Specification

CTR 2
ESD calibration target

The CTR 2 is a coaxial current target to monitor Electro Static Discharges as required in the draft IEC 61000-4-2 Ed.2 standard. The target is manufactured by EM TEST and can be purchased as an option to the ESD generator model “dito”.

- IEC 61000-4-2
- IEC 61000-4-2 778/378/CDV
- ISO CD 10605 N1347
CTR 2

**Technical data CTR 2:**

Measuring resistor: 2Ω ± 5%

Design: as per Draft revision IEC 61000-4-2, doc 77B 538E CD

Installation: The target shall be mounted into the wall of a shielded room or into a metal plate of at least 1.2 x 1.2m size

Output: Coaxial SMA connector

Attenuator: An additional attenuator must be connected to the output of the CTR 2 depending on the input capability of the oscilloscope. ±0.5dB up to 1 GHz and ±1.2dB up to 4GHz. This must always be measured as a "Target-Attenuator-Cable" chain. The target itself must not be measured.

Insertion loss

ESD test voltage ± 15kV

Dimension Ø 70mm x 30mm

Weight CTR2 approx. 400g

The current targets are tested to meet the required insertion loss of ±0.3dB up to 1 GHz and ±1dB up to 4GHz.

In addition to the current monitor, a Huber&Suhner 2W/20db attenuator with a 1m Huber&Suhner coaxial cable with type “SMA” connectors are used.

Verification setup for the CTR 2 current monitor

![Diagram](chart1.png)

The ESD current target, Attenuator A and Cable A are the target – attenuator-cable chain which is calibrated using this setup. Attenuator B and C may not be needed.

The S21 measurement of the ESD current target.

Note: The target is measured with a cable; according to the standard, the cable should be part of the target-attenuator chain measurement.

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CTR2-AD 50Ω conical adapter line to calibrate the CTR 2 current monitor

The target adapter line shown above connects a 50- coaxial cable to the input of the ESD current target. Geometrically it smoothly expands from the diameter of the coaxial cable to the target diameter. If the target is made such that impedance calculated from the diameter ratio d to D (see figure A 2) is not equal to 50, the target adapter line shall be made such that the outer diameter of its inner conductor equals the diameter of the inner electrode of the current target. The impedance has to be calculated using the dielectric constant of the material that fills the conical adapter line (typically air). The target adapter line shall maintain 50 ± 2% within a 4 GHz bandwidth. The reflection coefficient of two target adapter lines placed face-to-face shall be better than 30 dB up to 1 GHz and better than 20 dB up to 4 GHz. The insertion loss of the two target adapter lines placed face to face shall be less than 0.3 dB up to 4 GHz.
Block diagram of the “Target – Attenuator – Cable” chain

ESD Generator → Current monitor CTR 2 → 20dB attenuator → Coaxial cable → Oscilloscope with at least 2GHz single shot bandwidth

Shielded room

Calibration setup using a shielded room

The photo below shows a typical test setup. Note the return cable on the ESD generator. The return cable is laid around a wooden support table to ensure the ground loop is as large as possible. There are no curls or loops in the cable to reduce oscillations seen by the scope. In case the floor at the calibration setup includes massive metallic structures, the ground cable layout can create oscillations in the 30ns and 60ns part of the current waveshape. To avoid such oscillations the ground cable must have sufficient distance (same as to metallic walls) to the floor or the floor must be covered by lossy materials.

Delivery parts:
- CTR2 target
- coaxial cable 1m
- Attenuator 20dB

Wooden support
For max ground loop

CTR 2
Discharge point

CTR 2 – Attenuator – Cable - Oscilloscope
ESD waveform verification

EM TEST recommends the following test equipment:

- Digital oscilloscope with at least 2GHz single shot bandwidth
- Faraday cage
- EM TEST CTR-2 Coaxial Target including 20dB attenuator and high quality coaxial cable

Capturing the waveform on the scope can only be achieved with the proper setup on the Digital Oscilloscope (DSO). The setup must be chosen to measure waveforms at ± 2KV, ± 4KV, ± 6KV and ± 8KV. There are five measurements required for each voltage:

- Initial peak current
- Risetime at 10% to 90% of initial peak current
- Current level at 30ns
- Current level at 60ns

The time domain for the initial peak and rise time measurement is 1ns/Div and 10ns/Div for the measurement of the current at 30ns and 60ns.

The below graph shows a typical waveform at 4KV:

![Graph showing a typical waveform at 4KV](CTR2_13.jpg)

V1 = 20dB x Vm  
V1 = 2Ω x I1  
⇒ Ip = 20dB x Vm / 2Ω  

Ip = 5 x Vm

A discharge current of 7.5A therefore will result in a displayed Vm = 1.5V