

Your response

Question	Your response
Question 1: Do you agree with the prioritisation of the agenda items, as shown in Annex 5, and if not why?	Confidential? – N We agree that Agenda Items 1.2 and 1.5 are of high priority and hereafter provides our detailed responses to Question 3c and Question 7.
Question 3c: What is your view on the use of 6425-7025 & 7025-7125 MHz, and what evidence do you have to support this view? How does that inform your views on a IMT identification in these bands?	Confidential? – N Please see our response below.
Question 7: What are you views on the proposed approach for 470-694 MHz, recognising the national decisions already in place and taken for DTT multiplex licensing in the band, and the additional and supplementary spectrum made available for UK PMSE usage?	Confidential? – N Please see our response below.



Shure's response to Ofcom's Call for Input on UK preparations for WRC-23:

For 97 years, Shure has been a leading manufacturer of high-quality, innovative audio products. The subsidiary Shure Distribution UK is located in London (www.shure.co.uk). Shure products are utilized worldwide in applications known as audio-PMSE (also known as SAB/SAP)¹, which includes deployments in industries such as broadcast and film production and other professional indoor and outdoor media content creation, in addition to a variety of other civic, business, and special event contexts. These applications continue to grow annually in scale and density to meet the needs of broadcast (incl. streaming) and event producers engaged in increasingly complex productions to meet audience expectations.

Shure welcomes the opportunity to share our views on the following two high priority agenda items of WRC-23.

- **Agenda Item 1.2 - potential IMT identification in frequency bands; 3.3-3.4, 3.6-3.8, 6.425-7.025, 7.025-7.125 & 10.0-10.5 GHz**

Question 3c

What is your view on the use of 6425-7025 & 7025-7125 MHz, and what evidence do you have to support this view? How does that inform your views on a IMT identification in these bands?

Shure agrees with Ofcom that “based on current technologies, it seems unlikely that IMT services, at relatively high power, could operate in the band with incumbent satellite services. In addition, there are a number of other terrestrial uses in this band, where the protection from IMT would predominantly need to be addressed at a national level. “

Instead, we support the opening of the 6425 MHz to 7125 MHz (upper 6 GHz) for RLAN use, given that the extensive growth of Wi-Fi needs more spectrum and the fact that a Wi-Fi ecosystem is being actively developed to support this range. While the use of the upper 6 GHz for IMT is under study for WRC-23, we note that no regulator has issued rules for IMT use of that band. While certain entities are asking to wait for WRC-23 decision before deciding on the use of the upper 6 GHz band, we are of the view that UK should open that band as soon as possible on an unlicensed basis so that its citizens can benefit from the 6 GHz Wi-Fi ecosystem enjoyed by the USA, Canada, Brazil and South Korea.

Furthermore, to make more efficient use of the spectrum, enable new use cases and benefit from the unlicensed ecosystem emerging from the USA, Ofcom could consider the additional FCC's regulations as follows:

- higher standard power indoor and outdoor operations controlled by an Automated Frequency Coordination (AFC) system that would prevent interference to any incumbent fixed systems with:
 - Access Points Power up to 36 dBm EIRP (EIRP PSD of 23 dBm/MHz).
 - Client Devices power up to 30 dBm EIRP (EIRP PSD of 17 dBm/MHz).

¹ Services Ancillary to Broadcasting (SAB)/Services Ancillary to Programme making (SAP)

The FCC's regulations could also be considered to protect incumbent Fixed Satellite Service uplink operation:

- Standard power access points and fixed client devices located outdoors must limit their maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon to 21 dBm (125 mW) to protect fixed satellite services.
- **Agenda Item 1.5 - to review the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review in accordance with Resolution 235 (WRC-15)**

Question 7:

What are your views on the proposed approach for 470-694 MHz, recognising the national decisions already in place and taken for DTT multiplex licensing in the band, and the additional and supplementary spectrum made available for UK PMSE usage?

Shure agrees with the preliminary view of Ofcom to support the No Change option. However, we understand that the option 'co-primary mobile allocation' might be raised by other countries in the WRC discussion.

Even if we support the No Change option, our interpretation of both options is that no additional mobile would be implemented in the band until after 2030 or even later and that the situation for PMSE would remain unchanged until at least the end of 2030 (or even later). We therefore ask Ofcom that their position on this agenda item should avoid any ambiguity and that UK should give priority to broadcasting and PMSE at least until the end of 2030.

We further note that it is unlikely that ITU-R Region 1 would develop yet another IMT ecosystem just for Region 1. It will likely pick between 2 options:

- The APT-600 MHz ecosystem (612-652/663-703 MHz): this ecosystem is yet to be developed and was one of the reasons why the APT-600 MHz spectrum in India received no bids in the 2022 spectrum auction that took place there.²
- The USA-600 MHz ecosystem (617-652/663-698 MHz, band 71/n71 in 3GPP): this is a more mature ecosystem and countries in ITU-R Region 1 interested in IMT will likely deploy this existing ecosystem even without a co-primary allocation. For example, Saudi Arabia has announced the auction of band 71/n71 and various models of the iPhones, including the newest iPhone 13 and iPhone 14 have band 71/n71 available for Saudi Arabia even without a mobile allocation in the 470-694 MHz band.^{3 4}

² <https://timesofindia.indiatimes.com/gadgets-news/5g-auction-ends-on-day-7-total-bids-recieved-who-bought-what-biggest-bidder-and-more/articleshow/93277120.cms>

³ https://www.gsma.com/spectrum/wp-content/uploads/2022/01/spec_mena_5g_report_01_22-1.pdf

⁴ <https://www.apple.com/iphone/cellular/>



Therefore, a mobile allocation and/or an IMT identification is not needed for Region 1 countries to deploy IMT based on band 71/n71 since the equipment ecosystem already exists and as long as they do not create any interference issues. To the contrary, a mobile allocation and even worse, an IMT identification without a clear path forward for the existing broadcasting and PMSE applications would prove to be detrimental and could jeopardize the value that broadcasting and PMSE contribute to the society and economy of a country like UK. Therefore, the best way forward at this point in time is indeed to unambiguously agree on a No Change at WRC-23 until the administrations are ready to discuss how to accommodate the future needs of broadcasting and PMSE.

Based on the controversial discussions in ITU-R Task Group 6/1 which has worked on scenarios about the future use of the 470-694 MHz band, the administrations in Region 1 have not been able to agree on a common way forward and we are left with a multitude of methods contradicting each other. If the administrations in Region 1 want a mobile allocation, then this should be tightly coupled with a clear way forward for broadcasting and PMSE applications and not be based on a strategy that “hopes for the best” for these existing valuable applications.

With respect to the 960-1164 MHz for PMSE that Ofcom made available to make up for the loss of spectrum for PMSE in the 700 MHz band, we note that while this spectrum is used for various events, it is a UK-only option. Just like the mobile industry, the PMSE industry seeks harmonized spectrum to drive economies of scale when developing products. Ofcom should consider how to make the 960-1164 MHz more widely used in Region 1. Other options may be more promising like the 1350-1400 MHz band as it can provide a harmonized solution in many countries in Region 1. Ofcom should consider whether there is real appetite from the mobile industry for IMT in 1350-1400 MHz or whether it would make more sense to help make it a good option for PMSE to compensate for its loss of spectrum in the sub-1GHz band over the years.

Shure would even go one step further and kindly request that a long-term stable solution (beyond 2030) for PMSE should be found in the 470-694 MHz band, given the critical importance of this band for PMSE as explained in the following sections. This could involve getting some amount of dedicated spectrum for PMSE while still sharing spectrum with the broadcasting service.

1. Importance of audio PMSE to content creation

PMSE can be considered the “pen and pencil” of the content production industry which includes web, theatre, adverts, films, sports, concerts and cultural events as emphasized in this [video](#)⁵. This is particularly relevant for Europe.

Today, it is virtually impossible to produce creative content without PMSE. Audio is of prime importance in the world of PMSE. Without the "audio" part of an event, CEOs, politicians, and entertainers cannot communicate with impact to their audience. Ultra-High Definition (UHD) video would be of little interest without high quality sound to accompany it.

⁵ <https://www.youtube.com/watch?v=9UnbcmVVKD8>



Wireless microphones are ubiquitous to public life. They are widely used and relied upon in schools, houses of worship, government buildings, museums, and many other public places. The lives of most citizens are touched and enhanced by wireless microphones every day, whether in one of these places or by enjoying programs that are produced using wireless microphones. In all of these applications, wireless microphones must operate flawlessly. Interruptions, interference, and noise are not tolerated. This highlights the need for adequate amount of appropriate, clean spectrum.

During the Covid pandemic we have seen a transition driven by the resilience of the sector and the power of the human spirit that have found new ways of reaching not only that same audience as before but a more diverse, wider global audience as well. The demands for high-quality online content and meetings have dramatically increased worldwide.

- Facebook and Instagram report that 800 million people per day are watching live streams. The trend is projected to continue with 74% of live stream viewers saying they would continue to watch live streams even after concerts returned, and 70% would be willing to pay for live stream.
- In addition to the traditional live audiences, both recorded & live streams to cinemas globally opened a whole new audience. In the face of a pandemic, this has grown to include the online, on demand, live-streaming platforms – a new engagement that is here to stay. To tackle this growing demand globally, there is mention of Netflix spending \$17 billion on content creation in 2020, rising to \$26bn in 2026. In 2022, Disney is making a \$33 billion investment in content creation, \$8 billion more than for 2021.

2. Continued access to spectrum below 1 GHz for audio PMSE is critical for its future

The continued availability of sufficient, interference-free spectrum is key to meet growing demand for wireless PMSE technologies (e.g., wireless microphones, In-Ear-Monitor Systems).

A typical event production today needs 40 – 80 wireless microphones and in-ear monitoring systems with high quality of service, which requires more than 60 MHz of clean spectrum in the TV-UHF band below 1 GHz. Studies in Europe concluded that approximately 96 MHz are sufficient for the daily use of audio PMSE in the UHF band below 1 GHz [Lamy Report]⁶.

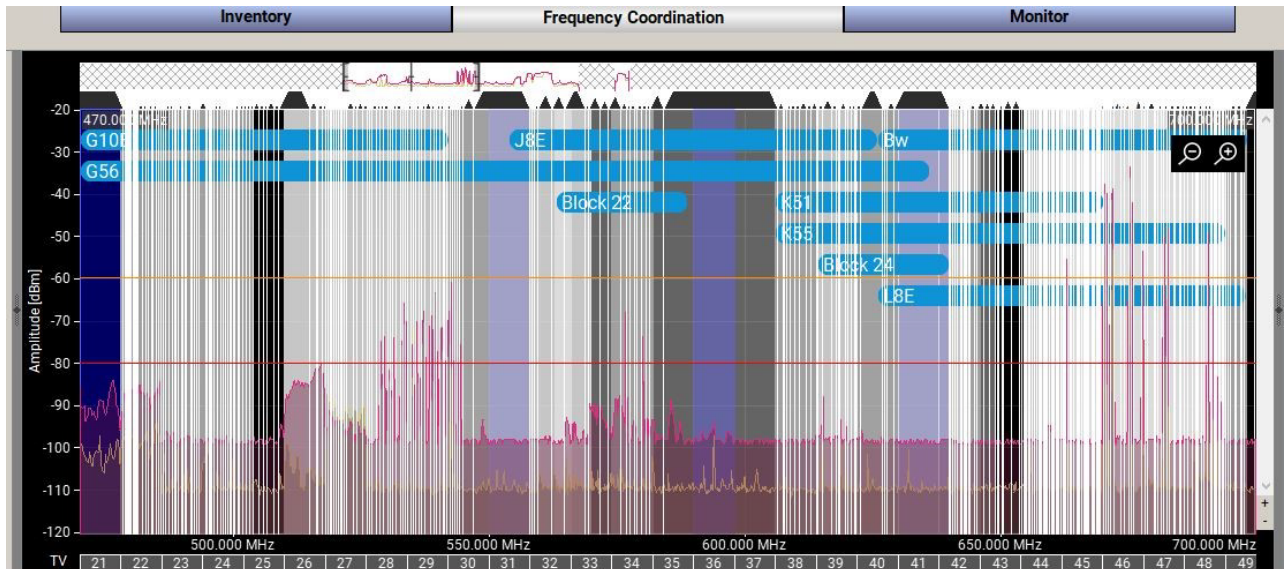
The 96 MHz requirement for daily use does not consider large events including events of national or global interest like the Olympics games. Those events do generate a very high “peak” demand, which might require more than 100 MHz of spectrum. For example, the EXPO 2020⁷ in the United Arab Emirates (UAE) required 318 wireless microphone channels at the centre stage area and more than 1000 channels (each channel is 200 kHz wide typically) on the EXPO campus (ceremonies, pavilions, broadcaster including news gathering teams) amounting to much more than 100 MHz of spectrum.

Such special events require a very detailed frequency planning from a local frequency coordinator. This local frequency management might be in coordination with the national administration, which could setup a special license registration or could allow the use of special frequencies on a temporary basis.

⁶ https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=6721

⁷ <https://www.youtube.com/watch?v=Rb5m8nT7meo>

The following figure shows the frequency management plan generated with Shure's Wireless Workbench Frequency Management Software at EXPO 2020 in UAE.



Picture legend:

- Scan from 470 – 700 MHz
- Blue vertical blocks (e.g., TV-channel 21 at 470 MHz and channel 36) indicate potential services, which need to be protected and therefore must be avoided.
- White lines show the planned and coordinated audio-PMSE devices

Daily spectrum requirement:

Required spectrum grows each year for medium and large events. A study conducted by Swiss Radio and Television⁸ to determine the spectrum need for audio PMSE, categorizes daily spectrum requirement into; permanent use, events, and exceptional spectrum requirements. The study analyses data of 111 events over the past three relevant years. The spectrum requirements for audio PMSE are summarized as follows:

Permanent use:

- Campus-Installations, which were considered in this analysis, require up to **110 MHz** spectrum in the UHF Band:
 - Example: Campus SRF Leutschenbach
 - Example: Seebecken in Zurich

Events:

- Today, the 82 analyzed **Small Events** (Events with less than 50 coordinated links) require prevailing **42 MHz** in the UHF Band:

⁸ <https://apwpt.org/wp-content/uploads/2022/03/Report-PMSE-Audio-spectrum-requirement.pdf>



- Examples in sports: Engadiner Skimarathon, Fussball Super League
- Examples in culture: Zürcher Sächsilüte, SRF bi de Lüt
- Today, the 18 analyzed **Medium Events** (Events with 50-100 coordinated links) require prevailing **69 MHz** in the UHF Band:
 - Example in politics: Local elections in Tessin
 - Examples in sports: Football national team games, Swiss Indoors Basel
 - Examples in culture: eidg. Jodlerfest, Film Festival Locarno
- Today, the 11 analyzed **Large Events** (Events with 100-200 coordinated links) require prevailing **115 MHz** in the UHF Band:
 - Example in politics: Federal council elections
 - Example in sports: Ski races in Adelboden and Wengen (Lauberhorn)
 - Example in culture: Gurtenfestival

Exceptional spectrum requirement:

- Major Events (events with more than 200 coordinated links) do not take place periodically. They have an exceptional cultural and economic value and large media response at national and international level. There were 5 Major Events between 2016 and 2019 analyzed. They had together **54 event days** (excl. setup & rehearsal) and average spectrum requirement of **174 MHz** in the UHF Band:
 - Example in sport: Ski World Championship St. Moritz
 - Example in culture: National wine festival “Fête de Vignerons”

Over the last decade we have seen audio PMSE spectrum reduce dramatically to go to the mobile service use while the demand for audio PMSE created content is experiencing significant growth driven by both the traditional audiences, mobile phone consumption and the new global audience realized by new delivery platforms as explained above. It is essential to recognize the significance and social and economic value of audio PMSE and the efforts the audio PMSE industry has made to improve spectral efficiency to mitigate the losses.

The spectrum range from 470 to 698 MHz below the 700 MHz band is critical for audio PMSE and the biggest possible amount of spectrum in that frequency range should be allowed for audio PMSE so that it can continue to support content creation⁹.

In summary, we respectfully ask OFCOM UK to take into account the PMSE spectrum needs in any future plans for bands below 1 GHz, especially for the 470 to 698 MHz range. The following section details the technical reasons as to why audio PMSE requires access to the TV-UHF Band.

⁹ <https://www.cept.org/ecc/groups/ecc/cpg/cpg-ptd/client/meeting-documents/file-history/?fid=6860>



3. Technical considerations as to why audio PMSE needs access to the TV-UHF Band below 1 GHz

The TV-UHF band is and will likely remain the primary global spectrum band for wireless microphone operation. It has been successfully shared with television broadcasting services for many years on a cooperative basis. For technical reasons, UHF spectrum is uniquely suited and vitally important to the operation of these devices.

Wireless Microphones, including In-Ear Monitors and Talkback Systems, are highly portable devices that give users mobility, which is critical for many types of content production activities. As mobile devices, they are dependent on batteries, making power consumption, size, and weight important considerations. The characteristics of the spectrum in which wireless microphones operate are the single most important high-level determiner of power consumption and link reliability.

UHF spectrum below 1 GHz is ideal for wireless microphone applications from a technical standpoint.

One characteristic of the TV-UHF spectrum that makes it useful for wireless microphone operation is wavelength. Because wireless microphones are physically small devices, antenna size is an important consideration. In this UHF band, it is possible to obtain relatively good efficiency using antennas that fit inside the device or extend a short distance outside of it. Lower (e.g., VHF) frequencies require larger antennas for efficient operation. It is possible to use electrically short antennas, but this results in lower efficiency, narrower tuning range, or both. Lower efficiency causes higher power consumption and reduced transmission range.

Another characteristic of UHF spectrum that is relevant to wireless microphone operation is the ambient noise level. Electrical noise typically declines with frequency. Thus, the amount of background noise present at UHF frequencies is lower than at VHF frequencies. The noise level is important because it determines how much power is required for a reliable radio link to be established. A higher noise level requires more transmitting power, which in turn means higher power drain and shorter operating time on batteries.

At frequencies above the 1 GHz range, both body absorption and path loss increase. Since wireless microphones are normally worn on the body or held in the hand, these losses have a negative impact on operation. Lab measurements indicate losses of 20 dB or more due to body absorption and shadowing. In addition, wireless microphone signals must often travel through obstructed paths like, e.g., the scenery on a theatre stage. Once again, this translates into a need for higher power, resulting in shorter battery life. UHF signals are better able to pass through such obstructions than higher frequency signals.

Reallocations and auctions of UHF television channels in some countries have dramatically reduced the amount of spectrum available for wireless microphones to use, particularly in cities where a great deal of content production takes place. In response, wireless microphone manufacturers have invested millions of dollars in developing spectrally efficient digital technologies. However, this technology requires clean spectrum in order to work properly.

In summary, we want to make sure that the spectrum needs for audio PMSE, especially in the 470-694 MHz band, are considered so that PMSE can continue to support events and content creation, thereby contributing to the society and economy of ITU-R Region 1.

Please contact the undersigned if you have any questions.

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Respectfully submitted,

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