Highfield Church

Additional comments:

PMSE and DTT licensees seek consistency and fairness in the treatment of all UHF spectrum licensees and the same concern regards freedom from spectrum pollution from non-licensees. Ofcom must not be seen to foster the exploitation of the privileges of spectrum use by non-licensees at the very real cost of the existing, compliant incumbents.
The main issues with the proposals concern:

- Problems with DTT indoor antennas, preamplifiers and receiver 'silicon' front ends;
- Risks of interference from errant Slave WSDs and the impact of interference being unacceptably high;
- Inadequate ETSI Standard and, thus, false 'compliance'.The mistakes of the release of 5GHz WLAN devices must NOT be repeated (unrecallable, spectrum-polluting equipment).

This response's main recommendations:

- Exclusion zone of 3km radius around geolocated PMSE licensees until further work is done that justifies any relaxation. This is the same, consistent level of protection afforded to users of Channel 38 and Channel 61;
- Registration fee for every WSD sold paid by the manufacturer to the Regulator in return for WSDB recognition. The revenue shall be used to properly manage and police WSDs for the protection of DTT and PMSE licensees.

There is concern about the very compressed timescales up to the 'launch' of WSD public use. The impact of the release of WSDs with inadequate compliance and control is so serious that proper caution is imperative. Ofcom - and the UK - cannot afford to be embarrassed by mistakes that will permanently damage the UHF spectrum.
J Adrian Pickering is an academic, chartered electronics engineer and PMSE licensee and has an interest in consumer electronics as well as professional sound production. He has been an active respondee to the 'Digital Dividend' consultations. In this response the interests of DTT licensees are dealt with in similar detail to those of PMSE licensees since many of the interference issues are shared.

Question 1: Do you have any comments on our proposed approach to ensuring a low probability of harmful interference to DTT services? Please state your reasons for your comments.:

There are three issues that have not been given enough consideration:
(a) Indoor (less than optimal) reception. There are many instances where a licensee has no option but to use a less than optimal antenna e.g. (i) rented accommodation (ii) conservation areas. There is a distinct risk that a WSD may be given Operating Parameters that will cause harmful interference to licensees.
(b) Increasing use of pre-amplifiers and near-mast distribution amplifiers. Ofcom's consultants acknowledge that these can cause a problem but one that was not considered in the studies. There is a significant risk of WSD emissions causing blocking/distortion that will

result in objectionable interference.
(c) Increasing use of ‘silicon’ front ends. Again, Ofcom’s consultants acknowledge this is a problem and it is documented in the results of the studies. Such receivers have- and will pass DTT-acceptability tests but fail regards the selectivity WSD schemes are assuming. These receivers are purchased in good faith by licence-payers and are in increasing use. Their existence must be accepted and afforded protection.
It is noted that Ofcom assume responsibility for the WSDB data for DTT services. This is in contrast to the more onerous ‘on the fly’ calculations for PMSE for which the WSDB authorities are solely responsible.
Much of what is said about the problems with non-geolocated Slave WSDs applies to protection of DTT. There are places and circumstances where a Slave may transmit which would cause harmful interference to DTT receiver licensees despite being given apparently legitimate Operating Parameters and being apparently conformant to ETSI (see below).
The nature of WSD interference is that it will be difficult to trace. It is by nature intermittent and only detectable by its effect on digital (‘go/nogo’) modulation schemes. However, its impact is much more significant than hitherto since it will impair/destroy reception of one or more complete MULTIPLEXES. That means ALL the services in a PSB channel/mux are likely to be unavailable to the licence-payer, not just the one. This much more serious consumer impact of ‘loss of service’ has not been taken into account in the thresholds: they are too focused on the old ‘analogue’ metric concerning loss of a SINGLE television service. Licensees have no idea what multiplex contains a particular service and on which channel it is broadcast. This is not surprising since the multiplex plan has been under regular revision. It is not easy to get or interpret such diagnostics from receivers.
Not enough is said about the resourcing of problem resolution and compliance (since there is no proper accompanying Impact Assessment). This will involve extra cost on a regulator for which there are no plans for matching income for the extra services attained. To achieve an income to sustain WS management WSD manufacturers should pay a pro-rata fee for every WSD they which to be serviced by a national WSDB (including Slaves). By this method Ofcom and fellow regulators will be able to retain proper control of WSDs within their jurisdiction and have the funds to ensure proper compliance.
It is not clear whether ‘locations’ or ‘households’ are the measure in 5.48 Figures 9-14. Any coverage statistician knows that these are significantly different.

Question 2: Do you have any comments on our proposed approach to ensuring a low probability of harmful interference to PMSE services? Please state your reasons for your comments.:

Generally, the approach is too aggressive/optimistic. It is trying to use more WS bandwidth than is technically safe, given what we know about the equipment in the field now.
Throughout the PMSE argument the phrase ‘low probability’ is mentioned without quantification. The quality thresholds used to underly WSDB operation for geo-located PMSE are flawed as they have no experimental basis, despite studies observed by Ofcom that do have a factual, physical and provable basis (see below).
In contrast, the approach to the protection of Channel 38 PMSE is reasonable. This acknowledges that PMSE Channel 38 licensees are nomadic and by definition cannot be geolocated. Accordingly, Channel 38 is WSD ‘sterile’ and, to a significant extent, its neighbouring channels. Geolocated PMSE licensees will accept nothing less than the reciprocal approach for protection from WSDs, particularly those which are non-geolocated. This protection approach is much the same as Ofcom have afforded 4G operators by making Channel 60 sterile.

Ofcom have again not taken on board the significance that PMSE equipment carries truly 'live' signals. This is information THAT CANNOT BE RESENT (unlike WSDs). Its loss can be extremely costly and embarrassing - particularly, say, to an internationally-broadcast, live PSB event (e.g. Live8). The damage accrues to the performers, producers, broadcasters and the licensee-fee paying audience and, potentially, the Nation.
PMSE users pay licence fees to Ofcom to protect a suitable quality of service. It is invidious that significant quantities of long-lived, reliable PMSE equipments performance should be put at ANY risk by such 'free loading', non-revenue-generating users, even for pilot trials. 'Low probability' needs to be VANISHINGLY low for critical PMSE. (See below for the scenario analysis.)
Though further WS use is attractive, it must be developed, managed and policed in a sustainable manner. Ofcom must be allowed some 'dividend' from the assumed 'wealth' generated from WSDs to properly manage WSD deployment and to respect the rights of the incumbent licensees (both DTT and PMSE)

Question 3: Do you have any comments on our proposed approach to ensuring a low probability of harmful interference to 4G services above the UHF TV band? Please state your reasons for your comments.:

Reciprocity and policy consistency. The same level of protection should be afforded to other licensees (see above).

Question 4: Do you have any comments on our proposed approach to ensuring a low probability of harmful interference to services below the UHF TV band? Please state your reasons for your comments.:

See answer to T18 (below).

Question T1: Do you have any comments on our proposal to cap the maximum in-block EIRP of all WSDs at 36 dBm/(8 MHz)?:

A cap is essential. It is noted that Ofcom will have the ability to lower this if needed, ASSUMING that the supposed ETSI-compliant WSDs comply with the requests in a timely fashion.

Question T2: Do you have any comments on our proposed approach for calculating WSD emission limits, as expressed in Equation (4.3), in relation to DTT coexistence calculations?:

Since Equation 4.3 says little more than the physics, it is not something that can be challenged. The problems arise when trying to quantify the constituent variables (see below).

Question T3: Do you have any comments on our proposed approach for dealing with the uncertainty in the locations of DTT receivers in relation to DTT calculations?:

The ITU antenna model is conservative (not particularly high gain or directional). Assuming linearity, it is not clear that it is worth including it in the interference calculations since any

WSD ‘behind’ the antenna will almost always be ‘in front’ of many others, particularly in an urban setting. Worse, if the failings of pre-amps and ‘silicon’ front ends are taken into account, it will underestimate the impact of a nearby WSD. The coupling gain of the WSD into the front of a ‘high gain’ and/or unselective (but DTT compliant) receiver will be high and will be likely to cause unacceptable interference to a nearby licence-payer. It should be noted that many commonly-used internal antennas also feature pre-amps.

Question T4: Do you have any comments on our proposed target of a 10% likelihood of a 1 dB rise in the noise-plus-interference floor at the edge of DTT coverage:

This is a statistical measure and of no comfort to those who actually suffer interference. For reasons already discussed, more licensees will suffer as Ofcom have chosen to ignore existing and reasonable use cases. More conservative WSDB planning and the securing of resourcing for WSDB management and WSD policing is required.

Question T5: Do you have any comments on our proposed approach for calculating coupling gains in relation to DTT calculations?:

2.23 state’s that the device type does not identify devices as indoor or outdoor. Ofcom or its WSDBs must NOT make any further assumptions from ‘volunteered’ (unverified) data provided - particularly height/altitude. In particular, Type B devices are only defined as ‘portable’, whether it be a Master or Slave. Portable means that it can be ANYWHERE indoors or outdoors. Thus the location assumptions of 2.94(a) and (b) are NOT admissable. Type B Master WSDs will be bought and deployed much like current wireless routers and can be installed practically anywhere, inside or outside. Worse, non-geolocated Slaves will also be absolutely anywhere a human can reasonably carry them, including inside the boresight of a (amplified) DTT antenna (e.g. across a street).

Question T6: Do you have any comments on our proposed protection ratios in relation to DTT calculations? :

Figures 4.12 and 4.13 show protection ratios for Class 1 devices, which is not representative of the devices likely to be most troublesome (i.e. Type B, handheld Slaves). Note that 4.12 shows that, despite the tight Class 1 mask, there are receivers (without external preamps etc.) that demand quite high protection which, presumably, are going to be ‘ignored’. It is noted that Table 4.3 covers differing Classes, notably Class 5, the latter being generally more realistic.
During the pilot and beyond, it is assumed that Ofcom will have tight control over the protection ratios that WSDBs will be working to. However, the important ‘adjustments’ that are described in 4.105 are barely explained. What does ‘high’, ‘medium’ and ‘low’ mean? In the contexts of discussions where probabilities are tightly prescribed, this seems disquietingly vague but critically important.
WSDBs will give a locus of validity for the leases they issue to WSDs (Table 2.3 and ETSI Table 5). WSD location variability (cf T7) is discussed but not whether the locus may be wider.

Question T7: Do you have any comments on our proposed approach for dealing with the uncertainty in the locations of WSDs in relation to DTT calculations?:

Even with an uncertainty of +/-50m 4.115 appears incorrect - Figure 4.14 shows that this case 'touches' 8 pixels. Location uncertainties larger than this will touch more.
The assumptions of uniform terrain etc. when trying to calculate the coverage area of a master with non-geolocated Slaves (Annex 3) is too crude. The Generic Operating Parameters that a WSDB may issue may be too generous, bearing in mind that the Slaves will be using these in ALL the area shown in Figure 4.15 by default. Notably, Slaves will be transmitting at their FULL permitted EIRP at any point on the perimeter of the nominal coverage area. It is noted that this issue is more fully explored in 5.60 et al in the context of PMSE. Thus it is a recognised issue but with inconsistent treatment.

Question T8: Do you have any comments on our proposed approach for calculating WSD emission limits, as expressed in Equation (5.2), in relation to PMSE coexistence calculations?:

Since Equation 5.2 says little more than the physics, it is not something that can be challenged. The problems arise when trying to quantify the constituent variables (see below).

Question T9: Do you have any comments on the PMSE wanted signal power levels that we propose in relation to coexistence calculations?:

The 'default PMSE signal strengths' mentioned in 5.38 have no experimental basis and are not suitable for use in these calculations. Ofcom participated in a thorough study undertaken by CSR (Reference 28) in which the function of PMSE wireless microphones was analysed and tested in great detail. The gain budget shows the necessary allowance for deep, multipath fading and is INTRINSIC to meeting the PMSE 'live' quality criteria. This is not theoretic: Plots of the signal strength over time received in a live PMSE situation show its practical necessity. WSD interference in these situations WILL cause damaging interference to PMSE licensed services. The sweeping statement that the proposed -65dBm/200kHz is broadly in line with 'various trials' has no reasoned basis. Indeed, the rest of 5.40 says, 'and is considerably higher than the typical wireless microphone minimum sensitivity of -95dBm/200kHz'. PMSE receivers would not have such sensitivities if they did not have a competitive purpose and is now widely exploited.
Unfortunately, this nullifies the work commissioned by Ofcom and the protection ratios that result. An approach that seems to ignore even the cited work it participated in seriously undermines Ofcom's credibility. Good availability of WS for WSDs must be proved using at least the evidence that exists and, preferably, subsequent further work of similar quality to that of CSR.

Question T10: Do you have any comments on our proposed approach for calculating coupling gains in relation to PMSE calculations:

Table 5.3 once again makes indoor/outdoor assumptions that conflict with the statement of 2.23 that the device type does not identify devices as indoor or outdoor. Remember that a mobile device can be ANYWHERE, notably co-sited with PMSE e.g. in an auditorium.

Nothing can be construed from the antenna heights of PMSE or WSDs in such cases. The CSR study shows a likely scenario where the assumptions of 5.48, 5.53 and 5.68 are invalid.

Question T11: Do you have any comments on our proposed approach for dealing with the uncertainty in the locations of WSDs in relation to PMSE calculations?:

Annex 3 presents a reasonable estimate of the coverage of a Master WSD given some quite sweeping assumptions (e.g. type conformance, consistent terrain etc.) so it is too crude for practical use. It should be remembered that the GOPs granted the Master by the WSDB will be used by default by any Slave on the periphery of the coverage area at the full, permitted EIRP of the Master. Figure 5.4 shows the corresponding locations where modelling is required to assess the final GOPs. Note that it appears that some 4 analysis points are missing (2xN and 2xW) according to the proximity criteria.

Question T12: Do you have any comments on our proposed approach for dealing with the uncertainty in the locations of PMSE receivers in relation to PMSE calculations?:

The suggestion of trying to refine this to take account of building loss are noted, though are probably swamped by much more significant issues concerned with WSD location uncertainty (see below).

Question T13: Do you have any comments on our proposed approach for the derivation of WSD-PMSE coupling gains for non-geolocated slaves in relation to PMSE calculations?:

The responsibility for the calculations is the WSDB operator. They are dependent on the correct interpretation of Ofcom-provided data of several types and currency, together with the claimed parameters provided by the WSDs. There is considerable scope for error and/or discrepancies between WSDBs. Since, currently, there appears to be no incentive for WSDBs to ensure that the issued Operating Parameters are correct or suitable (no revenue model), there cannot be any trust by licensees in their ability to properly control WSDs. The impact of errors will be borne wholly by the licensees with little redress. This is totally unacceptable.
No standards are cited concerning the format and validity of WSDB data. Since there is no revenue model, there is every risk that there will be a conflict of interest between WSD manufacturers and WSDB providers, which will compromise proper WSD control.
Portable, Slave WSDs pose the most serious threat to PMSE (and DTT) licensees. Though compliance with the ETSI Standard (as currently drafted) is assumed, this is no assurance that Slaves will not open up in inappropriate places. Though the Standard tests that Slaves must cease transmission if they can no longer detect their Master, even the short burst it may emit could be seriously damaging to a PMSE licensee (e.g. live broadcast event, auditorium of a London theatre) and be annoying to the audience, which could be in millions.
Further, if the Slave can still receive what it BELIEVES to be its Master, it could continue transmission for longer causing even more damage. This scenario is not tested by the ETSI regime since the test arrangement has no concept of more than one Test Master operating at any one time or in sequence. There is no enforcement of exchange of device parameters between Master and Slave to resolve Master/Slave association ambiguity. This is just one example of the many expected flaws in a draft standard. The risks of allowing any WSD into

the market complying with this Draft Standard are far too high.
Note that it must be mandatory for a Slave to communicate its unique ID to the Master and thence to the WSDB. The Master must refuse association with any non-registered Slave. Even the (continued) attempts at association will cause unwanted and potentially damaging emissions from the Slave.
The Standard stipulates that devices cannot be user-configured or field updated. It is unlikely that manufacturers will wish to comply with this since it is market-unattractive, though they may appear to do so superficially. The experiences with market deployment of 5GHz WLAN are salutary. They show that attempts to enforce these restrictions are soon overcome or ignored by users, probably with manufacturers unofficial assistance.

Question T14: Do you have any comments on our proposed protection ratios in relation to PMSE calculations?:

The ratios are based on a -65dBm/200kHz threshold and thus they are neither practical nor acceptable. The tests in Annex 5 use a SINAD/distortion acceptability metric which would not be acceptable to broadcast reception (<1%THD), let alone original capture (which is what PMSE is used for).
Further, no account has been taken of the effects of intermodulation products, which are inevitable in a densely populated PMSE environment. This worsens the in-band noise floor and further taxes the PMSE receivers. This effect was clearly demonstrated in the CSR study.
Live events are likely to feature an increasingly dense population of portable WSDs among the audience, typically joining the venue after the sound-checks have been performed. It will be too late for the production to make compensating changes. Users will no more understand what a WSD does than they do a Smart phone or tablet. They WILL be used until the user either gets service or gives up in the attempt. As has been discussed, the risk of this sound 'black out' scenario in such a very-public (broadcast) event does not bear contemplation.
There is sufficient ambiguity over lease times that attempting to shut down spectrum availability via WSDBs would take too long to mitigate the damage, even assuming total compliance by the WSDs. This situation must NEVER HAPPEN.

Question T15: Do you have any comments on our assessment that a margin for uncertainties in radio propagation is not necessary given the proposed parameters for derivation of coupling gains in relation to PMSE coexistence calculations?:

A 'median' does not say much about the RANGE of values. Multipath and deep fading are a physical reality, demonstrated in the CSR study. PMSE receivers have to cope with a large dynamic range of wanted signal. Diversity reception has proved a robust way of reducing the risk of 'losing' the live modulating signal (a 'drop-out'), though it is not perfect. 'Blinding' both receivers with intermittent WSD interference will increase the risk of drop-outs, not just distortion. It is possible to have the benefits of WSD but it must not be at the cost of in-the-field, licensed equipment performance.
The issue of polarisation coupling gain is not relevant. Multi-path propagation inherent in the function of PMSE with moving transmitters in a complex, built environment is naturally accompanied by shifts in polarisation. The polarisation coupling between transmitter and receiver antennas should be assumed random and thus often less than unity.
Figure 5.6 is instructive. It suggests that it is possible for a Slave WSD under the stated conditions to 'knock-out' a PMSE installation at a distance of 700m. This is even assuming

the receive threshold of -65dBm/200kHz. It will only be worse if the installation is exploiting more sensitive receivers (likely).
Note that no assumptions can be made about the height of PMSE receivers. Until such time as Ofcom have licensee-provided data, worst case scenarios must be used.

Question T16 Do you have any comments on our proposed WSD emission limits in relation to PMSE use in channel 38?:

Yes. The same criteria should be applied to PMSE licensees using other channels but with a geographic exclusion zone. The argument is simply reciprocal: (i) Channel 38 licensees get robust protection because they are not geolocated, therefore (ii) fixed-location licensees get the same protection from mobile, non-geolocated WSDs.
Because of the aforementioned problems with doing any reliable modelling near to fixed PMSE licensees, to make any progress with WS coexistence, some conservative assumptions about high-threat WSDs need to be made:
(a) A co-channel WSD operating at maximum capped power is likely to cause unacceptable interference at a distance of 1km or more.
(b) Portable (cheap) WSDs are likely to have Class 5 emission templates.
(c) Such WSDs may not immediately be aware of their association status and/or continue to transmit at full permitted (capped) power.
(d) Being non-geolocated, it will not be known where they are, but it might be reasonably assumed that they will not have moved far from their last place of use. It is hoped that WSDs leaving an association region will have ceased transmitting before causing any damage to PMSE.
Accordingly, it is proposed here that there be an exclusion zone of at least 3km radius around any PMSE licensee. The channels licensed and adjacent +/-1 must be sterile for the purposes of WSD operation in its early years. This may be relaxed in the light of published studies, consultations and open verification, managed and financed by Ofcom from WSD registration revenues.
Parallel work must proceed on improving the ETSI Standard's fitness for purpose. WSD co-existence must learn from the serious mismanagement of the introduction of 5GHz WLAN devices to the European market. Equipment that causes 5GHz spectrum pollution is now irrecoverably in the field. This must NOT happen again with WSDs.

Question T17: Do you have any comments on our proposal not to permit WSDs to operate in channel 60?:

There are significant licensees operating from Channels 61 and higher. PMSE licensees will accept nothing less than the same level of protection. PMSE licensees seek consistency and fairness in the treatment of all UHF spectrum licensees and the same concern regards freedom from spectrum pollution from non-licensees. Ofcom must not be seen to foster the to exploitation by non-licensees of the privileges of spectrum use at the very real cost of the existing, compliant incumbents.

Question T18: Do you have any comments on our proposal that, if the unwanted emissions limit (over 230-470 MHz) in the draft ETSI standard (EN 301 598) is tightened by 8 dB, there should be no further restrictions on the operation of WSDs in relation to services below the UHF TV band?:

No comment, save to echo the sentiments in T17 on behalf of affected licensees in these bands.

Question T19: Do you have any comments on our proposal that, if unwanted emissions limit (over 230-470 MHz) in the draft ETSI standard (EN 301 598) is not changed, there should be restrictions on the in-block powers of WSDs in channels 21 to 23?:

Answer as T18.