

**U. S. Department of Agriculture Funded
Experiment to Evaluate Interference to
Television Broadcasting from Wind Turbines**

There has been a very significant growth in wind turbine deployment in the United States in recent years as the country looks toward the development of clean and renewable sources of energy. This proliferation has also lead to a not so insignificant number of cases of interference to television reception as well as other forms of radio communication.

Rotating blades are known to introduce interference when turbines are located between transmitters and receivers. However, interference due to turbines that are sited very near digital television (DTV) transmitters is unexplored. The thought is that if the turbines are located very near the transmitter and the transmit antenna is of sufficient height then the most the area served by the transmitter will be unaffected.

The objective of this project, which is being funded by a grant from the U. S. Department of Agriculture (USDA) (NIFA 2011-00466), is to characterize the interference and develop an initial set of guidelines for positioning wind turbines near digital transmitter facilities that will enable the site designer to optimize the tradeoff between wind efficiency and signal interference.

This specific experiment proposes to place a low power (200 Watts maximum ERP) DTV signal on television channel 44 with the transmitting antenna on a tower located near existing wind turbines. The experiment will be done by placing an instrumented receiver on the ground at a fixed location in line with a wind turbine and the transmitter tower. The transmit antenna will be then be moved down the tower in steps so that the line of sight from antenna to the receiver will first pass several blade heights above the top of the blade tip arc then progress down in steps to the turbine's hub. The instrumented DTV receiver will record the activity of its AGC and equalizer for each signal height, which will indicate the amount of signal distortion being corrected by the receiver at each signal height. Tests will be conducted with the turbines in motion as

well as stopped (locked to prevent rotation). In addition RF recordings will be made so that they can be replayed in the lab in order to further analyze the effects of the turbines on the television signal.

Television station WGBA-TV Green Bay, WI has agreed to allow the transmit antenna to be placed on its tower and the owners of two different wind turbine operations in the area have agreed to cooperate in the testing. In addition, local land owners are also participating by allowing access to the precise measurement locations required for this experiment.

Channel 44 was selected so as to minimize any potential interference to existing stations due to the fact that there are no nearby stations on channels 43, 44 or 45. It is also noted that there will be no interference concerns toward Canada in that the nearest point to the Canadian border is 354.8 km and is in the direction of minimum radiation based on the antenna pattern being utilized.

OET-69 studies (results attached) show that no new interference will be caused. These studies were conducted using the planned maximum ERP of 200 Watts and for the proposed different antenna heights of 150, 135, 120 and 105 meters above ground. The proposed directional transmitting antenna (horizontally polarized single bay Scala Model 4DR-4S) with the main beam pointed at 239 degrees from true north was also used in the OET-69 studies. The antenna rotation (239 degrees) was selected so that it will be exactly in line with the wind turbine and a preselected measurement location.

The experiment is expected to last about one week and scheduled to start on December 4, 2011; however, the request is for six months to account for any unforeseen delays. The proliferation of wind turbine deployment and the associated history of television interference problems have prompted an urgent need for development of tools to assist in the placement of the turbines so as to minimize interference. In view of that, this project needs to be completed as soon as possible which is the reason for the desired start date. It is also noted that additional funding is likely to be provided to by USDA for a further more detailed evaluation depending on the results of this experiment provided this initial phase can be completed in a timely manner.

Proposed Transmit Facility

Channel 44 (650-656 MHz)

Modulation DTV (8-VSB - Emission 6M0C7W)

Site Location: 44-21-30 N
87-58-48 W

Tower Registration Number: 1034782 (Tower Owned by WGBA-TV – Journal Broadcast Group)

Site Elevation: 301.8 m AMSL
Overall Tower Height 316.4 m AGL
Antenna Center of Radiation 150 m AGL (also 135 m, 120 m & 105 m AGL)

Power (ERP) 200 Watts Maximum

Antenna: Directional SCALA Model 4DR-4S

No Beam Tilt

Antenna Rotation: 239 degrees

Directional Antenna Pattern SCALA Model 4DR-4S (Not Rotated)

Azimuth	Relative Field	Azimuth	Relative Field	Azimuth	Relative Field
0	1.000	120	0.025	240	0.025
10	0.980	130	0.020	250	0.030
20	0.916	140	0.025	260	0.043
30	0.812	150	0.035	270	0.050
40	0.680	160	0.067	280	0.087
50	0.520	170	0.102	290	0.175
60	0.350	180	0.110	300	0.350
70	0.175	190	0.102	310	0.520
80	0.087	200	0.067	320	0.680
90	0.050	210	0.035	330	0.812
100	0.043	220	0.025	340	0.916
110	0.030	230	0.020	350	0.980