UV LED Measurement, Part 2: How Good is Good Enough?

Editor's note: Part 1 of this column appeared in the Q3 2025 issue of UV+EB Technology *and stressed the importance of using a measurement instrument optimized for the source.*

Many companies already have a radiometer for broadband (mercury) sources. In most cases, this is not the right tool for measuring UV LEDs. Only you can decide if the values on your broadband radiometer are "good enough" to measure UV LEDs. Part 2 presents actual radiometer measurements to let you decide: "How good is good enough?"

Test Set-Up

For reference, the EIT 2.0 instrument responses of the bands used for this test are as follows:

- UVA: 320-390 nm
- UVV: 395-445 nm
- L-365: 340-392 nm
- L-385: 360-412 nm
- L-395: 370-422 nm
- L-405: 380-432 nm

Tests were performed using four different Excelitas AC 8150 UV LEDs (365, 385, 395 and 405 nm) as LED sources. The CWL of each LED was measured with a spectral radiometer.

- 365 LED CWL: 367.96 nm
- 385 LED CWL: 386.52 nm
- 395 LED CWL: 397.50 nm
- 405 LED CWL: 405.03 nm

Reflective surfaces were minimized with black tape. Each LED was warmed up for at least 10 minutes before any tests were run. Applied electrical power was set at 70% power. Measured irradiance (W/cm^2) was kept below 10 Watts/cm^2 on each run. The conveyor belt was well supported and ran at 25 feet per minute. The LED quartz window was 1.5 inches (3.81 cm) above the conveyor.

A total of four recently calibrated EIT 2.0 radiometers were used: two EIT 2.0 Power Puck II Profilers with UV-A, UV-B, UV-C and UV-V, and two LED (EIT 2.0 LEDCure Four Band Profilers with L-365, L-385, L-395 and L-405). Each instrument was set to a sample rate of 128 Hz (Smooth Profiler) and optics were cleaned per EIT 2.0's procedures. Each individual instrument was tested three times on each UV LED source type.

A total of 48 runs were used, and the data were compiled. The tests were conducted in our lab on a conveyor. The conveyor has a precision speed controller, and the units are supported by a metal plate under the belt. Conveyor and fixtures/alignment guides used are shown in Figures 4 and 5.

Figure 4. *Lab conveyor used for tests*

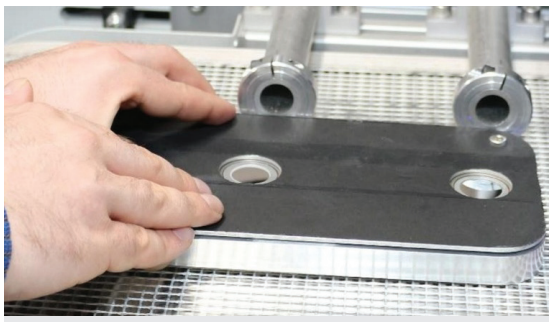

Figure 5. *Alignment fixture and locator guides to ensure the data is collected in the same position under the LED source on each run.*

Measurement Results/Notes

The Power Puck II readings from UV-B and UV-C were ignored. The analysis first looked at how the Power Puck II and LEDCure units compared to each other. When used on the correct source, it is normal to see +/- 5% as typical under controlled conditions. When units are not used on the correct source, higher variation would be expected.

The EIT 2.0 L-Band values were considered as the "reference." The Power Puck II values were compared to it for each appropriate band. Each irradiance measurement was kept under 10 W/cm^2. If measuring high-power LEDs with a broadband radiometer, you most likely are over-ranging it. (EIT 2.0 units will show *OR on the display if the unit over-ranges.)

Band	Power Puck II UV-A	LEDCure L-365	Difference %
W/cm²	2828.64	2531.09	+11.76
J/cm²	1163.77	1049.93	+10.84

Table 1. *Power Puck II UV-A to LEDCure L-365 Comparison*

365 Results: EIT Power Puck II UV-A to LEDCure L-365 (Table 1)
Same Unit Comparison Variation

- Power Puck II to Power Puck II UV-A: 2.04% W/2.65% J
- LEDCure L-365 to L-365 Variation: 2.76% W/2.20% J

Comments: The Power Puck II UV-A values were close to the LEDCure L-365 values, but you could be fooled into assuming there is more UV present than there really is.

Band	Power Puck II UV-A	LEDCure L-385	Difference %
W/cm²	1058.47	3025.50	-65.02
J/cm²	376.27	1057.07	-64.41

Table 2. *Power Puck II UV-A to LEDCure L-385 Comparison*

385 Results: EIT Power Puck II UV-A to L-385 (Table 2)
Same Unit Comparison Variation

- Power Puck II to Power Puck II UV-A: 10.11% W/10.34% J
- LEDCure L-385 to L-385 Variation: 2.91% W/2.67% J

Comments: The unit-to-unit matching on the Power Puck II is poor because the LED output is on the steep slope (as shown in Figure 3, Part 1). of the response and not matched to the instrument. The Power Puck II underreports the UV by 65% of the LEDCure value.

Band	Power Puck II UV-V	LEDCure L-385	Difference %
W/cm²	2746.73	3025.50	-9.21
J/cm²	975.55	1057.07	-7.71

Table 3. *EIT Power Puck II UV-V to L-385*

385 Results: EIT Power Puck II UV-V to L-385 (Table 3)
Same Unit Comparison Variation

- Power Puck II to Power Puck II UV-V: 4.37% W/3.94% J
- LEDCure L-385 to L-385 Variation: 2.91% W/2.66% J

Comments: The 385 LED source was at 386.52 nm. Greater variations are possible if the LED CWL is not centered near 385 nm.

Band	Power Puck II UV-A	LEDCure L-395	Difference %
W/cm²	253.46	3119.77	-91.875
J/cm²	81.20	1002.62	-91.901

Table 4. *Power Puck II UV-A to LEDCure L-395 Comparison*

395 Results: EIT Power Puck II UV-A to L-395 (Table 4)
Same Unit Comparison Variation

- Power Puck II to Power Puck II UV-A: 13.85% W/14.01% J
- LEDCure L-395 to L-395 Variation: 1.55% W/1.16% J

Comments: The UV-A band is not optimized for a 395 nm source.

Band	Power Puck II UV-V	LEDCure L-395	Difference %
W/cm²	4070.74	3119.77	+30.48
J/cm²	1302.26	1002.62	+29.89

Table 5. *Power Puck II UV-V to LEDCure L-395 Comparison*

395 Results: EIT Power Puck II UV-V to L-395 (Table 5)
Same Unit Comparison Variation

- Power Puck II to Power Puck II UV-V: 0.79% W/0.36% J
- LEDCure L-395 to L-395 Variation: 1.55% W/1.16% J

Comments: The Power Puck II overreports the values by 30% compared to the L-395 band. There could be differences based on the UV-V filter response, which normally does not impact broadband (mercury) readings.

Band	Power Puck II UV-V	LEDCure L-405	Difference %
W/cm²	3840.59	2724.81	+40.95
J/cm²	1380.53	968.54	+42.54

Table 6. *Power Puck II UV-V to LEDCure L-405 Comparison*

405 Results: EIT Power Puck II UV-V to L-405 (Table 6)
Same Unit Comparison Variation

- Power Puck II to Power Puck II UV-V: 2.35% W/2.39% J
- LEDCure L-405 to L-405 Variation: 1.77% W/1.65% J

Comments: The Power Puck II over-reports the UV values by over 40%. There could be differences based on the UV-V filter response, which normally does not impact broadband (mercury) readings.

LED Output	Power Puck II Band	Difference
365	UV-A	+11%
385	UV-A	-65%
385	UV-V	-9%
395	UV-A	-91%
395	UV-V	+30%
405	UV-V	+40%

Table 7. *Measurement differences*

Summary

The data collected for this column was collected under controlled, clean, ideal lab conditions on LED systems that had their CWL < 3 nm from the center wavelength. We only used readings under 10 Watts/cm^2 to avoid over-ranging the instrument. Measuring in a production environment without the ability to precisely control the variables could lead to even larger differences.

The question to ask yourself is, "How good is good enough?" If you elect to use the wrong instrument to measure a UV LED, you run the risk of being off by 9-91% from the value measured with a proper instrument (see Table 7).

Whether it is home repair or your UV process, the right tools (not whatever is lying around), used correctly and combined with some common sense make the difference.

Acknowledgement: Thanks to Lev Axler from EIT 2.0 for the data collection and initial analysis. These results were presented at the 2025 RadTech Conference in Detroit.

Parting Shot

As I have gotten older, I have learned to "Call the guy" when a lot of gravity (high ladders) is involved.

The good news is that last week I used a piece of wood that I had saved for nine years. Any suggestions on what to do about my collection of Amazon delivery boxes? ◆

Jim Raymont
Director of Sales
EIT 2.0 LLC
jraymont@eit20.com