Award of the 700 MHz and 3.6-3.8 GHz spectrum bands

Annexes 19-26 – licences and licence procedures

Contents

A19. Draft guidance on 700 MHz band coexistence

Summary

A19.1 Future use of the 700 MHz band by mobile services presents the risk of undue interference to some DTT viewers. That is, interference from mobile signals which degrades, obstructs or repeatedly interrupts the images, sounds and messages in DTT broadcasts. DTT services provide important benefits to viewers and such interference to them by 700 MHz mobile services is undue. Viewers should be able to enjoy DTT services free from it.

A19.2 Ofcom's objective, therefore, is to ensure that 700 MHz mobile services do not cause undue interference to DTT viewers (and that, if they do, the mobile licensees resolve it). To ensure viewers can continue to enjoy the benefits DTT services provide, those suffering from such interference need appropriate information about how to seek help and support should be given to them when they need it. Failing to provide it might leave viewers at risk. Vulnerable consumers could be particularly susceptible to harm.

A19.3 Licences for spectrum in the 700 MHz band (694 - 790 MHz) therefore contain co-existence and viewer support obligations. These require licensees to operate a scheme, approved by Ofcom,[1] to provide information and advice to DTT viewers who suffer undue interference caused by mobile services using the band and to provide them with assistance to resolve it. Licensees are required to submit a joint plan for a co-existence scheme or schemes to Ofcom for approval.

A19.4 The purpose of this guidance is to assist mobile licensees by outlining our expectations for the kind of viewer support scheme Ofcom is likely to approve and how we are likely to assess whether licensees are meeting their obligations. There are three aspects of our guidance, to which licensees should refer when developing their plans for their viewer support schemes.

a) First, we set out which viewers the 700 MHz licensees are required to support under their licence obligation.

b) There are then four broad areas of viewer support in which we will usually expect the 700 MHz licensees to make provisions in order that DTT viewers are protected from undue interference. We would normally expect that licensees would need to make provisions in at least these areas to satisfy their licence obligations.

[1] Or, in default of a scheme being approved by Ofcom, in accordance with a scheme we impose.

c) In each of the four areas, there are then more specific considerations we might normally expect the 700 MHz licensees to take account of. However, licensees may be able to meet their licence obligations in other ways, provided the scheme they operate gives DTT viewers adequate protection from interference.

A19.5 This guidance is not legal advice on how licensees should comply with their licence obligations; nor does it prescribe rules in addition to the licence condition. While Ofcom is likely to take account of it in assessing whether to approve licensees' schemes and whether they are meeting their obligations, licensees may formulate other schemes and seek our approval for them. They may also take other steps to meet their obligations (provided they continue to meet them).

The viewers we expect the 700 MHz licensees to assist

A19.6 In general, the guidance here applies to the provision of information, advice and assistance to DTT viewers using rooftop aerials who lack other means of receiving TV services.

A19.7 The licensees should also ensure that advice is available to viewers with indoor aerials. However, we are unlikely generally to require licensees to offer mitigation assistance and resolve interference to these viewers.

A19.8 Some DTT viewers may be affected by interference but have other means to receive TV channels via a cable or satellite pay TV subscription (e.g from Sky or Virgin Media). In these cases, licensees should consider proportionate means of helping these viewers. For example, they could choose to ensure that advice is available and that filters are available via retail, but not provide the full set of assistance measures that may be available to DTT-only users.

A19.9 We will not require any consumer assistance scheme to help recover TV services provided on an interim basis in the 700 MHz band. The provider of these TV services, Arqiva, may separately make its own arrangements to offer support to viewers affected by interference should it wish to do so.

A19.10 Viewers who experience interference may include vulnerable people. We will expect viewer support schemes to make specific provision to protect these viewers, who may be at increased risk of harm on account of their vulnerability and may consequently require a higher level of support.

Areas in which we expect licensees to make provisions for viewer support

A19.11 Below we outline the broad areas where we will usually expect the 700 MHz licensees to make provisions in order to provide support to viewers affected by undue interference.

a) **Engaging with consumers** – We would normally expect licensees to make reasonable arrangements to inform viewers who are at risk of being affected by undue interference.

b) **Assisting viewers who experience problems** – We expect licensees to make arrangements to provide information and advice to viewers who experience undue interference from mobile services in the 700 MHz band and to assist them to resolve it.

c) **Helping vulnerable consumers** – We would normally expect licensees to take account of the needs of vulnerable consumers, both in terms of communication and the information, advice and assistance they provide to resolve problems. This may involve delivering a higher level of service to vulnerable viewers than other DTT viewers receive.

d) **Operational functions** – Licensees are required to make reasonable arrangements for the operational side of supporting DTT viewers. This includes how the costs of viewer support will be funded, how the required scheme will be operated and managed and its performance tracked, and how evidence of these matters will be provided to Ofcom.

Specific guidance

A19.12 In the following section we provide further detail on the specific considerations within each of the above we will usually apply, including the kind of measures they could involve. We would usually expect these to be covered in the plans for schemes submitted by licensees.

Engaging with consumers

Advice line

A19.13 Viewers who experience interference may not know how to resolve their problems. We would therefore anticipate that a viewer support scheme would provide a source of information that viewers can turn to. For this reason, we would normally expect licensees to operate an advice line that viewers can contact.

A19.14 Multiple advice lines (each run by a separate 700 MHz licensee) may create difficulties for viewers, inhibit their seeking help and limit a scheme's effectiveness. For this reason, we would normally expect licensees to provide a single advice line, with one number to call, to serve as a sole point of contact for viewers, even if licensees choose to have more than one entity implementing other parts of the scheme. .

A19.15 Licensees could meet the expectation to provide an advice line in different ways. For instance, they might decide to set up a new call centre to field calls related to 700 MHz interference or enter into a commercial agreement with another party to provide this service.

Advertising and communications

A19.16 Consumers will need to know what help is available to them should their DTT service suffer from interference. Failing this, viewers are unlikely to know who to contact to resolve their problems.

A19.17 Therefore, we would normally expect licensees to make reasonable efforts to advertise the existence of an advice line as well as the availability of assistance to resolve interference

issues. There are a number of channels that licensees might consider using to reach consumers, including social media, print advertising and "pop-up" messages on viewers' TV screens.

A19.18 We would also normally expect licensees to consider how to communicate proactively with viewers who received assistance from at800 in confirmed cases of 4G interference. Viewers who suffered interference to their DTT service caused by mobile in the 800 MHz band are more likely to be at high risk of interference from mobile services in the 700 MHz band.

Assisting consumers who experience undue interference to resolve it

Providing filters

A19.19 Most reception problems resulting from 700 MHz coexistence issues can be fixed via the installation of a 700 MHz filter to the back of the television. Filters are smaller than a pack of cards and most people should be able to install them themselves without difficulty.[2] However, viewers could be left at risk of wasting time and money on ineffective equipment if required to seek out and purchase the appropriate model of filter on their own.

A19.20 We would therefore normally expect licensees to take measures to help viewers who experience undue interference from mobile in the 700 MHz band. We would normally expect this to involve sending a filter to viewers who contact the advice line and who are considered to be suffering from interference resulting from mobile in the 700 MHz band.

A19.21 We would also normally expect additional assistance to be given to consumers if a filter does not resolve their interference problem. Licensees' obligations are to provide viewers with assistance to resolve undue interference they cause. A key consideration, therefore, is that the steps they take must be effective to secure such resolution.

Helping vulnerable consumers

A19.22 Some people's ability to participate in society and receive services is affected by factors such as age-related conditions, disability or income. Life events such as bereavement, redundancy or illness can also temporarily affect them.

A19.23 Some vulnerable consumers may face greater risk of missing advertising messages or be less able to make use of an advice line. For instance, a TV viewer with a visual impairment could miss on-screen messages. Some vulnerable consumers may be less able to install a filter by themselves. Mobility issues, for example, may prevent a vulnerable person from accessing the rear of their television to plug in the filter.

A19.24 We would normally expect licensees to make specific arrangements to communicate with vulnerable consumers. Consumers may be considered vulnerable due to circumstances such as:

a) age (particularly those over 75 years);

[2] In research for 800 MHz coexistence, 95% of people said that fitting the filter having seen instructions was "easy". https://www.ofcom.org.uk/__data/assets/pdf_file/0024/45528/dttinterference.pdf

b) physical or learning disability;

c) physical or mental illness;

d) low literacy;

e) communications difficulties; or

f) changes in circumstances, such as bereavement.

A19.25 There are a number of ways in which licensees may give special consideration to communicating with vulnerable consumers. For example, they might engage with community organisations with expertise in disseminating information among vulnerable people.

A19.26 We would also normally expect licensees to make reasonable arrangements to resolve vulnerable consumers' interference issues. This might involve making reasonable adjustments to the measures they offer other viewers. Such adjustments might include, for example, a home visit from an engineer, in lieu of sending a filter in the mail, when callers to the advice line identify themselves as vulnerable consumers.

Operational functions

Tracking performance

A19.27 Once support for DTT viewers affected by coexistence issues has been set up, it is important that licensees are able to track its performance. This will ensure that viewer support delivers positive outcomes and identifies where changes might improve performance.

A19.28 We would therefore normally expect licensees to adopt KPIs and / or SLAs and use them to track the performance of viewer support over its lifetime. Examples of areas in which it might be valuable to measure performance might include the timely delivery of filters to consumers with interference problems, the successful restoration of service to viewers, assistance provided to vulnerable consumers and the number of complaints received.

A19.29 We would normally expect licensees to report quarterly to Ofcom on the performance of the support scheme, though the intervals between reports could be shorter as required. Licensees can therefore expect to need to keep records of performance and to ensure that this information is in a format that can easily be shared and understood.

A19.30 Should it appear to Ofcom that viewer support is failing to achieve its objectives then we would review its activities. The KPIs developed by licensees would assist us in reaching this decision. We would also be guided by the performance of the scheme in comparison to past viewer support operations (specifically the 800 MHz viewer support scheme and the viewer support scheme to assist viewers affected by 700 MHz clearance events).

Complaints

A19.31 In order to have their plan approved by Ofcom, the 700 MHz licensees will have to demonstrate that overall it will deliver an effective and good quality service to viewers and

produce positive outcomes for them. However, it is possible that individual DTT viewers may still find their interactions with the viewer support provider (or providers) unsatisfactory.

A19.32 Therefore, we would normally expect licensees to demonstrate that they have made appropriate arrangements for managing any consumer complaints that may arise in the operation of the viewer support scheme.

Funding and management

A19.33 We would expect to see an indication in the plan submitted by licensees that reasonable consideration has been given to the costs involved in delivering the funding scheme.

A19.34 This would be even more important should licensees choose, as they may, to form a single joint entity to deliver support to viewers along the lines of DMSL. In that case we might expect to see not only that licensees have considered the cost of delivering the support scheme, but also to how they will split this cost between themselves and the arrangements they make for the effective operation, management and oversight of any such body.

Change control

A19.35 Once viewer support is in operation, experience may show the need to react to new information or changing circumstances. This may necessitate changes to the initial plan submitted to Ofcom. We consider it appropriate to allow licensees to retain the flexibility to adapt to new information and to amend their approach to supporting viewers accordingly.

A19.36 However, we would normally expect licensees would need to submit any changes to the plan for consideration and approval by Ofcom.

A20. Interface requirements for the 700 MHz band

IR 2xxx - UK Interface Requirement 2xxx

Terrestrial systems capable of providing electronic communications services in the 700 MHz band

Interface Requirement	2015/1535/EU Notification number	Date
IR 2xxx	2019/xxx/UK	xxx 2019

Contents

1. References

1.1 Decision (EU) 2017/899 of the European Parliament and of the Council of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union

1.2 Commission Implementing Decision (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union

1.3 ECC Decision (15)01 (06 March 2015) which harmonised technical conditions for mobile/fixed communications networks (MFCN) in the band 694-790 MHz including a paired frequency arrangement (Frequency Division Duplex 2x30 MHz) and an optional unpaired frequency arrangement (Supplemental Downlink)

1.4 CEPT Report 53 (28 November 2014) Report A from CEPT to the European Commission in response to the Mandate “To develop harmonised technical conditions for the 694 -790 MHz ('700 MHz') frequency band in the EU for the provision of wireless broadband and other uses in support of EU spectrum policy objectives”

1.5 CEPT Report 60 (01 March 2016) Report B from CEPT to the European Commission in response to the Mandate “to develop harmonised technical conditions for the 694 -790 MHz ('700 MHz') frequency band in the EU for the provision of wireless broadband and other uses in support of EU spectrum policy objectives”

1.6 ETSI EN 301 908: IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the Radio Equipment Directive (Directive 2014/53/EU)

2. Foreword

2.1 The Radio Equipment Directive (Directive 2014/53/EU) was implemented in the United Kingdom (UK) by the Radio Equipment Regulations 2017. In accordance with Articles 8 and 7 of Directive 2014/53/EU, this UK Interface Requirement contains the requirements for the licensing and use of terrestrial systems capable of providing electronic communications services in the specified frequency bands.

2.2 Nothing in this UK Radio Interface Requirement shall preclude the need for equipment to comply with Directive 2014/53/EU.

2.3 It is required by the Wireless Telegraphy Act 2006 that no radio equipment is installed or used in the UK except under the authority of a licence granted by or otherwise exempted by regulations made by Ofcom. It is a condition of such a licence or exemption regulations as appropriate that, in order to be installed or used in the UK, the equipment must meet the minimum requirements specified in this UK Interface Requirement for the stated equipment types and for the stated frequency bands. Nothing in this UK Interface Requirement shall preclude equipment from being placed on the market in the UK that complies with the 'essential requirements' specified in Directive 2014/53/EU.

2.4 The requirements given in the main body of this UK Radio Interface Requirement will apply to the licensing of terrestrial systems capable of providing electronic communications services in the 700 MHz band (694 – 790 MHz).

2.5 This UK Radio Interface Requirement will be revised as necessary, for example to follow:

i) current technology developments for reasons related to the effective and appropriate use of the spectrum in particular maximising spectrum utilisation; and

ii) changes to the available spectrum allocated for terrestrial systems capable of providing electronic communications services in the 700 MHz band.

2.6 All UK Radio Interface Requirements notified under Directive 2015/1535/EU will be published and will be made available free of charge from the Ofcom website at www.ofcom.org.uk.

2.7 Further information on this UK Radio Interface Requirement can be obtained from the technical enquiry contact given at the back of this document.

3. Minimum requirements for operation within the UK

3.1 The minimum requirements in this document are made for reasons related to the effective and appropriate use of the radio spectrum, in particular maximising spectrum utilisation.

3.2 This UK Radio Interface Requirement gives a high level description of how the spectrum in the UK is used for terrestrial systems capable of providing electronic communications services in the 700 MHz band. It does not prescribe technical interpretation of the 'essential requirements' of Directive 2014/53/EU.

3.3 This UK Radio Interface Requirement therefore stipulates the necessary equipment parameters for the authorisation of terrestrial systems capable of providing electronic communications services in the 700 MHz band in the UK. Tables 3.1, 3.2 and 3.3 contain the relevant equipment parameters. These, taken together with the 'essential requirements' detailed in Article 3(3) of Directive 2014/53/EU, constitute the minimum requirements for terrestrial systems capable of providing electronic communications services in the 700 MHz band within the UK. Nothing in this UK Interface Requirement shall preclude equipment from being placed on the market in the UK that complies with the 'essential requirements' specified in Directive 2014/53/EU.

3.4 The technical parameters specified in the UK Radio Interface Requirement are applied to achieve the desired level of compatibility within the spectrum for terrestrial systems capable of providing electronic communications services in the 700 MHz band and with other radiocommunications services, whilst promoting enterprise, innovation and competition.

3.5 This UK Radio Interface requirement provides the necessary technical information which facilitates access to the 700 MHz spectrum by making clear the assumptions that are made in planning the use of the spectrum for terrestrial systems capable of providing electronic communications services in the 700 MHz band in the UK. It is not the intention of this UK Radio Interface Requirement to duplicate or impose any additional 'essential requirements' of Directive 2014/53/EU on products. Any specified parameters within this document are for the purpose of identifying product options and not as a national de facto product requirement.

IR 2xxx.1

Table 3.1: Minimum requirements for the use of: - terrestrial systems capable of providing electronic communications services operating in the 758 – 788 MHz band		
Mandatory (1-10)		
1	Frequency band(s)	758 – 788 MHz
2	Radiocommunication Service	Mobile or Fixed service
3	Application	TRA-ECS (Terrestrial radio applications capable of providing electronic communication services)
4	Channelling	N/A
5	Modulation / Occupied bandwidth	N/A
6	Direction / Separation	Base station transmit Repeater downlink transmit Uplink / downlink separation: 55 MHz
7	Maximum Transmit Power / Power Density	Radio equipment must have a maximum mean power no greater than: 64 dBm / (5 MHz) EIRP per antenna
8	Channel access and occupation rules	N/A
9	Authorisation regime	WT Act licence required for base stations. repeaters and fixed installations.
10	Additional essential requirements	None
Informative (11-13)		
11	Frequency planning assumptions	EU Decision 2017/899/EU EU Decision 2016/687/EU ECC DEC (15)01 CEPT Report 53 CEPT Report 60
12	Planned changes	
13	Reference	ETSI EN 301 908
14	Notification	2019/xxx/UK
15	Remarks	

IR 2xxx.2

Table 3.2: Minimum requirements for the use of: - terrestrial systems capable of providing electronic communications services operating in the 703 – 733 MHz band		
Mandatory (1-10)		
1	Frequency band(s)	703 – 733 MHz
2	Radiocommunication Service	Mobile or Fixed service
3	Application	TRA-ECS (Terrestrial radio applications capable of providing electronic communication services)
4	Channelling	N/A
5	Modulation / Occupied bandwidth	N/A
6	Direction / Separation	Terminal station transmit Repeater uplink transmit Uplink / downlink separation: 55 MHz
7	Maximum Transmit Power / Power Density	Mobile or nomadic terminal stations or repeaters must have a maximum mean power no greater than: 23 dBm TRP per device* Fixed or installed terminal stations or repeaters must have a maximum mean power no greater than: 23 dBm EIRP per device* * The maximum mean power relates to the EIRP or TRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.
8	Channel access and occupation rules	N/A
9	Authorisation regime	Network user equipment meeting the minimum requirements outlined in this Interface Requirement is exempt from licensing provided that it meets the requirements of the relevant exemption regulations WT Act licence required for repeaters
10	Additional essential requirements	None
Informative (11-13)		
11	Frequency planning assumptions	EU Decision 2017/899/EU EU Decision 2016/687/EU ECC DEC (15)01 CEPT Report 53 CEPT Report 60

12	Planned changes	
13	Reference	ETSI EN 301 908
14	Notification	2019/xxx/UK
15	Remarks	

IR 2xxx.3

Table 3.3: Minimum requirements for the use of: - terrestrial systems capable of providing electronic communications services operating in the 738 – 758 MHz band		
Mandatory (1-10)		
1	Frequency band(s)	738 – 758 MHz
2	Radiocommunication Service	Mobile or Fixed service
3	Application	TRA-ECS (Terrestrial radio applications capable of providing electronic communication services)
4	Channelling	N/A
5	Modulation / Occupied bandwidth	N/A
6	Direction / Separation	Base station transmit Repeater downlink transmit
7	Maximum Transmit Power / Power Density	Radio equipment must have a maximum mean power no greater than: 64 dBm / 5 MHz EIRP per antenna
8	Channel access and occupation rules	N/A
9	Authorisation regime	WT Act licence required for base stations. repeaters and fixed installations.
10	Additional essential requirements	None
Informative (11-13)		
11	Frequency planning assumptions	EU Decision 2017/899/EU EU Decision 2016/687/EU ECC DEC (15)01 CEPT Report 53 CEPT Report 60
12	Planned changes	
13	Reference	ETSI EN 301 908
14	Notification	2019/xxx/UK
15	Remarks	

4. Additional performance parameters

(informative)

None specified

5. Contact details

Ofcom Spectrum Licensing, PO Box 1285 Warrington, WA1 9GL

- Tel: 020 7981 3131
- Fax: 020 7981 3235
- Email: spectrum.licensing@ofcom.org.uk
- Website: http://www.ofcom.org.uk

A21. Interface requirements for the 3.6-3.8 GHz band

IR 2097 - UK Interface Requirement 2079

Terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz band

Interface Requirement	2015/1535/EU Notification number	Date
IR 2097.1	2015/291/UK	February 2016
IR 2097.2	2015/291/UK	February 2016
	Date amended	January 2018
	Date amended	xxxx 2019

Contents

1. References

1.1 European Commission Decision of 21 May 2008 on the harmonisation of the 3400- 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community (2008/411/EC)

1.2 Commission Implementing decision of 2 May 2014 on amending Decision 2008/411/EC on the harmonisation of the 3400 - 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community (2014/276/EU)

1.3 ECC/DEC (11)06 (December 2011) which harmonised the frequency arrangements for mobile/fixed communications networks (MFCN) operating in the bands 3400 to 3600 MHz and 3600 to 3800 MHz

1.4 CEPT Report 49: Technical conditions regarding spectrum harmonisation for terrestrial wireless systems in the 3400-3800 MHz frequency band

1.5 ECC Report 203 on Least Restrictive Technical Conditions suitable for Mobile/Fixed Communication Networks (MFCN), including IMT, in the frequency bands 3400-3600 MHz and 3600-3800 MHz

1.6 ECC Report 216 on Practical guidance for TDD networks synchronisation

1.7 ETSI EN 301 908: IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the Radio Equipment Directive (Directive 2014/53/EU)

1.8 ECC Report 281: Analysis of the suitability of the regulatory technical conditions for 5G MFCN operation in the 3400-3800 MHz band

2. Foreword

2.1 The Radio Equipment Directive (Directive 2014/53/EU) was implemented in the United Kingdom (UK) by the Radio Equipment Regulations 2017. In accordance with Articles 8 and 7 of Directive 2014/53/EU, this UK Interface Requirement contains the requirements for the licensing and use of terrestrial systems capable of providing electronic communications services in the specified frequency bands.

2.2 Nothing in this UK Radio Interface Requirement shall preclude the need for equipment to comply with Directive 2014/53/EU.

2.3 It is required by the Wireless Telegraphy Act 2006 that no radio equipment is installed or used in the UK except under the authority of a licence granted by or otherwise exempted by regulations made by Ofcom. It is a condition of such a licence or exemption regulations as appropriate that, in order to be installed or used in the UK, the equipment must meet the minimum requirements specified in this UK Interface Requirement for the stated equipment types and for the stated frequency bands. Nothing in this UK Interface Requirement shall preclude equipment from being placed on the market in the UK that complies with the 'essential requirements' specified in Directive 2014/53/EU.

2.4 The requirements given in the main body of this UK Radio Interface Requirement will apply to the licensing of terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz band (3400 – 3800 MHz).

2.5 This UK Radio Interface Requirement will be revised as necessary, for example to follow:

i) current technology developments for reasons related to the effective and appropriate use of the spectrum in particular maximising spectrum utilisation; and;

ii) changes to the available spectrum allocated for terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz band.

2.6 All UK Radio Interface Requirements notified under Directive 2015/1535/EU will be published and will be made available free of charge from the Ofcom website at www.ofcom.org.uk.

2.7 Further information on this UK Radio Interface Requirement can be obtained from the technical enquiry contact given at the back of this document.

3. Minimum requirements for operation within the UK

3.1 The minimum requirements in this document are made for reasons related to the effective and appropriate use of the radio spectrum, in particular maximising spectrum utilisation.

3.2 This UK Radio Interface Requirement gives a high level description of how the spectrum in the UK is used for terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz band. It does not prescribe technical interpretation of the 'essential requirements' of Directive 2014/53/EU.

3.3 This UK Radio Interface Requirement therefore stipulates the necessary equipment parameters for the authorisation of terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz band in the UK. Tables 3.1 and 3.2 contain the relevant equipment parameters. These, taken together with the 'essential requirements' detailed in Article 3(3) of Directive 2014/53/EU, constitute the minimum requirements for terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz band within the UK. Nothing in this UK Interface Requirement shall preclude equipment from being placed on the market in the UK that complies with the 'essential requirements' specified in Directive 2014/53/EU.

3.4 The technical parameters specified in the UK Radio Interface Requirement are applied to achieve the desired level of compatibility within the spectrum for terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz band and with other radiocommunications services, whilst promoting enterprise, innovation and competition.

3.5 This UK Radio Interface requirement provides the necessary technical information which facilitates access to the 3.4 to 3.8 GHz spectrum by making clear the assumptions that are made in planning the use of the spectrum for terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz band in the UK. It is not the intention of this UK Radio Interface Requirement to duplicate or impose any additional 'essential requirements' of the Directive 2014/53/EU on products. Any specified parameters within this document are for the purpose of identifying product options and not as a national de facto product requirement.

IR 2097.1

Table 3.1: Minimum requirements for the use of: - terrestrial systems capable of providing electronic communications services operating in the 3400-3800 MHz band		
Mandatory (1-10)		
1	Frequency band(s)	3400 to 3800 MHz
2	Radiocommunication Service	Mobile or Fixed service
3	Application	TRA-ECS (Terrestrial radio applications capable of providing electronic communication services)
4	Channelling	N/A
5	Modulation / Occupied bandwidth	N/A
6	Direction / Separation	N/A
7	Maximum Transmit Power / Power Density	Non-AAS base station transmit Repeater downlink transmit 65 dBm / 5 MHz EIRP per cell AAS base station transmit 44 dBm / 5 MHz TRP per cell Mobile or nomadic repeater uplink transmit 28 dBm TRP* Fixed or installed terminal stations or repeaters uplink transmit 35 dBm / 5 MHz EIRP* * The maximum mean power relates to the EIRP or TRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.
8	Channel access and occupation rules	Licensee shall ensure that the Radio Equipment is operated in compliance with any Inter-operator synchronization requirements according to the relevant Licence provisions.
9	Authorisation regime	WT Act licence required for base stations. repeaters and fixed installations.
10	Additional essential requirements	None
Informative (11-13)		
11	Frequency planning assumptions	EU Decision 2008/411/EC EU Decision 2014/276/EU ECC/DEC (11)06 ECC Report 203 ECC Report 216 ECC Report 281
12	Planned changes	

13	Reference	ETSI EN 301 908
14	Notification	2019/xxx/UK
15	Remarks	

IR 2097.2

Table 3.2: Minimum requirements for the use of: - terrestrial systems capable of providing electronic communications services operating in the 3400-3800 MHz band		
Mandatory (1-10)		
1	Frequency band(s)	3400 to 3800 MHz
2	Radiocommunication Service	Mobile or Fixed service
3	Application	TRA-ECS (Terrestrial radio applications capable of providing electronic communication services)
4	Channelling	N/A
5	Modulation / Occupied bandwidth	N/A
6	Direction / Separation	N/A
7	Maximum Transmit Power / Power Density	Mobile or nomadic terminal stations 28 dBm TRP per device* * Irrespective of the number of transmit antennas
8	Channel access and occupation rules	Licensee shall ensure that the Radio Equipment is operated in compliance with any Inter-operator Synchronisation Procedures as notified within the Licence
9	Authorisation regime	The use of mobile / nomadic terminal stations meeting the minimum requirements outlined in this Interface Requirement is exempt from licensing provided that it meets the requirements of the relevant exemption regulations.
10	Additional essential requirements	None
Informative (11-13)		
11	Frequency planning assumptions	EU Decision 2008/411/EC EU Decision 2014/276/EU ECC/DEC (11)06 ECC Report 203 ECC Report 216 Draft ECC Report 281
12	Planned changes	
13	Reference	ETSI EN 301 908
14	Notification	2019/xxx/UK
15	Remarks	

4. Additional performance parameters

(informative)

None specified

5. Contact details

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A22. Draft 700 MHz licence

[Header (to all pages)]

[Company] – Spectrum Access 700 MHz Licence **Company Reg No: xxxxxxxx** **First Issued: xx/xx/20 – Licence Number: xxxxxxx – xx/xx/20**

Office of Communications (Ofcom)
Wireless Telegraphy Act 2006

SPECTRUM ACCESS 700 MHz

Licence no:	**xxxxxxx**
Date of issue:	**xx xxxx 2020**
Date of commencement:	**[Q2] 2020**
Fee payment date:	**xx xxxx** (annually from xx xxxx 2040)

1. The Office of Communications (Ofcom) grants this wireless telegraphy licence ("the Licence") to

   Company
   (Company registration number **XXXX**)
   ("the Licensee")
   Add 1
   Add 2
   Add 3
   Postcode

   to establish, install and use wireless telegraphy stations and/or wireless telegraphy apparatus as described in the schedule to this Licence (together "the Radio Equipment") subject to the terms set out below.

Licence Term

2. This Licence shall continue in force from the date of commencement until revoked by Ofcom or surrendered by the Licensee.

Licence Variation and Revocation

3. Pursuant to schedule 1 paragraph 8 of the Wireless Telegraphy Act 2006 ("the Act"), Ofcom may not revoke this Licence under schedule 1 paragraph 6 of the Act except:

   a) at the request, or with the consent, of the Licensee;

   b) if there has been a breach of any of the terms of this Licence;

c) in accordance with schedule 1 paragraph 8(5) of the Act;

d) if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purpose of complying with a direction by the Secretary of State given to Ofcom under section 5 of the Act or section 5 of the Communications Act 2003;

e) if, in connection with the transfer or proposed transfer of rights and obligations arising by virtue of the Licence, there has been a breach of any provision of regulations made by Ofcom under the powers conferred by section 30 of the Act[3];

f) for reasons related to the management of the radio spectrum, provided that in such a case the power to revoke may only be exercised after at least five years' notice is given in writing (such notice period must not expire before xx xxxx 2040); or

g) if the Licensee has been found to the reasonable satisfaction of Ofcom to have been involved in any act, or omission of any act, constituting a breach of the Wireless Telegraphy (Licence Award) Regulations 2019 ("the Regulations").

4. Ofcom may only revoke or vary this Licence by notification in writing to the Licensee and in accordance with schedule 1 paragraphs 6, 6A and 7 of the Act.

Transfer

5. This Licence may not be transferred. The transfer of rights and obligations arising by virtue of this Licence may however be authorised in accordance with regulations made by Ofcom under powers conferred by section 30 of the Act[4].

Changes to Licensee details

6. The Licensee shall give prior notice to Ofcom in writing of any proposed change to the Licensee's name and address as recorded in paragraph 1 of this Licence.

Fees

7. In accordance with the Regulations, the fee in consideration of which this licence is granted is [£**XXXX**].

8. From xx xxxx 2040, the Licensee shall each year pay to Ofcom the relevant fee(s) as provided in section 12 of the Act and the regulations made thereunder on or before the fee payment date shown above, or on or before such dates as are notified in writing to the Licensee.

9. The Licensee shall also pay interest to Ofcom on any amount which is due to Ofcom under the terms of this Licence or provided for in any regulations made by Ofcom under sections 12 or 13(2) of the Act from the date such amount falls due until the date of payment, at the then applicable Bank of England base rate. In accordance with section 15 of the Act any such amount and any such interest is recoverable by Ofcom.

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[3] These are regulations on spectrum trading.

[4] See Ofcom's website for the latest position on spectrum trading and the types of trade which are permitted.

10. If the Licence is surrendered, revoked or varied, no refund, whether in whole or in part, of any amount which is due under the terms of this Licence, payable in accordance with the Regulations, or provided for in any regulations made by Ofcom under sections 12 and 13(2) of the Act will be made, except at the absolute discretion of Ofcom.

Radio Equipment Use

11. The Licensee shall ensure that the Radio Equipment is established, installed and used only in accordance with the provisions specified in the schedule to this Licence. Any proposal to amend any detail specified in any of the schedule to this Licence must be agreed with Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.

12. The Licensee shall ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.

Access and Inspection

13. The Licensee shall permit a person authorised by Ofcom:

    (a) to have access to the Radio Equipment; and

    (b) to inspect this Licence and to inspect, examine and test the Radio Equipment, at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time to ensure the Radio Equipment is being used in accordance with the terms of this Licence.

Modification, Restriction and Closedown

14. Any person authorised by Ofcom may require the Radio Equipment or any part thereof, to be modified or restricted in use, or temporarily or permanently closed down immediately if in the opinion of the person authorised by Ofcom:

    (a) a breach of a term of the Licence has occurred; and/or

    (b) the use of the Radio Equipment is, or may be, causing or contributing to undue interference to the use of other authorised radio equipment.

15. Ofcom may require any of Radio Equipment to be modified or restricted in use, or temporarily closed down either immediately or on the expiry of such period as may be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice has been served on the Licensee or a general notice applicable to holders of a named class of licence has been published.

Geographical Boundaries

16. Subject to the requirements of any coordination procedures notified to the Licensee pursuant to paragraph 4 of Schedule 1 to this Licence, the Licensee is authorised to establish, install and use the Radio Equipment in the United Kingdom. For the avoidance of

doubt, the United Kingdom includes the United Kingdom territorial sea (measured in accordance with section 1 of the Territorial Sea Act 1987) and does not include the Channel Islands or the Isle of Man.

Interpretation

17. In this Licence:

(a) the establishment, installation and use of the Radio Equipment shall be interpreted as establishment and use of wireless telegraphy stations and installation and use of wireless telegraphy apparatus as specified in section 8(1) of the Act;

(b) the expression "DTT Viewers" means viewers of digital terrestrial television services operating at frequencies below [694 MHz] who suffer or may be likely to suffer undue interference from [mobile services].

(c) the expressions "interference" and "undue interference" shall have the meanings given by section 115 of the Act;

(e) the expression "Scheme" means a scheme for the purpose of providing information and advice to DTT Viewers and assisting DTT Viewers to resolve undue interference suffered by them as a result of the Licensee's use of the Radio Equipment, which meets the requirements in the Scheme Notice;

(f) the expression "Scheme Notice" means the notice notified by Ofcom to each licensee of the 694-790 MHz frequency range which either:

(i) confirms the provisional scheme submitted jointly by all such licensees by [DATE];

(ii) confirms the provisional scheme submitted jointly by all such licensees by [DATE] but with such changes as Ofcom considers necessary to meet the policy objectives in [Document title]; or

(iii) Ofcom has devised in the absence of any provisional scheme submitted jointly by all such licensees by [DATE] which Ofcom considers appropriate to meet the policy objectives in [Document title],

and which at the date of this Licence is the notice set out in [insert reference] and which may be amended from time to time with the prior written consent of Ofcom or by Ofcom on reasonable notice to all such licensees;

(g) the expression "territorial sea" shall be determined in accordance with the Territorial Sea Act 1987;

(h) the expressions "wireless telegraphy station" and "wireless telegraphy apparatus" shall have the meanings given by section 117 of the Act;

(i) the schedule forms part of this Licence together with any subsequent schedule(s) which Ofcom may issue as a variation to this Licence at a later date; and

(j) the Interpretation Act 1978 shall apply to this Licence as it applies to an Act of Parliament.

Issued by Ofcom
Office of Communications

SCHEDULE 1 TO LICENCE NUMBER: xxxxxxx

Schedule Date: xx xxxx 2020

Licence category: Spectrum Access 700 MHz

Description of Radio Equipment

1. References in this schedule to the Radio Equipment are references to any wireless telegraphy station or wireless telegraphy apparatus that is established, installed and/or used under this schedule.

Interface Requirements for the Radio Equipment

2. Use of the Radio Equipment shall be in accordance with the following Interface Requirement:
IR 20xx: Terrestrial systems capable of providing electronic communications services in the 700 MHz band

Special conditions relating to the Radio Equipment

3.

(a) Subject to paragraphs 3(b) and (c) of this schedule, during the period that this Licence remains in force, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of the following details relating to the Radio Equipment:

(i) postal address (including post code);

(ii) National Grid Reference, to at least 10m resolution;

(iii) antenna height (above ground level), type, and boresight bearing east of true north (if applicable);

(iv) radio frequencies which the Radio Equipment uses; and

(v) Transmitted power expressed in dBm / 5 MHz EIRP per cell,

and the Licensee must produce these records if requested by any person authorised by Ofcom.

(b) The conditions relating to the keeping of records contained in sub-paragraphs 3(a)(i), (ii) and (iii) of this Schedule shall not apply in respect of femtocell equipment and smart/intelligent low power repeater equipment.

(c) The conditions relating to the keeping of records contained in paragraph 3(a) of this Schedule shall not apply in respect of licence exempt radio equipment.

(d) The Licensee shall submit to Ofcom copies of the records detailed in sub-paragraph 3(a) above at such intervals as Ofcom may notify to the Licensee.

(e) The Licensee shall submit to Ofcom in such manner and within such period as specified by Ofcom, such other information in relation to the Radio Equipment, or any wireless telegraphy station or wireless telegraphy apparatus which the Licensee is planning to use, as Ofcom may from time to time request. Such information may include, but is not limited to, information in relation to the radio frequency, transmitted power and date of first use for wireless telegraphy stations or wireless telegraphy apparatus to be established, installed or used within such timeframe and in such areas as Ofcom may reasonably request.

(f) During the period this Licence remains in force, unless consent has otherwise been given in writing by Ofcom, the Licensee shall operate the Scheme and comply with its obligations in the Scheme Notice. The Licensee shall provide to Ofcom and any entity established as part of the Scheme, in such manner and at such times as they may reasonably require, such documents or other information as they may require for the purposes of the Scheme's operation, monitoring that operation and assessing its appropriateness and effectiveness.

(g) In relation to any frequency between 733 MHz and 758 MHz within the Permitted Frequency Blocks (see paragraph 6 below) in any area in the United Kingdom, the Licensee shall only be authorised to use the Radio Equipment to transmit where it has given Ofcom three months' (or such other period as Ofcom shall determine) written notice of the following specified matters and that notice period has expired (such notice not to expire before the Date of commencement). The specified matters are, in respect of the Radio Equipment the Licensee intends to use:

(i) the nature of the equipment and the purpose of its use;

(ii) the extent of that use and the geographic areas in which it will occur;

(iii) the date or dates on which the Licensee intends to begin using the equipment; and

(iv) such other information as Ofcom may specify.

Coordination at frequency and geographical boundaries and compliance with other procedures relating to interference

4. The Licensee shall ensure that the Radio Equipment is operated in compliance with such coordination procedures as may be notified to the Licensee by Ofcom from time to time. The Licensee shall also ensure that it complies with any other procedures relating to the mitigation of interference as may be notified to the Licensee by Ofcom from time to time.

International cross-border coordination

5. The Licensee shall ensure that the Radio Equipment is operated in compliance with such cross-border coordination and sharing procedures as may be notified to the Licensee by Ofcom from time to time.

Permitted Frequency Blocks

6. Subject to the emissions permitted under paragraph 10 of this Schedule, the Radio Equipment may only transmit within the following frequency bands (the "Permitted Frequency Blocks"):

Downlink frequencies	**[Uplink frequencies]**
xxx – xxx MHz [; and **xxx – xxx** MHz]	[**xxx – xxx** MHz]

Maximum power within the Permitted Frequency Blocks

7. Subject to any more restrictive limitations imposed by the coordination requirements notified by Ofcom in accordance with paragraphs 4 and 5 of this schedule, the power transmitted in the Permitted Frequency Blocks shall not exceed:

(a) Downlink Frequencies

Radio Equipment	*Maximum mean power* *dBm / 5 MHz EIRP per antenna*
Base station*	64

* For femtocell base stations, power control must be applied to minimise interference to adjacent channels.

(b) Uplink Frequencies[5]

Radio Equipment	*Maximum mean power*
Fixed or installed Radio Equipment*	23 dBm EIRP
Mobile or nomadic Radio Equipment*	23 dBm TRP

* The maximum mean power relates to the EIRP or TRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas. This value is subject to a tolerance of up to + 2 dB, to take account of operation under extreme environmental conditions and production spread.

[5] Consumer user equipment will be authorised by means of a licence exemption under section 8 of the Wireless Telegraphy Act 2006

Maximum power of base stations outside the Permitted Frequency Blocks

8. For transmissions on the downlink frequencies, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the downlink frequencies of the Permitted Frequency Blocks, but within 738 – 788 MHz, shall not exceed:

Frequency Range	*Maximum mean EIRP limit dBm / 5 MHz EIRP per antenna*
-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	22
-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	18
Out of block baseline power limit (BS) < -10 MHz offset from lower block edge > 10 MHz offset from upper block edge	16

9. In addition, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the downlink frequencies of the Permitted Frequency Blocks shall not exceed the higher (least stringent) of (a) the baseline requirements and (b) the transitional requirements for that frequency.

(a) Baseline requirements

Frequency Range	*Maximum mean EIRP limit*
470 – 694 MHz	-23 dBm / 8 MHz per cell
694 – 703 MHz	-32 dBm / 1 MHz per cell
703 – 733 MHz	-50 dBm / 5 MHz per cell
733 – 738 MHz	16 dBm / 5 MHz per antenna
788 – 791 MHz	14 dBm / 3 MHz per antenna
791 – 821 MHz	16 dBm / 5 MHz per antenna
832 – 862 MHz	-49 dBm / 5 MHz per cell

(b) Transitional requirements

for a block with lower edge at 738 MHz

Frequency Range	*Maximum mean EIRP limit*
733 – 738 MHz	22 dBm / 5 MHz per antenna

for a block with lower edge at 743 MHz

Frequency Range	*Maximum mean EIRP limit*
733 – 738 MHz	18 dBm / 5 MHz per antenna

for a block with upper edge at 783 MHz

Frequency Range	*Maximum mean EIRP limit*
788 – 791 MHz	16 dBm / 3 MHz per antenna
791 – 796 MHz	17 dBm / 5 MHz per antenna

for a block with upper edge at 788 MHz

Frequency Range	*Maximum mean EIRP limit*
788 – 791 MHz	21 dBm / 3 MHz per antenna
791 – 796 MHz	19 dBm / 5 MHz per antenna
796 – 801 MHz	17 dBm / 5 MHz per antenna

Maximum power of terminals outside the Permitted Frequency Blocks

10. For transmissions on the uplink frequencies, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the uplink frequencies of the Permitted Frequency Blocks shall not exceed:

Frequency Range	*Maximum mean EIRP limit**
470 – 694 MHz	-42 dBm / 8 MHz
694 – 698 MHz	-7 dBm / 4 MHz
698 – 703 MHz	2 dBm / 5 MHz

* The power limits are specified as equivalent isotropically radiated power (EIRP) for terminal stations designed to be fixed or installed and as total radiated power (TRP) for terminal stations designed to be mobile or nomadic. The maximum mean power relates to the EIRP or TRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas. This value is subject to a tolerance of up to + 2 dB, to take account of operation under extreme environmental conditions and production spread.

[Coverage Obligation

11. The Licensee shall by no later than [X] 2024 provide, and thereafter maintain, an electronic communications network that provides with a high level of confidence:

a) mobile telecommunications service with a sustained downlink speed of not less than 2 megabits per second, to users; and

b) a mobile telecommunications service on which 90 second voice calls can be made without interruption, to an area covering at least:

(i) 90% of the geographic landmass of the United Kingdom;

(ii) 90% of the geographic landmass of England;

(iii) 90% of the geographic landmass of Northern Ireland;

(iv) 74% of the geographic landmass of Scotland; and

(v) 83% of the geographic landmass of Wales.

12. In addition, the Licensee shall by no later than [X] 2024:

a) provide the services described in condition 11 above to an area which covers at least 140,000 premises in the United Kingdom to which the Licensee does not provide outdoor coverage that meets the requirements set out in condition 11(a) and (b) above as at the date of first issue of this licence; and

b) deploy at least 500 [wide area coverage] sites in addition to the sites which comprise the electronic communications network which it uses to provide mobile telecommunications services as at the date on which this licence is first issued. Each of these new sites shall be at least [1-2][6] kilometres away from any of the Licensee's existing sites.

13. Where relevant, words and phrases used in conditions 11 and 12 of this Licence shall have the meaning ascribed to them in the document "[2019 Coverage Obligation Notice of Compliance Methodology]" published by Ofcom on [X] 2019.

14. For the avoidance of doubt the Licensee is permitted to meet the obligations set out in this condition using any frequencies and technologies available to the Licensee.

Assessment of compliance with coverage obligation

15. Ofcom will assess the Licensee's compliance with the obligations set out in condition [X] above by reference to the document "[2019 Coverage Obligation Notice of Compliance Methodology]" published by Ofcom on [X] 2019.]

Interpretation of terms in this schedule

16. In this Schedule:

(a) **dBm** means the power level in decibels (logarithmic scale) referenced against 1 milliwatt (i.e. a value of 0 dBm is 1 milliwatt);

(b) **Downlink** means transmissions from a base station or repeater to a terminal station (handset);

(c) **EIRP** means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an

[6] To be decided.

isotropic antenna (absolute or isotropic gain), measured during the “on” part of the transmission;

(d) **femtocell** means Radio Equipment transmitting on the downlink frequencies, which operates at a power not exceeding 24 dBm EIRP per carrier, and which is or will be used only by and under the control of the Licensee, following the establishment of a telecommunications link between the femtocell and a network of the Licensee;

(e) **Fixed or installed** means used or installed at specific fixed points;

(f) **Indoor** means a location inside a building or place in which the shielding will typically provide the necessary attenuation to protect wireless telegraphy against harmful interference;

(g) **IR** means a United Kingdom Radio Interface Requirement notified by Ofcom in accordance with Article 8 of Directive 2014/53/EU of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment (known as the Radio Equipment Directive);

(h) **lower block edge** means, in relation to each Permitted Frequency Block, the lowest frequency in that Permitted Frequency Block;

(i) **measurement bandwidth** means the size of an individual spectrum segment within the specified frequency range that is used to measure compliance with the specified power limit;

(j) **mobile or nomadic** means intended to be used while in motion or during halts at unspecified points;

(k) **per antenna** means per radiating component (irrespective of the number of radiating elements that make up that component).

(l) **per cell** means that the maximum mean power relates to the radiated power of a specific piece of Radio Equipment irrespective of the number of transmit antennas. In a multi-sector base station, the radiated power limit refers to the level corresponding to each one of the individual sectors.

(m) **Permitted Frequency Blocks** has the meaning given to it in paragraph [6] of this Schedule;

(n) **smart/intelligent low power repeater** means a repeater which operates with power not exceeding 24 dBm EIRP per carrier, which may be established by customers of the Licensee who have written agreements with the Licensee and:

- The Licensee has ultimate control of the repeater, i.e. each individual repeater can be disabled remotely by the Licensee;

- The repeater operates only on the Licensee's frequencies and with their valid Public Land Mobile Network Identifier;
- Must not cause undue interference to other spectrum users; and
- The repeater only transmits on the uplink frequencies when actively carrying a call (voice, video or data) or signalling from serviced handsets;

(o) **TRP** means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere;

(p) **Uplink** means transmissions from a terminal station (handset) to a base station; and

(q) **upper block edge** means, in relation to each Permitted Frequency Block, the highest frequency in that Permitted Frequency Block.

A23. Draft 3.6-3.8 GHz licence

[Header (to all pages)]

Company Limited – Spectrum Access 3.6-3.8 GHz Licence **Company Reg No: xxxxxxxx** **First Issued: xx/xx/20 – Licence Number: xxxxxxx – xx/xx/20**

Office of Communications (Ofcom)
Wireless Telegraphy Act 2006

SPECTRUM ACCESS 3.6 – 3.8 GHz

Licence no:	**xxxxxxx**
Date of issue:	**xx xxxx 2020**
Fee payment date	**xx xxxx** (annually from xx xxxx 2040)

1. The Office of Communications (Ofcom) grants this wireless telegraphy licence ("the Licence") to

Company
(Company registration number **XXXX**)
("the Licensee")
Add 1
Add 2
Add 3
Postcode

to establish, install and use wireless telegraphy stations and/or wireless telegraphy apparatus as described in the schedule to this Licence (together "the Radio Equipment") subject to the terms set out below.

Licence Term

2. This Licence shall continue in force until revoked by Ofcom or surrendered by the Licensee.

Licence Variation and Revocation

3. Pursuant to schedule 1 paragraph 8 of the Wireless Telegraphy Act 2006 ("the Act"), Ofcom may not revoke this Licence under schedule 1 paragraph 6 of the Act except:
   (a) at the request, or with the consent, of the Licensee;
   (b) if there has been a breach of any of the terms of this Licence;
   (c) in accordance with schedule 1 paragraph 8(5) of the Act;

(d) if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purpose of complying with a direction by the Secretary of State given to Ofcom under section 5 of the Act or section 5 of the Communications Act 2003;

(e) if, in connection with the transfer or proposed transfer of rights and obligations arising by virtue of the Licence, there has been a breach of any provision of regulations made by Ofcom under the powers conferred by section 30 of the Act[7];

(f) for reasons related to the management of the radio spectrum, provided that in such a case the power to revoke may only be exercised after at least five years' notice is given in writing (such notice must not expire before XX XXXX 2040); or

(g) if the Licensee has been found to the reasonable satisfaction of Ofcom to have been involved in any act, or omission of any act, constituting a breach of the Wireless Telegraphy (Licence Award) Regulations 2019 ("the Regulations").

4. Ofcom may only revoke or vary this Licence by notification in writing to the Licensee and in accordance with schedule 1 paragraphs 6, 6A and 7 of the Act.

Transfer

5. This Licence may not be transferred. The transfer of rights and obligations arising by virtue of this Licence may however be authorised in accordance with regulations made by Ofcom under powers conferred by section 30 of the Act[8].

Changes to Licensee details

6. The Licensee shall give prior notice to Ofcom in writing of any proposed change to the Licensee's name and address as recorded in paragraph 1 of this Licence.

Fees

7. In accordance with the Regulations, the fee in consideration of which this licence is granted is [£**XXXX**].

8. From XX XXXX 2040, the Licensee shall each year pay to Ofcom the relevant fee(s) as provided in section 12 of the Act and the regulations made thereunder on or before the fee payment date shown above, or on or before such dates as are notified in writing to the Licensee.

9. The Licensee shall also pay interest to Ofcom on any amount which is due to Ofcom under the terms of this Licence or provided for in any regulations made by Ofcom under sections 12 or 13(2) of the Act from the date such amount falls due until the date of payment, at the

[7] These are regulations on spectrum trading.
[8] See Ofcom's website for the latest position on spectrum trading and the types of trade which are permitted.

then applicable Bank of England base rate. In accordance with section 15 of the Act any such amount and any such interest is recoverable by Ofcom.

10. If the Licence is surrendered, revoked or varied, no refund, whether in whole or in part, of any amount which is due under the terms of this Licence, payable in accordance with the Regulations, or provided for in any regulations made by Ofcom under sections 12 and 13(2) of the Act will be made, except at the absolute discretion of Ofcom.

Radio Equipment Use

11. The Licensee shall ensure that the Radio Equipment is established, installed and used only in accordance with the provisions specified in the schedule to this Licence. Any proposal to amend any detail specified in any of the schedule to this Licence must be agreed with Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.

12. The Licensee shall ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.

Access and Inspection

13. The Licensee shall permit a person authorised by Ofcom:

    (a) to have access to the Radio Equipment; and

    (b) to inspect this Licence and to inspect, examine and test the Radio Equipment, at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time to ensure the Radio Equipment is being used in accordance with the terms of this Licence.

Modification, Restriction and Closedown

14. Any person authorised by Ofcom may require the Radio Equipment or any part thereof, to be modified or restricted in use, or temporarily or permanently closed down immediately if in the opinion of the person authorised by Ofcom:

    (a) a breach of a term of the Licence has occurred; and/or

    (b) the use of the Radio Equipment is, or may be, causing or contributing to undue interference to the use of other authorised radio equipment.

15. Ofcom may require any of Radio Equipment to be modified or restricted in use, or temporarily closed down either immediately or on the expiry of such period as may be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice has been served on the Licensee or a general notice applicable to holders of a named class of licence has been published.

Geographical Boundaries

16. Subject to the requirements of any coordination procedures notified to the Licensee pursuant to schedule 1 to this Licence, the Licensee is authorised to establish, install and use the Radio Equipment in the United Kingdom. For the avoidance of doubt, this licence does not authorise use in the Channel Islands or the Isle of Man.

17. This licence does not authorise use in the United Kingdom territorial sea (measured in accordance with section 1 of the Territorial Sea Act 1987) and any inland waters adjacent to the territorial sea, but in the case of streams, rivers or other watercourses which form part of such inland waters they are only excluded where such stream, river or watercourse is more than 2km wide.

Interpretation

18. In this Licence:

a) the establishment, installation and use of the Radio Equipment shall be interpreted as establishment and use of wireless telegraphy stations and installation and use of wireless telegraphy apparatus as specified in section 8(1) of the Act;

b) the expression “interference” shall have the meaning given by section 115 of the Act;

c) the expressions “wireless telegraphy station” and “wireless telegraphy apparatus” shall have the meanings given by section 117 of the Act;

d) the expression “territorial sea” shall be determined in accordance with the Territorial Sea Act 1987;

e) the expression “inland waters” shall have the meaning given by section 221(1) of the Water Resources Act 1991;

f) the schedule forms part of this Licence together with any subsequent schedule(s) which Ofcom may issue as a variation to this Licence at a later date; and

g) the Interpretation Act 1978 shall apply to this Licence as it applies to an Act of Parliament.

Issued by Ofcom
Office of Communications

SCHEDULE 1 TO LICENCE NUMBER: xxxxxxx

Schedule Date: xx xxxx 2020

Licence category: Spectrum Access 3.6-3.8 GHz

Description of Radio Equipment

1. References in this schedule to the Radio Equipment are references to any wireless telegraphy station or wireless telegraphy apparatus that is established, installed and/or used under this schedule.

Interface Requirements for the Radio Equipment

2. Use of the Radio Equipment shall be in accordance with the following Interface Requirement: IR 2097: Terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz band.

Special conditions relating to the Radio Equipment

3.

(a) Subject to paragraph 3(b) of this schedule, during the period that this Licence remains in force, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of the following details relating to the Radio Equipment:

(i) postal address (including post code);

(ii) National Grid Reference, to at least 10m resolution;

(iii) antenna height (above ground level), type (including whether AAS or non-AAS), and boresight bearing east of true north (if applicable);

(iv) radio frequencies which the Radio Equipment uses;

(v) Transmitted power expressed in dBm / 5 MHz EIRP per cell for non-AAS Radio Equipment; and

(vi) Transmitted power expressed in dBm / 5 MHz TRP per cell for AAS Radio Equipment.

(b) and the Licensee must produce these records if requested by any person authorised by Ofcom.

(c) The conditions relating to the keeping of records contained in sub-paragraphs 3(a)(i)(ii) and (iii) of this Schedule shall not apply in respect of femtocell equipment and smart/intelligent low power repeater equipment.

(d) The conditions relating to the keeping of records contained in paragraph 3(a) of this Schedule shall not apply in respect of licence exempt radio equipment.

(e) The Licensee shall submit to Ofcom copies of the records detailed in sub-paragraph 3(a) above at such intervals as Ofcom may notify to the Licensee.

(f) The Licensee shall submit to Ofcom in such manner and within such period as specified by Ofcom, such other information in relation to the Radio Equipment, or any wireless telegraphy station or wireless telegraphy apparatus which the Licensee is planning to use, as Ofcom may from time to time request. Such information may include, but is not limited to, information in relation to the radio frequency, transmitted power and date of first use for wireless telegraphy stations or wireless telegraphy apparatus to be established, installed or used within such timeframe and in such areas as Ofcom may reasonably request.

Coordination at frequency and geographical boundaries

4. The Licensee shall ensure that the Radio Equipment is operated in compliance with such coordination procedures as may be notified to the Licensee by Ofcom from time to time.

International cross-border coordination

5. The Licensee shall ensure that the Radio Equipment is operated in compliance with such cross-border coordination and sharing procedures as may be notified to the Licensee by Ofcom from time to time.

Cooperation between Licensees

6. In addition to complying with the specific transmission terms, conditions and limitations set out in this Licence, the Licensee must liaise and co-operate with other holders of licences in the [3410][3600][3680] MHz – 3800 MHz band (if necessary adjusting transmission power and other technical parameters of transmission) in such a way that harmful interference is not caused by one network deployment to that of another Licensee within the band.

Permitted Frequency Blocks

7. The Radio Equipment may only transmit within the following frequency bands (the "Permitted Frequency Blocks"):

xxxx – xxxx MHz

Maximum power within the Permitted Frequency Blocks

8. Subject to any more restrictive limitations imposed by the coordination requirements notified by Ofcom in accordance with paragraphs 4 and 5 of this schedule, the power transmitted in the Permitted Frequency Blocks shall not exceed:

Radio Equipment[9]	*Maximum mean power*
non-AAS base station[a]	65 dBm / 5 MHz EIRP per cell
AAS base station[a]	44 dBm / 5 MHz TRP per cell
Mobile or nomadic terminal station[b]	28 dBm TRP
Fixed or installed terminal station[b]	35 dBm / 5 MHz EIRP

[a] For femtocell base stations, power control must be applied to minimise interference to adjacent channels.

[b] The maximum mean power relates to the EIRP or TRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.

Maximum power of base stations outside the Permitted Frequency Blocks

9. [When transmitting, the Licensee must either transmit in accordance with the condition in paragraph (a) or in accordance with the condition in paragraph (b). –

a) The condition referred to is that the Licensee must transmit within the limits of the Permissive Transmission Mask and, if doing so, the Licensee must also transmit within the limits of transmission Frame Structure A;

b) The condition referred to is that the Licensee must transmit within the limits of the Restrictive Transmission Mask, and, if doing so, the Licensee must also transmit within the limits of transmission Frame Structure B.

10. The Permissive Transmission Mask means that –

for transmissions on the downlink frequencies, the maximum mean EIRP or TRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks, but within 3410 – 3800 MHz, shall not exceed the transitional and baseline requirements in the following table:

[9] Consumer user equipment will be authorised by means of licence exemption under section 8 of the Wireless Telegraphy Act 2006

	Non-AAS *dBm / 5 MHz EIRP per antenna*	AAS *dBm / 5 MHz TRP per cell*
-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	Min(PMax – 40, 21)	Min(PMax' – 40, 16)
-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	Min(PMax – 43, 15)	Min(PMax' – 43, 12)
Out of block baseline power limit (BS) < -10 MHz offset from lower block edge > 10 MHz offset from upper block edge	Min(PMax – 43, 13)	Min(PMax' – 43, 1)]

11. The Restrictive Transmission Mask means that –

for transmissions on the downlink frequencies, the maximum mean EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks, but within 3410 – 3800 MHz, shall not exceed baseline in the following table:

	Non-AAS *dBm / 5 MHz EIRP per cell*	AAS *dBm / 5 MHz TRP per cell*
Out of block baseline power limit (BS)	-34	-43

12. Frame Structure A (also commonly known as the "Preferred Frame Structure") means that

a) transmissions from the Licensee's base stations have a frame structure as shown in Figure 1. Timeslots (or subframes) 0, 2 to 5 and 7 to 9 must be allocated to Downlink (D) or Uplink (U) transmissions as indicated or may be left with no transmissions;

b) the Licensee must ensure that the special subframe (S) in timeslots 1 and 6 have a structure that is compatible with TD-LTE special subframe configuration 6, also known as 9:3:2 (DwPTS: GP: UpPTS). For the avoidance of doubt, a special subframe structure is compatible where there are no uplink transmissions within the downlink pilot timeslot (DwPTS) or guard period (GP) and no downlink transmissions within the uplink pilot timeslot (UpPTS) or guard period (GP);

c) timeslots must have a duration of 1 millisecond;

d) the Licensee shall ensure that frames start at a common reference time so that all licensees' frames are aligned and transmissions synchronised;

e) TD-LTE frame configuration 2 (3:1) is compatible with this frame structure, as are some 5G NR frame configurations. Other technologies are permitted provided that the requirements of 12(a) to 12(d) are met.

13. Frame Structure B (also commonly known as the "Compatible Frame Structure") means that:

a) transmissions from the Licensee's base stations must have a frame structure as shown in Figure 2. Timeslots (or subframes) 0 and 2 must be allocated to Downlink (D), or Uplink (U) transmissions as indicated;

b) the Licensee must ensure that the special subframe (S) in timeslot 1 has a structure that is compatible with TD-LTE special subframe configuration 6, also known as 9:3:2 (DwPTS: GP: UpPTS). For the avoidance of doubt, a special subframe structure is compatible where there are no uplink transmissions within the downlink pilot timeslot (DwPTS) or guard period (GP) and no downlink transmissions within the uplink pilot timeslot (UpPTS) or guard period (GP);

c) timeslots must have a duration of 1 millisecond;

d) the Licensee shall ensure that frames start at a common reference time so that all licensees' frames are aligned and transmissions synchronised;

e) all current TD-LTE frame configurations are compatible with this frame structure, as are some 5G NR frame configurations. Other technologies are permitted provided that the requirements of 13(a) to 13(d) are met;

f) timeslots with no transmission indicated may have no transmission or must be determined as a Downlink, Uplink or Special subframe as necessary in order to ensure compliance with paragraph 13(c) and 13(g);

g) the Licensee must cooperate with other licensees to minimise harmful sub-frame overlaps if different technologies are used. On rare occasions this may require the frame alignment or guard period to be slightly offset;

h) for the avoidance of doubt downlink-only frame structures such as Supplementary Downlink (SDL) are not permitted.

Figure 1: Frame Structure A

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

Figure 2: Frame Structure B

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

14. Irrespective of whether the Restrictive Transmission Mask or the Permissive Transmission Mask is being used, the EIRP or TRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks shall not exceed the following additional band edge requirements:

	Non-AAS *dBm / MHz[a] EIRP per antenna*	AAS *dBm / MHz[a] TRP per cell*
Below 3390 MHz	-50	-52

[a] We note this level is defined in the Commission Decision 2014/276/EU as per MHz rather than per 5 MHz

	Non-AAS *dBm / 5 MHz EIRP per antenna*	AAS *dBm / 5 MHz TRP per cell*
3390 – 3400 MHz	Min(PMax – 43, 13)	Min(PMax' – 43, 1)
3400 – 3405 MHz	Min(PMax – 43, 15)	Min(PMax' – 43, 12)
3405 – 3410 MHz	Min(PMax – 40, 21)	Min(PMax' – 40, 16)
3800 – 3805 MHz	Min(PMax – 40, 21)	Min(PMax' – 40, 16)
3805 – 3810 MHz	Min(PMax – 43, 15)	Min(PMax' – 43, 12)
3810 – 3840 MHz	Min(PMax – 43, 13)	Min(PMax' – 43, 1)
Above 3840 MHz	-2	-14

Small Cells

15. The Licensee is required to comply with the Permissive Transmission Mask as set out in paragraph 10 of this schedule but is not required to comply with the frame structure requirements set out in paragraphs 12 or 13 above, for:

    (a) Indoor Domestic Small Cells; or

    (b) Indoor Non-domestic Small Cells, except where another licensee demonstrates that they are suffering harmful interference as a result.

    If another licensee demonstrates that they are suffering harmful interference as a result of an Indoor Non-domestic Small Cell, the Indoor Non-domestic Small Cell must comply with the requirements set out in paragraphs 9 and 12 above, where Frame Structure A is used or those requirements set out in both paragraphs 9 and 13 above where Frame Structure B is used.

[Coverage Obligation

16. The Licensee shall by no later than [X] 2024 provide, and thereafter maintain, an electronic communications network that provides with a high level of confidence:

    a) mobile telecommunications service with a sustained downlink speed of not less than 2 megabits per second, to users; and

b) a mobile telecommunications service on which 90 second voice calls can be made without interruption, to an area covering at least:

(i) 90% of the geographic landmass of the United Kingdom;

(ii) 90% of the geographic landmass of England;

(iii) 90% of the geographic landmass of Northern Ireland;

(iv) 74% of the geographic landmass of Scotland; and

(v) 83% of the geographic landmass of Wales.

17. In addition, the Licensee shall by no later than [X] 2024:

a) provide the services described in condition 16 above to an area which covers at least 140,000 premises in the United Kingdom to which the Licensee does not provide outdoor coverage that meets the requirements set out in condition 16(a) and (b) above as at the date of first issue of this licence; and

b) deploy at least 500 [wide area coverage] sites in addition to the sites which comprise the electronic communications network which it uses to provide mobile telecommunications services as at the date on which this licence is first issued. Each of these new sites shall be at least [1-2][10] kilometres away from any of the Licensee's existing sites.

18. Where relevant, words and phrases used in conditions 16 and 17 of this Licence shall have the meaning ascribed to them in the document "[2019 Coverage Obligation Notice of Compliance Methodology]" published by Ofcom on [X] 2019.

19. For the avoidance of doubt the Licensee is permitted to meet the obligations set out in this condition using any frequencies and technologies available to the Licensee.

Assessment of compliance with coverage obligation

20. Ofcom will assess the Licensee's compliance with the obligations set out in condition [X] above by reference to the document "[2019 Coverage Obligation Notice of Compliance Methodology]" published by Ofcom on [X] 2019.]

Interpretation of terms in this Schedule

21. In this Schedule:

a) **5G NR** means "5G New Radio" and refers to the air interface that has been developed by 3GPP for fifth generation (5G) mobile radio networks. This air interface defines how 5G base stations and user devices both transmit and receive radio signals using spectrum.

[10] To be decided.

b) **AAS** means active antenna system. An AAS is a base station and antenna system where the amplitude and / or phase between antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This is not intended to include long term beam shaping such as fixed electrical down tilt.

c) **dBm** means the power level in decibels (logarithmic scale) referenced against 1 milliwatt (i.e. a value of 0 dBm is 1 milliwatt);

d) **Downlink** means transmissions from a base station to a terminal station (handset);

e) **EIRP** means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain), measured during the "on" part of the transmission;

f) **femtocell** means Radio Equipment transmitting on the downlink frequencies, which operates at a power not exceeding 24 dBm EIRP per carrier, and which is or will be used only by and under the control of the Licensee, following the establishment of a telecommunications link between the femtocell and a network of the Licensee;

g) **Fixed or installed** means used or installed at specific fixed points;

h) **Indoor** means a location inside a building or place in which the shielding will typically provide the necessary attenuation to protect wireless telegraphy against harmful interference;

i) **Indoor Domestic Small Cell** means a base station with an EIRP of less than or equal to 24 dBm per 20 MHz carrier that is located within a residential property;

j) **Indoor Non-domestic Small Cell** means a base station with an EIRP of less than or equal to 24 dBm per 20 MHz carrier that is located Indoors but not within a residential property;

k) **IR** means a United Kingdom Radio Interface Requirement notified by Ofcom in accordance with Article 8 of Directive 2014/53/EU of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment (known as the Radio Equipment Directive)

l) **lower block edge** means, in relation to each Permitted Frequency Block, the lowest frequency in that Permitted Frequency Block;

m) **mobile or nomadic** means intended to be used while in motion or during halts at unspecified points;

n) **non-AAS** means a piece of Radio Equipment which is not an AAS.

o) **per antenna** means per radiating component (irrespective of the number of radiating elements that make up that component).

p) **per cell** means that the maximum mean power relates to the EIRP or TRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas. In a multi-

sector base station, the EIRP or TRP limit refers to the level corresponding to each one of the individual sectors.

q) **Permitted Frequency Blocks** has the meaning given to it in paragraph 7 of this Schedule;

r) **PMax** is the maximum mean power for the base station in question if it is using a non-AAS. This is measured as EIRP per carrier and determined on a per antenna basis;

s) **PMax'** is the maximum mean power for the base station in question if it is using an AAS. This is measured as TRP per carrier and determined on a per cell basis;

t) **smart/intelligent low power repeater** means a repeater which operates with power not exceeding 24 dBm EIRP per carrier, which may be established by customers of the Licensee who have written agreements with the Licensee and:

- The Licensee has ultimate control of the repeater, i.e. each individual repeater can be disabled remotely by the Licensee;
- The repeater operates only on the Licensee's frequencies and with their valid Public Land Mobile Network Identifier;
- Must not cause undue interference to other spectrum users; and
- The repeater only transmits on the uplink timeslot when actively carrying a call (voice, video or data) or signalling from serviced handsets.

u) **TDD** means the application of time-division multiplexing to separate uplink and downlink signals;

v) **TD-LTE** means the TDD variant of LTE (Long Term Evolution or 4G technology);

w) **TRP** means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere, measured during the on part of the transmission;

x) **Uplink** means transmissions from a terminal station (handset) to a base station; and

y) **upper block edge** means, in relation to each Permitted Frequency Block, the highest frequency in that Permitted Frequency Block.

A24. Interim coordination notice

Notice: interim coordination procedure for 3.6-3.8 GHz spectrum access licences

About this document

This notice sets out the interim co-ordination procedure that 3.6 GHz spectrum access licensees must follow before transmitting from base stations in the 3.6-3.8 GHz band.

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1. Introduction

1.1 The notice sets out the interim co-ordination procedure to be followed by 3.6 GHz spectrum access licensees prior to transmitting from base stations in the frequency band 3.6-3.8 GHz. Co-ordination will be effected by means of a 'co-ordination tool' administered by Ofcom.

1.2 As of the date of issue of the 3.6 GHz spectrum access licences, there are a number of incumbent Fixed Link (FL) and Permanent Earth Station (PES) licences and grants of Recognised Spectrum Access (RSA) in the frequency band 3.6-3.8 GHz. In December 2017, Ofcom issued notices to revoke all FL licences in the band with an effective date of 23 December 2022. At the same time Ofcom varied PES licences and grants of RSA, such that we will no longer take satellite earth stations with a receiver component in the band into account for frequency management purposes, with an effective date of 1 June 2020, except for one grant of RSA where variation comes into effect on 1 September 2020.

1.3 During the interim period Ofcom will ensure the protection of the incumbent FL and PES licensees and grants of RSA by means of the procedure set out in this notice.

1.4 This notice will remain in place until the 23 December 2022 (or sooner if the remaining FL licensees vacate the band before this date).

1.5 This notice replaces the coordination procedure specified in OfW188 with respect to schedule [2] of the UKB [3.6/3.8 GHz] licence, though OfW188 remains in place with respect to schedule [1] of that licence.

2. Procedure

2.1 When planning its network deployments, a 3.6 GHz spectrum access licensee must check whether any of its base stations are located within the co-ordination areas defined in Annex A1 of this notice.

2.2 For any base station within a co-ordination area, the 3.6 GHz licensee must submit the technical details, as defined in Annex A2 of this notice, prior to transmitting on any frequency within the 3.6-3.8 GHz band.

2.3 For practical reasons, Ofcom is not able to process individual base stations through the co-ordination tool. Therefore, unless agreed with Ofcom beforehand, 3.6 GHz spectrum access licensees are required to submit technical details in batches of at least 100. As it is more efficient for Ofcom to process larger batch sizes, licensees are encouraged to submit batches that are as large as possible. Submitting multiple small batches will result in slower processing through the co-ordination tool and may lead to delays in Ofcom providing results.

2.4 Upon receipt of a batch of technical details Ofcom will determine, using the co-ordination tool, whether any base station in the batch is likely to cause interference to a FL, or to a PES or RSA Earth station.

2.5 In the case that interference is predicted, Ofcom will inform the 3.6 GHz spectrum access license of all base stations that have failed co-ordination, we will provide information indicating which PES or RSA Earth station and/or which FL the base stations have failed against and the margin of each failure. Licensees may not transmit from base stations that have failed co-ordination on any frequency within the 3.6-3.8 GHz band prior to a specified date[11]. Licensees may transmit from bases stations that have passed co-ordination provided they stay within the submitted technical details.

2.6 At their choice, 3.6 GHz spectrum access licensees may resubmit, with amended technical details, any base stations that have failed co-ordination (noting the batch size requirement above still applies). If they then pass co-ordination, the 3.6 GHz spectrum access licensee may transmit from these base stations provided they stay within the re-submitted technical details.

2.7 For the avoidance of doubt, Ofcom is not able to provide further information, guidance or advice about base stations that have failed co-ordination; nor is Ofcom able to facilitate further/detailed discussion between 3.6 GHz spectrum access licensees and FL and PES licensees and RSA grantees.

[11] For interference into FL, the date will be 23 December 2022 (sooner if FL licensees agree to vacate earlier). For into PES or RSA Earth stations, the date will be either 1 June 2020 or 1 September 2020 depending on the case.

A1 Co-ordination areas

- [200] km from the locations specified below.

Earth stations:

Station name	NGR location	License end date
Bedford	TL 03743 61087	01/06/2020
Chalfont	SU 98730 91732	01/06/2020
Crawley Court	SU 42200 34800	01/06/2020
Martlesham	TM 25500 45300	01/06/2020
Madley	SO 42500 37200	01/06/2020
Kirkhill Industrial Estate	NJ 87370 12694	01/06/2020
Cobbett Hill	SU 94365 53401	01/06/2020
Brookmans Park	TL 26058 05090	01/06/2020
Goonhilly	SW 72270 21070	01/06/2020
Nesscliff	SJ 38278 18566	01/06/2020
Redhill	TQ 28756 52468	01/06/2020
Whitehill	SP 47862 18634	01/06/2020
Caversham Park	SU 72717 76214	01/06/2020
Crowsley Park	SU 72781 80385	01/09/2020
Woofferton	SO 50930 68253	01/06/2020

Fixed Links locations:

NGR location (Link end 1)	NGR location (Link end 2)	Licence end date
NG 75520 89850	NB 30500 30290	23/12/2022
HY 78450 55800	HU 38740 18780	23/12/2022
HY 62760 37330	HZ 21290 73180	23/12/2022
HY 62760 37330	HY 41270 11600	23/12/2022
HY 78450 55800	HY 36580 21020	23/12/2022
ND 17770 65820	HY 37700 10190	23/12/2022
SU 65650 05400	SZ 44730 86540	23/12/2022

HY 62760 37330	HZ 21290 73180	23/12/2022
HY 78450 55800	HU 38740 18780	23/12/2022
HY 62760 37330	HY 41270 11600	23/12/2022
NG 75520 89850	NB 30500 30290	23/12/2022
NG 75520 89850	NG 78600 42390	23/12/2022
HU 50300 38700	HZ 21290 73180	23/12/2022
NG 75520 89850	NB 30500 30290	23/12/2022
HY 78450 55800	HY 36580 21020	23/12/2022
ND 17770 65820	HY 37700 10190	23/12/2022
TQ 59483 60442	SU 94829 81394	30/03/2020
TQ 59483 60442	TR 27405 39719	30/03/2020
NJ 98080 57046	NJ 76159 33025	01/06/2019
NJ 85600 09100	NJ 76159 33025	01/06/2019
TR 07811 59065	TQ 72237 90367	28/11/2019
TQ 97065 72388	TR 37740 67348	28/11/2019

A2. Technical details

Below we define the details and format of the files containing the station information necessary to carry out the coordination.
Files should be submitted in a specific format (a .xlsb Excel binary file), with a set of columns as follows. Note blank fields must not be populated:

Index Column	Name	Comments
1	Assignment ID	
2	Link ID	
3	Type	
4	Name of Station	Alphanumerical, as defined by stakeholder
5	Service	
6	Sub-Service	
7	Class of Station	
8	Co-ordinate Reference	NGR
9	Station Location X	6-digit NGR location
10	Station Location Y	
11	Network ID	
12	Antenna Location	OUTDOOR/INDOOR
13	Antenna Height (m) - AGL	Antenna above ground level value (m)
14	HCM V Code	
15	HCM H Code	
16	Antenna Gain	Antenna boresight gain (dB)
17	Antenna Azimuth (degrees)	Antenna azimuth (degree)
18	Antenna Elevation	Antenna elevation (degree). Negative values refer to down-tilt angles.
19	Tx Frequency (MHz)	Transmission frequency (MHz)
20	Rx Frequency (MHz)	Reception frequency (MHz)
21	Bandwidth (MHz)	Bandwidth (MHz)
22	Channel Spacing (MHz)	Channel Spacing (MHz)
23	Power Reference	
24	Radiated Power (dBW)	E.I.R.P (dBW)
25	Antenna Polarisation	Horizontal, Vertical or Cross-Polar
26	Coverage Radius (km)	
27	Validity Start Date	
28	Validity End Date	
29	MPL (dBm)	
30	T/I (dB)	
31	Result	
32	Result Margin (dB)	
33	Description of Result	
34	Channel Priority	
35	Location (Indoor,Outdoor)	

36	Airborne (for information)	
37	Antenna Type	Reference given by Ofcom
38	Antenna Beamwidth (Degrees)	
39	Tx Station Activity Factor	
40	Tuning Range Start (MHz)	
41	Tuning Range End (MHz)	
42	Tuning Range Step (kHz)	
43	Tuning Range Duplex Space (kHz)	
44	Spec Efficiency Class	Reference given by Ofcom
45	Antenna Ident	Reference given by Ofcom

A25. Notice of in-band restriction zones

Notice: In-band restriction zones around satellite earth stations in 3.6-3.8 GHz

About this document

This notice sets out the procedure that 3.6 GHz spectrum access licensees must follow before transmitting from base stations in the 3.6-3.8 GHz band in order to respect the in-band restriction zones around satellite earth stations in 3.6-3.8 GHz.

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1. Introduction

1.1 The notice sets out the procedure to be followed by 3.6 GHz spectrum access licensees prior to transmitting from base stations in the frequency band 3.6-3.8 GHz in order to respect the in-band restriction zones around specific satellite earth stations in 3.6-3.8 GHz.

1.2 As of the date of issue of the 3.6 GHz spectrum access licences, there are a number of Permanent Earth Station (PES) licences and grants of Recognised Spectrum Access (RSA) in the frequency band 3.6-3.8 GHz. In December 2017, Ofcom varied PES licences and grants of RSA, such that we will no longer take satellite earth stations with a receiver component in the band into account for frequency management purposes, with an effective date of 1 June 2020, except for one grant of RSA where variation comes into effect on 1 September 2020.

1.3 In October 2017 we told the operators of satellite Earth stations that they could continue to operate in the band on a licence exempt basis following the end of the periods indicated above (noting that their ability to continue to receive without suffering interference, that might adversely affect their service, could vary between sites), and that we would explore the possibility of applying localised restrictions in future licences to facilitate continuing operation of satellite services in the 3.6 3.8 GHz band, where these would not have a material impact on mobile deployment.

1.4 [Two] satellite Earth station operators have expressed an interest in restriction zones around their sites and we have concluded that a restriction zone with a radius of 1km around each site would be appropriate to ensure new mobile base stations will not be situated directly next to their SES sites , while meeting the objective to ensure that constraints to mobile deployment be kept to a minimum and whilst not preventing MNOs from offering mobile services in the area affected.

1.5 This notice applies to 3.6 GHz spectrum access licences and is effective from 1 June 2020. It replaces the coordination procedure specified in OfW188 with respect to schedule 2 of the UKB 3.6/3.8 GHz licence, though OfW188 remains in place with respect to schedule 1 of that licence.

2. Procedure

2.1 When planning its network deployments, a 3.6 GHz spectrum access licensee must check whether any of its base stations are located within the satellite Earth station (SES) restriction zones defined in Annex A1 of this notice.

2.2 For any base station within a restriction zone, the 3.6 GHz spectrum access licensee must ensure that the calculated signal power at the SES location within the any 5 MHz portion of the operating bandwidth of the SES is no greater than -43 dBm/5 MHz.

2.3 The 3.6 GHz spectrum access licensee must calculate the power level at the SES receiver, assuming free space path loss, according to the following formula:

$$P_{Rx} = P_{Tx} - L_{fs} \quad \text{(dBm/5 MHz)}$$

where:

P_{Rx}:	Power received at the SES location (dBm/5 MHz)
P_{Tx}:	Equivalent isotropically radiated power from the base station in the direction of the SES receiver (dBm/5 MHz) including accounting for base station antenna downtilt
L_{fs}:	Free space path loss between the base station and SES (dB)

and where:

$$L_{fs} = 32.4 + 20 \log f + 20 \log d \quad \text{(dB)}$$

where:

f:	frequency of transmission (MHz)
d:	distance between the base station and the SES (km).

2.4 The 3.6 GHz spectrum access licensee must maintain records demonstrating that the requirements of this notice have been met for all base stations deployed within each satellite Earth station restriction zone and must make these records available to Ofcom on request.

2.5 For the avoidance of doubt, 3.6 GHz spectrum access licensees do not need to apply the procedure in this notice to any base station located outside the restriction zones defined in Annex A1 of the notice.

A1. Restriction zones

1 km from the locations specified below

Name Station	NGR location
Whitehill	SP 47862 18634
Woofferton	SO 50930 68253

A26. Notice of coordination procedure for MOD sites related to the 3.6-3.8 GHz band

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Notice of coordination procedure for MOD sites related to the 3.6-3.8 GHz band

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Section

1. Introduction

1.1 This Notice is notified to each 3.6 GHz Licensee under their respective 3.6 GHz licences.

1.2 MOD has a small amount of ongoing use within the band at one location in Cornwall which must be protected.

1.3 This Notice specifies the protection thresholds and coordination procedure necessary to ensure the protection of existing and continuing MOD usage in the 3.6 to 3.8 GHz band from potential harmful interference from the networks in the 3.6 GHz Band.

1.4 In this Notice:

- "3.6 GHz Band" means the following frequencies: 3600 MHz to 3800 MHz;
- "3.6 GHz Base Station" means a Base Station which are licensed to transmit using frequencies in the 3.6 GHz Band;
- "3.6 GHz Deployment" means a 3.6 GHz Base Station or a 3.6 GHz Fixed or Installed Terminal Station deployed by a 3.6 GHz Licensee. For the purposes of this Notice indoor femtocells and indoor smart/intelligent repeaters, as defined in Schedule 1 of the 3.6 GHz licence, are excluded from a 3.6 GHz Deployment;
- "3.6 GHz Fixed or Installed Terminal Station" means a fixed or installed Terminal Stations which is not exempt from licensing by the Wireless Telegraphy Act (Exemption) Regulations and which is licensed to transmit using frequencies in the 3.6 GHz Band;
- "3.6 GHz Licensee" means the licensee under a licence authorising use in the United Kingdom of frequencies in the 3.6 GHz Band;
- "Base Station" means radio equipment that transmits to a Terminal Station(s);
- "MOD" means the Ministry of Defence;
- "Protected Site" means the list of sites set out in this Notice;
- "Signals" means the transmission in the 3600 to 3800 MHz band from the 3.6 GHz communications equipment;
- "Site Protection Threshold" means the threshold that the 3.6 GHz Licensee must comply with as specified in this Notice;
- "Terminal Station" means radio equipment that receives downlink transmissions from Base Stations.

2. The procedure

Overview of coordination procedure

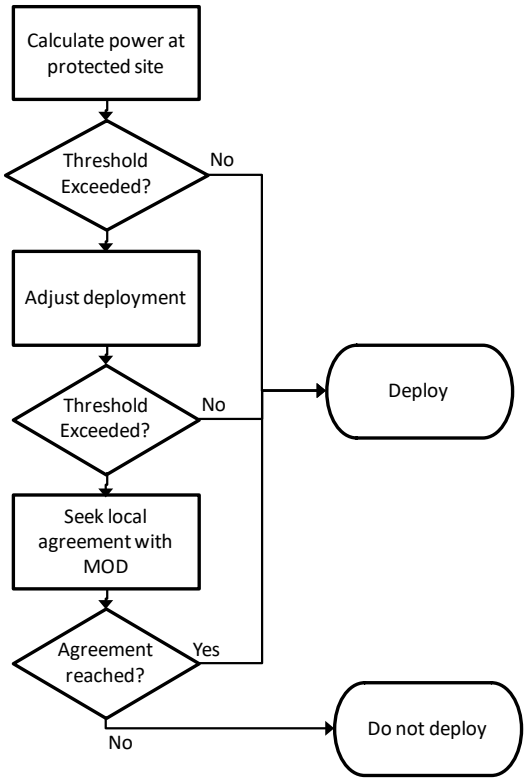
2.1 When planning its network deployment, the 3.6 GHz Licensee must check whether the protection thresholds set out in this document would be exceeded as a result of any proposed 3.6 GHz Deployment. To do so, the 3.6 GHz Licensee will need to calculate the communications signal at the relevant Protected Site location(s) (see protection thresholds section below).

2.2 If these calculations show that the relevant threshold will not be exceeded as a result of the planned deployment, then deployment can go ahead. If the calculations show that the relevant threshold(s) would be exceeded as a result of the planned deployment, the 3.6 GHz Licensee may consider adjusting the deployment.

2.3 If it is not possible to adjust the deployment so that the threshold(s) are not exceeded, the 3.6 GHz Licensee may only deploy if agreement is reached with the operator(s) of the relevant site(s).

2.4 In the first instance, contact should be made via Ofcom who will facilitate a discussion between the licensee's appropriately security cleared personnel and the operator of the Protected Site.

Figure 2:1: Flowchart illustrating coordination procedures for deployments within the coordination zone



List of sites to be protected

2.5 The sites to which these coordination procedures apply are listed in Figure 2.2 below.

Figure 2.2: 3.6 GHz Band Protected Site Locations

Site	Location
Bude	SS 208 126

Protection thresholds

2.6 The 3.6 GHz Licensee must use the methodology in this Notice to ensure that emissions from each proposed 3.6 GHz deployment (or combination of deployments) in its licensed 3.6 GHz Band do not exceed the threshold for the in-band communications signal given in Figure 2.3.

Figure 2.3: Site Protection Thresholds

In-band communication signal		
	Bude	
Site Protection thresholds	Threshold for Signals in the 3410 to 3600 MHz band [1]	-69 dBm /5 MHz
	Height	18m above ground level
	Area where calculation is to be performed	Up to 25km from Bude
Note [1]: The protection thresholds are defined during the 'on' period of the transmit signal and referenced to a 0dBi receive antenna		

Compliance with the thresholds

2.7 Prior to deployment, the 3.6 GHz Licensee must use the methodology in this Notice to assess whether the protection thresholds specified in Figure 2.3 will be exceeded as a result of its planned 3.6 GHz deployment for any Protected Site. There is no requirement to undertake an assessment outside of the calculation areas given in Figure 2.3 except as described in paragraph 2.8 below.

2.8 The calculation areas in Figure 2.3 have been developed on the basis of Base Stations at 30m above ground level in order to constrain the area over which coordination must be undertaken. However, Licensees are advised that sites which are higher than this but located outside of the coordination area may still cause interference to MOD systems in certain circumstances. The 3.6 GHz Licensee must therefore consider whether any of its deployments which are greater than 30m above ground level are likely to cause any impact to the Protected Site and coordinate if it deems necessary.

2.9 In carrying out this assessment for deployments within the calculation areas described in Figure 2.3 the 3.6 GHz Licensee must use propagation models described below with the parameters given in Figure 2.4.

2.10 The 3.6 GHz Licensee must maintain records of its calculations and assessments and make these available to Ofcom if required.

Exceeding the threshold

2.11 The thresholds may only be exceeded in relation to a specific Protected Site if the 3.6 GHz Licensee has reached an agreement with the operator of that Protected Site (Ofcom will facilitate the necessary introductions). Any such agreement must be recorded in writing in a form agreed by both the 3.6 GHz Licensee and the site operator. The 3.6 GHz Licensee must maintain a record of all such agreements, and make them available to Ofcom on request.

Propagation Model

2.12 A basic transmission loss (path loss) will be calculated using ITU-R Recommendation P.1812-4 "A path-specific propagation prediction method for point-to-area terrestrial services in the VHF and UHF bands"[12].It predicts signal levels exceeded for a given percentage of time. The assessment will use a time percentage of 10% as included in Figure 2.4 below.

2.13 This recommendation predicts signal levels exceeded for a given percentage of locations and a given percentage of time. The assessment will use locations percentage of 50% for all cases. Time percentage of 10% for Base Stations and Fixed or Installed Terminal will be used, as included in Figure 2.4 below.

2.14 Predictions are based on the terrain profile and clutter along the path.

2.15 Additional losses due to terminal surroundings (terminal clutter losses) shall be applied at both the transmitter and receiver where they are on land. This is based on a representative clutter height assigned to each clutter category. The representative clutter height depends not only on the typical physical height of clutter objects but also on the horizontal spacing of objects and the gaps between them. The required values are given in Figure 2.5.

Figure 2.4: ITU-R P.1812 parameters

Time percentage	10%
Nominal path centre latitude φ (°)	Bude: 51 The path centre latitude φ may be selected on a case by case basis
Sea level surface refractivity, N_0 (N-units)	obtained from digital maps provided in Recommendation P.1812-4 as described in §3.5

[12] www.itu.int/rec/R-REC-P.1812-4-201507-I/en

The average radio-refractive index lapse-rate through the lowest 1km of the atmosphere, ΔN (N-units/km)	obtained from digital maps provided in Recommendation P.1812-4 as described in §3.5

Figure 2.5: Representative clutter heights

ITU-R P.1812-4 Clutter Type	Representative Clutter Height (m)	
	Use in profile equation[13] For i=2 to n-1	Use in Terminal clutter losses[14] and add to profile equation for i=1 and n
Water/Sea	0	10
Open/Rural	0	10
Suburban	10	10
Urban/Trees/Forest	15	15
Dense Urban	20	20
In all cases the default parameter value for w_s of 27 should be used		

Terrain database

2.16 Digital terrain map data with 50m resolution shall be used. Examples include Ordnance Survey "Landform Panorama®" or "OS Terrain® 50" datasets[15].

Clutter database

2.17 A digital land classification ("clutter") dataset with 50m or better resolution such as Infoterra 50m clutter[16], Siradel 20m clutter[17] or other equivalent shall be used.

[13] Equation 1c in P.1812-2: http://www.itu.int/rec/R-REC-P.1812-2-201202-I/en
[14] Section 4.7 in P.1812-2 applicable to Equation 64b for water/sea/open and rural categories and Equation 64a for the other categories and profile equation 1c

[15] http://www.ordnancesurvey.co.uk/business-and-government/products/opendata-products-grid.html
[16] http://www.space-airbusds.com

[17] https://www.siradel.com/

2.18 The Infoterra and Siradel datasets identify 10 and 17 different clutter categories respectively. Mapping of these clutter categories to the required P.1812 clutter designations in Figure 2.5 is given in Figure 2.6.

Figure 2.6: P-1812-4 clutter code mapping

ITU-R P 1812-4 Clutter Categories	Infoterra		Siradel	
	Category	Code	Category	Code
Water/Sea	Water	10	Sea	1
			River	2
			Lake	3
Open/Rural	Parks/Recreation	6	Open	4
	Open	7	Low density vegetation	5
	Open in urban	8	Park	7
Suburban	Industry	3	Village	8
	Suburban	4	Residential	9
	Village	5	Dense residential	10
Urban	Urban	2	Urban	11
			Mean dense urban	12
Trees/Forest	Forest	9	High density vegetation	6
Dense urban	Dense urban	1	Dense urban	13
			High dense urban	14
			Industrial	15
			Building blocks	16
			Airport	17