2.5.3 Lower Band Only

The FCC rules define that UWB devices in communications systems operate between 3.1 and 10.6 GHz. Given that this bandwidth accommodates a wide range of commercial and Government communications systems, Ofcom wishes to understand where the majority of interference costs may arise in this range, and the impact on benefits if Europe were to define a different operating bandwidth for UWB to that of the FCC.

As highlighted in the UWB technology comparison in the previous section (Table 2.3), it is apparent that both rival standards are designed to operate in defined sub-bands of the 3.1 to 10.6 GHz range. The DS-CDMA approach uses two sub bands, which we understand to be from 3.1 to 4.9 GHz and from 6 to 10 GHz. The MB-OFDM approach divides the bandwidth into 528 MHz wide sub bands (a total of fourteen across the 3.1 to 10.6 GHz bandwidth). Products can support a sub set of the 15 bands. The three lower bands (between 3.1 and 5 GHz) are defined as mandatory for 'standard' operation, with the rest of the bands reserved for future expansion. Thus, we understand that initial MBOA products will cover sub bands in the lower (3 to 5 GHz) band, with which it is still possible to achieve a data rate of 440 Mbps[22]. Since vendors have anticipated that UWB signals may be impacted by interference from 802.11a WLAN systems, the IEEE standards group has elected to avoid UWB devices transmitting in the 5-6 GHz band to limit this effect. Figure 2.3 illustrates this for the MB-OFDM UWB technique.

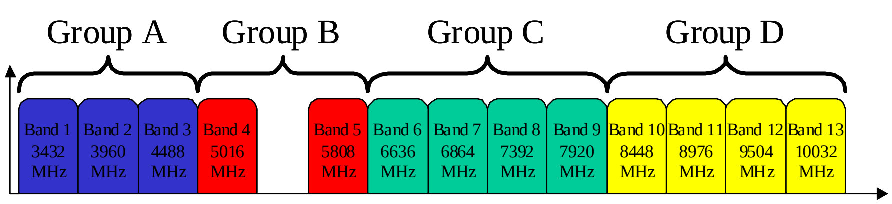

Figure 2.3: UWB OFDM Technique, Illustrating 'Notch' from 5.1 to 5.8 GHz (Source: IEEE)

To consider the impact of the UWB bandwidth on costs and benefits under the lower band scenario, we thus assume that UWB operation is limited, by regulation, to the lower portion of the 3.1 to 10.6 GHz band, which we have defined to be from 3.1 to 5 GHz.

Given our understanding that initial chipsets for both UWB approaches are being designed to operate within the lower band only (owing to compatibility concerns with 802.11a systems and also due to current limitations of existing silicon technology to operate above 6 GHz), we consider that this scenario will not impact on the initial UWB market. However, it may place a potential constraint on future options, if vendors are able to design products that

[22] The addition of further sub bands at a later date would increase the number of simultaneous piconets that the system supports rather than increasing the data rates (for further explanation, see Appendix A).

overcome the operating constraints at higher frequencies. For the purposes of our analysis, we assume a partial reduction in quality benefits for consumers from 2010 relative to the first two scenarios (see Section 4.2 for further explanation).

2.5.4 Upper Band Only

The fourth scenario we have investigated for Ofcom is if the UWB bandwidth were limited to the upper portion of the FCC bandwidth, which we have defined to be between 6 and 10.6 GHz.

In practice, whilst this scenario avoids the interference costs arising from UWB transmission in the proximity of the 2.1 GHz UMTS bands, this option represents a serious constraint on the UWB industry given the constraints imposed by operation at the higher frequencies. As discussed in the previous section, advances in silicon technology will be required for UWB to operate in this frequency range[23]. It is likely that operation at higher frequencies will affect UWB performance and may impact some of its perceived advantages; the propagation loss in the upper band will severely limit the signal range, in turn impacting on power and battery consumption[24]. Vendors we have spoken to as part of this study suggest that the impact of this scenario being adopted in practice is that it may delay the introduction of UWB in the European market indefinitely. For the purposes of our analysis, we make the conservative assumption of a delay of five years relative to the other scenarios (see Section 4.2 for further explanation).

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[23] Research is advancing in some parts of the world (particularly Japan and Korea).

[24] Potential range reduction of 6.5 dB, which assuming a free space path loss, equates to a 50% range reduction.