Panasonic

Wireless Modules

PAN1026A

PAN1322 to PAN1026A

Migration Guide

Rev. 1.0

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Table of Contents

1 About This Document

1.1 Purpose and Audience

This Migration Guide describes the migration process from the discontinued PAN1322 Bluetooth module to the PAN1026A Bluetooth module. Necessary hardware as well as software changes are described with the intention of quick and easy migration.

The products are referred to as "the PAN1322" respectively "the PAN1026A" or "the modules" within this document.

The document is intended for hardware as well as software engineers.

1.2 Revision History

Revision	Date	Modifications/Remarks
0.1	12.07.2017	Initial draft
1.0	16.08.2017	Editorial review

1.3 Use of Symbols

Symbol	Description
(i)	**Note** Indicates important information for the proper use of the product. Non-observance can lead to errors.
⚠	**Attention** Indicates important notes that, if not observed, can put the product's functionality at risk.
⇨ [chapter number] [chapter title]	**Cross reference** Indicates cross references within the document. **Example:** Description of the symbols used in this document ⇨ 1.3 Use of Symbols.

1.4 Related Documents

[1] Panasonic. eUniStone PAN1322 Design Guide Rev.1.2

[2] Intel. eUniStone SPP-AT Application SW 3.1 Rev.0.2

[3] Panasonic. PAN1026A Product Specification Rev.1.0

[4] Toshiba. TC35661-ROM551 Extended HCI Command Interface Document

[5] Toshiba. TC35661-ROM551 Bluetooth Basic Management Command Interface Document

[6] Toshiba. TC35661-ROM551 SPP Command Interface Document

Please refer to the Panasonic website for more information as well as related documents ⇨ 5.1.2 Product Information.

2 Overview

PAN1322

- Overall size of 15.6 mm x 8.7 mm x 2.8 mm
- Industrial temperature range of -40 °C to + 85 °C
- Operational voltage range of 2.9 V to 4.1 V
- Output power of +4 dBm
- Receiver sensitivity of -86 dBm
- Integrated 32 kB EEPROM for device configuration data and application
- GPIOs with interrupt and wake-up capabilities
- AT command set
- Follows EMC, Safety, EN300328, FCC and IC regulations

PAN1026A

- Overall size of 15.6 mm x 8.7 mm x 1.9 mm
- Industrial temperature range of -40 °C to + 85 °C
- Operational voltage range of 2.7 V to 3.6 V
- Output power of +4 dBm
- Receiver sensitivity of -88 dBm
- Integrated 32 kB EEPROM for device configuration data and application
- GPIOs and wake-up control pins
- High-level API commands
- Follows EMC, Safety, EN300328, FCC, MIC and IC regulations

2.1 Bluetooth Features

PAN1322

- Bluetooth 2.1 compliant
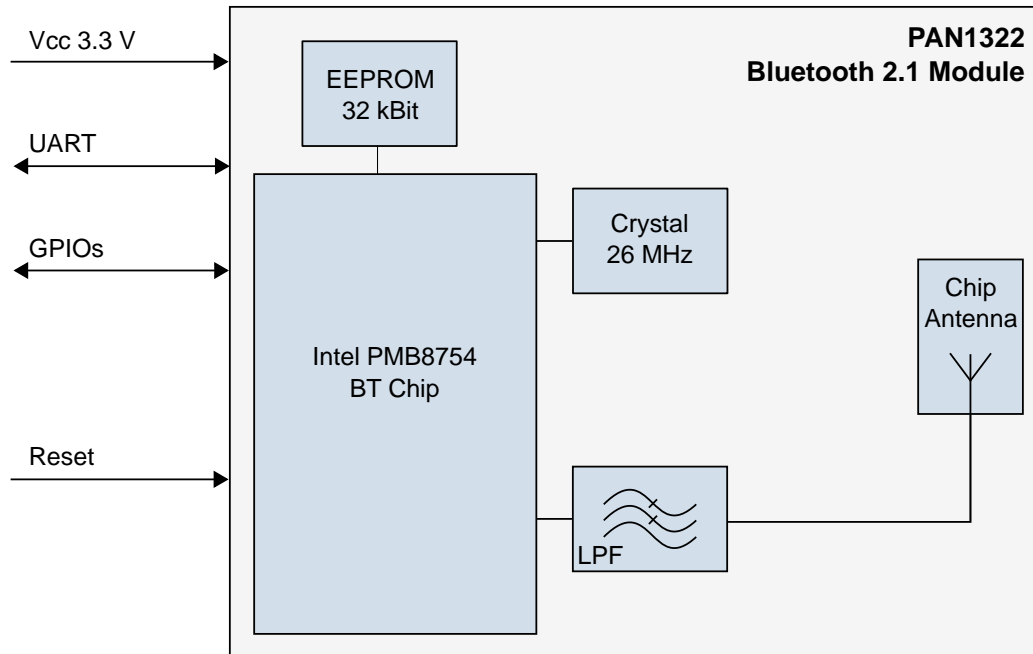- Bluetooth class 2 device
- SPP profile support
- Single active connection

PAN1026A

- Bluetooth 2.1 and 4.2 standard compliant
- Bluetooth class 2 device
- Bluetooth Basic Rate SPP profile support
- Bluetooth Low Energy GATT profile support for server and client mode
- Single active connection for Bluetooth Classic and Low Energy

2.2 Block Diagram

PAN1322

PAN1026A
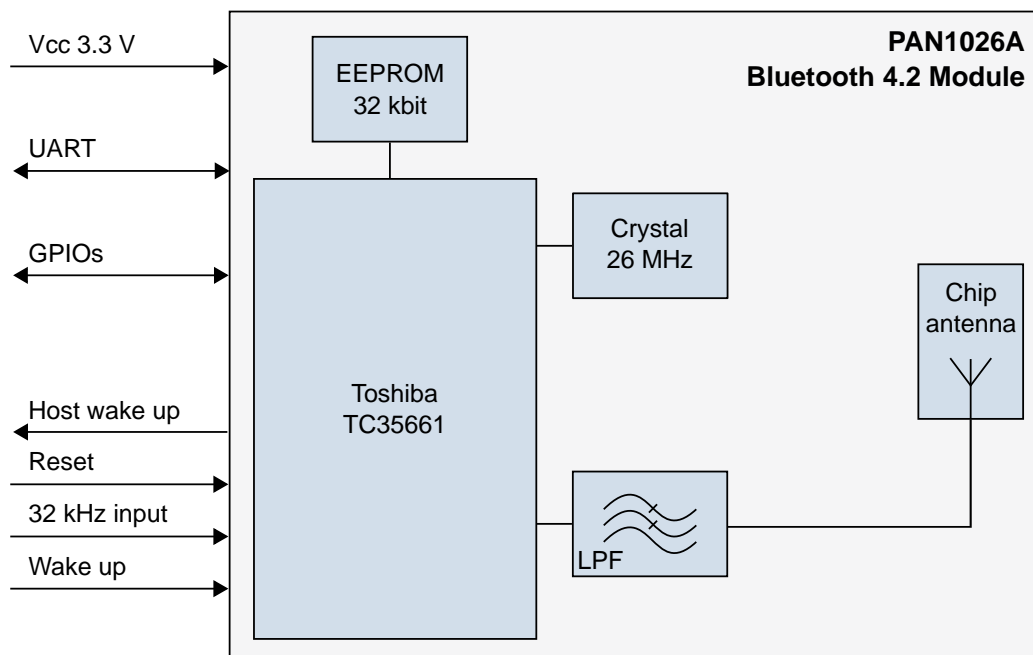
3 Hardware

3.1 Pin Configuration

Pin Layout

The pin layout of the PAN1322 and the PAN1026A are based on the same module footprint, which is depicted below.

Top View
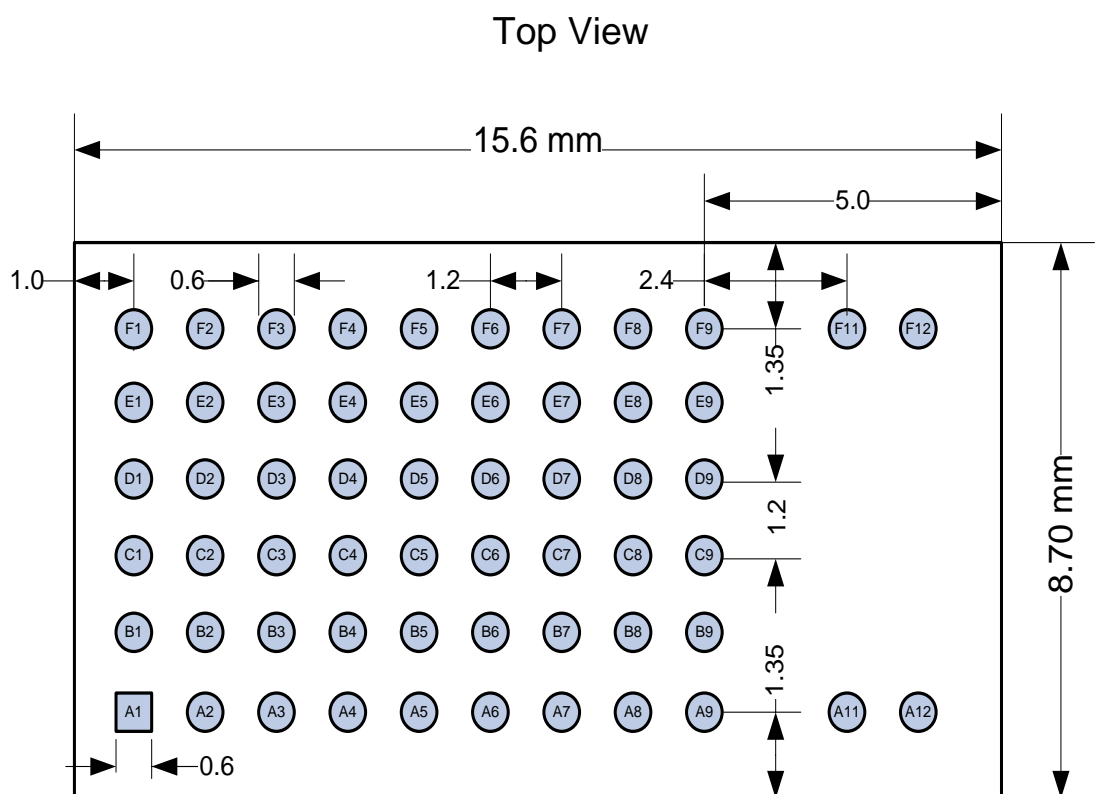
Pin Assignment Comparison

Although the footprint of the modules is identical, not all of the pins have the same assignment. Thus, the following table compares both pin assignments and notes the changes to be made.

No	Pin Name PAN1026A	Pin Name PAN1322	Change notice
A1	GND	GND	
A2	NC	P1.6	Check if this port is used
A3	Reset	RESET	
A4	VCC	VCC	
A5	VCC	VCC	
A6	VCC	VCC	
A7	GND	GND	

No	Pin Name PAN1026A	Pin Name PAN1322	Change notice
A8	NC	P1.5	Check if this port is used
A9	GND	GND	
A11	GND	X	Connect to GND
A12	GND	X	Connect to GND
B1	NC	P1.7	Check if this port is used
B2	BTS	P1.8	Check if this port is used
B3	BTA	P1.0	Check if this port is used
B4	NC	P1.4	Check if this port is used
B5	NC	ONOFF	Check if this port is used
B6	NC	NC	
B7	NC	NC	
B8	NC	NC	
B9	NC	SLEEPX	Host sleep mode is implemented via UART
C1	CS0X	VREG	Check if this port is used
C2	BTI	P0.9	Check if this port is used
C3	WIA	JTAG#	
C4	NC	TRST#	
C5	NC	VDD1	
C6	PCMCLK	NC	
C7	FSYNC	NC	
C8	GND	GND	
C9	GND	GND	
D1	CS1X	P0.10	
D2	DIN	P0.8	
D3	GPIO1	P1.1	Check if this port is used
D4	GPIO0	P0.3	Check if this port is used
D5	NC	P0.2	Check if this port is used
D6	PCMIN	NC	
D7	GND	GND	
D8	GND	GND	
D9	ANT	ANT	

No	Pin Name PAN1026A	Pin Name PAN1322	Change notice
E1	SDA	SDA0	
E2	SCL	SCL0	
E3	GND	P1.3	Check if this port is used
E4	USB	P0.0	Check if this port is used
E5	CLKREQ	P0.1	Check if this port is used
E6	UARTRXD	UARTRXD	
E7	PCMOUT	NC	
E8	GND	GND	
E9	GND	GND	
F1	GND	GND	
F2	EEPROM_WP	P1.2	Check if this port is used
F3	GND	P0.11	Check if this port is used
F4	GND	P0.14	Check if this port is used
F5	UART CTS	UARTCTS	HW flow control is mandatory
F6	SLEEPCLK	VDDUART	When not used, pull down with 100 kΩ
F7	UARTTXD	UARTTXD	
F8	UARTRTS	UARTRTS	HW flow control is mandatory
F9	GND	GND	
F11	GND	X	Connect to GND
F12	GND	X	Connect to GND

3.2 UART Interface

As the pin comparison table in section ⇨ 3.1 Pin Configuration shows, the UART interfaces of the PAN1322 and the PAN1026A are identical. Both modules require a 4 wire UART interface featuring hardware flow control pins.

4 Software Migration

4.1 Introduction

In order to migrate the software from the PAN1322 to the PAN1026A, it is important to understand the different command interfaces of the modules. The PAN1322 uses human-readable AT commands for module interaction, while the PAN1026A uses binary commands for module interaction. This binary-based interaction is separated into Host Controller Interface (HCI) commands for low level configuration commands and Toshiba Control Unit (TCU) commands for high level abstraction commands similar to the AT abstraction level.

The following sections will describe the PAN1322 commands and the associated PAN1026A Bluetooth Classic binary commands only. The Bluetooth Low Energy commands for the PAN1026A will not be described within this document.

A set of example command sequences for initialization, device discovery, service discovery, connection handling and data exchange can be found in the last section.

4.2 General Device Configuration

4.2.1 UART Configuration

The following table lists both default UART configurations.

Module	Baudrate	Data Bits	Parity	Stop Bits	Flow Control
PAN1322	115200 bps	8	None	1	Hardware (RTS/CTS)
PAN1026A	115200 bps	8	None	1	Hardware (RTS/CTS)

4.2.2 End-Of-Line Markers

The PAN1322 and PAN1026A modules use different end-of-line-markers.

While the PAN1322 ends all commands, responses and events with carriage return (CR) and line feed (LF), the PAN1026A uses a different approach.

For HCI commands, the length of a command, request or event cannot be fully determined without parsing. However, HCI commands will only be used for low level configuration after the startup of the module.

After that, the command mode will be changed to TCU mode, in which commands, responses and events use the first three bytes to determine the length of the message.

4.2.3 Device Initialization

The PAN1026A is using an internal EEPROM, which contains pre-programmed information such as the Bluetooth Device (BD) address. During the initialization of the module this address needs to be read from the EEPROM and has to be stored in RAM. In order to do that, the I²C interface of the chip has to be enabled. For the PAN1322 such an initialization was not required. The commands needed for the PAN1026A initialization are listed and described below. The usage of these commands can be found in an example sequence in chapter
⇨ 4.7.1 Initialization.

4.2.3.1 Resetting the device

PAN1322

Command	AT+JRES
Description	Software reset of the PAN1322.
Response	ROK
Description	Startup response.

PAN1026A

Command	HCI_RESET_REQ
	01 03 0C 00
Description	Software reset of the PAN1026A.
Response	HCI_RESET_RESP
	04 0E 04 04 03 0C 00
Description	Software reset response of the PAN1026A.

4.2.3.2 Enabling the I²C Interface

PAN1026A

Command	HCI_M2_BTL_SET_I2C_ENABLE_REQ
	01 08 FC 0B 00 A0 00 00 00 14 5B FF 02 03 01
Description	Enable I²C of the PAN1026A.
Response	HCI_M2_BTL_SET_I2C_ENABLE_RESP
	04 FF 0A 08 00 A0 00 00 00 14 5B 00 00
Description	Enable I²C response of the PAN1026A.

4.2.3.3 Reading the BD Address from EEPROM

PAN1026A

Command	HCI_M2_GENERAL_READ_EEPROM_REQ
	01 08 FC 10 00 A1 00 00 00 14 88 FF 10 06 A0 01 01 06 02 00
Description	Reads the BD address from EEPROM of the PAN1026A.
Response	HCI_M2_GENERAL_READ_EEPROM_RESP
	04 FF 11 08 00 A1 00 00 00 14 88 00 10 06 BD BD BD BD BD BD
	BD: Local Device Address (6 bytes): The local Bluetooth device address.
	Note: The BD address is passed MSB first!
Description	Reads the BD address from EEPROM response of the PAN1026A.

4.2.3.4 Writing the BD Address to RAM

PAN1026A

Command	HCI_WRITE_BD_ADDR_REQ
	01 13 10 06 BD BD BD BD BD BD
	BD: Local Device Address (6 bytes): The local Bluetooth device address.
	Note: The BD address has to be passed LSB first!
Description	Writes the BD address previously read from EEPROM to RAM of the PAN1026A.
Response	HCI_WRITE_BD_ADDR_RESP
	04 0E 04 04 13 10 ST
	ST: Status (1 byte): The status of the write process.
	Successful 0x00
	Failure 0xXX (anything > 0x00)
Description	Write BD address to RAM response of the PAN1026A.

4.2.3.5 Switching the API Mode

As initially mentioned, the PAN1026A uses HCI and TCU modes to interact with the host controller. To change from HCI to TCU mode, the following command has to be used.

PAN1026A

Command	HCI_SET_MODE_REQ
	01 08 FC 03 00 99 01
Description	Request to switch from HCI to TCU mode.
Response	HCI_SET_MODE_RESP
	04 FF 05 08 00 99 ST 01
	ST: Status (1 byte):
	Successful 0x00
	Failure 0xXX (anything > 0x00)
Description	Response to the request to switch from HCI to TCU mode.

ⓘ Once in the TCU mode, the HCI mode is no longer available for configuration. The module has to be reset in order to perform another configuration in the HCI mode.

Please note that HCI and TCU commands can only be sent in the appropriate command mode. Sending HCI commands in TCU mode and vice versa will not work.

4.2.3.6 Initializing the Firmware

In order to initialize the PAN1026A firmware and to set the device name the following command has to be used.

PAN1026A

Command	TCU_MNG_INIT_REQ
	RL 00 00 E1 01 PL 00 04 00 LD DN …
	RL: Request length (1 byte): The length of the total request.
	PL: Parameter length (1 byte): The length of the following parameters -1.
	LD: Device name length (1 byte): The length of the device name (0x00-0x80).
	DN: Device name (LD bytes): The UTF-8 encoded device name (max. 128 bytes).
Description	TCU_MNG_INIT_REQ initializes the PAN1026A firmware and sets the device name.
Response	TCU_MNG_INIT_RESP
	0E 00 00 E1 01 07 00 ST BD BD BD BD BD BD
	ST: Status (1 byte):
	Successful 0x00
	Parameter failure 0x01
	Device Initialization finished 0x02
	BD: Local Device Address (6 bytes):
	The local Bluetooth device address. If status is failed, it will be 0xFFFFFFFFFFFF.
Description	TCU_MNG_INIT_RESP is the acknowledging response for TCU_MNG_INIT_REQ.

> (i) Please note that the use of the command TCU_MNG_INIT_REQ is mandatory and that is can only be executed once per runtime.

4.2.3.7 Setting Up the SPP Device

PAN1026A

Command	TCU_SPP_SETUP_REQ
	07 00 00 E5 01 00 00
Description	TCU_SPP_SETUP_REQ sets up the SPP device. TCU_SPP_SETUP_RESP is generated, when this command is completed.
Response	TCU_SPP_SETUP_RESP
	08 00 00 E5 81 01 00 ST
	ST: Status (1 byte):
	Successful 0x00
	Parameter Failure 0x01
	No Device Initialization 0x03
	Setup SPP 0x40
Description	The response for TCU_SPP_STUP_REQ.

4.2.4 Setting the Device Name

PAN1322

Command	AT+JSLN= <length_friendly_name>, <friendly_name>
	<length_friendly_name> (2 characters (DEC)):
	The length of the friendly name (max. 18).
	<friendly_name> (<length_friendly_name> characters):
	The friendly name used for EIR and RNR. It should be written at start-up or reset. The default name after reset is "eUniStone SPP BT2.1 features".
Description	Sets the local device name.
Response	<general_response>
	<general_response> (2 or 6 characters (DEC)):
	The general response of the module for requests indicating that the executing went OK or that an error occurred.
	OK Syntax correct, execution allowed and successful
	ERR=-1 Syntax error
	ERR=-2 Command not allowed at present execution status
	ERR=-3 Internal unknown protocol stack error
Description	The general response to requests.

Setting the device name on the PAN1026A can only be achieved once during the initialization phase using the command TCU_MNG_INIT_REQ.

4.2.5 Enabling Security

PAN1322

Command	AT+JSEC= <security_mode>,<PIN_type>, <length_PIN_code>, <PIN_code>, <Input_capability>,<Output_ capability>
	<security_mode> (1 char (DEC)): The security mode.
	N/A 1
	N/A 2
	N/A 3
	Security Mode 4 4
	<PIN_type> (1 char (DEC)): The PIN code type.
	Variable PIN (default) 1
	Fixed PIN 2
	<length_PIN_code> (2 chars (DEC)):
	The length of the PIN code. The maximum PIN length value is 16.
	<PIN_code> (<length_PIN_code> chars):
	Normal user PIN, for example "0000". This parameter is taken into account if the Pin type is fixed.
	<Input_capability> (1 char (DEC)):

	Input None 0
	 Input Yes/No 1
	 Input Keyboard 2
	 <Output_ capability> (1 char (DEC)):
	      Output None 0
	      Output Yes/No 1

Description	AT+JSEC sets the security mode of the device. The command shall be the first command that is sent after a SW reset.

Response	**<general_response>**
	
	 <general_response> (2 or 6 characters (DEC)):
	
	      The general response of the module for requests indicating that the executing went OK or that an error occurred.
	
	      OK Syntax correct, execution allowed and successful
	      ERR=-1 Syntax error
	      ERR=-2 Command not allowed at present execution status
	      ERR=-3 Internal unknown protocol stack error

Description	The general response to requests.

The PAN1026A does not provide a single command to set the desired security measures as the PAN1322. The security measures used for a connection depend on the input and output capabilities of a device and these will be requested during the pairing process ⇨ 4.5.5 Security Handling.

4.2.6 Registering local services

PAN1322

Command	**AT+JRLS=<length_uuid>,<length_service_name>,** **<uuid>,<service_name>,<service_channel>, <CoD>** <length_uuid> (2 chars (DEC)): The length of the UUID (4 or 32). <length_service_name> (2 chars (DEC)): The length of the service name (01 to 16). <uuid> (4 or 32 chars (HEX)): The UUID for supported profile. <service_name> (<length_service_name> chars (DEC)): The name of the service. <service_channel> (2 chars (DEC)): The service channel number (01 to 30). <CoD> (6 chars (HEX)): The Class of Device (default 000000).
Description	Request to register up to three local services. Once the command is issued, the service is registered even though an identical service has already been registered. **Note:** There is no default service configuration. Services need to be re-registered after a SW or HW reset.
Response	**<general_response>** <general_response> (2 or 6 characters (DEC)): The general response of the module for requests indicating that the executing went OK or that an error occurred.

	OK	Syntax correct, execution allowed and successful
	ERR=-1	Syntax error
	ERR=-2	Command not allowed at present execution status
	ERR=-3	Internal unknown protocol stack error
Description	The general response to requests.	

PAN1026A

Command	TCU_MNG_STANDARD_HCI_SET_REQ_WriteClassOfDeviceCommand
	
	0D 00 00 E1 3D 06 00 24 0C 03 CD CD CD
	
	    CD: Class of Device (3 bytes): The class of the device (LSB, LSB+1, MSB).
	
	TCU_SPP_UUID_ASSIGN_REQ
	
	RL 00 00 E5 20 PL 00 IT IV … AT AV …
	
	    RL: Request Length (1 byte): The length of the total request.
	
	    PL: Parameter Length (1 byte): The length of the following fields -1.
	
	    IT: Initiate UUID Data Type (1 byte): The UUID data type for initiation.
	
	        UUID16 0x19
	        UUID32 0x1A
	        UUID128 0x1C
	
	    IV: Initiate UUID Value (2 / 4 /16 bytes): The UUID value for initiate connection.
	
	    AT: Accept UUID Data Type (1 byte): The UUID data type for initiation.
	
	        UUID16 0x19
	        UUID32 0x1A
	        UUID128 0x1C
	
	    AV: Accept UUID Value (2 / 4 /16 bytes): The UUID value for accept connection.

Description	The command TCU_MNG_STANDARD_HCI_SET_REQ_WriteClassOfDeviceCommand requests to write the class of device to the module. The command TCU_SPP_UUID_ASSIGN_REQ requests to set the service class ID for SPP. It is used to connect to the service with UUID the Bluetooth SIG does not specify. The command sets the UUID for both initiator and acceptor. TCU_SPP_UUID_ASSIGN_RESP is generated, when this command is completed. **Note:** There is a default service configuration that uses the well-known SPP service UUID and the service channel "5". Thus, this command does only have to be used when the desired SPP service UUID deviates from the default. However, the service channel cannot be changed.

Response	TCU_MNG_STANDARD_HCI_SET_RESP_WriteClassOfDeviceResponse
	
	RL 00 00 E1 BD PL 00 ST PE 0E 04 01 24 0C SA
	
	    RL: Response Length (1 byte): The length of the total response.
	
	        No Error occurred 0x0F
	        Error occurred 0x09
	
	    PL: Parameter Length (1 byte): The length of
	        TCU_MNG_STANDARD_HCI_SET_RESP.

	No Error occurred	0x06
	Error occurred	0x02
	ST: Status (1 byte): The status of the TCU_MNG_STANDARD_HCI_SET_RESP.	
	Successful	0x00
	Parameter Failure	0x01
	No Device Initialization	0x03
	PE: Parameter Length (1 byte): The length of WriteClassOfDeviceResponse.	
	No Error occurred	0x06
	Error occurred	0x02
	SA: Status parameter (1 byte): The status of WriteClassOfDeviceResponse.	
	TCU_SPP_UUID_ASSIGN_RESP	
	08 00 00 E5 A0 01 00 ST	
	ST: Status (1 byte):	
	Successful	0x00
	Parameter failure	0x01
	No Device Initialization	0x03
	Setup SPP	0x40
Description	TCU_MNG_STANDARD_HCI_SET_RESP_WriteClassOfDeviceResponse is the response to TCU_MNG_STANDARD_HCI_SET_REQ_WriteClassOfDeviceCommand indicating the status of the class of device writing request.	
	TCU_SPP_UUID_ASSIGN_RESP is the response to TCU_SPP_UUID_ASSIGN_REQ indicating the status of the UUID setting request.	

4.3 Device Discovery

4.3.1 Making the device discoverable

PAN1322

Command	**AT+JDIS=<discoverable>**	
	<discoverable> (1 character (DEC)):	
	No scans enabled	0
	Inquiry Scan enabled (visible)	1
	Page Scan enabled (connectable)	2
	Inquiry & Page Scan enabled (visible & connectable)	3
Description	Forces PAN1322 into Page Scan / Inquiry Scan.	
	Scan is automatically disabled when connected and at disconnection they are automatically enabled. Default configuration after a HW or SW reset is no scans enabled. A device with no service registered and discoverable, will not accept any incoming SPP connection request.	
Response	**<general_response>**	
	<general_response> (2 or 6 characters (DEC)):	
	The general response of the module for requests indicating that the executing	

went OK or that an error occurred.

OK	Syntax correct, execution allowed and successful
ERR=-1	Syntax error
ERR=-2	Command not allowed at present execution status
ERR=-3	Internal unknown protocol stack error

Description	The general response to requests.

PAN1026A

Command	TCU_MNG_SET_SCAN_REQ
	08 00 00 E1 0C 01 00 SM
	SM: Scan Mode (1 byte):
	Inquiry Scan OFF, Page Scan OFF 0x00
	Inquiry Scan ON, Page Scan OFF 0x01
	Inquiry Scan OFF, Page Scan ON 0x02
	Inquiry Scan ON, Page Scan ON 0x03
Description	Set Inquiry Scan and/or Page Scan.
	When this command is completed, TCU_MNG_SET_SCAN_RESP is generated.
Response	TCU_MNG_SET_SCAN_RESP
	08 00 00 E1 8C 01 00 ST
	Status (ST) (1 byte):
	Successful 0x00
	Parameter failure 0x01
	No device initialization 0x03
	No setup profile 0x08
Description	This response is generated, when Inquiry Scan and Page Scan setting is completed.

4.3.2 Starting the device discovery

PAN1322

Command	**AT+JDDS=<Extended_Inquiry>**
	<Extended Inquiry> (1 character (DEC)):
	No remote name needed: Only information from EIR (Extended Inquiry Response) is used no RNR (Remote Name Request) is performed, all found addresses and the CoD are presented. 0
	Shortened name requested: Shortened name is used if it is available. If it is not available RNR is performed. 1
	Full name requested: RNR is performed for devices that do not respond with full name in EIR. 2
Description	Causes PAN1322 to start a Device Discovery (Inquiry and Remote Name Request).
Responses	**<general_response>**
	<general_response> (2 or 6 chars (DEC)):

	The general response of the module for requests indicating that the executing went OK or that an error occurred.
	OK — Syntax correct, execution allowed and successful
	ERR=-1 — Syntax error
	ERR=-2 — Command not allowed at present execution status
	ERR=-3 — Internal unknown protocol stack error
	Then, if responses are returned:
	+RDDSRES=<bd_addr>,<remote_name>,<COD>
	<bd_addr> (12 chars (HEX)): The BD address of the remote device
	<remote_name> (variable length): The name of the remote device.
	If Extended Inquiry = 0, then remote name will be empty if no name is available.
	If Extended Inquiry = 1 or 2, remote_name will be page timeout if the RNR does not find any devices answering.
	<COD> (6 chars (HEX)): The class of the remote device.
	Completed by:
	+RDDSCNF=<status>
	<status> (1 char (DEC)): The status of the device discovery process.
	Success — 0
	Failure — Anything > 0
Description	Returns the discovered devices.

PAN1026A

Command	TCU_MNG_DISCOVER_REMOTE_DEVICE_REQ
	08 00 00 E1 03 01 00 NR
	NR: Number of Reports (1 byte):
	Number of searched devices — 0x01 – 0x10
Description	Set remote device discovery.
	When the PAN1026A starts the device discovery, TCU_ACCEPT is generated.
	In case remote devices were found, TCU_MNG_DISCOVER_REMOTE_DEVICE_RESULT_EVENT is generated.
	When this command is completed, TCU_MNG_DISCOVER_REMOTE_DEVICE_COMPLETE_EVENT is generated.
	When the PAN1026A finds the remote devices and the number of searched devices reaches the setting number, the PAN1026A continues to get the names of the discovered remote devices and transfers the remote device information to the Host CPU.
	If the number of discovered devices does not reach the setting number, the PAN1026A continues to get the device names 10.24 s later.
	After PAN1026A created a result event for all searched devices, the complete event is generated to Host CPU.
Responses	TCU_ACCEPT
	0A 00 00 E1 F1 03 00 ST E1 03

	ST Status (1 byte):
	Successful 0x00
	Parameter failure 0x01
	No device initialization 0x03
	On searching device 0x04
	On searching device service 0x05
	On progress of other profile connection 0x0E
	On releasing SPP connection 0x43
	TCU_MNG_DISCOVER_REMOTE_DEVICE_RESULT_EVENT
	RL 00 00 E1 44 PL 00 BD BD BD BD BD BD CD CD CD LD DN …
	RL: Response length (1 byte): The total length of the response (0x11 – 0x8F).
	PL: Parameter length (1 byte):
	The length of the following parameters -1 (0x0A – 0x8A).
	BD: BD address (6 bytes): The BD address of the remote device.
	CD: Class of Device (3 bytes): The device class of the remote device.
	LD: Length of Device Name (1 byte):
	The length of the user-friendly name (0x00 – 0x80).
	DN: Device Name (max. 128 bytes): The UTF-8 encoded User-friendly name.
	TCU_MNG_DISCOVER_REMOTE_DEVICE_COMPLETE_EVENT
	07 00 00 E1 43 00 00
Description	The TCU_ACCEPT event is used to notify that the module has received the command from the host controller. After this event has been received, the host can send the next command to the module.
	The TCU_MNG_DISCOVER_REMOTE_DEVICE_RESULT_EVENT is generated, when remote devices were found.
	When device discovery is complete, the TCU_MNG_DISCOVER_REMOTE_DEVICE_COMPLETE_EVENT is generated.

4.4 Service Discovery

PAN1322

Command	**AT+JSDS= <bd_addr>,<length_uuid>, <uuid>**
	<bd_addr> (12 chars (HEX)): The BD address of the remote device.
	<length_uuid> (2 chars (DEC)): The length of the UUID (04 or 32).
	<uuid> (4/32 chars (HEX)):
	The service UUID to search for eg. 1101 or 0000110100001000800000805F9B34FB for Serial Port Profile.
Description	AT+JSDS causes the PAN1322 to start a specified service discovery of a specified remote device with the given BD address and UUID.
Response	**<general_response>**
	<general_response> (2 or 6 chars (DEC)):

The general response of the module for requests indicating that the executing went OK or that an error occurred.

OK	Syntax correct, execution allowed and successful
ERR=-1	Syntax error
ERR=-2	Command not allowed at present execution status
ERR=-3	Internal unknown protocol stack error

Then, if responses are returned:

+RSDSRES=<remote_service_name>,<remote_service_channel>

<remote_service_name> (variable length): The name of the remote service.

<remote_service_channel> (2 chars (DEC)): The channel of the service.

Completed by:

+RSDSCNF=<status>

<status> (1 char (DEC)): The status of the service discovery process.

Success	0
Failure	Anything > 0

Description	Returns the discovered services.

PAN1026A

Command	TCU_MNG_DISCOVER_REMOTE_SERVICE_REQ
	
	RL 00 00 E1 05 PL 00 SM BD BD BD BD BD BD UL LK …
	
	RL: Request length (1 byte): The total length of the request (0x0F or 0x1F).
	
	PL: Parameter length (1 byte):
	
	    The length of the following parameters -1 (0x08 or 0x18).
	
	SM: Security Mode (1 byte): Set of Bluetooth security modes.
	
	    Mode 3 0x00
	    Mode 2 0x01
	
	BD: BD Address (6 bytes): The BD address of the remote device.
	
	UL: Use of link key (1 byte): Set link key for Bluetooth connection.
	
	    No 0x00
	    Yes 0x01
	
	LK: Link key (16 bytes):
	
	    The link key of the connection. This field can be omitted when UL is 0x00.
	
	Note: PAN1026A link keys have to be handled and stored by the host controller.

Description	TCU_MNG_DISCOVER_REMOTE_SERVICE_REQ causes the PAN1026A to search the remote device for services. TCU_ACCEPT is generated to notify to Host CPU, when this command operation is started. TCU_MNG_DISCOVER_REMOTE_SERVICE_EVENT is generated, when this command is completed.
Response	TCU_ACCEPT **0A 00 00 E1 F1 03 00 ST E1 05**

ST Status (1 byte):

Successful	0x00
Parameter failure	0x01
No device initialization	0x03
On searching device	0x04
On searching device service	0x05
On progress of other profile connection	0x0E
On progress of SPP connection or establishing SPP	0x42
On releasing SPP connection	0x43

TCU_MNG_DISCOVER_REMOTE_SERVICE_EVENT

RL RL 00 E1 45 PL 00 ST BD BD BD BD BD BD SC SE … IP IL EI

RL: Response length (2 bytes): The total length of the response (0xXX – 0xXX).

PL: Parameter length (1 byte):

 The length of the following parameters -1 (0x08 – 0xFF).

ST: Status (1 byte): The operation result status.

Successful	0x00
SDP connection failure	0x8C
No supported SDP	0x8D

BD: BD address (6 bytes): The BD address of the remote device.

SC: Service count (1 byte): The number of services on the remote device.

SE: Service type (1 byte): The profile indicator for each supported profile.

SPP (B-Party)	0x03
Device ID (DI)	0x0E

IP: Extension info profile (1 byte): The profile that has additional information.

SPP	0x02
Device ID	0x03

IL: Extension info length (1 byte): The length of the additional information.

EI: Extension info (186 bytes): The additional information.

Example: Device ID and SPP

Parameter length:	0x1D
Status:	0x00
BD Address:	0x001343XXXXXX
Service count:	0x02
Service type:	0x03 (SPP)
Service type:	0x0B (Device ID)
Extension info profile:	0x02 (SPP)
Extension info length:	0x03
Extension info:	0x02 (Number of server channels)
Extension info:	0x01 (Server channel 1)
Extension info:	0x02 (Server channel 2)

	Extension info profile: 0x03 (Device ID)
	Extension info length: 0x0B (Device ID description length)
	Extension info: 0xXXXX (Specification ID)
	Extension info: 0xXXXX (Vendor ID)
	Extension info: 0xXXXX (Product ID)
	Extension info: 0xXXXX (Version)
	Extension info: 0xXX (Primary record)
	Extension info: 0xXXXX (Vendor ID source)
Description	TCU_MNG_DISCOVER_REMOTE_SERVICE_EVENT is generated, when the service information of a remote device was found. With this event, the BD_ADDR and service information of a remote device is transferred to the host CPU.

In addition to the mentioned commands above, the PAN1026A provides a function to cancel an ongoing service discovery. This command and its response are described in the following table.

PAN1026A

Command	TCU_MNG_ DISCOVER_REMOTE_SERVICE_ CANCEL_REQ **0D 00 00 E1 12 06 00 BD BD BD BD BD BD** BD: BD address (6 bytes): The BD address of the remote device.
Description	TCU_MNG_ DISCOVER_REMOTE_SERVICE_ CANCEL_REQ causes the PAN1026A to cancel the service discovery. TCU_ACCEPT is generated to notify the host controller, when this command operation is started.
Response	TCU_ACCEPT **0A 00 00 E1 F1 03 00 ST E1 12** ST Status (1 byte): 　Successful　　　　　　　　　　　　　　　　0x00 　Parameter failure　　　　　　　　　　　　　0x01 　No device initialization　　　　　　　　　　0x03 TCU_MNG_DISCOVER_REMOTE_SERVICE_CANCEL_EVENT **0D 00 00 E1 52 06 00 BD BD BD BD BD BD** BD: BD address (6 bytes): The BD address of the remote device.
Description	TCU_MNG_ DISCOVER_REMOTE_SERVICE_ CANCEL_REQ is the acknowledging response for the TCU_MNG_ DISCOVER_REMOTE_SERVICE_ CANCEL_REQ.

4.5   Device Connection

4.5.1   Connecting an SPP Link

PAN1322

Command	**AT+JCCR=<bd_addr>, <service channel>**
	<bd_addr> (12 chars (HEX)): The bluetooth address of the remote device.
	<service_channel> (2 chars (DEC)):
	The service channel to connect to (01 - 30). It can be received from a service discovery AT+JSDS.
Description	Instructs the PAN1322 to connect to a remote Bluetooth device.
Response	**<general_response>**
	<general_response> (2 or 6 chars (DEC)):
	The general response of the module for requests indicating that the executing went OK or that an error occurred.
	OK Syntax correct, execution allowed and successful
	ERR=-1 Syntax error
	ERR=-2 Command not allowed at present execution status
	ERR=-3 Internal unknown protocol stack error
	Followed by:
	+RCCRCNF = <MTU_size>, <service>, <status>
	<MTU_size> (3 chars (DEC)): The maximum transmission unit (01 to 500).
	<service> (4 or 32 chars (DEC)):
	The service the remote device is connected to. The host of the initializing device specifies which service it connects to in AT+JCCR.
	<status> (1 char (DEC)):
	The status of the request. If maximum number of allowed connections already exists: ERR=-2.
Description	Indicates the status of the connection process.

PAN1026A

Command	TCU_SPP_CONNECT_REQ
	RL 00 00 E5 03 PL 00 BD BD BD BD BD BD 07 03 00 00 00 00 00 00 UL LK …
	RL: Request length (1 byte): The total length of the request (0x16 or 0x26).
	PL: Parameter length (1 byte): The length of the following parameters (0x0F or 0x1F).
	BD: BD Address (6 bytes): The Bluetooth device address of the remote device.
	UL: Use of Link Key (1 byte): The link key usage setting.
	Don't use link key. Pairing will be performed again. 0x00
	Use a link key, if it is available from a previous pairing process 0x01
	LK: Link Key (16 bytes): The link key of a previous pairing process.
	Note: PAN1026A link keys have to be handled and stored by the host controller.

Description	To establish an SPP connection with a specific remote device. TCU_ACCEPT is generated to notify the command operation started on host controller. When the service level connection is established, TCU_SPP_CONNECT_EVENT is generated.

Response	TCU_ACCEPT
	
	0A 00 00 E1 F1 03 00 ST E5 03
	
	    ST: Status (1 byte):
	
	        Successful 0x00
	        Parameter failure 0x01
	        No device initialization 0x03
	        On Searching device 0x04
	        On searching device service 0x05
	        Under connection setup of other profile 0x0E
	        No setup SPP 0x41
	        On progress SPP connection or Establish SPP 0x42
	        Releasing SPP 0x43
	
	    TCU_SPP_CONNECT_EVENT
	
	    EL 00 00 E5 43 PL 00 ST BD BD BD BD BD BD NF NF LN DN …
	
	    EL: Event length (2 bytes): The total length of the event (0x11 – 0x29).
	
	    PL: Parameter length (1 byte): The length of the following parameters -1 (0xA – 0x22).
	
	    ST: Status (1 byte): The status of the connection establishment.
	
	        Successful 0x00
	        No Simple Device Pairing (SDP) service supported 0x8D
	        SPP connection timeout 0xD0
	        SPP connection failure 0xD3
	
	    BD: BD Address (6 bytes): The Bluetooth device address of the remote device.
	
	    NF: Negotiated Frame Size (NF) (2 bytes):
	
	        The maximum frame size of an SPP frame. This value has to be used in the Length of Data field of the TCU_SPP_DATA_TRANSFER_REQ request.
	
	    LN: Length of device name (1 byte):
	
	        The length of the remote device name. When no name is set the value is 0x00.
	
	    DN: Device Name (max. 24 bytes):
	
	        The UTF-8 encoded remote device name. Not present if the length is 0x00.

Description	The TCU_ACCEPT event is used to notify that the module has received the command from the host controller. After this event has been received, the host can send the next command to the module. TCU_SPP_CONNECT_EVENT is generated, when SPP connection is established.

4.5.2 Incoming Connection Request Events

PAN1322

Response	**+RCOI=<bd_addr>**
	<bd_addr> (12 chars (HEX)): The Bluetooth device address of the remote device.
Description	Indicates a remote connection request. This request can be answered with the command AT+JACR= <accept>.

PAN1026A

Event	TCU_MNG_CONNECTION_REQUEST_EVENT
	10 00 00 E1 55 07 00 BD BD BD BD BD BD CD CD CD
	BD: BD address (6 bytes): BD address of the remote device.
	CD: Class of device (3 bytes): The class of the remote device.
Description	TCU_MNG_CONNECTION_REQUEST_EVENT is generated when a remote device requests to connect to the PAN1026A. If the host controller does not execute TCU_MNG_CONNECTION_ACCEPT_REQ within 5 seconds, the PAN1026A will automatically cancel the request and generate TCU_MNG_CONNECTION_STATUS_EVENT.

4.5.3 Accepting Connection Requests

PAN1322

Command	**AT+JACR=<accept>**	
	<accept> (1 char (DEC)): The parameter to control connection acception.	
	Do not accept	0
	Accept	1
Description	AT+JACR=<accept> is used to answer to a connection indication (+RCOI).	
Response	**<general_response>**	
	<general_response> (2 or 6 chars (DEC)):	
	The general response of the module for requests indicating that the executing went OK or that an error occurred.	
	OK	Syntax correct, execution allowed and successful
	ERR=-1	Syntax error
	ERR=-2	Command not allowed at present execution status
	ERR=-3	Internal unknown protocol stack error
Description	The different responses possible to the request.	

PAN1026A

Command	TCU_MNG_CONNECTION_ACCEPT_REQ
	RL 00 00 E1 13 PL 00 RT BD BD BD BD BD BD UL LK …
	RL: Request length (1 byte): The total length of the request.
	PL: Parameter length (1 byte): The length of the parameters.
	RT: Response Type (1 byte): The response type of the request.

	Accept 0x00 Reject 0x01 BD: BD address (6 bytes): The BD address of the remote device. UL: Use of link key (1 byte): Indicator for the use of a link key. LK: Link key (16 bytes): The link key of the connection. **Note:** PAN1026A link keys have to be handled and stored by the host controller.
Description	TCU_MNG_CONNECTION_ACCEPT_REQ is used to accept or reject a received connection request from a remote device. When this command is completed, TCU_MNG_CONNECTION_ACCEPT_RESP is generated.

Response	TCU_MNG_CONNECTION_ACCEPT_RESP
	
	08 00 00 E1 93 01 00 ST
	
	ST: Status (1 byte):
	
	    Successful 0x00
	    Parameter failure 0x01
	    No device initialization 0x03
	    No connection 0x06

Description	When TCU_MNG_CONNECTION_ACCEPT_REQ is completed, this response is generated.

4.5.4 Accepting Connection Requests Automatically

PAN1322

Command	**AT+JAAC=<auto_accept>**
	
	<auto_accept> (1 char (DEC)): The parameter to control auto connection acception.
	
	    Host will be notified with incoming connection indication (+RCOI) – (no auto accept). This is the default configuration. 0
	
	    PAN1322 will automatically accept incoming connection requests. Host will be notified. 1

Description	Forces the PAN1322 to automatically accept connection requests.

Response	**<general_response>**
	
	<general_response> (2 or 6 chars (DEC)):
	
	    The general response of the module for requests indicating that the executing went OK or that an error occurred.
	
	    OK Syntax correct, execution allowed and successful
	    ERR=-1 Syntax error
	    ERR=-2 Command not allowed at present execution status
	    ERR=-3 Internal unknown protocol stack error

Description	The general response to a request.

In order to connect to the PAN1026A automatically (Just works scenario) the input and output capabilities have to be set, when the module requests these from the host. To do that, please refer to the PAN1026A commands listed in section ⇨ 4.5.5 Security Handling as well as the PAN1026A example sequences for connection establishment (⇨ 4.7.4 Connection Establishment).

4.5.5 Security Handling

Due to the different command interfaces of the PAN1322 and the PAN1026A, the security handling differs. The PAN1322's AT commands can be used to predefine the capabilities of the device, which are automatically used by the module when necessary. The PAN1026A's command interface does not provide this feature. Device capabilities are actively requested when necessary, leading to a different handling for the host controller.

Unlike before and due to the mentioned reasons, in this section the PAN1322 and PAN1026A security handling will be listed separately.

PAN1322

Response	+RPCI=<bd_addr>, <simple_pairing>
	<bd_addr> (12 chars (HEX)): The BD address of the remote device.
	<simple_pairing> (1 char (DEC)): The pairing setting.
	Legacy pairing 0
	Secure simple pairing 1
Description	The PIN code request from a remote Bluetooth device. This event has to be answered with the AT+JPCR command.

Command	AT+JPCR=<length_PIN_code>, <PIN_code>
	<length_PIN_code> (2 chars (DEC)): The length of the PIN code (01 - 16).
	<PIN_code> (<length_PIN_code> chars (DEC)): The PIN code for the pairing.
Description	The PIN code reply in response to a PIN code request from a remote Bluetooth device.
Response	<general_response>
	<general_response> (2 or 6 chars (DEC)):
	The general response of the module for requests indicating that the executing went OK or that an error occurred.
	OK Syntax correct, execution allowed and successful
	ERR=-1 Syntax error
	ERR=-2 Command not allowed at present execution status
	ERR=-3 Internal unknown protocol stack error
	+RSLE
Description	The general response to a request and an indication that a secure link has been established.

Response	+RPNE= <Numerical_Value>
	<Numerical_Value> (6 chars (DEC)): The numerical value to be display.
Description	The passkey notification event. This event will only be generated, when the device has output capabilities.

Response	+RUCE= <Numerical_Value>
	<Numerical_Value> (6 chars (DEC)): The numerical value to be display.
Description	The user confirmation event. This event has to be answered with the AT+JUCR command.

Command	AT+JUCR=<Status>
	<Status> (1 char (DEC)): The status of the response. Not accepted 0 Accepted 1
Description	The user confirmation reply command to confirm or reject a numerical value.
Response	<general_response> <general_response> (2 or 6 chars (DEC)): The general response of the module for requests indicating that the executing went OK or that an error occurred. OK Syntax correct, execution allowed and successful ERR=-1 Syntax error ERR=-2 Command not allowed at present execution status ERR=-3 Internal unknown protocol stack error
Description	The general response to a request.

PAN1026A

In order to fully understand the usage of the commands listed below, please refer to the PAN1026A example sequences for connection establishment ⇨ 4.7.4 Connection Establishment.

Event	TCU_MNG_SSP_INFO_EVENT_HCI_IO_Capability_Request_Event
	0F 00 00 E1 7D 08 00 31 06 BD BD BD BD BD BD BD: BD address (6 bytes): The BD address of the remote device (LSB first).
Description	Indicates that the IO capabilities of the host controller are required for a simple pairing process. The host shall respond with a TCU_MNG_SSP_SET_REQ_HCI_IO_Capability_Request_Reply or TCU_MNG_SSP_SET_REQ_HCI_IO_Capability_Request_Negative_Reply.

Command	TCU_MNG_SSP_SET_REQ_HCI_IO_Capability_Request_Reply
	13 00 00 E1 3D 0C 00 2B 04 09 BD BD BD BD BD BD IO OB AR BD: BD address (6 bytes): The BD address of the remote device (LSB first). IO: IO capability (1 byte): The IO capability of the remote device.

	DisplayOnly	0x00
	DisplayYesNo	0x01
	KeyboardOnly	0x02
	NoInputNoOutput	0x03
	Reserved for future use	0x04 – 0xFF

OB: OOB data present (1 byte):

The indication whether OOB authentication data is present or not.

OOB authentication data not present	0x00
OOB authentication data from remote device present	0x01
Reserved for future use	0x02 – 0xFF

AR: Authentication requirement (1 byte):

MITM and general/dedicated bonding.

MITM protection not required – No bonding. Numeric comparison with automatic accept allowed.	0x00
MITM protection required – No bonding. Use IO capabilities to determine authentication procedure.	0x01
MITM protection required – Dedicated bonding. Numeric comparison with automatic accept allowed.	0x02
MITM Protection Required – Dedicated Bonding. Use IO Capabilities to determine authentication procedure.	0x03
MITM Protection Not Required – General Bonding. Numeric Comparison with automatic accept allowed.	0x04
MITM Protection Required – General Bonding. Use IO capabilities to determine authentication procedure.	0x05
Reserved for future use.	0x06 – 0xFF

Description	TCU_MNG_SSP_SET_REQ_HCI_IO_Capability_Request_Reply is used to reply to a TCU_MNG_SSP_INFO_EVENT_HCI_IO_Capability_Request_Event and specifies the current I/O capabilities of the host. This includes the host input, output and out-of-band (OOB) capabilities.
Response	TCU_MNG_SSP_SET_RESP_HCI_IO_Capability_Request_Reply_Response **15 00 00 E1 BD 0E 00 00 0C 0E 0A 01 2B 04 ST BD BD BD BD BD BD** ST: Status (1 byte): <table><tr><td>Command success</td><td>0x00</td></tr><tr><td>Command failure</td><td>0xXX (anything > 0x00)</td></tr></table> BD: BD address (6 bytes): The BD address of the remote device (LSB first).
Description	TCU_MNG_SSP_SET_RESP_HCI_IO_Capability_Request_Reply_Response is the response to the TCU_MNG_SSP_SET_REQ_HCI_IO_Capability_Request_Reply.

Command	TCU_MNG_SSP_SET_REQ_HCI_IO_Capability_Request_Negative_Reply **11 00 00 E1 3D 0C 00 34 04 07 BD BD BD BD BD BD 38** BD: BD address (6 bytes): The BD address of the remote device (LSB first).
Description	TCU_MNG_SSP_SET_REQ_HCI_IO_Capability_Request_Negative_Reply is used to reject a pairing attempt after a TCU_MNG_SSP_INFO_EVENT_HCI_IO_Capability_Request_Event has been received by the host.

Response	TCU_MNG_SSP_SET_RESP_HCI_IO_Capability_Request_Negative_Reply_Response
	15 00 00 E1 BD 0E 00 00 0C 0E 0A 01 34 04 ST BD BD BD BD BD BD
	ST: Status (1 byte):
	Command success 0x00
	Command failure 0xXX (anything > 0x00)
	BD: BD address (6 bytes): The BD address of the remote device (LSB first).
Description	TCU_MNG_SSP_SET_RESP_HCI_IO_Capability_Request_Negative_Reply_Response is the response to the TCU_MNG_SSP_SET_REQ_HCI_IO_Capability_Request_Negative_Reply.

Event	TCU_MNG_SSP_INFO_EVENT_HCI_IO_Capability_Response_Event
	12 00 00 E1 7D 0B 00 32 09 BD BD BD BD BD BD IO OB AR
	BD: BD address (6 bytes): The BD address of the remote device (LSB first).
	IO: IO capability (1 byte): The IO capability of the remote device.
	DisplayOnly 0x00
	DisplayYesNo 0x01
	KeyboardOnly 0x02
	NoInputNoOutput 0x03
	Reserved for future use 0x04 – 0xFF
	OB: OOB data present (1 byte):
	The indication whether OOB authentication data is present or not.
	OOB authentication data not present 0x00
	OOB authentication data from remote device present 0x01
	Reserved for future use 0x02 – 0xFF
	AR: Authentication requirement (1 byte):
	Man in the middle (MITM) and general/dedicated bonding.
	MITM protection not required – No bonding. Numeric comparison with automatic accept allowed. 0x00
	MITM protection required – No bonding. Use IO capabilities to determine authentication procedure. 0x01
	MITM protection required – Dedicated bonding. Numeric comparison with automatic accept allowed. 0x02
	MITM Protection Required – Dedicated Bonding. Use IO Capabilities to determine authentication procedure. 0x03
	MITM Protection Not Required – General Bonding. Numeric Comparison with automatic accept allowed. 0x04
	MITM Protection Required – General Bonding. Use IO capabilities to determine authentication procedure. 0x05
	Reserved for future use. 0x06 – 0xFF
Description	Indicates to the host that IO capabilities from a remote device specified by BD address have been received during a simple pairing process.

Event	TCU_MNG_SSP_INFO_EVENT_HCI_IO_User_Confirmation_Request_Event
	13 00 00 E1 7D 0C 00 33 0A BD BD BD BD BD BD NV NV NV NV
	BD: BD address (6 bytes): The BD address of the remote device (LSB first).
	NV: Numeric value (4 bytes): The numeric value for user confirmation. Range: 0x00000000 – 0x000F423F (0 - 999999).
Description	Indicates that a user confirmation of a numeric value is required. The host shall replay with either the TCU_MNG_SSP_SET_REQ_HCI_User_Confirmation_Request_Reply or TCU_MNG_SSP_SET_REQ_ HCI_User_Confirmation_Negative_Reply. If the Host CPU has output capability it shall display the numeric value until the TCU_MNG_SSP_INFO_EVENT_HCI_Simple_Pairing_Complete_Event is received. It shall reply based on the yes/no response from the user. If the host has no input and no output it shall reply with the TCU_MNG_SSP_SET_REQ_HCI_User_Confirmation_Request_Reply command.

Command	TCU_MNG_SSP_SET_REQ_ HCI_User_Confirmation_Request_Reply
	10 00 00 E1 3D 09 00 2C 04 06 BD BD BD BD BD BD
	BD: BD address (6 bytes): The BD address of the remote device (LSB first).
Description	TCU_MNG_SSP_SET_REQ_ HCI_User_Confirmation_Request_Reply is used to reply to a TCU_MNG_SSP_INFO_EVENT_HCI_IO_User_Confirmation_Request_Event and indicates that the user accepts the request.
Response	TCU_MNG_SSP_SET_RESP_ HCI_User_Confirmation_Request_Reply_Response
	15 00 00 E1 BD 0E 00 00 0C 0E 0A 01 2C 04 ST BD BD BD BD BD BD
	ST: Status (1 byte):
	Command success 0x00
	Command failure 0xXX (anything > 0x00)
	BD: BD address (6 bytes): The BD address of the remote device (LSB first).
Description	The response to TCU_MNG_SSP_SET_REQ_ HCI_User_Confirmation_Request_Reply.

Command	TCU_MNG_SSP_SET_REQ_ HCI_User_Confirmation_Request_Negative_Reply
	10 00 00 E1 3D 09 00 2D 04 06 BD BD BD BD BD BD
	BD: BD address (6 bytes): The BD address of the remote device (LSB first).
Description	TCU_MNG_SSP_SET_REQ_ HCI_User_Confirmation_Request_Negative_Reply is used to reply to a TCU_MNG_SSP_INFO_EVENT_HCI_IO_User_Confirmation_Request_Event and indicates that the user rejects the request.
Response	TCU_MNG_SSP_SET_RESP_ HCI_User_Confirmation_Request_Negative_Reply_Response
	15 00 00 E1 BD 0E 00 00 0C 0E 0A 01 2D 04 ST BD BD BD BD BD BD
	ST: Status (1 byte):
	Command success 0x00
	Command failure 0xXX (anything > 0x00)
	BD: BD address (6 bytes): The BD address of the remote device (LSB first).

Description	The response to TCU_MNG_SSP_SET_REQ_ HCI_User_Confirmation_Request_Negative_Reply.

Event	TCU_MNG_SSP_INFO_EVENT_HCI_Simple_Pairing_Complete_Event
	10 00 00 E1 7D 09 00 36 07 ST BD BD BD BD BD BD
	ST: Status (1 byte): The status of the event.
	Command success 0x00
	Command failure 0xXX (anything > 0x00)
	BD: BD address (6 bytes): The BD address of the remote device (LSB first).
Description	Indicates that the simple pairing process has completed. A host that is displaying a numeric value can use this event to change its UI.

4.5.6 Disconnecting SPP Link

PAN1322

Command	**AT+JSDR**
Description	Forces an SPP disconnection.
Response	**OK**
Description	Disconnection Response.

PAN1026A

Command	TCU_SPP_DISCONNECT_REQ
	07 00 00 E5 04 00 00
Description	TCU_SPP_DISCONNECT_REQ requests to disconnect an SPP connection. TCU_ACCEPT is generated to notify the start of this command operation. When the connection is disconnected, TCU_SPP_DISCONNECT_EVENT is generated.
Response	TCU_ACCEPT
	0A 00 00 E1 F1 03 00 ST E5 04
	ST: Status (1 byte):
	Success 0x00
	Parameter failure 0x01
	No device initialization 0x03
	Under Connection setup of other profile 0x0E
	No setup SPP 0x41
	TCU_SPP_DISCONNECT_EVENT
	0F 00 00 E5 44 08 00 ST BD BD BD BD BD BD RE
	ST: Status (1 byte): The status of the disconnection.
	Successful 0x00
	SPP release timeout 0xD2
	BD: BD Address (6 bytes): The BD address of the remote device.
	RE: Reason (1 byte): The reason for the disconnection.

	Releasing required from local host	0x01
	Releasing required from remote device	0x02
	Disconnection error	0x03
	Link loss	0x04
Description	TCU_ACCEPT is generated to notify the start of the TCU_SPP_DISCONNECT command execution. TCU_SPP_DISCONNECT_EVENT is generated, when the SPP disconnection is completed.	

4.5.7 Connection Status Events

To provide a connection status feedback to the host controller, the PAN1322 uses multiple events, which are listed below.

PAN1322

Event	**+RSLE**
Description	Indicates that a secure link has been established.

PAN1322

Event	**+RDII**
Description	Indicates the disconnection.

The PAN1026A combines its connection status information in the following event.

PAN1026A

Event	TCU_MNG_CONNECTION_STATUS_EVENT
	EL 00 00 E1 47 PL 00 ST BD … CS LK … LT SI ..
	EL: Event length (1 byte): The length of the event.
	PL: Parameter length (1 byte): The length of the following parameters -1.
	ST: Status (1 byte): The status of the process.

	Successful	0x00
	Page timeout	0x80
	Local device connection reject	0x81
	Link loss	0x82
	Pin code input timeout	0x83
	Pin code failure	0x84
	Local device pin code input reject	0x85
	Remote device pin code input reject	0x86
	Link key failure	0x87

BD: BD Address (6 bytes): The BD address of the remote device.

CS: Connection status (1 byte): The status of the connection process.

	Connected	0x00
	Disconnected	0x01
	Connection failure	0x02

	Link key	0x03
	Mode change active	0x04
	Mode change hold	0x05
	Mode change sniff	0x06
	Mode change park	0x07

LK: Link key (16 bytes): The link key of the pairing process.

If the connection status is 0x00 – 0x02, this parameter is omitted.

LT: Link key type (1 byte): The type of the link key.

Combination key	0x00
Local unit key	0x01
Remote unit key	0x02
Debug combination key	0x03
Unauthenticated combination key	0x04
Authenticated combination key	0x05
Changed combination key	0x06
Reserved	0x07 – 0xFF

SI: Sniff Interval (2 bytes): The sniff interval to set sniff subrating.

When sniff subrating on TCU_MNG_INIT_REQ is selected, and the connection status on this event is "Mode Change Sniff", this parameter is generated.

Note: PAN1026A link keys have to be handled and stored by the host controller.

Description	TCU_MNG_CONNECTION_STATUS_EVENT is generated for the following situations: • Establish ACL connection • Disconnect ACL connection • Pairing is successful and link key is generated • Pairing or authentication is failed

4.6 Data Transmission

4.6.1 Transferring Data

PAN1322

Command	**AT+JSDA=<length>, <data>** <length> (3 chars (DEC)): The amount of bytes to be sent. Can be 001 to max MTU size. <data> (001 – max MTU size): The data to be sent.
Description	Sends a specified amount of data. The maximum number of bytes for each packet is reported at connection confirmation (MTU size). The value for this parameter is negotiated by the two devices during the connection setup.

Response	**<general_response>**
	
	 <general_response> (2 or 6 chars (DEC)):
	
	   The general response of the module for requests indicating that the executing went OK or that an error occurred.
	
	   OK Syntax correct, execution allowed and successful
	   ERR=-1 Syntax error

	ERR=-2	Command not allowed at present execution status
	ERR=-3	Internal unknown protocol stack error
Description	The general responses to a request.	

PAN1026A

Command	TCU_SPP_DATA_TRANSFER_REQ **RL RL 00 E5 08 PL PL LD LD DA …** RL: Request length (2 bytes): The total length of the request. PL: Parameter length (2 bytes): The length of the following parameters. LD: Length of data (2 bytes): The length of the data to be sent. This can be 0x01 to max MTU size. The actual MTU size has to be taken from the TCU_SPP_CONNECT_EVENT parameter "Negotiated frame size". DA: Data (1 byte to LD bytes – max MTU size bytes): The data to be sent.
Description	TCU_SPP_DATA_TRANSFER_REQ is used to send SPP data to a remote device. TCU_ACCEPT is generated to notify the execution of this command. Afterwards, TCU_SPP_DATA_SEND_EVENT is generated, when this command is completed.
Response	TCU_ACCEPT **0A 00 00 E1 F1 03 00 ST E5 08** ST: Status (1 byte):

	Success	0x00
	Parameter failure	0x01
	No device initialization	0x03
	No setup SPP	0x41
	Releasing SPP	0x43
	No SPP connection	0x44
	On transferring SPP data	0x46

	TCU_SPP_DATA_SEND_EVENT **07 00 00 E5 F1 00 00**
Description	TCU_ACCEPT is generated to notify the start of the TCU_SPP_DATA_TRANSFER_REQ command execution. TCU_SPP_DATA_SEND_EVENT is generated when the PAN1026A has completed sending data to the remote device.

4.6.2 Receiving Data

PAN1322

Response	**+RDAI=<length>, <data>**
	<length> (3 chars (DEC)): The amount of bytes received.
	<data> (<length> chars): The received data.
Description	Indicate that data has been received. This response is not available during stream mode.

PAN1026A

Event	TCU_SPP_DATA_RECEIVE_EVENT
	EL EL 00 E5 48 PL PL LD LD DA …
	EL: Event length (2 bytes): The total length of the event.
	PL: Parameter length (2 bytes): The length of the following parameters.
	LD: Length of data (2 bytes): The length of the received SPP data.
	DA: Data (1 byte to LD bytes – max. 543 bytes): The received SPP data.
Description	TCU_SPP_DATA_RECEIVE_EVENT notifies the host that data has been received from the remote device.

4.6.3 Switching Transmission Modes

The PAN1322 can use two operation modes: Command Mode and Stream Mode.

In Command Mode, the module will execute the AT commands sent from the host controller via UART. The mode is used to control the module behavior as well as to transmit data bursts and packetized data to a remote device that has a Bluetooth connection on SPP level with the PAN1322.

In Stream Mode, the host controller can send un-packetized data to the PAN1322, which will transfer this data to the remote device. This mode is used when transmitting a small amount of data in a random way and for serial cable replacement applications.

> (i) The Command Mode yields higher throughput than Stream Mode, because the filling of Bluetooth packets can be optimized.

The following commands are used to switch back and forth between the modes.

PAN1322

| Command	**AT+JSCR**
Description	The stream connection request, requests the PAN1322 to switch from Command Mode and to Stream Mode.
Response	**OK**
Description	Response that indicates a successful command execution.

PAN1322

| Command	^^^
Description	Escape character sequence, that causes the PAN1322 to switch from Stream Mode to Command Mode. A wait time greater than 100 ms after the last byte transmission is mandatory. This sequence is not terminated with <CR><LF>.
Response	**OK**
Description	Response that indicates a successful command execution.

The PAN1026A does not provide a Stream Mode. Data has to be sent using the appropriate command similar to the Command Mode of the PAN1322.

4.7 PAN1026A Example Sequences

4.7.1 Initialization
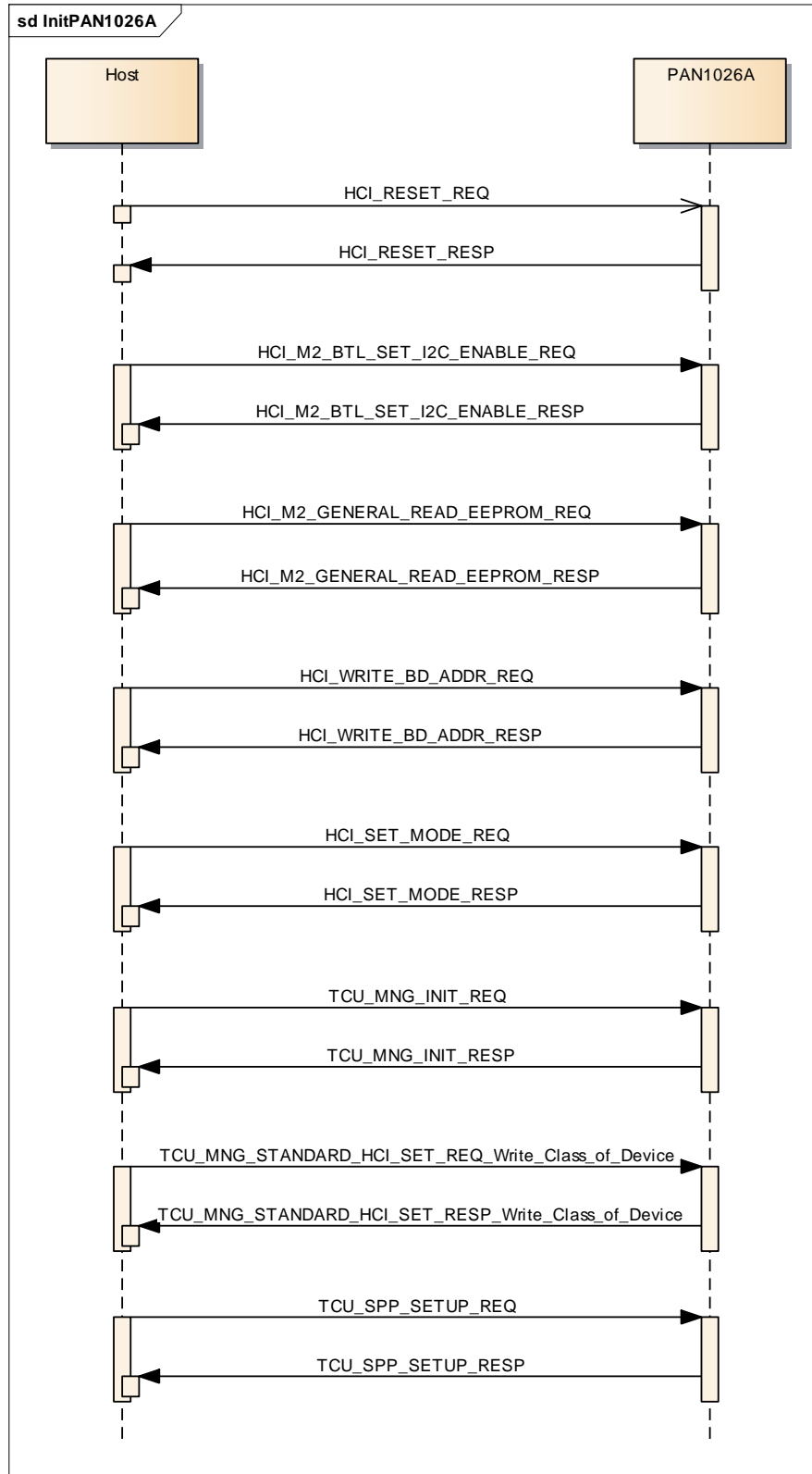
4.7.2 Device Discovery
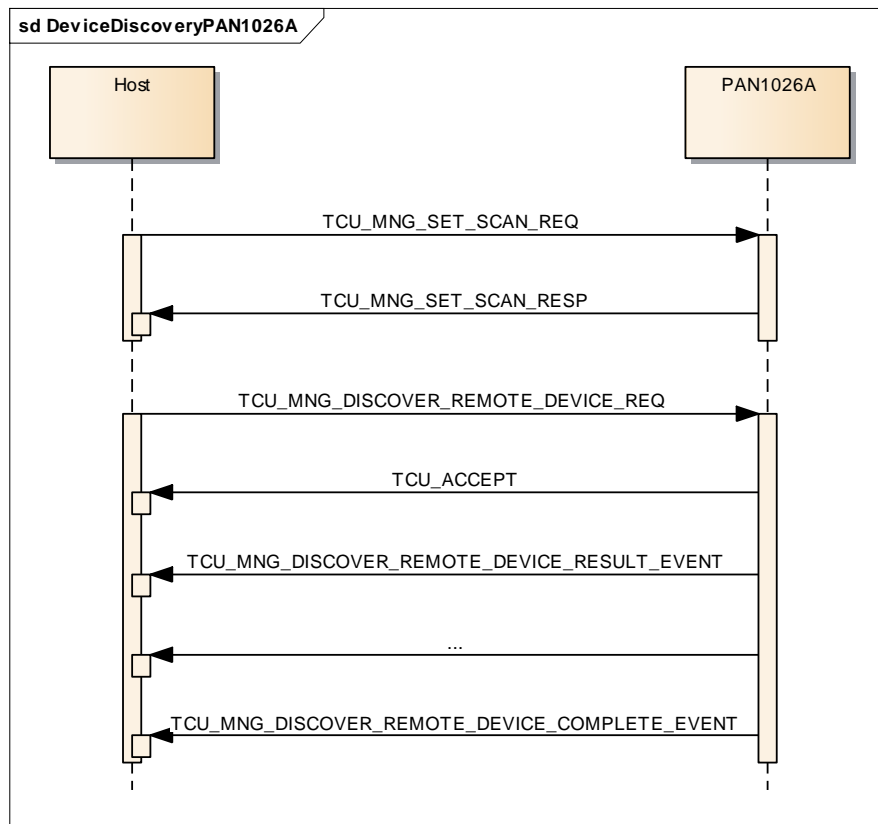
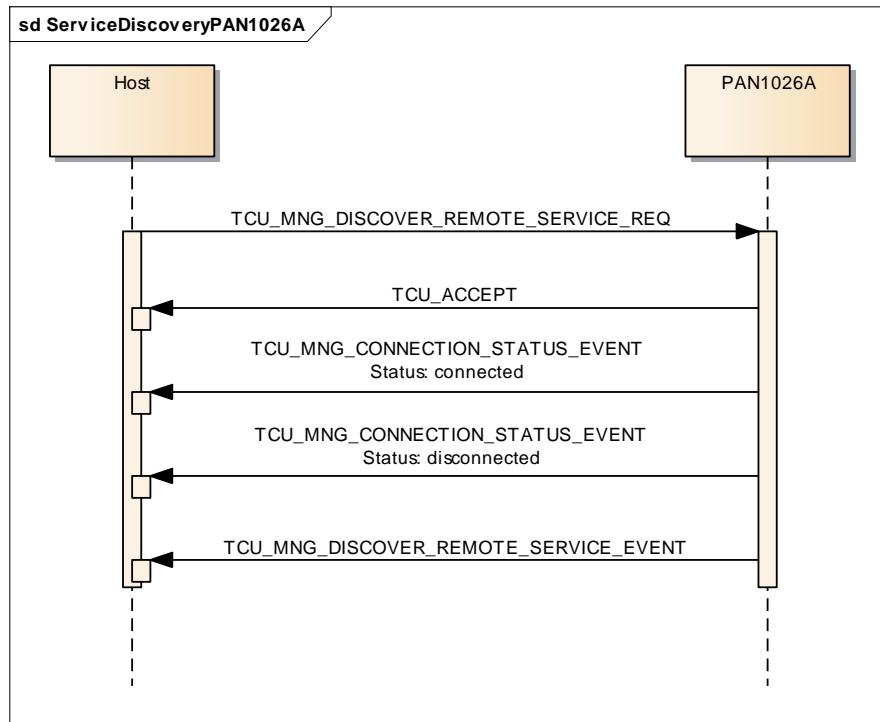> Please note that the device discovery can only be performed after the initialization has been successful.
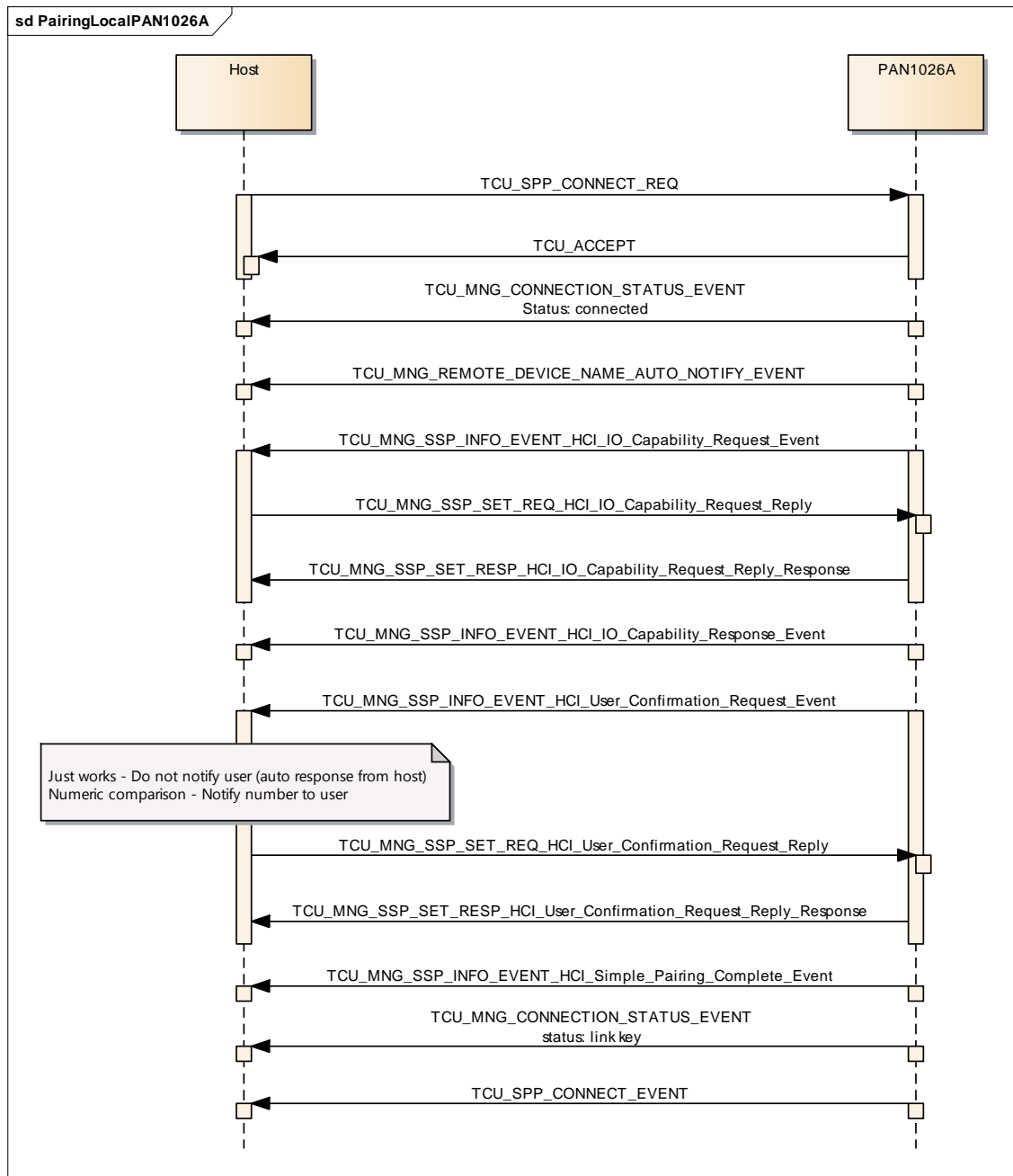
4.7.3 Service Discovery

Please note that the service discovery can only be performed after the initialization has been successful.
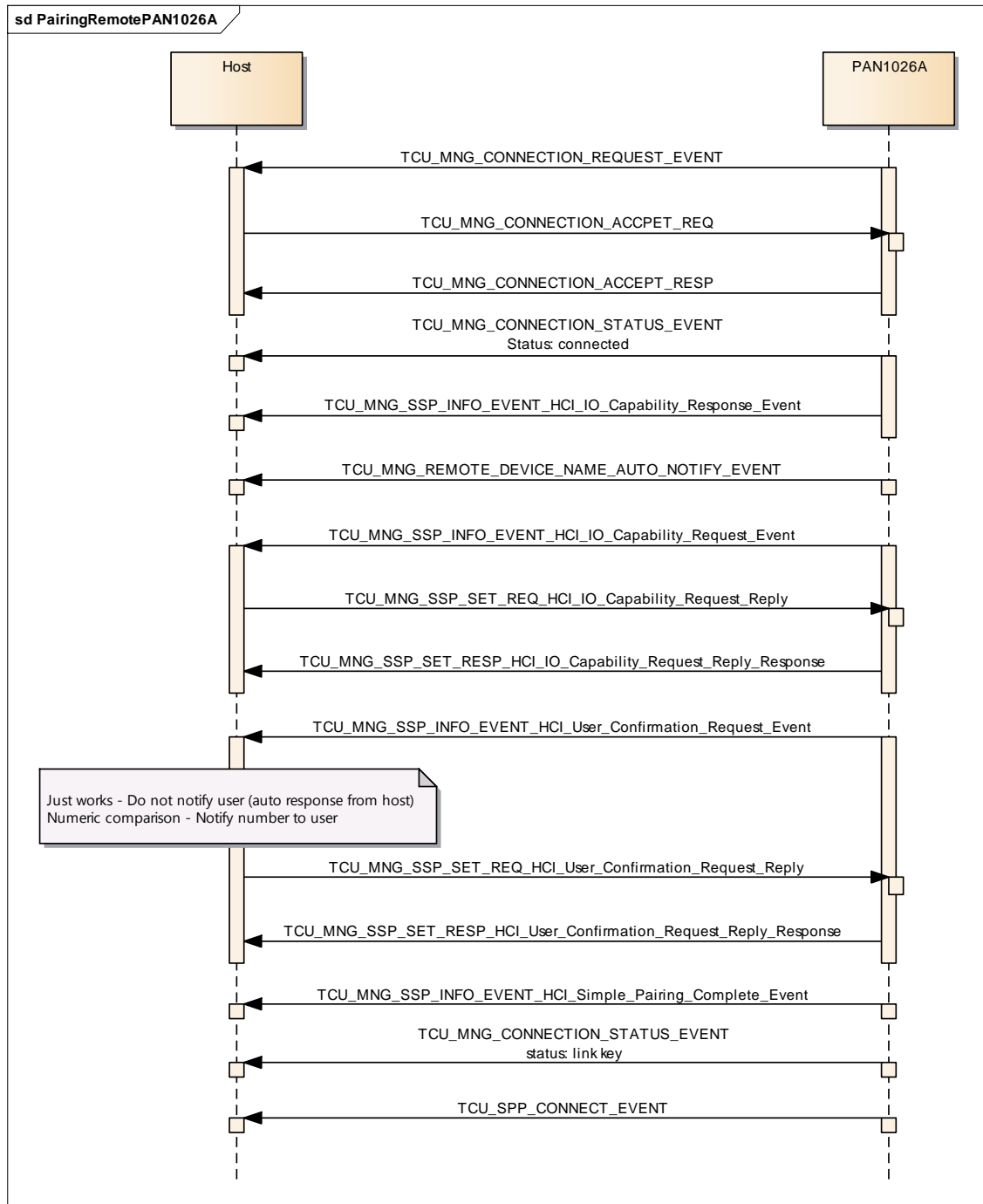
4.7.4 Connection Establishment

4.7.4.1 Pairing from Local Device

> ⓘ Please note that the connection establishment can only be performed after the initialization has been successful.

4.7.4.2 Pairing from Remote Device

sd PairingRemotePAN1026A

Host		PAN1026A

TCU_MNG_CONNECTION_REQUEST_EVENT

TCU_MNG_CONNECTION_ACCPET_REQ

TCU_MNG_CONNECTION_ACCEPT_RESP

TCU_MNG_CONNECTION_STATUS_EVENT
Status: connected

TCU_MNG_SSP_INFO_EVENT_HCI_IO_Capability_Response_Event

TCU_MNG_REMOTE_DEVICE_NAME_AUTO_NOTIFY_EVENT

TCU_MNG_SSP_INFO_EVENT_HCI_IO_Capability_Request_Event

TCU_MNG_SSP_SET_REQ_HCI_IO_Capability_Request_Reply

TCU_MNG_SSP_SET_RESP_HCI_IO_Capability_Request_Reply_Response

TCU_MNG_SSP_INFO_EVENT_HCI_User_Confirmation_Request_Event

Just works - Do not notify user (auto response from host)
Numeric comparison - Notify number to user

TCU_MNG_SSP_SET_REQ_HCI_User_Confirmation_Request_Reply

TCU_MNG_SSP_SET_RESP_HCI_User_Confirmation_Request_Reply_Response

TCU_MNG_SSP_INFO_EVENT_HCI_Simple_Pairing_Complete_Event

TCU_MNG_CONNECTION_STATUS_EVENT
status: link key
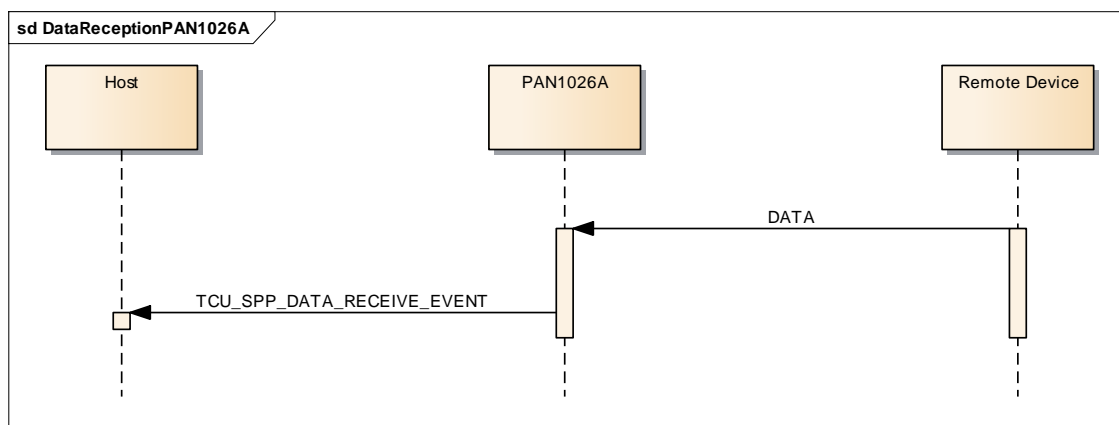
TCU_SPP_CONNECT_EVENT

ⓘ Please note that the connection establishment can only be performed after the initialization has been successful.

4.7.5 Data Transmission
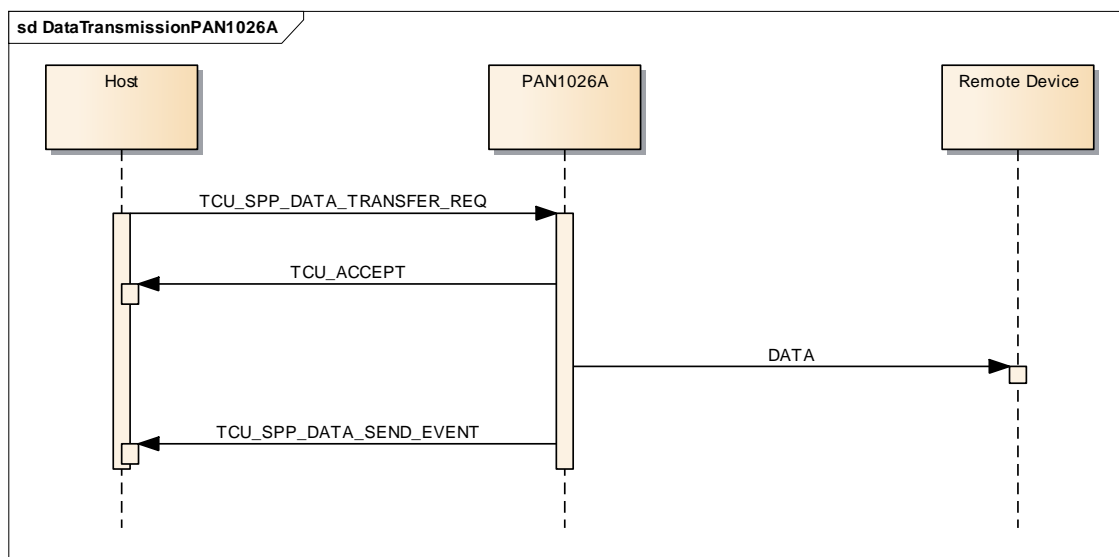
Please note that the data transmission can only be performed after the initialization and connection establishment has been successful.

4.7.6 Data Reception

Please note that the data transmission can only be performed after the initialization and connection establishment has been successful.

5 Appendix

5.1 Contact Details

5.1.1 Contact Us

Please contact your local Panasonic Sales office for details on additional product options and services:

For Panasonic Sales assistance in the **EU**, visit
https://eu.industrial.panasonic.com/about-us/contact-us
Email: wireless@eu.panasonic.com

For Panasonic Sales assistance in **North America**, visit the Panasonic Sales & Support Tool to find assistance near you at
https://na.industrial.panasonic.com/distributors

Please visit the **Panasonic Wireless Technical Forum** to submit a question at
https://forum.na.industrial.panasonic.com

5.1.2 Product Information

Please refer to the Panasonic Wireless Connectivity website for further information on our products and related documents:

For complete Panasonic product details in the **EU**, visit
http://pideu.panasonic.de/products/wireless-modules.html

For complete Panasonic product details in **North America**, visit
http://www.panasonic.com/rfmodules