APR001 APPLICATION NOTE

UWB REGULATIONS

A Summary of Worldwide Telecommunications Regulations governing the use of Ultra Wideband

Version 1.0

This document is subject to change without notice

Table of Contents

List of Tables

List of Figures

DOCUMENT INFORMATION

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UWB regulations are subject to ongoing change and customers are advised to check with the regulatory authorities in the markets in which they intend to sell their UWB products for the latest information in relation to UWB regulations, certification procedures and certified test bodies.

1 INTRODUCTION

1.1 Overview

The landscape of worldwide telecommunications standards is varied and complex and has been evolving for over 100 years. Standards are addressed at a number of different levels. At a national level almost all nations have their own telecommunications standards authority. At the next level various geographic or political groupings of countries have standards bodies while at international level standards authorities exist also.

Industry associations also promote particular standards relevant to their members that operate within the established regulatory framework. Industry associations are, in many cases, the driving force behind effecting change in communications regulations.

Generally speaking, agreed standards at regional level flow downwards to national level.

In the case of the European Union, the European Conference of Postal & Telecommunications Administrations (CEPT) is responsible for establishing the regulatory framework for telecommunications. Most of the work behind these regulations is carried out by the Electronic Communications Committee (ECC) of CEPT which publishes reports and decisions. These decisions are then enacted as directives to member states by the European Commission making them mandatory for all member states.

In the USA the Federal Communications Commission together with the National Telecommunications & Information Administration set the communications regulations. While these are national organizations, because the US is such a large producer and user of communications systems, regulations produced by the FCC have considerable influence on standards worldwide. FCC part 15 has been widely established for many years.

Table 1: Examples of Telecommunications Standards & Regulatory Bodies as well as relevant Industry Associations at international, national & regional level

Regulatory Body	Logo	Description
EXAMPLES OF INTERNATIONAL REGULATORY BODIES		
ITU		International Telecommunications Union. The ITU is the leading United Nations agency for information and communication technology issues worldwide. For nearly 145 years, the ITU has coordinated the shared global use of the radio spectrum, promoted international cooperation in assigning satellite orbits, worked to improve telecommunication infrastructure in the developing world and established the worldwide standards that foster seamless interconnection of a vast range of communications systems The ITU-R Task Group 1/8 studied UWB (2003-2005) and developed 4 Recommendations • SM.1754 on measurements [26] • SM.1755 on UWB characteristics [27] • SM.1756 on UWB regulations [28] • SM.1757 on UWB compatibility [29] ITU-RT also published a Report (SM.2057) of studies submitted to the ITU-R on UWB compatibility.

Regulatory Body	Logo	Description
EXAMPLES OF REGIONAL REGULATORY BODIES		
APT		Asia-Pacific Telecommunity The APT is a unique organization of Governments, telecom service providers, manufactures of communication equipment, research & development organizations and other stake holders active in the field of communication and information technology. APT serves as the focal organization for communication and information technology in the Asia Pacific region
CEPT		European Conference of Postal & Telecommunications Administrations. Established in 1959 by 19 countries CEPT has now expanded to include 48 members (see section 5).
ECC		Electronic Communications Committee – one of CEPT's working committees dealing with Radio Spectrum use & Telecommunications numbering / addressing.
ETSI		European Telecommunications Standards Institute ETSI is recognised as an official European Standards Organisation by the European Union, enabling valuable access to European markets.
EXAMPLES OF NATIONAL REGULAOTRY BODIES		
FCC		USA – see section 3.2
IDA		Singapore – see section 7.8
MIC		Japan – see section 7.5
OFCOM		U.K – see section 5.1
EXAMPLES OF INDUSTRY ASSOCIATIONS & STANDARDS BODIES		
ARIB		Association of Radio Industries and Business (ARIB). Japan. The objectives of ARIB are to conduct investigation, research & development and consultation on the utilization of radio waves from the view of developing radio industries, and to promote realization and popularization of new radio systems in the field of telecommunications and broadcasting.
ECMA		European Computer Manufacturers Association. ECMA International is an industry association founded in 1961 and dedicated to the standardization of Information and Communication Technology (ICT) and Consumer Electronics (CE).
IEEE		Institute of Electrical & Electronic Engineers. Large professional association. Publishes technology standards and other publications, holds conferences and professional and educational activities.

1.2 This document

1.2.1 Overview

This document sets out the current situation regarding the use of UWB in all the principal geographies in the world. In some areas the situation is very clear and fixed, at least for now, while in others it is evolving rapidly.

1.2.2 Structure

This document is structured into sections as follows: -

Section No	Section Title	Description
1	Introduction	This section
2	UWB Worldwide regulations summary	Presents an overall summary of the global regulatory situation in tabular form
3	North America	Presents the current status of UWB regulation in North America
4	South America	Presents the current status of UWB regulation in South America
5	Europe	Presents the current status of UWB regulation in Europe
6	Middle East	Presents the current status of UWB regulation in the Middle East
7	Asia Pacific	Presents the current status of UWB regulation in the Asia PAC region
8	References	Lists the references used in this document
9	Document History	Details the history of this document
10	Major Changes	Outlines the changes between revisions of this document
11	About Decawave	
12	Appendix 1: The chronology of UWB regulation	Presents a timeline of UWB regulation in various jurisdictions.

1.2.3 Per Country Information

In sections 3 through 7, for each country listed, the following information is presented: -

Item	Description
Geographic Location	The location of the country presented in graphical format
Regulatory Body	The governmental or other body in the country responsible for matters relating to spectrum regulation
Location	The location of the regulatory body
Postal Address	The postal address of the regulatory body
Phone	The phone number of the regulatory body
Web	The website of the regulatory body
Do UWB regulations exist?	Yes or No
Specific regulations	If specific regulations do exist what is the legislation /

Item	Description
	regulatory instruments from which they derive
Max mean Emission Limits	Emission mask(s) are presented in graphical format
Notes	Any other relevant information is given here

1.3 Ultra Wideband

1.3.1 Introduction

While the theory behind UWB is not new – essentially the earliest spark gap transmitters were ultra wideband in nature – it is only relatively recently we have seen a move towards greater adoption of the technology. Regulation has followed as a result.

Greater adoption is as a result of two important attributes of UWB – the prospect of very high data rate communications (because of the wide bandwidth and the relationship between max data rate and bandwidth established by Shannon [25]) and the ability of UWB to allow very accurate time of flight measurements.

The very high data rate path has been followed aggressively by a number of companies under the IEEE802.15.3a working group (which failed to ratify a standard) and the subsequent ECMA standards, (ECMA 368, 369, 381), the move towards Wireless USB and the drive towards cable replacement in the home and office. To date it is this path that has driven UWB regulations.

The ability of UWB to accurately measure time of flight and thereby provide very accurate location estimation has been implemented by a small number of companies using proprietary systems. This ability is now driving an explosion in demand for UWB with the advent of the IEEE802.15.4a standard in 2007, now incorporated into the IEEE 802.15.14-2011 standard, which, for the first time, incorporates a UWB PHY into a Personal Area Network standard and allows for power efficient, high data rate communications together with accurate location estimation. The advent of this standard has added increasing pressure on regulatory authorities to allow the use of UWB in their respective geographies.

1.3.2 Generally perceived issues and mitigating approaches

The general concern with UWB has been that because the signal occupies such a wide bandwidth (500 MHz to 1300 MHz as defined in the IEEE802.15.4-2011 UWB standard) there is the potential to interfere with a variety of other telecommunication services occupying the same electromagnetic spectrum.

In many respects this is unfounded given the power levels that are permitted for UWB transmission (extremely low compared to the potential victim services) however there are some services with which interference is possible. There are a number of mitigation strategies that regulators have adopted: -

1. Restrict the use of UWB to particular frequency bands / channels and in particular shift the use of UWB away from currently occupied areas of the spectrum.

2. Permit the use of UWB but restrict the permitted transmit power – this approach has been adopted by pretty much every jurisdiction that has allowed UWB.

- Generally the power emission limits are defined in terms of equivalent isotropically radiated power (EIRP) which is defined as the product of the power supplied to an antenna and its gain in a given direction relative to a genuinely isotropic antenna.

  The transmit power limits vary considerably from region to region but almost all share one characteristic which is that the max permitted transmit power density is -41.3 dBm / MHz. This number has its roots in part 15 of the FCC standard; it is the maximum limit for unintended

radiation from a non-UWB electronic system – so essentially UWB transmission has been limited to the level of background noise.

3. Permit the use of UWB but insist that systems use mitigating approaches to limit the possibility / effect of interference with other systems. Two main approaches have been adopted in various jurisdictions: -

    - Low Duty Cycle (LDC) in which UWB equipment must limit the relative time for which it is transmitting – see section Table 13 for more details on this.

    - Detect & Avoid (DAA) in which UWB systems listen for other UWB transmissions before they themselves transmit.

1.3.3 General trends in UWB regulations for Communications Devices

By examining the UWB regulations currently in force in various jurisdictions it's possible to draw some conclusions about where the regulatory regime is likely to end up: -

- The general trend is towards license-exemption on a no-interference / no-protection basis. Various regulatory bodies have reached this point already; others have adopted a more cautious approach and have not yet reached this point.

- The 6.0 to 8.5 GHz band seems to be emerging as the band with least restrictions for UWB communications.

- Interference mitigation techniques including LDC & DAA are specified on a national or regional basis to remove the requirement for lower emission limits in the 3.1 – 4.8 GHz band (and in the 8.5 GHz to 9.0 GHz band in some cases).

2 UWB WORLDWIDE REGULATIONS SUMMARY

2.1 Introduction

This section presents a summary of the global regulatory situation relating to UWB. Each jurisdiction in the world is considered and the current situation presented in tabular form. This section is only concerned with UWB as a communications medium, it does not concern itself with other UWB uses for which there may be additional regulations (e.g. ground penetrating radar, through wall imaging systems or automotive radar applications).

Colours are used to give a visual indication of the status with the following meanings: -

Table Colour	What does this mean?
	Specific UWB regulations exist in the named jurisdiction and under those regulations the DW1000 can operate in that jurisdiction
	Specific UWB regulations exist in the named jurisdiction. Whether the DW1000 can operate under those regulations remains to be clarified.
	Specific UWB regulations do not exist in the named jurisdiction. Either: - • the regulatory regime remains to be clarified or • under the regulations that typically apply (usually FCC or ETSI) the DW1000 can operate in that jurisdiction
	Based on our latest information, the DW1000 cannot be used in this jurisdiction

Where regulations do exist, they are dealt with in more detail in separate sections of this document.

The various headings in the tables that follow have the following meanings: -

Table Heading	What does this mean?	Potential responses
Country	The name of the jurisdiction	
Do Specific UWB regulations exist?	Has the communications regulatory body in this jurisdiction introduced specific regulations governing the use of UWB in this jurisdiction?	Y = Yes N = No
What is the regulatory regime?	What is the source of the regulations governing the use of UWB in this jurisdiction?	Where the jurisdiction has implemented specific regulations the source reference is listed.

Table Heading		What does this mean?	Potential responses
			Where the jurisdiction has not implemented specific regulations, the usual approach to such matters is described
What frequency range is permitted?		What range of frequencies is permitted to be used for UWB transmission at the mean EIRP under the applicable regulatory regime?	Given in GHz range of frequencies e.g. 6.0 – 8.5 GHz
Do these regulations permit outdoor use?		Does the applicable regulatory regime permit use of UWB outdoors?	Y = Yes, regulations permit use outdoors TBC = To be confirmed N = No, regulations do not permit use outdoors
EIRP (dBm / MHz)		What is the maximum value of mean power spectral density permitted under the applicable regulatory regime?	Where known this is given in dBm / MHz otherwise it is marked as TBC
Emission profile		What is the spectral emissions profile allowed under the applicable regulatory regime?	This column refers to later sections in the document, which will follow at the end of our 4 week analysis period, when more detailed information will be provided.
Can DW1000 be used under this regime?	Indoors	Based on the applicable regulatory regime is there at least one use case where the DW1000 be used for indoor applications?	Y = Yes TBC = To be confirmed N = No
	Outdoors	Based on the regulatory regime as it currently stands is there at least one use case where the DW1000 be used for outdoor applications?	

2.2 Europe, Middle East & Africa (EMEA)

2.2.1 Europe

Table 2: UWB Regulations Europe

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
1	Albania	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
2	Andorra	N	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 9.0	Y	-41.3	ETSI Sec 5	Y	Y
3	Austria	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
4	Belarus	N	Generally will approve ETSI compliant equipment	3.1 – 9.0	Y	-41.3	ETSI Sec 5	Y	Y
5	Belgium	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
6	Bosnia & Herzegovina	Y	Only for Vehicular Short Range Radar	21.4 – 27 76 – 81	Y	-41.3	ETSI Sec 5	N	N
7	Bulgaria	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
8	Canary Islands	Y	Telecoms matters overseen by government of Spain	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
9	Croatia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1]	Y	-41.3	ETSI Sec 5	Y	Y

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
				6.0 – 8.5 8.5 – 9.0[1]					
10	Cyprus	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
11	Czech Republic	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
12	Denmark	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
13	Estonia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
14	Finland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
15	France	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
16	Germany	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
17	Gibraltar	N	Telecoms matters overseen by government of United Kingdom	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
18	Greece	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
19	Hungary	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
20	Iceland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
21	Ireland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
22	Italy	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
23	Latvia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
24	Lithuania	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
25	Luxembourg	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
26	Macedonia	N	TBC	TBC				TBC	TBC
27	Malta	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
28	Moldova	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
29	Monaco	N	ECC Rec 70-03 / ECC Decision	3.1 – 4.8[1]	Y	-41.3	ETSI Sec 5	Y	Y

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
			06(04) / ETSI EN 302065	6.0 – 8.5 8.5 – 9.0[1]					
30	Montenegro	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
31	Netherlands	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
32	Norway	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
33	Poland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
34	Portugal	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
35	Romania	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
36	Russia	Y	Has implemented ECC 70-03 but with local modifications Addendum No. 16 the GRFC decision May 7, 2007 No. 07-20-03-001 Addendum to the GRFC decision from December 15, 2009 # 5/9/02-05-02	6.0 – 8.1 8.625-9.15 9.15 – 10.6	Y	-47 -45 (in 9.15 to 10.6 freq range)	Sec 5	Y	Y
37	San Marino	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5	Y	-41.3	ETSI Sec 5	Y	Y

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
				8.5 – 9.0[1]					
38	Serbia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
39	Slovakia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
40	Slovenia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
41	Spain	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
42	Sweden	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
43	Switzerland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
44	Turkey	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
45	United Kingdom	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302065	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
46	Ukraine	N	ECC Rec 70-03 under consideration but not yet adopted	TBC				TBC	TBC

[1]Mitigation techniques required

2.2.2 Middle East

Table 3: UWB Regulations Middle East

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
47	Bahrain	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
49	Iran	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
49	Iraq	N	TBC	TBC				TBC	TBC
50	Israel	N	Generally will approve ETSI compliant equipment. Confusion exists over the approval status of UWB equipment. Anecdotally we have heard that the low band is being allocated for UWB trials	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
51	Jordan	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
52	Kuwait	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
53	Lebanon	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
54	Oman	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
55	Qatar	N	Generally will approve ETSI	3.1 – 4.8[1]	Y	-41.3	ETSI Sec 5	Y	Y

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
			compliant equipment	6.0 – 8.5 8.5 – 9.0[1]					
56	Saudi Arabia	Y	CITC Technical Specification Document Number: RI085 Revision: Issue 1 Date: 10/01/2010	6.0 – 8.5	Y	-41.3	Sec 6	Y	Y
57	Syria	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
58	UAE	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
59	Yemen	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y

[1]Mitigation techniques required

2.2.3 Africa

Table 4: UWB Regulations Africa

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
60	Algeria	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
61	Angola	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
62	Benin	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
63	Burkina Faso	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
64	Cameroon	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
65	Cape Verde	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
66	Central African Republic	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
67	Chad	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
68	Democratic Republic of the Congo	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
69	Djibouti	N	TBC	TBC				TBC	TBC
70	Egypt	N	TBC	TBC				TBC	TBC
71	Ethiopia	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
72	Gabon	N	Generally will approve either ETSI or FCC compliant	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
			equipment						
73	Gambia	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
74	Ghana	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
75	Guinea-Bissau	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
76	Ivory Coast	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
77	Kenya	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
78	Lesotho	N	Generally will approve equipment approved for use in South Africa	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
79	Liberia	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
80	Libya	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
81	Madagascar	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
82	Malawi	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
83	Mali	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
84	Mauritius	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
85	Morocco	N	TBC	TBC				TBC	TBC
86	Mozambique	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
87	Namibia	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
88	Niger	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
89	Nigeria	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
90	Rwanda	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
91	Senegal	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
92	Sierra Leone	N	Generally will approve either ETSI or FCC compliant equipment	3.1 – 9.0	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
93	Somalia	N	TBC	TBC				TBC	TBC
94	South Africa	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5	Y	-41.3	ETSI Sec 5	Y	Y

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
				8.5 – 9.0[1]					
95	Sudan	N	TBC	TBC				TBC	TBC
96	Swaziland	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
97	Tanzania	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
98	Togo	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
99	Tunisia	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
100	Uganda	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
101	Zambia	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
102	Zimbabwe	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y

[1]Mitigation techniques required

2.3 Asia Pacific (APAC)

Table 5: UWB Regulations APAC

#	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
103	Afghanistan	N	TBC	TBC				TBC	TBC
104	Armenia	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
105	Australia	Y	Radio Communications (Low Interference Potential Devices) Class Licence 2000 as modified July 2014	6.0 – 8.4	Y	-41.3	ETSI Sec 5	Y	Y
106	Azerbaijan	N	TBC	TBC				TBC	TBC
107	Bangladesh	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
108	Brunei	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
109	Cambodia	N	TBC	TBC				TBC	TBC
110	China	Y	MIIT Wireless File 358 (2008)	6.0 – 9.0	Y	-41	Sec 6	Y	Y
111	Cook Islands	N	TBC	TBC				TBC	TBC
112	Fiji	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
113	French Polynesia	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
114	Georgia		TBC	TBC				TBC	TBC

#	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
115	Guam	Y	Territory of the USA	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
116	Hong Kong	N	Specific regulations do not currently exist. Regulator is currently considering regulations allowing the use of unlicensed UWB in the range 3.4 – 8.5 GHz. Historically, HK has approved ETSI certified equipment	3.4 – 4.2[1] 4.2 – 4.8 6.0 – 8.5 (proposed)	TBC	-41.3 (proposed)	Sec 7 (proposed)	TBC	TBC
117	India	N	Specific regulations do not currently exist. Regulator is currently considering regulations allowing the use of unlicensed UWB in the range 6.0 – 7.25 GHz. Historically, India has approved ETSI certified equipment	6.0 – 7.25 (proposed)	TBC	-41 (proposed)	Sec 7 (proposed)	TBC	TBC
118	Japan	Y	ARIB STD-T91 Ver. 2.0 2015	3.4 – 4.8[1] 7.25 – 10.5	N	-41.3	Sec 7	TBC	TBC
119	Kazakhstan	N	Generally will approve ETSI compliant equipment	3.1 – 9.0	Y	-41.3	ETSI Sec 5	Y	Y
120	Korea, North	N	TBC	TBC				TBC	TBC
121	Korea, South	Y	Ministry of Information and Communication Republic of Korea	3.1 – 4.8[1] 7.2 – 10.2	Y	-41.3	Sec 7	Y	Y
122	Kyrgyzstan	N	TBC	TBC				TBC	TBC
123	Laos	N	TBC	TBC				TBC	TBC
124	Macau	N	TBC	TBC				TBC	TBC
125	Malaysia	Y	SKMM SRSP-549 UWB 5th December 2013 Refers to ETSI and ITU docs	6.0 – 8.5	Y	-41.3	Sec 7	Y	Y

#	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
126	Myanmar	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
127	Nepal	N	TBC	TBC				TBC	TBC
128	New Caledonia	Y	Telecoms matters overseen by government of France	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
129	New Zealand	Y	Radio Communications Regulations (General User Radio Licence for Ultra Wide Band Devices) Notice 2015. Refers to EN 302065	6.0 – 8.5	Y	-41.3	Sec 7	Y	Y
130	Pakistan	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
131	Papua New Guinea	N	Generally will approve FCC compliant equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
132	Philippines	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
133	Reunion	Y	Telecoms matters overseen by government of France	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
134	Samoa (Independent State of)	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
135	Singapore	Y	IDA TS UWB Issue 1 Rev 1, May 2011. Refers to ETSI standards EN 302 500 and EN 302 065	3.4 – 4.2[1] 4.2 – 4.8 6.0 – 8.5	Y	-41.3	Sec 7	Y	Y
136	Sri Lanka	N	TBC	TBC				TBC	TBC
137	Thailand	N	Generally will approve either	FCC Sec 3	Y	-41.3	FCC Sec 3	Y	Y

#	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
			ETSI or FCC compliant equipment	ETSI Sec 5			ETSI Sec 5		
138	Turkmenistan	N	TBC	TBC				TBC	TBC
139	Uzbekistan	N	TBC	TBC				TBC	TBC
140	Vietnam	N	TBC	TBC				TBC	TBC

[1]Mitigation techniques required

2.4 Americas

2.4.1 North America

Table 6: UWB Regulations North America

#	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
141	Antigua & Barbuda	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
142	Aruba	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
143	Bahamas	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
144	Barbados	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
145	Bermuda	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
146	British Virgin Islands	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y

#	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
147	Canada	Y	Industry Canada RSS-220 specification	4.75 – 10.6	Y	-41.3	Sec 3	Y	Y
148	Cayman Islands	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
149	Costa Rica	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
150	Cuba	N	TBC	TBC				TBC	TBC
151	Curacao	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
152	Dominica	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
153	Dominican Republic	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
154	El Salvador	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
155	Grenada	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
156	Guadeloupe	Y	Telecoms matters overseen by government of France	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
157	Guatemala	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
158	Haiti	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
159	Honduras	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
160	Martinique	Y	Telecoms matters overseen by	3.1 – 4.8[1]	Y	-41.3	ETSI Sec 5	Y	Y

#	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
			government of France	6.0 – 8.5 8.5 – 9.0[1]					
161	Jamaica	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
162	Mexico	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
163	Nicaragua	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
164	Panama	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
165	St Kitts & Nevis	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
166	St Lucia	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
167	St Vincent & the Grenadines	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
168	Trinidad & Tobago	N	Generally will approve FCC certified equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
169	USA	Y	FCC CFR 47 Part 15	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
170	US Virgin islands	Y	Telecoms matters overseen by government of USA	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y

[1] Mitigation techniques required

2.4.2 South America

Table 7: UWB Regulations South America

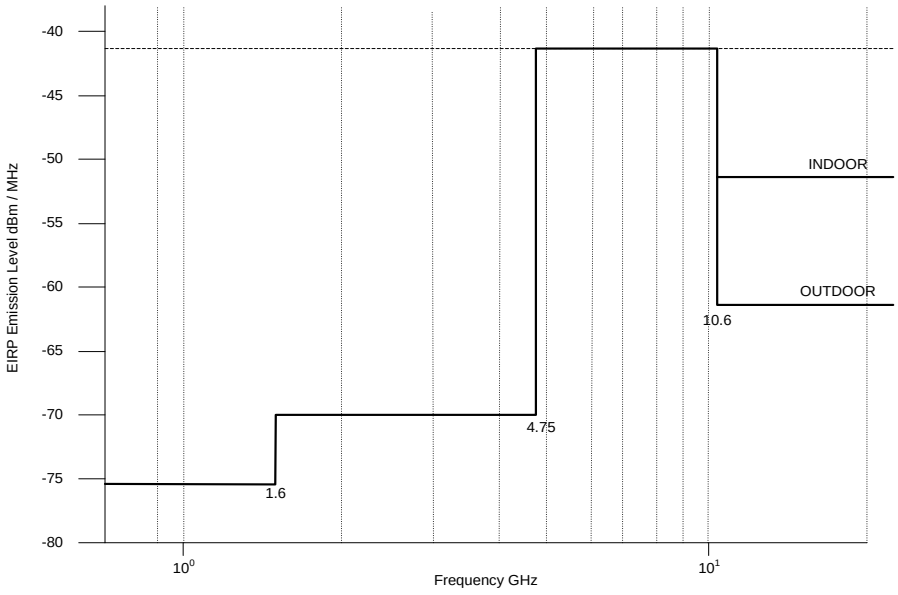
#	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
171	Argentina	N	TBC	TBC				TBC	TBC
172	Bolivia	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
173	Brazil	N	TBC	TBC				TBC	TBC
174	Chile	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
175	Colombia	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
176	Ecuador	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
177	Falkland Islands	N	Generally will approve ETSI compliant equipment	3.1 – 4.8[1] 6.0 – 8.5 8.5 – 9.0[1]	Y	-41.3	ETSI Sec 5	Y	Y
178	Guyana	N	Generally will approve FCC compliant equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
179	Paraguay	N	Generally will approve FCC compliant equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
180	Peru	N	Generally will approve either ETSI or FCC compliant equipment	FCC Sec 3 ETSI Sec 5	Y	-41.3	FCC Sec 3 ETSI Sec 5	Y	Y
181	Uruguay	N	Generally will approve FCC compliant equipment	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y
182	Venezuela	N	Generally will approve FCC	3.1 – 10.6	Y	-41.3	FCC Sec 3	Y	Y

#	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	EIRP (dBm / MHz)	Emission Profile	Can DW1000 be used under this regime?	
								Indoors	Outdoors
			compliant equipment						

[1] Mitigation techniques required

3 NORTH AMERICA

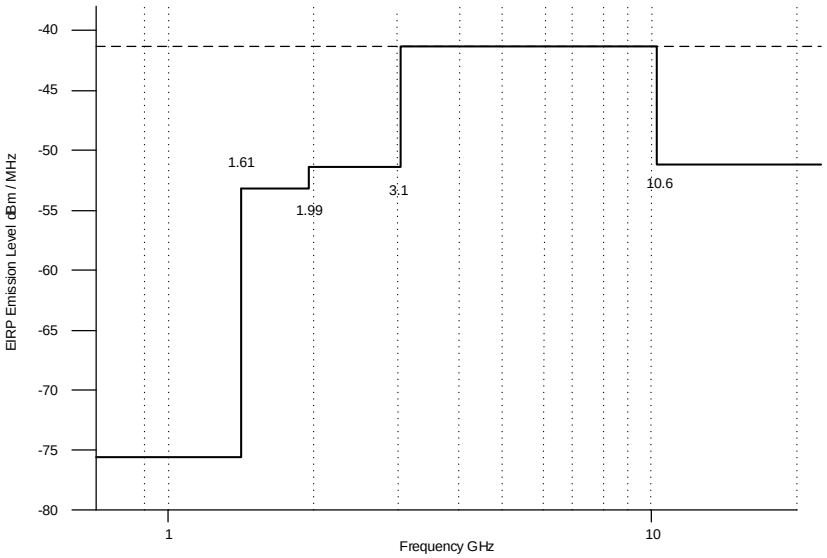
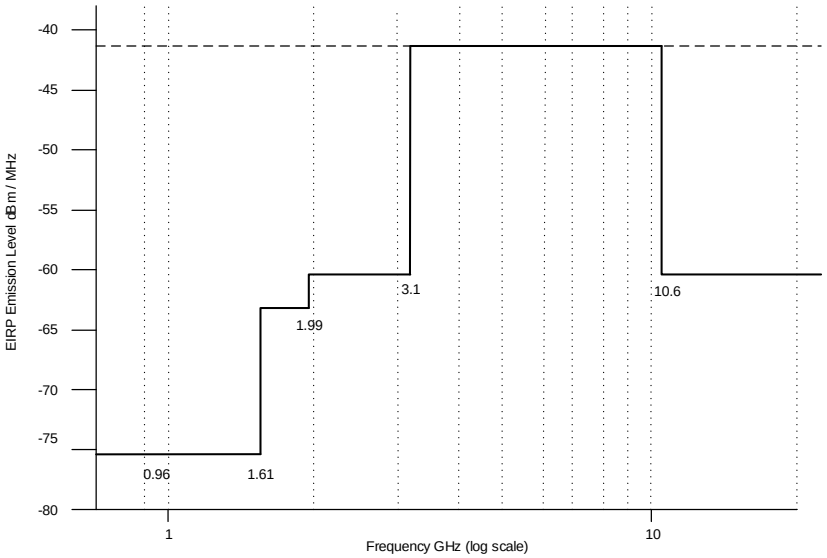
3.1 Canada

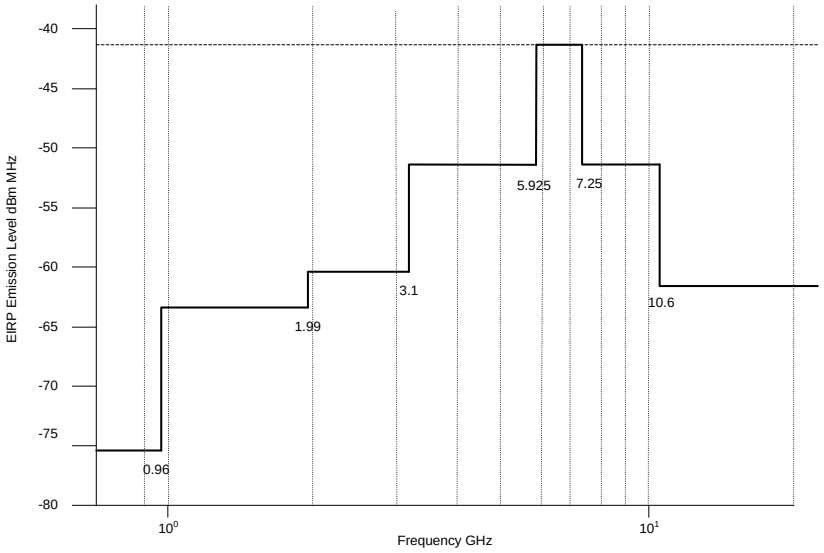
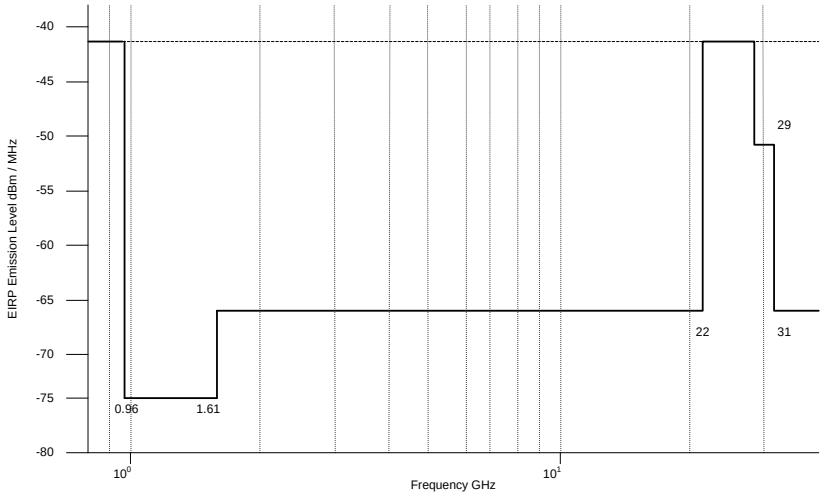
Item	Description
Geographic Location	
Regulatory Body	Industry Canada
Location	Ottawa, Canada
Postal Address	Service Canada Ottawa (Ontario) K1A 0J9 CANADA
Phone	+ 1 613 957 1954
Web	http://strategis.ic.gc.ca/engdoc/main.html
Do UWB regulations exist?	**Yes**
Specific regulations	RSS-220 — Devices Using Ultra-Wideband (UWB) Technology
Max Mean Emission Limits	 **Figure 1: Max mean emission limits under RSS 220**
Other relevant notes	Makes distinction between 3 classes of device: • Vehicular Radar • Radar Imaging • Communications Devices (both indoor and handheld)

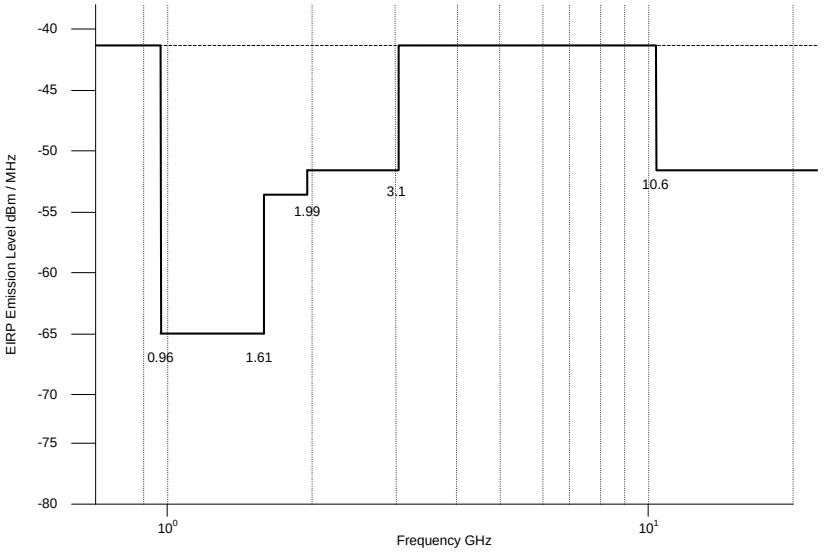
3.2 USA

Note: The latest information in relation to FCC UWB regulations may be found here http://www.ecfr.gov/cgi-bin/text-idx?SID=1a40e658fbd837802772cc5a361bae85&mc=true&tpl=/ecfrbrowse/Title47/47cfrv1_02.tpl#0.

Item	Description
Geographic Location	
Regulatory Body	In the USA, spectrum jurisdiction is split between the Federal Communications Commission (**FCC**) and the National Telecommunications & Information Administration (**NTIA**) The FCC regulates private users and state and local governments and is an independent agency. The NTIA regulates Federal Government users and acts on behalf of the President. Frequency bands are either: - • Controlled by FCC • Controlled by NTIA • Shared and subject to mutual agreement UWB issues involved both agencies and needed mutual agreement. Certification and commercial product approval is handled by the FCC.
Location	Federal Communications Commission Washington; USA
Postal Address	Federal Communications Commission 445 12th Street SW Washington, DC 20554
Phone	+1 888 225 5322 (toll free)
Web	http://www.fcc.gov/
Do UWB regulations exist?	**Yes**
Specific regulations	Code of Federal Regulations (CFR) 47 Part 15 including among others: - • Section 15.517 technical requirements for indoor UWB systems. • Section 15.519 technical requirements for hand held UWB systems. • Section 15.521 technical requirements applicable to all UWB devices • Section 15.250 technical requirements for Wideband Devices (not specifically UWB devices but UWB devices can certify under this section).

Item	Description
Max mean Emission Limits – Indoor Systems	 **Figure 2: Max. mean emission limits for indoor communication systems under §15.517**
Max mean Emission Limits – Handheld Systems	 **Figure 3: Max. mean emission limits for handheld systems under §15.519**

Item	Description
Max mean Emission Limits – Wideband devices under §15.250	 **Figure 4: Max mean emission limits for wideband devices under §15.250**
Max Mean Emission Limits – Vehicular radar systems Not of direct relevance to Decawave products but included here for completeness	 **Figure 5: Max mean emission limits for vehicular radar systems**

Item	Description
Max Mean Emission Limits – Medical Imaging Systems Not of direct relevance to Decawave products but included here for completeness	 **Figure 6: Max. mean emission limits for Medical Imaging Systems**
Notes	The USA was the first to introduce regulations that allowed Ultra Wideband systems. Unlicensed use was first allowed in 2002. The regulations make a distinction between 3 different types of system: - • Communications Systems • Vehicular Radar Systems • Imaging Systems **See Reference [1] for a detailed discussion of the FCC regulations and the FCC product approvals process.**

4 SOUTH AMERICA

4.1 Argentina

Item	Description
Geographic location	
Regulatory Body	Secretaria de Comunicaciones Comisión Nacional de Comunicaciones
Location	Comisión Nacional de Comunicaciones Buenos Aires Argentina
Postal Address	Perú 103 (C1067AAC), Buenos Aires, Argentina
Phone	+54 114 347 9242
Web	http://www.cnc.gov.ar/index.asp
Do UWB regulations exist?	**TBD**
Specific regulations	TBD
Notes	TBD

4.2 Bolivia

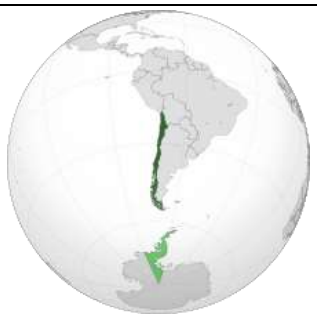
Item	Description
Geographic Location	
Regulatory Body	Superintendencia de Telecomunicaciones de Bolivia
Location	Oficina Central La-Paz Bolivia
Postal Address	Oficina Central Calle 13 NÂº8260 – 8280 Calacoto Casilla Postal 6692 La-Paz

Item	Description
	Bolivia
Phone	+591 2 3120978 -3120587
Web	http://att.gob.bo/
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve either ETSI or FCC compliant equipment

4.3 Brazil

Item	Description
Geographic Location	
Regulatory Body	Ministério das Comunicações Agência Nacional de Telecomunicações (ANATEL)
Location	Ministério das Comunicações Esplanada dos Ministérios, Bloco “R”, CEP 70044-900 Brazilia – DF
Postal Address	NA
Phone	NA
Web	http://www.anatel.gov.br
Do UWB regulations exist?	TBD
Specific regulations	TBD
Notes	

4.4 Chile

Item	Description
Geographic Location	
Regulatory Body	Subsecretería de Telecomunicaciones
Location	Subsecretería de Telecomunicaciones Ministerio de Transportes y Telecomunicaciones

Item	Description
	Santiago de Chile, Chile
Postal Address	Subsecretería de Telecomunicaciones Ministerio de Transportes y Telecomunicaciones Amunátegui 139 – Clasificador 120 Correo 21 Santiago de Chile Chile
Phone	+506 220 60103
Web	http://www.subtel.cl
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve either ETSI or FCC compliant equipment

4.5 Colombia

Item	Description
Geographic Location	
Regulatory Body	Ministerio de Comunicaciones
Location	See below
Postal Address	Ministerio de Comunicaciones Edificio Murillo Toro Cra. 8a entre calles 12 y 13 Atención al Ciudadano
Phone	+506 800 206 1000
Web	http://www.mincomunicaciones.gov.co
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve either ETSI or FCC compliant equipment

4.6 Ecuador

Item	Description
Geographic Location	
Regulatory Body	Superintendence of Telecommunications of Ecuador
Location	Av. Diego de Almagro N31-95 entre Whymper y Alpallana. Edificio Senatel
Postal Address	NA
Phone	02 2 50 8535
Web	http://www.conatel.gov.ec
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve either ETSI or FCC compliant equipment

4.7 Guyana

Item	Description
Geographic Location	
Regulatory Body	National Frequency Management Unit
Location	See below
Postal Address	68 Hadfield Street D'Urban Park, Georgetown, Guyana.
Phone	592 226 2233
Web	http://www.sdnp.org.gy/nfmu/index.htm
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve FCC compliant equipment

4.8 Paraguay

Item	Description
Geographic Location	
Regulatory Body	Comisión Nacional de Telecomunicaciones
Location	See below
Postal Address	Comisión Nacional de Telecomunicaciones Yegros Nro. 437 y 25 de Mayo
Phone	440 020 R.A
Web	http://www.conatel.gov.py/licencias.htm
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve FCC compliant equipment

4.9 Peru

Item	Description
Geographic Location	
Regulatory Body	Ministry of Transport and Communication
Location	Jr. Zorritos 1203 – Lima 1
Postal Address	NA
Phone	315 7800
Web	http://www.mtc.gob.pe/
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve either ETSI or FCC compliant equipment

4.10 Uruguay

Item	Description
Geographic Location	
Regulatory Body	Unidad Reguladora de Servicios de Communicaciones (URSEC)
Location	Montevideo Uruguay
Postal Address	URSEC Uruguay 988 cp 11100 Montevideo
Phone	598 2 9028082
Web	www.ursec.gub.uy
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve FCC compliant equipment

4.11 Venezuela

Item	Description
Geographic Location	
Regulatory Body	Comision Nacional de Telecomunicaciones Républica Bolivariana de Venezuela (CoNaTel)
Location	Ministerio de Infraestructura Comision Nacional de Telecomunicaciones Républica Bolivariana de Venezuela Caracas Venezuela
Postal Address	Planta Baja de la Torre MINFRA Av. Francisco de Miranda Chacao Caracas Venezuela
Phone	0212 201 59 40

Item	Description
Web	http://www.conatel.gov.ve
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve FCC compliant equipment

5 EUROPE

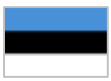
5.1 European Union

Note: The latest information in relation to the status of UWB regulations in individual European countries may be found using the European Communications Office (ECO) documentation database at this link http://www.erodocdb.dk, and European Communications Office Frequency Information System (EFIS) at this link www.efis.dk.

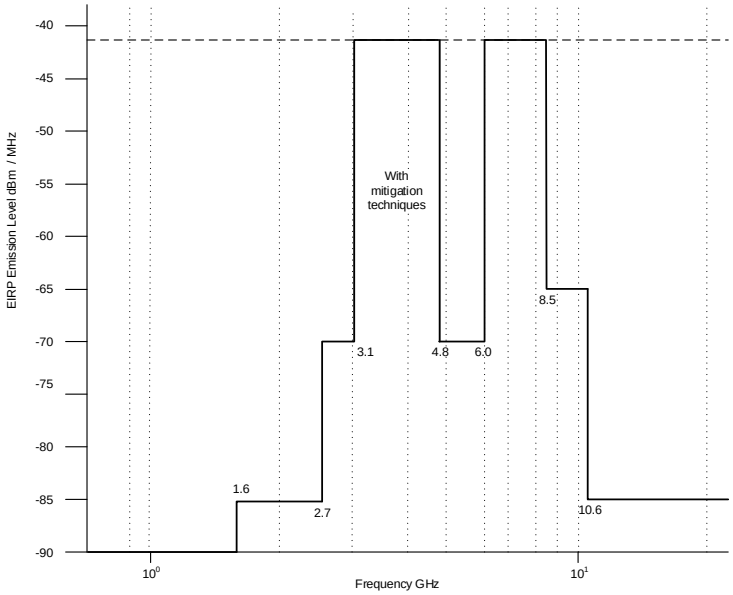
Item	Description
Geographic Location	

Regulatory Bodies – pan European		
CEPT		Nyropsgade 37, 4th floor 1602 Copenhagen Denmark
ETSI		650, Route des Lucioles 06921 Sophia-Antipolis Cedex France

Regulatory Bodies – National					
Country		EU Member State	CEPT Member	Regulatory Body	Web
Austria		Y	Y	Regulatory Authority for Telecommunications and Broadcasting Ministry of Transport, Innovation and Technology	www.rtr.at
Belgium		Y	Y	Belgian Institute for postal services and Telecommunications	www.ibpt.be
Bulgaria		Y	Y	Communications Regulation Commission	www.crc.bg
Croatia		Y	Y	Ministry of the Sea, Tourism, Transport and Development	www.mmtpr.hr
Cyprus		Y	Y	Department of Electronic Communications	www.mcw.gov.cy
Czech Republic		Y	Y	Czech Telecommunications Office	www.ctu.eu

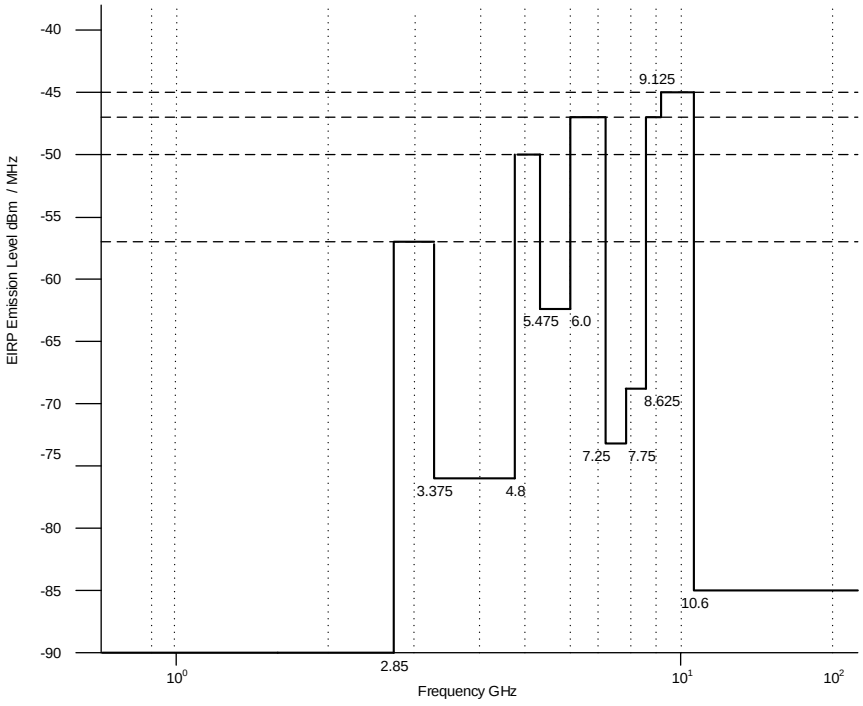
Regulatory Bodies – National					
Country		**EU Member State**	**CEPT Member**	**Regulatory Body**	**Web**
Denmark		Y	Y	National IT and Telecom Agency	www.en.itst.dk
Estonia		Y	Y	Technical Surveillance Authority	www.tja.ee
Finland		Y	Y	Ministry of Transport & Communications	www.lvm.fi
France		Y	Y	ARCEP	www.arcep.fr/eng
Germany		Y	Y	Regulierungsbehoerde für Telekommunikation und Post	www.bundesnetzagentur.de
Greece		Y	Y	Hellenic Telecommunications and Post Commission	www.eett.gr
Hungary		Y	Y	Ministry of Transport, Communication and Water Management	www.meh.hu
Ireland		Y	Y	COMREG – Commission for Communication Regulation	www.comreg.ie
Italy		Y	Y	Communications Regulatory Authority	www.agcom.it
Latvia		Y	Y	Latvia Telecommunication State Inspector	www.vei.lv
Lithuania		Y	Y	Lithuanian Communications Regulatory Authority	www.radio.lt
Luxembourg		Y	Y	Institut Luxembourgeois de Régulation	www.ilr.public.lu
Malta		Y	Y	Malta Communications Authority	www.mca.org.mt
Netherlands		Y	Y	OPTA	www.opta.nl
Poland		Y	Y	Office of Electronic Communications	www.en.uke.gov.pl
Portugal		Y	Y	ANACOM	www.anacom.pt
Romania		Y	Y	National Regulatory Authority for Communications	www.ancom.org.ro
Slovakia		Y	Y	Telecommunications Office of the Slovak Republic	www.teleoff.gov.sk
Slovenia		Y	Y	AKOS – Agency for communications networks	www.akos-rs.si/akos-ang

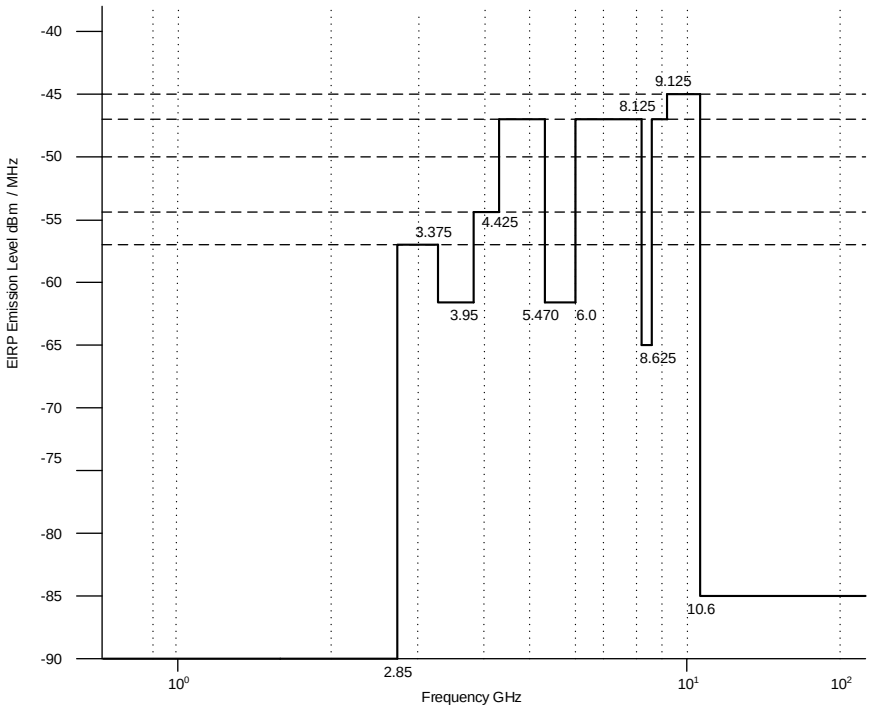
Regulatory Bodies – National					
Country		**EU Member State**	**CEPT Member**	**Regulatory Body**	**Web**
				and services, republic of Slovenia	
Spain		Y	Y	Comison del Mercado de las Telecommunicaciones	www.cnmc.es
Sweden		Y	Y	Swedish Post and Telecom Agency	www.pts.se
United Kingdom		Y	Y	OFCOM	www.ofcom.org.uk

Item	Description
Max mean Emission limits	 **Figure 7: Max. mean emission limits defined in ETSI EN 302065-01 (generic UWB devices)**
Notes	**See Reference [2] for a detailed discussion of European regulations and the European product approvals process.**

5.2 Other European Countries

5.2.1 Russia

Item	Description
Geographic Location	
Regulatory Body	General Radio Frequency Centre (GRFC)
Location	As below
Postal Address	7, Tverskaya Street 125375 Moscow Russian Federation
Phone	+7 095 771 84 00
Web	http://www.gov.ru/
Do UWB regulations exist?	**Yes**
Specific regulations	Addendum to the GRFC decision from December 15, 2009 # 5/9/02-05-02 Addendum No. 16 the GRFC decision May 7, 2007 No. 07-20-03-001
Max Mean Emission Limits – Unrestricted Use	 **Figure 8: Max mean emission limits Russia – unrestricted use**

Item	Description
Max Mean Emission Limits – Restricted Use	 **Figure 9: Max. mean emission limits Russia – restricted use**
Notes	Restricted use mentioned above refers to the following: - 1. Outdoor use is prohibited 2. Use on board aircraft during taxing, take-off or landing is prohibited. 3. Use is prohibited in freight terminals at airports.

5.2.2 Switzerland

Item	Description
Geographic Location	
Regulatory Body	Federal Office of Communication
Location	Federal Office of Communications Biel Switzerland
Postal Address	Federal Office of Communications Zukunftstrasse 44 P.O. Box 2501 Biel

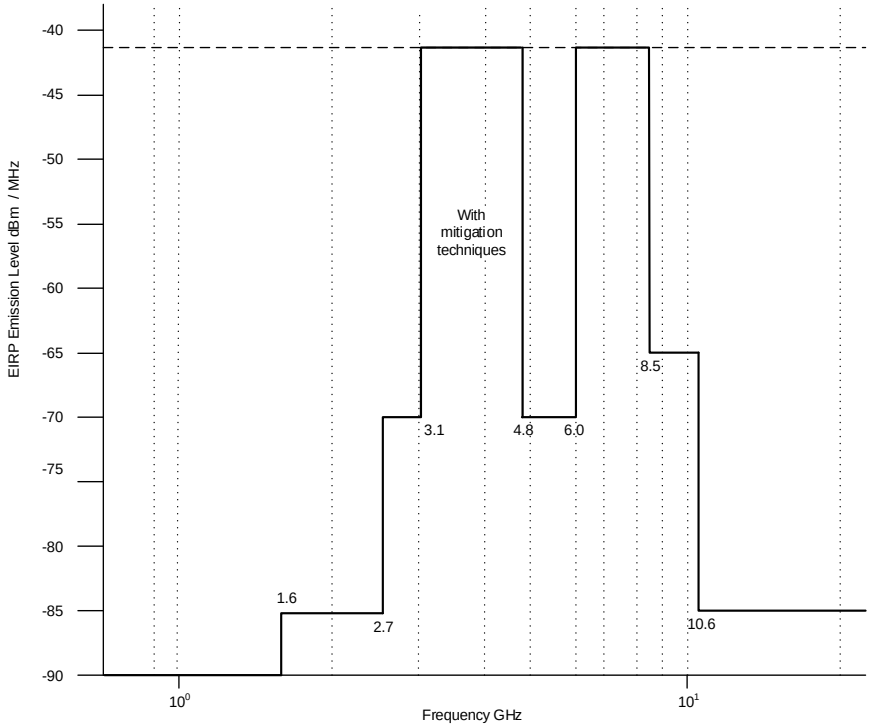
Item	Description
Phone	+41 32 327 5511
Web	www.bakom.ch
Do UWB regulations exist?	**Yes**
Specific regulations	Same as ECC regulations
Max Mean Emission Limits	

Figure 10: Max mean emission limits – Switzerland

6 MIDDLE EAST

6.1 Bahrain

Item	Description
Geographic Location	
Regulatory Body	Telecommunications Regulatory Authority
Location	5th Floor, Building No. 852, Road No. 3618 Seef 436
Postal Address	Telecommunications Regulatory Authority PO Box 10353 Manama, Kingdom of Bahrain
Phone	+973 1752 0000
Web	http://www.tra.org.bh/
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve ETSI certified equipment

6.2 Iran

Item	Description
Geographic Location	
Regulatory Body	Communications Regulatory Authority (CRA) of Iran
Location	NA
Postal Address	NA
Phone	NA
Web	http://www.cra.ir/
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve ETSI certified equipment

6.3 Iraq

Item	Description
Geographic Location	
Regulatory Body	The Iraqi National Communications and Media Commission (NCMC)
Location	NA
Postal Address	NA
Phone	NA
Web	NA
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	TBC

6.4 Israel

Item	Description
Geographic Location	
Regulatory Body	Ministry of Communications
Location	Tel Aviv, Israel
Postal Address	NA
Phone	+972 3 5198281
Web	http://www.moc.gov.il/
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	No official regulations exist for UWB in Israel although unofficially it has been reported that the 3.8 – 4.8 GHz band is being considered for UWB.

6.5 Jordan

Item	Description
Geographic Location	
Regulatory Body	Telecommunications Regulatory Commission
Location	Amman, Jordan
Postal Address	The Telecommunications Regulatory Commission (TRC) Shmeisani Area / Abd Al-Hamid Sharaf Street, building no. (90). P.O.Box: 941794 Amman 11194 Jordan
Phone	+962 6 5501120
Web	http://www.trc.gov.jo/
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve ETSI certified equipment

6.6 Lebanon

Item	Description
Geographic Location	
Regulatory Body	Ministry of Telecommunications
Location	See below
Postal Address	Beirut, Riad El Solh Str. MoT 3rd
Phone	+961 1 979 979
Web	http://www.mpt.gov.lb/
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve ETSI certified equipment

6.7 Qatar

Item	Description
Geographic Location	
Regulatory Body	Communications Regulatory Authority
Location	Doha, Qatar
Postal Address	Al Nasr Tower B, Corniche PO Box 23404, Doha, Qatar
Phone	+974 4 935 922
Web	http://www.cra.gov.qa/en
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve ETSI certified equipment

6.8 Saudi Arabia

Item	Description
Geographic Location	
Regulatory Body	The Communications and Information Technology Commission of Saudi Arabia (CITC)
Location	Communications and Information Technology Commission Riyadh Kingdom of Saudi Arabia
Postal Address	Communications and Information Technology Commission P.O. Box 75606 Riyadh 11588 K.S.A
Phone	+966 1 4618000
Web	http://www.citc.gov.sa
Do UWB regulations exist?	**Yes**
Specific regulations	CITC R1085 Issue 1 10/01/2010. See [23].

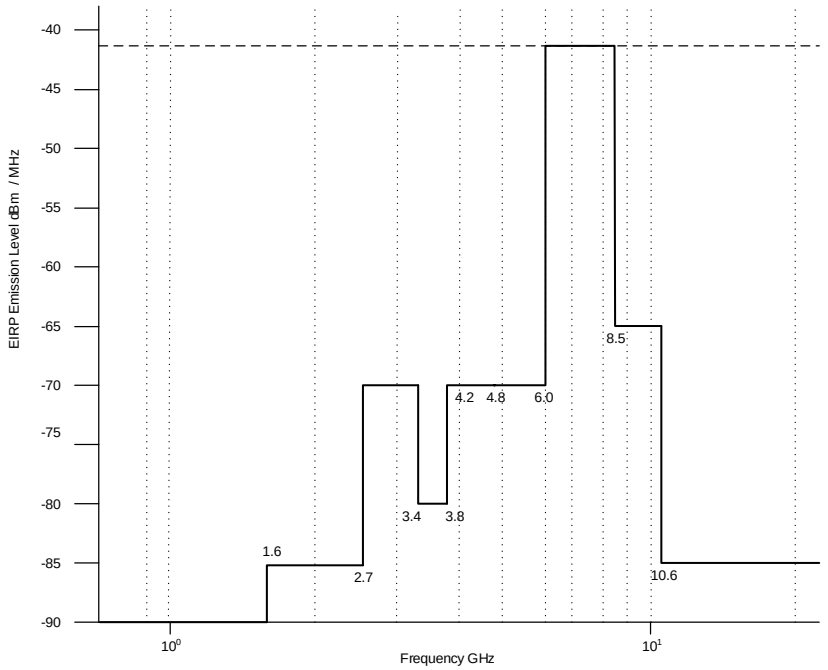
Item	Description
Max Mean Emission Limits Emission limits are the same as those specified in the original ETSI EN 302 065 with the exception that only the high band channels (6.0 to 8.5 GHz) are permitted to transmit at the maximum mean level of -41.3 dBm / MHz.	 **Figure 11: Max. mean emission limits for Saudi Arabia set by CITC**
Notes	The CITC regulations follow those of ETSI and the ETSI standards listed in Table 8 are specifically referenced in the CITC R1085 document.

Table 8: ETSI standards specifically referenced in CITC R1085

No	Doc Number / Title	Ref
1	EN 301 489 -1	[5]
2	EN 301 489 -32	[6]
3	EN 301 489 -33	[7]
4	ETSI EN 302 065	[8]
5	ETSI EN 302 066	[12]
6	ETSI EN 302 500-02	[14]

6.9 Syria

Item	Description
Geographic Location	
Regulatory Body	Ministry of Communications and Technology
Location	NA

Item	Description
Postal Address	NA
Phone	NA
Web	www.moct.gov.sy
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve ETSI certified equipment

6.10 UAE

Item	Description
Geographic Location	
Regulatory Body	Telecommunications Regulatory Authority
Location	Sheikh Zayed Street, Abu Dhabi, United Arab Emirates
Postal Address	P.O.Box: 26662 Abu Dhabi, United Arab Emirates
Phone	+971 2 626 9999
Web	http://www.tra.gov.ae/
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve ETSI certified equipment

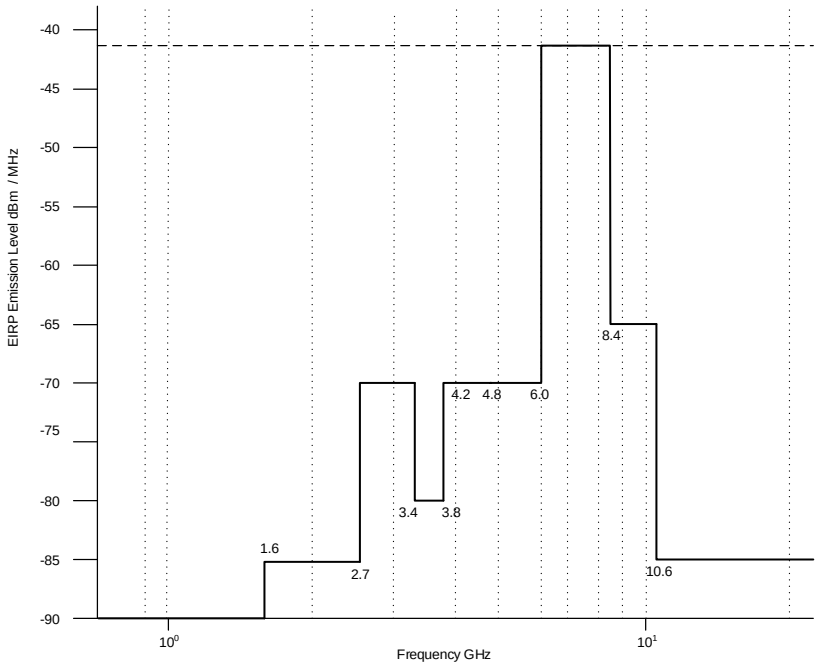
6.11 Yemen

Item	Description
Geographic Location	
Regulatory Body	The Ministry of Telecommunications and Information Technology
Location	Sanaa, Yemen
Postal Address	NA
Phone	+967 1 331456
Web	www.mtit.gov.ye

Item	Description
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Generally will approve ETSI certified equipment

7 ASIA PACIFIC

7.1 Australia

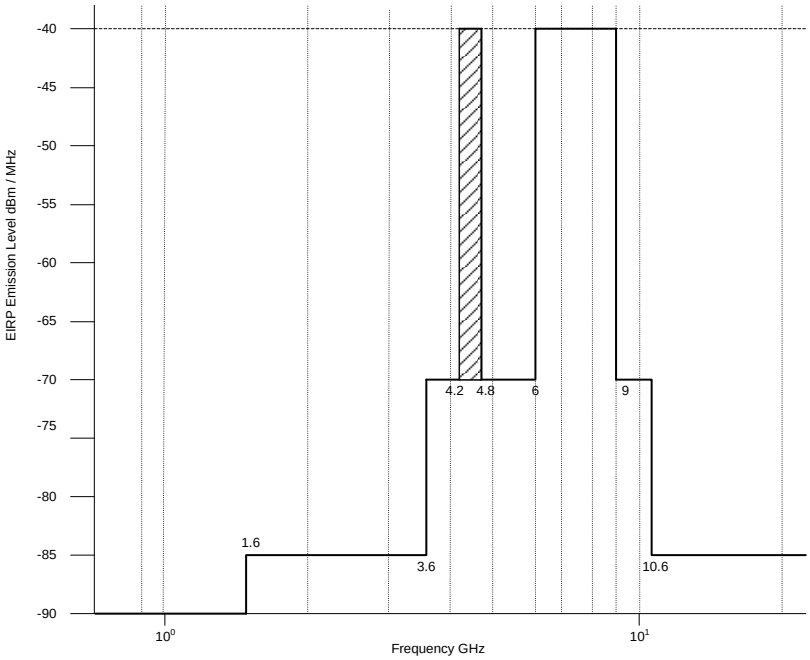
Item	Description
Geographic Location	
Regulatory Body	Australian Communications and Media Authority (ACMA)
Location	Canberra, Melbourne & Sydney Central Offices
Postal Address	Canberra Central Office Purple Building, Benjamin Offices, Chan Street, PO Box 78
Phone	+61 2 6219 5555
Web	http://www.acma.gov.au
Do UWB regulations exist?	**Yes**
Specific regulations	Radio-communications (Low Interference Potential Devices) Class Licence 2000, as amended, made under sections 132 and 135 of the Radio-communications Act 1992 taking into account amendments up to Radio-communications (Low Interference Potential Devices) Class Licence Variation Notice 2014 (No. 1)
Max Mean Emission Limits	 **Figure 12: Max mean emission limits – Australia**

Item	Description
Notes	Radio-communications (Low Interference Potential Devices) Class Licence 2000, as amended (see [18]). Refers to the ETSI standards listed in Table 9. The following limitations are specified: - 1. UWB transmitter must operate within the frequency range 6 – 8.4 GHz 2. A transmitter mentioned in this item must comply with either ETSI Standard EN 302 500 or ETSI Standard EN 302 065 3. Must not be operated on board any aircraft or from any fixed outdoor location 4. Must not be operated within a nominated distance of a specified Australian radio astronomy site. Nominated distance of a specified Australian radio astronomy site is defined as follows: - 1. Within 10 km of Parkes Observatory located near Parkes (Latitude 32^{o} 59’ 59.8657” S Longitude 148^{o} 15’ 44.3591” E); or 2. Within 10 km of Paul Wild Observatory located near Narrabri (Latitude 30^{o} 18’ 52.048” S Longitude 149^{o} 32’ 56.327” E); or 3. Within 3 km of the Canberra Deep Space Communications Complex (Latitude 35^{o} 23’ 54”S Longitude 148^{o} 58’ 40” E); or 4. Within 10 km of the Radio Astronomy Park in Western Australia (Latitude 26^{o} 37’ 13.4” S Longitude 117^{o} 30’ 40” E).

Table 9: ETSI standards referenced in the ACMA Class License

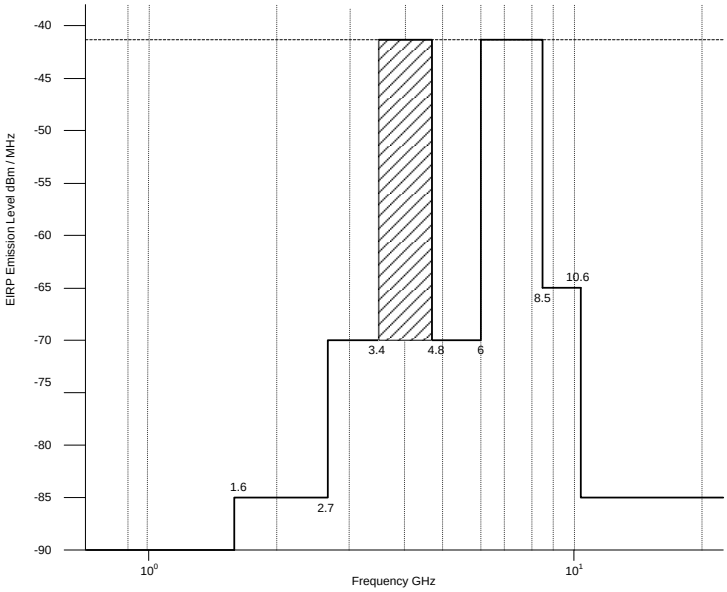
No	Doc Number / Title	Ref
1	ETSI EN 302 065	[8]
2	ETSI EN 302 500-01	[13]
3	ETSI EN 302 500-02	[14]

7.2 China

Item	Description
Geographic Location	
Regulatory Body	Ministry of Industry and Information Technology (MIIT)
Location	Beijing China
Postal Address	No.80, Beilishi Road, Beijing, 100037, China
Phone	+660 122 37
Web	http://www.mii.gov.cn/
Do UWB regulations exist?	**Yes**
Specific regulations	MIIT wireless [2008] 354 file. See [19].
Max Mean Emission Limits Note: appropriate anti-interference technologies must be implemented in the 4.2 to 4.8 GHz and such technologies must be approved by the Agency of Radio Management of the Peoples' Republic of China	 **Figure 13: Max. mean emission limits – China**
Notes	China has approved the use of UWB for WiMedia applications. The approved bands are 3 and 7 through 11 of the appropriate ECMA standard (4.2 – 4.8 GHz and 6 – 9 GHz approximately). Many of the constraints on the use of UWB equipment are common to other jurisdictions: - • Not permitted on aircraft • Not permitted in an area of 1 km around listed radio astronomy observatories

Item	Description
	• UWB radio transmitting equipment must obtain an approval certificate from the Ministry of Industry and Information Technology of the People's Republic of China

7.3 Hong Kong

Item	Description
Geographic Location	
Regulatory Body	Office of the Telecommunications Authority (OFTA)
Location	OFTA Wan Chai Hong Kong
Postal Address	OFTA 29/F Wu Chung House 213 Queens Road East Wan Chai Hong Kong
Phone	+852 2961 6333
Web	http://www.ofta.gov.hk/
Do UWB regulations exist?	**No**
Specific regulations	Proposals only
Proposed Max Mean Emission Limits	 **Figure 14: Proposed max. mean emission limits – Hong Kong**

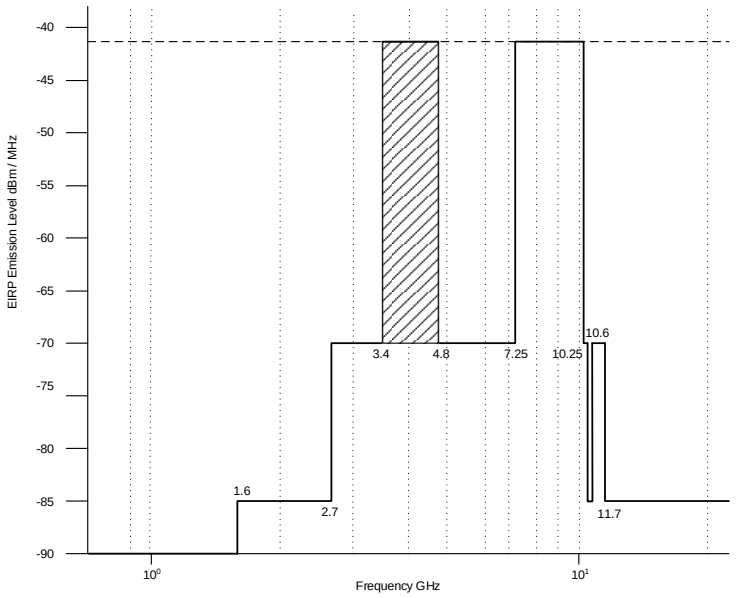
Item	Description
Notes	UWB regulations have not yet been ratified in Hong Kong although draft proposals have been issued with emission limits as above.

7.4 India

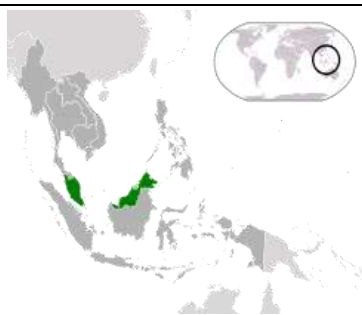
Item	Description
Geographic Location	
Regulatory Body	Government of India Wireless Planning & Coordination Wing Ministry of Communications and Information Technology Department of Telecommunications
Location	New Delhi, India
Postal Address	Various – check website
Phone	Various – check website
Web	http://www.wpc.dot.gov.in/
Do UWB regulations exist?	**No**
Specific regulations	None
Notes	Regulator is currently considering regulations allowing the use of unlicensed UWB in the range 6.0 – 7.25 GHz. Historically, India has approved ETSI certified equipment

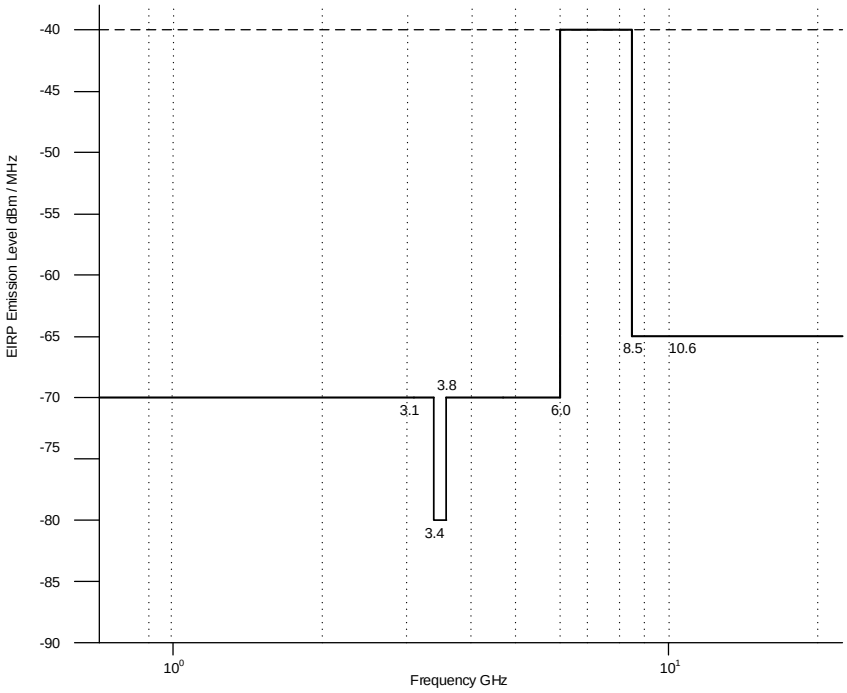
7.5 Japan

Item	Description
Geographic Location	
Regulatory Body	Ministry of Internal Affairs and Communication
Location	NA
Postal Address	NA
Phone	NA
Web	http://www.tele.soumu.go.jp/e/index.htm

Item	Description
Do UWB regulations exist?	**Yes**
Specific regulations	ARIB STD-T91 v2.0 March 2015. See [20].
Max Mean Emission Limits	 **Figure 15: Max. mean emission limits for indoor devices – Japan**
Notes	The 3.4 to 4.8 GHz band requires a minimum data rate of 50 Mb/s and the use of DAA mitigation techniques. The 7.25 to 10.25 GHz band has neither of these restrictions.
Caution	Under existing regulations, DW1000 / DWM1000 cannot be certified for use in Japan. Contact Decawave for further information.

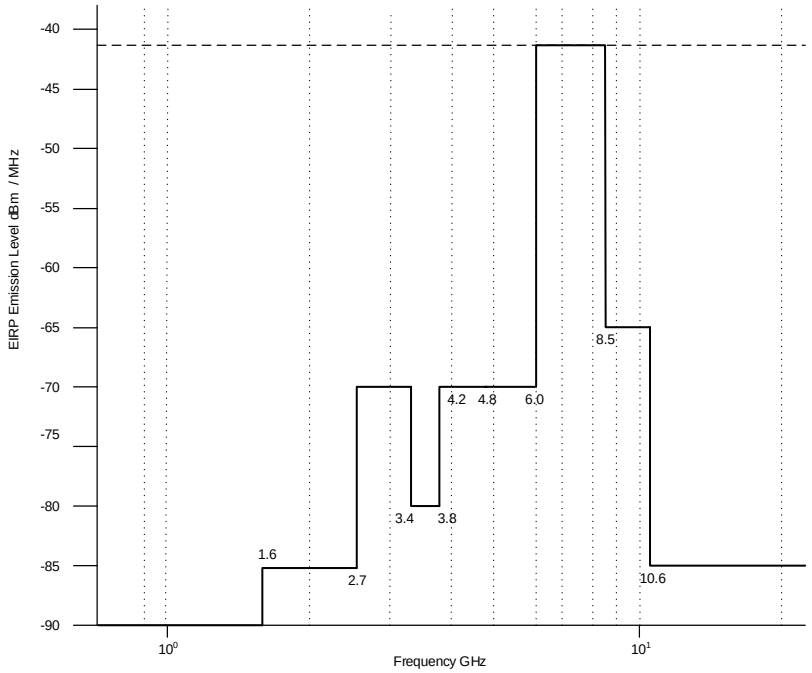
7.6 Malaysia

Item	Description
Geographic Location	
Regulatory Body	Malaysian Communications and Multimedia Commission
Location	See below
Postal Address	63000 Cyberjaya, Selangor Darul Ehsan, Malaysia
Phone	+603 8688 8000
Web	http://www.mcmc.gov.my
Do UWB regulations exist?	**Yes**

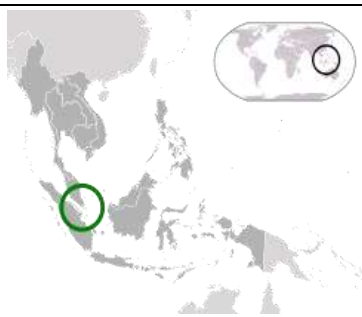
Item	Description
Specific regulations	SKMM SRSP-549 UWB 5th December 2013. See [21].
Max Mean Emission Limits	 **Figure 16: Max. mean emission limits for indoor devices – Malaysia**
Notes	Emissions mask is only specified from 3.1 to 10.6 GHz. Emissions beyond those frequencies are not specified

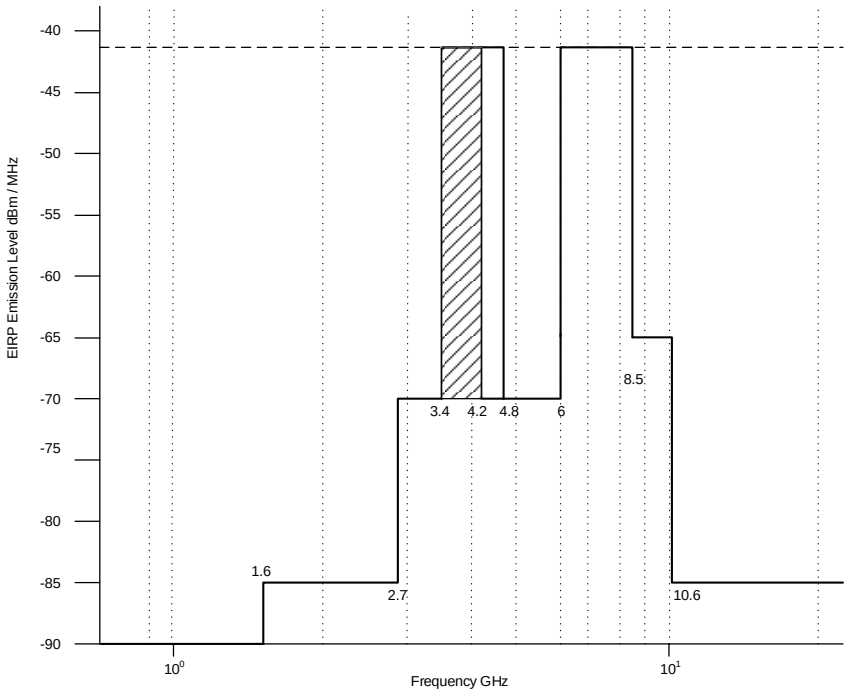
7.7 New Zealand

Item	Description
Geographic Location	
Regulatory Body	Commerce Commission of New Zealand (ComCom)
Location	44 The Terrace PO Box 2351 Wellington 6140 New Zealand
Postal Address	PO Box 2351 Wellington 6140 New Zealand
Phone	+64 4 924 3600
Web	http://www.rsm.govt.nz/index.html

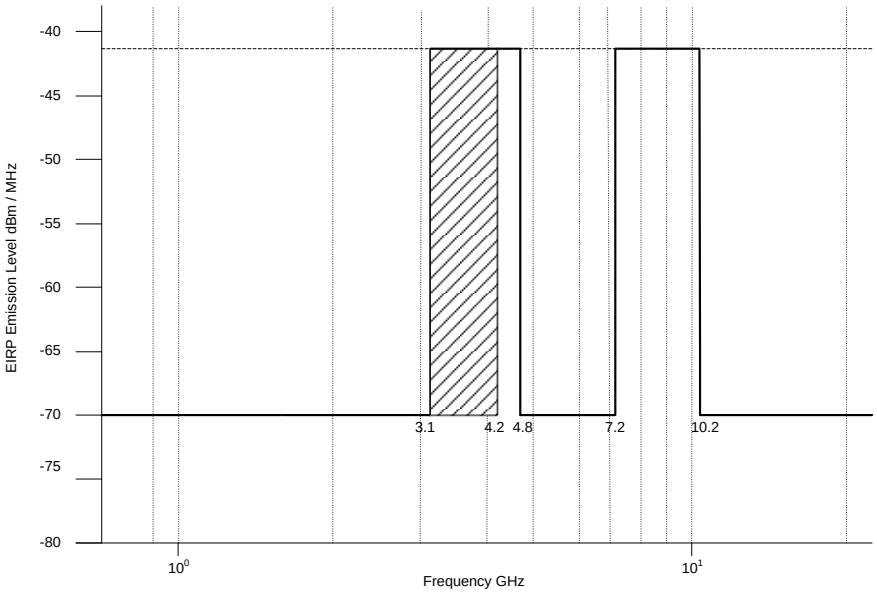
Item	Description
Do UWB regulations exist?	**Yes**
Specific regulations	Radiocommunications Regulations (General User Radio Licence for Ultra Wide Band Communication Devices) Notice 2008. See [22].
Max Mean Emission Limits	 **Figure 17: Max. mean emission limits for New Zealand**
Notes	The use of Ultra Wide Band transmitting equipment is not permitted on board aircraft or from any fixed outdoor transmitter or antenna

7.8 Singapore

Item	Description
Geographic Location	
Regulatory Body	Info-Communications Development Authority of Singapore (IDA)
Location	Spectrum & Number Management Info-Communications Development Authority of Singapore Singapore
Postal Address	Resource Management & Standards 10 Pasir Panjang Road #10-01 Mapletree Business City Singapore 117438
Phone	+ 65 322 1999

Item	Description
Web	http://www.ida.gov.sg
Do UWB regulations exist?	**Yes**
Specific regulations	IDA TS UWB: 2011. See [24].
Max Mean Emission Limits	 **Figure 18: Max. mean emission limits for communication devices in Singapore**
Notes	The Singapore regulations adopt much of the FCC and ECC rulings: - • Indoor operation is permitted • Operation is permitted outdoors but only when mobile – “UWB devices used outdoors shall not be operating from a fixed antenna” • The -10 Db bandwidth must be contained in the frequency ranges permitted in the emission mask. • Equipment may transmit only when sending information to an associated receiver. • A transmitter 10 s timeout must be implemented UWB devices with mitigation techniques are allowed to operate at a level of -41.3dBm / MHz in the 3.4 to 4.2 GHz band. Otherwise the emission level is capped at -70 dBm / MHz

7.9 South Korea

Item	Description
Geographic Location	
Regulatory Body	Korean Communications Commission (KCC) formed from merger of Ministry of Communications (MIC) and the Korean Broadcasting Commission (KBC)
Location	See below
Postal Address	47, Gwanmun-ro, Gwacheon-si, Gyeonggi-do, 13809, Rep. of Korea
Phone	+82 2 500 9000
Web	http://www.kcc.go.kr/
Do UWB regulations exist?	**Yes**
Specific regulations	TBC
Max Mean Emission Limits	 **Figure 19: Max. mean emission limits for Korea**
Notes	UWB is permitted for indoor and outdoor use subject to the emission limits shown above.

8 REFERENCES

Reference is made to the following documents in the course of this document: -

Table 10: Table of References

Ref	Author	Date	Version	Title
[1]	Decawave		Current	APR002: UWB product certification process in USA
[2]	Decawave		Current	APR003: UWB product certification process in Europe
AMERICAS				
[3]	Industry Canada	03/2009	Issue 1	RS220 Devices using UWB Issue 1 Spectrum Management and Telecommunications Radio Standards Specification
[4]	FCC		Current	Code of Federal Regulations (CFR) Section 47 part 15 available here http://www.ecfr.gov/ (follow the links to Section 47 and then Part 15).
EMEA				
All ETSI EN harmonised standards available here: http://www.etsi.org/standards/looking-for-an-etsi-standard/list-of-harmonised-standards				
[5]	ETSI EN 301 489-1	08/2002	V1.4.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electro-Magnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements.
[6]	ETSI EN 301 489-32	09/2005	V1.1.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electro-Magnetic Compatibility (EMC) standard for radio equipment and services; Part 32: Specific conditions for Wall & Ground Probing radar applications.
[7]	ETSI EN 301 489-33	12/2008	V1.1.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electro-Magnetic Compatibility (EMC) standard for radio equipment and services; Part 33: Specific conditions for Ultra Wide Band (UWB) communications devices.
[8]	ETSI EN 302 065		Now Superseded	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band technology (UWB) for communications devices; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive. Original version – now split into a number of separate parts – see following.
[9]	ETSI EN 302 065-01	04/2014	V1.3.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band technology (UWB) for communications devices; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 1: Generic Requirements for UWB devices.
[10]	ETSI EN 302 065-02	02/2014	V1.1.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band technology (UWB) for location systems; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive;

Ref	Author	Date	Version	Title
				Part 2: Requirements for UWB Location Tracking.
[11]	ETSI EN 302 065-03	04/2014	V1.3.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 3: Requirements for UWB devices for road and rail vehicles.
[12]	ETSI EN 302 066-02	02/2008	V1.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Ground & wall probing radar applications (GPR / WPR) imaging systems; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive.
[13]	ETSI EN 302 500-01	10/2010	V2.2.2	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra WideBand (UWB) technology; Location Tracking equipment operating in the frequency range from 6 GHz to 9 GHz; Part 1: Technical characteristics and methods of measurement.
[14]	ETSI EN 302 500-02	01/2010	V2.1.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra WideBand (UWB) technology; Location Tracking equipment operating in the frequency range from 6 GHz to 9 GHz; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive.
[15]	EU Commission Directive 1999-5-EC (R&TTE)	03/1999		Directive 1999-5-EC of the European Parliament and of the council of 9th March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.
[16]	EU Commission Directive 2014-53-EU (RED)	04/2014		Directive 2014-53-EU of the European Parliament and of the Council of 16th April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999-5-EC.
[17]	GRFC (Russia)			Addendum to the GRFC decision from December 15, 2009 # 5/9/02-05-02 Addendum No. 16 the GRFC decision May 7, 2007 No. 07-20-03-001
APAC				
[18]	ACMA (Australia)	09/2010		Radio communications (Low Interference Potential Devices) Class Licence Variation Notice 2010 (No. 1) and subsequent amendments including compilation made 14th July 2014
[19]	MIIT (China)	2008		File 354
[20]	ARIB (Japan)	03/2015	v2.0	STD-T91 (Japanese UWB regulations)
[21]	Communications and Multimedia Commission (Malaysia)	12/2013	None stated	SKMM SRSP-549 UWB
[22]	ComCom	03/2015		Radiocommunications Regulations (General User Radio Licence for Ultra Wide Band Communication

Ref	Author	Date	Version	Title
	(New Zealand)			Devices) Notice 2010 as amended in New Zealand Gazette No 26 dated 19th March, 2015.
[23]	CITC (Saudi Arabia)	01/2010	Issue 1	R1085
[24]	IDA (Singapore)	05/2011	Issue 1 Rev 1	IDA TS UWB (Singapore UWB regulations)
OTHER				
[25]	Shannon, Claude	1948		A Mathematical Theory of Communication
[26]	ITU	2006		SM.1754: Measurement techniques of ultra-wideband transmissions
[27]	ITU	2006		SM.1755: Characteristics of ultra-wideband technology
[28]	ITU	2006		SM.1756: Framework for the introduction of devices using ultra-wideband technology
[29]	ITU	2006		SM.1757: Impact of devices using ultra-wideband technology on systems operating within radiocommunication services

9 DOCUMENT HISTORY

Table 11: Document History

Revision	Date	Description
1.0	31/10/15	Initial release

10 MAJOR CHANGES

Table 12: Changes in v1.0

Page	Change Description
All	Initial release

11 ABOUT DECAWAVE

Decawave is a pioneering fabless semiconductor company whose flagship product, the DW1000, is a complete, single chip CMOS Ultra-Wideband IC based on the IEEE 802.15.4-2011 UWB standard. This device is the first in a family of parts that will operate at data rates of 110 kbps, 850 kbps and 6.8 Mbps.

The resulting silicon has a wide range of standards-based applications for both Real Time Location Systems (RTLS) and Ultra Low Power Wireless Transceivers in areas as diverse as manufacturing, healthcare, lighting, security, transport, inventory & supply chain management.

Further Information

For further information on this or any other Decawave product contact a sales representative as follows: -

Decawave Ltd
Adelaide Chambers
Peter Street
Dublin 8
t: +353 1 697 5030
e: sales@Decawave.com
w: www.Decawave.com

12 APPENDIX 1: THE CHRONOLOGY OF UWB REGULATION IN SELECTED JURISDICTIONS

12.1 Canada

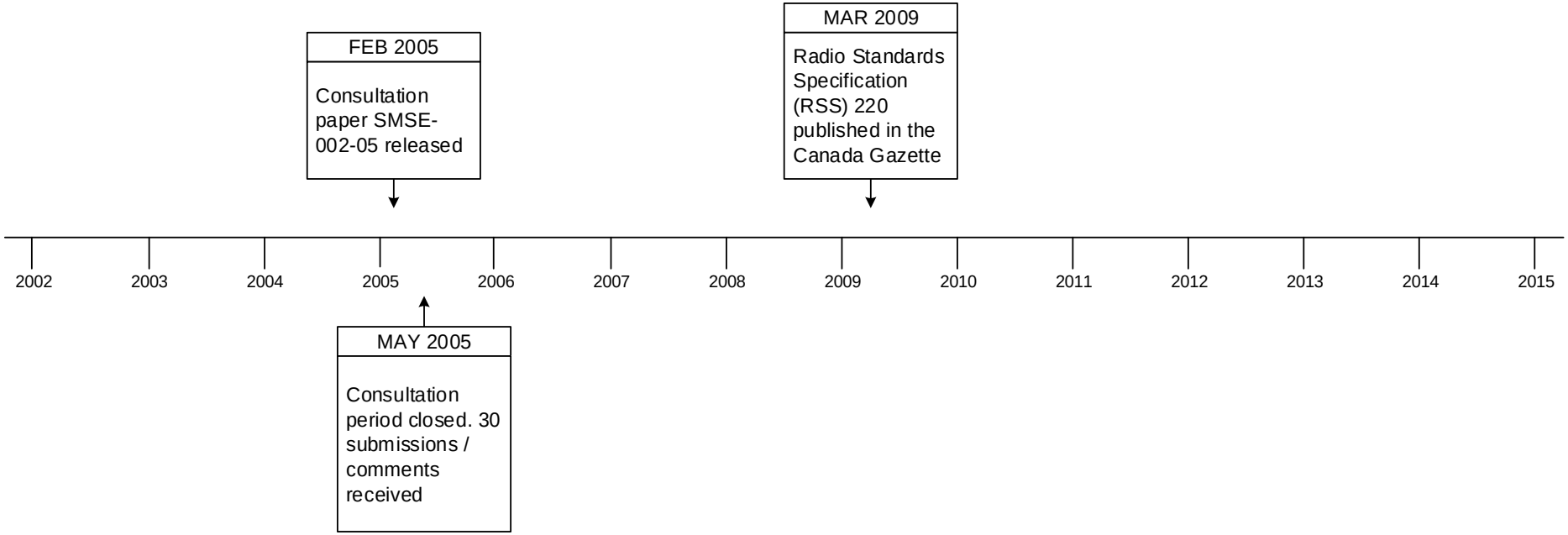


Figure 20: Chronology of UWB regulation in Canada

12.2 USA

1998: Notice of Inquiry begun

1999: June: Specific waivers were granted for 3 UWB devices:

- Time Domain (through-wall imaging)
- Zircon (“stud-finder” for rebar in concrete)
- U.S. Radar (ground penetrating radar)

2000: May: A Notice of Proposed Rule Making adopted

2002: February: The First Report and Order was adopted

2004: December: The Second Report and Order was adopted as part of which the FCC amended Part 15 rules to provide greater flexibility for introduction of new UWB devices / systems.

Latest updates and amendments will be added in the next revision of this document.

12.3 Europe

12.3.1 Initial Consultation Period

2004: March: (and later again in 2005), the European Commission (EC) mandated the Conference of European Posts & Telegraphs (CEPT) to develop technical implementation measures for the harmonised use of radio spectrum for UWB within the European Union

2005: December 24: In Europe, Draft ECC Decision ECC/DEC (06) AA was under "public consultation". A total of 67 comments were made, which were dealt with during the next meeting of the corresponding European Conference of Postal and Telecommunications Administration (CEPT) Task Group (TG3).

12.3.2 Initial Decision

12.3.2.1 Decision ECC/DEC (06)04

2006: March 24: ECC/DEC (06)04 first made

2007: July: ECC/DEC (06)04 amended

Regulatory work

2005: ECC Report 64 and Annexes: The protection requirements of Radio Communications systems below 10.6 GHz from generic UWB applications. This report included the analysis of the following aspects:

- Complementary technical studies focused on three selected coexistence scenarios (Fixed Satellite Services, outdoor Fixed Services and indoor FWA scenarios);
- An impact analysis, structured per frequency range, initially considering a mean EIRP spectral density limit of -55 dBm / MHz in the 3.1 - 10.6 GHz frequency range, taking into account possible mitigation factors in particular restriction to indoor UWB applications.

2005 / 2006 Complementary technical studies

- Review of UWB deployment scenarios, impact on outdoor FS/FSS stations…

Initial adoption of Decision ECC/DEC (06)04 March 2006 subject to further work

- Phased approach in the band 4.2 –4.8 GHz
- Power levels in the bands 2.7 –3.8 GHz (amended) and 8.5 – 9 GHz (no change)
- Installations in vehicles

Allowed UWB operation in the upper band (6 GHz to 8.5 GHz).

The main points of this decision were: -

1. that this ECC Decision defines general harmonised conditions for the use in Europe of devices using UWB technology in bands below 10.6 GHz;
2. that the devices permitted under this ECC Decision are exempt from individual licensing and operate on a non-interference, non-protected basis;
3. that this ECC decision is not applicable to:

    - flying models,
    - outdoor installations and infrastructure, including those with externally mounted antennas,
    - devices installed in road and rail vehicles, aircraft and other aviation;

4. that devices covered by the scope of this ECC Decision are not allowed to be used at a fixed outdoor location or connected to a fixed outdoor antenna;
5. that the technical requirements detailed in Annex 1 apply to devices permitted under this ECC Decision;
6. that this Decision enters into force on 24 March 2006;
1. that the preferred date for implementation of this Decision shall be 1 October 2006;
2. that CEPT administrations shall communicate the national measures implementing this Decision to the ECC Chairman and the Office when the Decision is nationally implemented.

12.3.2.2 Decision ECC / DEC (06)12

2006: December: ECC / DEC (06)12 adopted

- Specifies technical requirements for Low Duty Cycle (LDC) mitigation technique enabling operation at -41.3 dBm / MHz EIRP within the band 3.4 – 4.8 GHz

2007 / 2008: Technical Studies

- LDC mitigation technique in the band 3.1 – 3.4 GHz
- Detect And Avoid (DAA) mitigation technique in the bands 3.1 – 4.8 GHz and 8.5 – 9 GHz

2008: October: ECC / DEC (06)12 amended by ECC

Made to permit uses of the low band (3.4 GHz to 4.8 GHz) in low-activity applications for which this band is essential, a mitigation technique called *Low Duty Cycle* was defined. A device implementing low duty cycle is a UWB device as stated under the generic rules that also meets the following requirements:

Parameter	Value	Definition
T_{on} max	5 ms	T_{on} is defined as the duration of a burst irrespective of the number of pulses contained
T_{off} mean	38 ms (averaged over 1 s)	T_{off} is defined as the time interval between two consecutive bursts when the UWB emission is kept idle.
$\sum T_{off}$	> 950 ms per second	
$\sum T_{on}$	< 5% per second and 0.5% per hour	

Table 13: ECC Definition of Low Duty Cycle Operation

2006: December: Report 94 adopted

- Technical Requirements for UWB LDC Devices to ensure the protection of FWA systems

2007: February 21st EC Decision (2007/131/EC)

Consistent with the initial versions of Decisions ECC / DEC (06)04 and ECC / DEC (06)12

2008: February: ETSI EN 302 065 V1.1.1 published

Essential requirements consistent with regulatory provisions developed by ECC:

- ECC / DEC (06)04 amended July 2007
- ECC / DEC (06)12
- Also contains provisions for installations in road and rail vehicles

Additional technical requirements:-

- Minimum operational bandwidth 50 MHz
- PRF (Pulse Repetition Frequency) > 1 MHz
- Transmitter timeout

2008: June: ECC Report 120 adopted by ECC

- Technical requirements for UWB DAA (Detect And Avoid) devices to ensure the protection of Radiolocation in the bands 3.1 –3.4 GHz and 8.5 –9 GHz and BWA terminals in the band 3.4 – 4.2 GHz

Fixed outdoor installations

- Fixed outdoor UWB installations operating at -41.3 dBm / MHz EIRP are not compatible with outdoor stations from the Fixed Service cf. single interference analysis in ECC Report 64

- Prohibition on fixed outdoor installations has been maintained in recent amendments of the generic UWB regulation

- Would also limit the operation of mobile outdoor devices

2009: April: Decision 2009/343/EC adopted which: -

- Came into force June 30th 2009
- Amended 2007 rules for Generic Communications Devices
- Introduced rules for devices installed in Automotive and Railway vehicles
    - Operation at -41.3 dBm / MHz EIRP subject to the implementation of Transmit Power Control (TPC) with a range of 12 dB (max -53.3 dBm / MHz EIRP otherwise)
    - Specific restriction meant to reduce potential aggregate interference on outdoor stations from radio services (typically FS/FSS)
    - No additional requirement in case of LDC UWB devices
- Introduced rules for Building Material Analysis
- Allowed LDC in 3.1 – 4.8 GHz at -41.3 dBm / MHz for Generic Communications Devices and for Automotive and Railway Vehicles
- Allowed DAA in 3.1 – 4.8 GHz and 8.5 – 9.0 GHz at -41.3dBm / MHz for Generic Communications Devices and for Automotive and Railway Vehicles

Latest updates and amendments will be added in the next revision of this document.

12.4 Saudi Arabia

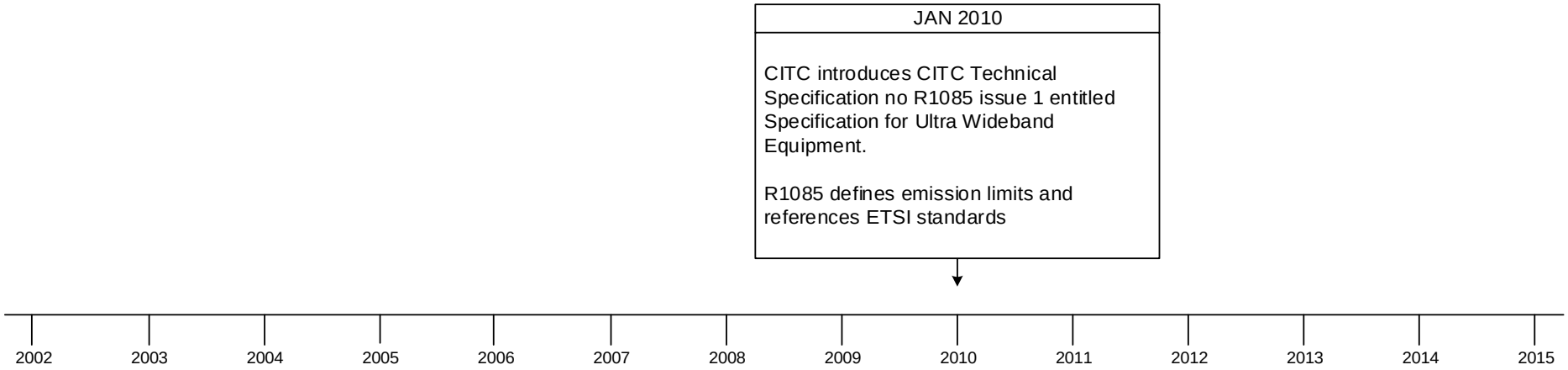


Figure 21: Chronology of UWB regulation in Saudi Arabia

12.5 Australia

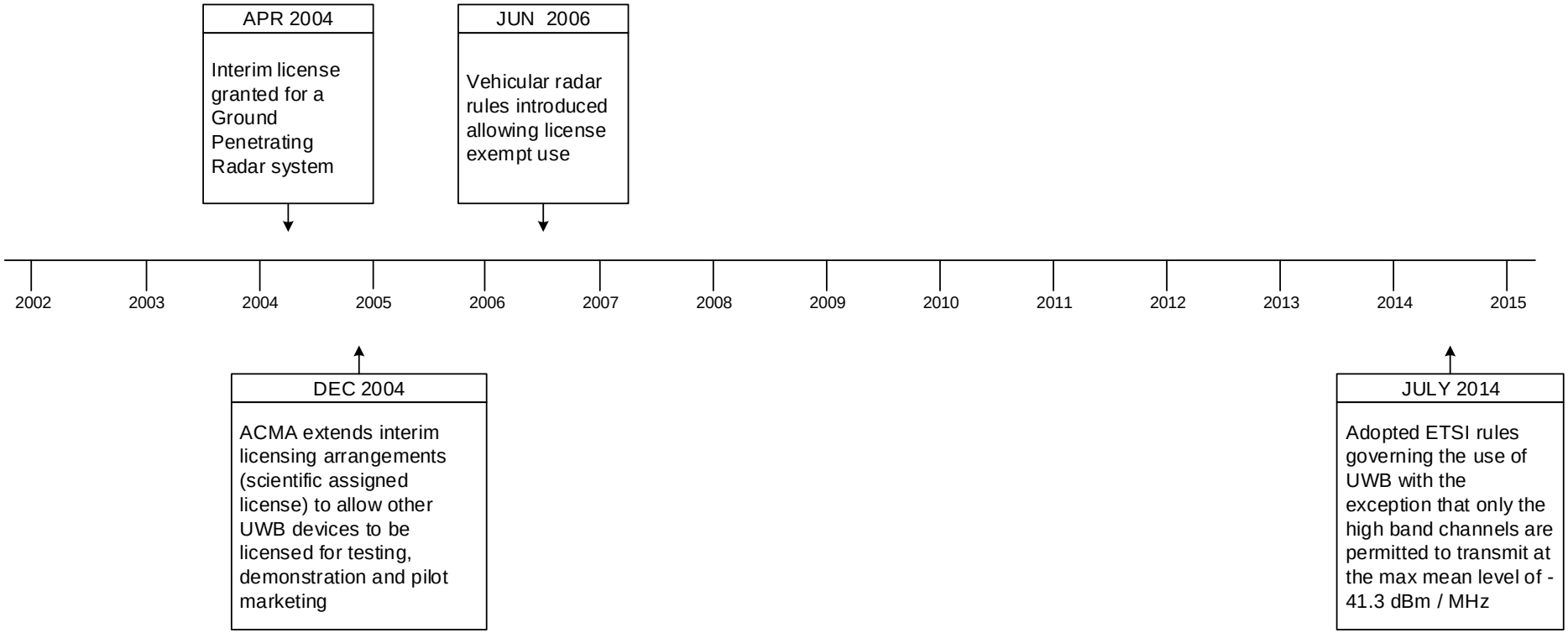


Figure 22: Chronology of UWB regulation in Australia

12.6 China

2009: UWB regulations adopted

12.7 Hong Kong

2005: May: OFTA announced the release of the 3.1 GHz to 10.6 GHz band for technical UWB trials.

- 3.2 GHz – 10.6 GHz assigned for indoor trials
- 4.1 GHz to 10.6 GHz assigned for outdoor trials
- Permitted EIRP density is relaxed by 8.3 dB relative to FCC UWB masks

2009: March: Consultation paper issued with a draft emission mask similar to the European 2006 mask.

12.8 Japan

2004: March: Interim Report Summary published

Produced interference study on compatibility between UWB and other radio systems – e.g. minimum separation distances

2005: October: Draft report published on the licensing of UWB systems

Unlicensed use is permitted at the 3.4 - 4.8 GHz and 7.25 - 10.25 GHz wireless spectrums, the latter of which is reserved for indoor products only. Products using the lower 3.4 - 4.8 GHz spectrum will be required to implement Detect And Avoid (DAA) technologies to avoid interference with other UWB products operating at the same frequencies.

The Ministry intends to finish its cogitation and testing by the end of the year, allowing developers to bring their products to the market in a timely fashion.

2006: January:

The Information and Communications Technology Sub-Council of the Telecommunications Council of MIC held the sixth UWB Radio Systems Committee on January 31, 2006 and compiled the final report on the allowed output values for UWB system. The major change from the draft published in October 2005 is as follows: Until December 31, 2008, devices with UWB system operating on the frequency between 4.2 and 4.8 GHz may be sold even without DAA function. An MIC source has told it is a "temporary measure" for permitting the products to be sold before DAA function is completely developed.

The plan was based on the report submitted by MIC at the ITU-R meeting held in October 2005. It determines an extension period up to the end of 2008 in which the use of devices without Detect and Avoid (DAA) function across a certain bandwidth is allowed. MIC invited public comments in order to publish a report by the end of March 2006

Further, the final report includes the following requirements to make UWB feasible in combination with other radio communication systems:

- Its application area is limited to indoors
- An AC power supply unit must be connected where the device works as a host in USB
- Use in aircrafts and vessels, and applications to toys and games are prohibited
- Technical requirements are to be revised when the actual usage status, e.g., user population density and usage occasions of the UWB system is varied significantly
- Validity of DAA must be confirmed through field experiments based on the official agreement
- Technical requirements are to be revised when UWB system causes radio disturbance to the existing radio systems.

2006: March: Ministry of Internal Affairs and Communication (MIC) authorized the regulations for indoor UWB devices. At that time use of UWB outdoors and inside automobiles was being investigated.

The average transmission power is limited to -41.3 dBm / MHz or lower (the peak value is set to 0 dBm / 50 MHz or lower) on both bands. As for the devices without an interference technology that uses the 3.4-4.8 GHz band, however, the average transmission power is limited to -70 dBm / MHz or lower (the peak value is set to -30 dBm / 50MHz or lower). Communication and modulation methods are not specified. Transmission speed of 50 Mbps or higher is required for the radio equipment, although lower speeds are permitted in order to avoid interference of noise.

Commenting on the future plans, an official of Japan's Ministry of Internal Affairs and Communications explains as follows. "First, we will promote discussions to define the interference reduction technology. Then, we will discuss approval of sensor applications, for example, distance measurement. Although the latest announcement was limited to the approval of indoor usage, outdoor usage must also be discussed. In addition, we plan to set up a working group to discuss regulations on the 24 GHz band for use in automotive radars."

2008: August: Rules amended

Latest updates will be added in the next revision of this document.

12.9 Korea

2006: Authorised indoor and outdoor UWB communications devices on a license exempt basis subject to emission limits shown in section 7.9

12.10 New Zealand

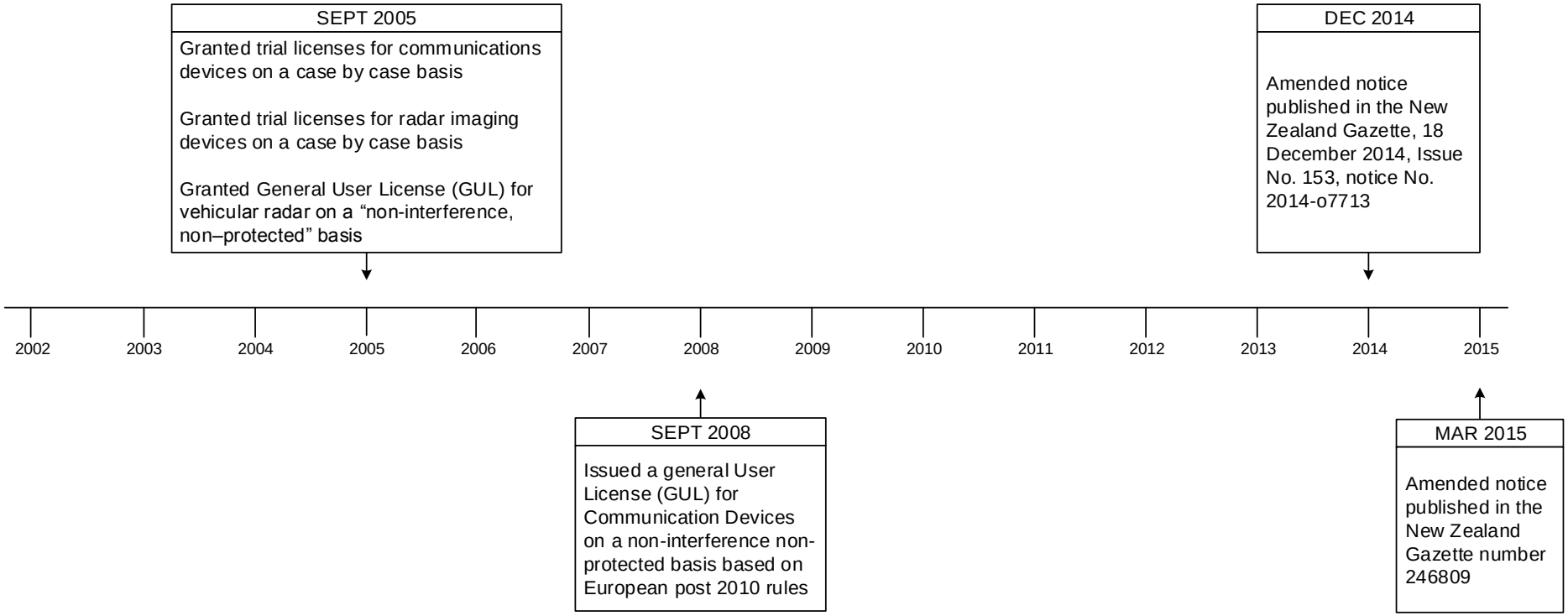


Figure 23: Chronology of UWB regulation in New Zealand

12.11 Singapore

2007: December: Technical Specification for Ultra Wideband devices published