RN-52-EK Evaluation Kit User's Guide

RN-52-EK-UG Version 1.0 1/27/13

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1.0 OVERVIEW

This document describes the hardware and software setup for the Roving Networks RN-52-EK evaluation kit. This kit contains the hardware you need to evaluate the RN52 Bluetooth audio module. The RN52 module is mounted to an evaluation board that demonstrates the module's key features. The board contains:

- Dual-channel audio output and input
- Easy access to GPIO pins
- Built-in amplifier for stereo audio output
- 6 pushbuttons to control audio playback
- Status LEDs
- Connections for the programmer and UART interfaces

The RN52 supports the following Bluetooth profiles:

- A2DP stereo audio (sink mode with an SBC CODEC)
- AVRCP media player remote control
- HFP/HSP for accepting a phone call from a mobile phone
- SPP (allows the module to receive serial data over the UART)
- iAP profile discovery for iOS devices

You use the evaluation kit to configure and program the Bluetooth module using the command interface, create connections, and transfer data. The command interface is made up of simple ASCII commands. See "Resources & Related Documents" on page 12 for information on available documentation.

2.0 EVALUATION KIT DESCRIPTION

The evaluation kit includes the hardware required to connect the evaluation board to your computer. See Table 2-1. To evaluate the module on the evaluation board, you need a computer with a USB port running the Microsoft Windows or Mac OS-X operating system.

> **Note:** Before beginning your evaluation, you may need to install the driver for the USB cable. You can download the driver (as well as other tools and utilities) from the Roving Networks website at http://www.rovingnetworks.com/support.php.

TABLE 2-1: EVALUATION KIT CONTENTS

Hardware	Description
Evaluation board	Contains the Bluetooth module and connectors.
Mini-USB cable	Links your computer to the evaluation board.
Stereo mini-speakers	USB powered speakers.
RN52 samples	Kit includes two sample RN52 modules.

Figure 1-1 provides the RN-52-EK evaluation board and pin information.

FIGURE 1-1:   RN-52-EK EVALUATION BOARD
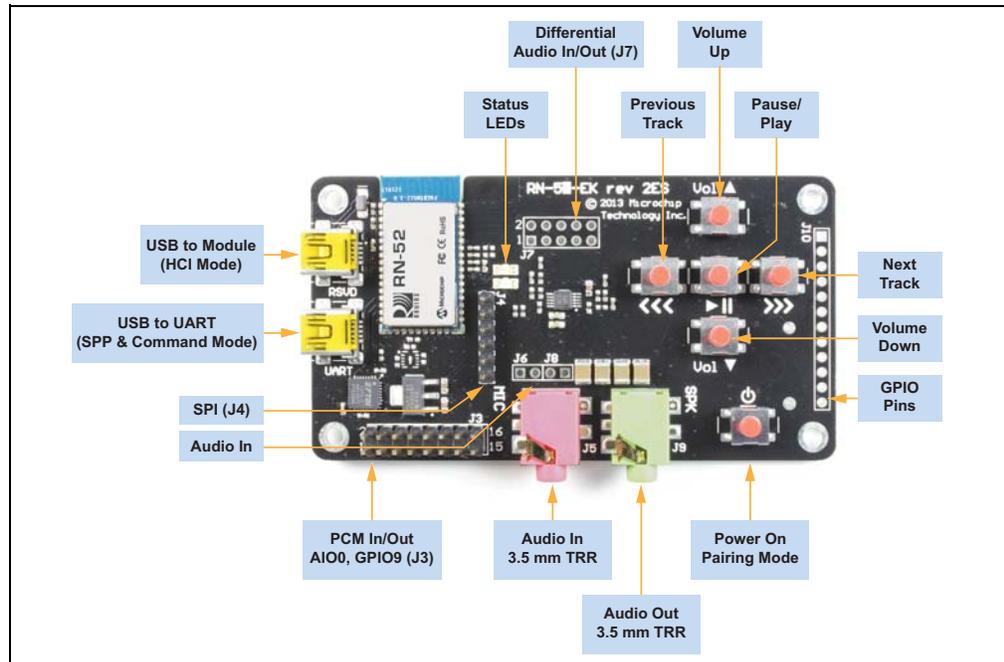
PCM In/Out, AIO0, GPIO9 (J3)
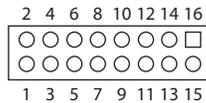
Differential Audio In/Out (J7)
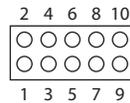
SPI (J4)
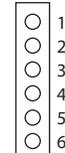
Pin	Description
1	UART_TX
2	VBUS
3	UART_RX
4	AIO0
5	GPIO9
6	GND
7	GND
8	PCM_IN
9	GND
10	PCM_OUT
11	GND
12	PCM_SYNC
13	GND
14	PCM_CLK
15	GND
16	3.3 V

Pin	Description
1	SPKR_R-
2	MIC_L+
3	SPKR_L-
4	MIC_R+
5	SPKR_R+
6	MIC_L-
7	SPKR_L+
8	MIC_R-
9	GND
10	MIC_BIAS

Pin	Description
1	SPI_MISO
2	SPI_MOSI
3	SPI_SCK
4	SPI_SS
5	3.3 V
6	GND

MIC Left (J8)

Pin	Description
1	MIC_L
2	GND

MIC Right (J6)

Pin	Description
1	MIC_R
2	GND

3.0   HARDWARE SETUP

To set up the evaluation hardware, perform the following steps:

1. Connect the min-USB cable to your computer's USB port and to the evaluation board's UART connector. This connection provides power to the board and provides a data connection to the command console.

> **Note:**   Windows should automatically install the drivers for the cable. If it does not, download and install the FTDI drivers from the Support page on the Roving Networks website at http://www.rovingnetworks.com/support.php.

2. Note the COM port to which you have attached the cable.
3. Connect the portable mini-speaker 3.5 mm TRR plug to the stereo audio out connector (J9). The mini speakers are powered via USB.

CAUTION

Roving Networks recommends that you connect the RN-52-EK evaluation board and min-speakers to different USB sources to avoid a ground loop that causes noise in the audio output.

Figure 1-2 shows the completed hardware setup for the evaluation board.

FIGURE 1-2:   COMPLETED HARDWARE SETUP
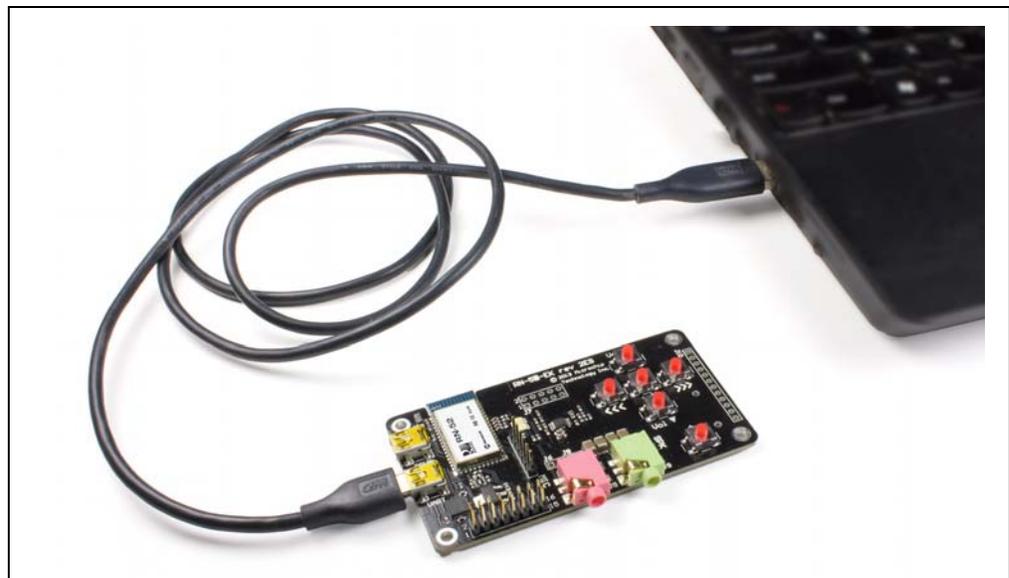
4.0   POWER UP THE BOARD

To power up the board, connect the board and mini-speakers to a power source via USB. Then press and hold the board's power on button until the speakers issue a two tone alert.

The board's status LEDs give you a visual confirmation that the board is powered up and operating. See Table 4-1.

TABLE 4-1:   STATUS LEDS

LED	Status	Description
Blue and red	Flashing	The RN52 module is discoverable.
Blue only	Flashing	The module is connectable.
Red only	Flashing	The module is connected.

5.0   USING THE EVALUATION KIT

This section assumes that you have a working knowledge of Bluetooth operation and communications. To program the Roving Networks devices you need a Bluetooth-enabled PC (either built-in or using a USB Bluetooth dongle). You can only program one device at a time. Once programmed and configured, device settings are saved (independent of power down) until they are explicitly changed or the factory defaults are restored.

5.1   Command Mode vs. Data Mode

The Bluetooth device operates in two modes: data mode (default) and command mode. While in data mode, the module is essentially a data pipe. When the module receives data, it strips the Bluetooth headers and trailers and passes the user data to the UART. When data is written to the UART, the module constructs the Bluetooth packet and sends it out over the Bluetooth connection. Thus, the entire process of sending/receiving data to the host is transparent to the end microprocessor. See Figure 1-3.

FIGURE 1-3:   DATA & COMMAND MODES
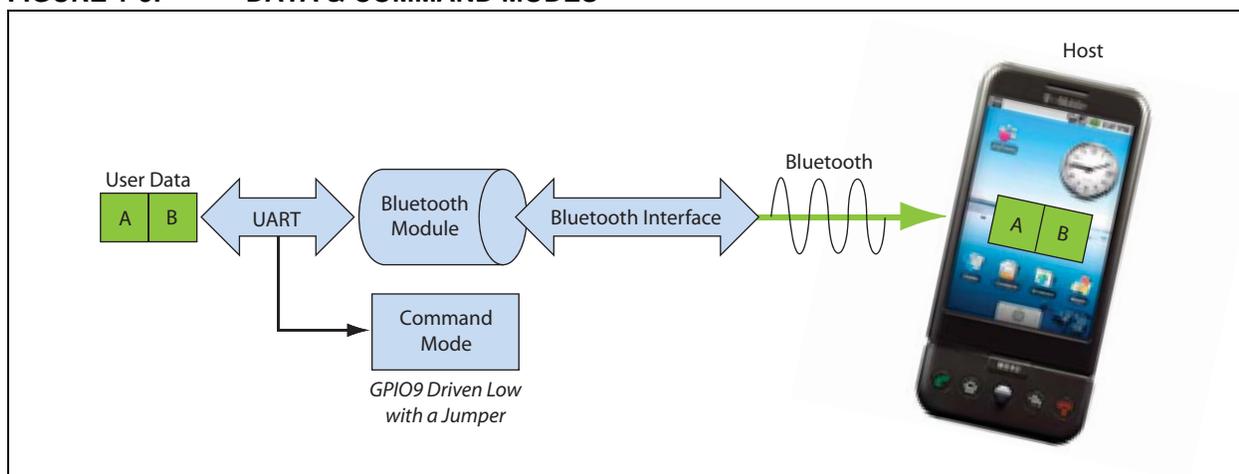
The default configuration for the Bluetooth device is:

- Bluetooth slave mode
- Keyboard default authentication mode (no pin code required)
- Serial port 115,200 Kbps baud rate, 8 bits, no parity, 1 stop bit
- Serial port flow control disabled
- Low power mode off

You configure the device by putting it into command mode and sending ASCII commands over a serial port. Once you change the configuration parameters, they persist until you change them or perform a factory reset.

> **NOTICE**
>
> **You can only configure the Bluetooh audio module locally using your computer's serial port. You *cannot* configure the module remotely over the Bluetooth link.**

You need a terminal emulator to complete the setup.

> **Note:** Roving Networks suggests using either the TeraTerm (Windows OS) or CoolTerm (Mac OS-X) terminal emulator program.

5.2   Configure the Module Using over the UART

Set up the RN-52-EK hardware as described in "Hardware Setup" on page 5. With the Bluetooth device connected and powered on, run a terminal emulator and open the COM port to which the cable is connected. The terminal emulator's communication settings should be the default serial port settings.

> **Note:** You can use local configuration at any time when the device does NOT have a Bluetooth connection, as well as under certain conditions. If the device is in configuration mode and a connection occurs, the device exits configuration mode and data passes back and forth from the remote device.

5.3   Enter Command Mode

The RN52 module enters command mode when GPIO09 goes low. The RN52 module leaves command mode and enters data mode when GPIO09 goes high. With the RN-52-EK evaluation board, you use a jumper to switch between command and data modes.

Launch a terminal emulator and specify the adapter's default settings. Figure 1-4 shows the serial port settings dialog box for TeraTerm (open this dialog box by choosing *Setup > Serial Port*).

FIGURE 1-4: **SERIAL PORT SETTINGS IN TERATERM**
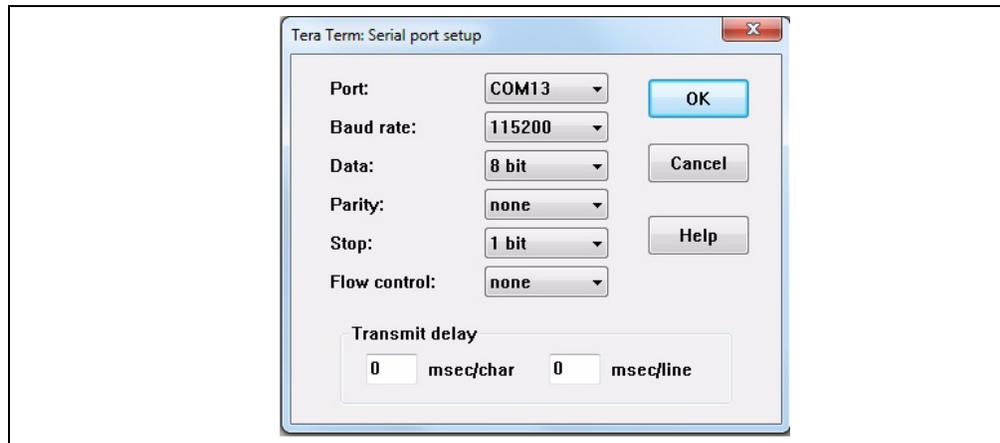
To place the module on the RN-52-EK evaluation board into command mode, connect a jumper to header pins 3 and 5 (GPIO9) on J3. See Figure 1-5. When entering command mode the module sends CMD to the UART.

FIGURE 1-5: **GPIO9 LOCATION**
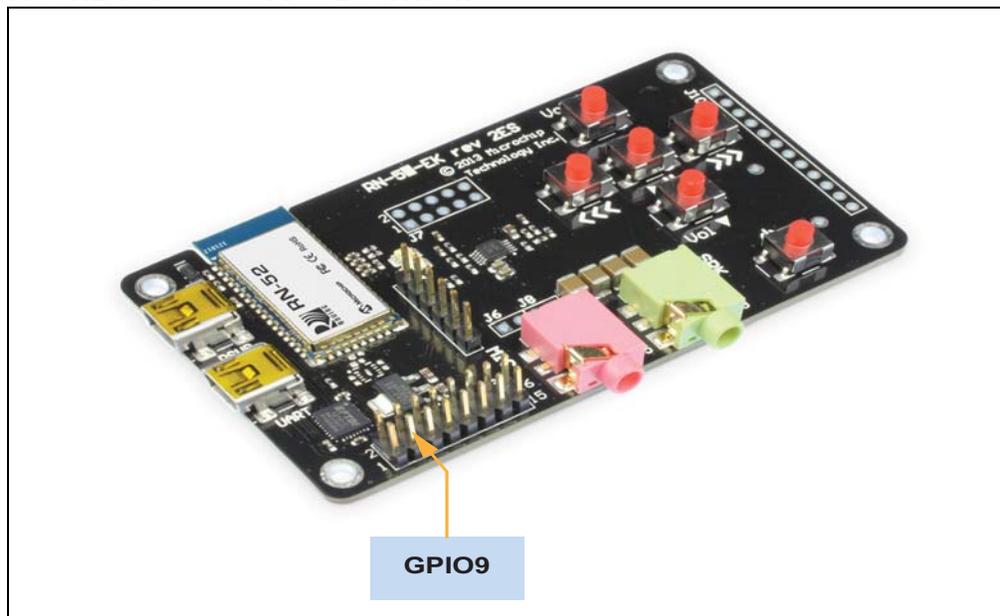
GPIO9

Type the following commands into the Tera Term console:

+   // Turn on local echo

v   // Display the firmware version

d   // Display the current settings

q   // Show the connection status

To switch into data mode, remove the jumper from header pins 3 and 5 (GPIO9) on J3. When leaving command mode the module sends END to the UART.

Figure 1-6 shows the Tera Term console after these actions.

FIGURE 1-6:   COMMAND MODE ACTIONS IN TERA TERM EMULATOR
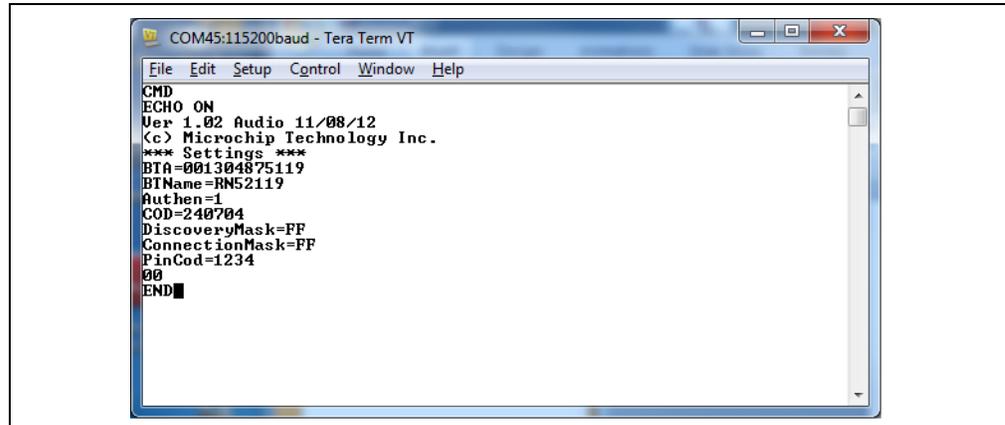
5.4   Making a Bluetooth Connection

By default, the Bluetooth adapter acts as a slave and the PC is the master. You connect to the Bluetooth adapter using your computer's Bluetooth device manager, which varies depending on the operating system. Regardless of the operating system, the process is the same: discovery, pairing, and connecting.

5.4.1   DISCOVERY

When you turn on the RN-52-EK, the blue LED should blink and the adapter should be discoverable. Open your PC's Bluetooth device manager and choose to add a new device. The Bluetooth device manager's icon is located in the bottom right corner of your screen in the taskbar for Windows and in the upper right corner for Mac OS-X. The Bluetooth device manager displays a list of discoverable Bluetooth devices. The board displays as **RN52-**XXXX, where XXXX is the last 4 digits of the module's MAC address.

5.4.2   PAIRING

To pair with the evaluation board, double-click the board's name in the list. The firmware automatically stores up to 8 pairings from remote hosts in a first in, first out fashion.

The default authentication mode is keyboard (no pin code required). When the Bluetooth device manager completes pairing, it issues a message that the Bluetooth device is installed on COMX where COMX is unique to your computer. In some cases, the Bluetooth device manager creates two COM ports; in this situation, only use the COM port labeled "outgoing."

The evaluation board's red LED flashes to indicate that the device is connected.

If the remote Bluetooth device does not require authentication, a connection can occur without the pairing process. However the Bluetooth specification requires that if either device involved in the pairing process requires authentication, the other device must participate to ensure a secure link. Roving Networks modules default to an open mode, such that the module does NOT require authentication. However, most PCs require authentication. See "Security Modes" on page 10 for more information on using pass keys.

The adapter may use simple secure pairing (SSP) if it is attempting to pair with devices that support the Bluetooth specification version 2.1 + EDR. SSP does not require the user to remember the pin code, but it asks to confirm the 6-digit number if the device has a display capability.

Once connected, the device is in data mode allowing data to flow in both directions. For configuration and programming, the device must be in command mode. See "Enter Command Mode" on page 7 for more information.

> **Note:** Only one client can connect to a slave device at a time. As a master, the device can make multiple connections, but only in a point-to-point, serialized fashion. Roving Networks devices do not currently support multi-point master mode.

Figure 1-7 shows some pairing/connecting examples.

FIGURE 1-7:   PAIRING/CONNECTING WITH THE BLUETOOTH ADAPTER

5.4.3   CONNECTING

To establish a Bluetooth connection, open the adapter's COM port from your application or a terminal emulator. When the COM port is open, the adapter's red LED flashes. The device remains connected until you close the COM port or remove power from the board.

5.5   Security Modes

The Bluetooth adapter supports authentication. If the local or remote Bluetooth device has authentication enabled, you must enter a pin code the first time you attempt to connect. The pin code is a series of numbers or characters from 1 to 16 characters in length. The default pin code is 1234.

After you enter the pin code, the Bluetooth devices compare them. If they match, a link key is generated and stored. Usually, but not always, the remote device stores the link key. For subsequent connections, the devices compare link keys. If they are correct, you do not need to re-enter the pin code.

If the remote device is a PC or PDA, the user generally is prompted to enter this pin code. To remove the stored link key on the remote device, you typically "unpair" or remove the device from the Bluetooth manager. You can change the pin code to remove the link key on the Bluetooth adapter, forcing a new pin code exchange to occur upon subsequent connection attempts.

> **Note:** Only one master can connect to the Bluetooth adapter at a time.

6.0   AUDIO DEMONSTRATION

In this demonstration, you play an audio stream on the RN-52-EK using a computer or smart-phone. The evaluation board broadcasts the audio through the mini-speakers. To perform the demonstration:

1. Connect the RN-52-EK to a host device (PC or smartphone) that has an audio source.
2. Connect the mini-speakers to RN-52-EK board's audio out connector (J9).
3. Open the audio source on the host device. Roving Networks recommends using a media player (e.g., Microsoft Media Player, iTunes, Android).
4. Start the audio stream on the media player.

When the RN-52-EK is connected to an audio source compatible with Bluetooth AVRCP, the audio control buttons are used to:

• Control the volume output
• Go to the previous track
• Go to the next track
• Start/stop playing the current track

Figure 1-8 shows the location of the audio control buttons.

FIGURE 1-8:   AUDIO CONTROL BUTTONS
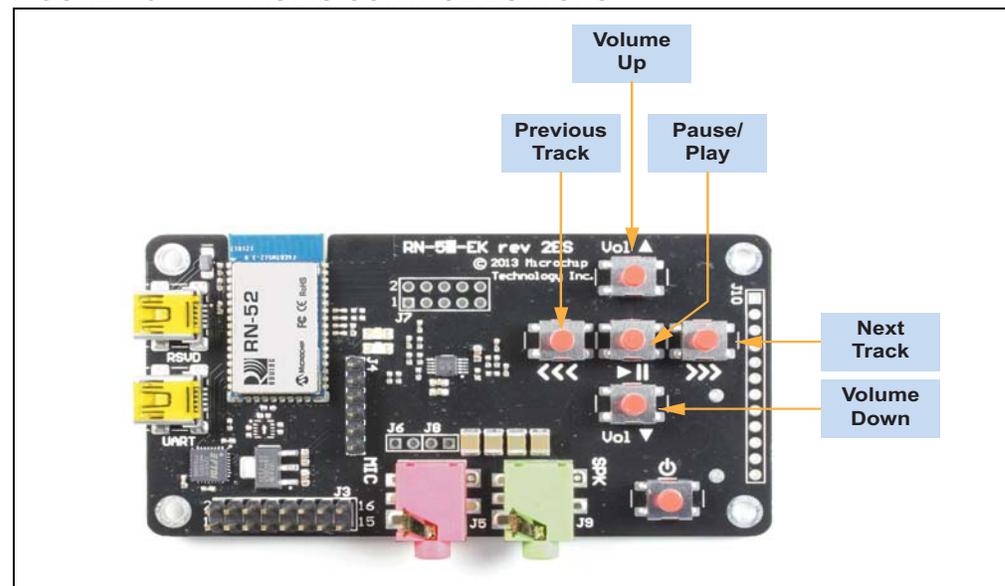
7.0   HSP/HFP DEMONSTRATION

In this demonstration you explore the hands-free profile setting. This demonstration requires a microphone. Roving Networks recommends using a PC headset/microphone (with two-plugs). To perform the demonstration:

1. Connect the RN-52-EK via a USB cable to a PC that has an audio source.
2. Using Bluetooth, pair and connect the RN-52-EK to a smartphone that supports the A2DP and HFP/HSP Bluetooth profiles.
3. Connect the headset/microphone to the RN-52-EK board's audio out connector (J9).
4. Open an audio source on the PC, such as a music player, and begin playing audio.

5. From another phone, initiate a call to the smartphone that is paired with the RN-52-EK. The A2DP stream pauses and the ringtone plays on the headset/microphone.

6. On your PC, identify the virtual serial port connection to the RN-52-EK UART USB port.

7. In a terminal emulator, open this port with the settings: 115,200 Kbps baud rate, 8 bits, no parity, 1 stop bit.

8. Connect a jumper to header pins 3 and 5 (GPIO9) on J3. Refer back to Figure 1-5 on page 8. The terminal emulator displays `CMD`, indicating that the RN52 module is in command mode and you can connect to it via the UART.

9. Try the following commands:
    - `D`—Display settings
    - `H`—Help
    - `Q`—Connection status (a non-zero value indicates the device is connected)

10. To exit command mode, remove the jumper from GPIO9. The terminal emulator displays the message `END`, indicating that the mdoule is no longer in command mode.

8.0   RESOURCES & RELATED DOCUMENTS

For more information, refer to the following sources:

• RN52 Bluetooth Audio Module Data Sheet

• Bluetooth Audio Module Command Reference User's Guide

9.0   DOCUMENT REVISION HISTORY

9.1   Version 1.0

Initial release.

Appendix 1. RN-52-EK Schematic

Figure 1-9 shows the RN-52-EK schematic.

FIGURE 1-9: **RN-52-EK SCHEMATIC**

NOTES: