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ETNO Expert Contribution on radio spectrum designation for Ultra Wide Band applications

Executive Summary:

ETNO Members operate a significant number of radio services within the frequency ranges currently under study in ITU and CEPT for the deployment of Ultra-Wideband (UWB) applications. These radio networks embody significant investments of network operators, but also from citizens using the corresponding terminal equipment.

UWB applications, especially for communication purposes, are expected to be operated with a large number of devices on a licence-exempt basis. Thus, potential interference is likely to occur at any time and place in densely populated areas, particularly indoors.

The preliminary results of ongoing studies in CEPT and ITU-R have proven a high degree of potential interference from UWB devices into radio services within the frequency range 1 – 10.6 GHz. The highest potential for interference is given in the range 1 – 6 GHz due to the close vicinity between UWB and radio applications.

In order to ensure the interference-free operation of existing and a successful development of innovative radio applications in this very valuable frequency range for radio communications services, ETNO is of the opinion that high density UWB applications, like communications devices, should be implemented above 6 GHz, with emission limits appropriate to protect services in the frequency range 6 – 10.6 GHz.

Introduction

ETNO represents the voice of 41 of Europe's largest, well established telecoms groups in 35 countries.

ETNO members operate a significant number of communications related radio services within the whole frequency range currently considered for the deployment of Ultra-Wideband applications, namely mobile cellular networks, Wireless Local Area Networks (WLAN) in Hotspots in complement to mobile and wired telecommunications networks and Fixed Service as well as Fixed Wireless Access (FWA) applications. These radio networks contribute significantly to the development of the Information Society and embody significant investments, not only from network operators but also from citizens using the corresponding terminal equipment.

In addition to the spectrum already used, further frequency bands might be identified for IMT-2000 and systems beyond at the forthcoming World Radio Conference in 2007.

Background

Currently, studies are carried out in CEPT and ITU-R to clarify the possible co-existence of UWB applications with radio services below 10.6 GHz whereby a possible deployment of UWB devices would be on a claimed "non-interference and non protected" basis relatively to existing radio services.

UWB devices are understood as any device which occupies a relative bandwidth of 20% or more of the centre frequency or an absolute bandwidth of 500 MHz or more. A major number of UWB applications aimed to address mass markets below 10.6 GHz is envisaged to be implemented for

- Consumer communications applications
- Data communications systems
- Wireless high-speed networking

Communication devices are expected to be operated in high numbers , and are likely to create aggregate "hot-spot" interference sources in densely populated regions and interfere directly into closely deployed radio equipment, which is likely to occur particularly for radio equipment used indoors.

For example, in densely populated sub-urban areas the highest buildings are generally owned by large companies. These companies could implement UWB high-speed communication networks for a large number of employees as an alternative to wired LAN. According modern architecture trends, such buildings usually have glass walls and large open-space work places that provide only small indoor/outdoor attenuation. Therefore, UWB operation in these buildings would potentially generate high aggregate interference to radio services operating nearby like FWA or cellular mobile networks which base stations are likely located on top of these buildings.

It was shown in various studies that the indoor scenario is the most critical case where UWB devices could be placed very closely to radio equipment. Radio services to cover indoor as well as outdoor areas are designed for frequencies below 6 GHz due to propagation conditions. Therefore, direct interferences into cellular mobile terminals or WLAN receivers separated only a few centimetres apart from UWB devices cannot be avoided if both applications use the same frequency range.

Potential of interference

The key issue with regard to the co-existence between UWB devices and existing and planned radio services is the fact that UWB devices are expected to be operated mainly on a license-exempt basis. Thus, potential interference is likely to be present at any time and place, in particular if high numbers of UWB devices are deployed.

Receivers of radio communication systems transmitting real-time data would be especially affected. The reduction of the receiver signal level range by the increase of noise power due to UWB emissions would impair potential victim system performances. There are two critical cases of interference:

1. direct interference into a closely placed radio receiver, which will be very probable if UWB devices and e.g. mobile or WLAN terminals are used indoors
2. increase of the noise level due to the aggregate interference into UMTS or fixed link base stations which will lead to a reduction of system capacity, quality of service and link availability.

In addition, the possible very high peak factor of UWB devices could instantaneously exceed the acceptable interference level causing for instance high error-rate bursts. The latter effect is the more affecting, the wider the victim receiver bandwidth is.

In cellular mobile service systems for instance, these effects can be compensated only by reducing cell sizes, i.e. a higher density of base stations transmitters which will lead to increased infrastructure costs. This would significantly burden existing services, contradicting the non interference – unprotected principle.

Preliminary results of the ongoing studies

The studies have been mainly based upon the US Federal Communications Committee (FCC) provisional regulation. The FCC UWB emissions limit is –41.3 dBm/MHz, except for the range between 1.66 and 3.1 MHz where more stringent limits apply in order to protect GPS and other radio systems. For indoor UWB applications a relaxation of 10 dB applies in the range 1.66 – 3.1 GHz compared to outdoor usage.

UMTS/IMT-2000

The preliminary results confirm that an IMT-2000 mobile station will potentially suffer interference from UWB devices in the close vicinity.

WLAN

With an active UWB device within a distance of 2.5 - 8.0 m one can expect WLAN receiver desensitising and fallback in data rate. With protection distances of 1 - 2 m the WLAN victim will get a much smaller operational coverage range and show several steps of fallback in data rate.

Fixed Service

The studies show that UWB emissions of –41.3 dBm/MHz r.m.s. and 0 dBm/50MHz Peak would lead to a potentially large incompatibility (in the order of 5 to 30 dB) with the Fixed Service in the band 3 – 10.6 GHz.

From the results above it can be concluded that the spectral power density of UWB devices would need to be decreased by 45 dB compared with the FCC regulation in order to ensure adequate protection of radio services operated in the same frequency range.

ETNO Conclusion

The preliminary results of the studies on co-existence between UWB applications and radio services in the band 1 – 10.6 GHz have proved that limits based on the FCC mask[1] do not provide protection to fixed and mobile radio services and that the spectral power density of UWB devices would need to be decreased by 45 dB in order to ensure adequate protection of radio services operated in this frequency range.

ETNO is of the opinion that UWB devices expected to be operated with high numbers of devices, namely communication and measurement applications, which will likely be 98% of all UWB devices according manufacturers statements, should be implemented above 6 GHz where radio services are more likely to be operated outdoor and, therefore, a spatial separation is given. This would ensure a long-term interference-free operation of existing services in the 1-6 GHz band and a successful development of innovative radio applications in this very valuable frequency range for radio communications services.

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