OPL2500

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

OPL1000 系列升级 OPL2500

功耗對比应用说明文档

OPULINKS

http://www.opulinks.com/ Copyright © 2017-2023 Opulinks. All Rights Reserved.

版本纪录

日期	版本	更新内容
2023-1-18	1.0	● 初版

Copyright © 2017-2023, Opulinks. All Rights Reserved.

TABLE OF CONTENTS

内容

1. **介绍** 1
   1.1. 文档应用范围 1
   1.2. 缩略语 1
2. **量测环境** 2
   2.1. OPL2500 2
   2.2. OPL1600 3
   2.3. 安装 APP 4
      2.3.1. Android 4
      2.3.2. iOS 6
   2.4. 测试固件 7
      2.4.1. 旺凌测试固件下载 7
      2.4.2. 旺凌原始程式码重新 build code 10
3. **量测步骤** 11
   3.1. Current Measurement 15
      3.1.1. Smart Sleep 16
      3.1.2. Timer Sleep 20
      3.1.3. Deep Sleep 22
4. **量测结果** 23
   4.1. OPL2500 24
   4.2. OPL1600 27

Copyright © 2017-2023, Opulinks. All Rights Reserved.

图目录

Figure 1：OPL2500 2
Figure 2：Devkit 接 Power Monitor(OPL2500) 2
Figure 3： OPL1600 3
Figure 4 ：Devkit 接 Power Monitor (OPL1600) 3
Figure 5：Google Play 下载 APP (Android) 4
Figure 6: 测试 App 链结 5
Figure 7：APP Store 下载 OWU (iOS) 6
Figure 8: 测试固件链结 8
Figure 9: 固件打包和下载工具 9
Figure 10：原始程式码 10
Figure 11：Current Measure 定义值 10
Figure 12：Opulinks Wireless Utilities (Android) 11
Figure 13：Opulinks Wireless Utilities 主界面 (Android) 12
Figure 14：BLE 扫描界面 (Android) 13
Figure 15：Opulinks Wireless Utitlities 功能界面(Android) 14
Figure 16：功耗量测模式 15
Figure 17：Smart Sleep 17
Figure 18：没有 Wi-Fi 连接和 BLE 广播无法执行 Smart Sleep 18
Figure 19: Opulinks Wireless Utilities APP 操作说明 19
Figure 20：Timer Sleep 21
Figure 21：Deep Sleep 22
Figure 22：Smart Sleep wifi conection Dtim period 100 (ms) & no ble adv 24
Figure 25：Smart Sleep wifi conection Dtim period 1000 (ms) & no ble adv 25
Figure 26：Smart Sleep wifi conection Dtim period 3000 (ms) & no ble adv 26
Figure 27：Smart Sleep wifi conection Dtim period 100 (ms) & no ble adv 27

Copyright © 2017-2023, Opulinks. All Rights Reserved.

LIST OF FIGURES

Figure 30：Smart Sleep wifi conection Dtim period 1000 (ms) & no ble adv _____ 28

Figure 31：Smart Sleep wifi conection Dtim period 3000 (ms) & no ble adv _____ 29

Copyright © 2017-2023, Opulinks. All Rights Reserved.

1. 介绍

1.1. 文档应用范围

本文档介绍一个简单快速的机制, 最主要使用在量测 Power Save 上，不同的情境所消耗的电流量，並且对比 OPL1000 系列(此文件以 OPL1600 为例)及 OPL2500。此机制将使用到旺凌提供的”Opulinks Wireless Utilities”App (目前仅 Android App 支持此功能), 以及使用由 QuickDev-Framework 的”qd_app”范例所编译出的固件。

1.2. 缩略语

Abbr.	Explanation
IOP	Interoperability
DUT	Device under test
DEVKIT	Development kit
QuickDev	Quick Development

Copyright © 2017-2023, Opulinks. All Rights Reserved.

2. 量测环境

2.1. OPL2500

Devkit 的配置方式，参照 FIGURE 1，跨接器(Jumper)的配置方式参照(FIGURE 1 红框处)

Figure 1：OPL2500

Chip 端的电源将会是由 Power Monitor 来提供 3V 的电给 Chip，参照 Figure 2。Power Monitor 的正电源接到 Devkit 的 VBAT(Figure 2 Devkit 蓝框处)，Power Monitor 的负电源接到 Devkit 的 GND(FIGURE 2 Devkit 红框处)。透过 Power Monitor 可以知道 Chip 使用了多少电流量。

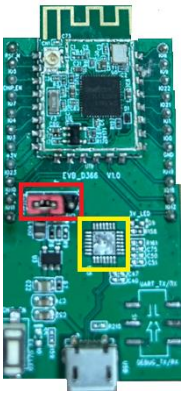
Figure 2：Devkit 接 Power Monitor(OPL2500)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

2.2. OPL1600

Devkit 的配置方式，参照 FIGURE 3，跨接器(Jumper)的配置方式参照(Figure 3 红框处)，并且移去 USB to UART Convertor(FIGURE 3 黄框处)。

Figure 3： OPL1600



Chip 端的电源将会是由 Power Monitor 来提供 3V 的电给 Chip，参照 FIGURE 4。Power Monitor 的正电源接到 Devkit 的 VBAT(FIGURE 4 Devkit 蓝框处)，Power Monitor 的负电源接到 Devkit 的 GND(FIGURE 4 Devkit 红框处)。透过 Power Monitor 可以知道 Chip 使用了多少电流量。

Figure 4 ：Devkit 接 Power Monitor (OPL1600)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

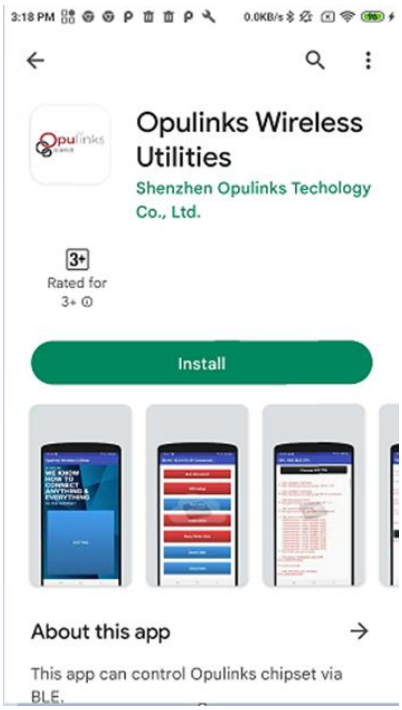
2.3. 安装 APP

2.3.1. Android

- 前往 Google Play 搜寻 Opulinks wireless Utilities
- 点击 Install 按钮，进行安装 APP

如 FIGURE 5

Figure 5：Google Play 下载 APP (Android)



或是从"Opulinks Wiki Tools"页面直接下载测试 apk (如 FIGURE 6), 并自行安装, 页面连结如下:

https://github.com/Opulinks-Tech/OpulinksTech-WIKI/wiki/tools

Copyright © 2017-2023, Opulinks. All Rights Reserved.

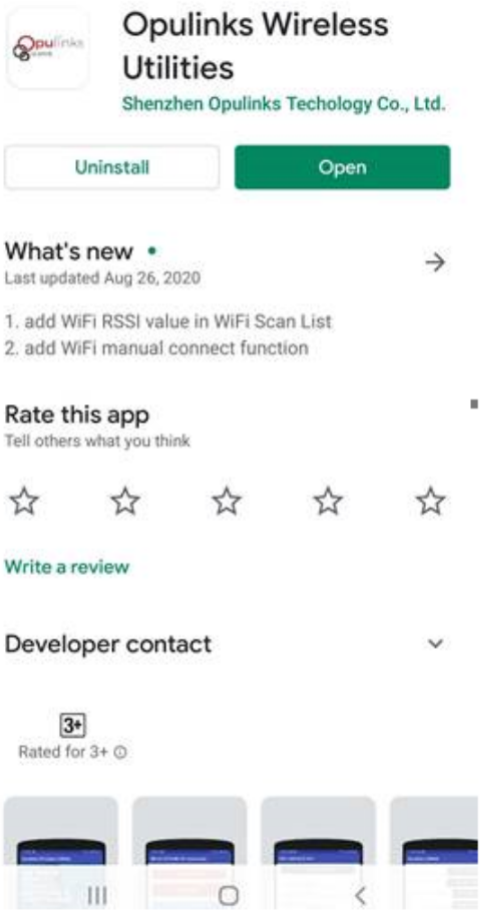
Figure 6: 测试 App 链结

Opulinks Wireless Utilities APP 下載

- [文檔] OPL1000系列/OPL2500 Opulinks Wireless Utilities APP操作說明

> Android

- 請直接在手機Google Play上搜尋" **Opulinks** "下載即可



- [下載] 電流功耗量測安卓測試應用程式
- [下載] OPL2500電流功耗量測測試固件(基於OPL2500A0 SDKv2.0)
- [下載] OPL1600電流功耗量測測試固件(基於OPL1000A3 SDKv3.4)

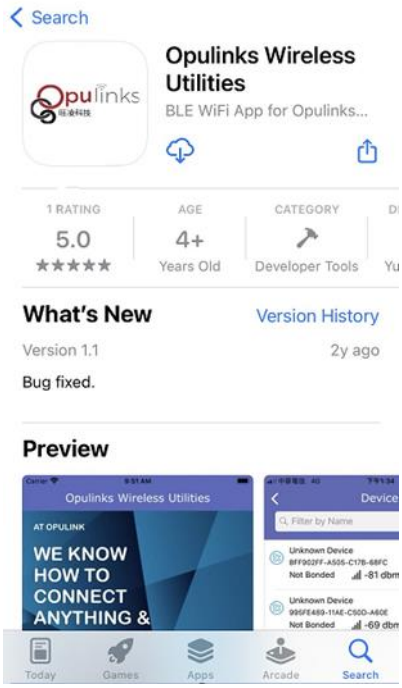
Copyright © 2017-2023, Opulinks. All Rights Reserved.

2.3.2. iOS

- 前往 APP store 搜寻 Opulinks wireless Utilities
- 点击，进行安装 APP

如 FIGURE 7

Figure 7：APP Store 下载 OWU (iOS)



Copyright © 2017-2023, Opulinks. All Rights Reserved.

2.4. 测试固件

测试固件有两个方式可以取得

- 旺凌测试固件下载
- 旺凌原始程式码重新 build code

2.4.1. 旺凌测试固件下载

请于 Opulinks WiKi Tools 页面下载测试固件(FIGURE 8)

OPL2500 测试固件, 目前基于 OPL2500 A0 SDK v2.0 编译, 更新将不另行通知

OPL1600 测试固件, 目前基于 OPL1000 A3 SDK v3.4 编译, 更新将不另行通知

Copyright © 2017-2023, Opulinks. All Rights Reserved.

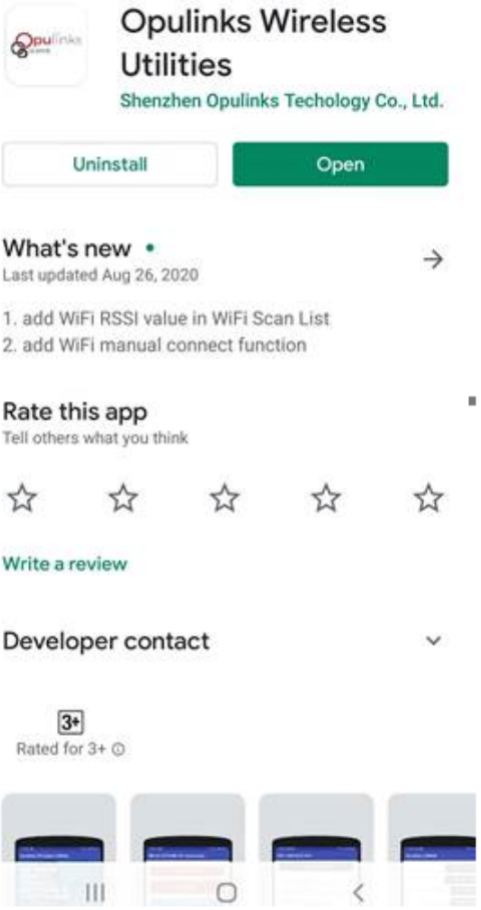
Figure 8: 测试固件链结

Opulinks Wireless Utilities APP 下載

- [文檔] OPL1000系列/OPL2500 Opulinks Wireless Utilities APP操作說明

> Android

- 請直接在手機Google Play上搜尋" **Opulinks** "下載即可

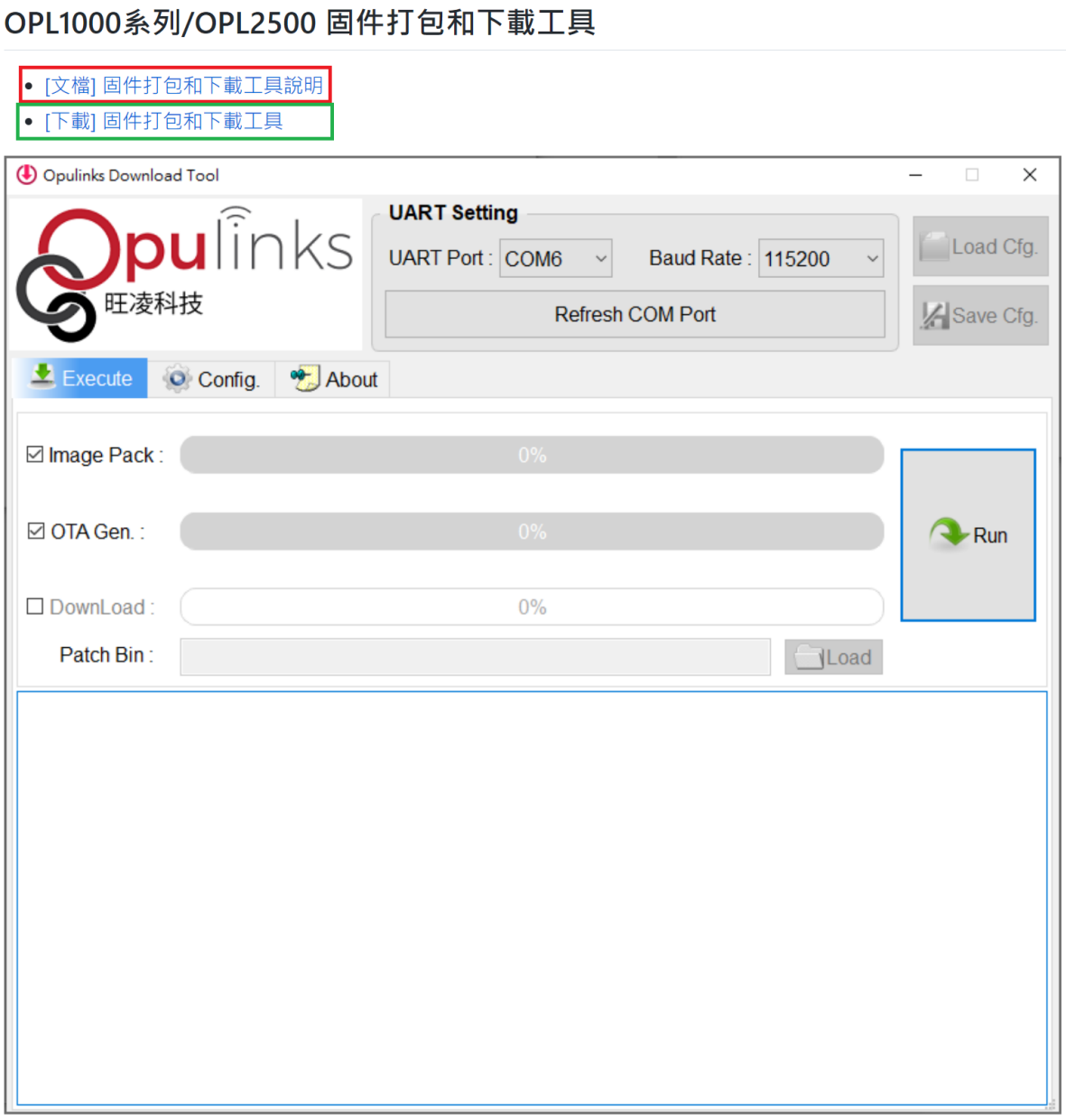


- [下載] 電流功耗量測安卓測試應用程式
- [下載] OPL2500電流功耗量測測試固件(基於OPL2500A0 SDKv2.0)
- [下載] OPL1600電流功耗量測測試固件(基於OPL1000A3 SDKv3.4)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

需使用"固件打包和下载工具"将固件下载至 Devkit, 请于 Opulinks WiKi Tools 页面下找到此工具及使用说明, 如 FIGURE 9

Figure 9: 固件打包和下载工具



Copyright © 2017-2023, Opulinks. All Rights Reserved.

2.4.2. 旺凌原始程式码重新 build code

原始程式码下载连结：https://github.com/Opulinks-Tech/OpulinksTech-WIKI/wiki/Solution

如 FIGURE 10

Figure 10：原始程式码

若开发者使用原始程式码重新 build code 的方式，在 build code 前，必须把 Current Measure 的定义设定成 1，其路径为 example\start_up\qd_app\main\sys_config\qd_module.h，如 FIGURE 11

Figure 11：Current Measure 定义值

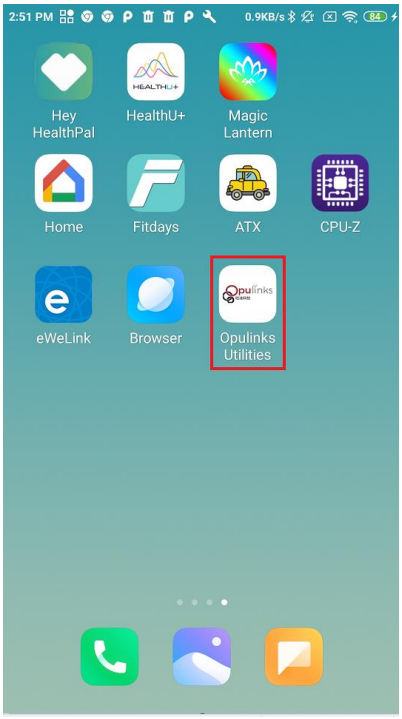
```
// <o> OPL_DATA_CURRENT_MEASURE_ENABLE - Enables current measure function in Opulinks BLE WI-FI data protocol
#ifndef OPL_DATA_CURRENT_MEASURE_ENABLED
#define OPL_DATA_CURRENT_MEASURE_ENABLED        (1) //For OWU current measurement default 0
#endif
```

Copyright © 2017-2023, Opulinks. All Rights Reserved.

3. 量测步骤

开发者在手机或平板等移动装置点击 APP (Opulinks Wireless Utilities)，如 FIGURE 12，可以进入主界面

Figure 12：Opulinks Wireless Utilities (Android)



Copyright © 2017-2023, Opulinks. All Rights Reserved.

在主界面，如 FIGURE 13，点击 BLE Tool，即可进入 BLE 扫描界面

Figure 13：Opulinks Wireless Utilities 主界面 (Android)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

在 BLE 扫描界面搜寻欲蓝牙连结的设备，如 FIGURE 14，选取欲连结的设备(FIGURE 14 红框处)，点击 CONNECT，进入 Opulinks Wireless Utilities 功能界面。

Figure 14：BLE 扫描界面 (Android)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

Opulinks Wireless Utilities 功能界面，如 FIGURE 15，点击 Current Measurement，可以在功耗量测模式进行功耗量测。

Figure 15：Opulinks Wireless Utitlities 功能界面(Android)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

3.1. Current Measurement

OPL1000 系列/OPL2500 芯片提供三种可配置的睡眠模式， 芯片支持的三种睡眠模式如下：

1. Smart Sleep
2. Timer Sleep
3. Deep Sleep

在功耗量测界面，如 FIGURE 16，开发者可以结合具体需求选择睡眠模式并且配置相对应的参数。

Figure 16：功耗量测模式

Copyright © 2017-2023, Opulinks. All Rights Reserved.

3.1.1. Smart Sleep

Smart Sleep 模式下，WIFI 系统本身会自动调整两次 DTIM Beacon 间隔时间的接收长短，关闭或开启 Wi-Fi 模块电路，达到省电效果。在时间快到达的下次 Beacon 到来前自动唤醒, 是系统时钟模块来实现。睡眠同时可以保持与路由器的 Wi-Fi 连接，并通过路由器接受来自手机或者服务器的交互信息。

功耗测量界面点选 Smart Sleep，如 FIGURE 17，可以配置的参数如下

1. DTIM Period：跳过 DTIM 功能，设定范围为 100 至 3000 毫秒，预设值为 3000 毫秒
2. BleAdvOnOff：是否开启蓝牙广播
3. BleAdvIntv：使用者若是选择开启蓝牙广播，需要设定蓝牙广播间隔，设定范围为 20 毫秒至 1000 毫秒，预设值为 1000 毫秒

Copyright © 2017-2023, Opulinks. All Rights Reserved.

使用者配置好参数后，確認 Power Monitor 儀器正確連結後，点击下方的 Run 功能键，即可执行 Smart Sleep

Figure 17：Smart Sleep

注意：使用者若想使用 Smart Sleep 模式量测功耗，而不打开蓝牙广播，Devkit 必须先连上 Wi-Fi，否则将无法使用，如 FIGURE 18。

Copyright © 2017-2023, Opulinks. All Rights Reserved.

Figure 18：没有 Wi-Fi 连接和 BLE 广播无法执行 Smart Sleep

请回 " Opulinks Wireless Utilities 功能界面" (如 FIGURE 13), 执行" WiFi Setup" 功能, 详情请参阅 "Opulinks Wireless Utilities APP 操作说明", 如 FIGURE 19 链结

Copyright © 2017-2023, Opulinks. All Rights Reserved.

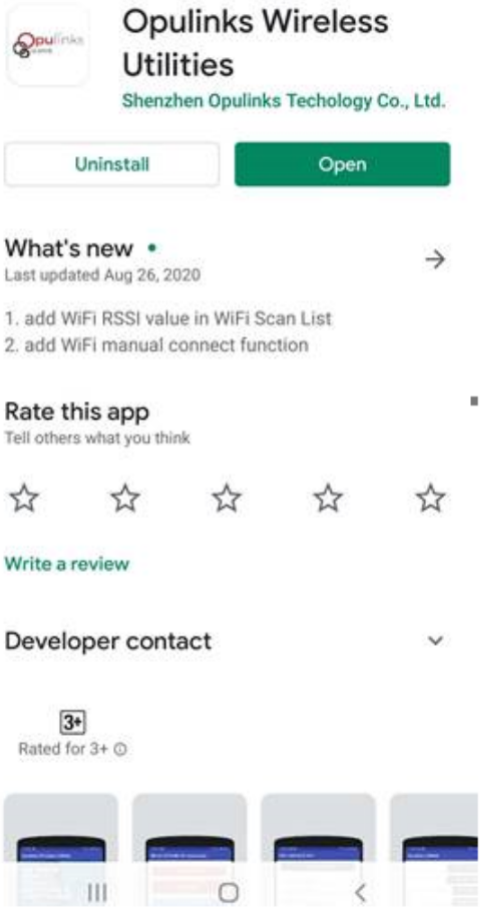
Figure 19: Opulinks Wireless Utilities APP 操作说明

Opulinks Wireless Utilities APP 下載

- [文檔] OPL1000系列/OPL2500 Opulinks Wireless Utilities APP操作說明

> Android

- 請直接在手機Google Play上搜尋" **Opulinks** "下載即可



- [下載] 電流功耗量測安卓測試應用程式
- [下載] OPL2500電流功耗量測測試固件(基於OPL2500A0 SDKv2.0)
- [下載] OPL1600電流功耗量測測試固件(基於OPL1000A3 SDKv3.4)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

3.1.2. Timer Sleep

Timer Sleep 模式下，芯片会断开所有 Wi-Fi 连接与数据连接，并且转入到 Idle 状态（没有 WIFI 和 BLE 通信操作），才能进入睡眠模式，只有系统时钟模块仍然工作，负责芯片的定时唤醒。

功耗量测界面点选 Timer Sleep，如 FIGURE 20，可以配置的参数如下：

SleepTime：Devkit 睡眠时长，范围为 15 毫秒到 150000 毫秒，预设值为 10000 毫秒。

WakeupTime：Devkit 清醒时长，范围为 0 毫秒到 1000 毫秒，预设值为 0 毫秒

例如用户配置 SleepTime=10000，以及 WakeupTime=0，如 FIGURE 20，Devkit 将会进入睡眠 10000 毫秒后唤醒，立马再度进入睡眠模式，周而复始的进行 Timer Sleep。

用户配置好参数后，确认 Power Monitor 仪器正确链接后，点击下方的 Run 功能键，即可执行 Timer Sleep。

Copyright © 2017-2023, Opulinks. All Rights Reserved.

Figure 20：Timer Sleep

Copyright © 2017-2023, Opulinks. All Rights Reserved.

3.1.3. Deep Sleep

Deep Sleep 模式下，芯片会断开所有 Wi-Fi 连接与数据连接，并且转入到 Idle 状态（没有 WIFI 和 BLE 通信操作），才能进入睡眠模式，就连系统时钟模块都会关闭。

使用者点选 Deep Sleep，確認 Power Monitor 儀器正確連結後，点击下方的 Run 功能键，即可执行 Deep Sleep，如 FIGURE 21。

Figure 21：Deep Sleep

注意：使用者若执行好睡眠模式，Opulinks Wireless Utilities 会主动跳至主界面(FIGURE 13)，若使用者欲重新操作，必须先重启 Devkit，重新执行 APP 与 Devkit 蓝牙连接。

Copyright © 2017-2023, Opulinks. All Rights Reserved.

4. 量测结果

此次测试以 OPL2500_A0 以及 OPL1600 为测试范例版本，使用 SDK 版本如下

- OPL2500
  - SDK: OPLI2500 v2.0
- OPL1600
  - SDK: OPL1000_A3 v3.4

测试结果如 TABLE 1。

Table 1：功耗测试

Test case name	OPL2500 (Open Env.)	OPL2500 (Shielding box)	OPL1600 (Open Env.)
Smart Sleep wifi conection Dtim period 100 (ms) & no ble adv	0.74 (mA)	0.73 (mA)	1.22 (mA)
Smart Sleep wifi conection Dtim period 1000 (ms) & no ble adv	0.30 (mA)	0.19 (mA)	0.28 (mA)
Smart Sleep wifi conection Dtim period 3000 (ms) & no ble adv	0.19 (mA)	0.13 (mA)	0.11 (mA)
Timer Sleep Sleep Time 10000(ms)	30.0 (uA)	30.0(uA)	50.9 (uA)
Deep Sleep	5.24 (uA)	6.07 (uA)	32.2 (uA)

以下章节详述测试结果(开放环境)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

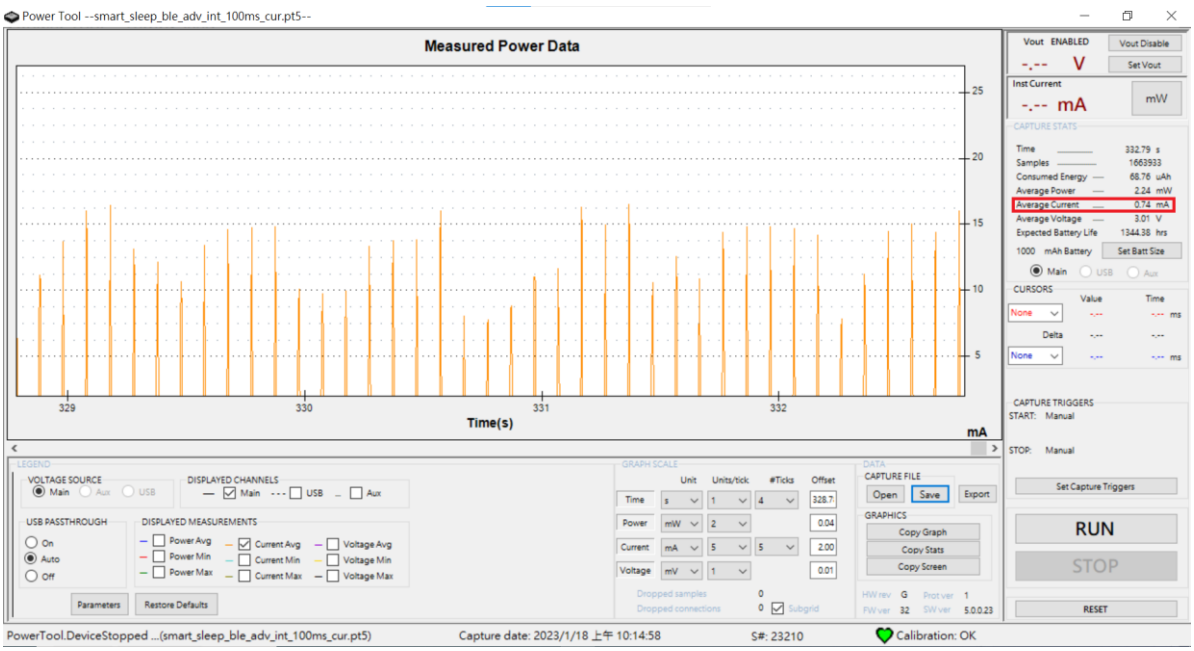
4.1. OPL2500

- Smart Sleep wifi conection Dtim period 100 (ms) & no ble adv

说明：设备端 Smart Sleep 并且 WiFi 的 DTIM Period 设定 100(ms)。

Power Monitor 的量测结果，如 FIGURE 22

Figure 22：Smart Sleep wifi conection Dtim period 100 (ms) & no ble adv



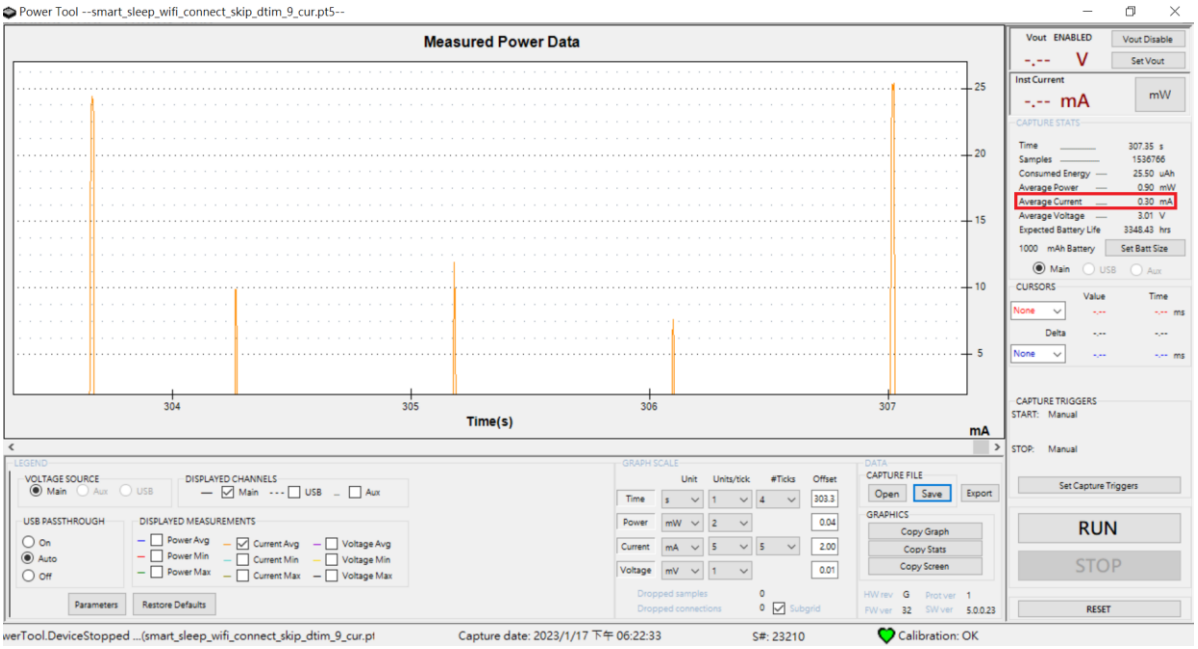
Copyright © 2017-2023, Opulinks. All Rights Reserved.

- Smart Sleep wifi conection Dtim period 1000 (ms) & no ble adv

说明：设备端 Smart Sleep 并且 WiFi 的 DTIM Period 设定 1000(ms)。

Power Monitor 的量测结果，如 FIGURE 23

Figure 23：Smart Sleep wifi conection Dtim period 1000 (ms) & no ble adv



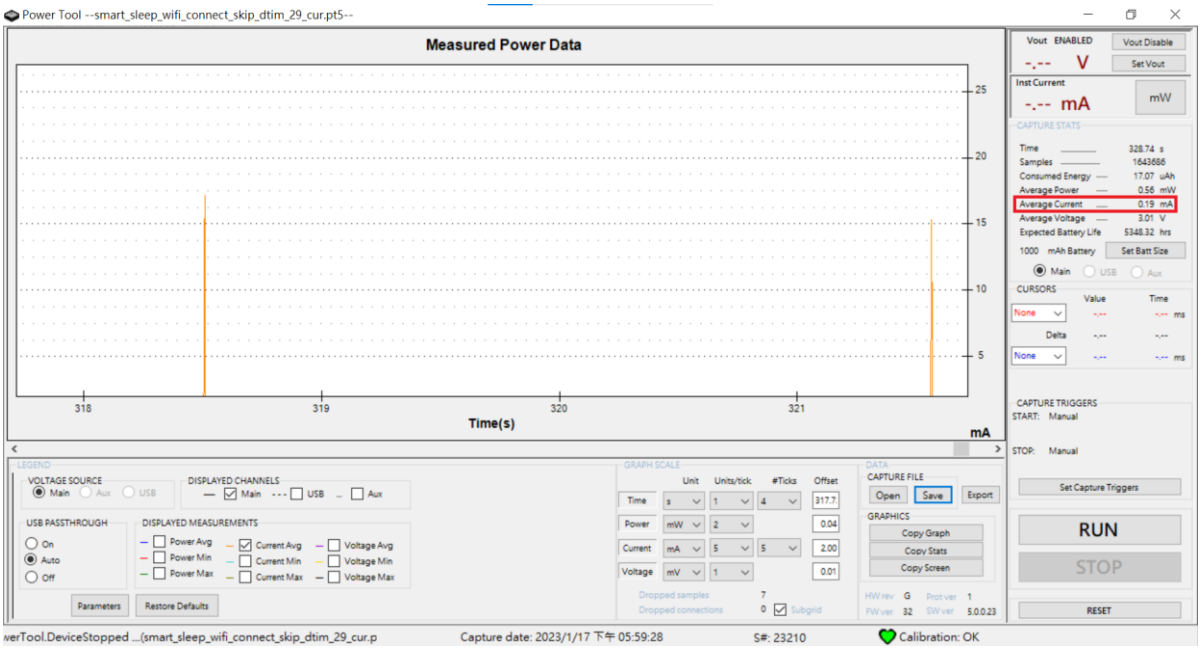
Copyright © 2017-2023, Opulinks. All Rights Reserved.

- Smart Sleep wifi conection Dtim period 3000 (ms) & no ble adv

说明：设备端 Smart Sleep 并且 WiFi 的 DTIM Period 设定 3000(ms)。

Power Monitor 的量测结果，如 FIGURE 24

Figure 24：Smart Sleep wifi conection Dtim period 3000 (ms) & no ble adv



- Timer Sleep Sleep Time 10000(ms)

说明：设备端 Timer Sleep，SleepTime 设定 10000 (ms)，WakeupTime 设定 0(ms)。

KEITHLEY 量测平均电流为 30.0 (uA)。

- Deep Sleep

说明：设备端 Deep Sleep

KEITHLEY 量测平均电流为 5.24(uA)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

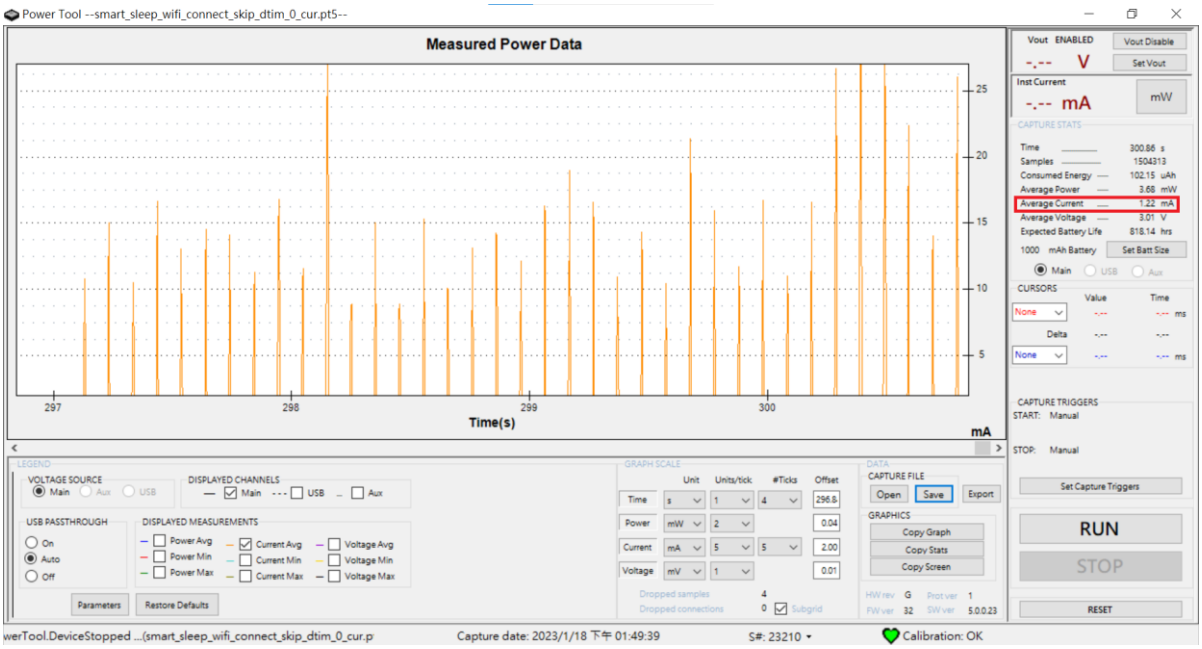
4.2. OPL1600

- Smart Sleep wifi conection Dtim period 100 (ms) & no ble adv

说明：设备端 Smart Sleep 并且 WiFi 的 DTIM Period 设定 100(ms)。

Power Monitor 的量测结果，如 FIGURE 25

Figure 25：Smart Sleep wifi conection Dtim period 100 (ms) & no ble adv



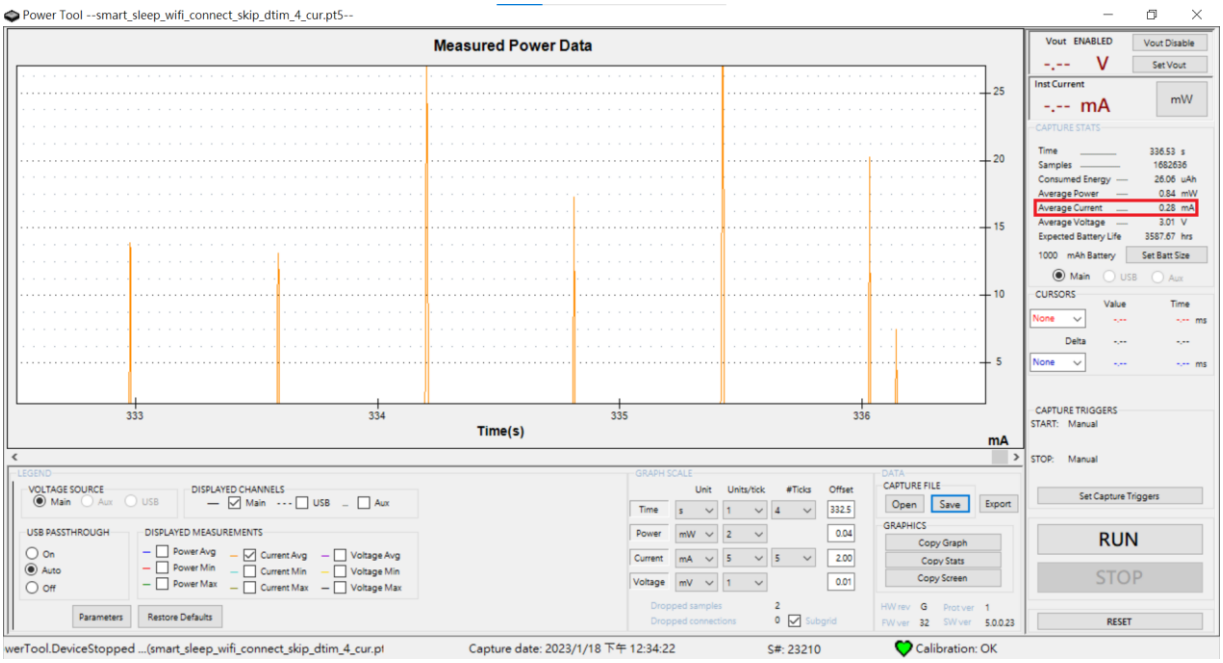
Copyright © 2017-2023, Opulinks. All Rights Reserved.

- Smart Sleep wifi conection Dtim period 1000 (ms) & no ble adv

说明：设备端 Smart Sleep 并且 WiFi 的 DTIM Period 设定 1000(ms)。

Power Monitor 的量测结果，如 FIGURE 26

Figure 26：Smart Sleep wifi conection Dtim period 1000 (ms) & no ble adv



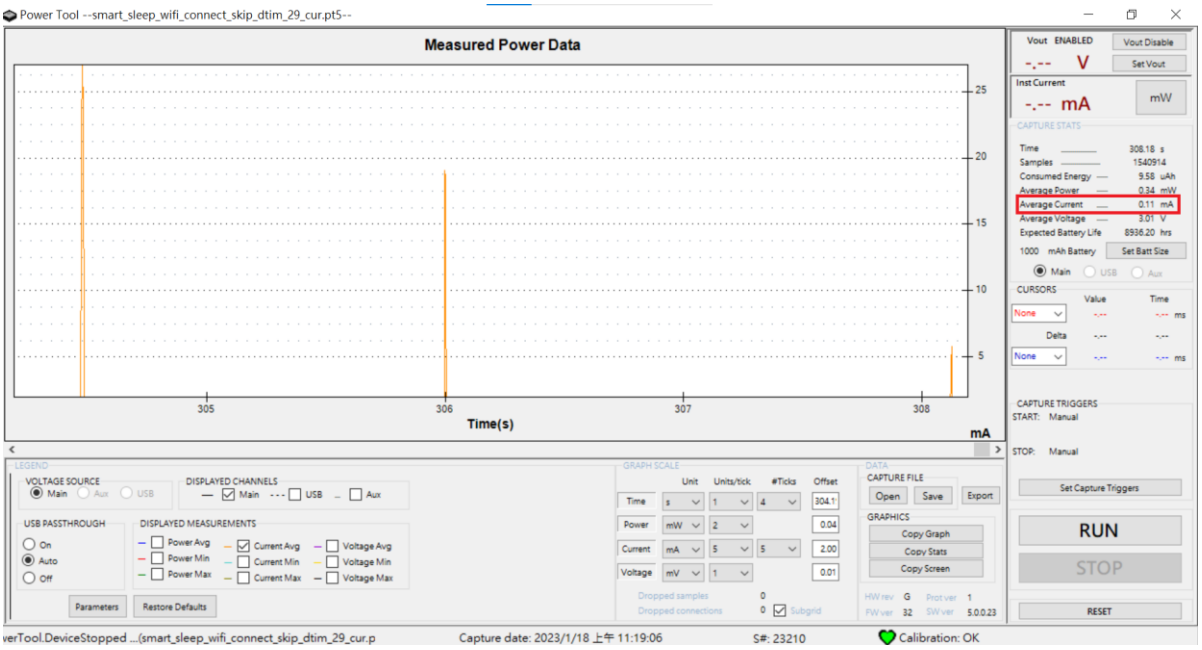
Copyright © 2017-2023, Opulinks. All Rights Reserved.

- Smart Sleep wifi conection Dtim period 3000 (ms) & no ble adv

说明：设备端 Smart Sleep 并且 WiFi 的 DTIM Period 设定 3000(ms)。

Power Monitor 的量测结果，如 FIGURE 27

Figure 27：Smart Sleep wifi conection Dtim period 3000 (ms) & no ble adv



- Timer Sleep Sleep Time 10000(ms)

说明：设备端 Timer Sleep，SleepTime 设定 10000 (ms)，WakeupTime 设定 0(ms)。

KEITHLEY 量测平均电流为 50.9 (uA)。

- Deep Sleep

说明：设备端 Deep Sleep

KEITHLEY 量测平均电流为 32.2(uA)

Copyright © 2017-2023, Opulinks. All Rights Reserved.

CONTACT

sales@Opulinks.com

Copyright © 2017-2023, Opulinks. All Rights Reserved.