iCOMBAT Research Division
P: 888-950-1221
F: 262-458-1010
www.icombat.com
iCOMBAT *is a division of Universal Electronics, Inc.*

ICOMBAT SAFETY REPORT: SAFE FOR EYE USE

The entire family of iCOMBAT products that emit any sort of light is completely eye safe. The laser tag units that iCOMBAT manufactures emit an invisible, harmless light just like all standard television remote controls. Despite the use of "lasers emitters," no lasers are actually used.

Unlike many standard products such as CD and DVD players which use lasers, iCOMBAT units use infrared laser diodes or light emitting diodes (IRED's or LED's.) These same diodes are used in consumer products and various remote control systems.

LED's and IRED's are basically small light bulbs that emit invisible infrared light. This invisible infrared light emits light over a very narrow bandwidth, unlike incandescent lamps which emit over a broad range of wavelengths.

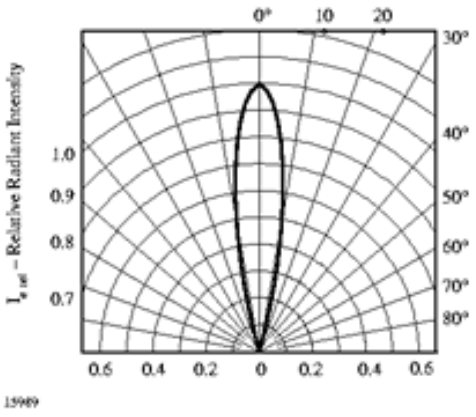
Eye Safety of Diode Emitters

There have been no reports on eye injuries caused by either working or non-working diode emitters worldwide. Some confusion might result from the term "laser tag" when talking about the products. The phrase originated in the 1970's following the launch of the Star Wars movies and subsequent popularity of indoor laser tag.

The use of the word "laser" is simply a marketing term. It is actually an acronym for *light amplifications by stimulated emission of radiation*. There are no lasers used in iCOMBAT equipment. Safe infrared light is used instead. Infrared is a non-coherent light, similar to what the sun produces in mass quantity. The potential danger lays with the coherent light that lasers use, which isn't found naturally in nature.

Figure 1: Dispersal of Light

As shown, the light beam is not coherent – rather it is dispersed. It does not travel in a straight line. The beam's angle of half intensity is + or – 10 degrees.



Viewing the infrared light that iCOMBAT units output require a darker room and special infrared (IR) camera. This proves that the iCOMBAT units have an output far smaller than the amount produced by the sun every day.

The light emitted by iCOMBAT units is incoherent. Sources of incoherent light can be viewed safely because the light reaching the eye is only a small portion of the total output and the energy is spread over the entire retina.

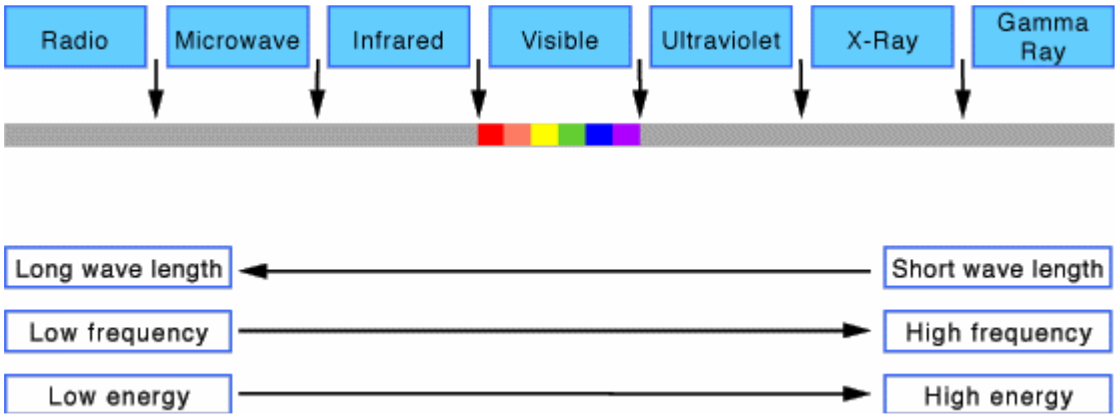
Vishay, the manufacturer of the emitter in iCOMBAT units, states recent studies performed in the USA have shown that eye injuries due to even the brightest LED's available are impossible.

A light wave consists of energy in the form of electric and magnetic fields. The fields vibrate at right angles to the direction of movement of the way and at right angles to each other. Because light has both electric and magnetic fields, it is also referred to as electromagnetic radiation.

Light waves come in many sizes. The size of a wave is measured as its wavelength, which is the distance between any two corresponding points on successive waves (usually peak to peak or trough to trough). The wavelengths of the light we can *see* range from 400 to 700 billionths of a meter, also known as a nanometer (nm). However, the full range of wavelengths included in the definition of electromagnetic radiation extends from one billionth of a meter (gamma rays) to centimeters and meters (radio waves). Light is one small portion of the spectrum. (http://science.howstuffworks.com/light2.htm).

There is a visible spectrum of light. Visible light starts at red with the least amount of energy and spreads out to violet, which has the most energy.

Figure 2: Electromagnetic Spectrum

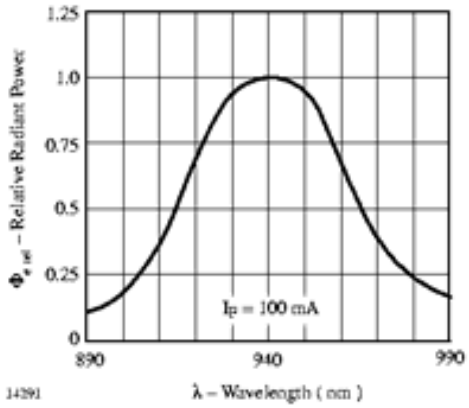


Lasers are categorized between Class I and Class IV depending on the amount of damage they can cause. According to Vishay's documentation, a standard

application of the TSAL emitter is less than the Class I classification. This means the iCOMBAT infrared emitter is safer under all reasonable conditions.

Figure 3: Peak Wavelength

The peak wavelength used in iCOMBAT emitters is 940nm.



The manufacturer's fact sheets on the emitter used in iCOMBAT units can be found in the following locations:

http://www.vishay.com/docs/81934/eyesafe.pdf

http://www.vishay.com/docs/81935/eyesafe.pdf

The complete datasheet is here: http://www.vishay.com/docs/81009/tsal6100.pdf

iCOMBAT Recommendations

iCOMBAT units are designed to operate at safe levels and do not constitute any form of health hazard provided normal safety precautions are taken. They are NOT lasers and are not considered to be dangerous to the unshielded eye. However, as with any light source, iCOMBAT recommends that the user takes precautions to avoid unnecessary exposure. For example, if heat or discomfort is felt, avoid continuing to use the product or staring into the light source.

All light emitting iCOMBAT products contain an FDA approval and warning sticker depending on the type of diode used.