

RESPONSE OF SHURE INCORPORATED

To Ofcom's

New Spectrum for Audio PMSE, Consultation (issued October 23, 2015)

Submitted December 18, 2015

Executive Summary

Shure Incorporated (“Shure”) welcomes the opportunity to provide input to Ofcom on this Consultation, a proceeding that marks an important and necessary effort to identify additional new spectrum for Programme Making and Special Events (“PMSE”) in the United Kingdom.¹ Shure applauds Ofcom’s efforts, in particular, its plans to investigate the 960-1164 MHz band for PMSE sharing. However, Ofcom’s plans will require further coordination and discussions with the incumbent band users, other U.K. and EU regulators, and national and international bodies dealing with spectrum matters. As a leading manufacturer of PMSE equipment, Shure will support Ofcom in a coordinated, systematic approach to explore the PMSE opportunities and to find mutually acceptable solutions to obstacles.

Background

For nearly 90 years, Shure has been a respected manufacturer of high-quality, innovative audio products. Today, headquartered in Niles, Illinois, U.S.A., Shure is a leading global manufacturer of audio electronics, including particularly wireless microphones used in a wide range of PMSE applications in the professional audio industry as well as in high-quality consumer applications.² As a pioneering innovator of PSME technology, Shure has participated in Ofcom’s spectrum proceedings³ and worked closely with regulatory authorities in analogous proceedings in other countries, notably, the United States, Canada, Japan, Australia, and at the European Commission.⁴

Shure appreciates the important work that Ofcom has undertaken to date to identify new spectrum for PMSE. Additional PMSE spectrum is needed to address the continuing reduction of PMSE spectrum in response to competing demands for spectrum by other services and rapidly expanding PMSE operations. Shure recognizes the significant challenges facing Ofcom and the PMSE community and pledges to work with Ofcom as it continues to explore new spectrum options and regulatory approaches that will assure the most effective and interference-free spectrum use for all parties involved.

¹ Ofcom, New Spectrum for Audio PMSE, Consultation (October 23, 2015) (“Consultation”).

² PMSE wireless microphones as used herein include a variety of audio devices that operate on a secondary basis on locally unoccupied television channels. In addition to wireless microphones, this equipment includes in-ear monitors, wireless intercoms, and wireless cueing (“IFB”) systems.

³ For instance, Shure has participated in the Ofcom proceeding “Securing long term benefits from scarce spectrum resources, a strategy for UHF bands IV and V,” Consultation (March 29, 2012), see Shure response at http://stakeholders.ofcom.org.uk/binaries/consultations/uhf-strategy/responses/Shure_Incorporated.pdf and Ofcom’s (formerly the Radio Communication Agency’s) Review of the Radio Management Report 2002. See Shure’s response at <http://www.ofcom.org.uk/static/archive/ra/spectrum-review/comments/shure-europe.pdf>.

⁴ Specifically, Shure has contributed its technical expertise as well as its real-world experience in proceedings addressing the digital TV transition, the migration of wireless microphones out of the 700 MHz band, the introduction of white space devices in the TV band, and the current examination of regulatory changes arising from the repurposing of TV broadcast spectrum for wireless mobile services. In all instances, Shure has urged regulators to ensure that UHF frequencies (470-694 MHz) continue to be made available, as much as possible, for PMSE devices, the great bulk of which operate in UHF.

Overall Principles

1. PMSE plays a critical role in the UK economy, national culture, and everyday life; the negative impact of the expected PMSE spectrum shortfall will be widespread.

Shure agrees with Ofcom that “audio PMSE involves a diverse set of activities and applications.”⁵ Wireless microphones are critical production tools essential to activities in many sectors—broadcast, entertainment, and sporting events as outlined in the Consultation. Shure would add that today audio PMSE is also important to commercial, educational, civic and religious events and gatherings. PMSE use has increased across all sectors and is now embedded in many facets of everyday life. As such, ensuring that users and audiences across these various applications can continue to rely on high-quality audio PMSE is a matter of economic, cultural, and civic concern.

Shure agrees with Ofcom’s statement in the Consultation that there will be a shortfall of spectrum as a result of various changes in Ofcom policies that reduce PMSE access to spectrum. However, Shure does not agree that the impact of this shortfall is likely to be limited to the largest event productions.⁶ Given steadily growing demand for PMSE in many sectors, Ofcom should expect that spectrum shortages will be felt across all PMSE applications.

2. Shure welcomes Ofcom’s thoughtful work to date exploring potential new spectrum resources suitable for sharing with PMSE. Targeted spectrum should be free from interference and not slated for reallocation to other services.

Wireless microphones have made excellent use of available spectrum resources. PMSE has successfully shared spectrum with other services for many years, well before spectrum sharing became the focus of national policies. For decades, wireless microphones have shared spectrum with TV broadcasters, and, depending on the jurisdiction, other services without any known interference incidences. Further, manufacturers have pushed technical advances to achieve significant gains in spectral efficiency and wireless microphone channel counts per megahertz continue to increase. However, production demands for spectrum are high and expanding every year; interference, latency or too little spectrum significantly undermines PSME services by restricting the ability to increase channel counts, and/or by degrading quality thereby frustrating both PMSE users, and the millions in the live, televised and online audiences who expect flawless, crystal clear audio for all professional productions.

Shure supports Ofcom’s exploration of new spectrum resources for PMSE but cautions that any new spectrum identified must be both reasonably free from interference and not targeted for later reallocation to different services. Interference free spectrum is necessary to meet current demand for clear, low latency transmissions, as well as to support further use and development of digital techniques and other means of achieving greater spectral efficiencies. Protection

⁵ Section 2 Consultation

⁶ Ofcom states in Paragraph 2.18 of the Consultation: “for the majority of events the spectrum supply following the reallocation of the 700 MHz band would be sufficient to meet the needs for wireless microphones, IEMs, and stage intercoms.” In Ofcom’s view, the anticipated shortfall in spectrum will have a significant negative impact only on “those events with the greatest spectrum demand.” Paragraph 2.19 Consultation.

against later reallocation is necessary to encourage the significant investment that will be required to foster growth of a new ecosystem of PMSE products taking advantage of newly available spectrum. Ofcom also should be mindful that PMSE users have already been displaced multiple times. Such dislocation imposes burdensome, and in some cases untenable, costs on users, and injects continuing uncertainty into the device market which further inhibits investment and innovation in any newly identified PMSE frequencies.

3. In examining potential new PMSE spectrum resources, Ofcom should look to supplement, not replace, UHF frequencies with spectrum that is comparable in quantity and quality of lost spectrum.

Shure applauds Ofcom's considered and deliberate efforts to address the spectrum needs of the PSME community. Given the extensive base of installed equipment and technical development in the UHF band, Shure supports continued PMSE access to UHF frequencies (470-694 MHz) as much as possible.⁷

The use of PMSE technology continues to expand rapidly in all major markets to meet increasing demand for more sophisticated productions and advanced audio services. At the same time, over a relatively short period, PMSE has lost access to a very significant amount of UHF spectrum where the vast majority of wireless microphones operate due to propagation and other favorable properties.⁸ While competing demands for UHF spectrum and expanding PMSE use requires examination of additional spectrum resources for PMSE, Ofcom must ensure that additional new PMSE bands offer a comparable quantity and quality of spectrum in order to adequately address PMSE user community needs. Targeted spectrum should be sufficiently free from interference and suitable for both indoor and outdoor PMSE use. As discussed below, Shure supports further focus on the 960-1164 MHz band to identify ways PMSE can share this spectrum. Shure also urges Ofcom to continue exploring other bands as possible sources of PMSE spectrum.

4. Ofcom should weigh the possibility of harmonization with other countries' regulations.

Ofcom should also pay close attention to the impact this proceeding will have on the international level. In Europe, Ofcom is perceived as a first mover on many spectrum issues. Shure is not aware that other European regulators have investigated or plan to investigate the 960-1164 MHz band for PMSE sharing. This is a harmonized DME band that is used for aeronautical and military uses in other EU countries. Shure therefore encourages Ofcom to enter into direct conversations with other spectrum administrations about the EU-wide use of this band.

Widespread adoption of Ofcom's plans for PMSE sharing throughout the EU would foster economies of scale important to manufacturers and end users to support equipment across

⁷ At the recent WRC-15, the 470 – 694 MHz band was one of the 19 candidate bands for mobile allocation under the WRC-15 agenda item 1.1. However, the WRC-15 decision in the relevant ITU-Region 1 was 'No Change' in the band. See WRC-15s Provisional Final Acts at <http://www.itu.int/pub/R-ACT-WRC.11-2015/en>

⁸ In the United Kingdom, PMSE users have lost access to a total of 175 MHz as a result of regulatory decisions affecting the 800 MHz (75 MHz) and 700 MHz (694-790 MHz) (100 MHz) bands. PMSE is currently facing DTT rebanding in the UHF band and it shares available UHF frequencies with white space devices.

multiple jurisdictions. The Ofcom spectrum proposal will require PMSE users to replace equipment -- not just retune to new frequencies. PMSE manufacturers will weigh the significant R&D outlay needed to develop new products for the UK market with expected return. Single market solutions often make it difficult to justify the business case for new development. Shure therefore recommends that at a minimum Ofcom raise its plans for the shared use of this band with CEPT and to secure a CEPT mandate for further testing and compatibility studies. Ofcom should also share its plans with the EU Radio Spectrum Policy Group ("RSPG") and other national regulators (e.g., ARCEP, BNetzA) for their input and evaluations and should adjust its analysis depending on their comments.

5. The PMSE industry has already reaped the benefits of skilled frequency planning and digital techniques.

The Consultation suggests that PMSE users can address the spectrum shortfall by improvements in central planning and frequency management "on the ground" as well as by incorporating digital techniques.⁹ The PMSE community is populated with many professional frequency coordinators and producers highly skilled and experienced in the task of providing audio PMSE support to the complex broadcast, entertainment, sports and other productions that are typical in today's production environment. Today, these professionals work cooperatively across different venues and productions to balance competing demands for PMSE spectrum. On any given night in London's West End there are a large number of live theater shows many operating within the spectrum that is to be cleared. Other productions involve sporting and civic events covered by multiple news outlets. These are everyday examples of events requiring sophisticated skills, technologies, and extensive consultation among the stakeholders.

Digital techniques also are not a simple cure to spectrum scarcity. In any event, PMSE manufacturers are already employing digital techniques, particularly for high end equipment to enable higher channel counts. Shure notes that clean, interference free spectrum must be available in order for users to reap the full potential of spectrum efficiencies made available by digital techniques. Without clean spectrum, the potential for alleviating spectrum congestion through the use of digital technology is limited. PMSE users cannot realize the full potential for efficiency and an expanded channel count even with digital equipment if, for example, it is operating in a noisy duplex gap situated between LTE signals.

In short, the PMSE industry is already taking advantage of the benefits of skilled frequency planning and digital techniques and it is not useful to focus on changes to those measures to address what is first and foremost an issue of spectrum scarcity. Shure thereby encourages Ofcom to continue to use its valuable resources and attention to analyze and study potential bands of supplemental PMSE spectrum.

Detailed response to Ofcom's questions in the Consultation document:

Question 1: Do you agree with our assessment that minimal growth in demand and stability in spectrum supply means that we do not need to implement any changes to meet the ongoing spectrum requirements for talkback, audio links and telemetry and tele-command applications?

⁹ Paragraphs 2.20-2.22 Consultation

Response 1: Shure does not agree that growth in demand and the spectrum supply for talkback, audio links, and telemetry and tele-command applications is stable or even distinct from that of wireless microphones. The use of talkback, audio links and telemetry and tele-command applications are part of the complex set of audio PMSE devices employed in sophisticated productions. As such, they are linked in virtually all circumstances to the broader use of wireless microphones and complementary PMSE devices in productions. Producers and frequency coordinators require flexibility to determine how the various components of audio PMSE equipment-- whether wireless microphones, talkback, audio links, or telemetry and tele-command applications -- should be employed to meet the needs of any given production. For example, the audio PMSE, and the mix of the various devices and applications necessary to support a sporting event in a large outdoor stadium is significantly different than the PMSE needs in a West End production of Cirque du Soleil,¹⁰ for example, and both differ from the audio PMSE needs of a large business convention with numerous diverse meetings and gatherings.

Ofcom should not impose artificial restraints on the use of a subset of audio PMSE by restricting the use of frequencies based on whether the intended application is for talkback, audio links, or telemetry and tele-command or wireless microphones. Such applications are intertwined. The increase in sophisticated productions for broadcast, entertainment, sports, business, civic and other uses entails the use of all audio PMSE applications -- wireless microphones, talkback, audio links, or telemetry and tele-command. A frequency limit based on application would inhibit the utility of the spectrum use, unnecessarily confining frequency coordinators and producers with no countervailing spectrum or public benefit.

Question 2: Do you agree with our sharing analysis which concludes that audio PMSE (low power microphones and IEMs) could co-exist with incumbent services in the bands 960-1164 MHz and 1525-1559 MHz? If not please provide specific details/evidence to illustrate your view.

Response 2: Shure generally agrees that Ofcom is correct in looking initially at the range of frequencies under 2 GHz, including 960-1164 MHz and 1525-1559 MHz, as possible candidates for PMSE sharing. At the outset, Shure supports a broad examination of spectrum that could also include the 1435-1525 MHz band. The United States has already created service rules for wireless microphone use in this band.¹¹ Setting aside some portion of this band would help harmonize the U.K. with U.S. PMSE regulation. Ofcom should also assess whether VHF band

¹⁰ See <http://www.londontheatre.co.uk/londontheatre/whatson/> for other examples of the wide variety of shows with audio PMSE needs in the London theater district.

¹¹ Promoting Spectrum Access for Wireless Microphone Operations, (available at <https://www.federalregister.gov/articles/2015/11/17/2015-28778/promoting-spectrum-access-for-wireless-microphone-operations>). The FCC stated there that “[a]s proposed in the NPRM, the Commission authorized limited use of the 1.4 GHz band for licensed wireless microphones operations, with secondary status in the band in the table of allocations, and only provided that certain conditions and safeguards designed to protect AMT services are met [...] Eligibility to use this band will be restricted to professional users (to include broadcasters, professional television and cable programmers, and professional sound engineering companies, and operators at major venues that manage and coordinate wireless microphone operations). The Commission also adopted Shure's recommendation, and will permit 200 kHz analog and digital masks and adopt the emission masks in Section 8.3 of ETSI standard EN 300-422-1 v1.4.2 (2011-08), with power levels of up to 250 mW consistent with the rules for UHF operations in the TV bands.” Paras. 88, 89.

frequencies (174 -230 MHz) could provide some supplemental spectrum for PMSE; particularly if access could be expanded beyond the limited number of spot frequencies currently available in the U.K. There is renewed interest within the PMSE industry in bringing VHF products to the market.

960-1164 MHz

The 960-1164 MHz band has radiofrequency characteristics capable of supporting PMSE. In the Consultation, Ofcom identifies three “primary” uses of the band DME, SSR, and JTIDS, but does not discuss the other non-primary uses. Shure encourages Ofcom to identify any other incumbent uses in the band and to analyze why such uses will not require specific sharing arrangements.

Shure strongly agrees that Ofcom’s initial sharing analysis, based on low power PMSE geographically interleaved with DME over large coverage areas, has the potential to protect both ground DME beacon receivers and airborne interrogator receivers. As mentioned above, wireless microphones have a long and successful history of sharing with other services and among PMSE users in an interleaved environment. The PMSE community has the infrastructure, practice, and expertise in place to take advantage of new supplemental spectrum in the 960-1164 MHz band quickly and efficiently with little risk of interference to incumbent services.

However, Shure recognizes that Ofcom’s sharing analysis is preliminary and much more theoretical and practical study is necessary to confirm the actual utility of this band to serve as supplemental PMSE spectrum. In particular, Shure believes that real-world testing will be required to determine how serious of a problem interference would be in each band, what, if any, additional measures are needed to minimize conflicts, and what expected timelines would apply. Shure is mindful that the analysis for shared use of this band must take into account the sensitive, safety-of-life and national security nature of legacy DME SSR and JTIDS services. Shure requests that Ofcom clarify what discussions it has had with the incumbent user community and the conclusions that it has drawn that make the 960-1164 MHz band a primary target for PMSE sharing. As a part of further study, Shure looks forward to better understanding the primary concerns raised by DME and SSR users and how much spectrum will actually be available given the current aviation use. Shure is hopeful that the low power nature of PMSE in its typical use cases (many of which are indoor) and existing sharing practices demonstrate that PMSE is a particularly suitable sharing partner for DME, SSR and JTIDS.

Further, the Consultation shows that relatively modest channel counts would be made available for PMSE in a shared environment in the 960-1164 MHz band, especially for the Seven Dials location, which is an area of intense PMSE use.¹² This initial projection of 50-55 available channels for audio PMSE would not be sufficient supplemental spectrum to respond to the everyday needs of this important theater district. Shure is hopeful that upon further analysis and testing, Ofcom will be able to predict that a much greater number of PMSE channels (e.g., 100+) can be made available for this and other areas of intense PMSE use.

¹² Paragraph 4.37, Consultation: Table 5 – Number of 1 MHz channels available to PMSE across the 960-1164 MHz band: 50 channels with no frequency offset required, 5 additional channels gained with frequency offset.

It should also be noted that although low power PMSE operation with an EIRP of less than 17 dBm/200 kHz is sufficient for many applications, there are situations, such as point-to-point links, in which higher power is necessary. Currently these higher power links are licensable in the UHF bands. We encourage Ofcom to study whether higher power operations could be permitted in specific portions of the proposed new bands.

1525-1559 MHz

The Consultation also identifies the 1525-1559 MHz band as a band that warrants further examination as a possible additional source of PMSE spectrum. As mentioned above, Shure supports a broad inquiry into multiple spectrum bands for the purpose of supplemental PMSE spectrum. Further theoretical and practical study needs to be done to identify which of these bands would be an effective supplement for PMSE spectrum. However, the 1525-1559 MHz band currently is currently used by Mobile Satellite Service (“MSS”) licensees. The Consultation notes that “land, aeronautical and maritime communications services including safety related applications require particular consideration.”¹³ Ofcom suggests that the respective geographic distribution and density of PMSE and MSS use means interference is unlikely.¹⁴ This band is being used by MSS receivers in diverse applications for space-to-earth signals which may be particularly susceptible to interference from other nearby devices. For that purpose, the Consultation suggests that a 1 km (best case) to 9 km (worst case) separation distance would protect MSS from PMSE interference.

Shure encourages Ofcom to continue to consult with the MSS industry and navigation users to determine areas of primary concern in a potential shared environment. Proposing the 1525-1559 MHz band for PMSE use may raise significant issues with GPS and mobile satellite interests and serious concerns should be understood earlier rather than later in the process. In particular, Shure encourages Ofcom to identify and evaluate expanded use of the band for existing and planned devices involved in Internet of Things (IOT) applications. As mentioned above, it will be important for the PMSE community that significant issues with spectrum potentially targeted for sharing be addressed to avoid later changes in policy that disrupt PMSE use unnecessarily.

In the same vein, Shure asks that Ofcom address whether and to what extent this band is being examined for future LTE use, which would raise concerns regarding the long term viability of assigning PMSE to this band. Finally, in its discussions with the MSS industry, Shure suggests that Ofcom address whether portions of this band present greater potential for effective sharing than others. In particular, would there be fewer potential interference concerns raised by a plan to permit PMSE sharing in the lower 15 megahertz (i.e., 1525-1540 MHz), which is adjacent to the 1517-1525 MHz band already available for PMSE use and further removed from the radio navigation signals at 1559 MHz?

Similar to proposals identifying other spectrum for PMSE sharing, real-world testing is required to assess whether and to what extent an interference problem would rule this band out entirely or, if not, how much spectrum will actually be usable now and in the future and what are the

¹³ Paragraph 4.43 Consultation

¹⁴ Paragraph 4.5 Consultation, Figure 2 – Allocations and services operating in the 960-1215 MHz band in the U.K.

potential terms for sharing. In that regard, Ofcom will need to examine more thoroughly the specific operation and technical limits that will apply to PMSE use of the 1525-1559 MHz band.

Question 3: Do you have any comments on our proposal to allow low power audio PMSE applications (wireless microphones and IEMs) access to the 960-1164 MHz band?

Response 3: Shure supports the proposal in the Consultation to identify 960-1164 MHz as a source of supplemental spectrum. Ofcom should continue its work with respect to this band including particularly further coordinating efforts with aviation (civil and military) users. Shure encourages Ofcom to involve the PMSE community in this process to ensure that both communities have the greatest possible understanding of the technical and operational issues that sharing poses for both incumbent users and PMSE operators. In particular, all parties should have a clear understanding of whether and under what circumstances, military aviation users will look to preempt PMSE use. Further, Ofcom should continue efforts at further refinement to interference protection modeling to explore what would be greatest amount of spectrum that could be made available to PMSE without risking interference to DME, SSR and JTIDS incumbent users. While Shure urges Ofcom to take immediate steps to gather and analyze more information necessary to advance its proposal with respect to this band, Shure also supports further study by Ofcom in other bands.

Sincerely,

/s/

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