Application Report

SimpleLink™ CC3220-OV788 Audio/Video Streaming Reference

ABSTRACT

This document demonstrates the ability of the CC3220 to provide a full system solution for audio-video streaming applications.

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Trademarks

1 Introduction

1.1 System Description

This software reference combines TI wireless technology with OmniVision A/V technology to enable live streaming of audio and video data over Wi-Fi®. This is an integrated solution demonstrating the ability of the CC3220 to provide a full system solution for audio-video streaming applications.

1.2 System Block Diagram

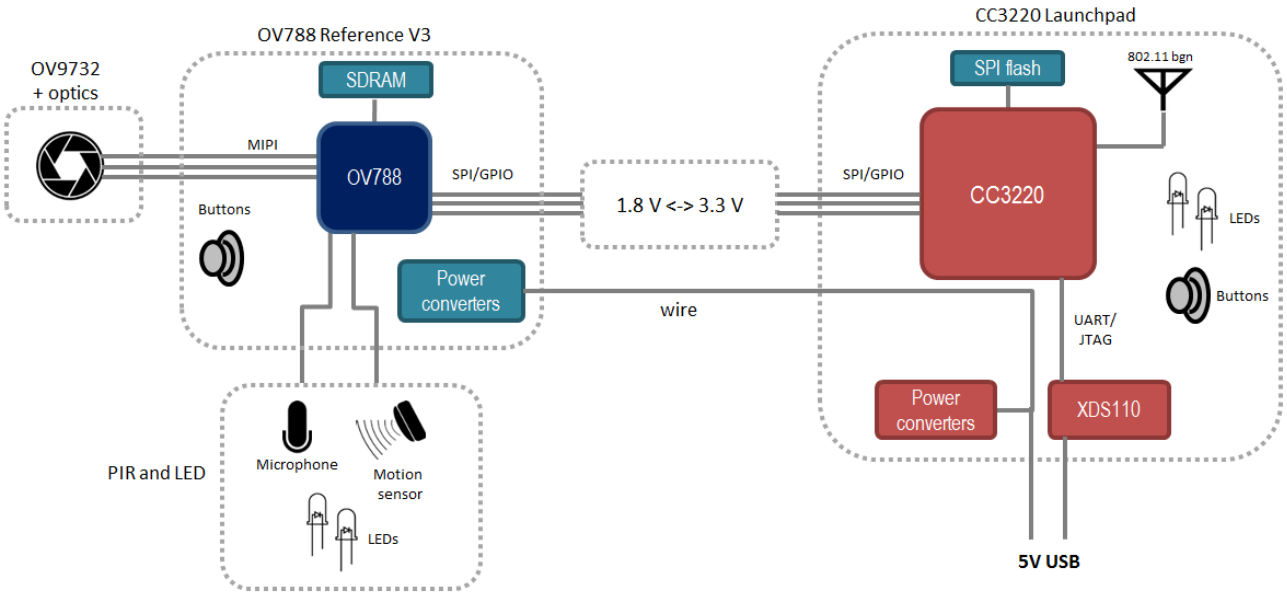

Figure 1-1. System Block Diagram

1.3 System Operation

On boot-up, the CC3220 application initializes the OV788 by loading its firmware and sending commands to configure the settings of the device. In parallel, the CC3220 begins connecting to an access point. After the AP connection, the CC3220 then opens an RTSP server on the local network, and waits for RTSP clients, such as media player applications, to connect and request live streams.

The CC3220 does not buffer video or audio data, but rather sends them out immediately over the network when received by the OV788. Thus, any latency seen in the video stream is mostly due to buffering on the part of the streaming client application. In a dedicated use case, this could be reduced by the system developer by using a custom application instead of using open source.

1.4 Key System Specifications

Table 1-1. Key System Specifications

PARAMETER	SPECIFICATION	DETAILS
Streaming quality	Video	720p, 30 fps, 2 Mbps
	Audio	PCM, 16 bps, 11025 Hz
Application protocols	RTP/RTSP	
Supported Wi-Fi networks	802.11 b/g/n	

2 Hardware Setup

The following pieces of hardware are required:

- CC3220S-LAUNCHXL or CC3220SF-LAUNCHXL
- BOOSTXL-OV788ADAPT
- Omnivision OV788 reference board V3
  - Order from Arrow: https://www.arrow.com/en/products/ov09712-ecvf-aw1b/omnivision-technologies
- 802.11 b/g/n Wi-Fi Access Point

2.1 CC3220 Launchpad Setup

Set up the jumpers on the CC3220 LaunchPad as shown in Figure 2-1.

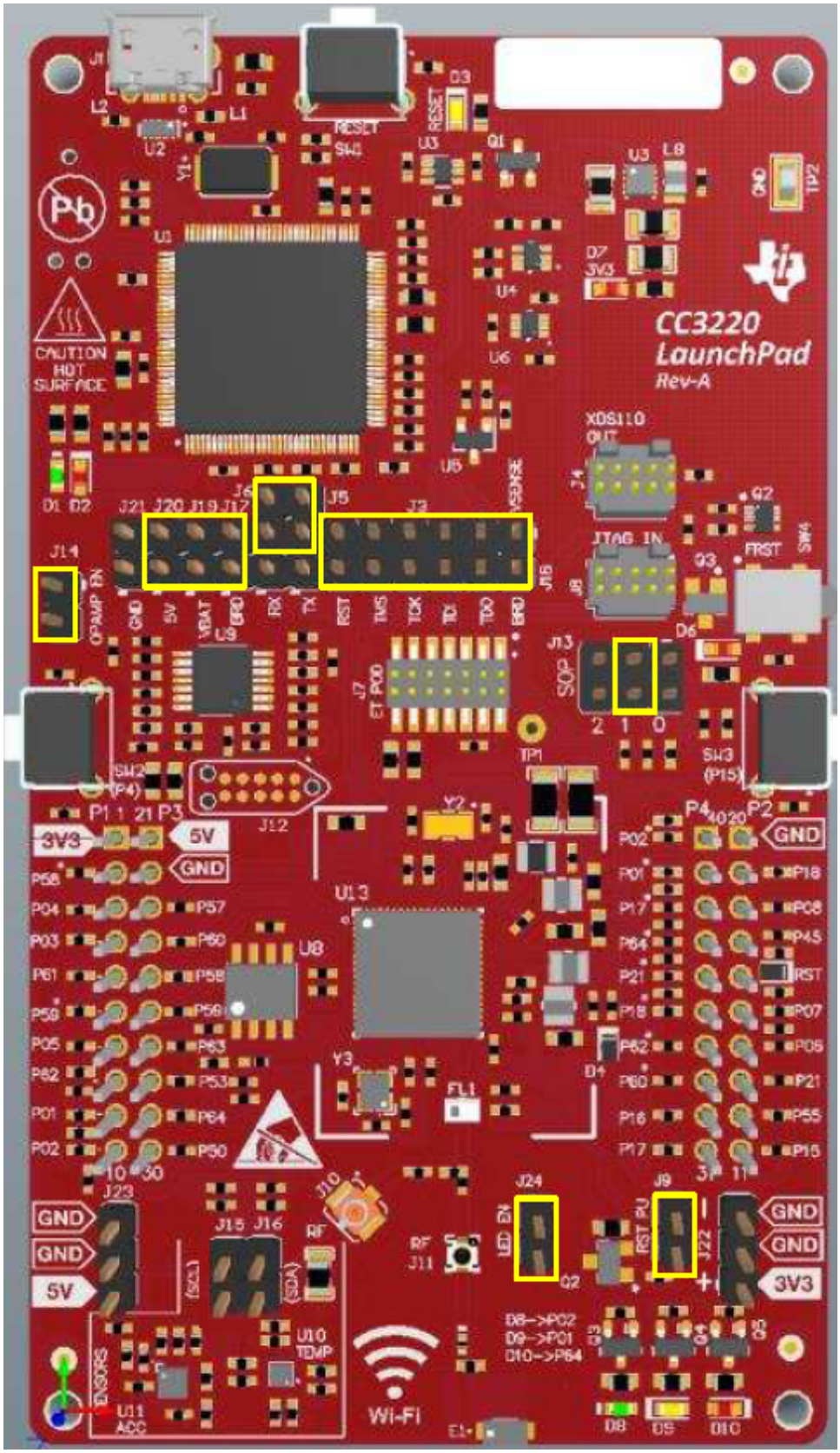

Figure 2-1. CC3220 LaunchPad

2.2 Omnivision OV788 Reference Board

The OV788 reference board V3 contains an OV788 and connectors for a sensor and optics board. The sensor board to be mounted should contain an OV9732, because the firmware loaded to the OV788 by the CC3220 (dsif_slave_9732.bin) is specific to this sensor. Mount the sensor on the board as shown in Figure 2-2.

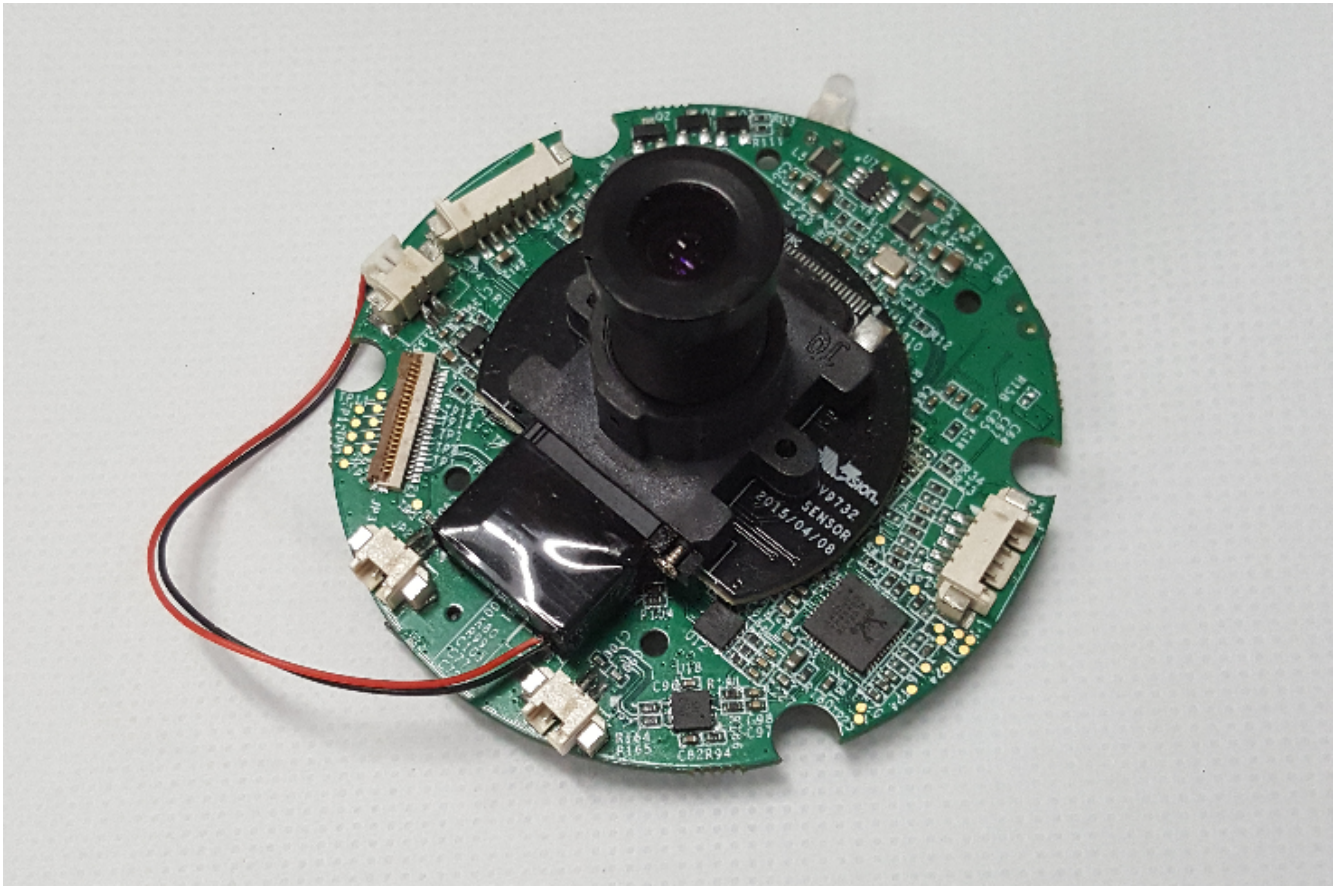

Figure 2-2. Omnivision OV788 Reference Board

Some ECOs may need to be performed on the OV788 reference board to ensure the correct boot mode is employed, and that reset lines are connected. Verify the following, and make ECOs if necessary:

- Remove R121
- Remove R30
- Populate R136 with 0 Ω
- Populate R29 with 0 Ω
- Populate R31 with 100 Ω
- Populate R32 with 100 Ω

If the onboard regulator for the 3_6V line does not supply 3.6 V, additional changes must be made. The voltage from the 3_6V regulator can be measured from header J2, pin 12. If the measured voltage is not 3.6 V, make the following changes:

- Change R46 to 200 kΩ
- Change R47 to 40 kΩ

If using the Omnivision PIR and LED board, this enables the OV788 to sample sound from the onboard microphone. The sound is sampled directly by the OV788 for this reference. The audio data is sent to the CC3220 over the SPI interface with the video data. Currently the microphone is the only functional component on this board.

There are some hardware considerations when using this:

- Mount a microphone on MIC2
- To reduce interference and get the best audio quality, twist the cable to the Omnivision reference board tightly, as shown in Figure 2-3.

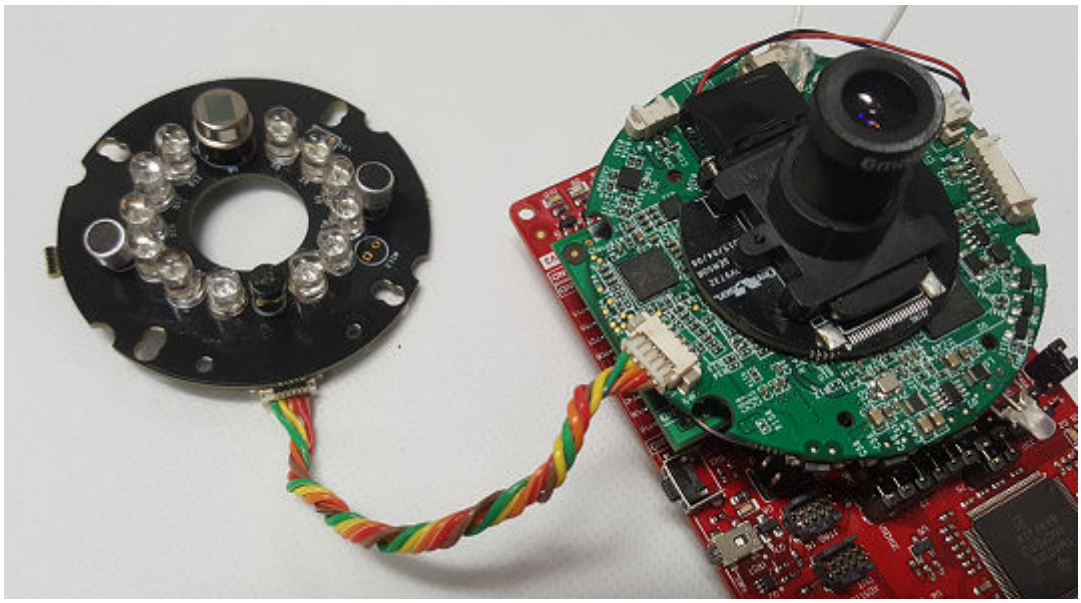

Figure 2-3. Cable Twist

2.3 BOOSTXL-OV788ADAPT

The OV788 adapter booster pack is used to connect the CC3220-LAUNCHXL to the OV788 reference board. This board provides voltage-level translation between the Launchpad, which operates at 3.3 V, and the OV788, which operates at 1.85 V. The OV788 reference board is mounted on the camera adapter board using the 12-pin 1.27-mm pitch headers. Connect the boards together as shown in Figure 2-4.

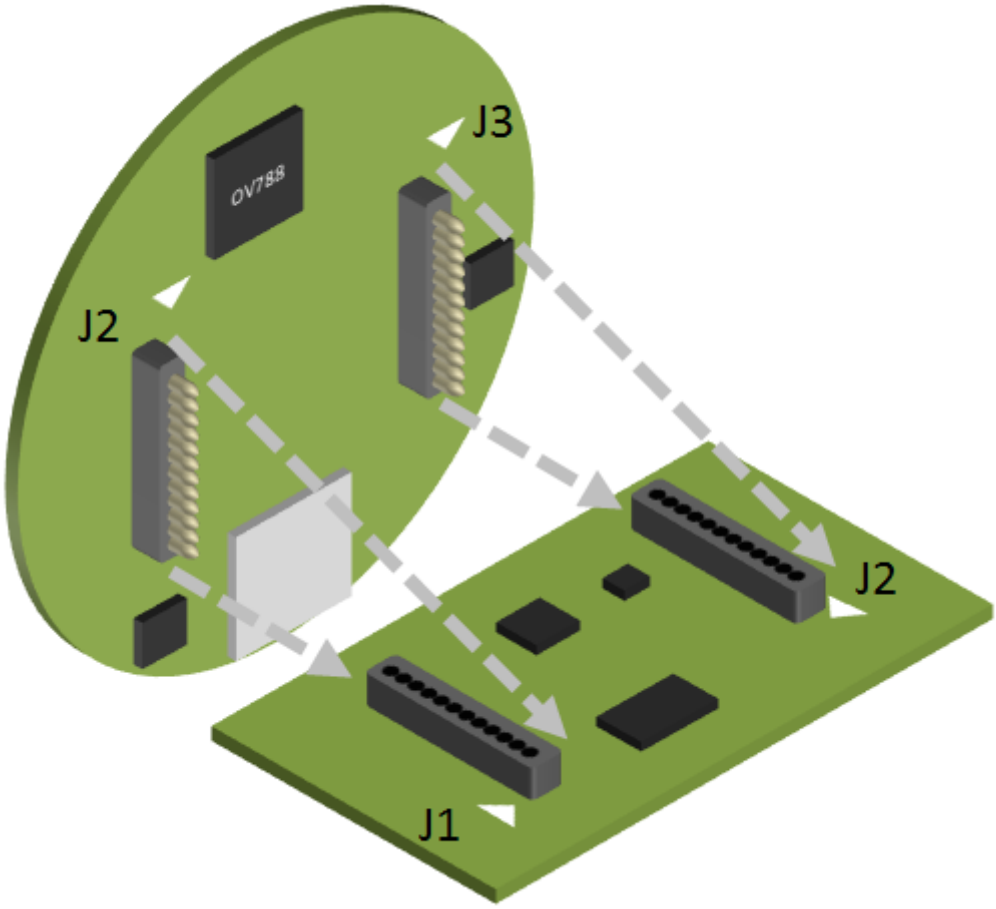

Figure 2-4. OV788 Adapter Booster Pack Connection

2.4 Hardware Setup With LaunchPad Only

Note

For this setup, a wire must be connected to the 5-V supply on the CC3220 LaunchPad and soldered to TP3 on the OV788 reference board to correctly supply power to it.

The adapter board does not supply 5-V power, as the connectors on the Omnivision board do not have a line for 5 V.

Mount the adapter on the CC3220 LaunchPad, ensuring the VCC and GND pins are aligned, then mount the OV788 board on the adapter, aligning the GND and power pins.

Set up the demo as shown in Figure 2-5.

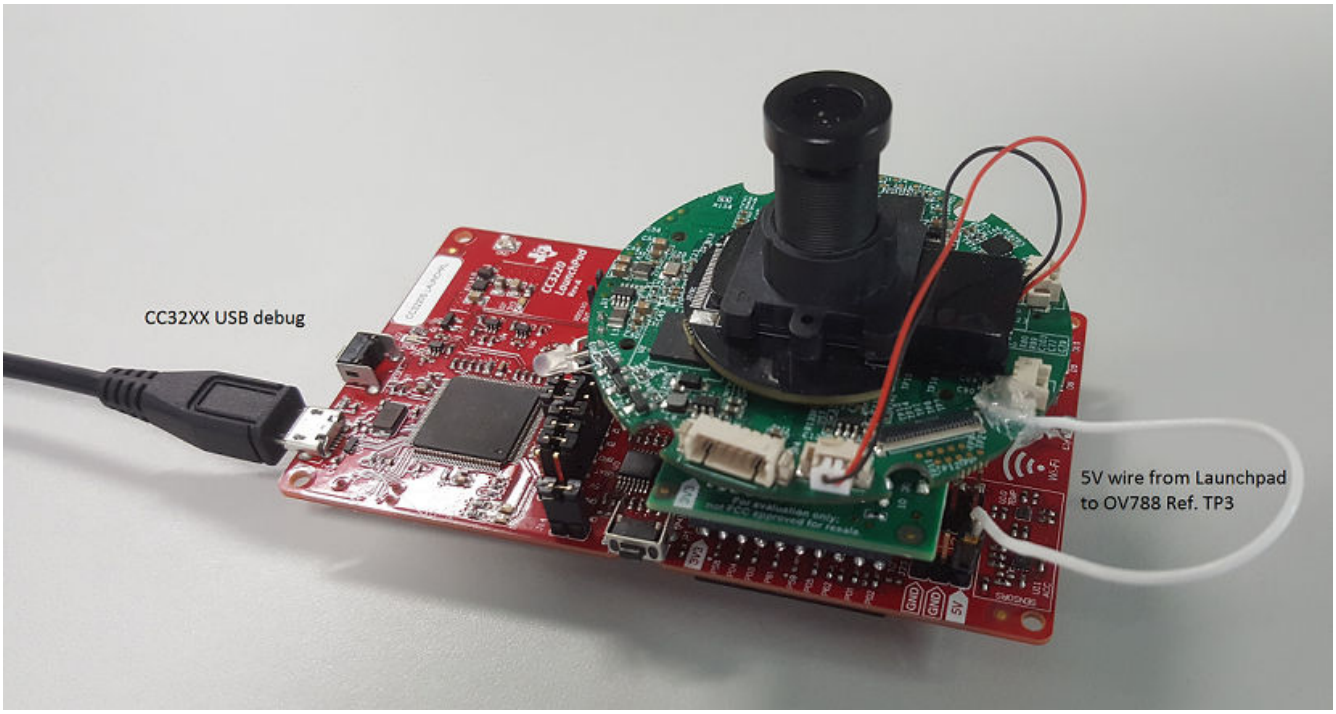

Figure 2-5. CC3220 LaunchPad Setup

2.5 Hardware Setup With RS232 Debug Board

Omnivision's RS232 debug board is an optional board containing a UART to USB converter, used to get UART debug information from the OV788. Connecting the RS232 debug board supplies 5 V power to the Omnivision reference board. Mount the adapter on the CC3220 LaunchPad, ensuring the VCC and GND pins are aligned, then mount the OV788 board on the adapter, aligning the GND and power pins. For this setup, do not connect a wire for 5-V power from the CC3220 LaunchPad to the OV788 reference board, as doing do may damage the components.

Set up the demo as shown in Figure 2-6.

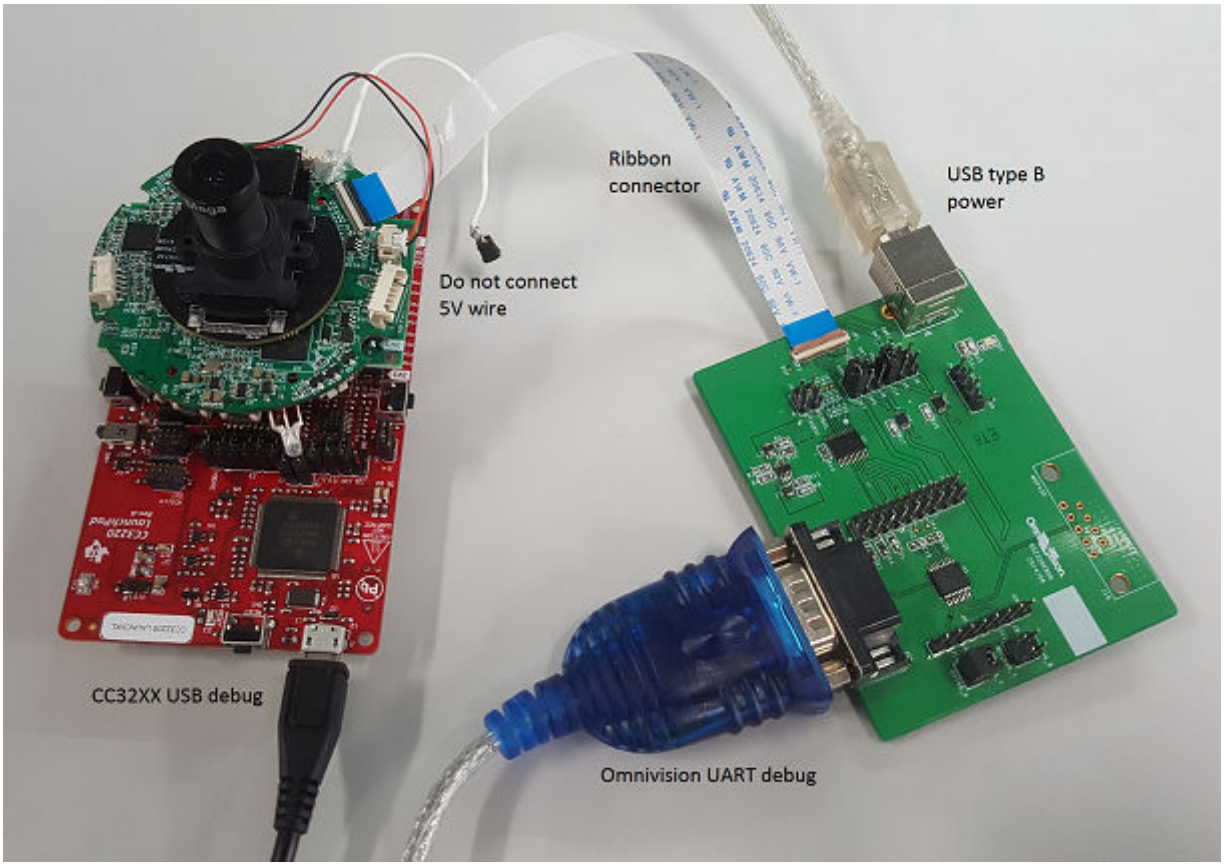

Figure 2-6. RS232 Debug Board Setup

For this setup, ensure the ribbon cable orientation is correct. The Omnivision debug port has the following settings:

- Bits per second: 115200
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None

3 Running the Setup

Prerequisites:

- CC3220 SDK: http://www.ti.com/tool/SIMPLELINK-CC3220-SDK
- CC3220-OV788 Video Camera Application software: http://www.ti.com/wireless-connectivity/simplelink-solutions/wi-fi/applications.html
- Uniflash 4.2 or greater: http://www.ti.com/tool/UNIFLASH
- RTP streaming client application, one of:
  - VLC for Android, Ver. 3.0.0
  - VLC for iOS, Ver. 2.8.7
  - VLC for Windows, Ver. 2.2.8
- Wi-Fi Starter Pro application for iOS/Android
- You must install the CC3220-OV788 Video Camera Application software, which is located here.

3.1 Programming the CC3220 LaunchPad

For the software to run correctly, the CC3220-LAUNCHXL must be programmed with a firmware binary file for the OV788 and the latest service pack for the CC3220. Directions for programming are:

1. Start Uniflash and create a new project for the device.
2. Under File, select Service Pack, and browse to the service pack in the most recent CC3220 SDK: <CC3220 SDK>\tools\CC3220_tools\servicepack-cc3x20\
3. Add a new folder named *user*.
4. In the new user folder, add the file dsif_slave_9732.bin located in the folder <CC3220 SDK>\source\third_party\ov788\. Name this file ovt_firmware.bin, as shown in Figure 3-1.

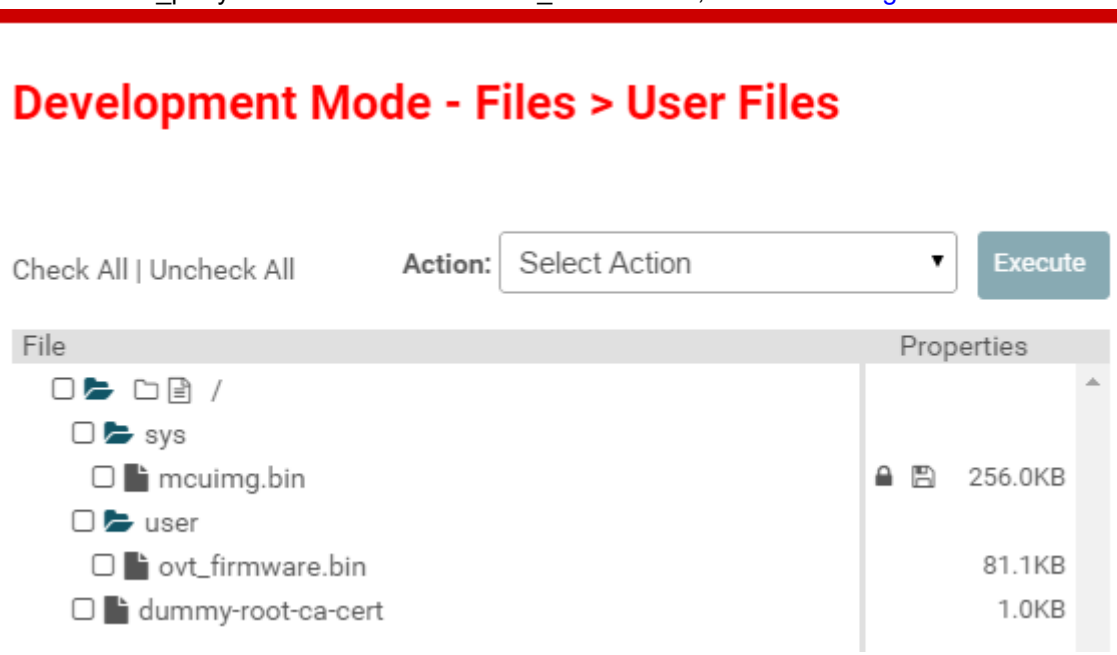

Figure 3-1. Uniflash File System

5. To program the CC3220 binary:
   a. Add the file <CC3220 SDK>\tools\CC3220_tools\certificate-playground\dummy-root-ca-cert. Note use of "dummy" certificates is for development only.
   b. Select Action, and Select MCU image as the CC3220 binary file located in <CC3220 SDK>\examples\rtos\CC3220S_LAUNCHXL\demos\video_streaming_ov788\freertos\iar\Debug\Exe.
   c. Use dummy-root-ca-cert as the certification file, and <CC3220 SDK>\tools\CC3220_tools\certificate-playground\dummy-root-ca-cert-key as the private key.
6. Connect the CC3220 LaunchPad to the PC, and press Connect.
7. Press Generate Image  , then Program Image.

3.2 Connecting the CC3220-OV788 Setup to the AP

The camera must first be provisioned an access point to enable streaming over a local network. Directions for provisioning are:

1. Connect the CC3220 LaunchPad USB to the PC.
2. (Optional) Open the serial terminal to the COM port for the CC3220. The Omnivision debug port has the following settings:
   - Bits per second: 115200
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None

   Reset the CC3220 LaunchPad and Figure 3-2 shows in the terminal if the CC3220 is not able to connect to an AP after 10 seconds:

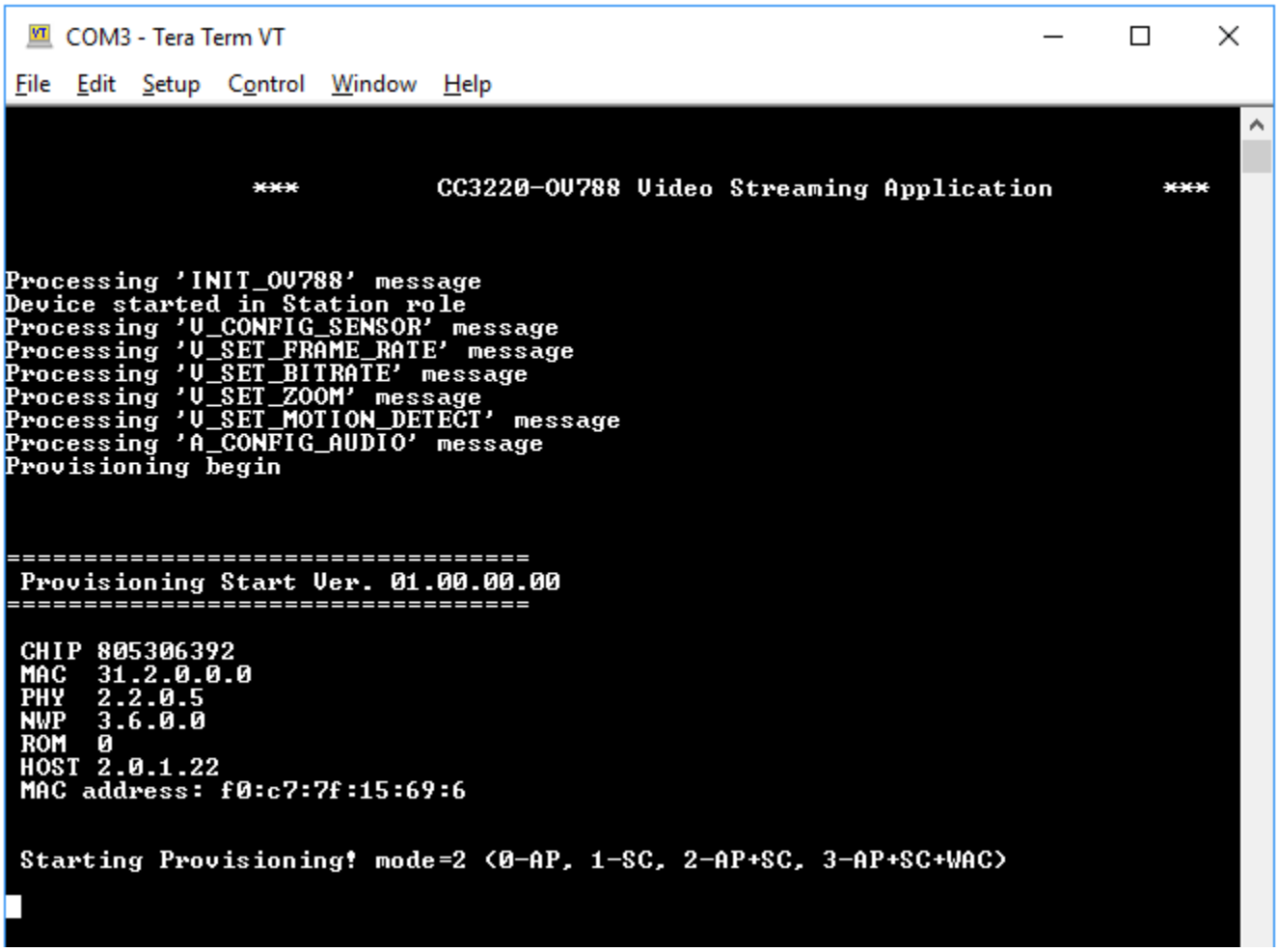

Figure 3-2. Starting Provisioning

3. Start the Wi-Fi starter Pro application, and begin provisioning. See the Wi-Fi starter Pro manual for details. Figure 3-3 illustrates the result of successful provisioning.

```
 [Provisioning] Profile Added: SSID: TI3XTEST
 [Provisioning] Profile confirmation: WLAN Connected!
 [Provisioning] Profile confirmation: IP Acquired!
 [Provisioning] Profile Confirmation Success!
 [Provisioning] Stopped: Current Role: STA
WLAN Status: CONNECTED
Connected to SSID: TI3XTEST
Listening for RTSP clients..!
System State: APP_STATE_INIT_DONE_CONNECTED
```

Figure 3-3. Successful Provisioning

4. If using the serial terminal, reset the board and note the IP address assigned to the camera after it connects to the access point, as shown in Figure 3-4.

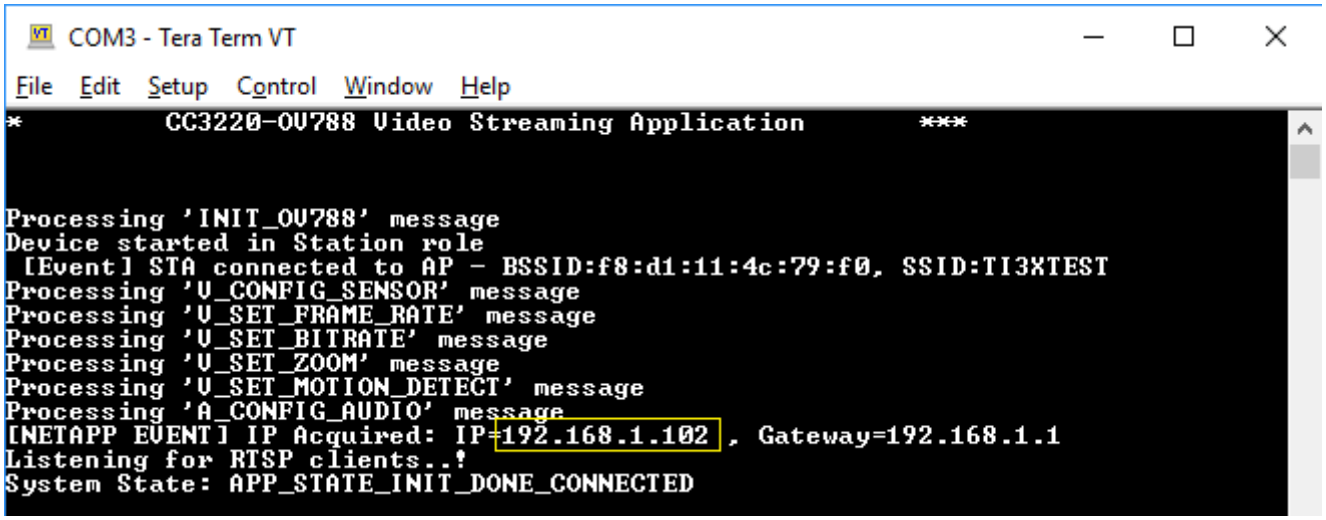

Figure 3-4. Camera IP Address

5. Alternatively, Bonjour for iOS™ or Bonjour Browser for Android™ can be used to discover the IP address through MDNS device discovery, as shown in Figure 3-5 and Figure 3-6.

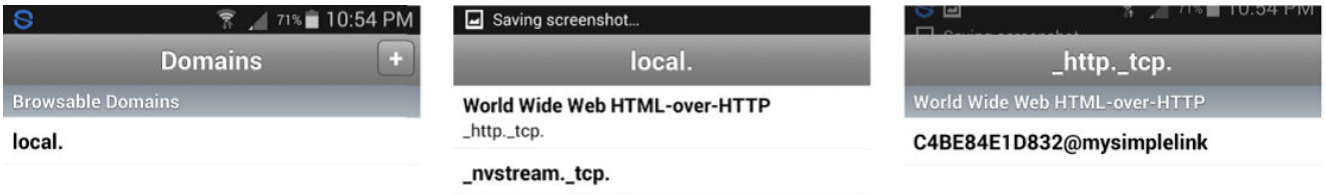

Figure 3-5. mDNS Device Discovery

Figure 3-6. IP Address from mDNS

3.3 Streaming From the Client Application

3.3.1 VLC for Windows

1. Connect the PC to the same access point as the CC3220-OV788 setup.
2. Run VLC and choose Open Network Stream from the Media menu, as shown in Figure 3-7.

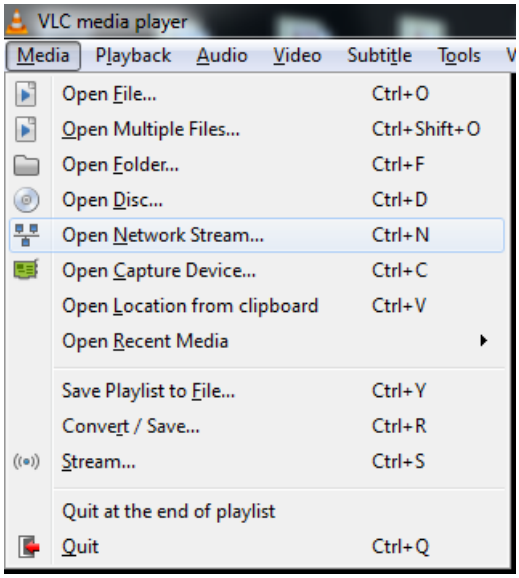

Figure 3-7. Open Network Stream

3. For the Network URL, enter ”rtsp://<local IP address>:8554/Video.264” and press Play, as shown in Figure 3-8.

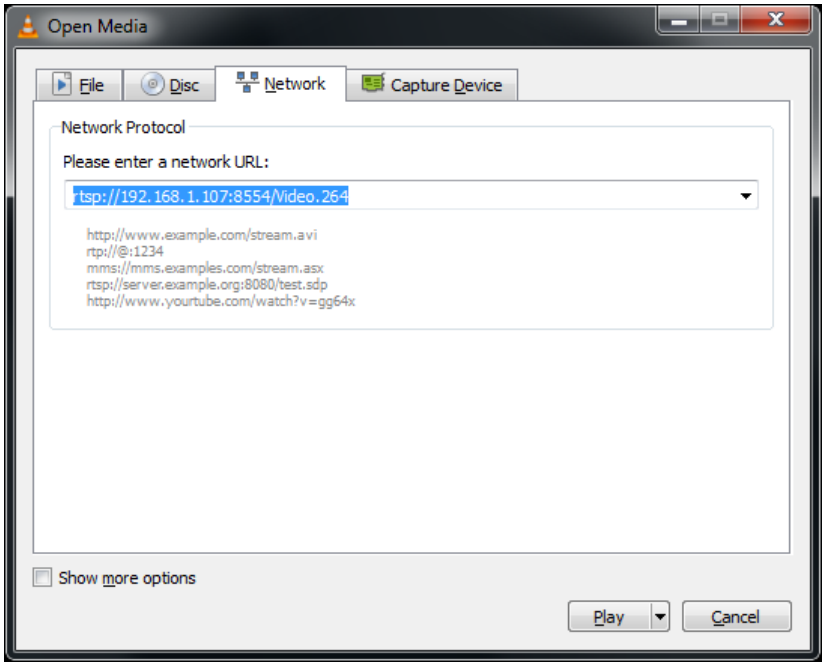

Figure 3-8. Enter Network URL

3.3.2 VLC for iOS

1. Connect the iOS device to the same access point as the CC3220-OV788 setup.
2. Run VLC, and Choose Open Network Stream, as shown in Figure 3-9.

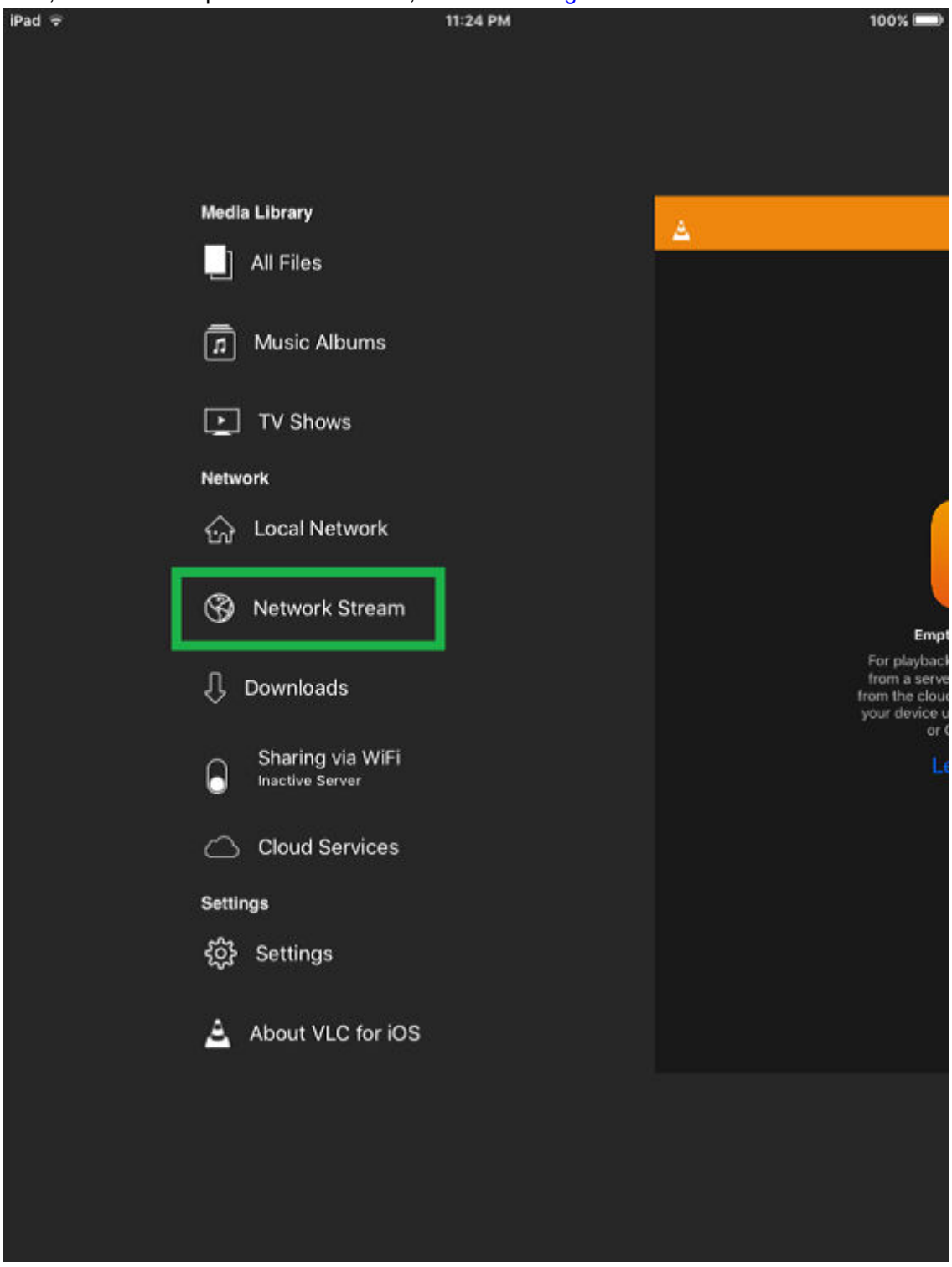

Figure 3-9. Open Network Stream

3. For the Network URL, enter ”rtsp://<local IP address>:8554", as shown in Figure 3-10.

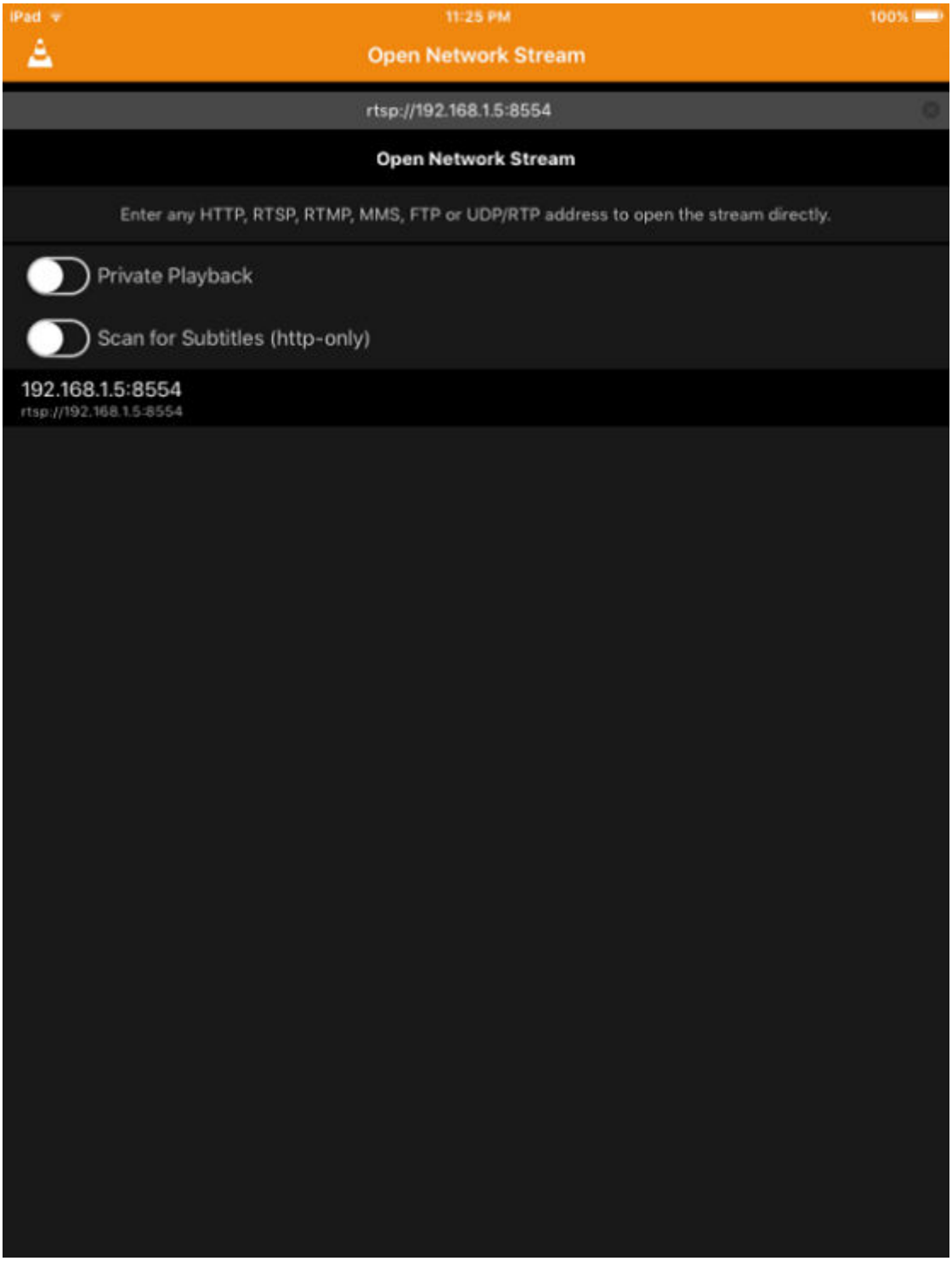

Figure 3-10. Enter Network URL

4. Press Open Network Stream.

3.3.3 VLC for Android

Note

Having other audio applications open may prevent the audio from playing.

1. Connect the Android device to the same access point as the CC3220-OV788 setup.
2. Run VLC, and Choose Stream, as shown in Figure 3-11.

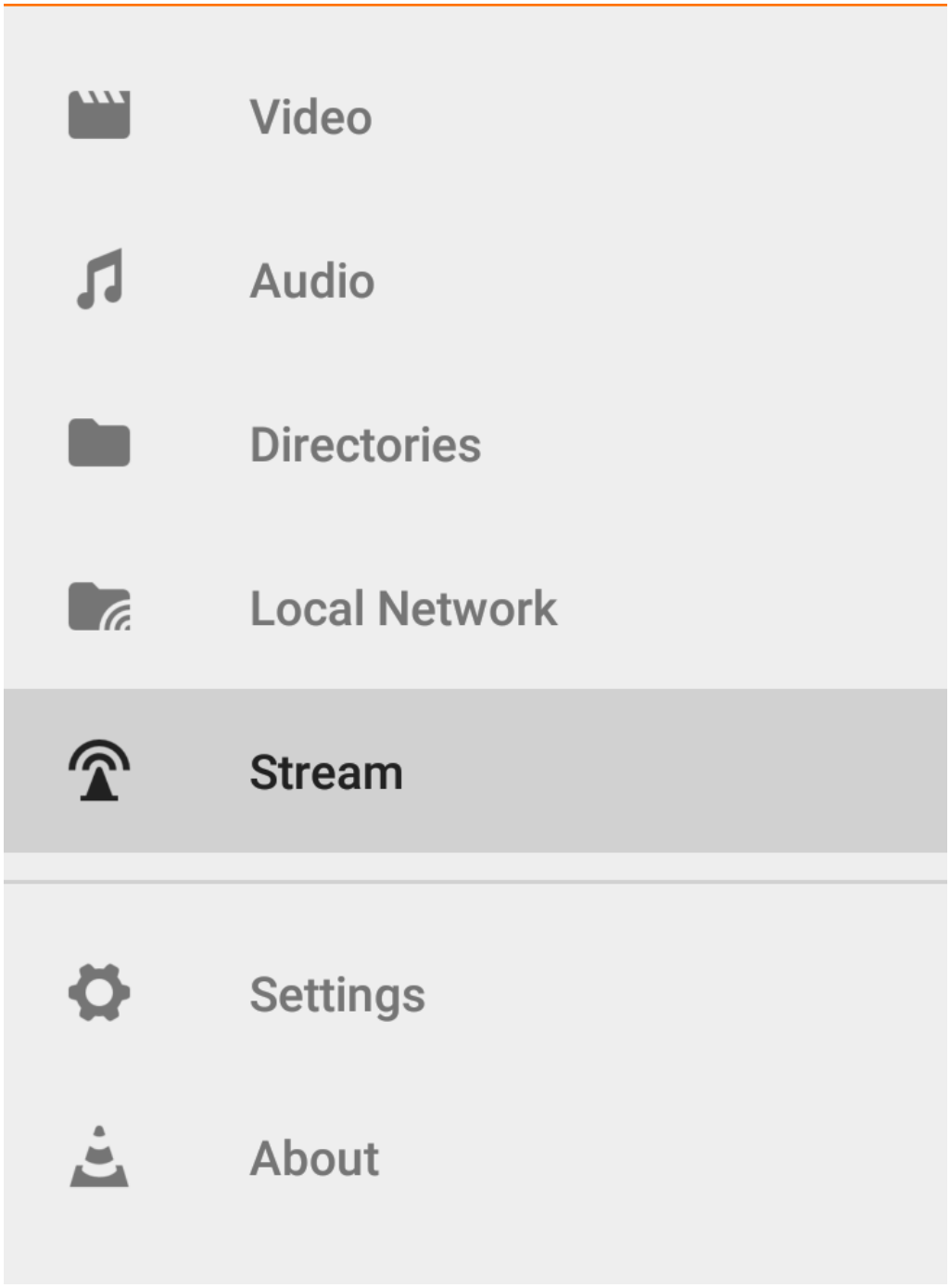

Figure 3-11. Choose Stream

3. For the Network URL, enter ”RTSP://<local IP address>:8554", and press the yellow arrow, as shown in Figure 3-12.

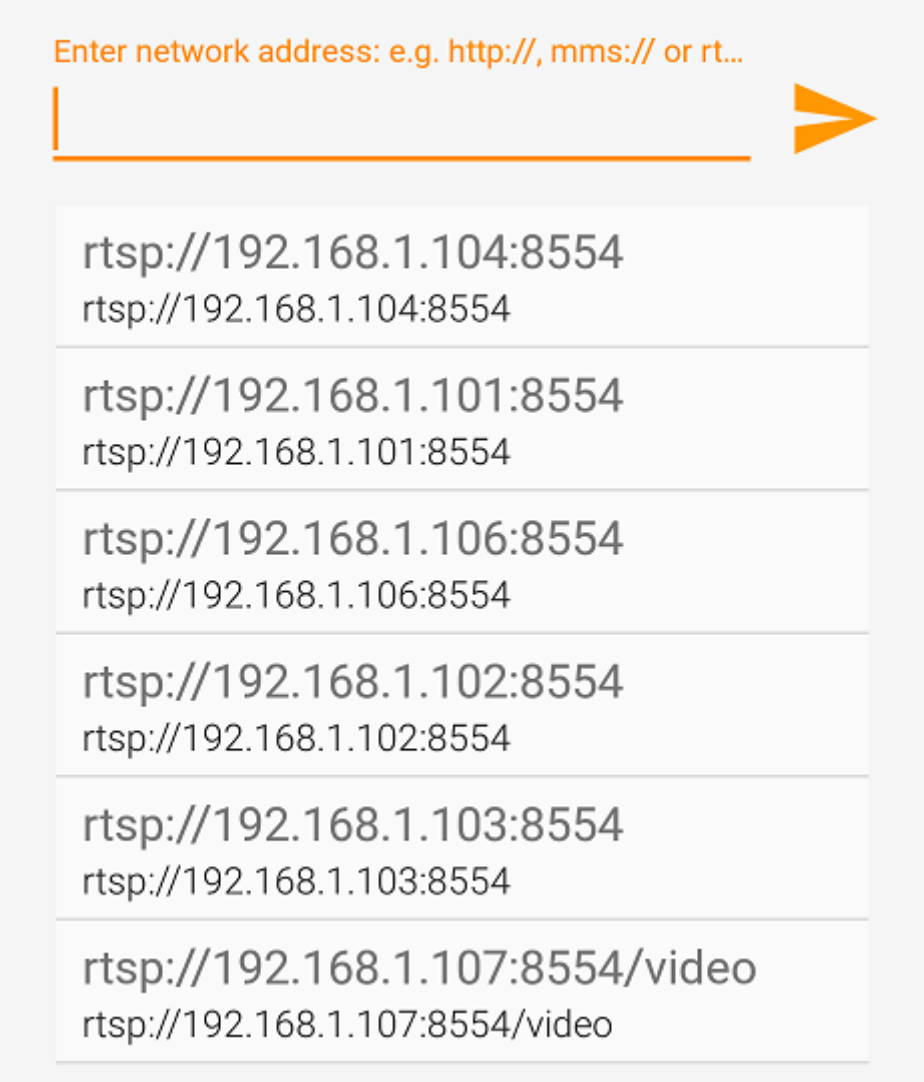

Figure 3-12. Enter Network URL

3.4 Results

The setup should now be streaming H.264 video from the camera setup to the streaming client. Adjust the lens attached to the camera (by twisting) to get the best quality picture. The latency settings in the streaming client can also be adjusted to reduce delay seen in the video stream. This setup serves as starting point in software and hardware for developing many different types of end equipment which stream video and audio over IP networks.

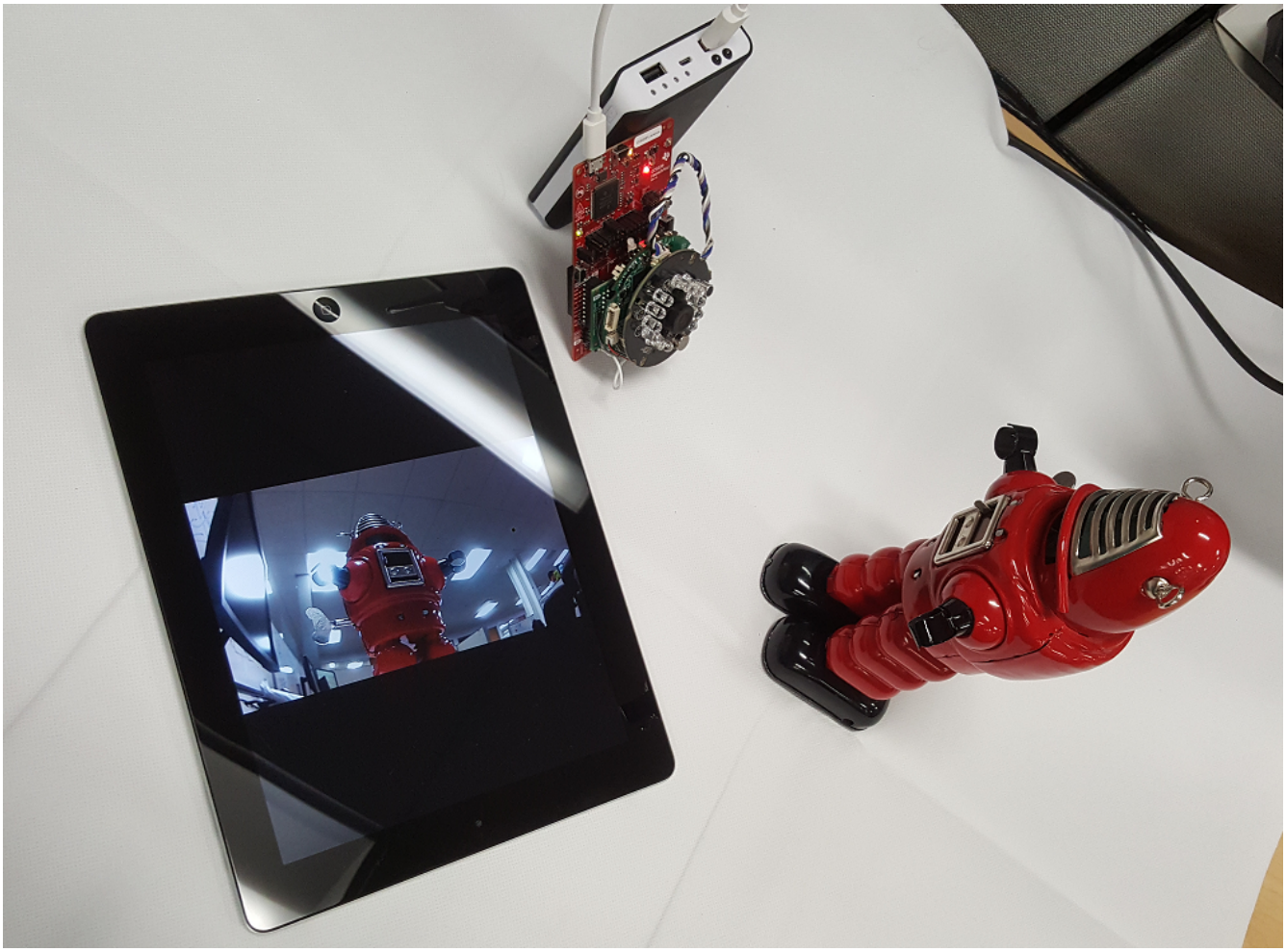

Figure 3-13. Final Setup

4 Revision History

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

Changes from Revision * (March 2018) to Revision A (May 2021)	Page
• Updated the numbering format for tables, figures and cross-references throughout the document	2
• Updated Running the Setup prerequisites	10
• Updated Programming the CC3220 LaunchPad section	10

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