



Ralink QA Tool Introduction

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System Application

Agenda

- **Why Need QA Tool?**
- **What Can QA Tool Provide?**
- **How to start QA Test Utility in AP**
- **EEPROM Structure Introduction**
- **Example: Calibration Procedure**
- **Q&A**





Why need QA Tool?

Ralink QA Test Program for RT2860

PCI Config TX/RX EEPROM MAC BBP Page1/2 BBP Page2/2 RF Sniffer About

MAC Address: 000C4310127F Set RF Type: RT2850 :: 2 T 3 R

Channel: 1 2412-MHz Mode: CCK Rate: MCS=0; LP 1 Mbps Bandwidth: 20 TxBandSel: Lower

TX

Frame Type: [20] User4(Data+CRC) Set Tx D ☐ Auto ALC ☐ Enable Beacon ☐ STBC ☒ 2.4G Side Band Option ☐ SGI ☐ A-MPDU

TX frame setting

FC (2)	Dur (2)	Address1 (6)	Address2 (6)	Address3 (6)	Seq (2)	
0800	0000	FFFFFFFFFFFF	000C4310127F	001122334455	0000	<input type="checkbox"/> Wait for ACK

Payload: ☐ Debug Info ☒ h ☐ Inc ☐ Random

Payload: Repeat Pattern: AA SW CRC Check: ☐ SW CRC Total Bytes: 1058

Repeat: 000 ☐ LoopBack IPG: 50

Start TX Transmitted: 51343 ☐ Conti. Tx ☐ Carrier test ☐ Carrier Suppression

TX Power0: 0A Calibrate TX Power1: 0B Calibrate Freq. Offset: 2E Calibrate

☐ Both DACs ☒ DAC 0 ☐ DAC 1

RX

RX Error (Dropped)

FCS error:	0 / 0
RX overflow:	0 / 0
PHY error:	0 / 0
False CCA:	0 / 0
<input type="checkbox"/> Frame Loss:	0%

☐ Auto Responder

RX Okay

U2M DATA:	0 / 0
Other DATA:	0 / 0
Beacon:	0 / 0
Others (Mgmt/Cntl):	0 / 0
FER:	0%

RSSI tune

RSSI1 =	xx dBm	Offset	00	Calibrate
RSSI2 =	xx dBm	Offset	00	Calibrate
RSSI0 =	xx dBm	Offset	00	Calibrate

Freq. Deviation: xxx KHz / xx ppm

☐ All ADCs ☐ One RX Path

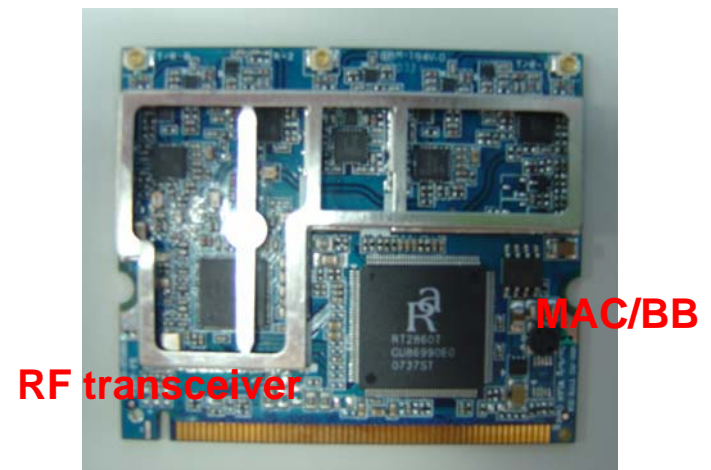
SNR0: xx dB SNR1: xx dB

Start RX Reset counter Dump DMA Load DMA

Dump Log Set Tx Env... Capture Mode

Why need QA Tool?

- Verify hardware function of Ralink WLAN 802.11 a/b/g/n MAC/BB and RF transceiver IC
- NDIS driver is not only verify the hardware part, but also includes WiFi protocol part.



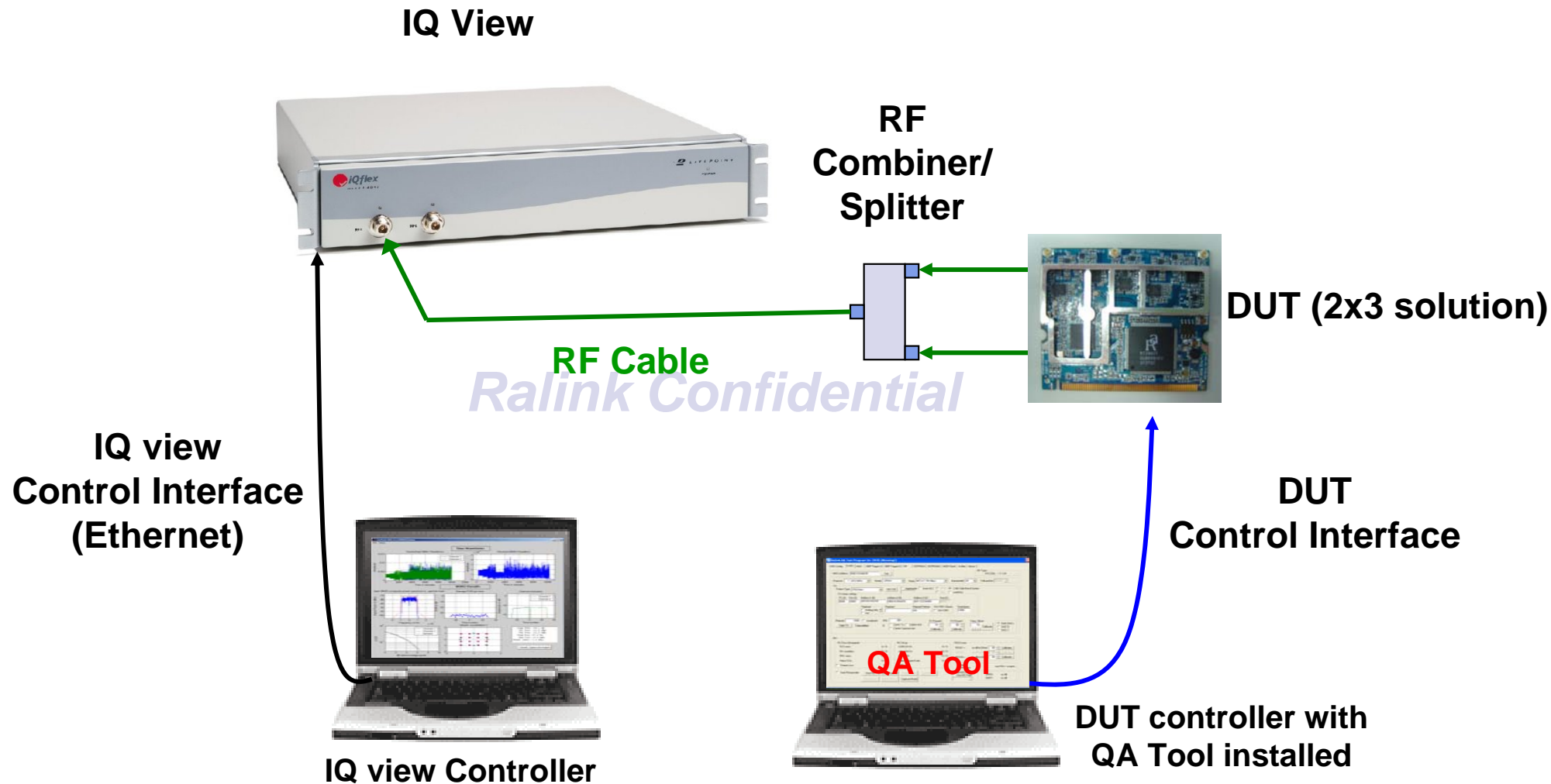


What Can QA Tool Provide?

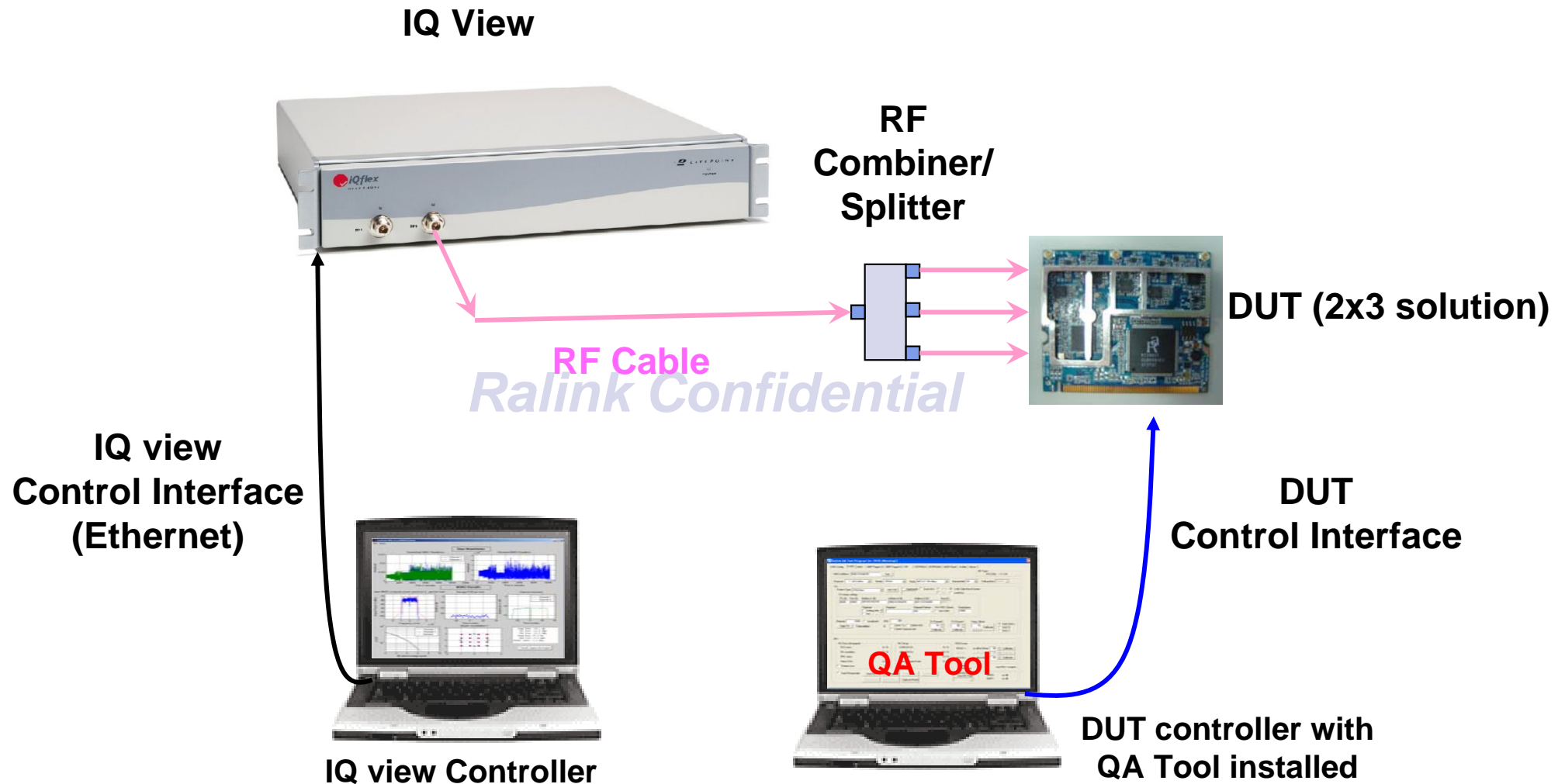
What can QA Tool provide?

- Frequency Calibration
- Tx Output Power Calibration & EVM Check
- Tx Spectrum Mask Check
- Rx Sensitivity Check
- EEPROM Content Modification

Setup for WiFi Tx testing (For MCS_0 to MCS_7)



Setup for WiFi Tx testing (For MCS_0 to MCS_7)



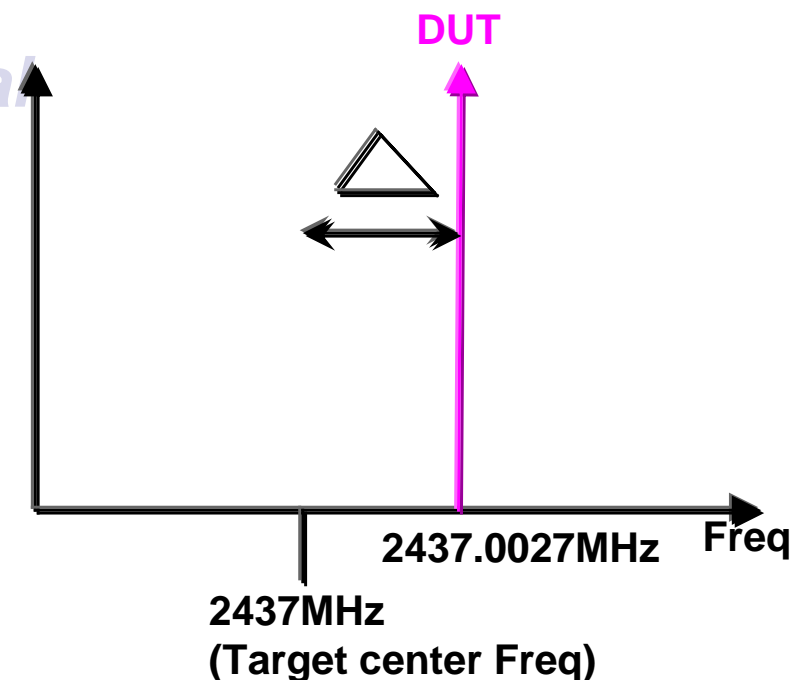
Frequency Calibration

- Purpose: Adjust center frequency to meet IEEE SPEC:20ppm (Ralink: +/- 5ppm @25 °C)

➤ Test Result: temperature @ 25°C

➤ Transmit Center Frequency Tolerance Test Result

Channel	CH6	CH100
Result (ppm)	1.1	2.34
Frequency Tolerance	2.7k	12.875k
Pass/Fail	PASS	PASS



Tx Output Power Calibration & EVM check

- Purpose: Check if Tx Output power with good signal quality to meet Ralink and Customer request

Mode	Rate	Ch 1	CH 6	CH 11	Modulation	Coding rate	Relative constellation error (dB)
11n 40MHz	MCS0	-20.0	-20.1	-20.1	BPSK	1/2	-5
	MCS 1	-20.8	-20.0	-20.6	QPSK	1/2	-10
	MCS 2	-22.5	-22.5	-22.7	QPSK	3/4	-13
	MCS 3	-23.6	-23.3	-23.2	16-QAM	1/2	-16
	MCS 4	-26.1	-25.9	-26.2	16-QAM	3/4	-19
	MCS 5	-26.2	-26.6	-26.0	64-QAM	2/3	-22
	MCS 6	-30	-29.8	-29.5	64-QAM	3/4	-25
	MCS 7	-30.1	-30.9	-30.5	64-QAM	5/6	-28

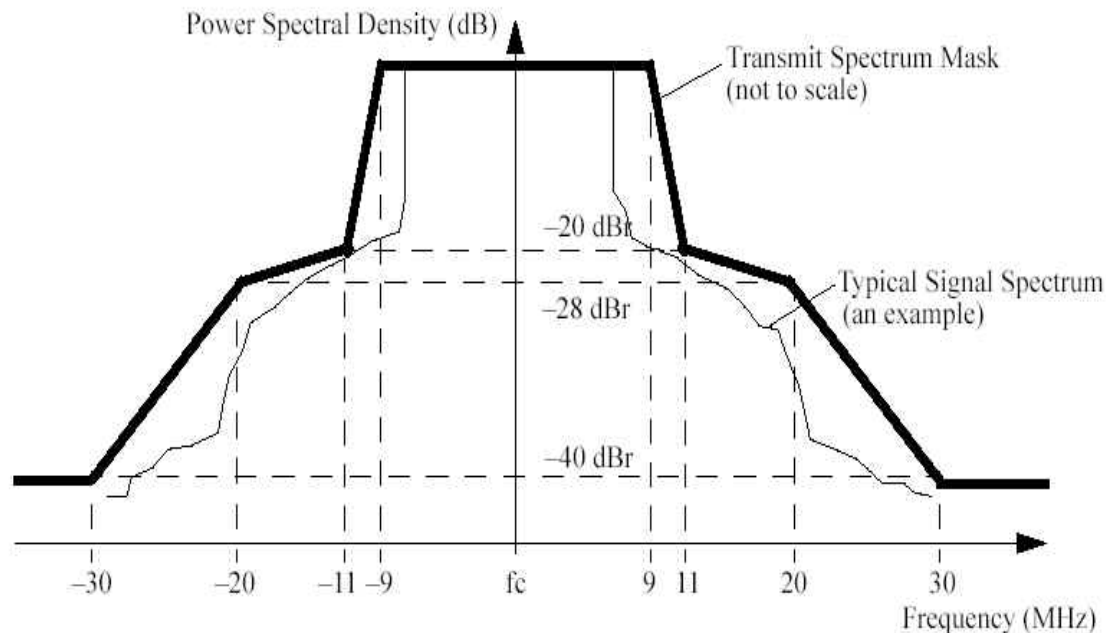
EVM test result

EVM table from IEEE

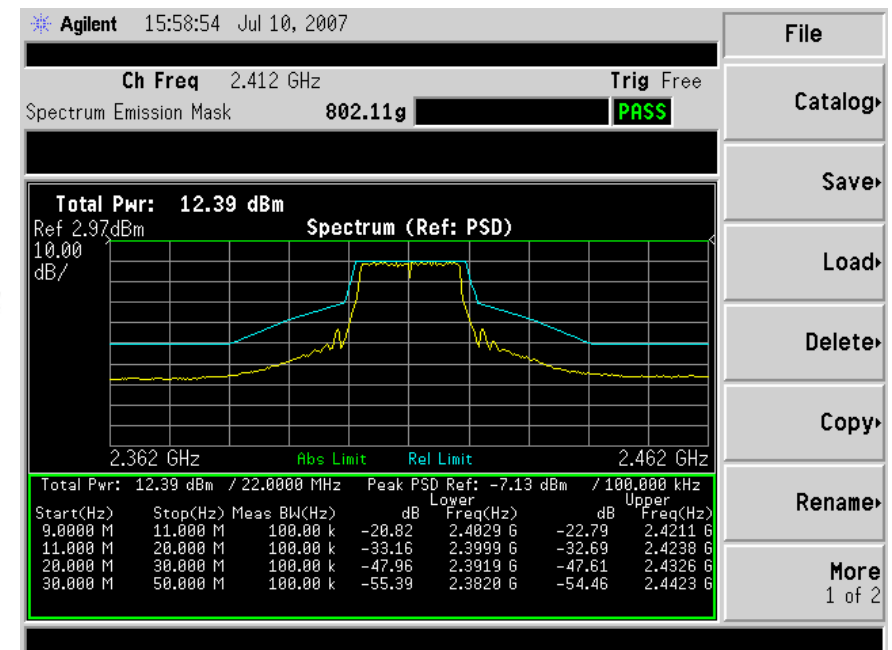
Note: EVM: Error Vector Magnitude => Tx signal quality index

Tx Spectrum Mask Check

- Purpose: Check if Tx Spectrum Mask meets IEEE standard as below



Transmit Spectrum Mask Limitation for 11g OFDM



Transmit Spectrum Mask test result for 11g OFDM

Rx Sensitivity Check

- Purpose: Check how low signal strength that WLAN still can receive

		Ch1	Ch6	Ch11
11n 20MHz	MCS0	-92	-92	-92
	MCS1	-89	-89	-89
	MCS2	-87	-87	-87
	MCS3	-84	-84	-84
	MCS4	-81	-81	-81
	MCS5	-77	-77	-77
	MCS6	-75	-75	-75
	MCS7	-73	-73	-73

EEPROM Content Modification

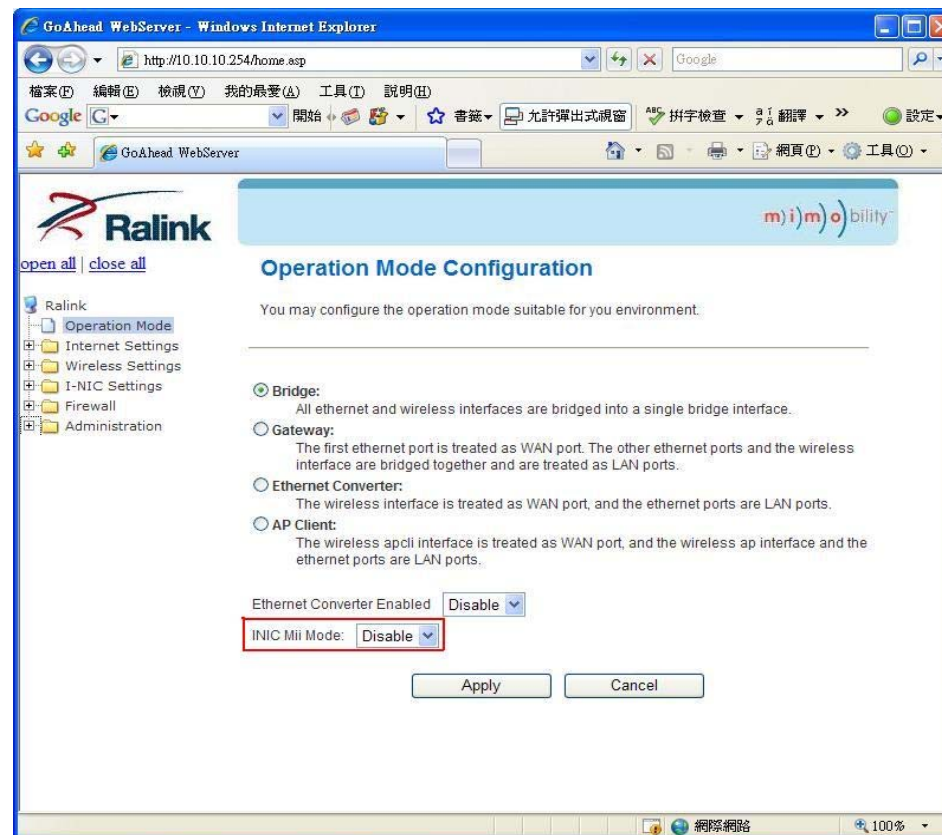
- Purpose:
 1. Modify the Tx Output Power Setting
 2. Modify Country Region Setting
 3. Modify MAC Address
 4. Modify Subsystem PID/VID
 5. Modify NIC Configuration



How to start QA Test Utility in AP

Step 1 Setting for RT2880 AP

- 1.1 Connect Ethernet port then enter <http://10.10.10.254> Ralink RT2880 Web page
- 1.2 Choose \Administration\System Command\
 - 1.3 Type “ated” command enter ATE mode
 - 1.4 Execute RT2880QA.exe (Please install WinPcap_3_1.exe when you first execute)



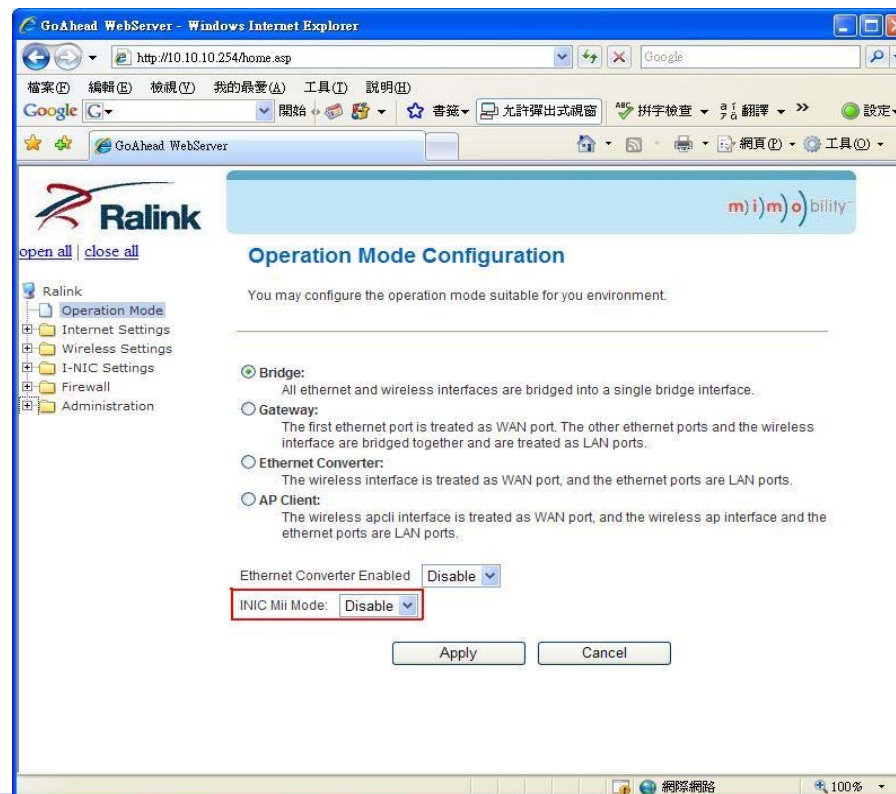
Step 2 Setting for RT2880 iNIC (MII or mPCI)

2.1 Connect Ethernet port then enter <http://10.10.10.254> Ralink RT2880 Web page,

2.2 Select iNIC MII Mode as “Enable” -> for MII iNIC

2.3 Select iNIC MII Mode as “Disable” -> for mPCI iNIC

PS: The SDK v2.4.0.0 and later version supports this function. The RT2880 AP platform hardware version must V30RW-FE-2X3 and above version.





How to start QA Test Utility in AP (3/6)

2.4 Then power off AP, insert iNIC into socket. Power on AP.

2.5 Connect Ethernet port then enter <http://10.10.10.254> Ralink RT2880 Web page,

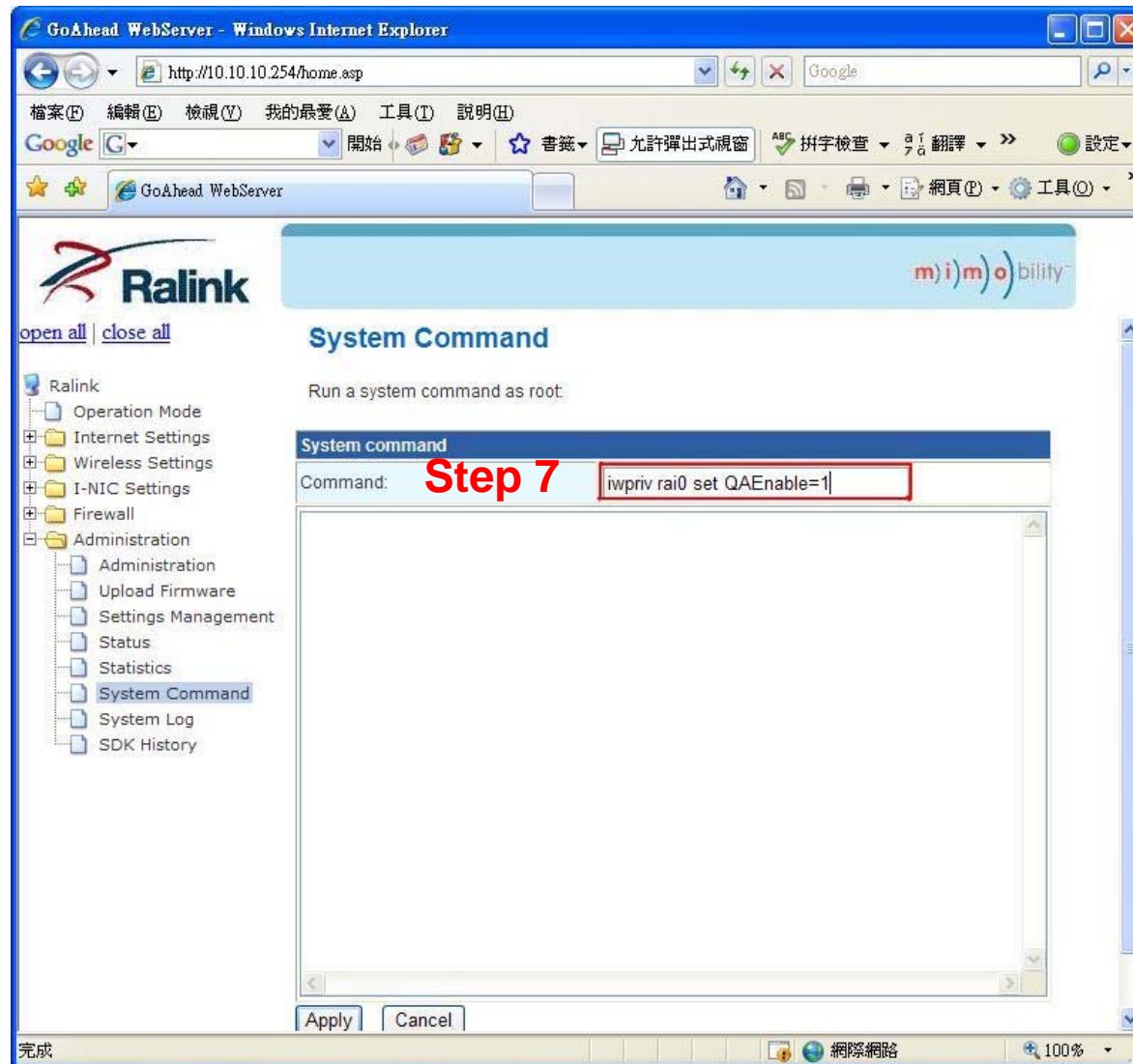
2.6 Choose \Administration\System Command\

Ralink Confidential

2.7 Type “iwpriv rai0 set QAEnable=1” command enter ATE mode

2.8 Execute RT2880QA.exe (Please install WinPcap_3_1.exe when you first execute)

2.9 Select Ethernet adapter, and tick iNicMode



Step 3: Use RS232 console port and the setting as below.

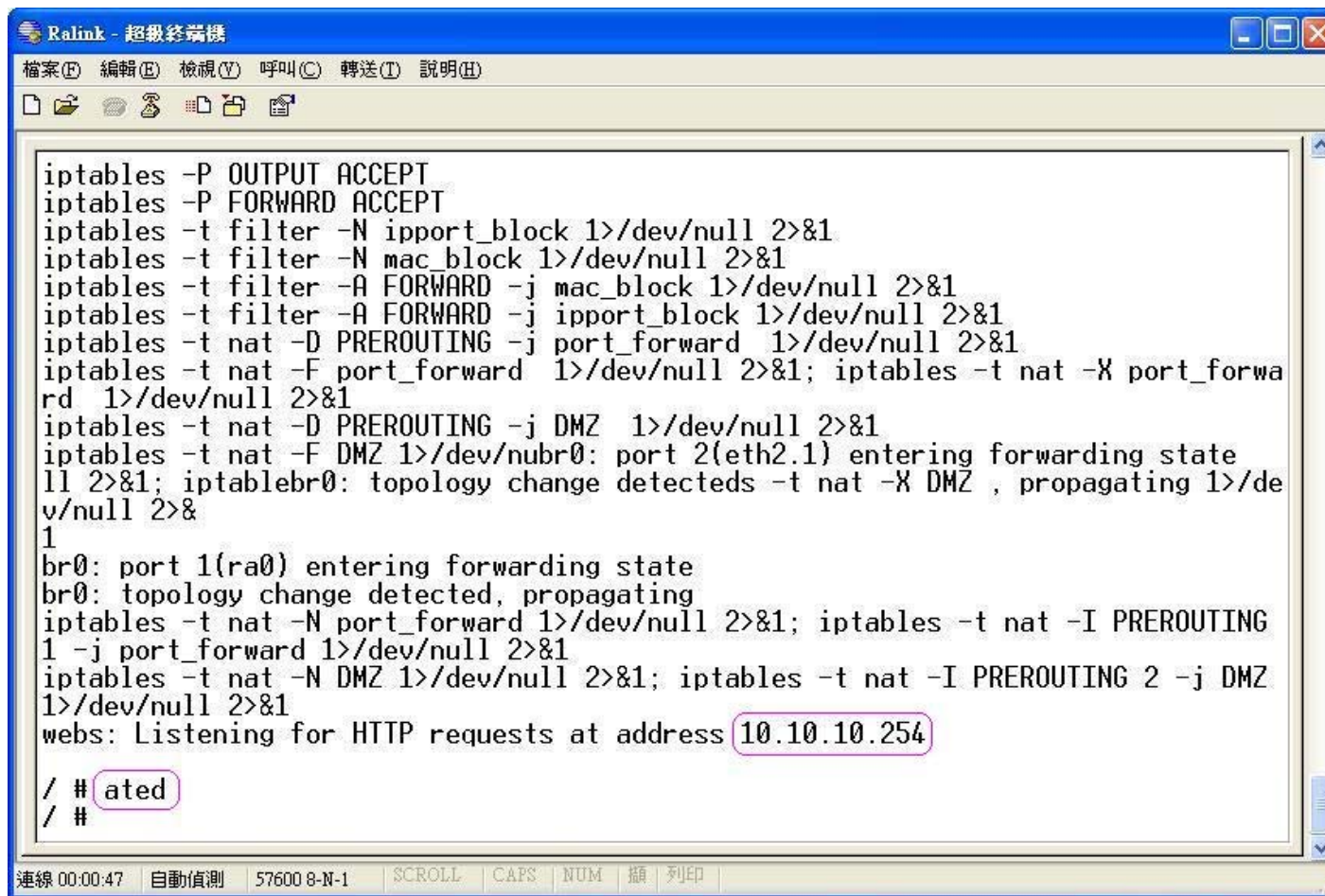


The image shows a Windows-style dialog box titled "COM1 內容". It has a tab labeled "連接埠設定". Inside the dialog, there are five settings, each with a label and a dropdown menu:

- 每秒傳輸位元(B): 57600
- 資料位元(D): 8
- 同位檢查(P): 無
- 停止位元(S): 1
- 流量控制(F): 無

Below these settings is a button labeled "還原成預設值(R)". At the bottom of the dialog are three buttons: "確定", "取消", and "套用(A)".

Step 4: Type “ated” command enter ATE mode when boot system code finished



```
Ralink - 超級終端機
檔案(F) 編輯(E) 檢視(V) 呼叫(C) 轉送(T) 說明(H)

iptables -P OUTPUT ACCEPT
iptables -P FORWARD ACCEPT
iptables -t filter -N ipport_block 1>/dev/null 2>&1
iptables -t filter -N mac_block 1>/dev/null 2>&1
iptables -t filter -A FORWARD -j mac_block 1>/dev/null 2>&1
iptables -t filter -A FORWARD -j ipport_block 1>/dev/null 2>&1
iptables -t nat -D PREROUTING -j port_forward 1>/dev/null 2>&1
iptables -t nat -F port_forward 1>/dev/null 2>&1; iptables -t nat -X port_forwa
rd 1>/dev/null 2>&1
iptables -t nat -D PREROUTING -j DMZ 1>/dev/null 2>&1
iptables -t nat -F DMZ 1>/dev/nubr0: port 2(eth2.1) entering forwarding state
ll 2>&1; iptablebr0: topology change detecteds -t nat -X DMZ , propagating 1>/de
v/null 2>&
1
br0: port 1(ra0) entering forwarding state
br0: topology change detected, propagating
iptables -t nat -N port_forward 1>/dev/null 2>&1; iptables -t nat -I PREROUTING
1 -j port_forward 1>/dev/null 2>&1
iptables -t nat -N DMZ 1>/dev/null 2>&1; iptables -t nat -I PREROUTING 2 -j DMZ
1>/dev/null 2>&1
webs: Listening for HTTP requests at address 10.10.10.254

/ # ated
/ #
```

Step 5: Connect Ethernet port then execute RT2880QA.EXE



EEPROM Structure Introduction

Brief EEPROM Structure

Offset	Function Description
00h~01h	Chip ID
04~09h	MAC address
0Ah~0Dh	PCI Device ID & PCI vendor ID
012h~15h	PCI subsystem ID and Subvendor ID
1Ah~33h	Reserved
34h~37h	NIC configuration
38h	Country Region for 2.4 and 5GHz
3Ah~41h	LED setting
42h~43h	NIC configuration
44h~4ch	Receiver setting
52h~6Ah	2.4GHz Power calibration setting
6Eh~76h	2.4GHz temperature compensation
78h~C6h	5GHz Power calibration setting
D4h~DDh	5GHz temperature compensation
DEh~EFh	Power level default setting for modulations

Ralink EEPROM Content (RT2860)

PCI Config | TX/RX | EEPROM | MAC | BBP Page1/2 | BBP Page2/2 | RF | Sniffer | About

EEPROM Type: 93c66 MAC Addr: 000C43031280 Set

Single Read/Write
 Mode: ☒ READ ☐ WRITE
 Read/Write Mode: ☒ Value-Mode
 Offset: 0000 Value: 00 Length: 0000

High or Low Active: [Dropdown]
 LED G: [Dropdown]
 Radio On and Link Down: [Dropdown]
 Link to G: [Dropdown]
 LED A: [Dropdown]
 Radio On and Link Down: [Dropdown]
 Link to G: [Dropdown]
 Link to A: [Dropdown]
 LED ACT: [Dropdown]
 Radio Off: [Dropdown]
 Radio On Link Down: [Dropdown]
 Link to G: [Dropdown]
 Link to A: [Dropdown]
 LED Mode(0x3B): LED Mode 00 Set

Read ALL

Keep Current TxPower
 Save As...

Offset	00	01	02	03	04	05	06	07
Value	60	28	03	01	00	0C	43	10

Offset	08	09
Value	12	80

Offset	38	39
Value	FF	FF

EEPROM Content (Hex):

```

00000000 60 28 03 01 00 0C 43 10 \(.C.
00000008 12 80 01 06 14 18 01 80 .....
00000010 00 00 60 28 14 18 00 00 ..\(.
00000018 01 00 0A FF 0C 00 FF FF .....
00000020 FF FF FF FF FF FF FF .....
00000028 FF FF FF FF FF FF FF .....
00000030 FF FF FF FF 23 02 0C 00 ....#...
00000038 FF FF 00 00 FF FF FF FF ..#....
00000040 FF FF FF FF 0A 10 00 00 .....
00000048 00 0C 00 00 00 08 FF FF .....
00000050 FF FF 0B 0B 0B 0B 0B 0B .....
00000058 0C 0C 0C 0C 0C 0C 0C 0C .....
00000060 0A 0A 0B 0B 0C 0C 0D 0D .....
00000068 0D 0E 0E 0E 0F 0F FF FF .....
00000070 FF FF FF FF FF FF FF .....
00000078 04 04 04 04 04 04 04 05 .....
00000080 05 05 05 05 06 06 06 07 .....
00000088 07 07 08 08 08 09 09 09 .....
00000090 0A 0A 0A 0B 0B 0B 0C 0C .....
00000098 0C 0D 0D 63 FF FF FF FF ...c...
000000A0 FF FF FF FF FF FF 06 06 .....
000000A8 06 05 05 04 04 04 03 03 .....
  
```

Example: EEPROM Setting

Offset	Default (hex)	b15 ~b8	b7 ~ b0
00h	2870 2770	Chip ID (28) (Offset 01)	(60) (Offset 00)
02h	0000	EEPROM Version (01) (03)	(03) (02)
04h		Mac Address [15:0] (0C) (05)	(00) (04)
06h		Mac Address [31:16] (10) (07)	(43) (06)
08h		Mac Address [47:32] (80) (09)	(12) (08)

34h	FFFF	NIC Configuration 0	
36h	FFFF	NIC Configuration 1	
38h	FFFF	Country Region 2.4G (FF) (39)	Country Region 5G band (FF) (38)

	Support Channels
0	CH 1-11
1	CH 1-13
2	CH 10 -11
3	CH 10 -13
4	CH 14
5	CH 1 -14
6	CH 3 - 9
7	CH 5 - 13

2.4GHz channel setting

Note: In country region setting, “FF” means country region will be controlled by software

Example: NIC Configuration

PCI Config | TX/RX | EEPROM | MAC | BBP Page1/2 | BBP Page2/2 | RF | Sniffer | About

EEPROM Type: 93c66 MAC Addr: 000C43101280 Set

Single Read/Write
 Mode: ☒ READ ☐ WRITE Offset: 0000 Value: 00 R/W
 Read/Write Mode: ☒ Value-Mode Length: 0000

High or Low Active: [Dropdown]

LED G
 Radio Off: [Dropdown]
 Radio On and Link Down: [Dropdown]
 Link to G: [Dropdown]
 Link to A: [Dropdown]

LED A
 Radio Off: 00
 Radio On and Link Down: [Dropdown]
 Link to G: [Dropdown]
 Link to A: [Dropdown]

LED ACT
 Radio Off: [Dropdown]
 Radio On Link Down: [Dropdown]
 Link to G: [Dropdown]
 Link to A: [Dropdown]

LED Mode(0x3B)
 LED Mode: 00 Set

Offset: 36 Value: 0C 37 00

Read ALL

Load File Keep Current TxPower Save As...

00000000 60 28 03 01 00 0C 43 10 `(. . . . C.
 00000008 12 80 01 06 14 18 01 80
 00000010 00 00 60 28 14 18 00 00 ..`(. . . .
 00000018 01 00 6A FF 0C 00 FF FF ..j. . . .
 00000020 FF FF FF FF FF FF FF FF
 00000028 FF FF FF FF FF FF FF FF
 00000030 FF FF FF FF 23 0C 0C 00 ..#...
 00000038 FF FF 23 00 FF FF FF FF ..#...
 00000040 FF FF FF FF 0A 10 00 00
 00000048 00 0C 00 00 00 08 FF FF
 00000050 FF FF 0B 0B 0B 0B 0B 0B
 00000058 0C 0C 0C 0C 0C 0C 0C
 00000060 0A 0A 0B 0B 0C 0C 0D 0D
 00000068 0D 0E 0E 0E 0F 0F FF FF
 00000070 FF FF FF FF FF FF FF FF
 00000078 04 04 04 04 04 04 05
 00000080 05 05 05 05 06 06 07
 00000088 07 07 08 08 08 09 09
 00000090 0A 0A 0A 0B 0B 0C 0C
 00000098 0C 0D 0D 63 FF FF FF FF ...c....
 000000A0 FF FF FF FF FF FF 06 06
 000000A8 06 05 05 04 04 04 03 03

NIC Configuration Example

NIC Configuration 1

Offset 0x36

7	6	5	4	3	2	1	0
<u>WPS</u> •PBC	5G side band for 40M BW	2.4G side band for 40M BW	Proprietary Test bit	EXT LNA 5G	EXT LNA 2.4G	TX ALC	HW CTRL
0: off (D) 1: on (0)	0: off(D) 1: on (0)	0: off 1: on(D) (0)	0: off(D) 1: on (0)	0: off 1: on(D) (1)	0: off 1: on(D) (1)	0: off(D) 1: on (0)	0: off(D) 1: on (0)

Offset 0x36
Value=0C h
= 0000 1100

0

C

Offset 0x37

15 ~ 11					10	9	8
Reserved					Broad band EXT LNA	40M BW in 5G band	40M BW in 2.4G band
					0: off 1: on (0)	0: on (D) 1: off (0)	0: on (D) 1: off (0)

Offset 0x37
Value=00 h
= 0000 0000

0

0

2.4GHz TX Power Calibration Setting

PCI Config | TX/RX | EEPROM | MAC | BBP Page1/2 | BBP Page2/2 | RF | Sniffer | About

EEPROM Type: 93c66 MAC Addr: 000C43101280 Set

Single Read/Write
 Mode: ☒ READ ☐ WRITE Offset: 0000 Value: 00 R/W
 Read/Write Mode: ☒ Value-Mode Length: 0000

Read ALL Load File ☐ Keep Current TxPower Save As...

High or Low Active: [Dropdown]
 LED G:
 Radio Off: [Dropdown]
 Radio On and Link Down: [Dropdown]
 Link to G: [Dropdown]
 Link to A: [Dropdown]
 LED A:
 Radio Off: [Dropdown]
 Radio On and Link Down: [Dropdown]
 Link to G: [Dropdown]
 Link to A: [Dropdown]
 LED ACT:
 Radio Off: [Dropdown]

Offset 52 (2.4GHz TX0 path)

Channel 1 8

Offset	52	53	54	55	56	57	58	59
Value	0B	0B	0B	0B	0B	0B	0C	0C

Channel 9 14

Offset	5A	5B	5C	5D	5E	5F		
Value	0C	0C	0C	0C	0C	0C		

EEPROM Data (Hex):

```

00000000 60 28 03 01 00 0C 43 10 \{....C.
00000008 12 80 01 06 14 18 01 80 .....
00000010 00 00 60 28 14 18 00 00 ..\{....
00000018 01 00 6A FF 0C 00 FF FF ..j.....
00000020 FF FF FF FF FF FF FF FF .....
00000028 FF FF FF FF FF FF FF FF .....
00000030 FF FF FF FF 23 02 0C 00 ..#....
00000038 FF FF 23 00 FF FF FF FF ..#....
00000040 FF FF FF FF 0A 10 00 00 .....
00000048 00 0C 00 00 00 08 FF FF .....
00000050 FF FF 0B 0B 0B 0B 0B 0B .....
00000058 0C 0C 0C 0C 0C 0C 0C 0C .....
00000060 0A 0A 0B 0B 0C 0C 0D 0D .....
00000068 0D 0E 0E 0E 0F 0F FF FF .....
00000070 FF FF FF FF FF FF FF FF .....
00000078 04 04 04 04 04 04 04 05 .....
00000080 05 05 05 05 06 06 06 07 .....
00000088 07 07 08 08 08 09 09 09 .....
00000090 0A 0A 0A 0B 0B 0C 0C 0C .....
00000098 0C 0D 0D 63 FF FF FF FF ...c....
000000A0 FF FF FF FF FF FF 06 06 .....
000000A8 06 05 05 04 04 04 03 03 .....
  
```



2.4GHz & 5GHz Power Calibration EEPROM Setting

Offset	Default (hex)	b15 ~ b8	b7 ~ b0
52h	FFFF	Channel 2 TX1 power (0B) (53)	Channel 1 TX1 power (0B) (52)
54h	FFFF	Channel 4 TX1 power (0B)	Channel 3 TX1 power (0B)
56h	FFFF	Channel 6 TX1 power (0B)	Channel 5 TX1 power (0B)
58h	FFFF	Channel 8 TX1 power (0C)	Channel 7 TX1 power (0C)
5Ah	FFFF	Channel 10 TX1 power (0C)	Channel 9 TX1 power (0C)
5Ch	FFFF	Channel 12 TX1 power (0C)	Channel 11 TX1 power (0C)
5Eh	FFFF	Channel 14 TX1 power (0C) (5F)	Channel 13 TX1 power (0C) (5E)
60h	FFFF	Channel 2 TX2power (0A) (61)	Channel 1 TX2 power (0A) (60)
62h	FFFF	Channel 4 TX2 power (0B)	Channel 3 TX2 power (0B)
64h	FFFF	Channel 6 TX2 power (0C)	Channel 5 TX2 power (0C)
66h	FFFF	Channel 8 TX2 power (0D)	Channel 7 TX2 power (0D)
68h	FFFF	Channel 10 TX2 power (0E)	Channel 9 TX2 power (0D)
6Ah	FFFF	Channel 12 TX2 power (0E)	Channel 11 TX2 power (0E)
6Ch	FFFF	Channel 14 TX2 power (0F) (6D)	Channel 13 TX2 power (0F) (6C)



Example: Calibration Procedure

1. Crystal Frequency Offset Calibration

- TX0 path (channel 6 only is needed)
- TX1 path (channel 6 only is needed)

Notes: The calibrated data of channel 6 will be also for other channels.

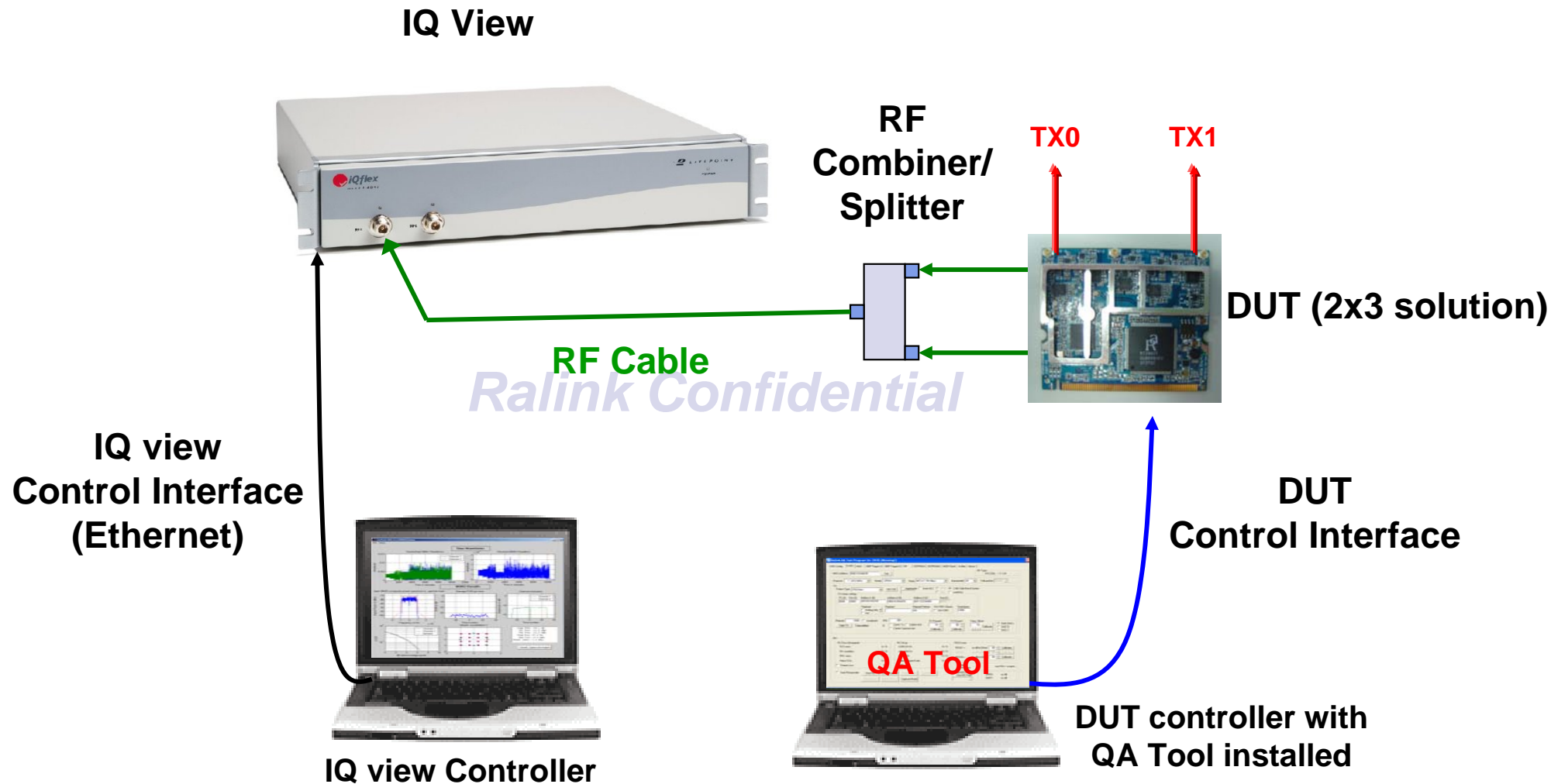
2. TX power Calibration

- TX0 path (channel 1~14 are needed)
- TX1 path (channel 1~14 are needed)

Notes: These calibration data will be used for b/g/n mode.

Detail QA Tool settings, please refer to below pages

Setup for WiFi Tx testing (For MCS_0 to MCS_7)



Frequency Offset Calibration Procedure

PCI Config | TX/RX | EEPROM | MAC | BBP Page1/2 | BBP Page2/2 | RF | Sniffer | About

MAC Address: 000C43101280 [Set]

RF Type: RT2850 :: 2 T 3 R

Channel: 6 2437-MHz | Mode: HT MixMode | Rate: MCS=7, 65 Mbps | Bandwidth: 20 | TxBandSel: Lower

TX

Frame type: [20] User4[Data+CRC] | Set TXD | ☐ Auto ALC | ☐ Enable Beacon | ☐ STBC | ☐ 2.4G Side Band Option | ☐ SGI | ☐ A-MPDU

TX frame setting

FC (2): 0800 | Dur (2): 0000 | Address1 (6): FFFFFFFF | Address2 (6): 000C43101280 | Address3 (6): 001122334455 | Seq (2): 0000 | ☐ Wait for ACK

Payload: ☐ Debug Info | ☐ Inc | ☐ Random | Payload: | Repeat Pattern: AA | SW CRC Check: ☐ SW CRC | Total Bytes: 1058

Repeat: 0 | LoopBack: ☐ IPG: 20 | ☐ Carrier test | ☐ Carrier Suppression

TX Power1: 0C | Freq. Offset: 23 | Calibrate

Both DACs | DAC 0 | DAC 1

8. Start

RX

RX Error (Dropped)

FCS error :	0 / 0
RX overflow :	0 / 0
PHY error :	0 / 0
False CCA :	0 / 0
<input type="checkbox"/> Frame Loss :	0%

RX Okay

U2M DATA :	0 / 0
Other DATA :	0 / 0
Beacon :	0 / 0
Others (Mgmt/Cntl) :	0 / 0
FER :	0%

RSSI tune

RSSI1 =	xx dBm	Offset	00	Calibrate
RSSI2 =	xx dBm	Offset	00	Calibrate
RSSI0 =	xx dBm	Offset	00	Calibrate

Freq. Deviation : xxx KHz / xx ppm

☐ All ADCs | ☐ One RX Path

SNR0 : xx dB | SNR1 : xx dB

☐ Auto Responder | Start RX | Reset counter | Dump DMA | Load DMA | Dump Log | Set Tx Env... | Capture Mode

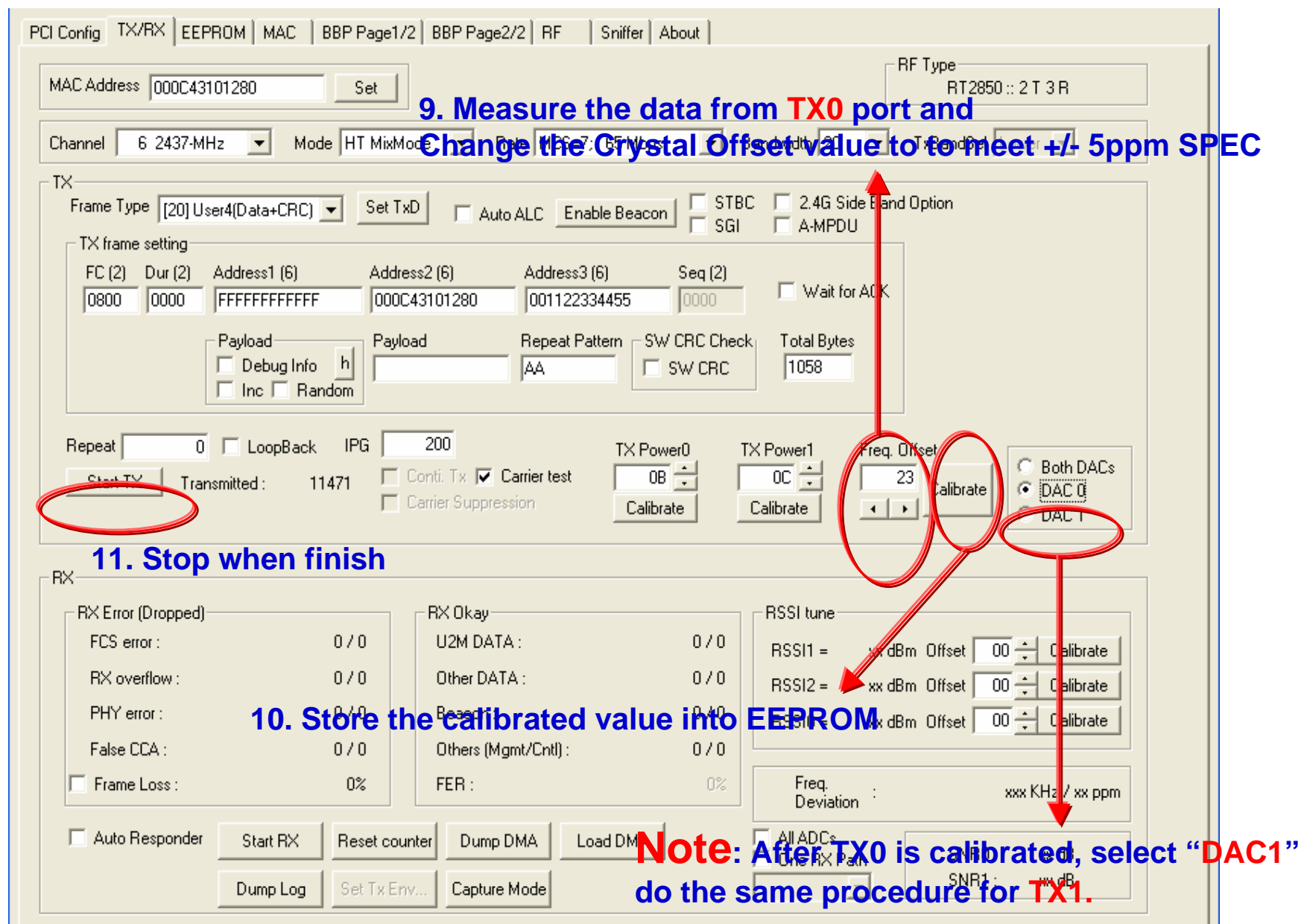
Frequency Offset Calibration Procedure (continuous)

9. Measure the data from **TX0** port and Change the Crystal Offset value to meet +/- 5ppm SPEC

11. Stop when finish

10. Store the calibrated value into EEPROM

Note: After TX0 is calibrated, select "DAC1" do the same procedure for TX1.



The screenshot displays the Ralink configuration utility interface. The 'TX' section is active, showing various settings for transmission. The 'Freq. Offset' field is highlighted with a red circle and contains the value '23'. The 'Calibrate' button is also highlighted. The 'DAC1' radio button is selected. The 'RX' section shows various error statistics and the 'Load DM' button. The 'Start TX' button is circled in red.

TX_0 Power Calibration Procedure

PCI Config TX/RX EEPROM MAC BBP Page1/2 BBP Page2/2 RF Sniffer About

MAC Address 000C43101280 Set

RF Type RT2850 :: 2 T 3 R

Channel 1 2412-MHz Mode HT MixMode Rate MCS=7; 65 Mbps Bandwidth 20 TX BandSel Lower

1. 2412MHz 2. HT Mix mode

3. MCS 7 4. BW=20

TX frame setting

FC (2) Dur (2) Address1 (6) Address2 (6) Address3 (6) Seq (2)

0800 0000 FFFFFFFF 000C43101280 001122334455 0000

Wait for ACK

Debug Info h

Inc Random

6. Key in "0"

Repeat 0 Loopback IPG 200

Start TX Transmitted: 0

Conti. Tx Carrier test

Carrier Suppression

TX Power0 0B Calibrate

TX Power1 0A Calibrate

Freq. Offset 23 Calibrate

5. Select TX0

Both DACs

DAC 0

DAC 1

7. Start

RX

RX Error (Dropped)

FCS error: 0 / 0

RX overflow: 0 / 0

PHY error: 0 / 0

False CCA: 0 / 0

Frame Loss: 0%

RX Okay

U2M DATA: 0 / 0

Other DATA: 0 / 0

Beacon: 0 / 0

Others (Mgmt/Cntl): 0 / 0

FER: 0%

RSSI tune

RSSI1 = xx dBm Offset 00 Calibrate

RSSI2 = xx dBm Offset 00 Calibrate

RSSI0 = xx dBm Offset 00 Calibrate

Freq. Deviation: xxx KHz / xx ppm

All ADCs

One RX Path

SNR0: xx dB

SNR1: xx dB

Auto Responder Start RX Reset counter Dump DMA Load DMA

Dump Log Set Tx Env... Capture Mode



8. Measure the TX0 Output Power by test equipment and change the power offset value to meet to 14dBm for MCS7 and also check if EVM is under -28dBm when power meets 14dBm.

9. Store the calibrated value of channel 1 into EEPROM

TX_0 Power Calibration Procedure (Other channels)

PCI Config TX/RX EEPROM MAC BBP Page1/2 BBP Page2/2 RF Sniffer About

MAC Address 000C43101280 Set

Channel **2 2417-MHz** Mode HT MixMode Rate MCS=7; 65 Mbps Bandwidth 20 TxBandSel Lower

1. After channel is calibrated, then go to channel 2.

TX

Frame Type [20] User4(Data+CRC) Set TxD ☐ Auto ALC ☐ Enable Beacon ☐ STBC ☐ 2.4G Side Band Option ☐ SGI ☐ A-MPDU

TX frame setting

FC (2) Dur (2) Address1 (6) Address2 (6) Address3 (6) Seq (2)

0800 0000 FFFFFFFF 000C43101280 001122334455 0000 ☐ Wait for ACK

Payload Decoding Info In Progress

Repeat Pattern AA SW CRC Check ☐ SW CRC Total Bytes 1058

2. Press "stop" and then "start" to make changes effective.

3. Adjust power offset

Repeat 0 ☐ LoopBack IPG 200

Start TX Transmitted: 11471 ☐ Conti. Tx ☐ Carrier test ☐ Carrier Suppression

TX Power0 0B Calibrate

TX Power1 0A Calibrate

Freq. Offset 23 Calibrate

☒ Both DACs ☐ DAC 0 ☐ DAC 1

4. Store the calibrated value of channel 2 into EEPROM

RX

RX Error (Dropped)

FCS error: 0 / 0

RX overflow: 0 / 0

PHY error: 0 / 0

False CCA: 0 / 0

☐ Frame Loss: 0%

☐ Auto Responder

Start RX Reset counter Dump DMA Load DMA

RX Okay

U2M DATA: 0 / 0

Other DATA: 0 / 0

Beacon: 0 / 0

Others (Mgmt/Cntl): 0 / 0

FER: 0%

RSSI tune

RSSI1 = xx dBm Offset 00 Calibrate

RSSI2 = xx dBm Offset 00 Calibrate

RSSI0 = xx dBm Offset 00 Calibrate

Freq. Deviation: xxx KHz / xx ppm

☐ All ADCs ☐ One RX Path

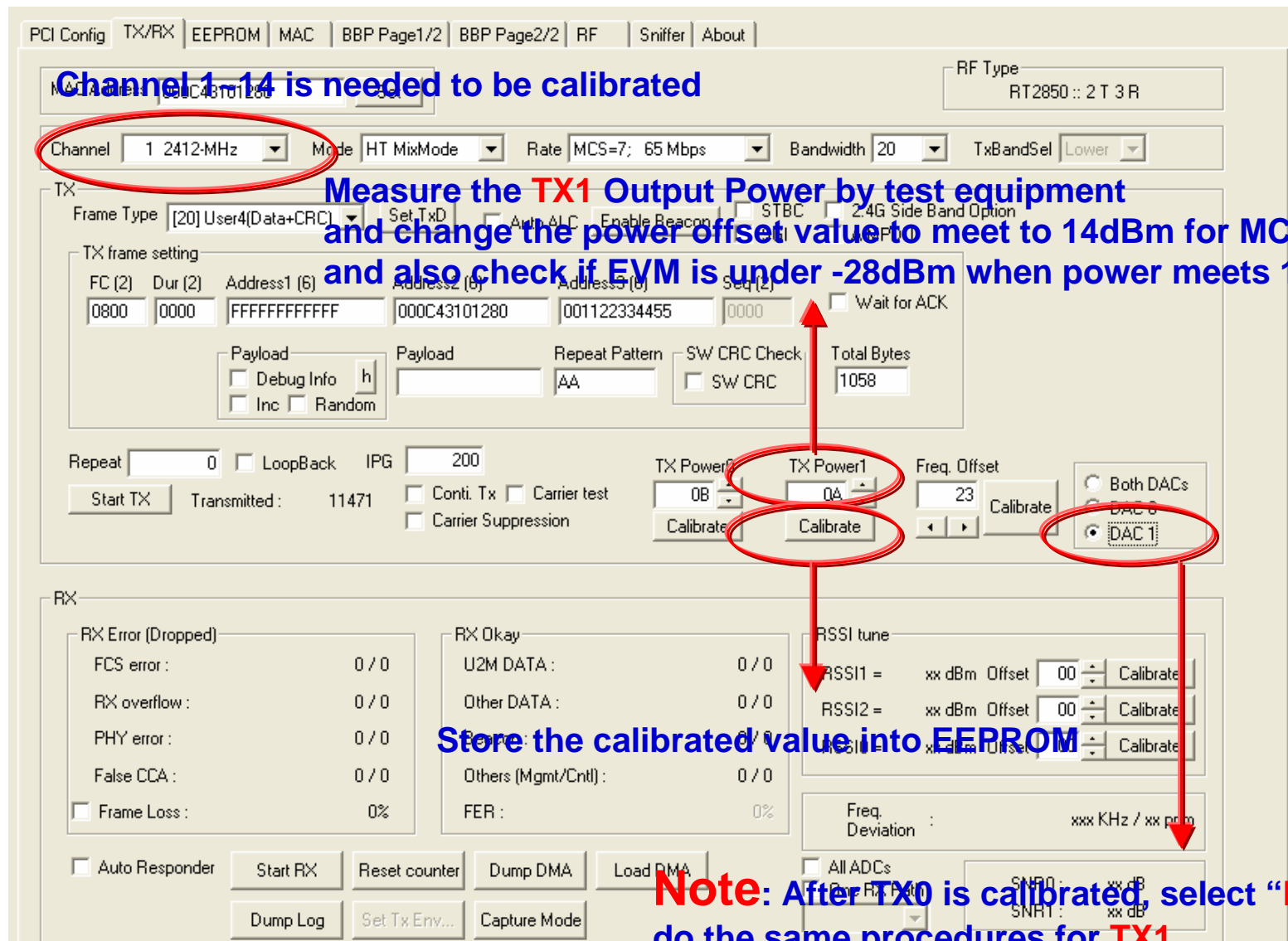
SNR0: xx dB

SNR1: xx dB

Dump Log Set Tx Env... Capture Mode

Note: After channel 2 is calibrated, channel 3~14 calibration are also needed to finish Tx0 power calibration.

TX_1 Power Calibration Procedure



Channel 1-14 is needed to be calibrated

Measure the TX1 Output Power by test equipment and change the power offset value to meet to 14dBm for MCS7 and also check if EVM is under -28dBm when power meets 14dBm.

Store the calibrated value into EEPROM

Note: After TX0 is calibrated, select "DAC1", do the same procedures for TX1.

Example: 2.4GHz Receive mode

PCI Config | TX/RX | EEPROM | MAC | BBP Page1/2 | BBP Page2/2 | RF | Sniffer | About

MAC Address: 000C43101280 [Set]

RF Type: RT2850 :: 2 T 3 R

Channel: 1 2412-MHz | Mode: HT MixMode | Rate: MCS=7; 65 Mbps | Bandwidth: 20 | Tx BandSel: Lower

1. 2412MHz **2. HT Mix mode** **3. BW=20**

TX frame setting

Frame Type: [20] User4(Data+CRC) | Set TXD | ☐ Auto ALC | ☐ Enable Beacon | ☐ STBC | ☐ SGI | ☐ 2.4G Side Band Option | ☐ A-MPDU

TX frame setting

FC (2): 0800 | Dur (2): 0000 | Address1 (6): FFFFFFFF | Address2 (6): 000C43101280 | Address3 (6): 001122334455 | Seq (2): 0000 | ☐ Wait for ACK

Payload: ☐ Debug Info | ☐ Inc | ☐ Random | Payload: | Repeat Pattern: AA | ☐ SW CRC Check | ☐ SW CRC

Repeat: 0 | ☐ LoopBack | IPG: 200 | TX Power0: 0B | TX Power1: 0A | Freq. Offset: 23 | Calibrate

Start TX | Transmitted: 0 | ☐ Conti. Tx | ☐ Carrier test | ☐ Carrier Suppression | Calibrate

Note: Do not care, modulation types will Be detected automatically

Fail packets received **Good packets received**

RX Error (Dropped)		RX Okay	
FCS error:	0 / 0	U2M DATA:	0 / 0
RX overflow:	0 / 0	Other DATA:	0 / 0
PHY error:	0 / 0	Beacon:	0 / 0
False CCA:	0 / 0	Others (Mgmt/Cntl):	0 / 0

RSSI tune

RSSI1 = xx dBm Offset 00 | Calibrate

RSSI2 = xx dBm Offset 00 | Calibrate

RSSI0 = xx dBm Offset 00 | Calibrate

4. Select RX0, RX1, or RX2 or all Rx paths you want

5. Start or Stop

☐ Frame Loss: 0% | FER: 0% | ☐ Auto Responder | ☐ Start RX | ☐ Reset counter | ☐ Dump DMA | ☐ Load DMA | ☐ Dump Log | ☐ Set Tx Env... | ☐ Capture Mode

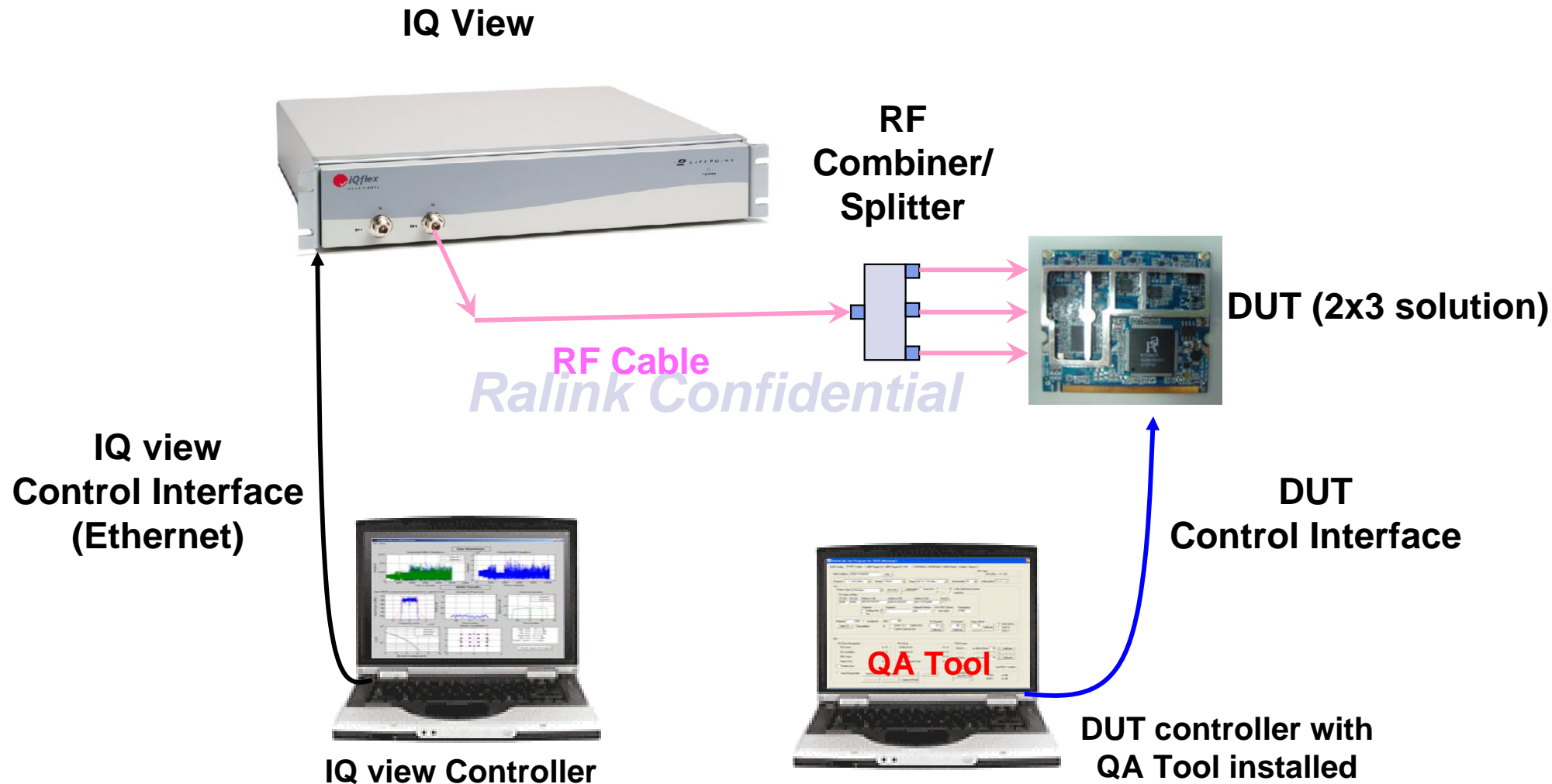
Note: Reset Rx test result if needed

All ADCs | ☐ One RX Path | SNR0: xx dB | SNR1: xx dB



Example: Rx mode Procedure

Setup for WiFi Tx testing (For MCS_0 to MCS_7)



- WiFi Tx & Rx Test Setup
- Key Testing Items of WiFi
- Key Functions of QA Tool
- EEPROM Structure Understanding

● Q & A

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Thank You

