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Emerging issues in white space regulation

Benoît Pierre Freyens [a,*], Mark Loney [b]

[a] University of Canberra, Economics, Faculty of Business & Government, Canberra, ACT 2601, Australia
[b] Australian Communications and Media Authority, PO Box 78, Belconnen, Canberra, ACT 2616, Australia

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ABSTRACT

The secondary use of vacant television channels (TV white spaces) and the reallocation of the digital dividend to provide wireless broadband services are in the final stages of implementation in some countries. Originally seen as a once in a generation opportunity to better allocate UHF spectrum, further digital dividends are now underway as regulators and industry strive to meet exponential increases in demand for mobile data services. Concurrent developments suggest that TV white spaces may be rapidly exploited by global networks with billions of supported devices. The potential for sub-optimal outcomes is identified if the prospect of further digital dividends is not taken into account as technical and regulatory arrangements are put in place to allow productive use of TV white spaces. The importance of considering the potential interaction between further digital dividends and the use of TV white spaces is discussed and technical and regulatory approaches to support optimal outcomes are identified.

1. Introduction

In more and more countries, the idea of using TV white spaces for unlicensed mobile broadband applications is making progress and follows in the wake of other applications such as wireless microphones and UWB devices. This interest is driven by the move to digital television broadcasting, the consequential end of analogue terrestrial television broadcasting (digital switchover), continuing growth in Internet usage, and increasing demand for wireless broadband access. In the United States, the Federal Communications Commission (FCC) has established regulatory arrangements for white space devices and Ofcom, the spectrum regulator and communications competition authority in the United Kingdom, is in the final stages of implementing its own white space arrangements. However, scenarios have emerged that are challenging these developments by implicitly earmarking additional portions of the UHF band for purposes other than broadcasting in the longer term: namely mobile phone networks and wireless broadband networks. In such a context, there is a risk that enabling the widespread deployment of unlicensed white space devices (WSD) in the UHF bands on a secondary basis will compromise the ability of regulators to achieve higher value use of the UHF band in the medium to long term.

An emerging scenario that must be taken into account is the further reduction or even cessation of terrestrial television broadcasting in the UHF band with the consequential recovery of additional UHF spectrum from broadcasting for higher value uses such as telecommunications. The complete cessation of broadcasting use of the UHF band was first foreshadowed in Finland (MTC, 2008) and one of two scenarios canvassed in a report to the European Union (EU) in

* Corresponding author. Tel.: +61 2 6201 2357.
E-mail addresses: ben.freyens@canberra.edu.au (B.P. Freyens), mark.loney@acma.gov.au (M. Loney).

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2009.[1] A significant step towards a further reduction in broadcasting use of the UHF band occurred in February 2012 when, consistent with the report presented to the EU in 2009, the World Radiocommunication Conference of the International Telecommunication Union (ITU) decided that countries in Europe, Africa and the Middle East could commence planning to use the 700 MHz band (694–790 MHz) for mobile telecommunications.[2] The following month, Ofcom released a discussion paper[3] that set out the case for reallocating use of the 700 MHz band in the UK from digital terrestrial television to mobile telecommunications. Should broadcasting services continue to withdraw from the UHF band in the years ahead, allowing widespread WSD operations in spectrum that is being used to broadcast digital TV could constrain the reallocation of a further digital dividend 2.0. This is particularly likely if the regulatory requirements and technical specifications for WSD are not developed in anticipation of further digital dividends that continue to clear the UHF band of digital TV services.

This concern is the result of significant differences between broadcasting and telecommunications use of the spectrum. These differences imply that WSD capable of successfully operating on a secondary basis in a broadcasting environment may have little or no capacity to operate in a telecommunications environment without causing harmful interference or themselves suffering from degraded performance and capacity. In contrast, designing a regulatory regime for white space devices that anticipated further changes in primary use of the UHF band could incentivise the development of WSD with technical characteristics that enable cooperative sharing with telecommunications services. In this optimistic scenario, intensive WSD deployments in the UHF band in the short term could allow early realisation of the telecommunications potential of the UHF band and lead to increased producer and consumer benefit in the medium to long term.

In previous contributions, it has been concluded that an optimal approach would be for WSD authorised on a secondary and ad hoc basis to have the capacity to collaboratively operate in conjunction with telecommunications networks that were deployed on a planned basis by network operators using advanced technologies to provide services such as mobile broadband access (Freyens, Loney, & Poole, 2010; Freyens & Loney, 2011, 2012). After considering recent developments, it is now suggested that establishing TVWS property rights may result in more efficient use of the spectrum resource—and particularly in high demand areas with limited supply.

2. White spaces—Typology and devices

TV white spaces (TVWS) are those channels that have been allocated for terrestrial television broadcasting but which have not been assigned to the provision of television services in a particular licence area. TVWS arise for three reasons. The first is the need for guard spaces between analog TV (ATV) services in the same licence area. If ATV services in the same licence area operated on immediately adjacent channels, the result would be mutual interference between the two services. Consequentially, planning for ATV services typically provided for at least one vacant channel (a guard space) between ATV services in the same licence area. Because of the superior performance characteristics of digital terrestrial television technologies, the need for guard spaces between DTV services in the same licence area can be significantly reduced or eliminated.

TVWS also arise from the need for geographic separation between TV services that are in different licence areas but are broadcasting on the same channel. Regardless of whether planning for TV services is noise-limited or interference-limited, there will be intermediate areas where the channel is unable to be used for TV services (if a noise-limited planning model is used, the TVWS will typically be larger). Geographic separation occurs in both ATV and DTV planning and deployments.

Finally, TVWS arise in areas where channels are not allocated to broadcasters for TV services, either because of the limited supply of broadcasting services (because only a small number have been authorised or deployed) or because there is limited demand for broadcasting services (traditionally because of low population density but, as convergence continues, perhaps commonly because of the increasing range of technologies that can be used to deliver broadcasting services such as fibre to the premises broadband networks and advanced wireless broadband services). In this context, TVWS occur regardless of whether ATV or DTV technology is in use.

A device, which opportunistically uses these available channels, is commonly referred to as a white space device. WSDs have so far come in two types:

(i) low power and narrow bandwidth devices such as wireless microphones and medical telemetry implants that operate over short ranges to provide local communications or data links—which are described as symbiotic WSD for the reasons discussed below; and
(ii) higher power and larger bandwidth devices that operate over longer ranges and are intended to connect to wide area telecommunications networks such as the Internet—and which are referred to as invasive WSD.

Symbiotic WSD operate on quasi-overlay basis with primary broadcast services and were often explicitly authorised by regulators as well as long accepted (or tolerated) by broadcasters. For the invasive WSD that have developed over the last

[1] The final report is retrieved from http://www.analysysmason.com/Research/Custom/Reports/Exploiting-the-digital-dividend–a-European-approach/Final-report-for-the-European-Commission/.
[2] Resolution 232 (WRC-12) is retrieved from http://www.itu.int/oth/R0A0600004B/en.
[3] The discussion paper is retrieved from http://stakeholders.ofcom.org.uk/consultations/uhf-strategy/.