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?	Most of the time I use your online booking system and it works pretty well and gives me relatively fast and accurate access to spectrum availability and booking. However, when inputting multiple single frequencies, it is very slow. Would be great to have a faster way to input multiple single frequencies. For larger events that require a specific booking directly with Ofcom, it frequently takes too long to get a response. The standard 72 hour notice we get, although rarely takes that long, it is not how the world now operates. This becomes a bigger issue when licences are required over the weekend. In today's productions, requirements change on virtually every production and normally with little or no notice and it is us that has to make that happen. Being able to do that legally requires a similar response time from Ofcom for items that cannot be dealt with by the online tool. Also because of the changes that frequently happen, It should also be possible to go back into a booking, even once paid, and amend it. Again production changes or even faulty equipment that needs to be swapped out for a different range means a licence that you've previously paid for in good faith may no longer be relevant and we should be able to reclaim or adjust that, rather than just be charged for an additional licence. For most shows we don't get weeks and weeks of notice, While we may have a rough brief of the event, the accurate details tend to come in the last couple of days before the even happens so getting the correct thing licenced at short notice is something that is essential but not always achievable. We've had several issue where multiple licences for the same venue have been issued to different people, normally due to NGR issues where two NGR's have been able to be used only being a very small distance apart. Confidential? – N

Question	Your response
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 think the general trend of your analysis is correct in that the demand only seems to be going one way. Every production I work on has increased demands from previous years. Productions get more ambitious; performers are more demanding and requiring an ever more mobile RF solution. IEM's, especially with the addition of WMAS systems are especially increasing and it would be good to see analysis of the difference between IEM's and Radio Mics. Would also be good to see the allocation of indoor and outdoor allocations. A lot of your focus of information seems to be about large scale events, which while very relevant are only a very small part of what is actually happening out there, so would possibly be good to see the size of the events to get a better picture of the entire usage as I have a feeling that a lot is getting missed, especially within the thousands of people that are using channel 38 every day that effectively go un noticed as they are not licensed, per use. 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?	I'm afraid I don't deal with Wireless video, so am not really in a position of authority to comment. However what I can say is that on all of the productions I work on and with, that requirement seems to be growing exponentially. Maybe some more details (asked when applying the licence) as to what each frequency's primary use is so some items may require less quality etc could create better use of the spectrum? Also would give you better analysis of types of links / wireless cameras etc are being used. 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: a) the increased use of coordinated wireless microphones and IEMs, particularly the peak number of simultaneous assignments used at the largest events? b) 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? c) the declines in talkback, fixed audio links and ADS licences?	a) As the technology has improved and become more stable, peoples trust in the equipment has increased the quantities required. While 10 years ago IEM's were probably in use for 50% of music shows, they are now in every single one. Monitor wedges are becoming less common as the IEM's increase. Because the technology now exists with the likes of WMAS etc to get more frequencies in the same bandwidth, where once a guitar tech had a duplicate pack of the person he was looking after, he now has his own mix, with things like his tuning pedal going to it that ducks the normal mix level down while they're tuning. Because everyone is on IEM's now, including all the backline techs, while not an RF increase but on most bands all of the musicians and techs have talk mics so they can all talk to each other whereas previously they just shouted! That's fine for one band but multiply that by 10 bands a day on each stage and a festival with 15 stages and you can see how the massive demand now occurs. b) Personally, I never use channel 38, unless I'm desperate. Because it is effectively open to anyone (with a licence) to use, I want to ensure my shows are licenced specific so I know they are "safe," and that the news crews etc can use channel 38 without causing any issues to me. Having said that I am surprised by the decline in licences for channel 38. I can only put that down to people becoming more frequency aware and choosing as we do to have a more proactive approach to ensuring that your signal is clean that has meant less people to licence 38. I would imagine this is largely used for smaller more local venues or as I mentioned for News crew etc that are coastally moving to a new location where they wont know about in advance, so stick with channel 38 to know they are safe and legal. c) The rise of DECT and other systems like Bolero has increased hugely over the last 5 years. I would imagine this is the major contributor to talkback frequencies being used less. However, the increase in 4 & 5G towers at a lot of venues has caused huge issues in the RF noise floor for

Question	Your response
	some of these systems making them virtually unusable. Heavily filtered antennas are now being developed for these systems to try and combat this, but I think the "motorola' form of communication is a long way from being dead. In fact, it still has a prominent part in any event. The distances you can cover and the price point that you can achieve that means a lot of productions simply can't afford the more elaborate systems so I would be surprised if that decline continues. In fact as these large events continue to grow, I wouldn't be surprised of the demand for these starts to increase again. Confidential? – N
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? b) national wireless microphone licences (UHF channel 38 and VHF)? c) talkback, fixed audio links and ADS licences?	a) As described above, simply productions are becoming more ambitious. We are now producing higher channel counts than ever before on every event. Even a basic TV chat show where everyone used ot be on cabled mics and cabled IFB's everyone expects everything to be radio'd now. Reality tv has seen a huge increase in not only RF requirements but also coverage requirements. Where previously it would be 10 people in one studio, we recently did 456 contestants, all with individual radio mics across 6 sound stages. As described above, Bands requirements have grown hugely and any large event the management of RF on site has become a huge challenge, that is getting harder each year and any loss of spectrum would be catastrophic to the various side of our industry. b) The huge increase in mobile reporting for both TV and social media could well increase the use of channel 38. The hunger for information now, means that getting licences for a place and time that you never knew was going to happen, you just need to turn up and go means that the facility that channel 38 gives is pretty vital c) As mentioned in Q5c, While the general trend of Talkback etc is declining, in favour of digital coms, I think it will probably plateaux or possibly start to increase. Certainly, the number of mobile handsets we provide is always increasing as a whole.. Confidential? – N
Question 6: Do you agree that, given the trends, we are right to focus on wireless microphones/IEMs?	Simply, yes.

Question	Your response
	But don't forget about the other parts as well but this is clearly the major growth area. 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? What are the barriers to greater use of the DME band?	The increase comes from the increase in the quality of the equipment. It's simply more in demand. Artists and productions want to keep pushing the boundaries for their shows and the technology so far has managed to provide for them. But it seems that we are at the end of the possible expansion technology wise. It takes a long time for new technology to get a hold in the industry, normally several years, before it becomes the new standard. WMAS systems for instance, while it is more readily available now, it is probably only in use for less than 1% of productions worldwide currently. In some locations we are already at the point where we are starting to say no to clients due to lack of bandwidth at certain locations and this is in danger of stifling the creativity that the UK is known for. DME is really still in its infancy. I think only the high end of professional suppliers will use it and in more controlled environments due to the airspace shared use and a reduce amount of inventory, but it is starting to grow, but it will never replace the UHF band, it will just be complimentary. To get more use from it, would need effectively some kind of advertising campaign to raise awareness. Confidential? – N
Question 8: What actions could enable greater take-up of the DME, DECT and licence exempt bands in the future?	As above, for DME more publicity. There need to be the demand from clients to use it. It can be supplied, but currently no one is actually requesting it. Maybe providing training for engineers and end users, so that they can learn to trust it. Maybe a reduce licencing cost for that band to encourage people to use it? For DECT, it can't replace UHF. It can be a part of the landscape, but they are simply not as reliable as UHF bands and there are too many other products in the general market that use the same bands that can cause issues. For small quantity events at a more local domestic level then they are OK but for professional use they are largely not suitable for Mics / IEM's but ok for Comms etc. Confidential? – N

Question	Your response
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?	I must be honest and say I'm unsure that there is a more suitable band, When you look at the whole RF spectrum, I don't see a space that can handle the level of requirement that we currently have, and use, in the UHF Band. While we manage to squeeze ourselves in between DTV, I'm not sure that there is another section where this would work. Obviously the higher up the spectrum we go the less beneficial it is for our style of bodyworn Transmitters and receivers and we are already seeing reduced range while using the DME band. Is there a more suitable band that can provide the same facilities of low latency, high density transmission that can cope with loss f Transmission and reception due to being placed on bodies? There may be something similar to DME that could compliment UHF but I see no way that it could replace it. It is fundamental to everything we do. 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?	Wireless mics and especially IEM's will only work with very robust low latency. This is now especially true that we are moving to digital transmission as the conversion from analogue to digital at both ends of the process has induced some additional latency that wasn't there in analogue transmissions. However due to the ever increasing demands, with the digital transition, we can now achieve these higher channel counts but any increase in IEM latency would make them unusable. We are already at what is considered to be the maximum latency for a singer. For other uses sauch as general coms and talkback, then the latency is far less of an issue and as such can be treated differently from the radio mics and IEM side of PMSE Confidential? – N

Question	Your response
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?	Changes have been introduction of digital, narrow band analogue, and more recently WMAS. Whatever the method, they have all increased the amount of channels of radio mics and IEM's within the same space. However while the technology has increased this, the clients requirements have grown in excess of the increase in availability so we are still no better off spectrum wise than we were five or so years ago, we simply are required to provide more in the same space. The software for frequency co-ordination and management of equipment has also greatly increased in efficiency of allocation and simplicity to operate and deploy. For larger events, time sharing is now better organised and people are better aware now in those environments of the need to obey their allocation, 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?	I am not aware of any new technology that is in the pipeline that will enable us to get further improved channel count from what we have available now. Digital, narrow band and WMAS are all available and in use and are now part of the standard arsenal of equipment to achieve a productions demands but we are already frequently at capacity, so any degradation of available frequency bands will have a detrimental affect and reduce what is possible. Will someone come out with something new, possibly. Will the industry invent its way out? Just because it has in the past, I genuinely don't think it can this time. We have maxed out what is possible 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?	The only barriers is the requirement for broadcast quality , low latency, rock solid transmission paths for high channel count environments. This has become the norm now and the public expects that level of professionalism. I think everyone in the professional side fo the industry is already very aware of the capabilities of the current technology and use it on a daily basis. I would expect WMAS to increase it's use across the spectrum but it's increase channel count is relatively marginal when you keep the same level of quality and latency. In fact in some cases it actually gives you less channels when trying to match the quality and latency of analogue (or at least get close)

Question	Your response
	As mentioned previously, possibly more aware ness of the DME band but again, this is a relatively small band and not suitable for anything more than being part of the plan, it is not a replacement. . 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?	In an ideal world, we would receive all information earlier and enable us to provide requirements in a more timely manner especially for larger events. However, in this modern world where everyone expects everything instantly, this is unlikely to happen. We will always have to deal with last minute requests, additions, cancellations. Having on site Frequency Managers at all of the large festivals and also a manned out of hours service and an on live on line web page that acts can log into and see their allocation of frequency and timing. Confidential? – N
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 could Ofcom do to facilitate those efficiencies?	No barriers, we are a highly technical industry and keen to accept and try new technologies but always with a higher priority for stability and quality. I think the vast majority of engineers and planners are now using the latest software for their planning and allocation. As mentioned above, ideally information further in advance but we are dealing with very creative people that constantly change their requirements and we hate to stem their creativity because of technology. We try and plan ahead of time and allow ourselves some spares and extras for what we know is the inevitable last minute requests. I'm honestly not sure what Ofcom could do apart from try and respond more quickly. Maybe Ofcom could do some industry presentations to explain the complexities of especially the larger events but as we are a group that are always on the move and always busy, I'm not sure how best to get that information across. Maybe some presentations on line, linked via social media to explain how important the engineers on site RF conduct is for the benefit of everyone. Confidential? – N

Question	Your response
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?	I'm going to duck out of these next few questions as I don't deal with Wireless Video, so don't wish to comment. However as mentioned before I can see a huge increase of wireless video on the shows and evnts I work on. Confidential? – 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?	N/A Confidential? – N

Question	Your response
Potential new 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?	N/. Confidential? – N
Question 19: Which potential additional bands might be suitable for video PMSE applications, particularly at the largest events and venues?	N/A Confidential? – 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?	N/A Confidential? – 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?	N/A Confidential? – 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?	N/A. Confidential? – N
Question 23: What types of video demand could realistically be supported by private (for example 5G) networks?	N/A. Confidential? – N
Question 24: What changes to working practices and spectrum planning could improve video spectrum efficiency in the future?	N/A Confidential? – 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?	N/A Confidential? – N

Question	Your response
Other comments **Question 26:** Do you have any other comments or views on the issues raised in this document?	While I work full time for a company, the RF side of what I do for a living is a huge part of my working time. I deal with all makes and models of Radio Mics and IEM's and do RF planning for events from small to very large. We have a small team that is nimble and able to deal with constant changes that happen in our industry. We are at the fore front of technology and I like to think we have an innovative approach to projects that provide a service that most other companies simply cannot provide. We regularly provide systems with hundreds of channels of RF / Bolero / Motorolas. The shows and events we do rely totally on the UHF PMSE Spectrum and the majority of TV Shows / concerts / Events simply couldn't function with reduced spectrum. If another sell of of spectrum occurs, I can see it would seriously harm our business as the coms and RF side, make sup probably about 60% of our entire work. If we can't provide the services we do now, that would inevitably lead to less sales, a reduced workforce which may well include my own position. Imagine watching he Kings coronation and not being able to hear what the Dean or the King was saying. Or watching Glastonbury and the Saturday night headliner lead singer not being audible, or the nine o'clock news in silence. The whole of our industry relies on this spectrum, it should not be put up for auction as I don't believe that the decision makers of this have any understanding of the damage it will cause to our world leading creative industry Confidential? – N

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- ☐ Saw it on social media
- ☐ Found it on Ofcom's website
- ☐ Found it on another website
- ☐ Heard about it on TV or radio
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