AN218224

# WICED™ Quick Start Guide for BT CYW20719

**Associated Part Family: CYW207x9**

**WICED™ Studio 4**

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This document describes how to use WICED Studio to develop Bluetooth applications for CYW20719 devices.

## Contents





## 1 Introduction

This document provides detailed instructions to set up the Cypress Wireless Internet Connectivity for Embedded Devices (WICED; pronounced "wick-ed") Studio Development System for Bluetooth Basic Rate (BR) and Low Energy (LE) devices based on CYW20719.

WICED Studio 4 supports application development using a WICED evaluation board (CYW9207x9WCDEVAL). The development system is compatible with the Windows, Mac OS X, and Linux operating systems. This document describes the software components included in the WICED Studio Development System and provides instructions for compiling WICED sample applications using the WICED Studio Integrated Development Environment (IDE).

The instructions in this document must be completed before the WICED evaluation board can be used.

**Note:** This document applies to **WICED Studio 4 and WICED Bluetooth 20719 modules.**

## 2 IoT Resources and Technical Support

Cypress provides a wealth of data at http://www.cypress.com/internet-things-iot to help you to select the right IoT device for your design, and quickly and effectively integrate the device into your design. Cypress provides customer access to a wide range of information, including technical documentation, schematic diagrams, product bill of materials, PCB layout information, and software updates. Customers can acquire technical documentation and software from the Cypress Support Community website (http://community.cypress.com/).

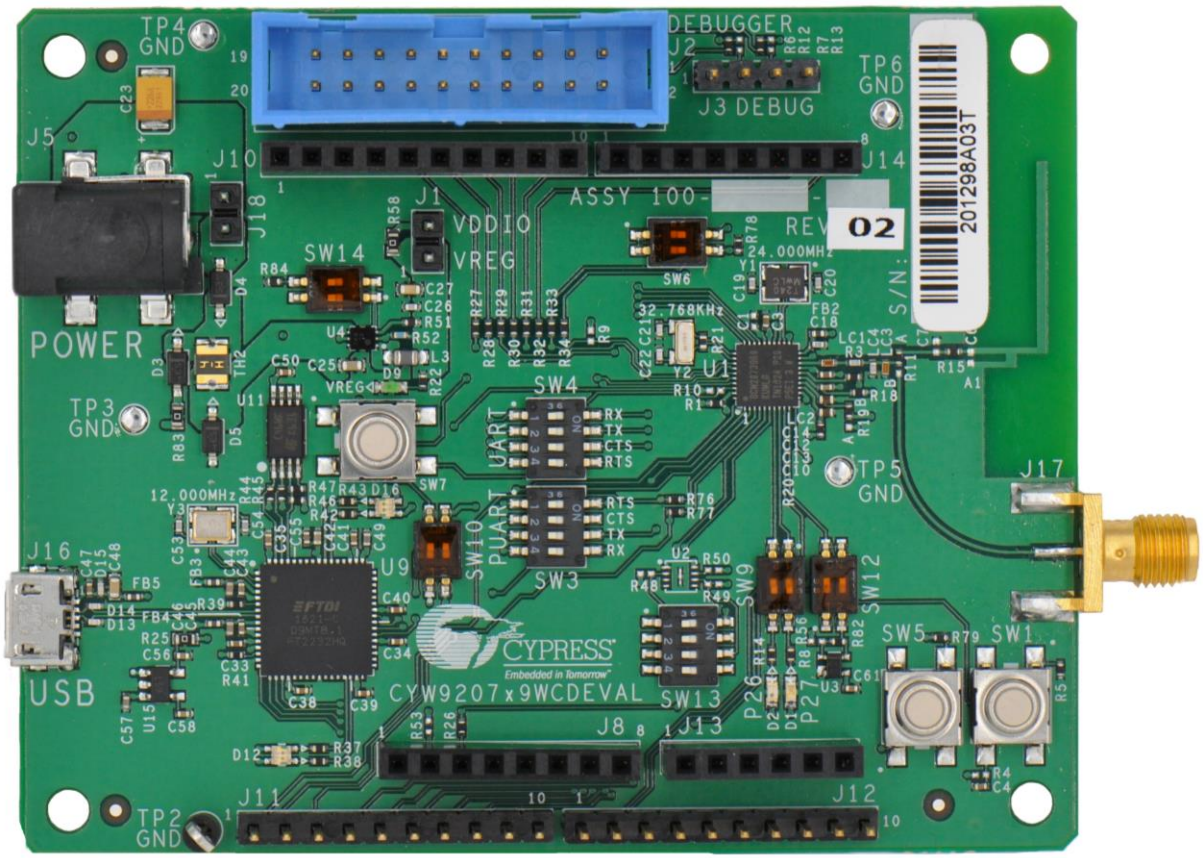
# 3 WICED Studio Development System Overview

WICED Studio comprises an evaluation board, a Software Development Kit (SDK), and the Eclipse Integrated Development Environment (IDE).

## 3.1 WICED Evaluation Board

The CYW9207x9WCDEVAL WICED evaluation board (Figure 1) incorporates a Cypress CYW20719 device and additional circuitry to enable application programming, debugging, and evaluation and can be used for feature evaluation, debugging, and developing BR/LE applications for designs based on CYW20719.

Figure 1. CYW9207x9WCDEVAL WICED Evaluation Board




## 3.2 Software Development Kit

The WICED Studio SDK includes the following:

- The Bluetooth Basic Rate and Low Energy software stack, including a number of sample applications that demonstrate the use of the API
- A generic profile-level API called the WICED BT API
- Drivers to access on-chip peripherals including UART, SPI, $I^2C$, ADC, PWM, etc.
- WICED BT API documentation
- Utilities to support development, testing, and mass production on Windows, Mac OS X, and Linux environments

## 3.3 Directory Structure

WICED Studio may support multiple types of WICED modules depending on installed components. Table 1 is an overview of the WICED Studio directory structure as pertaining to the Bluetooth CYW20719 development.

Table 1. WICED Studio Directory Structure

| WICED Studio Directory | Directory Contents |
|---|---|
| Doc | API, reference documentation, and schematics |
| Drivers | USB drivers for the evaluation board |
| wiced_tools | Tools including download tool, and other utilities and scripts |
| 43xxx_Wi-Fi\tools\ARM_GNU | Toolchain including compiler, linker, libraries, and headers |
| 20719-B0_Bluetooth\apps | Sample applications |
| 20719-B0_Bluetooth\build | Output files of built applications |
| 20719-B0_Bluetooth\include | WICED API function prototypes and definitions |
| 20719-B0_Bluetooth\platforms | Configuration files and information for supported hardware platforms |
| 20719-B0_Bluetooth\tools | Common utilities used by the IDE build processes |
| 20719-B0_Bluetooth\WICED | WICED core components |

### 3.4 Hardware and Software Requirement

- WICED Studio runs on 32- and 64-bit versions of Microsoft Windows, Mac OS X, and Linux
- WICED Studio is distributed as a bundle with the Eclipse IDE as executable installers for Windows, Mac OS X, and Linux
- The development computer requires a single USB port to connect to the WICED evaluation board

### 3.5 Development Process

To prepare and run an application, perform the following high-level steps:

1. Download and install WICED Studio 4 (see Install WICED Studio)
2. Connect the WICED evaluation board (see Connect the WICED Evaluation Board)
3. Create and load an application (see Build and Load a Sample Application)

## 4 Setting up WICED Studio

Download WICED Studio 4 from the Cypress WICED Products website or Cypress Customer Support Portal.

### 4.1 Install WICED Studio

The WICED Studio distribution is provided as a self-installing executable files. Double-click the *WICED-Studio-4.0.x.x-IDE-Installer.exe* file to begin the installation. Follow the prompts to choose any available customizations, for example destination folders for the Eclipse IDE and the WICED Studio SDK files.

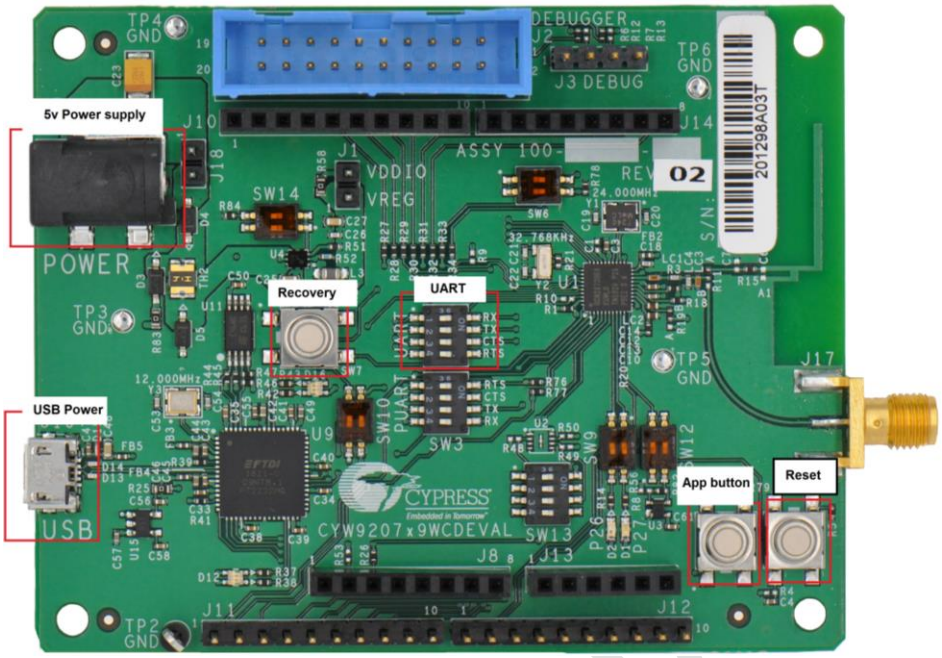
After installation has completed, start WICED Studio IDE by using the WICED Studio desktop icon.



### 4.2 Connect the WICED Evaluation Board

Figure 2 shows the CYW9207x9WCDEVAL WICED evaluation board. The figure shows call-outs to the ports, switches, and switch positions relevant to this document.

Figure 2. CYW9207x9WCDEVAL WICED Evaluation Board Settings




The Micro-USB connector (J16) supports UART connections and provides +5V power to the board. The barrel connector J5 can also be used to power the board when UART connectivity to the PC is not required.

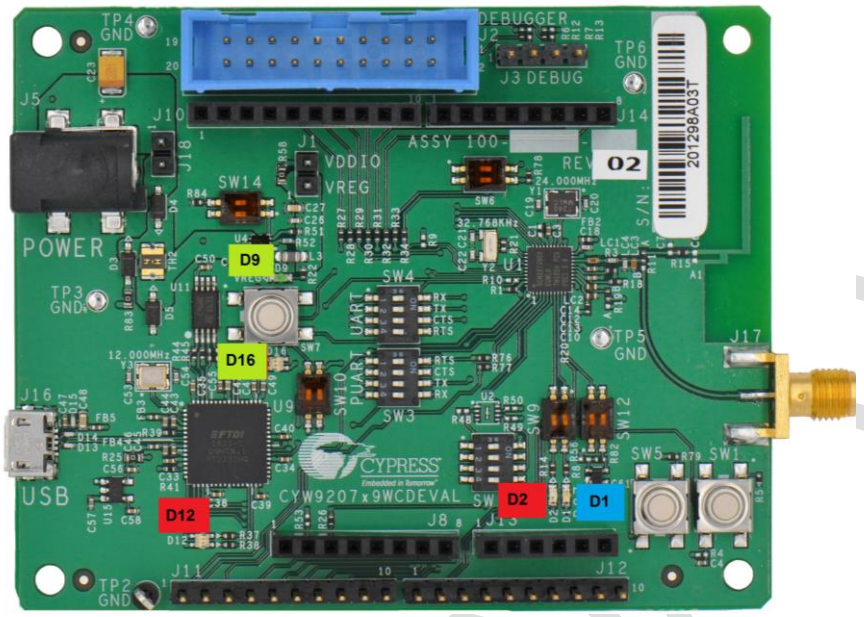
Perform the following steps before verifying driver installation:

1. Verify that the following mini-switches are set with the correct pin settings to allow proper operation with WICED Studio (see [2] for complete switch setting information):
    a. **SW4:** pins 1 through 4 **ON**
    b. **SW3:** pins 1 through 4 **OFF**
    c. **SW6:** pin 1 **OFF,** pin 2 **ON**
    d. **SW9:** pins 1 and 2 **OFF**
    e. **SW10:** pin 1 **ON,** pin 2 **OFF**
    f. **SW12:** pin 1 **ON,** pin 2 **OFF**
    g. **SW13:** pins 1 through 4 **ON**
    h. **SW14:** pin 1 **ON,** pin 2 **OFF**
2. Connect J16 of the WICED evaluation board to the development PC with a USB cable. The USB UART driver will load automatically.

The LEDs called out in Figure 3 serve the following purposes:

- D9 (green) indicates that 3.3-V power is on.
- D12 (red, blinking) indicates that HCI UART is in use; for example, the firmware is being downloaded to the evaluation board.
- D16 (green, blinking) indicates that PUART is in use; for example, the logs are being sent to the PC via USB.
- D1 (blue) and D2 (red) are for application use.

Figure 3. LEDs on a WICED Evaluation Board

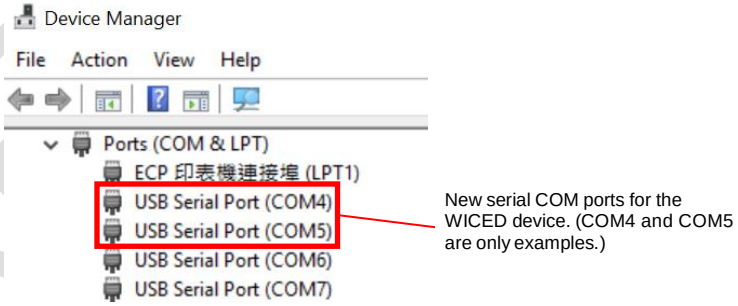



## 4.3 Verify Driver Installation

Do the following to verify that the driver installation is complete:

1. On a Windows system, open **Device Manager** (right-click **My Computer**, select **Properties**, and then select **Device Manager**).
2. In the **Device Manager** window, verify that two new USB serial COM ports are listed under **Ports (COM & LPT)**.
   **Note:** In Figure 4, Device Manager identifies the new (WICED evaluation board) USB serial COM ports as COM4 and COM5. Assigned port numbers vary among systems.

Figure 4. Device Manager COM Ports




**Note:** If an error occurs during driver installation, download new drivers from Windows Update. Ensure that you have an Internet connection. Disconnect and then reconnect the board and wait for the drivers to automatically install. If the new WICED evaluation board serial COM ports do not appear in Device Manager after reinstalling drivers via Windows Update, then the drivers can be manually installed from the Drivers folder of the WICED Studio installation. If the error persists, check all switch settings (see Connect the WICED Evaluation Board) on the board and/or replace the USB cable.

# 5 Using the WICED Studio IDE

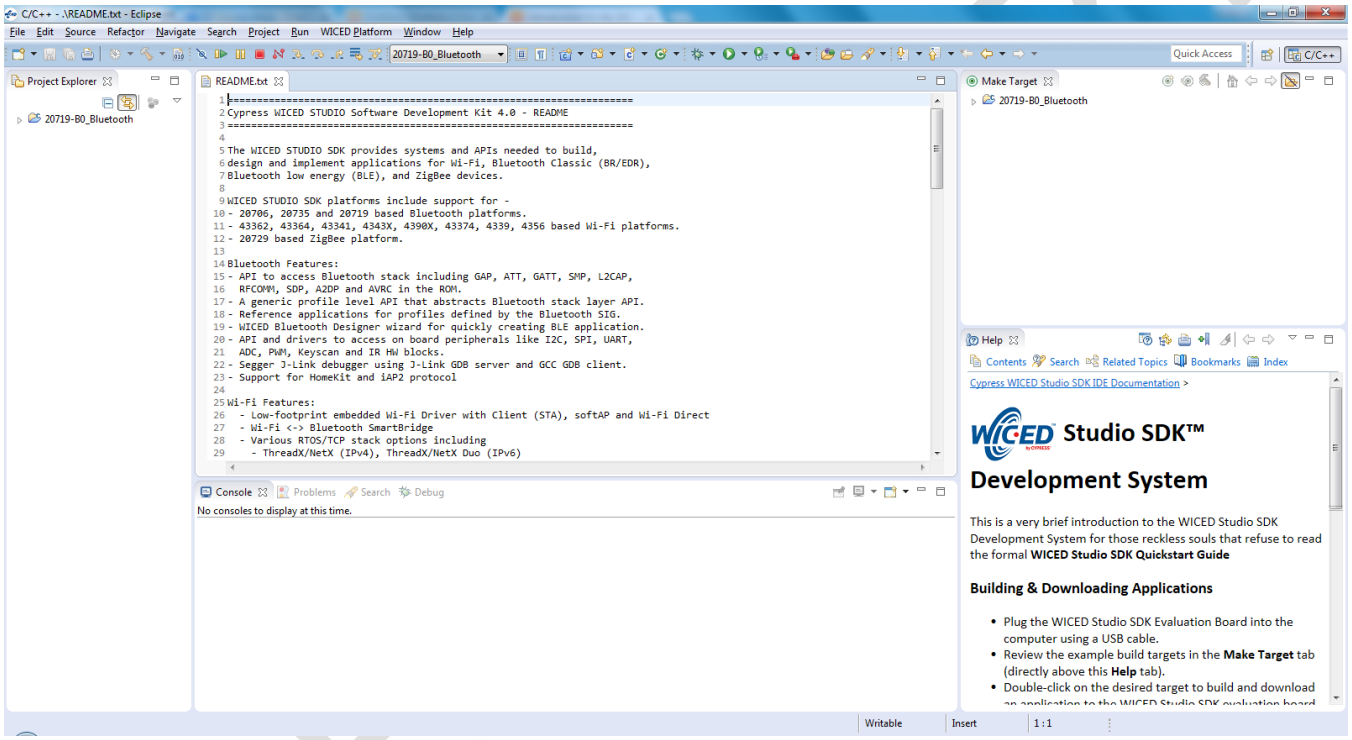
This section describes how to do the following:

- Use the WICED Studio IDE to create application build targets for the WICED evaluation board
- Download applications to the board
- Verify that the application running on the board is working correctly using a Windows 8.x PC with Bluetooth capability

## 5.1 Build and Load a Sample Application

Start the IDE by selecting **START** > **All Programs** > **Cypress** > **WICED-Studio** or double-click the **WICED-Studio** icon on desktop. The WICED Studio IDE looks similar to the screenshot shown in Figure 5.

Figure 5. WICED Studio IDE




The **Help** pane in the lower-right corner of the IDE (see Figure 5) describes how to build and download the sample applications shown in the **Make Target** pane, which is located above the Help pane, and describes how to create new applications and targets based on the samples. The Make Target pane contains build targets that are preconfigured for sample applications that run on the CYW9207x9WCDEVAL evaluation boards.

The following example shows how to build and run the sample application, which can then connect the WICED evaluation board to a Windows 8.x host PC. A sample host application is provided as part of WICED Studio under the peerapps sub-folders located under the various application folders.

1. Connect the WICED evaluation board to the PC.
2. Check the UART port after WICED evaluation board is connected to the PC (see Verify Driver Installation)
3. Right-Click the target **hello_sensor-BCM920719EVAL_Q40 download** in the **Make Target** pane and select **Edit** to change it and add **UART=COMx** where COMx is the port number of the USB Serial port (see Figure 4).
4. Before every download to the device, the CYW20719 device must be reset into “boot-to-autobaud” mode. See Appendix D for details on the procedure (this procedure is the same as the “recovery” procedure).

5. Double-click the modified **hello_sensor-BCM920719EVAL_Q40 UART=COMx download** target start the build process. The IDE console pane (bottom center of the IDE window) will display the build and download progress.

   The build output looks similar to the following:

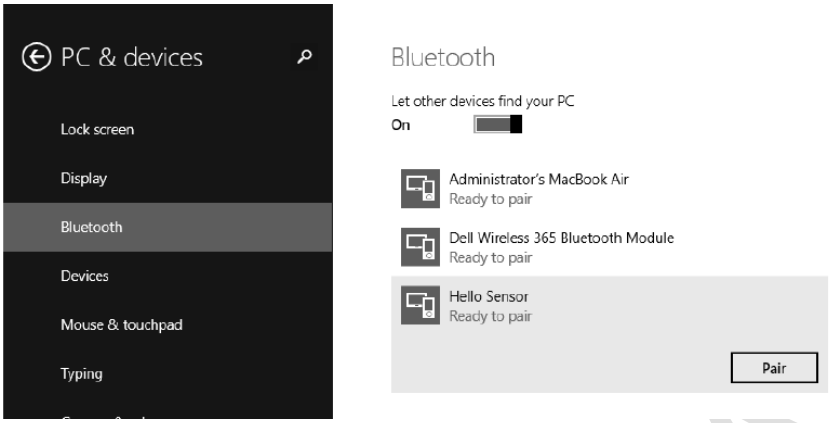
```
22:24:45 **** Build of configuration Release for project 20719-B0_Bluetooth ****

"C:\\Users\\arvinds\\Documents\\WICED\\WICED-STUDIO-SDK-4.0\\20719-B0_Bluetooth\\make.exe"
hello_sensor-BCM920719EVAL_Q40 download
Compiling spar_setup.c
Compiling hello_sensor.c
Compiling wiced_bt_cfg.c
Compiling lib_installer.c
Linking target ELF
OK, made elf.
..\..\..\43xxx_Wi-Fi\tools\ARM_GNU\bin\Win32\arm-none-eabi-objdump: section '.aon'
mentioned in a -j option, but not found in any input file
Call to hello_sensor_spar_crt_setup @ 0021844d
OK, made C:/Users/arvinds/Documents/WICED/WICED-STUDIO-SDK-4.0/20719-
B0_Bluetooth/WICED/wpan/../../build/hello_sensor-BCM920719EVAL_Q40-rom-ram-Wiced-
release/A_20719B0-hello_sensor-rom-ram-spar.cgs. MD5 sum is:
806c5323f8b67625baf701f62d71e7c9 *../../build/hello_sensor-BCM920719EVAL_Q40-rom-ram-Wiced-
release/A_20719B0-hello_sensor-rom-ram-spar.cgs

--------------------------------------------------------------------------------
Patch code starts at              0x00270400 (RAM address)
Patch code ends at                0x00271C2C (RAM address)
Patch RW/ZI size                  2140 bytes
Application starts at             0x002173FC (RAM address)
Application ends at               0x00218449 (RAM address)

Patch code size                       6188 bytes
Application RAM footprint             4173 bytes
                                  ------
Total RAM footprint                   6313 bytes (6.2kiB)
--------------------------------------------------------------------------------


Converting CGS to HEX...
Conversion complete

Creating OTA images...
Conversion complete
OTA image footprint in NV is 21935 bytes

Downloading application...
Download complete

Application running

09:11:40 Build Finished (took 1m:46s.379ms)
```

   **Note:** The warning '`section '.aon' mentioned in a -j option, but not found in any input file`' above is not critical; it is only an indication that the application did not use any data in retention RAM.

6. Because the sample target includes the ***download*** option, the tool will download the firmware to the evaluation board automatically when the build is complete, as shown with the "Download Complete" console output above.
7. After finishing the downloading, on the Windows 8.x PC, open the **Settings** charm (move the mouse to the lower- or the upper-right corner of the screen, then up or down, and click **Settings.**
8. Click **Change PC Settings** and select the **Bluetooth** tab (see Figure 6).

9. Click **Add a device** and wait while the PC searches for devices in range.
10. Select the **Hello Sensor** device, click **Pair**, and wait for the device connection to complete.

Figure 6. Windows Bluetooth Pairing Screen




## 5.2 The Hello Client PC application

The Hello Client (hello_client) PC application is provided with the SDK to complement the Hello Sensor (hello_sensor) tag application. It is located here:

<WICED-Studio>\20719-B0_Bluetooth\Apps\hello_sensor\peerapps\Windows\HelloClient\Release

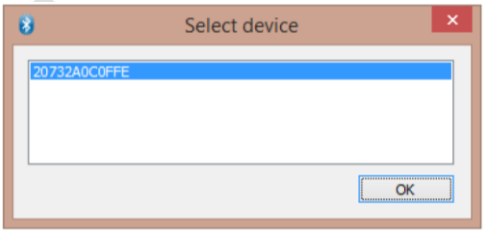
The application is provided as full source code, along with an executable binary that runs on Windows 32-bit and 64-bit machines.

1. Run *HelloClient.exe*. A HelloClient Select device window similar to that shown in Figure 7 is displayed. The window shows a list of Bluetooth device addresses for Hello Sensors paired to the PC.
2. The Bluetooth device address programmed in the tag is located in:

   <WICED-Studio>\20719-B0_Bluetooth\platforms\BCM920719EVAL_Q40\20719_OCF.btp

   To change the Bluetooth device address, open the file and modify the **DLConfigBD_ADDRBase** variable (or you may set **BT_DEVICE_ADDRESS=xxxxxxxxxxxx** where xxxxxxxxxxxx are the 12 hex nibbles of the device address).
3. Select the correct device (if it is not already selected) and click **OK** to initiate a connection to the tag. The connection process may take 5–10 seconds.

Figure 7. Hello Client Select Device Window



## 5.3 Testing the Hello Sensor Application

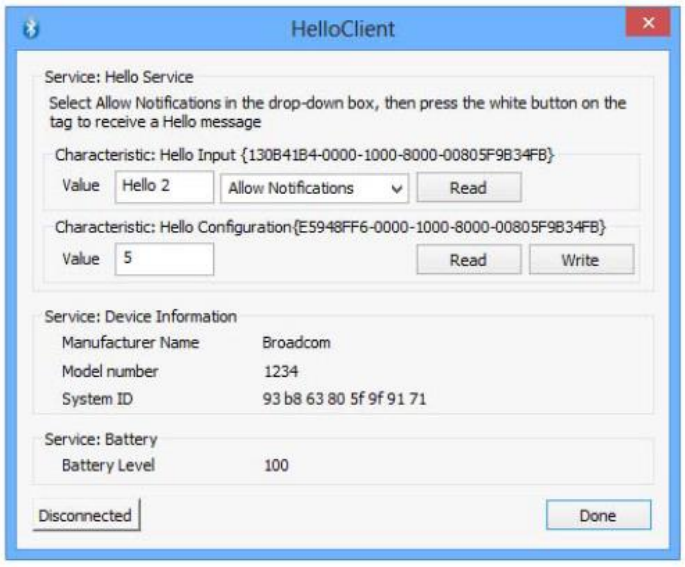
The Hello Sensor application provides the following information to paired devices:

- A Hello Service (a proprietary service) with two proprietary characteristics:
  - The value of the Hello Input read-only characteristic may be retrieved using either of the following methods:
    - Manually by using a mouse to click the Read button on the HelloClient PC application.
    - Automatically by pressing the **Application** button **SW5** (see Figure 2) on the WICED evaluation board (the **Allow Notifications** drop-down must be selected to allow automatic notifications).
  - The Hello Configuration read-write characteristic is used to configure how many times a LED on the tag blinks (see Figure 3) when the **Application** button is pressed.
- A Device Information Service that provides information including:
  - Manufacturer Name
  - Model Number
  - System ID
- A Battery Service that provides a battery-level indication

To test the application with a WICED evaluation board, follow the instructions provided for each of the Hello Service characteristics (see Figure 8).

- Hello Input Characteristic
  - Select **Allow Notifications** in the combo box.
  - Push the **Application** button **SW5** on the WICED board (see Figure 2). The Hello X message is displayed in the Value field. Each time the button is pressed, the message number increments.
- Hello Configuration Characteristic
  - Change the value for the Hello Configuration to '**5**' and then click **Write**.
  - Push the **Application** button **SW5** on the WICED board (see Figure 2). The LED on the tag blinks five times.

Figure 8. Hello Client Services Window




## 5.4 Viewing Traces

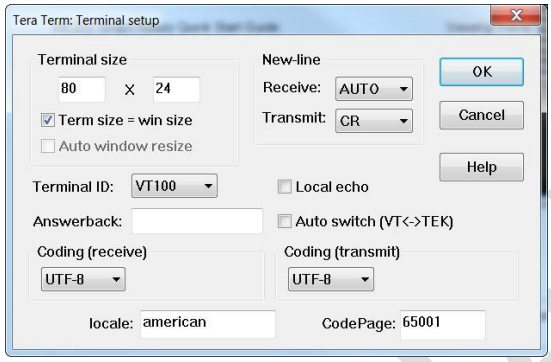
1. Compile and download an application to the WICED evaluation board. See Build and Load a Sample Application.

2. Wait for the *Build Finished* message to display in the console window.
3. Use a terminal emulation program such as Tera Term (see View Traces Using a Terminal Emulation Program).

### 5.4.1 View Traces Using a Terminal Emulation Program

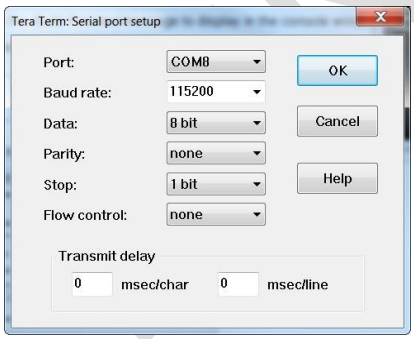
1. Start the terminal emulation program.
2. Set the **Terminal ID** to **VT100** and New-Line **Receive** to **AUTO**.

Figure 9. Tera Term Settings




3. In the terminal emulator, initiate a connection with the following serial port settings:

Figure 10. Serial Port Settings




4. Press the Reset button (see Figure 2) on the WICED evaluation board to view the application start-up messages.

## 5.5 What's NEXT?

Now that you have a basic understanding of how to compile and download a WICED Studio application, we recommend building and running the example applications provided in the 20719-B0_Bluetooth\apps directory.

The header of the main source file of every application provides additional information on the features demonstrated by the application and the usage model.

See IDE Hints & Tips for hints and tips about navigating the WICED Studio code base.

We hope you enjoy using the WICED Studio Development System!

*-- The WICED Development Team*

# 6 References


[1] CYW9207x9WCDEVAL Schematic

[2] AN218282 - CYW9207x9WCDEVAL Hardware User Manual

# Appendix A: Eclipse IDE Hints & Tips

## A.1 Hints

1. The **Help** tab (and any other tab) may be click-dragged to any window pane to customize the IDE layout.
2. To revert to the C/C++ perspective (rather than the Debug perspective, for example), click the C/C++ icon in the top-right corner of the window.

## A.2 Shortcuts

A useful cheat sheet outlining shortcuts for the WICED Studio IDE (Eclipse) is available online at:

http://www.cheat-sheets.org/saved-copy/eclipseCDT8.0-cheatsheet.pdf

Particularly useful keystrokes are listed below:

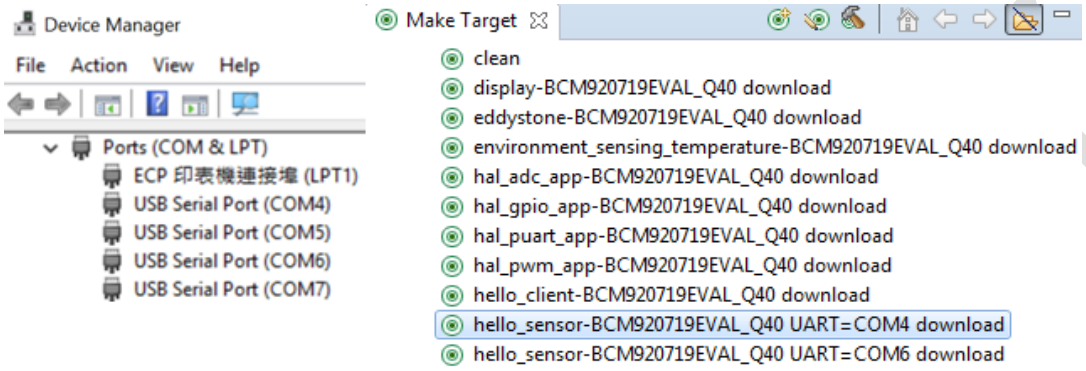
- General search: to search the WICED-Studio tree for a variable:
  1. **Click** the root WICED-Studio folder in the Project Explorer pane.
  2. Press **CTRL-H** (on Windows).
  3. In the File Search tab, enter the variable name (regular expressions work too).
  4. Click **Search.**
- Search for a *C* source element (variable, function, enum, etc.).
  1. Open a *C* source file, for example: `<20719-B0_Bluetooth/apps/hello_sensor/hello_sensor.c`.
  2. Press **CTRL-SHIFT-T**
  3. Start typing an element, for example, BTM_BLE_ADVERT_
  4. Suggestions appear in the pop-up window.
- Press **ALT-Left** (arrow) and **ALT-Right** (arrow) to navigate between open files.

# Appendix B: Multiple WICED Evaluation Boards

Multiple boards can be programmed from a single computer to run the same or different applications. To use the feature, edit the make target for the required application to add the `UART=COMx` parameters.

Figure 11 shows two WICED evaluation boards connected to a PC and appropriate targets to build and download the hello sensor application.

Figure 11. Configuration for Two WICED Evaluation Boards



# Appendix C: Connecting to Linux Platforms

An additional step is required when connecting a WICED board to a computer running Linux. On common Linux distributions, the serial UART ports (usually `/dev/ttySx or /dev/ttyUSBx devices`) belong to the root user and to the dialout group. Standard users are not allowed to access these devices.

An easy way to allow the current user access to Linux's serial ports is by adding the user to the dialout group. This can be done using the following command:

```
$sudo usermod -a -G dialout $USER
```

**Note:** For this command to take effect, the user must log out and then log back in.

# Appendix D: Recovering a Corrupted Board

If you need to recover the CYW9207x9WCDEVAL board from an inoperative state, refer to Figure 2 and follow these steps:

1. Verify the steps in Sections 4.2 and 4.3.
2. Press and hold **SW7,** the recovery button.
3. Press and hold **SW1,** the reset button.
4. Release **SW1**, wait for one second, and then release **SW7**.
5. Continue the download process as described in Section 5.1.

## Document History

Document Title: AN218224 – WICED™ Quick Start Guide for BT CYW20719

Document Number: 002-18224

| Revision | Submission Date | Description of Change |
|---|---|---|
| *A | 01/12/17 | Updates to DIP switch settings and template convergence - preliminary |
| ** | 12/16/16 | Preliminary release (from ANCYWICED001) |

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