Your response

Question	Your response
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.	Confidential? – N Dense Air fully supports the initiative towards spectrum sharing. We agree that the proposed approach is a pragmatic one for the short term, but are keen to see full DSA adopted as soon as possible. This will enable flexible and more rapid deployments, ultimately leading to more efficient use of spectrum assets. However, Dense Air believes the bands selected for shared access will limit scope for innovation due to insufficient bandwidth for emerging applications in 1.8GHz and 2.3GHz, and a lack of short term mobile eco-system in 3.8-4.2GHz. As we've proposed in the 700MHz and 3.7GHz consultation, we believe that allocating a portion of 3.6-3.8GHz to neutral host operators would allow new market entrants with innovative 5G service offerings to complement the current MNOs. As a second preference, we would encourage OFCOM to assign an allocation of 3.6-3.8GHz to shared access, maximising the scope for innovation and aligning the UK with the US CBRS eco-system. In addition, 10 MHz of 2.3 GHz when linked to the Telefonica O2 frame structure in the adjacent band, together with adjacent channel interference from Channel 1 Wi-Fi at 2412 MHz provides a very limited service.
Question 2: (Section 3) Are there other potential uses in the three shared access bands that we have not identified?	Confidential? – N Dense Air views the use of shared spectrum as a way to extend coverage and capacity into underserved locations. This includes rural, but also lends itself to economically challenging locations such as transportation corridors. Shared spectrum presents an opportunity for new neutral host operators to address mobile coverage and capacity along the UK's road and rail networks, leading to further innovation and UK leadership in Connected Autonomous Vehicles. Dense Air is leading part of the DCMS

	funded AutoAir project which has successfully demonstrated neutral host 5G connectivity to high speed vehicles. A fixed only service SHOULD NOT be a mandatory in 3.8-4.2GHz. Indoor or outdoor use of n77 5G smartphone should not be restricted. Wide-area mobility will by default be provide by other systems and bands, so there is no impact on using this band for pedestrian and indoor services. Again, the choice of band and available bandwidth will be critical to the potential scale of UK leadership in this area. Allocating a portion of 3.6-3.8GHz spectrum overlapping with the US CBRS band, will accelerate innovation.
Question 3: (Section 3) Do you have any other comments on our authorisation proposal for the three shared access bands?	Confidential? – N Dense Air views the proposed manual authorisation scheme as a short term solution ahead of establishing DSA systems. We believe that the industry can establish these systems rapidly.
Question 4: (Section 3) What is your view on the status of equipment availability that could support DSA and how should DSA be implemented?	Confidential? – N Our understanding is that the CBRS infrastructure for enabling DSA in mid-band spectrum is commercially ready. We believe that the UK should leverage this technology to accelerate DSA in UK shared bands.
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.	Confidential? – N We agree that shared bands should be for low and medium power use only, and that high power should be limited to Mobile Operators in auctioned bands. Dense Air agree with the principle being applied for low power devices. It is unclear how the Tx Power and EiRP limits (for low and medium power) have been derived. Setting absolute power limits has a direct impact on the commercial viability of any deployment as well as imposing limitations to innovation scope. Any limits therefore need to be very carefully considered.

	The proposed limit of 24dBm EiRP for low power devices is too low in our opinion as this power level only represents residential femto-cells. We recommend applying a 4W EiRP limit in order to cater for enterprise grade indoor small cells. The coordination process outlined in Section 5 considers Tx power and propagation losses and lends itself well to assessing applications based on actual equipment performance. We would recommend setting a higher nominal limit for the low power class of equipment and assessing co-existence based on actual Tx Power provided on application.
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.	Confidential? – N Mobile use cases in 3.xGHz spectrum are precluded under this proposal. This will significantly reduce the scope of innovation potential and Dense Air strongly recommends that this is reconsidered. We believe that 3.8-4.2 GHz offers promise in the medium term (2022 to 2025), but will not allow much deployment until the n77 5G NR eco-system develops and becomes available in devices. However, the spectrum rules must allow for full 5G operation (fixed and mobile)
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.	Confidential? – N Dense Air do not agree with the approach of restricting usage to pre-defined rural areas only. All under served locations, including transportation corridors and large industrial complexes, should be open to benefit from this initiative to encourage innovation. We suggest that there are no limitations imposed, and any pre DSA process should consider each application case by case.
Question 8: (Section 4) Do you have other comments on our proposed new licence for the three shared access bands?	Confidential? –N No other comments.
Question 9: (Section 4) Do you agree that our standard approach to non-technical licence	Confidential? –N

conditions is appropriate? Please give reasons supported by evidence for your views.	Dense Air agrees in general with OFCOM's standard approach to non-technical licence conditions. However, the provision of information referred to in Clause 4.29 could require the registration of thousands of small cells which would need amendments to the information requested and volume processes compared to individual or clustered macro sites.
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?	Confidential? –N Dense Air agree that there should not be any issues relating to numbering resources. Furthermore, Dense Air strongly believes that Neutral Host small cells should not require additional numbering resources, instead utilising the numbering resources of retail service providers to ensure full transparency to end users. Dense Air also believes that service providers should be able to re-use MNC resources across different geographic domains and industry sectors. For example, a service provider specialising in healthcare could utilise a single MNC across all deployments, rather than establishing a new MNC for each network. The existing mobile numbering allocations would therefore be appropriate for service providers utilising the proposed shared spectrum.
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.	Confidential? –N It is unclear how the Tx Power and EiRP limits have been derived. Setting absolute power limits has a direct impact on the commercial viability of any deployment as well as imposing limitations to innovation scope. Any limits therefore need to be very carefully considered. The proposed limit of 24dBm EiRP for low power devices is too low in our opinion. The coordination process outlined in section 5 considers Tx power and propagation losses and lends itself well to assessing applications based on actual equipment performance. We would recommending setting a higher nominal limit for the low power class of equipment and

	assessing co-existence based on actual Tx Power provided on application. Typical, and financially viable, solutions for mid band Enterprise grade indoor base stations are capable of higher powers. We suggest setting a limit of 4W EiRP.
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.	Confidential? – N Please see answers to previous questions.
Question 13: (Section 5) Do you agree with our proposed coordination parameters and methodology? Please give reasons supported by evidence for your views.	Confidential? – N No specific comments regarding the technical coordination parameters. However, despite the technology neutrality being adopted, Dense Air encourage OFCOM to consider LTE and 5GNR coexistence. At present OFCOM proposes to lock sync to a legacy 4G frame structure, which precludes 5G New Radio technologies delivering lower latency services critical to a huge number of 5G use cases. In addition, 5G use cases beyond eMBB for MNOs, such as Industry 4.0, Connected Highways, Private Networks for Enterprise and Smart Cities are traditionally uplink centric. These solutions cannot be delivered using a mandated downlink centric frame structure as OFCOM proposes. We believe that spectrum holders should work together to agree what is the best frame structure for 4G and 5G and this should not be a matter for OFCOM to mandate. With regards the 2.3GHz band, we propose that the bandwidth could be expanded when considering indoor deployments where isolation from airborne MOD systems are significantly increased. In addition, further coordination with MOD involving agreed shut-down periods could be considered. The likely impact of such shut down periods would have minimal impact on the business case of many 2.3GHz use-cases.
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	Confidential? –N Dense Air views the shared and locally licensed bands for network densification delivering high

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?	data capacity in targeted locations (mostly indoor). This is most effectively delivered by deploying small (low power) cells in close proximity to the end users. Creating license rules to allow the use of AAS and Massive MIMO deployments on conventional cell sites (rooftops or towers) with high EiRP levels poses operator co-existence challenges as well as creating health and safety concerns in public areas. We request that low EiRP limits are considered (in the order to 5W) in order to encourage a deployment model that enables network densification and maximises overall network spectral efficiency.
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?	Confidential? – N No comment.
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.	Confidential? – Y [✂]
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.	Confidential? – N No comment.
Question 18: (Section 8) Do you agree with our proposal for the Local Access licence? Please give reasons supported by evidence for your views.	Confidential? – N Dense Air supports the concept of the Local Access License in principle. We see this as especially effective in liberating mid-band (2.xGHz and 3.xGHz) spectrum for use in areas where the spectrum does not fit the primary license holder's business. Band 7 (2.6GHz FDD) and Band 38 (2.6GHz TDD) are prime examples of where current license holders have very limited deployments. For the national MNO's, this spectrum is clearly a capacity infill tool, which has been tactically deployed in high usage locations. The Local Access License will allow this valuable spectrum asset to be used for other purposes in locations where the MNO's do not require a capacity uplift. However, it is hard to determine how this proposal could be effective. Economics typically determine when MNOs stop network because

	of a poor business case and a third-party will likely face the same issue. A three year business case for return on investment looks almost impossible for a neutral host operator or a private 4G / 5G network deployment.
Question 19: (Section 8) Do you have any other comments on our proposal?	Confidential? – N Dense Air have concerns relating to the motivation for the existing license holders to agree to Local License Applications. We would therefore encourage OFCOM to consider an incentive for existing license holders to cooperate in this process.
Question 20: (Section 8) What information should Ofcom consider providing for potential applicants in the future and why would this be of use?	Confidential? – N There are various public and commercial sources of spectrum usage data, which any serious applicant would need to source to build a business case. During the application process, the onus should be placed on the applicant to provide evidence that the spectrum is not utilised in that area and, if rejected, the current license holder to provide evidence that the spectrum is being suitably used.
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?	Confidential? – N Dense Air supports a minimum period, but believe that three years is too short to underpin a credible business case. We would recommend that the actual license period is agreed per application. We would like to understand OFCOM's view on the maximum license period that could be considered.
Question 22: (Section 8) Do you have any other comments on the proposed Local Access licence terms and conditions?	Confidential? – N No comments at this stage.
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.	Confidential? – N We understand that the fee is to cover OFCOM expenses and it is per application which can cover a geographic area with multiple planned base station sites. OFCOMs proposal is supported.