Calculated versus Direct Measurements for Bulk Current Injection Immunity Tests

802.3bp RTPGE

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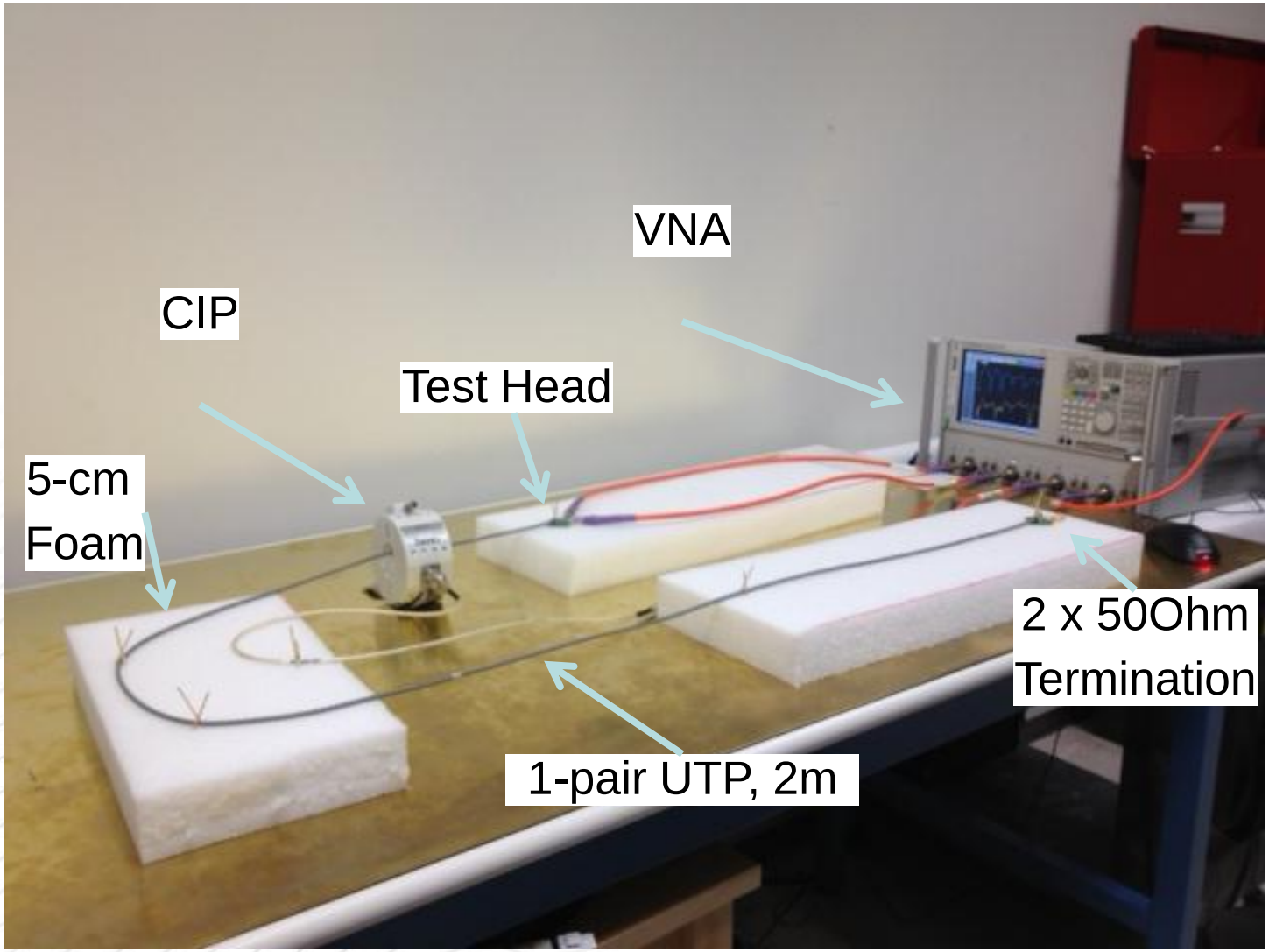
Overview

- Objective
  - Investigate the correlation between calculated and direct BCI measurements

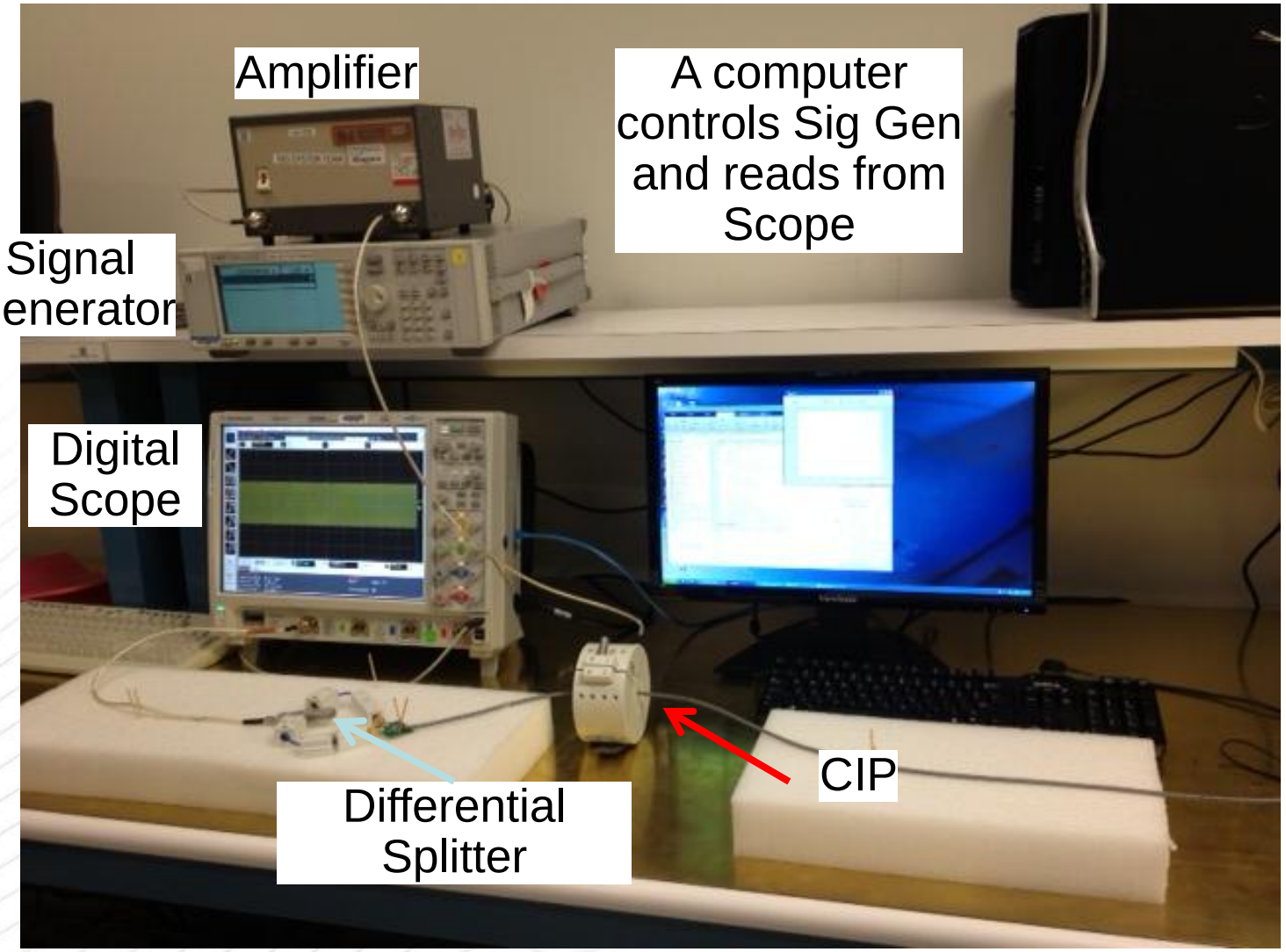
- Test Setups
  - Setup#1: Transfer Function Measurement (via 3-port VNA and 2-port VNA w/splitter)
  - Setup#2: Direct BCI Measurement (via scope w/splitter)

- Notes:
  - BCI test setup is arranged according to ISO 11452-4.
  - The balance of the measurement setups is super critical (cables, equipments' balance & dynamic range etc.)
  - A differential splitter is used to provide a precise balance measurement

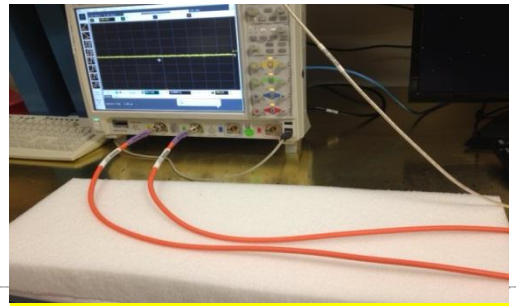
Setup#1: Transfer Function Measurement



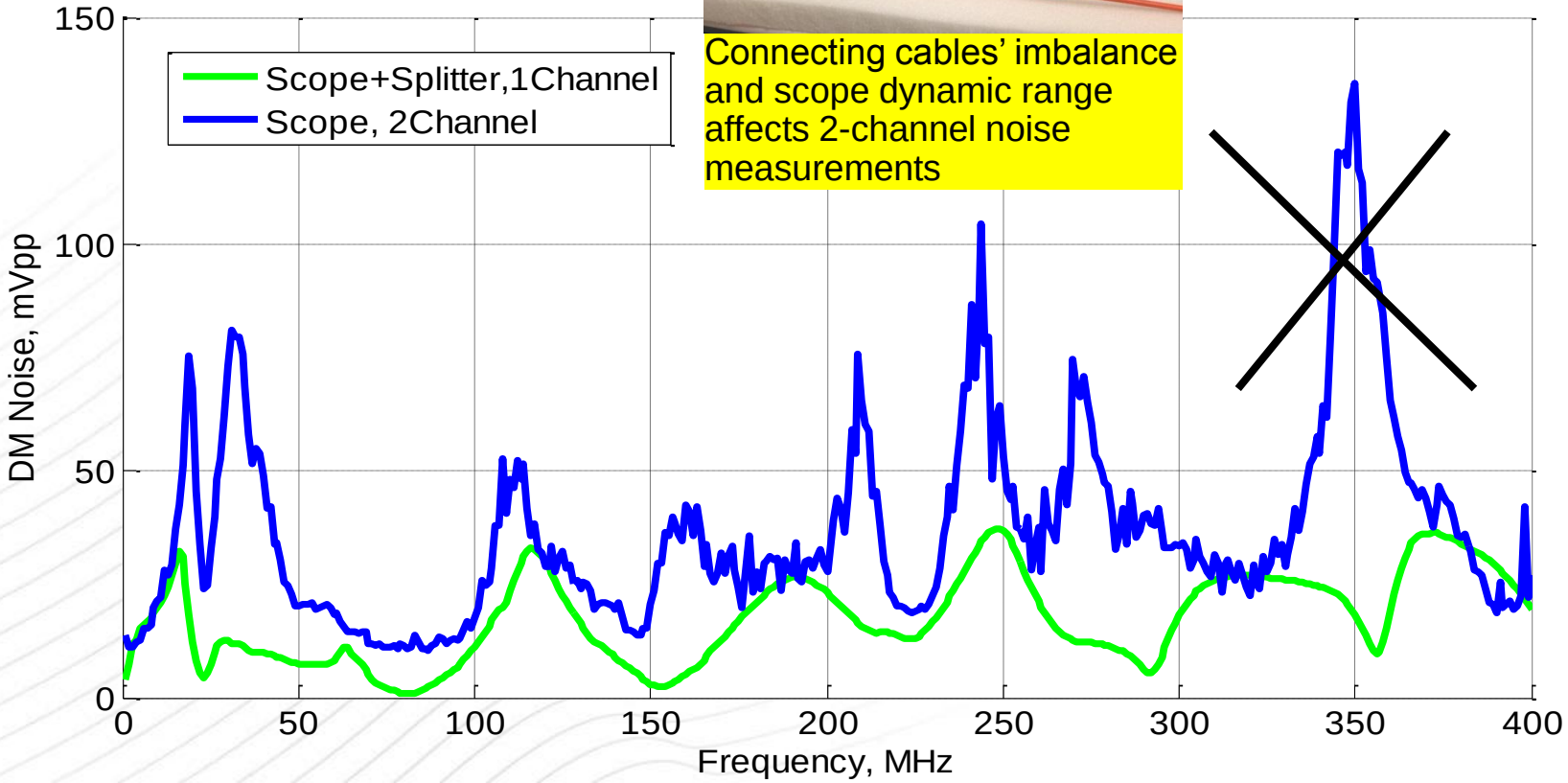
Setup#2: Direct BCI Measurement



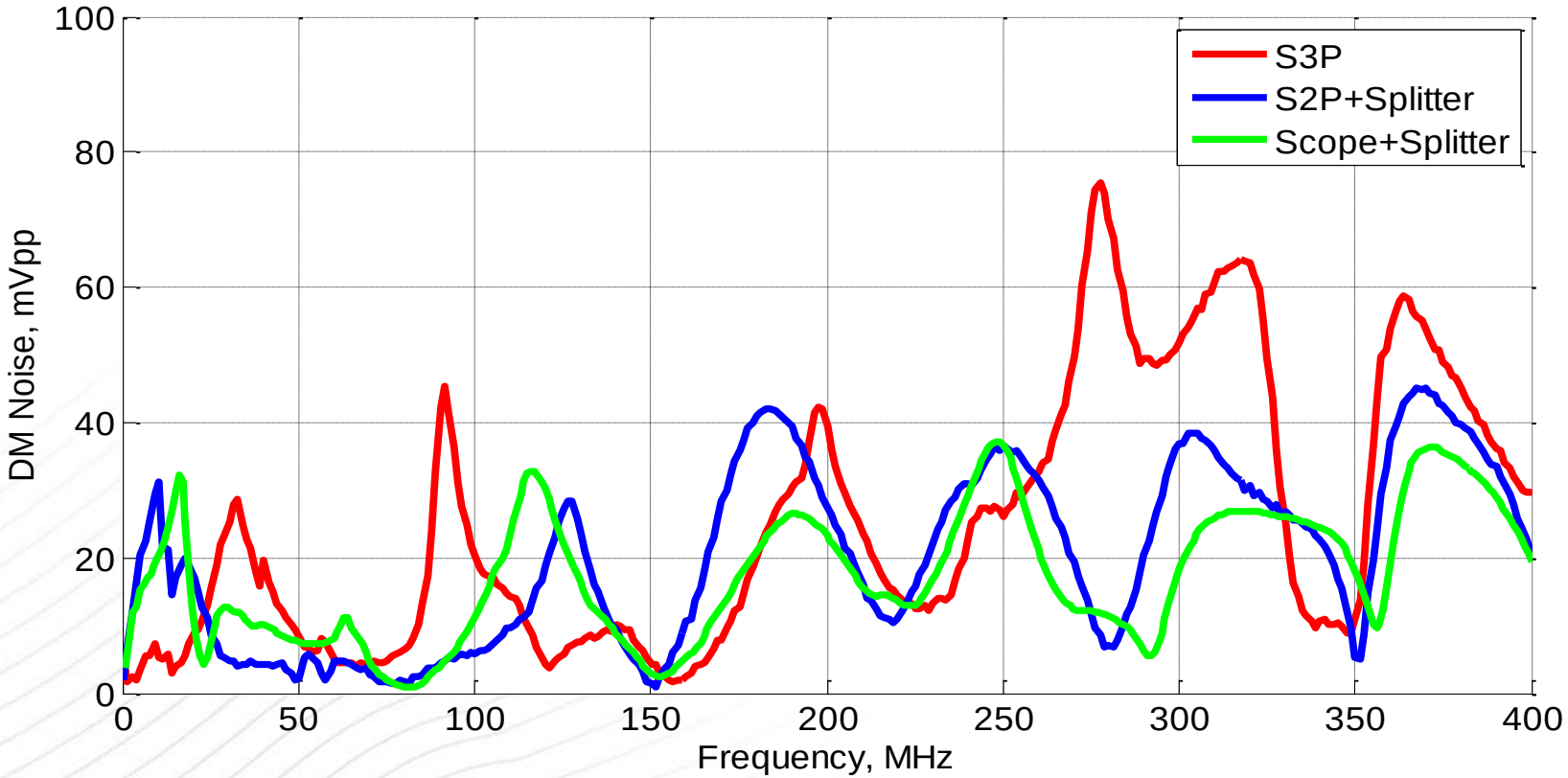
Scope Measurements (1-ch versus 2-ch)



Connecting cables' imbalance and scope dynamic range affects 2-channel noise measurements



Correlation Results



Notes: VNA and Scope measurements are close when using a differential splitter.
Larger resonances are seen using 3-port VNA measurements

Conclusions

- Noise measurements using BCI Transfer Function is validated comparing various measurement methods.
- There are challenges when 2-Scope channels measure DM noise.
  - Specially using a scope, the imbalance between 2 channels are not calibrated and results in higher and inaccurate noise levels at the MDI.
  - VNA calibration improves imbalance between the 2 ports measuring DM noise, however cable bending and distance to GND plane affects the results.
  - The most accurate results are observed using a well balanced differential combiner. In that case, VNA and Scope measurement results are very close.
- The attained results show that there is strong correlation between calculated and directly measured BCI noise as long as the test setups are accurately calibrated and setup