Commission for
Communications Regulation

Mobile Termination Rates:

Draft Bottom Up Pure Long Run Incremental Cost Model

Information Notice

Reference: ComReg 14/55

Version: Final

Date: 30/05/2014

An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation
Abbey Court Irish Life Centre Lower Abbey Street Dublin 1 Ireland
Telephone +353 1 804 9600 Fax +353 1 804 9680 Email info@comreg.ie Web www.comreg.ie

Content

Section **Page**

1 Introduction

Bilateral meeting with Vodafone

1. This Information Notice relates to mobile termination rates ('**MTRs'**). Following a request for a meeting from Vodafone Ireland Limited ('**Vodafone**'), the Commission for Communications Regulation ('**ComReg**') agreed to meet with Vodafone on 21 May 2014 in order to respond to the Vodafone list of queries. ComReg's consultants, Deloitte LLP, also participated in the meeting via teleconference.

2. This Information Notice details:

    a. the list of queries raised by Vodafone on ComReg's Draft Mobile Termination Rate Bottom Up Pure Long Run Incremental Cost Model ('**Draft BU Pure LRIC Model**') which was provided to the mobile service providers ('**MSPs**') designated with significant market power ('**SMP**'). A copy of the non confidential Draft BU Pure LRIC Model was also provided to BT Ireland[1].

    b. the responses by ComReg and its advisors to the queries raised by Vodafone on ComReg's Draft BU Pure LRIC Model.

3. In the interests of openness, transparency and to ensure that all interested parties have sufficient time to consider the information included in this Information Notice, ComReg has today extended the deadline for the submission of responses to Consultation Document No 14/29 "*Mobile Termination Rates: Draft Bottom Up Pure Long Run Incremental Cost Model*"[2] ('MTR Consultation') to 5pm on Friday 20 June 2014[3].

[1] ComReg Document No 14/50: Mobile Termination Rates: Draft Bottom Up Pure Long Run Incremental Cost Model; published on 23 May 2014 at the following link http://www.comreg.ie/_fileupload/publications/ComReg1450.pdf

[2] ComReg Document No 14/29: Mobile Termination Rates: Draft Bottom Up Pure Long Run Incremental Cost Model; published on 11 April 2014 at the following link http://www.comreg.ie/_fileupload/publications/ComReg1429.pdf ('**MTR Consultation**')

[3] The consultation period was previously extended in ComReg Document No 14/40: Mobile Termination Rates: Draft Bottom Up Pure Long Run Incremental Cost Model – ComReg grants extension to consultation period for ComReg Document 14/29; published on 1 May 2014 at the following link http://www.comreg.ie/_fileupload/publications/ComReg1440.pdf ('**MTR Information Notice**')

2 Queries raised by Vodafone on ComReg's Draft Pure LRIC Model

No	Model module	Reference to model	Questions for Deloitte
1	Load	d1. Demand, d2. Forecast	Traffic profile informed by data returns from operators (p.23). What calculations where used to arrive at the numbers in the model used as inputs?
2	Load	c4.CFs	Based on simple sensitivity testing the conversion factor calculation seems to produce counter-intuitive results. Can you please explain the calculations in detail?
3	Network	d7. MER	Minimum Element Requirements (MER) calculations, TX assumption underlying calculations?
4	Network	c1. Ran	Please explain in detail the calculations of 2g and 3G site numbers on the Network sheet In 3G Logic of AI HSPA carriers.
5	Network	d3. RAN parameters	The interplay of cell radius, reuse factor and spectrum allocation assumptions is not clear. Can you please explain calculations in the model.
6	Network	D3 RAN parameters	Co-location logic : % of sites equipped for 1800MHz, % of 1800MHz cells collocated with 900HMz cells
7	Network	d3. RAN parameters	How are RAN assumptions normalised based on operators inputs
8	Network	d3. RAN parameters	900MHz: Required number of TRXs per cell : eg cell H129 - why are number of TRX not rounded up
9	Network	c1. Ran, Rows 84	Explain RAN ratio assumptions and related calculations
10	Network	c1. Ran eg H329	Please explain step by step the 3G RAN calculations and formula use (see below) IF(INDEX('d3.RAN parameters'!H$117:H$121,MATCH($E329,'d3.RAN parameters'!$E$117:$E$121,0))=1,MIN(IFERROR((((($E329*'d3.RAN parameters'!H$133/('d3.RAN parameters'!H$142^('d3.RAN parameters'!H$132/'d3.RAN parameters'!H$142))/'d3.RAN parameters'!H$136/(1-'d3.RAN parameters'!H$137+'d3.RAN parameters'!H$138)*'d3.RAN parameters'!H$144*(1-'d3.RAN parameters'!H$135)*(1-'d3.RAN parameters'!H$134)/(1+'d3.RAN parameters'!H$139))/1000)*H$324*INDEX(c1.RAN!H$289:H$291,MATCH($C$329,c1.RAN!$E$289:$E$291,0))/('d3.RAN parameters'!H$27*INDEX(c1.RAN!H$320:H$322,MATCH($C$329,c1.RAN!$E$320:$E$322,0))))^0.5,INDEX(H$304:H$306,MATCH($C$329,$E$304:$E$306,0))),INDEX(H$304:H$306,MATCH($C$329,$E$304:$E$306,0))),0)
11	Costs	c1. Pure LRIC	TBD: Economic depreciation calculations. There seems to be something off, however, we are still reviewing the details.
12	General		Where is the average unit cost breakdown used in the Draft BU Pure LRIC Model calculated?
13	General		Further to ComReg's information note 14/46 para 2 to outline what anonymised parameters if any lie outside of the range of values submitted by operators and an indication of the extent of the deviation

3 ComReg Response to Vodafone Queries listed in Section 2

Question 1:

No	Model module	Reference to model	Questions for Deloitte
1	Load	d1. Demand, d2. Forecast	Traffic profile informed by data returns from operators (p.23). What calculations where used to arrive at the numbers in the model used as inputs?

4. The traffic profile input data used to derive the on-net/off-net ratio coefficient was sourced from operator data returns on per subscriber usage per service. This information is not available in data published in ComReg's Quarterly Key Data Reports. Therefore, it is not considered appropriate to share the underlying calculations due to the confidentiality of data used.

5. The specification of the calculation, as presented in section 4.1.2 of the Deloitte Draft BU Pure LRIC Model Specification Document[4], applies the Ordinary Least Squares ('**OLS**') estimator. The coefficient is statistically significant at the 1% level and has an R^2 of 0.74, which is a measure of goodness of fit of an estimator, i.e. how well the equation reflects the underlying data.

6. 2G/3G service splits are based on a range informed by technology migration forecasts provided by operators and those assumed in other European Union ('**EU**') National Regulatory Authorities ('**NRA**') models.

Question 2:

No	Model module	Reference to model	Questions for Deloitte
2	Load	c4.CFs	Based on simple sensitivity testing the conversion factor calculation seems to produce counter-intuitive results. Can you please explain the calculations in detail?

7. As presented in section 4.3.2 of the Deloitte Draft BU Pure LRIC Model Specification Document, 2G load is calculated and used in the dimensioning of 2G Radio Access Network ('RAN') elements, on the basis of Erlangs. In contrast, 3G load is calculated units of MB/s.

[4] ComReg Document No 14/29a Deloitte: MTR Model Specification Document for Ireland – A Report for ComReg ('**Deloitte Model Specification Document**'), published at the following link: http://www.comreg.ie/_fileupload/publications/ComReg1429a.pdf

8. As a consequence, a 2G BH voice minute, regardless of the defined bitrate, will be defined to contribute 1/60 Erlang ('**E'**) to the 2G RAN. Changing the 2G voice bitrate parameter in the Draft BU Pure LRIC Model will therefore not have the effect assumed by Vodafone, of increasing the over-the-air load of 2G voice demand, but will instead impact on the conversion factor applied to traffic such as 2G data, as measured in E. A change to the relative conversion factor such as this, may then lead to a change in the relative network load, used to dimension elements, and the apportionment of the cost of these elements to services.

Question 3:

No	Model module	Reference to model	Questions for Deloitte
3	Network	d7. MER	MER calculations, TX assumption underlying calculations

9. For clarification, it is confirmed that that multiprotocol label switching ('**MPLS**') and cross-connect costs are contained in the indirect cost mark-ups. Element descriptions may be reviewed in the documentation of the final BU Pure LRIC Model as a result of the consultation process.

Question 4:

No	Model module	Reference to model	Questions for Deloitte
4	Network	c1. Ran	Please explain in detail the calculations of 2g and 3G site numbers on the Network sheet In 3G Logic of AI HSPA carriers.

10. Please see sections 5.3.1.2 and 5.3.1.4 of the Deloitte Draft BU Pure LRIC Model Specification Document for 2G and 3G respectively.

11. The network is assumed to consist of a number of radio sites. Within the Draft BU Pure LRIC Model, cells are assumed to be hexagonal. Each site is assumed to provide omni directional coverage (i.e. 360^{o} coverage around the cell centre) or 3 sector coverage (i.e. 3 x 120^{o} arcs of coverage around the cell centre). The number and size of the equipment depends on the coverage area of the cell and the required level of traffic within the cell.

12. To calculate the required number of cells, the Draft BU Pure LRIC Model determines the number and type of cells required to carry the traffic load. It does this separately for the different geo-types i.e. urban, suburban and rural areas and for different frequency bands.

13. The cell radius is calculated using the following formula, also presented in equation 16 of the Deloitte Draft BU Pure LRIC Model Specification Document:

14. $$\text{Cell radius} = \left(\frac{T_C}{2.6\ T_D} \right)^{0.5}$$

where:

a. TC = the traffic capacity within that particular cell (as defined by the available spectrum, the re-use factor and traffic loading)

b. TD is the traffic density within the area served by that cell (i.e. the total traffic in the geo-type area divided by the illuminated area)

15. The calculated cell radius is constrained to be within a maximum and minimum range, where the maximum range is set primarily by propagation characteristics for the given frequency band and the minimum range is set by interference limits.

16. From the cell radii and the total illuminated area, the Deloitte Draft BU Pure LRIC Model Specification Document calculates the required number of cells and from the proportion of omni and sectorised sites it then calculates the number of sites. The number of cells takes into account the cell tessellation factor (e.g. cell overlap, non-idealised shaped cells etc).

17. The required number of radios per cell is determined from the traffic per cell, the grade of service, and the traffic carrying capability per radio. This number is compared to the maximum available number of spectrum channels per site as determined from the available overall spectrum and the re-use pattern to ensure that this does not exceed the available spectrum.

Question 5:

No	Model module	Reference to model	Questions for Deloitte
5	Network	d3. RAN parameters	The interplay of cell radius, reuse factor and spectrum allocation assumptions is not clear. Can you please explain calculations in the model.

18. The Draft BU Pure LRIC Model uses the assumed spectrum allocation divided by the re-use factor (applicable to 2G, set to unity for 3G) to determine the available spectrum per cell (see page 37 of the Deloitte Draft BU Pure LRIC Model Specification Document).

19. For the cell radius calculation please see the answer to question 4.

Question 6:

No	Model module	Reference to model	Questions for Deloitte
6	Network	D3 RAN parameters	Co-location logic : % of sites equipped for 1800MHz, % of 1800MHz cells collocated with 900HMz cells

20. The calculation of the number of collocated sites is as given by equation 18 in section 5.3.1.2 of the Deloitte Draft BU Pure LRIC Model Specification Document.

21. The proportion of sites equipped with 900MHz and 1800MHz cells, and the proportion of sites equipped with 1800MHz cells are determined based on operator data returns on the proportionate breakdown of sites, by technology configuration. This will be reviewed as part of operators' submissions to the MTR Consultation and ultimately as part of ComReg's Response to Consultation and Final Decision.

22. It is also confirmed that equation 9 of the Deloitte Draft BU Pure LRIC Model Specification Document accurately reflects the calculation methodology used.

Question 7:

No	Model module	Reference to model	Questions for Deloitte
7	Network	d3. RAN parameters	How are RAN assumptions normalised based on operators inputs

23. It is confirmed that that the referenced value is the maximum value provided by an operator and is used in conjunction with paired information associated with 2G RAN dimensioning.

Question 8:

No	Model module	Reference to model	Questions for Deloitte
8	Network	d3. RAN parameters	900MHz: Required number of TRXs per cell : eg cell H129 - why are number of TRX not rounded up

24. The model is not calculating the TRX requirements for individual cells, but is working out the average number of TRXs across all the cells within a given geo-type and frequency band to support a busy hour load across the whole of the served area. Uplifts are also applied, for example, to account for imperfect cell tessellation, cell specific loading factors, realistic TRX utilisation, busy hour peaks etc. In these circumstances we consider it appropriate to use non-integer average values. However we recognise that where the calculated average is less than one then it could be appropriate to set this to a minimum value of one. This will be considered together with all the other points made by respondents in ComReg's Response to Consultation and Final Decision phase[5]. In 3G, the values are rounded up since the numbers of radios are very much smaller (eg assuming that only a maximum of 3 x 5MHz channels are available). Nevertheless a similar approach could also be adopted in the equivalent 3G calculation.

Question 9:

No	Model module	Reference to model	Questions for Deloitte
9	Network	c1. Ran, Rows 84	Explain RAN ratio assumptions and related calculations

25. The route factored 2G busy hour voice and data load is determined, by geo-type, in busy hour E. The 2G BH traffic load is apportioned to 900MHz or 1800MHz spectrum on the basis of the spectrum holding and the proportion of sites equipped with 1800MHz. The calculation is given by equation 14 in section 5.3.1.2 of the Deloitte Draft BU Pure LRIC Model Specification Document.

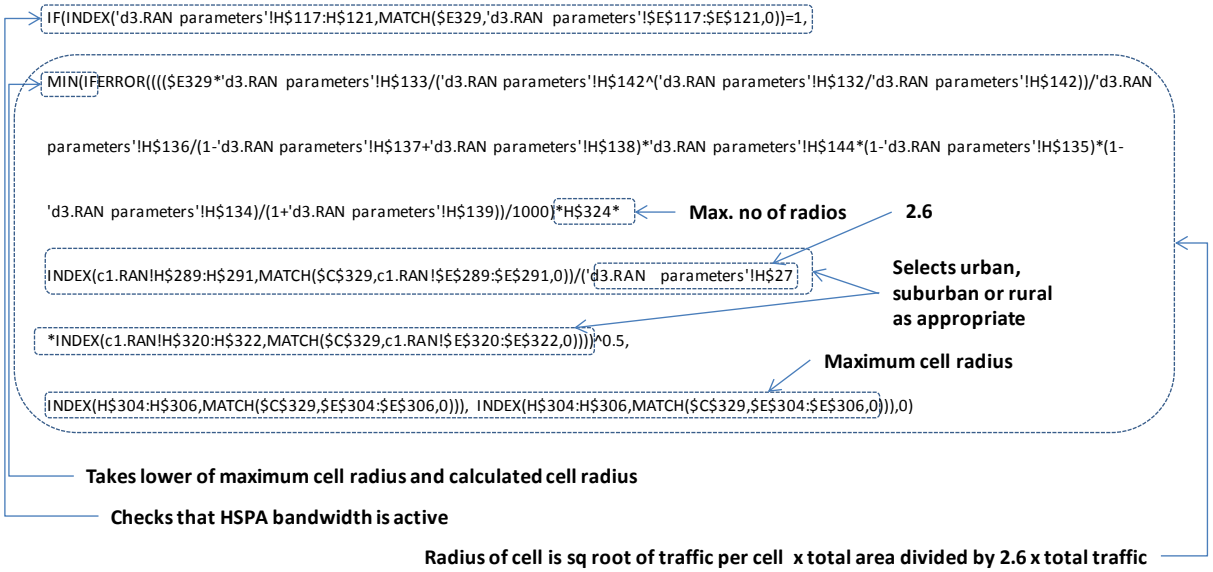
[5] Without prejudice to the existing calculations, ComReg have applied a round-up function to the formulas that calculate the required number of TRXs per cell for 900Mhz (rows 129 to 131) and 1800Mhz (rows 141 to 143). While being aware that a more comprehensive review would be needed to fully assess the efficacy of such a change, ComReg note that this simple test did not result in a material change to the Pure LRIC MTR results.

Question 10:

No	Model module	Reference to model	Questions for Deloitte
10	Network	c1. Ran eg H329	Please explain step by step the 3G RAN calculations and formula use (see below) IF(INDEX('d3.RAN parameters'!H$117:H$121,MATCH($E329,'d3.RAN parameters'!$E$117:$E$121,0))=1,MIN(IFERROR((((($E329*'d3.RAN parameters'!H$133/('d3.RAN parameters'!H$142^('d3.RAN parameters'!H$132/'d3.RAN parameters'!H$142))/'d3.RAN parameters'!H$136/(1-'d3.RAN parameters'!H$137+'d3.RAN parameters'!H$138)*'d3.RAN parameters'!H$144*(1-'d3.RAN parameters'!H$135)*(1-'d3.RAN parameters'!H$134)/(1+'d3.RAN parameters'!H$139))/1000)*H$324*INDEX(c1.RAN!H$289:H$291,MATCH($C$329,c1.RAN!$E$289:$E$291,0))/('d3.RAN parameters'!H$27*INDEX(c1.RAN!H$320:H$322,MATCH($C$329,c1.RAN!$E$320:$E$322,0))))^0.5,INDEX(H$304:H$306,MATCH($C$329,$E$304:$E$306,0))),INDEX(H$304:H$306,MATCH($C$329,$E$304:$E$306,0))),0)

26. This formula is calculating the cell radius based on the approach outlined in the answer to question 4 above.

27. An annotated version of this formula showing the major components in the calculation is shown below:



Question 11

No	Model module	Reference to model	Questions for Deloitte
11	Costs	c1. Pure LRIC	TBD: Economic depreciation calculations. There seems to be something off, however, we are still reviewing the details.

28. The motivation for use of economic depreciation methodology is detailed in section 2.5 of the Deloitte Draft BU Pure LRIC Model Specification Document. Inputs and intermediate calculations that support the calculation of economic depreciation are discussed in section 6.1 of the Deloitte Draft BU Pure LRIC Model Specification Document. The form and methodology of the implemented economic depreciation calculations is presented in section 6.2 of the Deloitte Draft BU Pure LRIC Model Specification Document and a mathematical presentation and simplified worked example are provided in Appendix C of the Deloitte Draft BU Pure LRIC Model Specification Document. The methodology adopted has also been reviewed for consistency against methodologies employed in other EU NRA models.

Question 12

No	Model module	Reference to model	Questions for Deloitte
12	General		Where is the average unit cost breakdown used in the Draft BU Pure LRIC Model calculated?

29. Unit cost data was selected from operator data, based on the completeness of associated data points (such as element planned utilisation, minimum elements and dimensioning rules). Where multiple cost observations were available the full set was reviewed to identify outliers and these unit cost points were also compared against those available in other publically available BU Pure LRIC models.

Question 13

No	Model module	Reference to model	Questions for Deloitte
13	General		Further to ComReg's information note 14/46 para 2 to outline what anonymised parameters if any lie outside of the range of values submitted by operators and an indication of the extent of the deviation

30. The anonymisation process led to one element falling outside the range of cost inputs provided by operators. The unit cost in the Draft BU Pure LRIC Model is above the range provided by operators. A simple test, of overriding the publically disclosed value with that of the highest provided by operators, did not result in a material reduction of the result.