

The Chair
CABINET ECONOMIC DEVELOPMENT COMMITTEE

ARRANGEMENTS FOR THE RENEWAL OF RADIO SPECTRUM MANAGEMENT RIGHTS USED FOR CELLULAR SERVICES

PROPOSAL

1 This paper seeks Cabinet agreement to the proposed arrangements for the renewal of radio spectrum management rights used for cellular services.

EXECUTIVE SUMMARY

2 In April 2003, Cabinet agreed to a policy for the renewal of commercial spectrum rights at expiry [POL Min (03) 9/1]. Subject to case-by-case assessment, replacement rights will be offered to existing right holders five years before expiry, and that if the renewal offers are rejected, the rights will be reallocated by auction. The policy requires the offer price to approximate the market value of the rights and produce a fair financial return to the Crown.

3 The Ministry of Economic Development (MED) has conducted a case-by-case review for the renewal of management rights used for cellular services in the 800 and 900 MHz bands, which are due to expire in 2011 and 2012. The review indicates that these bands are being used and will continue to be used for cellular services until at least 2015. The review, however, shows that incumbent operators, Vodafone New Zealand Limited ("Vodafone") and Telecom Corporation of New Zealand Limited ("Telecom") have ample spectrum to operate nationwide cellular services. Potential market entrants, New Zealand Communications Limited (previously Econet Wireless New Zealand Limited) and TelstraClear Limited ("TelstraClear"), have also expressed interest in gaining access to spectrum in these bands, as they are more economic for providing coverage in low population density areas.

4 While there will be ongoing use of these bands for cellular services, a balance is required in setting the appropriate proportion of existing spectrum holdings between the needs of incumbents and those of potential entrants to have sufficient spectrum to run a nationwide network. Analysis indicates that existing spectrum holdings are not fully or efficiently utilised. There is a strong public policy case for reallocating a proportion of that spectrum that is not foreseen to be reallocated via other contractual or market mechanism.

5 It is proposed that freeing up 7.5 MHz* in each band to the open market would strike the best balance between providing certainty for incumbents and making the mobile market more attractive to new entrants.

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* All spectrum quantities cited in this paper, unless otherwise stated, refer to paired spectrum.

BACKGROUND

7 In April 2003, Cabinet agreed that subject to case-by-case assessment, replacement rights will be offered to existing right holders, and that if the renewal offers are not accepted, the rights will be reallocated by auction [POL Min (03) 9/1]. The policy requires the offer price to approximate the market value of the rights and produce a fair financial return to the Crown.

8 Cabinet has agreed policies for offers in regard to UHF-TV licences [CAB Min (04) 41/24] and AM/FM licences [POL Min (04) 12/4], and has decided not to make renewal offers to current right holders in the 2.3 GHz band, which have not had any significant use to date [CAB Min (04) 41/24]. This paper considers rights used for cellular services.

COMMERCE COMMISSION REVIEW

9 A report by the Commerce Commission, released in October 2006, following its review of the mobile sector, found that the unavailability of spectrum in the 800 MHz and 900 MHz bands for new entrants is a barrier to market entry as it raises the cost of entry and can make some service options difficult or impossible. The Commission invited MED to give weight to the benefits of new entry in its review of expiring cellular rights.

CASE-BY-CASE REVIEW OF CELLULAR RIGHTS

10 In July 2006, following Cabinet approval [CBC Min (06) 13/7], MED released a discussion paper on the case-by-case review for the renewal of management rights in the 800 and 900 MHz spectrum bands, the main bands currently used for cellular services in New Zealand. The discussion paper sought stakeholders' views on the current usage and likely future use of these bands, the level of infrastructure investment, whether the rights should be renewed, the appropriate renewal period, and the appropriate pricing approach.

11 Four submissions were received and evaluated. The respondents were NZ Communications, TelstraClear, Telecom and Vodafone. Cross submissions were invited and received from the respondents on the specific issue of the optimal quantities of spectrum required by current right holders and potential new entrants for the period 2011 to 2031.

Infrastructure investment and current usage

12 Significant investments have been made to use the 800 and 900 MHz bands. Vodafone indicated in its submission that it has invested over \$2 billion since it entered the New Zealand market, including the purchase of BellSouth for [].

13 Telecom uses the 800 MHz band for all of its existing cellular operations. Vodafone uses the 900 MHz band as its core network for 2G services but also uses the 1.8 GHz band and 2.1 GHz band for 2G and 3G services, respectively.

14 Both NZ Communications and TelstraClear expressed interest in also deploying cellular networks in the 800 and 900 MHz bands if they could gain access to them. These bands are valued for their superior performance and longer reach, which results in lower deployment costs, particularly for coverage outside metro areas.

The "non-scarcity" of cellular spectrum

15 A report by Network Strategies Ltd in November 2006 confirms that, in comparison to overseas operators, both Telecom and Vodafone have generous spectrum allocations in the 800 and 900 MHz bands, after allowing for differences between New Zealand and other countries. This is consistent with an earlier report by PricewaterhouseCoopers and the New Zealand Institute of Economic Research in July 2006, which noted that cellular spectrum in New Zealand is “not scarce”, with existing right holders having more spectrum than technically required to operate nationwide networks.

Likely future use

16 Recent work by the International Telecommunications Union – Radiocommunications (Study Group 8) on future cellular technologies suggests that the 800 and 900 MHz bands will continue to be used for cellular services until at least 2025. These bands are currently used for 2G and 3G cellular services and are candidate bands for 4G services, which are anticipated to be implemented from 2015.

17 Telecom and Vodafone have long-term plans for advanced cellular services in these bands. In December 2006, Telecom announced the upgrade of its CDMA2000 (Code Division Multiple Access) network to the next generation EVDO (Evolution Data Optimised) Revision A system. In its submission, Telecom states that it may further upgrade to Revision B (higher data rates) and other advanced services in the future. In October 2006, Vodafone launched its HSDPA (High Speed Data Packet Access) broadband network, with 42% population coverage, using its 2.1 GHz (3G) spectrum, and intends to use its 900 MHz spectrum to build HSDPA outside city areas. These types of enhancements can increase the intensity of use in the frequency band.

18 NZ Communications, which owns or has access to 1.8 GHz and 2.1 GHz spectrum, has been planning to deploy a cellular GSM (Global Service for Mobile Communications) type network. However, it would prefer to use the 900 MHz band, over which Vodafone holds the only private management rights, for low population density areas because of its coverage and cost advantages. The ownership changes announced by NZ Communications are likely to give a new readiness to implement a network in New Zealand.

19 TelstraClear, which owns 1.8 GHz and 2.1 GHz spectrum, has announced the launch of its 3G service “Unplugged”, initially in Tauranga, in 2007. TelstraClear would prefer the option of deploying this service using 800 MHz spectrum, as is currently being done by its parent company, Telstra Corporation in Australia, or alternatively, in the 900 MHz band.

Appropriateness of renewal

20 The desired policy outcome is a renewal package that supports competition in the relevant markets, minimises the risk of stranded investment, avoids undue disruption of services, facilitates the migration to new technologies, and maximises the opportunity for new investment in the spectrum. The renewal price is to also produce a fair financial return to the Crown.

Respondents’ views on renewal

21 NZ Communication’s view is that the rights must not be renewed in their current format and would like the 900 MHz band to be divided into equal portions to the four respondents. For NZ Communications, there is no distinction between the optimal requirement of an incumbent and a new entrant, which is approximately 8 MHz.

22 TelstraClear recommends that the bands be reconfigured because incumbents' holdings exceed their current and future requirements. It suggests that 10 MHz be freed up in each band and be reallocated through a competitive process to allow two new viable entrants into the market.

23 Telecom states that it will require the renewal of its entire current holdings to be able to provide a full range of advanced services and higher data speeds, particularly for rural customers. Vodafone (using GSM) and other CDMA operators in the USA and Europe have "companion bands" in the 1.8 GHz and 2.1 GHz bands. Telecom can only operate in the 800 MHz band using its current technology because the 1.9 GHz band in New Zealand is not configured for CDMA use. If Telecom chooses to adopt the UMTS (Universal Mobile Telecommunications System) path, then it can operate in both the 800 MHz and 2.1 GHz bands.

24 Vodafone's preference is for right holders to be given the right of first refusal to all their current spectrum holdings and opposes an auction as a method of reallocating rights, stating that this is inconsistent with the Government's long-standing approach to renewal issues.

RENEWAL OPTIONS

25 The current and likely future investments by incumbents in these bands provide a reasonable case to renew the present management rights. However, analysis (see Paragraph 32) suggests that the incumbent right holders already hold ample cellular spectrum.

26 Offering renewal of all of the rights to the incumbents would minimise the risk of stranding investment. This option, however, would reduce the opportunity for non-incumbents to gain access to these bands, as it would make them dependent on the secondary market.

27 Auctioning all of the rights to be renewed in 2011 and 2012, on the other hand, would increase the risk of stranding investment, through the incumbents losing their spectrum at auction. There is also the risk of undue disruption of services during the transition from one period to another.

28 Given the ample spectrum currently available to incumbents and the expressions of interest from non-incumbents in these bands, it would be appropriate for incumbents to retain part of their spectrum that is reasonably required to operate their networks and avoid unreasonably stranding their existing investment. The remainder could be auctioned, providing opportunities for entry of competition.

29 It is important that incumbents are allowed to bid at auction. This will allow them to regain spectrum that was not renewed if this was seen to be essential for their future business plans. It would also ensure that there is contestable bidding for the spectrum.

30 NZ Communications has expressed concern that incumbents could easily outbid other operators at auction. However, any serious nationwide investor should be capable of competing in this scenario. There are no clear reasons why constraints should be applied to favour any particular parties.

Quantities to be offered for renewal and auction

31 MED engaged Network Strategies Ltd (NSL) to estimate the quantities of spectrum that current right holders and new entrants require for the period 2011 to 2031. Telecom has total holdings of 20 MHz in the 800 MHz band, which are all expiring in 2012. Vodafone has some 22 MHz (and some 4 MHz unpaired that is unusable for its current GSM technology) in the 900 MHz band. About two-thirds of Vodafone's holdings will expire in 2011 and 2012.

Actual utilisation of spectrum

32 NSL found that Vodafone uses 14-16 MHz, which is approximately 75% of its usable 900 MHz spectrum. They also found that Telecom significantly uses at least 6-9 MHz, excluding guard bands. While Vodafone's possession of a companion band would allow alternative means for managing capacity constraints that may occur if its spectrum holdings are reduced, this is not the case for Telecom. NSL suggested that the cost to Telecom of having less spectrum would be more significant.

33 A peer review of the NSL report by economist Matt Burgess, suggested that the policy decisions should also take into account a) the impact of legacy systems on spectrum demand, considering incumbents' sunk costs, b) the need for sufficient spectrum to enable incumbents to migrate to advanced technologies ("spectrum slack"), and c) the uncertainty of entry by other operators, who could purchase spectrum but might end up not using it for any reason. These factors imply that the actual usage could be higher than indicated above.

Optimal deployment cost

34 The NSL study also shows that, assuming the likely entry of a new operator in each band, the amount of spectrum that would lead to the lowest overall (optimal) deployment cost for all operators is for the new entrant to gain access to a parcel of spectrum in the range of 25%-50% of the total spectrum available or 5-10 MHz in each band. If no companion band is available, as is the case with Telecom (and its current technology), the optimal deployment cost would require a 75%-25% allocation split in favour of the incumbent.

New entrant requirements

35 NSL advised that the minimum amount of spectrum that a new entrant would usefully require is 5 MHz, which is the smallest useful size of a UMTS (3G) carrier used by Vodafone, utilising its 2.1 GHz spectrum. This is also the minimum size of the carrier of the future CDMA technology (W-CDMA), which Telecom may choose to adopt.

36 NSL also advised that cellular operators in similar countries with access to additional spectrum in companion bands are able to deliver services using approximately 5 MHz to 7.5 MHz in the 800 or 900 MHz band [see Appendix 1]. Operators such as Orange Nederland, Telfort Netherlands, O2 Ireland, Vodafone Ireland and Telia Denmark have between 5 MHz to 7.5 MHz, with subscribers of more than one to two million each (which is already about a quarter to half of the New Zealand population).

37 MED engineers have confirmed that 5 MHz should be sufficient for the likely new entrants, given that they already have cellular spectrum in higher bands for high-density areas, but 7.5 MHz would further reduce technical constraints and costs.

Quantities for renewal offers

38 On balance, auctioning 7.5 MHz (the midpoint between the quantity required for the smallest UMTS or W-CDMA carrier and the highest quantity sought by any new entrant) would strike the best balance between a) providing certainty for existing investment and sufficient spectrum for incumbents' migration to new technologies without excessive costs, and b) making the mobile market more attractive to new entrants. This quantity is also within the optimal range of deployment costs for all operators, which is for a new entrant to gain 5-10 MHz in each band.

39 [].

40 []... it is proposed that, as a default, 7.5 MHz of the spectrum that expires in 2011 or 2012 in each band should not be offered for renewal. Renewal offers will be made to existing right holders for their remaining spectrum and 7.5 MHz would be offered by auction. Existing right holders will have some ability to choose which spectrum pairs should be offered for renewal or auction.

41 However, if Telecom or Vodafone sell at least 5 MHz of 800 or 900 MHz spectrum on the secondary market to a person who does not currently hold spectrum in these bands within six months of the renewal offer being made, then:

- a If the rights sold expire after 2012, (Vodafone has some rights expiring in 2022) then the seller (Vodafone) will be offered the 7.5 MHz otherwise intended for auction.
- b If the rights sold expire in 2011 or 2012, the purchaser would be offered corresponding renewed management rights at the price and substantially on the same terms offered to Telecom or Vodafone, and the present rightholders will be offered renewed management rights over the remaining part of the 7.5 MHz otherwise intended for auction.

42 If any renewal offer is rejected by the existing right holder, then all of the rights will be reallocated by auction. All interested parties, including current right holders, will be allowed to bid at auction, subject to any Commerce Act requirements.

43 The legal form of arrangements to implement the above policy proposals will be finalised prior to renewal offers being made to Telecom and Vodafone.

Length of the renewal period

44 Telecom and Vodafone prefer a 20-year renewal period. TelstraClear supports a 20-year period only if some spectrum is reallocated to new entrants. Otherwise, TelstraClear suggests a shorter period of say, eight years, so that other operators will not be precluded from gaining access to these bands for a longer period. NZ Communications did not make any comment on how long an appropriate renewal period should be.

45 A 20-year period, the maximum possible renewal period under the *Radiocommunications Act 1989*, is a reasonable timeframe, considering the investments that have been made by current right holders or that will potentially be made by any new entrant in deploying a cellular network. This timeframe would also be consistent with the likely future use of these bands for the evolution of advanced cellular technologies. It is also desirable to allow for a common expiry date by slight adjustment of the term of the renewal offer.

Pricing approach

46 PwC and NZIER jointly recommended an incremental optimised deprival (incremental ODV) pricing approach for the renewal of cellular rights, which Cabinet noted in July 2006 [CBC Min (06) 13/7]. This approach calculates the costs that a generic New Zealand cellular operator, operating an optimal network, would incur to maintain the quantity and quality of services to customers if deprived of spectrum at the margin. The incremental ODV-calculated price will then be checked to ensure that it is within a reasonable range from New Zealand and overseas spectrum values.

47 Incremental ODV is mainly an engineering exercise, where every costing step has a basis, and thus, has a strong underlying logic as to how it approximates market value. Given the difficulty of implementing alternative approaches, including the Covec formula, incremental ODV represents the best compromise and most practical methodology for forming an estimate of market value for cellular rights.

48 TelstraClear, Telecom and Vodafone give conditional support to the incremental ODV pricing approach, subject to the technical input parameters being reasonable. NZ Communications does not agree with this approach, stating that it will subsidise incumbents. MED notes that the incremental ODV price is intended to be a proxy for a market price based on objective information and, therefore, would not represent a subsidy to any party.

49 Following Cabinet approval of the proposed arrangements, MED will engage a consultant to develop a working model that will be used in the calculation of the incremental ODV price. MED will consult with stakeholders on the technical details of the model.

50 It is proposed that the Minister of Communications be authorised to approve and announce the renewal price offer, the terms of offer and settlement, and the timing of the auction as soon as practicable. This would allow current right holders to consider their options as soon as practicable.

51 It is further proposed that right holders be given six months to consider the renewal price offer. This is considered to be a reasonable length of time, given the amounts likely to be involved, and noting that Vodafone may need to obtain overseas approval from its parent company for a decision in relation to the renewal offer.

Use Conditions

52 There is a small risk that the spectrum in each band which is to be reallocated by way of renewal offer or auction may remain substantially unused by the new owner, and this would not be a desirable outcome in terms of promoting investment in new infrastructure.

53 It is proposed that conditions of use can be applied to mitigate this risk and encourage the new owners to invest in infrastructure. Failure to comply with the conditions would result in revocation of spectrum without compensation and/or other penalties being applied.

54 To date, conditions of use have not generally been applied to spectrum allocations in New Zealand, rather reliance has been placed on the secondary market to redistribute unused spectrum. However, our 2005 review of Radio Spectrum Policy identified a lack of secondary market transactions as a key issue in spectrum policy. Accordingly such

conditions have been authorised in two recent cases; the allocation of the 3.5 GHz Crown reserved spectrum included a two year implementation requirement, and the reallocation of the 2.3 GHz band includes a requirement for the rights to be sold with conditions of use that managers must meet or face revocation without compensation. Neither of these two cases has yet reached the date of application.

55 Such conditions need to be carefully crafted to ensure that they are workable and do not have the unintended consequences of discouraging investment or providing less than a fair return to the Crown. A definition of use would need to be developed and would be enforced through a management rights deed which the purchasers are required to enter into as a condition of settlement of purchase of these new rights, requiring demonstration of use within a specified time frame. Both the definition and the timeframe require further consideration but the Ministry's current thinking is that a five year timeframe might be appropriate.

56 Under the recommendations in this paper, substantially the same conditions of use would apply to purchasers of all the new management rights, whether they purchase the rights through a renewal offer process (i.e. Vodafone and Telecom), through an auction process, or by a renewal offer subsequent to a secondary market transaction.

57 Appropriate consequences of failing to use also require further consideration. There are a range of potential options including a requirement to relinquish the right or, alternatively, requiring the owner to grant licences or allow access to other operators on an open access basis. An additional possible condition, that of financial penalties for non-use, may require additional statutory authority and may be unnecessary in addition to the other use conditions described above. For this reason they are not recommended at this time.

COMMENT

58 The renewal process agreed by Cabinet provides for decisions on renewal at least five years before expiry. The first pair of 900 MHz rights expires in November 2011, with other rights expiring progressively in mid-late 2012. Given the long lead time, the exact timing of offers is unlikely to be critical to the businesses that use the spectrum for renewal. An early Cabinet decision on renewal arrangements, however, [], and will provide certainty to all parties in advance of final offers being calculated.

OTHER CONSIDERATION – []

59 [].

60 [].

61 [].

62 [].

63 [].

CONSULTATION

64 The Treasury, Te Puni Kōkiri and the Department of Corrections were consulted and the Department of Prime Minister and Cabinet was advised in the preparation of this paper.

FISCAL IMPLICATIONS

65 Funding to implement the renewal process is provided under existing appropriation for radio spectrum sales under output class D2 "Management and Enforcement of The Radiocommunications Act 1989".

66 [].

HUMAN RIGHTS AND LEGISLATIVE IMPLICATIONS

67 There are no human rights or legislative implications issued raised by this paper.

REGULATORY IMPACT AND COMPLIANCE COST STATEMENT

68 Not required.

PUBLICITY

69 It is proposed that the Minister of Communications be authorised to announce the proposed arrangements, following Cabinet approval.

RECOMMENDATIONS

70 It is recommended that the Committee:

Policy on the expiry of commercial radio spectrum rights

- 1 **Note** that in April 2003, Cabinet agreed to a policy for the reallocation of commercial spectrum rights on expiry, which provides that subject to case-by-case assessment, replacement rights will be offered to existing right holders five years before expiry, and that if the renewal offers are rejected, the rights will be reallocated by auction [POL Min (03) 9/1];
- 2 **Note** that the policy requires the offer price to approximate the market value of the rights and produce a fair financial return to the Crown;

Case-by-case review of cellular rights

- 3 **Note** that management rights for cellular services in the 800 and 900 MHz bands are due to expire in 2011 and 2012, necessitating policy decisions in 2007;
- 4 **Note** that the Ministry of Economic Development (MED) has undertaken a case-by-case review, including consultations with stakeholders on such issues as the current usage and likely future use of these bands, the level of infrastructure investment, whether the rights should be renewed, the appropriate renewal period, and the appropriate pricing approach;
- 5 **Note** that these bands are currently used for 2G and 3G services and that the significant investments made in these bands provide a reasonable case to make renewal offers to incumbent operators while on the other hand, Vodafone and Telecom have ample spectrum in these bands to operate nationwide cellular networks, and that NZ Communications and TelstraClear have expressed interest in also deploying cellular networks in these bands;

- 6 **Note** that a 20-year renewal period for these rights is preferred by Vodafone and Telecom, that TelstraClear would prefer the same period only if some spectrum is reallocated to new entrants, and that NZ Communications did not make any comment on this issue;
- 7 **Note** that MED considers the incremental optimised deprival valuation (ODV) approach to be an appropriate and reasonable pricing approach in the calculation of a renewal price, which is conditionally supported by TelstraClear, Telecom and Vodafone, subject to the inputs required, and that NZ Communications does not support this approach;

Arrangements for the renewal of cellular rights

- 8 **Note** that freeing up 7.5 MHz to the open market would strike the best balance between providing certainty for incumbents and making the mobile market more attractive to new entrants, and that this quantity is within the range where overall network deployment costs are minimised, assuming a new entrant in each band;
- 9 **Note** [].
- 10 **Agree** that...[]...as a default, 7.5 MHz of the spectrum that expires in 2011 or 2012 in each band should not be offered for renewal but that renewal offers will be made to existing right holders for their remaining spectrum and 7.5 MHz would be offered by auction;
- 11 **Agree**, however, that if Telecom or Vodafone sell at least 5 MHz of 800 or 900 MHz spectrum on the secondary market to a person who does not currently hold spectrum in these bands within six months of the renewal offer being made, then:
- a if the rights sold expire after 2012, (Vodafone has some rights expiring in 2022) then the seller (Vodafone) will be offered the 7.5 MHz otherwise intended for auction;
 - b if the rights sold expire in 2011 or 2012, the purchaser would be offered corresponding renewed management rights at the price and substantially on the same terms offered to Telecom or Vodafone, and Telecom or Vodafone (as the case may be) will be able to purchase renewed management rights over the remaining part of the 7.5 MHz otherwise intended for auction;
- 12 **Agree** that the management rights be offered for a period of 20 years, subject to equalisation of expiry dates, and that the Ministry should consult with the present rightholders regarding the exact spectrum to be offered for renewal and for auction, including guard band requirements;
- 13 **Agree** that if any renewal offer is rejected by the existing right holder, then all of these rights will be reallocated by auction;
- 14 **Agree** that the offer price be determined using an incremental optimised deprival valuation (incremental ODV) approach, which will be checked for reasonableness against New Zealand and overseas benchmark values;

- 15 **Note** there is some risk that the spectrum in each band which is to be reallocated (by way of renewal offer or auction) could become or remain substantially unused by the new owner, and this would not be a desirable outcome;
- 16 **Agree** that the Minister of Communications be authorised to develop criteria to ensure that the reallocated spectrum rights are effectively used, including usage criteria and requirements to relinquish spectrum without compensation, and/or other measures short of relinquishment that would encourage use, and to apply such measures to the renewal process;
- 17 **Agree** that the legal form of arrangements to effect the above policy proposals will be finalised prior to renewal offers being made to Telecom and Vodafone;
- 18 **Agree** to authorise the Minister of Communications to approve and announce the renewal price offer, the terms of offer and settlement, and the timing of the auction as soon as practicable;
- 19 **Agree** that the current right holders be given six months from the date of the renewal offer to accept or reject the offer;
- 20 **Agree** that all interested parties, including current right holders, will be allowed to bid at auction, subject to any Commerce Act requirements

□.

21 □.

22 □.

Publicity

- 23 **Agree** to authorise the Minister of Communications to announce arrangements for the renewal of management rights for cellular services, and publish this paper and associated Cabinet papers and minutes in due course.

Hon David Cunliffe
Minister of Communications

Appendix 1 - Comparison of cellular spectrum holdings

Cellular operators with around a million subscribers
(a quarter of New Zealand's population)

Cellular operator	Subscribers	800-900 MHz (paired)	1800-1900 MHz (paired)	IMT2000 - 3G (paired)	Total cellular spectrum (paired)
Alliant Canada	715,493	12.5	5	-	17.5
Finnet Finland	830,000	13.2	14.6	14.8	42.6
Telia Denmark	1,146,667	7.2	14.2	15	36.4
Sonofon Denmark	1,284,443	8.8	19.2	15	43
O2 Ireland	1,602,000	7.5	14.4	15	36.9
Netcom Norway	1,651,000	14.2	16.4	15	45.6
Orange Nederland	1,914,000	5	15	10	30
Elisa Finland	1,962,101	18.8	15.6	14.8	49.2
Hutchison Hong Kong	1,971,000	11.4	11.6	14.8	37.8
Vodafone Ireland	2,047,000	7.5	14.4	15	36.9
Telfort Netherlands	2,332,000	5	17.4	10	32.4
NZ Communications New Zealand	-	-	10	potential access to 15 (via Hautaki Ltd)	10
TelstraClear New Zealand	-	-	25	15	40
Telecom New Zealand	1,808,000	20	25 (unusable under current technology)	15 (unusable under current technology)	60 (40 is unusable under current technology)
Vodafone New Zealand	2,024,000	22.5	15	15	52.5

Sources: Network Strategies (2006); MED (2007)