

# VIRTEST 2.1

## USER GUIDE

### 1 COPYRIGHT NOTICE

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INFRAMET [info@inframet.pl](mailto:info@inframet.pl) [www.inframet.pl](http://www.inframet.pl)

### 2 What is MRTD?

The minimum resolvable temperature difference (MRTD) is currently considered as the most important parameter of thermal imaging systems [1-9]. MRTD enables us to estimate probability of detection, recognition, and identification of military targets knowing MRTD of the evaluated thermal camera [2,6,11,12]. Military standards determining testing the thermal imaging systems usually specify that MRTD values for a set of spatial frequencies of the tested imager must be lower than certain values if the imager is to pass the test [4,5]. MRTD has been also the most important parameter of commercial thermal cameras used in non-destructive thermal testing (NDTT) for at least last decade [13]. Nowadays it proves its usefulness in evaluation process of thermal cameras to be used in automotive industry.

The MRTD is a subjective parameter that describes ability of the imager-human system for detection of low contrast details of the tested object. It is a function of a minimum temperature difference between the bars of the standard 4-bar target and the background required to resolve the thermal image of the bars by an observer versus spatial frequency of the target. The measurement results of a typical military thermal camera for airborne surveillance are shown in Fig. 5.

Due to subjective character of MRTD measurement of thermal cameras the biggest source of uncertainty of measurement results is usually low repeatability of observers indications. MRTD variability as high as 50% are often cited from laboratory-to-laboratory with 20% variability reported in one laboratory [7]. It seems that apart from the observer variability, non-standardised equipment and measurement methodology are other significant sources of the dispersion of measurement results. However, for sure observers variability is one of the main sources of uncertainties of MRTD measurement results. Training observers using real test equipment and real thermal cameras is time consuming and costly.

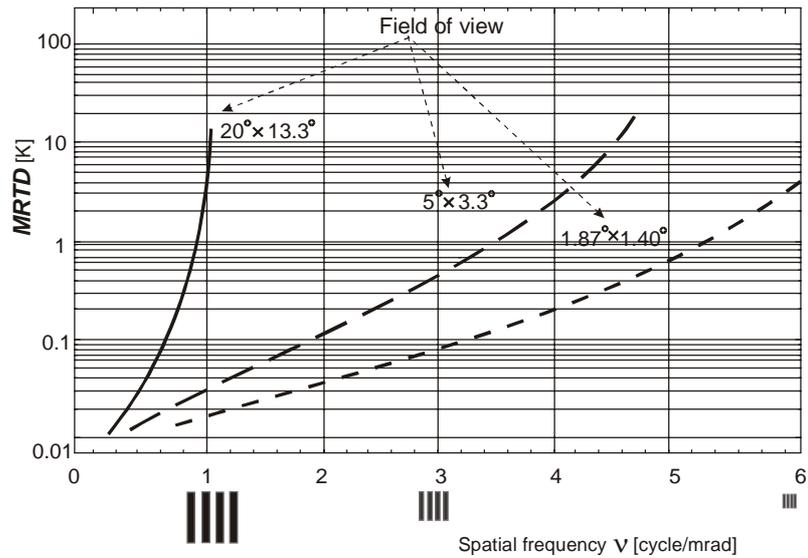


Fig. 1. MRTD of exemplary military thermal camera used in airborne surveillance

### 3 What is VIRTEST and how it works?

VIRTEST (virtual test) is a computer program that enables simulation of MRTD measuring procedure of two exemplary thermal cameras. Using VIRTEST MRTD measurement procedure can be fully simulated and repeated many times at any suitable conditions. By carrying frequent virtual MRTD tests using VIRTEST observers can significantly improve repeatability of their indications.

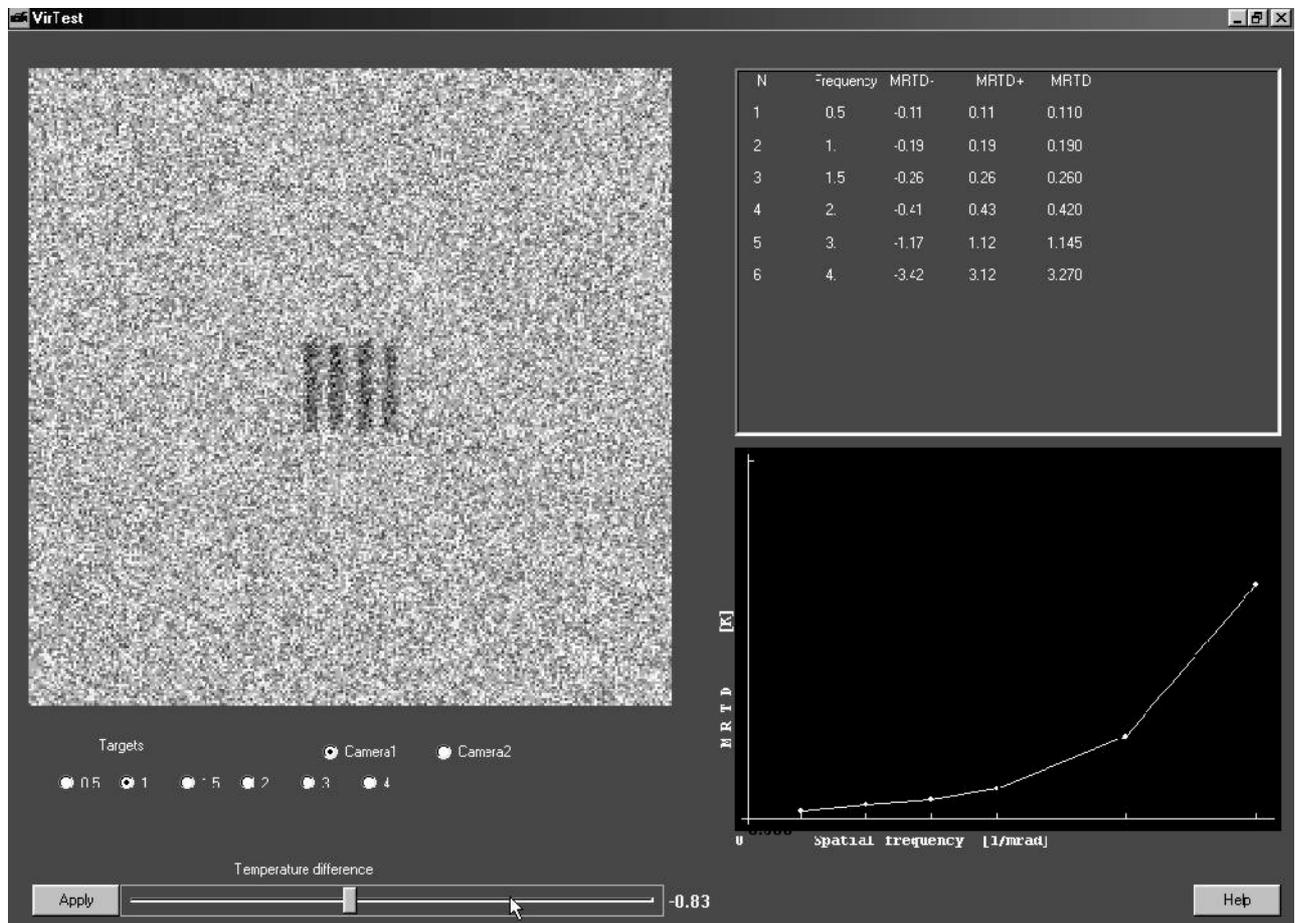


Fig. 2. VIRTEST – the main window

VIRTEST generates images of standard 4-bar targets closely resembling images seen by operators of measuring systems used to test thermal cameras during MRTD measurement. The user can choose spatial frequency of the 4-bar target, temperature difference. Like in case of real measuring systems the user chooses the temperature difference, when he recognises the bars. MRTD curve is automatically drawn on the bases of the user decisions.

VIRTEST was created for:

- Professional working in field of testing thermal cameras to improve accuracy of MRTD measurements.
- Students interested in field of IR technology to help them understand MRTD test methodology.
- Any person loving fun who want to carry out virtual test of thermal cameras.

## 4 How to use VIRTEST?

### 4.1 How to download?

1. Download self-extracting file VIRT.exe
2. Copy file to any folder.
3. Uncompress the file VIRT.exe.

### 4.2 System configuration requirements

- Windows 98, 2000, XP
- 32 MB RAM (minimum)
- 1024×768 display resolution (recommended)

### 4.3 How to run?

1. Double click on the icon Virtest.exe. After a few second you should see the main window (Fig. 2).
2. Click on the target of the lowest frequency (0.05 1/mrad)
3. Using the temperature difference bar find minimal positive temperature difference when you are still able to recognise all four bars of the 4-bar target.
4. Using the same bar find minimal negative temperature difference when you are still able to recognise all four bars of the 4-bar target.
5. Click on the target of the frequency  $1 \text{ mrad}^{-1}$ .
6. Repeat the points 2 and 3.
7. Click on the target of the frequency  $1.5 \text{ mrad}^{-1}$ .
8. Repeat the points 2 and 3.
9. Click on the target of the frequency  $2 \text{ mrad}^{-1}$ .
10. Repeat the points 2 and 3.
11. Click on the target of the frequency  $3 \text{ mrad}^{-1}$ .
12. Repeat the points 2 and 3.
13. Click on the target of the frequency  $4 \text{ mrad}^{-1}$ .
14. Repeat the points 2 and 3.
15. By this time you should have the table with MRTD measurement results of the Camera 1 filled and the MRTD curve plotted.
16. Click on the Camera 2 button.
17. Repeat the points 1-13.

18. Repeat points 1-17 a dozen or so times with 1 day or more intervals. If your indications do not differ than 20% than you can consider yourself as a quite good qualified observer. If your indications differ more work with VIRTEST and try to improve yourself.

In case you have further questions please contact INFRAMET.

## 5 References

1. STANAG No. 4349, Measurement of the minimum resolvable temperature difference (MRTD) of thermal cameras.
2. STANAG 4347, Definition of nominal static range performance for thermal imaging systems, 1995.
3. MIL-STD-1859, Thermal imaging devices, performance parameters.
4. MIL-T-49381 Test Set, Thermal sight TS-3681/VSG, USAERADCOM, 1980.
5. MIL-I-24698(SH), Infrared thermal imaging systems, Department of Defence USA, 1988.
6. "Electro-optical systems design, analysis and testing," in *The Infrared & Electro-Optical Systems Handbook*, Vol. 4, edited by M.C. Dudzik, SPIE, 1993.
7. G.C. Holst, *Testing and Evaluation of Infrared Imaging Systems*, JCD Publishing Company, 1993.
8. C.W Hoover Jr. and C.M. Webb, "What is MRT? How can I get one ?", *Proc. SPIE* **1488**, 280–288 (1991).
9. *The Infrared & Electro-Optical Systems Handbook*, Vol. 4: Electro-Optical Systems Design, Chapt. 4: EO System Performance Prediction, edited by M.C. Dudzik, SPIE (1993).
10. J.T. Wood, W.J. Bentz, T. Pohle, and H. Hepfer, "Specification of thermal imagers," *Optical Eng.* **15**, 531–536 (1976).
11. J.A. Ratches, "Static performance model for thermal imaging systems," *Opt. Eng.* **15**, 525–530 (1976).
12. J.A. Ratches, W.R. Lawson, L.P. Obert, J.M. Swenson, *Night Vision Laboratory Static Performance Model for Thermal Imaging Systems*, USA Electronics Command Report 7043, April 1975, AD/A 011212.
13. K. Chrzanowski, J. Fischer, W. Wrona, Testing of Thermal Imagers For Non-Destructive Thermal Testing Applications, *ASTM Journal of Testing and Evaluation*, 28, 395-402 (2000).