



# EE application for licence variations in support of enhanced mobile communications for the emergency services

Consultation

Publication date: 19 August 2016

Closing Date for Responses: 30 September 2016

# About this document

This document discusses two licence variation requests from EE Limited, which would enable the use of 4G technology and support the provision of enhanced mobile communications for the emergency services.

In 2015 EE signed a contract with the Home Office to provide mobile services for a new emergency services network based on its LTE network. To support this EE has asked for:

- a variation of its Spectrum Access 2100 MHz licence to permit the use of LTE technology in the unpaired frequencies 1899.9 to 1909.9 MHz; and
- a variation of its 800 MHz/2.6 GHz and 1800 MHz licences to permit the use of mobile transmit frequencies to connect additional temporary base stations to its network at powers up to 31 dBm e.i.r.p in the 800 MHz and 1800 MHz bands for use as gateways for the new emergency services network.

This consultation sets out Ofcom's preliminary view that granting the requests is an efficient use of the spectrum and would benefit citizens and consumers, with low risk of harmful interference to other stakeholders.

We invite comments on our provisional conclusions by 30 September 2016.

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## Section 1

# Executive Summary

- 1.1 EE Limited (EE) has submitted the following two licence variation requests to Ofcom.
  - i) A request to vary its Spectrum Access 2100 MHz Wireless Telegraphy Act 2006 licence in order to liberalise the use of its unpaired frequencies 1899.9 to 1909.9 MHz to allow Long Term Evolution (LTE) (a 4G technology); and
  - ii) A request to vary its 800 MHz/2.6 GHz and 1800MHz Wireless Telegraphy Act 2006 licences in order to permit the use of mobile transmit (uplink) frequencies as a backhaul path to connect Emergency Services Network (“ESN”) nomadic base stations (“ESN Gateway devices”) operating at 1899.9 to 1909.9 MHz to its network at powers up to 31 dBm e.i.r.p.
- 1.2 This document assesses EE’s requests and in doing so:
  - provides background information on the requests, the spectrum band concerned and EE’s licences;
  - sets out and considers the requests in the context of Ofcom’s statutory and policy framework;
  - considers the impact of the proposals, including the potential for interference to other users; and
  - sets out how we propose to implement the changes.
- 1.3 After assessing the above our provisional conclusions are that the liberalisation from 3G to 4G technologies in 1899.9 to 1909.9 MHz would:
  - be an efficient use of the spectrum and would not result in undue interference to other spectrum users given that:
    - the technical parameters we propose to implement are in line with the least restrictive technical conditions for this band as set out in CEPT Report 39. This report addresses the coexistence issues with uses in spectrum adjacent to the 1900 to 1920 MHz band;
    - we will include a requirement to adopt a specific Time Division (TD) frame structure and to synchronise this with other TD-LTE (or equivalent) networks operating in the rest of the 1900 to 1920 MHz band as and when such networks are deployed; and
    - we will prohibit the use of ESN Gateway devices fitted to vehicles whilst they are in motion;
  - not distort competition in the mobile market. We note also that this spectrum is unlikely to be used for the provision of mobile services in general; and
  - provide benefits to citizens through supporting the provision of a new emergency services communication network.

- 1.4 Additionally, we would consider requests to liberalise the other two licences in the 1899.9 to 1920 MHz band.
- 1.5 We further consider that the that the increase in transmit powers in the 800 MHz and 1800 MHz spectrum for the backhaul of ESN Gateways would:
- not result in undue interference to adjacent users, providing it is limited to the provision of backhaul for ESN Gateway devices which are intended only for occasional and limited use;
  - not distort competition due to the restrictions placed on its use; and
  - provide benefits to citizens through supporting the provision of a new emergency services communication network.
- 1.6 Our initial view is that we should make the licence changes as soon as practicable subject to the outcome of this consultation.
- 1.7 In order to implement the changes we would:
- amend EE's Spectrum Access 2100 MHz licence to allow the use of LTE technology in the band 1899.9 to 1909.9 MHz;
  - amend the Wireless Telegraphy (Exemption) Regulations 2003<sup>1</sup> at the next opportunity to authorise LTE user terminal devices in 1899.9 to 1920 MHz band; and
  - amend EE's licences for the 800 MHz and 1800 MHz bands, to authorise the backhaul of ESN Gateway devices at a maximum mean transmit power of 31 dBm e.i.r.p. in the uplink frequencies 837.0 to 842.0 MHz and 1736.7 to 1781.7 MHz.
- 1.8 Links to copies of the draft licences that include the proposed new licence schedules can be found in Annex 5 of this document.
- 1.9 Ofcom is asking stakeholders to consider the following questions when responding to this consultation:
- Q1) Do you agree with our proposal to vary EE's Spectrum Access 2100 MHz licence to allow LTE technology? If not, please explain why you think it would not be appropriate to vary the licence?*
- Q2) Do you agree with our proposal to authorise the backhaul of ESN Gateway devices at a maximum mean transmit power of 31 dBm e.i.r.p. in the uplink frequencies 837.0 to 842.0 MHz and 1736.7 to 1781.7 MHz in EE's 800 MHz and 1800 MHz licensed spectrum to facilitate the occasional and limited use of higher power uplink transmission? If not, please explain why you think it would not be appropriate to vary the licence?*
- 1.10 Comments on our provisional conclusion that we should grant the requested variations are invited by 5pm on 30 September 2016.

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<sup>1</sup> <http://www.legislation.gov.uk/ukxi/2003/74/made/data.pdf>

## Section 2

# Introduction

2.1 In this document we set out our assessment of the two variation requests submitted by EE Limited (EE) to:

- vary its Spectrum Access 2100 MHz Wireless Telegraphy Act 2006 licence in order to liberalise the use of its unpaired frequencies 1899.9 to 1909.9 MHz to allow Long Term Evolution (LTE) (a 4G technology); and
- vary its 800 MHz/2.6 GHz and 1800MHz Wireless Telegraphy Act 2006 licences in order to permit the use of mobile transmit (uplink) frequencies as a backhaul path to connect Emergency Services Network (“ESN”) nomadic base stations (“ESN Gateway devices”) operating at 1899.9 to 1909.9 MHz to its network at powers up to 31 dBm e.i.r.p.

2.2 The remainder of this document is structured as follows:

- Section 3 describes the history and background to EE’s unpaired 1900 MHz spectrum holding in the 2100 MHz band;
- Section 4 sets out the legal and regulatory framework within which Ofcom must make its decisions;
- Section 5 sets out our assessment of EEs variation requests and our provisional conclusion;
- Annex 4 sets out our consultation questions;
- Annex 5 provides links to the draft licences;
- Annex 6 sets out our interference analysis of the LTE liberalisation request in the unpaired 1900 MHz band; and
- Annex 7 explains the synchronisation requirement we propose for inclusion in the 2100 MHz licence.

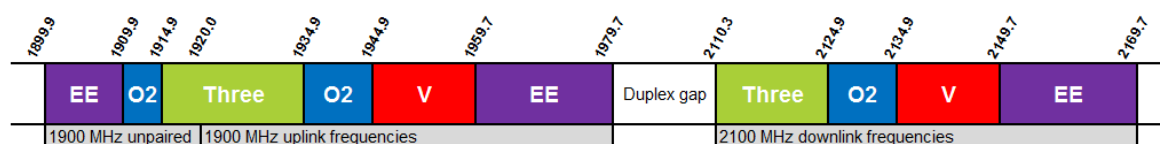
## Section 3

# Background

## Spectrum Access 2100 MHz licence liberalisation

- 3.1 In December 1998 the European Commission brought into force “Decision 128/1999/EC of the European Parliament and of the Council of 14 December 1998 on the coordinated introduction of UMTS” (the “UMTS Decision”)<sup>2</sup>. Member States were required to organise the provision of Universal Mobile Telecommunications System (UMTS), a Third Generation (3G) Mobile technology, in frequency bands that were harmonised by the European Conference of Postal and Telecommunications Administrations (CEPT) in accordance with procedures laid down in Article 5 of the UMTS Decision. This resulted in the bands 1900 to 1980 MHz, 2100 to 2200 MHz and 2170 to 2200 MHz being harmonised for UMTS. The UMTS Decision expired 4 years after 22 January 1999 (as per Article 14).
- 3.2 Following the UMTS Decision, in 2000 the Radiocommunications Agency auctioned spectrum licences for 3G mobile services in the 1900 to 1980 MHz and 2110 to 2170 MHz (the “2100 MHz band”). These 3G licences were granted to Orange 3G Limited and T-Mobile (now merged as EE), O2 Third Generation Limited (now Telefónica), TIW (now Hutchison 3G) and Vodafone. The licences authorise the use of paired Frequency Division Duplex (FDD) spectrum in the ranges 1920 to 1980 MHz paired with 2110 to 2170 MHz and unpaired Time Division Duplex (TDD) spectrum in the range 1899.9 to 1920.0 MHz (the “1900 MHz unpaired”) as detailed in Figure 1.

Figure 1: Spectrum holdings in the 2100 MHz Band



- 3.3 This consultation primarily concerns the unpaired TDD spectrum allocated to EE (1899.9 to 1909.9 MHz) of the 1900 MHz unpaired band.
- 3.4 In 2012, the European Commission adopted “Commission implementing decision of 5 November 2012 on the harmonisation of the frequency bands 1920-1980 MHz and 2110-2170 for terrestrial systems capable of providing electronic communication services in the Union (2012/688/EU)”<sup>3</sup>. This harmonised technical conditions to allow for the liberalisation of the paired FDD spectrum in order to allow for the deployment of 4G technologies. However, the Decision did not include proposals for the 1900 MHz unpaired spectrum. The technical conditions set out in the decision were the result of a mandate from the European Commission to CEPT. This considered the technical coexistence issues of allowing 4G technologies in the band and resulted in publication of CEPT Report 39<sup>4</sup>.
- 3.5 Ofcom has a long-standing commitment to liberalisation in order to avoid unnecessary technology restrictions in spectrum licences and to maximise the

<sup>2</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999D0128&from=EN>

<sup>3</sup> <http://www.ecodocdb.dk/Docs/doc98/official/pdf/C2012-7697.pdf>

<sup>4</sup> CEPT Report 39 <http://www.eroocdb.dk/Docs/doc98/official/pdf/CEPTREP039.PDF>

flexibility with which spectrum can be used. In 2013, we consulted on<sup>5</sup> and subsequently granted variation requests from mobile operators to liberalise their spectrum licences in several mobile bands, including the 3G licences for the 2100 MHz band.

- 3.6 We decided to remove the restriction on UMTS and allow the use of 4G technologies including WiMax and LTE<sup>6</sup> and as part of this process, we renamed the 3G licences “Spectrum Access 2100 MHz” (the “2100 MHz licences”). However, the liberalisation of these licences did not include the 1900 MHz unpaired TDD frequencies at that time. This was because the TDD frequency ranges included in the 2100 MHz licences were the subject of ongoing regulatory work in Europe to examine potential future uses and the technical conditions that might be required to enable such uses.
- 3.7 In the absence of concrete plans to deploy services using the TDD spectrum in these licences, we did not consider it sensible to vary the technical conditions for UK operators at that time. The 1900 MHz unpaired TDD spectrum therefore remained as UMTS only and, for clarity, was placed into a separate licence schedule from the liberalised FDD spectrum.
- 3.8 We noted at the time that CEPT SE 42 project team did develop a set of minimal and least restrictive technical conditions that would be appropriate for 4G use of these TDD frequencies (see CEPT Report 39). Report 39 concluded that significantly lower power limits than those contained in the current licences are necessary to protect adjacent FDD use of the 2100 MHz band (with different power limits for different TDD frequency blocks). We therefore stated that if operators were to make a formal application to vary their licences, the sole effect of which would be to reflect these technical conditions for 4G use of their TDD blocks, then we would consult on a proposal to make the appropriate licence variation.
- 3.9 EE has advised that it had not considered it technically or commercially feasible to deploy 3G technology in this spectrum but now has a demonstrable use case to deploy an LTE-based application, which, if permitted, would bring the spectrum into productive use.
- 3.10 Recently the European Commission has investigated alternative uses of the 1900 MHz unpaired spectrum and the 2010 to 2025 MHz band due to this spectrum being unused in a number of Member States. As part of this process they mandated CEPT undertake studies looking at the harmonisation of the technical conditions in these bands, which resulted in CEPT Report 52<sup>7</sup>. This identified a number of potential uses of the bands including Broadband Direct Air to Ground and short range devices in the 1900 MHz unpaired band and Programme Making and Special Events (PMSE) in the 2010 to 2025 MHz band. No clear consensus could be reached on what is the best use of the 1900 MHz unpaired band so a decision was taken to only harmonise the technical conditions for 2010 to 2025 MHz spectrum for PMSE<sup>8</sup> and await the outcome of further studies on possible uses of the 1900 MHz unpaired spectrum in the future. Throughout this process we have advised the European Commission that the 1900 MHz unpaired spectrum has

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<sup>5</sup> <http://stakeholders.ofcom.org.uk/binaries/consultations/variation-900-1800-2100/summary/condoc.pdf>

<sup>6</sup> <http://stakeholders.ofcom.org.uk/binaries/consultations/variation-900-1800-2100/statement/statement.pdf>

<sup>7</sup> <http://www.erodocdb.dk/Docs/doc98/official/pdf/CEPTREP052.PDF>

<sup>8</sup> “Commission implementing Decision (EU) 2016/339 of 8 March 2016 on the harmonisation of the 2010-2025 MHz frequency band for portable or mobile wireless video links and cordless cameras used for programme making and special events”.



already been authorised to three operators through an open and transparent award process in the UK.

## Section 4

# Ofcom's duties and functions

- 4.1 This section provides an overview of the main UK and European legislative provisions relevant to wireless telegraphy licensing and to the requested variation. It is not a full statement of all legal provisions which may be relevant to Ofcom's functions and to wireless telegraphy licensing.
- 4.2 The applicable legal framework derives from our duties under both domestic and European legislation, specifically from:
- the Communications Act 2003 (the "2003 Act") and the Wireless Telegraphy Act 2006 (the "2006 Act"); and
  - the European Common Regulatory Framework<sup>9</sup> for electronic communications networks and services, in particular, the Framework Directive and the Authorisation Directive – together with a number of Decisions that apply to these specific spectrum bands.

## Ofcom's general duties

- 4.3 Section 3 of the 2003 Act states the general duties of Ofcom. Under section 3(1) it is the principal duty of Ofcom in carrying out its functions:
- to further the interests of citizens in relation to communications matters; and
  - to further the interests of consumers in relevant markets, where appropriate by promoting competition.
- 4.4 In doing so, Ofcom is required to secure, amongst others (under section 3(2)):
- the optimal use for wireless telegraphy of the electro-magnetic spectrum;
  - the availability throughout the UK of a wide range of services;
- 4.5 In performing its duties, Ofcom must have regard to, amongst others, the following matters:
- the desirability of promoting competition (section 3(4)(b));
  - the desirability of encouraging investment and innovation (section 3(4)(d));
  - the desirability of encouraging availability and use of broadband services throughout the UK (section 3(4)(e)); and
  - the different needs and interests of persons in different parts of the UK (section 3(4)(l)).

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<sup>9</sup> The European Common Regulatory Framework comprises the Framework Directive (Directive 2002/21/EC), the Authorisation Directive (Directive 2002/20/EC), the Access Directive (Directive 2002/19/EC), the Universal Service Directive (Directive 2002/22/EC) and the Directive on privacy and electronic communications (Directive 2002/58/EC), as amended.

- 4.6 The management of the UK radio spectrum is carried out within a framework set out by the European Common Regulatory Framework, which aims to harmonise the regulation of electronic communications networks and services throughout the European Union. Related to that, Section 4 of the 2003 Act requires Ofcom when carrying out its spectrum functions to act in accordance with “six community requirements” when managing the wireless spectrum within the UK. These include:
- the requirement to promote competition (section 4(3));
  - the requirement to secure that Ofcom’s activities contribute to the development of the European internal market (section 4(4));
  - the requirement to promote the interests of all persons who are citizens of the European Union (section 4(5)).

### **Ofcom’s duties when carrying out spectrum functions**

- 4.7 In carrying out its spectrum functions it is the duty of Ofcom (under section 3 of the 2006 Act) to have regard in particular to:
- the extent to which the spectrum is available for use or further use, for wireless telegraphy;
  - the demand for use of that spectrum for wireless telegraphy; and
  - the demand that is likely to arise in future for the use of that spectrum for wireless telegraphy.
- 4.8 It is also the duty of Ofcom to have regard, in particular, to the desirability of promoting:
- the efficient management and use of the spectrum for wireless telegraphy;
  - the economic and other benefits that may arise from the use of wireless telegraphy;
  - the development of innovative services; and
  - competition in the provision of electronic communications services.
- 4.9 Where it appears to Ofcom that any of its duties in section 3 of the 2006 Act conflict with one or more of its general duties under sections 3 to 6 of the 2003 Act, priority must be given to its duties under the 2003 Act.

### **Ofcom’s spectrum functions**

- 4.10 Ofcom’s powers to carry out its spectrum functions are set out in the 2006 Act. Such powers include, under paragraph 6 of Schedule 1 of the 2006 Act, the general discretion to revoke or vary any wireless telegraphy licences by serving a notice in writing on the licence holder or by way of general notice to licensees in a class.
- 4.11 Ofcom also has a duty set out in section 9(7) of the 2006 Act, reflecting Article 6 of the EU Authorisation Directive 2002/20/EC, to ensure that wireless telegraphy licence conditions are objectively justified in relation to networks and services to which they relate, non-discriminatory, proportionate and transparent. Ofcom

considers that this obligation is ongoing and must be assessed against market circumstances and the state of technology development at the time.

4.12 Ofcom has a broad discretion under paragraph 6 of Schedule 1 of the 2006 Act to agree to vary licences, but legal rules operate to limit that discretion. These legal rules on licence variation include the following, in summary:

- Pursuant to paragraph 6A of Schedule 1 of the 2006 Act, any variation of a wireless telegraphy licence must be objectively justifiable;
- UK obligations under European law or international agreements where use of spectrum has been harmonised: Ofcom will not agree to remove restrictions from licences or other changes that would conflict with the UK's obligations under international law. This includes changes in use or technology that would contravene binding Community measures, such as directives or harmonisation measures adopted under the Radio Spectrum Decision (676/2002/EC) and ITU Radio Regulations.
- Ofcom must comply with any direction from the Secretary of State under section 5 of the 2003 Act and section 5 of the 2006 Act.
- Ofcom must act in accordance with its statutory duties, including the duty to ensure optimal use of the spectrum, the duty mentioned in paragraph 4.7 and obligations under the European Authorisation Directive (2002/20/EC).
- General legal principles, which include the duties to act reasonably and rationally when making decisions and to take account of any legitimate expectations.

## **Liberalisation and the framework for analysis of licence variation requests**

4.13 The radio spectrum is a finite resource of considerable economic and social value. Where possible we have adopted market-based mechanisms, including trading and liberalisation, which empower spectrum users to take more decisions on spectrum. We believe that this is likely to lead to optimal use of the radio spectrum.

4.14 Liberalisation, the removal or reduction of restrictions in licences, is central to this approach to spectrum management. Together with incentive pricing, auctions and spectrum trading, it makes spectrum available on a more flexible and dynamic basis for new wireless applications. It is also consistent with Ofcom's aim to deregulate or simplify regulation wherever possible.

4.15 Our approach to liberalisation operates within the legal rules described above that limit Ofcom's discretion to vary licences. Therefore in considering requests for the variation of individual licences the factors that we will take into account include:

- impact on spectrum users in adjacent bands;
- benefits for consumers and citizens;
- optimal spectrum use;
- impact on competition;
- objective justification for licence conditions; and

- legal considerations that limit Ofcom's discretion to vary licence conditions.
- 4.16 In section 5, the analytical framework we have applied in considering this variation request reflects our relevant regulatory objectives and our statutory duties, as set out above.
- 4.17 We have considered both the likely impact on competition and consumers of granting the variation and the likely effect on spectrum management, in particular the impact on existing licensed or exempted use of adjacent spectrum.

## Impact assessment

- 4.18 This consultation as a whole, including its annexes, comprises an impact assessment as defined in Section 7 of the 2003 Act.
- 4.19 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making. This is reflected in Section 7 of the 2003 Act, which means that generally, we have to carry out impact assessments where our proposals would be likely to have a significant impact on businesses or the public, or when there is a major change in Ofcom's activities.
- 4.20 Ofcom is an evidence-based organisation and welcomes responses to this consultation. Any comments about our assessment of the impact of our proposals should be sent to us by the closing date for this consultation. We will consider all comments before deciding whether to implement our proposals. For further information about our approach to impact assessments, see the guidelines, Better policy-making: Ofcom's approach to impact assessment, which are on our website: <http://stakeholders.ofcom.org.uk/consultations/better-policy-making/-policy-making/>

## Equality Impact Assessment

- 4.21 Ofcom is separately required by statute to assess the potential impact of all our functions, policies, projects and practices on race, disability and gender equality. Equality Impact Assessments (EIAs) also assist us in making sure that we are meeting our principal duty of furthering the interests of citizens and consumers regardless of their background or identity.
- 4.22 We do not consider that our proposals in respect to EE's licence variation are likely to have a particular impact on one group of stakeholders as opposed to another.
- 4.23 Additionally, we do not believe any aspect of the question of whether or not to vary EE's licence raises issues requiring separate EIAs in relation to race or gender equality or equality schemes under the Northern Ireland and Disability Equality Schemes.

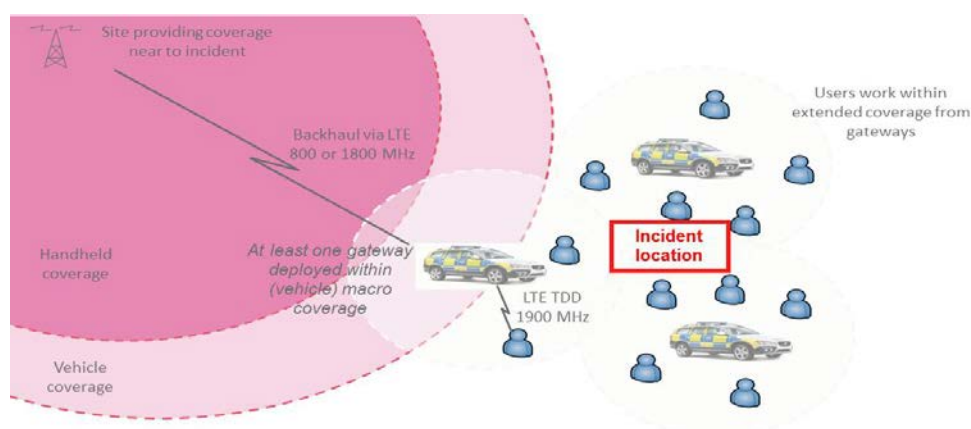
## Section 5

# Assessment of EE's licence variation requests

## Context

- 5.1 EE has been awarded a contract by the UK Home Office to provide Mobile Services for a new Emergency Services Network (ESN) based on its LTE network<sup>10</sup>. As part of that contract, the Home Office wants EE to provide an ESN Gateway device solution also based on an LTE air interface that, for instance, could be fitted to some emergency services vehicles.
- 5.2 The ESN Gateway device is intended to provide an extension to mobile coverage if the emergency services are responding to an incident in an area or location that has weak network coverage (Figure 2) or for penetrating into buildings where the signal level from the external network is insufficient to support reliable communications (Figure 3). Within normal coverage of EE's macro network, ESN user terminal devices are expected to connect to the network directly.
- 5.3 Where the incident is occurring in a location with insufficient coverage, the emergency services vehicle fitted with an ESN Gateway can be deployed at the edge of the networks' ordinary coverage. The ESN terminal devices will connect to the ESN Gateway device, which will in turn connect to the main network. The approximate number of ESN Gateway devices expected to be deployed is of the order of 10,000 (noting that there are approximately 45,000 Emergency Services vehicles in total that could, in theory, be fitted).
- 5.4 The ESN Gateways will use TD-LTE technology operation in EE's 1900 MHz unpaired spectrum holding at 1899.9 to 1909.9 MHz to effectively provide a bubble of coverage around the ESN Gateway device. The ESN Gateway will be connected back (backhaul<sup>11</sup>) to the EE network via EEs 800 MHz or 1800 MHz access spectrum.

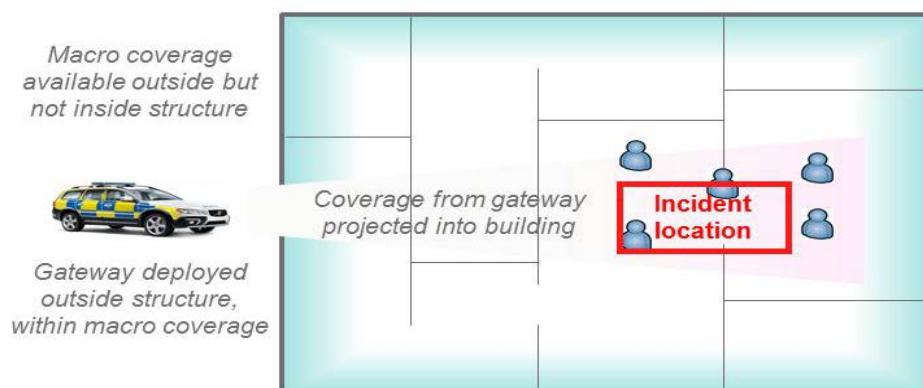
**Figure 2: Extension of coverage to a remote location**



<sup>10</sup> <https://www.gov.uk/government/publications/the-emergency-services-mobile-communications-programme/emergency-services-network#about-the-emergency-services-network>

<sup>11</sup> For the purposes of this licence variation consultation, use of the term "backhaul" should be taken to mean the connection between the ESN Gateway device and the main EE LTE access network.

**Figure 3: Extension of coverage into a building**



- 5.5 In support of the above, EE has requested that its spectrum access licences be varied so as to permit it to:
- i) use its 1900 MHz unpaired spectrum for communications between ESN user terminal devices and ESN Gateways. In order to achieve this EE has asked us to vary its 2100 MHz licence in order to allow TD-LTE use as the licence currently restricts use of the 1900 MHz unpaired spectrum to UMTS use; and
  - ii) connect (backhaul) the ESN Gateway devices to the main EE network using EE's paired spectrum at 800 MHz (796 to 801 MHz paired with 837 to 842 MHz) and at 1800 MHz (1831.7 to 1876.7 MHz paired with 1736.7 to 1781.7 MHz). To do this EE would like ESN Gateway devices to be authorised to transmit at a maximum mean power of 31 dBm e.i.r.p.<sup>12</sup> in the uplink frequencies 837.0 to 842.0 MHz and 1736.7 to 1781.7 MHz; this power is higher than that currently permitted in these bands. Apart for the maximum transmit power, all other technical conditions for the backhaul function of ESN Gateway devices should be as specified in EN 301 908-13. To achieve this EE has asked us to consider how we might authorise this (including the increase in power over exempt apparatus), suggesting a variation of the licences which include the 800 MHz and 1800 MHz bands.
- 5.6 We discuss these two requests separately in our analysis below.

## **Implications for LTE deployment in the frequency band 1900 to 1920 MHz**

### **Impact on citizens and consumers**

- 5.7 In general, we believe that supporting innovation by liberalising spectrum use should bring about benefits for citizens and consumers, as it enables operators to use new technologies and provide new services. In this instance, the liberalisation of EE's 1900 MHz unpaired spectrum to permit the use of LTE equipment will benefit citizens and consumers by supporting the provision of a new emergency services communications network. However, as outlined below this liberalisation measure could provide further opportunities to exploit this previously unused spectrum band.

<sup>12</sup> 3GPP UE class 1

- 5.8 The 1900 MHz unpaired spectrum is already designated for use for TD-LTE by the 3rd Generation Partnership Project (3GPP). The 1900 to 1920 MHz band is covered by 3GPP Band 33 and it is a subset of 3GPP Band 39. Although deployment of equipment covering 1900 MHz unpaired spectrum is currently limited to China, many mobile handsets available to UK consumers already support the use of this band. While availability of networks that use Band 33 and 39 may be limited, we consider that clarity around the use of the band for TD-LTE and the availability of equipment will provide additional momentum to expand the use of this spectrum.
- 5.9 Given the availability of equipment, if in the future EE or other licensees in the 1900 MHz unpaired spectrum wished to use this spectrum for services other than ESN then it may provide additional capacity for broadband services which may result in benefits for consumers. This would provide the networks greater capacity to deal with increased data demand. However, at present we believe it to be more likely that the use of this spectrum would be to provide niche solutions rather than be available to all users and therefore any consumer benefits may be relatively limited in scope.
- 5.10 The Home Office has advised that the use of cheaper, smarter communications network, which this variation is part of, will enable more effective use of police, fire and ambulance resources<sup>13</sup>. They cite the example of ambulance crews being able to send high-resolution images and video to waiting consultants or live streaming of body worn cameras at a crime scene. Although difficult for Ofcom to quantify, we believe that granting this variation request would provide benefits to citizens through supporting the provision of a new emergency services communication network.

### **Impact on competition**

- 5.11 In the past where we have liberalised the licences of mobile operators, we have taken account of the market effect of such changes. The fact that different Mobile Network Operators (“MNOs”) have different spectrum holdings means that licence variations can have differential impacts on the competitive position of different MNOs.
- 5.12 The requested licence variation would increase the amount of EE’s existing spectrum holdings which can be used for LTE equipment by 10 MHz. A similar licence variation for O2 and H3G (the holders of the other 10 MHz of spectrum in the 1900 MHz unpaired band) would increase the availability of LTE spectrum for each of them in their existing spectrum holdings by 5 MHz. We have considered whether our proposal could have implications for competition in the provision of mobile services. Our understanding is that this spectrum is unlikely to be useful for the provision of general, wide area, mobile services and is more suitable for specific, ‘niche’, applications such as that which EE is planning. We therefore have not identified any reason why we should not agree to the licence variation on competition grounds.

### **Impact on spectrum management**

- 5.13 We consider that allowing this spectrum to be brought into productive use will be beneficial provided it does not cause interference to users in adjacent bands. We have therefore considered varying the licence in line with technical conditions

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<sup>13</sup> <https://www.gov.uk/government/news/final-contracts-for-new-emergency-services-network-are-signed>



necessary to provide other users adequate protection against harmful interference. Specifically, our analysis includes considering the potential impact to the following adjacent users: DECT in the band 1880 to 1900 MHz; other licensees of 1900 MHz unpaired spectrum, Telefónica Ltd (1909.9 to 1914.9 MHz) and Hutchison 3G Ltd (1914.9 to 1920.0); the uplink band of paired 2100 MHz spectrum, particularly Hutchison 3G which holds the nearest such allocation 1920.0 to 1934.9 MHz.

5.14 Figure 5 below illustrates EE’s 1899.9 to 1909.9 MHz unpaired band in relation to the neighbouring spectrum.

**Figure 5: EE’s Unpaired Band and Neighbouring Spectrum Use**



**Coexistence analysis – 1900 MHz Unpaired spectrum (1899.9 to 1920.0 MHz)**

5.15 CEPT Report 39<sup>14</sup>, published in 2010, established a set of least restrictive technical conditions for Electronic Communication Networks (ECN) including conditions that are appropriate for the use of TD-LTE in the unpaired band 1900 to 1920 MHz. In particular, CEPT Report 39 analysed the potential interference into:

- DECT systems in the band 1880 to 1900 MHz;
- other unpaired (TD-LTE) systems in the band 1900 to 1920 MHz; and
- the paired (FDD) uplink above 1920 MHz.

5.16 It concluded that the minimal and least restrictive technical conditions included in the report, and set out below in Table 1, were sufficient to manage the risk of interference in general.

**Table 1: CEPT Report 39 key conditions**

Maximum mean in-block e.i.r.p of base stations	1900 to 1905 MHz	43 dBm/5MHz
	1905 to 1910 MHz	30 dBm/5MHz
	1910 to 1920 MHz	20 dBm/5MHz
Maximum mean out-of-block e.i.r.p of base stations	1920-1980 MHz	-50 dBm/5MHz
Other main elements of the base station block-edge-mask	As described in CEPT Report 39	

5.17 CEPT Report 39 also concluded that a guard band of 5 MHz is necessary between unsynchronised TDD systems in adjacent blocks in the 1900 to 1920 MHz band; however, it also concluded that no guard band is needed between synchronised TDD systems.

5.18 In addition to the findings of CEPT’s work, we have further considered the potential for interference from the use of ESN Gateway devices. In particular, we have looked at whether there is anything specific to the proposed ESN Gateway usage which lead us to believe that a set of technical conditions based on those contained

<sup>14</sup> [Report from CEPT to the European Commission in response to the Mandate to develop least restrictive technical conditions for 2GHz bands, Final Report 25 June 2010](#)

in CEPT Report 39 would not be sufficient to manage the risk of interference to neighbouring spectrum users. Details of this analysis are given in annex 6 of this document.

- 5.19 We found that a key mitigation in relation to ESN Gateway use is its short term, transient nature and that the ESN Gateways are at a lower height (approximately 2 to 3 meters for most vehicles) than the base stations considered in Report 39 (which assumed a height of 20 metres), i.e. more likely to be shielded by local clutter.
- 5.20 In addition, the use of synchronisation between licensees will further minimise the risks of interference. Synchronisation is where networks coordinate the timeslots that base stations transmit on to avoid the situation where one nearby base station is trying to receive while the other is transmitting. Our synchronisation analysis is contained in Annex 7 of this document.
- 5.21 However, use of ESN Gateway devices at (vehicular) speeds may increase the risk of interference to neighbouring spectrum users and should be avoided. We are therefore proposing to include a condition in the licence that ESN Gateways mounted on vehicles are not to be used while the vehicle is in motion.

## Provisional conclusion

- 5.22 Our provisional conclusion is to grant the request to permit TD-LTE technologies in the 1899.9 to 1909.9 MHz unpaired spectrum as we believe this to be an efficient use of the spectrum. However, our decision is on the basis that additional technical conditions be included in EE's licence<sup>15</sup>. These technical conditions are required to prevent undue interference to other users of the adjacent spectrum. The technical conditions we propose:
- are consistent with CEPT Report 39 (as set out in schedule 3 of the licence at annex 5);
  - impose a requirement to adopt a specific TD frame structure (3:1 DL:UL configuration) and be capable of frame synchronisation (i.e. alignment of the frame start times and all frames/sub-frames being the same) with other unpaired TD-LTE (or equivalent) systems deployed in the 1900 MHz unpaired band in accordance with the relevant licence schedule (explained further at annex 7); and
  - prohibit the use of ESN Gateway devices fitted to vehicles whilst they are in motion.
- 5.23 Given the above conditions, we do not consider that undue interference from EE's proposed use of 1899.9 to 1909.9 MHz is likely. We believe our decision would provide benefits to citizens through supporting the provision of a new emergency services communication network. We see no competition grounds that would prevent us from approving this request.

## Varying the other two licences in the 1900 MHz unpaired band to allow the use of 4G technologies

- 5.24 We have not specifically considered the impact of extending this variation to the other two licences in the 1900 MHz unpaired band. However, our preliminary view is that a set of technical conditions based on those contained in CEPT Report 39 is

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<sup>15</sup> Links to draft copies of the proposed licences can be found in Annex 5.

likely to be appropriate to most use cases based on TD-LTE (or equivalent) technology and that synchronisation between TDD networks in the band is likely to be necessary.

- 5.25 It should be noted that CEPT Report 39 established an in-band power limit for the 1910 to 1920 MHz block that is lower than the limits for the 1900 to 1905 MHz and 1905 to 1910 MHz blocks. Any variation for the other two licences may have to reflect this difference.

## Legal tests

- 5.26 We consider that the variation we are proposing to make to EE's 2100 MHz spectrum access licence are:
- **objectively justifiable** as they are necessary in order to enable the use of 4G technology in the 1900 MHz unpaired band;
  - **non-discriminatory** as we would consider any requests from other operators to vary other comparable licences in the same band on the same basis;
  - **proportionate** because the proposed licence variation would permit operators the maximum flexibility to use of their spectrum in line with current technical reports and the restrictions and conditions placed on the use of that spectrum go no further than is necessary to protect spectrum users in adjacent bands; and
  - **transparent** because it is clear on the face of the proposed licence variation what it is intended to achieve.

*Q1) Do you agree with our proposal to vary EE's Spectrum Access 2100 MHz licence to allow LTE technology? If not, please explain why you think it would not be appropriate to vary the licence?*

## Implications of authorising the backhaul of ESN Gateway devices using the 800 MHz and 1800 MHz bands

- 5.27 EE's request to authorise the backhaul of ESN Gateway devices at a maximum mean power of 31 dBm e.i.r.p. in the uplink frequencies 837.0 to 842.0 MHz and 1736.7 to 1781.7 MHz would exceed the user terminal devices power limit currently authorised by exemptions regulations<sup>16</sup>. User terminal devices that connect to networks are normally exempted from the requirement for licensing under the 2006 Act, subject to complying with the relevant technical criteria and the terms of the exemption. However, ESN Gateway devices are considered to be base stations rather than user terminal devices and both the level of power and the mode of use proposed for backhaul fall outside the exemption criteria. The ESN Gateway devices will therefore need to be licensed; therefore, we propose to amend EE's 800 MHz and 1800 MHz licences to include a new schedule covering this equipment.
- 5.28 EE's request specifically relates to the occasional and limited use of the higher power uplink transmission for the backhaul of ESN Gateway devices in the 800 MHz and 1800 MHz bands. We have not considered the impact of authorising 31 dBm e.i.r.p. devices in the uplink frequencies 837.0 to 842.0 MHz and 1736.7 to 1781.7 MHz beyond this use and consequently we propose to limit use of 31 dBm

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<sup>16</sup> Wireless Telegraphy (Exemption) Regulations 2003

e.i.r.p. devices in these bands specifically to the provision of backhaul for ESN Gateway devices.

## Impact on consumers and citizens

5.29 We have discussed the impact on citizens and consumers of the proposed variation of EE's 2100 MHz licence to permit the use of LTE technology in paragraphs 5.6 to 5.10 of this document. In so far as the proposed use of the 800 MHz and 1800 MHz bands for backhaul is concerned, given the proposed restriction on the deployment of backhaul on these bands for ESN use only, we believe that the proposed variation will benefit users of the emergency services but that benefits to other consumers will be limited. We have outlined the impact on citizens previously when discussed the proposed variation of EE's 2100 MHz licence in paragraph and that discussion applies equally to the related proposed variations of EE's 800 MHz / 2.6 GHz and 1800 MHz licences.

## Impact on competition

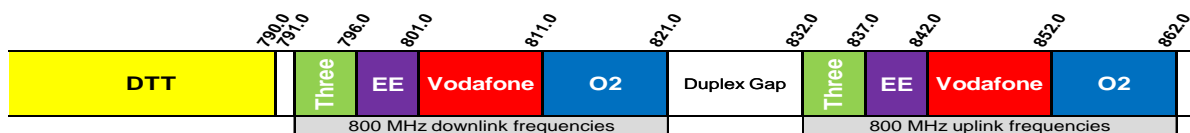
5.30 EE's proposal to use the 800 MHz and 1800 MHz bands for backhaul at powers up to 31 dBm e.i.r.p. relates specifically to the support of emergency services communications and does not change the conditions of the licences authorising the general use of the 800 MHz and 1800 MHz bands. We have not considered more generally the impact of allowing uplink transmissions in the 800 MHz and 1800 MHz bands from devices with a maximum mean power of 31 dBm e.i.r.p.. Consequently, we are proposing that the use of devices using 31 dBm e.i.r.p should be restricted in the licence to the backhaul of ESN Gateway devices only, which are intended only for occasional and limited use. Given this restriction, we do not believe that granting the request would give rise to any adverse impact on competition in the mobile market.

## Impact on spectrum management

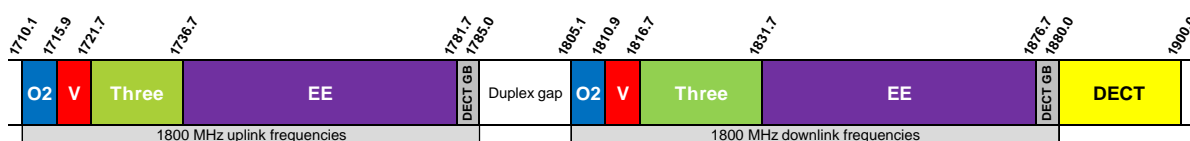
### Interference analysis – ESN Gateway backhaul at 800 MHz and 1800 MHz

5.31 In considering EE's request to use the 800 MHz and 1800 MHz bands for ESN Gateway backhaul, Ofcom has assessed the potential coexistence impact on the use of neighbouring spectrum. Figures 7 and 8 below illustrate EE's paired spectrum holdings in the 800 MHz and 1800 MHz bands in relation to the neighbouring spectrum.

**Figure 7: EE's 800 MHz Paired Bands and Neighbouring Spectrum Use**



**Figure 8: EE's 1800 MHz Paired Bands and Neighbouring Spectrum Use**



5.32 We have assessed the potential interference impact of allowing uplink transmissions with a maximum mean power of 31 dBm e.i.r.p. using 800 MHz and 1800 MHz to provide backhaul for ESN Gateway devices. It should be noted that all other uplink transmissions (under the licence exemption regulations) are limited to a

maximum mean power of 23 dBm e.i.r.p. The main interference mechanism to consider is interference into the base station receivers of other mobile operators operating in adjacent paired spectrum (primarily Three and Vodafone in the 800 MHz band; Three in the 1800 MHz band and Concurrent Spectrum Access licensees in the 1781.7-1785 and 1876.7-1880 MHz bands (the “DECT Guard Band”)).

- 5.33 Devices with a maximum mean power of 31 dBm e.i.r.p. operating in the uplink frequencies 837.0 to 842.0 MHz and 1736.7 to 1781.7 MHz could potentially cause desensitisation of base station receivers in adjacent spectrum over a relatively large distance. However, base stations are designed to operate in an environment where such desensitisation could occur. This interference is most pronounced where terminal stations are operating at their maximum power, are located close to the ‘victim’ base station, and where the ‘victim’ base station is receiving a relatively weak signal from one of its own user terminal devices. This interference is naturally mitigated as these circumstances are generally encountered relatively rarely due to the naturally transient nature of mobile transitions and the power control mechanism implemented.
- 5.34 Given the supporting network density and the outdoor use case of the ESN Gateway solution, it is considered that transmit powers close to or at the maximum will more likely be needed in rural areas. As noted above, a key mitigation in relation to ESN Gateways (and therefore also in relation to backhaul related to their use) is that their use is intended to be short term, occasional and transient in nature, with generally a very low return period to any specific location. The low return period and the generally lower loading of rural base stations offer additional mitigation in relation to such interference.
- 5.35 We have also considered the potential interference impact of devices with a maximum mean power of 31 dBm e.i.r.p. on Digital Terrestrial Television (DTT) receivers operating below 790 MHz. Given the frequency separation between EEs uplink spectrum (837 to 842 MHz) and the DTT block below 790 MHz and the mitigation factors described above it is not considered likely that use of devices with a maximum mean power of 31 dBm e.i.r.p. for ESN Gateway backhaul will be problematic for DTT reception.

## **Provisional conclusion**

- 5.36 We propose to grant EE’s variation request to its 800 MHz / 2.6 GHz and 1800 MHz licences in order to allow the backhaul of ESN Gateway devices at a maximum mean power of 31 dBm e.i.r.p. in the uplink frequencies 837.0 to 842.0 MHz and 1736.7 to 1781.7 MHz. We do not consider that this will result in undue interference to adjacent users.
- 5.37 However, we have not considered more generally the impact of allowing uplink transmissions in the 800 MHz and 1800 MHz bands from devices with a maximum mean power of 31 dBm e.i.r.p. For this reason, if we grant the variation, we propose to authorise this only in relation to its use for the backhaul of ESN Gateways, which are intended only for occasional and limited use.
- 5.38 As discussed previously we believe that there are benefits to citizens through supporting the provision of a new emergency services communication network. We see no competition reasons not to approve the request.

## Legal tests

- 5.39 We consider that the variation we are proposing to make to EE's 800 MHz / 2.6 GHz and 1800 MHz spectrum access licence are:
- **objectively justifiable** as they are necessary in order to enable the use of ESN Gateways in connection with the new national emergency services network;
  - **non-discriminatory** as we would consider any requests from other operators to vary other comparable licences in the same bands on the same basis;
  - **proportionate** because the proposed restrictions and conditions placed on the use of that spectrum go no further than is necessary to achieve the objective of permitting the use of ESN Gateways in connection with the new national emergency services network whilst protecting spectrum users in adjacent bands; and
  - **transparent** because it is clear on the face of the proposed licence variations what they are intended to achieve.

*Q2) Do you agree with our proposal to authorise the backhaul of ESN Gateway devices at a maximum mean transmit power of 31 dBm e.i.r.p. in the uplink frequencies 837.0 to 842.0 MHz and 1736.7 to 1781.7 MHz in EE's 800 MHz and 1800 MHz licensed spectrum to facilitate the occasional and limited use of higher power uplink transmission? If not, please explain why you think it would not be appropriate to vary the licence?*

## Next steps

- 5.40 Following consideration of responses to this consultation, we expect to publish a statement with our decision in autumn 2016.
- 5.41 If appropriate, we would grant the variations as soon as is practicable.
- 5.42 If the liberalisation of the 1900 MHz unpaired spectrum is granted, we would consider similar variation requests from the other spectrum users (Hutchison 3G Ltd and Telefónica Ltd). Any requests would be subject to engineering and coordination considerations appropriate to their spectrum and adjacencies and may be subject to consultation before granting.
- 5.43 We propose that TD-LTE user terminal devices for use in the 1900 MHz unpaired spectrum will be authorised on a licence exempt basis with a maximum mean total radiated power (TRP) of 23 dBm. If we decide to grant the variation, we propose to make regulations to give effect to that exemption at the earliest opportunity.
- 5.44 If we decide to grant the variation, we expect also to draft and implement a suitable Interface Requirement (IR) to cover the 1900 MHz unpaired spectrum TD-LTE use.

## Annex 1

# Responding to this consultation

## How to respond

- A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made by 5pm on 30 September 2016.
- A1.2 Ofcom strongly prefers to receive responses using the online web form at <http://stakeholders.ofcom.org.uk/consultations/EE-licence-variation-1990-1920MHz/howtorespond/form>, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.
- A1.3 For larger consultation responses - particularly those with supporting charts, tables or other data - please email [cliff.mason@ofcom.org.uk](mailto:cliff.mason@ofcom.org.uk) attaching your response in Microsoft Word format, together with a consultation response coversheet.
- A1.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.
- Cliff Mason  
Desk 3:188  
Spectrum Group  
Riverside House  
2A Southwark Bridge Road  
London SE1 9HA
- A1.5 Note that we do not need a hard copy in addition to an electronic version. Ofcom will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.
- A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 4. It would also help if you can explain why you hold your views and how Ofcom's proposals would impact you.

## Further information

- A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Cliff Mason on 020 7783 4353.

## Confidentiality

- A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, [www.ofcom.org.uk](http://www.ofcom.org.uk), ideally on receipt. If you think your response should be kept confidential, can you please specify what part or whether all of your response should be kept confidential, and specify why. Please also place such parts in a separate annex.

- A1.9 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and will try to respect this. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.
- A1.10 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's approach on intellectual property rights is explained further on its website at <http://www.ofcom.org.uk/terms-of-use/>

## Next steps

- A1.11 Following the end of the consultation period, Ofcom intends to publish a statement by November 2016.
- A1.12 Please note that you can register to receive free mail Updates alerting you to the publications of relevant Ofcom documents. For more details please see: <http://www.ofcom.org.uk/email-updates/>

## Ofcom's consultation processes

- A1.13 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.
- A1.14 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at [consult@ofcom.org.uk](mailto:consult@ofcom.org.uk). We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.
- A1.15 If you would like to discuss these issues or Ofcom's consultation processes more generally you can alternatively contact Steve Gettings, Secretary to the Corporation, who is Ofcom's consultation champion:

Steve Gettings  
Ofcom  
Riverside House  
2a Southwark Bridge Road  
London SE1 9HA

Tel: 020 7783 4652

Email [steve.gettings@ofcom.org.uk](mailto:steve.gettings@ofcom.org.uk)



## Annex 2

# Ofcom's consultation principles

A2.1 Ofcom has published the following seven principles that it will follow for each public written consultation:

### Before the consultation

A2.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

### During the consultation

A2.3 We will be clear about who we are consulting, why, on what questions and for how long.

A2.4 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened Plain English Guide for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will consult for up to 10 weeks depending on the potential impact of our proposals.

A2.6 A person within Ofcom will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. Ofcom's 'Consultation Champion' will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why.

### After the consultation

A2.8 We think it is important for everyone interested in an issue to see the views of others during a consultation. We would usually publish all the responses we have received on our website. In our statement, we will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

## Annex 3

# Consultation response cover sheet

- A3.1 In the interests of transparency and good regulatory practice, we will publish all consultation responses in full on our website, [www.ofcom.org.uk](http://www.ofcom.org.uk).
- A3.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality where appropriate.
- A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.
- A3.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at <http://stakeholders.ofcom.org.uk/consultations/consultation-response-coversheet/>.
- A3.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only, so that we don't have to edit your response.

## Cover sheet for response to an Ofcom consultation

### BASIC DETAILS

Consultation title: Variation of EE's Spectrum Access 2100 MHz Licence

To (Ofcom contact): Cliff Mason

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

### CONFIDENTIALITY

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing	<input type="checkbox"/>	Name/contact details/job title	<input type="checkbox"/>
Whole response	<input type="checkbox"/>	Organisation	<input type="checkbox"/>
Part of the response	<input type="checkbox"/>		

If there is no separate annex, which parts?

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

### DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name

Signed (if hard copy)

## Annex 4

# Consultation questions

A4.1 Ofcom invites response to the following questions:

*Q1) Do you agree with our proposal to vary EE's Spectrum Access 2100 MHz licence to allow LTE technology? If not, please explain why you think it would not be appropriate to vary the licence?*

*Q2) Do you agree with our proposal to authorise the backhaul of ESN Gateway devices at a maximum mean transmit power of 31 dBm e.i.r.p. in the uplink frequencies 837.0 to 842.0 MHz and 1736.7 to 1781.7 MHz in EE's 800 MHz and 1800 MHz licensed spectrum to facilitate the occasional and limited use of higher power uplink transmission? If not, please explain why you think it would not be appropriate to vary the licence?*

## Annex 5

# Draft licences

A5.1 Copies of the draft licences, including the proposed amendments, can be found using the following links.

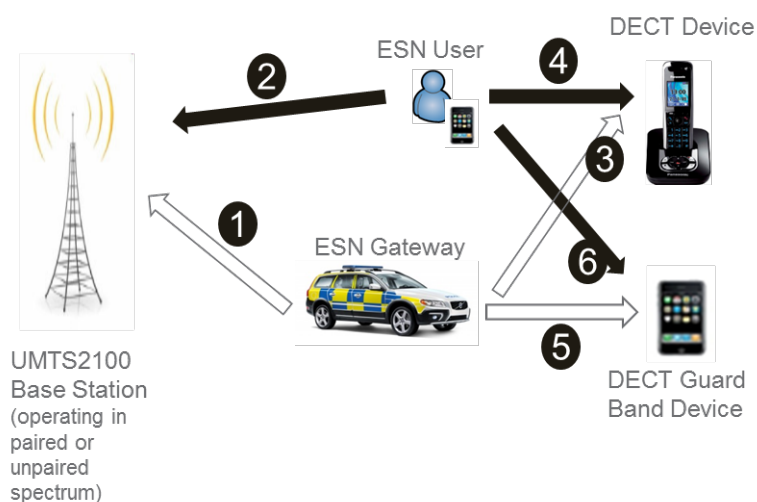
- [Spectrum Access 800 MHz / 2.6 GHz](#)
- [Public Wireless Network](#)
- [Spectrum Access 2100 MHz](#)

## Annex 6

# Interference analysis for the 1899.9 to 1909.9 MHz licence variation

- A6.1 As noted above, CEPT Report 39 provides a set of minimal and least restrictive technical conditions that are appropriate for the use of TD-LTE in the unpaired band 1900 to 1920 MHz. These technical conditions were derived on the basis of certain assumptions about the networks deployed.
- A6.2 One of the key assumptions was that TDD and FDD base stations are separated by at least 100 m with a clear line-of-sight between them. For line-of-sight base station separations of less than 100 metres, CEPT Report 39 assumes that some form of cooperation between licensees may be necessary (e.g. adjusting transmission power and/or other technical parameters of transmission if necessary).
- A6.3 Given the nomadic, transitory nature of the ESN Gateway solution being considered by EE, it is not reasonable to expect detailed cooperation between licensees' every time an ESN Gateway device is used in a particular location. We therefore need to ensure that technical conditions established in CEPT Report 39 are still appropriate for the ESN Gateway mode of operation.
- A6.4 The analysis below steps through the main potential interference mechanisms and indicates why we do not consider them to be a cause for concern.
- A6.5 The main potential interference mechanisms are outlined in Figure 6 below and are assessed further in the table below. Note that, for clarity, low-power concurrent use systems operating in the spectrum bands 1781.7 to 1785 MHz paired with 1876.7 to 1880 MHz are referred to as "DECT Guard Band" systems.

**Figure 6: Potential Interference Mechanisms**



- A6.6 It should be noted that the technical conditions established in CEPT 39 require a significantly lower maximum mean transmit power compared to those allowed for UMTS in the current licence.
- A6.7 In general, the interference scenarios will be limited substantially due to the likely small scale and transient nature of ESN Gateways use, compared to a full commercial terrestrial network capable of providing electronic communications

services. ESN Gateway devices will not be authorised to operate whilst the vehicles they are mounted on are in motion and will most likely be used in circumstances where improved coverage is needed, e.g. at incidents where coverage from EEs terrestrial mobile network is not robust enough.

**Table 2: Analysis of Interference Mechanisms**

Interference Mechanism	Assessment
<p>1 Possible interference from ESN Gateway device to UMTS2100 base station uplink, operating in paired or unpaired spectrum in adjacent or nearby spectrum</p>	<p>The lower maximum mean transmit power proposed here for TD-LTE are in line with CEPT Report 39 to allow for co-existence with paired spectrum in 1920 to 1980 and unpaired spectrum of other licensees in 1909.9 to 1919.9 MHz.</p> <p>A 10 MHz guard band is effectively presented between this licensed spectrum and 1920 MHz, the lower boundary of paired spectrum licenced in the 2100 MHz band.</p> <p>The short term, transient nature of transmissions from ESN Gateway devices at any specific location is a key mitigation. As is the lower height of the ESN Gateway antenna (approximately 2-3 metres for most vehicles) than the base stations considered in Report 39 (which assumed a height of 20 metres), meaning that there is much more likelihood of shielding by local clutter. Using the Okumura-Hata propagation model with suburban clutter and an ESN Gateway antenna height of 2 metres (with other parameters as assumed in CEPT Report 39) then separation distances are reduced from the 100 metres in CEPT Report 39 to approximately 50 metres for interference into the UMTS2100 FDD uplink.</p> <p>There are, as yet, no applications for the 1909.9 to 1920.0 MHz unpaired spectrum adjacent to the spectrum to which this variation request pertains. However, to protect any potential future TD-LTE (or equivalent) application emerging in this band, it is proposed that frame synchronisation to a common time reference shall be implemented as soon as adjacent TD-LTE (or equivalent) systems are deployed within the 1899.9 to 1920.0 MHz band. To facilitate this synchronisation, it is proposed to adopt a specific TD frame structure (3:1, DL:UL). This frame structure is aligned to that proposed for the 2.3 and 3.4 GHz bands (see Annex 7 for details).</p>

Interference Mechanism	Assessment
<p>2 Possible interference from user terminal devices (e.g. handsets) connected to the ESN Gateway device to UMTS2100 base station uplink, operating in paired or unpaired spectrum</p>	<p>As for Mechanism 1, the co-existence recommendations of CEPT Report 39 are respected in this proposal. There is nothing specific or unique about the use of user terminal devices connected to ESN gateways and the analysis in CEPT Report 39 is sufficient to cover this particular interference mechanism.</p> <p>The proposed frame structure and the requirement to synchronisation should be sufficient to protect any future potential future TD-LTE (or equivalent) applications in 1909.9 to 1920.0 MHz.</p>
<p>3 Possible adjacent channel interference from ESN Gateway device to DECT handset or base station</p>	<p>The scope for this interference mechanism is fundamentally low due to the limited number of devices that will likely use the 1899.9 to 1909.9 MHz</p> <p>DECT cordless systems employ automatic carrier selection and can use any of the 10 carriers in the 1880 to 1900 MHz band. Where operation in close proximity does occur, DECT can automatically maximise the frequency separation between the ESN Gateway device and DECT operation.</p> <p>In addition, the ESN Gateway device will operate principally outdoors and its usage will be very transient in nature, according to the occurrence of incidents requiring additional coverage for the emergency services responding to such incidents.</p>
<p>4 Possible adjacent channel interference from User Terminal Equipment connected to the ESN Gateway device to DECT handset or base station</p>	<p>Interference would only potentially occur when the ESN user is in close proximity to a DECT system when responding to an incident that requires operation of a ESN Gateway device.</p> <p>The assessment is otherwise similar to mechanism 3.</p>
<p>5 Possible adjacent channel interference from ESN Gateway device to the downlink of a handset operating in spectrum bands 1781.7to 1785 MHz paired with 1876.7 to 1880 MHz</p>	<p>The scope for this interference mechanism is fundamentally low due to the limited number of devices that will use the 1899.9 to 1909.9 MHz spectrum.</p> <p>There is a gap of almost 20 MHz in frequency between the ESN Gateway device operating in the 1899.9 to 1909.9 MHz spectrum and systems operating in the spectrum bands 1781.7 to 1785 MHz paired with 1876.7 to 1880 MHz.</p> <p>In addition, the ESN Gateway device will operate principally outdoors and its usage will be very transient in nature, according to the occurrence of incidents requiring additional coverage.</p>



Interference Mechanism	Assessment
<p>6 Possible adjacent channel interference from User Terminal Equipment connected to the ESN Gateway device to the downlink of a handset operating in spectrum bands 1781.7 to 1785 MHz paired with 1876.7 to 1880 MHz</p>	<p>The scope for this interference mechanism is fundamentally low due to the limited number of devices that will use the 1899.9 to 1909.9 MHz spectrum.</p> <p>Interference would only potentially occur when the ESN user is in close proximity to a handset operating in spectrum bands 1781.7 to 1785 MHz paired with 1876.7 to 1880 MHz during an emergency operation.</p> <p>The assessment is otherwise similar to mechanism 5.</p>

## Synchronisation

- A7.1 To help manage interference between adjacent licensees, it is also often necessary to coordinate nearby base stations to avoid the situation where one base station is transmitting in the same timeslot as another is receiving. Base stations are typically at a higher height (often above surrounding clutter) and transmit at a higher power than user terminal devices. Base stations will also have a more sensitive receiver to pick up the lower power user terminal signals. Therefore there is a significant risk from two nearby located base stations when one is transmitting and the other is trying to receive.
- A7.2 Similarly, for two nearby user terminal devices, there is a greater degree of out of block emissions than for base stations. Avoiding a situation where one is trying to receive while the other is transmitting is also helpful in minimising interference. This coordination of timeslots is called synchronisation and applies to networks in adjacent spectrum as well as within a licensee’s own network.
- A7.3 We propose that a specific TD frame structure should be adopted, consistent with that proposed by Ofcom for TD use in the 2.3 GHz and 3.4 GHz bands. We will require this TD frame structure to be synchronised to a common time reference with other TD-LTE (or equivalent) systems as and when they are deployed within the band 1899.9 to 1919.9 MHz.
- A7.4 Consequently, any TD-LTE equipment deployed in EE’s 1899.9 to 1909.9 MHz unpaired spectrum must be capable of frame synchronisation (i.e. alignment of the frame start times and all frames/sub-frames being the same) with other TD-LTE systems deployed in the frequency range 1899.9 to 1919.9 MHz in accordance with the licence conditions specified by Ofcom. The frame structure proposed is based on the TD-LTE frame configuration 2 (3:1). This frame structure is likely to be suitable for a range of usage scenarios that other operators may wish to deploy in their own unpaired spectrum in the band 1899.9 to 1919.9 GHz.

**Figure 4: Frame Structure**

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
3:1	D	S	U	D	D	D	S	U	D	D

- A7.5 It is expected that under normal operating conditions, ESN Gateway devices will have visibility of GPS satellites in order to maintain a common timing reference. There may be a limited number of circumstances where an ESN Gateway loses GPS connectivity such as in road tunnels or multi-story car parks. To deal with such circumstances, ESN Gateway devices must be provided with an internal clock that can maintain adequate timing stability for the purpose of maintaining frame synchronisation for a period of not less than 15 minutes.
- A7.6 In the rare circumstances where GPS connectivity is lost for a period of greater than 15 minutes, it is considered that any interference to neighbouring systems would be mitigated by the inherent shielded nature of the circumstances causing loss of GPS

connectivity (e.g. where ESN Gateway devices are used in road tunnels or multi-story car parks).