

## NRL Arch Reflectivity Testing

The NRL Arch is the industry standard for testing the reflectivity of materials. Originally designed at the Naval Research Laboratory, the NRL Arch allows for quick, repeatable non-destructive testing of microwave absorbent materials over a wide frequency range.

Reflectivity is defined as the reduction in reflected power caused by the introduction of an absorbent material. This reduction in power is compared to a 'perfect' reflection which is approximated very well by the reflection off a flat metallic plate.

As seen in the diagram below, an NRL arch consists of a transmit and receive antenna which are oriented towards a metal plate. To measure normal incidence reflectivity the antennas are located as close to each other as physically possible. Absorbent material is often used to minimize antenna cross talk. The antennas can be located anywhere on the arch to allow measurements of performance at off normal angles of incidence with the practical limitation of the ability to separate the signal from the material under test from the direct antenna to antenna cross talk.

In general a network analyzer is used for measurements on an NRL Arch to provide both the stimulus and the measurement. A calibration is performed by measuring the resultant power reflecting off the metal plate over a broad frequency range. This is established as the 'perfect' reflection or 0 dB level. The material under test is then placed on the plate and the reflected signal measured in dB. Time domain gating may be used to eliminate antenna cross talk and reduce the error introduced by room reflections.

The size of the material under test and the antenna to plate distance are determined by the desired frequency range of test. A standard setup tests from 2-18 GHz using a material size of 12"x12" or 24"x24" and an antenna to plate distance of 30"-36". Lower frequency (longer wavelength) testing would require a larger sample size and longer antenna-plate distance. Higher frequencies could use a smaller arch and sample size.

Emerson & Cuming Microwave Products uses several NRL Arches covering a wide frequency range including

- 600 MHz-1.8 GHz
- 2-18 GHz
- 18-26.5 GHz
- 18-40 GHz
- 33-50 GHz
- 40-67 GHz

