



**WESTBORO
PHOTONICS**

DRS100

1 METER DIFFUSE
REFLECTANCE SPHERE

DRS100

KEY FEATURES

Uniform Hemispherical
Illumination

Reflectance from 5° to 80°

Specular Included or
Excluded

Illumination to over
10,000 lux



APPLICATIONS

Display Characterization
to ICDM 11.2, 11.3

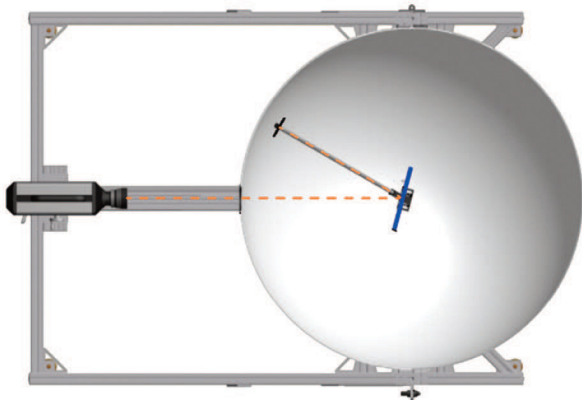
The DRS100 is the ideal platform to completely characterize the diffuse reflectance properties of mobile displays.

BACKGROUND

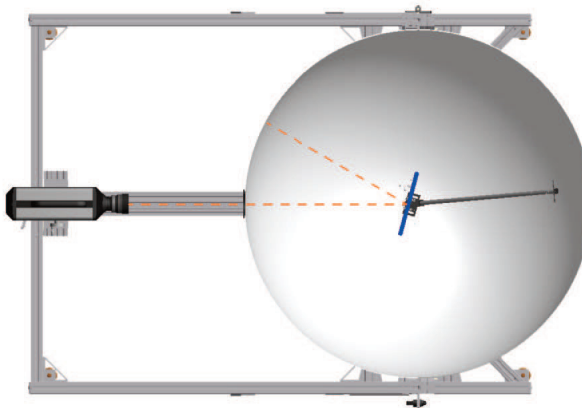
Users of mobile displays use them in all ambient lighting environments; from the brightest days outdoors to complete darkness. When there is strong ambient lighting, observers of mobile devices will automatically tilt the display or change their angle of regard in order to avoid seeing unwanted glare caused by direct sunlight or bright lighting fixtures. However, wide angle overhead lighting or sky illumination must, in general be accommodated. Typical office lighting can provide up to 1000 lux of illumination, while

overcast or blue sky (without direct sunlight) can be over 10,000 lux. The evaluation of mobile displays in these diffuse illumination conditions is critical to the understanding of display performance in the real world.

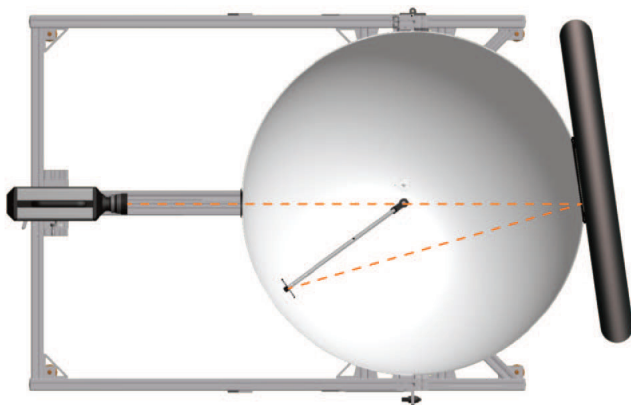
The DRS's patented technology allows for the measurement of the light reflectance at any angle, with or without the specular component. It can also accommodate very high or low illumination levels.



DRS100 configured to measure a small display at the centre of the sphere, at 15° rotation, specular excluded.



DRS100 configured to measure a sample in the specular included geometry. The trap behind the display and of no consequence in the measurement.



DRS100 configured to measure a large display at 8°, specular excluded. This measurement conforms to IDMS 11.2.2 sampling sphere implementation.

DESCRIPTION

The display being tested is mounted on the post in the center of the sphere. The post can be rotated and the angle of rotation is read off the goniometer at the base of the sphere. There is a 63 mm port through which the measuring instrument views the display. The DRS100 can be used to measure reflectance as near as 5° from normal to as oblique as 80°. The angular readout on the goniometer base is better than 1°.

A baffled 20 W tungsten halogen lamp at the top of the sphere provides illumination of over 1000 lux at the sample. For greater lux levels inside the sphere, additional baffled lamps at the bottom of the sphere may be operated.

The centre post holding the sample platform is made of standard 1/2" optical mounting posts. Spare posts of various sizes are included with the system so that users may raise or lower the sample platform to properly center their displays. The sample platform comes with posts and clips suitable to mount cell phones or tablets.

Display cabling may be routed through a 25 mm port at the bottom of the sphere beside the sample post.

Simple spot photometers, colorimeters or spectroradiometers will work well with the DRS100, however, imaging versions of those instruments can also effortlessly measure more areas of interest on, or around the display.

An imaging system can:

- measure both black and white states simultaneously if a checkerboard is on the display
- simultaneously measure a reference reflector in the scene to monitor the illumination of the display
- provide a visual record of the setup superimposed with the photometric or colorimetric information for further investigation.

SPECULAR INCLUDED OR EXCLUDED

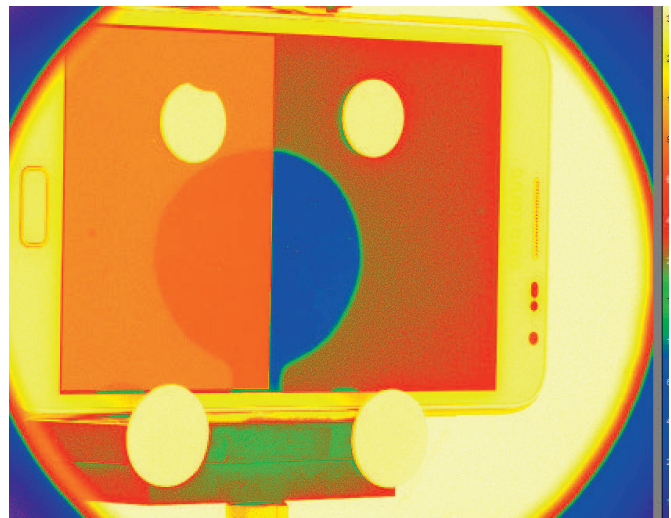
If the specular component is “excluded”, a light trap is placed at the angle where mirror like reflections are sourced. For the specular “included” condition, the specular angle includes the specular angle source (the bright sphere wall).

Sections 11.2 and 11.3 of the IDMS version 1.03 cover measurements of diffuse reflection with hemispherical illumination. Section 11.2 describes measurements with the specular included and 11.3 covers the specular excluded case. It is noted in 11.3 that the reflections assessment of glossy displays may be markedly different if the specular component is included or excluded.

Depending upon the haze properties of the display, the size of the light trap and measurement spot may affect the measurement. The DRS100 includes a set of uniform, circular light traps of 20, 40, 60 and 80 mm in diameter.

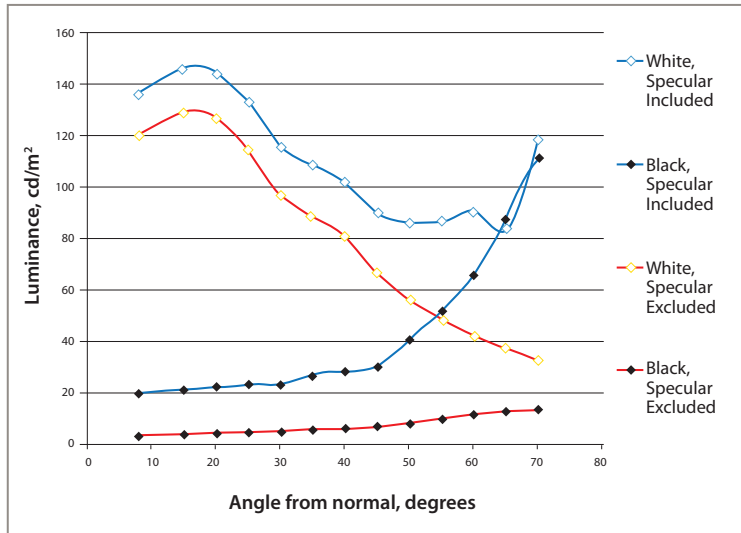
The image on the right shows a 2-dimensional measurement of a display inside the DRS100. The pseudo-color representation of luminance is logarithmically mapped from 1.7 cd/m² to 600 cd/m².

- The color coding shows that the display luminance is dependent upon the state of the display grey scale (black or white) and whether or not the specular angle from the photometer “sees” the white sphere wall or the black light trap.
- The angular reflectance measurement data for this display is plotted on the next page.
- The four white reflectance targets can be monitored to normalize the illumination on the measurement plane (IDMS 11.2.2).

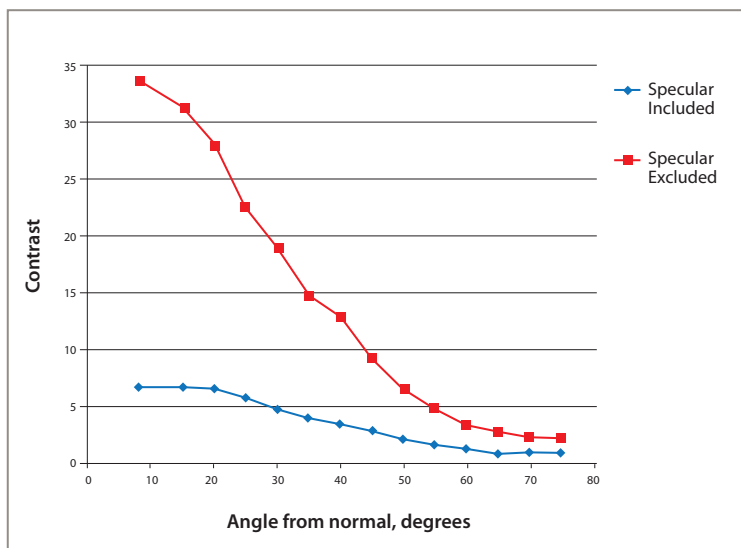


Photometrica™ software and a P501F imaging photometer are used to measure an OLED cell phone tilted at 40° to the measurement axis inside the DRS100. The right half of the display is set to black and the left to white. The mirror-like surface of the display provides a specular image of the circular light trap.

DISPLAY REFLECTANCE VS. OBSERVATION ANGLE



The luminance of an OLED display set to black and white is measured from 8° to 80° with the specular angle included and excluded.



Diffuse contrast of an OLED cell phone as a function of angle for both specular included and specular excluded.

SPECIFICATIONS

Sphere diameter	1m
Sphere interior coating	98% reflective BASO ₄
Standard ports	Photometer: 63.5 mm 1st lamp: 0.31 mm 2nd lamp: 0.31 mm Cable: 0.25 mm
Optional 8 degree port for large displays	203 mm, (max spot size: 38 mm)
Lamp type	20W, 1,000 lux tungsten lamp and power supply included. Optional sources to over 10,000 lux are available.
Trap(s)	1% diffuse reflectance, 0, 20, 40, 60 and 80 mm
Working distance	55 cm to 95 cm when display under test is in the center of the sphere
Photometer stage	1 cm (left-right), 14 cm (up-down)
Photometer max weight	6 kg
Overall dimensions	175 x 125 x 140 cm (L x W x H)
Overall weight	140 kg

ORDERING INFORMATION

DRS100	1 meter integrating sphere for diffuse reflectance of displays
DRS100-8	Optional 8° for externally mounted displays

Protected by US Patent 9,528,938

