Spectral Data Report FAQ

Photometry 101
There are two types of testing done when photometry is being created. The goniophotometer (goni) test and the sphere test. In simple terms the goni measures the quantity of light and the sphere measures the quality of light. Goni test results are used to generate the IES files we use to create layouts. They tell you how much light you have and where its going. The sphere test (sometimes called the LM-79 test) tells you about the quality of the light. From exact CCT and CRI, to spectral graphs, R values, and more. TM-30 reports are derived from the data in the sphere test.

Spectral Data Report
The spectral data report was created to provide the critical data around the spectral properties of the light in a concise, easily digested format. This guide will cover how to read the critical pieces of data displayed on the report.

Why is this so important now?
The effects of lighting on people in spaces is being explored in ways we never thought of 20 years ago. The right lighting, used correctly provides visual comfort, task visibility and positive spatial perception.

The Well Building Standard, Living Building Challenge and LEED all offer credits for using lighting to make interior spaces more comfortable. Lighting effects not only our vision but also our biology. Two of the biggest criteria we can use to measure those effects are glare and quality of light.

Even organizations like DLC are incorporating human centric metrics like glare mitigation into their requirements. As we move beyond LED systems being more than just great energy savers, these human centric measures will become more important.

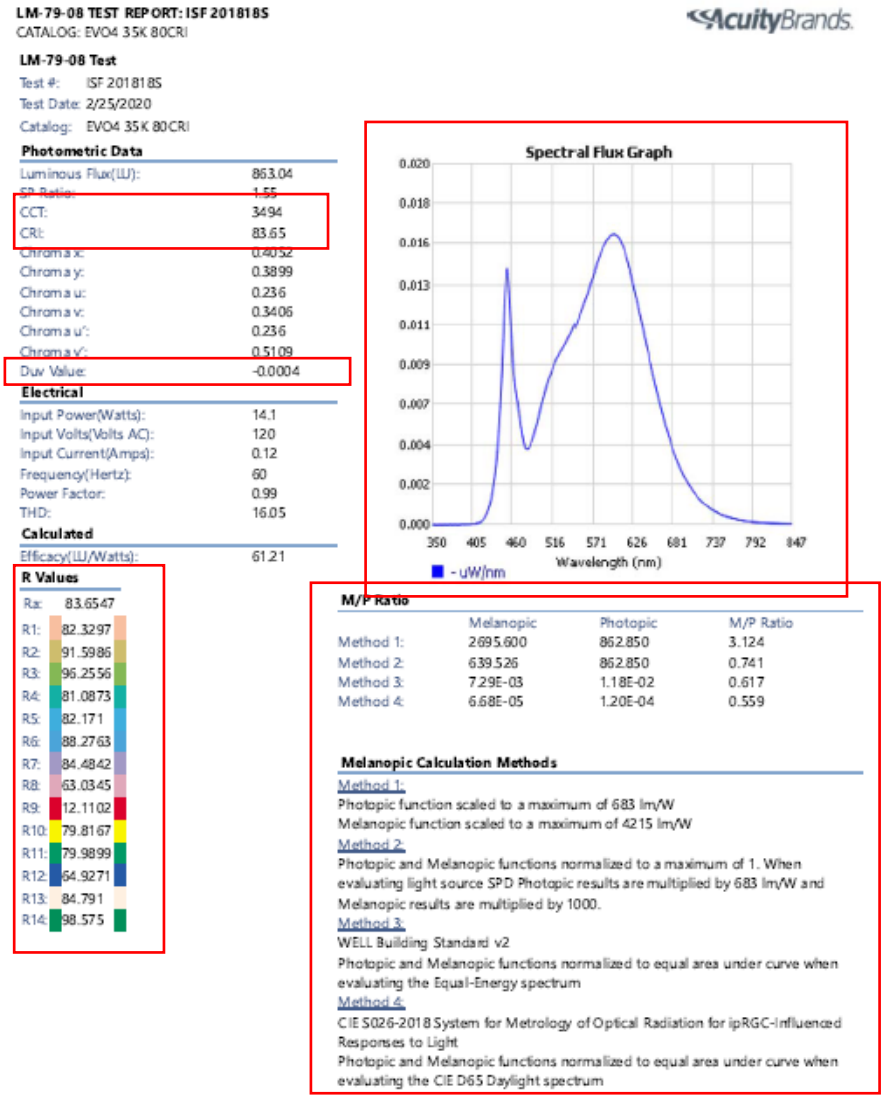
Spectral Data Report FAQ

Spectral Data Report - page 1
The cover page lets you know the brand, series, CCT, CRI and any other critical information to understand the set of fixtures this report applies to. This data is about the LED chips and the light they emit, lumen output and the size of the fixture do not effect the spectral information. As long as the chips are the same, the spectral data will be the same.

Size differences of luminaires just mean there are more or less of the same chip. Lumen output differences are a factor of quantity of chips and drive current. Neither variable effects spectral qualities.

Note - you may see several series within a family that use the same spectral data sheet, that is because they have the same light engine, therefore the same LED chips.

Spectral Data Report - page 2
This is a modified version of a standard sphere test, the most critical difference is the addition of the melanopic ratio.
Key points to be reviewed:
CCT
CRI
DuV (reviewed with page 3 data)
R Values
Spectral Flux Graph
Melanopic Ratio



LM-79-08 TEST REPORT: ISF 201818S
CATALOG: EVO4 35K 80CRI

LM-79-08 Test

Test #:	ISF 201818S
Test Date:	2/25/2020
Catalog:	EVO4 35K 80CRI

Photometric Data

Luminous Flux(LU):	863.04
SP Ratio:	1.55
CCT:	3494
CRI:	83.65
Chroma x:	0.4032
Chroma y:	0.3899
Chroma u:	0.236
Chroma v:	0.3406
Chroma u':	0.236
Chroma v':	0.5109
Duv Value:	-0.0004

Electrical

Input Power(Watts):	14.1
Input Volts(Volts AC):	120
Input Current(Amps):	0.12
Frequency(Hertz):	60
Power Factor:	0.99
THD:	16.05

Calculated

Efficacy(LU/Watts):	61.21

R Values

Ra:	83.6547
R1:	82.3297
R2:	91.5986
R3:	96.2556
R4:	81.0873
R5:	82.171
R6:	88.2763
R7:	84.4842
R8:	63.0345
R9:	12.1102
R10:	79.8167
R11:	79.9899
R12:	64.9271
R13:	84.791
R14:	98.575

Spectral Flux Graph
0.020
0.018
0.016
0.013
0.011
0.009
0.007
0.004
0.002
0.000
350 405 460 516 571 626 681 737 792 847
Wavelength (nm)
- uW/nm

M/P Ratio

	Melanopic	Photopic	M/P Ratio
Method 1:	2695.600	862.850	3.124
Method 2:	639.526	862.850	0.741
Method 3:	7.29E-03	1.18E-02	0.617
Method 4:	6.68E-05	1.20E-04	0.559

Melanopic Calculation Methods

Method 1:
Photopic function scaled to a maximum of 683 lm/W
Melanopic function scaled to a maximum of 4215 lm/W
Method 2:
Photopic and Melanopic functions normalized to a maximum of 1. When evaluating light source SPD Photopic results are multiplied by 683 lm/W and Melanopic results are multiplied by 1000.
Method 3:
WELL Building Standard v2
Photopic and Melanopic functions normalized to equal area under curve when evaluating the Equal-Energy spectrum
Method 4:
CIE S026-2018 System for Metrology of Optical Radiation for ipRGC-Influenced Responses to Light
Photopic and Melanopic functions normalized to equal area under curve when evaluating the CIE D65 Daylight spectrum

Spectral Data Report FAQ

CCT = Correlated Color Temperature
It is a measure of how warm or cool the light source appears as measured by its location on a black body (Planckian locus) radiator curve. CCT is measured in Kelvins

Photometric Data	
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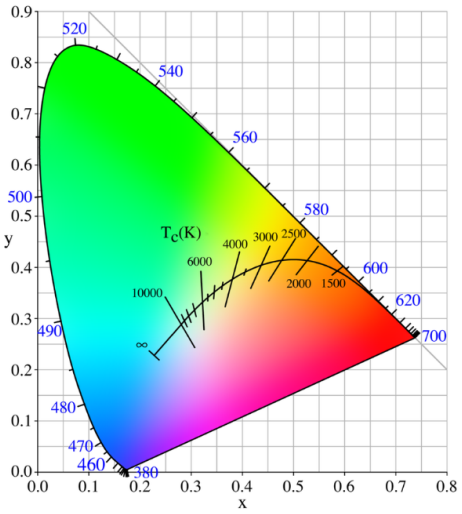
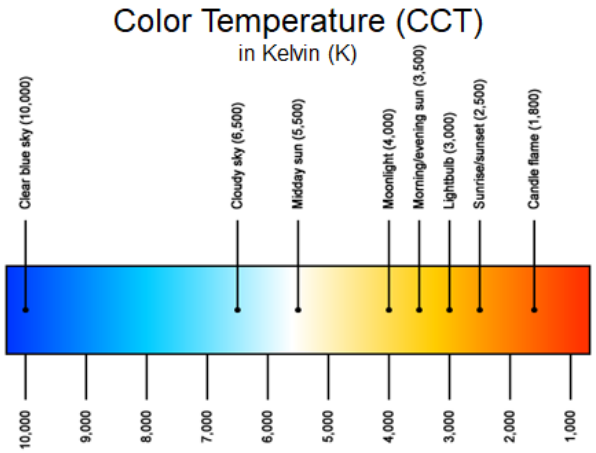
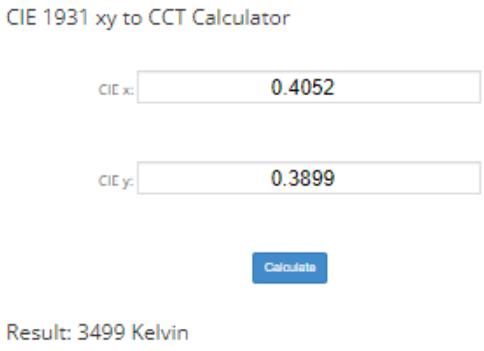




Chroma x and Chroma y are used to plot the location on the black body curve to determine the CCT (see link below for more information)



https://www.waveformlighting.com/tech/calculate-color-temperature-cct-from-cie-1931-xy-coordinates

Spectral Data Report FAQ

Color Rendering Index (CRI)- is a measure of how well the light source renders the colors that we see compared to natural daylight (100).
CRI is based on the first 8 Munsell colors (R1 - R8) however they have some limitations, particularly in gauging how they render the color red.

By expanding the range of color being analyzed we get a better picture, particularly by assessing the R9 number.

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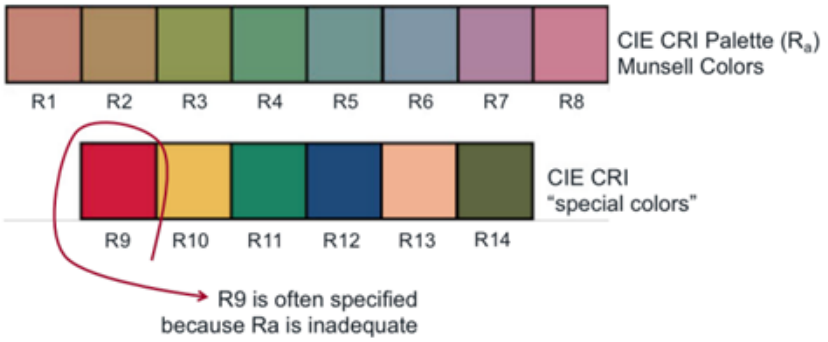

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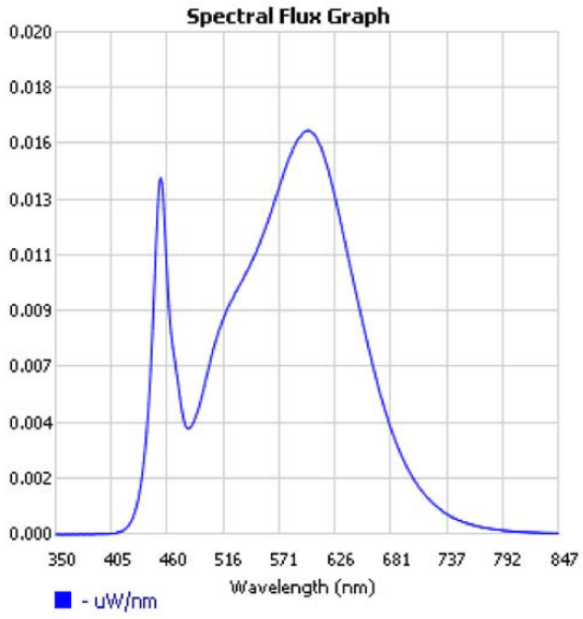
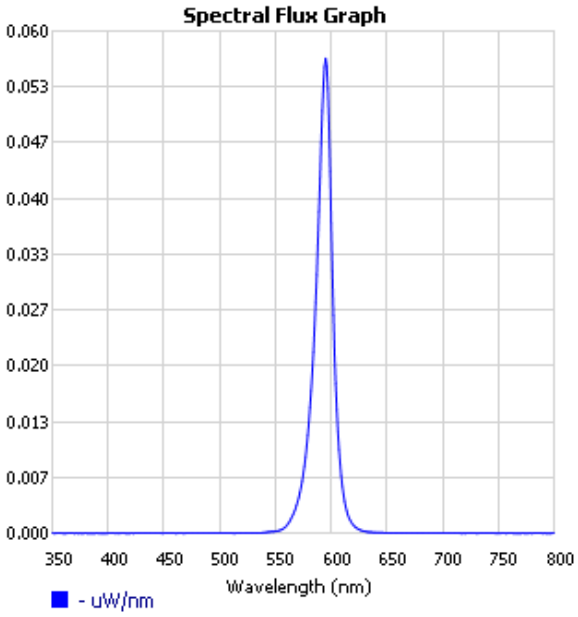
Spectral Data Report FAQ

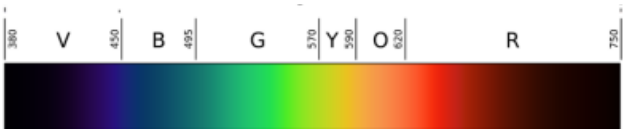
Spectral Flux Graph
(also called Spectral Distribution, Spectral Power Distribution)
Is a graphic representation of the visible wavelengths of light measured in nanometers.



Typical 35K white source



Limited wavelength amber



Spectral Data Report FAQ

Melanopic Ratio -
The M/P ratio measures the circadian effects of the light source on the human body.
The confusion around this topic is because there are currently four different methods available to calculate a M/P number and no agreement from the industry on which is the best.

Acuity has calculated all four M/P ratios for you. The most common one you will use is method 3 for the Well Building Standard. However, it is always a good idea to confirm which calculation method is required for the specific circadian application you are designing.

M/P Ratio

	Melanopic	Photopic	M/P Ratio
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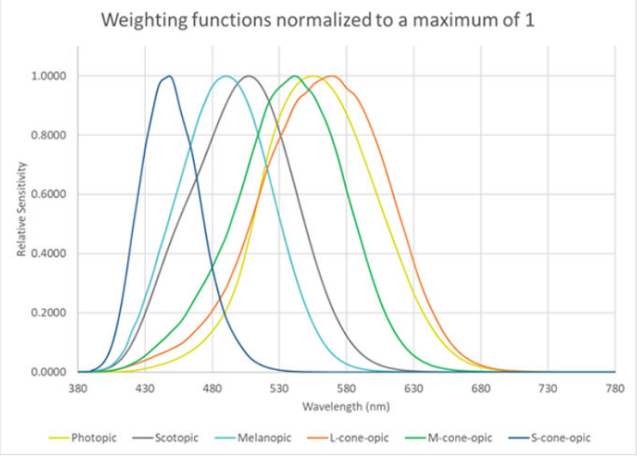


Reference document:
https://www.ies.org/research/fires/m-p-ratios-can-we-agree-on-how-to-calculate-them/

Spectral Data Report FAQ

Page 3 of the spectral data report focuses on TM-30 data. TM-30 seeks to improve CRI by using 99 color data points versus the 8 Munsell colors used in CRI.

CRI TM-30

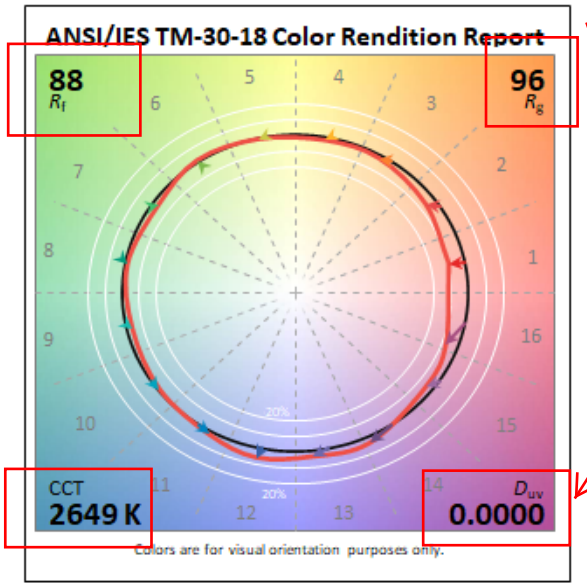
Table 1. Comparison of the CIE Test-Colour Method (commonly known as CRI) and IES TM-30-15.

	CIE 13.3-1995 (CRI)	IES TM-30-15
Year of Issuance	1965, 1974 (Revision), 1995	2015
Color Space	CIE 1964 U*V*W*	CAM02-UCS (CIECAM02)
Number of Color Samples	8 general (for R_a) plus 6 special (for R_is)	99
Color Volume Coverage	Limited	Full and equal
Saturated Samples	No	Yes
Sample Types	Munsell samples only (limited pigments)	Variety of real objects
Sample Spectral Uniformity	No	Yes
Reference Illuminants	Blackbody radiation, CIE D series	Blackbody radiation, CIE D series
Reference Transition	Sharp at 5000 K	Blended between 4500 K and 5500 K
Output Measures	General index, R_a (fidelity) 6 special indices, R_i (fidelity)	Fidelity Index, R_f Gamut Index, R_g Color Vector/Saturation Graphics 16 hue-based fidelity indices 16 hue-based chroma indices 1 skin-specific fidelity index 99 individual fidelity values
Score Ranges	Max 100 with no lower limit, variable scaling	0 to 100, consistent scaling

Spectral Data Report FAQ

How to read the TM-30-18 Color Rendition Report

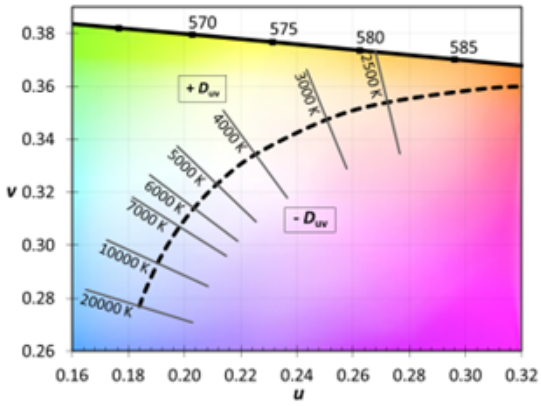
Rf Fidelity Index
Measures color distortion. This is an average of how far the red circle varies from the black circle (either inside or outside) with 100 being a perfect match.



Rg Gamut Index
This measures saturation compared to natural light. 100 = exact match, numbers over 100 indicate increased saturation, under 100 indicates decreased saturation.

Exact CCT

Duv Value
Measures the distance to the black body locus. Negative Duv indicate the light falling below the black body curve giving it a purplish cast, positive Duv is above the curve giving it a greenish tint.



Spectral Data Report FAQ

Hue Data

Provides a numerical characterization of color fidelity in each of the 16 hue bins. This can be used to evaluate how similarly the light source renders color hues compared to the reference. Values range from 0 to 100. These scores are analogous to the special indices of the CRI system (e.g., R9), but are more robust because they combine several samples with different spectral features. Different hues are rendered in different ways.