







**TELECOMMUNICATION ENGINEERING PROJECTS**

**STUDY OF RADIOELECTRIC INTERFERENCES IN THE AMHERST WIND FARM (NOVA SCOTIA, CANADA)**


		
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<i>DAVID GOÑI</i> Telecommunication Engineer Practicing license N° 14.656	<i>MIGUEL YÁBAR</i> Telecommunication Engineer Practicing license N° 14.130	<i>MIGUEL YÁBAR</i> Telecommunication Engineer Practicing license N° 14.130
<u>WRITTEN</u>	<u>CHECKED</u>	<u>APPROVED</u>



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## 1. INTRODUCTION

The purpose of this report is to perform an extended study of the consequences that the implantation of Amherst wind farm may have in the radio communications of the area. Amherst wind farm is located in the eastern part of the Province of Nova Scotia, in Canada, near to the coast and distant 140 Km Northwest from the city of Halifax.

A wind farm can cause radioelectric interferences to the communications systems of the area if it is located in the coverage zone of any relay station (television, radio, telephony or data transmission). To check the suitability of the wind farm establishment, it is necessary to perform many television signal measurements. The measurement of the television signal was carried out with a TV PROMAX PROLINK-TV signal analyzer and a Nova antenna manufactured by Televés.

For the study it has been considered the layout of February 2008, with 20 AW77 GLII wind turbines. Any change in the established parameters will require a review of the report.

Throughout all the study except the table below, the coordinates used are UTM North zone 20 and datum NAD27 (Canada Mean). All the angular data provided in the report are represented taking into account the magnetic deviation in the zone under study (-18,929°).

<b>Turbine No.</b>	<b>UTM X</b>	<b>UTM Y</b>	<b>Hub Height (m)</b>	<b>Turbine</b>
1	402.916	5.075.278	78.8 / 100	AW 77/1500 GLII T80A / T100A
2	402.796	5.075.496	78.8 / 100	AW 77/1500 GLII T80A / T100A
3	402.677	5.075.714	78.8 / 100	AW 77/1500 GLII T80A / T100A
4	403.364	5.075.328	78.8 / 100	AW 77/1500 GLII T80A / T100A
5	403.267	5.075.520	78.8 / 100	AW 77/1500 GLII T80A / T100A
6	403.169	5.075.712	78.8 / 100	AW 77/1500 GLII T80A / T100A
7	403.071	5.075.904	78.8 / 100	AW 77/1500 GLII T80A / T100A
8	403.035	5.076.147	78.8 / 100	AW 77/1500 GLII T80A / T100A
9	402.920	5.076.348	78.8 / 100	AW 77/1500 GLII T80A / T100A
10	402.801	5.076.551	78.8 / 100	AW 77/1500 GLII T80A / T100A
11	402.699	5.076.753	78.8 / 100	AW 77/1500 GLII T80A / T100A
12	402.596	5.076.942	78.8 / 100	AW 77/1500 GLII T80A / T100A
13	403.567	5.075.774	78.8 / 100	AW 77/1500 GLII T80A / T100A
14	403.507	5.075.995	78.8 / 100	AW 77/1500 GLII T80A / T100A
15	403.448	5.076.215	78.8 / 100	AW 77/1500 GLII T80A / T100A
16	403.288	5.076.386	78.8 / 100	AW 77/1500 GLII T80A / T100A
17	403.145	5.076.572	78.8 / 100	AW 77/1500 GLII T80A / T100A
18	403.021	5.076.827	78.8 / 100	AW 77/1500 GLII T80A / T100A
19	402.460	5.077.192	78.8 / 100	AW 77/1500 GLII T80A / T100A
20	402.086	5.077.047	78.8 / 100	AW 77/1500 GLII T80A / T100A

Table 1.1 Coordinates of the wind turbines. UTM North zone 20, datum NAD83

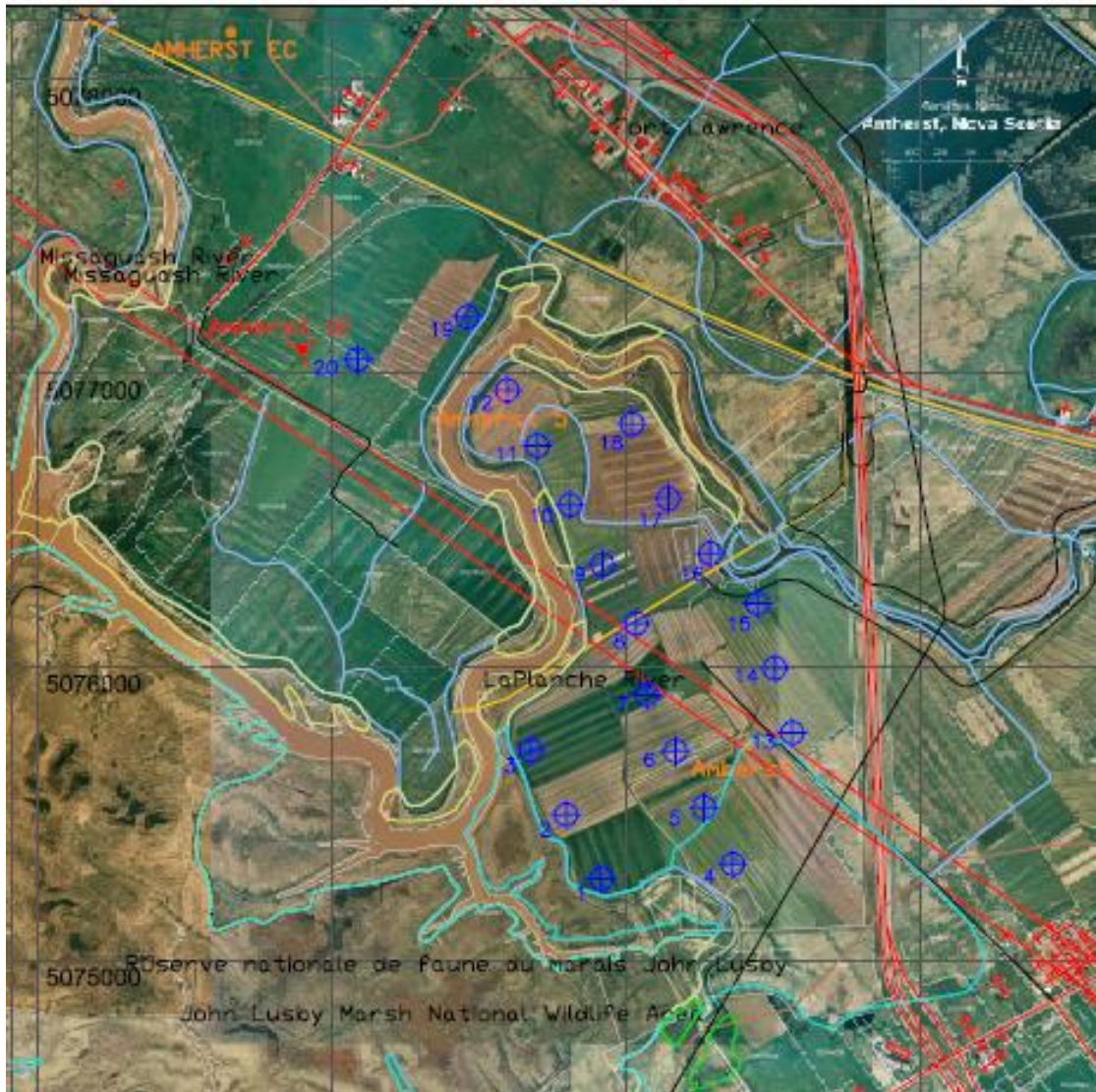



Figure 1.1 Area of study

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## 2. STUDY OF THE OPERATORS' NETWORK RELAY STATIONS

In this section the different telecommunication towers of the area are going to be analyzed, showing which point-to-point microwave radio links can be interfered with the future wind farm.

All telecommunication towers in the area were visited and analyzed to show if any point-to-point microwave radio links would be affected. Results show that none of the radio links will be interfered with by construction of the proposed wind farm.

## 3. TELEVISION AND RADIO BROADCASTING STATIONS IN THE AREA

This section deals with the different systems of broadcasting and the potential effect that the proposed Amherst wind farm may have on the reception of the broadcasted signals in the nearby villages.

For that purpose, the different broadcasting stations located in the area close to the wind farm have been visited and analyzed, in order to determine the zone to which they give coverage. Furthermore, the nearest villages to the wind farm have also been visited to check which stations they receive the television signal from and if there are any alternative relay stations in case of problems.

Taking all the data into account, potential interference problems associated with the construction of the proposed Amherst wind farm will be pointed out and, consequently, the corresponding solutions.

### 3.1. RELAY STATIONS OF THE AREA


#### 3.1.1. RCI SHORT WAVE RADIO STATION

Located approximately in the coordinates (397409, 5082688), there is a short wave radio broadcasting station of the company Radio Canada International (RCI). This company broadcasts the signal to different countries.

The center has several 70m towers wired one to each other in a net (see figure 3.2) that creates the suitable radiating pattern.

The station broadcasts in the band from 6 to 21MHz and with a tilt of 15°. After studying the problem in depth, taking into account the distance between the wind farm and



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the station and tilt of the broadcasted signal, it can be concluded that the establishment of Amherst wind farm will not interfere the RCI Sackville shortwave transmitting station.




*Figure 3.1. Image of the entrance board and of the radio station*



*Figure 3.2. Image of the transmitter antennas of the radio station*

### **3.1.2. AM RADIO TOWERS**

Near the wind farm location, in the coordinates (405817, 5077387) and (405911, 5077376), there are two AM radio transmitter towers. The towers are owned by Lite Rock 900. The stations emit under the call-sign of CKDH, with a radiated power of 1KW at a frequency of 900 KHz and using the following pattern shown in the figure 3.3.

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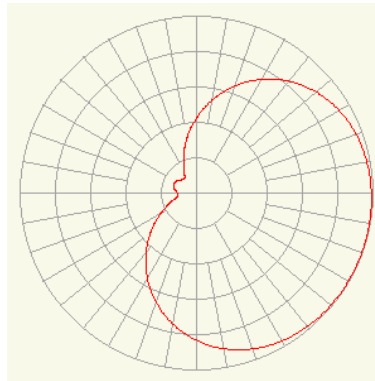


Figure 3.3. Radiating pattern of the towers under study




Figure 3.4. Image of the AM radio towers

After studying the radiating pattern, the distance from the towers to the wind farm and taking into account that behind the wind farm there are not nearby houses, it can be concluded that the emission of the radio stations is not going to be interfered by Amherst wind farm.

### 3.1.3. EASTLINK STATION

This station located in the coordinates (407857, 5075331), receives the television signal from satellite or off-air emissions and then distributes it via cable to all the zone of Amherst and the nearby villages like Sackville, Truemanville, Minudie, Nappan, Maccan and Point de Bute.

The center takes the off-air television signal from Moncton repeater by means of a highly directive yagi antenna oriented to approximately 304°. The received programs are

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the following: CBC, Global, SRC (CBC French) and CTV. The received levels in the station location are shown in the following table:

PROGRAM	RECEIVES FROM	CHANNEL	POLARIZATION	LEVEL (dB $\mu$ V)
CTV	Moncton Rpt.	2	H	71
Global TV	Moncton Rpt.	7	H	83
CBC	Moncton Rpt.	11	H	50
SRC	Moncton Rpt.	27	H	72

The off-air received television signal in the Eastlink station is not going to be affected by the establishment of Amherst wind farm. The possible reflections of the television signal emitted from Moncton repeater in the wind turbines can reach the television station. However, the level of the reflected signal will be negligible in comparison with the direct one and Eastlink station will not notice any interference.

Satellite television reception in the station will not be interfered either.

### 3.2. TELEVISION RECEPTION

In order to complete this study, we have visited all the villages around the wind farm, which could be interfered by it. In these villages, we have checked the direction of the television off-air or satellite antennas, and taken data of the channels received using a television measurer, in order to determine the television station from which they receive the signal. With all this information and after finishing the study, it will be possible to determine whether these towns will be interfered with by Amherst wind farm or not.

After visiting all the villages and isolated houses of the zone, it can be concluded that the houses of the surroundings do not receive off air television signal, instead of that, the houses take their signal via satellite or cable. Rarely the houses had off air antennas and most of them appeared to be in bad condition or out of order. Moreover, all the houses with off air antennas had cable or satellite television too.




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Figure 3.5. Image of a house with an old off an air antenna


The majority of the satellite dishes are from Star Choice or Bell companies, and the cable television, as previously said, is distributed by Eastlink.

After studying the problem in depth it can be concluded that the houses of the zone will not have problems in its received television signal after the construction of Amherst wind farm.

### 3.3. RADIO RECEPTION


Finally, the short wave and FM radio reception in the villages of the zone has been studied showing the following available radio channels:

PROGRAM / CALL SIGN	MODULATION	FREQUENCY (MHz)
SRC (Societe Radio Canada)	FM	88.5
Central Nova Information Radio	FM	90.1
K945	FM	94.5
CBC Radio Two	FM	95.5
Prince Edward Island	FM	96.1
XL96	FM	96.9
-	FM	98.3
Choix 999	FM	99.9
C103	FM	103.1
Magic 104	FM	103.9

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CBC Radio Two	FM	104.7
CHNT	AM	0.61
CFCY	AM	0.63
CHTN	AM	0.72
CKDH	AM	0.9
CBC Radio One	AM	1.07

After studying the case, it can be concluded that the houses of the zone will not have interference problems with their radio signal reception, caused by the construction of Amherst wind farm.

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## 4. RADAR STATIONS

There is a radar station located in the coordinates (360880, 5079280), at 365m of height. The station is operated by the private corporation NAV Canada, which owns and operates Canada's civil Air Navigation Service (ANS). This facility contains a PSR (primary surveillance radar) and a SSR (secondary surveillance radar) working in the 1030-1090 MHz frequency band.

The radar is approximately 42Km far away from the wind farm location and there is direct sight between the station and the wind farm (see figure 4.1, the direct vision area is shown in blue, and the wind farm in green). Despite of that, the construction of Amherst wind farm is not going to interfere with the radar signal, due to de distance and the fact of the radar is located more than 200m higher than Amherst wind farm. However, the consultation radius for PSR is set to 60km in Canada, therefore NAV Canada should be contacted to know if the radar could be affected by the wind farm.

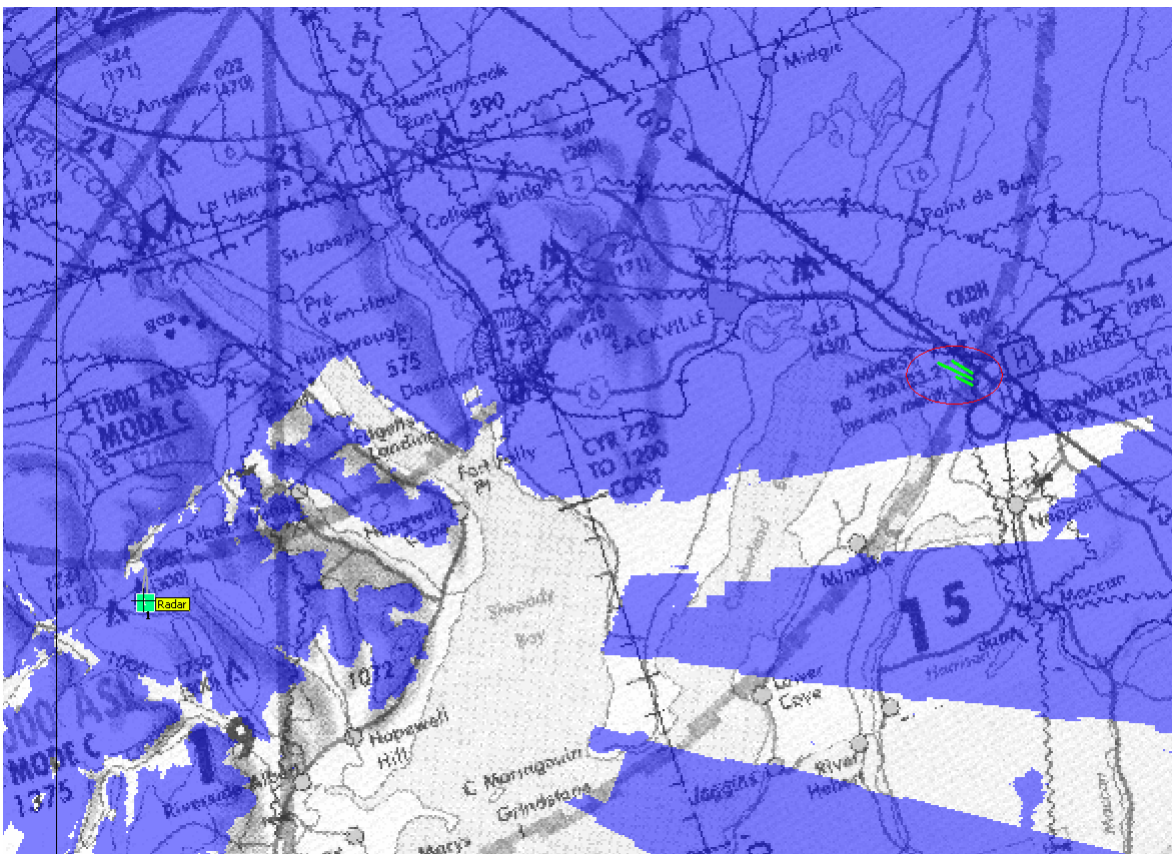




Figure 4.1. In blue sensitive area of the radar station. Study performed for a radar tower of 10m of height and a receiver antenna of 145m

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*Figure 4.2. NAV Canada radar station*

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## 5. RADIONAVIGATION AIDS

### 5.1. AMHERST AERODROME

This aerodrome is located approximately in the coordinates (403936, 5073959), beside the road but hidden from sight.

The aerodrome has no radionavigation aid devices and is only used by small sized planes in case of emergency. The planes communicate via walkie-talkie with the owner of the lanes and perform manual landing maneuvers.

The aerodrome is not going to be interfered by the construction of Amherst wind farm.


### 5.2. AMHERST HELIPORT

The heliport is located in (405139, 5073690), it has no radionavigation aids and consequently it is not going to be affected by the establishment of the wind farm in Amherst.



*Figure 5.1. Image of Amherst heliport*



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## 6. SYSTEM FOR RECORDING COMPLAINTS

### 6.1. RECORDING


In the case that a complaint is received regarding telecommunications interference, the incident will be logged in the logbook of the Site Manager. The Site Manager will then conduct due diligence to determine the nature and extent of the problem and will take detailed notes in the logbook.

### 6.2. INVESTIGATION

Once due diligence has been conducted, the appropriate internal telecommunications consultant will be contacted and a study will be initiated that includes measuring the amount of interference. Meetings will be held internally and with the complainant throughout the process. The Site Manager will record these details in the log.

### 6.3. MITIGATION

Mitigation will be conducted on a case by case basis pending results of the investigation.

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## 7. CONCLUSIONS

All the telecommunication stations and signal receivers in the area have been analysed, the following conclusions can therefore be drawn:

1.- Any radio link in the area will not be interfered with by the construction of the proposed Amherst wind farm.

2.- The reflections in the turbines of off-air television signal emitted from Moncton repeater can reach the Eastlink cable television distribution station. However, as the station has a highly directive receiver antenna, the level of the reflected signal in comparison with the direct one will be negligible and the interference will be imperceptible.

3.- Any of the houses of Amherst will not have problems with their received television signal caused by the construction of the wind farm. Any of the villages of the surroundings, like Sackville, Truemanville, Minudie, Nappan, Maccan and Point de Bute will not have problems either.

4.- Any of the houses of Amherst will not have problems with their received radio signal caused by the construction of the wind farm. Any of the villages of the surroundings, like Sackville, Truemanville, Minudie, Nappan, Maccan and Point de Bute will not have problems either.

5.- The NAV Canada radar station located in the coordinates (360880, 5079280) is not expected to have problems caused by the proposed Amherst wind farm. NAV Canada should be contacted because the radar is located within the consultation radius for PSR radars (60km).

6.- Neither the Amherst aerodrome nor the heliport will have problems after the construction Amherst wind farm; because both of them have no radionavigation aid devices.