

Feasibility Study of UV Intensity Monitoring in Water Disinfection Systems using Reverse-Biased LED Photometers

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Figure S1. UV lamp monitoring alternatives tree diagram, where (A) and (B) can be used for external devices, (C), and (D) and (E) can be used for internal components.

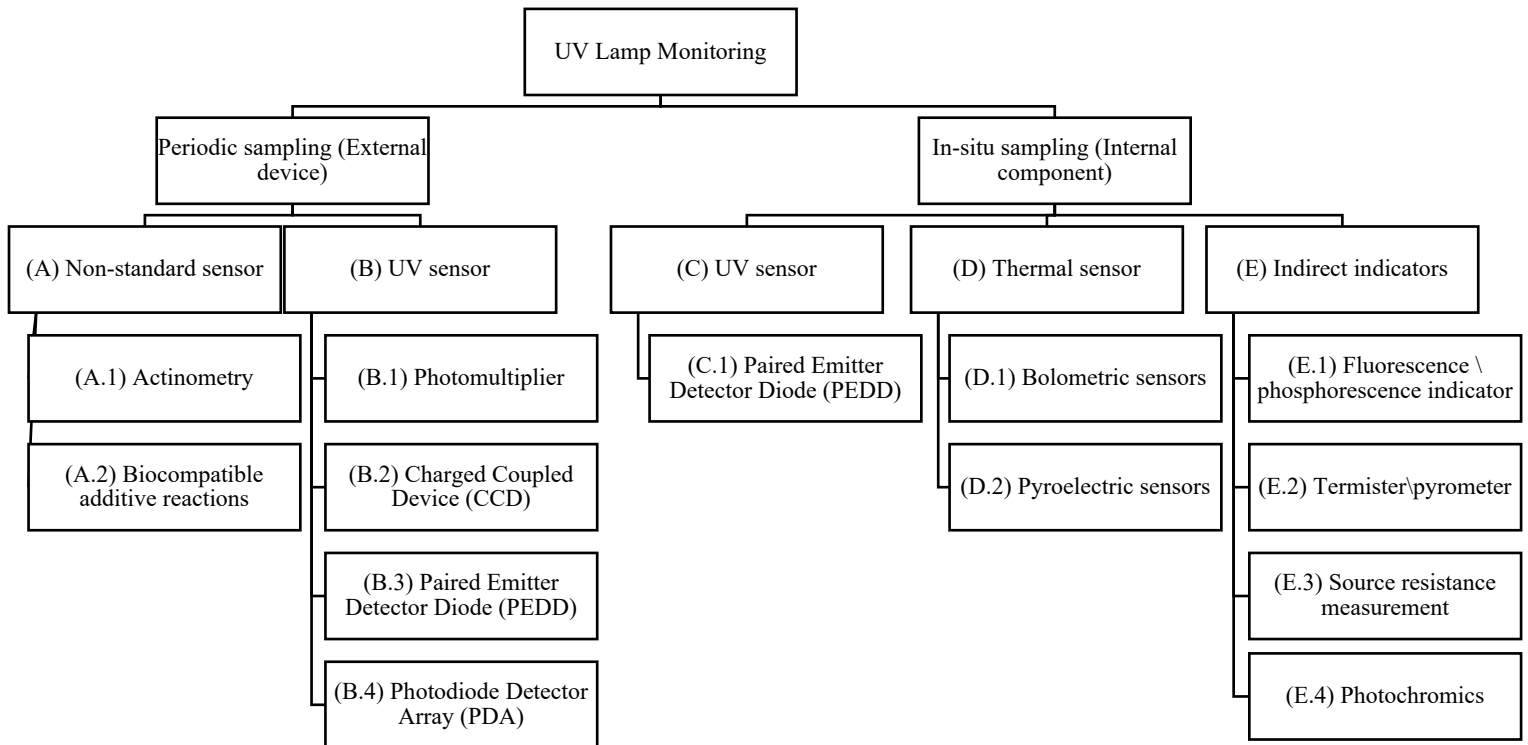


Figure S2. Violumas VC12X1C48LB-275 LED Strip Spectrum Measured by Ocean Optics USB4000 Spectroradiometer

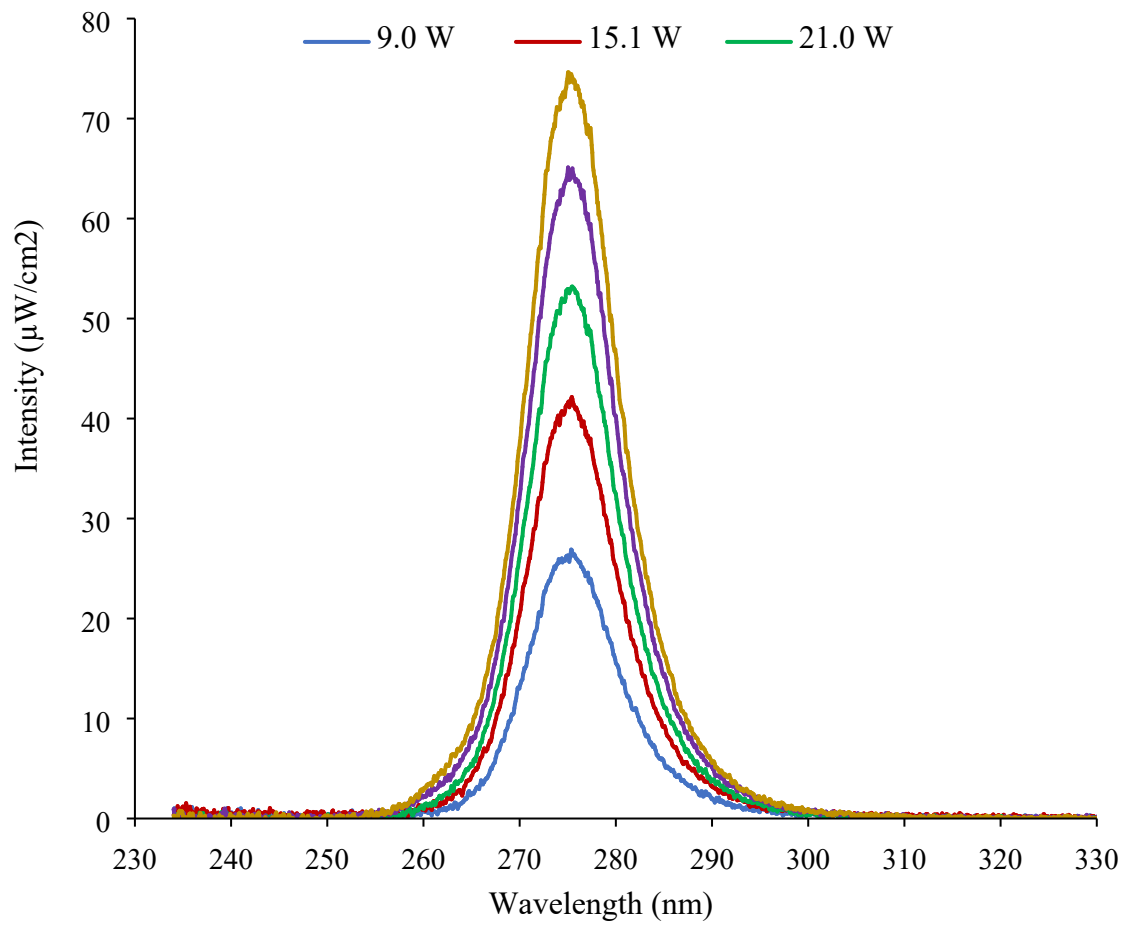


Figure S3. Neutral Density (FDU-0.4, OFR, NJ, USA) Transmittance Spectrum

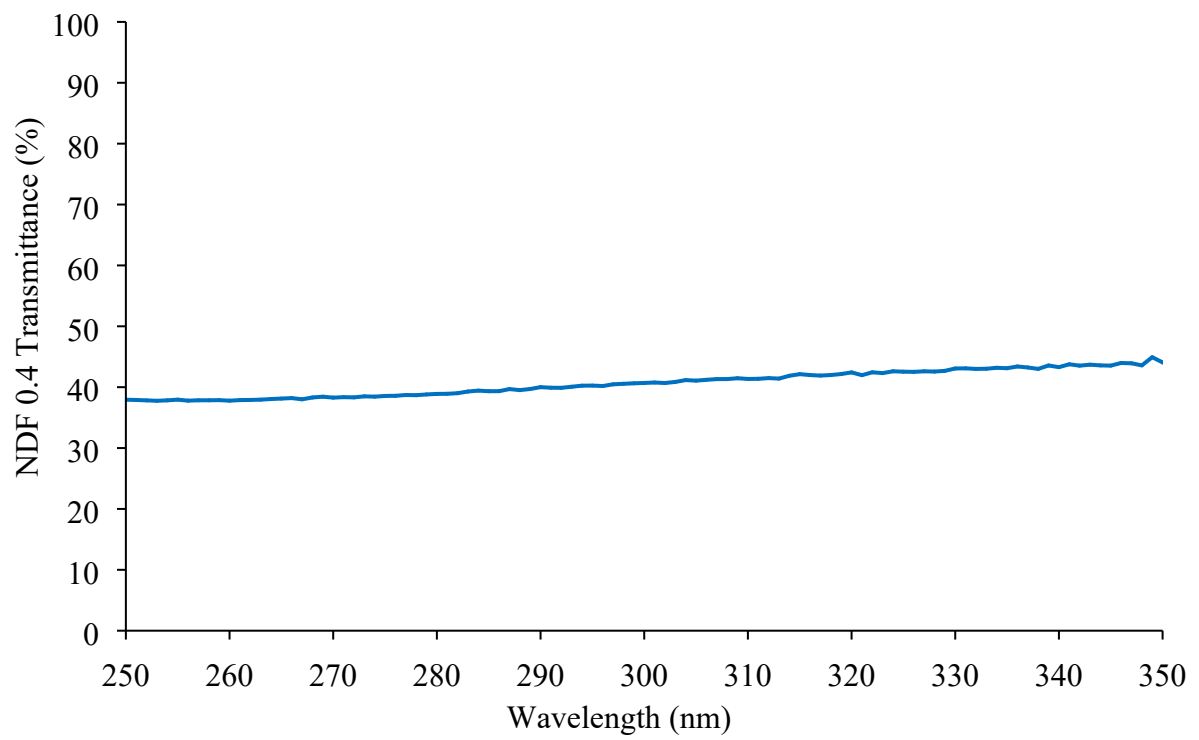


Figure S4. Photo of study set up

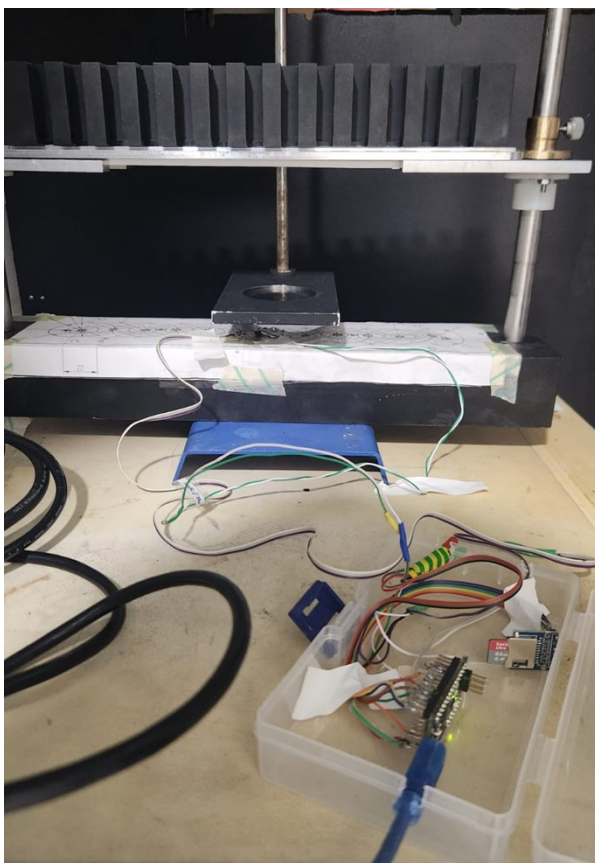


Figure S5. Electrical circuit diagram rLED configuration

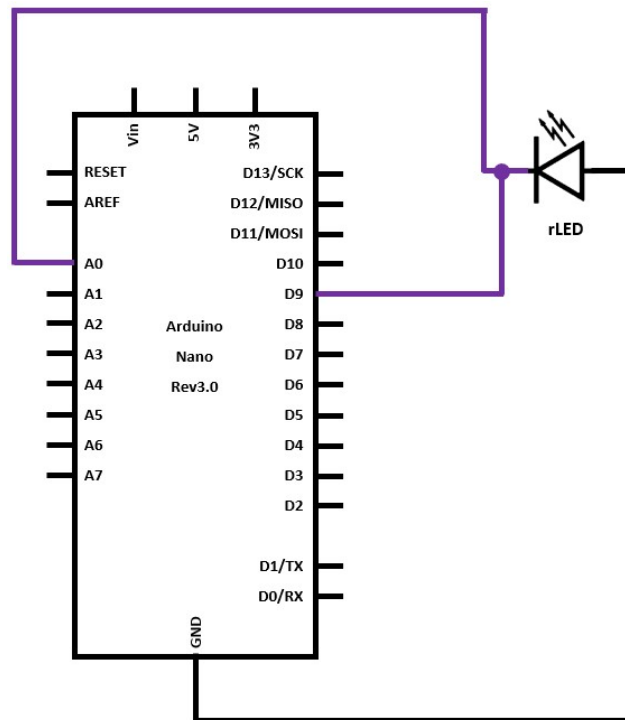


Figure S6. Electrical circuit diagram thermal influence configuration

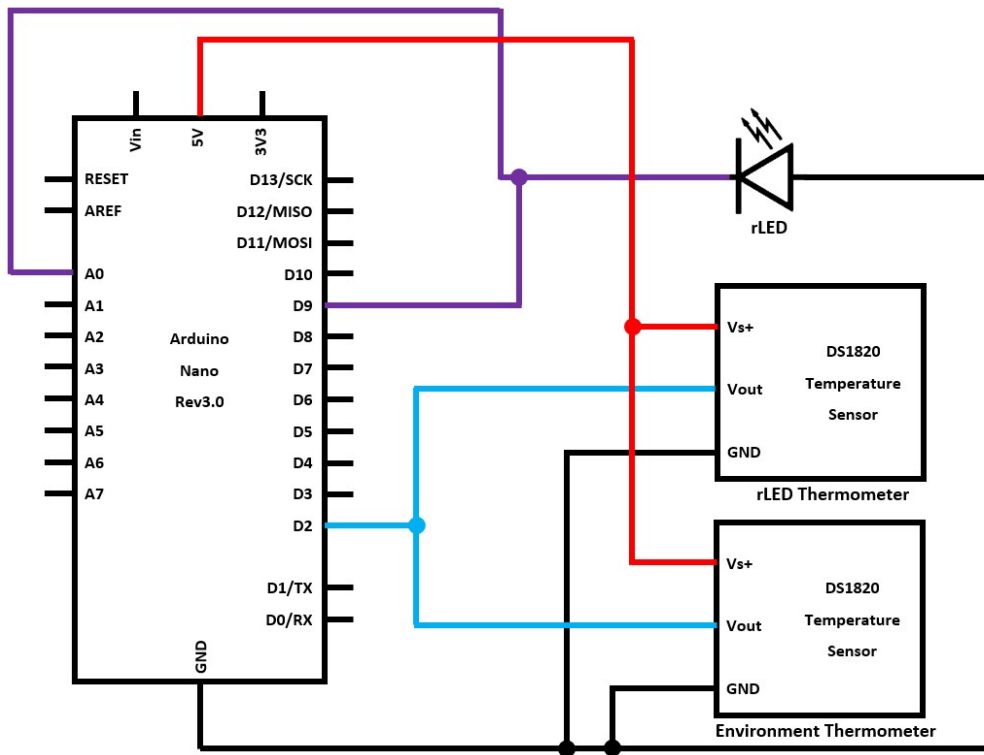
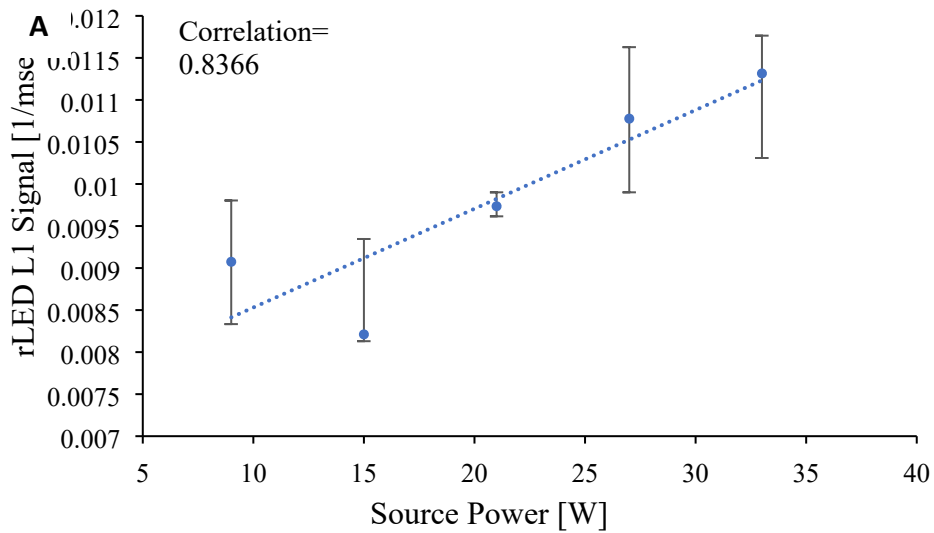
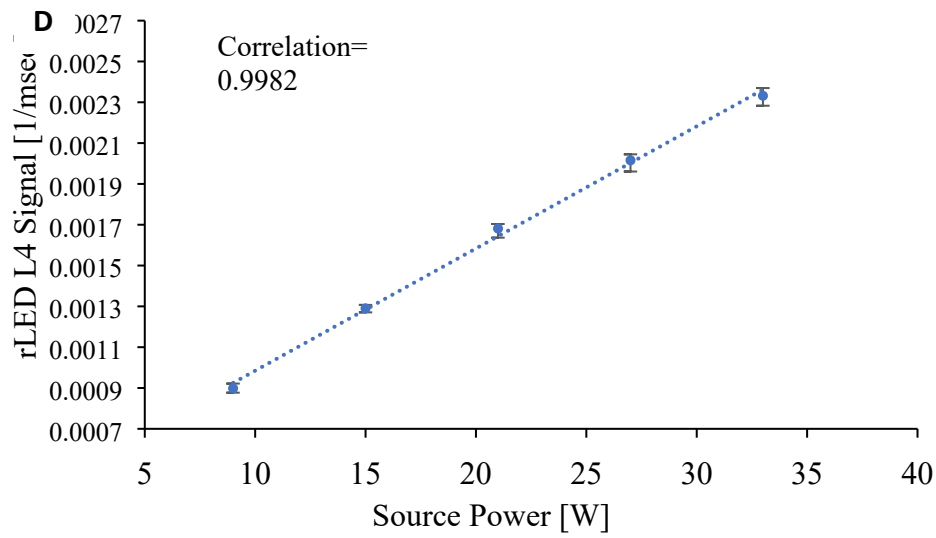
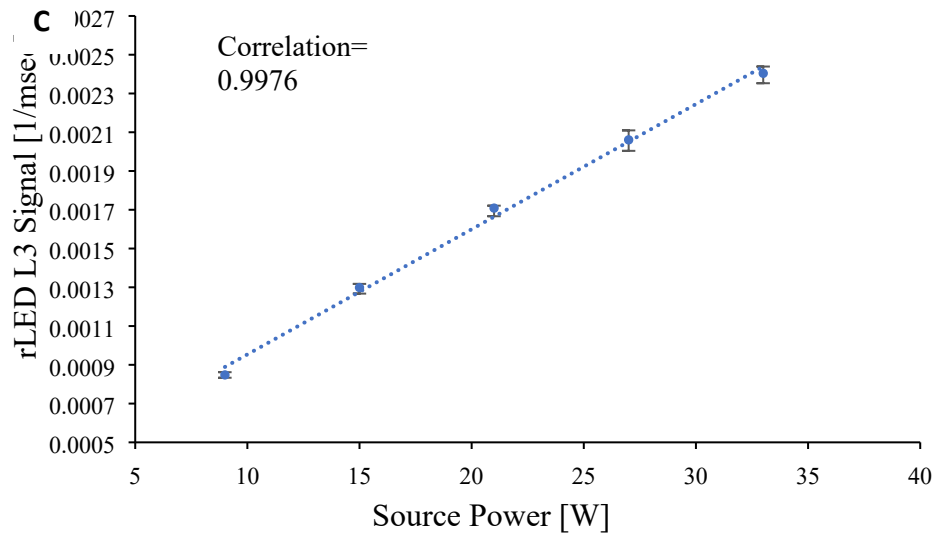
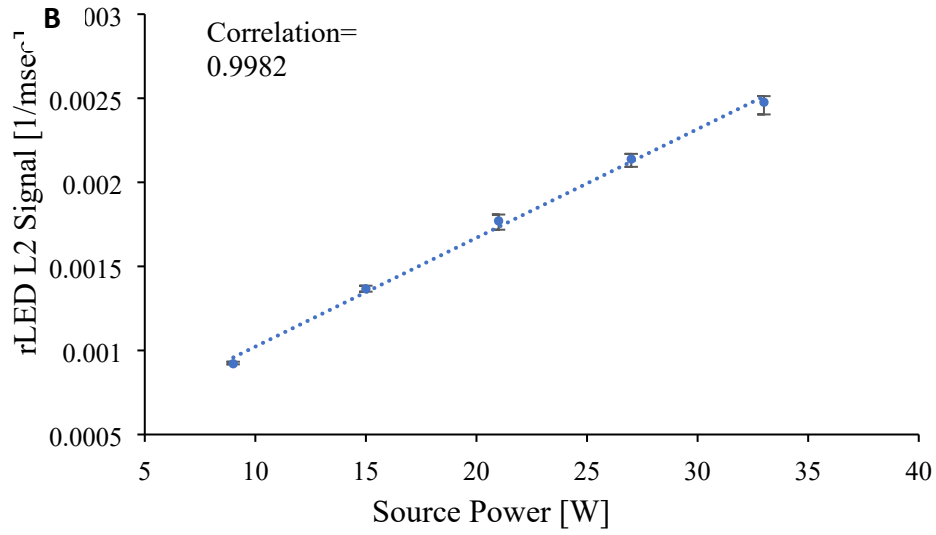
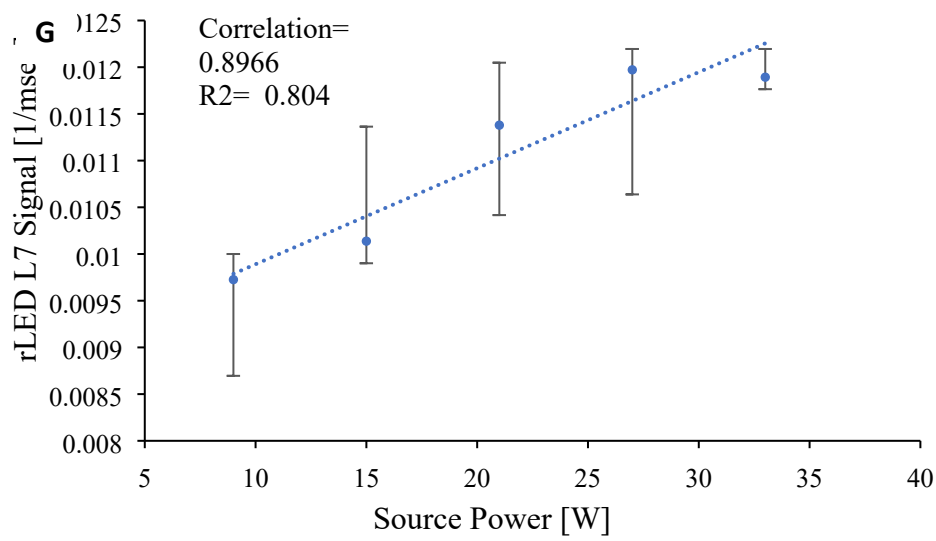
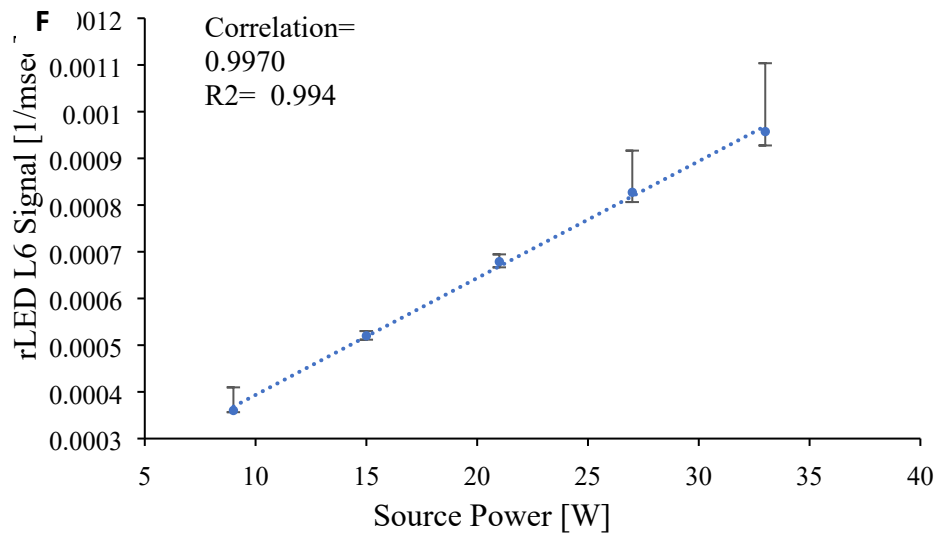
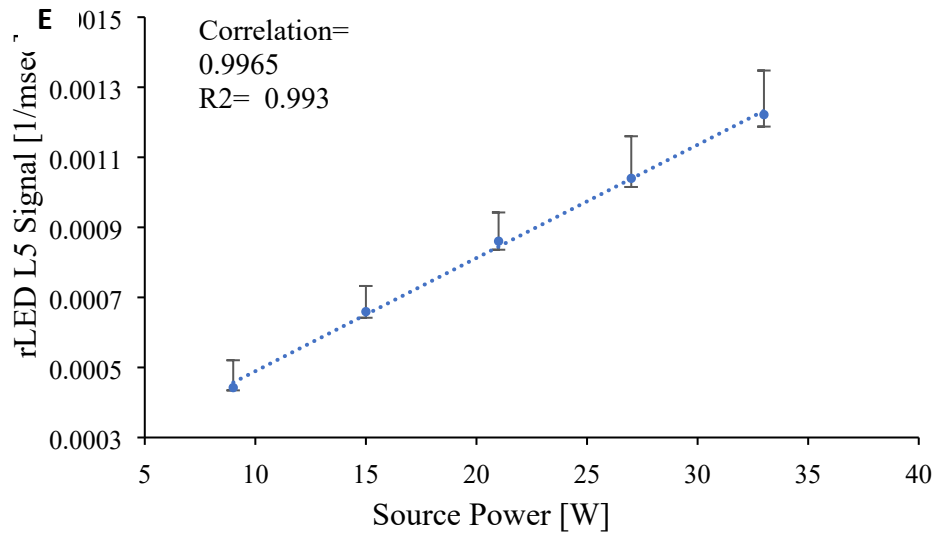


Figure S7. Correlation between source power and rLED output, each fig represents different rLED as following (A)L1 (B)L2 (C)L3 (D)L4 (E)L5 (F)L6 (G)L7 (H)L8 (I)L9 (J)L10







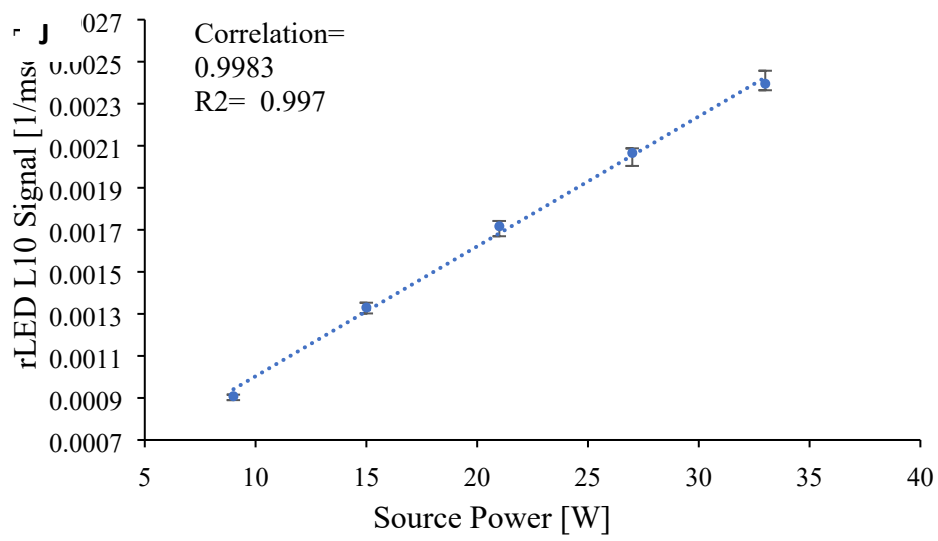
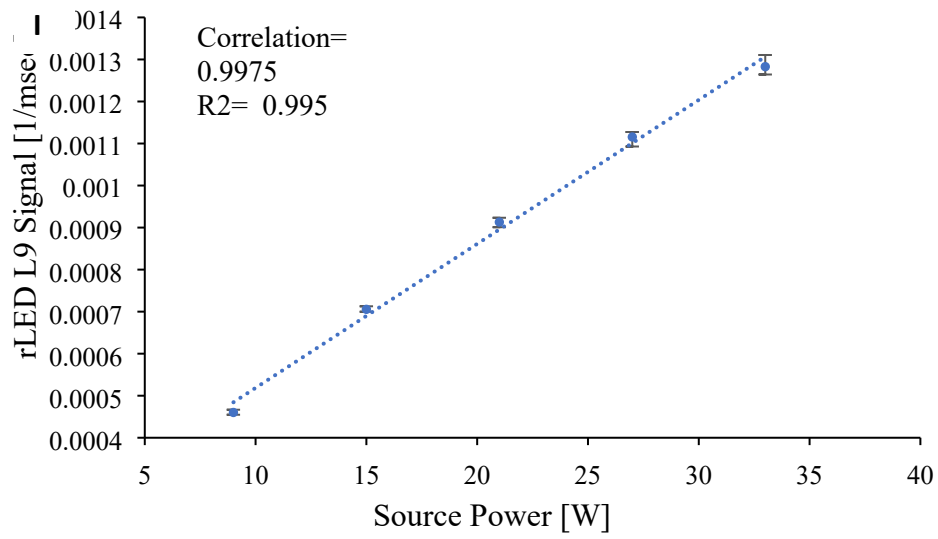
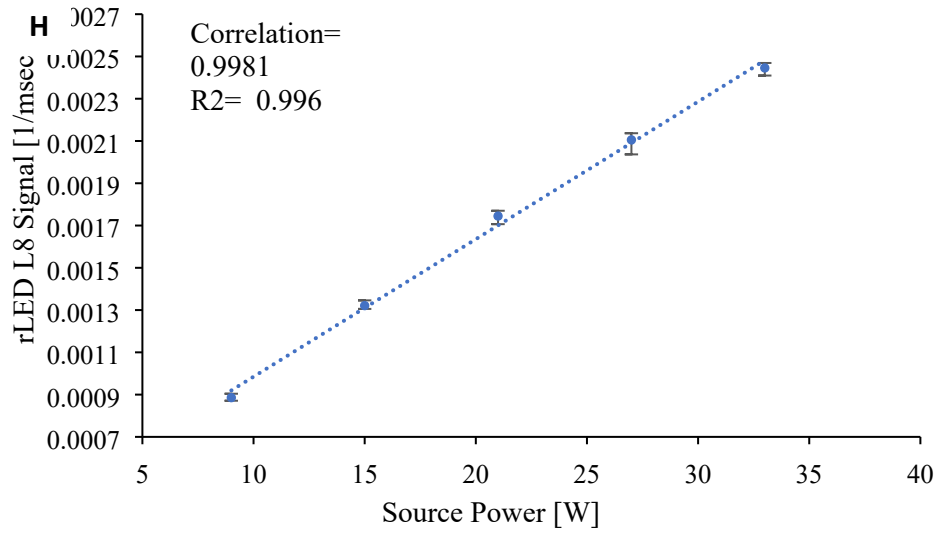


Table S4. rLED spectroradiometer measurements and the normalized values

| Sensor ID | Source Power [W] | Mean | Range | Maximum | Measurements Normalized by maximum |
|-------------------|------------------|-----------|-----------|----------|------------------------------------|
| OceanOpticsSensor | 9 | 3.39E+02 | 0.000E+00 | 3.39E+02 | 3.47E-01 |
| | 15 | 5.38E+02 | 0.000E+00 | 5.38E+02 | 5.50E-01 |
| | 21 | 6.79E+02 | 0.000E+00 | 6.79E+02 | 6.94E-01 |
| | 27 | 8.460E+02 | 0.000E+00 | 8.46E+02 | 8.64E-01 |
| | 33 | 9.79E+02 | 0.000E+00 | 9.79E+02 | 1.00E+00 |
| L1 | 9 | 9.07E-03 | 1.47E-03 | 9.80E-03 | 7.71E-01 |
| | 15 | 8.21E-03 | 1.22E-03 | 9.35E-03 | 6.98E-01 |
| | 21 | 9.73E-03 | 2.86E-04 | 9.91E-03 | 8.25E-01 |
| | 27 | 1.08E-02 | 1.73E-03 | 1.16E-02 | 9.16E-01 |
| | 33 | 1.13E-02 | 1.45E-03 | 1.18E-02 | 9.62E-01 |
| L2 | 9 | 9.21E-04 | 1.54E-05 | 9.33E-04 | 3.66E-01 |
| | 15 | 1.37E-03 | 3.55E-05 | 1.38E-03 | 5.44E-01 |
| | 21 | 1.77E-03 | 9.01E-05 | 1.81E-03 | 7.05E-01 |
| | 27 | 2.14E-03 | 7.71E-05 | 2.17E-03 | 8.51E-01 |
| | 33 | 2.47E-03 | 1.09E-04 | 2.51E-03 | 9.85E-01 |
| L3 | 9 | 8.48E-04 | 2.87E-05 | 8.62E-04 | 3.48E-01 |
| | 15 | 1.30E-03 | 5.01E-05 | 1.32E-03 | 5.32E-01 |
| | 21 | 1.71E-03 | 5.45E-05 | 1.72E-03 | 7.01E-01 |
| | 27 | 2.06E-03 | 1.06E-04 | 2.11E-03 | 8.45E-01 |
| | 33 | 2.40E-03 | 8.61E-05 | 2.44E-03 | 9.86E-01 |
| L4 | 9 | 8.98E-04 | 4.45E-05 | 9.22E-04 | 3.79E-01 |
| | 15 | 1.29E-03 | 3.65E-05 | 1.31E-03 | 5.44E-01 |
| | 21 | 1.68E-03 | 6.69E-05 | 1.70E-03 | 7.09E-01 |
| | 27 | 2.02E-03 | 8.42E-05 | 2.04E-03 | 8.51E-01 |
| | 33 | 2.33E-03 | 8.66E-05 | 2.37E-03 | 9.84E-01 |

| | | | | | |
|-----|----|----------|----------|----------|----------|
| L5 | 9 | 4.42E-04 | 8.60E-05 | 5.21E-04 | 3.28E-01 |
| | 15 | 6.59E-04 | 9.07E-05 | 7.33E-04 | 4.89E-01 |
| | 21 | 8.60E-04 | 1.06E-04 | 9.42E-04 | 6.38E-01 |
| | 27 | 1.04E-03 | 1.45E-04 | 1.16E-03 | 7.72E-01 |
| | 33 | 1.22E-03 | 1.60E-04 | 1.35E-03 | 9.07E-01 |
| L6 | 9 | 3.60E-04 | 5.32E-05 | 4.10E-04 | 3.26E-01 |
| | 15 | 5.20E-04 | 1.84E-05 | 5.30E-04 | 4.71E-01 |
| | 21 | 6.79E-04 | 2.78E-05 | 6.94E-04 | 6.15E-01 |
| | 27 | 8.27E-04 | 1.10E-04 | 9.17E-04 | 7.49E-01 |
| | 33 | 9.57E-04 | 1.76E-04 | 1.10E-03 | 8.67E-01 |
| L7 | 9 | 9.77E-03 | 1.30E-03 | 1.00E-02 | 7.97E-01 |
| | 15 | 1.01E-02 | 1.46E-03 | 1.14E-02 | 8.31E-01 |
| | 21 | 1.14E-02 | 1.63E-03 | 1.20E-02 | 9.33E-01 |
| | 27 | 1.20E-02 | 1.56E-03 | 1.22E-02 | 9.82E-01 |
| | 33 | 1.19E-02 | 4.30E-04 | 1.22E-02 | 9.75E-01 |
| L8 | 9 | 8.86E-04 | 3.31E-05 | 9.04E-04 | 3.59E-01 |
| | 15 | 1.32E-03 | 4.04E-05 | 1.35E-03 | 5.35E-01 |
| | 21 | 1.74E-03 | 6.34E-05 | 1.77E-03 | 7.07E-01 |
| | 27 | 2.10E-03 | 1.00E-04 | 2.14E-03 | 8.53E-01 |
| | 33 | 2.45E-03 | 5.95E-05 | 2.47E-03 | 9.90E-01 |
| L9 | 9 | 4.60E-04 | 1.19E-05 | 4.66E-04 | 3.51E-01 |
| | 15 | 7.05E-04 | 1.30E-05 | 7.13E-04 | 5.38E-01 |
| | 21 | 9.13E-04 | 2.25E-05 | 9.23E-04 | 6.97E-01 |
| | 27 | 1.12E-03 | 3.45E-05 | 1.13E-03 | 8.51E-01 |
| | 33 | 1.28E-03 | 4.64E-05 | 1.31E-03 | 9.79E-01 |
| L10 | 9 | 9.08E-04 | 2.61E-05 | 9.16E-04 | 3.70E-01 |
| | 15 | 1.33E-03 | 5.11E-05 | 1.35E-03 | 5.41E-01 |

| | | | | | |
|--|----|----------|----------|----------|----------|
| | 21 | 1.72E-03 | 7.27E-05 | 1.74E-03 | 6.99E-01 |
| | 27 | 2.07E-03 | 8.37E-05 | 2.09E-03 | 8.41E-01 |
| | 33 | 2.39E-03 | 9.29E-05 | 2.46E-03 | 9.75E-01 |

Figure S8. 365nm/3W rLED normalized light intensity measurements during long term exposure.

