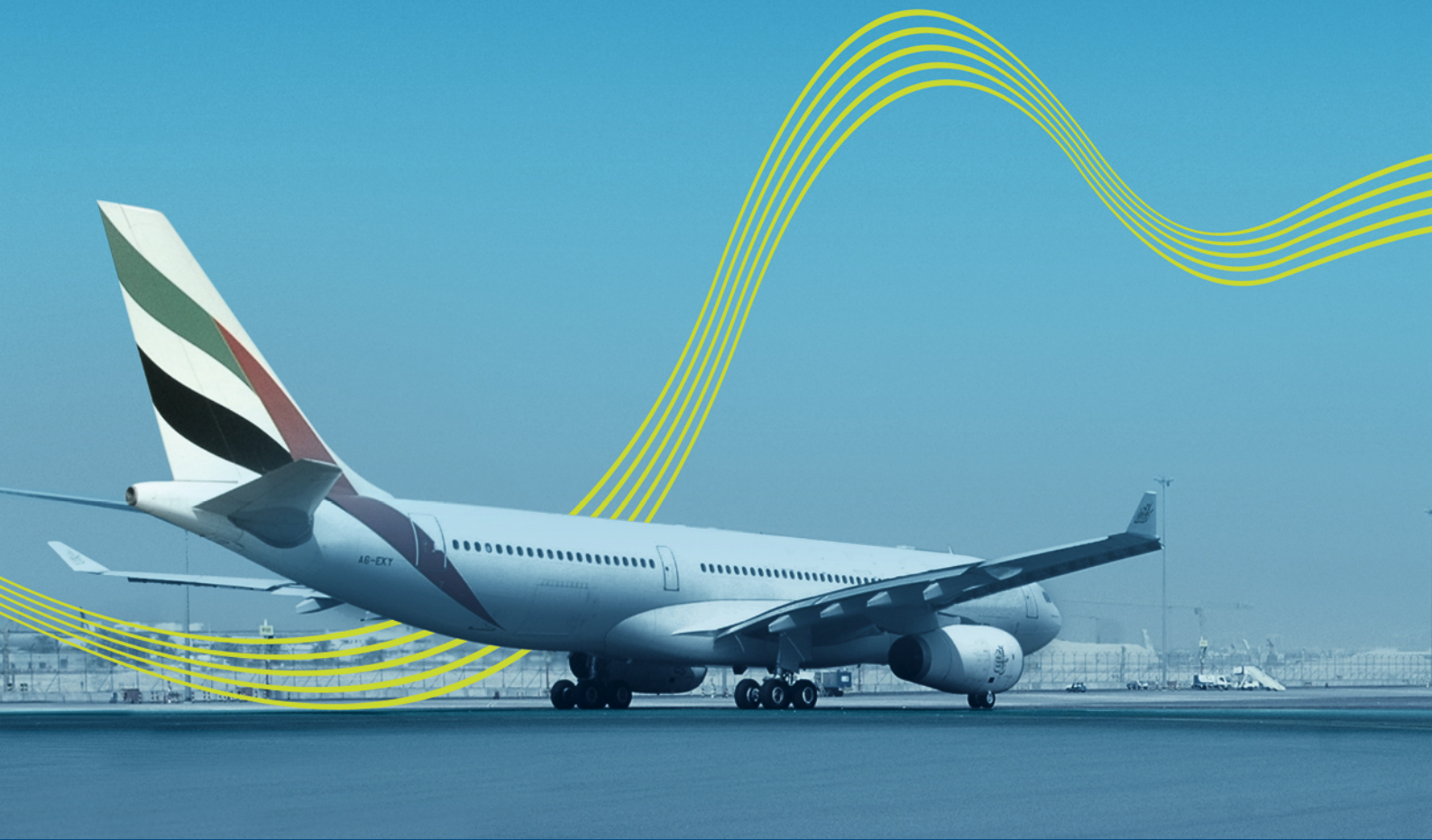
A further response to Ofcom's consultation: New Spectrum for Audio PMSE

Version 1.0
22nd January 2016

Prepared by Stephen Parry



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1 Introduction

NATS is grateful to Ofcom for providing some additional information to its consultation on New Spectrum for Audio PMSE, although it would have been preferred to have seen more complete information so that all parties could understand how Ofcom is reaching its conclusions on this issue. We have considered this additional material as far as possible in the time available and have a number of observations and questions that we would be willing to discuss further with Ofcom.

A number of propagation parameters, e.g. clutter and building losses, have been used that are statistical in nature and for which single (average?) values have been quoted without indication of the potential ranges / distributions. No details have been provided by Ofcom as to the terrain model applied. Other parameters such as PMSE height have been quoted about which NATS comments below. A sensitivity analysis should be published by Ofcom such that it is clear to all parties as to how dependent the potential amount of spectrum available for PMSE use is on these parameters for which Ofcom has provided values, some of which are perhaps more judgement based. This is particularly the case because Ofcom is discounting the use of a safety margin in its evaluations, where this is normally considered by aviation, in part to account for variations in averaged input parameters that are not otherwise characterised.

NATS remains concerned that the parameter values quoted by Ofcom will not adequately safeguard DME (or potential PMSE) operation not least as it appears that "average" parameter values have been used, although Ofcom has characterised its chosen values as "conservative". NATS therefore still does not support Ofcom's proposals for sharing in the 960–1164 MHz band.

Although our comments herein relate only to DME, the NATS views on 1030 and 1090 MHz remain unchanged from those stated in our first response.

2 Detailed comments

Paragraph references in this second response are to Ofcom's "Further details" document published on 8th January, unless otherwise qualified.

2.1 Time percentage (§2.4)

NATS notes the use of 1% time in the propagation models for both ground to air and ground to ground scenarios. NATS would have expected a smaller time percentage to be used but recognise that this is the value agreed by CAA in this case.

2.2 Interference thresholds (§2.6)

With reference to the first NATS response to the consultation it is reiterated that the threshold values (as stated in Table 1) are at the absolute thresholds of 70% reply efficiency, which is the minimum reply efficiency specified by ICAO. It is unlikely in the real world situation, where a DME transponder is transmitting Identification signal, that the DME transponder would operate correctly when subject to these supposed 'interference threshold' signal levels that drive its performance down to the very limit of its tolerable operating envelope.

Reiterating our position that NATS does not agree with the test methodology used and consequently questions the resultant DME interference thresholds derived for the reasons explained in our first response; with reference to paragraph 2.6 and the associated Tables, we note the following anomaly: Table 1 gives the interference thresholds for DME ground transponders and the stated X channel interference threshold for 0 MHz delta F is -111dBm, however the JCSys report states in paragraph 5.3.4.3 that "A signal level of -111dBm just causes a fail of the criteria for X mode." So unlike the other derived thresholds it appears that this one has been selected using an interference level that exceeds the pass criteria used by JCSys in the study so it would appear to be an incorrect value.

It is stated that "In all cases the most restrictive threshold for each frequency offset was used to provide the most limiting envelope for coexistence". It is assumed then given the presentation of Tables 1 and 2 that different thresholds have been applied to X channels and Y channels for both interrogators and transponders and it would be helpful if Ofcom would confirm whether this is the case / clarify which values have actually been used.

2.3 Building entry loss (§2.9)

Only a single figure is given, presumably an average. NATS notes from ITU material (e.g. ITU-R Report P.2346) that measured building loss figures vary with the relative heights of the source and point of measurement. NATS also has experience of investigations into interference experienced by aircraft from ground based sources over many years where it has been demonstrated that building roofs can provide less attenuation than side walls, to the extent that interference can be experienced by aircraft when it cannot be detected at ground level next to the building containing the source. We would therefore seek Ofcom's justification for the use of a single figure and, while we recognise that there is indeed a broad range of building loss figures, additional explanation is required as to the source of the 11dB value.

NATS also notes that the MediaCityUK studio complex offers outdoor studio provision and we would request that Ofcom makes available an additional set of spectrum availability results for this location (ideally for all three) that do not consider building loss to reflect this – we noted that §2.3 recognises the possibility of outdoor use at the three test locations other than Glastonbury but that it is still indicated that building entry loss was considered in both the indoor and outdoor cases for all three, which appears to be an anomaly.

2.4 PMSE antenna height (§2.9)

The quoted height of 1.5m – presumed to be above ground level – appears to represent a body worn / handheld microphone transmitter or IEM receiver where the user is standing directly on the ground. NATS observes that the heights above ground of theatre / event stages (e.g. Seven Dials and Glastonbury) appear to be of the order of 1.5m upwards and that staging / scenery may raise the users above stage level so the actual height above ground of the body worn element needs to be considered as being greater than just 1.5m for the compatibility analysis. It would be assumed that the other end of the PMSE link, whether microphone receiver or IEM transmitter would be at least at similar height, if not higher than the "stage" end of the links. In the absence of any published sensitivity analysis for Ofcom's calculations, the effects on potential PMSE spectrum availability of using what would appear to be more representative, PMSE antenna heights that take the above into account should be made available by Ofcom.

2.5 Body loss (§2.10)

It is stated that a body loss figure has not been used. The consultation documentation indicates potential use of this band for IEMs and wireless microphones. NATS infers from this that the transmitting elements of some of the PMSE systems being considered for this band would not warrant body loss being a factor anyway. In NATS view it is therefore completely appropriate that body loss should not be considered in this compatibility analysis. We also are of the view that Ofcom should not be taking 'credit' for this when discounting the application of the safety margin (§2.15). Furthermore, if wireless microphones and IEMs could not be distinguished in Ofcom's licensing regime – Ofcom's current documentation is unclear on this point – then in NATS opinion no account should be made for body loss in actual frequency planning, should Ofcom choose to proceed with sharing.

2.6 Reference frequency (§2.11)

It is noted that although path loss is lower (~1.7dB for free space) at 960 MHz than at 1164 MHz, DME antenna gain can vary across this band to a similar degree. The antenna gain pattern also varies with frequency. The resulting combination of factors appears to reduce the benefit claimed by Ofcom of having a 960 MHz reference frequency, this being one of the "conservative" choices used to argue against the use of a safety margin.

2.7 Clutter loss (§2.12)

It is stated that the clutter loss figures have been taken from ITU-R P.1812. It appears from the description of the evaluation method in paragraph 2.20 that clutter loss is only applied for the PMSE to DME transponder / ground paths and it is inferred that this is a point to point calculation given that the specific locations of both are known. Further details are requested of the clutter loss derivation, use of P.1812 and how the figures are then used in conjunction with Recommendation P.452.

Recommendation P.1812 is described as being for point to area consideration. It is noted the introduction to the Recommendation's Annex 1 states that, should it be used with known terminal locations, as we take to be the case here, then the model is only applicable with 50% of locations. It may be that the location element of the basic transmission loss calculation in P.1812 is not relevant for the elements of the Recommendation that Ofcom is using. However, if they are used then it would appear that additional factors may need to be considered to ensure that the losses calculated are valid for all locations.

Again, having an understanding of the sensitivity of the model to the values of clutter loss used would be helpful for all parties.

2.8 DME antenna height (§2.13)

NATS is aware of a small number of airport DME installations where the antenna height exceeds 10m agl (e.g. 12m) and when new en-route DMEs are implemented or re-located as indicated in section 4.2 of our first response, the siting of their antennas would not be restricted by co-location with VOR and thus could also exceed 10m.

2.9 Safety margin (§2.15 and §2.17)

Several of the modelling scenario factors are not worst case, as identified in the original NATS consultation response, and so do not justify exclusion of the safety margin. As noted previously, the additional information document restates in a number of places the "conservative", in Ofcom's opinion, nature of the parameter values used.

For consideration of potential sharing with a safety of life application like DME, the types of uncertainty described in our responses, along with questions over the values chosen by Ofcom for building and clutter losses and variability in antenna gains are examples of why it remains necessary to apply a safety margin in this sharing situation.

2.10 Evaluation methodology (§2.20)

The airborne scenario relies on Ofcom's previously stated assumption of no use of a given DME transponder outside its Designated Operational Coverage, DOC. The

impact of this is that DME signal levels higher than those predicted by Ofcom may be received by PMSE equipment, risking interference to the audio channel.

The point at which a DME interrogator on the aircraft is tuned to a DME transponder channel and begins to transmit is controlled from within the aircraft. DME tuning may be automatic using data held in a flight management system or manually carried out by the pilot in a less automated aircraft. In either case it cannot and should not be taken for granted that interrogations would only occur within a transponder's DOC in order to protect PMSE use; this is a different point to whether or not the aircraft is making use of a range solution where the interrogator could be subject to interference from PMSE planned on the assumption of the DME transponder only being used within its DOC.
