AN214922

Improving Bluetooth®-WLAN Coexistence on Products Using BlueZ Stack

Associated Part Family: CYW4325/CYW4329

This document addresses some of the basic stack requirements to facilitate coexistence between Cypress and WLAN operations on Cypress's combo chips (CYW4325, CYW4329). It is assumed that the reader has a basic understanding of Bluetooth technology and is familiar with the problem of Bluetooth-WLAN coexistence.

1 Introduction

The default stack shipped with the Android™ SDK is the BlueZ stack. This stack is an open source implementation and has little vendor support. Consequently, there are several Bluetooth-WLAN coexistence issues on the BlueZ stack that are not found on other commercial-grade Bluetooth stacks. The purpose of this document is to inform customers about recommended engineering approaches for dealing with these issues. By following these recommendations, customers can improve the Bluetooth-WLAN coexistence performance of their products.

Note:

- On CYW4325 and CYW4329, the Bluetooth and WLAN firmware releases are released as a pair for suitable coexistence performance. Do not mix a Bluetooth release from one pair with a WLAN release from another pair. Contact your Cypress support engineer for additional details.
- Designs using Cypress's stack do not need these additional engineering efforts.
- It is also recommended to monitor http://android.git.kernel.org/?p=platform/external/bluetooth/bluez.git;a=summary to stay abreast of the BlueZ fixes. It is likely that the following modifications could be patched into the main BlueZ branch in the future.

1.1 Cypress Part Numbering Scheme

Cypress is converting the acquired IoT part numbers from Cypress to the Cypress part numbering scheme. Due to this conversion, there is no change in form, fit, or function as a result of offering the device with Cypress part number marking. The table provides Cypress ordering part number that matches an existing IoT part number.

Table 1. Mapping Table for Part Number between Broadcom and Cypress

Broadcom Part Number	Cypress Part Number
BCM4325	CYW4325
BCM4329	CYW4329

1.2 Acronyms and Abbreviations

In most cases, acronyms and abbreviations are defined upon first use. For a more complete list of acronyms and other terms used in Cypress documents, go to: http://www.cypress.com/glossary.

2 IoT Resources

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 Stack Modifications

3.1 Generic Modifications

3.1.1 Downloading Bluetooth Config File

Background: For the Bluetooth radio to function properly, it is essential that a Bluetooth config file be downloaded onto the chip. The Bluetooth config file contains design-specific RF tables, power settings, and firmware fixes that have become available since chip tapeout. This config file, which follows a given protocol, is downloaded via a series of vendor-specific commands.

Solution: Cypress has released an Android program called brcm_patchram_plus that downloads the config file. For help on using the program, use the `-h-` or `-?` or `--help` switches as parameters to the program.

This program should be present in the Android operating system. If you cannot find it, contact your Cypress FAE to obtain a copy.

3.1.2 Configuring Bluetooth Low-Power Mode

Background: By default, upon coming out of hardware reset, the Bluetooth controller is configured to never enter low-power mode/sleep mode. In production environments, however, sleep mode is essential, and additional host logic to issue the appropriate vendor-specific commands is needed to enable sleep mode.

Solution: The sleep mode configuration of the Bluetooth controller is handled by the brcm_patchram_plus program referenced earlier. Although there are various forms of sleep mode, the most common sleep mode protocol uses two additional GPIOs for out-of-band signaling. Contact the Cypress Bluetooth field applications engineer for additional integration details or for assistance in locating the brcm_patchram_plus program within the Android codebase.

3.2 Modifications Related to Coexistence

3.2.1 Automatic Flushing of Real-time/Streaming Packets

Background: The Bluetooth specification allows for the automatic flushing of stale packets within the controller itself. The idea is to flush real-time packets that have outlived their real-time usefulness, either due to multiple retransmissions, severe deferrals, or for other reasons.

Solution: issue the HCI_Write_Automatic_Flush_Timeout command. This fix has already been delivered to the BlueZ open source repository. Have your software engineer refer to the commit hash ID a5bf8023f4e8760132e63c37299076a98df7eaba for details.

The default value for the automatic flush timer is 0, which is equivalent to “infinity” or “never flush the packet.” The flushing also is conditional on the Packet Boundary flag present in the HCI ACL data packet header. Therefore, reliable packets and real-time packets must be marked differently. Once the stack is aware that the ACL link is carrying real-time streams (A2DP, for example), as a defensive programming measure, it should program a suitable value to this timer. A reasonable value is approximately 100 ms. The optimal value, however, depends on the headset in use because, among other things, the delay is dependent on headset buffer size. In addition to the event generated when the command is issued, there is an event generated for each packet that is flushed in the controller.

Timing: This command should be issued only after the A2DP connection is established over the ACL connection. After the A2DP connection is torn down, it is appropriate to set the timer back to “infinity.”

Additional details:

- HCI Command: Bluetooth Specification Version 3.0, Volume 2, Part E, Section 7.3.30
- HCI Event: Bluetooth Specification Version 3.0, Volume 2, Part E, Section 7.7.17
- Packet Boundary Flag: Bluetooth Specification Version 3.0, Volume 2, Part E, Section 5.4.2

3.3 Rate Limiting of Real-time Streams at Source

Background: During connection setup, the controller reports the number of free buffers. BlueZ instantly fills up all free buffers and then sends a new packet as soon as one buffer becomes free. This burstiness violates the bit rate agreed upon during A2DP connection setup. As a result, packets exceeding the rate are put into a queue, outlive their useful lifetime, and are dropped, which results in gaps in the audio.

Solution: This fix has already been delivered to the BlueZ open source repository. Have your software engineer refer to the commit hash ID 464dbc9c5d6e4346ba0af20008849826ca30380c for details.

3.4 Prioritization of A2DP Streams

Background: Multiple ACL connections can exist in a piconet, and priority must be given to real-time streams.

Solution: When an A2DP connection is established over an ACL connection, the Write_High_Priority_Connection command, which ensures that real-time streams can be scheduled more aggressively, must be issued. This fix has already been delivered to the BlueZ open source repository. Have your software engineer refer to the commit hash ID 60a51ae85f9e049d3522e118de1d4518b543e1ff for details.

Document History Page

Document Title: AN214922 - Improving Bluetooth®-WLAN Coexistence on Products Using BlueZ Stack Document Number: 002-14922				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
**	-	-	04/21/2010	4325_4329-AN100-R Initial release
*A	5453202	UTSV	09/30/2016	Added Cypress Part Numbering Scheme and Mapping Table. Updated in Cypress template
*B	5840391	AESATMP8	08/01/2017	Updated logo and Copyright.

Worldwide Sales and Design Support

Cypress maintains a worldwide network of offices, solution centers, manufacturer's representatives, and distributors. To find the office closest to you, visit us at Cypress Locations.

Products

ARM® Cortex® Microcontrollers	cypress.com/arm
Automotive	cypress.com/automotive
Clocks & Buffers	cypress.com/clocks
Interface	cypress.com/interface
Internet of Things	cypress.com/iot
Memory	cypress.com/memory
Microcontrollers	cypress.com/mcu
PSoC	cypress.com/psoc
Power Management ICs	cypress.com/pmic
Touch Sensing	cypress.com/touch
USB Controllers	cypress.com/usb
Wireless Connectivity	cypress.com/wireless

PSoC® Solutions

PSoC 1 | PSoC 3 | PSoC 4 | PSoC 5LP | PSoC 6

Cypress Developer Community

Forums | WICED IOT Forums | Projects | Video | Blogs | Training | Components

Technical Support

cypress.com/support

Cypress Semiconductor
198 Champion Court
San Jose, CA 95134-1709