

# VDU 12 - 2D Spectral Imaging Colorimeters

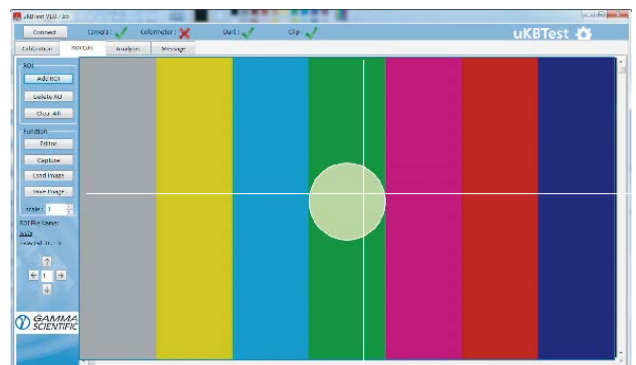
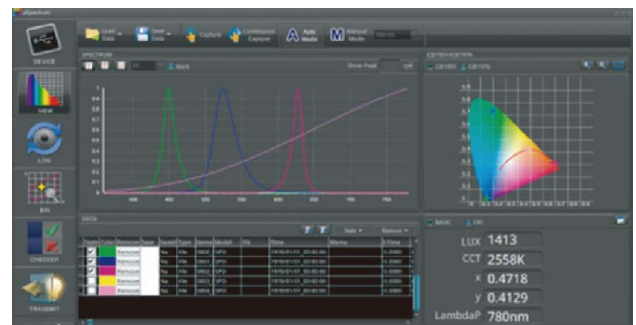


The VDU 12 is a next generation family of 2D spectral imaging colorimeters combining the strengths of a CCD image sensor and high performance spectroradiometer. This results in a rapid and highly accurate system for display measurements including luminance, correlated color temperature (CCT), CIE chromaticity, spectrum and uniformity. The system is particularly well suited for test and characterization of LCD, LED, OLED and quantum dot displays. Laboratory grade accuracy and flexibility are combined with high speed and durability for demanding production environments.

## Rapid, Accurate and Repeatable Display Characterization

### Features

- Integrated spectroradiometer, significantly improving accuracy, repeatability and unit-to-unit consistency
- 2D Luminance, CCT, CIE x, y, u', v', and uniformity
- User-programmable regions of interest
- Auto darkness and flat field correction
- Spectral measurement and data including spectrum power distribution, peak and dominant wavelength
- Lens options vary for screens of different sizes, from micro to large
- ISO 17025 certified and NIST traceable calibration



Camera Specifications	
Active Image (H x V)	4096 x 3000 (12.29 MP)
Pixel Size	3.45 $\mu\text{m}$
Sensor Size	1.1" Diagonal
Measurement Time Range	30 $\mu\text{s}$ to 10 seconds
Measuring Parameters	Luminance ( $\text{cd}/\text{m}^2$ ) Correlated color temperature (CCT) CIE chromaticity coordinates (1) CIE 1931 x,y coordinates (2) CIE 1931 XYZ value Delta uv (Duv)

Spectroradiometer Specifications		
Wavelength Range (nm)	380 to 780	
Wavelength Data Increment (nm)	1	
Wavelength Reproducibility	$\pm 1$ nm	
Stray Light	-25 dB max.*3	
Polarization	< 3%	
Integration Time Range	100 $\mu\text{s}$ to 5 seconds	
Luminance *1*2*4	Measurement range (for Accuracy and Repeatability)	0.005 ~ 5,000 $\text{cd}/\text{m}^2$
	Accuracy	$\pm 1.5\%$ @ 0.1 to 5,000 $\text{cd}/\text{m}^2$ $\pm 4\%$ @ 0.005 to 0.1 $\text{cd}/\text{m}^2$
	Repeatability (2 $\sigma$ )	0.5% @ 0.005 to 5,000 $\text{cd}/\text{m}^2$
Color *1*2*4	Measurement range (for Accuracy and Repeatability)	0.005 ~ 5,000 $\text{cd}/\text{m}^2$
	Accuracy	$\pm 0.001$ in CIE1931 x, y for white @ 0.1 to 5,000 $\text{cd}/\text{m}^2$ $\pm 0.002$ in CIE1931 x, y for white @ 0.005 to 0.1 $\text{cd}/\text{m}^2$
	Repeatability (2 $\sigma$ )	0.0005 in CIE1931 x, y for white @ 0.1 to 5,000 $\text{cd}/\text{m}^2$ 0.0015 in CIE1931 x, y for white @ 0.005 to 0.1 $\text{cd}/\text{m}^2$

System Configuration	
Interface	Ethernet 100/1000, USB 2.0, RS232
Power	48V 2.5A via an external 110-240V power supply. Power supply is included with the VDU-1160.
Dimensions (mm) with 50 mm lens	214 W x 223 L x 170 H <4.4 kg
Environmental	15 to 35 $^{\circ}\text{C}$ , relative humidity 70% or less without condensation

Spot Size and Field of View at Selected Working Distances for 35 mm f/1.4 Lens							
Working Distance (mm)	300	400	500	600	700	800	850
Spot Size (mm)	13	19	25	31	37	43	46
VDU 12							
Field of View, Horizontal (mm) <sup>(6)</sup>	128	172	214	254	294	333	355
Field of View, Vertical (mm) <sup>(6)</sup>	94	126	157	186	214	244	260
Field of View, Diagonal (inches) <sup>(6)</sup>	6.3	8.4	10.4	12.4	14.3	16.3	17.3

\*1. Luminance and color testing are based on white color with correlated color temperature @7200K.

Specifications are subject to change without notice.

\*2. Measure in normal mode with temperature  $23 \pm 2^{\circ}\text{C}$  and relative humidity 50% or less.

\*3. Repeatability test is based on the status of shutter opening.

\*4. Under 0.1 nits luminance level, measurement is done by camera only.

## VDU 12-CF 2D Spectral Imaging Colorimeter

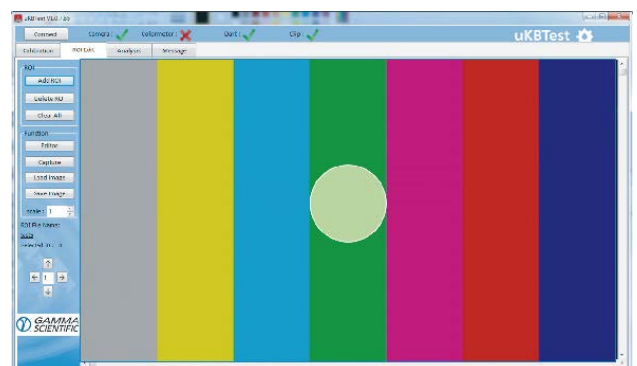


The VDU 12-CF is the next generation family of 2D spectral imaging colorimeters that includes a 2D CCD image sensor, CIE matching filters and high performance spectroradiometer (optional) for the optimization of the performance, which are used to minimize the uncertainty due to spectral mismatch for DUT with highly saturated colors. This results in a rapid, highly accurate, and repeatable measurement system covering luminance, CIE chromaticity ( $x$ ,  $y$ ,  $u'$ ,  $v'$ ), correlated color temperature (CCT), dominant and peak wavelength, spectral power distribution, and uniformity. The system is particularly well suited for test and characterization of LCD, Mini LED, OLED and quantum dot displays as well as back lighting, automotive applications, and lighting. Laboratory grade accuracy and flexibility are combined with high speed and durability for demanding production environments.

## Rapid, Accurate and Repeatable Display Characterization

### Features and Applications

- Rapid, highly accurate, and repeatable measurement system
- Measures luminance, CIE chromaticity, CCT, dominant and peak wavelength, SPD, and uniformity
- Capability to test and measure rigid, flexible, and stretchable displays
- Testing for LCD, OLED, mini LED, and quantum dot displays
- Optimized testing for back lighting, keyboards, automotive lamps and dashboards, architecture, and luminaire lighting



Camera Specifications		
Active Image (H x V)	4096 x 3000 (12.29 MP)	
Pixel Size	3.45 $\mu\text{m}$	
Sensor Size	1.1" Diagonal	
Measurement Range	0.01 $\text{cd}/\text{m}^2$ to 50,000 $\text{cd}/\text{m}^2$	
Luminance	Accuracy	$\pm 1\%$ compared to spectroradiometer
	Repeatability	$\pm 0.10\%$
Color	Accuracy	$\pm 0.001$ in CIE1931 x, y compared to spectroradiometer
	Repeatability	0.0005 in CIE1931 x, y
Measurement Time Range	30 $\mu\text{s}$ to 10 seconds	
Measurement Parameters	Luminance ( $\text{cd}/\text{m}^2$ )	
	Correlated color temperature (CCT)	
	CIE chromaticity coordinates (1) CIE 1931 x,y coordinates (2) CIE 1931 XYZ value	
	Delta uv (Duv)	

Spectroradiometer Specifications		
Wavelength Range (nm)	380 to 780	
Wavelength Data Increment (nm)	1	
Wavelength Reproducibility	$\pm 1$ nm	
Stray Light	-25 dB max. *4	
Polarization	< 3%	
Integration Time Range	100 $\mu\text{s}$ to 5000 ms	
Luminance	Measurement range (for Accuracy and Repeatability)	0.05 ~ 5,000 $\text{cd}/\text{m}^2$
	Accuracy	$\pm 2\%$
	Repeatability ( $2\sigma$ )	$\pm 0.2\%$
Color	Measurement range (for Accuracy and Repeatability)	0.05 ~ 5,000 $\text{cd}/\text{m}^2$
	Accuracy	$\pm 0.002$ in CIE1931 x, y
	Repeatability ( $2\sigma$ )	0.0005 in CIE1931 x, y

System Configuration		
Interface	Ethernet 100/1000, USB 2.0, RS232	
Power	48V 2.5A via an external 110-240V power supply	
Dimensions (mm) with 50 mm lens	270 W x 263.6 L x 170 H	<6.5 kg
Environmental	15 to 35 $^{\circ}\text{C}$ , relative humidity 70% or less without condensation	

Spot Size and Field of View at Selected Working Distances for 35 mm f/1.4 Lens							
Working Distance (mm)	300	400	500	600	700	800	850
Spot Size (mm)	13	19	25	31	37	43	46
Field of View, Horizontal (mm) <sup>(6)</sup>	128	172	214	254	294	333	355
Field of View, Vertical (mm) <sup>(6)</sup>	94	126	157	186	214	244	260
Field of View, Diagonal (inches) <sup>(6)</sup>	6.3	8.4	10.4	12.4	14.3	16.3	17.3

\*1. Luminance and color testing are based on Gamma Scientific standard light source.

\*2. Measure in normal mode with temperature  $23 \pm 2^{\circ}\text{C}$  and relative humidity 50% or less.

\*3. Field of view is calculated. Actual field of view may vary depending upon setup.

\*4. Accuracy and repeatability specifications are for 100-5000 nit range.

\*5. Specifications are subject to change without notice.

## VDU 65-CF 2D Spectral Imaging Colorimeters



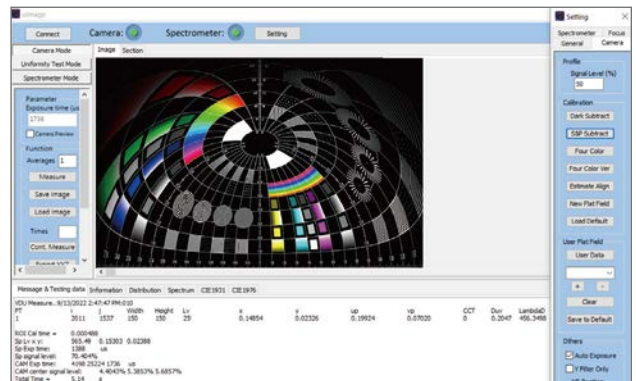
The VDU 65-CF is the next generation family of 2D spectral imaging colorimeters that includes a 2D CCD image sensor, CIE matching filters and high performance spectroradiometer (optional) for the optimization of the CCD, which are used to minimize the uncertainty due to spectral mismatch for DUT with highly saturated colors. This results in a rapid, highly accurate, and repeatable measurements system covering luminance, CIE chromaticity (XYZ value, x, y, u', v'), correlated color temperature (CCT), dominant wavelength, peak wavelength, spectral power distribution, and uniformity. The system is particularly well suited for test and characterization of LCD, Mini LED, OLED and quantum dot displays and backlight, automotive applications, and lighting. Laboratory grade accuracy and flexibility are combined with high speed and durability for demanding production environments.

## High Resolution, Rapid, and Repeatable Display Characterization

### Features

Lv, x/y, uniformity by luminance and color for:

- Size of OLED, LCD, and Mini LED displays
- Ultra-small size displays like LCOS, micro OLED, and micro LED displays
- Automotive applications including CID, HUD, instrument panels, interior lighting, tail lights, camera monitoring systems (CMS), mirrors, and more
- Keyboard or mini LED backlight module
- Indoor, outdoor, street, and tunnel lighting products



Camera Specifications		
Active Image (H x V)	9,344 x 7,000 (65 MP)	
Pixel Size	3.2 $\mu\text{m}$	
Sensor Size	37.36 mm Diagonal	
Measurement Range	0.01 $\text{cd}/\text{m}^2$ to 50,000 $\text{cd}/\text{m}^2$	
Luminance <sup>*1*4</sup>	Accuracy	$\pm 1\%$ compared to external spectroradiometer
	Repeatability	0.10%
Color <sup>*1*4</sup>	Accuracy	$\pm 0.001$ in CIE1931 x, y compared to spectroradiometer
	Repeatability	0.0005 in CIE1931 x, y
Measurement Parameters	Luminance ( $\text{cd}/\text{m}^2$ )	
	Correlated color temperature (CCT)	
	CIE chromaticity coordinates (1) CIE 1931 x,y coordinates (2) CIE 1931 XYZ value	
	CIE (1) CIE 1931 x/y; (2) CIE 1931 XYZ	
	Delta uv (Duv)/CIE 1960 uv	
	Dominant Wavelength $\lambda_D$ Uniformity	

Spectroradiometer Specifications		
Wavelength Range (nm)	380 to 780	
Wavelength Data Increment (nm)	1	
Wavelength Reproducibility	$\pm 1$ nm	
Stray Light	-25 dB max.	
Polarization	< 3%	
Integration Time Range	100 $\mu\text{s}$ to 5000 ms	
Luminance	Measurement range (for Accuracy and Repeatability)	0.05 ~ 5,000 $\text{cd}/\text{m}^2$
	Accuracy	$\pm 2\%$
	Repeatability ( $2\sigma$ )	$\pm 0.2\%$
Color	Measurement range (for Accuracy and Repeatability)	0.05 ~ 5,000 $\text{cd}/\text{m}^2$
	Accuracy	$\pm 0.002$ in CIE1931 x, y
	Repeatability ( $2\sigma$ )	0.0005 in CIE1931 x, y
Dimensions (mm) with 50 mm lens	270 W x 263.6 L x 170 H	<6.5 kg
Environmental	15 to 35 $^{\circ}\text{C}$ , relative humidity 70% or less without condensation	

Field of View (FOV) with Different Lens Options		
Sensor Pixel Resolution	4,096 x 3,000 (12.3 MP)	9,344 x 7,000 (65 MP)
Field of View <sup>*3</sup> (Full Angle, H x V degrees)	18 mm $43^{\circ}$ x $32^{\circ}$	18 mm $79^{\circ}$ x $64^{\circ}$
	35 mm $23^{\circ}$ x $17^{\circ}$	35 mm $46^{\circ}$ x $35^{\circ}$
	50 mm $16^{\circ}$ x $12^{\circ}$	50 mm $33^{\circ}$ x $25^{\circ}$
	100 mm $8^{\circ}$ x $6^{\circ}$	100 mm $17^{\circ}$ x $13^{\circ}$

- \*1. Luminance and color testing are based on Gamma Scientific standard light source.
- \*2. Measure in normal mode with temperature  $23 \pm 2^{\circ}\text{C}$  and relative humidity 50% or less.
- \*3. Field of view is calculated. Actual field of view may vary depending upon setup.
- \*4. Accuracy and repeatability specifications are for 100-5000 nit range.
- \*5. Specifications are subject to change without notice.

## VDU 65-CF Macro 2D Spectral Imaging Colorimeter

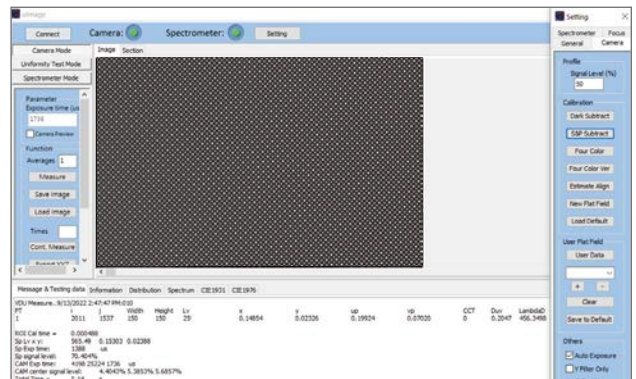


The VDU 65-CF Macro is the next generation in our family of 2D spectral imaging colorimeters that includes a 65M 2D CCD image sensor, CIE matching filters and high performance spectroradiometer (optional) for acting as a live reference, which are used to minimize the uncertainty due to spectral mismatch for DUT with highly saturated colors. This results in a rapid, highly accurate, and repeatable measurements system covering luminance, CIE chromaticity (XYZ value,  $x$ ,  $y$ ,  $u'$ ,  $v'$ ), correlated color temperature (CCT), dominant wavelength, peak wavelength, spectral power distribution, and uniformity. The system is particularly well suited for test and characterization of high-resolution LCD, Mini LED, OLED and quantum dot displays, as well as backlighting, automotive applications, and lighting. Laboratory grade accuracy and flexibility are combined with high speed and durability for demanding production environments.

## High Resolution, Rapid, and Repeatable Display Characterization

### Features and Applications

- Optimized for the high resolution and single pixel characterization of high definition displays plus exceptional low light sensitivity on a subpixel level
- Rapid, highly accurate, and repeatable measurement system
- Measures luminance, CIE chromaticity, CCT, dominant and peak wavelength, SPD, and uniformity
- Testing for LCOS, mini- and micro-OLED, mini- and micro-LED, and micro displays with quantum dot technology
- Capability to test and measure rigid, flexible, rollable, and stretchable displays



Camera Specifications		
Active Image (H x V)	9,344 x 7,000 (65 MP)	
Pixel Size	3.2 $\mu\text{m}$	
Sensor Size	37.36 mm Diagonal	
Measurement Range	0.01 $\text{cd}/\text{m}^2$ to 50,000 $\text{cd}/\text{m}^2$	
Luminance*1*4	Accuracy	$\pm 1\%$ compared to external spectroradiometer
	Repeatability	0.10%
Color*1*4	Accuracy	$\pm 0.001$ in CIE1931 x, y compared to spectroradiometer
	Repeatability	0.0005 in CIE1931 x, y
Measurement Parameters	Luminance ( $\text{cd}/\text{m}^2$ )	
	Correlated color temperature (CCT)	
	CIE chromaticity coordinates (1) CIE 1931 x,y coordinates (2) CIE 1931 XYZ value	
	CIE (1) CIE 1931 x/y; (2) CIE 1931 XYZ	
	Delta uv (Duv)/CIE 1960 uv	
	Dominant Wavelength LambdaD Uniformity	

Spectroradiometer Specifications		
Wavelength Range (nm)	380 to 780	
Wavelength Data Increment (nm)	1	
Wavelength Reproducibility	$\pm 1$ nm	
Stray Light	-25 dB max.	
Polarization	< 3%	
Integration Time Range	100 $\mu\text{s}$ to 5000 ms	
Luminance	Measurement range (for Accuracy and Repeatability)	0.05 ~ 5,000 $\text{cd}/\text{m}^2$
	Accuracy	$\pm 2\%$
	Repeatability ( $2\sigma$ )	$\pm 0.2\%$
Color	Measurement range (for Accuracy and Repeatability)	0.05 ~ 5,000 $\text{cd}/\text{m}^2$
	Accuracy	$\pm 0.002$ in CIE1931 x, y
	Repeatability ( $2\sigma$ )	0.0005 in CIE1931 x, y
Dimensions (mm) with 50 mm lens	270 W x 263.6 L x 170 H	<6.5 kg
Environmental	15 to 35 $^{\circ}\text{C}$ , relative humidity 70% or less without condensation	

Field of View (FOV) with Different Lens Options					
Lens Option	25 mm Macro Lens (mm)		25 mm Macro Lens (mm) with Enhanced Lens	100 mm Macro Lens (mm)	
	2.5X	5X	10X	0.5X	2X
Magnification	2.5X	5X	10X	0.5X	2X
Field of View (FOV)	11.96 (H)	5.98 (H)	2.99 (H)	59.80 (H)	14.95 (H)
	8.96 (V)	4.48 (V)	2.24 (V)	44.80 (V)	11.20 (V)
	14.94 (DIAG)	7.47 (DIAG)	3.74 (DIAG)	74.72 (DIAG)	18.68 (DIAG)
Working Distance (mm)	45	39	36	174	72

\*1. Luminance and color testing are based on Gamma Scientific standard light source.  
 \*2. Measure in normal mode with temperature  $23 \pm 2^{\circ}\text{C}$  and relative humidity 50% or less.  
 \*3. Field of view is calculated. Actual field of view may vary depending upon setup.  
 \*4. Accuracy and repeatability specifications are for 100-5000 nit range.  
 \*5. Specifications are subject to change without notice.