



Digital Dividend Review

British Entertainment Industry Radio Group (BEIRG)

Geographic interleaved awards 470 - 550 MHz and 630 - 790 MHz; response to consultation on detailed award design

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Introduction

The British Entertainment Industry Radio Group (BEIRG) is a non-profit making trade association set up to represent all organisations that use radio spectrum in the Programme Making and Special Events (PMSE) sector.

The Programme Making and Special Events (PMSE) sector is a disparate, diverse and diffuse community of content producers, manufacturers, rental organisations and freelance engineers. The PMSE sector is responsible for both content production and content delivery for live and recorded entertainment. It plays a crucial role in the ongoing success of the £15 billion pa British Entertainment Industry. The PMSE sector is critical to the production of content for live entertainment of all genres. This sector extensively utilises wireless equipment such as Wireless Microphones, Wireless In-Ear Monitor Systems, Wireless Talk Back Systems and Wireless Instrument Systems.

For over fifty years wireless products have been used in the entertainment industry. In the past thirty years there have been vast improvements in production values and safety levels as a result of advances in wireless technology. The PMSE sector currently relies on the spectrum interleaved between existing TV Broadcast channels to enable the use of Radio Microphones, In-Ear Devices and other short-range wireless devices. This equipment has become an essential component of the British Entertainment Industry.

On a daily basis this sector is responsible for the production of content that receives world-wide acclaim and continues to attract a global audience. A vast array of organisations are reliant on radio spectrum for the production of content for Performing Arts, Broadcasting, News Gathering, Independent Film and TV Production, Corporate Events, Concerts, Night Venues and Sports Events. In addition, other sectors that utilise UHF spectrum include the Health Service, Education, Local Government, Political Programming and Conferencing.

Wireless equipment and the spectrum it operates on are now crucial to the British Entertainment Industry. All parts of this important industry have a major impact on the daily lives of the entire UK population.

Ofcom currently plan to auction UHF spectrum that is critical for use of wireless microphones, in-ear devices and talkback; this is referred to the 'cleared' spectrum. Despite the eviction of the incumbent PMSE users from the 'cleared' spectrum, Ofcom claim that that there will be 'broadly' sufficient spectrum availability for the PMSE sector post-DSO. BEIRG strongly disagrees with this assessment.

This document must be read in conjunction with BEIRG's response to the consultation on the release of the DDR cleared spectrum (attached as annex 1). The latter demonstrates that, under plans understood at the time of consultation publication (i.e. not taking into account geographic interleaved awards), the digital interleaved and channel 69 will not provide sufficient spectrum availability to cater for current and anticipated levels of PMSE demand post-DSO. Indeed, even if all digital interleaved spectrum were awarded to the band manager along with channel 69, large-scale PMSE productions such as musicals and live music events would be impossible to stage in many prime locations across the UK post-DSO.

BEIRG is extremely concerned that, whilst Ofcom is prepared to consult on its detailed proposals to release packages of geographic interleaved and the cleared spectrum through the auction process, they have not consulted on whether there will be sufficient spectrum availability for PMSE post-DSO. This further illustrates that Ofcom is prepared to act without adequate knowledge of the consequences of their actions; in this case auctioning the UHF spectrum without adequate knowledge of the impact on incumbent PMSE users. Ofcom might think that there will be 'broadly' sufficient spectrum for PMSE post-DSO, but Ofcom, as a responsible public body, should ask whether other parties (especially PMSE stakeholders) agree with this assessment. Ofcom should not auction any cleared spectrum or packages of geographic interleaved until they have undertaken this public consultation process in detail.

BEIRG notes that ‘geographic interleaved awards 470 – 550 MHz and 630 – 790 MHz’ is a slightly misleading title to this consultation document. This consultation is about the proposed auction of one or two channels (packages) of interleaved spectrum at each of 81 transmission sites across the UK. In any one location, Ofcom are proposing that a maximum of two UHF interleaved channels be awarded, which is a maximum of 16 MHz¹ in any one location. This consultation is therefore not about the interleaved spectrum in general, which of course is geographic in its nature², but about small sections of it that have been earmarked for auction rather than award to the band manager with PMSE obligations. For the purposes of this consultation, when we refer to ‘geographic interleaved award’, this means the proposed award of one or two channels of interleaved spectrum at 81 transmission sites across the UK rather than award of the interleaved spectrum in general, which would include the band manager award.

It is important to note that when conducting the spectrum availability assessment for PMSE post-DSO outlined in the response to the DDR cleared condoc, BEIRG used the JFMG online database containing information generated and approved by Ofcom. However, this database does not take into account the decision to vacate radioastronomy from channel 38 and Ofcom’s proposal to include channel 38 in the DDR cleared spectrum auctions. According to the JFMG database, channel 38 will still be available for PMSE use post-DSO where not used for radioastronomy. As this will not be the case if Ofcom proceed as proposed, spectrum available for PMSE post-DSO will be significantly less than outlined in BEIRG’s response to the cleared condoc. BEIRG has since reviewed this issue and consequently, this consultation response is based on the assumption that channel 38 will not be available for PMSE post-DSO.

The PMSE sector currently works on the basis that 8 wireless microphones can be used interference-free in a standard 8 MHz TV band in complex multi-channel set-ups. This is the practical operating maximum in the context of large-scale productions. Most large-scale PMSE productions such as musicals currently require in excess of 50 MHz of interference-free UHF spectrum for use of essential wireless microphone and in-ear monitor systems.

1. Reduction in spectrum availability for PMSE post-DSO

If Ofcom’s current proposals are adopted, large scale PMSE events such as musicals and live music productions will not be possible in certain prime locations across the UK, which will result in the closure of a number of major venues and long term cultural and employment loss in those regions, and within the industry in general. For instance, the country’s largest touring theatres rely for over 50% of their annual output on musical productions. In the event that through the loss of spectrum it becomes impossible to stage these shows at certain theatres, the theatres would have to close³. Ofcom will also create a geographic cultural, economic and social divide whereby certain venues will not be able to host large-scale PMSE events⁴ whereas others will be able to continue to do so. If Ofcom auctions certain channels of interleaved spectrum in the 81 locations outlined in the consultation document in addition to the cleared spectrum, the PMSE sector’s spectrum availability problem will be significantly worsened in many affected areas⁵, as is demonstrated in the following table:

¹ Not taking into account guard bands etc

² The interleaved spectrum is the UHF spectrum that is not used for television broadcasting in any particular geographic location. As different multiplexes in different locations that broadcast television do so at different frequencies, the available interleaved spectrum varies in frequency from location to location and is therefore ‘geographic’ in its nature.

³ Many of these large theatres are unsuitable for the staging of Drama. Furthermore, the supply of Drama will not increase to fill the gap left by the absence of musicals.

⁴ For the purposes of this document, large-scale PMSE events may be regarded as musicals, concerts and other large-scale productions that require more than 50 MHz of interference-free spectrum to operate essential wireless microphones, in-ear devices and other short-range wireless devices

⁵ Indeed, as Ofcom state that the ‘geographic interleaved spectrum that we propose to award.....could in aggregate cover around 80 per cent of the UK population’ (condoc 1.8) BEIRG presumes that the reduction in PMSE spectrum availability will impact upon a similarly high proportion of venues.

Site	Area ⁶	Example affected venue	Availability for PMSE post-DSO if geographic interleaved awarded to band manager ⁷	Interleaved channel(s) identified for auction	Availability for PMSE post-DSO if geographic interleaved not awarded to band manager ⁸ (MHz) ⁹
Craigkelly	Edinburgh	Playhouse Theatre, Edinburgh	25.4 MHz	52 and 30	19.6 MHz
Oxford	Oxford	Silverstone Motor Race ¹⁰	50.6 MHz	49 and 29	43.8 MHz
Waltham	Leicester	Donington Park, British GP ¹¹	37.0 MHz	55 and 59	31.2 MHz
Emley Moor	Leeds	Alhambra Theatre, Bradford	37.0 MHz	45 and 56	31.2 MHz
Sudbury	Suffolk	Hylands Park, V Festival ¹²	48.6 MHz	49 and 57	42.8 MHz
Crystal Palace	London	Cliffes Pavilion, Southend	31.2 MHz	29 and 42	25.4 MHz
Crystal Palace	London	New Victoria Theatre, Woking	13.8 MHz	29 and 42	13.8 MHz
Kilvey Hill	Swansea	Grand Theatre, Swansea	42.8 MHz	30	37.0 MHz
Angus	Dundee	Tannadice Park	44.8 MHz	48	39.0 MHz
Nottingham	Nottingham	Albert Hall, Nottingham	48.6 MHz	62 ¹³	48.6 MHz
Fenton	Stoke on Trent	Theatre Royal, Stoke	46.8 MHz	29	41.0 MHz
Guildford	Guildford	Yvonne Arnaud Theatre	33.2 MHz	54	26.4 MHz
Tunbridge Wells	Tunbridge Wells	Assembly Hall Theatre	48.8 MHz	51	42.0 MHz

⁶ The 'area' that corresponds to the 'site' is a replication of the 'relevant area' contained in table 6.1 of Ofcom's geographic interleaved consultation document. It should be noted that Ofcom's indication of the 'relevant area' inadequately represents the locations that will have reduced PMSE spectrum availability post-DSO if the geographic award goes ahead as planned. For instance, as Bradford receives TV from the Emley Moor transmitter as well as Leeds, the Alhambra Theatre in Bradford will suffer from reduced PMSE spectrum availability post-DSO if channels 45 and 56, as broadcast from the Emley Moor transmitter, are released for uses other than PMSE.

⁷ Including channel 69

⁸ Assuming that PMSE stakeholders cannot buy the packages of geographic interleaved spectrum through the auction process; this point is addressed later in the document

⁹ Including channel 69

¹⁰ Outdoors

¹¹ Outdoors

¹² Outdoors

¹³ Ofcom's proposal to award interleaved channel 62 in the Nottingham area conflicts with their proposal to include interleaved channels 61 and 62 in the DDR cleared award

- 1.1. The table shows that post-DSO, PMSE spectrum availability will be reduced to such an extent that large-scale musicals will be impossible to stage at theatres in Edinburgh, Bradford, Southend, Woking, Swansea, Nottingham, Stoke, Guildford and Tunbridge Wells.
- 1.2. Whilst BEIRG chose the example affected venues based on in-depth knowledge of touring theatre, venues of any sort in the affected locations (whether used¹⁴ for Performing Arts, Broadcasting, News Gathering, Independent Film and TV Production, Corporate Events, Concerts, Night Venues or Sports Events) will suffer from spectrum paucity post-DSO, which will in turn threaten the viability of these productions.
- 1.3. Taking Edinburgh as an example, the table shows that even if Ofcom do not auction interleaved channels 52 and 30, as transmitted by the Craigkelly transmitter, there will be barely half the required spectrum availability post-DSO required to stage musicals and other large-scale PMSE productions in this location. If Ofcom do include channels 52 and 30 in the geographic interleaved award then less than 40% of the required spectrum for staging musicals and large-scale PMSE productions will be available for PMSE use in Edinburgh post-DSO.
- 1.4. The table shows how venues within the coverage-zone of certain DTT transmission sites earmarked for the geographic interleaved award will be affected by reduced PMSE spectrum availability post-DSO. Auctioning the packages of geographic interleaved spectrum will certainly result in reduced PMSE spectrum availability in many other locations, potentially precluding large-scale PMSE productions from ever taking place in those locations. Furthermore, this assessment does not take into account the locations where there may be insufficient PMSE spectrum availability post-DSO despite no interleaved channels being auctioned in those locations. In short, the table above provides only an illustration of the problems posed to the PMSE sector by the geographic interleaved awards and the DDR as a whole.
- 1.5. It is important to note that, post-DSO, the same amount of interference-free digital interleaved spectrum may not be able to accommodate as many wireless microphones and IEMs as the existing analogue interleaved spectrum due to the change in pattern of availability. The increased fragmentation of interleaved spectrum post-DSO and hence reduced availability of contiguous spectrum will increase the number and variability of applications operating in adjacent spectrum. Consequently, the increased potential for interference to PMSE applications from users of adjacent bands will reduce the certainty that a definitive number of wireless microphones will be able to fit into a specific bandwidth.
- 1.6. Ofcom may claim that, based on 2005 PMSE spectrum demand (data gathered from the JFMG licensing database), there will be 'broadly' sufficient spectrum availability post-DSO to cater for the PMSE requirements in the vast majority of locations. However, this argument reflects Ofcom's poor understanding of (i) the importance of the PMSE sector to citizens and consumers of the UK, (ii) how the PMSE sector functions, (iii) the inadequacies of the licensing/enforcement regime, (iv) the uncertainty involved in the suggestion that DTT protection might be manipulated to 'enlarge' the white spaces, (v) the major limitations of new technologies when compared to analogue systems and (vi) the fact that there are no short or medium-term alternatives for PMSE other than the use of UHF spectrum.
 - i. If Ofcom reduce spectrum availability for PMSE post-DSO as planned, they will deny the citizens and consumers living in the affected locations the opportunity to see or take part in large-scale musicals or live music events, thus resulting in cultural deprivation in certain areas of the UK¹⁵. Ofcom may argue that, in 2005, spectrum demand in these

¹⁴ Or potentially used

¹⁵ The 'cultural divide'

locations did not reach levels required to stage large scale PMSE events. However, this should not provide the justification for Ofcom reducing spectrum availability post-DSO to the extent that large-scale musicals and live music events will never be able to take place in these prime locations.

- ii. The licensing data from 2005 (i.e. a single production year) gives a woefully inadequate representation of past and future PMSE demand. Large-scale musicals and live music events which require 50+ wireless microphone channels are not staged at a particular venue every year. For instance, even if 50+ wireless microphone channels were not required for musical productions in Edinburgh, Woking, Stoke, Nottingham, Southend and Bradford in 2005, they will be required in coming years (as demonstrated by the real-life planned touring musical productions described in BEIRG's response to the DDR cleared condoc). Furthermore, whereas spectrum demand in certain locations may not have reached levels required to stage large-scale musicals and live music events in 2005, it may have done so prior to 2005 or in 2006/2007.
- iii. BEIRG has estimated that over 90% of wireless microphone usage is unlicensed, a statistic that has never been refuted. In their analysis of PMSE demand in 2005 (and consequent prediction of whether there will be sufficient spectrum availability for PMSE post-DSO), Ofcom only took licensed usage into account (using JFMG data). The fact that Ofcom have drastically underestimated the PMSE sector's spectrum requirements further undermines their claim that there will be 'broadly' sufficient spectrum availability for PMSE post-DSO. Ofcom may argue that the only measure of PMSE spectrum demand is the licensing statistics and if the licensing statistics do not adequately represent PMSE use then this is the fault of those PMSE users who operate illegally. However, a significant proportion of the blame for unlicensed usage (and hence the drastic underestimation of PMSE spectrum requirements) lies with Ofcom, which has undertaken neither invigilation nor enforcement of the licensing regime¹⁶, as evidenced by the lack of a single prosecution of a PMSE user for operating without a licence. Moreover, there is no evidence that Ofcom is going to do anything about this problem in future. While the onus for purchasing a licence lies with the user, if there is no incentive to do so then the proliferation of unlicensed use is unsurprising. In addition, there is little awareness in the PMSE sector, especially among community users, that a licence is required to operate a wireless microphone, IEM or talkback system. It is important to note that the current band manager JFMG can accept no blame for unlicensed usage – it has no enforcement powers and, since all licensing revenue is transferred directly to Ofcom, it has no financial incentive to raise awareness of the issue.
- iv. Ofcom have stated that they might be able to 'enlarge' the white space available to PMSE post-DSO by altering the protection options to DTT multiplexes in locations where there are coverage overlaps. However, even if Ofcom protect only the coverage of the 'best' DTT transmission site (referred to as the Digital Preferred Service Area ('DPSA') in NGW's original study for 71 transmission sites), this would not necessarily increase the amount interleaved spectrum available for wireless microphones and IEMs post-DSO. While the 'non-preferred' DTT transmission sites are no longer protected in the DPSA protection option (in the overlap region), RF will still be present and, depending on the power of the signal, will potentially interfere with low-power PMSE applications. Furthermore, Ofcom state in point 5.35 of the consultation document that *'predictions cannot tell us how many of these households actually receive signals from overlap DTT multiplexes and hence could be affected, in practice, by new DTT transmissions after DSO.'* If Ofcom cannot be sure how many households actually receive signals from overlap DTT multiplexes then they cannot be sure to what extent they can 'enlarge' the white spaces available for PMSE applications by altering DTT protection options.
- v. Of course, if technologies existed that used the UHF spectrum more efficiently than the

¹⁶ Though it is Ofcom's responsibility to do so

'analogue' wireless microphones and IEMs currently favoured by the PMSE industry, this could help alleviate the PMSE sector's spectrum scarcity problem post-DSO. In light of this, Ofcom recently commissioned CSMG, a telecoms and media consultancy, to analyse how wireless microphones, in-ear monitors (IEM) and talkback systems might make efficient use of spectrum, and potentially operate in alternative spectrum to the UHF band, in the future¹⁷. BEIRG is disappointed and surprised that Ofcom has not published the results of CSMG's analysis. We understand that the following conclusion appears in the draft report - that wireless microphone technology is unlikely to either become more spectrally efficient or be able to operate in alternative spectrum to the UHF band, at least into the medium term. BEIRG agrees with this assessment for the following reasons:

- a. In terms of bandwidth requirement, analogue microphones already use the UHF spectrum as efficiently as possible whilst ensuring that high audio-quality, low-latency and reliability, as required by PMSE users, are maintained. Conversely, digital wireless microphone technology is in its infancy and those which do exist are yet to demonstrate that they can use spectrum as efficiently as their analogue counterparts and that comparable efficiency to analogue devices does not come at the expense of audio quality and latency¹⁸.
 - b. Development of spectrally efficient equipment in terms of bandwidth requirement is constrained by the 200 KHz standard bandwidth of a professional radio microphone, a specification which exists to ensure professional audio quality.¹⁹
 - c. Any transition to a new technology (such as digital) is likely to take a considerable period of time. Analogue wireless microphones and IEMs are currently favoured by the vast majority of PMSE users (professional and community users alike); this will remain the case for the foreseeable future.
 - d. Whilst systems with a larger tuning range than existing equipment could help alleviate the problems of interleaved spectrum scarcity and fragmentation post-DSO, developing the corresponding equipment with required filtration characteristics is extremely expensive.
 - e. Ofcom have stated that only *'currently available wireless microphones, in-ear monitors and talkback systems'* should be afforded protection from interference from cognitive devices²⁰, which might in future share the interleaved spectrum with PMSE users. The fact that new PMSE equipment will not be protected from cognitive devices will be a barrier to development of new PMSE equipment. Indeed, no existing manufacturer will produce new PMSE equipment without a set of recognised guidelines.
- vi. Ofcom may suggest that, in order to alleviate the problem of reduced UHF spectrum availability for PMSE post-DSO, wireless microphones and IEMs should be manufactured to operate in spectrum outside the 470-862 MHz band currently used. However, there are very few viable frequencies available for wireless microphones, IEM and talkback use. Wireless microphones and IEM use 470 – 862 MHz almost exclusively due to historical security of tenure, quality and quantity of spectrum. Talkback uses 425.3125-469.8750 MHz almost exclusively for the same reasons. Spectrum below 470 MHz has very limited capacity for PMSE. Of those bands that are currently available for PMSE above 862 MHz, those above 1800 MHz are not desirable

¹⁷ It seems perverse that Ofcom decided to commission an inquiry into whether technological developments might allow the PMSE sector to operate at current and anticipated levels post-DSO in the context of significantly reduced spectrum availability after the decision to reduce spectrum availability (i.e. auction the cleared spectrum and evict incumbent PMSE users) had been made. BEIRG believes that Ofcom should endeavour to fully understand the implications of their decisions prior to making them.

¹⁸ It is important to note that Sennheiser and Shure, leading equipment manufacturers for theatres and concerts, do not currently produce digital equipment. Whilst doing R&D in digital, they do not consider digital to offer sufficient performance and commercial advantages, relative to analogue, for high-end users.

¹⁹ Please see ETSI TR 102 546 V1.1.1: Electromagnetic compatibility and Radio spectrum Matters (ERM); Technical characteristics for Professional Wireless Microphone Systems (PWMS); System Reference Document

²⁰ <http://www.ofcom.gov.uk/consult/condocs/ddrinterleaved/interleaved.pdf> section 4.34

for use of wireless microphone and IEM systems and Ofcom has already started the auction processes for the 1517 MHz – 1525 MHz and 1785 MHz – 1800 MHz bands respectively²¹. Furthermore, without guarantees of security of tenure in areas of spectrum where there is sufficient quality and quantity, the corresponding equipment will not be developed²². In relation to the cleared spectrum, Ofcom have stated that ‘if licensees are to have a reasonable prospect of earning a commercial return on their investments they will therefore need a reasonable degree of certainty that they will be able to continue offering service through to around 2027’²³. The same issue of commercial viability applies to the PMSE sector, irrespective of whether spectrum is rented or owned.

- 1.7. Ofcom may also suggest that, in order to secure sufficient spectrum availability for use of wireless microphones and IEMs post-DSO, PMSE stakeholders should acquire additional spectrum through the DDR auction process. This would be unviable for the following reasons:
- 1.8. As Ofcom have themselves stated, *‘(the PMSE) sector is an extremely diverse community, and we do not think it would be able to take part effectively in an auction, creating a serious risk of market failure.’*²⁴ This is why Ofcom decided to *‘hold a beauty contest to award a package of interleaved spectrum to meet PMSE users’ needs.’*²⁵ This situation has not changed; as we stated in our response to the DDR statement, *‘the PMSE sector is a disparate, diverse and diffuse community of content producers, manufacturers and rental organisations. Many of its members are extremely small and there is no way they could compete at auction. They possess neither the financial resources nor is there a mechanism to coordinate bidding for the collective needs of this community...therefore it cannot take part in an auction system.’*²⁶ If the DDR spectrum is as valuable as the US spectrum auctions might indicate, then the PMSE sector has no chance of raising the revenue required to secure it for the reasons that we have outlined and Ofcom have accepted.
- 1.9. The band manager will not be in place in time to acquire additional interleaved or cleared spectrum in the DDR auction. Even if it was, it would have no obligations to licence this to the PMSE sector in order to meet reasonable demand from PMSE users because, presumably, these obligations will only apply to the package of spectrum awarded through the beauty contest.

Section 1: Conclusion

If Ofcom are wrong about the implications of the DDR/DSO for PMSE but auction the cleared spectrum and geographic interleaved nonetheless, the consequences of this irreversible decision will be disastrous for the British Entertainment Industry. Therefore, we strongly urge Ofcom to allow PMSE users to retain access to the cleared and geographic interleaved spectrum²⁷ until it is proven in practice as well as theory²⁸ that the remaining digital interleaved²⁹ and channel 69 will be

²¹ As far as BEIRG is aware, no wireless microphones or IEMs are currently manufactured to operate in either the 1517-1525 or 1785-1800 MHz bands

²² In relation to security of access that the PMSE sector requires in the digital interleaved, the PMSE Pro User Group stated that ‘whilst manufacturers have invested, and continue to invest, heavily in developing new technologies the earliest conceivable date to complete this transition would almost certainly adhere to the following timetable. It is the PMSE Pro User Group’s considered opinion that there would be a further development lead in time for new equipment of at least 3 years from now, followed by a further 7 years for market penetration, and then in addition a further period for the equipment’s life span. This would constitute a minimum period of 10 years for professional usage, and for all that total 20 year period (3+7+10 years), there would have to be the certainty of defined spectrum availability.’ (See PMSE Pro User Group’s response to Programme Making and Special Events: Future Spectrum Access

²³ <http://www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf> Section 6.56

²⁴ <http://www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf>

²⁵ <http://www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf>

²⁶ <http://www.ofcom.org.uk/consult/condocs/ddr/responses/nr/PMSEProUserGroup.pdf>

²⁷ Please see paragraph 9 of the introduction (above) for definitions of geographic interleaved spectrum

²⁸ E.g. finalised white space maps based on modelling and practical testing, as carried out and formulated in conjunction

sufficient to cater for current and anticipated levels of PMSE demand post-DSO, including the Olympics in 2012. If the digital interleaved and channel 69 prove to be insufficient, then more spectrum must be awarded to the band manager with PMSE obligations.

BEIRG has demonstrated that, under Ofcom's current plans, large scale live music events and musicals will not be possible in certain prime venues across the UK post-DSO due to insufficient spectrum availability. Ofcom will deny the citizens and consumers the opportunity to experience large-scale live music events and musical productions in those locations, thus creating a geographic 'cultural divide'.

BEIRG has also demonstrated that the spectrum scarcity problem post-DSO is unlikely to be solved³⁰ by (1) altering the protection options of the DTT multiplexes, (2) the arrival of new 'spectrally efficient' technologies, (3) using 'alternative' spectrum available for PMSE or (4) acquiring new or additional spectrum through the auction process.

The only way that Ofcom can secure the future of the PMSE industry is by awarding more spectrum, of sufficient quantity and quality with enduring security of access, to the band manager with PMSE obligations.

For the reasons outlined above, we fundamentally disagree with Ofcom's proposals to auction any interleaved spectrum rather than award it to the band manager with PMSE obligations. The geographic interleaved spectrum at each location should be awarded to the band manager with PMSE obligations unless Ofcom can prove³¹ that there will be sufficient remaining interleaved spectrum for large-scale PMSE events to take place at the location in question if the packages of geographic interleaved spectrum at the 81 identified transmission sites are auctioned. Based merely on the information contained in the table above, BEIRG believes that the following transmission sites should not be included in the geographic interleaved award, but rather be awarded to the band manager with PMSE obligations: Craigkelly, Oxford, Waltham, Emley Moor, Sudbury, Crystal Palace, Kilvey Hill, Angus, Fenton, Guildford and Tunbridge Wells³².

2. Increased fragmentation of spectrum available for PMSE post-DSO

2.1. As stated in BEIRG's response to the DDR cleared consultation document, since the frequencies used for DTT will change from those used for analogue terrestrial television, the pattern of interleaved spectrum will also change and become much more fragmented. As a consequence of the greatly increased fragmentation of spectrum availability post-DSO, the increased level of equipment that will be required in the venues where staging productions is still possible may lead to many touring productions being rendered financially unviable.

2.2. Currently, certain combinations of adjacent UHF bands are available for PMSE use on a near-nationwide basis. This allows travelling productions to use the same equipment at all tour venues. However, in the wake of DSO, spectrum availability for PMSE will become so fragmented that multiple sets of equipment will be required³³. BEIRG's models outlined in the response to the DDR cleared condoc suggest that equipment costs for touring theatre will increase by a minimum of a factor of 2 post-DSO. However, these sample touring productions did not take into account either the geographic interleaved awards, the fact

with PMSE stakeholders

²⁹ I.e. the digital interleaved spectrum minus the packages identified for auction at the 81 transmission sites

³⁰ At least into the medium term

³¹ i.e. it has been proven in theory and in practice and all parties, including PMSE stakeholders (and BEIRG in particular), are satisfied that the package to be awarded to the band manager will provide sufficient useable spectrum availability to cater for large-scale PMSE events in the affected locations post-DSO

³² BEIRG does not object to the geographic interleaved award in Nottingham because it will not reduce spectrum availability for PMSE post-DSO any further than the original DSO plan. However, this is because Ofcom propose to award channel 62 in Nottingham, which has been earmarked for inclusion in the DDR cleared award.

³³ Indeed, equipment costs for every large-scale professional PMSE user will increase due to the change in pattern of spectrum availability

that channel 38 will not be available for PMSE post-DSO or Ofcom's recently stated intention to migrate PMSE users out of channels 69, despite all previous assurances that *'We will include channel 69 with the rights to be awarded to the band manager'*³⁴ Therefore, as the interleaved spectrum available for PMSE post-DSO will be further reduced and more fragmented than previously thought, it is more likely that many touring productions will be rendered financially unviable post-DSO than suggested in BEIRG's response to the DDR cleared condoc. Therefore, assuming that the geographic interleaved awards will take place, it is even more imperative that more spectrum is awarded to the band manager with PMSE obligations that will be available on a nationwide basis post-DSO. This must have sufficient bandwidth to be useable for professional PMSE productions. To this end, BEIRG would like to refer Ofcom to the PMSE Pro User Group's 2007 submission in which it recommended that channels 67 and 68 be reserved for PMSE use in conjunction with channel 69.

3. Questions 3 and 4 – protection of PMSE applications from interference from cognitive devices

- 3.1. We strongly agree with Ofcom's statement that protection from interference from 'cognitive' devices should be afforded to PMSE use³⁵. Indeed, all applications that use the interleaved spectrum on a licensed basis should be afforded protection from interference from 'cognitive' devices. This, of course, will include wireless microphones, in-ear monitor systems and talkback. Put simply, all those who pay to use interleaved spectrum should be protected from interference from other users, especially those who do not pay to use it. While Ofcom should consult separately on whether cognitive devices should be permitted to operate in the interleaved spectrum, the following questions should be considered:
- 3.1.1. What form would the protection to licensed users of the interleaved spectrum from interference from cognitive devices take?
- 3.1.2. How long would the protection be in place?
- 3.1.3. Are Ofcom in a position to ensure that protection from interference from cognitive devices is ensured once those devices have entered the marketplace?
- 3.2. Prototype cognitive devices submitted to the FCC³⁶ have so far failed to demonstrate that they can adequately detect digital TV signals, let alone low power devices like radio microphones (i.e. incumbent and future users of the interleaved spectrum and channel 69)³⁷. Indeed, prototype 'White Space' devices recently failed field tests carried out by the FCC at an NFL game between the Washington Redskins and the Buffalo Bills. The prototype devices were unable to consistently identify operating wireless microphones or distinguish occupied from unoccupied TV channels.
- 3.3. We also note Ofcom's concern that there is also a risk that new services will subsequently emerge that do merit protection from cognitive devices. However, this does not align with Ofcom's subsequent statement that *'we suggest that protection be offered to currently available wireless microphones, in-ear monitors and talkback systems'*³⁸. All new technologies and applications that use the interleaved spectrum on a licensed basis should be protected from interference from cognitive devices, including PMSE devices.
- 3.4. BEIRG is extremely concerned about Ofcom's apparent view that 'transitory' harmful

³⁴ See <http://www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf> Section 7.82

³⁵ <http://www.ofcom.org.uk/consult/condocs/ddrinterleaved/interleaved.pdf> Section 4.34

³⁶ Federal Communications Commission

³⁷ The transient nature of spectrum use by the PMSE sector makes it difficult to see how cognitive devices will be able to avoid interfering with radio microphones and in-ear monitor systems. However frequently cognitive devices scan, they cannot predict when a PMSE device will start to use a certain licensed frequency, which is dictated by human agency. Furthermore, as anyone who has been to a musical or live music event will know, no level of interference with PMSE applications is acceptable; unless there is no delay whatsoever between scans of the cognitive device, then we cannot see how interference with PMSE applications can be avoided.

³⁸ <http://www.ofcom.org.uk/consult/condocs/ddrinterleaved/interleaved.pdf> Section 4.34

interference is acceptable³⁹. In the context of production of content for Performing Arts, Broadcasting, News Gathering, Independent Film and TV Production, Corporate Events, Concerts, Night Venues and Sports Events, no interference to PMSE applications is acceptable. In this regard, Ofcom seem to concentrate on interference protection for DTT and neglect lower-power PMSE devices such as wireless microphones. This is nonsensical. As Ofcom recognise that protection from interference from 'cognitive' devices should be afforded to PMSE use as well as DTT, the emphasis should be placed on protection for the lower-power devices. Put simply, if it is proven that cognitive devices detect and do not interfere with low-power PMSE devices such as wireless microphones, they will be able to detect and avoid interference with DTT. Conversely, if it is proven that cognitive devices detect and do not interfere with DTT, they will not necessarily detect and avoid interference with lower-power PMSE devices. Therefore, it must be proven that cognitive devices do not interfere with low-power PMSE devices such as wireless microphones to the satisfaction of PMSE stakeholders before any cognitive access to the interleaved spectrum is permitted.

- 3.5. Ofcom stated in section 4.42 of the consultation document that *'(a)s yet, it is unknown whether cognitive technologies would be able to detect and avoid other potential uses of the cleared spectrum. Moreover, as explained in the DDR Statement there may only be a small incremental benefit in allowing cognitive access to the cleared spectrum over and above our proposal to allow cognitive use of the interleaved spectrum. This leads us to believe that the associated costs and risks to licensees of the cleared spectrum might be too high given the size of the possible benefits. If, in the future, cognitive radio is developed that can be used in the cleared spectrum, these could be used by licensees.'*⁴⁰
- 3.6. Like the potential new licensees of the cleared spectrum, the risks to the licensees of the interleaved spectrum and channel 69 (i.e. the PMSE sector) will be too high given the possible benefits. Irrespective of whether spectrum is rented or owned, the licensees must be afforded the same degree of protection.
- 3.7. BEIRG believes that it is essential for Ofcom to undertake its own testing of cognitive equipment and take into account test results in the EU as well as the United States⁴¹. Ofcom must be cautious of accepting test results from the FCC, which do not necessarily apply to the type of DVB in the UK.
- 3.8. The PMSE sector must be fully and actively involved in the testing process, which should be undertaken with an agreed⁴² methodology and conducted at a dignified pace. It is essential that PMSE sector representatives, as well as Ofcom, are completely satisfied that cognitive devices will not interfere with their applications before any cognitive access to the interleaved is permitted.
- 3.9. Separate from the more technical concerns, we believe that the principle that these devices should be allowed to operate, on a license exempt basis, in the same area of spectrum that PMSE users will be paying for via AIP requires further detailed consultation and discussion.

Question 4. Are there any potential future PMSE applications, other than currently available wireless microphones, in-ear monitors and talkback systems, that you consider should be protected from potential cognitive devices?

All future PMSE devices that use the interleaved spectrum on a licensed basis should be protected

³⁹ <http://www.ofcom.org.uk/consult/condocs/ddrinterleaved/interleaved.pdf> Section 4.31

⁴⁰ See <http://www.ofcom.org.uk/consult/condocs/clearedaward/condoc.pdf> Section 4.42

⁴¹ The prototype cognitive radio devices being are currently being designed to detect U.S. 8VSB DTV signals, not the OFDM-A type used in the UK and elsewhere in Europe. Also, these cognitive devices submitted to the FCC so far do not even pretend to be able to detect wireless microphones let alone offer protection. This does not entail a genuine cognitive radio function and therefore are only in effect manual scanners.

⁴² Methodology agreed with PMSE stakeholders

from interference from cognitive devices.

4. Impact of new DTT services on secondary users of the interleaved spectrum

- 4.1. In 5.27 of the consultation document Ofcom state that *'introducing new DTT services in the interleaved spectrum could have an impact on the coverage of the existing DTT multiplexes following DSO.'* Ofcom should also acknowledge that introducing new DTT services in the interleaved spectrum could have an impact on the interleaved spectrum available for secondary users of the interleaved spectrum such as PMSE. Assuming that the release of the packages of geographic interleaved spectrum at the 81 identified transmission sites will take place⁴³, it cannot be known which interleaved spectrum will be available for PMSE until new owners of the geographic interleaved spectrum have deployed their services. Therefore, the PMSE sector must retain access to the cleared spectrum until it is known for certain which spectrum they will be able to operate in post-DSO. If this is not the case then many PMSE users could acquire new 'future-proofed' equipment in preparation for the DSO transition which subsequently becomes redundant or requires extensive modification as a result of the new services which are deployed in the geographic interleaved spectrum.
- 4.2. Ofcom also state in point 5.35 of the consultation document that *'predictions cannot tell us how many of these households actually receive signals from overlap DTT multiplexes and hence could be affected, in practice, by new DTT transmissions after DSO.'* As outlined in point 1.5 (iv) above, this undermines Ofcom's argument that DTT protection options might be altered to enlarge the interleaved spectrum available for PMSE. Furthermore, it illustrates the fact that until new DTT services are deployed and practical assessment of the white spaces is subsequently carried out, the impact of DSO on interleaved spectrum availability for the PMSE sector cannot be fully understood. Therefore, until this is possible and the results prove⁴⁴ that there will be sufficient useable interleaved spectrum available to cater for current and anticipated levels of PMSE demand post-DSO, including the Olympics in 2012, PMSE users should retain access to the cleared spectrum.

5. The geographic interleaved award timetable and consequent uncertainty for the PMSE sector

- 5.1.1. BEIRG notes that *'the full list of 81 sites could be included in the award'*⁴⁵ and the final phased awards may be held as late as early 2011. As a result, it will not become clear which interleaved spectrum will be available for PMSE use post-DSO until these new services have been deployed, potentially as late as 2012. Until then, Ofcom will not know whether there will be sufficient interleaved spectrum availability to cater for current and anticipated levels of PMSE demand post-DSO, including the Olympics in 2012. Therefore, assuming the auctions of the geographic interleaved spectrum packages take place (which BEIRG believes they shouldn't for reasons outlined above), the PMSE sector must retain access to the cleared spectrum until Ofcom have proven that there will be sufficient remaining interleaved spectrum availability to cater for current and anticipated levels of PMSE demand post-DSO, which cannot be known until new services have been deployed in the geographic interleaved spectrum released via the auction process.

- 5.2. BEIRG notes Ofcom's recognition that *'users wanting to provide services in a particular defined locality.....may like us to award the relevant frequency some time ahead of DSO in*

⁴³As stated above, the geographic interleaved spectrum at each location should be awarded to the band manager with PMSE obligations unless Ofcom can prove⁴³ that there will be sufficient remaining interleaved spectrum for large-scale PMSE events to take place at the location in question if the packages of geographic interleaved spectrum at the 81 identified transmission sites are auctioned.

⁴⁴ To the satisfaction of the PMSE sector

⁴⁵ <http://www.ofcom.org.uk/consult/condocs/ddrinterleaved/interleaved.pdf> section 6.18

order to allow them to develop their operational and associated business plans.⁴⁶ Ofcom must provide the same certainty for the PMSE sector.

- 5.3. BEIRG is also concerned that further geographic interleaved channels may be included in future awards in accordance with 'expressions of demand'. This will further increase uncertainty for the PMSE sector. As long as the potential exists for further reductions in interleaved spectrum to be available for PMSE post-DSO, PMSE equipment that has been specifically future-proofed to operate in the digital interleaved spectrum may still be rendered redundant or require modification. Indeed, Ofcom state that '*it may be necessary, when considering which lots are offered to market, to amend or reconsider the channel offered from a particular transmission site in order to optimise possible outcomes.*'⁴⁷ This is a further reason why the PMSE sector must retain access to the cleared spectrum until all geographic interleaved awards are complete⁴⁸, no further awards will take place, all relevant services are deployed and Ofcom can prove that the remaining interleaved spectrum and channel 69 are sufficient to cater for current and anticipated levels of PMSE demand post-DSO.

Indeed, we have demonstrated that, under current plans, the digital interleaved and channel 69 will not provide sufficient spectrum availability to cater for current and anticipated levels of PMSE demand post-DSO. As discussed in section 1 of this document, the spectrum availability problem for PMSE post-DSO is unlikely to be solved⁴⁹ by (1) altering the protection options of the DTT multiplexes, (2) the arrival of new 'spectrally efficient' technologies, (3) using 'alternative' spectrum available for PMSE or (4) acquiring new spectrum through the auction process. Therefore, in order to secure the future of the PMSE sector, more UHF spectrum, of sufficient quantity and quality with enduring security of access, must be awarded to the band manager with PMSE obligations for use of wireless microphones and IEMs post-DSO.

As each DDR consultation is published, Ofcom are proposing to award less and less spectrum to the band manager with PMSE obligations, thus increasing the likelihood that there will be insufficient spectrum availability to cater for current and anticipated PMSE demand post-DSO. Furthermore, Ofcom are putting forward these proposals without knowing what the eventual impact on the PMSE sector will be, which cannot be known until DTT services are deployed and practical testing to determine the availability of interleaved spectrum post-DSO is carried out.

Ofcom must realise that until it is proven in practice that there will be sufficient interleaved spectrum to cater for current and anticipated PMSE demand post-DSO, PMSE users should not be evicted from the cleared spectrum and no packages of geographic interleaved should be auctioned. Furthermore, as long as the PMSE sector is forced to wait to find out which spectrum will be available for PMSE use post-DSO (a situation which is made worse by Ofcom's latest proposals), the less time will be available for the PMSE sector to adjust to the changes.

⁴⁶ <http://www.ofcom.org.uk/consult/condocs/ddrinterleaved/interleaved.pdf> section 6.27

⁴⁷ <http://www.ofcom.org.uk/consult/condocs/ddrinterleaved/interleaved.pdf> section 6.21

⁴⁸ Assuming they take place; BEIRG believes that they should not

⁴⁹ At least into the medium term