Report

Ballyfasy Wind Farm
Telecommunications Impact Assessment Report

Document Number:

Author: DM/PT

Approved for Release: Rev 4.0 KH **Date:** 04/12/25

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

Executive Summary

Ai Bridges was commissioned to evaluate the possible impacts that the proposed wind farm at Ballyfasy, Co Kilkenny could have on existing telecommunications operator networks. During consultations with telecom operators (undertaken by TOBIN Engineering Consultancy), it was found that ESB Networks have three radio links that cross over/near the proposed wind farm site. These radio links are listed below in Table 1. The scope of work for this study included field and desktop surveys to assess the possible impact of the proposed turbines at Ballyfasy on the ESB radio links.

Using the information obtained during the field survey assessments and consultation responses, a desktop impact analysis was carried out, and each of the ESB radio links were analysed using radio planning \ modelling software (2D and 3D).

Radio link analysis indicates that an ESB Networks microwave radio link (between Glenpipe and Cheek Point),(ESB_L1), is already obstructed by one of the existing operational wind turbines at Ballymartin wind farm. One of the proposed turbines at Ballyfasy (T03) would also partially obstruct the Fresnel Zone of the radio link between Glenpipe and Cheek Point (ESB_L1).

If it is shown that a mitigation measure is required, the recommended mitigation measure would be a *Radio Link Re-route* via an existing ESB Telecoms Mast (as described in Section 6). In the case where the proposed wind farm is consented, and mitigation is deemed necessary, it is recommended that the mitigation measure strategy as set out in Section 7, should be effected.

Radio link analysis indicates that the UHF radio links (ESB_2 and ESB_L3) will not be impacted by the proposed development and mitigation measures would not be required for either of these UHF radio links.

Link ID	Link Description	Nearest Turbine	Observations	Mitigation Measures (Post-Consent)
ESB_L1	PTP microwave radio link between Glenpipe and Cheek Point.	T03	The 3D analysis results shows that this link is already obstructed by one of the existing operational wind turbines at Ballymartin wind farm, The proposed Ballyfasy wind turbine T03 would also partially obstruct the Fresnel Zone of this link.	Re-route the radio link via an existing ESB Telecoms Mast (e.g. Glencoum).
ESB_L2	PTP UHF radio link between Glenpipe and Bealistown 38KV.	T05	No Impacts. (Clearance > 40 m)	N.A.
ESB_L3	PTP UHF radio link between Glenpipe and Ballycullane Solar 10KV.	T05	No Impacts. (Clearance > 100 m)	N.A.

Table 1. ESB radio links that cross over the proposed development site.

Sections

Appendix

Section 1 - Wind Farm Site Information

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 proposed wind farm development is located in County Kilkenny and is approximately 8 km west of New Ross, Co Wexford. The dimensions of the proposed turbines at Ballyfasy are yet to be finalized; however, a range of dimensions are being considered. These turbine dimensions are shown below in Table 2.

The coordinates of the turbines assessed in this report are provided in Appendix A.

Wind Farm	Number of Turbines	Turbine Dimensions		
		Hub Height	Rotor Diameter	Tip Height
Ballyfasy	10	95m -105.5m	149m -163m	170m -180m

Table 2. Wind Farm Turbine Details

The location of the proposed wind farm development is shown below in Figure 1.

Figure 1. Location of proposed wind farm.

Section 2 - Methodology

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 Ballyfasy. Figure 2 below shows the proposed wind farm site boundary plotted in the radio planning tool.

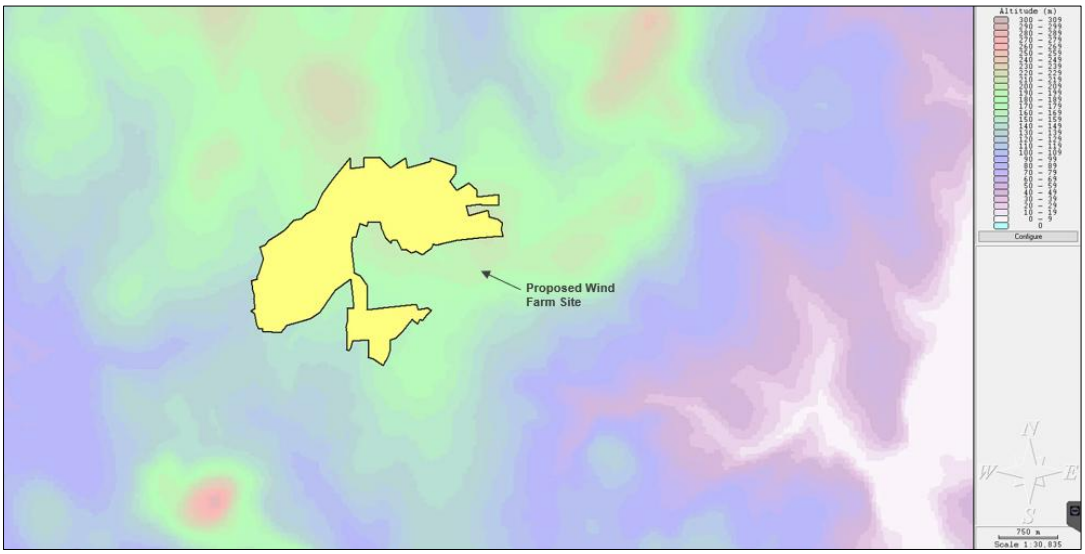


Figure 2. Wind Farm Boundary plotted in Radio Planning Software

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 boundary modelled in radio planning software.

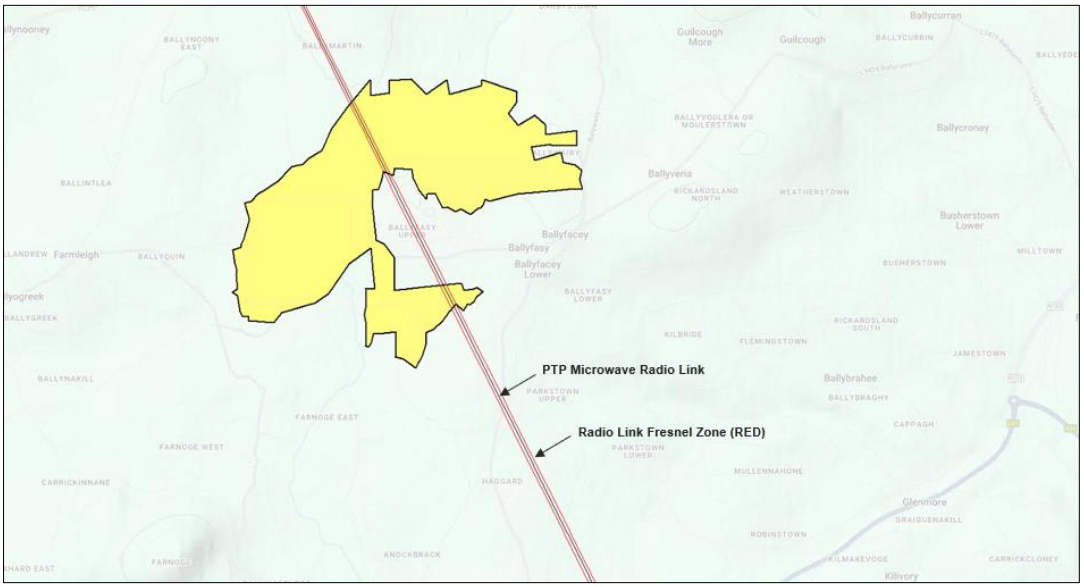


Figure 3. Example of a microwave radio link crossing over/near the proposed wind farm boundary modelled in radio planning software.

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.

Section 3 - Telecom Operator Consultations

3. Introduction

In this section the consultation process undertaken with the relevant telecom operator(s) is described. The responses received from the telecom operator(s) are also provided.

3.1 Telecom Operator Consultations

Consultations beginning in 2022 were undertaken (by TOBIN Engineering Consultancy) with telecom network operators to identify telecommunication infrastructure that could be impacted by the 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.

A follow up round of consultations was carried out in April 2025. During the follow up round of consultations ESB Networks responded with concerns regarding a number of their radio links that cross over/near the proposed wind farm development. ESB Networks also proposed an Exclusion Zone around their radio links, but no specific details regarding the radio links were provided.

Ai Bridges Ltd were subsequently requested to engage with ESB Networks to ascertain the technical details regarding their radio links, and to assess the potential impact of the proposed turbines.

The correspondences with ESB Networks regarding the proposed wind farm development at Ballyfasy are provided in Sections 3.1.1 below.

3.1.1 Consultations - ESB Networks

The correspondence between ESB Networks and TOBIN / Ai Bridges Ltd are provided below.

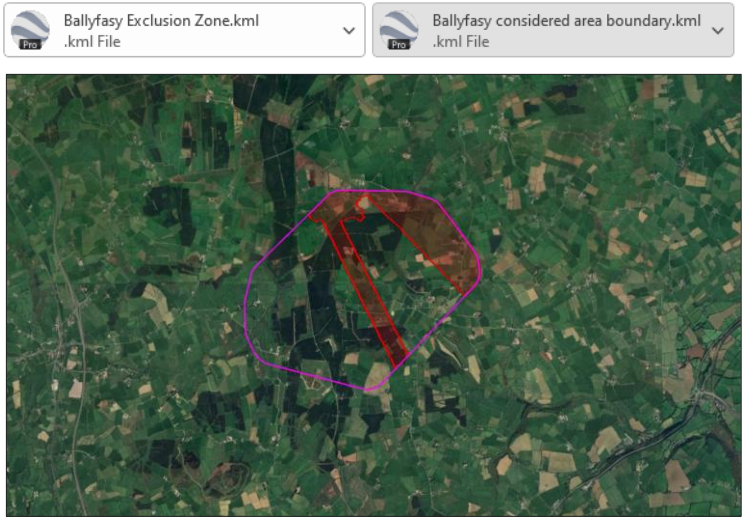
28.08.25 - Email from ESB Networks to TOBIN

"Good afternoon,

We have completed our assessment of the Ballyfasy Wind Farm development and have identified an exclusion zone necessary to protect our link. To avoid potential interference, it is essential that the turbine base be situated outside of this exclusion zone.

Please find attached the GIS file in KML format for your reference. If you have any further questions, please feel free to reach out.

We appreciate your patience during this assessment process."



06.10.25 - Email sent by Ai Bridges Ltd to ESB Networks

We have been contacted by the wind farm developer Future energy Ireland, a company that is a joint venture between Coillte and ESB, in relation to the ESB Networks request for a radio link exclusion zone through the Ballyfasy wind Farm. The

In order to assist the developer with their planning application we have been requested to engage directly with ESB Networks .

As previously discussed with you in relation to previous project development project, we observe all telecoms operators links as exclusion zones to be avoided by the developer as part of the constraints mapping. The developer then considers where possible viable areas outside of the identified exclusion zone areas i.e. exclusion areas should be avoided where possible and mitigation measure proposals presented to telecoms operators to avoid impacts to radio links and networks

It is critical that all telecoms operators provide their link details in the tabular format below so that their links can be considered and protected as part of the telecoms constraints mapping carried out by Ai Bridges.

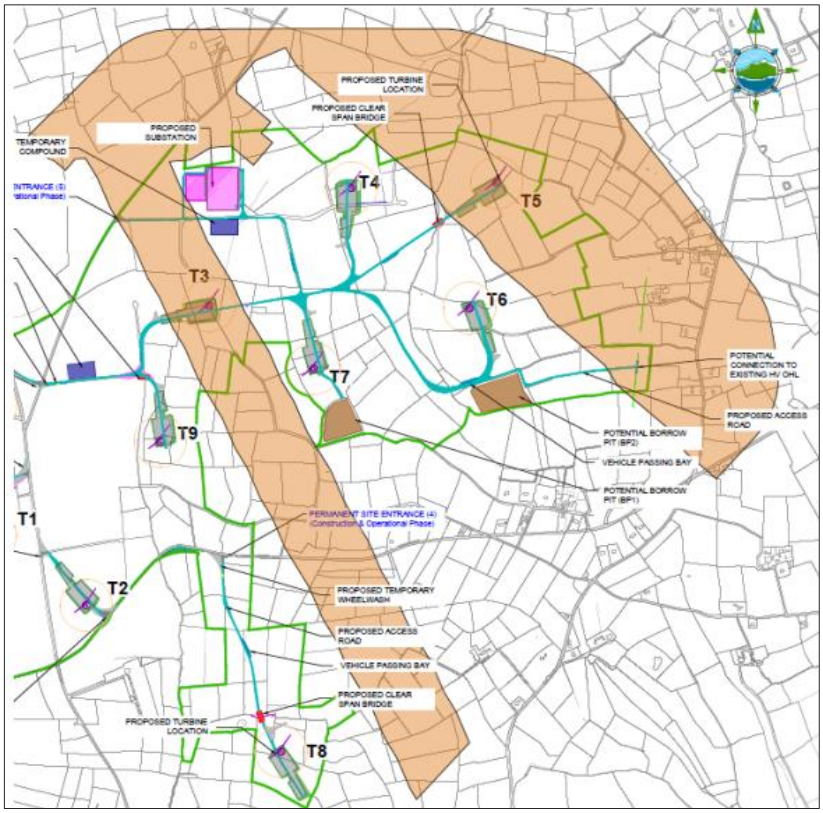
If possible, we would request that the details of link in question traversing the proposed Ballyfasy Wind Farm development be populated in the table provided below i.e. GPS co-ordinates, radio frequency, Ante height etc.

Please note that all telecoms operators, including statutory consultees provide all details of there radio links and networks to facilitate the inclusion of all links for assessment as part of the EIA planning process i.e. this is essential so that all of the links can be screened and proofed.

We will then look to generate exclusion zones and set back distances for these ESB links to ensure that all potential impacts are investigated and where applicable mitigation measure I would be grateful if you could expedite this information request, thank you for your assistance and your co-operation in this matter.

I am available to discuss with you if you have any queries,

Link Name / ID	Band MHz/GHz	Link Length	Site A					Site B				
			Lat	Long	Easting	Northing	Ant Height	Lat	Long	Easting	Northing	Ant Height



09.10.25 - Email sent by Ai Bridges Ltd to ESB Networks

I am following up from our call earlier this week in relation to the Ballyfasy Wind Farm

As discussed, can you confirm that will be able to expedite the radio links that have been identified that may be potentially impacted so that our engineers can create an exclusion zone around these links

As discussed, we are requesting the basic information of the radio links, as identified in the table 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

Thank you for your co-operation and assistance.

28.08.25 - Email from ESB Networks to Ai Bridges Ltd

"Please find the relevant parameters for the affected ESB Networks services in the vicinity of the proposed development.

Link Name / ID	Band MHz\GHz	Link Length	Site A			Site B		
			Lat	Long	Ant Height	Lat	Long	Ant Height
ESB026 Glenpipe – Cheek point	1513MHz	17890m	52.4082343	-7.1216007	17m	52.2652537	-7.004622	4.1m
JESBBE00 Glenpipe RS -JESBBE01 Bealistown 38KV	463MHz	23000m	52.4082343	-7.1216007	30m	52.271835	-6.867220	10m
JESBBE00 Glenpipe RS - JESBBE09 Ballycullane Solar 10KV	463MHz	24200m	52.4082343	-7.1216007	30m	52.2691265	-6.84772592	6m

An exclusion zone has also been created which has already been sent. The turbine base must be outside this exclusion zone to avoid potential interference with our link.

We would like to emphasize that this exclusion zone must be adhered to in full. If for any reason the proposed wind farm layout cannot comply with the exclusion zone, we request that you notify ESB Networks immediately. Any deviation from the exclusion zone without prior agreement may result in a formal objection to the development. Please find attached a summary report of the Exclusion zone calculation.

Please also note that while we are providing this information in the interest of cooperation, it is shared on the understanding that it will be used solely for the purposes of this assessment and not published or distributed further without our written consent.

Section 4 - Field Surveys

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-Site A to Mast-Site D) 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.

Section 5 - Desktop Survey Analysis

5. Introduction

Based on the findings of the consultation process, there is one Telecom Operator with a network in the vicinity of the proposed development that requires a detailed technical analysis:

- ESB Networks

Section 5.1 below outlines the desktop survey analysis findings* for the Telecom Operator Networks listed above.

As stated in Section 1.1 the dimensions of the proposed turbines at Ballyfasy are yet to be finalized and a range of dimensions are being considered. In the analysis below, the proposed turbines at Ballyfasy have been modelled based on two turbine dimension options, as shown below.

These turbine options have been chosen to represent the lower-end (smallest hub-height) and higher-end (highest hub-height) of the turbine range that is being considered. This ensures that all possible options for turbine dimensions have been considered.

Turbine Option	Turbine Dimensions		
	Hub Height	Rotor Diameter	Tip Height
Option 1	95 m	163 m	176.5 m
Option 2	105.5 m	149 m	180 m

Table 3. Turbine Dimensions (Option 1 and Option 2)

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

5.1 ESB Networks Analysis

The ESB network in the vicinity of the proposed wind farm consists of one Point-to-Point (PTP) microwave radio link and two PTP UHF radio links. The radio links are listed below in Table 3 and a Plan View of the ESB network is shown in Figure 5.

Link ID	Link Description
ESB_L1	PTP microwave radio link (1.5 GHz) from to Glenpipe to Cheek Point.
ESB_L2	PTP UHF radio link (463 MHz) from to Glenpipe to Bealistown 38KV.
ESB_L3	PTP UHF radio link (463 MHz) from to Glenpipe to Ballycullane Solar 10KV.

Table 4. ESB Radio Links requiring Analysis

Figure 5. ESB Radio Network – Plan View

Figure 6 below shows a close-up Plan View of the ESB radio links relatives to the proposed wind turbines. The plan view indicates that Turbine T03 is likely to obstruct the radio path of the ESB radio link between Glenpipe and Cheek Point. However, it should be noted that the radio path of this link is already obstructed by one of the existing wind turbines at the adjacent Ballymartin wind farm.

The plan view also indicates that Turbine T05 is relatively near to ESB's UHF radio link between Glenpipe and Bealistown 38KV.

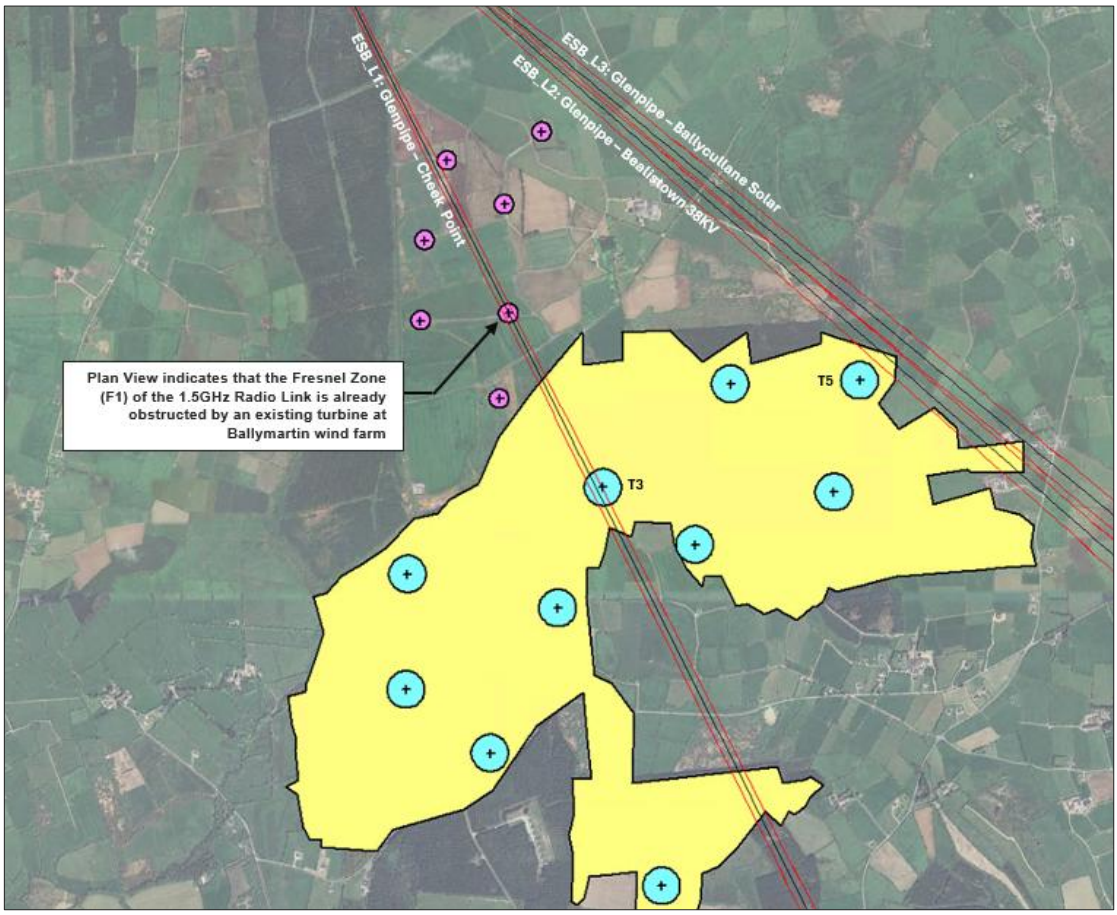


Figure 6. ESB Network – Close-up Plan View.

To further assess the potential impact of the proposed turbines, the radio links have been modelled in 3D and the Clearance Distances between the Fresnel Zone(s) of the links and the blade-tip of the nearest turbines have been calculated. To account for the range of turbine dimensions that are being considered by the developer, the turbines have been modelled based on Option 1 and Option 2 as previously specified.

5.1.1 Radio Link Analysis - ESB_L1 (Glenpipe to Cheek Point)

A 3D view of ESB_L1 link is shown below in Figure 7 (Turbine Option 1) and Figure 8 (Turbine Option 2) . The 3D analysis results shows that the link is already obstructed by one of the existing operational wind turbines at Ballymartin wind farm, which was constructed in 2011. It can also be seen that one of the proposed turbines at Ballyfasey (T03) would also partially obstruct the Fresnel Zone (F1) of this radio link.

Both turbine options modelled would partially obstruct the radio link; however, Turbine Option 2 has less of an impact on the radio link, as this option has a higher hub-height, but smaller rotor diameter, which allows a larger proportion of the radio link to pass underneath the turbine blades.

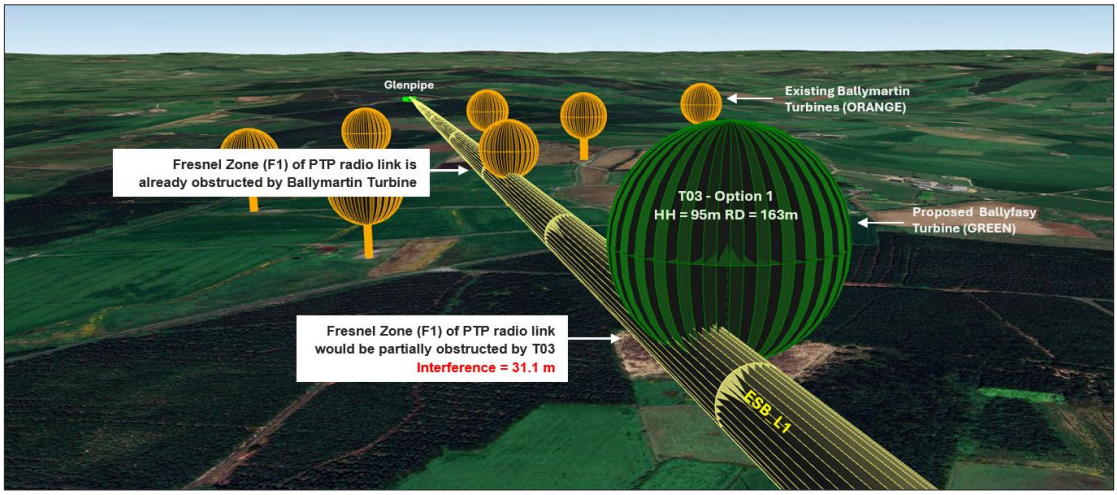


Figure 7. 3D View – ESB_L1 (Turbine Option 1)

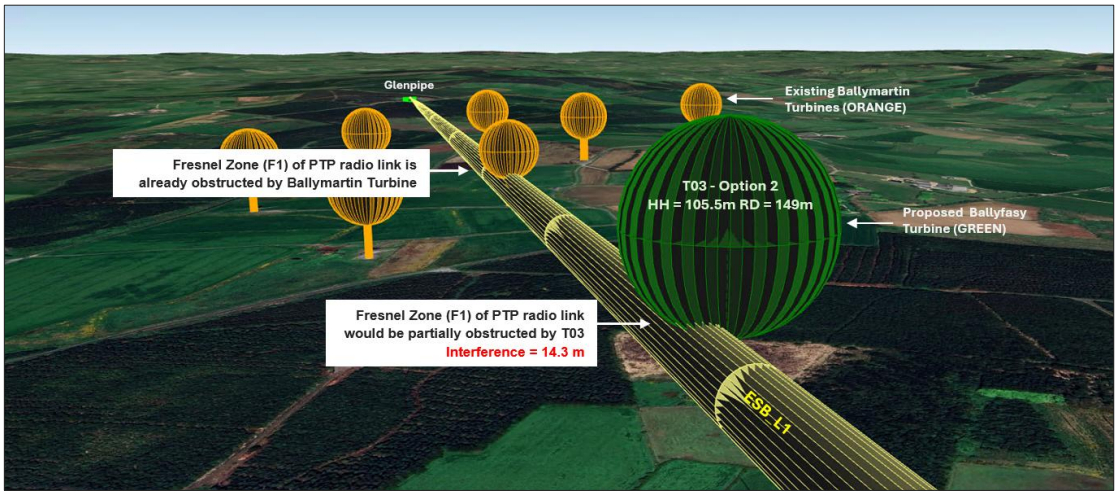


Figure 8. 3D View – ESB_L1 (Turbine Option 2)

Link ID	Link Description	Nearest Turbine	Fresnel Zone Clearance	
ESB_L1	Glenpipe - Cheek Point. (Microwave)	T03	Option 1 (HH = 95 m RD = 163 m)	- 31.1 m (Infringement into Fresnel Zone)
			Option 2 (HH = 105.5 m RD = 149 m)	- 14.3 m (Infringement into Fresnel Zone)

Table 5. Fresnel Zone Clearance Results - ESB_L1

5.1.2 Radio Link Analysis - ESB_L2 (Glenpipe to Bealistown 38KV)

A 3D view of ESB_L2 link is shown below in Figure 9 (Turbine Option 1) and Figure 10 (Turbine Option 2). The 3D analysis results indicate that the nearest turbine (T05) would not obstruct the Fresnel Zone of the UHF radio link.

The results indicate that the Clearance Distance between the blade-tip of T05 and the Fresnel Zone (0.6F1) of ESB_L2 would be over 40m. This distance is sufficiently far that there will be no impact on the operation of the radio link.

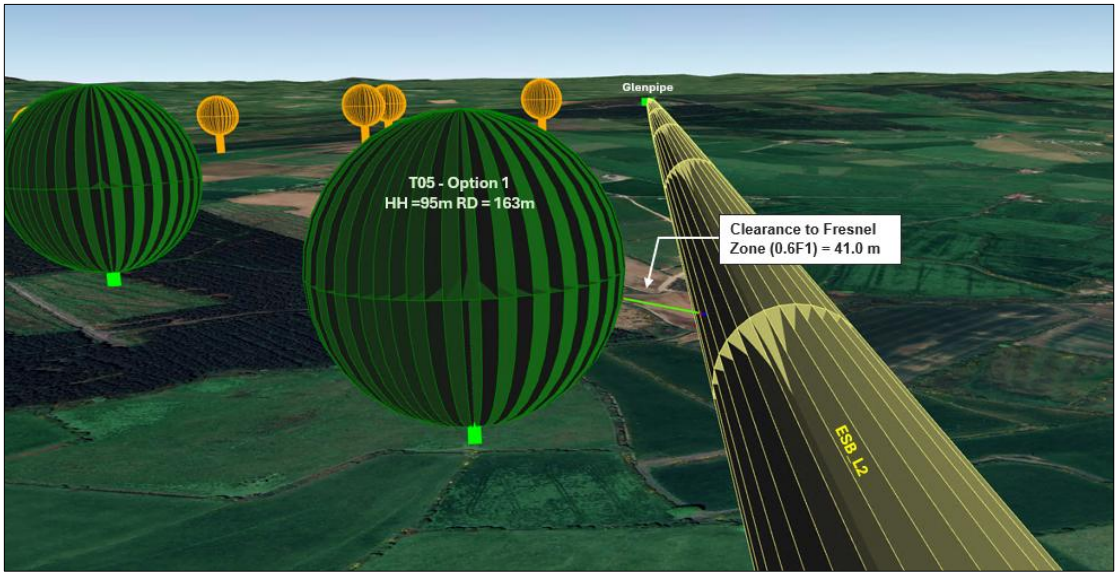


Figure 9. 3D View – ESB_L2 (Turbine Option 1)

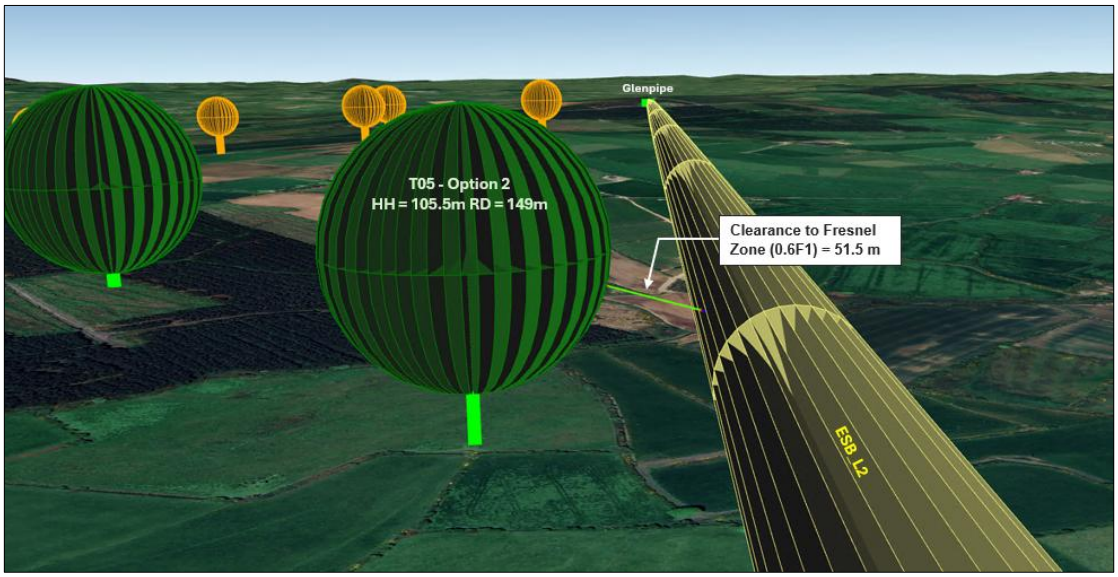


Figure 10. 3D View – ESB_L2 (Turbine Option 2)

Link ID	Link Description	Nearest Turbine	Fresnel Zone Clearance	
ESB_L2	Glenpipe - Bealistown 38KV (UHF)	T05	Option 1 (HH = 95 m RD = 163 m)	41.0 m (No impacts.)
			Option 2 (HH = 105.5 m RD = 14 9m)	51.5 m (No impacts.)

Table 6. Radio Link Analysis Summary - ESB_L2

It should also be noted that UHF links are inherently robust against interference due to obstructions. This is illustrated by observing that the existing UHF links are operating without issues, even though their respective Fresnel Zones of are significantly obstructed by terrain, as shown in Figure 11.

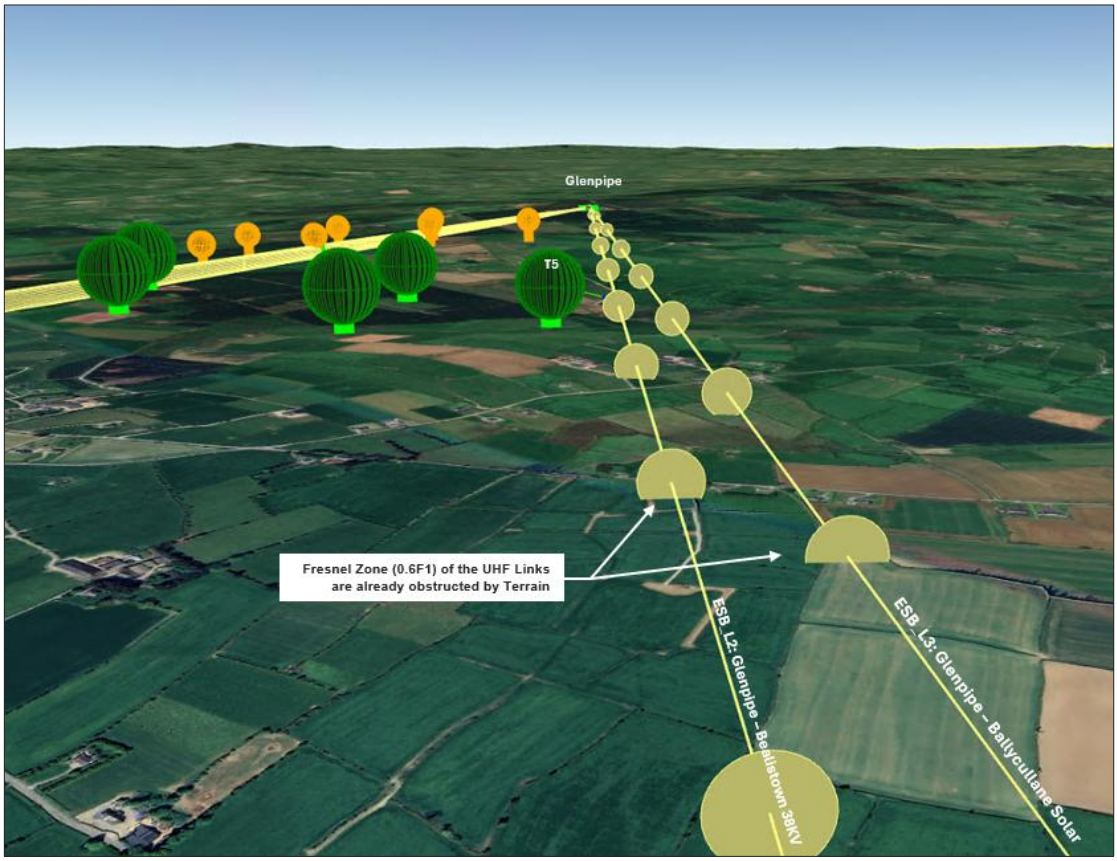


Figure 11. 3D View showing that the Fresnel Zones of the UHF links are significantly obstructed by terrain.

5.1.3 Radio Link Analysis - ESB_L3 (Glenpipe to Ballycullane Solar 10KV)

A 3D view of ESB_L3 link is shown below in Figure 12 (Turbine Option 1) and Figure 13 (Turbine Option 2). The 3D analysis results indicate that the nearest turbine (T05) would not obstruct the Fresnel Zone of the UHF radio link.

The results indicate that the Clearance Distance between the blade-tip of T05 and the Fresnel Zone (0.6F1) of ESB_L2 would be over 100m. This distance is sufficiently far that there will be no impact on the operation of the radio link.

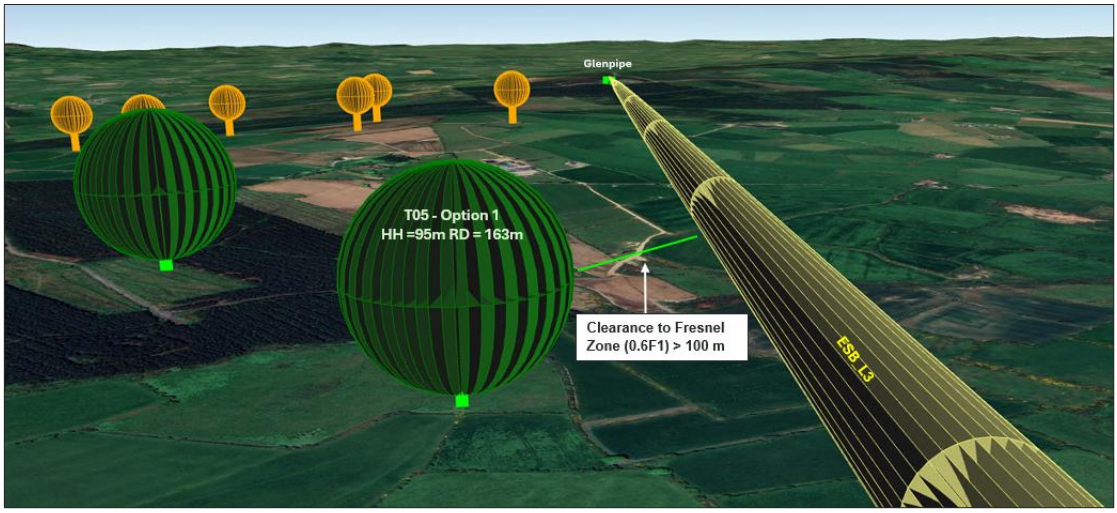


Figure 12. 3D View – ESB_L3 (Turbine Option 1)

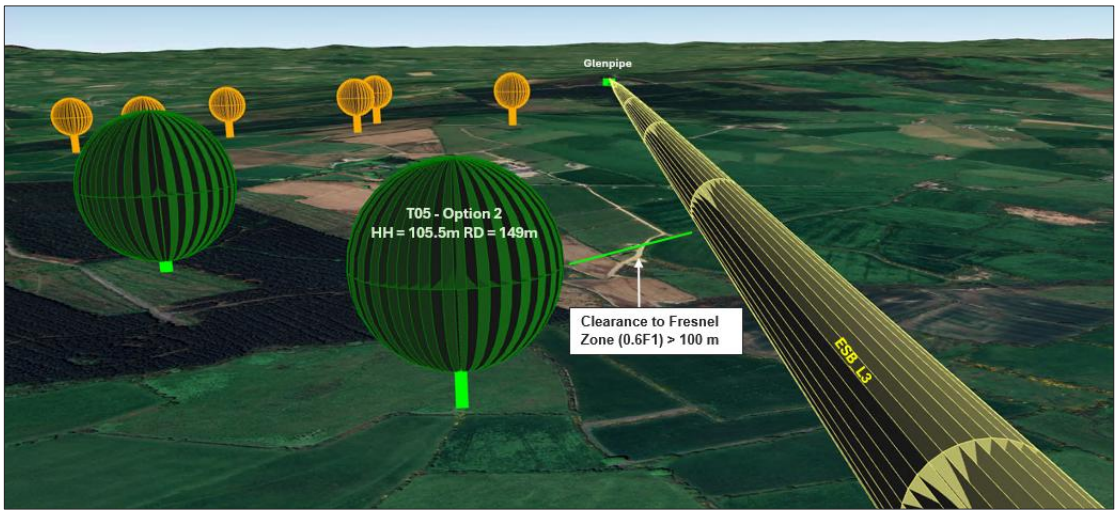


Figure 13. 3D View – ESB_L3 (Turbine Option 2)

Link ID	Description	Nearest Turbine	Fresnel Zone Clearance	
ESB_L2	Glenpipe - Bealistown 38KV (UHF)	T05	Option 1 (HH = 95 m RD = 163 m)	> 100 m (No impacts.)
			Option 2 (HH = 105.5 m RD = 149 m)	> 100 m (No impacts.)

Table 7. Radio Link Analysis Summary - ESB_L3

5.2 ESB Network Analysis Summary

Figure 14 below shows the radio link Exclusion Zone which was requested by ESB Networks. From the network analysis findings above, the ESB-defined Exclusion Zone is deemed to be excessive. Neither of the UHF radio links would be impacted by the proposed turbines; however, mitigation measures should be considered for the potential impact of T03 on the microwave radio link between Glenpipe and Cheek Point.

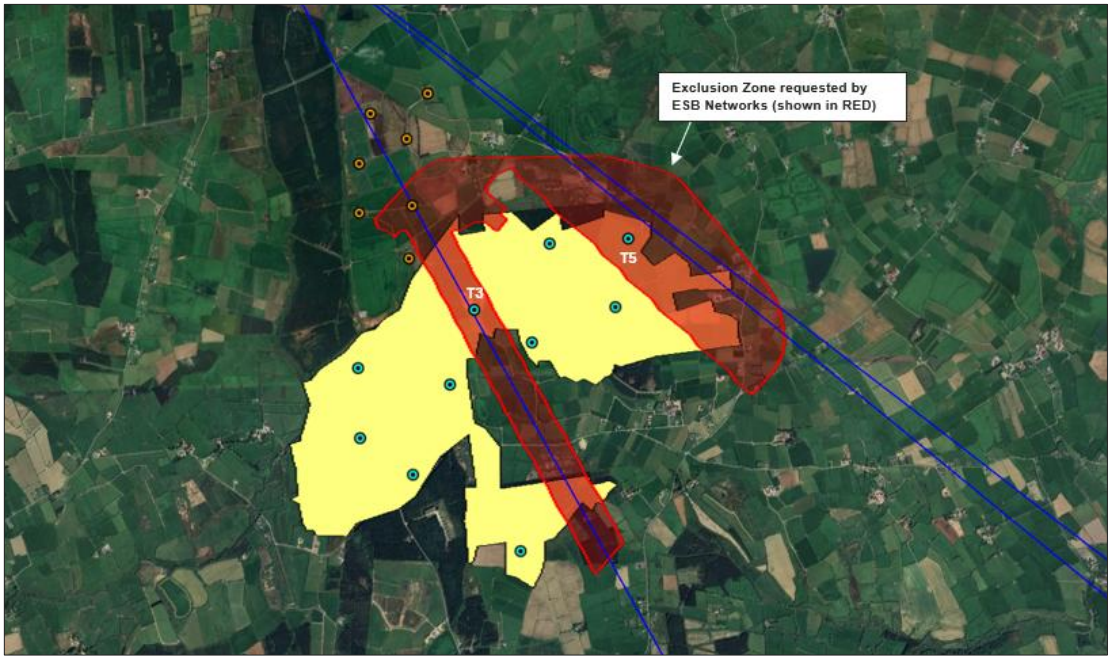


Figure 14. ESB-defined Exclusion Zone (Deemed to be excessive based on Network Analysis findings).

Table 8 below provides a brief summary of the interference analysis for the ESB radio network.

Link ID	Link Description	Nearest Turbine	Fresnel Zone Clearance		Observations
ESB_L1	Glenpipe - Cheek Point. (Microwave)	T03	Option 1	-31.1 m (Infringement into Fresnel Zone)	The 3D analysis results shows that the link is already obstructed by one of the existing operational wind turbines at Ballymartin wind farm, One of the proposed wind turbines at Ballyfasy (T03) would also partially obstruct the Fresnel Zone (F1) of this radio link. Mitigation measures should be considered for the potential impact of T03 on this radio link.
			Option 2	-14.3 m (Infringement into Fresnel Zone)	
ESB_L2	Glenpipe - Bealistown 38KV (UHF)	T05	Option 1	41.0 m (Clearance)	No impacts.
			Option 2	50.5 m (Clearance)	
ESB_L3	Glenpipe - Ballycullane Solar 10KV (UHF)	T05	Option 1	> 100 m (Clearance)	No impacts.
			Option 2	> 100 m (Clearance)	

Table 8. ESB Network – Analysis Summary

Section 6 - Mitigation Measures

6. Mitigation Measures

The proposed turbines are unlikely to have any significant impact beyond the existing effects of terrain and the existing turbines at Ballymartin wind farm. However, to account for any impacts that may occur during the operational phase of the proposed wind farm, the mitigation measure solution described below in Section 6.1 is available to the developer. The Applicant would agree to cover the costs associated with the implementable and viable mitigation measure as outlined below.

6.1 Re-route the radio link via an existing ESB Telecoms Mast

An option to mitigate any impact on the radio link between Glenpipe and Cheek Point would be to use an existing ESB telecoms mast to re-route the radio link. Figure 15 below illustrates how the existing telecoms mast at Glencoum could be used to re-route a radio link between Glenpipe and Cheek Point.

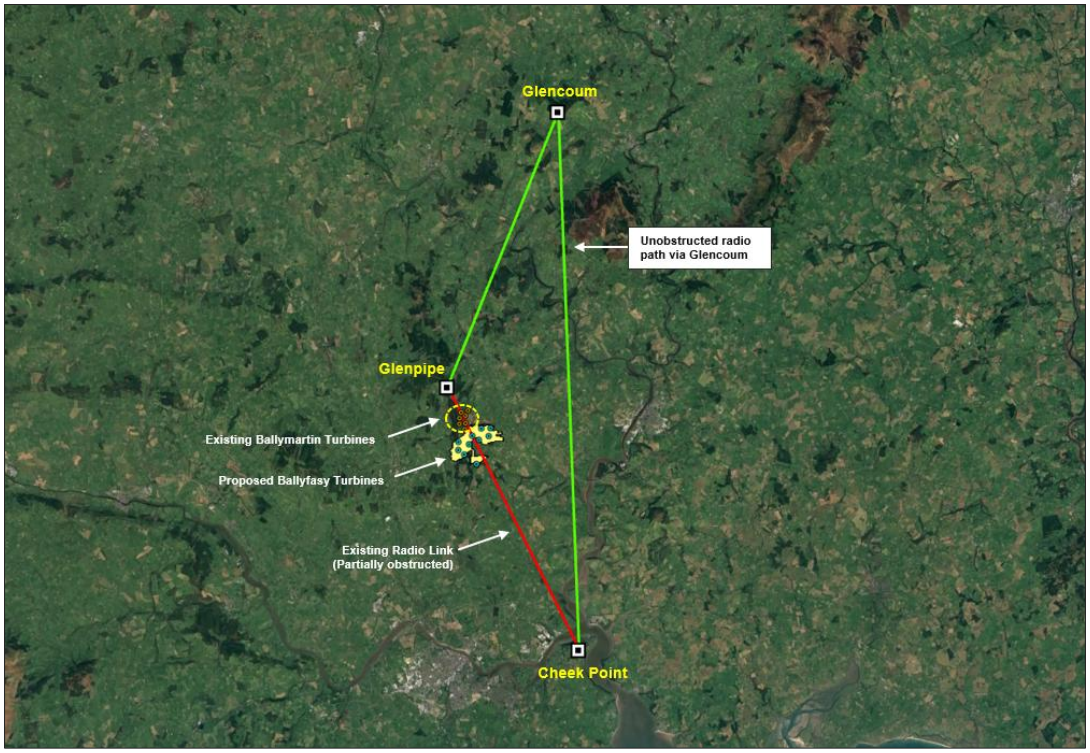


Figure 15. Example of how an existing ESB telecoms mast could be used to relay the radio link between Glenpipe and Cheek Point.

To determine if the telecoms mast at Glencoum could be used to facilitate viable connection between Glenpipe and Cheek Point, radio link Path Profiles have been generated.

Radio Link Budgets were also carried out to determine if the proposed radio links would meet the Radio Link Availability Criteria required by ComReg for radio licensing. 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 6.1.1 and Section 6.1.2. The Radio Link Budgets can be found in Appendix C (Sections C.1 and C.2).

6.1.1 Path Profile – Glenpipe to Glencoum

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 C.1.

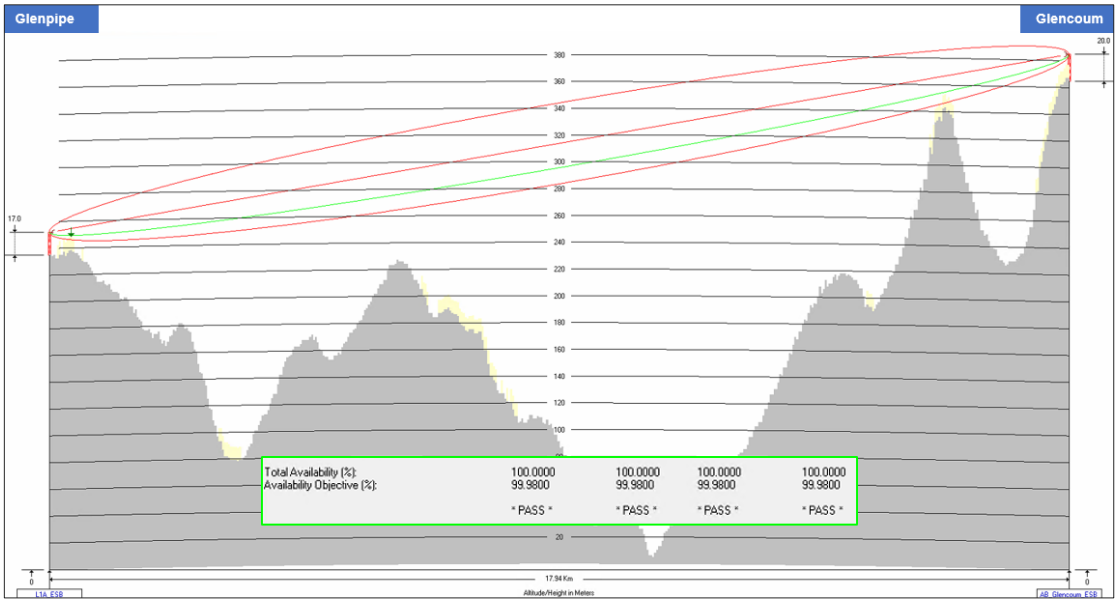


Figure 16. Path Profile - Glenpipe to Glencoum

6.1.2 Path Profile – Glencoum to Cheek Point

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 C.2.

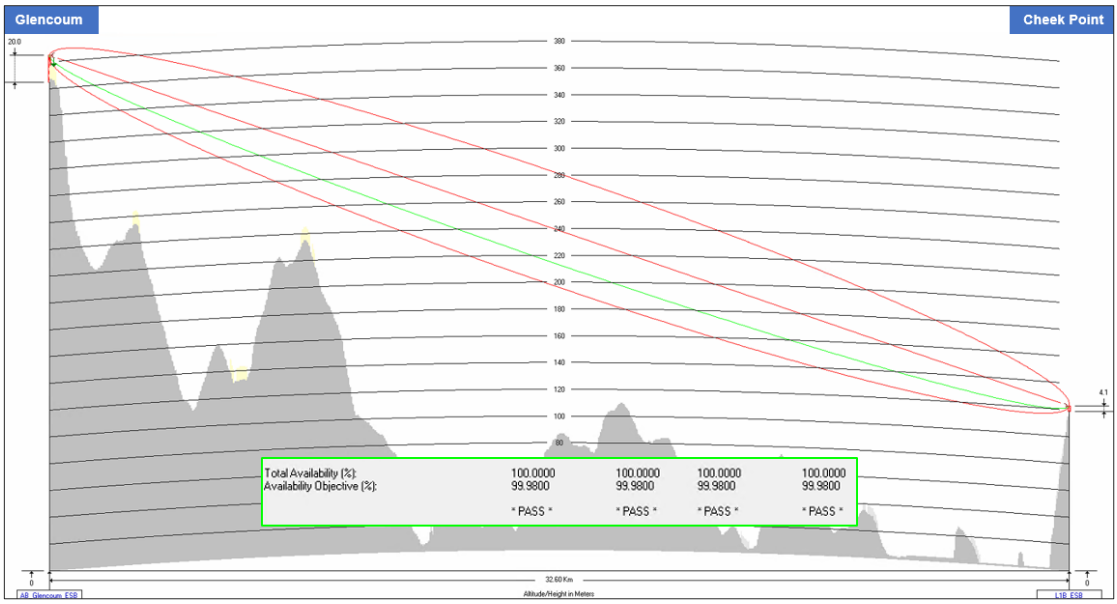


Figure 17. Path Profile - Glencoum to Cheek Point

Section 7 - Recommendations

7. Recommendations

To offset any potential impact due to the proposed wind turbines, and to allay any concerns that ESB Networks may have in relation to potential interference due to the proposed development, 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 would agree to cover the costs associated with the implementable and viable mitigation measure as outlined below.

Radio Link	Recommended Mitigation Measure
Glenpipe to Cheek Point	A Transmission Link Re-route via an existing ESB Telecoms Mast. (i.e. re-routing of the existing ESB radio link via another existing telecoms mast structure, Glencoum Co. Kilkenny, within the ESB National Network.)

Table 9. Recommended Mitigation Measure (Post Planning Consent)

Section 8 - Conclusions

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 three ESB radio links that cross over/near the proposed wind farm site (Ref. Table 6 below).
- Network Analysis (2D and 3D) shows that the Fresnel Zone (F1) of the PTP microwave link between Glenpipe and Cheek Point (ESB_L1) is already obstructed by one of the existing operational wind turbines at Ballymartin wind farm. One of the proposed Ballyfasy turbines (T03) would also partially obstruct this radio link.
- In the case where the proposed wind farm is consented, and mitigation is deemed necessary for the link between Glenpipe and Cheek Point, it is recommended that the mitigation measure strategy as set out in Section 7 of this report, should be agreed as per a protocol agreement. The Applicant would agree to cover the costs associated with the implementable and viable mitigation measure as outlined below.
- Network Analysis (2D and 3D) indicates that the UHF radio links (ESB_L2 and ESB_L3) would not be impacted by the proposed wind turbines and no mitigation measures would be required for either of these UHF radio links.

Link ID	Link Description	Observations	Mitigation Measures (Post-Consent)
ESB_L1	PTP microwave radio link between Glenpipe and Cheek Point	The 3D analysis results shows that the link is already obstructed by one of the existing operational wind turbines at Ballymartin wind farm, The proposed wind turbine T03 would also partially obstruct the Fresnel Zone (F1) of this link.	Re-route the radio link via an existing ESB Telecoms Mast (e.g. Glencoum).
ESB_L2	PTP UHF radio link between Glenpipe and Bealistown 38KV	No impacts. (Clearance > 30m)	N.A.
ESB_L3	PTP UHF radio link between Glenpipe and Ballycullane Solar 10KV	No impacts. (Clearance > 100m)	N.A.

Table 10. ESB radio links in vicinity of proposed development

- Figure 18 below has been provided to illustrate each of the ESB radio links in the vicinity of the proposed development.

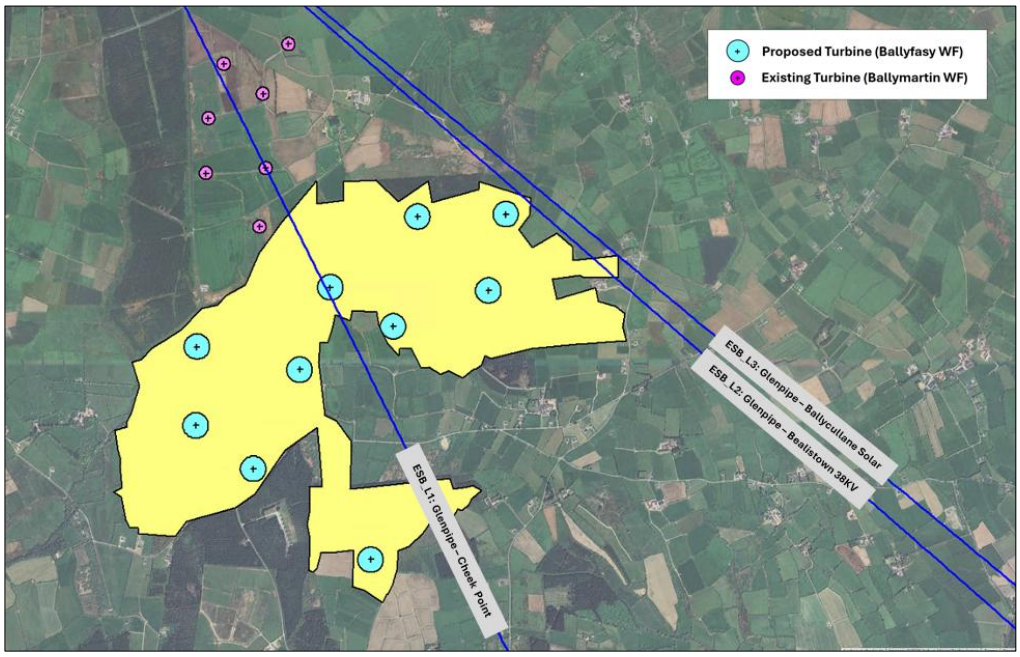


Figure 18. ESB Radio links in the vicinity of the proposed development site.

APPENDIX A – Wind Farm Turbine Coordinates

Appendix A – Wind Farm Turbine Co-ordinates

The turbine layout considered in this Telecommunications Impact Study is provided below.

Turbine ID	Co-ordinates (ITM)	
	Latitude	Longitude
T01	660473.2	625075.7
T02	660841.2	624806.8
T03	661312.3	625957.2
T04	661856.9	626410.1
T05	662414.2	626430.7
T06	662309.1	625948.5
T07	661712.5	625715.4
T08	661587.6	624244.8
T09	661124.4	625435.9
T10	660474.3	625571.0

Table 11. Wind Farm Layout - Turbine Co-ordinates

APPENDIX B – Field Survey Findings

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 19 below.

Figure 19. Telecom Mast-Sites shown relative to proposed wind farm.

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

Mast-Site A (Glenpipe)

Telecommunications Mast-Site A is located in the townland of Glenpipe and is approximately 3 km northwest of the proposed wind farm. A photo of the mast-structure at this location is shown below. The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 12.

Figure 20. Mast-site A

Mast ID	Telecom Operators with radio links in direction of proposed wind farm
Mast A	ESB

Table 12. Field Survey Summary – Mast-Site A

Mast-Site B (Cheek Point)

Telecommunications Mast-Site B is located on Minaun Hill, Cheek Point, Co Waterford and is approximately 13 km southeast of the proposed wind farm. A photo of the mast-structure at this location is shown in the figure below. The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 13.

Figure 21. Mast B

Mast ID	Telecom Operators with radio links in direction of proposed wind farm
Mast B	ESB

Table 13. Field Survey Summary – Mast-Site B

Mast-Site C (Bealistown 38kV)

Telecommunications Mast-Site C is located at Bealistown 38kV Substation, in the townland of Ballygowny, Co Wexford, and is approximately 18 km southeast of the proposed wind farm. A photo of the mast-structure at this location is shown below. The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 14.

Figure 22. Mast-site C

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast C	ESB

Table 14. Field Survey Summary – Mast C

Mast-Site D (Ballycullane Solar 10kV)

Telecommunications Mast-Site D is located at Ballycullane Solar Substation, in the townland of Coolroe, Co Wexford, and is approximately 20 km southeast of the proposed wind farm. A photo of the mast-structure at this location is shown below. The Telecom Operators who have radio links operating from this mast in the direction of the wind farm are listed in Table 15.

Figure 23. Mast-site D

Mast ID	Telecom operators with radio links in direction of proposed wind farm
Mast D	ESB

Table 15. Field Survey Summary – Mast D

APPENDIX C – Radio Link Budget Reports

Appendix C – Radio Link Budget Reports

C.1 Radio Link Budget Report (Glenpipe – Glencoum)

Link Budget Report

Site Name:	L1A_ESB (Glenpipe)		AB_Glencoum_ESB (Glencoum)	
Type:	Cell	Cell		
Latitude:	52°24'29.6"N		52°33'27.4"N	
Longitude:	7°07'17.7"W		7°01'23.0"W	
Altitude (m):	235.0		365.0	
UserData1:	User Data			
Datum:	World Geodetic System 1984 (WGS 84)			
	Forward Link		Reverse Link	
Transmission Site:	L1A_ESB		AB_Glencoum_ESB	
Reception Site:	AB_Glencoum_ESB		L1A_ESB	
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):	1513		1513	
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:	G6-1.3-NSMA		G6-1.3-NSMA	
Transmission Antenna Size (m):	1.8		1.8	
Transmission Antenna Height (m):	17		20	
Transmission Antenna Gain (dBd):	23.46		23.46	
Transmission Antenna Gain (dBi):	25.6		25.6	
Transmission Power EIRP (dBm):	54.6		54.6	
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:	G6-1.3-NSMA		G6-1.3-NSMA	
Reception Antenna Size (m):	1.8		1.8	
Reception Antenna Height (m):		20		17
Reception Antenna Gain (dBd):		23.46		23.46
Reception Antenna Gain (dBi):		25.6		25.6
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	17935.729		17935.729	
Azimuth - True (°):	21.846	201.924		
Azimuth - Magnetic (°):	23.262		203.325	
Transmission Inclination (°):	-0.425		0.425	
Reception Inclination (°):	-0.425		0.425	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	17936.22		17936.22	
Center Frequency (MHz):	1513		1513	
Free Space Loss (dB):	121.111		121.111	
Max Fresnel Radius (m):	29.817		29.817	
Max 2nd Fresnel Radius (m):	42.168		42.168	
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):	1.272		1.272	
Minimum Clearance Point (m):		383.385		383.385
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	1183.491		1183.491	
Reflection Area 2 (m):	1683.558		1683.558	
Reflection Area 3 (m):	1816.909		1816.909	
Reflection Area 4 (m):	1983.598		1983.598	
Reflection Area 5 (m):	2050.274		2050.274	
Reflection Area 6 (m):	3117.083		3117.083	
Reflection Area 7 (m):	3283.772		3283.772	
Reflection Area 8 (m):	4350.581		4350.581	
Reflection Area 9 (m):	4483.9 - 4517.3			4483.9 - 4517.3
Reflection Area 10 (m):	4950.661		4950.661	
Reflection Area 11 (m):	6017.47		6017.47	
Reflection Area 12 (m):	6784.24		6784.24	
Reflection Area 13 (m):	9884.653		9884.653	
Reflection Area 14 (m):	9984.666		9984.666	
Reflection Area 15 (m):	11451.5 - 11518.2			11451.5 - 11518.2
Reflection Area 16 (m):	11618.218			11618.218
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):		0.115		0.115
Total Path Loss (dB):	121.226		121.226	
Reception Signal Level (dBm):		-42.026		-42.026

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	48.974	47.974	48.974	47.974

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

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 (%): 1.66E-02 1.66E-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): 0.000933 0.000933
Rainfall Attenuation (dB): 0.042 0.042

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%):	2.35E-08	2.96E-08	2.35E-08	2.96E-08
Selective Fading Outage (%):	1.19E-09	1.19E-09	1.19E-09	1.19E-09
Composite Fading Outage (%):		2.47E-08	3.08E-08	2.47E-08	3.08E-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 (%):		2.47E-08	3.08E-08	2.47E-08	3.08E-08
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Unavailability (%):	2.47E-08	3.08E-08	2.47E-08	3.08E-08
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02

Unavailability due to Fading (s/Year):	0.008	0.01	0.008	0.01
Unavailability due to Rain (s/Year):	0	0	0	0
Total Unavailability (s/Year):	0.008	0.01	0.008	0.01
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 *

C.2 Radio Link Budget Report (Glencoum – Cheek Point)

Link Budget Report

Site Name:	AB_Glencoum_ESB (Glencoum)		L1B_ESB (Cheek Point)	
Type:	Cell	Cell		
Latitude:	52°33'27.4"N	52°15'54.9"N		
Longitude:	7°01'23.0"W	7°00'16.6"W		
Altitude (m):	365.0	119.0		
UserData1:	User Data			
Datum:	World Geodetic System 1984 (WGS 84)			
	Forward Link	Reverse Link		
Transmission Site:	AB_Glencoum_ESB		L1B_ESB	
Reception Site:	L1B_ESB	AB_Glencoum_ESB		
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):	1513		1513	
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:	G6-1.3-NSMA		G6-1.3-NSMA	
Transmission Antenna Size (m):	1.8		1.8	
Transmission Antenna Height (m):	20		4.1	
Transmission Antenna Gain (dBd):	23.46		23.46	
Transmission Antenna Gain (dBi):	25.6		25.6	
Transmission Power EIRP (dBm):	54.6		54.6	
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:	G6-1.3-NSMA		G6-1.3-NSMA	
Reception Antenna Size (m):	1.8		1.8	
Reception Antenna Height (m):	4.1		20	
Reception Antenna Gain (dBd):	23.46		23.46	

Reception Antenna Gain (dBi):		25.6		25.6
Link Polarization:	Vertical	Vertical		
Cross Polarization Factor (dB):		30		30
Link Distance (m):	32597.283		32597.283	
Azimuth - True (°):	177.788	357.803		
Azimuth - Magnetic (°):	179.189		359.154	
Transmission Inclination (°):	0.46		-0.46	
Reception Inclination (°):	0.46		-0.46	
ITU Recommendation:	ITU-R P.525-2			
Free Space Distance (m):	32598.336			32598.336
Center Frequency (MHz):	1513		1513	
Free Space Loss (dB):	126.301		126.301	
Max Fresnel Radius (m):	40.198		40.198	
Max 2nd Fresnel Radius (m):	56.848		56.848	
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):	4.465		4.465	
Minimum Clearance Point (m):		139.437		139.437
Terrain Reflection Dispersion (°):		0.5		
Reflection Area 1 (m):	263.381		263.381	
Reflection Area 2 (m):	1223.947		1223.947	
Reflection Area 3 (m):	4291.6 - 4322.5			4291.6 - 4322.5
Reflection Area 4 (m):	4446.5 - 4508.5			4446.5 - 4508.5
Reflection Area 5 (m):	4570.437		4570.437	
Reflection Area 6 (m):	6243.681		6243.681	
Reflection Area 7 (m):	7359.178		7359.178	
Reflection Area 8 (m):	9869.045		9869.045	
Reflection Area 9 (m):	9931 - 10024.0			9931 - 10024.0
Reflection Area 10 (m):	10085.9 - 10147.9			10085.9 - 10147.9
Reflection Area 11 (m):	10271.862			10271.862
Reflection Area 12 (m):	10364.8 - 10426.8			10364.8 - 10426.8
Reflection Area 13 (m):	10488.8 - 10550.7			10488.8 - 10550.7
Reflection Area 14 (m):	10643.694			10643.694
Reflection Area 15 (m):	10984.541			10984.541
Reflection Area 16 (m):	11046.513			11046.513
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):		0.209		0.209
Total Path Loss (dB):	126.51		126.51	
Reception Signal Level (dBm):		-47.31		-47.31

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Service Threshold (dBm):	-91	-90	-91	-90
Link Gross Margin (dB):	43.69	42.69	43.69	42.69

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

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 (%):	1.26E-01	1.26E-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):	0.000933	0.000933
Rainfall Attenuation (dB):	-0.185	-0.185

	BER 10-3	BER 10-6	BER 10-3	BER 10-6
Fading Outage (%):	6.99E-07	8.80E-07	6.99E-07	8.80E-07
Selective Fading Outage (%):	2.57E-08	2.57E-08	2.57E-08	2.57E-08
Composite Fading Outage (%):		7.25E-07	9.06E-07	7.25E-07	9.06E-07

Fading Outage (s/Month):	0.018	0.023	0.018	0.023	
Selective Fading Outage (s/Month):		0.001	0.001	0.001	0.001
Composite Fading Outage (s/Month):		0.019	0.024	0.019	0.024

	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 (%):		7.25E-07	9.06E-07	7.25E-07	9.06E-07
Unavailability due to Rain (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Unavailability (%):	7.25E-07	9.06E-07	7.25E-07	9.06E-07
Unavailability Objective (%):	2.00E-02	2.00E-02	2.00E-02	2.00E-02

Unavailability due to Fading (s/Year):		0.229	0.286	0.229	0.286
Unavailability due to Rain (s/Year):		0	0	0	0
Total Unavailability (s/Year):	0.229	0.286	0.229	0.286
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 *