NIST-114
(REV. 3-2008)
ADMAN 4.09

U.S. DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

ERB Control Number (G#/B#)	Division	JRES?
G2012-0975	685.03	☐

NOTING? Check box and enter previously-approved control number and reason in Supplementary Notes. ☐

MANUSCRIPT REVIEW AND APPROVAL

Title and Subtitle (Cite in full, Capitalize first letter of each word except articles)
PV-MCT working standard radiometer

Author/Point of Contact for this Submission (name, phone, mailstop)
Eppeldauer, George P. Dr. (George P.); 685.05; george.eppeldauer@nist.gov; (301) 975-2338 Mailstop 8442

Performing Organization (check one box)
- ☒ NIST/Gaithersburg
- ☐ NIST/Boulder
- ☐ NIST/JILA

Sponsoring Organization and Address (street, city, state, zip)

Contract or Grant Number

Type of Report and/or Period Covered

Proposed for NIST Publication

- ☐ Journal of Research (NIST JRES)
- ☐ J. Phys. & Chem. Ref. Data (JPCRD)
- ☐ Handbook (NIST HB)
- ☐ Special Publication (NIST SP)
- ☐ Technical Note (TN)
- ☐ Grant/Contract Reports (NISTGCR)
- ☐ Natl. STD. Ref. Data Series (NIST NSRDS)
- ☐ Federal Info. Process. STDS. (NIST FIPS)
- ☐ NIST Interagency/Internal Report (NISTIR)
- ☐ National Construction Safety Team Act Reports (NIST NCSTAR)
- ☐ Monograph (NIST MN)
- ☐ Letter Circular
- ☐ Building SCI. Series
- ☐ Product Standards
- ☐ ITL Bulletin
- ☐ Other

Proposed for Non-NIST Publication (cite fully): ☒ U.S. ☐ Foreign
Proceedings of SPIE, Vol. 8355, SPIE Defense, Security + Sensing, Infraed Imaging Systems: Design Analysis, Modeling, and Testing XXIII, Baltimore, MD, United States, 04/24/2012 to 04/27/2012

Publishing Medium: ☒ Paper ☐ Diskette ☐ CD-ROM ☐ WWW ☐ Other

SUPPLEMENTARY NOTES (IF A MANUSCRIPT IS BEING NOTED, PLEASE CITE THE PREVIOUSLY APPROVED DOCUMENT BY ERB CONTROL NUMBER)
Publication ID = (911291):

Abstract (A 2000-character or less factual summary of most significant information. If document includes a significant bibliography or literature survey, cite it here. Spell acronyms on first reference.)
Sensitive infrared working-standard detectors with large active area are needed to extend the signal dynamic range of the National Institute of Standards and Technology (NIST) pyroelectric transfer-standards used for infrared spectral power responsivity calibrations. Increased sensitivity is especially important for irradiance mode responsivity measurements. The noise equivalent power (NEP) of the NIST used pyroelectric transfer-standards is about 8 nW/Hz^¿, equal to a D*= 5.5 x 10^7 cm Hz^1/2 / W. A large-area photovoltaic HgCdTe (PV-MCT) detector was custom made for the 2.5 to 11 micrometers wavelength range using a 4-stage thermoelectric cooler. At least an order of magnitude lower NEP was expected than that of the pyroelectric transfer-standards to measure irradiance. The large detector area was produced with multiple p-n junctions. The periodical, multiple-junction structure produced a spatial non-uniformity in the detector response. The PV-MCT radiometer was characterized for spatial non-uniformity of response using different incident beam sizes to evaluate the uncertainty component caused by the spatial non-uniformity. The output voltage noise and also the current and voltage responsivities were evaluated at different signal gains and frequencies. The output voltage noise was decreased and the voltage responsivity was increased to lower the NEP of the radiometer. The uncertainty of the spectral power responsivity measurements was evaluated. It is recommended to use a bootstrap type trans-impedance amplifier along with a cold field-of-view limiter to improve the NEP of the PV-MCT radiometer.

Key Words (Maximum of 9; 28 characters and spaces each; separate with semicolons; alphabetic order; capitalize only proper names.)
If the paper is relevant to a strategic focus area (SFA) namely homeland security, nanotechnology, biosystems and health, or information/knowledge management, list the SFA as a keyword so that we can identify the work for SFA bibliographies.
current responsivity; infrared; low-NEP; PV-MCT; output noise; spectral responsivity; voltage responsivity; working standard detector

Availability:
☒ Unlimited ☐ For official distribution - do not release to NTIS or GPO

AUTHORS: if you do not wish this manuscript announced before publication, please check here. ☒

AUTHORS

Author(s) Affiliation, if NIST, give organization code, phone, and mailstop; order as on manuscript	*Author Signature	Date
Eppeldauer, G. P. , 685.05; george.eppeldauer@nist.gov; (301) 975-2338 Podobedov, V. B. , 685.05; vyacheslav.podobedov@nist.gov; (301) 975-4253		

Form Submitted By – if not point of contact, page 1 (name, division, phone, and mail stop)

Armiger, Lorna F. - 685 - (301) 975-8138 - Mailstop 8442

DIVISION AND OU APPROVALS

Division Reader Yoon, Howard W	**Signature**	**Date**
Group Leader (If required) Shirley, Eric L	**Signature**	**Date**
***Division Chief** (Certifies Homeland Defense Clearance) Fraser, Gerald T	**Signature**	**Date**
Organizational Unit (OU) Director (If required) (Likely to draw conspicuous public attention to NIST) Gebbie, Katharine Blodgett	**Signature**	**Date**
NIST Counsel (If required, e.g., for evaluation of commercial products) or BFRL Director (If World Trade Center is mentioned)	**Signature**	**Date**

EDITORIAL REVIEW BOARD INFORMATION AND ACTIONS

ERB Reader: name, mailstop (or address), and phone Rice, Joseph P. (Joseph P), Division 685	**SIGNATURE**	**DATE**

- ☐ **Approve**
- ☐ **Approve – suggested changes**
- ☐ **Approve – changes have been agreed to by author**
- ☐ **Approve – only if specified changes are made**
- ☐ **Do Not Approve** (Please comment)
- ☐ **Recommend Consideration for an Award**
  - ☐ **For Technical Content**
  - ☐ **For Quality of Exposition**

***ERB SPONSOR:** name, mail stop, and phone Benck, Eric C,	**Signature**	**Date**

- ☐ **Approve**
- ☐ **Do Not Approve** (see comments under Return to Sponsor below)
- ☐ **Approve – Author has agreed to changes**
- ☐ **Recommend for an Award**

Sponsors' Final Review Initials	**J. RES., JPCRD, OR NIST-NSRDS Editor Approval, Date**
Return to Sponsor, Further Action Requested: Specify	**Released for Publication** (Authorizing Official)**, Date**

***Asterisks indicate signatures required for NOTING only**

GUIDE FOR AUTHORS AND REVIEWERS

TO AUTHORS: The following list is taken from SP 811, *Guide for the Use of the International System of Units*, available at http://www.physics.nist.gov/Pubs. This is a ***partial*** list (numbered as in the original) that contains errors frequently encountered in WERB review, and is provided here to help NIST authors review the conformity of their manuscripts with proper SI usage and the basic principles concerning quantities and units. (The chapter or section numbers in parentheses indicate where additional information may be found in SP 811.)

1. Only units of the SI and those units recognized for use with the SI are used to express the values of quantities. Equivalent values in other units are given in parentheses following values in acceptable units *only* when deemed necessary for the intended audience. (See Chapter 2.)

2. Abbreviations such as sec (for either s or second), cc (for either cm^3 or cubic centimeter), or mps (for either m/s or meter per second) are avoided and only standard unit symbols, SI prefix symbols, unit names, and SI prefix names are used. (See Sec. 6.1.8.)

4. Unit symbols (or names) are not modified by the addition of subscripts or other information. The following forms, for example, are used instead. (See Sec. 7.4 and Sec. 7.10.2.)

   V_{max} = 1000 V *but not*: V = 1000 V_{max}

   a mass fraction of 10 % *but not*: 10 % (*m*/*m*) or 10 % (by weight)

6. Information is not mixed with unit symbols (or names). For example, the form "the water content is 20 mL/kg" is used and not "20 mL H_2O/kg" or "20 mL of water/kg." (See Sec. 7.5.)

7. It is clear to which unit symbol a numerical value belongs and which mathematical operation applies to the value of a quantity because forms such as the following are used. (See Sec. 7.7.)

   35 cm × 48 cm *but not*: 35 × 48 cm

   1 MHz to 10 MHz or (1 to 10) MHz *but not*: 1 MHz-10 MHz or 1 to 10 MHz

10. There is a space between the numerical value and unit symbol, even when the value is used in an adjectival sense, except in the case of superscript units for plane angle. (See Sec. 7.2.)

    a 25 kg sphere *but not*: a 25-kg sphere

11. The digits of numerical values having more than four digits on either side of the decimal marker are separated into groups of three using a thin, fixed space counting from both the left and right of the decimal marker. For example, 15 739.012 53 is highly preferred to 15739.01253. Commas are not used to separate digits into groups of three. (See Sec. 10.5.3.)

18. The obsolete terms normality and the symbol *N*, and the obsolete term molarity and the symbol M, are not used, but the quantity amount-of-substance concentration of B (more commonly called concentration of B), and its symbol c_B and SI unit mol/m^3 (or a related acceptable unit), are used instead. Similarly, the obsolete term molal and the symbol m are not used, but the quantity molality of solute B, and its symbol b_B or m_B and SI unit mol/kg (or a related unit of the SI), are used instead. (See Sec. 8.6.5 and Sec. 8.6.8.)

TO READERS: Please consider the items below in making comments (written on the manuscript) directed to the authors. (Sign WERB form.)

1. The conclusions are supported by the data and observations in the paper.

2. Figures and tables are correct, clear, useful, necessary, relevant, and properly labeled.

3. The manuscript is organized efficiently and appropriately and contains proper syntax, grammar, and spelling. Acronyms are used sparingly and defined properly the first time that they are used.

4. SI units are used correctly. For guidance on this matter, see NIST SP 811 - *Guide for the Use of the International System of Units* by B. N. Taylor available at http:/www.physics.nist.gov/Pubs. (Portions of the Check List for Reviewing Manuscripts (pp. v and vi) are reproduced above for convenience.)

5. Avoid the use of trade and product names, except where public safety or health is involved, or where mention of the name is essential to comprehension of reported results and will not result in a competitive advantage or disadvantage to a manufacturer. An appropriate disclaimer (preferably in a footnote) must accompany trade names, company names, and/or commercial products (including commercial software). Suggested disclaimers are in the NIST Adman section 4.09.03.i(10), available at http://www-i.nist.gov/admin/mo/adman/contents.htm. The disclaimer is found on page _____ of the manuscript.

6. For manuscripts that contain significant measurement data, the associated measurement uncertainty issues are adequately addressed. For guidance on this matter, see NIST TN 1297 - *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, by B. N. Taylor and C. E. Kuyatt, available at http://www.physics.nist.gov/Pubs.

7. The quality of the studies reported has been assured by the inclusion of appropriate control studies and good experimental design.

8. If written solely by NIST authors for a non-NIST publication, the manuscript includes a NIST/government copyright disclaimer. Suggested: *"Official contribution of the National Institute of Standards and Technology; not subject to copyright in the United States."*

9. There are no implications to, insinuations on, or infractions of NIST institutional policies that would require additional signatures (e.g., evaluation of commercial products requiring signature by OU director and NIST Counsel).