Wind Loading

Calculation of the Wind Surface and the Wind Load of Antennas

1. EXPLANATION OF TERMS:

L : Length [m]
D : Diameter [m]
A_P : »Projected« Area (or effective »frontal area«) [m^2]
A_W : Wind Surface [m^2]
c : Shape Factor
v : Wind Speed short-time mean value (gust speed) [ms^{-1}]
q : Dynamic Wind Pressure [Nm^{-2}]
F : Wind Load [N]

2. WIND SURFACE:

The projected area for e.g. a cylindrical antenna rod is calculated simply as:

$$A_P = L \cdot D \ [m^2]$$

For round antenna whips, shape factor c = 1.2, and the wind surface is calculated as:

$$A_W = c \cdot A_P = 1.2 \cdot A_P \ [m^2]$$

3. WIND LOAD:

The wind load F is determined by: $F = q \cdot A_W$

– where the dynamic wind pressure $q = 0.64 \cdot v^2$

@ v = 150 km/h, F is given by:

$$F = 1111 \cdot A_W \quad \text{or} \quad F = 1333 \cdot A_p \ [N]$$

@ v = 160 km/h, F is given by:

$$F = 1264 \cdot A_W \quad \text{or} \quad F = 1533 \cdot A_p \ [N]$$

(As v is the short-time mean value wind speed, a gust factor is not included).

4. SURVIVAL WIND SPEED

The majority of the antennas are rated at a survival wind speed of v = 160 km/h with a safety margin of at least 30%.

5. ICE LOADING

With radial ice the maximum survival wind speed will be reduced and is calculated assuming the same wind loading F as:

$$v_{MAX} = 150 \sqrt{\frac{A_w}{A_{w,\,ICE}}} \ [km\ h^{-1}] \qquad v_{MAX} = 160 \sqrt{\frac{A_w}{A_{w,\,ICE}}} \ [km\ h^{-1}]$$

- where $A_{w,\,ICE}$ is the new wind surface including the ice layer.