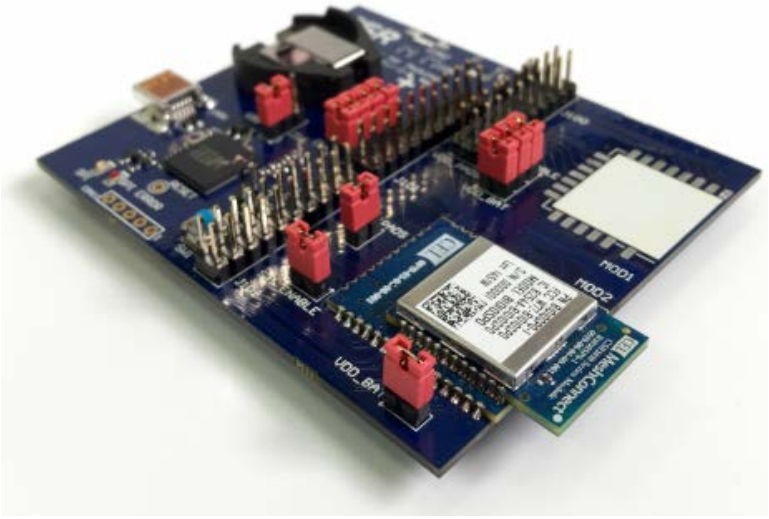
0019-02-08-01-000
B1010SP0-EVB-1 Bluetooth® Smart Evaluation Board User Guide

Document No:
0019-02-08-01-000 (issue B)



INTRODUCTION

CEL's Bluetooth Smart Evaluation Board is a simple yet comprehensive way for designers to develop Bluetooth Smart applications using CSR's µEnergy® solution. B1010SP0-EVB-1 is based on CSR's µEnergy Starter Development Kit, but has been populated with a CEL B1010SP0 Mini Module. For more information on the CEL B1010SP0 Mini Modules, please visit http://meshconnect.cel.com/B1010.

B1010SP0-EVB-1 is designed to be used in conjunction with CSR's µEnergy platform for software development, and is a complete development environment for rapid prototyping of Bluetooth Smart products. It provides access to CSR's µEnergy and CSRmesh® stacks for developing interoperable BLE 4.x and CSRmesh-based designs, including:

- Software Development Kit (SDK)
- Example embedded applications for popular Bluetooth Smart and CSRmesh profiles
- Example host applications for iOS and Android
- xIDE for µEnergy (includes compiler)
- Production test and configuration tools

This User Guide describes the kit contents, SDK installation, and running the first application for both the µEnergy and CSRmesh SDKs, used for BLE and CSRmesh applications, respectively.

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KIT CONTENTS

The following components are included in B1010SP0-EVB-1:

1. Target Board:

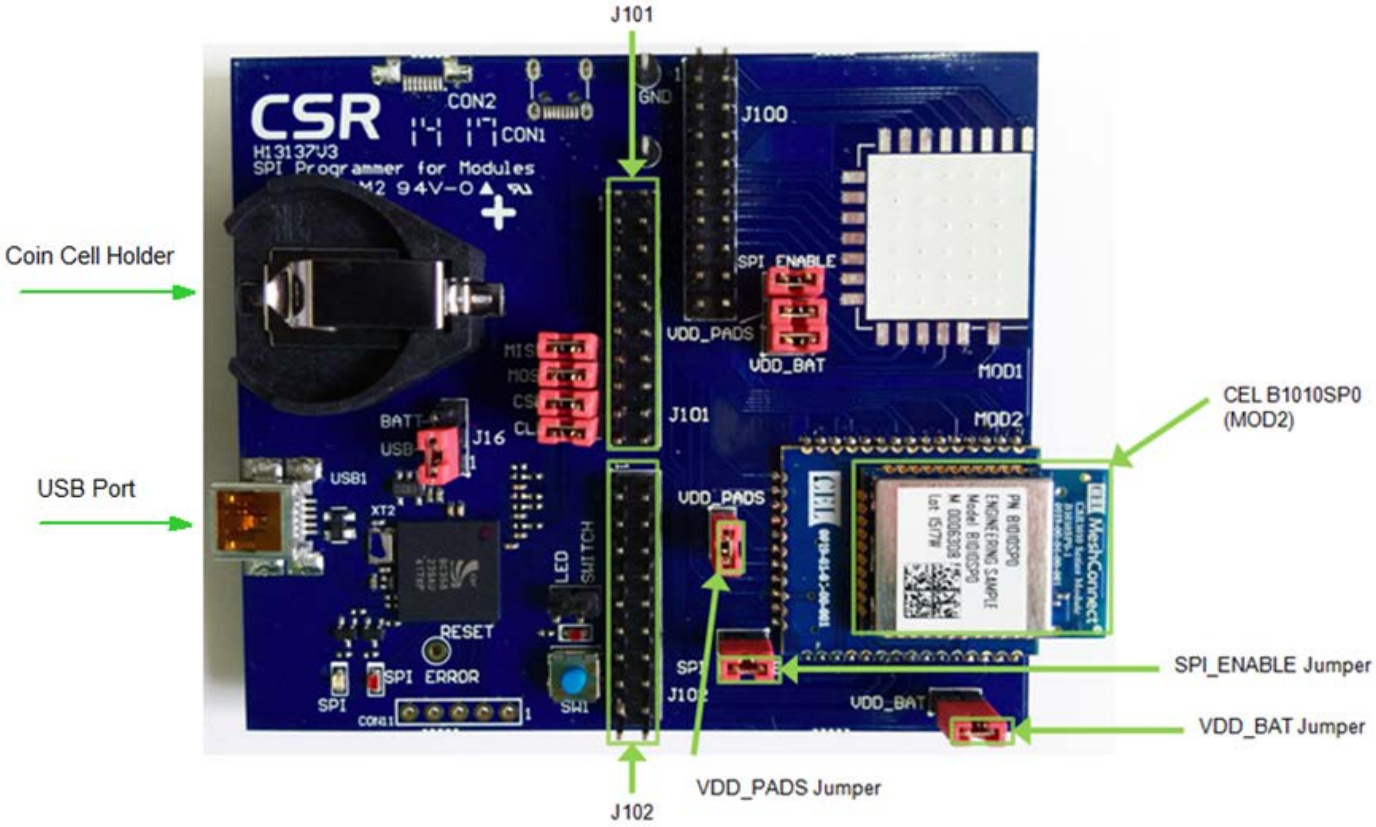


Figure 1 - Evaluation Kit Target Board

For proper operation of the B1010SP0 Mini Module, ensure that the VDD_PADS, SPI_ENABLE, and VDD_BAT jumpers are installed as shown in Figure 1.

2. A Mini-USB cable to connect the target board to the development PC:

Figure 2 - Mini-USB Cable

3. Card with website link to view/download the documentation.

SOFTWARE INSTALLATION

The following steps are required to complete the CSR µEnergy SDK setup:

1. Obtain the activation code for the kit. This is printed on a label on the side of the kit box, and looks similar to Figure 3. For more information, visit https://wiki.csr.com/wiki/Activation_Codes.

Figure 3 - B1010SP0-EVB-1 Activation Code

2. Register your kit at http://www.csrsupport.com using the activation code to create a CSR Support account. For more information, visit https://wiki.csr.com/wiki/CSR_Support_Registration.

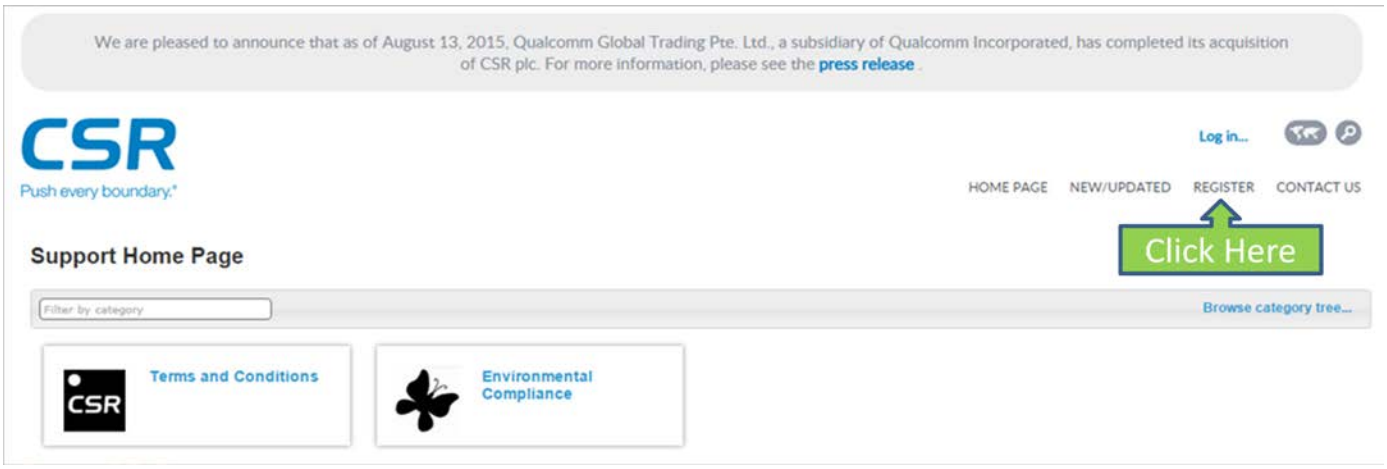


Figure 4 - CSR Support Registration

3. Once you have approved the terms and conditions and ECA agreement been approved for access you will be able to login the CSR Support.

   Note: Please make sure you use your company email address or you may be required to change your email address to gain access. This is done through your account setting which will require an additional email be sent to your email address to be verified for access requests.

   Once authorized, it is possible to download the uEnergy SDK from CSRsupport with the CSRmesh level of access.

   For access to CSRmesh SDK, click on the link highlighted below in green (at https://wiki.csr.com/wiki/Main_Page) and enter activation code following steps at https://wiki.csr.com/wiki/Activation_Codes

Dev Kit Part Number	Latest SDK	Release Notes	
DK-CSR1010-10169 Starter Kit	CSR µEnergy SDK 2.5 Installer OTAU encryption library	SDK Release Note	Activation Codes
DK-CSR1010-10184 CSRmesh Kit	CSR µEnergy SDK 2.5 Installer OTAU encryption library	SDK Release Note	Activation Codes
DK-CSR1010-10136-1A,DK-CSR1011-10138-1A	CSR µEnergy SDK 2.5 Installer OTAU encryption library	Release Note	Requires an approved representative.

Figure 5 – uEnergy SDK and CSRMesh SDK

4. Once you have successfully created a CSR Support account, download and install the latest version of the µEnergy SDK (for BLE applications) or the CSRmesh SDK (for CSRmesh applications) from http://www.csrsupport.com. The default configuration options are recommended during the installation process.

   Note: always install the software before plugging in the hardware.

   To continue with the µEnergy SDK, please see the section below called "Connecting the Hardware: µEnergy SDK".

   To continue with the CSRmesh SDK, please see the section later in this document called "Connecting the Hardware: CSRmesh SDK".

Figure 6 - CSR µEnergy SDK Installer

CONNECTING THE HARDWARE: µENERGY SDK

1. Remove the target board from the anti-static packaging.

2. Connect the mini-USB cable to the target board USB port and connect the other end of the cable to a free USB port on the development PC. The device drivers necessary to connect to the target board are automatically installed on the PC.

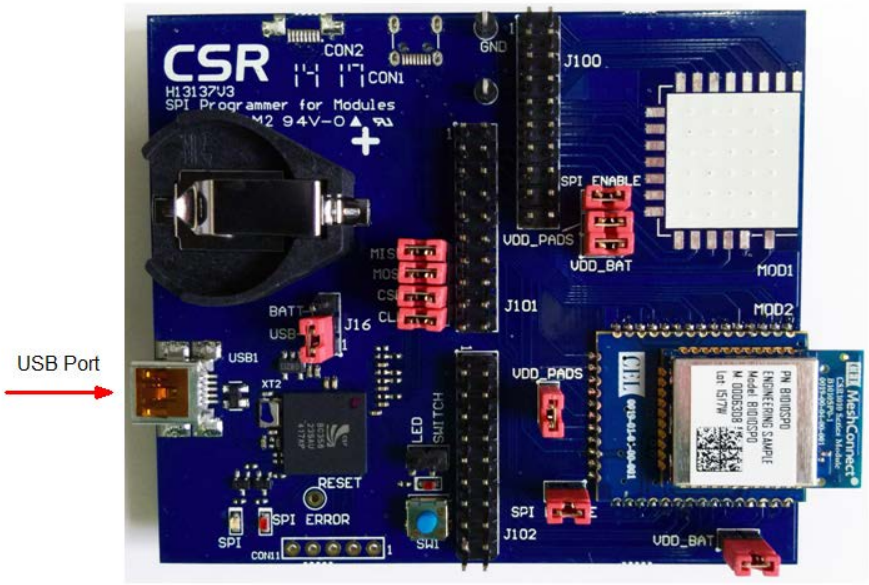


Figure 7 - Evaluation Kit Target Board Showing USB Port Location

RUNNING THE FIRST APPLICATION: µENERGY SDK

1. Launch xIDE by clicking on the xIDE shortcut on the desktop or navigating to it using the Windows Start Menu.

Figure 8 - xIDE Shortcut

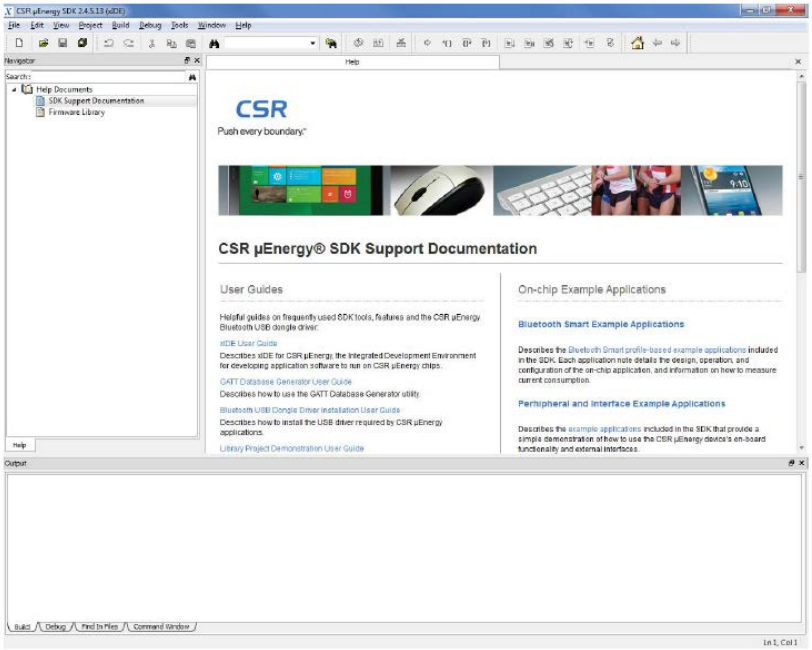


Figure 9 - xIDE Window

2. Open the Heart Rate project by clicking on "Project" in the menu bar and selecting "Open Workspace". Navigate to the SDK installation folder. If the default installation path was chosen, this will be ***C:\CSR_uEnergy_SDK-x.x.x.x\apps\hr_sensor***.

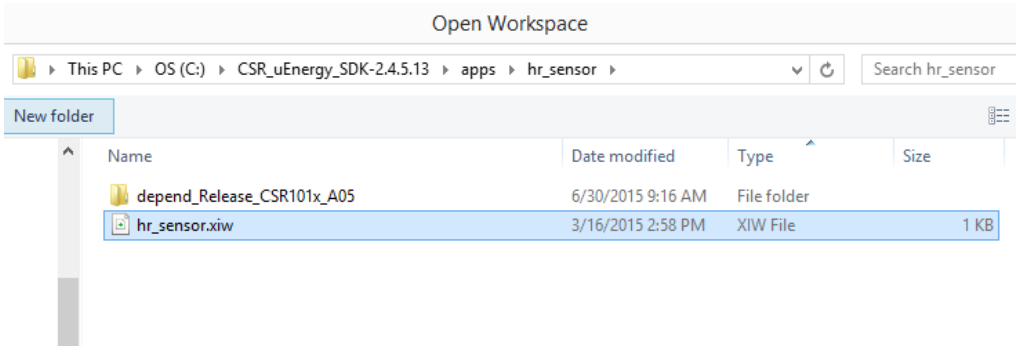


Figure 10 - Default Location of hr_sensor Project

3. Some of the default settings need to be customized for your particular evaluation kit, including:
   a. Bluetooth Address
   b. Crystal Trim
   c. Device Name

The Bluetooth Address and Crystal Trim need to match the values printed on the target board label.

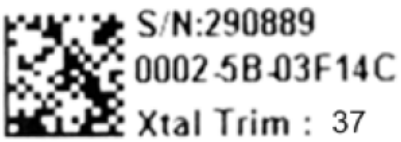


Figure 11 - Example Target Board Label

4. Open the **hr_sensor_cs101x_A05.keyr** file in the SDK and change the values `&BDADDR` and `&CRYSTAL_FTRIM` to match the label.

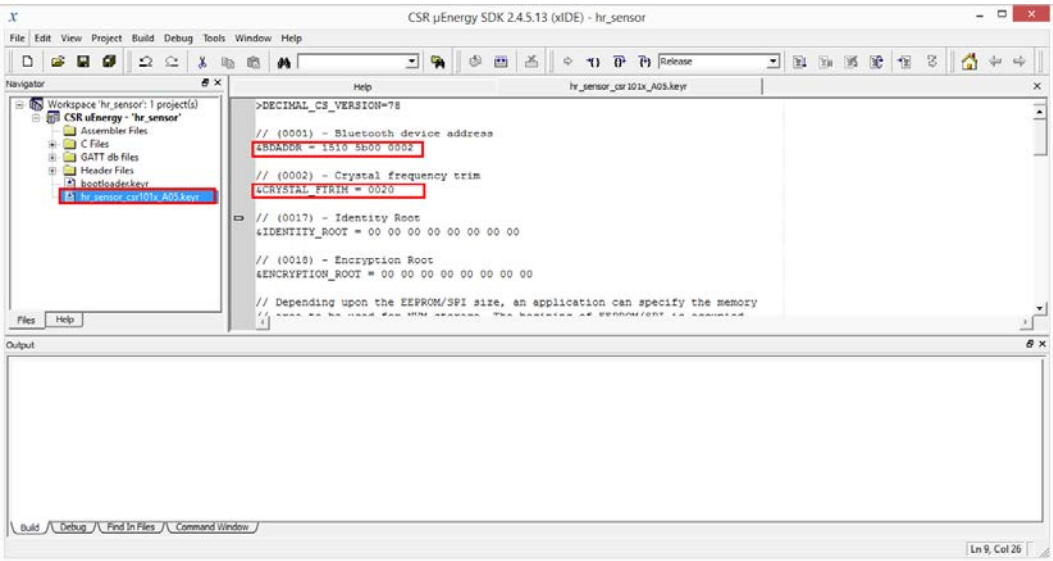
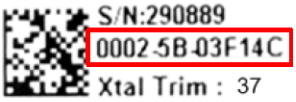


Figure 12 - Location of Bluetooth Address and Crystal Trim Values to be Modified

5. For the Bluetooth Address, the Endian format of the value on the label must be converted as shown below.




```
>DECIMAL_CS_VERSION=78

// (0001) - Bluetooth device address
&BDADDR = F14C 5b03 0002
```

Figure 13 - Example Bluetooth Address Conversion

6. For the Crystal Trim value, the decimal value on the label must be converted to hexadecimal as shown below.

Figure 14 - Example Crystal Trim Value Conversion

7. To customize the Device Name, search for the declaration `g_device_name` in **gap_service.c** within the SDK.

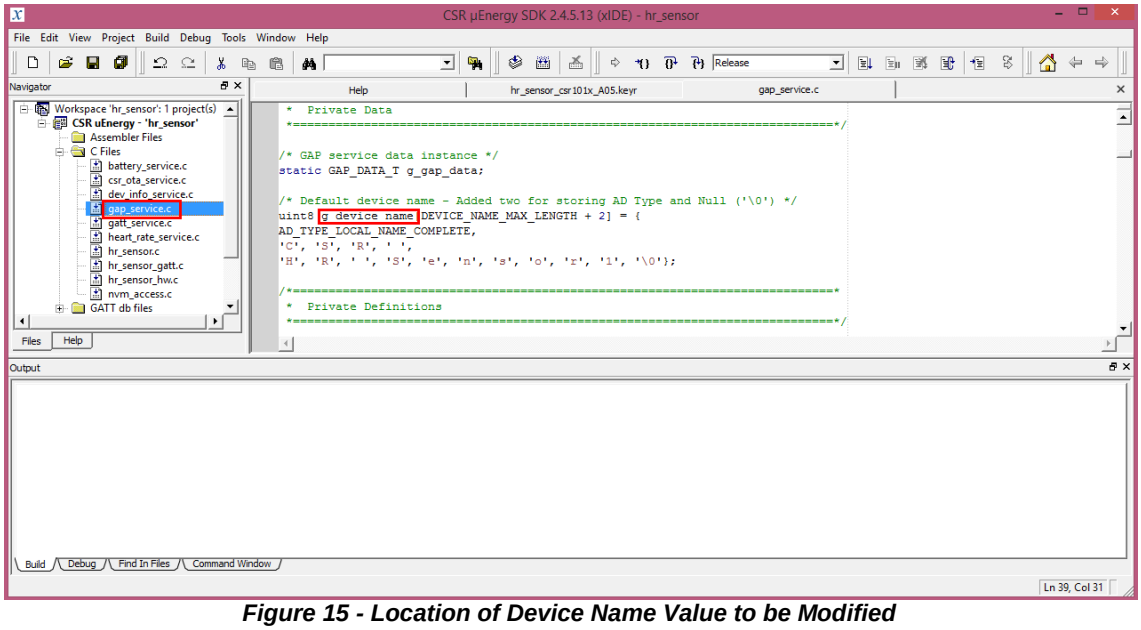
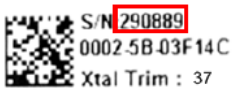


Figure 15 - Location of Device Name Value to be Modified

8. Replace the word "Sensor" with the serial number on the label.

```
uint8 g_device_name[DEVICE_NAME_MAX_LENGTH + 2] = {
AD_TYPE_LOCAL_NAME_COMPLETE,
'C', 'S', 'R', ' ',
'H', 'R', ' ', 'S', 'e', 'n', 's', 'o', 'r', '\0'};
```




```
uint8 g_device_name[DEVICE_NAME_MAX_LENGTH + 2] = {
AD_TYPE_LOCAL_NAME_COMPLETE,
'C', 'S', 'R', ' ',
'H', 'R', ' ', '2', '9', '0', '8', '8', '9', '\0'};
```

Figure 16 - Modification to Device Name

9. Compile the Heart Rate application by clicking on **Build** in the SDK menu bar. Select **Build Active Project** or press **F7** shortcut key. This will build all of the files included in the active project in the current workspace using the selected configuration into an application image for the Target board.

   The build is incremental, so the minimum set of builds are performed in order to reflect changes to source files and configurations. The Target board must remain connected during compilation.

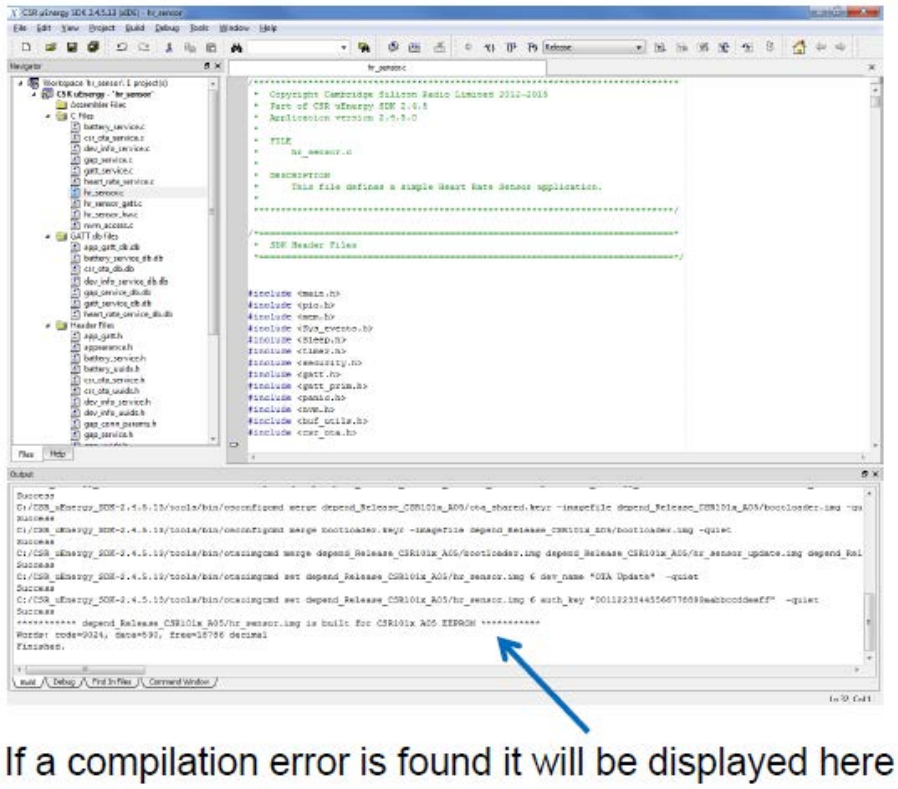


Figure 17 - Successfully Built Project

10. Download the application to the hardware by selecting **Run** from the **Debug** menu or press the **F5** shortcut key. The Heart Rate application will now be running on the hardware.

    Note that it will stop advertising after a few minutes so will not be visible to any searching phones. To re-enable advertisements, the button can be connected to PIO11 with a jumper (not supplied) or the eval board can be power cycled.

    For more information on the heart rate application, see the *Heart Rate Sensor Application Note* installed with the SDK. If the default installation path was chosen, this will be located at **C:\CSR_uEnergy_SDK-2.4.5.13\apps\hr_sensor\ CS-227117-AN_CSRuEnergyHeartRateSensorApplicationNote.pdf**

USING B1010SP0-EVB-1 UART DEBUG PORT

The B1010SP0-EVB-1 does not include a 3.3V level shifter required to connect to a computer's USB or RS232 interface. CEL recommends purchasing an external 3.3V to USB level shifter.

For more information about debugging please see the debug module of the xIDE. It's located under the Navigator window by selecting *Help Documents -> Firmware Library*, select the *Modules* tab and scroll to the bottom and select the *Debug* module. The Debug module contains a number of functions to allow an application to send basic text strings across the UART, primarily for sending debugging messages to a serial terminal.

COMPANION PHONE APPS: µENERGY SDK

Reported pulse information from the Heart Rate application can be viewed with an iOS or Android phone. Visit the "Mobile Applications" section at http://wiki.csr.com for information on downloading the example apps.

Figure 18 - CSR Profile Demonstrator App for iOS

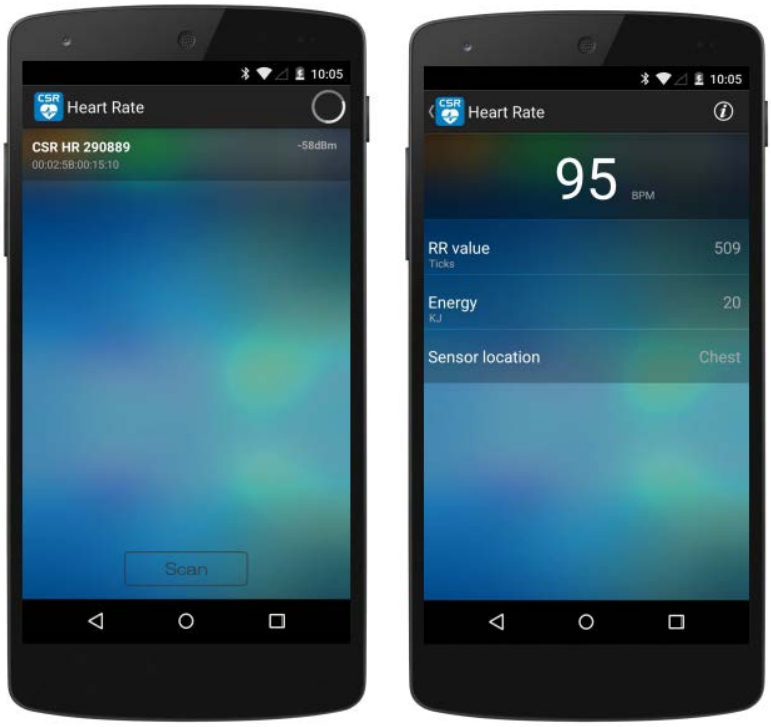


Figure 5 - Heart Rate App for Android

CONNECTING THE HARDWARE: CSRMESH SDK

This section follows the "Software Installation" section (earlier in this document) for users developing with the CSRmesh SDK.

1. Remove the target board from the anti-static packaging.
2. Connect the mini-USB cable to the target board USB port and connect the other end of the cable to a free USB port on the development PC. The device drivers necessary to connect to the target board are automatically installed on the PC.
3. Connect a jumper wire (not supplied) between J101 pin 14 (PIO10) and the LED control pin as shown in the figure below. This wire will be used to control the LED.

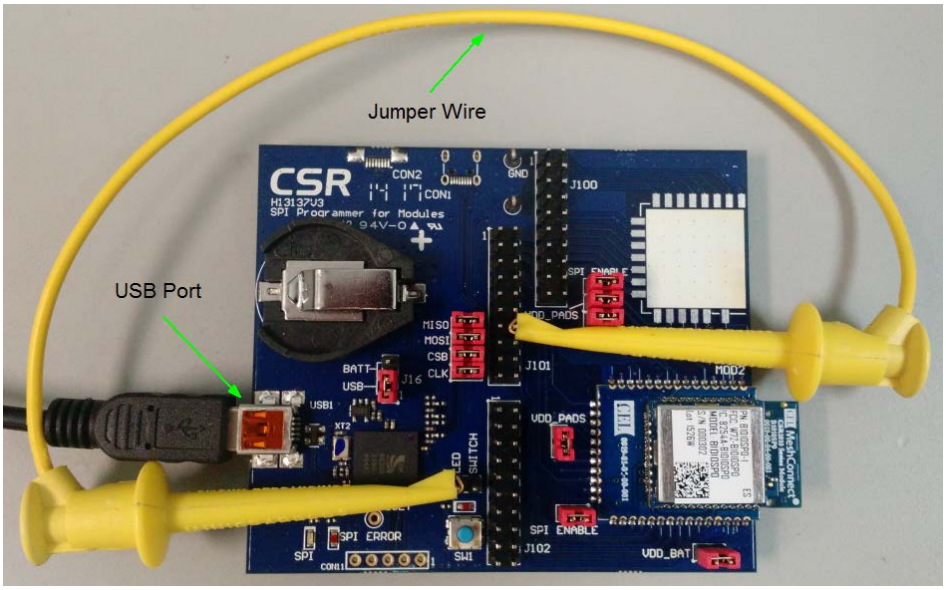


Figure 20 - Evaluation Kit Target Board Showing USB Port Location & Jumper Wire

RUNNING THE FIRST APPLICATION: CSRMESH SDK

1. Launch xIDE by clicking on the xIDE shortcut on the desktop or navigating to it using the Windows Start Menu.

Figure 21 - xIDE Shortcut

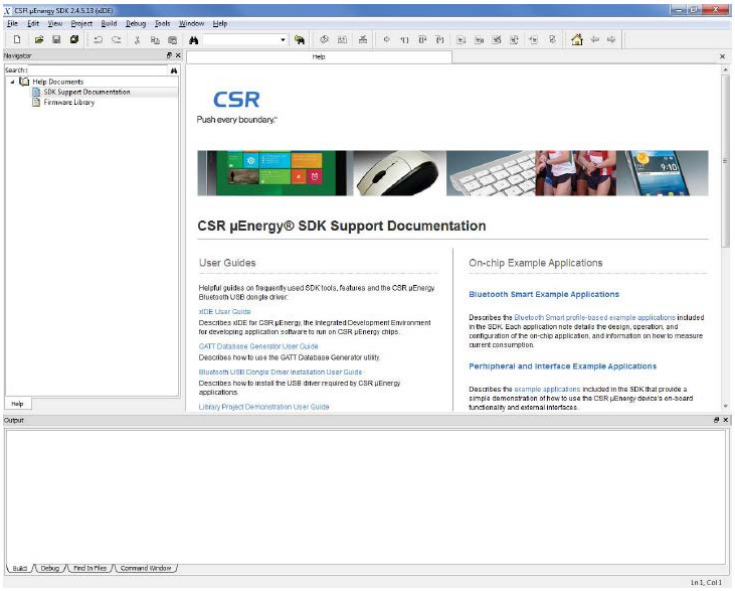


Figure 22 - xIDE Window

2. Open the Light Control project by clicking on "Project" in the menu bar and selecting "Open Workspace". Navigate to the SDK installation folder. If the default installation path was chosen, this will be ***C:\CSR_uEnergy_CSRmesh\applications\CSRmeshLight***.

   The Light Control application allows a Bluetooth Smart-enabled phone to send and receive CSRmesh commands and enables the user to control the LED on the Target board.

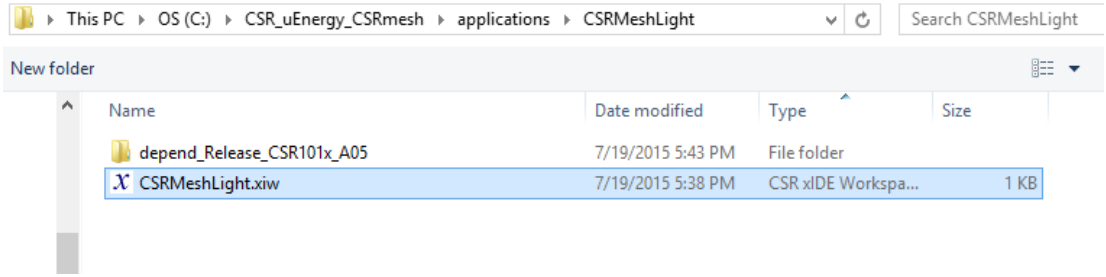


Figure 23 - Default Location of CSRmeshLight Project

3. Compile the Light Control application by clicking on **Build** in the SDK menu bar. Select **Build Active Project** or press **F7** shortcut key. This will build all of the files included in the active project in the current workspace using the selected configuration into an application image for the Target board.

   The build is incremental, so the minimum set of builds are performed in order to reflect changes to source files and configurations. The Target board must remain connected during compilation.

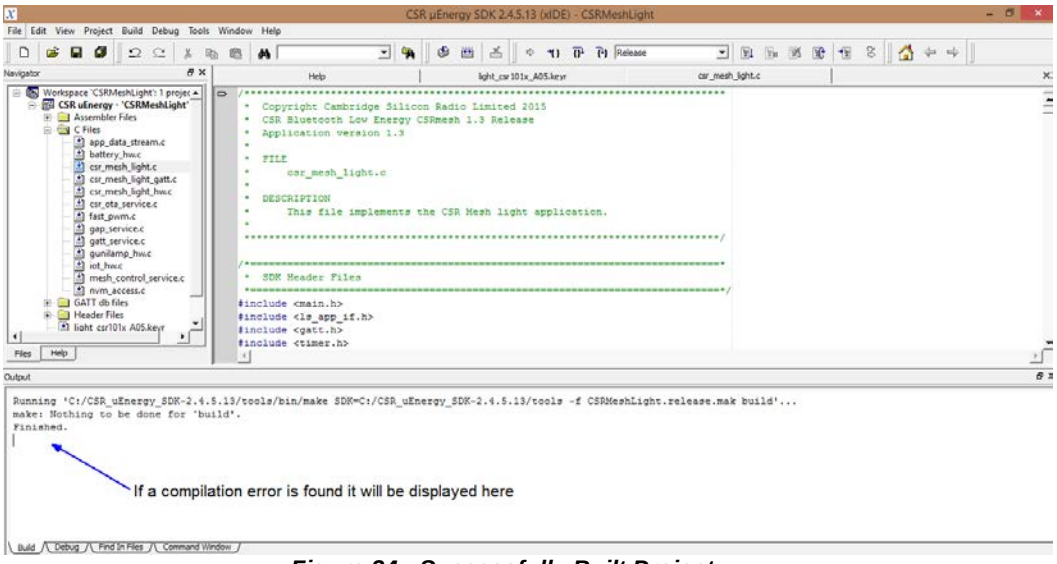


Figure 24 - Successfully Built Project

4. Download the application to the hardware by selecting **Run** from the **Debug** menu or press the **F5** shortcut key. The Light Control application will now be running on the hardware.

   For more information on the Light Control application, see the *CSRmesh Light Application Note* available for download from the CSR Support website.

   If desired, add additional B1010SP0-EVB-1 eval boards to the setup, following the same steps listed above. The eval boards will automatically mesh.

COMPANION PHONE APPS: CSRMESH SDK

The Target board LED can be controlled via a companion Android or iOS app. The apps can be downloaded from the CSRmesh portion of the CSR Support website. This section will describe the operation of the Android app.

The app will connect to a CSRmesh device. The device acts as a bridge from the phone app to the rest of the CSRmesh network.

1. When the app is launched, the initial screen shown below is displayed.
2. Tap on "Device Association" to search for devices that support CSRmesh.
3. Tap a discovered device to connect to it.
4. The app may ask you for a network passphrase. Enter any suitable passphrase to be used by all your trusted devices. Select the check box "Authorise Devices" only if you wish to use optional device authentication and know the short codes (private keys) for each of your end devices.
5. To control the Target board LED, select the Light Control menu option. Tap on the red portion of the color wheel and switch the control to "On". You should see the Target board LED toggle off/on as you tap between "Off" and "On".

Note: The app was designed to be used with a tri-color LED, while this eval board only has a single-color red LED, so ensure that the red region on the color wheel is selected. Also, the dimming feature of the app is not supported.

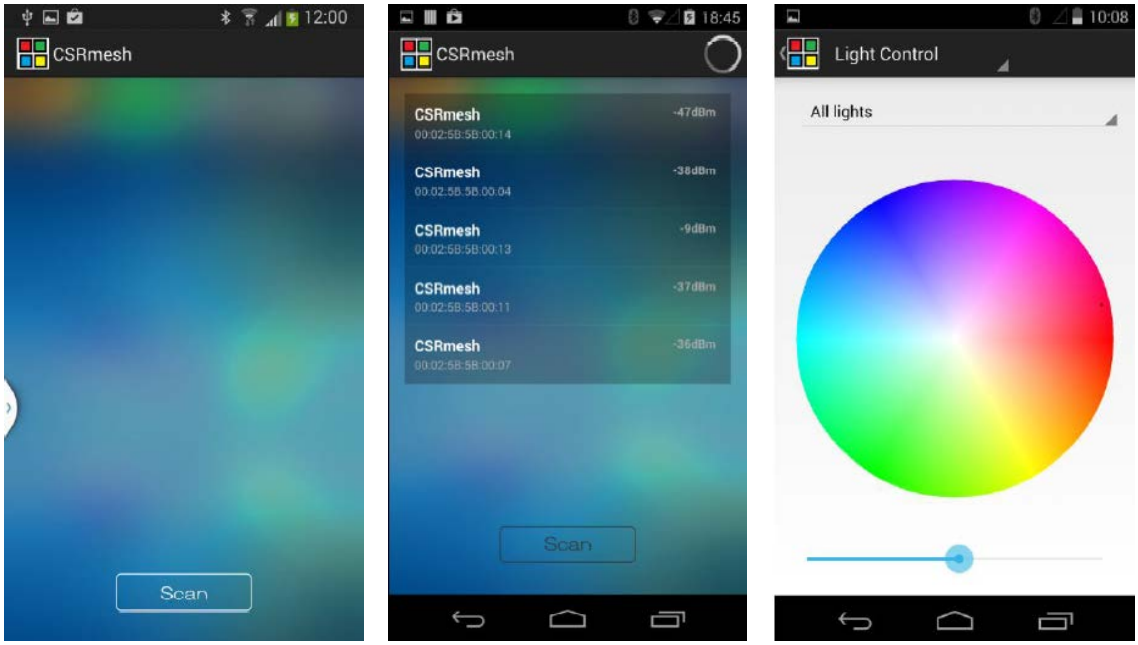


Figure 25 - Initial Screen, Device Association Screen, Light Control Screen

NEXT STEPS

For the µEnergy SDK, CSR provides application notes for many different BLE example applications, including an Alert Tag, Blood Glucose Sensor, Blood Pressure Sensor, Keyboard, Mouse, etc. Visit the "Example Applications" section at http://wiki.csr.com for a complete list.

For the CSRmesh SDK, CSR provides application notes for many different CSRmesh example applications, including a Switch, Heater, Temperature Sensor, etc. Visit the CSRmesh portion of the CSR Support website for a complete list.

REFERENCE: MEASURING CURRENT ON B1010SP0-EVB-1

To measure the total current consumed by the CEL module, a precision digital multi-meter can be used in place of the VDD_BAT jumper. This measures all of the current flowing to the module.

In order to measure the correct current, it is also necessary to temporarily remove the SPI_ENABLE jumper on the module. This is because in SPI mode the module has a 47kΩ pull-down resistor that is pulled high. See the figure below for the location of the VDD_BAT and SPI_ENABLE jumpers.

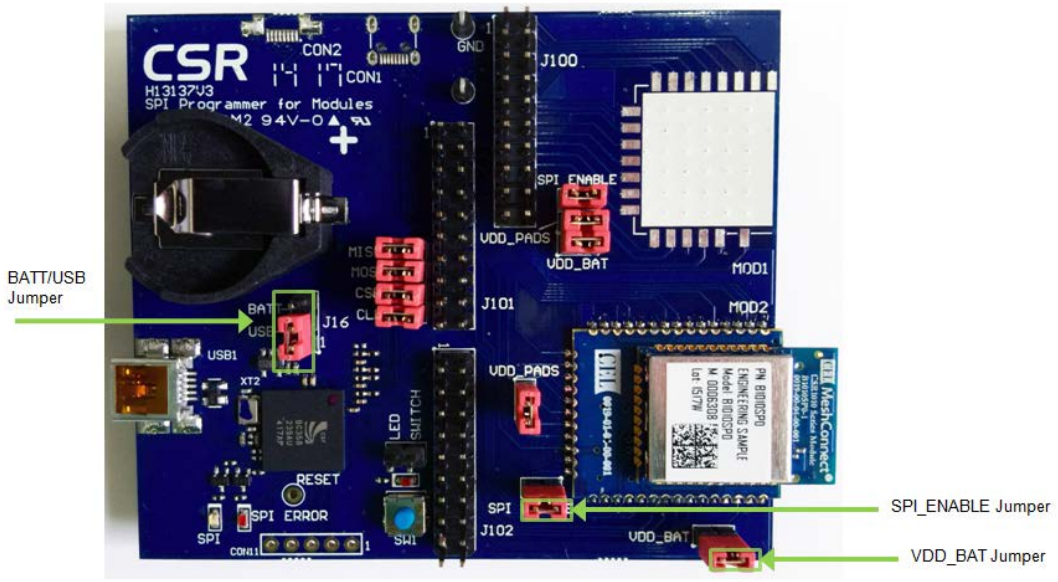


Figure 26 - SPI_ENABLE, VDD_BAT, BATT/USB Jumper Settings

REFERENCE: BATTERY OPERATION

The Target board can be powered from a CR2032 3V Lithium Ion battery (not supplied). It should be fitted to the battery holder with the positive (+) side upwards.

When the battery is in use, the BATT/USB jumper should be moved to the BATT position. The location of this jumper is shown in the above figure.

REFERENCE: J101 AND J102 HEADER PINOUTS

The following tables describe the breakout connections J101 and J102 (MOD2 connections) and are intended to show where the corresponding J101 and J102 pins can be used to make a connection to the CEL B1010SP0. CSR1010 IC pin information is also included below.

J101 Breakout Connections:

Description	CEL B1010SP0 Module Pin	CSR1010 IC Pin	J101 Header Pin
N/C	N/C	N/C	1
AIO0	25	13	3
PIO0/UART_TX	19	14	5
PIO3	10	16	7
PIO5/D_CLK	27	18	9
PIO7/MOSI	23	20	11
PIO9	18	23	13
PIO11	29	25	15
N/C	N/C	N/C	17
N/C	N/C	N/C	19

J101 Header Pin	CSR1010 IC Pin	CEL B1010SP0 Module Pin	Description
2	N/C	N/C	N/C
4	15	20	PIO1/UART_RX
6	N/C	N/C	N/C
8	17	15	PIO4
10	19	22	PIO6/CSB
12	22	24	PIO8/MISO
14	24	21	PIO10
16	N/C	N/C	N/C
18	N/C	N/C	N/C
20	N/C	N/C	N/C

J102 Breakout Connections:

Description	CEL B1010SP0 Module Pin	CSR1010 IC Pin	J102 Header Pin
I2C_SDA	11	29	1
N/C	N/C	N/C	3
N/C	N/C	N/C	5
N/C	N/C	N/C	7
N/C	N/C	N/C	9
N/C	N/C	N/C	11
N/C	N/C	N/C	13
AIO1	28	12	15
VDD_BAT	13	1	17
GND	1, 2, 12, 31, 33	PAD	19

J102 Header Pin	CSR1010 IC Pin	CEL B1010SP0 Module Pin	Description
2	28	14	I2C_SCL
4	N/C	N/C	N/C
6	N/C	N/C	N/C
8	N/C	N/C	N/C
10	N/C	N/C	N/C
12	N/C	N/C	N/C
14	11	30	AIO2
16	4	7	WAKE
18	N/C	N/C	N/C
20	PAD	1, 2, 12, 31, 33	GND

* See CSR1010 and B1010SP0 datasheets for detail pin descriptions.

REFERENCES

Reference Documents	Download
California Eastern Laboratories	
0019-00-07-00-000 B1010SP0 Mini Module Datasheet	Link
CSR	
CSR1010 Datasheet	Link
CSR Wiki	Link

REVISION HISTORY

Previous Versions	Changes to Current Version	Page(s)
0019-02-08-01-000 (Issue A) July 20, 2015	Initial Release	N/A
0019-02-08-01-000 (Issue B) Sept. 9, 2015	Updated Login and CSR software download procedure and figure numbers. Added section Using B1010SP0-EVB-1 UART Debug Port	All

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FOR MORE INFORMATION

For more information about CEL MeshConnect products and solutions, visit our website at www.cel.com/MeshConnect.

TECHNICAL ASSISTANCE

For Technical Assistance, visit http://www.cel.com/MeshConnectHelp

OCEAN CHIPS
Океан Электроники
Поставка электронных компонентов

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Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

AVIC JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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