

NRC7292 Evaluation Kit User Manual

(Standalone Mode: iPerf Test)

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NEWRACOM, Inc.

NRC7292 Evaluation Kit User Manual (Standalone Mode - iPerf Test)

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1 Overview

This guide introduces the software development kit (SDK). We will explain how to write and build user application program with SDK application program interface (API). And the way to evaluate the performance on the NRC7292 evaluation kit (EVK). NRC7292 EVK contains Newracom's IEEE 802.11ah Wi-Fi system on a chip (SoC) solution. The following figure shows HW of NRC7292 EVK and its components.

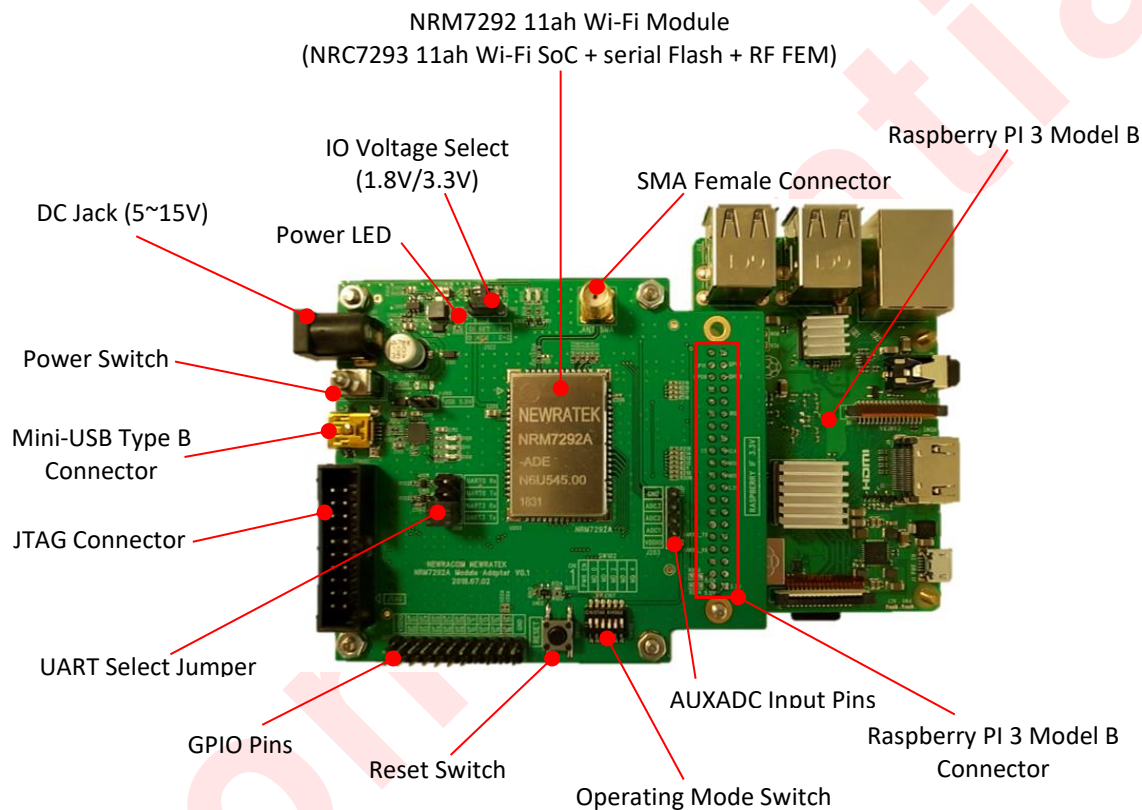


Figure 1.1 NRC7292 evaluation board

1.1 HW list

As shown in Figure 1.2, NRC7292 EVK consists of three boards.

1.1.1 NRC7292 module board

NRC7292 module contains IEEE 802.11ah Wi-Fi SoC solution and includes RF front end module FEM to increase transmission power up to +23 dBm. The on-board serial flash memory can be used for over-the-air (OTA) software development and with a 32KB cache in the NRC7292, execution in place (XIP) feature is supported.

1.1.2 NRC7292 adapter board

NRC7292 adapter board mainly offers communication interfaces to sensors or external host. It also supplies main power for NRC7292 Wi-Fi module.

1.1.3 Host board

NRC7292 module can be used either as a standalone or a slave to a host processor via serial peripheral interface (SPI) or universal asynchronous receive transmitter (UART). Raspberry PI 3 can be used as one of the hosts used for testing, evaluation, and normal operation. When used in standalone, Raspberry PI 3 board is not required because NRC7292 will operate without additional host processor.

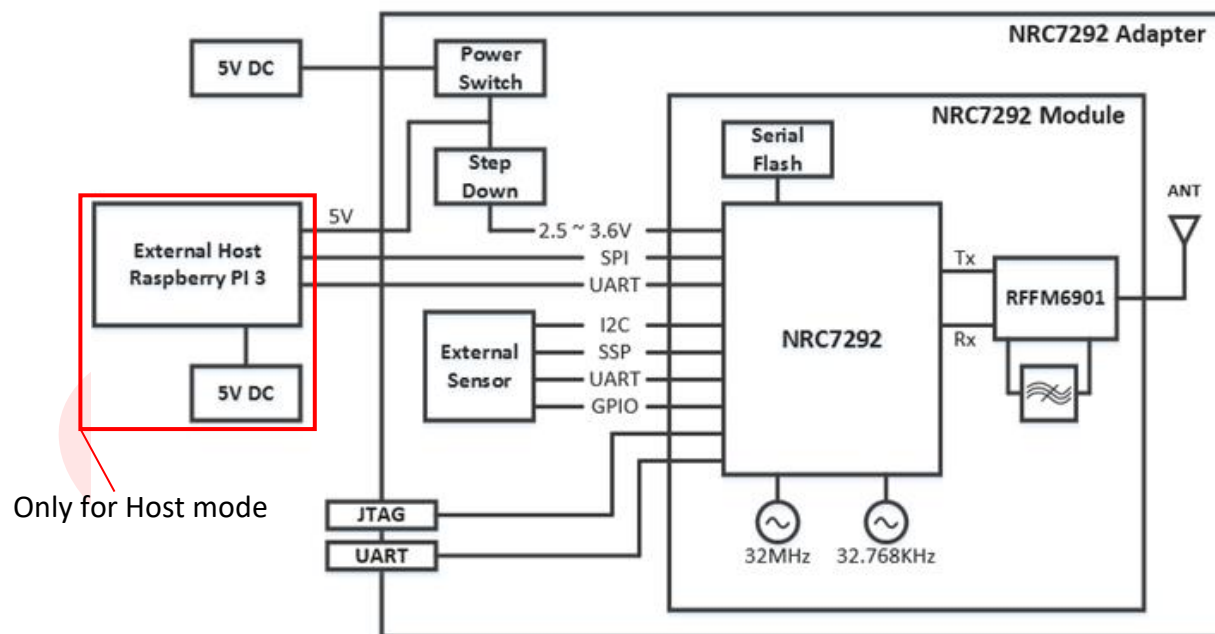


Figure 1.2 Block diagram of NRC7292 evaluation board

1.2 SW list

NRC7292 EVK provides followings for application program development.

1.2.1 NRC7292 SDK

NRC7292 software development kit (SDK) is provided to users to develop custom application on the NRC7292 EVK. It includes various types of APIs for Wi-Fi and TCP/IP communication, peripherals, timer, memory, etc. In addition, user can attach various sensors for their application via UART, SPI, and I2C interface on EVK.

FreeRTOS is adopted as real-time OS, users can take the advantage of FreeRTOS features such as: multi-tasking, inter task communication (ITC), memory management, etc.

(Refer to at <https://www.freertos.org/> for more information)

1.2.2 NRC7292 IDE

NRC7292 Integrated development environment (IDE) is provided to users so users can build custom application programs. It contains NRC7292 SDK and static library including firmware, TCP/IP stack, WPA supplicant, etc. Therefore, user can create unified binaries to run on the EVK. For more information, refer to chapter 2. Setup SW Build Environment and 3. How to make binary.

1.2.3 NRC7292 binary download tool

The binary download tool (BDT) included in the release packet can be used to download unified binary built by IDE to the flash memory on the EVK. This tool can be used both on Windows and Linux operating system. For more information, refer to chapter 4. How to download binary.

2 Setup SW build environment

Please refer to the doc/NRC7292_EVK_User_Guide(SM).pdf of SDK.

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3 How to download binary

After building a user application on Eclipse, users can confirm the successfulness of the build. If it is a successfully build, users will find the unified binary in “out” directory.

(<workspace_root>/out/<project_name>.bin)

NRC7292 BDT can be used to download unified binary onto EVK. The BDT is included in ‘tool’ directory (<workspace_root>/tool) of release package.

To download unified binary, follow the procedure below.

1) Download mode settings

Configure Operating Mode Switch to Download mode as shown in Figure 3.1.



U(Up), D(Down)

Figure 3.1 Download mode configuration

2) UART connection between PC and EVK

Before downloading, connect user PC (USB port) to EVK (Mini USB Type B port) and check the COM port number in Device Manager in Windows. User will need to provide this number to BDT.

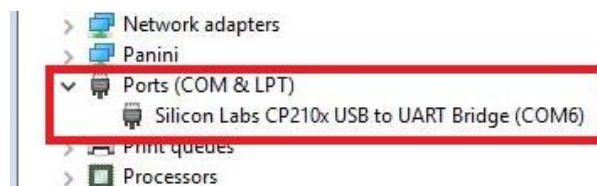


Figure 3.2 Checking COM port number in Device Manager

3) Download unified binary with BDT

Start BDT by double clicking “newrafc_gui_xip.exe” executable file and enter full path of the binary file (nrc7292_standalone_xip.bin) or select from the opening dialog box. After selecting binary file to download, user will need to provide the BDT the location of bootloader file (boot.bin) and COM port number. If user do not move “boot.bin” file to other location, BDT can automatically find it in the default path (<workspace_root>/tool/bootloader/boot.bin).

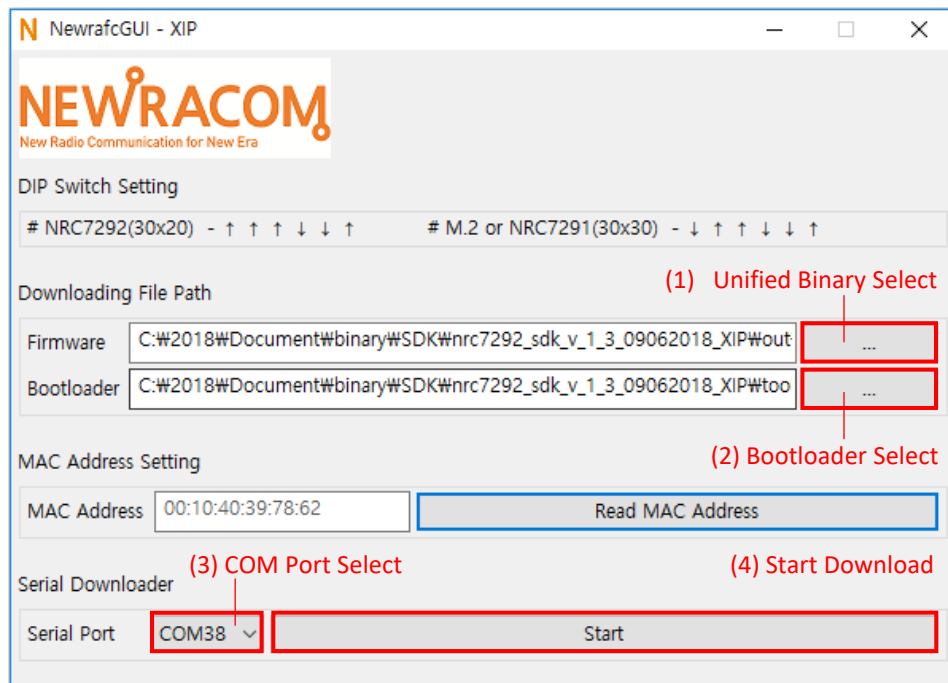


Figure 3.3 NRC7292 binary download tool

After completing binary, bootloader, and COM port selection, user can start downloading by pressing “Start” button.

(Downloading 이 성공적으로 완료된 것을 확인할 수 있는 방법이 있으면 좋겠음)

4) Standalone operation mode settings

Once download is complete, configure the Operating Mode Switch to Standalone mode as shown in Figure 3.4.

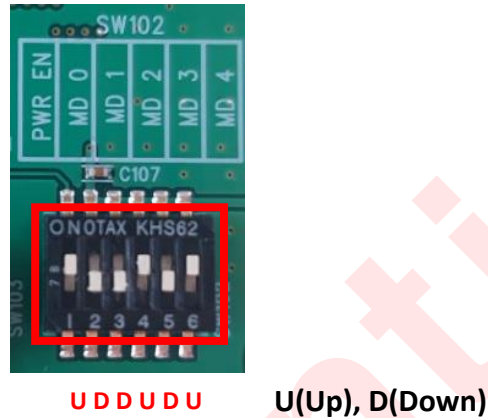


Figure 3.4 Standalone mode configuration

5) Start standalone mode on EVK

Start standalone mode by powering on the EVK by the power switch.



Figure 3.5 Power switch

4 How to conduct iPerf test

 **Note:** In this iPerf test , we use *iperf* instead of *iperf3*.

4.1 AP Preparation

Please refer to the doc/NRC7292_EVK_User_Guide(HM).pdf of SDK.

4.1.1 Run iperf server at AP side

 **Note:** Following *iperf* commands can be used in standalone STA.

4.1.1.1 TCP mode

```
pi@aaron-halow-ap1:~ $ iperf -s
-----
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
-----
```

4.1.1.2 UDP mode

```
pi@aaron-halow-ap1:~ $ iperf -s -u
-----
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size: 160 KByte (default)
-----
```

4.2 STA Preparation

xxx

4.2.1 Run standalone mode STA

When you power on the STA, you can see the log as below.

```

Serial-COM16 - SecureCRT
File Edit View Options Transfer Script Tools Help
Serial-COM16
WPA IE: null
freq mode(0), freq(5220), channel(0), ht_enabled=(0)sec_channel_offset=(0), vht_enabled=(0), center
_freq1=(0)center_freq2=(0), bandwidth=(0)
Driver: wpa_driver_nrc_sta_associate
ll_us: 0
WPA: Event ASSOC (0) received
WPA: Association info event
resp_ies - hexdump(len=103): 01 08 8c 12 98 24 b0 48 60 6c 2d 1a 00 00 00 00 00 00 01 08 8c 12 98 2
4 b0 48 60 6c 42 10 ec c1 43 10 ec c1 43 10 3d 16 00 00 01 08 8c 12 98 24 b0 48 60 6c 42 10 ec c1 4
3 10 ec c1 43 10 5a 03 02 40 00 7f 08 42 10 ec c1 43 10 ec c1 dd 18 00 50 f2 02 01 01 00 00 03 a4 0
0 00 27 a4 00 00 42 43 5e 00 62 32 2f 00
WPA: freq=2457 MHZ
WPA: State: ASSOCIATING -> ASSOCIATED
Driver: wpa_driver_nrc_set_operstate(0x104262a0,state=0)
WPA: Associated to a new BSS: BSSID=02:00:eb:1b:e9:cd
WPA: Associated with 02:00:eb:1b:e9:cd
WPA: WPA: Association event - clear replay counter
WPA: WPA: Clear old PTK
l2_packet_notify_auth_start
[time]<4way>
EAPOL: External notification - portEnabled=0
EAPOL: External notification - portValid=0
EAPOL: External notification - portEnabled=1
EAPOL: SUPP_PAE entering state S_FORCE_AUTH
EAPOL: Supplicant port status: Authorized
Driver: wpa_driver_nrc_set_supp_port 1
EAPOL: SUPP_BE entering state IDLE
WPA: Cancelling authentication timeout
WPA: State: ASSOCIATED -> COMPLETED
WPA: Radio work 'sme-connect'@0x10426ee8 done in 0.000000 seconds
WPA: radio_work_free('sme-connect'@0x10426ee8: num_active_works --> 0
WPA: CTRL-EVENT-CONNECTED - Connection to 02:00:eb:1b:e9:cd completed [id=0 id_str=]
Driver: wpa_driver_nrc_set_operstate(0x104262a0,state=1)
WPA: Cancelling scan request
WMM AC: Missing U-APSD configuration
WPA: CTRL-EVENT-SUBNET-STATUS-UPDATE status=0
Driver: wpa_driver_nrc_get_aid() AID = 1

[on_set] WIM_TLV_AID (AID: 1)
[on_set] WIM_TLV_BSSID (BSSID: 02:00:eb:1b:e9:cd)
wim-manager: on_sta_cmd
[on_sta_cmd_handle] WIM_STA_CMD_ADD:02:00:eb:1b:e9:cd,aid:1

Ready Serial: COM16 43, 1 43 Rows, 99 Cols VT100 CAP NUM

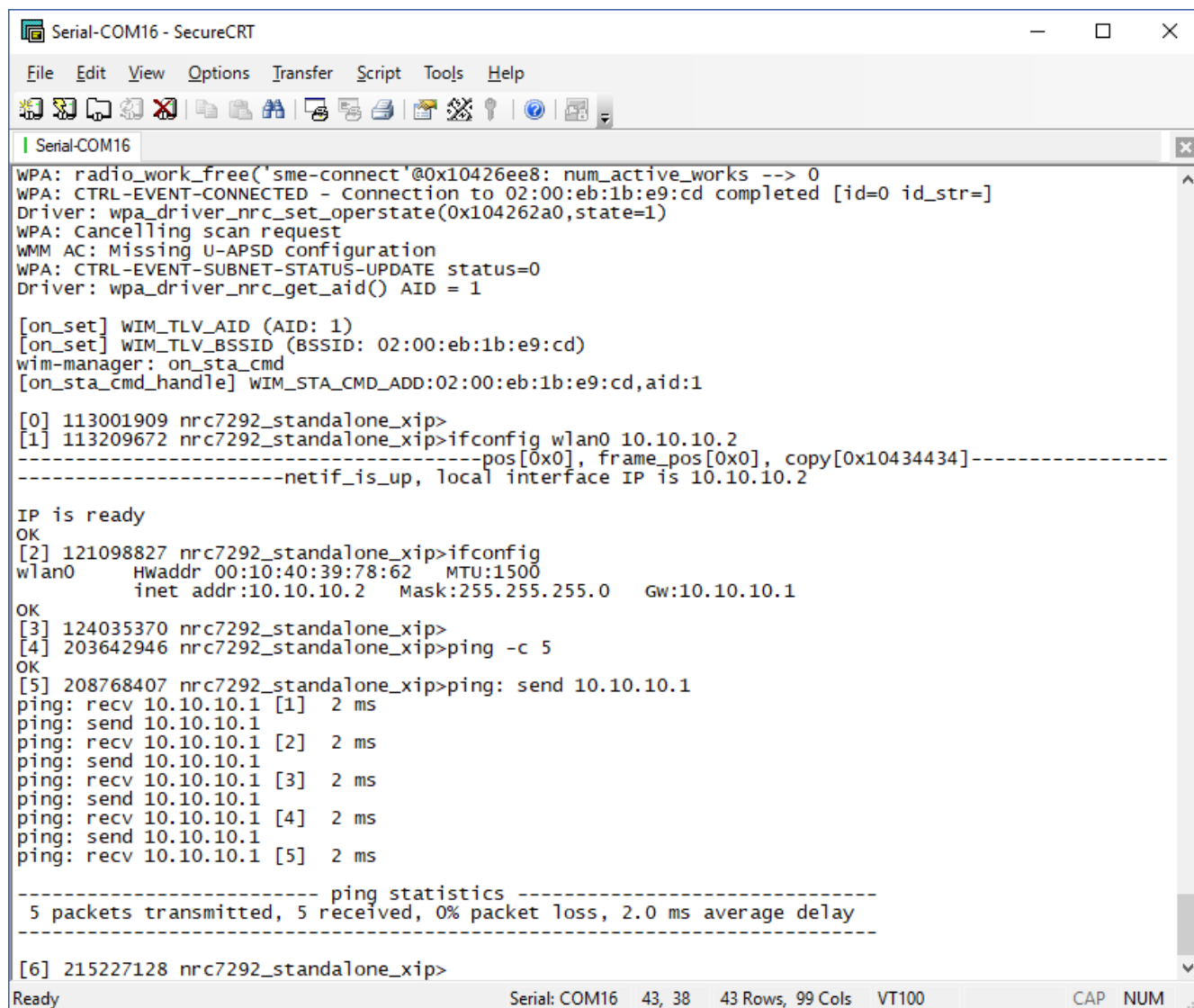
```

4.2.2 Configure IP address of STA

Now you need to configure IP address of STA with ifconfig command like this.

```
ifconfig wlan0 10.10.10.2
```

And then you can check the connection with ping command.



```

Serial-COM16 - SecureCRT
File Edit View Options Transfer Script Tools Help
Serial-COM16
WPA: radio_work_free('sme-connect'@0x10426ee8: num_active_works --> 0
WPA: CTRL-EVENT-CONNECTED - Connection to 02:00:eb:1b:e9:cd completed [id=0 id_str=]
Driver: wpa_driver_nrc_set_operstate(0x104262a0,state=1)
WPA: Cancelling scan request
WMM AC: Missing U-APSD configuration
WPA: CTRL-EVENT-SUBNET-STATUS-UPDATE status=0
Driver: wpa_driver_nrc_get_aid() AID = 1

[on_set] WIM_TLV_AID (AID: 1)
[on_set] WIM_TLV_BSSID (BSSID: 02:00:eb:1b:e9:cd)
wim-manager: on_sta_cmd
[on_sta_cmd_handle] WIM_STA_CMD_ADD:02:00:eb:1b:e9:cd,aid:1

[0] 113001909 nrc7292_standalone_xip>
[1] 113209672 nrc7292_standalone_xip>ifconfig wlan0 10.10.10.2
-----pos[0x0], frame_pos[0x0], copy[0x10434434]-----
-----netif_is_up, local interface IP is 10.10.10.2

IP is ready
OK
[2] 121098827 nrc7292_standalone_xip>ifconfig
wlan0      Hwaddr 00:10:40:39:78:62  MTU:1500
          inet addr:10.10.10.2  Mask:255.255.255.0  Gw:10.10.10.1
OK
[3] 124035370 nrc7292_standalone_xip>
[4] 203642946 nrc7292_standalone_xip>ping -c 5
OK
[5] 208768407 nrc7292_standalone_xip>ping: send 10.10.10.1
ping: rcv 10.10.10.1 [1]  2 ms
ping: send 10.10.10.1
ping: rcv 10.10.10.1 [2]  2 ms
ping: send 10.10.10.1
ping: rcv 10.10.10.1 [3]  2 ms
ping: send 10.10.10.1
ping: rcv 10.10.10.1 [4]  2 ms
ping: send 10.10.10.1
ping: rcv 10.10.10.1 [5]  2 ms

----- ping statistics -----
 5 packets transmitted, 5 received, 0% packet loss, 2.0 ms average delay

[6] 215227128 nrc7292_standalone_xip>
Ready                               Serial: COM16  43, 38  43 Rows, 99 Cols  VT100  CAP  NUM

```

Now standalone mode STA is ready for iperf test.

4.2.3 Run iperf client at STA side

 **Note:** Following iperf commands can be used in AP.

4.2.3.1 TCP mode

Following figure shows the iperf TCP client example.

```
[11] 40516315 nrc7292_standalone_xip>iperf -c 10.10.10.1 -w 320k -t 10
iperf_threOK
ad start!!!
[12] 4iperf ttcp cp client client modemode, port:5, port:5001001 duration duration:1:10[sec]
0[sec]
[IPERF Report] type=1, Remote: 10.10.10.1:5001, 1070096 [Bytes], Duration:10017 [msec], 854 [kbits/
s]
```

4.2.3.2 UDP mode

Following figure shows the iperf UDP client example.

```
[15] 116621624 nrc7292_standalone_xip>iperf -c 10.10.10.1 -u -b 15M -t 10
OK
[16] 124897986 nrc7292_standalone_xip>iperf udp client mode, port:5001 duration:10[sec]
iperf start: packet delay = 0 ms, bandwidth = 15000000
[IPERF Report] type=7, Remote: 10.10.10.1:5001, 2121210 [Bytes], Duration:10020 [msec], 1693 [kbits
/s]
```


5 Abbreviations and acronyms

[illegible]

6 Revision history

Revision No	Date	Comments
Ver 0.1	10/30/2018	Initial version