

RECOMMENDATION ITU-R SM.1756

Framework for the introduction of devices using ultra-wideband technology

(Question ITU-R 226/1)

(2006)

Scope

This Recommendation is offering a framework for the introduction of devices using ultra-wideband (UWB) technology together with guiding principles for administrations.

The ITU Radiocommunication Assembly,

considering

- a) that intentional transmissions from devices using (UWB) technology may extend over a very large frequency range;
- b) that devices using UWB technology are being developed with transmissions that span numerous radiocommunication service allocations;
- c) that devices using UWB technology may therefore impact, simultaneously, many systems operating within a number of radiocommunication services, including those which are used internationally;
- d) that UWB technology may be integrated into many wireless applications such as short-range indoor and outdoor communications, radar imaging, medical imaging, asset tracking, surveillance, vehicular radar and intelligent transportation;
- e) that it may be difficult to distinguish UWB transmissions from emissions or radiations in equipment that also contains other technologies, where different limits may apply;
- f) that applications using UWB technology may benefit sectors such as public protection, construction, engineering, science, medical, consumer applications, information technology, multimedia entertainment and transportation;
- g) that devices using UWB technology for certain applications may result in their high-density deployment in some environments where stations of radiocommunication services have already been or will be deployed;
- h) that the impact of a specific UWB application on a radiocommunication service will vary according to the characteristics and the protection requirements of that service and the characteristics of the specific type of UWB application;
- j) that the limits for unwanted emissions associated with radiocommunication services cannot be applied to devices using UWB technology;
- k) that UWB technology will be incorporated in mobile and/or portable devices that are expected to cross national boundaries;
- l) that if devices using UWB technology in certain applications are not individually licensed, administrations may be unable to limit the density of deployment of those devices;

m) that it may not be practical to individually license devices using UWB technology which are expected to be of a ubiquitous nature;

n) that applications using UWB technology that are not presently recognized as operating under allocations to radiocommunication services would operate on a non-protected, non-interference basis,

recognizing

a) Nos. 1, 37 and 199 of the Constitution of the ITU;

b) Nos. 0.4, 1.59, 1.61, 1.138, 1.166, 1.167, 1.168, 1.169, 3.3, 4.4, 4.5, 4.10, 4.22, 5.223, 5.260, 5.267, 5.340¹, 13.15, 13.14, relevant parts of Article 15, and Appendices 13 and 15 of the Radio Regulations (RR);

c) that passive services Earth exploration-satellite service (EESS), radio astronomy service (RAS) and space research service (SRS) measure natural radiation at very low levels;

d) that, in accordance with Resolution 952 (WRC-03), devices using UWB technology are not considered by ITU-R as ISM applications under RR No. 1.15,

noting

1 that the following ITU-R Recommendations can be used as a guide by administrations when considering the introduction of devices using UWB technology:

- Recommendation ITU-R SM.1755 which deals with characteristics of UWB technology;
- Recommendation ITU-R SM.1754 which deals with measurement techniques of UWB transmissions;

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- ¹ **5.340** All emissions are prohibited in the following bands:
- | | |
|------------------------------|---|
| 1 400-1 427 MHz, | |
| 2 690-2 700 MHz, | except those provided for by No. 5.422 , |
| 10.68-10.7 GHz, | except those provided for by No. 5.483 , |
| 15.35-15.4 GHz, | except those provided for by No. 5.511 , |
| 23.6-24 GHz, | |
| 31.3-31.5 GHz, | |
| 31.5-31.8 GHz, | in Region 2, |
| 48.94-49.04 GHz, | from airborne stations |
| 50.2-50.4 GHz ² , | |
| 52.6-54.25 GHz, | |
| 86-92 GHz, | |
| 100-102 GHz, | |
| 109.5-111.8 GHz, | |
| 114.25-116 GHz, | |
| 148.5-151.5 GHz, | |
| 164-167 GHz, | |
| 182-185 GHz, | |
| 190-191.8 GHz, | |
| 200-209 GHz, | |
| 226-231.5 GHz, | |
| 250-252 GHz. | (WRC-03) |

- ² **5.340.1** The allocation to the Earth exploration-satellite service (passive) and the space research service (passive) in the band 50.2-50.4 GHz should not impose undue constraints on the use of the adjacent bands by the primary allocated services in those bands. (WRC-97)

- Recommendation ITU-R SM.1757 which deals with the impact of devices using UWB technology on systems operating within radiocommunication services;
- 2 that administrations have adopted, or are in the process of adopting, regulations that incorporate emission masks for UWB devices, some of which are shown in Appendices 1 to 3 to Annex 1 of this Recommendation;
- 3 that some limits given in the Appendices to the Annex may not, by themselves, be sufficient to protect radiocommunication services, some limits may not allow UWB applications, while other limits may both protect radiocommunication services and allow UWB applications,

recommends

- 1 that the framework contained in Annex 1 to this Recommendation should be used as a guide by administrations when considering the introduction of devices using UWB technology and their impact on radiocommunication services;
- 2 that the following Notes will be considered as part of this Recommendation.

NOTE 1 – Administrations authorizing or licensing devices using UWB technology should ensure, pursuant to the provisions of the RR, that these devices do not cause interference to and do not claim protection from, or place constraints on, the radiocommunication services of other administrations as defined in the RR and operating in accordance with those Regulations.

NOTE 2 – Upon receipt of a notice of interference to the radiocommunication services referred to in Note 1, above, from devices using UWB technology, administrations should take immediate action(s) to eliminate such interference.

Annex 1

Framework for the introduction of devices using UWB technology

1 Introduction

This framework is intended to provide guidance to administrations when considering the introduction of devices using UWB technology. Even though the development and implementation of new technologies are important parts of meeting the changing and growing needs of the public, attention must be given to the impact of these new technologies on the operation of existing and planned stations within radiocommunication services.

UWB brings new challenges to administrations. Devices using UWB technology typically transmit at low-power and utilize bandwidths that extend over multiple bands allocated to numerous services.

Current devices using UWB technology do not belong to any radiocommunication service and they are considered as being short-range devices (SRD) not claiming protection from harmful interference. However, on a national basis, licensing of some specific UWB applications may provide protection for them from radiocommunication services operating within their national territory.

The susceptibility to interference from devices using UWB technology depends on the operational characteristics and sensitivity of the victim service, as well as on the spectral characteristics, deployment density, and operational parameters of the devices using UWB technology. The most significant challenge for administrations in the introduction of devices using UWB technology is

the protection of radiocommunication services from interference, while at the same time not unnecessarily impeding the development of devices using UWB technology.

The widespread deployment of devices using UWB technology could possibly raise the noise floor such that under some circumstances, the resulting interference to radiocommunication services could reduce the performance of the affected services. For example, an increase of the noise is of particular concern to highly sensitive passive service receivers that measure very low energy levels for purposes such as weather prediction and scientific research. As the passive services usually have instrumentation that is significantly more sensitive than that used by other radiocommunication services, they may be more vulnerable to interference from UWB transmissions.

2 Guiding principles for administrations relevant to the management of devices using UWB technology

2.1 Basis for operation of devices using UWB technology

The development and implementation of new technologies are important in meeting the changing and growing needs of the public. Devices using UWB technology are expected to operate within radio spectrum that is allocated to radiocommunication services. UWB transmissions, whether of a single device or of an aggregate nature, have the potential for interference into radiocommunication services, particularly in the safety and passive services bands. The following principles should be applied by administrations when considering the introduction of devices using UWB technology and their impact on radiocommunication services.

Guiding principles for consideration by administrations

- Administrations have a sovereign right to regulate the use of devices using UWB technology within their territory, provided that such devices do not impact stations of other administrations in accordance with the RR.
- National UWB regulations should reflect characteristics and appropriate mitigation techniques for devices using UWB technology, and be based on the protection criteria of all services in the affected frequency bands.
- National frameworks for the implementation of devices using UWB technology should take into account the inherent differences found in the various types of UWB applications.
- Special attention should be given to provide the required protection to safety services.
- Special attention should be given to provide the required protection to services operating in the frequency bands listed in RR No. 5.340.
- Consideration should be given as to how transmissions from devices using UWB technology may affect systems that provide global services.
- The authorization of devices using UWB technology on a licence-exempt or class authorization or general licence regime basis, as the case may be, should include appropriate strong certification procedures or relevant provisions incorporated into national regulations.
- The impact on the operation of stations of radiocommunication services as a result of the movement and use of devices using UWB technology across national borders should be considered.
- Relevant ITU-R Recommendations, particularly those indicated in *noting* 1, should be considered.

2.2 Impact on radiocommunication services

2.2.1 General

Providing protection to all radiocommunication services from interference caused by devices using UWB technology is essential for the introduction of UWB technology worldwide. Particular attention should be given to the protection of safety and passive services among others, as there may be a direct impact on operating certain UWB devices with respect to the protection of human life and property. These two categories are considered in the following subsections.

2.2.2 Safety services

Civil aviation and maritime systems depend on radio frequencies that can be used worldwide. Safety services, such as some elements of the radionavigation service, the radionavigation-satellite service and MMS, are radiocommunication services used for safeguarding human life and property. The aeronautical-mobile service (route) and the aeronautical mobile-satellite service (route) are reserved for communications related to safety and regularity of flight. Safety services often operate in the situation where interference can critically affect reception and impair the safety radiocommunications being provided. The necessity for safety systems to meet high levels of integrity, reliability, and availability makes it essential that these systems operate in an environment free from interference, due to the critical requirement to protect human life and property. Therefore, special attention should be given to the protection requirements of the safety services.

In some cases, it might be difficult to avoid frequency bands allocated to safety services. In those cases, administrations should consider factors such as the impact on safety service link margins, and consider techniques to preclude interference from devices using UWB technology that malfunction.

2.2.3 Passive services

The operations of the RAS, EESS (passive) and SRS (passive) necessarily involve the measurement of naturally-occurring radiations, of very low power levels, which contain essential information on the physical process under investigation. The relevant frequency bands are mainly determined by fixed physical properties (e.g. molecular resonance) that cannot be changed. Those properties support scientific activities including weather forecasting, as well as water and climate modelling. These frequency bands are, therefore, an important natural resource. Even low levels of interference received at the input of the passive sensors may have a degrading effect on passive service band usage. Additionally, in most cases the sensors are unable to discriminate between these natural radiations and man-made radiations. In this respect, RR No. 5.340 enables the passive services to deploy and operate their systems.

As an example, the EESS (passive) monitors the Earth and its atmosphere worldwide. Corrupted measurements from one or more areas may affect the ability to make reliable weather forecasts for the entire world, which may have significant economic and public safety impact.

Therefore, special attention should be given to the protection requirements of the passive services.

2.3 Consideration of different types of applications using UWB technology

UWB technology can be integrated into many applications. Some examples of UWB applications and their characteristics are given below.

2.3.1 Imaging applications

Due to the limited demand for these applications, it may be appropriate that imaging devices using UWB technology be licensed on an individual basis, or otherwise controlled or restricted in some manner. In the case of ground-penetrating radar and in-wall radar imaging devices, use could be

restricted to law enforcement professionals, fire and rescue organizations, scientific research institutions, commercial mining companies and construction companies. In the case of through-wall imaging devices, use could be restricted to law enforcement and fire and rescue organizations. In the case of medical imaging devices, use could be restricted to under the direction or supervision of a licensed healthcare practitioner. In the case of surveillance devices, use could be restricted to law enforcement, fire and rescue organizations, public utilities and industrial utilities.

Considering that it may be possible to control the use and deployment of imaging devices using UWB technology, it is not expected to be a difficult task to minimize the risk of interference to radiocommunication services.

2.3.2 Short-range indoor and outdoor communication applications

Foreseen short-range indoor and outdoor UWB communication applications are best suited for deployment under a licence-exempt or class authorization or a general licence regime, as the case may be. This is due to their low power, limited outdoor usage and expected large number. Licence exemptions should include limits on the type of use and emission masks to minimize the impact on other services or technologies.

2.3.3 Automotive short-range radar applications

UWB vehicular radar applications, also called automotive short-range radar (SRR), are currently envisaged to operate in the 24 GHz and/or 79 GHz bands. Such devices using UWB technology have an operating range of up to about 30 m and are used for a number of applications to enhance safety for all kinds of land transport vehicles. These devices are able to detect the location and movement of objects near a vehicle, enabling safety features such as near-collision avoidance warning, improved airbag activation, parking aid and pedestrian protection. UWB automotive short-range radar applications are best suited for deployment under licence-exempt or class authorization or a general licence regime, as the case may be.

At the same time, it is important to consider that the 23.6-24.0 GHz band is a unique natural resource. It is of crucial importance for weather forecasting, water and climate modelling and other related operations. It is also instrumental to environmental activities having social and economic implications, including enhancement of public safety. The potential loss of data at 24 GHz, that are assimilated in models, would affect the quality of weather forecasting.

2.4 Arrangements between administrations

Administrations are encouraged to develop bilateral or multilateral arrangements so as to avoid scenarios that may result in interference to radiocommunication services of other administrations. For example, special consideration should be given to difficult scenarios that may arise as a result of the aggregate effect of the deployment of devices, systems or networks using UWB technology, and trans-border circulation.

3 Examples of possible regulatory implementations

Regulatory implementations by individual administrations should take into account the inherent differences between the various types of UWB applications, while also considering the guiding principles provided in this Recommendation. Administrations may consider the frameworks adopted by other administrations. The following examples of regulatory implementations may be considered.

3.1 General regulatory implementations

The following generalized regulatory implementations could be considered to address interference concerns in developing a national framework for any UWB implementation, regardless of application and operational characteristics:

- technical limits such as appropriate maximum limits for average and peak UWB power or power spectral density;
- mitigation techniques as described in Recommendation ITU-R SM.1757 and in Report ITU-R SM.2057, to achieve the different protection criteria of various radiocommunication services, and especially of safety and passive services;
- technical controls, such as UWB activity factors and power kept to the minimum necessary, to support the intended operation; and
- appropriate operational restrictions according to geographical locations, modes of transportation, type of applications, and type of products into which devices using UWB technology may be embedded and used.

3.2 Application-dependent regulatory implementations

The following application-dependent regulatory implementations may be considered in developing a national framework for specific UWB applications:

- restrict the use of imaging devices to trained individuals such as law enforcement, emergency rescue, fire and medical personnel;
- require manual operation for the activation and operation of imaging devices, thereby limiting the UWB transmissions to periods when the device is in direct operation by personnel;
- imaging devices may lend themselves well to a limited-use licence or individual licence;
- restrict the use of UWB automotive short-range radar (SRR) to land transportation vehicles. Further, restrict these devices to operate only when the vehicle is operating, e.g. when the engine is running;
- employ technical means to require communication devices to only allow transmissions when in communication with their intended receiver;
- require that devices using UWB technology be employed only for the authorized application, e.g. prohibit UWB imaging devices from being used in the detection of tags, or in the transfer of data or voice information;
- prohibit the use of outdoor mounted antennas, e.g. antennas mounted on the outside of a building or on a telephone pole, or any other outdoor infrastructure;
- restrict devices using UWB technology designed for indoor use from being deployed outdoors;
- restrict devices using UWB technology designed for indoor use from intentionally emitting outside the building in which the equipment is located, such as through a window or a doorway, or to perform an outdoor function, such as the detection of persons about to enter a building;
- national authorization of UWB communication and automotive applications may be more suited to deployment under a licence-exempt or class authorization or a general licence regime, as the case may be.

3.3 Implementation summary

Procedures for administering and ensuring technical specifications and adherence to national regulations should be kept to the minimum necessary, but should include such provisions as may be necessary for the protection of radiocommunication services, as well as requirements for personnel training on the use of devices using UWB technology, as applicable. These procedures should also provide for UWB equipment measurements.

3.4 Appendices

Appendices 1 to 3 to this Annex include summaries of technical and operational provisions adopted or being considered by some administrations for UWB regulations.

These Appendices are provided for information only. They contain extracts of regional or national regulations which results in an inconsistency with the use of language compared to that used in the main body of the Recommendation.

Appendix 1: Summary of Regulations of the United States of America

Appendix 2: Summary of proposed European Conference of Postal and Telecommunications Administrations (CEPT) Regulations

Appendix 3: Specific technical requirements for Japan.

Appendix 1 to Annex 1

Summary of Regulations of the United States of America*

1.1 Introduction

The United States of America has adopted national rules for eight different UWB applications, which include emission limits for: ground-penetrating radars (GPR) and wall imaging systems, through-wall imaging systems, surveillance systems, medical imaging systems, vehicular radar systems, and short-range communication systems (indoor and outdoor).

Definitions associated with the rules of the United States include:

UWB bandwidth: The UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L . The frequency at which the highest radiated emission occurs is designated f_M .

Centre frequency: The centre frequency, f_C , equals $(f_H + f_L)/2$.

Fractional bandwidth: The fractional bandwidth equals $2(f_H - f_L)/(f_H + f_L)$.

Ultra-wideband (UWB) transmitter: An intentional radiator that, at any point in time, has a fractional bandwidth equal to, or greater than 0.20, or has a UWB bandwidth equal to, or greater than 500 MHz, regardless of the fractional bandwidth.

* The complete body of the United States of America ultra-wideband regulations is found in Subpart F of the US Code of Federal Regulations at the website: <http://www.fcc.gov/oet/info/rules/part15/part15-91905.pdf>.