

CLASSIF	ICATION	Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJEC	r CLAS	S 2 BLUETOOTH MODULE Low Energy BT 4.1	PAGE 2 of	41
CUSTOM PAN1740	ER'S CODE Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04.	2016
TABLE	E OF CONTENTS			
1	Scope of this Docum	pent		1
2	Key benefits when i	using PAN1740		+ 4
3.	Bluetooth I ow Ener	av		4
4.	Description PAN174	9 · · · · · · · · · · · · · · · · · · ·		5
5.	Block Diagram PAN	1740 Module		6
6.	PAN1740 USB-Don	gle		7
	6.1. Functionality	~		7
	6.2. Schematic			8
7.	Mother Board			7
	7.1. Functionality			.11
	7.2. Placement			.12
8.	PAN1740 Adapter E	Board		.13
	8.1. Schematic			.13
9.	Beacon			.14
	9.1. Schematic			.14
10.	Beacon Kit			.15
11.	Layout Recommend	ation		.17
12.	Development of App	plications		.18
	12.1. Basic Platform	Tools		.19
	12.2. Dialog Specifi	c Tools		.19
	12.3. Bluetooth Add	ress and Crystal Trim Values		.19
	12.4. Example for C	onnection Manager		.20
	12.4.1. USB	Driver		.20
	12.4.2. Start	a Demo		.21
	12.4.3. IPHUN 12.4.4 Novt 9			.22
13	Run the Keil project	example		.22
13.	Example Provimity	Profile with two PAN1740-LISB dopo	lles	.25 26
15	Smart Snippets		100	.29
10.	15.1. Program Struc	ture		.29
	15.1.1. Projec	ct and Port Selection		.29
	15.1.2. Board	l Setup		.29
	15.1.3. UART	Booter		.30
	15.1.4. Powe	r Profiler		.30
	15.1.5. Sleep	Mode Advisor		.32
	15.1.6. OTP	Programmer, SPI Flash Programme	r and EEPROM Programme	r 33
	15.1.7. SPotA	A (Software Patch over the Air)		.33
	15.2. Application De	emo: Proximity Profile		.34
16.	Dialog Serial Port S	ervice (DSPS)		.35
	16.1. Pro Kit with P	AN1740 Adapter Board - IPod		.35

CLASSIF	ICATION	Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJEC	T CLASS 2	BLUETOOTH MODULE	PAGE 3 of	41
CUSTON PAN1740	IER'S CODE Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04.2	2016
	16.2. Two Pro Kits with	PAN1740 Adapter Board		37
	16.3. Two PAN1740 US	B sticks		37
17.	Production Tools			39
18.	18. History for this Document			40
19.	Related Documents		40	
20.	General Information			41

21.

22.

CLASSIFICATION		Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE ow Energy BT 4.1	PAGE 4 of	41
CUSTOMER'S CODE PAN1740 Evaluation To	ols	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04.2	2016

# 1. SCOPE OF THIS DOCUMENT

This Design Guide applies to the Bluetooth development modules PAN1740 Experimenter Kit (PAN1740 EXP). The intention is to enable our customers to easily and quickly integrate Panasonic's PAN1740 module in their product.

This guide describes the Hardware and gives useful hints.

## 2. KEY BENEFITS WHEN USING PAN1740

- Single-mode Bluetooth Smart System-on-Chip
- ARM CORTEX M0 CPU
- Small 9.0 x 9.5 x 1.8 mm SMD package with antenna
- Includes 16 MHz and 32.768 kHz crystal
- Temperature Range from -40°C to +85°C
- Pre-programmed calibration data and BT-Address
- Peak Power consumption 4.9mA Rx and Tx
- Less than a few  $\mu A$  in low power modes
- Link budget 93dBm (Rx Sensitivity -93, Tx 0 dBm)

# 3. 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.

#### Bluetooth marks

According to the new Bluetooth SIG marks "Bluetooth Smart" (single mode  $\rightarrow$  mainly sensors) and "Bluetooth Smart Ready" (dual mode  $\rightarrow$  gateway and hub devices) the PAN1740 fulfills criteria to label a product as a Bluetooth Smart device.



CLASSIFICATION		Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE ow Energy BT 4.1	PAGE 5 of	41
CUSTOMER'S CODE PAN1740 Evaluation To	ols	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04	.2016

# 4. DESCRIPTION PAN1740

PAN1740 is the next generation Bluetooth Low Energy Module from Panasonic with reduced form factor, significantly lower power consumption and embedded Software Stack. The Single mode Bluetooth Smart System-on-Chip module is optimized for low power, small size and low system cost products. It reduces external component count, development effort and time to market.

The Module is manufactured in a very small 9.0\* 9.5\* 1.8 mm SMD package with shielded case and chip antenna. The power consumption of only 4.9mA in Tx and Rx mode makes the use of coin cell batteries possible or reduces the needed battery capacity and cost of existing solution by at least 50%. It is qualified according to Bluetooth 4.0 standard. FCC, IC and CE approvals are under preparation.

The PAN1740 comes with a complete software development platform, which includes a qualified Bluetooth Smart single-mode stack that can be compiled with a number of available BLE profiles, custom application and programmed on the module. Multiple Bluetooth Smart profiles for consumer wellness, sport, fitness, security and proximity applications are supplied as standard, while additional customer profiles can be developed and added as needed.

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

CLASSIFICATION	Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJECT CLASS 2	PAGE 6 of	41	
CUSTOMER'S CODE PAN1740 Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04.2	2016
5. BLOCK DIAGRAM PAN			
3 DC/DC V <sub>supply</sub> Full Port Multiplexer UART SPI I2C GP-ADC Quad-Decoder Wakup-Timer	Crystal 2.768kHz Dialog		
	Crystal 16 MHz PAN1740		



# 6.1. Functionality

Atmel µC includes Segger USB-to-UART programmer (serial number on the backside) OTP cannot be damaged - Failsafe development Runs with Dialog's Keil compiler projects Runs with "Connection Manager" Can be used for SW development "on the fly"





1.1. Functionality

Atmel µC includes Segger USB-to-UART programmer (serial number on the backside) OTP cannot be damaged - Failsafe development Runs with Dialog's Keil compiler projects Runs with "Connection Manager" Can be used for SW development "on the fly" Includes 1Mb flash W25X10CLUX from Winbond



CLASSIFICATION	[	Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJECT	CLASS 2 BLUE Low End	ETOOTH MODULE ergy BT 4.1	PAGE 11 o	f 41
CUSTOMER'S CODE PAN1740 Evaluation To	PAN pols PAN	ASONIC'S CODE 1740 Evaluation Tools	DATE 11.04	.2016

# 2. MOTHER BOARD



# 2.1. Functionality

The details of the mother board are described in the Dialog documentation

Can be used with PAN1740 Adapter Board

OTP can be programmed

Runs with Dialog's Keil compiler projects

Runs with "Connection Manager"

Can be used for SW development "on the fly"

Runs with "Smart Snippets" including Power Profiler





CLASSIFICATION	Design Guide	No. DS-DG-17	40ETU	REV. 2.1
SUBJECT CLASS 2	BLUETOOTH MODULE ow Energy BT 4.1	PAGE	14 of -	41
CUSTOMER'S CODE PAN1740 Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016
4. BEACON	PAN1740 iBeacon			
4.1. Schematic				
	$\frac{VBAT}{11 \text{ PAN 1740}} + \frac{VBAT}{11 \text{ PAN 1}} + \frac$	TITLE: PAN1740_CR2	VPP SW DIO SW DIO SW DIO SW DIO SW DIO SW DIO SW DIO SW DIO SW DIO SW DIO WAT PO3 WAT WAT PO3 WAT PO3 WAT PO3 WAT WAT PO3 WAT WAT PO3 WAT WAT PO3 WAT WAT PO3 WAT WAT WAT WAT WAT WAT WAT WAT	
	GT GZ G3 G4 <b>G</b> Ø Ø Ø Ø 	Document Number: Date: 12.06.2015 09:0	33 <b>:</b> 31 She	REV:

CLASSIFICATION	Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJECT CLASS 2	BLUETOOTH MODULE ow Energy BT 4.1	PAGE 15 of	41
CUSTOMER'S CODE PAN1740 Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04.2	016
5. BEACON KIT Concept			
<ul> <li>The PAN1740 Beacor PAN1740, carrier PCE and battery holder.</li> </ul>	n mainly consists of 3, Flash <u>memory</u>	PAN1740	
<ul> <li>Only electronics without firmware, since this is specific</li> </ul>	out housing and very customer <sup>Flash Memory (256kB)</sup>	Holder for CR2I coin cell batter	)32 X
<ul> <li>Based on proven des Low Energy Module</li> </ul>	ign of PAN1740	g/Programming Interface	
<ul> <li>Flash memory for cus application and beacc parameters (UUID, Magenta)</li> </ul>	stomer specific on specific ajor/MinorID)	ATT AND A	
Battery Holder for por cell battery	oular CR2032 coin	Reacon Beacon	
Reference design for	standard housing		
The Beacon-Kit consists of:			
1 pc. Dialog Motherbox	ard		
<ul> <li>1 pc. Flexible Flat Cab</li> </ul>	le – 0.50 mm pitch – 18 conductor	s – 50 mm length – Type 2	
• 1 pc. Beacon Adapter	Board		
• 5 pcs. Beacon			
The Beacons come along pre- to start evaluating. Simply pow them using the <i>Locate Beacon</i> scenario is depicted below.	-configured with Dialog's Beacon S wer them up by plugging a CR2032 <i>n</i> App which can be downloaded in	Software which makes it eas battery and watch out for the Google Play Store. Th	sy is

CLASSIFICATION		Design Guide	No. DS-DG-1740ETU	J	REV. 2.1
SUBJECT	CLASS 2 La	BLUETOOTH MODULE ow Energy BT 4.1	PAGE	16 of -	41
CUSTOMER'S CODE PAN1740 Evaluation T	ools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016



The Beacon software is stored in the SPI Flash (IC2) on the PCB and can be changed by establishing a connection between Dialog's Motherboard and a Beacon via the Beacon Adapter Board and the FFC as shown below.

**Note:** An FFC longer than 5cm can cause transmission errors when using JTAG. Hence, longer cables should use the UART interface to download software to the Beacon.



Simply change Dialog's Beacon code available on our website to your needs with Keil uVision, compile it and download it to the device using Smart Snippets for instance. The following chapters and Dialog's Documentation show how to download your code into the Beacon.

http://pideu.panasonic.de/



CLASSIFICATION		Design Guide	No. DS-DG-1740E	ΓU	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE w Energy BT 4.1	PAGE	18 of 4	41
CUSTOMER'S CODE PAN1740 Evaluation To	ols	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

# 7. DEVELOPMENT OF APPLICATIONS

In this and the following chapters, the basic tools and some examples are shown to get the USB-dongles running. All examples use Windows7 OS and iPhone 5Gand above.

Installing and running HW drivers on any system requires time and each step may require rebooting your system. Contact your system administrator if any system related problems appear during the installation phase. Install the drivers step-by-step in the below order and use the latest software releases.

There are two basic approaches for implementation:

#### 1. Full embedded HCI with external host controller

If BLE functionality is being added to a running application -- E.g. for porting the setup GUI from your application into a smart phone -- developing a smart phone "App" and installing either a proprietary BLE profile on the host controller and or a BT-Sig certified profile should be considered. The BT-Developers portal provides guidance for this process - <u>http://developer.bluetooth.org/</u>

#### 2. Standalone sensor application

Applications requiring less than 32KB can reside and execute on the PAN1740 module. There are several examples in the Keil projects. The download link is in chapter 7.1. The profiles are located in the SDK folder (use the latest release from Dialog website):

#### 3. Smart Snippets

is needed to burn the application into the module. If you are working with the PAN1740ETU USB-Dongle applications can be developed and executed in RAM, but for security reasons it is not possible burn the OTP. Panasonic's Experimenters' kit is required to access OTP is accessible. contact your local sales distributor for support. The Experimenters' kit may be mandatory for production. For items beyond the scope of this design guide, refer to the Smart Snippets guide on the Dialog's support website. Following is a list of supported profiles.

(use the latest release from Dialog website)

CLASSIFICATION		Design Guide	No. DS-DG-1740E	ГU	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE w Energy BT 4.1	PAGE	19 of 4	41
CUSTOMER'S CODE PAN1740 Evaluation To	ols	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

## 7.1. Basic Platform Tools

- 1. Windows 7 or higher www.microsoft.com
- 2. Keil Compiler 32K free license www.keil.com/arm/mdk.asp
- 3. Segger J-Link software www.segger.com/jlink-software.html

Use the serial number from the bottom side of the USB-Dongle

4. Bluetooth 4.1 - www.bluetooth.org

## 7.2. Dialog Specific Tools

Download in the support forum http://support.dialog-semiconductor.com under the top menu bar "Software".

1. Connection Manager

Enables basic GATT connections between two BLE devices.

2. Dialogs Projects

Keil Projects with BLE Profiles and examples. These project files are used to implement the customers application. The BLE profiles are already implemented and you can setup the full feature set and I/O capability of the module.

3. Smart Snippets

Smart Snippets is the Tool for reading and writing the OTP. With this tool, the last step in the development chain can be performed by burning the OTP fuses. This tool does not work with the USB-Dongle for security reasons. The programming voltage of 6.8V needed to enable the programming is not supported.

### 7.3. Bluetooth Address and Crystal Trim Values

1. Main Frequency Calibration up to 1ppm @ 2.4GHz

Panasonic calibrates the 16 MHz crystal and writes this calibration data in the OTP header. This provides best performance and a stable frequency. Customers do not need to take care of this step in their production.

2. Pre-programmed Bluetooth/MAC Address

Each Bluetooth device must have a unique MAC address which is provided from the IEEE. Since this may lead to additional costs and registration effort for customers Panasonic burns a unique address into the OTP header from our database. Customers do not need to take care of this step in their production.

3. Precise High Performance Crystal Sleep clock

Since this is a low energy device and the key functionalities are the sleep functions with just a few  $\mu$ A current draw Panasonic has integrated a 32.768 kHz crystal clock into the PAN1740 module. Therefore no external components are needed and there are no hidden costs.

CLASSIFICATION	Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJECT CLASS 2	BLUETOOTH MODULE ow Energy BT 4.1	PAGE 20 of	41
CUSTOMER'S CODE PAN1740 Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04.20	016
7.4. Example for Conne	ction Manager		
7.4.1. USB Driver			
Download and install USB Drivers from Segger			

🚓 Geräte-Manager	Institutes 1	
Datei Aktion Ansicht ?		
🖌 🚑 LG875-Wagner		*
Andere Geräte		
🔤 🔤 🔤 🔤 🔤 🔤 🔤 🔤 🔤 🔤		
🛛 🔤 🔤 🔤 🔤 🔤 🔤 🔤 🔤 🔤		
🖌 ሞ Anschlüsse (COM & LPT)		
JLink CDC UART Port (COM4)		
Kommunikationsanschluss (COML)		
📲 Standardmäßgige Seriell-über-Bluetooth-Verbindung (COM11)		
📲 Standardmäßgige Seriell-über-Bluetooth-Verbindung (COM20)		
📲 Standardmäßgige Seriell-über-Bluetooth-Verbindung (COM7)		
📲 Standardmäßgige Seriell-über-Bluetooth-Verbindung (COM8)		=
📲 Standardmäßgige Seriell-über-Bluetooth-Verbindung (COM9)		
USB Serial Port (COM10)		
Audio-, Video- und Gamecontroller		
⊳8) Bluetooth-Funkgerät		
⊳		
DVD/CD-ROM-Laufwerke		
🗁 🖓 Eingabegeräte (Human Interface Devices)		
🔉 📲 Grafikkarte		
De ATA/ATAPI-Controller		
bing Laufwerke		
🖕 🖑 Mäuse und andere Zeigegeräte		
- 🖳 Monitore		
👂 📲 Netzwerkadapter		
Prozessoren		<b>.</b>

CLASSIFICATION	Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJECT CLASS 2	BLUETOOTH MODULE	PAGE 21 of	41
CUSTOMER'S CODE PAN1740 Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04.2	016
<ul> <li>7.4.2. Start the Connection</li> <li>1. Make sure you h</li> <li>2. Wait until the init</li> <li>3. Press load Firm</li> <li>4. Wait until the init</li> <li>5. Press either "Bo</li> </ul>	Manager have admin rights and access to the t phase is finished ware and select "full_emb.hex" t phase is finished hot as Central" or "Boot as Periphera	program folder al" (Example shows Centra	1)
Connection Manager          Help         Discover/Connect         Discovery         Scan Interval:         16       x 0.625 ms = 11         Scan Window:         16       x 0.625 ms = 11         Connection Settings         Min Connection Interval:       128         X 1.25 ms = 16         Max Connection Interval:       128         Slave latency:       0         Supervision Timeout:       200         x 10 ms = 20 s	Boot as Central         COM4         Hardware Ro           0 ms         Boot as Penpheral         Load Firmware         Boot Iest           0 ms         Dat Task         : 0x404 (TASK_GAPM)         Boot Iest           0 ms         Dat Task         : 0x404 (GAPM SET_DEV_CONFT Role         : 0x504 (GAPM SET_DEV_CONFT Role         : 0x404 (GAPM SET_DEV_CONFT Role         : 0x00 00 00 00 00 00 00 00 00           appearance_write_perm         : 0x0         appearance_write_perm         : 0x0           name_write_perm         : 0x0         0 00 00 00 00 00 00 00 00 00 00 00 00 0	ow Control:       RTS/CTS       Clear Log         t Mode       Save Log         (G_CHD)       00 00 00 00 00 00 00         0 00 00 00 00 00 00 00 00 00 00 00 00 0	

>===> [10:01:22.735] Tx <==== Src Task : 0x3f (TASK\_APP) Dst Task : 0xd (TASK\_GAPM) Msg Id : 0x3407 (GAPM\_GET\_DEV\_INFO\_CMD) Operation : 0x7 Payload : 07 34 0d 00 3f 00 01 00 07

Description

 Payload
 : 07 34 0d 00 3f 00 01 00 07

 mem> [10:01:22.744] Rx <====</th>

 Src Task
 : 0x0004 (TASK\_GAP)

 Dat Task
 : 0x003f (TASK\_APP)

 Msg Id
 : 0x3040 (GAPM\_DEV\_VERSION\_IND)

 HOI Version
 : 0x066

 HOI Version
 : 0x066

 HOI Subversion
 : 0x0701

 LMP Subversion
 : 0x0701

 Mest Subversion
 : 0x0703

 Manuf. Name
 : 0x0060

 Payload
 : 0 a 34 3f 00 0d 00 0c 00 06 06 06 00 01 07 01 07 03 07 60 00

Е

Get Set

Properties

Establish Link

•

Link Control

Handle

Address:

UUID

CLASSIFICATION Design Guide		No. DS-DG-1740ETU	REV. 2.1
SUBJECT CLASS 2	BLUETOOTH MODULE ow Energy BT 4.1	PAGE 22 c	of 41
CUSTOMER'S CODE PAN1740 Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04	.2016
7.4.3. IPhone Demo	•••••• Vodafone.de 3G 10:08     ▲     ▲     Back     86A2F6F1-7260-7310-8F08-E2B05593836     Name : DialogDemo     RSSI : -63 dBm 2014-04-29 10:08:37.284     CHANNEL     39		

 39
 LOCALNAME
Dialog Demo
 ISCONNECTABLE
 YES
 Show RAW data

"Bluetooth Smart Scanner" may be replaced by other BLE Apps for Android or Windows based smart phones. Depending on the application, a proprietary app may be written or existing certified BLE profile used.

#### 7.4.4. Next Steps

The Connection Manager cannot send data, since it installs only the central or peripheral functionality on the PAN1740, but not the profile. Two PAN1740 USB dongles can be connected by setting one side to Central and the other to Peripheral. To send data you need to run the Keil project in debug mode together with a profile e.g. peripheral example, chapter 8 describes this process.

CLASSIFICATION	Design Guide	DS-DG-1740ETU	REV. 2.1
SUBJECT	CLASS 2 BLUETOOTH MODULE Low Energy BT 4.1	PAGE 23 of	41
CUSTOMER'S CODE PAN1740 Evaluation Tool	PANASONIC'S CODE s PAN1740 Evaluation Tools	DATE 11.04.2	016

### 8. RUN THE KEIL PROJECT EXAMPLE

For more detailed information on project examples, refer to the Projects in Dialog's software download page. Recommended is the proximity example as this is the most common profile.

Download and install the SDK using the following URL:

http://support.dialog-semiconductor.com/software-downloads/index

Install the dongle after the Segger J-Link software driver installation.

Refer to chapter 7.1 Basic Platform Tools to download them.

🗍 Gerätetreiberinstallation	<b>X</b>
Installieren von Gerätetre	ibersoftware
USB-Verbundgerät J-Link J-Link OB CDC	Verwendung jetzt möglich Treibersoftware wird installiert Verwendung jetzt möglich
	Schließen

Open the proximity project example found in the Dialog SDK. The project is located in the following SDK folder ( use the latest release from Dialog website):



CLASSIFICATION		Design Guide	No. DS-DG-1740E	TU	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE ow Energy BT 4.1	PAGE	24 of	41
CUSTOMER'S CODE PAN1740 Evaluation 1	Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

In the Keil compiler Configure the Flash Target (Flash >> Configure Flash Tools). Choose "Settings".

Device Target 0	utput   Listing   User   Menu Command	C/C++ Asm	Linker Debug	Utilities	
Use Target I J Init File:	Driver for Flash Programmi -LINK / J-Trace Cortex JLink Settings.ini		Settings	Use Debug Driver Update Target before De Edit	bugging
C Use External Command: Arguments:	Tool for Flash Programmi	ng			<u></u>
Ē	Run Independent				

Click the Debug tab. Setup the Port in the J-Flash Settings to "SW". Press "OK".

Debug Trace   Flash Download	
J-Link / J-Trace Adapter	SW Device
SN:         480040823         •           Device:         J-Link OB-SAM3U128	IDCODE         Device Name         Move           SWD         Ox08BB11477         ARM CoreSight SW-DP         Up
HW :         V1.00         dll :         V4.78f           FW :         J-Link OB-SAM3U128 V1 corr	Down
Port: Max Clock: SW _ ZMHz _	Automatic Detection ID CODE:     Manual Configuration Device Name:
Connect: Normal  Reset: Normal Reset: Normal Reset: Normal Reset: Normal	mal ▼ Cache Options Download Options mal ▼ Cache Code ✓ Verify Code Download ✓ Cache Memory Download to Flash
Connect: Normal ▼ Reset: No ✓ Reset after Connect Interface ✓ USB ○ TCP/IP Scan State: ready Connect: Normal ✓ Reset: Normal ✓ Network S 127 .	Cache Options       Download Options         Image: Cache Code       Verify Code Download         Image: Cache Code       Download to Flash         Image: Cache Code       Download to Flash         Image: Cache Code       Download to Flash         Image: Cache Code       Port (Auto: 0)         Image: Cache Code       Port (Auto: 0)         Image: Cache Code       Ping         Image: Cache Code       Ping

CLASSIFICATION	SIFICATION Design Guide D		ETU	REV. 2.1
SUBJECT CLASS 2	2 BLUETOOTH MODULE ow Energy BT 4.1	PAGE	25 of	41
CUSTOMER'S CODE PAN1740 Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

Build Target files (Press F7 or click on the build button) and run the debug session (Press "Ctrl"+F5 or click on the "Debug" button).





Build

Debug

	A CONTRACTOR OF THE OWNER		
file Edit View	v <u>P</u> roject Fl <u>a</u> sh	Debug Perjapherals Iools SVCS Window Help	
1 🐸 🖬 🖉	X 41 23	イ ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (	
27 1 3	0 9 9 9		
Registers			
Perinter	Value	0x0000211E BD10 POP (r4,pc)	
Core	1000	153: (	
RO	0x20008480	E)000002120 B508 F058 (r3,kr)	
H1 - R2	0x20008580	155: char mcholce;	
- R3	Gk20008580	156: 0.00003133 2000 MOTE TO 5000	
R4	Gx00007594		,
R6	0x00000000	P. darfun CNSNE CM0.4 P. oxfeer CMSDEr P. DataSall examples c	<b>•</b> 7
R7	0x00000000	142 * Addicional Mardware (SFI, EEPROM boadrs) or Mardware modification may needed for some tof the tests.	
	OWFFFFFFFF	143 * More information in the file periph_setup.h, Application Notes, and User Guide for DA14580	
R10		144 • - UART only ( No HM modifications on rev C2 motherboard, No additional hardware) 146 - ST Flash with UNDF (MM modifications I additional Mardware acaded ST DT DN on the additional SDI ( FEEDOM demotrathered )	
R11	0x00007594	146 • - Boot From SPI Flash with UART (HM modifications & additional Mardware needed, (UART IX))	
- R13 (SP)	Gx20008780	147 * - Boot From SPI Flash without UART (Additional Hardware needed)	
R14 (LR)		149 * - BOOT FTOM ELFNOW WITH UART (AddItional Hardware needed) 149 *	
R15 (PC)	0x00002120	150	
Banked	0001000000		
+ System			
Mode	Thread	154 short int index = 0;	
Stack	MSP	156 Char McDology	
		157 periph_init();	
		158 printf string("DA14500 Engineering Examples/http://	
		160 print_string("Refer to Engineering Examples use Guide(h)('h)(");	
		161	
		162 print menu(); 163	
		169 while(1)(	
		165 if (index==) break;	
		160 micholde = uart_receive_byte()) 167 m switch (mchoice) {	
		168 cose 'u': uart_test(); endtest_bridge(&index); break;	
		169 case 'f': spl test(): endtest bridge(4index): break:	
		171 case 'e': 12 test(): endess bridge(sindex), break;	
		172 case 'd': 12c_image(); endtest_bridge(imdex); break;	
		173 // case t': swt_test(); endtest_bridge(&index); break; 174 detoire follope: Public	
		175 case 'q': quad_decoder_test(); endtest_bridge(sindex); break;	
		176 - tendif //QUADEC_ENABLED	
100		1// CGBE '-: LIMECU_LEDI)/ BINDERS DIAUGE(AINDER)/ DEEMS	
In Project   III Re	egisters		
Command		0 🔯 Call Stack + Locals	0
LOAD %L		Anne Location/Value Type	
*** Restrict	ed Version w	with 32768 Byte Code Size Limit int f0	
*** Currentl	y used: 3013	12 Bytes (91%)	
2			

The proximity project has now been compiled and downloaded into the RAM of the PAN1740ETU.

CLASSIFICATION	Design Guide		No. DS-DG-1740ET	ſU	REV. 2.1
SUBJECT	CLASS 2 BLUETOOTH MODULE Low Energy BT 4.1		PAGE	26 of 4	41
CUSTOMER'S CODE PAN1740 Evaluation To	ols	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	)16

# 9. EXAMPLE PROXIMITY PROFILE WITH TWO PAN1740-USB DONGLES

Refer to the Basic Development Kit User Manual.

Additional Tools:

Microsoft Visual C++ 2010 Express – Freeware Compiler

This example uses Dialog's SDK version 3.0.2.1

Receiver Configuration:

Download the proximity/monitor\_fe\_usb image into the dongle and refer to Section 8 for details ( use the latest release from Dialog website):

DA14580\_SDK\_3.0.2.1\dk\_apps\keil\_projects\proximity\monitor\_fe\_usb

Open Keil, compile this project and download the hex file. To download, either start and stop the debug mode or load the hex file with Connection Manager. For debug mode using the Keil compiler be sure to check the Configure Flash Tool setting described in section 8.

F:Modules/PAN1740-ENW89846A1KF-Dialog/09_Software/Software and Tools/DA14580_SDK_v_3.0.1.116/DA14580_SDK_v_3.0.1.116/peripheral_examples/DA14580_p	ripheral s
File Edit View Project Figsh Debug Peripherals Tools SVCS Window Help	
□ 🖉 🖬 🖉   A (4) 🕲   つ ト   マ モ   作 市 市 市   字 津 /// // 🦉 ust.int 📃 🗟 📌 🔞 🔍 Ο 🔗 🌒 🗊	
諸 🗷 ② (1) (1) (1) 🧇 (二〇) 🛲 🗐 🖓 🖉 - (二・) 🗰 - (二・) 🗰 - (大・)	
Registers 🛛 👪 Disassembly	a 🖂
Register Value 0x0000211E BD10 POP (r4,pc)	
T53: ( 153: )	
R0 0/2008/40 35/1 85/8 FUSH (75,17)	
R2 0-2000550 155: char mcholce;	
R3 9-20005560 [356: 0x00002122 2000 M0V8 ±0.±0x00	-
84 accounts 1	•
R6 0x0000000 A startup_CMSDK_CM0.s System_CMSDK.c A DA14580 examples.c	××
R7 0x0000000 142 * Addicional Hardware (SFI, EEPRON boadrs) or Hardware modification may needed	for some tof the tests.
R9 Control 143 * More information in the file periph setup.h, Application Notes, and User Gu	de for DA14580
RIO 640007544 145 * - SPI Flash with User (HW modifications & additional Hardware needed	, SFI DI FIN on the additional SFI / EEPROM daughterboard )
All dourse 146 - Boot From SPI Flash with UART (BW modifications 4 additional Hardw	are needed, (UART IX) )
R13(SP) 0-2005700 147 - Soft From SPF 13aB WithOut UART (Additional Hardware needed)	
R14 (LR) 6x0000137 149 *	
0 vPsn 0ct100000 150	
(*) Barked 152 int main (void)	
b internal D 153 C (	
Mode Tread 154 short int index = 0;	
Stack MSP 156	
157 periph_init(); 158 print_string(PD11590 Engineering Examples)(v=);	
159 printf_string ("Connect the appropriate peripheral before choosing each test	:("z/n/z//
<pre>160 printf_string("Refer to Engineering Examples User Guide\n\r\n\r");</pre>	
161 162 print menu();	
163	
166 Mile(1)( 185 If (indexe1) break	
166 mchoice = uart_receive byte();	
147 e switch (mohoice) (	
<pre>165 case 'u': uart_lest(); endtest_bridge(sindex); break; 166 case 'f': ani test(); endtest_bridge(sindex); break;</pre>	
<pre>170 case 'i': spi image(); endtest_bridge(&amp;index); break;</pre>	
171 case 'e': 120 test(); endtest bridge(&index); break;	
173 // case to: avt test (); endtest bridge (index); break;	
174 Geitder QUADEC_ENABLED	
175 case 'q': quad decoder_test(); endtest_bridge(&index); break; 176 - #endif //OADPC ENKALED	
177 case 't': timer0_test(); endtest_bridge(&index); break;	
Project  Registers	
Command 3	Call Stack + Locals 0 60
LOAD %L	Name Location/Value Type
	P main 0x00002120 int f0
*** Currently used: 30132 Bytes (91%)	
	when the second se
*	
>	
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR Display Enter EVALua	e Call Stack - Locals Memory 1

Note: Debug session must be stopped.

Open the Monitor Host Application folder in the SDK (use the latest release from Dialog website).

Open the project file "host\_proxm.sln" with Microsoft C++ compiler. Compile (Press F7") and run this SW (F5) and determine the correct COM port using Windows Device Manager and enter this port number in the Proximity Host application (DOS window).

CLASSIFICATION	Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJECT CLASS 2	BLUETOOTH MODULE ow Energy BT 4.1	PAGE 27	of 41
CUSTOMER'S CODE PAN1740 Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.0	)4.2016
C:\Users\Wagner\Desktop\host_p ####################################	proxm_sdk.exe	Image: state	

Transmitter Configuration:

Download the proximity/reporter\_fe\_usb image into the dongle: Open Keil, compile this project and download the hex file. To download, either start and stop the debug mode or load the hex file with Connection Manager.

Open the reporter host application (use the latest release from Dialog website)

Open the project file "host\_proxr.sln" with Microsoft C++ compiler. Compile (Press F7") and run this SW (F5) and determine the correct COM port using Windows Device Manager and enter this port number in the proximity host application (DOS window).

📧 F:\Modules\!PAN_General\26Trainee\Christian Deege\PAN1740\Demo Proximity Profile\host_prox 💼 🔳 💌
No cmdline arguments. Enter COM port number (values: 1-65535, blank to exit): 12 Connecting to COM12 COM12 succesfully opened, baud rate 115200 Waiting for DA14580 Device Advertising Sending DISS_ENABLE_REQ
# DA14580 Proximity Reporter demo application # ###################################
Connected to Device
BDA: 00:13:43:0c:ba:64 Bonded: NO Sending PROXR_ENABLE_REQ ####################################
Connected to Device
BDA: 00:13:43:0c:ba:64 Bonded: YES ALERT STARTED. Type:2 Level:1 ALERT STOPPED. Type:2

CLASSIFICATION	Design Guide	No. DS-DG-1740ETU	REV. 2.1
SUBJECT CLASS 2	BLUETOOTH MODULE ow Energy BT 4.1	PAGE 28 of	41
CUSTOMER'S CODE PAN1740 Evaluation Tools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11.04.	2016
Receiver Side will show conne F:\Modules\!PAN_General\26Trai ####################################	ection status inee\Christian Deege\PAN1740\Demo Proximity F ####################################	Profile\host_prox   Profile\host_prox	
'G' - Set Link Loss Alert 'H' - Set Link Loss Alert 'I' - Disconnect from dev 'Q' - Display/Hide Device 'Esc' - Exit	Level to Mild Level to High ice Information		Ŧ

The dongles are now connected with the proximity profile.

CLASSIFICATION		Design Guide	No. DS-DG-1740E	TU	REV. 2.1
SUBJECT	CLASS 2 BLUETOOTH MODULE Low Energy BT 4.1		PAGE	29 of	41
CUSTOMER'S CODE PAN1740 Evaluation Tools		PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

### **10. SMART SNIPPETS**

The following description describes the structure and the usage of Smart Snippets in a nutshell. For additional information select  $Help \rightarrow User Guide$  in Smart Snippets after the Software has been fully launched.

### 10.1. Program Structure

#### 10.1.1. Project and Port Selection

The first task after launching the application *Smart Snippets* is to select a project, the virtual COM port and the chip version to be able to control the development kit.

SmartSnippets - Project and Virtual COM port selection	n		×
Please select a project from the list:	Please select the Virtual COM Port:      ① UART/SPI mode     ① UART mode	Please select the DA14580 chip version:	
ProximityMonitor	UART PORT: COM6 - SPI PORT: COM7	DA14580-00	1
ProximityReporter Test		☑ DA14580-01	
	Cannot see my board?		
Open	Edit Delete New	Refresh	

When the application launches the first time, there will be no projects to select. The user will have to create one by pressing the "New" button. The name should not contain any spaces or special characters.

After selecting a project, the user will have to select the DA14580 chip version and a virtual COM port which is assigned to the connected dialog development kit.

Finally, the user needs to press *Open* to establish a connection to the development kit. The software will show its default layout with a toolbar (Board Setup, UART Booter, Power Profiler, Sleep Mode Advisor, OTP Programmer, SPI Flash Programmer, EEPROM Programmer and SPotA) and a few of these tools in the center of the display. Every single tool can be enlarged to full screen if necessary by double clicking its header or the maximize button. The previously listed tools will be explained in the following sections.

#### 10.1.2. Board Setup

The tab *Board Setup* in the toolbox has to be used before any other toll as it establishes a communication with the development kit during the boot sequence and comes along with two lists.

The upper list contains UART ports with its baud rate, which connect the FTDI chip with the DA14580. The lower one selects the GPIO pin which enables 6.8V for OTP programming.

CLASSIFICATION		Design Guide	No. DS-DG-174	0ETU	REV. 2.1
SUBJECT	CLASS 2 BLUETOOTH MODULE Low Energy BT 4.1		PAGE	30 of	41
CUSTOMER'S CODE PAN1740 Evaluation T	ools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

### 10.1.3. UART Booter

The UART Booter enables to download application code directly into the RAM of the DA14580 to test its behavior in terms of power consumption for instance.

The user has to select the desired code (.bin, hex. or .ihex), press *Download* and observe the log to handle the requested hardware reset by the user.

🐾 UART Booter 🗙	
Select file to download:	
Profile\monitor_fe_usb_full_emb_sysram.hex Browse Download	
Uart Terminal	
	Start Terminal
	Stop Terminal
	Clear
Log	
[INFO @15-01-08 09:22:50] Connection to COM6 port has	
[INFO @15-01-08 09:28:04] Successfully disconnected from port COM6.	
[INFO @15-01-08 09:28:09] Connection to COM6 port has successfully opened.	
[INFO @15-01-08 09:28:11] Successfully disconnected from port COM6.	
[INFO @15-01-08 09:51:29] Connection to COM6 port has successfully opened.	

Furthermore, the UART Booter enables the opportunity to receive debugging information via UART. To activate this functionality the user will have to press *Start Terminal*. note that an activated UART connection disables the OTP connection with the result that the UART connection has to be closed to enable the OTP connection and vice versa.

#### 10.1.4. Power Profiler

The tool Power Profiler enables the user to measure the power consumption of the desired application with all its functionality.

To start the measurement the user will have to press *Initialize* and *Start* after the initialization has successfully opened the COM-Port connection. A measurement example of the Bluetooth scanning process of the PAN1740 is depicted below.



On the right hand side, the tool provides the measurement information about *Peak Current* (*mA*), *Average Current* (*mA*), *Charge* ( $\mu$ C) and the *Sleep Mode* of the current measurement. In addition, the tool provides the following control functionalities *Auto Trigger Mode* and *Auto Stop Mode*.

In *Auto Trigger Mode* the measurement process starts as soon as the current (mA) exceeds a user-definable threshold.

In *Auto Stop Mode* the measurement process stops automatically when the user-definable time (ms) is elapsed.



The previously depicted toolbar can be found in the top of Smart Snippets and enables the user to add measurements and markers, export/import data to/from csv files, clear secondary current data and to take snapshots of the Power Profiler chart (.png), which can be found in the path Dialog/Smart Snippets/Projects/UserProject.

For additional information about the Power Profiler Configuration Dialog, refer to the Smart Snippet help (Help/User Guide/Power Profiler).

CLASSIFICATION		Design Guide	No. DS-DG-1740E	TU	REV. 2.1
SUBJECT	CLASS 2 BLUETOOTH MODULE Low Energy BT 4.1		PAGE	32 of	41
CUSTOMER'S CODE PAN1740 Evaluation Tools		PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

### 10.1.5. Sleep Mode Advisor

This tool uses the gathered consumption data from the Power Profiler and depicts the power consumption in the sleep modes *Deep Sleep* and *Extended Sleep* in a circle diagram. The user will have to configure parameters such as battery size etc., to obtain reliable calculation results.

🍝 Sleep Mode Advisor 🗙				
Active Time Charge (uC):	219.0563		Update	
Connection interval (msec):	3000			
OTP program size (KBytes):	32			
Transmitted data (bytes):	2			
Battery size:	300 mAh (10800	00 mC)		
Include battery discharge m	odel: 🗹			
Deep Sleep discharge volta	je: 2.35	•		
Extended Sleep discharge v	oltage: 2.0	•		
Power Profiler Sleep Mode:	Deep			
Aver	ge Connection Interval Ch	arge		
	Consumed (uC)	Battery life tir	ne (days)	
Extended Sleep	219.2452		171.0	
Deep Sleep	220.4785		170.1	
	Power Breakdown			
CPU/BLE Stack (9%) Analog / XTAL (9%) OTP Mirror (17%)		RX/TX Radio (57%)		

This previous figure from the Smart Snippets help shows an example that prefers the Extended Sleep Mode as the battery lasts 171 days compared to 170 days in deep sleep.

For detailed information, refer to the Smart Snippets help (Help/User Guide/Sleep Mode Advisor).

CLASSIFICATION		Design Guide	No. DS-DG-1740E	TU	REV. 2.1
SUBJECT	CLASS 2 BLUETOOTH MODULE Low Energy BT 4.1		PAGE	33 of	41
CUSTOMER'S CODE PAN1740 Evaluation Tools		PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

10.1.6. OTP Programmer, SPI Flash Programmer and EEPROM Programmer

To burn the OTP Memory and the OTP Header on the DA14580 with a userdefinable .hex/.ihex or .bin file, the tool OTP Programmer is used.

The OTP Image tab serves the purpose to read and burn the OTP Memory while the OTP Header tab is used to validate and burn the OTP header. The tab OTP NVDS works similar to the OTP Header and is used to burn the OTP NVDS memory block.

The SPI Flash Programmer enables the user to download an image file to the SPI flash memory of the DA14580. The functionality is similar to the OTP Programmer functionality, but the used firmware is different.

The EEPROM Programmer is used for downloading an image file to the DA14580 EEPROM Memory similar to the OTP and SPI Programmer functionality.

For detailed information of how to use the OTP Programmer, the SPI Flash Programmer and/or the EEPROM Programmer, refer to the Smart Snippets help (Help/User Guide/OTP Programmer or SPI Flash Programmer or EEPROM Programmer).

10.1.7. SPotA (Software Patch over the Air)

The tab SPotA can be used to execute Software patches from changing a single variable in the code which resides in the SRAM to changing an instruction or data value read from the ROM used for protocol realization. note that a SPotA is only possible with an SPotA capable counterpart.

refer to the Smart Snippets help (Help/User Guide/SPotA) to understand how to establish a connection and patch the software.

CLASSIFICATION		Design Guide	No. DS-DG-1740ETU	J	REV. 2.1
SUBJECT	CLASS 2 BLUETOOTH MODULE Low Energy BT 4.1		PAGE	34 of 4	41
CUSTOMER'S CODE PAN1740 Evaluation Tools		PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	)16

## 10.2. Application Demo: Proximity Profile

This application example demonstrates the usage of Smart Snippets based on the previously used proximity profile demo. Two DA14580 evaluation boards with PAN1740 adapter boards have been used which have both been connected to Smart Snippets.

One kit is loaded with the application code for the monitor (monitor\_fe\_usb\_full\_emb\_sysram.hex) by the UART Booter, the other one with the application code for the reporter (reporter\_fe\_usb\_full\_emb\_sysram.hex).

After that, the applications *host\_proxm\_sdk* and *host\_proxr\_sdk* have been launched and the respective COM ports have been entered and opened.

Once the devices have been connected, Smart Snippets enables live evaluation of the application code for instance by measuring the power consumption as depicted below.



CLASSIFICATION		Design Guide	No. DS-DG-1740E	TU	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE ow Energy BT 4.1	PAGE 35 of 4		41
CUSTOMER'S CODE PAN1740 Evaluation To	ools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

# 11. DIALOG SERIAL PORT SERVICE (DSPS)

Dialog provides with DSPS its own BLE communication profile. Software has been developed for the Development Kit Pro and tablets resp. phones allowing a serial port to be emulated between development kits, handheld devices and PAN1740 USB Sticks. This software can be downloaded from dialogs support website. Following are a few different examples.

11.1. Pro Kit with PAN1740 Adapter Board - IPod

The following example shows an easy application of the SPS with Dialog's Pro Kit with a PAN1740 Adapter Board as device and an IPod running the DSPS application as host to exchange data. The kit needs to be set up as device using Dialogs SPS application example *"sps\_device"*. For that to happen, either the Connection Manager or Smart Snippets can be used.

The default pin assignment for the DSPS application software with hardware flow control on the Pro Kit is as follows.



This pin assignment can be changed to any desired pin assignment in the application source code file *periph\_setup.h*. To simplify the connection by using jumpers the following pin assignment is suitable.



This assignment does only require a simple amendment in the code.

//#define GPIO UART1 RTS PIN

#define GPIO\_UART1\_RTS\_PIN GPIO\_PIN\_6 //New configuration
#define GPIO\_UART1\_CTS\_PORT GPIO\_PORT\_0
//#define GPIO\_UART1\_CTS\_PIN GPIO\_PIN\_2 //Previous configuration
#define GPIO\_UART1\_CTS\_PIN GPIO\_PIN\_7 //New configuration

GPIO PIN 3 //Previous configuration

CLASSIFICATION		Design Guide	No. DS-DG-1740ETU	J	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE ow Energy BT 4.1	PAGE	PAGE 36 of 4	
CUSTOMER'S CODE PAN1740 Evaluation To	ools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

As soon as the kit has been set up as described in previous chapters, the user can launch the DSPS iOS application which starts scanning automatically for discoverable devices. The user can connect to the desired device by selection. This procedure is depicted below.

iPod ᅙ	11:18	∢ ∦ <b>==</b> •+	iPod 후	10:55	⋪ 🕸 📖	iPod 후	11:01	<b>∛ ≵</b> █■)•
🔿 1 devi	ce found	$\mathbf{x}$	O 1 devic	e found	$(\mathbf{x})$	Receive Co	DA1458x	62501715
	Searching		DA :DB 1FB662	98E661-FCE5-79A2 501715	-8865-	ASCII     Send Cons		
<b>DA14</b> DA :DB 1FB66	- <b>58x</b> 198E661-FCE5-79A2 2501715	<b>&gt;</b> -B865-						
						ASCII		
				(C) search again		Console	RX/TX File	About

After the connection has been established the user should see a tabbed view with a connection status bar at the top and the tabs *Console*, *RX/TX*, *File* and *About* at the bottom.

The *Console* tab enables to send data (ASCII or HEX) immediately after typing the data into the field *Send Console Mode Data* and receives data from the device, e.g. Smart Snippet UART Terminal, as shown below.

iPod ♀ 12:19 ┦ ¥ ■ +	Booter 🗙 📁 Terminal 🗙	
DA1458x DB98E661-FCE5-79A2-B865-1FB662501715 Receive Console Mode Data	Vart Terminal	
Sent from SmartSnippet Terminal	Sent from SmartSnippet Terminal Sent from DSPS Application	
OASCIL OHEX		
Send Console Mode Data		
Sent from DSPS Application		
●ascii Ohex	Start Terminal Stop Terminal	Clear
	Log	
	[INFO @15-02-05 09:28:04] Connection to COM23 port has successfully opened. [INFO @15-02-05 10:08:57] Successfully disconnected from port COM23. [INFO @15-02-05 10:09:07] Connection to COM23 port has successfully opened.	
Console RX/TX File About		

The tab *RX/TX* allows similar functionality as the *Console* tab, but enables to send data character by character manually or based on a cyclic sending interval which can be determined by the user.

CLASSIFICATION		Design Guide	No. DS-DG-1740E	ГU	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE w Energy BT 4.1	PAGE 37 of		41
CUSTOMER'S CODE PAN1740 Evaluation To	ols	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

The tab *File* enables to send data files instead of character strings. After the definition of a connection interval, the file directory of the device can be browsed to select the desired file.

For detailed information, refer to the Dialog document UM-B-038.

### 11.2. Two Pro Kits with PAN1740 Adapter Board

Similar to the previous example it is also possible to use two of Dialog's Pro Kits with PAN1740 Adapter Boards to emulate a serial port. Note the HW flow control changes (jumper or source code) required as explained in chapter 11.1.

The first step is to set up one kit with the "*sps\_device*" application software and the other one with the "*sps\_host*" application software by downloading the .hex files onto the kits.

After that, the host should have discovered and connected to the device enabling the user to launch a terminal (for instance the Smart Snippet Terminal) and exchange data.

### 11.3. Two PAN1740 USB sticks

To establish a serial port connection with two PAN1740 USB sticks it is necessary to amend the *user\_periph\_setup.h* of the host and the device source code as follows.

Initially, it is mandatory to change the flow control mode from the default hardware flow control to software flow control.

#undef CFG\_UART\_HW\_FLOW\_CTRL
#define CFG\_UART\_SW\_FLOW\_CTRL

The next step is to disable the sleep mode, as this is not fully supported for software flow control in *user\_config.h*.

const static sleep\_state\_t app\_default\_sleep\_mode = ARCH\_SLEEP\_OFF;

After that, the amended source codes have to be compiled and the output .hex files have to be downloaded onto the sticks by using Dialogs *Connection Manager* or *Keil uVision*. note that it is not possible to run the sticks with Dialogs Smart Snippets.

After the application software has been successfully downloaded to the sticks, launch two terminals (e.g. Tera Term) with the corresponding COM port and the following settings:

Baud Rate: 115200

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: Xon/Xoff

Expecting the previous steps to be successful, the data exchange can be started. The data transmission happens immediately, so that one terminal window will stay empty for unidirectional data transfer as depicted below.

CLASSIFICATION		Design Guide	No. DS-DG-174	0ETU	REV. 2.1
SUBJECT	CLASS 2 La	BLUETOOTH MODULE ow Energy BT 4.1	PAGE 38 of 4		41
CUSTOMER'S CODE PAN1740 Evaluation T	ools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

🖳 COM31:115200baud - Tera Term VT 📃 💻 🗶	SCOM14:115200baud - Tera Term VT 🛛 💻 🗙
Datei Bearbeiten Einstellungen Steuerung Fenster	Datei Bearbeiten Einstellungen Steuerung Fenster
Hilfe	Hilfe
Sent from Host[	Sent from Device[
	E
· · · · · · · · · · · · · · · · · · ·	<b>v</b>

CLASSIFICATION		Design Guide	No. DS-DG-1740E	TU	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE ow Energy BT 4.1	PAGE	39 of -	41
CUSTOMER'S CODE PAN1740 Evaluation To	ols	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

# **12. PRODUCTION TOOLS**

To program the PAN1740 in production a J-Link programmer and the 6.8V programming voltage on the VPP input pin is required. Here is an example schematic for a programming jig.



For more details on programming the OTP refer to the Smart Snippets documention and Dialog's programming guide located on Dialog's website.

Note: The crystal frequency register and flag as well as the Bluetooth MAC address is already burned.

In regards to implement the smart snippets into production tooling there is a help file in it that explains the command mode.

Here is an example of the programming into OTP:



More details are explained in the help file of Smart Snippets.

CLASSIFICATION		Design Guide	No. DS-DG-1740ET	ſU	REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE w Energy BT 4.1	PAGE 40 of 4		41
CUSTOMER'S CODE PAN1740 Evaluation To	ools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE	11.04.20	016

# 13. HISTORY FOR THIS DOCUMENT

Revision	Date	Modification / Remarks
0.1	02.04.2014	Initial Preliminary Release.
1.0	04.06.2014	Added USB dongle and Connection Manager description. Release Version.
1.1	25.06.2014	Added Keil Project example.
1.2	17.07.2014	Added Proximity example for connecting two PAN1740 USB dongles.
1.3	05.09.2014	Added information about production tools.
1.4	26.09.2014	Editoral changes.
1.5	13.01.2015	Added chapter about Mother Board, Adapter Board and Smart Snippets
1.6	06.02.2015	Added chapter about SPS
1.7	16.02.2015	Added software flow control source code amendments in SPS chapter
1.8	30.07.2015	Added chapter Beacon
1.9	17.08.2015	Added a note about beacon programming with FFC
2.0	01.10.2015	Added the schematic for the Beacon
2.1	11.04.2016	Deleted link to the old SDK. Added information in chapter 12 Production Tools. SDK5.x supported.

# 14. RELATED DOCUMENTS

- [1] PAN1740 Datasheet http://pideu.panasonic.de/files/Documents/WM%20Documents/PAN1740/PAN1740\_Datasheet.pdf
- [2] Dialog Website http://support.dialog-semiconductor.com/
- [3] Additional Information http://pideu.panasonic.de/
- [4] http://developer.bluetooth.org

CLASSIFICATION		Design Guide	No. DS-DG-1740ETU		REV. 2.1
SUBJECT	CLASS 2 Lo	BLUETOOTH MODULE w Energy BT 4.1	PAGE 41 of 4		41
CUSTOMER'S CODE PAN1740 Evaluation To	ools	PANASONIC'S CODE PAN1740 Evaluation Tools	DATE 11	1.04.20	16

### **15. GENERAL INFORMATION**

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Panasonic disclaimes any liability for consequential and incidental damages.

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

#### 16. 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 PAN1740 will be published in the PAN1740 Datasheet.

### 17. 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.