

Appendix 15.3

Television and Radio Written Scheme

Y Bryn Wind Farm

February 2022

PLANNING SOLUTIONS FOR:

- Solar
- Telecoms
- Railways
- Defence
- Buildings
- Wind
- Airports
- Radar
- Mitigation

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INTRODUCTION

Purpose of this Document

This document sets out the approach for investigation and alleviation of potential disruption to television and radio services as a result of the Y Bryn wind development.

Technical Context

Wind turbines can cause disruption to television and radio signals. In cases where interference attributed to a wind development is experienced, the developer has the responsibility to mitigate the impact.

This document sets out the recommended procedure for:

- 1) Quantifying the interference effect;
- 2) Determining whether the interference is due to the wind developments;
- 3) Provision of mitigation.

Any reported interference will be thoroughly investigated by means of signal measurement, comparison with desk-based modelling. The modelling approach that is to be implemented is described within this document.

The cause of any reported interference can be characterised further during a measurement of the signal. A schedule of mitigation options which could be employed in the event of interference being experienced is provided within this document.

MODELLING METHODOLOGY

Television Signals

Terrestrial television signals propagate from transmitters to receiving aerials which in turn are connected to television receiving equipment. The surrounding areas will receive services from the Wenvoe, Croeserw, Kilvey Hill, Myndd Emroch, Cwmafon, and Maestag transmitters, which broadcast digital services. Terrestrial television coverage in the vicinity of the wind turbines may be weak due to the varying terrain levels in the area.

When considering interference from wind developments it is usual to consider direct signals – those that pass from transmitter to receiver in a straight line and reflected, or indirect, signals. The reflected signal goes from the transmitter to a turbine and then on to the receiver.

Standard receiving aerials are directional meaning that signals from the direction of the transmitter are amplified and signals from other angles are attenuated.

Radio Signals

Generally speaking, radio signals are more tolerant to wind turbine interference than television signals. The interference mechanisms are largely the same for radio signals and television signals. The interference modelling for the television interference model described in this section is therefore applicable for radio signals, however the acceptable CIR threshold can vary for the two. Ofcom's advice regarding radio interference (see Reference 9) includes the below:

"Although reports of new structures causing problems to radio reception are rare, the possibility of difficulties cannot be ruled out entirely. Broadcast radio (FM, AM and DAB digital radio) are transmitted on lower frequencies than those used by terrestrial TV signals. Lower frequency signals tend to pass through obstructions more easily than the higher frequency TV signals, and diffraction effects also become more significant at lower frequencies. Both these factors will tend to lessen the impact of new structures on radio reception.

Strong signal reflections will reduce the quality of FM reception leading to fluttering noises or sound distortion. In contrast, the signal format used for DAB digital radio is designed to offer high levels of robustness in difficult conditions and it is not materially affected by reflections.

FM and DAB reception can be affected where a structure blocks signals and both may cease to function if signals are reduced below a certain threshold."

Relevant Parameters

The following parameters are relevant to modelling interference:

Carrier to Interference Ratio

The likelihood of television interference is determined by considering the strength of the direct, or carrier, signal in comparison to the reflected, or interfering, signal. The Carrier to Interference Ratio (CIR) quantifies the relative strength of the direct and reflected signals.

A high CIR means interference is less likely. A low CIR means that interference is more likely. The CIR is normally expressed in decibels (dB).

Free Space Path Loss

Television and radio signals weaken over distance. The closer a receiver is to a transmitter the stronger its received signal will be. This reduction in signal strength due to separation distance is referred to as Free Space Path Loss (FSPL).

Electromagnetic Propagation by Diffraction

An electromagnetic signal may travel between two points, even when no direct line of sight exists between those two points. This is because transmission travels as a series of waves rather than as a direct ray. When no direct line of sight exists between the two points the signal is considerably weakened. This weakening is known as a diffraction loss.

International Telecommunications Union (ITU) Recommendation ITU-R P526-7 describes a method for calculating diffraction losses over regular terrain.

Total path loss for a specific path is determined by adding Free Space Path Loss to Diffraction Loss.

Radar Cross Section

The size of the interfering signal is dependent on the amount of energy that is reflected from the wind turbine. This reflective quality is known as the Radar Cross Section (RCS) and can be expressed in metres squared or in dBm².

A lot of work has been carried out to help determine wind turbine RCS by various parties although little work has been carried out at UHF frequencies. Values cited typically vary between 25 and 300 m² with instantaneous peaks reaching 3000 m² for a single wind turbine.

The moving and static parts of the turbine are often considered separately.

Pager Power's Approach

Pager Power employs compound methodology including some additional factors such as:

- Triplicate calculations accounting for tip, hub and rotor bottom;
- Accounting for actual field strength;
- Calculating interference in accordance with the Dabis Method;
- Calculating interference in accordance with the ITU method.

Following assessment by these various methods the following conclusions have been drawn:

- Although it is true that wind turbine interference appears more likely when the received signal is weak there is no direct relationship between direct signal strength and observed picture and audio interference;
- Observed picture interference is directly related to the CI Ratio;
- The ITU-R BT805 method appears to be significantly more accurate than the Dabis method for assessing observed interference;
- Summing of unwanted signals from each turbine to determine a total unwanted signal level appears to be reasonably accurate;
- The CIR threshold of 10dB cited by RES appears to be reasonable – it is certainly true that the threshold of 28-34 cited by BT805 is too high when using this method. Observations on a 32 wind turbine development suggest that a threshold of 15dB may be more reasonable in this case;
- Pager Power's basis for concluding that the threshold in BT805 is too high comes from experience of existing wind developments where interference effects have been modelled and recorded;
- Carrying out an assessment based on the hub height appears to be fairly representative – however there can be significant variation in CI Ratio over the blade span. In an example with no direct line of sight between transmitter and receiver the CI Ratio varies by 31dB between the top and bottom of the rotor. This is a large variation and should be considered or accounted for.

It was concluded therefore that triplicate calculations at tip, hub and rotor base should be considered. The principals of this calculation are as follows:

- The interference signal calculation should be carried out three times for each turbine – at tip, hub and rotor base;
- A weighted average of the three unwanted interference signal levels should be made (of absolute levels not decibel levels);
- A signal passing through the turbine at hub height is clearly going to be affected much more than one passing through the tip or rotor base so an increased weighting should be applied to the hub signal;
- The weighting applied to rotor tip and rotor base should be identical as the proportion of the signal passing through the rotor is identical at both heights;

- A geometric calculation suggested that following weightings be used for averaging:

Turbine Part	Weighting (%)
Tip	19.55
Hub	60.9
Rotor Bottom	19.55

- The following rounded values are used for calculation purposes:

Turbine Part	Weighting (%)
Tip	20
Hub	60
Rotor Bottom	20

Digital Television

The interference mechanisms for digital transmissions are the same as those for analogue transmission. The main difference is the manner in which the interference is manifested on the television screen. Analogue signals may suffer degradation that reduces the signal quality by causing various effects such as ghosting or flickering. Digital transmissions tend to be robust to small amounts of interference but are drastically affected by more severe interference. The modelling methodology is applicable to digital transmissions.

Schedule of Mitigation Options – Television

Below is a list of standard actions to mitigate television reception issues caused by a building development should a valid report of interference be received:

1. Replacement of receiving aerial with a more directional, or higher gain, aerial;
2. Repositioning the receiving aerial so that the received signal is strongest;
3. Directing the receiving aerial to an alternative transmitter that covers the area and retuning the television accordingly;
4. Upgrading antenna cabling and connections;
5. Installation of signal amplifiers;
6. Replacing terrestrial reception equipment with satellite or cable reception equipment;
7. Provision of television services via the internet;
8. Development of a bespoke local solution using a receiving aerial some distance from the dwelling.

Actions 1-7 are unlikely to occur as individual solutions and are likely to be deployed in combination. The requirement for the implementation of such measures will be addressed on a case-by-case basis.

Actions	Basis
Combination of #1-5 aerial system upgrade	Per residence
#6 bespoke reception system	Per residence / per area
#7 combination of 1-6	Per residence / per area
#8 satellite installation	Per residence

The requirement for the implementation of such measures will be addressed on a case-by-case basis.

Schedule of Mitigation Options – Radio

Below is a list of standard actions to mitigate radio reception issues caused by wind developments:

1. Re-tuning the radio;
2. Relocation of the radio;
3. Upgrading the aerial or the radio itself;
4. Provision of an external aerial for receiving radio services;
5. Provision of radio services via the internet;
6. Development of a bespoke local solution using a receiving aerial some distance from the dwelling.

The most appropriate solution if radio services at residences are affected may be provision of a new radio or an external aerial. The requirement for the implementation of such measures will be addressed on a case-by-case basis.

Actions	Basis
#1 – 4	Per residence
#5 bespoke reception system	Per residence / per area

The requirement for the implementation of such measures will be addressed on a case-by-case basis.

PROTOCOL FOR DEALING WITH ANY REPORTED INTERFERENCE ARISING FROM THE OPERATION OF THE WIND TURBINES

Overview

A typical process for addressing reported interference is as follows:

Notification for reported television or radio interference should be limited to a fixed period of 12 months from the commissioning of the wind development. Reported interference will be made to the LPA or to the wind development operator. If it is found that the interference is attributable to the wind development, mitigation will be put in place. Investigation of any issues will be undertaken within one month of the wind development operator receiving details of the reported interference in writing. Any required mitigation will be installed within 2 months of completion of the investigation.

Protocol

The recommended process can be summarised in the following five steps.

- Step 1** Consider the location of the reported interference with reference to wind development location and relevant transmitter.
- Step 2** Undertake desk-based modelling of predicted interference locations (if required).
- Step 3** Carry out measurements at relevant locations (where reported interference has been received). Characterise interference and compare it to the results of completed modelling. Investigate receiving equipment where appropriate.
- Step 4** Determine whether the interference is attributable to the Y Bryn wind development based on steps 1 to 3.
- Step 5** Apply mitigation if required, based on step 4. The requirement for the implementation of such measures will be addressed on a case-by-case basis.

References

The following published works have been considered in the process of devising Pager Power's modelling approach:

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