Application Report
SLOA187A–August 2013–Revised March 2016

Automating Bluetooth® Pairing With Near-Field Communications (NFC)

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ABSTRACT

The NFC Forum and the Bluetooth Special Interest Group (SIG) collaborated to produce an application document titled *NFC Forum Bluetooth Secure Simple Pairing Using NFC* (NFCForum-AD-BTSSP_1_1).

This collaborative document is a follow up to a previously released specification by the NFC Forum entitled, NFC Forum Connection Handover Specification, which began to define the structure and sequence of interactions that enable two NFC-enabled devices to establish a connection using other wireless communication technologies.

This application report explains how to implement the NFC Forum/Bluetooth SIG specification in an embedded application using the RF430CL330H dynamic NFC transponder.

Project collateral and source code discussed in this application report can be downloaded from the following URL: http://www.ti.com/lit/zip/sloa187.

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1 Reference Design Hardware

1.1 RF430CL330HTB + MSP-EXP430FR5739

In this document, the RF430CL330HTB and MSP-EXP430FR5739 evaluation boards are referenced as hardware examples. Example code projects are written for the MSP430FR5739, but could be ported to other platforms as required. The example code uses a I2C communication between the MSP430FR5739 and RF430CL330H. For more information on the RF430CL330HTB board, see the following link: http://www.ti.com/tool/rf430cl330htb.

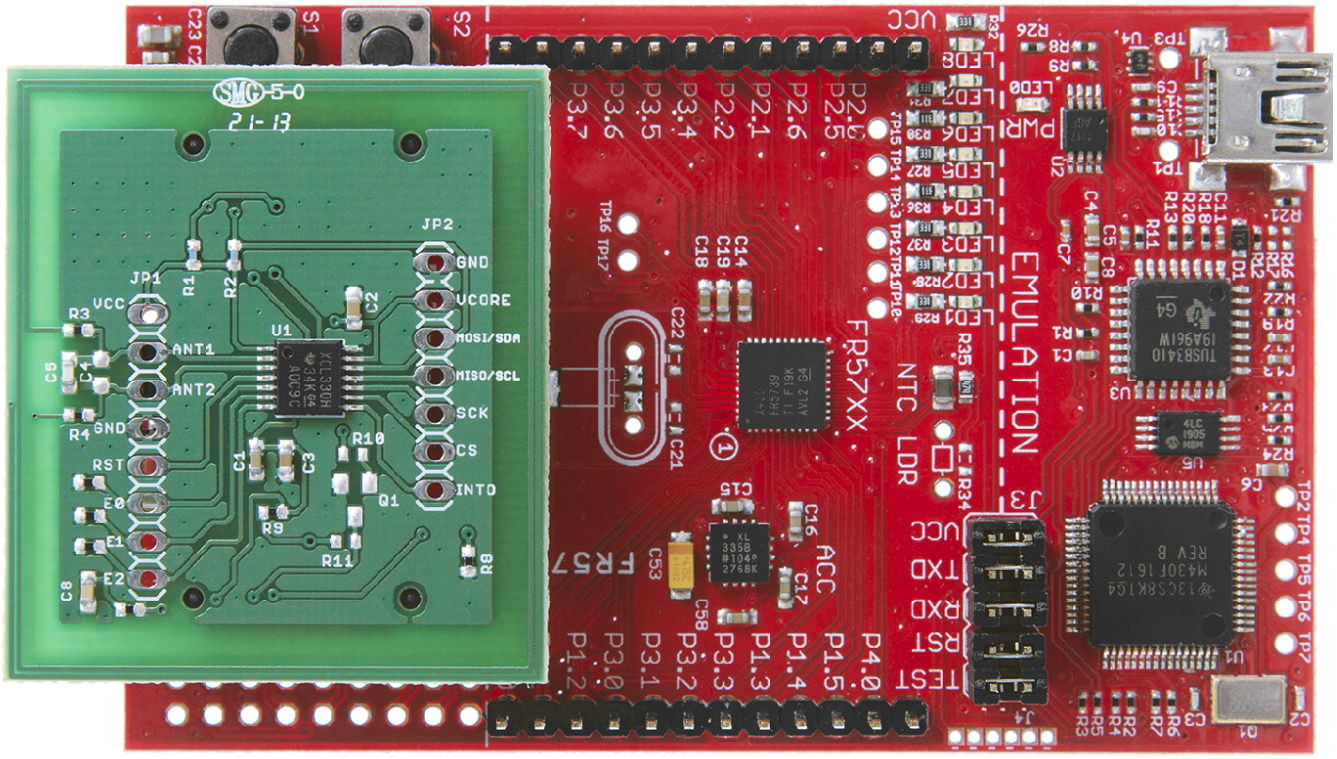

Figure 1. RF430CL330HTB + MSP-EXP430FR5739

2 NDEF Message Data Structure (for RF430CL330H)

In the included example MSP430FR5739 project, the NFC Data Exchange Format (NDEF) data can be found in RF430.h. The default message is a simple text RTD containing “Hello, World!” as the payload. The data is organized into two different file IDs:

- 0xE103 for the capability container
- 0xE104 for the NDEF record

2.1 NDEF Message (RTD Text)

```
#define RF430_DEFAULT_DATA {
/*NDEF Tag Application Name*/                                          \
0xD2, 0x76, 0x00, 0x00, 0x85, 0x01, 0x01,                              \
/*Capability Container File ID*/                                       \
0xE1, 0x03,                                                            \
0x00, 0x0F, /* CCLEN */                                                \
0x20, /* Mapping version 2.0 */                                        \
0x00, 0x3B, /* MLe (49 bytes); Maximum R-APDU data size */             \
0x00, 0x34, /* MLc (52 bytes); Maximum C-APDU data size */             \
0x04, /* Tag, File Control TLV (4 = NDEF file) */                      \
0x06, /* Length, File Control TLV (6 = 6 bytes of data for this tag) */ \
0xE1, 0x04, /* File Identifier */                                      \
0x0B, 0xDF, /* Max NDEF size (3037 bytes of useable memory) */         \
0x00, /* NDEF file read access condition, read access w/o any security */ \
0x00, /* NDEF file write access condition, write access w/o any security */ \
/* NDEF File ID */                                                     \
0xE1, 0x04,                                                            \
/* NDEF File for Hello World */                                        \
0x00, 0x14, /* NLEN; NDEF length (20 byte long message) */             \
0xD1, /* Record Header */                                              \
0x01, 0x10, /*type length, payload length                              \
0x54, /* T = text */                                                   \
0x02, /* Status Byte (2 byte language code) */                         \
0x65, 0x6E, /* 'e', 'n',                                              \
* Payload Data 'Hello, world!' */                                      \
0x48, 0x65, 0x6C, 0x6C, 0x6f, 0x2c, 0x20,                              \
0x77, 0x6f, 0x72, 0x6c, 0x64, 0x21                                     \
}
```

3 NDEF Maker Application

This application report includes a Microsoft® Excel® application, which can be used to easily generate the required Bluetooth pairing NDEF message. This application can be found at the following link: http://www.ti.com/lit/zip/sloa187.

3.1 Using the NDEF Maker

Upon opening the NDEF Maker, a selection of the NDEF type should be made. For the purpose of this application report, select “Bluetooth Handover”.

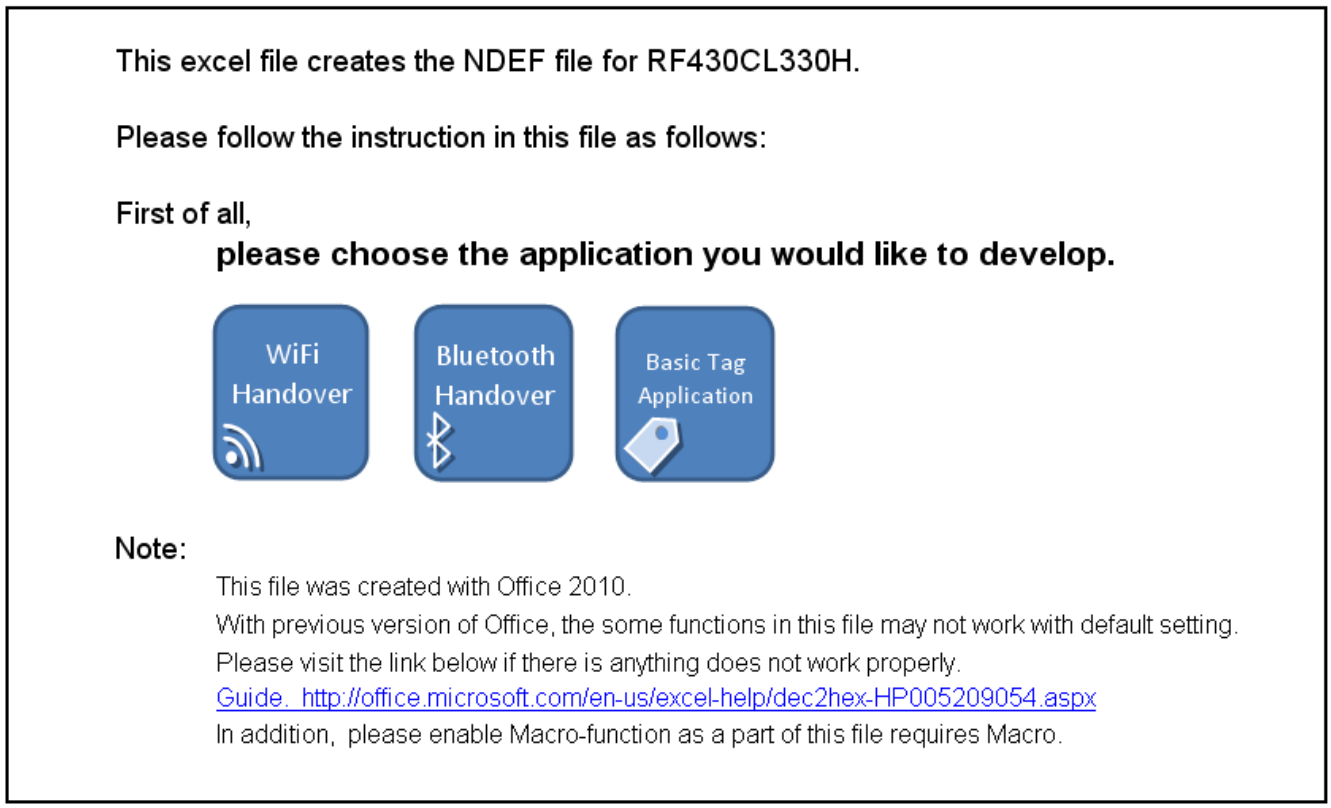

Figure 2. NDEF Maker Home screen

After “Bluetooth Handover” has been selected, fields are available for the required and optional information. These fields should be filled in with the data corresponding to the Bluetooth device that should be associated with the RF430CL330H.

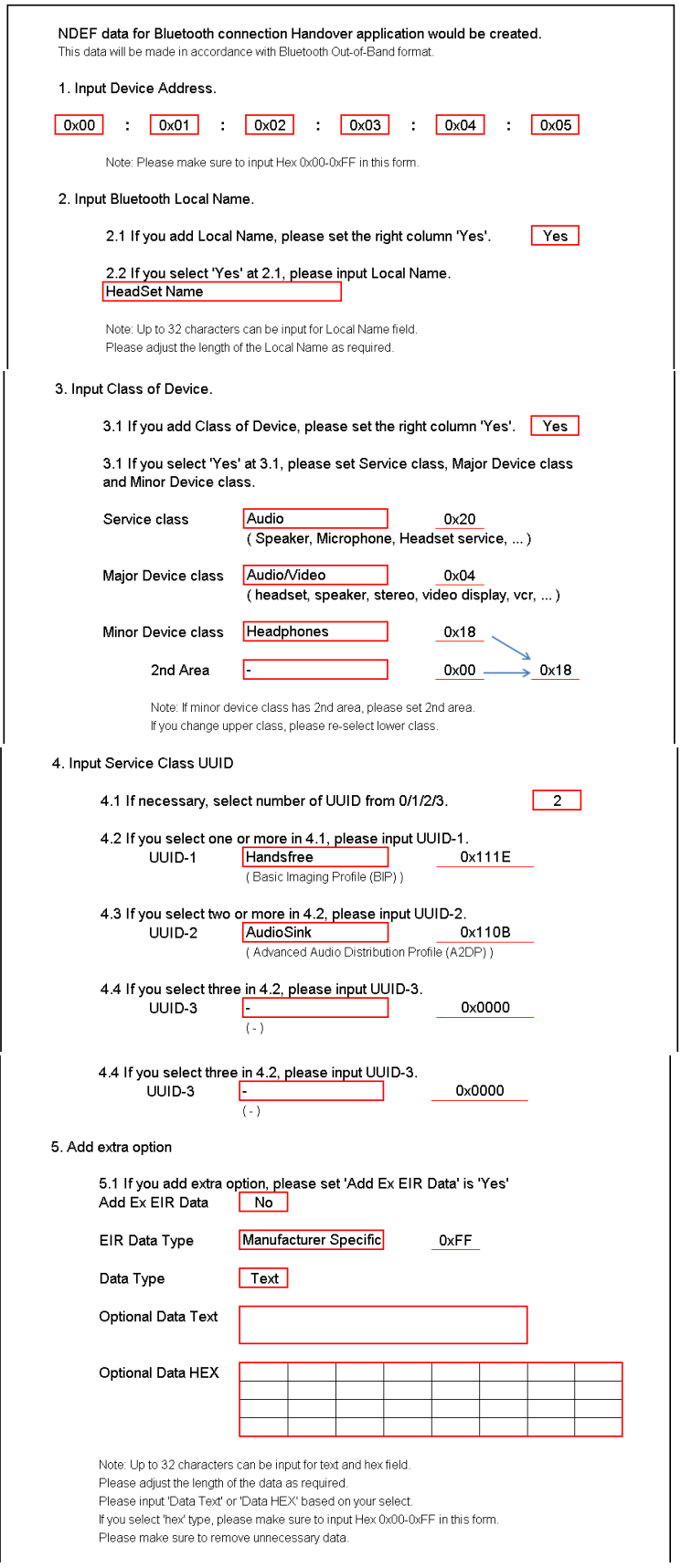

Figure 3. NDEF Maker Data Fields

After the desired information has been filled out, the NDEF code structure can be seen in the lower portion of the spreadsheet as seen in Figure 4 and Figure 5. After reviewing this information, click “Make output file” to generate a .txt that can be copied and pasted into the MSP430FR5739 project. For the purpose of this application, “Use Def file” should be set to “On”.

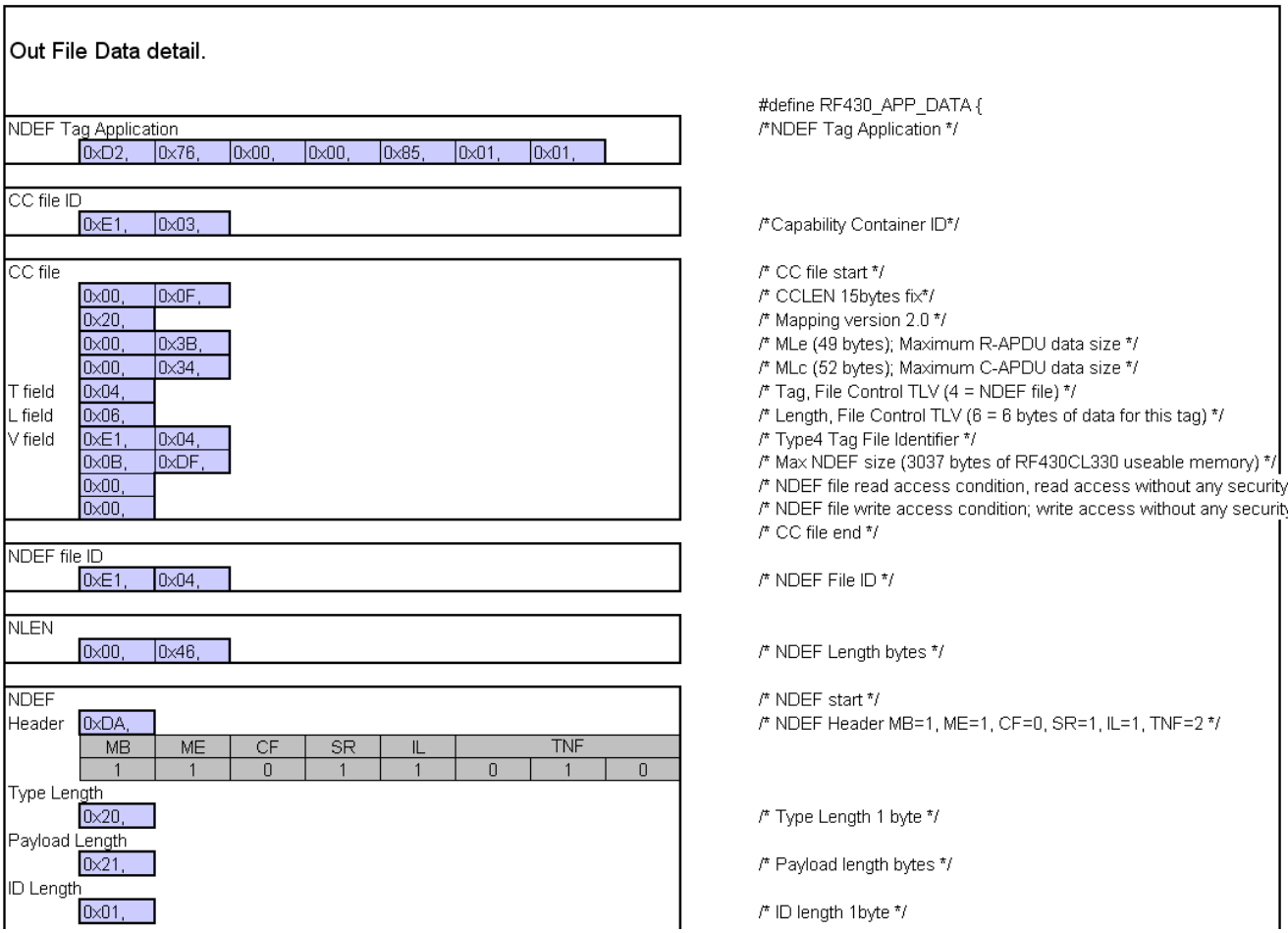

Figure 4. Bluetooth Handover Structured Data

Record Type: application/vnd.bluetooth.ep.oob	/* Type Name: application/vnd.bluetooth.ep.oob */
0x61, 0x70, 0x70, 0x6C, 0x69, 0x63, 0x61, 0x74, 0x69, 0x6F, 0x6E, 0x2F, 0x76, 0x6E, 0x64, 0x2E, 0x62, 0x6C, 0x75, 0x65, 0x74, 0x6F, 0x6F, 0x74, 0x68, 0x2E, 0x65, 0x70, 0x2E, 0x6F, 0x6F, 0x62,	
ID	
0x01,	/* ID : 0x01 */
Payload	/* Payload start */
Bluetooth OOB Data Length	/* Bluetooth OOB Data */
0x21, 0x00,	/* OOB Data Length */
Device Address	
0x05, 0x04, 0x03, 0x02, 0x01, 0x00,	/* Device Address 00:01:02:03:04:05 */
Local Name Field	
Local Name Field Length	/* Local Name Field Start */
0x0D,	/* Local Name Length: 12bytes plus Data Type 1byte */
Local Name EIR Data Type	
0x09,	/* EIR Data Type: Local Name 0x09 */
Local Name	/* Local Name HeadSet Name */
0x48, 0x65, 0x61, 0x64, 0x53, 0x65, 0x74, 0x20, 0x4E, 0x61, 0x6D, 0x65,	
Class of Device Field	
Class of Device Field Length	/* Class of Device Field Start */
0x04,	/* Class of Device Length 3bytes plus Data Type 1byte */
Class of Device EIR Data Type	
0x0D,	/* EIR Data Type : Class of Device 0x0D */
Class of Device	/* Class of Device, Service Class : Audio */ /* Major Class : Audio/Video */ /* Mainor Class : Headphones */
0x18, 0x04, 0x20,	
UUID Field	
UUID Field Length	/* UUID Field Start */
0x05,	/* UUID Field Length 5bytes */
UUID Field EIR Data Type	
0x03,	/* UUID Field EIR Type 0x03 */
UUID Field 1	
0x1E, 0x11,	/* UUID 1 Handsfree */
UUID Field 2	
0x0B, 0x11,	/* UUID 2 AudioSink */
UUID Field 3	

Figure 5. Bluetooth Handover Structured Data (continued)

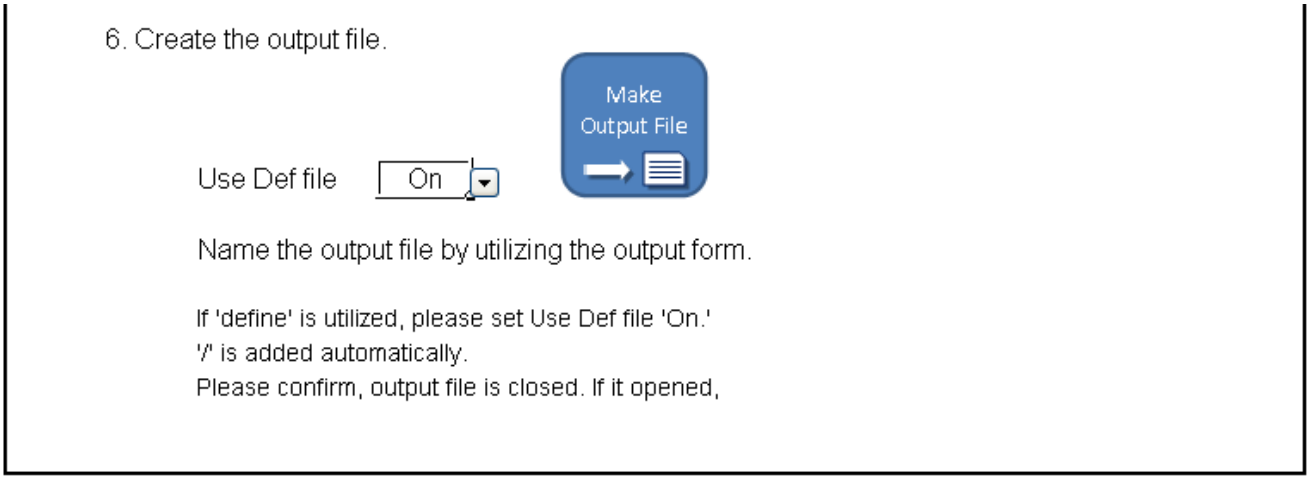

Figure 6. Make Output File

Figure 7 shows the recommended firmware flow.

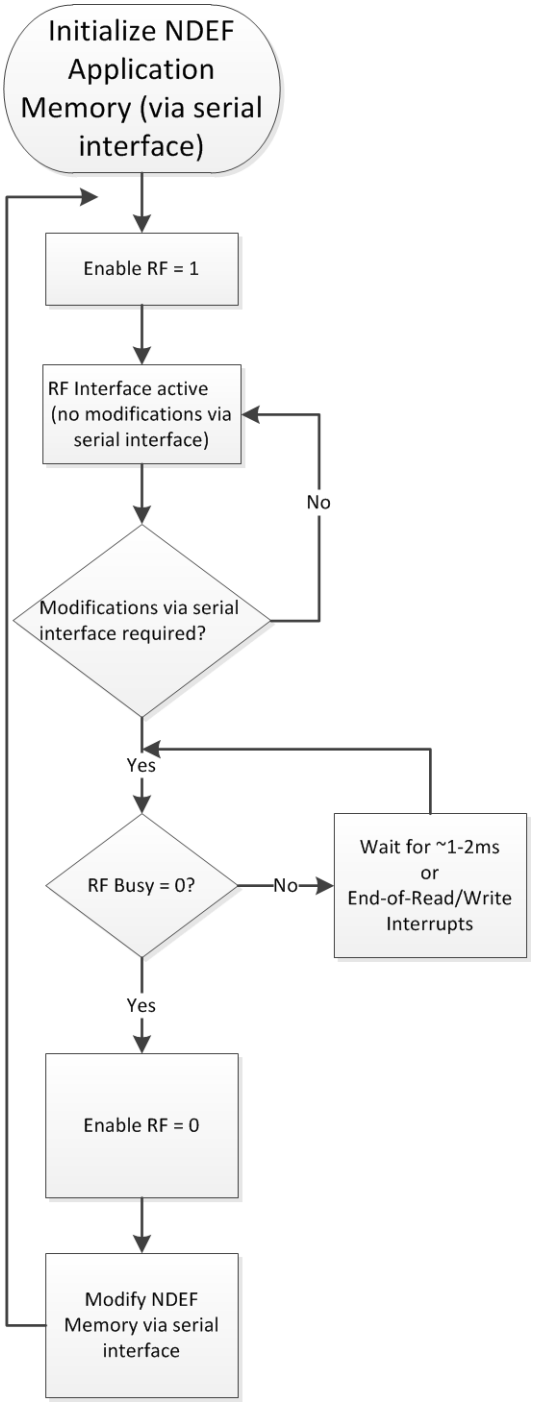

Figure 7. Recommended Firmware Flow

The resulting .txt should be pasted into RF430.h to overwrite the existing NDEF message as shown in Section 2.1. The data length will be different from the original “Hello, World!” message, therefore, the “Write_Continuous” function in main.c must be modified to match the data length. The code snippet below demonstrates an example that is 104 bytes long. Depending on the device name and what optional fields are used, this length can vary.

```
    /**************************************************************************/
    /* Configure RF430CL330H for Typical Usage Scenario                       */
    /**************************************************************************/

    //write NDEF memory with Capability Container + NDEF message
    Write_Continuous(0, NDEF_Application_Data, 104);   //104 bytes = 28 bytes overhead + NDEF
message

    //Enable interrupts for End of Read and End of Write
    Write_Register(INT_ENABLE_REG, EOW_INT_ENABLE + EOR_INT_ENABLE);

    //Configure INTO pin for active low and enable RF
    Write_Register(CONTROL_REG, INT_ENABLE + INTO_DRIVE + RF_ENABLE);
```

4 Bluetooth Pairing Experience With Android OS Handsets

Bluetooth pairing via NFC is native to Android 4.1.1 and above, so if using Android 4.1.1 or above, there is no requirement to install any additional application. For earlier versions of Android, there are applications available on the market that will perform a similar pairing experience.

Once the new NDEF message is written to the RF430CL330H and RF has been enabled, the back of the Android handset where the NFC antenna is located should be placed in close proximity to the RF430CL330H antenna. The Android handset must be unlocked and NFC must be enabled. If the handset has never been paired to this Bluetooth device, the message seen in Figure 8 will be displayed.

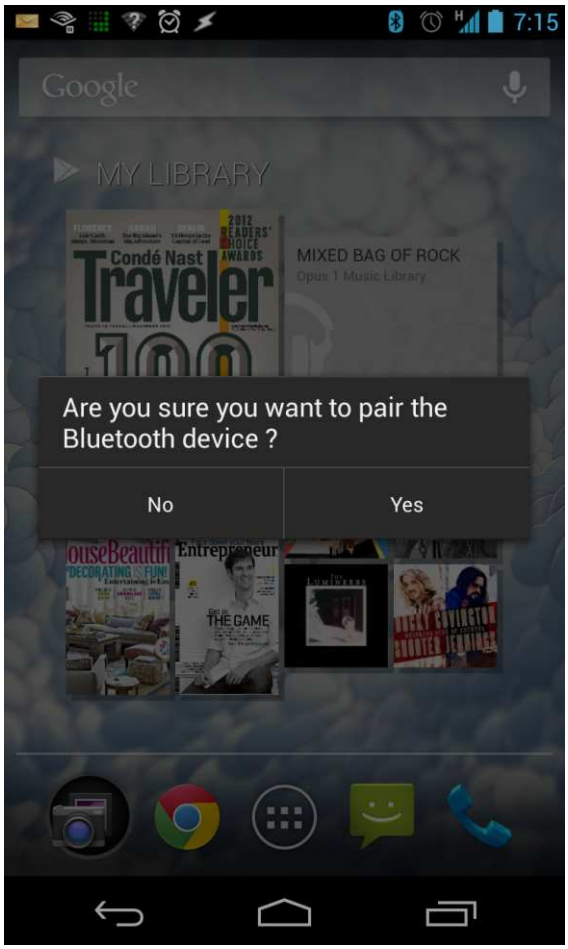

Figure 8. Pairing Request Message

After selecting “Yes”, the handset will attempt to pair to the device described in the NDEF message. The screens shown in Figure 9 will appear indicating the pairing and connection process.

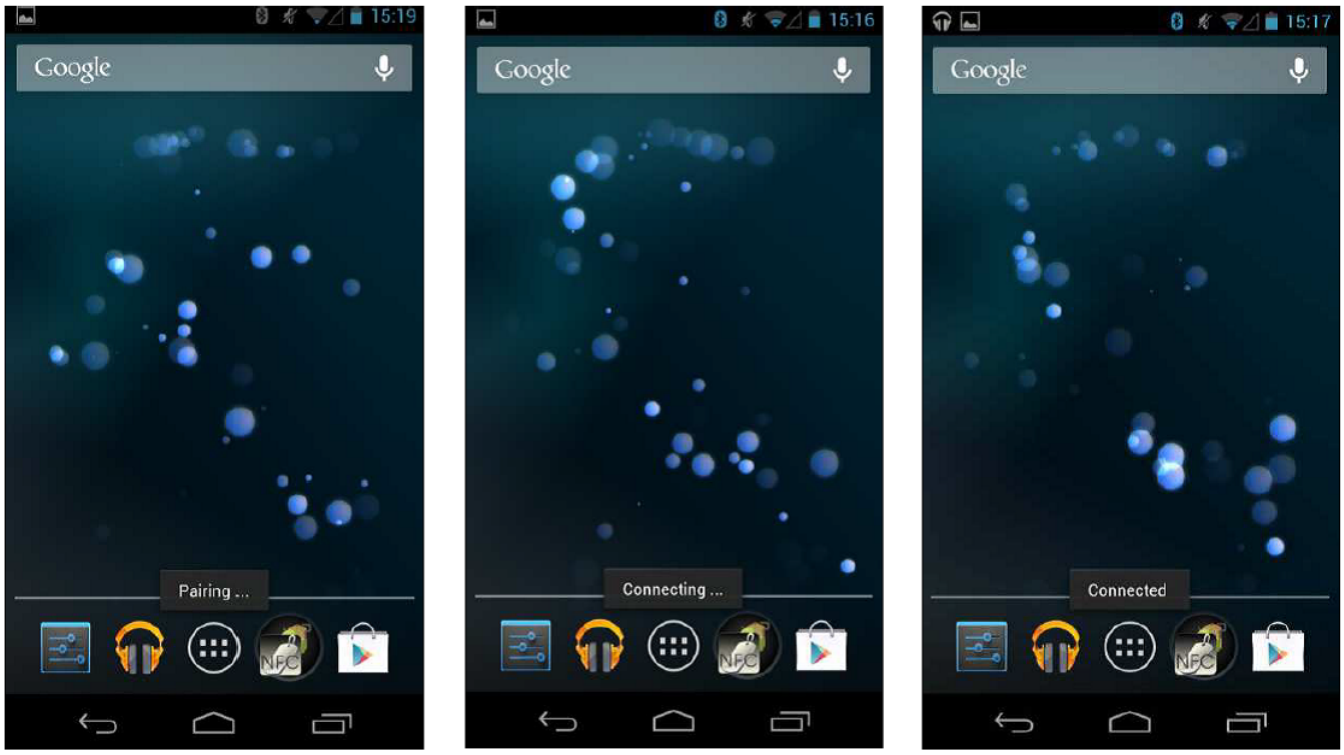

Figure 9. Pairing and Connecting

After the device is paired, NFC can also be used to subsequently disconnect or reconnect to the Bluetooth device by presenting the phone to the RF430CL330H antenna again.

5 References

1. RF430CL330H Product Folder
2. *RF430CL330H Example Code*: (SLOC290)
3. MSP-EXP430FR5739 Tool Folder
4. NFC Forum Tag Type 4 Operation Specifications
5. Connection Handover Specification
6. Bluetooth Secure Simple Pairing Using NFC – Application Document NFC Forum

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from August 15, 2013 to March 31, 2016 **Page**

- Changed link to NFC Forum document 1
- Changed link in reference [5]..... 11

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