From: nbpmapping@dccae.gov.ie
To: NBP Mapping
Subject: New Submission
Date: 17 September 2019 13:34:26

Conclusion of the Mapping Exercise

Username: AnonymousRespondent
Numeric Response ID: 114621
Response GUID: d224f4a2-22e3-42de-9b3e-813d994619e1
Survey Start Date: 17 September 2019 09:30:02
Survey Completed Date: 17 September 2019 13:34:25

Page 1

National Broadband Plan

Conclusion of the Mapping Exercise

Submissions: nbpmapping@dccae.gov.ie

The Department of Communications Climate Action and Environment is running a consultation on the National Broadband Plan Map.

We would like to hear from you if you have a problem accessing a high speed broadband service for your home or business.

Issues may include placing an order, getting connected, and/or getting the service you have ordered.

Name:
[redacted]

Address:
[redacted]

Eircode:
[redacted]

Email:
[redacted]

Location on NBP Map
Blue

Detail of correspondence with service providers:

Eir advised 4/5 years ago that our area had fibre of 100mbps , yet thats not the case after speed/line tests, its actually < 15mbps

Per Eir the Fibre line is passing our house to the local exchange, but it is not coming back up the road to our residence

Detail of issue experienced:

Not Answered

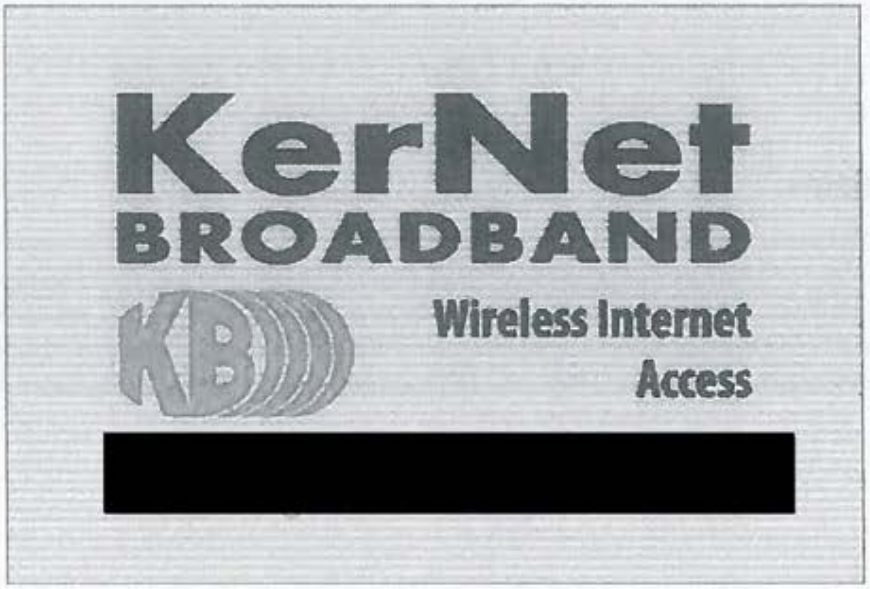
In some cases queries may need referral to operators after the consultation has concluded.

Has permission been given to pass on details supplied to the relevant operator(s) in the course of investigating any issues?

Yes

By responding to the consultation, respondents consent to their name being published online with the submission. The Department will redact personal addresses and personal email addresses prior to publication. We would draw your attention to the Department's privacy statement:

The Department of Communications, Climate Action and the Environment requires responders to provide certain personal data in order to provide services and carry out the functions of the Department. Your personal data may be exchanged with other Government Departments and Agencies in certain circumstances, where lawful. Full details can be found in our Data Privacy Notice which is available on our website or in hard copy on request.



[redacted]

NBP Mapping Submission

Prepared by:

[redacted] Network Design

26th Sept 2019

V2.1

1 PRELIMINARY

We regret that due to the very short space of time allowed by the Department for this Consultation and due to the very large and time-consuming amount of data required to fully comply with its requirements we have been unable to address the totality required. We and other SME FWA ISPs have written to the Department in September explaining the problems that this short time-scale holiday-centred consultation has caused and seeking an extension of time. It is most regrettable that to-date none has been forthcoming.

2 INTRODUCTION TO KERNET

KerNet is a registered trading name of Ker Broadband Communications Ltd and is a connectivity provider of FWA internet and FTTH internet services.

***** START CONFIDENTIAL INFORMATION *****

[redacted]

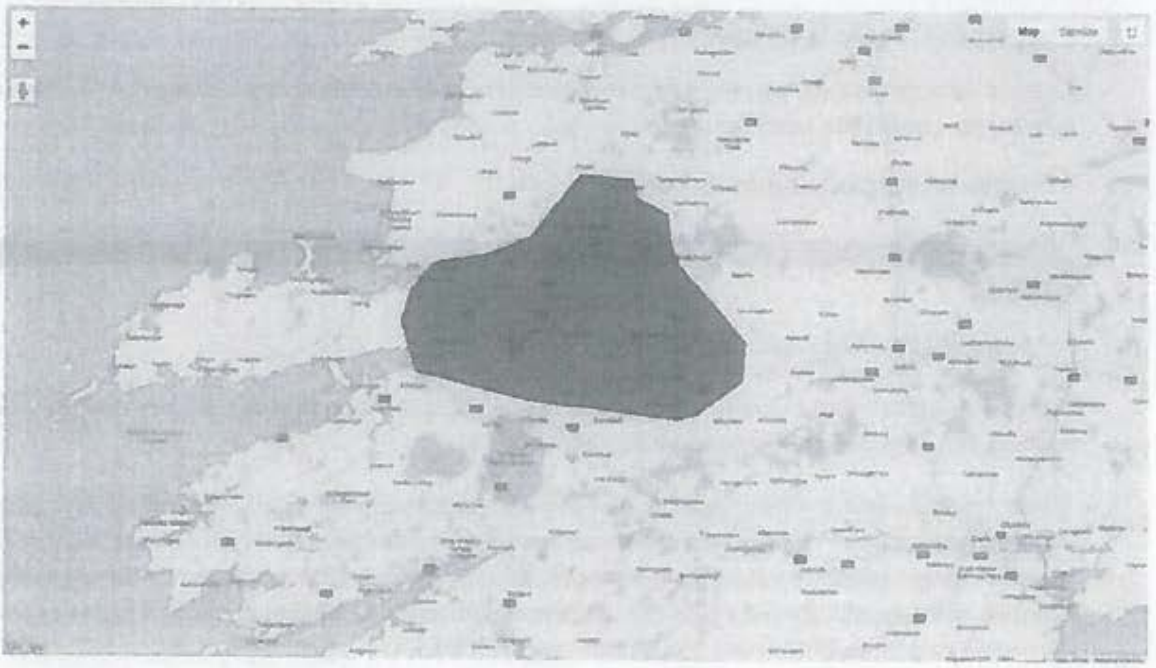
***** END CONFIDENTIAL INFORMATION *****

Founded in 2005, KerNet provide various connectivity and resilient connectivity solutions as well as VoIP, Hosted PBX for our residential and business clients.

We are headquartered in Ballymacelligott, Co Kerry, and use a combination of Tier 1 fibre backhaul, license exempt radio links and license exempt spectrum to deliver our high-quality internet services to our growing customer base. KerNet has over 25 transmission sites located across Ireland. KerNet is registered with Comreg and Ireland's Data Protection Commissioner and is also a member of the Regional Internet Service Providers Association (RISPA) and of the internet registry, RIPE.

KerNet is currently an approved vendor under the Primary Schools Broadband Framework and a Retail ISP for the Enet Proof of Concept Network in [redacted]

KerNet, through our sister company BBnet, are also interconnected with Tier 1 fibre and backhaul operators in Ireland, thus giving us complete national presence over Fibre, Wireless and Copper based networks with offers from 10Mbps to 10Gbps.



3 Current Network Implementation

***** START CONFIDENTIAL INFORMATION *****

[redacted]

***** END CONFIDENTIAL INFORMATION *****

3.1. Internet Facing Connectivity (External)

KerNet's 'External' network is our Internet facing network in the MAN Point-of-Presence in Castleisland, Co Kerry. This connects us to the BBnet internet facing network based in Equinix Kilcarberry.

BBnet Upstream Providers in Equinix Kilcarbery are:

- Cogent - Primary & Secondary
- GTT (previously Hibernia) - Primary & Secondary
- INEX LAN1 & LAN2

Each Upstream provider are terminated on their routers using dual presentation on independent hardware with downstream occurring via in-cabinet patch or multiple national fibre across their core network delivery layer-2 connectivity to their various points of handover (POH).

Interconnectivity between their External facing routers and downstream facing routers is via an iBGP mesh topology.

The network has been designed for delivery of high availability.

3.2. Core Network

Our Core is heavily dependent on Fibre and we then use high capacity FDD Links to transfer bandwidth from a fibre POH to high sites.

Through our connection to our sister company BBnet, their national core fibre network comprises of multi-gigabit Fibre networks delivery to POH locations. Licence exempt wireless technologies are then deployed from POH to further connect high sites to our national fibre network.

KerNet's core has been designed around using quality fibre providers with an SLA that is appropriate for Enterprise, Government & Residential applications.

BBnet's core network spans across multiple datacentres nationally & internationally

- Equinix DB2, Dublin, Telehouse 1
  - Tier 1 IP Providers:
    - Cogent Primary & Secondary
    - GTT Primary & Secondary
    - INEX LAN 1 & 2
  - Interconnects:
    - Enet
    - OpenEir
    - BT
    - ESBT
    - Viatel
    - Host Ireland
    - PermNET
    - INEX
    - Cogent
    - GTT
    - Irish Telecom (Paradyn)
    - IMS
- Westpark Business Campus, Shannon
  - Interconnects:
    - Enet
    - OpenEir
    - BT
- Interxion, Dublin
  - Interconnects:
    - INEX LAN1 & LAN2
    - HEAnet
- Cork Internet Exchange (CIX), Cork
  - Tier 1 IP Providers:
    - CIX
  - Interconnects:
    - Enet
    - CIX
- International PoP's in London, New York, Barbados

3.3. Backhaul Network

Our backhaul networks interconnect our various key high sites into our Fibre POH locations using high capacity Ethernet radio links. We have designed the radio links with adequate fade margins to achieve 99.9% availability where feasible.

Redundant paths between high sites are also implemented allowing for hardware and fibre resiliency in the case of fibre breaks/maintenance.

KerNet use a range of licence-exempt microwave radio links for connectivity between POH to various high sites.

- SIAE Microelettronica ALFOplus2 6-42GHz 2+0 XPIC 2Gbps Licensed Radio
  - "ALFOplus2 Datasheet.pdf"
- SIAE Microelettronica ALFOplus 6-42GHz 500Mbps FDX Licenced Radio Link
  - "ALFOplus Datasheet.pdf"
- SIAE Microelettronica ALFOplus 80HD 80GHz 2Gbps FDX FDD Licenced Radio Link
  - "ALFOplus80HD Datasheet.pdf"
- SIAE Microelettronica ALFOplus 80HDx 80GHz 10Gbps FDX FDD Licenced Radio Link
  - "ALFOplus80HDx Datasheet.pdf"
- SIAE Microelettronica ALFOplus 17/17GHz 500Mbps FDD FDX Radio Link
- Racom Ray2 17GHz 360Mbps FDX FDD Radio Link
  - [redacted]

Datasheets;

[redacted]

3.4. Access Layer Network

We operate a Fixed Wireless Access (FWA) Network in the ISM 5GHz & License Exempt 5.8GHz bands. We use Ethernet based data link layer technology. For our NGA Access Deployment we have chosen RADWIN JET integrated Base Station/Sectors and Subscriber Units.

On our Base Station sites, we have deployed Sectors with the technical specifications as outlined in the following section. They have already been deployed following the deployment strategy which allows for self-funded organic growth and infill as the site matures and consumers become aware of the improved new service offering available to them.

On a given site that has 360 Degrees field of view (on top of a hill / mountain) we have deployed 4x 90-degree RADWIN JET sector antennas to provide coverage in the area. On a Base station site that has less of a field of view, in that case we have deployed the requisite number of 90-degree RADWIN JET sector antennas to cover that area.

RDWIN JET delivers the highest possible capacity per given distance. It supports broadband connectivity of up to 3Gbps per 4-sector site and enables 'triple-play' services with HD/4K quality. The RADWIN JET sector antenna's high gain, achieved with beamforming technology, combined with its wide channel bandwidth support and constant transmit power in all modulations, increases the actual end-user capacity for a given distance while maximizing the distance per given capacity.

Additional capacity is added on an ongoing basis to maintain performance in line with User expectations to ensure NGA Performance peak times.

3.4.1. Access Layer Network

The RADWIN JET beamforming offers service providers a unique set of benefits, high service performance that is applicable to a wider range of customer segments, and low TCO (total cost of ownership). RADWIN JET beamforming delivers reliable connectivity in the licence-exempt 5GHz band.

RADWIN JET PtMP beamforming antennae have a very narrow beam width (8°) which imitates PtP transmission to end-users. Combined with RADWIN's air-interface capabilities (i.e. fast-ARQ, unique adaptive code-modulation, adaptive MIMO-diversity and dynamic channel bandwidth per end-user) RADWIN JET is second-to-none in radio interference mitigation, which ensures reliable connectivity in tough congested spectrums.

RDWIN JET delivers the highest possible capacity per given distance. It supports broadband connectivity of up to 3Gbps per 4-sector site and enables 'triple-play' services with HD/4K quality. The RADWIN JET sector antenna's high gain, achieved with beamforming technology, combined with its wide channel bandwidth support and constant transmit power in all modulations, increases the actual end-user capacity for a given distance while maximizing the distance per given capacity.

JET Beamforming enables service providers to deliver greater network capacity with less spectrum and less wireless infrastructure. RADWIN JET's ability to use only two (2) frequency channels per network, combined with high spectrum efficiency, enables it to deliver the highest capacity per available clear spectrum in unlicensed bands. A built-in GPS receiver assures TDD synchronization between all sites, minimizing self-interference and maximizing spectrum utilisation. Its superiority in spectrum efficiency and the extra distance it supports, reduces the number of towers, base stations and backhaul required per network

RADWIN JET's dynamic bandwidth allocation (DBA) ensures a Committed Information Rate (CIR) for heavy bandwidth applications, business customers and IPTV service. JET's dynamic bandwidth management allows residential oversubscription, while maintaining overall high sector capacity without capacity reduction. RADWIN DBA guarantees that not only will the throughput not be degraded when more subscriber units are integrated into the system, but on the contrary – performance (throughput and latency) can be improved when such scenarios occur.

The DBA algorithm is responsible for allocating the radio frames to the remote radios. The purpose of this allocation is to ensure the quality of service to each of the remote unit in terms of delay and throughput and in parallel provide the maximum possible peak rate.

The pre-allocated bandwidth defines the assured capacity and delay for each radio. The DBA is responsible for assigning additional bandwidth to a radio by either using the unallocated bandwidth or re-assign "unused" downlink bandwidth between different radios.

When more subscriber units are integrated into the system, they can be defined as "Best-Effort" users, or to be assigned with "committed" resources (percentage of the sector capacity) in order to guaranty SLA under congestion. When DBA comes into action, minimum service is maintained while peak rates are granted when conditions apply.

3.4.2. Subscriber Units

RADWIN's powerful Subscriber Unit (SU) deliver fibre-like connectivity with high Packet-Per-Second (PPS) processing power to maintain the highest capacity even in small packet applications.

RADWIN's proprietary PtMP system ensures that RADWIN custom design of it's hardware and software ensures unrivalled performance.

Also designed for low visual impact, RADWIN's ruggedized SUs assure long-lasting operation even in the harshest conditions.

The RADWIN SU features include:

- SU-AIR: Up to 100Mbps aggregate, automatic asynchronous
- SU-PRO: Up to 500Mbps aggregate, automatic asynchronous
- 16 / 22dBi integrated antenna
- High durability – IP67 enclosure
- Compatible with all RADWIN base stations
- SU AIR: Designed for residential subscribers
- SU PRO: Offers SLA for enterprise and bandwidth demanding applications, based on CIR

3.4.3. Datasheets

- RADWIN SU-AIR 100 Series
  - PDF Datasheet "RW-5H00-2A54.pdf"
- RADWIN Jet Air 250Mbps Integrated Base Station/Beamforming Sector with built-in GPS sync
  - PDF Datasheet attached "RW-5AB5-2654.pdf"
- RADWIN Jet Pro 750Mbps Integrated Base Station/Beamforming Sector with built-in GPS sync
  - PDF Datasheet attached "RW-5BG5-2650.pdf"
- RADWIN Jet PtMP Brochure
  - PDF Datasheet attached "RADWIN JET PtMP Brochure"
- Explainer video on RADWIN Jet Beamforming
  - https://youtu.be/r6X_qZrqY_0
  - [redacted]

3.4.4. Noise Mitigation Technology

At the core of the RADWIN JET is a proprietary air interface protocol that enables carrier-class wireless Ethernet services in licence-exempt bands. To ensure high quality and reliable delivery of these services, RADWIN radio systems employ several mechanisms that work together to mitigate interference:

- Smart BEAMFORMING & BEAMSTEERING (2nd Gen)
- Network Synchronisation (GPS) (TDD sync)
- Automatic Adaptive Rate
- Forward Error Correction (FEC)
- Advanced Automatic Repeat Request (ARQ) Mechanism
- Non-interrupted transmission
- Orthogonal Frequency Division Multiplexing (OFDM)
- Automatic Channel Selection (ACS)
- Dynamic Channel Bandwidth Allocation (D-CBA)

3.5. Backhaul Capacity Management & Planning

KerNet NOC is based in Shannon, Co. Clare where our Customer & Networks Support teams are constantly monitoring our network performances. We use a combination of software with triggered SLA alerts setup on various parameters. Some NMS systems in operation are:

- ISPAdmin
- RADWIN WinNMS
- Smoke Ping
- Nagios
- Xymon

Further information is available on request.

4 Network Growth

4.1. Core Network

***** BEGIN CONFIDENTIAL INFORMATION *****

Commercially Sensative

***** END CONFIDENTIAL INFORMATION *****

4.2. Planned NGA Services Growth

KerNet will continue organic growth of it's NGA network and will continue to upgrade backhaul as necessary by implementing a continuous improvement programme on non-NGA KerNet coverage spots. KerNet is also constantly identifying new coverage areas.

We are however unable to furnish the department with this information due to the detailed information requested and limited timescale.

5 Coverage data as illustrated in the form of Polygonised Data set

5.1. Table of Location of Base stations

Commercially Sensative

5.2. Location of Base stations

5.3.

5.4. Table of Location of Premises Passed based on High Resolution LIDAR and DSM data

KerNetBroadband_NGA_Detail.csv

6 LIDAR LOS testing and Methodology

We have engaged WirelessCoverage.com to build a Digital surface model based on high quality LIDAR / DSM data. We have supplied Wirelesscoverage.com a list of Sites and height of sectors to produce a list of premises that would be covered with clear line of sight

6.1. WirelessCoverage.com Approach

The approach used for this project was designed to be as comprehensive and detailed as possible, using the best quality data and modelling tools available.

Detailed data was prepared to perform this analysis comprising of:

- The latest EIRCODE dataset, purchased in August 2019
- A Digital Surface Model (DSM) for the whole country from Bluesky International, who have the most contemporary dataset currently available. They hold data at 1m resolution, which was scaled to 2.5m resolution using a bilinear interpolation method. Where any gaps in their coverage were identified SRTM data was used and interpolated to avoid any hard edges in the height data. More information on the data is available in Appendix A.
- Mast Site Data from our ISP

- WISDM Wireless Modelling system, which performs detailed line of sight tests between all properties and all tower sites. Further details on the WISDM Line of Sight Engine are included in Appendix C.

6.2. WirelessCoverage.com Method

Data from our ISP was collected in September 2019 and imported into WISDM. Sites were classified as Standard or NGA and we also gathered details on future planned sites. The distinction between Standard and NGA sites is based upon the quality and style of equipment currently installed at these sites, along with the backhaul feeds. Those classified as NGA are capable of connecting premises at NGA speeds of minimum 30Mbps download & 6Mbps upload.

Using WISDM, WirelessCoverage ran several coverage passes to all EIRCODE centroids:

- All Sites from our ISP at NGA
- All Sites from our ISP at Non-NGA

Within each pass, WISDM takes each Site within the test and performs a Wireless Line of Sight test to each property within a given radius. It is important to note that a Wireless Line of Sight Test differs from an optical test, as it takes into account the Fresnel 1 Zone around the direct (optical) path. This is a more robust means of determining line of sight. In this exercise, we discounted all properties that had more than 15% Fresnel 1 incursion, and therefore does not include properties with Near Line of Sight, which in many cases could successfully be connected.

Where a property does have Wireless Line of Sight, it is excluded from further tests within that pass, in order to avoid double-counting properties.

We then performed analysis of the coverage list from each operator with NGA coverage to identify those properties that could receive NGA service from more than one operator.

6.3. NGA Assumptions

KerNet use RADWIN for the provision of its FWA NGA services across it's access layer network as described above.

Table: Typical RADWIN JET Base Station with a required throughput of 100Mbps per subscriber unit

Band	5.4 ETSI	
Channel Bandwidth	40 MHz	
Propagation Model	Free Space	
	HBS	HSU
Max TX Power	25 dBm	21 dBm
Antenna Gain	20 dBi	23 dBi
Regulation Limits	EIRP up to 30 dBm	
Required Throughput	100 (Mb/s)	

Table: RADWIN JET Throughput table vs Distance

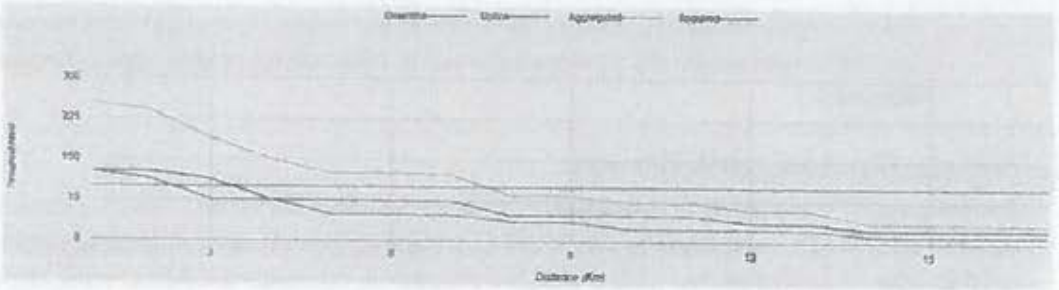


Table: RADWIN JET Distance, RSSI, Aggregated throughput per subscriber, Air rate (MCS)

Distance (Km)	Receive Signal (dBm)		Throughput (Mb/s)			Air Rate (MCS)	
	Downlink	Uplink	Downlink	Uplink	Aggregated	Downlink	Uplink
1	-57	-60	127.7	127.7	255.4	2 x 64-QAM 0.83 (300 Mb/s)	2 x 64-QAM 0.83 (300 Mb/s)
2	-63	-66	126.7	113.8	240.5	2 x 64-QAM 0.83 (300 Mb/s)	2 x 64-QAM 0.75 (270 Mb/s)
3	-67	-70	113.8	76.1	189.9	2 x 64-QAM 0.75 (270 Mb/s)	2 x 16-QAM 0.75 (180 Mb/s)
4	-69	-72	75.9	75.5	151	2 x 16-QAM 0.75 (180 Mb/s)	2 x 16-QAM 0.75 (180 Mb/s)
5	-71	-74	75	50.1	125.1	2 x 16-QAM 0.75 (180 Mb/s)	2 x 16-QAM 0.5 (120 Mb/s)
6	-73	-76	74.4	49.7	124.1	2 x 16-QAM 0.75 (180 Mb/s)	2 x 16-QAM 0.5 (120 Mb/s)
7	-74	-77	73.8	49.3	123.1	2 x 16-QAM 0.75 (180 Mb/s)	2 x 16-QAM 0.5 (120 Mb/s)
8	-75	-78	48.9	36.5	85.4	2 x 16-QAM 0.5 (120 Mb/s)	2 x QPSK 0.75 (90 Mb/s)
9	-76	-79	48.9	36.5	85.4	2 x 16-QAM 0.5 (120 Mb/s)	2 x QPSK 0.75 (90 Mb/s)
10	-77	-80	48.6	24.4	73	2 x 16-QAM 0.5 (120 Mb/s)	2 x QPSK 0.5 (60 Mb/s)
11	-78	-81	48.2	24.2	72.4	2 x 16-QAM 0.5 (120 Mb/s)	2 x QPSK 0.5 (60 Mb/s)
12	-79	-82	35.6	24	59.6	2 x QPSK 0.75 (90 Mb/s)	2 x QPSK 0.5 (60 Mb/s)
13	-79	-82	35.3	23.9	59.2	2 x QPSK 0.75 (90 Mb/s)	2 x QPSK 0.5 (60 Mb/s)
14	-80	-83	23.7	11.7	35.4	2 x QPSK 0.5 (60 Mb/s)	2 x BPSK 0.5 (30 Mb/s)
15	-81	-84	23.7	11.7	35.4	2 x QPSK 0.5 (60 Mb/s)	2 x BPSK 0.5 (30 Mb/s)
16	-81	-84	23.5	11.6	35.1	2 x QPSK 0.5 (60 Mb/s)	2 x BPSK 0.5 (30 Mb/s)
17	-82	-85	23.3	11.5	34.8	2 x QPSK 0.5 (60 Mb/s)	2 x BPSK 0.5 (30 Mb/s)

6.4. Assumptions and Constraints

As with all modelling approaches to wireless coverage, there are factors which could over-state or under-state coverage. Here is a summary of the key factors as they relate to this project: -

Over-statement factors

6.5. A small percentage of the national map data used was derived from low-resolution (10 to 30m) data, which could mean in theory that potential obstructions to the wireless signal path calculations were missed. Based upon the algorithmly-driven model developed by WIDSM for error calculation, we estimate an error rate of <2% over-statement.

6.6. Since the high-resolution data was produced between 2015 and 2017, it is likely that a small amount of unmanaged tree growth has occurred and that new building works will have taken place in the intervening period, which means that a small number of wireless paths may have developed obstructions that reduce their performance and in extremely rare instances, may be blocked. Based upon the algorithmly-driven model developed by WIDSM for error calculation, we estimate a resultant over-statement of <1% from this.

6.7. Whilst it may be possible to receive a high-quality signal at a given property, it is possible that there is no suitable location on the property to mount a receiver due to the construction or location of the property. For example, waterside properties or those with unusual construction such as all-glass exterior can be very challenging.

6.8. Under-statement factors

6.9. In this exercise, we performed single-point line of sight tests to each EIRCODE property. It is possible that the Wireless Line of Sight to that one point may be obscured and therefore reported as no coverage, but if a receiver was mounted at a different point on the property, a connection could be established. Based upon assumptions derived from previous mapping exercises and benchmarked against WIDSM's model, we estimate an under-statement of 3-4% from this factor.

6.10. We used a watershed method for wireless line of sight calculation which allows for little or no Near Line of Sight connections. Many modern radio systems using the diversity associated with MIMO transmission allow for high quality connections to be established in Near Line of Sight operation and these have not been incorporated in the model. This is estimated to have an affect of <10%, but it is highly dependent on the technology used by the operator.

6.11. We have assumed that small 30cm dishes are used at the customer property to achieve an appropriate signal level. It is common practice to install 40cm medium dishes or larger, which have higher gain and therefore can receive a good signal at a longer range. Using larger dishes could significantly increase the overall coverage from each access point substantially.

6.12. Multi Dwelling Units (MDUs)

WISDM currently has a design constraint which means that the premises counted in coverage checks shows the same EIRCODE for all properties that have the same physical location (ie. Multi-dwelling units). This means that the coverage lists appear to have duplications. It was not possible to resolve this issue in the time available to complete the project.

6.13. LIDAR DSM Data Source Coverage According To wirelesscoverage.com

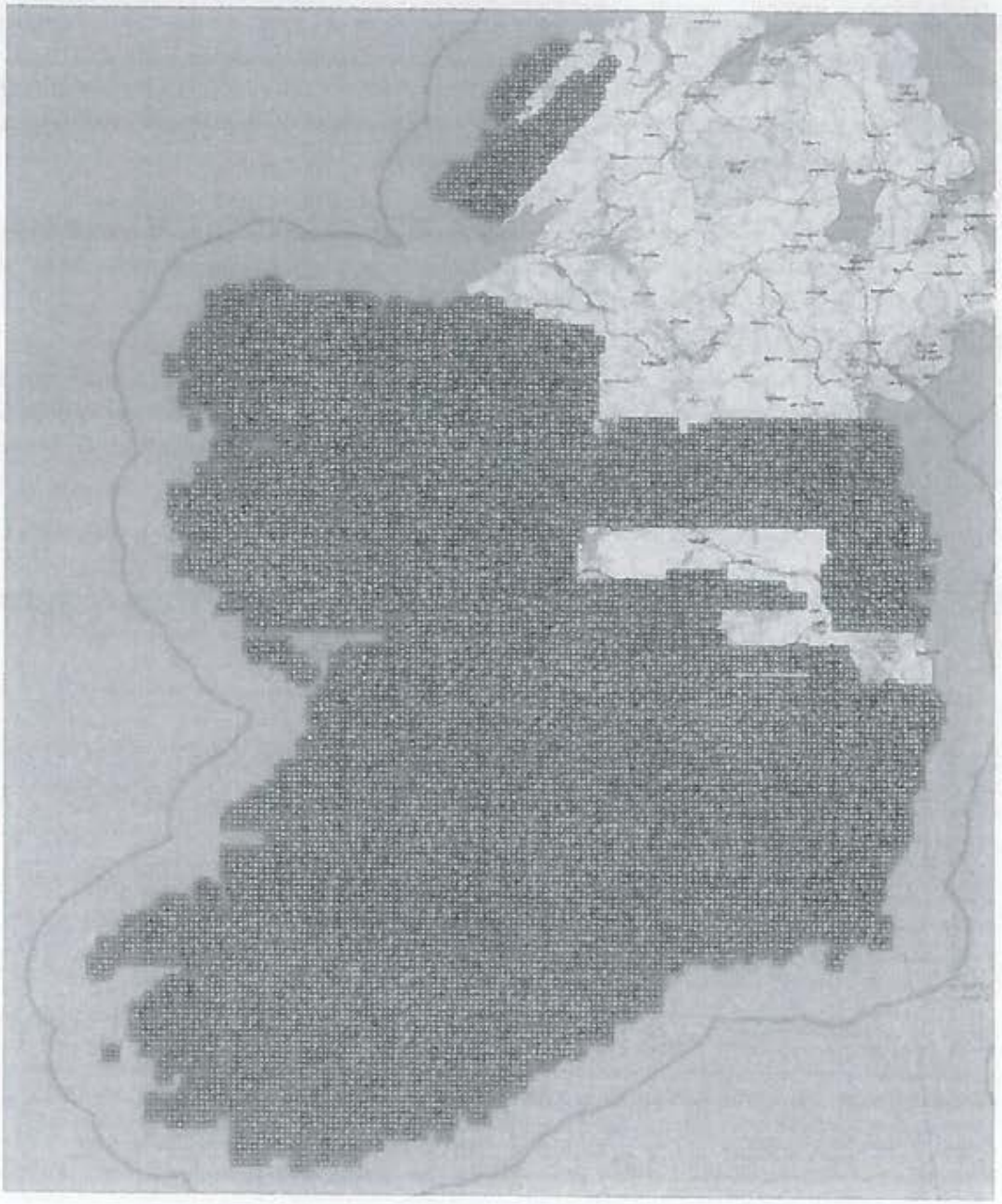
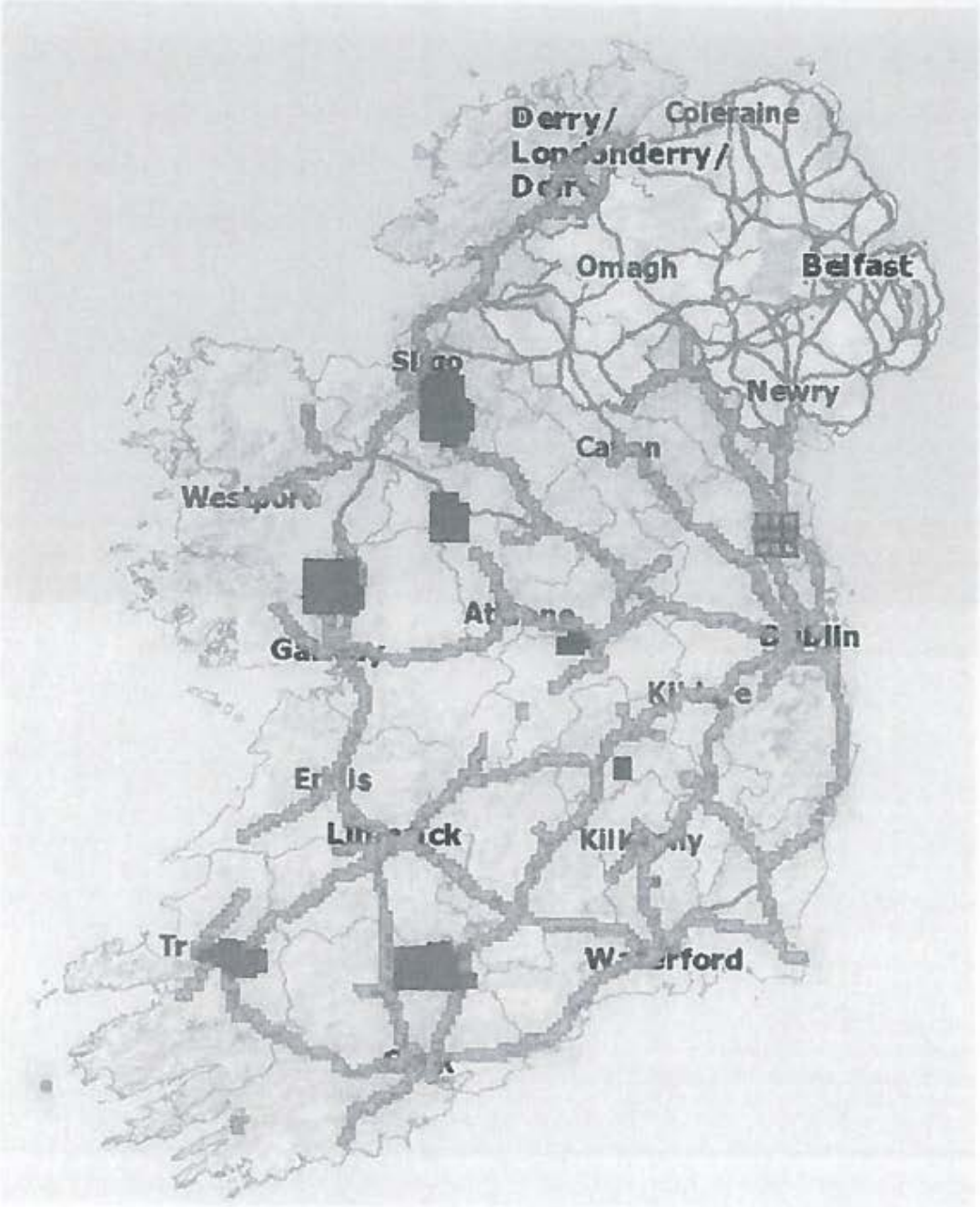


Figure 1. Map of 1m DSM Data from Bluesky International, collected between 2015 and 2017

Figure 2. Example render of DSM Data showing trees, buildings and other surface features.


Derry/
Coleraine
Omagh
Belfast
Newry
Westport
Dublin
Limerick
Waterford

7 WIRELESSCOVERAGE.COM WISDM™ LINE OF SIGHT ENGINE

7.1. HIGHLIGHTS

Wireless coverage WISDM comprises of a family of ultra-high performance wireless planning systems developed by Boundless Networks Ltd.

WISDM WISP Edition is an interactive planning and design system built to facilitate the creation of scalable, robust and performant fixed wireless networks for Wireless IPSs. It enables the rapid creation of 'Ideal' wireless networks over very large areas of thousands of square kilometres. It is well suited to rural expanses as well as mixed and urban environments too. Once an Ideal network has been designed, the network can be fine-tuned to consider build constraints and resiliency in real time.

WISDM can also be used to analyse the coverage of an existing wireless network and perform 'what-if' tests to plan ad-hoc extensions to a network to verify potential coverage and backhaul.

Using WISDM, a predictable coverage model can be prepared in hours and detailed coverage of individual properties can be predicted with an extremely high level of accuracy. Site planning and acquisition is accelerated by use of the interactive planning tools, allowing rapid decisions about mast location to be made with instant coverage impact reporting.

7.2. OVERVIEW

WISDM comprises of several components and processes to complete the overall solution. At the heart of the system is a very high performance wireless Line of Sight (LoS) calculation engine. The LoS engine can calculate over 150 million wireless line of sight tests per second and can use a wide variety of terrain and surface obstruction data sets at any resolution.

Overall, WISDM WISP Edition performs the following tasks:

- **Site Finder**

  This creates an 'Ideal' list of sites where masts could be located for optimum coverage for a given number of target premises passed from a target premises dataset. Target premises can be a list of all properties from a comprehensive source, such as Ordnance Survey AddressBase, or a subset of premises in say, a Government Intervention area. Assumptions can be used to set mast profiles which would include mast height and effective wireless range. For example, the Site Finder can be run with parameters which state that 20 locations could be built with 30m towers, then calculate how many 15m towers would be needed to pass a certain quantity of target premises.

- **Backhaul Modelling**

  The Backhaul Modeller analyses a Site Location dataset and performs line of sight tests between them to create microwave backhaul. Assumptions can be used to help plan for the style of links to be used. For example, links up to 5km can be coloured differently than links from 5km to 17km. This helps when planning a network that has optimum resilience, performance and operating costs due to the potential costs incurred to run licensed microwave links or fibre backbone.

- **Wide Area Network (WAN) Visualizer**

The WAN Visualizer provides full-screen mapping to allow users to see the overall shape of a network and the distribution of different sized towers and backhaul connections between sites. The WAN Visualizer can be called from the Site Coverage and Modelling system.

- **Site Coverage and Modelling System**

This is an interactive web-based tool that allows planners to review the calculated Ideal Sites and move them on a map. At each point, the user can see instantly the impact of changes to coverage of Target Premises, as well as backhaul connections to other sites.

- **Backhaul Link Capacity Planning**

Backhaul links can be described in terms of capacity and latency. Client connection volumes can also be applied to sites and WISDM will predict traffic load and volumes relative to transit or fibre injection points.

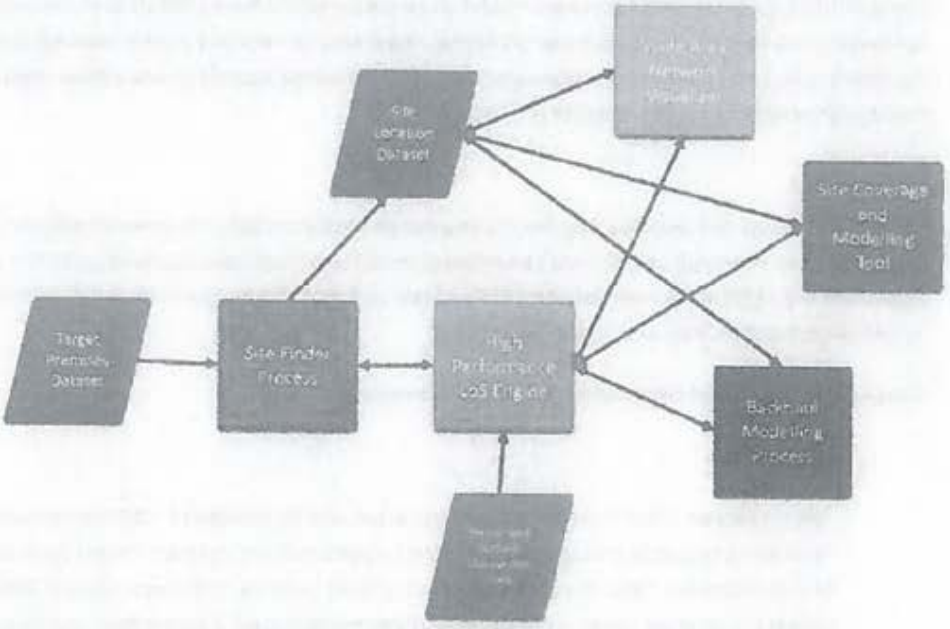


FIGURE 1 WISDM SCHEMATIC SYSTEM OVERVIEW

7.3. WIRELESSCOVERAGE.COM WISDM LOS ENGINE

The WISDM LoS Engine is a custom-built high performance wireless propagation calculator developed in Native C and CUDA. It is a multi-threaded application, currently running on a server farm at Wireless Coverage and is accessed via a C API. This currently operates with 5,000 GPU cores to achieve around 500 million line of sight transactions per second when creating viewsheds but can be scaled further as required.

The LoS Engine has forward and reverse lookup features that are optimised to illustrate coverage from a single point, or supply from multiple points. These features are so fast that they can be operated in real time and take into consideration precision line of sight calculations as well as frequency, loss (according to ITU recommendations) and 3d antenna patterns for both transmitter and receiver.

Point A Co-ords:	52.721996, -8.735649
Point B Co-ords:	52.747408, -8.789013
Height of A:	10 m
Height of B:	6 m
Tx Power:	13 dBm
Ant Gain A:	20 dBm
Ant Gain B:	22 dBm
RF Frequency:	5740 GHz

Estimated RSSI:	-70 dBm
Azimuth from A:	308 degrees
Azimuth from B:	128 degrees
Elevation from A:	-3.24 degrees
Elevation from B:	3.24 degrees
Link distance:	4.8 km

FIGURE 2 SAMPLE LOS ENGINE INPUT AND OUTPUT

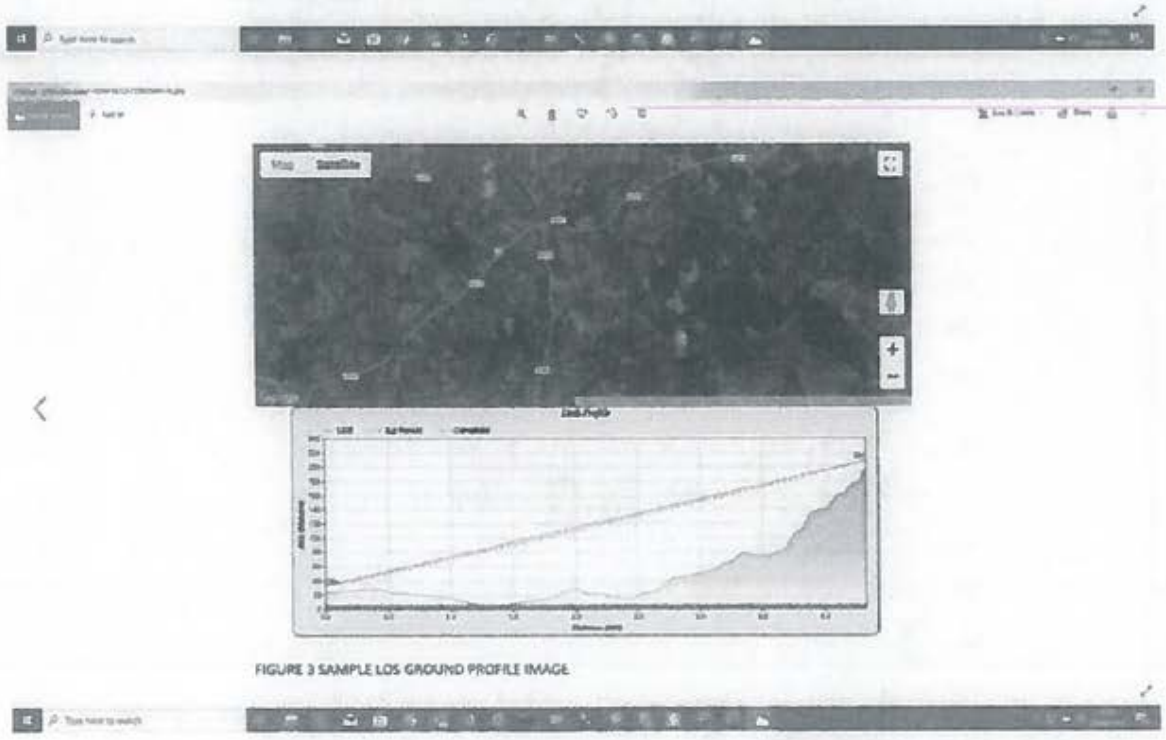


FIGURE 3 SAMPLE LOS GROUND PROFILE IMAGE

7.4. Mathematical and Technical LoS Model

A DSM elevation raster (of chosen resolution) of the target area is loaded into memory (~11GB GeoTIFF file equates to around 6,500 sq miles, imported with GDAL C library) into a flat array of 32-bit floats in a geodetic WGS84 latitude / longitude grid. This stays loaded in memory for every call of the function. A function exists to return the height in metres above sea level for any given latitude + longitude using bilinear interpolation in the grid. This allows for very fast indexed surface elevation lookups for any point in target area with high resolution.

64-bit integers are used for indexing coordinates and x87 80-bit floating-point numbers are used in coordinate calculations.

2 functions exist, geodetic_to_ecef and ecef_to_geodetic for converting between ellipsoidal WGS84 coordinates and cartesian ECEF coordinates.

geodetic_to_ecef is an implementation of Section 10.2.1 from B. Hofmann-Wellenhof, H. Lichtenegger, J. Collins' GPS - theory and practice as follows:

$$
\begin{aligned}
N(\phi) &= \frac{a^2}{\sqrt{a^2\cos^2\phi + b^2\sin^2\phi}} \\
X &= (N(\phi) + h)\cos\phi\cos\lambda \\
Y &= (N(\phi) + h)\cos\phi\sin\lambda \\
Z &= \left(\frac{b^2}{a^2}N(\phi) + h\right)\sin\phi
\end{aligned}
$$

where h is height in metres; φ is latitude; λ is longitude; a is the Earth's equatorial radius in metres; b is the Earth's polar radius in metres; (X,Y,Z) is the cartesian ECEF coordinate.

ecef_to_geodetic is an implementation of J. Zhu's "Exact conversion of earth-centred, earth-fixed coordinates to geodetic coordinates" formula as follows:

$$
\begin{aligned}
r &= \sqrt{X^2 + Y^2} \\
E^2 &= a^2 - b^2 \\
F &= 54b^2Z^2 \\
G &= r^2 + (1 - e^2)Z^2 - e^2E^2 \\
C &= \frac{e^4Fr^2}{G^3} \\
S &= \sqrt[3]{1 + C + \sqrt{C^2 + 2C}} \\
P &= \frac{F}{3\left(S + \frac{1}{S} + 1\right)^2G^2} \\
Q &= \sqrt{1 + 2e^4P} \\
r_0 &= \frac{-(Pe^2r)}{1+Q} + \sqrt{\frac{1}{2}a^2(1 + 1/Q) - \frac{P(1 - e^2)Z^2}{Q(1+Q)} - \frac{1}{2}Pr^2} \\
U &= \sqrt{(r - e^2r_0)^2 + Z^2} \\
V &= \sqrt{(r - e^2r_0)^2 + (1 - e^2)Z^2} \\
Z_0 &= \frac{b^2Z}{aV} \\
h &= U\left(1 - \frac{b^2}{aV}\right) \\
\phi &= \arctan\left(\frac{Z + e'^2Z_0}{r}\right) \\
\lambda &= \arctan2(Y, X)
\end{aligned}
$$

where (X,Y,Z) is the cartesian ECEF coordinate; h is height in metres; φ is latitude; λ is longitude; a is the Earth's equatorial radius in metres; b is the Earth's polar radius in metres; e is the Earth's first orbital eccentricity; e' is the Earth's second orbital eccentricity.

The 3D cartesian coordinates of each radio is found by sampling the ground elevation of the two points and adding on the mast heights, and then using geodetic to ecef. The accurate straight-line distance between the two radios can be found by using $\sqrt{dx^2 + dy^2 + dz^2}$.

The straight line between each *(x,y,z)* position is divided into linear interval points at the desired scan resolution. These points are then converted back into (latitude, longitude, height) WGS84 coordinates using ecef_to_geodetic.

The surface elevation at each of these WGS84 points is sampled and the resulting coordinates + height are converted back into ECEF coordinates.

The resulting 3D ECEF coordinates should mostly be in a flat plane and represent the elevation profile of the terrain under the line between the two radios, including the curvature of the Earth. These coordinates are transformed into flat 2D coordinates by rotating them through 3 axes using transformation matrices. Once they are rotated to a flat plane against the axes, the resulting Z coordinate will be approximately zero and is discarded to produce 2D coordinates.

A 2D straight line is plotted between the two radio coordinates and perpendicular to this line, points are calculated and plotted for the first Fresnel zone and given threshold percentages within the Fresnel zone. The radius r in metres of the first fresnel zone is calculated using:

$$r = \sqrt{\frac{cd(t-d)}{1000000ft}}$$

where c is the speed of light in ms−1; d is the distance along the line in metres; t is the total distance between the two radios; f is the frequency in megahertz.

Intersection with the surface profile polygon and the plotted Fresnel threshold points is tested using binary search + linear interpolation.

The basic RSL s in decibels is calculated using:

$$l = 92.5 + 20\log_{10}\left(\frac{d}{1000}\right) + 20\log_{10}\left(\frac{f}{1000}\right)$$

$$s = p + g_1 + g_2 - l - t$$

WHERE L IS THE FREE-SPACE PATH LOSS IN DECIBELS; D IS THE DISTANCE IN METRES; F IS THE FREQUENCY IN MEGAHERTZ; P IS THE POWER OF THE TRANSMITTER; G1 AND G2 ARE THE ANTENNA GAINS OF EACH ANTENNA; T IS THE TRANSMISSION LINE LOSS, ASSUMED TO BE 1 DECIBEL. FURTHER ITU-R ATTENUATION MODELS ARE APPLIED FOR APPROPRIATE BANDS, BUT NOT DESCRIBED IN THIS DOCUMENT.

A2 Future Deployment Information

Due to the lack of notice, timing of the consultation period in peak holiday season, short initial consultation period and short extensions to the consultation period we have had insufficient time to present our exciting future plans for expanding our network. We will continue to grow our network and invest in new technologies in the same manner as we have done in the past. It is profoundly regrettable that the DCCAE NBP Team wilfully disregarded the best practices document on public consultations that another government department DPER had gone to the trouble of issuing on the topic of running a public consultation. Specifically DCCAE's NBP Team ignored the guidelines around giving more time for a consultation period so that smaller businesses would be given a fair opportunity to respond given the inherent constraints on resources that small business have. A copy of the DPER guidelines can be downloaded from the following url; https://www.gov.ie/en/publication/e9b052-consultation-principles-and-guidance/

A3 Future Financial Information

The comments made in A2 are repeated here. More importantly, it is impossible for us and other similarly placed FWA operators to obtain the certainty of financing required by DCCAE's Assessment Criteria until DCCAE has accepted that we are providing NGA service and ruled our coverage area out of the currently proposed NBP .Intervention Area. By definition therefore, because the DCCAE has placed this impossibly high bar in our way, we are blocked as a result from being able to comply with DCCAE's requirements for future plans and therefore any future plans we and other existing FWA operators have can be totally disregarded by DCCAE. We cannot and do not accept that the EU's State Aid Guidelines are intended to be applied in this way.

From: [redacted]
To: NBP Mapping
Subject: Pdf of hard copy submission [redacted]
Date: 20 September 2019 16:11:35
Attachments: [redacted] HardCopySubmission.pdf
image001.jpg
image002.jpg

Dear NBP Mapping

Please find attached a Pdf of hard copy submission from [redacted], dated 17th September and received by me today 20th September 2019

Regards

[redacted]

[redacted]

National Broadband Plan

E: [redacted]

T: [redacted]

Roinn Cumarsáide, Gníomhaithe ar son na hAeráide & Comhshaoil

Department of Communications, Climate Action & Environment

29-31 Bóthar Adelaide, Baile Átha Cliath [redacted]

29-31 Adelaide Road, Dublin [redacted]

Residents of [redacted]
[redacted]
Celbridge
Co. Kildare

Eir Broadband Head Office,
[redacted]

17/09/2019

Dear Sir/Madam,

We are writing on behalf of the residents of the [redacted] area in regards to a Broadband black spot on a 2 km stretch of our road where high fibre broadband is available on either end.

We are 12 miles from Dublin, and close to the urban areas of Celbridge, Leixlip and Lucan. Our road, which is 3.5 km long, stretches from [redacted] on one end and [redacted] on the other.

High Speed Broadband is available at the beginning of the road at [redacted] and to a number of houses at the [redacted] end of the road. **We are the forgotten 2km in the middle of this road.**

In this 2 km gap there are 20 houses. At least 10 of these houses are business owners and run offices from their homes, and excluding [redacted] there are three operating businesses on this stretch also. We depend on low speed broadband which drops out daily and causes huge disruption to the small SMEs trying to run their businesses from their home. This is so frustrating especially when the fibre optic cable which supplies most areas in the country runs along the Grand Canal. This cable is only a couple of metres from some of the houses in our neighbourhood.

We have huge difficulty downloading basic information and sending day to day emails. Children who live in this area have difficulty studying at home due to the lack of reliable broadband and have to either stay in school or go to the local library/university to complete projects that they should be able to do at home. As you are aware, everything has become online based, even booking a hospital appointment must be done online.

We need to emphasise that we are not in a rural location. We are close to many amenities, as already mentioned [redacted] and [redacted] Ianroid Eireann are also moving their services operations to an area accessed through [redacted] and the new forensic laboratories which is currently being built, is also located in [redacted]

We are a very active community but we are disadvantaged by living on this 2km stretch of road. The lack of high speed broadband affects every member in our community, young and

old. Each house has tried several different providers over the last few years with little success. Can you please advise us the best way forward to progress our issue.

Yours faithfully,

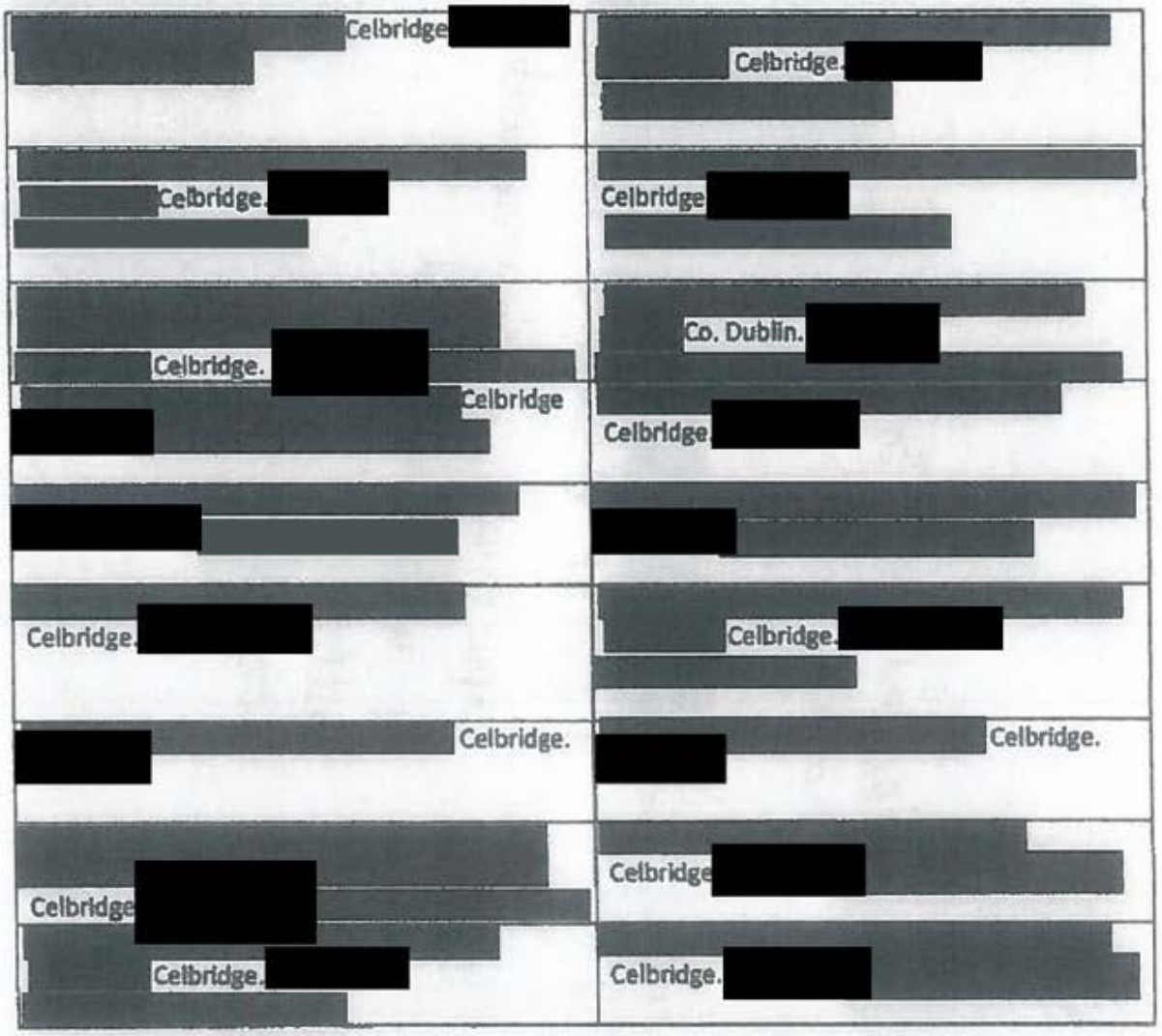
[redacted]

[redacted] Celbridge.

[redacted]

[redacted] Celbridge.

Signed on behalf of and with the permission of the following,



c.c [redacted] National Broadband Plan Division, Department of Communications, Climate Action & Environment

[redacted]

Received 20th Sep 2019
9.00 am

[redacted]

National Broadband Plan Division
Department of Communications, Climate & Environment
29-31 Adelaide Road
Dublin 2

[redacted]

From: [redacted]
To: NBP Mapping
Subject: Broadband
Date: 13 September 2019 13:46:39

I am in blue area despite the fact that many in my neighborhood including community school which is literally on my back doorstep have fibre broadband.

I am with Eir and have been for over 30 years. Despite several phone calls and endless hours on the phone I cannot make any progress.

Eircode [redacted]

I would appreciate an up date on the position.

Regards

[redacted]

From: [redacted]
To: Broadband; NBP Mapping
Subject: Re: Broadband Connection
Date: 02 August 2019 14:30:18

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

[redacted],

I asked Eir for a landline but they said that they could'nt provide me with a phone line or with fibre broadband either.
I ordered fibre broadband and phone line from virgin media twice and on both occasions they were unable to complete the order.
I was told that they were unable to provide broadband at my address at [redacted]

I look forward to your reply,

Yours sincerely,

[redacted]

From: DCCAE
Sent: Friday 2 August 2019 08:46
To [redacted]
Subject: Broadband Connection
CCAE-CS-00089-2019

[redacted],

[redacted]

02 August, 2019

Dear [redacted],

Thank you for your correspondence regarding broadband connection to your premises.

The National Broadband Plan (NBP) aims to ensure high speed broadband access (minimum 30 megabits per second) to all premises in Ireland, regardless of location. This is being achieved via a combination of commercial investment and a State led intervention.

The NBP has been a catalyst in encouraging investment by the telecoms sector. In 2012, less than 700,000, or 30% of Irish premises had access to high speed broadband. Today, 75% of the 2.4 million premises in the Country can access high speed broadband.

According to the Department's High Speed Broadband Map, available at www.broadband.gov.ie, your premises is in a BLUE area. BLUE areas are parts of the country where commercial operators are already providing high speed broadband or have indicated future plans to do so. The Department defines high speed broadband as a connection with minimum speeds of 30Mbps download and 6Mbps upload.

Please note that the installation of telecommunications infrastructure and delivery of

services via same is undertaken by private companies operating on a commercial basis in a liberalised market. The Department has no input in the planning of commercial operators and does not have access to their specific deployment plans.

My Department is currently engaged in a Consultation Process where we have identified premises' like yours that are in the BLUE area but not receiving a service from any provider. Please see the Consultation page

on our website for further information. As part of this process we are gathering together information in relation to premises located in the Blue area. Can you provide us with details of any correspondence with service providers where you requested a broadband service, the eircode of the premises and any other relevant information? Please send any correspondence to the email address referenced on the Consultation page which is nbpmapping@dccae.gov.ie

With regard to a landline connection you should contact eir at [redacted]

Kind Regards

[redacted], **Communications Team**

National Broadband Plan Division

Roinn Cumarsáide, Gníomhaithe ar son na hAeráide & Comhshaoil

Department of Communications, Climate Action & Environment

29-31 Bóthar Adelaide, Baile Átha Cliath, [redacted]

29-31 Adelaide Road, Dublin, [redacted]

[redacted]

[redacted]

Kind regards,

[redacted]

Department of Communications, Climate Action and Environment

From: [redacted]
To: NBP Mapping
Subject: NBP Mapping Submission [redacted], Galway
Date: 20 September 2019 09:18:35

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

To who it may concern

I would like to make a submission to be added to the NBP for the [redacted] Galway. My air code is [redacted]

We are a household of 6. We use internet for personal and business. My husband and I run [redacted] from this address. We also need to download [redacted] for business purposes. This can be very slow and at times has has to be adandoned and move locations closer to Kinvara - parents house. Streaming programmers for personal use wouldn't even be a consideration it's so slow. As you can see we have had numerous issues over the past 5 years trying to get suitable internet coverage and speed to run simple everyday applications such as banking on line and sending emails.
I have been in contact with all the providers - Eir/sky/three and none cover our area. Our only choice is Mobil WiFi and this is expensive and very unreliable.
I would implore you to include us and our neighbours on the NBP - because if our location we are often disadvantaged with lack of services/infrastructure.

Thank you
Regards
[redacted]

From: [redacted]
To: NBP Mapping
Cc: [redacted]
Subject: Consultation on Conclusion of the NBP Mapping Exercise for the Intervention Area
Date: 20 September 2019 10:14:15
Attachments: [redacted].pdf
Appendix 1 - CommercialConsultationResponse - [redacted]959R-August2019.pdf

---

For the Attention of:
[redacted],

National Broadband Plan Division

Department of Communications, Climate Action & Environment

29-31 Adelaide Road

Dublin 2

Ireland

[redacted]

Please find attached a submission to the recent Consultation Document issued by the Department.
I would appreciate if you would acknowledge receipt of this submission to [redacted]
My contact details are shown below.
Yours sincerely,
[redacted]

Submission in Response to

Department of Communications, Climate Action and the Environment

National Broadband Plan Public Consultation

Document Reference:

NBP – Conclusion of Mapping Exercise for the Intervention Area Pre Deployment

Submitted by

[redacted]

20th September, 2019

This document contains a Non-Confidential Submission for Unrestricted Publication

Table of Contents

Section 1: Executive Summary

Thank you for the opportunity to submit a response to the Department's Consultation "NBP - Conclusion of Mapping Exercise for the Intervention Area Pre-Deployment".

The author has no particular mandate to represent the views of any group of stakeholders, and offers the views of a single individual citizen, taxpayer, personal and business broadband user, and business owner operating internationally and with operations located in remote parts of rural Ireland.

In summary, this submission puts forward the view that the Department should abandon its current strategy of incurring a cost recently estimated at €2,900,000,000 in rolling out a fibre network, and instead encourage the use of mobile technologies, fixed mobile and public cellular mobile networks, to achieve full high-speed broadband coverage in Ireland.

Further, this submission argues that, while the use of Irish taxpayers' funds to provide gap-funding under EU state-aid rules to finance the NBP may have been permissible back in 2015, this is clearly no longer the case in 2019, since commercially available alternatives are now evidently in the process of being rolled out, and will be available to rural users well within the timeframe in which the planned fibre roll-out is intended to be completed.

The Department's use of this consultation process to ascertain whether commercial operators plan to roll out alternatives is unlikely to achieve its stated purpose, for the following reason.

There are significant disincentives in place that discourage mobile and fixed telecoms operators from submitting plans to the Department as invited by this consultation, since the Department's expected follow-up from such submissions will be to seek a commitment from that operator to guarantee this intended network roll-out, as occurred with eir in 2016.

There is simply no incentive in place for any network operator to volunteer such plans to the Department, and very considerable downside in the form of a likely requirement to enter contractual commitments publicly. On the contrary, it is in the commercial interests of network operators, including mobile network operators, *not* to set out any such plans to the Department. Given a choice, network operators would far prefer to have the freedom to roll-out their networks in a timeframe, and to a coverage plan, that best suits their own commercial, financial and operational requirements, and not based on a formal commitment to a government agency. For this reason, a poor response, or a lack of enthusiasm from network operators to share future network roll-out plans should not be viewed by the Department as confirmation that a broadband deficit will continue to exist, since the Department's approach to this issue so far, whether intentional or not, has served to actively discourage any such cooperation.

Section 2: The Case for Adopting A New Approach

Background to Current Position

Up to 2015, the Department estimated that the number of firms, business and homes without high-speed broadband in Ireland, and located within the "intervention area", was 840,000 premises. Following a consultation, this number was reduced to 540,000, as, at that time, eir indicated its willingness to connect 300,000 premises located within the intervention area, and without government subsidy. These 300,000 premises have now been successfully passed by eir, though less than half of these premises have chosen to take a connection.

Recently, a second provider, Imagine Network Services Ltd, has indicated that its fixed wireless network has been rolled out, following a €300m investment, and is now in a position to connect 800,000 premises located in rural Ireland, of which 234,000 premises are located within the NBP intervention area. Imagine's service offers broadband download speeds exceeding 100mb/s, and are available without government subsidy. It isn't clear whether any of these 234,000 premises overlap the 300,000 premises already passed by eir, but it is likely that a significant proportion do not, given that the networks deployed by both are very different, one using a fixed fibre solution, and the other using fixed wireless technology. Other network operators with networks under construction, including SIRO and eir, will clearly overlap some of their network footprint with premises currently within the intervention area.

In June 2019, Comreg issued a consultation document relating to the licencing of radio frequencies in the 700Mhz band, which is largely expected to be used by Irish mobile operators to roll-out new mobile services using 5G technology. In its consultation document, Comreg sets out a number of options it is considering regarding the use of licence obligations to ensure high population coverage and download speeds, and comes to the preliminary view that it will impose a 30Mbit/s download obligation on licencees, as set out in Table 1 below:

Table 1 – Section 8.88, Comreg Document 19/59R

"8.88 Alternatively, a 30 Mbit/s obligation is likely to be appropriate for the purpose of setting a coverage obligation for the following reasons.

- It takes account of the need to achieve the target speed and quality objectives set out in Article 6(1) of Decision No 243/2012/EU.
- It would appear to be economically viable given the availability of carrier aggregation and 700 MHz rights of use.
- Targeting 30 Mbit/s would result in significant incidental 50 Mbit/s speed for a significant proportion of the population. For example, a 90% population coverage requirement at 30 Mbit/s would result in 74% of Ireland's population getting speeds of 50 Mbit/s."

In its consultation document, Comreg also considers various options regarding the imposition of coverage obligations in the forthcoming award process, and comes to the preliminary view that it will require licencees to achieve 85% population coverage within 3 years, 92% within 5 years, and 95% within 7 years, as set out in Table 2 below:

Table 2 – Section 8.118, Comreg Document 19/59R

"8.118 Applying the above information to a coverage and rollout obligation, and assuming that 700 MHz spectrum rights becomes available in mid-2020, ComReg proposes the following coverage population percentage obligation for 30 Mbit/s single user throughput at cell edge, namely to achieve:

- 85% population in 3 years;
- 92% population in 5 years, and;
- 95% population in 7 years."

These licence obligations, even if set at Comreg's proposed conservative or "precautionary" levels, have significant implications for the NBP, since the coverage and download speed requirements overlap with the deficit in high speed broadband availability as defined by the Department in setting its NBP intervention area.

The Department estimates that 1.1 million people, or 23% of the Irish population are currently without high speed broadband coverage, implying that existing coverage is only 77%. Even if Comreg's conservative mobile licence obligation plan is adopted, this means that a further 8% will have access to high speed broadband within three years totalling 85% coverage, and a further 7% will be covered within 5 years, and a total of 95% of the population will be covered within 7 years, implying that less than 90,000 premises, or 5% of the population will remain uncovered at that point. What this means is that only 16% of the premises in the intervention area will be without high-speed broadband by the time the planned fibre roll-out is completed, as 450,000 premises will have been covered by 5G mobile networks, with access to download speeds of over 30Mbit/s. In some cases, this may involve installing mobile repeater equipment to ensure indoor coverage, (as is currently successfully used by the author in a home setting) and which is readily available commercially for less than €300 per premises.

Of course, Comreg could simply decide to adopt more ambitious coverage and download speed targets, which would ensure that all premises Ireland are covered by 5G networks within 7 years, negating the need to incur any spend on the NBP, and thereby saving the taxpayer €3Bn. In my view, there is no reason why Comreg shouldn't set a population coverage obligation on incumbent mobile operators of 98% within 3 years and 100% coverage within 5 years, ensuring that Irish rural users enjoy both improved indoor and outdoor mobile coverage, and high- speed broadband download speeds from a single network provider. Sensible use of mobile network coverage obligations will negate the need to incur any fibre roll-out cost, thereby saving the taxpayer at least €2,900,000,000, and delivering a higher coverage mobile solution for rural communities.

My submission to Comreg's Consultation Document, setting out my reasons for this view, is attached as an Appendix to this submission.

Section 3: Why Roll-out of 5G Mobile Networks in Ireland Changes the Landscape

5G Service Quality / Backhaul Speeds

There was has been much media discussion and debate as to whether mobile networks can deliver broadband service at speeds and quality comparable to fixed fibre broadband. Much of this commentary, in my view, is misinformed, and based on erroneous assumptions as to the nature and definition of data download service quality parameters.

Download Speed: The download speed related to both fixed, fixed mobile, and mobile operators is directly comparable, and so a download speed is no different whether delivered over any of the three transmission mechanisms. If a mobile licence obligation requires a minimum download speed of 30Mbit/s, then this obligation requires the mobile operator to deliver this service on a continuous and end-to-end basis, as would be the case for a contractor providing a fixed fibre service. Some commentators have suggested that 5G technology does not have the same coverage radius, and so is unsuited to rural broadband applications. This observation confuses two issues, since 5G technology in itself does not have either wide or narrow reach, rather it is the radio frequency it uses that is the main determinant of its coverage area. Since Comreg is planning to licence the use of the 700Mhz frequency band, and since mobile operators will also be free to re-use existing 800Mhz and 900Mhz ranges currently used for 3G and 4G networks, none of these frequencies would be considered to be coverage limiting, and, on the contrary, will allow network operators to achieve better coverage than currently is the case with existing 3G and 4G networks.

Backhaul Network: Many commentators have erroneously suggested that mobile operators do not have the capability to deliver network capacity from the mobile mast back to their central network locations, as would be the case for a fibre network provider. This is simply not the case, and mobile network operators typically use either high capacity fixed wireless or fibre network capacity to route calls and data connections back into their core networks. A licence obligation to deliver high speed broadband over a mobile network simply implies that the backhaul capacity required to ensure delivery of this service must be dimensioned appropriately to meet the anticipated demand. This same set of resource considerations exists for fibre-to-the-home network providers, since fibre networks do not, contrary to public perception, deliver infinite network capacity.

Latency: Historically, users of mobile data services have found that mobile networks suffer from poor network latency compared with fixed network services, typically manifesting itself in connection delays between a webpage being requested, and the webpage downloading. This issue has improved considerably since the introduction of 4G LTE services, but is likely to improve dramatically with the introduction of 5G services. There is no reason why Comreg cannot contractually ensure that maximum latency thresholds are delivered by licencees, as has been the case in Germany, where the Bundesnetzagentur has imposed a licence condition on mobile operators mandating a maximum network latency of 10ms.

In summary, the perception that high speed broadband services delivered over mobile networks is somewhat inferior to data services delivered over fibre is historically correct, but should not be assumed to be indicative of future broadband services for two reasons. Firstly,

technology improvements in the way 5G services are delivered have been designed to deliver a much better online experience, and secondly, Comreg, as the state's regulator responsible for managing radio frequency licences, has the ability to control and dictate the coverage and quality of mobile data services delivered by licencees.

ENDS

Submission in Response to Comreg's Consultation on the Proposed Multi Band Spectrum Award Including the 700MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands

Comreg Document Reference 19/59R

Submitted by

[redacted]

7th August, 2019

This document contains a Non-Confidential Submission for Unrestricted Publication

The views expressed in this document are the views of the author alone, and do not represent the views of any other individual or organisations with which the author may be associated. The author's contact details have been submitted separately to Comreg.

This report was submitted to Comreg on 07/08/19 from the author's home in [redacted] located within the NBP intervention area, using a Vodafone 4G LTE signal, and using a mobile signal repeater to deliver an indoor 24Mbit/s download speed and a 6Mbit/s upload speed. The fixed network alternative available from eir at this location delivers a maximum download speed of 2.1Mbit/s, with a maximum 0.3Mbit/s upload speed. No other network operators, including, mobile, fixed or fixed wireless currently offer broadband services to this address (except those retailing eir's same network infrastructure).

Table of Contents

1. Executive Summary

Thank you for the opportunity to submit a response to the Spectrum Award proposals as set out in Comreg's Consultation Document Reference Number 19/59R. This submission sets out the case that Irish mobile users, consumers and Irish citizens generally, are best served by the adoption by Comreg of an interventionist approach in setting licence conditions in the forthcoming spectrum awards process. Further, this submission urges the Commission to apply higher quality of service conditions to licences than the levels of service indicated as being preferred by it in its preliminary view. In particular, this submission argues that both the network coverage licence conditions and the download speed licence conditions require intervention by Comreg, particularly since there is strong evidence that the current user experience of Irish mobile users lags well behind those of other EU countries, and behind many countries internationally.

The radio spectrum bands being considered for licence in this consultation represent a very significant scarce resource managed and regulated by Comreg on behalf of the Irish State. The forthcoming awards process represents a once-off opportunity for Comreg to ensure that the benefits of this resource are maximised for the benefit of Ireland's citizens. This awards process, once completed, will be key to determining the extent to which Irish users, consumers and businesses, urban and rural, will have access to crucial connectivity services that compare favourably (or unfavourably) with those available in other countries for at least the next 15 years. From a personal and business perspective, the quality of this connectivity has a crucial bearing on the relative competitiveness of Irish businesses, and their consequent ability to grow and create employment in Ireland.

According to most recent research data, the quality of service data relating to coverage levels and data connectivity speeds compare Ireland very poorly in international comparisons, with Ireland achieving only just around average coverage levels for 4G LTE, and according to the most recent DESI Report[1] published by the European Commission. According to the Speedtest Global Index[2], Irish users suffer the worst MBB average data download speeds of any on of the 28 EU member countries, with an average download speed of only 24.07 Mbit/s, ranking only 71st in the world, behind countries such as Armenia, Sri Lanka and Iran. More depressingly, Ireland's ranking has actually fallen three places since the last survey. For further evidence, a report published in May 2019 by OpenSignal[3] paints a similar picture regarding average download speeds, also placing Ireland slowest among all EU member states. The OpenSignal Report also places Ireland towards the bottom of the rankings in terms of 4G availability.

References:

1. Digital Economy and Society Index Report 2019 on Connectivity, published by the European Commission
2. Speedtest Global Index, published by Ookla LLC, June 2019
3. The State of Mobile Network Experience, OpenSignal, May 2019

The evidence is clear that competition among Irish MNO's, which has been a feature of the market in Ireland since 1998, is not sufficient to ensure that Irish mobile users receive best in class quality of service and coverage levels, and most of the data suggests that the opposite is true. For this reason, Comreg must consider the use of strong levels of intervention in setting quality of service levels that meet international standards of comparison.

Although there is currently no research data to confirm the preference of non-industry stakeholders, this submission argues strongly that given a choice between better quality of service or higher spectrum licence fees, the vast majority of Irish users and taxpayers would prefer that Comreg makes decisions that seek to ensure better quality of service in terms of network coverage and download speeds from MNO's, rather than securing higher licence fees.

1.1 Key Points of this Submission

(a) Comreg should adopt ***an interventionist approach*** to setting licence obligations to ensure minimum coverage and download speeds, rather than the precautionary approach favoured by Comreg in its consultation document.

(b) Comreg should set much more ***challenging network coverage and minimum download speed conditions*** than those set out in the consultation document.

(c) Comreg should include in its licence awards a coverage condition on incumbent MNOs of ***98% of all Irish Eircode addresses within 3 years, and 100% within 5 years.***

(d) Comreg should set a minimum download speed of ***50Mbit/s within 3 years***, increased to a minimum download speed of ***100Mbit/s within 5 years***.

(e) Comreg should include a minimum network latency target for data downloads of ***10ms within 3 years***.

(f) Comreg should ***permit licencees the freedom to use any resources and technologies available*** and within their control to allow them to meet their licence obligations, including, but not limited to, the licenced spectrum awarded, other spectrum already licenced by the MNO, and should explicitly permit fixed wireless connections, and also consider permitting non-radio based fixed connections including copper and fiber to satisfy the licencees coverage obligation.

(g) Comreg should ensure that the decisions it makes are made having taken proper account of the ***significant potential for industry bias*** in the responses it receives to this consultation.

(h) Comreg should ensure that its approach to the licence award process is not constrained or influenced by considerations relating to the Government's National Broadband Plan. ***Comreg's statutory obligations regarding maximizing the use of Ireland's radio spectrum resources for Irish consumers is unqualified,*** and should not be constrained or restricted by overlapping plans for fixed network solutions.

(i) Comreg should study closely the outcome of the recent licence award process overseen by the Bundesetzagentur in Germany, which concluded in June 2019, ***where similar interventionist coverage and download speed conditions to those recommended in this submission have been successfully imposed and accepted by licencees***.

(j) Comreg should study closely the spectrum awards process adopted and subsequent network rollout in Sweden, where ***4G LTE coverage has now exceeded 99.9% population coverage***, driven by a regulatory intervention, and despite having a much lower population density than Ireland.

(k) This submission strongly recommends that Comreg, in setting its licence conditions, considers that the business case for an incumbent MNO to invest in new spectrum ***does not just involve the economics of an investment relative to its associated return,*** as assessed by the various reports commissioned by Comreg. An MNO's bid considerations also involve other priorities, ***aimed at protecting and continuing to extract returns from all previous investments***, often expressed as goodwill, stretching back in time to the rollout of its first network and the acquisition of its first customer.

1.2 Background to this Submission

The author's motivation in submitting a response to Comreg's consultation is based on a concern, having reviewed the Comreg consultation document and associated industry consultant reports, that Comreg and it's consultants may not be sufficiently exposed to the views of Irish consumers and citizens on this issue, views which may contrast significantly from the views of industry players with significant commercial and financial interest in the outcome of Comreg's deliberations and decision-making.

The author has no particular mandate to represent the views of any group of stakeholders, and offers only the views of a single individual citizen and business owner operating internationally and with operations located in remote parts of rural Ireland.

My perspective is one which is very supportive of initiatives that are designed to maximise and optimise the use of our national resources, such as, in this case, radio frequency spectrum. I hope that this submission will help to contribute towards providing helpful and balanced feedback to the Commission in its task of making important decisions regarding the optimal plan to award frequency spectrum licences that benefits all stakeholders.

1.3 Scope and Structure of Response

The second part of this submission *(Section 2)* addresses an important issue relating to this consultation process which I believe warrants serious attention by Comreg's Commissioners, and which is intended to be a constructive input to Comreg's consideration of its approach to this and future consultations.

The third part of this submission *(Section 3)* directly addresses and provides summary responses to the "Overview of Key Proposals" as set out in Comreg's Consultation Document No 19/59R.

The fourth and final part of this submission *(Section 4)* purposely focusses on the issues raised in "*Chapter 8 – Licence Conditions*" of the Comreg consultation document, as the issues raised in this section, and the proposals being suggested, are those which the author considers have the most significant consequences for all stakeholders. In particular, the issues and options being considered by Comreg relating to *Coverage and Roll-Out Conditions* are issues which are considered to be the most critical, and which are very likely to have diverging views between industry and non-industry stakeholders. This submission endeavours to provide a clear and coherent rationale where the views expressed differ significantly from those being favoured by Comreg or those being recommended by Comreg's economic or technical consultants.

1.4 About the Author

[redacted] commenced his business career as a member of Telecom Eireann's commercial team that planned and executed the launch of Eircell, Ireland's first mobile network, in 1985. [redacted] was employed in various roles in Telecom Eireann and subsequently joined BT, where he led to the establishment of BT's operations in Ireland. [redacted] was the founder and [redacted] a successful international directory information services provider that has worked closely with many of Europe's mobile operators including Vodafone and O2 in Ireland, Orange, O2 and Vodafone in the UK, One and Mobilkom in Austria, Orange in Switzerland, and Sonera of Finland. [redacted] has served as a non-executive director of [redacted] a SaaS fleet management company using mobile network technology, until its acquisition in 2016 by Verizon. [redacted] is currently Chairman and CEO of [redacted] an export-driven seafood producer with 150 employees, with operations in Donegal and Wexford.

2. Comreg Consultation – User Representation of Views

As outlined in the Executive Summary of this submission, the author's primary motivation in submitting a response to Comreg's consultation is a concern that Comreg may, in this instance, be under-exposed to the views of Irish consumers and taxpayers, and Irish citizens generally, views which may contrast significantly from the views of industry players with significant commercial and financial interest in the outcome of Comreg's deliberations and decision-making.

As I am sure the Commission is aware, Comreg is required to seek the views of all stakeholders, and to ensure that a broad spectrum of interests is considered before making decisions that, in this case, will have wide-ranging implications for Irish society for decades to come. In the case of this particular consultation, it appears that the consultation process is aimed primarily at seeking responses from industry players, with little evidence of efforts by Comreg to stimulate public awareness that this process is underway or even exists.

For example, the Comreg Consultation document inviting responses only appears within the "Industry" section of Comreg's own website, and seems to have been excluded from all sections of the "Consumer" section, including the "Consumer News" section, "Consumer Information" section, the "Consumer Engagement" section, and is even excluded from the "Open Consultations" tab within Comreg's Consumer microsite. While this may be an inadvertent omission on Comreg's part, the general sense conveyed is that Comreg is primarily interested in the views of industry players, and is not especially interested in the views of other stakeholders.

In addition, and reinforcing this impression, the very detailed technical content of Comreg's consultation document, coupled with multiple references to previous consultations, and consultant reports, while very important and useful in teasing out issues with industry players and especially from intending spectrum award applicants, has less relevance and renders less accessible the process to other stakeholders who may wish to have an input to some of the more important general policy-making aspects of Comreg's decisions relating to the forthcoming frequency awards.

While this may not be Comreg's intention, the fact remains that it is very likely that a significant proportion of the respondent submissions to this consultation will be industry players, and that those responses will be prepared using deep access to information and resources. While these industry players may be more knowledgeable and undoubtedly possess a high degree of technical, human and financial resources to research and respond to Comreg's consultation in an articulate and insightful way, the problem for Comreg is that the analysis and views received will be naturally designed towards influencing a decision outcome that maximises their own commercial interests. While this is of course each respondent's right, the net effect of this set of circumstances is the possibility that the views received by Comreg in response to this consultation are skewed in favour of the interests of industry players, views which are unlikely to reflect the views of other stakeholders.

Comreg must already be aware that this "motivated to respond" bias from industry stakeholders brings with it the danger that the views of other less vocal or even silent stakeholders are not given the same level of attention or consideration in a detailed and complex process such as pertains in decisions relating to frequency spectrum awards.

To put this simply, the detailed technical and economic issues, and the complex nature of the considerations and technical jargon that are inherent in this process, and as set out by Comreg

and its consultant reports, are not likely to be easily understood by the average citizen or mobile user, and will very likely discourage many from responding to Comreg's consultation invitation.

However, the decision outcomes of this process have significant implications for Irish users and even non-users of mobile and broadband services in Ireland for at least the next 15 years, and therefore requires that that the views of all stakeholders are sought, fully understood and carefully considered before action is taken.

Without wishing to second-guess Comreg's means of addressing the problem described above, if it recognises that a problem exists at all, the submitter respectfully suggests that Comreg should actively review the proportion of industry and non-industry representation of the responses it receives to this consultation, and consider the consequent weight with which it attaches to those responses. It should also consider consulting further, in an effort to address the imbalance which I believe may occur.

Given the importance of the issue being considered, I would suggest and recommend that the Commission consider the possibility of adopting more accessible mechanisms to consult more widely with non-professional and non-industry stakeholders on this topic, possibly using an emailed multi-choice survey method regularly adopted by business and non-business organisations to research consumer views, or possibly using focus groups to elicit the views of a broader section of stakeholders.

I do appreciate that Comreg does have mechanisms in place to ensure it receives input from non-industry sources, such as the Consumer Advisory Panel, and also receives reports also from specific groups such as the Mobile Phone and Broadband Taskforce. However, the existence of these mechanisms should not reduce or negate the need to ensure that the particular issues being canvassed and addressed in this consultation are made as accessible as possible, and that the resulting views of non-industry stakeholders are given sufficient regard in coming to decisions.

In any case, the issues raised in this response are intended to be constructive, and not intended to diminish the important work of Comreg, nor its efforts to consult with stakeholders. I hope that this submission will help to provide balance to the Commission in coming to conclusions and making important decisions regarding the optimal plan to award frequency spectrum licences in Ireland to the benefit of all stakeholders.

3. Direct Response to Comreg's Overview of Key Proposals

The responses contained in this section directly address the numbered paragraphs set out in Comreg's Consultation document, contained in the "Overview of Key Proposals" section, and are in summary form. A more detailed response to Comreg's proposals that relate to *"Licence Conditions"* is provided in *Section 4* of this response.

Point 1: *Noted*

Point 2: *Noted*

Point 3: *Noted and fully agree with and support this proposal*

Point 4: *Noted and fully agree with and support this proposal*

Point 5: *Noted*

Point 6: *Noted and fully agree with Comreg's comments*

Point 7: *Noted and fully agree with and support this proposal*

Point 8: *Noted*

Point 9: *Noted and I do not agree with or support this proposal.*

I believe that the interests of Irish consumers, taxpayers and in particular, rural MBB users are best served by the adoption of an interventionist approach to coverage obligations, rather than the precautionary approach favoured by Comreg in its consultation document.

Point 10: *Noted and I do not agree with or support this proposal.*

I would strongly urge Comreg to set substantially higher minimum download speed targets than those set out in its consultation document. In order to demonstrate the practical workability of this approach, I would refer Comreg to the recent coverage and download speed obligations set by the Bundesnetzagetur in the recent awards process which successfully concluded recently in Germany. Among the licence conditions imposed on German bidders, the regulator required that licence holders must provide

".....coverage with a transmission rate of at least 100Mbit/s for at least 98% of households in each federal state by the end of 2022".

Further, I would recommend that Comreg's licence obligations include, as is the case in Germany, a minimum network latency target, measured in milliseconds, as an important measure of data download service quality, and would include challenging milestones by which licence holder should achieve each target.

This submission questions the use of population coverage percentage as the best method of setting and measuring minimum coverage obligations. Comreg's definition of population coverage leaves scope for various interpretations as to how the measure is actually calculated, and, in particular, the precise method of

determining actual population location. For this reason, and without full clarity of how population coverage is calculated, this submission recommends that either Eircode coverage or a combination of geographic coverage and Eircode coverage should be considered by Comreg as better alternatives to drive network coverage obligations.

Point 11: *Noted. I agree with and support this proposal with some reservations.*

Please also refer to Response to Point 9 above. An interventionist approach to download speeds and coverage obligations is considered by many telco regulators across the globe to be a critical component in ensuring that licence holders roll out services quickly, and that radio frequency spectrum is used efficiently and to the maximum benefit of users. The interests of users and MNOs are unlikely to coincide on this issue, and it is to be expected that MNO's would prefer to be free to rollout services and network coverage plans in a manner that suits their own operational and financial needs, rather than have these measures imposed on them externally.

A precautionary approach risks reinforcing a widely-held perception among Ireland's rural population that urban-dwellers are unfairly favoured and prioritised over rural communities whenever infrastructural services are being considered. A rapid roll-out of advanced mobile services to rural communities ahead of, or at least at the same time as roll-out to urban centres will be a significant contribution towards countering this perception. Aside from the social benefits, a challenging network and services roll-out timetable is also crucial from a national competitiveness viewpoint, helping to ensure that businesses and consumers enjoy the benefits of connectivity and new services within the earliest possible timeframe, ahead of, or at least as quickly as, those enjoyed in other countries.

While a balanced approach to this issue is of course required, a precautionary approach also risks allowing network equipment vendors and MNOs to push Ireland's roll-out of 5G services down their priority list. At a practical operational level, MNO's and equipment manufacturers that operate across many international markets are unable to deliver network equipment and services to all markets served simultaneously. In assessing the international priority with which each market will have new services rolled out, a key consideration will be the regulatory roll-out obligations which must be met in each market. Adopting a precautionary approach will almost certainly serve to encourage equipment manufacturers and MNOs to push Irish 5G networks down their order of priority list.

The evidence from international studies referred to in the Executive Summary of this submission demonstrates that Ireland lags far behind most developed nations in average mobile data download speeds, and is at or below the rural population coverage average of most nations in terms of our current 4G LTE coverage. This performance demonstrates that the dynamics of competition among licencees in Ireland is unlikely to address the quality of service deficit without significant intervention measures by Comreg.

Point 12: *Noted and I do not agree with or support this proposal*

Please also refer to Response to Point 11 above.

Comreg's consultation document offers no rational reasoning behind the view put forward that *"interventionalist obligations are ideally achieved via a sequential step in a spectrum award or through a separate process."* In my view, neither the regulator, the licence holders, or indeed any other stakeholders would benefit from the prospect of sequential changes to the licencees obligations following the award process, as this would only serve to create a degree of uncertainty for all stakeholders as to the precise benefits and obligations of the licence at the time of bidding for the frequency licence. This uncertainty could cause intending bidders to assign less value to the licence in light of the prospect of shifting or increasing licence obligations that may or may not arise over time. From an Irish taxpayers' and users' viewpoint, the likelihood that MNOs will accept new "sequential" obligations voluntarily once the licence agreement is in place is very low, and the imposition of new licence obligations post the award process is likely in any case to be too late to address a market failure once it occurs. From a contractual point of view, it seems unlikely that Comreg could unilaterally impose new conditions on a licence that has already been granted, and which would at best, be open to legal challenge.

It is also worth pointing out that Comreg has, to my knowledge, no record of engaging in post-award obligation changes to address deficits in quality of service performance, despite the evidence of significant deficits in the international comparisons cited above.

Point 13: *Noted*

Point 14: *Noted*

Point 15: *Noted and I support with this proposal subject to the coverage obligation relating to the deployment of a specific number of base stations being sufficiently challenging to ensure the efficient use of spectrum to deliver maximum coverage.*

Point 16: *Noted*

Point 17: *Noted and I support with this proposal subject to the coverage obligation relating to the deployment of a specific number of base stations being sufficiently challenging to ensure the efficient use of spectrum to deliver maximum coverage.*

Point 18: *Noted*

Point 19: *Noted and I support this proposal subject to the coverage obligation relating to the deployment of a specific number of base stations being sufficiently challenging to ensure the efficient use of spectrum to deliver maximum coverage.*

Point 20: Bullet Point 1: *I agree with and support this Proposal*

Bullet Point 2: *I agree with and support this Proposal*

Bullet Point 3: *I agree with and support this Proposal*

Bullet Point 4: *I agree with and support this Proposal*

4. Response to Proposals relating to Proposed Licence Conditions

I have set out below a summary of the reasons why Comreg should consider setting a challenging intervention level of coverage and download licence obligations on successful bidders in the forthcoming 700MHz award process.

4.1 The National Broadband Plan (NBP) and associated rollout schedule ***should not be used as a reason to deprioritise***, or to choose not to drive MBB coverage or pace of rollout, because:

(a) The NBP process is already well behind schedule and, given the delays that have already been encountered since it's inception in 2012, could well be delayed further from it's intended rollout schedule. The suggestion that Comreg might adopt a strategy that involves favoring a rural fixed fibre-based broadband solution to address rural broadband connectivity rather than simultaneously driving rapid MBB rollout, ***exposes rural communities to the risk that neither solution will deliver a satisfactory solution*** within a reasonable timeframe.

(b) Comreg has a statutory responsibility to ensure that Ireland's radio spectrum is used in an optimal manner, to deliver services to users in the most efficient manner possible. It could be argued that an approach that involved sub-optimising this responsibility in favor of a strategy that involves dovetailing the award and rollout of 5G networks with the Irish Government's NBP rollout is not compatible with Comreg's obligations in this regard.

(c) Furthermore, Comreg may need to ensure that its approach is compatible with EU State Aid and EU Competition Rules, since the adoption of a strategy that is perceived to be taking a less than optimal approach to the spectrum licence award, in an effort to avoid or discourage licencees from encroaching on the objectives of the NBP may be problematic. Irrespective of your views on this issue, ***a rapid rollout and coverage of both fixed and mobile high-speed broadband infrastructure is in the Irish rural consumers' best interests.***

While it is appreciated that this is a complicated issue, the question arises as to why it is that fixed high-speed rural broadband services require Government intervention in Ireland, while mobile high-speed rural broadband services do not, according to Comreg's preliminary view as set out in its consultation document? From a rural users' perspective, ***both*** technologies should be enabled and incentivized, partly because their use cases and applications are often different, and also because EU Competition Law is based on the premise that ***the consumer is best served by promoting fair competition between vendors offering different but competing solutions to the fullest extent possible.***

This implies that Comreg needs to consider not just the extent of competition between mobile operators, but between all operators offering high speed connectivity solutions, both fixed and mobile, and including those offering fixed wireless solutions. It seems logical that an interventionist approach by Comreg to the issue of network coverage and download speeds in the forthcoming awards

process best serves this objective, ***since this matches the approach taken in respect of fixed broadband services, and provides the best means of ensuring rapid delivery of high speed MBB services to all parts of the country,*** and not just those in urban and semi-urban areas.

(d) It is accepted by most experts that fibre broadband is currently the best solution for many user applications delivering high speed connectivity, low latency and good network reliability. However, there are also many rural high-speed broadband applications that are best delivered using a mobile network solution rather than fixed, such as applications in the farming, fishing, mining and forestry industries.

For example, the NBP solution, involving the predominant use of fiber to a fixed customer point, does not address the likely requirement among the estimated 56,000 farms within the NBP "intervention area" that require connectivity not just within the main farm building, but also across external farm buildings including milking parlours, grain and fodder stores, and, depending on the application, across the entire acreage of the farm. ***A public mobile network solution is likely to be far more effective in meeting a farm-wide solution than a fixed broadband solution***, which would likely require the user to invest in further private radio network infrastructure to propagate connectivity across all the farm building and land acreage. Similarly, many non-farm businesses located in rural areas (44,000 in the NBP intervention area) can uniquely benefit from a wide-area mobile network solution rather than a fixed network solution, including those engaged in transport and logistics, manufacturing and local utilities that require remote connectivity including, water, power and environmental services management.

(e) Many Irish rural businesses compete internationally, and require services not simply comparable with those available in Irish urban locations, but which match or compare favourably with MBB services available to its supply chain partners and competitors in other countries. Ireland is already behind a number of other European countries in rolling out 5G networks, with live 5G networks now launched in 26 countries so far this year (as of the submission date), and the priority in applying intervention coverage obligations should be less about ensuring coverage is eventually achieved, ***but in ensuring coverage and high download speeds are achieved within a short period of time***. The urgency with which rural high-speed broadband services are required is far more acute than the Comreg consultation document would appear to suggest, and more urgent than existing Irish MNOs are likely to acknowledge.

(f) In Section 8.86 of the consultation document, Comreg seeks to assess whether 30Mbit/s or 50Mbit/s is an appropriate download speed obligation, and concludes that 30Mbit/s is sufficient. This conclusion is at least partly reached based on DotEcon's assertion that

> *"mobile coverage obligations should not be seeking to replicate the speeds and consumer experience deliverable over fixed broadband..."*

Why not? DotEcon's assertion needs to be rigorously tested and analysed by Comreg, as this issue goes to the core of the formulation of its policies regarding

MBB in Ireland, ***and its acceptance or rejection will directly influence the consideration of issues addressed in this consultation.*** Since the mid-1980's, mobile network technologies have challenged and become a direct replacement for services that were traditionally delivered over fixed networks, progressively replacing fixed voice telephony services, messaging services, email download services, and more recently, data download and internet access services. Live video streaming and other data-intensive services are already gaining popularity over mobile networks using 4G LTE, and, while perhaps not quite matching the quality of fixed alternatives, ***will very likely meet and even exceed the fixed network experience with the launch and maturing of 5G services***.

The debate as to whether MBB will become a direct replacement to fixed broadband will likely not reach a clear conclusion for some years, but Comreg would be remiss in not seeking to ensure that the rollout of both technologies is developed and encouraged to their full potential. It is instructive to note that many voice users have abandoned fixed line telephone services in favor of the mobile alternative, not for quality of service reasons, but for reasons to do with convenience and the logic of purchasing bundled services including voice, voicemail, messaging and data as a package delivered by one provider to one device rather than two or more.

Despite the arguably higher quality and reliability of fixed line voice services compared to mobile, ***users have predominantly chosen mobile because it delivers an acceptable solution in both home and mobile scenarios***, and it makes more sense to use and pay for one service rather than two. According to the *Digital Economy and Society Index Report 2019 on Connectivity*[1] prepared for the European Commission, households using MBB alone to deliver their home broadband needs has grown rapidly over the past few years, and this trend is expected to continue. This trend is partly driven by the relatively high fixed rental element of both fixed and mobile services, which drives users to avoid paying multiple service providers for similar services. Fixed broadband providers may find they are swimming against the tide, with users deciding to choose to use one service for both mobile and home broadband requirements, ***even if the standalone fixed broadband solution is superior in terms of download speeds and reliability***.

(g) The consultant reports provide useful analysis in weighing up the costs and implications of an interventionist approach to drive coverage and download speeds, yet ultimately reach overly pessimistic conclusions in their estimates of the ability and incremental cost to operators of delivering higher coverage rates and download speeds. I believe some of the reports suffer from an analysis approach that is somewhat retrospective rather than forward looking, and often fail to recognise all of the of potential for improved coverage and download speeds that are possible using available new technologies which are both 5G and non - 5G related.

(h) The report prepared by Oxera, entitled *"Future Mobile Connectivity in Ireland"* while thought-provoking and interesting in exploring current trends, should, in my view, be treated with some caution as a reliable predictor of future usage of mobile services in Ireland by Comreg. The primary research methodology of the study, as set out in Section 3.2 of Oxera's report, appears to be confined to interviews with Irish MNOs and equipment vendors, and does not include any surveys of likely end-user demand. The industry players interviewed, while undoubtedly very knowledgeable about the markets in which they serve, are not the users of services that will ultimately determine how the market develops.

(i) Of even greater concern, the Oxera Report methodology describes its use of *".....comparisons with demand patterns in other countries (provided similar services have been launched)."* But the services that are being considered and planned for in Comreg's consultation document are services that will almost certainly use 5G technologies and standards, none of which had been launched commercially in any country prior to the publication date of the Oxera Report. For this reason, it's difficult to see how demand patterns from other countries could usefully be applied by Comreg in coming to conclusions regarding the forthcoming spectrum awards, ***since the services that would generate these demand patterns does not yet exist.***

(j) Although the Oxera modelling exercise takes account of the use of Carrier Aggregation in coming to its conclusions, it does not detail the extent to which it assumes Carrier Aggregation is deployed in its model by the MNOs. ***This is a critical issue in coming to conclusions about the future download speed capability of Irish MNOs.*** While Carrier Aggregation might not always be a practical solution in more densely populated areas, Ireland's rural population characteristics actually provide a relative advantage to MNOs operating in Ireland in deploying both two-band and three-band Carrier Aggregation, since the relatively low population density and therefore consequent number of users contending for channels in each cell area in rural areas of Ireland is less, and therefore the number of channels available to deploy three-band Carrier Aggregation is greater than would otherwise be the case.

(k) The network cost conclusions reached using the synthetic mobile network model adopted by Oxera appear to depend significantly on assumptions about the Macrosite Height per Geotype Area. The report authors acknowledge that these assumptions are based on estimates, and not based on height information from real deployments in the Irish licensed data. These height assumptions require close scrutiny by Comreg in assessing the reliability of the study findings, as they may not match existing actual macrosite heights used in the transmission networks of Irish MNOs, nor bear any relationship to actual Irish topographical data. For example, the assumption built into the Oxera model that the average height of rural macrosites in Ireland is lower than those sited in urban locations, although possible, seems unlikely given Irish planning restrictions on urban building height, and the topographical features of rural Ireland, where hilltop macrosites are commonly located.

(l) The Oxera study also appears not to consider the impending availability to MNOs of technologies that are closely related, if not fully part to the 5G standard, such as improved antenna and beam-forming technologies that are particularly designed to improve coverage in rural scenarios. Nor does it consider other technical developments that form part of 5G, such as the emergence of new small cell antenna solutions that are designed to assist operators in overcoming local authority planning compliance. In addition, the recent emergence of fixed wireless broadband solutions as a complimentary solution to deliver high speed rural broadband should be considered by Comreg as a further complimentary tool towards allowing MNOs to deliver on their coverage obligations. Incumbent MNOs have already commenced using fixed wireless solutions as an integral part of their network offering in other countries, and this trend is likely to help MNOs to achieve coverage and high-speed connectivity in otherwise difficult to reach rural locations.

(m) Although referred to in passing, but not apparently factored into Oxera's model, is the fact that the use of the 700MHz band brings with it a further benefit – its propagation characteristics are inherently an improvement over those of the 800MHz and 900MHz bands, and dramatically better than those currently in use in the 1800MHz and 2100MHz bands. Although difficult to quantify, this improvement should, on its own, lead Comreg to the conclusion that operators will have an enhanced capability to improve rural network coverage using the 700MHz band.

(n) The fact that all three incumbent MNOs already use the 800MHz and 900MHz bands, as well as the mid-band frequencies to achieve high coverage levels, leads to the obvious conclusion that the addition of a further even lower band provides incumbent MNOs with a combination of frequencies that allows for an even higher degree of coverage by re-engineering and repurposing their existing frequency use. From a coverage capability viewpoint, the benefit for MNOs in adding the 700MHz band to an existing "stock" of current-use frequencies is not simply incremental, ***but can have a compounding effect if engineered correctly***.

(o) None of the reports commissioned by Comreg appear to adequately consider the strategic and competitive issues facing MNOs in formulating their approach to the forthcoming spectrum awards process, other than the basic financial and economic considerations. ***Mobile operators and their shareholders, like most businesses, have a range of issues to consider in deciding on their business strategy, some of which are not captured by a straight economic analysis.***

This is best exemplified by studying the outcome of the recent German 5G spectrum award process, where higher than expected bids were made by the incumbent MNOs, despite the inclusion of very demanding licence obligations, which included 98% household coverage nationally within three years, and a commitment to deliver a 100M/bits download speed capability. Despite the very high bids, totalling €6.5Bn, all of the successful bidders subsequently complained about both the licence obligations and the cost of the licences. The bidding process was entered into by each bidder voluntary, and the minimum coverage and download licence obligations were known by each in advance. Although each bidder could have chosen not to bid, or to bid less than they did, the bidders chose to bid the amounts they did.

While it remains to be seen whether the bidders have overpaid for the spectrum licences, there are clearly a number of underlying factors at work in driving experienced MNOs to not only accept the challenging licence obligations and yet bid higher than predicted amounts to secure the licences. Mobile network operators, liken most organizations, are certainly driven by financial and economic considerations, but also need to ensure that their business model for growth and competitiveness remains intact and sustainable, and a mobile operator that has already invested heavily in previous generations of infrastructure, intellectual property and customer acquisition cannot easily decide to change or abandon its course.

These previous investments, while still very valuable, are largely sunk investments, meaning that they cannot be easily realized if the business decides not to continue to grow into the future. ***A mobile network operator without radio spectrum availability into the future risks its sunk investments becoming stranded investments.*** Consequently, this submission strongly recommends that Comreg takes into account the fact that the business case for an incumbent MNO to invest in new spectrum does not just involve the economics of an investment relative to its associated return, as analysed by the various reports commissioned by Comreg, but also involves other important MNO considerations aimed at protecting and continuing to extract returns from all previous investments, often expressed as goodwill, stretching back in time to the acquisition of its first customer.

Comreg, in representing the interests of both Irish consumers and the Irish State, both of whom have a keen interest in ensuring Ireland is at the forefront of international connectivity, now has a once off opportunity to ensure that the forthcoming spectrum licence award process is designed in a way that delivers tangible MBB quality of service results for Irish business and consumers over the next 15 years. I hope and trust that the Commission will deliver on this task.

[redacted]

7th August, 2019

ENDS

From: [redacted]
To: NBP Mapping
Subject: Consultation on Conclusion of the NBP Mapping Exercise for the Intervention Area [redacted] Submission
Date: 20 September 2019 12:00:05

Thank you for the receipt acknowledgement.
I noticed that my contact details were omitted on my previous email, so now include them below.
Yours sincerely,

[redacted]

==========

[redacted]

==========

From: NBP Mapping
Sent: 20 September 2019 10:14
[redacted]
Subject: National Broadband Plan

Thank you for your response to the Department of Communications, Climate Action & Environment's public consultation, "National Broadband Plan - Conclusion of the Mapping Exercise for the Intervention Area".

Please note that this mailbox is for submissions to the consultation only. If you have a general query on the National Broadband Plan map or any other query, please use the following email address *broadband@dccae.gov.ie*

From: NBP Mapping
To: [redacted] NBP Mapping
Cc: [redacted]
Subject: RE: Consultation on Conclusion of the NBP Mapping Exercise for the Intervention Area
Date: 20 September 2019 15:04:40

[redacted],

Thank you for your response to the Department of Communications, Climate Action & Environment's public consultation, "National Broadband Plan - Conclusion of the Mapping Exercise for the Intervention Area". The NBP Mapping Team can confirm your email was received on 20 September 2019 at 10:09

Regards

NBP Mapping Team

From: [redacted]
Sent: 20 September 2019 10:09
To: NBP Mapping
Cc: [redacted]
Subject: Consultation on Conclusion of the NBP Mapping Exercise for the Intervention Area

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe

For the Attention of:

[redacted]

National Broadband Plan Division

Department of Communications, Climate Action & Environment

29-31 Adelaide Road

Dublin 2

Ireland

[redacted]

Please find attached a submission to the recent Consultation Document issued by the Department.

I would appreciate if you would acknowledge receipt of this submission to [redacted].

My contact details are shown below.

Yours sincerely,

[redacted]

From: [redacted]
To: NBP Mapping
Subject: [redacted]
Date: 23 September 2019 15:15:39

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

[redacted]

Begin forwarded message:

From: [redacted]

[redacted]

Thank you for your enquiry about [redacted]

Unfortunately you are currently outside of range for our Wireless service and Fibre has not yet been enabled in your area so we are unable to provide you with service at this time.

We will hold your details on file and keep you updated on any coverage progression.

[redacted]

From: [redacted]
To: [illegible]
Cc: [redacted]
Subject: Submission re Conclusion of the NBP Mapping Exercise for the Intervention Area
Date: 19 September 2018 [illegible]
Attachments: image001.png

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hi
Fibre to the home is available in my local village of [redacted] but for some reason a number of houses can not avail of this.
Please see the map attached where you can see that my house is [redacted] in amongst a pool of houses that can avail of fibre to the home but somehow a number of houses can not.
And yet there are more houses past ours, up hills and small roads that can avail.
And there is nobody to speak to within EI that can explain their commercial decision as to why these small pockets of houses can not receive fibre.
Many Thanks
[redacted]

From: [redacted]
To: NBP Mapping
Subject: Quality of broadband received
Date: 20 September 2019 16:44:02

To whom it concerns,

I live at [redacted]
The quality and throughput of my broadband is well below the 30Mbps which is NGA and I request that our house and street/road is added to the intervention area which will be served by the NBP..

Regards

[redacted]