MT7628/7603/7636 ATE User Manual

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Specifications are subject to change without notice.

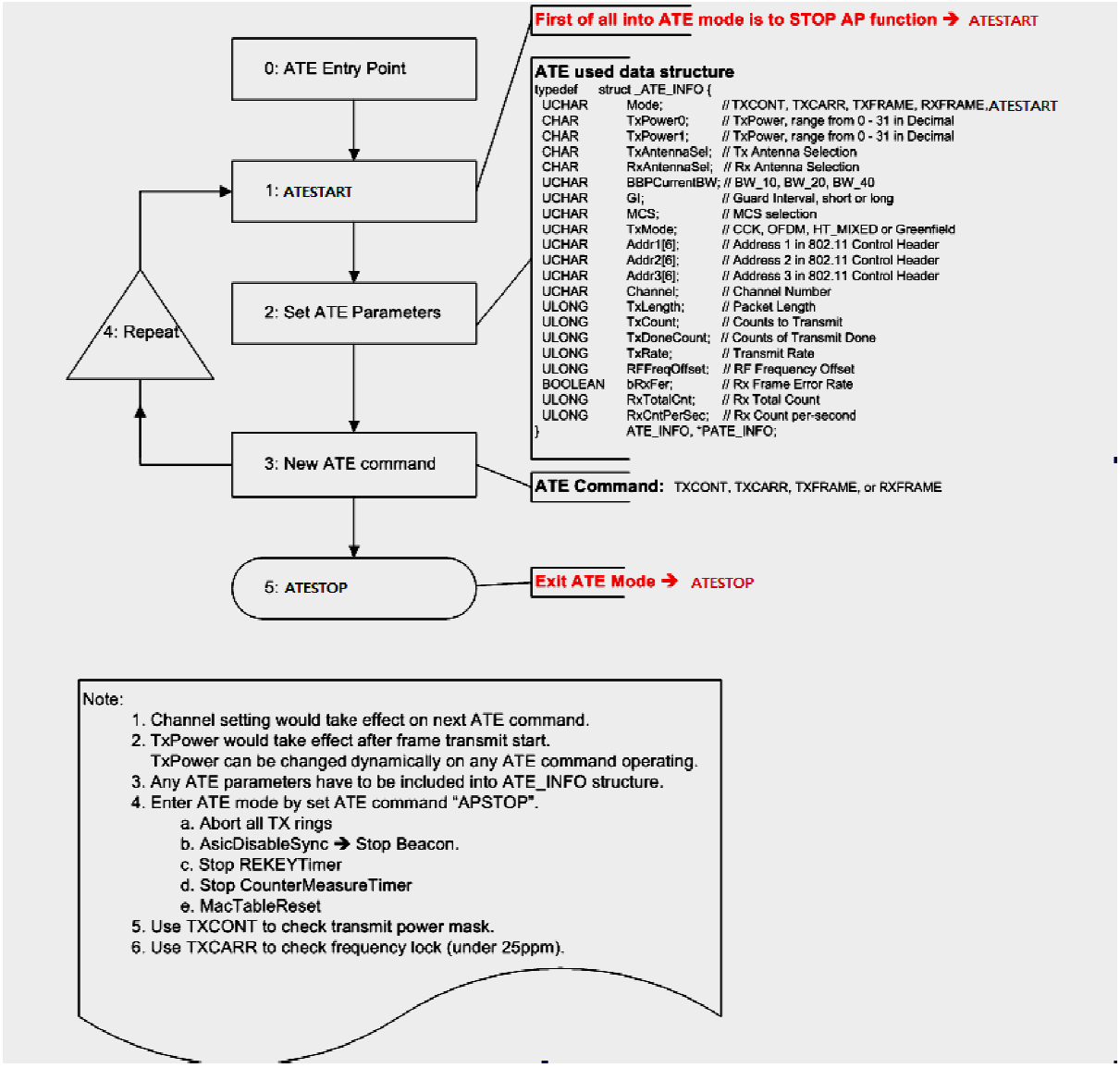
Document Revision History

Revision	Date	Author	Description
1.0	2014-07-16	Yuchi Wang	Modify “ATE User Manual V2.6” for MT7603, MT7628, MT7636
1.01	2014-09-02	Yuchi Wang	Modify Recommended flow for Rx/Tx, shift set channel to the last command, which responsible for BW switch also

Table of Contents

1 Introduction

This document is the user manual of MediaTek Wi-Fi Chip ATE usage. It covers ATE command list, testing flow and ATE command examples.



1.1 ATE Command List

All of ATE commands are executed through the “ iwpriv command” as below format.
Example:

iwpriv ra0 set [parameters] = [value]

1.1.1 ATE

Description:
Set ATE actions.

Value:

ATESTART: Enter/Reset ATE mode and set Tx/Rx Idle.
ATESTOP: Leave ATE mode.
TXCARR: Send out single carrier wave at channel frequency from hardware for frequency calibration.
TXCONT: Send out frames without time gap from hardware for power mask.
TXFRAME: Send out WIFI frames from driver, Transmit frame, for EVM.
RXFRAME: Receive all frames from MAC block, Continuous RX, for PER/FER.

Example:

iwpriv ra0 set ATE=ATESTART

1.1.2 ATEDA

Description:
Set ATE frame header address 1.

Value:

xx:xx:xx:xx:xx:xx [xx = hex value]

Example:

iwpriv ra0 set ATEDA=00:11:22:33:44:55

Note: STA mode, ATEDA → Header address3

1.1.3 ATESA

Description:
Set ATE frame header address 3.

Value:

xx:xx:xx:xx:xx:xx [xx = hex value]

Example:

iwpriv ra0 set ATESA=00:aa:bb:cc:dd:ee

Note: STA mode, ATESA → Header address2

1.1.4 ATEBSSID

Description:
Set ATE frame header address 2.

Value:
xx:xx:xx:xx:xx:xx [xx = hex value]

Example:
iwpriv ra0 set ATEBSSID=00:aa:bb:cc:dd:ee

Note: STA mode, ATEBSSID → Header address1

1.1.5 ATECHANNEL

Description:
Set ATE Channel, decimal.

Value:
802.11b/g: [1 -14]. Decimal value.
802.11a: [36 -173]. Please follow 5GHz channel setting. Decimal value.

Example:
iwpriv ra0 set ATECHANNEL=6

1.1.6 ATETXPOW0

Description:
Set ATE Tx power for Antenna 0.

Value:
0 ~ 31 ; 2.4GHz, 5-bits only, decimal
Example:
iwpriv ra0 set ATETXPOW0=15

1.1.7 ATETXPOW1

Description:
Set ATE Tx power for Antenna 1.
Only needed to specify antenna 1when it is in continuous Tx and Tx tone mode. It is available on 2x2 and 3X3 device.

Value:

0 ~ 31 ; 2.4GHz, 5-bits only, decimal

Example:

iwpriv ra0 set ATETXPOW1=15

1.1.8 ATETXFREQOFFSET

Description:

Set ATE RF frequency offset.

Value:

0 ~ 63 ; unit: 2KHz, decimal value

Example:

iwpriv ra0 set ATETXFREQOFFSET=40

1.1.9 ATETXLEN

Description:

Set ATE frame length.

Value:

24 ~ 1500 ; decimal value

Example:

iwpriv ra0 set ATETXLEN=1500

1.1.10 ATETXCNT

Description:

Set ATE frame Tx count.

Value:

1 ~; 32-bit, decimal value

Example:

iwpriv ra0 set ATETXCNT=10000

1.1.11 ATETXMODE

Description:

Set ATE Tx Mode.

Value:

0:	CCK	802.11b
1:	OFDM	802.11g
2:	HT_MIX	802.11b/g/n
3:	Green Field	802.11n

Example:

iwpriv ra0 set ATETXMODE=1

1.1.12 ATETXBW

Description:
Set ATE Tx and Rx Bandwidth.

Value:
0: 20MHz
1: 40MHz

Example:
iwpriv ra0 set ATETXBW=0

1.1.13 ATETXGI

Description:
Set ATE Tx Guard Interval.

Value:
0: Long GI
1: Short GI

Example:
iwpriv ra0 set ATETXGI=0

1.1.14 ATETXMCS

Description:
Set ATE Tx MCS type.

Value:
0 ~ 15

Example:
iwpriv ra0 set ATETXMCS=0

Note:
When ATE TX Mode is CCK/OFDM/HT, MCS 0~7 → 1ss , 8~15 → 2ss,

1.1.15 ATETXANT

Description:
Set ATE TX antenna.

Value:
0: All Antenna TX
1: Antenna 0 TX
2: Antenna 1 TX
3: Antenna 2 TX (Only available @ 3x3)

Example:
iwpriv ra0 set ATETXANT=0

1.1.16 ATERXANT

Description:
Set ATE RX antenna.

Value:
0: All Antenna RX
1: Antenna 0 RX
2: Antenna 1 RX
3: Antenna 2 RX (only available @ 3x3)

Example:
iwpriv ra0 set ATERXANT=0

1.1.17 ATESHOW

Description:
Show all parameters of ATE.
Value:
1: Display all parameters of ATE

Example:
iwpriv ra0 set ATESHOW=1

1.1.18 ATEHELP

Description:
List all commands of ATE.

Value:
1: List all ATE command

Example:
iwpriv ra0 set ATEHELP=1

1.1.19 ResetCounter

Description:
Reset statistic counter.

Value:
0 : Reset ATE statistic counter.

Example:

iwpriv ra0 set ResetCounter=1

1.1.20 ATERRF

Description:
Read all of the RF registers.

Value:
1: Read all RF registers

Example:
iwpriv ra0 set ATERRF=1

1.1.21 ATEIPG

Description:
Set ATE Tx frame Inter-packet gap.

Value: 200 ; decimal (Default)

Example:
iwpriv ra0 set ATEIPG=200

1.1.22 ATEPAYLOAD

Description:
Set ATE payload pattern for Tx Frame.

Value: x ; only one octet acceptable

Example:
iwpriv ra0 set ATEPAYLOAD=10

1.1.23 ATEFIXEDPAYLOAD

Description:
Set ATE fixed/random payload pattern for TxFrame.

Value:
0: random payload
1: enable Fixed payload

Example:
iwpriv ra0 set ATEFIXEDPAYLOAD=1

1.1.24 ATELDE2P

Description: Load and write EEPROM from a binary file prepared in advance.

Value: File path of the EEPROM binary file

Example:
iwpriv ra0 set ATELDE2P=/etc/Wireless/RT2870STA/e2p.bin

1.1.25 SKUEnable

Description: On/Off Single Sku function

Value: 0: off, 1: on

Example:

Iwpriv ra0 set SKUEnable=1

==>SetSKUEnable_Proc (ON)

mt7628_switch_channel(): Switch to Ch#1(2T2R), BBP_BW=1

2 ATE command examples

2.1 Check EVM and TX power

2.4GHZ Band, Channel=1, OFDM mode, MCS=7, BW=20, Short GI, TX0 Power=18, TX count=10000, ATE mode = TXFRAME, and Frequency offset=10.

```
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATEDA=00:11:22:33:44:55
iwpriv ra0 set ATESA=00:aa:bb:cc:dd:ee
iwpriv ra0 set ATEBSSID=00:11:22:33:44:55
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set ATECHANNEL=1
iwpriv ra0 set ATETXGI=0
iwpriv ra0 set ATETXLEN=1024
iwpriv ra0 set ATETXANT=1
iwpriv ra0 set ATETXPOW0=18
iwpriv ra0 set ATETXCNT=100000
iwpriv ra0 set ATETXFREQOFFSET=10
iwpriv ra0 set ATE=TXFRAME

//Adjust TX0 power
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXPOW0=20
iwpriv ra0 set ATE=TXFRAME
```

2.2 Check TX Carrier

2.4GHZ Band, Channel=1, OFDM mode, MCS=7, BW=20, TX0 Power=5, TX count=0 (Continuously), ATE mode = TXCARR, and Frequency offset=19.

```
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set ATECHANNEL=1
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set ATETXANT=1
iwpriv ra0 set ATETXPOW0=5
iwpriv ra0 set ATETXFREQOFFSET=19
iwpriv ra0 set ATE=TXCARR
```

2.3 Check TX spectrum mask

2.4GHZ Band, Channel=1, OFDM mode, MCS=7, BW=20, TX0 Power=5, TX count=0, ATE mode = TXCONT, and Frequency offset=10.

```
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set ATECHANNEL=1
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set ATETXFREQOFFSET=10
iwpriv ra0 set ATETXPOW0=5
iwpriv ra0 set ATETXANT=1
iwpriv ra0 set ATE=TXCONT
```

2.4 Frequency offset tuning

2.4GHZ Band, Channel=1, OFDM mode, MCS=7, BW=20, TX0 Power=5, TX count=0, ATE mode = TXCARR, and Frequency offset=0.

```
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATECHANNEL=1
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set ATETXFREQOFFSET=0
iwpriv ra0 set ATETXPOW0=5
iwpriv ra0 set ATETXANT=1
iwpriv ra0 set ATE=TXCARR
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXFREQOFFSET=10
iwpriv ra0 set ATE=TXCARR
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXFREQOFFSET=20
iwpriv ra0 set ATE=TXCARR
```

2.5 Rx Test

2.4GHZ Band, Channel=1, OFDM mode, MCS=7, BW=20, ATE mode = RXFRAME, and Frequency offset=20.

```
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ResetCounter=0
iwpriv ra0 set ATETXFREQOFFSET=20
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
```

iwpriv ra0 set ATECHANNEL=1
iwpriv ra0 set ATE=RXFRAME

iwpriv ra0 stat //Read statistic
iwpriv ra0 set ATERXANT=1

2.6 Show ATE parameters

iwpriv ra0 set ATESHOW=1

Result:

Mode=4
TxPower0=0
TxPower1=0
TxAntennaSel=0
RxAntennaSel=0
BBPCurrentBW=0
GI=0
MCS=7
TxMode=1
Addr1=00:11:22:aa:bb:cc
Addr2=00:11:22:aa:bb:cc
Addr3=00:11:22:aa:bb:cc
Channel=1
TxLength=1024
TxCount=40000
TxRate=11
RFFreqOffset=0

2.7 ATE Help

iwpriv ra0 set ATEHELP=1

Result:

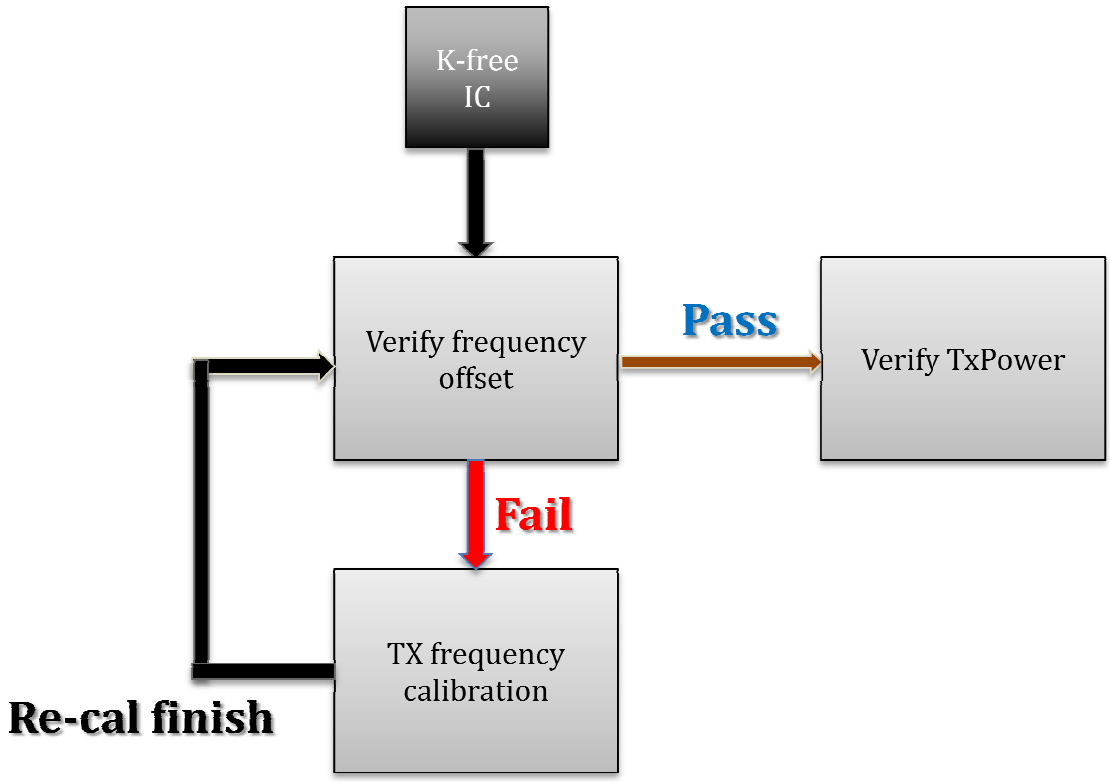
ATE=ATESTART, ATESTOP, TXCONT, TXCARR, TXFRAME, RXFRAME
ATEDA
ATESA
ATEBSSID
ATECHANNEL, range:0~14
ATETXPOW0, set power level of antenna 1.
ATETXPOW1, set power level of antenna 2.
ATETXPOW2, set power level of antenna 3
ATETXANT, set TX antenna. 0: all, 1: antenna one, 2: antenna two.
ATERXANT, set RX antenna.0: all, 1: antenna one, 2: antenna two, 3: antenna three.
ATETXFREQOFFSET, set frequency offset, range 0~63
ATETXBW, set BandWidth, 0:20MHz, 1:40MHz.
ATETXLEN, set Frame length, range 24~1500
ATETXCNT, set how many frame going to transmit.
ATETXRATE, set rate, reference to rate table.
ATETXMCS, set MCS, reference to rate table.
ATETXMODE, set Mode 0: CCK, 1: OFDM, 2: HT-Mix, 3: GreenField, reference to rate table.

ATETXGI, set GI interval, 0: Long, 1: Short
ATESHOW, display all parameters of ATE.
ATEHELP, online help.

2.8 MT7603 Internal PA Tx Power Calibration

For ATE TX Power calibration and verification, please flows the following steps.

2.8.1 ATE TX calibration sequence, step.1~3



Example Flow for iPA Tx Power

2.8.1.1 Step 1: Check EEPROM

Before calibration, please check the following EEPORM fields. For iPA Tx Power Calibration, please disable ePA in field 0x35.

1) 0x35[0:2]:
    a. Bit[0]=0/1, disable ePA/enable ePA, for 2.4G,
    b. Bit[1]=0/1, disable ePA /enable ePA, for 5G
    c. Bit[2]=0/1, 16mA/8mA.

2.8.1.2 Step 2: Check Frequency Offset Accuracy

1. Verify the accuracy of frequency offset, if more accurate frequency offset is needed

2. Command sequence please reference Frequency offset tuning in previous Chapter

2.8.1.3 Step3: 2.4 G Power calibration (Both Tx0 and Tx1 are necessary)

Note:

1. For K-Free IC, there is no need to do TSSI calibration. Therefore, only channel offset power compensation is needed.
2. For channel power compensation in 2.4G, channels are grouped into 3 groups
   a. group1: 1 ~ 5, corresponding effuse field are [0x59] for Tx0, [0x5F] for Tx1
   b. group2: 6 ~ 10, corresponding effuse field are [0x5A] for Tx0, [0x60] for Tx1
   c. group3: 11 ~14, corresponding effuse field are [0x5B] for Tx0, [0x61] for Tx1

   ,and choose one channel from each of the groups for channel power compensation is recommended, ex. choosing **1, 7**, and **13**
3. Rules for channel offset power compensation field:
   a. Bit[7]: 0/1 disable/enable power compensation
   b. Bit[6]: 0/1 increase/decrease bit[0:5] delta power
   c. Bit[0:5]: delta power for power compensation, of which maximum is 3 dBm, and resolution is 0.5 dBm.
4. Other power calibration commands (depends on your design flow)
5. 0x58 is the target power when TSSI is on

Command Sequence:

iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set **ATECHANNEL=1**
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set **ATETXANT**=1
iwpriv ra0 set **ATETXPOW0=9**
iwpriv ra0 set **ATETXPOW1=9**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=11**
iwpriv ra0 set **ATETXPOW1=11**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=10** //supposed this value is the calibration result
iwpriv ra0 set **ATETXPOW1=10**
iwpriv ra0 set ATE=TXFRAME //store the difference between target power and current power setting into corresponding effuse field, in this example, it is 0x59

iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set **ATECHANNEL=1**
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set **ATETXANT**=2
iwpriv ra0 set **ATETXPOW0=9**
iwpriv ra0 set **ATETXPOW1=9**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set ATETXPOW1=11
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set ATETXPOW1=10 //supposed this value is the calibration result
iwpriv ra0 set ATE=TXFRAME //store the difference between target power and current power setting into corresponding effuse field, in this example, it is 0x5F

iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=1

iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set **ATECHANNEL=7**
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set **ATETXANT**=1
iwpriv ra0 set **ATETXPOW0=9**
iwpriv ra0 set **ATETXPOW1=9**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=11**
iwpriv ra0 set **ATETXPOW1=11**

iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=10** //supposed this value is the calibration result
iwpriv ra0 set **ATETXPOW1=10**
iwpriv ra0 set ATE=TXFRAME //store the difference between target power and current power setting into corresponding effuse field, in this example, it is 0x5A

iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set **ATECHANNEL=7**
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set **ATETXANT=2**
iwpriv ra0 set **ATETXPOW0=9**
iwpriv ra0 set **ATETXPOW1=9**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=11**
iwpriv ra0 set **ATETXPOW1=11**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=10**
iwpriv ra0 set **ATETXPOW1=10** //supposed this value is the calibration result
iwpriv ra0 set ATE=TXFRAME //store the difference between target power and current power setting into corresponding effuse field, in this example, it is 0x60

iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set **ATECHANNEL=13**
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set **ATETXANT=1**
iwpriv ra0 set **ATETXPOW0=9**
iwpriv ra0 set **ATETXPOW1=9**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=11**
iwpriv ra0 set **ATETXPOW1=11**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=10** //supposed this value is the calibration result
iwpriv ra0 set **ATETXPOW1=10**
iwpriv ra0 set ATE=TXFRAME ////store the difference between target power and current power setting into corresponding effuse field, in this example, it is 0x5B

iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0

iwpriv ra0 set **ATECHANNEL=13**
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set **ATETXANT=2**
iwpriv ra0 set **ATETXPOW0=9**
iwpriv ra0 set **ATETXPOW1=9**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=11**
iwpriv ra0 set **ATETXPOW1=11**
iwpriv ra0 set ATE=TXFRAME
iwpriv ra0 set **ATETXPOW0=10**
iwpriv ra0 set **ATETXPOW1=10** //supposed this value is the calibration result
iwpriv ra0 set ATE=TXFRAME //store the difference between target power and current power setting into corresponding effuse field, in this example, it is 0x61

iwpriv ra0 set ATE=ATESTART

At last, write channel compensation value back to the corresponding EEPROM field, which is mentioned at the very beginning of this section.

2.8.2 MT7603 ATE TX verification sequence, step.4~6

Supposed power calibration at channel 1, 7, and 13 is completed.

2.8.2.1 Step4: Write EFUSE buffer, back to effuse/Flash

iwpriv ra0 set bufferWriteBack=1 (EFUSE)
iwpriv ra0 set bufferWriteBack=2 (Flash)
iwpriv ra0 set bufferWriteBack=4 (BufferBin)

2.8.2.2 Step5: Reload EEPROM content

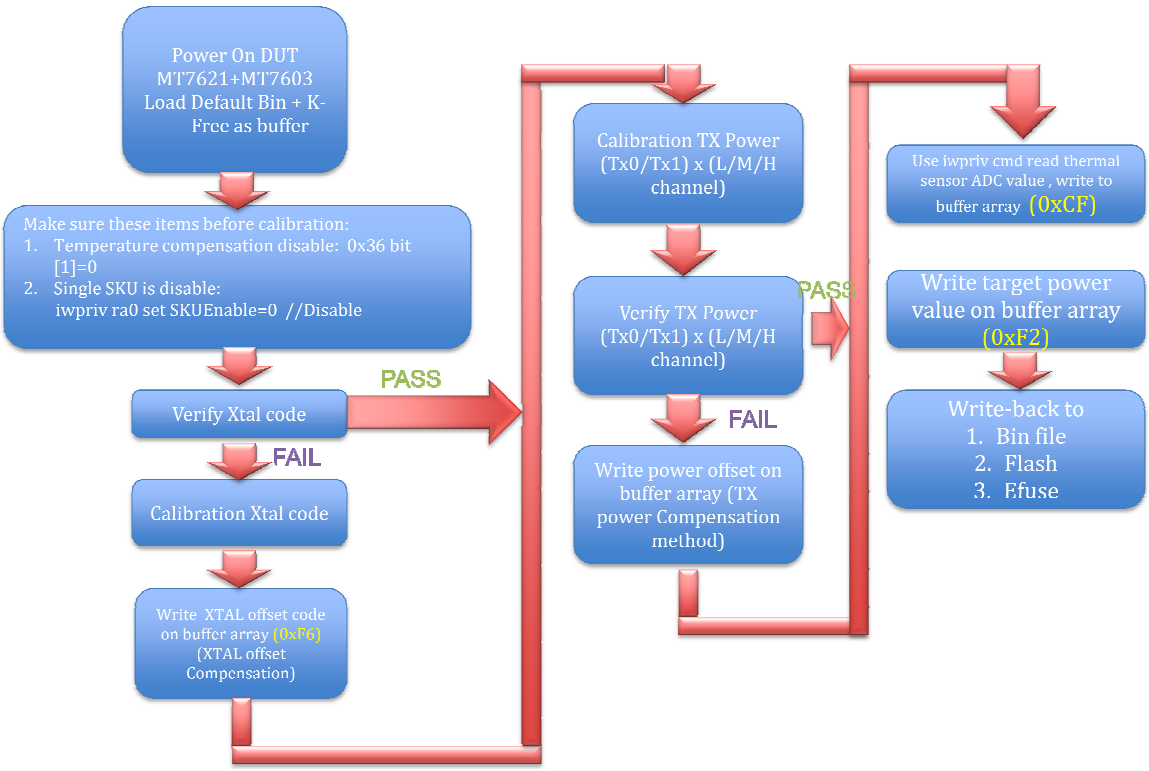
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATE=ATESTOP
ifconfig ra0 down
ifconfig ra0 up

2.8.2.3 Step6: Verify Tx channel compensation of each channel group

iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set **ATECHANNEL=1** **(=1, 7, 13, for each channel group in verification)**
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set **ATETXANT**=1 **(=1, 2, for each antenna in verification)**
iwpriv ra0 set ATE=TXFRAME

2.9 MT7603 External PA Tx Power Calibration

2.9.1 ATE TX calibration sequence, step.1~6



Example Flow for MT7621 + MT7603

2.9.1.1 Step 1: Check EEPROM

1) Before calibration, please check the following EEPORM fields. For ePA Tx Power Calibration, please enable ePA in field 0x35.
    a. 0x35[0:2]:
        i. Bit[0]=0/1, disable ePA/enable ePA, for 2.4G,
        ii. Bit[1]=0/1, disable ePA /enable ePA, for 5G
        iii. Bit[2]=0/1, 16mA/8mA.
2) For measuring transmission power vs. temperature variation table, please check 0x36[1] is set to 0, which disable temperature compensation during calibration

2.9.1.2 Step2:

Verify the output power value if it meets customer target power setting, e.g. OFDM 54M 15dBm, at room temperature (25°C).

Command Sequence:

iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATEDA=00:11:22:33:44:55

iwpriv ra0 set ATESA=00:aa:bb:cc:dd:ee
iwpriv ra0 set ATEBSSID=00:11:22:33:44:55
iwpriv ra0 set ATETXMODE=1
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
iwpriv ra0 set ATECHANNEL=1
iwpriv ra0 set ATETXGI=0
iwpriv ra0 set ATETXLEN=1024
iwpriv ra0 set ATETXCNT=0
iwpriv ra0 set ATE TXFRAME
(Note:Enable temperature compensation)

2.9.1.3 Step3:

1. Wait 5~10 minutes untill TX Power is stable
2. iwpriv ra0 set get_thermal_sensor=1 (Get ADC value)

2.9.1.4 Step4:

1. Read ADC value by step 2~3
2. Repeat step 2~3 and observe the transmission output power variation. Change the environment temperature from low to high when in step 5 operation (the below example, the temperature varied from -40°C to +85°C) and observe the transmission output power variation. Notice that the test temperature environment should rise from -40°C to +85°C orderly. Record the temperature and ADC value when transmission power has variation of ±1/2/3/4/5/6/7 dB step, which compared with the power at room temperature (25°C).

2.9.1.5 Step5:

Record the results. For example, transmission power variation vs. temperature variation table

Disable ALC				
Temp (°C)	ADC value	TX Power (dBm)	Power Difference with +25°C	Power Compensation Value
		11g 54Mbps		
-40	1F	25.5	+3	-3
-10	29	24.5	+2	-2
0	32	23.5	+1	-1
25	3E	22.5	0	0
45	47	21.5	-1	+1
65	51	20.5	-2	+2
85	5D	19.5	-3	+3

2.9.1.6 Step6:

Fill the record values into EEPROM TX power boundary registers as following:

Offset	Default (hex)	b15 ~b8 (ALC)		b7 ~ b0 (ALC)	
C6h	FFFF	TX power -6 TSSI boundary	00	TX power -7 TSSI boundary	00
C8h	FFFF	TX power -4 TSSI boundary	00	TX power -5 TSSI boundary	00
CAh	FFFF	TX power -2 TSSI boundary	29	TX power -3 TSSI boundary	1F
CCh	FFFF	TX power +0 TSSI boundary	3E	TX power -1 TSSI boundary	32
CEh	FFFF	2.4G reference temp		2.4G reference step	01
D0h	FFFF	TX power +2 TSSI boundary	51	TX power +1 TSSI boundary	47
D2h	FFFF	TX power +4 TSSI boundary	7F	TX power +3 TSSI boundary	5D
D4h	FFFF	TX power +6 TSSI boundary	7F	TX power +5 TSSI boundary	7F
D6h	FFFF	Reserved		TX power +7 TSSI boundary	7F

Note:

1. Transmission power will be compensated ±1/2/3/4/5/6/7 dB after ADC value exceeding TSSI boundary value.
2. TX power +1 TSSI boundary means that the transmission power will be compensated +1 dB after ADC value exceeding 47.
3. Please note, MUST fill a constant value to the unused threshold. For the low temperature, please fill 0x00. For the high temperature, please fill 0x7F.
4. 2.4G reference step can be used scale of 0.5 or 1dB for compensated power. CEh[0]==0 step is 0.5dBm, CEh[0]==1 step is1dBm. Ex. CEh[0]=0, then CCh[7:0] means" TX power -0.5 TSSI boundary"
5. To enable the auto transmit power compensation function, the EEPROM NIC Configuration 0 register "Automatic transmission power compensation" bit must be enabled 1. For example, we set EEPROM Offset 36h bit[1] = 1 in MT7603E

Chip	EEPROM Offset	Description
MT7603E	36h	Set bit[1]=1

6. The test temperature is not always at +25degree at customer's production line, so we need to get current temperature from IC and mapping the table2 to correct one.
   - iwpriv ra0 set get_thermal_sensor=0 (Get temperature value)
7. At the moment, the result of "get_thermal_sensor" could only be seen at kernel log
8. 0xF2 is the target power when TSSI is off

3 EERPOM Access Mode switch Mechanism

This feature is only available after SoftAP driver v2.7.1.2.

3.1 In WLAN Profile Setting

The detailed setting in *DAT profile* is shown as below:

3.1.1 E2pAccessMode

Description: Select the EEPROM access mode from interface start-up
Value:

E2pAccessMode=2

0: NONE
1: EFUSE mode
2: FLASH mode
3: EEPROM mode
4: BIN FILE mode

3.2 iwpriv Command support

Syntax:

iwpriv ra0 set [Parameter]=[Value]

The detailed usage of the new *commands* is shown as below:

3.2.1 bufferWriteBack

Description: Write buffer contents back to EFUSE/FLASH/EEPROM/BIN FILE
Value:

iwpriv ra0 set **bufferWriteBack**=2

0: NONE
1: EFUSE
2: FLASH
3: EEPROM
4: BIN FILE

3.2.2 bufferLoadFromBin

Description: Load from BIN file to be the buffer contents, and change to use BIN file mode
Value:

iwpriv ra0 set **bufferLoadFromBin**=0

0: Disable
1: Enable

3.2.3 bufferLoadFromEfuse

Description: Load from eFuse to be the buffer contents, and change to use BIN file mode
Value:

iwpriv ra0 set **bufferLoadFromEfuse**=0

0: Disable
1: Enable

3.2.4 efuseFreeNumber

Description: Display current EFUSE free block number
Value:

iwpriv ra0 efuseFreeNumber=0

any

3.2.5 efuseDump

Description: Dump out EFUSE data
Value:

iwpriv ra0 efuseDump=0

any

3.3 Efuse Buffer mode Example

Step by Step:

1. Set E2pAccessMode=1 in RT2860AP.dat. If this parameter does not exist, then add it into the profile.

2. Re-load Wi-Fi driver or re-download image/firmware.

3. Perform Wi-Fi RF calibration

4. After you are done with RF calibration, use “bufferWriteBack” to write data back to the bin file
   iwpriv ra0 set bufferWriteBack=4

5. If the bin file content is the final result, then use “bufferWriteBack” to write data into effuse
   iwpriv ra0 set bufferWriteBack=1

6. Set E2pAccessMode=0 in RT2860AP.dat, or remove this parameter from the profile

7. Done

4 FAQ

FAQ1: After ATE command is typed, “there is no available command” is shown in console? What should I check next?

Please check the driver is enabled with ATE support or not.
In file “config.mk”

```
# Support ATE function
HAS_ATE=y
# Support QA ATE function
HAS_QA_SUPPORT=y
```

In file “Makefile”, please check below two flags.

```
EXTRA_CFLAGS += -DCONFIG_ATE -DCONFIG_QA
```

FAQ2: Can the driver connect to STA/SofAP during the ATE process?

No, it can’t do that.
During the ATE process, the driver will be switched into test mode. At mean time, the driver can’t work as normal mode. It only processes specific ATE commands for testing WiFi RF purpose.

FAQ3: Can QAtool and ATE command be executed at the same time?

No, it can’t do that.
QAtool and ATE command can’t work at the same time. Only one application can be executed at once.

FAQ4: In the ATE mode, can the driver perform WiFi throughput test?

No, the same reason as FAQ3. ATE is only for testing purpose.

FAQ5: How to turn on debug message in the driver?

To enable debug message, # iwpriv ra0 set Debug=3

FAQ6: How can I verify TX power delta?

Please check the ATE command sequence as below!

```
iwpriv ra0 set ATE=ATESTART
iwpriv ra0 set ATETXMODE=2
iwpriv ra0 set ATETXMCS=7
iwpriv ra0 set ATETXBW=0
```

```
iwpriv ra0 set ATECHANNEL=36
iwpriv ra0 set ATETXGI=0
iwpriv ra0 set ATETXANT=1
iwpriv ra0 set ATETXLEN=1024
iwpriv ra0 set ATETXCNT=100000000000
iwpriv ra0 set ATETXFREQOFFSET=25
iwpriv ra0 set ATE=TXFRAME
```