Number	
2.5.5	
Subject	
Dielectric Constant of Printed Wiring Materials	
Date	Revision
7/75	**A**
Originating Task Group	
N/A	

IPC-TM-650
TEST METHODS MANUAL

1 Scope The purpose of this test method is to provide a procedure to determine the dielectric constant at 1 MHz of laminate or substrate material.

2 Applicable Documents None

3 Test Specimen

3.1 Each specimen shall be 10 cm x 10 cm by the thickness of the laminate or substrate material. Remove copper foil from both sides by etching using standard commercial practices. At least three specimens are required.

4 Equipment/Apparatus

4.1 A standard capacitance bridge, generator, null detector, and accessories

5 Procedure

5.1 Preparation

5.1.1 Remove foil from both sides of specimens using standard copper etching practices. Rinse in tap water until clean.

5.1.2 Condition specimens in distilled water for 24 hours at 23°C, then air dry.

5.1.3 Coat both sides of the specimens with silver conductive paint, dry, and file all edges to prevent a conductive path.

5.1.4 Calibrate the capacitance bridge assembly.

5.1.5 Set the Method dial on ''Substitute'' and connect the balancing capacitor to the unknown direct terminals.

5.1.6 The balancing capacitor must be 100 picofarads greater than the test specimen.

5.1.7 Turn the Method switch to the ''Substitute'' position.

5.2 Test

5.2.1 Set the Voltage dial for maximum output and obtain a null on the detector by balancing the Capacitance and Dissipation dials, then take the reading of the capacitance of the dissipation.

5.2.2 Proceed by connecting the test specimen to the unknown substitute terminals.

5.2.3 Obtain a null on the detector by balancing the capacitance bridge, then read the capacitance and the dissipation factor as before.

5.3 Calculation The dielectric constant is computed by using the following equation:

$$K = \frac{4.45t\,(C_1 - C)}{A}$$

where:

t $\quad$ = thickness of specimen
A $\quad$ = area of specimen
C_1 = capacitance of balancing capacitor
C $\quad$ = capacitance of test specimen

5.4 Report The results should be recorded in a written report, which contains the following as a minimum:

• Certification that the test was performed in accordance with this test method

• Identification of specimens tested

• The dielectric constant of each specimen tested and the average of the specimens tested for each material

6 *Notes* The dielectric constant is defined as the ratio of the capacitance with the test material between the two plates to the capacitance of air between the two plates.