

Dielectric Spectroscopy at Low Frequency

This measurement employs parallel plate electrodes to evaluate the dielectric constant and dielectric loss of the material.

a) Direct contact method

The sample is placed between the two metal electrodes of the dielectric test fixture ([Keysight 16451B](#)). The metal electrodes are pressed against the sample to make direct contact. An LCR meter (e.g. [Keysight E4890A](#)) is connected to the test fixture to measure the capacitance and resistance of the sample to calculate the dielectric constant and dielectric loss. The testing frequency range is 20 Hz ~ 30 MHz.

When it comes to [thin film evaluation](#), the test accuracy can be impacted by the air pocket trapped between the metal electrodes and the film surface. Therefore, metal electrodes deposited on the film surface are recommended to improve the contact and the measurement accuracy. See [here](#) for more details

b) Two fluid cell method (non-contact)

The sample is placed between the two metal electrodes of the cell ([Rigid Dielectric Cell LD3](#)) without requiring direct contact with the electrodes. An LCR meter is connected to the test fixture to measure the capacitance and resistance of the cell four times (empty cell, cell with sample inserted, cell filled with dielectric fluid, and cell with the sample inserted in the dielectric fluid) to calculate the dielectric constant and dielectric loss. The testing frequency range is 50 Hz ~ 1 MHz.

For a maximized measurement accuracy of thin film evaluation, individual specimens should be stacked to a **minimum of 0.4 mm**.

A summary of testing capability in ADL supporting dielectric spectroscopy tests at low frequency is listed below. More technical details can be found [here](#).

Labs	Frequency Range	Standards	Sample Size
ADL Alpharetta Bollate	20 Hz ~ 30 MHz	ASTM D150	Thickness <= 10 mm Diameter: 10~56 mm
ADL Bollate	50 Hz ~ 1 MHz	IPC-TM-650.2.5.5.3	Max. width: 80 mm Max. thickness: 110 mm (For samples <= 0.254 mm, individual specimens should be stacked to a minimum of 0.381 mm)