BM77 PICtail / PICtail Plus Board User's Guide

BM77 PICtail / PICtail Plus Board

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BM77 PICtail / PICtail Plus Board

1. Overview

This document describes the hardware and software for the BM77 PICtail/ PICtail Plus board.

The BM77 PICtail board allows the designer to evaluate and demonstrate the capabilities of the BM77 Dual Mode Bluetooth RF Module. The evaluation board includes an integrated configuration and programming interface for plug-and-play capability. It also includes on-board connection and data status LEDs enabling rapid prototyping and fast time to market.

In addition to BM77 PICtail board hardware, several software applications are provided to demonstrate Bluetooth data connections to the onboard BM77 module and optionally configure the BM77 module.

The demonstration software application consists:

- Android Chat Application (SPP)
- iOS Bluetooth Terminal (BLETR)
- BT Chat Tool

The configuration software consists of:

- BM77 Configuration Library
- BM77 Configuration User Interface (UI) Tool
- BM77 EEPROM Table Utility

1.1. BM77 PICtail Board Description

BM77 PICtail board provides rapid prototyping and developing for Bluetooth data applications for Classic SPP or Bluetooth Low Energy. It can be powered via USB host or through the Microchip PICtail Plus interface. The BM77 PICtail board utilizes the BM77 module, a fully certified Bluetooth 4.0 dual mode RF module supporting Bluetooth Classic SPP (Serial Port Profile) and Bluetooth Low Energy (BTLE) – providing Bluetooth serial data connections. The BM77 PICtail board provides a USB-UART converter allowing flexible interface to host PC, a PC terminal utility and SmartPhone APPs to drive both classic SPP and BTLE data connections. The BM77 PICtail board also provides Microchip PICtail Plus and PICtail interfaces to be able to interface with the Microchip PIC microcontrollers (MCU) using standard Microchip development tools.

BM77 PICtail / PICtail Plus Board
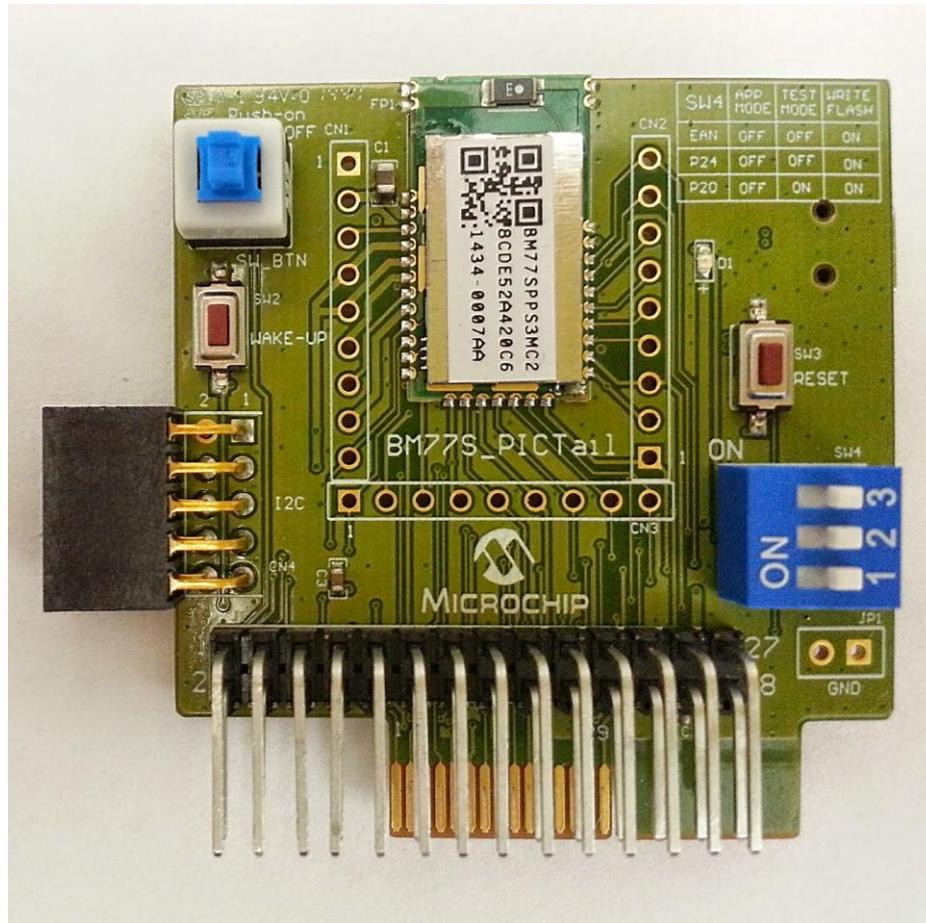
1.2. Features

- Fully certified on board Bluetooth 3.0+EDR and Bluetooth 4.0 stack.

- Class 2 transmitter, +2dBM typical.

- Transparent serial data connection over Bluetooth Classic Serial Port Profile (SPP) and Bluetooth Low Energy transparent serial data service.

- Automatic configuration mode for quick setup (default)

- Manual configuration mode where MCU can access configuration settings

- Configuration settings stored in internal EEPROM on BM77

- Onboard dip switch block to set operating modes

- PICtail Plus and PICtail interfaces to fully access BM77 pins using external PIC MCU

- Embedded MCP2200 USB-UART converter to enable application mode and programming interface to update firmware and configuration settings

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2. Interface Description

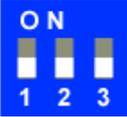The illustration below shows a BM77 PICtail board in its default configuration as shipped.
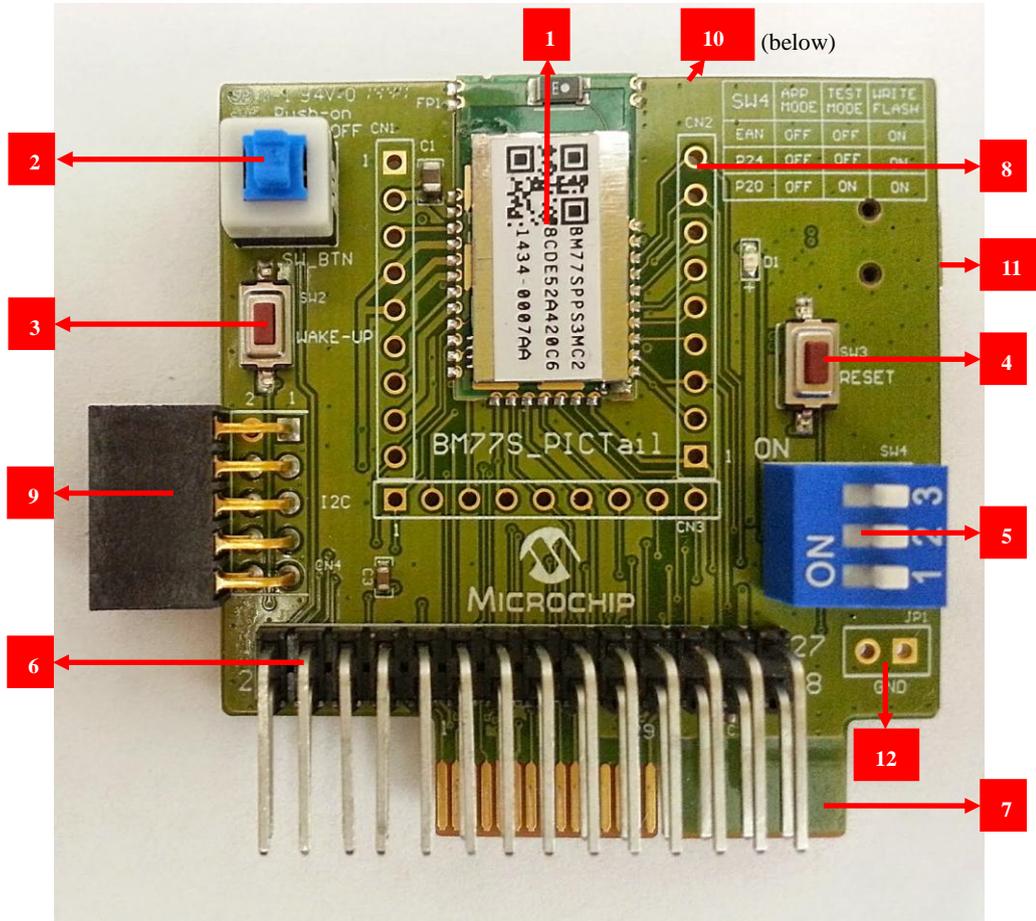
Description

1. FP1- Bluetooth Module- BM77

2. SW1- Button to SW_BTN pin. The button must be pressed down to turn on BM77.

3. SW2- Wake up button to wake up module from shutdown state

4. SW3- Reset button for BM77 Bluetooth module

5. SW4- Mode Switch (*see 2.1 Mode Definition, 2.2 Mode Settings*)

6. J1- PICtail interface

7. J2- PICtail Plus interface

8. CN2- Header that brings out BM77 pins

9. CN4- I2C expansion port

10. U3- Microchip MCP2200 chip, USB/UART serial converter.

11. P1- Mini-B USB connector
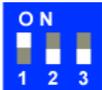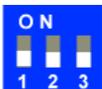
12. JP1- Ground (GND) test points

Note: SW_BTN/SW1button must be pressed down to wake BM77.

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2.1. Mode Definitions

	Switch Number	1	2	3
	Pin	P20	P24	EAN
	ON	Low	Low	High
	Function	EEPROM/Test Mode	Flash Write	Boot to Flash or ROM Application
		High=Disable/ Application	High=Disable	High=ROM
		Low=Enable/ Test Mode	Low=Enable	Low=Flash

2.2. Mode Switch Settings

Mode	Switch	PIN Definition
Write Flash		1. P20: Low 2. P24: Low 3. EAN: High
EEPROM /Test		1. P20: Low 2. P24: High 3. EAN: Low
Application (default)		1. P20: High 2. P24: High 3. EAN: Low

2.3. USB-UART Serial Interface

The BM77 PICtail board consists of an USB-UART converter allowing flexible interface to host PC, a PC terminal utility and SmartPhone APPs to drive both classic SPP and BTLE data connections. The UART port on the BM77 is exposed through a MCP2200 USB-UART serial converter for easy interfacing with a host PC.

Connecting the mini-B USB receptacle (P1) on the BM77 PICtail board to the USB port on a PC will enumerate the BM77 PICtail board as a Composite Device Class (CDC) USB device for serial communication. After the MCP2200 enumerates, a dedicated COM port is assigned on the host PC for serial communication with the BM77 on the BM77 PICtail board. A PC terminal utility or application can then open the assigned COM port and connect to the UART port on BM77 for serial data transfer or to configure and control BM77. If the MCP2200 does not enumerate ensure that the MCP2200 drivers are downloaded and manually installed from www.microchip.com/MCP2200.

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2.4. PICtail Interface

Using the PICtail Plus (J2) or PICtail (J1) interface, the board can be plugged into any standard Microchip development board that supports the PICtail Plus, or PICtail, connection interface. The BM77 PICtail board can be plugged in to the PICtail or PICtail Plus interface headers available on Microchip development boards like the Explorer 16 Development Board (DM240001) or the PIC18 Explorer Board (DM183032).

The PICtail interface provides access to the Universal Asynchronous Receiver/Transmitter (UART) port, the control and general purpose input output (GPIO) pins on the BM77. The PICtail interface can be used to configure the BM77 by updating Bluetooth parameters residing on the internal EEPROM, update the BM77 firmware on the internal flash and put the BM77 to application mode. In application mode, pairing procedure can be performed on the BM77 followed by establishing a Bluetooth connection for Serial Port Profile (SPP) or Bluetooth Low Energy data transfer.

Fig 1. shows the pin mapping for the PICtail Plus 30 pin interface and Fig 2. shows the pin mapping for the PICtail 28 pin interface.

Figure 1. PICtail Plus 30-pin interface on BM77 PICtail board

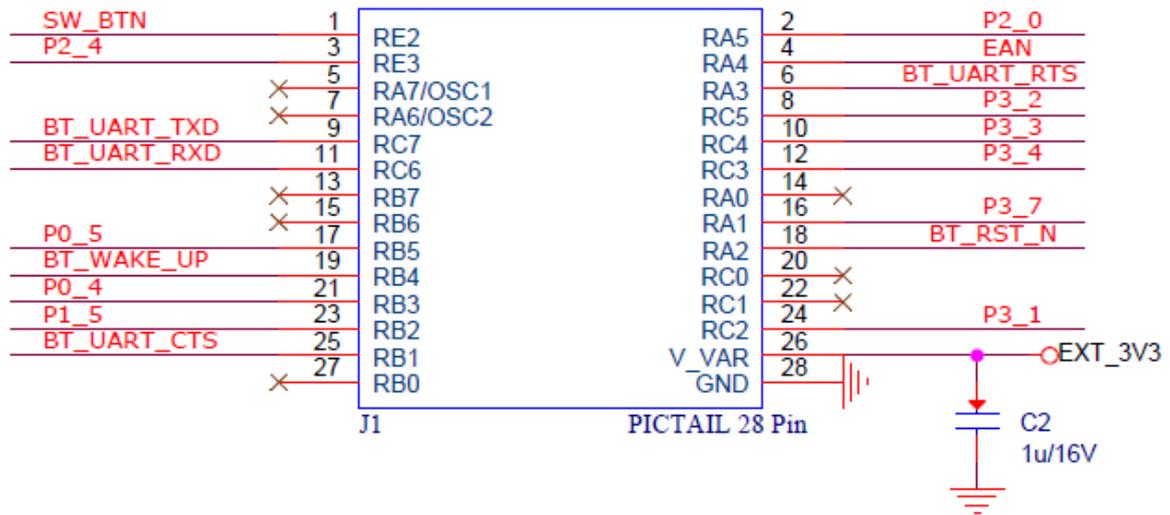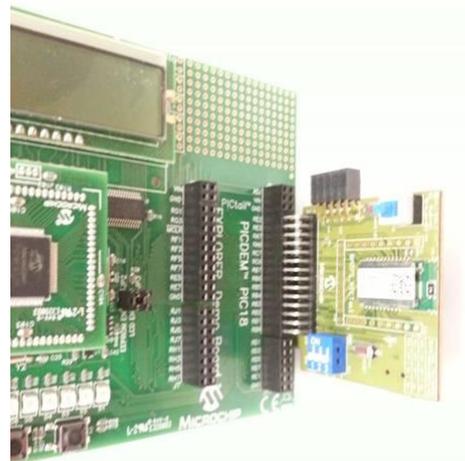# BM77 PICtail / PICtail Plus Board

Figure 2. PICtail Plus 30-pin interface on BM77 PICtail board

The BM77 PICtail board can be inserted into the PICtail Plus interface header or PICtail interface header available on Microchip development tools as shown in the illustrations.

NOTE: Ensure that the BM77 module on the board is facing the PIC PIM while inserting the BM77 PICtail board into either of the PICtail headers.

BM77 PICtail board inserted into
PICtail Plus interface

BM77 PICtail board inserted into
PICtail interface

3. Quick Start Guide to Using the BM77 PICtail Board

The following sections describe how to establish Bluetooth serial data connections using the BM77 PICtail board over USB-UART MCP2200 interface (P1). The purpose of the exercise is to demonstrate the basic data capabilities of the BM77, and interoperability with other Bluetooth devices. Please note that in all these demonstrations, the BM77 is a Bluetooth slave waiting for a connection initiated by the Bluetooth master device.

For this demonstration, the following hardware and software is required:

Required Hardware:

- BM77 PICtail board, part number BM77-PICTAIL available on www.microchipdirect.com
- Bluetooth enabled Smartphone or Tablet
    - o Android device running Android 4.3 or later
    - o iOS: iPhone 4S or later, iPad3 or later, must support Bluetooth Low Energy
- Windows Host PC with USB port

Required Software:

The software applications needed to demonstrate the BM77 PICtail is shown below:

- BM77-PICTAIL webpage: www.microchip.com/bm-77-pictail
- BT Chat Tool, "*BT Chat v004.exe*" available at www.microchip.com/bm-77-pictail
- Android Chat Tool, "*BTChat_V1.0.3.apk*" available www.microchip.com/bm-77-pictail
- iOS Terminal **"BLETR"**, available on Apple AppStore™
- MCP2200 driver for Windows, available at www.microchip.com/MCP2200

3.1. Using BM77 PICtail Board in USB-UART Serial Interface Mode

This section contains instructions to exercise the BM77 module using the USB-UART serial interface available on the BM77 PICtail board. Establishing the Bluetooth Classic and Bluetooth Low Energy data connections and transferring data on the BM77 module through the USB-UART serial interface is shown with the help of PC utility and SmartPhone applications.

3.1.1. Bluetooth SPP Connection to Android Smartphone/Tablet

In this demonstration a Bluetooth (SPP) data connection will be established between the BT Chat Tool, across BM77 PICtail board to the Smartphone application. **For the SPP demonstration an Android 4.3 or later smartphone or tablet is required.**

As illustrated below, the host PC runs a BT Chat Tool application, which transfers serial data over a COM port (USB virtual COM port) to BM77 PICtail, which is then transmitted over a Bluetooth connection to the remote Bluetooth

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host, which is this example is a Smartphone application.
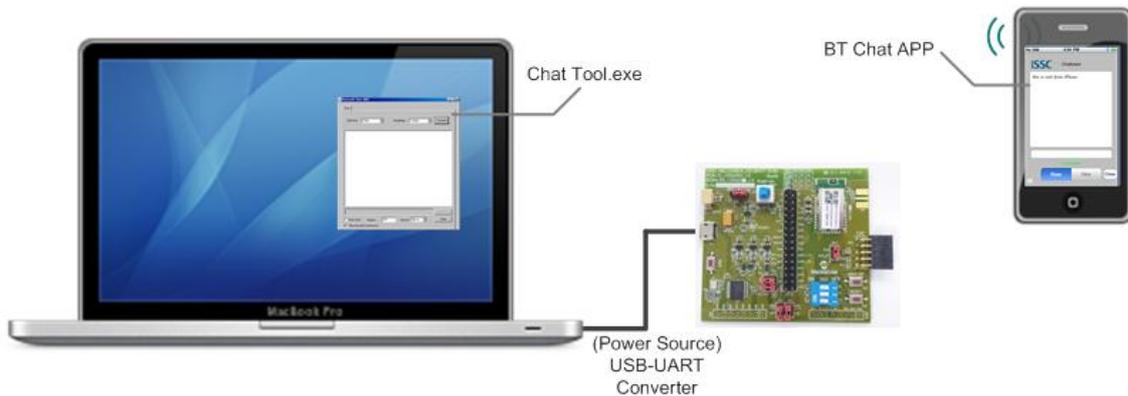
Step 1. Make sure the BM77 PICtail board is not plugged in to the PICtail interface of a Microchip development board.

Step 2. Verify SW4 switches are set to Application mode.
Make sure the **SW4** is under the **Application** Mode. 1: *OFF*, 2: *OFF*, 3: *OFF*

Step 3. Verify SW1 button is in the ON position (pushed down).

Step 4. Using the mini-B USB cable, connect the BM77 PICtail board mini-B USB receptacle (P1) to a host PC USB port to power up BM77 PICtail board.

    The blue connection LED1 (D1) indicates connection state as follows:

    Stand-by State- the **LED1** on BM77 PICtail board will blink **once** at a time.

    Pairing, **Connected** State- the **LED1** will blink **twice** at a time.

Step 5. Verify Virtual COM port is created

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A virtual COM port should be created when the BM77 PICtail board is connected to a PC. If a virtual COM is not observed in the Device Manager port list, it may be necessary to install Microchip MCP2200 driver. (Search Internet by typing keywords "Microchip MCP2200 Driver" to download MCP2200 drivers.)

Step 6. Run the **BT Chat Tool.exe** on your PC and make sure the COM Port is connected.
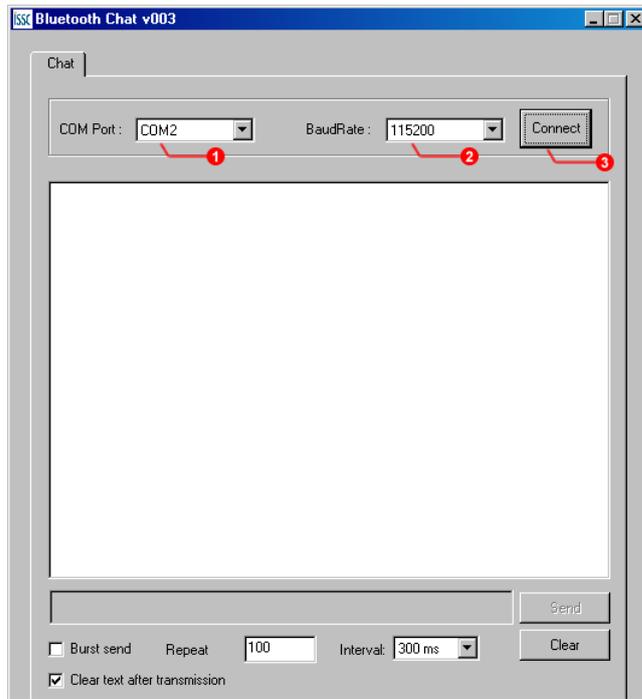
a. Select the **COM Port** assigned to the BM77 PICtail board.

b. Verify default **BaudRate** is 115200.

c. Click **Connect** button.

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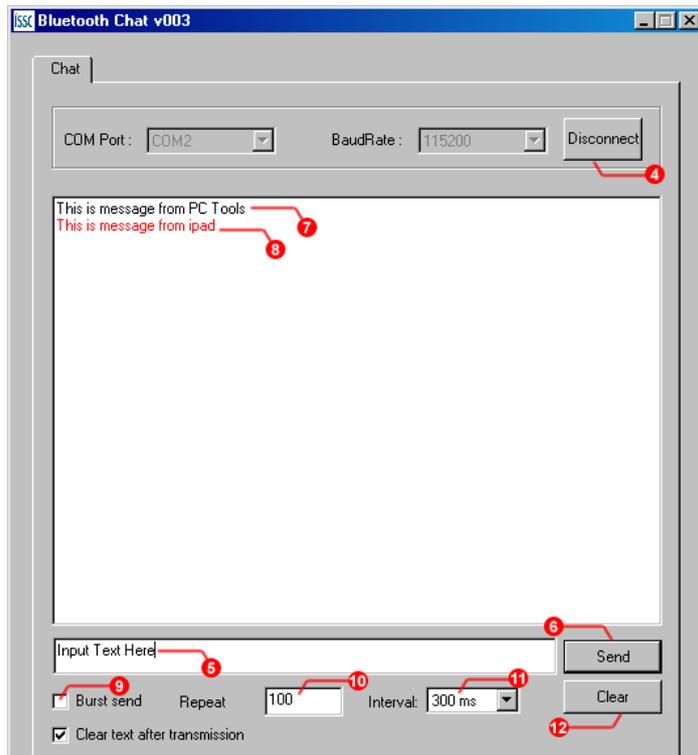
d. The **Connect** button will change into a **Disconnect** button after connected.

e. Text box to enter characters to transmit**.**

f. Click **Send** to transmit text to SmartPhone over BM77 PICtail board Bluetooth connection.

g. The **Black** text are sent from PC tool (BM77 PICtail board) to smart phone

h. The **Red** texts are sent from smart phone to the PC tool (BM77 PICtail board)

i. Click the check box of **Burst Send** to repeatedly send the text from this tool.

j. **Repeat** column means the how many times these to resend text.

k. **Interval** means the interval between two resends.

l. **Clear** button will clear up the texts on the screen.

Step 7. Install the Android BT Chat APP on the Android device.

The installation is performed by copying or downloading the "***BTChat_V1.0.3.apk"*** file onto the Android device. The APK file can be copied onto Android device by using an SD Card to transfer file, or plugging Android device into host PC where Android device mounts as external USB drive (Android MTP is required on host). Once the APK file copied onto Android device, follow the instructions below.

a. As shown below in left illustration, click open file for install from Android File Manager "My Files" App. It may be necessary to enable the "Unknown Sources" in Device Security settings during installation.

b. After successful install, the BtChat APP is displayed in Application view

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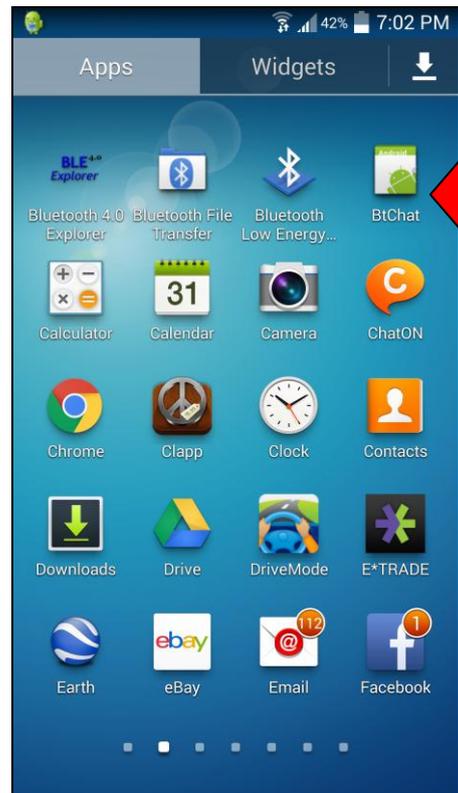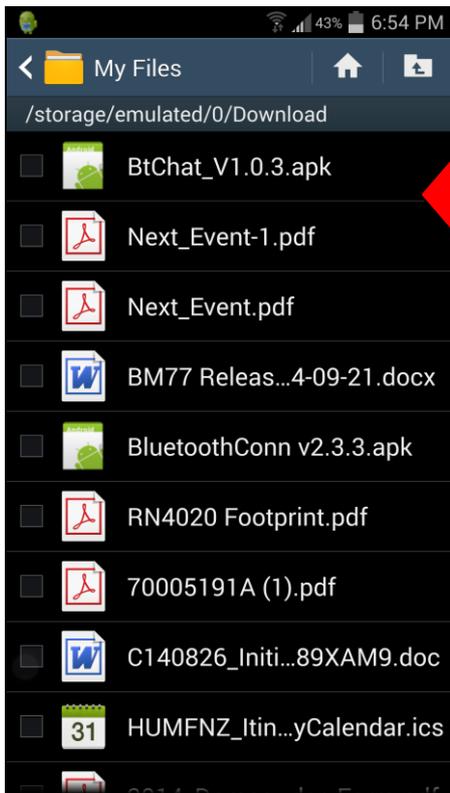
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Step 8. Pairing the BM77 PICtail board to the Android Device

    a. Open **Settings/ Bluetooth** page on the Android device and **ON** the Turn On Bluetooth.

    b. Press **Scan** button to initiate the Bluetooth Device scan

    c. Find the BM77 PICtail board device named "**Dual-SPP**" and select it to start the pairing process.

    d. Once paired, the Dual-SPP (BM77 PICtail board) device will be listed in paired device list.
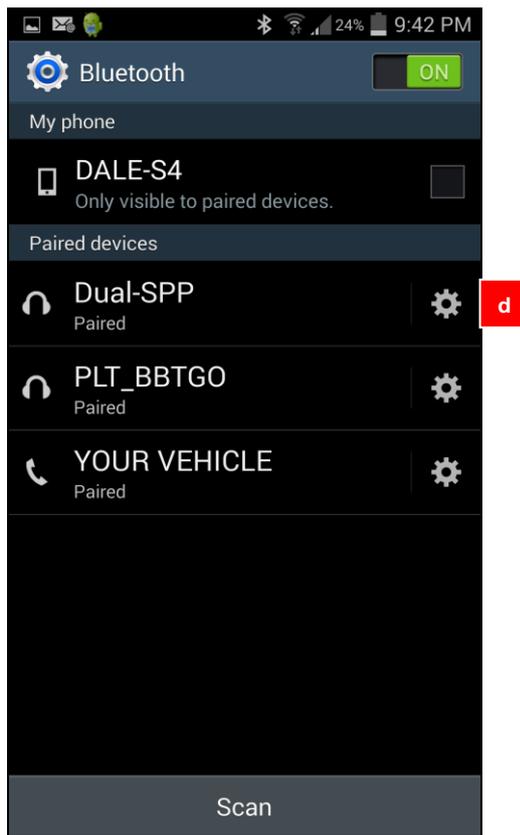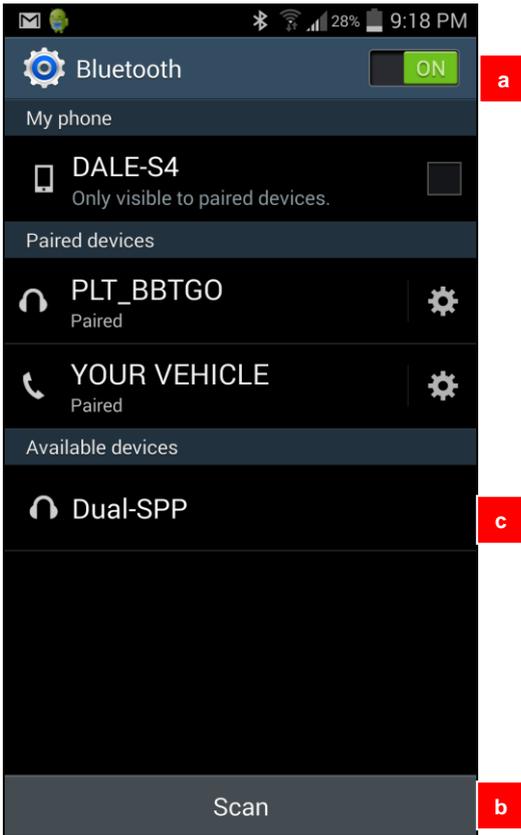
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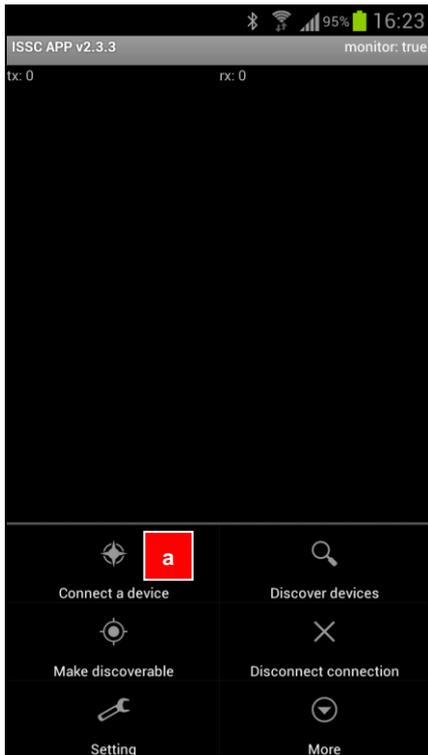**Step 9.** Launch the BtChat APP on Android Device

    a. BT Chat APP main window is displayed.

    b. Use the Android menu button to open BT Chat menu options. Select the **Setting** button to open APP setting view.

    c. Enable the "Show Rx Text" option to show the received text in the app. Press the **Back** button to return to main window.
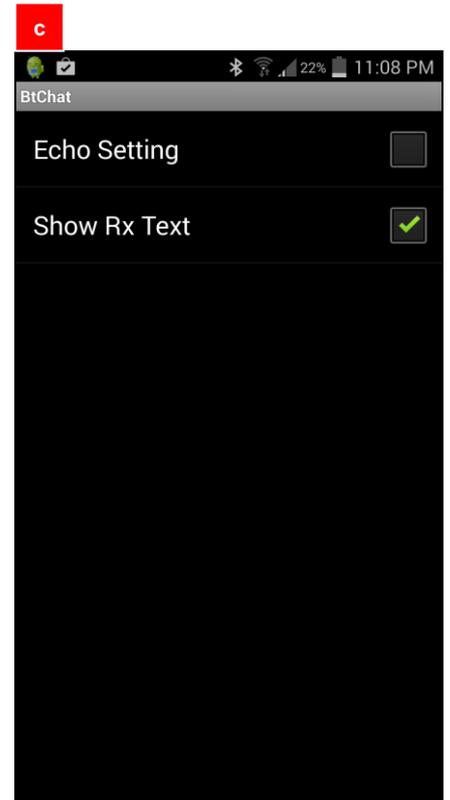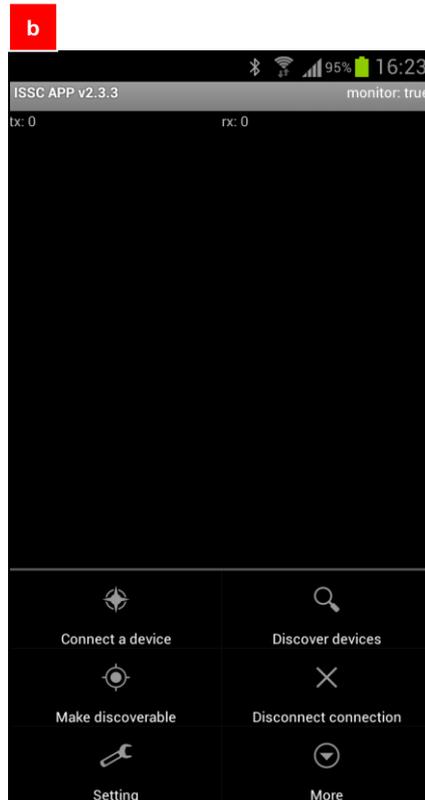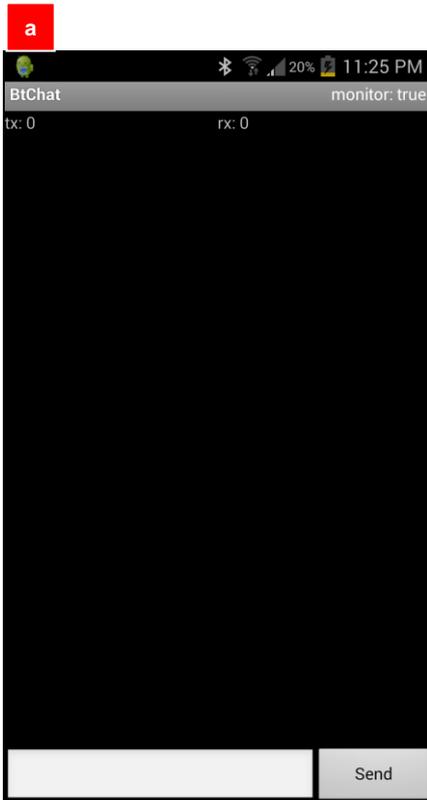
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Step 10. Setting up Bluetooth SPP connection to the BM77 PICtail board device

    a. From BT Chat APP main window, press the Android menu button to open BT Chat menu options. Select the **Connect a device** button to open paired device list.

    b. Select the "**Dual-SPP**" device to open an SPP connection to BM77 PICtail board.

   **c.** After connection is established the status message is displayed in main window.
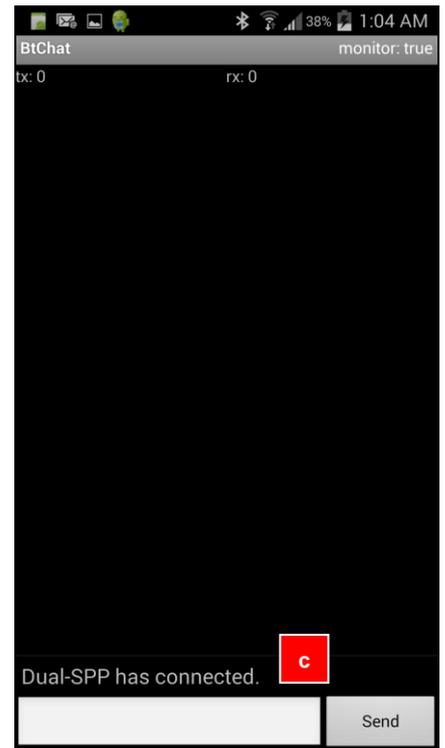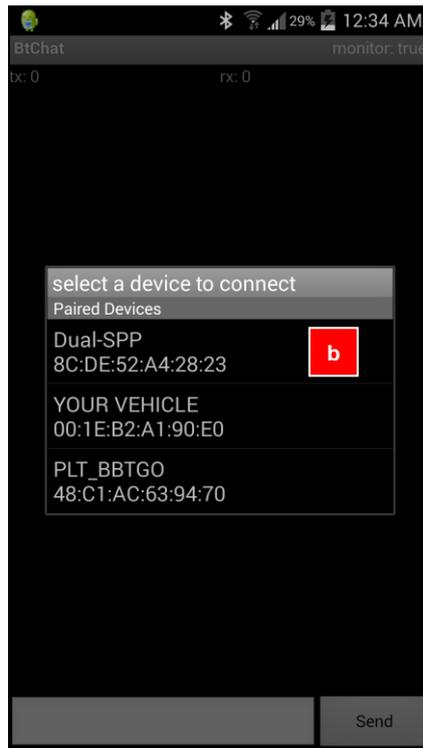
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Step 11. Transferring data from BM77 to Android Device via Bluetooth SPP connection

Launch the Bluetooth Chat application on host PC tool and set the correct COM port corresponding to the BM77 PICtail board.

- **a.** Enter text to send to Bluetooth Chat tool on PC in BTChat Android APP.
- **b.** Click "Send" in the BTChat Android app to transmit entered text to BM77 connected to Bluetooth Chat tool on PC.
- **c.** Observe received text in red color font on Bluetooth Chat PC tool window.
- **d.** Enter text to send to BM77 PICtail board in Bluetooth Chat tool on PC.
- **e.** Click "Send" to transmit text to BTChat Android APP.
- **f.** Observe received text in BTChat Android APP.
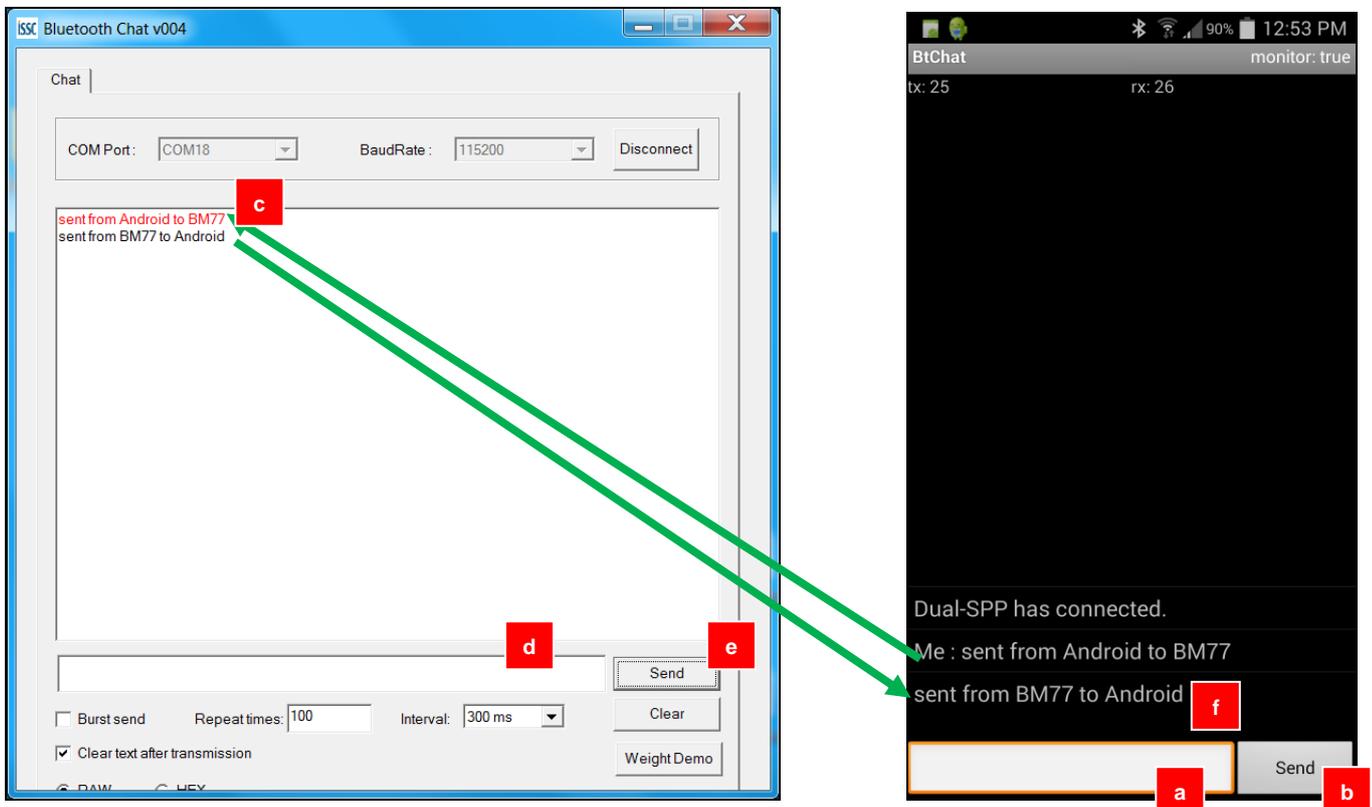
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3.1.2. Bluetooth Low Energy Data Connection to iOS Device

This demonstration show how serial data is transmitted from BM77 PICtail board (via PC Chat) to an iOS device using Bluetooth Low Energy (BLE) connection. This demonstration uses ISSC BLETR APP to establish connection with the BM77 PICtail board. Bluetooth Low Energy is utilized since iOS devices support Bluetooth Classic SPP data connections only as part of Apple Made For iPod (MFi) program. A key feature of the BM77 is transparent serial data connection from BM77 UART to an iOS device over Bluetooth Low Energy connection.

a. Using an iPhone 4S or later, iPad3 or later device, download and install "**ISSC BLETR**" APP from Apple App Store. As illustrated below, the BLETR App is available on the Apple App Store.

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   b. Turn on the **Bluetooth** radio in iPhone, iPod or iPad Settings application.

    c. Go to **Settings/ General/ Bluetooth** Page.

    d. Turn **ON** the Bluetooth.

    e. Launch the **ISSC BLETR APP** and it will scan for the Bluetooth Low Energy Peripheral devices and list them. If the device does not appear, press the **Refresh** or **Scan** button to restart the BTLE peripheral scan. Find the **Dual-SPP** BTLE peripheral device. Select it to start a connection to the BM77 PICtail board named **Dual-SPP**.
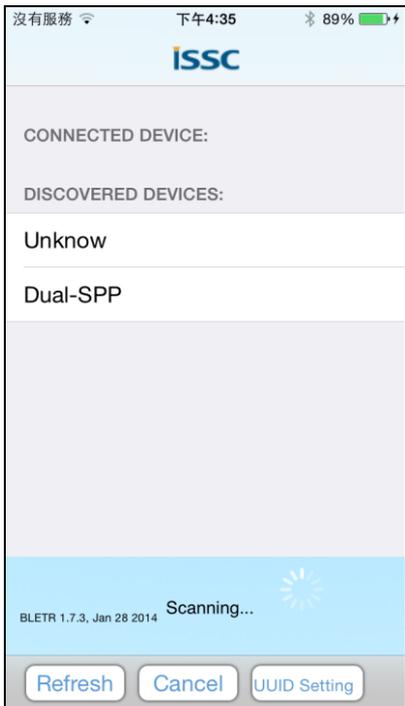
f. After a successful connection to BM77 PICtail board, BLETR will display the Dual-SPP device as connected as shown below.
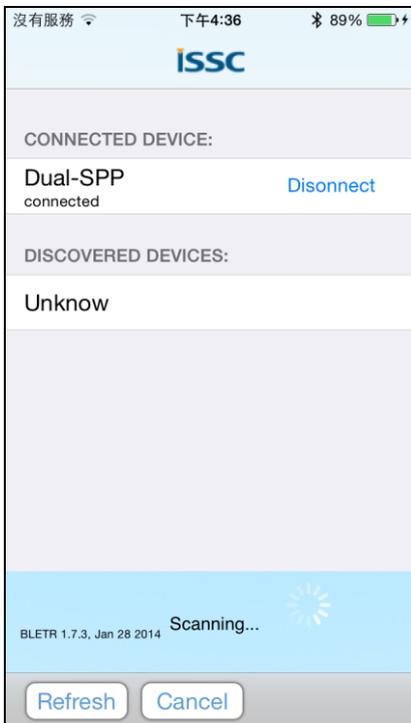

g. Select the connected Dual-SPP device to display the top level view. This view presents three options when connected to a BM77 PICtail board.

Transparent- View to display received data, send data, and enable features

Proprietary- This view sets Bluetooth Low Energy connection parameters.

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Device Info- This view displays the settings for Bluetooth Low Energy Device Information Service.
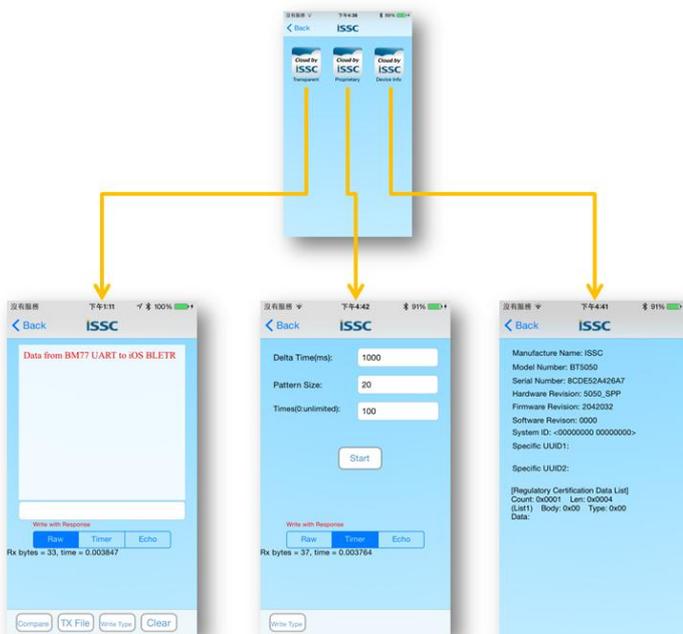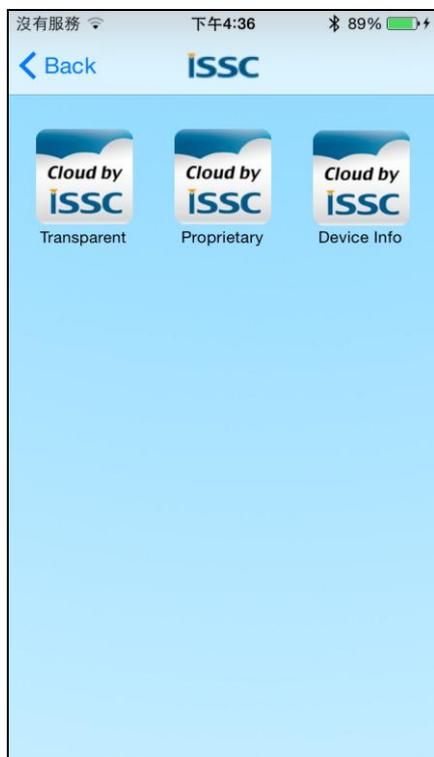
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h. Selecting **Transparent** button opens the transparent serial data view as shown below. The default mode is Raw (ASCII) mode where any data characters received are displayed in the large text box in red font.

Data Mode Transfer
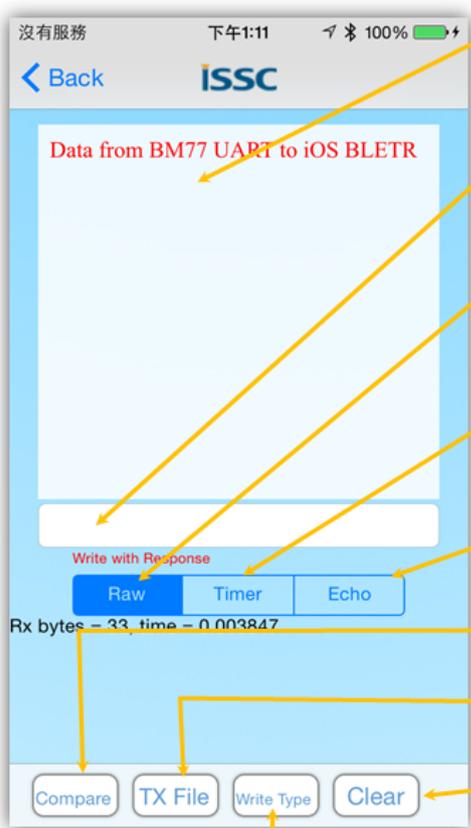
Tx/Rx Data View
This text box displays all sent data from BLETR and received data from BM77. Received text is displayed in Red font color. Sent text is displayed in black text color.

Send Data Box
Text box used to enter the text that will be sent to BM77. Select it to bring up the soft keyboard and enter the text. Press the "Send" button to soft keyboard to transmit the text.

Raw Mode
Displays all received and sent data as ASCII instead of HEX value. Raw is default display mode.

Timer Mode
The Timer view allows BLETR to send repeated text patterns using the following: (1) configuration interval between transmission, (2) number of characters per transmission (3) number of times to transmit.

Echo Mode
When Echo mode is enabled any character received is transmitted back to sender.

Compare
Not Supported

TX File
Performs a block transfer of files of various sizes.

Clear
Clears the text from Tx/Rx text box.

Write Type
Toggle between Write with Response and Write w/o Response. Write w/o Response provides increased throughput.

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To send data from BLETR iOS device to the BM77, select the input text box. The soft keyboard will be displayed as shown below. Enter text in the input text box. Click **Send** button to transmit text to BM77 over BLE connection.
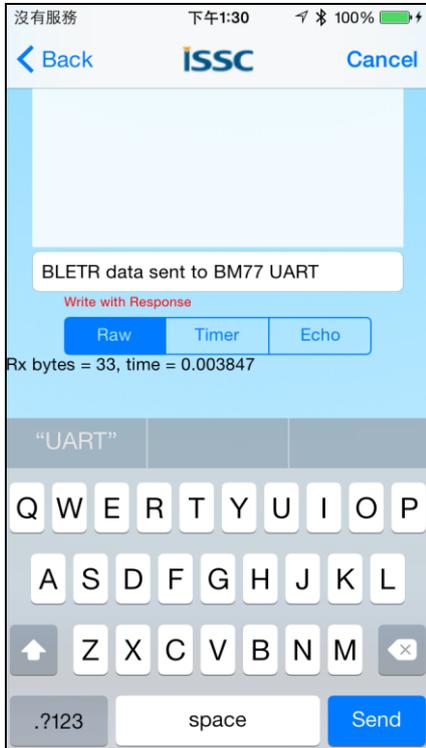
After clicking "Send" the text is received via the BM77 UART and displayed in the BT Chat PC tool text window.

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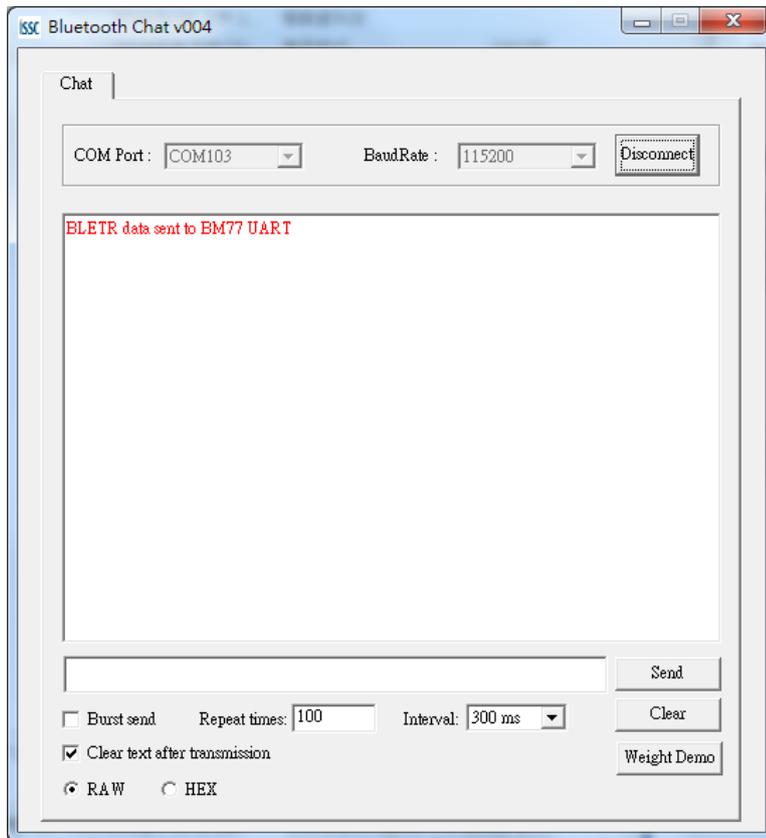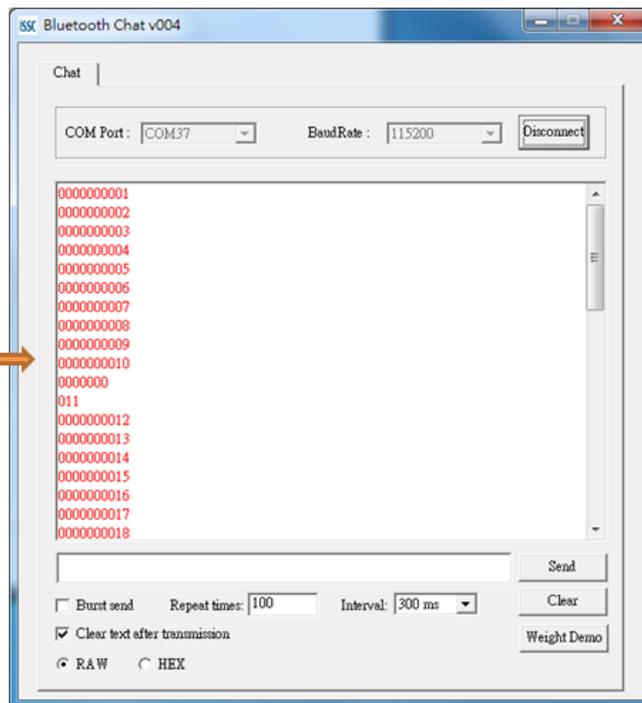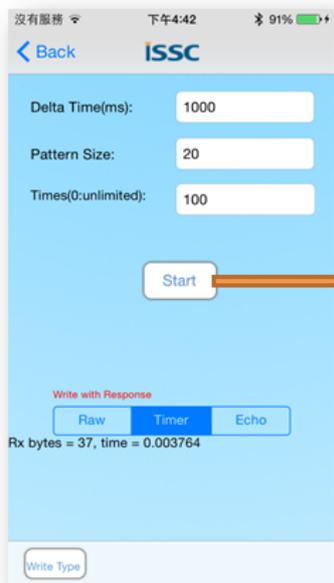

Timer Feature

In addition to Raw mode (ASCII) the Transparent data view also has Timer and Echo features. The Timer feature allows the BLETR to send a repeated test pattern to BT Chat PC tool for throughput and data transfer test.

An example of the "Timer" test feature is shown below.

BLETR configured to transmit a 100 test blocks of 20 characters, every 1000ms. BT Chat PC tool receives the test pattern data and displays it in red text. The line break indicates a Bluetooth Low Energy packet break, meaning a transmittted test block was fragmented into multiple BLE packets.

Clicking the **Start** button initiates the data transfer.
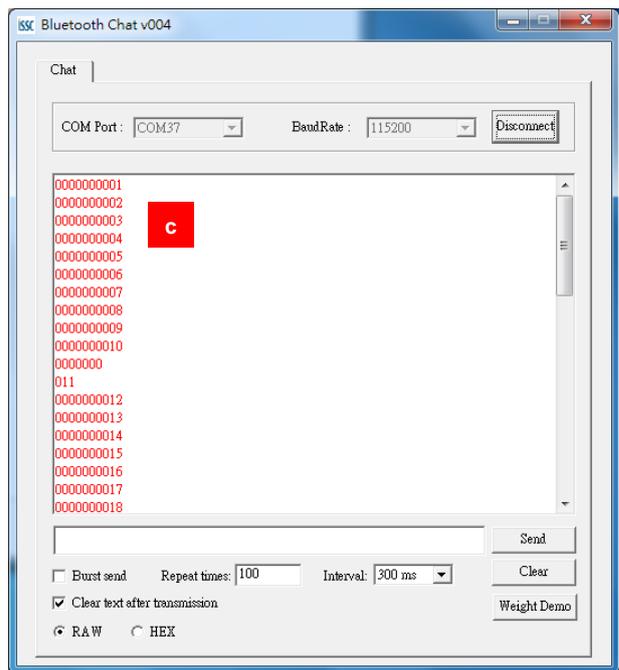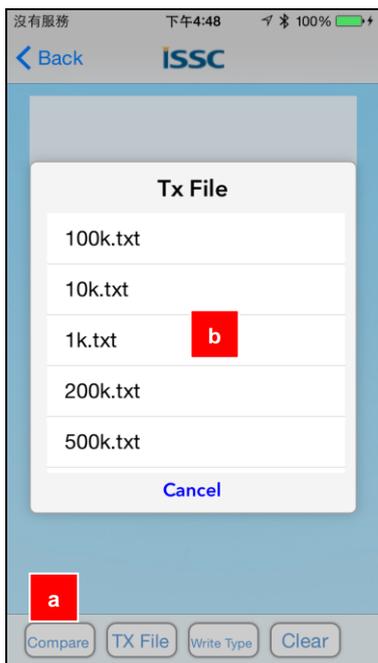
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Tx File Feature

Another test feature similar to the Timer feature is the "TX File" transfer. The "TX File" functions transfers files, which is embedded in the BLETR APP, to the BM77. The steps to use this feature are as follows.

  a. Click the **TX File** button to open a dialog with list of file sizes to transmit

  b. Select the file size to send
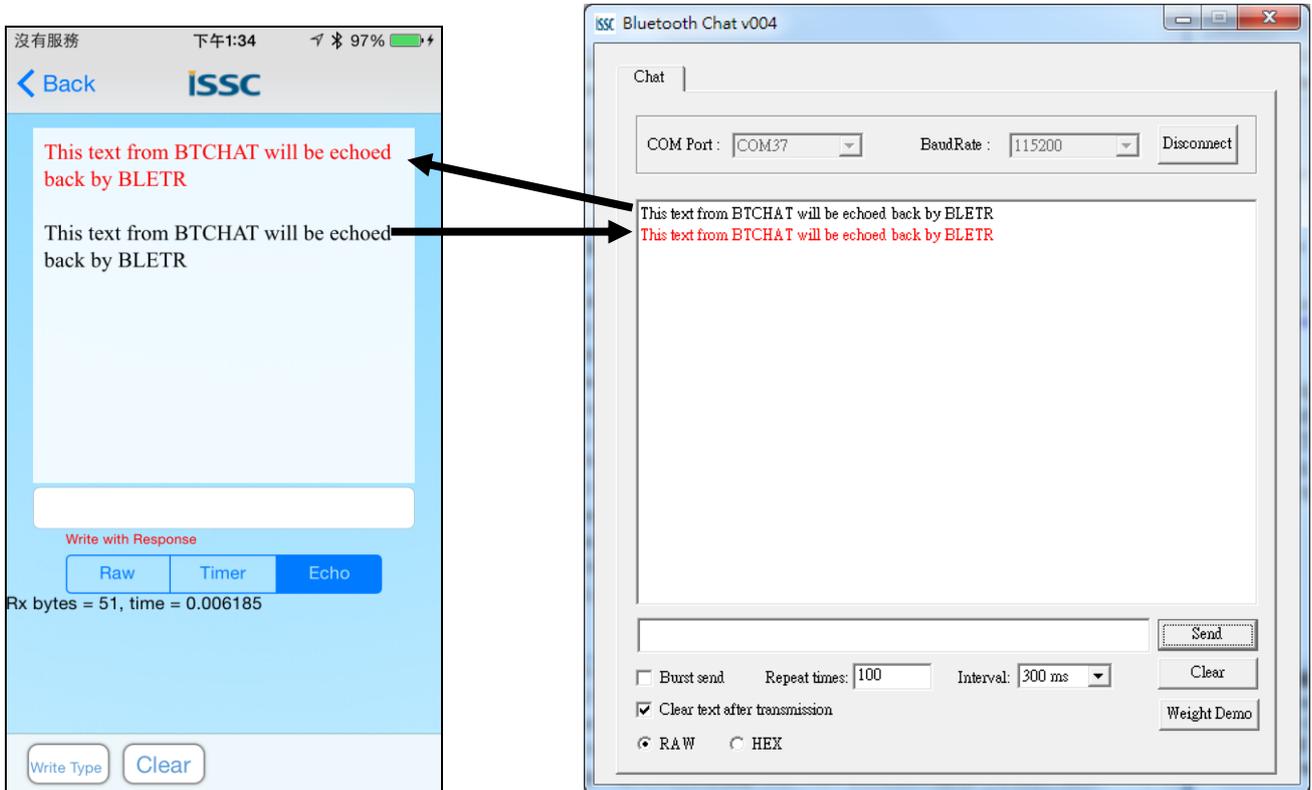
  c. Observe the file received on BT Chat.

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Echo Feature

The Echo feature is an optional function for the Transparent mode data view. When Echo is enabled, any data received by BLETR is echoed back to sender.

The example below show text sent from BT Chat PC tool being echoed to BLETR when the Echo mode is enabled.

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Device Information Feature

The Device Information view displays the characteristics associated with Device Information service. The Device Information service is available to all Bluetooth 4.0 low energy host that access the BM77 PICtail board. It exposes the identification information about the BM77 BLE peripheral device.
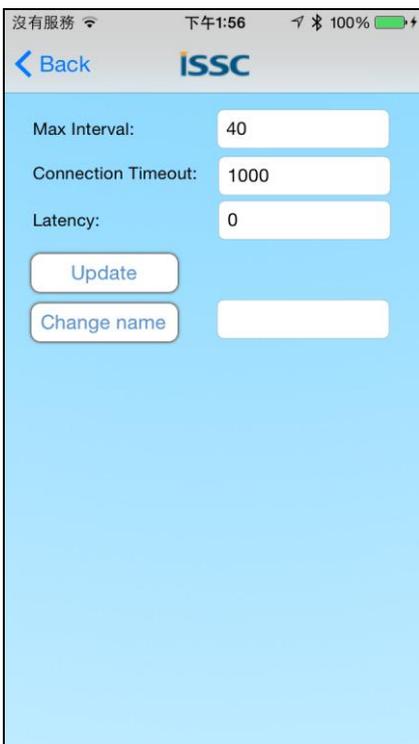
Proprietary (Configuration) Feature

The Proprietary view demonstrates the capability to change Bluetooth Low Energy connection parameters remotely via BLETR application. **These parameters only affect Bluetooth Low Energy connections.**

1. Max Interval: time (ms) between communication interval between BM77 and Bluetooth LE Central device.
2. Connection Timeout: time (ms) between communication events before a connections considered lost
3. Latency: Number of connection events peripheral (BM77) is allowed to skip
4. Bluetooth LE Name used to advertise Peripheral name to scanning Central devices. Enter new name in text box and click "Change Name" to invoke change.

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## 3.2. Using BM77 PICtail Board in PICtail Interface Mode

This section provides an overview of tools that can be used to configure the BM77 module on the BM77 PICtail board using a PIC MCU through the PICtail interface. The BM77 Configuration User Interface (UI) Tool is used to change Bluetooth parameters and generate a EEPROM configuration dump file. The BM77 EEPROM Table Utility can be used to convert the EEPROM configuration dump file generated by the BM77 UI tool into an EEPROM structure file which can be imported by the BM77 Configuration Library demo workspace to program the Bluetooth parameters on to BM77 module through the PICtail interface over UART.

3.2.1. BM77 Configuration User Interface (UI) Tool

BM77 module provides the ability to update and configure various Bluetooth configuration parameters. The BM77 Configuration UI Tool or BM77 UI Tool is an easy to use PC application which lets user update the various Bluetooth parameters available and save them in to the EEPROM configuration dump file. The Bluetooth parameters saved in the EEPROM configuration dump file can be downloaded on to the BM77 module using the BM77 Configuration Library.

The BM77 UI tool is available for download from the BM77 PICtail board webpage.

Step 1. Download the BM77 UI tool on to a Windows PC and run the application.
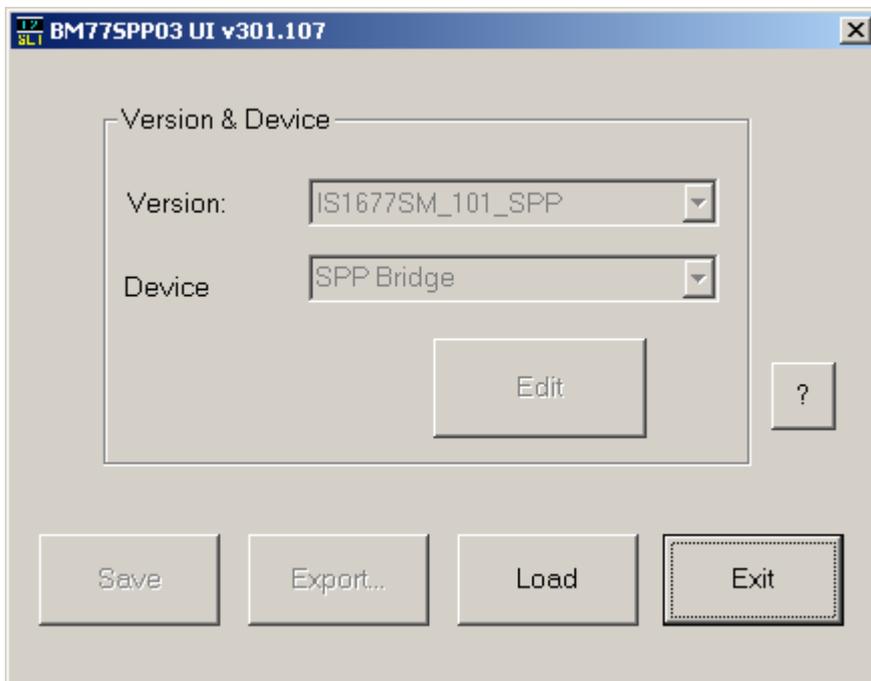
Step 2. Click **Load** button to import the default EEPROM configuration dump file (bm77_eeprom_configuration_dump_default.txt) provided with the application.

BM77 PICtail / PICtail Plus Board

Step 3. Browse to import the default EEPROM configuration dump file

(bm77_eeprom_configuration_dump_default.txt) provided with the application and click **Open** button.
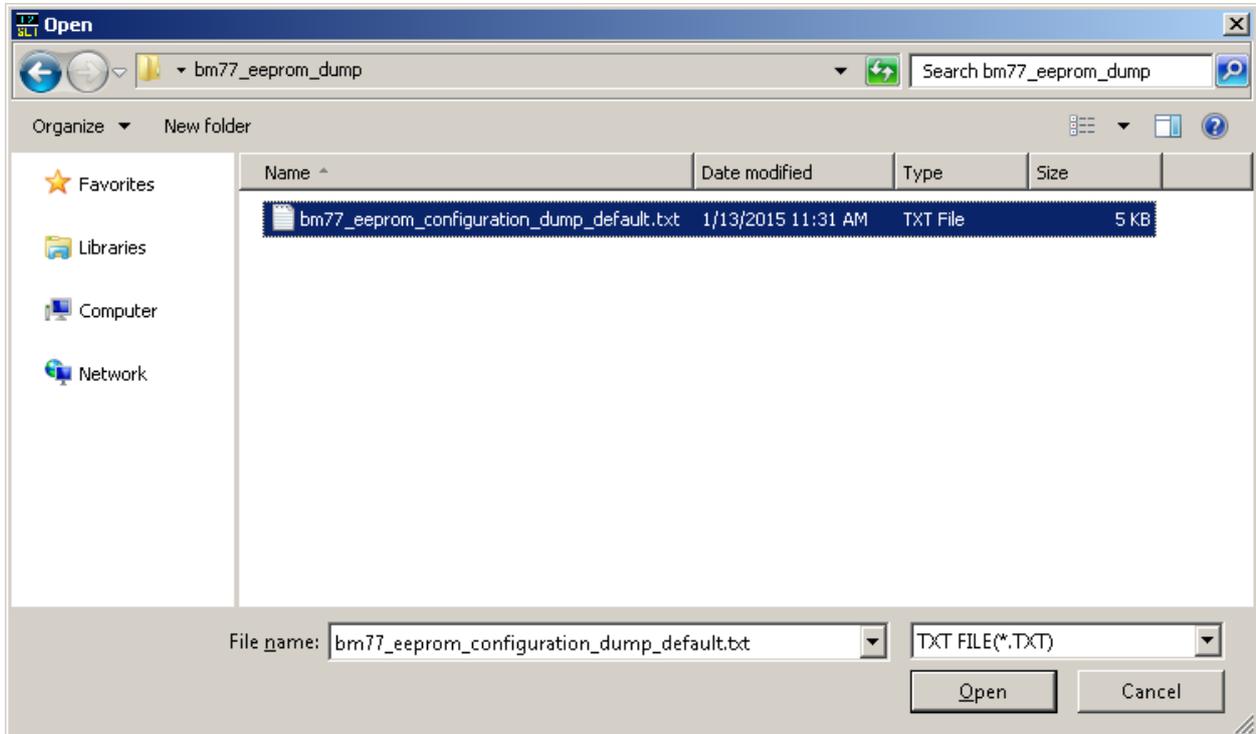
Step 4. Click **Edit** button after the default EEPROM configuration dump file has been imported in to the BM77 UI tool.

BM77 PICtail / PICtail Plus Board

Step 5. The BM77 UI tool will open the Bluetooth configuration window with various tabs to configure various available parameters. Configure the parameters as desired for your specific application by checking Help button for each parameter.

Step 6. After updating the Bluetooth parameters click **Finish** button.
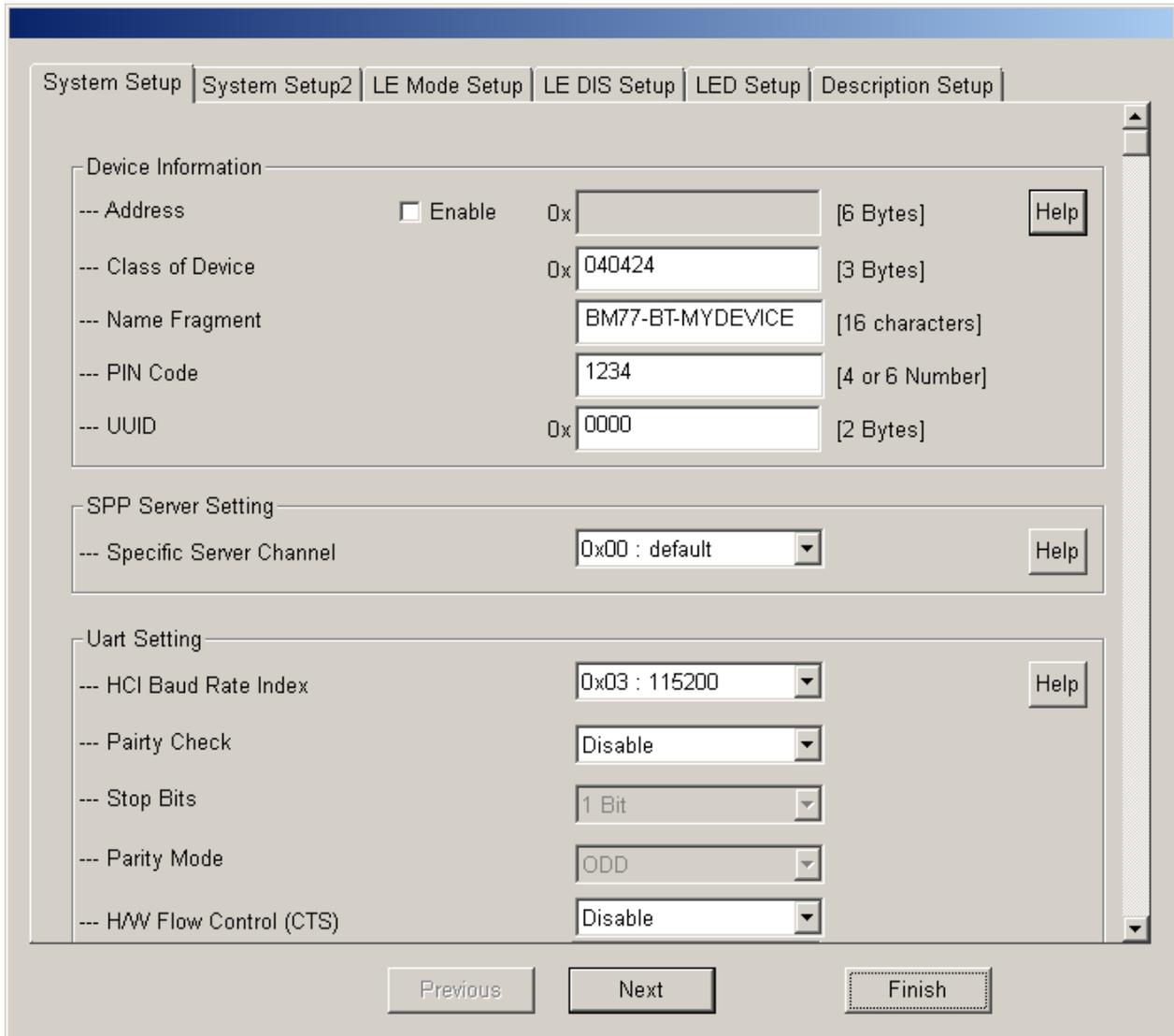
BM77 PICtail / PICtail Plus Board

Step 7. Click **Save** button to save the updated EEPROM configuration dump file. The new EEPROM configuration dump file will be different from the default EEPROM configuration dump file that was imported in **Step 3.** due to the updates made to the Bluetooth parameters using the BM77 UI tool by the user.
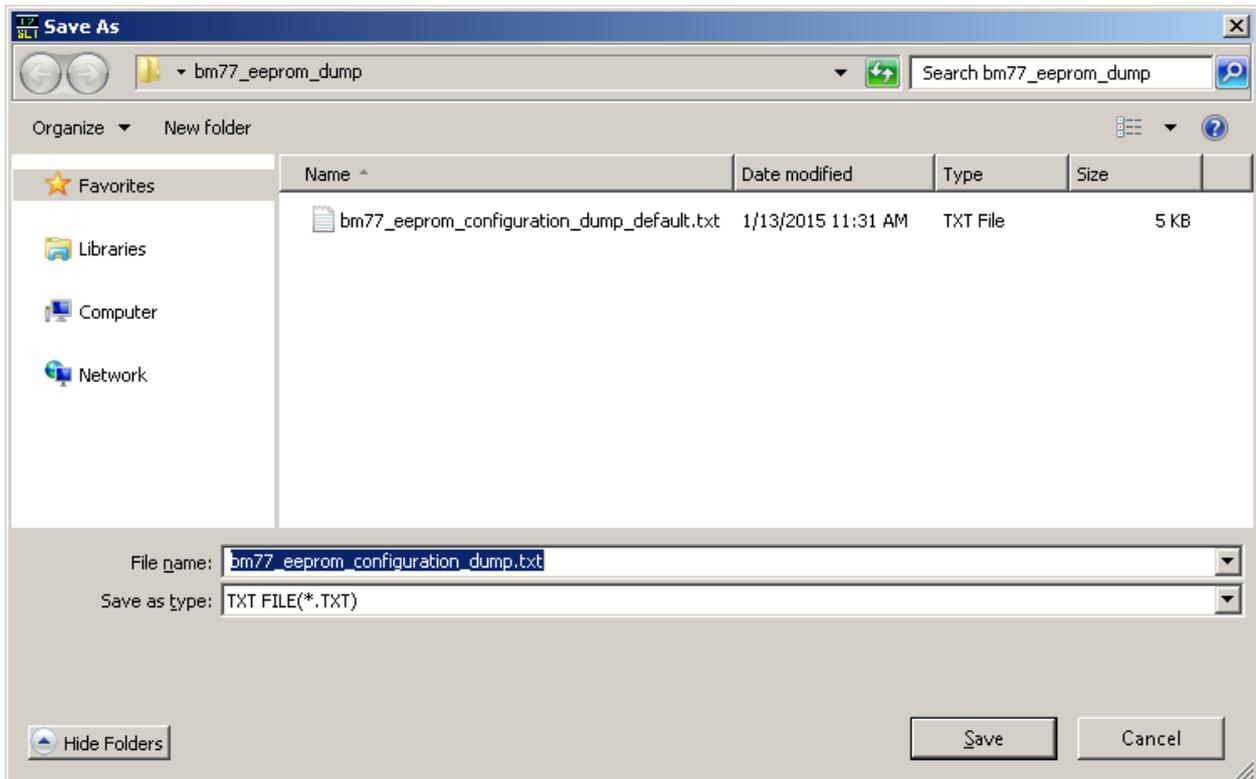
BM77 PICtail / PICtail Plus Board

3.2.2. BM77 EEPROM Table Utility

The BM77 EEPROM Table Utility is used to create a file with an EEPROM table structure from the EEPROM configuration dump file that is created by the **BM77 Configuration User Interface (UI) Tool** as seen in the previous **Section 3.2.1. BM77 Configuration User Interface (UI) Tool**. Using the EEPROM configuration dump file, the utility creates an EEPROM table structure file which can be imported into BM77 Configuration Library MPLAB workspace. Using this EEPROM table file, all of the EEPROM parameters on the BM77 can be updated. The BM77 EEPROM Table Utility is installed by the BM77 Configuration Library Installer. Below are the steps which show the usage of the BM77 EEPROM Table Utility.

Step 1. Execute the 'bm77_eeprom_table_utility.exe' utility in the 'bm77_eeprom_table_utility' directory.

Step 2. User is prompted to browse and open the EEPROM configuration dump file created using the BM77 Configuration UI tool in the previous **Section 3.2.1. BM77 Configuration User Interface (UI) Tool**. Click **OK** button on the message dialog box.

Message on the command window prompting the user to open the EEPROM dump file in the next step
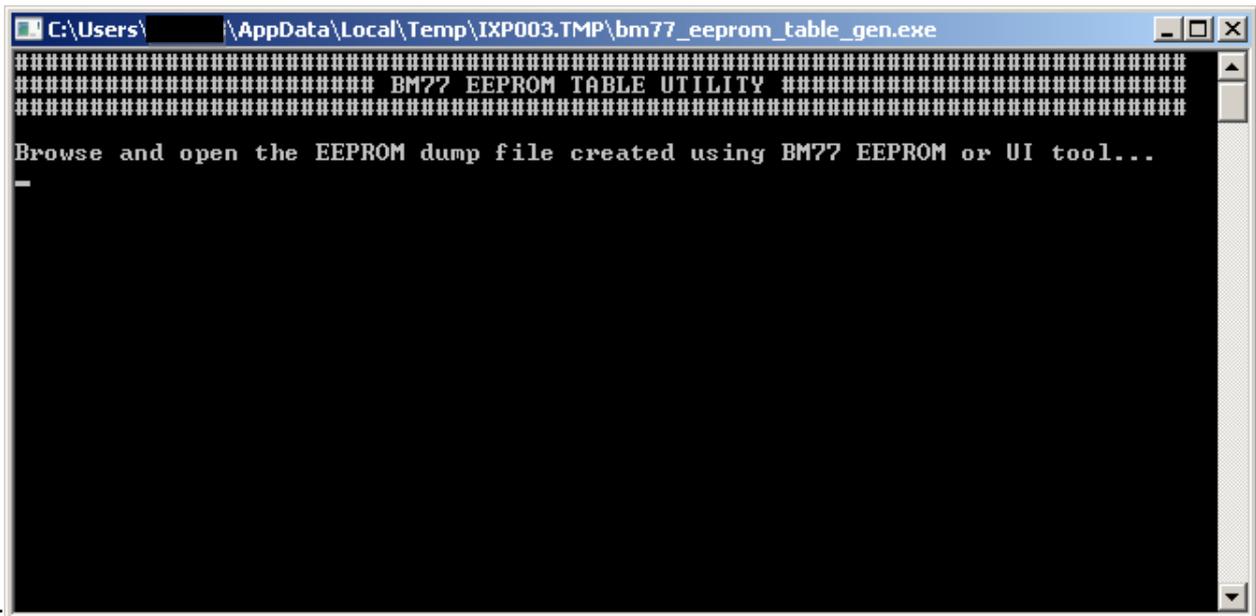
Message dialog box prompting the user to open the EEPROM dump file in the next step:
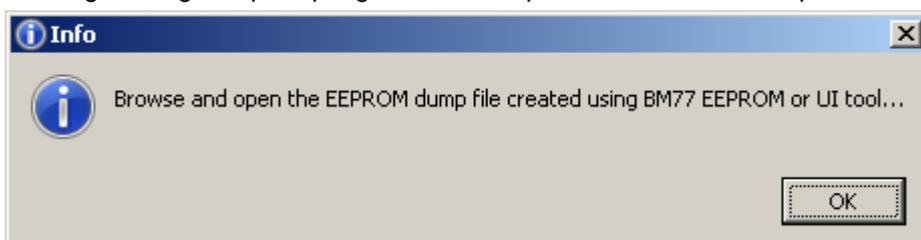
BM77 PICtail / PICtail Plus Board

Step 3. A file browse dialog box opens so that the user can browse and open the EEPROM configuration dump file created using the BM77 Configuration UI tool.

File browser dialog box for the user to browse and open the EEPROM dump file:
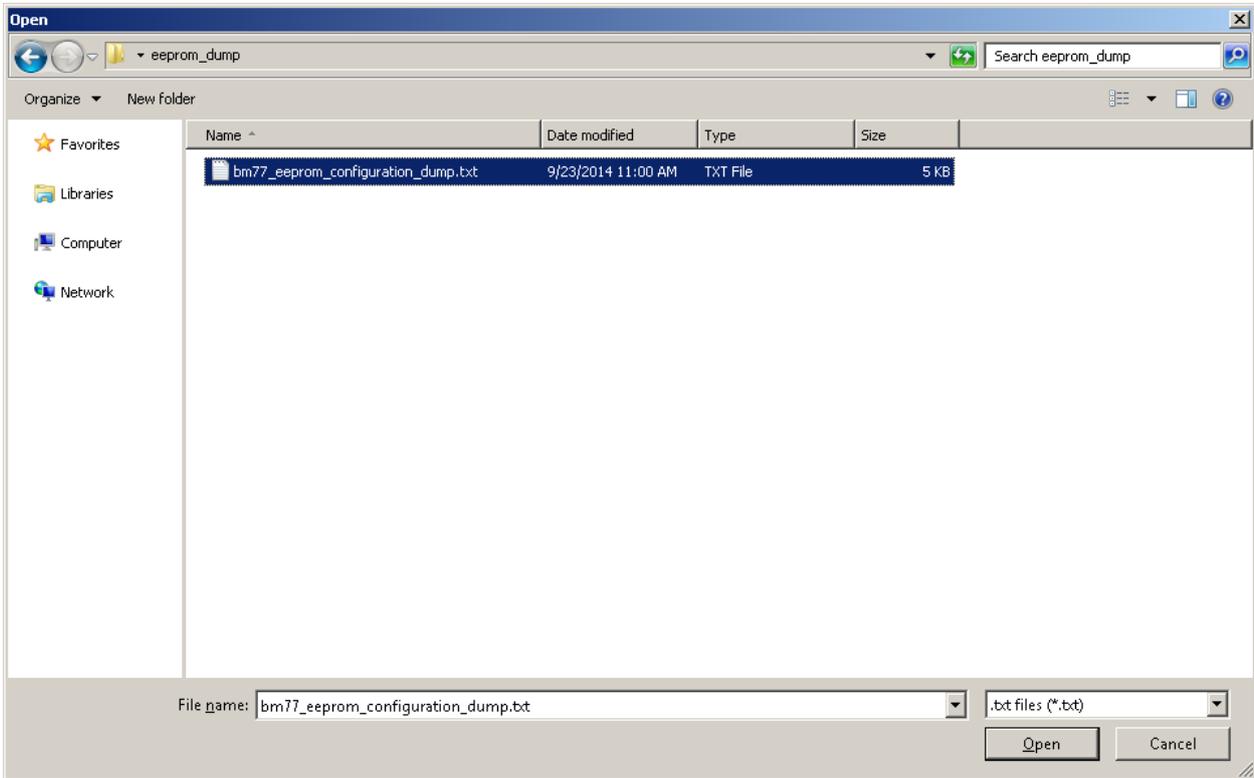
Browse and open the EEPROM configuration dump file by clicking **Open** button. The file path is indicated on the command window and the application goes to next step.

If the user chooses to click the **Cancel** button and not browse and open the EEPROM dump file then an user error is displayed on the command window. A message dialog box opens to indicate the error. Click **OK** button on the message dialog box to close the application and restart the application if desired.

Message on the command window warning the user of error while opening the EEPROM dump file:

BM77 PICtail / PICtail Plus Board
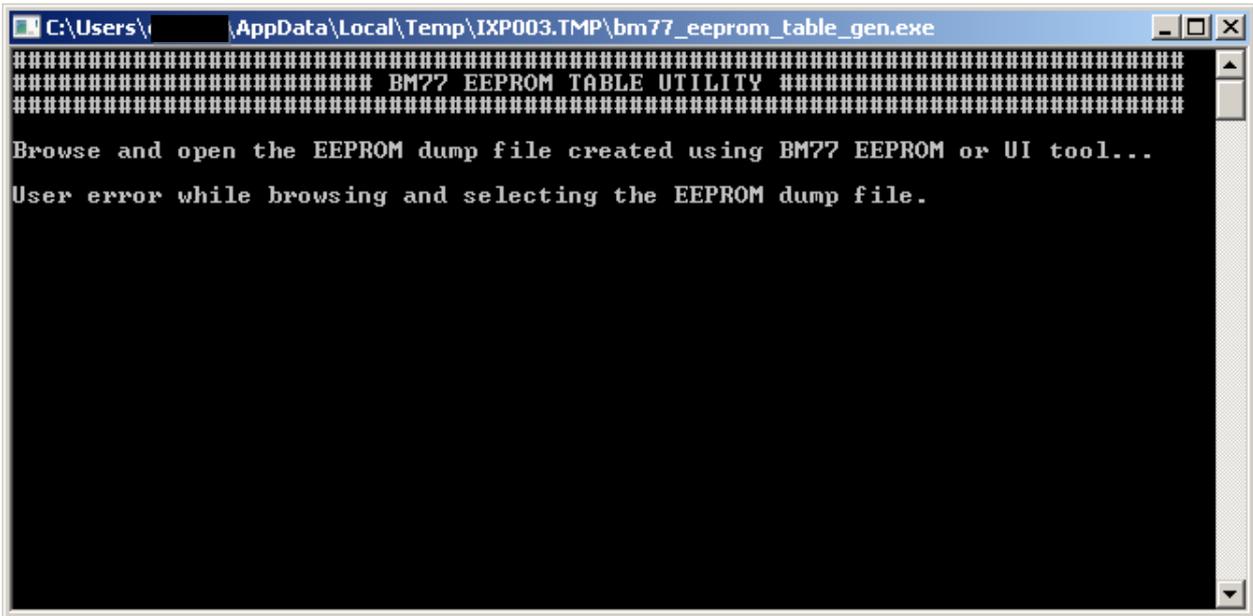

```
C:\Users\          \AppData\Local\Temp\IXP003.TMP\bm77_eeprom_table_gen.exe

##################################################################################
###################### BM77 EEPROM TABLE UTILITY ##########################
##################################################################################

Browse and open the EEPROM dump file created using BM77 EEPROM or UI tool...

User error while browsing and selecting the EEPROM dump file.
```

Message dialog box warning the user of the error while opening the EEPROM dump file:

Error

User error while browsing and selecting the EEPROM dump file.

OK

Step 4. User is prompted to browse, assign a name and save the EEPROM table file to be used by the BM77

BM77 PICtail / PICtail Plus Board

Configuration Library. Click **OK** button on the message dialog box.

Message on the command window prompting the user to save the EEPROM table in the next step:
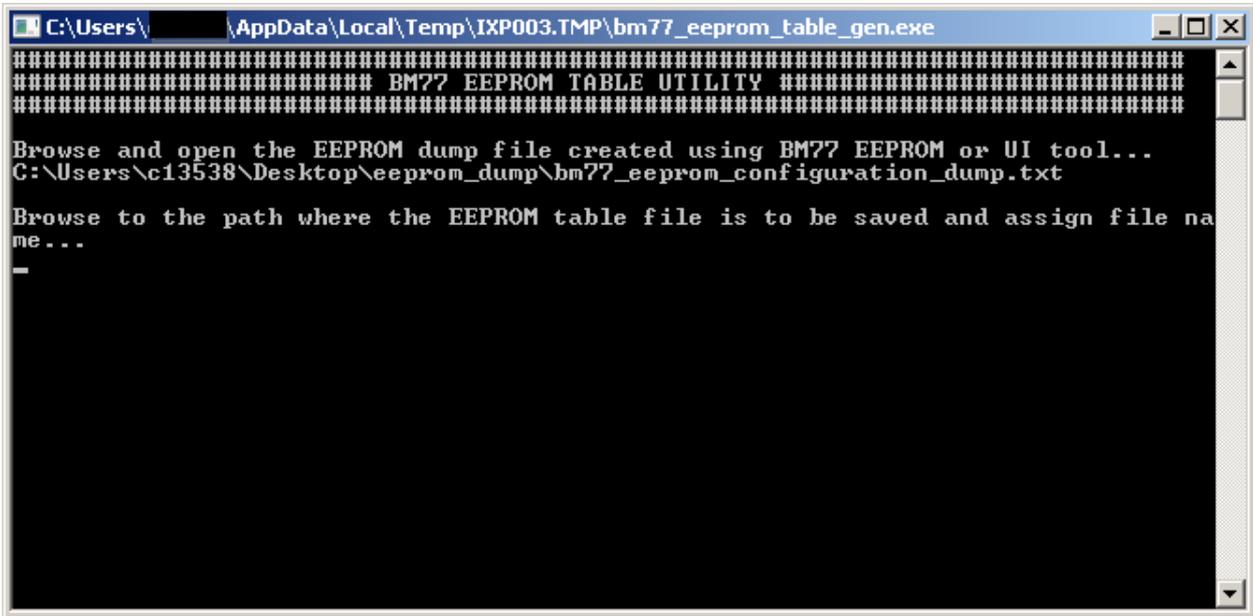
Message dialog box prompting the user to save the EEPROM table file in the next step:
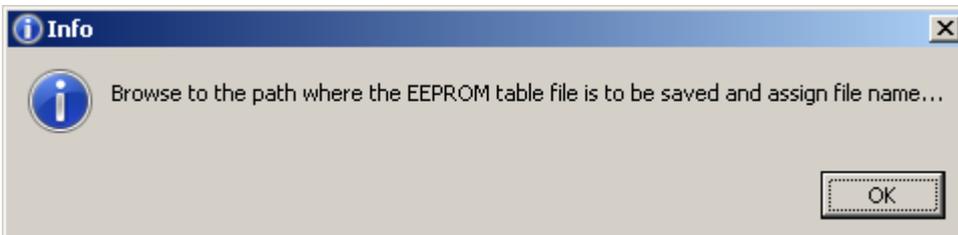
Step 5. A file browse dialog box opens so that the user can browse, assign a name and save the EEPROM table

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file to be used by the BM77 Configuration Library.

File browser dialog box for the user to browse and save the EEPROM table file:
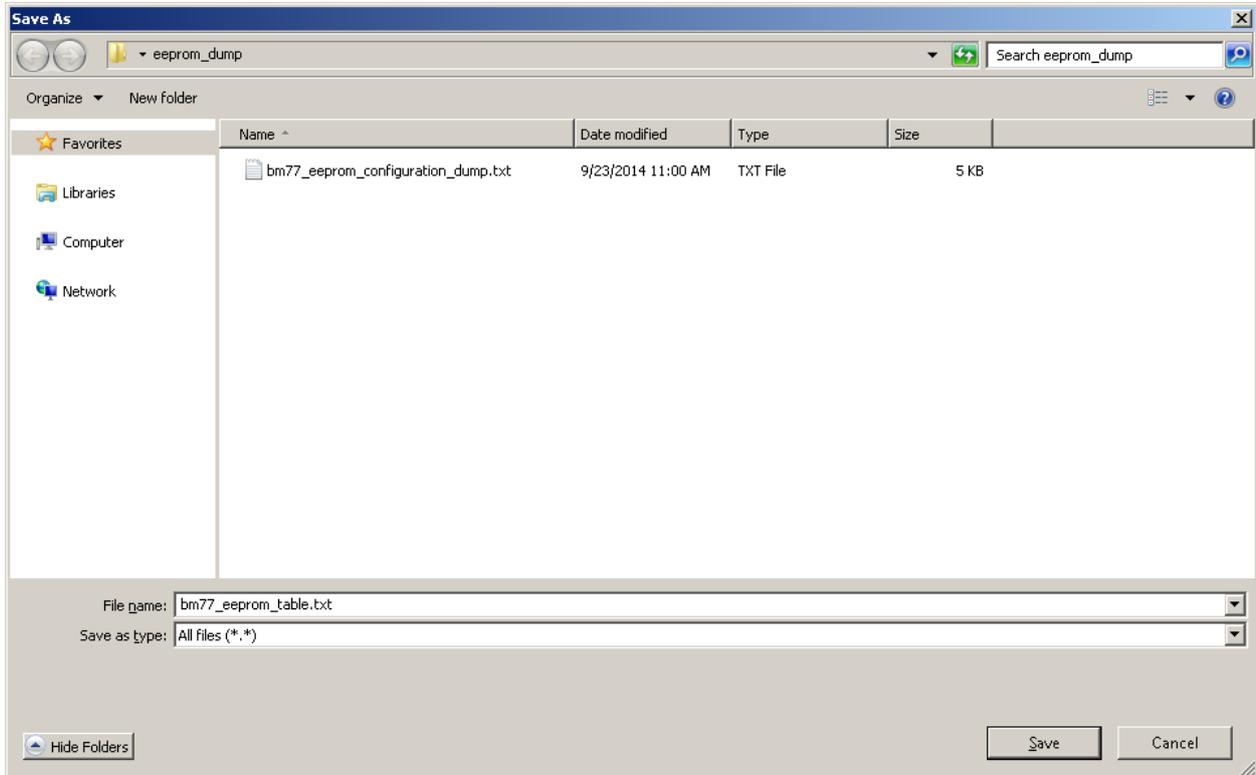
Type in a file name and click **Save** button to save the EEPROM table file. The file path is indicated on the command window and the application goes to next step.
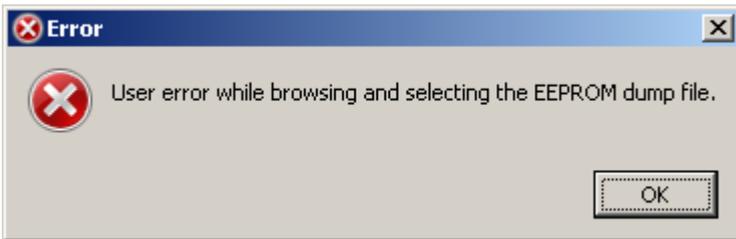
If the user chooses to click **Cancel** button and not browse and open the EEPROM dump file then the user error is displayed on the command window. A message dialog box opens to indicate the error. Click **OK** button on the message dialog box to close the application and restart the application if desired.

Message on the command window warning the user of error while saving the EEPROM table file:

BM77 PICtail / PICtail Plus Board
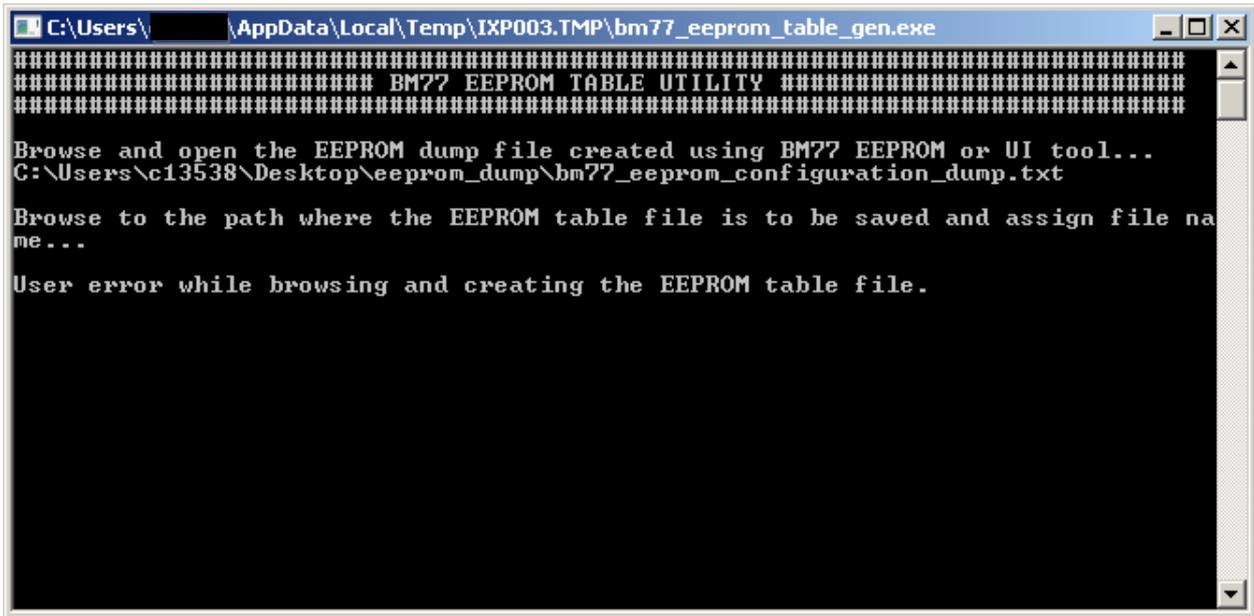
Message dialog box warning the user of the error while saving the EEPROM table file:
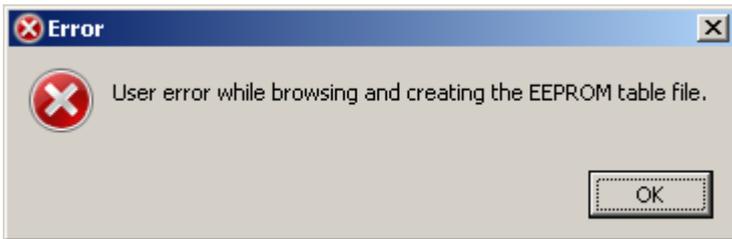
Step 6. The application creates the EEPROM table structure file. The progress is shown on the command window.

BM77 PICtail / PICtail Plus Board

The EEPROM table is created in the file chosen by the user in **Step 5**. After an EEPROM table file (bm77_eeprom_table.txt) is successfully created a success message is displayed on the command window and a message dialog box. Click **OK** button on the message dialog box to go to the next step.

Message on the command window showing the progress and completion of the EEPROM table creation.
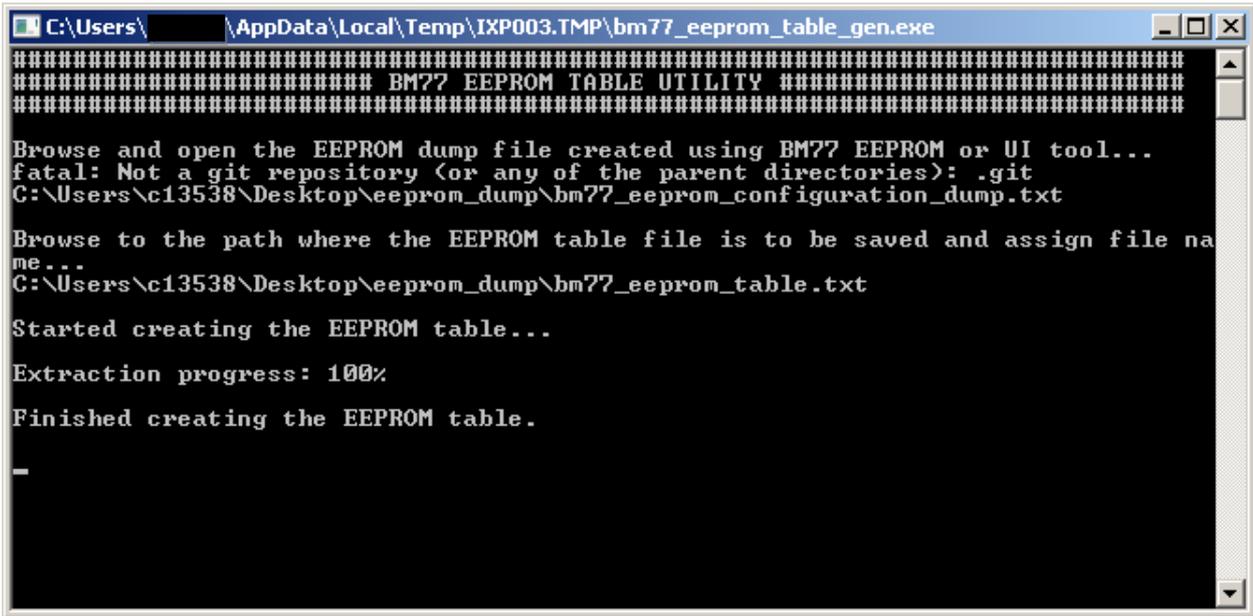
Message dialog box indicating the user that the EEPROM table file was successfully created:
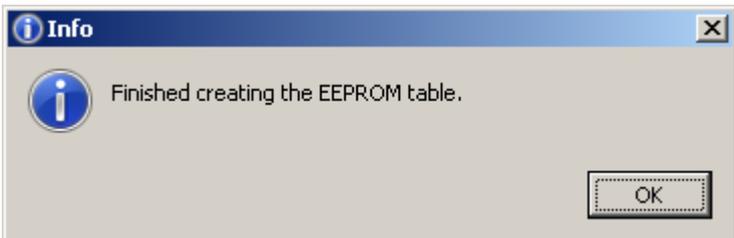
If the EEPROM configuration dump file selected by the user in **Step 3** is corrupted, an error is displayed in the

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command window and an error dialog box. Click **OK** button on the error dialog box and restart the application with a good EEPROM configuration dump file if desired.

Message on the command window showing the error due to corrupted EEPROM dump file:
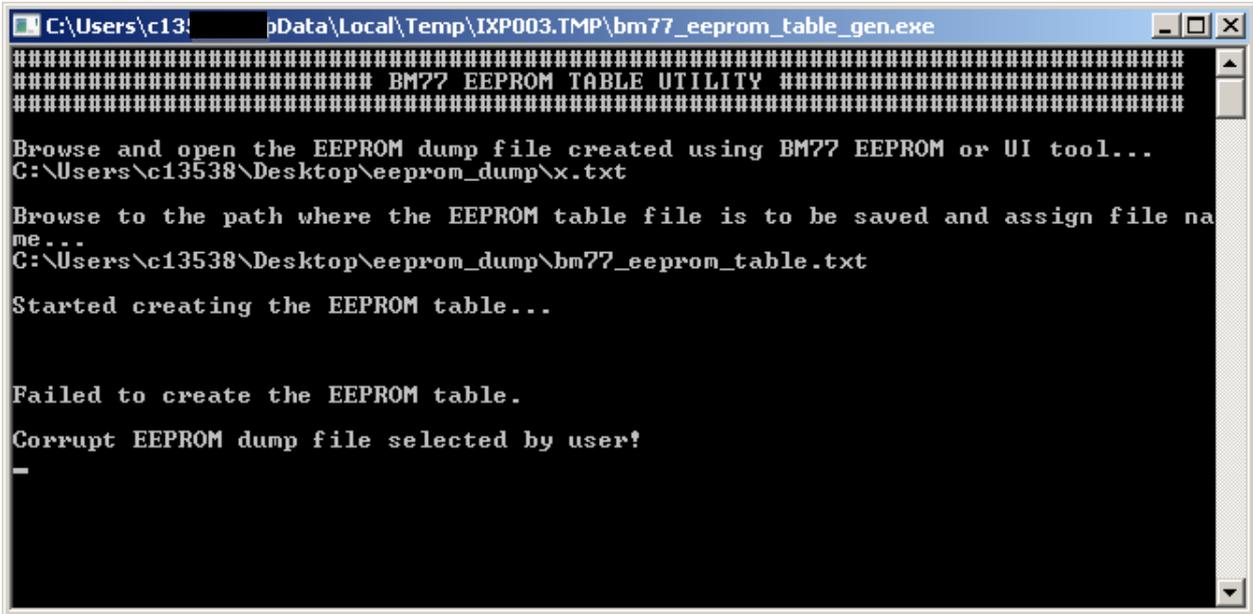
Message dialog box warning the user of the error due to corrupt EEPROM configuration dump file.
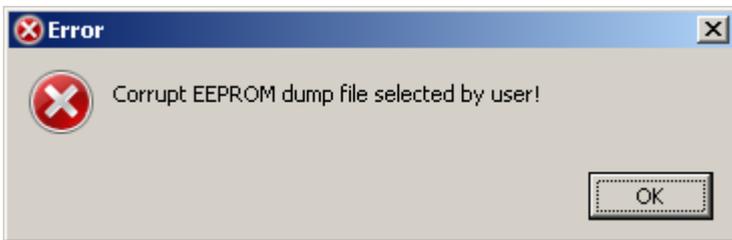
Step 7. Copy the EEPROM table file created by the utility in to BM77 Configuration Library workspace folder and import the EEPROM table file into the workspace so that BM77 can be configured with the EEPROM table. An example of importing and using the EEPROM table is shown in the 'bm77_configure_demo.X' workspace.

BM77 PICtail / PICtail Plus Board

3.2.3. BM77 Configuration Library

The BM77 Configuration Library provides a set of functions which create command protocol packets to:

- Update the System, Bluetooth Classic and Low Energy configuration parameters of BM77
- Set/get the EEPROM configuration parameters
- Bulk write of EEPROM configuration
- Perform pairing procedure with BM77
- Configure a subset of parameters in application mode on BM77
- Put the BM77 in different operating modes

The BM77 Configuration Library Installer is available on the BM77-PICTAIL webpage (www.microchip.com/bm-77-pictail). It installs the BM77 Configuration Library along with BM77 Configure Demo MPLAB workspace and BM77 EEPROM Table Utility. To install the BM77 Configuration Library, download the BM77 Configuration Library Installer from the BM77-PICTAIL webpage on to a Windows PC and open the installer application and follow the installer instructions as the installer guides through the installation. The 'readme.txt' provides an overview of the components installed and available documentation.

The BM77 uses the UART interface for configuration and data transfer. The data transferred after the BM77 has paired and connected and the SPP profile is active will be raw by nature. However the BM77 Configuration and Events are defined as command and response protocol packets. Command packet is sent to BM77 over UART to update a parameter. Response packet is received from BM77 over UART for the command issued. BM77 also sends out Event packets over UART when a defined event occurs. For more information on the available functions in the BM77 configuration library refer to the 'BM77ConfigLibraryHelp.chm' file.

The BM77 configure demo showcases a proof-of-concept example of interfacing the BM77 PICtail Plus with a PIC microcontroller (MCU). In this demonstration the BM77 module on the BM77 PICtail can be configured through the PIC MCU. After configuring the BM77, a Bluetooth device can pair and connect with the BM77 module. Once connected, data can be transferred to and from BM77 module.

The demo starts by setting a few Bluetooth parameters by using the EEPROM Mode to access and update the parameters on the EEPROM. Then the demo initiates the Application Mode after which the BM77 module enters the Configure Mode. While in Configure Mode the demo access and updates some of the Bluetooth parameters again to show an example of the Application Mode functions usage. After the BM77 exits the Configure Mode, it waits for the Pairing Procedure. When the Pairing Procedure is initiated by the connecting Bluetooth device, the BM77 will then perform pairing by prompting the user for passkey or confirmation if needed which is handled by the demo. Once the pairing is complete and the Bluetooth device is connected to BM77 and the Serial Port Profile (SPP) is active with an

emulated serial cable connection enabled. Demo will allow the data transfer over UART between the BM77 and the connected Bluetooth device.

The debug UART can be used to perform the pairing procedure and also for data transfer to and from the BM77 once the BM77 is connected.

EEPROM_BULK_WRITE pre-processor directive enables bulk write of the EEPROM instead of the default function calls to configure each EEPROM parameter. If using EEPROM_BULK_WRITE then the EEPROM table file to be included in BM77_EEPROM_TABLE eeprom_table[] can be created using BM77 EEPROM Table Utility ('bm77_eeprom_table_utility.exe') in 'bm77_eeprom_table_utility' folder as seen in **Section 3.2.2 BM77 EEPROM Table Utility**.

The BM77 configure demo performs the following:

- Configuration: Sets and Gets a few BM77 EEPROM configuration parameters or does bulk write of EEPROM bases on option selected and invokes functions in the Configure Mode.
- Pairing Procedure: Performs pairing based on the pairing mode selected. If "Just Works" mode is selected the pairing does not need any user intervention. But if "Passkey Entry" mode or "Passkey Yes/No Confirm" mode is required user intervention is required. In this demo the debug UART port is used to enter passkey or yes/no confirmation. If "Passkey Entry" mode is selected the program prompts user to enter the entry key on the debug UART port. Enter the six-digit passkey and hit Enter. If "Passkey Yes/No Confirm" mode is selected the program prompts user to enter the yes/no confirmation on the debug UART port. Enter the 'y' or 'n' and hit Enter.
- Data Connection: Once pairing procedure completes successfully and the Bluetooth device connects to BM77, the debug UART can be used to transfer data to and from the BM77.

The BM77 PICtail uses Universal Asynchronous Receiver/Transmitter (UART) interface and the General Purpose Input Output (GPIO) Ports to configure, control and transfer data to the PIC MCU. For more information on the UART configuration, refer the BM77 Module Datasheet.

As an example, the supported hardware combinations in the BM77 Configure Demo MPLAB workspace are as shown below.

MPLAB PIC32 Configuration:

Explorer 16 Development Board (DM240001)   +

PIC32MX795F512L Plug In Module (MA320003)   +

BM77 PICtail Plus (BM-77-PICTAIL)

BM77 PICtail / PICtail Plus Board

MPLAB PIC24 Configuration:

Explorer 16 Development Board (DM240001)   +

PIC24FJ128GA010 Plug In Module (MA240011)   +

BM77 PICtail Plus (BM-77-PICTAIL)

MPLAB PIC18 Configuration:

PIC18 Explorer Board (DM183032)   +

PIC18F87J11 Plug In Module (MA180020)   +

BM77 PICtail Plus (BM-77-PICTAIL)

The steps required to program/debug the BM77 Configure Demo MPLAB workspace are shown below. Steps in **Section 3.1.1.** and **Section 3.1.2.** specifically related to using the BTChat APP on Android and ISSC BLETR APP can be used to pair, connect and transfer data to the BM77 PICtail board with the exception being that the BM77 PICtail board will be interfaced to a PIC MCU over the PICtail interface and transfers data through the PICtail interface and not the USB-UART MCP2200 interface.

Step 1. Plug-in the PIC Plug-In-Module (PIM) into the relevant Explorer Development Board based on the hardware combination selected for evaluation.

Note: If using PIC32MX795F512L PIM, ensure that on jumpers J1 and J2 on the PIM, pins 2 and 3 are connected using a jumper to select the CAN configuration and all jumpers on J9 and J10 on the PIM are not connected.

Step 2. Plug-in the BM77 PICtail Plus board in to the Explorer Development Board with the BM77 module facing towards the PIC PIM as shown in Fig 1. or Fig 2 based on hardware combination used.

Step 3. Optionally a debug UART port can be connected to a PC terminal emulator program.

Note: On the Explorer 16 Development Board, debug UART is available on the DB9 UART serial connector P1. On the PIC18 Explorer Board, the debug UART will need to be manually tapped from pins RG1/TX2 and RG2/RX2 on J5 header using external wiring.


Step 4. Provide power through the 9V power input port available on the Explorer Development Board.

Step 5. Program the PIC32 with the 'bm77_configure_demo_xc32.hex' or PIC24 with the 'bm77_configure_demo_xc16.hex' or PIC18 with the 'bm77_configure_demo_xc8.hex' in the 'precompiled_hex' sub-directory.

Step 6. Alternately open the 'bm77_configure_demo.X' MPLABX workspace provided using the MPLABX IDE and compile and program or enter debug mode either selecting the PIC32 workspace configuration or the PIC24

BM77 PICtail / PICtail Plus Board

workspace configuration or the PIC18 workspace configuration based on the hardware combination selected as shown in the figure below:
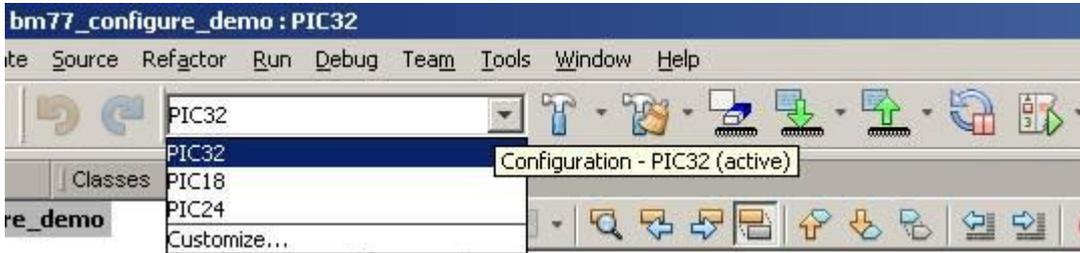
The steps required to run the BM77 Configure Demo MPLAB workspace are shown below.

Step 1. After setting up the hardware combination and programming the PIC using the above steps run the PIC program.

Step 2. Observe the BM77 configuration by putting break points in the workspace or by optionally using the debug UART mentioned above.

Step 3. Download and install the "BtChat_V1.0.3.apk" on the Android device from the BM77 PICtail Plus webpage.

Step 4. Open the "BtChat" app installed by the "BtChat_V1.0.3.apk" on the Android device.

Step 5. Scan for the Bluetooth devices on the Android app.

Step 6. Select your BM77 device listed in the scan list and click to pair and connect.

Step 7. By default the application uses "Just Works" pairing. If using the "Passkey Entry" or "Passkey Yes/No Confirm" mode then provide the passkey or confirmation using the debug UART port.
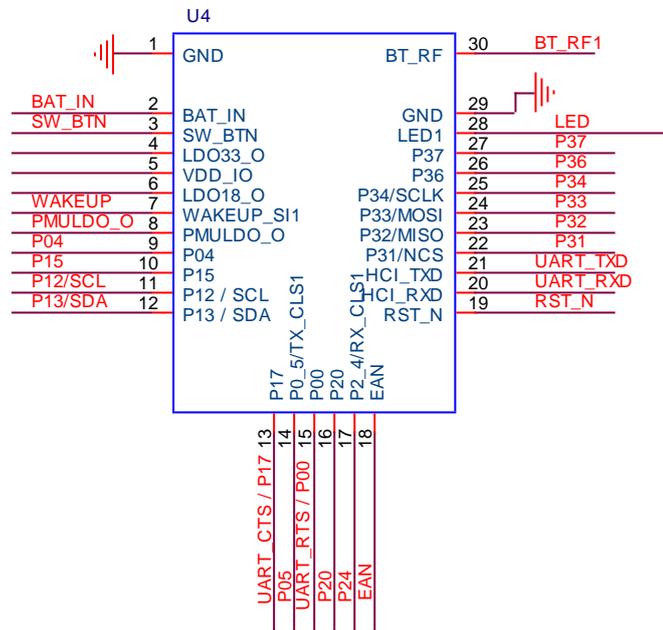
Step 8. Once connected, the data can be transmitted from BM77 through the debug UART port to the "BtChat" app over Bluetooth link. Enable **Show Rx Text** option in the "BtChat" app **Settings**. The "BtChat" app can send data back to the BM77 which is later received through the debug UART.

Alternately, any suitable Bluetooth SPP Data Terminal app can be used to transfer data back and forth using this demonstration.

Note: The Bluetooth Low Energy mode is supported for both Apple and Android devices. For Apple Made for iPod support for SPP mode please send a message to: **AppleSupport@microchip.com**

BM77 PICtail / PICtail Plus Board

## 4. Appendix A: BM77SPP03 Module PIN Assignment

BM77 Module PIN Define

| P/N	I/O	Name	Description
1	P	GND	Ground
2	P	BAT_IN	4.2~3.3V Power input
3	I	SW_BTN	Input for software button. H: Power On L: Power Off
4	P	LDO33_O	3V3 LDO output
5	P	VDD_IO	Main power supply
6	P	LDO18_O	LDO18 output
7	I	WAKEUP	Wakeup BM77 from Shutdown State. (Low Active) It is only valid while BM77 into Shutdown State.
8	P	PMULDO_O	Output of PMULDO
9	O	P04	UART_TX_IND: H: BM77 indicate UART data will be transmitted out after a certain timing. (Setting by EEPROM, default 5ms) L: Otherwise. STATUS_IND_2: BM77 State indication , refer to P15

BM77 PICtail / PICtail Plus Board

| P/N	I/O	Name	Description
10	O	P15	STATUS_IND: Bluetooth link status indication P15/P04: HH → Power default value and Shutdown State. P15/P04: HL → Access State. P15/P04: LL → Link State w/o UART_TXD. P15/P04: LH → Link State with UART_TXD.
11	N/A	P12/ SCL	I2C_SCL, Reserved
12	N/A	P13/ SDA	I2C_SDA, Reserved
13	I	**P17**	- UART_CTS: - Configurable Functional GPIO
14	I/O	**P05**	Configurable Functional GPIO
15	O	**P00**	- UART_RTS - Configurable Functional GPIO
16	I	P20	System configuration, refer to P2_4. (No drive under APP Mode)
17	I	P24	Boot mode selection. (No drive under APP Mode) P2_0/ P2_4: HH → Application LL → Boot mode LH → HCI UART mode for testing and system configuration.
18	I	EAN	ROM/Flash selection. (No drive under APP Mode) H: ROM code; L: Flash code
19	I	RST_N	External reset input (Low Active), Clock period 62.5n at least
20	I	HCI_RXD	UART_RXD
21	O	HCI_TXD	UART_TXD
22	I/O	**P31**	Configurable Functional GPIO
23	I	**P32**	Configurable Functional GPIO
24	I	**P33**	Configurable Functional GPIO
25	I	**P34**	Configurable Functional GPIO
26	O	P36	Reserved
27	I/O	**P37**	Configurable Functional GPIO
28	O	LED1	LED1 driver
29	P	GND	Ground
30	RI/O	BT_RF	RF Port

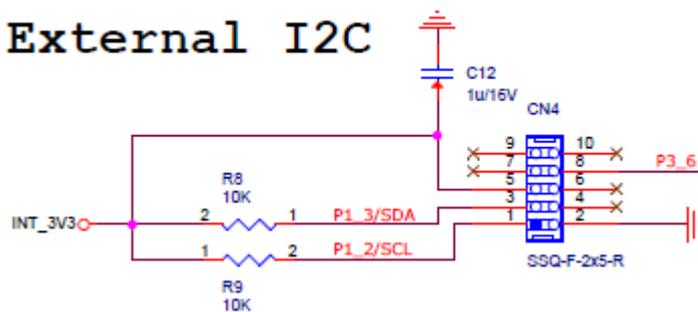# BM77 PICtail / PICtail Plus Board

5. Appendix B: BM77 PICtail / PICtail Plus Board Schematics
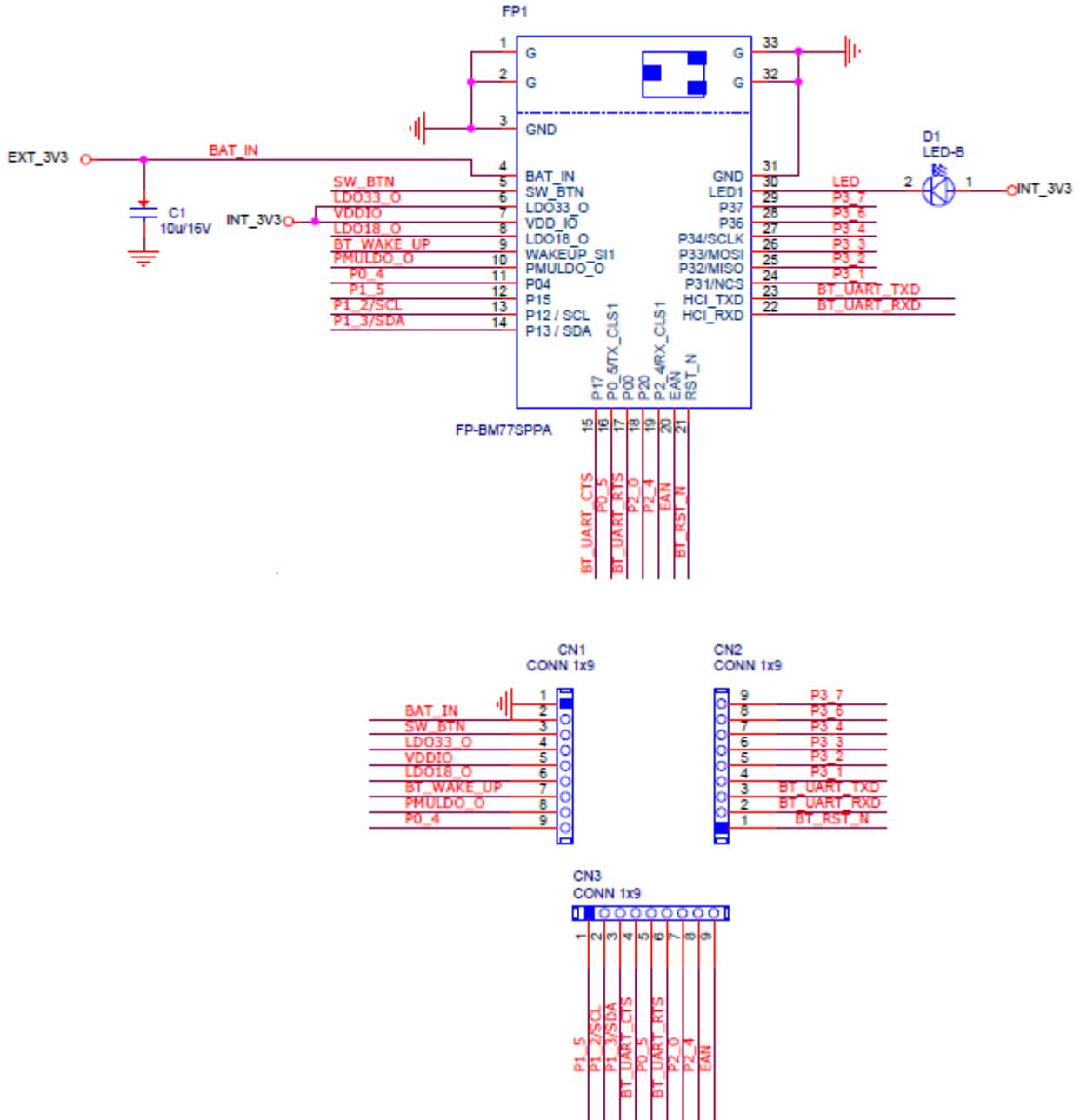
BM77 PICtail / PICtail Plus Board

SW4
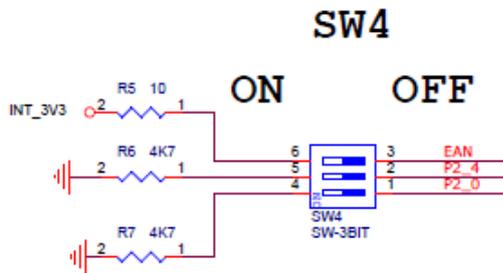
SW4	APP MODE	TEST MODE	WRITE FLASH
EAN	OFF	OFF	ON
P24	OFF	OFF	ON
P20	OFF	ON	ON

SW_BTN

Push-on : pin 2-3
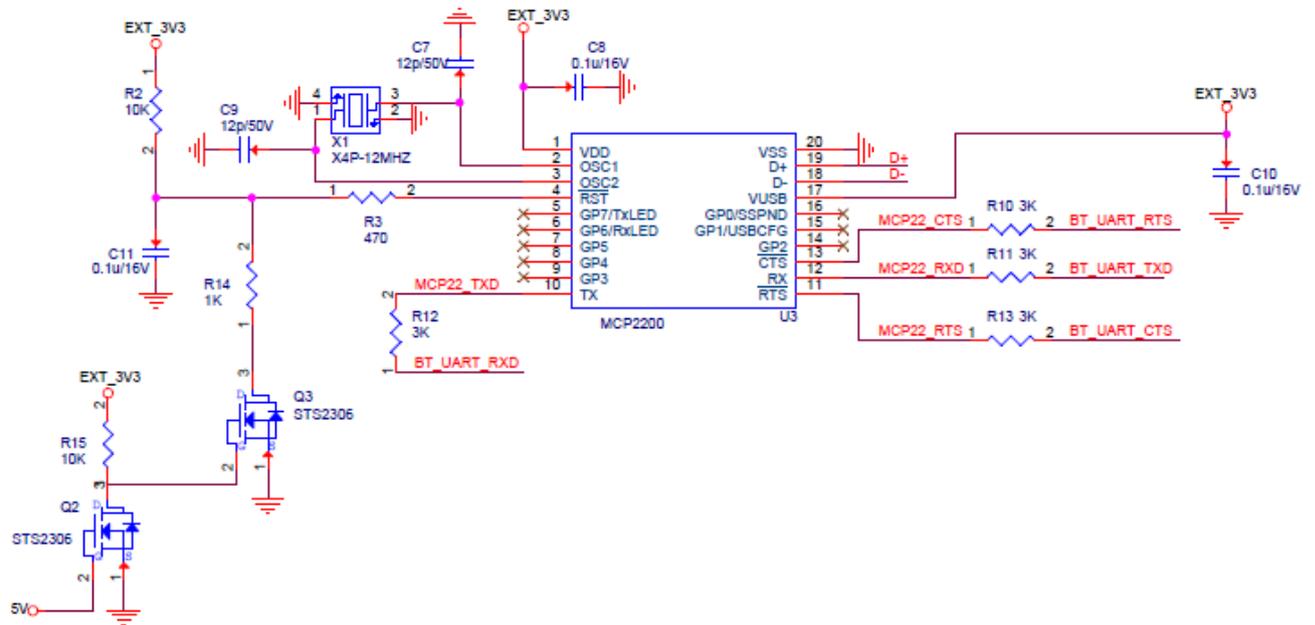Push-off : pin 1-2

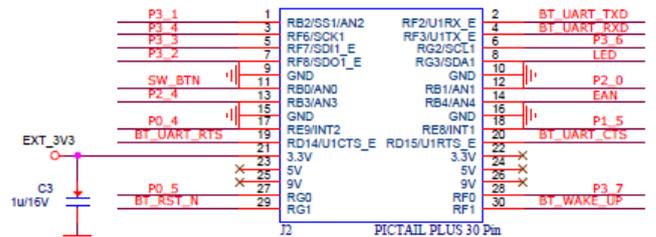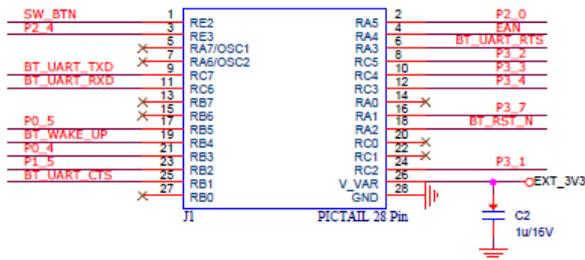### WAKE-UP

RESET
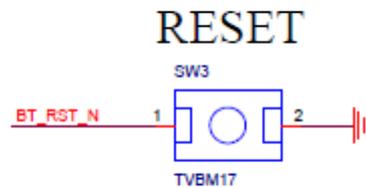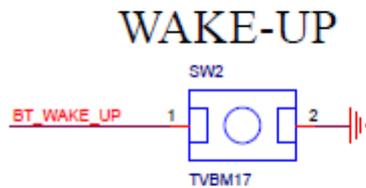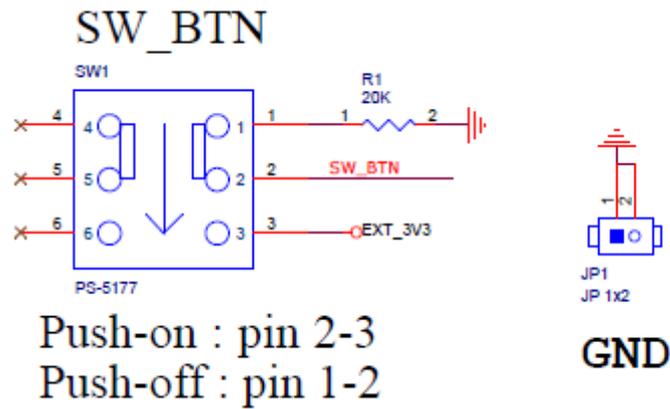
External I2C

BM77 PICtail / PICtail Plus Board
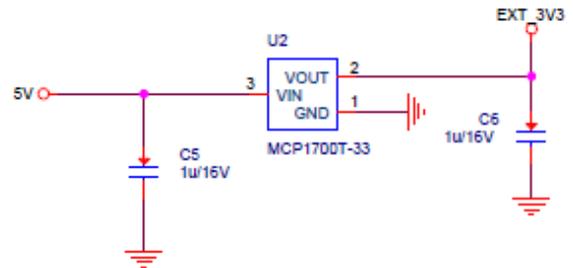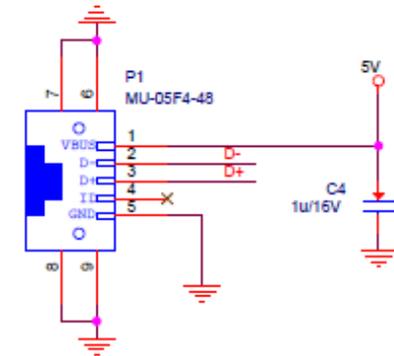
max-current:250 mA

BM77 PICtail / PICtail Plus Board

6. Appendix C: Q & A

1. Is the BM77 Module Data Sheet available?

   Yes. The BM77 data sheet is available for download on www.microchip.com/bm77.

2. When I connect the BM77 PICtail board to the host PC the COM port does not appear?

   Try resetting the MCP2200 by pressing SW3. Check if the MCP2200 drivers are installed. If not download and install the MCP2200 drivers.

3. What is maximum supported baud rate of BM77 UART?

   The maximum baud rate is 921600 with used with of 16MHz crystal.

4. How do you change Bluetooth parameters such as name, Device Info, COD, rate, inquiry and page scan windows?

   The configuration settings are accessed using the "UI Tool" software utility. The configuration settings can be updated on the BM77 using the BM77 Configuration Library.

5. What is default security mode for SPP?

   Simple Secure Pairing (SSP) / 'Just Works' mode

6. Is there an Android BTLE demonstration application?

   At this time Android support for dual-mode Bluetooth devices, such as the BM77, is limited to Bluetooth classic SPP data service.

7. Is the source code for iOS and Android APP available

   Contact your Microchip representative to request the source code packages for the smartphone Apps.

BM77 PICtail / PICtail Plus Board

Notes: