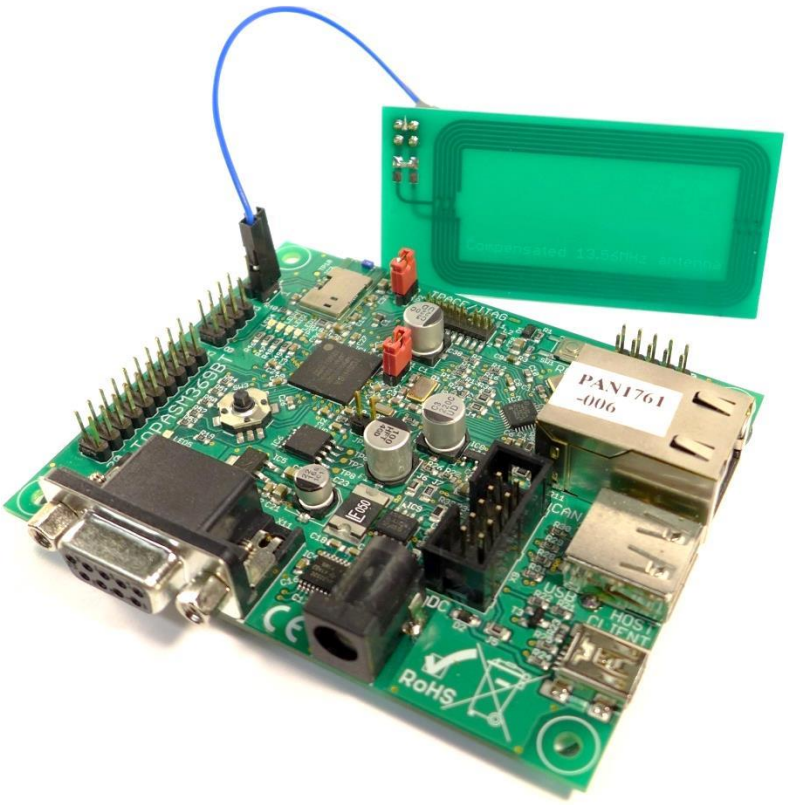
Design Guide

PAN1761-EMK

BMSKTOPASM369BT1761(kc)



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1 SCOPE OF THIS DOCUMENT

This Design Guide applies to the PAN1761 Bluetooth® + NFC EMK (Evaluation Module Kit). The EMK is based on the Toshiba BMSKTOPASM369BT1761(kc) development platform.

The intention of this document is to enable customers to easily and quickly get their projects running and to reduce the integration time for the PAN1761 module. Guidance on module-integration by means of reference design and module antenna placement recommendation is provided in order to help to achieve the best performance.

This Design Guide covers different aspects of the development process:

In section 4 you will find a startup-guide to set up the PAN1761-EMK and the relevant software to start development for the PAN1761 Bluetooth® + NFC module.

The following section 5 is covering the Toshiba Bluetooth® SDK and API for the PAN1761 module, which can be accessed via the Toshiba Bluetooth® Developer Zone.

A reference design for the PAN1761 Bluetooth® + NFC module as well as additional information about the usage of the NFC and Out-of-Band-Pairing feature of the PAN1761 are described in section 6.

2 BLUETOOTH®

The Bluetooth® SIG specifies two types of implementation: Bluetooth® Low Energy (LE) and Bluetooth® Basic Datarate (BR). The PAN1761 as a LE module implements the low energy specification and consumes just a fraction of the power of Basic Datarate devices, allowing the short-range wireless standard to extend to coin cell battery applications.

Note:

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The "N" Mark and the NFC Certification Mark are trademarks or registered trademarks of NFC Forum, Inc.

4 STARTUP GUIDE

The PAN1761 Bluetooth® + NFC Starter Kit uses the Toshiba BMSKTOPASM369BT1761(kc) development board. The board has been designed to use different Panasonic Bluetooth® modules. This manual is for the combination of M369 (MCU) and the PAN1761 (Bluetooth® Module) that is based on Toshiba´s single chip TC35670.

http://toshiba.semicon-storage.com/eu/product/wireless-communication/bluetooth.html

Starter-Kit Content:

- Toshiba BMSKTOPASM369BT Board with PAN1761 (Note: The board is generic and other starter kit use different type of modules.)
- Segger J-Link JTAG/SWD Emulator with USB interface including J-Link 19-pin Cortex-M Adapter and USB Cable
- Panasonic NFC Antenna with 2 cables

http://toshiba.semicon-storage.com/eu/product/wireless-communication/bluetooth/TC35670-Starterkit.html

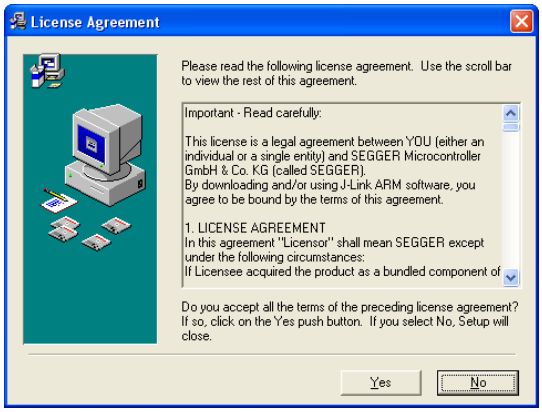
The Starter Kit as it comes out of the box, can be tested by following steps:

1. Connect USB power with the cable.
2. Connect NFC antenna to the board.
3. Check the module's bluetooth function by e.g. Melody Smart App on iOS or Android.
4. Check the NFC tag by e.g. NXP App "NFC Info" on Android.

4.1 DRIVER INSTALLATION FOR SEGGER J-LINK JTAG/SWD EMULATOR

! Before you connect the debug probe to the target board, please install the drivers first.

1. Before you plug your J-Link / J-Trace into your computer's USB port, extract the setup tool Setup_JLinkARM_V<VersionNumber>.zip. The setup wizard will install the software and documentation pack that also includes the certified JLink USB driver.



2. Start the setup by double clicking Setup_JLinkARM_V<Version-Number>.exe. More information about the installation and about the debug probe itself can be found on the Segger website.

3. Connect your J-Link via USB with your PC. The J-Link will be identified and after a short period the J-Link LED stops rapidly flashing and stays on permanently.

https://www.segger.com/jlink-debug-probes.html

4.2 INSTALLING THE IDE

Depending on your preferences you may want to install and use one of the following IDEs with our board:

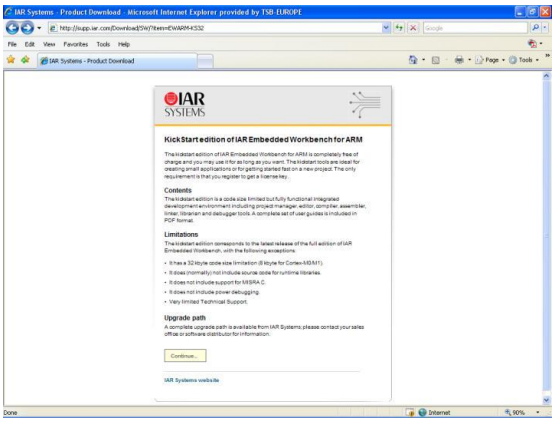
- IAR Kickstart Edition
- Keil MDK with µVision IDE/Debugger

4.2.1 IAR EWAR

Software Tool Vendor :	IAR http://www.iar.com/Products/IAR-Embedded-Workbench/ARM/
Name of Environment :	IAR Embedded Workbench for ARM

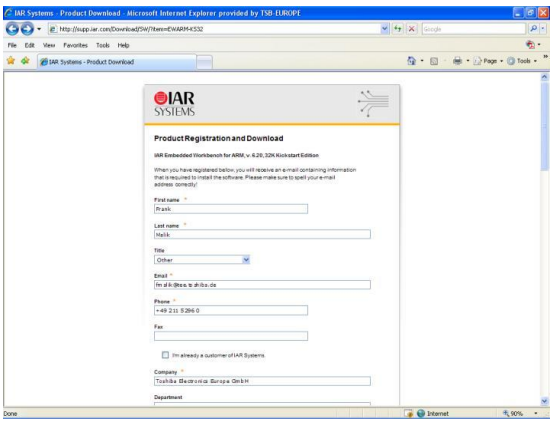
You can download the latest version from IAR website.

1. When you click on "continue" you will be sending to the registration form.



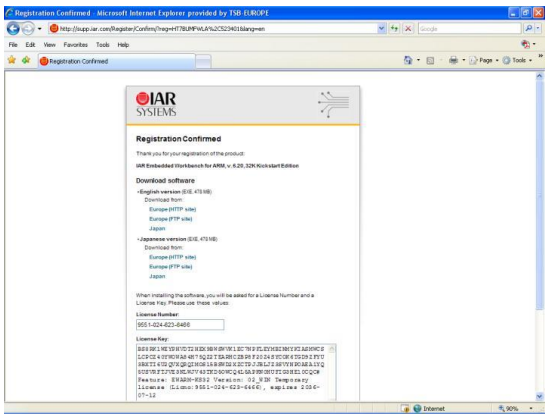
2. On the registration form you have to enter some basic information and answer some questions about your project.

3. After registration you will receive an email with further instruction.



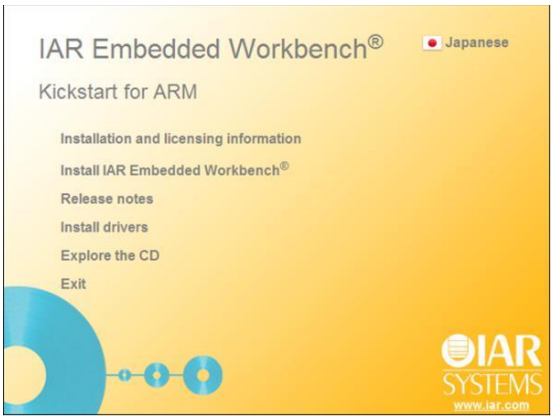
4. By confirming this registration you will open the download webpage which also contains your license number and license key. Optionally you can allow receive this information by email for later use. You should do this!

5. Download the executable from one of the listed websites.



6. Start the downloaded executable file.

7. Click on "Install IAR Embedded Workbench"

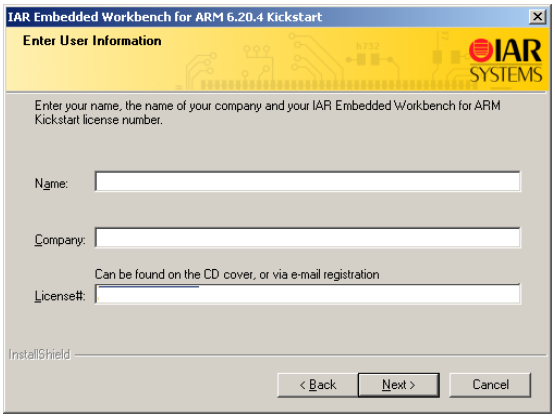


8. Click on "Next" until you have to enter the User Information.

9. Please enter your Name and Company.

10. Enter or copy the License number from the Email you have received before.

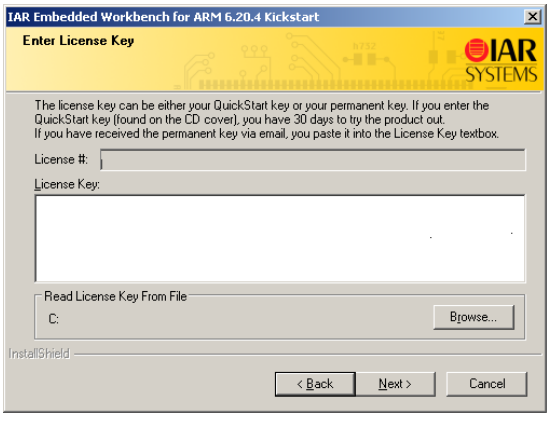
11. Click "Next".



12. In the screen "Enter License Key", please copy the license key from the registration email.

13. Click "Next"

14. The installation will start now. Depending on the speed of your system this may take quite a while.

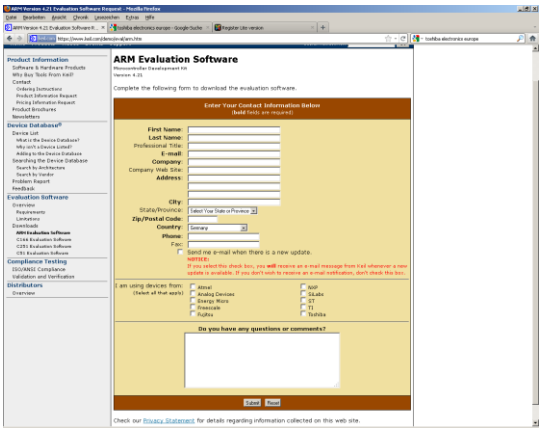


4.2.2 Keil MDK

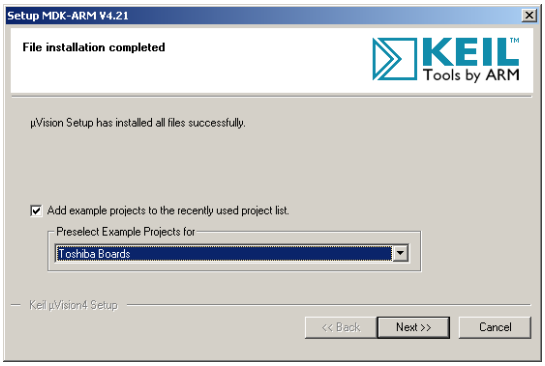
Software Tool Vendor :	Keil, www.keil.com
Name of Environment :	MDK Version 5 Microcontroller Development Kit

The Keil MDK µVision software works together with the Segger J-Link and other tools. You can download the latest version from the software download site.

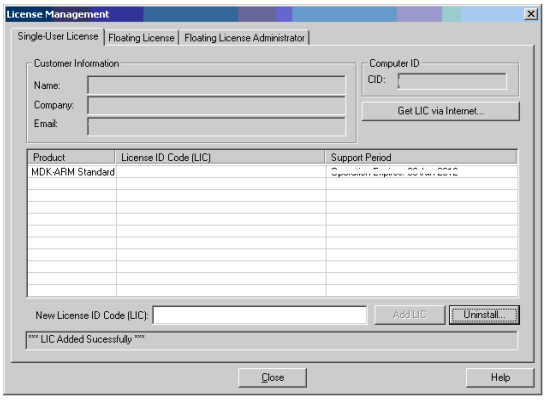
1. When you click on download you will have to register on the following form:



2. After registration you will be sending to the download page, from where you can get the latest version of the software. Please download the file to your computer.
3. Start the executable file.
4. At the end of the installation you will be asked for selecting the example projects.
   Select Toshiba Boards.



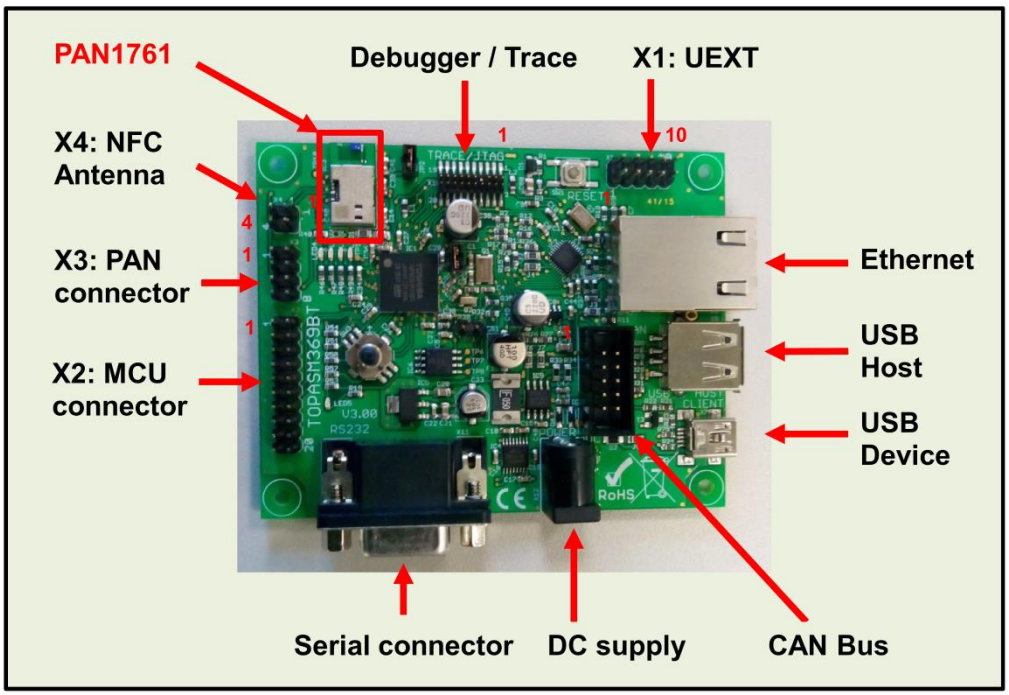
5. If you have a registration code for ARM-MDK and want to install this, start up Keil MDK.
   Select File → Licence Manager.
6. Click on "Get LIC via Internet"
7. On the opened Browser page fill in the code you have received under "Product Serial # (PSN)"
8. After submitting you will receive a mail with the LIC.
9. Copy this over to the "New Licence ID Code (LIC)" field and click "Add LIC".



4.3 HARDWARE SETUP OF THE BMSKTOPASM369BT1761(KC)

4.3.1 Connectors and power supply of the board

Place the MCU Board in front of you as below. The major connectors on the board are as follows.



The board is generic and other starter kit use different type of modules. This board is equipped with PAN1761.

The board can be powered in three ways:

- By the USB client connector
- By the debug connector
- By the DC jack connector

These three inputs are secured by diodes. There is no need to select a power input by a jumper.

!!! Please note when you make use of the power supply by a debug probe like the JLINK that comes with that starter kit, that this function is disabled by default. This can be enabled by the **J-Link Commander.** JLink.exe is a command line based utility that is part of the Segger J-Link software package. When you enter at the prompt the command "power on perm" power supply to the target will be done by the J-LINK.

http://www.segger.com/j-link-commander.html

The input voltage provided to the board by the USB device or the DC Jack has to be 5V.
That 5V could be used as USB Host output voltage and is switchable by the port PK3 (active high enable) and has overcurrent detection connected to PK1 (active low trigger). Please note that the current capability of this USB host is much lower than the USB specification of 500mA (~100mA). Furthermore the 5V is provided to the CAN transceiver. For the other circuit the main supply voltage of 3.3 volt is derived by a linear regulator.

4.3.2 Pin Out of Connectors

CAN Connector

	1	2	GND
CAN_L	3	4	CAN_H
GND	5	6	
	7	8	V+ (5V)
	9	10	

Connector : CAN Signals according to CiA

PAN Connector (X3)

PAN1760 has several ports. These ports are also used as input/output pins as well as for built-in peripheral functions. For the header pin some terminal has been selected. The description below shows the major function, for the details refer to the PAN1760 Data Sheet.

VCC	1	2	GND
GPIO5/UARTRTS/UART2TXD	3	4	GPIO6/UARTCTS/UART2RXD
GPIO4 / UARTRXD	5	6	GPIO3/UARTTXD
RESET_PAN/PD7	7	8	GPIO1/AIN0

NFC Connector (X4)

That connector has been separated to be used for as antenna connector for the NFC version, PAN1761.

NC	3	1	TAG_L1
NC	4	2	TAG_L0

UEXT Connector (X1)

VCC	1	2	GND
PE5 / TXD1	3	4	PE6/ RXD1
PF6 / CL1	5	6	PF7 / SDA1
PB3 /SP2DO	7	8	PB2 / SP2CLK
PB2 / SP2CLK	9	10	PB5 / SP2FSS

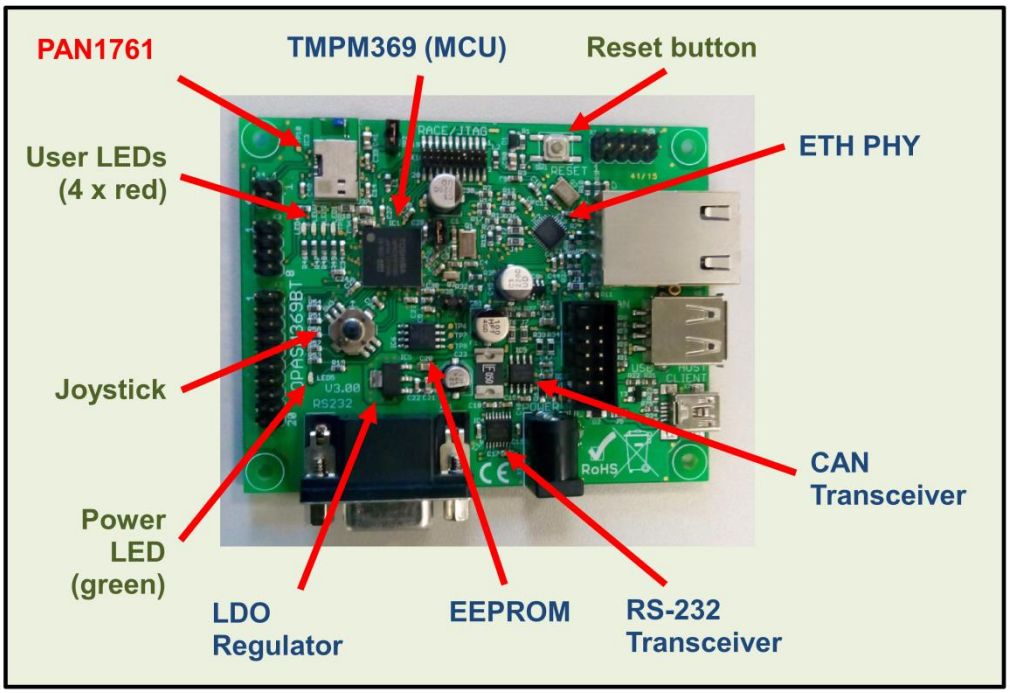
MCU Connector (X2)

TMPM369 has several ports. These ports are also used as input/output pins as well as for built-in peripheral functions. For the header pin some terminal has been selected. The description below shows the major function, for the details refer to the TMPM369 Data Sheet.

VCC	1	2	GND
DA0	3	4	DA1
PJ0 / AINB4	5	6	PJ1 / AINB5
PJ2 / AINB6	7	8	PJ3 / AINB7
PI0 / AIN0 / INT9	9	10	PI1 / AIN1 / INTA
PI2 / AIN2 / INTB	11	12	PE4 / SCLK1 / A4 / A20 / CTS1 / TB2OUT
PE7 / A7 / A23 / INT6 / TB2IN	13	14	PG4 / D12/AD12 / YO0 / SP1CLK
PG5 / D13/AD13 / VO0 / SP1DO	15	16	PG6 / D14/AD14 / XO0 / / SP1DI
PG7 / D15/AD15 / UO0 / SP1FSS	17	18	PH1 / CS1 / TB4OUT / GEMG2 / SI2/SCL2
PH0 /TB5OUT /MT2IN /SO2 /SDA2	19	20	NMI

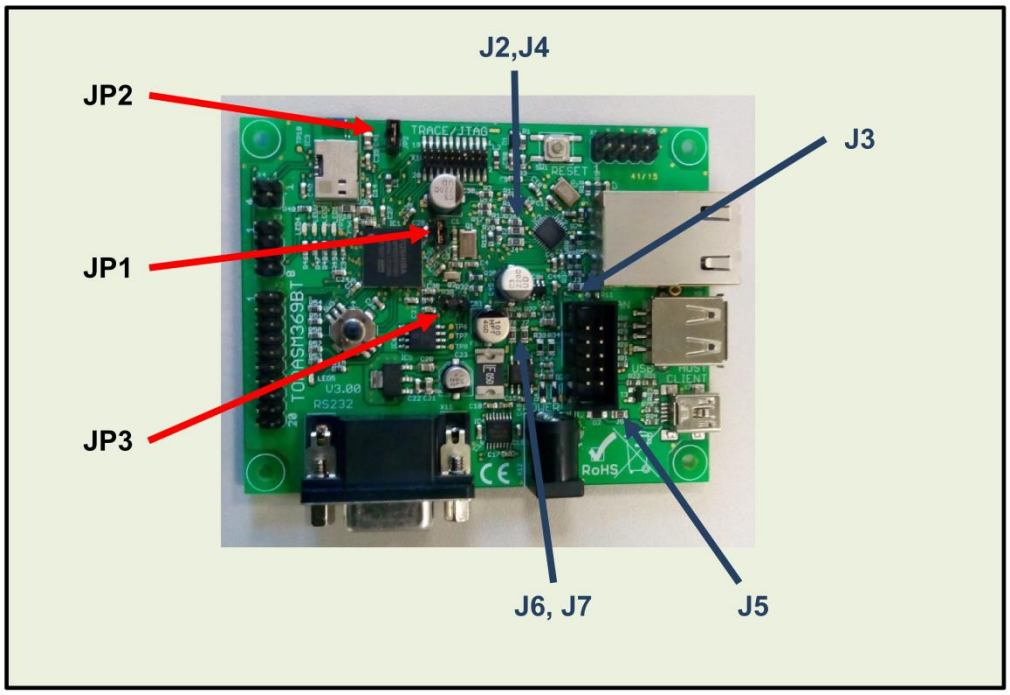
4.3.3 Component placement and jumpers of the board

The major component placement on the board is as follows:



- The joystick is connected to the port PD0...PD4.
- The user LEDs are connected to the port PC0...PC3.

The major jumpers and 0-Ohm resistors on the board are positioned as follows:



The jumpers JP1 and JP2 are normally closed. They can be opened to separate the microcontroller or the Bluetooth® module from VCC and to insert an ammeter there in order to measure current draw.

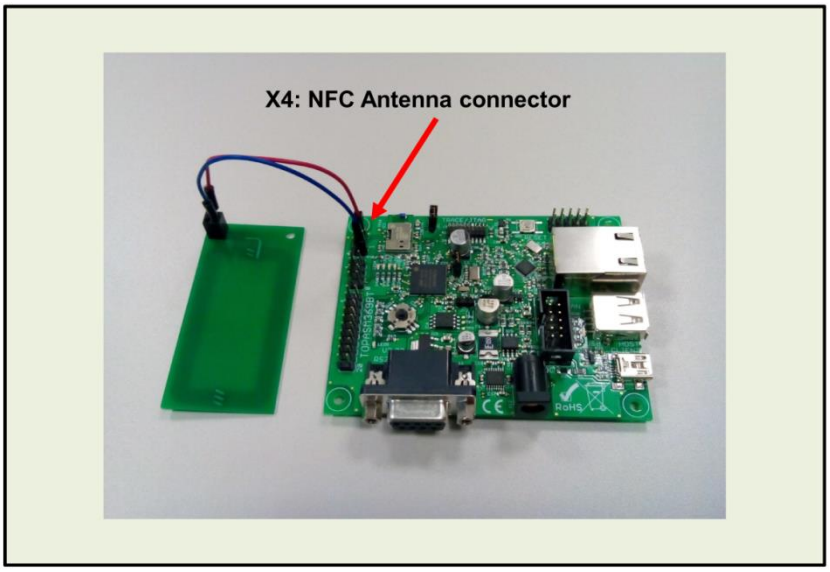
- JP1 is for TMPM369 power supply (default setting: close)
- JP2 is for PAN1761 power supply (default setting: close)
- JP3 can be used to connect the BOOT-mode-pin of the microcontroller to GND (default setting: open)

The board is populated with 0-Ohm resistors, which can be easily identified because their SMD size is 0805 (regular resistors are SMD size 0603).
They are populated by default, except J3, and can be de-soldered to change the behavior of the board.

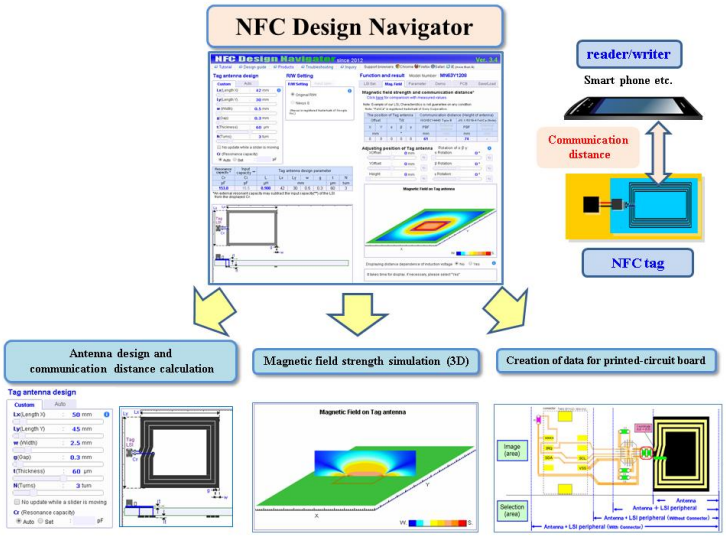
- J2 connects of PHY interrupt to MCU port PI3
- J3 connects LED of the PHY to MCU port PH7
- J4 connects reset input of the PHY to the reset button.
- J5 connects power input of the usb client connector to MCU port PK0
- J6 connects STB line of ZJA1040 CAN-Transceiver to GND.
- J7 connects pin 5 of CAN-connector to GND.

4.3.4 NFC Antenna

An NFC antenna must be connected to the NFC connector (X4), to the terminals TAG_L1 and TAG_L0, by wire or in example direct as shown in the picture:



For the development of NFC compliant antennas, Panasonic offers an online design tool called "Panasonic NFC Design Navigator". This tool supports the user in the development of the antenna design, the RF path and the PCB layout.



The tool can be accessed via the following link:

http://www.semicon.panasonic.co.jp/en/tool/nfcdesignnavigator/#

4.3.5 Out-of-Band Pairing

The NFC Forum Type 3 compliant tag feature of the PAN1761 module simplifies the pairing process with the PAN1761. By using Out-of-Band Pairing the user does not have to handle pairing keys. The pairing process can be triggered by the NFC tag. This makes the pairing both secure and user-friendly at the same time.

The Out-of-Band Pairing feature can be evaluated by using the Toshiba Pairing over NFC Package. This package includes:

- Application source code and "pairing via NFC" library for Cortex M3 processor.
- Android demo application source code.
- Application Note about the concept of Out-of-Band Pairing

To access the package please register for the Toshiba Bluetooth Developer Zone first. The registration process is described in section 5.

After registration you will find the Package in the Download Zone. To get access a special confirmation is needed. By clicking on the following link the user can request access to the package.

https://apps.toshiba.de/extranet/display/TBTSW/Pairing+over+NFC+Package

The access then will be granted by a Toshiba representative.

Please Note:

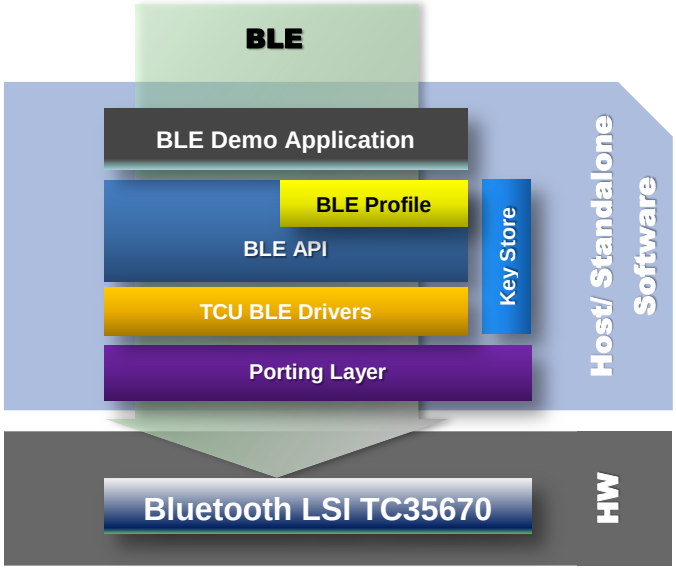
As of now, not all NFC-enabled Android devices are compatible to Out-of-band Pairing.

The BLE and NFC behavior of different Android versions and Smartphone manufacturer deployments may vary slightly.

Therefore, when designing your final Android App, please be sure to test with as many smartphones and Android versions as possible.

5 BLUETOOTH® SDK AND HIGH-LEVEL APIS

The Toshiba Bluetooth® SDK is the best way to speed up the development process and to easily test applications on the PAN1761 module.



The easy to use high-level BLE API for PAN1761 shown above helps to setup, connect and to transfer data in an easy way. Driver layer provide access to the entire function set of the module. Bluetooth® Low Energy application example is available on Toshiba CortexM3 MCU with FreeRTOS integration.

With the LE+GATT Driver the use of PAN1761 Command Interface is simplified. It encapsulates Chiron LE MNG, GAP & GATT Commands in one.

The API is accessible through the Toshiba Bluetooth® SDK. For full development support, from documents to software downloads, please register for the Toshiba Bluetooth® Developer Zone. There the Toshiba Bluetooth® SDK will also be available.

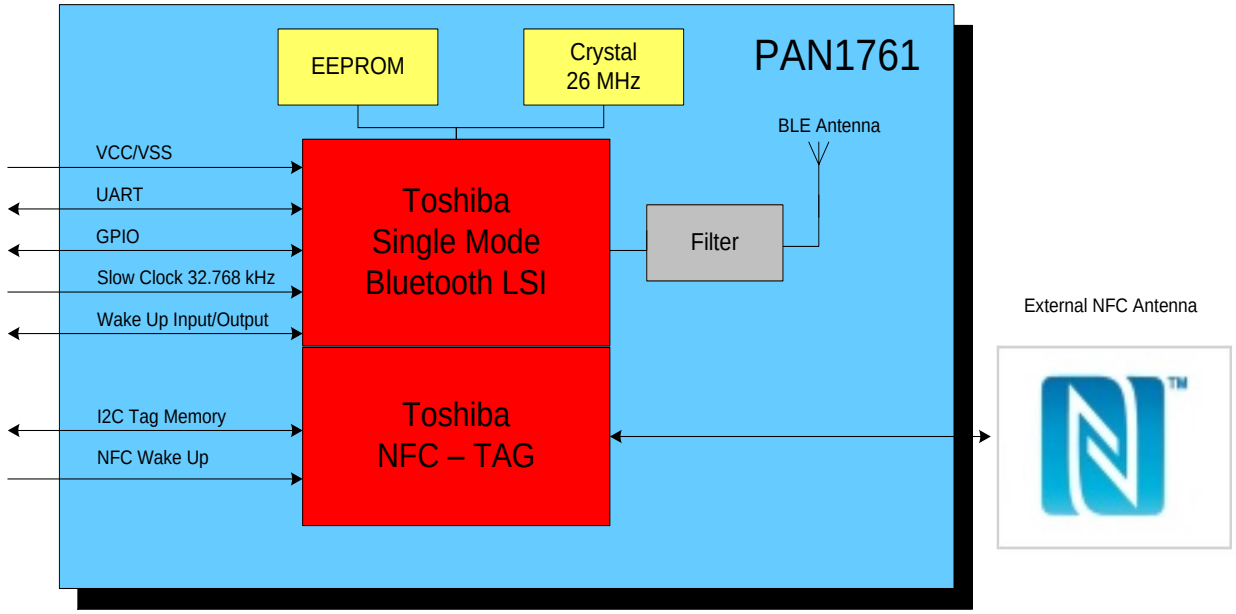
For registration visit: https://apps.toshiba.de/web/SDKRegistration/

After registration (may take up to 3 days) you can access the Developer Zone via the following link:

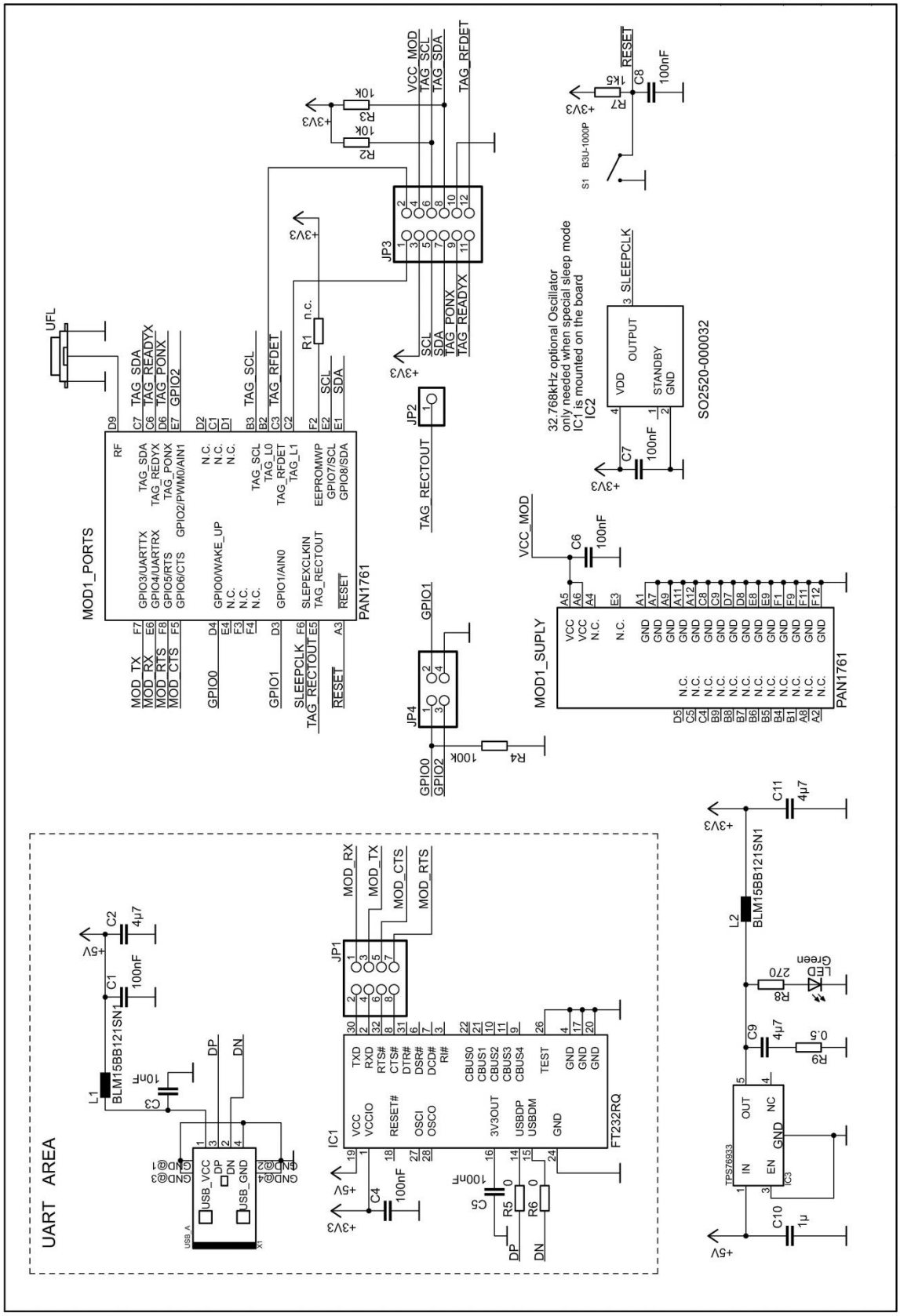
https://apps.toshiba.de/extranet/display/TBTSW/Toshiba+Bluetooth+Software+Page

6 REFERENCE DESIGN PAN1761

6.1 PAN1761 BLOCK DIAGRAM



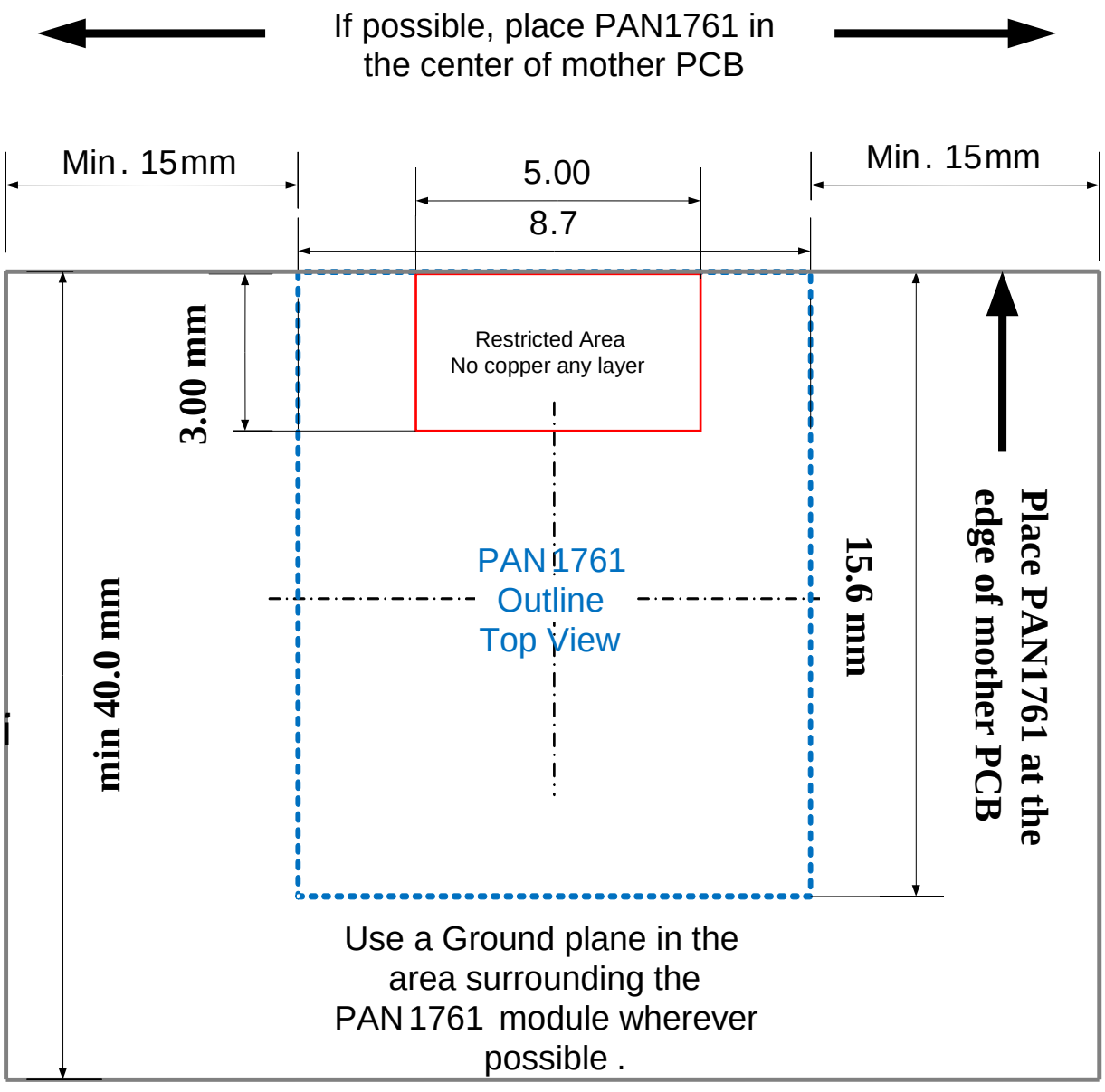
6.2 PAN1761 REFERENCE DESIGN SCHEMATIC



The above shown reference design for the PAN1761 module shows the basic connection to the module, including power supply, serial data connection via USB, antenna connections, sleep clock and reset circuitry.

6.3 BLUETOOTH® ANTENNA PLACEMENT RECOMMENDATION

PAN1761 WITH ANTENNA PLACEMENT



Dimensions are in mm .

6.4 UNIQUE MAC/BLUETOOTH® ADDRESS

If the Toshiba Bluetooth SDK is not used for application development, the customer has to take care of the Bluetooth® address handling.

The PAN1761 has a preprogrammed address in the EEPROM that needs to be copied into the RAM during the initialisation. Therefore three TCU commands need to be used. Below is an example with the individual address 00 13 43 00 00 1A

I2C Enable:
--> 01 08 FC 0B 00 A0 00 00 00 14 5B FF 02 03 01
<-- 04 FF 0A 08 00 A0 00 00 00 14 5B 00 00
I2C Enable: Success

Read BT address from E2PROM:
--> 01 08 FC 10 00 A1 00 00 00 14 88 FF 10 06 A0 01 01 06 02 00
<-- 04 FF 11 08 00 A1 00 00 00 14 88 00 10 06 00 13 43 00 00 1A
Read E2PROM: Success

Set BD Addr (into RAM):
--> 01 13 10 06 1A 00 00 43 13 00
<-- 04 0E 04 04 13 10 00
Set BD Addr: Success

Comment: The "red" Bluetooth® address is original and needs to be byte switched to write into the RAM of the module to be visible in an Bluetooth® inquiry as example.

7 ORDERING INFORMATION

Ordering part number	Description	Remarks
	Development Kits	
ENW89848AZKF	ETU (Single USB Stick)	under preparation
ENW89848AYKF	PAN1761-ETU Development Kit (includes 2 USB Sticks)	under preparation
ENW89848AUKF	Morpheus + PAN1761-USB + NFC antenna (Standalone Development)	under preparation
ENW89848AVKF	PAN1761-EMK (Starter Kit Hosted Mode)	
	Modules	
ENW89848A1KF	PAN1761 CLASS 2 Bluetooth® low energy Module according to BT-4.1, 115kBaud Bluetooth® low energy + NFC	

8 HISTORY FOR THIS DOCUMENT

Revision	Date	Modification / Remarks
1.0	05.07.2016	1st version.
1.1	23.08.2016	Bluetooth version 4.1

9 RELATED DOCUMENTS

[1] PAN1761 Datasheet

[2] Toshiba SDK and Developer Zone

https://apps.toshiba.de/web/SDKRegistration/

10 GENERAL INFORMATION

This product description does not lodge the claim to be complete and free of mistakes.
Please contact the related product manager in every case.
If we deliver ES samples to the customer, these samples have the status Engineering Samples. This means, the design of this product is not yet concluded. Engineering Samples may be partially or fully functional, and there may be differences to be published Data Sheet.
Engineering Samples are not qualified and are not to be used for reliability testing or series production.

Disclaimer:
Customer acknowledges that samples may deviate from the Data Sheet and may bear defects due to their status of development and the lack of qualification mentioned above.
Panasonic rejects any liability or product warranty for Engineering Samples. In particular, Panasonic disclaims liability for damages caused by

- the use of the Engineering Sample other than for Evaluation Purposes, particularly the installation or integration in an other product to be sold by Customer,
- deviation or lapse in function of Engineering Sample,
- improper use of Engineering Samples.

Panasonic disclaimes any liability for consequential and incidental damages.
In case of any questions, please contact your local sales partner or the related product manager.

11 FCC WARNING

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

The FCC and other regulatory certifications for the PAN1761 will be published in the relevant Datasheet.

12 LIFE SUPPORT POLICY

This Panasonic product is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness. Panasonic customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Panasonic for any damages resulting.