NOMOY PET LED CALCIUM LAMP 5.0 AND 10.0 REPORT

An investigation into the UVB LED Lamps from Nomoy Pet.

Thomas Griffiths, 2023
tom@tomaskas.co.uk
V 3.2.23

Tomaskas Ltd

TABLE OF CONTENTS

Disclaimer 1

REASONS FOR TEST 2

TERMINOLOGY USED 4

Kit 4
Lamp/Unit 4
Diode/LED 5
UVI 5
UVB 5
Ferguson Zone(s) 6
Colour Temperature (and Corrected Colour Temperature) 6
Colour Rendering (Index)/CRI 7

TESTING METHODS 8

Equipment 8
Methods 10

PRODUCTS TESTED 11

Calcium LED Lamp – 5.0 11
Calcium LED Lamp – 10.0 11

INITIAL OBSERVATIONS 12

Description and Build Quality 12
Box/Packaging 13
Photographs 14

UV PERFORMANCE 17

Centre Point After Burn-in 17

IRRADIANCE CHARTS 19

Purpose 19
Disclaimer 19
5.0 Lamp 20
10.0 Lamp 21

SPECTRAL MEASUREMENTS 22

5.0 LAMP - 250 – 800nm 22
5.0 LAMP - 260 – 340nm 24
5.0 LAMP – Sunlight Comparison 26
10.0 LAMP - 250 – 800nm 28
14.0 LAMP - 280 – 340nm 30

10.0 LAMP – Sunlight Comparison 32

COLOUR MEASUREMENTS 34

Overview 34
Colour Values 35

OTHER MEASUREMENTS 38

Overview 38
Measurments 39
Light Category Breakdown 40
Relevant Action Spectra – 5.0 41
Relevant Action Spectra – 10.0 42

COMMENTARY ON FINDINGS 43

Overall 43
UVI and UVB 43
Spectrum and Vitamin D3 synthesis 44
Colour Rendering and vision 45
Other Comments 45

FURTHER TESTS 47

Longevity and Degridation 47
Teardown 47

SPECIAL THANKS 48

Colleagues 48

LITERATURE AND FURTHER READING 49

Peer-Reviewed Literature 49
Other Literature 52

DISCLAIMER

The content in this document including, but not limited to, the text, graphics, images, links, and other materials is for informational purposes only. The content is not intended to be a substitute for professional veterinary advice, diagnosis, or treatment, and does not constitute as medical or other professional advice. Tomaskas Ltd. does not recommend or endorse any specific tests, physicians, products, procedures, opinions, or other information that may be mentioned in this document, or on other company websites. Reliance on any information provided herein is solely at your own risk. The information provided in this document is designed to support, not replace, the relationship that exists between yourself and a veterinary surgeon. Never disregard professional medical advice or delay in seeking it because of something you have read in this document.

The details provided in this document are based on sole use, and the document contains both scientific information as well as personal opinion. Other people may have different results. The tests have been performed to our best knowledge. Although, the tests do not substitute that of a laboratory test. There are uncontrollable variables when testing a small batch of any item. Different items of the same model number may differ due to their manufacturing batch or operating conditions.

This document may refer to the overall exotic animal keeping hobby as the “reptile hobby”, but this is a force of habit – Tomaskas Ltd. does in fact mean the keeping of the broader herpetological spectrum, including invertebrates, amphibians, and even birds.

REASONS FOR TEST

These tests were completed independently of Jiaxing Nomoy Pet Products Co., Ltd. trading as Nomoy Pet (Nomoy).

Nomoy is a manufacturer based in China, with a range of products sold. They produce and sell products for the reptile community.

In order to provide the hobby with a base understanding of such products, it's important that impartial tests are conducted. We have a duty, as a community, to look out for each other and share appropriate good practice.

These tests aim to discover if products are suitable for the hobby, independent of the manufacturer's claims.

These tests aim to provide a better understanding of the products in question. The products are aimed at primarily providing a UVB provision, but also acts as a source of visible light.

I have contacted Nomoy on various occasions to offer services of independent testing – with no mention of cost. Nomoy responded to state that they were wanting to only sell lamps, not have them tested.

tom@tomaskas.co.uk

I gave the company another offer, presuming that there was perhaps a language barrier and translation problem.

Throughout January 2023 I contacted Nomoy via Whatsapp, email, and phone. I received no further correspondence from them.

I decided to purchase the lamps myself as I wasn't getting anywhere with Nomoy.

I will let the reader come to their own conclusions about Nomoy's lack of response or correspondence.

tom@tomaskas.co.uk

TERMINOLOGY USED

As with many things, there may be more than one correct or colloquial way to describe the same item. There may also be common terms used that may not be correct in everyday usage. I've tried to remain consistent throughout the document so that if I refer to a specific part of an item, you as the reader will know with confidence which part I'm referring to. I'm only human though, and there may be mistakes.

KIT

This refers to everything that comes in the box, including fittings and instructions.

LAMP/UNIT

This refers to the main item in the kit. Both types are a small E27 screw in unit. Inside the lamp are electronics to ensure that the lamp turns on and works as intended.

tom@tomaskas.co.uk

DIODE/LED

The individual electronic parts that emit light (including UV).

UVI

This is shorthand for Ultra Violet Index. UVI is a standardised measurement for the appropriate wavelengths of radiation associated with essential biological processes involving the synthesis of Vitamin D3 – it is often used as a measure of solar UV radiation at the Earth's surface in terms of potential damage to the skin and the eye. The higher the UVI, the less time it takes for harm to occur. This document does not aim to educate about this biological process specifically, and further reading is readily available online. By continuing, it is presumed that you have an understanding of UVI and its relevance to these tests. UVI is not to be confused with UVB. UVI is not to be confused with the Ferguson Zones.

UVB

UVB is the term for part of the electromagnetic spectrum on certain wavelengths, generally between 280 and 320nm. This document does not aim to educate about this specifically, and further reading is readily available online. By continuing, it is presumed that you have an understanding of UVB – including the differences between terrestrial (solar) UVB, which is around 295-320nm, and the more dangerous non-terrestrial (non-solar) UVB, which is from 280nm to around 295nm.

tom@tomaskas.co.uk

FERGUSON ZONE(S)

The Ferguson Zones are classification markers for different exposure levels to different UVI. There are 4 Zones. Animals that expose themselves naturally to lower UVI are classified as Ferguson Zone 1, and animals that naturally expose themselves to high UVI are classified as Ferguson Zone 4. This document does not aim to educate about this specifically, and further reading is readily available online. By continuing, it is presumed that you have an understanding of Ferguson Zones – including the differences between the different Zones.

COLOUR TEMPERATURE (AND CORRECTED COLOUR TEMPERATURE)

Colour temperature, or CT, is widely used to define the colour appearance of a light source. Colour temperature is technically only used for "true" light sources – defined as a black body that reads close enough to the Planckian locus.

Corrected Colour Temperature, or CCT, is used on a light source that doesn't read close to the Planckian locus.

Both are defined in degrees Kelvin where a Warm White is around 2700K moving to Neutral White at around 4000K to Cool White, 5000K or more. Note that Colour Temperature and CCT do not tell you anything about the colour rendering ability of a light.

This document does not aim to educate about this specifically, and further reading is readily available online. By continuing, it is presumed that you have an understanding of CT/CCT – including the differences and similarities.

tom@tomaskas.co.uk

COLOUR RENDERING (INDEX)/CRI

Broadly defined as an indication of how well a light source can provide wavelengths that allow for certain colours to be visible to the human eye. This is defined by the CIE in greater detail, along with standardisations on measuring the level of colour rendering capability – referred to as the "index" of colour rendering.

Light with a low CRI is less effective as one with a high CRI. The CRI of unobstructed sunlight is 100.

This document does not aim to educate about this specifically, and further reading is readily available online. By continuing, it is presumed that you have an understanding of CRI.

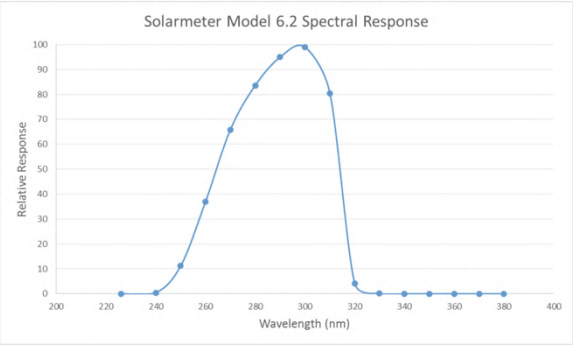
tom@tomaskas.co.uk

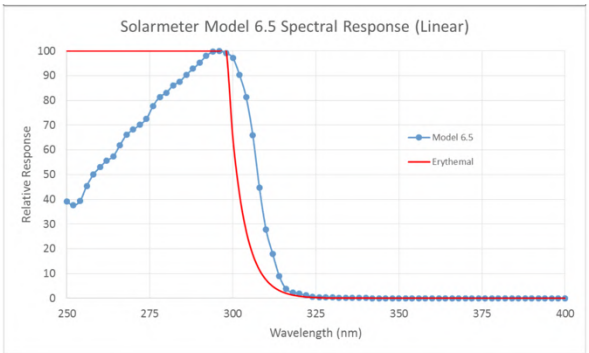
TESTING METHODS

EQUIPMENT

In order to ensure that results are as true and comparable as possible, I have used standardised measuring devices for the tests. I have used a SolarMeter 6.5 for measuring UVI, and a SolarMeter 6.2 for measuring UV in μW/cm².

The spectral response of these broadband meters is shown below. On these graphs, "Erythemal" refers to the action spectrum for the UV Index, since this is derived directly from the action spectrum for skin reddening ("erythema") under UVB.





tom@tomaskas.co.uk

Tomaskas

To allow for full spectrometry, a calibrated FLAME Spectrometer from Ocean Optics was used alongside their flagship software – OceanView.

Room temperature measurements were taken with an Inkbird branded digital thermometer, with part number IBS-TH2. The manufacturer claims the device to have an accuracy of ±0.3°C.

A drywipe backboard was used for the "manual" portions of the tests. The backboard was pre-marked with a grid pattern. The grid used is 2.5cm squares. The board is approx. 2mx2m in total. The board does not reflect UV.

The distance from the unit was determined using a Stanley tape measure, with points marked on the backboard.

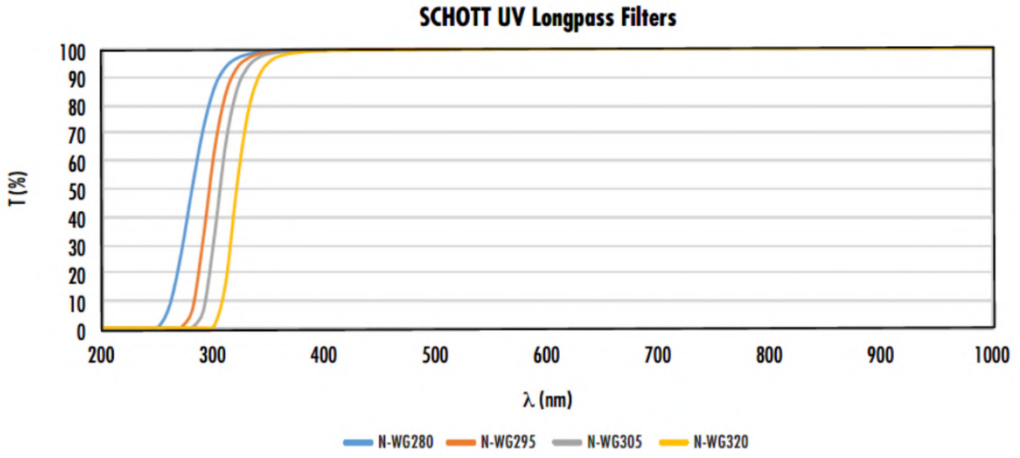
A Windows 10 PC with Microsoft Office and Adobe Photoshop CC 2015 was used to digitise the results and write up this report.

A power meter was used, model KWE-PM01, to monitor power usage.

A Dr Meter LX1330B was used to manually determine LUX values.

The lamps are 220-240V. I used a voltage transformer to correctly power the lamps.

SCHOTT N-WG295 Long Pass Glass (WG295 Glass) was used where appropriate to monitor for UVC vs noise on the spectrometer.



tom@tomaskas.co.uk

Tomaskas

METHODS

Precaution was taken with all tests, as there should be when dealing with UVB-emitting devices. "Factor 50" UV protection sun cream was used on skin, with care taken not to spread any onto the equipment or lamps.

The method for creating ISO Irradiance charts is very close to the method documented by UV Guide. I have made comparisons with my results and those of the UV Guide, and the results are within tolerances – this means that the results are comparable to those of the UV Guide.
Info here: (http://www.uvguide.co.uk/makingspreadcharts.htm)

Before every test took place, a dry microfibre towel was used to wipe the lamp to ensure that the lamp was clean.

UVI was measured in the testing room before each test to ensure that results were only measuring the lamps and not any other sources.

Spectrometer readings were taken in line with standard processes.

The Reptile Lamp Database, courtesy of Dr. Sarina Wunderlich, was utilised for some technical analysis.

The lamps were given 30 minutes to "warm up" before each individual test, unless otherwise noted.

The lamps had 50 hours of "burn-in" before the tests began, unless otherwise noted.

tom@tomaskas.co.uk

PRODUCTS TESTED

The following products were tested.

CALCIUM LED LAMP – 5.0

I tested one of these lamps (*n=1*) in total. This lamp was sent in retail packaging from the seller. Referred to as "5.0" from here. The website sales page for this lamp (https://www.nomoy-pet.com/led-calcium-lights-product/) shows the model number as ND-24.

CALCIUM LED LAMP – 10.0

I tested one of these lamps (*n=1*) in total. This lamp was sent in retail packaging from the seller. Referred to as "10.0" from here. The website sales page for this lamp (https://www.nomoy-pet.com/led-calcium-lights-product/) shows the model number as ND-24.

tom@tomaskas.co.uk

INITIAL OBSERVATIONS

DESCRIPTION AND BUILD QUALITY

The lamps are both near-identical in external appearance, with the 5.0 being a silver colour and the 10.0 being black. And they appear well built. They have a metal outer chassis and feel high quality to hold.

They weigh approximately 55g, and feel solid.

They are both small, with a diameter of approx. 49mm at their widest part, and are only approx. 66mm “tall” in total, including the E27 fitting. They are not dissimilar in formfactor from a HR16 lamp.

The E27 fitting itself looks well made. There are no marks or solder burns on the faces of the units or the E27 fitting.

There is no protective plastic or glass on the face of the lamps, meaning that the diodes can be directly accessed.

The lamps both look significantly different from the ND-24 on the website.

The font is different on both lamps.

tom@tomaskas.co.uk

Both lamps seem to include the exact same diodes, just in different proportions.

BOX/PACKAGING

The boxes are both identical. They look and feel high quality in general, there is no blurry printing or any off colours. The product name is underneath the word “heating” on the front of the box.

The boxes feature an image of a tortoise on nearly every side.

The colour accents are not dissimilar from the “Creatures” range from Zoo Med. I have included a picture for comparison in a later section.

There is an area in which the manufacturer can mark exactly what product is on the inside. This box has, at the bottom of both sides, a “tick box” for “5.0” and for “10.0”. They are appropriately marked.

There are no guidelines for how close either lamp should be in order to achieve the relevant results. However, the boxes do state that the 5.0 is suitable for tropical forest species, meanwhile the 10.0 is suitable for desert species.

One side features a QR code which is invalid and doesn’t link to a website. Presumably this is a sales code and not a link to a website.

There are no CE or UKCA markings on the packaging or on the lamps.

The boxes are clear that this is the model ND-26.

The boxes claim that the units use 5W.

tom@tomaskas.co.uk

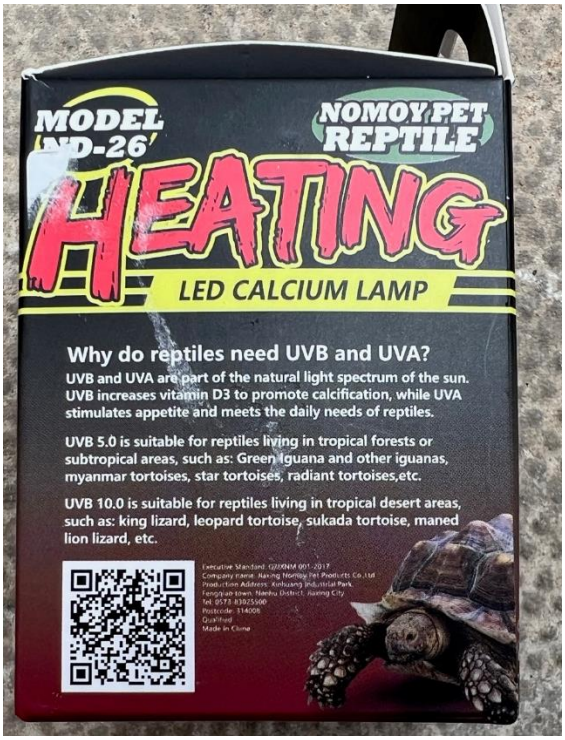
PHOTOGRAPHS

Here are some images of the lamps and accessories etc. Descriptions are provided where appropriate.





Comparison of the design on the box to the Zoo Med Creatures line. Note that the Zoo Med product pictured above is not a UVB LED and is not being reviewed here.



tom@tomaskas.co.uk



Lamps are appropriately marked





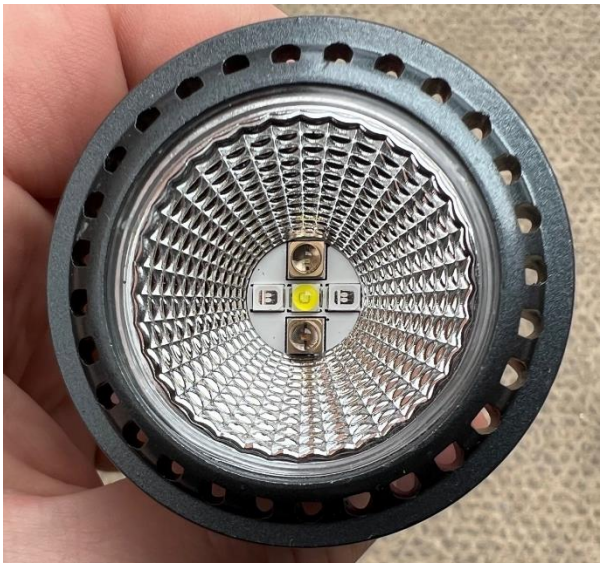
Note the different font

tom@tomaskas.co.uk

Tomaskas



5.0
1x ‘UVB’ diode
2x ‘UVA’ diodes
2x ‘White’ diodes



10.0
2x ‘UVB’ diodes
2x ‘UVA’ diodes
1x ‘White’ diode

tom@tomaskas.co.uk

Tomaskas

UV PERFORMANCE

As it can be presumed that most average consumers will not burn-in their lamp, I have allowed a 50-hour burn-in and then began measuring.

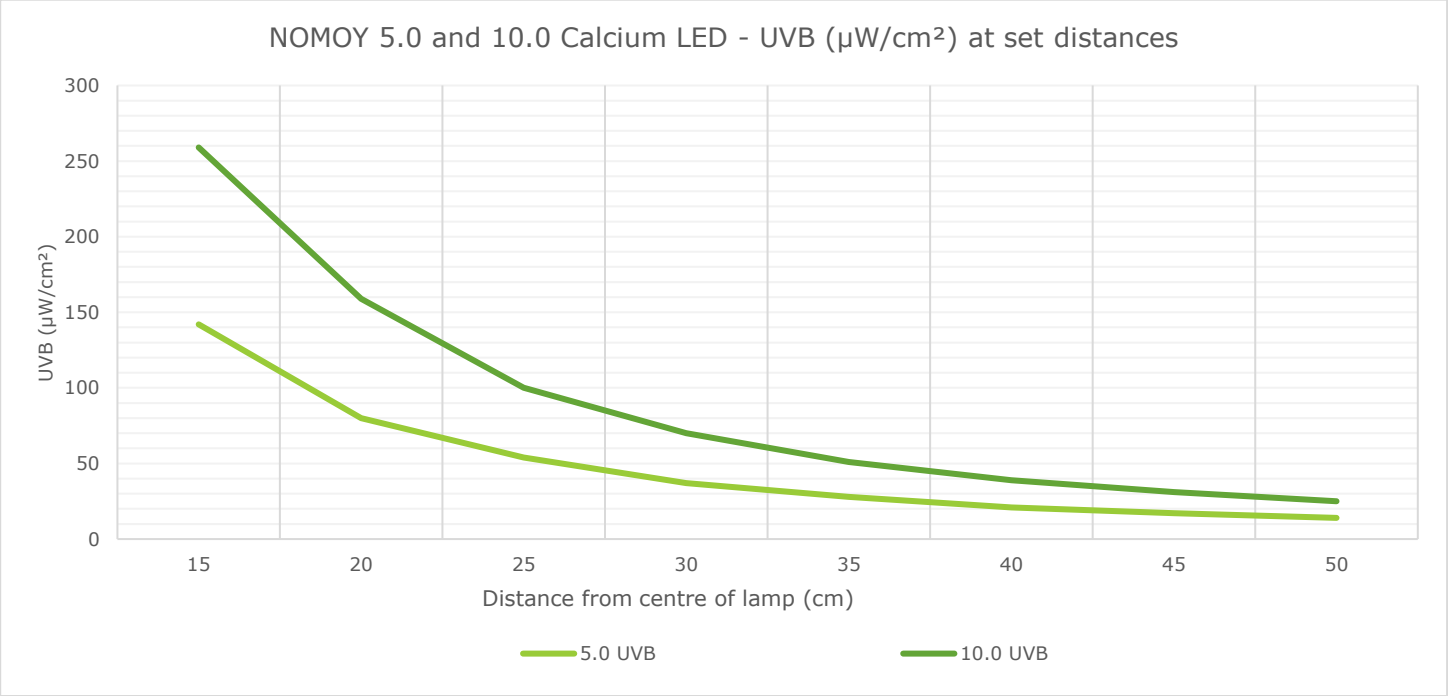
CENTRE POINT AFTER BURN-IN

The below measurements were taken at set distances from directly below the lamps after a 50-hour burn-in.

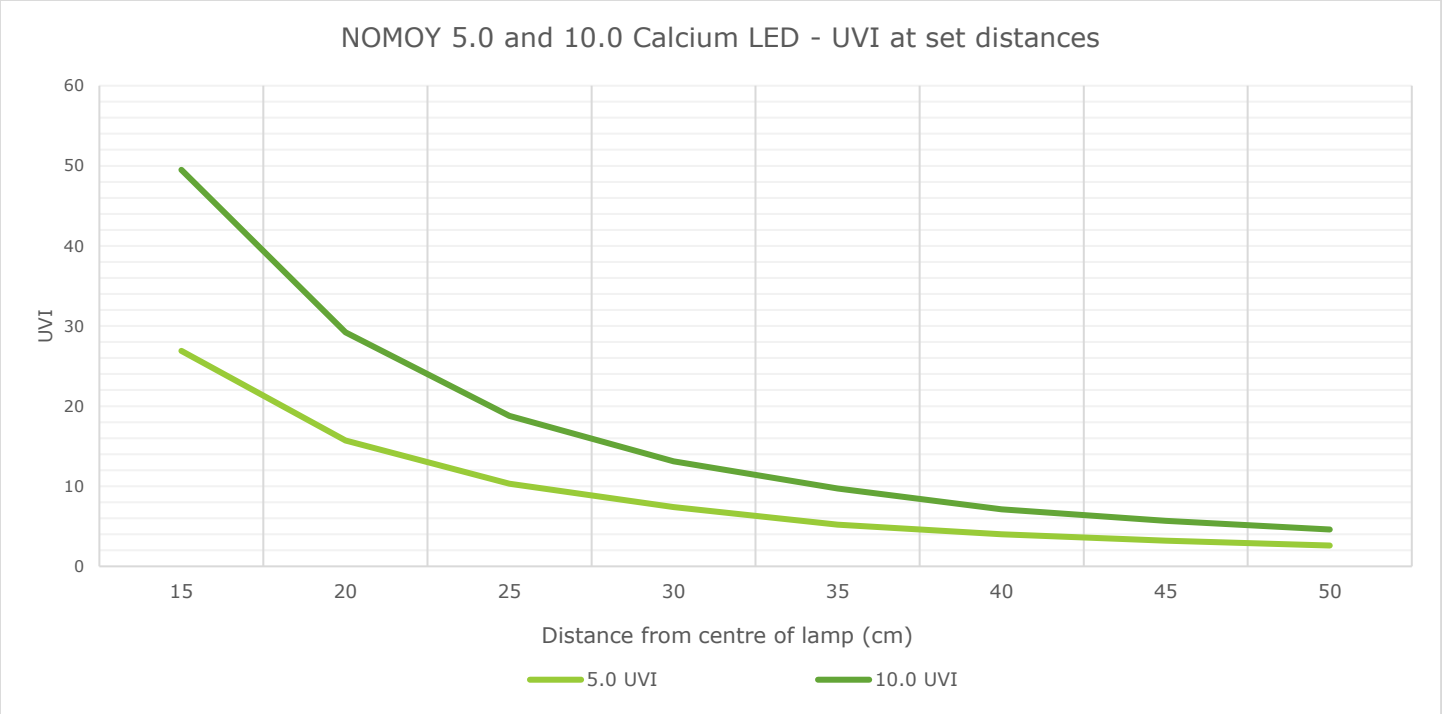
Distance (cm)		15	20	25	30	35	40	45	50
5.0	UVB	142	80	54	37	28	21	17	14
	UVI	26.9	15.7	10.3	7.4	5.2	4.0	3.2	2.6
10.0	UVB	259	159	100	70	51	39	31	25
	UVI	49.5	29.2	18.8	13.1	9.7	7.1	5.7	4.6

tom@tomaskas.co.uk

The following is a graph of the same data, showing how the UVB changes over distance.



The following is a graph of the same data, showing how the UVI changes over distance.



tom@tomaskas.co.uk

Tomaskas

IRRADIANCE CHARTS

PURPOSE

The charts in this chapter are an indication of UVI output from the lamps at set distances.

It is possible to visualise how the lamps emit UVB as a whole, using UVI as a figure.

DISCLAIMER

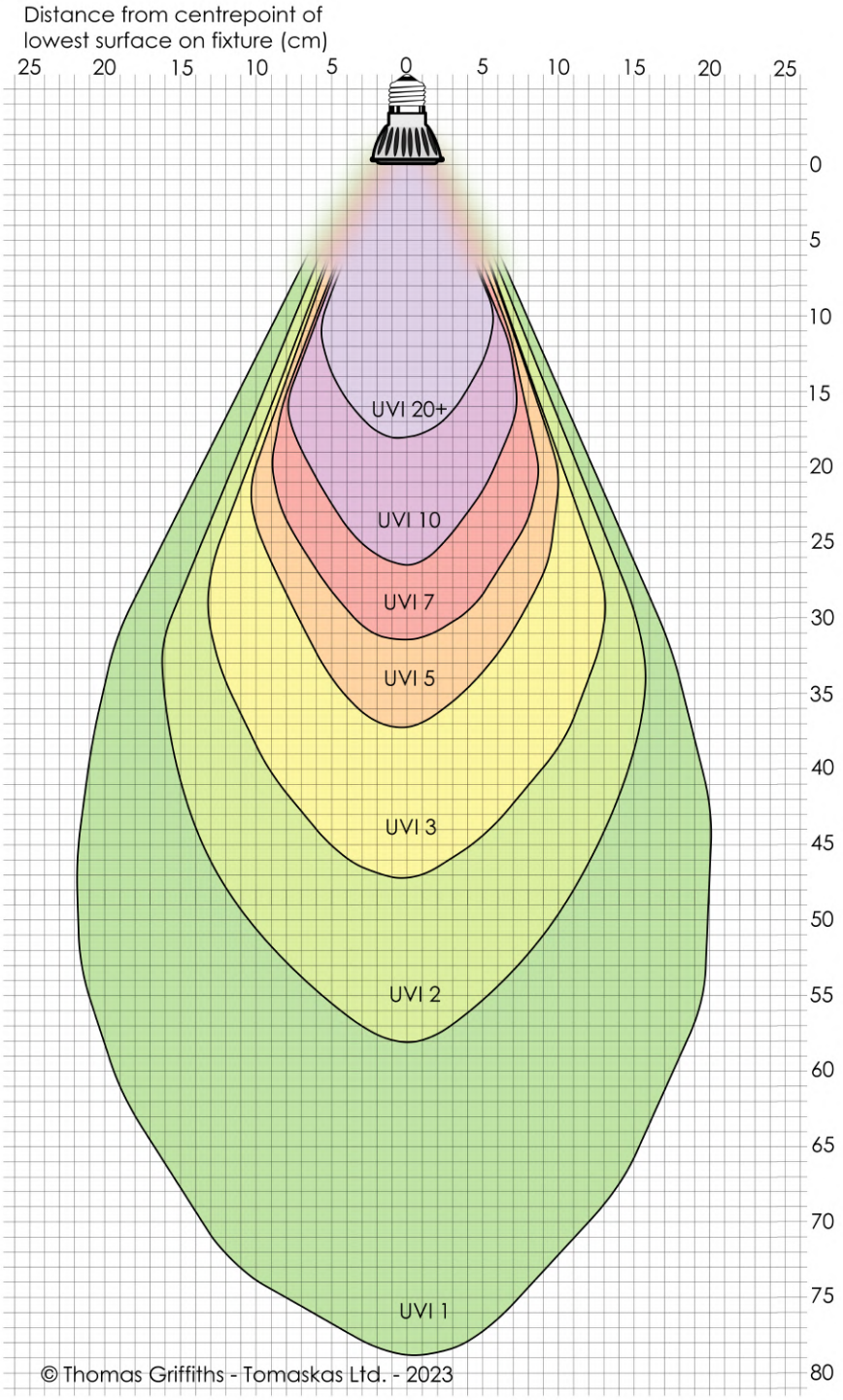
The charts do not make claim to the safety of the lamps, as there is no data on the spectrum included in the charts. The charts are a guide only.

The charts are to scale.

tom@tomaskas.co.uk

5.0 LAMP

This is the ISO Irradiance Chart for the 5.0 lamp.



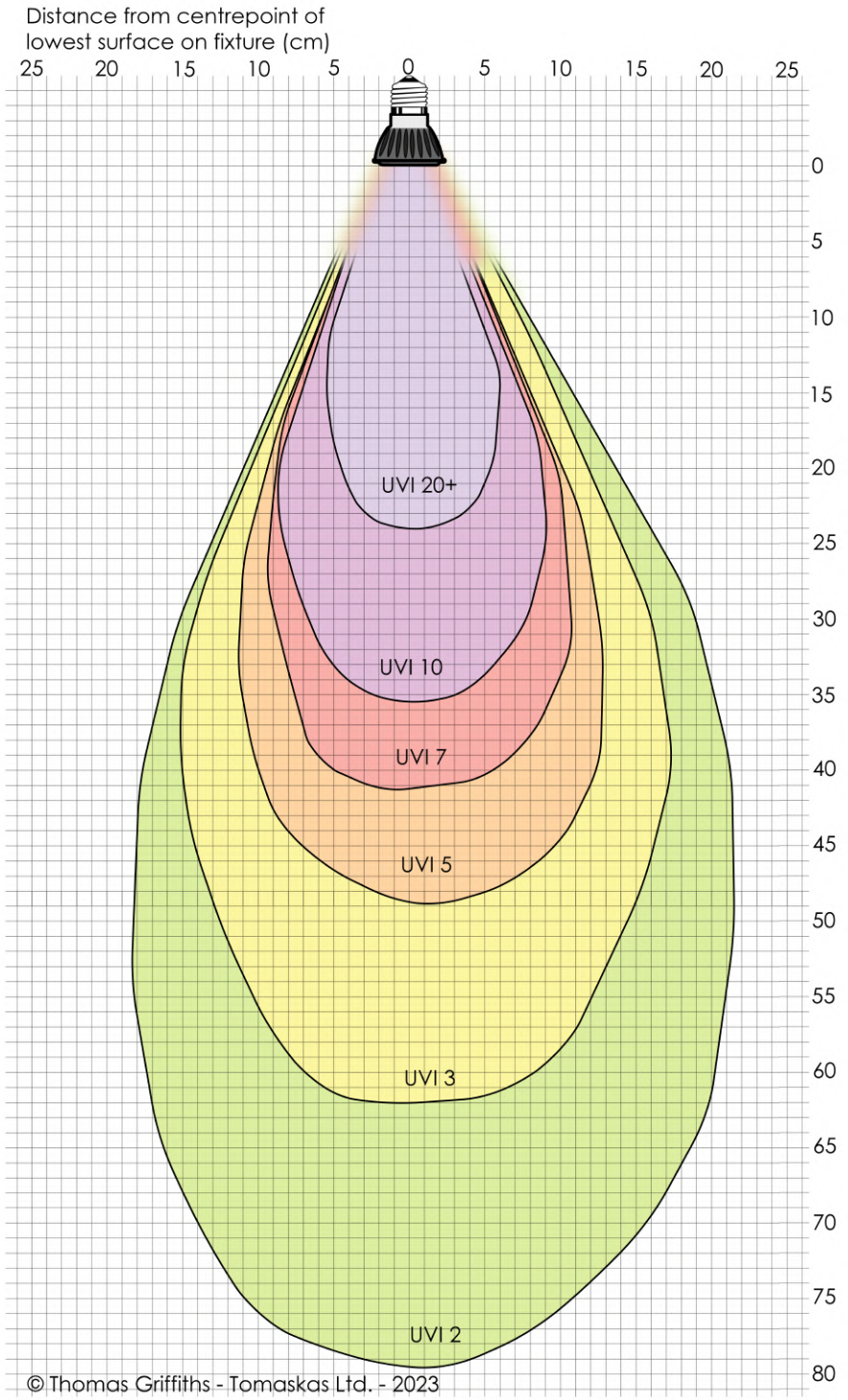
ISO IRRADIANCE CHART (Spread pattern diargram)
NOMOY Pet Calcium LED 5.0
Tested after 50 hour burn-in and after 1 hour warm up

tom@tomaskas.co.uk

Tomaskas

10.0 LAMP

This is the ISO Irradiance Chart for the 10.0 lamp.



ISO IRRADIANCE CHART (Spread pattern diargram)
NOMOY Pet Calcium LED 10.0
Tested after 50 hour burn-in and after 1 hour warm up

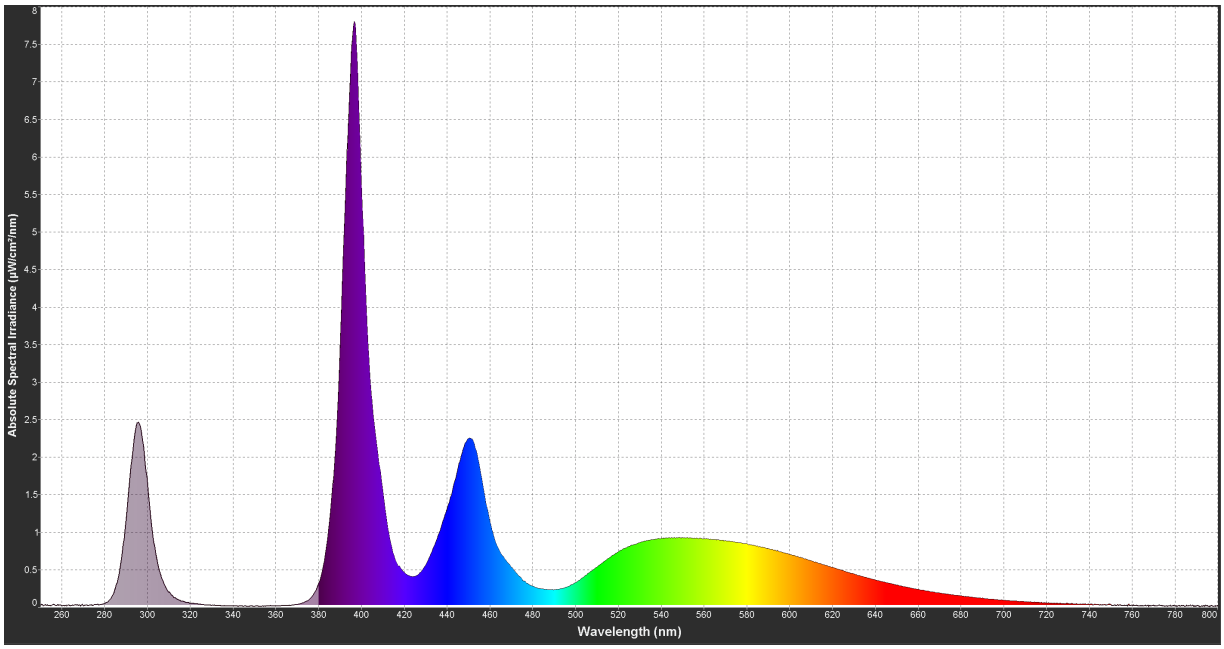
tom@tomaskas.co.uk

Tomaskas

SPECTRAL MEASUREMENTS

5.0 LAMP - 250 – 800NM

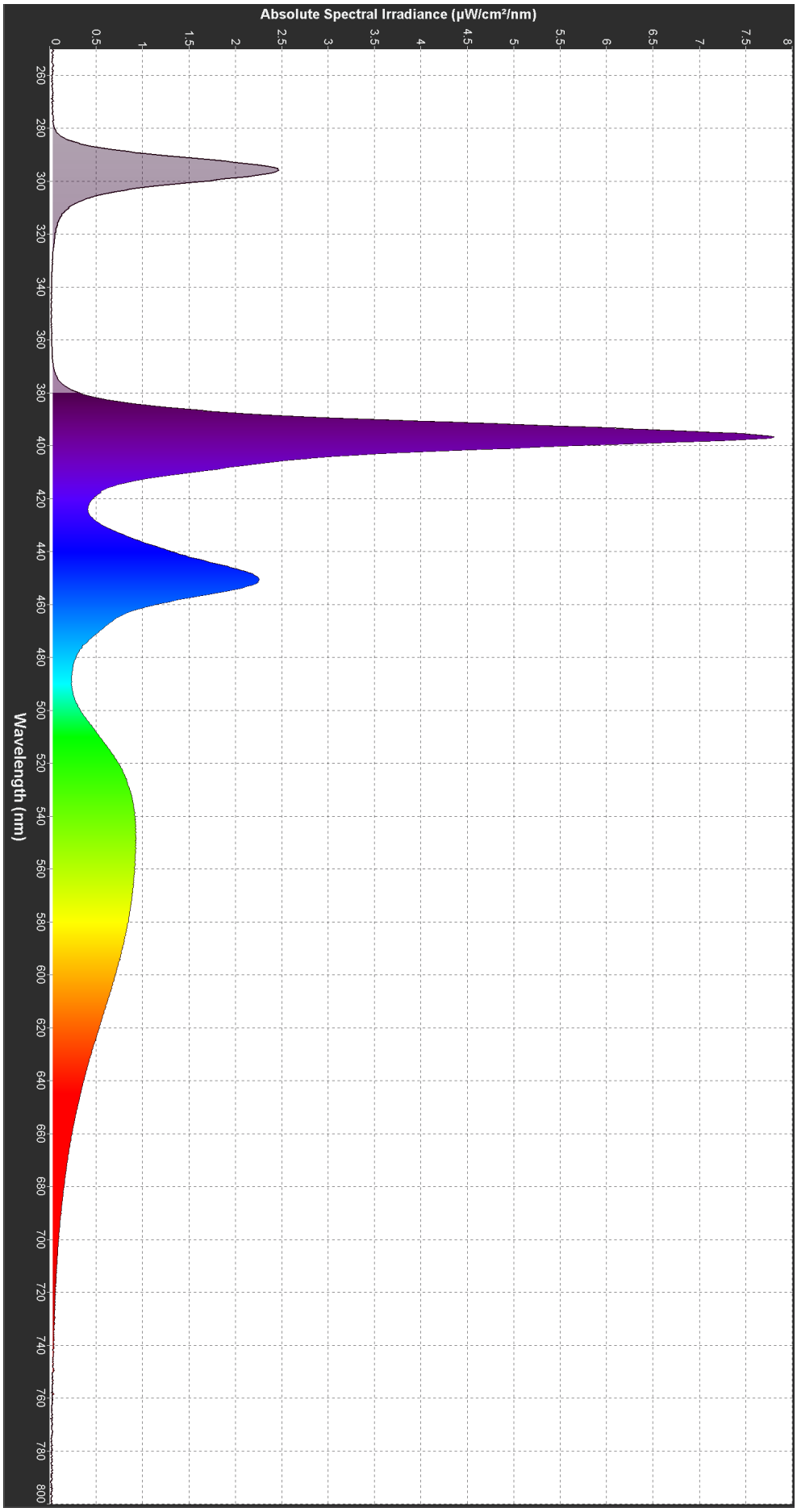
Reading taken at 30cm away from the lamp. Lamp warm-up was 30 minutes. This reading was taken **after** the lamp had burned-in for 50 hours.



Full page graph is on the next page. Commentary is in a later section.

tom@tomaskas.co.uk

Tomaskas

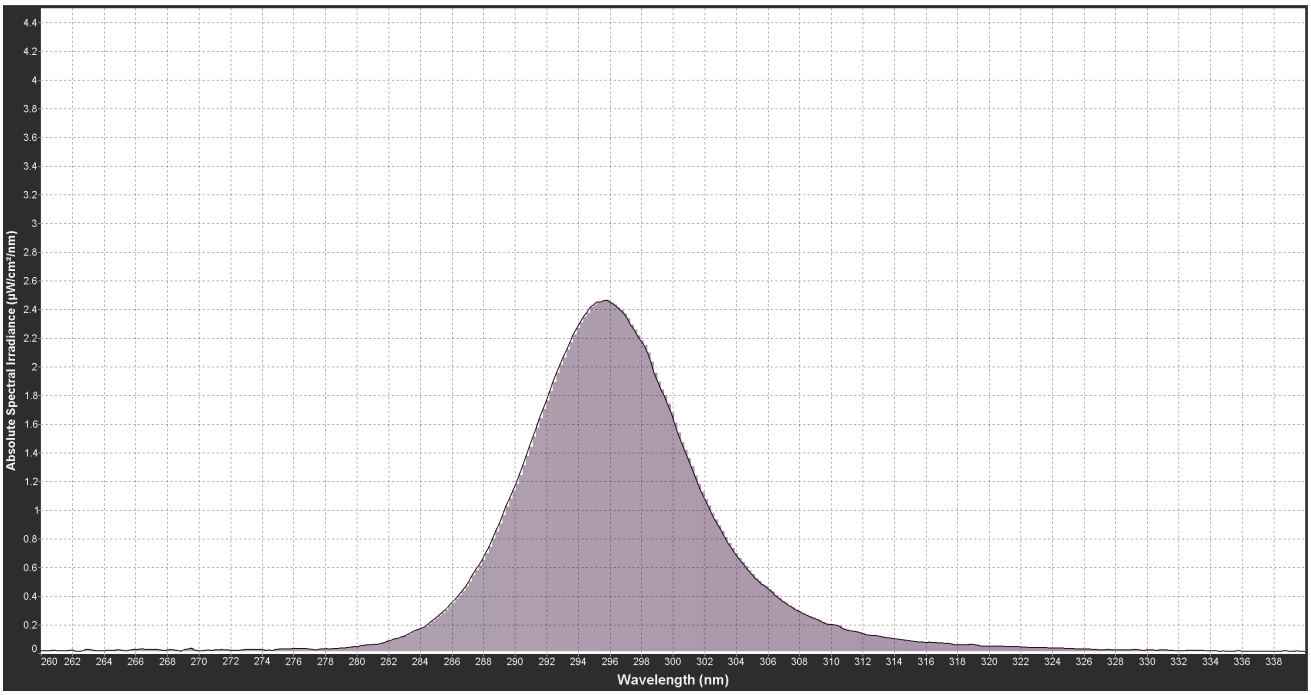


tom@tomaskas.co.uk

Tomaskas

5.0 LAMP - 260 – 340NM

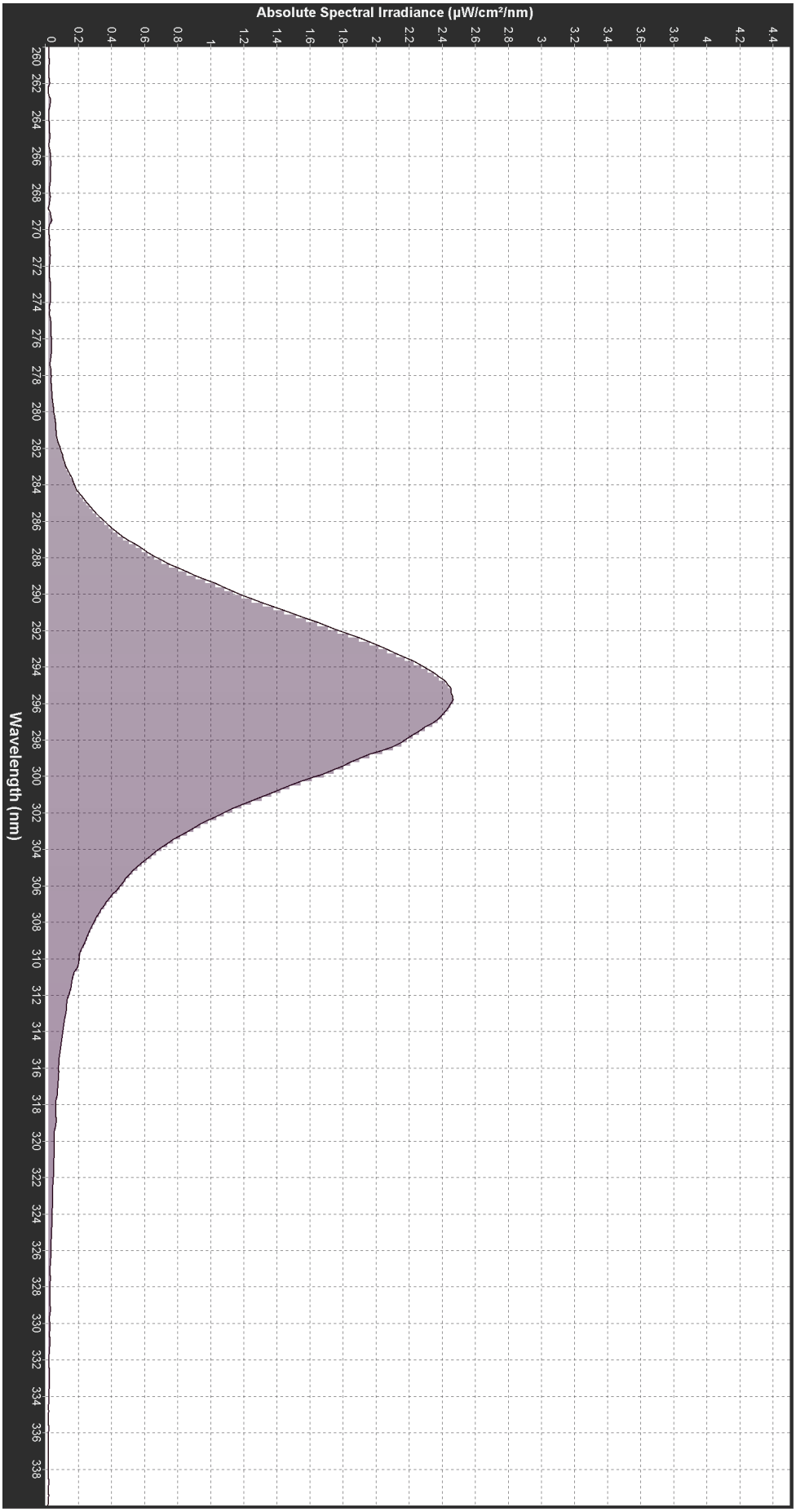
Reading taken at 30cm away from the lamp. Lamp warm-up was 30 minutes. This reading was taken **after** the lamp had burned-in for 50 hours.



Full page graph is on the next page. Commentary is in a later section.

tom@tomaskas.co.uk

Tomaskas



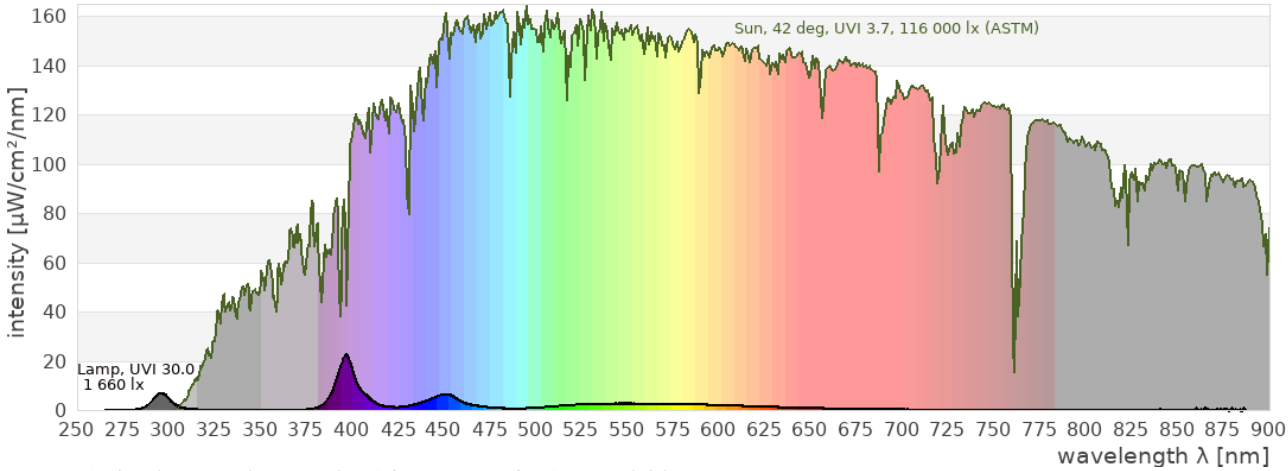
tom@tomaskas.co.uk

Tomaskas Ltd

5.0 LAMP – SUNLIGHT COMPARISON

The below chart shows the spectrum from the lamp to sunlight (ASTM sunlight). The spectral plot of the lamp has been up-scaled (to approx. UVI 30.0) in order to be visually comparable to sunlight for the sake of analysis.

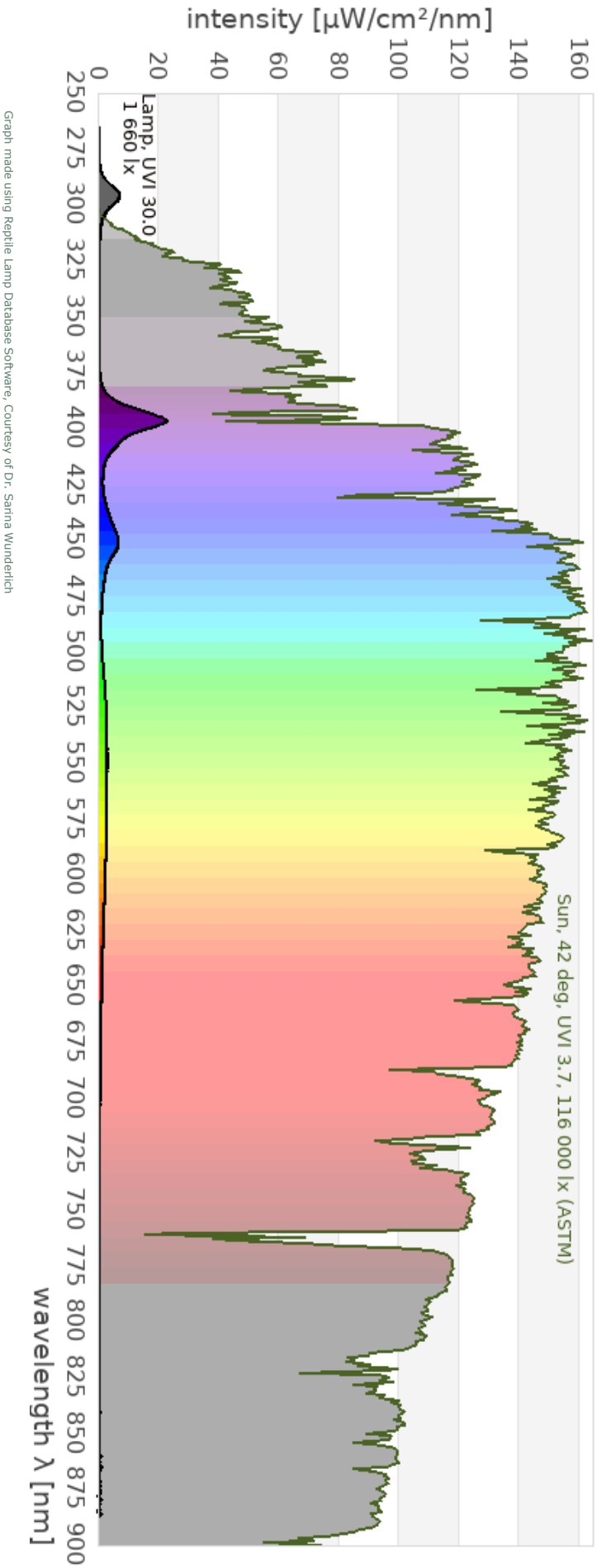
Reading taken at 30cm away from the lamp. Lamp warm-up was 30 minutes. This reading was taken **after** the lamp had burned-in for 50 hours.



Graph made using Reptile Lamp Database Software, Courtesy of Dr. Sarina Wunderlich

Full page graph is on the next page. Commentary is in a later section.

tom@tomaskas.co.uk

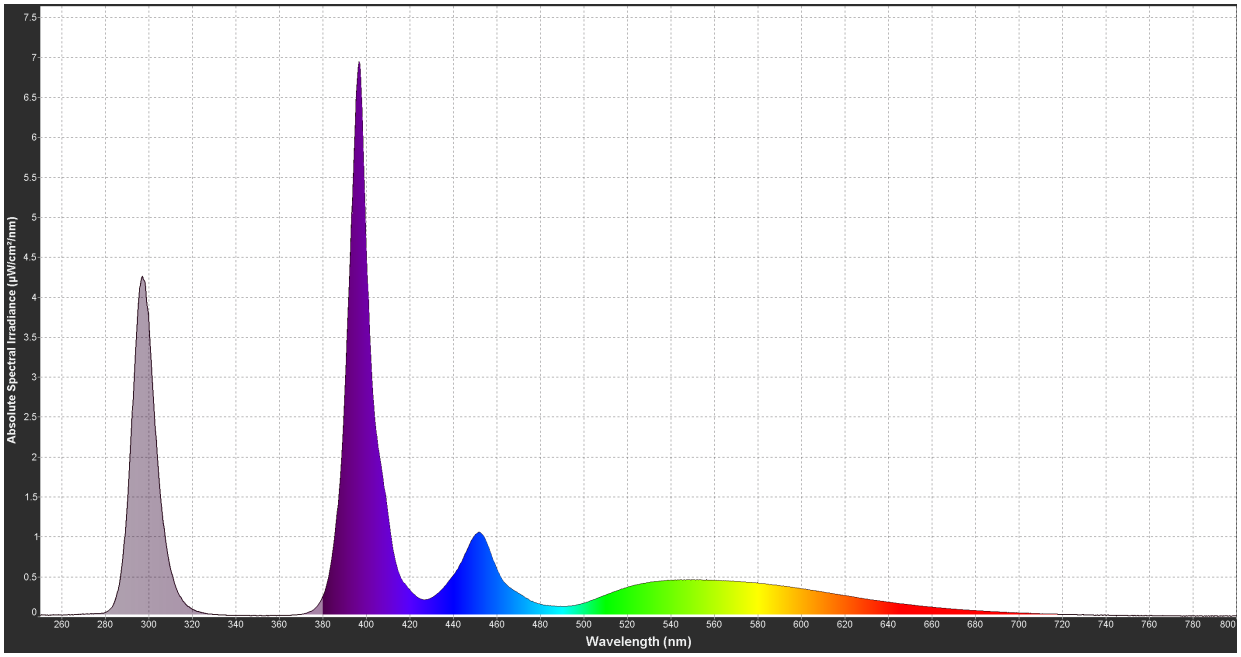


tom@tomaskas.co.uk

Tomaskas

10.0 LAMP - 250 – 800NM

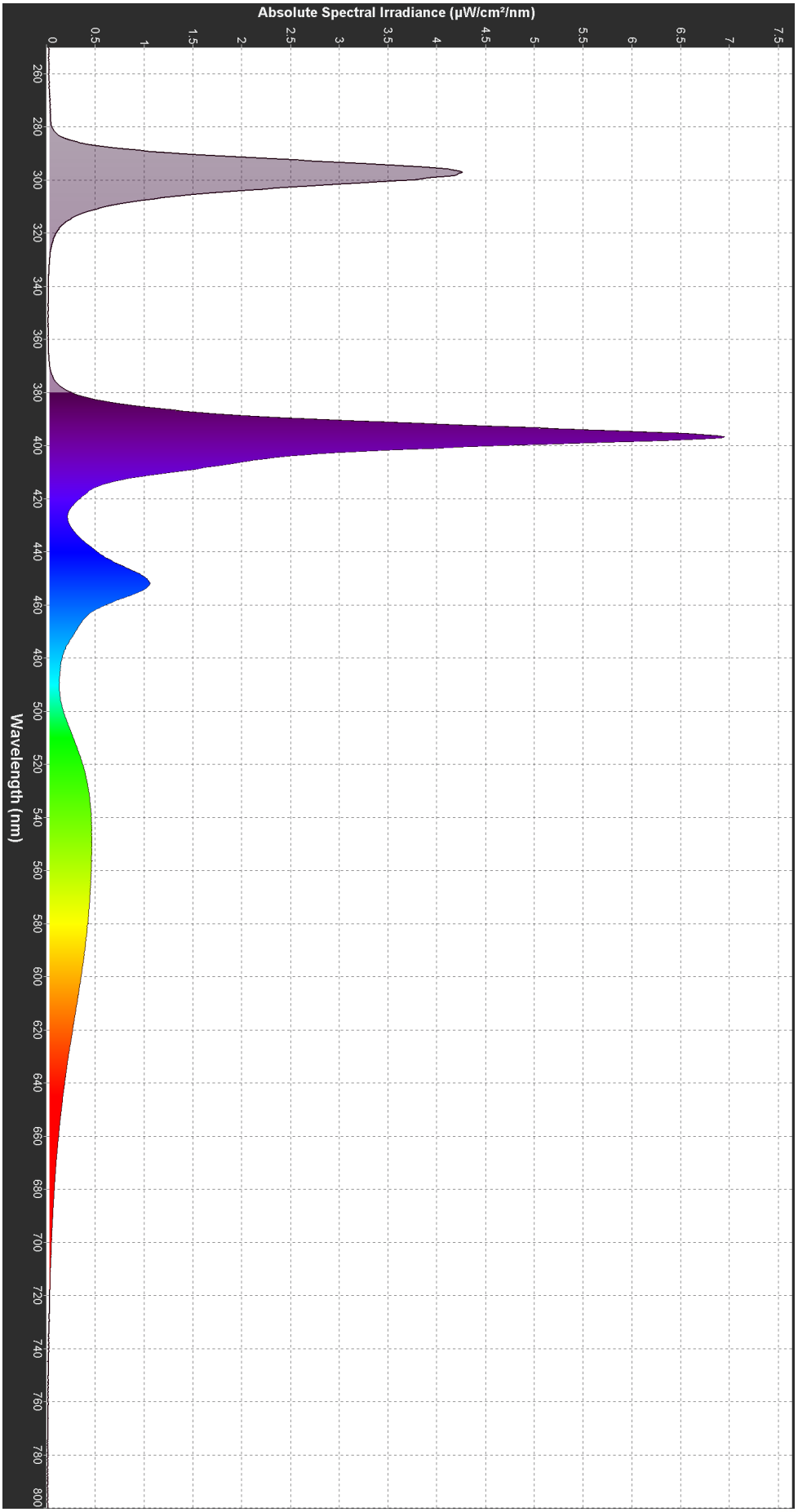
Reading taken at 30cm away from the lamp. Lamp warm-up was 30 minutes. This reading was taken **after** the lamp had burned-in for 50 hours.



Full page graph is on the next page. Commentary is in a later section.

tom@tomaskas.co.uk

Tomaskas

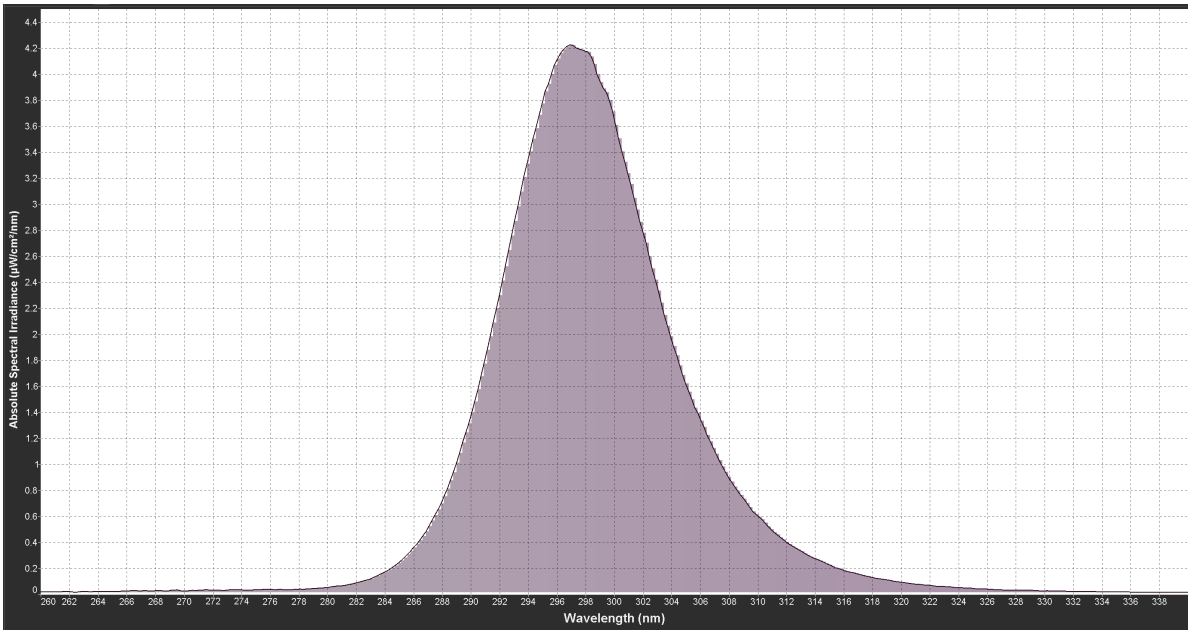


tom@tomaskas.co.uk

Tomaskas

14.0 LAMP - 280 – 340NM

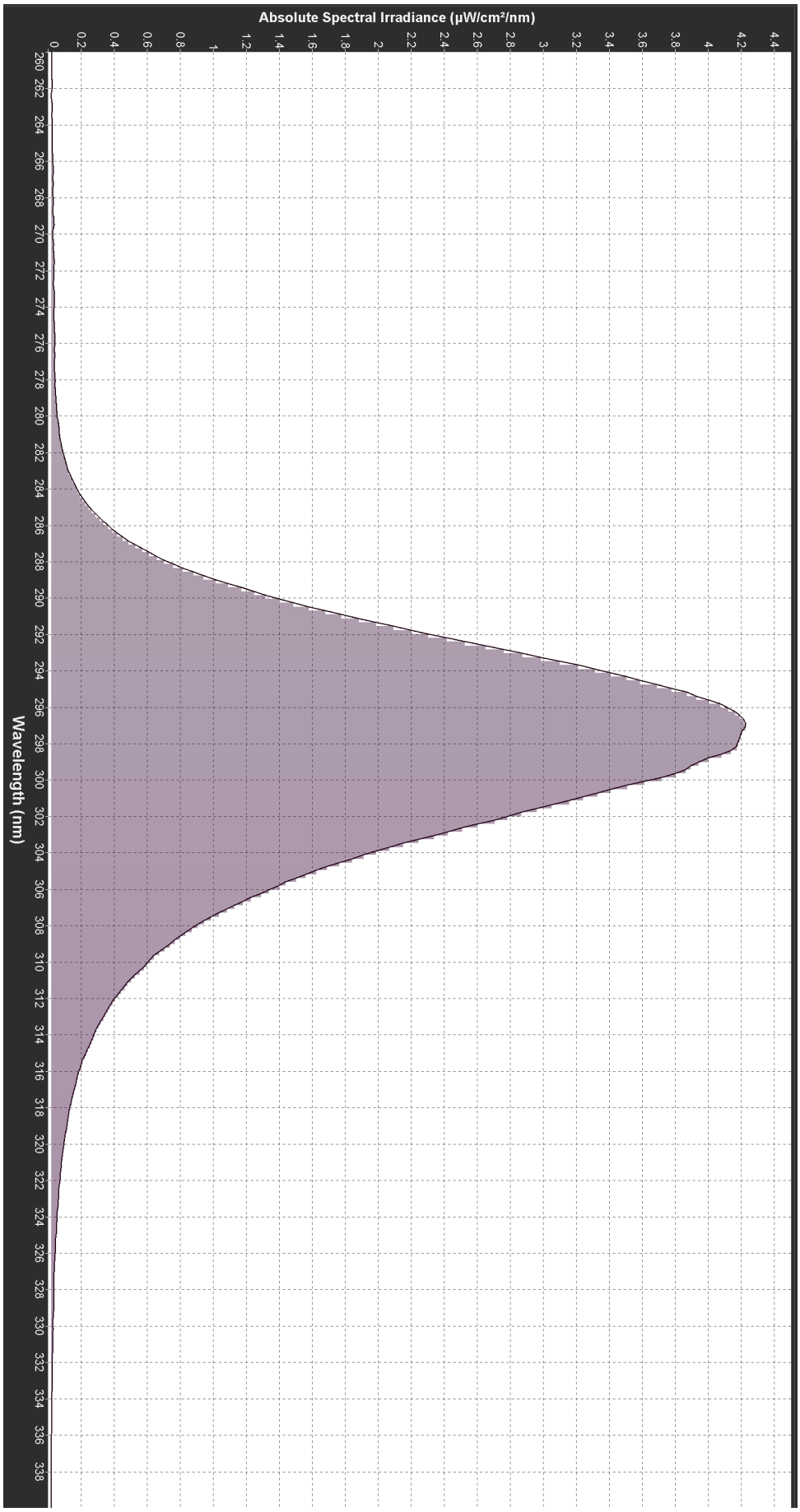
Reading taken at 30cm away from the lamp. Lamp warm-up was 30 minutes. This reading was taken **after** the lamp had burned-in for 50 hours.



Full page graph is on the next page. Commentary is in a later section.

tom@tomaskas.co.uk

Tomaskas



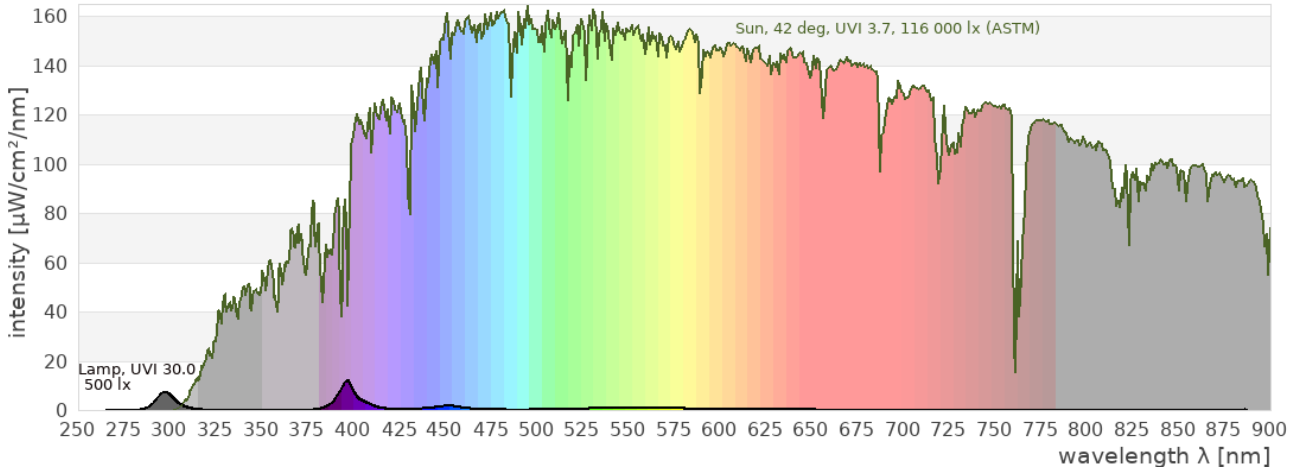
tom@tomaskas.co.uk

Tomaskas

10.0 LAMP – SUNLIGHT COMPARISON

The below chart shows the spectrum from the lamp to sunlight (ASTM sunlight). The spectral plot of the lamp has been up-scaled (to approx. UVI 30.0) in order to be visually comparable to sunlight for the sake of analysis.

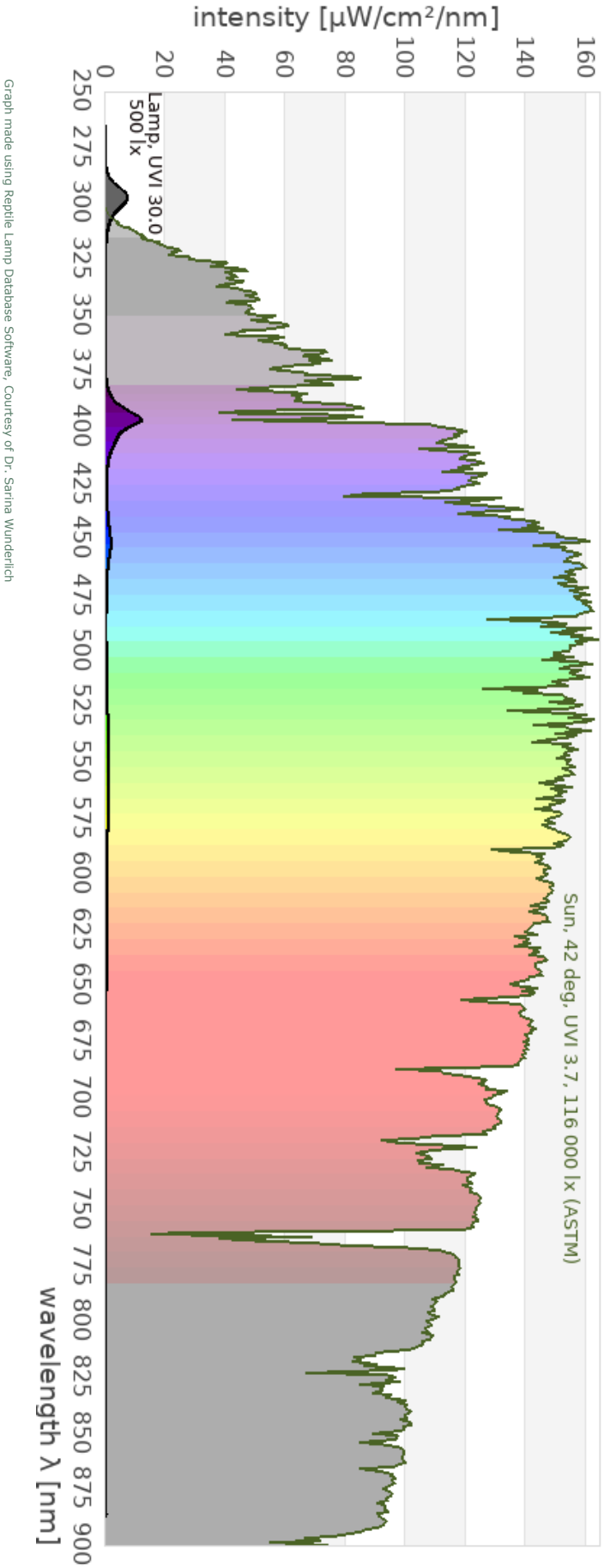
Reading taken at 30cm away from the lamp. Lamp warm-up was 30 minutes. This reading was taken **after** the lamp had burned-in for 50 hours.



Graph made using Reptile Lamp Database Software, Courtesy of Dr. Sarina Wunderlich

Full page graph is on the next page. Commentary is in a later section.

tom@tomaskas.co.uk



Graph made using Reptile Lamp Database Software, Courtesy of Dr. Sarina Wunderlich

tom@tomaskas.co.uk

Tomaskas

COLOUR MEASUREMENTS

OVERVIEW

The spectrometer software is able to calculate colour values based on the readings from the lamps.

The range of wavelengths used to generate these values is dictated by the CIE. Their range defined is 400nm to 750nm.

These standards are defined as such for human vision only, and they do not take into consideration reptile vision in the UVA range.

I have also used a slightly wider range (350nm to 850nm) to allow analysis of typical reptile photoreceptor excitation by software.

Measurements taken using centre point of lamps at 30cm away, with all diodes on.

tom@tomaskas.co.uk

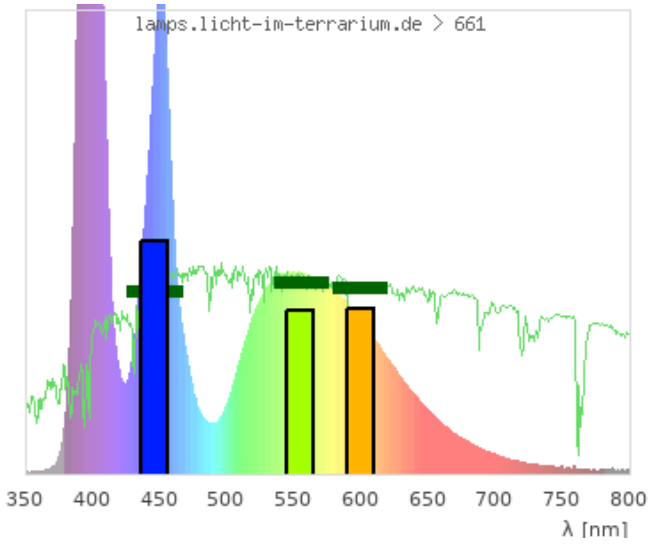
COLOUR VALUES

The lamps each had their colour values checked. Data is below.

Category	Ref	5.0	10.0
CCT (Kelvin)		8454K	8110K
CRI(a)		75.9	76.3
R1		78.8	78.4
R2		75.9	75.8
R3		69.3	70.6
R4		78.7	77.8
R5		78.4	78.2
R6		69.7	72.5
R7		71.4	82.0
R8		75.3	75.4
R9		6.0	2.9
R10		38.2	38.9
R11		78.7	78.1
R12		48.3	52.5
R13		74.7	72.9
R14		81.7	82.2
R15		77.1	75.3
DC<5.4E-3		False	False

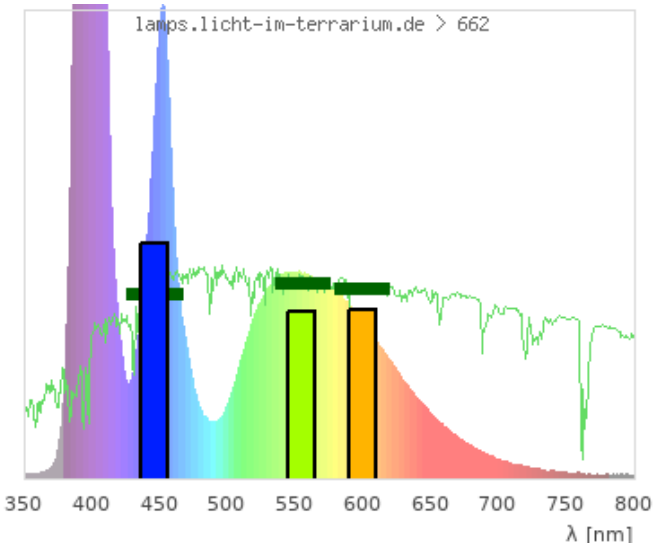
tom@tomaskas.co.uk

Below is a chart showing excitation of the 3 “cone” visual photoreceptors used in human vision, as they would be stimulated by the spectrum on the platforms. The coloured vertical bars show the cone stimulation level; the short green horizontal bars show the equivalent stimulation by natural sunlight. The chart gives a visual representation of how well colour is rendered by humans.



Graph made using Reptile Lamp Database Software, Courtesy of Dr. Sarina Wunderlich

5.0 Lamp



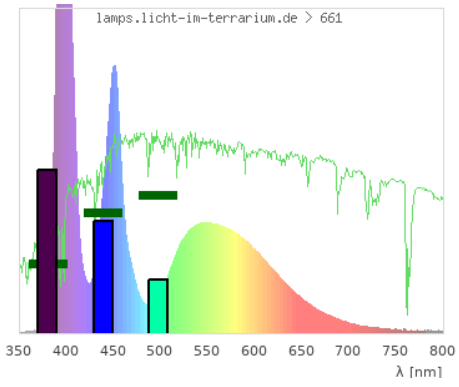
Graph made using Reptile Lamp Database Software, Courtesy of Dr. Sarina Wunderlich

10.0 Lamp

tom@tomaskas.co.uk

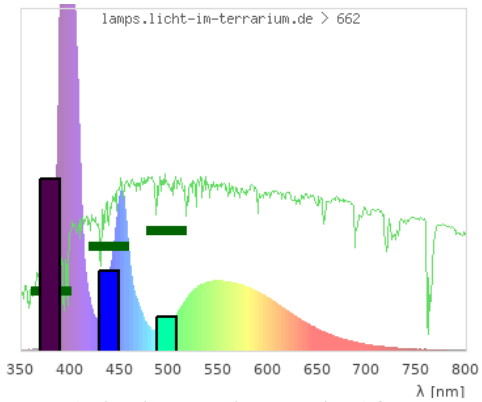
Tomaskas

Reptiles have different photoreceptors to humans. And most species are also different to each other. This makes it difficult to quantify and analyse light for reptile vision. Basic assumptions can be made though. Below are the same charts showing excitation of the “3 cone” visual photoreceptors used by some reptiles and birds (top), and the same for “4 cone” visual photoreceptors used by other species of reptile and birds (bottom), as they would be stimulated by the spectrum in this enclosure. The coloured vertical bars show the cone stimulation level; the short green horizontal bars show the equivalent stimulation by natural sunlight. The chart gives a visual representation of how well colour is rendered by different species of reptile or bird.



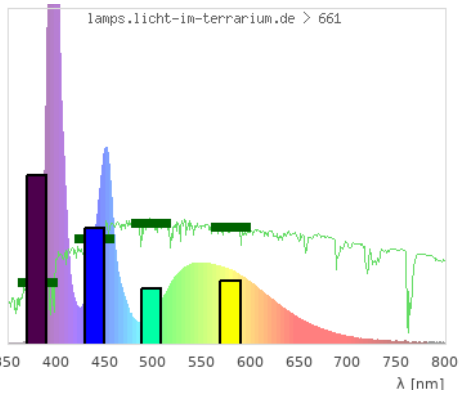
Graph made using Reptile Lamp Database Software
Courtesy of Dr. Sarina Wunderlich

5.0 Lamp



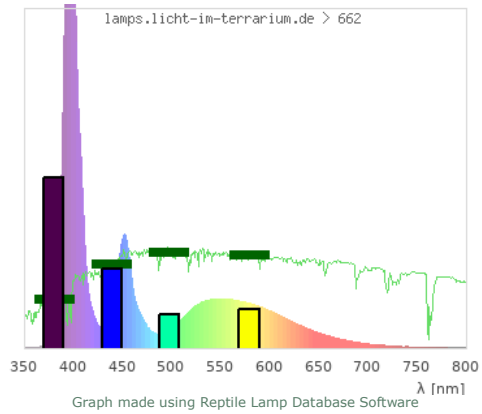
Graph made using Reptile Lamp Database Software
Courtesy of Dr. Sarina Wunderlich

10.0 Lamp



Graph made using Reptile Lamp Database Software
Courtesy of Dr. Sarina Wunderlich

5.0 Lamp



Graph made using Reptile Lamp Database Software
Courtesy of Dr. Sarina Wunderlich

10.0 Lamp

tom@tomaskas.co.uk

Tomaskas

OTHER MEASUREMENTS

OVERVIEW

The spectrometer software is able to ascertain certain values based on the readings from the lamps. Each reading was taken at 30cm where appropriate. Readings taken after 50-hour burn-in. The lamps were given 30 minutes to warm up before each test. I have listed the Illuminance (Lux), Luminous intensity (Candela), Power Density (µWatt/cm²), UVB density (250-320nm in µWatt/cm² using SolarMeter 6.2), UVI (SolarMeter 6.5), SolarMeter Ratio, Power Factor, and average wattage values. Integration began at 280nm and ended at 850nm for measurements, excluding the tests done with the SolarMeter 6.2 and SolarMeter 6.5. This encompasses the range of UV, Visible Light, and the very shortest Infrared Wavelengths. Simpson's rule was used for integration between 270 and 800nm.

This section also contains light category breakdown and action spectra analysis.

tom@tomaskas.co.uk

MEASURMENTS

The following are readings taken from the lamps after a 50-hour burn-in period at 30cm.

Category	5.0	10.0
Lux	570	285
PD µW/cm²	327.78	239.43
Candela	0.0064076	0.0031666
(SM6.2) UVB	37 µW/cm²	70 µW/cm²
(SM6.5) UVI	7.4	13.1
SolarMeter Ratio	5:1	5.3:1
Power Factor	3.1	3.2
Average Wattage	2.8	1.8
Voltage	237.8	238.0

tom@tomaskas.co.uk

LIGHT CATEGORY BREAKDOWN

The light from the lamps underneath the UVB-emitting diodes can be broken down as follows. The measured range for these readings is 280nm to 780nm.

5.0:

Grouping	W/m2	Percentage of total Measured Range
UVB (280-320nm)	0.313	7.76%
UVA (320-400nm)	0.783	19.40%
Visible (400-780nm)	2.94	72.84%

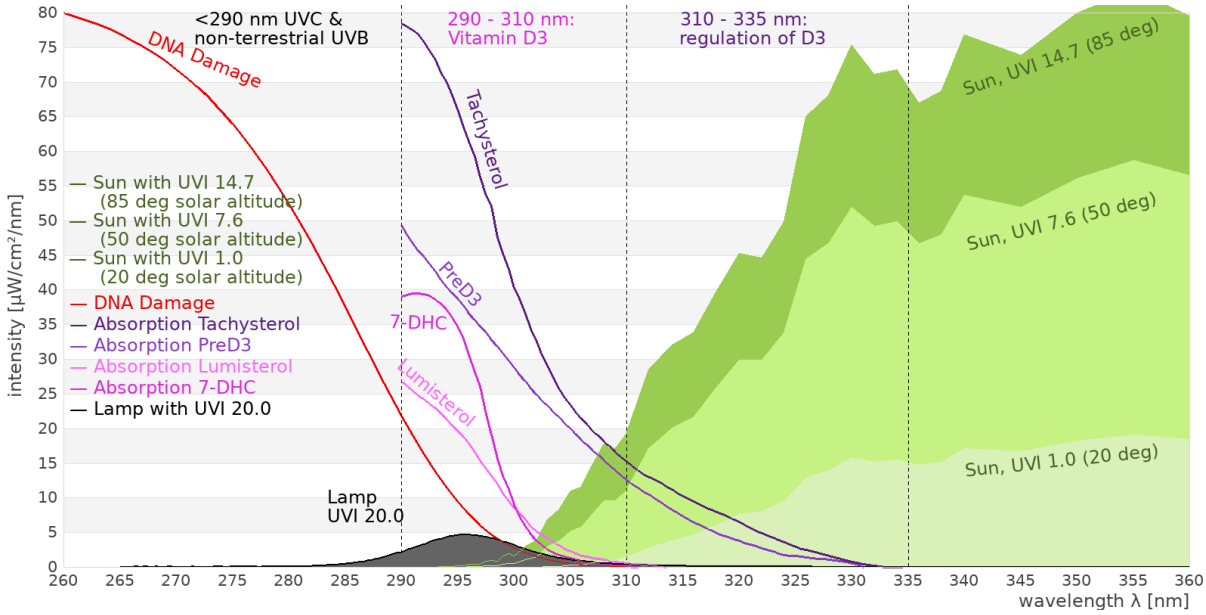
10.0:

Grouping	W/m2	Percentage of total Measured Range
UVB (280-320nm)	0.579	18.93%
UVA (320-400nm)	0.66	21.58%
Visible (400-780nm)	1.82	59.50%

tom@tomaskas.co.uk

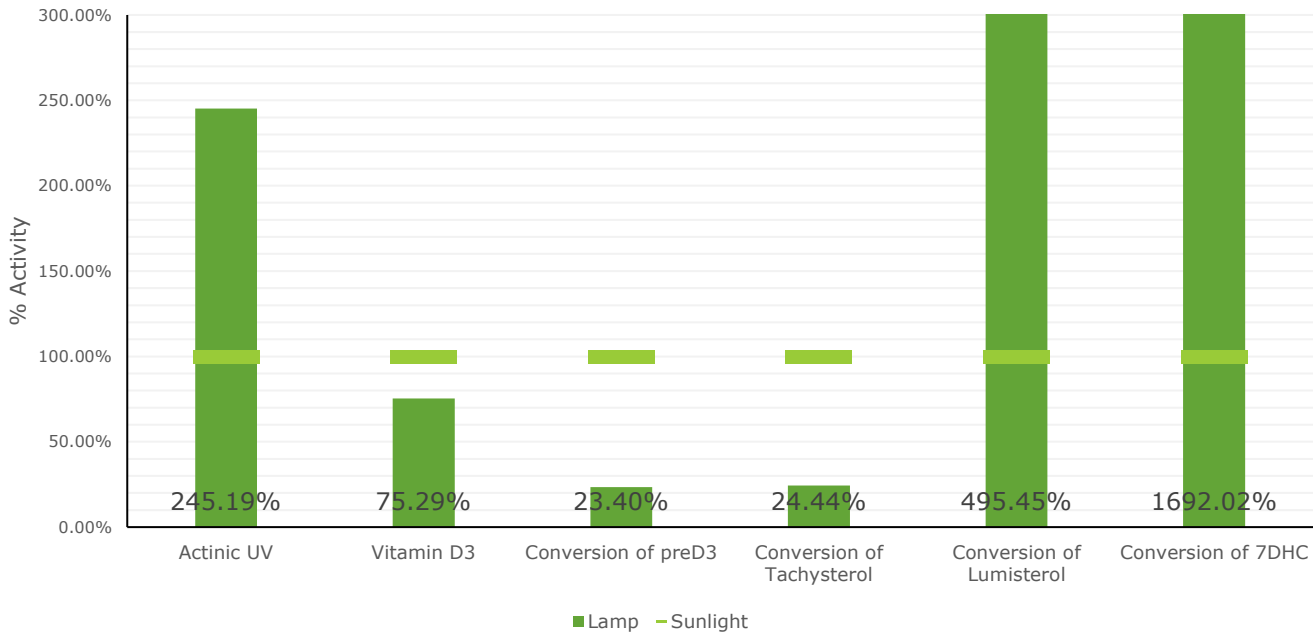
RELEVANT ACTION SPECTRA – 5.0

I have compared the activity of the spectrum in relation to action spectra related with VitaminD3 synthesis and actinic activity, and the same expected from sunlight. The spectral plot of the lamp has been up-scaled to UVI 20.0 for analysis purposes.



Graph made using Reptile Lamp Database Software, Courtesy of Dr. Sarina Wunderlich

Percentage of activity in different action spectra - NOMOY 5.0 CALCIUM Lamp compared to sunlight

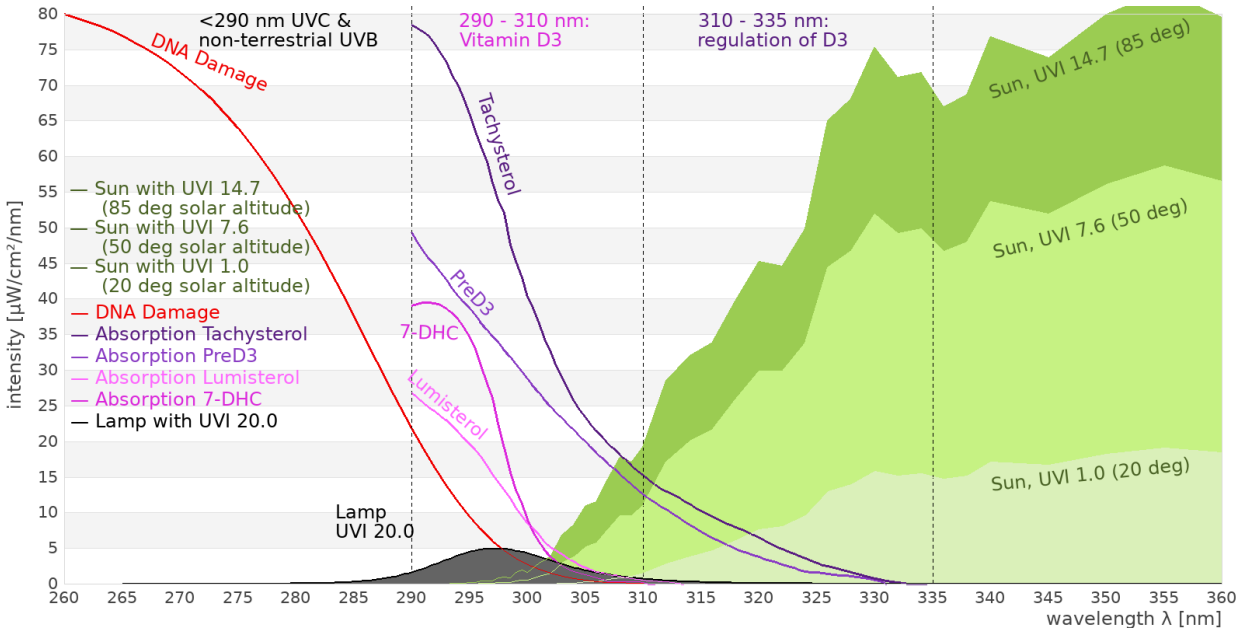


tom@tomaskas.co.uk

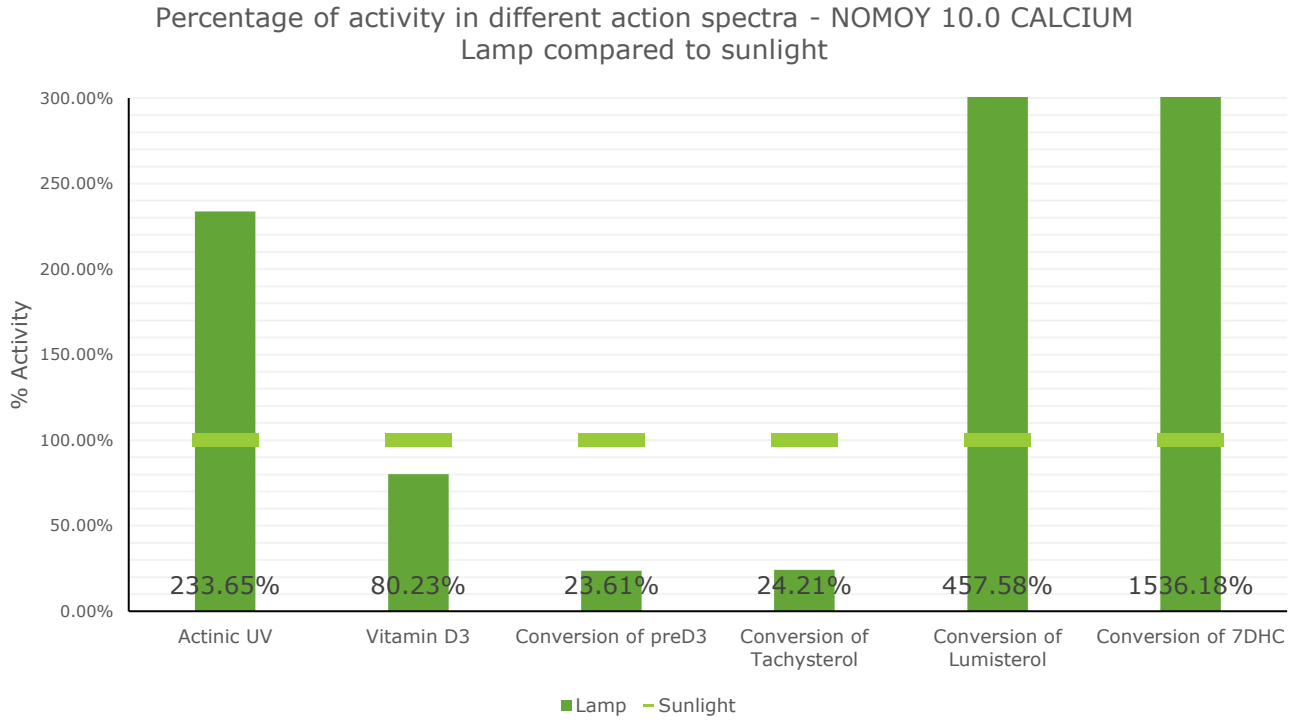
Tomaskas

RELEVANT ACTION SPECTRA – 10.0

I have compared the activity of the spectrum in relation to action spectra related with VitaminD3 synthesis and actinic activity, and the same expected from sunlight. The spectral plot of the lamp has been up-scaled to UVI 20.0 for analysis purposes.



Graph made using Reptile Lamp Database Software, Courtesy of Dr. Sarina Wunderlich



tom@tomaskas.co.uk

Tomaskas

COMMENTARY ON FINDINGS

OVERALL

The lamps worked without any faults during the tests. Neither got concerningly warm during use.

Despite the word “heating” on the front, there is no heating effect from these lamps.

The lamps did not use the 5W as stated on the box.

UVI AND UVB

The UVB output from the lamps very high. It is significantly higher than any recommended lamp at the same distance.

The Solarmeter ratio can be used as a way of estimating the biologically-appropriate UV from a light source. By comparing the ratio to that of the sun, we can discern how similar or different a light

tom@tomaskas.co.uk

source is to sunlight in the UV wavelengths. Sunlight is generally shown to have a ratio of 50-55:1 at "full strength".

The Solarmeter ratio for the 5.0 lamp was 5:1. This is extremely low. The Solarmeter ratio for the 10.0 lamp was 5.3. This is also very low. A low ratio implies a significant amount of short-wavelength UVB compared to longer wavelengths.

The spread of the UV (in UVI) followed the same pattern for both lamps. However, the output from the 10.0 was stronger, as is expected.

Given that the 5.0 and 10.0 emit approx. 8% and 19% UVB respectively, the use of "5.0" and "10.0" in their naming is confusing and appears to be for no real reason other than to follow the trend of other manufacturers.

SPECTRUM AND VITAMIN D3 SYNTHESIS

From the data collected, the for both lamps the following can be stated:

1. *The lamps emit dangerously short-wavelength (unnatural) UVB.*

2. *The lamps emit some amount of UVC.*

3. *The lamps are likely to cause skin problems and eye problems in animals and humans.*

4. *There is activity in the wavelengths associated with the synthesis of Vitamin D3.*

5. *There is hardly any activity in the wavelength range associated with the regulation of Vitamin D3 synthesis.*

tom@tomaskas.co.uk

In practical terms, this tells us that the lamps will cause the skin to synthesise Vitamin D3, however the lamps are also very likely to cause eye problems if used long term with animals.

These lamps could cause overproduction of Vitamin D3 if the animal is exposed to the lamp for any significant length of time. This could lead to hypervitaminosisD.

There is activity in the visual spectrum – typical of white LEDs.

The "UVA" diodes included peak in activity just below 400nm. A large proportion of their output is in the "violet" range rather than the ultraviolet range.

The lamps do not approximate sunlight in the UVB range at all.

COLOUR RENDERING AND VISION

The colour, to my eyes, is fairly white with a slight tint towards blue. The lamps render colour for human vision poorly. To an animal, the lamps would appear very tinted towards the UVA part of the spectrum, due to the very disproportionate activity in this range.

The lamps are not very bright. But this is to be expected if considering the fact that a number of the diodes are non-visual and are using up a portion of the overall wattage.

OTHER COMMENTS

The Power Factor of the 5.0 lamp is approximately 3.1. This is very low and considered poor. This is not atypical of a UVB LED product. The Power Factor for the 10.0 lamp is approximately 3.2. This is very low and considered poor. This is not atypical of a UVB LED product.

tom@tomaskas.co.uk

There are no safety markings on the lamps, which concerns me as they are for sale in the UK.

I do not recommend either of these lamps for use with animals. I recommend anyone who has purchased these lamps to contact their seller and request a refund.

tom@tomaskas.co.uk

FURTHER TESTS

LONGEVITY AND DEGRIDATION

There is no statement that the lamps will emit UVB for any amount of time. This was not tested, although such a test is doable if time was put aside for the test.

TEARDOWN

At this point I have not conducted a teardown of the lamps. This could involve reviewing electronics inside, although I may seek further counsel on this first as I don't want to break any laws regarding intellectual property.

LEDs are widely used in many sectors, and I don't suspect there is any ground-breaking technology inside to warrant a teardown.

tom@tomaskas.co.uk

SPECIAL THANKS

Special thanks are in order for many friends, colleagues, and partners. I'd like to give a thank you to the following, but there are undoubtedly more that have not been named.

COLLEAGUES

Dr Sarina Wunderlich has kindly allowed me to utilise her Reptile Lamp Database system to generate some technical graphs and datasets. She has not explicitly endorsed this document or seen it before release.

LITERATURE AND FURTHER READING

In this paper, I have made comments supported by scientific literature, both peer-reviewed and not. Here is a list of literature that I have either directly referenced, or used in support of points and claims that I've made. The list is not extensive.

PEER-REVIEWED LITERATURE

Holick, M. F (2016) - Biological Effects of Sunlight, Ultraviolet Radiation, Visible Light, Infrared Radiation and Vitamin D for Health. Anticancer Research 36: 1345-1356 (2016)

Wacker and Holick (2013) - Sunlight and Vitamin D. Dermatoendocrinol. Jan 1; 5(1): 51–108.

Christopher J. Laing, Angelika Trube, Glenn M. Shea, and David R. Fraser (2001) - The requirement for natural sunlight to prevent

tom@tomaskas.co.uk

vitamin D deficiency in iguanian lizards. Journal of Zoo and Wildlife Medicine 32(3), 342-348.

Acierno, M.J., Mithcell, M.A., Roundtree, M.K., and Zachariah, T.T., (2006) - Effects of ultraviolet radiation on 25-hydroxyvitamin D3 synthesis in red-eared slider turtles (Trachemys scripta elegans). American Journal of Veterinary Research, 67(12), pp. 2046-2049.

MacLaughlin, J., Anderson, R. & Holick, M. F. (1982) - Spectral character of sunlight modulates photosynthesis of previtamin D3 and its photoisomers in human skin. Science, 216 1001–1003.

Baines, F. M. et al. (2016) - How much UV-B does my reptile need? The UV-Tool, a guide to the selection of UV lighting for reptiles and amphibians in captivity. Journal of Zoo and Aquarium Research, 4.

Ferguson, G. W. et al. (2010) - Voluntary exposure of some western-hemisphere snake and lizard species to ultraviolet-B radiation in the field: how much ultraviolet-B should a lizard or snake receive in captivity? Zoo Biology 29(3), 317-34.

Scott, R. K. et al. (2015) - Evolutionary transformation of rod photoreceptors in the all-cone retina of a diurnal garter snake. PNAS 113, 2.

Sillman et al. (1999) - The photoreceptors and visual pigments in the retina of a boid snake, the ball python (Python regius). The Journal of Experimental Biology, 202, 1931–1938.

Kelber, A., Vorobyev, M. & Osorio, D. (2003) - Animal colour vision - behavioural tests and physiological concepts. Biological Reviews, 78 81–118.

Katti C, Stacey-Solis M, Coronel-Rojas NA and Davies WIL (2019) - The Diversity and Adaptive Evolution of Visual Photopigments in Reptiles. Front. Ecol. Evol. 7:35.

tom@tomaskas.co.uk

Sarika Paul and Timothy M Brown (2019) - Direct effects of the light environment on daily neuroendocrine control. Journal of Endocrinology, 243:1.

Albers et al. (2019) - Blue light (λ=453 nm) nitric oxide dependently induces β-endorphin production of human skin keratinocytes in-vitro and increases systemic βendorphin levels in humans in-vivo. Free Radical Biology and Medicine 145 78-86.

Grace, Michael S. (1997) - The visual system and non-visual photoreception. The Biology Husbandry, and Health Care of Reptiles. Lowell Ackerman, DVM, ed. Vol. I, pp. 325-341.

G. Chen et al. (2017) - Mercury speciation by differential photochemical vapor generation at UV-B vs. UV-C wavelength. Spectrochimica Acta Part B 137, 1–7.

C. M. Lerche et al. (2017) - UVR: sun, lamps, pigmentation and vitamin D. Photochem. Photobiol. Sci., 2017, 16, 291-301

Lindgren, J., Gehrmann, W. H., Ferguson, G. W. & Pinder, J. E. (2008) - Measuring Effective Vitamin D3-Producing Ultraviolet B Radiation Using Solartech's Solarmeter® 6.4 Handheld, UVB Radiometer. Bulletin of the Chicago Herpetological Society, 43 57–62.

Holick, M. F. (2016) - Biological Effects of Sunlight, Ultraviolet Radiation, Visible Light, Infrared Radiation and Vitamin D for Health. Anticancer Research, 36 1345–1356.

James K. Bowmaker (2012) - Evolution of the Vertebrate Eye. How Animals See the World: Comparative Behavior, Biology, and Evolution of Vision 23 441–472.

Tosini et al. (2001) - The circadian system of reptiles: a multioscillatory and multiphotoreceptive system. Physiology & Behavior 72 (2001) 461-471.

Kalajian, T. A., Aldoukhi, A., Veronikis, T.J., Persons, K.& Holick, M. F. (2017) - Ultraviolet B Light Emitting Diodes (LEDs) Are More Efficient and Effective in Producing Vitamin D3 in Human Skin Compared to Natural Sunlight. Scientific Reports, 7 11489.

Sakich and Tattersall (2022) - Regulation of Exposure to Ultraviolet Light in Bearded Dragons (Pogona vitticeps) in Relation to Temperature and Scalation Phenotype. Ichthyology & Herpetology 110, No. 3, 2022, 477–488.

Cusack, L., Rivera, S., Lock, B., Benboe, D., Brothers, D. & Divers, S. (2017) - Effects of a light-emitting diode on the production of cholecalciferol and associated blood parameters in the bearded dragon (pogona vitticeps). Journal of zoo and wildlife medicine, 48 1120–1126.

OTHER LITERATURE

Sinclair, Sandra (1985) - How Animals See: Other Visions of Our World. Croom Helm, London.

Dr Frances M Baines (2021) - Vitamin D3 Synthesis: A self-limiting process in natural sunlight.

Loos, B. de (Babette) (2016) – Production of cutaneous vitamin D3 after UVB radiation in reptiles and amphibians. Faculty of Veterinary Medicine Research Internship Department: Biochemistry and Cell Biology

Baines, F. M. (2008) - Photo-kerato-conjunctivitis in reptiles. In Proceedings of the Autumn British Veterinary Zoological Society Meeting. BVZS: UK.

GOV . UK (2023) – Guidance - Using the UKCA marking.

GOV . UK (2023) – Guidance - Using the CE marking.