TOBIN

Rooaunalaghta Green Energy Project

Appendix 11-1

Telecommunications Impact Assessment

ROOAUNALAGHTA
Green Energy

BUILT ON KNOWLEDGE

Report

Rooaunalaghta Wind Farm Telecommunications Impact Assessment Report

Document Number:

Author: DMG/PT

Approved for Release: Rev 6.0 KH **Date:** 01/10/2026

Document Filename: *Rooaunalaghta Wind Farm Telecommunications Impact Assessment.*

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Executive Summary

Ai Bridges was commissioned to evaluate the possible impacts that the proposed wind farm development at Rooaunalaghta, Co. Mayo could have on existing telecommunications operator networks. The scope of work included field and desktop surveys to determine telecommunications network infrastructure that could be impacted by the proposed development. Consultations with telecom operators were also undertaken to assist in identifying network infrastructure that could be impacted by the proposed wind farm.

Telecommunications mast-sites with network infrastructure that could potentially be impacted by the development were identified and a field survey of each of these sites was carried out. During the field surveys, radio antennas with bearings in the direction of the wind farm were recorded. The findings of the field surveys are provided in Appendix B of this report.

During the consultation process, nineteen telecom operators were contacted. At the time of writing this report, sixteen of these operators have responded to the consultation request. The responses received from each of the telecom operators can be found in Section 3 of this report.

Using the information obtained during the field survey assessments and consultation process a desktop impact analysis was carried out and all of the telecommunication operator networks were analysed using radio planning \ modelling software. The findings of the desktop analysis shows that there are nine licensed PTP (Point-to-Point) microwave radio links and one Tetra Basestation in the vicinity of the proposed development. These radio links (and Tetra basestation) are listed below in Table 1.

Operator	Network/Link Description	Impact of Wind Farm	Mitigation Measures
Eir	Brodullagh South to Carrowoughteragh.	Impacted by T08 (Infringement into Fresnel Zone > 15m)	Relay the radio link via an existing Telecoms Mast-Site (e.g. the existing mast-site at Ballinrobe).
	Brodullagh South to Cloghanower.	Potentially Impacted by T12 (Clearance to Fresnel Zone < 5m)	Relay the radio link via an existing Telecoms Mast-Site (e.g. the existing mast-site at Headford).
	Brodullagh South to Ballinrobe.	No impacts	N.A
Imagine Broadband	Brodullagh South to Ballinrobe.	No impacts	N.A
Tetra Ireland	Tetra Basestation at Brodullagh South	Potentially impacted by T13 (T13 located inside 500m Exclusion Zone)	Undertake detailed assessment (see Appendix 11-2)
Three Ireland	Carrowoughteragh to Ramolin	Impacted by T06 & T07 (Infringement into Fresnel Zone > 10m)	Relay the radio link via an existing Telecoms Mast-Site (e.g. the existing mast-site at Cloghanower).
	Carrowoughteragh to Gortnamona	No impacts	N.A
	Carrowoughteragh to Cloghanower	No impacts	N.A

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

	Carrowoughteragh to Letir	No impacts	N.A
Vodafone	Brodullagh South to Oughterard Garda Station.	Impacted by T05 (Infringement into Fresnel Zone > 10m)	Relay the radio link via an existing Telecoms Mast-Site (e.g. the existing mast-site at Letir).

Table 1. Radio Links / Tetra Basestation in vicinity of Proposed Wind Farm.

The results from network analysis (2D & 3D) indicate the proposed turbine layout would impact the Eir, Three Ireland and Vodafone radio link networks, and mitigation measures would be required to offset the impact of the proposed turbines.

It should also be noted that one of the proposed turbines would be located within the 500m Tetra Ireland (TI) Exclusion Zone around the Tetra Basestation at the Brodullagh South telecommunications mast-site. A Tetra Impact Study would be required to assess the extent of the impact on the Tetra Ireland network. It may be determined, from a detailed drive-through survey, that there is sufficient service coverage in the area from secondary TETRA base stations in the region.

Section 6 contained within this report, outlines the technically viable mitigation measures that could be implemented to remediate any impacts from the proposed turbines on the Eir, Three Ireland and Vodafone Ireland networks. The proposed mitigations measures are based on industry standard best practices, and on previous experience of solutions and precedents that have been agreed with telecommunications operators on previous wind farm developments.

In the case where the proposed wind farm is consented, it is recommended that the mitigation measure strategy as set out in Section 7 of this report, should be effected to offset the likely impact of the proposed turbines on the Eir, Tera Ireland, Three Ireland and Vodafone networks.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Sections

Section 1 - Wind Farm Site Information 5

Section 2 - Methodology 7

Section 3 - Telecom Operator Consultations 10

Section 4 - Field Surveys 17

Section 5 - Network Analysis 19

Section 6 - Mitigation Measures 33

Section 7 - Recommendations 44

Section 8 - Conclusions 46

Appendix

Appendix A – Rooaunalaghta Wind Farm Turbine Coordinates……..……50

Appendix B – Field Survey Findings……..……...……52

Appendix C – Radio Link Budget Reports..……..……...……62

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Section 1 - Wind Farm Site Information

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

1. Introduction

In this section a brief summary of the wind farm site is provided. Details regarding the site's geographic location and the proposed wind turbine dimensions are presented.

1.1 Wind Farm Site Information

The wind farm development is located in County Mayo approximately 3 km southwest of Shrule, as shown in Figure 1. The development is in the pre-planning stage and exact details regarding the quantity, location and turbine dimension have yet to be finalized.

For this study, a 13-turbine layout has been considered. The coordinates of the turbines assessed in this report are provided in Appendix A. The dimensions of the turbines assessed in this report are shown in Table 2 below.



Figure 1. Location of proposed wind farm.

Wind Farm	Number of Turbines	Turbine Hub Height	Turbine Rotor Diameter
Rooaunalaghta	13	82 m	136 m

Table 2. Wind Farm Turbine Details

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Section 2 - Methodology

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

2. Introduction

In this section a brief summary of the Telecommunication Impact Study Methodology is provided.

2.1 Methodology

There are four primary stages in preparing and compiling a communication impact study:

- Telecom Operator Consultations
- Field Surveys
- Desktop Survey Network Modelling and Analysis
- Report Generation

A summary of each of these stages is provided below:

Telecom Operator Consultations

Consultations are commenced with telecom operators who are requested to raise any concerns they have regarding the impact of the proposed wind farm on their networks. The consultation process is used to assist in identifying telecoms infrastructure that could be impacted by the proposed wind farm development.

Field Surveys

Field surveys are undertaken and the co-ordinates of communication masts are recorded. During the field surveys of the communication sites, approximations of antenna size, bearing and height are made for the antennas installed on each of the masts surveyed.

Desktop Survey and Analysis

A desktop survey is carried out to plot the wind turbines in a radio planning tool. The radio planning tool uses GIS and terrain mapping databases to enable accurate modelling. A selection of mast-site coordinates is then obtained and inputs from various operators \ service providers are converted from Irish National Grid (Easting and Northing in meters) to degrees minutes seconds format and then imported into the radio planning tool. This provides a means of graphically showing telecommunications sites in the vicinity relative to the proposed wind farm at Rooaunalaghta. Figure 2 below shows the proposed wind farm site boundary plotted in the radio planning tool.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

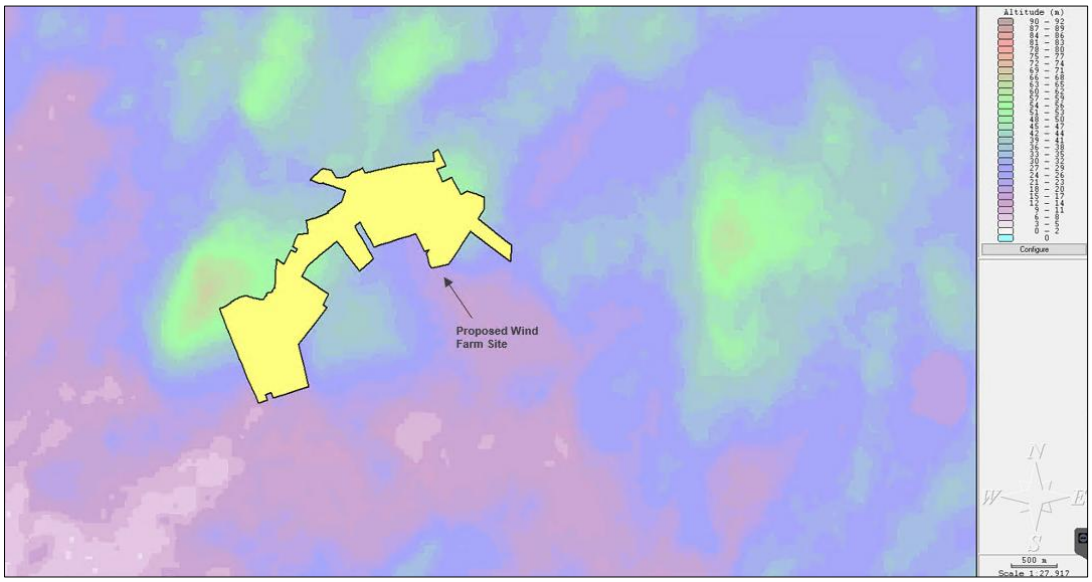


Figure 2. Wind Farm Site Boundary plotted in Radio Planning Software

The findings from the consultations and field surveys are collated and the communications networks requiring further analysis are identified. Network modeling is used to assess the impact of the turbines on the communications networks. The results from the network modeling are used to determine if mitigation measures are required. Figure 3 below shows an example of a microwave radio link that crosses over/near the wind farm site boundary modelled in radio planning software.

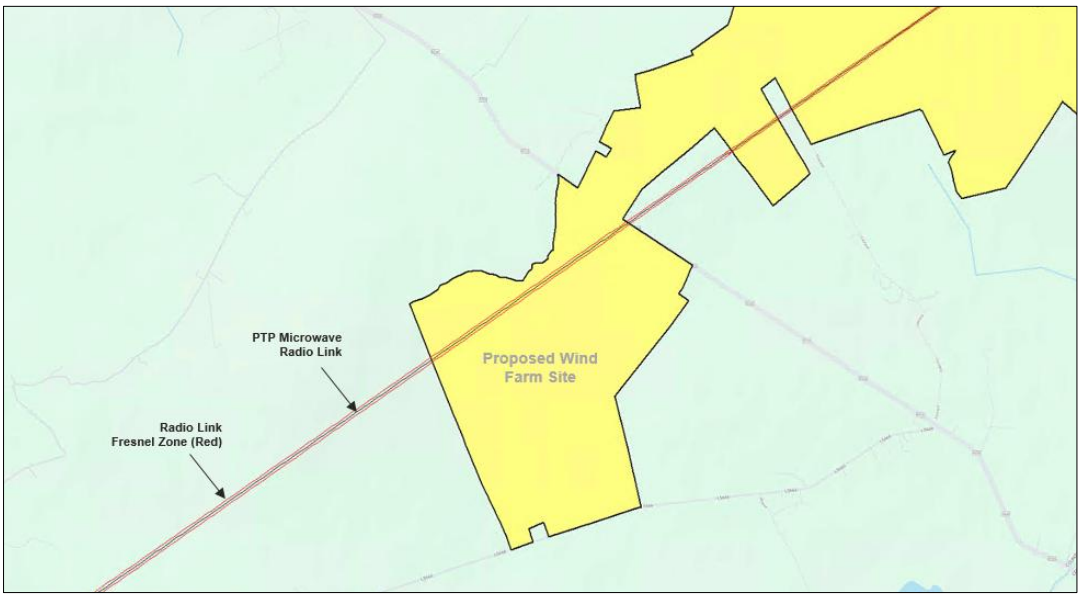


Figure 3. Example of microwave radio link crossing over/near the proposed wind farm site boundary modelled in radio planning software.

Report Generation

The final stage of the communications impact study process is to collate the data and present the findings & analysis into a report for submission.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Section 3 - Telecom Operator Consultations

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

3. Introduction

In this section the consultation process undertaken with telecom operators is described. The response received from each operator is also provided.

3.1 Telecom Operator Consultations

Consultations beginning in February 2025 were undertaken with telecom network operators to assist in identifying telecommunication infrastructure that could be impacted by proposed wind farm. The operators were requested to raise any concerns they may have regarding impacts to their networks due to the proposed wind farm development. Table 3 lists the telecom operators contacted and the issues raised by the operators. The responses received from each of the Telecom Operators are provided in Sections 3.1.1 to 3.1.19.

ID	Operator	Issues raised by Operator \ Observations.
1	2RN	No issues regarding transmission links; however, 2RN have requested that a protocol document be signed should the wind farm go ahead (regarding the TV broadcast service in the area).
2	Airwave	No response. (No response expected.)
3	An Garda Síochána	An Garda Síochána raised a concern regarding one Tetra Basestation.
4	Coimisiún na Meán	No issues.
5	BT Ireland	No issues.
6	CIE	CIE have stated that the wind farm would be located within the “Coordination Zone” of their GSM-R network (Mobile Network for Railways). The nearest rail line to the proposed development is over 10 km away and at this distance there will be no impact to the GSM-R network.
7	Dept. of Defence	No issues. Pending review by relevant Military Authorities.
8	Eir	Eir have raised a concern regarding three Licensed PTP microwave radio links.
9	Enet	No issues.
10	ESB Networks	No response.
11	Imagine Broadband	Imagine Broadband have raised a concern regarding one Licensed PTP microwave radio link.
12	AirNav Ireland	No issues.
13	Uisce Éireann	No issues.
14	Mayo County Council	No response. (No response expected.)
15	Tetra Ireland (TI)	Tetra Ireland have raised a concern regarding one Tetra Basestation.
16	Three Ireland	Three Ireland have raised a concern regarding four Licensed PTP microwave radio links.
17	Viatel	No issues.
18	Virgin Media	No issues.
19	Vodafone Ireland	Vodafone have raised a concern regarding one Licensed PTP microwave radio link.

Table 3. Telecom Operators Consulted

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

3.1.1 2RN Response to Consultations

2RN provided the following email response to consultations:

> *"We don't have any fixed linking in the area outlined.*
>
> *There is a risk of interference to broadcast services in the area from our sites at Castlebar and Tonabrooky. We would therefore ask that a protocol be signed between 2rn and the developer should the site go ahead."*

3.1.2 Airwave Response to Consultations

To date no response has been received.

3.1.3 An Garda Síochána Response to Consultations

An Garda Síochána provided the following email response to consultations:

> *"Please see below from TI* [Tetra Ireland]*. Potential issue noted.*
>
> *Potentially an issue here, as Kiopla Shrule is inside the proposed boundry, exact co-ordinates needed to determine extent of impact."*
>
> Note: Tetra Ireland run and maintain the Tetra network on behalf of An Garda Síochána. Tetra Ireland have confirmed (Ref Section 3.1.15) that they have equipment at the Brodullagh South telecommunications mast-site.

3.1.4 Coimisiún na Meán Response to Consultations

Coimisiún na Meán provided the following email response to consultations:

> *"Coimisiún na Meán does not perform an in-depth analysis of the effect of wind turbines or electrical sub stations on FM networks. However, we are not aware of any issues from existing windfarms or electrical sub stations into existing FM networks. Also, the proposed sub station is not located close to any existing or planned FM transmission sites."*

3.1.5 BT Ireland Response to Consultations

BT provided the following email response to consultations:

> *"BT no longer have a radio microwave network."*

3.1.6 CIE Response to Consultations

CIE provided the following email response to consultations:

> *"The proposed site lies within the GSM-R (Mobile Network for Railways) coordination zone. Please see below:*
>
> *From a study carried out by the ANFR (Agence Nationale des Frequences in France), the output calls for 2 main recommendations by defining 2 main zones as follows:*
>
> *1 - Exclusion zone: wind farm not less than 5 Km from antenna*
>
> *2 - Coordination zone : 5 Km <wind farm < 30 Km: this area, coordination between operators is required to fix any issue and impact on the signal propagation."*

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

3.1.7 Department of Defence Response to Consultations

The Department of Defence provided the following email response to consultations:

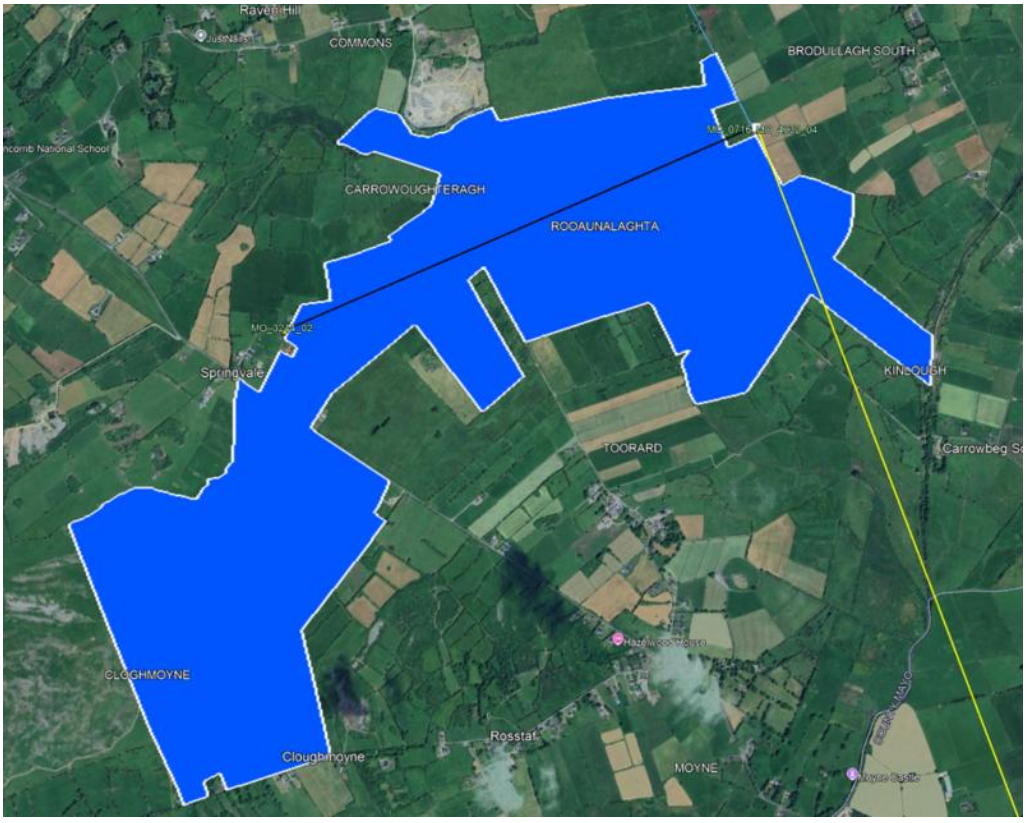
> *"The Department of Defence wished to acknowledge receipt of your below e-mail and the attached documentation. We will consult with our Military colleagues and will revert in due course."*

3.1.8 Eir Response to Consultations

Eir provided the following email response to consultations:

> *"We have three links that cross the area, link details are below if you can add a buffer for planning clearance."*

#	Band	A-end			Height		B-end			Height
Link1	15Ghz	MO_4032	53°30'36.12"N	9° 7'32.17"W	23	<--->	MO_3244	53°30'11.56"N	9° 9'6.81"W	18
Link2	13Ghz	MO_4032	53°30'36.12"N	9° 7'32.17"W	22	<--->	WX_2056	53°26'52.84"N	9° 5'9.70"W	20
Link3	13Ghz	MO_4032	53°30'36.12"N	9° 7'32.17"W	18	<--->	MO_4030	53°37'27.38"N	9°13'33.70"W	40



3.1.9 Enet Response to Consultations

Enet provided the following email response to consultations:

> *"This won't affect our current network."*

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

3.1.10 ESB Networks Response to Consultations

To date no response has been received.

3.1.11 Imagine Broadband Response to Consultations

Imagine Broadband provided the following email response to consultations:

"At present Imagine use a site located in the Northeastern region of this area. We have one MW link, detail below.

	MO079 WIG Shrule	MO007 Towercom Ballinrobe
Latitude	53.51004141 N	53.62432371 N
Longitude	9.12559612 W	9.22599132 W
ITM Eastings	525339	518899
ITM Northings	751707	764533
Elevation (m)	44.95	45.36
Antenna height (m)	25.00	15.00
Frequency (MHz)	15075.00	
Path length (km)	14.36	

Please inform us of any proposed wind turbine locations, Fresnel zone clearances & set-back safety buffers in relation to the above microwave link.
Your mail has been forwarded to our radio planning department. They will respond directly if they have any concerns."

3.1.12 AirNav Ireland Response to Consultations

AirNav Ireland provided the following email response to consultations:

"No issue for Airnav navaids."

3.1.13 Uisce Éireann Response to Consultations

Uisce Éireann provided the following email response to consultations:

"I can confirm that Uisce Éireann do not have any communication links traversing the proposed wind farm."

3.1.14 Mayo County Council Response to Consultations

To date no response has been received.

3.1.15 Tetra Ireland (TI) Response to Consultations

Tetra Ireland provided the following email response to consultations:

"We have equipment at E125486 / N251532. We specify a 500m exclusion zone from the equipment."

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

3.1.16 Three Ireland Response to Consultations

Three Ireland provided the following email response to consultations:

> *"This area surrounds an important site for us in this area (MY0139). We have 4 x transmission links that pass though this area. Please see list below."*

Link Name / ID	Band MHz\GHz	Link Length	Site A					Site B				
			Lat	Long	Easting	Northing	Ant Height	Lat	Long	Easting	Northing	Ant Height
ML020879	26	4.7km	53.5031	-9.15191	123617	250948	26	53.528	-9.09439	127476	253649	22m
ML021587	18	4.6km	53.5031	-9.15191	123617	250948	26	53.4739	-9.10182	126890	247638	22.5m
ML021012	26	7.5km	53.5031	-9.15191	123617	250948	26	53.448	-9.0861	127890	244739	22.2m
ML021395	23	17km	53.5031	-9.15191	123617	250948	26	53.3781	-9.29827	113652	237197	10m



3.1.17 Viatel Response to Consultations

Viatel provided the following email response to consultations:

> *"No impact on Viatel's wireless infrastructure."*

3.1.18 Virgin Media Response to Consultations

Virgin Media the following email response to consultations:

> *"Virgin Media Ireland DO NOT have any radio links in this area."*

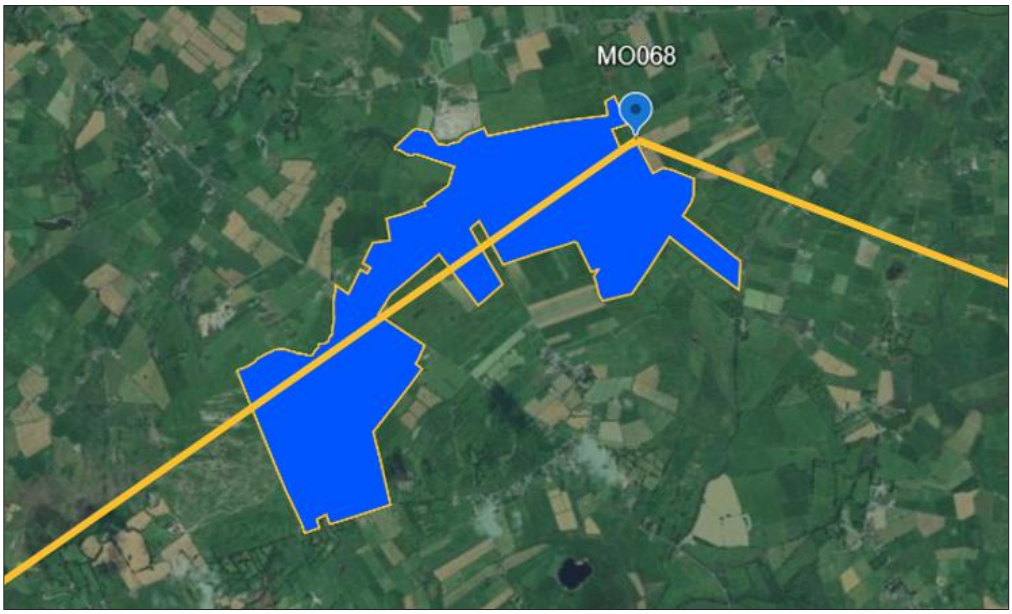
3.1.19 Vodafone Ireland Response to Consultations

Vodafone provided the following email response to consultations:

> *"Vodafone has one link passing directly over the proposed development. A clearance of 30m from the first Fresnel zone is desired."*

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Link Name / ID	Band GHz	Link Length Km	Site A			Site B		
			Northing (Irish Grid)	Easting (Irish Grid)	Ant Height m	Northing (Irish Grid)	Easting (Irish Grid)	Ant Height m
MO068-GY210	15	16.085	251682	125368	15	242710	112016	14



Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Section 4 - Field Surveys

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

4. Introduction

To assess the accuracy of the network information (radio link co-ordinates, antenna heights etc.) provided by the telecom operators, field surveys of the telecom-mast sites in the vicinity of the proposed wind farm were carried out. During the field surveys, radio antennas with bearings in the direction of the wind farm were recorded.

The telecom mast-sites surveyed for this study (labelled Mast-Sites A, B, C, D, E, F and G) are shown relative to the proposed wind farm site in Figure 4 below. The findings from the field surveys of the mast-sites are presented in Appendix B of this report.

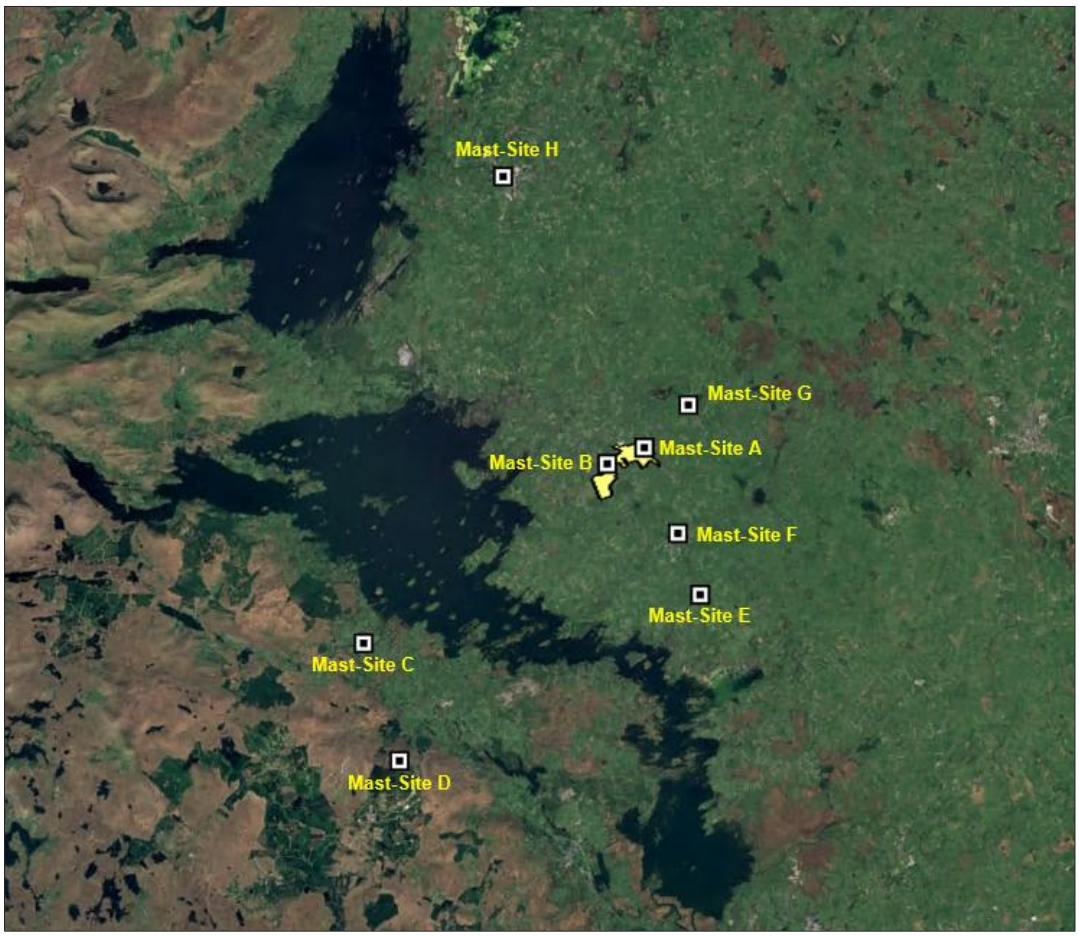


Figure 4. Telecom Mast-Sites Surveyed.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Section 5 - Network Analysis

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

5. Introduction

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

- Eir Network
- Imagine Broadband Network
- Tetra Ireland Network
- Three Ireland Network
- Vodafone Ireland Network

Sections 5.1 to 5.5 below outline the Network Analysis findings* for each of the Telecom Operator networks listed above.

5.1 Eir Network Analysis

The Eir 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 Table 4 below and a Plan View of the Eir network is shown in Figure 5.

Link ID	Link Description
Eir_L1	PTP microwave radio link from Brodullagh South to Carrowoughteragh.
Eir_L2	PTP microwave radio link from Brodullagh South to Cloghanower.
Eir_L3	PTP microwave radio link from Brodullagh South to Ballinrobe.

Table 4. Eir Radio Links requiring Analysis



Figure 5. Eir Radio Network – Plan View

** The Desktop Survey Analysis findings are subject to accuracy of the information (GPS co-ordinates, turbine dimensions, etc.) provided to Ai Bridges.*

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Figure 6 below shows a close-up view of the Eir microwave radio links relative to the proposed wind turbines. Desktop survey analysis indicates that two Eir links (Eir_L1 and Eir_L2) could be impacted by the proposed turbine layout.

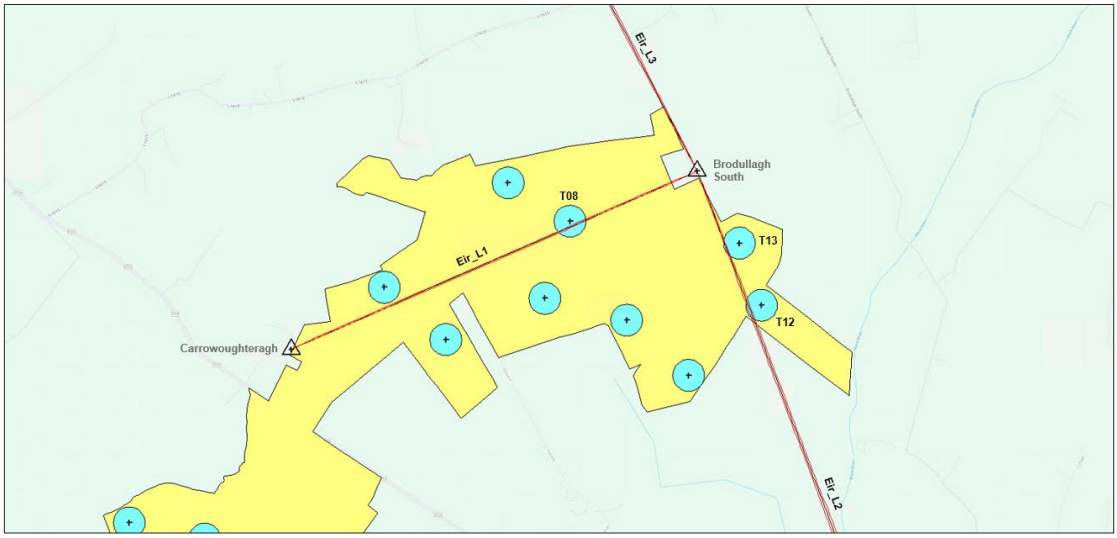


Figure 6. Eir Network – Close-up Plan View.

To further assess the potential impact of the proposed turbine layout, the turbines and the radio links have been modelled in 3D, as shown below in Figure 7. The Clearance Distances between the Fresnel Zone (F1) of each radio link and the blade-tip of the nearest turbine(s) have also been calculated.

The results of the 3D analysis indicate that:

- Eir_L1 (Brodullagh South to Carrowoughteragh) would be obstructed by Turbine T08.
- Eir_L2 (Brodullagh South to Cloghanower) would not be obstructed by any of the proposed turbines. However, it should be noted that the clearance distance between two of the proposed turbines (T12 and T13) and the Fresnel Zone of the radio link has been calculated to be less than 15 m.
- Eir_L3 (Brodullagh South to Ballinrobe) would not be obstructed by any of the proposed turbines.

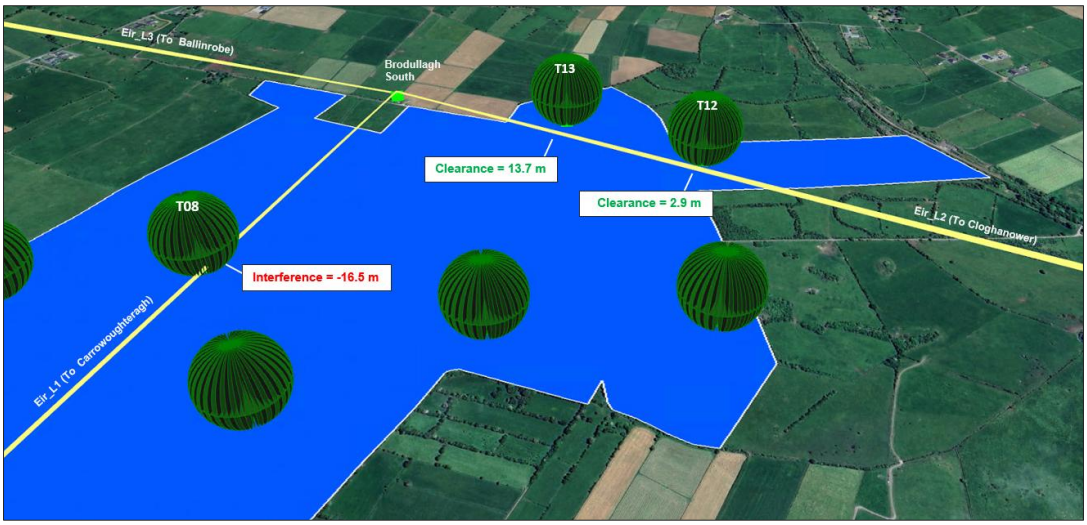


Figure 7. Eir Network – 3D View.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Table 7 below provides a brief summary of the network analysis for the Eir network in the vicinity of the proposed wind farm.

Radio Link ID	Link Description	Nearest Turbine(s)	Fresnel Zone (F1) Clearance / Interference	Observations
Eir_L1	Brodullagh South to Carrowoughteragh	T08	- 16.5 m (Infringement into Fresnel Zone)	Interference Impact (Mitigation measures required)
Eir_L2	Brodullagh South to Cloghanower	T12	2.9 m	Operator Consultation Required (Optional Mitigation measures are subject to further confirmatory assessments and consultations with the operator)
		T13	13.7 m	
Eir_L3	Brodullagh South to Ballinrobe	T13	> 250 m	No impacts

Table 5. Eir Network – Analysis Summary

Note: Although the 3D modelling analysis indicates that the radio link between Brodullagh South to Cloghanower will not be impacted, it is recommended that additional operator consultations are required regarding this radio link, due to the close proximity of T12 and T13 (less than 15 m).

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

5.2 Imagine Broadband Network Analysis

The Imagine Broadband 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 Table 6 below and a Plan View of the Imagine Broadband network is shown in Figure 8.

Link ID	Link Description
IMG_L1	PTP microwave radio link from Brodullagh South to Ballinrobe

Table 6. Eir Radio Links requiring Analysis



Figure 8. Imagine Broadband Radio Network – Plan View

Figure 9 below shows a close-up plan view of the Imagine Broadband microwave radio link relative to the proposed wind turbines. The plan view shows that the radio link would not be impacted by any of the proposed turbines.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

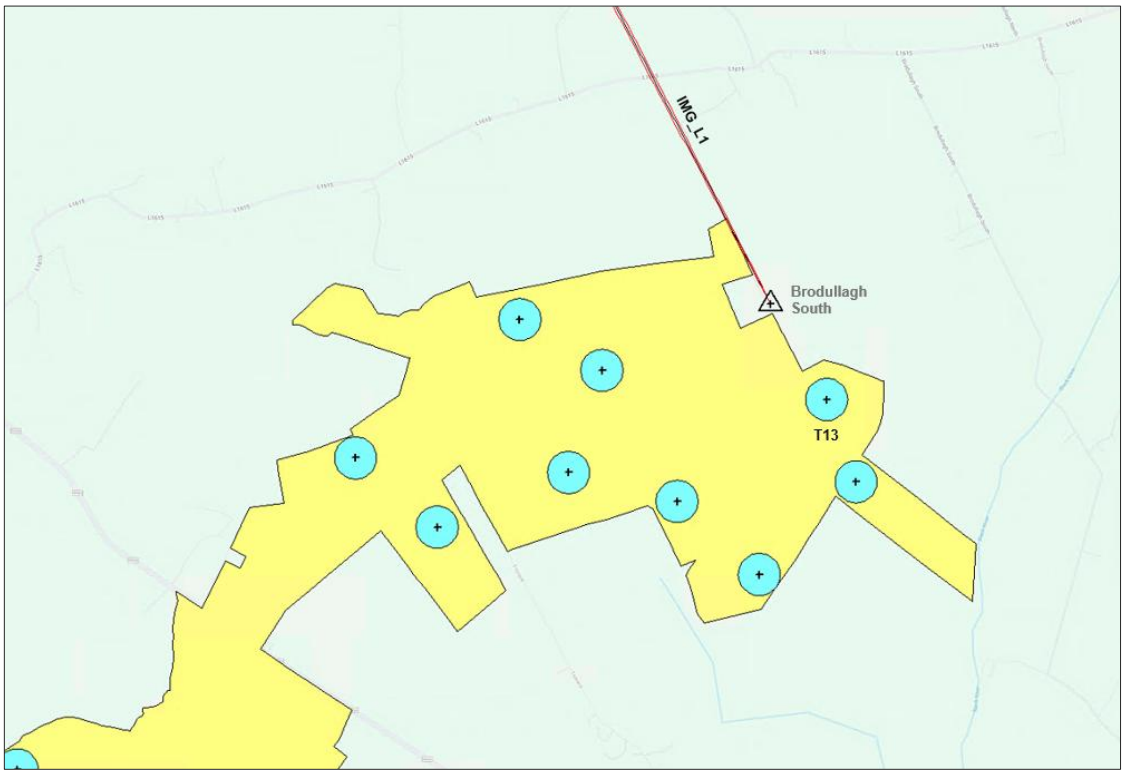


Figure 9. Imagine Broadband Network – Close-up Plan View.

Table 7 below provides a brief summary of the network analysis for the Imagine Broadband network in the vicinity of the proposed wind farm.

Radio Link ID	Link Description	Nearest Turbine(s)	Fresnel Zone (F1) Clearance / Interference	Observations
IMG_L1	Brodullagh South to Ballinrobe	T13	> 250 m	No impacts

Table 7. Imagine Broadband Network – Analysis Summary

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

5.3 Tetra Ireland Network Analysis

The Tetra Ireland network in the vicinity of the proposed wind farm consists of one Tetra Basestation located at the Brodullagh South mast-site. The basestation is listed in Table 8 below and a Plan View of the Tetra Ireland network is shown in Figure 10.

BS ID	Basestation Description
TI_BS1	Tetra Basestation at Brodullagh South Mast-Site.

Table 8. Tetra Ireland Basestations requiring Analysis



Figure 10. Tetra Ireland Network – Plan View

Figure 11 below shows a close-up view of the 500m Tetra Exclusion Zone (as specified by Tetra Ireland), relative to the proposed wind turbines. Desktop survey analysis indicates that one of the proposed turbines (T13) would be within the 500m Exclusion Zone and may impact service coverage from the Brodullagh South Mast-Site.

While there may be some signal degradation due to T13, it is unlikely that there would be any significant impact to Tetra service coverage in the area, as it is likely that there would be sufficient service coverage from secondary TETRA basestations in the region. However, a Tetra Impact Study would be required to assess the potential impact on the Tetra Ireland network.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Table 9 below provides a brief summary of the network analysis for the Tetra Ireland network in the vicinity of the proposed wind farm.

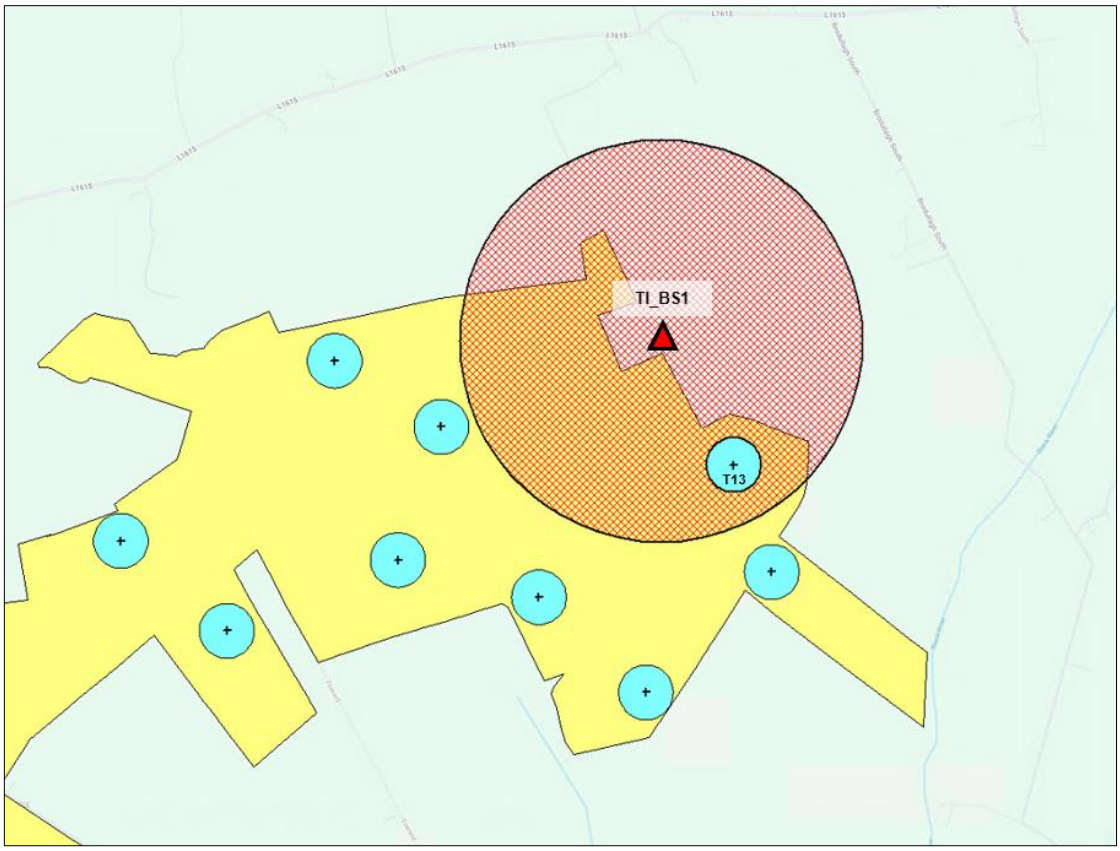


Figure 11. Tetra Ireland Network – Close-up Plan View.

Link ID	Link Description	Link Type	Tetra Exclusion Zone	Observations
TI_BS1	Brodullagh South Basestation	Tetra Basestation	500 m	Potentially impacted by T13. Mitigation Measures may be required.

Table 9. Tetra Ireland Network – Analysis Summary

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

5.4 Three Ireland Network Analysis

The Three Ireland network in the vicinity of the proposed wind farm consists of four Point-to-Point (PTP) microwave radio links. The radio links are listed in Table 10 below and a Plan View of the Three Ireland network is shown in Figure 12.

Link ID	Link Description
3IRL_L1	PTP microwave radio link from Carrowoughteragh to Ramolin.
3IRL_L2	PTP microwave radio link from Carrowoughteragh to Gortnamona.
3IRL_L3	PTP microwave radio link from Carrowoughteragh to Cloghanower.
3IRL_L4	PTP microwave radio link from Carrowoughteragh to Letir.

Table 10. Three Ireland Radio Links requiring Analysis

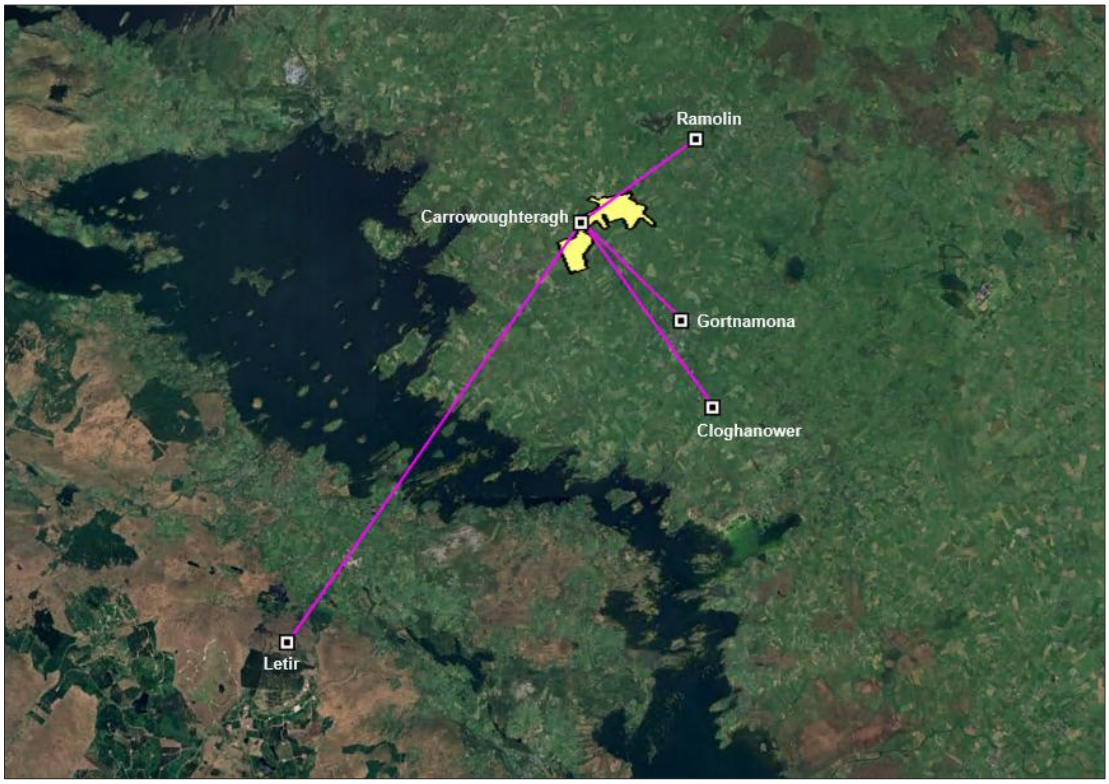


Figure 12. Three Ireland Radio Network – Plan View

Figure 13 below shows a close-up view of the Three Ireland microwave radio links relative to the proposed wind turbines. Desktop survey analysis indicates that one of the radio links (3IRL_L1) could be impacted by the proposed turbine layout.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

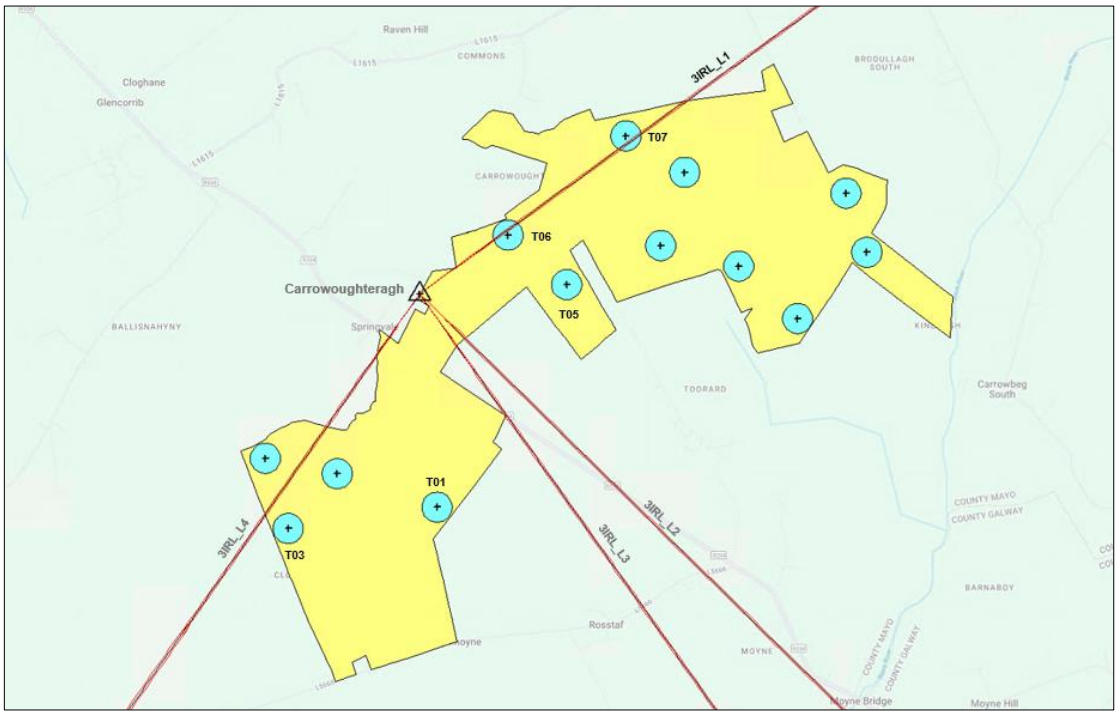


Figure 13. Three Ireland Network – Close-up Plan View.

To further assess the potential impacts, the radio link has been modelled in 3D and the Clearance Distances between the Fresnel Zone (F1) and the blade-tip of turbines T06 and T07 has been calculated. A 3D view of the microwave radio link relative to the proposed turbines is shown below in Figure 14.

The 3D model indicates that the radio link between Carrowoughteragh and Ramolin would be obstructed by both T06 and T07.

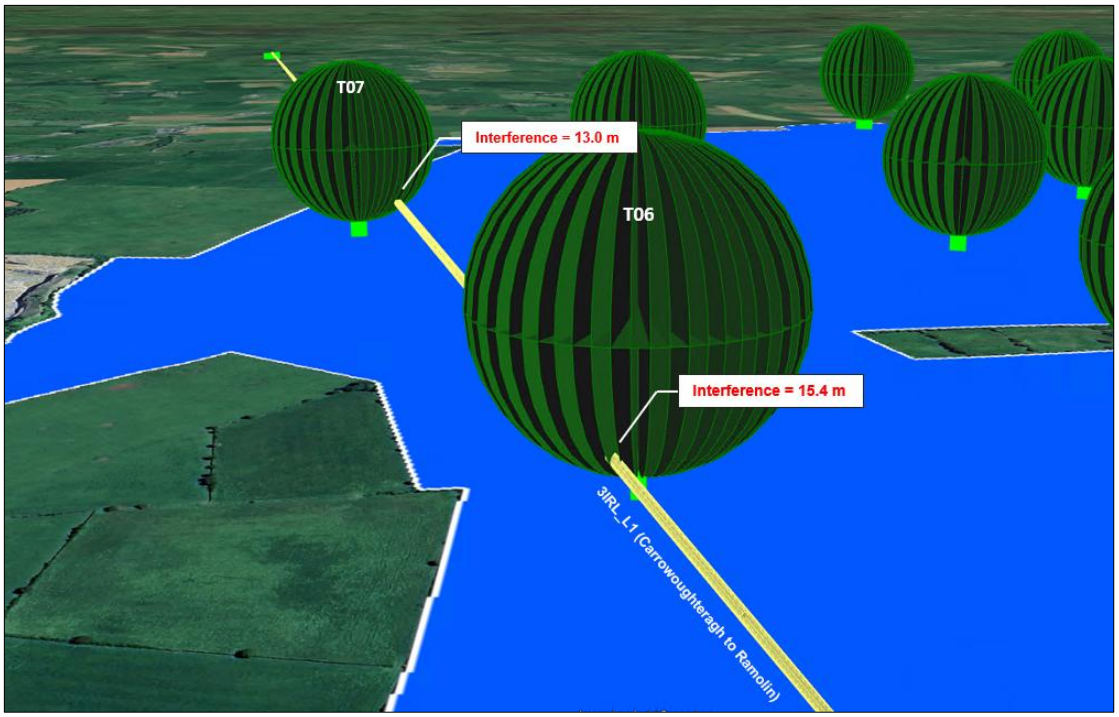


Figure 14. Three Ireland Network – 3D View.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Table 11 below provides a brief summary of the network analysis for the Three Ireland network in the vicinity of the proposed wind farm.

Radio Link ID	Link Description	Nearest Turbine(s)	Fresnel Zone (F1) Clearance / Interference	Observations
3IRL_L1	Carrowoughteragh to Ramolin	T06	- 15.4 m (Infringement into Fresnel Zone)	Interference Impact (Mitigation measures required)
		T07	- 13.0 m (Infringement into Fresnel Zone)	
3IRL_L2	Carrowoughteragh to Gortnamona	T05	> 50 m	No impacts
3IRL_L3	Carrowoughteragh to Cloghanower	T01	> 50 m	No impacts
3IRL_L4	Carrowoughteragh to Letir	T03	> 50 m	No impacts

Table 11. Three Ireland Network – Analysis Summary

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

5.5 Vodafone Network Analysis

The Vodafone 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 Table 12 below and a Plan View of the Vodafone network is shown in Figure 15.

Link ID	Link Description
VF_L1	PTP microwave radio link from Brodullagh South to Oughterard Garda Station.

Table 12. Vodafone Radio Links requiring Analysis



Figure 15. Vodafone Radio Network – Plan View

Figure 16 below shows a close-up plan view of the Vodafone microwave radio link relative to the proposed wind turbines. The plan view indicates that the radio link is potentially obstructed by three turbines (T02, T05 and T09).

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

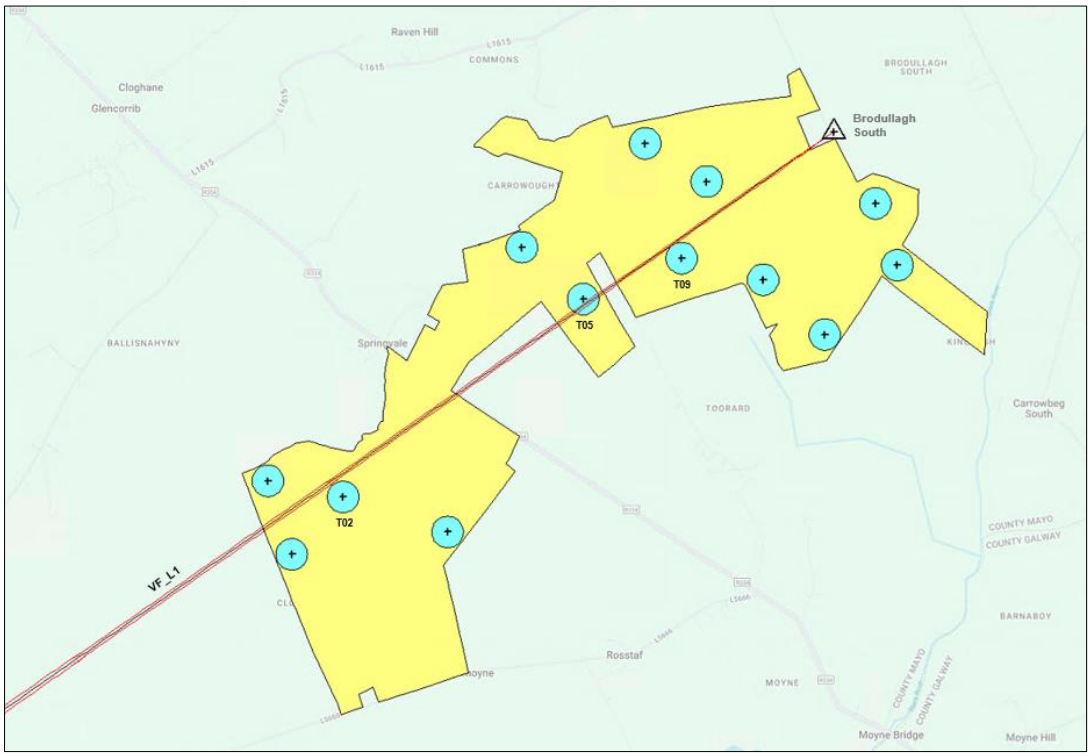


Figure 16. Vodafone Network – Close-up Plan View.

To further assess the potential impacts, the radio link has been modelled in 3D and the Clearance Distances between the Fresnel Zone (F1) and the blade-tip of the turbines (T02, T05 & T09) has been calculated. A 3D view of the microwave radio link relative to the proposed turbines is shown below in Figure 17.

The 3D model indicates that the radio link between Brodullagh South and Oughterard Garda Station would be obstructed by Turbine T05.

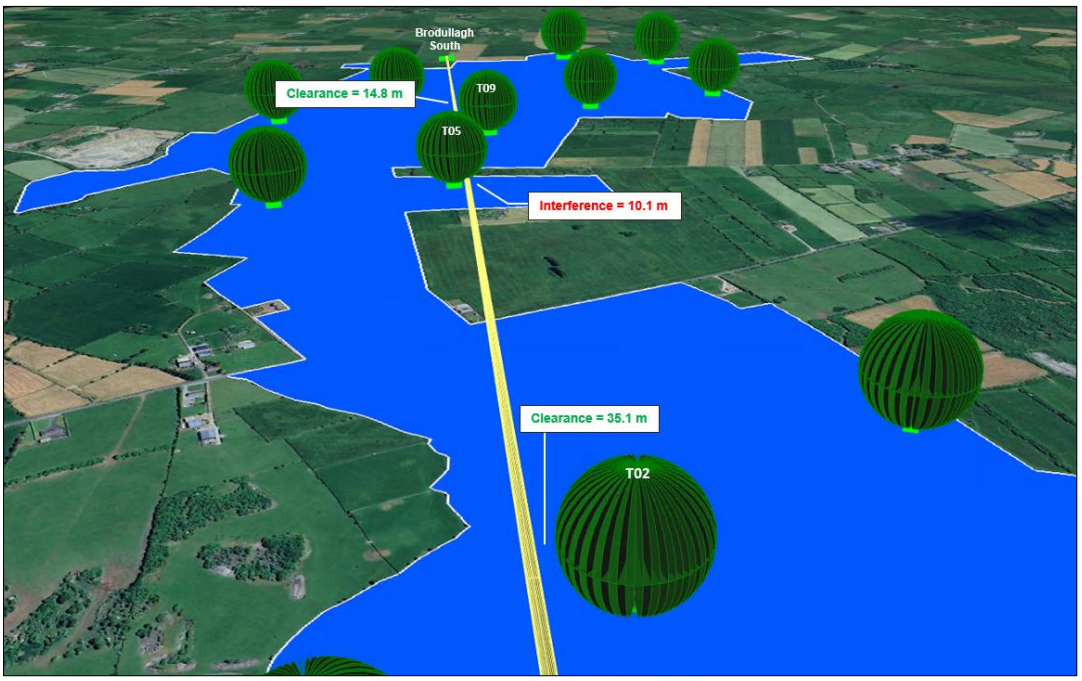


Figure 17. Vodafone Network – 3D View.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Table 13 below provides a brief summary of the network analysis for the Vodafone network in the vicinity of the proposed wind farm.

Radio Link ID	Link Description	Nearest Turbine(s)	Fresnel Zone (F1) Clearance / Interference	Observations
VF_L1	Brodullagh South to Oughterard Garda Station.	T02	35.1 m	Interference Impact (Mitigation measures required)
		T05	- 10.1 m (Infringement into Fresnel Zone)	
		T09	14.8 m	

Table 13. Vodafone Network – Analysis Summary

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Section 6 - Mitigation Measures

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

6. Mitigation Measures

Sections 6.1 to 6.4 herein, describe some of the technically viable mitigation measures that can be implemented to offset the potential impact of the proposed turbines on the Telecom Operator networks (i.e. Eir, Tetra Ireland, Three Ireland and Vodafone Networks).

6.1 Mitigation Measure Solutions – Eir Network

The most technically viable mitigation measure option to offset the potential impact on the Eir link between Brodullagh South and Carrowoughteragh (Eir_L1) is to relay the radio link via an existing telecoms mast. This mitigation measure is described in Sections 6.1.1 below.

The most technically viable mitigation measure option to offset the potential impact on the Eir link between Brodullagh South and Cloghanower (Eir_L2) is to relay the radio link via an existing telecoms mast. This mitigation measure is described in Sections 6.1.2 below.

6.1.1 Eir_L1 - Relay the radio link via an existing Telecoms Mast.

Figure 18 below illustrates how the existing telecoms mast-site at Ballinrobe could be used to relay a radio link between Brodullagh South and Carrowoughteragh.

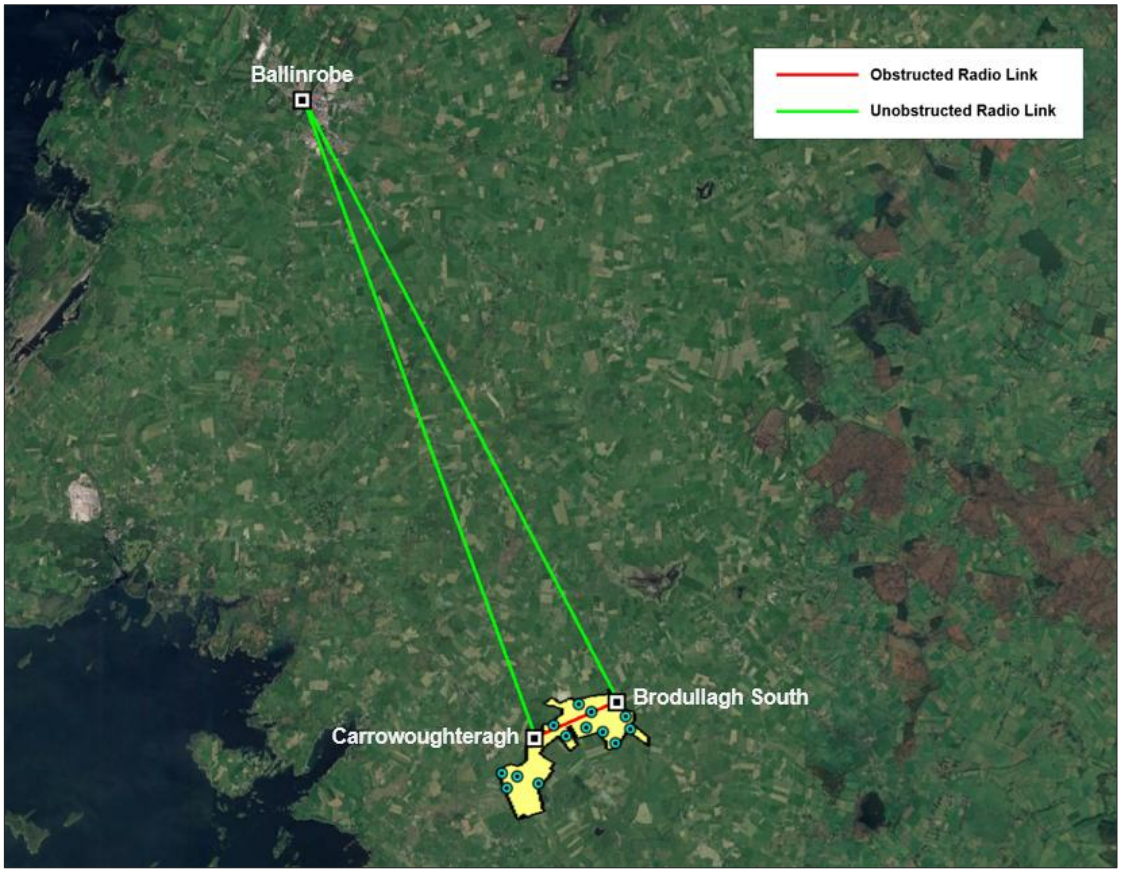


Figure 18. Example of how an existing telecoms mast could be used to relay the radio link between Brodullagh South and Carrowoughteragh (Eir_L1).

To determine if Ballinrobe could be used as a viable relay-mast, radio link path profiles were generated. Radio Link Budgets were also carried out to determine if the proposed links would meet the Radio Link Availability Criteria required by ComReg for radio licensing. The Radio

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Link Path Profiles and Radio Link Budgets are based on the following ITU-R Recommendations:

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

The Radio Path Profiles are shown below in Section 6.1.1.1 and Section 6.1.1.2. The Radio Link Budgets can be found in Appendix C (Sections C.1 and C.2).

6.1.1.1 Path Profile – Brodullagh South to Ballinrobe

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

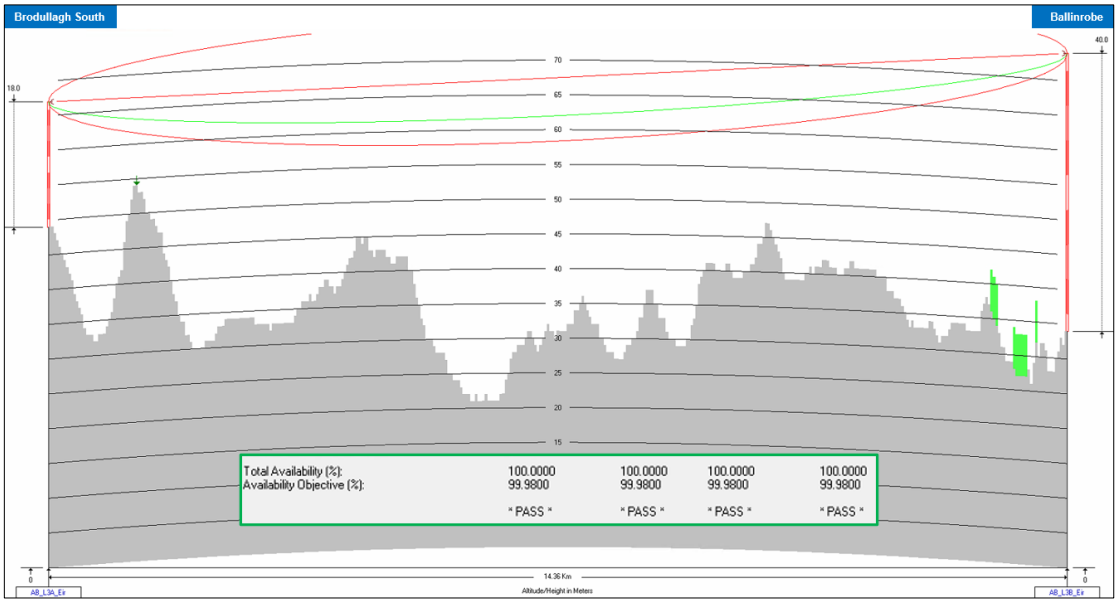


Figure 19. Path Profile – Brodullagh South to Ballinrobe

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

6.1.1.2 Path Profile – Ballinrobe to Carrowoughteragh

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

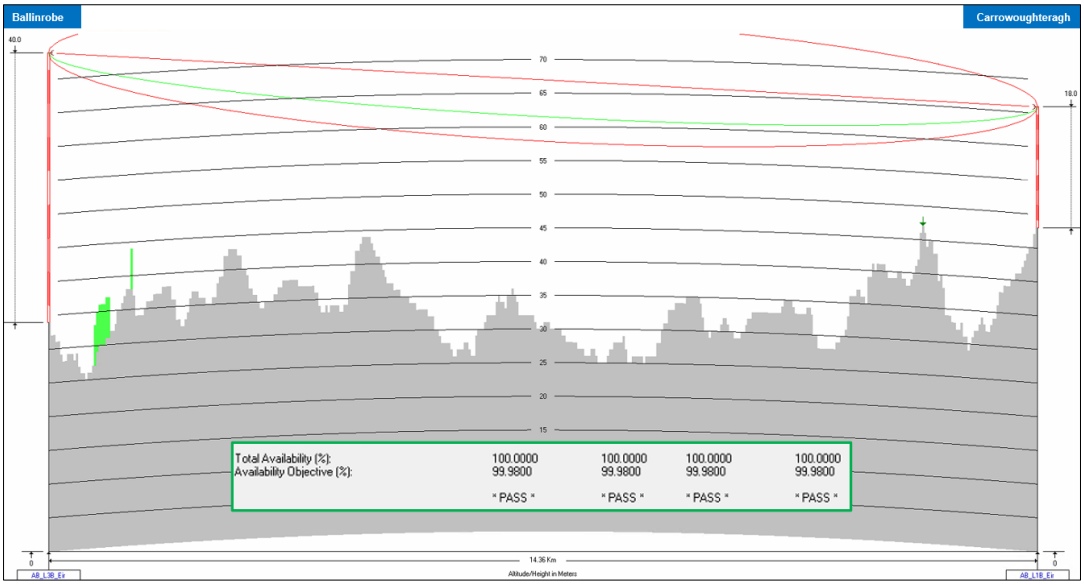


Figure 20. Path Profile – Ballinrobe to Carrowoughteragh

6.1.1.3 Relay radio link via an existing Telecoms Mast – Reference Example

An example of where this mitigation measure was proposed and accepted, is at Tullacondra Wind Farm, Co Cork (planning ref: 245503). In this example, the telecom operator agreed that an impacted radio link could be mitigated by relaying the connection via one of their existing telecom mast sites in the subject area.

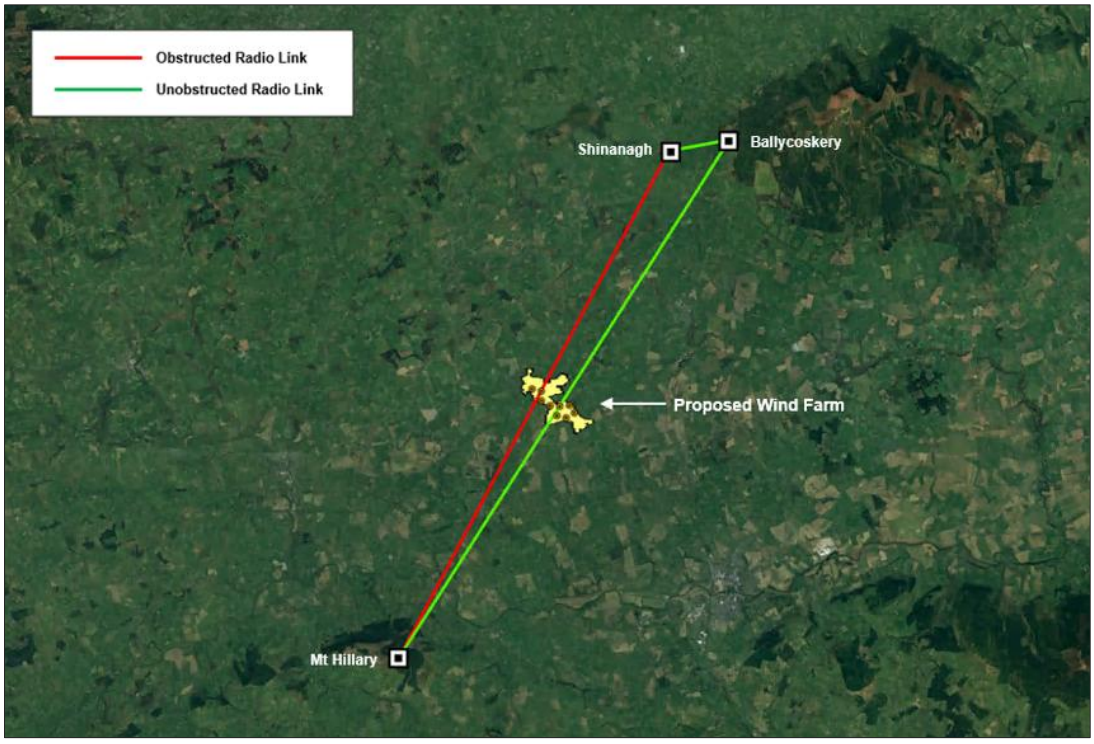


Figure 21. Relay radio link via existing Telecoms Mast – Tullacondra Wind Farm Example

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

6.1.2 Eir_L2 - Relay the radio link via an existing Telecoms Mast.

Figure 22 below illustrates how the existing telecoms mast-site at Headford could be used to relay a radio link between Brodullagh South and Cloghanower.

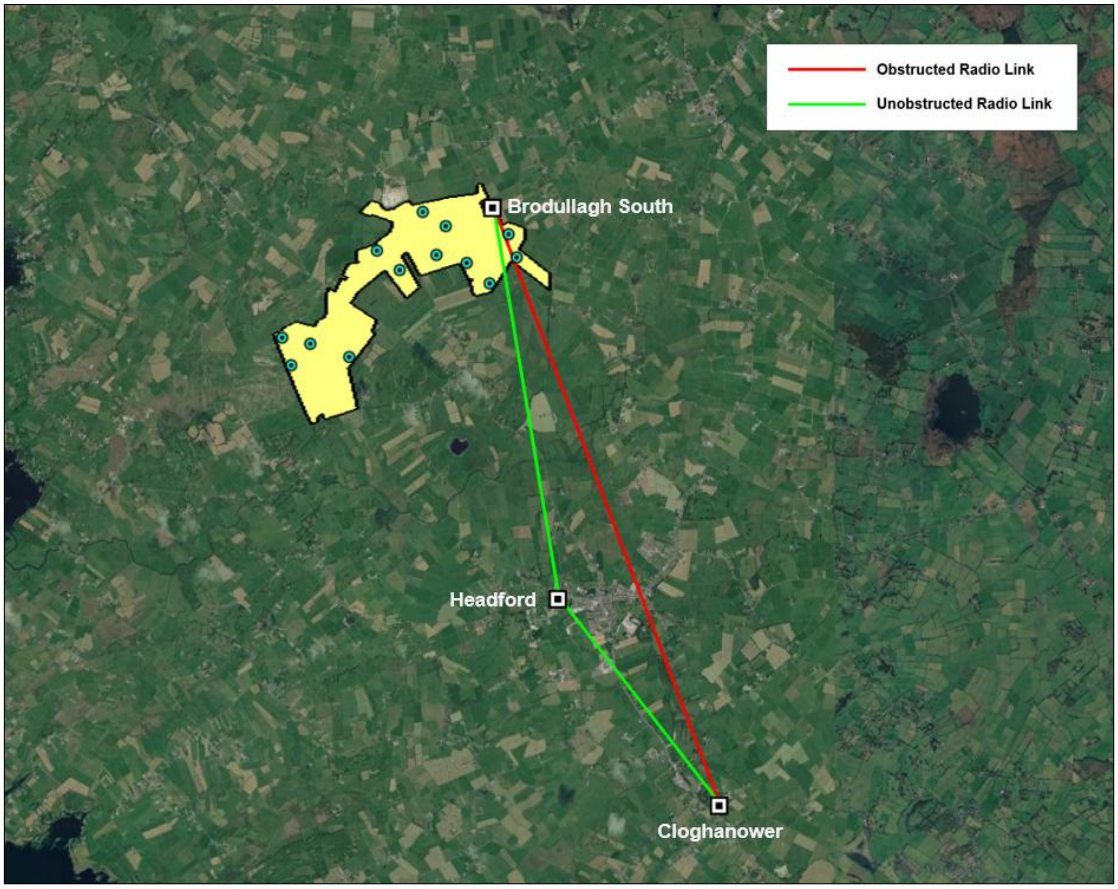


Figure 22. Example of how an existing telecoms mast could be used to relay the radio link between Brodullagh South and Cloghanower (Eir_L2).

To determine if Headford could be used as a viable relay-mast, radio link path profiles were generated. Radio Link Budgets were also carried out to determine if the proposed links would meet the Radio Link Availability Criteria required by ComReg for radio licensing. The Radio Link Path Profiles and Radio Link Budgets are based on the following ITU-R Recommendations:

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

The Radio Path Profiles are shown below in Section 6.1.2.1 and Section 6.1.2.2. The Radio Link Budgets can be found in Appendix C (Sections C.3 and C.4).

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

6.1.2.1 Path Profile – Brodullagh South to Headford

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

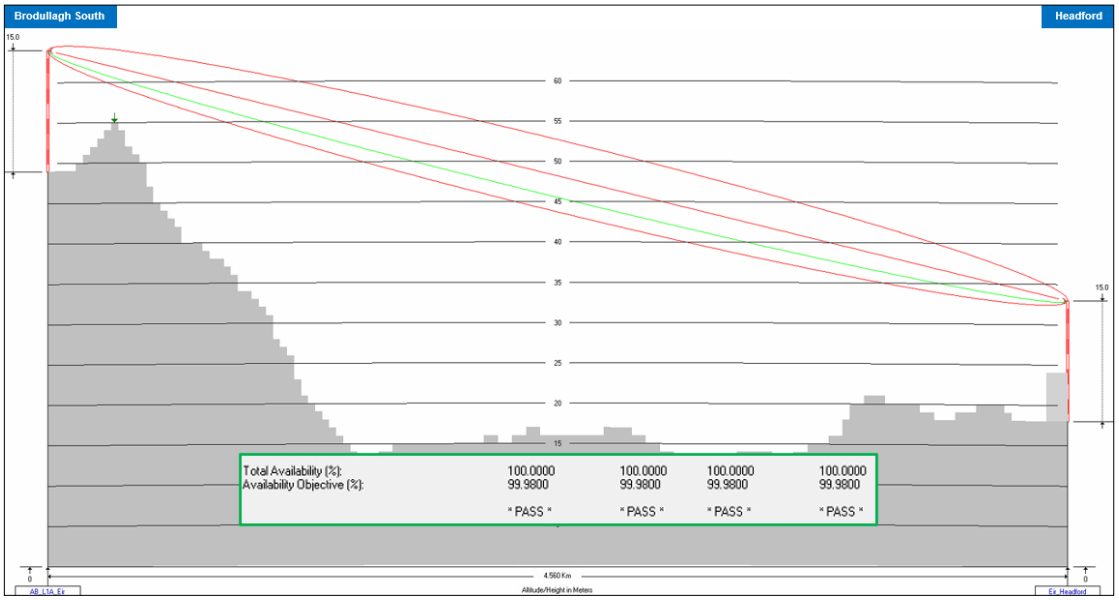


Figure 23. Path Profile – Brodullagh South to Headford

6.1.2.2 Path Profile – Headford to Cloghanower

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

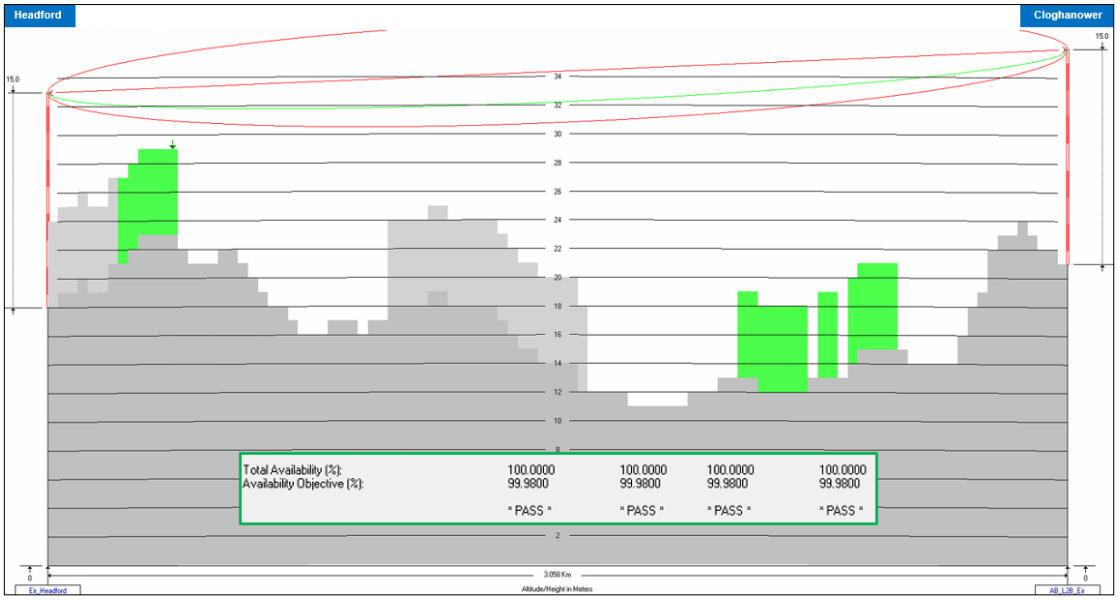


Figure 24. Path Profile – Headford to Cloghanower

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

6.2 Mitigation Measure Solutions – Tetra Network

A Tetra Impact Study would be required to assess the potential impact on service coverage and to determine if mitigation measures are required for the Tetra Ireland network.
If mitigation measures are deemed to be necessary, the following technically viable solutions are available:

- Install a Secondary Tetra Transmitter – to provide service coverage the area potentially impacted by T13.
- Relocate Existing Tetra Basestation – so that a 500m Exclusion Zone form all turbines is observed.

A brief description of both of the above-listed mitigation measures is provided below.

6.2.1 Install a Secondary Tetra Transmitter

An alternative option to offset any potential impact due to T13, would be to install a second Tetra transmitter (i.e. in addition to the existing Basestation), to serve the area to the southeast of the proposed development.
The additional transmitter (e.g. monopole, with electrical power supply, etc.) required for the second TETRA site could be sited adjacent to one of the proposed turbines.

6.2.2 Relocate Existing Tetra Basestation.

As TETRA Ireland have specified that turbines should not be located within 500m of their Tetra Transmitter / Basestation, a technically viable mitigation measure option would be to re-locate the basestation to an area within the wind farm site boundary, to ensure that this minimum distance is achieved.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

6.3 Mitigation Measure Solutions – Three Ireland Network

The most technically viable mitigation measure option to offset the potential impact on the Three Ireland link between between Carrowoughteragh and Ramolin (3IRL_L1) is to relay the radio link via an existing telecoms mast. This mitigation measure is described in Sections 6.2.1 below.

6.3.1 3IRL_L1 - Relay the radio link via an existing Telecoms Mast.

Figure 25 below illustrates how the existing telecoms mast-site at Cloghanower could be used to relay a radio link between Carrowoughteragh and Ramolin.

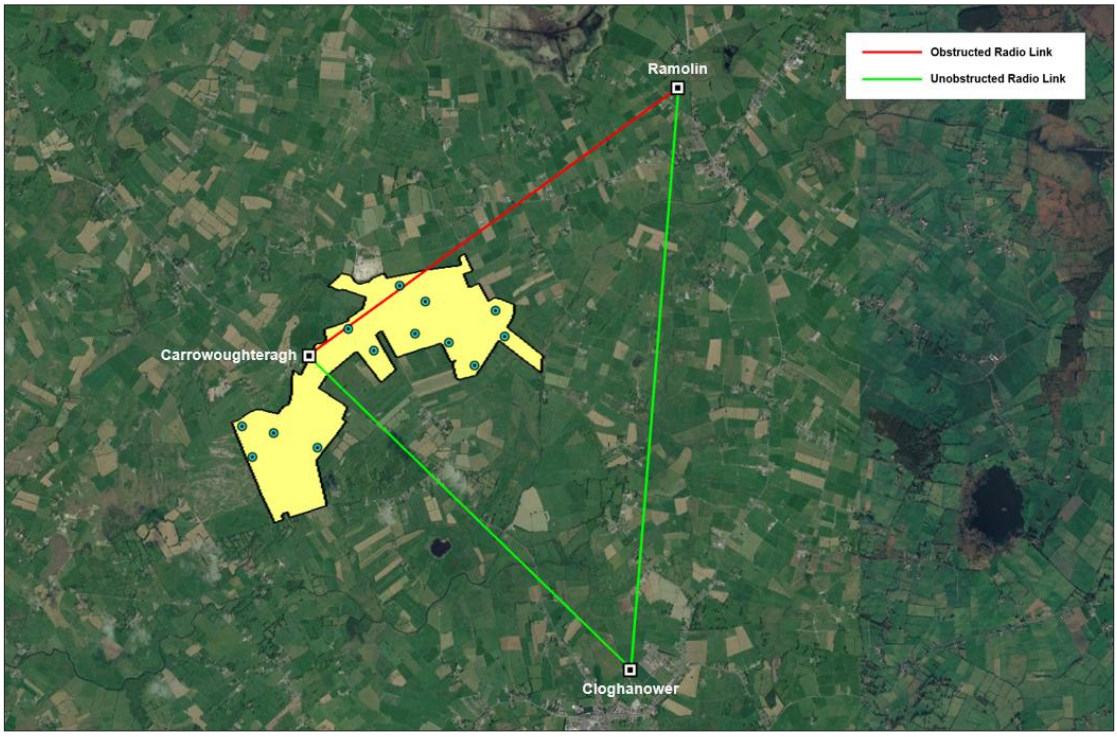


Figure 25. Example of how an existing telecoms mast could be used to relay the radio link between Carrowoughteragh and Ramolin.

To determine if Cloghanower could be used as a viable relay-mast, radio link path profiles were generated. Radio Link Budgets were also carried out to determine if the proposed links would meet the Radio Link Availability Criteria required by ComReg for radio licensing. The Radio Link Path Profiles and Radio Link Budgets are based on the following ITU-R Recommendations:

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

The Radio Path Profiles are shown below in Section 6.3.1.1 and Section 6.3.1.2. The Radio Link Budgets can be found in Appendix C (Sections C.5 and C.6).

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

6.3.1.1 Path Profile – Carrowoughteragh to Cloghanower

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

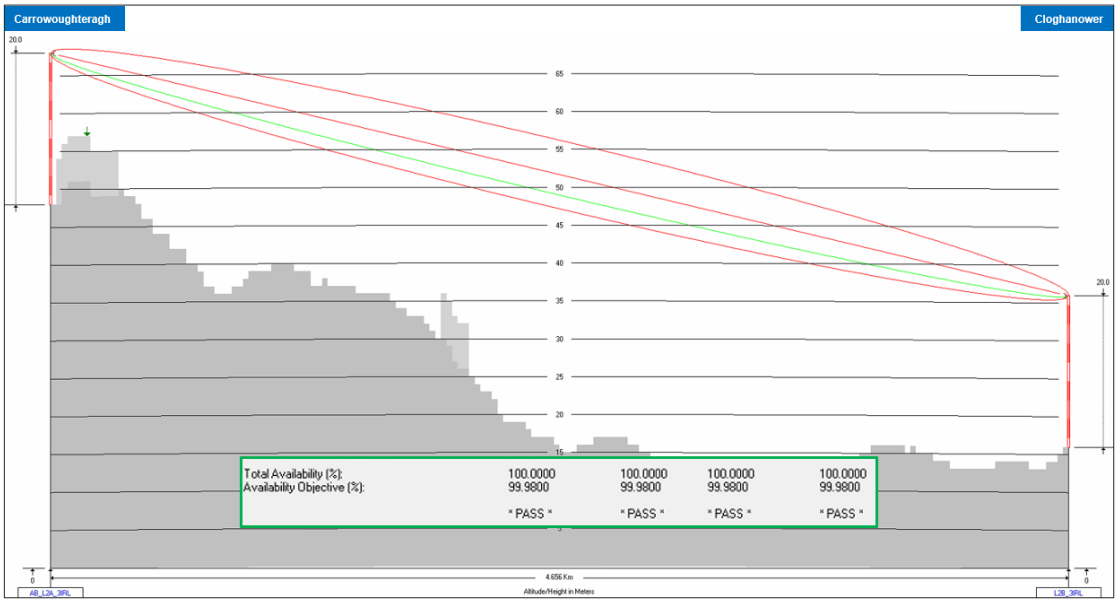


Figure 26. Path Profile – Carrowoughteragh to Cloghanower

6.3.1.2 Path Profile – Cloghanower to Ramolin

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

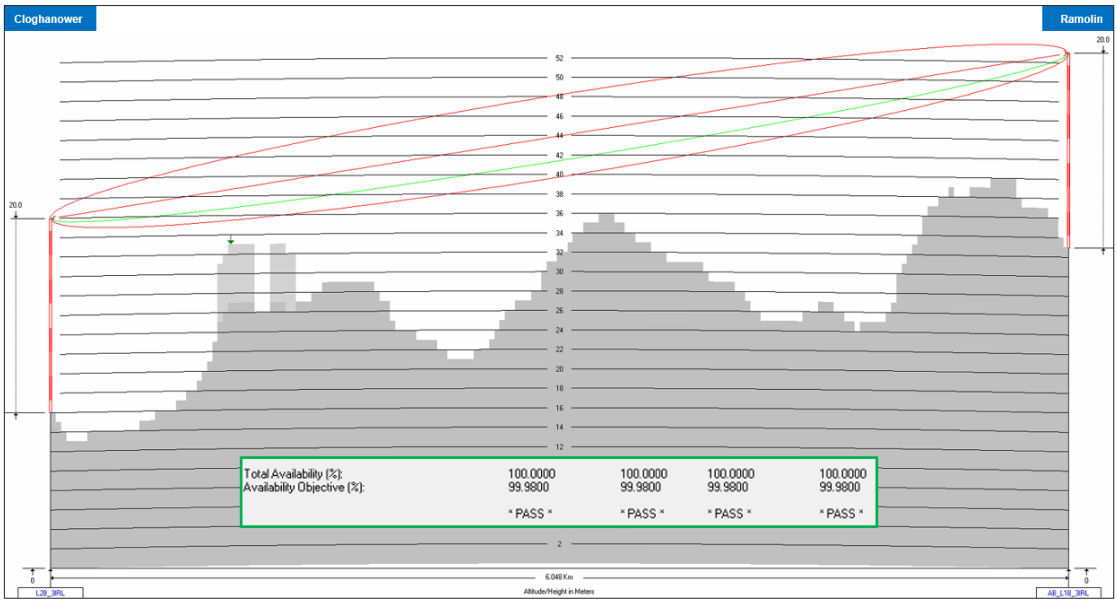


Figure 27. Path Profile – Cloghanower to Ramolin

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

6.4 Mitigation Measure Solutions – Vodafone Network

The most technically viable mitigation measure option to offset the potential impact on the Vodafone link between Brodullagh South and Oughterard (VfL_L1) is to relay the radio link via an existing telecoms mast. This mitigation measure is described in Sections 6.3.1 below.

6.4.1 VF_L1 - Relay the radio link via an existing telecoms mast.

Figure 28 below illustrates how the existing telecoms mast-site at Letir could be used to relay a radio link between Brodullagh South and Oughterard Garda Station.

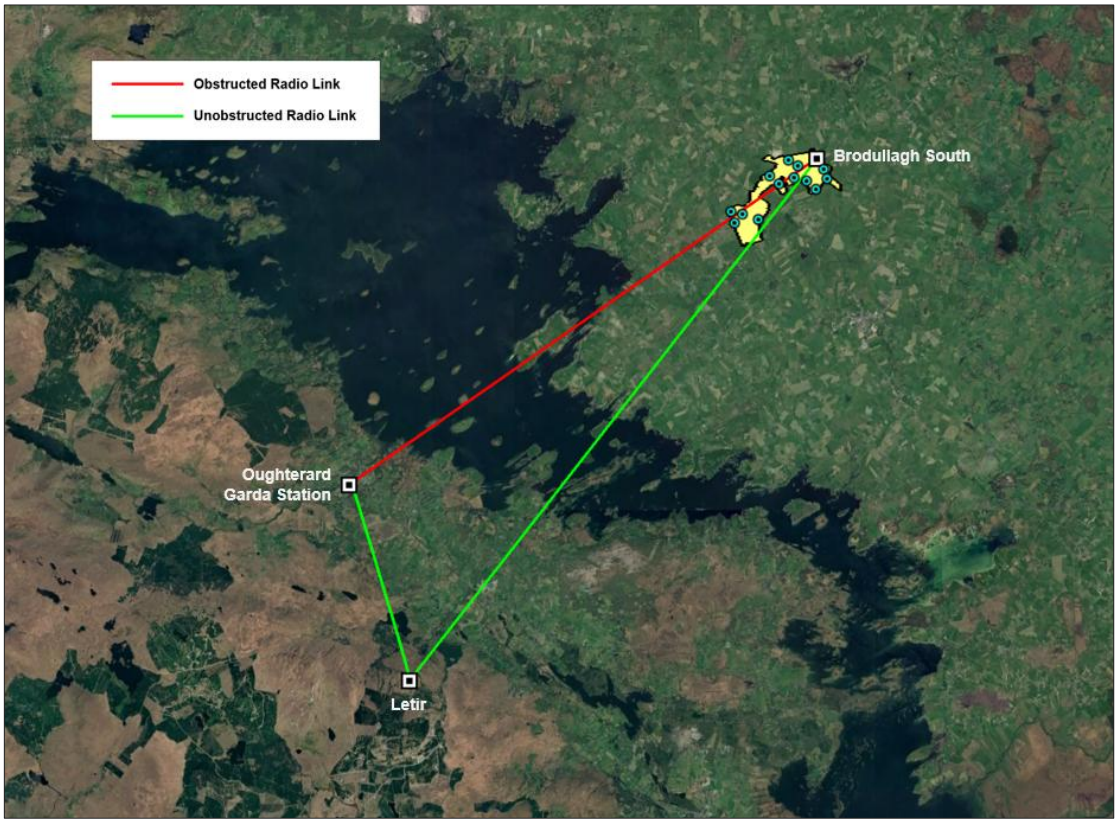


Figure 28. Example of how an existing telecoms mast could be used to relay the radio link between Brodullagh South and Oughterard Garda Station.

To determine if Letir could be used as a viable relay-mast, radio link path profiles were generated. Radio Link Budgets were also carried out to determine if the proposed links would meet the Radio Link Availability Criteria required by ComReg for radio licensing. The Radio Link Path Profiles and Radio Link Budgets are based on the following ITU-R Recommendations:

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

The radio Path Profiles are shown below in Section 6.3.1.1 and Section 6.3.1.2. The Radio Link Budgets can be found in Appendix C (Sections C.7 and C.8).

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

6.4.1.1 Path Profile – Brodullagh South to Letir

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

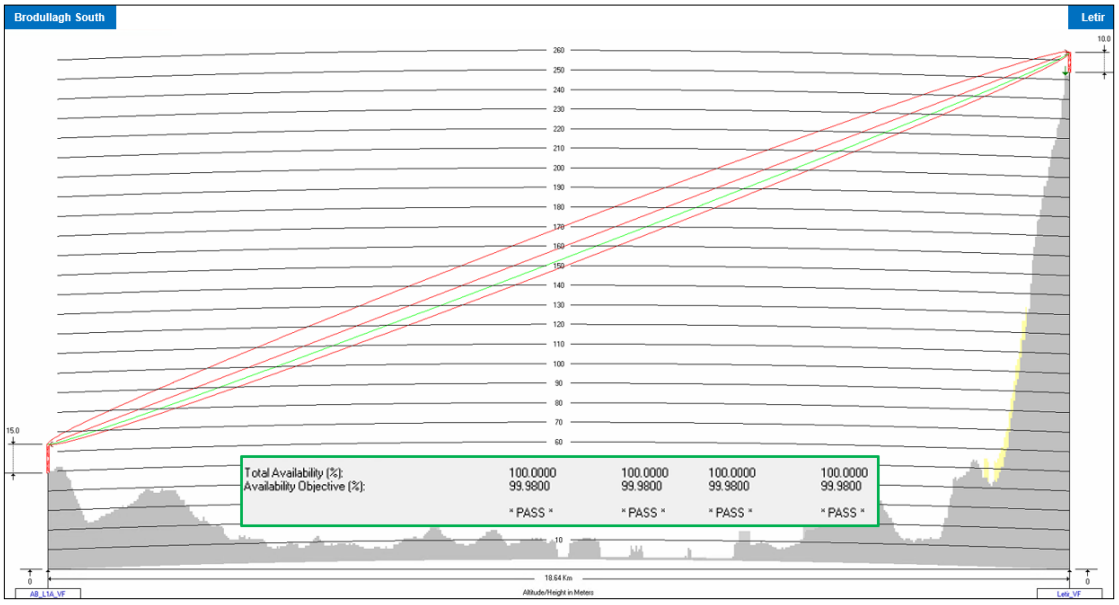


Figure 29. Path Profile – Brodullagh South to Letir

6.4.1.2 Path Profile – Letir to Oughterard Garda Station

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

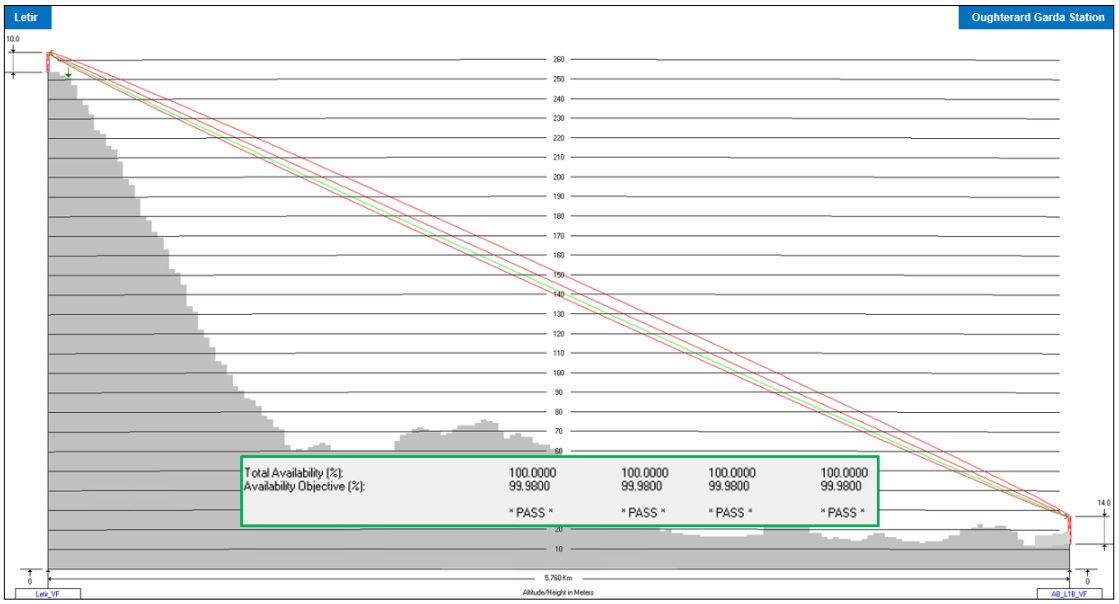


Figure 30. Path Profile – Letir to Brodullagh South

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Section 7 - Recommendations

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

7. Recommendations

To offset the potential impact to the Eir, Tetra Ireland, Three Ireland and Vodafone radio networks due to the proposed wind turbines, it is recommended that the following technically viable mitigation measure proposal should be effected as a condition of planning in the event of a successful planning application.

The Applicant in this instance will be responsible for all costs associated with the mitigation measures set out. A protocol agreement will be put in place between the Applicant and the telecoms operators (Eir, Three Ireland and Vodafone), prior to the construction of the proposed wind farm, to agree terms such as estate management, operator access, electricity supply etc.

Telecom Operator	Link ID	Recommended Mitigation Measures
Eir	Eir_L1	A Transmission Link Relay via an existing Eir Telecoms Mast-site. (i.e. re-routing of the existing Eir radio link via another existing telecoms mast structure, e.g. Ballinrobe)
	Eir_L2	A Transmission Link Relay via an existing Eir Telecoms Mast-site. (i.e. re-routing of the existing Eir radio link via another existing telecoms mast structure, e.g. Headford)
Tetra Ireland	TI_BS1	Relocate Existing Tetra Basestation / Install Secondary Tetra Transmitter
Three Ireland	3IRL_L1	A Transmission Link Relay via an existing Three Ireland Telecoms Mast-site. (i.e. re-routing of the existing Eir radio link via another existing telecoms mast structure, e.g. Cloghanower)
Vodafone	VF_L1	A Transmission Link Relay via an existing Vodafone Telecoms Mast-site. (i.e. re-routing of the existing Eir radio link via another existing telecoms mast structure, e.g. Letir)

Table 14. Recommended Mitigation Measures (Post Planning Consent)

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Section 8 - Conclusions

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

8. Conclusions

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

- Results from the telecom operator consultations and desktop survey analysis indicate that there are nine radio links and one Tetra Basestation in the vicinity of the proposed development.
- The impacts of the proposed turbine layout on the Telecom Operator radio links are listed below in Table 15.

Operator	Network Description	Impact of Wind Farm	Mitigation Measures
Eir	PTP radio link from Brodullagh South to Carrowoughteragh.	Impacted by T08	Relay the radio link via an existing Telecoms Mast-Site (e.g. the existing mast-site at Ballinrobe).
	PTP radio link from Brodullagh South to Cloghanower.	Potentially impacted by T12 & T13 (3D analysis indicates that the link would not be obstructed. However, the clearance distance between two turbines (T12 and T13) and the radio link would be relatively small (< 15 m) and further consultations with Eir are recommended).	Relay the radio link via an existing Telecoms Mast-Site (e.g. the existing mast-site at Headford).
	PTP radio link from Brodullagh South to Ballinrobe.	No impacts.	N.A
Imagine Broadband	PTP radio link from Brodullagh South to Ballinrobe.	No impacts.	N.A
Tetra Ireland	Tetra Basestation at Brodullagh South.	Potentially Impacted by T13. (T13 is located within the TI 500m Exclusion Zone)	Relocate Existing Tetra Basestation / Install Secondary Tetra Transmitter
Three Ireland	PTP radio link from Carrowoughteragh to Ramolin.	Impacted by T06 & T07	Relay the radio link via an existing Telecoms Mast-Site (e.g. the existing mast-site at Cloghanower).
Three Ireland	PTP radio link from Carrowoughteragh to Gortnamona.	No impacts	N.A
Three Ireland	PTP radio link from Carrowoughteragh to Cloghanower.	No impacts	N.A
Three Ireland	PTP radio link from Carrowoughteragh to Leitir.	No impacts	N.A
Vodafone	PTP radio link from Brodullagh South to Oughterard Garda Station.	Impacted by T05	Relay the radio link via an existing Telecoms Mast-Site (e.g. the existing mast-site at Letir).

Table 15. Radio Links / Tetra Basestation in vicinity of proposed wind farm.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

- Figure 31 below has been provided to illustrate each of the four radio links that could be impacted by the proposed turbine layout (i.e. 2 Eir links, 1 Three Ireland link and 1 Vodafone link).

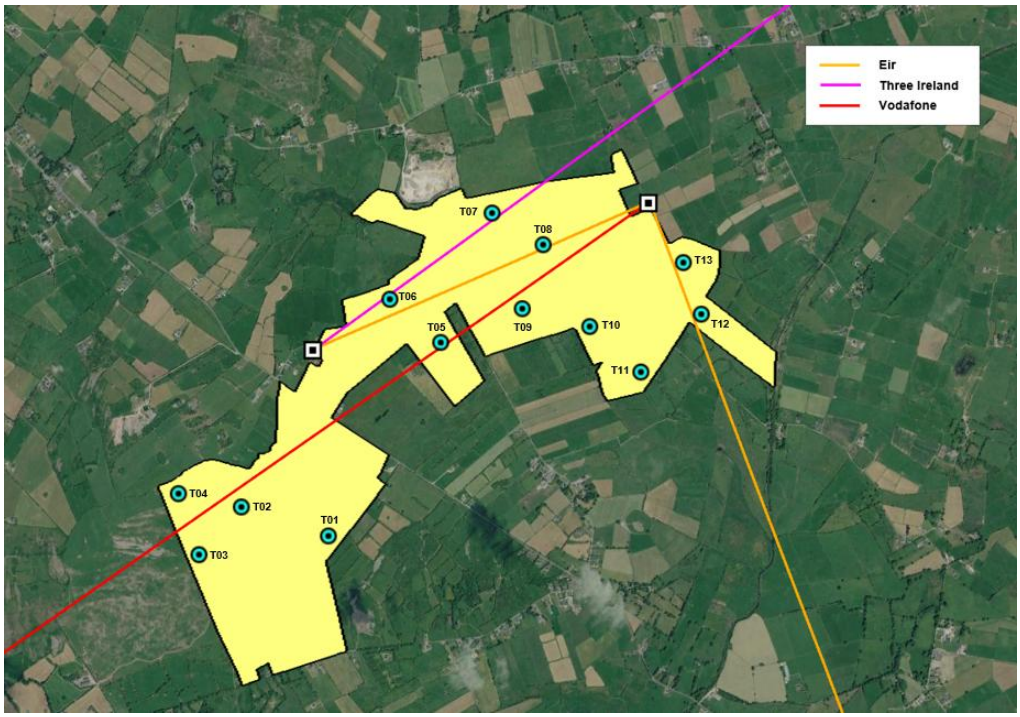


Figure 31. Telecommunication links impacted by proposed turbines

- The most technically feasible mitigation measure to offset the potential impact on the Eir link between Brodullagh South to Carrowoughteragh (Eir_L1) is to relay the radio link via an existing Telecoms Mast (e.g. the existing mast-site at Ballinrobe). This mitigation measure is described in Sections 6.1.1.

- The most technically feasible mitigation measure to offset the potential impact on the Eir link between Brodullagh South to Cloghanower (Eir_L2) is to relay the radio link via an existing Telecoms Mast (e.g. the existing mast-site at Headford). This mitigation measure is described in Sections 6.1.2.

- The most technically feasible mitigation measure to offset the potential impact on the Tetra Ireland Network is to relocate the existing Tetra Basestation (or install a Secondary Tetra Transmitter) to a location within the proposed wind farm site. This mitigation measure is described in Sections 6.1.3.

- The most technically feasible mitigation measure to offset the potential impact on the Three Ireland link between Carrowoughteragh to Ramolin (3IRL_L1) is to relay the radio link via an existing Telecoms Mast (e.g. the existing mast-site at Cloghanower). This mitigation measure is described in Sections 6.3.1

- The most technically feasible mitigation measure to offset the potential impact on the Vodafone link between Brodullagh South to Oughterard Garda Station (VF_L1) is to relay the radio link via an existing Telecoms Mast (e.g. the existing mast-site at Letir). This mitigation measure is described in Sections 6.4.1

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Based on previous experience and precedents of similar mitigation proposals being proposed and accepted, the most technically feasible mitigation measures are outlined in this report. The proposed measures will offset the potential impacts of the proposed turbines at Rooaunalaghta on the existing telecommunications network infrastructure.

The Applicant in this instance will be responsible for all costs associated with the mitigation measures set out. A protocol agreement will be put in place between the Applicant and the telecoms operators (Eir, Tetra Ireland, Three Ireland and Vodafone), prior to the construction of the proposed wind farm to agree terms such as estate management, operator access, electricity supply etc.

Based on the implementation of the proposed mitigation measures outlined in this report it is considered that there will be no residual adverse effects on the existing telecommunication infrastructure network as a result of the proposed wind farm.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

APPENDIX A – Wind Farm Turbine Coordinates

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Appendix A – Wind Farm Turbine Co-ordinates

The co-ordinates of the turbines considered in this Telecommunications Impact Study are provided in the Table below.

Turbine ID	Co-ordinates (WGS 84)	
	Latitude	Longitude
T01	53° 29' 40.380"N	9° 9' 02.488"W
T02	53° 29' 45.267"N	9° 9' 26.926"W
T03	53° 29' 37.258"N	9° 9' 38.942"W
T04	53° 29' 47.509"N	9° 9' 44.517"W
T05	53° 30' 12.849"N	9° 8' 30.787"W
T06	53° 30' 20.076"N	9° 8' 45.110"W
T07	53° 30' 34.546"N	9° 8' 16.271"W
T08	53° 30' 29.243"N	9° 8' 01.861"W
T09	53° 30' 18.549"N	9° 8' 07.726"W
T10	53° 30' 15.548"N	9° 7' 48.673"W
T11	53° 30' 07.895"N	9° 7' 34.241"W
T12	53° 30' 17.579"N	9° 7' 17.256"W
T13	53° 30' 26.186"N	9° 7' 22.393"W

Table 16. Rooaunalaghta Wind Farm - Turbine Co-ordinates

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

APPENDIX B – Field Survey Findings

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Appendix B – Field Survey Findings

The telecom mast-sites surveyed for this Telecoms Impact Study are shown relative to the proposed wind farm site in Figure 32 below.

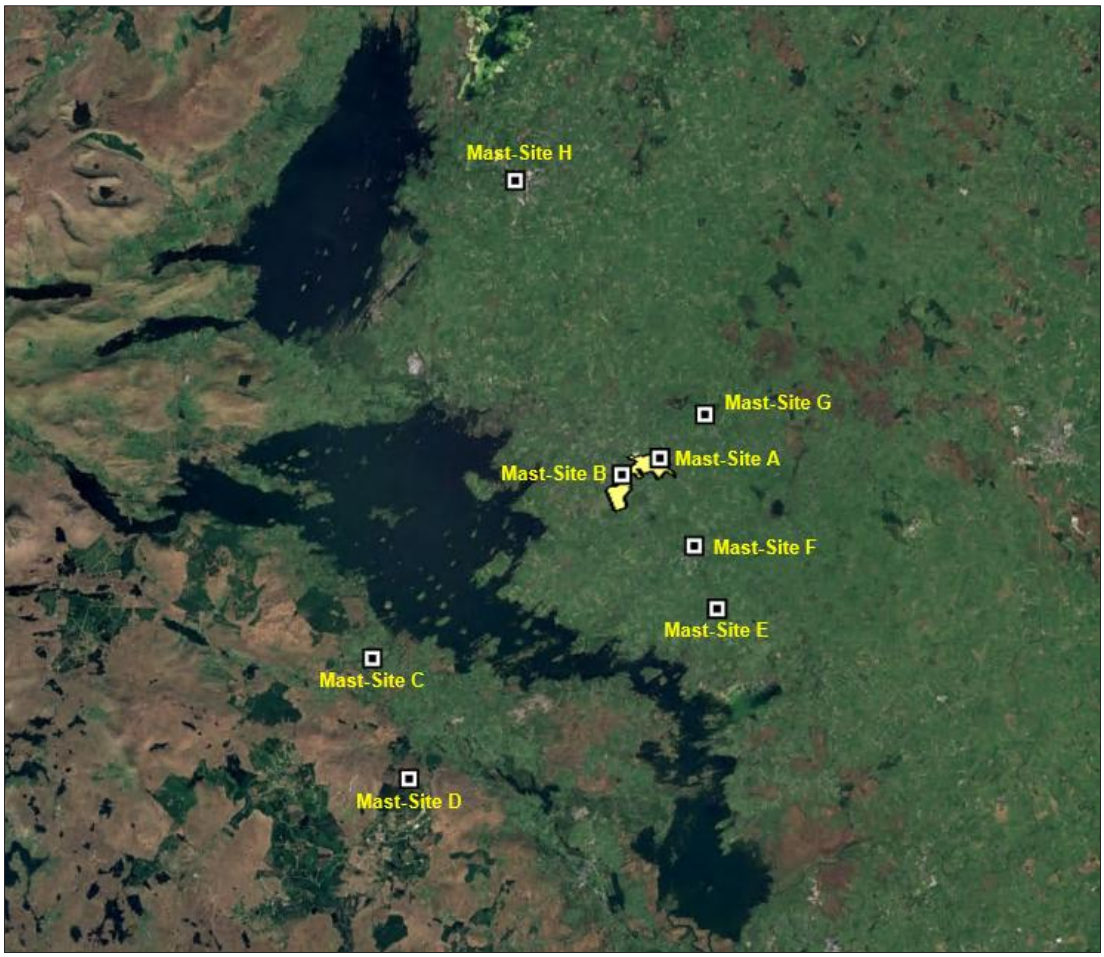


Figure 32. Telecom Mast-Sites shown relative to proposed Wind Farm

The findings from the field surveys of each of the mast-sites are presented below.

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Mast-Site A (Brodullagh South)

Telecommunications Mast-Site A is in the townland of Brodullagh South, Co Mayo and is located within 50 m of the proposed wind farm site. A photo of the mast at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 17.



Figure 33. Mast A1

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast A1	Eir, Imagine Broadband Tetra Ireland, Vodafone

Table 17. Field Survey Summary – Mast-site A

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Mast-Site B (Carrowougheragh)

Telecommunications Mast-Site B is in the townland of Carrowoughteragh, Co Mayo and is located within 10 m of the proposed wind farm site. A photo of the mast at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 18.



Figure 34. Mast B1

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast B1	Eir, Three Ireland

Table 18. Field Survey Summary – Mast-site B

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Mast-Site C (Oughterard Garda Station)

Telecommunications Mast-Site C is located at the Garda Station in the town of Oughtterard, Co Galway and is approximately 13 km southwest of the proposed wind farm. A photo of the mast at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 19.



Figure 35. Mast C1

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast C1	Vodafone

Table 19. Field Survey Summary – Mast-site C

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Mast-Site D (Letir)

Telecommunications Mast-Site D is located in the townland of Letir, Co Galway and is approximately 15 km southwest of the proposed wind farm. A photo of the mast at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 20.



Figure 36. Mast D1

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast D1	Three Ireland

Table 20. Field Survey Summary – Mast-site D

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Mast-Site E (Cloghanower)

Telecommunications Mast-Site E is located in the townland of Cloghanower, Co Galway and is approximately 6 km southeast of the proposed wind farm. A photo of the mast at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 21.



Figure 37. Mast E1

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast E1	Eir

Table 21. Field Survey Summary – Mast-site E

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Mast-Site F (Gortnamona)

Telecommunications Mast-Site F is located in the townland of Gortnamona, on the outskirts of Headford, Co Galway, and is approximately 3 km southeast of the proposed wind farm. Access to this mast-site was not possible on the day of survey. However, the mast location, as specified by Three Ireland, is shown in the aerial view of the site below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 22.



Figure 38. Mast F1

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast F1	Three Ireland

Table 22. Field Survey Summary – Mast-site F

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Mast-Site G (Ramolin)

Telecommunications Mast-Site G is located in the townland of Ramolin, Co Mayo and is approximately 3 km northeast of the proposed wind farm site. A photo of the mast at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 23.



Figure 39. Mast G1

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast G1	Three Ireland

Table 23. Field Survey Summary – Mast-site G

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Mast-Site H (Ballinrobe)

Telecommunications Mast-Site E is located in Ballinrobe, Co Mayo and is approximately 14 km north of the proposed wind farm site. A photo of the mast at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast-site in the direction of the wind farm are listed in Table 24.



Figure 40. Mast G1

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast G1	Imagine Broadband, Eir

Table 24. Field Survey Summary – Mast-site G

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

APPENDIX C – Radio Link Budget Reports

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Appendix C – Radio Link Budget Reports

C.1 Radio Link Budget Report (Brodullagh South - Ballinrobe)

Link Budget Report

Site Name:	AB_L3A_Eir (Brodullagh South)		AB_L3B_Eir (Ballinrobe)				
Type:	Cell	Cell					
Latitude:	53°30'36.1"N		53°37'27.3"N				
Longitude:	9°07'32.1"W		9°13'33.8"W				
Altitude (m):	49.0		34.0				
UserData1:	User Data						
Datum:	World Geodetic System 1984 (WGS 84)						
	Forward Link		Reverse Link				
Transmission Site:	AB_L3A_Eir		AB_L3B_Eir				
Reception Site:	AB_L3B_Eir		AB_L3A_Eir				
Radio Type:	NetRadio0001		NetRadio0001				
Modulation Scheme:	4-QAM		4-QAM				
Bandwidth (MHz):	2		2				
Roll-Off Factor:	0.2		0.2				
Coding Gain (dB):	0		0				
System Gains (dB):	0		0				
Channel Overhead (%):	20		20				
FEC Overhead (%):	0		0				
Reference Temperature (°K):	290		290				
Receiver Noise Figure (dB):	5		5				
Maximum Data Rate (Mbps):	2.667		2.667				
Maximum Bit Rate (Mbps):	3.333		3.333				
Required Bit Error Rate:	BER 10-3	BER 10-6	BER 10-3	BER 10-6			
Service Threshold (dBm):	-91	-90	-91	-90			
Carrier to Noise Ratio (dB):	14.965	15.965	14.965	15.965			
Cross Polarization Improvement Factor (dB):			20	20	20	20	
Rx Equalization Sig Norm Parameter (Kn,M):			0.1	0.1	0.1	0.1	
Rx Equalization Sig Norm Parameter (Kn,NM):			0.1	0.1	0.1	0.1	
UserData1:	User Data		User Data				
Center Frequency (MHz):	13000		13000				
Channel Bandwidth (MHz):	28		28				
Transmission Power (dBm):	30		30				
Transmission Gains (dB):	0		0				
Transmission System Loss (dB):		0		0			
Transmission Line Loss (dB/100 m):		4		4			
Transmission Line Length (m):		10		10			
Transmission Connection Loss (dB):		0.3		0.3			
Transmission Number of Connections:		2		2			
Transmission Additional Loss (dB):		0		0			
Transmission Losses (dB):	1		1				
Transmission Antenna:	HP2-13-NSMA		HP2-13-NSMA				
Transmission Antenna Size (m):		0.6		0.6			
Transmission Antenna Height (m):		18		40			
Transmission Antenna Gain (dBd):		33.76		33.76			
Transmission Antenna Gain (dBi):		35.9		35.9			
Transmission Power EIRP (dBm):		64.9		64.9			
Reception Gains (dB):	0		0				
Reception System Loss (dB):	0		0				
Reception Line Loss (dB/100 m):		4		4			
Reception Line Length (m):	10		10				
Reception Connection Loss (dB):		0.3		0.3			
Reception Number of Connections:		2		2			
Reception Additional Loss (dB):		0		0			
Reception Losses (dB):	1		1				

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Reception Antenna:	HP2-13-NSMA		HP2-13-NSMA	
Reception Antenna Size (m):	0.6		0.6	
Reception Antenna Height (m):		40		18
Reception Antenna Gain (dBd):		33.76		33.76
Reception Antenna Gain (dBi):		35.9		35.9
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	14359.168		14359.168	
Azimuth - True (°):	332.462	152.381		
Azimuth - Magnetic (°):	334.687		154.666	
Transmission Inclination (°):	-0.028		0.028	
Reception Inclination (°):	-0.028		0.028	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	14359.17		14359.17	
Center Frequency (MHz):	13000		13000	
Free Space Loss (dB):	137.861		137.861	
Max Fresnel Radius (m):	9.102		9.102	
Max 2nd Fresnel Radius (m):	12.872		12.872	
Earth Radius Factor (K):	4/3			
Effective Radius (m):	8502056.000			
ITU Recommendation:	ITU-R P.526-11			
Diffraction Model:	Cascade Knife Edge			
Diffraction:	No LOS Diffraction		No LOS Diffraction	
Diffraction Loss (dB):	0		0	
Clearance Target (%):	60			
Minimum Clearance (m):	9.58		9.58	
Minimum Clearance Point (m):		1240.269		1240.269
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	2847.377		2847.377	
Reflection Area 2 (m):	2952.2 - 3057			2952.2 - 3057
Reflection Area 3 (m):	3126.875		3126.875	
Reflection Area 4 (m):	3196.7 - 3406.4			3196.7 - 3406.4
Reflection Area 5 (m):	3615.995		3615.995	
Reflection Area 6 (m):	3685.869		3685.869	
Reflection Area 7 (m):	4035.240		4035.240	
Reflection Area 8 (m):	4419.55		4419.55	
Reflection Area 9 (m):	4594.235		4594.235	
Reflection Area 10 (m):	4664.1 - 4699			4664.1 - 4699
Reflection Area 11 (m):	4943.6 - 5013.5			4943.6 - 5013.5
Reflection Area 12 (m):	5362.852		5362.852	
Reflection Area 13 (m):	5502.6 - 5537.5			5502.6 - 5537.5
Reflection Area 14 (m):	5747.161		5747.161	
Reflection Area 15 (m):	5886.909		5886.909	
Reflection Area 16 (m):	6026.658		6026.658	
ITU Recommendation:	ITU-R P.676-8			
Atmospheric Pressure (hPa):	1013		1013	
Standard Temperature (°C):	15		15	
Water Vapor Density (g/m³):	7.5		7.5	
Atmospheric Gases Loss (dB):		0.314		0.314
Total Path Loss (dB):	138.175		138.175	
Reception Signal Level (dBm):		-38.375		-38.375

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	52.625	51.625	52.625	51.625

ITU Recommendation:	ITU-R F.1703-0 / ITU-T G.827
Objective ITU Quality Grade:	Short Haul SDH Networks
Unavailability Objective (%):	2.00E-02
Availability Objective (%):	99.9800

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

ITU Recommendation: ITU-R F.1668-1 / ITU-T G.826
Error Performance Objective BBER (%): 1.60E-05 1.60E-05
Error Performance Objective BBER (s/Month): 0.42 0.42

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	3.20E-03	1.60E-04	3.20E-03
Error Performance Objective (s/Month):	4.205	84.096	4.205	84.096

ITU Recommendation: ITU-R F.1668-1 / ITU-T G.828
Error Performance Objective BBER (%): 4.00E-06 4.00E-06
Error Performance Objective BBER (s/Month): 0.105 0.105

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	8.00E-04	1.60E-04	8.00E-04
Error Performance Objective (s/Month):	4.205	21.024	4.205	21.024

Multipath Model: ITU-R P.530-15
Multipath Planning Type: Quick Planning
Multipath Time Frame: Average annual distribution
ITU Recommendation: ITU-R P.453-9
Point Refractivity Gradient (dN1): -76.7
Geoclimatic Factor: 4.05E-05 4.05E-05
Multipath Occurrence Factor (%): 6.36E-01 6.36E-01

Precipitation Model: ITU-R P.530-15
ITU Recommendation: ITU-R P.837-5 / ITU-R P.841-4
Precipitation Time Frame: Average annual distribution
Precipitation Rate @ 0.01% (mm/h): 22
ITU Recommendation: ITU-R P.838-3
Specific Attenuation (dB/km): 0.949099 0.949099
Rainfall Attenuation (dB): 9.512 9.512

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%):	4.77E-07	6.00E-07	4.77E-07	6.00E-07
Selective Fading Outage (%):	1.03E-08	1.03E-08	1.03E-08	1.03E-08
Composite Fading Outage (%):		4.87E-07	6.10E-07	4.87E-07	6.10E-07

Fading Outage (s/Month):	0.013	0.016	0.013	0.016
Selective Fading Outage (s/Month):	0	0	0	0
Composite Fading Outage (s/Month):	0.013	0.016	0.013	0.016

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Unavailability due to Rain (s/Year):		0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Fading (%):		4.87E-07	6.10E-07	4.87E-07	6.10E-07
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Unavailability (%):	4.87E-07	6.10E-07	4.87E-07	6.10E-07
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02

Unavailability due to Fading (s/Year):	0.154	0.192	0.154	0.192
Unavailability due to Rain (s/Year):	0	0	0	0
Total Unavailability (s/Year):	0.154	0.192	0.154	0.192
Unavailability Objective (s/Year):	6307.2	6307.2	6307.2	6307.2

Total Availability (%):	100.0000	100.0000	100.0000	100.0000
Availability Objective (%):	99.9800	99.9800	99.9800	99.9800

* PASS * * PASS * * PASS * * PASS *

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

C.2 Radio Link Budget Report (Ballinrobe - Carrowoughteragh)

Link Budget Report

Site Name:	AB_L3B_Eir (Ballinrobe)	AB_L1B_Eir (Carrowoughteragh)
Type:	Cell	Cell
Latitude:	53°37'27.3"N	53°30'11.5"N
Longitude:	9°13'33.8"W	9°09'06.7"W
Altitude (m):	34.0	48.0
UserData1:	User Data	
Datum:	World Geodetic System 1984 (WGS 84)	

	Forward Link	Reverse Link
Transmission Site:	AB_L3B_Eir	AB_L1B_Eir
Reception Site:	AB_L1B_Eir	AB_L3B_Eir
Radio Type:	NetRadio0001	NetRadio0001
Modulation Scheme:	4-QAM	4-QAM
Bandwidth (MHz):	2	2
Roll-Off Factor:	0.2	0.2
Coding Gain (dB):	0	0
System Gains (dB):	0	0
Channel Overhead (%):	20	20
FEC Overhead (%):	0	0
Reference Temperature (°K):	290	290
Receiver Noise Figure (dB):	5	5
Maximum Data Rate (Mbps):	2.667	2.667
Maximum Bit Rate (Mbps):	3.333	3.333
Required Bit Error Rate:	BER 10-3 BER 10-6	BER 10-3 BER 10-6
Service Threshold (dBm):	-91 -90	-91 -90
Carrier to Noise Ratio (dB):	14.965 15.965	14.965 15.965
Cross Polarization Improvement Factor (dB):	20 20	20 20
Rx Equalization Sig Norm Parameter (Kn,M):	0.1 0.1	0.1 0.1
Rx Equalization Sig Norm Parameter (Kn,NM):	0.1 0.1	0.1 0.1
UserData1:	User Data	User Data
Center Frequency (MHz):	13000	13000
Channel Bandwidth (MHz):	28	28
Transmission Power (dBm):	30	30
Transmission Gains (dB):	0	0
Transmission System Loss (dB):	0	0
Transmission Line Loss (dB/100 m):	4	4
Transmission Line Length (m):	10	10
Transmission Connection Loss (dB):	0.3	0.3
Transmission Number of Connections:	2	2
Transmission Additional Loss (dB):	0	0
Transmission Losses (dB):	1	1
Transmission Antenna:	HP2-13-NSMA	HP2-13-NSMA
Transmission Antenna Size (m):	0.6	0.6
Transmission Antenna Height (m):	40	18
Transmission Antenna Gain (dBd):	33.76	33.76
Transmission Antenna Gain (dBi):	35.9	35.9
Transmission Power EIRP (dBm):	64.9	64.9
Reception Gains (dB):	0	0
Reception System Loss (dB):	0	0
Reception Line Loss (dB/100 m):	4	4
Reception Line Length (m):	10	10
Reception Connection Loss (dB):	0.3	0.3
Reception Number of Connections:	2	2
Reception Additional Loss (dB):	0	0
Reception Losses (dB):	1	1
Reception Antenna:	HP2-13-NSMA	HP2-13-NSMA
Reception Antenna Size (m):	0.6	0.6
Reception Antenna Height (m):	18	40
Reception Antenna Gain (dBd):	33.76	33.76

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Reception Antenna Gain (dBi):		35.9		35.9
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	14355.64	14355.64		
Azimuth - True (°):	159.972	340.032		
Azimuth - Magnetic (°):	162.256		342.265	
Transmission Inclination (°):	0.032		-0.032	
Reception Inclination (°):	0.032		-0.032	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	14355.642			14355.642
Center Frequency (MHz):	13000		13000	
Free Space Loss (dB):	137.859		137.859	
Max Fresnel Radius (m):	9.101		9.101	
Max 2nd Fresnel Radius (m):	12.87		12.87	
Earth Radius Factor (K):	4/3			
Effective Radius (m):	8502056.000			
ITU Recommendation:	ITU-R P.526-11			
Diffraction Model:	Cascade Knife Edge			
Diffraction:	No LOS Diffraction		No LOS Diffraction	
Diffraction Loss (dB):	0		0	
Clearance Target (%):	60			
Minimum Clearance (m):	15.191		15.191	
Minimum Clearance Point (m):		12692.888		12692.888
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	1201.791		1201.791	
Reflection Area 2 (m):	3440.7 - 3572.4			3440.7 - 3572.4
Reflection Area 3 (m):	3671.2 - 3802.9			3671.2 - 3802.9
Reflection Area 4 (m):	4033.4 - 4066.3			4033.4 - 4066.3
Reflection Area 5 (m):	4132.2 - 4165.1			4132.2 - 4165.1
Reflection Area 6 (m):	4593.1 - 4626			4593.1 - 4626
Reflection Area 7 (m):	4955.33		4955.33	
Reflection Area 8 (m):	5054.107		5054.107	
Reflection Area 9 (m):	5152.9 - 5185.8			5152.9 - 5185.8
Reflection Area 10 (m):	5284.588		5284.588	
Reflection Area 11 (m):	5383.4 - 5449.2			5383.4 - 5449.2
Reflection Area 12 (m):	5547.994		5547.994	
Reflection Area 13 (m):	5745.5 - 5778.5			5745.5 - 5778.5
Reflection Area 14 (m):	5976.029		5976.029	
Reflection Area 15 (m):	6272.361		6272.361	
Reflection Area 16 (m):	6404 - 6437.0			6404 - 6437.0
ITU Recommendation:	ITU-R P.676-8			
Atmospheric Pressure (hPa):	1013		1013	
Standard Temperature (°C):	15		15	
Water Vapor Density (g/m³):	7.5		7.5	
Atmospheric Gases Loss (dB):		0.314		0.314
Total Path Loss (dB):	138.173		138.173	
Reception Signal Level (dBm):		-38.373		-38.373

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	52.627	51.627	52.627	51.627

ITU Recommendation:	ITU-R F.1703-0 / ITU-T G.827			
Objective ITU Quality Grade:	Short Haul SDH Networks			
Unavailability Objective (%):	2.00E-02			
Availability Objective (%):	99.9800			
ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.826			
Error Performance Objective BBER (%):	1.60E-05			1.60E-05
Error Performance Objective BBER (s/Month):			0.42	0.42

SESR	ESR	SESR	ESR

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Error Performance Objective (%):	1.60E-04	3.20E-03	1.60E-04	3.20E-03
Error Performance Objective (s/Month):	4.205	84.096	4.205	84.096

ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.828			
Error Performance Objective BBER (%):	4.00E-06		4.00E-06	
Error Performance Objective BBER (s/Month):		0.105		0.105
	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	8.00E-04	1.60E-04	8.00E-04
Error Performance Objective (s/Month):	4.205	21.024	4.205	21.024

Multipath Model:	ITU-R P.530-15			
Multipath Planning Type:	Quick Planning			
Multipath Time Frame:	Average annual distribution			
ITU Recommendation:	ITU-R P.453-9			
Point Refractivity Gradient (dN1):	-76.7			
Geoclimatic Factor:	4.05E-05	4.05E-05		
Multipath Occurrence Factor (%):	6.00E-01		6.00E-01	

Precipitation Model:	ITU-R P.530-15			
ITU Recommendation:	ITU-R P.837-5 / ITU-R P.841-4			
Precipitation Time Frame:	Average annual distribution			
Precipitation Rate @ 0.01% (mm/h):	22			
ITU Recommendation:	ITU-R P.838-3			
Specific Attenuation (dB/km):	0.949099		0.949099	
Rainfall Attenuation (dB):	9.51		9.51	

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%):	4.46E-07	5.62E-07	4.46E-07	5.62E-07
Selective Fading Outage (%):	9.82E-09	9.82E-09	9.82E-09	9.82E-09
Composite Fading Outage (%):		4.56E-07	5.72E-07	4.56E-07	5.72E-07

Fading Outage (s/Month):	0.012	0.015	0.012	0.015	
Selective Fading Outage (s/Month):		0	0	0	0
Composite Fading Outage (s/Month):		0.012	0.015	0.012	0.015

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Unavailability due to Rain (s/Year):		0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Fading (%):		4.56E-07	5.72E-07	4.56E-07	5.72E-07
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Unavailability (%):	4.56E-07	5.72E-07	4.56E-07	5.72E-07
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02

Unavailability due to Fading (s/Year):		0.144	0.18	0.144	0.18
Unavailability due to Rain (s/Year):		0	0	0	0
Total Unavailability (s/Year):	0.144	0.18	0.144	0.18	
Unavailability Objective (s/Year):		6307.2	6307.2	6307.2	6307.2

Total Availability (%):	100.0000	100.0000	100.0000	100.0000
Availability Objective (%):	99.9800	99.9800	99.9800	99.9800

* PASS *	* PASS *	* PASS *	* PASS *

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

C.3 Radio Link Budget Report (Brodullagh South - Headford)

Link Budget Report

Site Name:	AB_L1A_Eir (Brodullagh South)			Eir_Headford (Headford)			
Type:	Cell	Cell					
Latitude:	53°30'36.1"N		53°28'10.8"N				
Longitude:	9°07'32.1"W			9°06'51.6"W			
Altitude (m):	49.0		18.0				
UserData1:	User Data						
Datum:	World Geodetic System 1984 (WGS 84)						
	Forward Link		Reverse Link				
Transmission Site:	AB_L1A_Eir			Eir_Headford			
Reception Site:	Eir_Headford			AB_L1A_Eir			
Radio Type:	NetRadio0001			NetRadio0001			
Modulation Scheme:	4-QAM			4-QAM			
Bandwidth (MHz):	2		2				
Roll-Off Factor:	0.2		0.2				
Coding Gain (dB):	0		0				
System Gains (dB):	0		0				
Channel Overhead (%):	20			20			
FEC Overhead (%):	0		0				
Reference Temperature (°K):	290			290			
Receiver Noise Figure (dB):	5			5			
Maximum Data Rate (Mbps):	2.667			2.667			
Maximum Bit Rate (Mbps):	3.333			3.333			
Required Bit Error Rate:	BER 10-3	BER 10-6	BER 10-3	BER 10-6			
Service Threshold (dBm):	-91	-90	-91	-90			
Carrier to Noise Ratio (dB):	14.965	15.965	14.965	15.965			
Cross Polarization Improvement Factor (dB):			20	20	20	20	
Rx Equalization Sig Norm Parameter (Kn,M):			0.1	0.1	0.1	0.1	
Rx Equalization Sig Norm Parameter (Kn,NM):			0.1	0.1	0.1	0.1	
UserData1:	User Data			User Data			
Center Frequency (MHz):	18000			18000			
Channel Bandwidth (MHz):	28			28			
Transmission Power (dBm):	30			30			
Transmission Gains (dB):	0			0			
Transmission System Loss (dB):		0			0		
Transmission Line Loss (dB/100 m):		4			4		
Transmission Line Length (m):		10			10		
Transmission Connection Loss (dB):		0.3			0.3		
Transmission Number of Connections:		2			2		
Transmission Additional Loss (dB):		0			0		
Transmission Losses (dB):	1			1			
Transmission Antenna:	HP2-18-NSMA			HP2-18-NSMA			
Transmission Antenna Size (m):		0.6			0.6		
Transmission Antenna Height (m):		15			15		
Transmission Antenna Gain (dBd):		36.46			36.46		
Transmission Antenna Gain (dBi):		38.6			38.6		
Transmission Power EIRP (dBm):		67.6			67.6		
Reception Gains (dB):	0			0			
Reception System Loss (dB):	0			0			
Reception Line Loss (dB/100 m):		4			4		
Reception Line Length (m):	10			10			
Reception Connection Loss (dB):		0.3			0.3		
Reception Number of Connections:		2			2		
Reception Additional Loss (dB):		0			0		
Reception Losses (dB):	1			1			
Reception Antenna:	HP2-18-NSMA			HP2-18-NSMA			
Reception Antenna Size (m):	0.6			0.6			
Reception Antenna Height (m):		15			15		
Reception Antenna Gain (dBd):		36.46			36.46		

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Reception Antenna Gain (dBi):		38.6		38.6
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	4560.344	4560.344		
Azimuth - True (°):	170.58	350.589		
Azimuth - Magnetic (°):	172.805		352.802	
Transmission Inclination (°):	0.389		-0.389	
Reception Inclination (°):	0.389		-0.389	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	4560.45		4560.45	
Center Frequency (MHz):	18000		18000	
Free Space Loss (dB):	130.726		130.726	
Max Fresnel Radius (m):	4.359		4.359	
Max 2nd Fresnel Radius (m):	6.165		6.165	
Earth Radius Factor (K):	4/3			
Effective Radius (m):	8502056.000			
ITU Recommendation:	ITU-R P.526-11			
Diffraction Model:	Cascade Knife Edge			
Diffraction:	No LOS Diffraction		No LOS Diffraction	
Diffraction Loss (dB):	0		0	
Clearance Target (%):	60			
Minimum Clearance (m):	5.6		5.6	
Minimum Clearance Point (m):		298.781		298.781
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	676.189		676.189	
Reflection Area 2 (m):	739.1 - 770.5			739.1 - 770.5
Reflection Area 3 (m):	896.344		896.344	
Reflection Area 4 (m):	1399.554		1399.554	
Reflection Area 5 (m):	2972 - 3035.0			2972 - 3035.0
Reflection Area 6 (m):	3129.3 - 3192.2			3129.3 - 3192.2
Reflection Area 7 (m):	3286.593		3286.593	
Reflection Area 8 (m):	3443.846		3443.846	
Reflection Area 9 (m):	3695.451		3695.451	
Reflection Area 10 (m):	3789.8 - 3852.7			3789.8 - 3852.7
ITU Recommendation:	ITU-R P.676-8			
Atmospheric Pressure (hPa):	1013		1013	
Standard Temperature (°C):	15		15	
Water Vapor Density (g/m³):	7.5		7.5	
Atmospheric Gases Loss (dB):		0.276		0.276
Total Path Loss (dB):	131.002		131.002	
Reception Signal Level (dBm):		-25.802		-25.802

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	65.198	64.198	65.198	64.198

ITU Recommendation:	ITU-R F.1703-0 / ITU-T G.827			
Objective ITU Quality Grade:	Short Haul SDH Networks			
Unavailability Objective (%):	2.00E-02			
Availability Objective (%):	99.9800			
ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.826			
Error Performance Objective BBER (%):	1.60E-05		1.60E-05	
Error Performance Objective BBER (s/Month):		0.42		0.42

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	3.20E-03	1.60E-04	3.20E-03
Error Performance Objective (s/Month):	4.205	84.096	4.205	84.096

ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.828			
Error Performance Objective BBER (%):	4.00E-06		4.00E-06	
Error Performance Objective BBER (s/Month):		0.105		0.105

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	8.00E-04	1.60E-04	8.00E-04
Error Performance Objective (s/Month):	4.205	21.024	4.205	21.024

Multipath Model:	ITU-R P.530-15			
Multipath Planning Type:	Quick Planning			
Multipath Time Frame:	Average annual distribution			
ITU Recommendation:	ITU-R P.453-9			
Point Refractivity Gradient (dN1):	-76.7			
Geoclimatic Factor: 4.05E-05	4.05E-05			
Multipath Occurrence Factor (%):	2.98E-03		2.98E-03	

Precipitation Model: ITU-R P.530-15				
ITU Recommendation:	ITU-R P.837-5 / ITU-R P.841-4			
Precipitation Time Frame:	Average annual distribution			
Precipitation Rate @ 0.01% (mm/h):	22			
ITU Recommendation:	ITU-R P.838-3			
Specific Attenuation (dB/km):	1.708859		1.708859	
Rainfall Attenuation (dB):	6.877		6.877	

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%): 6.86E-11	8.63E-11	6.86E-11	8.63E-11	
Selective Fading Outage (%):	9.34E-12	9.34E-12	9.34E-12	9.34E-12
Composite Fading Outage (%):	7.79E-11	9.56E-11	7.79E-11	9.56E-11

Fading Outage (s/Month):	0	0	0	0
Selective Fading Outage (s/Month):	0	0	0	0
Composite Fading Outage (s/Month):	0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Unavailability due to Rain (s/Year):	0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Fading (%):	7.79E-11	9.56E-11	7.79E-11	9.56E-11
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Unavailability (%):	7.79E-11	9.56E-11	7.79E-11	9.56E-11
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02

Unavailability due to Fading (s/Year):	0	0	0	0
Unavailability due to Rain (s/Year):	0	0	0	0
Total Unavailability (s/Year):	0	0	0	
Unavailability Objective (s/Year):	6307.2	6307.2	6307.2	6307.2

Total Availability (%):	100.0000	100.0000	100.0000	100.0000
Availability Objective (%):	99.9800	99.9800	99.9800	99.9800

* PASS *	* PASS *	* PASS *	* PASS *

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

C.4 Radio Link Budget Report (Headford - Cloghanower)

Link Budget Report

Site:	Eir_Headford (Headford)		AB_L2B_Eir (Cloghanower)					
Name:								
Type:	Cell	Cell						
Latitude:	53°28'10.8"N		53°26'52.8"N					
Longitude:	9°06'51.6"W		9°05'09.7"W					
Altitude (m):	18.0		21.0					
UserData1:	User Data							
Datum:	World Geodetic System 1984 (WGS 84)							
	Forward Link		Reverse Link					
Transmission Site:	Eir_Headford		AB_L2B_Eir					
Reception Site:	AB_L2B_Eir		Eir_Headford					
Radio Type:	NetRadio0001		NetRadio0001					
Modulation Scheme:	4-QAM		4-QAM					
Bandwidth (MHz):	2	2						
Roll-Off Factor:	0.2	0.2						
Coding Gain (dB):	0	0						
System Gains (dB):	0	0						
Channel Overhead (%):	20		20					
FEC Overhead (%):	0	0						
Reference Temperature (°K):	290		290					
Receiver Noise Figure (dB):	5		5					
Maximum Data Rate (Mbps):	2.667		2.667					
Maximum Bit Rate (Mbps):	3.333		3.333					
Required Bit Error Rate:	BER 10-3	BER 10-6	BER 10-3	BER 10-6				
Service Threshold (dBm):	-91	-90	-91	-90				
Carrier to Noise Ratio (dB):	14.965	15.965	14.965	15.965				
Cross Polarization Improvement Factor (dB):			20	20	20	20		
Rx Equalization Sig Norm Parameter (Kn,M):			0.1	0.1	0.1	0.1		
Rx Equalization Sig Norm Parameter (Kn,NM):			0.1	0.1	0.1	0.1		
UserData1:	User Data		User Data					
Center Frequency (MHz):	18000		18000					
Channel Bandwidth (MHz):	28		28					
Transmission Power (dBm):	30		30					
Transmission Gains (dB):	0		0					
Transmission System Loss (dB):		0		0				
Transmission Line Loss (dB/100 m):		4		4				
Transmission Line Length (m):		10		10				
Transmission Connection Loss (dB):		0.3		0.3				
Transmission Number of Connections:		2		2				
Transmission Additional Loss (dB):		0		0				
Transmission Losses (dB):	1		1					
Transmission Antenna:	HP2-18-NSMA			HP2-18-NSMA				
Transmission Antenna Size (m):		0.6		0.6				
Transmission Antenna Height (m):		15		15				
Transmission Antenna Gain (dBd):		36.46		36.46				
Transmission Antenna Gain (dBi):		38.6		38.6				
Transmission Power EIRP (dBm):		67.6		67.6				
Reception Gains (dB):	0		0					
Reception System Loss (dB):	0		0					
Reception Line Loss (dB/100 m):		4		4				
Reception Line Length (m):	10		10					
Reception Connection Loss (dB):		0.3		0.3				
Reception Number of Connections:		2		2				
Reception Additional Loss (dB):		0		0				
Reception Losses (dB):	1		1					
Reception Antenna:	HP2-18-NSMA		HP2-18-NSMA					
Reception Antenna Size (m):	0.6		0.6					
Reception Antenna Height (m):		15		15				
Reception Antenna Gain (dBd):		36.46		36.46				

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Reception Antenna Gain (dBi):		38.6		38.6
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	3057.636	3057.636		
Azimuth - True (°):	142.088	322.111		
Azimuth - Magnetic (°):	144.301		324.309	
Transmission Inclination (°):	-0.056		0.056	
Reception Inclination (°):	-0.056		0.056	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	3057.637		3057.637	
Center Frequency (MHz):	18000		18000	
Free Space Loss (dB):	127.253		127.253	
Max Fresnel Radius (m):	3.569		3.569	
Max 2nd Fresnel Radius (m):	5.048		5.048	
Earth Radius Factor (K):	4/3			
Effective Radius (m):	8502056.000			
ITU Recommendation:	ITU-R P.526-11			
Diffraction Model:	Cascade Knife Edge			
Diffraction:	No LOS Diffraction		No LOS Diffraction	
Diffraction Loss (dB):	0		0	
Clearance Target (%):	60			
Minimum Clearance (m):	2.904		2.904	
Minimum Clearance Point (m):		374.71		374.71
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	944.27		944.27	
Reflection Area 2 (m):	1064.2 - 1094.2			1064.2 - 1094.2
Reflection Area 3 (m):	1244 - 1304			1244 - 1304
Reflection Area 4 (m):	1513.8 - 1543.8			1513.8 - 1543.8
Reflection Area 5 (m):	1663.7 - 1693.7			1663.7 - 1693.7
Reflection Area 6 (m):	1783.6 - 1843.6			1783.6 - 1843.6
Reflection Area 7 (m):	2383.157		2383.157	
ITU Recommendation:	ITU-R P.676-8			
Atmospheric Pressure (hPa):	1013		1013	
Standard Temperature (°C):	15		15	
Water Vapor Density (g/m³):	7.5		7.5	
Atmospheric Gases Loss (dB):		0.185		0.185
Total Path Loss (dB):	127.438		127.438	
Reception Signal Level (dBm):		-22.238		-22.238

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	68.762	67.762	68.762	67.762

ITU Recommendation:	ITU-R F.1703-0 / ITU-T G.827			
Objective ITU Quality Grade:	Short Haul SDH Networks			
Unavailability Objective (%):	2.00E-02			
Availability Objective (%):	99.9800			
ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.826			
Error Performance Objective BBER (%):		1.60E-05		1.60E-05
Error Performance Objective BBER (s/Month):		0.42		0.42

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	3.20E-03	1.60E-04	3.20E-03
Error Performance Objective (s/Month):	4.205	84.096	4.205	84.096

ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.828			
Error Performance Objective BBER (%):		4.00E-06		4.00E-06
Error Performance Objective BBER (s/Month):		0.105		0.105

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	8.00E-04	1.60E-04	8.00E-04
Error Performance Objective (s/Month):	4.205	21.024	4.205	21.024

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Multipath Model: ITU-R P.530-15
Multipath Planning Type: Quick Planning
Multipath Time Frame: Average annual distribution
ITU Recommendation: ITU-R P.453-9
Point Refractivity Gradient (dN1): -76.7
Geoclimatic Factor: 4.05E-05 4.05E-05
Multipath Occurrence Factor (%): 5.05E-03 5.05E-03

Precipitation Model: ITU-R P.530-15
ITU Recommendation: ITU-R P.837-5 / ITU-R P.841-4
Precipitation Time Frame: Average annual distribution
Precipitation Rate @ 0.01% (mm/h): 22
ITU Recommendation: ITU-R P.838-3
Specific Attenuation (dB/km): 1.708854 1.708854
Rainfall Attenuation (dB): 5.316 5.316

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%):	5.80E-11	7.31E-11	5.80E-11	7.31E-11
Selective Fading Outage (%):	4.91E-12	4.91E-12	4.91E-12	4.91E-12
Composite Fading Outage (%):		6.29E-11	7.80E-11	6.29E-11	7.80E-11

Fading Outage (s/Month):	0	0	0	0
Selective Fading Outage (s/Month):	0	0	0	0
Composite Fading Outage (s/Month):	0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Unavailability due to Rain (s/Year):	0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Fading (%):		6.29E-11	7.80E-11	6.29E-11	7.80E-11
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Unavailability (%):	6.29E-11	7.80E-11	6.29E-11	7.80E-11
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02

Unavailability due to Fading (s/Year):	0	0	0	0
Unavailability due to Rain (s/Year):	0	0	0	0
Total Unavailability (s/Year):	0	0	0	0
Unavailability Objective (s/Year):		6307.2	6307.2	6307.2	6307.2

Total Availability (%):	100.0000	100.0000	100.0000	100.0000
Availability Objective (%):	99.9800	99.9800	99.9800	99.9800

* PASS * * PASS * * PASS * * PASS *

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

C.5 Radio Link Budget Report (Carrowoughteragh - Cloghanower)

Link Budget Report

Site Name:	AB_L2A_3IRL (Carrowoughteragh)		L2B_3IRL (Cloghanower)				
Type:	Cell	Cell					
Latitude:	53°30'11.5"N		53°28'26.0"N				
Longitude:	9°09'06.7"W		9°06'06.5"W				
Altitude (m):	48.0		16.0				
UserData1:	User Data						
Datum:	World Geodetic System 1984 (WGS 84)						
	Forward Link		Reverse Link				
Transmission Site:	AB_L2A_3IRL		L2B_3IRL				
Reception Site:	L2B_3IRL		AB_L2A_3IRL				
Radio Type:	NetRadio0001		NetRadio0001				
Modulation Scheme:	4-QAM		4-QAM				
Bandwidth (MHz):	2		2				
Roll-Off Factor:	0.2		0.2				
Coding Gain (dB):	0		0				
System Gains (dB):	0		0				
Channel Overhead (%):	20		20				
FEC Overhead (%):	0		0				
Reference Temperature (°K):	290		290				
Receiver Noise Figure (dB):	5		5				
Maximum Data Rate (Mbps):	2.667		2.667				
Maximum Bit Rate (Mbps):	3.333		3.333				
Required Bit Error Rate:	BER 10-3	BER 10-6	BER 10-3	BER 10-6			
Service Threshold (dBm):	-91	-90	-91	-90			
Carrier to Noise Ratio (dB):	14.965	15.965	14.965	15.965			
Cross Polarization Improvement Factor (dB):			20	20	20	20	
Rx Equalization Sig Norm Parameter (Kn,M):			0.1	0.1	0.1	0.1	
Rx Equalization Sig Norm Parameter (Kn,NM):			0.1	0.1	0.1	0.1	
UserData1:	User Data		User Data				
Center Frequency (MHz):	18000		18000				
Channel Bandwidth (MHz):	28		28				
Transmission Power (dBm):	30		30				
Transmission Gains (dB):	0		0				
Transmission System Loss (dB):		0		0			
Transmission Line Loss (dB/100 m):		4		4			
Transmission Line Length (m):		10		10			
Transmission Connection Loss (dB):		0.3		0.3			
Transmission Number of Connections:		2		2			
Transmission Additional Loss (dB):		0		0			
Transmission Losses (dB):	1		1				
Transmission Antenna:	HP2-18-NSMA		HP2-18-NSMA				
Transmission Antenna Size (m):		0.6		0.6			
Transmission Antenna Height (m):		26		22.5			
Transmission Antenna Gain (dBd):		36.46		36.46			
Transmission Antenna Gain (dBi):		38.6		38.6			
Transmission Power EIRP (dBm):		67.6		67.6			
Reception Gains (dB):	0		0				
Reception System Loss (dB):	0		0				
Reception Line Loss (dB/100 m):		4		4			
Reception Line Length (m):	10		10				
Reception Connection Loss (dB):		0.3		0.3			
Reception Number of Connections:		2		2			
Reception Additional Loss (dB):		0		0			
Reception Losses (dB):	1		1				
Reception Antenna:	HP2-18-NSMA		HP2-18-NSMA				
Reception Antenna Size (m):	0.6		0.6				
Reception Antenna Height (m):		22.5		26			
Reception Antenna Gain (dBd):		36.46		36.46			

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Reception Antenna Gain (dBi):		38.6		38.6
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	4655.6	4655.6		
Azimuth - True (°):	134.509	314.549		
Azimuth - Magnetic (°):	136.743		316.758	
Transmission Inclination (°):	0.437		-0.437	
Reception Inclination (°):	0.437		-0.437	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	4655.735		4655.735	
Center Frequency (MHz):	18000		18000	
Free Space Loss (dB):	130.905		130.905	
Max Fresnel Radius (m):	4.404		4.404	
Max 2nd Fresnel Radius (m):	6.229		6.229	
Earth Radius Factor (K):	4/3			
Effective Radius (m):	8502056.000			
ITU Recommendation:	ITU-R P.526-11			
Diffraction Model:	Cascade Knife Edge			
Diffraction:	No LOS Diffraction		No LOS Diffraction	
Diffraction Loss (dB):	0		0	
Clearance Target (%):	60			
Minimum Clearance (m):	14.688		14.688	
Minimum Clearance Point (m):		168.119		168.119
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	1099.2 - 1125.1			1099.2 - 1125.1
Reflection Area 2 (m):	2780.4 - 2883.9			2780.4 - 2883.9
Reflection Area 3 (m):	3039.072		3039.072	
Reflection Area 4 (m):	3142.5 - 3194.3			3142.5 - 3194.3
Reflection Area 5 (m):	3245.988		3245.988	
Reflection Area 6 (m):	3297.7 - 3427			3297.7 - 3427
Reflection Area 7 (m):	3504.6 - 3530.5			3504.6 - 3530.5
Reflection Area 8 (m):	3659.819		3659.819	
ITU Recommendation:	ITU-R P.676-8			
Atmospheric Pressure (hPa):	1013		1013	
Standard Temperature (°C):	15		15	
Water Vapor Density (g/m³):	7.5		7.5	
Atmospheric Gases Loss (dB):		0.282		0.282
Total Path Loss (dB):	131.187		131.187	
Reception Signal Level (dBm):		-25.987		-25.987

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	65.013	64.013	65.013	64.013

ITU Recommendation:	ITU-R F.1703-0 / ITU-T G.827			
Objective ITU Quality Grade:	Short Haul SDH Networks			
Unavailability Objective (%):	2.00E-02			
Availability Objective (%):	99.9800			
ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.826			
Error Performance Objective BBER (%):	1.60E-05		1.60E-05	
Error Performance Objective BBER (s/Month):		0.42		0.42

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	3.20E-03	1.60E-04	3.20E-03
Error Performance Objective (s/Month):	4.205	84.096	4.205	84.096

ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.828			
Error Performance Objective BBER (%):	4.00E-06		4.00E-06	
Error Performance Objective BBER (s/Month):		0.105		0.105

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	8.00E-04	1.60E-04	8.00E-04

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Error Performance Objective (s/Month):	4.205	21.024	4.205	21.024

Multipath Model:	ITU-R P.530-15			
Multipath Planning Type:	Quick Planning			
Multipath Time Frame:	Average annual distribution			
ITU Recommendation:	ITU-R P.453-9			
Point Refractivity Gradient (dN1):	-76.7			
Geoclimatic Factor: 4.05E-05	4.05E-05			
Multipath Occurrence Factor (%):	2.76E-03		2.76E-03	

Precipitation Model: ITU-R P.530-15				
ITU Recommendation:	ITU-R P.837-5 / ITU-R P.841-4			
Precipitation Time Frame:	Average annual distribution			
Precipitation Rate @ 0.01% (mm/h):	22			
ITU Recommendation:	ITU-R P.838-3			
Specific Attenuation (dB/km):	1.70886		1.70886	
Rainfall Attenuation (dB):	6.973		6.973	

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%):	6.55E-11	8.24E-11	6.55E-11	8.24E-11
Selective Fading Outage (%):	9.30E-12	9.30E-12	9.30E-12	9.30E-12
Composite Fading Outage (%):		7.48E-11	9.17E-11	7.48E-11	9.17E-11

Fading Outage (s/Month):	0	0	0	0	
Selective Fading Outage (s/Month):	0	0	0	0	0
Composite Fading Outage (s/Month):	0	0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Unavailability due to Rain (s/Year):	0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Fading (%):		7.48E-11	9.17E-11	7.48E-11	9.17E-11
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Total Unavailability (%):	7.48E-11	9.17E-11	7.48E-11	9.17E-11	
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02	

Unavailability due to Fading (s/Year):		0	0	0	0
Unavailability due to Rain (s/Year):		0	0	0	0
Total Unavailability (s/Year):	0	0	0	0	
Unavailability Objective (s/Year):		6307.2	6307.2	6307.2	6307.2

Total Availability (%):	100.0000	100.0000	100.0000	100.0000
Availability Objective (%):	99.9800	99.9800	99.9800	99.9800

* PASS *	* PASS *	* PASS *	* PASS *

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

C.6 Radio Link Budget Report (Cloghanower - Ramolin)

Link Budget Report

Site:	L2B_3IRL (Cloghanower)		AB_L1B_3IRL (Ramolin)				
Name:							
Type:	Cell	Cell					
Latitude:	53°28'26.0"N		53°31'40.7"N				
Longitude:	9°06'06.5"W		9°05'39.5"W				
Altitude (m):	16.0		33.0				
UserData1:	User Data						
Datum:	World Geodetic System 1984 (WGS 84)						
	Forward Link		Reverse Link				
Transmission Site:	L2B_3IRL		AB_L1B_3IRL				
Reception Site:	AB_L1B_3IRL		L2B_3IRL				
Radio Type:	NetRadio0001		NetRadio0001				
Modulation Scheme:	4-QAM		4-QAM				
Bandwidth (MHz):	2		2				
Roll-Off Factor:	0.2		0.2				
Coding Gain (dB):	0		0				
System Gains (dB):	0		0				
Channel Overhead (%):	20		20				
FEC Overhead (%):	0		0				
Reference Temperature (°K):	290		290				
Receiver Noise Figure (dB):	5		5				
Maximum Data Rate (Mbps):	2.667		2.667				
Maximum Bit Rate (Mbps):	3.333		3.333				
Required Bit Error Rate:	BER 10-3	BER 10-6	BER 10-3	BER 10-6			
Service Threshold (dBm):	-91	-90	-91	-90			
Carrier to Noise Ratio (dB):	14.965	15.965	14.965	15.965			
Cross Polarization Improvement Factor (dB):			20	20	20	20	
Rx Equalization Sig Norm Parameter (Kn,M):			0.1	0.1	0.1	0.1	
Rx Equalization Sig Norm Parameter (Kn,NM):			0.1	0.1	0.1	0.1	
UserData1:	User Data		User Data				
Center Frequency (MHz):	26000		26000				
Channel Bandwidth (MHz):	28		28				
Transmission Power (dBm):	30		30				
Transmission Gains (dB):	0		0				
Transmission System Loss (dB):		0		0			
Transmission Line Loss (dB/100 m):		4		4			
Transmission Line Length (m):		10		10			
Transmission Connection Loss (dB):		0.3		0.3			
Transmission Number of Connections:		2		2			
Transmission Additional Loss (dB):		0		0			
Transmission Losses (dB):	1		1				
Transmission Antenna:	HP2-26		HP2-26				
Transmission Antenna Size (m):		0.6		0.6			
Transmission Antenna Height (m):		20		20			
Transmission Antenna Gain (dBd):		38.96		38.96			
Transmission Antenna Gain (dBi):		41.1		41.1			
Transmission Power EIRP (dBm):		70.1		70.1			
Reception Gains (dB):	0		0				
Reception System Loss (dB):	0		0				
Reception Line Loss (dB/100 m):		4		4			
Reception Line Length (m):	10		10				
Reception Connection Loss (dB):		0.3		0.3			
Reception Number of Connections:		2		2			
Reception Additional Loss (dB):		0		0			
Reception Losses (dB):	1		1				
Reception Antenna:	HP2-26		HP2-26				
Reception Antenna Size (m):	0.6		0.6				
Reception Antenna Height (m):		20		20			
Reception Antenna Gain (dBd):		38.96		38.96			

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Reception Antenna Gain (dBi):		41.1		41.1
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	6048.392	6048.392		
Azimuth - True (°):	4.708	184.714		
Azimuth - Magnetic (°):	6.916		186.929	
Transmission Inclination (°):	-0.161		0.161	
Reception Inclination (°):	-0.161		0.161	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	6048.416		6048.416	
Center Frequency (MHz):	26000		26000	
Free Space Loss (dB):	136.372		136.372	
Max Fresnel Radius (m):	4.177		4.177	
Max 2nd Fresnel Radius (m):	5.907		5.907	
Earth Radius Factor (K):	4/3			
Effective Radius (m):	8502056.000			
ITU Recommendation:	ITU-R P.526-11			
Diffraction Model:	Cascade Knife Edge			
Diffraction:	No LOS Diffraction		No LOS Diffraction	
Diffraction Loss (dB):	0		0	
Clearance Target (%):	60			
Minimum Clearance (m):	3.782		3.782	
Minimum Clearance Point (m):		1070.1		1070.1
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	1101.1 - 1163.2			1101.1 - 1163.2
Reflection Area 2 (m):	1256.204		1256.204	
Reflection Area 3 (m):	1349.257		1349.257	
Reflection Area 4 (m):	1504.344		1504.344	
Reflection Area 5 (m):	1659.4 - 1876.6			1659.4 - 1876.6
Reflection Area 6 (m):	2093.7 - 2124.7			2093.7 - 2124.7
Reflection Area 7 (m):	2217.7 - 2248.8			2217.7 - 2248.8
Reflection Area 8 (m):	2403.8 - 2465.9			2403.8 - 2465.9
Reflection Area 9 (m):	2558.935		2558.935	
Reflection Area 10 (m):	2807.074		2807.074	
Reflection Area 11 (m):	3210.3		3210.3	
Reflection Area 12 (m):	3303.353		3303.353	
Reflection Area 13 (m):	3520.474		3520.474	
Reflection Area 14 (m):	3613.526		3613.526	
Reflection Area 15 (m):	3706.6 - 3830.6			3706.6 - 3830.6
Reflection Area 16 (m):	5443.6 - 5474.6			5443.6 - 5474.6
ITU Recommendation:	ITU-R P.676-8			
Atmospheric Pressure (hPa):	1013		1013	
Standard Temperature (°C):	15		15	
Water Vapor Density (g/m³):	7.5		7.5	
Atmospheric Gases Loss (dB):		0.8		0.8
Total Path Loss (dB):	137.173		137.173	
Reception Signal Level (dBm):		-26.973		-26.973

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	64.027	63.027	64.027	63.027

ITU Recommendation:	ITU-R F.1703-0 / ITU-T G.827			
Objective ITU Quality Grade:	Short Haul SDH Networks			
Unavailability Objective (%):	2.00E-02			
Availability Objective (%):	99.9800			
ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.826			
Error Performance Objective BBER (%):	1.60E-05			1.60E-05
Error Performance Objective BBER (s/Month):			0.42	0.42

SESR	ESR	SESR	ESR

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Error Performance Objective (%):	1.60E-04	3.20E-03	1.60E-04	3.20E-03
Error Performance Objective (s/Month):	4.205	84.096	4.205	84.096

ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.828			
Error Performance Objective BBER (%):	4.00E-06		4.00E-06	
Error Performance Objective BBER (s/Month):		0.105		0.105
	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	8.00E-04	1.60E-04	8.00E-04
Error Performance Objective (s/Month):	4.205	21.024	4.205	21.024

Multipath Model:	ITU-R P.530-15
Multipath Planning Type:	Quick Planning
Multipath Time Frame:	Average annual distribution
ITU Recommendation:	ITU-R P.453-9
Point Refractivity Gradient (dN1):	-76.7
Geoclimatic Factor: 4.05E-05	4.05E-05
Multipath Occurrence Factor (%):	2.40E-02 2.40E-02

Precipitation Model:	ITU-R P.530-15
ITU Recommendation:	ITU-R P.837-5 / ITU-R P.841-4
Precipitation Time Frame:	Average annual distribution
Precipitation Rate @ 0.01% (mm/h):	22
ITU Recommendation:	ITU-R P.838-3
Specific Attenuation (dB/km):	3.06948 3.06948
Rainfall Attenuation (dB):	14.036 14.036

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%):	8.82E-10	1.11E-09	8.82E-10	1.11E-09
Selective Fading Outage (%):	9.31E-11	9.31E-11	9.31E-11	9.31E-11
Composite Fading Outage (%):		9.75E-10	1.20E-09	9.75E-10 1.20E-09

Fading Outage (s/Month):	0	0	0	0	
Selective Fading Outage (s/Month):		0	0	0	0
Composite Fading Outage (s/Month):		0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Unavailability due to Rain (s/Year):		0	0	0 0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Fading (%):		9.75E-10	1.20E-09	9.75E-10 1.20E-09
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Unavailability (%):	9.75E-10	1.20E-09	9.75E-10	1.20E-09
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02

Unavailability due to Fading (s/Year):		0	0	0 0
Unavailability due to Rain (s/Year):		0	0	0 0
Total Unavailability (s/Year):	0	0	0	0
Unavailability Objective (s/Year):		6307.2	6307.2	6307.2 6307.2

Total Availability (%):	100.0000	100.0000	100.0000	100.0000
Availability Objective (%):	99.9800	99.9800	99.9800	99.9800

* PASS * * PASS * * PASS * * PASS *

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

C.7 Radio Link Budget Report (Brodullagh South - Letir)

Link Budget Report

Site:	AB_L1A_VF (Brodullagh South)			Letir_VF (Letir)			
Name:							
Type:	Cell		Cell				
Latitude:	53°30'36.1"N			53°22'41.1"N			
Longitude:	9°07'32.1"W			9°17'53.6"W			
Altitude (m):	49.0			254.0			
UserData1:	User Data						
Datum:	World Geodetic System 1984 (WGS 84)						
	Forward Link			Reverse Link			
Transmission Site:	AB_L1A_VF			Letir_VF			
Reception Site:	Letir_VF			AB_L1A_VF			
Radio Type:	NetRadio0001			NetRadio0001			
Modulation Scheme:	4-QAM			4-QAM			
Bandwidth (MHz):	2			2			
Roll-Off Factor:	0.2			0.2			
Coding Gain (dB):	0			0			
System Gains (dB):	0			0			
Channel Overhead (%):	20			20			
FEC Overhead (%):	0			0			
Reference Temperature (°K):	290			290			
Receiver Noise Figure (dB):	5			5			
Maximum Data Rate (Mbps):	2.667			2.667			
Maximum Bit Rate (Mbps):	3.333			3.333			
Required Bit Error Rate:	BER 10-3	BER 10-6		BER 10-3	BER 10-6		
Service Threshold (dBm):	-91	-90		-91	-90		
Carrier to Noise Ratio (dB):	14.965	15.965		14.965	15.965		
Cross Polarization Improvement Factor (dB):				20	20	20	20
Rx Equalization Sig Norm Parameter (Kn,M):				0.1	0.1	0.1	0.1
Rx Equalization Sig Norm Parameter (Kn,NM):				0.1	0.1	0.1	0.1
UserData1:	User Data			User Data			
Center Frequency (MHz):	15000			15000			
Channel Bandwidth (MHz):	28			28			
Transmission Power (dBm):	30			30			
Transmission Gains (dB):	0			0			
Transmission System Loss (dB):		0			0		
Transmission Line Loss (dB/100 m):		4			4		
Transmission Line Length (m):		10			10		
Transmission Connection Loss (dB):		0.3			0.3		
Transmission Number of Connections:		2			2		
Transmission Additional Loss (dB):		0			0		
Transmission Losses (dB):	1			1			
Transmission Antenna:	HP2-15			HP2-15			
Transmission Antenna Size (m):		0.6			0.6		
Transmission Antenna Height (m):		15			10		
Transmission Antenna Gain (dBd):		34.86			34.86		
Transmission Antenna Gain (dBi):		37			37		
Transmission Power EIRP (dBm):		66			66		
Reception Gains (dB):	0			0			
Reception System Loss (dB):	0			0			
Reception Line Loss (dB/100 m):		4			4		
Reception Line Length (m):	10			10			
Reception Connection Loss (dB):		0.3			0.3		
Reception Number of Connections:		2			2		
Reception Additional Loss (dB):		0			0		
Reception Losses (dB):	1			1			
Reception Antenna:	HP2-15			HP2-15			
Reception Antenna Size (m):	0.6			0.6			
Reception Antenna Height (m):		10			15		
Reception Antenna Gain (dBd):		34.86			34.86		

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Reception Antenna Gain (dBi):		37		37
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	18639.42	18639.42		
Azimuth - True (°):	217.995	37.857		
Azimuth - Magnetic (°):	220.22		40.127	
Transmission Inclination (°):	-0.615		0.615	
Reception Inclination (°):	-0.615		0.615	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	18640.492			18640.492
Center Frequency (MHz):	15000		15000	
Free Space Loss (dB):	141.371		141.371	
Max Fresnel Radius (m):	9.654		9.654	
Max 2nd Fresnel Radius (m):	13.653		13.653	
Earth Radius Factor (K):	4/3			
Effective Radius (m):	8502056.000			
ITU Recommendation:	ITU-R P.526-11			
Diffraction Model:	Cascade Knife Edge			
Diffraction:	No LOS Diffraction		No LOS Diffraction	
Diffraction Loss (dB):	0		0	
Clearance Target (%):	60			
Minimum Clearance (m):	10.379		10.379	
Minimum Clearance Point (m):		18564.38		18564.38
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	1815.918		1815.918	
Reflection Area 2 (m):	1966 - 1996			1966 - 1996
Reflection Area 3 (m):	2086.054		2086.054	
Reflection Area 4 (m):	2146 - 2296.2			2146 - 2296.2
Reflection Area 5 (m):	2446.236		2446.236	
Reflection Area 6 (m):	2536.282		2536.282	
Reflection Area 7 (m):	2836.433		2836.433	
Reflection Area 8 (m):	3016.524		3016.524	
Reflection Area 9 (m):	3346.7 - 3436.7			3346.7 - 3436.7
Reflection Area 10 (m):	3676.858		3676.858	
Reflection Area 11 (m):	3736.9 - 3887.0			3736.9 - 3887.0
Reflection Area 12 (m):	4037.04		4037.04	
Reflection Area 13 (m):	4127.085		4127.085	
Reflection Area 14 (m):	4187.1 - 4217.1			4187.1 - 4217.1
Reflection Area 15 (m):	4277.2 - 4307.2			4277.2 - 4307.2
Reflection Area 16 (m):	4427.237		4427.237	
ITU Recommendation:	ITU-R P.676-8			
Atmospheric Pressure (hPa):	1013		1013	
Standard Temperature (°C):	15		15	
Water Vapor Density (g/m³):	7.5		7.5	
Atmospheric Gases Loss (dB):		0.569		0.569
Total Path Loss (dB):	141.94		141.94	
Reception Signal Level (dBm):		-39.94		-39.94

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	51.06	50.06	51.06	50.06

ITU Recommendation:	ITU-R F.1703-0 / ITU-T G.827			
Objective ITU Quality Grade:	Short Haul SDH Networks			
Unavailability Objective (%):	2.00E-02			
Availability Objective (%):	99.9800			
ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.826			
Error Performance Objective BBER (%):	1.60E-05			1.60E-05
Error Performance Objective BBER (s/Month):			0.42	0.42

	SESR	ESR	SESR	ESR

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Error Performance Objective (%):	1.60E-04	3.20E-03	1.60E-04	3.20E-03
Error Performance Objective (s/Month):	4.205	84.096	4.205	84.096

ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.828			
Error Performance Objective BBER (%):	4.00E-06		4.00E-06	
Error Performance Objective BBER (s/Month):		0.105		0.105
	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	8.00E-04	1.60E-04	8.00E-04
Error Performance Objective (s/Month):	4.205	21.024	4.205	21.024

Multipath Model:	ITU-R P.530-15
Multipath Planning Type:	Quick Planning
Multipath Time Frame:	Average annual distribution
ITU Recommendation:	ITU-R P.453-9
Point Refractivity Gradient (dN1):	-76.7
Geoclimatic Factor: 4.05E-05	4.05E-05
Multipath Occurrence Factor (%):	1.12E-01 1.12E-01

Precipitation Model:	ITU-R P.530-15
ITU Recommendation:	ITU-R P.837-5 / ITU-R P.841-4
Precipitation Time Frame:	Average annual distribution
Precipitation Rate @ 0.01% (mm/h):	22
ITU Recommendation:	ITU-R P.838-3
Specific Attenuation (dB/km):	1.262312 1.262312
Rainfall Attenuation (dB):	15.174 15.174

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%):	9.14E-08	1.15E-07	9.14E-08	1.15E-07
Selective Fading Outage (%):	5.51E-09	5.51E-09	5.51E-09	5.51E-09
Composite Fading Outage (%):		9.70E-08	1.21E-07	9.70E-08 1.21E-07

Fading Outage (s/Month):	0.002	0.003	0.002	0.003	
Selective Fading Outage (s/Month):		0	0	0	0
Composite Fading Outage (s/Month):		0.003	0.003	0.003	0.003

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Rain (%):	3.11E-05	4.16E-05	3.11E-05	4.16E-05
Unavailability due to Rain (s/Year):		9.811	13.131	9.811 13.131

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Fading (%):		9.70E-08	1.21E-07	9.70E-08 1.21E-07
Unavailability due to Rain (%):	3.11E-05	4.16E-05	3.11E-05	4.16E-05
Total Unavailability (%):	3.12E-05	4.18E-05	3.12E-05	4.18E-05
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02

Unavailability due to Fading (s/Year):		0.031	0.038	0.031 0.038
Unavailability due to Rain (s/Year):		9.811	13.131	9.811 13.131
Total Unavailability (s/Year):	9.842	13.169	9.842	13.169
Unavailability Objective (s/Year):		6307.2	6307.2	6307.2 6307.2

Total Availability (%):	100.0000	100.0000	100.0000	100.0000
Availability Objective (%):	99.9800	99.9800	99.9800	99.9800

* PASS *	* PASS *	* PASS *	* PASS *

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

C.8 Radio Link Budget Report (Letir to Oughterard Garda Station)

Link Budget Report

Site Name:	Letir_VF (Letir)		AB_L1B_VF (Oughterard Garda Station)				
Type:	Cell	Cell					
Latitude:	53°22'41.1"N		53°25'38.6"N				
Longitude:	9°17'53.6"W		9°19'27.4"W				
Altitude (m):	254.0		13.0				
UserData1:	User Data						
Datum:	World Geodetic System 1984 (WGS 84)						
	Forward Link		Reverse Link				
Transmission Site:	Letir_VF		AB_L1B_VF				
Reception Site:	AB_L1B_VF		Letir_VF				
Radio Type:	NetRadio0001		NetRadio0001				
Modulation Scheme:	4-QAM		4-QAM				
Bandwidth (MHz):	2		2				
Roll-Off Factor:	0.2		0.2				
Coding Gain (dB):	0		0				
System Gains (dB):	0		0				
Channel Overhead (%):	20		20				
FEC Overhead (%):	0		0				
Reference Temperature (°K):	290		290				
Receiver Noise Figure (dB):	5		5				
Maximum Data Rate (Mbps):	2.667		2.667				
Maximum Bit Rate (Mbps):	3.333		3.333				
Required Bit Error Rate:	BER 10-3	BER 10-6	BER 10-3	BER 10-6			
Service Threshold (dBm):	-91	-90	-91	-90			
Carrier to Noise Ratio (dB):	14.965	15.965	14.965	15.965			
Cross Polarization Improvement Factor (dB):			20	20	20	20	
Rx Equalization Sig Norm Parameter (Kn,M):			0.1	0.1	0.1	0.1	
Rx Equalization Sig Norm Parameter (Kn,NM):			0.1	0.1	0.1	0.1	
UserData1:	User Data		User Data				
Center Frequency (MHz):	15000		15000				
Channel Bandwidth (MHz):	28		28				
Transmission Power (dBm):	30		30				
Transmission Gains (dB):	0		0				
Transmission System Loss (dB):		0		0			
Transmission Line Loss (dB/100 m):		4		4			
Transmission Line Length (m):		10		10			
Transmission Connection Loss (dB):		0.3		0.3			
Transmission Number of Connections:		2		2			
Transmission Additional Loss (dB):		0		0			
Transmission Losses (dB):	1		1				
Transmission Antenna:	HP2-15		HP2-15				
Transmission Antenna Size (m):		0.6		0.6			
Transmission Antenna Height (m):		10		14			
Transmission Antenna Gain (dBd):		34.86		34.86			
Transmission Antenna Gain (dBi):		37		37			
Transmission Power EIRP (dBm):		66		66			
Reception Gains (dB):	0		0				
Reception System Loss (dB):	0		0				
Reception Line Loss (dB/100 m):		4		4			
Reception Line Length (m):	10		10				
Reception Connection Loss (dB):		0.3		0.3			
Reception Number of Connections:		2		2			
Reception Additional Loss (dB):		0		0			
Reception Losses (dB):	1		1				
Reception Antenna:	HP2-15		HP2-15				
Reception Antenna Size (m):	0.6		0.6				
Reception Antenna Height (m):		14		10			
Reception Antenna Gain (dBd):		34.86		34.86			

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Reception Antenna Gain (dBi):		37		37
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	5759.709	5759.709		
Azimuth - True (°):	342.518	162.497		
Azimuth - Magnetic (°):	344.788		164.786	
Transmission Inclination (°):	2.356		-2.356	
Reception Inclination (°):	2.356		-2.356	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	5764.583		5764.583	
Center Frequency (MHz):	15000		15000	
Free Space Loss (dB):	131.177		131.177	
Max Fresnel Radius (m):	5.366		5.366	
Max 2nd Fresnel Radius (m):	7.589		7.589	
Earth Radius Factor (K):	4/3			
Effective Radius (m):	8502056.000			
ITU Recommendation:	ITU-R P.526-11			
Diffraction Model:	Cascade Knife Edge			
Diffraction:	No LOS Diffraction		No LOS Diffraction	
Diffraction Loss (dB):	0		0	
Clearance Target (%):	60			
Minimum Clearance (m):	7.379		7.379	
Minimum Clearance Point (m):		113.893		113.893
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	113.893		113.893	
Reflection Area 2 (m):	1285.359		1285.359	
Reflection Area 3 (m):	2717.151		2717.151	
Reflection Area 4 (m):	3530.669		3530.669	
Reflection Area 5 (m):	4246.565		4246.565	
Reflection Area 6 (m):	4832.298		4832.298	
Reflection Area 7 (m):	4897.38		4897.38	
ITU Recommendation:	ITU-R P.676-8			
Atmospheric Pressure (hPa):	1013		1013	
Standard Temperature (°C):	15		15	
Water Vapor Density (g/m³):	7.5		7.5	
Atmospheric Gases Loss (dB):		0.176		0.176
Total Path Loss (dB):	131.353		131.353	
Reception Signal Level (dBm):		-29.353		-29.353

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	61.647	60.647	61.647	60.647

ITU Recommendation:	ITU-R F.1703-0 / ITU-T G.827			
Objective ITU Quality Grade:	Short Haul SDH Networks			
Unavailability Objective (%):	2.00E-02			
Availability Objective (%):	99.9800			
ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.826			
Error Performance Objective BBER (%):		1.60E-05		1.60E-05
Error Performance Objective BBER (s/Month):		0.42		0.42

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	3.20E-03	1.60E-04	3.20E-03
Error Performance Objective (s/Month):	4.205	84.096	4.205	84.096

ITU Recommendation:	ITU-R F.1668-1 / ITU-T G.828			
Error Performance Objective BBER (%):		4.00E-06		4.00E-06
Error Performance Objective BBER (s/Month):		0.105		0.105

	SESR	ESR	SESR	ESR
Error Performance Objective (%):	1.60E-04	8.00E-04	1.60E-04	8.00E-04
Error Performance Objective (s/Month):	4.205	21.024	4.205	21.024

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.

Multipath Model: ITU-R P.530-15
Multipath Planning Type: Quick Planning
Multipath Time Frame: Average annual distribution
ITU Recommendation: ITU-R P.453-9
Point Refractivity Gradient (dN1): -76.7
Geoclimatic Factor: 4.05E-05 4.05E-05
Multipath Occurrence Factor (%): 6.12E-04 6.12E-04

Precipitation Model: ITU-R P.530-15
ITU Recommendation: ITU-R P.837-5 / ITU-R P.841-4
Precipitation Time Frame: Average annual distribution
Precipitation Rate @ 0.01% (mm/h): 22
ITU Recommendation: ITU-R P.838-3
Specific Attenuation (dB/km): 1.262426 1.262426
Rainfall Attenuation (dB): 6.135 6.135

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%):	2.56E-11	3.22E-11	2.56E-11	3.22E-11
Selective Fading Outage (%):	5.24E-12	5.24E-12	5.24E-12	5.24E-12
Composite Fading Outage (%):		3.08E-11	3.74E-11	3.08E-11	3.74E-11

Fading Outage (s/Month):	0	0	0	0
Selective Fading Outage (s/Month):	0	0	0	0
Composite Fading Outage (s/Month):	0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Unavailability due to Rain (s/Year):	0	0	0	0

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Unavailability due to Fading (%):		3.08E-11	3.74E-11	3.08E-11	3.74E-11
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Unavailability (%):	3.08E-11	3.74E-11	3.08E-11	3.74E-11
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02

Unavailability due to Fading (s/Year):	0	0	0	0
Unavailability due to Rain (s/Year):	0	0	0	0
Total Unavailability (s/Year):	0	0	0	0
Unavailability Objective (s/Year):		6307.2	6307.2	6307.2	6307.2

Total Availability (%):	100.0000	100.0000	100.0000	100.0000
Availability Objective (%):	99.9800	99.9800	99.9800	99.9800

* PASS * * PASS * * PASS * * PASS *

Copyright of this document is vested in Ai Bridges Limited. Ai Bridges Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language, without prior written permission of Ai Bridges Limited.