Huawei response to the Ofcom consultation: "Enabling opportunities for innovation"

Summary

Huawei welcomes the opportunity to comment on this important consultation on enabling opportunities for innovation.

Firstly, we appreciate Ofcom's very sensible intention to proceed with the award of national licences for the remaining portions of the 3400-3800 MHz European 5G primary band to enable the roll out of public mobile networks in the UK. We emphasise the importance of 80-100 MHz contiguous channels per mobile operator in order to deliver to UK citizens and consumers advanced 5G services that are competitive with those expected in many countries worldwide.

We also broadly welcome Ofcom's proposals to expand the availability of the 1800 MHz DECT guard band, and to make the 2390-2400 MHz and 3800-4200 MHz bands available for new users of wireless communication systems, which is the subject of the present consultation.

Specifically, we agree with Ofcom's view that the band 3800-4200 MHz can be suitable for fixed wireless access (FWA) and for local networks for the support of IoT applications including wireless industrial automation.

However, we note that FWA and IoT applications are two widely different use cases – both in terms of technical requirements and market maturity. As such, we question the merits of considering a single authorisation model for their accommodation in the 3800-4200 MHz band.

For this reason, we propose that:

a) Ofcom limits its proposed approach of shared access via individual per-location licensing (on a first-come-first-served basis) to only a *portion* of the 3800-4200 MHz band, the size of which could be determined based on additional investigations to better understand the spectrum needs of the relevant *vertical* use cases. We consider Ofcom's planned engagements with various sectors – including the upcoming event on "supporting wireless innovation in manufacturing and health" – to be important initiatives in this respect.

b) Ofcom maintains the existing approach of individual national licensing subject to per-location coordination with FSS/FS – consistent with the licence conditions applied to UK Broadband at 3925-4009 MHz – in the remainder of the 3800-4200 MHz band.

We also consider that the proposed in-block EIRPs for the low and medium power licence products are over-stringent. In particular, these would restrict the coverage of our low power pico-cell and medium power micro-cell base stations for channel bandwidths of 40 MHz or lower (i.e., 10, 20, 30, and 40 MHz). Furthermore, we consider that the proposed in-block EIRP limit in the medium power licence product is not suitable for the efficient deployment of FWA at 3800-4200 MHz.

We present our views with respect to the frame structure and alignment frameworks within the 3800-4200 MHz and the 2390-2400 MHz bands, as well as in relation to their adjacent mobile bands, namely 2350-2390 MHz and 3400-3800 MHz, respectively.

Finally, we seek clarification regarding certain elements of the proposed coordination processes, and also the authorisation of fixed/installed and nomadic terminal stations.

Consultation questions and our responses

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.

We understand that Ofcom proposes a single authorisation approach based on shared access to spectrum via individual per-area or per-location licensing on a first-come-first-served basis in all three bands. This is shown in Figure (1) below for the 3.8-4.2 GHz band.

We also understand that Ofcom proposes to itself coordinate the users of the bands – through its licensing tools and processes – in order to minimize the risk of harmful interference among new and existing users.

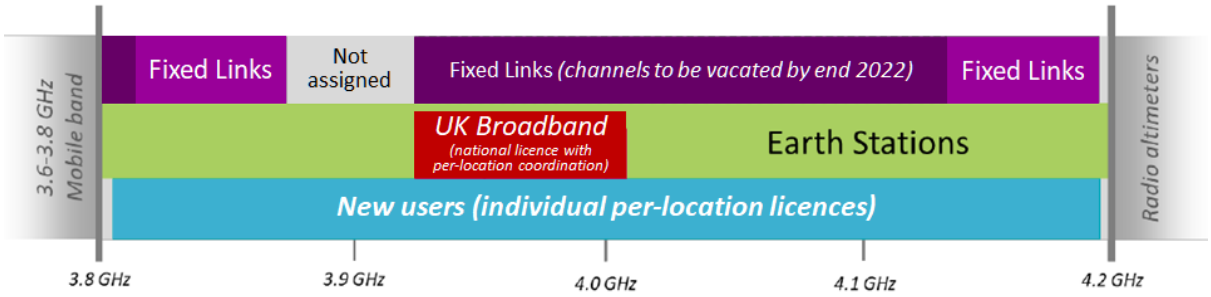

Figure 1. Ofcom's proposal for shared use of 3.8-4.2 GHz
via per-area/per-location licensing on a first-come-first-served basis.

To the extent that Ofcom does not consider the three bands as intended for the provision of national mobile networks, and only intended for communication networks with a limited geographic footprint, we agree that individual per-area/per-location licensing might be the appropriate approach for use of the bands.

However, in the context of the very large bandwidth available in the 3.8-4.2 GHz band, we are not convinced that the use of a single authorisation approach for the whole frequency range is the most appropriate approach.

We note that Ofcom highlights local private networks and fixed wireless access (FWA) as the two key uses of the 3.8-4.2 GHz band. But these are two widely different use cases, with different technical requirements, and which are at different levels of market maturity. As such, the imposition of a single authorisation model to accommodate both use cases is questionable.

Local private networks

Ofcom states (see Paragraph 3.14) that local private networks *"could be deployed by many different kinds of users for a wide range of purposes, including IoT devices"* and *"that 5G technology could support ultra-reliable, low-latency communications which may be needed for some industrial uses such as wireless automation, control and monitoring"*.

We agree with the importance of 5G for provision of URLLC in local networks for IoT use cases such as wireless industrial automation in factories. We have also stated on a number of occasions in the past that the frequency range 3.8-4.2 GHz can be important for so-called Industry 4.0 use cases, especially given that the band benefits from an eco-system in 5G equipment (due to deployments of 5G for mobile broadband in this band in other regions of the world).

However, we also recognise that IoT use cases – including wireless industrial automation – are still in their early days, and there is considerable uncertainty[1] with regards to the frequency and amount of bandwidth required for such applications.

Fixed wireless access

FWA, on the other hand, is a more mature use case. We note that UK Broadband already holds a national licence for 3925-4009 MHz, subject to per-location coordination by Ofcom for the protection of existing FSS and FS.

We expect to see a growing market for the provision of FWA via 5G, which as Ofcom states in Paragraph 3.14: *"… could offer more cost-effective delivery of wireless broadband to consumer premises, particularly in rural areas where fibre is not available or is too expensive to install".*

However, we are not convinced that the shared access framework proposed by Ofcom is the best approach for the efficient provision of FWA in the UK. This is for two reasons:

1) The issuing of per-location licences on a first-come-first-served basis among a wide range of stakeholders may create uncertainty for a FWA operator who wishes to deploy in a number of different locations in the UK. That is to say, a FWA operator cannot be sure that spectrum will not be first licensed to another party at a target location. Such uncertainty would have a negative impact on business planning and incentives for investment.

2) We note that the maximum permitted in-block EIRP for the proposed medium power licence product – presumably intended for FWA among other uses – falls well short of the +53 dBm/MHz specified in UK Broadband's existing licence for 3925-4009 MHz. This will negatively impact the competitiveness of future deployments of FWA by new licensees (see also Question 11).

[1] This uncertainty is further exacerbated by the fact that there will be opportunities for licensed access to large amounts of bandwidth at 26 and 40 GHz, not to mention licence exempt access to 57-71 GHz in Europe. Note that due to high building penetration loss at mm-wave frequencies, licence exempt use of 57-71 GHz by a local network within the indoor confines of a building or factory will be essentially as free from harmful interference as for licensed access.

Our proposal for an alternative approach

In light of the above arguments, we propose that

c) Ofcom limits its proposed approach of shared access via individual per-area or per-location licensing (on a first-come-first-served basis) to only a *portion* of the 3.8-4.2 MHz band, and that

d) Ofcom maintains the existing approach of individual national licensing subject to per-location coordination with FSS/FS – consistent with the licence conditions applied to UK Broadband at 3925-4009 MHz – in the remainder of the 3.8-4.2 GHz band.

Our proposed approach is illustrated in Figure (2) below.

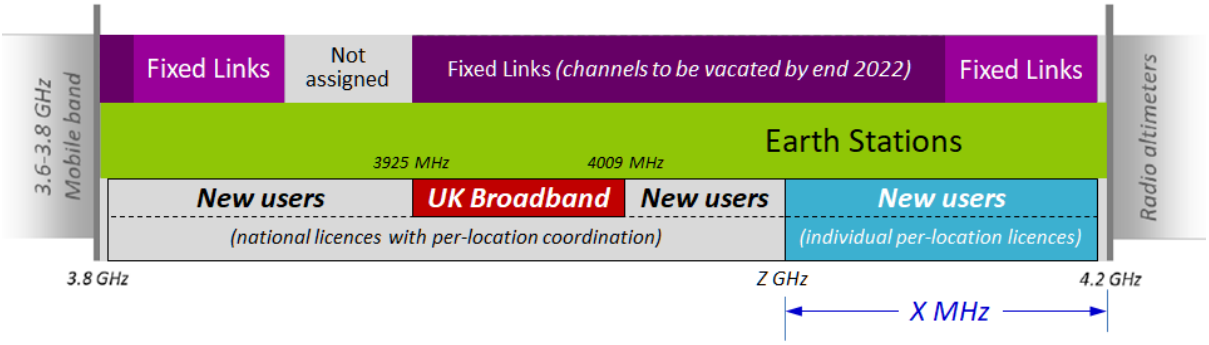

Figure 2. An alternative proposal with shared access via per-area/per-location licensing on a first-come-first-served basis over a portion of 3.8-4.2 GHz, with the remainder licensed nationally subject to per-location coordination as applied today to UK Broadband at 3925-4009 MHz.

We consider that this proposed approach would better address the two key use cases which Ofcom has highlighted for 3.8-4.2 GHz. The frequency Z GHz at the boundary between the two proposed licensing frameworks can be decided based on the outcome of investigations to better understand the spectrum needs for local networks, especially for challenging use cases such as wireless industrial automation. We consider Ofcom's planned engagements with various sectors – including the upcoming event on "supporting wireless innovation in manufacturing and health" – to be important initiatives in this respect.

Question 2: (Section 3) Are there other potential uses in the three shared access bands that we have not identified?

Ofcom highlights local private networks and fixed wireless access (FWA) as two key uses of the 3.8-4.2 GHz band. We agree with this assessment, although we have concerns with regards to Ofcom's proposed authorisation approach and its impact on the provision of FWA (see Question 1).

Question 3: (Section 3) Do you have any other comments on our authorisation proposal for the three shared access bands?

We recognise Ofcom's high competence in the area of spectrum management, and its database tools for automated coordination and interference management. We are encouraged to see that Ofcom is itself taking on the responsibility of coordinating existing and new users. We consider that this is essential to ensure that the risk of harmful interference is minimised, and is a pragmatic approach.

Licensed access to spectrum brings with it the benefits of guarantees in quality of service, which is a result of managed interference among different users. Such guarantees are important for use cases such as MBB and FWA, but are even more critical for ultra-reliable low latency communications envisaged in the 3.8-4.2 GHz band for wireless industrial automation and so-called Industry 4.0 use cases.

It is important for such users to be confident that the interference environment in which they operate is overseen by the regulator, and that any interference issues will be addressed in a fair and non-discriminatory manner.

Question 4: (Section 3) What is your view on the status of equipment availability that could support DSA and how should DSA be implemented?

We urge caution with regards to the use of the term "dynamic spectrum access (DSA)".

The term DSA has its origins in the notion that secondary users can access spectrum in an opportunistic (statistical) manner, at time scales which may extend down to milliseconds or lower. This is precisely the way in which technologies such as Wi-Fi access spectrum through the use of contention-based medium access control protocols.

We do not consider that DSA is an appropriate term in the context of licensed spectrum access, especially in the context of use cases which require ultra-reliable low-latency communications where *dynamic* access to spectrum on an opportunistic/statistical basis is not adequate for meeting key radio performance targets. For this reason, we consider that *dynamic* (and by definition, variable) access to spectrum is a disincentive to investment for the use cases considered in this consultation.

We consider that "database assisted access/coordination" is a more accurate and descriptive term in the context of shared use of licensed spectrum.

We note that Ofcom already implements database assisted licensed access to spectrum. A very pertinent example is the licensing of PMSE at UHF, where users can register their request on-line for access to spectrum at a specific location and for a specified period of time, and are then issued with an appropriate licence to access spectrum. The technical conditions for the licences are the result of database calculations which minimise the likelihood of harmful interference with other licensees. Ofcom is responsible for thousands of such licences at any given time.

We note that the proposed per-area or per-location licensing in the three shared access bands can be handled in a similar manner by Ofcom databases.

We expect that the number of per-area or per-location licences in the three shared bands is likely to be low for a number of years, and is unlikely to approach the number of users already coordinated by Ofcom in other bands for some time.

Should the number of per-area or per-location licences grow to the extent that they can no longer be efficiently managed by Ofcom's databases, Ofcom may choose to outsource the coordination to an external party.

Given the above, we do not foresee the need for any special additional functionality in the radio equipment in order to support database assisted access in the three 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.

We seek a number of clarifications with regards to the description of the medium power licences in Section 4:

- Paragraph 4.20 states that for the 1800 MHz DECT guard band mobile/nomadic terminal stations will be licence exempt. Nothing is said with regards to fixed/installed terminal stations. Will these be individually licensed? And will these be subject to the same coordination measures as base stations? These require clarification.

- There is no explicit explanation of the approach to the licensing of terminal stations at 2300 MHz, although Figure (5) of the consultation document suggests that fixed/installed terminal stations will be licensed while mobile/nomadic terminal stations will be licence exempt. This requires confirmation. It is also not clear whether fixed/installed terminal stations will be subject to the same coordination measures as base stations.

- Paragraph 4.21 states for the 3.8-4.2 GHz band that:

  "We propose to make the medium power licence product in the band available for fixed services only, and to authorise both the base station and the associated fixed and installed terminal stations in the same licence".

  It is not clear whether the fixed/installed terminals stations will be subject to the same coordination measures as base stations, although the indication in later sections is that they are not. There is also no mention of nomadic terminal stations. Are these excluded from medium power licences at 3.8-4.2 GHz? Annex A9 to the consultation suggests otherwise. These require clarification.

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.

As discussed under Question (2), we note that the maximum permitted EIRP specified for medium power licences falls well short of existing limits for deployments of FWA in 3925-4009 MHz. This will negatively impact future deployments of FWA by new licensees. As such, we do not consider that the proposed medium power licence conditions are suitable for the efficient deployment of FWA at 3.8-4.2 GHz (see also Questions 1 and 11).

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.

We understand that Ofcom proposes to limit medium power licences to rural areas, as defined by specific thresholds relating to the geographic distributions of population.

We recognise the importance of FWA in rural areas. However, we question whether exclusion of FWA in urban and suburban areas is the right approach in the 3.8-4.2 GHz band.

As outlined in our response to Question (1), we propose an alternative approach whereby low/medium power per-area or per-location licences – as described in the consultation – are issued on a first-come-first-served basis in an X MHz portion of the 3.8-4.2 GHz band, with the remainder of the band licensed on a national basis subject to per-location coordination, as currently applied in the UK Broadband licence; i.e., without any restrictions to deploy in rural areas alone.

Question 8: (Section 4) Do you have other comments on our proposed new licence for the three shared access bands?

No comment.

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.

No comment.

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?

No comment.

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.

<u>In-block power limits at 3.8-4.2 GHz</u>

We understand that the maximum permitted base station in-block EIRPs in the proposed *low power* and *medium power* licence classes are 24 and 42 dBm per sector per carrier respectively for carrier bandwidths of up to 20 MHz, or 18 and 36 dBm/(5 MHz) for larger carrier bandwidths.

We would like to provide the following feedback in relation to the above limits:

1) Ofcom's proposed in-block EIRP limit for the low power licence product would restrict the coverage of our low power pico-cell base stations for channel bandwidths of 40 MHz or lower (i.e., 10, 20, 30, and 40 MHz).

2) Ofcom's proposed in-block EIRP limit for the medium power licence product would restrict the coverage of our medium power micro-cell base stations for channel bandwidths of 40 MHz or lower (i.e., 10, 20, 30 and 40 MHz).

3) Ofcom's proposed in-block EIRP limit in the medium power licence product falls well short of the maximum permitted EIRP of +53 dBm/MHz specified in UK Broadband's existing licence for 3925-4009 MHz. As such, we consider that the proposed in-block power limit is not suitable for the efficient deployment of FWA at 3.8-4.2 GHz (see also Questions 1 and 6).

We would appreciate it if Ofcom could clarify the rationale behind the proposed limits, and could account for the above feedback in any revisions to the proposals.

Frame structure and alignment

In Paragraphs 5.11 and 5.12, Ofcom states the following for the 3.8-4.2 GHz:

"In order to facilitate sharing between new users in this TDD band, we propose to impose a frame alignment and frame structure requirement on any authorised outdoor base stations. We propose a 3:1 frame structure which is compatible with both LTE and 5G NR. In addition, if any other licensees of the 3.8-4.2 GHz band demonstrate that they are suffering harmful interference in a shared indoor environment, then the user must also comply with these frame alignment and frame structure requirements."

"A user may deviate from the required frame structure (but must still align the start of the frame at a common time) provided that they also apply a more restricted emission mask outside of the authorised bandwidth."

We seek clarification regarding some of the above elements. For example, it is not fully clear whether frame alignment and use of the same frame structure are *mandatory* for outdoor deployments. That is to say, it is not clear if the option of deviating from the required frame structure applies to all deployments or only those in *shared indoor environments*. It is not fully clear if the frame alignment framework should also apply in relation to the 3400-3800 MHz range. It is also not fully clear whether the measures with respect to *shared indoor environments* relate only to indoor victim deployments or also outdoor victim deployments.

We present our own position on this topic below, where for brevity we use the term "synchronisation" to mean frame alignment (time alignment of UL and DL transmissions) and use of the same preferred frame structure:

1) We consider that it is essential for outdoor deployments in 3.8-4.2 GHz to be synchronised in order to avoid base-to-base and terminal-to-terminal interference.

2) For the case of indoor deployments in 3.8-4.2 GHz, we recognise that these can be unsynchronised with respect to outdoor deployments in 3.8-4.2 GHz if the indoor deployments implement site engineering measures which mitigate mutual base-to-base and terminal-to-terminal interference with the outdoor deployments. If any outdoor licensee in 3.8-4.2 GHz demonstrates that it is suffering from harmful interference due to lack of synchronisation of an indoor deployment, then the indoor licensee that is responsible for the harmful interference must either implement further site engineering measures or synchronise with the outdoor licensee which suffers from interference[2].

[2] Such coexistence scenarios were deeply investigated in the draft ECC Report 296, Section 4.4 and Annex 7.

3) For the case of indoor deployments in a shared indoor environment in 3.8-4.2 GHz, we recognise that these can be unsynchronised with respect to each other if they implement radio engineering measures which mitigate mutual base-to-base and terminal-to-terminal interference. If any licensee in the shared indoor environment demonstrates that it is suffering from harmful interference due to lack of synchronisation of an indoor deployment, then the indoor licensee that is responsible for the harmful interference in the shared indoor environment must synchronise with the licensee which suffers from interference, or arrive at some form of mutually agreed arrangement.

We consider that a similar framework should be adopted in the 2390-2400 MHz band.

We address in Question (15) the issue of frame structure and time alignment with respect to the 3400-3800 MHz and 2350-2390 MHz bands.

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.

See our response to Question (11) regarding the stringent in-block EIRP limit for the medium power licence product at 3.8-4.2 GHz in relation to FWA.

Question 13: (Section 5) Do you agree with our proposed coordination parameters and methodology? Please give reasons supported by evidence for your views.

In Paragraphs 5.51 and 5.52, Ofcom states that it intends to assume omnidirectional antennas in its coordination of low power and medium power licences. We consider that in many circumstances the base stations which are expected to be deployed in the proposed three shared bands will use directional (fixed or adaptive) antennas. Such directional antennas may be installed to minimise the impact of interference to other non-synchronised communication systems or other services. As such, spectrum availability at a given location might be far greater than that which might be calculated based on the assumption of omni-directional antennas. We propose that Ofcom accounts for directional antennas in its coordination processes. See also our response to Question (14) in relation to active antenna system (AAS) technologies.

In Paragraphs 5.58 and 5.59 Ofcom states in the context of low power licences:

"We therefore propose that in our coordination calculations our "proxy" base station will have an additional 2 dB EIRP to account for these effects. This applies to both indoor and outdoor base stations."

"In a similar way, when considering the proposed base stations as potential victims of interference from other users, we need to take account of the building entry losses for indoor-only base stations and also the deployment nearer to the interferer within the authorised area. We don't need to take account of any aggregation on the receive side and therefore we assume only half of the 2 dB impact. This results in a proposed receive relative gain of +1 dB."

We would appreciate further details on how the above coordination parameters values have been arrived at.

It is also not immediately clear whether fixed/installed terminals will be subject to the same coordination process as base stations.

Figure 15 of the consultation document indicates that the party requesting a licence would provide Ofcom with a number of deployment parameters (e.g., location, EIRP, channel bandwidth, antenna height and antenna gain, in the case of medium power licences) and that the outcome of Ofcom's coordination process would be a binary yes/no feedback to the requesting party.

It might be more helpful to the requesting party if Ofcom could provide a more granular feedback. For example, instead of "cannot assign channel", a more helpful feedback might be "cannot assign channel based on requested parameters, but an X MHz channel is available for an EIRP of P dBm".

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?

We consider that future products and deployments in the three proposed shared bands – and especially in 3.8-4.2 GHz – will use active antenna system (AAS) technologies. This would have implications in relation to the low power and medium power licences proposed by Ofcom in the UK.

We therefore suggest that Ofcom considers the regulatory limits specified in ECC Decision (11)06 as revised in October 2018 to account for AAS base stations in 3.8-4.2 GHz.

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?

We understand that Ofcom assumes that deployments above and below 3.8 GHz will not be synchronised, and that as such, a guard band of 5 MHz would mitigate any resulting mutual base-to-base interference across the 3.8 GHz boundary.

We note that – as acknowledged by Ofcom – this assumes that base-to-base interference is dominated by spectral leakage and not receiver selectivity. We also note that the analysis does not account for the issue of terminal-to-terminal interference.

For the above reason, we consider that the approach we propose in Question (11) in relation to synchronisation (frame alignment and use of the same frame structure) for deployments in 3.8-4.2 GHz should also be applied in relation to deployments below and above 3.8 GHz. Specifically:

1) We consider that it is essential for outdoor deployments in 3.8-4.2 GHz to be synchronised with outdoor deployments in 3.4-3.8 GHz in order to avoid base-to-base and terminal-to-terminal interference. We note that Ofcom is proposing the same

preferred frame structure above and below 3.8 GHz, and that this would facilitate the synchronisation process.

2) For the case of indoor deployments in 3.8-4.2 GHz, we recognise that these can be unsynchronised with respect to outdoor deployments in 3.4-3.8 GHz if the indoor deployments implement radio engineering measures which mitigate mutual base-to-base and terminal-to-terminal interference with the outdoor deployments. If any outdoor licensees in 3.4-3.8 GHz demonstrates that it is suffering from harmful interference due to lack of synchronisation of an indoor deployment in 3.8-4.2 GHz, then the indoor licensee in 3.8-4.2 GHz that is responsible for the harmful interference must either implement further site engineering measures or synchronise with the outdoor licensee in 3.4-3.8 GHz which suffers from interference[3].

3) For the case of indoor deployments in a shared indoor environment in 3.8-4.2 GHz and in 3.4-3.8 GHz, we recognise that these can be unsynchronised with respect to each other if they implement radio engineering measures which mitigate mutual base-to-base and terminal-to-terminal interference. If any licensee in the shared indoor environment demonstrates that it is suffering from harmful interference due to lack of synchronisation of an indoor deployment, then the indoor licensee that is responsible for the harmful interference in the shared indoor environment must synchronise with the licensee which suffers from interference, or arrive at some form of mutually agreed arrangement.

We consider that a similar framework should be adopted in relation to the 2390-2400 and 2350-2390 MHz bands.

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.

No comment.

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.

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.

No comment.

Question 19: (Section 8) Do you have any other comments on our proposal?

No comment.

[3] Such coexistence scenarios were deeply investigated in the draft ECC Report 296, Section 4.4 and Annex 7.

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

No comment.

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?

No comment.

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

No comment.

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.

No comment.

■