

RECOMMENDATION 805

ASSESSMENT OF IMPAIRMENT CAUSED TO TELEVISION
RECEPTION BY A WIND TURBINE

(Question 6/11)

(1992)

The CCIR,

considering

- a) that severe degradation of television reception can be caused by reflections from moving objects such as the blades of a wind turbine;
- b) that these effects are particularly serious because the impairment caused can be quasi-permanent, being reduced only during periods when the wind turbine is not rotating;
- c) that it is important to have available a simple method for calculating the potential impairments which could be caused by the installation of any proposed wind turbine;
- d) that ghost cancellation techniques are being investigated and that these may offer some amelioration of the impairment caused by wind turbines,

recommends

- 1. that the method given in Annex 1 be used to assess the potential interference from a proposed wind turbine installation consisting of a single machine;
- 2. that further work be carried out to refine the simplified model given in Annex 1;
- 3. that further work be carried out to investigate the impairment caused by a multiple-machine wind turbine installation;
- 4. that the temporal nature of the impairment caused by a wind turbine be investigated.

ANNEX 1

Simplified model of impairment caused to television reception by a wind turbine

Figure 1 shows the plan view of the general wind turbine problem.

At any receiving location, R the wanted field strength is FSR . At the wind turbine site, WT, the field strength is $FSWT$. A "reflection factor", RF , may be defined which includes the free-space path loss for the first km of the path from the wind turbine site to R. Thus, $FSWT + RF$ gives the maximum amplitude, at a distance of 1 km from the wind turbine, of the signal scattered from the wind turbine. The maximum value of this reflection factor due to the wind turbine blades is $20 \log (A/\lambda) - 60$ dB.

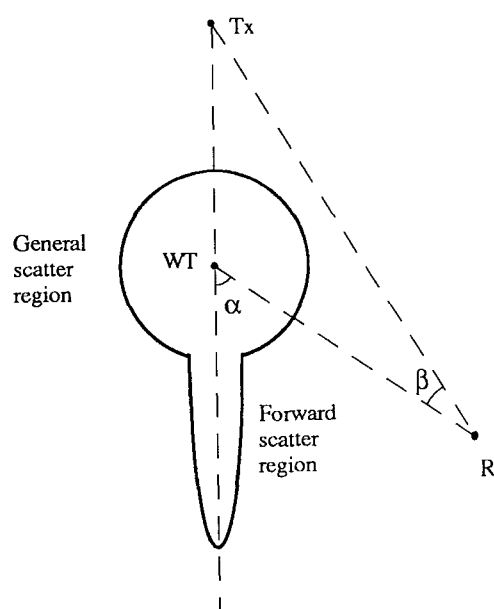
The relative amplitude, RA , in the forward scatter region is given by:

$$RA = 20 \log \frac{\sin (\pi \cdot W/\lambda \cdot \sin \alpha)}{\pi \cdot W/\lambda \cdot \sin \alpha}$$

where:

 A : blade area (m^2) W : width of the blade (m) λ : wavelength (m).The relative amplitude in the general scatter area is taken to be -10 dB.

FIGURE 1



Tx: television transmitter
 WT: wind turbine
 R: receiving location

In the case of a free-space path, of length d (km), between the wind turbine and the receiving location, the unwanted field strength may be calculated as:

$$FSWT + RF + \max(-10, RA) - 20 \log d$$

where:

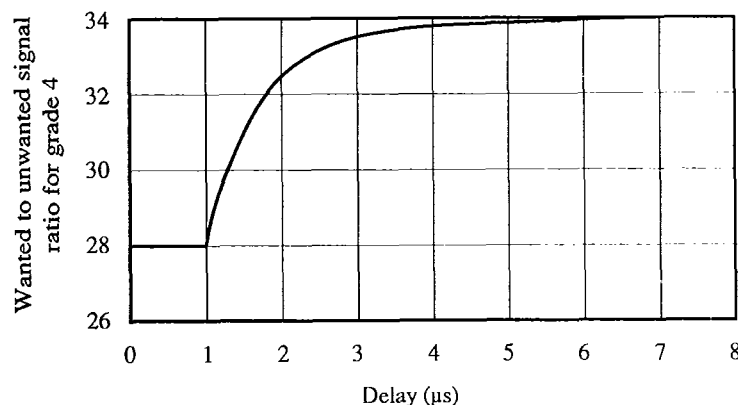
$\max(-10, RA)$: larger of -10 dB and the relative amplitude of the forward lobe.

If this path is obstructed, the field strength may be calculated by other means, with the first three terms giving the field strength at 1 km on an unobstructed path.

The receiving antenna directivity discrimination as a function of β is given in CCIR Recommendation 419 and this should be applied to determine the ratio of the wanted to unwanted signal for any specific receiving location.

The required wanted to unwanted signal ratio as a function of the time difference between the wanted and unwanted signals is given in Fig. 2.

FIGURE 2



An example of the use of this method is given in Appendix 1.