Huawei Response

To Ofcom Public Consultation document:

"Mobile Data Strategy"

INTRODUCTION

Huawei is glad to provide feedback on this very important consultation and fully agrees with Ofcom on the strategic, economic and social value of the radio spectrum, and on the key contribution from the mobile broadband sector. Huawei greatly appreciates how Ofcom has assessed the growing demand for mobile data and the accurate methodology that has used to identify the frequency ranges, priorities and associated timelines.

Huawei recognizes and appreciates the key role of Ofcom in consistently proposing inspiring and future looking proposals in this field. This feedback is intended to assist Ofcom on the finalization of the priorities for the various frequency ranges as well as on the associated possible actions.

CONSULTATION QUESTION

Question 1: Have we correctly identified the future characteristics of mobile data demand?

FEEDBACK

Huawei had approached this question in a slightly different way ending up with similar information to Ofcom. We asked the question: "What are the drivers for the predicted increases in mobile traffic?"

Mobile broadband traffic has grown enormously in recent years. This is due to the emergence and proliferation of new types of mobile broadband devices – smartphones, tablets and dongles – which have enabled people to use data-hungry software 'apps', higher-definition video, video conferencing, in combination with social networking, and growing Machine-to-Machine (M2M) traffic. The ongoing introduction of LTE technology in the world's leading markets is stimulating further demand for mobile broadband services from the more advanced end user devices. The major driving forces of mobile data traffic growth are summarised in the following figure.

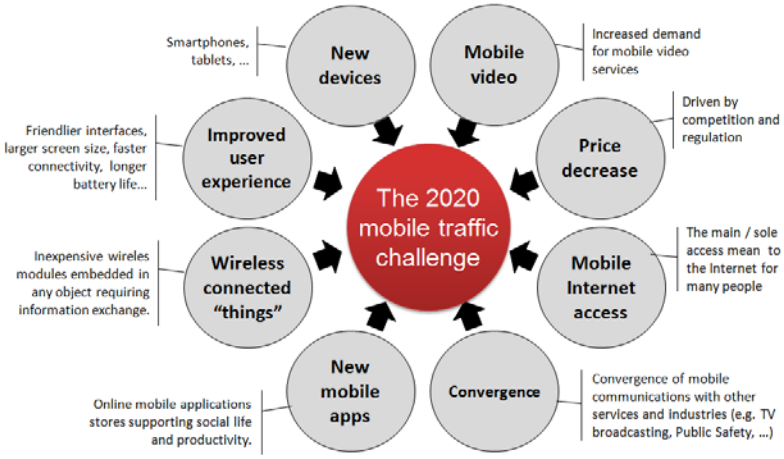

Figure 1: Drivers for the mobile broadband traffic growth.

In relation to the continuous growth of mobile data traffic, there are a few other aspects of mobile data demand that Huawei believes important to be considered by the Mobile Data Strategy. In the future end users will demand not only large amount of mobile data traffic, but also new mobile applications with good quality of usage experiences. Some examples:

- Ultra high data rate will be required by some new applications, e.g. accessing to high quality video or cloud computing service in mobility environment. The number of users of this type of applications would be higher in dense urban area which could create a challenge to mobile communications systems;
- Extremely low latency will be required by some new applications, e.g. certain e-health real-time applications but also real-time remote working for professionals on the go (train / car) who still need access to corporate informational servers or cloud service and synchronize their mobile terminals without noticeable delay.

Huawei is confident that new applications with these types of requirements will come within the time frame that the Mobile Data Strategy is targeting. In fact some prototype applications have already been developed but with only limited end user experience at this time.

A Huawei study shows that the new services and applications that are expected to be delivered on future mobile communication systems (e.g. 5G) will have complex performance requirements:

- Latency from one millisecond to a few seconds;
- Always-on users per cell from a few hundred to several millions;
- Duty cycles from few milliseconds to entire days;
- Signaling loads from less than 1% to almost 100%.

The "5G HyperService Cube" shown below provides a multi-dimensional overview in terms of throughput, latency and number of connections required for the many types of services 5G networks will need to run (see also the Huawei whitepaper "5G: A Technology Vision"). [1]

[1] Huawei whitepaper[1] "5G: A Technology Vision" is available at:
www.huawei.com/ilink/en/download/HW_314849

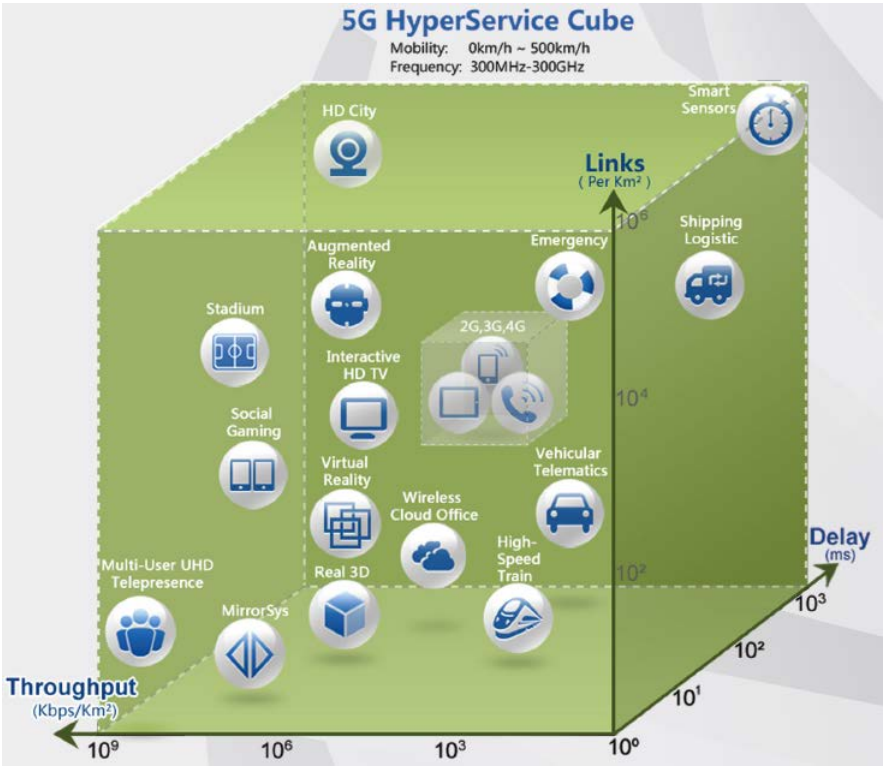

Figure 2: Huawei whitepaper on "5G: A Technology Vision"

The spectrum bands currently assigned to mobile network operators cannot meet all these requirements even if the spectrum efficiency of mobile communication networks will improve thanks to continuous technology innovation. Spectrum bands providing very wide contiguous bandwidths are required to meet those requirements. This is the reason why this emerging characterization of the mobile data demand should be considered by the Mobile Data Strategy.
This matter was also addressed within the EU FP7 METIS Project. [2]

CONSULTATION QUESTION

Question 2: Do you agree that there is a prospect of significant continuing growth in demand for mobile data services?

FEEDBACK

With reference to the growing demand for mobile data, Huawei fully supports Ofcom analysis on the end user driven mobile broadband traffic growth and on the motivations behind it.

While nobody can precisely predict the future demand for mobile data traffic, virtually all the studies and models are predicting a rapid growth in demand, with a strong acceleration expected by 2025.

Another key aspect that needs to be considered together with the drivers which have been highlighted in our response to Question 1 is represented by the large growth in vertical opportunities as various sectors are looking at the exploitation of the benefits from the wireless connectivity that

[2] www.metis2020.com/

can be provided from the mobile industry with its associated fast technology developments and economies of scale.

Figure 3: The "Everything on Wireless" opportunity.

Huawei's own predictions are in line with the latest ITU-R traffic growth estimations for 2015, as reported in Report ITU-R M.2243. For the longer term, Huawei projects that the growth of mobile data traffic will continue to be strong even up to 2020 and beyond. In addition to dramatically higher average data consumption values, future spectrum availability will need to address high peak data rate requirement from specific users, as well as user demand for consistent quality of experience.

The figure below (from Report ITU-R M.2290) shows the mobile traffic forecasts towards 2020 by extrapolation. The two traffic growth ratios of 44-fold and 80-fold were used to define the market attributes for lower and higher user density settings, which have been used by the ITU-R to estimate future spectrum requirements for terrestrial IMT.[3]

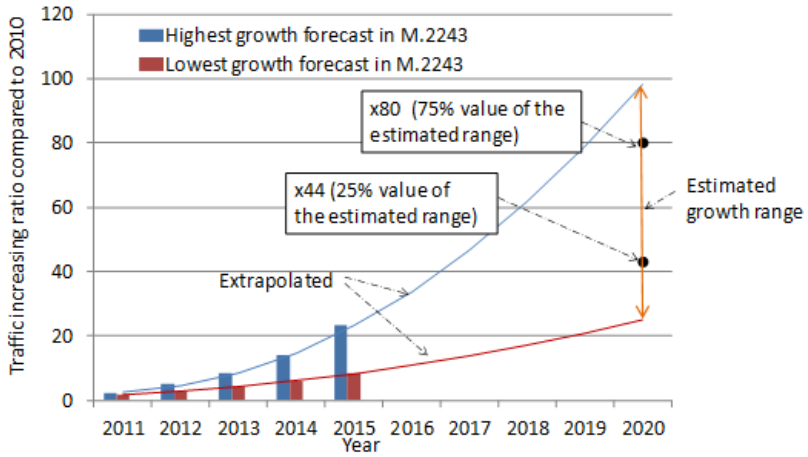

Figure 3: ITU-R traffic growth forecasts (source: Report ITU-R M.2290)

[3] ITU-R spectrum requirement estimation: 1960MHz to be identified for IMT by 2020 in the "higher market setting", 1340MHz "in the lower market setting" by 2020.

While technology innovation will certainly address today's increasing demand (enhancements on the air interface will lead to increased spectral efficiency, topology enhancements will lead to a higher degree of frequency reuse across the coverage area), it is important to highlight that such innovation will trigger the availability of more performing devices which will trigger new demand. Technology innovation and the market are therefore part of a virtuous cycle that continuously delivers new value to the end users (whether citizens or "machines").

CONSULTATION QUESTION

Question 3: Have we identified all the challenges in realising future growth in citizen and consumer benefits from use of mobile data services and do you have any comments on the nature or the scale of the challenges we have identified?

FEEDBACK

Huawei shares the view on the challenges that have been identified in the Mobile Data Strategy.

In addition to continuous strong growth of mobile data traffic, some future mobile applications and services will pose stringent requirements on mobile communications, e.g. ultra high data rate and extreme low latency, which may represent severe challenges in fully realizing both the citizen and consumer benefits.

Huawei proposes the following amendment to the last section of the "Challenges" paragraph in the Mobile Data Strategy:

1. Change the title from "Improving coverage" to "Improving coverage and end users experience".
2. Add the following paragraph after Section 3.31:

   In the future some new mobile applications may require ultra high data rate or extremely low latency from the mobile communications, in order to provide the required or improved quality of user experience. Even considering the potential technology improvement in that time frame, those extreme requirements could not be met without assigning very wide bandwidth spectrum bands to mobile communications.

CONSULTATION QUESTION

Question 4: Have we correctly identified all the areas where Ofcom has a role in addressing the challenges of growing demand for mobile data services?

FEEDBACK

With reference to Ofcom's role in addressing the challenges of growing demand for mobile data services:

Given the complexity and length of the spectrum harmonization process which needs to be carried out on a global scale, it is of key importance for the more active administrations to define a long term strategy for the spectrum resource, defining concrete actions that need to be concretely prepared from today while maintaining flexibility for the non-fully predictable future. This principle

certainly applies to the UHF band (470-694 MHz), some portions of the L-Band (within the 1350-1518 MHz range) and to the C-Band (3600-4200 MHz) where the importance of today's users require an in-depth analysis and longer term planning.

CONSULTATION QUESTION

Question 5: Do you agree that the main additional area that our mobile data strategy needs to address is in relation to potential future spectrum options?

FEEDBACK

Yes. Huawei believes that potential future spectrum options are a number one priority and, whilst WRC-15 requires the primary focus, we are pleased that Ofcom has already started considering the topics for the WRC-18 Conference.

CONSULTATION QUESTION

Question 6: "Is Ofcom doing all that it needs to do in other areas identified as being relevant to the mobile data challenge?"

FEEDBACK

Yes.

CONSULTATION QUESTION

Question 7: Do you agree with our high-level assessment of likely technology and topology trends and their implications for future spectrum use? We are particularly interested in views on:

a) the potential demand for spectrum above 10 GHz;

b) the potential impact of integrating broadcast capability into mobile networks;

c) whether the technical and commercial challenges of supporting additional frequency bands in mobile devices drives interest towards bands close in frequency to existing bands;

d) the relative importance of large contiguous blocks of spectrum versus aggregation of smaller blocks

FEEDBACK

With reference to the Technology and network topology trends and their implications:

As for the potential demand for spectrum above 10 GHz: such higher frequencies can allow availability of very wide contiguous bands for mobile broadband (i.e. 1GHz bandwidths and beyond). Such spectrum availability, combined with the future availability of spectrum in the range below 6GHz, will help to address the new services which have been described in our answer to Question 1. Huawei supports further studies on the spectrum demand above the 10GHz range: such studies should target the global allocation of appropriate spectrum to mobile and identification for IMT at the future WRC-18 Conference.

The potential impact of integrating broadcast capability into mobile networks is addressed within our feedback to Question 11.

Huawei agrees with Ofcom on the trend for which lower frequencies will always remain fundamental to provide ubiquitous coverage while higher frequency spectrum and shared use of spectrum will play a larger role in the future. Demand for spectrum where wider channel bandwidths can be supported is likely to increase.

Cloud based networking is an additional trend that should be explicitly addressed in relation to the impact that it will have on the traffic volumes associated the end users applications.

As previously stated, an additional aspect to be considered is the positive impact that the fast technology evolution at network level (e.g. LTE-A enhancements and 5G), and at device level, will have on the traffic demand growth.

CONSULTATION QUESTION

Question 8: Are there any additional technology or topology trends that we need to consider that could have an effect on spectrum use?

FEEDBACK

See our feedbacks to Question 1.

CONSULTATION QUESTION

Question 9: Do you agree with the short list of bands we have identified for more detailed consideration?

FEEDBACK

Huawei agrees with the shortlisted bands.

CONSULTATION QUESTION

Question 10: Do you agree with our methodology for prioritising potential bands for mobile data use?

FEEDBACK

Huawei agrees on the adopted methodology in broad terms.

Ofcom bands prioritization has a direct link[4] with the expected bands availability timelines (e.g. the medium-high priority bands, like the 3800-4200 MHz range, are expected by 2025, the medium priority bands are expected starting from 2030): while understanding the logic, we believe that there are very important actions that leading administrations should already be considering today in order to enable appropriate spectrum availability even in 5-15 years time frame.

CONSULTATION QUESTION

[4] Accoring to Ofcom consultation document "For our scenarios analysis we have assumed that the proposed high priority bands are all available from 2020; our medium – high priorities - by 2025; and our medium riorities by 2030. We recognise there is significant uncertainty over the potential future timings of release."

Question 11: Do you agree with our provisional assessment and the results of our band prioritisation?

FEEDBACK

The following paragraphs provide Huawei suggestions on the frequency ranges prioritizations which are summarized in the table below.

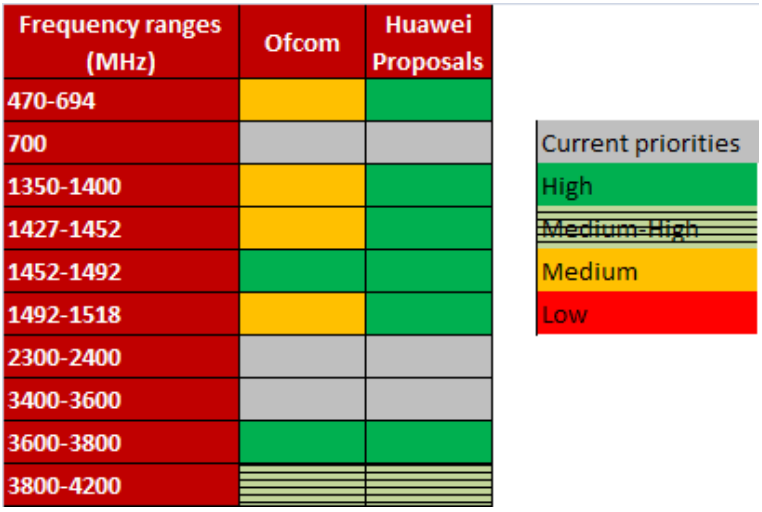

Figure 4: Summary of Huawei proposals on frequency ranges prioritization.

High priority should be assigned to the 470-694 MHz range:

Ofcom has correctly identified the huge potential that this portion of spectrum would represent for the development of mobile broadband services. Beyond the excellent contribution this range would provide in terms of broad coverage with high capacity, the adjacency of this frequency range to other bands (namely, the 450-470 MHz and 694-960 MHz bands) which have already been identified for IMT for ITU-R Region 1 would facilitate the implementation of mobile broadband networks in the 470-694 MHz range. Site infrastructure synergies could be exploited and common RF components could be reused (such as base stations' amplifiers and antennas).

From the technological perspective, mobile technologies already have the capabilities to become the converged network supporting both broadcasting and MBB services. LTE eMBMS can provide both linear and non-linear TV services (such as for Video on Demand), including in a mobile environment.

While Huawei also understands the issues behind a possible identification of this frequency range in the short/medium term, bandwidth-hungry TV services, such as ultra-high definition television (UHDTV) and three-dimensional television (3DTV), will increasingly rely on other available platforms, such as conventional copper and fibre-optic lines (xDSL, PON, etc.), as well as satellite. There is a clear need on the broadcasters side to address mobile end user devices such as smartphones and tablets with their TV services (including linear and non-linear TV).

Europe's transition from analogue TV to digital terrestrial television (DVB-T) was the key enabler for the availability of the 800MHz band (790-862 MHz) for mobile broadband services. Similarly, the transition to more advanced broadcasting schemes and technologies (single-frequency networks,

the DVB-T2 signal transmission standard and newer video compression schemes) would significantly reduce broadcasting spectrum requirements and facilitate the convergence process.

End-user behavior is converging. Today, it is all about seamless video content distribution across multiple devices (TV sets, smartphones, tablets, etc.) and across multiple distribution platforms (wireless terrestrial, wired terrestrial and satellite). Broadcasters and mobile broadband operators would certainly benefit in the longer term from a gradual elimination of redundant wireless terrestrial distribution platforms by moving towards a common and flexible platform. Once such strategic decisions have been made, spectrum decisions in the 470-694 MHz will become a straightforward consequence.

Huawei believes that important decisions could be made in the shorter term in order to enable such convergent/cooperative scenarios in the longer term: a co-primary allocation of the Mobile service (and possible IMT identification) with the existing Broadcasting service during the WRC-15 conference is seen as an appropriate, non binding[5], step forward. The Mobile allocation will open the opportunity to study in detail the development of the new and flexible convergent/cooperative scenarios providing linear or non-linear video services at anytime.

The highlighted transition will involve significant changes within both very large industries: it will require a forward looking plan which has to start as soon as possible in order to guarantee a smooth evolution path for both industries.

Medium-high priority should be maintained for the 3800-4200 MHz range[6]:

The 3800-4200 MHz in combination with the 3400-3800 MHz range represents a unique opportunity for the evolution of mobile broadband networks:

- A unique high capacity licensed band (the largest amount of contiguous available spectrum below 5GHz): allowing wide contiguous licensed spectrum (i.e. 100MHz contiguous channels), enabling higher throughputs, end user Quality of Experience (QoE) also at macro cell edge, appropriate for HETNET layers (cooperating layers of small cells and macro cells in urban / suburban areas);
- "E2E spectrum" for small cells: enabling access and (self) backhaul within the same band, flexibly, providing focused coverage (100s metres coverage radius) with high frequency reuse (i.e. enhanced spectrum efficiency);
- Allowing full exploitation of LTE-A capabilities: aggregation of carriers belonging to macro cell layer and small cell layer (TDD & FDD), full implementation of 3GPP Rel. 12 "small cell enhancements" (to be frozen by Jun '14).

In line with extensive discussions taking place across the globe on the future utilisation of the 3400-4200 MHz range, Huawei believes that the identification of the 3800-4200 MHz band for IMT

[5] The 470-698 MHz range was allocated to Mobile services on a co-primary basis in Asia-Pacific (ITU-R Region 3) several years ago enabling future potential opportunities to harmonise the band globally in the future while not determining any switch-off the broadcasting networks nor IMT rollouts in those frequencies.

[6] More detailed information on the sharing between IMT and FSS services was provided by huawei in its recent submission for Ofcom "Spectrum management strategy" public consultation.

would place Europe in a leading role with a forward-looking strategy for the expansion of mobile broadband services.

Recognizing the significant FSS rollouts in the 3600-4200 MHz range, depending on the specific case, several options are available to ensure smooth coexistence between mobile broadband and FSS systems in different situations:

- Updated FSS vs. IMT coexistence analysis should be considered during the implementation of the coordination process, accounting for the latest channel models, the actual FSS link budget and Earth stations characteristics;
- Ad hoc radio planning, with the possible adoption of additional filtering and shielding;
- Gerographic separation: facilitated by the fact that FSS ES installations are situated in suburban or rural areas, while LTE-A systems operating in the 3400-4200 MHz band will more likely focus on suburban and rural coverage;
- Segmentation: a limited number of cases might require parts of this frequency range for the use of incumbent services, but the sheer size of this combined frequency range makes band segmentation possible, addressing the specific local FSS needs.

High priority should be assigned to the 1350-1400, 1427-1452, 1492-1518 MHz ranges:

Huawei agrees on the need to look at the opportunities that may be provided by the combination of the largest possible number of blocks within the 1350-1518 MHz range, starting from the 1452-1492 MHz range that has already been harmonized at European level for mobile broadband supplemental downlink.

The 1350-1518 MHz range would provide some key benefits such as a reasonable balance between coverage and capacity and considerable potential towards global harmonization given the already existing allocations to Mobile service (the 1350-1400 MHz portion of the band is already allocated to Mobile service in Europe, the Middle East and Africa; the 1452-1492 MHz range can be used in about 50% of countries in the world - see response of Question 15).

In the 1300-1400MHz band, the 1300-1350 MHz sub-band is allocated inter-alia to the aeronautical radio navigation service on a worldwide basis. It is heavily used for long-range primary surveillance radars supporting, among other applications, air traffic control in the en-route and terminal environments and as such is considered as carrying out an essential safety of life service, recognized by the International Civil Aviation Organization (ICAO) and ITU-R as aeronautical safety. Although no ICAO standards govern the use of radar systems operating in the 1300-1350MHz sub-band, Article 4.10 of the ITU Radio Regulations applies in recognition of the safety aspects related to its use by aviation. As a consequence, the 1350-1400 MHz range is not an essential spectrum for safety of life service.

Additionally, it is to be noted that, in a number of Countries, civil aviation authorities are migrating radar equipment dedicated to the aeronautical safety from 1215-1400 MHz band to upper bands with ARNS allocations, around 3GHz, with hardware modernization and cost reduction as driving factors

As the number of radars in the afore-mentioned lower band declines, it will become increasingly easier to coordinate deployment of a new Mobile service.

CONSULTATION QUESTION

Question 12: Do you agree with the possible timelines we have identified in this section?

FEEDBACK

470-694 MHz

Huawei believes that the growing end user expectations towards a convergent experience with seamless utilization of video content across a variety of end user devices, combined with the overall economic efficiency from the gradual creation of convergent/cooperative video content distribution infrastructure, will translate into tangible network deployments within the 2020 and 2030 timescale.

3800-4200 MHz

It is difficult to predict the timelines for the actual start of possible IMT systems rollout in this frequency range: many factors including the market dynamics will determine the final timeline. We would like to underline that the RSPG Opinion on the "wireless broadband challenges in Europe" assigns to this range a medium term potential for mobile broadband applications ("starting from 2015").

1350-1400 MHz & 1427-1452 MHz & 1492-1518 MHz

Depending on the results from the ongoing compatibility studies, the 1350-1400, 1427-1442, 1492-1518 MHz ranges could become available for IMT starting from 2020. Several parties have already proposed specific solutions (e.g. border coordination, relocation of fixed services into a new frequency band, …) to improve the compatibility between incumbent users and IMT.

In the short term, the first European auctions in the 1452-1492 MHz band could take place as early as in 2015 (3GPP is now working on the relevant specifications).

CONSULTATION QUESTION

Question 13: Do you have any comments on the capacity implications outlined in this section?

FEEDBACK

No additional comment.

CONSULTATION QUESTION

Question 14: Do you agree with the next steps we have identified for further domestic work based on the proposed priorities?

FEEDBACK

470-694 MHz

Ofcom should keep investigating on the challenges and opportunities in the broadcast-broadband cooperation / convergence and on its impact on spectrum and network rollouts.

3600-4200 MHz

Frequency coordination between mobile broadband and Fixed Satellite Service in the 3800-4200 MHz range should be addressed on a case-by-case basis at national level. Ofcom should consider

establishing guidelines targeting an agile while accurate co-ordination process which maximises efficient use of the available spectrum whilst protecting, but not over protecting, existing licensed uses of the band. Such coordination process should start from the reciprocal exchange of rollout parameters between both interested parties.

This proposal is in line with the statement reported in a recent RSPG Opinion on the "wireless broadband challenges in Europe": "The frequency range 3800-4200 MHz may play a role in the provision of ECS to enhance future capacity requirements especially in urban areas. The Commission should study the possible application of new sharing techniques in Europe between the FSS and terrestrial wireless broadband services in this frequency range, while recognizing that the situation within and outside Europe may differ, thus not enabling worldwide harmonisation for shared use of the band by wireless broadband services."

Huawei as a leading global ICT solutions provider is willing to cooperate with Ofcom and relevant stakeholders towards the exploitation of enhanced sharing opportunities in the C-Band.

Ofcom should continue its feasibility and impact assessment analysis' associated with a possible future introduction of mobile broadband applications on a sharing basis with existing FSS Earth stations (coexistence opportunities should be assessed in detail; possible costs associated with the implementation of mitigation solutions and with the possible relocation of Earth Stations should be quantified).

Given the commonality of the issues, the detailed assessment of the 3600-3800 MHz range and of the 3800-4200 MHz range should be carried out in parallel.

1350-1400 MHz & 1427-1452 MHz & 1492-1518 MHz

While Ofcom has already identified the possibility for sharing in the 1427-1452 MHz range, additional studies should also be considered:

- On the possible relocation of the radar service below 1350MHz and/or around 3GHz, especially for new technologies;
- On the migration of the existing Fixed Services in the 6GHz band and/or 10GHz bands.

CONSULTATION QUESTION

Question 15: How do you think we should adjust our support for international harmonisation based on our proposed priorities?

470-694 MHz

Ofcom should continue its engagement in international discussions on the long term future of this band. Significant steps forward are expected within the WRC-15 conference.

3800-4200 MHz

Ofcom should keep its International engagement to support appropriate international agreements at ITU-R and CEPT level. This includes the preparation of WRC-15 as well as other possible initiatives that could be triggered at European (CEPT) level , and keeping them in line with the statements in the RSPG Opinion on the "wireless broadband challenges in Europe".

1350-1400 MHz & 1427-1452 MHz & 1492-1518 MHz

In addition to the continued support for the identification of the 1452-1492 MHz band for IMT at the upcoming WRC-15 conference, Ofcom should also maintain its efforts in the development of the sharing studies for the 1350-1400, 1427-1452 and 1492-1518 MHz ranges.
