ULTRA-LOW POWER 2.4GHZ WI-FI + BLUETOOTH SMART SOC

# **RF Testing Guide**



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# **REVISION HISTORY**

Date	Version	Contents Updated
2018-07-20	0.1	Initial Release
2018-07-27	0.2	Update section 2.3
2019-03-04	0.3	Add section 2.5



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### 1. 介紹

### 1.1. 文檔應用範圍

本文檔介紹了在 OPL1000 上測試 RF 流程和方法。

### 1.2. 縮略語

Abbr.	Explanation
BLE	低功率藍芽
WIFI	無限區域網路
RF	射頻
RSSI	訊號強度
VSA	訊號分析
VSG	訊號產生
DUT	待測物

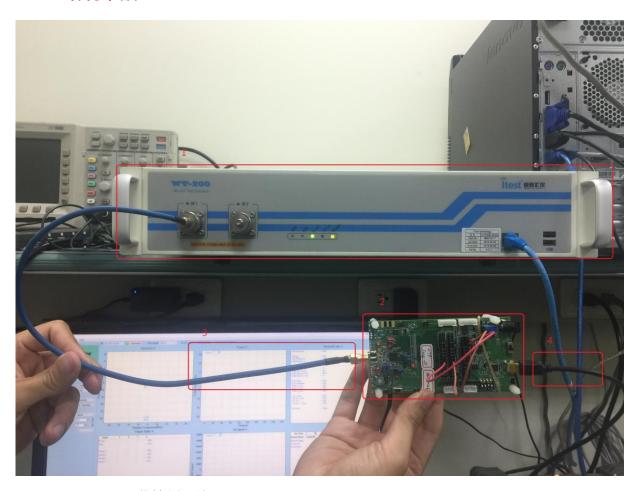
### 1.3. 參考文獻

[1] AT 命令和常式說明 OPL1000-AT-instruction-set-and-examples.pdf



### 2. OPL1000 測試 RF 方式

#### 2.1. 環境架設



1. WLAN Meter: 此範例是使用 WT-200

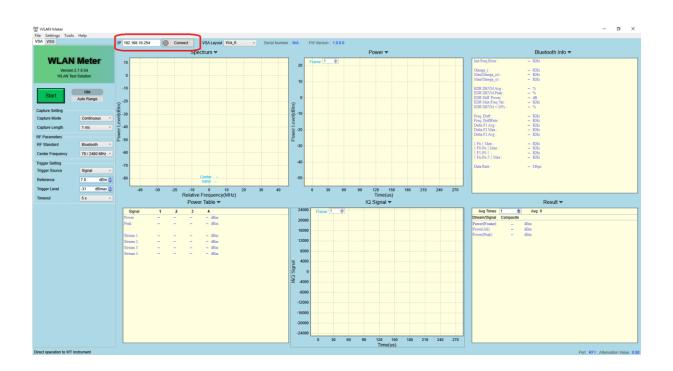
2. OPL1000 board: 被測試的 board

3. RF cable: 透過有線的方式, 連接 WLAN Meter 和 OPL1000 board

4. USB to UART cable: 用來連接電腦,進行 UART 命令的操作

連接 WLAN Meter: 開啟 WLAN Meter 之後,設定 IP,點擊 Connect



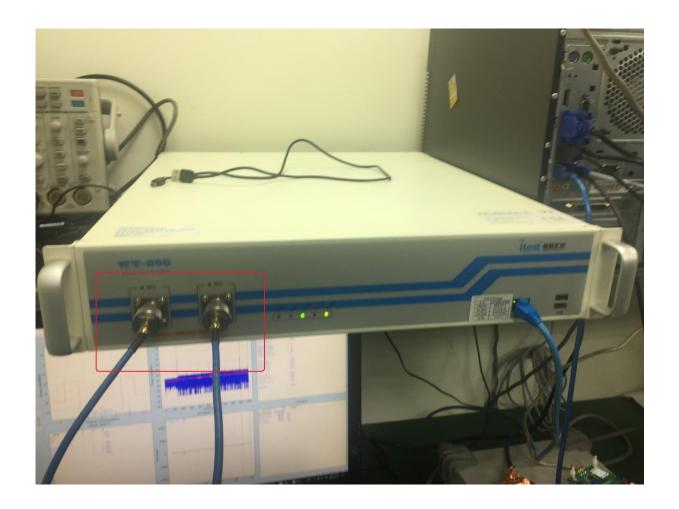


### 2.2. RF cable 衰減測試與補償

RF Cable 連接:請將 RF cable 連接至兩個 Port,如下圖所示



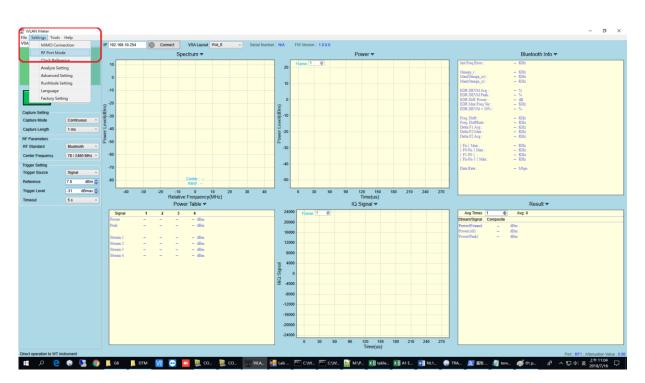
# **CHAPTER TWO**



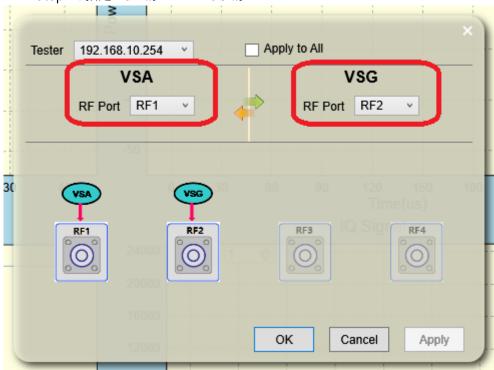
RF Port 設定:開啟 WLAN Meter 之後,進行 RF Port 設定

Step1:開啟設定頁面



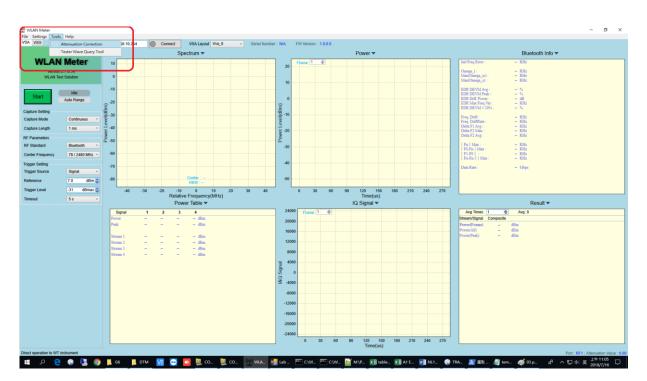


● Step 2: 指定 VSA 為 RF 1、VSG 為 RF 2

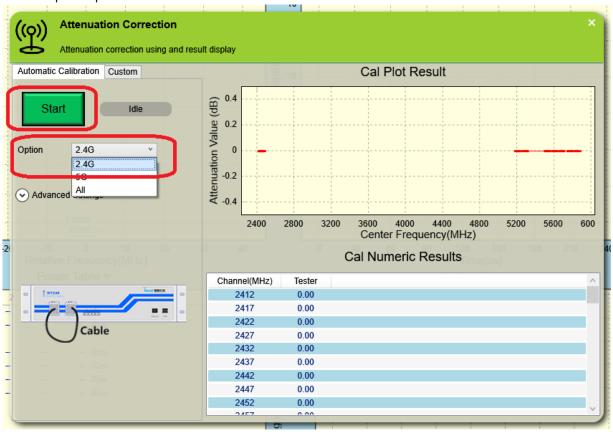


● Step 3: 開啟測試頁面





● Step 4: Option 選擇 2.4G, 然後按下 Start





● Step 5: 套用結果是 RF 1



### 2.3. WiFi 測試

#### 指令集:

● 初始化

at+mode= [ Mode ]		
Mode	3	

● 設定 Channel

at+channel= [ Channe	]
Channel	1 ~ 14



#### 設定 WiFi packet 格式

at+go=[ bLongPreamble ], [ Data Length ], [ Interval ], [ Data Rate ], [ Packet Count ]	
bLongPreamble	1 for LONG
	Others for SHORT
Data Length	n bytes
Interval	n us (Packet interval)
Data Rate	1, 2, 5.5, 11 Mbps
Packet Count	0 for infinite
	Others for given number

#### 啟動/關閉 WiFi Tx 測試

at+tx=[ bEnable ]	
	1 for enable
bEnable	0 for disable

#### 啟動/關閉 WiFi Rx 測試

at+rx=[ bEnable ]	
h Cashla	1 for enable
bEnable	0 for disable

#### 清除 WiFi Rx 統計量

at+reset_cnts	

#### 讀取 WiFi Rx 統計量

at+counters?	



#### 測試項目:

1. 初始化

#### at+mode=3

```
COM14:115200baud - Tera Term VT — X

Eile Edit Setup Control Window KanjiCode Help

> at+mode=3

Mode is RF

OK
```

2. 設定與開始 WiFi Tx 測試

```
at+channel=7
```

at+go=1,30,40,1,0

at+tx=1

```
>at+channel=7

99, 7

OK

>at+go=1,30,40,1,0

Preamble type: LONG
Data length: 30 bytes
Interval: 40 us
Data rate: 1 Mbps
Tx Counts: 0

OK

>at+tx=1

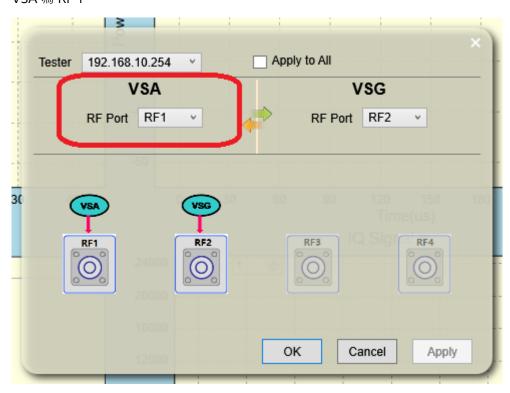
OK
```

#### WLAN Meter 設定

● 設定 RF port



#### VSA 為 RF 1



#### ● 設定相關參數

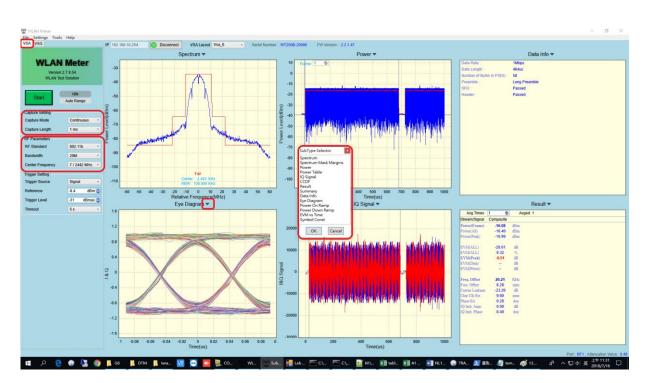
#### 選取 VSA 頁面

設定 Capture Settings: Continuous mode、Length 為 1ms

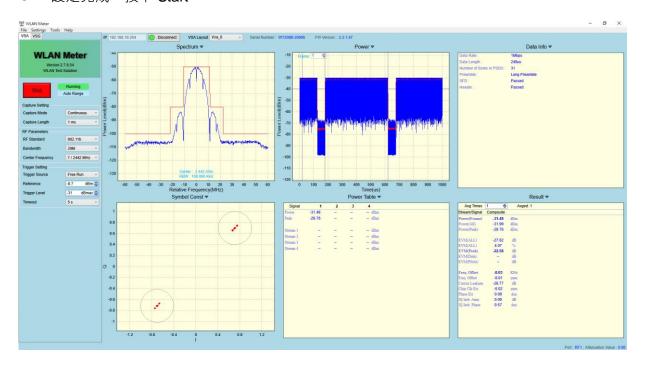
設定 RF parameters: 802.11b、20M、Center Frequency 為7

選擇要觀察圖形: Spectrum、Power、Symbol Const、Eye Diagram





● 設定完成,按下 Start



#### 3. 結束 WiFi Tx 測試

at+tx=0



>at+tx=0 OK

4. 開始 WiFi RX 測試

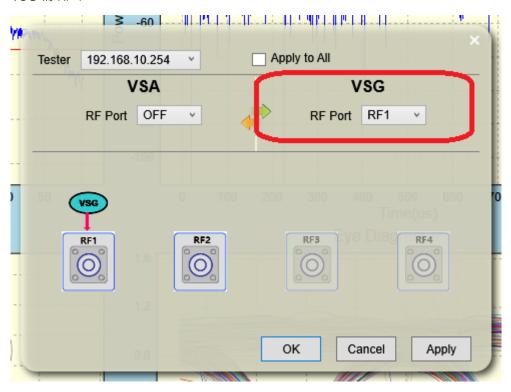
at+rx=1



#### WLAN Meter 設定

● 設定 RF port

VSG 為 RF 1



● 設定相關參數



選取 VSG 頁面

設定 RF standard: 802.11b

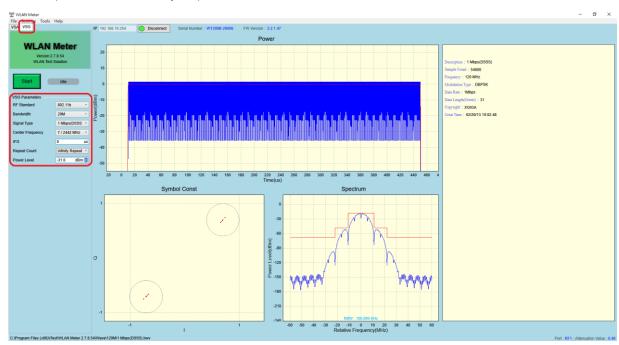
設定 Bandwidth: 20M

設定 Signal Type: 1 Mbps(DSSS)

設定 Center Frequency: 7 / 2442 MHz

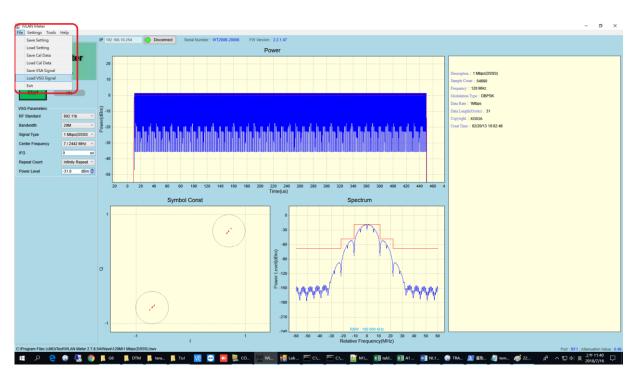
設定 IFG: 40 us

設定 Repeat Count: Infinity Repeat

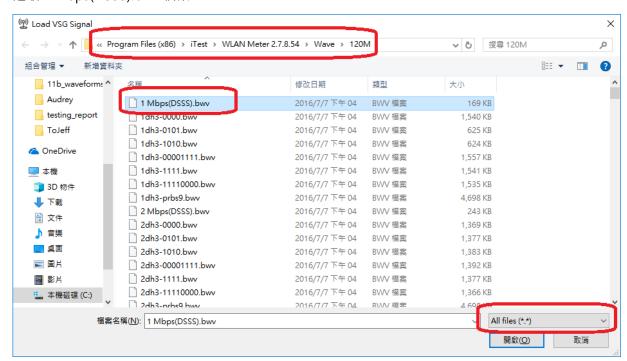


● 載入 VSG Signal



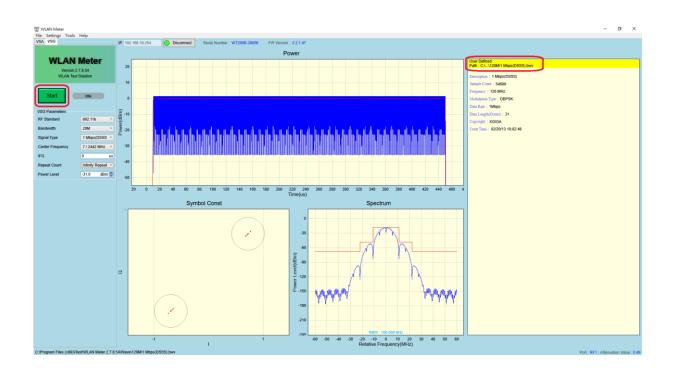


選取 1 Mbps(DSSS).bwv 檔案



● 確認載入結果,並按下 Start





#### 5. 清除 WiFi Rx 統計量

#### at+reset\_cnts

```
>
>at+reset_cnts
OK
```

#### 6. 讀取 WiFi Rx 統計量

#### at+counters?

```
>at+counters?
ok: 70558, err: 3836, rssi: −38
OK
```

ok:期間收到 CRC 正確封包數

err:期間收到的 CRC 錯誤封包數

rssi: RSSI值(訊號強度)

#### 7. 結束 WiFi Rx 測試



at+rx=0

>at+rx=0 ov

Note: TX 跟 RX 不能同時測試. 需要結束後才能進行另一個功能.

### 2.4. BLE 測試

#### 指令集:

● 設定與開始 BLE Tx 測試

at+dtm= tx [ Channel ] [ Data Length ] [ Packet Type ]	
Channel	0 ~ 39
Data Length	n bytes
	0:PRBS9
	1 : Pattern 11110000
D 1 1 T	2 : Pattern 10101010
Packet Type	3:PRBS15
	4 : Pattern 11111111
	5 : Pattern 00000000

#### ● 設定與開始 BLE Rx 測試

at+dtm= rx [ Channel ]		
Channel	0 ~ 39	

#### ● 結束 BLE 測試

at+dtm= end	



#### 測試項目:

1. 設定與開始 BLE Tx 測試

at+dtm=tx,20,30,2

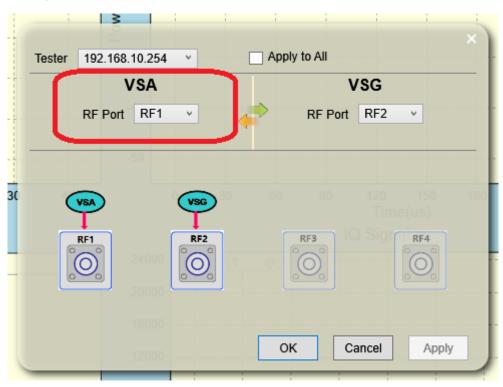
```
>at+dtm=tx,20,30,2
Start DTM Tx
frequency: 20, length: 30, type: 2
OK
```

Note: Channel = 20,相當於 2442 MHz

#### WLAN Meter 設定

● 設定 RF port

VSA 為 RF 1



● 設定相關參數

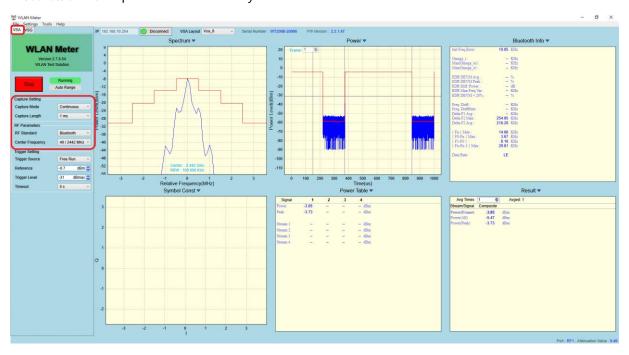


#### 選取 VSA 頁面

設定 Capture Settings: Continuous mode、Length 為 1ms

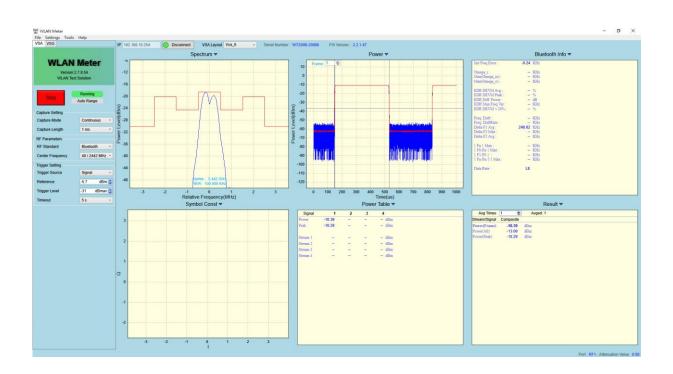
設定 RF parameters: Bluetooth、Center Frequency 為 40 / 2442 MHz

選擇要觀察圖形: Spectrum、Power、Symbol Const、Power Table



● 設定完成,按下 Start





#### 2. 結束 BLE Tx 測試

#### at+dtm=end

```
>at+dtm=end

RX CNT: 0

CRC OK: 0

CRC FAIL: 0

packet count: 0

OK
```

#### 3. 設定與開始 BLE Rx 測試

#### at+dtm=rx,20



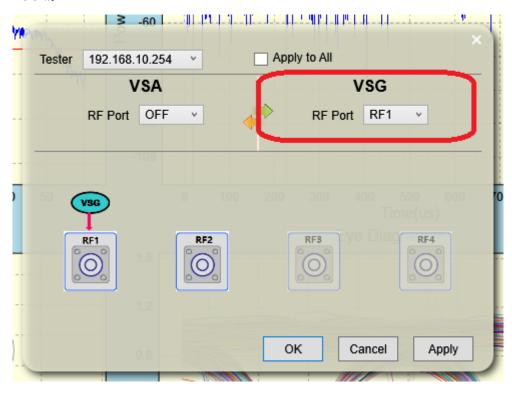


Note: Channel = 20,相當於 2442 MHz

#### WLAN Meter 設定

● 設定 RF port

VSG 為 RF 1



● 設定相關參數

選取 VSG 頁面

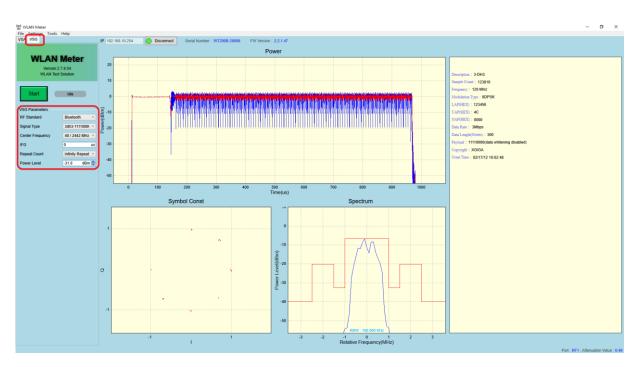
設定 RF standard: Bluetooth

設定 Center Frequency: 40 / 2442 MHz

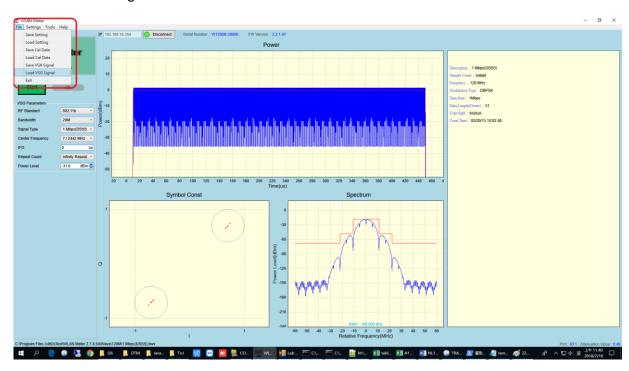
設定 IFG: 40 us

設定 Repeat Count: Infinity Repeat



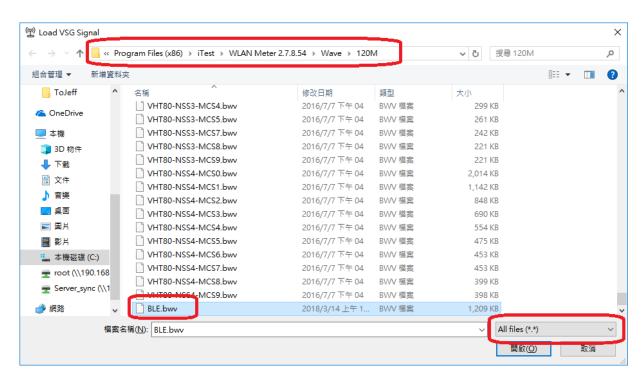


### ● 載入 VSG Signal



選取 BLE.bwv 檔案





● 確認載入結果,並按下 Start



#### 4. 結束 BLE Rx 測試

at+dtm=end



# **CHAPTER TWO**

 >at+dtm=end

 RX CNT: 28613

 CRC OK: 28613

 CRC FAIL: 0

 packet count: 28613

 OK

RX CNT: 收到總封包數

CRC OK: 期間收到 CRC 正確封包數

CRC FAIL:期間收到的 CRC 錯誤封包數

RSSI: RSSI值(訊號強度)



### 2.5. 其他注意事項

```
1. 假如要測試其他 Channel, 其 DUT 命令如下:
   例如:
   a. WiFi CH1, 5.5Mbps 測試 Tx power,
   at+channel=1
   at+go=1,30,40,5.5,0
   at+tx=1
   b. WiFi <mark>CH13, 11</mark>Mbps 測試 Tx power
   at+channel=13
   at+go=1,30,40,11,0
   at+tx=1
   c. WiFi CH1 測試 Rx PER
   at+channel=1
   at+rx=1
   at+reset_cnts
   at+counters?
   d. WiFi CH13 測試 Rx PER
   at+channel=13
   at+rx=1
   at+reset cnts
   at+counters?
   e. BLE CHO 測試 Tx power, payload=PRBS9
   at+dtm=tx,0,30,0
   at+dtm=end
   f. BLE CH39 測試 Tx power, payload=0xFF
   at+dtm=tx,39,30,4
```



at+dtm=end

# **CHAPTER TWO**

g. BLE CHO 測試 Rx PER at+dtm=rx, 0 at+dtm=end

h. BLE CH39 測試 Rx PER at+dtm=rx,39 at+dtm=end



# **CONTACT**

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