Commission for
Communications Regulation

Submissions to Consultation

Review of the Period 2008 – 2010 & Proposed Strategy for Managing the Radio Spectrum: 2011 – 2013.

Futher Submissions received from respondents

Document No:	**11/87**
Date:	**22 November 2011**

Consultation:	**11/28**
Submissions to Consultation	**11/28s**

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7 October 2011

Dear Sinead

RE: SUBMISSION RE COMREG 11/28

I refer to ComReg Doc. No. 11/28, *"Review of the Period 2008 – 2010 & Proposed Strategy for Managing the Radio Spectrum: 2011 – 2013"* ("ComReg's Proposed Spectrum Strategy Statement") and our previous response dated 24 May 2011. I now have great pleasure in enclosing an independent report commissioned by Hutchison 3G Ireland Limited ("H3GI") from NERA Economic Consulting ("NERA") in relation to indefinite licences. NERA concludes that there is a strong case for Ireland to adopt indefinite terms for mobile spectrum licences, subject to suitable conditions being imposed to protect ComReg's ability to fulfil its statutory objectives. In particular, NERA concludes that:

1. The current approach in Ireland of fixed term licences with no renewal option is inconsistent with ComReg's core objective of encouraging efficient use of spectrum. A shift to an indefinite licence regime would provide stronger incentives for investment and for spectrum trading.

2. There could be static and dynamic efficiency gains in Ireland of €250 million to €450 million over a 15 year period if a policy of indefinite terms is adopted.

3. Indefinite licence terms are better suited to meet the relevant objectives of a spectrum manager (ComReg), provide incentives for efficient utilisation of scarce spectrum, and promote competition and investment which should benefit consumers as well.

4. Consumers are also likely to be better off with indefinite term licences. This is because, amongst other matters, indefinite terms may increase the scope for entry and make the market more contestable, and competitive.

5. Countries that have been at the forefront of spectrum management reforms have either implemented or are considering implementing indefinite licences. The United Kingdom has implemented indefinite licences. New Zealand and the United States have implemented similar concepts. Australia and Canada are both considering indefinite licences.

Please let me know if ComReg would like NERA to present its report to ComReg.

[redacted]

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Yours sincerely

MARK HUGHES
Head of Regulatory

Encl.

[redacted]

04 October 2011

Indefinite Term Licences for Mobile Spectrum

A Report for Hutchison 3G Ireland Limited

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Executive Summary

NERA Economic Consulting has been commissioned by Hutchison 3G Ireland Limited to provide an independent review of the economic rationale for a change in approach to licence duration and renewal for spectrum used by mobile operators in Ireland. In the context of Ireland's on-going transition to a market-based spectrum management regime, a shift to indefinite licences would create better incentives for efficient use of spectrum over the long term. Currently, ComReg issues mobile licences for a fixed term of 15 or 20 years, after which licences may be reclaimed and re-auctioned. This report explores the economic rationale for a change in regime. We conclude that there is a strong case for Ireland to adopt indefinite terms for mobile spectrum licences, subject to suitable conditions being imposed to protect ComReg's ability to fulfil its statutory objectives.

Broadly speaking there are three main approaches to licence expiry: fixed-term licences with spectrum reverting to the state on expiry; fixed-term licences with provision for renewal; and indefinite licence terms which can be revoked under well-defined and specific circumstances. Historically, fixed terms have been the dominant approach in most countries, with great variation across regulators with respect to the duration of licences (from ten up to twenty years) and the extent to which procedures for renewal are defined and/or expected to be applied. In the context of a traditional command and control approach to spectrum management, regulators are typically reluctant to grant long terms and are cautious about creating expectation of renewal. Absent regulations that allow trading and change of use, reclaiming licences is the main tool available to regulators to support refarming of spectrum for new services and technologies.

However, the introduction of spectrum trading and liberalisation by the European Commission alters this picture. These reforms make it possible for the market to facilitate introduction of new services and technologies. Furthermore, fixed licence expiry dates are a potential barrier to market-driven change. As licences approach their expiry date, incentives for operators to trade spectrum in the secondary market and/or invest in networks dependent on spectrum diminish.

Licence expiry is associated with market illiquidity because the value of a licence will diminish toward the end of the licence term which is likely to hinder the development of trading markets. This will result in a lower volume of trading, and some of the benefits of a flexible and efficient market based approach to spectrum allocation will be lost. Fixed term licences also carry the risk that spectrum lies idle as reassignment by the spectrum manager normally takes significant time and resources. Indefinite licence terms which can be revoked under well-defined and specific circumstances, liberalisation and spectrum trading offer a simpler and less expensive approach to ensure that spectrum is utilised efficiently.

The adverse impact of licence expiry on investment has a solid basis in economic theory, and is supported by empirical observations from other sectors like agriculture. We note that empirical evidence for decreasing investment in mobile networks as licence expiry approaches is ambiguous. However, we believe that this can be explained by other factors, such as an expectation amongst operators that their licences will be renewed, that they will be able to win back spectrum that is re-awarded, or the fact that the investment relates to networks (for example 3G) for which licences are not about to expire. Moreover, fixed expiry dates may create anti-competitive asymmetries between operators, as larger operators

enjoy greater certainty than smaller rivals that they can win back spectrum in an auction, and therefore may have greater confidence about maintaining investment levels.

In this context, it is no coincidence that the countries that have been at the forefront of spectrum management reforms, such as Australia, Canada, New Zealand, the United Kingdom and the United States, are also at the forefront of reforms to licence terms.

Particular attention has focused on the reforms made by the UK regulator Ofcom, which uniquely has characterized its licence term regime as "indefinite". The term "indefinite" is somewhat misleading though. It does not imply, as some critics suggest, that spectrum is assigned indefinitely to an operator, with the implication that the spectrum manager surrenders its ability to reallocate the spectrum. In fact, UK mobile licences still have a fixed term of 15 or 20 years, after which licences may be revoked for defined spectrum management reasons given 5-years notice (or less in exceptional circumstances).

Although other leading reform countries have not yet introduced indefinite licences, many have similar regimes or are reviewing their approach. For example, in practice, the New Zealand approach of 20-year licences, with provision for notice of renewal at least 5 years before expiry, is not much different from the UK with respect to certainty provided to operators. Similarly, although the United States awards spectrum licences for only 10 years, the licence terms provide such a strong expectation of renewal that the regime may be characterised as similar to the United Kingdom. Both Australia and Canada have implemented market reforms while maintaining fixed term licences (10-15 years) which expire with no right of renewal. However, in recent consultations, regulators in both countries expressed concern that this approach was undermining incentives for investment, and indicated a desire to move to longer licences (possibly indefinite) that offer a strong expectation of renewal.

As these examples show, it is quite practical for the regulator to maintain powers to reclaim licences in defined circumstances, while at the same time giving operators sufficient certainty that they trade spectrum and invest in network construction. There are a variety of ways this can be achieved but the key elements are a very high (and well defined) expectation of renewal and, ideally, at least five years notice of any potential revocation for spectrum management reasons.

A further concern for any government may be the loss of future revenue streams if licences cannot be reclaimed and re-auctioned. However, this need not be a concern. In the United Kingdom, administrative incentive pricing (AIP) is applied to licences after the expiry of their initial term. AIP charges proxy the opportunity cost of the spectrum, and can provide a steady payment stream as an alternative to one-off auction revenues.

Most operators will prefer indefinite licences for the security of tenure they provide. Potential new licensees are sometimes an exception, even though they would benefit from the security of tenure of indefinite terms once they enter the market. An obvious reason why licensees may say that they prefer fixed terms over indefinite terms is that they are typically looking for an entry opportunity which may be provided by a government-run award. In practice, it is unclear a priori if the costs of acquiring spectrum are less under fixed terms or indefinite terms, but liberalised indefinite term tradable spectrum usage rights may provide more flexibility with regard to entry timing as a potential entrant can acquire spectrum from

the market. This will allow entry and exit decisions to be based on market developments and business plans and not be constrained by the timing of expiry of existing fixed term licences or new spectrum release.

There is a risk that a single operator acquires a disproportionate amount of spectrum via trading in order to preclude market entry or gain a competitive advantage. With indefinite licences, a regulator may be concerned that the situation may persist indefinitely. In such cases safeguards such as limits on the amount of spectrum that can be held by any operator at any time and ex-ante competition review of spectrum trading when such trading would lead to significantly less competition in the downstream market may be required. Spectrum caps or forced divestment of spectrum may also be required when secondary spectrum trading is not efficient. For example trading may not result in a socially optimal redistribution of strategically important mobile spectrum (for example sub-1 GHz spectrum bands). This is because, given the competitive advantage of holding such spectrum, incumbents may be reluctant to sell any spectrum they hold in these bands.

Consumers are also likely to be better off with indefinite term licences because as mentioned earlier the additional flexibility with regard to entry timing should make the market more contestable and competitive, and provide incentives for operators to invest adequately to meet growing traffic demand, to expand their network footprint and roll-out new services like mobile broadband more extensively. The importance of (high speed) broadband access for Ireland is recognised by both ComReg and DCENR which identifies high speed broadband services as being critical in attaining the Government's twin goals of becoming a 'Smart Economy' and a 'Knowledge Society'. Given the low population density in Ireland, next generation (4G) mobile networks will play an important role in providing fast broadband access to Irish consumers. Indefinite terms will mean more investment in these new networks and better internet access for Irish consumers.

Ireland is currently in the process of adopting its own market-based reforms, including trading and liberalisation of mobile spectrum, in line with EU directives. The implementation of these reforms provides a natural backdrop for complementary reforms to licence terms. We find that there would be static and dynamic efficiency benefits for Ireland if a policy of indefinite terms were to be adopted. Static efficiency gains derive from improved utilisation of spectrum by new or existing users of spectrum resulting from trades of licences that would not have occurred without a shift to indefinite licences. Dynamic efficiency gains capture increases in consumer surplus where investment, roll out and adoption of new services and technologies happens earlier than would otherwise have been the case. We estimate that these static and dynamic efficiency gains in Ireland could plausibly be of the order of €250 million to €450 million over a 15 year period.

In conclusion, we find that the current approach in Ireland of fixed term licences with no renewal option is inconsistent with ComReg's core objective of encouraging efficient use of spectrum. A shift to an indefinite licence regime would provide stronger incentives for investment and for spectrum trading. The potential benefits from reform are particular great in relation to the mobile sector.

1. Introduction

Hutchison 3G Ireland Limited ("H3GI") has commissioned NERA UK Limited ("NERA") to provide an independent expert analysis of the economic rationale for introducing indefinite licence terms for mobile spectrum in Ireland. This could involve an indefinite licence extension for existing 2.1GHz 3G licences and licensing of the pending 800MHz, 900MHz, and 1800MHz licences on an indefinite basis. It should be noted at the outset that an indefinite licence term does not mean irrevocable spectrum rights. The government should continue to have the right to revoke licences and reclaim spectrum in specific and well defined circumstances.

This report sets out our analysis of the relevant issues, and is structured as follows:

- Section 2 provides definitions for different approaches to licence terms;
- Section 3 discusses possible advantages and disadvantages of different approaches in the context of spectrum trading and liberalisation from the perspective of different stakeholders – the spectrum manager, incumbent licensees, potential future licensees and consumers;
- Section 4 presents information on the approach adopted to license terms for selected countries, and summarises the trend in licensing conditions across these countries;
- Section 5 analyses the static, dynamic and competitive effects of indefinite term licences in Ireland; and
- Section 6 presents our conclusions and recommendations.

2. Approaches to Licence Duration and Renewal

Spectrum licences for mobile services may have many different terms and conditions attached to them. These can be grouped into three categories: policy conditions (such as roll-out obligations) designed to achieve specific public interest goals; technical conditions (such as frequency endowments, guard bands and block-edge masks), designed to promote efficient use of spectrum and management of interference; and non-technical conditions (such as licence duration, usage restrictions and tradability), which determine how the spectrum is used. This report focuses on the third category: non-technical conditions. Specifically, we explore the approaches available for determining licence duration (the number of years that a licence is valid for) and conditions for renewal. However, any discussion of licence duration and renewal would be impossible without considering the broader context of controls on spectrum use and trading.

Historically, the dominant approach towards licence duration in most countries has been to set fixed terms, but there is great variation across regulators with respect to the length of term. There is also variation in the extent to which procedures for renewal are defined and/or expected to be applied. Many countries require licensees to re-apply for licences on expiry, often as part of a competitive process. In the context of a traditional command and control approach to spectrum management, many regulators have tended towards a rigid approach of fixed terms with no direct renewal. Under such a regime, regulators are entirely responsible for determining how spectrum is allocated, and the ability to reclaim licences through licence expiry is the main standard tool available to them to support refarming of spectrum for new services and technologies.

In recent years, European countries have tended to move away from the command and control approach to spectrum management in favour of market-based approaches, such as auctions, trading and liberalisation. Indeed, with respect to mobile services, the European Commission has recommended that all licenses be issued on a technology and service neutral basis, and that these licenses allow for spectrum trading.[1] These reforms mean that in the future:

- Mobile spectrum will be tradable both between incumbents and entrants, and may potentially be partitioned or aggregated to form licences with different frequency, time or geographic endowments; and

- Licences will be issued or refarmed on a service and technology neutral basis, meaning that mobile operators will have great flexibility over the services that they provide to end users and the technology and equipment that they deploy to provide these services. For example, existing mobile licences at 900MHz and 1800MHz, which historically have been restricted to GSM technologies, will be available to be redeployed for new technologies, such as 3G and LTE.

These changes also have implications for the approach that governments take to licence duration and renewal. Such reforms mean that it is possible for the market to facilitate introduction of new services and technologies by existing operators or new service providers.

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[1] *Commission Directive 2009/140/EC*, European Commission, 25 November 2009.

In this context, the importance of licence expiry as a tool for re-allocation of spectrum may be greatly diminished. Therefore, with the introduction of other spectrum management reforms, it is appropriate for regulators to review their approach to licence duration.

We explore the potential costs and benefits of different approaches to licence renewal in Section 3. To facilitate comparison, we define three types of approach that regulators can and have adopted for licence duration:

- Fixed term with no defined renewal provision or expectation of renewal;
- Fixed term with a renewal provision or expectation of renewal for another fixed term; and
- Indefinite term with revocation possible in specific and well defined circumstances.

In practice, of course, the particular approach taken by countries may not fit neatly into any one of these categories. For example, there is a continuum of approaches to licence renewal, from possible but not expected to guaranteed except under specific defined circumstances.

Fixed term with no renewal provision or expectation of renewal

The key characteristic of this approach is that, upon expiry of the fixed term, the licence reverts back to the spectrum manager. The existing licensee has no guarantee that it will be able to reacquire the frequencies that it was previously using. The regulator may decide to reallocate the spectrum to the same or different use, and has discretion over the assignment process. In Europe, the most common approach is to re-assign frequencies using an auction. Such auctions are typically scheduled before expiry, so as to prevent any discontinuity in licence use between terms.

This is the current mobile licensing regime in Ireland. Mobile licences are typically granted for a fixed term of 15 or 20 years, and there are no explicit renewal provisions in either the 2G or 3G licences. With respect to 2G licences, which expire between 2011 and 2015 in Ireland, ComReg proposes to reclaim and reassign these frequencies via an auction. It has not yet adopted a formal position on the 3G licences, but the de facto assumption would be that without a change of policy it would adopt the same approach again.

Fixed term with a renewal provision or expectation of renewal for another fixed term

In this case, the licensee has a degree of certainty that its licence term will be renewed for a further fixed term upon expiry of the initial fixed term. The expectation of renewal of spectrum usage rights may be based on an explicit provision dealing with renewal terms in the original licence or based on precedent i.e. past instances when the spectrum manager has renewed licences. Typically, there will also be some procedure for notifying the licensee of a decision to (or not to) renew the licence some time in advance of expiry.

Many countries have adopted renewal processes for mobile licences. For example, this is the standard approach in Canada and the United States, where terms are only ten years but renewal is usually automatic provided that licensees fulfil their policy and technical conditions. However, there is great variation with respect to the certainty and notice provided by different regulators with respect to renewal.

Indefinite term with revocation possible in specific and well defined circumstances

An indefinite term licence is defined as having the following term conditions:

- An initial fixed term (say 20 years) during which the licence can be revoked in a limited and narrowly defined set of conditions similar to revocation conditions attached to current fixed term licences (e.g. for non-payment of licence fees, a breach of the terms of the licence or national security reasons). During this initial term the licence may not be revoked for spectrum management reasons.

- Once the initial period has expired, the grounds for revocation include the right to revoke for spectrum management reasons subject to a minimum notice period of five years. Unless revoked, the licence remains in force and the licensee continues to hold the licence (i.e. it is indefinite in duration). Alternatively, this may be defined as a process of automatic, rolling renewal, with a minimum term always equal to the notice period.

Under these conditions, an indefinite licence is clearly not the same as an irrevocable licence. The spectrum regulator retains the power to intervene if it perceives that the market is no longer delivering an efficient outcome in terms of spectrum allocation.

The UK has led the way in introducing indefinite licences, as defined above, for commercially used spectrum. Most recently, following a decision on refarming of 2G spectrum, it has announced its intention to convert existing 3G licences to indefinite terms, from the previous fixed terms of 20 years.[2] It also plans to award new licences at 800MHz and 2.6GHz on an indefinite term basis.[3]

[2] *Statement on variation of 2100 MHz Third Generation Mobile Wireless Telegraphy Act Licences,* Ofcom, 20 June 2011.

[3] *Consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6GHz spectrum and related issues*, Ofcom, 22 March 2011.

3. Licence Terms and Stakeholders

In this section, we consider the costs and benefits of the three approaches to licence duration and renewal from the perspective of various stakeholders:

- Spectrum manager (Section 3.1);
- Incumbent licensees (Section 3.2);
- Potential new licensees (Section 3.3); and
- Consumers (Section 3.4).

In Section 3.5 we summarise the position of these different stakeholders under different licence terms and renewal regimes.

3.1. Spectrum Manager

Spectrum is a scarce and valuable resource. ComReg estimates that in 2009 the use of radio spectrum contributed about 2 % to Irish GDP, and employed over 26,000 people.[4] Given the scarcity value of spectrum, a spectrum manager needs to ensure that spectrum is allocated efficiently and that it is not left unused for long periods.

Although the economic efficiency of spectrum use is typically defined as the primary goal of the spectrum manager, it will also have a number of other objectives, which may or may not be consistent with the efficiency objective. In summary, a typical set of objectives for a regulator may include:

- Promoting efficient use of spectrum, meaning allocating spectrum to the most high value uses, assigning it to users that can generate the highest value, and encouraging sustainable investment by licence holders; [5]
- Ensuring that radio frequencies do not lie unused for long periods of time if there is a viable use for the spectrum;
- Meeting the country's international obligations, including management of interference at national borders and taking account of European and international harmonisation initiatives;
- Promoting competition in downstream markets, so as to ensure that a variety of services are delivered to consumers at reasonable prices;
- Supporting related public policy objectives, such as the availability of broadband services to rural areas and access by different groups within society, such as the poor and elderly; and

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4 *ComReg Document 11/28*, 12 April 2011.

5 See for example *ComReg Document 11/28*, 12 April 2011.

- Generating revenues from the sale of spectrum.

In the following subsections, we analyse each of these possible objectives and explore how effectively they may be achieved under different approaches to licence duration and renewal.

3.1.1. Efficient allocation

In the absence of spectrum trading and liberalisation, a fixed term licence is a useful spectrum management tool. This is because it allows the spectrum manager to periodically reallocate and reassign spectrum in response to changing technologies and market developments. This command and control approach to spectrum assumes that the spectrum manager can:

- Identify the best use and technology for a band of spectrum at a given time;
- Predict the technology, investment and market cycles accurately to set the fixed term; and
- Allocate radio spectrum to users who will use it efficiently for the entire fixed term of the licence.

In practice, it is unlikely that the spectrum manager has the information required to make all these decisions. Technology and markets develop rapidly, continually and unpredictably. It will be difficult to set fixed terms to correspond to these developments. A more flexible market based approach is likely to allocate scarce spectrum more efficiently. Following the revisions to the Common Regulatory Framework for Electronic Communications Networks and Services at the European level, [6] ComReg identifies the following implications for spectrum management: [7]

- *"limits on the restrictions that can be placed on the rights of use of Electronic Communications Services (ECS), with the aim of moving to a more technology-and service-neutral licensing environment; and*
- *allowing for the transfer or lease of individual usage rights for radio frequencies between undertakings."*

The move to technology and service neutral licensing and spectrum trading recognises that market based mechanisms are better at reallocating and reassigning spectrum usage rights on a continuous basis, and able to accommodate inherently unpredictable technology and market developments.

To date spectrum auctions have been the most prominent market based mechanisms used to allocate mobile spectrum, but as Martin Cave points out in his paper on spectrum management, [8]

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6 *Commission Directive 2009/140/EC*, European Commission, 25 November 2009.

7 *ComReg Document 11/28*, 12 April 2011, Pg 20.

8 *Cave, M., Market-Based Methods of Spectrum Management in the UK and the European Union*, Telecommunications Journal of Australia , Volume 58, Number 2-3, 2008, Monash University Epress.

> *"…auctions by themselves do not make a fundamental change in spectrum management, because they usually operate in a framework of command and control over the use of the licence that is being auctioned. Thus they introduce a competitive element into the assignment process, but do not necessarily introduce flexibility into spectrum use."*

What is required in order to ensure the efficient use of spectrum is that initial allocations made via auctions are combined with liberalised spectrum usage rights which are tradable. Spectrum liberalisation and trading both between incumbents and entrants will help allocate spectrum to its most valuable use and efficient user, and facilitate the introduction of new services and technologies.

A fixed term licence with no renewal will interrupt efficient allocations via spectrum trading because it will disrupt the market when licences expire, and reduce the value of spectrum when licences are close to expiry. A fixed term licence with some expectation of renewal will also impede efficient market based allocations because buyers and sellers will be unsure if spectrum usage rights will be valid beyond the fixed term. This uncertainty of licence tenure will diminish incentives to trade spectrum as it will be difficult to estimate the value of spectrum. An indefinite term licence with revocation possible in specific circumstances has well defined spectrum usage rights in the sense that there is minimal uncertainty with regard to the licence term. This will facilitate spectrum trading and the efficient allocation of spectrum, a conclusion also reached by the Australian Productivity Commission: [9]

> *"…There was some concern that long term or perpetual licences would lock in spectrum uses. It was presumed that spectrum licences would be limited to specified uses, and hence that a limited term might still be needed to give the regulator scope to change spectrum use when licences expire. But as explained previously, the RC Act does not require that spectrum licences be limited to a specified use. They are not linked to the spectrum plan and have considerable latitude to adopt different uses and technologies. With some attention to creating core conditions that are as technologically neutral as possible, spectrum licences would have the characteristics required for perpetual licences."*

We note that contrary to what ComReg suggests, there is no incentive for licensees to "hold out" and delay trading in the expectation that they will be able to sell spectrum at a higher price later if licences are issued for an indefinite term.[10] This is because:

- Firstly, as explained above, indefinite terms make it easier to value and hence trade spectrum usage rights. All relevant information at a given point in time (for example foreseeable technological developments and new uses) will be reflected in the spectrum trading price in an efficient market. Any changes in the value of spectrum will be the result of new information such as technological breakthroughs, etc. Once revealed this information will also be incorporated in the spectrum trading price in an efficient market. Unless a licensee has private information there is unlikely to be any gain from holding out.

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9 *Productivity Commission 2002, Radiocommunications,* Report no. 22, AusInfo, Canberra, 1 July 2002, Pg. XLV.

10 *ComReg Document 11/28*, 12 April 2011, Pg 24.

- Secondly, it need not be the case that the value of spectrum increases as new technologies are developed; it might decrease, and to delay selling could be a loss making strategy. For example, increasing substitutability of spectrum bands, and the development of radio technologies and devices that can operate across multiple frequencies may decrease the relative value of a particular spectrum band.

We also note that once spectrum usage rights are technology and service neutral, it no longer makes sense to set the licence term in line with future technology and investment cycles as the market will facilitate the introduction of new services and technologies. In this context the basis for setting fixed terms is unclear and the importance of licence expiry as a tool for reallocation of spectrum may be greatly diminished.

The investment incentives for licensees under fixed and indefinite licence terms are discussed in detail Section 3.2.1. In general, security of tenure associated with indefinite licences will allow mobile operators to invest in their networks continuously as markets and technologies develop without the threat of potential termination of the licence leading to unexploited stranded investments. This will result in sustainable and high levels of investment by licensees.

3.1.2. Unused spectrum

Given the scarcity value of spectrum, a spectrum manager would like to avoid situations when useful spectrum is left unused. Such a situation can arise because:

- The spectrum manager fails to reallocate spectrum in a timely fashion; and/or
- A licensee does not use its spectrum allocation.

3.1.2.1. Spectrum manager fails to reallocate spectrum

The risk that a spectrum manager fails to reallocate spectrum in a timely fashion is higher with fixed terms because in every period that the licence expires the spectrum manager needs to organize and implement a reallocation mechanism. Ofcom sees this as one of the disadvantages of fixed term licences, and states,[11]

> *"…In particular, reassignment by the regulator typically takes significant time and resource. The spectrum may also lie idle for a period as the regulator prepares for reassignment. While it may be possible to reduce this problem through the use of overlay auctions, the approach of an indefinite term together with spectrum trading seems likely to offer a simpler and less costly way of ensuring the spectrum is used efficiently."*

Another problem with fixed terms is that licences may not co-terminate. This can occur either because licences are issued at the same time with different fixed terms (though this is not usually true), or because licences with the same fixed term are issued at different times – for example in the case of operators entering the market in different years. The renewal of licences is complicated because renewal decisions for expiring licences should not favour one

[11] *Consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues*, Ofcom, 22 March 201, Pg 74.

licensee over another, and this can delay and complicate spectrum liberalisation and renewal. For example, if expiring licences are renewed on a liberalised basis whereas existing licences continue to have technology and service restrictions then existing licensees will be disadvantaged. The problem of non co-terminating licences will not occur with indefinite terms.

3.1.2.2. Licensee fails to use spectrum

The risk that a licensee does not utilise the entire spectrum allocated to it is also lower with indefinite terms provided spectrum usage rights are liberalised and traded efficiently. ComReg recognises that indefinite term licenses will be more tradable, and says that *"as a term-limited licence approaches its end date, the market for such a licence will diminish."*[12] The higher tradability of spectrum usage rights provides licensees an incentive to use or sell their spectrum. The Australian Productivity Commission also reached the same conclusion in its study:[13]

> *"…But perpetual rights would not lock in spectrum use. On the contrary, their greatly improved marketability would emphasize the opportunity cost of not using licences efficiently. Competing users, new technologies and changing market opportunities would impose a discipline on incumbents to use the spectrum efficiently or sell it or lease it to others who can."*

The incentives for mobile network operators to use spectrum efficiently or trade unused spectrum arise because they are commercial organizations which strive to minimize costs by optimising spectrum usage. For a given spectrum allocation, more capacity can be provided by increasing network investment. Conversely, for given network investment, more capacity may be provided if more spectrum is deployed. The operator's technical valuation of marginal spectrum will be no more than the network costs that it will avoid as a result of having that spectrum. If a buyer is willing to pay more for marginal spectrum than the seller's avoidable network costs, it will be profit maximising for an operator to sell spectrum.

In this context, there is a risk that a single operator acquires a disproportionate amount of spectrum via trading and hoards this spectrum in order to preclude market entry and/or gain a competitive advantage. It is also possible that the secondary spectrum trading market is not efficient. For example trading may not result in a socially optimal redistribution of strategically important mobile spectrum (for example sub-1 GHz spectrum bands). This is because, given the competitive advantage of holding such spectrum, incumbents may be reluctant to sell any spectrum they hold in these bands. With indefinite licences, a regulator may be concerned that the situation may persist indefinitely. In such cases other policy tools may be required to address competition concerns. For example, ex-ante competition reviews of mobile spectrum trading that might significantly lessen competition in the downstream market should prevent significant risk to competition in the downstream market arising via trading in the first place.[14] Further, as a pre-emptive measure, a regulator may impose caps

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[12] *ComReg Document 11/28*, 12 April 2011, Pg 26.

[13] *Productivity Commission 2002, Radiocommunications*, Report no. 22, AusInfo, Canberra, 1 July 2002, Pg. XLVI.

[14] For example Ofcom proposes undertake *ex-ante* competition reviews (Source: *Statement to make 900MHz, 1800MHz and 2100MHz public wireless network licences tradable*, Ofcom, 20 June 2011).

on spectrum holdings below 3 GHz and particularly sub-1 GHz, for example, as proposed by the Telecommunication and Internet Federation.[15]

3.1.3. International coordination and harmonisation

The allocation and use of radio spectrum needs to be coordinated internationally in order to avoid interference problems. There are also advantages for end-users, service providers, and equipment manufacturers if spectrum use is coordinated internationally as this allows operators and equipment manufacturers to exploit economies of scale.[16] This means that from time to time ComReg may need to make major allocation and harmonisation changes in line with other European countries or internationally. Usually such major allocation and harmonisation changes happen infrequently and take a long time to develop and finalise. For example the reallocation of spectrum originally used for analogue television for mobile services (also known as the Digital Dividend) has taken over ten years in Europe.[17] We also note that existing 2G licences in Ireland have a fixed term of 15 years, and 3G licences a fixed term of 20 years.[18] This suggests that at the time these licences were issued no major allocation and harmonisation changes were foreseen for the next 15/20 years in the spectrum bands used for these services.

On expiry a fixed term licence reverts back to the spectrum manager who can take this opportunity to make major allocation and harmonisation changes if required. This reallocation will proceed smoothly if the year of expiry of the fixed term licence coincides with the year when major allocation and harmonisation changes need to be made. However, this may not always be the case. For example although the 2.6 GHz band is subject to a June 2008 Commission decision which harmonizes this band for the provision of electronic communication services,[19] it has been difficult to implement these changes in Ireland where this band is licensed to UPC for MMDS TV services for a fixed term that does not expire till April 2014.[20]

An indefinite term licence during its initial term is similar to a fixed term licence. After that an indefinite term licence can be revoked for spectrum management reasons subject to a minimum notice period of five years. Given that major allocation and harmonisation changes take place infrequently and take a long time to develop there should be sufficient time for a spectrum manager to provide five years notice before undertaking major allocation and harmonisation changes.

In fact an indefinite term licence with an initial term of 20 years and subject to revocation after the initial term for spectrum management reasons, given five years notice, will provide

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15 *IBEC Telecommunications and Internet Federation*, Submission on ComReg 11/28-Review of the Period 2008-2010 and Proposed Strategy for Managing the Radio Spectrum: 2011-2013, 24 May 2011.

16 *Commission Directive 2009/140/EC*, European Commission, 25 November 2009, Para 33.

17 For example see: http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/topics/reorg/dividend/index_en.htm , and ComReg 09/15.

18 http://www.comreg.ie/radio_spectrum/search.541.874.10003.0.rslicensing.html.

19 *Commission Decision 2008/477/EC*, European Commission, 13 June 2008.

20 *ComReg Document 10/38*, 14 May 2010 and *ComReg Document 10/58s*, 27 July 2010.

more flexibility than a fixed term license of 20 years which is reacquired and then reallocated for another fixed term of 20 years. This is because the latter would only permit major allocation and harmonisation changes in the year when the first fixed term expires (i.e. in the 20th year) and then when the second fixed term expires (i.e. in the 40th year). The indefinite term license on the other hand would allow for major allocation and harmonisation changes to be made in any year after the initial period has expired subject to a five year notice period i.e. in year 21 (notice given in year 16), year 22 (notice given in year 17), year 23 (notice given in year 18) and so on.

3.1.4. Promoting competition

Effective competition between operators will ensure that consumers are offered a wide variety of services at reasonable prices. Both actual entry and the potential threat of entry will promote competition.

With fixed term licences entry is only likely to occur periodically when existing licences expire and are reallocated, or new spectrum is released. This is because the closer a fixed term licence is to expiry the less attractive it will be for a potential entrant to buy the associated spectrum usage rights. This will be true even if there is an expectation of renewal, as this does not guarantee that the licence will be renewed. It will be difficult for an entrant to develop a business case given the uncertainty of tenure. Indefinite term licences will provide greater security of tenure which should facilitate entry (and exit) at any time during the term of the licence. This is because a potential entrant will be guaranteed that spectrum usage rights will not be revoked except for major allocation and harmonisation changes, and this should provide sufficient time to recover investments and make a reasonable profit. This in turn should lead to more competitive pressure as the market will be contestable to a greater degree than under fixed term licences. As the Australian Productivity Commission states:[21]

> *"Perpetual licences would allow market participants to choose if and when they enter or exit the industry. Instead of facing an arbitrary cut off date, licensees could match their licence holdings to their business plans."*

However, a potential concern with spectrum trading and indefinite terms as opposed to fixed terms is that one operator could acquire a disproportionate amount of spectrum, and this situation might persist and reduce competition. As ComReg says, it *"needs to ensure that spectrum rights do not become concentrated in too few hands such that competition in downstream markets would be restricted to a significant extent (or otherwise foreclosed)."*[22] As mentioned earlier, in such cases additional safeguards such as trading in spectrum bands being subject to limits on the amount of spectrum that can be held by any one operator at any time, and ex-ante competition reviews of trading which might significantly lessen competition in the downstream market may be required. Ex-post competition law can be used to identify other anti-competitive practices that are not related to spectrum allocation. Once identified, these practices can be tackled directly.

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[21] *Productivity Commission 2002, Radiocommunications,* Report no. 22, AusInfo, Canberra, 1 July 2002, Pg XLVI.

[22] *ComReg Document 11/28,* Pg 24.

The periodic re-release of spectrum through auctions is in any case unlikely to be helpful in dealing with the existing market power of operators. This is because the strength of a bidder will to some extent be based on its current position in the market. As a result the same licensees are likely to reacquire spectrum when spectrum is re-released. For example ComReg found with regard to GSM licences that the *"likelihood of O2 and Vodafone not winning spectrum in a competitive award is very low."*[23] Fixed expiry dates may in fact favour larger operators if they enjoy greater certainty than smaller rivals that they can win back spectrum in an auction.

There is also a pan-European dimension to spectrum trading and licensing. Operators present in multiple countries will be able to realise economies of scale in production and marketing and this may also lead to more competition. It is likely to be easier to implement such a strategy by acquiring indefinite term spectrum usage rights from the market rather than waiting for fixed term licences to expire in different countries and/or wait for spectrum managers in these countries to release new spectrum. It is also unlikely that fixed term licences in different countries will expire simultaneously. The European Commission emphasizes this Community dimension in its 2009 directive:[24]

> *"The undue fragmentation amongst national policies results in increased costs and lost market opportunities for spectrum users, and slows down innovation, to the detriment of the internal market, consumers and the economy as a whole. Moreover, the conditions for access to, and use of, radio frequencies may vary according to the type of operator, while electronic services provided by these operators increasingly overlap, thereby creating tensions between rights holders, discrepancies in the cost of access to spectrum, and potential distortions in the functioning of the internal market."*

Finally, we note that irrespective of whether licences are issued for fixed or indefinite terms, a spectrum manager will always be able to use primary allocations of new harmonised bands (like the 2.6 GHz band, and possibly spectrum currently being used by the military and other public bodies) to influence competition among existing operators or to promote its other policy goals.

3.1.5. Public policy goals

In relation to spectrum use, regulators often have related public policy goals. Historically, these have often been included in spectrum licences in the form of roll-out and coverage conditions. Repeated spectrum awards provide a tool for addressing new public policy issues as they arise. Therefore, a possible concern with the introduction of indefinite licences, is that regulators may be surrendering a tool to intervene in the market.

For example, in the case of mobile, spectrum managers may be mandated to:

- extend and/or improve the availability of mobile services to areas which are not covered at present; and/or

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[23] *ComReg Document 09/99*, 21 December 2009, Pg 44.

[24] *Directive 2009/140/EC*, European Commission, 25 November 2009.

- enable internet access and use by groups within society, such as the poor and elderly, who may either lack the skills or financial means to access broadband services.

One way to extend the availability of services for users is to include service coverage obligations in the original licence conditions. Of course, coverage obligations can be included in both fixed and indefinite term licences. For example, Ofcom proposes to include broadband coverage obligations in one of the 800 MHz licences to be issued for an indefinite term.[25] However, with indefinite licences, changing terms later may be more difficult as licensees may raise concerns with regard to changes to existing terms and conditions.

How concerned should regulators be about this loss of flexibility? Our view is that this should not be a major concern, for three reasons:

Firstly, imposing policy conditions on licences may be a rather blunt tool. It is far from straightforward to specify various technical parameters used to measure quality and coverage obligations, especially when technologies are new and evolving. Such obligations could distort investment and roll-out decisions and result in a less valuable service than would otherwise have been the case. This might occur if regulators misjudge the value that consumers place on different services. For example, consumers might value indoor coverage more than speed but regulators might emphasize the latter in mandated coverage obligations. Alternatively, conditions designed to promote one type of service may inadvertently prevent roll-out of another type of service that emerges later which offers superior benefits to consumers.

Secondly, it is always possible to set up incentive schemes outside the initial licence terms and conditions to deal with new public policy concerns. The Rural Broadband Scheme and the National Broadband Scheme are two such examples in Ireland.[26]

Finally, demand side interventions by governments, such as subsidies to groups who cannot afford broadband services or training to previously excluded groups within society, may be a much more effective and less distorting way of achieving public policy goals. These demand side interventions are unrelated to licence terms, and can be undertaken with both fixed and indefinite terms.

3.1.6. Revenue generation

The initial allocation of spectrum can be used to generate revenues via licence fees. These licence fees can be set to recover the costs of the licensing process and managing spectrum, to ensure that spectrum is allocated to its most valuable use, and/or to raise revenue for the government. Given the substantial benefits of mobile services to consumers and the economy, and the scarcity of mobile spectrum, the most important goal of spectrum managers should be to ensure that this spectrum is used efficiently. Revenue generation should be a secondary

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[25] *Consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6GHz spectrum and related issues*, Ofcom, 22 March 2011, Pg 80.

[26] The Rural Broadband Scheme in Ireland aims "to enable a basic broadband service to be provided to individual rural premises which are not capable of obtaining a broadband service from existing internet service providers." The National Broadband Scheme in Ireland aims to provide broadband in areas where these services have been found to be insufficient (Source: http://www.dcenr.gov.ie/Communications/Communications+Development/).

objective. As mentioned earlier, indefinite term licences should result in efficient utilisation of spectrum (Section 3.1.1and 3.1.2), and in cost savings for the spectrum manager because there will be no need to organise a licence renewal process every time a licence expires.

However, if licences are issued for an indefinite term, then a concern for any government may be the loss of future revenue streams if licences cannot be reclaimed and re-auctioned. This need not be a concern if the spectrum manager uses administrative incentive pricing (AIP). With AIP the fee levels are set by the spectrum manager based on its estimate of the market value of spectrum. AIP can provide a steady payment stream as an alternative to one-off auction revenues, and help ensure that incumbent operators pay a fair price for the spectrum they hold. In the United Kingdom, AIP (now Annual License Fee - ALF) is applied to licences after the expiry of their initial term.

In principle, in an efficient trading market, the price for which spectrum could be sold would signal the opportunity cost of spectrum and promote its optimal use. Ofcom, the UK regulator, proposes to assess the respective roles of trading and AIP on a sector-by-sector basis.[27]

Next we discuss the costs and benefits of the three approaches to licence duration and renewal from the perspective of incumbent licensees.

3.2. Incumbent Licensees

Incumbent licensees typically prefer indefinite term licences to fixed term licences. The main reason is that security of tenure will allow mobile operators to invest in their networks continuously as markets and technologies develop without the threat of potential termination of the licence leading to unexploited stranded investments. We discuss this further in Section 3.2.1 below. Before that we consider how licence terms might affect optimal utilisation of spectrum, raising funds for investment, and competition between fixed and mobile operators.

Optimal Utilisation

As discussed in Section 3.1.1 and 3.1.2, minimal uncertainty with regard to renewal rights associated with indefinite terms makes spectrum more marketable and this is likely to lead to a more active spectrum trading market. A more active trading market will allow operators to optimise their spectrum holdings and minimise operating costs by balancing investment in network equipment and spectrum as described in Section 3.1.2.2. The increased scope for entry and exit associated with indefinite terms also means that the market will be contestable to a greater degree which should increase the competitive pressure on incumbent operators to use their spectrum efficiently.

Raising funds for investment

With fixed terms, uncertainty related to the renewal of the licence and the cost of renewal may mean that operators will not be able to raise adequate funds for investment and/or face an increase in the cost of funds towards the end of the licence terms. This is due to the

[27] *SRSP: The revised Framework for Spectrum pricing*, Ofcom, 29 March 2010.

potential destruction of shareholder value and increase in costs of business which will occur if an operator:

- Fails to win any spectrum: In this case the operator will no longer be able to use its network infrastructure to provide mobile services, and it may need to exit the market.

- Wins less spectrum than it had before: In this case it will need to exploit the spectrum it wins more intensively thereby raising network costs and/or incur additional costs of non-technical measures like roaming agreements.

- Wins spectrum in a different band than before: In this case the operator may need to incur costs of retooling its network to work with new frequencies, costs of non-technical measures such as roaming, and additional costs of migrating some end users between spectrum bands.[28]

In all three situations the operator's competitive position in the market will be adversely affected and its costs will increase. This is likely to affect its ability to raise funds. The inability to raise adequate funds or the increased cost of funds will mean that an operator may not be able to invest adequately to meet growing traffic demand, to expand its network footprint, and/or to roll-out new services like mobile broadband extensively.

Competition between fixed and mobile operators

Mobile operators increasingly compete with fixed operators to provide voice, data and video services. Fixed operator licences in Europe are usually for an indefinite term which means fixed operators can continually invest in their networks without the risk that their licences may not be renewed. Indefinite term spectrum licences will put mobile operators on an equal footing and allow them to compete better with fixed operators.

3.2.1. Licensee investment incentives

Mobile networks require continuous investment to cope with expected growth in traffic, both in terms of scale, for example deploying more backhaul and configuring more uplink capacity, and innovation, for example deploying more spectrum efficient network technology and network upgrades which also require significant investment. If licences are for fixed terms operators need to ensure that there is significant payback early – in general an operator would expect to break-even about a third of the way through a fixed term, recover investment in the first half, and generate free cash flow in the second half to be able to earn a reasonable return on its investment. This means there is unlikely to be substantial new investment in new sites or services in the second half of a fixed term licence because there might be insufficient time to recover investments, and make a reasonable profit. So, as licences approach their expiry date, incentives diminish for operators to invest in networks dependent on spectrum. Such

[28] These might be customers who do not have multi-band phones and/or are using a technology (for example 2G) which is not provided in the reacquired spectrum band.

behaviour has a solid basis in economic theory, and is supported by empirical observations from other sectors such as agriculture.[29]

We note that empirical evidence for decreasing investment in mobile networks as licence expiry approaches is ambiguous. However, we believe that this can be explained by other factors, such as an expectation amongst operators that their licences will be renewed, that they will be able to win back spectrum that is re-awarded, or the fact that the investment relates to networks (for example 3G) for which licences are not about to expire. We believe that ComReg's observation that three of the mobile operators in the Irish market invested significantly towards the end of their licence terms can be explained by these factors.[30] For example eircom in its submission to ComReg states:[31]

> *"In the last two financial years (1July 2008 to 30 June 2010) eircom Group has invested [ ] in its mobile network. The vast majority of this investment, [ ], has been in respect of our 2100MHz licence (expiry date in 2027). Limited sums have been invested in maintaining existing capabilities provided under our GSM licence given the regulatory uncertainty created by the publication of ComReg 08/57 calling into question our legitimate expectation of licence renewal.*
>
> *The regulatory uncertainty resulting from ComReg's ongoing review has inhibited rather than promoted investment contrary to ComReg's objectives. It is arguable that under a more flexible licensing regime (with indefinite licences or at the very least clearly defined renewal rights) we would have adopted an investment profile generating greater societal benefits. The root of the problem is the arbitrary nature of finite licence durations and the inflexible nature of current licences. Flexible spectrum rights support continuous investment which is infinitely superior to ComReg's apparent policy approach of periodic re-release which serves to stall service development in the run-up to the re-release process."*

Telefonica and Vodafone also make similar points. Telefonica in its submission to ComReg states that it expected its licence to be renewed, and this was the reason it continued to invest in its GSM network. Without such an understanding it would not have made these investments.[32] Vodafone says that it invested in its 3G network because its 3G licence is not due to expire for about 10 years, and it too expected that its 900 MHz licence would be renewed, and this was the reason for continued investment in its 2G network.[33]

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[29] See for example: Besley, T., *Property Rights and Investment Incentives: Theory and Evidence from Ghana*, Journal of Political Economy, 1995, vol. 103, no.5; and
Li Guo, Rozelle S., and Brandt L., Tenure, land rights and farmer investment incentives in China, Agricultural Economics 19 (1998), 63-71.

[30] *ComReg Document 11/28*, 12 April 2011, Pg. 25.

[31] *Response to ComReg Consultation paper Review of the Period 2008-2010 & Proposed Strategy for Managing the Radio Spectrum: 2011-2013 ComReg Document 11/28*, eircom Group, 24 May 2011.

[32] *Spectrum Strategy 2011-2013 Response to Consultation 11/28 (Public Version)*, Telefonica.

[33] *Vodafone response to ComReg Consultation on Review of the Period 2008-2010 & Proposed Strategy for Managing the Radio Spectrum: 2011-2013 (Non-confidential)*, Vodafone, 24 May 2011.

We note that longer licence terms (for example 30 years) might mitigate some of the negative effects of fixed terms initially, but investment incentives will still be distorted towards the end of the licence term, and the spectrum trading market will not be as effective in allocating spectrum efficiently as it would with indefinite term licences (Sections 3.1.1and 3.1.2). In this context the Electronic Communications Committee[34] writing in 2006 recommended that rolling term licences which remain in force with no fixed end date (similar to the indefinite term licence described in Section 2) balance the spectrum manager's need for flexibility and the licensee's need for security of tenure.[35] It is no surprise then that countries that have been at the forefront of spectrum management reforms, such as Australia, Canada, New Zealand, the United Kingdom and the United States, are also at the forefront of reforms to licence terms and are moving to indefinite terms or fixed terms with very strong expectation of renewal (as we discuss in Section 4).

3.3. Potential New Licensees

Once potential entrants enter the market, their interests typically align with existing licensees, i.e. they will prefer indefinite terms for the reasons discussed in the previous section. For example, in the case of the recent consultation in Canada on this issue (as discussed in Section 4.2), both incumbents and small recent entrants supported indefinite terms. Typically, only aspiring new licensees prefer fixed terms over indefinite terms as they may hope that it will be easier and/or cheaper for them to enter the market in the case of fixed term licences. However, in practice, it is far from clear whether shifting to indefinite licences would really constrain opportunities for entrants; in fact, it may significantly increase scope for entry.

As discussed earlier in Section 3.1.4, with fixed licence terms entry is only likely to occur at the expiry of licence terms. A potential entrant is likely to wait for the spectrum manager to reacquire and reallocate spectrum or release new spectrum before it enters the market. Liberalised indefinite term tradable spectrum usage rights provide more flexibility as a potential entrant can acquire spectrum from the market. This allows a potential entrant to base its entry decision on market developments and its business plans, and not be constrained by the timing of expiry of existing fixed term licences or new spectrum release.

The cost of acquiring spectrum under indefinite terms will be determined by the market price of spectrum, and that under fixed terms by the licence fee determined in an auction. It is unclear a priori which will be the cheaper alternative. The answer will depend on the market price of spectrum, the level of AIP, and the outcome of any auction held to allocate the spectrum. Only if a spectrum manager plans to administratively allocate spectrum at below the market price to a new entrant might it be cheaper to enter the market with fixed term licences.

A potential concern for new entrants who buy indefinite spectrum usage rights after the initial period is over is that these usage rights can be revoked for spectrum management reasons subject to a minimum notice period of five years, which is unlikely to be sufficient time to

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[34] The Electronic Communications Committee is a body that helps develop common policies for regulating spectrum in Europe and represents it at international bodies.

[35] *Enhancing Harmonisation and Introducing Flexibility in the Spectrum Regulatory Framework*, Electronic Communications Committee, March 2006, Pg 14.

make a reasonable return on investments. However as mentioned earlier major allocation and harmonisation changes occur infrequently and take a long time to implement – from 10 to 20 years (Section 3.1.3). Entrants should be well informed about such changes, and be able to take these into account before making their entry decision. If a major allocation and harmonisation change is imminent then entry may not be feasible till after such changes have been implemented.

Finally, a spectrum manager has other policy tools that can be used to promote entry. For example, primary allocations of new harmonized bands, limits on the amount of spectrum that could be held by any one operator, and ex-ante reviews of mobile spectrum trading which might adversely affect competition in the downstream market can be used to remove obstacles to entry.

3.4. Consumers

The impact of a shift to indefinite licences would be felt only indirectly on consumers, via the impact on the timing and quality of available services, and on price levels. Consumers will be better off if there is effective competition in the downstream market for mobile services, and if operators invest adequately to meet growing traffic demand, expand their network footprint and roll-out new services like mobile broadband extensively. As discussed in Section 3.1.4, indefinite terms should encourage entry. Entry and the threat of potential entry should make the downstream market contestable by disciplining incumbent operators, and making the market more competitive which will help ensure that consumers are offered a wide variety of services at reasonable prices.

With regard to investments by operators, the security of tenure that indefinite terms provide means that operators will be able to invest continuously as markets and technologies develop without the threat of potential termination of their licences which is likely lead to earlier availability of new services and service upgrades for consumers (Section 3.2.1). Under a fixed term, licence investments may be delayed or diminished till the licence is renewed and the benefits of immediate investment and/or more investment for consumers will be lost.

Indefinite terms will also provide incentives for optimal and efficient utilisation of spectrum by operators (Sections 3.1.1 and 3.1.2), and make it easier to raise capital for investment (Section 3.2). In a competitive market, these cost savings would be passed on to consumers in the form of lower prices. More investment will also enable mobile communication providers to compete better with their fixed network counterparts. This increase in inter-modal competition should also benefit consumers. In contrast, with fixed terms, there is potential for discontinuity of service and/or the need for operators to make costly adjustments which might be passed on to consumers in the form of higher prices or lower quality of service. It is also possible that an operator has to exit the market which will increase market concentration. Such discontinuity of service and reduction in competition are unlikely to occur with indefinite term licences.

3.5. Conclusion

The discussion above suggests that there is a strong case to adopt indefinite terms for mobile spectrum from the perspective of various stakeholders. Indefinite licence terms are better suited to meet the relevant objectives of a spectrum manager, provide incentives for efficient utilisation of scarce spectrum, and promote competition and investment which should benefit consumers as well.

The primary aim of a spectrum manager is to ensure that spectrum is used efficiently and that no viable spectrum is left unused. With the introduction of liberalisation and spectrum trading, indefinite terms are better at achieving these goals. Indefinite terms facilitate efficient allocation of spectrum via trading because security of tenure is required for effective trading markets. Uncertainty of tenure, a feature of fixed terms, diminishes incentives to trade and this impedes the efficient allocation of spectrum via trading both between incumbents and entrants. Valuable spectrum is also less likely to be left unused with indefinite terms because an efficient trading market should emphasise the opportunity cost of holding spectrum for licensees, and with indefinite terms spectrum managers do not need to organise a reallocation mechanism in every period that a licence expires which eliminates the possibility of spectrum remaining unallocated and unused.

Meanwhile, there is no evidence to suggest that other objectives of a spectrum manager, such as international coordination and harmonisation, promoting competition, and support of related public policy goals, would be adversely affected by a shift to indefinite licences. Where necessary, other tools such as ex-ante reviews of spectrum trading which might lessen competition in the downstream market, limits on the amount of spectrum that can be held by any one operator, and demand-side interventions, may be used to achieve such objectives.

For incumbent licensees, indefinite terms provide the advantage of security of tenure. This means that they can invest in their networks continually as markets and technologies develop without being constrained by potential licence expiry. This allows operators to cope with growing customer demand, introduce new services and spectrum efficient network technologies and upgrades, and compete better with fixed operators. Indefinite terms also avoid the potential destruction of business value in case an operator fails to reacquire the spectrum it previously held, and an efficient trading market should allow operators to optimise their spectrum holdings.

Potential new licensees, once they enter the market, typically have the same interests as incumbent licensees. Aspiring new licensees may prefer fixed terms over indefinite terms as they may hope that it will be easier and/or cheaper for them to enter the market in the case of fixed term licences. However, in practice, it is far from clear whether shifting to indefinite licences would really constrain opportunities for entrants; in fact, it may significantly increase scope for entry by providing more flexibility with regard to entry timing as potential entrants can acquire spectrum from the market. This allows a potential entrant to base its entry decision on market developments and its business plans, and not be constrained by the timing of expiry of existing fixed term licences or new spectrum release.

Consumers are also likely to be better off with indefinite term licences. This is because the increased scope for entry associated with indefinite terms is likely to lead to a more contestable and competitive market, and indefinite term licences provide incentives for

operators to invest adequately to meet growing traffic demand, to expand their network footprint and roll-out new services like mobile broadband more extensively. Higher investments will mean better services for consumers. Indefinite terms also avoid the potential for discontinuity of service.

4. Licence Terms in Different Countries

In this section we discuss the approach to license terms in a selected group of countries. Table 4-1 provides an overview of licensing terms in these countries. Section 4.6 concludes based on licence terms in the countries discussed below, that it is quite practical for the regulator to maintain powers to reclaim licences in defined circumstances, while at the same time giving operators the certainty they need to trade spectrum and invest in network build. Indefinite term spectrum licences which may be revoked for defined spectrum management reasons given 5-years notice (defined in Section 2) are not impractical, and similar or equivalent licensing terms have either been adopted by some countries or are under review elsewhere.

Table 4-1
Overview of Licensing Conditions in Different Countries

Country	Type of regime	Term of licences	Renewal conditions	Tradable?	Liberalised?
Australia	Fixed term, no renewal (but renewal approach under review)	15 years	Licences resold by auction, but may be bought by current user	Yes	Yes
Canada	Fixed term, with strong expectation of renewal	10 years (but likely to move to longer terms)	Presumption of renewal, but greater clarity requested by operators	Yes, but subject to constraints	Yes, but subject to constraints
New Zealand	Fixed term, with high likelihood of renewal	20 years	Renewal notice posted 5 years before licence expiry	Yes	Yes
United States	Fixed term, with strong expectation of renewal	10 years	Renewal usually automatic subject to meeting usage conditions	Yes, but subject to approval	Yes, but subject to approval
United Kingdom	Indefinite term	Remain in force until revoked	May be revoked for well defined spectrum management reasons subject to a five year notice period	Yes, proposed to be subject to ex-ante competition review	Yes

4.1. Australia

Concerns that fixed terms may be impeding trading

Australia has been a world leader in spectrum management reform, and has had a comprehensive spectrum trading regime since 1997. The ACMA considers these reforms a great success, with trading volumes of about 5% of licences, "similar to turnover in [the] housing market"[36]. Nevertheless, following the tenth anniversary of the introduction of trading, it launched a major review with the aim of identifying further changes that could

[36] Richard Scheelings, February 2009, "Spectrum Tading: Improving the efficiency of the secondary market for spectrum", an ACMA presentation.

improve the efficiency with which spectrum is used. The issue of licence renewal was identified as one of the key barriers to a fully efficient market, prompting government support for a shift to much greater certainty on renewal.

Spectrum licences are offered for terms of up to 15 years, and historically have been issued with no automatic right of renewal. Typically, expiring licences are reallocated using an auction, but may be re-acquired by the existing user. The ACMA sends expiry reminders to licensees during the last two years of their licence; for example, notices arising from allocations made in 2000 will be issued in 2013. Licences may only be reissued to the same user without a price-based contest under limited circumstances, such as special approval from the Minister or identification of a special public interest by the ACMA.

In the ACMA's Spectrum Trading paper, length of tenure was identified as an issue that "*affects the dynamism of trade in secondary markets as well as the willingness of operators to continue to invest in the network with limited remaining tenure when there is currently no certainty of licence re-issue*."[37] This view was widely supported by respondents to the consultation, many of whom called for measures to provide greater security of tenure for rights, so as to provide greater certainty over the timeframes for trades, investment and financial return. In particular, the security of licence tenure beyond licence expiry was identified as the most significant impediment to spectrum trading. Specifically, respondents argued that: "*[t]he consequence of uncertain tenure is sellers have weaker incentives to sell in the first half of the licence term, and aspirant buyers are discouraged from buying during the remaining half of the term."*[38]

In its own concluding document, the ACMA accepted these arguments in principle, and announced its intention to draw up new guidelines that will favour renewal of licences. However, a full shift away from fixed terms to a framework that allows for a presumption of renewal will require primary legislation. It is unclear from our research when this will happen. However, we note that the Government has already accepted in principle that apparatus licences should be renewed unless licensees have failed to comply with their licence conditions or there are compelling spectrum management reasons for re-allocation.[39]

4.2. Canada

Reviewing framework for licence renewal

Industry Canada is currently in the process of reviewing the licence terms applied to spectrum sold by auction, including spectrum for mobile services. In a public consultation released in April 2009, it initially proposed to maintain the current approach of 10-year licences with a high expectation of renewal.[40] However, following comments from the industry which strongly favoured longer licences and a possible switch to indefinite duration, Industry Canada revised its position. In its statement on decisions, released March 2011, it recognizes

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37 The ACMA, July 2009, Response to Submission of Spectrum Trading, page 4.

38 Ibid, page 4.

39 Ibid, page 3.

40 Industry Canada, Consultation on Revisions to the Framework for Spectrum Auctions in Canada, April 2009, Canada Gazette notice DGRB-001-09.

the role of longer licence terms in facilitating investment, and asks for comments on its proposal to explore changes to legislation to support "*longer or indefinite licence terms*."[41]

Canada's spectrum manager cites a number of influences for its proposed change in approach. First, it states that all eight respondents on this issue "*were in agreement that a 10-year licence term is insufficient*".[42] In this regard, it is notable that the respondents represent a broad range of stakeholders from across Canada's mobile industry who often disagree on other issues. They included: the three national incumbent operators (Bell Mobility, Rogers and Telus), two established regional incumbents (MTS Allstream and SaskTel – the former being also a provider of business communication solutions nationwide), one newly established regional entrant (Bragg) and the CWTA, an industry body for the wireless industry. All respondents asked for licence terms of at least 15 years and ideally 20 years in duration. Two respondents (Bell Mobility and Bragg) went further in calling for indefinite licences, and no respondents seem to have opposed this.

There was full support from industry for the concept that licences be issued with a high expectation of renewal, but a number of respondents called for greater clarity on circumstances under which renewal might not be granted, and called for this expectation to be clarified in both the text of policy documents and conditions placed on spectrum licences. Two respondents also expressed concern about the lack of clear guidance with respect to expectation of renewal for previously renewed licences.

Secondly, Industry Canada highlights "extensive reviews" undertaken by other countries, "*such as Australia, the United Kingdom and the United States". It observes, a "common finding in these reviews is that traditional methods of spectrum management have often impeded access to spectrum and are slow to adapt to changes in technology and markets. As a result of the reviews, these countries are taking steps to evolve from a prescriptive style of spectrum management to an approach that embraces more flexibility and less regulatory intervention in the market, while retaining necessary regulatory powers to manage the spectrum effectively when required. Consequently, some countries are adopting longer licence terms, ranging from 10-year to indefinite.*"

In light of such evidence, Industry Canada concluded that licence terms in excess of ten years would provide greater incentives for the industry to invest in developing network infrastructure, technologies and related innovations. It also found that longer terms would be consistent with a modernized approach to spectrum management, and reduce administrative burden associated with licence renewal. In conclusion, it proposed to "*explore and consider changes to legislation, regulations, policies and frameworks that would confer the necessary powers to permit Industry Canada to move to longer or indefinite licence terms while maintaining the flexibility to deal with policy requirements and potential reallocation of spectrum*." It also proposed to make terms related to expectation of renewal more explicit and to apply annual licence fees to licences once the initial terms have expired.

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41 Industry Canada, Decisions on Revisions to the Framework for Spectrum Auctions in Canada and Other Related Issues, March 2011, p.5-6.

42 Ibid, p.5.

4.3. New Zealand

Long licence terms and five-year notice of renewals

New Zealand was the first country in the world to introduce market reforms in spectrum management, introducing trading and liberalization for many frequency bands from 1997. Licences from this period onwards were allocated for 20 years, sufficient to provide great certainty over tenure for licence holders at the point of acquisition. However, no policy was initially adopted for licences approaching expiry. As licences matured, it became obvious that incentives for investment and trading may be undermined if action was not taken to address this oversight in policy. In particular, there was concern about the status of 800MHz and 900MHz cellular rights, which were due to expire in 2011.

Accordingly, in 2003, the Cabinet agreed to a policy for the allocation of commercial spectrum rights at expiry. It describes this as follows:

> *"Subject to a case-by-case review, replacement rights will be offered to existing rightholders five years before expiry to provide certainty for investment and to ensure a seamless transition from one term to another. If a rightholder does not accept the renewal offer, the rights will be auctioned. The policy requires the offer price to approximate the market value of the rights and produce a fair return to the Crown. The offer price will be determined using a methodology that is transparent and simple to administer."*[43]

The 800 MHz and 900 MHz bands were the test case for this new policy. The government ultimately approved the renewal of existing licences, for a further 20 years, subject to the reallocation of some spectrum to an entrant operator, and the introduction of a new approach for administratively assessing the market value of the spectrum bands (known as the optimised deprival valuation [incremental ODV] approach).

4.4. United States

10 year terms with de facto automatic renewal

In the United States, licences are only granted for terms of 10 years. However, there is a strong presumption of renewal, and the requirements that a licensee must meet in order to reasonably expect renewal are well defined. In general terms, a licensee must provide "substantial service" to its license service area no later than the end of its license term. "Substantial" service is defined as service which is sound, favourable, and substantially above a level of mediocre service which might minimally warrant renewal. Licensees that fail to meet this requirement will forfeit their licence and will not be eligible to regain it.

For cellular licences, the requirements to prove substantial services are typically described in specific terms. For example, licensees in the Lower 700 MHz Band are expected to demonstrate the following:[44]

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[43] New Zealand Ministry of Economic Development website (http://www.med.govt.nz/).

[44] FCC website, http://wireless.fcc.gov/services/index.htm?job=licensing&id=lower700.

1. *"the construction of four permanent links per one million people in the licensed service area of a licensee that chooses to offer fixed, point-to-point services;*
2. *the demonstration of coverage for 20 percent of the population of the licensed service area of a licensee that chooses to offer fixed, point-to-multipoint services; and*
3. *the demonstration of coverage for 20 percent of the population of the licensed service area of a licensee that chooses to offer mobile services."*

So although the United States awards spectrum licences for only 10 years, the licence terms provide such a strong expectation of renewal that the regime may be characterised as similar to the indefinite licence terms in the United Kingdom which we discuss next.

4.5. United Kingdom

Indefinite licence terms which may be revoked for well defined reasons subject to 5-years notice

Particular attention has focused on the reforms made by UK regulator Ofcom, which uniquely has characterized its licence term regime as "indefinite". The term "indefinite" is somewhat misleading though. It does not imply, as some critics suggest, that spectrum is assigned indefinitely to an operator, with the implication that the spectrum manager surrenders its ability to reallocate the spectrum. In fact, UK cellular licences have a fixed term of 15 or 20 years, after which licences may be revoked for defined spectrum management reasons given 5-years notice (or less in exceptional circumstances). Ofcom states a number of reasons why it prefers indefinite terms,[45]

> *"In particular, the award of licences with an indefinite duration reduces the need for regulatory intervention to reassign spectrum at the end of the licence term. One disadvantage of fixed term licences is that at the end of the licence term the licence expires and so the rights to use it must be returned to the regulator, unless any other action has been taken. This may result in a period during which the spectrum remains unused, as the regulator must go through a process to reassign those rights. Furthermore, incentives to invest closer to the end of a licence term are significantly reduced given that communications networks generally require continual investment. This lack of investment could result in detriment to consumers and citizens. The alternative of licences with an indefinite duration removes the requirement for return to the regulator, removes the risk of discouraging investment and creates additional opportunities for the market to secure the efficient use of the spectrum, particularly in the presence of spectrum trading."*

And further that,

> *"We consider that, as a matter of principle, it is preferable to look to market mechanisms to promote the efficient use of resources rather than regulatory*

[45] *Consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues*, Ofcom, 22 March 201, Pg 74.

intervention, unless the case for such intervention is clear. In relation to our spectrum awards to date we have not identified a general need to recover spectrum at the end of the initial term."

4.6. Conclusion

It is no coincidence that countries that have been at the forefront of spectrum management reforms, such as Australia, Canada, New Zealand, the United Kingdom and the United States, are also at the forefront of reforms to licence terms. Both Australia and Canada have implemented market reforms while maintaining fixed term licences (10-15 years) which expire with no right of renewal. However, in recent consultations, both regulators have expressed concern that this approach undermines incentives for investment, and indicate a desire to move to longer licences (possibly indefinite) that offer a strong expectation of renewal.

Particular attention has focused on the reforms made by UK regulator Ofcom, which uniquely has characterized its licence term regime as "indefinite". UK cellular licences have a fixed term of 15 or 20 years, after which they remain in force until revoked. Licences may be revoked for defined spectrum management reasons given 5-years notice (or less in exceptional circumstances). In practice, this is not so different from the New Zealand approach of 20-year licences, with provision for notice of renewal at least 5-years before expiry. Similarly, although the United States awards spectrum licences for only 10 years, the licence terms provide such a strong expectation of renewal that the regime may be characterised as similar to the United Kingdom.

These examples show, it is quite practical for the regulator to maintain powers to reclaim licences in defined circumstances, while at the same time giving operators the certainty they need to trade spectrum and invest in network build. There are a variety of ways this can be achieved but the key elements are a very high (and well defined) expectation of renewal and, ideally, at least five years notice of any potential revocation for spectrum management reasons.

5. Mobile Networks in Ireland

Spectrum licences in Ireland are currently for fixed terms with no renewal provision or expectation of renewal. In this context we discuss the level of competition in the Irish mobile market, the role of mobile broadband in Ireland, investment risks and incentives associated with rolling out 4G networks, and the static, dynamic and competitive benefits of moving to indefinite terms.

5.1. The Mobile Market in Ireland

Ireland has four mobile network operators (MNOs) and this compares well with other Member States in the European Union which usually have three to four operators.[46] An indication of the level of competition between MNOs in Ireland is the number of subscribers switching service providers. Almost two and half million mobile numbers were ported between Irish mobile operators since mobile number portability was launched in June 2003.[47] There is also a downward trend in the HHI index[48] calculated based on revenue market shares of the four Irish MNOs (Figure 5.1). Competition for customers is stronger in the mobile broadband market with shares more evenly distributed compared to overall market shares.[49]

In addition to competing with each other, MNOs also compete with mobile virtual network operators (MVNOs) like Tesco mobile and fixed network operators. There is increasing competition between fixed and mobile operators because these networks now provide similar services to end users – voice and internet access.[50] The mobile handset penetration level in Ireland is also high – as of March 2011 the mobile penetration rate in Ireland was 107.8% excluding mobile broadband.[51] This suggests that most people who want to subscribe to mobile services can do so.

The high level of penetration and competition (both between mobile operators and between fixed and mobile operators) suggest that the Irish mobile market is a mature market which should supply consumers a wide range of services at reasonable prices. Spectrum management policies like indefinite terms will encourage investment in existing and new services like next generation mobile broadband, and can therefore be adopted. In any case, as discussed in Section 3.1.4, indefinite terms should also promote competition (see Section 3.1.4). Furthermore safeguards such as limits on the amount of spectrum that can be held by

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46 *Commission staff working document accompanying the Progress report on the Single European Electronic Communications Market (15th report)*, European Commission, 25 May 2010.

47 *ComReg Document 11/40*, 26 May 2011, Pg 62.

48 The standard HHI is calculated as $H = \sum_{i=1}^{n} s_i^2$ where s_i is the market share of each individual MNO.

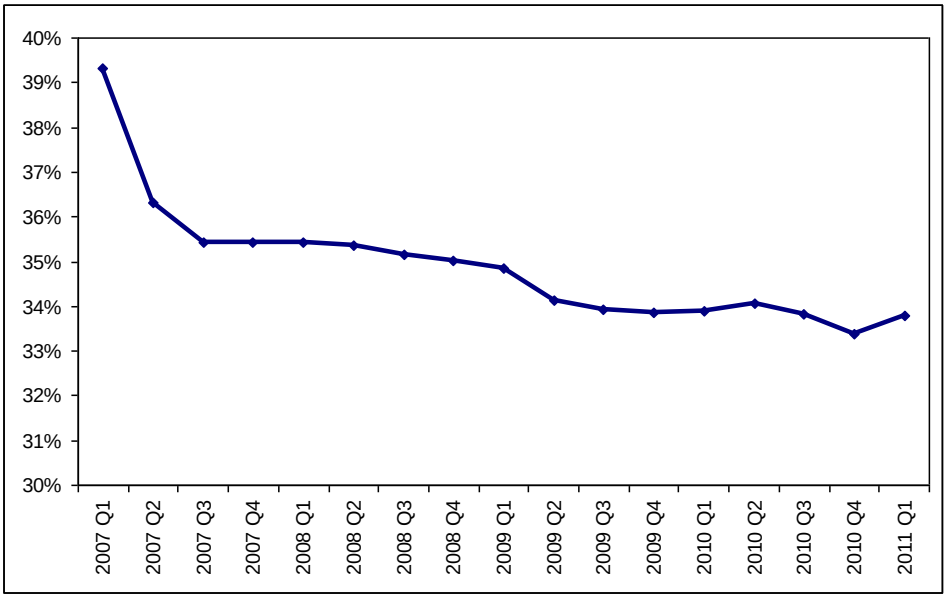
49 The mobile broadband subscription market shares of the four MNOs in Q1 2011 were as follows: Three: 33.8%; O2: 28.8%; Vodafone: 27.2%; and Meteor: 10.2%. This compares to overall market shares in Q1 2011 of 6.5% for Three, 31.5% for O2, 42.3% for Vodafone, and 19.7% for Meteor (Source: *ComReg Document 11/40*, 26 May 2011).

50 The development of faster mobile broadband networks like LTE is likely to further intensify the competition between fixed and mobile operators.

51 The penetration level was 121% including mobile broadband (Source: *ComReg Document 11/44*, 21 June 2011, Pg. 51).

any one operator and ex-ante competition reviews of spectrum trading can be used to ensure a level playing field for all operators.

Figure 5.1
Evolution of HHI Index based on the Revenue Market Share of Four Irish MNOs



Source: ComReg Quarterly Key Data Reports – ComReg Documents 11/44, 10/43, 09/71, and 09/17, and NERA calculation.
Note: We have not used subscriber market shares to calculate the HHI index because subscriber numbers were revised by ComReg in November 2010 to reflect corrections made to Three's subscriber numbers. This means that the subscriber market share time series may not be consistent.

5.2. Mobile Broadband in Ireland

The importance of (high speed) broadband access for Ireland is recognised by both ComReg and DCENR which identifies high speed broadband services as being critical in attaining the Government's twin goals of becoming a 'Smart Economy' and a 'Knowledge Society'.[52] [53] Mobile broadband provides broadband access to many consumers in Ireland today, and it will play an important role in providing next generation broadband access to consumers.

Mobile broadband subscriptions have been growing in Ireland and accounted for 36.4% of all broadband subscriptions in Q1 2011. The contribution of mobile broadband to broadband growth is also higher than other technologies like DSL and Cable. In Q1 2011 45.2% of total broadband net additions were mobile. The relative importance of mobile broadband in Ireland compared to other EU countries is illustrated by the fact that, while Ireland's per capita fixed broadband penetration rate of 23.2% is lower than the EU27 average of 26.6%, the Irish per capita broadband penetration rate including mobile broadband (36.1%) is higher than the EU27 average (33.8%).[54] Mobile broadband in Ireland has also been instrumental,

[52] DCENR: The Department of Communications, Energy, and Natural Resources.

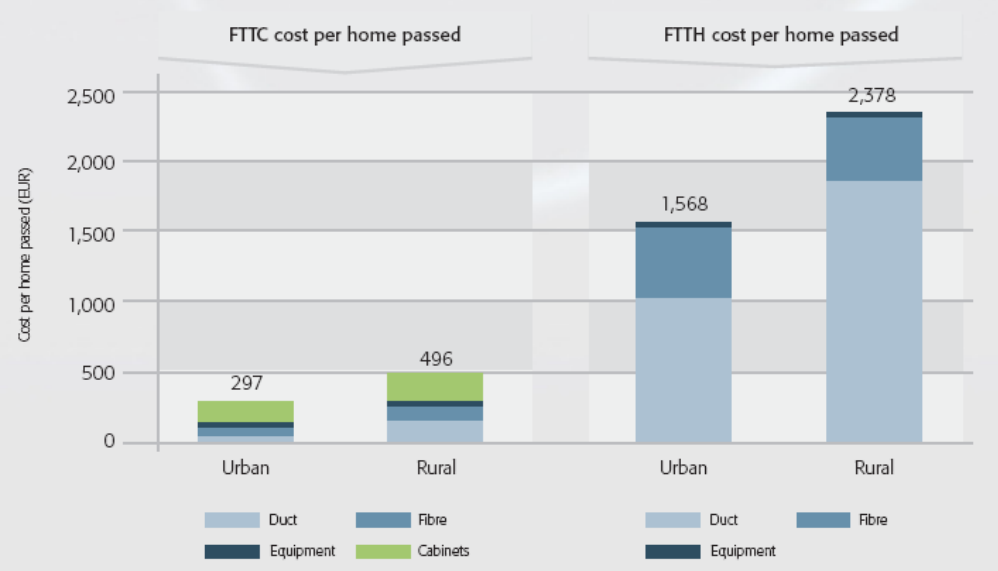
[53] *ComReg Document 11/40*, 26 May 2011, Pg 8.

[54] *ComReg Document 11/40*, 26 May 2011.

through the National Broadband Scheme, in providing broadband access in areas where it was previously not provided.[55] In some of these areas, in addition to providing broadband, mobile voice provides an alternative to fixed voice where no choice was available previously.

Given the low population density in Ireland,[56] next generation (4G) mobile networks will play an important role in providing fast broadband access to Irish consumers. In rural areas the business case for the rollout of next generation fixed broadband access is weak, and mobile broadband may be the more practicable solution. In urban areas it will provide an alternative to fixed networks, and this cross-platform competition will benefit consumers. Figure 5.2 presents estimated costs of rolling out next generation fixed broadband access in Ireland. For comparison the costs of rolling out BT's super fast broadband in the UK are about 50% less expensive than the costs of rolling out FTTC (Fibre to the Cabinet) in Ireland.[57]

Figure 5.2
Estimated FTTC and FTTH Costs per Home Passed (EUR) in Ireland



Source: Summary of Analysys Mason Report, TIF NGN Subgroup, February 2010.
Note: FTTC – Fibre to the Cabinet; FTTH – Fibre to the Home.

Next generation mobile broadband is cheaper to roll out than next generation fixed broadband because the latter requires extensive civil works to lay fibre in ducts to cabinets or to customer premises. Wireless networks like LTE do not require extensive civil works, and the cost of rolling out these networks is consequently lower in rural areas given the spectrum made available for mobile services through the digital dividend. Figure 5.3 presents the

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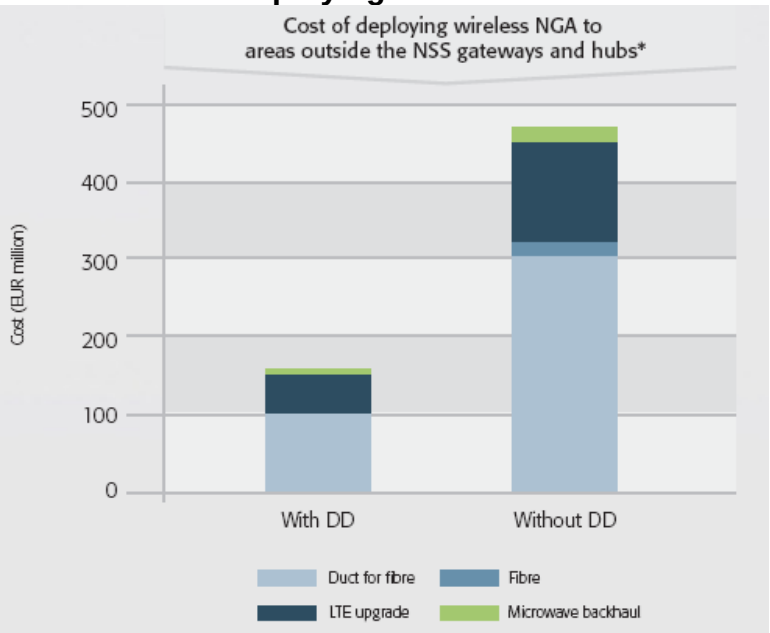
55 http://www.dcenr.gov.ie/Communications/.

56 In 2010, 38.38% of the population in Ireland lived in rural areas and the population density was less than 65 people per square kilometre. (Source: World Bank online database).

57 *Summary of Analysys Mason Report*, TIF NGN Subgroup, February 2010 attached to *Building a Next Generation Access Network for Ireland, Issues and Options*, A Report by the Telecommunication and Internet Federation (TIF), April 2010.

estimated costs of deploying wireless LTE in rural Ireland which can be used to provide high speed broadband services like high definition video and video conferencing.[58] [59]

Figure 5.3
Estimated Cost of Deploying Wireless LTE in Rural Areas



Source: Summary of Analysys Mason Report, TIF NGN Subgroup, February 2010.
Note: With DD – With Digital Dividend Spectrum; Without DD – Without Digital Dividend Spectrum.

5.3. Investment Incentives and Risks

Given the crucial role of mobile networks in providing current and next generation broadband access in Ireland, it is important that spectrum managers adopt policies that encourage continuous and sustainable investment in these networks. These investments will depend on a number of factors such as the upcoming spectrum auction in Ireland, and the spectrum each MNO wins in this auction. In any case, security of tenure provided by indefinite terms will result in strong incentives for operators to invest in their networks as explained in Section 3.2.1. Security of tenure is especially important given uncertain market and technological developments in the context of next generation broadband networks which means there are significant risks associated with investments in these networks. The European Commission notes the following in the context of next generation fixed access networks: [60]

> *"(i) uncertainty relating to retail and wholesale demand; (ii) uncertainty relating to the costs of deployment, civil engineering works and managerial execution; (iii) uncertainty relating to technological progress; (iv) uncertainty relating to market dynamics and the evolving competitive situation, such as the degree of infrastructure-based and/or cable competition; and (v) macroeconomic uncertainty."*

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[58] LTE based mobile broadband will provide download peak rates of at least 100 Mbps, and uplink rates of at least 50 Mbps (Source: *Review of the wholesale local access market,* OFCOM, 23 March 2010, Pg 21).

[59] *ComReg Document 11/28*, 12 April 2011, Pg15.

[60] *Commission Recommendation 2010/572/*EU, 20 September 2010, Annex 1.

Of these factors, uncertainty with regard to the level of retail demand, the willingness of consumers to pay for data access, technological progress, and the changing competitive landscape also affect MNOs investing in next generation 4G networks. These uncertainties mean that the time required to recover investments and earn a reasonable return on investments is uncertain, and there is a risk that this may take longer than expected. In addition macroeconomic uncertainty is particularly relevant to Ireland. As ComReg states[61],

> *"At the same time, Ireland is confronting an economic recession that may impact on the ability of operators to access capital markets, constrains consumer spending and, as a result, brings uncertainty regarding the financial returns potentially available on foot of investment in communications infrastructure."*

The value that retail consumers place on broadband connections will depend on the services that are available, not on the underlying technology used to deliver these services. Consumers who primarily use their broadband for surfing and checking emails will not place additional value on faster broadband connections. In addition it is not clear if and when new content and services like IP TV will become widely available in Ireland, and it is the development of new internet based services and content that will make it worthwhile for consumers to pay for faster broadband access. BEREC in a recent survey found that the actual take-up of NGA products in most Member States of the European Union falls significantly short of the coverage already achieved, and that customers may not be willing to pay higher prices for high speed broadband services as they can access the services they want using existing broadband connections.[62]

While consumers are not willing to pay more for data access, they are consuming increasing amounts of data, and there is a growing gap between the growth of mobile data volumes and revenues. Figure 5.4 illustrates the problem faced by UK mobile operators. Low consumer willingness-to-pay for data services means that it is likely to take longer to recoup investment made in deploying next generation mobile networks – how much longer is difficult to predict.[63]

Mobile networks will require continuous investment to cope with expected growth in traffic. Investment will be needed both for increased scale, for example deploying more backhaul and configuring more uplink capacity, and innovation, for example deploying more spectrum efficient network technology and network upgrades. In this context it is important to note that the growth rate of traffic is uncertain,[64] and that mobile broadband is a developing technology.

Indefinite terms will allow MNOs the freedom to recoup their investments over a suitable time frame and not be constrained by the need to do so before a licence expires. It will also allow them to develop business and investment plans that take into account changing markets,

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61 *ComReg Document 11/40*, 26 May 2011, Pg3.

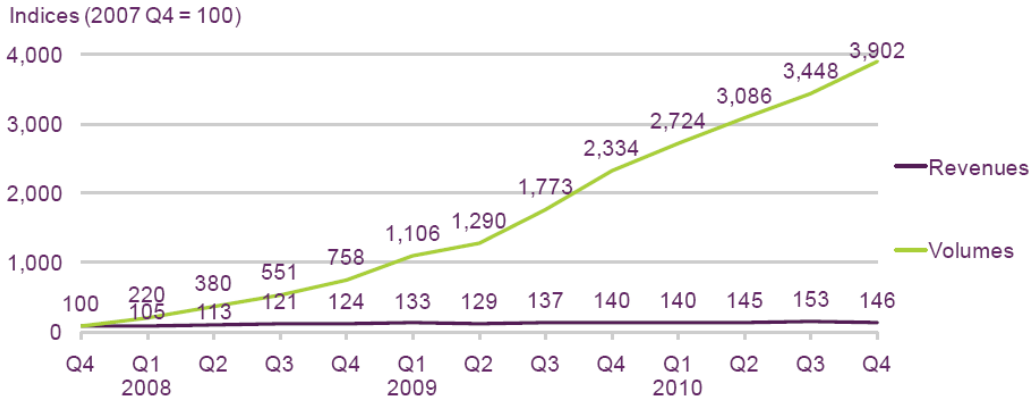
62 *Next Generation Access – Collection of factual information and new issues of NGA roll-out*, BEREC, Feb 2011.

63 At the same time revenues generated from traditional voice services are also being eroded with the increasing use of SMS, email, and VoIP services like Skype by consumers.

64 The growth rate will depend on the development of new services, the adoption of new devices like smart phones and tablets, and the changing competitive landscape – both mobile and fixed.

services and technologies as explained in Section 3.2.1. This will mean more investment in mobile networks and better internet access for Irish consumers.

Figure 5.4
Mobile Data Volume and Revenue Growth in the UK



Source: Communications Market Report: UK, Ofcom, 4 August 2011, Pg 265.

5.4. Potential Benefits to Ireland from Adopting Indefinite Licence Terms

In this section we discuss the static, dynamic and competitive effects of moving to indefinite term spectrum licences (as defined in Section 2) in Ireland. It is assumed that these licences may be revoked subject to a five year notice period following an initial fixed term. We conclude based on our high level analysis below that the potential benefits could be in the region of €250m-€450m over a 15-year period.

5.4.1. Static Effects

As discussed in Sections 3.1.1 and 3.1.2 indefinite terms facilitate efficient allocation of spectrum because security of tenure helps in the development of active trading markets by removing market illiquidity associated with licence expiry. Spectrum is also less likely to be left unused. Efficient allocation and utilisation of spectrum will lead to efficiency gains when existing or new users make better use of spectrum. One way to estimate the gains in static efficiency is to use the following formula:[65]

Static efficiency gains = No. of usage rights

** (% of trades per annum with indefinite licences*

minus % of trades per annum with expiring licences)

** Value to new user minus value to previous user*

[65] *Study on conditions and options in introducing secondary trading of radio spectrum in the European Community*, Analysys Consulting Ltd, DotEcon Ltd., and Hogan & Hartson LLP for the European Commission, May 2004, Exhibit 15.6.

Based on this method we estimate that these static efficiency gains in Ireland could plausibly be of the order of = €23m-€41m million over a 15-year period. We explain how this estimate is derived below.

- No. of Usage Rights: We define the number of usage rights in 5MHz blocks instead of pairs of 5MHz blocks in order to include TDD spectrum in our calculations. We consider all spectrum currently available for mobile or likely to become available in the medium-term in Ireland. This amounts to 122 blocks:
  - 800MHz = 2x30MHz = 12 blocks of 5 MHz;
  - 900MHz = 2x35MHz = 14 blocks of 5 MHz;
  - 1800MHz = 2x75MHz =30 blocks of 5 MHz;
  - 2.1GHz (3G) = 2x60MHz + 20MHz TDD = 28 blocks of 5 MHz; and
  - 2.6GHz = 2x70MHz + 50MHz TDD = 38 blocks of 5 MHz.

  This is arguably a conservative estimate because it does not consider potential additional bands that might be made available for mobile in the future, such as new digital dividend spectrum at 700MHz.

- Volume of trading: A 2002 study for the European Commission assumed that up to 10% of all spectrum would be traded each year if spectrum usage rights are liberalised and tradable (it also recommended a UK-type approach to licence renewal).[66] However, experience from early adopters of trading suggests that volumes are rather lower for high-value bands, such as mobile, where there are smaller numbers of licensees. We therefore conservatively assume that an average of only 2% of blocks would be traded each year with indefinite licences (roughly 37 blocks every 15 years). Without indefinite licences, there would be a diminishing incentive to trade as the licence approached expiry. For simplicity, we suppose that for the first 5 years, 80% of trades would still happen, for the middle 5 years, 50% of trades would still happen, and for the final five years only 20% of trades would still happen – which implies an average of 1% of block traded every year (roughly 18 every 15 years).[67]

- Current value of spectrum: As a proxy for the value of spectrum, we adopt the minimum price recommendations proposed by DotEcon to ComReg for the forthcoming mobile spectrum auction, which were based on a benchmarking exercise for international spectrum awards. DotEcon proposed a price of €18-26m for 2x5MHz of sub-1GHz spectrum and €8-16m for 2x5MHz of 1800MHz spectrum (which provides a proxy for all

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66 *Study on conditions and options in introducing secondary trading of radio spectrum in the European Community*, Analysys Consulting Ltd, DotEcon Ltd., and Hogan & Hartson LLP for the European Commission, May 2004, Exhibit 15.4.

67 With indefinite terms we assume that the trading level will be 2% per year which is 10% over a five year period. With fixed terms we assume that 80 % of trades go ahead in the first five years (80% of 10%), 50 % of trades go ahead in the middle five years (50% of 10%), and 20 % of trades go ahead in the final five years (20% of 10%). This means that with a 15 year fixed term the level of trading is 15% which is an average of 1% per year.

mobile spectrum above 1GHz).[68]
Translating this into 5MHz blocks, this implies a total value for all 122 blocks of 5MHz of €0.618bn - €1.106bn (€234m-€338m for sub-1GHz[69] + €384m-€768m for spectrum above 1GHz[70]), which equals an average of approximately €5m-9m per block.

- We assume that in the case of trades, the spectrum will continue to be used to provide mobile services. An average gain in value of trade of 25% can be expected because of better and more efficient utilisation of spectrum. [71]

Accordingly, based on these assumptions, the gain in static efficiency can be calculated as:

[122 blocks] x [2% minus 1%] x [€5m-9m range in value] x 25%

= € 1.53m-€2.75m per annum static efficiency gains

This formula can be used to calculate the static efficiency gains in Ireland over a 15 year period as follows:

[122 blocks] x [1% x 15 years] x [[€5m-9m range in value] x 25%

= €23m-€41m.

5.4.2. Dynamic Effects

We would also expect substantial dynamic efficiency gains from more investment on the one hand, and earlier investment on the other leading to the rapid adoption and rollout of new services and technologies. This is because security of tenure will enable mobile operators to keep investing in their networks on a continuous basis as markets and technologies develop. So when more spectrum efficient network technology, network upgrades or new technologies become available, operators can invest in these technologies and roll out better and new services without the risk that their licence may not be renewed and that they do not have enough time to recover their investment and make a reasonable profit (see Section 3.2.1). At the same time indefinite terms should lead to an efficient spectrum trading market which should emphasize the opportunity cost of not making investments, and stimulate investment by operators. As discussed in Sections 5.2 and 5.3 this will mean better high speed broadband access for Irish consumers which will be critical in attaining the Government's twin goals of becoming a 'Smart Economy' and a 'Knowledge Society'.

An example of the rapid introduction of a new service via spectrum trading (through mergers) and liberalisation is the introduction of mobile broadband data networks in the US. By 2006

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68 Source: *ComReg Document 10/105a*, December 2010, pp.40-61.

69 26 blocks of sub-1GHz spectrum multiplied by €9-13m (the value of 5MHz sub-1GHz spectrum based on minimum price recommendations proposed by DotEcon to ComReg).

70 96 blocks of spectrum above 1GHz multiplied by €4-8m (the value of 5MHz spectrum above 1GHz based on minimum price recommendations proposed by DotEcon to ComReg).

71 25% is the minimum difference in valuation between buyers and sellers sufficient to stimulate a trade if the buyer and seller have imperfect information about each other's true valuation (Source: Myerson R.B. and Satterthwaite M.A., Efficient Mechanisms for Bilateral Trading, Journal of Economic Theory, 29 (1983)).

the US was served by three mobile broadband data networks though no 3G licences had been distributed as yet.[72] It should be noted that in addition to liberalisation and trading, licence terms in the US provide such a strong expectation of renewal that the regime may be characterised as similar to indefinite licence terms (see Section 4.4).

Dynamic efficiency gains, whether resulting from trading or investment from existing operators, normally substantially outweigh static efficiency gains if they realise earlier adoption of valuable services by consumers, especially if the services represent significant improvements on previous ones. For example, Hausmann estimates that the total cumulative cost of regulatory delays in making spectrum available for mobile network operators in the USA in the 1980-1990s was around USD100bn.[73] Further, an Analysys Mason study for the European Commission estimating Europe-wide benefits from trading and liberalisation, estimated dynamic efficiency gains to exceed static gains by a ratio of approximately 200:1.[74] Of these, approximately 20% of gains were associated with smaller scale innovations which include improvements in existing services by employing new technology rather than entirely new innovations.

We have not attempted a detailed model of the impact on consumer surplus of indefinite licences leading to earlier adoption of new mobile services for this study. However, as a simple proxy, if we use the Analysys Mason ratio of dynamic to static gains, but assume that trades only realised smaller scale innovations and that only one in four trades realised such benefits, this would still imply dynamic efficiency gains of €230-€410m over a 15-year period. This should be an underestimate of the gains because in practice we may expect even greater dynamic efficiency gains from earlier investments by existing operators, whether or not there are spectrum trades.

5.4.3. Competitive Effects

It is not clear that competition in the market will be adversely affected if indefinite term licences are issued. In fact indefinite terms accompanied by other policy tools, where necessary, may promote competition.

As discussed in Section 3.1.4, indefinite terms provide greater security of tenure which should facilitate entry at any time during the term of the licence. This should lead to more competition as the market will be contestable to a greater degree than under fixed term licences when entry is only likely to take place at the end of the licence term. There is a risk that one operator acquires a disproportionate amount of spectrum via trading and then hoards this spectrum to preclude market entry and gain a competitive advantage, and/or that the secondary spectrum trading market for strategically important mobile spectrum (for example sub-1 GHz spectrum bands) is inefficient. This may be because given the competitive advantage of holding such spectrum incumbents may be reluctant to sell any spectrum they

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[72] *Hazlett, Thomas W., Spectrum policy and competition in mobile services* in Making Broadband Accessible For All, Vodafone Policy Paper Series, Number 12, May 2011.

[73] Hausman, JA, Valuing the effect of regulation on new services in telecommunications (1997), Brookings Papers on Economic Activity, Microeconomics, p.2.

[74] *Study on conditions and options in introducing secondary trading of radio spectrum in the European Community*, Analysys Consulting Ltd, DotEcon Ltd., and Hogan & Hartson LLP for the European Commission, May 2004, chap 15 Exhibit 15.7 and 15.13.

hold in these bands. In such cases additional regulatory tools such as limits on the amount of spectrum that can be held by any operator at any time and ex-ante competition reviews of spectrum trading which might adversely affect downstream competition may be required.

There is also a pan-European dimension to spectrum trading and licensing. Potential new entrants could consider entry into multiple markets simultaneously, and realise economies of scale in production and marketing. It is likely to be easier to implement such a strategy by acquiring indefinite term spectrum usage rights from the market rather than waiting for fixed term licences to expire in different countries and/or wait for spectrum managers in these countries to release new spectrum. It is also unlikely that fixed term licences in different countries will expire simultaneously.

Finally as mentioned earlier there is increasing competition between fixed and mobile operators because these networks provide the same services to end users – voice and data. Fixed operator licences in Europe are usually for an indefinite term which means fixed operators can continually invest in their networks without the risk that their licences may not be renewed. Indefinite term spectrum licences will put mobile operators on an equal footing and allow them to compete better with fixed operators. This should increase inter-modal competition to the benefit of consumers.

6. Conclusions and Recommendations

We find that the current approach in Ireland of fixed term licences with no renewal option is inconsistent with ComReg's core objective of encouraging efficient use of spectrum. A shift to an indefinite licence regime would provide stronger incentives for investment and for spectrum trading. The potential benefits from reform are particularly great in the case of the mobile sector.

Indefinite licence terms are better suited to meet the relevant objectives of a spectrum manager, provide incentives for efficient utilisation of scarce spectrum, and promote competition and investment which should benefit consumers as well. For incumbent licensees, indefinite terms provide the advantage of security of tenure. This means that they can invest in their networks continually as markets and technologies develop without being constrained by potential licence expiry. Potential new licensees, once they enter the market, will typically have the same interests as incumbent licensees. It is far from clear whether shifting to indefinite licences would really constrain opportunities for entrants; in fact, it may significantly increase scope for entry.

Consumers are also likely to be better off with indefinite term licences. This is because indefinite terms may increase the scope for entry and make the market more contestable, and competitive. The increased contestability and competition may result from the actual new entry and/or the discipline of potential entry occurring at any time during the lifetime of a licence, as opposed to only at the end of a licence term. Increased competitive pressure and security of tenure will create incentives for operators to invest adequately to meet growing traffic demand, to expand their network footprint and roll-out new services like mobile broadband more extensively. Higher investments will mean better services for consumers.

There is a risk that one operator acquires a disproportionate amount of spectrum via trading and then hoards this spectrum to preclude market entry and gain a competitive advantage, and/or that the secondary spectrum trading market for strategically important mobile spectrum (for example sub-1 GHz spectrum bands) is inefficient. In such cases additional regulatory tools such as limits on the amount of spectrum that can be held by any one operator at any time and ex-ante competition reviews of spectrum trading which might adversely affect downstream competition may be required.

Finally, there will be static and dynamic benefits for Ireland if a policy of indefinite terms is adopted. Efficient allocation and utilisation of spectrum will lead to efficiency gains when existing or new users make better use of spectrum resulting from trades of licences that would not have occurred without a shift to indefinite licences. In addition to static efficiency gains there will also be dynamic efficiency gains from more investment on the one hand, and earlier investment on the other, leading to the rapid adoption and rollout of new services and technologies. We estimate that these static and dynamic efficiency gains in Ireland could plausibly be of the order of €250 million to €450 million over a 15 year period.

Countries that have been at the forefront of spectrum management reforms, such as Australia, Canada, New Zealand, the United Kingdom and the United States, are also at the forefront of reforms to licence terms. The experience from these countries shows that it is quite practical for the regulator to maintain powers to reclaim licences in defined circumstances, while at the same time giving operators the certainty they need to trade spectrum and invest in network

build. There are a variety of ways this can be achieved but the key elements are a very high (and well defined) expectation of renewal and, ideally, at least five years notice of any potential revocation for spectrum management reasons.

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