/K option – Material Test

6500B Series Precision Impedance Analyzer
6500P Series High Frequency LCR Meter

The /K Material Test firmware option allows the parameters associated with two types of the dielectric properties of material testing to be calculated.

1. The Complex Relative Permittivity, Real & Imaginary parts, of the Material Under Test (MUT) can be calculated using 6500 measurements and user-entered MUT dimensions. Both the Contacting Electrode Method and the Non-contacting Electrode Method can be used with a Wayne Kerr 1J1020 Material Test Fixture (or equivalent).
2. The Complex Permeability, Real & Imaginary parts, of the Material Under Test (MUT) can be calculated using 6500 measurements and user-entered MUT dimensions.

Permeability tests involve comparing results from an air-cored toroidal core with those for the same coil when wound onto a core.

COMPLEX PERMITTIVITY METHOD

Contacting Method

The Material Under Test (MUT) is placed between two parallel plates, one of which consists of a guarded electrode surrounded by the guard electrode. The other electrode is referred to as the unguarded electrode. The plates are moved towards each other until the touch the MUT on both faces. From standard impedance measurements and the material/fixture dimensions the complex relative permittivity ε_r, can be calculated

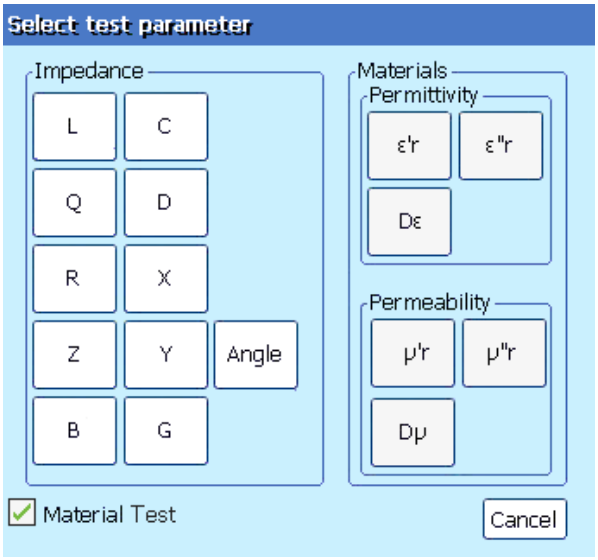
Non-contacting Method

The two parallel plates of the test fixture are set to a gap greater than the thickness of the MUT. The capacitance of the air-gap C_g is measured. The MUT is then positioned in the fixture and a second capacitance reading C_m is taken. From these measurements and the material/fixture dimensions the complex relative permittivity ε_r, can be calculated.

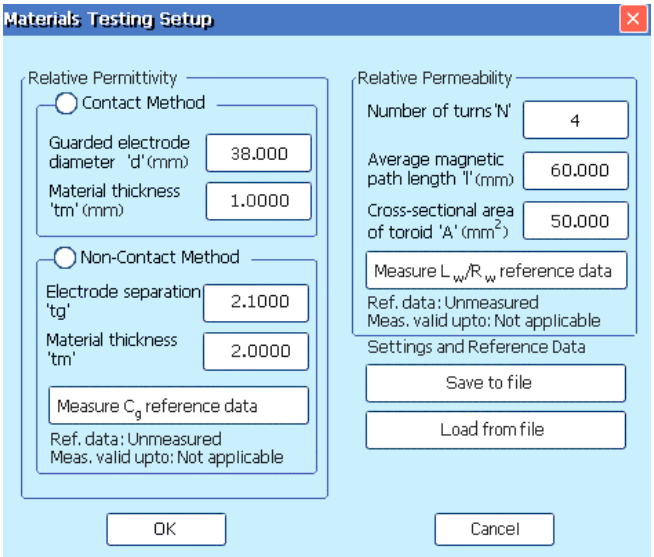
The calculation consists of two separate measurements, C_g and C_m. The measurement of C_g can be treated as a 'calibration', i.e. the user sets the gap and performs a calibration which measures and stores C across the frequency range. The values obtained during this process can then be used for all successive measurements as the value of C_g, as long as the gap is not changed.

COMPLEX RELATIVE PERMEABILITY METHOD

The permeability of a material can be found by comparing the inductance/resistance of an air-cored toroidal coil with the inductance/resistance of the same coil when wound on a toroidal core made from the MUT. One calculation therefore consists of two separate measurements. Similarly to the Non-contacting Permittivity method above, the user will perform a reference/calibration measurement across the frequency range on the air-cored coil, the results of which will be stored in a file. These results will then be used as the values for R_w and L_w in all subsequent measurements (or until the user changes the air-cored coil).



Test Parameter Selection Screen



Materials Test Setup Screen

Specification

Permittivity Parameters		Permeability Parameters	
ε'_r	Real part of Complex Relative Permittivity	μ'_r	Real part of Complex Relative Permeability
ε''_r	Imaginary part of Complex Relative Permittivity	μ''_r	Imaginary part of Complex Relative Permeability
Dε	Dissipation Factor	Dμ	Dissipation Factor

Installation

This option can be installed on a unit at the time of manufacture, or by the customer later after a licence has been emailed to them.