Audible Noise Performance of OHL Conductor Bundles

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Presentation: Rudolf Woschitz
Content

• Behaviour of audible noise (AN) under foul weather conditions
• Twin-conductor and three-conductor bundles
  – FEM calculation of surface voltage gradients
  – Test arrangement for OHL conductors for AN measurement in laboratory
  – Influence of different conductor surface: uncoated and coated
  – Results
  – Conclusions
Prediction of AN

• Empirical equations from corona cage testing
  (Transmission Line Reference Book – 345 kV and above, EPRI 1982)

• Influence factors
  – Number of sub conductors in the bundle
  – Bundle diameter
  – Conductor surface
  – Voltage gradient

• Mechanisms of AN are still under discussion
  – Laboratory tests
  – FEM calculation
Surface voltage gradients
FEM calculation

- Three-conductor bundle – smooth surface

- Conductor diameter 36 mm
- Bundle spacing 400 mm
- Height above ground 7 m
- $E_{\text{max}} = 5.07 \text{ kV/mm} \ (U=100 \text{ kV})$
Surface voltage gradients
FEM calculation

- Three-conductor bundle – stranded

- conductor diameter 36 mm
- bundle spacing 400 mm
- height above ground 7 m
- $E_{\text{max}} = 7.0 \text{ kV/mm (U=100 kV)}$
Test arrangement for OHL conductors (single phase)

- Conductor length: 10 m
- Height above ground: 3 – 7 m
- Clearance to wall and other equipment: > 5.5 m
- Artificial rain with defined rainfall rate: 1 - 15 mm/h
- Number of microphones: 4
- Visual inspection: corona camera, digital camera
Overhead sprinkling system

Defined rainfall rate: 1 – 15 mm/h
## Test parameters for audible noise measurement on OHL conductors

### Step 1
- Conductor bundle height above ground: 3 m
- Artificial rainfall rate: 6 mm/h
- Test voltage: 180 – 300 kV
- Voltage step: 20 kV, 30 s
- Measurements at each voltage step: AN, RIV, PD, visual inspection

### Step 2
- Pre-wetting of conductors
- Increase of test voltage to 240 kV, 15 min
- Measurements after 1 min and 15 min: AN, RIV, PD, visual inspection
Results of AN measurement on OHL conductors

- Twin-conductor bundle
  - Voltage: 180 kV to 300 kV
  - Time: 1 min to 15 min
  - Loudness (L_{eq}): 20 dB(A) to 56 dB(A)
  - New, Old, Coated New

- Three-conductor bundle
  - Voltage: 180 kV to 300 kV
  - Time: 1 min to 15 min
  - Loudness (L_{eq}): 20 dB(A) to 56 dB(A)
  - New, Old, Coated New
Conclusions

- Coated conductors with hydrophilic surface show an AN reduction of -10 dB(A) compared to new standard conductors
- Coated conductors show similar AN performance like service-aged conductors
- Investigations have to be continued
  - Laboratory tests
  - FEM calculations – helpful tool
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