MOTOROLA

The Response of Motorola Ltd

to the

Consultation on Spectrum Commons Classes for Licence Exemption

Motorola is grateful for the opportunity to contribute to the consultation on Spectrum Commons Classes for Licence Exemption.

The radio spectrum is widely held to be a much under-utilised resource in many countries. It would appear that considerable economic and societal value remains to be unlocked through better utilisation of this resource. It is therefore important that the regulatory measures that are introduced actually do result in improvements and not impediments to further utilisation of the spectrum.

Whilst Motorola fully recognises that this is formally a consultation, we note with regret that the phraseology in many places leads to the perception that the ideas contained in the document are perhaps already strongly favoured. This is most unfortunate as Motorola has concerns over the proposals both in terms of whether they actually will lead to improved utilisation and secondly, whether these proposals will be adopted by other countries. If they are not widely adopted, there is the risk that the UK will be isolated.

Key Points

1. **The introduction of highly complex politeness regulation risks introducing a significant cost and performance efficiency impact on services which otherwise would work better and so yield more benefits to users.**
2. **It is not clear that similar regulations are currently being considered in other countries to any great extent. This risks a future situation that the UK market has less equipment choice than other markets.**
3. **The concept of classes and interference characteristics seems open to a huge variation of interpretations. Were this approach to be adopted and then promoted to the EU it seems likely that a very wide range of interpretations would be created by the Member States leading to market fragmentation, inefficient use of the spectrum and consequential loss of user value.**

4. **The consultation appears to mostly consider the introduction of "Detect and Avoid" strategies. These are well known to be problematic in practice for the delivery of many types of content.**
5. **The proposals appear to consider taking worst case situations as the assumptions upon which to base detailed requirements. As there is likely to be very considerable variability in traffic characteristics, this raises the concern that the regulations will be overly prescriptive and so less efficient.**
6. **Motorola considers that the existing arrangements may prove to be more efficient and fair.**

Detailed Questions

Q1: Do you agree that the spectrum commons class of a technology should be based on its interference characteristics?

It is not clear that there will be any overall benefit resulting from the proposed regime compared to the current situation in which there are simple rules for services placed into the band and measures have to be implemented to sustain the desired service. It seems more probable that the proposals could severely deteriorate the opportunities to carry certain types of services using the radio spectrum.

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Considering the variety of uses and devices that already exist and are most likely to come into existence in the future, it is not clear how a classification approach can be sustained. It is further unclear how any such regime could be imposed without giving preference to some technologies over others.

Q2: Do you think that the ratio of channel bandwidth to the width of the band is a good representation of the use of the frequency domain resource and the interference potential of a technology in this domain?

No.

Such approaches appear not to adequately cater for new technologies such as spread spectrum modulation. These are significant interferers when deployed in close proximity to other devices. It can be expected that close proximity will be a very common deployment scenario in residential situations and that the desired data rates will be higher than today.

In relation to the general principle that one only uses the needed bandwidth at any time, the proposals seem to indicate that the worst case (i.e. the maximum)

bandwidth will be used to assess the interference potential. As this usage may be quite rare it seems unnecessarily pessimistic and not an efficient representation of the behaviour typically.

Q3: Do you think that the duty cycle is a good representation of the use of the time domain resource and the interference potential of a technology in this domain? Do you agree that the duty cycle should be evaluated at the busy hour?

No.

Motorola expects the duty cycle for modern and future devices to be extremely variable, depending on the service being carried at any one time. So in a converged service deployment, the device would be delivering entertainment[1] one time and simple status messages another. Again, taking the worst case might lead to significant divergence between the assessment of bandwidth for regulatory purposes and the experience seen in the field.

In relation to the use of the busy hour for assessment, this has been standard practice for congestion assessments for many years.

Q4: Do you think that the interference coverage plus the density of transmitters give a good representation of the use of the space resource and the interference potential of a technology in this domain?

No.

There are many parameters that could significantly affect the coverage actually achieved; a well-known example is use amongst buildings. With today's arrangements many devices are able to operate and give a perfectly adequate service because the coverage of other potentially interfering devices is actually less than it might be.

More importantly, it may be very difficult to assess the density of transmitters in an area in any meaningful way.

Is the consultation actually proposing that all licence-exempt transmitters will have to be registered using a "light-licensing" regime?

Q5: Do you agree with our method to calculate the interference coverage area of a transmitter? What is your view on a threshold level of -80 dBm/MHz to determine the

[1] This is an example of the service that may be desired. Under the proposals of this consultation it may be extremely difficult to deliver entertainment at all due to the politeness rules.

interference range? Do you think the threshold level should be expressed as power density (dBm/MHz) or as power (dBm)?

No.

The method and level chosen appear to have been derived from some ETSI specifications for certain limited low-frequency applications having a listen-before-transmit requirement and it thus technology specific and unlikely to meet the wider future needs.

In reality, the interference range will vary over a wide range depending on the propagation conditions, the frequency and of course, the ability of the victim receiver to reject the signal.

It appears extremely difficult to state a single value that could satisfy the current and future requirements.

Q6: Do you agree with using a busy yet realistic scenario to derive the transmitter density of a technology?

No.

It is not clear how the transmitter density could be estimated in a realistic way unless it were to be done using user surveys after the market had become established.

Q7: Do you agree with the Interference Indicator being a product of the frequency domain factor, the time domain factor, the interference coverage area and the transmitter density?

Motorola is concerned by these proposals from first principles. On efficiency and fairness grounds, we would prefer the current arrangements to be maintained.

Q8: Do you think that three classes of spectrum commons is the right number? What is your view on the proposed boundary values for the three classes?

Motorola cannot assess the future development of the market. We would prefer not to comment on the number of classes as we believe it is not possible to know the answer in advance.

Q9: Do you agree with our definition of fairness and that all systems should be required to behave in a fair manner?

Motorola is confused by this question.

The definition proposed by this consultation[2] relates to a "fair wireless user" and seeks that the user:

- **Shares the resources equitably with other systems, and**
- **Behaves appropriately according to its needs.**

Clearly, the current regulatory arrangements for licence-exempt users meet this definition but it is much less clear that the proposals will result in fair use once they are implemented.

The proposals discussed in section 8 favour short, "bursty" traffic over other forms of communication and thus limit the types of services that can be sustained. Future VoIP users (for example) could thus be at an unfair disadvantage in terms of access and maintenance of the call where currently they are able to have a good service.

So whilst we can appreciate that it is desirable that access and call maintenance should be on an equitable basis, we do not see the proposed rules on politeness having that outcome. Indeed, we have great difficulty in thinking of a better regime than the one we currently have in terms of fairness.

Q10: What is your opinion on the effectiveness of blind detection sensing techniques compared to signal specific techniques?

Motorola notes that whilst it is obviously true that knowledge of the nature of the schemes that could potentially interfere with the desired service allows designers to invent counter-measures designed to improve the user experience, it is most unlikely that sufficient detail would be known about all the various possible systems that share the band to make any real difference. Even if such knowledge was available, it would be unlikely to remain current sufficiently long to ensure that any service depending on such knowledge could be sustained in a "technology neutral" licence-exempt band for the lifetime of the equipment.

If in the future some spectrum were to come available for licence-exempt deployment without the requirement of re-locating the incumbent, the situation would be different. In this case, the incumbent may well have rights that need to be maintained. In order to obtain the maximum benefit from the spectrum for all users, it may be necessary to carefully coordinate usage with knowledge of the current technologies employed by the incumbent. When the incumbent migrates to new services the analysis may have to be repeated and there may even be limitations on what the incumbent can migrate to. This is a very difficult situation and it may be better to seek alternative solutions to avoid incumbents and licence-exempt services sharing the same band.

[2] Section 8.8

Q11: Do you agree with the proposed polite rules?

No. We see the existing regime as more efficient, fairer and more likely to maximise the overall benefits to the user.

It appears that the consultation document advises that Ofcom intends to introduce requirements for detect and avoid[3] mechanisms in equipment. This is most likely to severely limit the types of service that can be supported.

By way of illustration we offer a simplified technology-neutral example of the impact on service provision were these proposals to go forward. For reasons of topicality, we have chosen to consider VoIP speech communication as the service. Such a service already exists and works well today. We derive the probability of the successful completion of one call during the busy hour.

Throughout this example we follow the proposals in section 8. Naturally, we choose a fairly busy environment to examine because were the spectrum to be only lightly occupied, there would be no need for any politeness protocol at all and so the whole consultation would be nugatory.

Many people use WiFi for distribution of services around their home and in the office. In many cases, using the tools available on the computer, it is possible to "see" several other systems in the "view available networks" list and so it is felt that considering only one such system in this example is, if anything, optimistic.

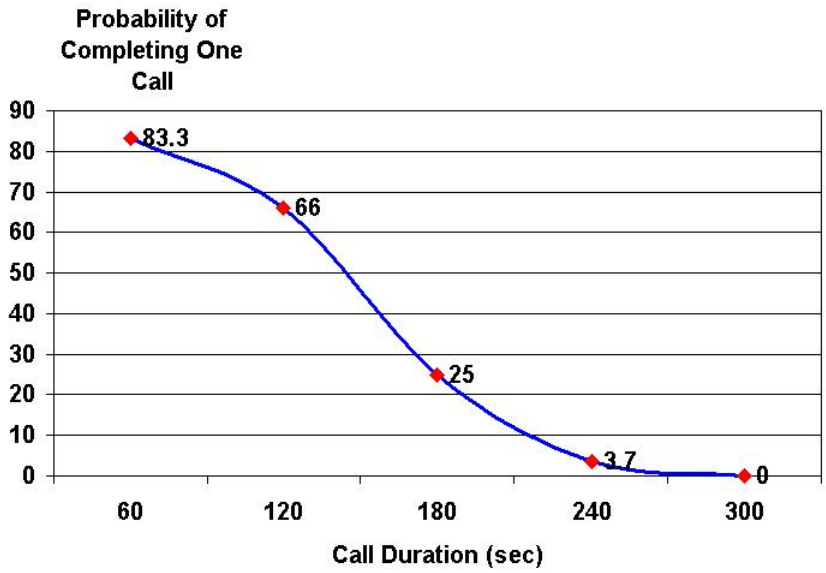
Assumptions:

1. The victim system is 5-unit system seeking service with one other operational system in the area with other channels each having one system.
2. Each user seeks to use the service once during the busy period
3. The busy period is taken as one hour
4. For simplicity, a perfect "Detect and Avoid" control is considered.
5. The "Listen Periodically" requirement is set to listen at 60 second intervals
6. Occupied channels can be deleted from the available channel list for a time that is long compared to the duration of a single call.
7. The only occupancy of the channel is from the second scheme.

Using very simple analysis, the following indicative results can be computed:

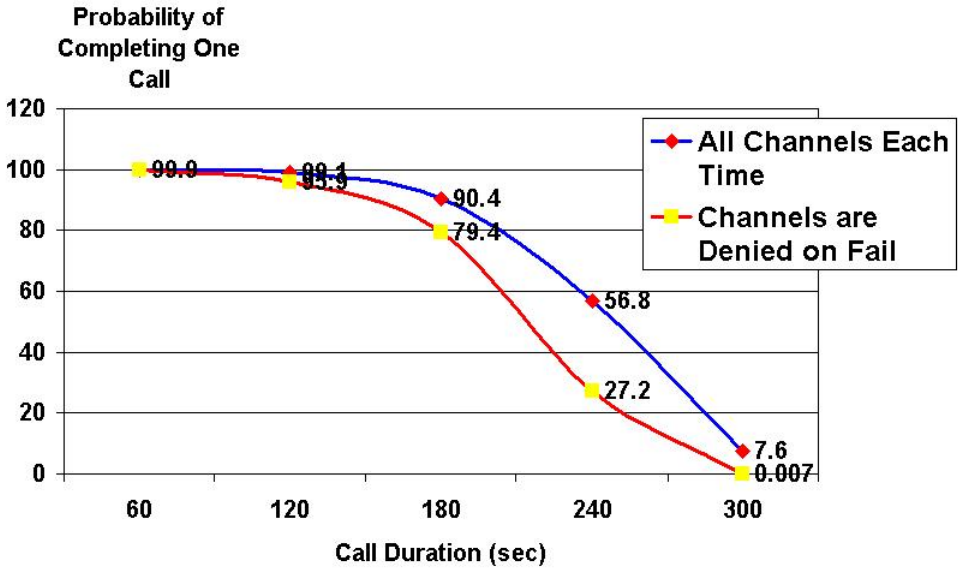
[3] The term "detect and coordinate" is used in the consultation. Coordination is explained to mean that different systems can communicate automatically to "agree" suitable sharing arrangements. However, it is also acknowledged in the document that this is rarely possible and so a simple detection threshold is advocated, reducing the "detect and coordinate" function to the less beneficial "detect and avoid" function.

A 1-Channel System

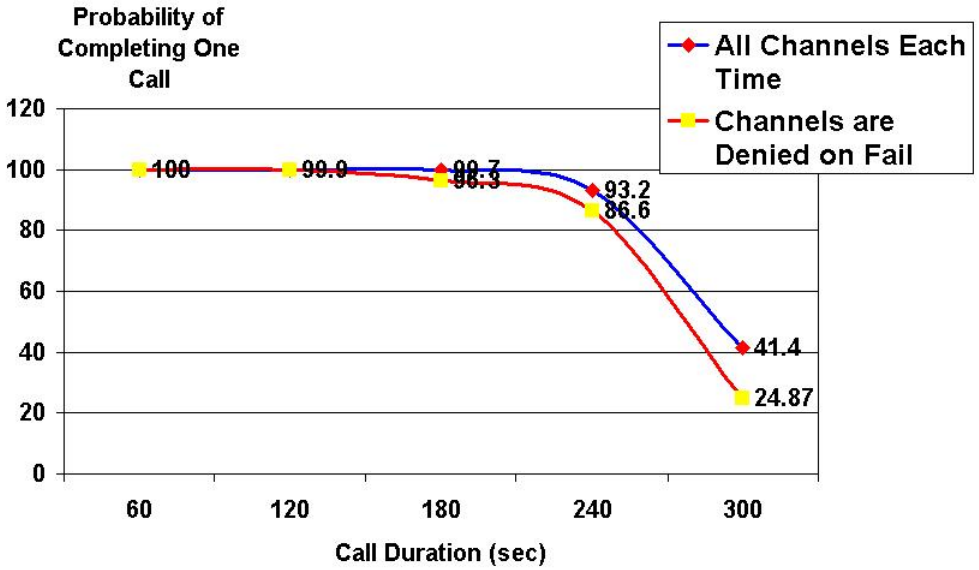


This illustration serves to indicate the considerable potential difference between the situation of today where users experience nothing like this fail rate on their service, even with equipment that essentially operates on one channel (in some cases) and what could be the result of these proposals were they to be introduced.

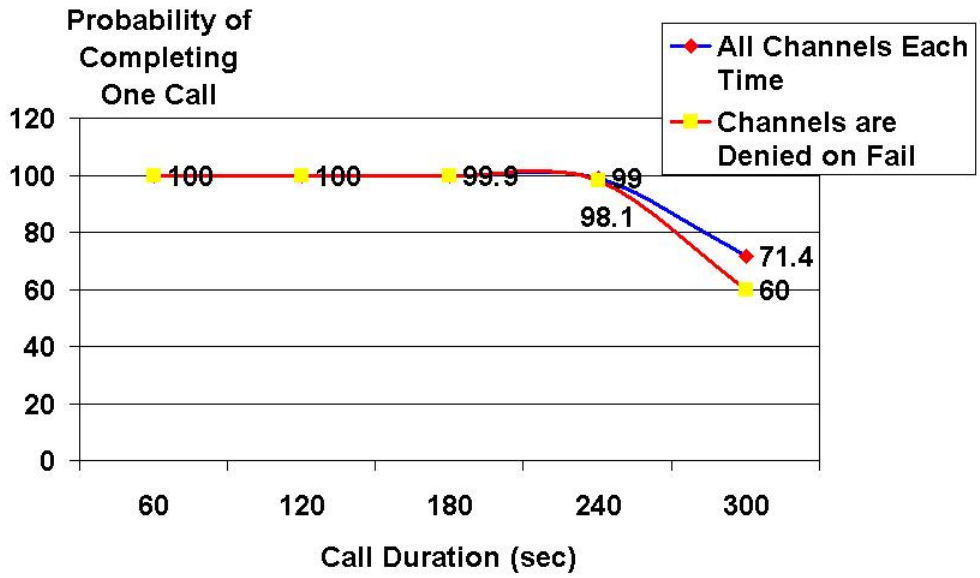
A 5-Channel System



A 10-Channel System



A 15-Channel System

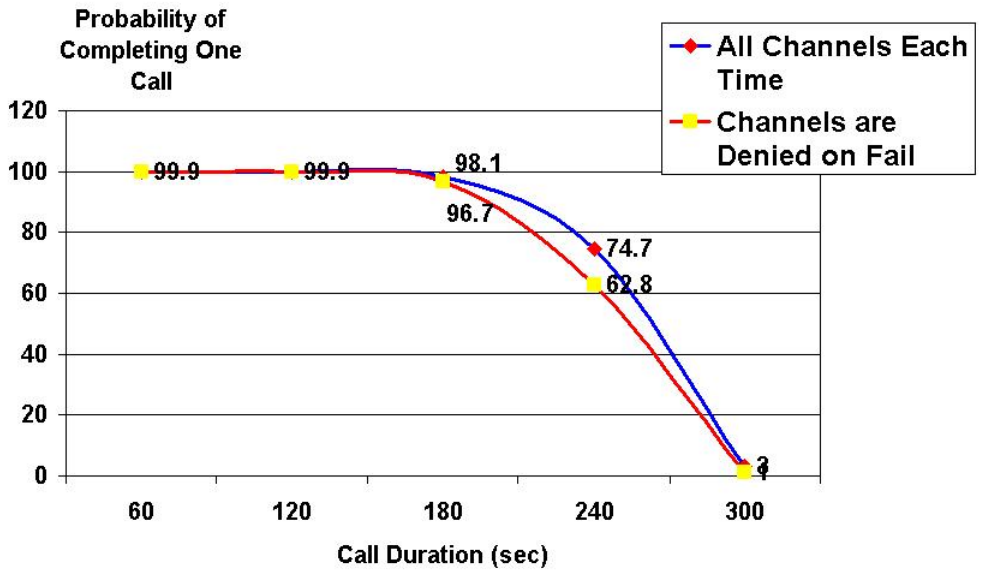


Note: In the above graphs, the blue line represents the situation that after every listen action, the whole channel list is again available. The red line depicts the situation where channel previously determined to have been occupied are denied to the unit. This second scheme is a current scheme used in certain ETSI standards.

It can be readily seen that the service that is easily supported using a small number of channels today might require a choice of a large number of channels to maintain it under the new proposals. Even the above 15 channel system can only provide a poor service for a 5-minute call. These shortfalls are of a size very likely to be noticed by users and as such can be expected to severely limit the usefulness of the service were they to prove representative of experience in the field.

Of course, it is extremely unlikely that any licence-exempt band will only have a few small number of other systems sharing. It is likely that there will be other services and, if the threshold is set low as proposed. In addition, there might also be a significant amount of falsing. The graph below shows the same 10-channel system outcomes with 10% of capacity taken by these other effects. In producing this last graph we change assumption 7 above to include these other activities.

A 10-Channel System with Other Users



Even today, many people can detect many systems at sufficient strength that their computer offers them service (if they have the appropriate security codes). It is possible that under these proposals the other systems would be considered interferers on that channel, causing the equipment to switch to another channel. As spectrum is limited, the service is likely to be rendered unavailable by such moves as all channels could have similar occupancy resulting in the unit not transmitting at all.

Under today's licence-exemption scheme, that doesn't happen because the wanted signal is stronger at the desired close range and so the service is provided to all parties in a fair manner.

Questions and comments regarding this response should be addressed to T. Cull in the first instance

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