



Technical Note

TN_171

Java D3XX for Android

Version 0.03

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This document describes the installation and use of the FTDI Java D3XX driver for USB 3 SuperSpeed devices, such as FT60x series, in an Android environment.

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1 Introduction

FTDI provides a proprietary D3XX interface for easy communication with USB 3 SuperSpeed devices, such as FT60x series of devices. D3XX is supported across several operating systems, namely Windows, Linux, Mac OS X and Android.

Android is becoming the most popular operating system in the world. It was designed as a mobile OS for smartphones, and later extended to tablets, TVs, PCs, wearables and even cars.

FTDI wants to embrace the mobile era and take advantage of Android's incredible ecosystem by providing Java D3XX library for Android. This document explains how to use install and use the Java D3XX library for Android.

FTDI also supports Android devices for D2XX devices. Refer to the following [link](#).

1.1 Android Support

To support Google Android OS, D3XX library uses Android's USB Host API. Android's USB Host API was introduced in version 3.1 and does not require special root access privileges.

1.2 Prerequisite

The following is required to run the demo application for Java D3XX library for Android:

- A UMFT601X-B PCB development module with FT601 USB 3.0 chip
- An Android device running version 3.1 or later OS, with a USB Host or OTG interface

FTDI conducted testing using the following Android devices:

- A Xiaomi Note phone running Android 6.0 Marshmallow
- A PC with Remix OS running Android 6.0 Marshmallow

To develop an application using the Java D3XX library for Android, the development machine needs Android Studio, the official IDE for Android development. Android Studio will install Android SDK including Android Debug Bridge (ADB). Installation and configuration of Android Studio is not described in this document but is described on the Android developer [website](#). Eclipse is an alternative IDE option but Android Studio is the recommended one.

Also, the Android device should have USB Debugging enabled to allow access using the ADB utility. To accomplish this, navigate to Settings > Developer options and enable USB debugging option. Refer to Android development for more information.

2 Using Java D3XX for Android

2.1 Introduction

Before version 3.1, an Android application could not access USB devices attached to a system naturally without root access rights. The Android USB Host API removes this limitation allowing us to utilize USB devices attached to Android Host or OTG port.

FTDI provides a Java D3XX class library that leverages the Android USB Host API to communicate with FTDI SuperSpeed devices, such as FT60x series. The library is named d3xx.jar.

2.2 Library Import

The D3XX library can be included in an Android application project in Android Studio easily by simply copying the library, d3xx.jar, to the *app\libs* folder of the project. The file will then appear under the *app\libs* folder project hierarchy in Android Studio.

To use the FTD3XX class of the D3XX library, *com.ftdi.d3xx.FTD3XX* should be imported in the Java files that will use the library.

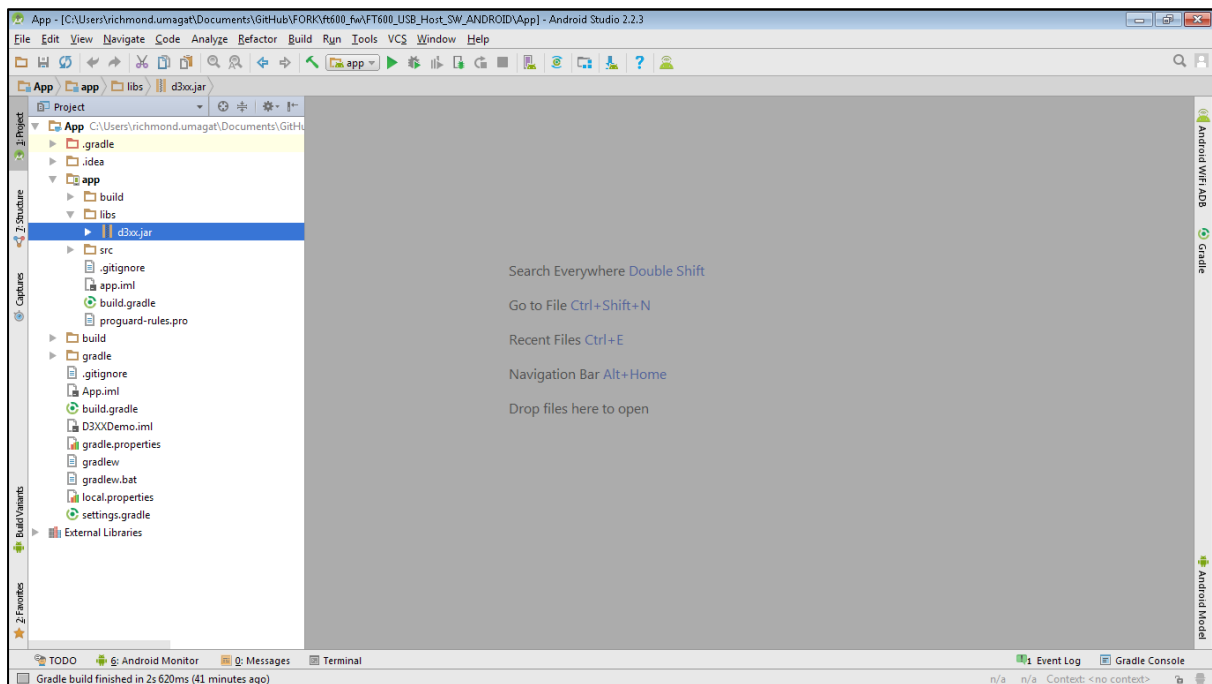


Figure 2.1 Importing Java D3XX library in Android Studio

2.3 Library Documentation

FTDI provides Javadoc-generated HTML documentation of the Java D3XX Library for Android. As a supplement, customers should familiarize with the original D3XX documentation, [D3XX Programmers Guide](#).

3 Application Example

Below are screenshots of the demo application.

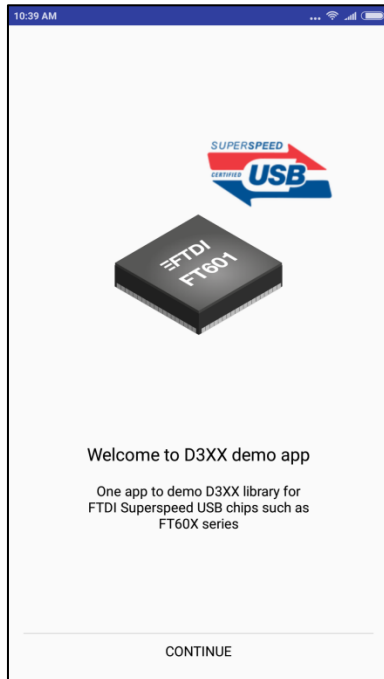


Figure 3.1 Demo App Introduction Page

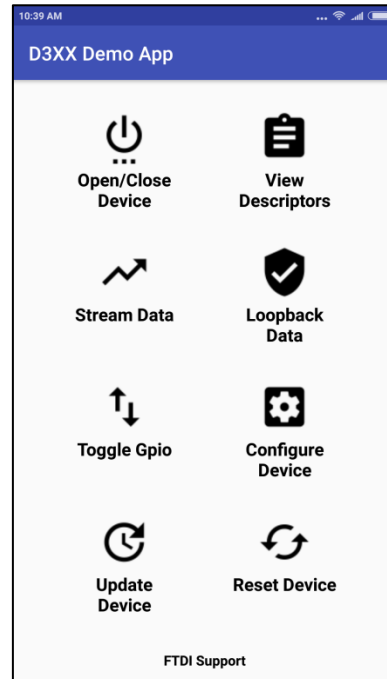


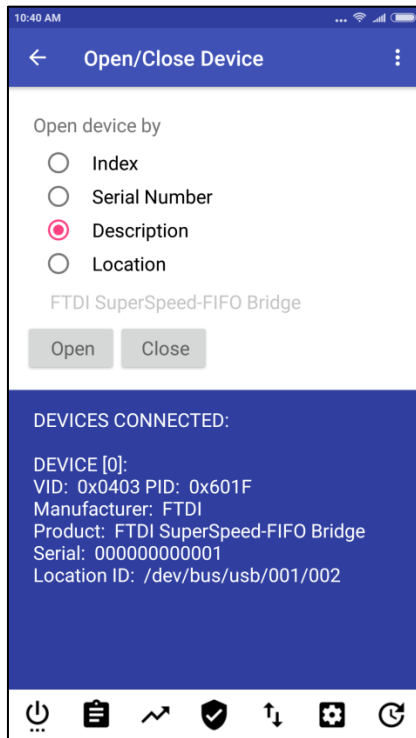
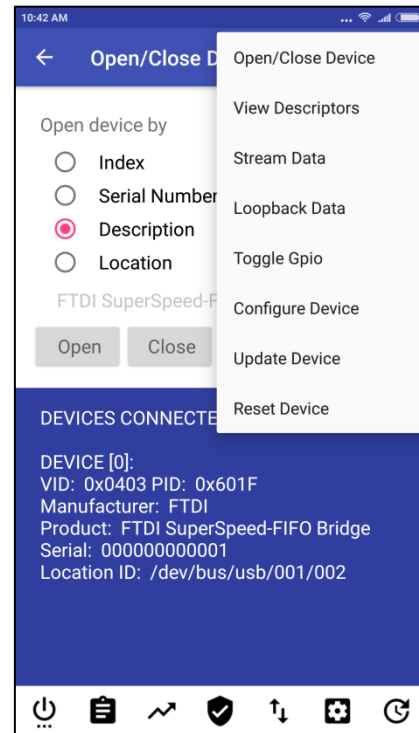
Figure 3.2 Demo App Main Page

3.1 Introduction

The demo application demonstrates the following functionalities of the D3XX Library on Android devices:

- Open/close device, enumerate connected devices
- View USB descriptors
- Stream data (data transfer performance)
- Loopback data (data transfer reliability)
- Configure device
- Toggle GPIOs
- Reset device
- Handle device unplug/plug (hotplugging)
- Notification-based reading

On each of the feature pages, menus are provided on the top right corner and at the bottom.


Figure 3.3 Demo App Open/Close Page

Figure 3.4 Demo App Top Right Menu

3.2 Open/Close Devices

The demo application enumerates connected devices and enables user to open/close one of these devices. In this page, these APIs are used:

- GetDeviceInfoList()
- Open()
- OpenByIndex()
- OpenBySerialNumber()
- OpenByDescription()
- OpenByLocation()
- GetDeviceInfo()
- Close()
- IsOpen()
- IsUsbDevice()

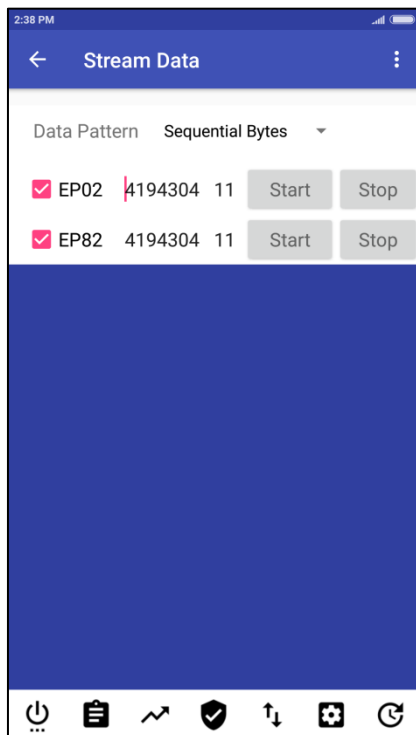


Figure 3.5 Demo App Data Streaming Page

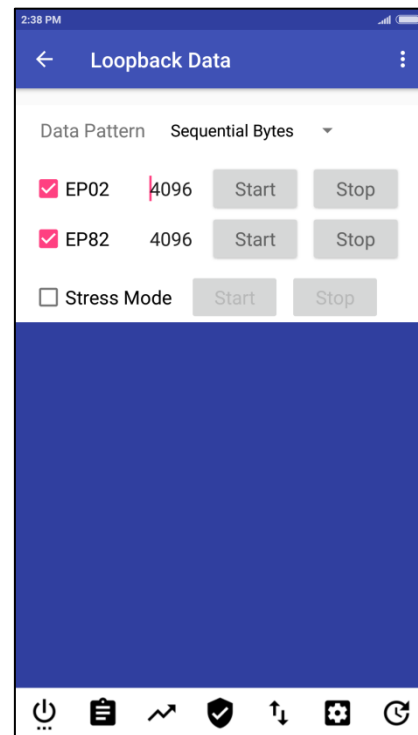


Figure 3.6 Demo App Data Loopback Page

3.3 Stream Data and Loopback Data

The demo application demonstrates data transfer performance and data transfer reliability through data streaming and data loopback pages. In addition, it also demonstrates the streaming and notification features. In these pages, these APIs are used:

- SetStreamPipe()
- ClearStreamPipe()
- AbortPipe()
- WritePipe()
- ReadPipe()
- SetNotificationCallback()
- ClearNotificationCallback()
- GetChipConfiguration()
- IsOpen()

Notes:

- Loopback and streaming pages require that the PCB is connected to a Xilinx Spartan 6 or Altera Cyclone V FPGA board with the Data Loopback or Data Streaming FPGA sample images provided at <http://www.ftdichip.com/Support/SoftwareExamples/FT60X.htm>.
- When notification feature is enabled in chip configuration, loopback data will notify user that data is available on the IN pipe after writing in the OUT pipe.
- Loopback page also supports stress test mode. When stress test mode is enabled, the application will continuously loopback data of random sizes. It will stop when it detects that read data is not the same as data written.
- Data pattern used for loopback and streaming can be updated to be sequential, random or fixed value. Fixed value is 0x55.
- Streaming page uses WritePipe () and ReadPipe () by default.
- Below is a table of the USB 3.0 streaming performance on the different channel configurations based on D3XX Android library version 1.0.0.3.

Table 1 USB 3.0 Data Streamer Maximum Performance

Channel Configuration	Write / Out performance	Read / In performance
4 CH	175 MBps	190 MBps
2 CH	250 MBps	230 MBps
1 CH	265 MBps	295 MBps
1 OUT	270 MBps	-
1 IN	-	300 MBps

Android performance is significantly lower than Windows and Linux due to Android's 16KB USB buffer limitation.

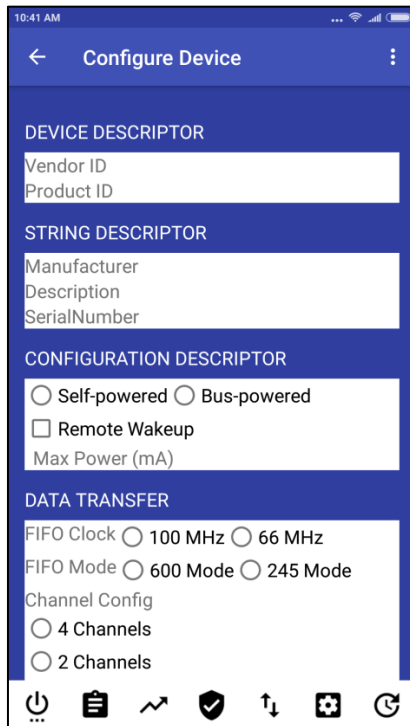


Figure 3.7 Demo App Chip Configuration Page

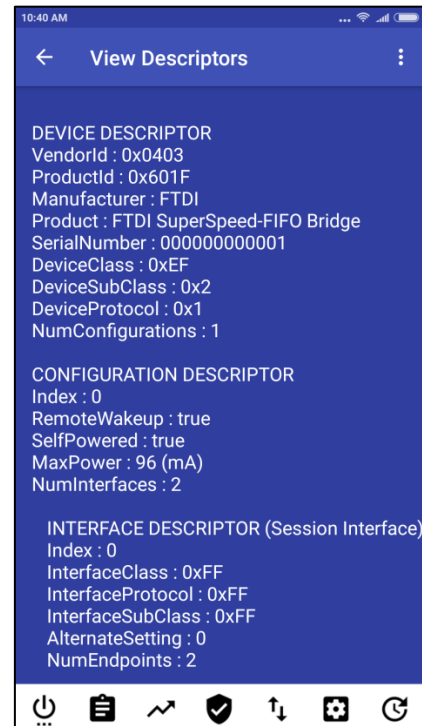
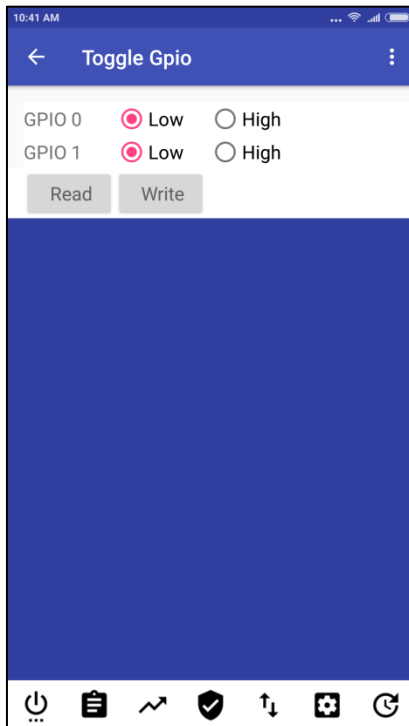
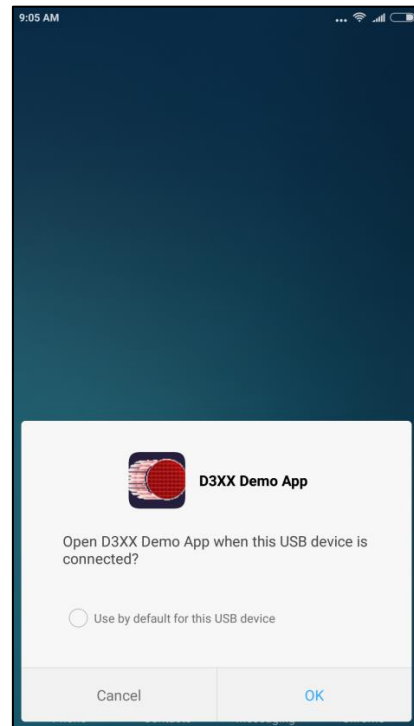


Figure 3.8 Demo App Descriptors Page

3.4 Configure Device and View Descriptors

The demo application demonstrates configuring device and querying USB descriptors. In these pages, these APIs are used:

- SetChipConfiguration()
- GetChipConfiguration()
- Close()
- GetDeviceDescriptor()
- GetConfigurationDescriptor()
- GetInterfaceDescriptor()
- GetPipeInformation()
- IsOpen()


Figure 3.9 Demo App GPIO Toggle Page

Figure 3.10 Demo App Device Plugin Popup

3.5 Toggle GPIO and Device Plugin Popup

The demo application demonstrates toggling GPIOs. In this page, these APIs are used:

- EnableGPIO()
- ReadGPIO()
- WriteGPIO()
- SetGPIOPull()
- IsOpen()
- IsUsbDevice()

Android pops-up a message to automatically open the demo application when the device is plugged in. User should allow this by selecting the option 'Use by default for this USB device'.

3.6 Hotplugging

Each page also supports detection of unplugging of connected devices. When a connected device is plugged out, the UI elements will be disabled.

For detection of plugged devices, *AndroidManifest.xml* and *res/xml/device_filter.xml* have been updated to contain the default Vendor ID and Product ID of the FT600 and FT601 devices. When a device is plugged in, the application will automatically redirect to the Open/Close page.

Refer to the following [link](#) for USB hotplugging support in Android.

3.7 Screen off

The data streaming and data loopback pages support handling of screen off event. When user clicks on the device power button or when device becomes idle for some time, the screen is expected to be turned off to save battery power. If the current page is on the data streaming or data loopback page when this event occurs, the data transfer will be aborted.

3.8 Installing the demo application

The demo application will soon be available in Google Play.

To manually install the demo application, download it from the FTDI website then follow the following procedure:

- Step 1 is to allow non-market applications to install. This is done from the settings window. Go to Settings > Unknown Sources and enable option to allow the application to install.
- Step 2 is to copy the demo application, d3xx.apk, to the Android device.
- Step 3 is to click the APK file. This will launch the installer which will install the demo application. Once installed, connect the D3XX device and then open the application.

For advanced users, the demo application can be remotely installed and run using the following Android Debugging Bridge (ADB) commands:

- adb devices
- adb connect <IP address of Android device>
- adb install -r d3xx.apk
- adb shell am start -a android.intent.action.MAIN -n com.ftdi.d3xxdemo/.Introduction

3.9 Email demo application logs

The demo application logs debug messages into a file named d3xx.log.

If customers encounter some issues with the demo application, customer can click on the "FTDI Support" link at the bottom of the main page. Clicking the link will redirect user to an email application such as Gmail and it will automatically create an email template with the d3xx.log attached.

The log disappears when application is closed. So customer must not close the application in order for the log to contain the debug messages for the error encountered.

4 Android development

Below is some useful information that can help customers jumpstart their Android application development.

4.1 Enable Developer Option

To develop an Android application, 'Developer option' must be enabled on the Android device. To enable it, go to *Settings > About Phone* then tap *Build Number* several times until the following message appears: 'You are now a developer!'. Once the message appears, 'Developer option' will now appear in the settings. Note that the exact location and item maybe different on various phones and flavors of Android OS.

4.2 Enable USB Debugging

Once developer option has been enabled, *USB Debugging* option must also be enabled to allow Instant Run feature on Android Studio. Instant Run allows user to quickly download and run the application in the device in a single click. Aside from *USB Debugging*, some Android devices also require enabling *Install via USB* and/or *Verify apps over USB*.

4.3 Install Android on PC

Android can be installed on a PC for easy development and debugging. FTDI recommends Remix OS by Jide Technology. Remix OS is an operating system based on Android that is customized for PCs. It can be downloaded at Jide's website: <http://www.jide.com/remixos-for-pc>.

4.4 Debug Application via network

To enable debugging via network connection, user must install the ADB WIFI plugin for Android Studio. This is especially useful when using Android on PC because connecting via USB Type A cable to Type A cable will not work.

Download the ADB WIFI plugin at <https://plugins.jetbrains.com/idea/plugin/7983-android-wifi-adb> and install it in Android Studio by going to *File > Settings > Plugins > Install plugins from disk*. Once installed, user can type *adb connect <ip address of Android PC>* in the Terminal window inside Android Studio or from the Windows command prompt. This will make the Android device appear in the list of connected devices on the *Select Deployment Target* window in Android Studio.

4.5 Compile Release-build

The open source code can only be compiled as debug-build. To compile a release-build, a signing key must be generated using a utility from the Android SDK. For detailed instructions, refer to <https://facebook.github.io/react-native/docs/signed-apk-android.html> and <https://developer.android.com/studio/publish/app-signing.html#considerations>. Generating a release-build is only necessary when publishing the application in Google Play. For testing and debugging purposes, using debug-build is sufficient.

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Appendix A – References

Online Resources

<http://www.ftdichip.com/Drivers/D3XX.htm>

<http://www.ftdichip.com/Products/Modules/SuperSpeedModules.htm>

<http://www.ftdichip.com/Products/ICs/FT600.html>

<http://www.ftdichip.com/Support/SoftwareExamples/FT60X.htm>

<https://developer.android.com/studio/index.html>

<https://developer.android.com/guide/topics/connectivity/usb/host.html>

<https://developer.android.com/guide/topics/connectivity/usb/host.html#manifest>

<http://www.jide.com/remixos-for-pc>

<https://plugins.jetbrains.com/idea/plugin/7983-android-wifi-adb>

<https://facebook.github.io/react-native/docs/signed-apk-android.html>

<https://developer.android.com/studio/publish/app-signing.html#considerations>

http://www.ftdichip.com/Support/Documents/TechnicalNotes/TN_147_Java_D2xx_for_Android.pdf

Document References

http://www.ftdichip.com/Support/Documents/ProgramGuides/AN_379%20D3xx%20Programmers%20Guide.pdf

Acronyms and Abbreviations

Terms	Description
ADB	Android Debugging Bridge
API	Application Programming Interface
D2XX	FTDI USB Driver for USB 2.0 devices
D3XX	FTDI USB Driver for USB 3.0 devices like FT60x
EP	USB Endpoint
FPGA	Field Programmable Gate Arrays
FT60X	FTDI's first USB 3.0 SuperSpeed chip
GPIO	General Purpose Input Output
IDE	Integrated Development Environment
MBPS	Mega Bytes Per Second
OS	Operating System
OTG	USB On-The-Go
PC	Personal Computer
PCB	Printed Circuit Board
SDK	Software Development Kit
UMFT601X-B	32BIT FIFO TO USB 3.0 Module for Xilinx
USB	Universal Serial Bus

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Appendix C – Revision History

Document Title: TN_171 Java D3XX for Android
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Document Feedback: [Send Feedback](#)

Revision	Changes	Date
1.0	Initial Release	2017-03-17

Revision History

Revision history (internal use only, please clearly state all changes here before saving the file)

Revision	Date YYYY-MM-DD	Changes	Editor
0.01	2017-02-14	First draft	Richmond Umagat
0.02	2017-03-03	Added Sections 3.7 and 4.5	Richmond Umagat
0.03	2017-03-17	Updated Section 3.3	Richmond Umagat
0.04	2017-03-22	Updated Section 3.3	Richmond Umagat