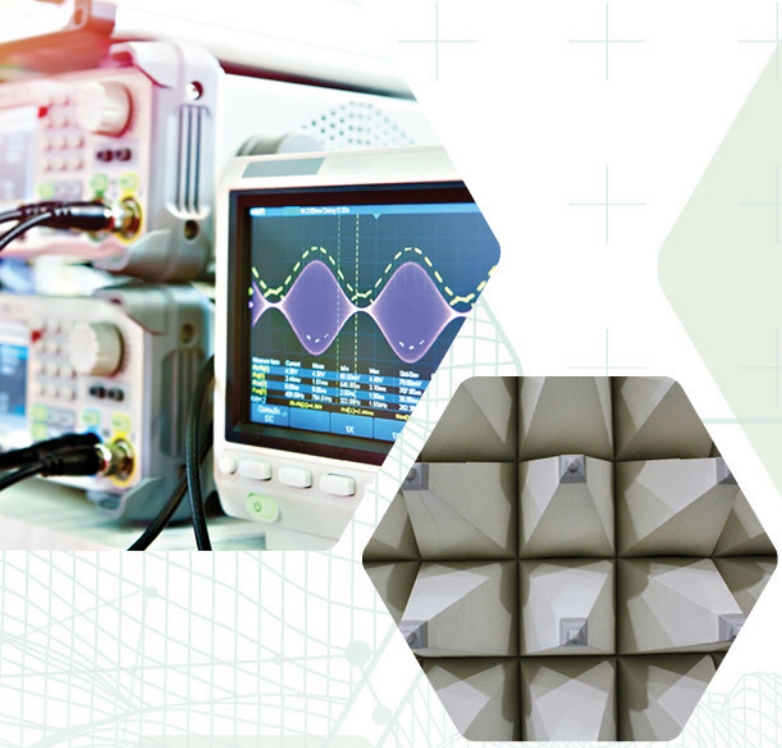

Science and Technology

TRANSPORTATION SECURITY & EXPLOSIVES CHARACTERIZATION

MEASUREMENT SYSTEM AND METHODS OF MEASURING A REFLECTION COEFFICIENT

FREE-SPACE MEASUREMENT SYSTEM TO INCREASE ACCURACY IN CHARACTERIZATION OF MATERIALS IN THE GIGAHERTZ RANGE

The dielectric properties, of materials (their ability to store electric energy in an electric field) are pertinent to many fields of research, including radar component and antenna design, pharmaceutical processing, and determination of moisture contents in foodstuffs and other materials. Future generations of advanced imaging technology (AIT) systems used for screening people for contraband are expected to distinguish threats from benign objects via their dielectric properties. To be of value, the systems require an accurate measurement of these properties.

Researchers at the Transportation Security Laboratory have invented the Measurement System and Methods of Measuring a Reflection Coefficient (MSMMRC) to address challenges with the setup and calibration of an apparatus to perform dielectric measurements. The innovation provides improved reflection data in the gigahertz frequency range, using a free-space measurement technique while also improving measurement dynamic range. These innovations can be incorporated into a commercialized measurement system.

KEY BENEFITS

+ Improves accuracy in reflection measurements
+ Reduces sensitivity to lateral movement
+ Enhances measurement dynamic range

STAGE OF DEVELOPMENT

Prototype

PARTNERSHIP SOUGHT

License

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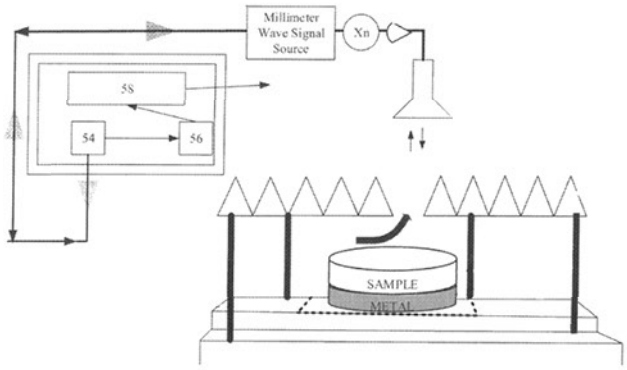
DHS COMPONENT

Science and Technology Directorate

The Technology Transfer and Commercialization Branch (T2C) within the Office of Industry Partnerships (OIP) of the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) serves as the centralized point to manage technology transfer activities throughout DHS and the DHS laboratory network. **T2C@hq.dhs.gov**

THE TECHNOLOGY

MSMMRC is a simple, one-port (single-sided) free-space measurement technique. A test sample is placed on top of a conductive material (e.g., metal) in the testing region. A transceiver antenna connects to an electromagnetic radiation source and directs the radiation to the sample. A radar absorbing material sits between the transceiver antenna and the measured sample and acts as an aperture. Radiation reflected from the test sample returns to the transceiver through the radar absorbing material aperture. The measured reflection coefficient of the test sample is used in conjunction with the sample thickness to extract the dielectric constant of the material as a function of frequency.



Schematic depicting the measurement system used to characterize samples by measuring an electric field-based reflection coefficient of the targeted item.

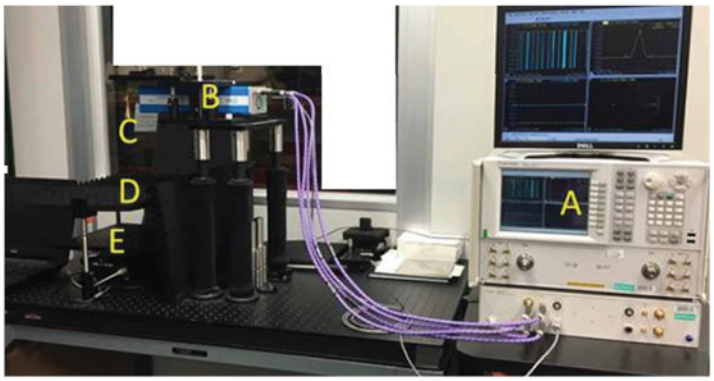


Illustration of the System Hardware with the Performance Network Analyzer (A), Millimeter Wave Vector Network Analyzer Extender (B), antenna (C), Radar absorbing material aperture (D), and sample holder plate (E). The vertical translation stage is below the sample holder plate.

APPLICATIONS

The technology has several potential end uses:

+ **Radar equipment manufacturers**
+ **RF electronics manufacturers**
+ **Test equipment manufacturers**
+ **Test and measurement standards organizations**

PATENT INFORMATION

US Patent numbers 11,035,949; 11,054,517; and 11,269,071

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TECHNOLOGY SOLUTION

FOR MORE INFORMATION ABOUT THE DHS TECHNOLOGY TRANSFER & COMMERCIALIZATION BRANCH:

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