Sennheiser electronic GmbH & Co. KG
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**Sennheiser response: Variation to the Low Interference Potential Device Class Licence Consultation paper (October 2022)**

Sennheiser electronic GmbH & Co. KG welcomes the opportunity to respond to the consultation on the variation to the Low Interference Potential Device Class Licence. Specifically, our response addresses the potential future updates in relation to Wireless Multichannel Audio system technologies for wireless microphones.

**About Sennheiser**

At Sennheiser, we aim to shape the future of audio by creating unique sound experiences for our customers. As a third-generation family-run business, we are equally proud of our over 75-year history and past accomplishments and innovations in the world of audio and of our ambition to shape its future.

Sennheiser electronic GmbH & Co. KG, headquartered in Wedemark (Germany), is the leading European manufacturer for professional audio solutions such as microphones, meeting solutions, streaming technologies and monitoring systems. The business with consumer devices such as headphones, soundbars and speech-enhanced hearables is operated by Sonova Holding AG under the license of Sennheiser.

**Response to consultation questions on potential future updates – WMAS**

Sennheiser's response to the consultations are presented below. Further information is provided in the Annex.

**Question 4**
What should be the maximum EIRP for WMAS devices in the 520-604 MHz and 1785-1800 MHz bands?

Sennheiser is of the view that the current maximum power limit of 100 mW is sufficient for WMAS operation in the 520-604 MHz band. There is in general no need to change existing radiated power limits.

**Question 5**
Should a maximum bandwidth limitation be implemented for WMAS devices? If so, what should the maximum emission bandwidth be?

It is important to note that the spectral efficiency of WMAS can only be realised if the RF bandwidth is significantly larger than the wireless channel's coherence bandwidth. Sennheiser's analysis has shown that the full potential of WMAS will only be realized if WMAS has an operational RF bandwidth of > 5 MHz.

However, Sennheiser is of the view that there should be no limit to the emission bandwidth to allow for greater flexibility and efficiency gains. Further, the maximum radiated power should remain at the current level and not scale with bandwidth as this could increase the risk of interference to other users.

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**Question 6**
Should a WMAS emission in 520–694 MHz be limited to fall entirely within a single TV channel? For emissions greater than a single TV channel, should a whole number of TV channels be required (for example, emission bandwidths of 7 MHz or 14 MHz)? Should any other limitations regarding the relative positioning of WMAS emissions with respect to the TV channel raster be implemented?

WMAS, like other audio PMSE equipment, will operate on a 'free-tuning' basis in a mixed technology environment with different applications and bandwidths of operation. PMSE users will coordinate the local spectrum use with other WMAS and narrowband PMSE users and TV broadcasting in the same way they do currently to protect all users and meet regulatory obligations, e.g. to not operate within the coverage area of a broadcasting station or datacasting service station.

On this basis, Sennheiser is of the view that there is no requirement to impose an additional condition on WMAS to operate entirely within a TV channel as this would limit flexibility and could lead to sub-optimal spectrum utilisation at a multi-channel event.

**Question 7**
Should a minimum spectral efficiency limitation be implemented for WMAS devices? If so, what should the minimum spectral efficiency be?

WMAS has been designed to support events where multiple audio channels are needed. The ETSI standard indicates an example of WMAS being able to support 3 channels/MHz. The spectral efficiency requirement should only be considered as a design objective for manufacturers, and Sennheiser is of the view that this requirement should not be included as a regulatory condition on the user.

**Question 8**
Should WMAS devices be required to comply with ETSI Standard EN 300 422?

Yes, specifically ETSI EN 300 422-1 V2.2.1[1] which contains technical compliance requirements for WMAS equipment.

**Question 9**
Should new items be added to Schedule 1 of the LIPD class licence to facilitate WMAS, or should existing items be modified?

Within the LIPD class licence, the regulatory condition which precludes the use of WMAS (in the bands of interest) is the bandwidth restriction of 330 kHz in items 28 and 29. This limitation applies

[1] EN 300 422-1 - V2.2.1 - Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Audio PMSE Equipment up to 3 GHz; Harmonised Standard for access to radio spectrum (etsi.org)

only to outdoor use of WMAS in 520-694 MHz as both items 30 and 31 do not contain a bandwidth limitation.

Sennheiser is of the view that the most effective regulatory action would be to remove the bandwidth limitation of 330 kHz in items 28 and 29 and replace the current limitation (a) with the requirement to comply with ETSI Standard EN 300 422.

It is highlighted to ACMA that WMAS devices are digitally modulated wireless audio transceivers and therefore this change only needs to be applied to item 29. Given that the only difference between items 28 and 29 currently appear to be that item 28 relates to analogue technology and item 29 to digital technology, ACMA could consider replacing both these items with a single item which would apply to outdoor use of analogue and digital narrowband systems and WMAS wireless audio transceivers. This approach is similar to that in item 31.

**Annex – Further information**

Wireless audio applications, such as wireless microphones, in ear monitors (IEMs) and talkback communication systems are extensively used in a range of cultural, creative, and societal activities collectively referred to as Programme Making and Special Events (PMSE). These include film and TV production, live music and theatre, cultural events and in organisations such as schools and colleges, places of worship and in businesses and exhibition halls.

As noted by the Bureau of Communications, Arts and Regional Research, cultural and creative activity is increasingly recognised as an important component of economic growth.[2] Wireless audio PMSE applications are fundamental to delivering this value for many cultural and creative industry sectors, providing the tools needed for creators and performers to capture and deliver content to live audiences, film and television viewers, and attendees at social and cultural events.

Events and productions have become larger and more sophisticated in line with audience and consumer expectations. To meet this increased requirement, Sennheiser has developed its Wireless Multichannel Audio System (WMAS) that provides improved quality, greater flexibility and simplified workflows and efficiency of use.

Sennheiser's WMAS technology is based on Time Division Multiple Access ("TDMA"), used together with Time Division Duplexing ("TDD") and Orthogonal Frequency Division Multiplexing ("OFDM") in a broadband RF channel configurable to 6 MHz or 8 MHz to interleave with existing DTT broadcasting, or 10 MHz for use in any band that would support this bandwidth. From its conception, Sennheiser designed the system to comply with the power limits specified for wireless microphones in Annex 10 of ERC Recommendation 70-03.[3]

As Sennheiser's WMAS uses TDD TDMA, no device in the system, including the WMAS base, is transmitting at the same time. The system can support multiple audio channels with a total radiated power level of only 50 mW regardless of the number of active audio channels within the WMAS bandwidth. Compared to alternative approaches, Sennheiser's WMAS implementation exhibits

[2] Cultural and Creative activity | Department of Infrastructure, Transport, Regional Development, Communications and the Arts
[3] ERC Recommendation 70-03 (cept.org)

significantly lower power spectral density (PSD) and additional technological capabilities resulting in the distinct benefit of substantially improved protection to other services.

**Coexistence with other services**

Broadcasting

DTT and PMSE has a long history of successfully sharing the UHF band. The potential for interference between TDD TDMA WMAS and broadcast reception is no greater, and arguably less, than that with conventional audio devices.

As can be seen in Figure 1, Sennheiser's approach to WMAS using TDD TDMA spreads the 50 mW radiated power across the whole DTT bandwidth (in this example 6 MHz) so a DTT receiver would only see a small increase in noise. Importantly this low-level interference is regardless of the number of audio devices deployed as only one WMAS device transmits at a time.

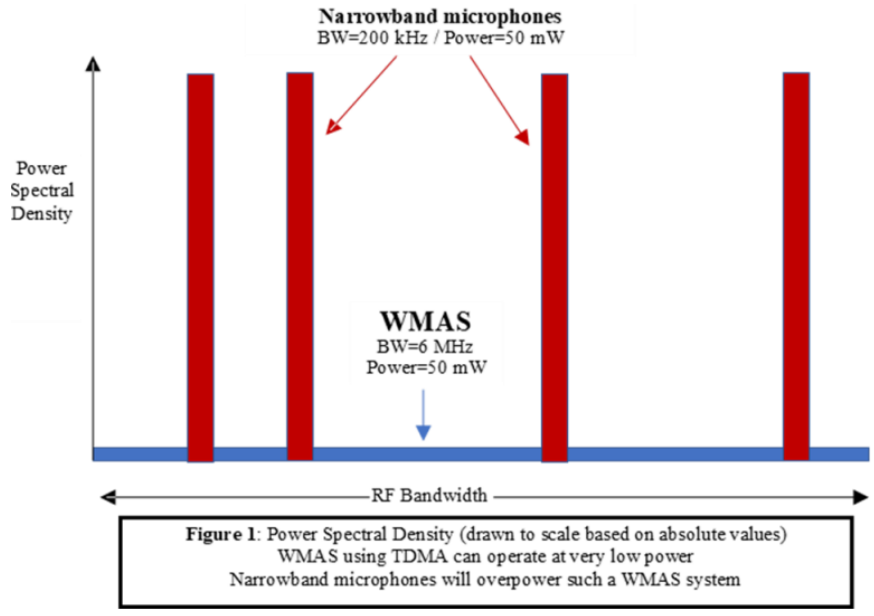


**Figure 1**: Power Spectral Density (drawn to scale based on absolute values)
WMAS using TDMA can operate at very low power
Narrowband microphones will overpower such a WMAS system

With 'traditional' narrowband PMSE devices the power is concentrated in a smaller bandwidth, and as more devices (and narrowband channels) are used the overall interference power (to DTT) increases. While this relationship between PMSE and DTT is successfully coordinated and managed today, it can be seen that WMAS using TDD TDMA presents a lower risk of interference to DTT than a corresponding multi-channel narrowband deployment.

Other PMSE (conventional wireless audio devices)

It is important to highlight that the frequency planning of WMAS and narrowband microphones follows the same operational principles as already established by the industry.

TDD TDMA WMAS is more vulnerable to interference from narrowband PMSE than the other way round. The concentrated power of a narrowband microphone will potentially block the receiver of a WMAS device, and if the connection between the base and device is lost the WMAS device will stop transmitting.

A narrowband receiver co-channel with WMAS will see some additional noise due to the low power spectral density in its receiver passband (similar to a distant DTT signal), but as WMAS suffers

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significantly it (WMAS) will inform the WMAS user to switch to another pre-coordinated channel that is free of interference to continue reliable operation.

Other possible coexistence issues

With regard to item 30 and wireless audio transmitters in 1785–1800 MHz, Sennheiser's view is that there is no requirement to change the existing power limits for WMAS. As explained above, the power spectral density for WMAS is less than for a narrowband audio transmitter. Assuming all other conditions remain the same, e.g. the transmitter must not be operated on a carrier frequency within 1 MHz of 1785 MHz, there would be no additional coexistence issues for WMAS use compared with narrowband audio transmitters.