Question	Your response
## Section 3 –Spectrum use by the PMSE sector in the UK **Question 1**: **What are your views on how our processes work - for example our online booking system**, **turnaround times**, **and event coordination. Do you think the current approach works well? How could we improve it**? In my experience the system works relatively well. I have the shared licence for Ch.38 (plus a VHF licence) and occasionally apply for channels in the 630-698 range. The one thing I think worth mentioning is; that when asking about licensing frequencies for use in a crowded studio, there isn't a clear understanding of the way it works for us. It is easier to have a whole channel rather than individual frequencies within a channel.	Confidential? – / N

Section 4 – PMSE historic trends

Question 2: **Do you have any comments on how we have analysed and characterised wireless microphone and IEM demand, or suggestions for alternative ways of characterising this demand**?

I have been a film and TV sound recordist/ mixer for over 30 years, working on both large scale film productions and smaller TV projects. It is based on this experience that I give the answers below.

The use of both wireless microphones and IEMs have increased almost exponentially over the last 25 years. 30 years ago IEMs were only occasionally used outside bigger budget films. They are now used extensively at all levels of production. For instance on the film I am currently working on, we have 20-30 out on a daily basis and more when there are visitors on set. These are spread across 3 or

visitors on set. These are spread across 3 or

4 different frequencies.The same increased demand has been seen where radio microphones are concerned.I regularly have 16plus out on my present film. In addition to this we have two “voice of god” mics that are wirelessly linked to speakers. All of the above is now common practice, even on a small to medium budget TV drama. With some TV coverage of sporting events there can be far more channels used. Consequently we need a wide range of the radio spectrum available to us as film and TV sound mixers. It is essential that all the existing channels that are currently available between 470-698Khz, remain available for use for film and TV use and free of anything other than radio mic/IEM use and free of intermodulation interference from powerful transmitters operating on frequencies outside this range. In addition the “E band” channels in the 800’s, that are commonly used for IEMs, should also be kept available (822-829.999 and 863-864.999 KHz). It is counterproductive to give over frequency bands to content providers/broadcasters and then leave the creators of this content hamstrung when it comes to the (essential) use of radio microphones and IEMs.	Confidential? – / N
Question 3: Do you have any comments on how we have analysed and characterised wireless video demand, or suggestions for alternative ways of characterising wireless video demand?	Confidential? – / N
## Section 5 – Future trends and opportunities ## Wireless audio ### Drivers of demand **Question 4: What factors have driven changes in the demand for audio PMSE applications, specifically for**: **applications, specifically for**:	

a)	**the increased use of coordinated wireless microphones and IEMs, particularly the peak number of simultaneous assignments used at the largest events?** On films and TV dramas, there is an expectation (from audio postproduction) that every on screen (and off screen) actor is mic'd up at all times. The expectation on set is that many of the crew will have an IEM with programme sound fed to them, this includes, directors, assistant directors, camera operators, script supervisors, all producers, and set visitors etc etc. This increased use is exacerbated when there are multiple productions working in the same studio (which is very common). At this point there is need for a wide range of frequencies to be available.	Confidential? – **Y**
a)	**the slight decline in the number of national wireless microphone licences (UHF channel 38 and VHF)? Has the extent of use of these licences changed, and if so why?** Sadly, I think some people use Ch38 without getting a licence, or have a Ch.38 licence yet don't apply for an additional channel when needed. The use has definitely increased, whatever the license applications indicate.	
b)	**the declines in talkback, fixed audio links and ADS licences?** We generally use Motorola's supplied and licensed by production for talkback purposes and therefore I can't comment accurately on this.	

Question 5: What factors could drive further changes in the demand for audio PMSE applications in the future, and what will this mean for future demand, specifically for: a) **coordinated wireless microphones and IEMs, particularly the peak number of simultaneous assignments used at the largest events**? I don't tend to do large events, so I can't give you an accurate picture of this. But on the few occasions where a film I've been working on has dovetailed with a large sporting event we have coordinated frequencies ourselves then gone to get the appropriate license. b) **national wireless microphone licences (UHF channel 38 and VHF)**? I think the use of UHF channel 38 will only get more frequent not less. VHF is starting to be used again for IEMs to some extent, because of how busy it is within UHF, although this can generally only be done with legacy equipment. c) **talkback, fixed audio links and ADS licences?** See above.	Confidential? – N
Question 6: Do you agree that, given the trends, we are right to focus on wireless microphones/IEMs? **Yes**	Confidential? – N

Changes in the take-up of bands already available **Question 7: What factors have driven the take-up of different bands for wireless audio**? See Abovc **What are the barriers to greater use of the DME band**? The greatest barrier to the use of DME, is the fact that to access it requires the purchase of expensive new radio mic equipment, while at the same time replacing equipment that works well in the 470-698KHz band. In addition it is not widely available in some other countries outside the UK. Sound recordists, operating as individuals, can't afford to have one set of equipment for work in the UK and another for work in Europe and the wider world.	Confidential? – N
Question 8: What actions could enable greater take-up of the DME, DECT and licence exempt bands in the future? There would have to be compensation (as with the previous sell off) for equipment that would no longer be of use in the 600's and DME would have to work well abroad. In addition Frequencies in the 2.4GHz and 5GHz bands are very crowded on film sets as it is and would be next to useless for radio mics at low power in this context.	Confidential? –N
Changes in spectrum availability **Question 9: Which potential additional bands might be suitable for wireless audio applications, particularly microphones and IEMs at the largest events and venues**? Additional bands would be useful, but the important thing is not to take away ant existing bands.	Confidential? –N

Question 10: To what extent do the characteristics of different audio applications drive their requirements for spectrum – for example particular requirements for latency, resilience or capacity? RF resilience and low latency is very important for radio mic applications.	Confidential? – N
Changes in efficiency of spectrum use **Question 11: What changes in spectrum use (technology, working practices, different bands, etc) have enabled audio wireless growth to be accommodated to date, particularly the increased use of wireless microphones and IEMs at the largest events and venues in the context of reduced UHF spectrum availability**? Newer radio mic transmitters, over the last 10 years or so have enabled us to move to channels other than Ch38. But of course this is predicated by the availability of plentiful channels between 470-698Mhz (especially in the UK of the space between 614-698Mhz).	Confidential? –N
Question 12: What technologies are currently available or are being developed which can improve audio spectrum efficiency in the future, particularly in the use of wireless microphones and IEMs at the largest events and venues? Narrow band and digital radio mic transmitters have helped fit more radio mics in one channel, but this has barely kept up with the increased demand for separate frequencies.	Confidential? – N
Question 13: Are there any barriers to adopting more efficient technologies for audio applications, particularly for wireless microphones and IEMs at the largest events and venues? **What could industry do and what could Ofcom do to facilitate greater use of those technologies**? What would help is protecting the existing channels and not selling them off.	Confidential? – N

Question 14: What changes to working practices and spectrum planning could improve audio spectrum efficiency in the future, particularly in the use of wireless microphones and IEMs at the largest events and venues? Continue refining the coordination of frequency use and educating users of the need for this co-ordination (and by implication the need for those users to purchase some form of license where appropriate).	Confidential? – Y
Question 15: Are there any barriers to adopting working practices that could enable more efficient use of spectrum by audio applications, particularly for wireless microphones and IEMs at the largest events and venues? **What could industry do and what coul**d **Ofcom do to facilitate those efficiencies**? See above. Essentially everything should be done to preserve what we have in the UK, so as not to descend into the free-for-all chaos that exists in countries like the US. Co-ordination with the EU or the main film making countries within Europe, would also be useful, so UK and European radio mic manufacturers can make products that work in as many countries as possible.	Confidential? – N

## Wireless video ### Drivers of demand **Question 16:** What factors (such as more complex events and use of higher resolution equipment) have driven the demand for wireless video bandwidth, in particular for: a) the increased bandwidth required for the largest sporting events such as Formula 1 at Silverstone and The Open Championship? b) the bandwidth required for nationally important state events such as The Coronation? c) the slow growth or decline in bandwidth used at horse racing fixtures?	Confidential? – Y/ N
Question 17: What factors could drive further changes in the demand for wireless video bandwidth in the future, and what will this mean for future demand, in particular for: a) the bandwidth required for the largest sporting events like Formula 1 at Silverstone and The Open Championship? b) the bandwidth required for nationally important state events such as The Coronation? c) the bandwidth used at horse racing fixtures and other major sporting events?	Confidential? – Y/ N
### Potential news bands **Question 18:** What factors have influenced the degree of take-up of existing bands used by wireless video applications, particularly the growth in take-up of the 7 GHz band?	Confidential? – Y / N

Question 19: Which potential additional bands might be suitable for video PMSE applications, particularly at the largest events and venues?	Confidential? – Y / N
Question 20: To what extent do the characteristics of different video applications drive their requirements for spectrum – for example particular requirements for resilience or capacity?	Confidential? – Y / N
Changes in efficiency of spectrum use **Question 21:** What technologies are currently available or are being developed which can improve wireless video spectrum efficiency in the future?	Confidential? – Y / N
Question 22: Are there any barriers to adopting more efficient technologies for wireless video? What could industry do and what could Ofcom do to facilitate greater use of those technologies?	Confidential? – Y / N
Question 23: What types of video demand could realistically be supported by private (for example 5G) networks?	Confidential? – Y / N
Question 24: What changes to working practices and spectrum planning could improve video spectrum efficiency in the future, particularly in the use of wireless microphones and IEMs at the largest events and venues?	Confidential? – Y / N
Question 25: Are there any barriers to adopting working practices that could enable more efficient use of spectrum by wireless video? What could industry do and what could Ofcom do to facilitate those efficiencies?	Confidential? – Y / N
Other comments **Question 26:** Do you have any other comments or views on the issues raised in this document?	Confidential? – Y / N

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