# AN1286: RS9116W BT Regulatory Test Application Note

Version 1.2

10/21/2020

# Table of Contents

# 1 About

This document provides information on the BT PER command sequences using the WiSeConnect Module.

# 2 Introduction

This document details the procedure, steps, and requirements for the Bluetooth/Bluetooth LE PER mode of WiSeConnect, and the commands supported by using a UART interface in AT command mode. It also describes Bluetooth / Bluetooth LE PER mode using the SAPIs. The DUT uses the UART interface for communicating with the Master (External Application such as Docklight) for configuring the Wireless System and for logging the Wireless performance.

**Note:** This example is applicable to WiSeConnect™. The feature(s) used in this example may or may not be available on your part number. Refer to the product data sheet, available at our Technical Resource Search site, to verify the features available.

# 3 Prerequisites

## 3.1 Hardware and Software Requirements

1. Windows PC.

2. Download the Tera-term application using URL: https://ttssh2.osdn.jp/index.html.en

## 3.2 Hardware Setup

Connect the USB cable to the UART port of the EVK and connect the other end to the PC. Now the PC will detect the module as a UART device.

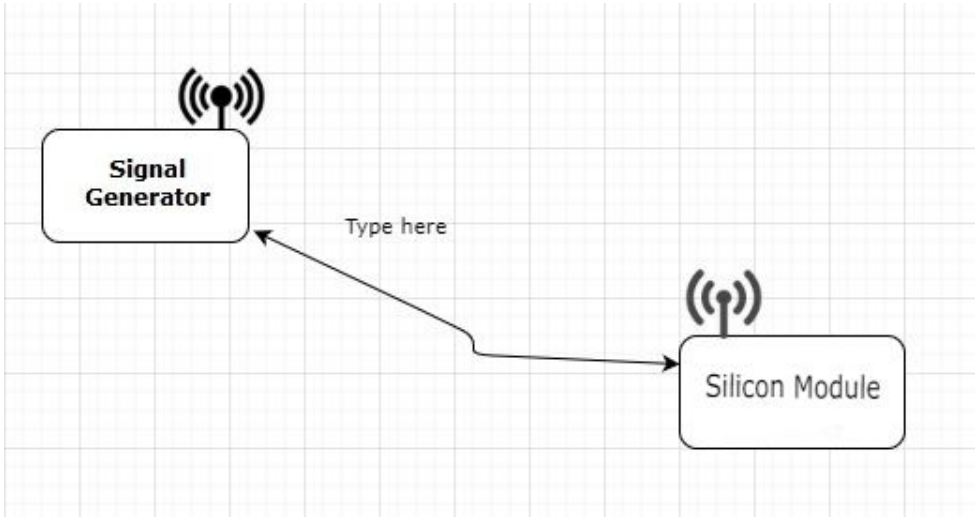
# 4 Terminology

1. EVK - Evaluation Kit

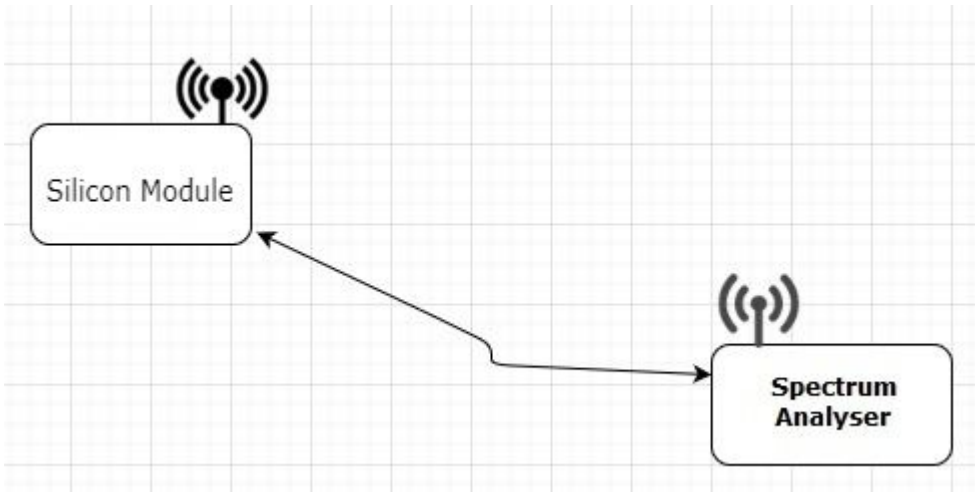
# 5 BT PER Mode

## 5.1 Block Diagram:

Rx Block Diagram:




Tx Block Diagram:




## 5.2 PER Commands to be Used

### 5.2.1 For Bluetooth

#### 5.2.1.1 Start

This command enables the Master to start the BT-Classic transmit with the transmit variables and the wireless features provided through this command.

**BT transmit cmd**

```
at+rsibt_bredrtransmit=<enable/disable>,<device_address>,<pkt_len>,<pkt_type>,<BR/EDR_mode>,<rx_channel_num>,<tx_channel_num>,<link_type>,<scrambler_seed>,<hopping_type>,<antenna_sel>,<pll_mode>,<rf_type>,<rf_chain>,<payload_type>,<tx_power_index>,<tx_mode>,<inter_packet_gap>,<num_of_packets>\r\n
```

**Parameters**

| Parameter | Value |
|---|---|
| Enable/disable | 1- enable |

| Parameter | Value |
|---|---|
| | 0- disable |
| Device_address | It is a 48-bit address in hexadecimal format, e.g.,0x000012345678<br>access_addr_lsb = 0x12345678<br>access_addr_msb = 0x0000 |
| pkt_type | Type of the packet to be transmitted, as per the Bluetooth standard.<br>3: BT_DM1_PKT_TYPE<br>4: BT_DH1_PKT_TYPE<br>10: BT_DM3_PKT_TYPE<br>11: BT_DH3_PKT_TYPE<br>14: BT_DM5_PKT_TYPE<br>15: BT_DH5_PKT_TYPE<br>4: BT_2DH1_PKT_TYPE<br>10: BT_2DH3_PKT_TYPE<br>14: BT_2DH5_PKT_TYPE<br>8: BT_3DH1_PKT_TYPE<br>11: BT_3DH3_PKT_TYPE<br>15: BT_3DH5_PKT_TYPE<br>5: BT_HV1_PKT_TYPE<br>6: BT_HV2_PKT_TYPE<br>7: BT_HV3_PKT_TYPE<br>8: BT_DV_PKT_TYPE<br>7: BT_EV3_PKT_TYPE<br>6: BT_2EV3_PKT_TYPE<br>7: BT_3EV3_PKT_TYPE<br>12: BT_EV4_PKT_TYPE<br>12: BT_2EV5_PKT_TYPE<br>13: BT_EV5_PKT_TYPE<br>13: BT_3EV5_PKT_TYPE |
| pkt_length | Length of the packet, in bytes, to be transmitted.<br>17 :BT_DM1_PAYLOAD_MAX_LEN<br>121 :BT_DM3_PAYLOAD_MAX_LEN<br>224 :BT_DM5_PAYLOAD_MAX_LEN<br>27 :BT_DH1_PAYLOAD_MAX_LEN<br>183 :BT_DH3_PAYLOAD_MAX_LEN<br>339 :BT_DH5_PAYLOAD_MAX_LEN<br>54 :BT_2DH1_PAYLOAD_MAX_LEN<br>367 :BT_2DH3_PAYLOAD_MAX_LEN<br>679 :BT_2DH5_PAYLOAD_MAX_LEN<br>83 :BT_3DH1_PAYLOAD_MAX_LEN<br>552 :BT_3DH3_PAYLOAD_MAX_LEN |

| Parameter | Value |
|---|---|
| | 1021 :BT_3DH5_PAYLOAD_MAX_LEN<br>10 :BT_HV1_VOICE_PAYLOAD_LEN<br>20 :BT_HV2_VOICE_PAYLOAD_LEN<br>30 :BT_HV3_VOICE_PAYLOAD_LEN<br>30 :BT_EV3_VOICE_PAYLOAD_LEN<br>60 :BT_2EV3_VOICE_PAYLOAD_LEN<br>90 :BT_3EV3_VOICE_PAYLOAD_LEN<br>120 :BT_EV4_VOICE_PAYLOAD_LEN<br>180 :BT_EV5_VOICE_PAYLOAD_LEN<br>360 :BT_2EV5_VOICE_PAYLOAD_LEN<br>540 :BT_3EV5_VOICE_PAYLOAD_LEN |
| br_edr_mode | 1 : basic rate<br>2/3 : enhanced_rate |
| rx_channel_index | Receive channel index, as per the Bluetooth standard.i.e, 0 to 78 |
| tx_channel_index | Transmit channel index, as per the Bluetooth standard. i.e, 0 to 78 |
| link_type | 0 : sco<br>1 : acl<br>2 : esco |
| scrambler_seed | Initial seed to be used for whitening. It should be set to ‘0’ in order to disable whitening. |
| no_of_packets | Number of packets to be transmitted. It is valid only when the <tx_mode> is set to Burst mode |
| payload_type | Type of payload to be transmitted<br>0 : Payload consists of all zeros<br>1 : Payload consists of all 0xFF’s<br>2 : Payload consists of all 0x55’s<br>3 : Payload consists of all 0xF0’s<br>4 : Payload consists of PN9 sequence. |
| tx_power | Transmit power value should be between 0 and 18 |
| tx_mode | 0 : Burst mode<br>1 : Continuous mode |
| hopping type | 0 : no hopping<br>1 : fixed hopping<br>2 : random hopping |
| ant_sel | 2 : onchip antenna<br>3 : u.f.l |
| inter_pkt_gap | Number of slots to be skipped between two packets |
| pll_mode | 0 : PLL_MODE0<br>1 : PLL_MODE1<br>2 : PLL_MODE2 |
| rf_type | 0 : External RF |

| Parameter | Value |
|---|---|
| | 1 : Internal RF |
| rf_chain | 0 : WLAN_HP_CHAIN<br>1 : WLAN_LP_CHAIN<br>2 : BT_HP_CHAIN<br>3 : BT_LP_CHAIN |

Example command: at+rsibt_bredrtransmit=1,11-11-11-11-11-11,339,15,3,10,10,1,0,0,3,0,1,3,1,31,0,0,0\r\n

#### 5.2.1.2 Stop

This command enables the Master to stop the BT-Classic transmit operation.

**BT Stop cmd**

```
at+rsibt_bredrtransmit=0\r\n
```

**Receive**

This command enables the Master to receive the BT-Classic transmit operation.

**BT Receive cmd**

```
at+rsibt_bredrreceive=<enable/disable>,<device_address>,<pkt_len>,<pkt_type>,<BR/EDR_mode>,<rx_channel_num>,<tx_channel_num>,<link_type>,<scrambler_seed>,<hopping_type>,<antenna_sel>,<pll_mode>,<rf_type>,<rf_chain>,<loop_back_mode>\r\n
```

**Parameters:**

| Parameters | Value |
|---|---|
| enable/disable | 1 -enable<br>0-disable |
| device_address | It is a 48-bit address in hexadecimal format, e.g.,0x000012345678 |
| pkt_type | Type of the packet to be transmitted, as per the Bluetooth standard. |
| pkt_length | Length of the packet, in bytes, to be transmitted. |
| br_edr_mode | 1 : basic rate<br>2 or 3 : enhanced_rate |
| rx_channel_index | Receive channel index, as per the Bluetooth standard.i.e, 0 to 78 |
| tx_channel_index | Transmit channel index, as per the Bluetooth standard. i.e, 0 to 78 |
| link_type | 0 : sco<br>1 : acl<br>2 : esco |
| scrambler_seed | Initial seed to be used for whitening. It should be set to ‘0’ in order to disable whitening. |
| hopping type | 0 : no hopping<br>1 : fixed hopping<br>2 : random hopping |
| ant_sel | 2 : onchip antenna |

| Parameters | Value |
|---|---|
| | 3 : u.f.l |
| pll_mode | 0 : PLL_MODE0<br>1 : PLL_MODE1<br>2 : PLL_MODE2 |
| rf_type | 0 : External RF<br>1 : Internal RF |
| rf_chain | 0 : WLAN_HP_CHAIN<br>1 : WLAN_LP_CHAIN<br>2 : BT_HP_CHAIN<br>3 : BT_LP_CHAIN |
| loop_back_mode | 0 : Disable<br>1 : Enable |

Example :at+rsibt_bredrreceive=1,11-11-11-11-11-11,339,15,3,10,10,1,0,0,3,0,1,3,0\r\n

**Statistics**

This command enables the Master to get the performance statistics(Packet Contents) from the Wireless system so that the Master can compute BER over the received packets.
The stats command will return the statistics like CRC pass count, CRC fail count, RSSI value.

**Stats command**:

```
at+rsibt_perstats\r\n
```

**For Bluetooth LE**

**Start cmd:**

```
at+rsibt_bletransmit=<enable/disable>,<access_addr>,<ble_rate>,<rx_channel_num>,<tx_channel_num>,<scrambler_seed>,<le_channel_type>,<hopping_type>,<antenna_sel>,
<pll_mode>,<rf_type>,<rf_chain>,<pkt_len>,<payload_type>,<tx_power_index>,<tx_mode>,<inter_packet_gap>,<num_of_packets>\r\n
```

**Description:**

| | |
|---|---|
| access_addr | It is a 32-bit address in Hex format (Access address of BLE PER packet : 0x71764129) |
| phy_rate: | Indicates the rate of transmission<br>1 : LE_1Mbps<br>2 : LE_2Mbps<br>4 : LR_125Kbps<br>8 : LR_500Kbps |
| rx_chnl_num | Receive channel index, as per the Bluetooth standard.i.e, 0 to 39 |
| tx_chnl_num | Transmit channel index, as per the Bluetooth standard. i.e, 0 to 39. |
| scrambler_seed | Initial seed to be used for whitening. It should be set to ‘0’ in order to disable whitening. |
| le_chnl_type | 0 : Advertising channel |

| | |
|---|---|
| | 1 : Data channel |
| freq_hop_en | 0 : No hopping<br>1 : Fixed hopping<br>2 : Random hopping |
| ant_sel | 2 : On-chip antenna<br>3 : u.f.l antenna |
| pll_mode | 0 : PLL_MODE0<br>1 : PLL_MODE1<br>2 : PLL_MODE2 |
| rf_type | 0 : External RF<br>1 : Internal RF |
| rf_chain | 0 : WLAN_HP_CHAIN<br>1 : WLAN_LP_CHAIN<br>2 : BT_HP_CHAIN<br>3 : BT_LP_CHAIN |
| pkt_len | Length of the packet, in bytes, to be transmitted. Max pkt_len to be transmitted is 240 |
| payload_type | Type of payload to be transmitted<br>0 : PRBS9 Sequence<br>1 : 0x0F<br>2 : 0x55<br>3 : PBRS15 sequence<br>4 : 0xFF<br>5 : 0x00<br>6 : 0xF0<br>7 : 0xA0 |
| tx_power | Transmit power value should be transmitted.<br>BLE-LP Chain, 1 - 31 - 0DBM Mode,<br>BLE-LP Chain, 33-63 - 10DBM Mode.<br>BLE-LP Chain tx_power value 0 and 32 are invalid. |
| transmit_mode | 0 : Burst mode<br>1 : Continuous mode |
| inter_pkt_gap | The number of slots to be skipped between two packets - Each slot will be 1250usec. |
| no_of_packets | Number of packets to be transmitted. It is valid only when the <tx_mode> is set to Burst mode. |

Example: at+rsibt_bletransmit=1,71764129,1,10,10,0,1,0,3,0,1,3,240,1,31,0,0,0\r\n

**Stop cmd**

at+rsibt_bletransmit=0\r\n

**BLE Receive cmd**

at+rsibt_blereceive=<enable/disable>,<access_addr>,<ble_rate>,<rx_channel_num>,<tx_channel_num>,<scrambler_seed>,<le_channel_type>,<hopping_type>,<antenna_sel>,

<pll_mode>,<rf_type>,<rf_chain>,<ext_data_len_ind>,<loop_back_mode>,<duty_cycling>\r\n

**Parameters**

| Parameters | Value |
|---|---|
| access_addr | It is a 32-bit address in hexadecimal format, e.g.,00112233 |
| phy_rate | Indicates the rate at which BLE transmits<br>1 : 1Mbps<br>2 : 2Mbps<br>4 : Long Range(LR) |
| rx_chnl_num | Receive channel index, as per the Bluetooth standard.i.e, 0 to 39 |
| tx_chnl_num | Transmit channel index, as per the Bluetooth standard. i.e, 0 to 39 |
| scrambler_seed | Initial seed to be used for whitening. It should be set to '0' in order to disable whitening |
| le_chnl_type | 0 : Advertising channel<br>1 : Data channel |
| freq_hop_en | 0 : No hopping<br>1 : Fixed hopping<br>2 : Random hopping |
| ant_sel | 2 : On-chip antenna<br>3 : u.f.l antenna |
| pll_mode | 0 : PLL_MODE0<br>1 : PLL_MODE1<br>2 : PLL_MODE2 |
| rf_type | 0 : External RF<br>1 : Internal RF |
| rf_chain | 0 : WLAN_HP_CHAIN<br>1 : WLAN_LP_CHAIN<br>2 : BT_HP_CHAIN<br>3 : BT_LP_CHAIN |
| ext_data_len_indication | 0 : Disable(<=37 Bytes)<br>1 : Enable(<=240 Bytes) |
| loop_back_mode | 0 : Disable<br>1 : Enable |
| duty_cycling | BIT(7) - BLE-4X Mode<br>BIT(0) - Duty Cycling Mode |

## 5.3 Bluetooth / Bluetooth LE PER mode execution

Refer the **Appendix C_Running Tera Term Scripts** section for usage of Tera-term to run the scripts in the **UG453: RS9116W EVK User's Guide** from **https://docs.silabs.com/rs9116.**

## 5.4 Bluetooth/Bluetooth LE PER Test Using SAPIs

For Bluetooth per mode, bt_per application is present in release path RS9116.NB0.WC.GENR.OSI.x.x.x\host\sapis\examples\bt\bt_per.

For Bluetooth LE per mode,ble_per application is present in release path RS9116\RS9116.NB0.WC.GENR.OSI.x.x.x\host\sapis\examples\ble\ble_per.

The above example applications will work for both Tx and Rx.

To define which transmission mode the module has to work. Configure the below MACRO for transmit or receive.

For Bluetooth LE:

#define RSI_CONFIG_PER_MODE RSI_BLE_PER_TRANSMIT_MODE

#define RSI_CONFIG_PER_MODE RSI_BLE_PER_RECEIVE_MODE

For BT:

#define RSI_CONFIG_PER_MODE RSI_BT_PER_TRANSMIT_MODE

#define RSI_CONFIG_PER_MODE RSI_BT_PER_RECEIVE_MODE

The above-mentioned command parameters are the same for SAPI mode, they can be configured as per customer requirement.

## 5.5 Expected Results

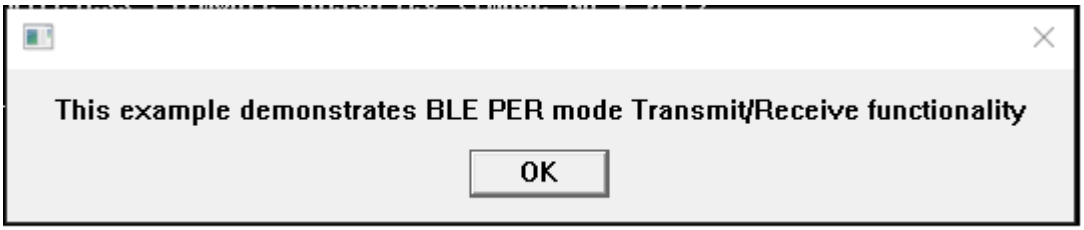
### 5.5.1 Bluetooth LE Sequence

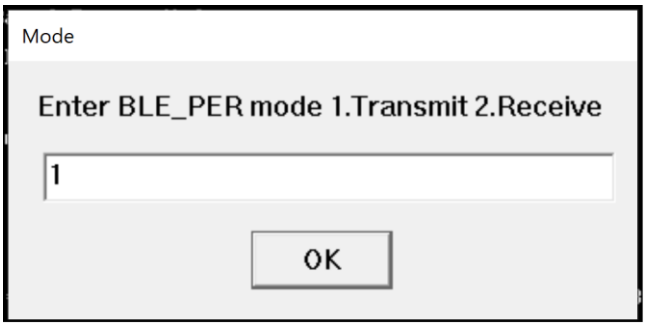
#### 5.5.1.1 For 0DBm PER transmit:

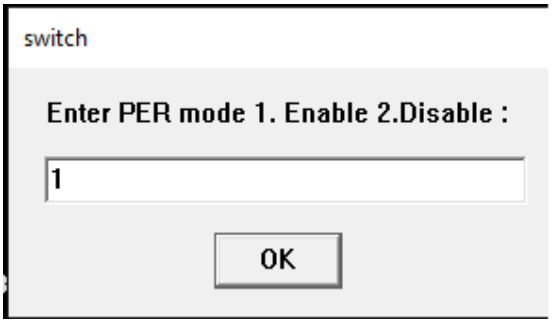
Note: The images which are referred below are of TTL Script which is mentioned in APPENDIX section.

at+rsi_opermode=851968,0,1,2147483648,2150629376,3221225472,0,376012800,2048<CR><LF>

at+rsibt_bletransmit=1,71764129,1,0,0,0,1,0,2,0,1,3,240,1,31,0,0,0<CR><LF>

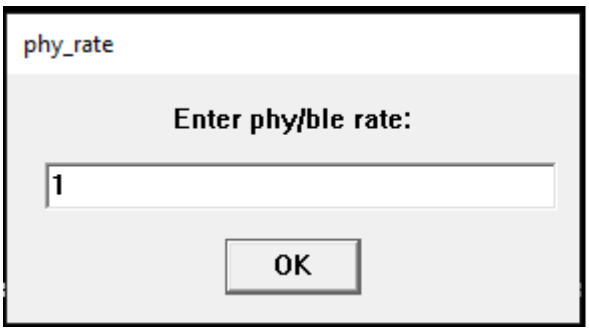


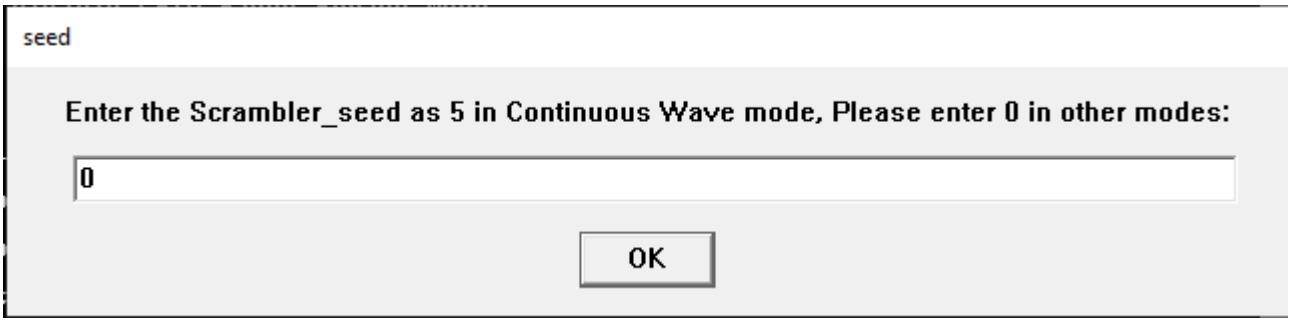

Opermode Successful
OK


address
Enter device_address:
71764129
OK

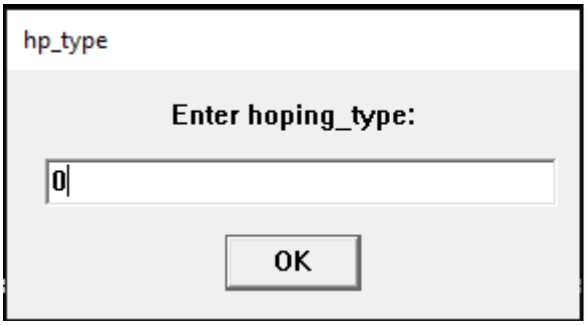

phy_rate
Enter phy/ble rate:
1
OK

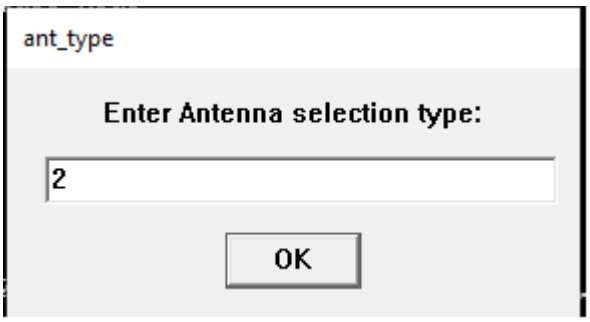

rx_no
Enter rx_channel_no:
0
OK

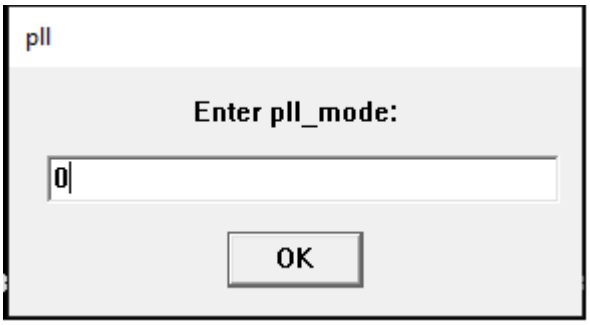

tx_no
Enter tx_channel_no:
0
OK

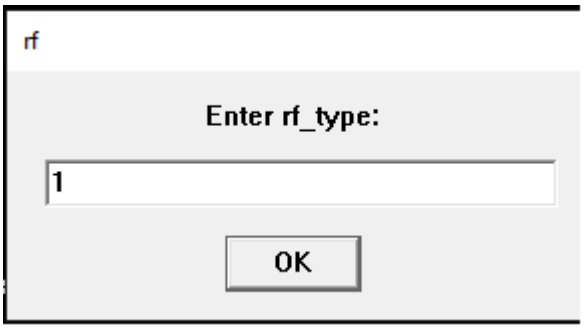

seed
Enter the Scrambler_seed as 5 in Continuous Wave mode, Please enter 0 in other modes:
0
OK


ltype
Enter le_channel_type:
1
OK

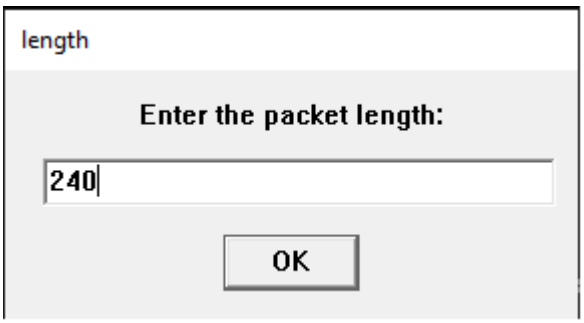

hp_type
Enter hoping_type:
0
OK


ant_type
Enter Antenna selection type:
2
OK

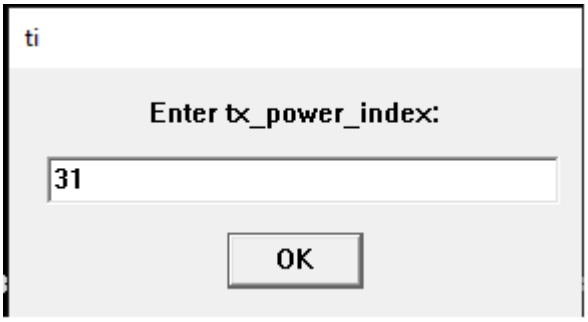

pll
Enter pll_mode:
0
OK

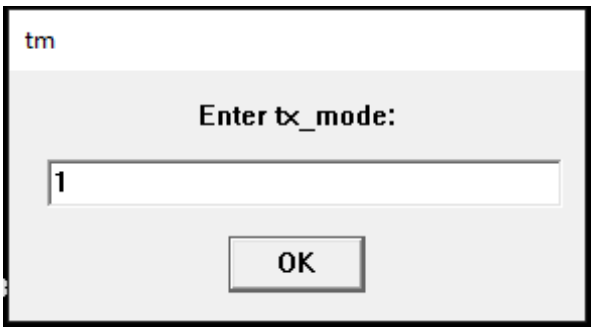

rf
Enter rf_type:
1
OK

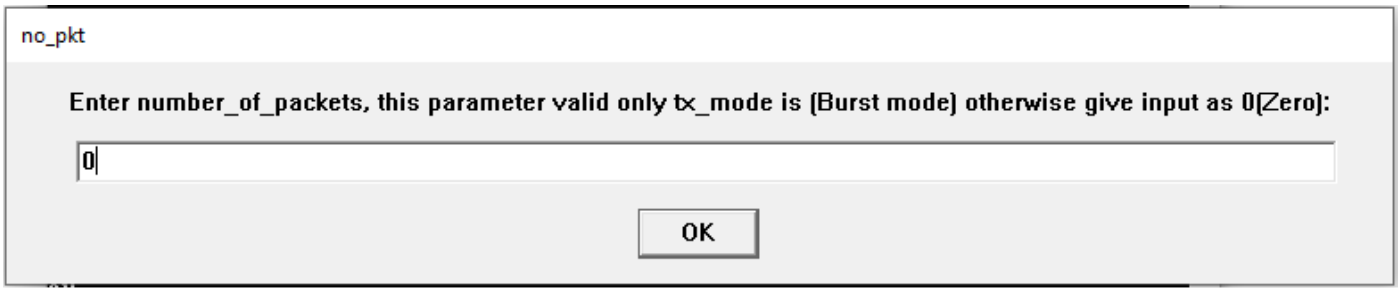

rc
Enter rf_chain:
3
OK

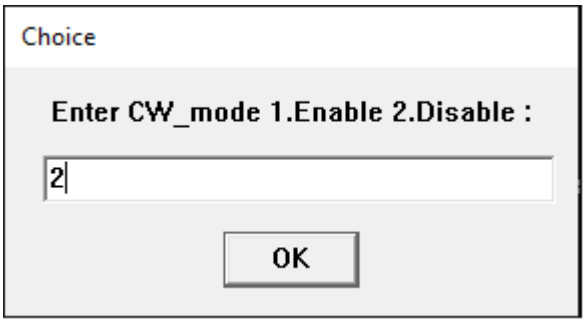

length
Enter the packet length:
240
OK

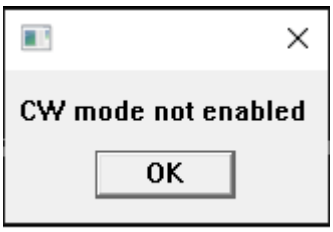

pt
Enter payload_type:
1
OK

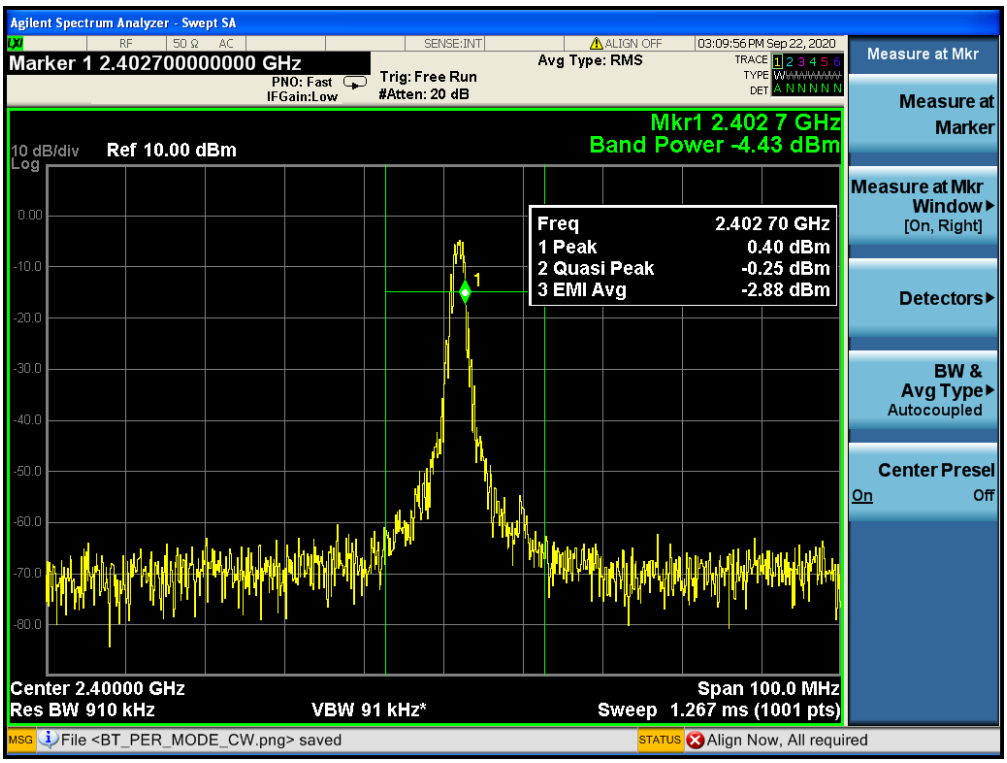

ti
Enter tx_power_index:
31
OK


tm
Enter tx_mode:
1
OK


no_pkt
Enter number_of_packets, this parameter valid only tx_mode is (Burst mode) otherwise give input as 0(Zero):
0
OK


Choice
Enter CW_mode 1.Enable 2.Disable :
2
OK




NOTE: The values taken in the picture are not done in idle environment. The values are taken including the cable losses, attenuator losses, etc.

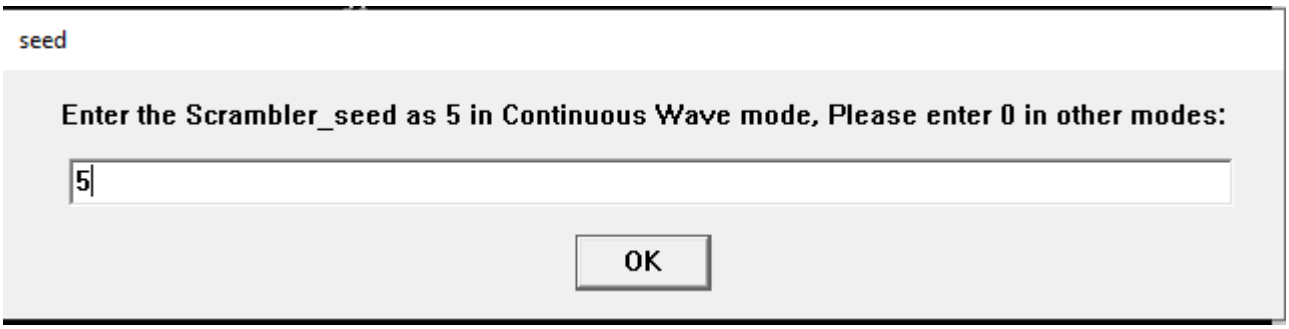
**CW Mode:**

at+rsi_opermode=851968,0,1,2147483648,2150629376,3221225472,0,376012800,2048<CR><LF>

at+rsibt_bletransmit=1,71764129,1,0,0,5,1,0,2,0,1,2,240,0,64,1,0,0<CR><LF>

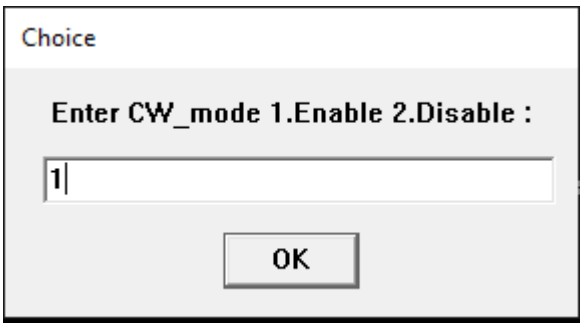
at+rsibt_percwmode=1<CR><LF>

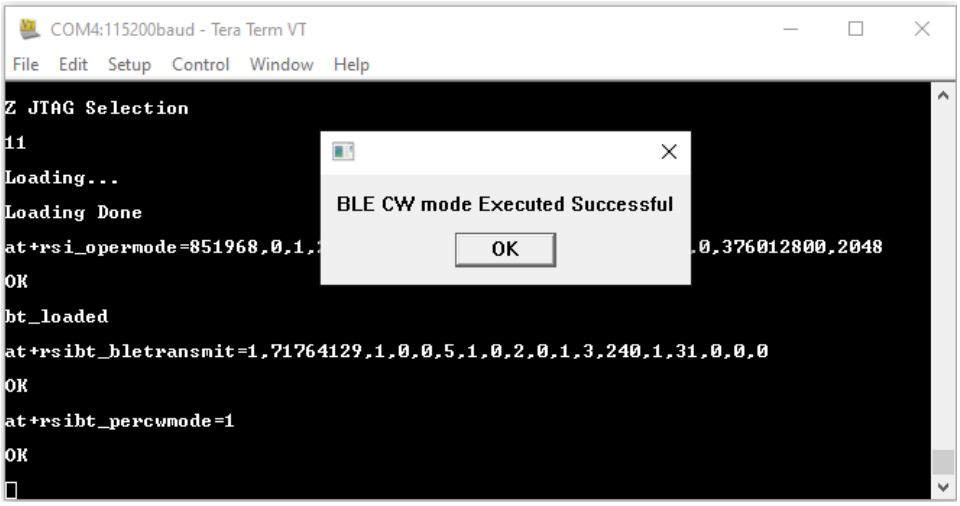
→ To run the BLE_CW mode all the parameters you need to enter as mentioned step by step procedure in above method. But "Scrambler_seed" parameter you need to give input as 5.

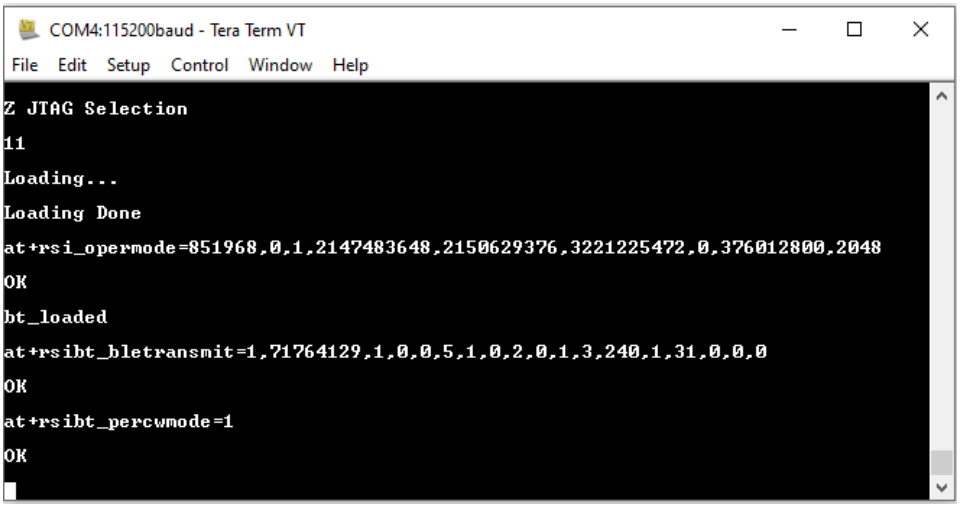


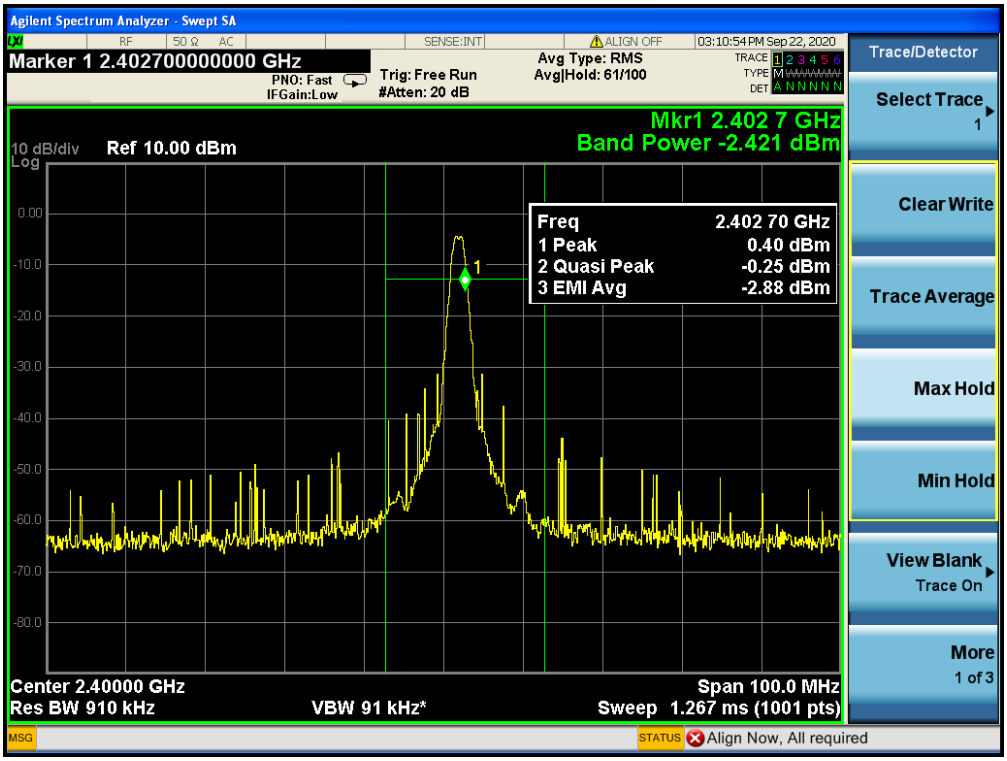

→ After "Scrambler_seed" parameter script will ask all the inputs as mentioned in above BLE_Trasmit method, you need to enter .

→ All the necessary inputs are completed , final input will ask for "Continuous Wave" selection you need to enter 2.Like as below pic.


Choice
Enter CW_mode 1.Enable 2.Disable :
1
OK


COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help
Z JTAG Selection
11
Loading...
Loading Done
at+rsi_opermode=851968,0,1,
.0,376012800,2048
OK
bt_loaded
at+rsibt_bletransmit=1,71764129,1,0,0,5,1,0,2,0,1,3,240,1,31,0,0,0
OK
at+rsibt_percwmode=1
OK
BLE CW mode Executed Successful
OK


COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help
Z JTAG Selection
11
Loading...
Loading Done
at+rsi_opermode=851968,0,1,2147483648,2150629376,3221225472,0,376012800,2048
OK
bt_loaded
at+rsibt_bletransmit=1,71764129,1,0,0,5,1,0,2,0,1,3,240,1,31,0,0,0
OK
at+rsibt_percwmode=1
OK



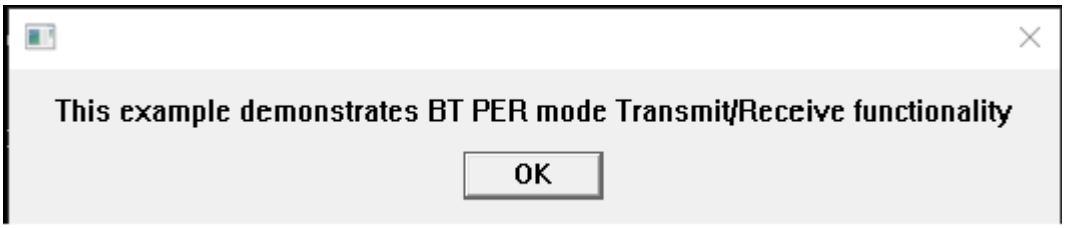

### 5.5.2 Bluetooth Sequence

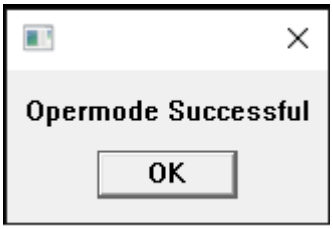
#### 5.5.2.1 For 0DBm PER transmit:

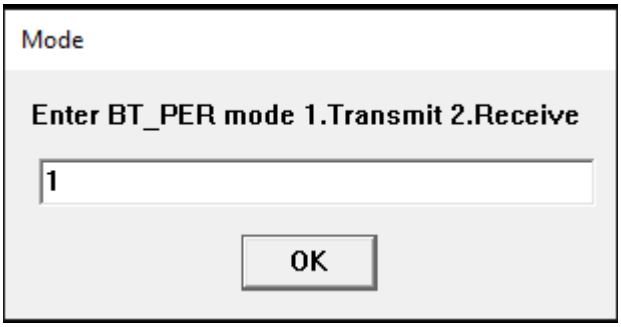
Note: The images which are referred below are of TTL Script which is mentioned in APPENDIX section.

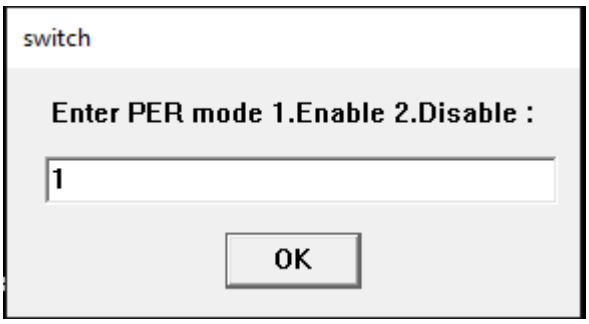
at+rsi_opermode=327680,0,1,2147483648,2150629376,1073741824<CR><LF>

at+rsibt_bredrtransmit=1,00-00-00-00-00-00,15,1,1,1,1,1,0,0,2,0,1,2,0,0,1,0,0<CR><LF>

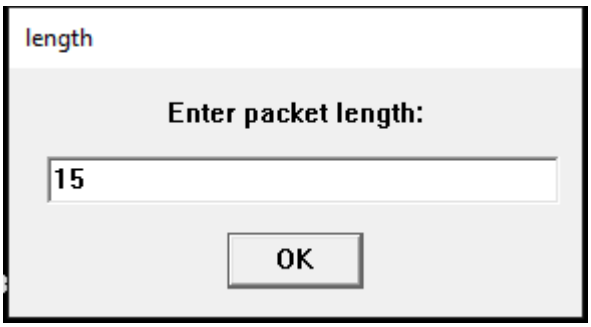


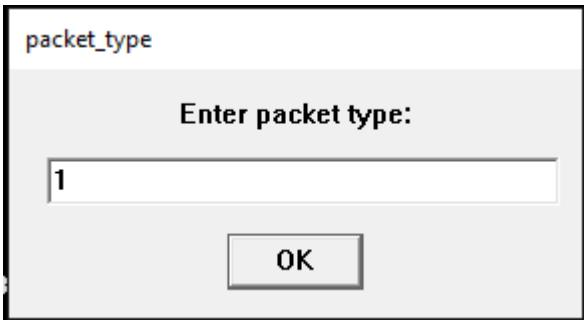



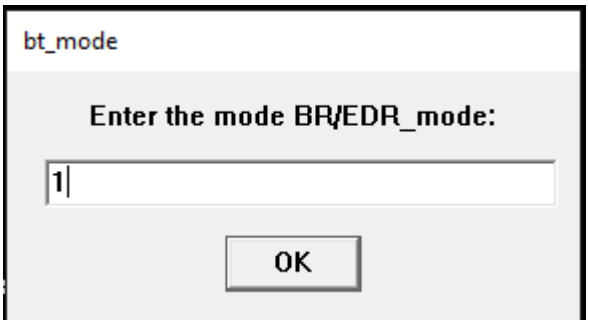




switch
Enter PER mode 1.Enable 2.Disable :
1
OK


address
Enter BT address:
00-00-00-00-00-00
OK


length
Enter packet length:
15
OK

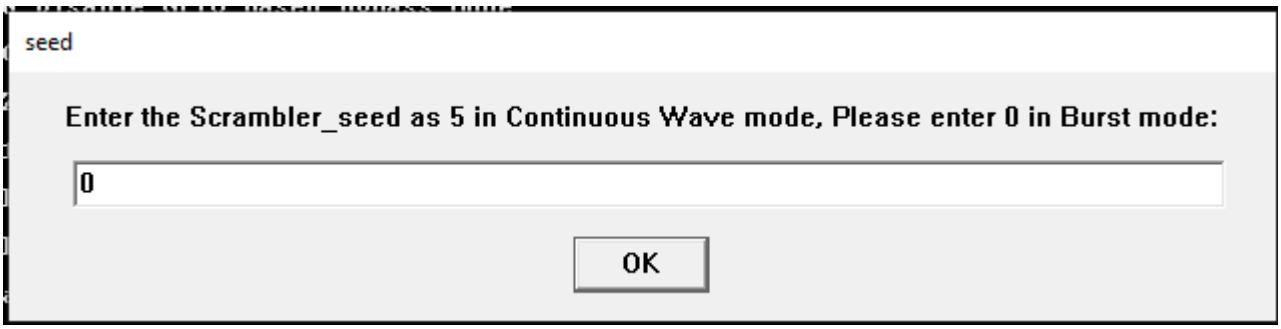

packet_type
Enter packet type:
1
OK

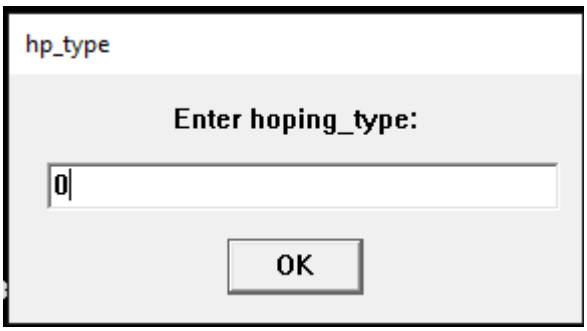

bt_mode
Enter the mode BR/EDR_mode:
1
OK

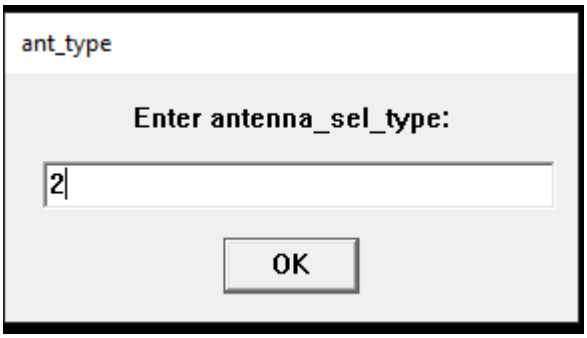

rx_no
Enter rx_channel_no:
1
OK

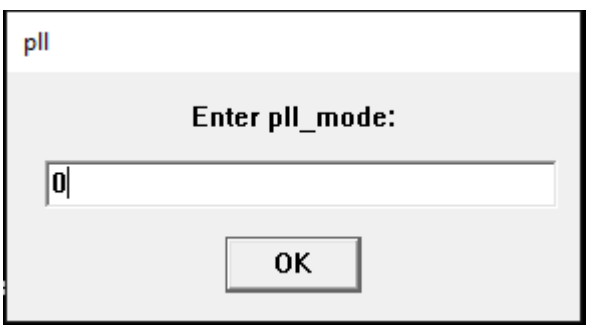

tx_no
Enter tx_channel_no:
1
OK

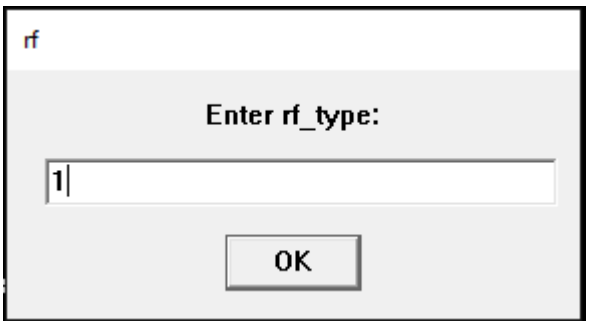

ltype
Enter link type:
1
OK


seed
Enter the Scrambler_seed as 5 in Continuous Wave mode, Please enter 0 in Burst mode:
0
OK


hp_type
Enter hoping_type:
0
OK

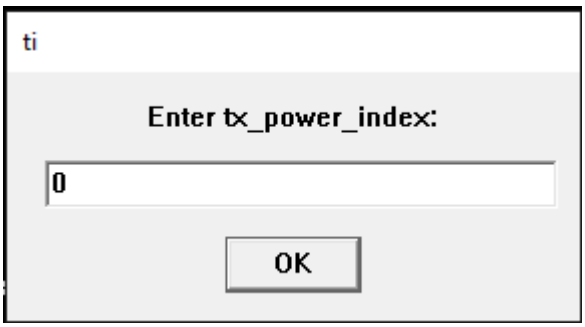

ant_type
Enter antenna_sel_type:
2
OK

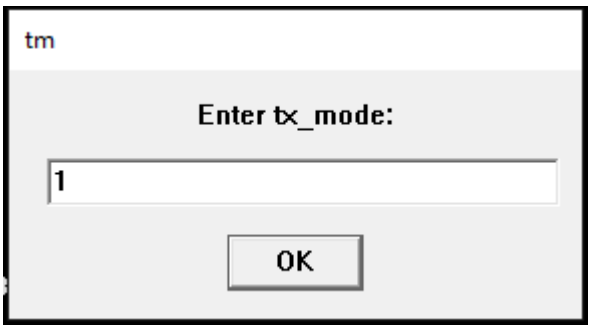

pll
Enter pll_mode:
0
OK

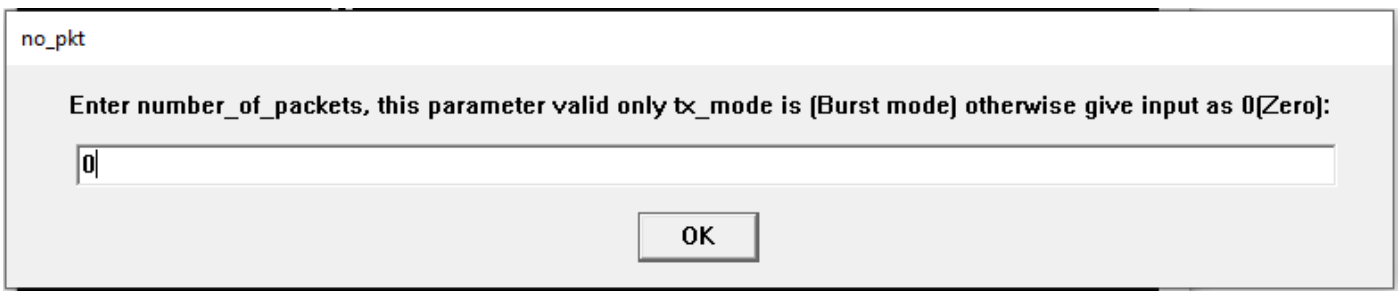

rf
Enter rf_type:
1
OK


rc
Enter rf_chain:
2
OK

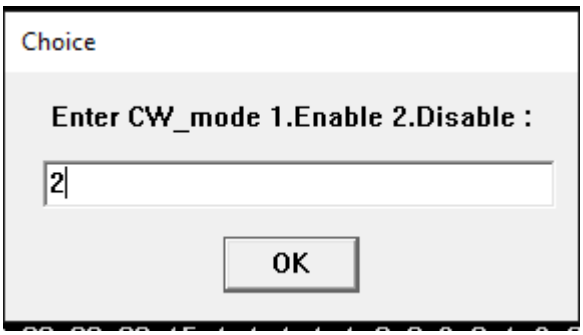

pt
Enter payload_type:
0
OK

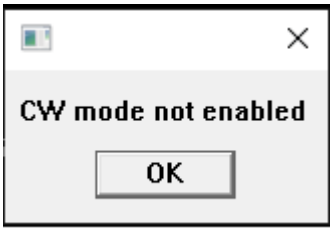

ti
Enter tx_power_index:
0
OK

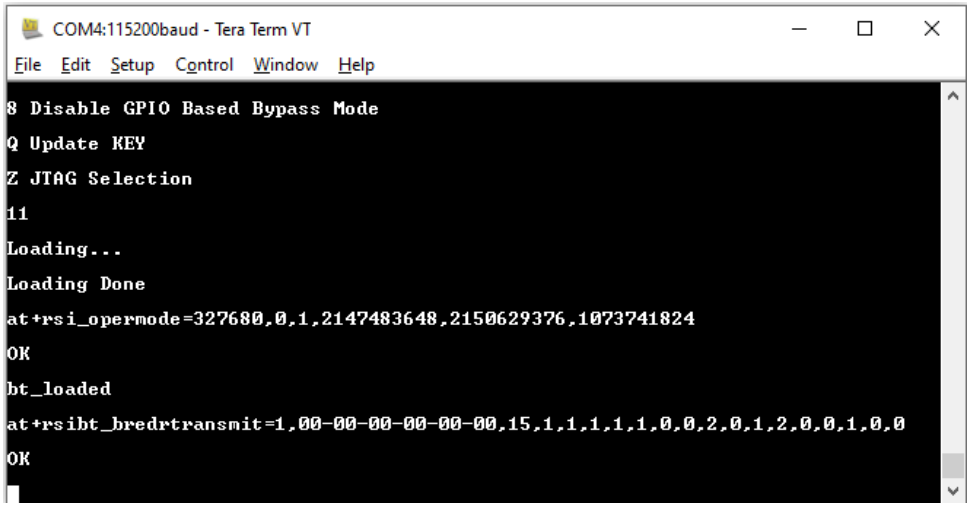

tm
Enter tx_mode:
1
OK

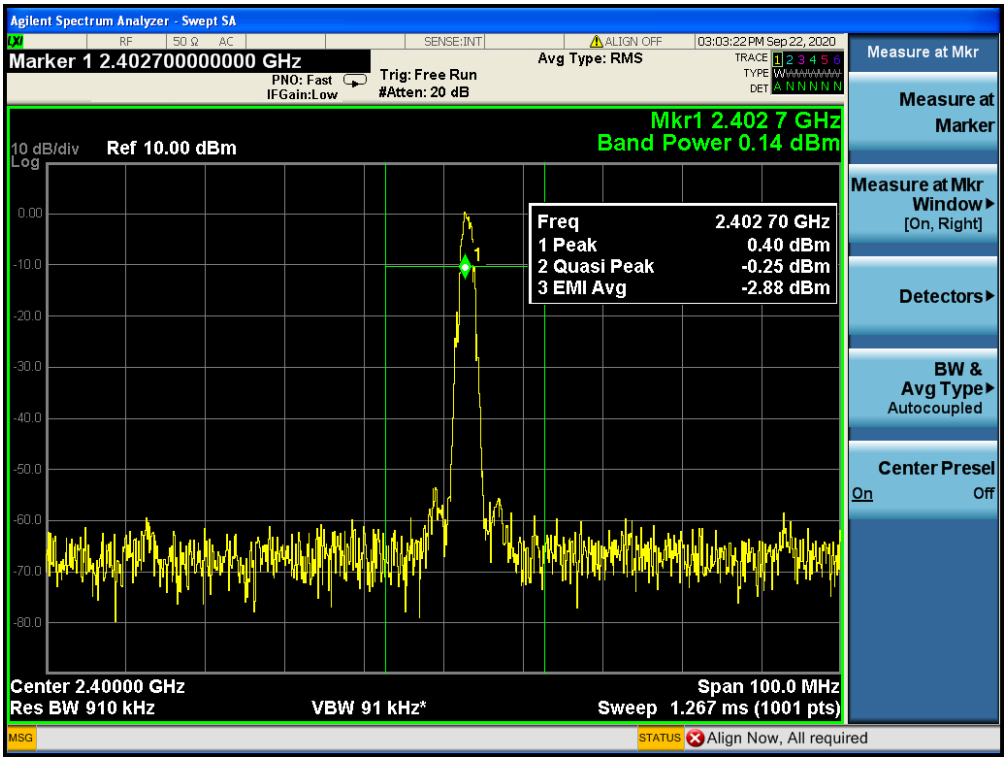

no_pkt
Enter number_of_packets, this parameter valid only tx_mode is (Burst mode) otherwise give input as 0(Zero):
0
OK


BT Transmit Executed Successful
OK


Choice
Enter CW_mode 1.Enable 2.Disable :
2
OK


CW mode not enabled
OK


COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help
8 Disable GPIO Based Bypass Mode
Q Update KEY
Z JTAG Selection
11
Loading...
Loading Done
at+rsi_opermode=327680,0,1,2147483648,2150629376,1073741824
OK
bt_loaded
at+rsibt_bredrtransmit=1,00-00-00-00-00-00,15,1,1,1,1,1,0,0,2,0,1,2,0,0,1,0,0
OK



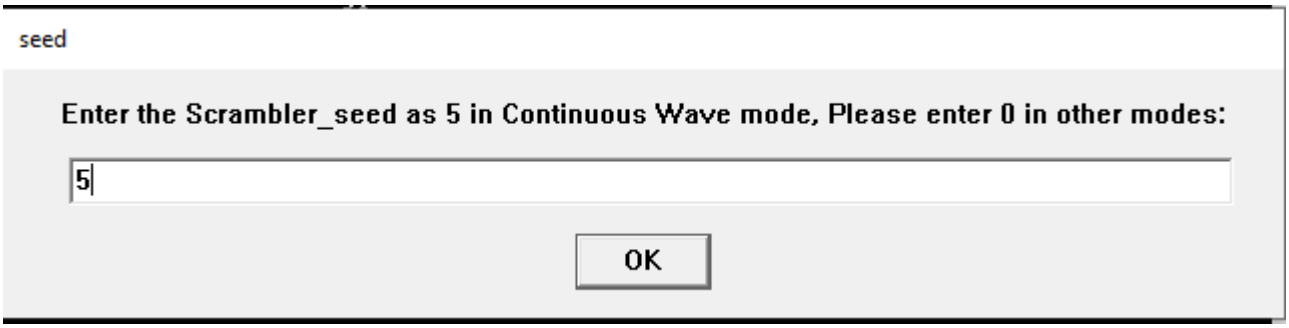

**CW_mode :-**

at+rsi_opermode=327680,0,1,2147483648,2150629376,1073741824<CR><LF>

at+rsibt_bredrtransmit=1,00-00-00-00-00-00,15,1,1,1,1,1,5,0,2,0,1,2,0,0,1,0,0<CR><LF>

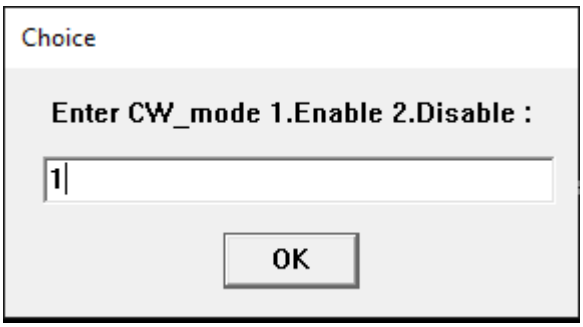
at+rsibt_percwmode=1<CR><LF>

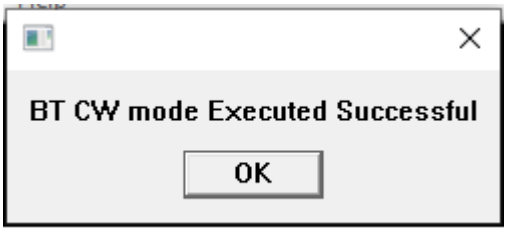
→ To run the BT_CW mode all the parameters you need enter as mentioned step by step procedure in above method. But "Scrambler_seed" parameter you need to give input as 5.

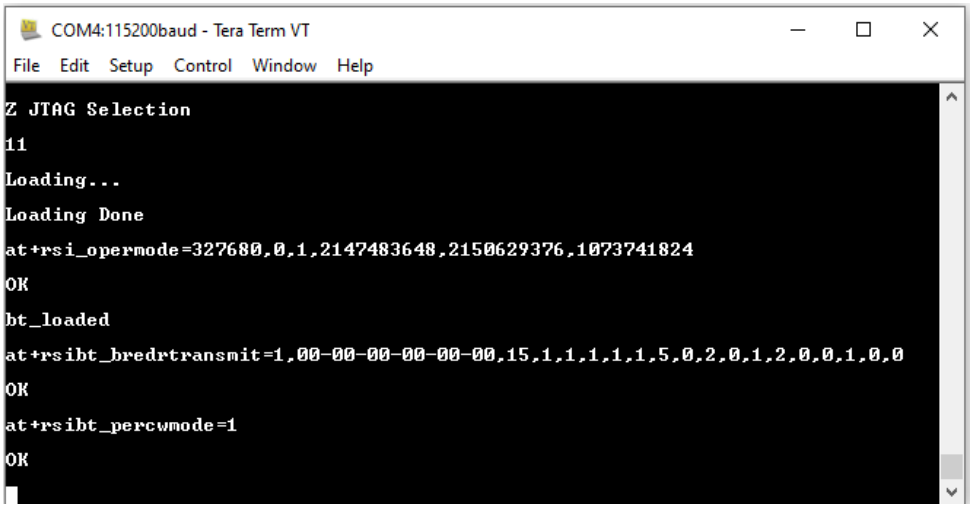



→ After "Scrambler_seed" parameter script will ask all the inputs as mentioned in above BT_Trasmit method, you need to enter .

→ All the necessary inputs are completed , final input will ask for "Continuous Wave" selection you need to enter 2.Like as below pic.





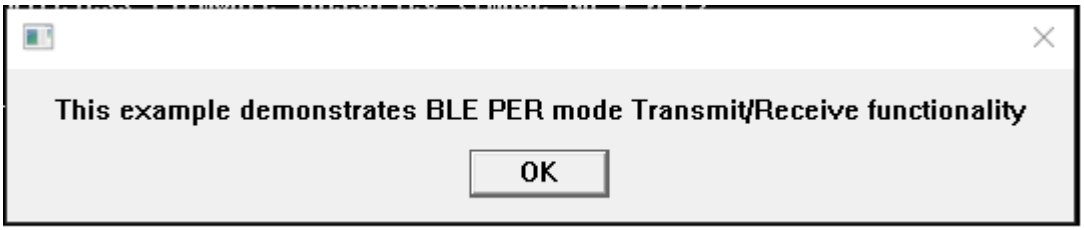

**For PER receive:**

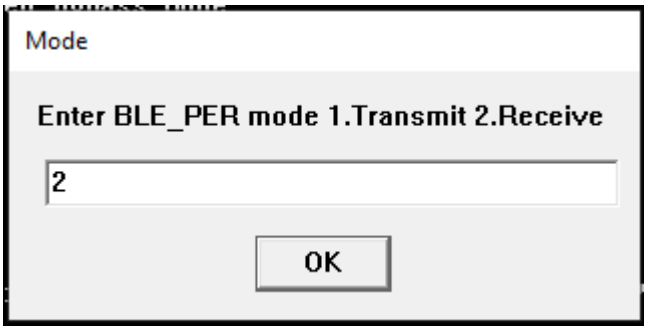
**This is the scenario need to run B/W the modules**

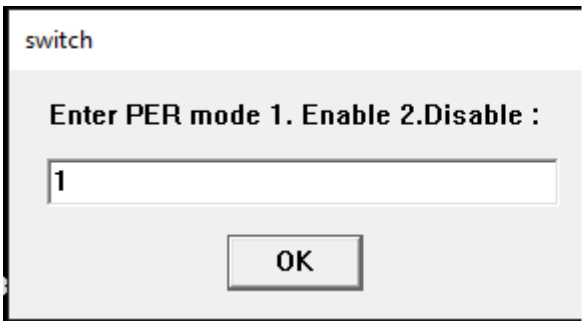
at+rsi_opermode=851968,0,1,2147483648,2150629376,3221225472,0,376012800,2048<CR><LF>

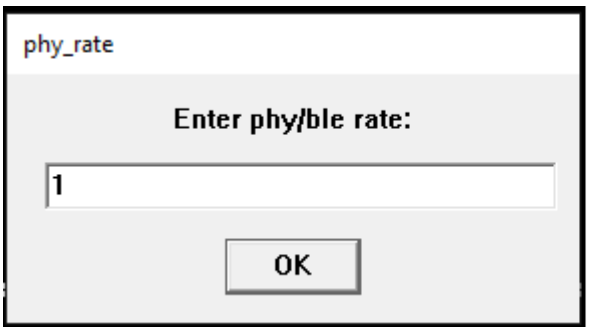
at+rsibt_bletransmit=1,71764129,1,0,0,0,1,0,2,0,1,2,240,1,0<CR><LF>

at+rsibt_perstats<CR><LF>



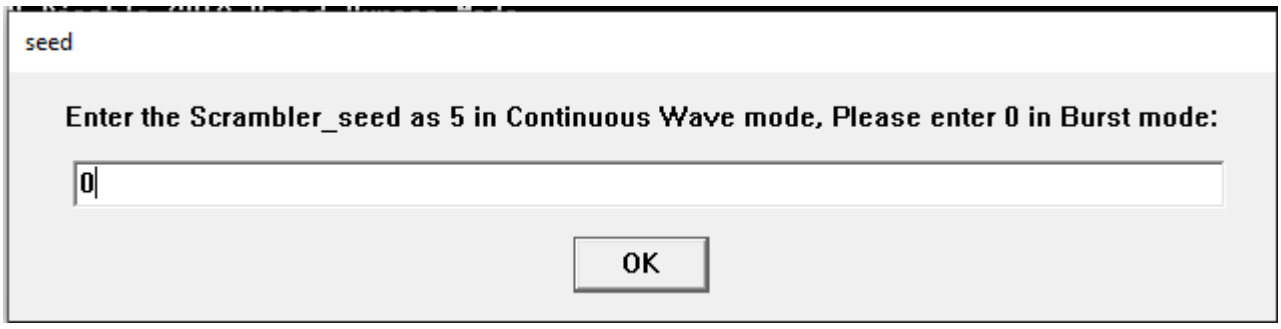





switch
Enter PER mode 1. Enable 2.Disable :
1
OK

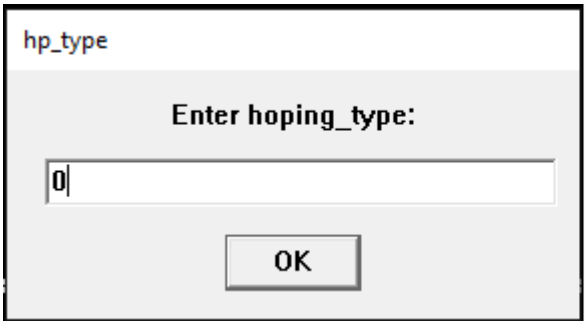

phy_rate
Enter phy/ble rate:
1
OK

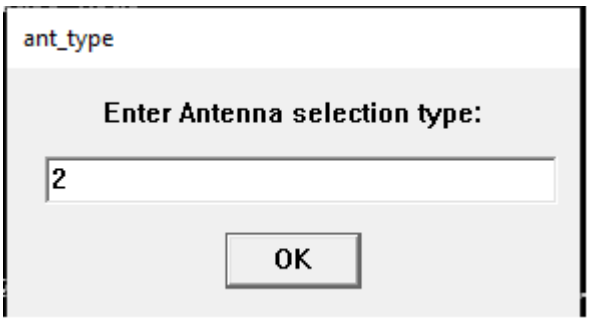

rx_no
Enter rx_channel_no:
0
OK

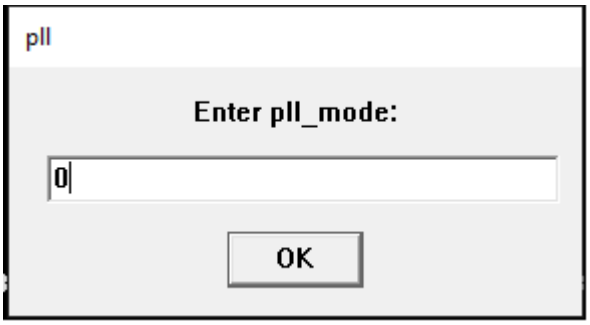

tx_no
Enter tx_channel_no:
0
OK

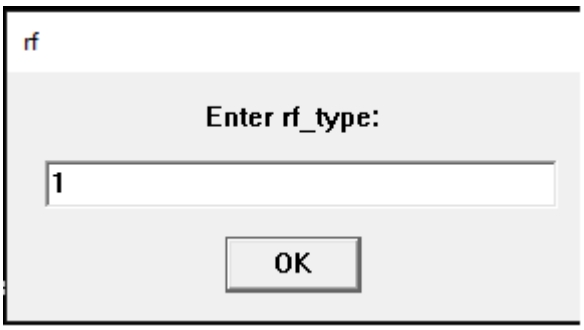

seed
Enter the Scrambler_seed as 5 in Continuous Wave mode, Please enter 0 in Burst mode:
0
OK


ltype
Enter le_channel_type:
1
OK

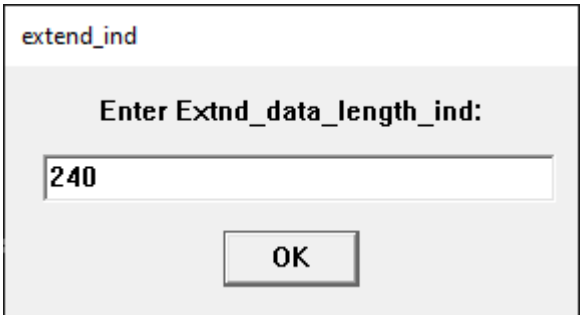

hp_type
Enter hoping_type:
0
OK

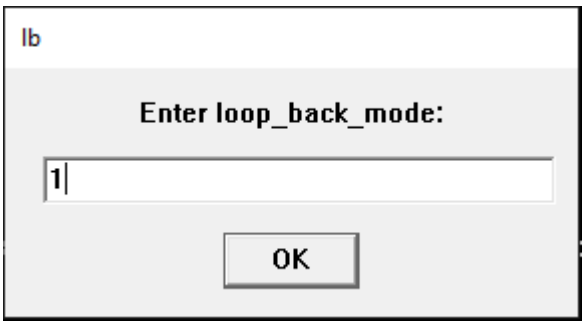

ant_type
Enter Antenna selection type:
2
OK


pll
Enter pll_mode:
0
OK

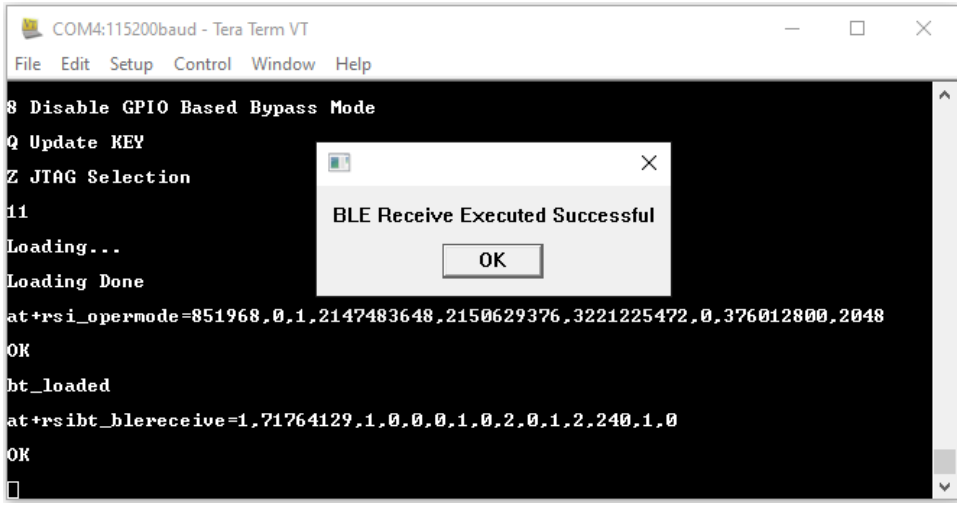

rf
Enter rf_type:
1
OK

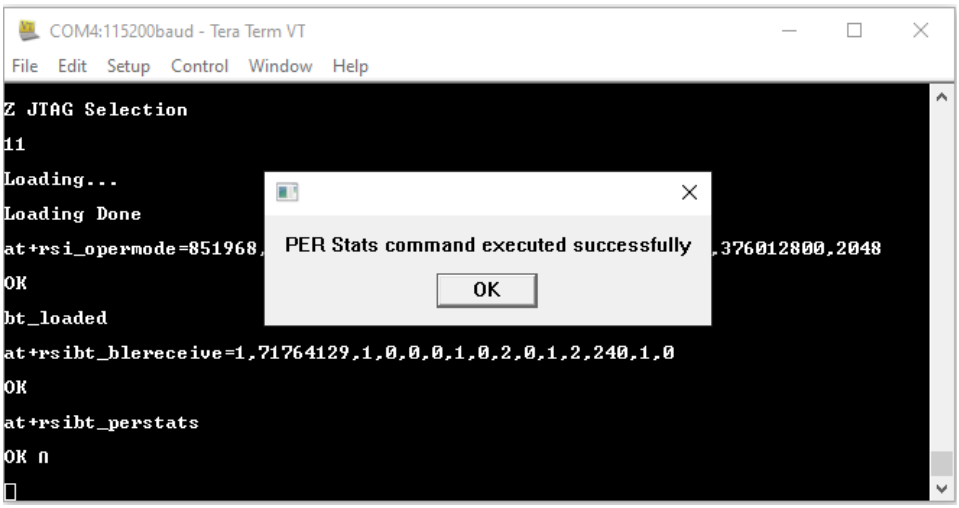

rc
Enter rf_chain:
3
OK


extend_ind
Enter Extnd_data_length_ind:
240
OK








-→ For BT_Receive also need to run the BT_PER script and select the Receive. Exactly same as BLE_Receive above mentioned method .

**For PER stats**:

At Transmitter side:

at+rsi_opermode=327680,0,1,2147483648,2150629376,1073741824<CR><LF>

at+rsibt_bredrtransmit=1,11-11-11-11-11-11,15,1,1,1,1,1,0,0,2,0,1,2,0,0,1,0,0<CR><LF>

At receiver side:

at+rsi_opermode=327680,0,1,2147483648,2150629376,1073741824<CR><LF>

at+rsibt_bredrreceive=1,11-11-11-11-11-11,15,1,1,1,1,1,0,0,2,0,1,2,0<CR><LF>

at+rsibt_perstats<CR><LF>

# 6 Summary

This detailed procedure has been performed with minimal traffic and performed using the internal RF of the evaluation kit. The module is connected to the spectrum analyzer( Used for measuring the DUT) using a cable and connected directly and hence losses will be present. By using the above commands user can test the Module in PER and CW mode.

# 7 References

Refer to RS9116W BLE AT Command Programming Reference Manual from https://docs.silabs.com/rs9116

Refer to RS9116W BT Classic AT Command Programming Reference Manual from https://docs.silabs.com/rs9116

# 8 Troubleshooting

1. If the UART port is not detected by the PC, please reset the module and try again.

2. For better values, please use a thick cable to avoid any losses.

3. After every iteration of measuring with the spectrum analyzer, make sure the module has been properly reset. Either use the button provided on the module or re-connect the module to the PC.

# 9 Appendix A: Running Tera Term Scripts

1) Here is the script code for BLE_PER Transmit & Receive. If we run the script it will ask the pop-up for Transmit/Receive, Based on the selection mode it will ask inputs.

```
TRUE = 1
FALSE = 0

message = 'This example demonstrates BLE PER mode Transmit/Receive functionality'
messagebox message ''

send '|'
wait 'U'
sendln 'U'
mpause 200
sendln '1'
wait 'Loading Done'
message = 'Firmware Loading Done Successfully'
messagebox message ''

sendln 'at+rsi_opermode=851968,0,1,2147483648,2150629376,3221225472,0,376012800,2048'
wait 'OK' ; 'bt_loaded' 'ERROR'
if result == 2 then
    goto error
else
    messagebox 'Opermode Successful' ''
endif

inputbox 'Enter BLE_PER mode 1.Transmit 2.Receive ' 'Mode'
Mode = inputstr

strcompare Mode '1'
if result=0 then
    inputbox 'Enter PER mode 1. Enable 2.Disable :' 'switch'
    switch = inputstr
    inputbox 'Enter device_address:' 'address'
    address = inputstr
    inputbox 'Enter phy/ble rate:' 'phy_rate'
    phy_rate = inputstr
    inputbox 'Enter rx_channel_no:' 'rx_no'
    rx_no = inputstr
    inputbox 'Enter tx_channel_no:' 'tx_no'
    tx_no = inputstr
    inputbox 'Enter the Scrambler_seed as 5 in Continuous Wave mode, Please enter 0 in other modes:'
'seed'
    seed = inputstr
    inputbox 'Enter le_channel_type:' 'ltype'
    ltype = inputstr
    inputbox 'Enter hoping_type:' 'hp_type'
    hp_type = inputstr
    inputbox 'Enter Antenna selection type:' 'ant_type'
    ant_type = inputstr
    inputbox 'Enter pll_mode:' 'pll'
    pll = inputstr
    inputbox 'Enter rf_type:' 'rf'
    rf = inputstr
    inputbox 'Enter rf_chain:' 'rc'
    rc = inputstr
    inputbox 'Enter the packet length:' 'length'
    length = inputstr
    inputbox 'Enter payload_type:' 'pt'
    pt = inputstr
    inputbox 'Enter tx_power_index:' 'ti'
    ti = inputstr
    inputbox 'Enter tx_mode:' 'tm'
    tm = inputstr
    inputbox 'Enter number_of_packets, this parameter valid only tx_mode is (Burst mode) otherwise give
input as 0(Zero):' 'no_pkt'
    no_pkt = inputstr

    sendln
'at+rsibt_bletransmit='switch','address','phy_rate','rx_no','tx_no','seed','ltype','hp_type','ant_type'
```

```
,'pll','rf','rc','length','pt','ti','tm',0,'no_pkt''
    wait 'OK' 'ERROR'
    if result == 2 then
        goto error
    else
        messagebox 'BLE Transmit Executed Successful' ''
        inputbox 'Enter CW_mode 1.Enable 2.Disable :' 'Choice'
        Choice = inputstr
        strcompare Choice '1'
        if result=0 then
              sendln 'at+rsibt_percwmode=1'
              wait 'OK' 'ERROR'
              if result == 2 then
                    goto error
              else
                      messagebox 'BLE CW mode Executed Successful' ''
              endif
         endif
         strcompare Choice '2'
         if result=0 then
                  messagebox 'CW mode not enabled ' ''
          endif
     endif
endif

strcompare Mode '2'
if result=0 then
     inputbox 'Enter PER mode 1. Enable 2.Disable :' 'switch'
     switch = inputstr
     inputbox 'Enter device_address:' 'address'
     address = inputstr
     inputbox 'Enter phy/ble rate:' 'phy_rate'
     phy_rate = inputstr
     inputbox 'Enter rx_channel_no:' 'rx_no'
     rx_no = inputstr
     inputbox 'Enter tx_channel_no:' 'tx_no'
     tx_no = inputstr
     inputbox 'Enter the Scrambler_seed as 5 in Continuous Wave mode, Please enter 0 in Burst mode:'
'seed'
     seed = inputstr
     inputbox 'Enter le_channel_type:' 'ltype'
     ltype = inputstr
     inputbox 'Enter hoping_type:' 'hp_type'
     hp_type = inputstr
     inputbox 'Enter Antenna selection type:' 'ant_type'
     ant_type = inputstr
     inputbox 'Enter pll_mode:' 'pll'
     pll = inputstr
     inputbox 'Enter rf_type:' 'rf'
     rf = inputstr
     inputbox 'Enter rf_chain:' 'rc'
     rc = inputstr
     inputbox 'Enter Extnd_data_length_ind:' 'extend_ind'
     extend_ind = inputstr
     inputbox 'Enter loop_back_mode:' 'lb'
     lb = inputstr
     inputbox 'Enter duty_cycling (power_save_options):' 'dc'
     dc = inputstr

     sendln
'at+rsibt_blereceive='switch','address','phy_rate','rx_no','tx_no','seed','ltype','hp_type','ant_type',
'pll','rf','rc','extend_ind','lb','dc''
     wait 'OK' 'ERROR'
     if result == 2 then
          goto error
     else
           messagebox 'BLE Receive Executed Successful' ''
     endif

    sendln 'at+rsibt_perstats'
    wait 'OK' 'ERROR'
```

```
    if result == 2 then
         goto error
    else
         messagebox 'PER Stats command executed successfully' ''
    endif
endif

goto endscript


:error
messagebox 'An error occurred, Please check your configuration and try again' 'ERROR'

:endscript
end
```

2) Here is the script code for BT_PER Transmit & Receive. If we run the script it will ask the pop-up for Transmit/Receive, Based on the selection mode it will ask inputs.

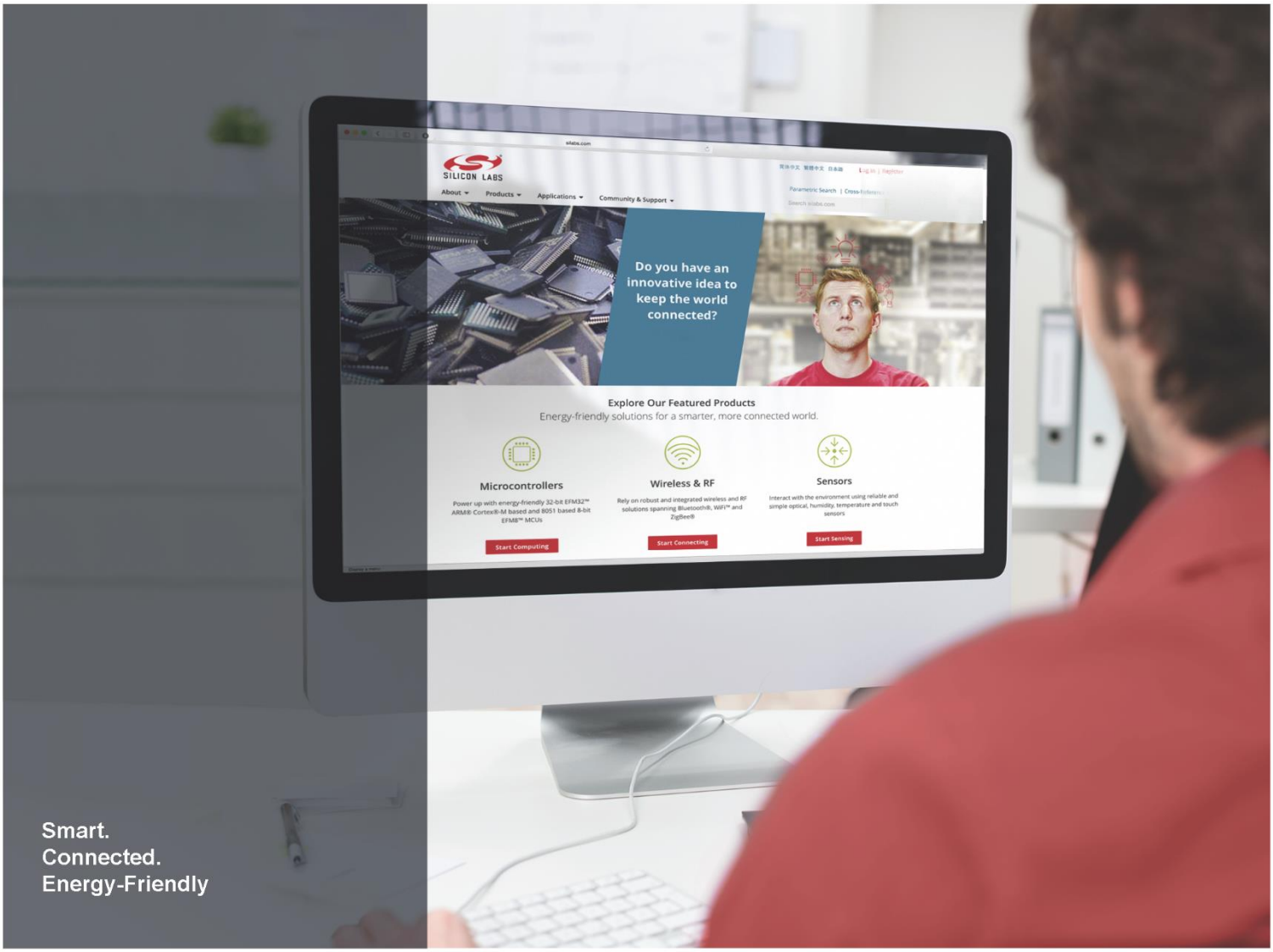
```
TRUE = 1
FALSE = 0

message = 'This example demonstrates BT PER mode Transmit/Receive functionality'
messagebox message ''

send '|'
wait 'U'
sendln 'U'
mpause 200
sendln '1'
wait 'Loading Done'
message = 'Firmware Loading Done Successfully'
messagebox message ''

sendln 'at+rsi_opermode=327680,0,1,2147483648,2150629376,1073741824'
wait 'OK' ; 'bt_loaded' 'ERROR'
if result == 2 then
    goto error
else
     messagebox 'Opermode Successful' ''
endif

inputbox 'Enter BT_PER mode 1.Transmit 2.Receive ' 'Mode'
Mode = inputstr

strcompare Mode '1'
if result=0 then
      inputbox 'Enter PER mode 1.Enable 2.Disable :' 'switch'
      switch = inputstr
      inputbox 'Enter BT address:' 'address'
      address = inputstr
      inputbox 'Enter packet length:' 'length'
      length = inputstr
      inputbox 'Enter packet type:' 'packet_type'
      packet_type = inputstr
      inputbox 'Enter the mode BR/EDR_mode:' 'bt_mode'
      bt_mode = inputstr
      inputbox 'Enter rx_channel_no:' 'rx_no'
      rx_no = inputstr
      inputbox 'Enter tx_channel_no:' 'tx_no'
      tx_no = inputstr
      inputbox 'Enter link type:' 'ltype'
      ltype = inputstr
      inputbox 'Enter the Scrambler_seed as 5 in Continuous Wave mode, Please enter 0 in Burst mode:'
'seed'
      seed = inputstr
      inputbox 'Enter hoping_type:' 'hp_type'
      hp_type = inputstr
      inputbox 'Enter antenna_sel_type:' 'ant_type'
      ant_type = inputstr
      inputbox 'Enter pll_mode:' 'pll'
      pll = inputstr
      inputbox 'Enter rf_type:' 'rf'
```

```
      rf = inputstr
      inputbox 'Enter rf_chain:' 'rc'
      rc = inputstr
      inputbox 'Enter payload_type:' 'pt'
      pt = inputstr
      inputbox 'Enter tx_power_index:' 'ti'
      ti = inputstr
      inputbox 'Enter tx_mode:' 'tm'
      tm = inputstr
      inputbox 'Enter number_of_packets, this parameter valid only tx_mode is (Burst mode) otherwise
give input as 0(Zero):' 'no_pkt'
      no_pkt = inputstr

       sendln
'at+rsibt_bredrtransmit='switch','address','length','packet_type','bt_mode','rx_no','tx_no','ltype','se
ed','hp_type','ant_type','pll','rf','rc','pt','ti','tm',0,'no_pkt''
       wait 'OK' 'ERROR'
       if result == 2 then
            goto error
       else
            messagebox 'BT Transmit Executed Successful' ''
            inputbox 'Enter CW_mode 1.Enable 2.Disable :' 'Choice'
            Choice = inputstr
            strcompare Choice '1'
            if result=0 then
                  sendln 'at+rsibt_percwmode=1'
                  wait 'OK' 'ERROR'
                  if result == 2 then
                        goto error
                  else
                        messagebox 'BT CW mode Executed Successful' ''
                  endif
            endif
            strcompare Choice '2'
            if result=0 then
                  messagebox 'CW mode not enabled ' ''
             endif
       endif
endif

strcompare Mode '2'
if result=0 then
      inputbox 'Enter PER mode 1.Enable 2.Disable :' 'switch'
      switch = inputstr
      inputbox 'Enter device_address:' 'address'
      address = inputstr
      inputbox 'Enter packet length:' 'length'
      length = inputstr
      inputbox 'Enter packet type:' 'packet_type'
      packet_type = inputstr
      inputbox 'Enter the mode BR/EDR_mode:' 'bt_mode'
      bt_mode = inputstr
      inputbox 'Enter rx_channel_no:' 'rx_no'
      rx_no = inputstr
      inputbox 'Enter tx_channel_no:' 'tx_no'
      tx_no = inputstr
      inputbox 'Enter link type:' 'ltype'
      ltype = inputstr
      inputbox 'Enter the Scrambler_seed as 5 in Continuous Wave mode, Please enter 0 in Burst mode:'
'seed'
      seed = inputstr
      inputbox 'Enter hoping_type:' 'hp_type'
      hp_type = inputstr
      inputbox 'Enter antenna_sel_type:' 'ant_type'
      ant_type = inputstr
      inputbox 'Enter pll_mode:' 'pll'
      pll = inputstr
      inputbox 'Enter rf_type:' 'rf'
      rf = inputstr
      inputbox 'Enter rf_chain:' 'rc'
      rc = inputstr
```

```
      inputbox 'Enter loop_back_mode:' 'lb'
      lb = inputstr

      sendln
'at+rsibt_bredrreceive='switch','address','length','packet_type','bt_mode','rx_no','tx_no','ltype','see
d','hp_type','ant_type','pll','rf','rc','lb''
      wait 'OK' 'ERROR'
      if result == 2 then
          goto error
      else
          messagebox 'BT Receive Executed Successful' ''
      endif

      sendln 'at+rsibt_perstats'
      wait 'OK' 'ERROR'
      if result == 2 then
          goto error
     else
          messagebox 'PER Stats command executed successfully' ''
     endif
endif

goto endscript

:error
messagebox 'An error occurred, Please check your configuration and try again' 'ERROR'

:endscript
end
```

# 10 Revision History

| Revision No. | Version No | Date | Changes |
|---|---|---|---|
| 1 | 1.1 | May, 2020 | Initial version |
| 2 | 1.2 | Oct, 2020 | 1. Updated the command sequences based on latest PRM updates<br>2. Added TTL Images.<br>3. Added APPENDIX Section with the TTL Script used for this APP notes<br>4. Updated links and document names |

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