# APPLICATION NOTE:
SX-ULPGN-BTZ
Power Measurement

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Revision 1.0, May 13, 2019

**Revision History**

| Rev. No. | Date | Revision by | Description |
|---|---|---|---|
| 1.0 | May 13, 2019 | T.Nakase | Initial draft |

# Table of Contents

# 1. Scope

The purpose of this document is to provide a methodology to measure power consumption data for the SX-ULPGN-BTZ-EVK.

# 2. References

## 2.1 SX-ULPGN-BTZ QSG

2.1.1    SX-ULPGN-BTZ Development Quick Start Guide, 140-00217-100 v1.4

## 2.2 Power Monitor

2.2.1    Monsoon Solutions Inc. FTA22D ([https://www.msoon.com/powermonitor-support](https://www.msoon.com/powermonitor-support))

## 2.3 QDN Document

2.3.1    QCA402x (CDB2x) Power Measurement Test Guide, 80-YA121-147 Rev. B

# 3. Equipment

## 3.1 Hardware

- The EVK board, SX-ULPGN-BTZ EVK (WCBN3516A_EVB V01) x3
- Power Monitor (Monsoon Solutions Inc. FTA22D)
- IEEE 802.11 Access Point (Linksys EA6350)
- Shield Box (Ramsey Electronics, LLC STE4400)
- Host PC
- USB 2.0 Cable (Type A male – Type B male) x5
- USB Gender Changer (Type B female – Type A male) x5
- USB Hub
- Jumper Cap x27
- Jumper Cable (female - female) x9

## 3.2 Host PC Configuration

- Intel Core i7-4790 Processor @ 3.60 GHz
- 8 GB RAM
- 160GB HDD
- USB 2.0/3.0 x3
- Gigabyte Ethernet Port x1
- Windows 10 Professional
- Username: silex, Account type: Administrator

# 4. Software Installation

## 4.1 SX-ULPGN-BTZ Development Environment

Follow Section 4 in the **SX-ULPGN-BTZ QSG** to setup a development environment to your **Host PC**.

## 4.2 Power Monitor

Follow the instructions provided by the **Power Monitor** manufacturer.

## 4.3 Program Firmware Image

You will need x3 **EVK boards**, x1 **DUT** (radio) and x2 **Reference Devices**. Follow Section 5 - 8 listed in the **SX-ULPGN-BTZ QSG** to build and flash the QCLI_power_demo to your EVK board. The DUT (radio) needs to run the QCLI_demo when executing test cases using a WiFi interface.
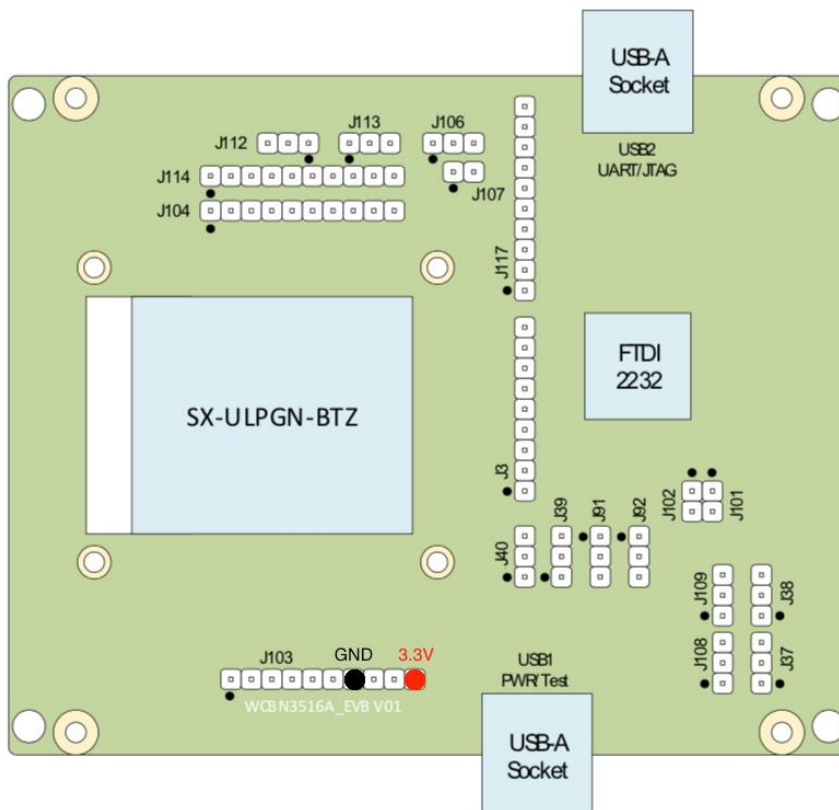
# 5. Hardware Setup

## 5.1 Humidity and Temperature Sensor

Remove the Humidity and Temperature Sensor **U73 on the EVK board** from the **DUT** (radio), which draws about 0.04 mA. It will have a non-negligible impact when the system is in the sleep floor state.

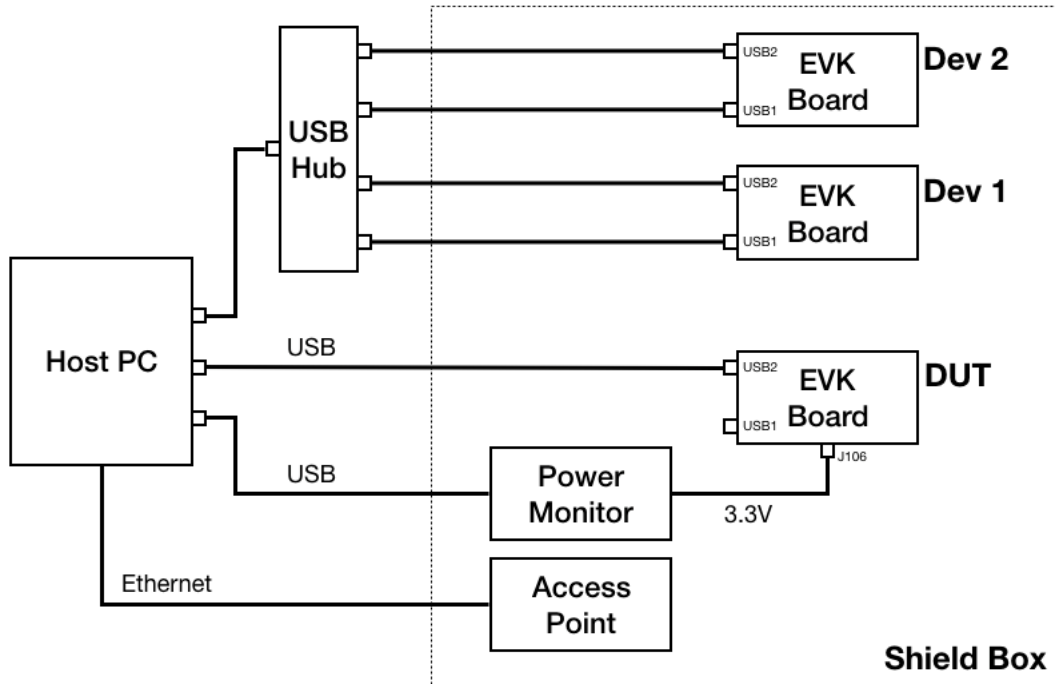## 5.2 Measurement Point and Power Supply

Connect the Power Monitor output to the DUT as follows:

- **GND** to **J103 Pin 7**
- **3.3V** to **J103 Pin 10**

# 6. Measurement System Setup

Place the **EVK boards**, **Power Monitor** and **Access Point** in the **Shield Box** as shown in the diagram below.



# 7. Measurement

Execute the test cases in Section 2 and 3 of **the QDN Document**. The measurement period is 30 seconds for each test case.

| Mode | Ave. Current [mA] | Note |
|---|---|---|
| Sleep Floor MOM | 0.08 | Section 2.1 |
| Sleep Floor SOM | 0.08 | Section 2.2 |
| Sleep Floor FOM | 0.09 | Section 2.3 |
| 15.4 Rx listen (no packet received) | 13.89 | Section 2.4 |
| 15.4 Rx packet | 13.56 | Section 2.5, pkt-type=5 len=127 |
| 15.4 Tx | 16.46 | Section 2.6, pkt-type=5 len=127 |
| BLE Rx listen (no packets received) | 9.86 | Section 2.7 |
| BLE Rx packet | 12.53 | Section 2.8 |

| | | |
|---|---|---|
| BLE Tx | 8.41 | Section 2.9 |
| BLE connection of 1000 ms, no-data | 0.15 | Section 2.10 |
| BLE scan every 1280 ms | 0.25 | Section 2.11 |
| System in wake-capable | 0.09 | Section 3.1 |
| BLE fast-advertising | 2.90 | Section 3.2 |
| BLE slow-advertising | 0.15 | Section 3.3 |
| BLE beaconing | 0.52 | Section 3.4 |
| BLE connected keyboard | 2.57 | Section 3.5 |
| BLE connected heart rate | 0.23 | Section 3.6 |
| BLE maximum data transfer | 12.45 | Section 3.7 |
| 15.4 sleep node with 1 sec wakeup interval | 0.15 | Section 3.8 |
| 15.4 sleep node with 6 sec wakeup interval | 0.14 | Section 3.9 |
| 15.4 FFD Rx always listen | 0.12 | Section 3.10 |
| 15.4 FFD maximum Tx data throughput | 9.06 | Section 3.11 |
| Wi-Fi/BLE/15.4 coexistence | 11.43 | Section 3.12, 5GHz AP DTIM=1 |
| BLE/15.4 coexistence | 1.11 | Section 3.13 |
| Wi-Fi suspend | 0.10 | Section 3.14 |
| Wi-Fi idle mode power save | 13.10 | Section 3.15 |
| Wi-Fi beacon mode power save | 2.32 | Section 3.16 |
| Wi-Fi TCP Rx (5GHz / 2GHz AP) | 70.63 / 8.55 | Section 3.17 |
| Wi-Fi TCP Tx (5GHz / 2GHz AP) | 209.08 / 67.79 | Section 3.18 |
| Wi-Fi UDP Rx (5GHz / 2GHz AP) | 70.40 / 67.61 | Section 3.19 |
| Wi-Fi UDP Tx (5GHz / 2GHz AP) | 219.71 / 67.58 | Section 3.20 |

NOTE: Section 2.5 and 2.6 of **the QDN Document** has an error in the instructions. We changed the command arguments for this document as shown below.

Section 2.5:

```
HMI\DUT> TxTest 2 20 0xf 0 5 127 2 (on Reference Device)
```

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```
HMI\DUT> RxTest 2 20 5 127 2 0 0 (on DUT)
```

Section 2.6:

```
HMI\DUT> TxTest 2 11 0xf 0 5 127 2
```