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Licensing Frameworks for Private Mobile Radio and Wireless Broadband Low Medium Power

DotEcon Report – Assessment of responses to ComReg Document 26/06

Consultant Report

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PMR licensing review – assessment of responses to draft Decision

Prepared for ComReg

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1 Introduction

In January 2026, ComReg published its draft Decisions and draft Regulations on spectrum licensing for Private Mobile Radio (PMR) and Low and Medium Power Wireless Broadband (LMP-WBB).[1] One of the main areas of feedback received by ComReg was in relation to how the Programme Making and Special Events (PMSE) fees would apply for Wireless Multichannel Audio systems (WMAS).

Narrowband audio PMSE

PMSE wireless audio systems (including wireless microphones, in-ear monitors (IEMs) and talkback) have to date typically operated over 200 kHz narrowband channels. This can be using either analogue or digital technology.

It requires a single 200 kHz channel per audio link (one for each wireless microphone, IEM etc.). Moreover, the channels used need to be sufficiently separated from one another to avoid interference of various forms, including adjacent channel interference, receiver blocking and intermodulation distortion. Intermodulation distortion is a particular risk in scenarios where there are many devices transmitting within close proximity of each other, such as in live musical events or theatre productions, and careful coordination is required. The extent of the frequency separation required varies depending on several factors such as the type of equipment used, the complexity of the setup and the quality of service required. In any case, the guard frequencies between channels (which are not included in audio PMSE licences) are not usable by other devices, so the total spectrum sterilised by a given number of PMSE audio links is greater than the sum of the licensed 200 kHz channels.

WMAS

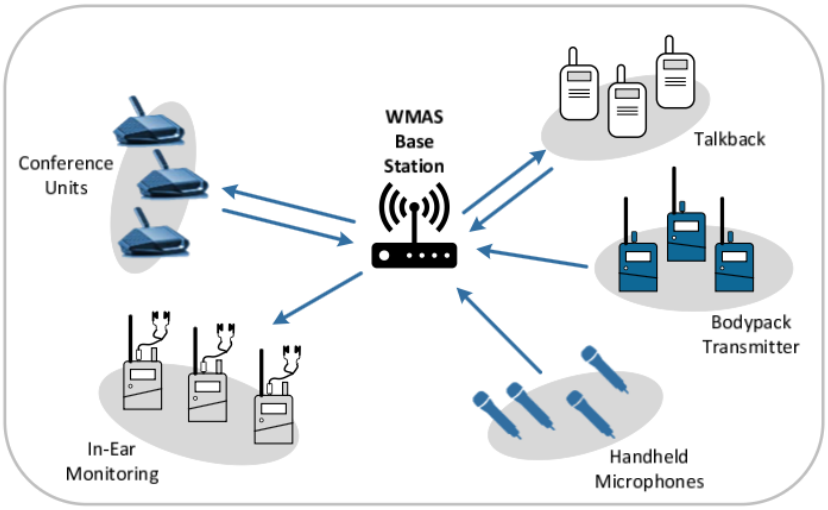
WMAS systems on the other hand allow for multiple devices to operate flexibly within the same frequency channel, and with reduced spacing between audio channels compared with narrowband setups. These systems, primarily focussed on running wireless microphones and IEMs, use the same bands as those designated for narrowband audio PMSE. They utilise larger channels, typically of 6, 8 or 10 MHz[2], although they are also scalable to efficiently utilise whatever bandwidth is

[1] ComReg 26/06

[2] Bandwidths used for WMAS are typically aligned with TV channel sizes, with 8 MHz being the standard in Europe.

available (up to a maximum of 20 MHz). Moreover, they are more spectrally efficient than standard narrowband setups, accommodating a greater number of audio channels per MHz of occupied spectrum.

Figure 1: Example of WMAS topology



Source: ETSI TR 102 546

WMAS is, therefore, most beneficial in situations where there is significant demand for audio channels relative to the available spectrum, for example at festivals, large sporting events, or theatres (particularly when there are multiple theatres/productions operating in close proximity). Our understanding is that this (at least at present) is unlikely to represent a large proportion of situations in Ireland, where the median number of audio PMSE channels licensed simultaneously is roughly ten and the number of cases where limited supply of spectrum might be an issue is small. It is only where there is sufficient utility of a wider spectrum band or significant localised usage where the efficiency benefits of WMAS might come into play.

Current fee structure

The fees proposed by ComReg for PMSE licences are primarily designed to ensure ComReg's administrative costs are covered, albeit with fees increasing in bandwidth to give some incentives to use only what is needed. The proposed fees are structured such that a fixed amount is charged for the typical bandwidth used; this is to accommodate the wide range of PMSE equipment used with varying bandwidth requirements.

In particular, for the typical bandwidth in a given band, under the proposal set out in ComReg's draft Decision, a PMSE licensee would pay, for the typical bandwidth:

- €100 for a licence with a duration of up to 3 months; or

- €131.50 for a longer licence of up to 12 months.

For audio PMSE, the typical user licenses ten 200 kHz channels, although smaller numbers of channels are not uncommon. ComReg proposed to structure fees such that, for a 12-month licence, a user of audio PMSE equipment would pay €65.75 for every five 200 kHz channels (or part thereof). This means paying €131.50 for the typical bandwidth, and permits more granular usage without over-complicating the fee structure.

ComReg received several comments regarding how the proposed PMSE fee structure would apply to WMAS, including concerns that WMAS users would face unduly high fees compared with users of more traditional narrowband equipment occupying the same bandwidth.

2 Stakeholder comments

RTÉ feedback

RTÉ generally supports the revised fee structure for PMSE, but has requested clarification on how they would apply to WMAS. It highlights the example of an 8 MHz WMAS system operating in the 470 – 703 MHz band, and asks if the fees would be calculated as:

a) *"€65.75 x 40 (i.e. 8MHz/Typical Channel Size (200kHz)) = €2,630, or*
b) *€65.75 x 8 (i.e. 40/5 Typical Channels) = €526, or*
c) *1 x 10MHz Wireless Broadband/Wireless Camera = €131.50"*

RTÉ argues that option a) would disincentivise the use of WMAS.

Sennheiser feedback

Sennheiser also expresses concerns over the potential for the new fee structure to disincentivise use of more efficient WMAS technologies in favour of conventional narrowband equipment. In particular, it highlights that under the licensing process and proposed fees set out by ComReg, a WMAS operator wanting to use an 8 MHz channel would need to apply for 40 adjacent 200 kHz channels for an annual fee of €526.[3]

In contrast, a user of conventional narrowband audio systems occupying the same bandwidth would pay a maximum of €263. This is based on the view that narrowband systems utilise 200 kHz channels (with each piece of equipment requiring a unique channel), but because of the minimum separation distances needed between channels to prevent interference the maximum number that could fit into an 8 MHz block is 16. To support this, Sennheiser refers to:

- ECC Report 204, ECC Report 323 and CEPT Report 32, which indicate the maximum number of audio channels that can be accommodated in an 8 MHz TV channel is 12; and
- ETSI TR 102 546, which highlights a channel density of 1-2 audio channels per MHz for equipment used in high-end events, putting the maximum number of channels within an 8 MHz TV channel at 16.

[3] Based on Sennheiser's interpretation of the proposed fee structure that a WMAS operator seeking a licence for an 8 MHz block would need to pay for eight sets of five 200 kHz channels (8 x €65.75 = €526).

Under the proposed new fee structure, 12-month licences for 16 200 kHz channels would cost 4 x €65.75 = €263.[4] This is half the amount (under Sennheiser's interpretation of the proposed pricing) that would be paid for operating WMAS within the same bandwidth. Sennheiser suggests that "*ComReg's proposal on licence fees for audio PMSE disincentivises adoption of this [WMAS] innovative and spectrally efficient technology… [which] is contrary to ComReg's stated principles and obligations under the European Union (Electronic Communications Code) Regulations 2022.*"

Sennheiser proposes a fee structure that it believes aligns fees for narrowband systems and WMAS utilising the same bandwidth. In particular, it proposes the following fees for 12-month licences:

- "*For an 8 MHz WMAS channel the licence fee is €263 (based on 20 X 200 kHz).*
- *For a 6 MHz WMAS channel the licence fee is €197.25 (at 500 kHz channel separation for narrowband it is possible to have 12 channels within 6 MHz, which would require the equivalent of 15 channels licensed @ 3 x €65.75*"

Fees for short-term licences would be scaled down based on the structure proposed in ComReg's draft Decision.

Sennheiser further suggests that the licensing process could be simplified by introducing the option for users to apply for an 8 MHz block. The spectrum could then be used for either WMAS or multiple narrowband channels (in the latter case removing the need for ComReg to issue multiple 200 kHz licences). The corresponding fee would be €263 for a 12-month licence.

Shure feedback

Shure's comments relating to WMAS focus more on the accommodation of WMAS in the regulations and licensing process (which is not within DotEcon's remit for assessment) but it does "*urge ComReg to ensure that licence fees for WMAS will not be disproportionately more expensive or inequitably priced in comparison to the licensing of narrowband PMSE*".

In relation to PMSE fees in general, Shure suggests that the "*…price floor has the appearance of being somewhat arbitrarily determined and, for some PMSE use cases, potentially artificially high.*" This is based on the premise that, as previously highlighted by DotEcon, the administrative cost to ComReg of

[4] The licensee would be required to pay €65.75 for each of the three full sets of five 200 kHz channels, plus another €65.75 for the partial set including only one 200 kHz channel.

running the PMSE licensing scheme is difficult to quantify and likely to be low.

3 DotEcon assessment – WMAS fees

Fees for WMAS need clarifying

Our expectation is that under the proposed licensing framework set out in ComReg's draft Decision, a WMAS operator wanting to use an 8 MHz frequency block would need to apply for forty 200 kHz channels and would pay the equivalent of a narrowband audio PMSE licensee getting eight blocks of five channels i.e. 8 x €65.75 = €526. This aligns with Sennheiser's understanding and option b) presented by RTÉ. Providing clarity over this would therefore be helpful.

Neutral pricing to align WMAS and narrowband fees

We agree with Sennheiser that the fees for WMAS should be broadly aligned with those that would be paid for use of narrowband equipment occupying the same bandwidth. Under the current draft Decision (and taking the interpretation of how fees would apply to WMAS as above), users of WMAS wanting to operate within a given bandwidth would need to pay for effectively internalised guard bands. This is not the case for narrowband operators, who do not need to pay for spectrum between their 200 kHz channels even if that is rendered unusable by the interference they would cause.

Aligning these fees based on the amount of spectrum precluded to other users might improve fairness and prevent a situation where a technology that potentially supports more efficient use of the spectrum is discouraged. More specifically, we do not see any particular reason why ComReg would have a strong policy preference over the use of WMAS or narrowband within a given bandwidth.

This suggests a neutral approach to technology choice would be appropriate, rather than actively incentivising use of particular technologies/equipment. A neutral pricing approach would involve a WMAS user paying an amount for a given bandwidth equal to the payment that would be made for the narrowband channels that would fit into the same bandwidth. Under this pricing rule, the internalised guard bands would effectively be made available for WMAS for no additional charge.

No need to go further than neutral pricing, because opportunity costs are immaterial

In other spectrum management scenarios, there may a benefit from actively promoting use of more spectrally efficient equipment. This would be the case if, for example:

- there is a need to migrate away from using a legacy technology in favour of newer, preferable systems; or

- there were significant issues of spectrum scarcity that meant promotion of spectrally efficient approaches would offer significant and widespread benefits.

However, we do not believe that this is currently applicable to the situation regarding audio PMSE in Ireland. WMAS is an emerging class of technology and not yet widely used. Narrowband is still prevalent and the two are likely to coexist for the foreseeable future, with narrowband being predominant. In this regard we note commentary by Shure in a 2024 blog on its website[5] which highlights that "*it should be noted that WMAS serves as an additional option for optimizing spectrum utilization more efficiently, rather than replacing traditional narrowband systems*".

In addition, as we found in our previous reports, there is at present no issue of scarcity of spectrum for PMSE. In most (if not all) cases, the decision over whether to use narrowband or WMAS will have no impact on the availability of sufficient bandwidth for others. For the time being it is likely to be beneficial only in a relatively small number of scenarios where there is a sufficient number of audio channels needed. As there are no material opportunity cost relating to using one technology or the other, the neutral pricing approach is appropriate.

A reference WMAS block pays the same as the maximum number of narrowband channels the block could hold

To align WMAS and narrowband fees, Sennheiser suggests using an 8 MHz frequency block as a reference point and setting the price a WMAS user would pay for that bandwidth equal to the price paid by a narrowband operator using the maximum possible number of narrowband channels in the same bandwidth. We agree with the broad approach, but there is a degree of uncertainty over how best to set the reference WMAS channel width and maximum number of narrowband channels, given the scalability of WMAS and the fact that the spectral efficiency of both WMAS and narrowband systems is not fixed.

Nevertheless, the Sennheiser suggestions are sensible; 8 MHz is the standard TV channel size in Europe and is the channel width within audio PMSE channel assignments tend to be planned. Although WMAS operates flexibly over a range of bandwidths, 8 MHz is suggested as the typical channel width for WMAS in ETSI TR 102 546 V2.1.1 (2021-10).

The number of narrowband audio links that can fit into an 8 MHz channel varies depending on a number of factors, such as

[5] https://www.shure.com/en-GB/insights/an-overview-of-wmas

the specific equipment and technology used, the mix of equipment used, the number of audio links needed, interference from external systems, and the link quality desired to meet the needs of the specific application. ECC Report 323 states that "*Spectrum efficiency numbers for wireless microphones vary between 12 and >25 audio channels for an equivalent audio quality in an 8 MHz channel, depending on the application. Where there is a mixture of wireless microphones and IEMs the numbers will vary.*" As highlighted by Sennheiser, ETSI TR 102 546[6] suggests spectrum efficiency for narrowband ranges from 1 - 2 audio channels per MHz, putting the maximum number of channels within 8 MHz at 16. This is supported by ETSI TR 103 450 V1.2.1, which states that "*[c]urrently, the number of 16 narrowband audio links placed in 8 MHz free spectrum is the maximum value, where operational robustness can be maintained in typical scenarios.*"[7]

In summary, the number of narrowband channels that can fit into an 8 MHz frequency block is case specific. A judgement therefore needs to be made over what would be an appropriate number to use for determining equivalent WMAS fees. In our view, the suggestion by Sennheiser of assuming 16 narrowband channels (two audio links per MHz) is not unreasonable. It aligns approximately with the middle of the range suggested by the ECC as being feasible and, based on the views of ETSI, is grounded in the premise of ensuring typical usage can be supported.

Fees are neutral across all PMSE equipment types

As with the Sennheiser proposal, the fee for an 8 MHz channel to be paid by a WMAS users would then be set equivalent to the total fees for 16 200 kHz narrowband channels, which is €65.75 x 4 = €263. This charging structure should then be scaled linearly such that, for any given bandwidth, a WMAS user would pay the fee that would apply to the maximum number of narrowband channels that could be accommodated (assuming,

6 https://www.etsi.org/deliver/etsi_tr/102500_102599/102546/02.01.01_60/tr_102546v020101p.pdf

7 https://www.etsi.org/deliver/etsi_tr/103400_103499/103450/01.02.01_60/tr_103450v010201p.pdf

for simplicity, two narrowband channels per MHz[8] and remembering that narrowband fees are based on increments of five channels).

We note that under this approach, a WMAS user operating with 4 MHz would pay €131.50, which is the fee for a "typical channel" under the general approach to PMSE licensing proposed by ComReg. This means that the fees paid by a typical audio PMSE licensee (ComReg assumes these users require ~10 audio links) would be broadly aligned with PMSE fees for other PMSE bands and equipment types irrelevant of whether WMAS or narrowband is used.[9]

Flexibility in licensed bandwidths might be helpful, but this does not affect fees

Sennheiser has also suggested that the PMSE licensing framework introduces "*the option for users to apply for an 8 MHz spectrum unit*" that would be listed as a single frequency assignment on the licence and could be used for WMAS or narrowband as desired by the licensee. It is unclear to us whether the suggestion is proposed as an additional option alongside the current setup with 200 kHz channels or as a replacement.

Based on our understanding we are of the view that, for WMAS operators at least, being able to apply for specific wider bandwidths (rather than multiple adjacent 200 kHz channels, as per the current proposals) seems reasonable. However, given the scalability of WMAS, we do not see any reason why this should be strictly limited to 8 MHz channels and should at least allow for smaller bandwidths to be applied for. This may not be the intention with Sennheiser's proposal but, for the avoidance of doubt, it would not be desirable to force WMAS operators needing less spectrum to take out full 8 MHz channels.

Precisely how the application process for WMAS licences is best implemented, in terms of allowing for wider bandwidth applications, is a matter for ComReg. There would also be an

[8] We are aware that, due to reverse intermodulation, the spectral efficiency of narrowband audio PMSE declines as the number of links increases. The maximum number of usable narrowband channels in a given bandwidth therefore falls as the bandwidth increases. However, this relationship is not fixed and depends on factors such as the type and mix of equipment (e.g. some equipment handles reverse intermodulation better than others). Representing this in the fee structure would be overly complicated with no clear benefit.

[9] ETSI TR 103 450 V1.2.1 states that "*[a] WMAS will have at least one mode, defined as the Standard Mode, which supports a minimum of three audio channels per MHz*". Operating in the standard mode, a WMAS user would therefore need a 3 – 4 MHz channel to run ten audio links.

implementation decision to be made by ComReg regarding licences for narrowband. In that regard, if ComReg were to allow WMAS operators to apply for wider bandwidths, there would then be two broad options for how to manage narrowband licences:

1. Keep the approach to narrowband licensing the same as currently proposed i.e. licensees are issued individual 200 kHz channels and licences do not explicitly include internal guard bands.
2. Issue all audio PMSE licences with a single contiguous bandwidth that includes all guard bands, with users then able to use it as they wish (i.e. with WMAS or narrowband).

4 DotEcon assessment – Floor on PMSE fees

Regarding Shure's comment in relation to the floor on PMSE fees, we first highlight that the PMSE fees have already been set low, with the view to ensuring ComReg's costs are recovered but without charging excessive amounts.

As Shure has highlighted, and as we mentioned in our previous report, there is of course a degree of uncertainty over exactly what the marginal cost to ComReg of issuing a PMSE licence is. However, ComReg needs to cover its administrative costs of running the licensing framework and should not be expected to take on excessive risk of under-recovery. It was therefore necessary to form a view as to what it could reasonably charge to give sufficient confidence of recovering costs without fees being prohibitively high. This was the approach taken, and ComReg was careful to ensure existing PMSE operators did not unreasonably face significant increases in their costs following revisions to the licensing structure. The alternative would be to conduct an in-depth review of ComReg's cost structure associated with PMSE and then set fees accordingly; the cost of conducting such an exercise would likely be disproportionate to the potential benefits.

It is unclear to us what exactly Shure means when it suggests the prices might be "*artificially high*" for some users i.e. does it mean prohibitively expensive for users or not reflective of the costs to ComReg? Either way, Shure has not provided any evidence or argument to support the claims or given details of the use cases it believes would be adversely affected.

The proposed fees for PMSE have now been subjected to two public consultations and ComReg has not received comments from any other party raising concerns. Moreover, the previous adjustment to (i) allow for 12-month licences for the same price as 6-month licences under previous proposals and (ii) charge €100 for a 3-month licence reduces PMSE fees relative to the initial proposals that had attracted no opposition.

In conclusion, we do not see any convincing argument as to why ComReg should divert from the level of fees proposed for PMSE in its draft Decision. It may of course choose to reduce the fees at some point in the future if it subsequently becomes clear that the revenues from PMSE licensing are in excess of the costs.