

AN11942

QN90xx TEST Commands of the Host Controller Interface

Rev. 1.1— February 2018

Application note

Document information

Info	Content
Keywords	QN908x, QN902x, BLE, HCI, Host Controller Interface
Abstract	This document describes the test commands of the Host Controller Interface to QN90xx controller.



Revision history

Rev	Date	Description
1.0	06/2017	Initial release
1.1	02/2018	Added clarification on QN902x Vendor Command supporting status

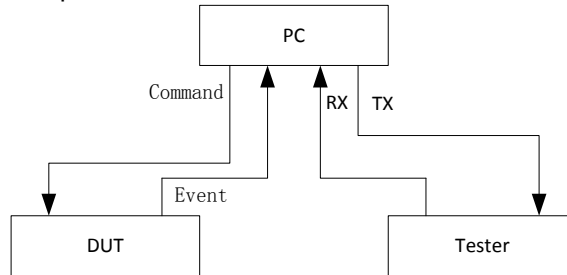
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1. Introduction

This document describes the test commands of the Host Controller Interface (HCI). This is called the HCI which is specified in the BT Core 4.0 specification Volume 2 Part E. The HCI provides a uniform command interface to a controller. These commands are vendor-specific commands generally used for testing.

The following flow chart provides an overview of the QN90XX TEST.



2. UART setting

Setting	Value
Band rate	1. 9600–902x 2. 115200–908x
Data	8 bits
Parity	No parity
Stop bit	1 stop bit
Flow control	RTS/CTS

3. HCI PDU format

First	Last		
HCI packet type	Packet		
0x01: HCI command	Opcode (2 bytes)	Parameter total length (1 byte)	Parameters (0,1,2.....)
0x04: HCI event	Event code (1 bytes)	Parameter total length (1 byte)	Parameters (0,1,2.....)

4. HCI commands and events

4.1 LE receiver test command

Opcode	Command parameters
0x1D 0x20	RX_Frequency

Description:

This command is used to start a test where the DUT (Device Under Test) receives test reference packets at a fixed interval. The tester generates the test reference packets.

Command parameters:

RX_Frequency

Value	Parameter description
N = 0xXX	$N = (F - 2402) / 2$ Range: 0x00–0x27. Frequency range: 2402 MHz–2480 MHz.

4.2 LE receiver test command complete event

Event code	Event parameters
0x0E	Num_HCI_Command_Packets, Command_Opcode, Return_Parameters

Description:

The command complete event is used by the controller for most commands to transmit the return status of a command and the other event parameters that are specified for the issued HCI command.

Event parameters:

Num_HCI_Command_Packets:

Value	Parameter description
N = 0xXX	The number of the HCI command packets that are allowed to be sent to the controller from the host. Range for N: 0–255.

Command_Opcode:

Value	Parameter description
0x1D, 0x20	Opcode of the command that caused this event.

Return_Parameters:

Status:

Value	Parameter description
0x00	LE_Receiver_Test command succeeded.
0x01 – 0xFF	LE_Receiver_Test command failed. See Core_V4.0, Part D, Error Codes on page 339 for a list of error codes and descriptions.

4.3 LE transmitter test command

Opcode	Command parameters
0x1E, 0x20	TX_Frequency, Length_Of_Test_Data, Packet_Payload

Description:

This command is used to start a test where the DUT generates test reference packets at a fixed interval. The controller shall transmit at maximum power.

The LE controller supporting the LE_Transmitter_Test command shall support the Packet_Payload values 0x00, 0x01, and 0x02. The LE controller may support other values of Packet_Payload.

Command parameters:

TX_Frequency: 1 octet

Value	Parameter description
N = 0xXX	$N = (F - 2402) / 2$ Range: 0x00–0x27. Frequency range: 2402 MHz–2480 MHz.

Length_Of_Test_Data: 1 octet

Value	Parameter description
0x00–0x25	Length of the payload data in each packet (in bytes)
0x26–0xFF	Reserved for future use

Packet_Payload: 1 octet

Value	Parameter description
0x00	Pseudo-random bit sequence 9
0x01	Pattern of alternating bits '11110000'
0x02	Pattern of alternating bits '10101010'
0x03	Pseudo-random bit sequence 15
0x04	Pattern of all '1' bits
0x05	Pattern of all '0' bits

0x06	Pattern of alternating bits '00001111'
0x07	Pattern of alternating bits '0101'
0x08-0xFF	Reserved for future use

4.4 LE transmitter test command complete event

Event code	Event parameters
0x0E	Num_HCI_Command_Packets, Command_Opcode, Return_Parameters

Description:

The command complete event is used by the controller for most commands to transmit the return status of a command and the other event parameters that are specified for the issued HCI command.

Event parameters:

Num_HCI_Command_Packets:

Value	Parameter description
N = 0xXX	The number of the HCI command packets that are allowed to be sent to the controller from the host. Range for N: 0–255.

Command_Opcode:

Value	Parameter description
0x1E, 0x20	Opcode of the command that caused this event.

Return_Parameters:

Status:

Value	Parameter description
0x00	LE_Receiver_Test command succeeded.
0x01–0xFF	LE_Receiver_Test command failed. See Core_V4.0, Part D, Error Codes on page 339 for a list of error codes and descriptions.

4.5 LE test end command

Opcode	Command parameters
0x1F, 0x20	None.

4.6 LE test end command complete event

Event code	Event parameters
0x0E	Num_HCI_Command_Packets, Command_Opcode, Return_Parameters (Status, Number_Of_Packets)

Description:

The command complete event is used by the controller for most commands to transmit the return status of a command and the other event parameters that are specified for the issued HCI command.

Event parameters:

Num_HCI_Command_Packets: 1 octet

Value	Parameter description
N = 0xXX	The number of the HCI command packets that are allowed to be sent to the controller from the host. Range for N: 0–255.

Command_Opcode: 2 octets

Value	Parameter description
0x1F, 0x20	The opcode of the command that caused this event.

Return_Parameters:

Status: 1 octet

Value	Parameter description
0x00	LE_Receiver_Test command succeeded.
0x01–0xFF	LE_Receiver_Test command failed. See Core_V4.0, Part D, Error Codes on page 339 for a list of error codes and descriptions.

Number_Of_Packets: 2 octets

Value	Parameter description
0xXXXX	Number of packets received

5. Vendor commands and events

5.1 LE_QN_REG_RD_CMD

OpCode	Command parameters
0x30, 0xFC	Register address

Description:

The LE_QN_REG_RD_CMD command is used by the host to get the value of a specific register.

Register address: 4 octets

5.2 LE_QN_REG_RD_CMD_CMP_EVENT

Event code	Event parameters
0x0E	Num_HCI_Command_Packets, Command_Opcode, Return_Parameters (status, register address, register value)

Event parameters:

Num_HCI_Command_Packets: 1 octet

Value	Parameter description
N = 0xXX	The number of the HCI command packets that are allowed to be sent to the controller from the host. Range for N: 0–255.

Command_Opcode: 2 octets

Value	Parameter description
0x30, 0xFC	Opcode of the command that caused this event.

Return_Parameters:

Status: 1 octet

Value	Parameter description
0x00	LE_Receiver_Test command succeeded.
0x01–0xFF	LE_Receiver_Test command failed. See Core_V4.0, Part D, Error Codes on page 339 for a list of error codes and descriptions.

Register address: 4 octets

Register value: 4 octets

5.3 LE_QN_REG_WR_CMD

Opcode	Command parameters
0x31, 0xFC	Length_Of_Parameters, register address, register value

Description:

The LE_QN_REG_WR_CMD command is used by the host to set the value of a specific register.

Command parameters:
 Length_Of_Parameters: 1 octet
 Register address: 4 octets
 Register value: 4 octets

5.4 LE_QN_REG_WR_CMD_CMP_EVENT

Event code	Event parameters
0x0E	Num_HCI_Command_Packets, Command_Opcode, Return_Parameters (status, register address)

Event parameters:
 Num_HCI_Command_Packets: 1 octet

Value	Parameter description
N = 0xXX	The number of the HCI command packets that are allowed to be sent to the controller from the host. Range for N: 0–255.

Command_Opcode: 2 octets

Value	Parameter description
0x31, 0xFC	Opcode of the command that caused this event.

Return_Parameters:
 Status: 1 octet

Value	Parameter description
0x00	LE_Receiver_Test command succeeded.
0x01–0xFF	LE_Receiver_Test command failed. See Core_V4.0, Part D, Error Codes on page 339 for a list of error codes and descriptions.

Register address: 4 octets

5.5 LE_QN_CFG_TEST_CMD

Opcode	Command parameters
0xF2, 0xFF	TX_Frequency, Test_Mode, Packet_Payload

Command parameters:
 TX_Frequency: 1 octet

Value	Parameter description
N = 0xXX	$N = (F - 2402) / 2$ Range: 0x00–0x27. Frequency range: 2402 MHz–2480 MHz.

Test_Mode: 1 octet

Value	Parameter description
0x00	Without modulation mode
0x01	With modulation mode
0x02–0xFF	Reserved for future use

Packet_Payload: 1 octet

Value	Parameter description
0x00	Pattern of all '0' bits
0x01	Pattern of all '1' bits
0x02	Pattern of alternating bits '01010101'
0x03	Pattern of alternating bits '10101010'
0x04	Pattern of alternating bits '00001111'
0x05	Pattern of alternating bits '11110000'
0x06	Pseudo-random bit sequence 9
0x07–0xFF	Reserved for future use

5.6 LE_QN_CFG_TEST_CMD_CMP_EVENT

Event code	Event parameters
0x0E	Num_HCI_Command_Packets, Command_Opcode, Return_Parameters (status)

Event parameters:

Num_HCI_Command_Packets: 1 octet

Value	Parameter description
N = 0xXX	The number of the HCI command packets that are allowed to be sent to the controller from the host. Range for N: 0–255.

Command_Opcode: 2 octets

Value	Parameter description
0xF2,0xFF	Opcode of the command that caused this event.

Return_Parameters:

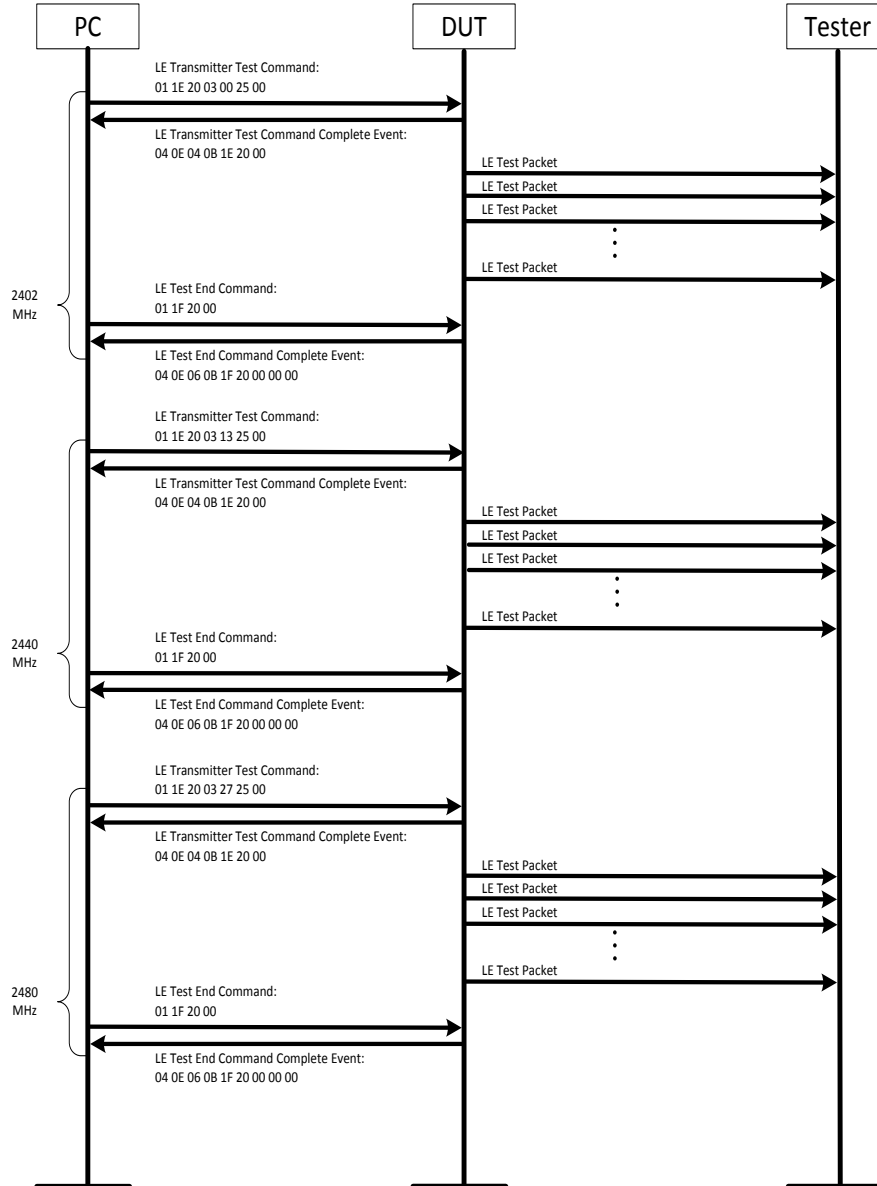
Status: 1 octet

Value	Parameter description
0x00	LE_Receiver_Test command succeeded.
0x01–0xFF	LE_Receiver_Test command failed. See Core_V4.0, Part D, Error Codes on page 339 for a list of error codes and descriptions.

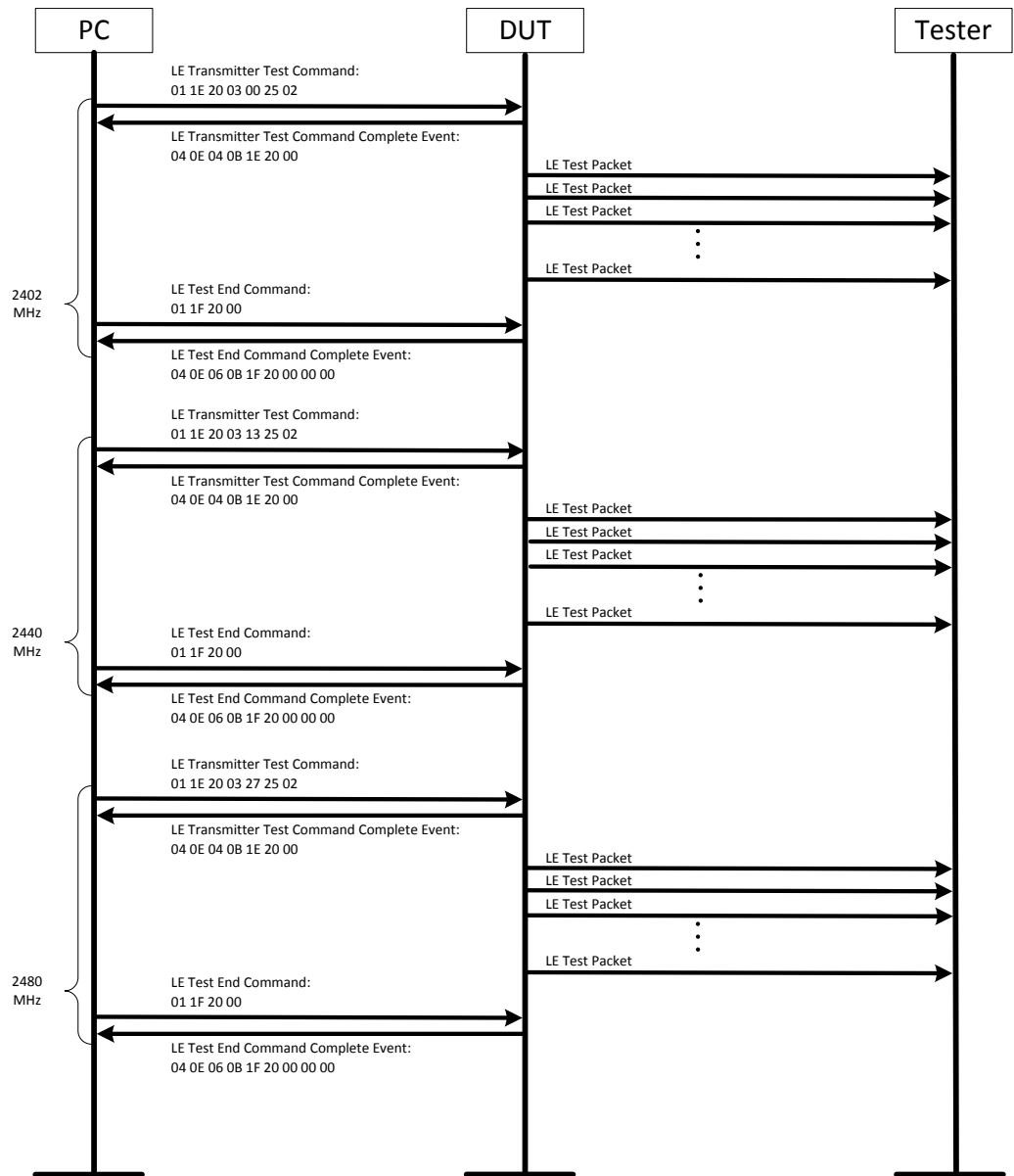
The QN902x currently does not support the (0xFFF2) command.

6. Message sequence charts

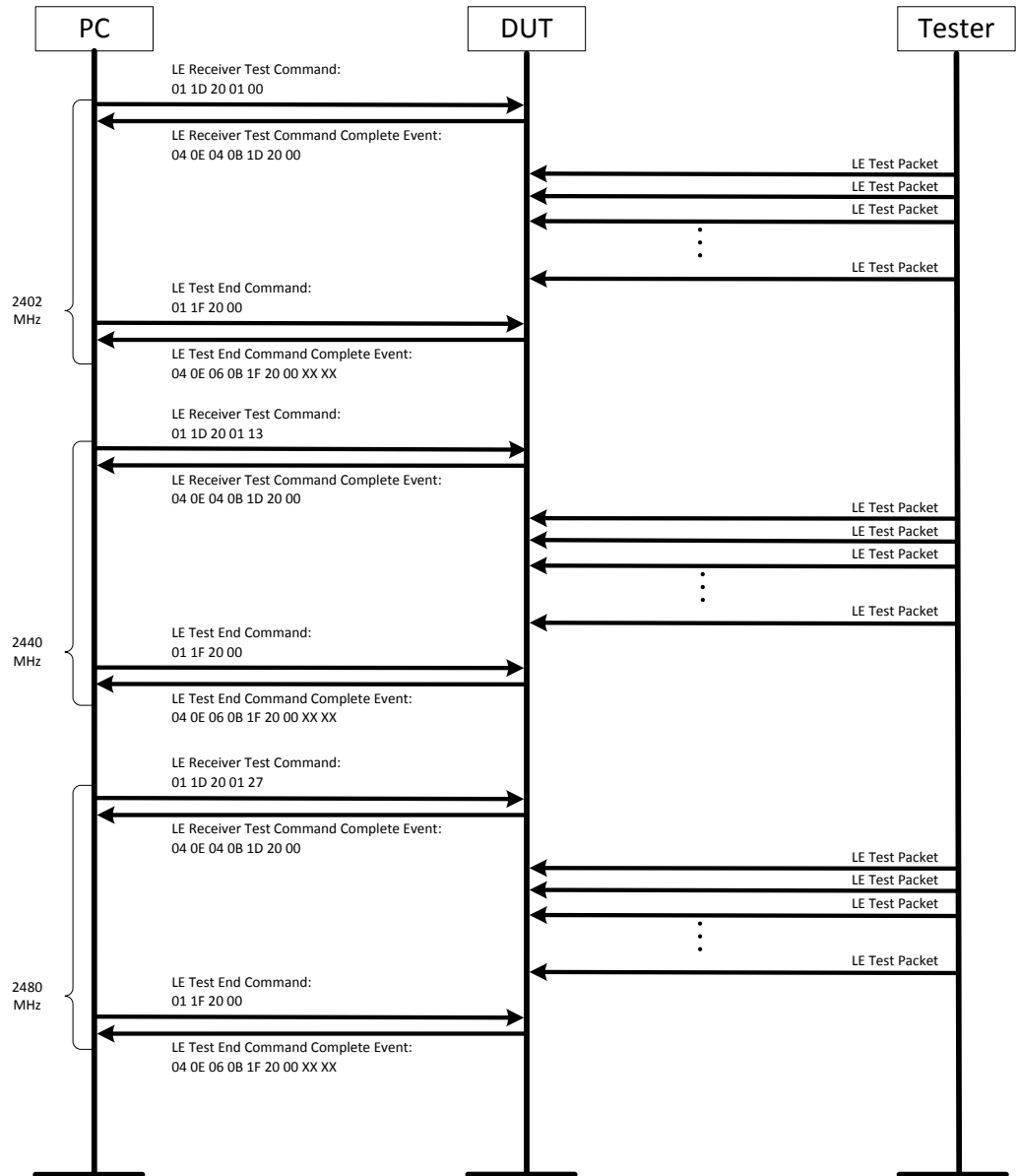
6.1 Output power at NOC (Normal Operation Condition)



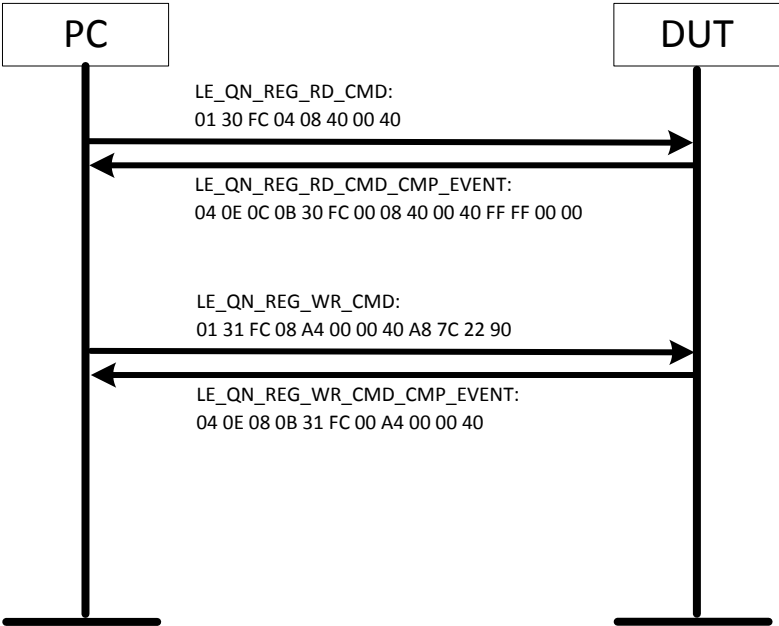
6.2 Carrier frequency offset and drift at NOC



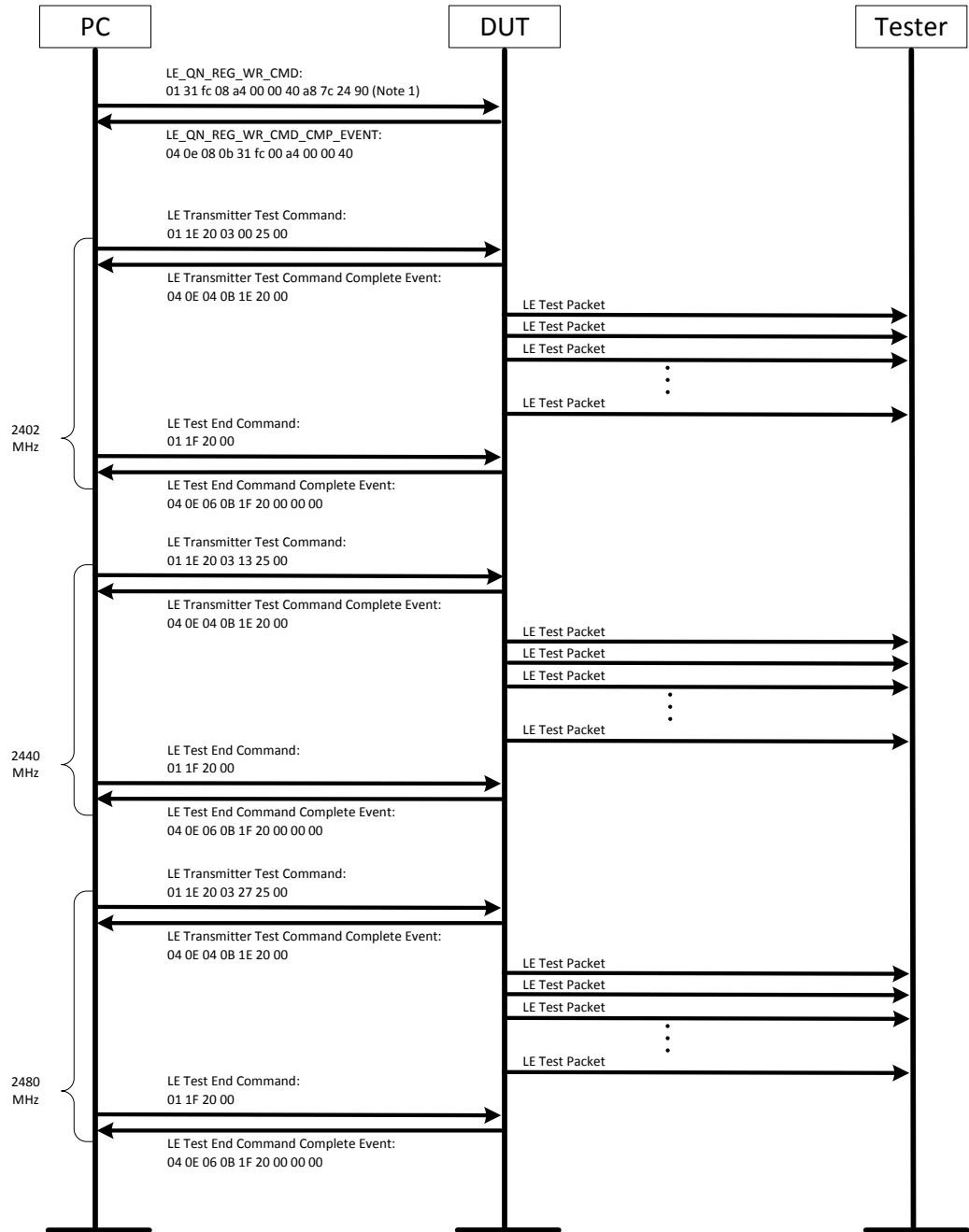
6.3 Receiver sensitivity at NOC



6.4 Read and write register



6.5 Calibrate XCSEL



Note 1: Register address: 0x400000A4,

Register value (22–17-bit): nXCSEL << 17 | (0x902A7CA8 & ~(0x3F << 17))

nXCSEL: Modify this value to calibrate the frequency offset. The default value is 0x11.

It ranges from 0x00 to 0x3E.

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