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## **Submission from Sennheiser Australia Pty Ltd**

To

### **Media Reform Green Paper, Modernising Television Reform in Australia**

Sennheiser Australia Pty Ltd thanks the Department of Infrastructure, Transport, Regional Development and Communications for the opportunity to respond to its Green Paper, Modernising Television Reform in Australia.

Sennheiser Australia Pty Ltd is a wholly owned subsidiary of Sennheiser electronic GmbH & Co. KG, a family-owned German company founded in 1945 by Professor Fritz Sennheiser to manufacture electronic measuring instruments and audio equipment for professional applications. It has grown to be a global company with subsidiaries and distributors across the world and is universally recognised as a leader in high quality audio solutions for professional and commercial applications.

What is proposed in the Green Paper will effectively halve the spectrum available for PMSE (Programme Making and Special Events) systems in Australia, producing significant constraints on the businesses and organisations whose operations depend on these systems and on the audiences who consume the content they deliver.

We seriously question whether there is any real need to repurpose all of the 600MHz band to 5G applications when there is so much spectrum already available for it, and new innovations are available to help make more efficient use of that spectrum.

We need to bring to your attention the fact that Broadcast Television is not the only user of the 600MHz spectrum. There are other major industries and sectors of the economy relying on devices which use the 600MHz band as a primary part of their spectrum. These industries include the media, arts and entertainment industries, education, houses of worship, real estate agents, wedding celebrants and many other groups who use PMSE systems to capture, link and monitor audio from a performer, speaker, preacher, lecturer, reporter to then be recorded, broadcast, streamed and/or amplified for live performance.

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These PMSE devices currently operate under Classes 28 and 29 of the LIPD licence, with FM or digital modulation, in the frequency range of 520 to 694 MHz.

**What are PMSE devices?**

Programme Making and Special Events (PMSE) describes the applications that use radio spectrum to support the capture, production, sound reinforcement and broadcast of audio content consumed live and across a multitude of platforms. Typical applications include televised sport, music events, theatre productions, live music, television studio productions, film production and television news gathering. PMSE is also widely used at Universities, schools, houses of worship, clubs, pubs, exhibitions and conferences; almost anywhere that sound needs to be captured.

PMSE content capture is the beginning of the supply and value chains for a wide range of products, such as broadcast and recordings of live performances and sporting events and the recording of culturally significant material. This means that content capture must provide the highest quality possible, with producers and programme makers taking steps to ensure the quality of the sound that is captured.

Audio PMSE has specific requirements in terms of latency. In the case of live performance, the round-trip-delay is important as the performer will normally be listening to their own performance (captured with a wireless microphone) mixed with that of other performers delivered back directly via a wireless In-Ear Monitor (IEM). Differences in latency between sources will produce unacceptable audio artefacts that make it very difficult for the performer to continue.

For these reasons, quality and reliability of the radio link are fundamental to PMSE users. For high-end (live) PMSE productions especially, the commercial pressures are significant because there is no opportunity to repeat or do another “take”. Therefore the tolerance for disturbance to the quality of audio is extremely low.

PMSE applications in Australia mostly share UHF spectrum with broadcast TV between 520 and 694MHz based on sharing criteria, primarily defined to protect these other services from interference from PMSE. Another important aspect of these sharing arrangements is that the spectrum is able to provide a predictable sharing environment, supporting the high quality of service required for live events and programme making.

Access to radio spectrum that provides high quality and reliability of wireless audio radio links is therefore a fundamental requirement for PMSE production.

Touring productions such as musical theatre and popular music bands usually take their own wireless equipment on tour. The frequency-ranges used are scattered across the available 520-694 MHz spectrum, so it is necessary to match the equipment that the touring band carries with the spectrum available at each location.

For users in the live performance sector, as well as for rental companies, it is therefore necessary to be able to have clear information on the spectrum available in each of the intended locations.

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PMSE devices are generally tuneable by the user over a limited range, typically 20- 40MHz. Clearing the 600MHz band for 5G use will mean that a large part (roughly half) of the spectrum these devices rely on will no longer be available for them to use. It is generally not economically feasible for them to be modified to operate in different frequency range, so those that are operating in the 600MHz band will become obsolete when the current legal uses of the 600MHz band change.

Another aspect to be considered is that because many of these wireless systems are engineered to a high standard, the equipment often has a productive operational life of 15 to 20 years. Operators need to have the security of long-term access to quality spectrum, significantly longer than their planned equipment life, if they are to make the business decision to invest in expensive equipment.

Product innovations are constantly being developed, often with spectral efficiency in mind.

An example of innovation which is yet to be realised by any manufacturer of PMSE equipment is Wireless Multichannel Audio Systems (WMAS) as described in [ETSI TR 103 450 V1.1.1 \(2017-07\)](#), titled Technical Characteristics and Parameters for Wireless Multichannel Audio Systems (WMAS). This technology is intended to operate in any frequency range that provides the required bandwidth and is allocated to its use by the relevant spectrum management authority.

We note that technical standards for WMAS technology have already been addressed in [ETSI EN 300 422-1 V2.1.2 \(2017-01\)](#).

While product innovations are constantly being developed, no operator will invest in new equipment if there is no long-term security for the spectrum it will use.

### **What does the industry need if the 600MHz band is cleared for 5G use?**

The owners and users of these PMSE systems will need Government support if this proposed move out of the 600MHz band goes ahead.

The first of these support needs is financial and the second is replacement spectrum allocation.

#### **1: Financial support.**

Many users of these devices have large sums of money invested in them; the ABC and Hillsong Church, as just 2 examples, each invested well over AUD\$1 million updating their wireless audio systems just 7 years ago in the first Digital Dividend. Other companies, such as JPJ Audio, Norwest Productions and NEP Australia have a similar, if not larger, scale of investment.

There are many thousands of organisations, large and small, who own and operate wireless audio systems.

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It is estimated that there are over 150,000 channels of wireless audio across the current user base in Australia. Sales of new systems normally run at about 15,000 systems per year.

Most of these businesses have been hit very hard by the Corona Virus pandemic because they rely on the entertainment, sporting and events industries for their livelihood. With these industries effectively shut down for more than 15 months now, their ability to invest in re-equipping their wireless audio fleets into the 500MHz band is non-existent.

Like the Free to Air Television broadcasters, these businesses will need Government financial support to re-equip into the 500MHz band and potentially other frequency bands that might become available.

## 2: **Replacement Spectrum.**

Each wireless audio system currently uses about 330KHz of RF spectrum in operation. Large scale shows: consider a large music-theatre production such as Hamilton, or the Hillsong Conference, can routinely use over 40 wireless audio channels simultaneously. Frequency co-ordination for this scale of production will typically consume most of the existing 184MHz of spectrum licenced for this application. Contiguous spectrum is an important consideration for large production, to ensure consistent performance across all the systems in use.

It is also important to remember that these events don't always happen isolation. Often there are multiple events running in adjacent venues, for example the Qudos Bank Arena, Stadium Australia and Sydney Showgrounds, all at Homebush. Similar situations occur in Melbourne around the MCG, Rod Laver Arena, Margaret Court Arena, John Cain Arena and AAMI Park, and also in other cities across Australia.

Events such as Olympic and Commonwealth Games, and sporting World Cup competitions, music festivals such as BluesFest and Splendour in the Grass rely on large numbers of wireless audio systems being deployed at multiple locations/stages in close proximity of each other.

Losing the use of the 600MHz spectrum will severely restrict the ability of large productions, music festivals and sporting events to go ahead, especially when there are multiple events at adjacent venues.

As mentioned previously, most of the use of PMSE in Australia is in the range of 520 – 694Mhz. This is because it provides a reliable predictable environment with a large contiguous range. We acknowledge the availability of some other frequency bands for PMSE use.

- The small window of spectrum available from 1785MHz to 1800MHz can provide for a small number of systems in a small venue, but is not very useful in the context of a large production.

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- The VHF frequency range between 174MHz and 230MHz is not well suited for this application because the large size of antennas required for transmitters and receivers makes them impractical to use.
- DECT technology (1880MHz to 1900MHz) finds some application for wireless audio in applications where recording, post-production and later replay is required, however the latency that is inherent in these systems means they are not at all suitable for live events. This latency also makes it difficult to incorporate DECT technology with other PMSE devices on the same event because mixing the audio from sources with different latency creates unacceptable audio artefacts.
- There some lower quality wireless audio systems that operate in the 2.4GHz band (2400MHz to 2483.5MHz) however their latency and unreliable reception qualities make them unacceptable for professional or commercial applications.

Professional end users in the live performance sector need 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.

The industry has little confidence in the long-term availability of the 500MHz band, based on the Digital Dividend of 2014 and now the impending loss of the 600MHz band. It seems a logical conclusion that the 500MHz will not be available for much longer after the 600MHz band is repurposed.

There needs to be discussion opened between the relevant regulatory authority in Australia and the wireless audio industry to establish options for the use of suitable spectrum, apart from the 500MHz band, possibly on a shared basis as is currently the case.

Page 24 of the Green Paper states that *“In the United States in 2017, 70 MHz (out of 84 MHz) of spectrum was reallocated from use by broadcasters to use for 5G mobile networks.”* It is important to be aware that part of the deal for giving up that spectrum was that 90MHz of spectrum, between 1435 and 1525 MHz was made available for PMSE use.

PMSE users in Australia need replacement spectrum to be made available, with a similarly sized piece of spectrum that is predictably and reliably available for such use across the country.

We understand that discussions of this nature are currently open in a number of other countries, with the possibility of using some frequencies currently used by the aeronautical industry, between 1200MHz and 1600MHz depending on the particular country or region, on a shared basis.

We refer to

- [ECC Report 245](#), dated 29 January, 2016, titled *Compatibility studies between PMSE and other systems/services in the band 1350-1400 MHz*, and

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- [ECC Report 253, dated 30 September 2016](#), titled *Compatibility studies on audio PMSE at 1492-1518 MHz and 1518-1525 MHz*,

as examples.

The opening of such a discussion in Australia would certainly be welcomed by the local industry.

**Summary:**

PMSE is a significant user of a number of frequency ranges in Australia, but none is relied upon more, than the 520 to 694MHz band. Removing the 600MHz spectrum from PMSE use will have a significant negative impact on users and audiences.

Planning to re-purpose the 600MHz band, especially in light of the relatively recent Digital Dividend (2014), demands that the needs of users and audiences of PMSE brought about by this re-purposing, are comprehensively addressed in a positive and co-operative way.

We would welcome an opportunity to actively participate in the consultative process around the planned changes.

Yours sincerely



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