

Your response

Question	Your response
<p>Question 1: (Section 3) Do you agree with our proposal for a single authorisation approach for new users to access the three shared access bands and that this will be coordinated by Ofcom and authorised through individual licensing on a per location, first come first served basis? Please give reasons supported by evidence for your views.</p>	<p>Not entirely. Whilst the selection of the three bands for Shared Access is well thought out, the proposed mechanism for assignment of licences appears over simplistic, lacking in detail for implementation and is unlikely to be optimally cost effective or flexible.</p> <p>The US Spectrum Access System (SAS) being employed with the Citizens Broadband Radio Service (CBRS) in the 3550-3650 MHz band appears to be a much more flexible and lower cost alternative for the DSA bands than the proposals outlined in this consultation.</p> <p>As this system is already being developed for the US market, adoption of the same system would result in significant savings in both cost and speed to deploy.</p> <p>Also, for the lowest tier General Authorized Access (GAA) of CBRS users do not require a licence to operate in a location, although the equipment being used does need to meet technical specifications and be type approved. This will in turn dramatically decrease costs and effort required to deploy infrastructure, whilst maintaining centralised control and interference mitigation.</p> <p>The levying of an annual licence fee is onerous both for the user and an administrative burden for Government. A better model would embed a component of cost in the capital cost of the type approved equipment(s) using the spectrum. Deploying such a device with pre-paid licence would only require simple online account activation in order to access the GAA tier. Users requiring access to the Priority Access License (PAL) tier would then be able to purchase higher priority spectrum access as required.</p>

<p>Question 2: (Section 3) Are there other potential uses in the three shared access bands that we have not identified?</p>	<p>No - the analysis of use of the three shared access bands has been carried out very thoroughly.</p> <p>In order to simplify the complexity of the licencing/interference prevent process, we would wish to see that the potential uses for each band are constrained.</p> <p>1800 MHz (Band 3): This band is not wide enough to deploy wide band waveforms efficiently, so we hold the view that this band should be licenced solely for narrowband waveforms (as suggested by comment in Table 1 [Page 22]), such as 2G/GSM/GERAN. LTE-M or IoT-NB/IoT-M. Device support, particularly with narrow band modes for this is excellent; services should be ready to be deployed rapidly as soon as spectrum becomes available. Users requiring to deploy wide band LTE waveforms can apply for spectrum in the 2300 MHz band.</p> <p>2300 MHz (Band 20): This band is well suited for use as LTE-TDD with either 2 x 5 MHz or 1 x 10 MHz channels. Other narrow band waveforms should not be licenced for use in this band. Device support for this band/LTE-TDD modes is good in recent devices and will continue to improve. Services and applications using this band should be deployable rapidly and cost effectively on release of spectrum.</p> <p>3.2-4.2 GHz: This band is particularly well suited for 5G wide band use, but as there are few commercially available User Equipments available for use at these frequencies it may be some time before this band can be effectively employed. This band is not well suited to narrow band operation.</p>
<p>Question 3: (Section 3) Do you have any other comments on our authorisation proposal for the three shared access bands?</p>	<p>It would appear that the only mechanisms being examined for interference reduction are frequency separation and power management. Modern waveforms (as used in 4G/5G systems) are designed to manage interference using bulity in Inter-Cell Interference Coordination</p>

	<p>(ICIC) and (from Release 10 onwards) Enhanced ICIC (eICIC).</p> <p>ICIC allows cell edge User Equipments in neighbouring cells to use different Resource Block (RB) and sub-carrier frequencies with the aim of achieving a mutually exclusive RB Allocation between cells.</p> <p>With eICIC, macro cells and small cells use radio resources in different time ranges through management of a number of technical measures [<i>Almost Blank Subframes (ABS), Multimedia Broadcast multicast service Single Frequency Network (MBSFN) and Symbol Shift</i>] in addition to Frequency Domain and Power Control measures, thereby allowing co-channel working without major catastrophic interference. The effect of co-channel interference simply has the effect of shrinking cell size rather than preventing operation.</p> <p>Note that it is common practice for MNOs to routinely run multiple cells using the same frequency channel, but with different configurations within the time domain in order to minimise interference.</p> <p>Any spectrum leasing/licencing system needs to take into account <u>both</u> frequency domain and time domain components together with power levels.</p>
<p>Question 4: (Section 3) What is your view on the status of equipment availability that could support DSA and how should DSA be implemented?</p>	<p>It is accepted that it may take some time for fully featured DSA systems and associated sub-systems to become widely available commercially. Until such time as such systems are affordable and proven it will be necessary to put in place some form of interim system which allows early access to spectrum.</p> <p>It is our view that rapid deployment of sub-optimal management systems is key - and we would be willing to accept a system with minor imperfections rather than delaying deployment to await better management systems to evolve.</p> <p>Modern 4G/5G waveforms are remarkably robust - and have been designed with</p>

	<p>co-channel use in mind - offering performance far better than WiFi under similarly highly congested urban scenarios. In most cases interference will simply cause a reduction in cell size.</p> <p>Any Shared Access spectrum system should take this into account so as not to block applications that may operate without interference whilst sharing wide band channels. For example, in a large multi-floor building there could be applications from different organizations operating on different levels within the proposed 50 metre radius for licencing. With careful configuration multiple network assets can coexist efficiently on the same channel.</p>
<p>Question 5: (Section 4) Do you agree with our proposal for the low power and medium power licence? Please give reasons supported by evidence for your views.</p>	<p>Yes - our operational experience with the CH4LKE Mobile Pilot (www.ch4lke.com) in Rural Wiltshire has shown that coverage from low power (24dBm) eNodeBs provides adequate coverage within habitated areas, but does not cover the surrounding areas well. Whilst this means that the majority of heavy bandwidth usage is catered for, a significant part of the coverage area (where rural sensors and systems are deployed) are not covered. We hold the view that the optimal solution is to deploy a number of small lower power cells where users live and work, then a small number of 'area' medium power cells to provide the 'fill in' coverage.</p> <p>Within urban areas, capacity is likely to be more of a constraint than coverage. The best way of dealing with this issue is to deploy larger numbers of small cells in order that spectral reuse can be maximised. Medium or high power cells in densely populated high traffic areas simply increase the noise floor and decrease the performance of radio systems over a wide area.</p>
<p>Question 6: (Section 4) Are there potential uses that may not be enabled by our proposals? Please give reasons supported by evidence for your views.</p>	<p>Yes</p> <p>It is not clear how management of multi-storey buildings will be catered for under the proposed system. Take as an example a 50 floor building in Central London - there is a clear</p>

	<p>need for in building infrastructure to provide coverage; existing macro cell coverage is generally useless above the tenth floor level. Under the deployment scenarios illustrated in Figure 4 (page 24) it is not clear how allocation of licences in the vertical dimension would be managed.</p> <p>Also, the proposed 50 metre radius from registered location scheme does not work well for small cells deployed in Rural scenarios. To illustrate this - within the CH4LKE Mobile Pilot, we have deployed 5 building mounted low power eNodeB cells (24 dBm 2 x MIMO) to cover the village of Bowerchalke - over an area of approximately 2 km by 1 km. All five cells use the same Band 40 channel but operate with negligible interference using eICIC. Under the proposed procedure, each one of these low power cells would require a separate application and licence fee. Ideally these five cells should be treated as a single installation and be licenced as such; to have to licence each individual cell as a separate entity would impose unnecessary administrative burden and costs.</p>
<p>Question 7: (Section 4) Do you agree with our proposal to limit the locations in which medium power licences are available? Please give reasons supported by evidence for your views.</p>	<p>Yes</p> <p>It may be possible to include measures to impose dynamic modification of transmitter power levels, together with active antenna use to further reduce the effects of co-channel interference. No mention of these mechanisms are made in the consultation paper.</p>
<p>Question 8: (Section 4) Do you have other comments on our proposed new licence for the three shared access bands?</p>	<p>There is no mention of licencing for mobile or nomadic cellular installations. It is highly likely that there will be scenarios where temporary deployments of infrastructure are required to cover events or incidents.</p>
<p>Question 9: (Section 4) Do you agree that our standard approach to non-technical licence conditions is appropriate? Please give reasons supported by evidence for your views.</p>	<p>It may be useful to differentiate between use cases where Public access is permitted (i.e. Multi Operator Neutral Host) versus Private Access only. In scenarios where there is demand from both MONEH and Private use cases, Public MONEH should be offered higher</p>

	<p>precedence (particularly if the MONEH network offers RAN access to Private networks).</p>
<p>Question 10: (Section 4) Are you aware of any issues regarding numbering resources and Mobile Network Codes raised by our proposals which we have not considered here?</p>	<p>[REDACTED - redacted for publication]</p>
<p>Question 11: (Section 5) Do you agree with the proposed technical licence conditions for the three shared access bands? Please give reasons supported by evidence for your views.</p>	<p>No</p> <p>We believe that better use could be gained from granting multiple narrow band licences within the 1800 MHz shared spectrum band rather than issuing one single paired 3.3MHz channel. As outlined earlier, this band is particularly well suited for use with existing narrowband systems (including existing 2G [200 kHz channels] and IoT-NB services[180 kHz channels] plus LTE-M [1.4 MHz]).</p> <p>Low cost, narrow band LTE-M systems (with VoLTE support) potentially offer an excellent long range alternative to the now outdated and technically challenged 2G GSM/GERAN systems</p>

	<p>The majority of the current low cost narrowband devices are available with quad-band (850/900/1800/1900 MHz) support - this makes the 1800 MHz band particularly well suited for these systems.</p> <p>Standard spectrum allocation within the 1800 MHz band could be 200 kHz channels</p> <p>If this band is used for narrow LTE services, then essential IoT and other narrowband services may be blocked. The 2300 MHz band is much better suited for LTE-A services.</p>
<p>Question 12: (Section 5) Are there other uses that these bands could enable which could not be facilitated by the proposed technical licence conditions? Please give reasons supported by evidence for your views.</p>	<p>Issue of single paired 3.3 MHz licences could block use of better suited narrowband modes.</p> <p>Similarly, the 2300 MHz spectrum could possibly be better configured as 2 x 5 MHz LTE-TDD channels in scenarios where multiple users require access to spectrum, rather than assigning one single 10 MHz channel.</p>
<p>Question 13: (Section 5) Do you agree with our proposed coordination parameters and methodology? Please give reasons supported by evidence for your views.</p>	<p>There appears to be no mention of inclusion of spectrum use reports from applicant locations in the process outlined in Figure 16.</p> <p>Virtually all current eNodeB equipments have the ability to scan the entire available bandwidth and report channel usage. This is seen as an essential component in the assessment of potential interference - and also would allow dynamic updates to be made to central spectrum databases.</p> <p>Such reporting would be extremely useful in identifying real time use of spectrum and in particular highlight cases where spectrum has been allocated but has not been used; in which case spectrum could be reassigned to another party.</p> <p>On the subject of updates to the central spectrum database, we would very much like to see the inclusion of a method for third party reporting of spectrum use from User Equipments [e.g. Android Smartphones] (using</p>

	<p>applications like <i>Network Signal Guru</i> or <i>Network Cell Info</i>).</p> <p>This would be hugely beneficial in identifying sources of interference and coverage not spots.</p> <p>This ‘crowd sourced’ information could provide essential independent verification of operator supplied data, particularly measuring coverage within buildings and on private property.</p>
<p>Question 14: (Section 5) What is your view on the potential use of equipment with adaptive antenna technology (AAS) in the 3.8-4.2 GHz band? What additional considerations would we need to take into account in the technical conditions and coordination methodology to support this technology and to ensure that incumbent users remain protected?</p>	<p>Phased array antennas with active beam forming capabilities are a key part of future 5G New Radio (NR) offerings. Clearly the operating parameters of these systems will have to be taken into account in order to minimise potential interference in this band.</p> <p>However, as commercially viable equipments in this band are still some way off, this work will not be required in the first iterations of the Shared Spectrum management system.</p>
<p>Question 15: (Section 5) Do you agree with our proposal not to assign spectrum to new users in the 3800-3805 MHz band and the 4195-4200 MHz band?</p>	<p>We do not see any obvious issues with the use of these guard bands. As the systems that will be deployed in this spectrum are likely to be using wide band spread spectrum waveforms, possibly with active beam forming antennas, the likelihood of interference at band edges is reduced. If guard bands are included in the band plan in the short term perhaps there might be value in examining their use with low power medium bandwidth use cases.</p>
<p>Question 16: (Section 6) Do you agree with our fee proposal for the new shared access licence? Please give reasons supported by evidence for your views.</p>	<p>No</p> <p>The proposed licence fees are likely to play a major factor in the slowing of the uptake in licences and subsequent deployment of infrastructure.</p> <p>We note that the GAA Tier within the US CBRS scheme is operated with no licence fee.</p> <p>In the bigger picture, the potential benefits of setting out an initial fee-less licencing structure coupled with the costs and complexities involved in setting up a fee collection system suggest that NOT charging for shared access spectrum (as with the US GAA Tier access) is probably the optimal course of action.</p>

	<p>Making the narrow band IoT allocations (in the 1800 MHz band) fee free is particularly important - the fees chargeable for narrow band licences (for typically 200 kHz channels) simply does not warrant the cost and complexity of setting up and operating a system to collect and account for these fees.</p> <p>It should be noted that OFCOM already do issue a number of licence types (such as Amateur Radio and Ship Portable licences) without fee payment. This has dramatically reduced the overheads and effort required to issue these licences.</p> <p>We also note that the minimum licence class described in the consultation proposals [Table 6, page 65] is for a 2 x 3.3 MHz channel size. The minimum required channel in the 1800 MHz band is likely to be 180/200 kHz!</p> <p>As previously discussed, the proposed 50 metre radius of operation for a single site is based solely on 2-dimensional urban use. This model fails when applied to rural deployments (such as the CH4LKE Mobile Pilot). The 50 metre radius constraint really needs to be replaced by some other clever way of expressing a single 'site' for licencing purposes.</p>
<p>Question 17: (Section 7) Do you agree with our proposal to change the approach to authorising existing CSA licensees in the 1800 MHz shared spectrum? Please give reasons supported by evidence for your views.</p>	<p>See answer to Question 16</p>
<p>Question 18: (Section 8) Do you agree with our proposal for the Local Access licence? Please give reasons supported by evidence for your views.</p>	<p>Emphatically YES!</p> <p>There is something fundamentally wrong about scenarios where no operator is utilising ANY of the valuable primary model spectrum bands (i.e. in a Not Spot) - but where smaller (and potentially more cost effective) operators are blocked from making use of the spectrum.</p> <p>As OFCOM has emphasised on numerous occasions, the licences awarded to the current MNO licence holders are NOT exclusive; and in certain circumstances OFCOM reserves the right to issue additional secondary licences for</p>

	<p>use of spectrum, particularly in areas where it is currently unused.</p> <p>Existing MNO licences are licences to USE spectrum, not to STOP others using spectrum!</p> <p>There are many places in the UK where the commercial case for deployment of conventional cellular infrastructure simply does not make sense, i.e. the incumbent cannot make any money from the deployment. In such cases MNOs are very reluctant to spend money without any firm indication of financial return.</p> <p>The proposed Local Access licence provides a viable procedure whereby a third party can identify mobile spectrum that is currently unused by the primary licence holder and follow a procedure whereby a full licence can be issued for a guaranteed period sufficiently long (3 years +) to make commercial sense.</p> <p>This will open the door for a range of completely new deployment scenarios for Radio Access Networks, particularly in Not Spot areas, where current MNOs cannot deploy infrastructure that is financially viable using their current architectures and procedures.</p>
<p>Question 19: (Section 8) Do you have any other comments on our proposal?</p>	<p>The Proposed Local Access licencing process depicted in Figure 20 (Page 76) shows a path where the incumbent licence holder does NOT support the pre-application AND does NOT support the subsequent application, yet has the outcome where the MNO objection is judged to be not reasonable.</p> <p>Clarification is sought on what the decision criteria to determine what is considered REASONABLE and what is NOT in these decision processes. If the selection criteria are too tight such that it becomes very difficult to get an application through the process, then uptake will be severely limited.</p> <p>Also - there is no mention of timescales for the whole process to take place. We believe that a suitable time frame of circa 1 week is sufficient to progress between submission of application to OFCOM to Grant of Licence.</p>

Question 20: (Section 8) What information should Ofcom consider providing for potential applicants in the future and why would this be of use?

Much more detailed coverage and capacity information showing gaps in service on an operator by operator basis are essential to potential Local Access licence applicants. Current OFCOM Mobile coverage prediction tools (which use predicted coverage data supplied by MNOs) have proved to be largely inaccurate, with many more Real World Not Spots than the predictions suggest.

Network capacity is particularly important; there are many locations where there is adequate signal strength, but users have great difficulty using services due to congestion (Example: Waterloo Railway Station at rush hour - where all mobile phones are unusable). We would very much like to see capacity/network availability included in any future coverage obligations associated with spectrum licences.

This should be coupled with actual spectrum use data (showing waveform/power/location/capacity) as an overlay on the existing coverage maps. Examples of the sort of data required to undertake planning can be seen on Peter Clark's website [<https://pedroc.co.uk/>].

Question 21: (Section 8) Do you agree with our proposal to have a defined licence period and do you have any comments on the proposed licence term of three years?

Yes to the minimum 3 year licence term. We would expect the normal term to be 5+ years in order to encourage investment in local infrastructure by non-MNO players.

We would like to see some kind of commercial protection for small Local Access licence holder in scenarios where the primary licence holder wishes to activate service in the same area at the end of the licence period.

We would like to see some kind of special provision made to protect infrastructure that is deployed within buildings and on private property.

Without some clearly defined commercial protection for local access licence holders the uptake on these licences is likely to be severely constrained.

Question 22: (Section 8) Do you have any other comments on the proposed Local Access licence terms and conditions?

The ability to deploy the Radio Access Network is only a very small part of engineering a fully featured Public Multi Operator Neutral Host system. Whilst this new provision does open up a very valuable route for third party operators to offer services specifically tailored towards solving Not Spots, we envisage that the total number of players that possess the technical and commercial knowledge to be able to deploy a complete competently engineered and commercially viable solution will be small.

Question 23: (Section 8) Do you agree with our fee proposal for the new local access licence? Please give reasons supported by evidence for your views.

Yes