Noise Floor Variability: Analysis of long term spectrum records

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P. Dejean de la Bâtie, J.L. Rogier, M. Dakhouani, C. Lamy-Bergot
Presentation Outline

- Measurements Characteristics
- Noise Level Estimation
- Day /Night Variability
- Season variability
- Frequency Variability
- Antenna variability
- Conclusion
Measurements Characteristics

Receiving antennas
- Multiple locations in metropolitan France
- Multiple directive antennas on each location

Measurement Period
- 8 consecutive years measurements
- HF spectrum recorded every couple hours for each location & direction

Spectrum
- Range : 2-30 MHz
- Relative levels:
  -> Analysis limited to noise variations
Noise Level Estimation (1/2)

- **Raw** Noise Level is estimated with a 1 MHz sliding window
  - Window width allows not to be biased by very powerful emissions
  - Noise estimation = mean of the 2% lowest bins
  - Ideally, a smaller frequency sliding window would be desirable (about 250 kHz)
  - Reducing the window width requires a better dynamic to cope with powerful transmissions

- Frequency polynomial fitting is applied on **raw noise level**
  - Smooth **raw** noise level
  - Provides a compact & continuous model as a function of frequency
Noise Level Estimation (2/2)

Measurement
Raw estimation
Estimation with poly. fitting
Daily variations

Daily variations: 5 MHz, June 2007

Time (s.)

Ref number: Date
Name of the company/Template: 87204467-DOC-GRP-EN-002
Comparison with UIT recommendations (SATIS software)

Daily variations: 5 MHz – June 2007:

UIT model / Measurements

**Notes:**

- "Quiet rural" model
- Mean values alignment (measured levels are relative levels)
Seasonal Variation – 5 MHz (2007)

- Mean day: average over the current month at a given hour
- Day/night variations overestimated by UIT model during winter

« Mean day » variation – 1 year period (ITU / Measurements)
Noise variability w.r.t. frequency

- Globally consistent with UIT model
- Similar to measurements made by R.K. Potter (USA, 1930)
Hour and month variability – 5 MHz

- Night -> Day Transition
- Day -> Night Transition
- No transition period
Location Variability

Amplitude of day / night variation

Urban Location
Rural Location

Higher industrial Noise reduces day / night variations

Consistent with UIT model
Antenna Variability: different directions at same receiving location

Noise value and its evolution differs from one direction to another one

Year 2011 - directions 1 / 2 / 3 – 6.8 MHz
Conclusions

- Noise level variation can be estimated for short term (few hours), daily and seasonal periods
- Atmospheric noise variation relatively consistent with UIT model
  - Considering, this measurement data base, UIT model overestimates daily variations during winter
- Noise level and noise evolution differs for directive antennas pointing in different directions (on the same receiving location)
  - Atmospheric / industrial noise cannot be modelled as isotropic
- Improving UIT models would benefit to better budget link evaluation
  - Influence of the antenna on noise level
  - Especially directivity / polarisation
  - Requires rigorous experimental protocol and long term measurements
If you have any questions

CATHERINE . LAMY – BERGOT @ THALESGROUP . COM

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