

## **British Entertainment Industry Radio Group (BEIRG)**

**Response to European Commission consultation on ‘the introduction of options for harmonisation of spectrum available for wireless microphones and cordless video-cameras (PMSE equipment)’**

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## **Response**

The British Entertainment Industry Radio Group (BEIRG) is an independent, not-for-profit organisation that works for the benefit of all those who produce, distribute and ultimately consume content made using radio spectrum in the UK. Productions that depend on radio spectrum include TV, film, sport, theatre, music, newsgathering, political and corporate events, and many others. In the context of the Digital Dividend Review (DDR), BEIRG campaigns for the maintenance of Programme Making and Special Events (PMSE) access to sufficient quantity of interference-free spectrum.

The economic and social importance of PMSE, and the creative industries which rely on it, is growing. In the UK the creative industries are currently responsible for 1.5 million jobs, and contribute £36 billion annually to the UK economy<sup>1</sup>. While PMSE is growing in size and importance, the access to spectrum which is vital to its operations is being steadily eroded. Without sufficient access to spectrum, the PMSE sector's ability to produce content for consumers is severely hindered.

Wireless PMSE technologies also play a vital role in helping to improve security and safety levels within the entertainment industry and other sectors. Their benefits include improving the management of electrical safety, the reduction of noise levels, the development of safety in communications and reducing trip hazards as well as providing an essential tool for the security orientated services. Wireless equipment and the spectrum it operates in are now more crucial to the British entertainment industry than they have ever been.

The First Digital Dividend (800 MHz), the planned introduction of White Space Devices in to UHF bands, and now the uncertainty over the future of the 700 MHz band have all raised serious questions with regards to the quantity and quality of spectrum available to PMSE in the UK for current and future production requirements.

Using white space information available from the UK spectrum regulator, Ofcom, BEIRG believes there will be insufficient spectrum available post DSO (Digital Switch Over) to operate the necessary quantities of PMSE equipment for large-scale musical productions to be staged at certain prime venues across the UK<sup>2</sup>. These venues include theatres in Edinburgh, Brighton, Southend, Woking, Cardiff, York, and Sunderland. In addition, BEIRG estimates that equipment costs for touring theatre could increase by a minimum of 100% post-DSO<sup>3</sup> due to the increased fragmentation of available spectrum.

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<sup>1</sup>[UK Government Department for Culture, Olympics, Media and Sport](#)

<sup>2</sup> Working on the basis that a large-scale production requires over 50 MHz of interference-free spectrum to operate its wireless microphones, in-ear monitor systems and wireless communications

<sup>3</sup> <http://www.ofcom.org.uk/consult/condocs/clearedaward/responses/beirg.pdf>

Unlike other technologies, wireless microphones do not have the capability to move to platforms other than radio spectrum. Whereas television broadcasts may potentially be able to be broadcast/delivered online in the longer-term, PMSE equipment cannot function on any platform other than clean, interference-free spectrum. Currently there is only a very limited pool of PMSE equipment that operates outside of UHF spectrum, due to the cost of developing and producing such equipment, the uncertainty of future access, and the overall suitability of use for large-scale applications.

PMSE is a primary user in Ch38 and a secondary user across other spectrum, where it must work around other users. However, at present, it is able to operate efficiently with DVB-T (Digital Video Broadcasting – Terrestrial) users. DVB-T is a reliable user of spectrum; it remains consistent in its spectrum use, only changing its frequencies after a long period of advance notice, which allows the secondary users of PMSE equipment reasonable time to move to other channels and avoid interference.

BEIRG welcomes the European Commission's work on options for harmonising spectrum availability for PMSE across Member States. However, we have serious concerns about the quantity of spectrum being discussed, as this does not adequately address the spectrum deficit from which PMSE will suffer.

BEIRG agrees with the principle of harmonised bands across Europe for PMSE operations. We believe this would bring positive benefits for manufacturers and PMSE professionals, and ultimately the citizens who consume the content they produce. Harmonised bands would allow manufacturers the opportunity to develop equipment, which can be sold across a much greater market, thereby increasing the funds available for research and product development. For touring productions, harmonised bands would allow productions to take their shows to an ever greater audience, without costs increasing exponentially. This would ensure that theatre and music are not reserved for the select few who live in those areas where spectrum is available.

BEIRG believes that the European Commission should also consider the impact that new mobile services will have on the existing harmonised band, 863-865 MHz, which testing has indicated could be rendered unusable for wireless microphones. This will negatively impact, both operationally and financially, on hundreds of thousands of users – many of them schools, colleges, houses of worship, and small businesses.

To meet current demand for PMSE services, BEIRG believes that 96 MHz at least (excluding guard bands) of harmonised UHF spectrum is required for wireless microphones (and in-ear monitors, instrument systems, etc.). To allow PMSE professionals to produce the best possible content, as much as possible of this should be reserved solely for PMSE use, and be contiguous.

A Study by the German Federal Network Agency in October 2008<sup>4</sup> identified that 96 MHz of spectrum was the minimum requirement for PMSE audio equipment to operate production on a daily basis. This study was carried out in an urban area, and took into consideration the operation of PMSE systems in close proximity to each other, including press and conference centres, operas, theatres, musicals, concerts, production studios and education facilities. The study excluded sites such as hotels, public/community centres, churches and other enterprises, which also utilise PMSE equipment. However, both practical application and the report shows that 96 MHz is required for each of these locations to operate PMSE services without interference or difficulty. It is fair to say that the UK situation is no different. Furthermore, this study did not include special events, such as national and international political gatherings and conferences, VIP visits, elections, large open air events, national and international sports events, religiously motivated meetings, parades and more. These would require a great deal more spectrum to be available in order to operate successfully.

The PMSE industry in the UK has faced serious upheaval during the past decade. The potential clearance of the 600 MHz band in the UK, and the actual clearance of the 800 MHz bands have placed a serious financial burden on the industry. The threat of future interference from unlicensed White Space Devices, and the potential clearance of the 700 MHz band, are providing further concern for PMSE professionals and undermining investor confidence. At the same time, consumer demand for PMSE derived content is consistently rising.

It is essential that a decision is made in a timely fashion on how to increase the quantity and quality available to PMSE across Europe. At present, however, we do have concerns about the proposals in this consultation, and believe additional detailed research needs to be undertaken in this area.

## **Consultation Questions**

### **Question 1: Which frequency bands is (your) equipment using?**

- Audio PMSE equipment in the UK currently operates on a licenced basis between 470–862 MHz. This situation is set to change as of 1<sup>st</sup> January 2013 when the frequencies above 790 MHz will become ‘off limits’ for PMSE operations. Access to the ‘600 MHz band’ (505-606MHz) has been temporarily extended until Ofcom considers the next steps for an auction of this spectrum.
- 863-865 MHz is used on an unlicensed basis, on the whole by amateur users.

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<sup>4</sup> <http://www.apwpt.org/downloads/reportonthefrequencyresourcerequirementsfopwms.pdf>

- There is also a limited quantity of equipment which operates in the 1785-1800 MHz band.
- VHF 174-230 MHz has wireless microphones, talk back links/audio links, and reporter sets.

**Question 2: To what extent is the use of (your) equipment at a local, national or European level (cross-border and EU-wide)?**

- Equipment owned and operated by PMSE professionals is used across the UK and Europe, for static and touring productions.
- UK PMSE hire companies also rent out radio mics and equipment throughout Europe, to groups such as touring theatre productions and static theatre shows, where rental is provided from the UK. For instance, UK based companies such as Autograph, Orbital and Blitz will provide the same theatre sound rental packages across Europe (to Holland, Germany, Italy, Spain, France, Denmark, Russia and others).

**Question 3: What is the typical spectrum requirement to guarantee sustainable service levels? Please give reasons and distinguish between an average use of wireless microphones and/or cordless video-cameras and “hot-spots” in case of a concentration of live performances and large social/sporting events.**

- At each performance in London’s West End there are around 1000 pieces of wireless PMSE equipment in use across all the venues. At the same time news crews and other content producers are also operating in this area, requiring further spectrum access. General daily production requirements require a minimum of 96 MHz with demand growing to in excess of 300 MHz for large and special events.
- Loss of spectrum for radio microphones at 800 MHz will bring pressure on PMSE operations, but it has not yet been determined how congested Ch38 spectrum will become, and therefore how this will also affect PMSE operations. However, there can be little doubt that the production of major events will be affected – more so if it attracts significant media attention.
- *Example 1: Eurovision Song Contest*

- The ESC transports European values far beyond European Borders, as it is an event under the umbrella of the European Broadcast Union. The ESC is the world's biggest live music event, and the third largest live event in the world.
- Several hundred million spectators expect perfect entertainment and technical perfection.
- As with most other events and content production, PMSE use at the Eurovision Song Contest has grown each year. See Table 1 below for further details.

**Table 1: PMSE use in the Eurovision Song Contest**

Year	Location	Wireless Mic Use	IEM Use <sup>5</sup>
1956	Lugano, Switzerland	Wired microphones only	-
1980	The Hague, Netherlands	4-24 ch wireless mics	-
1998	Birmingham, UK	40 ch wireless mics	2 ch IEM
2001	Copenhagen, Denmark	48 ch wireless mics	16 ch IEM
2004	Istanbul, Turkey	54 ch wireless mics	16 ch IEM
2007	Helsinki, Finland	56 ch wireless mics	16 ch IEM
2010	Oslo, Norway	72 ch wireless mics	32 ch IEM
2012	Baku, Azerbaijan	104 ch wireless mics	80 ch IEM

- *Example 2: European Champions League*

- Football is the most popular sport in Europe; for events of this magnitude, it is imperative that all viewers and listeners have high quality coverage.
- TV stations and production companies from across Europe operate in the stadium in parallel with their production equipment.
- At the latest Champions League final there were more than 220 links of wireless microphones operating, alongside roughly 60 wireless in-ear monitoring systems for individual production co-ordination.
- Loss of PMSE capability at major sporting events such as these will lead to significant reductions in production quality, consumer dissatisfaction, and lost revenue from sponsors, audiences and media.

**Question 4: In your view, which frequency bands are needed for long term future operation (please distinguish between wireless microphones and cordless video-cameras)? Please explain why.**

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<sup>5</sup> IEM – Wireless in-ear monitoring system

- BEIRG represents users of audio equipment; as such answers will not refer to requirements for video-cameras. As mentioned above, the German Federal Network Agency's 2008 study identified that to meet current demand for PMSE services, at least 96MHz (excluding guard bands) of harmonised spectrum is required for wireless microphones (and in-ear monitors, instrument systems, etc.). Since 2008 demand for PMSE equipment has grown. To allow PMSE professionals to produce the best possible content, this should be reserved solely for PMSE use, and be contiguous.
- The L-Band should be harmonised for PMSE use. It should not, however, be seen as an alternative to UHF spectrum for the PMSE industry, and should be allocated alongside UHF frequencies. Having a frequency twice as high as UHF, using the L-band would mean higher propagation losses (around twice as much as UHF) and more body absorption (at four times as high as UHF). Though a useful addition to the PMSE spectrum portfolio, it will be more of a challenge to work in.
- When harmonising the L-Band, BEIRG believes that Qualcomm should be required to forego its access to 1.452 – 1.492 MHz, having failed to make use of it since obtaining licences for the band.
- The unpaired bands 1900-1920 MHz and 2010-2025 MHz are allocated to PMSE use. This could be mixed radio microphone, IEM and camera use, and these bands should also be harmonised.

**Question 5: What would be the impact/added value of EU harmonisation of the frequency bands 821-832 MHz and 1785-1805MHz to the use of wireless microphones (which can include in-ear systems and control systems) in comparison to national allocation and bilateral coordination between EU Member States? Please motivate your answer in terms of costs, benefits and timing.**

- CEPT Report 30 identified 821-832 MHz as a potential location for PMSE on the basis that no interference would be suffered by LTE from PMSE services. No work has, however, been undertaken to establish whether PMSE services would be able to operate without suffering interference from LTE services.
- The guard bands here reduce the useable spectrum and recent compatibility work suggests that only 3-4 new channels may be available. This does not come anywhere close to providing the quantity of spectrum required to meet the demands from the professional PMSE industry, to allow it to operate at a required level.

- Historically a large proportion of PMSE equipment has operated in the 800 MHz band. However, with the recent clearance of this band for new mobile services, many PMSE professionals have replaced their equipment. Virtually none of this new equipment is capable of tuning to 821-832 MHz. It should be emphasised that 821-832 MHz **will not be suitable for professional use**. If 821-832 MHz proves to be usable at all, it will be consumers or general public users who will benefit. Depending on licensing terms, it may act as a “safe haven” for users who will be forced out of 863-865 MHz due to interference from new LTE services. The question of who should pay for any enforced migration is an open one.
- Similarly, the use of 1785-1805MHz requires investment in equipment which is able to tune to this range. At present, only one manufacturer produces equipment to operate in this band. Over time BEIRG expects more manufacturers to produce equipment but security over continued interference free access to the band is critical in order for more manufacturers to produce equipment.
- BEIRG is concerned about the decision by Ofcom (announced 21<sup>st</sup> August 2012) to allow the spectrum which is adjacent to 1785-1800 MHz to be used for LTE and WiMax operations. BEIRG believes there is a significant risk of this band being rendered unusable by out of band emissions by the new services.

**Question 6: Concerning the bands 1900-1920 MHz and 2010-2025MHz, what would be the impact/added value if these bands were designated for harmonised use by cordless video-cameras in the EU? Please motivate your answer in terms of costs, benefits and timing.**

- BEIRG believes that these bands should be harmonised for “PMSE use”. That way wireless camera and wireless microphone use could be integrated on a site-specific basis. Local administrations should ensure that spectrum users either side of the bands are not permitted to interfere with PMSE operations.

**Question 7: How could EU harmonisation through specific standardisation measures on specific bands contribute to an efficient use of spectrum by PMSE equipment? Substantiate and motivate. Please distinguish between wireless microphones and cordless video-cameras.**

- Long term security of access to clearly assigned blocks of spectrum are critical. All of the continued uncertainty results in an unwillingness on the part of manufacturers to invest in new designs and technologies. Longer term certainty



will allow the development of more 'frequency efficient' equipment and working practices.

- European harmonisation of spectrum at fixed sites and for mobile events would be supported by users of PMSE equipment. The efficiency of PMSE equipment, such as wireless microphones, allows for co-existence with DVB-T users, due to the reliability of DVB-T and the improvements that have been made to PMSE equipment over time. This will result in longer-term reliability and ease of operations across borders, allowing for easier production of content across Europe.
- BEIRG does not believe that, whilst important, efficiency is the main benefit to harmonisation, however. As well as efficiency, harmonisation would see:
  - o the culture and creative industry to grow further as new production opportunities are made and the usage of PMSE will increase;
  - o higher returns on investment for spectrum users from the systems they require for their services;
  - o manufacturers gaining better returns on investment, and motivate new developments;
  - o set uniform technical specifications within the European Community;
  - o improvements in production levels as costs decrease and the PMSE industry's future becoming more stable.

**Question 8: How and in which way could technological improvements allow a more efficient sharing with other spectrum users (please indicate relevant frequency bands) in the case of: wireless microphones; cordless wireless cameras.**

- Please see previous answer.
- The key point lies with certainty within the industry. If spectrum were to be made available for the long term, then there is an economic value for manufacturers to develop and perfect equipment to make use of it. This may reduce costs, but far more important is the benefit in improved reliability.
- As already stated, sharing spectrum with DVB-T is both efficient and reliable for both PMSE and DVB-T users. Ours is an efficient industry in terms of spectrum usage, but we are seeing the levels of spectrum available to us being worn away. The bands used by PMSE are already very congested.

**Question 9: What impact would digitalisation of PMSE equipment have in terms of spectrum efficiency, costs and deployment in professional and or non-professional environments? Please substantiate your answer.**

- At the time of writing, the digital PMSE systems that are currently on the market do not match analogue systems in terms of the trade-off between spectral efficiency, RF stability and audio quality. The PMSE sector, especially its manufacturers, are progressive and forward thinking, and are committed to ensuring greater spectral efficiency and frequency agility in the future. However, as previously stated, a lack of clarity on the long term stability of operating environment has hampered investment in some areas. The overriding demand for professional PMSE equipment is the fundamental ability to ensure the highest audio quality, 100% reliability – in terms of mechanical construction and RF stability - and flexibility, to cope with ever changing RF landscapes. In order to produce new technology the manufacturers must be able to deliver new products that, as well as guaranteeing spectral efficiency and reliability, must also deliver the same high level of audio quality that the industry and the public demand.
- Digitalisation is not necessarily an efficient way to use spectrum. It is not expected that digital technology at the production front end would deliver positive results with regard to either cost or spectrum efficiency.
- It is expected by consumers that front end production delivers premium quality. As a result, the front end has to operate without digital compression, or any form of interference. A digital uncompressed signal occupies more spectrum than the corresponding analogue signal. As a result, currently the quality of an analogue signal is higher than a digital one and its transmission is also more reliable.
- For example, an analogue wireless microphone transmits frequencies from 20 Hz to 20 kHz. To transmit this signal in a comparable quality with a digital system, a sampling rate of 48 kHz is taken at a sampling resolution of 16bit. By this, 768 Kbit/sec or 768 kHz has to be transmitted along with some administrative overhead of around 10-30%. At the minimum 10% administrative overhead, the signal would use about 850 kHz of spectrum. As a comparison, an analogue transmission only requires 20 kHz, to be sent, which is of a higher quality, and has a continuous transmission (unlike the compressed samples sent by digital technology, which can much more easily lose data, and therefore reduce in quality).

**Question 10: Which approaches, other than an increase of spectrum supply, could best contribute to meet future growth in demand by wireless microphone and/or cordless video-camera users? What would be the feasible time scale for implementation?**

- Future growth in demand from PMSE users will have to be met with an increase in spectrum supply, given current technology. There is **no** alternative means to meet demand for, and growth of, PMSE services.
- Due to the very specific nature of live performance, real time, no-latency products are the only means to produce PMSE content; and spectrum is fundamental to their use. It is evident that a reduction of production quality to save spectrum is not an option. There are no alternatives.
- The demand for more realistic TV picture and audio content will result in increased demand for more spectrum. New technologies require better production values for content; HD pictures need more spectrum than SD, 3D pictures need more spectrum than HD. The same is true for HD Audio as compared to 3D Audio. The demand for this content is already clear, and it is quickly outstripping supply. PMSE must be allowed the resources to meet this growth in demand.

**Question 11: What other measures excluding spectrum harmonisation could sustainably enable an EU-wide use of wireless microphones and/or cordless video-cameras? Please motivate your answer.**

- Serious recognition by politicians and policymakers of the importance of the PMSE sector. There needs to be full recognition and appreciation of where we actually are in terms of wireless services provision, particularly with regard to PMSE, before new services are permitted to deploy networks and commence operations. A policy platform needs to be formed upon which PMSE, with all the benefits that it brings to the EU's citizens and consumers, can thrive, rather than the current situation whereby seemingly every policy decision results in damage to PMSE's operating environment, either through diminishing access to a sufficient quantity of spectrum (Digital Dividend 1 and now potentially Digital Dividend 2) or the pollution of any remaining spectrum (deployment of White Space devices into remaining UHF interleaved frequencies).

**Question 12: Could you provide quantitative information on the use of wireless microphones and/or cordless video-cameras, such as the number of equipment in use in your EU Member State or the EU as a whole; an indication of the yearly turnover of equipment or other relevant socio-economic information related to the use of wireless microphones and/or cordless video-cameras?**

- The information below does not provide a definitive breakdown of wireless microphone use, but covers various examples.
- Demand for spectrum in the UK is substantial, and growing. Upwards of 90,000 requests for PMSE spectrum access are made to the licencing band manager in the UK each year.<sup>6</sup> These include temporary and annual assignments.
- PMSE services contribute significantly to the economic and social wellbeing of the UK. For example, the West End of London, which uses PMSE equipment to produce much of its content, attracts visitors from all over Britain and tourists from across the world. The current estimated annual turnover of the West End is £500 million, and it receives around 15 million visitors a year. Including downstream revenue such as merchandise, the estimated economic impact is £1.5 billion. Similarly, music festivals, major sporting events and live music concerts also contribute a significant amount to the British economy.
- In 2005 it was estimated that Glastonbury Festival's impact on the local economy was over £50 million. Glastonbury is only one of hundreds of music festivals which currently take place annually in the UK.
- A May 2011 Study by Bournemouth University's International Centre for Tourism and Hospitality Research showed the live UK music events in 2009 made a positive contribution to the UK economy of £864m. PMSE is an essential component of the live music scene. Even if the microphones are cabled, it is more than likely that in-ear monitors are being used. Good examples of this were the bands that performed at the London 2012 opening ceremony. It is now extremely unusual for professional acts to perform without some form of PMSE equipment being employed.
- The London Olympics would not have been possible to produce without the spectrum made specially available for the event, in the 2.5 – 2.69 GHz spectrum and the 800 MHz radio mic channels, both of which are due to completely close to the PMSE sector at the end of 2012. Capital cities will always expect to be able to produce such large-scale events; but may find their capability to do so severely hindered in the future if spectrum access for PMSE continues to be reduced.
- We welcome the EC invitation to experts to the SMART study<sup>7</sup> to work on developing definitive figures on this, and we look forward to the results of this study expected mid or end 2013.

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<sup>6</sup> <http://stakeholders.ofcom.org.uk/consultations/simplify/summary>

**Question 13: Would you have any additional relevant comment for the purposes of this public consultation?**

- See comments above.
- PMSE use can often require deployment and operation of radio microphones at short notice, with limited set up time. Spectrum that calls for different tuning at different times or at different locations would be impractical for this purpose.
- Effective entertainment productions require that radio microphones can be used with confidence whenever they are needed. The nature of PMSE makes it unfeasible to run out long cables or bulky equipment which would affect productions and reduce their quality significantly. Harmonised spectrum across Europe would be beneficial only if it is sufficient for the level of use and is free from interference. The argument that the ever decreasing range of frequencies available now in the UK can be replaced with a far smaller but EU wide allocation, and that this would be a better option for PMSE users, is unsound. There is already heavy pressure on spectrum availability for PMSE and the situation will worsen with the loss of 790-862 MHz which has yet to be fully felt.
- PMSE is a growing industry with a growing market. Its growth must be supported and allowed to continue, without being hindered by regulators. The First Digital Dividend saw no benefits for PMSE, and future plans for further reductions of PMSE spectrum are of deep concern to the industry.
- The possibility of sharing Military and Public Sector spectrum holdings should be more fully explored.
- BEIRG believes that the growth of the PMSE sector has gone largely un-noticed by regulators and policy makers. Spectrum policy appears to be driven by the attraction of new mobile communications services which appear to take precedent over the services which existing users require and provide. The economic and social benefits of the PMSE sector are too often overlooked, leaving the sector viewed as a hindrance to mobile communications developers wanting to gain access to UHF spectrum. However, as efficient and responsible existing users of UHF spectrum, the PMSE sector is already providing valuable and popular content to millions of citizens and consumers across Europe and beyond. Harmonisation of sufficient spectrum on a pan European basis for the

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<sup>7</sup> Study "Assessment of socio-economic aspects of spectrum harmonisation regarding wireless microphones and cordless video-cameras (PMSE equipment)" – SMART,  
[http://ec.europa.eu/information\\_society/newsroom/cf/dae/itemdetail.cfm?item\\_id=8205](http://ec.europa.eu/information_society/newsroom/cf/dae/itemdetail.cfm?item_id=8205)

continuation of PMSE delivery should be of equal stature to the provision of mobile broadband. It's time to re-address the balance.