



# **Technical Appendix 9-2 Copy of 2025 Wind Energy Ireland Position Paper on AM Conditions**

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**WIND ENERGY  
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# WEI Position Paper on Amplitude Modulation Planning Conditions

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## Executive Summary

Wind Energy Ireland (WEI) is committed to ensuring that wind energy development in Ireland is delivered in a way that protects local communities, provides certainty for project developers, and supports national climate and energy security objectives.

**Amplitude Modulation (AM)** is a naturally occurring feature of wind turbine operation, sometimes experienced as a “swishing” sound from rotating blades. While AM has been referenced in some recent planning decisions, there is currently **no endorsed government guidance** on how it should be regulated.

In early 2025, planning permissions for several wind farms included conditions completely restricting AM at noise sensitive locations. These conditions were **unworkable**, lacking any scientific basis or practical means of compliance, and they created major barriers to project financing and delivery.

Encouragingly, more recent decisions by An Coimisiún Pleanála made in June and July 2025 **did not impose AM conditions**, marking a welcome return to a more practical and evidence-based approach.

WEI’s position can be summarised by the following key points:

- **“No AM” conditions should not be included** in planning permissions, as AM cannot be eliminated and such conditions are unsupported by scientific evidence or best practice.
- A **complaints-based monitoring system**, in line with established UK good practice, offers a fair and effective approach.
- A **sample noise condition** with clear thresholds, combined with a Noise Complaint Monitoring Programme, provides a balanced framework that protects local amenity while maintaining the viability of projects.

By adopting consistent, evidence-led planning permission conditions, Ireland can continue to expand renewable energy, while protecting communities and ensuring that the planning system supports—not hinders—our shared climate and energy security goals.

## 1 Introduction

Wind Energy Ireland (WEI) is Ireland's largest renewable energy organisation with over 200 members who have come together to plan, build, operate and support the development of Ireland's onshore and offshore wind generation. Over the past two decades, wind energy has become Ireland's leading source of renewable electricity, playing a key role in reducing our dependency on imported fossil fuels.

In 2024 Irish wind farms provided 32 per cent of the country's electricity and no country in Europe gets a larger share of their power from onshore wind farms than we do.

WEI members are at the forefront of the transition to a decarbonised electricity system and are actively planning and delivering the gigawatts (GW) of new onshore wind projects that will power Irish society into the future.

In line with our climate ambitions, and as stated in Irish law, Ireland must achieve a carbon neutral economy by 2050. That is no easy feat and will require considerable effort across society. The Draghi Report, published last year, identified Ireland as having the slowest planning and consenting regime of anywhere in the European Union.

The next fifteen years present an opportunity to make unprecedented progress in moving to relying on locally produced renewable energy and accelerating the next phase of Ireland's economic development.

The Irish wind energy industry can deliver cleaner and more affordable power to hundreds of thousands of homes and businesses across Ireland and lay the foundation for Irish energy independence.

## 2 What is Amplitude Modulation?

Amplitude Modulation can be described as the periodic variation in noise level associated with turbine operation. This variation is related to the rate at which the blades of the turbine rotate. It is often referred to as blade swish or amplitude / aerodynamic modulation.

Amplitude modulation is technically defined as:

*“Periodic fluctuations in the level of audible noise from a wind turbine (or wind turbines), the frequency of the fluctuations being related to the blade passing frequency of the turbine rotor(s).” [1]*

The level of Amplitude Modulation (AM) expected and fully considered within the UK guidance *The Assessment & Rating of Noise from Wind Farms* (ETSU-R-97) [2] is up to a level of 3 dB when measured close to the turbine.

The terms ‘Ordinary Amplitude Modulation’ and ‘Excessive Amplitude Modulation’ have been used in the past to describe AM over this 3 dB level. However, since the publication of the Institute of Acoustician’s (IOA) Method for Rating AM in Wind Turbine Noise, the term AM is used whatever the rated level. It should also be noted that AM is an inherent characteristic of wind turbine noise close to the turbine, which may also be measurable at other locations under certain conditions. For the avoidance of confusion, throughout this paper, we will refer to AM to cover all types of AM.

The current UK policy for AM is stated in section 7.2 of the IOA Good Practice Guide (GPG):

*“The evidence in relation to “Excess” or “Other” Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM.” [3]*

However, the UK is consulting on an update for the Assessment and Rating of Wind Turbine Noise [4], which includes a new methodology for rating AM from wind turbines. It should be noted that the document is under consultation and Department of Energy Security and Net Zero (DESNZ) states:

*“It is important to note, the draft guidance update does not represent a final position from government. It should not be used by local planning authorities during or after the consultation period in relation to ongoing planning applications. Following this consultation, we will analyse responses and issue a formal government response. Until this time the current guidance remains suitable for assessing wind turbine noise. As is typical, planning authorities should continue to use existing guidance. Planning authorities are advised not to delay planning decisions on the basis of this consultation. “ [5]*

## 2.1 Lack of Guidance on Amplitude Modulation

It is interesting to note that, generally speaking, other EU countries have not required the regulation of AM.

While there are best practice methods available to measure and quantify AM, at the time of writing, there is no guidance that has been endorsed by the UK or Irish governments to compare the measured levels to a threshold / limit / penalty system.

The current Wind Energy Development Guidelines were drafted in 2006 and do not include any reference to AM.

The “preferred draft approach” (a set of changes to the Wind Energy Development Guidelines), announced by the Department of Housing, Planning, Community and Local Government (DHPCLG) and the Department of Communications, Climate Action and the Environment (DCCAE) on 13 June 2017, proposed noise restriction limits. The preferred draft approach is based on 5 dB(A) above existing background noise with rating penalties to be applied if certain characteristics arise in the noise emanating from a wind energy development (including tonal and amplitude modulation).

The Draft Revised Wind Energy Development Guidelines were published in December 2019 (Draft WEGs) and AM is referred to throughout the document, where it is described as one of three categories of “special audible characteristics” that arise from wind turbines. Section 3.2 of the Draft WEGs covers AM.

However, the Draft WEGs were never adopted and remain in draft, leaving the 2006 WEGs as the guidance which is currently in force. These guidelines are nearing 20 years old and do not reflect the improvements in turbine technology and changes in the policy landscape since their adoption. In the absence of any adopted guidance around the assessment of AM, and in the absence of updated Wind Energy Development Guidelines, this paper sets out WEI’s position on AM, including what exactly it is, when it occurs, how to measure it, and how it should be dealt with by the planning authorities.

## 3 Amplitude Modulation Occurrence and Measurement

### 3.1 Prediction of Amplitude Modulation

AM cannot be accurately predicted owing to several factors such as site-specific effects, wind shear, terrain, turbine layout, background noise, receptor location etc [6] [7]. Partial blade stall is the most likely cause of AM under specific conditions [8].

It is not possible to know or to predict the level of AM that a wind turbine will generate in advance of its construction and operation. The [WSP report](#) states that AM is an expected characteristic in wind turbine operation [9] although occurrence can be low [10] [11].

### 3.2 Measurement and Rating Methods (Quantifying and Assessing Significance AM)

Currently there are several methods to measure and rate AM, such as the IOA AM rating method [1], IEC 61400-11-2 [12], Den Brook [13], the German Environment Agency's method [2], and RenewableUK [3].

The Den Brook "method" is not suitable as it is unreliable for rating AM, since it provides a high proportion of false positives in the absence of AM, and cannot discriminate between AM and non-AM events [16] [17].

The accepted best practice method of determining AM is currently the IOA AM method [11] [17] [18] [7] [9] [6] or using IEC TS 61400-11-2 [12, p. 9].

Examples of differing approaches to determining the relationship between AM rating to character correction are shown in the 2013 RenewableUK example condition [15], 2016 DECC report [6], 2017 article in the IOA bulletin [18], 2024 IEC TS 61400-11-2 Annex A [12] and the 2025 consultation on the update of UK wind turbine noise guidance [5]. Currently there is no agreed character correction relationship/method.

As stated previously, at time of writing there is no guidance, method or planning conditions for AM that have been endorsed by the UK or Irish governments. The IOA GPG in section 7.2 states:

*Amplitude Modulation: The evidence in relation to "Excess" or "Other" Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM.*

## 4 Recent ACP Conditions on Amplitude Modulation

We note that in two recent decisions issued by An Coimisiún Pleanála in June and July 2025 there were no AM conditions attached to those decisions.

We welcome these decisions and the approach taken regarding noise and the noise conditions. This is a very helpful and positive change from previous decisions that were issued on three other wind farm applications earlier in 2025 which contained AM conditions which were not workable (these are explained in more detail below).

While we broadly support the approach taken for these noise conditions, particularly around AM, we do note several concerns with the wording of those conditions, which we have set out in the table below:

Wind Farm - Condition	WEDG 2006 Compliant Condition
(a) For the daytime period 0700 to 2300, in quiet environments, where background noise is less than 30dB(A)L90T10, <u>a maximum noise level of 40dB(A)L90 T10.</u>	(a) For the daytime period 0700 to 2300 hrs, in quiet environments, where background noise is less than 30 dB LA90,10min, <u>the greater of 40 dB LA90,10min, or 5 dBA above background levels.</u>
(b) For daytime periods, 0700 to 2300, where the background noise level exceeds 30 dB(A)L90 T10, the greater of 45dB(A)L90 T10, or 5dB(A) above background levels.	No change required
(c) For the nighttime period 2300 to 0700, for all noise environments, 43dB(A)L90 T10.	(c) For the nighttime period 2300 to 0700, for all noise environments, <u>the greater of 43 dB LA90,10min, or 5 dBA above background levels.</u>

While we welcome this change in approach taken by ACP to the wording of the noise condition, we would recommend a move towards a ‘complaints-based’ monitoring programme for the operational stage of the wind farm (in line with ETSU), rather than a system based on carrying out pre and post-commissioning surveys, which can sometimes require further surveys following the receipt of a complaint in any case. An example of an appropriate planning condition regulating AM and further detail on the ‘complaints-based’ system is set out in Section 6.3.

### Previous Noise Conditions Applied by ACP Were Unworkable

Prior to the granting of permission for two wind farms in June and July 2025 (referred to above) planning conditions were attached by ACP to the grants of planning permission for three wind farms which were issued earlier in 2025 which were unworkable. These are:

- Knockanarragh Wind Farm Limited (ACP-319448-24),
- Inchnamore Wind Designated Activity Company (ACP-319216-24) and
- Futureenergy Glenard Designated Activity Company (ACP-312659-22).

The noise conditions attached to the above decisions appear to have been based on a new (unsupported by guidance or scientific rationale) approach taken by ACP as each of the abovementioned decisions includes the following wording in the noise condition which is new in planning decisions on wind energy applications: *“The wind farm shall not give rise to amplitude modulation, tonal or impulsive noise at noise sensitive locations.”*

The main concern we have with the wording of the noise conditions for the abovementioned planning permissions is that they simply cannot be complied with. While the board has granted planning permission for these projects it has done so in a manner which may mean they cannot be developed and operated in accordance with the terms of the permissions. Further details on these concerns are set out in the following section.

## 5 Why such conditions should not be included?

While we acknowledge and welcome ACP’s approach to noise conditions as applied in the decisions on 2 wind farms made in June & July 2025, there was significant concern at the potential implications of what appeared to be a new condition proposed by ACP, on Knockanarragh Wind Farm (ACP-319448-24), Inchnamore Wind Farm (ACP-319216-24) and Glenard Wind farm (ACP-312659-22).

Our concerns can be summarised as follows:

Firstly, the condition was inserted without any scientific evidence, research or data provided to support the necessity for the condition and in the absence of any guidance, endorsed by the Irish Government or the relevant expert body, the Institute of Acoustics, on how to compare measured levels to a specific threshold.

Secondly, as AM cannot be measured or predicted in advance of the construction and operation of the wind turbine, it is not possible for a project developer to know how much amplitude modulation a turbine will create once it is operable or to commit to a condition that requires no AM.

The requirement of no AM cannot be achieved, regardless of any measures which are implemented. AM may be measured at properties near to a wind farm site at any time. The level of AM may be low, but could occur infrequently or frequently, and result in a low character correction [11] [9] [7].

This approach to conditions would have created serious challenges to the development of renewable energy and, consequently, delivery of the wind energy targets within the most recent approved Climate Action Plan and the furtherance of the national climate and energy security objectives

For all of the reasons above we welcome what appears to be a shift by ACP away from these types of conditions for AM noise and towards a more practical and evidence-based approach as was adopted in the decisions made in June & July 2025.

## 6 What AM condition would be appropriate?

This section sets out what type of noise condition we feel would be appropriate, drawing on examples of how AM is dealt with in other jurisdictions, explaining how a move to a ‘complaints based’ noise monitoring programme would be more appropriate and finally, a sample noise condition is set out, one that we feel should be applied to wind farm planning permissions going forward.

### 6.1 Examples of how AM is dealt with in other jurisdictions

The investigation and the control of AM vary by country and on a development basis. The UK does not have a policy that requires the use of planning conditions for the purposes of managing AM; although, individual sites may have associated planning conditions. However, these planning conditions vary from site to site and does not set precedence with each planning application being judged on its own merits.

The New Zealand standard NZ 6808:2010 provides a penalty scheme for AM, either 0 dB or +5 dB, but no methodology on how to measure and rate AM [20], which means that the New Zealand standard does not provide a method of measurement, rating, correction and mitigation. For these reasons, it is not suitable for application here.

Inclusion of robust and enforceable noise related planning conditions is necessary, and welcomed, to ensure that the amenity of wind farm neighbours is protected. Such conditions can be complex and technical in nature so, to assist consenting authorities, example planning conditions were included in the UK Good Practice Guidance (IOA GPG) [3], produced by the Institute of Acoustics (IOA), which are regularly used in the United Kingdom.

A condition based on the example in the IOA GPG was also included in the Standard Onshore Wind Conditions document issued by Scottish Government in February 2025 [21].

The planning conditions typically applied to wind farm consents in Ireland are often much shorter than the example in the IOA GPG and, in the absence of detailed information within such conditions, acousticians often refer to the guidance in the IOA GPG and use this when undertaking assessments in accordance with the planning conditions.

While research into AM is ongoing, and in the absence of a validated penalty system or approved guidance, **standard practice in Ireland has been not to include AM within noise conditions.**

## 6.2 Move to Complaint Investigation Based Noise Monitoring

A complaint investigation-based system would allow for a more focused, tailored and effective, method to noise compliance.

Any planning conditions should be proportionate, effective and efficient from the local authority, wind farm operator and complainant's perspective. A complaint based / (specific request from the local authority based) system enables focused and specific action to address genuine issues which may arise. It is a much more efficient and effective use of resources, rather than a generic condition requiring ongoing monitoring compliance and submission of records to local authorities.

Many local authorities are currently overburdened. Local authorities are also now required to meet mandatory decision deadlines for renewable energy projects. This increases the pressure on their resources. Consideration should be given to reducing unnecessary burdens in the planning system. Complaint based monitoring requirements (or providing monitoring on foot of specific requests from a local authority) streamlines the approach for everyone. It reduces a significant and unnecessary administrative burden on local authorities, while ensuring that any genuine complaints can be swiftly and appropriately addressed by the wind farm operator. Any necessary mitigation measures, specific to the issue, can then be implemented.

For the reasons outlined above, WEI requests that a complaint based / (at the specific request of the local authority) – monitoring condition should be implemented in planning permissions going forward, in place of the generic ongoing monitoring condition which we have seen in recent permissions.

## 6.3 Sample Noise Condition

Having regard to the latest research, policy, guidance and best practice summarised in this document, our view is that the following sample condition sets out the most appropriate noise limits and approach to noise monitoring, and the industry would welcome the application of this sample noise condition to planning permissions for wind farms going forward.

*Noise levels generated by the wind farm, following commissioning, , when measured externally at noise sensitive locations, shall not exceed:*

- (a) For the daytime period 0700 to 2300 hrs, in quiet environments, where background noise is less than 30 dB LA90,10min, 40 dB LA90,10min.*

*(b) For daytime periods, 0700 to 2300, where the background noise level exceeds 30dB(A)L90 T10, the greater of 45dB(A)L90 T10, or 5dB(A) above background levels, whichever is greater.*

*(c) For the nighttime period 2300 to 0700, for all noise environments, the greater of 43 dB LA90,10min, or 5 dBA above background levels, whichever is greater.*

*Prior to the commissioning of the wind farm, the developer shall submit and agree in writing with the planning authority a Noise Complaint Monitoring Programme (NCMP). This programme shall detail how noise complaints shall be addressed.*

**Reason:** *In order to protect the amenities of noise sensitive properties in the vicinity of the development.*

## 7 Summary

In summary, this paper outlines WEI's position on **Amplitude Modulation (AM)**, which is a characteristic of wind turbine noise, and the following can be considered the key points of the paper:

AM is a natural feature of turbine operation, but there is **no official guidance** for regulating it.

Previous planning decisions by ACP on three wind farm applications in early 2025 included unworkable conditions that required "no AM" which created a significant degree of uncertainty and project financing risks.

More recent ACP decisions in June–July 2025 did **not include AM conditions**, marking a positive shift.

WEI's recommendation is that conditions requiring "no AM" are not realistic, not evidence based and are unsupported by science.

WEI supports a move to a **complaints-based monitoring system** in line with UK best practice (IOA guidance).

WEI recommends adopting a **clear sample noise condition** which sets appropriate thresholds with a complaints-based monitoring programme, to protect communities while ensuring project deliverability.

**In conclusion**, WEI calls for consistent, evidence-based planning conditions that balance residential amenity, project feasibility, and delivering on the State's renewable energy and climate targets.

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