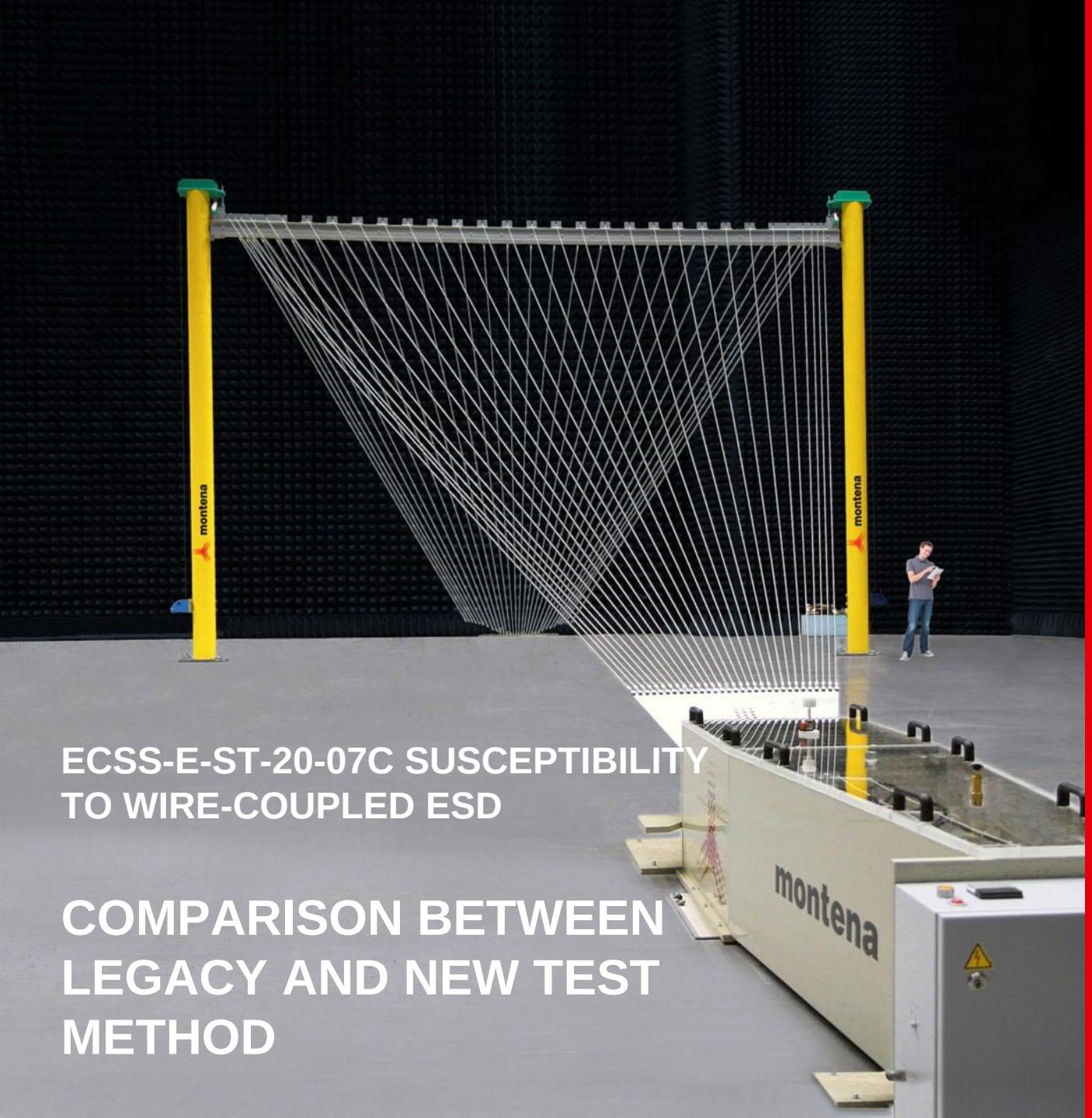

ECSS-E-ST-20-07C SUSCEPTIBILITY TO WIRE-COUPLED ESD

COMPARISON BETWEEN LEGACY AND NEW TEST METHOD

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Introduction

- An alternative test method for the susceptibility to wire-coupled electrostatic discharges of the ECSS-E-ST-20-07C was developed and introduced in the latest revision of the standard.
- It improves many weak points observed in the previous method.
- The goal of this presentation is to compare the previous (legacy) test method and the alternative (new) test method.

Standard

ECSS-E-ST-20-07C Rev.2
3 January 2022

! NEW !

- Paragraph 5.4.12

Susceptibility to wire-coupled electrostatic discharges

=> legacy method

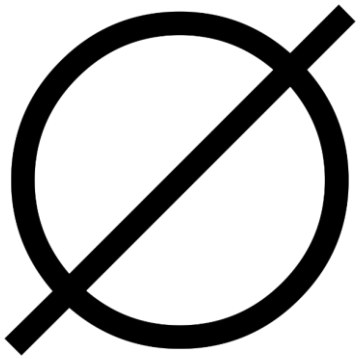
- Paragraph 5.4.13

Susceptibility to wire-coupled electrostatic discharges

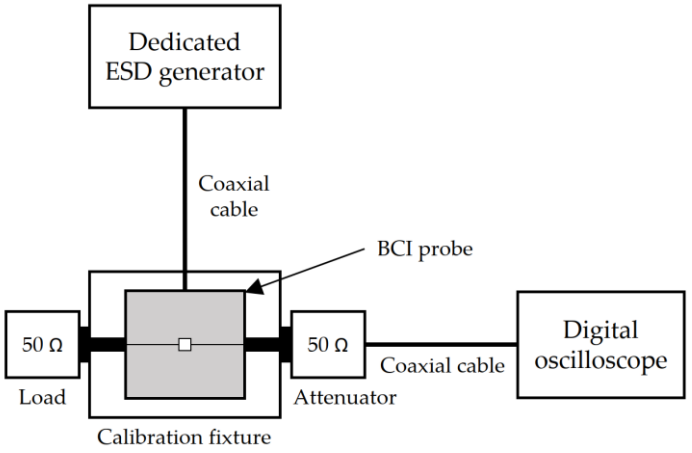
=> current injection probe method

Calibration setup schematic

- Legagy method
  - No calibration schematic is defined.

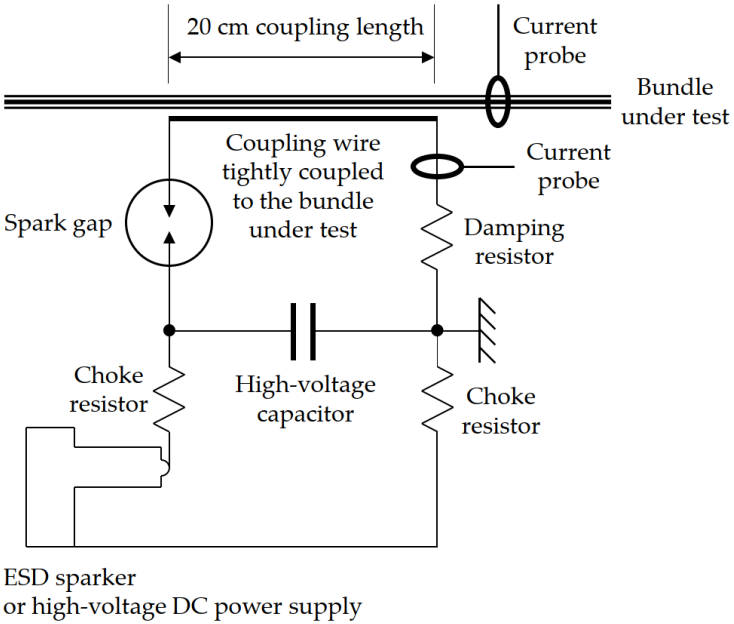


- New method
  - A proper calibration schematic is defined.

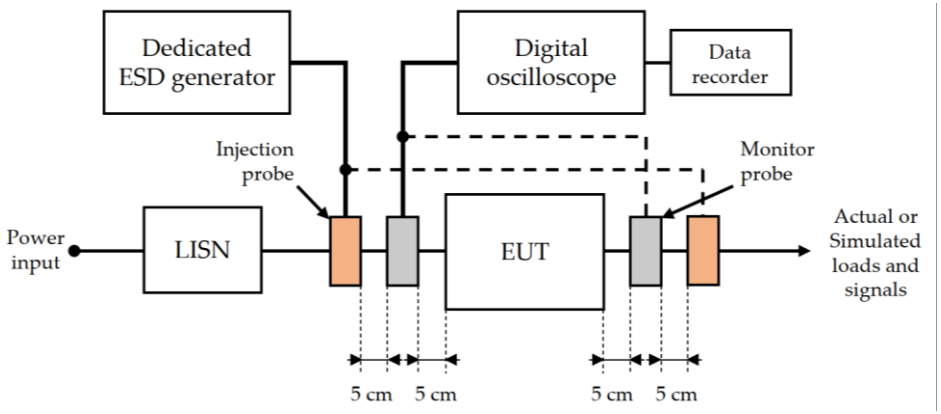


Test setup schematic

- Legagy method



- New method



Generator requirements

- Legagy method
  - The generator internal components are specified.
  - Without any tolerances.

The discharge primary circuit is constituted of:

(a) 6 kV spark gap,

(b) 100 pF capacitance, high-voltage capacitor with inductance less than 20 nH,

(c) 47 Ω damping resistor (high voltage specification),

(d) 10 kΩ resistors (high voltage specification).

  - Often built in the lab with discrete components.

- New method
  - The injected current waveform is specified.
  - Including tolerances.

(a) amplitude: 13 A ± 1 A

(b) rise time: 1,5 ns ± 0,3 ns, measured between 10% and 90% of the peak amplitude

(c) duration: 3 ns ± 1 ns at 50% amplitude

  - Commercially available.

Generator implementation

- Legagy method
  - The 6 kV spark gap is difficult to procure.
  - Only a fixed susceptibility level can be tested.
- New method
  - Spark gap replaced by a high voltage relay.
  - This enables an easy change of susceptibility levels.

Coupling device requirements

- Legagy method
  - Coupling wire.
  - Comprising a 20 cm long straight section and some extra length for connection to the rest of the circuit.
  - Tightly coupled to the bundle under test.

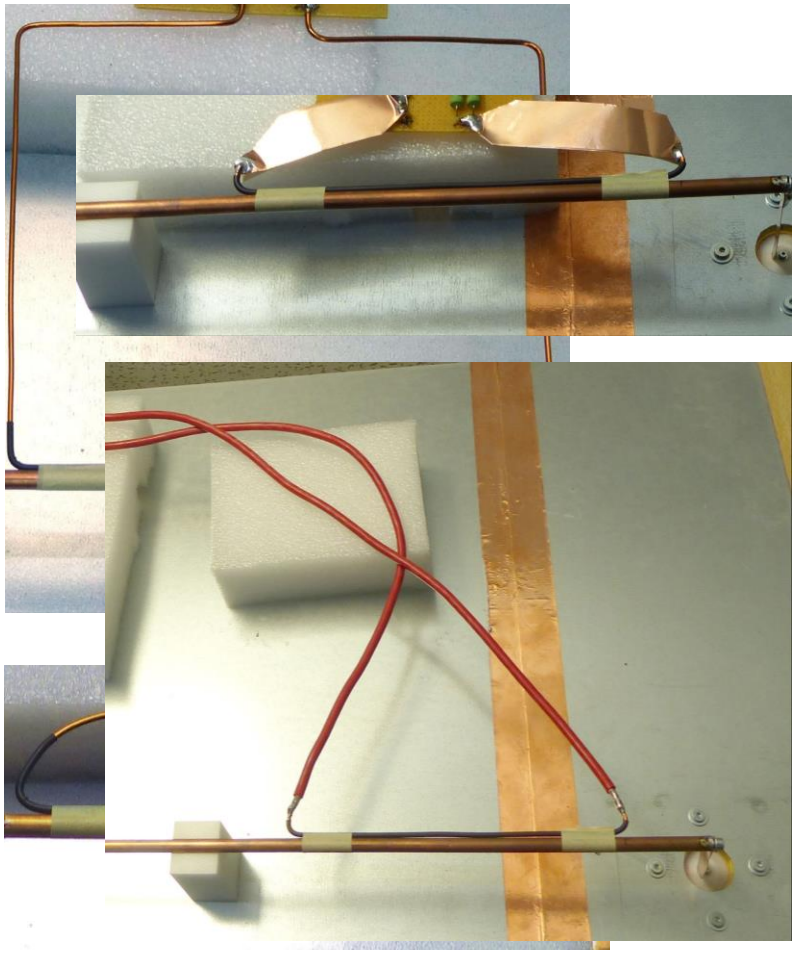
=> Many possible implementations

- New method
  - BCI current probe.
  - 30A peak capability.
  - with a flat frequency response at least from Fmin-3dB = 7.5 MHz to Fmax-3dB = 400 MHz.

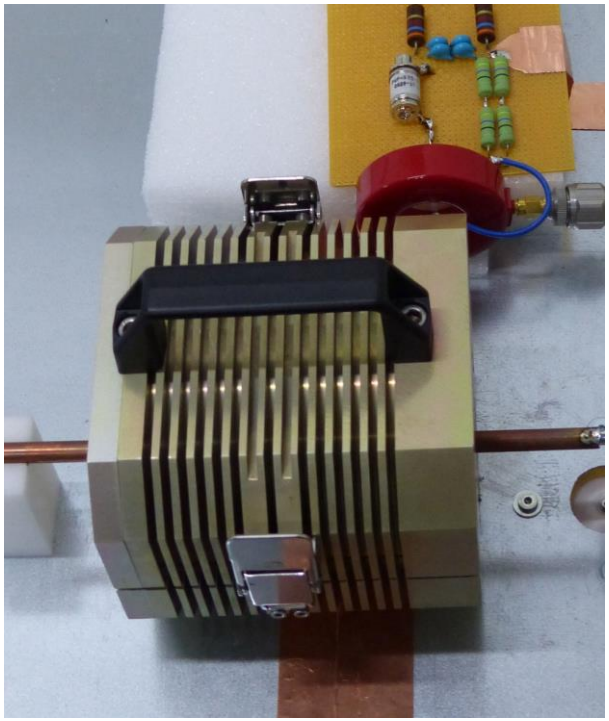
=> Clear definition

Coupling device implementation

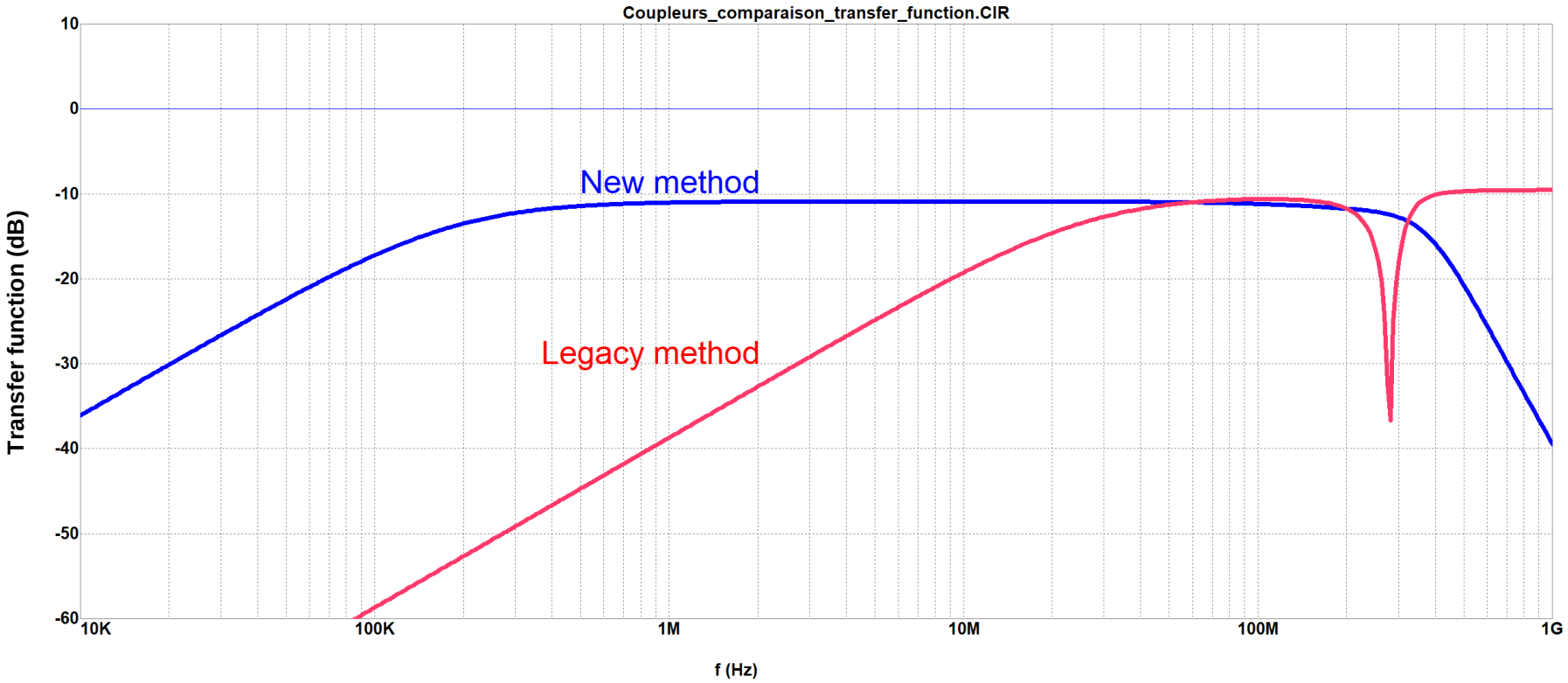
- Legagy method
  - Many options



- New method
  - Stable setup

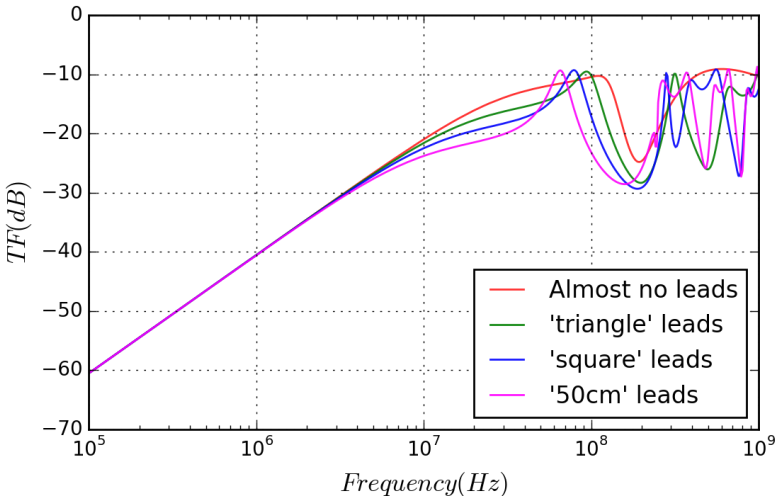


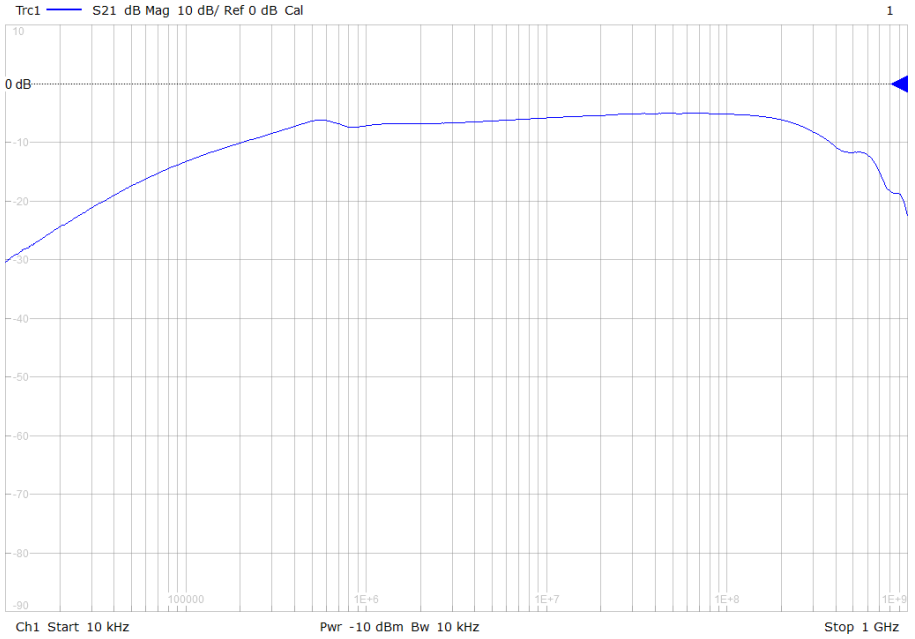
Coupling device nominal transfer function



Coupling device transfer function implementation

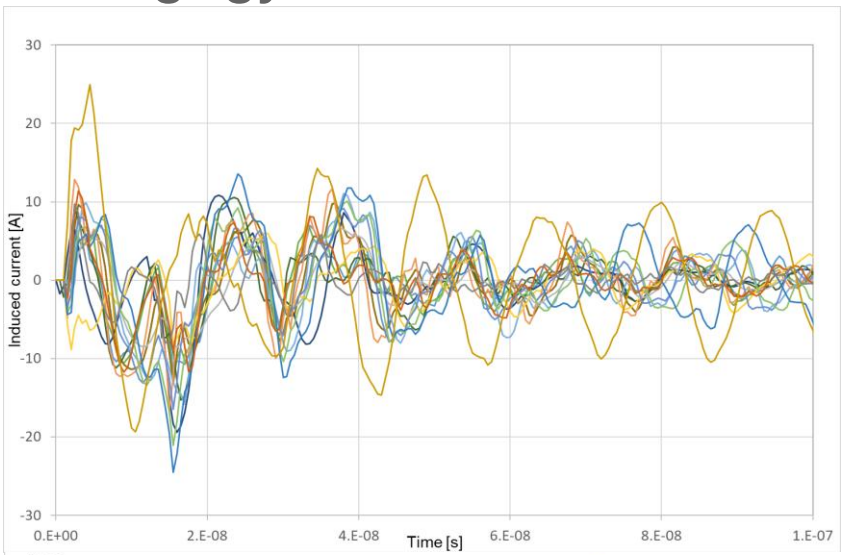
- Legagy method
  - Depends on the specific arrangement
- New method
  - Reproducible transfer function

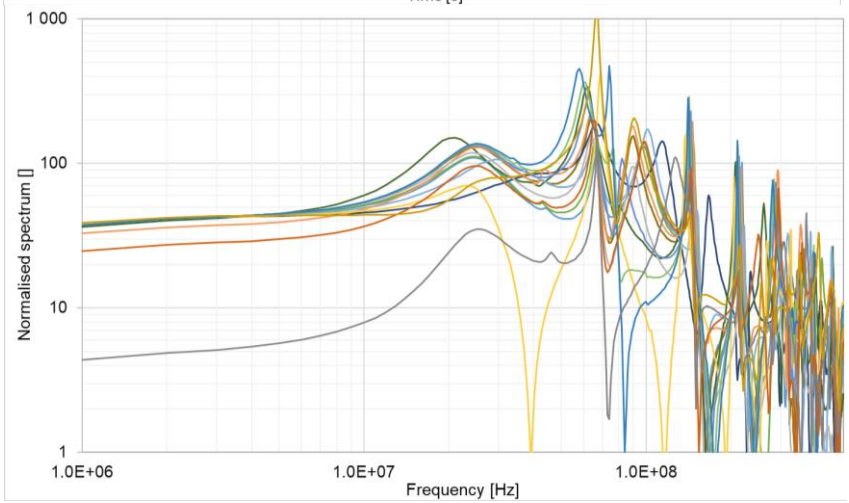




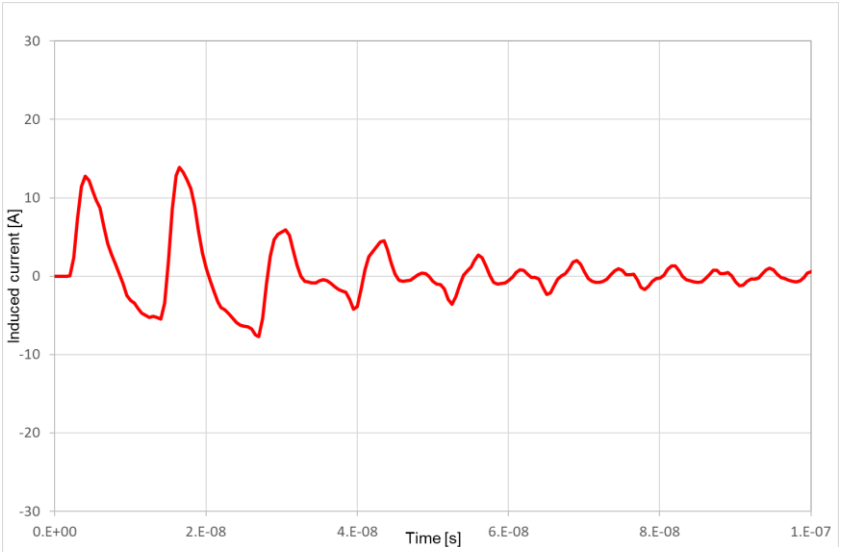
Induced current waveform reproducibility Time-domain and spectrum

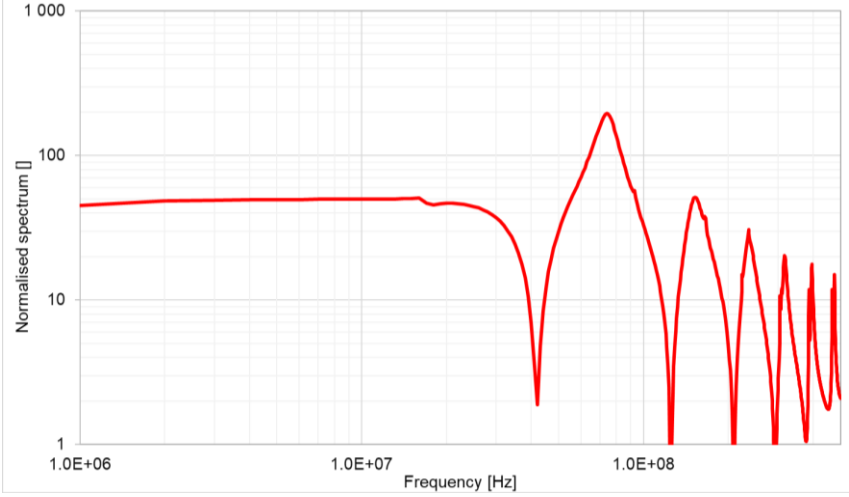
- Legagy method





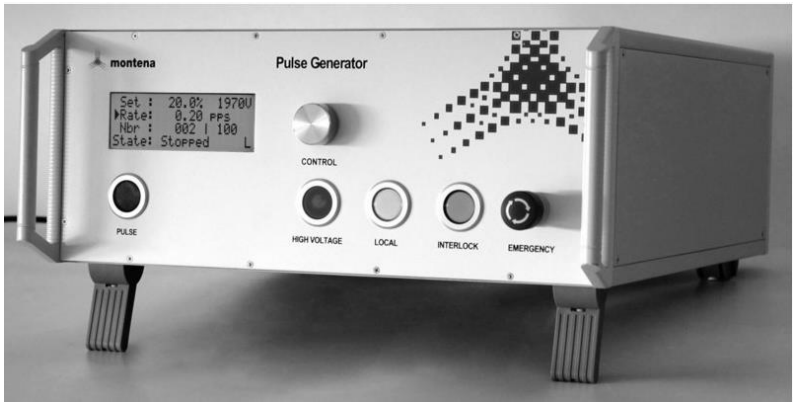
- New method

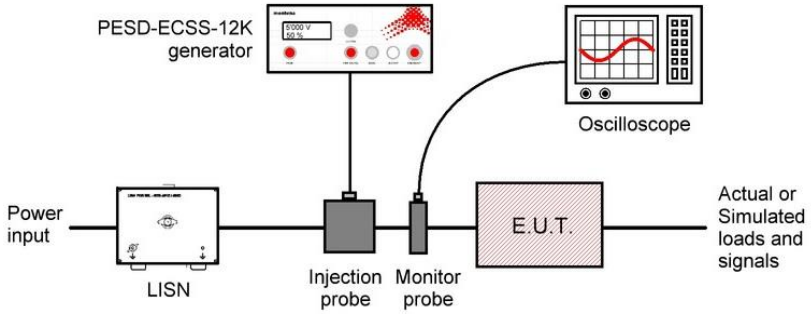




Availability of components

- The generator and the accessories compliant with the new method are available as commercial products and turn-key systems.





Conclusion

- An alternative test method for the susceptibility to wire-coupled electrostatic discharges of the ECSS-E-ST-20-07C was developed and introduced in the latest revision of the standard, improving many weak points of the previous test method.

Conclusion

- The test methods were compared and the advantages of the new method can be summarized below:
  - Improved reliability.
  - Improved waveform stability.
  - Robustness against external influence parameters.
  - Improved waveform reproducibility between different labs.
  - No use of high voltage components difficult to procure.
  - Ability to change the pulse peak amplitude.
  - Ability to modify waveform parameters (rise-time, energy) by exchanging internal pulse modules.
  - Use of easily commercially available components as accessories.
  - Very simple test setup.
  - Defined calibration procedure.

Thank you for your attention

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