Decawave

APR001

UWB Regulations

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

Version 1.2

This document is subject to change without notice

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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.

1.2 This document

1.2.1 About

This document is one of three application notes on ultra-wideband (UWB) regulations.
APR002 [1] and APR003 [2] focus on America (FCC) and Europe (ETSI) respectively

1.2.2 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.

Information in this document has also been contributed to ETSI Technical Report ETSI TR 103 181-3 [30], which is available from http://www.etsi.org/

1.2.3 Structure

This document is structured into sections as follows: -

Section No	Section Title	Description
1	Introduction	This section
2	UWB Worldwide regulations summary	Presents a summary and current status of the regulatory situation per region in tabular form

Section No	Section Title	Description
3	Current status of UWB regulations and regulatory bodies including contact details	The current known status of UWB regulations per region.
4	References	Lists the references used in this document
5	Document History	Details the history of this document
6	Major Changes	Outlines the changes between revisions of this document
7	Further Information	

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 802.15.4 (2015) 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. For more information see [3]

    - 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 1: Colour Legend

Table Colour	What does this mean?
	Specific UWB regulations exist in the named jurisdiction
	Specific UWB regulations do not exist in the named jurisdiction. Either: • the regulatory regime remains to be clarified; or • the regulations that most typically apply (usually FCC or ETSI) are listed

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 2: Heading Legend

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. 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
e.i.r.p. (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 clause in the present document

2.2 Europe, Middle East & Africa (EMEA)

2.2.1 Europe

A short overview is given in table 3, for more details please check, section 7.4 and ETSI TR 103 181-3 V2.0.3 (2018-04).

Table 3: Europe regulations

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	Max mean e.i.r.p. (dBm / MHz)	Emission Profile
1	Albania	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
2	Andorra	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 9,0	Y	-41,3	ETSI Sec 3.4
3	Austria	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
4	Belarus	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 9,0	Y	-41,3	ETSI Sec 3.4
5	Belgium	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
6	Bosnia & Herzegovina	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
7	Bulgaria	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
8	Canary Islands	Y	Telecoms matters overseen by government of Spain	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
9	Croatia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	Max mean e.i.r.p. (dBm / MHz)	Emission Profile
10	Cyprus	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
11	Czech Republic	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
12	Denmark	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
13	Estonia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
14	Finland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note 1) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
15	France	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
16	Germany	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
17	Gibraltar	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
18	Greece	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
19	Hungary	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
20	Iceland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
21	Ireland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
22	Italy	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5	Y	-41,3	ETSI Sec 3.4

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	Max mean e.i.r.p. (dBm / MHz)	Emission Profile
				8,5 - 9,0 (see note)			
23	Latvia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
24	Lithuania	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
25	Luxembourg	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
26	Macedonia	N	TBC	TBC			
27	Malta	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
28	Moldova	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
29	Monaco	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
30	Montenegro	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
31	Netherlands	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
32	Norway	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
33	Poland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
34	Portugal	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
35	Romania	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4

	Country	Do specific UWB regs exist?	What is the regulatory regime?	What frequency range is permitted (GHz)?	Do these regs permit outdoor use?	Max mean e.i.r.p. (dBm / MHz)	Emission Profile
36	Russia	Y	Has implemented ECC Rec 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)	ETSI Sec 3.4
37	San Marino	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
38	Serbia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
39	Slovakia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
40	Slovenia	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
41	Spain	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
42	Sweden	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
43	Switzerland	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
44	Turkey	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
45	United Kingdom	Y	ECC Rec 70-03 / ECC Decision 06(04) / ETSI EN 302 065	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
46	Ukraine	N	ECC Rec 70-03 under consideration but not yet adopted	TBC			

NOTE: Mitigation techniques required.

[1]Mitigation techniques required

2.2.2 Middle East

Table 4: 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
47	Bahrain	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
49	Iran	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
49	Iraq	N	TBC	TBC			
50	Israel	N	Generally, will approve ETSI compliant equipment where compatible with national band plan. Confusion exists over the approval status of UWB equipment. There are rumours that the low band is being allocated for UWB trials.	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
51	Jordan	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
52	Kuwait	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
53	Lebanon	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
54	Oman	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
55	Qatar	Y	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
56	Saudi Arabia	Y	National frequency allocation plan refers to EN 302 065	6,0 - 8,5	Y	-41,3	Sec 3.5

	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
57	Syria	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
58	UAE	Y	TRA Regulations for Ultra-Wideband and short-range devices	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
59	Yemen	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
NOTE: Mitigation techniques required.							

2.2.3 Africa

Table 5: 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
60	Algeria	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
61	Angola	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
62	Benin	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
63	Burkina Faso	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2

	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
64	Cameroon	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
65	Cape Verde	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
66	Central African Republic	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
67	Chad	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
68	Democratic Republic of the Congo	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
69	Djibouti	N	TBC	TBC			
70	Egypt	N	TBC	TBC			
71	Ethiopia	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
72	Gabon	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
73	Gambia	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
74	Ghana	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
75	Guinea-Bissau	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
76	Ivory Coast	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
77	Kenya	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4	Y	-41,3	ETSI Sec 3.4

	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
78	Lesotho	N	Generally, will approve equipment approved for use in South Africa	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
79	Liberia	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
80	Libya	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
81	Madagascar	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
82	Malawi	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
83	Mali	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
84	Mauritius	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
85	Morocco	N	TBC	TBC			
86	Mozambique	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
87	Namibia	N	Generally, will approve either ETSI or FCC compliant equipment	FCC section 7 Section 7	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
88	Niger	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
89	Nigeria	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
90	Rwanda	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2

	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
91	Senegal	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
92	Sierra Leone	N	Generally, will approve either ETSI or FCC compliant equipment	3,1 - 9,0	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
93	Somalia	N	TBC	TBC			
94	South Africa	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
95	Sudan	N	TBC	TBC			
96	Swaziland	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
97	Tanzania	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
98	Togo	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
99	Tunisia	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
100	Uganda	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
101	Zambia	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
102	Zimbabwe	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2

NOTE: Mitigation techniques required.

2.3 Asia Pacific (APAC)

Table 6: 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
103	Afghanistan	N	TBC	TBC			
104	Armenia	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
105	Australia	Y	Radio Communications (Low Interference Potential Devices) Class Licence 2000 as modified July 2014	3,4 – 4,8 6,0 – 8,4	Y	-41,3	Sec 3.6
106	Azerbaijan	N	TBC	TBC			
107	Bangladesh	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
108	Brunei	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
109	Cambodia	N	TBC	TBC			
110	China	Y	MIIT Wireless File 354 (2008)	6.0 - 9.0	Y	-41	Sec 3.6
111	Cook Islands	N	TBC	TBC			
112	Fiji	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
113	French Polynesia	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
114	Georgia		TBC	TBC			
115	Guam	Y	Territory of the USA	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
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 compliant equipment where compatible with national band plan	3,4 - 4,2 (see note) 4,2 - 4,8 6,0 - 8,5 (proposed)	TBC	-41,3 (proposed)	Sec 3.6

#	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
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 compliant equipment where compatible with national band plan	6,0 - 7,25 (proposed)	TBC	-41 (proposed)	Sec 3.6
118	Japan	Y	ARIB STD-T91 Ver. 2.0 2015	3,4 - 4,8 (see note) 7,25 - 10,25	N	-41,3	Sec 3.6
119	Kazakhstan	N	Generally, will approve ETSI compliant equipment where compatible with national band plan	3,1 - 9,0	Y	-41,3	ETSI Sec 3.4
120	Korea, North	N	TBC	TBC			
121	Korea, South	Y	Korean Communications Commission Republic of Korea	3,735 - 4,8 (see note) 7,2 - 10,2	Y	-41,3	Sec 3.6
122	Kyrgyzstan	N	TBC	TBC			
123	Laos	N	TBC	TBC			
124	Macau	N	TBC	TBC			
125	Malaysia	Y	SKMM SRSP-549 UWB, 5th December 2013 Refers to ETSI EN 302 065, ETSI EN 302 066-1 and Recommendation ITU R SM.1754	6,0 - 8,5	Y	-41,3	Sec 3.6
126	Myanmar	N	Generally, will approve either ETSI or FCC compliant equipment where compatible with national band plan	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
127	Nepal	N	TBC	TBC			
128	New Caledonia	Y	Telecoms matters overseen by government of France	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
129	New Zealand	Y	New Zealand Gazette, 2/2/2017. Refers to ETSI EN 302 065	2.7 – 4.8 (see note) 6.0 - 8.5	Y	-41,3	Sec 3.6
130	Pakistan	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
131	Papua New Guinea	N	Generally, will approve FCC compliant equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2

#	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
132	Philippines	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
133	Reunion	Y	Telecoms matters overseen by government of France	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
134	Samoa (Independent State of)	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
135	Singapore	Y	IDA TS UWB Issue 1 Rev 1, May 2011. Refers to ETSI EN 302 500 and ETSI EN 302 065	3,4 - 4,2 (see note) 4,2 - 4,8 6,0 - 8,5	Y	-41,3	Sec 3.6
136	Sri Lanka	N	TBC	TBC			
137	Thailand	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
138	Turkmenistan	N	TBC	TBC			
139	Uzbekistan	N	TBC	TBC			
140	Vietnam	Y	Circular 46/2016/TT-BTTTT from MIC Vietnam	6,0 – 8,5	N	-41,3	Sec 3.6

NOTE: Mitigation techniques required.

2.4 North America

Table 7: 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
141	Antigua & Barbuda	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
142	Aruba	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
143	Bahamas	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
144	Barbados	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
145	Bermuda	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
146	British Virgin Islands	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
147	Canada	Y	Industry Canada RSS-220 specification.	4,75 - 10,6	Y	-41,3	Sec 3.1
148	Cayman Islands	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	FCC Sec 3.2 ETSI Sec 3.4
149	Costa Rica	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
150	Cuba	N	TBC	TBC			
151	Curacao	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
152	Dominica	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
153	Dominican Republic	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
154	El Salvador	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	FCC Sec 3.2
155	Grenada	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	FCC Sec 3.2
156	Guadeloupe	Y	Telecoms matters overseen by government of France	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4

#	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
157	Guatemala	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	FCC Sec 3.2 ETSI Sec 3.4
158	Haiti	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	Section 7
159	Honduras	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	Section 7
160	Martinique	Y	Telecoms matters overseen by government of France	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
161	Jamaica	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
162	Mexico	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
163	Nicaragua	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2 ETSI Sec 3.4
164	Panama	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	FCC Sec 3.2 ETSI Sec 3.4
165	St Kitts & Nevis	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	FCC Sec 3.2 ETSI Sec 3.4
166	St Lucia	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	FCC Sec 3.2 ETSI Sec 3.4
167	St Vincent & the Grenadines	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	FCC Sec 3.2 ETSI Sec 3.4
168	Trinidad & Tobago	N	Generally, will approve FCC certified equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
169	USA	Y	FCC CFR 47 Part 15	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
170	US Virgin Islands	Y	Telecoms matters overseen by government of USA	3,1 - 10,6	Y	-41,3	FCC Sec 3.2

2.5 South America

Table 8: 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
171	Argentina	N	TBC	TBC			
172	Bolivia	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
173	Brazil	Y	Anatel Act No. 11542 of August 23, 2017	3,1 – 10,6	Y	-41,3	See Sec 3.3
174	Chile	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
175	Colombia	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
176	Ecuador	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
177	Falkland Islands	N	Generally, will approve ETSI compliant equipment	3,1 - 4,8 (see note) 6,0 - 8,5 8,5 - 9,0 (see note)	Y	-41,3	ETSI Sec 3.4
178	Guyana	N	Generally, will approve FCC compliant equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
179	Paraguay	N	Generally, will approve FCC compliant equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
180	Peru	N	Generally, will approve either ETSI or FCC compliant equipment	ETSI Sec 3.4 FCC Sec 3.2	Y	-41,3	ETSI Sec 3.4 FCC Sec 3.2
181	Uruguay	N	Generally, will approve FCC compliant equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2
182	Venezuela	N	Generally, will approve FCC compliant equipment	3,1 - 10,6	Y	-41,3	FCC Sec 3.2

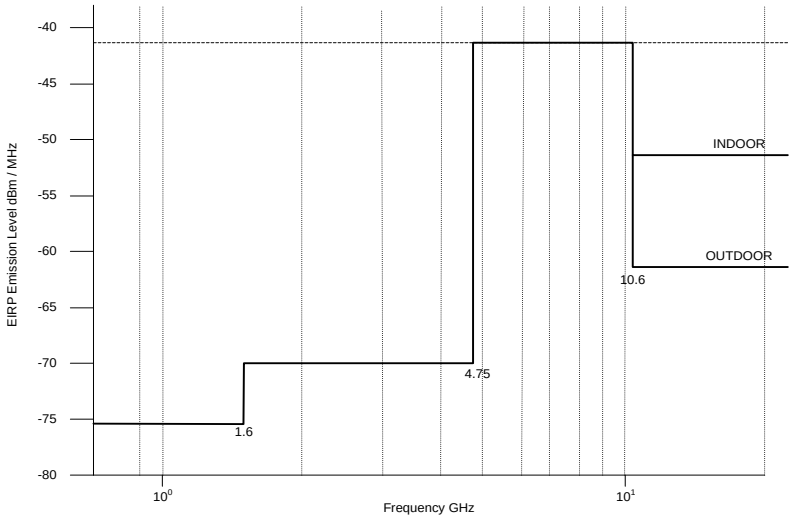
3 CURRENT STATUS OF UWB REGULATION, REGULATORY BODIES AND CONTACT DETAILS

3.1 Canada

Note: The latest information in relation to Canada regulations may be found here: https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09347.html

A searchable database exists here: https://sms-sgs.ic.gc.ca/equipmentSearch/searchRadioEquipments?execution=e2s1

You can search for all UWB devices by selecting RS-220 from the dropdown for Radio Specification under “Advanced search”

Item	Description
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)

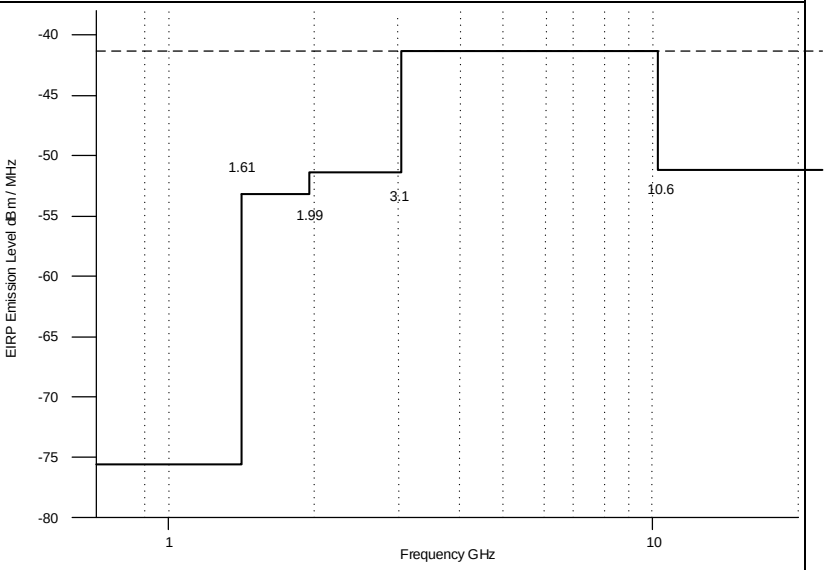
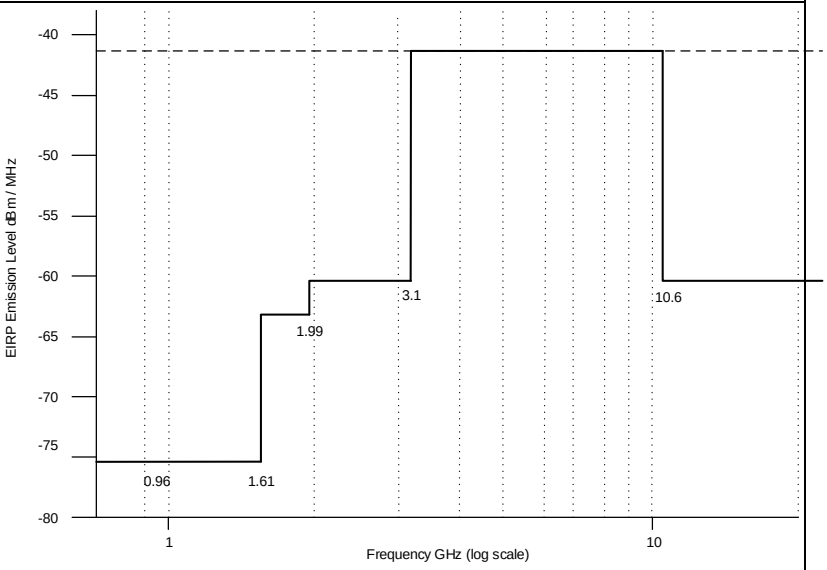
3.2 USA

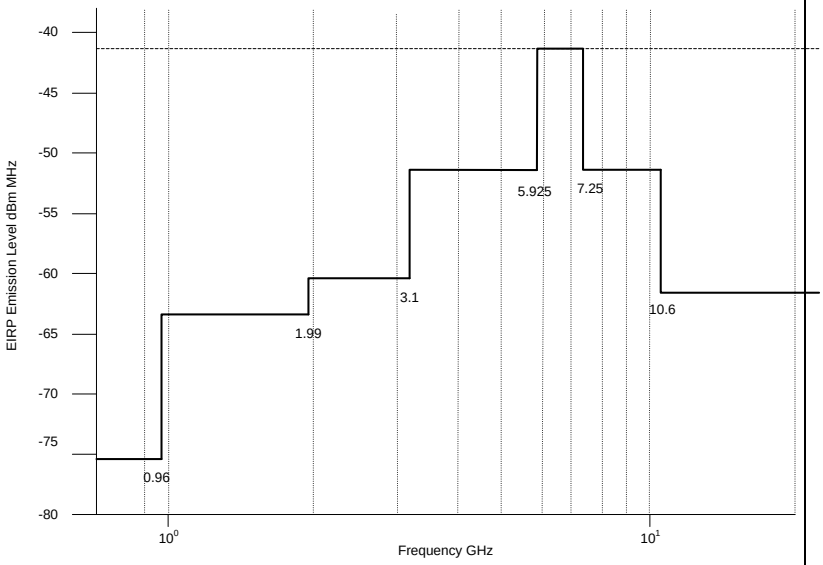
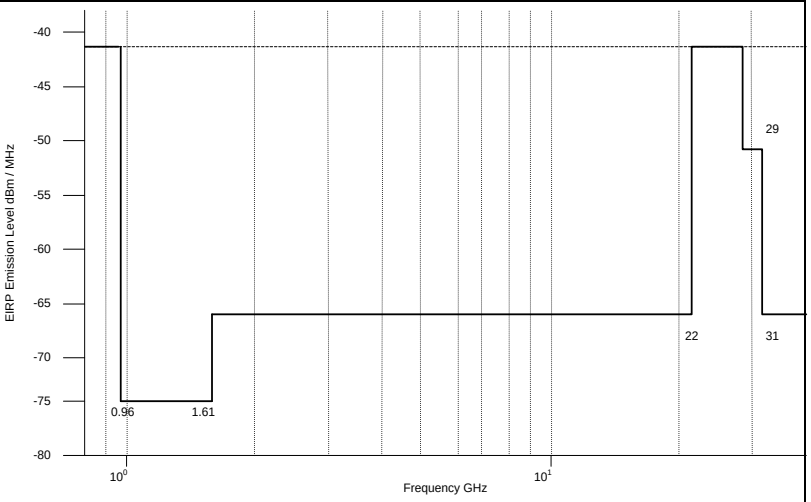
Note: The latest information in relation to FCC UWB regulations may be found here http://www.ecfr.gov/

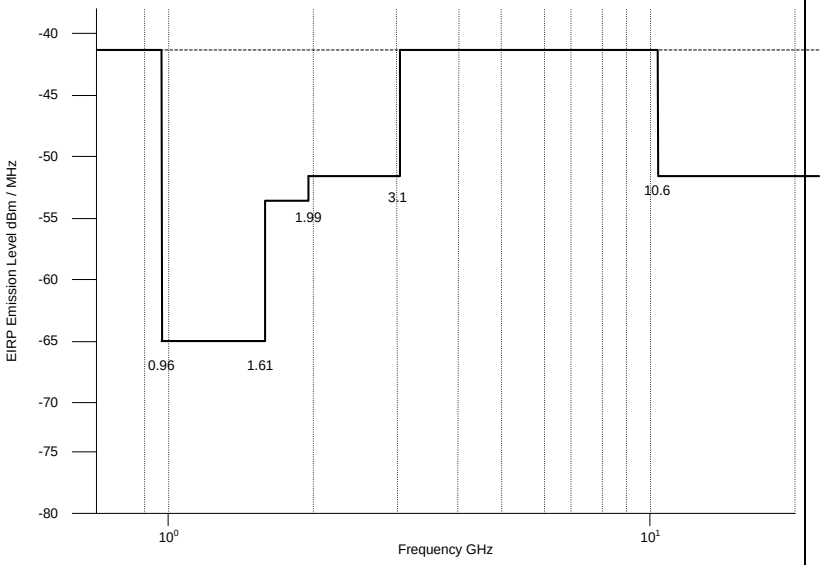
You can "search" the FCC database via this link:
https://apps.fcc.gov/oetcf/eas/reports/GenericSearch.cfm

Search for both "UWB-Ultrawideband transmitter" (parts 15.517 and 15.519 at 3.1-10.6GHz) and "WBT-wideband transmitter" (part 15.250 at ~6.5GHz) under "Equipment Class" to see all of the approved products from our customers. Also, at the bottom of the search screen, I suggest you use "html" and select 500 records to see them all for each class. One the list pops up you can click on the header for "final action date" to see newest to oldest

Item	Description
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.

3.3 South America

3.3.1 Argentina

Item	Description
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	https://www.enacom.gob.ar/
Do UWB regulations exist?	TBD
Specific regulations	TBD

Item	Description
Notes	TBD

3.3.2 Bolivia

Item	Description
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 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

3.3.3 Brazil

Item	Description
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	YES
UWB Definition	Intentional emissions with fractional bandwidth greater than or equal to 20%, or a bandwidth measured between the points of 10 dB of the carrier wave peak, greater than or equal to 500 MHz, regardless of the fractional bandwidth.
Specific regulations	• Portable devices • Indoor communications • Medical imaging systems For limits see Table 9

Table 9: Special regulations limits - Brazil

Radio frequency band	Operational Restrictions	Power or Field Strength Limit in the Operating Band	Power or Field Strength Limit for Out of Band and Spurious Emissions
3100 - 10,600 MHz.	Medical imaging systems	1) 0 dBm [1]; and 2) −41.3 dBm [2]	1) Table 18 (below 960 MHz); 2) -53,3 dBm [2] (between 960 and 1164 MHz); 3) -75,3 dBm [2] (between 1164 and 1240 MHz); 4) -53,3 dBm [2] (between 1240 and 1559 MHz); 5) -75,3 dBm [2] (between 1559 and 1610 MHz); 6) -51,3 dBm [2] (Above 1610MHz)
3100 - 10,600 MHz.	Restricted to indoor use in buildings	1) 0 dBm [1]; and 2) −41.3 dBm [2]	1) Table18 (below 960 MHz); 2) -75,3 dBm [2] (between 960 and 1164 MHz); 3) -85,3 dBm [2] (between 1164 and 1240 MHz); 4) -75,3 dBm [2] (between 1240 and 1559 MHz); 5) -85,3 dBm [2] (between 1559 and 1610 MHz); 6) -53,3 dBm [2] (1610-1990 MHz); and 7) 7) -51,3 dBm [2] (Above 1990 MHz)
3100 - 10,600 MHz.	Portable devices [3]	1) 0 dBm [1]; and 2) −41.3 dBm [2]	1) Table 18 (below 960 MHz); 2) -75,3 dBm [2] (between 960 and 1164 MHz); 3) -85,3 dBm [2] (between 1164 and 1240 MHz); 4) -75,3 dBm [2] (between 1240 and 1559 MHz); 5) -85,3 dBm [2] (between 1559 and 1610 MHz); 6) -63,3 dBm [2] (1610-1990); and 7) -61,3 dBm [2] (Above 1990)

Notes:

[1]: Peak EIRP limit measured with 50 MHz resolution bandwidth centred on the frequency that has the greatest radiated emission. It is acceptable to use a different resolution bandwidth, in which case the EIRP limit shall be 20 log(RBW/50) dBm where RBW is the used resolution bandwidth in MHz.

[2]: Average EIRP limit measured using 1 MHz resolution bandwidth.

[3]: A relatively small device that can be handheld whilst being operated and does not use fixed infrastructure. These devices can operate both indoors and outdoors.

Other emissions shall not exceed the values stated in Table 10 below:

Table 10: Other and spurious limits - Brazil

Radio Frequency Band (MHz, unless stated otherwise)	Field Strength (microvolt per metre)	Measurement Distance (metre)
9-490 kHz	2.400/*f*(kHz)	300
490-1705 kHz	24.000/*f*(kHz)	30
1,705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
The field strength of any spurious emissions or harmonics shall not exceed the value of the fundamental frequency emission. At the transition frequencies in Table II, the most restrictive field strength limit shall apply.		

3.3.4 Chile

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

3.3.5 Colombia

Item	Description
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

Item	Description
Specific regulations	None
Notes	Generally, will approve either ETSI or FCC compliant equipment

3.3.6 Ecuador

Item	Description
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

3.3.7 Guyana

Item	Description
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

3.3.8 Paraguay

Item	Description
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

3.3.9 Peru

Item	Description
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

3.3.10 Uruguay

Item	Description
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

3.3.11 Venezuela

Item	Description
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
Web	http://www.conatel.gov.ve
Do UWB regulations exist?	No

Item	Description
Specific regulations	None
Notes	Generally, will approve FCC compliant equipment

3.4 Europe

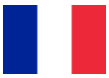
3.4.1 European Union

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.

Regulatory Authority: European Commission and CEPT/ECC
Standards Authority: ETSI

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
Denmark		Y	Y	National IT and Telecom Agency	www.en.itst.dk
Estonia		Y	Y	Technical Surveillance Authority	www.tja.ee

Regulatory Bodies – National					
Country		**EU Member State**	**CEPT Member**	**Regulatory Body**	**Web**
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 and services, republic of Slovenia	www.akos-rs.si/akos-ang

Regulatory Bodies – National					
Country		**EU Member State**	**CEPT Member**	**Regulatory Body**	**Web**
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

3.4.2 Applications

- Communications
- Locations Tracking
- Road and rail vehicles
- Ground probing radar
- On-board aircraft

For more information please see ETSI TR 103 181-1.

3.4.3 Requirements

3.4.3.1 Communication devices

Regulations are defined in ETSI EN 302 065-1.
Applies to fixed (indoor only), mobile or portable applications.

3.4.3.2 Location tracking devices

Regulations are defined in ETSI EN 302 065-2.

Three different types of location tracking system are defined:

- LT1 systems: These systems, operating in the 6 GHz to 9 GHz region, are intended for general location tracking of people and objects. They operate on an unlicensed basis. The transmitting terminals in these systems are mobile (indoors or outdoors), or fixed (indoors only). Fixed outdoor LT1 transmitters are not permitted. Typically, LT1 transmitters are mobile location tracking tags which are attached to people or objects, and tags are tracked using a fixed receiver infrastructure to only receive the UWB emission emitted by the tags.
- LT2 systems: These systems, operating in the 3,1 GHz to 4,8 GHz region, are intended for person and object tracking and industrial applications at well-defined locations. The transmitting terminals in these systems may be located indoors or outdoors, and may be fixed or mobile. They operate at fixed sites and may be subject to registration and authorization, provided local coordination with possible interference victims has been performed.
- LAES systems: These systems, operating in the 3,1 GHz to 4,8 GHz region, are intended for tracking staff belonging to the fire and other emergency services, who need to work in dangerous situations. Being able to track such people, even when deep inside a building, provides an important enhancement to command and control and to their personal safety. Typically, an LAES system is deployed temporarily at the scene of a fire or other emergency in a building. Licences may be required for user organization.

Table 11: Operating frequency bands per system type under ETSI EN 302 065-2- Europe

System type	Mode	Frequency band
LT1	Transmit	6,0 - 9,0 GHz
	Receive	6,0 - 9,0 GHz
LT2	Transmit	3,1 - 4,8 GHz
	Receive	3,1 - 4,8 GHz
LAES	Transmit	3,1 - 4,8 GHz
	Receive	3,1 - 4,8 GHz

3.4.3.3 Road & Rail mounted devices

Regulations are defined in ETSI EN 302 065-3.

3.4.4 On-board aircraft

Regulations are defined in ETSI EN 302 065-5.

3.4.5 Mitigation Techniques

3.4.5.1 General

Various techniques are described:

- Low Duty Cycle (LDC)
- Detect and Avoid (DAA)

Additional mitigation techniques used and implemented in CEPT/ECC and EC are described in more detail in ETSI TR 103 181-2.

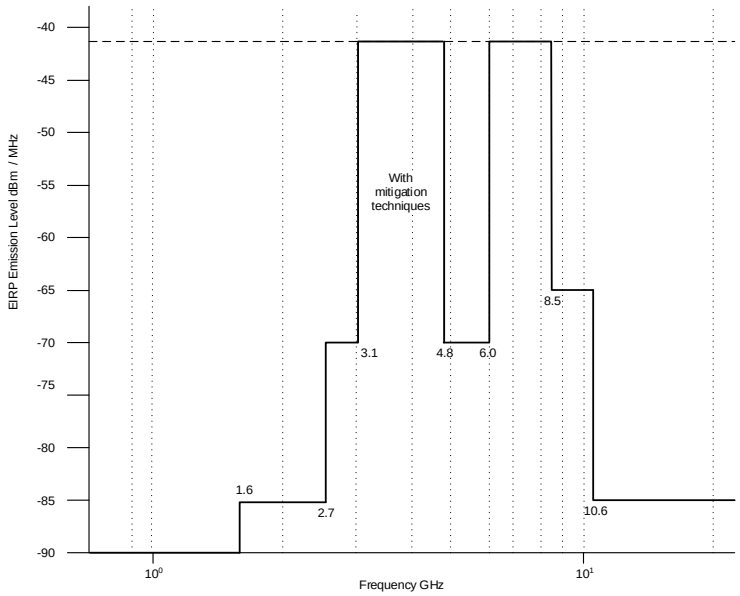
3.4.5.2 Low Duty Cycle (LDC)

Table 12: Low Duty Cycle baseline limits

Parameter	Symbol	Limit
Max transmitter on time	$T_{on\ max}$	5 ms
Mean transmitter off time	$T_{off\ mean}$	≥ 38 ms (averaged over 1 s)
Sum transmitter off time	ΣT_{off}	> 950 ms per second
Sum transmitter on time	ΣT_{on}	< 18 s per hour

3.4.5.3 Detect and Avoid (DAA)

Before transmitting, a system should sense the channel within its operative bandwidth in order to detect the possible presence of other systems. If another system is detected, the first system should avoid transmission until the detected system disappears.

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.

3.4.6 Other European Countries

3.4.6.1 Russia

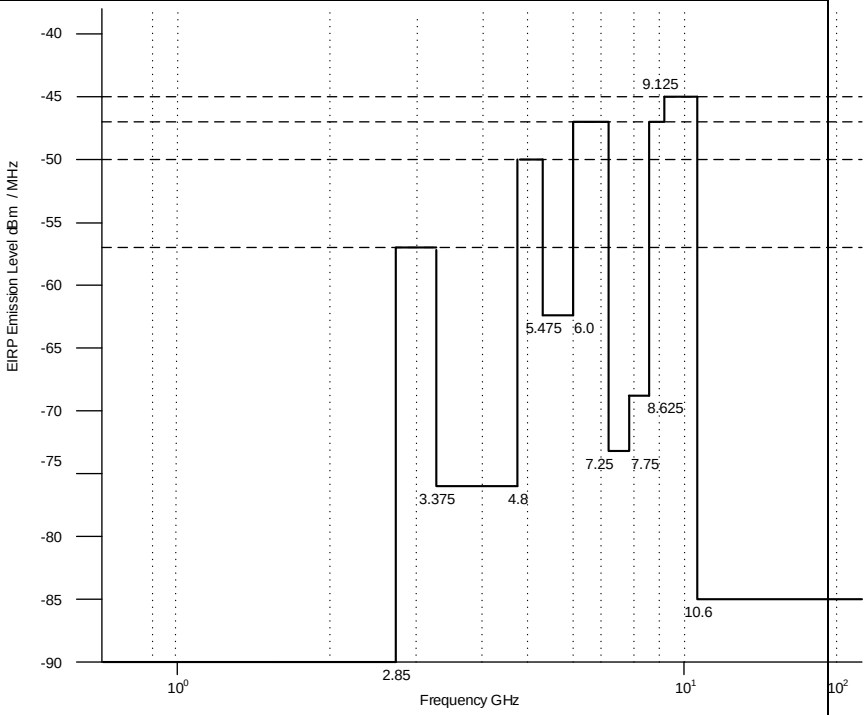
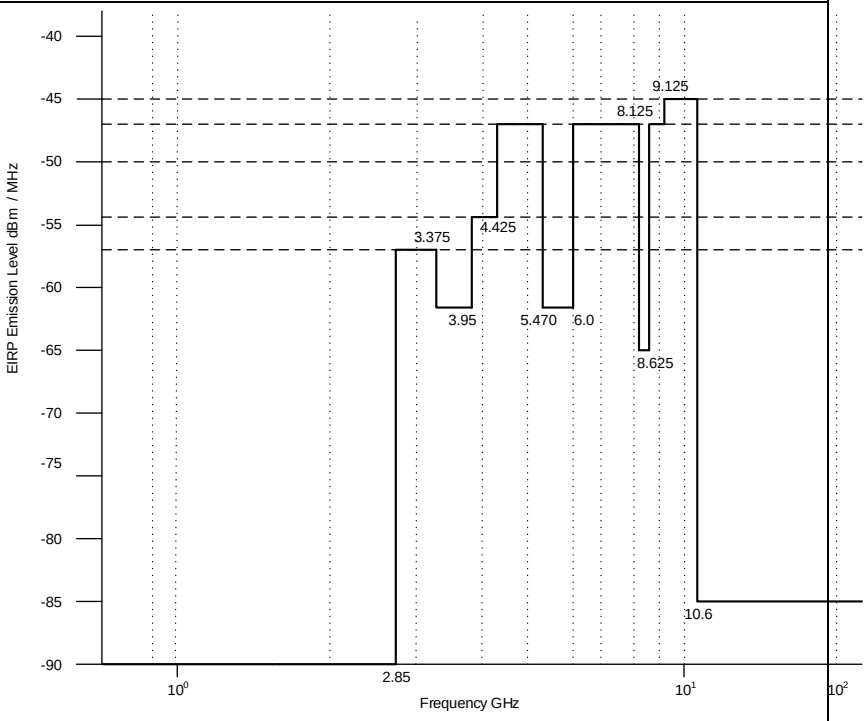
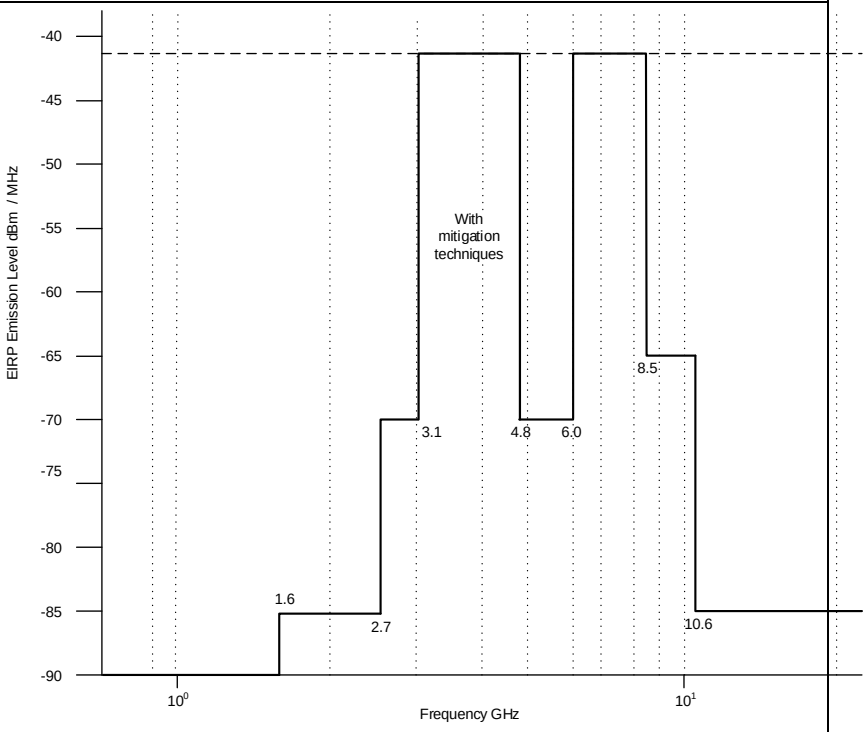
Item	Description
Regulatory Body	General Radio Frequency Centre (GRFC)
Location	As below
Postal Address	7, Tverskaya Street 125375 Moscow Russian Federation
Phone	+7 095 771 84 00
Web	http://www.gov.ru/
Do UWB regulations exist?	Yes
Specific regulations	Addendum to the GRFC decision from December 15, 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.

3.4.6.2 Switzerland

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

Item	Description
Max Mean Emission Limits	 **Figure 10: Max mean emission limits – Switzerland**

3.5 Middle East

3.5.1 Bahrain

Item	Description
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

3.5.2 Iran

Item	Description
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

3.5.3 Iraq

Item	Description
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

3.5.4 Israel

Item	Description
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.

3.5.5 Jordan

Item	Description
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).

Item	Description
	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

3.5.6 Lebanon

Item	Description
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

3.5.7 Qatar

Item	Description
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?	Yes
Specific regulations	Yes
Notes	Generic UWB devices shall comply with EN 302 065 -1

3.5.8 Saudi Arabia

Item	Description
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.

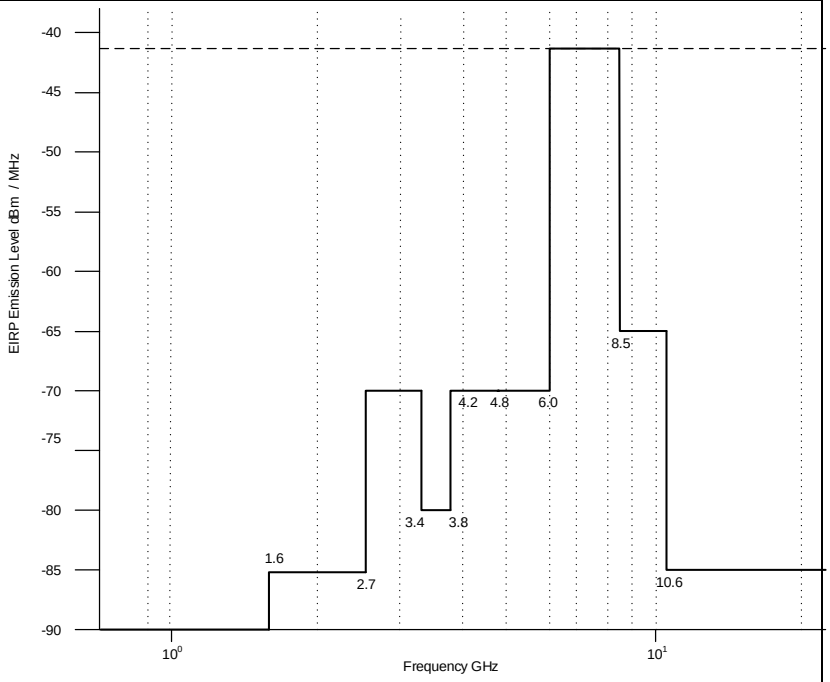
Item	Description
Phone	+966 1 4618000
Web	http://www.citc.gov.sa
Do UWB regulations exist?	Yes
Specific regulations	CITC R1085 Issue 1 10/01/2010. See [23].
Max Mean Emission Limits Emission limits are the same as those specified in the original ETSI EN 302 065 with the exception that only the high band 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 12 are specifically referenced in the CITC R1085 document.

Table 13: ETSI standards specially 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]

3.5.9 Syria

Item	Description
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

3.5.10 UAE

Item	Description
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?	Yes
Specific regulations	None
Notes	Generally, will approve ETSI certified equipment

3.5.11 Yemen

Item	Description
Regulatory Body	The Ministry of Telecommunications and Information Technology
Location	Sanaa, Yemen
Postal Address	NA
Phone	+967 1 331456
Web	www.mtit.gov.ye
Do UWB regulations exist?	No
Specific regulations	None
Notes	Generally, will approve ETSI certified equipment

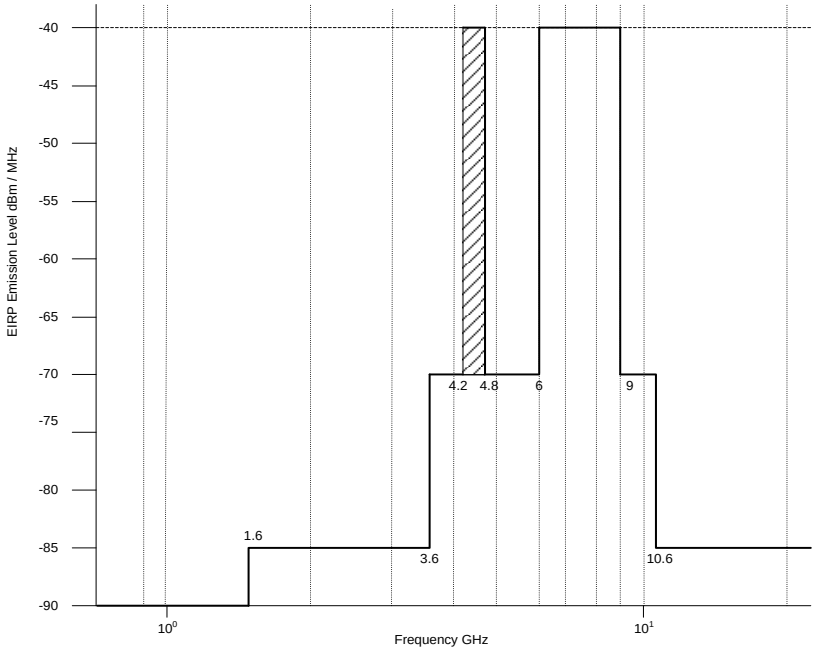
3.6 Asia Pacific

3.6.1 Australia

Item	Description
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	• Communications. • Short range vehicle radar. • In-ground UWB sensors. • Building material analysis devices. Generic UWB transmitters can operate between 3,4 – 4,8 and 6,0 – 8,5 GHz and must comply with EN 302 065 or EN 302 500. In-ground UWB transmitters are restricted to -62 dBm/MHz between 4,2 – 4,8 and 6,0 – 6,8 GHz. Building material analysis transmitters can operate in the 2,2 – 8,5 GHz range and must comply with EN 302 435.
Notes	For generic UWB transmitters: - a) The transmitter must comply with either: (i) ETSI Standard EN 302 500; or (ii) ETSI Standard EN 302 065. b) The transmitter must not be operated on board any aircraft or from any fixed outdoor location. c) The transmitter must not be operated in the 3425-3575 MHz band before 14 December 2015. d) The transmitter must not be operated within a nominated distance of a specified Australian radio-astronomy site. e) The transmitter must not be operated in the 8400–8500 MHz band within the nominated distance of a specified SRS earth station. For in-ground UWB transmitters: - a) The transmitter must comply with Part 2 of ETSI Standard EN 302 065. b) The transmitter must not be operated within a nominated distance of a specified Australian radio-astronomy site For building material analysis transmitters: - a) The transmitter must comply with ETSI Standard EN 302 435.

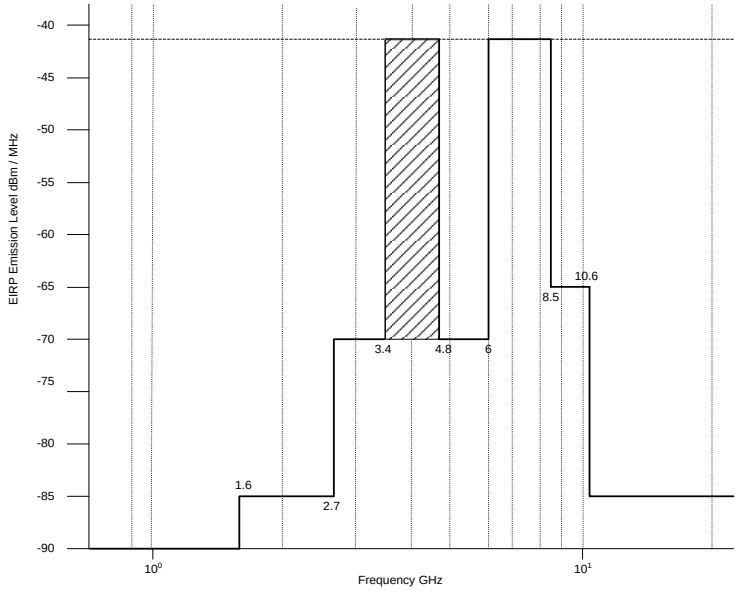
Item	Description
	b) The transmitter must be operated in a position such that emissions are directed into building material. c) The transmitter must not be operated within a nominated distance of a specified Australian radio-astronomy site. d) The transmitter must not be operated in the 8400–8500 MHz band within the nominated distance of a specified SRS earth station. Restricted sites are listed at https://www.acma.gov.au/Industry/Spectrum/Radiocomms-licensing/Class-licences/lipd-class-licence-spectrum-acma

3.6.2 China

Item	Description
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 12: 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

Item	Description
	jurisdictions: - • Not permitted on aircraft • Not permitted in an area of 1 km around listed radio astronomy observatories • UWB radio transmitting equipment must obtain an approval certificate from the Ministry of Industry and Information Technology of the People's Republic of China

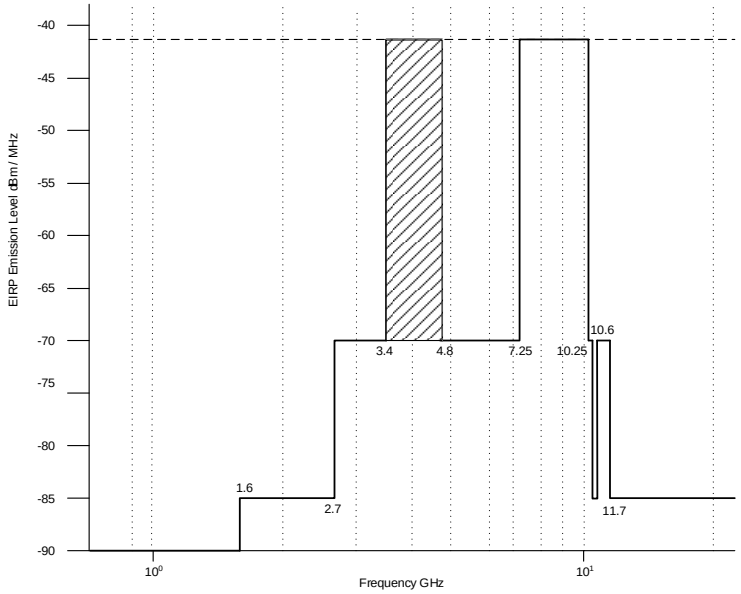
3.6.3 Hong Kong

Item	Description
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 13: Proposed max. mean emission limits – Hong Kong**
Notes	UWB regulations have not yet been ratified in Hong Kong although draft proposals have been issued with emission limits as above.

3.6.4 India

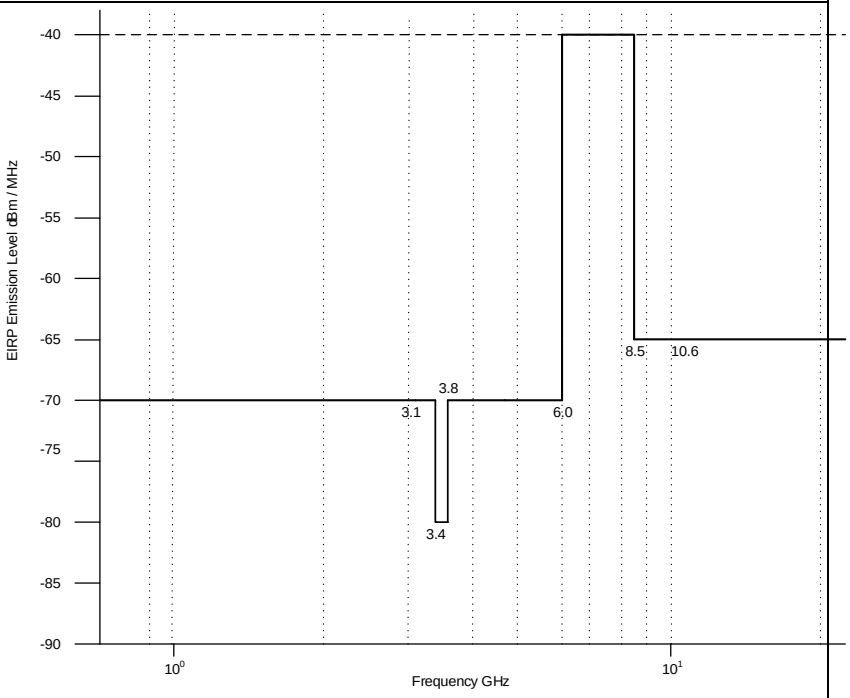
Item	Description
Regulatory Body	Government of India Wireless Planning & Coordination Wing Ministry of Communications and Information Technology Department of Telecommunications
Location	New Delhi, India
Postal Address	Various – check website
Phone	Various – check website
Web	http://www.wpc.dot.gov.in/
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

3.6.5 Japan

Item	Description
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
Do UWB regulations exist?	Yes
Specific regulations	ARIB STD-T91 v2.0 March 2015. See [20].
Max Mean Emission Limits	 **Figure 14: 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

Item	Description
	and the use of DAA mitigation techniques. The 7.25 to 10.25 GHz band has neither of these restrictions.

3.6.6 Malaysia

Item	Description
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
Specific regulations	SKMM SRSP-549 UWB 5th December 2013. See [21].
Max Mean Emission Limits	 **Figure 15: 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

3.6.7 New Zealand

Item	Description
Regulatory Body	Commerce Commission of New Zealand (ComCom). The rules can be found in New Zealand Gazette, 2/2/2017
Location	44 The Terrace PO Box 2351

Item	Description
	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
Do UWB regulations exist?	Yes
	Device transmit bandwidth (-10 dB) is at least 500 MHz or a fractional bandwidth of greater than 0.2. • UWB is prohibited on board of aircrafts. • Fixed outdoor transmitter or antenna is prohibited. A general user radio licence is granted for transmitting devices conforming to the rules.

Max Mean Emission Limits

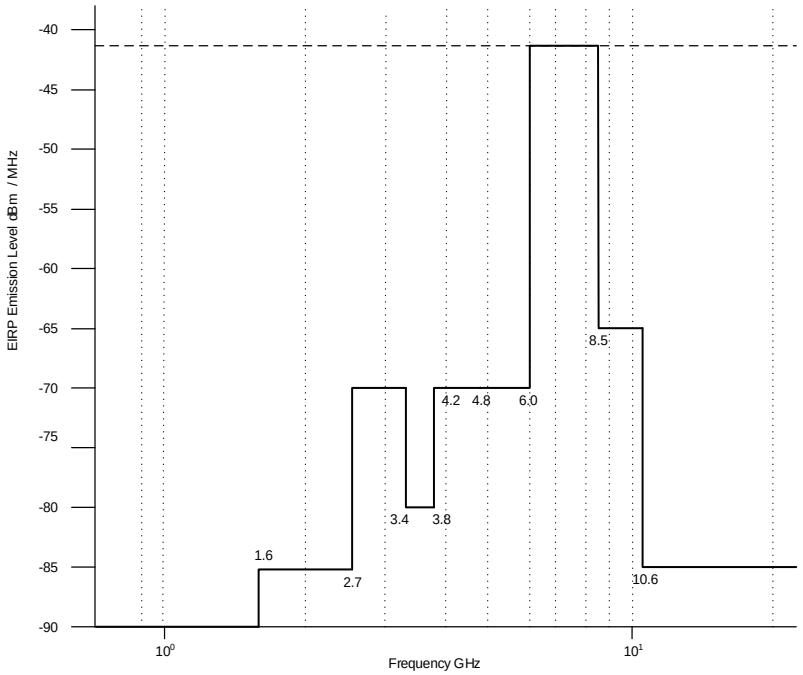
Table 14: e.i.r.p. emission limits - New Zealand

Frequency	Max. e.i.r.p. (dBm/MHz)	Max. Peak e.i.r.p. (dBm / 50MHz)
< 1.6 GHz	- 90	- 50
1.6 - 2.7 GHz	- 85	- 45
2.7 - 3.4 GHz (Note 1)	- 70	- 36
3.4 - 3.8 GHz (Note 1)	- 80	- 40
3.8 - 4.2 GHz (Note 1)	- 70	- 30
4.2 - 4.8 GHz (Note 1, 2, 3)	- 70	- 30
4.8 - 6 GHz	- 70	- 30
6 - 8.5 GHz (Note 2, 3)	- 41.3	0
8.5 - 10.6 GHz	- 65	- 25
> 10.6 GHz	- 85	- 45

Note 1: If Low Duty Cycle (LDC) is implemented a maximum mean e.i.r.p. spectral density of -41.3dBm / MHz and a maximum peak e.i.r.p. of 0 dBm applies.

Note 2: If the devices are **installed in road and rail vehicles**, where transmit power control is implemented a maximum mean e.i.r.p. spectral density is -41.3 dBm / MHz and a maximum peak e.i.r.p. of 0 dBm applies and a transmit power control must operate with a range of 12 dB below the maximum mean e.i.r.p. spectral density.

Note 3: If the devices are **installed in road and rail vehicles**, where transmit power control is not implemented a maximum mean

Item	Description
	e.i.r.p. of -53.3dBm / MHz and the maximum peak e.i.r.p. of -12 dBm is defined.  **Figure 16: Max. mean emission limits for indoor devices – New Zealand**
Notes	The use of Ultra-Wideband transmitting equipment is not permitted on board aircraft or from any fixed outdoor transmitter or antenna

3.6.8 Singapore

Item	Description
Regulatory Body	Info-Communications Development Authority of Singapore (IDA) The Singaporean UWB rules are defined in
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
Web	http://www.ida.gov.sg
Do UWB regulations exist?	Yes
UWB Definition	Devices using UWB technology have intentional radiation from the antenna with either a -10 dB bandwidth of at least 500 MHz or a -10 dB fractional bandwidth greater than 0.2
Specific regulations	

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td></td><td>A wide variety of new short-range devices may employ the UWB technology. This includes the use of UWB devices in communications, measurement, location, imaging, surveillance and medical systems

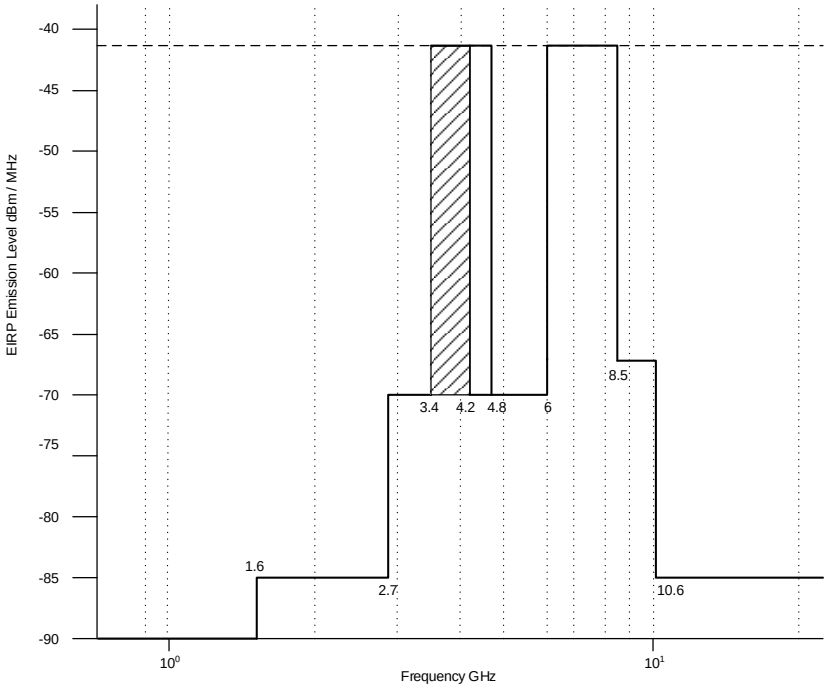
Outdoor operation from a fixed antenna or a fixed location is not allowed.

If the UWB device is operating as a communication system, it shall transmit only when it is sending information to an associated receiver. The UWB device shall cease transmission within 10 seconds unless it receives acknowledgment from the associated receiver. The UWB device must continue to receive an acknowledgement of transmission at least every 10 seconds else it must cease transmitting.
If the UWB device is operating as a non-communication system such as an imaging system, it shall contain a manually operated switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. It is also permissible to operate an imaging system by remote control provided the imaging system ceases transmission within 10 seconds of the remote switch being released by the operator.</td></tr>
<tr><td>Max Mean Emission Limits</td><td>The references for these regulations are ETSI EN 302 065 and ECC Decision (06)04 amended 6 July 2007.

Table 15: e.i.r.p. emission limits for communication devices - Singapore

<table>
<tr><th>Frequency</th><th>Max e.i.r.p. (dBm/MHz)</th><th>Max. Peak e.i.r.p. (dBm / 50MHz)</th></tr>
<tr><td>< 1.6 GHz</td><td>- 90</td><td>- 50</td></tr>
<tr><td>1.6 - 2.7 GHz</td><td>- 85</td><td>- 45</td></tr>
<tr><td>2.7 - 3.4 GHz</td><td>- 70</td><td>- 36</td></tr>
<tr><td>3.4 - 4.2 GHz (Note 1)</td><td>- 70</td><td>- 30</td></tr>
<tr><td>4.2 - 4.8 GHz (Note 2)</td><td>- 41.3</td><td>0</td></tr>
<tr><td>4.8 - 6 GHz</td><td>- 70</td><td>- 30</td></tr>
<tr><td>6 - 8.5 GHz (Note 3)</td><td>- 41.3</td><td>0</td></tr>
<tr><td>8.5 - 10.6 GHz</td><td>- 65</td><td>- 25</td></tr>
<tr><td>> 10.6 GHz</td><td>- 85</td><td>- 45</td></tr>
</table>

Note 1: If appropriate mitigation techniques are implemented, then a mean spectral density of -41.3dBm/MHz and a peak spectral density of 0 dBm /50MHz applies.
Note 2: Conditions in the 4.2 to 4.8 GHz band for equipment using UWB technology without appropriate mitigation techniques are said to be time-limited and to be replaced by more restrictive conditions beyond 31 December 2010.
Note 3: The extension of this band from 6 to 9 GHz is also acceptable in the light of new applications</td></tr>
</table>

Item	Description
	 **Figure 17: Max mean e.i.r.p. limits for communication devices - 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 • For Radar/Imaging systems see fig 20 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

Technical Requirements for Ultra-Wideband (UWB) Imaging Systems based on FCC Part 15 Subpart F (In this Table, unless otherwise stated, the unit of frequency is MHz and the unit of e.i.r.p. is dBm/MHz.)						
Systems / Applications	**GPR and wall imaging**		**Through-wall imaging**		**Surveillance imaging**	**Medical imaging**
Operating bands	Below 960 MHz	Between 3400 and 10600 MHz	Below 960 MHz	Between 3400 MHz and 10600 MHz	Between 3400 MHz and 10600 MHz.	Between 3400 MHz and 10600 MHz.
Radiated emission limits of resolution bandwidth of 1 MHz	See FCC Part 15 § 15.209 for emission limits	*Frequency e.i.r.p.* 960-1610 –65.3 1610-1990 –53.3 1990-3100 –51.3 3100-10600 –41.3 Above 10600 –51.3	*Frequency e.i.r.p.* 960-1610 –65.3 1610-1990 –53.3 Above 1990 –51.3	*Frequency e.i.r.p.* 960-1610 –46.3 1610-1990 –41.3 Above 1990 –51.3	*Frequency e.i.r.p.* 960-1610 –53.3 1610-1990 –51.3 1990-10600 –41.3 Above 10600 –51.3	*Frequency e.i.r.p.* 960-1610 –65.3 1610-1990 –53.3 1990-3100 –51.3 3100-10600 –41.3 Above 10600 –51.3
Limits for resolution bandwidth of no less than 1 kHz		*Frequency e.i.r.p.* 1164-1240 –75.3 1559-1610 –75.3	*Frequency e.i.r.p.* 1164-1240 –75.3 1559-1610 –75.3	*Frequency e.i.r.p.* 1164-1240 –56.3 1559-1610 –56.3	*Frequency e.i.r.p.* 1164-1240 –63.3 1559-1610 –63.3	*Frequency e.i.r.p.* 1164-1240 –75.3 1559-1610 –75.3
Peak level emissions in 50 MHz bandwidth		0 dBm e.i.r.p.	0 dBm e.i.r.p.	0 dBm e.i.r.p.	0 dBm e.i.r.p.	0 dBm e.i.r.p.
Remarks	**The use of UWB imaging system with peak emission below the 960 MHz or in the 3400 to 10600 MHz band shall be approved on an exceptional basis.**					

Figure 18: e.i.r.p. emission limits for radar devices & imaging systems - Singapore

3.6.9 South Korea

Item	Description
Regulatory Body	The regulatory body is called "RAPA - Korea Radio Promotion Association" (www.rapa.or.kr) and the regulation can be checked at www.spectrum.or.krThe Korean rules are defined in
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
UWB Definition	Device transmit bandwidth (-10 dB) is at least 450 MHz.
Specific regulations	Use in model airplanes, aircraft, ships and satellites is prohibited.
Max Mean Emission Limits	**Table 16: e.i.r.p. emission limits - Korea**

Frequency	Max. mean EIRP (dBm/MHz)	Max. Peak e.i.r.p. (dBm / 50MHz)
< 1.6 GHz	- 90	
1.6 - 2.7 GHz	- 85	
2.7 - 3.1 GHz	- 70	
3.1 - 3.735 GHz	- 51.3	
3.735 - 4.8 GHz (Note 1)	- 41.3	0
4.8 - 7.2 GHz	- 70	
7.2 - 10.2 GHz	- 41.3	0
> 10.2 GHz	- 70	
Note 1: Wireless equipment used in 3.735 – 4.8 GHz shall use one of the mitigation techniques below		

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Mitigation Techniques</td><td>
Wireless equipment used in 3.735Ghz – 4.8Ghz shall conform the following one of DAA or LDC condition
(A – D)
A. Average Power density including Antenna gain should b e below -70dBm/MHz
B. Continuous transmission time and idle time (sleep time) should follow the condition in the table below for indoor a pplication. In case of outdoor application, the continuous transmission time should be below 5ms with more than 1 sec idle time
<table>
<tr><th>Classification</th><th>Shall be</th><th>Out of</th></tr>
<tr><td>Continuous transmission time</td><td></td><td></td></tr>
<tr><td>Sum of transmission time</td><td>Under 18 s</td><td>1 hour</td></tr>
<tr><td>Idle time</td><td>Over 950 ms</td><td>1 sec</td></tr>
<tr><td>Idle time of 1 time transmission(average)</td><td>Over 38 ms</td><td>1 sec</td></tr>
</table>
C. When detecting any other wireless signal stronger than -61dBm while in operation, should reduce the power belo w -70dBm/MHz in 2 sec.
D. When detecting stronger signal than -61dBm from other wireless equipment, should avoid in 2 sec.
</td></tr>
</table>

3.6.10 Vietnam

Item	Description
Regulatory Body	Regulatory is the Ministry of Information and Communications (MIC).
Location	
Email:	banbientap@mic.gov.vn
Phone	8424.3.5563461
Web	http://english.mic.gov.vn/Pages/home.aspx
Do UWB regulations exist?	Yes
UWB Definition	An Ultra-Wideband (UWB) Communication Device is a short-range radio device that is used to transmit data at gigahertz frequencies with a bandwidth of more than 500 MHz
Specific regulations	• UWB rules are part of the Circular No. 46/2016/TT-BTTTT dated 26 December 2016 • Device must be used indoors or in an environment that provides equivalent shielding. • Use on airplanes is forbidden.
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

Item	Description
Limits	**Table 17: e.i.r.p. emission limits Vietnam**

Frequency (f)	Mean power (EIRP) spectral density limits	Peak power (EIRP) spectral density limits, defined at 50MHz bandwidth
f ≤ 1.6 GHz	-90 dBm/MHz	-50 dBm
1.6 GHz < f ≤ 2.7 GHz	-85 dBm/MHz	-45 dBm
2.7 GHz < f ≤ 3.1 GHz	-70 dBm/MHz	-36 dBm
3.1 GHz < f ≤ 3.4 GHz	-70 dBm/MHz	-36 dBm
3.4 GHz < f ≤ 3.8 GHz	-80 dBm/MHz	-40 dBm
3.8 GHz < f ≤ 4.2 GHz	-70 dBm/MHz	-30 dBm
4.8 GHz < f ≤ 6 GHz	-70 dBm/MHz	-30 dBm
6 GHz < f ≤ 8.5 GHz	-41.3 dBm/MHz	0 dBm
8.5 GHz < f ≤ 9 GHz	-65 dBm/MHz	-25 dBm
9 GHz < f ≤ 10.6 GHz	-65 dBm/MHz	-25 dBm
f > 10.6 GHz	-85 dBm/MHz	-45 dBm

4 REFERENCES

Table 18: 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-Wideband (UWB) communications devices.
[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; Part 2: Requirements for UWB Location Tracking.
[11]	ETSI	04/2014	V1.3.1	Electromagnetic compatibility and Radio

Ref	Author	Date	Version	Title
	EN 302 065-03			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	12/2013	None stated	SKMM SRSP-549 UWB

Ref	Author	Date	Version	Title
	(Malaysia)			
[22]	ComCom (New Zealand)	03/2015		Radiocommunications Regulations (General User Radio Licence for Ultra-Wideband Communication 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 radio communication services
Technical reports				
[30]	ETSI TR 103 181-3	2018	V2.0.3	Short Range Devices (SRD) using Ultra Wide Band (UWB); Part 3: Worldwide UWB regulations between 3,1 and 10,6 GHz

5 DOCUMENT HISTORY

Table 19: Document History

Revision	Date	Description
1.0	31/10/15	Initial release
1.1	31/05/18	Updated with updated regulations
1.2	05/07/18	Update of document with new logo

6 MAJOR CHANGES

Table 20: Changes in v1.0

Page	Change Description
All	Initial release

Table 21: Changes in V1.1

Page	Change Description
ALL	Updated document format and layout in accordance with Decawave document directives
All	Removed required information
Various pages	EU/ETSI: changed references to RED versions, added on-board aircraft.
88	Japan: upper limit adjusted
Chapter 2	Colour legend and heading legend updated
Chapter 2	Reference to APR002 and APR003 made
Table 3	Korea: low band lower boundary has increased.
Table 3	Singapore: updated to 2016 regulation
Table 3	Australia: now also allows lower band
Table 3	New Zealand and Vietnam updated
Table 12	Brazilian regulations updated
page 15	Qatar and UAE regulation summary updated

Table 22: Changes in V1.2

Page	Change Description
All	Updated with New Logo

7 FURTHER INFORMATION

Decawave develops semiconductors solutions, software, modules, reference designs - that enable real-time, ultra-accurate, ultra-reliable local area micro-location services. Decawave's technology enables an entirely new class of easy to implement, highly secure, intelligent location functionality and services for IoT and smart consumer products and applications.

For further information on this or any other Decawave product, please refer to our website www.decawave.com.