Overview of Methodology for Estimating SIRO and Virgin Media market shares and network coverage within Eircom Exchange Area boundaries

Tranche 3:
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1 Context

As part of the analysis of Markets 3 (a) and 3 (b), the Wholesale Local Access ('WLA') and Wholesale Central Access ('WCA') markets respectively[1], the Commission for Communications Regulation ("ComReg") published a public consultation seeking the views of interested parties on 11th November 2016.[2]

ComReg's preliminary view was that there are differences in competitive conditions within the WCA market between urban and rural markets, and outlined a geographic assessment to determine the scope of each of the relevant WCA markets. ComReg takes as the basis of its analysis Eircom's Exchange areas as the appropriate geographic unit, and determines which exchange areas fall into each of the relevant markets taking into account a list of cumulative criteria. These criteria relate, among other issues, to operators' market shares and network presence within an Eircom Exchange area. This study enables ComReg to assess operators' network coverage and their market shares.

The Irish telecoms landscape includes several operators who compete in the wholesale and retail markets using:

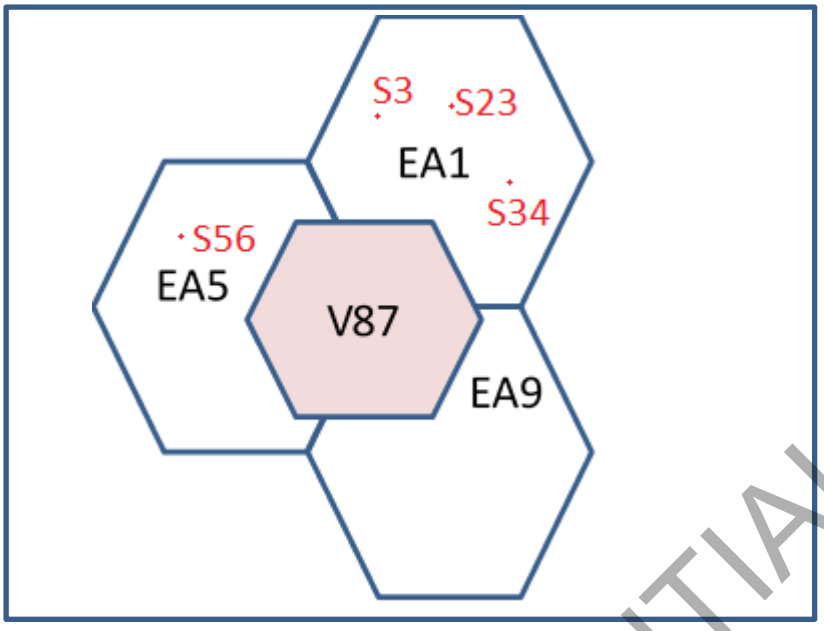
- Their own infrastructure (i.e. Eircom, SIRO, Virgin Media);
- Wholesale inputs provided by another operator (e.g. BT Ireland); or
- A combination of both (e.g. Vodafone).

The purpose of the study is to enable ComReg to estimate the network coverage of each network operator in the relevant Eircom exchange area. In addition, the study enables ComReg to estimate the market shares of relevant operators (Eircom, SIRO, Virgin Media, BT and Vodafone) in each exchange area.

As the network architecture and layout used by Virgin Media and SIRO does not align with the infrastructure and/or network topology used by Eircom, aligning all broadband subscribers (for the purposes of considering shares within a particular Exchange area) to Eircom's Exchange areas is complex[3]. The diagram below (Figure 1) shows the networks of Eircom, Virgin Media and SIRO schematically. EA1, EA5 and EA9 are Eircom exchange areas, S3, S23…are SIRO addresses and V87 is a Virgin Media node.

[1] European Commission Recommendation of 9 October 2014 on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation (the '**2014 Recommendation**').
[2] See ComReg Consultation Document No. 16/96.
[3] BT and Vodafone use Eircom inputs; their networks have the same topography as Eircom.

Figure 1 : Illustration of Mapping Virgin Media and SIRO to Eircom Exchange Areas



ComReg has obtained network mapping information (e.g. Polygon AutoCAD map files, XY coordinates and details of each network node and associated subscriber connections) from the relevant operators and seeks to determine what network nodes (and associated subscriber connections) for each operator fall within each Eircom Exchange area i.e. to overlay non-Eircom operator network topologies and associated subscribers over the Eircom Exchange area network topology for the purpose of calculating overall operator market shares and network coverage within each Eircom Exchange area.

ComReg engaged TERA Consultants and Geocible to map

- the network nodes and associated subscriber connections of Virgin Media
- the SIRO addresses

onto a map of Eircom's network.

The output of this analysis allows ComReg to determine the market share and network coverage of operators within each Eircom Exchange Area. Subscriber numbers (active lines) are used to determine the market share, while connections (both active and inactive) are used to determine network coverage.[4]

The mapping exercise involves the following tasks:

- Data collection: input data and maps have been received;
- Data validation;
- Data cleansing;
- Computation of SQL spatial queries;
- Deliverable production.

To estimate network coverage of Virgin Media: the counts of their connections (active and inactive) is estimated in each exchange area; this enables ComReg to estimate the coverage as a percentage of the number of addresses in each exchange area.

[4] In other words, total number of addresses that can be served.

To estimate network coverage of SIRO, each SIRO premise is located in each appropriate exchange area.

To assess market shares, the active connections of Eircom, SIRO, Virgin Media, BT and Vodafone are considered by ComReg; this study provides the estimates of the number of SIRO and Virgin Media active connections in each exchange area.

The purpose of this report is to give an overview of the methodology applied in undertaking each of the tasks above.

This mapping exercise had been undertaken twice for each operator:

- Tranche 1: Spring 2017;
- Tranche 2: Summer 2017.

The new estimation of market share is therefore the third estimation.

The method is unchanged concerning Virgin Media.

In 2017, the method concerning SIRO was similar to the one of Virgin Media.
In this tranche it is based on the count of addresses inside Eircom Areas.

2 Estimation Process

2.1 Virgin Media

The process used to estimate network coverage is outlined below.

Assume for illustrative purposes:

- Eircom exchange areas EA1, EA5 and EA9 (see Figure 1). Each has 1,000 addresses and an area of 100 km²;
- Eircom, BT and Vodafone have a total of 850 active connections in EA1;
- Virgin Media polygon V87 has 600 connected lines (active and inactive) of which 300 are active and an area of 30 km²
- V87 overlaps each of EA1, EA5 and EA9 by 33%.

This leads to the area of intersection between Virgin Media and EA5 (EA5 ∩ V87) amounting to 10 km² (30 * 33%)

Assume connected lines are evenly distributed throughout the polygon, so that:

Connected Lines in intersection =
Connected Lines in operator's polygon * Area of overlap/Area of operator's polygon

Therefore, Virgin Media connected lines in intersection (EA5 ∩ V87) = 600*10/30 = 200, and we can estimate Virgin network coverage as Virgin Media connected lines/addresses

- Virgin Media network coverage in EA5 = 200/1,000 = 20%[5]

Similarly

[5] Note that the calculations of market share and network coverage are carried out by ComReg

Active lines in intersection =
Active lines in operator's polygon * Area of overlap/Area of operator's polygon

- Virgin Media active lines in intersection (EA5 ∩ V87) = *300*10/30 = 100*

To estimate market share, Virgin Media active lines as a percentage of all active lines (in this case Eircom, BT, Vodafone and Virgin Media lines) are calculated, so that:
Virgin Media market share = 100 / (850+ 100) =10.5%[6].

To summarise, the study estimates the number of Virgin Media connections and active lines for each Eircom exchange area. With this information, combined with other data from Eircom, Vodafone, BT and Eircode[7], ComReg can estimate network coverage and market share by exchange area.

2.2 SIRO

This time, SIRO has not provided clusters but geocoded addresses data.
Thus, estimating connected or active lines in Eircom Exchange is by counting SIRO addresses inside the Eircom Exchange using spatial queries

3 Source files

Geocible has received a number of files from ComReg:

- a list of [✂ [redacted]] SIRO geocoded addresses from SIRO with eligibility status (Excel file)
  - connected active,
  - connected inactive,
  - passed
- a map (AutoCAD format) of [✂ [redacted]] Virgin Media polygons with codes
- a list of codes (Excel file) with Available BB split into
  - Active BB
  - Non-Active BB
- a map of [✂ [redacted]] Eircom Exchanges (format = shape files). This map has been obtained from EIRCOM by ComReg and corrected by Geocible during previous tranches (see Tranche 1 and Tranche 2 documentation)
- 2017 Q3 EIRCODE database and documentation. In this database, tables exist that describe 1,918,047 buildings in Ireland with
  - coordinates,
  - residential, non-residential and mixed address points
  - residential, non-residential and mixed postal addresses

[6] Note that the calculations of market share and network coverage are carried out by ComReg
[7] No. of addresses provided by Eircode

4 Preliminary tasks performed on input data

This section describes the preliminary data processing undertaken in order to validate and cleanse the data. Data processing for Tranche 3 were very similar to the one of Tranche 1 and Tranche 2 (same problems, same corrections).

4.1 Eircom

The Eircom Map data had already been cleansed during Tranche 2.

As a reminder, here are the corrections that had been applied:

- Holes: there were some gaps in the map ("holes") where the area had not been assigned to a polygon. These "Holes" in the map have been filled

- Error in projection: a difference of approximatively 30 meters existed between the map provided and reality. The map has been globally moved by 30m towards the North-West in order to be aligned with the road network.

- Overlapping polygons: some overlaps between the polygons (where an area was included in two polygons) existed and were corrected.

Every modification has been validated by EIRCOM[8].

[8] Eircom was asked to confirm the accuracy of the mapping. [✂]

Figure 2 : Map of Eircom Exchanges

4.2 Virgin Media

The corrections of Virgin Media Map and Data were very similar to the one of Tranche 2.

Geocible verified that:

- the correspondence between data and map was perfect (same number of records, same codes);
- the map had no overlaps;
- the data were coherent (no negative values, active + inactive = total…);
- the polygons were correctly positioned on map;
- the codes (text objects) could be attributed to polygons (AutoCAD files have no attributes and the code of a polygon is an object containing a text;
- the distance between a point (data file) and the corresponding polygon (map) was not too high.

Some issues had to be resolved in collaboration with Virgin Media.
The third version of files and data was perfect.

Figure 3 : Map of Virgin Media Areas

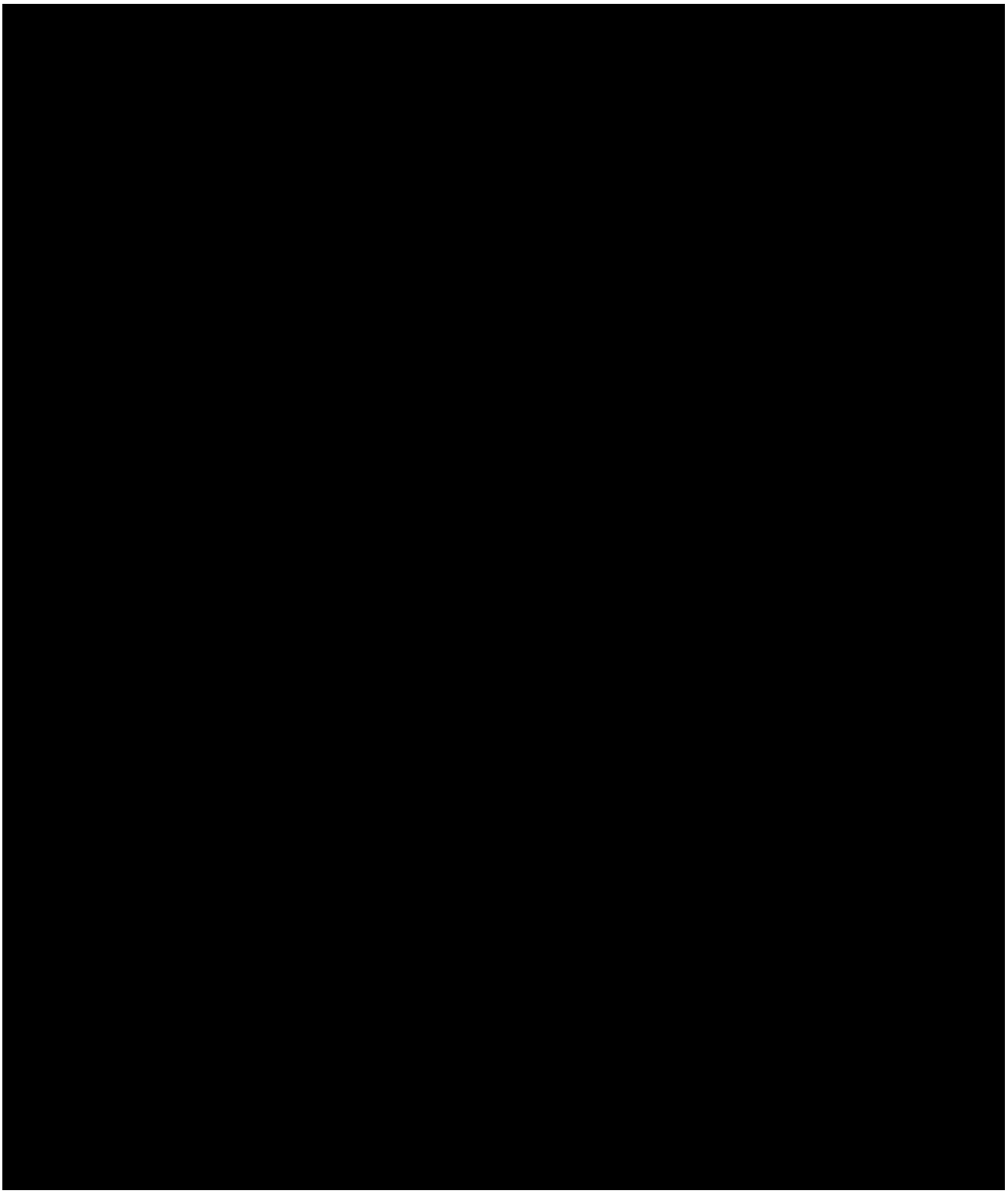
4.3 SIRO

SIRO sent a file containing addresses.
Geocible confirmed that:

- each address was correctly geocoded
  - near roads;
  - not outside Ireland;
  - alignment between an address and a building in EIRCODE Database.

- Eligibility status was correctly filled.

Figure 3 *:* Map of SIRO Areas



5 Computing intersections

5.1 Virgin Media

The estimation of counts at the Eircom exchange level is based on this formula:

$$\textit{Active lines (E)} = \sum_i^n Active\ lines(P)\ x\ Area(P \cap E)/Area(P)$$

Where:
Active lines (E) is an estimation of the number of active lines inside the Eircom exchange area (E)
Active lines (P) is the number of active lines inside the polygon(s) provided by operator.

Assume that the active lines inside P are uniformly distributed. Thus, the number of active lines in P that are also in E is proportional to the area of the intersection of P and E.

$$\text{Active lines } (P)\ x\ Area(P \cap E)/Area(P)$$

In order to obtain the estimate concerning all of E, all contributions from every polygon or POP "P" are added.
Note that the assumption that the active lines inside P are uniformly distributed is a strong assumption, but this is the only one that allows the calculation of the intersection. In general, the smaller the POPs, the more accurate the assumption will be.

For Virgin Media, on one side, and Eircom on other side, a SQL spatial query is computed that provides this result:

- Code of operator's polygon,
- Area of operator's polygon,
- Code of Eircom polygon,
- Area of Eircom polygon,
- Area of Intersection.

5.2 SIRO

For each EIRCOM Exchange, SIRO addresses have been counted and corresponding active or inactive accounts have been summed.

5.3 EIRCODE

EIRCODE counts have also been computed in EIRCOM Exchanges.
Similarly to SIRO, buildings have been counted inside each EIRCOM area and corresponding Address points and postal addresses have been summed.

6 Deliverable structure

The final output is a spreadsheet with the following structure:

Eircom	**Code**	
	Name	
	Ipid	
	Area (m²)	
Eircode	**Buildings**	
	Address points	**Total**
		Residential
		Non residential
		Mixed
	Postal addresses	**Total**
		Residential
		Non residential
		Mixed
Siro addresses	**Total**	
	Connected	**Active**
		Inactive
	Passed	
Virgin Media connected accounts	**Area (m²)**	
	Total	
	Active	
	Non Active	

Therefore the output of the study enables ComReg to estimate the network coverage of Virgin Media and SIRO within each Eircom exchange area boundary. It also enables ComReg to estimate the market shares of Eircom, Virgin Media, SIRO, Vodafone and BT within each Eircom exchange area boundary.