OPL1000

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

RF Testing Guide

OPULINKS

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

TABLE OF CONTENTS

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

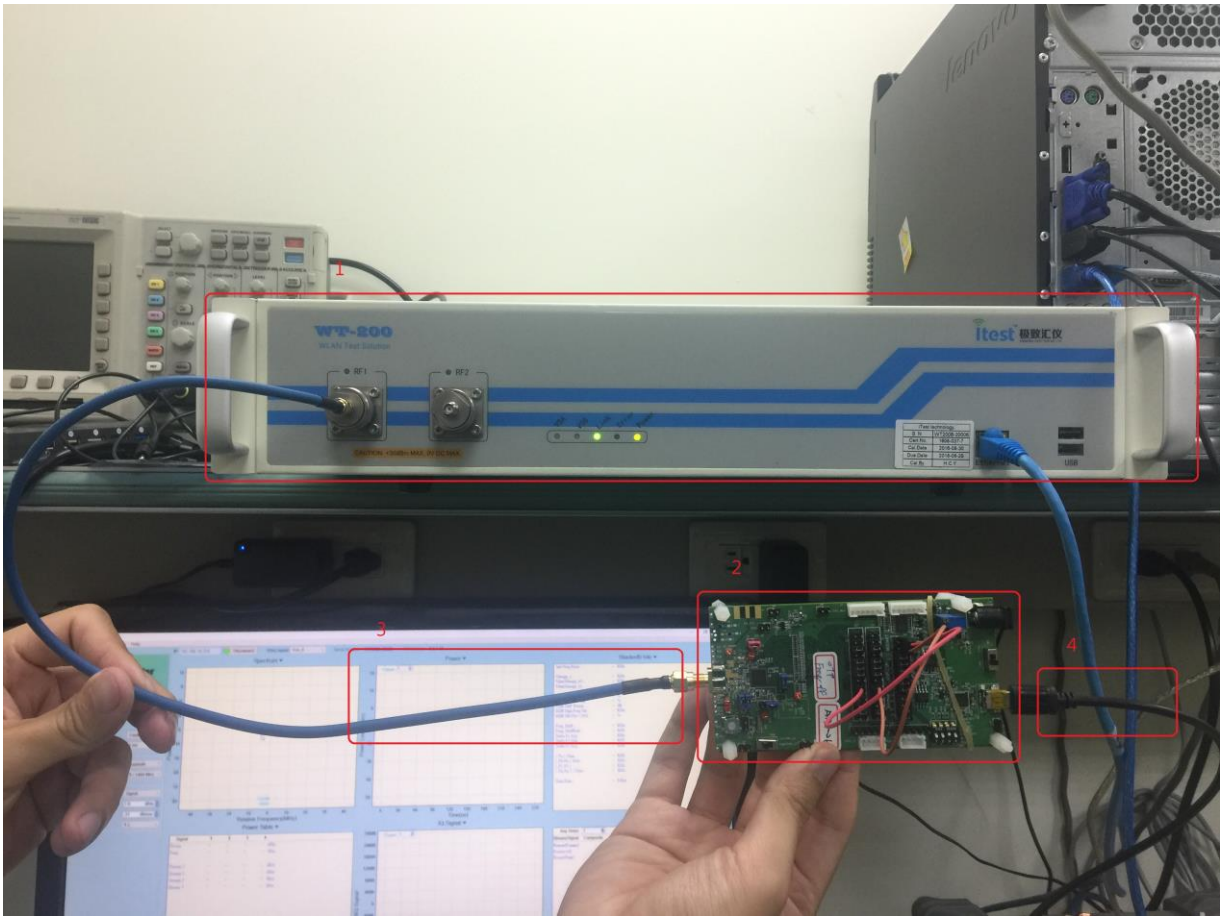
Abbr.	Explanation
BLE	低功率藍芽
WIFI	無限區域網路
RF	射頻
RSSI	訊號強度
VSA	訊號分析
VSG	訊號產生
DUT	待測物

1.3. 參考文獻

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

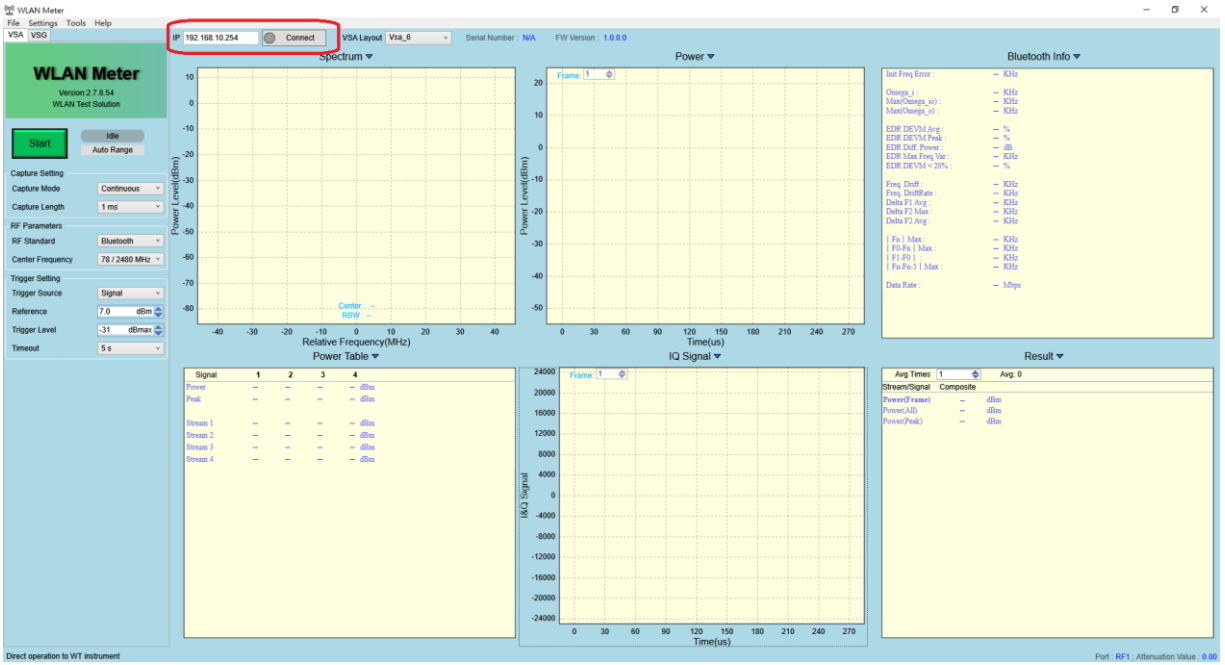
2. OPL1000 測試 RF 方式

2.1. 環境架設



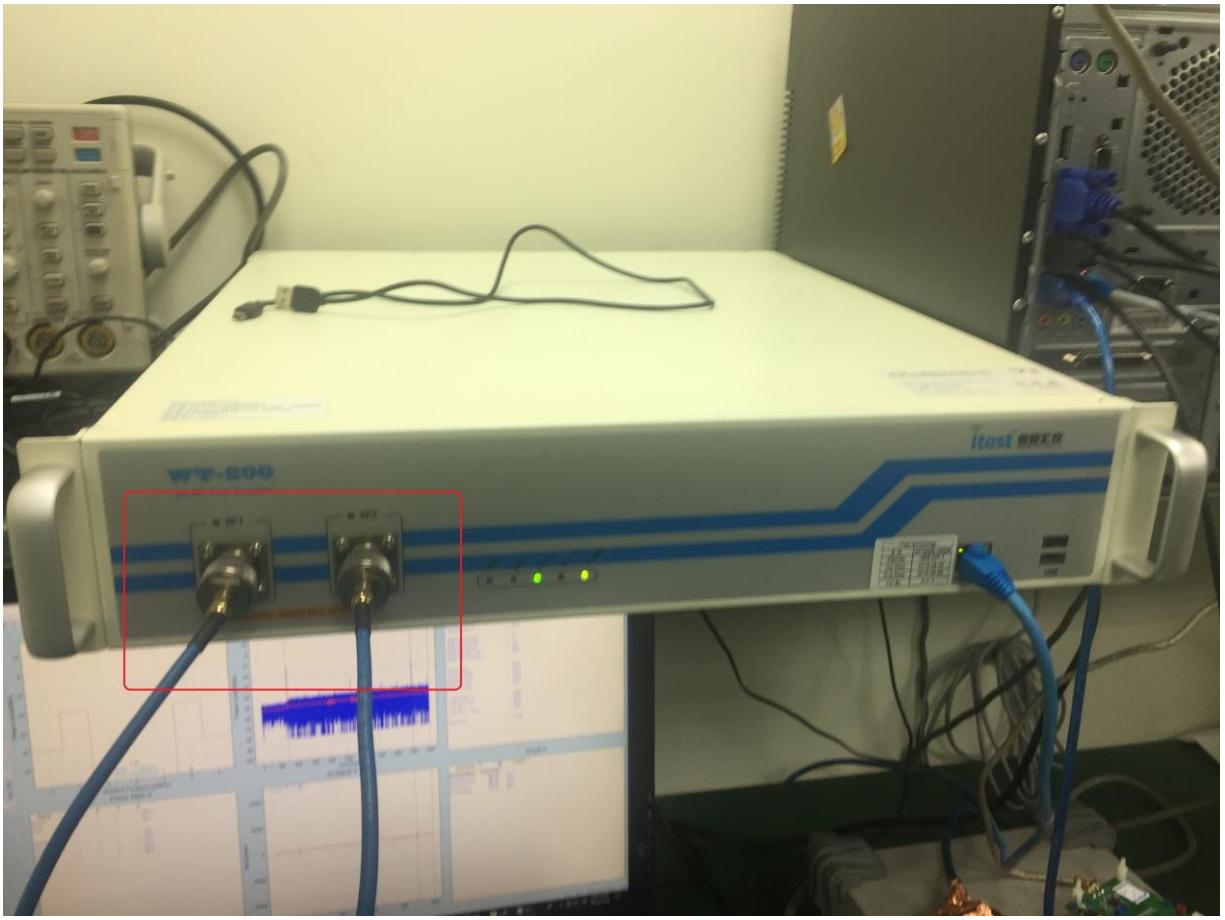
1. WLAN Meter : 此範例是使用 WT-200
2. OPL1000 board : 被測試的 board
3. RF cable : 透過有線的方式，連接 WLAN Meter 和 OPL1000 board
4. USB to UART cable : 用來連接電腦，進行 UART 命令的操作

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



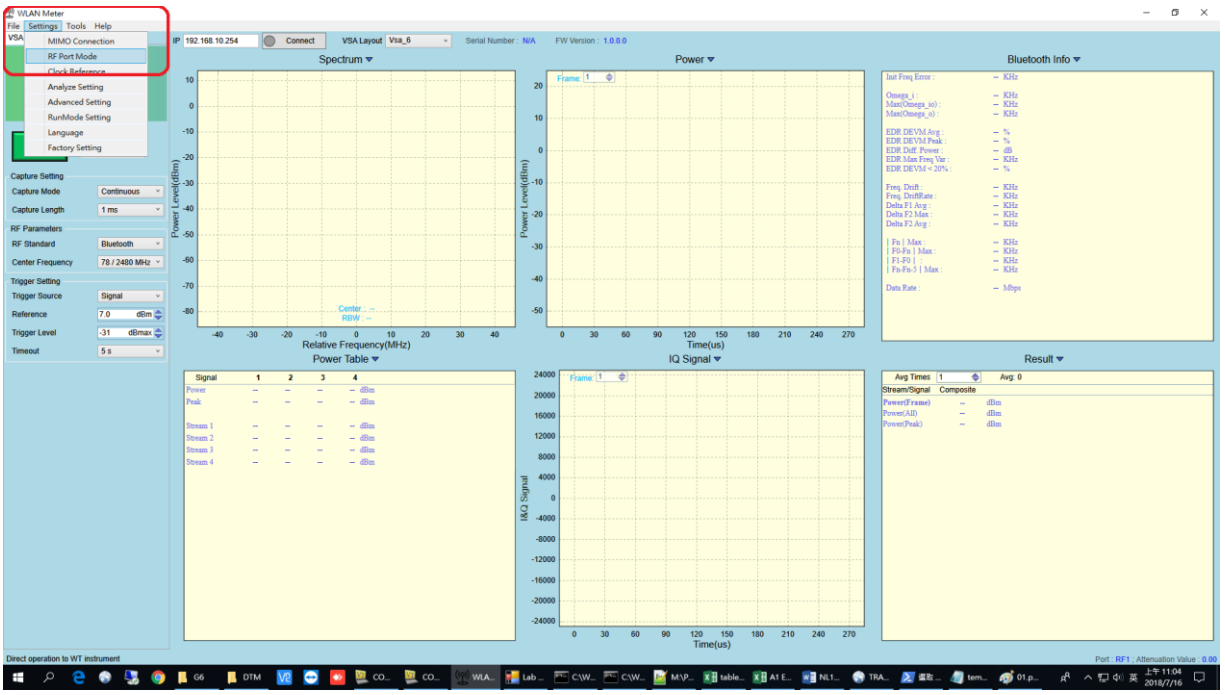
2.2. RF cable 衰減測試與補償

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

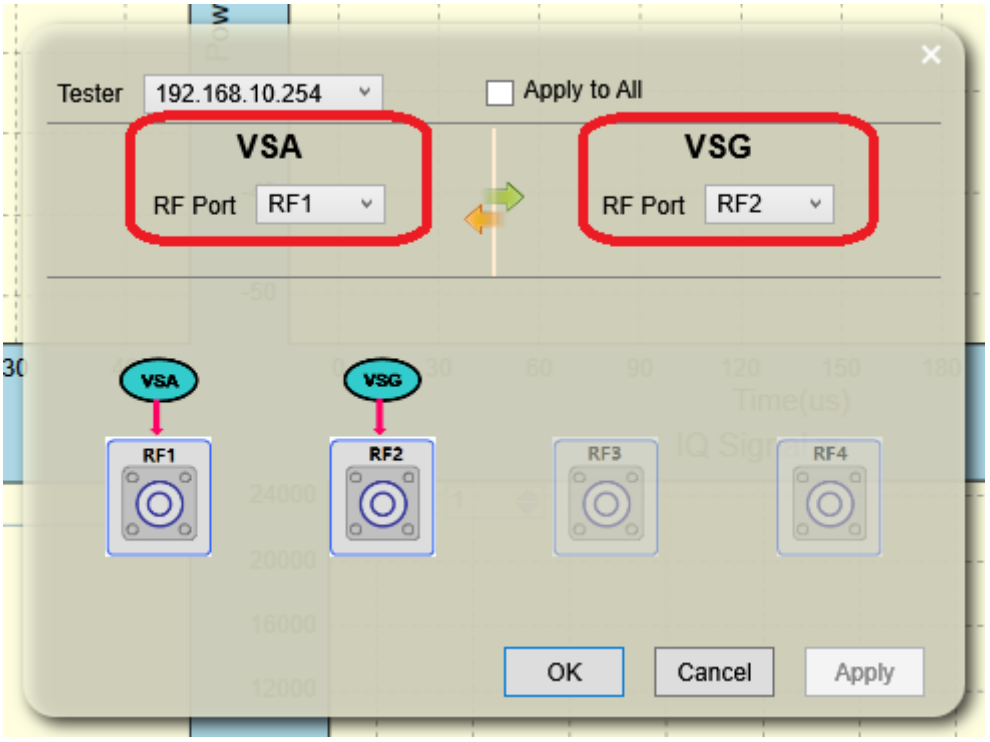


RF Port 設定：開啟 WLAN Meter 之後，進行 RF Port 設定

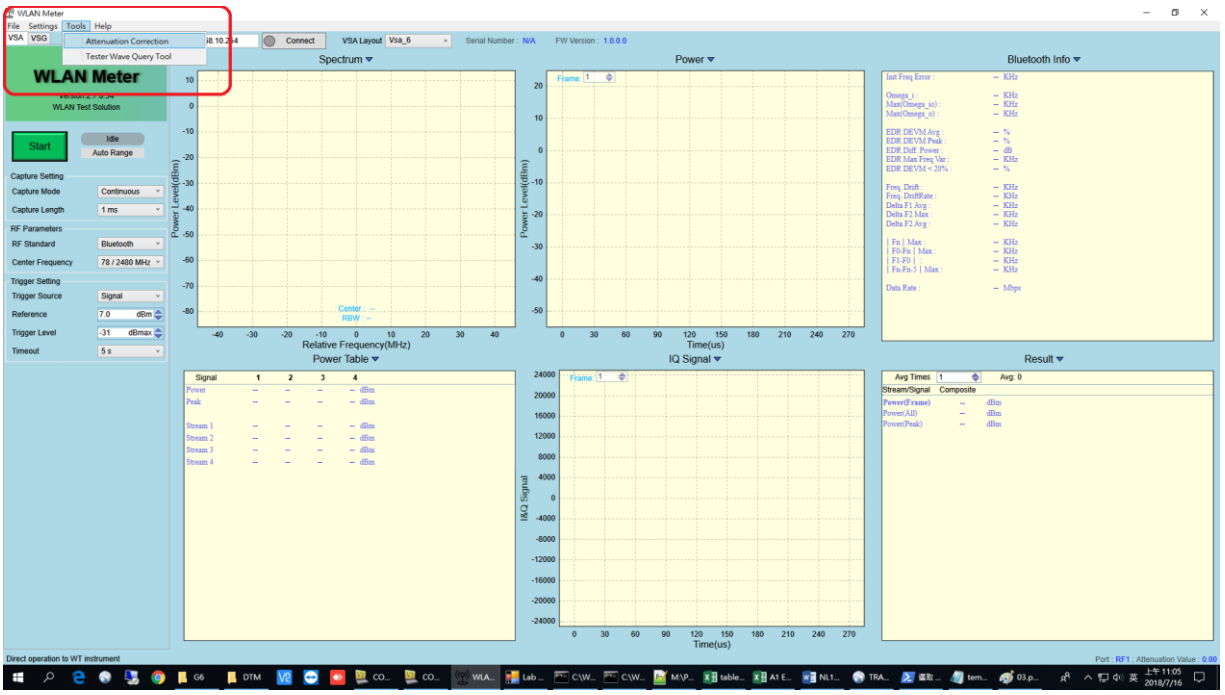
- Step1 : 開啟設定頁面



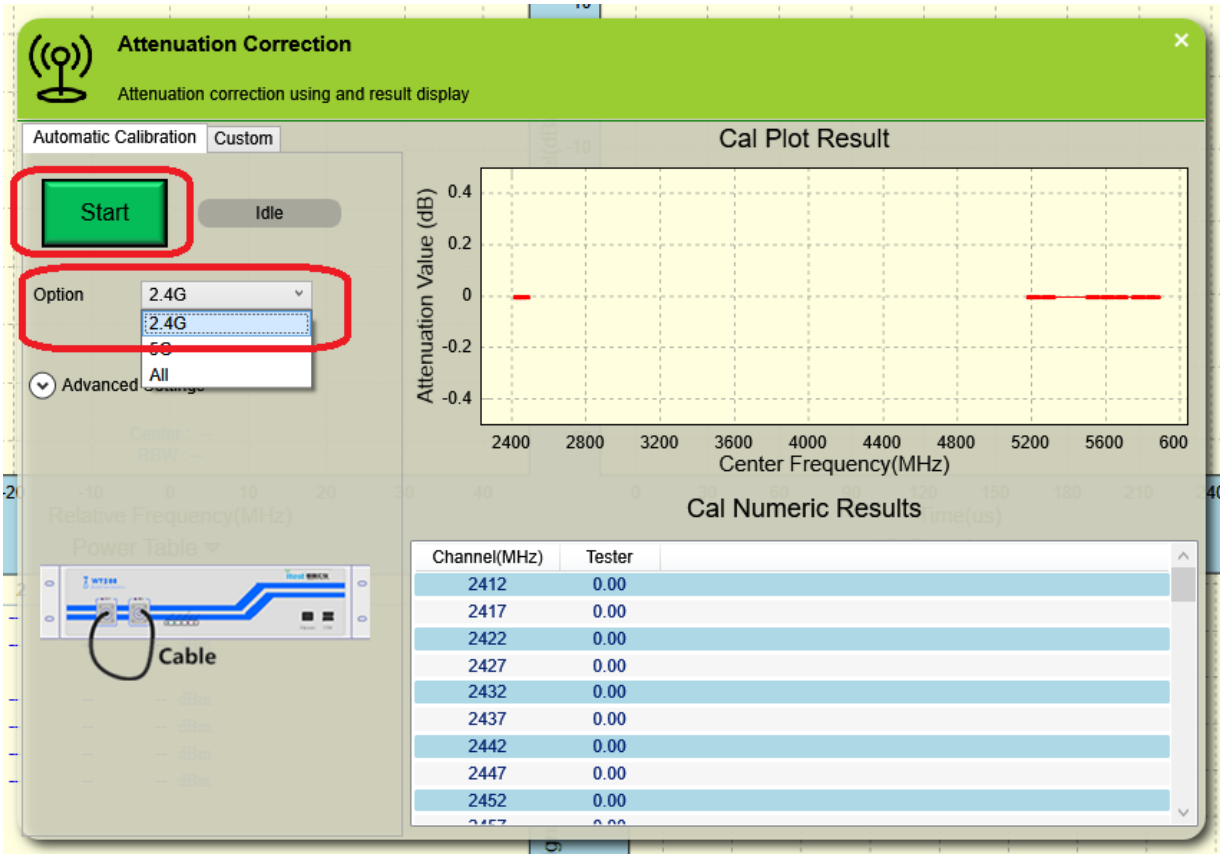
- Step 2 : 指定 VSA 為 RF 1、VSG 為 RF 2



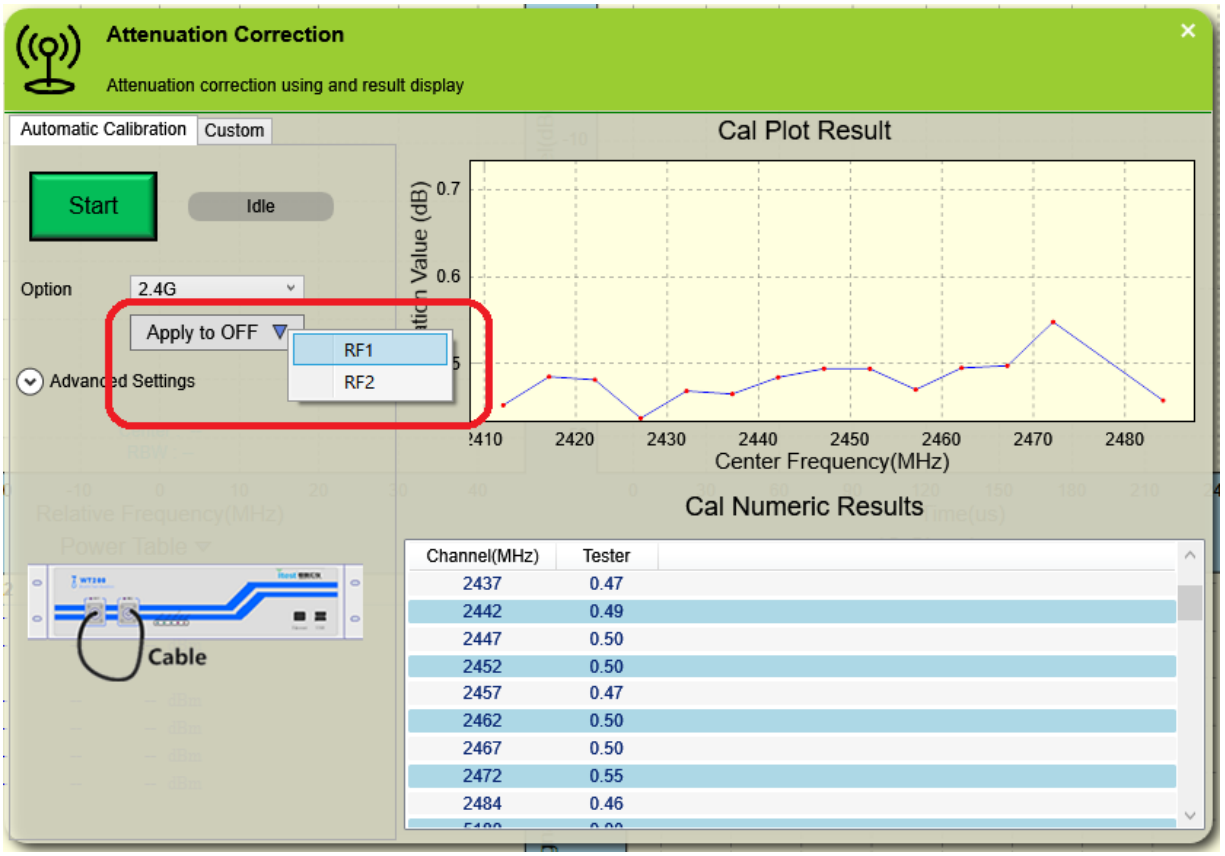
- Step 3 : 開啟測試頁面



- 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= [Channel]	
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]	
bEnable	1 for enable 0 for disable

- 啟動/關閉 WiFi Rx 測試

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

- 清除 WiFi Rx 統計量

at+reset_cnts	

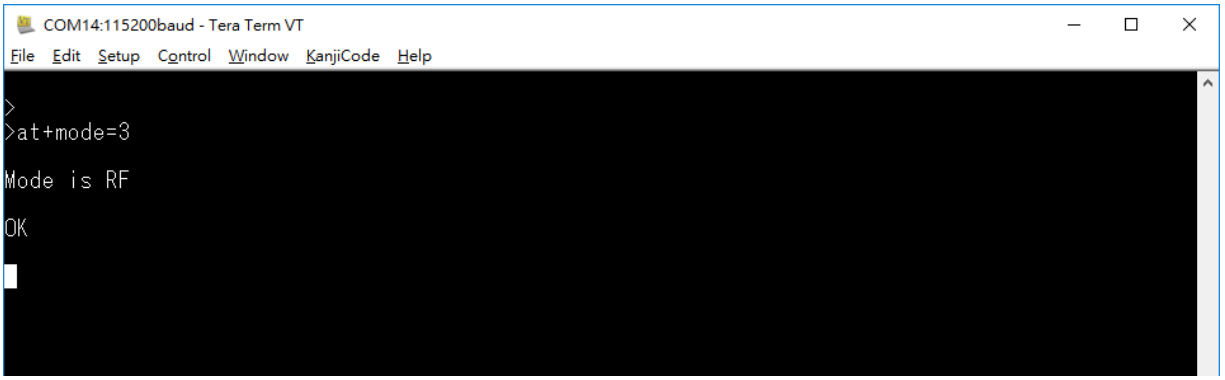
- 讀取 WiFi Rx 統計量

at+counters?	

測試項目:

1. 初始化

at+mode=3



2. 設定與開始 WiFi Tx 測試

at+channel=7

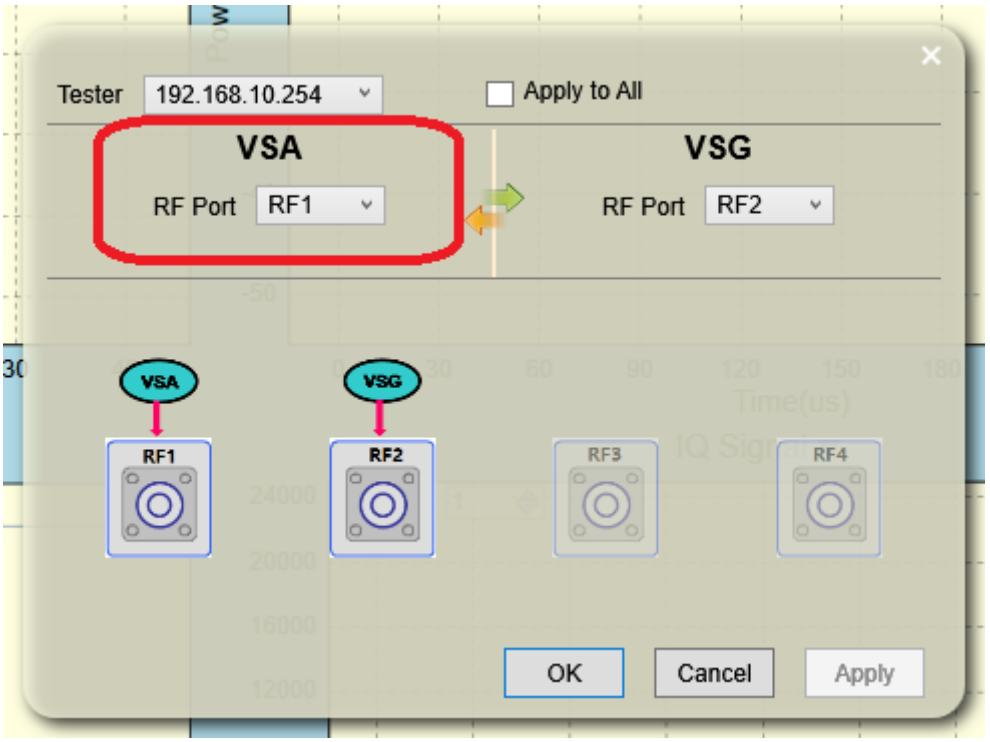
at+go=1,30,40,1,0

at+tx=1

WLAN Meter 設定

- 設定 RF port

VSA 為 RF 1



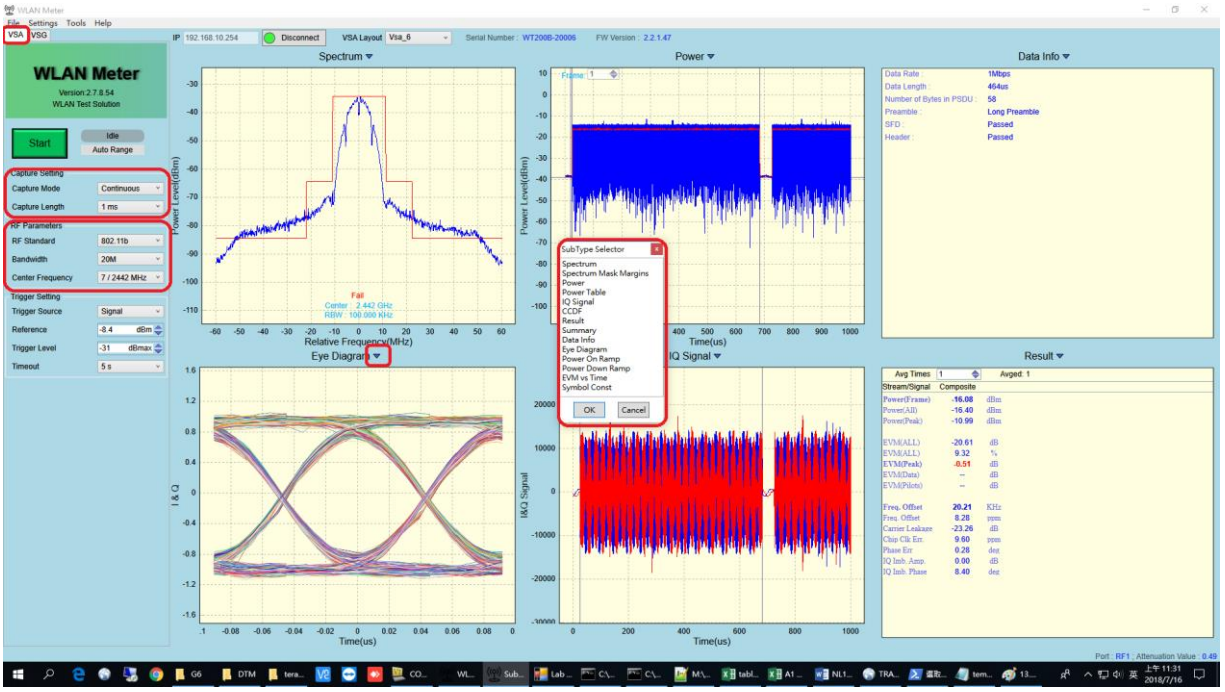
- 設定相關參數

選取 VSA 頁面

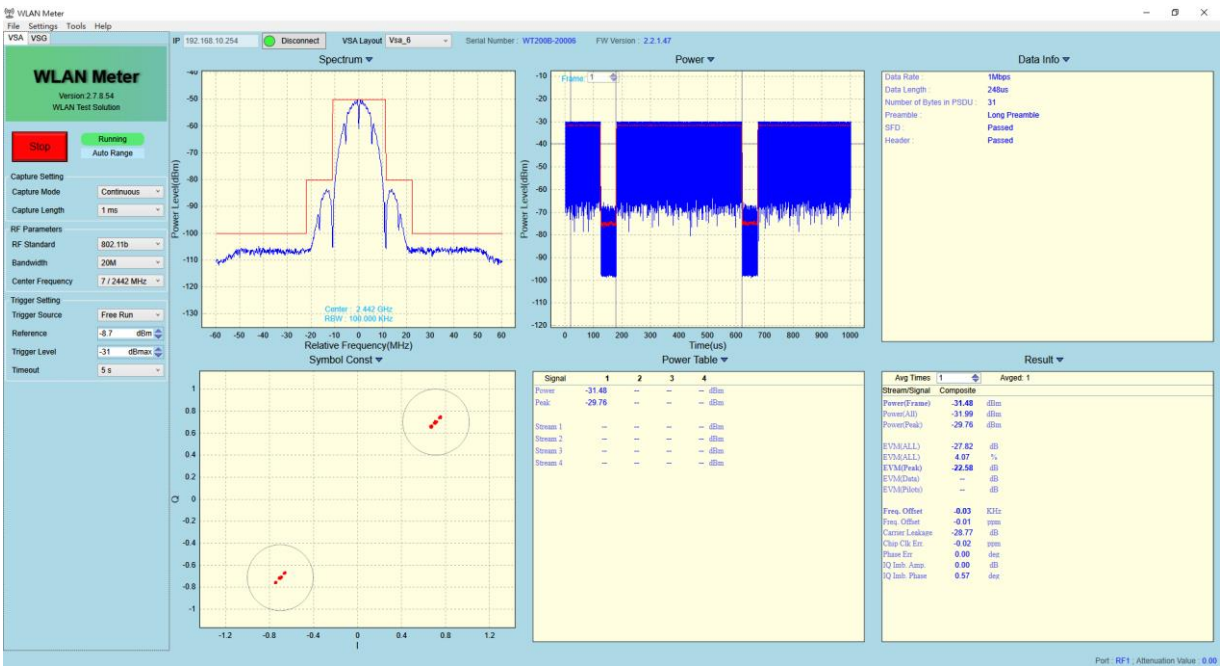
設定 Capture Settings : Continuous mode、Length 為 1ms

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

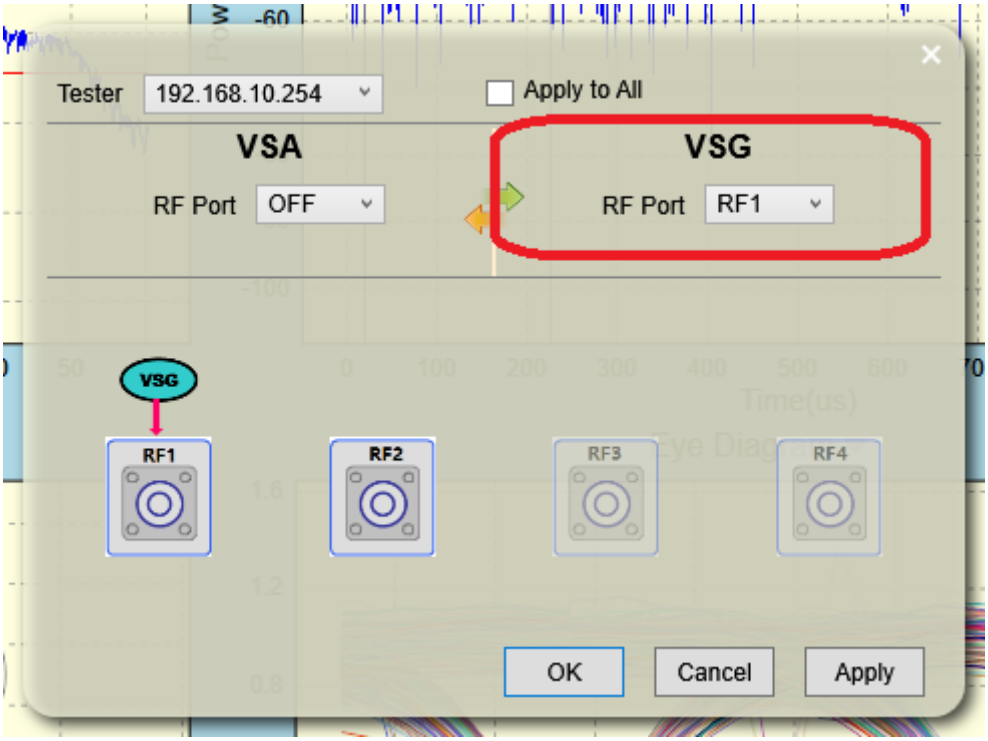
at+rx=1

```
>at+rx=1
OK
```

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

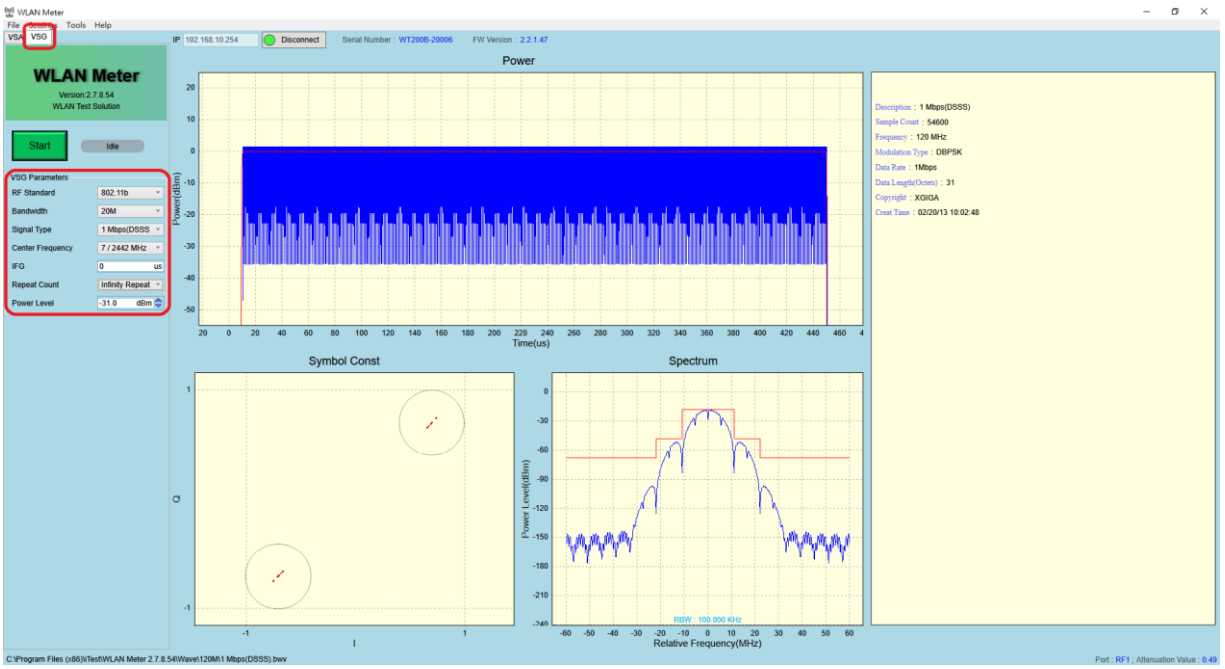
設定 Bandwidth : 20M

設定 Signal Type : 1 Mbps(DSSS)

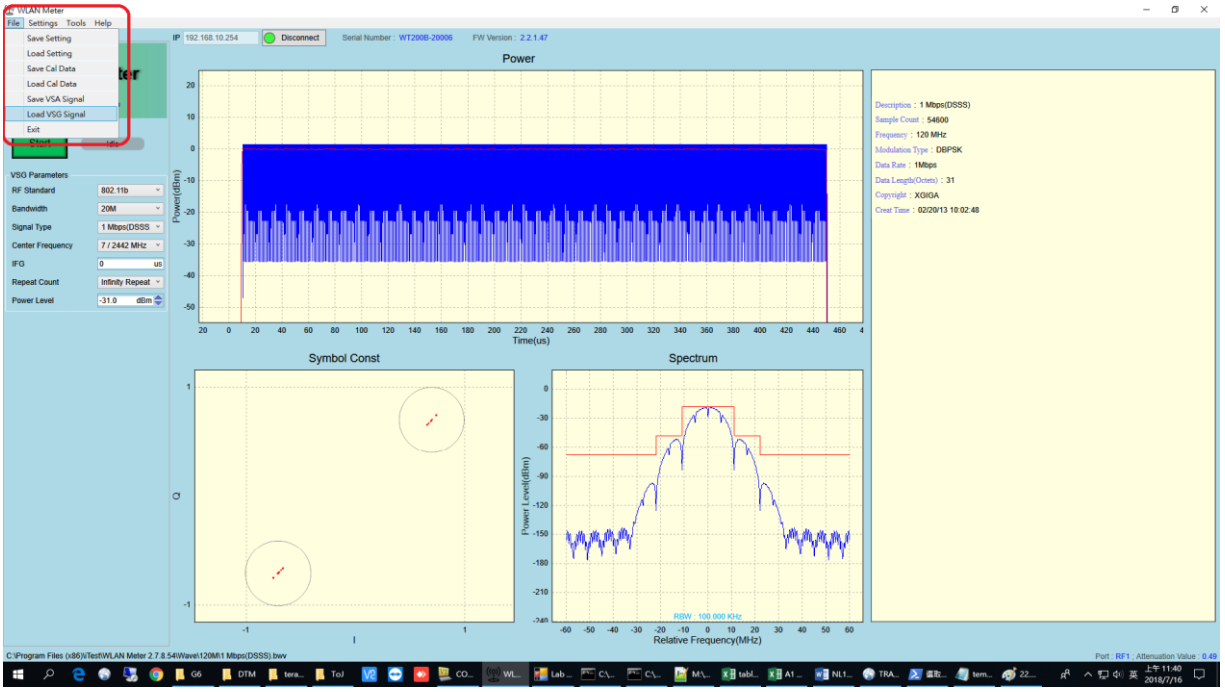
設定 Center Frequency : 7 / 2442 MHz

設定 IFG : 40 us

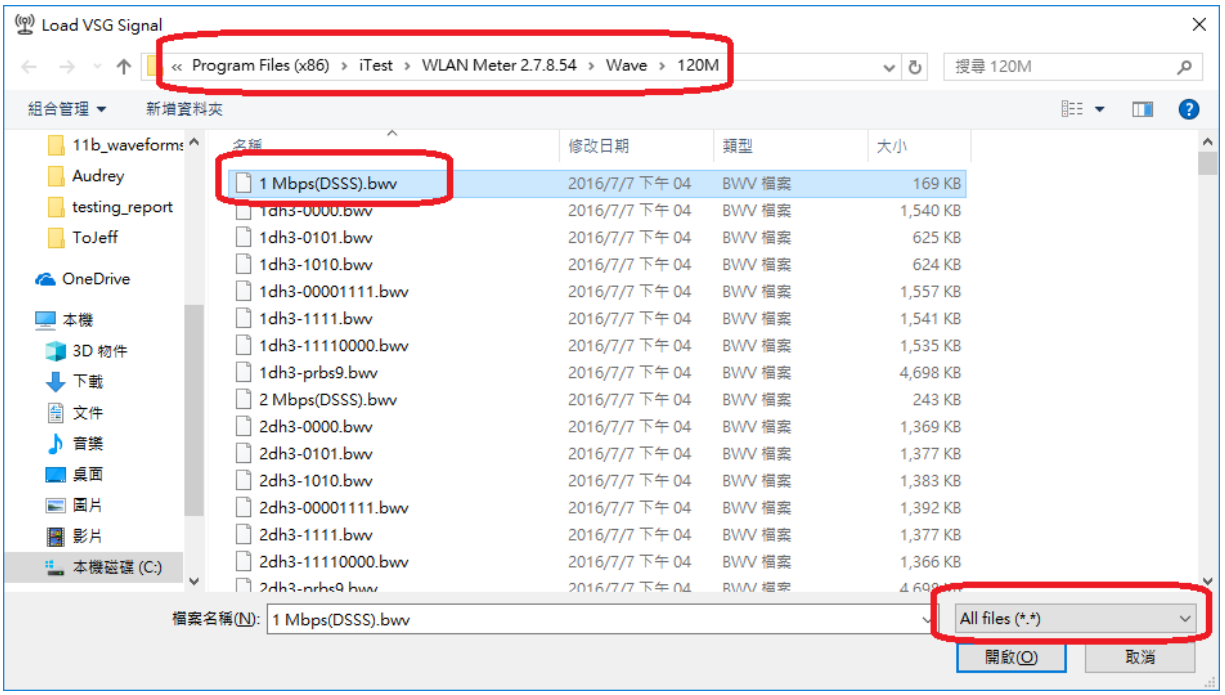
設定 Repeat Count : Infinity Repeat



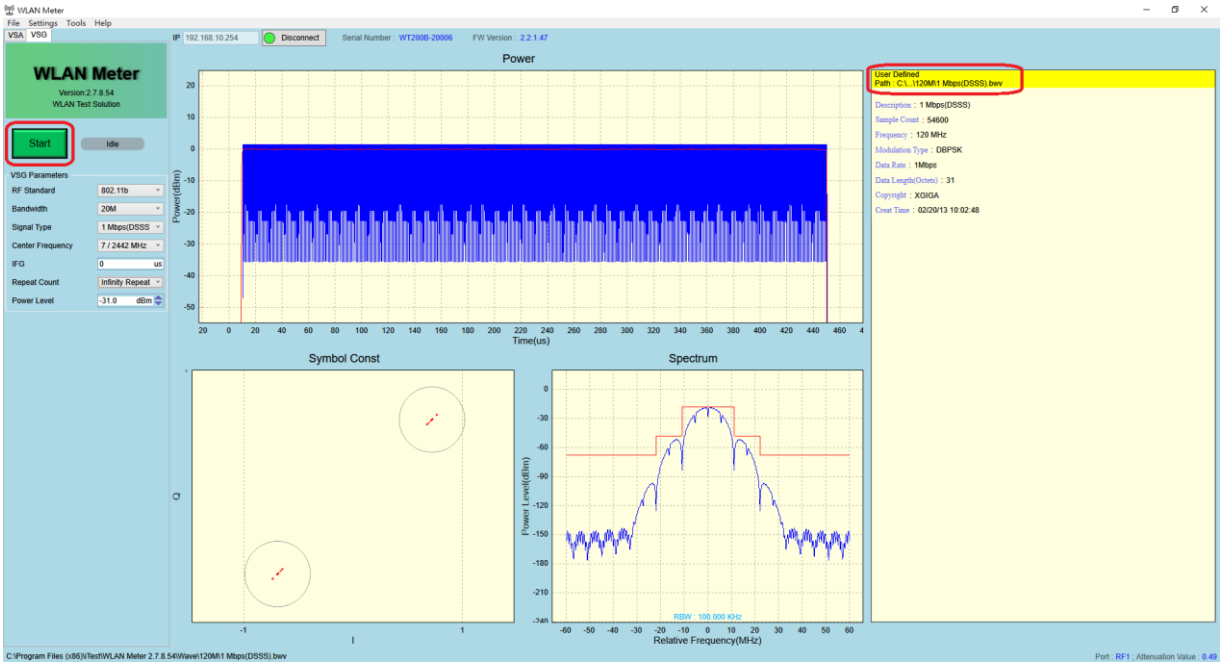
- 載入 VSG Signal



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
OK
```

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
Packet Type	0 : PRBS9 1 : Pattern 11110000 2 : Pattern 10101010 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

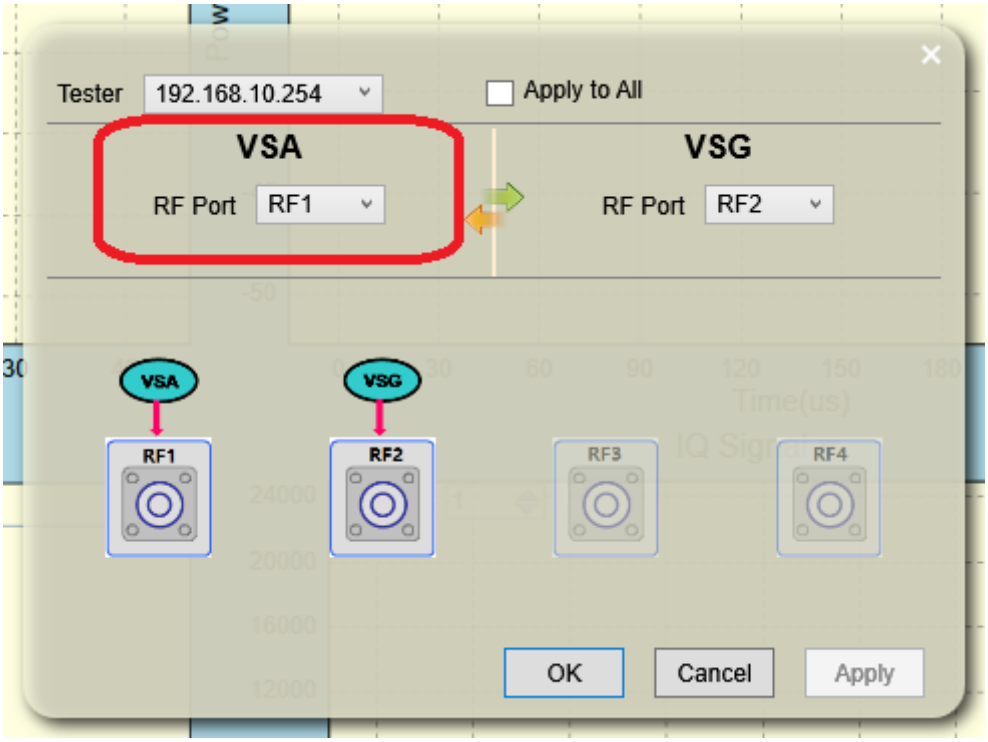
```
>at+dtm=tx,20,30,2
Start DTM Tx
frequency: 20, length: 30, type: 2
OK
```

Note : Channel = 20，相當於 2442 MHz

WLAN Meter 設定

- 設定 RF port

VSA 為 RF 1



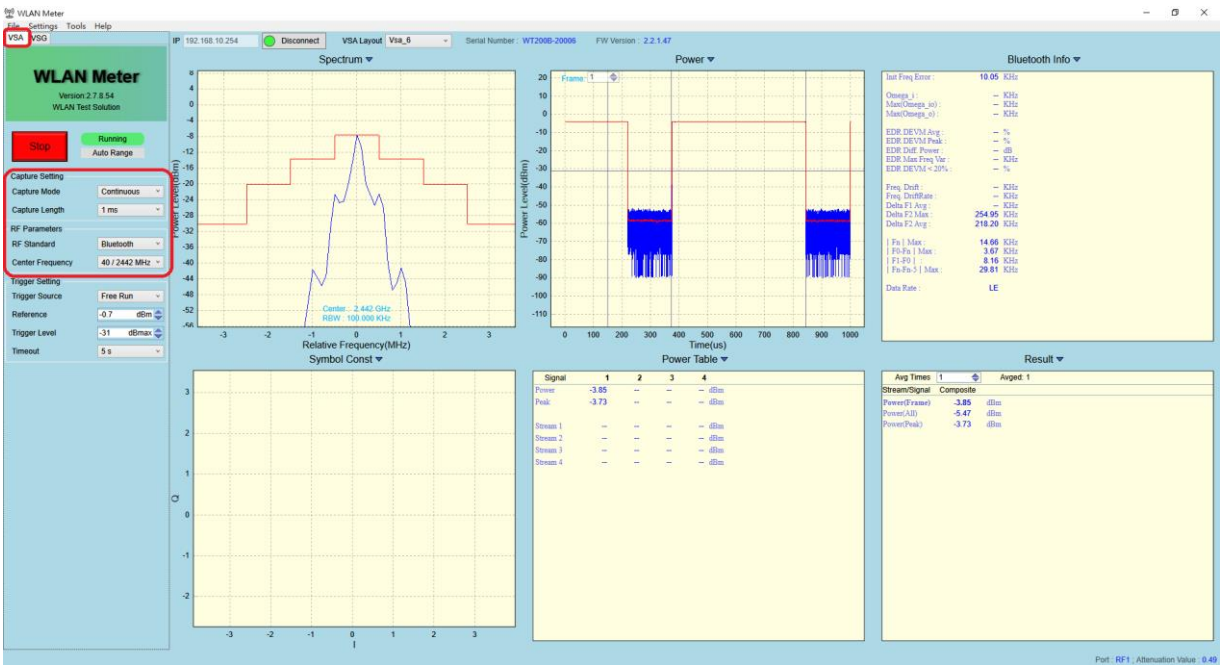
- 設定相關參數

選取 VSA 頁面

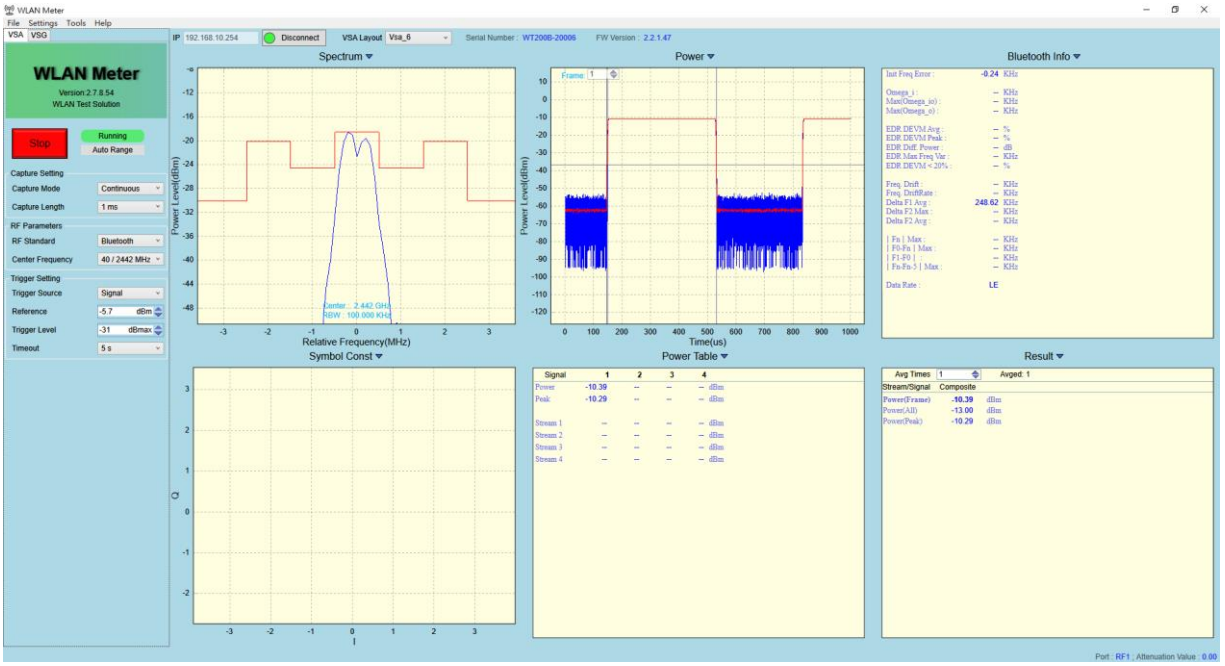
設定 Capture Settings : Continuous mode、Length 為 1ms

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

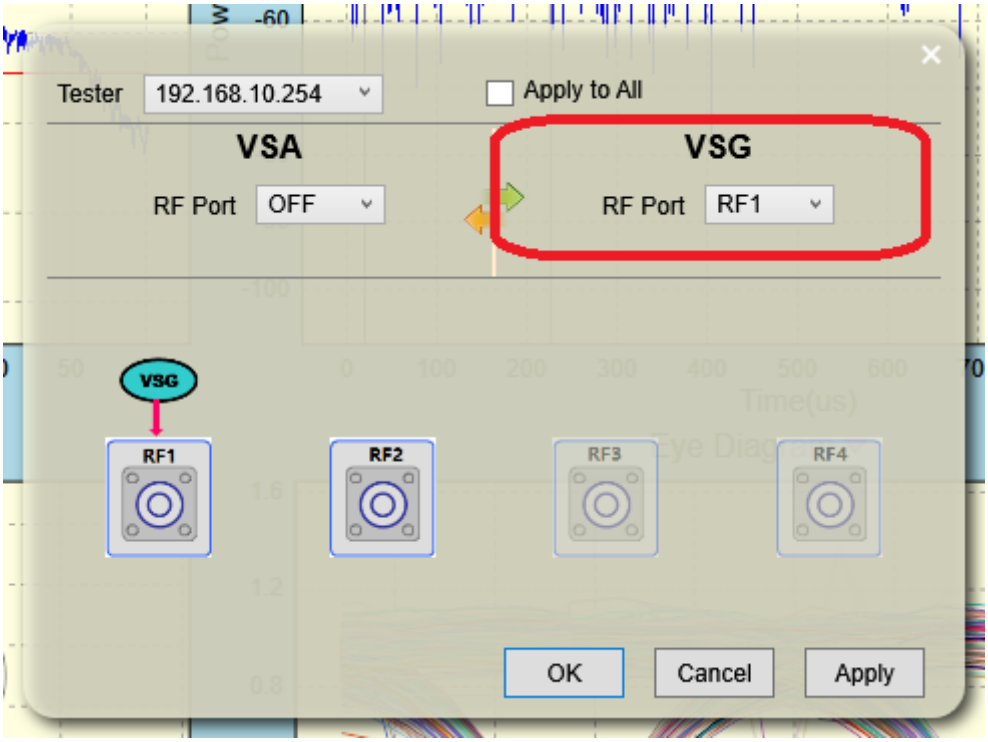
```
>
>at+dtm=rx,20
Start DTM Rx
frequency: 20
OK
```

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

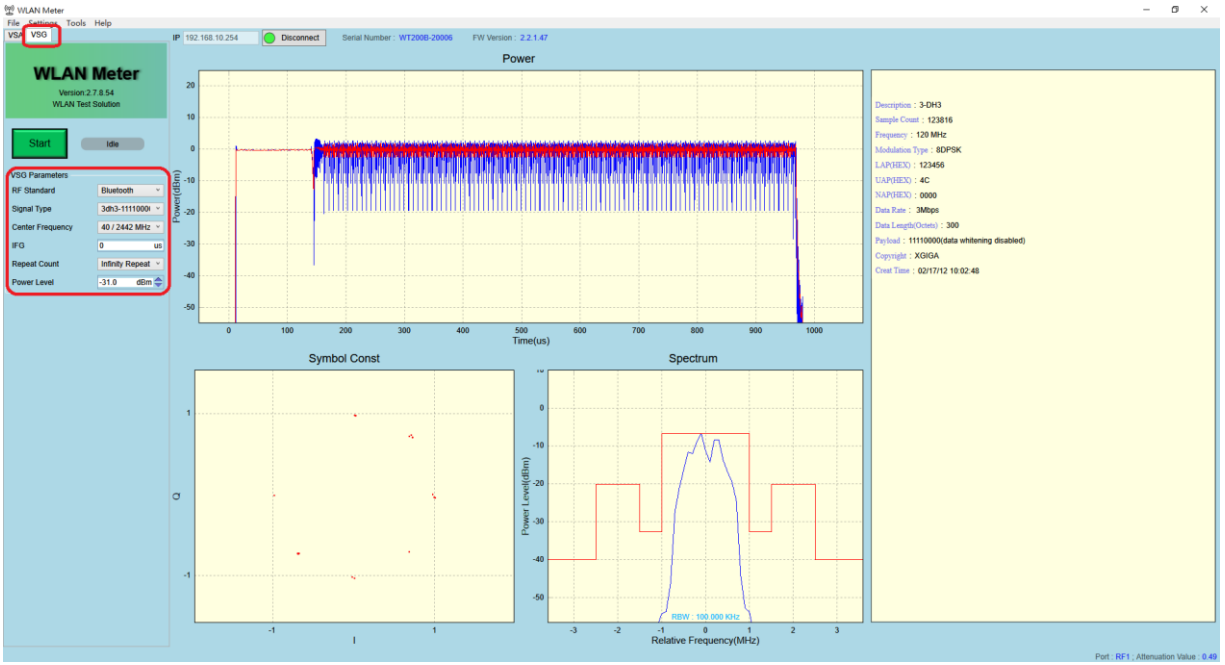
選取 VSG 頁面

設定 RF standard : Bluetooth

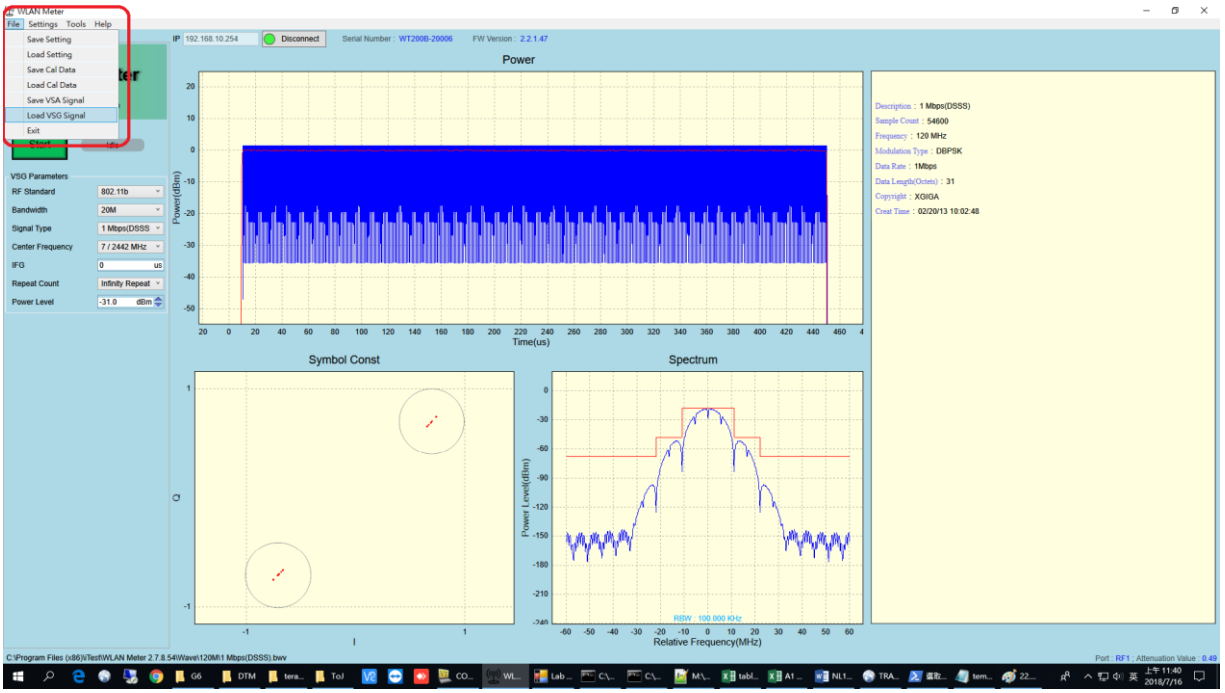
設定 Center Frequency : 40 / 2442 MHz

設定 IFG : 40 us

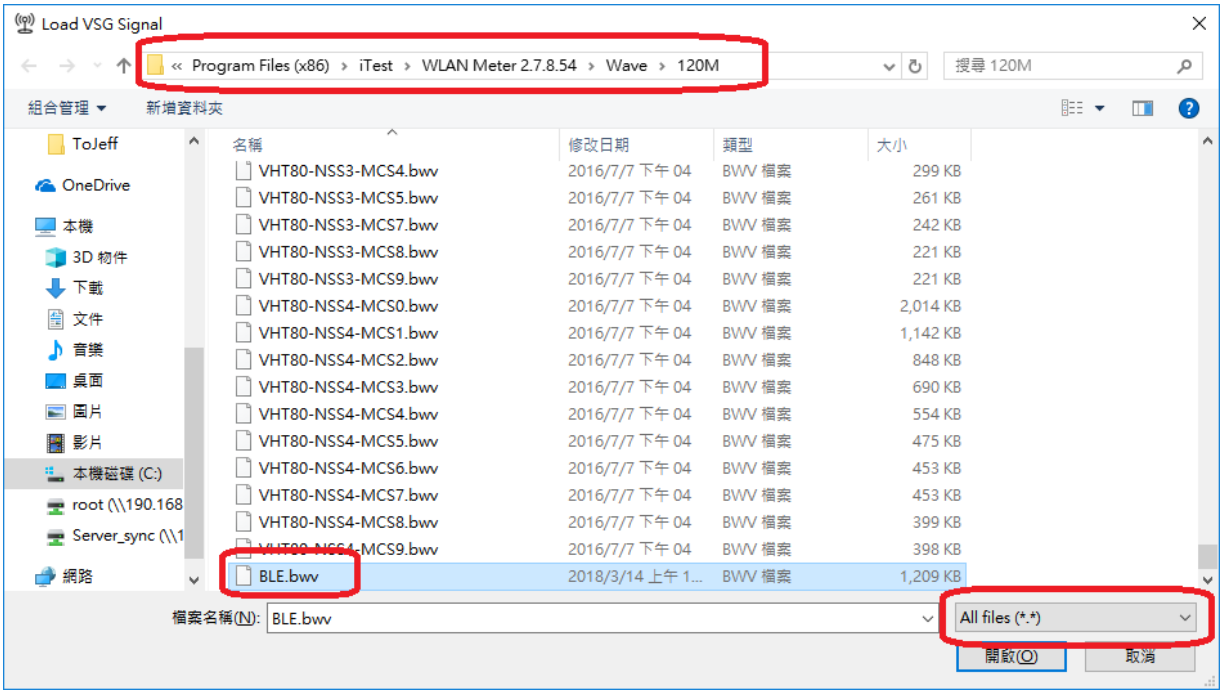
設定 Repeat Count : Infinity Repeat



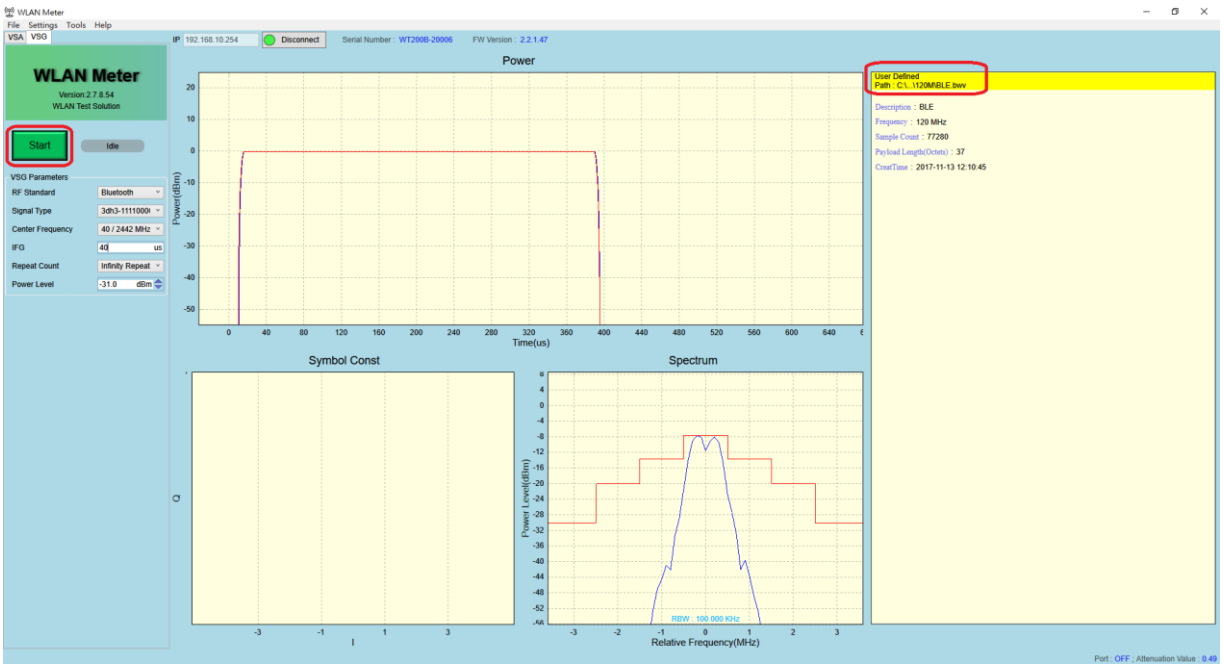
- 載入 VSG Signal



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

```
>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 CH13, 11Mbps 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 CH0 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

g. BLE CH0 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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