

# DUT Electronics

0.047" interconnect

Measurement Results

12/30/2021

## Table of Contents

TABLE OF CONTENTS.....	2
OBJECTIVE.....	3
METHODOLOGY.....	3
<i>Test procedures</i> .....	3
<i>Setup</i> .....	3
MEASUREMENTS .....	4
<i>Time domain</i> .....	4
<i>Frequency domain</i> .....	6
SUMMARY.....	9
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## **Objective**

The objective of these measurements is to determine the RF performance of a DUT Electronics 0.047" interconnect. Measurements in both frequency and time domain form the basis for the evaluation. Parameters to be determined are S-parameters, impedance and propagation delay to 109.999 GHz.

## **Methodology**

### **Test procedures**

Frequency domain measurements were acquired with a network analyzer (Agilent HP8510C). The instrument was calibrated up to the end of the 0.047" diameter coax probes that are part of the test fixturing. The device under test (DUT) was then mounted to the fixture and the response measured.

Time domain measurements are obtained via inverse Fourier transform from VNA tests. These measurements reveal the type of discontinuities at the interfaces plus contacts and establish bounds for digital system risetime and clock speeds.

### **Setup**

Testing was performed with a test setup that consists of a brass plate that contains an embedded coaxial probe. The DUT is aligned and mounted to that plate. The opposite termination is also a metal plate with a coaxial probe.

The 0.047" interconnect and base plate as well as the DUT plate are then mounted in a test.

Connections to the VNA are made with high quality coaxial cables with 1mm connectors.

## Measurements

### Time domain

The time domain measurements will be presented first:

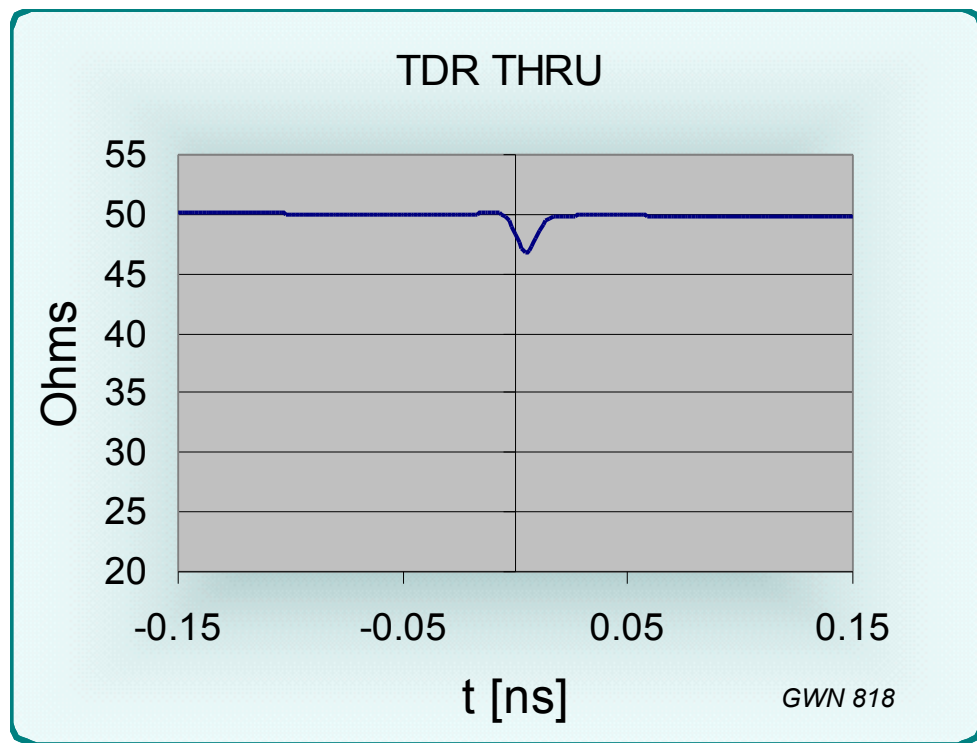


Figure 1 TDR measurement into a 50 Ohm probe

The thru TDR measurement shows impedance as the signal propagates through the interconnect. The peaks/dips reach an impedance of 46.8 Ohms. It should be kept in mind that the impedance recorded here is not as high or as low as actually found in the specimen because of the risetime of the time step, in this case 12.0 ps. For connections with comparable or shorter electrical lengths this does not allow the peak to reach its full height.

The TDT performance for a step propagating through the contact arrangement was also recorded:

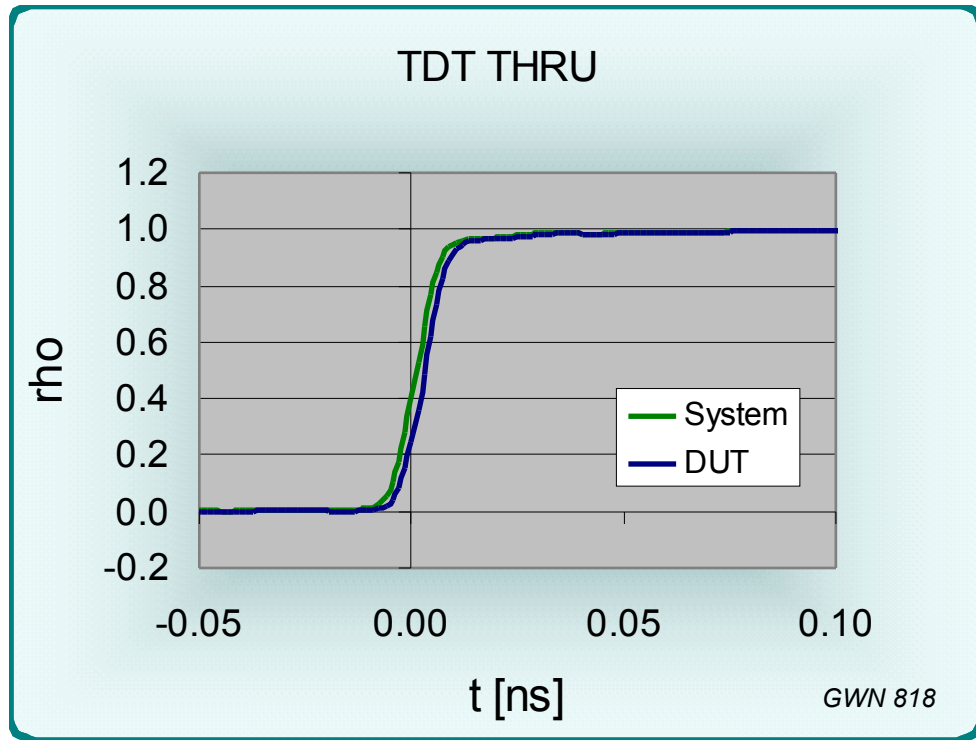


Figure 2 TDT measurement

The TDT measurements for transmission show an identical risetime from the pin array as the system itself (10-90% RT = 12.0 ps, system risetime is 12.0 ps). The added delay at the 50% point is 2.0 ps. There is no signal distortion. If the 20%-80% values are extracted, the risetime is only 7.5 ps.

## Frequency domain

An insertion loss measurement is shown below for frequencies up to 100 GHz:

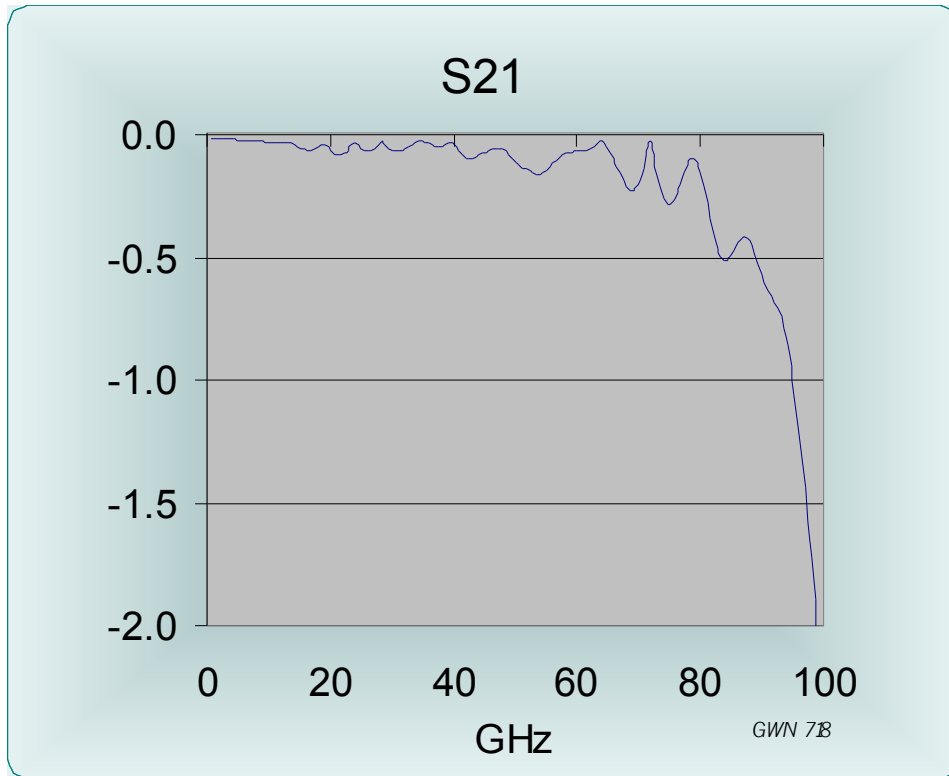


Figure 3 Insertion loss S21 (f)

Insertion loss is less than 1 dB to 98 GHz. The 3 dB point is not reached before 103.5 GHz.

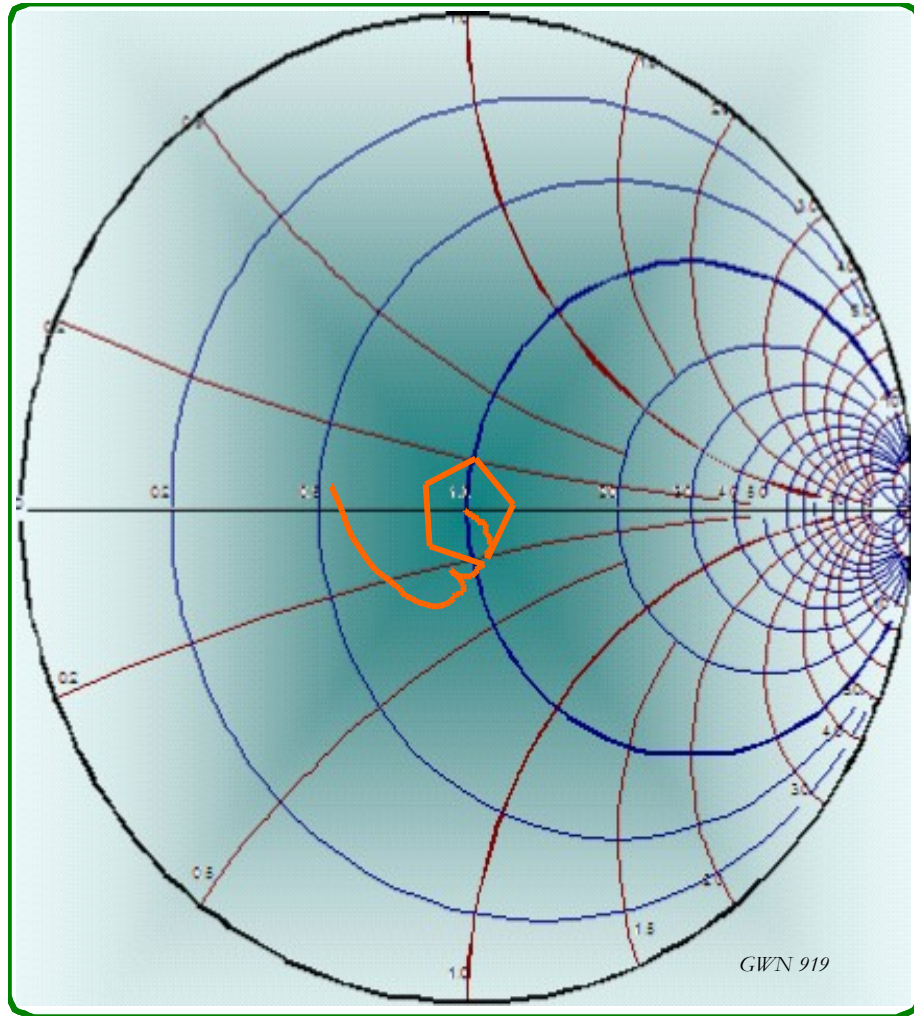


Figure 4 Smith chart for the thru measurement into a 50 Ohm probe

The Smith chart for thru measurements shows a good match at low frequencies. At higher frequencies reactive components become apparent.

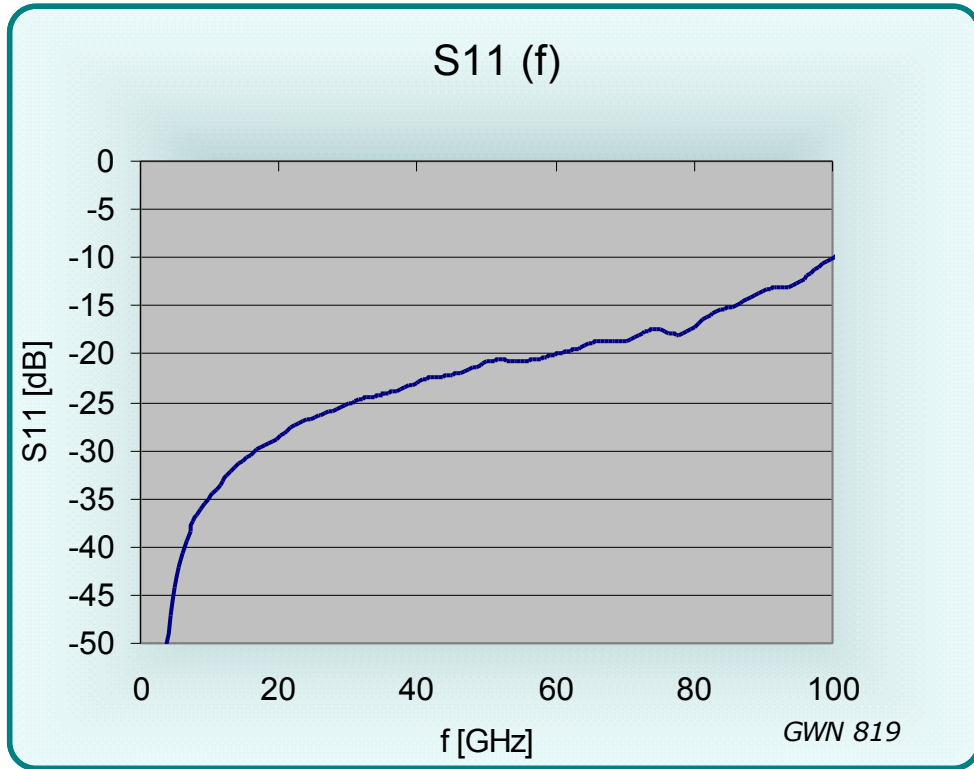


Figure 5 S11 magnitude (f) for the thru measurement into a 50 Ohm probe

Return loss reaches -20 dB at 60.4 GHz.



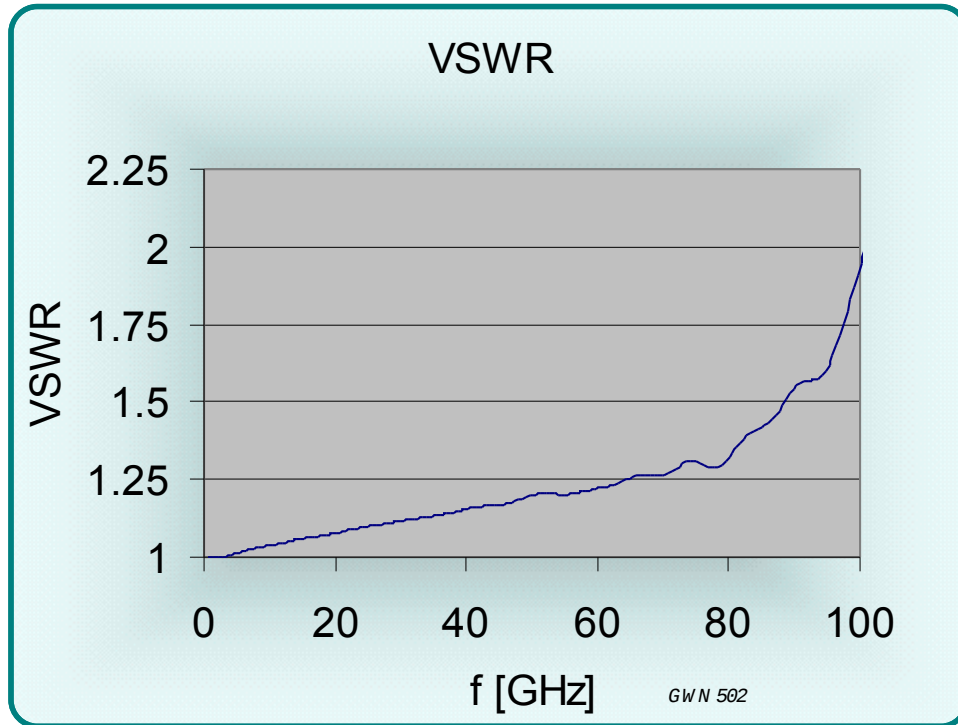


Figure 6 Standing wave ratio VSWR (f) [1 / div.]

The VSWR remains below 2 : 1 to a frequency of 100.7 GHz.

### Summary

DUT Electronics

0.047" interconnect

S21 (insertion loss) @ -1dB, GSG	98.0	GHz
S11 (return loss) @ -20 dB, GSG	60.4	GHz
Impedance, GSG	48.0	$\Omega$