TN002 ESD Target Calibration Method

1. Calibration Objective

The objective of this report is to calibrate the ESD target and check its performance and compare the results to the requirements of the IEC 61000-4-2 standard.

Requirements from IEC 61000-4-2 standard:

1. ***Input Impedance of ESD target***

Figure 1 The Front Side of ESDEMC A4001 ESD Current Target

The ESD current target used to measure the discharge current from ESD generators should have input impedance between the inner electrode and ground **≤ 2.1 Ohm @ DC**.

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2. *Insertion Loss of the Target-Attenuator-Cable Chain*

Figure 2 ESDEMC A4001 ESD Current Target-Attenuator-Cable Chain

Instead of specifying the insertion loss of the ESD current target, the insertion loss of the measurement chain consisting of the target, attenuator and cable is specified. The variation of the insertion loss may not exceed:

+/- 0.5 dB up to 1 GHz
+/- 1.2 dB 1 to 4 GHz.

The nominal value S21 of the insertion loss:

$S21 = 20*\log [2*Z_{sys}/(R_{in} + 50\ \Omega)]$ dB

Where R_{in} is the DC input impedance of the chain when loaded with 50 Ω.

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2. Measurement Setup and Results:

Device	Manufacture	Model	Serial Number	Calibration Due
Network Analyzer	Agilent	E8357A	US42070561	08/13/2016
VNA Calibration Kit	Agilent	85092C	MY46180831	08/14/2016
Digital Multi-meter	Keithley	2110	1374108	07/15/2016
Digital Power Supply	Agilent	E3648A	MY40004580	07/20/2016
ESD Target Adapter Line	ESDEMC	A4002	A4002-001	09/02/2016

Table 1. Measurement Equipment used in this report

1. For the DC input impedance

An LCR meter or a 4 wire source-measurement-meter (SMU) should be used to measure the DC input impedance. The electrodes should be connected in parallel to the input of the target. In this calibration report, the target was connected with a 20 dB attenuator plus the RG400 cable and a 50-Ohm termination. A value of around 2.00 Ohm should be measured.

2. For the frequency response

The ESD current target, attenuator and coax cable are attached to the target adapter for determination of the frequency response. The typical setup is shown in figure 3:

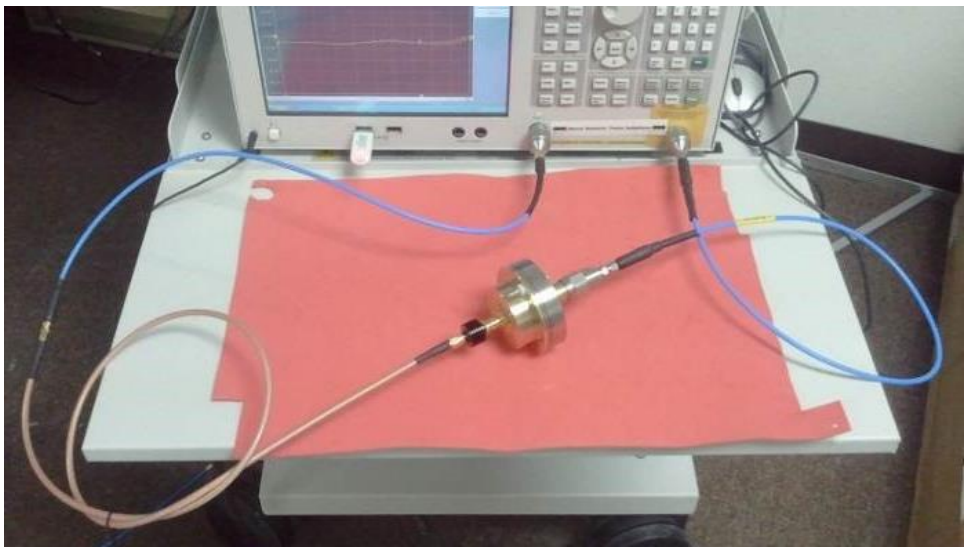

Figure 3 Mount ESD Target on to Target Adapter Line and connect to VNA

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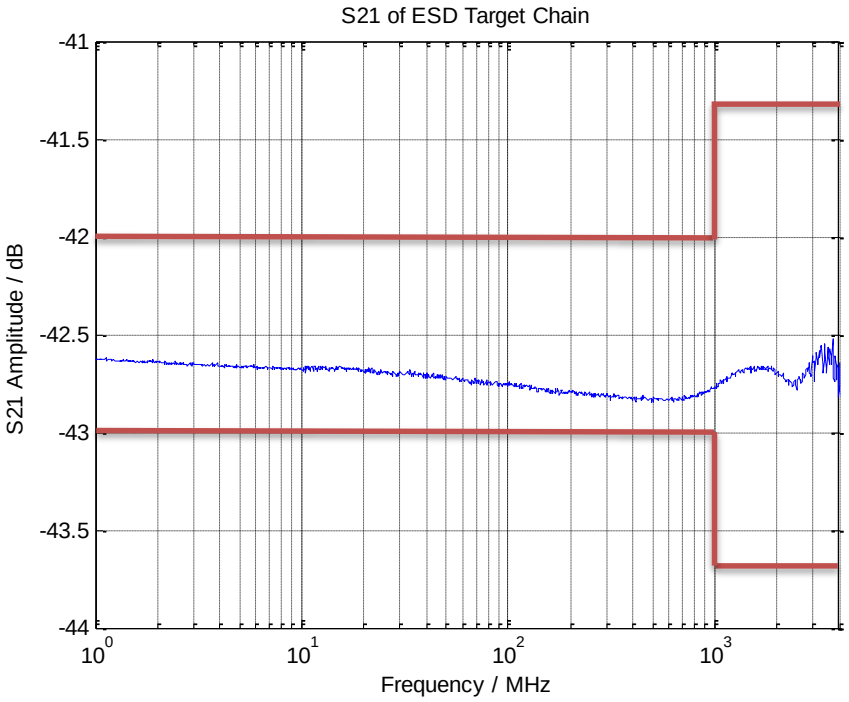

Figure 4 The Insertion Loss - S21 of ESDEMC A4001 ESD Target Chain (SN A4001-195)

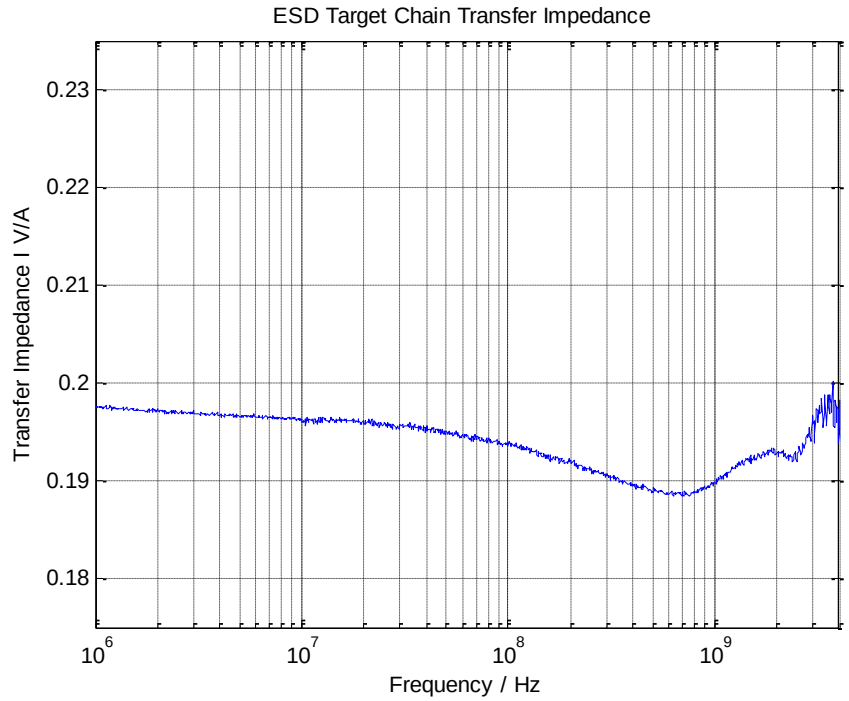

Figure 5 Transfer Impedance of the ESDEMC A4001 ESD Target Chain (SN A4001-195)

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For measuring insertion loss of the target-attenuator-cable chain, a network analyzer was used to measure the S21. The S21 result of the setup is shown on figure 4. The red dash lines are the limits from the ICE 61000-4-2 standard. So this ESD Target is within the spec per ICE 61000-4-2 standard.

3. Maintaining the Current Target Performance

The performance of the current target shall be verified at least every two years. It is sufficient to verify the DC-characteristics of the target. The rational is that changes in the overall mechanical geometry are very unlikely, as they require a lot of force. The only place damage can occur is at the connector (inspect visually) and at the resistors due to excessive force on the center conductor of the target. If resistors break or get otherwise damage these change will be seen at DC and at high frequencies.

The test can be done by injecting a current of about 1 A into the target while terminating the target with 50-Ohm. The DC transfer impedance, defined as the voltage measured across the 50 Ohm termination divided by the input DC current of about 1A. It shall not deviate from the expected by more than 2%. Care must be taken to inject the current at two points that are different from the points at which the voltage is measured. This is typical for 4-wire resistance measurements. It is suggested to inject the current at the front side of the target and to measure the voltage on the back side of the target. A T-junction connector can be used to attach a DC voltage meter and a 50-Ohm termination at the same time. Often it is advisable to perform the test with two opposing polarities of the DC current and to take the average of the two resistance readings. This cancels effects of thermal voltages that might occur across contacts of different material. A direct use of a 4-wire, 4-contact impedance meter might lead to instable results as long as the target is mounted in a large ground plane, due to noise coupled into the 4-wire, 4- contact connection setup. It is suggested to test the measurement setup on a known, low impedance (e.g., 1 Ohm) resistor at first.

Reference: ***IEC 61000-4-2 standard ed2.0 - 2008***

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