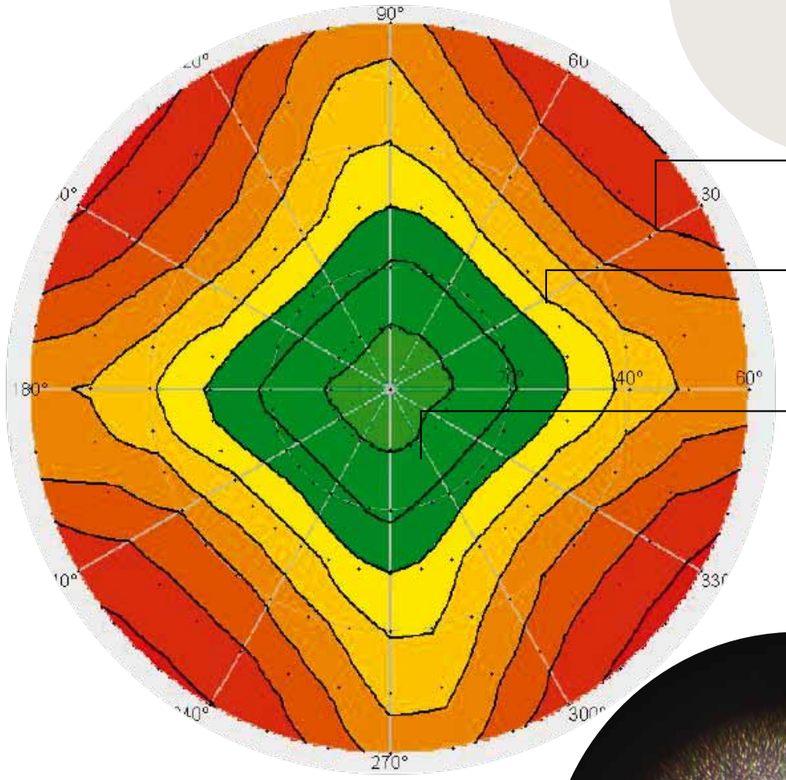
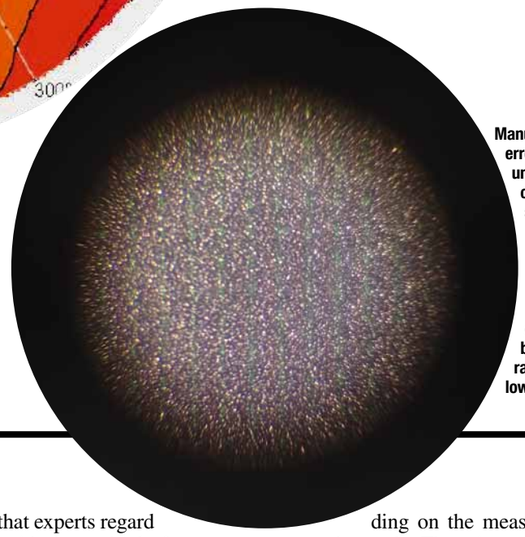


● dark orange and red areas document a low contrast

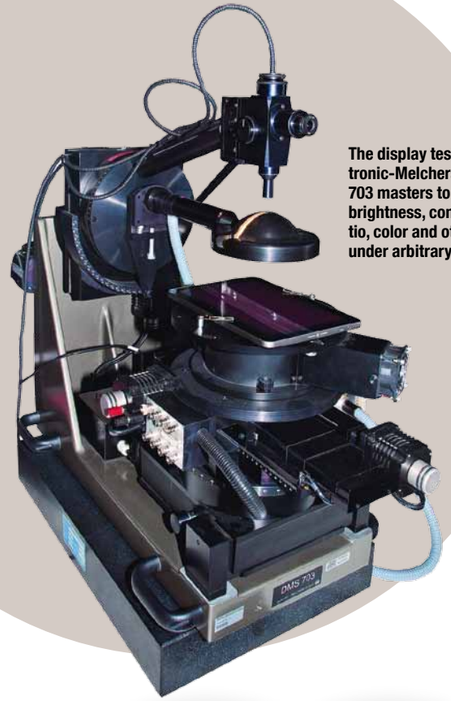
● the yellow-orange areas show an still sufficing contrast

● green marked areas view directions with high contrast with a high contrast

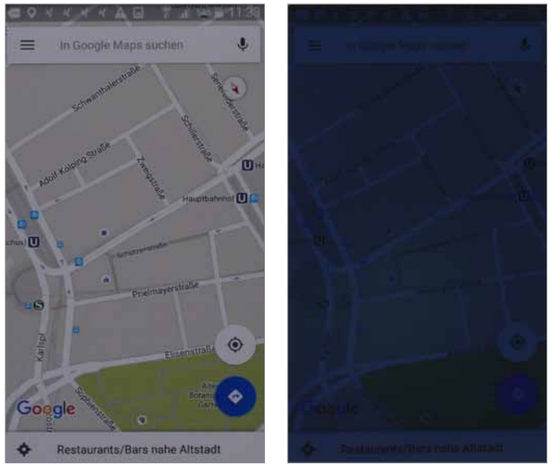


Manufacturing error: A display under extraneous light shows impurities as white points. These are brighter than te pixels in green, red and blue. Contrast ratio is very low.

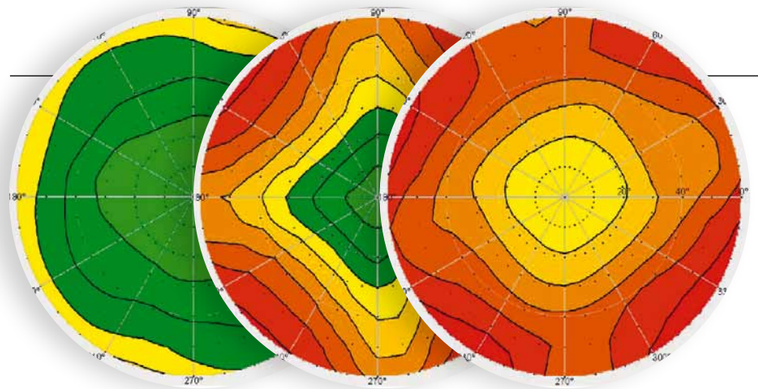
LIGHT IN THE DARK



The display test site Autronic-Melchers DMS 703 masters to measure brightness, contrast ratio, color and other KPIs under arbitrary angles.



The influence of ambient light on the presentation of a display should not be underestimated. The left picture displays illustrates a display at normal office light, on the right the influence of a slightly clouded summer day is shown.



CONTRAST DIAGRAM

The diagram indicates the maximum screen contrast from different viewing angles, from green for high contrast to red for very low contrast. The angle around the circular chart indicates the side from which the display is viewed; 0 degree corresponds to viewing from the right, 90 degrees from direction of the top of the smartphone. Along the middle or polar axis, the frontal viewing angle of up to 60 degrees is represented. The frontal direction (0 degrees) itself can be found in the centre of the diagram.

The display is the most important interface between a smartphone or tablet and its user. connect's inhouse Testlab carries out measurements to find out how good it is at its job.

Even the best navigation app is useless if the user cannot see the route in the sunlight. And even the best smartphone camera will annoy users if they cannot see the subject on the screen. No wonder that experts regard the display, with the multiple factors that affect its quality, as the most important component of a smartphone.

More than 100 kilos of precision

The connect Testlab operates measuring station DMS 703 of AutronicMelchers, which carries a price tag of 150,000 euros. This consists of a horizontal rotary table on which a smartphone or tablet can be clamped. A measuring microscope is attached on one arm over the turntable, to which a brightness gauge or spectrometer is connected via a light conductor, depending on the measurement to be made. The microscope can be rotated on a vertical plane around the object, so that the display can be measured at different angles. An additional incident light source is installed between microscope and display, which essentially consists of a hemispherical shell with white coating inside, which can illuminate the display with very bright and diffuse light of up to 40 kilolux via three dozen light conductors mounted around the edge. A slit in the shell allows the optical equipment to look at the display. The rotary axes of microscope, smartphone holder and much more can be driven by powerful highprecision servo motors via PC. The system consists out of 100 kilos steel, cast iron and granite, not including the control unit, which is about the size of a refrigerator.

In addition to the brightness, one of the most important KPIs of a display is the contrast, which represents the ratio of brightness of a completely white screen to a completely black screen. The Testlab measures the display once at a frontal angle in a completely dark environment. This results in the very high values which manufacturers like to brag about. More realistic however is the contrast measured in a bright office environment and at an angle of up to 60 degrees from the normal line of sight in all directions. From over 500 measurements, also shown in the contrast chart, an average contrast is calculated, which shows how anglestable a screen is under normal conditions.While OLED displays reigned supreme in this test for a long time, recently the best TFT displays inplaneswitching technology (IPS) are coming toetotoe with their competitors made of organic material.

Displays which fail in the sunshine outdoors are a particular nuisance for many users. To separate the wheat from the chaff, the test lab measures again the contrast, also at 20 kilolux. Good screens can achieve values of up to 1:40. Displays that fall below levels of 1:10 are not recommended for outdoor use because only text which is written black on white remains readable. In addition to brightness and contrast, the Testlab also measures display glass reflection, and how exactly a display complies with the socalled CIE colour space, and is thus able to reproduce natural skin tones. But these KPIs are only the icing on the cake of a perfect display.

BERND THEISS, HEAD OF TESTLAB