Appendix 15B

Telecoms Report

Report

Ballycar Wind Farm
Telecommunications Impact Study

Document Number:

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Executive Summary

From the Telecom Impact Assessment study conducted in 2021, ten radio links were identified as crossing over/near the proposed wind farm at Ballycar. The ten radio links are listed in Table 1 below. A detailed 2D and 3D radio link analyses was carried out and it was found that a number of radio links would be impacted by the proposed turbines. The findings of the 2021 telecommunications impact assessment are provided in Appendix 2.

In January 2022 Ai Bridges were provided with a revised Turbine Network Layout and an updated EMI assessment was carried out. The results of the January 2022 turbine layout are provided in Appendix 3. Subsequent Turbine Network Layouts were provided in February 2022, May 2022 and in May 2023 and are also included in the Appendices. The findings of the revised telecommunications impact assessment analysis carried out are presented in the body of this report.

To offset the impact of the proposed turbines additional 2D and 3D network analyses was undertaken and a number of mitigation measures were assessed. The network analysis findings were collated and a consultation process was commenced with each of the impacted Telecom Operators. (i.e. Enet, Eir and Three Ireland). The consultations between AiBridges Ltd and the Telecom Operators are presented in Section 2 of this report.

During the consultations, a number of mitigation measures were proposed and discussed, including the provision of a relay mast located within the proposed wind farm site. Upon further engagements with the telecom operators, it was determined that that the provision of a new relay mast would not be required. It was agreed with the telecoms operators that the impacts on each of the affected telecoms networks could be mitigated by re-routing the radio links via existing operational masts.

As a result of the consultation process, each of the telecom operators have no objection to the proposed wind farm development on the basis of agreed mitigation measures consisting of re-routing of radio links prior to the construction of the wind farm and all mitigation measure construction costs will be covered by the wind farm developer.

Link No.	Link ID (Operator)	Link Description
1	Enet (L1)	Woodcock Hill - Newport College
2	Enet (L2)	Woodcock Hill - Birdhill
3	Enet (L3)	Woodcock Hill - Boher National School
4	Eir Mobile (L1)	Woodcock Hill - Dromintobin North
5	Eir Mobile (L2)	Woodcock Hill - Newport
6	Eir Mobile (L3)	Woodcock Hill - Glenoe Newtown
7	Eir Mobile (L4)	Woodcock Hill - Woodstown Limerick
8	Three Ireland (L1)	Woodcock Hill - Ardnacrusha
9	Three Ireland (L2)	Woodcock Hill - Ardnacrusha
10	Virgin Media (L1)	Woodcock Hill - Glenstall

Table 1. Radio Links crossing over proposed wind farm development

Sections

Appendices

Section 1 – Network Analysis

1. Introduction

Based on the findings of the 2021 consultation process, there are four Telecom Operators with networks in the vicinity of the proposed wind farm that require a detailed technical analysis:

- Enet Network
- Eir Network
- Three Ireland Network
- Virgin Media

Figure 1 below shows a Plan View of each of the four Telecom Operator Networks with respect to the proposed turbines at Ballycar. Network analysis* was carried out on each of the telecom operator networks and is presented below in Sections 1.1 to 1.3. The analysis presented contains the findings of the field surveys, desktop surveys and mitigation measure proposals.

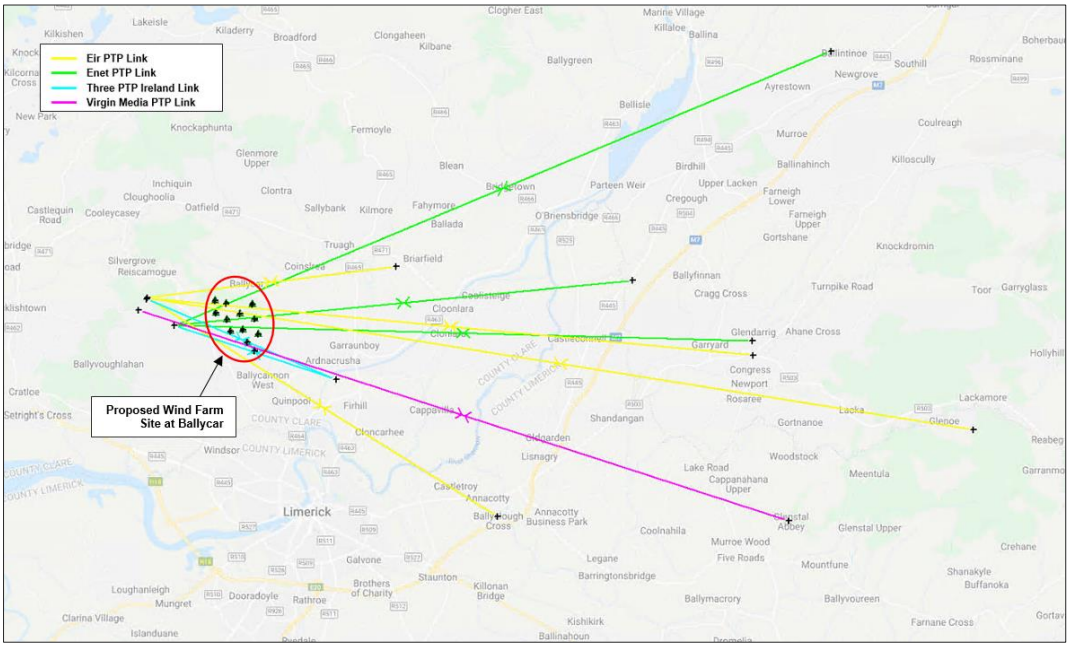


Figure 1. Telecom Operator Networks shown relative to proposed wind farm site

Note 1: The network analysis that follows was carried out based on the 2022 Turbine Layout. The updated Turbine Layout (May 23) has no significant impact on the network analysis findings presented below.

Note 2: Following consultations with the telecom operators, it was deemed that the mitigation measure presented below (i.e. provision of a new relay mast) would not be required, as a radio link re-routing solution could be implemented. The description of the relay mast mitigation measure is included below for reference purposes only.

** The Desktop Survey Analysis findings are subject to accuracy of the information (GPS co-ordinates, turbine dimensions, etc.) provided to Ai Bridges. Clearance calculations have been based on the 2nd Fresnel Zone of the radio links.*

1.1 Enet Network Analysis

The Enet network in the vicinity of the proposed wind farm consists of three Point-to-Point (PTP) microwave radio links. The radio links are listed in the Table below and a Plan view of the Enet network is shown in Figure 2.

Link ID	Operator	Link Description
1	Enet	PTP microwave radio link from Woodcock Hill to Newport College
2	Enet	PTP microwave radio link from Woodcock Hill to Birdhill
3	Enet	PTP microwave radio link from Woodcock Hill to Boher National School

Table 2. Enet Radio Links requiring Analysis

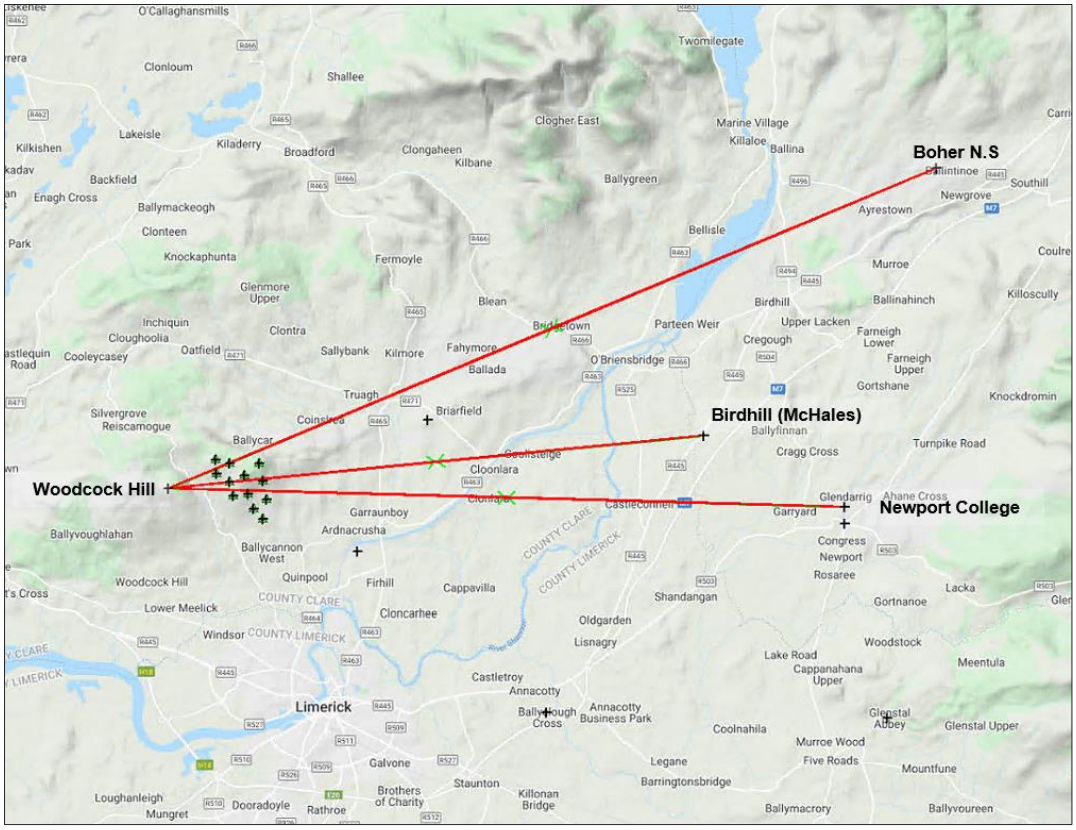


Figure 2. Enet Radio Network – Plan View

In order that the Enet radio network could be modelled as accurately as possible, field surveys of the radio links were carried out. The A-End and B-End of each radio link was surveyed to determine the accuracy of the antenna coordinates, and antenna heights. Photos from the Field Surveys are provided in Section 1.1.1.

Following the Field Survey of the Enet radio links, a desktop survey was carried out to assess which of the Enet radio links could potentially be impacted by the proposed turbines at Ballycar. The Desktop Survey results are provided in Section 1.1.2.

In Section 1.1.3. a mitigation measure solution has been provided to offset the impact of the proposed Ballycar turbines on the Enet radio link network.

1.1.1 Field Survey – Enet Network

In this section the photographs from the Field Survey of the Enet radio link network are provided. The following sites were surveyed:

- Woodcock Hill (Enet Mast)
- Newport College
- Birdhill (McHale Plant Sales Ltd)
- Boher National School

1.1.1.1 Woodcock Hill

A photo of the Telecoms Mast-structure at Woodcock Hill which was taken during the field survey is shown below.

Figure 3. Telecoms Mast at Woodcock Hill (Enet Mast)

1.1.1.2 Newport College

A photo of the PTP radio antenna at Newport College which was taken during the field survey is shown below.

Figure 4. Newport College

1.1.1.3 Birdhill (McHale Plant Sales Ltd)

A photo of the PTP radio antenna at McHale Plant Sales Ltd which was taken during the field survey is shown below.

Figure 5. Birdhill (McHales Plant Sales Ltd)

1.1.1.4 Boher National School

A photo of the PTP radio antenna at Boher National School which was taken during the field survey is shown below.

Figure 6. Boher National School

1.1.2. Desktop Survey – Enet Network

A Plan View (2D) and a 3D View of Enet radio link network relative to the proposed turbines are shown in the figures below. The results indicate that Enet Link 2 and Enet Link 3 are likely to be impacted by the proposed wind farm development.

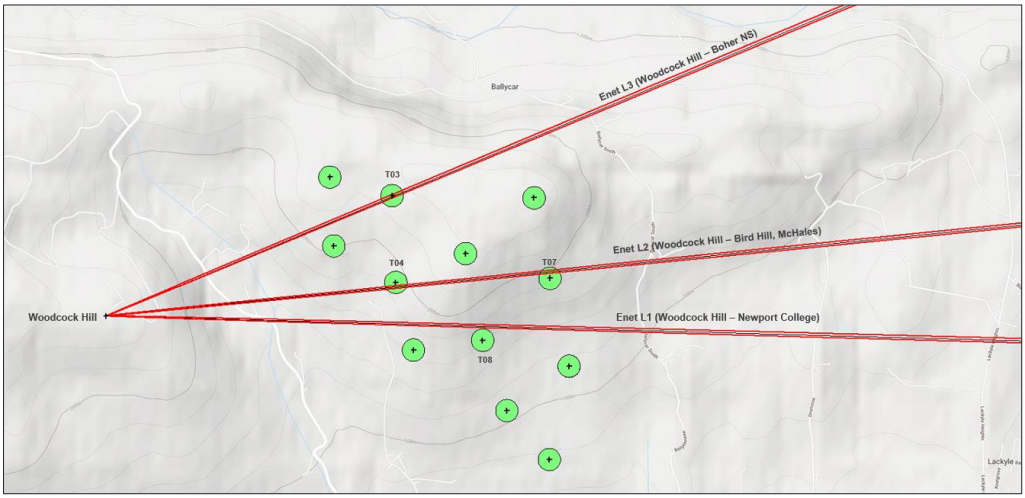


Figure 7. Enet Network - Close-up Plan View

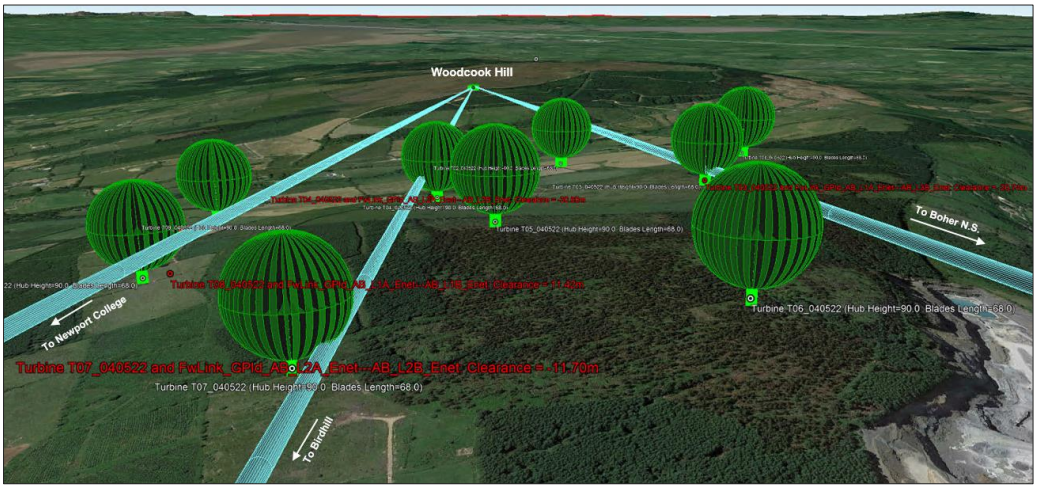


Figure 8. Enet Network – 3D View

Analysis Results:

Table 3 below provides a brief summary of the Network Analysis findings for the Enet network.

Radio Link ID	Nearest Turbine(s)	Clearance\Interference on Radio Link (2nd Fresnel Zone)	Result
Enet L1 (WCH – Newport College)	T08	11.42 m	Clearance
Enet L2 (WCH – Birdhill)	T04	-30.60 m	Interference
	T07	-11.70 m	
Enet L3 (WCH – Boher N.S.)	T03	-20.47 m	Interference

Table 3. Analysis Summary – Enet Network

1.1.3. Mitigation Measure – Enet Network

A relay mast at the location shown in the figure below could be used to offset the possible impact of turbines T03, T04 and T07 on Enet Link 2 and Enet Link 3.

To determine if a relay mast at the proposed location could be used to facilitate viable connections from Woodcock Hill to Birdhill and Boher N.S., radio link path profiles were generated. Radio Link Budgets were also carried out to determine if the proposed radio links would meet the Radio Link Availability Criteria required by ComReg for radio licensing.

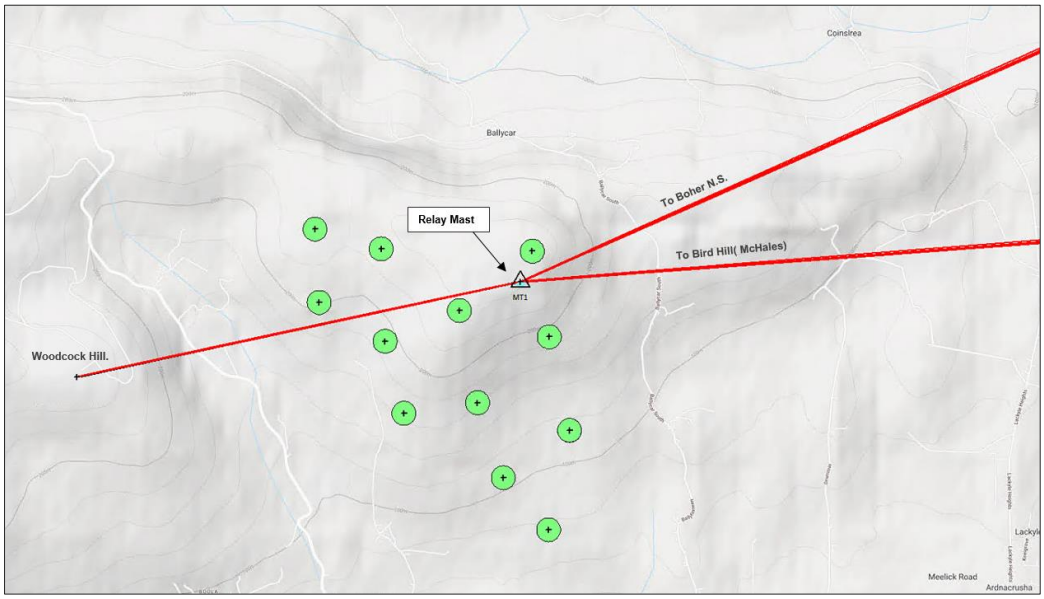


Figure 9. Proposed Relay Mast Location and relay links to Boher N.S and Birdhill

1.1.3.1 Path Profile – Woodcock Hill (Enet Mast) to Proposed Relay Mast

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria.

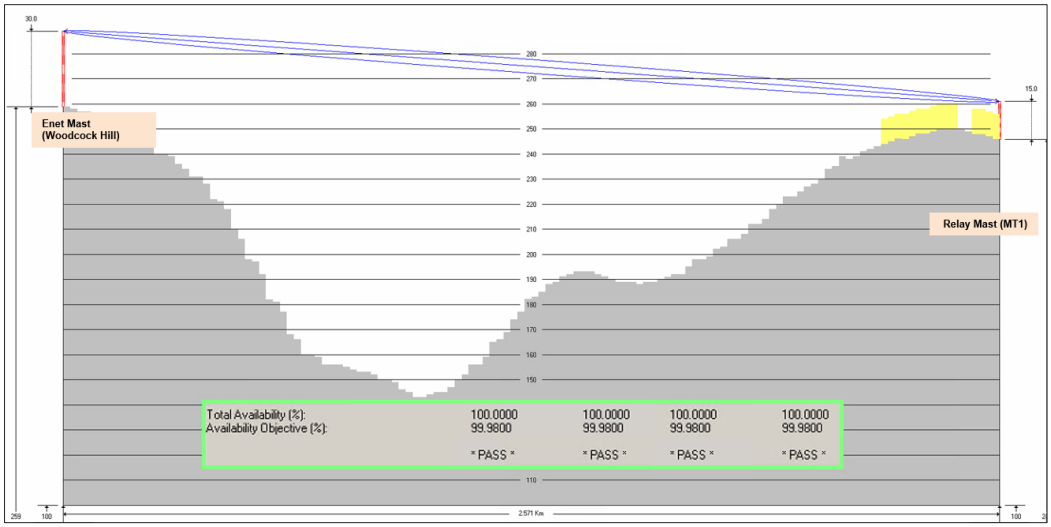


Figure 10. Woodcock Hill – Relay Mast Path Profile

1.1.3.2 Path Profile – Proposed Relay Mast to Birdhill (Enet L2)

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria.

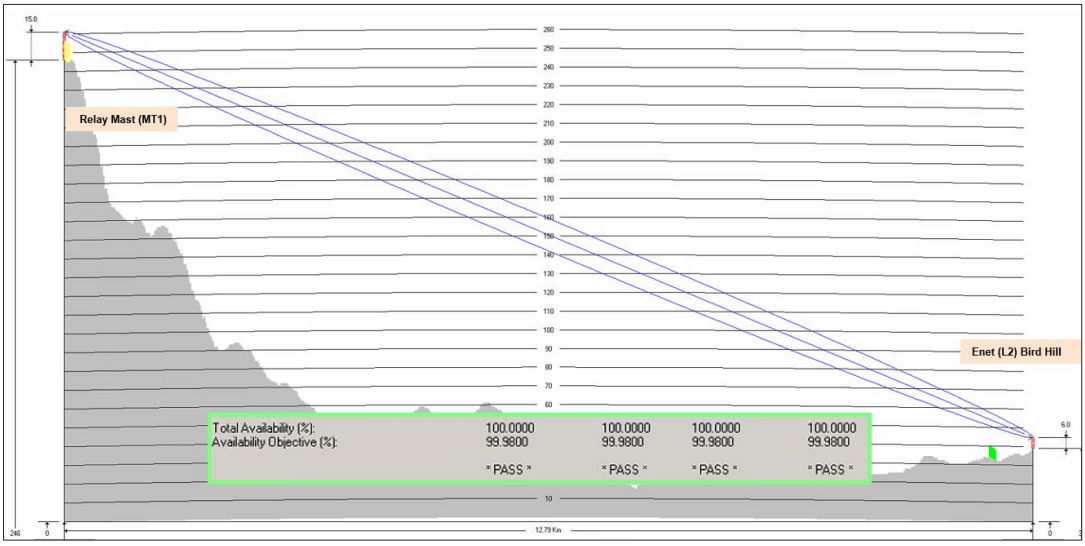


Figure 11. Relay Mast – Birdhill Path Profile

1.1.3.3 Path Profile – Proposed Relay Mast to Boher N.S. (Enet L3)

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria.

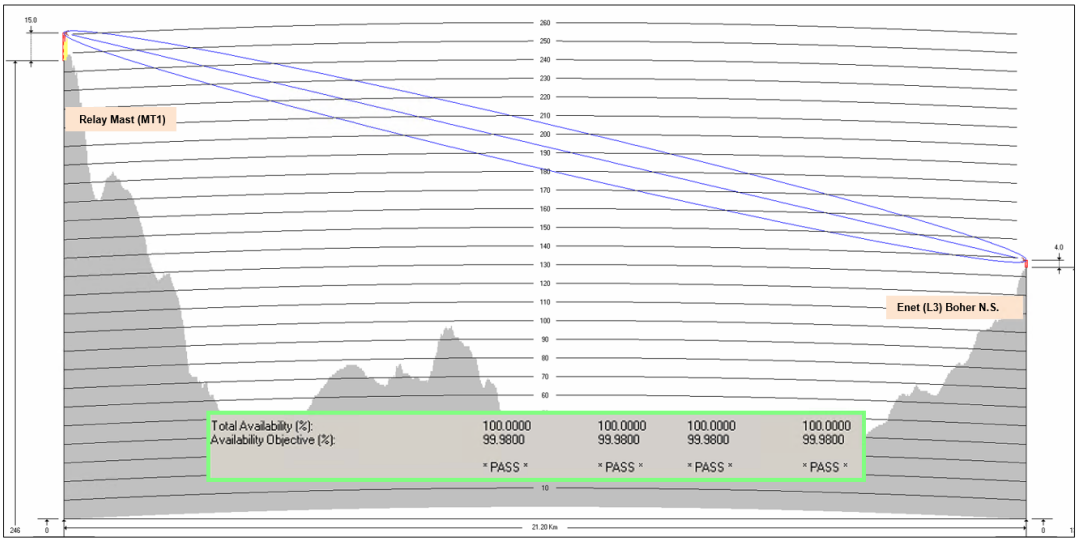


Figure 12. Relay Mast – Boher N.S. Path Profile

Following further engagement with Enet outlined in Section 2.1, it was determined that a relay mast on the site would not be required as impacts on the Enet links could be mitigated by re-routing the radio links via existing operational masts. In addition, the link to Boher N.S has been cancelled.

1.2 Eir Network Analysis

The Eir network in the vicinity of the proposed wind farm consists of four Point-to-Point (PTP) microwave radio link. The radio links are listed in the Table below and a Plan view of the Eir network is shown in Figure 13.

Link ID	Operator	Link Description
1	Eir	PTP microwave radio link from Woodcock Hill to Dromintobin North
2	Eir	PTP microwave radio link from Woodcock Hill to Newport
3	Eir	PTP microwave radio link from Woodcock Hill to Glenoe Newtown
4	Eir	PTP microwave radio link from Woodcock Hill to Woodstown Limerick

Table 4. Eir Radio Links requiring Analysis

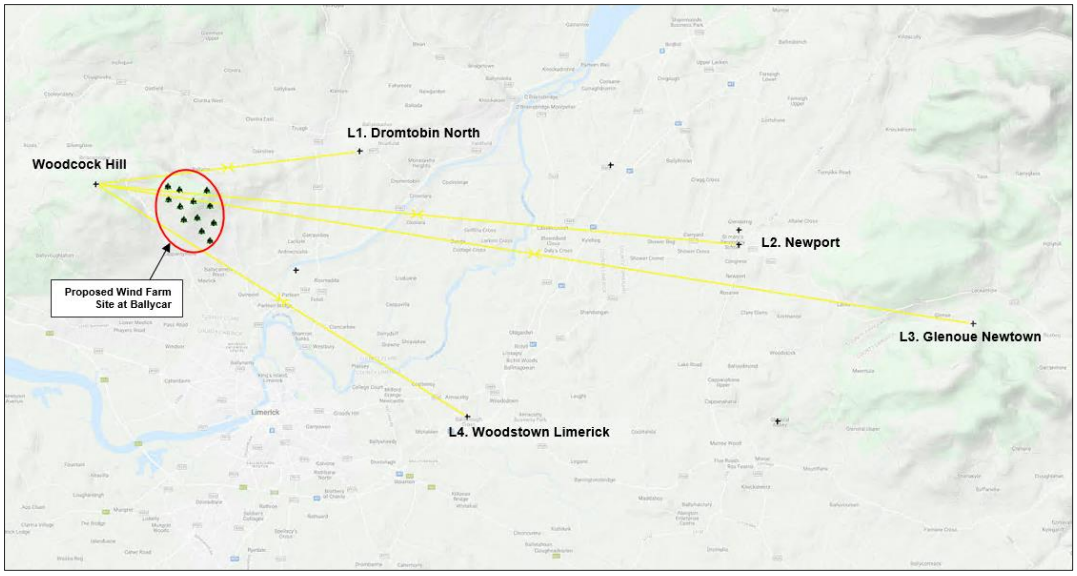


Figure 13. Eir Radio Network – Plan View

In order that the Eir radio network could be modelled as accurately as possible, field surveys of the radio links were carried out. The A-End and B-End of each radio link was surveyed to determine the accuracy of the antenna coordinates, and antenna heights. Photos from the Field Surveys are provided in Section 1.2.1.

Following the Field Survey of the Eir radio links a desktop survey was carried out to assess which of the Eir radio links could potentially be impacted by the proposed turbines at Ballycar. The Desktop Survey results are provided in Section 1.2.2.

In Section 1.2.3. a mitigation measure solution has been provided to offset the impact of the proposed Ballycar turbines on the Eir radio link network.

1.2.1 Field Survey – Eir Network

In this section the photographs from the Field Survey of the Eir radio link network are provided. The following sites were surveyed:

- Woodcock Hill (Eir Mast)
- Dromintobin North
- Newport
- Glenoue Newtown
- Woodstown, Limerick

1.2.1.1 Woodcock Hill

A photo of the Telecoms Mast-structure at Woodcock Hill which was taken during the field survey is shown below.

Figure 14. Telecoms Mast at Woodcock Hill (Eir Mast)

1.2.1.2 Dromintobin North

A photo of the Telecoms Mast-structure at Dromintobin is shown below.

Figure 15. Telecoms Mast at Dromintobin North

1.2.1.3 Newport

A photo of the PTP radio antenna at Newport which was taken during the field survey is shown below.

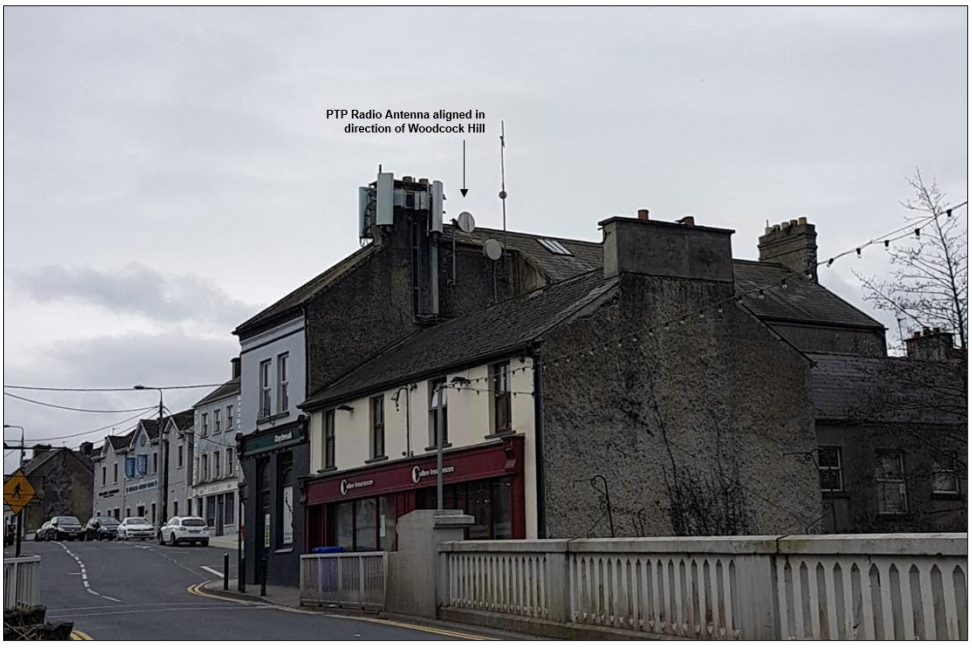


Figure 16. Newport

1.2.1.4 Glenoue Newtown

A photo of the Telecoms Mast-structure at Glenoue Newtown which was taken during the field survey is shown below.

Figure 17. Glenoue Newtown

1.2.1.5 Woodstown, Limerick

A photo of the Telecoms Mast-structure at Woodstown, Limerick is shown below.

Figure 18. Woodstown, Limerick

1.2.2 Desktop Survey – Eir Network

A Plan View (2D) and a 3D View of Eir radio link network relative to the proposed turbines are shown in the figures below. The results indicate that Eir Link 2 and Eir Link 3 are likely to be impacted by the proposed wind farm development.

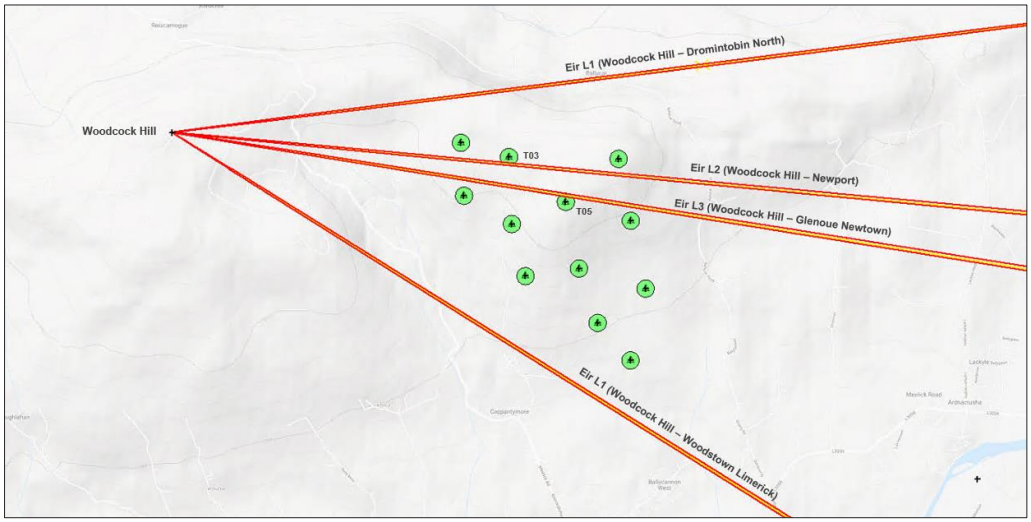


Figure 19. Eir Network - Close-up Plan View

Figure 20. Eir Network – 3D View

Analysis Results:

Table 5 below provides a brief summary of the Network Analysis findings for the Eir network.

Radio Link ID	Nearest Turbine(s)	Clearance\Interference on Radio Link (2nd Fresnel Zone)	Result
Eir L1 (WCH – Dromintobin North)	T01	>30 m	Clearance
Eir L2 (WCH – Newport)	T03	-8.12 m	Interference
Eir L3 (WCH – Glenoue Newtown)	T05	-18.65 m	Interference
Eir L4 (WCH – Woodstown Limerick)	T12	>30 m	Clearance.

Table 5. Analysis Summary – Eir Network

1.2.3 Mitigation Measure – Eir Network

A relay mast at the location shown in the figure below could be used to offset the possible impact of turbines T03, T05 on Eir Link 2 and Eir Link 3.

To determine if a relay mast at the proposed location could be used to facilitate viable connections from Woodcock Hill to Newport and Glenoue Newtown, radio link path profiles were generated. Radio Link Budgets were also carried out to determine if the proposed radio links would meet the Radio Link Availability Criteria required by ComReg for radio licensing.

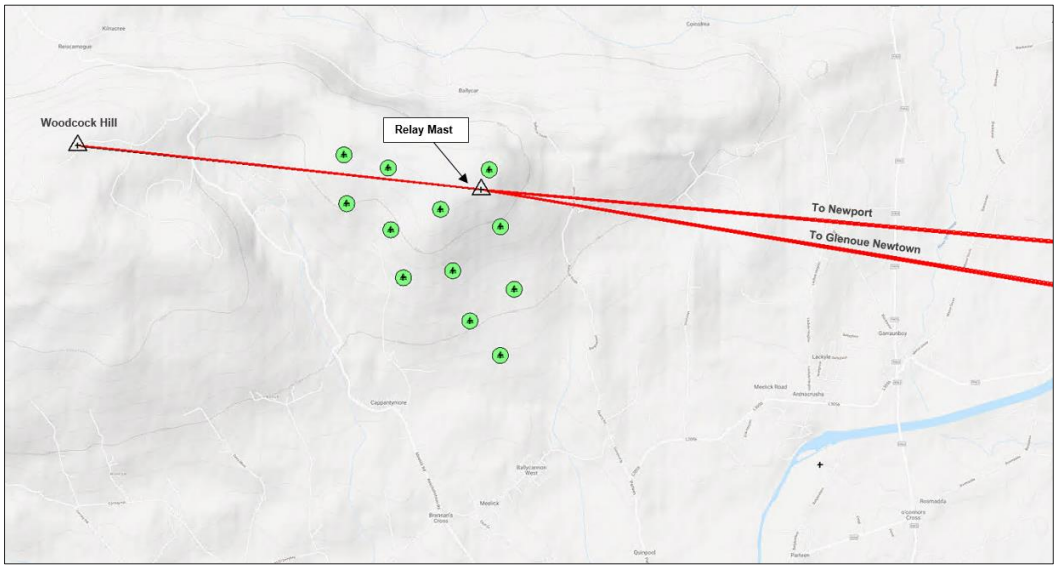


Figure 21. Proposed Relay Mast Location and relay links to Newport and Glenoue Newtown

1.2.3.1 Path Profile – Woodcock Hill (Eir Mast) to Proposed Relay Mast

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria.

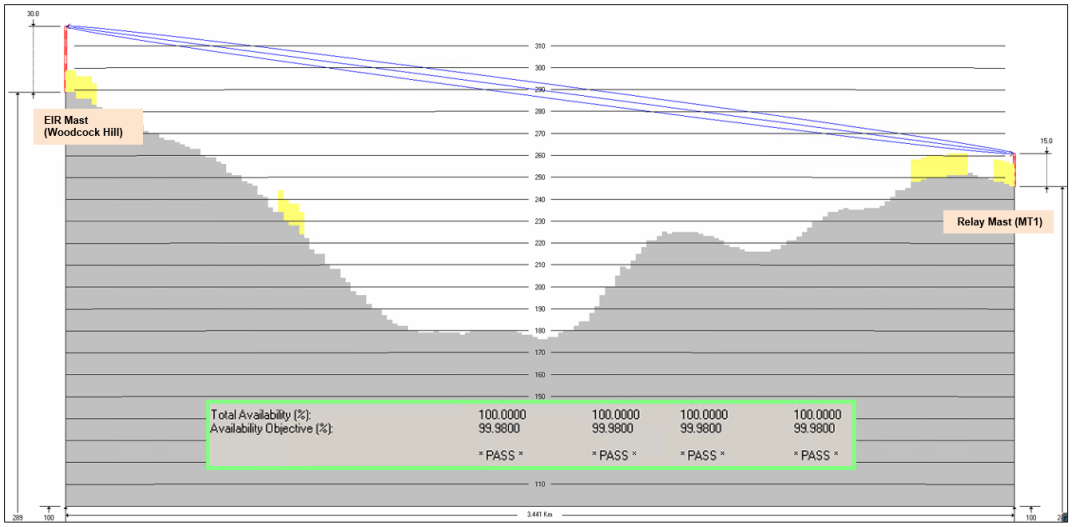


Figure 22. Woodcock Hill – Relay Mast Path Profile

1.2.3.2 Path Profile – Proposed Relay Mast to Newport (Eir L2)

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria.

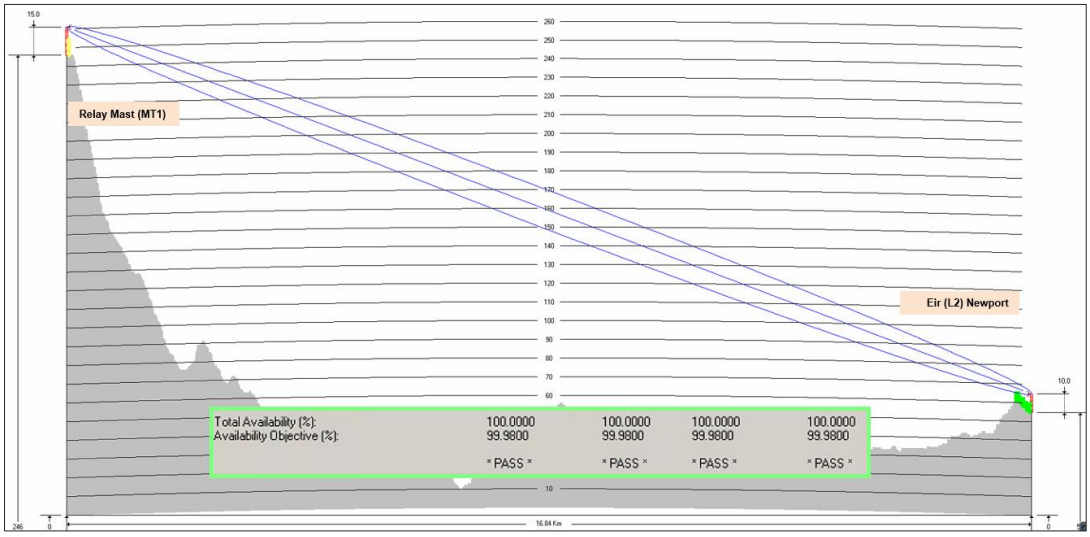


Figure 23. Relay Mast – Newport Path Profile

1.2.3.3 Path Profile – Proposed Relay Mast to Glenoue Newtown (Eir L3)

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria.

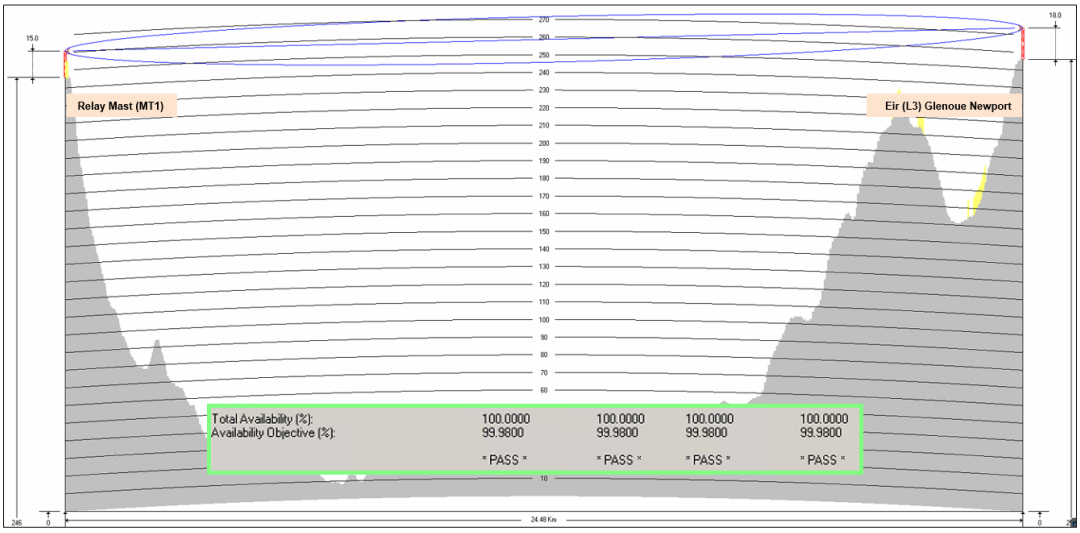


Figure 24. Relay Mast – Glenoue Newtown Path Profile

Following further engagement with Eir outlined in Section 2.2, it was determined that a relay mast on the site would not be required as impacts on the Eir links could be mitigated by re-routing the radio links via existing operational masts. In addition, the link to Newport is redundant.

1.3 Three Ireland Network Analysis

The Three Ireland network in the vicinity of the proposed wind farm consists of two Point-to-Point (PTP) microwave radio links. The radio links are listed in the Table below and a Plan view of the Three Ireland network is shown in Figure 5.

Link ID	Operator	Link Description
1	Three Ireland	PTP microwave radio link from Woodcock Hill Mast #1 to Ardnacrusha
2	Three Ireland	PTP microwave radio link from Woodcock Hill Mast #1 to Ardnacrusha

Table 6. Three Ireland Radio Links requiring Analysis

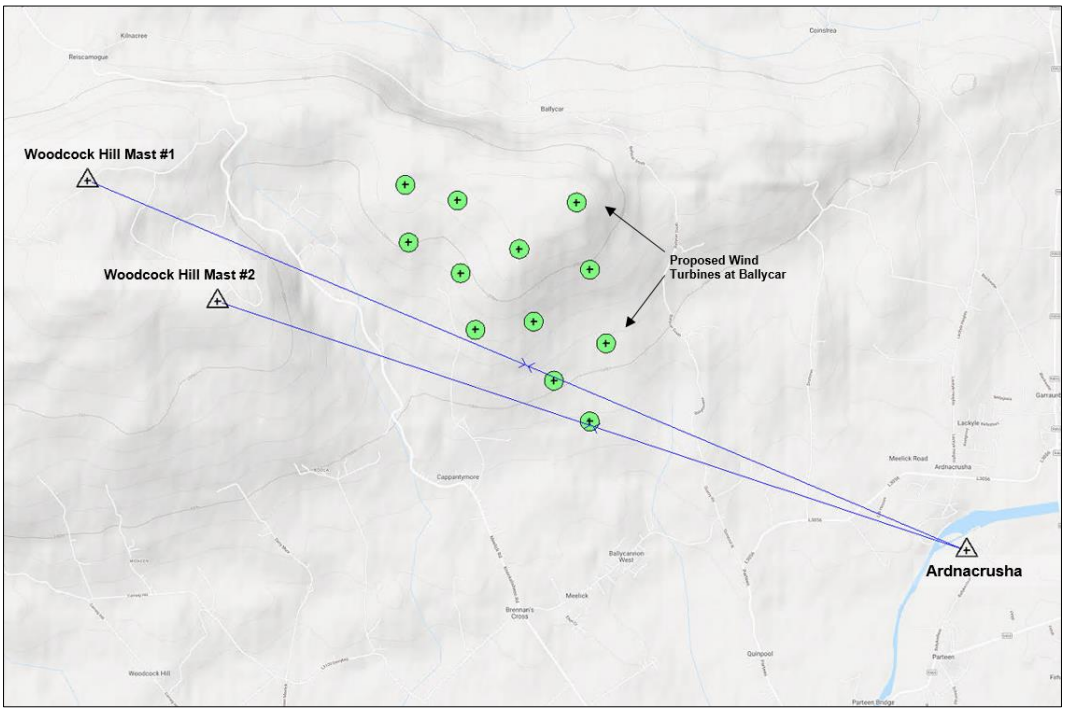


Figure 25. Three Ireland Radio Network – Plan View

In order that the Three Ireland radio network could be modelled as accurately as possible, field surveys of the radio links were carried out. The A-End and B-End of each radio link was surveyed to determine the accuracy of the antenna coordinates, and antenna heights. Photos from the Field Surveys are provided in Section 1.3.1.

Following the Field Survey of the Three Ireland radio links a desktop survey was carried out to assess which of the Three Ireland radio links could potentially be impacted by the proposed turbines at Ballycar. The Desktop Survey results are provided in Section 1.3.2.

In Section 1.3.3. a mitigation measure solution has been provided to offset the impact of the proposed Ballycar turbines on the Three Ireland radio link network.

1.3.1 Field Survey – Three Ireland Network

In this section the photographs from the Field Survey of the Three Ireland radio link network are provided. The following sites were surveyed:

- Woodcock Hill - Mast #1
- Woodcock Hill - Mast #2
- Ardancrusha

1.3.1.1 Woodcock Hill - Mast #1

A photo of Woodcock Hill Mast #1 which was taken during the field survey is shown below.

Figure 26. Telecoms Mast at Woodcock Hill (Mast #1)

1.3.1.2 Woodcock Hill - Mast #2

A photo of the Woodcock Hill Mast #2 which was taken during the field survey is shown below.

Figure 27. Telecoms Mast at Woodcock Hill (Mast #2)

1.3.1.3 Ardacrusha

A photo of the Telecoms Mast-structure at Ardnacrusha which was taken during the field survey is shown below.

Figure 28. Telecoms Mast at Ardnacrusha

1.3.2 Desktop Survey – Three Ireland Network

A Plan View (2D) and a 3D View of Three Ireland radio link network relative to the proposed turbines are shown in the figures below. The results indicate that Three Ireland Link 1 and Link 2 are likely to be impacted by the proposed wind farm development.

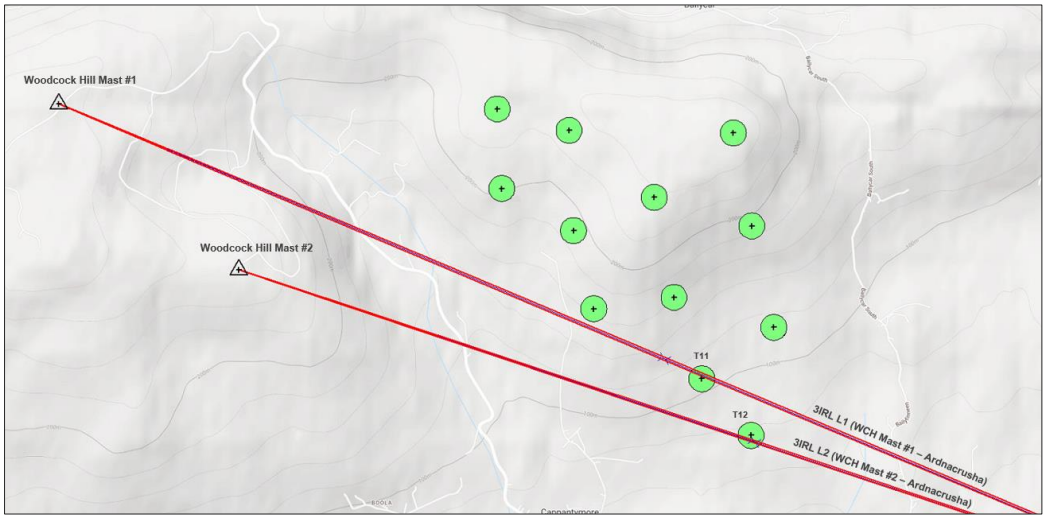


Figure 29.Three Ireland Network - Close-up Plan View

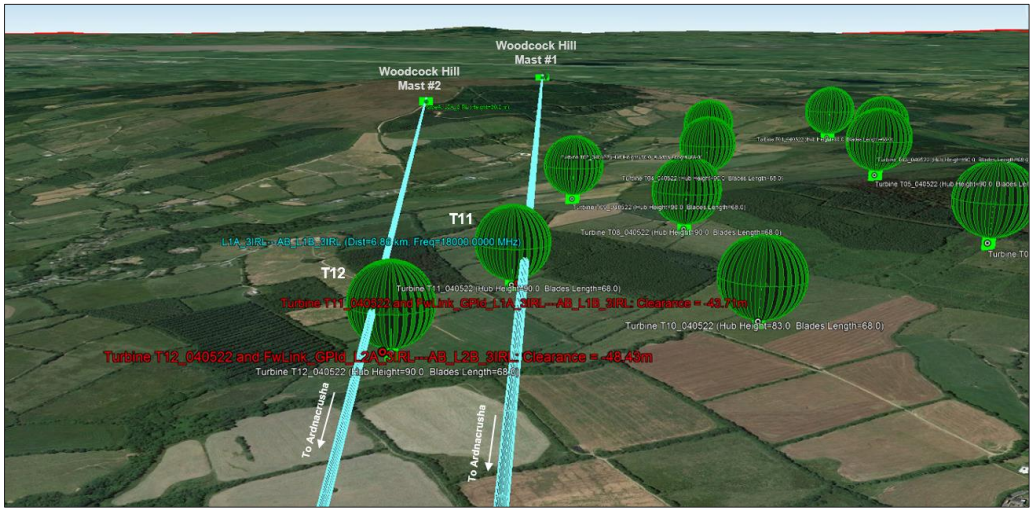


Figure 30. Three Ireland Network – 3D View

Analysis Results:

Table 7 below provides a brief summary of the Network Analysis findings for the Three Ireland network.

Radio Link ID	Nearest Turbine(s)	Clearance\Interference on Radio Link (2nd Fresnel Zone)	Result
Three Ireland L1 (WCH Mast #1 – Ardnacrusha)	T11	-43.71 m	Interference
Three Ireland L2 (WCH Mast #2 – Ardnacrusha)	T03	-48.43 m	Interference

Table 7. Analysis Summary – Three Ireland Network

1.3.3 Mitigation Measure – Three Ireland Network

A relay mast at the location shown in the figure below could be used to offset the possible impact of turbines T11, T12 on Three Ireland Link 1 and Three Ireland Link 2.

To determine if a relay mast at the proposed location could be used to facilitate viable connections from Woodcock Hill Mast #1 and Mast #2 to Ardnacrusha, radio link path profiles were generated. Radio Link Budgets were also carried out to determine if the proposed radio links would meet the Radio Link Availability Criteria required by ComReg for radio licensing.

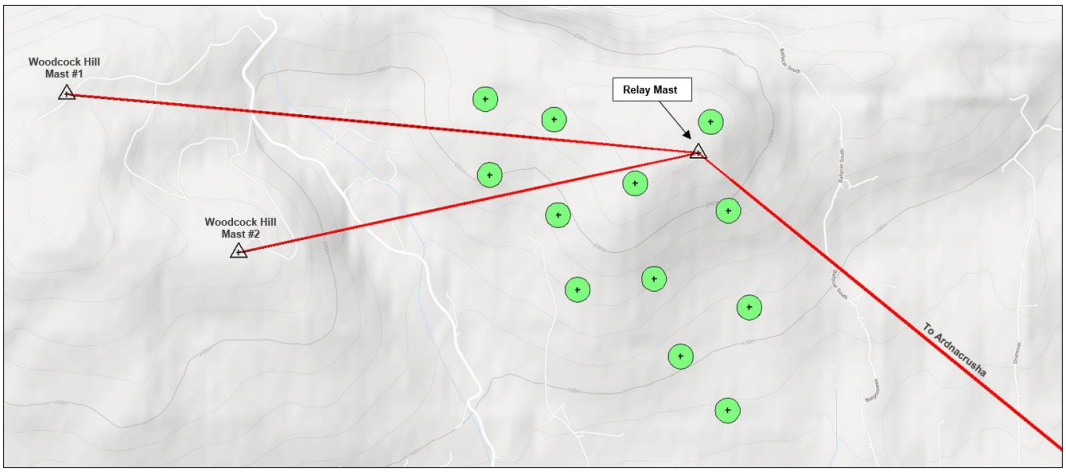


Figure 31. Proposed Relay Mast Location and relay links to Ardnacrusha

1.3.3.1 Path Profile – Woodcock Hill (Mast #1) to Proposed Relay Mast

The radio link Path Profile shows clear LOS and the radio link budget would pass the radio link budget availability criteria.

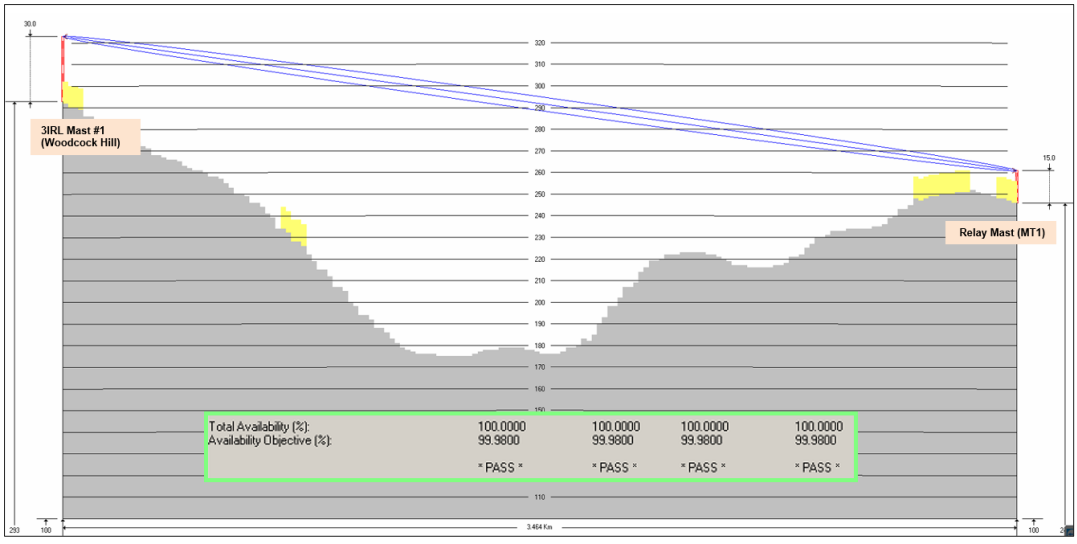


Figure 32. Woodcock Hill Mast #1 – Relay Mast

1.3.3.2 Path Profile – Woodcock Hill (Mast #2) to Proposed Relay Mast

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria.

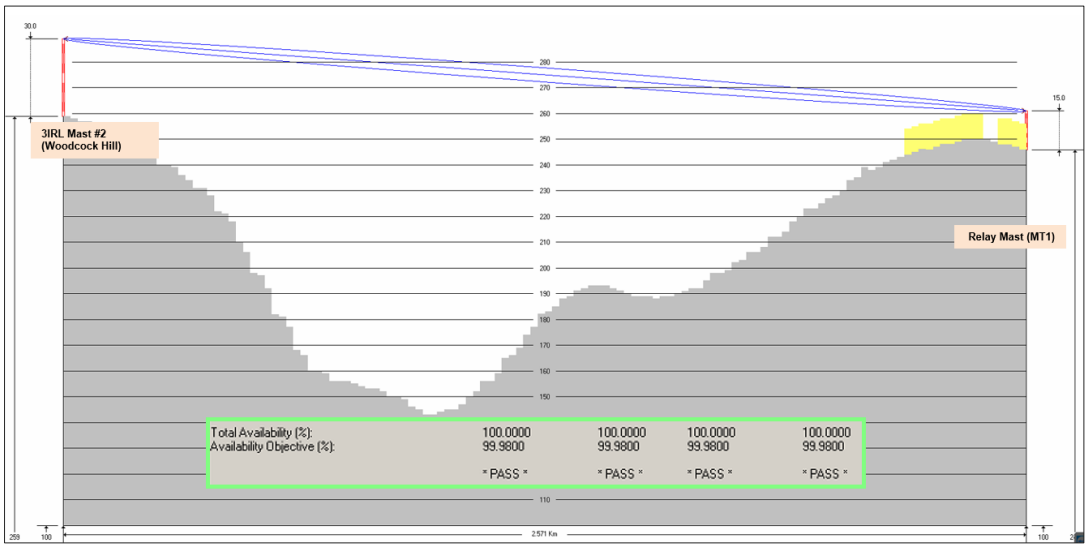


Figure 33. Woodcock Hill Mast #2 – Relay Mast

1.3.3.3 Path Profile – Proposed Relay Mast to Ardnacrusha

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria.

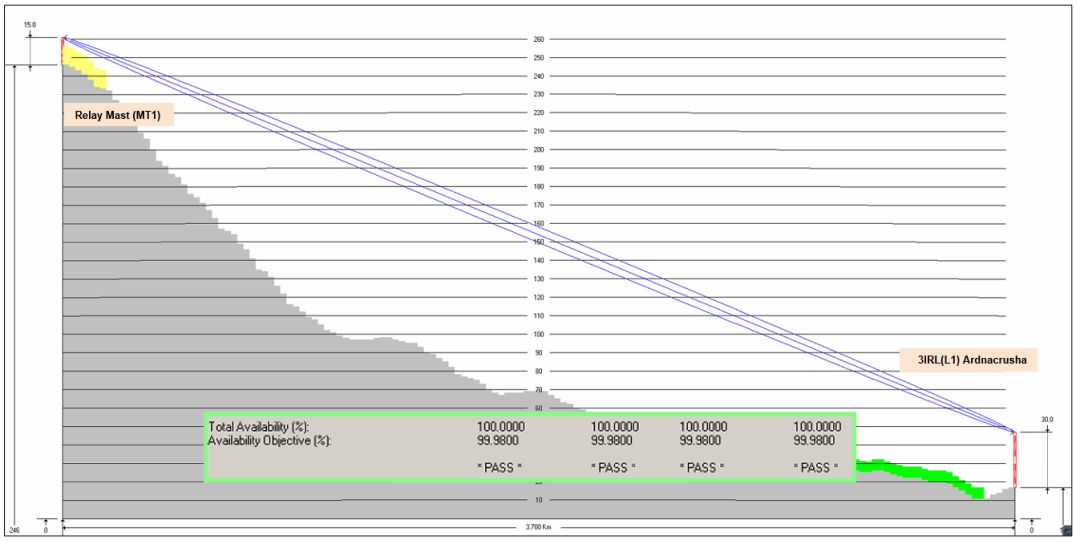


Figure 34. Relay Mast - Ardnacrusha

Following further engagement with Three Ireland outlined in Section 2.3, it was determined that a relay mast on the site would not be required as impacts on the Three Ireland links could be mitigated by re-routing the radio links via existing operational masts.

1.4 Virgin Media Network Analysis

The Virgin Media network in the vicinity of the proposed wind farm consists of one Point-to-Point (PTP) microwave radio link. The radio link is listed in the Table below and a Plan view of the Virgin Media network is shown in Figure 35.

Link ID	Operator	Link Description
1	Virgin Media	PTP microwave radio link from Woodcock Hill to Glenstall

Table 8. Virgin Media Radio Links requiring Analysis

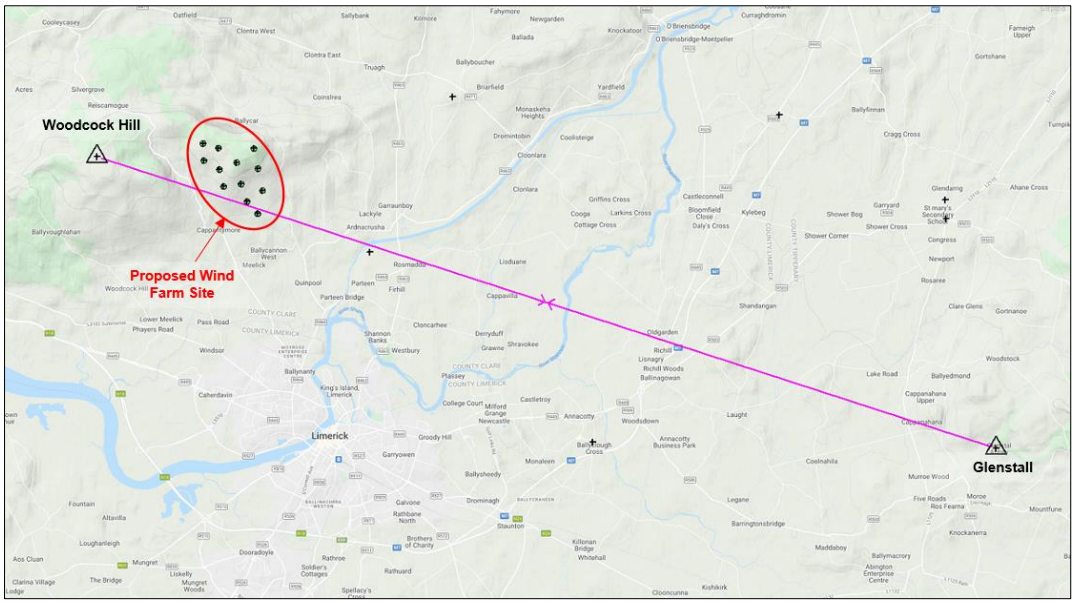


Figure 35. Virgin Media Radio Network – Plan View

In order that the Virgin Media radio network could be modelled as accurately as possible, field surveys of the radio link(s) were carried out. The A-End and B-End of each radio link was surveyed to determine the accuracy of the antenna coordinates, and antenna heights. Photos from the Field Surveys are provided in Section 1.4.1.

Following the Field Survey of the Virgin Media radio link, a desktop survey was carried out to assess if the radio link could potentially be impacted by the proposed turbines at Ballycar. The Desktop Survey results are provided in Section 1.4.2.

1.4.1 Field Survey – Virgin Media Network

In this section the photographs from the Field Survey of the Virgin Media radio link network are provided. The following sites were surveyed:

- Woodcock Hill
- Glenstall

1.4.1.1 Woodcock Hill

A photo of the Telecoms Mast-structure at Woodcock Hill which was taken during the field survey is shown below.

Figure 36. Telecoms Mast at Woodcock Hill

1.4.1.2 Glenstall

A photo of the PTP radio antenna at Glenstall which was taken during the field survey is shown below.

Figure 37. Glenstall

1.4.2 Desktop Survey – Virgin Media Network

A Plan View (2D) and a 3D View of Virgin Media radio link network relative to the proposed turbines are shown in the figures below. The results indicate that the Virgin Media network will not be impacted by the proposed wind farm development.

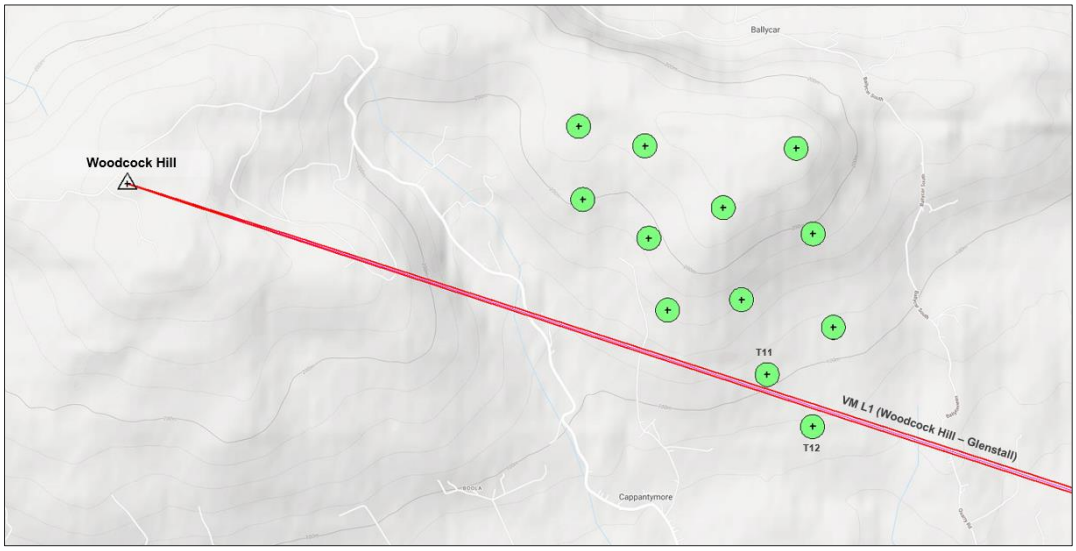


Figure 38. Virgin Media Network - Close-up Plan View

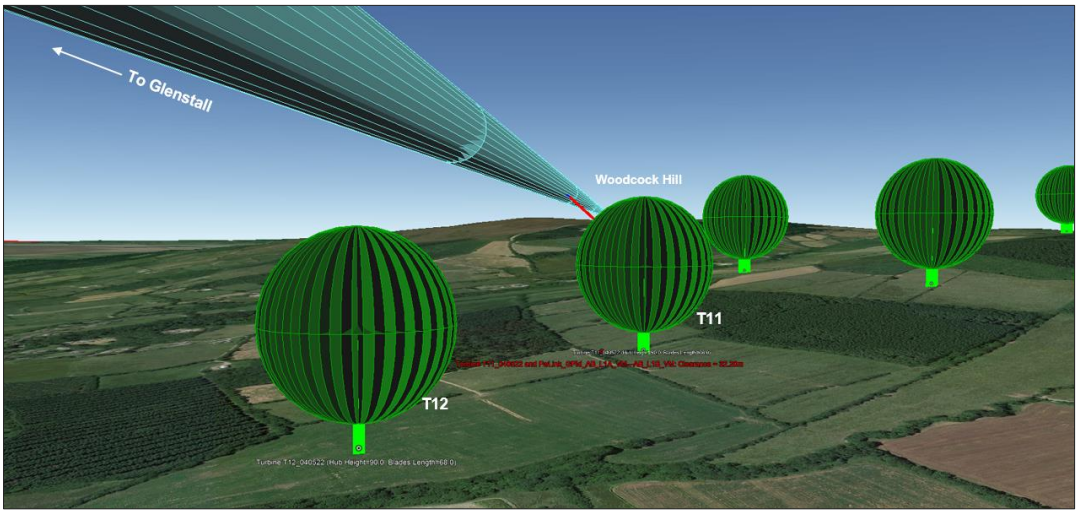


Figure 39. Virgin Media Network – 3D View

Analysis Results:

Table 9 below provides a brief summary of the Network Analysis findings for the Three Ireland network.

Radio Link ID	Nearest Turbine(s)	Clearance\Interference on Radio Link (2nd Fresnel Zone)	Result
Virgin Media L1 (WCH – Glenstall)	T11	32.20 m	Clearance.

Table 9. Analysis Summary – Virgin Media Network

1.4.3 Mitigation Measure – Virgin Media Network

As the Virgin Media radio network will not be impacted by the proposed wind farm development, no mitigation measures are required for Virgin Media.

Section 2 - Telecom Operator Consultations

2. Introduction

In this section the consultations undertaken with each of the impacted Telecom Operators are provided (i.e. the consultations with Enet, Eir and Three Ireland).

2.1 Enet Consultations

The consultations between AiBridges Ltd and Enet are provided below. The EMI Network Analysis findings (presented in Section 1.1 of this report) were provided to, and discussed with Enet during the course of the consultation process.

04.08.22 Ai Bridges Ltd Email to Enet

Peter,

We have completed a detailed Telecommunications Impact Assessment for the proposed Wind Farm development at Ballycar, Co Clare as requested by the wind farm developer.

The results of our radio link analysis indicate that two of the radio links that you have identified will potentially be impacted by turbines in the proposed development. The two radio links are highlighted in red in the table below (i.e. Woodcock Hill – Bird Hill and Woodcock Hill – Boher N.S.).

Radio Link ID	Nearest Turbine(s)	Clearance\Interference on Radio Link (2nd Fresnel Zone)	Result
Enet L1 (WCH – Newport College)	T08	11.42 m	Clearance
Enet L2 (WCH – Birdhill)	T04	-30.60 m	Interference
	T07	-11.70 m	
Enet L3 (WCH – Boher N.S.)	T03	-20.47 m	Interference

As the proposed development is designated with Strategic Infrastructure Development (SID) status, the developer has requested us to propose a suitable mitigation measure to offset the potential impact on your existing telecommunication infrastructure. We have carried out a detailed Radio Planning Analysis, the results of which show that a telecoms mast at the location shown in the figure below could be used as a relay for both of your impacted radio links.

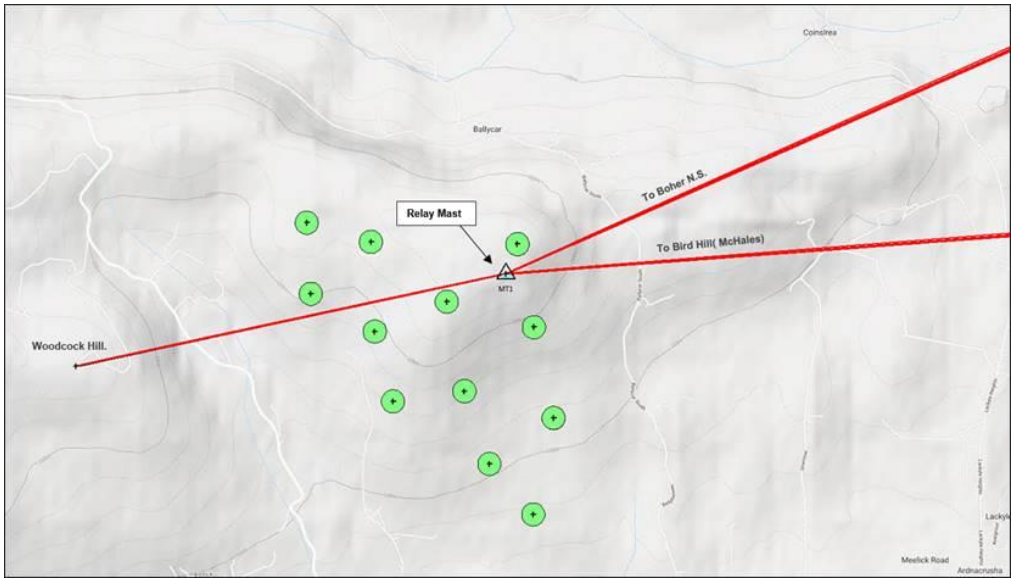
For your reference this mitigation measure has been previously accepted and adopted by Licensed Telecom and Mobile Operators on previous wind farm developments. We are recommending that all mitigation measure costs would be borne by the developer and should the Planning Application for the wind farm be successful, it is expected that turbines would be erected within a 3-5 year timeframe.

We have conducted a due-diligence field survey and also completed Path Profiles and Radio Link Budgets to ensure that the proposed relay links would pass the 99.99% availability criteria required by ComReg for licensed radio links. For your reference, we have attached an extract from our Telecoms Impact Assessment Report relating to the Enet Telecommunications Infrastructure. This report extract contains all Radio Link Path Profiles, Radio Link Budgets which are based on the following ITU-R Recommendations.

- ITU-R P.525-2
- ITU-R P.526-11
- ITU-R P.676-8

We would be grateful if you could review the details contained in this email and let us know if you would be available for an initial call to discuss our Telecoms Impact Assessment and Mitigation Measure Proposal

We look forward to hearing from you.



Best Regards,
Kevin Hayes,

Ai Bridges Ltd.,
...Total Communications Solutions...
UNIT 9, BLOCK B,
Quin Rd. Business Park,
Ennis, Co. Clare,
Ireland.

08.08.22 Enet response to AiBridges Ltd

"Hi Kevin,

I think a more straight forward solution would be for a link re-route to another high site tower,
For the Birdhill link I was thinking we could re-route to ESB Tountina (existing Enet used tower) if LOS was confirmed,
The Boher N.S. link is still in planning and hasn't been built yet, but if we resurveyed here I think LOS might be possible to RTE Kilduff (Existing Enet used tower),
My manager John Byrne is on annual leave but he will be able to provide costs for this when he gets back, but either way it will be a much cheaper and easier solution than a new tower,

Regards,

Peter O`Brien
Licensed Link planner
enet Open Access Networks Connectivity Everywhere"

08.08.22 Ai Bridges Ltd response to Enet

Hello Peter,

Thank you for the prompt response

As our Engineering Team will have site details for both RTE and ESB sites they will carry out a desktop radio profile and revert to you with indicative link budgets and radio path profiles. They can also conduct a ground survey of both relay towers for availability and take a photomontage of the mast legs on the correct bearing.

We would propose a mitigation measure plan and cost analysis and submit for your review based on industry standard carrier grade equipment and service costs.

Best Regards,
Kevin Hayes,

08.08.22 Enet response to AiBridges Ltd

"Hi Kevin,

I just found out the Boher N.S. link has been cancelled in delivery so this is one less link to worry about,

Regards,
Peter"

2.2 Eir Consultations

The consultations between AiBridges Ltd and Eir are provided below. The EMI Network Analysis findings (presented in Section 1.2 of this report) were provided to, and discussed with Eir during the course of the consultation process.

04.08.22 Ai Bridges Ltd email to Eir

John,

We have completed a detailed Telecommunications Impact Assessment for the proposed Wind Farm development at Ballycar, Co Clare as requested by the wind farm developer.

The results of our radio link analysis indicate that two of the radio links that you have identified will potentially be impacted by turbines in the proposed development. The two radio links are highlighted in red in the table below (i.e. Woodcock Hill – Newport and Woodcock Hill – Glenoue Newtown).

Radio Link ID	Nearest Turbine(s)	Clearance\Interference on Radio Link (2nd Fresnel Zone)	Result
Eir L1 (WCH – Dromintobin North)	T01	>30 m	Clearance
Eir L2 (WCH – Newport)	T03	-8.12 m	Interference
Eir L3 (WCH – Glenoue Newtown)	T05	-18.65 m	Interference
Eir L4 (WCH – Woodstown Limerick)	T12	>30 m	Clearance.

As the proposed development is designated with Strategic Infrastructure Development (SID) status, the developer has requested us to propose a suitable mitigation measure to offset the potential impact on your existing telecommunication infrastructure. We have carried out a detailed Radio Planning Analysis, the results of which show that a telecoms mast at the location shown in the figure below could be used as a relay for both of your impacted radio links.

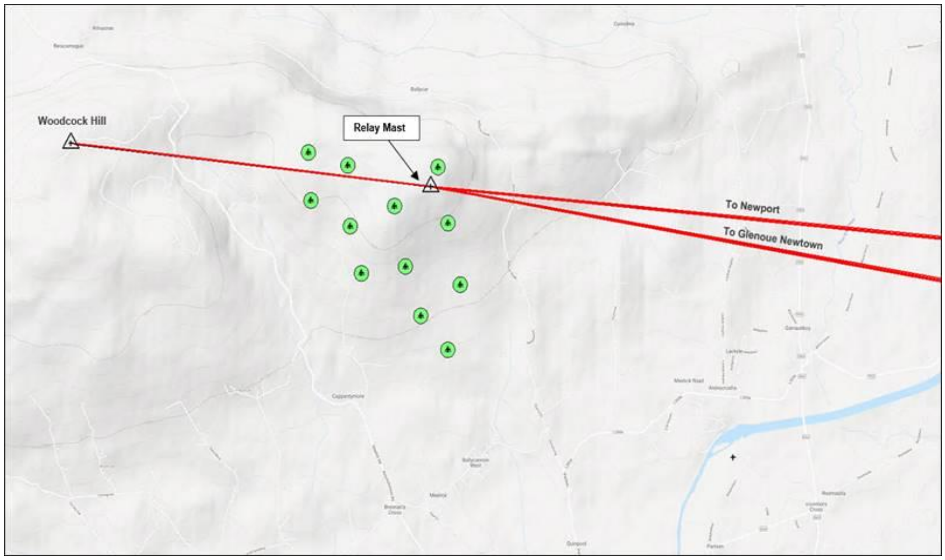
For your reference this mitigation measure has been previously accepted and adopted by Licensed Telecom and Mobile Operators on previous wind farm developments. We are recommending that all mitigation measure costs would be borne by the developer and should the Planning Application for the wind farm be successful, it is expected that turbines would be constructed within a 3-5 year timeframe.

We have conducted a due-diligence field survey and also completed Path Profiles and Radio Link Budgets to ensure that the proposed relay links would pass the 99.99% availability criteria required by ComReg for licensed radio links. For your reference, we have attached an extract from our Telecoms Impact Assessment Report relating to the Eir Telecommunications Infrastructure. This report extract contains all Radio Link Path Profiles, Radio Link Budgets which are based on the following ITU-R Recommendations.

- ITU-R P.525-2
- ITU-R P.526-11
- ITU-R P.676-8

We would be grateful if you could review the details contained in this email and let us know if you would be available for an initial call to discuss our Telecoms Impact Assessment and Mitigation Measure Proposal

We look forward to hearing from you.



Best Regards,
Kevin Hayes,

Ai Bridges Ltd.,
...Total Communications Solutions...
UNIT 9, BLOCK B,
Quin Rd. Business Park,
Ennis, Co. Clare,
Ireland.

12.08.22 Eir response to AiBridges Ltd

"Hi Kevin,

Our Newport link is now redundant due to a recent fibre delivery to a site behind so you can eliminate that link.
The Glenoue Newtown link for TY_4893 we would prefer not to add the extra failure point of a repeater site could T5 be relocated slightly.

Kind regards,
John"

04.08.22 Ai Bridges Ltd response to Eir

Hello John,

I am just following up from your email below.

The turbine locations have been finalised due to other constraints and set back buffers from residential properties and micro-siting of turbines is not possible for this project.

We have also been engaging with other mobile operators and we have managed to agree an alternative option for mitigation for their impacted links.

We have revised our mitigation measure proposal report with an additional option as agreed with other operators, please find attached. There are two options with the first option involving the

construction of a relay mast within the site boundary of the wind farm which is not viable now given other constraints. Our engineers have also included a second option where our engineers have provisionally selected an "alternative" Eir relay mast (known to our engineers as part of a previous consultation) and demonstrated radio line of sight from this site (i.e. Roches St selected for demonstration purposes only) to Woodcock Hill to both Newport\Glenoue Newtown and have included radio path profile and link budget reports.

Would you be able to review our proposed mitigation measures to see if the second option would be viable.

Based on previous projects we had anticipated per links costs of circa €9K - €11K and other mobile operators have indicated replacement links hardware and installation costs of circa €10K.

I would be available for a call\teams meeting early next week and I can also look to see if I can be in Dublin for the early part of next week for a meeting pending your availability.

Best Regards,
Kevin Hayes,

07.09.22 Ai Bridges Ltd response to Eir

Hello John,

I am just following up on our email below.

I would be grateful if you had some availability to briefly to discuss our proposed mitigation measure?

Best Regards,
Kevin Hayes,

09.09.22 Eir response to AiBridges Ltd

"Hi Kevin,

Apologies for the delay in getting back to you. We are checking the viability of fibre reaching our site to avoid a microwave reroute being needed. Once I find out I let you know?

Regards,
John Bagnall
Transmission Design & Engineering

eir "

14.09.22 Ai Bridges Ltd response to Eir

Hello John,

Thank you for your email response. Would you be available for a brief call this afternoon or sometime later this week to discuss.

Our customer is looking to close out all chapters in their Planning Application Submission
We are suggesting a covering letter (as we have done for other mobile operators) stating that the wind farm developer would cover the cost of mitigation measures i.e. for replacement radio links and with an option for fibre links . Would it be possible that a alternative radio link path network could ask as redundancy of a fibre link i.e. if a fibre path were to become available ?
Bearing in mind that should the wind farm application be granted it may be 3 – 4 years before construction works would commence.

Best Regards,
Kevin Hayes,

16.09.22 Eir response to AiBridges Ltd

"Hi Kevin,

I found out fibre won't be an option here, so a new link would be the on option if needed. I can make a call today or Monday if it suits you to discuss.

Kind regards,
John Bagnall "

21.09.22 Eir response to AiBridges Ltd

"Hi Kevin,

Eir are open to agreeing the rerouting our site TY_2486 Cullens Newport on a single HOP link to another Eir site avoiding the windfarm, we would be looking for verification that the costs associated with providing equipment, licencing, engineering and installing the link will be cover to €12,000. All to be conducted prior to the wind farms installation.

Kind regards,
John Bagnall "

21.09.22 Ai Bridges Ltd response to Eir

Hello John,

Just to confirm that

1. The wind farm developer would cover the mitigation measure costs of €12,000
2. The link re-route and build-out would take place in advance of the construction and operation of the wind farm.

Thank you for your co-operation on this and I would be grateful if you could confirm Eir acceptance of the above mitigation measure proposal.

Best Regards,
Kevin Hayes,

22.09.22 Eir response to AiBridges Ltd

"Hi Kevin,

Yes, Eir can confirm we agree to the below conditions.

1. *The wind farm developer would cover the mitigation measure costs of €12,000*
2. *The link re-route and build-out would take place in advance of the construction and operation of the wind farm.*

Regards,
John Bagnall "

2.3 Three Ireland Consultations

The consultations between AiBridges Ltd and Three Ireland are provided below. The EMI Network Analysis findings (presented in Section 1.3 of this report) were provided to, and discussed with Three Ireland during the course of the consultation process.

04.08.22 Ai Bridges Ltd Email to Three Ireland

Alister,

We have completed a detailed Telecommunications Impact Assessment for the proposed Wind Farm development at Ballycar, Co Clare as requested by the wind farm developer.

The results of our radio link analysis indicate that two of the radio links that you have identified will potentially be impacted by turbines in the proposed development. The two radio links are highlighted in red in the table below (i.e. Woodcock Hill Mast #1 – Ardnacrusha and Woodcock Hill Mast #2 – Ardnacrusha).

Radio Link ID	Nearest Turbine(s)	Clearance\Interference on Radio Link (2nd Fresnel Zone)	Result
Three Ireland L1 (WCH Mast #1 – Ardnacrusha)	T11	-43.71 m	Interference
Three Ireland L2 (WCH Mast #2 – Ardnacrusha)	T03	-48.43 m	Interference

As the proposed development is designated with Strategic Infrastructure Development (SID) status, the developer has requested us to propose a suitable mitigation measure to offset the potential impact on your existing telecommunication infrastructure. We have carried out a detailed Radio Planning Analysis, the results of which show that a telecoms mast at the location shown in the figure below could be used as a relay for both of your impacted radio links.

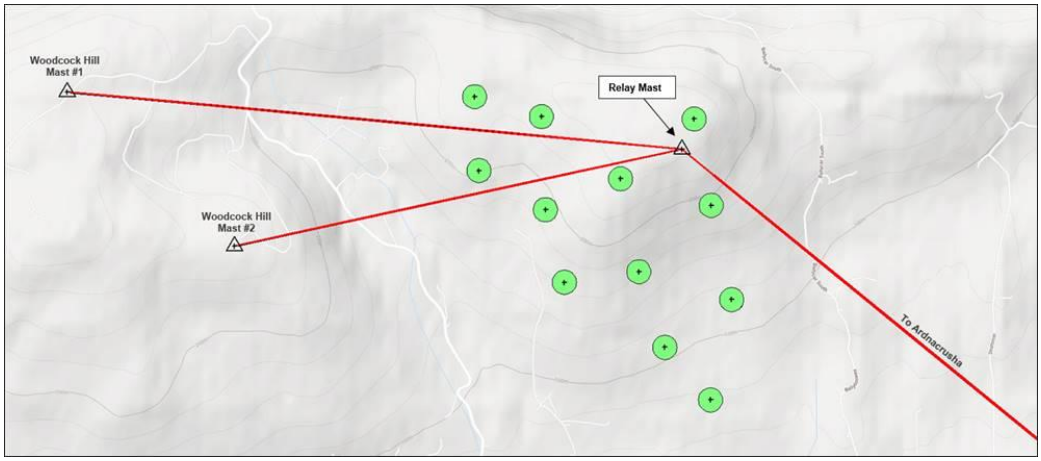
For your reference this mitigation measure has been previously accepted and adopted by Licensed Telecom and Mobile Operators on previous wind farm developments. We are recommending that all mitigation measure costs would be borne by the developer and should the Planning Application for the wind farm be successful, it is expected that turbines would be erected within a 3-5 year timeframe.

We have conducted a due-diligence field survey and also completed Path Profiles and Radio Link Budgets to ensure that the proposed relay links would pass the 99.99% availability criteria required by ComReg for licensed radio links. For your reference, we have attached an extract from our Telecoms Impact Assessment Report relating to the Three Ireland Telecommunications Infrastructure. This report extract contains all Radio Link Path Profiles, Radio Link Budgets which are based on the following ITU-R Recommendations.

- ITU-R P.525-2
- ITU-R P.526-11
- ITU-R P.676-8

We would be grateful if you could review the details contained in this email and let us know if you would be available for an initial call to discuss our Telecoms Impact Assessment and Mitigation Measure Proposal

We look forward to hearing from you.



Best Regards,
Kevin Hayes,

Ai Bridges Ltd.,
...Total Communications Solutions...
UNIT 9, BLOCK B,
Quin Rd. Business Park,
Ennis, Co. Clare,
Ireland.

01.09.22 Three Ireland response to AiBridges Ltd

"Hi Kevin,

My name is John McGrane and I'm the Transmission Manager at Three Ireland.

We have reviewed your proposal below and for a variety of reasons, we do not consider a relay site as a suitable alternative. This solution increases the number of hops to fibre, is more vulnerable to hardware failures, requires the build of a new mast, requires power, maintenance and access for in life management of the solution and finally halves the available capacity with both sites served by a single radio link.

Instead, we have come up with a far cheaper and simpler alternative. We can replace both radio links and re-route them to different fibre sites on our network instead.

Typical cost for this would be approximately €10k per radio link or €20k in total which includes the hardware and services costs involved.

I'm available for a meeting to discuss in more detail if that suits. I'm available early next week and can set up a Teams meeting if that would work.

Many thanks,

John

Three.ie

John McGrane
Transmission Manager "

Sent: *10 August 2022 11:20*

Hi Alister and John,

Dave and I had a look at this and to avoid an extra hop to fibre with a relay mast:
For CE0158, the option would be to upgrade the link to Drumline ESB CE0140 or the link to Shannon Airport CE0128 and migrate the traffic from Ardnacrusha. The BT fibre for Shannon Airport would have to be upgraded to 10Gb.
For CE0163, the option would be to reroute this link to Johnston Logistics LK0024.

Kind regards
Hayley

Sent: *10 August 2022 11:20*

Hi Hayley/Dave,

Could you please review the attached proposal to re-route 2 links from Ardnacrusha to Woodcock Hill (2 sites). They are proposing a re-route via a new tower.

Cheers,

Alister

Alister Cole
Transmission Engineer"

01.09.22 AiBridges Ltd response to Three Ireland

Hello John

Thank you for your email. We had a meeting with the client yesterday in relation to impacts on other telecoms networks

We have agreed a mitigation measure proposal along the same lines of what you have proposed below.

We have completed a mitigation measure proposal report also for the impacts on the Three Ireland network , please find attached. There are two options with the first option involving the construction of a relay mast within the site boundary of the wind farm which is not viable now given other third-party constraints. Our engineers have also included a second option where our engineers have provisionally selected another "potential" Three Ireland alternative relay mast (known to our engineers as part of another consultation) and demonstrated radio line of sight from this site (Strand Hotel, Limerick City to both Woocdock Hill and Ardnacrusha and have included radio path profile and link budget reports. This is a reference which we have used as part a previous project.

Based on previous projects we had anticipated per links costs of circa €9K - €11K which is in line with what you have proposed below.

I would be available for a call early next week and I can also look to see if I can be in Dublin for the early part of next week

Best Regards,
Kevin Hayes,

07.09.22 AiBridges Ltd response to Three Ireland

Hello John,

Apologies for the delay in getting back to you
Would you be available for a call at some point tomorrow or Friday ?

Best Regards,
Kevin Hayes,

07.09.22 Three Ireland response to AiBridges Ltd

"Hi Kevin,

Friday would suit me. What time did would suit?

Thanks,
John"

16.09.22 AiBridges Ltd response to Three Ireland

Hello John,

I am just following up from our call last week.

As discussed I would be grateful if you could confirm that Three Ireland are in agreement to the proposed mitigation measure of an alternative relay link path on the basis that the wind farm developer would cover the hardware and services costs of €20,000.

This would allow the wind farm developer complete the specific chapter in the Environmental Impact Assessment Report relating to Telecommunications for Ballycar Wind Farm with the observation that agreement for a mutually agreed mitigation measure with Three Ireland is in place.

I look forward to hearing from you,

Best Regards,
Kevin Hayes,

16.09.22 Three Ireland response to AiBridges Ltd

"Hi Kevin,

Yes, I can confirm that Three Ireland are in agreement that we can re-route the traffic differently in the event that the development takes place.

We estimate that the approximate costs would be €10k per link or €20k in total to re-route both sites.

We are happy for the development to proceed on the basis that the wind farm developer would re-imburse us for these expenses. We would require that the re-routes take place in advance of construction of the windfarm.
Thanks,

John"

16.09.22 AiBridges Ltd response to Three Ireland

Hello John

Thank you for your prompt response
We can confirm that

1.The wind farm developer would cover the mitigation measure costs of €20K
2.The link re-routes would take place in advance of the construction and operation of the wind farm.

Thank you for your co-operation on this

Best Regards,
Kevin Hayes,

Section 3 - Conclusions

3. Introduction

From the findings made in this report the following conclusions have been made:

- Based on the findings of the 2021 consultation process, there are four Telecom Operators with networks in the vicinity of the proposed wind farm that required a detailed technical analysis. A 2D and a 3D network analysis was carried out on each of the Telecom Operator radio networks, the results of which found that only three of the Telecom Operator Networks could be impacted by the proposed wind farm development. (i.e. Enet, Eir and Three Ireland).

- Extensive field survey and software modelling analysis was carried out to determine viable mitigation measures to offset the impact of the proposed wind turbines. The mitigation measures that were assessed include the option of provisioning a relay mast. Through extensive operator consultations it was determined that a new relay mast would not be required within the proposed development. It was agreed with the impacted telecoms operators that each of the affected networks could be mitigated by re-routing the radio links via existing operational masts.

- Consultations with each of the three impacted telecom operators were carried out and mitigation measures were agreed. The agreed Mitigation Measures and estimated costs are presented in Table 10 below. One Enet link (Woodcock Hill to Boher N.S.) and one Eir link (Woodcock Hill to Newport) are redundant/cancelled and do not require mitigation/re-routing.

Operator	Impacted PTP Link	Mitigation Measure	Mitigation Cost	Mitigation Agreed
Enet	One PTP microwave radio link Woodcock Hill to Birdhill.	Radio Link Re-routing	TBC	Yes
Eir	One PTP microwave radio link Woodcock Hill to Glenoue Newtown.	Radio Link Re-routing.	€12,000	Yes
Three Ireland	Two PTP microwave radio links from Woodcock Hill to Ardnacrusha	Radio Link Re-routing	€20,000	Yes

Table 10. Mitigation Measures Summary

Appendix 1

3D Network Analysis Results Table
18.02.22 Turbine Layout

3D Network Analysis Results Table - 18.02.22 Turbine Layout

Link No.	Operator	Description	Link Type	Radio Link Co-ordinates		Antenna Heights (m)		Link Distance (km)	Frequency	Fresnel	Clearance Distance to Fresnel (m)											
				Site A	Site B	Site A	Site B				T01_180222	T02_180222	T03_180222	T04_180222	T05_180222	T06_180222	T07_180222	T08_180222	T09_180222	T10_180222	T11_180222	T12_180222
1	Enet (L1)	Woodcock Hill - Newport College	PTP	52 43 11.33 N 08 41 32.28 W	52 42 54.35 N 08 24 24.10 W	12	6	19.3	13 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
2	Enet (L2)	Woodcock Hill - Birdhill	PTP	52 43 11.33 N 08 41 32.28 W	52 44 00.29 N 08 27 57.84 W	12	6	15.3	15 GHz	0.6 F1	Pass	Pass	Pass	-27.18	Pass	Pass	-7.33	Pass	Pass	Pass	Pass	Pass
3	Enet (L3)	Woodcock Hill - Boher National School	PTP	52 43 11.33 N 08 41 32.28 W	52 48 07.23 N 08 22 03.89 W	15	6	23.7	11 GHz	0.6 F1	Pass	Pass	-12.25	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
4	Eir Mobile (L1)	Woodcock Hill - Dromintobin North	PTP	52 43 40.90 N 08 42 20.64 W	52 44 14.67 N 08 34 58.60 W	15	18	8.4	11 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
5	Eir Mobile (L2)	Woodcock Hill - Newport	PTP	53 43 40.90 N 08 42 20.64 W	52 42 39.28 N 08 24 23.44 W	15.5	10	20.3	13 GHz	0.6 F1	Pass	Pass	-3.45	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
6	Eir Mobile (L3)	Woodcock Hill - Glenoe Newtown	PTP	54 43 40.90 N 08 42 20.64 W	52 41 18.96 N 08 17 50.63 W	21	18	27.9	11 GHz	0.6 F1	Pass	Pass	Pass	Pass	-13.17	Pass	Pass	Pass	Pass	Pass	Pass	Pass
7	Eir Mobile (L4)	Woodcock Hill - Woodstown Limerick	PTP	55 43 40.90 N 08 42 20.64 W	52 39 44.91 N 08 31 57.97 W	12	13	13.8	11 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
8	Three Ireland (L1)	Woodcock Hill - Ardnacrusha	PTP	52 43 39.23 N 08 42 22.15 W	52 42 13.31 N08 36 45.11 W	30	30	6.9	18 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-27.04	Pass
9	Three Ireland (L2)	Woodcock Hill - Ardnacrusha	PTP	52 43 11.25 N 08 41 32.21 W	52 42 13.31 N08 36 45.11 W	30	30	5.7	28 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-24.21
10	Virgin Media (L1)	Woodcock Hill - Glenstall	PTP	52 43 27.82 N 08 42 36.55 W	52 39 40.11 N 08 23 19.19 W	10	10	22.7	13 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Pass

Further Analysis Required

Fail

Appendix 2

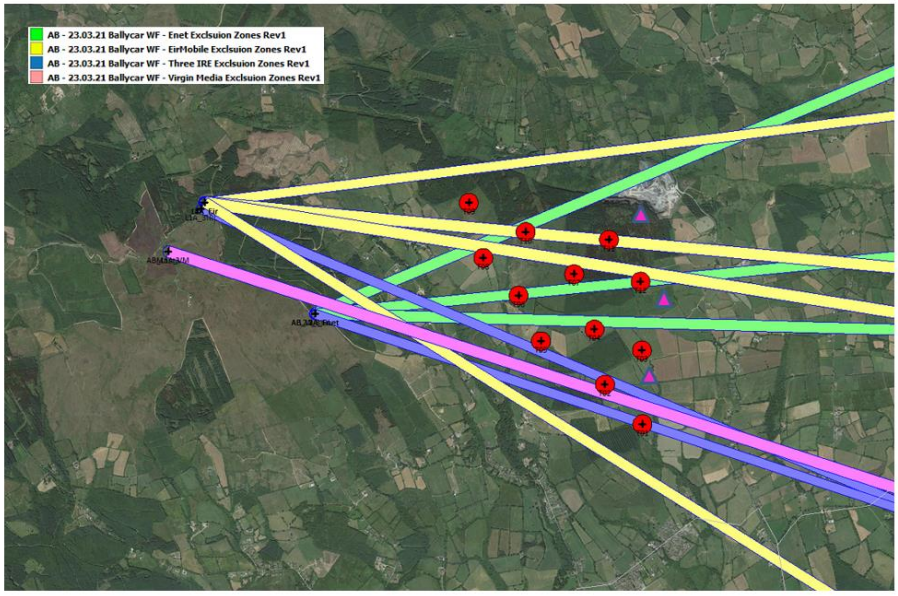
Ballycar Wind Farm EMI Assessment - 10.03.21 Turbine Layout

Ballycar Wind Farm, EMI – 2RN - Aviation Assessment Review

Ai Bridges Ltd.	
Document Title: Ballycar WF	Date: 25.03.21
Document Number: AITESC001	Revision: 0.1

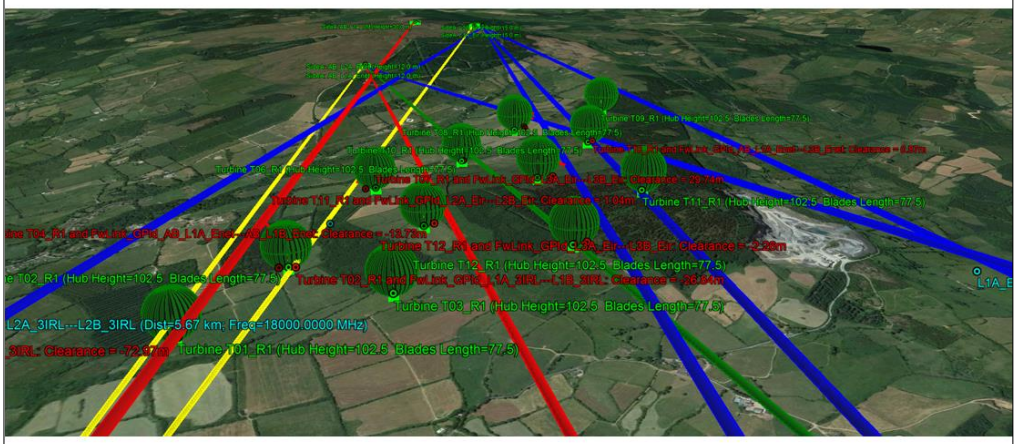
P 1

Microwave Radio PTP Exclusion Zones



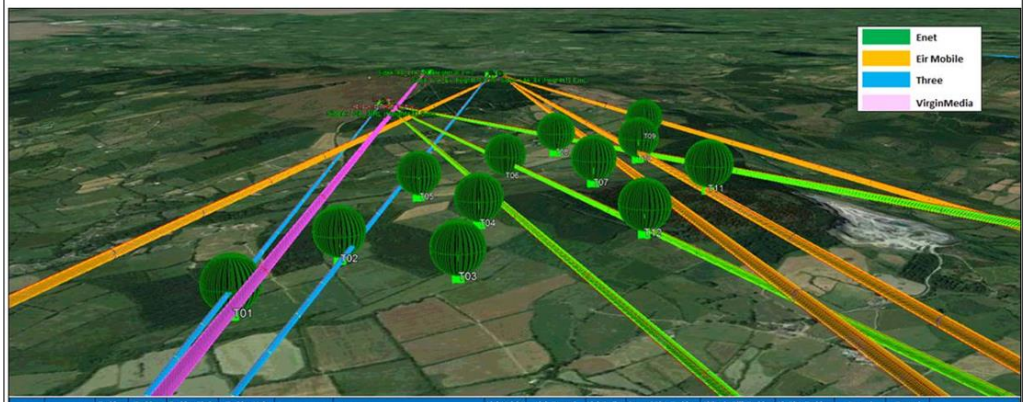
P2

Microwave Radio Links – 3D Analysis



P3

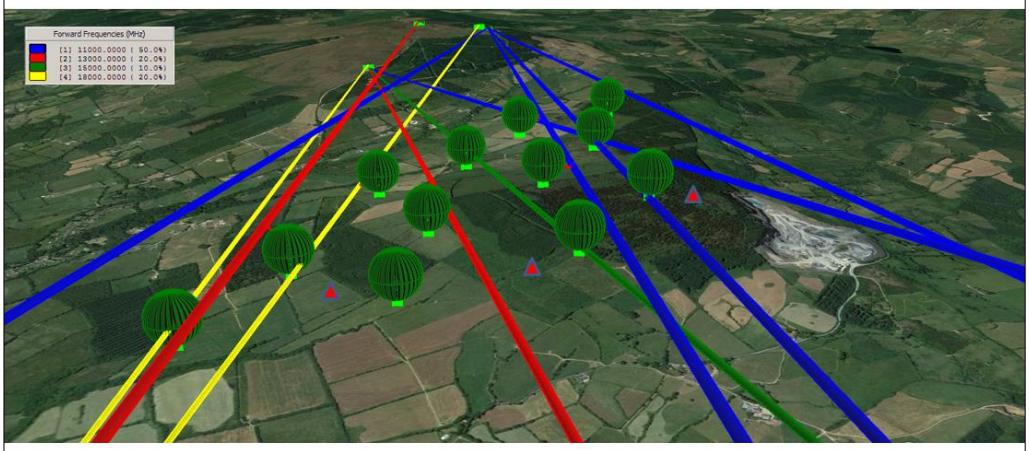
Microwave Radio Links – 3D Analysis



Rec#	Turbine Ident	Turbine Lat	Turbine Long	Turbine Blade Length (m)	Turbine Hub Height AGL (m)	Ground Altitude	Link Ident	Link Height AGL (m)	Link Ground Altitude ASL (m)	Link Radius (m)	Ground Dist. Turbine-Link "a" (m)	Altitude Diff. Turbine-Link "b" (m)	Air Dist. Turbine-Link "c" (m)	Fresnel Number (nth)	Fresnel Freq. (MHz)	Clearance(m)
1	T01_R1	52.7117	-8.65247	77.5	102.5	72.81	PwLink_GPid_L2A_3IRL--L2B_3IRL	94.12	73.47	6.87	8.39	7.72	11.4	2	18000	-72.97
2	T02_R1	52.7146	-8.65702	77.5	102.5	109.3	PwLink_GPid_L2A_3IRL--L1B_3IRL	65.25	111.44	7.54	46.41	35.12	58.2	2	18000	-26.84
3	T02_R1	52.7146	-8.65702	77.5	102.5	109.3	PwLink_GPid_AB_L1A_VM--AB_L1B_VM	188.83	104.64	12.02	61.88	81.67	102.46	2	15000	12.95
4	T04_R1	52.7187	-8.6583	77.5	102.5	163.13	PwLink_GPid_AB_L1A_Enet--AB_L1B_Enet	71.55	173.59	9.64	70.49	20.49	73.41	2	15000	-13.73
5	T05_R1	52.7178	-8.66483	77.5	102.5	162.59	PwLink_GPid_L1A_3IRL--L1B_3IRL	48.86	152.52	7.49	77.84	63.71	100.59	2	18000	15.6
6	T06_R1	52.7212	-8.66756	77.5	102.5	177.4	PwLink_GPid_AB_L2A_Enet--AB_L2B_Enet	65.59	178.61	7.7	17.29	35.7	39.67	2	15000	-45.54
7	T07_R1	52.7227	-8.66079	77.5	102.5	233.97	PwLink_GPid_L3A_Eir--L3B_Eir	58.63	240.01	12.2	113.29	37.83	119.44	2	11000	29.74
8	T08_R1	52.7239	-8.67184	77.5	102.5	205.52	PwLink_GPid_AB_L1A_Enet--L3B_Enet	44.41	214.94	8.58	112.89	48.66	122.93	2	11000	36.85
9	T08_R1	52.7239	-8.67184	77.5	102.5	205.52	PwLink_GPid_L3A_Eir--L3B_Eir	85.34	214.21	10.73	96.56	8.47	96.93	2	11000	8.7
10	T10_R1	52.7258	-8.66668	77.5	102.5	226.27	PwLink_GPid_AB_L1A_Enet--L3B_Enet	30.49	226.82	9.6	51.31	71.46	87.97	2	11000	0.87
11	T10_R1	52.7258	-8.66668	77.5	102.5	226.27	PwLink_GPid_L2A_Eir--L2B_Eir	44.84	228.21	11.2	1.11	57.72	57.73	2	11000	-30.06
12	T11_R1	52.7253	-8.65655	77.5	102.5	251.27	PwLink_GPid_L2A_Eir--L2B_Eir	11.7	251.22	12.32	1.25	90.85	90.86	2	11000	1.04
13	T12_R1	52.7222	-8.65269	77.5	102.5	196.59	PwLink_GPid_AB_L2A_Enet--AB_L2B_Enet	32.03	197.41	9.4	4.48	69.64	69.79	2	15000	-17.11
14	T12_R1	52.7222	-8.65269	77.5	102.5	196.59	PwLink_GPid_L3A_Eir--L3B_Eir	88.55	209.43	13.13	88.37	1.11	88.37	2	11000	-2.26

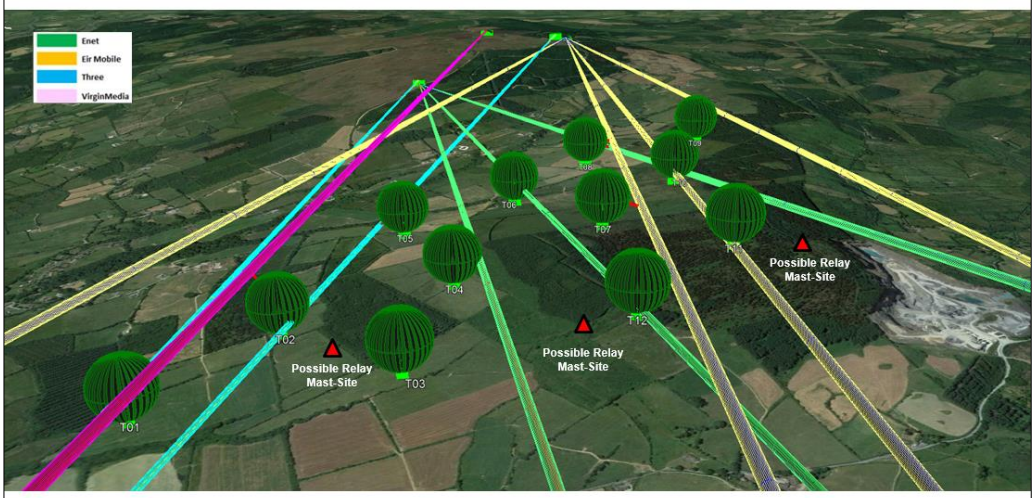
P4

Microwave Radio Links – 3D Analysis



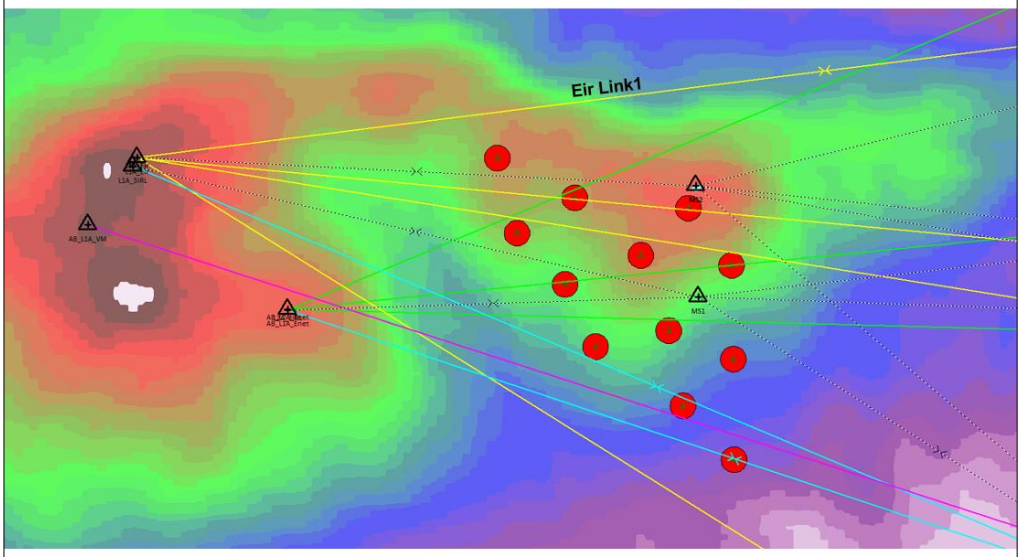
P5

Microwave Radio Links – Possible Relay Mast Sites



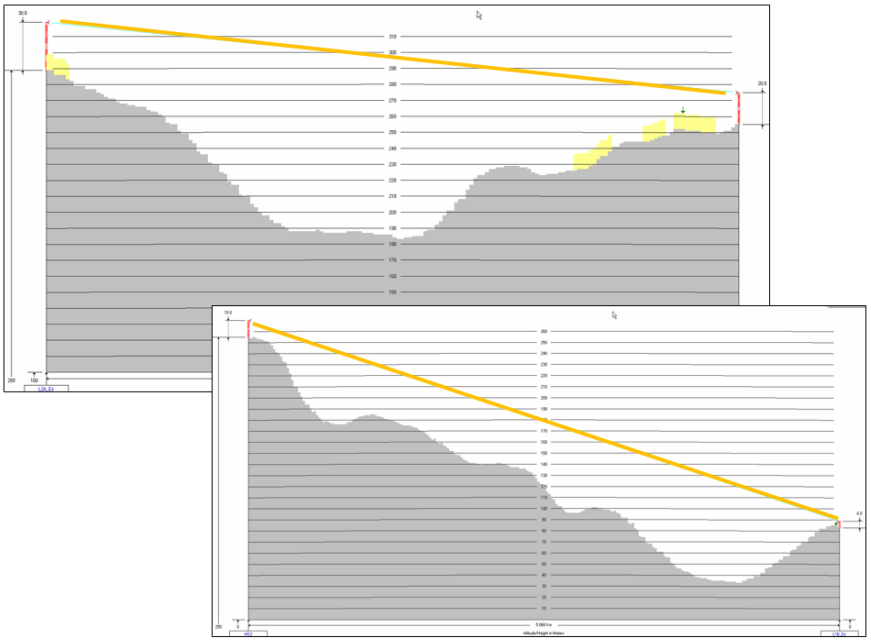
P6

Microwave Radio Links – Topography



P7

Microwave Radio Links – Relay Link (Eir Link1)



P8

Appendix 3

Ballycar Wind Farm EMI Assessment - 19.01.22 Turbine Layout

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

Report

Ballycar Wind Farm
EMI Network Analysis
(19.01.22 Turbine Layout)

Document Number:

Author: David McGrath

Approved for Release: Rev 0.2 D McG **Date:** 27/01/22

Document Filename: *Ballycar Wind Farm EMI Network Analysis (19.01.22 Turbine Layout)*

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

Sections

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

Executive Summary

From the Telecom Impact Assessment study conducted in 2021, ten radio links were identified as crossing over/near the proposed wind farm at Ballycar. The 10 radio links are listed below in Table 1. On January 19th 2022 Ai Bridges were provided with a revised Turbine Network Layout. The revised turbine coordinates and turbine dimensions are provided below in Table 2.

Link No.	Link ID (Operator)	Link Description
1	Enet (L1)	Woodcock Hill - Newport College
2	Enet (L2)	Woodcock Hill - Birdhill
3	Enet (L3)	Woodcock Hill - Boher National School
4	Eir Mobile (L1)	Woodcock Hill - Dromintobin North
5	Eir Mobile (L2)	Woodcock Hill - Newport
6	Eir Mobile (L3)	Woodcock Hill - Glenoe Newtown
7	Eir Mobile (L4)	Woodcock Hill - Woodstown Limerick
8	Three Ireland (L1)	Woodcock Hill - Ardnacrusha
9	Three Ireland (L2)	Woodcock Hill - Ardnacrusha
10	Virgin Media (L1)	Woodcock Hill - Glenstall

Table 1. Radio Links

Turbine	Hub Height	Blade Length	X	Y
T1	90	68	554496	664315
T2	90	68	554632	663833
T3	90	68	554860	664132
T4	90	68	554984	663637
T5	90	68	555455	663745
T6	90	68	555791	664097
T7	90	68	555910	663609
T8	90	68	555486	663236
T9	90	68	555092	663181
T10	83	68	556023	663086
T11	90	68	555635	662799
T12	90	68	555937	662535

Table 2. Turbine Layout (19.01.22)

A network analysis has been carried out on each of the 12 turbines, the results of which are provided in Section 1 to Section 12 that follow. At the end of each Section, a summary of the network analysis result for is provided. The results have been color coded as outline in the Table below.

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

Color	Result	Description
Green	Pass	No Impacts. Turbine does not obstruct the radio link Fresnel Zone.
Amber	Pass (Provisional)	Turbine does not obstruct radio the radio link Fresnel Zone; however the Fresnel Zone Clearance margin is very small. Further analysis required.
Red	Fail	Fresnel Zone is impeded by turbines. Radio Link likely to be impacted.

Table 3. Results Colour Code Legend

Note: Network Operators typically request that wind turbines are sited outside the 2nd Fresnel Zone of their radio links plus an additional buffer distance of 30m; however, according to radio link modelling theory, a radio link will operate normally provided that 0.6 of the 1st Fresnel (0.6 F1) is unobstructed. The network analysis results in this report have been based on a Fresnel Zone of 0.6 F1.

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

1. T01 Network Analysis

A Plan View (2D) and a 3D View of T01 relative to the nearest radio links are shown in the figures below. The results indicate that T01 will have no impact on the radio link network.

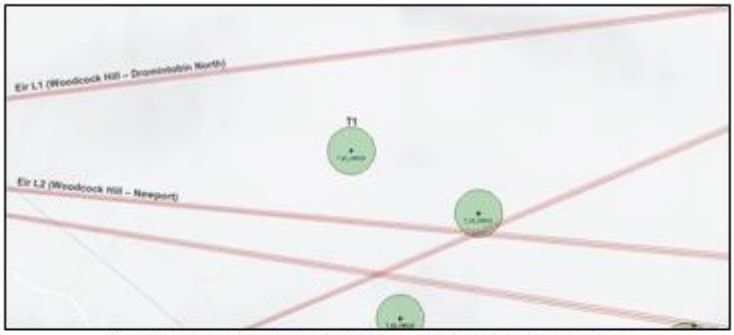


Figure 1. Close-up Plan View of T01 relative to nearest radio links

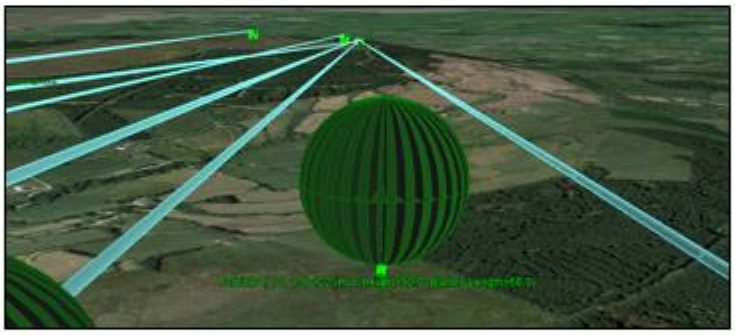


Figure 2. 3D View of T01 relative to nearest radio links

Analysis Results:

Table 4 below provides a brief summary of the Network Analysis findings for turbine T01.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Eir L1	Pass	Pass (>30m)	Pass
Eir L2	Pass	Pass (>30m)	Pass

Table 4. Analysis Summary – T01

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

2. T02 Network Analysis

A Plan View (2D) and a 3D View of T02 relative to the nearest radio links are shown in the figures below. The results indicate that T02 will have no impact on the radio link network.

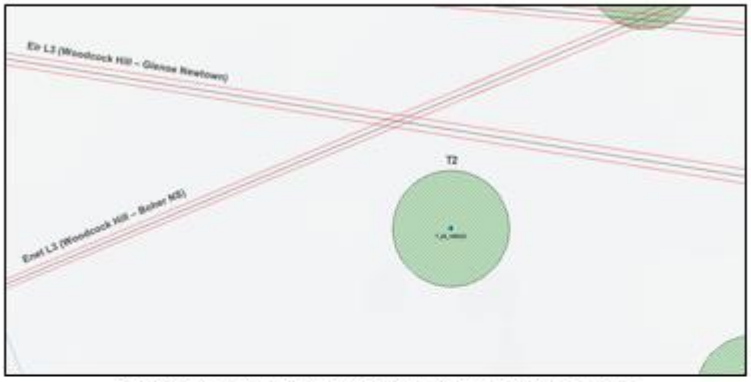


Figure 3. Close-up Plan View of T02 relative to nearest radio links

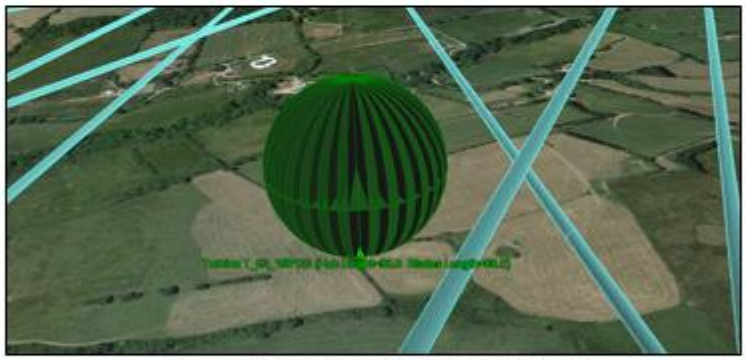


Figure 4. 3D View of T02 relative to nearest radio links

Analysis Results:

Table 5 below provides a brief summary of the Network Analysis findings for T02.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Eir L3	Pass	Pass (>30m)	Pass
Enet L3	Pass	Pass (>30m)	Pass

Table 5. Analysis Summary – T02

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

3. T03 Network Analysis

A Plan View (2D) and a 3D View of T03 relative to the nearest radio links are shown in the figures below. The results indicate that T03 will impeded the Fresnel Zone of Eir's radio link between Woodcock Hill and Newport and Enet's radio link between Woodcock Hill and Boher National School.

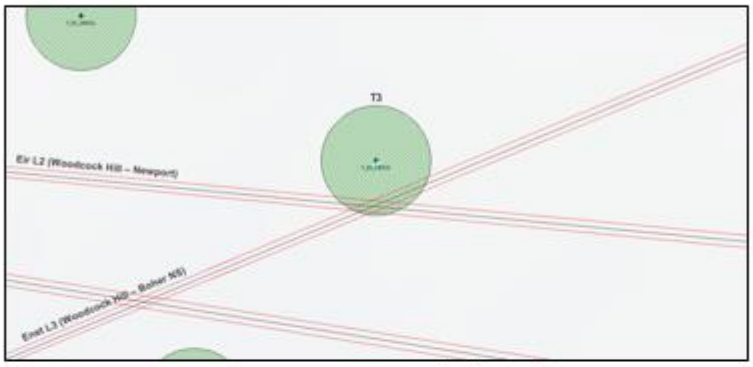


Figure 5. Close-up Plan View of T03 relative to nearest radio links

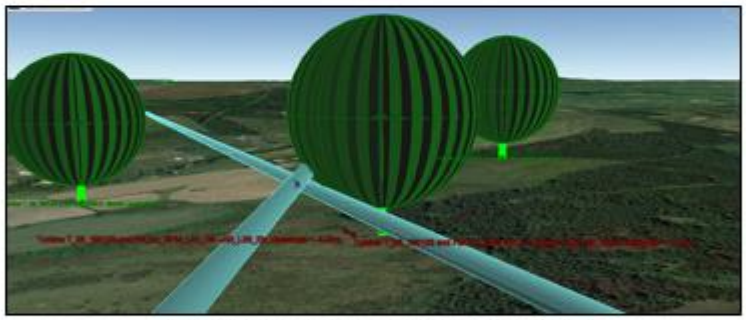


Figure 6. 3D View of T03 relative to nearest radio links

Analysis Results:

Table 6 below provides a brief summary of the Network Analysis findings for T03.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Eir L2	Fail	-8.22 m (Fail)	Fail
Enet L3	Fail	-1.15 m (Fail)	Fail

Table 6. Analysis Summary – T03

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

4. T04 Network Analysis

A Plan View (2D) and a 3D View of T04 relative to the nearest radio links are shown in the figures below. The results indicate that there is a small clearance between the blade-tip of T04 and the Fresnel Zone (0.6 F1) of Enet's radio link between Woodcock Hill and Birdhill.

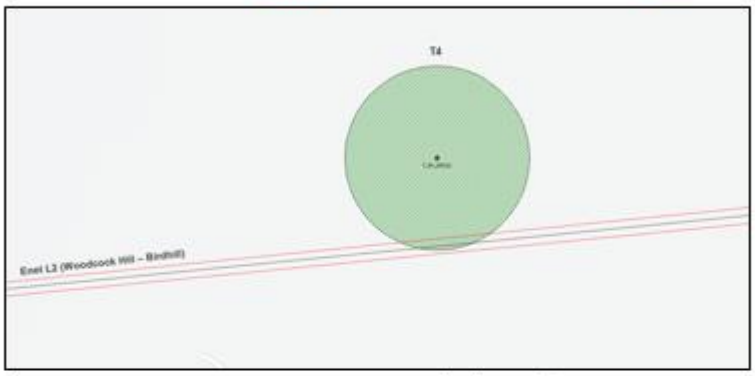


Figure 7. Close-up Plan View of T04 relative to nearest radio links

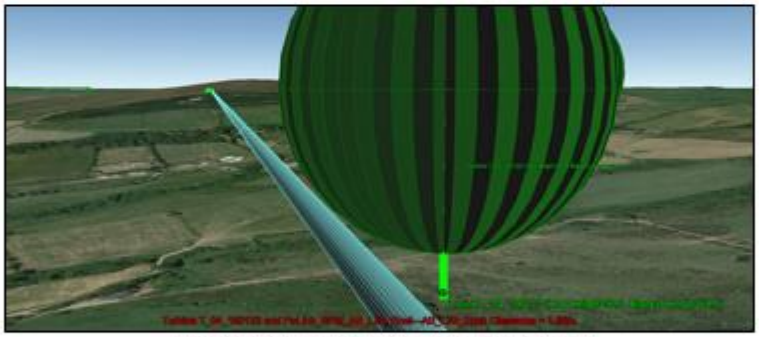


Figure 8. 3D View of T04 relative to nearest radio links

Analysis Results:

Table 7 below provides a brief summary of the Network Analysis findings for T04.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Enet L2	Fail	1.96m (Pass)	Pass

Table 7. Analysis Summary – T04

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

5. T05 Network Analysis

A Plan View (2D) and a 3D View of T05 relative to the nearest radio links are shown in the figures below. The results indicate that there is a small clearance between the blade-tip of T05 and the Fresnel Zone (0.6 F1) of Eir's radio link between Woodcock Hill and Glenoue Newtown.

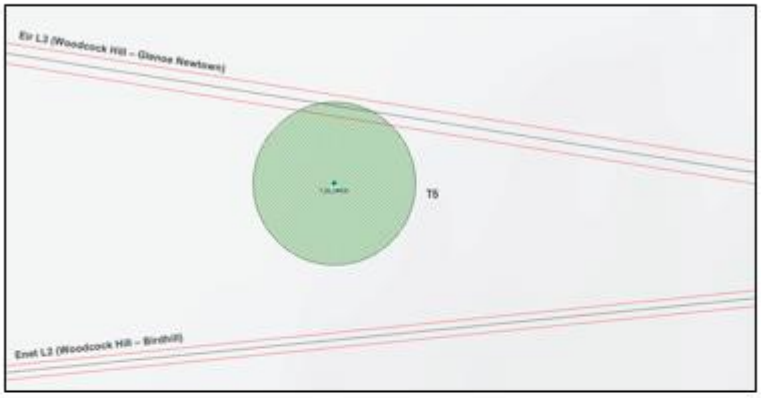


Figure 9. Close-up Plan View of T05 relative to nearest radio links

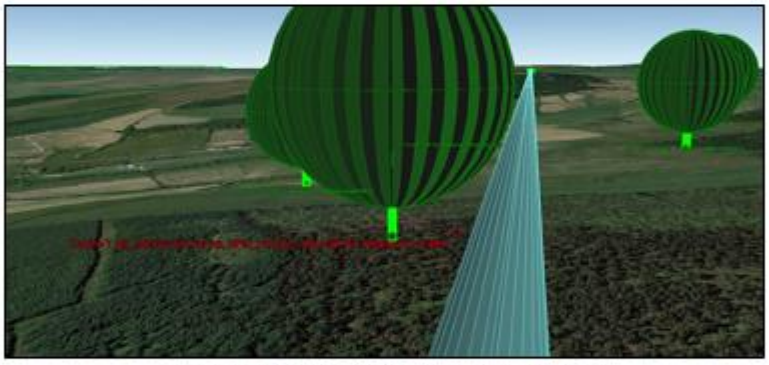


Figure 10. 3D View of T05 relative to nearest radio links

Analysis Results:

Table 8 below provides a brief summary of the Network Analysis findings for T05.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Enet L2	Pass	Pass (>30m)	Pass
Eir L3	Fail	0.89 m (Pass)	Pass

Table 8. Analysis Summary – T05

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

6. T06 Network Analysis

A Plan View (2D) and a 3D View of T06 relative to the nearest radio links are shown in the figures below. The results indicate that T06 will have no impact on the radio link network.

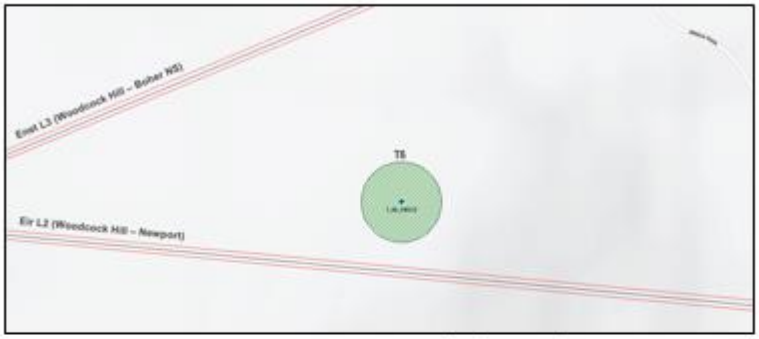


Figure 11. Close-up Plan View of T06 relative to nearest radio links

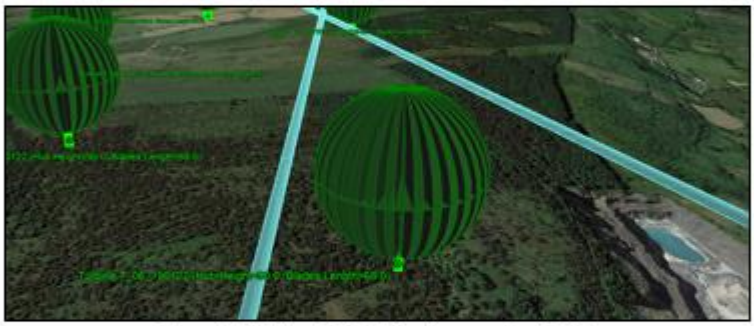


Figure 12. 3D View of T06 relative to nearest radio links

Analysis Results:

Table 9 below provides a brief summary of the Network Analysis findings for T06.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Enet L3	Pass	Pass (>30m)	Pass
Eir L2	Pass	Pass (>30m)	Pass

Table 9. Analysis Summary – T06

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

7. T07 Network Analysis

A Plan View (2D) and a 3D of T07 relative to the nearest radio links are shown in the figures below. The results indicate that T07 will impeded the Fresnel Zone of Enet's radio link between Woodcock Hill and Birdhill.

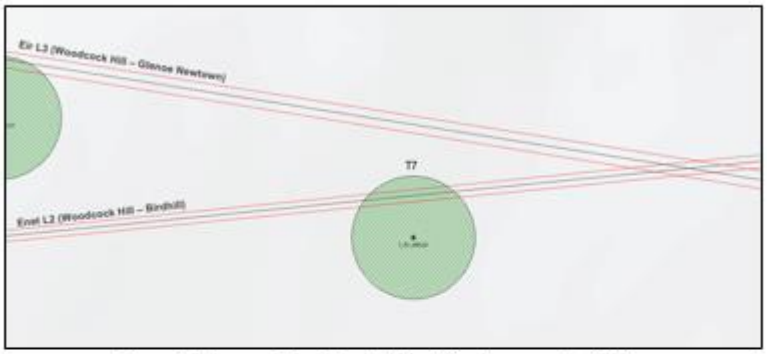


Figure 13. Close-up Plan View of T07 relative to nearest radio links

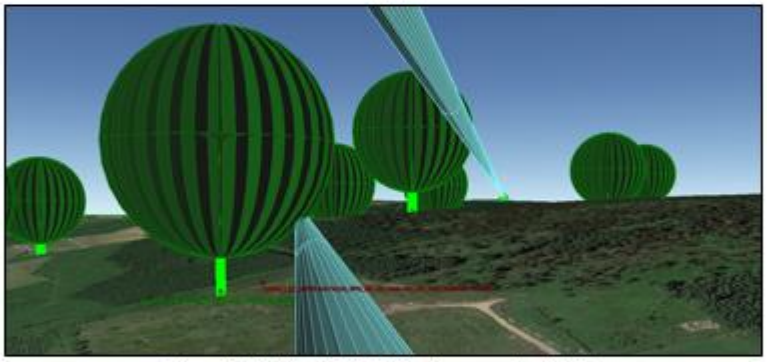


Figure 14. 3D View of T07 relative to nearest radio links

Analysis Results:

Table 10 below provides a brief summary of the Network Analysis findings for T07.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Enet L2	Fail	-3.85 m (Fail)	Fail
Eir L3	Pass	Pass (>30m)	Pass

Table 10. Analysis Summary – T07

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

8. T08 Network Analysis

A Plan View (2D) and a 3D View of T08 relative to the nearest radio links are shown in the figures below. The results indicate that T08 will have no impact on the radio link network.

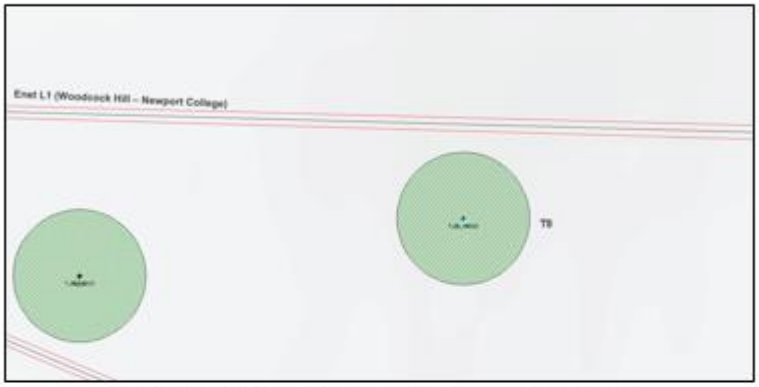


Figure 15. Close-up Plan View of T08 relative to nearest radio links

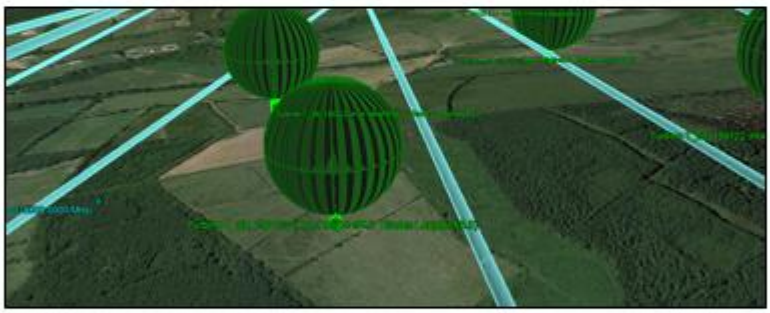


Figure 16. 3D View of T08 relative to nearest radio links

Analysis Results:

Table 11 below provides a brief summary of the Network Analysis findings for turbine T08.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Enet L1	Pass	Pass (>30m)	Pass

Table 11. Analysis Summary – T08

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

9. T09 Network Analysis

A Plan View (2D) and a 3D View of T09 relative to the nearest radio links are shown in the figures below. The results indicate that T09 will have no impact on the radio link network.

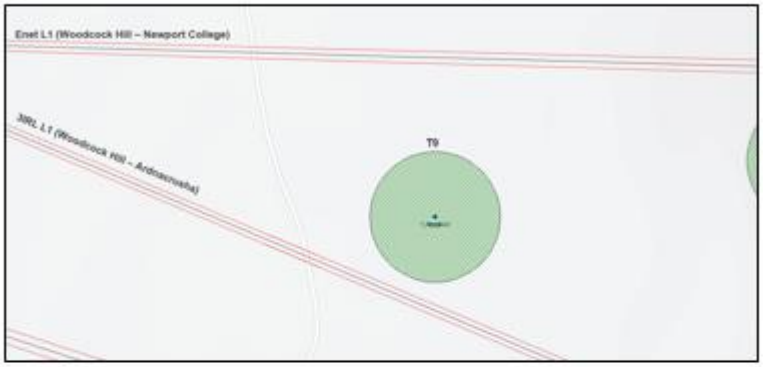


Figure 17. Close-up Plan View of T09 relative to nearest radio links

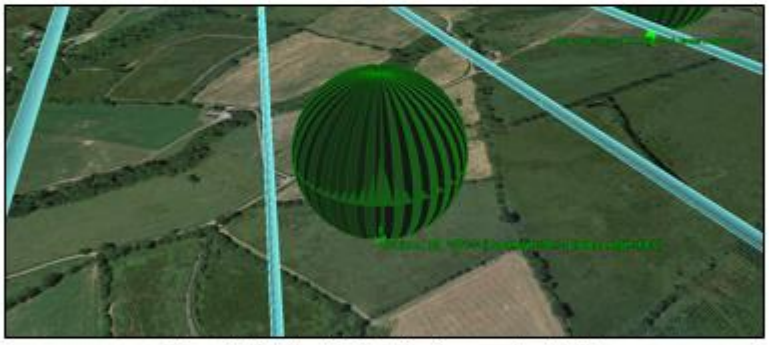


Figure 18. 3D View of T09 relative to nearest radio links

Analysis Results:

Table 12 below provides a brief summary of the Network Analysis findings for turbine T09.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Enet L1	Pass	Pass (>30m)	Pass
3IRL L1	Pass	Pass (>30m)	Pass

Table 12. Analysis Summary – T09

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

10. T10 Network Analysis

A Plan View (2D) and a 3D View of T10 relative to the nearest radio links are shown in the figures below. The results indicate that T10 will have no impact on the radio link network.

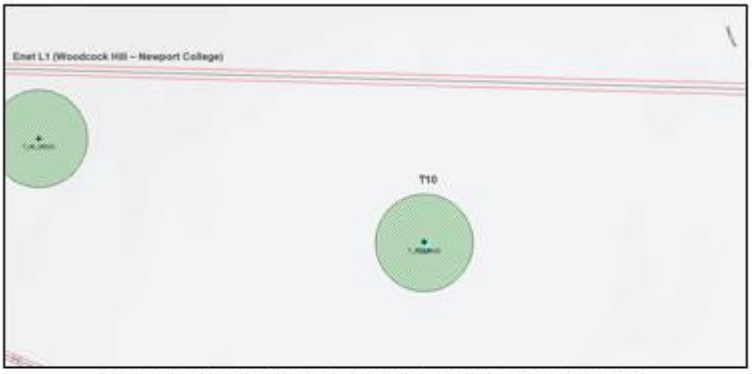


Figure 19. Close-up Plan View of T10 relative to nearest radio links

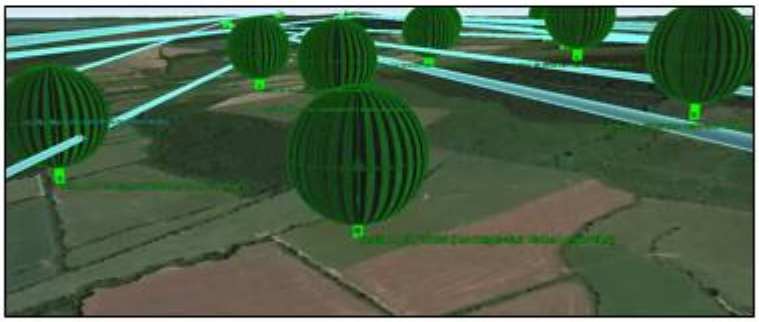


Figure 20. 3D View of T10 relative to nearest radio links

Analysis Results:

Table 13 below provides a brief summary of the Network Analysis findings for turbine T10.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Enet L1	Pass	Pass (>30m)	Pass

Table 13. Analysis Summary – T10

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

11. T11 Network Analysis

A Plan View (2D) and a 3D View of T11 relative to the nearest radio links are shown in the figures below. The results indicate that T11 will impeded the Fresnel Zone of Three Ireland's radio link between Woodcock Hill and Ardnacrusha.

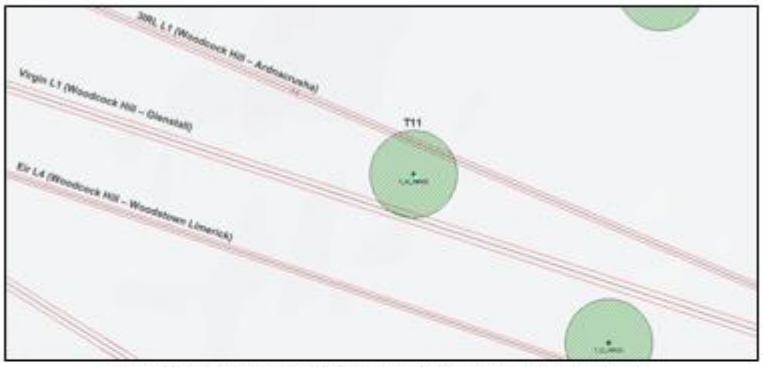


Figure 21. Close-up Plan View of T11 relative to nearest radio links

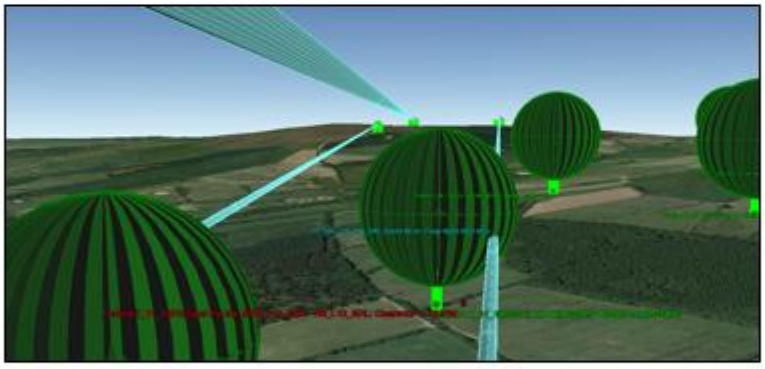


Figure 22. 3D View of T11 relative to nearest radio links

Analysis Results:

Table 14 below provides a brief summary of the Network Analysis findings for T11.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Eir L4	Pass	Pass (>30m)	Pass
Three Ireland L1	Fail	-19.97 m (Fail)	Fail
Virgin L1	Pass	Pass (>30m)	Pass

Table 14. Analysis Summary – T11

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

12. T12 Network Analysis

A Plan View (2D) and a 3D View of T12 relative to the nearest radio links are shown in the figures below. The results indicate that T12 will impeded the Fresnel Zone of Eir's radio link between Woodcock Hill and Woodstown Limerick.

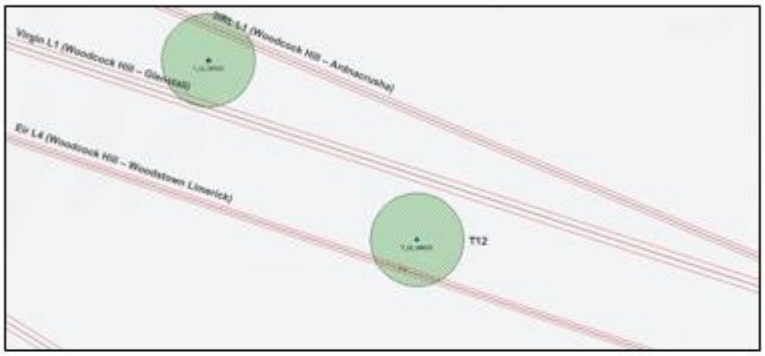


Figure 23. Close-up Plan View of T12 relative to nearest radio links

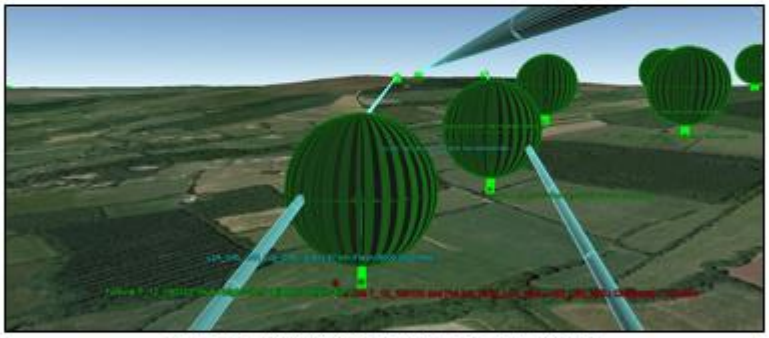


Figure 24. 3D View of T12 relative to nearest radio links

Analysis Results:

Table 15 below provides a brief summary of the Network Analysis findings for T12.

Radio Link ID	Clearance to Radio Link Fresnel Zone (0.6 F1)		Result
	Plan View	3D View	
Eir L4	Fail	-25.09 m (Fail)	Fail
Three Ireland L1	Pass	Pass (>30m)	Pass
Virgin L1	Pass	Pass (>30m)	Pass

Table 15. Analysis Summary – T12

AiBridges	Procedure: 001	Rev: 0.2
Title: Ballycar WF Telecommunications Impact Study	Approved: KH	Date: 28/01/22

Appendix A

3D Network Analysis Results Table

3D Network Analysis Results Table - 19.01.22 Turbine Layout

Link No.	Operator	Description	Link Type	Radio Link Co-ordinates		Antenna Heights (m)		Link Distance (km)	Frequency	Fresnel	Clearance Distance to Fresnel (m)											
				Site A	Site B	Site A	Site B				T01_190122	T02_190122	T03_190122	T04_190122	T05_190122	T06_190122	T07_190122	T08_190122	T09_190122	T10_190122	T11_190122	T12_190122
1	Eir (L1)	Woodcock Hill - Newport College	PTP	52 43 11.33 N 08 41 32.28 W	52 42 54.35 N 08 24 24.10 W	12	6	19.3	13 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
2	Eir (L2)	Woodcock Hill - Bedhill	PTP	52 43 11.33 N 08 41 32.28 W	52 44 00.29 N 08 27 57.84 W	12	6	15.3	15 GHz	0.6 F1	Pass	Pass	Pass	1.96	Pass	Pass	-3.95	Pass	Pass	Pass	Pass	Pass
3	Eir (L3)	Woodcock Hill - Boher National School	PTP	52 43 11.33 N 08 41 32.28 W	52 48 07.23 N 08 22 03.89 W	15	6	23.7	11 GHz	0.6 F1	Pass	Pass	-3.95	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
4	Eir Mobile (L1)	Woodcock Hill - Dromintobin North	PTP	52 43 43.90 N 08 42 20.64 W	52 44 14.67 N 08 34 58.60 W	15	18	8.4	11 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
5	Eir Mobile (L2)	Woodcock Hill - Newport	PTP	53 43 43.90 N 08 42 20.64 W	52 42 39.28 N 08 24 23.44 W	15.5	10	20.3	13 GHz	0.6 F1	Pass	Pass	-5.22	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
6	Eir Mobile (L3)	Woodcock Hill - Glence Newtown	PTP	54 43 43.90 N 08 42 20.64 W	52 41 18.96 N 08 17 58.63 W	21	18	27.9	11 GHz	0.6 F1	Pass	Pass	Pass	Pass	0.89	Pass	Pass	Pass	Pass	Pass	Pass	Pass
7	Eir Mobile (L4)	Woodcock Hill - Woodstown Limerick	PTP	55 43 43.90 N 08 42 20.64 W	52 39 44.91 N 08 26 57.97 W	12	13	13.6	11 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
8	Three Ireland (L1)	Woodcock Hill - Ardnacrusha	PTP	52 43 39.23 N 08 42 22.15 W	52 42 13.31 N 08 36 45.11 W	30	30	6.9	18 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-10.97	Pass
9	Three Ireland (L2)	Woodcock Hill - Ardnacrusha	PTP	52 43 11.25 N 08 41 32.21 W	52 42 13.31 N 08 36 45.11 W	30	30	5.7	28 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-25.08
10	Virgin Media (L1)	Woodcock Hill - Glenstall	PTP	52 43 27.82 N 08 42 36.55 W	52 39 43.11 N 08 23 19.19 W	18	18	22.7	13 GHz	0.6 F1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Pass

Further Analysis Required

Fail