




## **APPENDIX 15-5**

***EIR TELCOMMUNICATIONS  
IMPACT ASSESSMENT REPORT***



	Procedure: 001	Rev: 2.0
Title: Carrow Wind Farm Eir Telecommunications Impact Assessment Report	Approved: KH	Date: 20/02/25

# Report


## *Carrow Wind Farm Eir Telecommunications Impact Assessment Report*

**Document Number:**

**Author:** DMG/PT

**Approved for Release:** Rev 2.0      KH      **Date:** 20/02/25

**Document Filename:** *Carrow Wind Farm, Eir Telecommunications Impact Assessment Report.*

	Procedure: 001	Rev: 2.0
Title: Carrow Wind Farm Eir Telecommunications Impact Assessment Report	Approved: KH	Date: 20/02/25


## Executive Summary

In 2024, Ai Bridges was commissioned to evaluate the possible impacts that the proposed wind farm at Carrow, Co Tipperary 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.

In the consultation response from Eir, eight microwave radio links were identified as potentially being impacted by the proposed wind turbines. The Eir radio links were subsequently modelled in radio planning software and a detailed impact analysis was carried out (2D and 3D). The findings of the impact analysis indicate that the proposed turbines would not obstruct any of the Eir radio links. However, it should be noted that the clearance distance between the blade-tip of one of the turbines (T03) and the Fresnel Zone of the Eir radio link between Laghtseeffin and Golden is relatively small at 13.5 m.

The results of the 3D analysis indicate that the proposed turbines will not obstruct the Eir microwave radio links and mitigation measures are not likely to be required. However, to allay any concerns that Eir may have in relation to potential interference due to T03, the following mitigation measure strategy should be implemented as a condition of planning in the event of a successful planning application:

1. *Eir would be re-consulted in the event of a successful planning application.*
2. *During the Construction Phase of the wind farm, it would be proposed that wind turbine T03 would be constructed and yaw wind turbine T03 on a perpendicular, worst-case-scenario, bearing into the Eir microwave radio link.*
3. *Eir would then monitor the telecommunications radio link performance to check for interference / loss of performance.*
4. *Eir would provide evidence-based demonstrable results of any wind turbine interference impacts.*
5. *If interference is detected and can be demonstrated to be attributable to the wind turbine T03, then the mitigation measure as described in this Report (Ref Section 4.1) should be implemented to the agreement of Eir.*
6. *It would be an agreed condition of planning that wind turbine T03 would not become operational until all impacts from wind turbine T03 would be remediated according to the agreed mitigation measure proposal. All costs of the mitigation measure strategy would be borne by the developer.*

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# Section 1 – Introduction

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# 1. Introduction

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

Link No.	Operator	Link Description
1	Eir	PTP microwave radio link from to Laghtseefin to Goulds Cross
2	Eir	PTP microwave radio link from to Laghtseefin to Rosegreen
3	Eir	PTP microwave radio link from to Laghtseefin to Golden
4	Eir	PTP microwave radio link from to Laghtseefin to Clonoulty
5	Eir	PTP microwave radio link from to Laghtseefin to Waller's-Lot, Cashel
6	Eir	PTP microwave radio link from to Laghtseefin to Tipperary Town
7	Eir	PTP microwave radio link from to Laghtseefin to Mount O'Meara
8	Eir	PTP microwave radio link from to Laghtseefin to Cashel

**Table 1. Eir Radio Links requiring Analysis**




**Figure 1. Eir Radio Network – Plan View**


In order that the Eir radio network could be modelled as accurately as possible, field surveys of the radio links were carried out. The A-End and B-End of each radio link was surveyed to determine the accuracy of the antenna coordinates, and antenna heights. Photos from the Field Surveys are provided in Section 2.

Following the Field Survey of the Eir radio links a network analysis was carried out to assess which of the Eir radio links could potentially be impacted by the proposed turbines at Carrow. The network analysis results are provided in Section 3.

In Section 4 mitigation measure solutions have been provided to offset any possible impacts due to the proposed Carrow turbines on the Eir radio link network.

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## Section 2 – Field Survey

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## 2. Field Survey

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


- Laghtseefin
- Goulds Cross
- Rosegreen
- Golden
- Clonoulty
- Waller's-Lot, Cashel
- Tipperary Town
- Mount O'Meara
- Cashel

### 2.1 Laghtseefin

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



**Figure 2. Telecoms Mast at Laghtseefin**

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## 2.2 Goulds Cross

A photo of the telecoms mast-structure at location is shown below.




**Figure 3. Telecoms Mast at Goulds Cross**

## 2.3 Rosegreen

A photo of the telecoms mast-structure at location is shown below.



**Figure 4. Telecoms Mast at Rosegreen**


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## 2.4 Golden

A photo of the telecoms mast-structure at location is shown below.



**Figure 5. Telecoms Mast at Golden**


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## 2.5 Clonoulty

A photo of the telecoms mast-structure at location is shown below.



Figure 6. Telecoms Mast at Clonoulty

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## 2.6 Waller’s-Lot, Cashel

A photo of the telecoms mast-structure at location is shown below.




**Figure 7. Telecoms Mast at Waller’s-Lot, Cashel**

## 2.7 Tipperary Town

A photo of the telecoms mast-structure at location is shown below.



**Figure 8. Telecoms Mast at Tipperary Town**

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## 2.8 Mount O'Meara

A photo of the telecoms mast-structure at location is shown below.




Figure 9. Telecoms Mast at Mount O'Meara

## 2.9 Cashel


A photo of the telecoms mast-structure at location is shown below.



Figure 10. Telecoms Mast at Cashel

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## Section 3 – Eir Transmission Network Analysis

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### 3. Eir Transmission Network Analysis

A Plan View (2D) and a 3D View of Eir radio link network relative to the proposed turbines are shown in the figures below. The results indicate that the proposed turbines would not obstruct the Eir radio links.

The nearest of the proposed turbines to any of the Eir links is T03. 3D analysis indicates that there would be a Clearance Distance of 13.5 m between the blade-tip of T03 and the Fresnel Zone (0.6F1) of the radio link between Laghtseeffin and Golden. At this distance there would be no impact on the Eir Link.

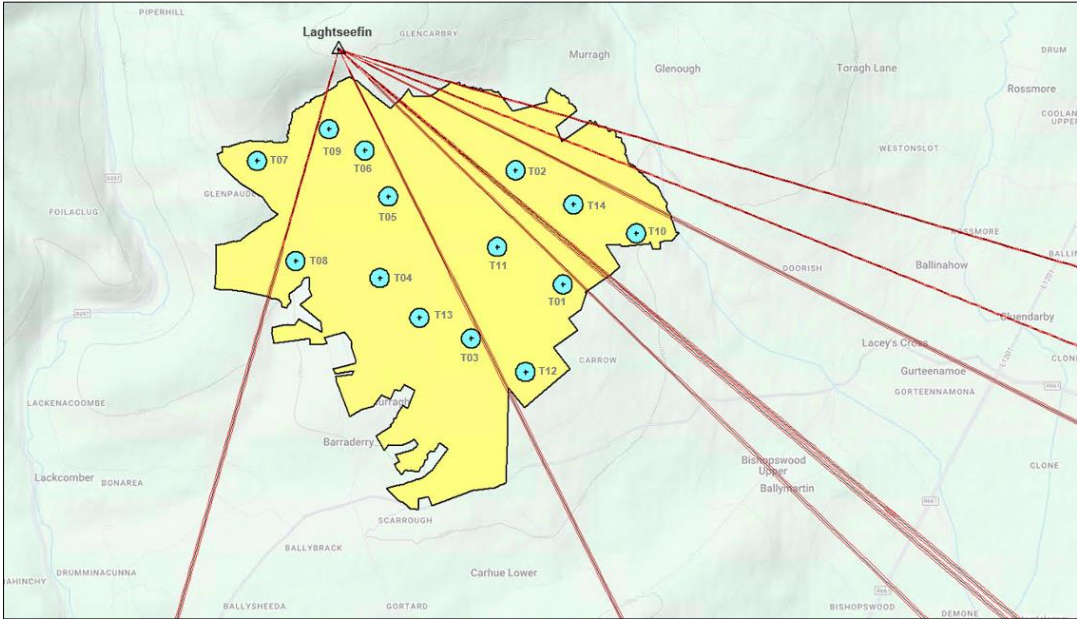


Figure 11. Eir Network - Close-up Plan (2D) View

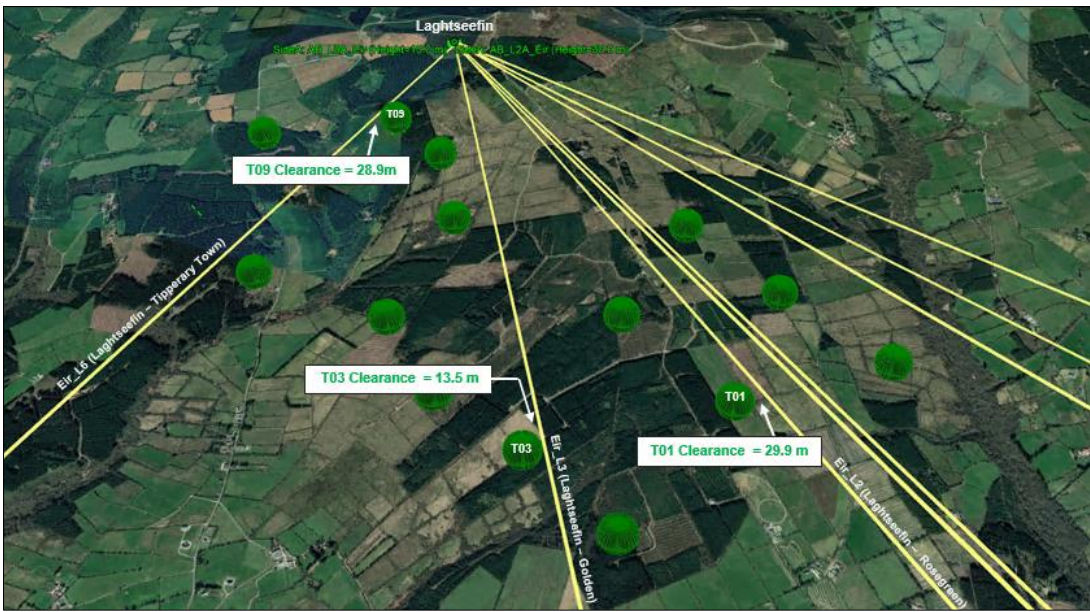



Figure 12. Eir Network – 3D Modelling View

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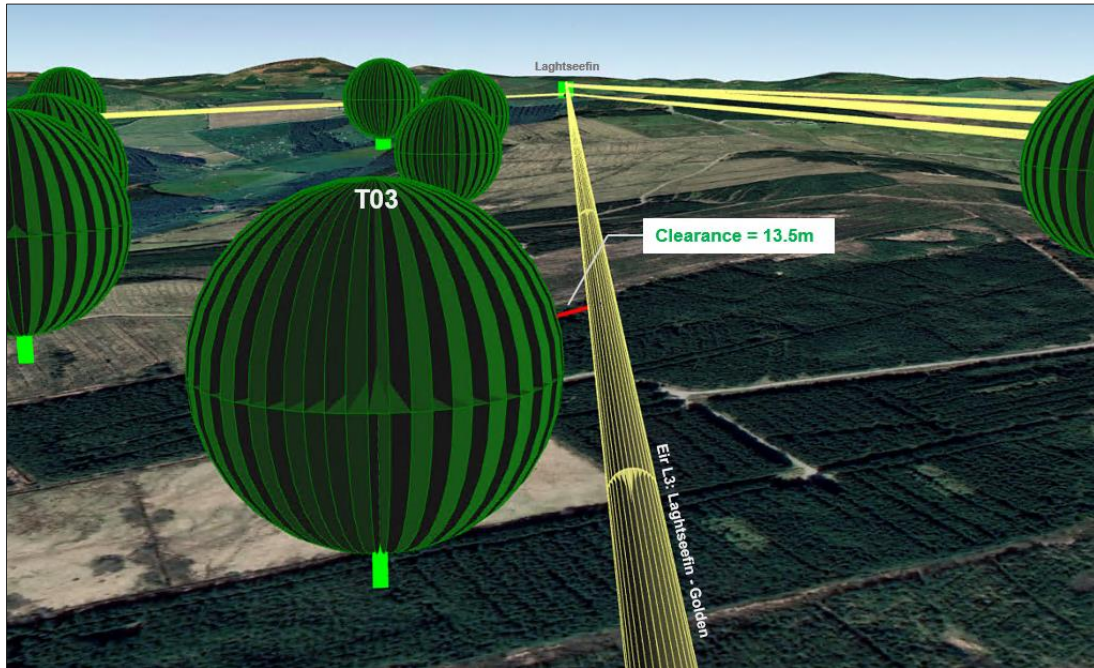



Figure 13. Close-up 3D View of T03 relative to the radio link between Laghtseeffin and Golden

**Analysis Results:**


The table below provides a brief summary of the Network Analysis findings for the Eir network.

Radio Link ID	Nearest Turbine(s)	Clearance Distance to Radio Link	Result
Eir L1 (Laghtseeffin - Goulds Cross)	T02	> 30.0 m	Clearance
Eir L2 (Laghtseeffin - Rosegreen)	T01	29.9 m	Clearance
Eir L3 (Laghtseeffin - Golden)	T03	13.5 m	Clearance
Eir L4 (Laghtseeffin – Clonoulty)	T02	> 30.0 m	Clearance
Eir L5 (Laghtseeffin - Waller’s-Lot, Cashel)	T02	> 30.0 m	Clearance
Eir L6 (Laghtseeffin - Tipperary Town)	T09	28.9 m	Clearance
Eir L7 (Laghtseeffin - Mount O’Meara)	T02	> 30 m	Clearance
Eir L8 (Laghtseeffin – Cashel)	T02	> 30 m	Clearance

Table 2. Analysis Summary – Eir Network

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## Section 4 – Mitigation Measures

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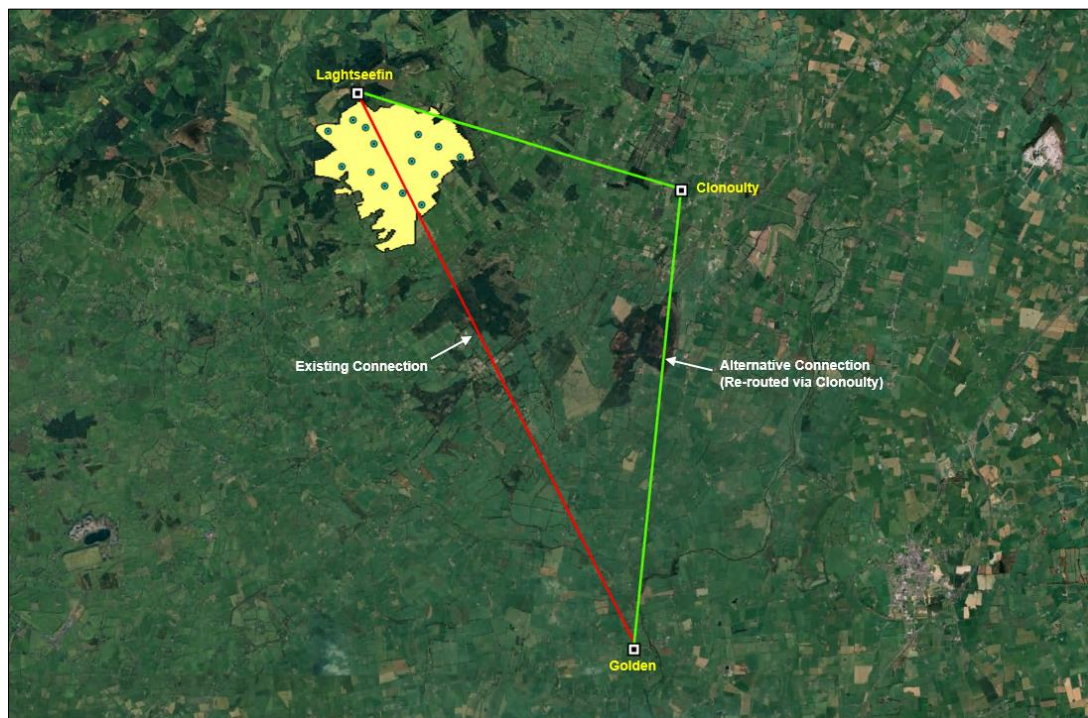
## 4. Mitigation Measures

The results of the 3D network analysis indicate that the Eir radio links would not be obstructed by any of the proposed turbines at Carrow i.e. there is no impact on the 60% of the 1<sup>st</sup> Fresnel Zone (0.6F1) and mitigation measures should not be required. However, if Eir have any concerns in relation to the proximity of T03 to the radio link between Laghtseefin and Golden, the mitigation measure outlined below in Section 4.1 is available.

### 4.1 Mitigation Measure – Re-route radio link via an Alternative Mast-Site

The service to/from Golden could be delivered via an alternative mast-site. The existing telecoms mast at Clonoulty has been identified as a mast, which could potentially be used for this purpose.

*Note: Eir have an existing radio link between the telecom masts at Laghtseefin and Clonoulty.*




**Figure 14. Re-route via Alternative Mast Site**

To determine if the telecoms mast in Clonoulty could be used to facilitate a viable connection between Laghtseefin and Golden, a radio link Path Profile has been generated.

A Radio Link Budget was also carried out to determine if the proposed radio link (Clonoulty – Golden) 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

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### 4.1.1 Path Profile – Clonoulty to Golden

The radio link path profile shows clear Line-of-Sight (LOS) and the link budget results would pass the radio availability criteria. The radio link budget for this link is provided in Appendix A.1.

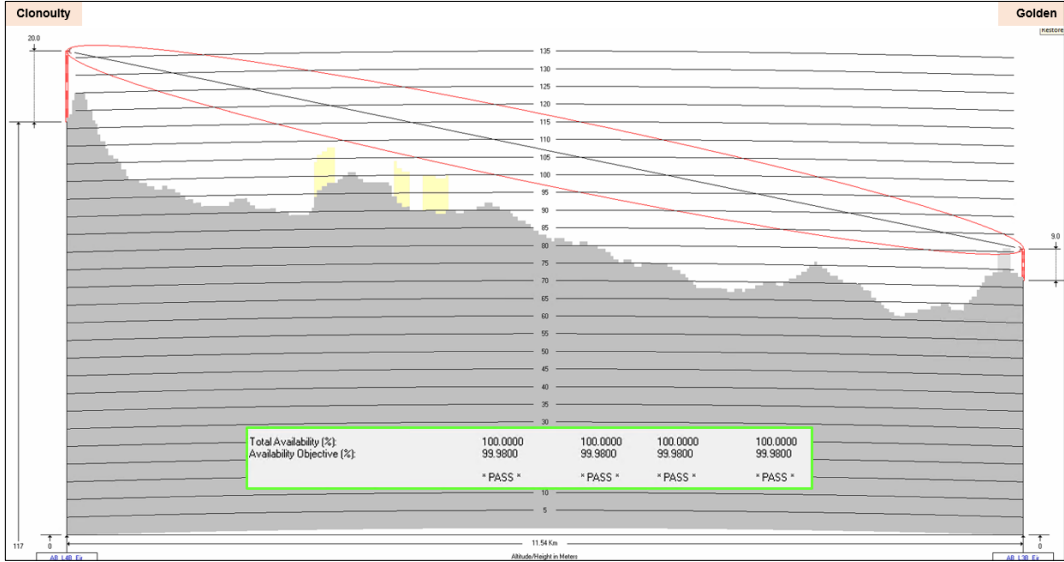




Figure 15. Path Profile – Clonoulty to Golden

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## Section 5 – Summary

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## 5. Summary

The final turbine layout for the proposed wind farm development incorporates clearances from all of the Eir transmission radio links. Radio Network analysis (2D and 3D) has been carried out and the results show that there will be no wind farm interference on any of the Eir radio links. The 3D modelling assessment is based on field survey data and ITU-R radio modelling standards.

The clearance distances between the turbines and the radio links are in-excess of 20 meters, with the exception of the radio link between Laghtseeffin and Golden which shows a clearance distance of 13.5 m. It is not expected that there will be interference at this distance, based on previous wind farm planning applications in other counties. However, an optional mitigation measure strategy has been proposed. The mitigation measure strategy, as detailed below, proposes that a condition of planning be incorporated into a grant of planning, which would invite further consultation with Eir to as to provide assurances that the developer would engage on the construction of T03 to the agreement of Eir.

A Letter of Reliance as to summary findings of this report has been provided based on the following mitigation measure strategy outlined below.

1. *Eir would be re-consulted in the event of a successful planning application.*
2. *During the Construction Phase of the wind farm, it would be proposed that wind turbine T03 would be constructed and yaw wind turbine T03 on a perpendicular, worst-case-scenario, bearing into the Eir microwave radio link.*
3. *Eir would then monitor the telecommunications radio link performance to check for interference / loss of performance.*
4. *Eir would provide evidence-based demonstrable results of any wind turbine interference impacts.*
5. *If interference is detected and can be demonstrated to be attributable to the wind turbine T03, then the mitigation measure as described in this Report (Ref Section 4.1) should be implemented to the agreement of Eir.*
6. *It would be an agreed condition of planning that wind turbine T03 would not become operational until all impacts from wind turbine T03 would be remediated according to the agreed mitigation measure proposal. All costs of the mitigation measure strategy would be borne by the developer.*

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# Appendix A – Radio Link Budgets

## A.1 Radio Link Budget Report (Clonoulty – Golden)


### Link Budget Report

Site:	AB_L4B_Eir (Clonoulty)	AB_L3B_Eir (Golden)
Name:		
Type:	Cell	Cell
Latitude:	52°36'01.2"N	52°29'50.2"N
Longitude:	7°58'21.8"W	7°59'24.8"W
Altitude (m):	117.0	72.0


UserData1: User Data

Datum: World Geodetic System 1984 (WGS 84)

	Forward Link	Reverse Link		
Transmission Site:	AB_L4B_Eir	AB_L3B_Eir		
Reception Site:	AB_L3B_Eir	AB_L4B_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):	20	9		
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		

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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):	9	20		
Reception Antenna Gain (dBi):	36.46	36.46		
Reception Antenna Gain (dB):	38.6	38.6		
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):	30	30		
Link Distance (m):	11543.661	11543.661		
Azimuth - True (°):	185.898	5.884		
Azimuth - Magnetic (°):	187.982	7.958		
Transmission Inclination (°):	0.278	-0.278		
Reception Inclination (°):	0.278	-0.278		
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	11543.797	11543.797		
Center Frequency (MHz):	18000	18000		
Free Space Loss (dB):	138.792	138.792		
Max Fresnel Radius (m):	6.935	6.935		
Max 2nd Fresnel Radius (m):	9.808	9.808		
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):	3.105	3.105		
Clearance Target (%):	60			
Minimum Clearance (m):	-0.29	-0.29		
Minimum Clearance Point (m):	11372.529	11372.529		
Terrain Reflection Dispersion (°):	0.5			
Reflection Area 1 (m):	202.247	202.247		
Reflection Area 2 (m):	420 - 451.2	420 - 451.2		
Reflection Area 3 (m):	513.397	513.397		
Reflection Area 4 (m):	1042.4 - 1073.5	1042.4 - 1073.5		
Reflection Area 5 (m):	1197.9 - 1229	1197.9 - 1229		
Reflection Area 6 (m):	1291.3 - 1446.8	1291.3 - 1446.8		
Reflection Area 7 (m):	1509 - 1540.2	1509 - 1540.2		
Reflection Area 8 (m):	1602.4 - 1633.5	1602.4 - 1633.5		
Reflection Area 9 (m):	6363.016	6363.016		
Reflection Area 10 (m):	6456.360	6456.360		
Reflection Area 11 (m):	6767.510	6767.510		
Reflection Area 12 (m):	6891.97	6891.97		
Reflection Area 13 (m):	6985.3 - 7203.1	6985.3 - 7203.1		
Reflection Area 14 (m):	7358.695	7358.695		
Reflection Area 15 (m):	7638.7 - 7918.8	7638.7 - 7918.8		
Reflection Area 16 (m):	8012.11	8012.11		
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):	0.699	0.699		
Total Path Loss (dB):	142.597	142.597		
Reception Signal Level (dBm):	-37.397	-37.397		
BER 10-3	BER 10-6	BER 10-3	BER 10-6	
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	53.603	52.603	53.603	52.603
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			

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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 (%): 6.96E-02 6.96E-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): 1.708857 1.708857  
Rainfall Attenuation (dB): 13.563 13.563

BER 10-3 BER 10-6 BER 10-3 BER 10-6  
Fading Outage (%): 3.20E-08 4.03E-08 3.20E-08 4.03E-08  
Selective Fading Outage (%): 1.11E-09 1.11E-09 1.11E-09 1.11E-09  
Composite Fading Outage (%): 3.31E-08 4.14E-08 3.31E-08 4.14E-08

Fading Outage (s/Month): 0.001 0.001 0.001 0.001  
Selective Fading Outage (s/Month): 0 0 0 0  
Composite Fading Outage (s/Month): 0.001 0.001 0.001 0.001

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 (%): 3.31E-08 4.14E-08 3.31E-08 4.14E-08  
Unavailability due to Rain (%): 0.00E+00 0.00E+00 0.00E+00 0.00E+00  
Total Unavailability (%): 3.31E-08 4.14E-08 3.31E-08 4.14E-08  
Unavailability Objective (%): 2.00E-02 2.00E-02 2.00E-02 2.00E-02

Unavailability due to Fading (s/Year): 0.01 0.013 0.01 0.013  
Unavailability due to Rain (s/Year): 0 0 0 0  
Total Unavailability (s/Year): 0.01 0.013 0.01 0.013  
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 \*

MKO.  
Tuam Road,  
Galway,  
Ireland.  
H91 VW84

20<sup>th</sup> February 2025.

**Re: Development of Carrow Windfarm (the “Project”)**

To Whom It May Concern

We, Ai Bridges Limited, confirm that we were commissioned by MKO Ireland (the “Client”) to prepare the following report in relation to the Project and in particular to Telecommunications EMI:

- *Carrow Wind Farm, Eir Telecommunications Impact Assessment Report*

(the “Report”)

The purpose of this Letter is to enable MKO (the “Addressee”) to rely on the findings contained in the Report in relation to a 3D Software Modelling Analysis of the Eir Telecommunications Network traversing the proposed Carrow Wind Farm development.

### **Executive Summary**

Ai Bridges were commissioned to carry out an independent Telecommunications Impact Assessment Study to assess the possible impacts to telecommunications transmission infrastructure due to the proposed Carrow Wind Farm development. The objectives of the Telecommunications Impact Assessment Study Report are as follows:

- i) Assess the existing Eir telecommunications networks in the area.
- ii) Predict if any existing Eir telecoms infrastructure could be impacted by interference attributable to the proposed wind turbines.
- iii) Show by way of 3D modelling that there is no interference from the proposed wind turbines on the Eir Telecommunications Network and demonstrate that there would be a clearance condition of more than 10m between the blade-tip of the nearest wind turbine (T03) and the Fresnel Zone of the Eir microwave radio link between Laghtseefin and Golden.

### **Mitigation Measure Process**

The findings of the Report shows that mitigation measures are not likely to be required. The results of the 3D analysis indicate that the proposed turbines will not obstruct any of the Eir microwave radio links.

However, to allay any concerns that Eir may have in relation to potential interference to the radio link between Laghtseefin and Golden due to the proposed turbines, the following mitigation measure strategy should be implemented as a condition of planning in the event of a successful planning application.

The following mitigation measure strategy is presented:

1. Eir would be re-consulted in the event of a successful planning application.
2. During the Construction Phase of the wind farm, it would be proposed that wind turbine T03 would be constructed and yaw wind turbine T03 on a perpendicular, worst-case-scenario, bearing into the microwave radio link.
3. Eir would then monitor the telecommunications radio link performance to check for interference / loss of performance.
4. Eir would provide evidence-based demonstrable results of any wind turbine interference impacts.
5. If interference is detected and can be demonstrated to be attributable to the wind turbine T03, then the mitigation measure as described in the Report should be implemented to the agreement of Eir.
6. It would be an agreed condition of planning that wind turbine T03 would not become operational until all impacts from wind turbine T03 would be remediated according to the agreed mitigation measure proposal. All costs of the mitigation measure strategy would be borne by the developer.

Yours Sincerely

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For and on behalf of  
Ai Bridges Limited