ATM33/e Series EVK
Power Consumption Evaluation

User Guide

SUMMARY: This document provides instructions for ATM33/e Evaluation Kit (EVK) users to perform power consumption evaluation of the ATM33/e Wireless SoC Series. Test setup and power consumption profiles are included in this document.

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Acronyms and Abbreviations

Acronyms	Definition
ATM33	ATM3325 ATM3330
ATM33e	ATM3330e
ATM33/e	ATM33/ATM33e
EVB	Evaluation Board
EVK	Evaluation Kit
SDK	Software Development Kit
SoC	System-on-Chip

1. Overview

This guide provides instructions for EVK users to perform a power consumption evaluation of the ATM33/e Wireless SoC Series.

2. Hardware and Software Requirements

Refer to the Reference Documents section for related documents.

2.1 Supported EVK

EVK	SoC	SoC Part Number	Kit Part Number
Evaluation Kit for ATM3325	40-pin 5x5 mm QFN	ATM3325-5DCAQK	ATMEVK-3325-QK
Evaluation Kit for ATM3325 w/ Extended Storage	40-pin 5x5 mm QFN	ATM3325-5LCAQK	ATMEVK-3325-LQK
Evaluation Kit for ATM3330	56-pin 7x7 mm QFN	ATM3330-5DCAQN	ATMEVK-3330-QN
Evaluation Kit for ATM3330e	56-pin 7x7 mm QFN	ATM3330E-5DCAQN	ATMEVK-3330e-QN

Table 1 - Applicable SoCs and EVKs

2.2 Supported SDK

The Atmosic SDK 5.4.0 or later can be used with the EVK. Refer to the **SDK User Guide** for more information.

3.   Evaluation Board Setup

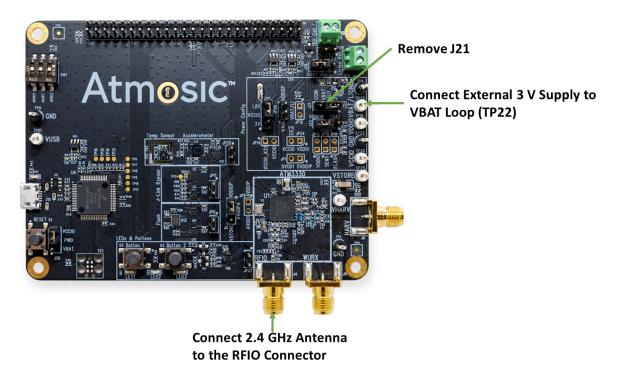Figure 1 shows the power consumption setup for the ATM3330e v3.x EVB.

Figure 1 - ATM3330e v3.x Evaluation Board Power Consumption Setup

The setup on the other EVBs based on the ATM33/e Wireless SoC Series uses the same instructions listed below:

1) Attach the 2.4 GHz antenna to the RFIO connector of the EVB.

2) Connect an external 3 V power supply to the VBAT loop at the right side of the board and remove the jumper on J21.

3) A DC power analyzer, 6-1/2 digit multimeter, or 10 Ω resistor and oscilloscope can be used for power measurements.

4) Other Power measurement tools such as Joulescope.

3.1 EVB Configuration

The default power configuration jumpers are shown in Figure 2, which sets the VBAT to be 3.0 V (J21), VDDIO at 1.8 V (J23), and sets VCCIO at 1.8 V (J22) I/O voltage for the MK22 microcontroller. The other headers are by default not populated. Note - For ATMEVK-3325-LQK, the jumper on J22 is not populated, since VCCIO is automatically configured based on the other setting on the EVK.
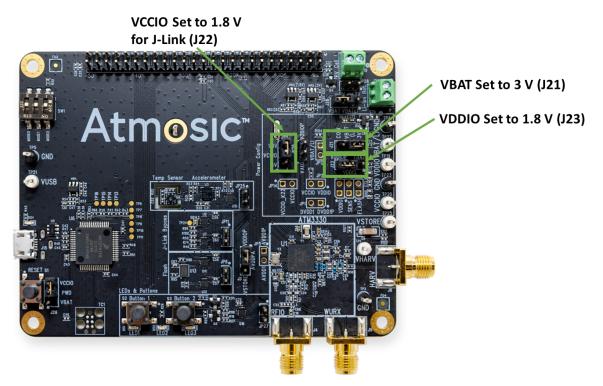

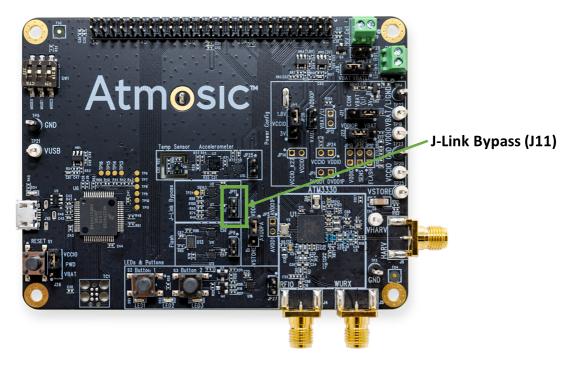*Figure 2 - ATM3330e v3.x Evaluation Board Default Configuration Jumpers*

Figure 3 - EVB Power Measurement Jumpers Configuration - J-Link Bypass

To configure the EVB for power measurements, please follow these instructions: (see Figure 2 and Figure 3 for jumper locations)

1) Remove the J21 jumper.

2) Connect an external 3 V power supply to the VBAT/GND loops at the right edge of the EVB.

3) A DC power analyzer, 6-1/2 digit multimeter, or 10 Ω resistor and oscilloscope can be used for power measurements.

4) Power on the EVB.

5) Please use the SDK to compile and load the BLE_adv application using the power_profile reference beacon configuration. Figure 4 shows the reference beacon power profile. Details in the Configure the BLE_adv application section.

6) Please make sure the USB port remains connected at all times during the power measurement. Regulators, which are powered by the USB port, provide voltage rails for the support circuitry on the EVB on a power domain separate from the DUT's power domain.

7) Add a jumper on JP11 to disconnect the MK22 and prevent it from drawing power from or providing power to the ATM33/e device (See Figure 3). Remove this jumper once the power measurement is done.
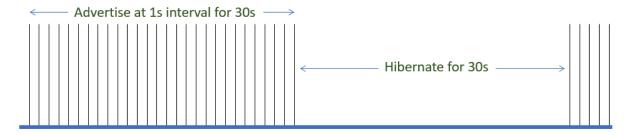
Figure 4 - Reference Beacon Power Profile

3.2 Configure the BLE_adv Application

Please see the **SDK User Guide** for more information on building and loading a beacon application using the SDK.

- Locate the BLE_adv application example from the SDK at /x.y.z/platform/atm33/ATM33xx-5/examples.
- Add the following flags in the makefile at the end of the first CFLAGS entry to configure the switching regulator optimally for the default EVB power configuration.
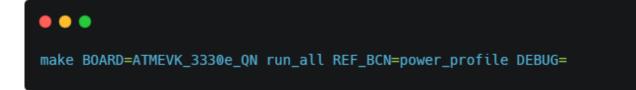
```
-DBATT_LEVEL=BATT_LEVEL_GT_1P8V \
-DBATT_TYPE=BATT_TYPE_NON_RECHARGEABLE \
-DVDDIO_TYPE=VDDIO_TYPE_INTERNAL
```

- Next, compile and load the BLE_adv application to use the beacon power profile configuration shown in Figure 4 .

Example command:

```
make BOARD=ATMEVK_3330e_QN run_all REF_BCN=power_profile
```

This command disable the debug logs and to reduce power consumption:

```
make BOARD=ATMEVK_3330e_QN run_all REF_BCN=power_profile DEBUG=
```

4. Power Measurement Procedures

4.1 Average Power Measurement with Multimeter

1) Connect a 6½ digit multimeter in series with the 3 V supply.
2) Set the multimeter for DC Current and increase averaging to as long as possible. For example, the Keysight 34465A averaging time can be set to 1s.

4.2 Average Power Profile Measurement

1) Connect a 10 Ω resistor in series between the ground of the bench power supply with the ground of the EVB.
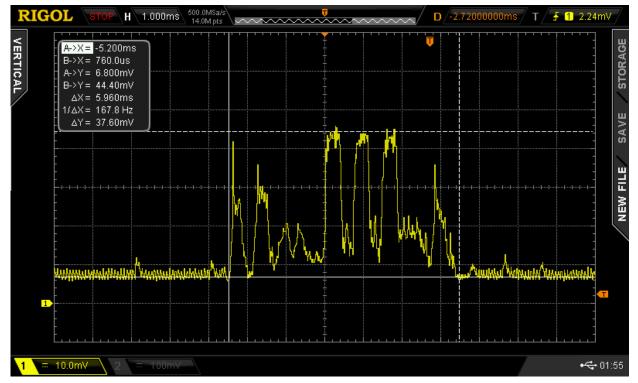
2) Put an oscilloscope probe across the 10 Ω resistor.

Figure 5 - Approximate Power Profile Measurement

3) The oscilloscope will show a periodic beacon profile (3 pulses for 3 channels) during the advertising phase followed by the retention phase without beacons. See Figure 5.

4) The approximate maximum transmit power can be approximated by dividing the measured peak voltage across the 10 Ω resistor. It should be approximately 4.0 mA. Note that the oscilloscope method may not provide enough resolution to measure other power states.

4.3 More Accurate Power Profile Measurement

Measuring the dynamic current more accurately requires a DC power analyzer such as the Keysight N6705C, or other equipment such as Joulescope. For the Keysight N6705C, it is important to use auto-ranging and the maximum number of horizontal data points to observe the most accurate power profile. Figures 6 to Figure 10 show current consumption measurements of various states using a Joulescope.

Figure 6 - Transmit Current Profile

Figure 7 - Receive Current Profile

Figure 8 - Current Profile Over 1s Interval During Advertising Phase

Figure 9 - Retention Current Profile

Figure 10 - Hibernation Current Profile

It is normal to observe peaks during low power or active modes such as the ones in Figure 9 and Figure 10. These peaks result from typical operation of the DC/DC switching regulator and are generally harmless in most applications.

Reference Documents

Title	Document Number
ATM33/e Series Datasheet	ATM33_e-DS
ATM33/e Series Evaluation Kit User Guide	ATM33_e-UGEVK
SDK User Guide	ATM-UGSDK

Revision History

Date	Version	Description
August 18, 2023	0.52	Added Hardware and Software Requirements. Updated Overview, Evaluation Board Setup, Figure 1 - ATM3330e Evaluation Board Power Consumption Setup, Figure 2 - ATM3330e Evaluation Board Default Configuration Jumpers, Figure 3 - EVB Power Measurement Jumpers Configuration - J-Link Bypass, Figure 5 - Approximate Power Profile Measurement, Figure 6 - Transmit Current Profile, Figure 7 - Receive Current Profile, Figure 8 - Current Profile Over 1s Interval During Advertising Phase, Figure 9 - Retention Current Profile, Figure 10 - Hibernation Current Profile, EVB Configuration, Configure the BLE adv Application, Average Power Profile Measurement, item 4), More Accurate Power Profile Measurement,
August 31, 2022	0.51	Updated Figure 1 - ATM3330e Evaluation Board Power Consumption Setup, Figure 2 - ATM3330e Evaluation Board Default Configuration Jumpers, Figure 3 - EVB Power Measurement Jumpers Configuration - J-Link Bypass, Figure 6 - Transmit Current Profile, Figure 7 - Receive Current Profile, Figure 8 - Current Profile Over 1s Interval During Advertising Phase, Figure 9 - Retention Current Profile, Figure 10 - Hibernation Current Profile Table 1 - Typical Current for Various States for ATM33/ATM33e Wireless SoC Series,
May 13, 2022	0.50	Initial version created

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