STUDY OF THE UNCERTAINTY AND ITS MINIMIZATION IN THE MEASUREMENTS OF ANTENNA GAIN IN FAR-FIELD CONDITIONS

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Motivation of the work

- Telecommunication services require **precise measurements** of antenna parameters.

TRUE VALUE = MEASUREMENT RESULT ± UNCERTAINTY

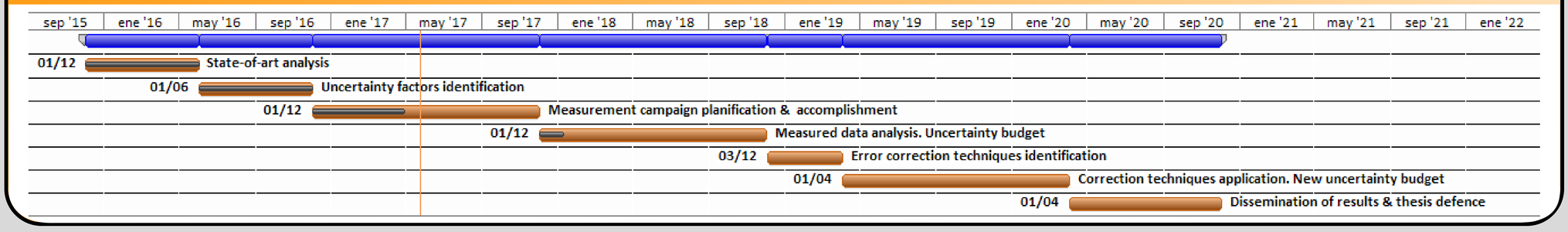
- Uncertainty
  - Quantitative indication of the reliability of the measurement result.
  - Implies assessment of all error sources and possible corrections.
  - Allows comparison with references or values obtained by others.
- Globally accepted measurement procedures but **no standard for uncertainty**.

Thesis objectives

Main objective → characterise uncertainty contributors in far field antenna gain measurements and how to mitigate them:

- State-of-art of uncertainty characterisation in antenna measurements.
- Identification of the factors contributing to uncertainty.
- Measurement campaign to quantify each factor.
- Error correction techniques.
- Uncertainty budget.

Research plan



Next year planning

- Keeping up with the measurement campaign.
- Analysis of measured data and quantification of uncertainty components.
- Uncertainty budget.

Results & Discussion

FACTORS

Uncertainties due to instrumentation:
- Source errors: absolute level and drift
- Receiver linearity
- Mismatch

Uncertainties due to the facility:
- Chamber ripple
- Chamber isolation
- Temperature & humidity
- Alignment

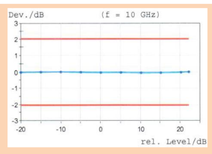
Uncertainties due to the method:
- Calibration of the reference antenna
- Measurement distance
- Mutual coupling

Uncertainties due to the device under test:
- Phase centre location

Others
- Repeatability
- Phase error

COMPUTATION

DATASHEET / CALIBRATION CERTIFICATES



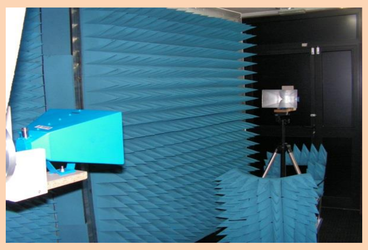
R&S ZVA67 Receiver Linearity

FORMULATION

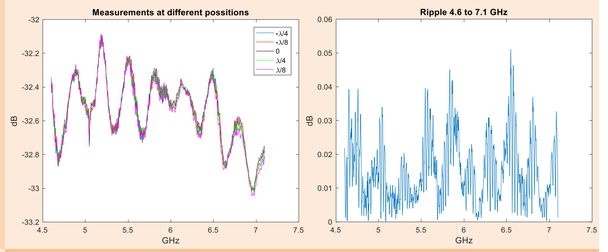
$$u\,(\text{mismatch}) = \frac{|\Gamma_{gen}| \cdot |\Gamma_{carga}| \cdot |S_{21}| \cdot |S_{12}| \cdot 100\%}{\sqrt{2} \cdot 11{,}5}$$

MEASUREMENTS

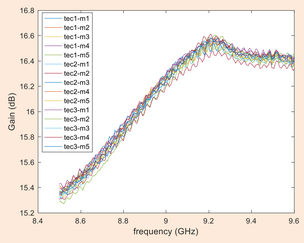
Chamber isolation
- Transmission measurements in two scenarios (doors opening vs. close)



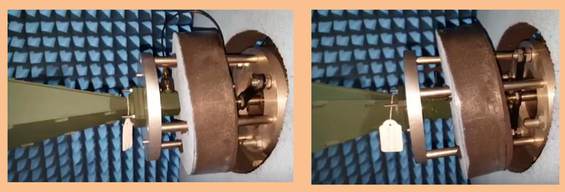
Chamber ripple
- Quiet zone characterization
- Transmission measurements at different positions



Repeatability
- Independent measurements
- Different technicians



Alignment
- Polarization misalignment
- Peak deviation



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