

REPORT OF TEST

NIST Test # 39081S - Responsivity Spatial Uniformity

for

Acme Instruments Silicon Photodiode
Model aa, S/N bbb

Submitted by:

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Group PPL2 (Mail Stop: F769)
Secretcity, NM 87545-0001

(See your Purchase Order No. YY-YYYY, dated April 1, 1997)

1. Description of Test Material

The test photodiode, Acme Instruments model aa, S/N bbb, consists of a silicon photodiode mounted in a cylindrical aluminum housing with the output signal available on a BNC connector. The active area of the photodiode is $\approx 1 \text{ cm}^2$. The test photodiode was measured as supplied by Bigtime Government National Laboratory.

2. Description of Test

The relative spatial uniformity of the responsivity across the test photodiode photosensitive area was measured using the NIST visible to near Infrared (Vis/NIR) monochromator-based comparator facility [1] from 400 nm to 700 nm in 100 nm increments. The relative uniformity was measured in 0.5 mm increments with a 1.1 mm diameter beam using a double monochromator and a quartz-halogen lamp as the tunable monochromatic source. The circular exit aperture of the Vis/NIR monochromator was imaged ($\approx f/9$) onto the photosensitive area resulting in a beam diameter of 1.1 mm.

The wavelength scale of the monochromator was calibrated with several laser and emission lines and is accurate to $\pm 0.1 \text{ nm}$ over the entire spectral range. The bandpass of the monochromator was 4 nm. The short-circuit photocurrent from the test photodiode was measured with a calibrated transimpedance amplifier. The test photodiode was measured with zero bias voltage. Beam power fluctuations were monitored with a beamsplitter and silicon photodiode.

3. Results of Test

Figure 1a is a plot of the relative uniformity of the test photodiode photosensitive area, showing 0.2 % contours at 400 nm of the deviations from the responsivity at the center of the photosensitive area. Figure 1b is a 3-dimensional plot showing the responsivity relative to the center of the photosensitive area.

Laboratory Environment:

Temperature: $23.x \text{ }^\circ\text{C} \pm 0.3 \text{ }^\circ\text{C}$

Test Date: December 24, 1997
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Figures 2, 3, and 4 are similar plots of the relative uniformity at 500 nm, 600 nm, and 700 nm respectively.

The relative expanded uncertainty ($k = 2$) for the responsivity values is 0.0024 %. This is the repeatability of the measured relative responsivity in the central portion of the active area during the measurement scan. The measurement repeatability uncertainty depends on the SNR of the detector and can vary spectrally. Note that the variation in responsivity over the measured area is much larger than this uncertainty value. The reported uncertainty is not an indication of the uniformity measurement reproducibility. The uncertainty analysis is described in Ref. [1].

The intended primary use of the reported uniformity results is qualitative. That is, to indicate if any large discontinuities are present in the responsivity uniformity which can lead to larger than expected uncertainties in absolute responsivity measurements. Quantitative application of the reported uniformity results requires examination of the irradiance geometry and equipment involved. The generalized application of the uniformity measurement results is currently being studied.

4. General Information

The laboratory temperature is reported for information only. It is not intended that this data be used for corrections to the spectral responsivity data in this report. This report shall not be reproduced, except in full, without the written approval of NIST.

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Reference:

- [1] T. C. Larason, S. S. Bruce, and A. C. Parr, NIST Measurement Services: Spectroradiometric Detector Measurements: Part I - Ultraviolet Detectors and Part II - Visible to Near-Infrared Detectors, Natl. Inst. Stand. Technol., Spec. Publ. 250-41 (1998).

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Figure 1a
Responsivity Uniformity of Acme Instruments aa, S/N bbb
0.2 % contours at 400 nm; 1.1 mm resolution; 0.5 mm/Step

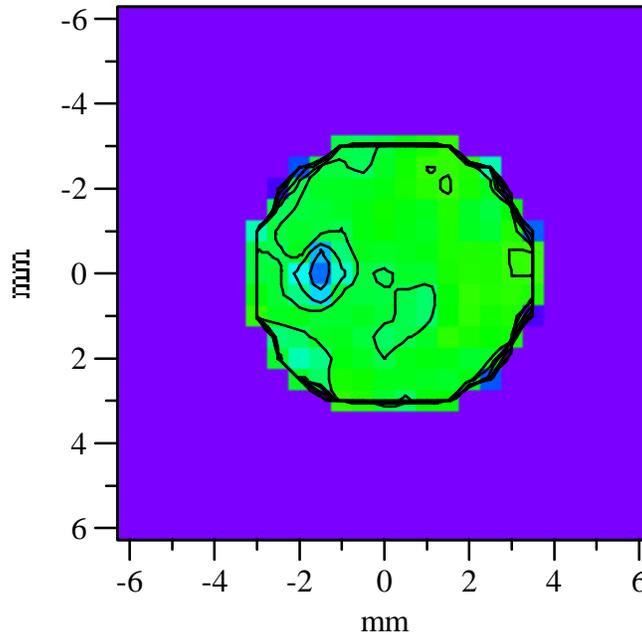
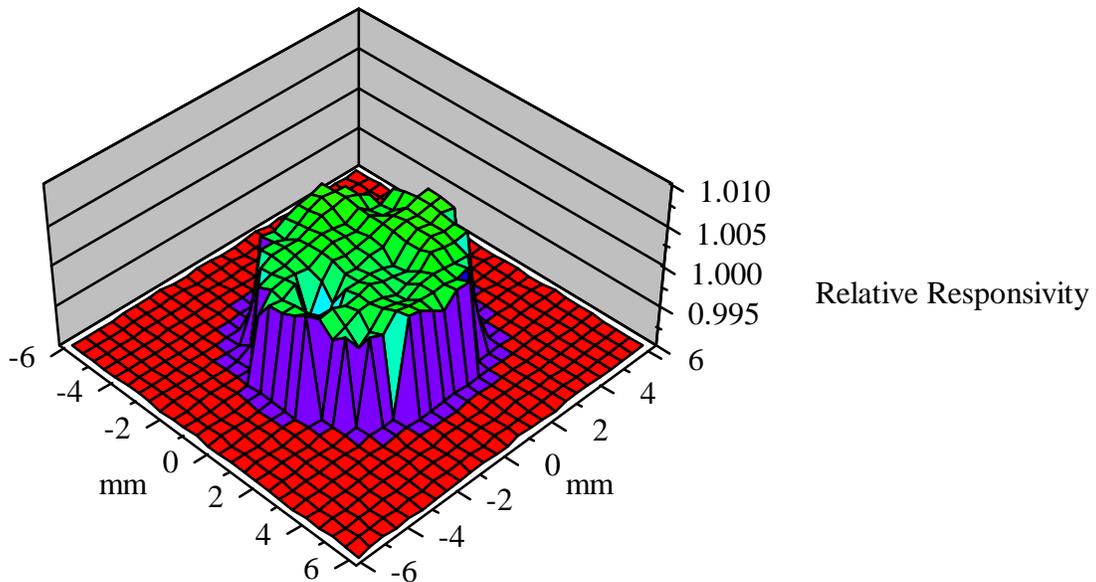


Figure 1b
Surface Plot of Responsivity Relative to
Center of Photosensitive Area for Acme Instruments aa, S/N bbb
at 400 nm; 0.5 mm/Step



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Figure 2a

**Responsivity Uniformity of Acme Instruments aa, S/N bbb
0.2 % contours at 500 nm; 1.1 mm resolution; 0.5 mm/Step**

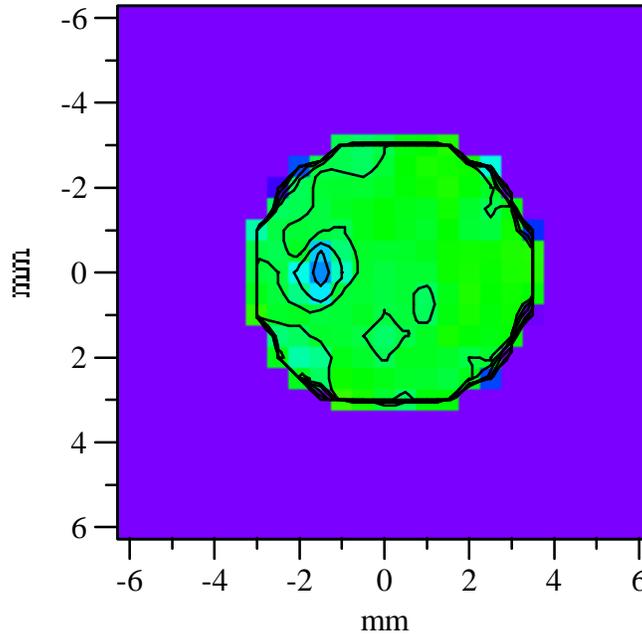
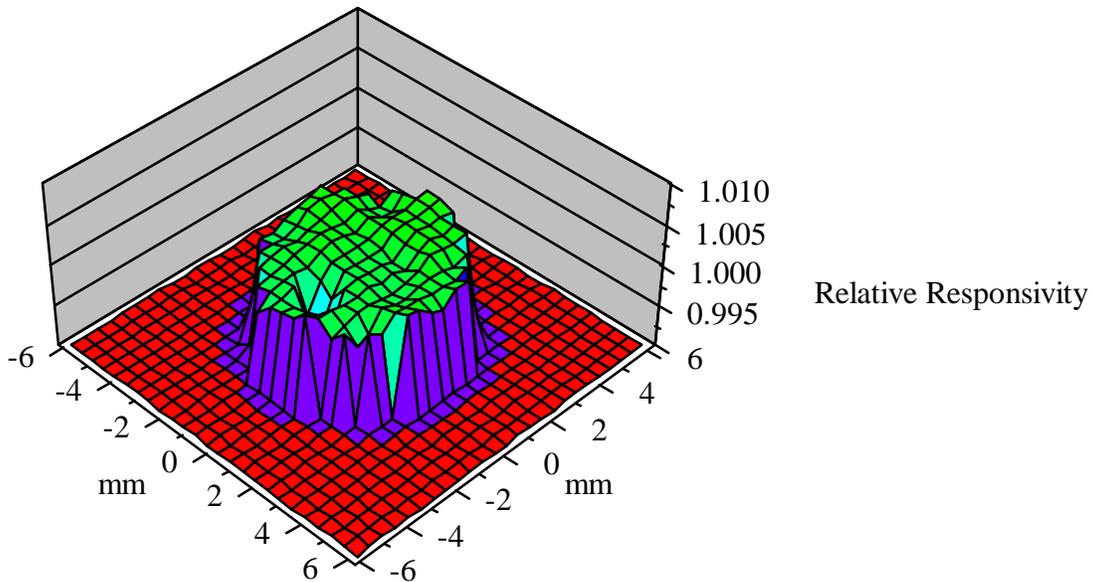


Figure 2b

**Surface Plot of Responsivity Relative to
Center of Photosensitive Area for Acme Instruments aa, S/N bbb
at 500 nm; 0.5 mm/Step**



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Figure 3a
Responsivity Uniformity of Acme Instruments aa, S/N bbb
0.2 % contours at 600 nm; 1.1 mm resolution; 0.5 mm/Step

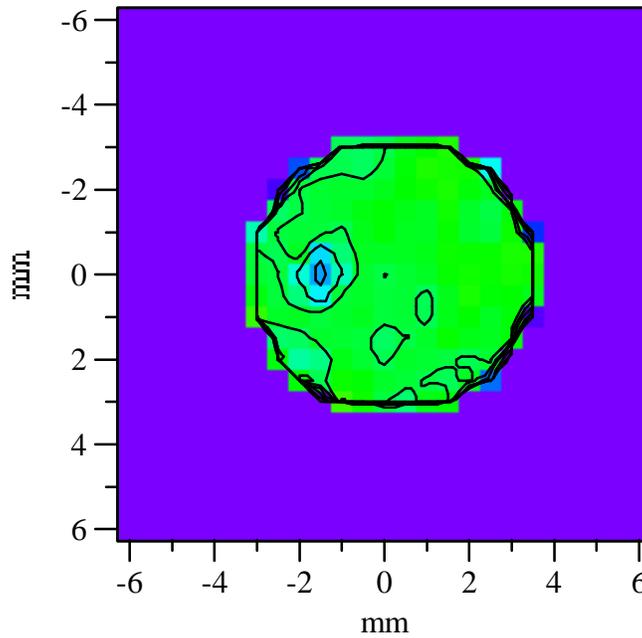
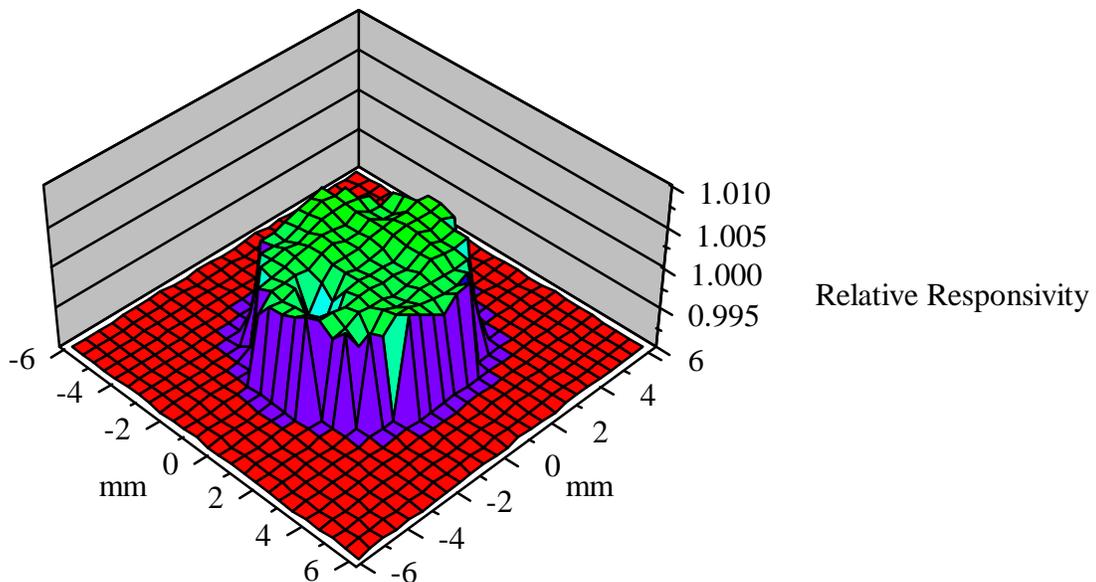


Figure 3b
Surface Plot of Responsivity Relative to
Center of Photosensitive Area for Acme Instruments aa, S/N bbb
at 600 nm; 0.5 mm/Step



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Figure 4a

**Responsivity Uniformity of Acme Instruments aa, S/N bbb
0.2 % contours at 700 nm; 1.1 mm resolution; 0.5 mm/Step**

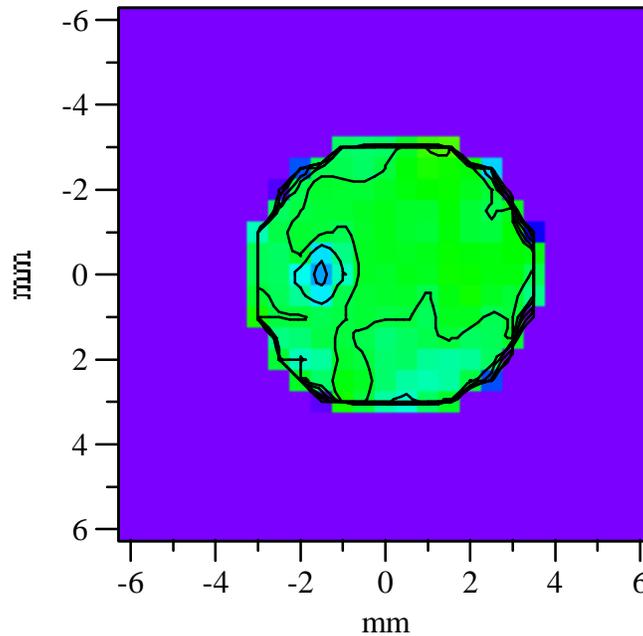


Figure 4b

**Surface Plot of Responsivity Relative to
Center of Photosensitive Area for Acme Instruments aa, S/N bbb
at 700 nm; 0.5 mm/Step**

