

DEVELOPMENT OF COAXIAL ADAPTER FOR CALIBRATION OF EMC DEVICES

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Motivation

Calibration of EMC testing equipment, especially of LISN, is problematic in aspect of traceability

- To assure traceable calibration, new calibration equipment is being developed
- Newly developed adapter N-type/CEE 7/4 designed for measurements up to 108 MHz is presented

Line Impedance Stabilization Network - LISN

- LISN is required to provide defined impedance at radio frequencies to the terminals of the equipment under test
- It is required to isolate the test circuit from unwanted radio frequency signals on the supply mains and to couple the disturbance voltage to the measuring receiver.

Impedance calibration of LISN

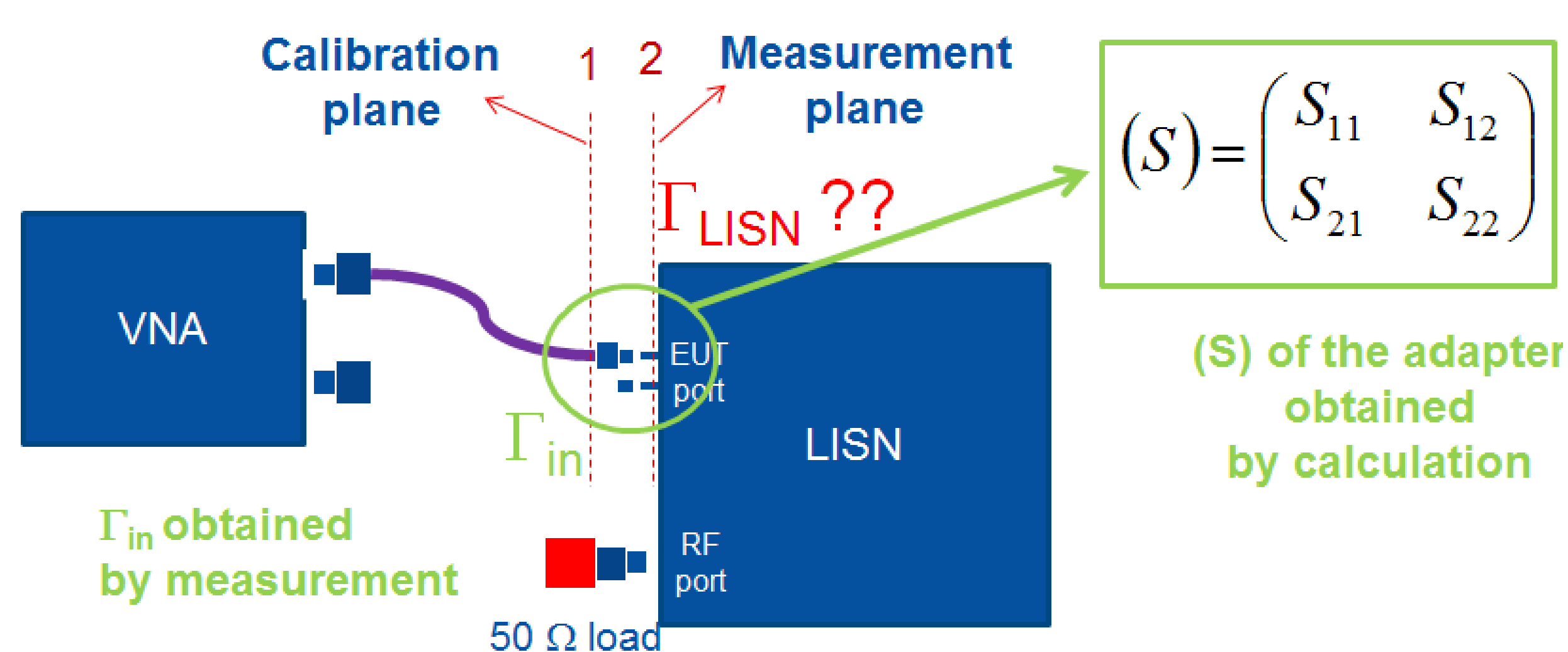
- The main problem of impedance calibration is connection to the EUT terminal "Schuko" e.g. CEE7/4 (very common in EU)
- Impedance of ESH2-Z5 is calibrated up to 30 MHz using VNA
- Schuko/N-type adapter is needed, which has to be verified at least up to 30 MHz



ESH2-Z5

E5061B

- Use of a commercial adapter is not suitable due to unknown input impedance and frequency response, which causes large uncertainties and poor traceability
- No calibration kit exists to make the calibration at the input of the EUT port („Schuko port“)
- Calibration and measurement plane are different, impedance on measurement plane must be therefore recalculated



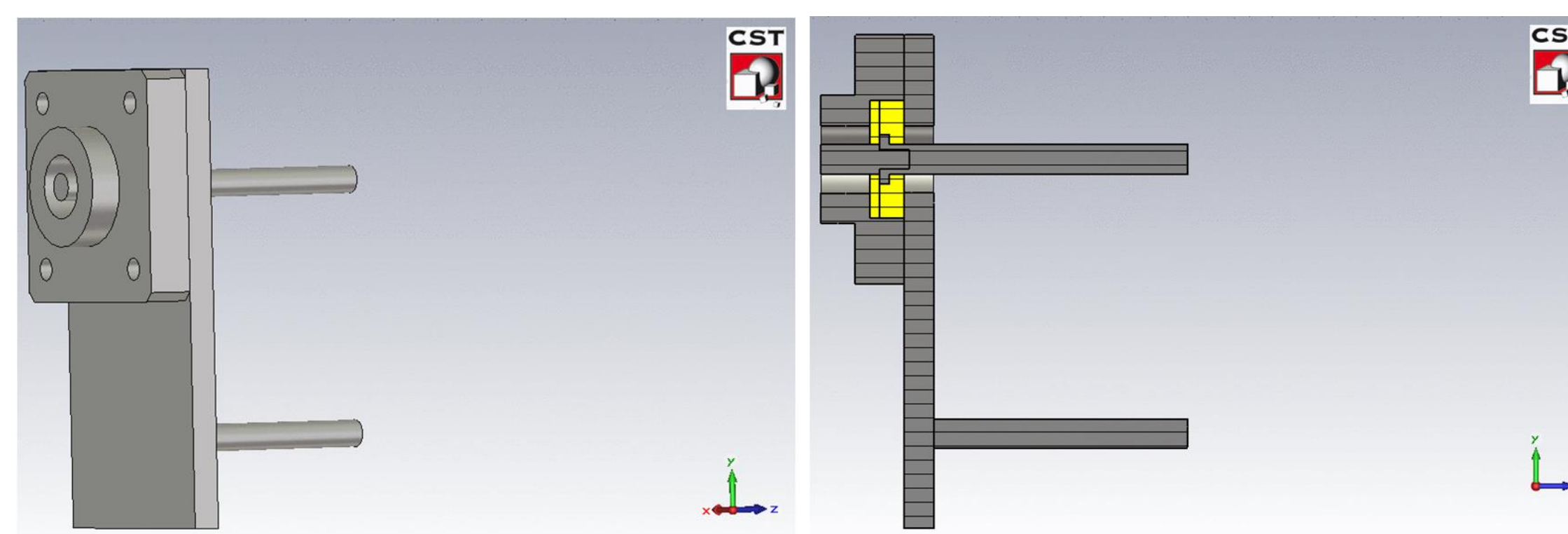
$$\Gamma_{LISN} = \frac{S_{11} - \Gamma_{IN}}{S_{22}(S_{11} - \Gamma_{in}) - S_{12}S_{21}}$$

„True“ impedance at the measurement plane

- Reflection coefficient of EUT is recalculated using S-matrix of the adapter

Adapter N-type/CEE 7/4

- The Schuko/N type adapter needs to be characterized on a very large bandwidth of frequencies
- Traceable measurement methods cannot be used because of the „banana“ connector side
- To overcome this lack of traceable measurement methods, our approach relies on the use of 3D electromagnetic computations
- Simulations show suitable performance up to 108 MHz



Adapter design and simulation in CST Microwave Studio



Manufactured adapter

Measurements and comparison

- Newly developed adapter was used for impedance and phase calibration of ESH2-Z5 up to 30 MHz
- measurements were performed between L1-PE using three different adapters for its comparison purposes



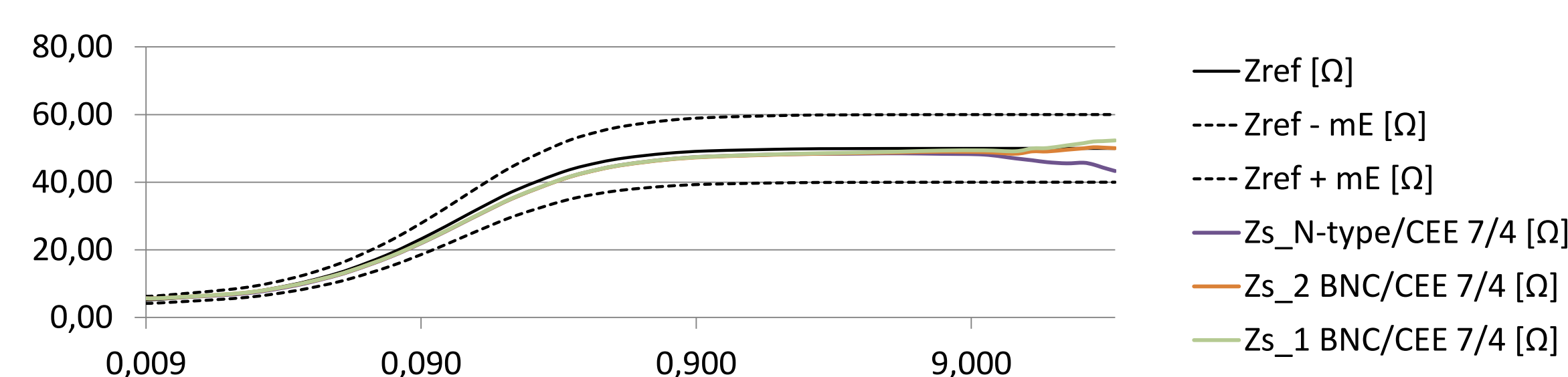
N-type/CEE 7/4

2 BNC/CEE 7/4

1 BNC/CEE 7/4

- Impedance and phase measurement (L1-PE) on ESH2-Z5 using three different adapters up to 30 MHz is shown on a graph below
- Adapter N-type/CEE 7/4 is the only one within phase limits at higher frequencies up to 30 MHz. All three adapters are within limits for impedance measurements.

Impedance



Phase

