Designation: E 1213 – 97 (Reapproved 2002)

# Standard Test Method for Minimum Resolvable Temperature Difference for Thermal Imaging Systems[1]

This standard is issued under the fixed designation E 1213; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers the determination of the minimum resolvable temperature difference (MRTD) capability of the compound observer-thermal imaging system as a function of spatial frequency.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

E 1316 Terminology for Nondestructive Examinations [2]

## 3. Terminology

3.1 *Definitions:*

3.1.1 *differential blackbody*—an apparatus for establishing two parallel isothermal planar zones of different temperatures, and with effective emissivities of 1.0.

3.1.2 See also Terminology E 1316.

## 4. Summary of Test Method

4.1 A standard four-bar target is used in conjunction with a differential blackbody that can establish one blackbody isothermal temperature for the set of bars and another blackbody isothermal temperature for the set of conjugate bars, which are formed by the regions between the bars (see Fig. 1). The target is imaged onto the monochrome video monitor of a thermal imaging system where the image is viewed by an observer. The temperature difference between the bars and their conjugates, initially zero, is increased incrementally only until the observer can distinguish the four bars. This critical temperature difference is the MRTD.

4.2 The spatial distribution of temperature of each target must be measured remotely at the critical temperature difference that determines the MRTD. The mean temperature of each bar must not differ from that of any other bar by more than the measured MRTD. A similar requirement applies to the temperature of each conjugate bar. Otherwise the MRTD value is unacceptable.

4.3 The background temperature and the spatial frequency of each target must be specified together with the measured value of MRTD.

4.4 The probability of resolution must be specified together with the reported value of MRTD.

## 5. Significance and Use

5.1 This test relates to a thermal imaging system's effectiveness for discerning details in a scene.

5.2 MRTD values provide estimates of resolution capability and may be used to compare one system with another. (Lower MRTD values indicate better resolution.)

NOTE 1—Test values obtained under idealized laboratory conditions may or may not correlate directly with service performance.

## 6. Apparatus

6.1 The apparatus consists of the following:

6.1.1 *Test Charts (Targets)*, comprised of four periodic bars of aspect ratio (width:height) 1:7, as shown in Fig. 1.

6.1.2 *Differential Blackbody*, temporally stable and controllable to within 0.1°C.

6.1.3 *Infrared Spot Radiometer*, calibrated with the aid of a blackbody source to an accuracy within 0.1°C.

NOTE 2—Test charts may be fabricated by cutting slots in metal and coating with black paint of emissivity greater than 0.95. In this case the slots would constitute the bars.

## 7. Procedure

7.1 Mount a test chart (target) onto the differential blackbody.

NOTE 3—Differential blackbodies may be used within an environmental isothermal temperature chamber. Then, at equilibrium the temperature of the conjugates approximately equals the temperature of the room, or ambient temperature.

7.2 Optimally focus the thermal imaging system directly on the target or on an optical projection of the target.

[1] This test method is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.10 on Emerging NDT Methods.

Current edition approved December 10, 1997. Published February, 1998. Originally published as E 1213 – 87. Last previous edition E 1213 – 92.

[2] *Annual Book of ASTM Standards*, Vol 03.03.