Telstra's Response to the Commission's Draft Decision on Telstra's ULLS Monthly Charge Undertaking Dated 23 December 2005

ULLS Price International Benchmarking

A Introduction

1 On 23 December 2005, Telstra lodged an access undertaking ("**the Undertakings**") with the Australian Competition and Consumer Commission ("**Commission**") in relation to the monthly charges for the Unconditioned Local Loop Service ("**ULLS**"). On 15 June 2006 the Commission released its Draft Decision[1] ("**Draft Decision**") to reject Telstra's Undertaking.

2 The Commission rejects the ULLS prices proposed in Telstra's Undertaking ("**Undertaking Price**"), in part, on the basis that Telstra's charges are above those that would be incurred by an efficient operator.

3 This submission shows that the undertaking price compares favourably relative to ULLS prices charged in other international jurisdictions similar to Australia, once differences in purchasing power parity and line densities have been taken into account.

4 This report is structured as follows:

- **Section B** details developments in the regulation of ULLS in a number of major jurisdictions.

- **Section C** outlines the current pricing structure of ULLS prices in these jurisdictions.

- **Section D** provides some illustrative comparison of ULLS monthly charges across the jurisdictions, taking into account differences in purchasing power parity and line density.

- **Section E** contains some general conclusions.

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[1] ACCC 2006, Assessment of Telstra's ULLS Monthly Charge Undertakings, Draft Decision, June.

B Developments in the regulation of ULLS

5 Developments in the regulation of ULLS in some key OECD countries (Canada, Finland, France, Germany, Italy, Japan, Korea, Spain, Sweden, the UK and the US) are detailed in Table 1 below. These countries have been selected, *inter alia,* because of their size and/or possible similarity with a range of telecommunications market conditions in Australia. The history of regulation in Australia is also included for comparative purposes.

6 Countries early to mandate ULLS (between 1996 and 1998) include Finland, Germany, Italy, Japan and the US. Later adopters (2000 onwards) include France, Korea, Spain, Sweden and the UK. Hence Australia, which mandated the ULLS in 1999 falls roughly in the middle in relation to time regulation commenced.

7 In most of the countries there has been a tightening of regulation over time in terms of the services that must be provided and the prices offered. The major exception to this is the US where unbundling obligations have diminished over time.

Table 1: Developments in the regulation of ULLS charges

Country	Regulatory history
Australia	ULLS was mandated by the decision of the regulator ACCC in July 1999 with different pricing structures in different geographical areas. After publishing a draft report on ULLS pricing in August 2000, the ACCC issued a final report in April 2002. Revised model price terms and conditions for the ULLS were issued in October 2003 following regulatory changes at the end of 2002 which designated the ULLS as a 'core' access service. Regular imputation testing of Telstra's retail prices with respect to the ULLS was also required as a result of these regulatory changes.
Canada	A form of LLU was introduced by a decision of the regulator CRTC in 1997. However, what is termed as LLU in Canada is quite different to the ULLS Telstra is required to supply and the unbundling required in most other countries. The only unbundling required is with respect to Type A and Type B loops. A Type A loop is defined as an analogue transmission path between the customer network interface and the ILEC's loop termination point, and supports a voice grade signal of about 3kHz usable bandwidth. A Type B loop is defined as a digital transmission path between the customer network interface and the ILEC's loop termination point, and supports the transmission of an integrated services digital network basic-rate, interface-type signal. The Type B service is used as a proxy for the ULLS in this study.
Finland	LLU was mandated in June 1997 following a ruling by the Finnish government.
France	LLU was mandated in January 2001 under Decree 2000-881 of September 2000. Following the decree, ART adopted non-binding guidelines that clarified cost-oriented pricing principles as well as the calculation method for LRIC. In July 2001, France Télécom issued its reference unbundling offer (RUO).
Germany	LLU was mandated in the Ordinance on Special Network Access on the basis of German Telecommunications Act in 1996. ULL was officially implemented when the telecommunications markets were opened to competition in January 1998. Under German telecommunications law, charges for access to the local network

Country	Regulatory history
	must be cost oriented and must be authorised in advance by RegTP. Germany has the largest number of fully unbundled lines in the EU (1,627,846 at July 2004).
Italy	Full LLU was mandated by Italian Ministerial Decree in April 1998. However, it was not until 2001 that it was made available. In May 2001, Telecom Italia (TI) published a reference offer for LLU. This offer was accepted with modifications in November 2001. Since then TI has published Reference Unbundled Offers (RUOs) in May 2001 and April 2002.
Japan	Full LLU was mandated by an amendment to Telecommunications Business Law in June 1997. Since then the specific details under which LLU is to be offered have been laid down by ministerial decree. For instance ministerial decrees have been issued that specify what terms and conditions are to be included in RUOs, such as co-location arrangements and co-location charges.
Korea	LLU was introduced by the amendment of the Telecommunication Business Act in January 2001. The government (MIC) issued a public notification of LLU requirements and standards and full implementation of LLU. LLU was introduced relatively late in Korea's case and at a time when Korea already had one of the highest broadband penetration rates in the world.
Spain	LLU was mandated by Royal Decree in December 2000. Telefonica's first RUO was approved with a set of modifications by the Ministry of Science and Technology in December 2000. Since January 2001, the regulator CMT has implemented administrative proceedings for the revision of the RUO. Several interim measures were taken in 2001 to respond to market needs (e.g. collocation). All these have been consolidated in the new RUO adopted in May 2002.
Sweden	Sweden mandated LLU in 1998, and Telia has offered full LLU since March 2000. Telia submitted a reference offer to the regulator PTS in 2001. PTS accepted Telia's RUO after some modifications.
United Kingdom	Full LLU was mandated in 1999. The regulator Oftel published guidelines on the application of the licence condition in September 2000. In 2004 Ofcom conducted a far ranging review of the wholesale access market including LLU. Ofcom views LLU as key to the development of "second generation" broadband services such as VoIP and hopes to emulate the success of LLU in other countries. Ofcom also appointed an independent Telecommunications Adjudicator to manage the working-level implementation of LLU.
United States	LLU and transport were mandated by the Telecommunications Act in 1996. In November 1999, the regulator FCC issued rules on unbundling of network elements including sub-loops and dark fibre. In February 2003, the FCC concluded a review of its unbundling policies. Among other things, the FCC continued to require incumbents to provide unbundled access to copper local loops, but declined to require unbundled broadband capacity over fibre-to-the-home and hybrid copper-fibre loops. A large fraction of all loops are hybrid fibre/copper – fibre to a remote network interface, and copper for the "last mile". In these cases, only the "last mile", copper-pair portion of the loop is required to be unbundled. The fibre links do not have to be unbundled. Following legal challenges, more recently unbundling requirements on incumbent local exchange carriers have been reduced to provision of ULL, which is effectively defined as copper pair from user premises to a network interface. ILECs are no longer required to offer the UNE "platform" (UNE-P) consisting of unbundled loop + switching + transport.

Sources: EC 2004, *10th implementation report*; OECD, 2003, Developments in local loop unbundling; CRA.

8   Table 2 presents figures on the take-up of ULLS by country. The countries with high levels of ULL take-up as a percentage of incumbent lines include Japan, Germany, Finland and the US. In the US there are a further 17,136,000 lines that include ULL plus switching. These services are more akin to the conditioned local loop service in Australia. Hence these are not counted as they include greater functionality than ULLS, plus they are no longer mandated in the US.

Table 2: ULLS access lines supplied by jurisdiction, mid 2004

Country	Incumbent lines	ULLS lines	ULLS as % incumbent lines
Australia	10,370,000	22,870	0.22%
Canada*	19,775,448	450,000[#]	2.28%
Finland	2,725,607	96,600	3.54%
France	33,826,000	13,066	0.04%
Germany	37,500,000	1,672,846	4.46%
Italy	26,596,000	697,530	2.62%
Japan*	50,738,000	4,183,886[#]	8.25%
Korea*	21,832,000	Na	Na
Spain	16,884,000	40,302	0.24%
Sweden	5,500,000	10,972	0.20%
UK	29,600,000	7,466	0.03%
US	171,129,000	4,290,000**	2.51%
EU15	181,469,260	2,646,079	1.46%

* Data from 2003 or earlier. # Expect includes all types of unbundling. ** Loop plus switching comprises an additional 17,136,000 lines. 'Na' = data not available. '-' = not applicable. Sources: EC 2004, *10th implementation report;* OECD, 2003, *Developments in local loop unbundling;* FCC, 2004, *Local Telephone Competition: Status as of June 30, 2004.* CRTC, 2004*, Report to Governor in Council: Status of Competition in Canadian Telecommunications Markets, November.*

C Pricing structure of ULLS Charges

9   All the EU countries, along with Japan and Korea have geographically uniform charges. The only countries along with Australia which have ULL charges that vary by geographic location (or customer density) are the US and Canada. As the

charges in the US are set by the state regulators, the charges also vary between states.

10 For three countries, the US, Canada and Finland, the charges vary depending on the company supplying the loop. The service/connection charges in Canada also differ between residential and business end-customers.

11 In Finland and Italy the charges vary according to the service for which the loop is used, with different charges for voice/ISDN and ADSL. A similar situation applies in Canada with differential charging for loops used for voice and ISDN.

12 The pricing structures by jurisdiction are detailed in Table 3 below.

Table 3: Pricing structure of ULLS charges by country

Country	Pricing Structure
Australia	ULLS monthly and connection charges vary according to the geographical location of the loop. The location is delineated on the basis of teledensity in the following ways: Band 1: CBD areas of Sydney, Melbourne, Brisbane, Adelaide and Perth. Band 2: Urban areas of capital cities, metropolitan regions and large provincial centres (including other CBD areas not included in Band 1). Band 3: Semi-urban areas including outer metropolitan and smaller provincial towns. Band 4: Rural and remote areas.
Canada	Type A and B local loop unbundling charges vary by 7 geographic bands and by the company supplying the loops. In the price comparisons made below, Bell Canada's charges are used. Bell Canada's connection charges do not vary by geographic location but differ for business and residential end-customers. There is a lower charge for loops used for voice and those used for ISDN.
Finland	Monthly charges vary according to the type of service delivered over the line by the access seekers. There are two charges, a lower price for voice services and ISDN and a higher price for ADSL. The charges also differ by the company supplying the loop.
France	Currently has a uniform pricing structure.
Germany	Currently has a uniform pricing structure.
Italy	Monthly charges vary according to the type of service delivered over the line by the access seekers. There are two charges, a lower price for voice services and ISDN and a higher price for ADSL.
Japan	Currently has a uniform pricing structure.
Korea	Currently has a uniform pricing structure.
Spain	Currently has a uniform pricing structure.
Sweden	Currently has a uniform pricing structure.
United Kingdom	Currently has a uniform pricing structure.
United States	In the U.S. the individual state regulators hold the ultimate responsibility for LLU charges. The FCC's role is limited to setting down broad guidelines within which prices are to be determined. Therefore prices are different in each state in the country. Additionally, prices within each state are often geographically de-averaged according to customer density and vary according to the carrier supplying the loop.

Sources: EC 2004, *10th implementation report;* OECD, 2003, *Developments in local loop unbundling.* CRA

13 The pricing methodologies that regulators employ or that carriers are required to follow in setting charges are listed in Table 4 below.

Table 4: Pricing methodologies for ULLS charges by country

Country	ULLS
Australia	TSLRIC
Canada	Actual incremental cost plus 25%
Finland	Cost-based co. specific
France	LRAIC
Germany	LRAIC
Italy	FDC*
Japan	LRIC
Korea	LRIC
Spain	LRAIC
Sweden	FDC*
UK	LRAIC
US	TELRIC

* Planning/may have moved to LRAIC

Source: Europe Economics, 2004, *Pricing methodologies for unbundled access to the local loop,* May; OECD, 2003, *Developments in local loop unbundling;* Telecoms Infotech Forum 2003, *Competition in the local loop: unbundling or unbungling?* July; CRA International.

14 Table 4 indicates that most countries use or are moving towards a LRIC/LRAIC pricing methodology.

D International Benchmarking of ULLS charges

15 This section provides a comparison of ULLS charges across the jurisdictions, including the average for the EU15 countries and the US states. The benchmarking is performed only for monthly rental charges – other charges may include connection, collocation and disconnection charges.

16 The base data and sources for all of the charges are listed in Appendix A.

D.1   Averaging ULLS charges

17 Differences in the averaging methods employed between countries/jurisdictions (as applicable) means that some of the comparisons should be regarded with a degree of caution, notably the overall averages for the EU15 countries and the US. In the case of the ULLS average charges derived for Canada and the three US states, the Australian distribution of ULLS lines across bands is used to derive a weighted average charge. The assumption is made that the three geographic bands in the US jurisdictions and the first three in Canada, correspond to the first three bands (Bands 1 to 3) in Australia.

D.2   Adjusting for differences in purchasing power parity

18 All the international charges are converted from local currencies[2] into Australian dollars using the OECD's Purchasing Power Parity (PPP) exchange rates for 2004. The use of PPP rates is understood to be the preferred practice of the ACCC and the Productivity Commission for international price comparisons.[3] It is noted that use of average market exchange rates would serve to improve Telstra's performance in the price comparisons, so in this sense the use of PPP exchange rates is if anything conservative.

19 The ULLS charges for each country in Australian dollar (A$) terms are listed in Appendix B.

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[2]   Where the charges have been quoted in a different currency to that of the country in question (UK, Sweden, and Korea) these are converted back to the local currency using the applicable exchange rate at the end of the applicable month in the year for which the charges are quoted.

[3]   PPP exchange rates eliminate the difference in price levels between countries. They are determined by the relative price of an identical basket of goods and services between countries.

D.3 Adjusting for differences in line density

20 The international charges are controlled for economies of line density. In its 1999 telecommunications services international benchmarking study, the Productivity Commission noted that "there is a general consensus that there are economies of density in the provision of local services in particular".[4] In a subsequent report, the Productivity Commission presented data indicating that the rural, and to a lesser extent the urban, population density in Australia is lower than other comparison jurisdictions, with the former in particular likely to contribute to higher telecommunications costs in Australia.[5] These data are shown in Table 5 below.

Table 5: Relative population densities

Jurisdiction	Average density (persons per km^2)	
	Urban areas*	Rural areas[#]
Australia	1,278	5.7
Canada	2,625	15.0
Europe	5,093	80.0
United States	1,225	35.5

Notes:

* Urban areas include cities with a population of 50,000 or more.

[#] Rural areas refer to arable land only.

Source: Productivity Commission 2001.

21 Given the data in Table 5, it would be expected, all else being equal, that Australia would have higher average costs of providing ULLS in particular, than most of the comparison jurisdictions.[6]

22 To test the effect of line density on estimates of network costs more formally, Telstra has relied upon analysis that derives some illustrative estimates of what

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4   Productivity Commission, 1999, *International Benchmarking of Australian Telecommunications Services,* Research Report, AusInfo, Melbourne, March, p. 191.

5   Productivity Commission, 2001, *International Benchmarking of Remote, Rural and Urban Telecommunications Services*, Research Report, AusInfo, Melbourne, July, pp. 14-16.

6   Japan and Korea would be expected to have very high urban and rural population densities relative to Australia as well.

the ULLS monthly charges would be in other countries if they had the same distribution of line density as in Australia.

23   To achieve this estimation the following steps are taken.

24   First, the PIEII Australian costs and SIOs by ESA are ordered into line density groups from lowest to highest density and the costs per SIO calculated.

25   Second, the distribution of Australian lines is moved "sideways" into higher density groups of ESAs to equate with the (higher) average line densities in each of the other countries. Figure 1 below provides an illustrative indication of the shift in the distribution of Australian lines to higher density ESA groups to reflect the densities in other countries. This means that there are more lines in the groups of ESAs that have a lower cost per SIO. Lastly, the aggregate network costs are then re-calculated for the adjusted Australian distribution that reflects the average density in each other country, by multiplying the costs per SIO by the derived number of lines in each ESA group and summing the resulting costs. This analysis uses Australian costs and the number of SIOs and does not adjust for economies of scale.

Adjusted exchange distributions by line denisty
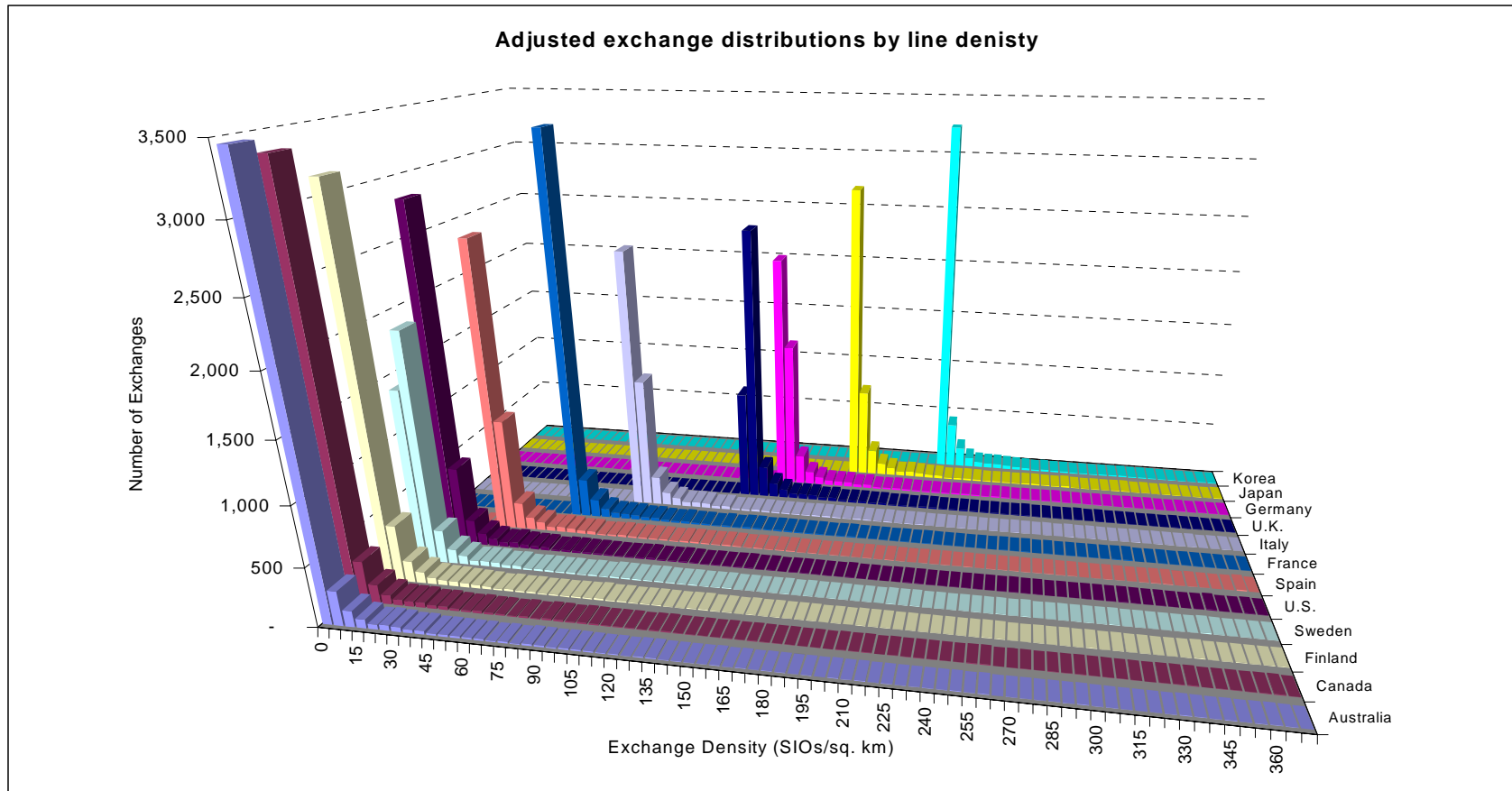
26 Third, having estimated the aggregate network costs as described above for Australia if it faced the line density equal to each comparison country, these aggregate cost amounts are used to derive 'cost ratios' by expressing the aggregate network costs derived for the line densities for each other country relative to the actual Australian aggregate network costs (see Table 6 below). The reciprocals of these cost ratios indicate the adjustment in overseas network costs that would occur if the same line density was observed in those countries as in Australia.

**Table 6: Average line densities and derived network cost ratios**

	Avg. Line density (fixed lines per km^2)	Cost ratio (based on network costs with Australian density vs other country density)
Australia	1.33	100%
Canada	2.19	95%
Finland	8.37	62%
Sweden	16.01	57%
U.S.	19.42	56%
Spain	35.17	53%
France	62.14	50%
Italy	90.46	48%
U.K.	141.15	48%
Germany	155.63	47%
Japan	189.86	46%
Korea	232.99	46%

27 Fourth, these reciprocals are then used to adjust the network component of actual ULLS prices for each country. In making the adjustment to other countries' prices it is assumed the ULLS network component of the ULLS prices is 50 per cent (in practice it probably varies significantly depending on how ULLS-specific costs are allocated between ULLS monthly and connection prices (if included at all) in the other countries).

28 To provide an example of how prices are adjusted, if another country has a network cost ratio equal to 75% that of Australia it follows that if it had the same density as Australia its costs would be 1.33 (i.e.1/0.75) times larger. Therefore the ULLS network cost component of this

country's ULLS price is multiplied by 1.33. The illustrative estimates of ULLS prices for each country, adjusted for line density, are shown in figure 2 below.

Figure 2
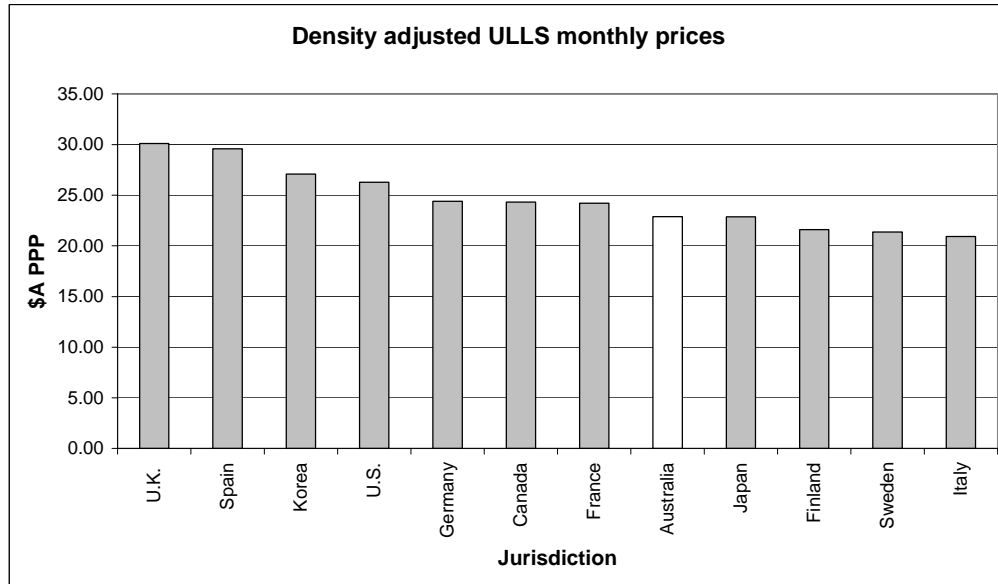
29 The estimates shown in figure 2 indicate in illustrative terms what the ULLS prices in overseas countries would be if they had the same line density as Australia. On the basis of this comparison the price of the ULLS supplied by Telstra compares favourably, being at the lower end of the sample of countries.

D.3 An alternative approach to adjusting for differences in line density

30 As a further exercise in examining the impact of differences in line density on costs, Telstra has estimated a total cost function using current PIE II data for 4,961 exchange service areas incorporating the number of SIOs and area as key cost drivers.

31 Assuming input prices are uniform across ESAs, the following translog total cost function was specified:

$$lnTC_i = \alpha_0 + \beta_1 lnSIO_i + \beta_2 lnAREA_i + .5\beta_3 lnSIO_i^2 + .5\beta_4 lnAREA_i^2$$
$$+ \beta_5 lnSIO_i * lnAREA_i + \delta_1 BAND1 + \delta_2 BAND2 + \delta_3 BAND3 + \mu_i$$

32 Descriptions of these variables are listed below:

TC_i	=	Total cost in the ith ESA
SIO_i	=	Number of services in operation in the ith ESA
$AREA_i$	=	Area served in square kilometres in the ith ESA
α_0	=	Constant
$BAND1$	=	Equals 1 if line density is greater than 1,000/sqkm, zero otherwise
$BAND2$	=	Equals 1 if line density is greater than 108 up to 1000/sqkm, zero otherwise
$BAND3$	=	Equals 1 if line density is between 6.54 to 108/sqkm, zero otherwise
ln	=	Natural logarithm operator
μ_i	=	Error term
TCi	=	Total cost in the ith ESA
SIOi	=	Number of services in operation in the ith ESA
AREAi	=	Area served in square kilometres in the ith ESA
α0	=	Constant
BAND1	=	Equals 1 if line density is greater than 1,000/sqkm, zero otherwise
BAND2	=	Equals 1 if line density is greater than 108 up to 1000/sqkm, zero otherwise
BAND3	=	Equals 1 if line density is between 6.54 to 108/sqkm, zero otherwise
ln	=	Natural logarithm operator
μi	=	Error term

33 The dummy variables are included to capture technological and other (e.g. input price) differences in serving ESAs falling within particular line density bands.

34 The estimated coefficients and associated statistical goodness of fit measures are provided in Appendix C. The equation displayed strong goodness of fit and the coefficients had the expected signs.

35 Evaluated at the means of the respective data series, the estimated translog total cost functions gave elasticities of total costs with respect to the number of SIOs of 0.36 and for area served 0.73. Hence, in terms of the variables that increase line density, a 1% increase in SIOs would

produce a 0.36% increase in total costs and 1% decrease in area a 0.73% decrease in total costs. Given these elasticities, all else constant average unit costs (measured on a per SIO basis) would fall for an increase in SIOs and for a decrease in area. Hence costs per SIO will fall with an increase in line density as represented by either an increase in SIOs or a reduction in area.

36 The estimated total cost function was then used to estimate the cost under the line densities prevailing in the five countries nearest to Australia in terms of line density – Canada, Finland, Sweden and the US. The analysis was restricted to these five countries on the basis that the choices of technologies used would be expected to conform most closely with those for Australia. The total cost was estimated for the line densities of these countries by estimating the costs of serving the area serviced by Telstra, but with higher line densities (i.e. by increasing the number of SIOs to achieve the average line density prevailing in each country). Dividing the resulting total costs for each country by the number of SIOs for each country provides an estimate of the average unit cost (i.e. network costs per SIO) in Australia assuming it had the line density of the comparator country. The resulting unit network costs are shown in Table 7.

Table 7: Estimated Australian network costs by country average line density

	Australia	Canada	Finland	Sweden	United States
A$ cost/ SIO/month	$33.16	$25.26	$13.53	$10.29	$9.52
Aust. cost relative to cost for country density	1	1.31	2.45	3.22	3.48

37 The results indicate that Australian network costs are substantially inflated by the less dense network in Australia, consistent with the earlier analysis described above.

38 Figure 3 below shows the resulting estimates of ULLS monthly costs when the networks cost component of ULLS prices (assumed to be 50% as previously) are multiplied by the ratio of the Australian networks costs to the estimates of network costs for the comparison country line densities from Table 6. This serves to adjust the ULLS monthly prices for the other countries if they faced the same line density that prevails in Australia. On this comparison Australia has the lowest monthly charges among the five countries compared.

Figure 3

ULLS monthly price estimates adjusted for Australian line density using cost function approach
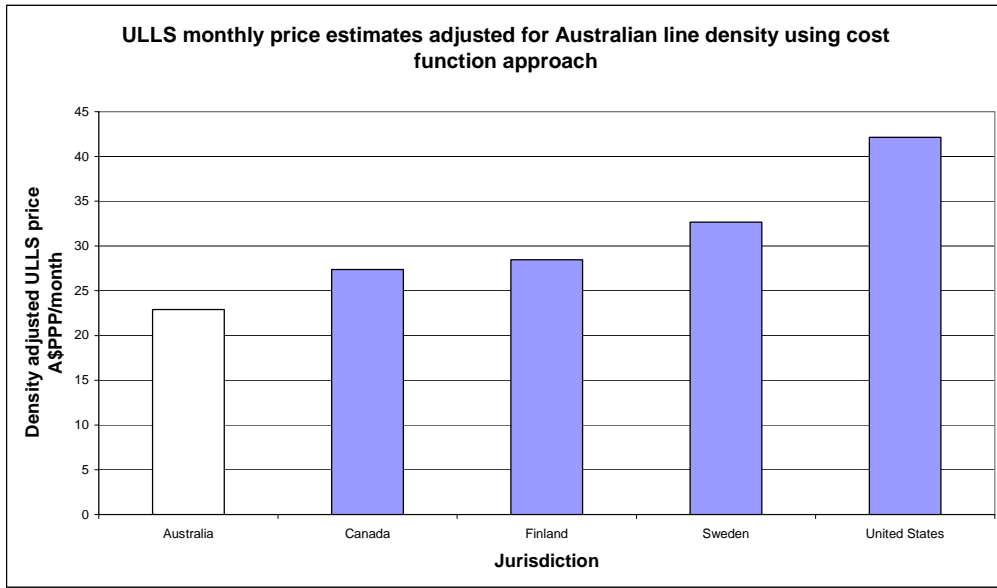
E Conclusion

39 It is evident from the above analysis that Telstra's average charges for ULLS largely fall at the middle to lower range of charges for these services offered in other major comparison jurisdictions, after purchasing power parity and line density differences have been taken into account.

Dated: 24 August 2006

Annexure A: Data and sources

Jurisdiction	Currency	Date as of.	ULLS	Sources
UK	GBP	Jan-05	8.7575	Ofcom media release 16 Dec 2004, www.ofcom.org.uk
Germany	EUR	Aug-04	10.65	EC 10th implementation report Dec 2004, RegTP press release 28 April 2005: http://www.regtp.de/en/aktuelles/pm/03223/index.html
France	EUR	Oct-04	10.5	Monthly rates are specified in a document published after consultation in October 2004 (http://www.art-telecom.fr/publications/c-publique/anmarch-deg051004.pdf (p7)).
Italy	EUR	Jan-05	8.3	Consultation paper published on 18 Jan 2005 by Agcom (http://www.agcom.it/provv/c_p_415_04_CONS/d_415_04_CONS_all_B.pdf - TABLE 6) - It is unclear whether these rates are actual or proposed, however monthly charges are consistent with EC 10th implementation report 2004.
Spain	EUR	Aug-04	11.4	EC 10th implementation report Dec 2004
Sweden	EUR*	Aug-04	11.4	EC 10th implementation report Dec 2004
Finland	EUR	Jan-05	11.26	Prices are from a FICORA price comparison. Prices are weighted averages for operators that are required to price in a "cost oriented way".http://www.ficora.fi/suomi/document/Tilaajayhteydet_hintavertailu_01012005.pdf
US ave	USD	Feb-05	13.69	Gregg, 2005, www.nrri.ohio-state.edu
Japan	USD*	Nov-04	13	Ofcom November 2004, Strategic Review of Telecommunications, Phase 2 consultation document , Annex O, www.ofcom.org.uk
Korea	KRW	Nov-04	9577	Ofcom November 2004, op .cit., ULLS charge is average over two years after applying discounts of 25% yr1, 18% yr 2. Base charge is KRW 12,200.
Australia	AUD	Dec-05	30	Telstra Undertaking price
Canada ave	CAD	Mar-05	21.88	www.bell.ca/tariffs. Bell Canada access service tariffs, Item 105, Type B local loop rates using CRA/Telstra weights.

Notes: * = Non local currency. na = data not available. nr = service not required by regulation

Annexure B: ULLS charges (PPP, A$)

Table B1: ULLS monthly charges (PPP, A$)

Jurisdiction	ULLS monthly
Canada average	23.67
Australia	30.00
Spain	20.40
UK	19.47
US average	18.81
Korea	17.06
Finland	16.50
France	16.09
Germany	15.53
Sweden	15.48
Japan	14.42
Italy	13.58

Annexure C: Estimated coefficients of the translog cost function

ESTIMATED COEFFICIENTS OF THE TRANSLOG COST FUNCTION				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.661695	0.337743	22.68501	0.0000
LSIO	0.319842	0.058151	5.500170	0.0000
LAREA	1.044201	0.066303	15.74893	0.0000
LSIO2	0.035238	0.006063	5.811607	0.0000
LAREA2	-0.117380	0.006440	-18.22638	0.0000
LSIOLAREA	-0.020791	0.007026	-2.958906	0.0031
BAND1	0.938931	0.102443	9.165391	0.0000
BAND2	0.302423	0.067206	4.499950	0.0000
BAND3	-0.183788	0.030558	-6.014361	0.0000
R-squared	0.695234	Mean dependent var		13.30382
Adjusted R-squared	0.694738	S.D. dependent var		0.881657
S.E. of regression	0.487119	Akaike info criterion		1.401209
Sum Squared resid	1167.919	Schwarz criterion		1.413079
Log likelihood	-3445.680	F-statistic		1403.511

CALCULATED ELASTICITY

ELASTICITY $\delta \, lnTC \, / \, \delta \, ln \, SIO$

$$= + \beta_1 + \beta_3 lnSIO + \beta_5 lnAREA^2$$
$$= .3198 + .0352 + 2.517 + .0208 + 2.254$$
$$= .3198 + .0866 - .0469$$
$$= .3615$$

ELASTICITY $\delta \ln TC / \delta \ln AREA$

$$= 1.0442 - .11738 \, x \, 2.254 - .208 \, x \, 2.517$$
$$= 1.0442 - .2646 - .0524$$
$$= .7272$$