Documentation Guide
for
PAN1026 / Toshiba TC35661

Version 1.1a

PANASONIC Bluetooth Module PAN1026 Documentation Guide

Document History

Version	Date	Author	Note
v1.0	**22-04-2014**	**ARE**	**Initial version**
V1.1	**22-08-2014**	**TH**	**Extended Introduction** **Include information about High Level API package and related documentation** **Added document name about configuration files for -501 (patches)** **Added document list about deep sleep mode use and power calculation for SPP and BLE mode** **Updated document name for TC35661 Hardware**
V1.1a	**10-09-2014**	**TH**	**Slight editorial amendments**

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Content

1. Acronyms, Definitions and References

Acronyms

API	Application Programming Interface
BT	Bluetooth
SPP	Serial Port Profile
MNG	Bluetooth Basic Management
CPU	Central Processing Unit
HCI	Host Controller Interface
UART	Universal Asynchronous Receiver Transmitter
HOST MCU	Host MCU device
Chiron	TC35661 Bluetooth HCI LSI
BLE	Bluetooth Low-Energy.
LE	Low-Energy
GATT	Generic Attribute Protocol
BLE	Indicates an Bluetooth Low-Energy Device

2. Introduction

Toshiba TC35661 is used with PAN1026, therefore all documentation refers to the Toshiba IC.

Along with TC35661-501 product, Toshiba provides a rich set of documents covering different topics, which might be relevant from a developer's perspective. This guide should help user find its way through the available documentation.

Notes:

a) It must be noted that TC35661-501 has an embedded and BQB qualified Bluetooth Stack V4.0, that can be used with HCI and extended HCI commands over UART. HCI standard commands are common to BT SIG specifications and not documented by Toshiba. Extended HCI commands are specific to Bluetooth LSIs and are documented by Toshiba. The format of HCI commands is explained in Chapter 4.1.1.

b) In addition TC35661-501 has > 300 embedded TCU commands, available over UART interface, that can be used to control nearly every bit and piece of the device. These TCU commands are is a mid-level Toshiba original API on top of the embedded stack, SPP classic profile and BLE GATT profile. Related documentation are shown in Table 1. The format of TCU commands is explained in Chapter 4.1.2. Flow Charts (called Message Sequence Charts) are described in Chapter 5.

c) Finally there is a High level abstracted Toshiba Bluetooth API, that is used on an external host controller to control the Bluetooth device and communication and simplifies the use of the device greatly. Toshiba offers a Bluetooth Application Package as API driver software, including reference profiles and demo applications. These can easily be ported to various host controllers, OS or OS-less configurations. Related documentation are shown in Table 2.

3. Available Documents

The following table lists documents describing TC35661-501 product, associated command set and different application scenarios.

Table 1. TC35661-501 Documentation

Nr.	Document	Desc.
Command Set Documents		
1	*TC35661APL_ROM501_Extension_HCI_E_18thSept2013*	Extended Host Controller Interface command set.
2	*TC35661APL_ROM501_MNG_E_26thJuly2013_1*	Device Management command set.
3	*TC35661APL_ROM501_LE_MNG_E_20thNovember2013*	Low-Energy Management command set.
4	*TC35661APL_ROM501_GATT_E_20thNovember2013*	GATT command set.
5	*TC35661APL_ROM501_SDB_E_26thJuly2013*	Service Database command set.
6	*TC35661APL_ROM501_SMP_SDS_E_21stAugust2013*	Security Manager Protocol command set.
7	*TC35661APL_ROM501_VEN_E_12ndDecember2013*	Vendor Specific command set
8	*TC35661APL_ROM501_SPP_E_24thJune2013*	Serial Port Profile command set.
Application Notes		
9	*TC35661APL_ROM501_SPP_LE_Application_Note_E_ 19thDec2013*	Generall stuff about dual-mode operation.
10	*TC35661APL_Deep_Sleep Function _July 2014*	Bluetooth LSI Sleep modes and use
11	*TC35661-501 Configuration Application Note V1.0*	Software patches for -501 firmware
12	*Simultaneous Operation of SPP and BLE App Note_v1.1*	Simultaneous operation of SPP classic & Bluetooth low energy.
Message Sequence Charts		
13	**TC35661APL_ROM501_SMP_MSC_E_3rdOctober2013**	Security Manager Protocol msg. Seq. charts.
14	**TC35661APL_ROM501_SPP_MSC_E_24thJune2013**	SPP classic message sequence chart.
15	**TC35661APL_ROM501_LE_MSC_E_20thNovember2013**	Bluetooth low-energy message sequence chart.

16	TC35661APL_ROM501_MNG_MSC_E_24thJune2013	BT Management sequence charts.
Datasheet		
17	**TC35661SBG-501_E_rev100_Oct_2013_Overview_Specification**	List of supported features.

The following table contains documents describing Software delivered along with Bluetooth TC35561-501 LSI.

Table 2. Software Documentation for TC35661-501 for Abstracted High Level API

Nr.	Document	Desc.
SW API Specifications		
1	**BT_LE_GATT_driver_specification**	High-level Bluetooth low-energy API specification.
2	**BT_LE_API_specification**	Low-Level Software driver specification.
3	**BT_SPP_API_specificationV1.01**	SPP API specification.
SW Application Notes		
5	**BT_LE_HeartRate_Profil_Application_Note_v1.01**	Shows how to develop Heart Rate profile for Bluetooth low-energy.
6	**BT_SPP_Application_Note_v1.01**	Shows how to use SPP API in the most efficient way.

4. Command-Set Documents

The command set of TC35661-501 is described in 8 individual documents (see Table1.), whereby each document describes a particular group of commands. The following table lists all command groups.

Table 3. Command Groups

Command Group	Description
Extension_HCI	Toshiba extended set of HCI commands.
MNG	General LSI management commands.
LE_MNG	Bluetooth low-energy management commands.
LE_GATT	General GATT commands.
LE_GATT_SDB	GATT Server Database commands.
LE_SMP_SDS	Security manager protocol command set.
VEN	Vendor (Toshiba) specific commands.
SPP	SPP classic (Serial Port Profile) commands

4.1. *Command Naming Convention*

There are two types of TC35661-501 commands:

1. **HCI Extension** [1]commands (Host Controller Interface level commands)

2. **TCU** commands (Higher-level commands)

Depending on operation mode used, you will either need to use HCI or TCU commands. Please note that both of them have their own naming convention.

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[1] **HCI Extension commands are commands defined by Toshiba. These commands are an addition to the standard set of HCI commands defined by Bluetooth SIG.**

4.1.1. HCI Extension Commands

<u>HCI Extension</u> commands described in the documentation all follow the same naming convention:
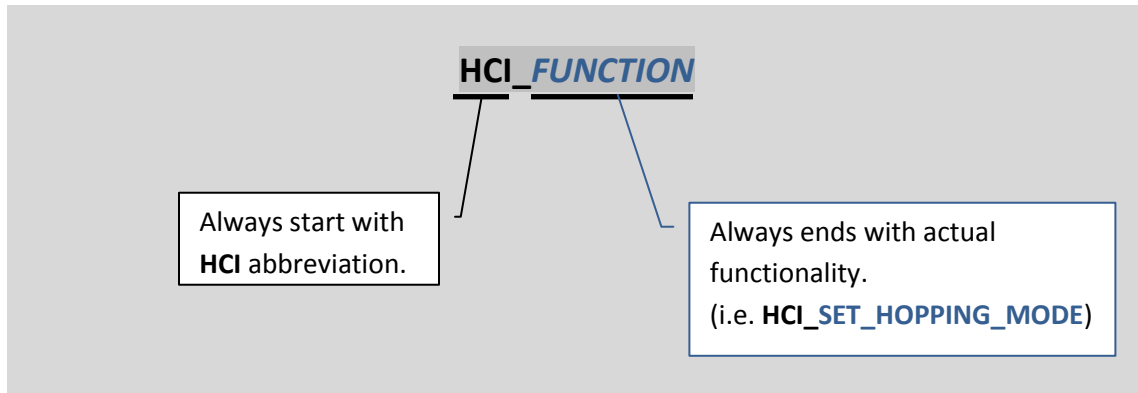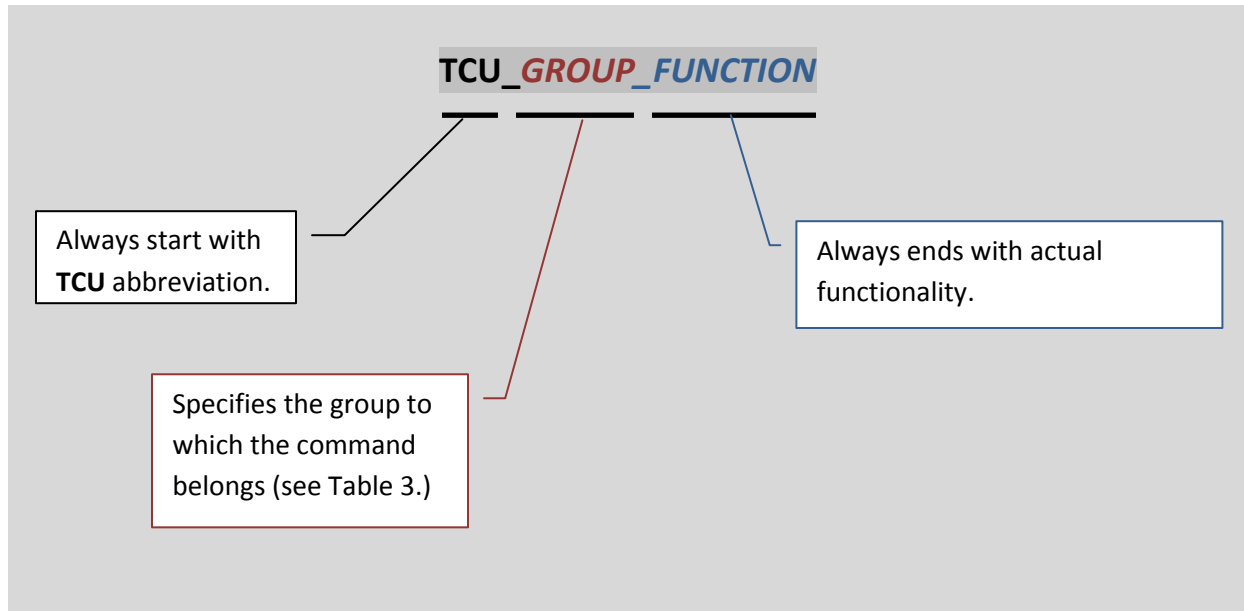

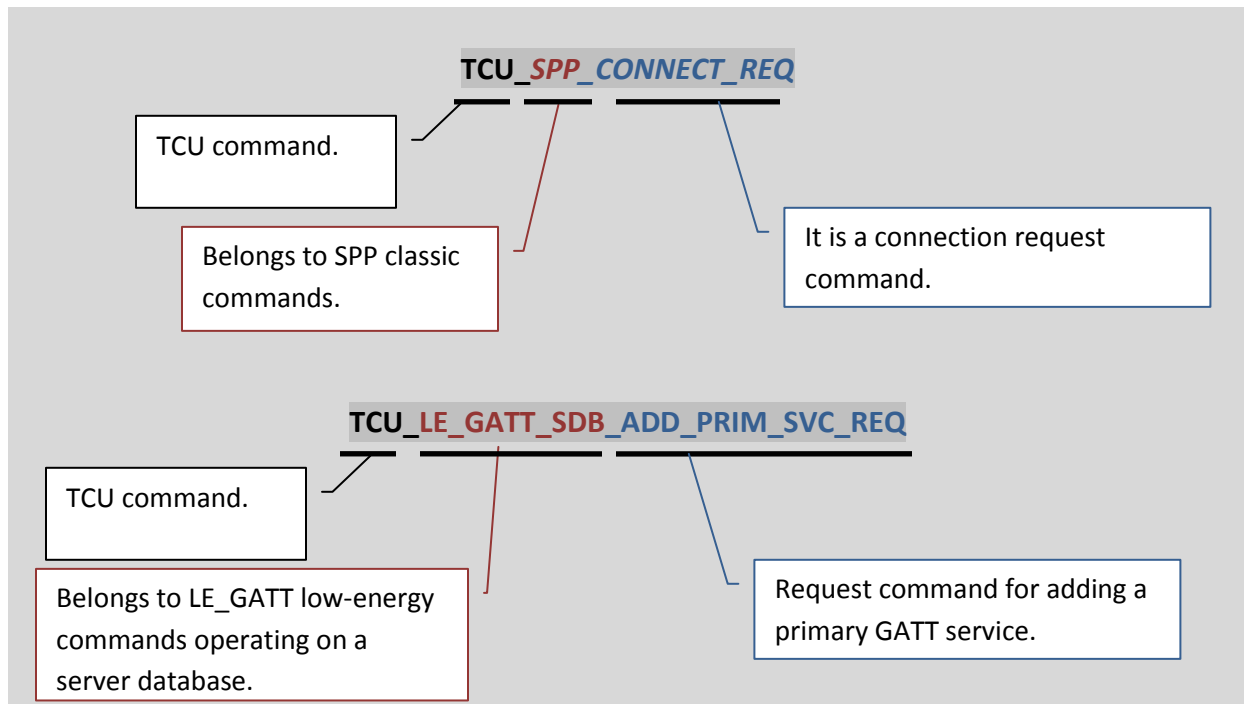Please note that **Extension HCI** document, as its name says, lists Toshiba defined HCI extension commands <u>only</u>.

The description of a <u>standard</u> HCI command set, as defined by Bluetooth SIG, can be found in: **Bluetooth 4.0 Core Specification** *Vol. 2 -> Part E -> "Host Controller Interface functional specification" -> 7. HCI COMMANDS AND EVENTS.*

4.1.2. TCU Commands

As it is the case with HCI extension commands, TCU commands also follow their own naming convention:

TCU_*GROUP*_*FUNCTION*

Always start with **TCU** abbreviation.

Specifies the group to which the command belongs (see Table 3.)

Always ends with actual functionality.

Examples:

TCU_*SPP*_*CONNECT_REQ*

TCU command.

Belongs to SPP classic commands.

It is a connection request command.

TCU_*LE_GATT*_*SDB*_*ADD_PRIM_SVC_REQ*

TCU command.

Belongs to LE_GATT low-energy commands operating on a server database.

Request command for adding a primary GATT service.

4.2. *Locating Command Description*

The first thing you need to do is to find out what type of the command it is (HCI or TCU). All HCI commands, as stated before, start with **HCI_...** and all TCU commands with **TCU_...** . Once you know of which type your command is and in case of TCU commands to which group it belongs, you can use following table to locate the document that describes it.

Table 4 Command-document mapping

Command Type	Command Group	Document
HCI	-	*- Extension HCI: TC35661APL_ROM501_Extension_HCI_E_18thSept2013* *- Standard HCI: Bluetooth 4.0 Core specification.*
TCU	MNG	*TC35661APL_ROM501_MNG_E_26thJuly2013_1*
	LE_MNG	*TC35661APL_ROM501_LE_MNG_E_20thNovember2013*
	LE_GATT	*TC35661APL_ROM501_GATT_E_20thNovember2013*
	LE_GATT_SDB	*TC35661APL_ROM501_SDB_E_26thJuly2013*
	LE_SMP_SDS	*TC35661APL_ROM501_SMP_SDS_E_21stAugust2013*
	VEN	*TC35661APL_ROM501_VEN_E_12ndDecember2013*
	SPP	*TC35661APL_ROM501_SPP_E_24thJune2013*

4.2.1. Example: Locating HCI Commands

1. **Extension** HCI command:

   Command **HCI_LOC_SET_WHITENING_MODE** *belongs to the extended set of HCI commands and is described in* **TC35661APL_ROM501_Extension_HCI_E_18thSept2013** *document.*

2. **Standard** HCI command:

   Command **HCI_Reset** *belongs to the standard HCI command set and therefore it is not listed in Toshiba documentation. This command can be found in* **Bluetooth 4.0 Core Specification Vol. 2 -> Part E -> "Host Controller Interface functional specification" -> 7. HCI COMMANDS AND EVENTS->7.3.2. Reset Command.**

4.2.2. <u>Example</u>: Locating TCU Commands

1. **TCU_SPP_CONNECT_REQ:** Belongs to SPP command group and can be found in the *TC35661APL_ROM501_SPP_E_24thJune2013* document.

2. **TCU_LE_GATT_SDB_ADD_PRIM_SVC_REQ:** Belongs to Bluetooth low-energy **GATT** commands operating over **Server Database**. Can be found in *TC35661APL_ROM501_SDB_E_26thJuly2013* document.

3. **TCU_VEN_SET_GPIO_WRITE_RESP:** Belongs to Vendor specific command group and can be found in *TC35661APL_ROM501_VEN_E_12ndDecember2013* document.

4. **TCU_MNG_DISCOVER_REMOTE_DEVICE_REQ:** Belongs to general management commands and can be found in *TC35661APL_ROM501_MNG_E_26thJuly2013_1* document.

5. Message Sequence Chart Documents

In order to illustrate how different Bluetooth procedures should be carried out, Toshiba provides a set of Message Sequence Chart documents (see Table 1). These charts show the exact sequence of the TC35661-501 commands/events exchanged between Host CPU and BT chip (see Figure 1).

Figure 1 Message Sequence Chart Example
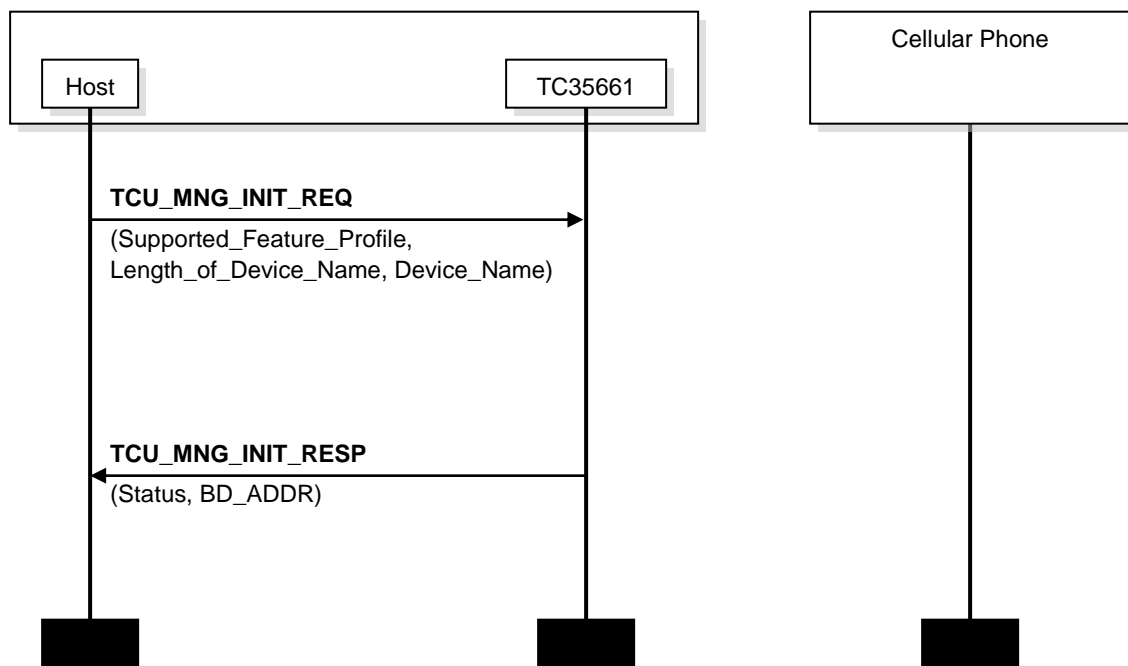
Above sequence for instance shows initialization sequence of the TC35661-501 and is described in **TC35661APL_ROM501_MNG_MSC_E_24thJune2013** document.

6. DataSheet

Toshiba supplies datasheet to describe the hardware and available features of TC35661-501. Pls note thet different versions of TC35661-xxx exist. They vary by embedded firmware and result in different list of supported features.

7. Software Documentation for High Level API

In case you are using the Bluetooth Application Software package for TC35661-501 provided by Toshiba Electronics Europe GmbH, there is a set of Software documents you can use (see Table 2).

Software documents are generally divided in following categories:

1. High-level API specifications (abstract SPP and BLE Software APIs)

2. Driver level API specifications (command encapsulation layer),

3. Application Notes (for SPP classic and Bluetooth Low-Energy).

In case you would like to quickly understand how the SPP classic or Bluetooth Low-energy works, the Software application notes might be quite helpful. Example of BLE profile for Heart-Rate is included.

The architecture of the High Level API is shown below for information only (Figure 2). Pls read more details in the High Level API Software Package available on Toshiba Electronics Europe GmbH Internet.

Pls check for technical documents on this site:

http://www.toshiba-components.com/bluetooth/index.html

Figure 2 High Level API Software Architecture
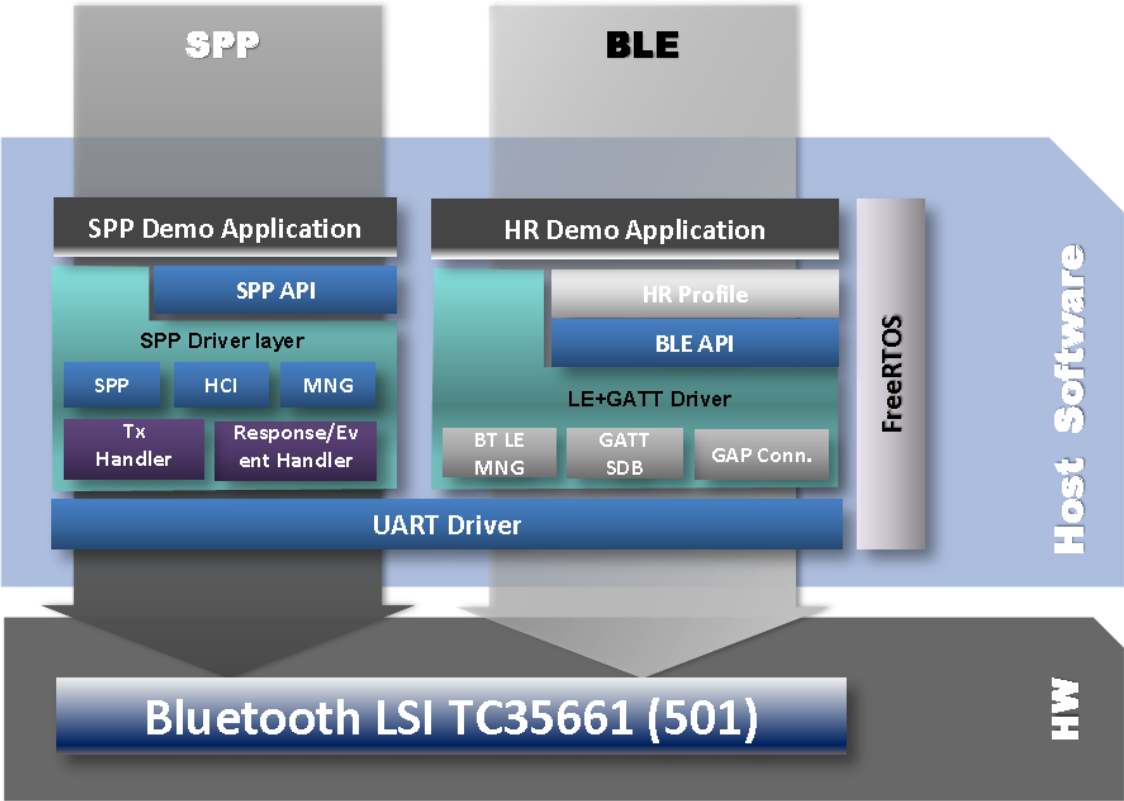
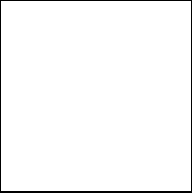# 8. TC35661-501 Application Notes

Available application notes cover different application areas and scenarios (see Table 1). Currently, there are application notes for TC35661-501 illustrating different interesting topics, like HW connection between CPU and BT chip, UART data transmission, simultaneous operation of SPP and BLE, sleep mode, optimization of the RF characteristic, power down power optimization etc.

In case you are looking for such kind of information, this is the right place to search for it.

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