# Ultraviolet

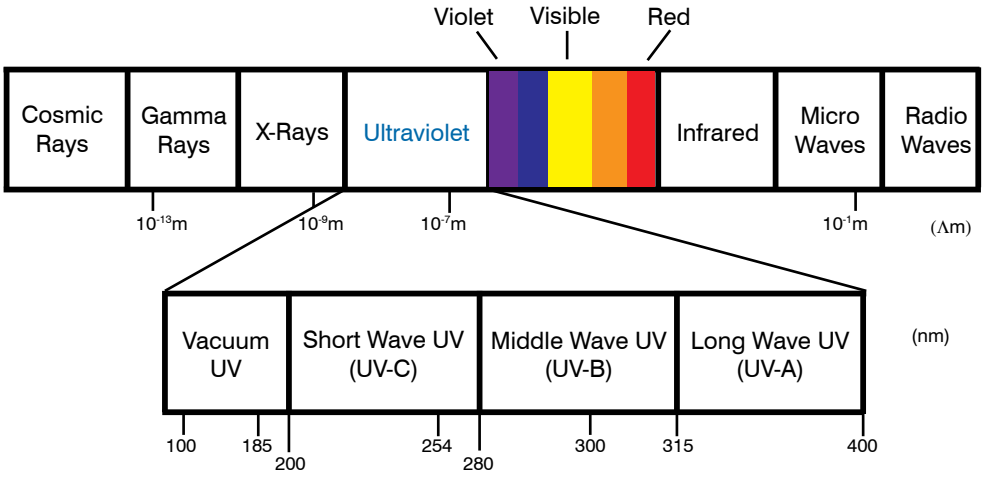
Ultraviolet electromagnetic radiation, commonly known as UV, is currently employed in many industries and applications. The emerging UV LEDs will be an enabling, competitive technology that drives new and innovative applications.

OPTEK's OUE8A Series of Ultraviolet LEDs in the UV-A range are intended to be used in Medical and Industrial applications. The series is packaged in a hermetic metal can package and offers a uniform optical light pattern and enhanced temperature range. OPTEK's OUE8A Series has a long operating life and eliminates environmental concerns associated with the disposal issues associated with traditional mercury UV lamps. The UV-A LED allows the designer the ability to target specific applications with narrow wavelength emission while also eliminating any mercury hazard. These devices provide excellent optical intensity providing a uniform optical light pattern to the target while also minimizing stay UV-A light that could be a safety concern.

**FEATURES:**

- **Center wavelengths from 375nm to 425nm**
- **Uniform optical light pattern**
- **Hermetic metal can TO-46 package**
- **Long Operating Life**
- **Environmentally Friendly**
- **RoHs Compliant**
- **ESD protected for reliable operation**

Electromagnetic Radiation Spectrum




# THE UV SPECTRUM

The Ultraviolet spectrum lies between the visible light range the human eye can detect and x-rays. The term Ultraviolet refers to all electromagnetic radiation with wavelengths in the range of 10 to 400 nanometers. In addition, there are several classifications inside of the UV range: UV-A, UV-B, and UV-C.

**UV-A** The UV-A range includes wavelengths from 315 to 400 nanometers which have the least amount of energy. Wavelengths in the UV-A range are used for currency validation, industrial curing, phototherapy, and for forensic / analytical instruments. UV-A wavelengths from 315 to 345 nm are used for sun tanning and are a suspected cause for premature aging of human skin. Most of the UV-A range can not be seen by the human eye. At approximately 385-390nm and below the human eye can not detect UV. Therefore it is essential to take precautions to protect your eyes and skin when working with UV light sources.

**UV-B** The UV-B range refers to wavelengths from 280 to 315 nanometers. These wavelengths are more hazardous than UV-A wavelengths, and are largely responsible for sunburn. The UV-B range is used in forensic and analytical instruments and for the more recent narrow band UV-B phototherapy skin treatments for Psoriasis (308-311nm). UV-B does not penetrate as deeply in the skin as UV-A, however, the deadliest types of skin cancer (malignant melanomas) start in the epidermis, an upper layer of the skin. UV-B is largely blamed for these cancers although shorter UV-A wavelengths are considered possibly cancer-causing as well.

**UV-C** The UV-C range refers to shorter UV wavelengths, usually 200 to 280 nanometers and is sometimes referred to as the Deep UV Range. Wavelengths in the UVC range, especially from the low 200's to about 275 nm, are especially damaging to microorganism's DNA. UV-C is often used for germicidal applications for water, air and surface decontaminations. The earth's atmosphere absorbs most of the UV-C radiated by the sun.
Vacuum UV – This range has the shortest wavelengths and highest energy level from 10 to 200 nm and are absorbed by the atmosphere. The strong absorption of Vacuum UV in the Earth's atmosphere is due to the presence of oxygen. State of the art semiconductor photolithography processes seek to use shorter UV wavelengths to manufacture the next generation of smaller IC chips.

| Some typical effects caused by Ultraviolet Electromagnetic radiation are: | |
|---|---|
| UV-A | Many organic & inorganic materials fluoresce under UV light. |
| UV-A and UV-B | Certain materials, such as adhesives and coatings undergo polymerization chemical reactions (curing) when exposed to UV light. |
| UV-A and UV-B | Electromagnetic radiation is used for phototherapy to treat certain types of skin conditions such as psoriasis. |
| UV-C | DNA of harmful microorganisms can be inactivated by UV radiation which is used in germicidal applications. The germicidal range is roughly between 225nm and 300nm. |
| Note: OPTEK UV products are in the UV-A spectrum. This information is provided only for information purposes. | |

| | Part Number | Peak Wavelength (nm) $1_F$ = 100 mA range | | Optical Power Output (mW) $1_F$ = 100 mA | |
|---|---|---|---|---|---|
| | | Minimum | Maximum | Minimum | Maximum |
|  18° Emission Angle | OUE8A380Y1 | 375 | 380 | 1.8 | 8.1 |
| | OUE8A385Y1 | 380 | 385 | 1.8 | 8.1 |
| | OUE8A390Y1 | 385 | 390 | 1.8 | 8.1 |
| | OUE8A395Y1 | 390 | 395 | 3.1 | 9.8 |
| | OUE8A400Y1 | 395 | 400 | 5.8 | 13.4 |
| | OUE8A405Y1 | 400 | 405 | 5.8 | 13.4 |
| | OUE8A410Y1 | 405 | 410 | 5.8 | 13.4 |
| | OUE8A415Y1 | 410 | 415 | 7.3 | 15.4 |
| | OUE8A420Y1 | 415 | 420 | 7.3 | 15.4 |
| | OUE8A425Y1 | 420 | 425 | 7.3 | 15.4 |

Part Number Guide

OUE8 A XXX Y 1

- OUE8: Optek UV TO-46 LED Series
- A: Sequence Numbers (A→Z)
- XXX: Wavelength (nm) Identifier
- Y: Power Output (mW) - A through J
- 1: Packaging 1 – Tray Pack

## UV Equipment Market Overview and Applications

| Markets & Applications | UV Market Segments | UV-C 200 - 280nm | UV-B 280 - 315nm | UV-A 315 - 400nm |
|---|---|---|---|---|
| Air Disinfection | Hospital, Commercial, Home, Car | X | O | X |
| H2O Disinfection | Municipal, Residential, Pool, Spas | X | O | |
| Disinfection - Other | Food, Beverage, Documents | X | | |
| Currency, Security | Passport, Stock Certificates, Stores, ATMs, Currency Counters | | | X |
| Photo Polymerization | Adhesives, Coatings, Paints, Flooring, Ink jet & Digital Printing | X | X | X |
| Medical | Skin Dermatology, Tanning, Instruments | | X | X |
| US Military | Aircraft Coatings, Germ Warfare | X | X | X |
| EPROM Erasure | Re-programming EPROM ICs | X | | |
| US Forensic, Automotive | Crime Scene, Engine Oil, A/C, Brake Fluid Detection, Scientific | | O | X |

X - Defines primary UV range for these applications
O - Defines secondary UV range for these applications
Blank - Defines ranges not effective

### WARNINGS AND HANDLING INSTRUCTIONS

UV-LEDs emit invisible ultraviolet radiation when in operation, which may be harmful to eyes or skin, even for brief periods. Do NOT look directly into the UV-LED during operation. Be sure that you and all persons in the vicinity wear adequate "UV" Safety protection fore eyes and skin. If you incorporate a UV-LED into a product, be sure to provide appropriate WARNING labels.





## TYPICAL APPLICATIONS

Paper currency & document validation:

Protecting the integrity of paper currency and other important financial documents such as stock & bond certificates against counterfeiting is fundamental to a sound monetary system. New anti-counterfeiting measures implement use of watermarks, updated colors, microprinting and security threads that emit a different color under ultraviolet radiation based on specifications. US passports and many credit cards have implemented UV threads and materials in their anti-counterfeiting efforts. Tomorrow's technology might include inserting a UV-LED emitter in cell phones that would allow consumers to validate the integrity of currency.

British currency illumination:


365nm UV-A light Fluorescent light

Photo-catalyst curing of inks & adhesives

UV curing uses electromagnetic energy (Photo Energy) to start a chemical reaction known as "photo polymerization". A mixture of fillers, wetting agents, monomers, oligimers and photo-initiators create polymer chains when UV light is used. UV curing eliminates VOCs (volatile organic compounds), promotes healthier and safer work environments, improves manufacturing yields, lowers operating energy cost with a much smaller UV equipment footprint than traditional methods, and because UV is a "cure on demand process" working time is more efficient.

Spectroscopy

The medical analytical instrument market also utilizes UV light sources in fluorescence spectroscopy and Ultraviolet-visible spectroscopy. Fluorescence spectroscopy is a type of electromagnetic spectroscopy which analyzes the fluorescence emitted from a sample being irradiated and evaluated. The light source is generally UV to excite the electrons in the specimen to emit light of a lower energy level usually in the visible spectrum. In fluorescence spectroscopy, the sample is excited, by absorbing the higher energy UV light, causing the sample to move from its ground electronic state to one of the various vibrational states in the excited electronic state. Analysis of the emission spectrum will permit the identification of the substance (chemical compound, tumor, food processing, cancer tumor). Fluorescence spectroscopy is also used in forensics and chemical research fields. Ultraviolet-visible spectroscopy (UV/ VIS) uses multiple wavelengths of light in the visible, ultraviolet and near infrared ranges.

Medical and Forensic

Phototherapy treatment: medical treatment for skin conditions using light
Dental applications: curing cavity fillings, brightening, instrument & toothbrush sterilization
Fluorescence spectroscopy: forensics and chemical research industries
Ultraviolet-visible spectroscopy: (ultraviolet and near IR range)

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OPTEK is a leading manufacturing and solutions provider for sensing and illumination covering the infrared, visible and ultraviolet spectrum; with standard as well as application specific products for a variety of markets, including, but not limited to office machines, industrial equipment, encoders, automotive electronics, military and high-reliability applications, medical diagnostic equipment and solid-state lighting.