



12 May 2023

**Shure's Comments to
Five-year spectrum outlook 2023–28 and 2023–24 work program Draft for
consultation of ACMA**

Shure Incorporated welcomes the opportunity to comment on ACMA's Five-Year Spectrum Outlook (FYSO).

Since 1925, Shure has been a leading manufacturer of high-quality, innovative audio products based in the United States. Shure products (www.shure.com) are utilized worldwide in applications known as audio Programme Making & Special Events (PMSE¹ also known as SAB/SAP²). PMSE includes wireless applications used in professional audio/video productions such as concerts, musicals, or other staging of entertainment, meetings, conferences, cultural and education activities, trade fairs, sport, religious, political and other public or private events. PMSE is defined as follows –

- Programme Making: the making of a programme for broadcast, the making of a film, presentation, advertisement or audio or video recordings, and the staging or performance of an entertainment, sporting, social or other public/private events.
- Special Event: an occurrence of limited duration, typically from one day to a few weeks, which take place in specifically defined locations. Examples include cultural, sport, entertainment, religious and other festivals, conferences and trade fairs. In the entertainment industry, theatrical productions may run for considerably longer.

PMSE applications fall into three broad categories:

- audio PMSE, e.g. wireless microphones, in-ear monitor systems (IEMs), talkback / intercom systems,
- video PMSE, e.g., wireless cameras, and

¹ PMSE is the ITU's inclusive term consisting of radio microphones, in-ear monitors, wireless cameras, talkback systems, etc

² Services Ancillary to Broadcasting (SAB)/Services Ancillary to Programme making (SAP)

- service PMSE, e.g., telemetry and remote control, effects control.

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](#). This is particularly relevant for Australia which has a flourishing media industry, which includes the cinema and film industry.³

Spectrum available for PMSE applications in the spectrum below 1 GHz has been shrinking over time, going to the mobile service for 3G, 4G and 5G deployments and as such, it is becoming harder and harder for the PMSE industry to support important cultural, sports and other events in the future.

While co-channel sharing of mobile with audio PMSE is problematic, audio PMSE has been sharing the 470-698 MHz band with TV stations for more than 60 years successfully, without creating interference issues.

The current process for gaining access to spectrum for PMSE productions is often manual, involving emails, telephone calls, and website visits. In almost all cases, spectrum is shared with other services, and PMSE users must contact a frequency coordinator to obtain access. They must determine who the appropriate coordinator is, locate that person, contact them, and wait for a response. Most coordinators are volunteers who have many other responsibilities. Thus, they may not be readily available to respond. Many PMSE productions are planned well in advance, but some require quick action like, for example, a breaking news story. Automated spectrum access technology would greatly simplify frequency coordination and make spectrum access faster and simpler.

Shure is therefore exploring other spectrum sharing frameworks and has completed a joint project between ETSI in Europe and the Wireless Innovation Forum (WInnForum) in USA to address technical approaches for automated spectrum access to support dynamic, temporary, and flexible spectrum sharing. The Technical Reports are available:

- ETSI: [TR 103 885](#)
- WInnF: [WINNF-TR-2011](#)

³ https://www.statista.com/topics/6499/cinema-in-australia/#topicHeader_wrapper

A joint white paper is being developed now. The applications and use cases described require a certain, typically high Quality of Service (QoS) but are often limited in range and differ in the duration of operation which can vary from short-term (e.g., some days to some weeks) to long-term (e.g., some weeks to some years). Some use cases allow for prior network planning, others require very short-term deployment without a prior planning phase.

To support the use cases described, the study evaluated:

- suitability of sharing frameworks for temporary and flexible spectrum access to support ad hoc and on-demand use cases,
- procedures and functionalities for automated spectrum negotiation, assignment, and application specific QoS guarantee,
- suitability for the support of scalable localized dedicated networks,
- suitability for the support of fixed, nomadic, or mobile deployments, and
- requirements, system architectures and high-level procedures for spectrum access for use cases described.

Before we provide more details on ACMA's spectrum outlook, we would like to share some general comments.

1. Audio PMSE enables content creation

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. 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 were 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. Spectrum Requirements for PMSE

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]².

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.

Required spectrum grows each year for medium and large events. A study conducted by Swiss Radio and Television³ 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:



a. **Daily spectrum requirement:**

Even, if the below examples are based on a PMSE database in Switzerland, the amount of needed PMSE devices and frequencies is very similar globally.

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:
 - Example sport: Engadiner Skimarathon, Fussball Super League
 - Example 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 politics: Local elections in Tessin
 - Example sport: Football national team games, Swiss Indoors Basel
 - Example 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 politics: Federal council elections
 - Example sport: Ski races in Adelboden and Wengen (Lauberhorn)
 - Example culture: Gurtenfestival

b. **Exceptional spectrum requirement:**

- Major Events (events with more than 200 coordinated links) do not take place periodically. They have an exceptional cultural value and large media response at national and international level. There were 5 Major Events between 2016 and 2019 analyzed. They had together during **54 event days**

(excl. setup & rehearsal) and average spectrum requirement of **174 MHz** in the UHF Band:

- Example sport: Ski World Championship St. Moritz
- Example culture: National wine festival “Fête de Vignerons”
- Example international major event: Expo 2020 Dubai

• Case studies from global events:

Hosting a global event can give many economic, social and cultural benefits to the host country including raising the profile of the host country in addition to social and economic benefits. Such special events require a very detailed frequency planning from a local frequency coordinator. Organizing and planning large events may take several months in advance. Case studies from past and future (planned) events are summarized below:

a. EXPO 2020 – Dubai, United Arab Emirates

EXPO 2020⁴ 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.

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

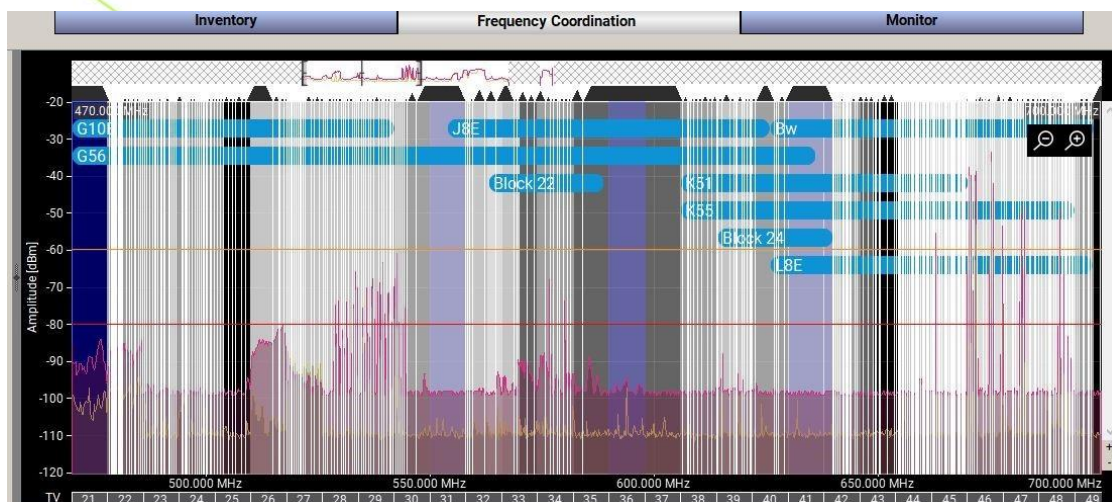


Figure 1: Frequency Management Plan at EXPO 2020

As observed from the figure, each thin white line represents a 200kHz wireless RF channel for audio PMSE. **Typically, special events do generate a very high “peak” demand, which might require more than 100 MHz of spectrum.**

b. Olympics and Paralympic Games 2024 – Paris, France

The summer Olympic and Paralympic Games (“the Paris 2024 Games”) will be held between July and September 2024 in Paris, France.

To anticipate the spectrum needed for the Paris 2024 Olympic and Paralympic Games (OPG), the national frequency agency (ANFR) and OPG organizing committee studied past OPG as well as other major international sport events, considering technological evolutions. The ANFR and OPG committee released the [Spectrum Management Plan](#) and conditions for the Paris Olympics.

Figure 2 shows frequency bands assigned to wireless microphones and IEM systems.

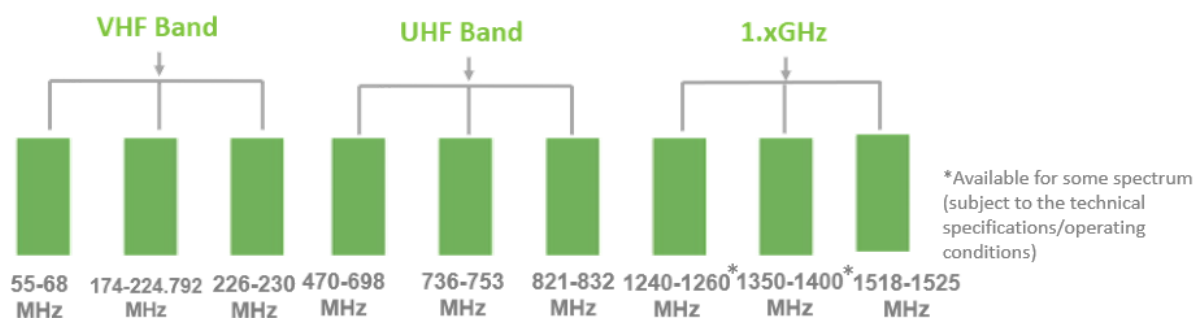


Figure 2: Spectrum for PMSE Use at Paris 2024 Olympics.

The host city, and its suburbs gather 16 % of the French population and most of the head offices of the main companies established in France, and there is accordingly already a very high use level of radio spectrum. Also, **5G deployments are reducing the bands historically allocated to the PMSE usages.** It is anticipated that the demand for spectrum for wireless microphones at music concerts or theatres in and around the Paris area will increase during the Games.

In addition to the 470-694 MHz band that is shared with TV and opening 3 bands in the 1.x GHz range, France recommends using wired communication systems for



microphones whenever possible to accommodate the high PMSE demand. While we understand the recommendation for stakeholders to use wired microphones because of the spectrum crunch, it is clearly not aligned with the trend we are seeing with increasing demand for wireless microphones. It would be interesting to see how this recommendation is actually put in use by the users. Shure will continue to work with regulators worldwide to ensure that enough spectrum in the 470-698 MHz band is available for audio PMSE.

In summary, we ask ACMA to please take into account the PMSE spectrum needs in any future plans for bands below 1 GHz, especially for the 470-698 MHz range.

3. Additional comments to specific sections

In addition to above sections on the importance of 470-698 MHz for audio PMSE, we wanted to offer some comments on:

- **600 MHz (617–698 MHz)**

The PMSE industry needs to have continued access to the 600MHz band to cater for increasing demands. The UHF band is primary global spectrum band for wireless microphones, successfully shared with television broadcasting service for many years on a cooperative basis. For technical reasons, UHF spectrum is uniquely suited and vitally important to the operation of these devices. Countries that deployed the band for mobile networks continued to provide PMSE access on special authorization. For example, in the USA, the Super Bowl, which is the biggest game in American football, takes place once every year. Technical and radio frequency planning for the Super Bowl begins months in advance and is dependent on available frequency bands. Mobile Network Operator T-Mobile has been building out its network on the 600 MHz band since the auction in 2017. Audio companies which relied on these frequencies to host large events had to apply for Special Temporary Authority (STA, see attachment 1) licenses with the FCC to operate on the 600 MHz mobile band to accommodate the needs of the Super Bowl since there was not enough spectrum below the mobile band.

Since there is currently no PMSE equipment that operate out of the UHF band and to meet audio PMSE requirements at the Super Bowl, the FCC had to grant audio PMSE companies a special temporary authorization for the use of 614-673 MHz for the event area in Los Angeles within one kilometre. Luckily, equipment from other regions, where this band is still available, e.g., EMEA, could be used for this event.

The available spectrum is not sufficient to meet PMSE needs, not only that but also, existing audio PMSE installations are already suffering interference from IMT in different bands. This causes extra costs for PMSE users to mitigate interference and increases challenges for audio PMSE companies to seamlessly enable such large and important events.

It is important to consider PMSE usage in this band when conducting technical research.

- **1350-1400MHz (L-Band) for audio PMSE**

PMSE sector needs secure access to spectrum in a clearly defined frequency range, where reliable, interference-free, operation can be confidently planned for, with long-term access guaranteed.

In the United States in 2017 when 70 MHz (in 600 MHz band) of spectrum was reallocated from use by broadcasters to use for 5G mobile networks, 90MHz of spectrum, between 1435 and 1525 MHz was made available for PMSE use.

PMSE users need replacement spectrum to be made available, with a similarly sized piece of spectrum that is predictably and reliably available for such use. Discussions are currently open in a number of other countries. The EU top-level group ECC has suggested this band for a national allocation in European countries. CEPT has finalized the compatibility studies, for example, ECC Report 245⁴, dated 29 January, 2016, titled Compatibility studies between PMSE and other systems/services in the band 1350-1400 MHz. This band has already been added to ERC REC 25-10 and ERC REC 70-03 and will be allocated in Europe.

⁴ <https://docdb.cept.org/download/1242>

Consequently, **Shure kindly requests ACMA to consider 1350-1400MHz with power up to 50 mW EIRP for audio PMSE applications.** We expect this band to be a candidate for a possible worldwide harmonized tuning range for audio PMSE.

- **1.9 GHz (1880–1920 MHz)**

DECT is one of the most successful communication technologies in bands like 1880-1900 MHz. Due to the success of this technology, an expansion band from 1900-1920 MHz is under discussion by the European regulatory body, CEPT.

With the reduction of the TV-UHF band, some PMSE applications have adopted DECT technology, e.g., talkback, Intercom and AV conferencing, thereby taking the place of systems that would traditionally share spectrum with wireless microphones and IEMs. It has the advantage of maximizing availability of spectrum for wireless microphones and IEMs in the range 470-698 MHz. The robust nature of DECT and the ability to deploy complex private networks is particularly attractive, and it serves a valuable purpose, though it does not achieve the low latency required for high quality PMSE applications.

In addition, DECT, together with the next generation of DECT, DECT-2020 NR, presents an exciting opportunity to bring new applications to Australia, with considerable economic and user benefits. The new DECT-2020 NR has been designed to be 100% spectrum-compatible with DECT, and hence this opportunity comes with no co-existence downside – in sharp contrast to the prospect of new technologies that are not compatible with DECT, including 3GPP-based NR technologies, sharing the band, that would likely cause interference, degrading Quality of Service. We hereby attach details about DECT and its evolution in the attached document named “DECT Professional Overview”.

- **3400–4000 MHz**

Shure supports ACMA’s innovative area-wide licence (AWL) in 3400-4000MHz band in remote areas and AWL arrangements in the 3800–3950 MHz frequency range in metropolitan and surrounding regional areas and in 3750–3950 MHz in other regional areas in Australia. In addition Shure supports the enablement of spectrum-licensed WBB services in the 3400–3575 MHz frequency range and the 3700–3800 MHz frequency range.

The following are some of the local/shared licensing approaches that can be considered/adapted:

- USA FCC's Broadband Radio Service (CBRS) band in which new commercial operations are governed by a Spectrum Access System (SAS) which ensures that the new systems can coexist with the incumbent military radar systems.⁶ The CBRS framework can be streamlined to something much simpler to satisfy Australia's 3.8-4.2 GHz needs since the incumbents are static FSS earth stations and not radars embarked on ships in USA. The CBRS specifications developed by the Wireless Innovation Forum (WInnForum) for the interactions of the SAS with the new commercial users can be adapted for the Australia situation.⁷ A letter on the success of CBRS to the US National Telecommunications and Information Administration (NTIA) and the Federal Communications Commission (FCC)⁵ highlighted that the CBRS framework has been providing "users with flexibility to choose from the broadest range of technologies and service models, driving innovation and competition" in the US. It was signed by diverse industry players that represent manufacturing, automotive, agriculture, energy, retail, commercial real estate, communications, media, and supply chain companies, as well as schools and libraries. Indeed, CBRS is currently being used throughout the US with more than 285,000 CBRS base station devices (CBSDs) deployed in under three years. This is compared with the commercial wireless industry that has a total of around 418,887 cell sites.
- UK OFCOM introduced a new licensing approach in the 3.8-4.2 GHz, through local licences (called Shared Access licences).⁸ Potential users can apply to OFCOM for coordinated access to these bands in specific locations on a first-come-first-served basis. Longer term, OFCOM is studying the use of automated spectrum management tools that would allow adjustment of technical parameters of these new users over time. These tools could be an adaptation of the SAS developed in the USA for the CBRS band or the Automated Frequency

⁵ <https://www.airspan.com/news/broad-industry-letter-on-cbrs-5g-success/>
<https://spectrumfuture.com/>

Coordination (AFC) system in the 6GHz band.

- Germany⁶: Germany opened 100 MHz in the 3.7-3.8 GHz band for 5G local spectrum licences. Applicants could apply for up to 100 MHz of spectrum, in 10 MHz blocks for use in a defined coverage area with licenses duration of up to 10 years, with the possibility of renewal. Users must ensure interference-free use, including by coordinating with other geographically near local users and protecting existing users in the band (e.g., FSS earth stations). The spectrum must be used within one year of assignment and any transfers must be approved by BNetzA. Several companies from various technology related industries applied for private 5G licenses.

We would respectfully suggest that Non-Public Network spectrum is valuable in providing a base for other industries to develop new innovative systems and solutions.

- **6 GHz (5925–7125 MHz)**

Given that the extensive growth of Wi-Fi needs more spectrum, we support the opening of the whole frequency range from 5925 MHz to 7125 MHz (“6 GHz”) for RLAN use. 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 Australia 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, South Korea and Saudi Arabia.

With the increase in demands for usage of the wireless spectrum it is expected that current spectrum allocation methods will no longer be sufficient. The demands on spectrum usage are going to be much more dynamic, and require the participation and cooperation of various entities, departments, and agencies within a country. Automated spectrum management systems will be required to handle the tasks of frequency allocation, frequency assignment, frequency allotment, etc., in a dynamic fashion to control and

⁶ <https://digitalregulation.org/spectrum-licensing-local-and-private-networks-in-germany/>



reduce potential interference. An example is the Automated Frequency Coordination (AFC)¹¹ system.

Furthermore, to make more efficient use of the spectrum, enable new use cases and benefit from the unlicensed ecosystem emerging from the USA, ACMA could consider the additional FCC's regulations as follows:¹⁰

- higher standard power indoor and outdoor operations controlled by AFC and 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).

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.



In summary, Shure wants to make sure that the spectrum needs for audio PMSE, especially in the 470-698 MHz TV-UHF band and the 1.9 GHz DECT band are taken into account as the ACMA defines their spectrum outlook so that PMSE can continue to support various events and contribute to the society and economy of Australia.

Please contact the undersigned if you have any questions.

Respectfully submitted,

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Attachment 1: Document named “FCC’s Special Temporary Authorization for the Super Bowl”.

Attachment 2: Document named “DECT Professional Overview”