Neul response on Notice of Proposed Rulemaking

(Docket No. 12-268)

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1. Summary

Neul's interest in this NPRM are restricted to its implications for white space access. Neul is the pioneer of the Weightless machine-to-machine wireless technology which we envisage will be initially deployed in white space spectrum around the world.

We appreciate that in devising the incentive auctions, the FCC is required to achieve certain objectives which will tend to reduce the amount of white space. We also appreciate that despite this the FCC has sought to minimise the impact on white space availability, and in some ways to take the opportunity to improve it. As such, we are broadly supportive of much of the direction of the NPRM.

Our assessment of the likely outcome, in so much as it is possible to predict at this stage, is that the amount of available white space will generally reduce, but importantly that the minimum available white space may increase in some locations where today there appears to be none available. Because our business case is better facilitated by a ubiquitous network of lower capacity than a patchy network with areas of higher capacity, this outcome is favourable and one of the key reasons we support the NPRM.

While the actions of the FCC are constrained, it has some freedom at the margin as to whether certain channels are cleared and re-auctioned or continue to be enabled for white space access. The FCC has signalled that it understands the value of having both licensed and unlicensed access in these bands. Much has been written on this matter and we do not seek to cover the issue in detail here. Suffice to note that our innovative solution to machine-to-machine communications would likely not have emerged were it not for the availability of white space spectrum. The current proposals in the NPRM will reduce the amount of white space in favour of more licensed spectrum. This can be mitigated to some extent if, where there is freedom of choice, there is a bias towards choosing white space access.

There are some areas of detail where minor changes could result in a materially better outcome for white space usage while remaining within the constraints of the process. These are as follows:

Channel 37 and neighbouring wireless microphone channels

The deep notch in emissions currently required for channel 37 is problematic, especially for low-cost portable equipment. It also appears unnecessary given the localisation of usage to a number of readily identifiable locations such as radio astronomy sites and hospitals. Removing this notching requirement, at least outside of these selected locations, would be helpful and should be the minimum achieved here.

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Going further and clearing channel 37 or the wireless microphone channels has much to recommend it. If cleared and made available for white space access, as the NPRM appears to be proposing, this would be of enormous value to white space users.

We note that wireless microphones might themselves act as white space devices, with perhaps some degree of preferential treatment or ability to make reservations. This would enable unlicensed white space access to the channels currently set aside for wireless microphone users and might benefit the microphone users themselves by simplifying their reservation process and possibly increasing the spectrum available to them.

Guard bands and the duplex gap

We are supportive of proposals to enable white space access to the guard and duplex bands. This is helpful in increasing white space availability and creating a guarantee of white space availability at a minimal level across the country. However, much will depend on the rules of access, in the power levels allowed and emission requirements. With such narrow bands they will, effectively, have “adjacent” usage on both edges. The FCC currently prohibits most cases of “adjacent channel operation” for white space devices. Ensuring that the receivers in the licensed devices are of good quality and are sensibly robust to adjacent channel interference will be critical in ensuring these bands are useful. We discuss the issue of receiver performance further below.

It is possible that the guard bands may be unduly polluted by licensed usage to either side. We would encourage the FCC to mandate tight filtering on the licensed users to restrict such emissions. For example, it would seem reasonable that the licensed users should have to meet the same severity of spectrum mask as the white space users.

TV and cellular receivers

One of the key restrictions in the use of white space is the often relatively poor performance of licensed receivers. This can require white space devices to avoid adjacent channels or transmit with lower power levels than would otherwise be the case. While legacy receivers cannot be readily modified, the FCC could take this opportunity to signal a tightening of receiver performance coupled with an equivalent relaxation in white space access rules. While the most problematic receivers currently appear to be TV receivers, it is an appropriate time to set rules for other licensed users, presumed to be cellular receivers, such that their performance does not unduly constrain white space access.

Rules of access to TV white space

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We have a number of other issues around the rules of access to white space spectrum. These include aspects such as the measurement of transmit power in narrow 100kHz bands, the use of simplified coverage contours in predicting TV coverage and the restrictions of use on adjacent channels when more intelligent rules such as those proposed by Ofcom in the UK could be applied. However, we recognise that this NPRM is not directly concerned with such issues and hence do not expand on them here.

In the subsequent sections we give detailed comment on the NPRM by following the FCC document structure.

2. Forward Auction-Reconfiguring the UHF band

§ 133

See comment on §405

§ 153, 175

See comment in §234 and §235.

§ 199

Channel 37 is protected by FCC 15-709 which limits the emission of WSD to 30dBµV/meter/120kHz over the whole country.

- Given that General Electric (FCC-08-260 §144) required that channel 37 is protected at the level of 50µV/meter at the WMTS location.
- Given that the 600MHz band will be licenced as a Part 27 service, in which the WMTS is protected at the level of 150 µV/m at the WMTS location.

We think it would be reasonable to apply the field limit described in part 27§804 in lieu of the 30dBµV/meter/120kHz requirement.

Channel 37

§ 180, 206, 209

- It is observed that WMTS devices have to be registered in the database operated by the ASHE/AHA[1] as specified in Title 47 FCC 95 subpart H. This includes the location of the WMTS equipment.
- As described in Title 47 FCC 15-709 the WMTS devices have to be protected from whitespace devices.

Given those two elements and public law No: 112-96 sec 6403 it would be natural to

[1] American Society for Healthcare Engineering of the American Hospital Association

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- Protect WMTS devices from whitespace devices only at WMTS location given that the location information is already present in a database.
- Coordinate between the ASHE/AHA database and the whitespace databases to include the WMTS devices location in the whitespace channel allocation

Low Power Auxiliary Stations and Unlicensed Wireless Microphones

§ 226

The uplink guard band frequency will be location depended. We think that any unlicensed operation in the guard band, which includes wireless microphone, can only practically be implemented by the interrogation of a whitespace database.

3. Whitespace and unlicensed operations

§ 234

It is understood that the guard bands could be between 6-10MHz wide and could be used for unlicensed operation. As discussed in § 226 we think that the operation in those guard bands should be based on the whitespace database principles.

§ 235

Are the existing power and emission limits for WD in the television bands appropriate for unlicensed operation in the guard band spectrum to protect licensed operations?

In this section we address the reverse problem, i.e. what is the amount of power that a LTE user terminal can emit in the TV channel adjacent to the uplink guard band. We then draw a conclusion on the white-space emission limits.

According to the 3-GPP E-UTRA User Equipment (UE) specification [2], the spectral emission have to follow the mask shown in Figure 1. The proposed uplink guard band will be at least 6MHz wide but could be up to 10MHz wide. Assuming that the guard band is only 6MHz wide we can infer the emitted power in the next available television channel from an E-UTRA UE. For a LTE user terminal emitting 23dBm the emissions could be up to -25 dBm/1MHz in the TV channel adjacent to the uplink band. This corresponds to -17 dBm in 6MHz.

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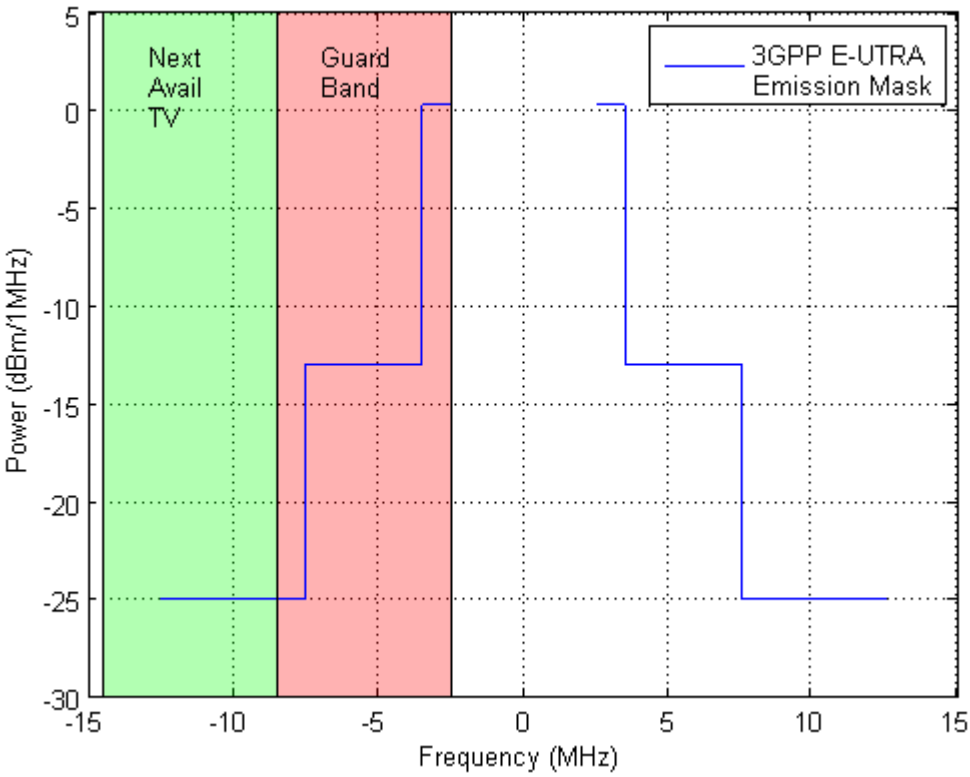

Figure 1: E-UTRA UE spectral mask for a 5MHz channel

As described in [3] the requirement for whitespace portable devices operating adjacent to a TV signal is to emit no more than 40mW (16dBm) with the requirement that the power emitted in the adjacent channel is no more than -39 dBm EIRP. This means that the LTE emissions in the TV channel closest to the guard band could be 22dB higher than what is allowed by a whitespace device.

Either the whitespace spectral requirements have to be relaxed to be consistent with the LTE emissions limits or the LTE limits have to be tightened.

§ 237

Yes this is coherent with our proposal in section §180, §206, §209.

§ 238

As described in the Cambridge TV White Space Trial, PMSE Trial Report [4] (section 7.2) the protection zone required to protect a wireless microphone from a whitespace device is estimated to be relatively small. Allowing whitespace devices to operate in the two channels designated for use by wireless microphone would improve the spectral usage of those

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bands. This would require the microphones to be registered in the whitespace database which in turn would simplify the usage of the uplink guardband by wireless microphones.

4. Regulatory Issues; Licensing and Operating Rules

Wireless Issues

§405

We support the Use-It or Share It proposition. As proposed in §133, the unpaired downlink spectrum could be licenced separately. It is understood that the asymmetrical nature of internet traffic would naturally require more downlink spectrum than uplink spectrum. However we observe that since the downlink band will be uniform in the whole of the US there could be parts of the country where the ratio of uplink/downlink allocations does not fit the typical uplink/downlink asymmetry. The remainder of the downlink spectrum that is not used could be used for whitespace operation. The regional variation of the used spectrum would naturally fit the geo-location database principles and the Geographic Area Licensing outlined in section 4§144. Such a provision would follow the principles of the second point of the Spectrum Act [1].

5. References

[1] "SPECTRUM Act," *112th CONGRESS 1St Session S.911,* 2011.

[2] 3GPP, "3rd Generation Partnership Project, Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 V10.7.0)," 3GPP, 2012.

[3] FCC, "Subpart H-Television Band Devices; 15.079 General technical requirements," FCC, 2012.

[4] C. W. Consortium, "Cambridge TV White Space Trial, PMSE Trial Report," Cambridge Whitespace Consortium, 2012.

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