Realtek Ameba-1 Power Modes

_____

Table of Contents

_____

1 Power State

Ameba supports three low power modes which are deep sleep mode, deep standby mode, and sleep mode. Deep sleep mode turn off more power domain than deep standby mode, and deep standby mode turn off more power domain than sleep mode. Various power modes can only switch back to run mode before change to other mode, as shown in Figure 1:
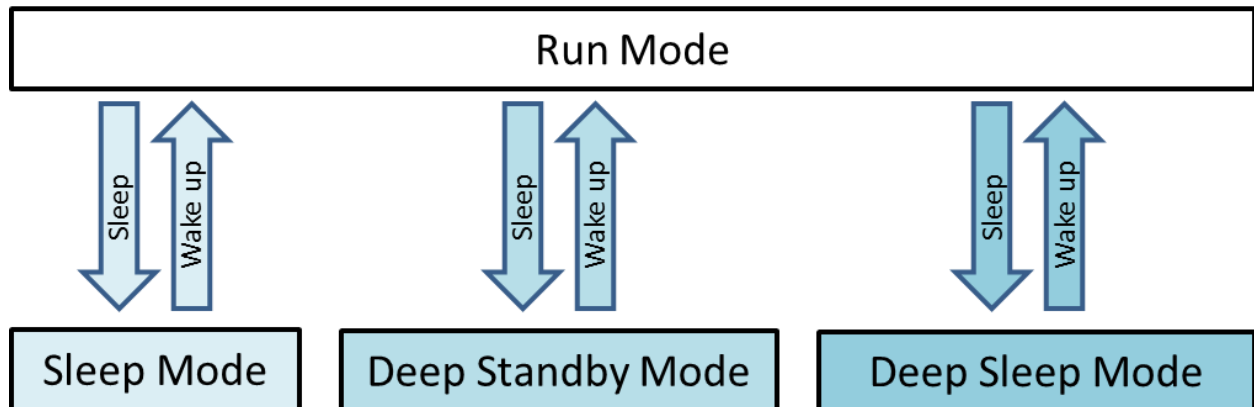

Figure 1. Ameba Power Mode

1.1 Deep Sleep Mode

- **Power Domain:** Deep sleep mode turn off power domain including cortex-M3 core, system clock, SRAM, SDRAM, and regulator. Peripherals are turned off except wakeup source which serve one wake-up pin and one low precision timer to wake up system. All of the registers are turned off expect the ones that are used to kept wake-up pin. System restarts after wakeup.
- **Wakeup Sources:** It can be wake up by GPIOB_1 and general purpose timer. Each wakeup sources can be OR'ed, that means, either one condition fire up triggers wakeup event. (Ex. Both GPIOB_1 and lower precision timer can wakeup device).

1.2 Deep Standby Mode

- **Power Domain:** Deep standby mode turn off power domain including cortex-M3 core, system clock, SRAM, SDRAM, and regulator. Peripherals are turned off except wakeup source which serve 4 GPIO and one timer to wake up system. Only around 200 bytes of registers are kept for wakeup usage, other registers are turned off. System restarts after wakeup.

_____

- **Wakeup Sources:** It can be wakeup by GPIOA_5, GPIOC_7, GPIOD_5, GPIOE_3, and system timer. Each wakeup sources can be OR'ed, that means, either one condition fire up triggers wakeup event.

1.3 Sleep Mode

- **Power Domain:** Sleep mode turn off power domain including cortex-M3 core, and system clock. System is not required to restart after wakeup.
- **Wakeup Sources:** It can be wakeup by GPIO interrupt, system timer, and general purpose timer.

1.4 Comparison

Table 1 shows the comparison of power domain in various sleep mode:

	System Status during Power Save							
	Cortex M3 core	System Clock	Lower Power Clock	SRAM	Register	Regulator	Main digital supply	Peripheral
Deep Sleep	X	X	O	X	X	X	O	Δ
Deep Standby	X	X	O	X	X	X	O	Δ
Sleep	Δ	Δ	O	O	O	O	O	O
Active	O	O	O	O	O	O	O	O

Table 1. Power domain comparison

Table 2 shows the comparison of wakeup source and wakeup procedure.

	Wakeup source	Wakeup Procedure Required			
	Wakeup Source	System restart	Wlan init	Wlan connect	Peripheral init
Deep Sleep	1 gpio / general purpose timer	Yes	Yes	Yes	Yes
Deep Standby	4 gpio / system timer	Yes	Yes	Yes	Yes
Sleep	gpio (interrupt) / system timer / general purpose timer / wlan	No	No	No	No
Active	N/A	No	No	No	No

_____
Table 2. Wake sources comparison

2 Measure Power Consumption

In Ameba-1 reference board 3V0, there are other components that consume power. For example, there are cortex-M0 for DAP usage, LEDs, and capacitances. To measure power consumptions only for Ameba-1, you need remove capacitance at R43. And you can weld wires as Figure 2:
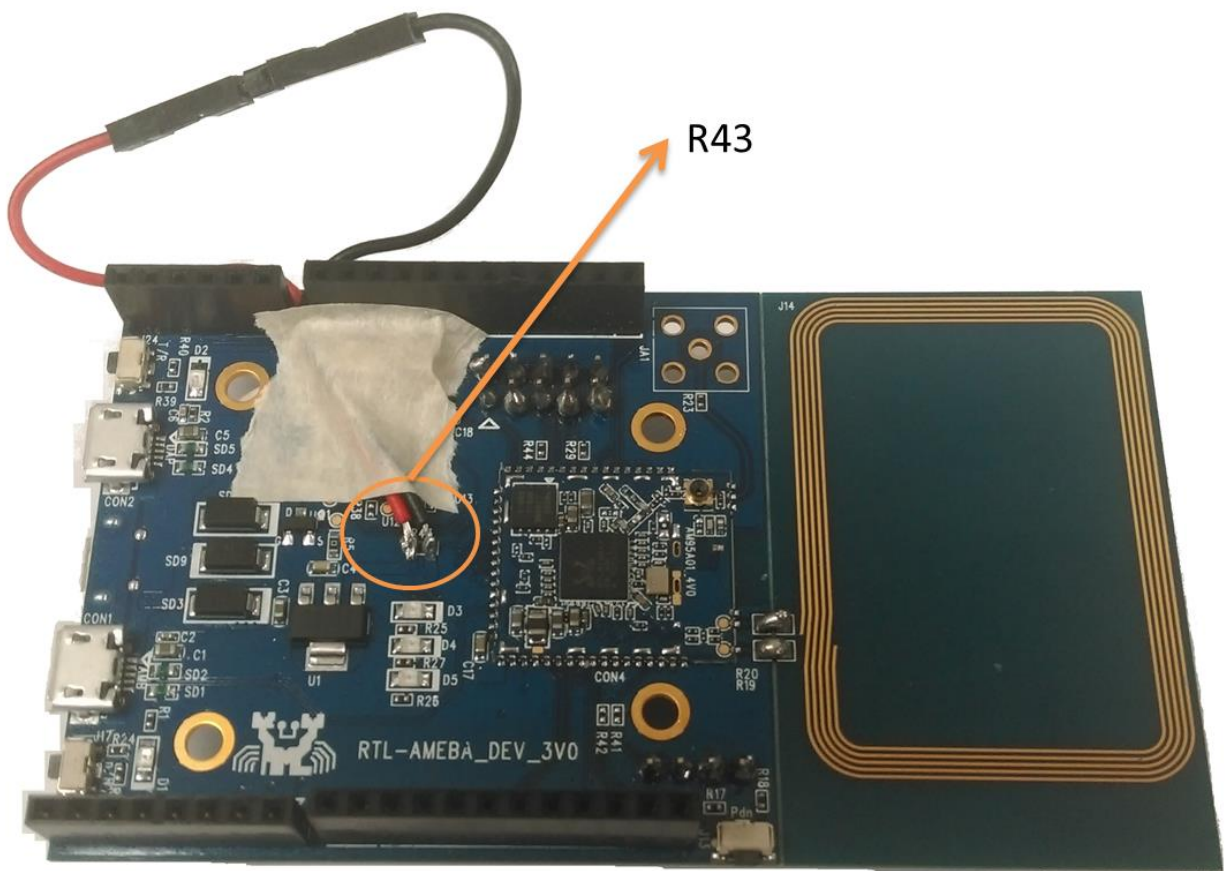

Figure 2. Power consumption measurement

In the right side of R43 as shown in figure 2, there is a black wire which is power source of Ameba-1. You can connect this point to current meter and 3V3 power supply to measure power consumption. In this case, it is required to use J-link interface for code loading, and it is also required to provide J-Link power separately.

_____

If you want to use power source from micro usb, you can use the red wire to connect to a current meter and then connect to the black wire. In this way, you have to consider power usage from JTAG component lunched by DAP component.