Ofcom UWB Consultation Response March 2005

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Introduction and background to the response

Artimi is a fab-less semiconductor manufacturer based in Cambridge, UK. We specialise in a range of UWB techniques from impulse based systems for short-range (in room) high rate and long-range low-rate communication, to the emerging OFDM based architectures. These address markets as diverse as the low-power location-aware sensor networks typified by the IEEE 802.15.4a standardisation process through to the emerging global standard for Wireless USB.

Artimi welcomes the Ofcom response and would encourage the proposal to use flat spectrum from 3.1 to 10.6GHz. We believe that this provides a simple and enforceable regulation that builds on the work of the FCC while being more conservative to out-of band services. Such regulation is an important part of building a global regulatory framework that will drive innovative new applications, and we applaud Ofcom for its lead in studying and addressing these important regulatory issues.

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

Yes. UWB radio technology occupies a unique position in terms of its potential applications and its regulatory issues.

Unique questions about the definition of ‘accidental’ and ‘deliberate’ spectral emissions are raised by the regulation of UWB, and in particular the way that these are assessed in practical interference scenarios. The Ofcom position has far reaching economic consequences, both for UK based UWB developers such as Artimi, and for the UK and global markets that such developers are trying to address.

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

We agree with the analysis of statutory duty presented.

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

We feel that the economic study has understated the capabilities, and hence benefits of UWB technology, and overstated the potential interference.

In particular it has omitted the effects of existing interference from accidental emissions from electronic equipment such as PCs or cell-phones, and from natural sources. Also, for the UMTS bands outside of the core UWB frequency range from 3.1GHz to 10.6GHz, extremely conservative emissions limits are proposed that are approximately 30 to 40dB lower than the accidental emission limit. We believe that failing to account for other real-world emissions greatly overstates the practical consequences of UWB interference when compared to other natural and artificial interference sources.

Since existing spectrum users must already provide sufficient signal strength to overcome these interferers, the additional effect of UWB is small.

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

We agree with the proposed approach.

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

Until it is shown in practice that UWB actually interferes with BFWA, we believe that Ofcom should adopt the approach outlined in the second bullet point - namely to make the end user of the BFWA equipment responsible for locating the receiver equipment appropriately to minimise any interference. For very closely co-located radios sharing the same band, the equipment designer will inevitably have to provide a coordination function to allow the UWB radio to operate in the presence of the comparatively high powered transmissions from the other radio(s). Such requirements are common in unlicensed spectrum, and seen in many existing devices that combine WiFi and Bluetooth functionality. Such measures are best dealt with by the radio equipment designers and standardisation bodies, rather than by regulation.

Furthermore, indoor BFWA terminals will require careful location by the end-user to avoid significant signal fading, signal obscuration, or other local interference sources - for example the accidental emissions resulting from a PC system. We believe that the additional real-world impact on these systems due to UWB transmission will be minor compared to these issues.

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

RA systems are passive receivers, making interference mitigation techniques problematic. However, we believe that that mitigation through separation is practicable due to the short range nature of UWB transmission.

Modern RA systems use powerful signal processing techniques that deal well with local interference that does not saturate the receiver front-ends. These function well in an environment where, for example, the largest RA antenna in the UK is sited alongside a research centre, a visitor centre, and a mainline electric railway. Such receiver systems generally respond better to Gaussian noise-like interference than to CW interference such as will typically be emitted ‘accidentally’ from electronic equipment.

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

We would like to stress the importance of a simple regulatory framework and spectral mask, and preferably one which encourages a single global standard for UWB devices. This is essential if the economic benefits attributed to UWB are to be realised in practise.

We would also encourage Ofcom to pursue practical studies of interference in representative real-world environments. These should include the effects of both existing UWB radio equipment that has been built to operate in the 3-10GHz band, and, for comparative purposes, typical consumer and business electronic equipment, such as a PC and peripherals, mobile phones, etc.

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

We believe that the studies sited are sufficiently comprehensive to provide the necessary input for this regulation.

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

The studies used take a very conservative view on UWB interference and Ofcom has been pragmatic in its assessment of their results. We still feel, however, that these studies over-state the potential for interference of UWB relative to existing background noise sources.

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

Ofcom should seek a common European framework, and we would further encourage work with other non-European regulatory agencies to provide a common world-wide baseline regulatory framework for all UWB applications.

However, as this process can be lengthy due to the number of participants, we would encourage early regulation within the UK.

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

The cut off point of -85dBm at 2.1GHz is unreasonably low, and will be difficult to measure with practical test equipment. This itself is an illustration of how conservative the limit is.

Furthermore, such an extreme requirement makes practical compliance extremely difficult. It will incur a significant device cost penalty since the antenna system will require substantial filter roll-off to accommodate the limit. Such additional costs will further constrain the commercial benefits of UWB technology.

We would strongly support further work from Ofcom to clarify how UWB devices are to be tested for certification. In particular, we are concerned about the difficulty of determining the emissions above 10GHz using practical equipment. Furthermore, building real systems with no emission above the -85dBm level at lower frequencies will be difficult due to the potential accidental coupling of local (no data carrying) clock sources. If the -85dBm limit is adopted we would therefore suggest that it be applied only to broad-band emissions from the UWB device, and that accidental narrow band emissions present in the output should be assessed under the accidental emissions rules. Such a distinction could be made using the bandwidth of the signal.

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

[*first bullet point*]: We strongly believe that there should be no minimum PRF specified. Some devices, such as room thermostats or active badges and others considered by the IEEE902.15.4a group may have very long intervals between pulses. A more appropriate limit for such systems would be to additionally limit the peak-to-average power levels for a UWB transmitter, as provided for in the US FCC regulations. Furthermore, such a regulation pre-supposes the radio architecture and may create inadvertent problems for non-pulse based UWB architectures, both current (eg: OFDM designs) and future.

[*second bullet point*]: All devices should be treated equally. An association model implies a particular set of uses and may artificially constrain some potentially novel applications for UWB.

[*third bullet point*]: The proposal that there is a mandated ability to turn off transmitters raises many problems. If this is intended to be an automatic process, which device has the authority to instruct the other to turn off and what is the corresponding ability for a UWB device to request cessation of a conventional radio interferer? If this is intended to be a manual process, such as is indicated by the example, we would expect such functionality to be market rather than regulatory driven.

[*fourth bullet point*]: Requiring UWB devices to have variable power implicitly makes assumptions about the application. Some specific emerging standards for UWB radios (such as the IEEE 802.15.3a, IEEE 802.15.4a, MBOA and UWB-Forum work) may adopt power control techniques to mitigate interference between adjacent UWB networks. However, potential applications such as un-coordinated low-duty-cycle systems, used for example by location-aware sensor networks, would become impractical due to the additional complexity for power control. This may also render future novel applications impractical.

[*fifth bullet point*]: We have no objection to a standard guidance wording.

[*sixth bullet point*]: We have no specific comment about minimum bandwidth under the current proposal.

[*seventh bullet point*]: UWB has economic advantages for a large range of application scenarios. Determining a candidate application set for regulatory purposes would be extremely difficult in practise, and furthermore would likely artificially inhibit the development of new and innovative applications not known of at the time of regulation.

Q13: Is our proposed approach to international bodies appropriate?

The development of UWB technology offers the chance for a single unified worldwide standard.

We welcome Ofcom's involvement in the CEPT and EC regulatory process, but are concerned that this will delay UK regulation. We would encourage dialogue with the regulatory process elsewhere, especially with the UK's major trading partners.

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

Defining an EMC policy, including out-of-band emissions would help clarify these issues. This is particularly an issue for UWB, where the definitions of 'deliberate' and 'accidental' emission levels are difficult in terms of definition and actual practical measurement and mitigation.

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

The development of an EMC standard, possibly compatible with EN55022 and the FCC Part 15 rules would be welcome.