Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title: **Ultra-Wideband**

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Name *Murray Niman & Peter Day* Signed (if hard copy)

UK Microwave Group Response to Ofcom Ultra Wideband Consultation

Who we are

The UK Microwave Group (UKuG, www.microwavers.org) is the representative body specifically for UK amateur radio enthusiasts who operate on the microwave bands. It is affiliated to the Radio Society of Great Britain (RSGB, www.rsgb.org) and the RSGB Spectrum Forum. UKuG also liase with AMSAT-UK and BATC who are also users of UK Amateur Microwave allocations.

UK Microwave Group membership includes operators of terrestrial, amateur satellite and Earth-Moon-Earth(EME) links, using a variety of leading edge weak signal receivers. Systems also include Microwave Propagation Beacons, Voice Repeaters and Fast-Scan Television Repeaters. Our membership base includes many people with professional backgrounds and extensive experience in science, engineering and communications.

Allocations for the Amateur Services include bands at 3.4, 5.6 and 10GHz which lie directly within the UWB range, as well as at 2.3GHz which lies in the roll-off mask

Our response is largely based on those bands for UK Amateur Microwave operations, but also includes notes based on our membership also being citizen consumers.

UK Microwave Group - www.microwavers.org

Chairman: **Peter Day G3PHO**

Secretary: **Martyn Kinder G0CZD**

Treasurer: **Steve Davies G4KNZ**

On the RSGB Spectrum Forum, UKuG is represented by the RSGB Microwave Manager Mike Dixon G3PFR, and actively supported by UKuG committee members Peter Day G3PHO and Murray Niman G6JYB

Ultra Wideband

Introduction

UK Microwave Group (UKuG) welcomes the opportunity to contribute to what we hope is a genuine consultation and policy making exercise by Ofcom. We recognise that potential markets for UWB devices would include video streaming for home entertainment and for wireless-USB. They will no doubt be deployed on a license-exempt non-protected, non-interference basis. However UKuG along with many others are concerned that it is far from proven that they will be non-interfering

The nature of UWB is as its name suggests is the unprecedented bandwidth it occupies. UWB proponents originally suggested that their systems would be indistinguishable from the noise floor. However it is clear that devices at –41dBm/MHz will certainly compromise the noise floor in many receivers that have sensitivities at least 40-60dB lower. This is just as true for commercial systems as it is for Amateur ones. Because of its nature UWB needs specific and pro-active regulatory stance rather than Ofcom's default light touch

At present huge economic value is tied up in the roughly 1GHz of spectrum bandwidth in the 1.7-2.7GHz range which covers GSM, WLANs, Bluetooth and 3G. This includes the '3G Expansion' band (at 2.5-2.69GHz), where Ofcom itself recognises a need for a better protection mask. Ofcom's assessments largely ignore the future potential of the 7GHz of spectrum above in the 3-10GHz range (notably in the 3-6GHz area) which is targeted for Wimax, 4G, FWA etc. These systems would need similarly good receive performance and low noise floors. UWB, particularly in denser urban and office environments, could easily become a major noise source here. Thus we would urge a pro-active effort by Ofcom now, to avoid huge economic damage which would be difficult to reverse later.

It is important to recognise that UWB is only reliable and has any net benefit for very lower power short-range applications. Ofcom and CEPT should take an early decision to not permit applications beyond 30m, nor fixed outdoor systems etc where alternative narrower bandwidth techniques are more effective.

Consultation Questions and Answers

Q1: Are these the appropriate topics to be consulting on?

Yes, as otherwise a UK policy vacuum would create significant uncertainty, both at home and in international regulatory bodies. We stress that it is important not to prejudge the benefit of UWB and recognise that a wide range of international studies and standards work is underway, much of it aimed at mitigating UWB's impact on conventional systems

Q2: Do you agree with this analysis of our statutory duties?
Are there any important factors that have been omitted?

The duties stated are summarised correctly but the document is prejudging and omitting matters, and therefore out of line with the Comms Act 2003

Efficient use of the spectrum. UWB is no different to any other system in that it must not cause interference. This duty could therefore be undermined in spectacular fashion over a 7GHz bandwidth. Ofcom has placed much store in spectrum trading yet, without controls, large amounts of auctionable value will be eroded.

Development of innovative services. Over the 7GHz of spectrum in question there can be no doubt that other innovative developments could take place, but only if they were not interfered with. Investment in other systems may be inadvertently undermined

Current and future demand for spectrum. The only significant area of spectrum considered for future use is 2.5-2.69GHz. Ofcom's Media Office FAQ's state on Q14:-

> **"Q14 Have you considered how this will affect future systems and technologies?**
> Answer: We decided not to consider the potential cost of interference from UWB to future systems . . ."

One duty has been totally omitted – Public Safety. UWB is a form of broadband EM pollution which can significantly increase the noise floor or block receiver front ends if nearby. Conventional systems such as cellphones, LANs etc often employ adaptive power control. When such systems find that Quality of Service is degrading, they ramp up their transmitter power to compensate. Thus it is conceivable that an indirect consequence will be a rise in average Human specific absorption rates (SAR) as cellphones etc use increased powers.

Another Omission - Impact Assessments. Even if safety above is not a primary issue, another consequence of raised noise floors for commercial systems is the impact it has on the value of spectrum and basestation planning. More basestations (for which planning permission is increasingly controversial) would be needed. These have a visual impact on the public as well as cost issues for the operators.

One final comment. The economic study does not seem to account for incompatible rival UWB systems, which may delay acceptance until 'the market decides'.

Q3: Do you agree with the economic study? Are there other studies that Ofcom should be conducting?

The economic study attempts guess the future for UWB whilst not similarly forecasting other systems such as Wimax and 3.5G etc over the same period. We also refer to our answer to Qustion-2 above and the quote from Ofcom FAQ-14. Many other high value systems will inevitably be developed in the same spectrum as UWB, including 4G etc.

We absolutely disagree with the forecast for 'UWB Low Band'-only as most initial chipsets will be low band only in any case!

It is important for both Amateur and Commercial interests that bands below 3.1GHz are much better protected. We suspect that the study assumed that the new mask in Fig 6.1 would be sufficient for 2.5-2.69GHz, but we are sure that protection of the noise floor here will need to be tighter still. Please also see our reply in Q2 above regarding omitted studies/duties

Q4: Is there a better way that future use of the spectrum could be taken into account?

It certainly needs far more research than the short chapter in the consultation document, as per our answer to Q3. Future spectrum use by others should be given just as much priority as UWB, especially given that non-UWB use will be Primary/Secondary.

Q5: What is the most appropriate solution to the potential interference from UWB to BFWA?

All mitigation measures possible should be considered including full notching.

Q6: Would it be possible to achieve sufficient isolation between radio astronomy and UWB through practical methods of physical separation?

UKuG membership includes Radio Astronomers, EME and Satellite users. Whilst exclusion zones are helpful for a few large observatories, we expect that low angle near horizon observations will put UWB devices within the high gain beams of sensitive receivers. It is not realistic to assume physical relocation of radio astronomy or other fixed installations. It should be note that both Radio Amateurs and Astronomers both operate with weak signal fluxes in narrow bands. Neither Astronomers or Amateurs have any 'magical' technique that contends with the noise floor rising 40dB!

Q7: Are there any other options that we should consider?

Yes, the document lists options but prematurely dismisses them despite the market evidence.

Many initial chipsets will be low-band only. The ITU is considering a lower power limit especially for the 3-6GHz range. Higher frequency chipsets at 7GHz are already available.

Given the relative ease that OFDM can notch bands or sub bands, it clearly has improved potential for lower interference, and one option would be to mandate this standard only, with the added benefit that the European Citizen-Consumer would not suffer confusion from potentially two incompatible systems.

Frequency compatibility is not an issue, as suppliers will have to resolve this for initial low-band UWB chips vs Mode-2 or later full band implementations. A similar issue on data rate protocols regarding 802.11b vs 802.11g systems already works well in the market place on the 2.45GHz band

Q8: Are there any major technical studies that we have omitted?

Market Impact of incompatible standards, increase in Human SAR rates, basestation numbers/planning/costs if noise levels increase, **and accurate and realistic studies for the Amateur and Amateur Satellite services**.

Q9: Have we made an accurate assessment of the existing studies?

The document covers a broad range of studies. However we note many references to reputable studies being considered to be 'conservative', some of which are Ofcom's own! This shows an inherent bias, which we believe, is inappropriate and premature.

For Galileo where hi-reliability and safety-critical applications may be at stake, it is assessed on a weak scenario of 30m separation distances. Given the dense deployment of both UWB and Galileo in future (for example on cars to enforce speed limits) these assumed distances might be much less.

For Amateur Radio we do not agree with Ofcom's analysis of the CEPT report.

For example we note the Ofcom statement

> 'Amateur receivers normally employ sophisticated filtering techniques to make it less susceptible to interference.'

UKuG can assure Ofcom that we cannot bend the laws of Physics better than others, and highlights that the CEPT report showed that UWB powers need to be at least 10dB less to avoid interference.

During the consultation we also observed that the French Regulator ANFR has made a submission to this question critical of Ofcom's summary, and UKuG calls for a formal response from Ofcom.

Q10: Do you agree that we should seek a common European framework for the introduction of UWB?

It is important that Ofcom becomes far more pro-active and influences the debate at CEPT and other European and international fora.

Q11: Have we proposed the most appropriate mask?
Will it be possible to deliver equipment conforming to this mask?

UKuG believes that tighter limits than that currently proposed are need at the UWB band edges to protect spectrum below 3.1GHz and would also advocate a roll-off starting at around 9.5 GHz to protect the 10GHz band. Serious consideration should be given to the 3.4 and 5.7GHz areas, including the use of notches.

The mask is not defined for emissions below 2GHz, which is legally ambiguous. The definition for out of band emissions should be extended across the spectrum.

We have confidence that UWB suppliers such as Intel and Motorola comfortably could meet the Ofcom mask if requested, and perhaps even tighter limits to protect valuable communication bands. For example Intel has demonstrated that their OFDM based system can notch either 500MHz blocks or individual sub-carriers purely by software control.

Q12: To what extent should we define parameters such as those listed above?
What is the most appropriate definition for each of these parameters?

The parameters listed represent a useful though incomplete summary of mitigation measures. We certainly support those that adaptively reduce power or inhibit transmissions if not in use.

The requirement for a minimum bandwidth perhaps may be too prescriptive and pre-empt ongoing international discussions. We also observe that decisions on minimum PRF's have also occurred and need to be reviewed. Measures on lower power limits (as per some ITU discussions), and notching ability must not be excluded

In order to assist interference in denser environments, it would be worth specifying a unique identifier in the data for every UWB device, in a similar manner to the MAC address on ethernet interfaces.

It is even possible to consider ruling in favour of OFDM on the grounds it offers considerable scope for adaptively notching out local problems.

Given that there are a large number of details which have not been resolved, it is important that Ofcom do not prematurely license this technology and UKuG calls for a second consultation when matters are clarified.

Q13: Is our proposed approach to international bodies appropriate?

Ofcom must become far more pro-active and influence the ITU, CEPT and EU debate. It should do so in such a manner that all spectrum users interests and the economic benefit that they generate are protected, not just UWB vendors

Q14: How should we best deal with the precedent potentially set by our proposed approach to UWB?

UWB is most unusual and must not be allowed to set any precedent for other relaxations. All cases must be dealt with on their own merits.

Q15: What should Ofcom's role be in setting and monitoring EMC standards?

It has been widely observed that Ofcom has been withdrawing from EMC and none-safety interference issues. Ofcom cannot hope to understand, manage and resolve interference/EMC matters if it does not reverse this trend, particularly as spectrum occupancy increases and systems such as UWB challenge long established principles.

In order to assist interference in denser environments, it would be worth specifying a unique identifier in the transmitted data for every UWB device, in a similar manner to the MAC address on ethernet interfaces.

We note that some research has been commissioned but detail is lacking. Ofcom's proposed fixed monitoring network will not resolve UWB issues, so a more portable solution will be needed. Our own professional experience tell us that UWB directional antennas and arrays to accurately trace rogue UWB radiation sources is technically challenging. Conventional spectrum analysers would also struggle to capture UWB signals. Ofcom should expand activity in such areas.

Background Information:-

Proposed Mask Reproduced from Fig 6.1 of the Ofcom Ultra WideBand Consultation:-

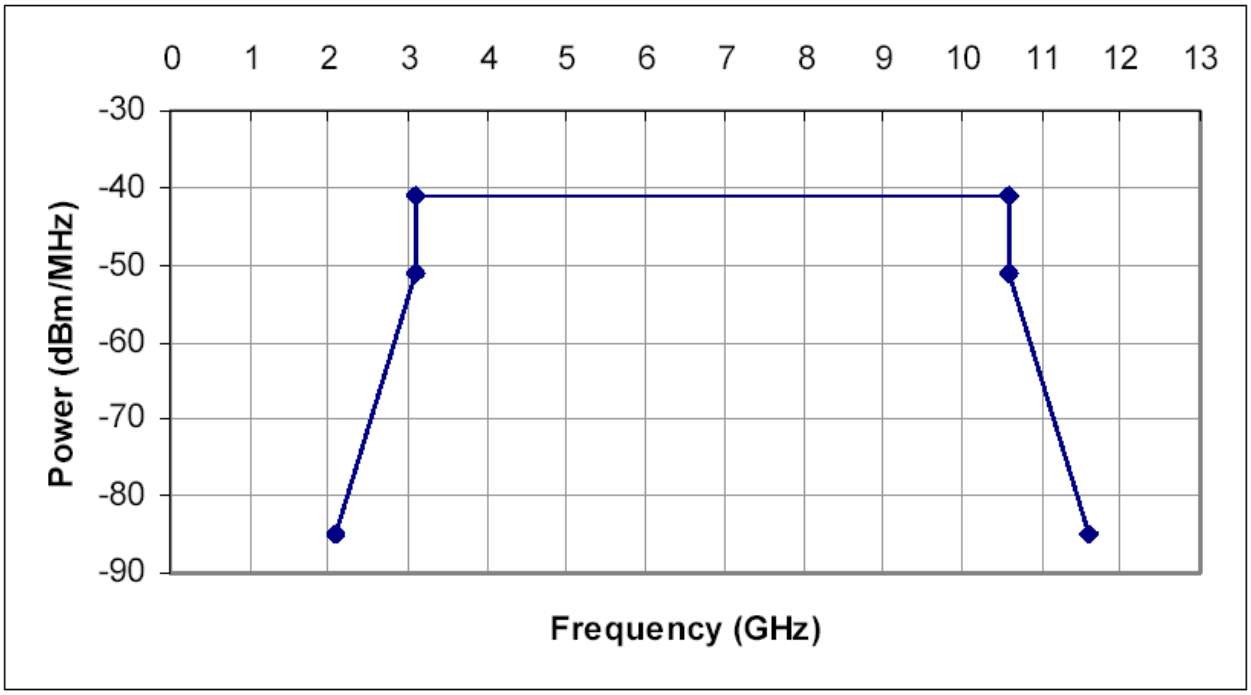

Figure 6-1 : The proposed Ofcom revision to the ETSI UWB Mask[16]

16 Key numbers are -85dBm at 2GHz, -51.3dBm just below 3.1GHz, -41.3dBm between 3.1GHz and 10.6GHz, -51.3dBm just above 10.6GHz and -85dBm at 11.6GHz.

UK Microwave Group does not believe that this mask offers adequate protection for both in-band and out of band Primary and Secondary services