



PMSE audio equipment and the effect of 700 MHz clearance

- The use of PMSE equipment underpins creative industries worth £billions every year to the UK economy.
- There will be a profound effect on the major audio PMSE users of the 700 MHz band when it is cleared for mobile data, particularly large theatres, major TV studio production facilities and outdoor events.
- Ofcom wants to bring clearance forward by 18 months such that the spectrum is available “no later than Q2 2020”, but are the risks to PMSE use understood?
- Sky currently uses 26 UHF channels at Osterley (not including c38)
 - ... for >200 analogue microphones and IEM devices
 - ... whereas post 700 Mhz clearance there will only be 27 UHF channels in total
 - Some analogue equipment is not (very) frequency agile
 - ... meaning some kit purchased to cope with 800 MHz clearance won't be suitable after 700 MHz clearance
- Is digital equipment the answer?
 - Compression not used in digital PMSE equipment (too much latency when used with monitoring such as IEM) ...
 - However, digital modulation enables more efficient use of spectrum (cross modulation tolerance enables tighter packing of carriers albeit with slightly increased latency),
 - but ...



Is digitally modulated equipment the answer to 700 MHz clearance?

- Tighter channel packing won't make up for the loss of 100 MHz, but could be part of the solution;
- The extra 3 to 4 milliseconds processing delay sounds small but will mean that audio systems need to be totally re-engineered;
- Studio operations typically need 8 hours battery life (not an issue with analogue devices) whereas many digital products offer 5 to 6 hours with a new battery and that will degrade to about 4 as the batteries age;
- Will there be new artefacts caused by the various extra processing stages?
 - Or other problems not discovered yet as use is not so widespread?
- What can be done about RF fading ?
 - Fading is gradual with analogue equipment, gives notice of failure through a hiss or crackle; will digital equipment take on “cliff effect” properties?
- And cost? Digital product is typically 50 to 100% more expensive;
 - ... some of which was only purchased for 800 MHz clearance and uses channels 39 – 60;
- Are there digital versions of all products?
 - None for IEM. Mix and match analogue with digital prolongs spectrum planning issues;
- Could new equipment work more intelligently, sensing the opportunity for avoiding or causing interference enabling more efficient spectrum sharing?
 - Some automatic channel re-selection exists but nothing for a new sharing scenario.
- Conclusion: Today's digital equipment does not offer a ready made solution to the loss of 700 MHz!
 - More development on the digital equipment is needed, and more spectrum.



Ofcom has authorised extra spectrum for audio PMSE, done deal?

Ofcom recently consulted about PMSE sharing with the Civil Aviation Authority at 960-1164 MHz and also Mobile Satellite Services at 1525-1559 MHz;

A statement was issued on March 10th authorising the 960 – 1164 MHz band.

- Both bands are globally assigned to the applications stated above and hence are highly unlikely to become candidate IMT bands in the foreseeable future. This means that they could be a longer term home for PMSE and have the potential for manufacturers to achieve ‘economies of scale’ – one piece of equipment that can be sold the world over. *However, no formal harmonisation dialogue at the EU level nor any other international forums has been started yet.*
- Existing or primary users in 960-1164 MHz must be protected, which Ofcom estimates will leave “50 MHz available in London and significantly more in other areas.” *Is 50 MHz really available and is it enough?*
- Government has pledged £550m to the 700 MHz clearance programme, the DTT programme is already underway, but little engagement yet with PMSE users. *800 MHz clearance was funded.*
- Ofcom’s studies have centred on their test site at Baldock and a London theatre; the available capacity and “quality” of these bands has yet to be fully assessed across industry. *Major TV broadcast centres have not been analysed in detail nor during trials to date, locations close to major airports will be the most problematic where the primary use of frequencies within the 960 – 1164 MHz band is the most prolific.*
- Possible TV sites with close proximity to airports:- BT’s Olympic Park Facility (City), Virgin Media Langley and Arqiva Feltham (Heathrow), BBC Media City (Manchester). *Any more?*



Any other major TV centers that are near an airport?



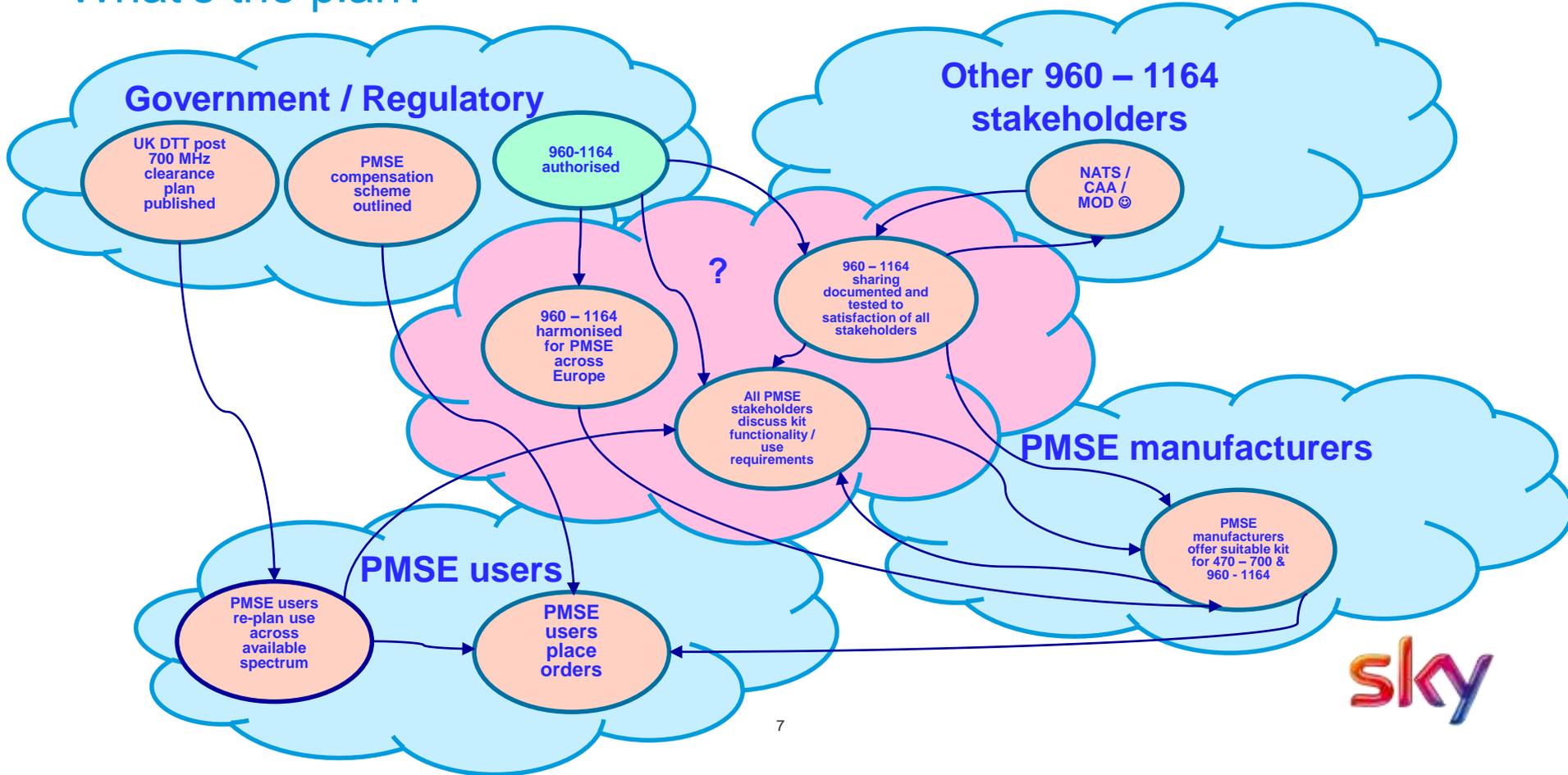
In summary, where is the UK on PMSE audio and 700 MHz clearance?

Assessment of full implications requires detailed post 700 MHz clearance DTT plan.

- PMSE users need information about compensation scheme to plan capital expenditure.
- The new 960 – 1164 MHz spectrum needs to be tested and confirmed in realistic scenarios at worst case locations to establish capacity and usability to the satisfaction of all stakeholders.
- Enhancements to digital equipment need consideration.
- European / international harmonisation would (seriously) help to make the new spectrum more attractive to users and equipment vendors.
- Equipment manufacturers will need to be convinced that there is a business opportunity before they develop equipment and get it approved.
- **There may be just over a year until London is affected** (Ofcom statement 11th March 2016 – ‘Maximising the benefits of 700 MHz clearance’ – “700 MHz clearance to start in late 2017”) – *London area first?*
- There is no industry consensus yet on the 960-1164 MHz band as the holy grail.
- A forum is required for PMSE users to discuss strategic matters.
 - *So that we can create an urgently needed roadmap to avoid impacting operations!!!*



What's the plan?



Questions?

