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1. SCOPE OF THIS DOCUMENT

This Design Guide applies to the Bluetooth development platform PAN1720ETU (Easy To Use). The intention is to enable our customers to easily and fast integrate our module PAN1720 in their product.

This guide describes the Hardware and gives usefull hints.

Please refer to chapter 6 Development of Applications for an overview.

2. KEY BENEFITS WHEN USING PAN1720

- Fast Time to Market
- Easy layout for the customer application with provided CAD data in open source Eagle format.
- 2 Layer PCB with 0.2mm line width possible compared to expensive chip design.
- Optional BlueRadios **nBlue™** stack implementation:
 - AT Command parser with scripting language
 - BlueRadios Serial Profile (BRSP) stack compatible with iPhone 4s
 - Over the air configuration and upgrade entire stack over 2-wire UART, or RF
 - BT certified BLE profiles selectively integrated on request and free of charge
- FCC, IC, CE certified and all other regulatory certifications on request
- Customers application can be integrated on the module
- Internal reference clock for ultra low power modes
- Supports UART and USB
- No external components needed
- Free Smartphone sample applications

3. BLUERADIOS FIRMWARE UPDATE PROCEDURE

1. Use BlueRadios nBlue Programmer (Software Tool downloadable in BlueRadios forum)
2. Connect RX,TX,VCC and GND to the module UART
3. Flow control is not used

Firmware updates should only be performed using nBlue Programmer, not a CC Debugger. CC Debugger unlocks the debug interface, erases the entire flash including the module's bootloader and IEEE address, making the module incapable of accepting firmware updates.

The complete firmware upgrade procedure is in Section 4 of the nBlue Module Users Guide v4.2.

Considerations:

When using a PC USB port to complete a firmware upgrade a USB to UART converter with level shifting is required. Consider:

1. FTDI's FT232RQ
2. SiLabs CP2104
3. Panasonic's PAN1720ETU-BR – Test pins six and eight

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4. BLUETOOTH LOW ENERGY

Bluetooth Low Energy (BLE), part of Bluetooth Ver. 4.0, specifies two types of implementation: Single mode and dual mode. Single mode chips implement the low energy specification and consume just a fraction of the power of classic Bluetooth, allowing the short-range wireless standard to extend to coin cell battery applications for the first time. Dual mode chips combine low energy with the power of classic Bluetooth and are likely to become a de facto feature in almost all new Bluetooth enabled cellular phones and computers.

Single mode Bluetooth 4.0 Low Energy is **not** backwards compatible with previous Bluetooth standards. Dual mode Bluetooth 4.0 Low Energy is backwards compatible but is not practical for low power devices but targeted to gateway products.

Throughput over BRSP is currently limited to a theoretical maximum of 1.3kB/s under ideal conditions at the minimum connection interval of 7.5ms (Throughput = $20000/\text{msConnInterval}$). This is a theoretical maximum that could only be achieved if there were no packet retries due to interference, in actual use ~1kB/s is more realistic. This is due to the fact that BRSP is currently using GATT Write Requests and Indications to transfer data in order to ensure stability. Write Requests and Indications take two connection intervals to complete, since they require the server to acknowledge the request, and a maximum of 20 bytes of user data can be sent in each request/indication.

In a future release we plan on removing this limitation and using GATT Write With No Response and Notifications to send data, which don't require an acknowledgement from the server, allowing each request to take only 1 connection interval. This would also allow the device to send up to 80 bytes per connection interval, which would lead to a theoretical maximum throughput of 10.6kB/s, although tests have shown ~6kB/s to be more realistic.

Bluetooth marks

According to the new Bluetooth SIG marks "Bluetooth Smart" (single mode → mainly sensors) and "Bluetooth Smart Ready" (dual mode → gateway and hub devices) the PAN1720 fulfills criteria to label your product as a Bluetooth Smart device.



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5. DESCRIPTION FOR THE MODULE

PAN1720ETU (EasyToUse) is a development platform for PAN1720 BLE module to implement Bluetooth functionality into various electronic devices.

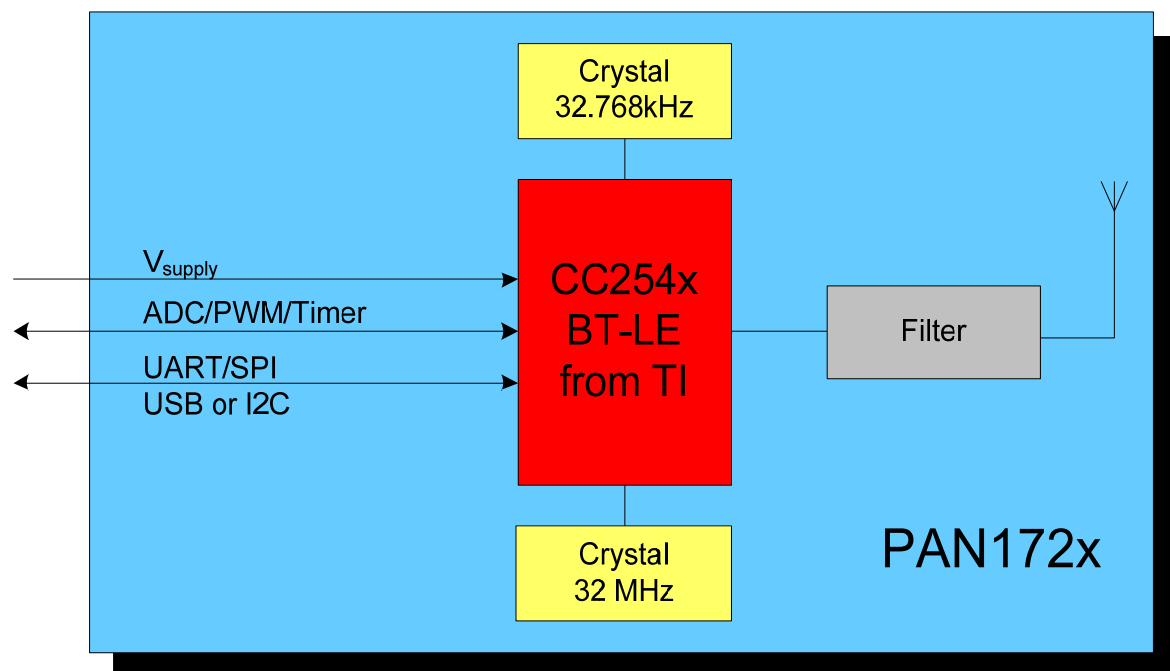
The PAN1720ETU is intended for evaluation purpose and can be used together with Texas Instrument's Software Development Kit.

Communication between the module and the host controller is normally carried out via UART, but also USB is supported with this hardware.

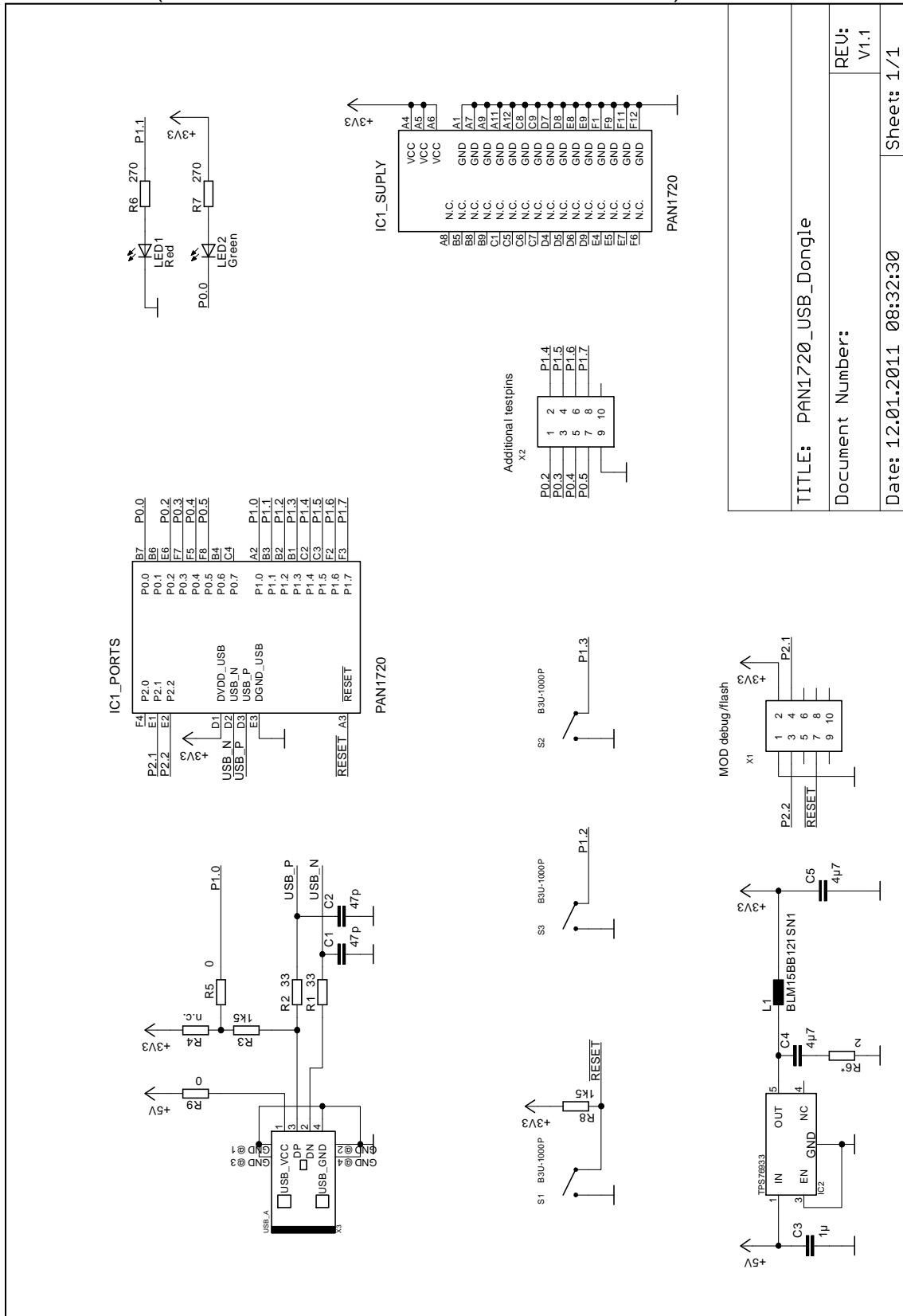
By using the BlueRadios embedded nBlue firmware no additional tools are needed and customized firmware can be updated via UART or over the AIR.

Please contact your local sales office for further details on additional options and services, by visiting www.panasonic.com/rfmodules for US and <http://industrial.panasonic.com/eu/> for Europe or write an e-mail to wireless@eu.panasonic.com

5.1. BLOCK DIAGRAM PAN1720 MODULE



5.2. SCHEMATIC (TI SW-VERSION ONLY – 1ST GENERATION)



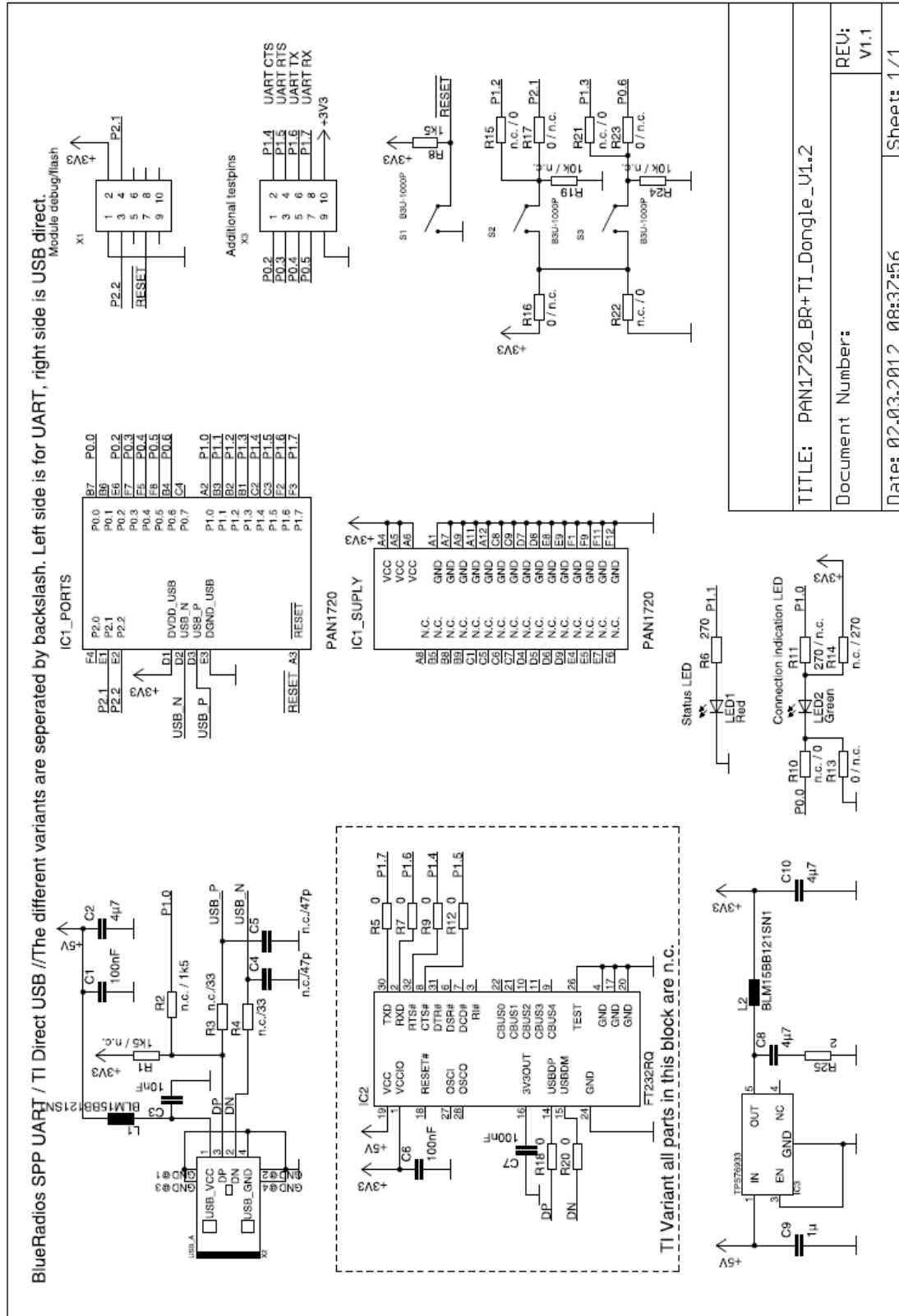
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Document Number:

REV: V1.1

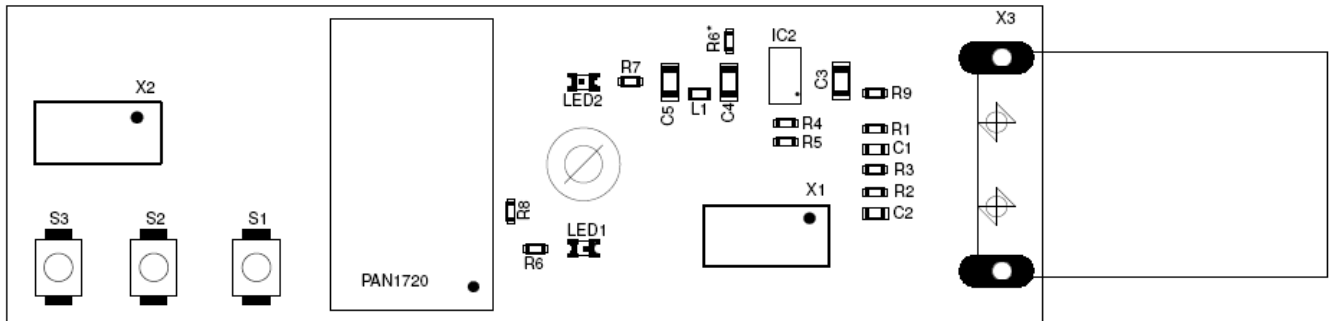
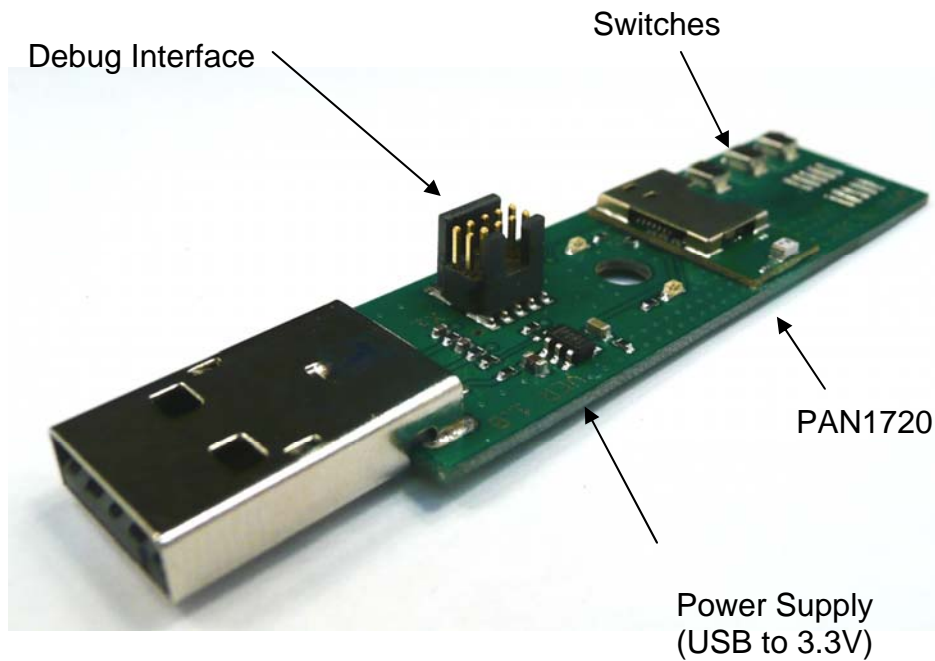
Date: 12.01.2011 08:32:30 Sheet: 1/1

5.3. SCHEMATIC (BR-SP/TI SW-VERSION MIXED OPTIONAL -2ND GENERATION)

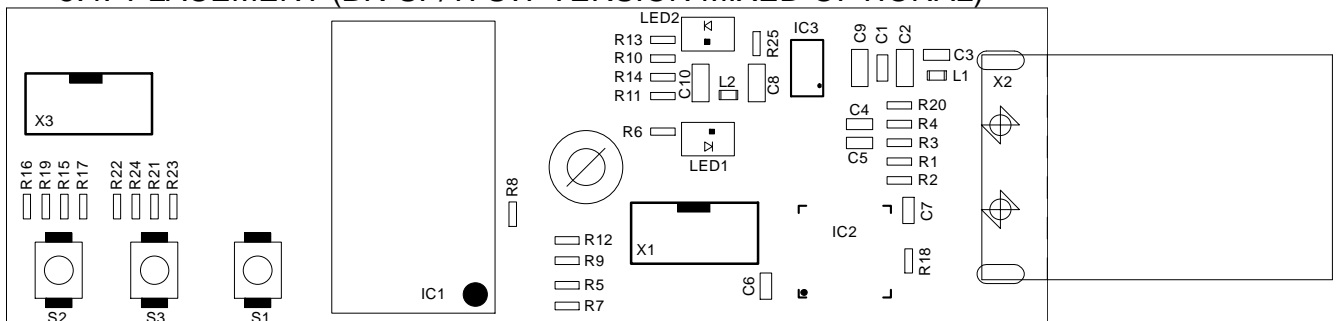


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PLACEMENT (TI SW-VERSION ONLY)



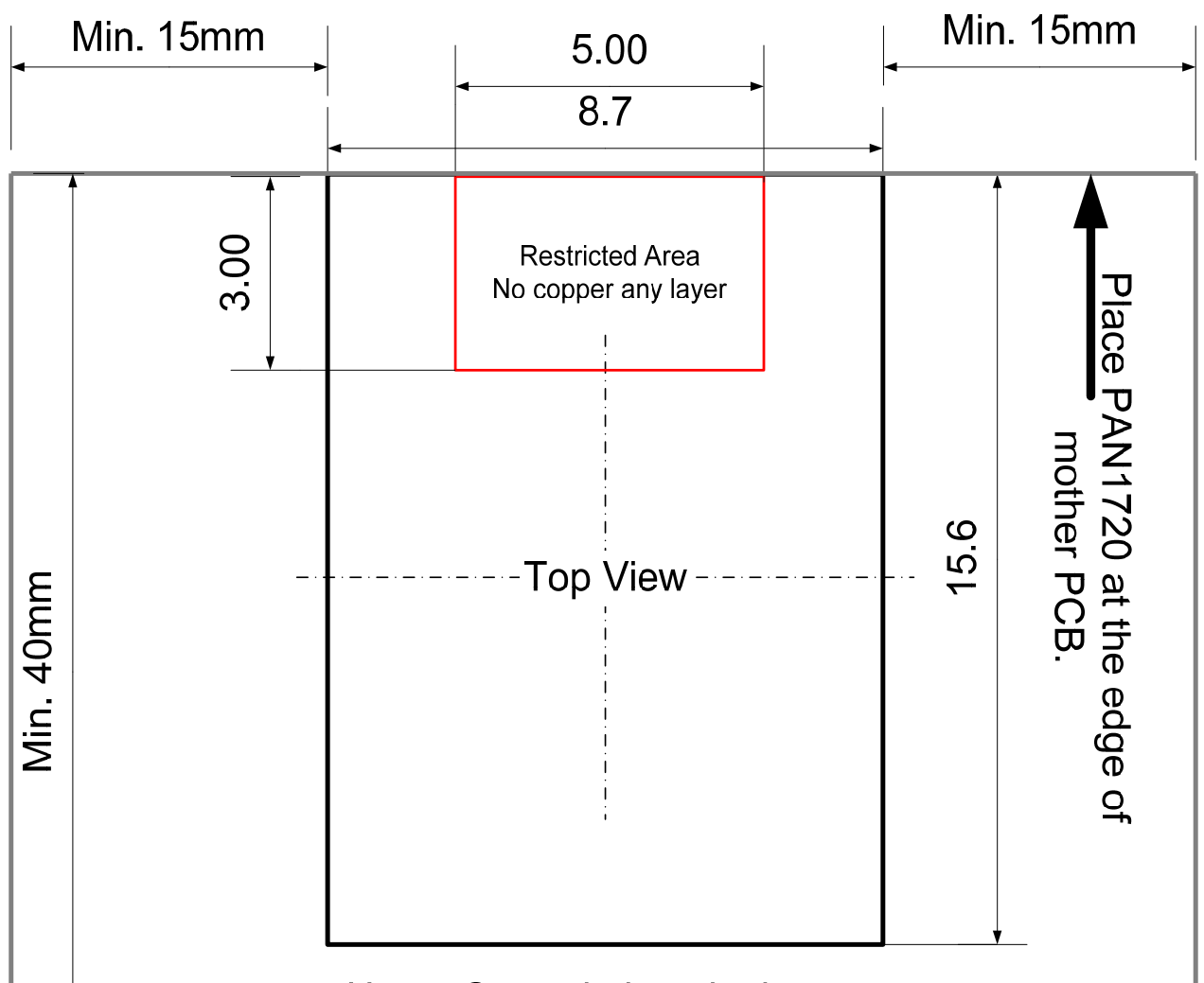
5.4. PLACEMENT (BR-SP/TI SW-VERSION MIXED OPTIONAL)



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PAN1720 WITH ANTENNA PLACEMENT

If possible place PAN1720 in the center of mother PCB.



Use a Ground plane in the area surrounding the PAN1720 module wherever possible.

Dimensions are in mm.

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6. DEVELOPMENT OF APPLICATIONS

Please contact your local sales office for customized development of your individual application.

You will need Microsoft .NET framework version 4, which can be downloaded from the Microsoft website.

6.1. TOOLS NEEDED

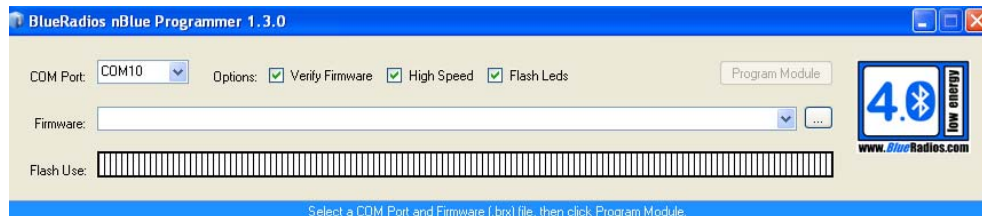
The needed tools are dependant on the ordered software version.

6.1.1. BlueRadios

Using the BlueRadios nBlue (BR-SP) option no additional tools are needed. The boot loader including the BR-SP Profile with AT-Commands are pre-flashed on the module.

Customized or further firmware options can be programmed via UART or over the air. They can be downloaded from the website or customized on request. All BLE profiles will be supported, but have to be selected on request.

The BlueRadios Programmer (see picture below) and BlueRadio AT-Commands Guide can be accessed after registration on the website of BlueRadios [6].



The PAN1720 USB Dongle Demo application can be used for range and function tests and well as evaluation. It can be downloaded including documentation from the Panasonic website [7]. For integrating the module into a host system TerraTerm is a recommended tool.



Additional information you may search for on the website [7] or refer to the overview on next page.

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6.1.2. Texas Instruments

Using PAN1720 with TI-Software the following tools are needed:

1. Texas Instruments BLE Stack [2] and Debugger [3]

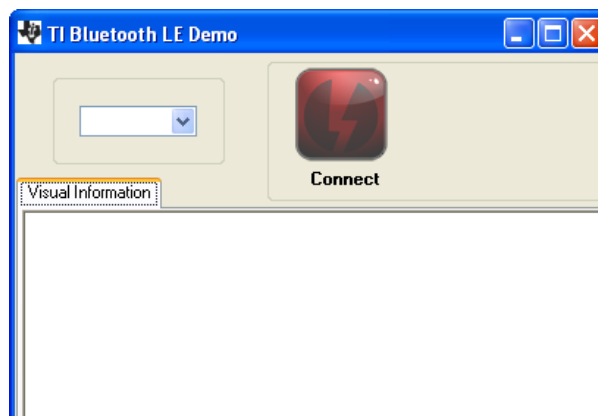
For programming customer specific firmware the debugger has to be connected to the debug interface.

2. Texas Instruments Bluetooth Low Energy Software Development Kit (SDK) [2]

The TI BLE Stack needs to be installed on the users PC. The SDK can be downloaded free of charge. After installation there will be a folder created with the source code files and also some example profiles like proximity or temperature profile. Some byte code files in .hex format are in this packages as well and should be programmed via the above debugger direct to the PAN1720. This process should be also part in the production process to burn the individual firmware into the PAN1720. The flash of the device will be deleted prior to delivery. Therefore the memory does not need to be deleted before burning the firmware on customer side.

3. Software development environment, e.g. IAR Embedded Workbench, please refer to [5]

For modifications in the above TI BLE Stack user need to download the IAR compiler for 8051 devices. Please note that there is a free of charge evaluation version available. This version is fully functional for 30days.



Please contact your local sales office for further details on additional options and services, by visiting www.panasonic.com/rfmodules for US and <http://industrial.panasonic.com/eu/> for Europe or write an e-mail to wireless@eu.panasonic.com

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*Secure, Versatile
and Award Winning
Network Radio Devices.*

Bluetooth® 4.0 Low Energy Single Mode Firmware Options



	AT Commands	BR-API
Language	Simple Scripting	"C" Library w/IAR Compiler
Cost	Free	\$1000 IAR Compiler if Evaluation kit is purchased
Ease of use	Easy - Fast proto-typing	Moderate - Good for using existing "C" application code.
Performance	Cable replacement - BR-SP	Flexible
Architecture	Ext. CPU required for custom application programs, but not for cable replacement	No external CPU required
Power Consumption	Low	Low
Tools	None required	IDE – IAR Systems
Profiles	BRSP, Battery, proximity, etc.	BRI supplied profile libraries
Misc.	N/A	Customer can define profiles
Target Market	Drop in P-to-P solution	Co-locate application in radio – high sensor integration, fast response time
Memory RAM FLASH	Application code space N/A N/A	Application code space 4Kb 128Kb

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7. ROHS DECLARATION

Declaration of environmental compatibility for supplied products:

Hereby we declare to our best present knowledge based on declaration of our suppliers that this product do not contain by now the following substances which are banned by Directive 2002/95/EC (RoHS) or if contain a maximum concentration of 0,1% by weight in homogeneous materials for

- Lead and lead compounds
- Mercury and mercury compounds
- Chromium (VI)
- PBB (polybrominated biphenyl) category
- PBDE (polybrominated biphenyl ether) category

And a maximum concentration of 0,01% by weight in homogeneous materials for

- Cadmium and cadmium compounds

8. ORDERING INFORMATION

Ordering part number	Description
	Development Kits
ENW89833A1KF	PAN1720ETU TI Development Kit (includes 2 USB Sticks). The TI Stack can be downloaded from TI website.
ENW89833A3KF	PAN1720ETU BR-SP Development Kit (includes 2 USB Sticks) Same as above including BlueRadios nBlue BR-SP FW version. Also a BlueRadios Kit is available integrating a USB dongle and evaluation board including the BlueRadios Module.
	Modules
ENW89820A1KF	PAN1720-TI CLASS 2 Bluetooth single mode Module according BT-4.0. <i>Bluetooth®</i> smart device.
ENW89820A3KF	PAN1720-BR Same as above including BlueRadios BR-SP FW version. <i>Bluetooth®</i> smart device.

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9. HISTORY FOR THIS DOCUMENT

Revision	Date	Modification / Remarks
0.01	27.01.2011	1 st preliminary version.
0.02	24.05.2011	Added BlueRadios Overview.
0.03	26.05.2011	Added Link to BlueRadios Homepage.
0.04	17.11.2011	Added several informational Links. Added ordering information.
0.05	25.11.2011	Added iPhone4S and Smart phone application information in chapter 2 "Key benefits when using PAN1720". Changed BR-SPP to BR-SP (Serial Profile). Corrected PIN assignment in schematic. Updated Link for TI SDK.
0.06	08.03.2012	Added BlueRadios Test Tool information.
1.00	01.04.2012	Released Version.
1.01	31.07.2012	Updated reference schematic.
1.02	01.04.2013	Added BR Firmware update procedure. Editorial changes.
1.03	01.05.2013	Changed ordering information and block diagram.

10. RELATED DOCUMENTS

For an update, please search in the suitable homepage.

[1] PAN1720 Datasheet

<http://www.pedeu.panasonic.de/pdf/168Datasheet.pdf>

[2] Texas Instruments Bluetooth Low Energy Software Development Kit (SDK)

<http://www.ti.com/tool/ble-stack>

[3] Texas Instruments CC2540 Debugger

<http://focus.ti.com/docs/toolsw/folders/print/cc-debugger.html>

[4] SmartRF Studio

<http://focus.ti.com/docs/toolsw/folders/print/smartrfm-studio.html>

[5] IAR Embedded Workbench for 8051 devices

<http://www.iar.com>

[6] BlueRadios Information

http://www.blueradios.com/hardware_LE4.0-S2.htm

<http://www.blueradios.com/panasonic/>

[7] PAN1720 USB Demo for BlueRadios SW

<http://www.pedeu.panasonic.de/pdf/168ext.zip>

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11. GENERAL INFORMATION

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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 disclaims any liability for consequential and incidental damages.

In case of any questions, please contact your local sales partner or the related product manager.

12. 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 PAN1720 will be published in the PAN1720 Datasheet.

13. 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.