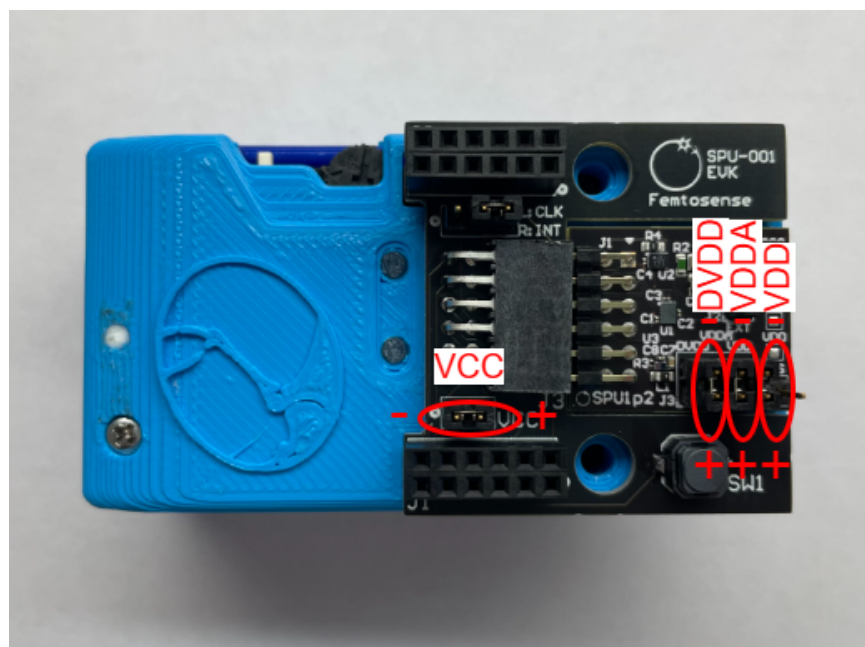


EVK2 Power Measurement

The power consumption of the SPU001 chip can be determined by measuring current on the SPU's three power supply rails. On the EVK Circuit board, these rails may be broken using the 3x vertical 2-pin jumpers labeled:

- VDD (0.8V): Main processor power supply
- VDDA (0.8V): PLL power supply
- DVDD (IO Voltage- 1.8V or 3.3V): IO power supply

Additionally, the power input to the entire EVK circuit may be broken using the 1x horizontal 2-pin jumper labeled VCC. Note that this measurement will include the power consumed by the on-board flash memory chip MX25R1635FBDIL0, as well as inefficiencies in the 0.8V switching regulator TPS62801YKAT. The following photo shows the location of each power measurement jumper:

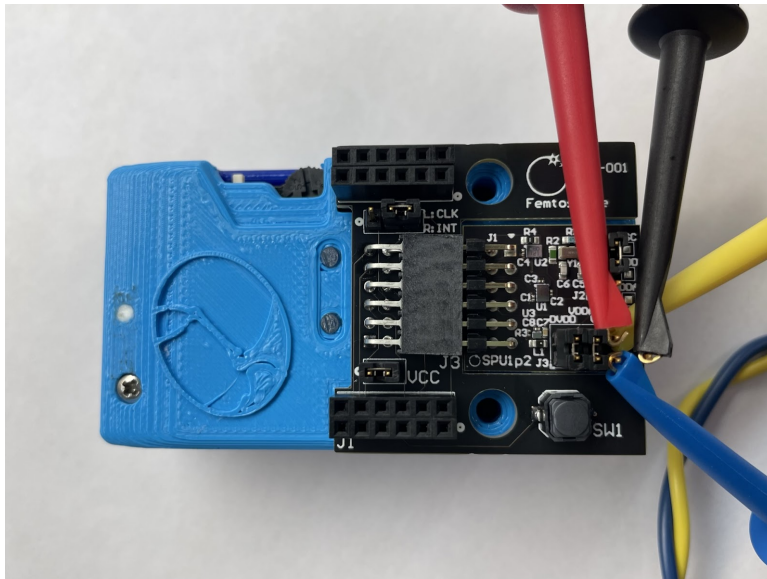


At Femtosense, the [Joulescope JS220](#) energy analyzer is used to simultaneously measure voltage and current on the 3 individual power rails. This instrument uses a shunt resistor sampled at 2MSPS, dynamically changing its resistance to minimize its voltage drop (“burden voltage”). It is important that your instrument does not create a significant burden voltage during measurement, particularly on VDD, where the SPU may spike to several milliamps during processing. In our measurements, VDD is maintained within 30mV of 0.8V at all times. The resolution of the Joulescope JS220 is 1.5uA, and its accuracy is +/-0.25% +/-15uA.

Application Note 004

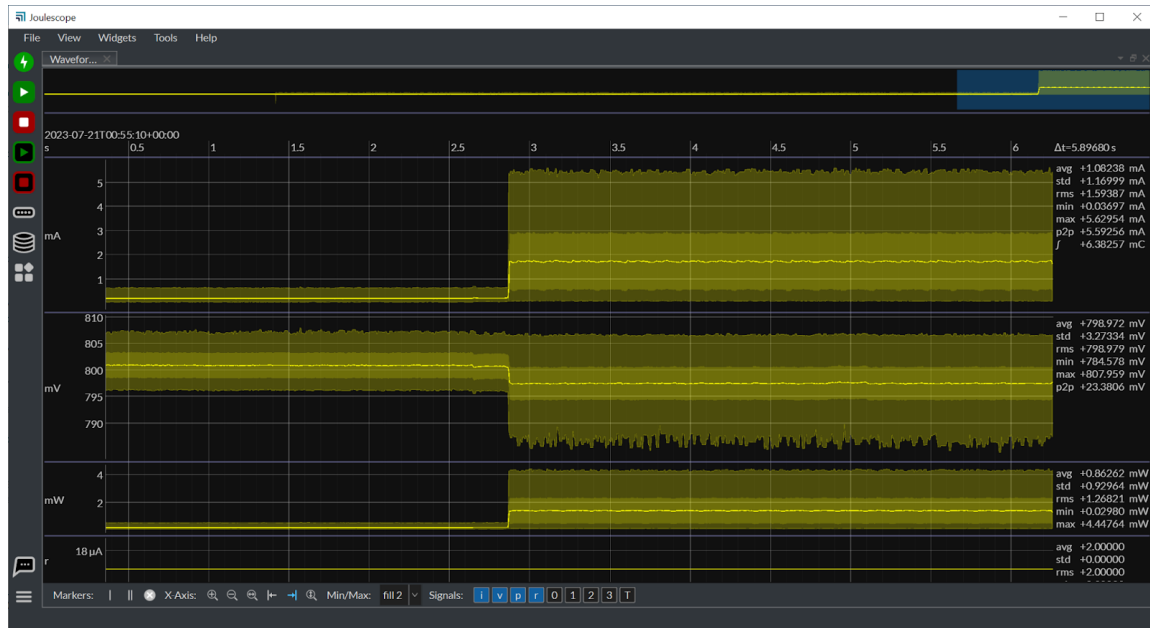
We have also produced similar measurements using a shunt resistor across the jumpers (<1 Ohm), amplifying the resistor's voltage using a discrete amplifier on a breadboard, and measuring the amplified signal with an oscilloscope. Calibration is necessary. If using this approach, be sure to individually measure the true values of the shunt resistor. A sourcemeter could also be used if the measurement sample rate is comparable to the Joulescope (connect across the negative terminal of the jumper and the EVK's ground post labeled VSS).

In order to measure power, connect your current and voltage probes according to the following photo. VDD measurement is shown, but the same method can be applied to VDDA, DVDD, or VCC.



Application Note 004

The screenshot below shows Current (first row), Voltage (second row), and Power (third row). Around $t=2.8\text{s}$, SPU001 starts processing, which can be seen as an increase in Current activity.



In order to measure average power consumption, take a long average, or zoom into the Current trace and select several periods of activity with your cursor. In this example, the period is 4ms, and we select 5 periods with the green cursor. The average power in this case (third trace) is $u=1.39038\text{mW}$ on VDD. A similar procedure can be used to measure the average power on VDDA and DVDD in order to obtain the total SPU001 consumption.



Application Note 004

An example of the average total power consumed on the 8ms AI Noise Reduction algorithm (AINRGP_16khz_4hop_8algo_v3) shown above is:

```
1395uW VDD
  34uW VDDA
  36uW DVDD (@3.3V, expect ~ $\frac{1}{3}$  power @1.8V)
```

1.465mW Total (Model On)

You can also measure the power when the model is turned off, but the chip is still powered. An example of this measurement is:

```
153uW VDD
  2uW VDDA
  9uW DVDD (@3.3V, expect ~ $\frac{1}{3}$  power @1.8V)
```

0.164mW Total (Model Off)

An example of the average total power consumed on the WWD algorithm (WWDSNIPS_8khz_16ms_v2) is:

```
176uW VDD
  21uW VDDA
  11uW DVDD (@3.3V, expect ~ $\frac{1}{3}$  power @1.8V)
```

0.208mW Total

Application Note 004

Change Log

| Version | Release Date | Description |
|---------|--------------|--|
| 1.0 | 2023-05-10 | Initial release |
| 1.1 | 2023-06-14 | Added info about VCC |
| 1.2 | 2023-07-23 | Updated with new models and WWD measurement examples |