Uncertainties of immunity measurements

DTI-NMSPU project R2.2b1

Annex C Graph results of measurements and models (conducted immunity)

SCHAFFNER

EMC services

Annex C

Graph results of measurements and models

This annex gives the detailed data from the measurements and models described in Annexes A and B.

Presentation

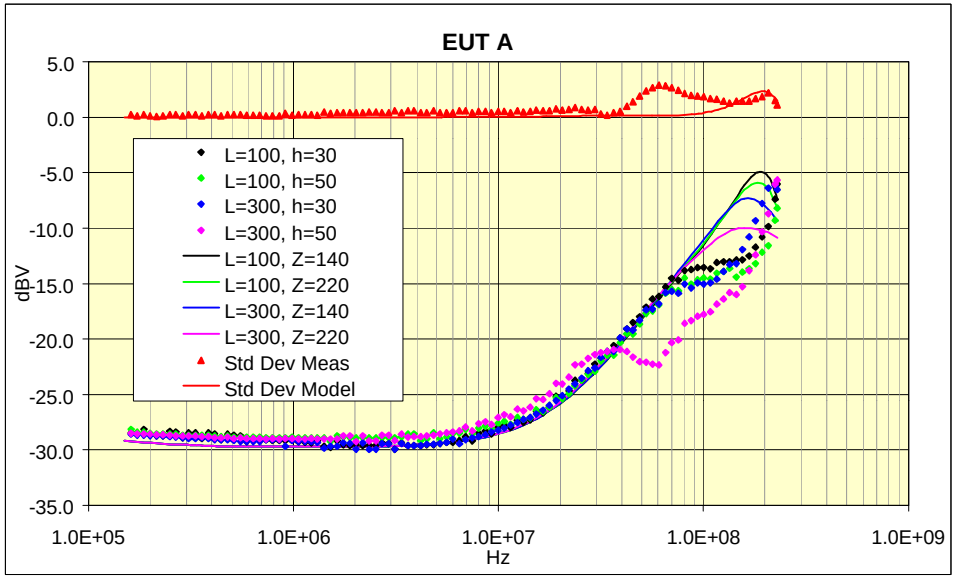
The graphs are presented for a given situation on each page for EUTs A, B, C and E. The EUT impedances are given at the foot of each page. EUTs D and F are not reported since their characteristics are very similar to combinations of the other EUTs.

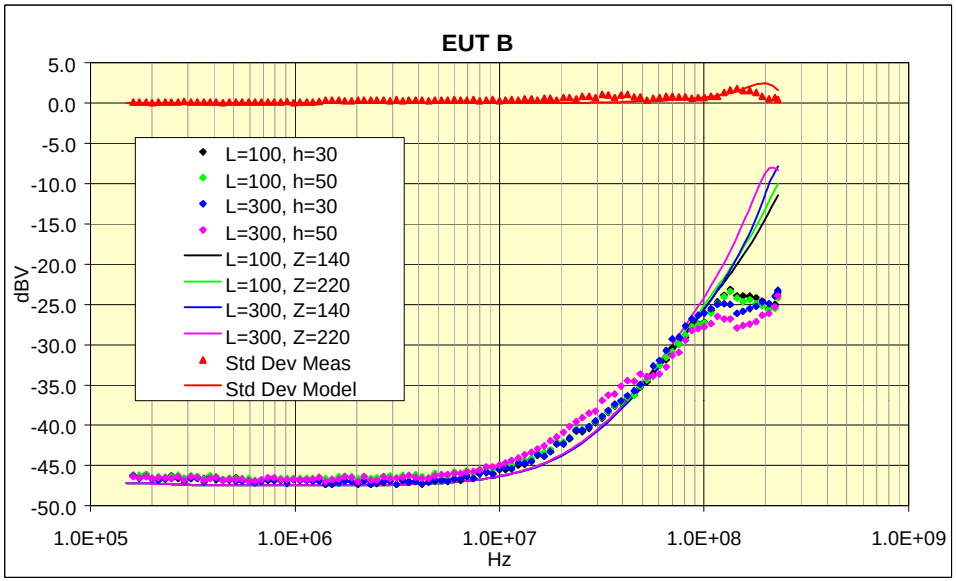
The situations described are as follows:

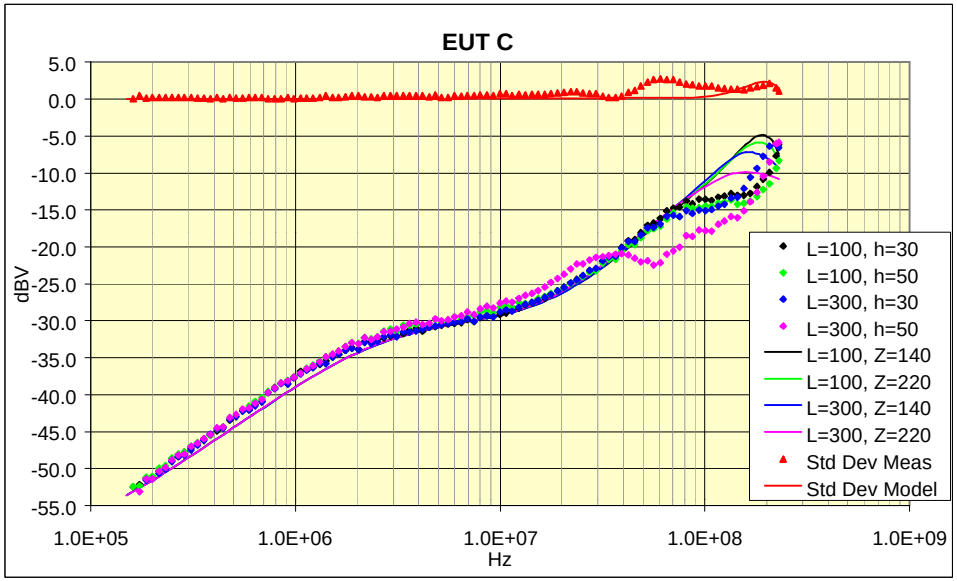
The legend on each graph describes the data. Impedances are reported in ohms. Z_{AE} is the termination common mode impedance at the AE (sometimes listed as RAE in the graphs), shown as Z1 in Annex B Figure 2.

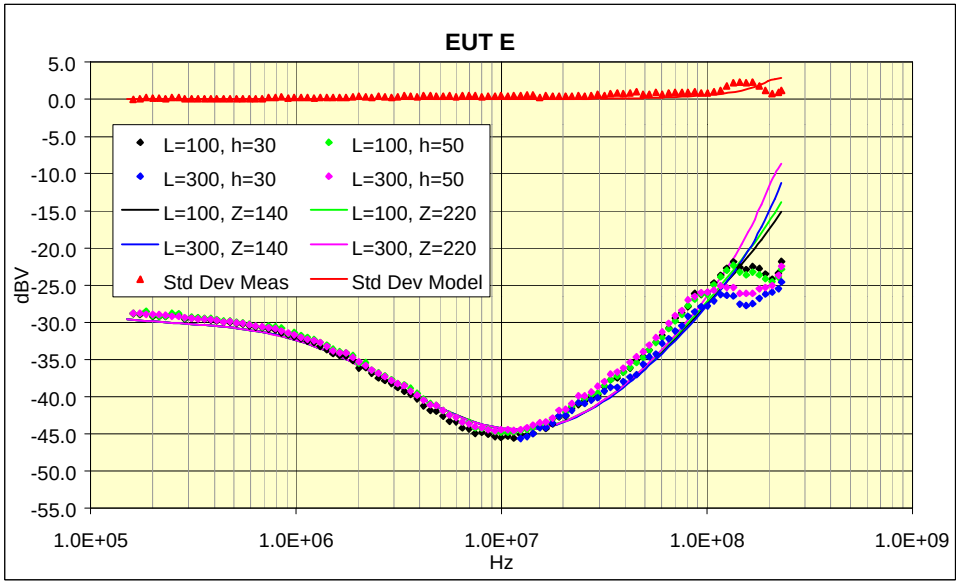
Diamond ◆ or triangle ▲ symbols show data taken from measurements, while continuous lines show data taken from modelling. Thus the model and measurement data can be directly compared. Some graphs also show the standard deviation of the results as red data on the same axis, where relevant. In a few cases artefacts in the measurement process result in incorrect measurement values at the beginning of the frequency range; these can be ignored.

CDN, good ground connection, Z_{AE} 150 ohms, cable variations (length and height in mm)



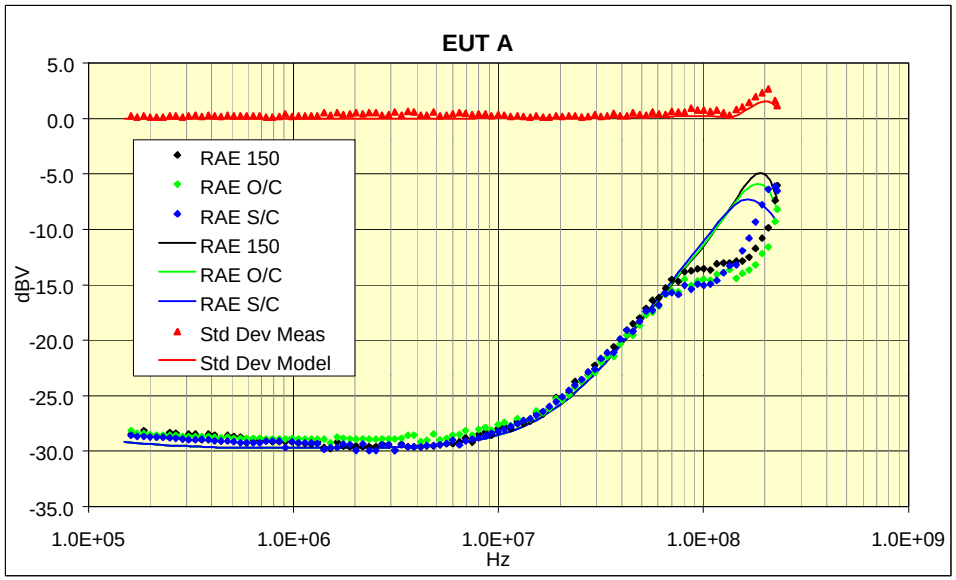


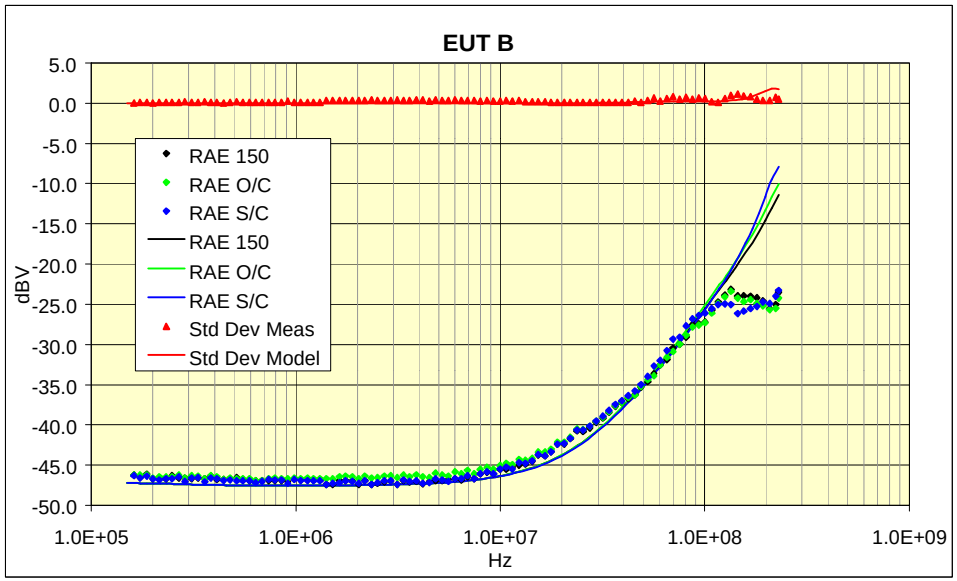


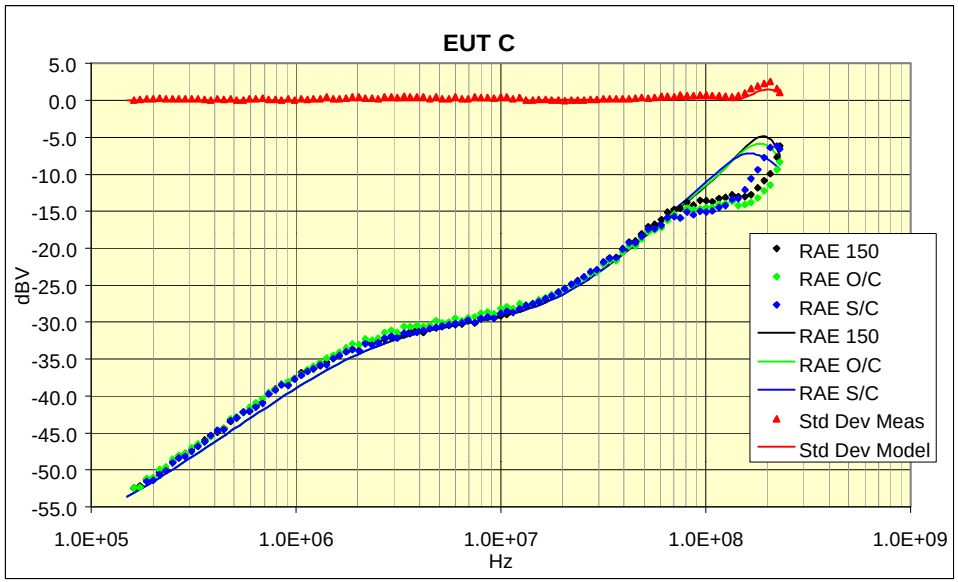


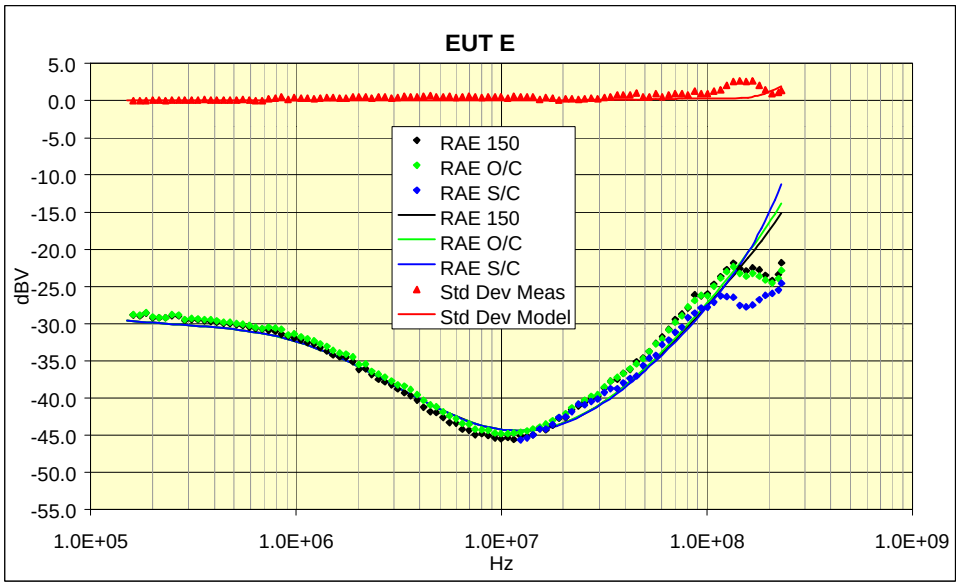
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

CDN, good ground connection, cable 0.1m L 3cm h, Z_{AE} (termination impedance) variations



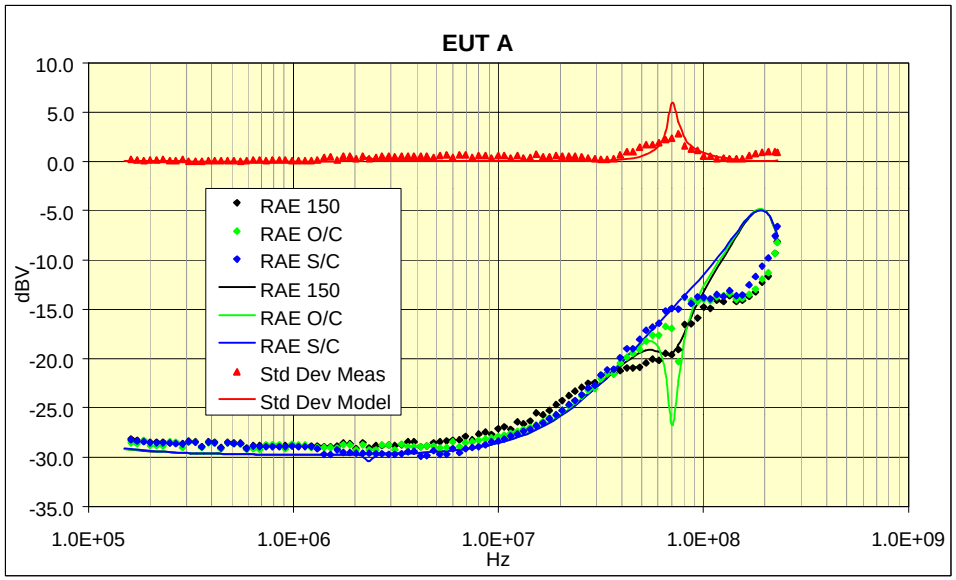


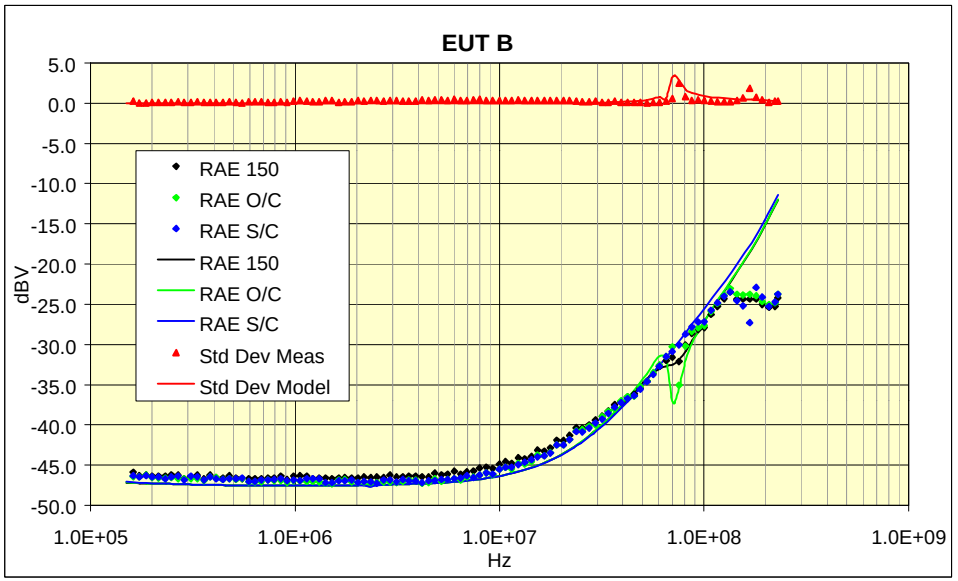


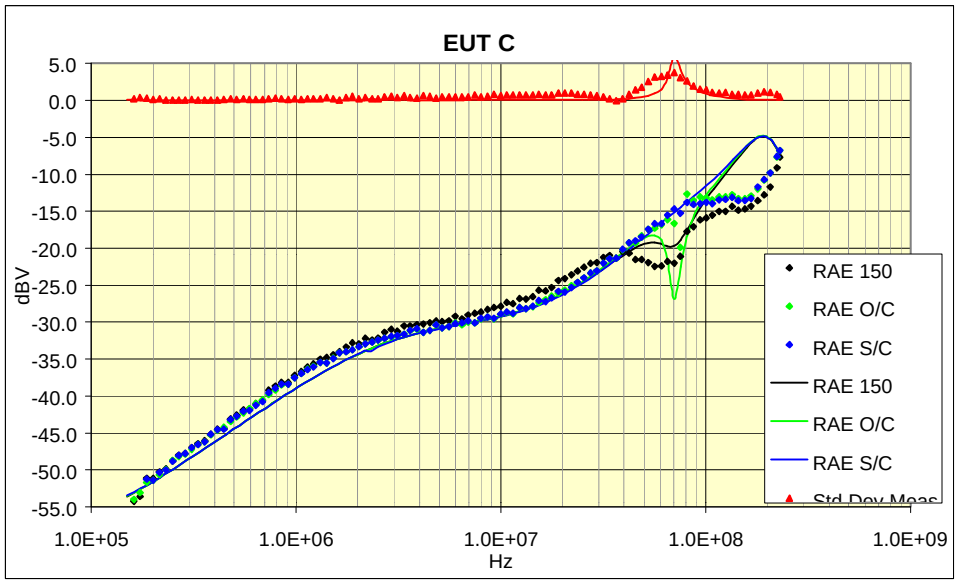


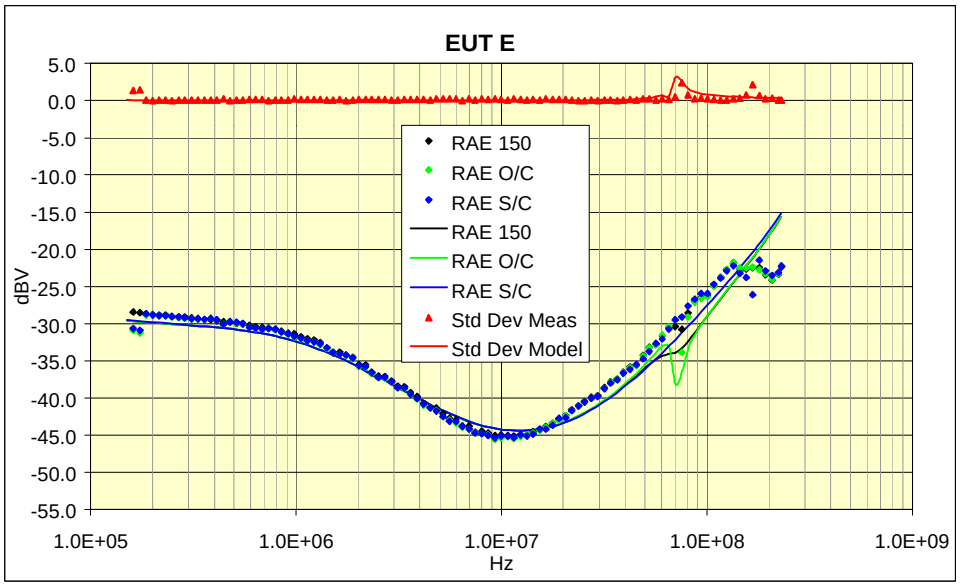
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

CDN, 0.1uH ground connection, cable 0.1m L 3cm h, Z_{AE} variations



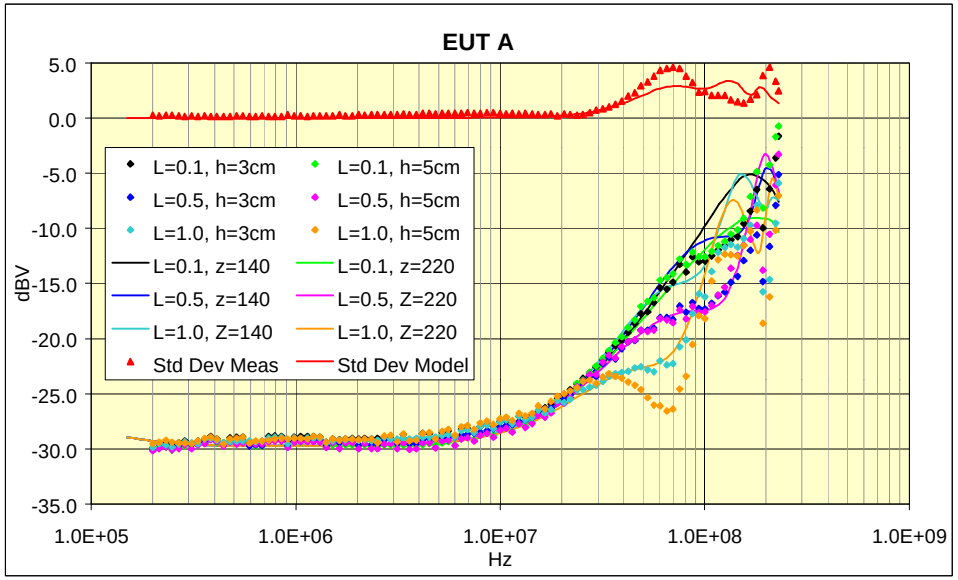


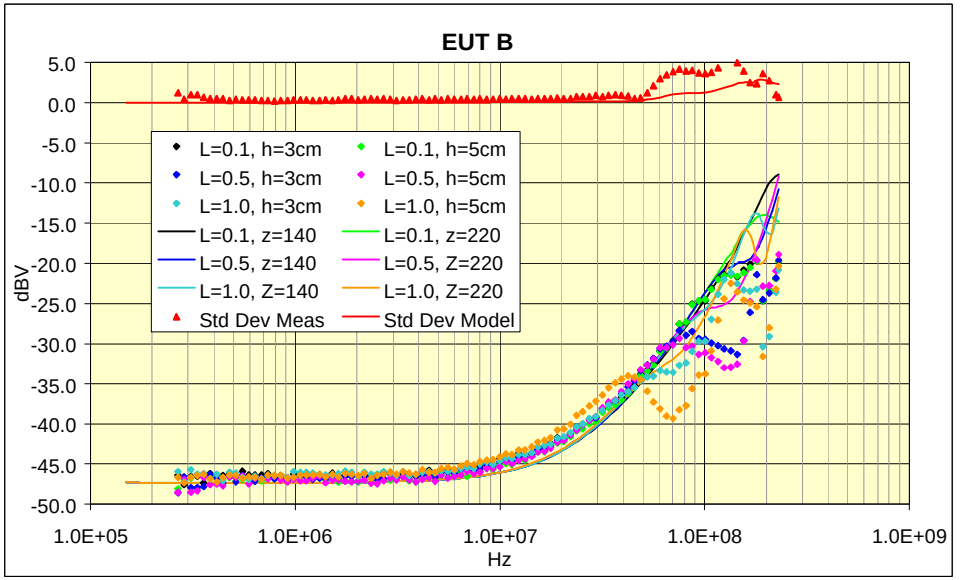


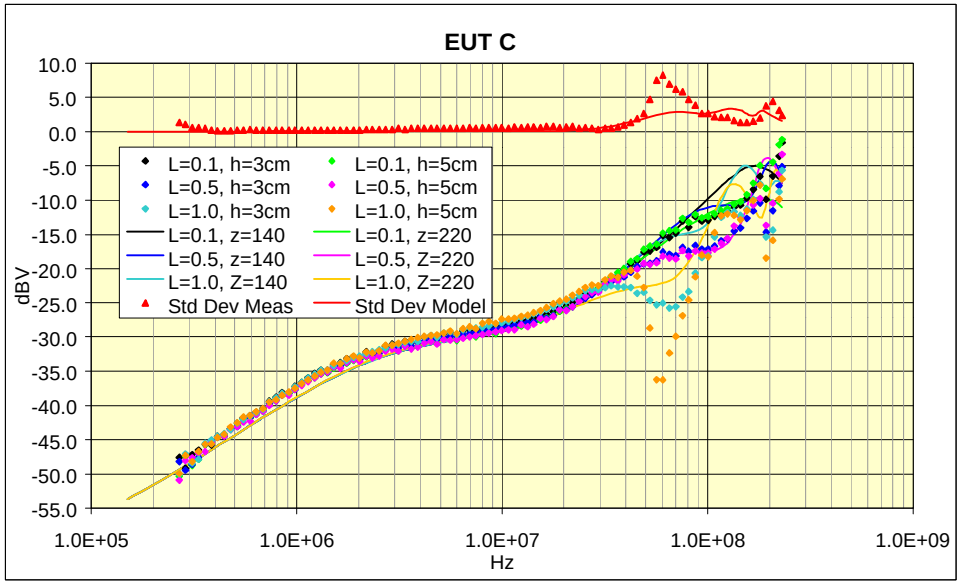


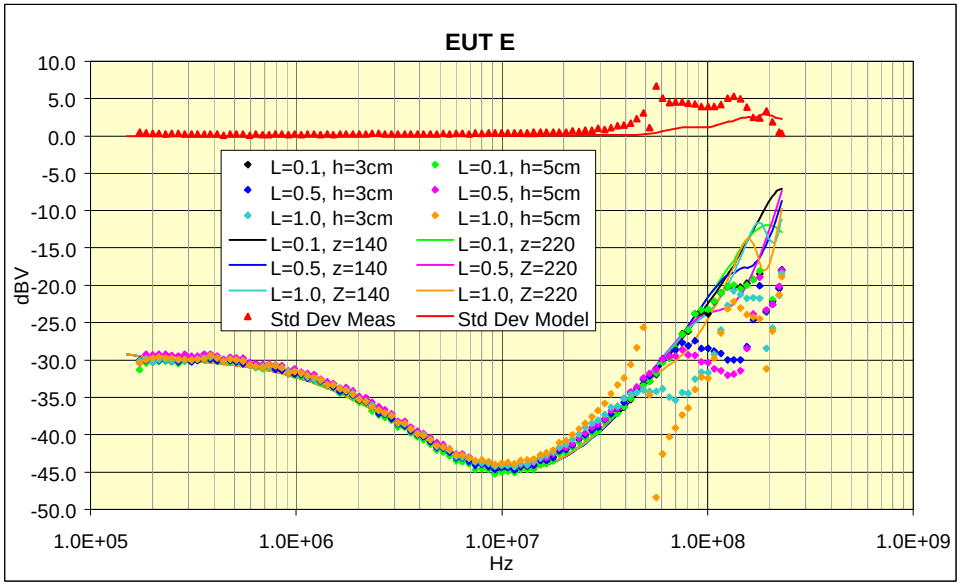
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

Current probe, effect of cable layout, Z_{AE} 150 ohms
Cable through middle, length to AE varied 0.1, 0.5, 1.0 m; H = 3cm and 5cm



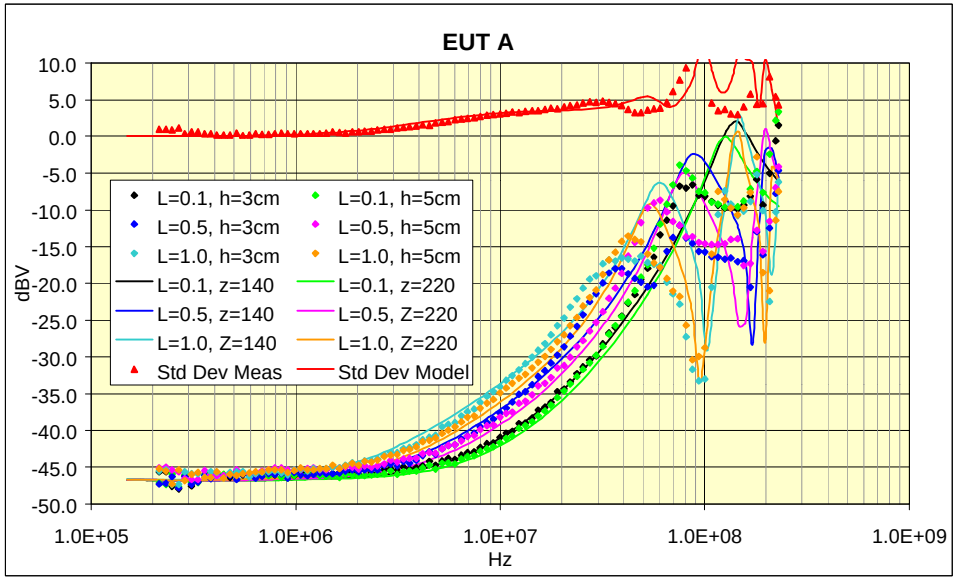


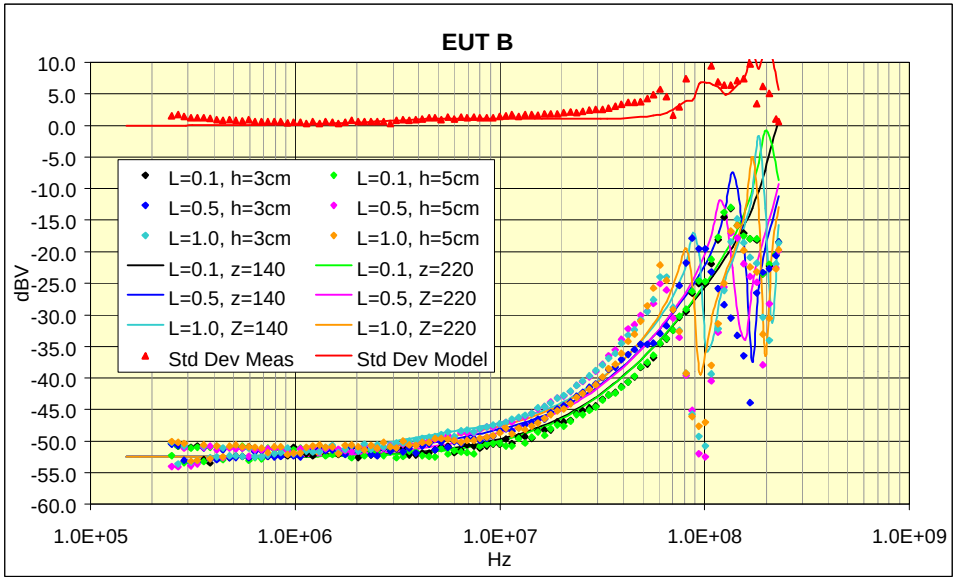


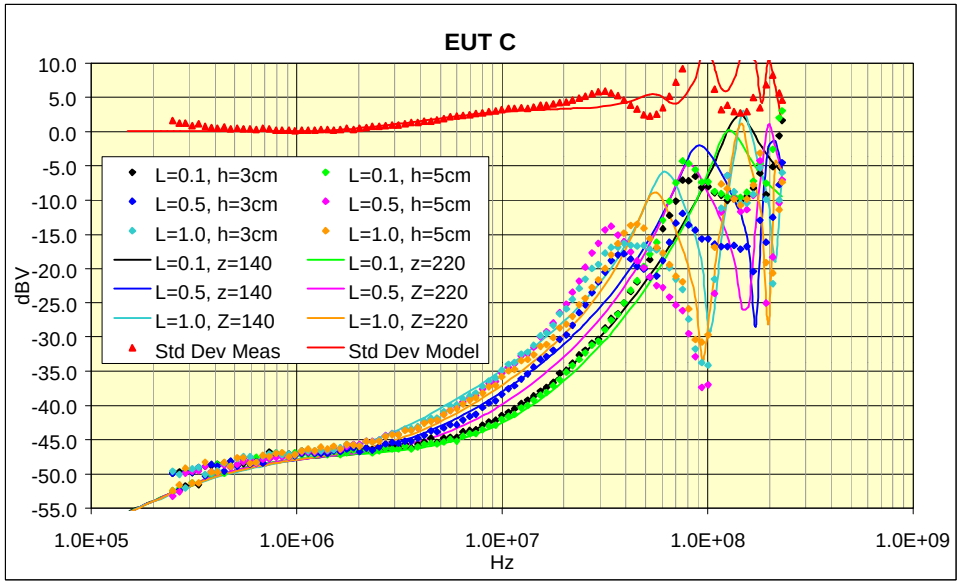


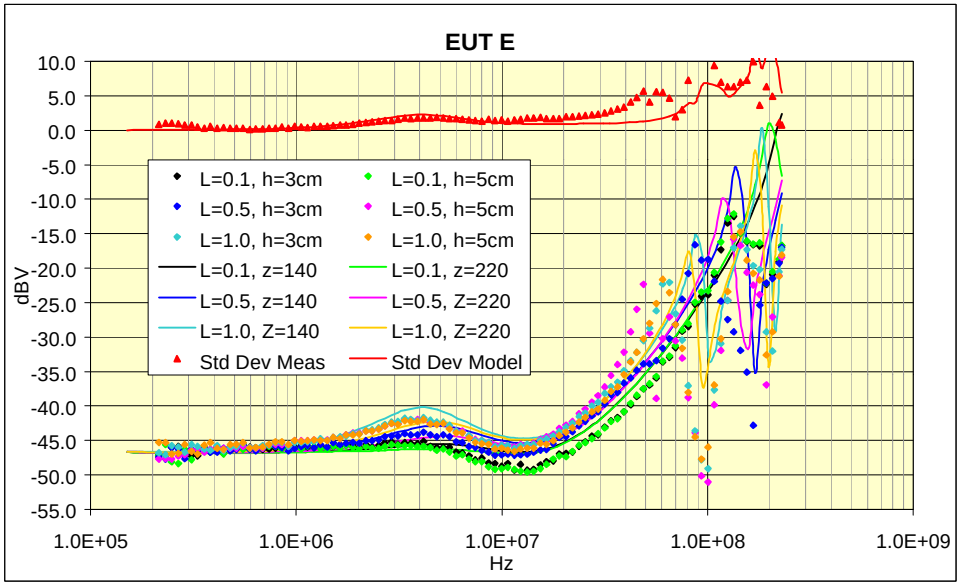
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

Current probe, effect of cable layout, Z_{AE} 2kohms
Cable through middle, length to AE varied 0.1, 0.5, 1.0 m; H = 3cm and 5cm



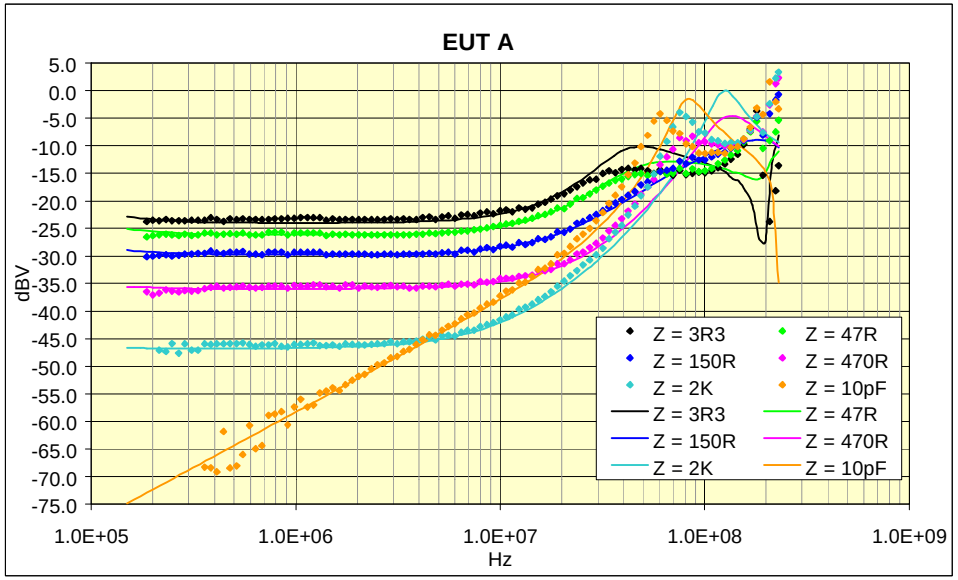


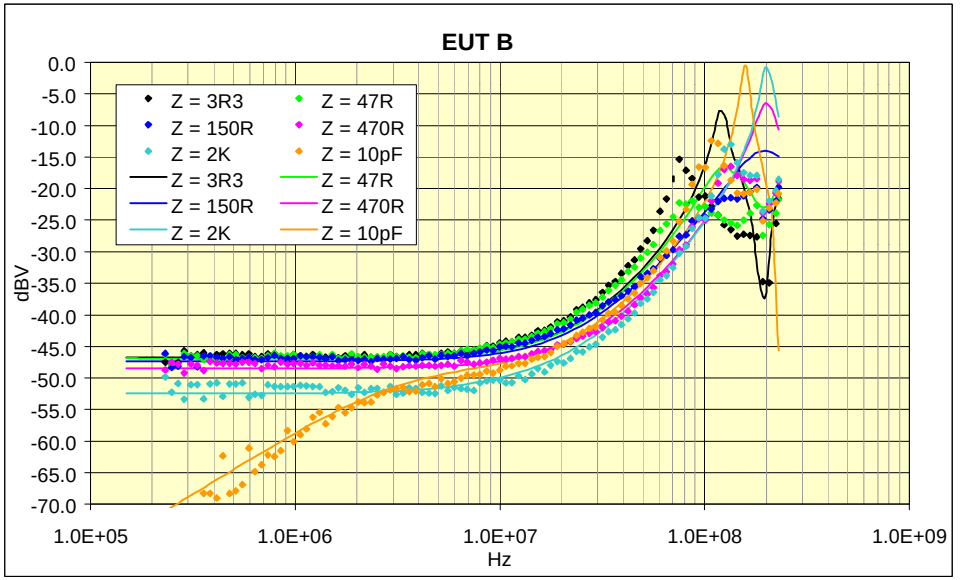


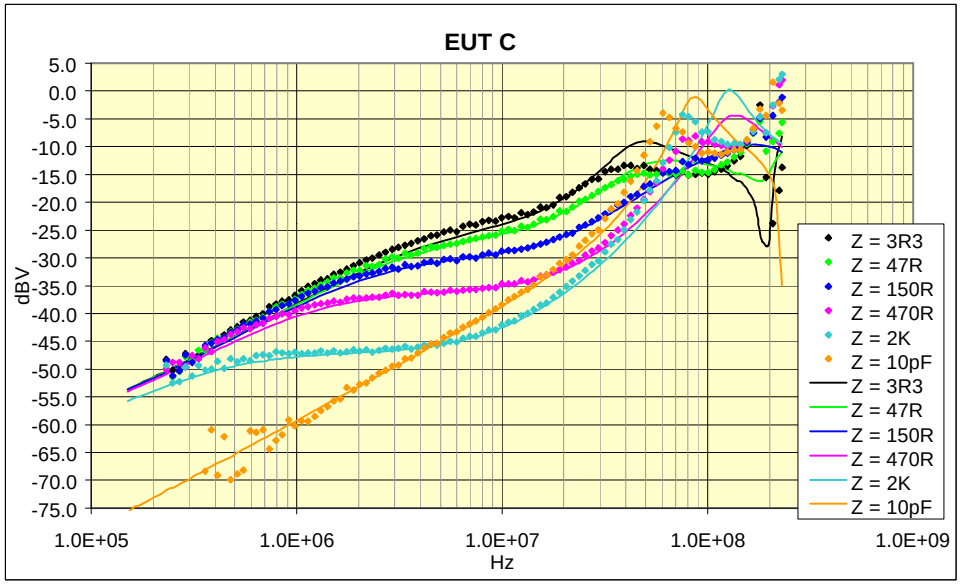


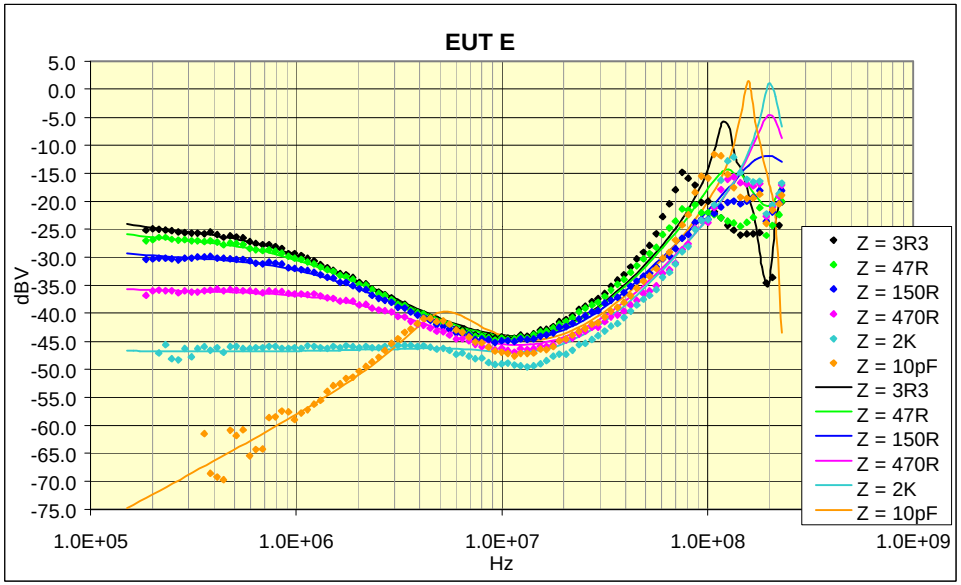
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

Current probe, effect of Z_{AE} with length 0.1m either side of clamp
Height 5cm, cable through middle



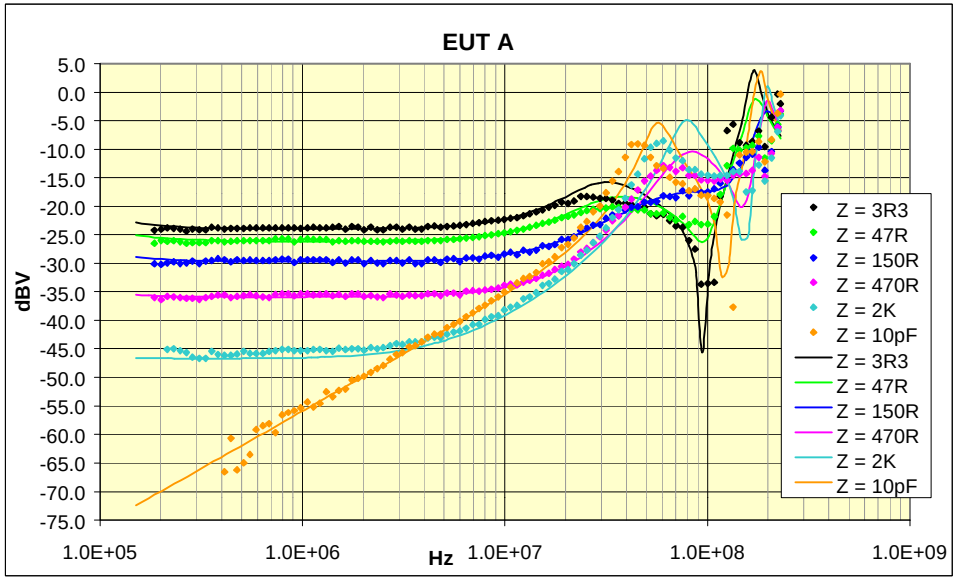


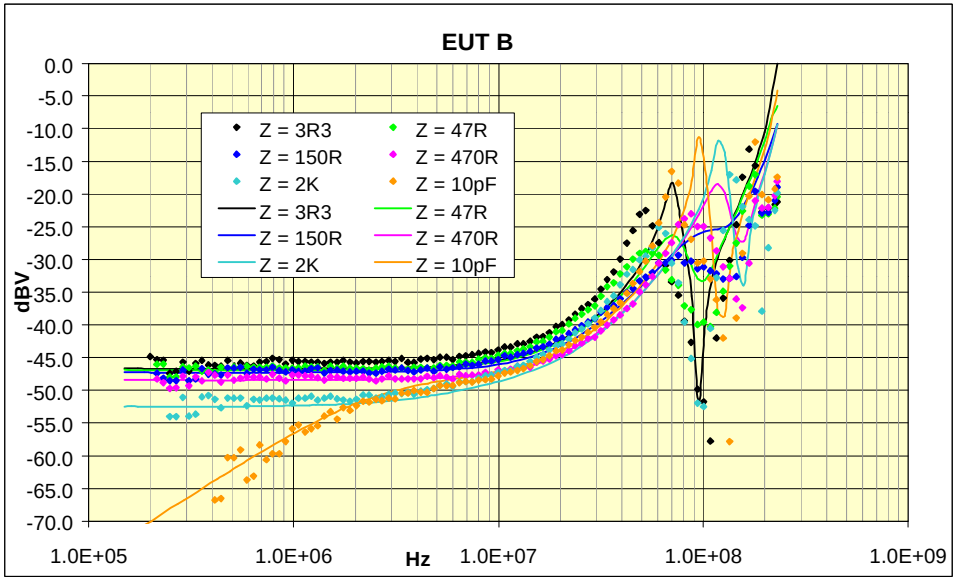


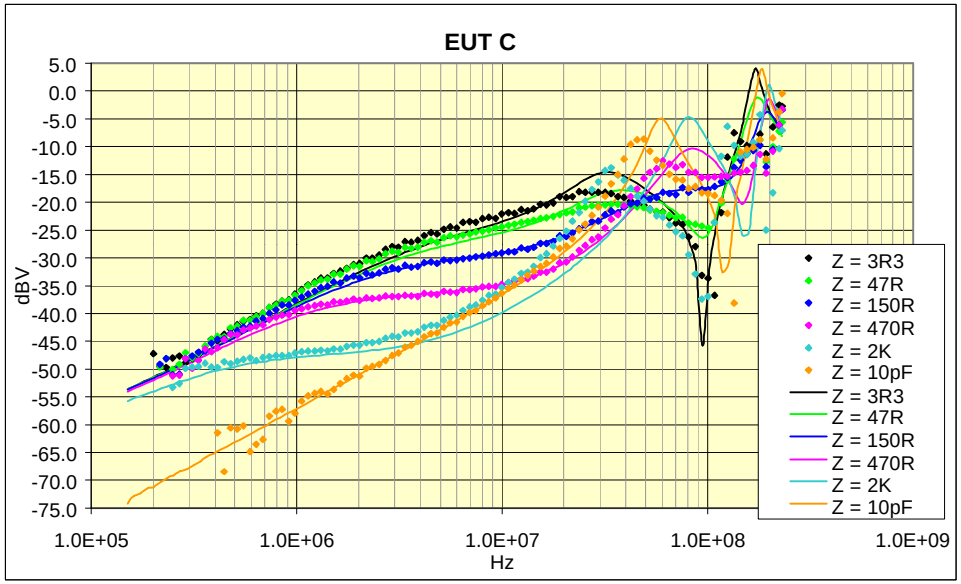


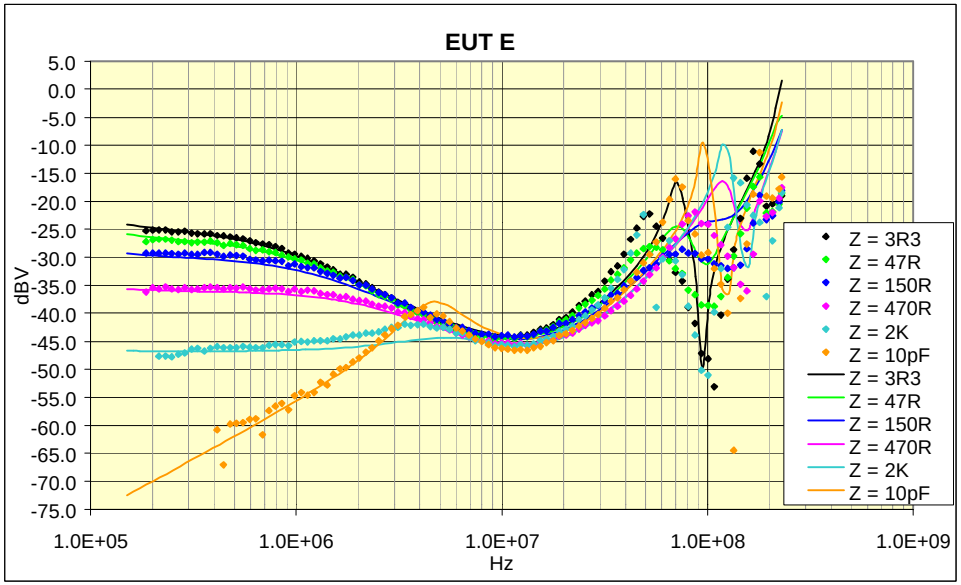
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

Current probe, effect of Z_{AE} with length 0.1m EUT side, 0.5m AE side of clamp
Height 5cm, cable through middle



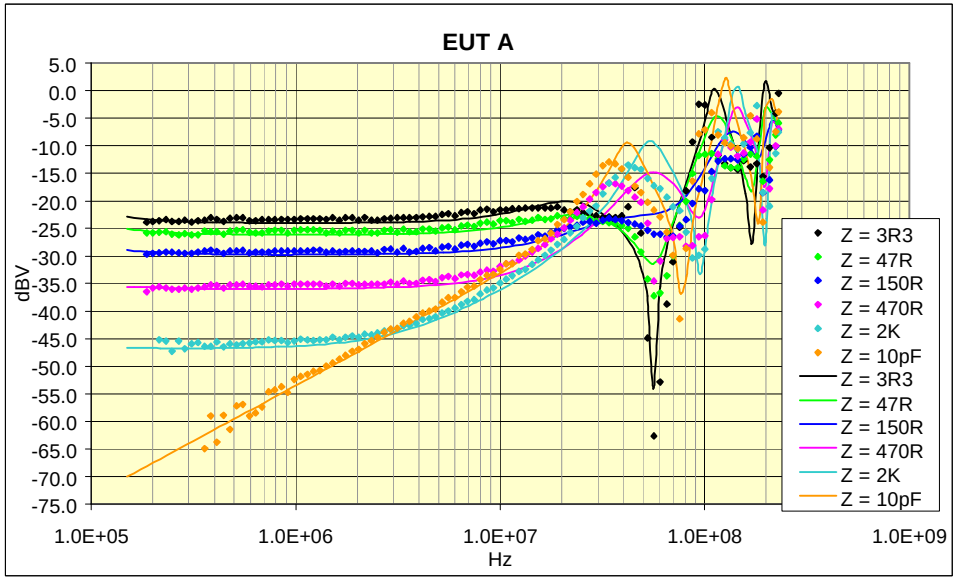


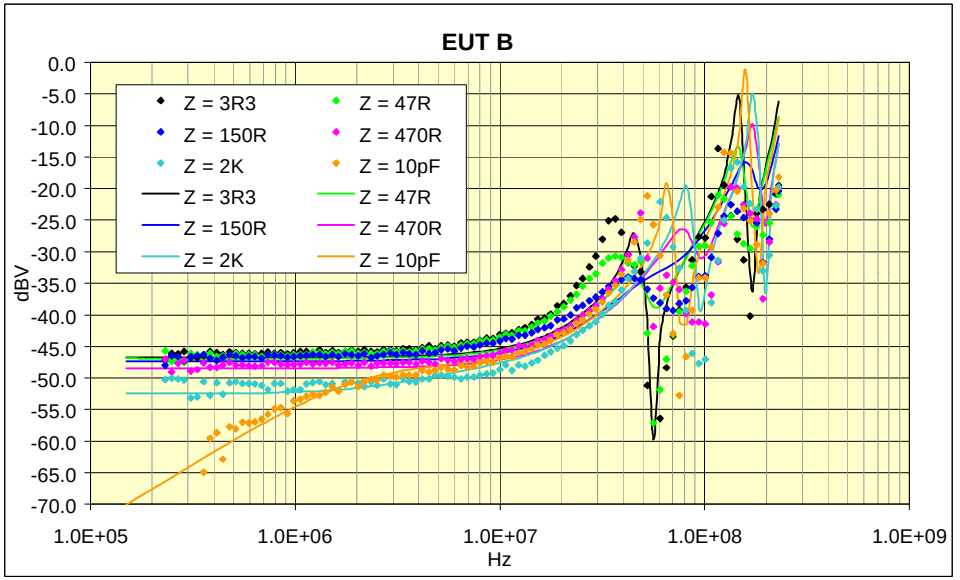


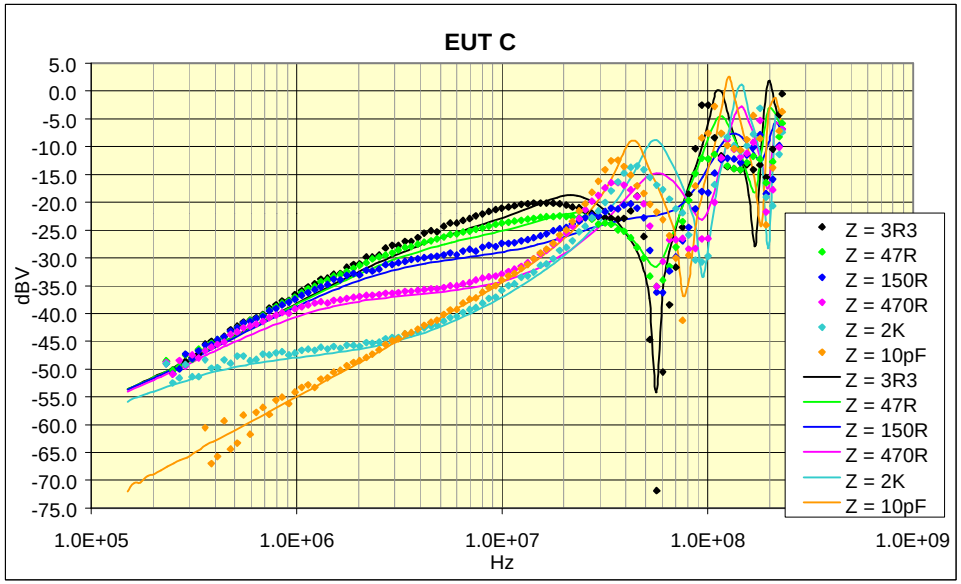


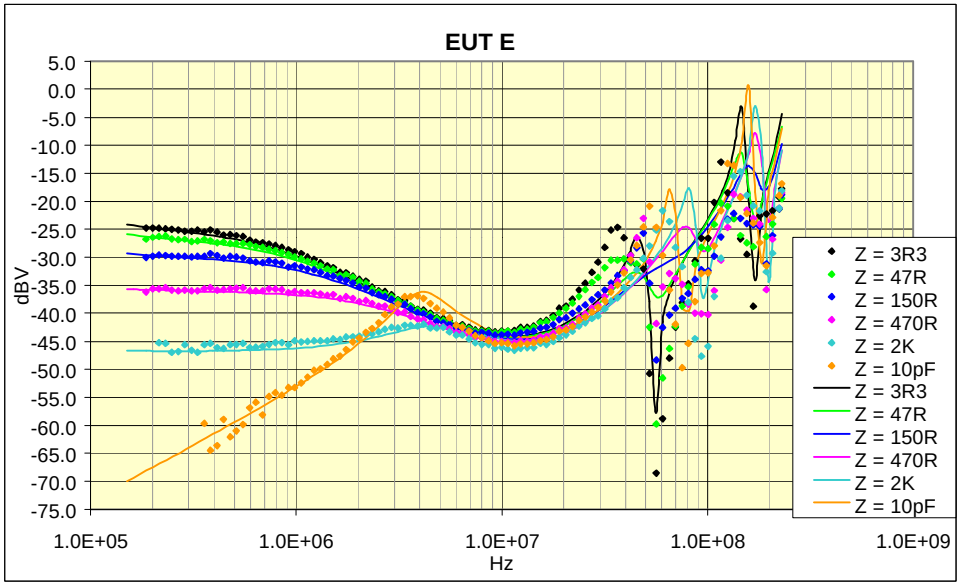
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

Current probe, effect of Z_{AE} with length 0.1m EUT side, 1m AE side of clamp
Height 5cm, cable through middle



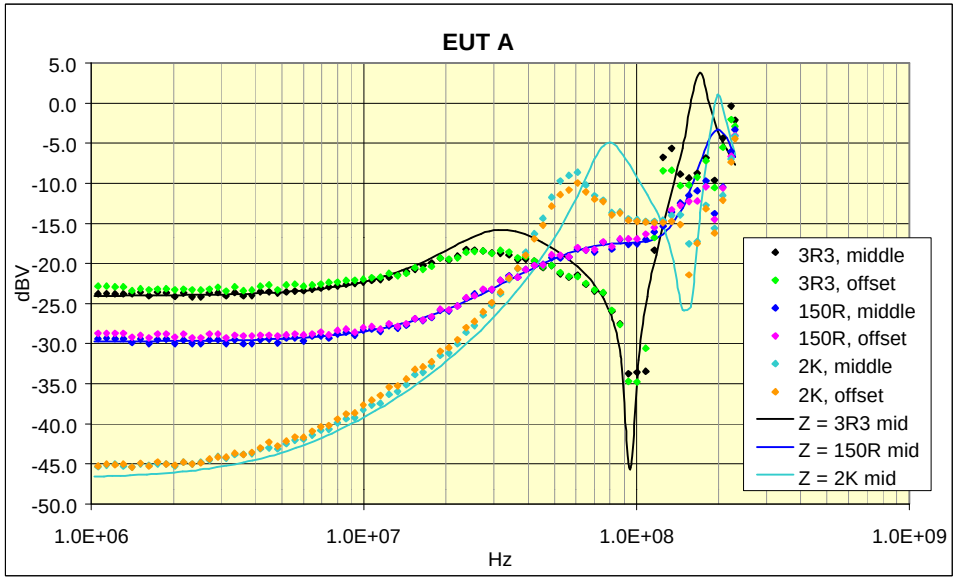


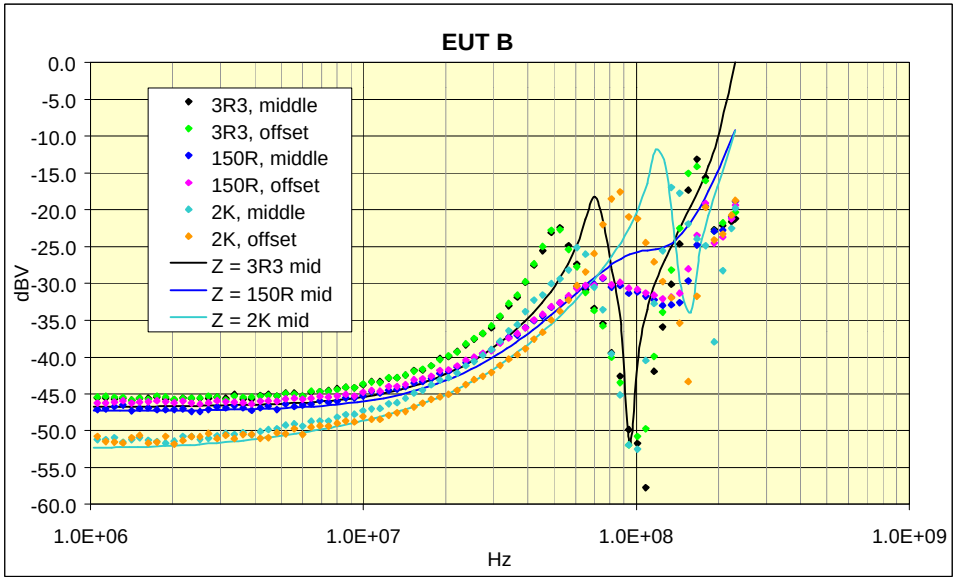


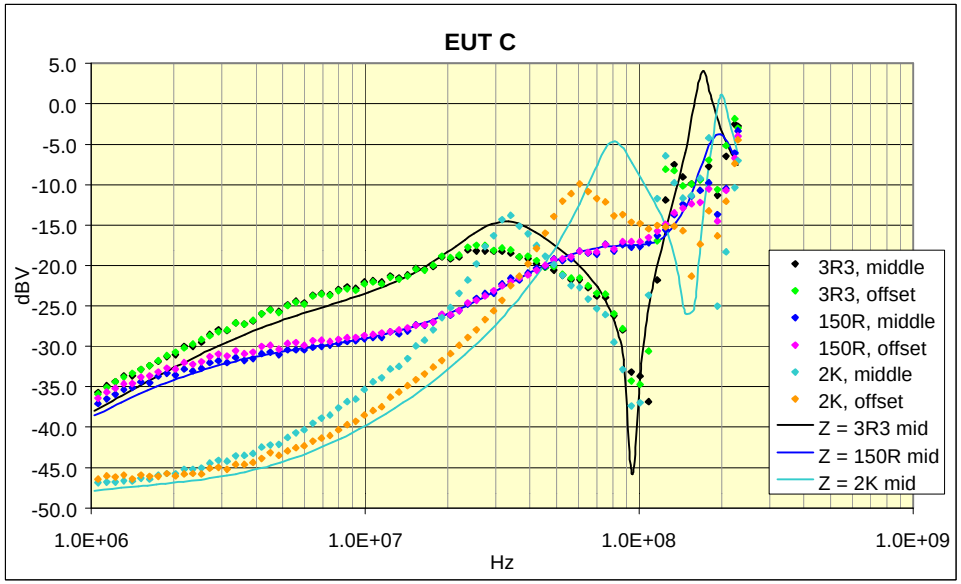


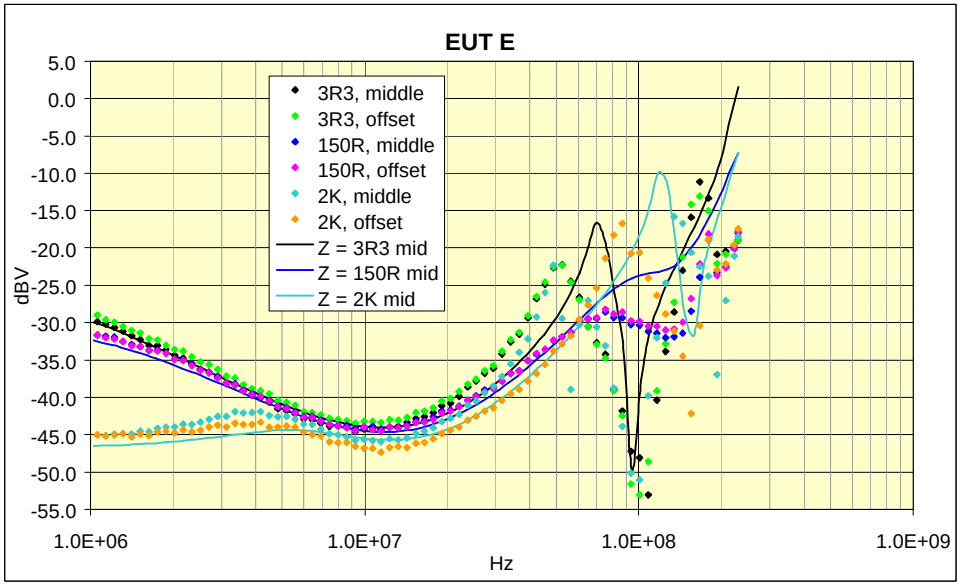
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

Current probe: effect of clamp offset for different Z_{AE} with length 0.1m EUT side, 0.5m AE side of clamp
Height 5cm, cable through middle versus cable offset



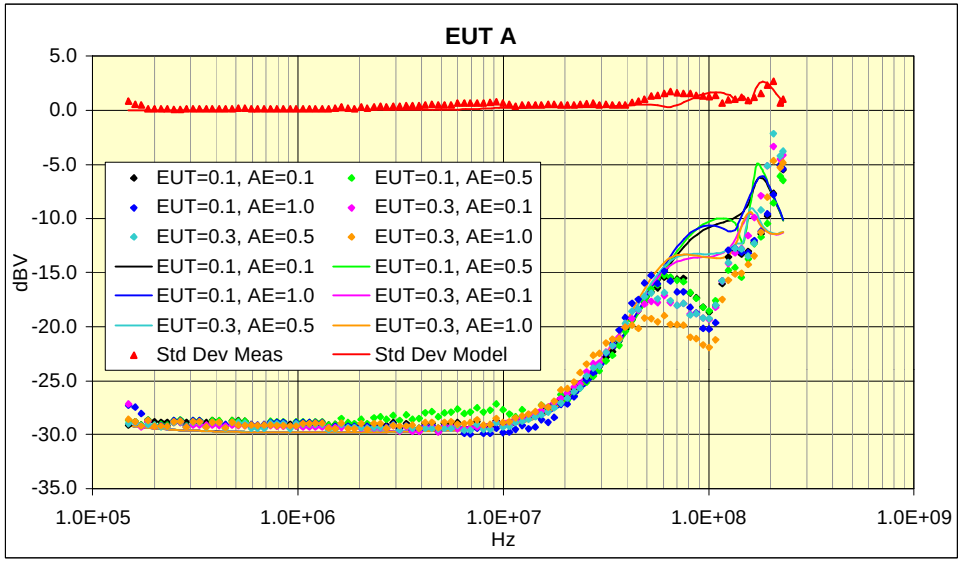


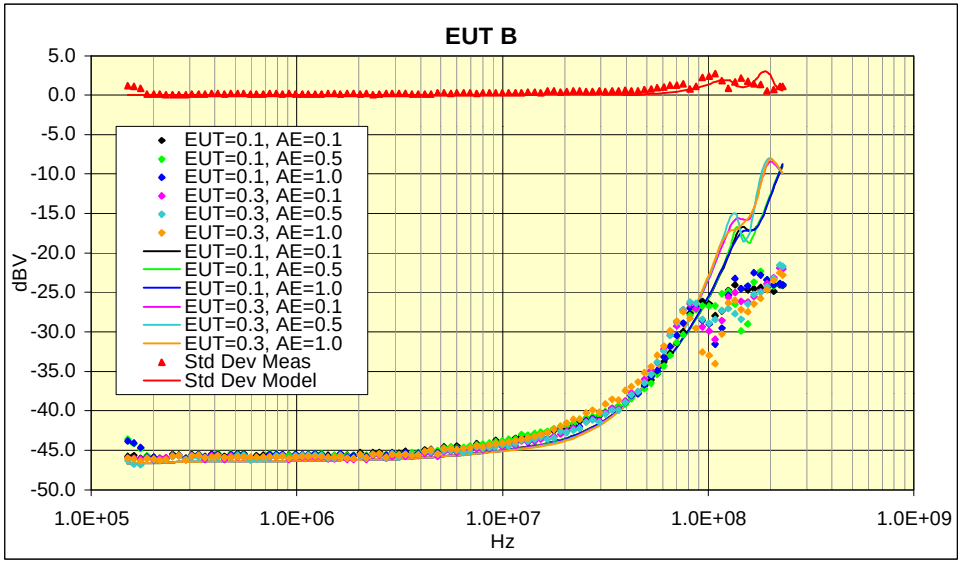


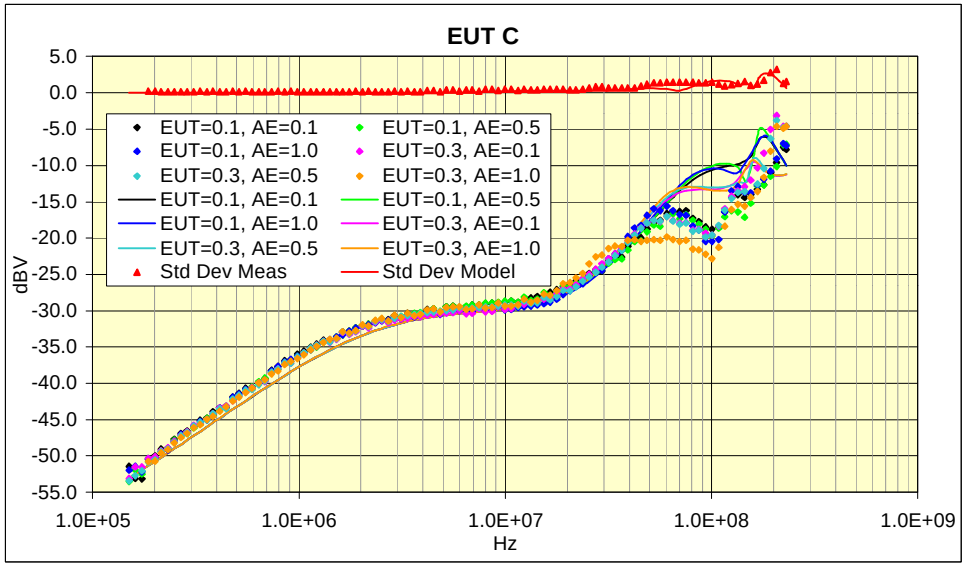


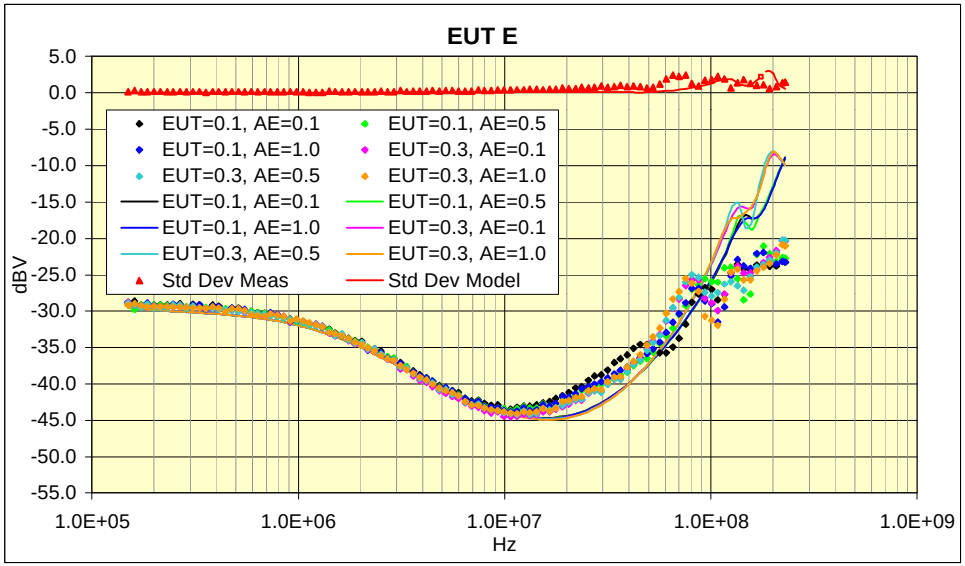
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

EM-Clamp, effect of cable layout, 150 ohm Z_{AE}
Wire height 5cm, cable on AE side varied 0.1m/0.5m/1.0m, on EUT side 0.1m/0.3m



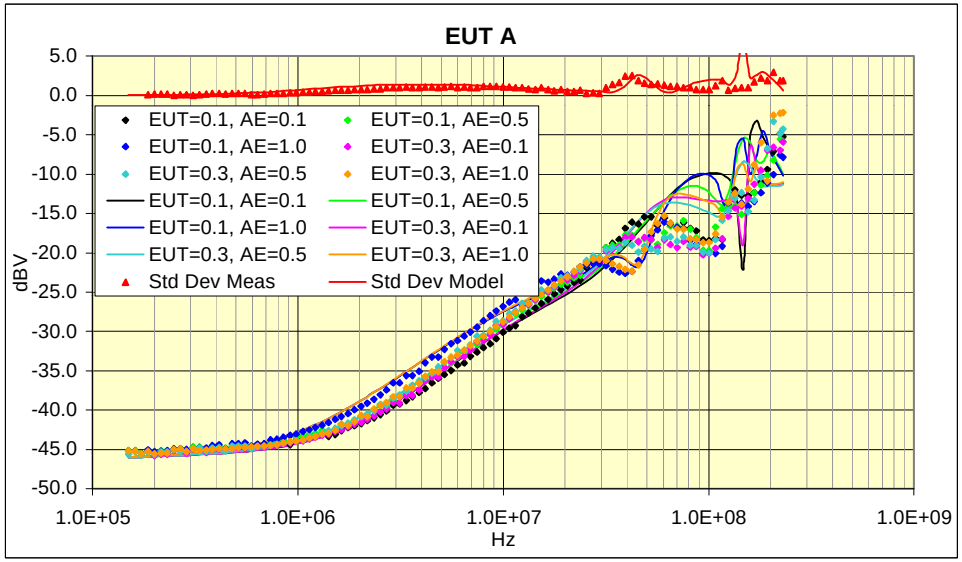


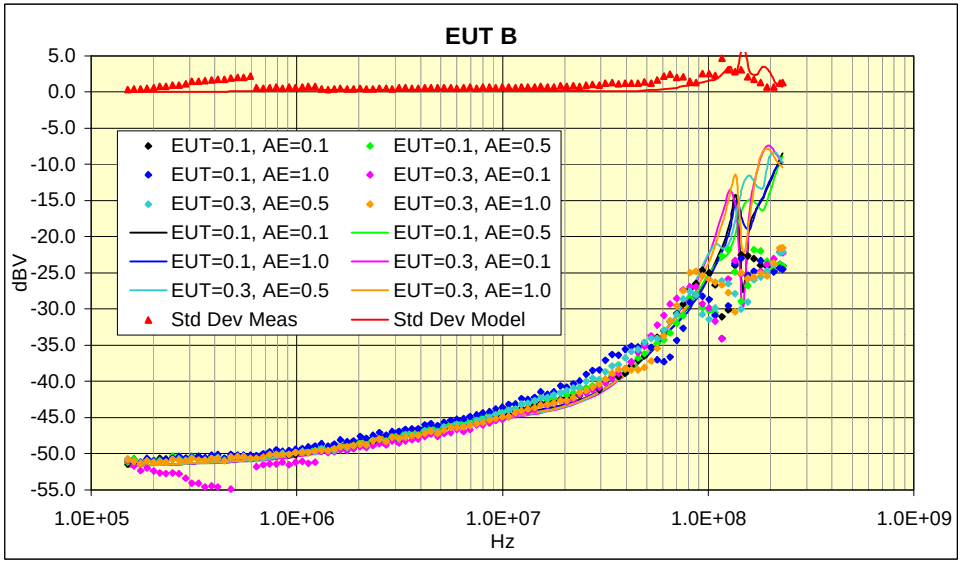


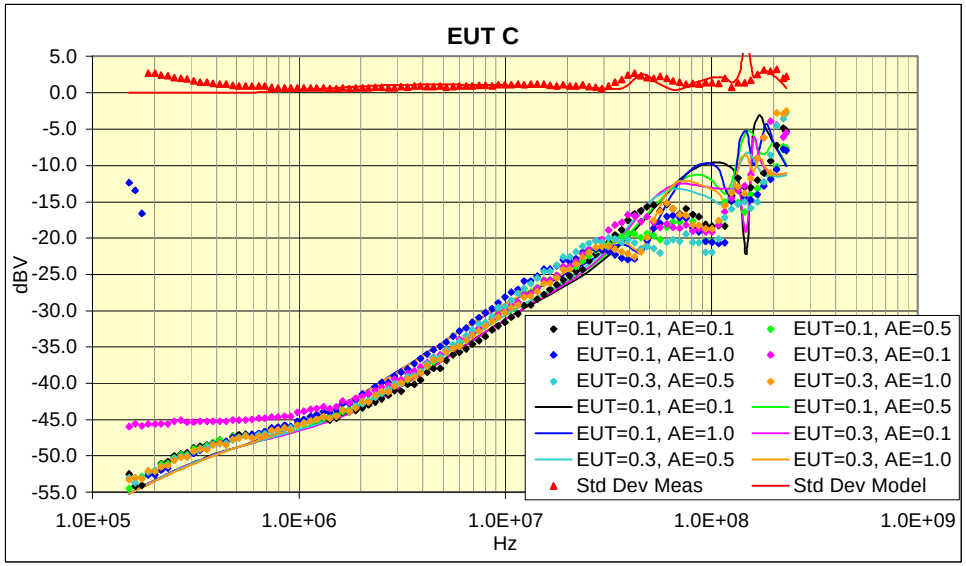


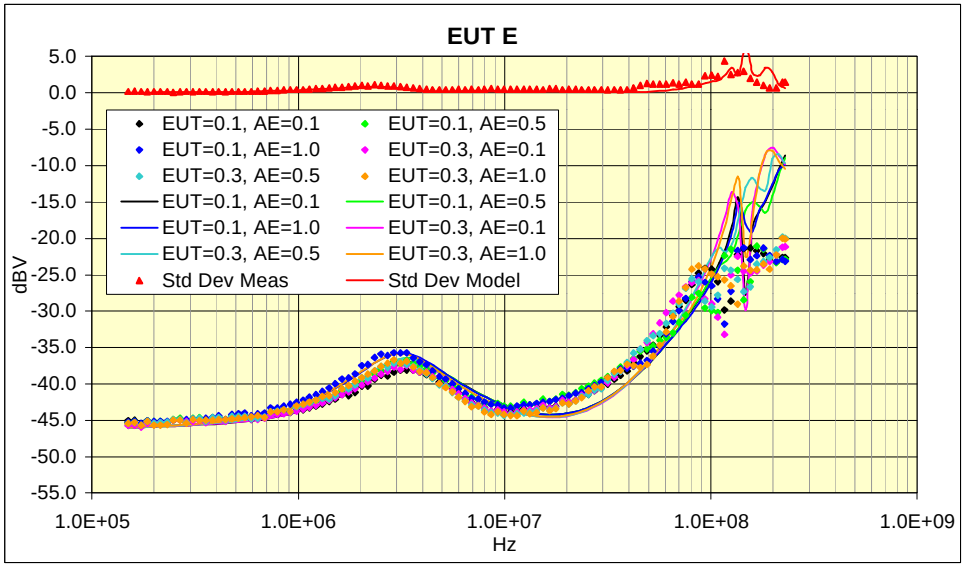
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

EM-Clamp, effect of cable layout, 2k ohm Z_{AE}
Wire height 5cm, cable on AE side varied 0.1m/0.5m/1.0m, on EUT side 0.1m/0.3m



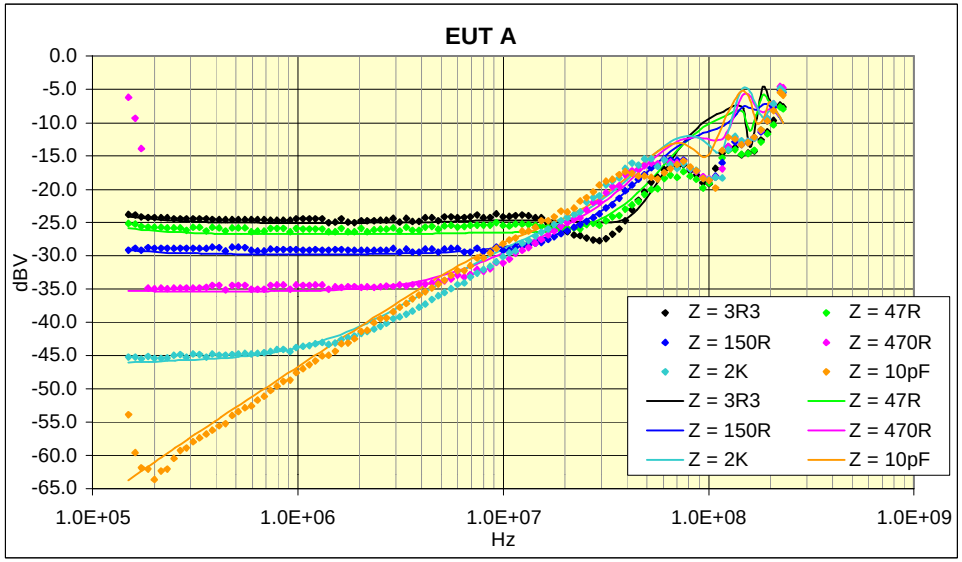


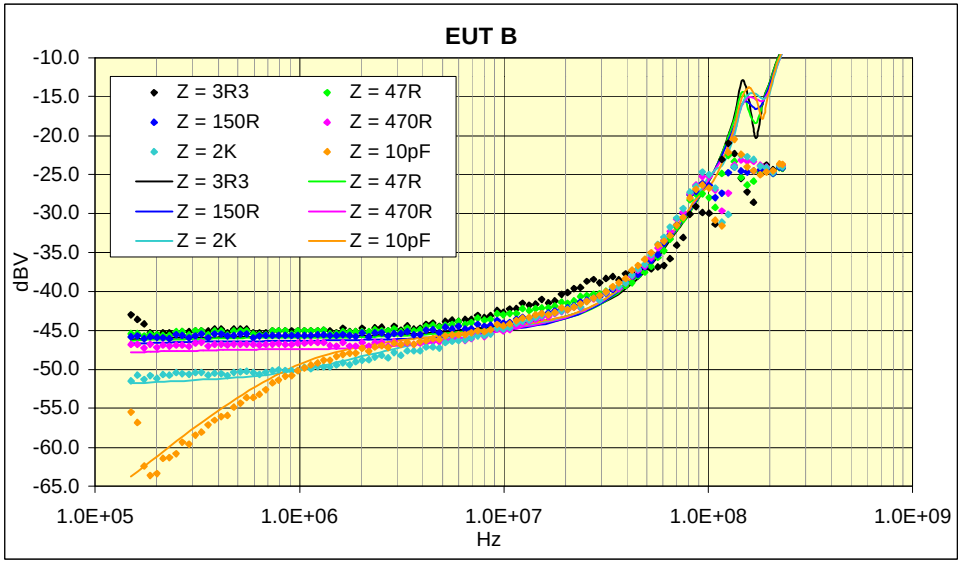


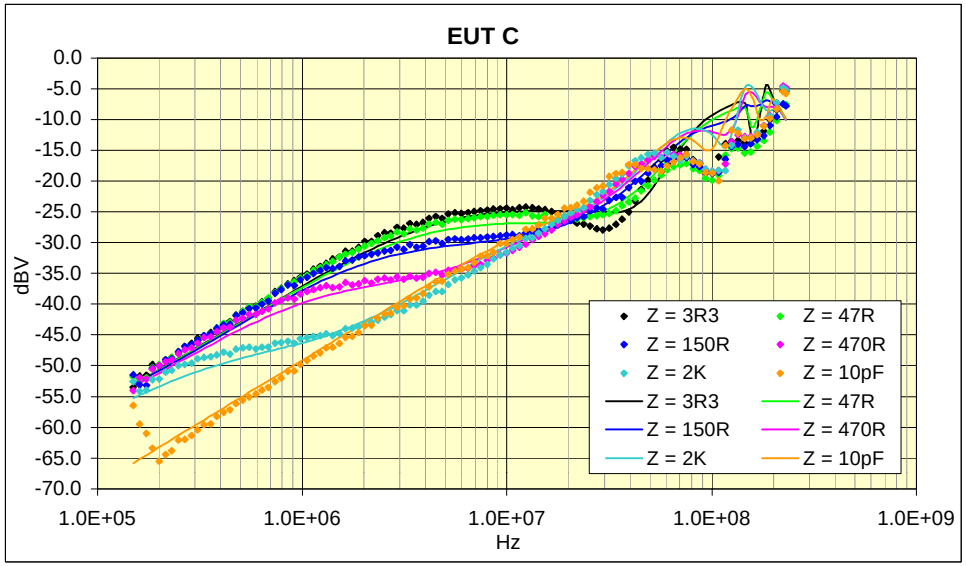


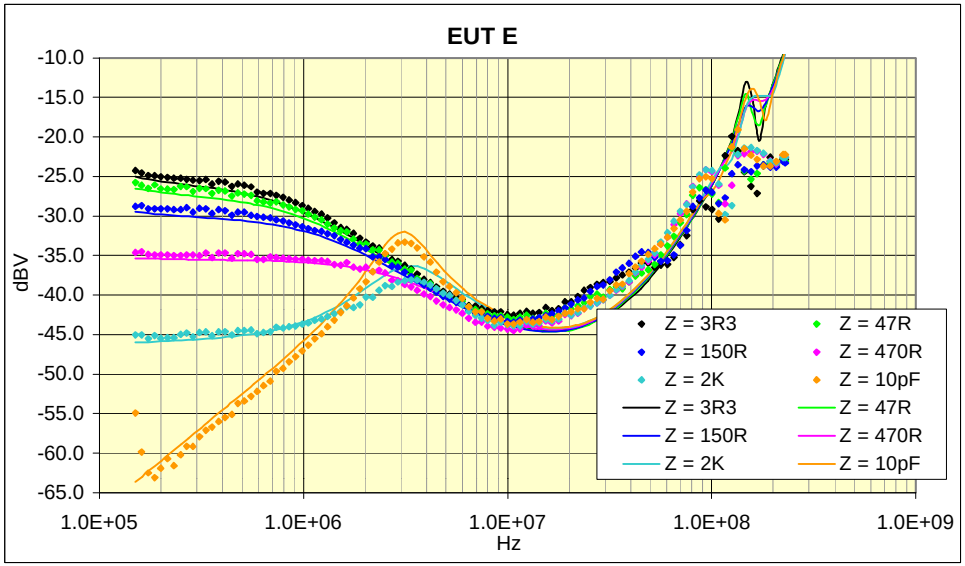
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

EM-clamp: effect of Z_{AE}, cable on AE side 0.1m, on EUT side 0.1m
Wire height 5cm



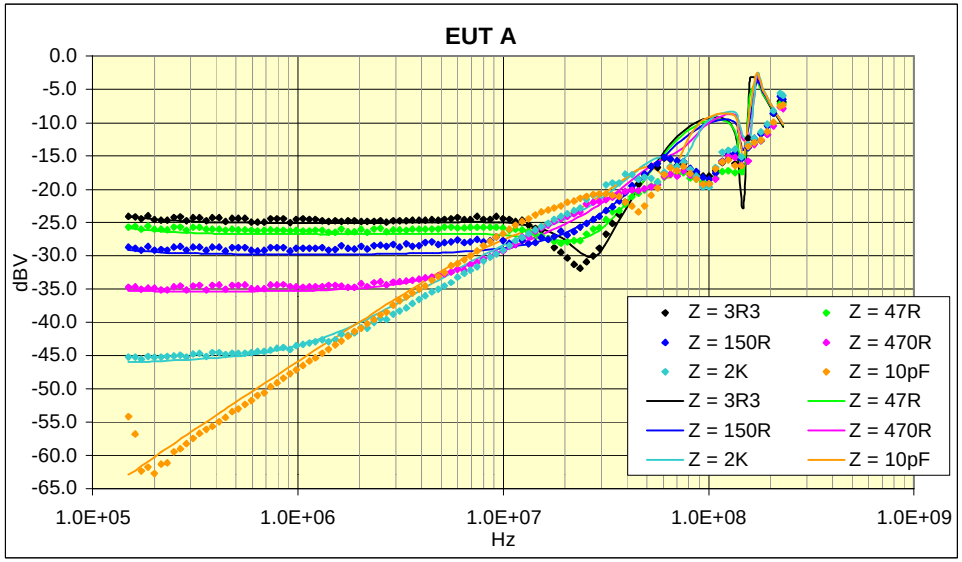


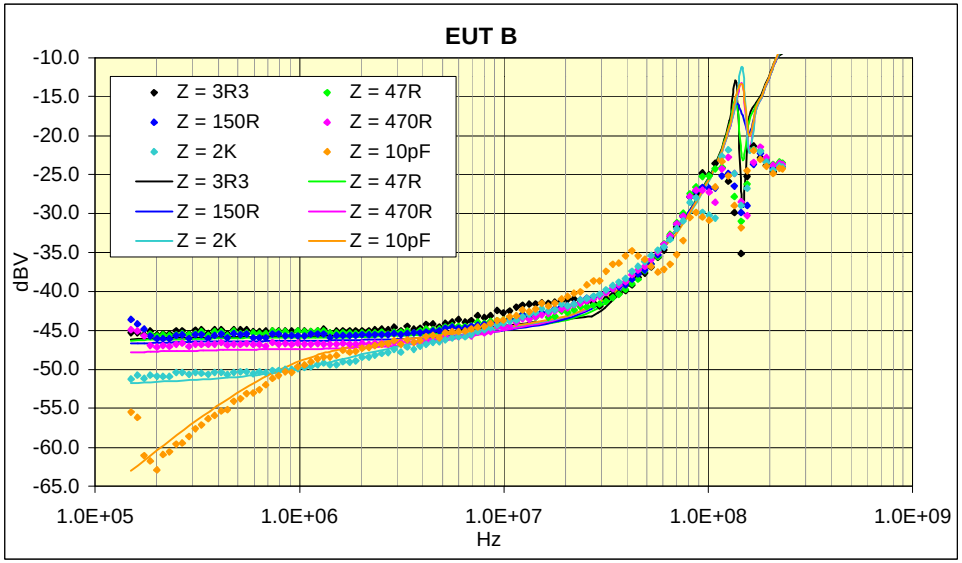


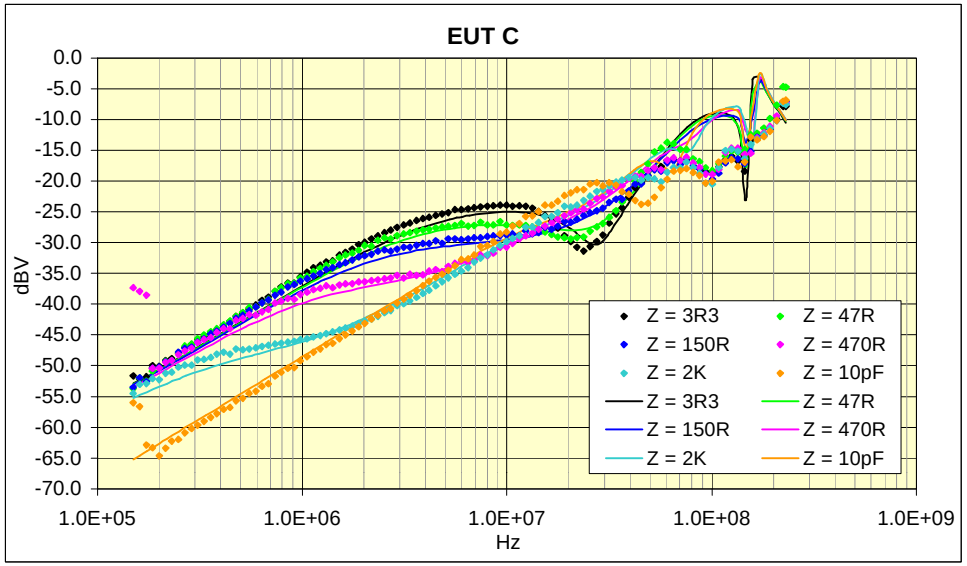


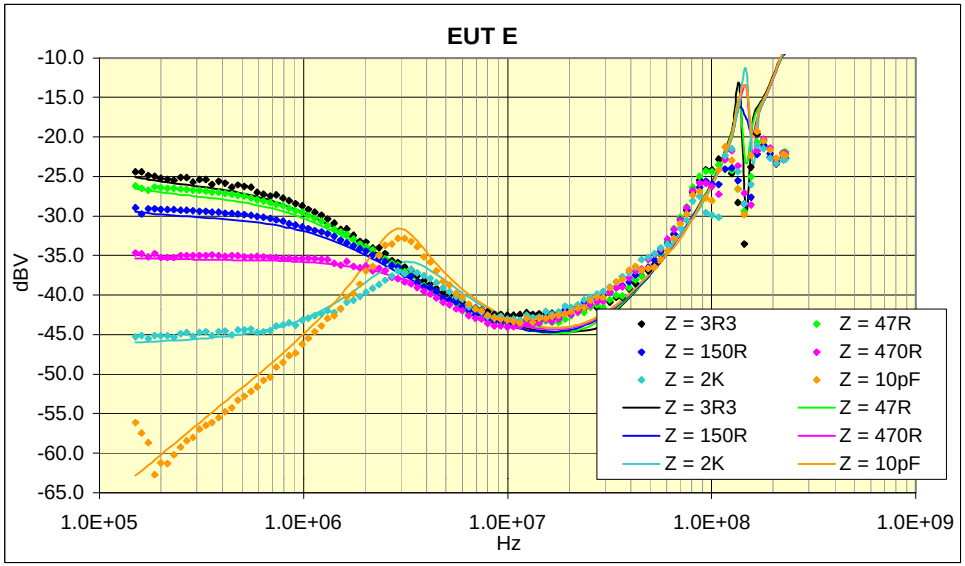
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

EM-clamp: effect of Z_{AE}, cable on AE side 0.5m, on EUT side 0.1m
Wire height 5cm



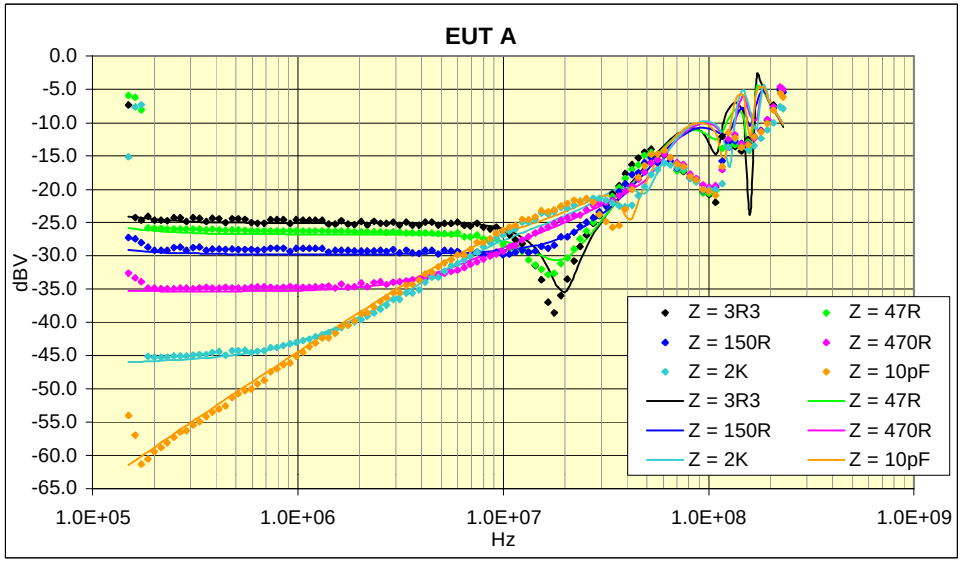


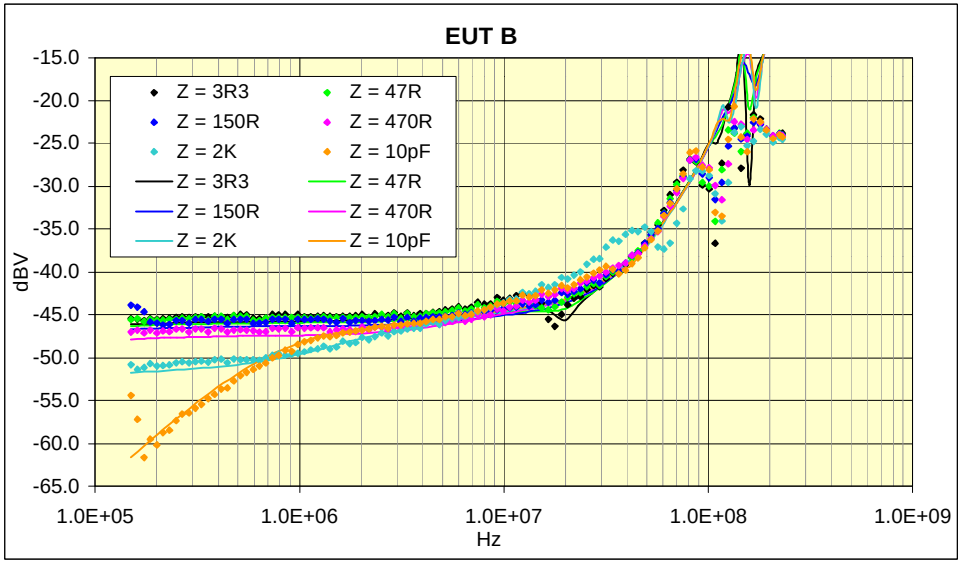


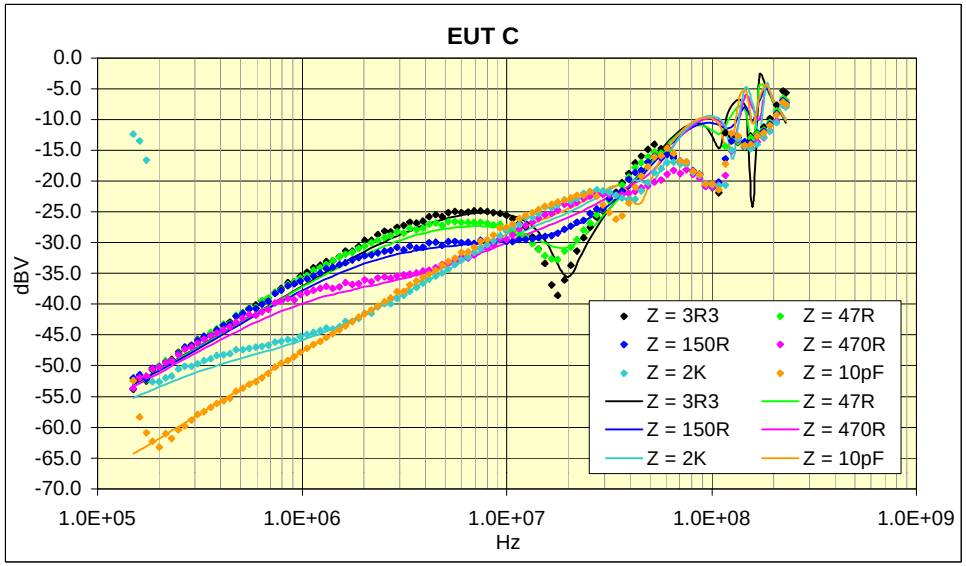


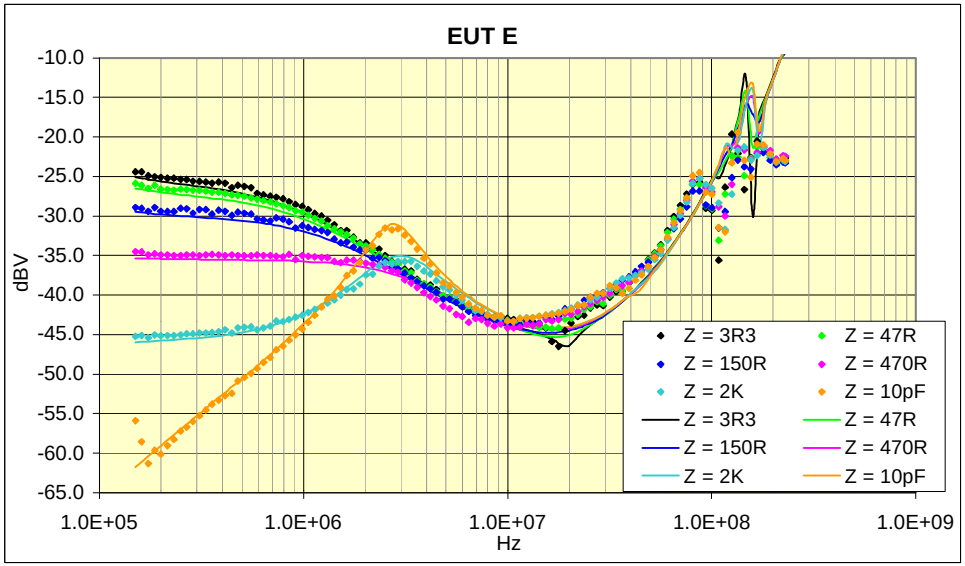
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

EM-clamp: effect of Z_{AE}, cable on AE side 1m, on EUT side 0.1m
Wire height 5cm



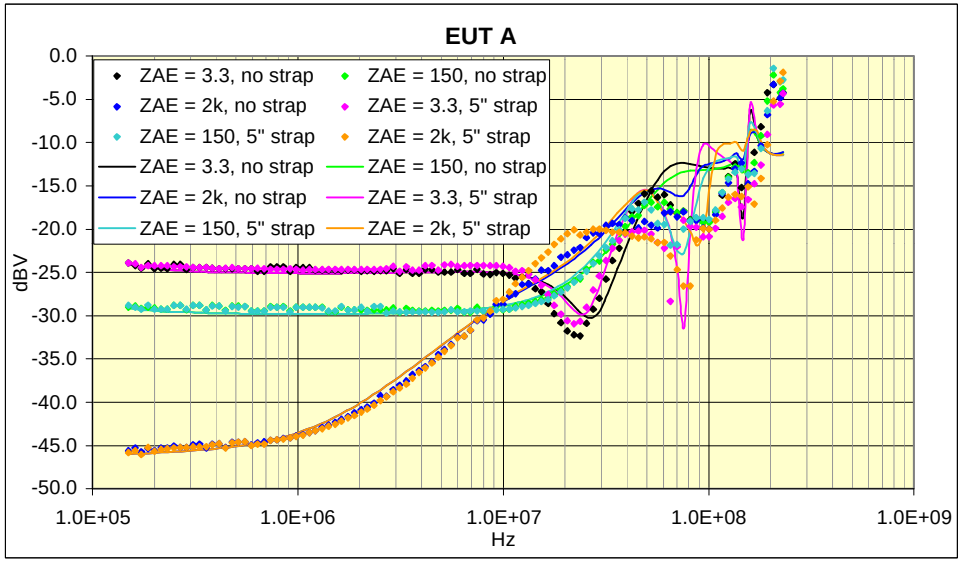


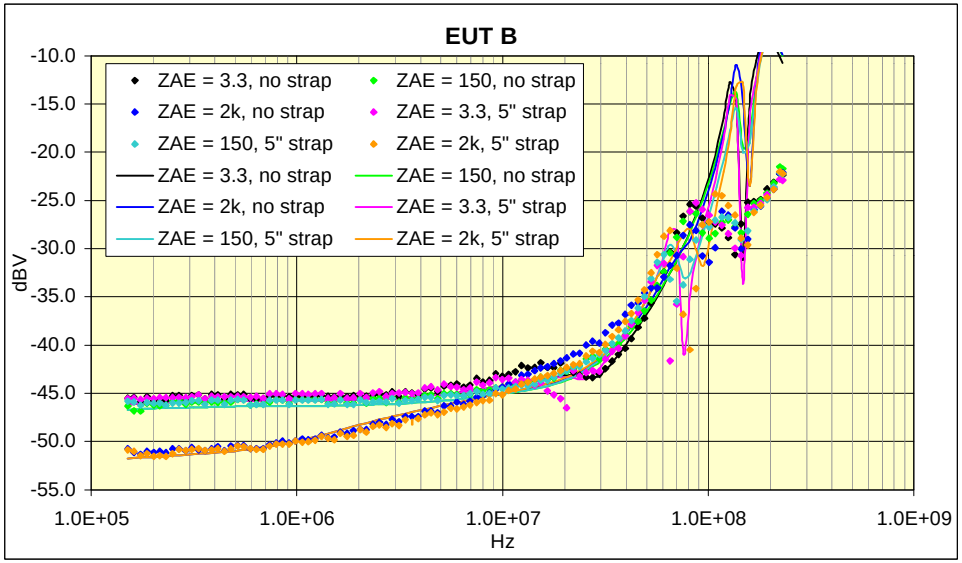


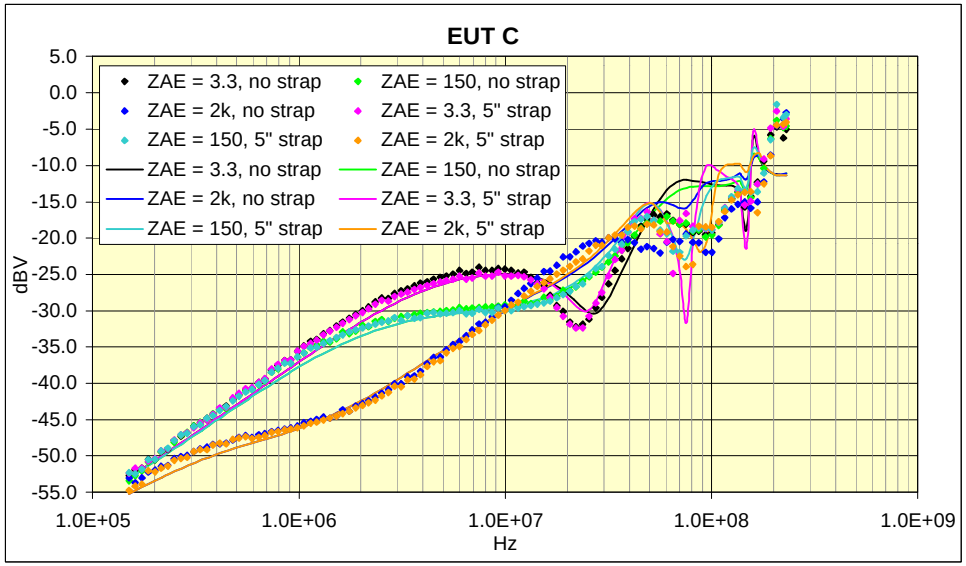


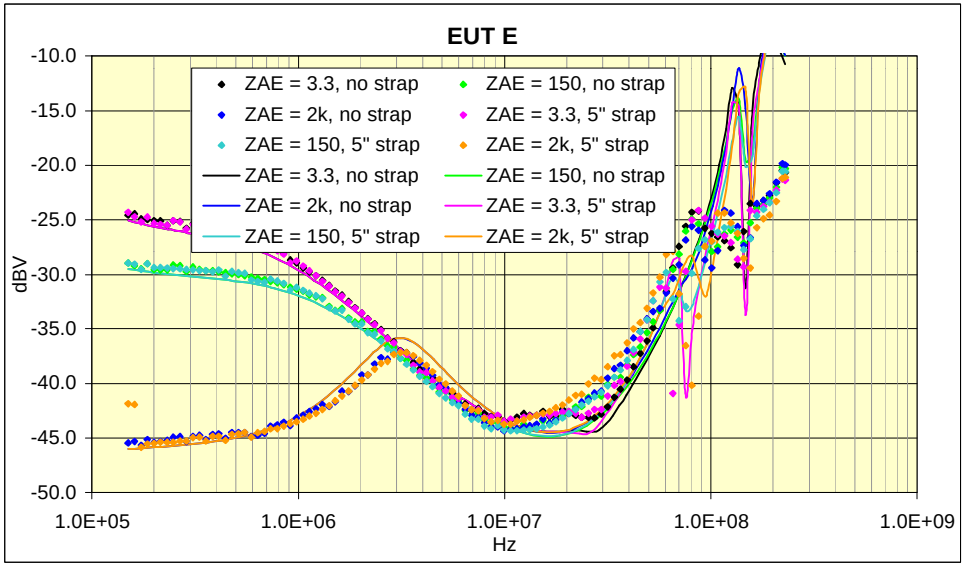
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

EM-clamp: grounding varied between no strap and 5" strap
Situation: 0.5m AE side, 0.3m EUT side, wire height 5cm, three impedance conditions







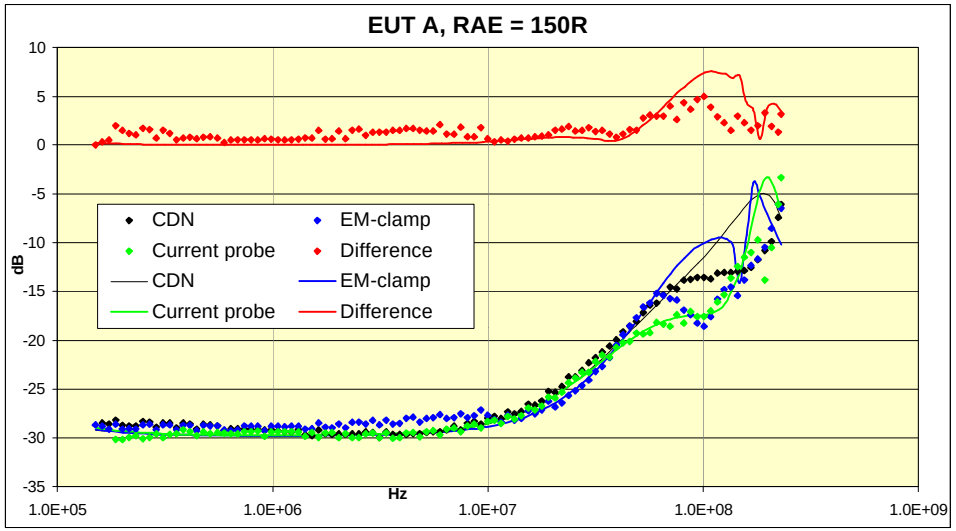


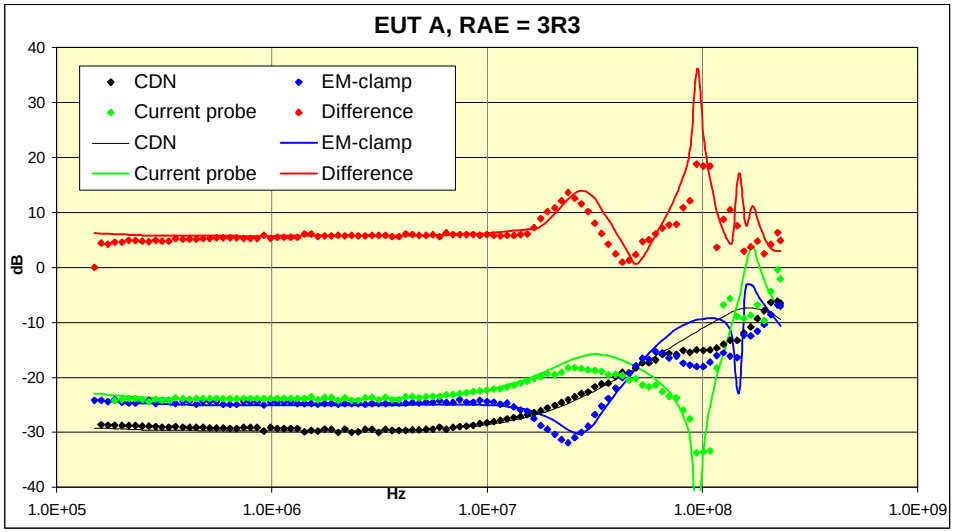
EUT A: 3 ohms resistive, EUT B: 2K ohms resistive, EUT C: 200pF capacitive, EUT E: 40µH inductive; ◆ or ▲ symbols show measurement, continuous line shows model

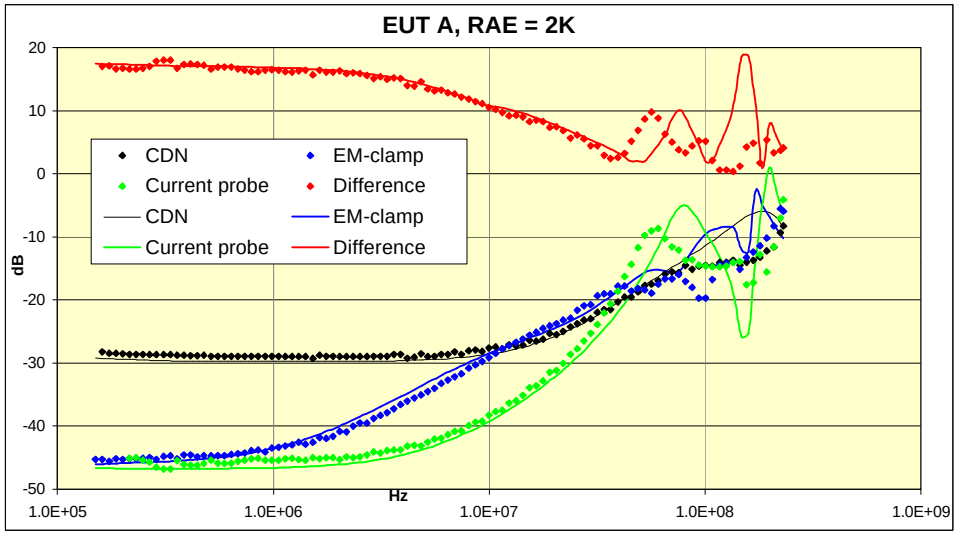
Comparison of three transducers, EUT A

Z_{AE} 150R, 3R3, 2K, short (0.1m) EUT cable, medium (0.5m) AE cable, 50mm height, good grounding/cable central

NB the curves marked “difference” are the maximum differences (absolute value) between all three transducers.







Comparison of three transducers, EUT B

Z_{AE} 150R, 3R3, 2K, short (0.1m) EUT cable, medium (0.5m) AE cable, 50mm height, good grounding/cable central

NB the curves marked “difference” are the maximum differences (absolute value) between all three transducers.