Realtek Bluetooth MP Flow

(Linux)

Date: 2018/03/19

1. Overview

This document is used to introduce MP (Mass Production) test tool for Realtek Bluetooth chip series. Customers should comply with the steps and requirements under this document. Contact Realtek Bluetooth FAE if any problem arises in the use of MP flow.

2. Prerequisites

Before MP tool startup, below items should be checked:

a) The Bluetooth Chip embedded is provided by Realtek;

Realtek Bluetooth Chip Number
RTL8723B series
RTL8761A series
RTL8821A series
RTL8703B series
RTL8723D series
RTL8822B series
RTL8821C series

b) The Bluetooth on target production is available and works normally;

2.1 Binary Files

MP tool package is provided to customers in binary format:

rtlbtmp	MP cmd tool
mp_rtl8723b_fw, mp_rtl8723b_config	8723b MP firmware and configure files
mp_rtl8761a_fw, mp_rtl8761a_config	8761a MP firmware and configure files
mp_rtl8821a_fw, mp_rtl8821a_config	8821a MP firmware and configure files
mp_rtl8703b_fw, mp_rtl8703b_config	8703b MP firmware and configure files
mp_rtl8723d_fw, mp_rtl8723d_config	8723d MP firmware and configure files
mp_rtl8822b_fw, mp_rtl8822b_config	8822b MP firmware and configure files
mp_rtl8821c_fw, mp_rtl8821c_config	8821c MP firmware and configure files

Customers should copy these binary files to respective directories on target production:

rtlbtmp --> /usr/sbin/rtlbtmp chmod 755 /usr/sbin/rtlbtmp

mp_rtlxxx_fw, mp_rtlxxx_config --> /lib/firmware

Notice: If customer use 8723b chip, then the mp_rtlxxx_config's name must be mp_rtl8723b_config, so as to other chips. Customers should copy the normal config file and rename it to mp_rtlxxx_conifg.

3. MP Tool Usage

3.1 MP Initial Commands

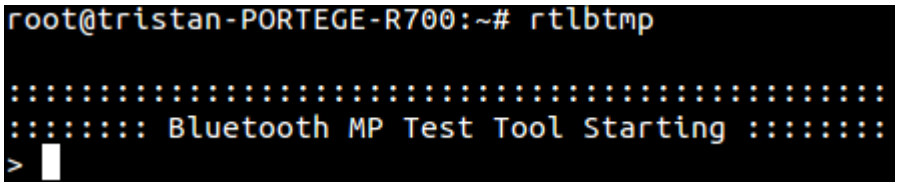
These commands used to initialize Bluetooth DUT in MP mode are listed as below:

MP Command	Parameters	Return	Description
rtlbtmp	None	[success]	Start the MP CMD tool.
enable	USB: enable usb:/dev/rtk_btusb	[success]	Enable USB I/F Bluetooth MP stack and download FW code. Device node is **fixed as rtk_btusb**.
	UART5: enable uart:/dev/ttyS0 enable uart5:/dev/ttyS0 UART4: enable uart4:/dev/ttyS0	[success]	Enable Uart I/F Bluetooth MP stack and download FW code. Device node is **chosen by vendor specifically**. H5 (UART5) or H4 (UART4) is determined by the chip configurations. Customers can consult FAE for detailed information.
disable	None	[success]	Disable Bluetooth MP stack and close the device.
quit	None	None	Exit from the MP CMD tool.
help	None	None	List all MP CMDs supported.

NOTE: Before running the MP CMD tool, BT on UI settings should be disabled; otherwise, MP tool will be at abnormal status.

3.1.1 Start MP CMD Tool

rtlbtmp

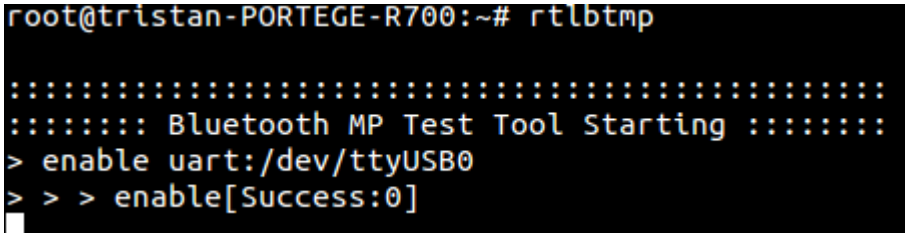


3.1.2 Enable MP Stack

Check Bluetooth stack HCI interface first, then run the enable MP stack CMD.

> enable usb:/dev/rtk_btusb // usb I/F

> enable uart:/dev/ttyS0 // uart I/F, device node specified by vendor (platform)



3.1.3 Disable MP Stack

> disable

```
> disable
disable[Success:0]
>
```

3.1.5 Exit MP Tool

> quit

```
> quit
:::::::: Bluetooth MP Test Tool Terminating ::::::::
root@tristan-PORTEGE-R700:~#
```

3.1.6 Lookup MP CMDs

> help

```
> help
help :: Lists all available console commands
quit :: Abort the MP tool test app
enable :: Enable bluetooth
disable :: Disable bluetooth
bt_mp_HciCmd :: Send HCI Commands
bt_mp_GetParam :: Get all/individual exposed parameters
bt_mp_SetParam :: Set specific parameters<index,value>
bt_mp_SetParam1 :: Set series 1 parameters
bt_mp_SetParam2 :: Set series 2 parameters
bt_mp_SetConfig :: Set configurations to the specific file
bt_mp_Exec :: Execute specific action<action id>
bt_mp_Report :: Report specific info according to item selected
bt_mp_RegRW :: R/W Modem, RF, SYS & BB registers
>
```

3.2 MP Mode Control Parameters Commands

3.2.1 Control Parameters Commands Format

These commands used to set/get Bluetooth DUT parameters.

MP Command	Parameters	Return		
bt_mp_SetParam	**Index0,value0;Index1,value1;...;IndexN,valueN**	Return Index	Return Status	
bt_mp_GetParam	Index	Return Index	Return Status	Return Value

TABLE CONTROL_PARAM_CMD

3.2.2 Control Commands: Set/Get parameter command

You can use "bt_mp_SetParam" to set parameters and can use "bt_mp_GetParam" to check it.
The Format is "bt_mp_SetParam **Index0,value0; Index1,..;IndexN,valueN"**.

Example : If you want to set the channel 10 and packet type "BT_PKT_3DH5", you can use" bt_mp_SetParam 0x01,0x0a;0x02,0x08"

```
> bt_mp_SetParam 0x01,0x0a;0x02,0x08
bt_mp_SetParam[Success:0]
> bt_mp_SetParam,2,0x00
```

Or set channel and packet type separately.

```
> bt_mp_SetParam 0x01,0x0a
bt_mp_SetParam[Success:0]
> bt_mp_SetParam,1,0x00

> bt_mp_SetParam 0x02,0x08
bt_mp_SetParam[Success:0]
> bt_mp_SetParam,2,0x00
```

Use **bt_mp_GetParam** to check parameter settings.

```
> bt_mp_GetParam 0x01
bt_mp_GetParam[Success:0]
> bt_mp_GetParam,1,0x00,0x0a

> bt_mp_GetParam 0x02
bt_mp_GetParam[Success:0]
> bt_mp_GetParam,2,0x00,0x08
```

The parameter Indexes define in "PARAM_INDEX" Table.

INDEX	VALUE	Length (Byte)	Value Range	Table Index
0	PGRawData	256	Row data	None
1	ChannelNumber	1	0~78	None
2	PacketType	1	0~9	**See PKT_TYPE**
3	PayloadType	1	0~7	**See PAYLOAD_TYPE**
4	TxPacketCount (only for packet tx)	2	0~0x3FFF	**See Section3.2.3**
6	WhiteningCoeffValue	1	0x00~0x7F	0x00~0x7F: Enable Whitening 0x80: Disable Whitening
7	TxGainIndex	1	Realtek define	**See Section3.2.5**
9	PacketHeader	4	0x0~0x3FFFF	**See PACKET_HEADER**
10	HoppingFixChannel (for Hopping mode)	1	0 : Disable 1 : Enable Fix Channel	None
11	HitTarget	6	6 bytes	None
14	Xtal	4	0~0x3F	None
15	LEDataLen	1	0~0x25	None

Table PARAM_INDEX

The packet types are defined in Table PKT_TYPE:

NAME	INDEX	Payload Length in bits
BT_PKT_DH1	0	0~27*8
BT_PKT_DH3	1	0~183*8
BT_PKT_DH5	2	0~339*8
BT_PKT_2DH1	3	0~54*8
BT_PKT_2DH3	4	0~367*8
BT_PKT_2DH5	5	0~679*8
BT_PKT_3DH1	6	0~83*8
BT_PKT_3DH3	7	0~552*8
BT_PKT_3DH5	8	0~1021*8
BT_PKT_LE	9	0~39*8

Table PKT_TYPE

The payload types are defined in Table PAYLOAD_TYPE.

NAME	INDEX
BT_PAYLOAD_TYPE_ALL0	0
BT_PAYLOAD_TYPE_ALL1	1
BT_PAYLOAD_TYPE_0101	2
BT_PAYLOAD_TYPE_1010	3
BT_PAYLOAD_TYPE_0x0_0xF	4
BT_PAYLOAD_TYPE_0000_1111	5

BT_PAYLOAD_TYPE_1111_0000	6
BT_PAYLOAD_TYPE_PRBS9	7

Table PAYLOAD_TYPE

Packet type	Payload(Bits)	Packet Header Hex
DH1	216	33820
DH3	1464	39858
DH5	2712	A078
2DH1	432	33820
2DH3	2936	C050
2DH5	5432	3F870
3DH1	664	15C40
3DH3	4416	39858
3DH5	8168	A078

Table PACKET_HEADER

3.2.3 TxPacketCount parameter

TxPacketCount is used to set how many TX packets will be transmitted. The range of TxPacketCount is from 0 to 0xFFF. In UI mode, the value of TxPacketCount is “0” that means to send the most tx packet counts “0xFFF”. In FW mode, the value of TxPacketCount is “0” that means to send tx packet counts continuously.

3.2.4 WhiteningCoeffValue parameter

The range of WhiteningCoeffValue is from 0 to 0x7F. However, if WhiteningCoeffValue is “0x80”, it means to disable whitening.

3.2.5 TxGainIndex parameter

IC TYPE	MODE	GET DEFAULT POWER	USED by "bt_mp_Exec" COMMAND
RTL8723B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index(usb) 1M/2M/3M/LE : 5/5/5/4 Default Tx Index(uart) 1M/2M/3M/LE : 4/4/4/4	
RTL8821A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 7/7/7/6	**"bt_mp_Exec"** 12~14(pkt tx) 15~17(cont tx) 18~20(pkt rx) 28~29(le cont tx)
RTL8703B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/6	
RTL8761A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/5	
	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of "TxGainIndex" value is from 0 to max tx index.	**"bt_mp_Exec"** 30~31(pkt tx) 32~33(pkt rx) 34~35(cont tx) 36~37(le cont tx)
RTL8723D RTL8822B RTL8821C	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of "TxGainIndex" value is from 0 to max tx index.	**"bt_mp_Exec"** 12~14(pkt tx) 15~17(cont tx) 18~20(pkt rx) 28~29(le cont tx) 30~31(pkt tx) 32~33(pkt rx) 34~35(cont tx) 36~37(le cont tx)

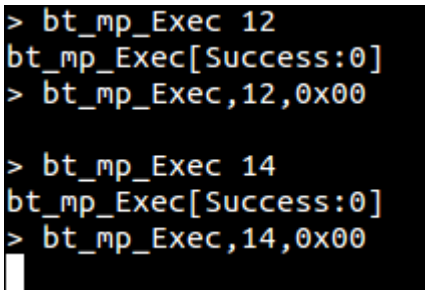
Only in packet tx, the UI mode and FW mode are different. In other operations they are the same. In UI mode, the value of TxPacketCount is "0" that means to send packet "0xFFF"counts. In FW mode, the value of TxPacketCount is "0" that means to send packets continuously.

3.3 MP Mode execute Commands

Using this command to control bt mp action, and get current report.

MP Command	Parameters	Return	
bt_mp_Exec	Action	Return Action	Return Status

You can use “bt_mp_Exec ACTION_INDEX”. The definition of ACTION_INDEX can refer to “BT_ACTIONCONTROL_TAG” Table.
Example: If you want to run “PACKET_TX_START” this action, please use the “bt_mp_Exec 12” command. On the contrary “bt_mp_Exec 14” is “PACKET_TX_STOP”.



Command	Index	Support Chip	
		RTL8723B RTL8761A RTL8821A	RTL8723D RTL8821C RTL8822B
HCI_RESET	0	■	■
TEST_MODE_ENABLE	1	■	■
WRITE_EFUSE_DATA	2	■	■
SET_TX_GAIN_TABLE	3	■	■
SET_TX_DAC_TABLE	4	■	■
SET_DEFAULT_TX_GAIN_TABLE	5	■	■
SET_DEFAULT_TX_DAC_TABLE	6	■	■
SET_POWER_GAIN_INDEX	7	■	■
SET_POWER_GAIN	8	■	■
SET_POWER_DAC	9	■	■
SET_XTAL	10	■	■
REPORT_CLEAR	11	■	■
PACKET_TX_START	12	■	
PACKET_TX_UPDATE	13	■	
PACKET_TX_STOP	14	■	
CONTINUE_TX_START	15	■	
CONTINUE_TX_UPDATE	16	■	

CONTINUE_TX_STOP	17	■	
PACKET_RX_START	18	■	
PACKET_RX_UPDATE	19	■	
PACKET_RX_STOP	20	■	
HOPPING_DWELL_TIME	21	■	■
LE_TX_DUT_TEST_CMD	22	■	■
LE_RX_DUT_TEST_CMD	23	■	■
LE_DUT_TEST_END_CMD	24	■	■
READ_EFUSE_DATA	25	■	■
LE_ CONTINUE _TX _START	28	■	
LE CONTINUE _TX _STOP	29	■	
FW_PACKET_TX_START	30		■
FW_PACKET_TX_STOP	31		■
FW_PACKET_RX_START	32		■
FW_PACKET_RX_STOP	33		■
FW_CONTINUE_TX_START	34		■
FW_CONTINUE_TX_STOP	35		■
FW_LE_CONTINUE_TX_START	36		■
FW_LE_CONTINUE_TX_STOP	37		■
FW_READ_TX_POWER_INFO	38		■

Table BT_ACTIONCONTROL_TAG

3.4 MP Mode Report Commands

These commands used to report Bluetooth DUT TX/RX status are listed as below:

#./bt_mp_Report "Item Index"

Item Index	Item Index	Return					
PKT TX = 1	1	Status	TXBits	TxCounts			
CONT TX = 2	2	Status	TXBits	TxCounts			
PKT RX = 3	3	Status	RxRssi	RXBits	RxCounts	RxErrorBits	
Tx Gain Table = 4	4	Status	Tx Gain Table				
Tx DAC Table = 5	5	Status	Tx DAC Table				
Xtal = 6	6	Status	Xtal				
Thermal = 7	7	Status	Thermal				
Stage = 8	8	Status	Stage				
Efuse = 10	10	Status	Efuse				
LE RX = 11	11	Status	RxCounts				
LE CONT TX=12	12	Status	TXBits	TxCounts			

FW_PKT_TX=13	13	Status	TXBits	TxCounts			
FW_CONT_TX=14	14	Status	TXBits	TxCounts			
FW_PKT_RX=15	15	Status	RxRssi	RXBits	RxCounts	RxErrorBits	
FW_LE_CONT_TX=16	16	Status	TXBits	TxCounts			
TX_POWER_INFO=17	17	Status	Max tx power index	1M default tx power index	2M default tx power index	3M default tx power index	LE default tx power index

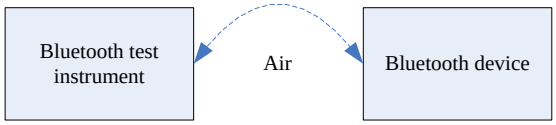
4. RF Test Mode (Certification)

This chapter describes the entering BQB test and RF safety testing

4.1 Direct Test Mode - BR/EDR (BQB Certification)

Enter the Bluetooth device to Bluetooth DUT Test and stop DUT Test Mode command below:
--Enter DUT Test Mode:
Use bt_mp_Exec(TEST_MODE_ENABLE) to enter Bluetooth test mode.
--Stop Test Mode
Use bt_mp_Exec(HCI_RESET) to stop Bluetooth test mode.

The Test connection diagram :



For example by ADB for android : ex usb interface and use Anritsu 8852B to test
(a) Enter MP Mode and download patch code

```
::::::::::::::::::::::::::::::::::::::::::::::::::
:::::::: Bluetooth MP Test Tool Starting ::::::::
> enable uart:/dev/ttyUSB0
> > > enable[Success:0]
```

(b) Enter DUT MP Mode

```
> bt_mp_Exec 1
bt_mp_Exec[Success:0]
> bt_mp_Exec,1,0x00
```

(c) Begin MP test by Bluetooth test instrument (e.g. Anritsu 8852B)
(d) bt_mp_Exec(HCI_RESET) to stop test.

```
> bt_mp_Exec 0
bt_mp_Exec[Success:0]
> bt_mp_Exec,0,0x00
```

(e) exit MP Mode

```
> disable
disable[Success:0]
> quit
:::::::: Bluetooth MP Test Tool Terminating ::::::::
root@tristan-PORTEGE-R700:~#
```

4.2 TX Test- BR/EDR (Certification)

In order to transmit a continuous signal, follow the process below:
Step0: Get default tx power index

IC TYPE	MODE	GET DEFAULT POWER
RTL8723B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index(usb) 1M/2M/3M/LE : 5/5/5/4 Default Tx Index(uart) 1M/2M/3M/LE : 4/4/4/4
RTL8821A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 7/7/7/6
RTL8703B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/6
RTL8761A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/5
	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.
RTL8723D RTL8822B RTL8821C	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.

Step1: bt_mp_SetParam

INDEX	VALUE
1	ChannelNumber
2	PacketType
3	PayloadType
6	WhiteningCoeffValue
7	TxGainIndex
9	PacketHeader
11	HitTarget

Step2: bt_mp_Exec(CONTINUE_TX_START = 15) or (FW_CONTINUE_TX_START=34)

Step3: bt_mp_Report 2

Step4: bt_mp_Exec(CONTINUE_TX_STOP = 17) or (FW_CONTINUE_TX_STOP=35)

4.3 LE Direct Test Mode (BQB Test)

After testing BT4.0 only enable device and download patch code, you should jump interface to the instrument.

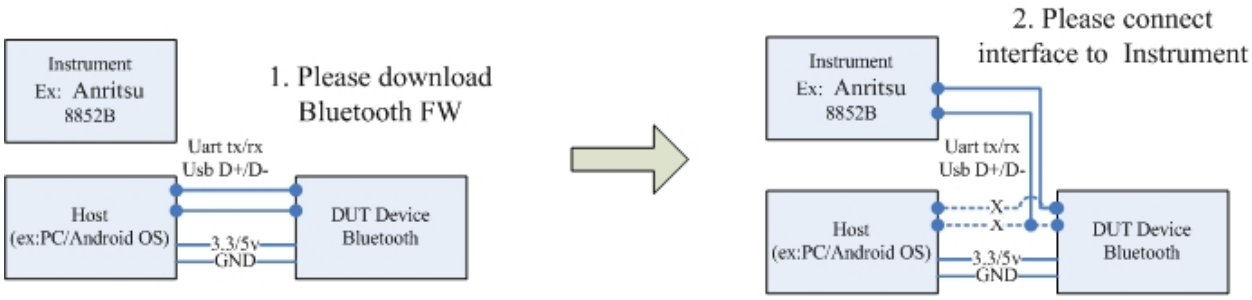
Step 1:rtlbtmp

Step 2:enable (xxxxxxxx)

Step 3: Jump hardware interface to the instrument.

Step 4:Begin test.

BLE is a schematic diagram of the test for Certification:



4.4 LE Certification TX Mode(Certification)

In order to facilitate RF safety testing, such as the band edge.

We often use to facilitate continuous tx RF safety testing. eg.Bandedge

Step0: Get default tx power index

IC TYPE	MODE	GET DEFAULT POWER
RTL8723B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index(usb) 1M/2M/3M/LE : 5/5/5/4 Default Tx Index(uart) 1M/2M/3M/LE : 4/4/4/4
RTL8821A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 7/7/7/6
RTL8703B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/6
	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/5

RTL8761A	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.
RTL8723D RTL8822B RTL8821C	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.

Step1: bt_mp_SetParam : Channel Number = 0~39

INDEX	VALUE
1	ChannelNumber
7	TxGainIndex

Step2: bt_mp_Exec(LE_ CONTINUE _TX _START = 28) or (FW_LE_CONTINUE_TX_START=36)

Step3: bt_mp_Exec(LE_ CONTINUE _TX _STOP = 29) or (FW_LE_CONTINUE_TX_STOP=37)

4.5 Hopping Test Mode(Certification- Dwell time)

In order to start hopping mode test, follow the steps below:

Step 1: bt_mp_SetParam….(to setting packet type:DH1,DH2….3DH5)

NAME	INDEX
BT_PKT_DH1	0
BT_PKT_DH3	1
BT_PKT_DH5	2
BT_PKT_2DH1	3
BT_PKT_2DH3	4
BT_PKT_2DH5	5
BT_PKT_3DH1	6
BT_PKT_3DH3	7

BT_PKT_3DH5	8
BT_PKT_LE	9
BT_PKT_NULL	10

INDEX	VALUE
2	PacketType
10	HoppingFixChannel (0 or 1)
1	ChannelNumber (0~78)
6	WhiteningCoeffValue

Step 2: bt_mp_Exec(HOPPING_DWELL_TIME = 21)

Step 3: bt_mp_Exec(HCI_RESET = 0) to disable hopping mode.

PS. If HoppingFixChannel = 1, it enable fix channel that is controlled by “ChannelNumber”.

If HoppingFixChannel = 0, “ChannelNumber” is useless.

5. MP Mode Test Control Steps (Certification)

5.1 DUT Single Tone TX Mode

To Set Single-Tone Tx, step by step:

Step0: Get default tx power index

IC TYPE	MODE	GET DEFAULT POWER
RTL8723B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index(usb) 1M/2M/3M/LE : 5/5/5/4 Default Tx Index(uart) 1M/2M/3M/LE : 4/4/4/4
RTL8821A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 7/7/7/6
RTL8703B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/6
	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/5

RTL8761A	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.
RTL8723D RTL8822B RTL8821C	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.

Step1: bt_mp_SetParam

INDEX	VALUE
1	ChannelNumber
2	PacketType
3	PayloadType
6	WhiteningCoeffValue
7	TxGainIndex
9	PacketHeader
11	HitTarget

Set fix parameter list below as:

PacketType=3DH5;

PayloadType=ALL0;

TxPacketCount=Infinite;

WhiteningCoeffValue =0xFF(disable);

TxGainIndex=7;

PacketHeader=0XA078;

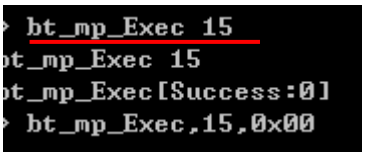
HitTarget= 0x000000c6967e

```
> bt_mp_SetParam 1,39;2,0x08;3,0x00;4,0x00;6,0xFF;7,0x07;9,0x3FFFF;11,0x000000c6
967e
bt_mp_SetParam 1,39;2,0x08;3,0x00;4,0x00;6,0xFF;7,0x07;9,0x3FFFF;11,0x000000c696
7e
bt_mp_SetParam[Success:0]
> bt_mp_SetParam,11,0x00
```

In this example we use 0X3FFFF that different PACKET_HEADER, please check PACKET_HEADER table.

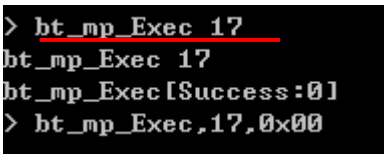
Step2: Execute :

CONTINUE_TX_START = 15 or FW_CONTINUE_TX_START=34



Step 3: Stop Single-Tone Tx.

CONTINUE_TX_STOP = 17 or FW_CONTINUE_TX_STOP=35



5.2 DUT TX Mode(MP)

In order to transmit a packet signal, follow the process below:

Step0: Get default tx power index

IC TYPE	MODE	GET DEFAULT POWER
RTL8723B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index(usb) 1M/2M/3M/LE : 5/5/5/4 Default Tx Index(uart) 1M/2M/3M/LE : 4/4/4/4
RTL8821A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 7/7/7/6
RTL8703B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/6
RTL8761A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/5
	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index**

		The range of “TxGainIndex” value is from 0 to max tx index.
RTL8723D RTL8822B RTL8821C	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.

Step1: bt_mp_SetParam….

INDEX	VALUE
1	ChannelNumber
2	PacketType
3	PayloadType
4	TxPacketCount
6	WhiteningCoeffValue
7	TxGainIndex
9	PacketHeader
11	HitTarget

Step2: bt_mp_Exec(PACKET_TX_START =12) or (FW_PACKET_TX_START=30)

Step3: bt_mp_Report 1 (if need report, to do..)

Step4: bt_mp_Exec(PACKET_TX_STOP =14) or (FW_PACKET_TX_STOP=31)

5.2 DUT RX Mode(MP)

In order to receive a packet signal, follow the process below:

Step1: bt_mp_SetParam….

INDEX	VALUE
1	ChannelNumber
2	PacketType
3	PayloadType
6	WhiteningCoeffValue
9	PacketHeader
11	HitTarget

Step2: bt_mp_Exec(PACKET_RX_START =18) or (FW_PACKET_RX_START=32)

Step3: bt_mp_Report 3

Step4: bt_mp_Exec(PACKET_RX_STOP=20) or (FW_PACKET_RX_STOP=33)

PS. bt_mp_Report 3” should be excuted every 1s.

5.3 LE DUT Test Mode-TX/RX (MP)

To start LE TX DUT test mode, follow the steps below:

Step0: Get default tx power index

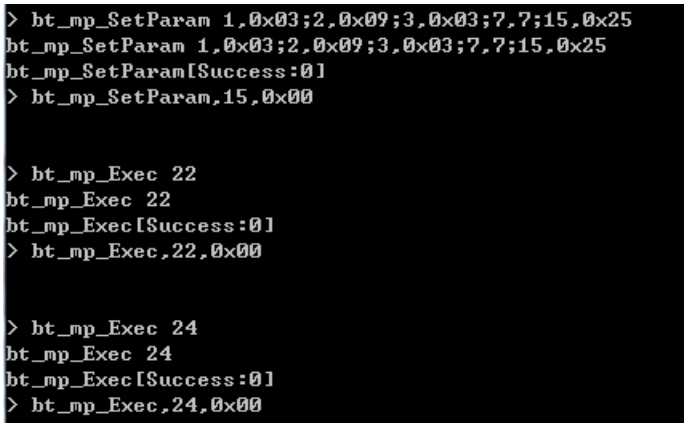
IC TYPE	MODE	GET DEFAULT POWER
RTL8723B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index(usb) 1M/2M/3M/LE : 5/5/5/4 Default Tx Index(uart) 1M/2M/3M/LE : 4/4/4/4
RTL8821A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 7/7/7/6
RTL8703B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/6
RTL8761A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/5
	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.
RTL8723D RTL8822B RTL8821C	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.

Step 1: bt_mp_SetParam

INDEX	VALUE	Value Range
1	ChannelNumber	0~39
3	PayloadType	BT_LE_PAYLOAD_TYPE_PRBS9 = 0, BT_LE_PAYLOAD_TYPE_1111_0000 = 1, BT_LE_PAYLOAD_TYPE_1010 = 2, BT_LE_PAYLOAD_TYPE_PRBS15 = 3, BT_LE_PAYLOAD_TYPE_ALL1 = 4, BT_LE_PAYLOAD_TYPE_ALL0 = 5, BT_LE_PAYLOAD_TYPE_0000_1111 = 6, BT_LE_PAYLOAD_TYPE_0101 = 7,
7	TxGainIndex	1~MAX_POWER_INDEX
15	LEDataLen	0x00~0x25

Step 2: bt_mp_Exec(LE_TX_DUT_TEST_CMD = 22)

Step 3: bt_mp_Exec(LE_DUT_TEST_END_CMD=24) to stop LE TX DUT mode.



To start LE RX DUT test mode, follow the steps below:

Step 1: bt_mp_SetParam

INDEX	VALUE	Value Range
1	ChannelNumber	0~39

Step 2: bt_mp_Exec(LE_RX_DUT_TEST_CMD=23)

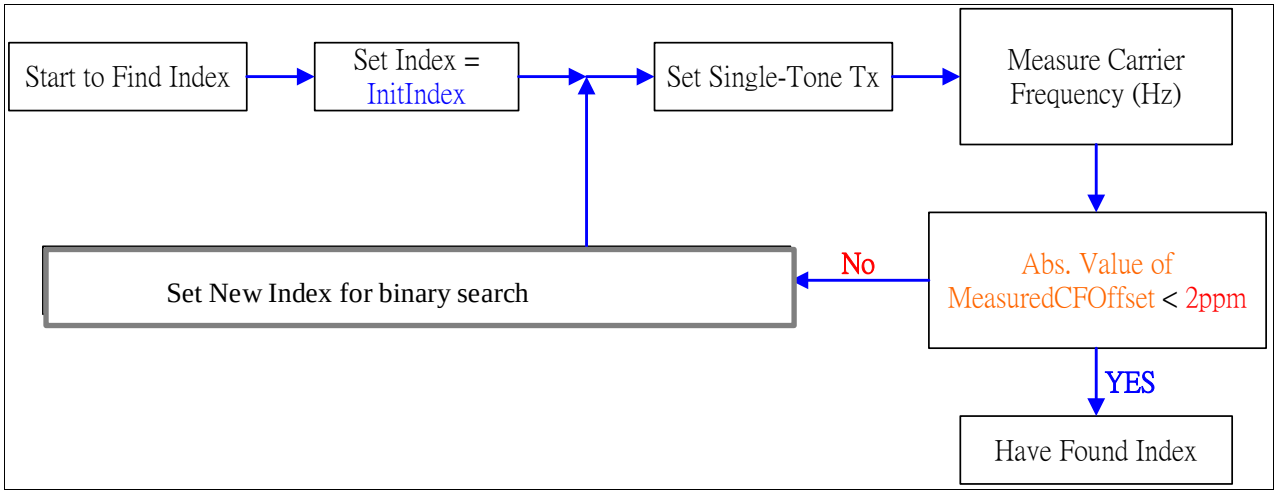
Step 3: bt_mp_Exec(LE_DUT_TEST_END_CMD=24) to stop LE RX DUT mode.

Step 4: bt_mp_Report 11

6. MP Test Flow

6.1 Bluetooth Calibrates Crystal (Xtal) Cap by Non-Signaling mode

First, take a look at eFuse content about setting of Crystal Cap. . Normal driver will load this value in initial step. So this value must be well-calibrated and filled on correct eFuse location.
The flow of calibration Bluetooth step is as below:



Finding Crystal Cap. Index Flow

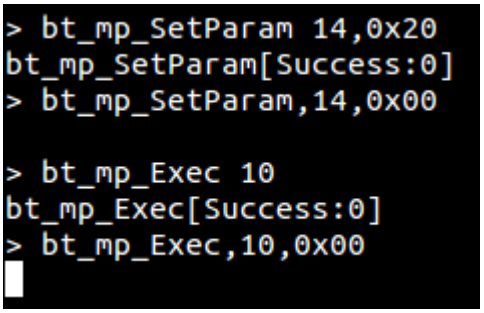
InitIndex: the default value is 0x20. Index range is 0x0 to 0x3F.
MeasuredCFOffset: Carrier frequency measured by instrument - Ideal Carrier Frequency Target range Abs. Value of 2ppm in 2.441GHz band is about 10KHz(±5KHz).

Step1 : Get default tx gain index

IC TYPE	MODE	GET DEFAULT POWER
RTL8723B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index(usb) 1M/2M/3M/LE : 5/5/5/4 Default Tx Index(uart) 1M/2M/3M/LE : 4/4/4/4
RTL8821A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 7/7/7/6
RTL8703B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/6

RTL8761A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/5
	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of "TxGainIndex" value is from 0 to max tx index.
RTL8723D RTL8822B RTL8821C	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of "TxGainIndex" value is from 0 to max tx index.

Step 2: Set Index = InitIndex(0x20)



Step 3: Set Single-Tone Tx

Channel=39;

PacketType=3DH5;

PayloadType=ALL0;

TxPacketCount=Infinite;

WhiteningCoeffValue =0xFF(disable);

TxGainIndex=7;

PacketHeader=0XA078;

HitTarget= 0x000000c6967e

CONTINUE_TX_START = 15 or FW_CONTINUE_TX_START=34

```
> bt_mp_SetParam 1,39;2,0x08;3,0x00;4,0x00;6,0xFF;7,0x07;9,0x3FFFF;11,0x000000C6967E
bt_mp_SetParam[Success:0]
> bt_mp_SetParam,11,0x00
```

In this example we use 0X3FFFF that different PACKET_HEADER, please check PACKET_HEADER table.

```
> bt_mp_Exec 15
bt_mp_Exec[Success:0]
> bt_mp_Exec,15,0x00
```

Step 4: Stop Single-Tone Tx.

CONTINUE_TX_STOP = 17 or FW_CONTINUE_TX_STOP=35

```
> bt_mp_Exec 17
bt_mp_Exec[Success:0]
> bt_mp_Exec,17,0x00
```

Step 5: Go to Step2and re-tune Index value until find the best Crystal index value.

6.2 Verify Bluetooth Legacy Tx Performance by Non-Signaling mode

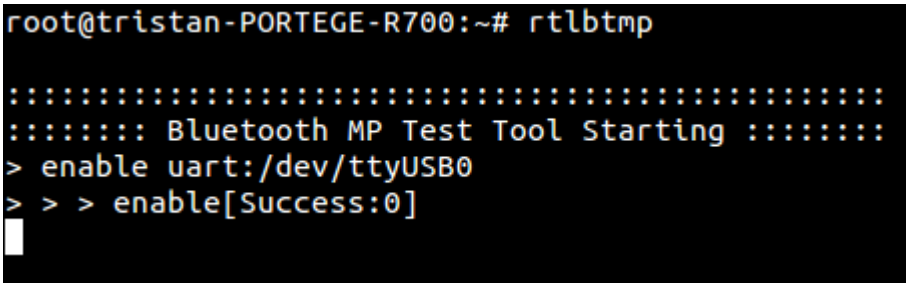
To measure the DUT TX power/initial Carrier offset/modulation characteristics to check Tx performance is ok or not. Bluetooth TX criterion is shown as below:

	Test Item	Sub Test Item	Packet Type	Channel	Criterion
					Bluetooth Spec.
Verify Tx DH1	Maximum Output Power	Average Power	DH1	Low (CH6-2408MHZ)	> 0dBm
				Middle (CH42-2444MHZ)	> 0dBm
				High (CH70-2472MHZ)	> 0dBm
	Modulation Characteristics	Delta F1 Avg.	DH1	Low (CH6-2408MHZ)	140KHz ~ 175KHz
		Delta F2 Max.		Middle (CH42-2444MHZ)	> 115KHz
		Modulation Index		High (CH70-2472MHZ)	> 0.8
	Initial Carrier Frequency Error		DH1	Low (CH6-2408MHZ)	-20KHz ~ 20KHz
				Middle (CH42-2444MHZ)	
				High (CH70-2472MHZ)	
Verify Tx 3DH1	Maximum Output Power	Average Power	3DH1	Low (CH6-2408MHZ)	> 0dBm
				Middle (CH42-2444MHZ)	> 0dBm
				High (CH70-2472MHZ)	> 0dBm
	Modulation Characteristics	RMS DEVM	3DH1	Low (CH6-2408MHZ)	0.13
		Peak DEVM		Middle (CH42-2444MHZ)	0.25
		99% DEVM		High (CH70-2472MHZ)	0.20
	Initial Carrier Frequency Error		3DH1	All	-20KHz ~ 20KHz

Table The recommended test items of Bluetooth Tx

For example, use adb commands android platform, device is UART interface.
step by step command:

(1) Enter MP Mode and download patch code



Get default tx gain index

IC TYPE	MODE	GET DEFAULT POWER
RTL8723B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index(usb) 1M/2M/3M/LE : 5/5/5/4 Default Tx Index(uart) 1M/2M/3M/LE : 4/4/4/4
RTL8821A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 7/7/7/6
RTL8703B	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/6
RTL8761A	UI mode	**Load Tx Table** # ./bt_mp_Exec 5 // SET TX GAIN TABLE #./ bt_mp_Exec 6 //SET TX DAC TABLE Default Tx Index 1M/2M/3M/LE : 6/6/6/5
	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of “TxGainIndex” value is from 0 to max tx index.

RTL8723D RTL8822B RTL8821C	FW mode	**Get Tx Power Info** #./ bt_mp_Exec 38 #./bt_mp_Report 17 **[Retuen format] 17,Status, max tx power index, 1M, 2M, 3M, LE default tx power index** The range of "TxGainIndex" value is from 0 to max tx index.

(2) Set Parameter :

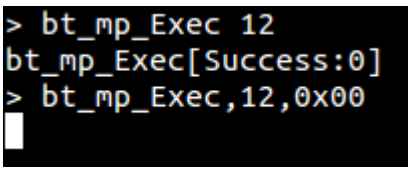
Test Item		adb command
	Test Item	Channel = 6
DH1	Maximum Power	bt_mp_SetParam 1,0x06;2,0x00;3,0x07;4,0x00;6,0x7F;7,0x7;9, 0x33820;11,0x0000009e8b33
DH1	Delta F1	bt_mp_SetParam 1,0x06;2,0x00;3,0x05;4,0x00;6,0xFF;7,0x7;9, 0x33820;11,0x0000009e8b33
DH1	Delta F2	bt_mp_SetParam 1,0x06;2,0x00;3,0x02;4,0x00;6,0xFF;7,0x7;9, 0x33820;11,0x0000009e8b33
3DH1	ALL	bt_mp_SetParam 1,0x06;2,0x06;3,0x07;4,0x00;6,0x7F;7,0x7;9, 0x15C40;11,0x0000009e8b33

Test Item		adb command
	Test Item	Channel = 42
DH1	Maximum Power	bt_mp_SetParam 1,0x2a;2,0x00;3,0x07;4,0x00;6,0x7F;7,0x7;9, 0x33820;11,0x0000009e8b33
DH1	Delta F1	bt_mp_SetParam 1,0x2a;2,0x00;3,0x05;4,0x00;6,0xFF;7,0x7;9,0x33820;11,0x0000009e8b33
DH1	Delta F2	bt_mp_SetParam 1,0x2a;2,0x00;3,0x02;4,0x00;6,0xFF;7,0x7;9,0x33820;11,0x0000009e8b33
3DH1	ALL	bt_mp_SetParam 1,0x2a;2,0x06;3,0x07;4,0x00;6,0x7F;7,0x7;9,0x15C40;11,0x0000009e8b33

Test Item		adb command
	Test Item	Channel = 70
DH1	Maximum Power	bt_mp_SetParam 1,0x46;2,0x00;3,0x07;4,0x00;6,0x7F;7,0x7;9, 0x33820;11,0x0000009e8b33
DH1	Delta F1	bt_mp_SetParam 1,0x46;2,0x00;3,0x05;4,0x00;6,0xFF;7,0x7;9, 0x33820;11,0x0000009e8b33
DH1	Delta F2	bt_mp_SetParam 1,0x46;2,0x00;3,0x02;4,0x00;6,0xFF;7,0x7;9, 0x33820;11,0x0000009e8b33
3DH1	ALL	bt_mp_SetParam 1,0x46;2,0x06;3,0x07;4,0x00;6,0x7F;7,0x7;9, 0x15C40;11,0x0000009e8b33

(3)Run Packe Tx

(PACKET_TX_START =12) or (FW_PACKET_TX_START=30)



(4) measured by Bluetooth test instrument (e.g. Litepoint IQNxN)

```
> bt_mp_Report 1
bt_mp_Report[Success:0]
> bt_mp_Report,1,0x00,0x042402a8,0x00002139
```

(5)Stop Packet Tx

(PACKET_TX_STOP =14) or (FW_PACKET_TX_STOP=31)

```
> bt_mp_Exec 14
bt_mp_Exec[Success:0]
> bt_mp_Exec,14,0x00
```

-- If you need to test other parameters, please stop packet tx and go back to step 2

(6)exit MP Mode

```
> disable
disable[Success:0]
> quit
:::::::: Bluetooth MP Test Tool Terminating ::::::::
root@tristan-PORTEGE-R700:~#
```

6.3 Verify Bluetooth Rx Performance by Non-Signaling mode

Measure the DUT Rx sensitivity to check Rx performance is ok or not. The Rx performance test can be measured in Signaling mode (ex: Anritsu 8852B, Agilent N4010A) or Non-Signaling mode (ex:LitePoint IQNxN). Bluetooth Rx criterion is shown as below:

Verify Bluetooth Rx	Test Item	Packet Type	Criterion
			Bluetooth Spec
	Sensitivity	DH1 or 3DH5	**< -70dBm**

For final MP, Rx can just test DH1, 3DH5 BER at sensitivity criterion power level at channel 0 and 78 to reduce time. All Bluetooth Rx criterion is shown as:

Test Item		Criterion(Bluetooth Spec)
Channel	Packet type	< -70dBm
6	DH1	< -70dBm
42	DH1	< -70dBm
70	DH1	< -70dBm
6	3DH1	< -70dBm
42	3DH1	< -70dBm
70	3DH1	< -70dBm

Figure The recommended test items of Bluetooth Rx

(1) Enter MP Mode and download patch code

```
root@tristan-PORTEGE-R700:~# rtlbtmp

::::::::::::::::::::::::::::::::::::::::::::::::::
:::::::: Bluetooth MP Test Tool Starting ::::::::
> enable uart:/dev/ttyUSB0
> > > enable[Success:0]
```

Set default table

```
> bt_mp_Exec 5
bt_mp_Exec[Success:0]
> bt_mp_Exec,5,0x00

> bt_mp_Exec 6
bt_mp_Exec[Success:0]
> bt_mp_Exec,6,0x00
```

(2) Set Parameter

Test Item		adb command
Channel	Packet type	PayloadType=PRBS9; WhiteningCoeffValue = 0xFF(disable); PacketHeader=**PACKET_HEADER Table;** HitTarget= 0x000000c6967e
6	DH1	bt_mp_SetParam 1,0x06;2,0x00;3,0x07;6,0xFF;9, 0x33820;11,0x000000c6967e
42	DH1	bt_mp_SetParam 1,0x2a;2,0x00;3,0x07;6,0xFF;9, 0x33820;11,0x000000c6967e
70	DH1	bt_mp_SetParam 1,0x46;2,0x00;3,0x07;6,0xFF;9, 0x33820;11,0x000000c6967e
6	3DH1	bt_mp_SetParam 1,0x06;2,0x06;3,0x07;6,0xFF;9, 0x15C40;11,0x000000c6967e
42	3DH1	bt_mp_SetParam 1,0x2a;2,0x06;3,0x07;6,0xFF;9, 0x15C40;11,0x000000c6967e
70	3DH1	bt_mp_SetParam 1,0x46;2,0x06;3,0x07;6,0xFF;9, 0x15C40;11,0x000000c6967e

Please refer to Chapter 3.

(3)To setting Parameter with the Bluetooth test instrument. Bluetooth test instrument begin transmit..

(4)Run Packe Rx

(PACKET_RX_START =18) or (FW_PACKET_RX_START=32)

```
> bt_mp_Exec 18
bt_mp_Exec[Success:0]
> bt_mp_Exec,18,0x00
```

(5) Report Received Result.

```
> bt_mp_Report 3
bt_mp_Report[Success:0]
> bt_mp_Report,3,0x00,-96,0x00000000,0x00000000,0x00000000
```

-- “bt_mp_Report 3” should be executed every 1s.

(6)Stop Packet Rx

(PACKET_RX_STOP=20) or (FW_PACKET_RX_STOP=33)

```
> bt_mp_Exec 20
bt_mp_Exec[Success:0]
> bt_mp_Exec,20,0x00
```

-- If you need to test other parameters, please stop packet Rx and go back to step 2.

(7)exit MP Mode

```
> disable
disable[Success:0]
> quit
:::::::: Bluetooth MP Test Tool Terminating ::::::::
root@tristan-PORTEGE-R700:~#
```

6.4 Verify Bluetooth BLE Tx Performance

To measure the DUT BLE TX power and modulation index to check BLE TX performance is ok or not. Bluetooth BLE TX criterion is shown as below:

	Test Item	Sub Test Item	Payload Type	Channel	Criterion
					Bluetooth Spec.
Verify BLE Tx	BLE Output Power	Average Power	PRBS9	Low (CH0-2402MHZ)	> 0dBm
				Middle (CH19-2440MHZ)	> 0dBm
				High (CH34-2470MHZ)	> 0dBm
	Modulation Characteristics	Delta F1 Avg.	BT_PAYLOAD_TYPE_1111_0000	2440MHZ CH19-	225 kHz ~ 275 kHz
		Delta F2 Max.	BT_PAYLOAD_TYPE_1010		≥ 185 kHz
		Modulation Index	None		≥ 0.8

Table The recommended test items of Bluetooth BLE Tx

For example, use adb commands android platform, device is UART interface.

step by step command:

(1) Enter MP Mode and download patch code

(2) Set Parameter :

Test Item		**adb command**
Channel	Test item	PayloadType=PRBS9; WhiteningCoeffValue = 0x(dis80able); PacketHeader=PACKET_HEADER Table; HitTarget= 0x000000c6967e
0	Avg_power	bt_mp_SetParam 1,0x00;3,0x00;7,0x06
19	Avg_power	bt_mp_SetParam 1,0x13;3,0x00;7,0x06
34	Avg_power	bt_mp_SetParam 1,0x22;3,0x00;7,0x06
0	Delta F1	bt_mp_SetParam 1,0x00;3,0x01;7,0x06
0	Delta F2	bt_mp_SetParam 1,0x00;3,0x02;7,0x06

6.5 Verify Bluetooth BLE Rx Performance

Measure the DUT BLE Rx sensitivity to check Rx performance is ok or not. The Bluetooth Rx criterion is shown as below:

Channel	Payload Type	BLE sensitivity limit	Criterion
			Bluetooth Spec
Low (CH0-2402MHZ)	PRBS9	PER<= 30.800 %	**< -70dBm**
Middle (CH19-2440MHZ)			
High (CH34-2470MHZ)			

Figure The recommended test items of Bluetooth BLE Rx

To calculate the Packet Error Rate(PER)

PER% = 100*(1-(Packets Received /Packets Send)

The step by step list below :

(1) Enter MP Mode and download patch code

(2) Set Parameter :

Test Item		adb command
Item	Payload type	
Sensitivity	PRBS9	bt_mp_SetParam 1,0x00;3,0x0
Sensitivity	PRBS9	bt_mp_SetParam 1,0x13;3,0x0
Sensitivity	PRBS9	bt_mp_SetParam 1,0x22;3,0x0

(3)To setting Parameter with the Bluetooth test instrument.

(4)Run LE Packet Rx

(5)Stop LE Packet Rx and to obtain the receive packet count

(6) Calculate PER

If (PER< limit) , goto step (3) , else Stop