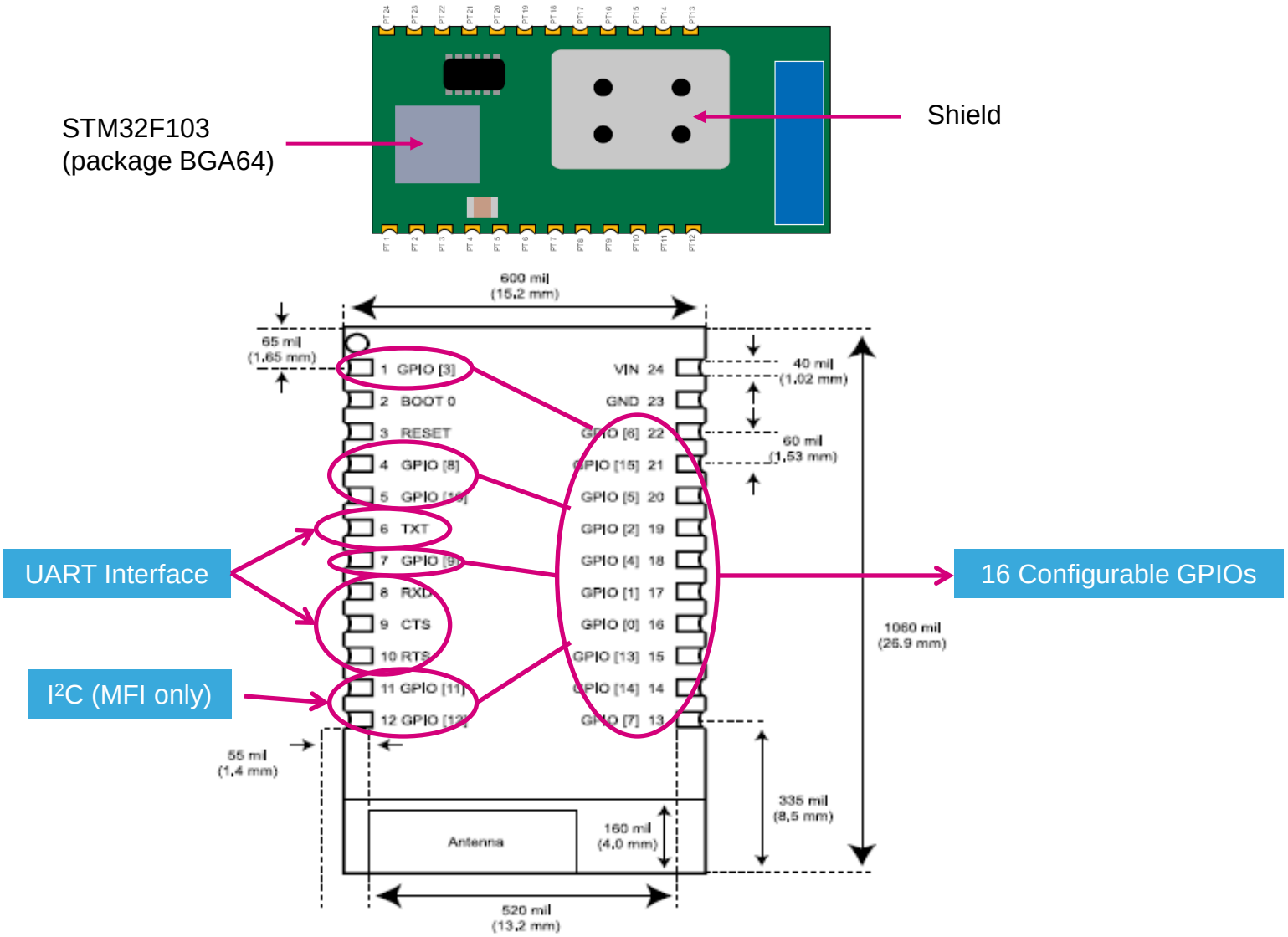
SPBT2632C1A Hardware Features

- Bluetooth 3.0 Compliant
- Integrated Chip Antenna
- Max Output Power transmission:
  - +10 dBm
- Small form factor:
  - 15 x 27 mm
- External Communication interfaces:
  - UART
  - 16 Configurable GPIOs
- 3.3V single supply voltage, integrated voltage regulator
- Integrated 26 MHz and 32 kHz quartz oscillators
- Operating temperature range:
  - -40º ~ +85 ºC



SPBT2632C1A Pinout



SPBT2632C1A Characterization Figures

Parameter	Conditions	Min	Typ	Max	Unit
Supply Voltage, Vin	---	+2.1	+2.5	+3.6	V
Operating Temperature Range	---	-40	---	+85	°C
Signal Pin Voltage	---	---	+2.1	---	V
Radio Rec. Sensitivity Level	BER < 0.001 with DH5	---	-90	---	dBm
Radio Transmitter Output Power	50 Ω Load	---	---	+10	dBm

Power Consumption. High Speed CPU Mode: 32 MHz	Average	Unit
ACL data 115KBaud UART at max throughput (Master)	23	mA
ACL data 115KBaud UART at max throughput (Slave)	27.5	mA
Connection, no data traffic, Master	9.1	mA
Connection, no data traffic, Slave	11.2	mA
Connection 375 ms sniff	490	µA
Standby, (page/inquiry scan), without deep sleep	8.6 (9.5)	mA
Standby, (page/inquiry scan), with deep sleep, with external LPO	70 (520)	µA

STEVAL-SPBTxATV
Hardware Features

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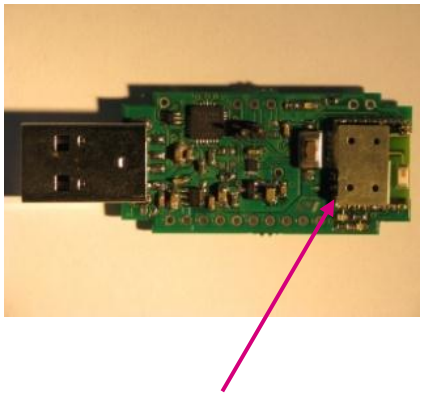
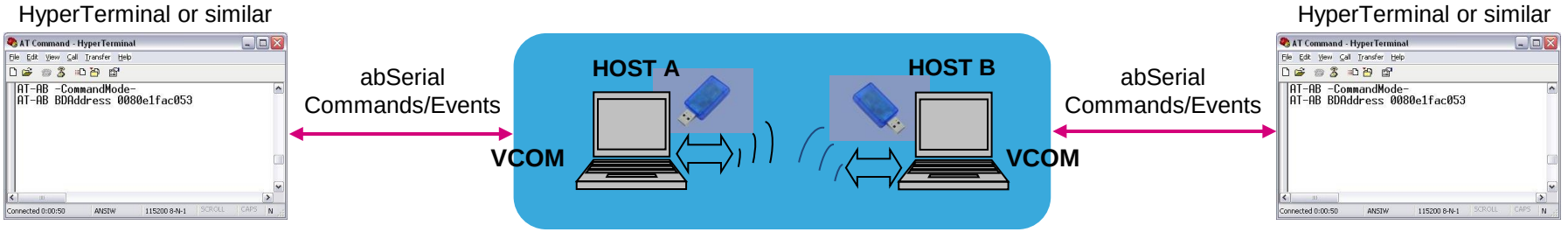
STEVAL-SPBTxATV3

Example: STEVAL-SPBT**3**ATV3



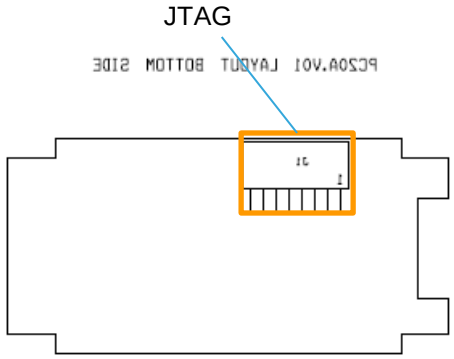
SPBT2632C2A.AT2

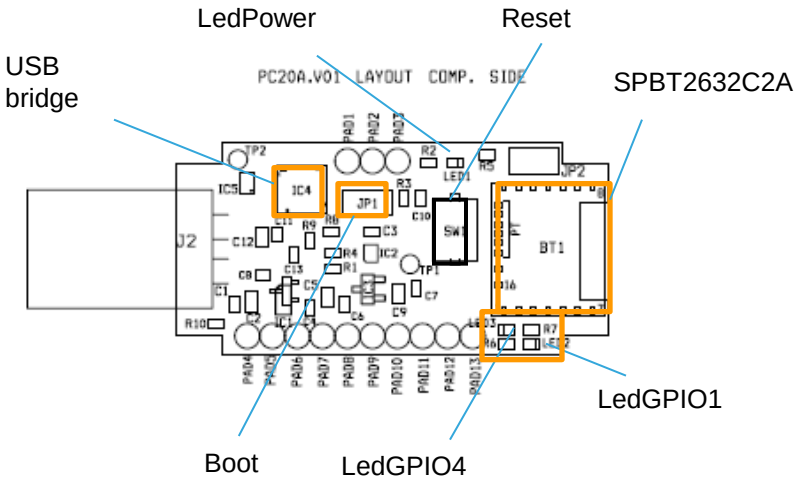
- Plug&Play Solution
- Reference designs and evaluation boards
- Evaluation tool of the integrated abSerial AT-like commands layer (abSerial)
- Power Supplied via the USB interface
- Compact and Small form factor
- LEDS connected to GPIO for testing purposes
- UART/USB bridge from Silicon Lab requires to install the correspondent driver on your PC



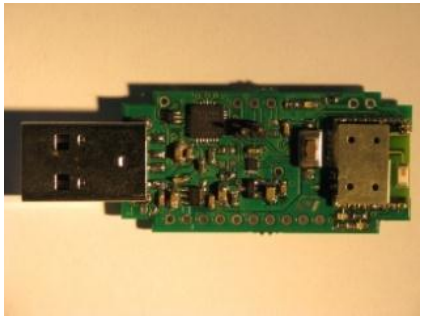
Refer to the related Application Notes to get started with schematics and basic procedures

STEVAL-SPBT3ATV3





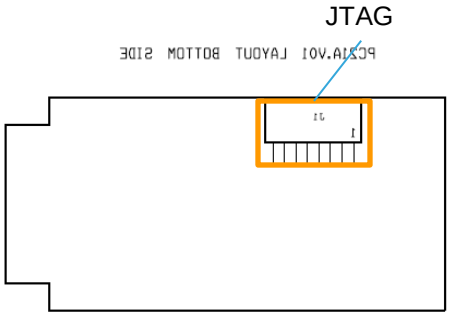
STEVAL-SPBT3ATV3

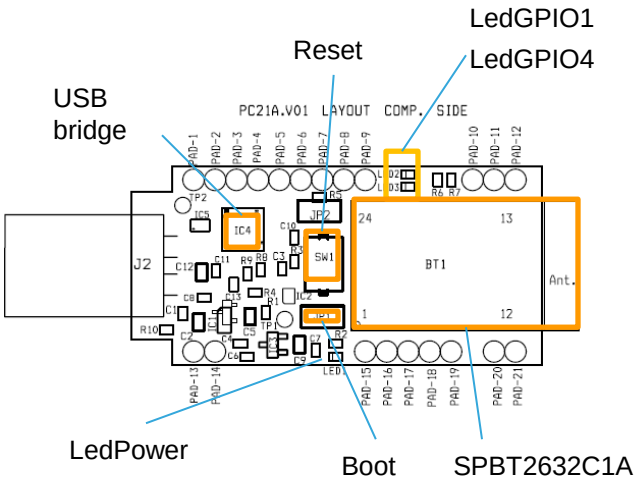


SPBT2632C2A Reference Design
STEVAL-SPBT3ATV3 BOM, Gerber and Schematic available on the ST website.
See detailed information and schematic in the

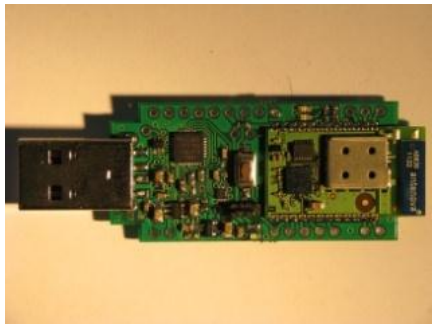
Application Note: AN4127
«*Demonstration board for Bluetooth® module class 2 SBT2632C2A.AT2*»

STEVAL-SPBT4ATV3





STEVAL-SPBT4ATV3



SPBT2632C1A Reference Design
STEVAL-SPBT4ATV3 BOM, Gerber and Schematic available on the ST website.
See detailed information and schematic in the

Application Note: AN4128
«*Demonstration board for Bluetooth® module class 1 SBT2632C1A.AT2*»

Section 3
Software Features

Software Architecture, AT Commands and Configuration Variables

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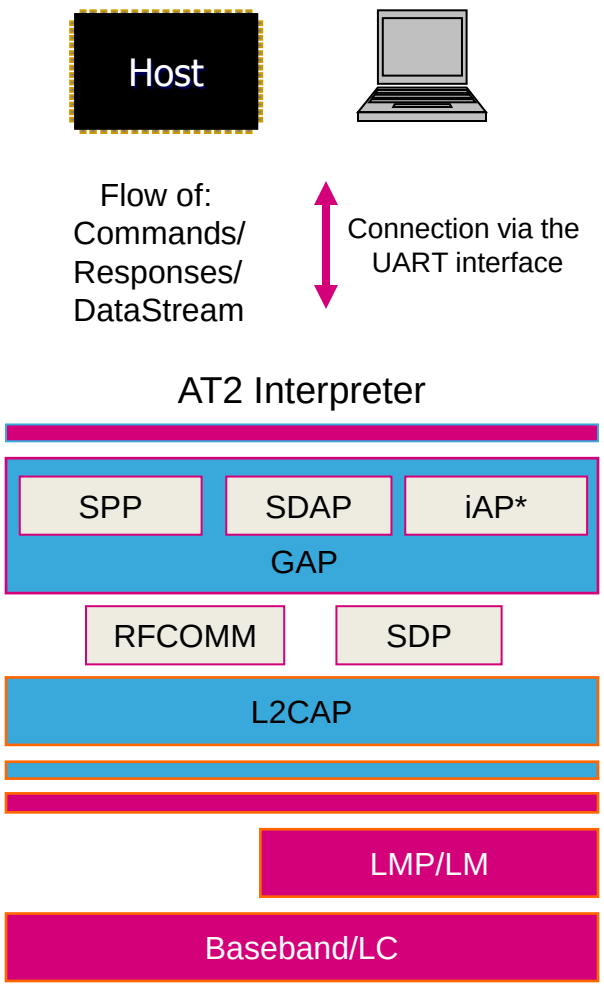
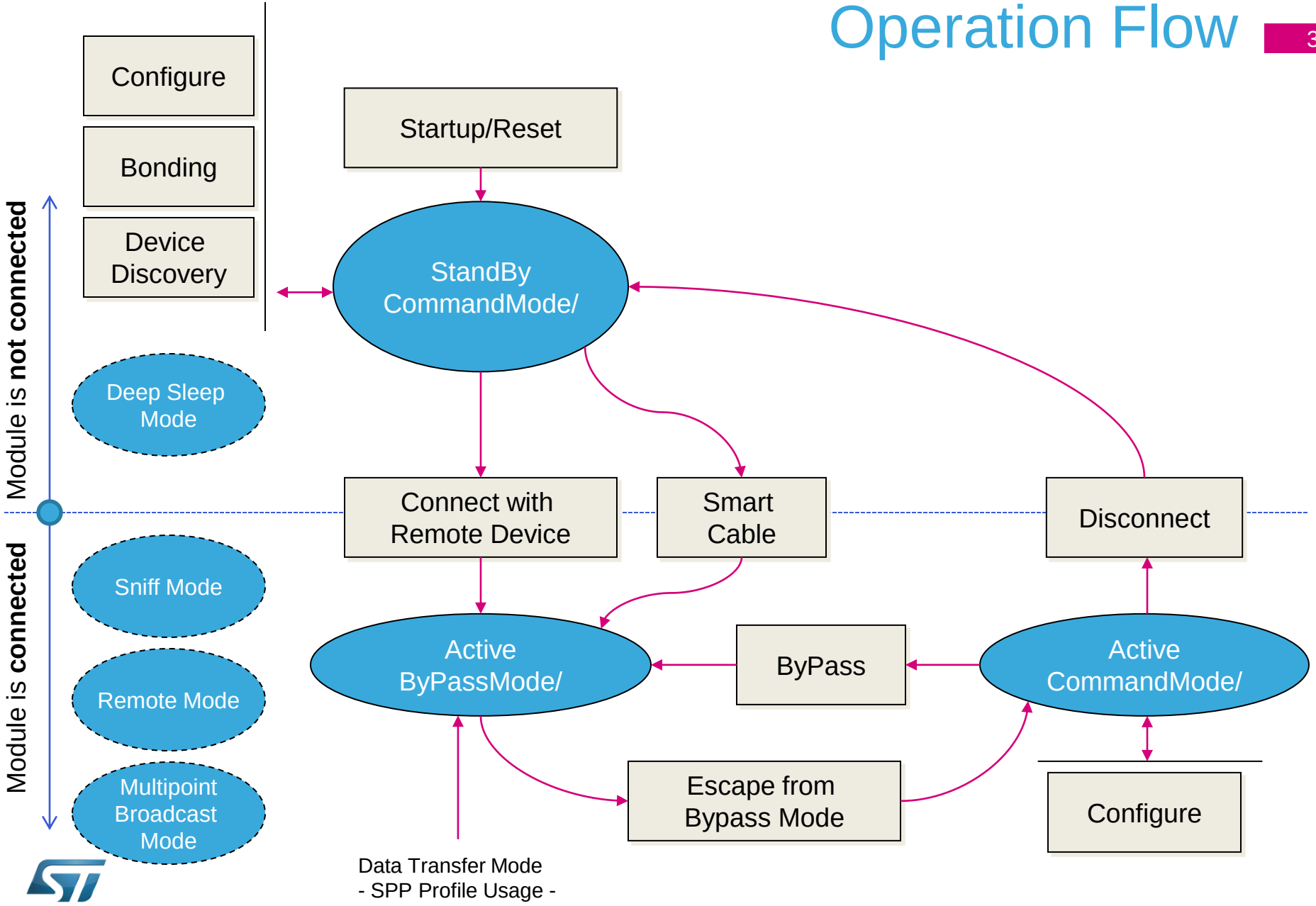
Modes of Operation



- The Firmware supports Multiple Modes of Operation:
  - Command Mode
  - Bypass Mode
  - Remote Mode
  - Sniff Mode
  - Deep Sleep Mode
  - Multipoint/Broadcast Mode
- Commands and Responses are handled only while the application is in Command Mode
- In Bypass Mode the data stream is transferred directly from the UART and the Bluetooth SPP
- In Remote Mode a node can be remotely configured (only in AT2)
- Sniff Mode is a low power consumption operation mode (only in AT2)
- Deep Sleep Mode is a low power consumption status mode
- Multipoint/Broadcast Mode manages connections between a master and multiple slaves

Operation Flow



AT2 Commands

Category	List of Commands
Reset	Reset
Device Information	BtcVersion Build DefaultLocalName LocalName GetBdAddress Version
GPIO Use	GPIOConfig GPIORead GPIOWrite
Serial Configuration	ChangeBaud ChangeDefaultBaud HostEvent StreamingSerial
Mode management	Escape Seq. ^#^$^% Remote Commands Seq. @#@$@% Bypass
Device Discovery	Discovery

Category	List of Commands
Bonding	Bond DisableBond EnableBond EraseBondTable ShowDev
Connection	SPP(Dis)Connect LinkDisconnect SmartCableSetup DeleteSmartCable IAP(Dis)Connect RoleSwitch PassKeyAccept ReadClock
Configuration	Config Cptest
Page/Inquiry timing	UpdateInquiryScan UpdatePageScan
SleepModes	(Exit)Sniff

The list and syntax of AT2 Commands are described in the User Manual **UM1547**

AT(2) Configuration Variables

Category	List of Variables
Device Informations	BuildVersion BD_ADDR DeviceName COD
UART Configuration	Streaming Serial UartBaudRate UartParity UartDataBits UartStopBits UartTimeout HostEvents
Hardware Configuration	CpuMHz HciBaudRate SPIEnable SPIMode I2CEnable UseExtLPO HSE_MHz *

Category	List of Variables
Security	PIN BondingAllowed EnableEncryption DefaultSecurity DefaultAuthentication MITMEvent
Power Modes	AutoSniff AutoSniffTimeout AutoSniffInterval HostShallowSleepEnable HostDeepSleepEnable GPIO_HostKeepAwake GPIO_HostWakeup AllowSniff
Mode	MPMode RmtEscapeSequence

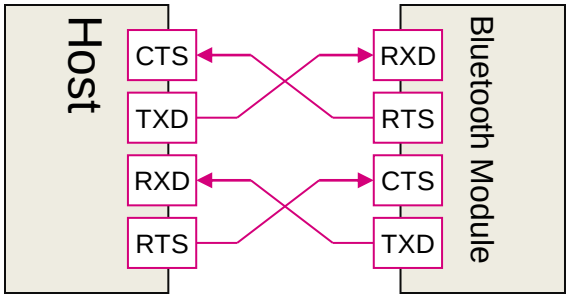
Category	List of Variables
Radio	UseSmallPackets EnableAFH EnablePowerControl QoS_latency PageScan InquiryScan
Smartphones	EnableIAP IAPAppID iAPPProtocolStrMain iAPProtocolStrAlt CPI2CMode SPP128UUID AltCPGPIO
Smartphone hidden variables	AccName AccManufacturer AccModelNumber AccSerialNumber
Others	ATReply

The complete list for AT2 Configuration Variables and their default values are described in the User Manual **UM1547**

UART Configuration

UART Configuration

The module allows to connect an external Host Processor via the UART interface



Four signals are provided with the UART interface.

The TXD and RXD are used for data while the CTS and RTS pins are used for the Hardware flow control

- The **baud rate** is configurable in the **1200-921600** range of values.
  It can be changed by using the correspondent variables or at commands
- Default serial port configuration is **115200/8/n/1**. The correspondent variables can be used to change the UART parameters
- To enable the use of the flow control the **streamingserial** variable/command can be used

GPIO Configuration

GPIOs Configuration

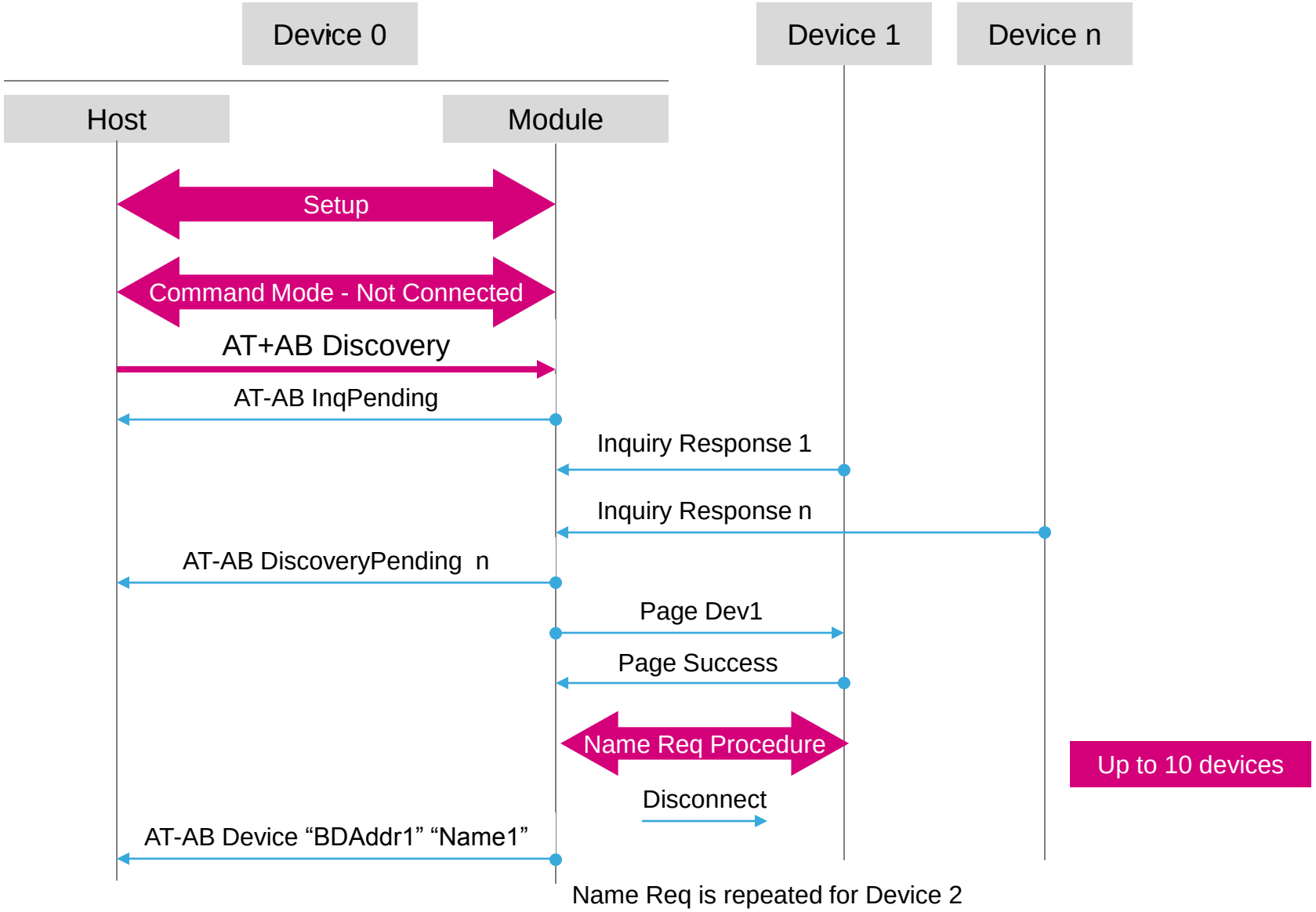
- The integrated Firmware configures the GPIOs as in the following table.
  - **Active Status Probe (MCU RUN)**: always on when the radio is in active mode; Blinking when the radio is in deep sleep mode
  - **Connection Status Probe**: always on when the module is connected

	GPIO1	GPIO2	GPIO3	GPIO4	GPIO5:GPIO7	GPIO8:GPIO16
SPBT2632C2A	Output/ Connection Status Probe	Input/ Pulled-down BOOT	Input/ Pulled-down	Output/ Active Status Probe	Input/ Pulled-down (MFI chip on 5,6)	---
SPBT2632C1A	Output/ Connection Status Probe	Input/ Pulled-down BOOT	Input/ Pulled-down	Output/ Active Status Probe	Input/ Pulled-down	Input/ Pulled-up

- GPIOs can be reconfigured with the following commands
  - AT+AB gpioconfig [GPIO pin] [I/O]
  - AT+AB gpioRead [GPIO pin]
  - AT+AB gpioWrite [GPIO pin] [1/0]
- **Special Use.** In the modules SPBT2632C1A the GPIO11 and GPIO12 can be also reconfigured as I^2C clock and I^2C data for integration of an MFI coprocessor

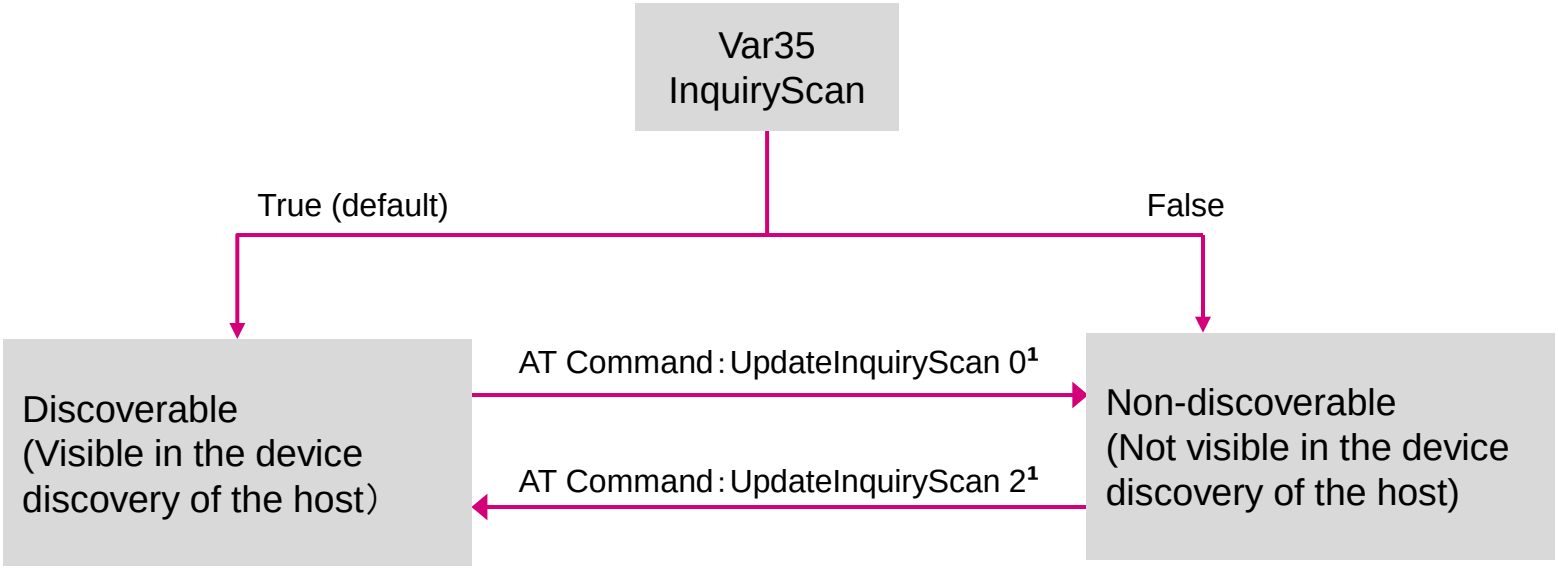
Basic Procedures

Device Discovery Procedure



Device Discovery Allowed

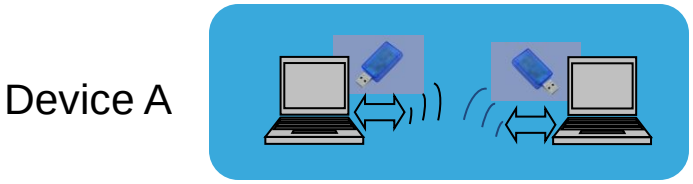
- Var35 InquiryScan = True (module Discoverable)
- Var35 InquiryScan = False (module Non-discoverable)

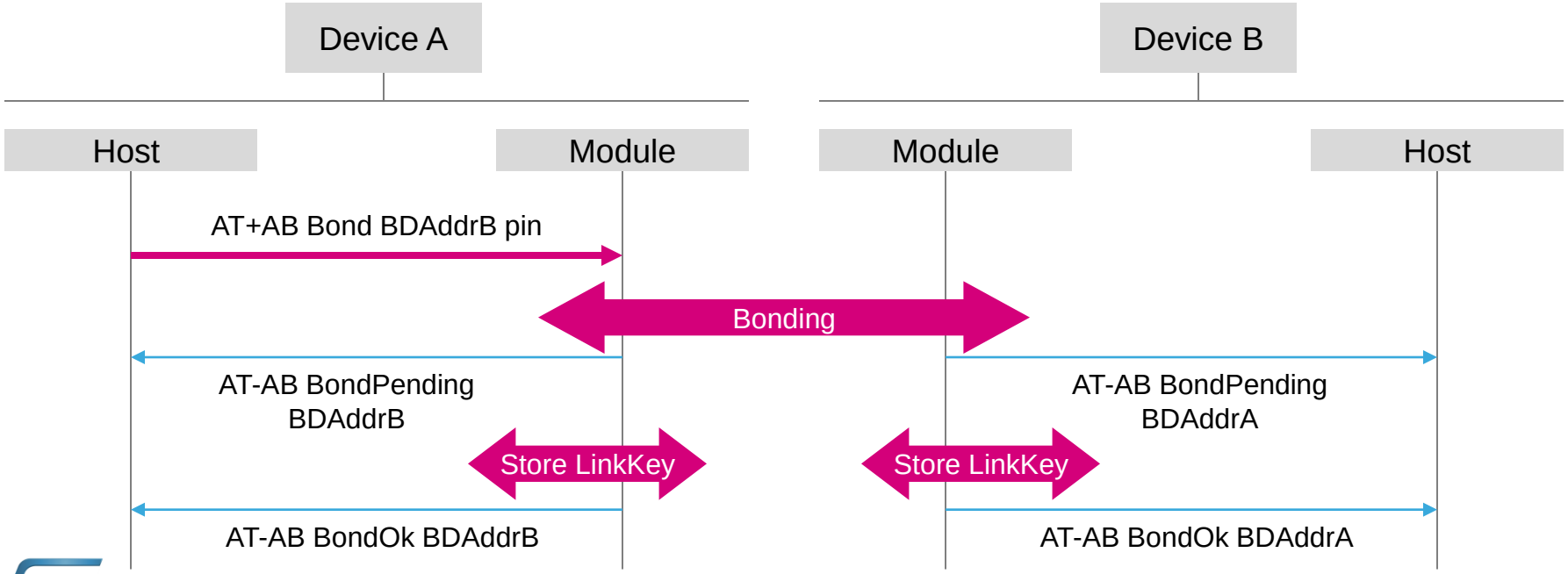


[1] Please refer to User Manual for AT command details

Bonding Procedure

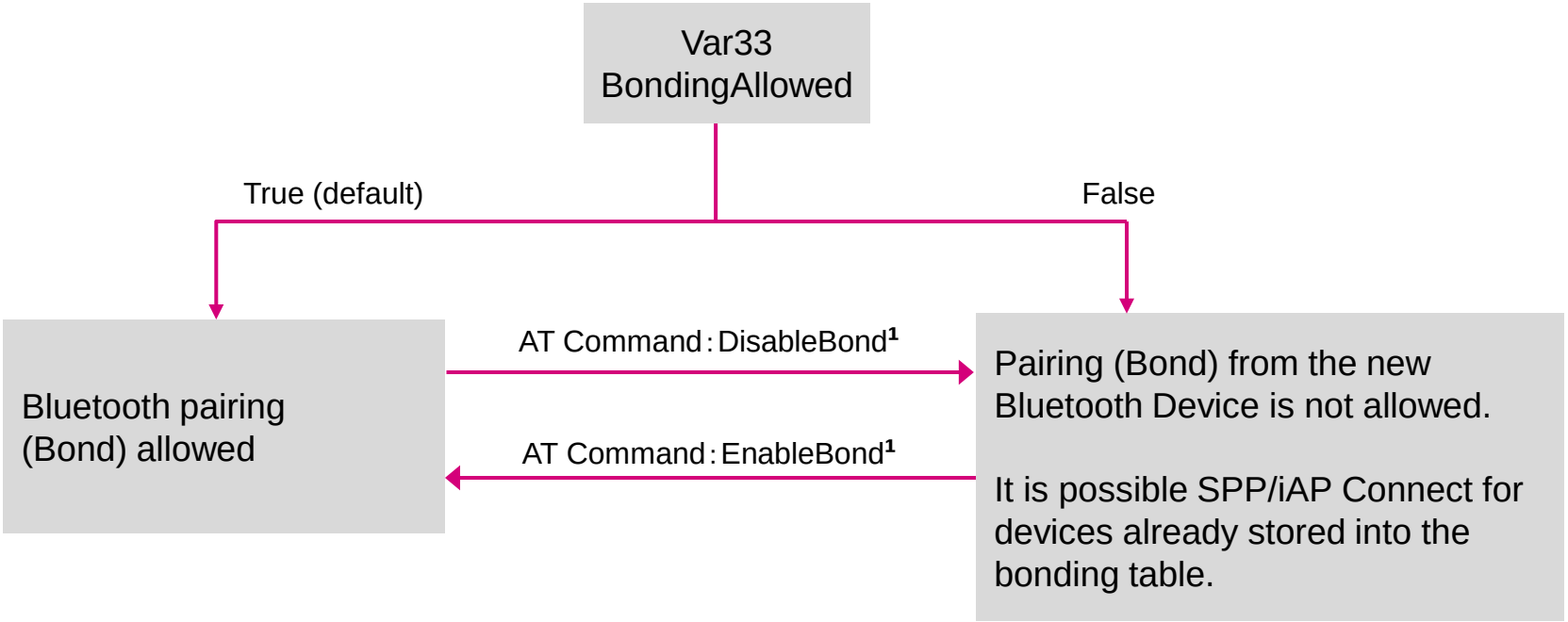
- Bonding is used for device pairing. The bonding effect is the generation of an encryption LinkKey
- By default, modules are configured with bonding allowed, meaning the device is always allowed to accept bonding request





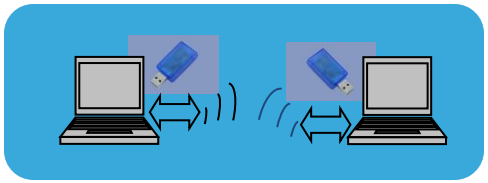
Bonding Allowed

- Var33 BondingAllowed = True (automatically allow Bond)
- Var33 BondingAllowed = False (Bond not allowed)



[1] Please refer to User Manual for AT command details

Connection with a Remote Device Procedure



Device A

Device B

Host

Module

Module

Host

Setup

Setup

Command Mode- Not Connected

Command Mode- Not Connected

AT+AB SPPConnect BDAddrB

SPP Connection Established

ByPass Mode - Connected

ByPass Mode - Connected

AT-AB ConnectionUp

AT-AB ConnectionUp

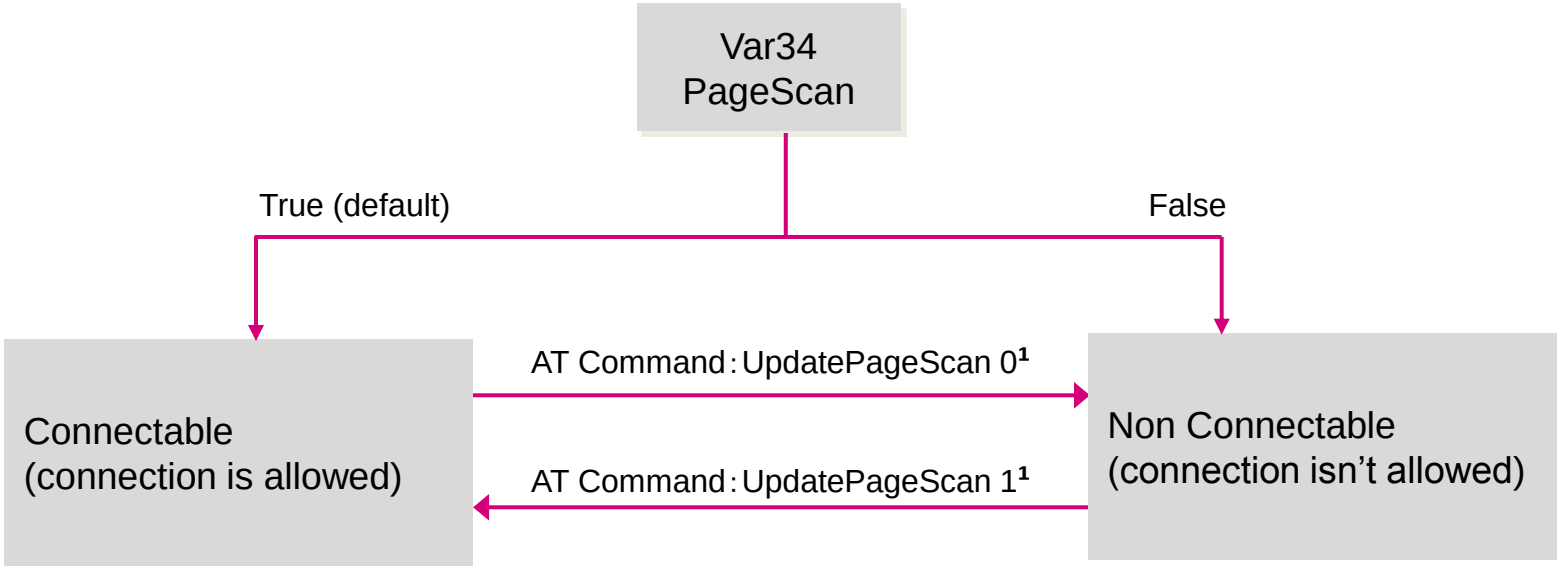
AT-AB – BypassMode -

AT-AB – BypassMode -

Data Exchange

Connection Allowed

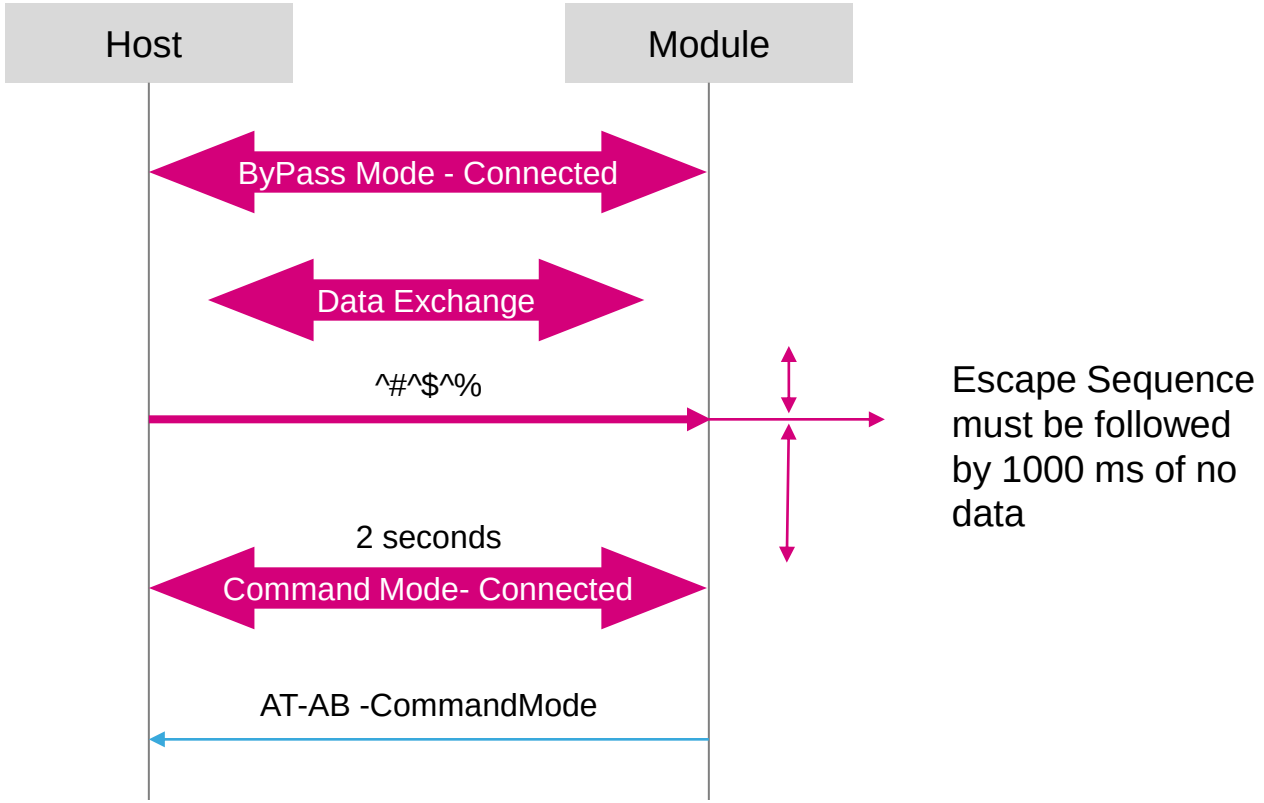
- Var34 PageScan = True (module Connectable)
- Var34 PageScan = False (module Non-connectable)



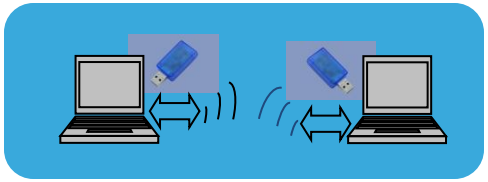
[1] Please refer to User Manual for AT command details

Escape from Bypass Mode Procedure

- Once a connection has been established between host and remote device, the host can put the abSerial interface back into command mode by using the Escape Sequence. Once back in command mode, new commands can be issued.

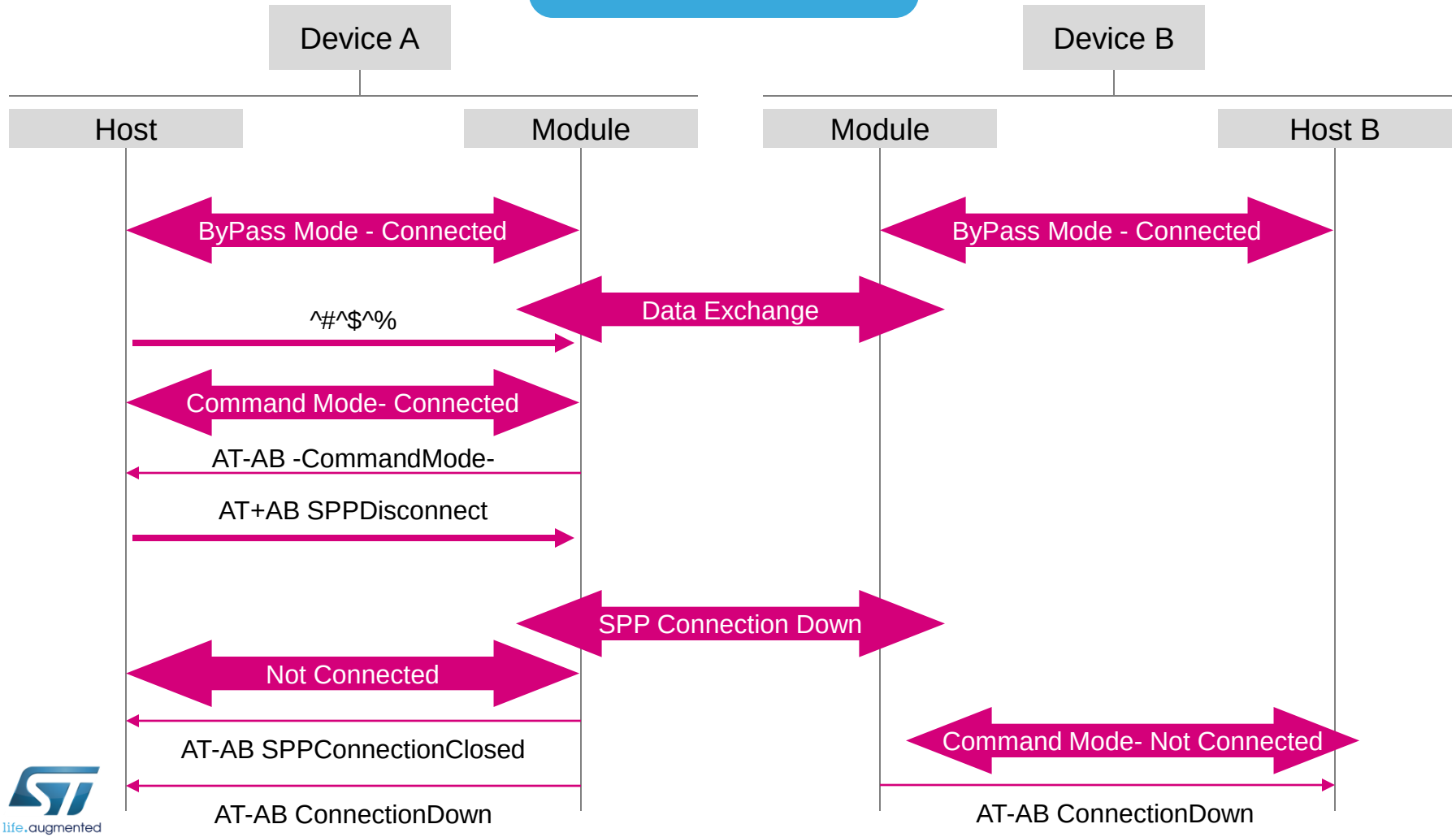


Disconnect with a Remote Device Procedure



Device A

Device B



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SmartCable

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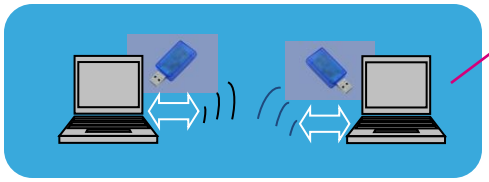
SmartCable

Remote Companion Device
BDAddress: 12345678



AT+AB smartcablesetup 12345678 10 100

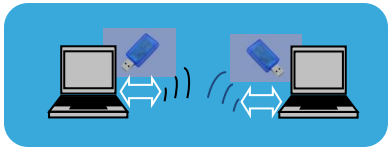
Allows this device to automatically connect with the remote companion at the startup with no user interaction

- The Smart Cable feature establishes an SPP link to the designed remote device automatically and at the startup time
  - Replace the need for AT connection commands
  - If a link is disconnected, The Smart cable feature will automatically reconnect the link without user interaction
  - Enabled with the command
    - AT+AB SmartCableSetup [bd address] [attempts] [interval]
      - The Bdaddress of the designed remote device is saved in the NV memory
      - The feature is active after a reset
      - Attempts and Interval define the paging options of the companion device
    - AT+AB DeleteSmartCable command removes the Smart Cable settings

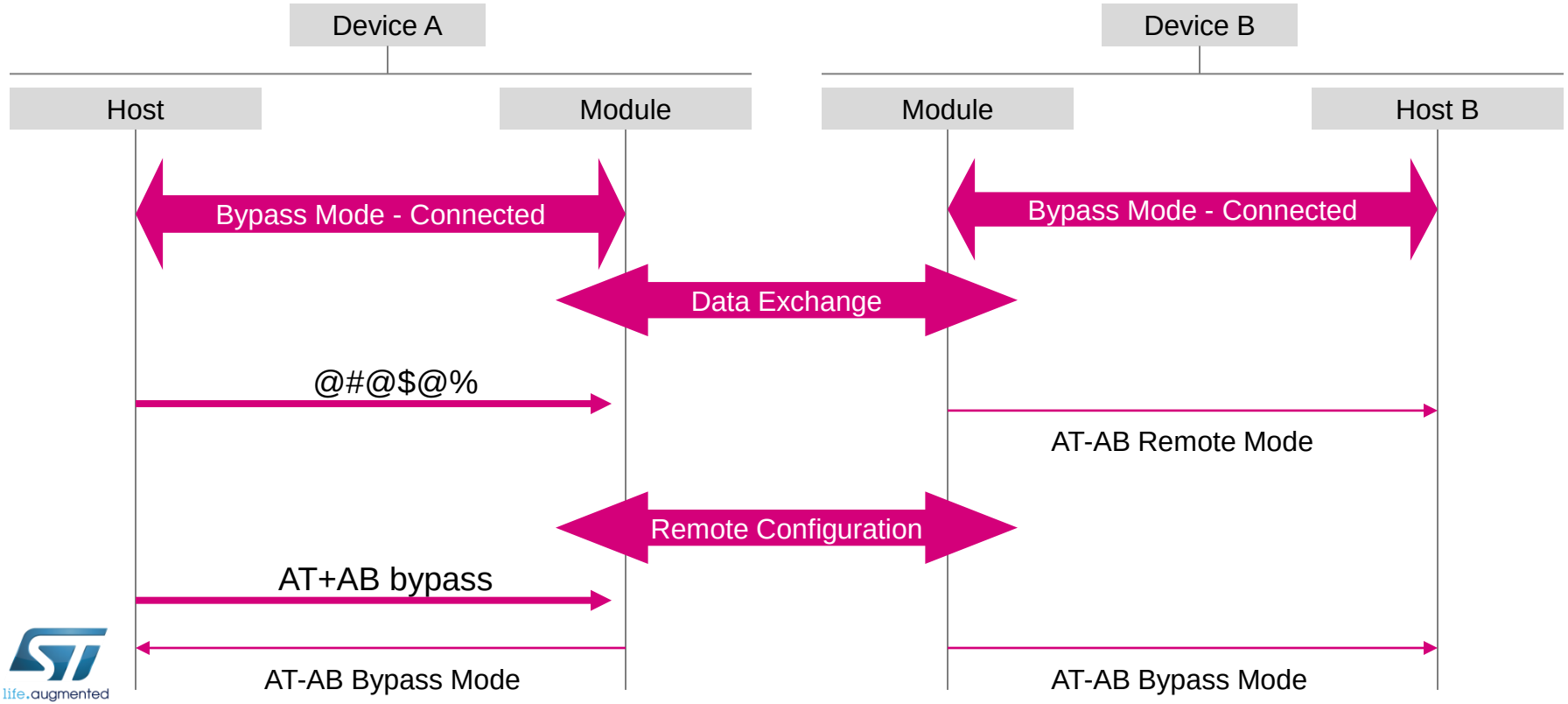
Remote Mode

Remote Mode

- A remote device can be controlled and configured by a BlueTooth link
- This function is tipically used to remotely configure UART or GPIOS of a Remote Device
- The Remote Mode Feature is enabled starting from the AT2 version of the firmware



To enable a remote node to be remotely controlled the following variable must be set **RmtEscapeSequence = true**



Multipoint

Broadcast and Multipoint Use Modes (1/2)

AT2 enables multipoint or broadcast connection modes to handle connections between a master and multiple slaves

- To select a connection mode the configuration variable **MPMode** must be used

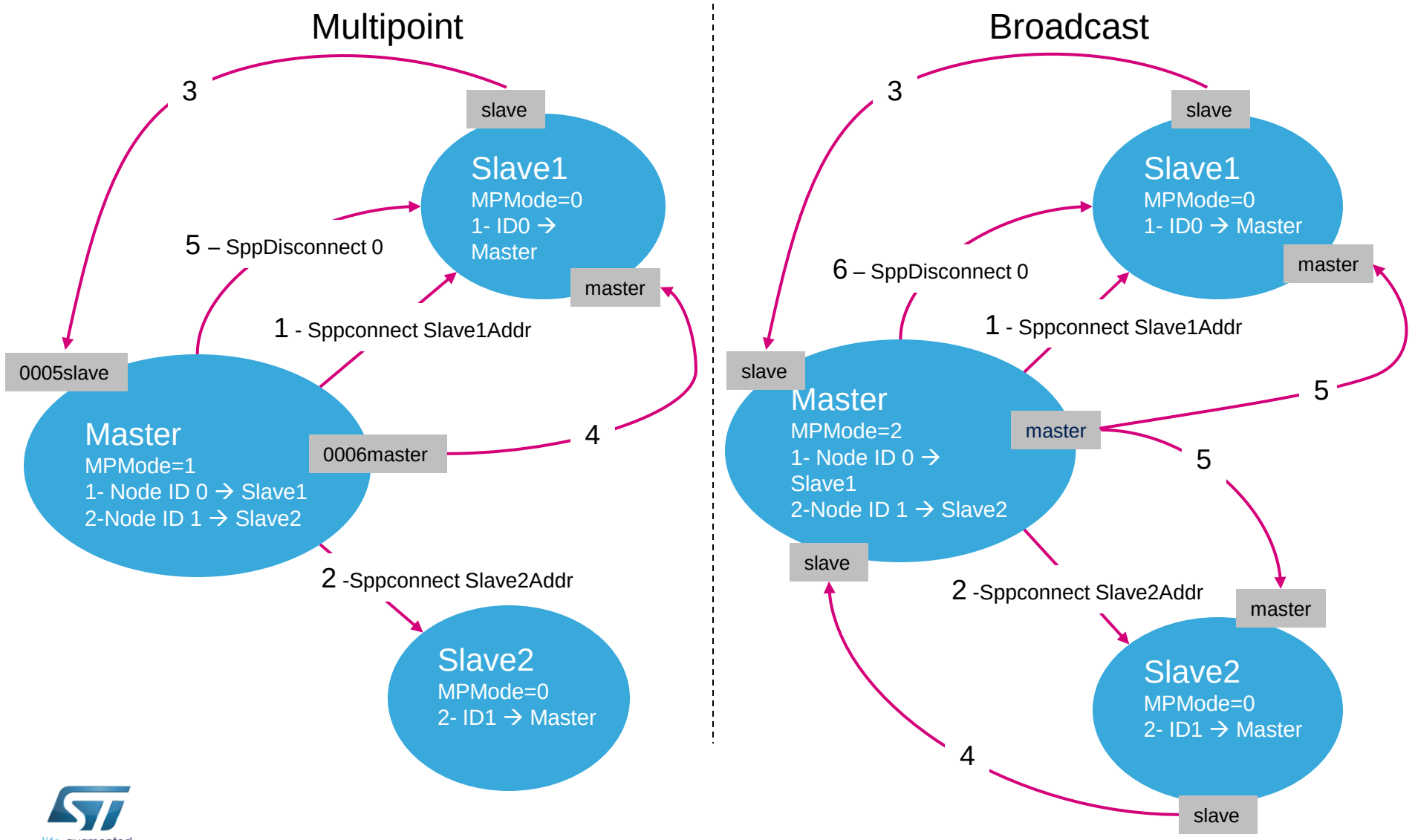
MPMode Variable	Use Mode
MPMode = 0 (Def.)	Point To Point
MPMode = 1	Multipoint
MPMode = 2	Broadcast

- Use Multipoint when a message needs to be sent to multiple slaves uniquely identified by an ID. When a message is sent by a slave to the master, it is also uniquely identified by the ID of the sender. An header defined by the protocol described in the following table is used with each packet of data

Dest/Source Node	Length	Data
1 byte	3 bytes	Up to 315 bytes
Node Id from 0 to 9, 1 ASCII decimal digit	3 ASCII decimal digit from 001 to 315	Up to 315 bytes

- Use Broadcast when a message needs to be broadcasted to multiple slaves.

AT2: Broadcast and Multipoint Use Modes (2/2)



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Power Modes

Power Modes

- Active Mode
  - Standard mode operation
- Sniff Mode
  - Sniffing is a process of listening for specific types of commands that occur periodically. The sniff mode is used to reduce the power consumption of the device as the receiver can be put into standby between sniff cycles
  - Requiring the use of an LPO, sleep mode is supported only by the modules SPBT2632C2A.AT2 and SPBT2632C1A.AT2
  - Sniff mode requires to set few dedicated configuration variables. It can be remotely activated with commands or can be automatically activated at the connection time.
- Deep Sleep Mode
  - The Deep Sleep Mode temporarily halt's the BT controller chip's operation by stopping the 26 MHz main crystal
  - Deep Sleep is activated by setting related configuration variables
  - Scheduled CPU activity, timers, remote link activity, and GPIO wakeup will resume active mode

Power Modes Setup

The use of DSM and Sniff are enabled via the following set of Configuration Variables and Commands

Variable/Command	Impacted Power Mode	Use
HostDeepSleepEnable	DSM/Sniff	Enables deep sleep mode. Mandatory for DSM. Advised for the Sniff Mode.
GPIO_HostWakeUp	DSM	GPIO register used to wake-up the module after it enters deep sleep mode. A setting of none means that this function is disabled.
GPIO_HostKeepAwake	DSM	GPIO register used to prevent the module from entering deep sleep mode. A setting of none means that this function is disabled.
AllowSniff	Sniff	Enables Sniff Mode
AutoSniff	Sniff	Enables automatic Sniff Mode
AutoSniffTimeout	Sniff	The inactivity timeout in seconds. After this time passed, Starts AutoSniff
AutoSniffInterval	Sniff	Sniff Slot interval applied AutoSniff
UseExtLPO	DSM/Sniff	A 32.768kHz low power oscillator needs to be connected to enable Sniff Mode
AT+AB sniff [BDAddress] [Sniff Int]	Sniff	Used to switch a remote device from active mode to sniff mode
AT+AB exit sniff [BDAddress]	Sniff	Used to switch a remote device from sniff mode to active mode

Deep Sleep WakeUp

- GPIO WakeUP. abSerial supports the GPIO-based Deep Sleep Wakeup
  - For example, the following variable configuration set GPIO3 to be used with this purpose.

```
AT+AB config GPIO_HostWakeUp = 3
AT+AB config GPIO_HostKeepAwake = 3
AT+AB config HostDeepSleepEnable = true
```

- The DSM will be enabled as long as the GPIO3 is maintained low.
- **Radio WakeUp.** When DSM is activated the module is still able to accept a connection request from a remote device.
- If a connection request is received the module goes awake and return to sleep when the connection is closed

Sniff mode

- To enter in Sniff mode Deep sleep variable must be configured as per following table
  - For example, the following variable configuration set GPIO3 to be used with this purpose.

```
AT+AB config GPIO_HostWakeUp = 3
AT+AB config GPIO_HostKeepAwake = 3
AT+AB config HostDeepSleepEnable = true
```

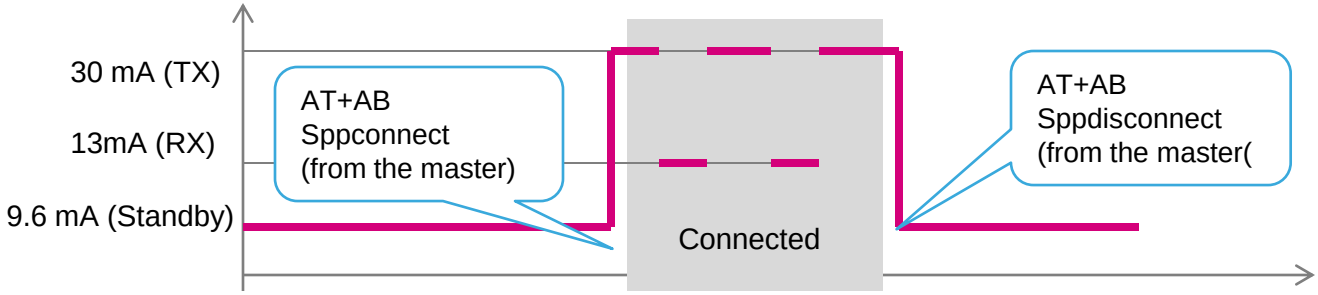
- The DSM will be enabled as long as the GPIO3 is maintained low
- To enter in sniff mode, once deep sleep mode is active, the variable allowsniff must be true
- The sniff can be automatic or enabled via AT command
  1. Automatic: the variable autosniff is set true
  2. Manual: the module is set into sniff mode using the command AT+AB sniff [Bdaddress of the device to be placed into Sniff Mode]

Power Mode Figures

ACTIVE MODE

Configuration Summary

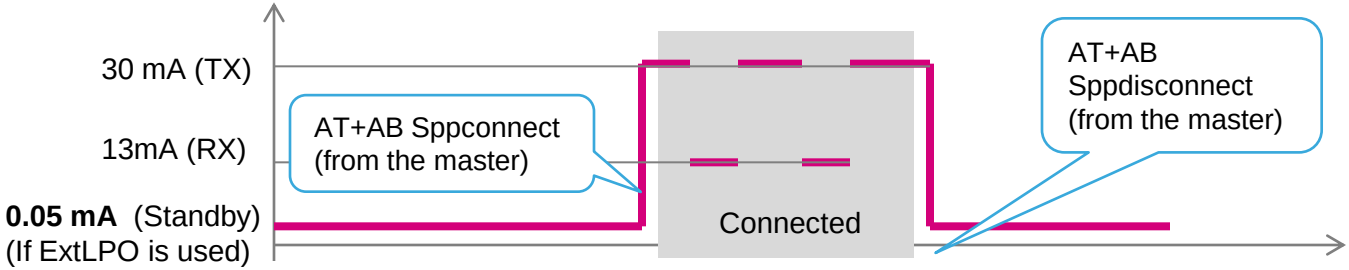
- HostDeepSleepEnable = false
- GPIO_HostKeepAwake = none
- GPIO_HostWakeup = none
- AllowSniff = false



DEEP SLEEP MODE

Configuration Summary

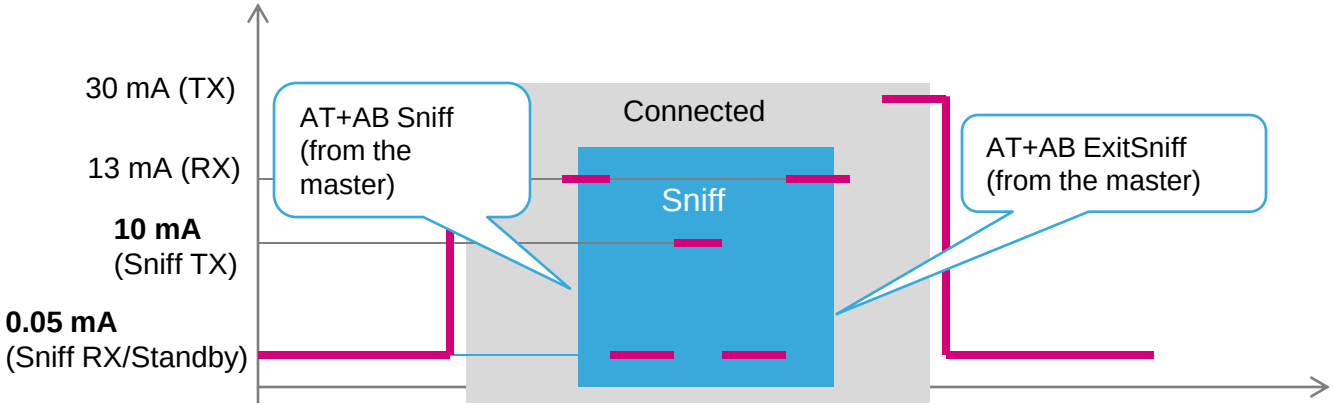
- HostDeepSleepEnable = true
- GPIO_HostKeepAwake = 3
- GPIO_HostWakeup = 3
- AllowSniff = false



SNIFF MODE

Configuration Summary

- HostDeepSleepEnable = true
- GPIO_HostKeepAwake = 3
- GPIO_HostWakeup = 3
- AllowSniff = true
- UseExtLPO=true



The values refer to an SPBT2632C1A.AT2; Slave Mode; CPU Speed: 32MHz; LPO Enabled

Security

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Security

- To maintain security, Bluetooth devices can use keys to verify the identify of other devices **(Pairing/Authentication)** and to modify data to make the data private (Encryption)
- Blue Modules implement the Bluetooth 2.1 security features for the Authentication and the Encryption
- When Paired with companion devices, Blue Modules support:
  - **Legacy Pairing** with 2.0 or earlier Bluetooth versions
  - **Secure Simple Pairing** with 2.1 or newer Bluetooth versions

Security

- Security features in Blue Modules are managed with a set of configuration variables
  - **AlwaysBonding** (boolean) to establish device connectability
  - **PIN**: PIN used when pairing is required by a companion device (only for comunication with 2.0 or earlier deprecated Bluetooth devices)
  - **DefaultSecurity**: Establishes the security level i.e. the authentication level with a companion device.
    - Possible Values:
      - 1- No Security;
      - 2/3 - Legacy Security for 2.0/earlier Bluetooth devices (deprecated)
      - 4 - SSP enabled. This value also supports legacy pairing with Bluetooth 2.0/earlier
  - **Encryption:** (Boolean) Establishes if an encryption key is used
  - **DefaultAuthentication**: establishes which level of SSP authentication is enabled.
    - Possible Values:
      - 4. SSP Just Works (no MITM protection)
      - 5. SSP pairing modes (with MITM protection setting the variable **MITMEvent** true)

AT2 Default Security Configuration

Variable Name	Variable Number	Default Value	Note
BondingAllowed	Var33	True	Device is always connectable
Pin	Var06	1234	Used only when connection is with 2.0 devices or earlier
DefaultSecurity	Var40	4	SSP enabled
DefaultAuthentication	Var41	5	MITM protection by asking for a confirmation message during pairing
MIMTEvent	Var55	False	Sends paring passkey to the main UART
EnableEncryption	Var39	True	Encryption Key is used

Communication with Smart Phones

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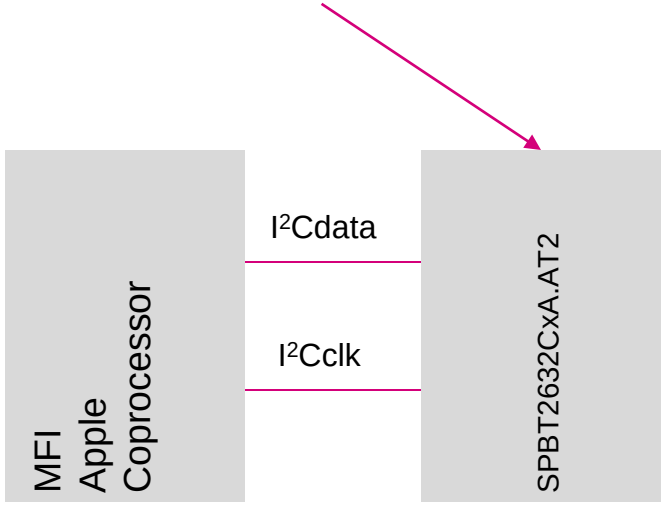
Communication with Smart Phones

- AT2 supports communication with Smart Phone, i.e. Android and Apple devices
- Supporting Apple iPhone and other iOS Bluetooth data oriented connections requires a proprietary profile called iAP
- MFI is a licensing program from Apple, to develop electronic accessories that connect to iPod, iPhone, and iPad
- Apple Accessory devices must utilize an iPod Authentication Co-processor (CP)
- Blue Modules are MFI ready and fully integrate the IAP protocol
- The MFI Apple Co-processor connected via the I2C pins

AT2 implements both the MFI protocol and the iAP profile



Buy the chipset from Apple

v2.0B chip Renesas SO8
v2.0C chip Infineon USON8

Set the CPI2CMode Variable of the module

CPI2CMode= 2 for v2.0B
3 for v2.0C

Configuration for communication with iAP Devices

Commands/Configuration Variables	Use/Default Value
AT2 Configuration	
COD	240404
EnableEncryption	true
DefaultSecurity	4
EnableIAP	true
Application Customization	
iAPAppID	A1B2C3D4E5
iAPProtocolStrmain	Com.AmpedRFTech.Demo
iAPProtocolStrAlt	Com.AmpedRFTech.ProtocolAlt
CPI2CMode	3 (MFI Coprocessor v2.0c)
AccName	Amped-Test
AccManufacturer	Amped RF
AccModelNumber	Test-Model
AccSerialNumber	Amp’ed Up!
iAP Commands	
AT+AB IAPConnect [BDAddress]	To connect a remote device with the IAP profile
AT+AB IAPDisconnect	To disconnect from a IAP session

Communication Speed

- SPP Connect
  - Actual value up to 500Kbps
- iAP Connect
  - Max speed theoretically possible:
    - iPhone4/iPad2: up to 100Kbps
    - iPhone4S/iPad3: up to 250Kbps
    - iPhone5/iPad4(mini): up to 250Kbps
  - Actual value (BTM ➔ Apple):
    - iPad3: up to 150Kbps
    - iPad1: up to 90Kbps

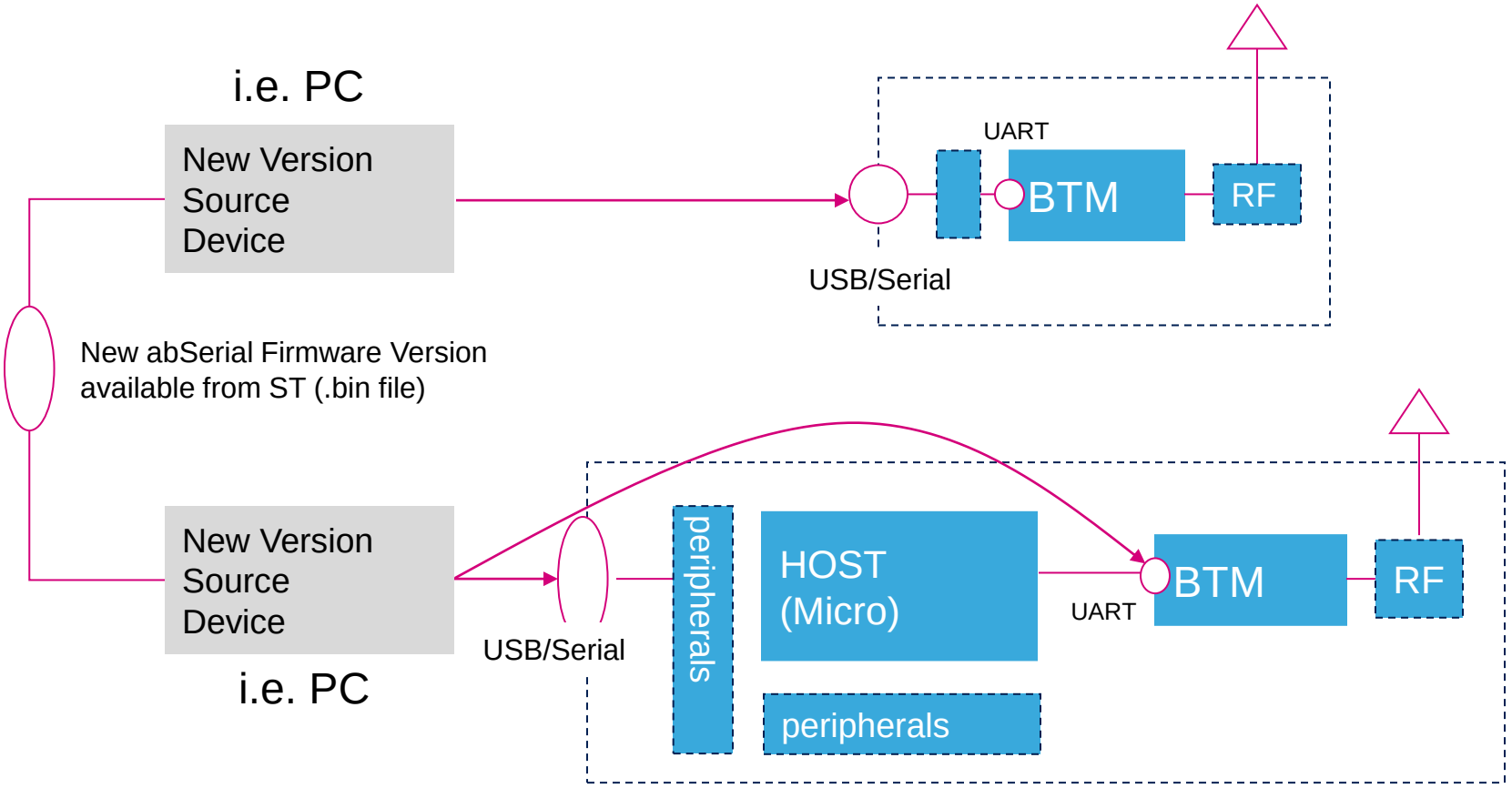
CoD setting

CoD setting

- CoD (Class of Device) is set by default 240404 corresponding to headset device
- The CoD can be changed using the AT command
- AT+AB config var30= [CoD]
- CoD value list can be retrieved at SIG website:
  https://www.bluetooth.org/en-us/specification/assigned-numbers/baseband

Upgrading Firmware

Upgrading Firmware Procedure



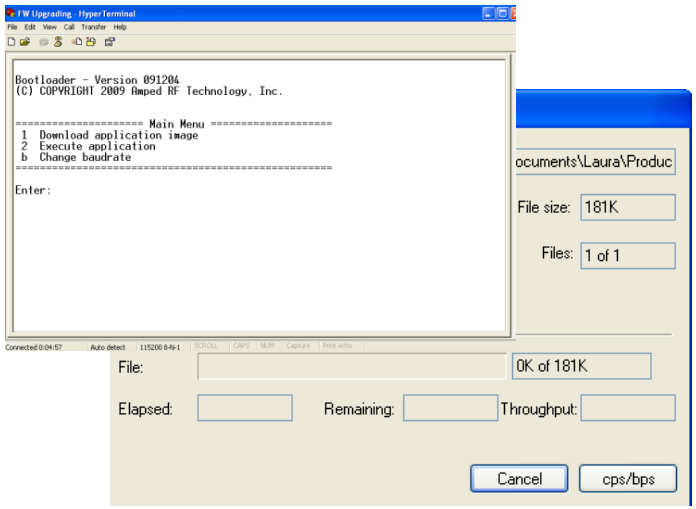
The Firmware on the Bluetooth nodes can be upgraded for bug fixing or for taking advantage of the introduction of new features. The Firmware upgrading is enabled via the UART interface of the module.

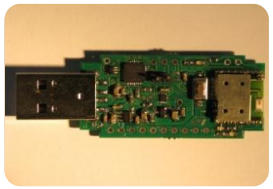
Firmware Upgrading Procedure

Different options are possible to upgrade the Firmware from the host via the UART

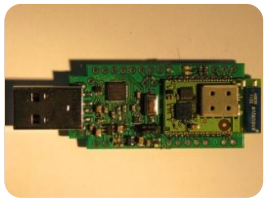
- The recommend procedure is using the AT command
  - AT+AB InvalidateApplication
  - And follow instruction on next slide
- Alternative procedures
  - Using the Flash Bootloader (based on the Y-Modem protocol) of the STM32
    - The Flash Bootloader is activated in two different ways:
      - Acting on the GPIO2 pin of the module
      - Using a special-purpose at-command
    - It can be used/tested by using the Y-Modem transmitter function integrated in the Hyperterminal or other terminal tool

Upgrading with the Flash Loader – AT command





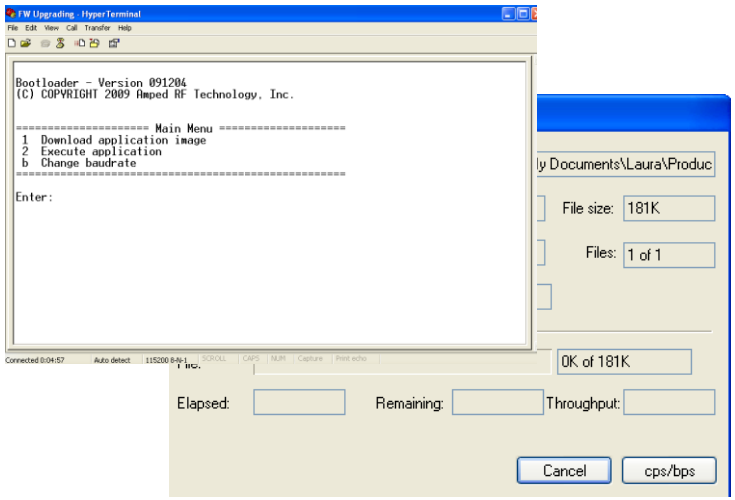
STEVAL-SPBT3ATV3

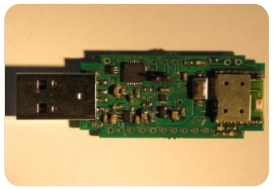


STEVAL-SPBT4ATV3

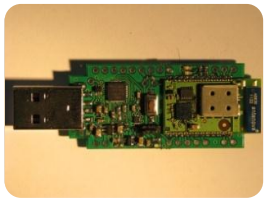
- User FLOW Description:
  - Insert the dongle in a USB slot of the PC
  - Open an HyperTerminal (115200:8:none:1:none)
  - Send the command “AT+AB InvalidateApplication
    (it deletes the abSerial application currently running on the module)
  - The module enters the boot state presenting the Main menu choices
  - Select option 1 (download application image)
  - Use the Y-modem function integrated in the HyperTerminal and select the file to download
  - The process Terminates with “Programming Completed Successfully!”
  - Reset the module

Upgrading with the Flash Loader - GPIO2





STEVAL-SPBT3ATV3



STEVAL-SPBT4ATV3

- User FLOW Description
  - Put the GPIO2 to 0 (use a jumper between the dongle PADs, for STEVAL-SPBT3ATV3 PAD4 and 9, for STEVAL-SPBT4ATV3 PAD5 and 13) for details refer to module application note
  - Insert the dongle in a slot
  - Open an HyperTerminal on the PC (115200:8:none:1)
  - Reset the module
  - The module enters in the boot state and three different Main menu choices are presented
  - In 5 seconds select option 1 (download application image) otherwise the module automatically enters the option 2 (execute application)
  - Use the Y-modem function integrated in the HyperTerminal by selecting the image file to download
  - The process terminates with “Programming Completed Successfully!”
  - Remove the jumper
  - Reset the module

Thank you

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