



TOE100G-IP Two-port Instruction

1	Overview	1
2	PC Setup.....	2
2.1	IP Setting	2
2.2	Frame Setting	3
2.3	Power Option Setting.....	5
3	Ping demo	6
3.1	Display TCPIP parameters	7
3.2	Reset TCPIP parameters.....	8
3.3	Send Data Test	10
3.4	Receive Data Test.....	15
3.5	Full duplex Test.....	18
3.6	Ping reply Test	20
4	DHCP demo	21
4.1	DHCP Server Setting.....	21
4.2	DHCP test.....	24
4.2.1	Boot menu.....	24
4.2.2	Release IP address.....	25
5	Revision History	27

TOE100G-IP Two-port Instruction

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1 Overview

This document shows the example to run TOE100G-IP two-port demo. The first port is for transferring high-speed TCP payload data with TOE100G-IP while the second port is the slow-speed connection. For slow-port connection, two demos are implemented, Ping test and DHCP test. The details of high-speed connection of two-port demo are similar to the standard demo.

The test environment uses one FPGA board connecting with one Test PC for transferring Ethernet packet on 100GbE network. The transfer performance of high-speed port is limited by Test PC resource. To achieve the best performance, it needs to run the demo by using two FPGA boards which integrates TOE100G-IP for transferring the data each other. Please see more details from TOE100G-IP instruction document.

In the document, topic 2 shows the example to set up 100Gb Ethernet card on Test PC to get the good performance for transferring Ethernet packet via 100GbE network. Next, topic 3 shows the example console to run Ping demo. Finally, topic 4 shows the example console to run DHCP demo. More details of each topic are described as follows.

2 PC Setup

Before running demo, please check the network setting on PC. The example for setting 100Gb Ethernet card is described as follows.

2.1 IP Setting

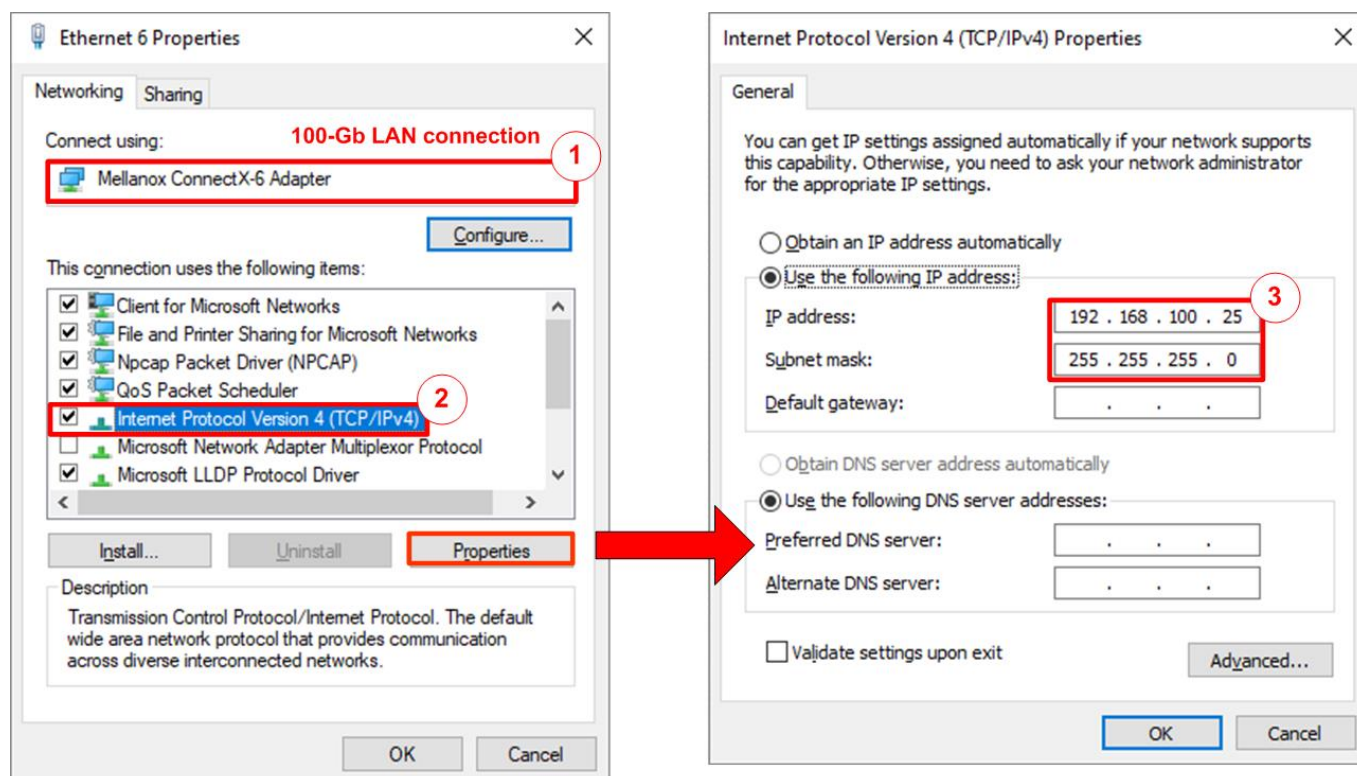


Figure 2-1 Setting IP address for PC

- 1) Open Local Area Connection Properties of 100-Gb connection, as shown in the left window of Figure 2-1.
- 2) Select "TCP/IPv4" and then click Properties.
- 3) Set IP address = 192.168.100.25 and Subnet mask = 255.255.255.0, as shown in the right window of Figure 2-1.

2.2 Frame Setting

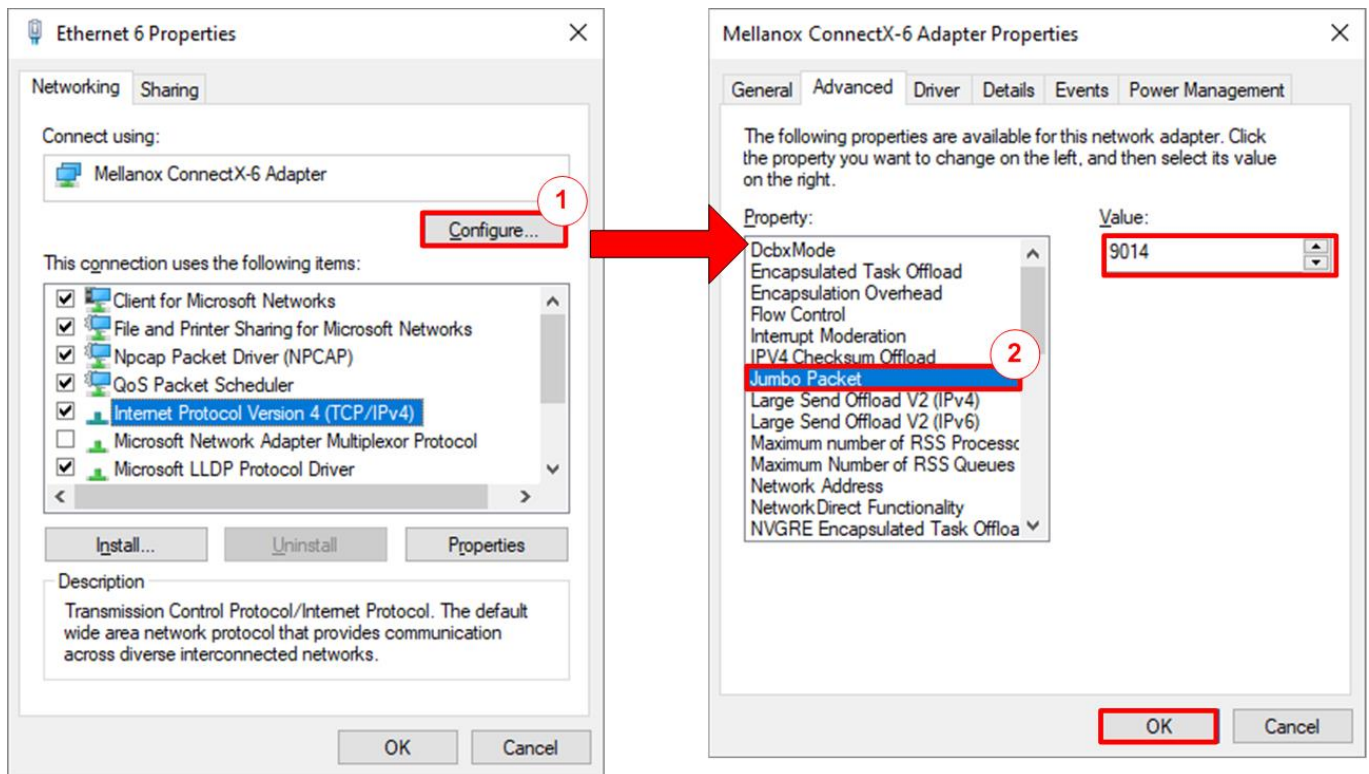


Figure 2-2 Set frame size = Jumbo frame

- 1) On Local Area Connection Properties window, click “Configure” as shown in Figure 2-2.
- 2) On Advanced Tab, select “Jumbo Packet”. Set Value to “9014 Bytes” for Jumbo Frame support or set value to “Disabled” for non-Jumbo Frame support, as shown in the right window of Figure 2-2.

- 3) Select “Flow Control” and set value to “Disabled”, as shown in the left window of Figure 2-3.
- 4) Select “Interrupt Moderation” and set value to “Disabled”, as shown in the right window of Figure 2-3.
- 5) Click “OK” button to save and exit all setting windows.

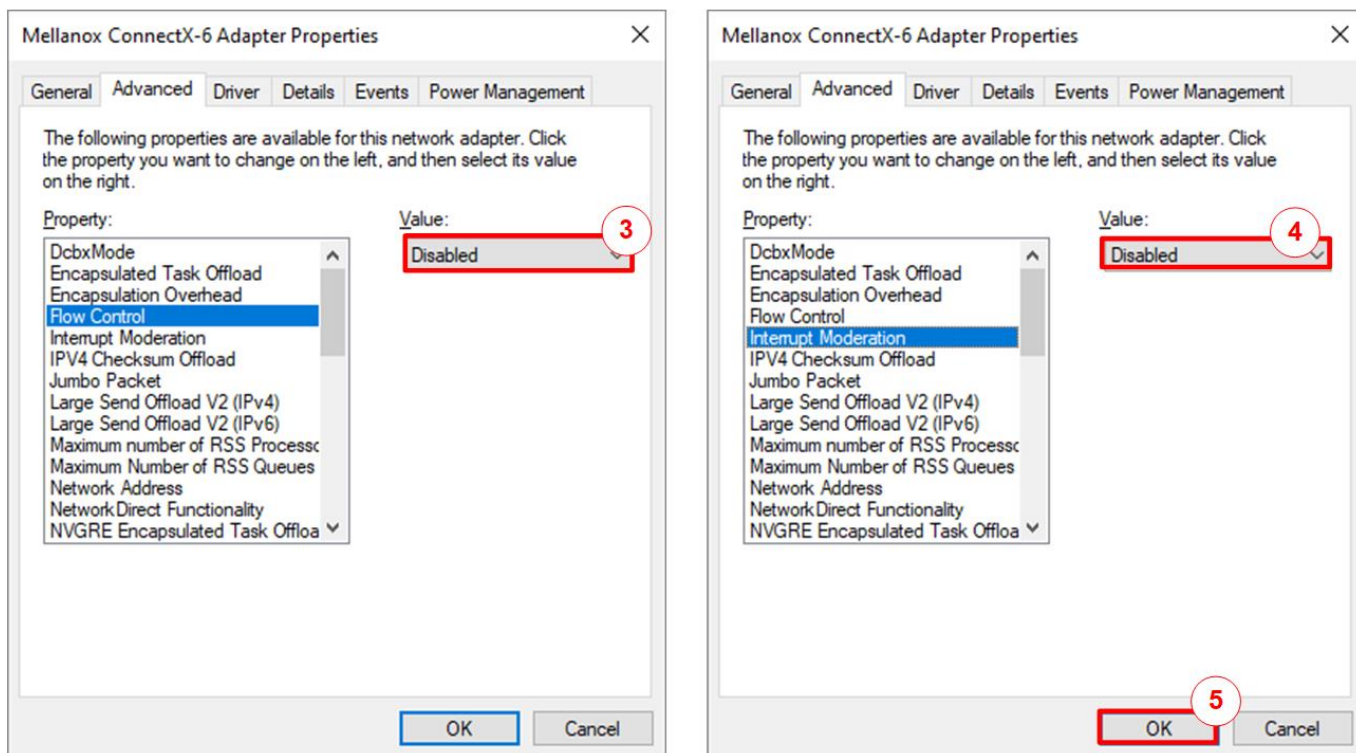


Figure 2-3 Set Flow Control and Interrupt Moderation

2.3 Power Option Setting

- 1) Open Control Panel and select Power Options as shown in the left window of Figure 2-4.
- 2) Change setting to High Performance as shown in the right window of Figure 2-4.

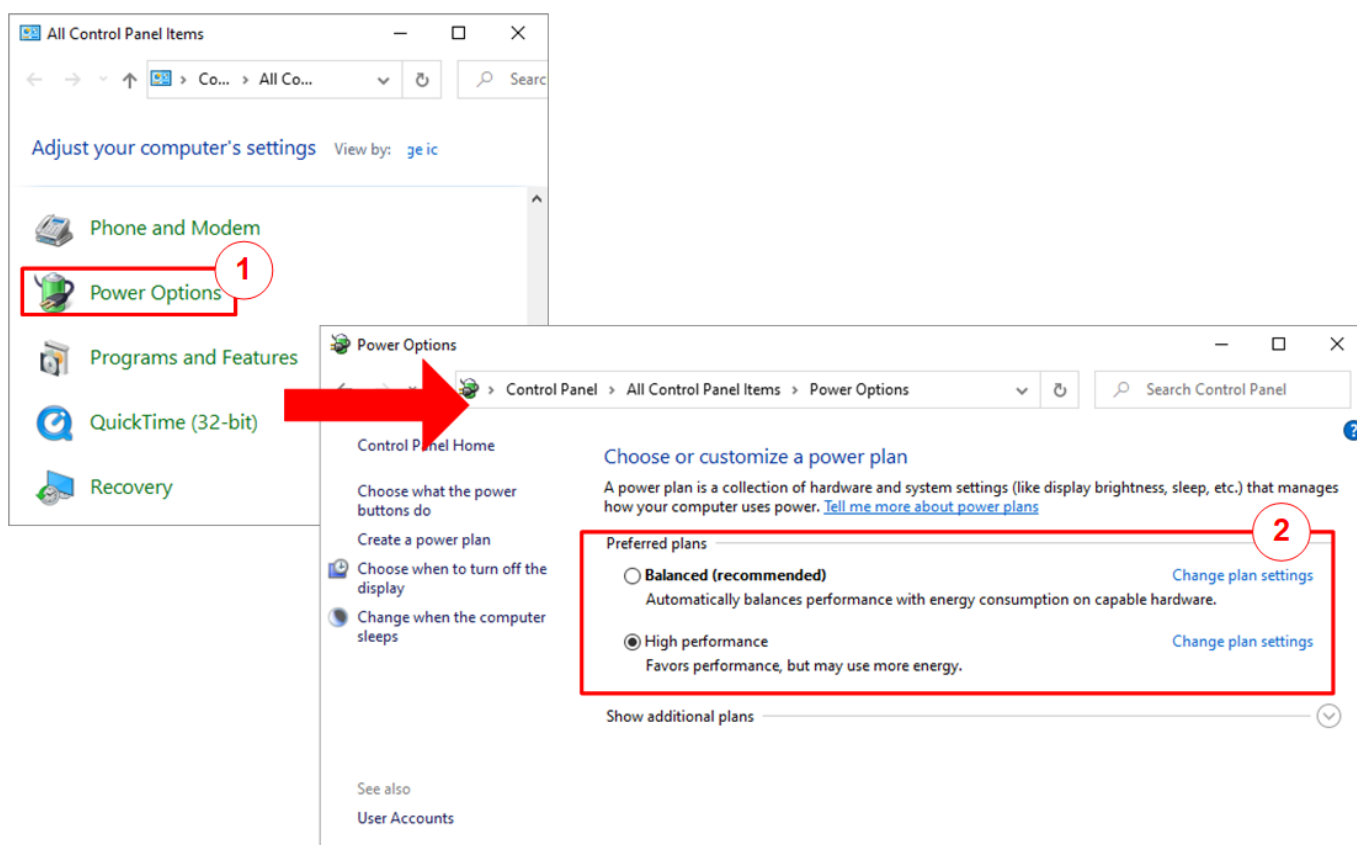


Figure 2-4 Power options

3 Ping demo

Before running the demo, please prepare test environment for VCK190 development board, as described in “dg_toeudp100gip_fpgasetup_xilinx” document. After finishing downloading configuration file, the main menu is displayed. Comparing to the standard demo, menu [5] is additional for running Ping reply test. The details of each menu are described as follows.

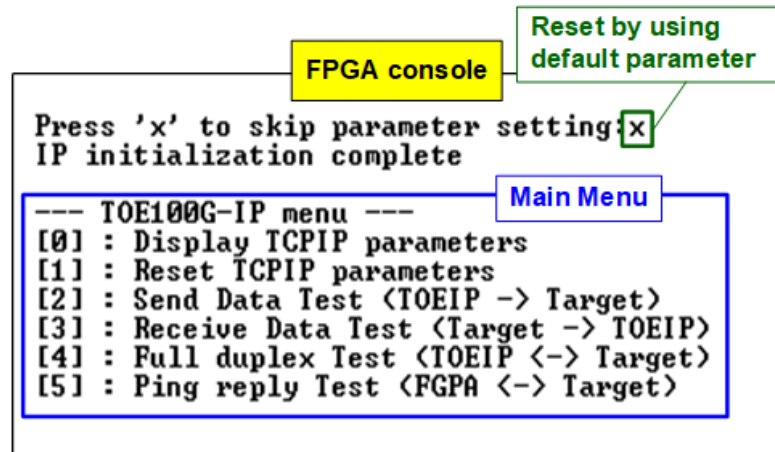


Figure 3-1 Main menu of Ping demo

3.1 Display TCPIP parameters

Select '0' to check current parameter in the demo. There are eight parameters in Client/Server mode or nine parameters in Fixed MAC mode displayed on the console.

Client Mode	Fixed MAC Mode
<pre> +++ Current Network Parameter Window Update Gap = 0 Reverse Packet = ENABLE Mode = CLIENT FPGA MAC address = 0x000102030405 FPGA IP = 192.168.100.42 FPGA port number = 60000 Target IP = 192.168.100.25 Target port number = 60001 --- TOE100G-IP menu --- [0] : Display TCPIP parameters [1] : Reset TCPIP parameters [2] : Send Data Test <TOEIP -> Target> [3] : Receive Data Test <Target -> TOEIP> [4] : Full duplex Test <TOEIP <-> Target> [5] : Ping reply Test <FGPA <-> Target> </pre>	<pre> +++ Current Network Parameter +++ Window Update Gap = 0 Reverse Packet = ENABLE Mode = FIXED MAC FPGA MAC address = 0x000102030405 FPGA IP = 192.168.100.42 FPGA port number = 60000 Target MAC address = 0x554433221100 Target IP = 192.168.100.25 Target port number = 60001 --- TOE100G-IP menu --- [0] : Display TCPIP parameters [1] : Reset TCPIP parameters [2] : Send Data Test <TOEIP -> Target> [3] : Receive Data Test <Target -> TOEIP> [4] : Full duplex Test <TOEIP <-> Target> [5] : Ping reply Test <FGPA <-> Target> </pre>

Figure 3-2 Display current parameter result

- 1) Window Update Gap: Set threshold value to transmit window update packet. Valid value is 0x00 – 0x3F (0-63). The unit size of threshold value is 1 Kbyte. Default value is 0 (disable window update feature).
- 2) Reverse Packet: This flag is enabled to allow the IP sending the retransmitted packet when IP waits Windows update packet returned from the target for long time. Default value is ENABLE.
- 3) Mode: Set mode to TOE100G-IP to initialize in Server, Client, or Fixed MAC. To run with PC, please input '0' to initialize the IP in client mode.
- 4) FPGA MAC address: 48-bit hex value to be MAC address of FPGA. Default value is 0x000102030405.
- 5) FPGA IP: IP address of FPGA. Default value is 192.168.100.42.
Note: This value is used to be server IP address parameter for test application on PC.
- 6) FPGA port number: Port number of FPGA. Default value is 60000.
Note: This value is used to be server port for test application on PC.
- 7) Target MAC address (displayed when running Fixed MAC mode only): 48-bit hex value to be MAC address of the target device. Default value is 0x554433221100.
- 8) Target IP: IP address of the target device (100 Gb Ethernet on PC). Default value is 192.168.100.25.
- 9) Target port number: Port number of the target device to transfer 100 Gb Ethernet data. Default value is 60001.

To change some parameters, user can set by using menu [1].

3.2 Reset TCPIP parameters

Select '1' to reset the IP and change IP parameters.

This menu is used to change IP parameters or send reset to TOE100G-IP. After user selects this menu, the current parameters are displayed on the console. User enters 'x' to use the same parameters while other keys are entered to change some parameters. After the parameters are fixed, TOE100G-IP is reset and start the initialization process.

There are 7-9 parameters to set in this menu. Each parameter is verified by CPU. The parameter is updated to TOE100G-IP when the input is valid. If the input is not valid, the parameter does not change. After user inputs all parameters, the IP is reset. The description of each parameter is shown in topic 3.1 (Display TCPIP parameter) and the range of each parameter is described as follows.

- 1) Mode: Input '0' to initialize the IP as client mode.
Note: When TestPC and FPGA are connected in different network which cannot communicate by ARP process, it needs to run TOE100G-IP in Fixed MAC mode to set MAC address manually via the console instead of using ARP process
- 2) Reverse Packet: Set '0' to disable or '1' to enable this feature.
- 3) Window Update Gap: Set threshold value to transmit window update packet. Valid value is 0x00 – 0x3F (0-63). The unit size of threshold value is 1 Kbyte. Default value is 0 (disable window update feature).
- 4) FPGA MAC address: Input 12 digits of hex value. Add "0x" as a prefix to input as hex value.
- 5) FPGA IP address: A set of four decimal digits is separated by ".". The valid range of each decimal digit is 0-255.
Note: This parameter is not displayed when running in DHCP demo.
- 6) FPGA port number: Valid range is 0-65535.
- 7) Target MAC address (displayed when running Fixed MAC mode only): Input 12 digits of hex value. Add "0x" as a prefix to input as hex value.
- 8) Target IP address: A set of four decimal digits, similar to FPGA IP address. This value is IP address of Test PC.
- 9) Target port number: Valid range is 0-65535.

After finishing parameter assignment, new parameter set is displayed on the console. Next, the reset signal is sent to the IP to initialize the IP by using new parameters. Finally, "IP initialization complete" is shown after IP completes initialization process, as shown in Figure 3-3.

Change parameters (Client mode)

Change parameters (Fixed MAC mode)

◆ : User Input
◆ : User Output

```

+++ Reset TOE100G-IP +++
+++ Current Network Parameter +++
Window Update Gap = 0
Reverse Packet = ENABLE
Mode = CLIENT
FPGA MAC address = 0x000102030405
FPGA IP = 192.168.100.42
FPGA port number = 60000
Target IP = 192.168.100.25
Target port number = 60001
Press 'x' to skip parameter setting:y
Input mode : [0] Client [1] Server [2] Fixed MAC => 2
+++ Current Network Parameter +++
Window Update Gap = 0
Reverse Packet = ENABLE
Mode = FIXED MAC
FPGA MAC address = 0x000102030405
FPGA IP = 192.168.100.42
FPGA port number = 60000
Target MAC address = 0x554433221100
Target IP = 192.168.100.25
Target port number = 60001
Press 'x' to skip parameter setting:y
Reverse Packet : [0] Disable [1] Enable => n
Invalid input : Parameter not change
Window Update Threshold <0-63> : n
Invalid input : Parameter not change
Input FPGA MAC address : n
Invalid input : Parameter not change
Input FPGA IP address : n
Invalid input : Parameter not change
Input FPGA port number : n
Invalid input : Parameter not change
Input Target IP address : n
Invalid input : Parameter not change
Input Target port number : 50000
+++ Current Network Parameter +++
Window Update Gap = 0
Reverse Packet = ENABLE
Mode = CLIENT
FPGA MAC address = 0x000102030405
FPGA IP = 192.168.100.42
FPGA port number = 60000
Target IP = 192.168.100.25
Target port number = 50000
WARNING: Please also change IP setting and port number on Test
IP initialization complete

--- TOE100G-IP menu ---
[0] : Display TCPIP parameters
[1] : Reset TCPIP parameters
[2] : Send Data Test <TOEIP -> Target>
[3] : Receive Data Test <Target -> TOEIP>
[4] : Full duplex Test <TOEIP <-> Target>
[5] : Ping reply Test <FGPA <-> Target>

+++ Current Network Parameter +++
Window Update Gap = 0
Reverse Packet = ENABLE
Mode = FIXED MAC
FPGA MAC address = 0x000102030405
FPGA IP = 192.168.100.42
FPGA port number = 60000
Target MAC address = 0xA1B2C3D4E5F6
Target IP = 192.168.100.25
Target port number = 60001
WARNING: Please also change IP setting and port number on Test
IP initialization complete
    
```

Annotations:

- Current parameter before changing:** Points to the initial parameter list.
- Input other keys (not 'x') to change parameter:** Points to the '2' key input.
- Input invalid value to use same value:** Points to 'n' inputs for Reverse Packet, Window Update Threshold, and Target IP.
- Input valid value to change parameter:** Points to the '50000' input for Target port number.
- Input '2' to change to Fixed MAC mode:** Points to the '2' key input.
- Current parameters are displayed when the mode is changed:** Points to the second parameter list.
- Input new Target MAC address:** Points to the '0xA1B2C3D4E5F6' input.
- New parameter:** Points to the updated '50000' Target port number.

Figure 3-3 Change IP parameter result

3.3 Send Data Test

To transfer data from FPGA to PC, select '2' to run send data test on FPGA and run "tcpdatatest.exe" on PC to receive data. User inputs test parameters for sending data on the console. On PC, user inputs test parameters of "tcpdatatest" to receive data via Command prompt. The sequence to run the test is shown as follows.

- 1) On FPGA console, input three parameters under send data test menu.
 - a) Input transfer size: Unit of transfer size is byte. Valid value is 0x40 - 0x3F_FFFF_FFC0. The input must be aligned to 64. The input is decimal unit when input only digit number. User adds "0x" to be a prefix for hexadecimal unit.
 - b) Input packet size: Unit of packet size is byte. Valid value is 64 – 8960. The input must be aligned to 64. The input is decimal unit when input only digit number. User adds "0x" to be a prefix for hexadecimal unit.

Note: If packet size is more than 1408, the packet output from TOE100G-IP is jumbo frame. In this case, Test PC must support jumbo frame.
 - c) Input Mode: Mode of FPGA to transfer data. Input '1' to transfer as Server mode.
- 2) If all inputs are valid, the recommended parameters to run test application on PC is displayed. Next, "Wait Open connection ..." is displayed to wait the application running on PC.
- 3) On Command prompt, input test parameters following the recommended value. There are six parameters for "tcpdatatest".


```
>> tcpdatatest <mode> <dir> <server IP> <server port> <bytelen> <pattern>
```

 - a) Mode: Input 'c' to run Test PC as a client.
 - b) Dir: Input 'r' to run Test PC for receiving and verifying test data from FPGA
 - c) Server IP: Input the same value as IP address of FPGA
 - d) Server port: Input the same value as port number of FPGA
 - e) Bytelen: Input the same value as "Input transfer size" of step 1a)
 - f) Pattern: Input '1' to verify data from FPGA or '0' to not verify data
- 4) After running the test application, the port is created. Current transfer size is displayed on the console (transmit size) and Command prompt (receive size) every second. "Send data complete" is displayed on the console after all data are sent.
- 5) FPGA closes the connection. Finally, total transfer size and performance are displayed on the console (transmit performance) and Command prompt (receive performance).

Figure 3-4 shows the example of send data test when using non-jumbo frame size with enabling data verification on Command prompt. The left window is FPGA console operating as Server and the right window is Command prompt on PC operating as Client.

Figure 3-5 shows the example performance when running non-jumbo frame size with disabling data verification. The result shows the better performance than enabling data verification.

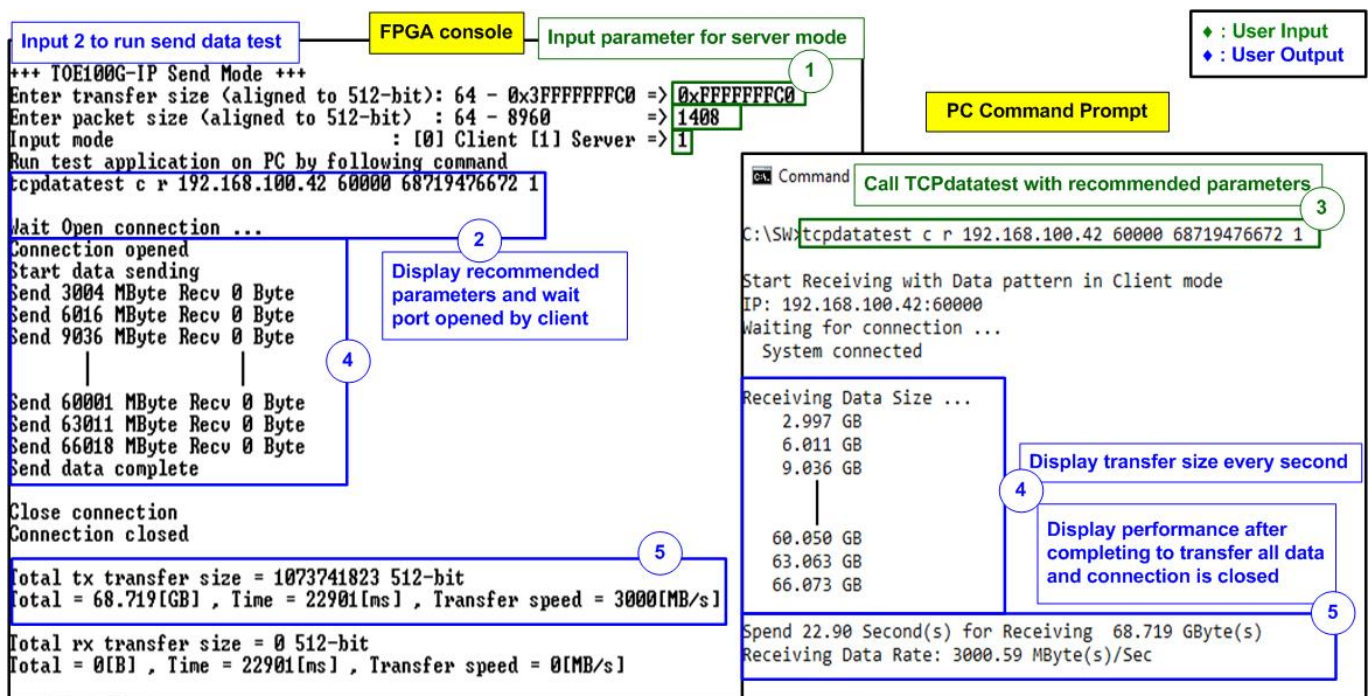


Figure 3-4 Send data test by using non-jumbo frame with data verification

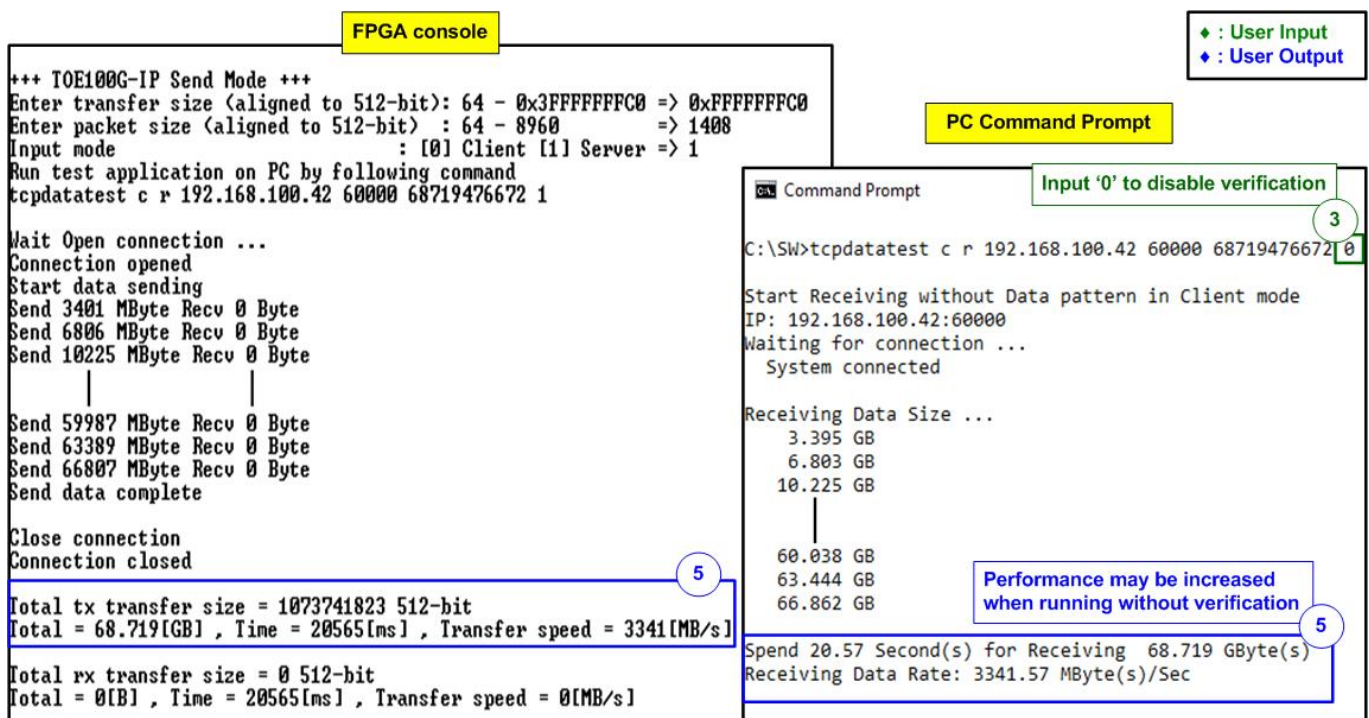


Figure 3-5 Send data test by using non-jumbo frame without data verification

Figure 3-6 shows the example performance when running by using maximum packet size. Comparing to Figure 3-4, the performance is reduced.

Figure 3-7 shows the example performance which can achieve the best performance in the test environment when using 3200-byte packet size and disable data verification.

Note:

- 1) Under 100Gb test environment, it is found that when using the maximum packet size, all data in the buffer of TOE100G-IP is completely transferred to PC very fast while ACK packet returned from PC which is applied to clear the buffer has much latency. Therefore, TOE100G-IP pauses data sending to wait until ACK packet is returned before sending the next data. The maximum performance is achieved when the packet size can balance the time usage for transmitting data and receiving the ACK packet.
- 2) The performance by FPGA and PC may be not stable. It depends on how to Windows OS handling the application during running the test.

FPGA console

```

+++ TOE100G-IP Send Mode +++
Enter transfer size (aligned to 512-bit): 64 - 0x3FFFFFFC0 => 0xFFFFFFFFC0
Enter packet size (aligned to 512-bit) : 64 - 8960 => 8960
Input mode : [0] Client [1] Server => 1
Run test application on PC by following command
tcpdatatest c r 192.168.100.42 60000 68719476672 1

Wait Open connection ...
Connection opened
Start data sending
Send 2798 MByte Recv 0 Byte
Send 5586 MByte Recv 0 Byte
Send 8383 MByte Recv 0 Byte

Send 63540 MByte Recv 0 Byte
Send 65925 MByte Recv 0 Byte
Send 68719 MByte Recv 0 Byte
Send data complete

Close connection
Connection closed

Total tx transfer size = 1073741823 512-bit
Total = 68.719[GB] , Time = 26007[ms] , Transfer speed = 2642[MB/s]

Total rx transfer size = 0 512-bit
Total = 0[B] , Time = 26007[ms] , Transfer speed = 0[MB/s]

```

PC Command Prompt

```

Select Command Prompt
C:\SW>tcpdatatest c r 192.168.100.42 60000 68719476672 1

Start Receiving with Data pattern in Client mode
IP: 192.168.100.42:60000
Waiting for connection ...
System connected

Receiving Data Size ...
2.792 GB
5.583 GB
8.384 GB

61.427 GB
64.202 GB
66.595 GB

Spend 26.01 Second(s) for Receiving 68.719 GByte(s)
Receiving Data Rate: 2642.24 MByte(s)/Sec

```

Figure 3-6 Send data test by using maximum packet size

FPGA console

```

+++ TOE100G-IP Send Mode +++
Enter transfer size (aligned to 512-bit): 64 - 0x3FFFFFFC0 => 0x3FFFFFFC0
Enter packet size (aligned to 512-bit) : 64 - 8960 => 3200
Input mode : [0] Client [1] Server => 1
Run test application on PC by following command
tcpdatatest c r 192.168.100.42 60000 68719476672 1

Wait Open connection ...
Connection opened
Start data sending
Send 3394 MByte Recv 0 Byte
Send 6794 MByte Recv 0 Byte
Send 10203 MByte Recv 0 Byte
|
Send 60727 MByte Recv 0 Byte
Send 64111 MByte Recv 0 Byte
Send 67506 MByte Recv 0 Byte
Send data complete

Close connection
Connection closed

Total tx transfer size = 1073741823 512-bit
Total = 68.719[GB] , Time = 20363[ms] , Transfer speed = 3374[MB/s]

Total rx transfer size = 0 512-bit
Total = 0[B] , Time = 20363[ms] , Transfer speed = 0[MB/s]

```

PC Command Prompt

```

C:\SW>tcpdatatest c r 192.168.100.42 60000 68719476672 0

Start Receiving without Data pattern in Client mode
IP: 192.168.100.42:60000
Waiting for connection ...
System connected

Receiving Data Size ...
 3.415 GB
 6.817 GB
10.230 GB
|
61.025 GB
64.411 GB
67.816 GB

Spend 20.36 Second(s) for Receiving 68.719 GByte(s)
Receiving Data Rate: 3374.56 MByte(s)/Sec

```

◆ : User Input
◆ : User Output

Figure 3-7 Send data test when using 3200-byte packet size

If the input is invalid, “Out-of-range input” or “Invalid input” is displayed. After that, the operation is cancelled, as shown in Figure 3-8 - Figure 3-10.

```

+++ TOE100G-IP Send Mode +++
Enter transfer size <aligned to 512-bit>: 64 - 0x3FFFFFFC0 => 0xFFFFFFFF
Out-of-range input
  
```

Figure 3-8 Error from invalid transfer size

```

+++ TOE100G-IP Send Mode +++
Enter transfer size <aligned to 512-bit>: 64 - 0x3FFFFFFC0 => 0xFFFFFFFFC0
Enter packet size <aligned to 512-bit> : 64 - 8960 => 1
Out-of-range input
  
```

Figure 3-9 Error from invalid packet size

```

+++ TOE100G-IP Send Mode +++
Enter transfer size <aligned to 512-bit>: 64 - 0x3FFFFFFC0 => 0xFFFFFFFFC0
Enter packet size <aligned to 512-bit> : 64 - 8960 => 8960
Input mode : [0] Client [1] Server => 3
Invalid input
  
```

Figure 3-10 Error from invalid mode

3.4 Receive Data Test

To transfer data from PC to FPGA, select '3' to run receive data test on FPGA and run "tcpdatatest.exe" on PC to send data. User inputs test parameters on FPGA for receiving data on FPGA console. On PC, user inputs test parameters of "tcpdatatest" to send data on Command prompt. The sequence to run the test is shown as below.

- 1) On FPGA console, input three parameters in receive data test.
 - a) Input transfer size: Unit of transfer size is byte. Valid value is 0x40 - 0x3F_FFFF_FFC0. The input must be aligned to 64. The input is decimal unit when input only digit number. User adds "0x" to be a prefix for hexadecimal unit.
 - b) Input data verification mode: Set '0' to disable data verification or '1' to enable data verification sent from PC.
 - c) Input Mode: Mode of FPGA to transfer data. Input '1' to transfer as server mode.
- 2) If inputs are valid, the recommended parameters to run test application on PC are displayed. Next, "Wait Open connection ..." is displayed to wait until the application on PC running.
- 3) On Command prompt, input test parameters following the recommended value. There are six parameters for "tcpdatatest".


```
>> tcpdatatest <mode> <dir> <server IP> <server port> <bytelen> <pattern>
```

 - a) Mode: Input 'c' to run Test PC as a client.
 - b) Dir: Input 't' to run Test PC for sending test data to FPGA
 - c) Server IP: Input the same value as IP address of FPGA
 - d) Server port: Input the same value as port number of FPGA
 - e) Bytelen: Input the same value as "Input transfer size" of step 1a)
 - f) Pattern: Input the same value as "Input data verification mode" of step 1b). Select '0' to send dummy data or '1' to send incremental data.
- 4) After running the test application, the port is created. Current transfer size is displayed on FPGA console (receive size) and Command prompt (transmit size) every second.
- 5) "Connection closed" and "Received data completed" are displayed on FPGA console after PC finishes sending all data and closing the connection. Finally, total transfer size and performance are displayed on FPGA console (receive performance) and Command prompt (transmit performance).

Figure 3-11 shows the example of receive data test when data verification mode on FPGA is disabled and dummy data is sent by PC. The left window is test result on FPGA console while the right window is test result on Command prompt.

Figure 3-12 shows the example of receive data test when data verification mode on FPGA is enabled and incremental data is sent by PC. Comparing to Figure 3-11, the performance in the test environment is reduced when running by using incremental data instead of dummy data.

Figure 3-13 shows the example of error when data verification is failed. In the example, the error is caused from mismatch verification mode value. FPGA enables data verification while "tcpdatatest" sends dummy data. The error message is displayed on FPGA console.

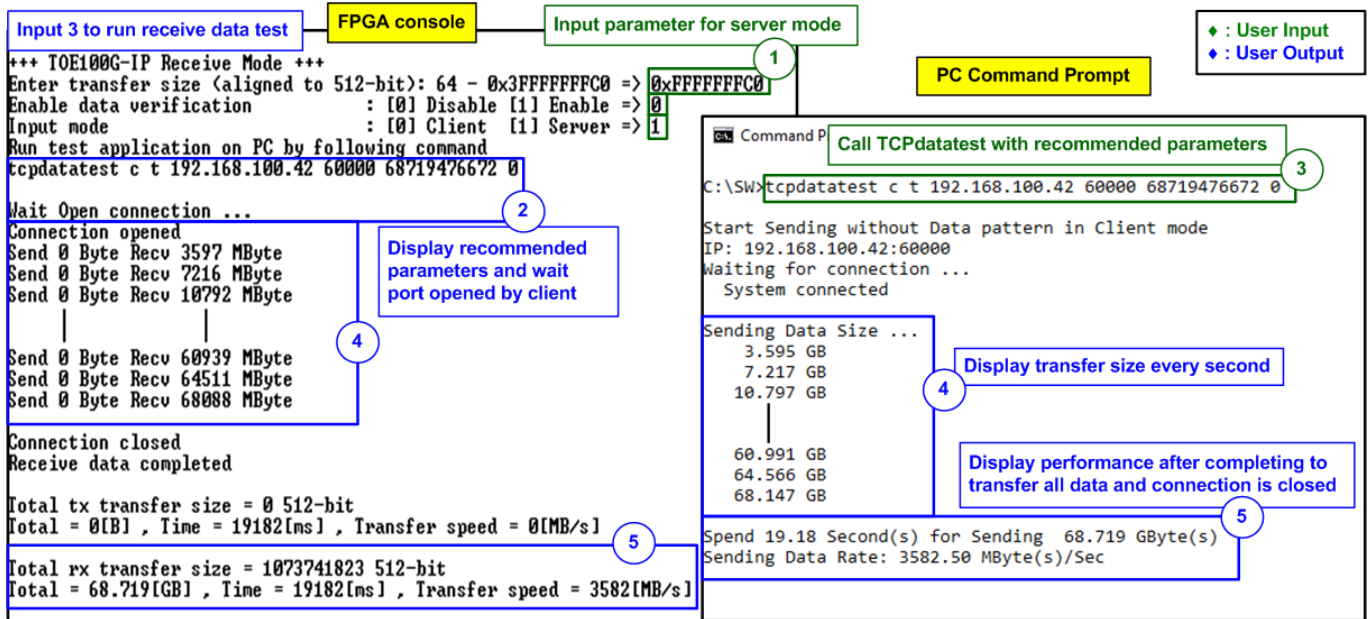


Figure 3-11 Receive data test without data verification

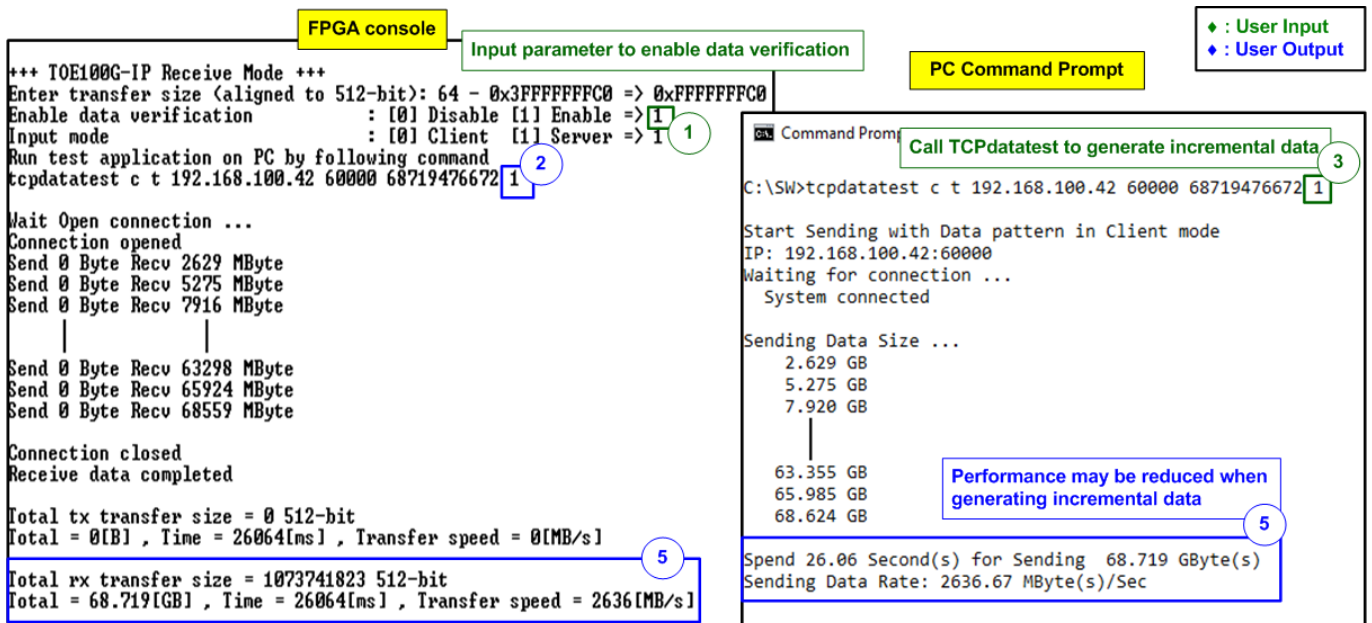


Figure 3-12 Receive data test when enabling data verification

FPGA console

Input parameter to enable data verification

◆ : User Input
♦ : User Output

PC Command Prompt

Call TCPdatatest to send dummy data

```

+++ TOE100G-IP Receive Mode +++
Enter transfer size (aligned to 512-bit): 64 - 0x3FFFFFFC0 => 0xFFFFFFFFC0
Enable data verification      : [0] Disable [1] Enable => 1
Input mode                    : [0] Client [1] Server => 1
Run test application on PC by following command
tcpdatatest c t 192.168.100.42 60000 68719476672 1

Wait Open connection ...
Connection opened
Send 0 Byte Recv 3437 MByte
Send 0 Byte Recv 6846 MByte
Send 0 Byte Recv 10326 MByte
|
|
Send 0 Byte Recv 58834 MByte
Send 0 Byte Recv 62285 MByte
Send 0 Byte Recv 65778 MByte
|
|
Connection closed
ERROR: Data verification failed
Receive data completed

Total tx transfer size = 0 512-bit
Total = 0[B], Time = 19851[ms], Transfer speed = 0[MB/s]

Total rx transfer size = 1073741823 512-bit
Total = 68.719[GB], Time = 19851[ms], Transfer speed = 3461[MB/s]

```

```

Command Prompt
C:\SW>tcpdatatest c t 192.168.100.42 60000 68719476672 0

Start Sending without Data pattern in Client mode
IP: 192.168.100.42:60000
Waiting for connection ...
System connected

Sending Data Size ...
3.437 GB
6.849 GB
10.333 GB
|
58.889 GB
62.342 GB
65.839 GB

Spend 19.85 Second(s) for Sending 68.719 GByte(s)
Sending Data Rate: 3462.29 MByte(s)/Sec

```

Figure 3-13 Receive data test when data verification is failed

3.5 Full duplex Test

Select '4' to run full duplex test to transfer data between FPGA and PC in both directions at the same time. User inputs test parameters on FPGA console and on PC Command prompt. "tcp_client_txrx_40G" application is called on PC to send and receive data by using the same port number. The sequence to run the test is shown as below.

- 1) On FPGA console, input four parameters in full duplex test.
 - a) Input transfer size: Unit of transfer size is byte. Valid value is 0x40 - 0x3F_FFFF_FFC0. The input must be aligned to 64. The input is decimal unit when input only digit number. User adds "0x" to be a prefix for hexadecimal unit. This value must be equal to total transfer size, set on test application.
 - b) Input packet size: Unit of packet size is byte. Valid value is 64 – 8960. The input must be aligned to 64. The input is decimal unit when input only digit number. User adds "0x" to be a prefix for hexadecimal unit.
 - c) Input data verification mode: Set '0' to disable data verification or '1' to enable data verification sent from PC.
 - d) Input Mode: Mode of FPGA to transfer data. Input '1' to transfer as Server mode.
- 2) If all inputs are valid, the recommended parameters to run test application on PC are displayed. Next, "Wait Open connection ..." is displayed to wait the application on PC running.
- 3) On Command prompt, input test parameters following the recommended value. There are four parameters for "tcp_client_txrx_40G".


```
>> tcp_client_txrx_40G <server IP> <server port> <bytelen> <pattern>
```

 - a) Server IP: Input the same value as IP address of FPGA
 - b) Server port: Input the same value as port number of FPGA
 - c) ByteLen: Total transfer size in byte unit. Input the same value as "Input transfer size" of step 1a).
 - d) Pattern: Input the same value as "Input data verification mode" of step 1c). Select '0' to send dummy data or '1' to send incremental data.
- 4) After running the test application, the port is created. During transferring data, current transfer size is displayed on FPGA console and Command prompt every second.
- 5) "Send data complete" is displayed on FPGA console after finishing sending data, receiving data, and closing the connection. Finally, total transfer size and performance are displayed on FPGA console and Command prompt.
Repeat Step 4) – 5) as forever loop until the user enters any keys on FPGA console and then enters "Ctrl+C" on Command prompt.

As shown in Figure 3-14 - Figure 3-15, transfer performance when running full duplex without data verification shows better performance than the test with data verification. Running without data verification takes less PC resource. The left window is the test result on FPGA console while the right window is the test result on Command prompt.

Note: There is an issue when running tcp_client_txrx_40G application on some Windows10 versions. The performance is much reduced. The results displayed in Figure 3-14 and Figure 3-15 use Windows10 Pro version1909. While using Windows10 Pro version2004 or 20H2, the performance is less than 200 MB/s.

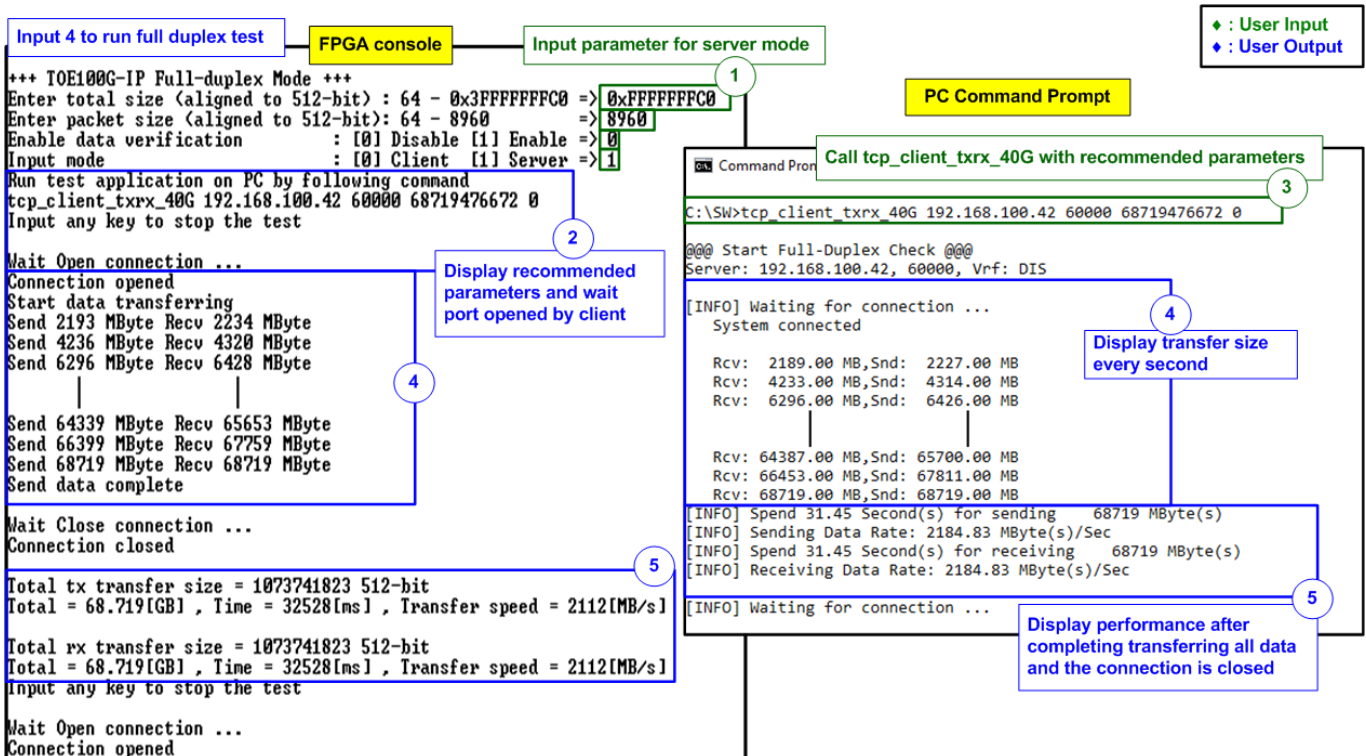


Figure 3-14 Full duplex test without data verification

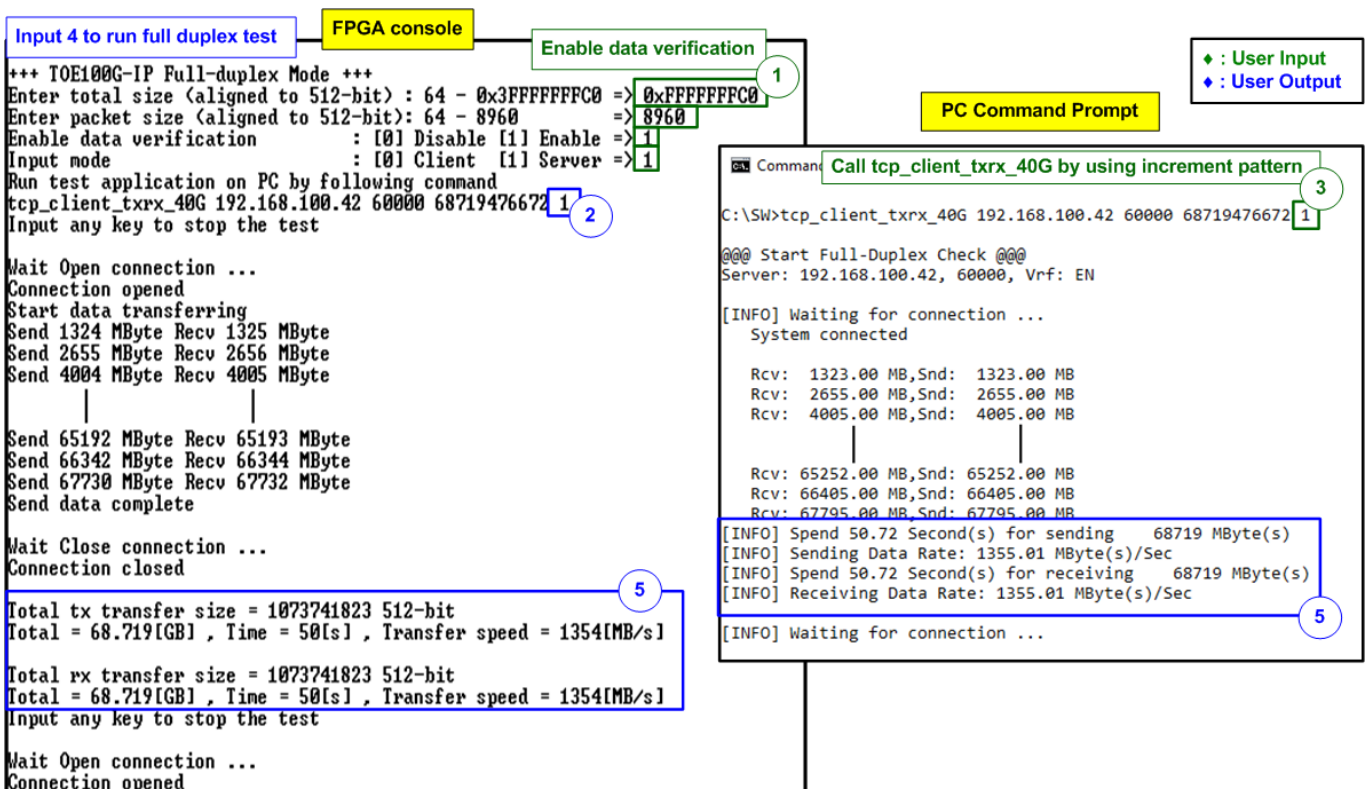


Figure 3-15 Full duplex test with data verification

3.6 Ping reply Test

Select '5' to run Ping reply mode. After selecting this menu, "Press any key to exit Ping test" is displayed on the console as shown in Figure 3-16. After that, user can type "ping <FPGA board IP address>" command on Command prompt to start Ping command test, as shown in Figure 3-17.

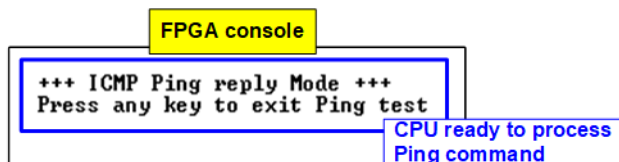


Figure 3-16 Ping reply mode result on FPGA console

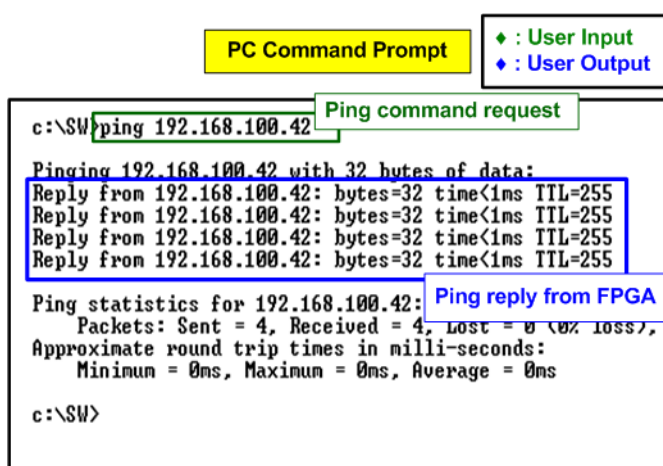


Figure 3-17 Ping command result on PC

User can exit this menu by pressing any key(s) to the console. After that, main menu is displayed as shown in Figure 3-18.

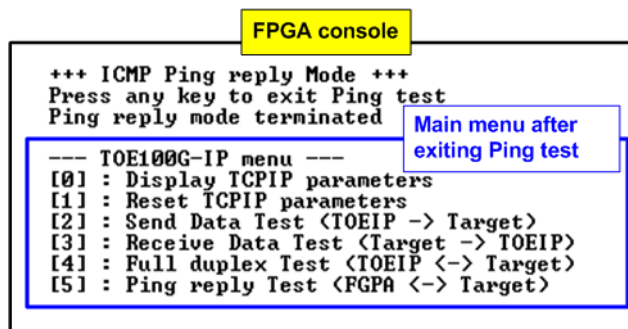


Figure 3-18 Main menu is displayed after exit the Ping test

4 DHCP demo

Before running DHCP demo, Test PC must be prepared to perform a DHCP server. In this demo, the application “dhcprsv” (version 2.5.2) is applied for running on Windows OS. After that, prepare the test environment as described in “dg_toeudp100gip_fpgasetup_xilinx” document. When finishing downloading configuration file to FPGA, the main menu of DHCP test is displayed. The menu for testing the fast port connection by TOE100G-IP has the same operation as Ping test. Please see more details from topic 3.1 - 3.5. This topic describes only menu [5] Release IP address. The details of running DHCP demo are described as follows.

Note: When running DHCP demo, FPGA IP address is not allowed to be assigned by user to avoid the conflict with FPGA IP address that is assigned by DHCP.

4.1 DHCP Server Setting

The procedure to run DHCP server software interface as shown in Figure 4-1.

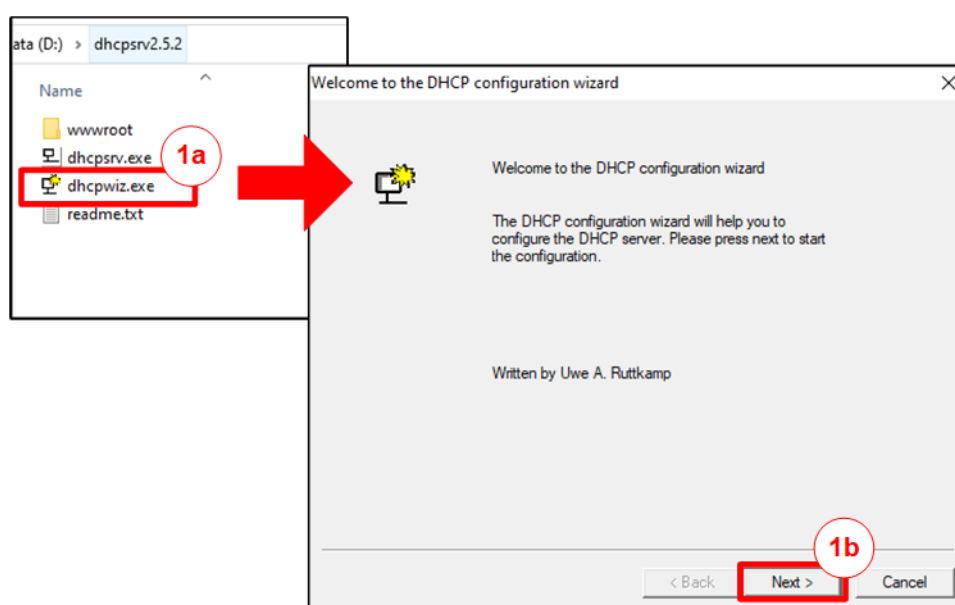


Figure 4-1 DHCP server software

- 1) From the installation package, user selects “dhcpwiz.exe”. After the software wizard is displayed, click “Next >” to start DHCP server configuration.

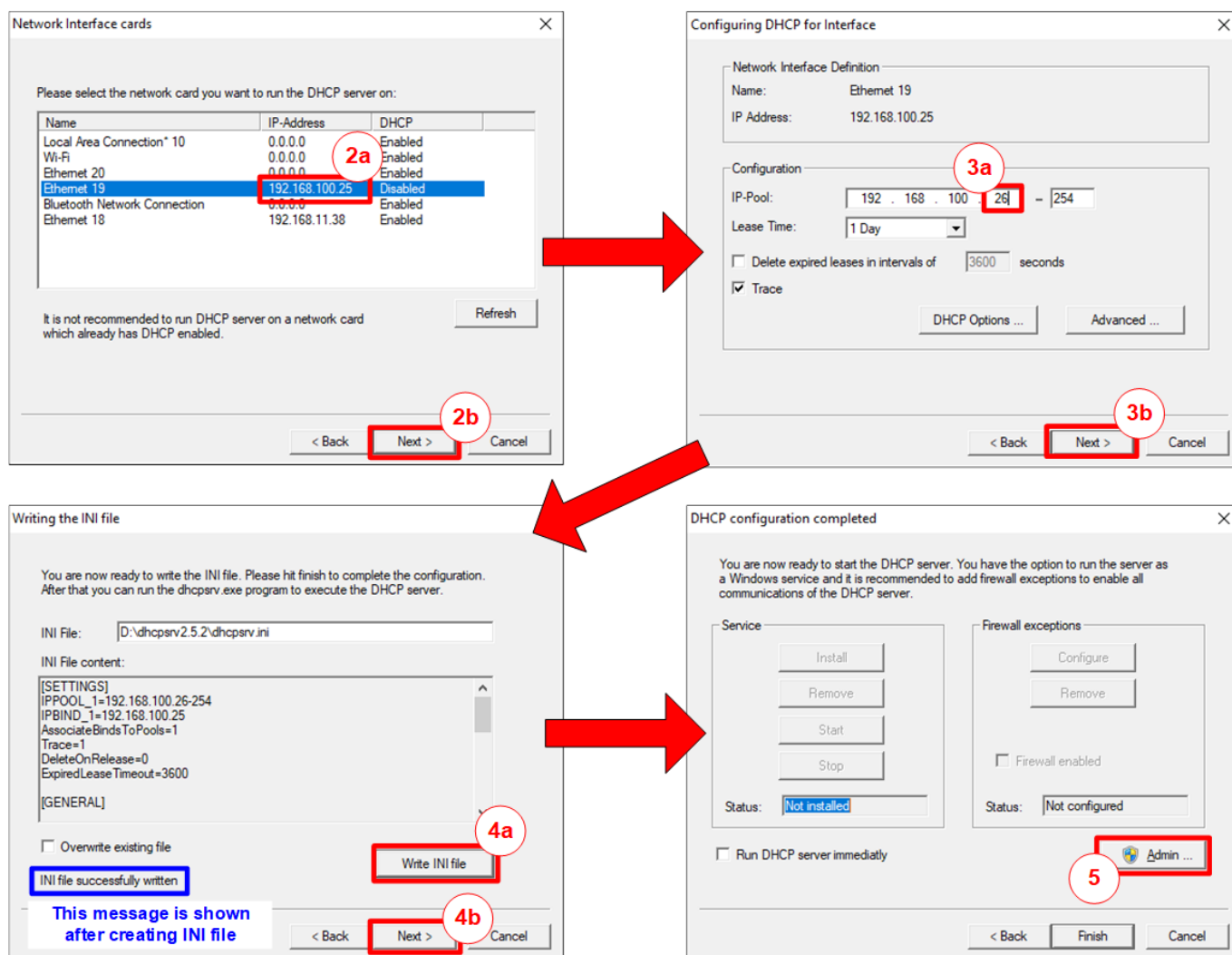


Figure 4-2 DHCP server configuration

- 2) Select the network interface that is connected to FPGA board. In this demo, the connection which uses 192.168.100.25 is applied. After that, click “Next >” to continue the next step.
- 3) Assign the IP address range that is allowed to assign to DHCP client. The example sets 26 to be the first IP address for DHCP client. After that, click “Next >” to continue the next step.
- 4) Click “Write INI file” to create the script file to run the server. The message “INI file successfully written” is displayed after clicking the button. Next, click “Next >” to continue the next step.
- 5) Click “Admin” for entering the administration mode. The DHCP server software is able to run after allowing the software for admin mode.

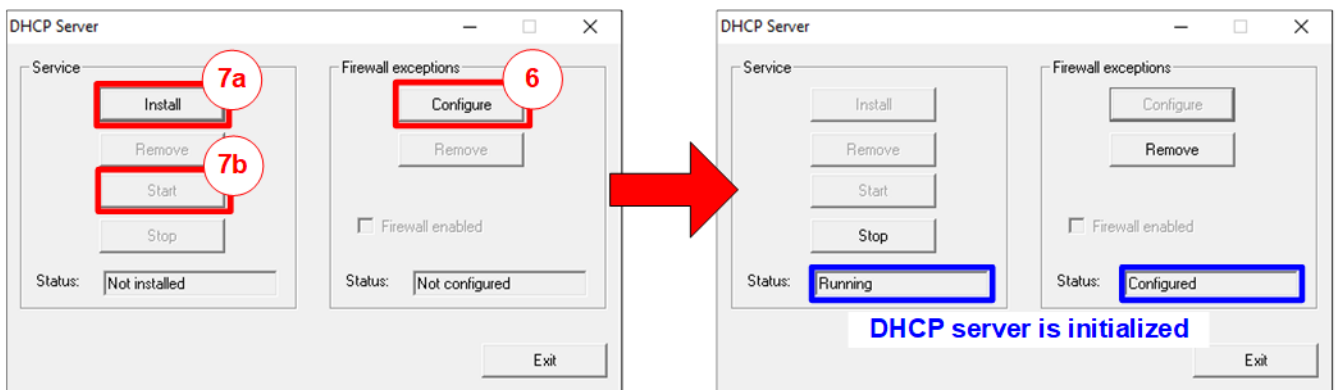


Figure 4-3 DHCP server software running

- 6) Click the “Configure” button in the Firewall exceptions block. Then, the status of Firewall exceptions is changed to “Configured”.
- 7) Click the “Install” button in the Service block and then click the “Start” button in the Service block. After that, the Status is changed to “Running” and the DHCP server is initialized.

More details about the DHCP server software are provided from the website.

<https://www.dhcpserver.de/cms/>

4.2 DHCP test

4.2.1 Boot menu

Please prepare test environment following the FPGA setup document. However, the system boot-up procedure is slightly different in the last step because the boot menu for IP address assignment by DHCP is displayed.

Note: Please make sure that the DHCP server is run, as described in topic 4.1, before continuing the next step.

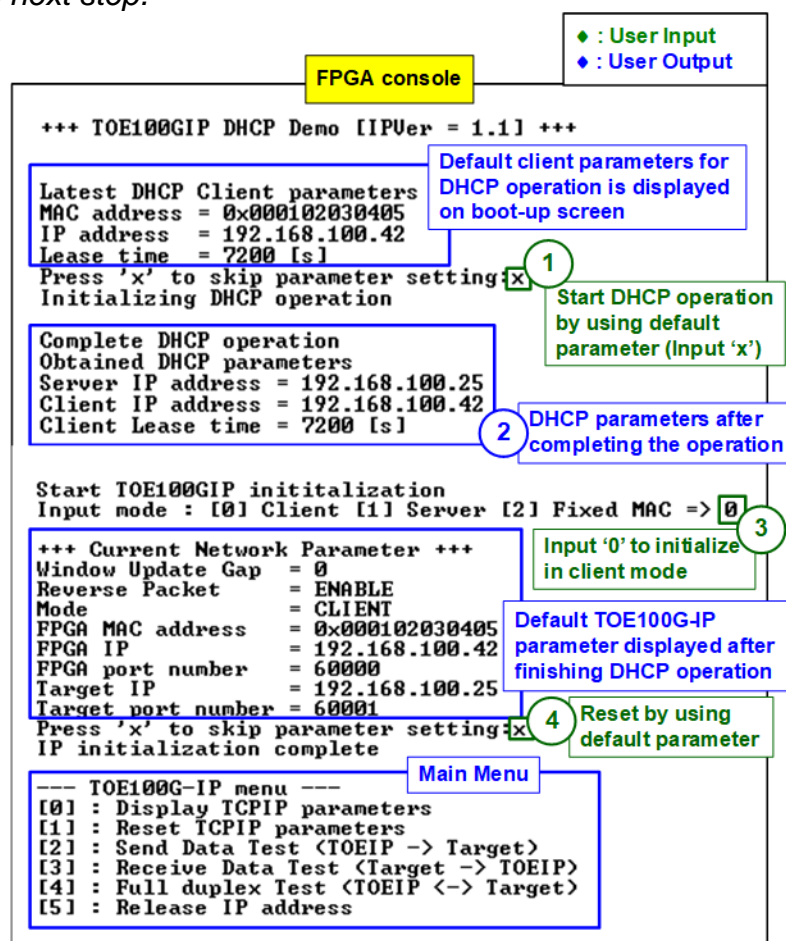


Figure 4-4 Message after system boot-up of DHCP test

- 1) The default parameters for IP address assignment by DHCP is displayed. User enters 'x' to start DHCP operation by using the default parameters. If other keys are set, the menu to change DHCP parameters are displayed, similar to menu [5] (Release IP address). After that, the DHCP operation is started.
- 2) After DHCP operation is completed, the parameters assigned by DHCP server are displayed on the console.
- 3) The menu to start TOE100G-IP initialization is displayed. Input '0' to start TOE100G-IP initialization in client mode (asking PC MAC address by sending ARP request). After that, the default parameters for TOE100G-IP are displayed on the console.
- 4) User enters 'x' to skip parameter setting for using default parameters to run TOE100G-IP initialization. If user enters other keys, the menu for changing parameter is displayed, similar to menu [1] (Reset TCPIP parameters).

4.2.2 Release IP address

Select '5' to release IP address of FPGA that is assigned by DHCP server. This menu can be used to change FPGA MAC address or FPGA IP address. When finishing IP release process, "Release IP address completed" is displayed, as shown in Figure 4-5.

```

+++ Release and reset IP address +++
Release IP address completed

Latest DHCP Client parameters
MAC address = 0x000102030405
IP address  = 192.168.100.42
Lease time  = 7200 [s]
Press 'x' to skip parameter setting:
  
```

Figure 4-5 Release IP address complete

After that, it returns to the boot menu to display the latest DHCP parameters on the console. User enters 'x' to use the same parameters for the DHCP operation. Other keys are entered to change some parameters. There are three parameters to set in this menu.

- 1) MAC address: This parameter is the FPGA MAC address. Default value is 0x000102030405. To change the parameter, input 12 digits of hex value. Add "0x" as a prefix to input as hex value.
- 2) IP address: This parameter is the preferred IP address requested to DHCP server. If the DHCP server allows the FPGA to use this IP address, it will be assigned to the FPGA IP address. Otherwise, the DHCP server assigns other value to be the FPGA IP address. The default value is 192.168.100.42. To change the requested parameter, input a set of four decimal digits is separated by ".". The valid range of each decimal digit is 0-255.
- 3) Lease time: This parameter is the requested lease time in second unit that sent to DHCP server. However, the final value is determined by DHCP server. Default value is 7200 second. The valid range is 600 (decimal unit) - 0xFFFFFFFF (hex unit).

Note: According the DHCP protocol, 0xFFFFFFFF is reserved for infinite lease time.

Each parameter is verified by CPU. The parameter is updated when the input is valid. If the input is not valid, the parameter does not change. After user inputs all parameters, the CPU starts the DHCP operation using the assigned parameters. If the DHCP operation is completed, the parameters that the DHCP server set to the FPGA are displayed. The parameters may be different from the requested parameters if the DHCP server changes it. Three parameters are displayed on the console.

- 1) Server IP address: The IP address of DHCP server.
- 2) Client IP address: The IP address that is assigned to be the FPGA IP address.
- 3) Client Lease time: The IP address lease time assigned by DHCP server in the second unit. User needs to perform the release IP address before this lease time is run out.

Note: The demo does not implement the timer to check lease time. If auto release must be implemented, please add Timer to the test system.

After completing the DHCP operation and displaying DHCP parameters, the message "Start TOE100GIP initialization" is displayed. Finally, the CPU automatically starts the Reset TCPIP parameters process to reset and re-assign the TOE100G-IP and its parameters, as shown in Figure 4-6.

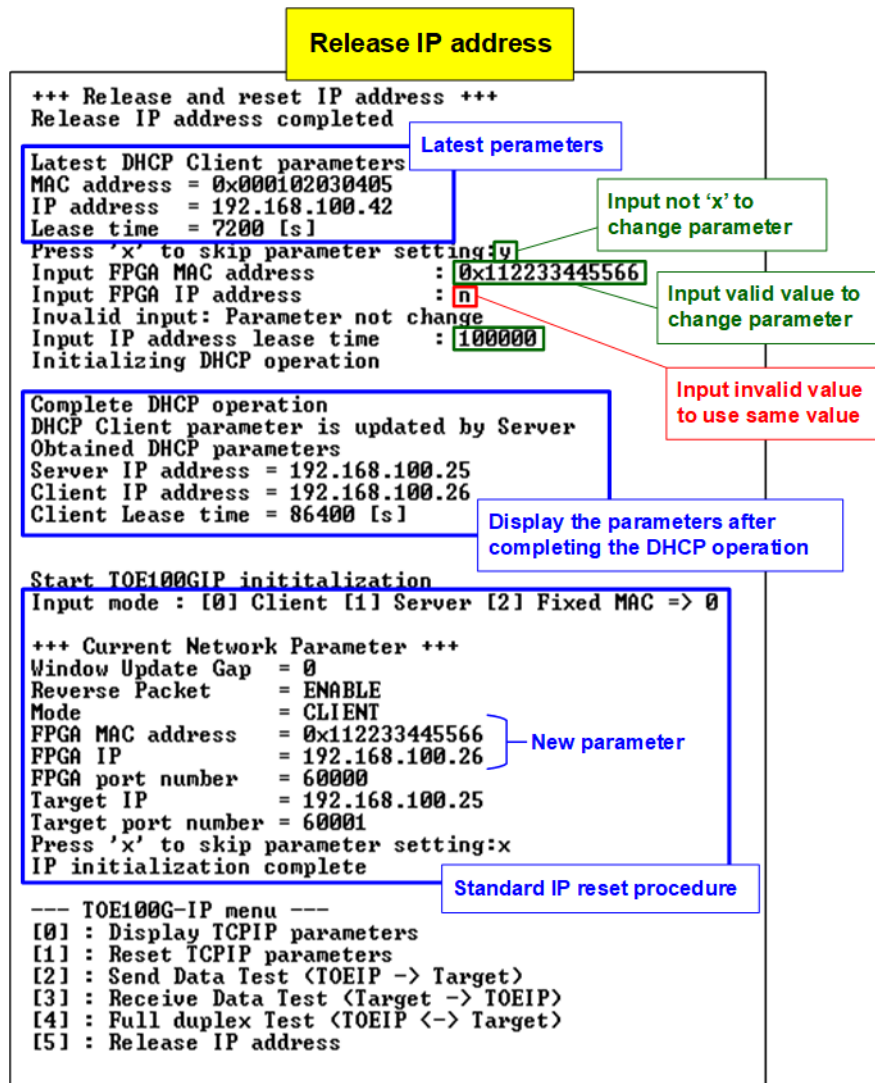


Figure 4-6 Re-initialize the DHCP operation

5 Revision History

Revision	Date	Description
1.0	27-May-22	Initial version release