

**Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)**

**Submission Title:** [UWB Regulation and Consideration on UWB Channelization]

**Date Submitted:** [September 2012]

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**Re:** [Information and discussion on UWB]

**Abstract:** [UWB Regulation and consideration on UWB Channelization for TG15.8 Peer Aware Communications]

**Purpose:** [This document is to provide a general review of IR-UWB for PAC]

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# UWB Regulation and Consideration on UWB Channelization

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# Purpose of This Document

- This document gives a review on the current status of UWB regulation in different countries and regions.
- A consideration on UWB channelization in the sense to achieve best performance is shown.

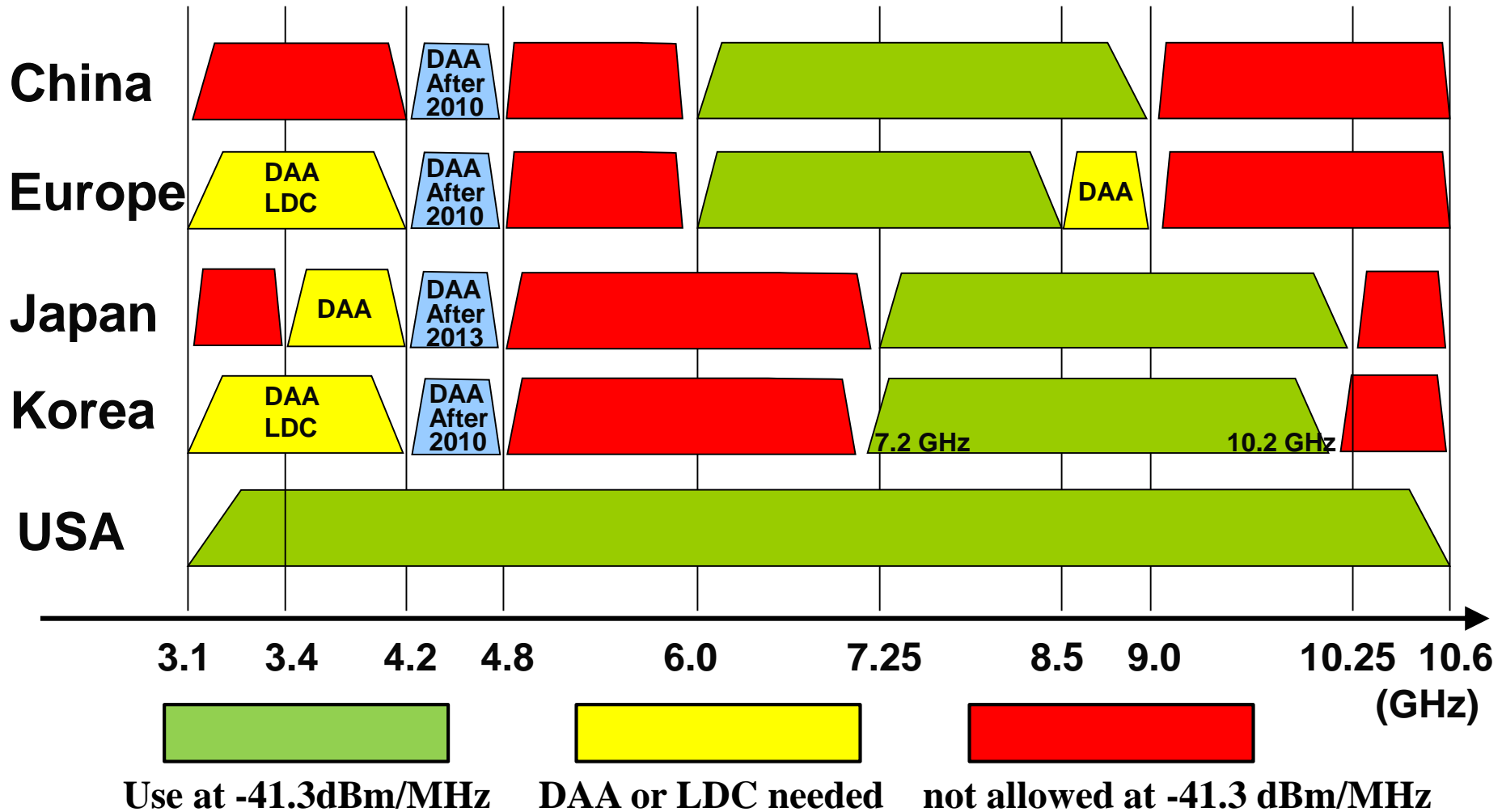
# Outlines

- Available UWB frequency band worldwide
- UWB regulation activities in Japan
- Effect of UWB bandwidth
- Consideration on UWB channelization
  
- Conclusion remarks

# UWB Regulation Status

- USA is the first country that allowed the UWB spectrum from 3.1 to 10.6 GHz at a maximum SPD of -41.3 dBm/MHz in 2002.
- While following to the USA's UWB regulations, other countries assigned smaller UWB spectrum and impelled various restrictions to mitigate interference into existing wireless systems.
- Although UWB regulations were already published in EU, Japan, Korea, etc., update or modification are still in process.

# UWB Bands In Various Regulations



# Comparison Between Japan and Others

Items	Japan	EU	Korea
<b>Indoor vs. outdoor</b>	Only for indoor. A radio equipment unconnected to the AC mains power supply shall be permitted to emit radio waves only after it receives a signal from another radio equipment connected to the AC mains power supply.	Can not be used to devices and infrastructure used at a fixed outdoor location or connected to a fixed outdoor antenna. Can be used in vehicle with TPC.	Only for indoor.
<b>Low band High band</b>	3.4 -4.8 GHz 7.25 -10.25 GHz	3.1 – 4.8 GHz 6.0 -9.0 GHz	3.1 – 4.8 GHz 7.2 -10.2 GHz
<b>Date rate</b>	Must be larger than 50Mbps	Not required	Not required
<b>DAA and LDC</b>	DAA is required for 3.4 -4.8 GHz. DAA for 4.2-4.8 GHz is waived until December 31, 2013.	DAA or LDC are required for 3.1 - 4.8 GHz and 8.5 -9 GHz.	DAA or LDC are required for 3.1 - 4.8 GHz.

# Update of Japanese UWB Regulation

- **November, 2002**  
Set up of **UWB radio systems committee** by **MIC**
- **February, 2004**  
**Interim report** on draft PSD mask issued by **MIC**
- **August, 2006**  
**Japanese UWB regulation** issued by **MIC**
- **2008 and 2010**  
**Extension of exemption of DAA** at 4.2 – 4.8 GHz.
- **2012**  
As asked by **MIC**, **UWB radio systems committee** is working on a new update.



# Discussion on UWB Band Usage

- Except USA, UWB low band is not or will not be 'free' in other regulations. LDC or DAA are or will be impelled at UWB low band.
- LDC will greatly restrict the available communication period while DAA will add significant burden for implementation.
- UWB high band is 'free' in all regulations while the available band changes in different regulations. The common 'free' band is only 1.25 GHz (7.25 – 10.25 GHz).

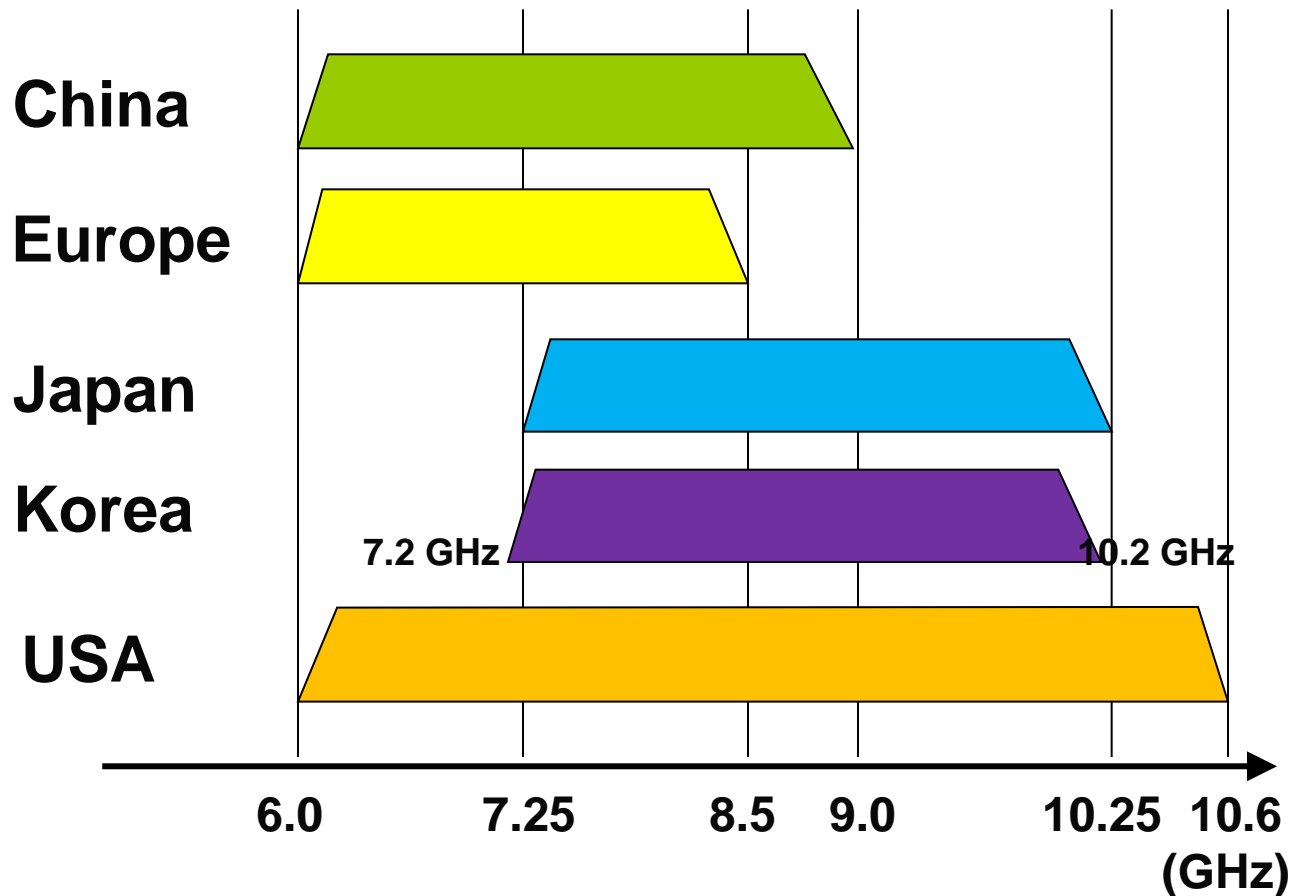
# Effect of UWB Bandwidth

Center frequency (GHz)	Bandwidth (GHz)	Frequency band (GHz)	Gain (dB)/ distance	Note
7.875	0.5	7.625 – 8.125	0 / d	Worldwide
7.875	1.25	7.25 – 8.5	4.0 / 1.6d	Worldwide
7.25	2.5	6.0-8.5	7.8 / 2.5d	EU
7.5	3	6.0-9.0	8.4 / 2.6d	China
8.7	3	7.2 – 10.2	7.0 / 2.2d	Korea
8.75	3	7.25 – 10.25	7.0 / 2.2d	Japan
8.3	4.6	6 -10.6	9.5 / 3.0d	USA

# Discussion On UWB Bandwidth

- As the maximum PSD is fixed at -41.3 dBm/MHz, a larger bandwidth will allow more transmission power.
- Because a big concern at UWB high band is the transmission range, it will be better to maximally use the available bandwidth.
- The maximum bandwidth is only 1.25 GHz (7.25-8.5 GHz) if we want to implement a common device worldwide.
- A practical solution is to 'localize' the channelization to maximally take the advantage of bandwidth.

# Channelization In accordance To Local Regulations



# Channelization in detail

<b>Center frequency (GHz)</b>	<b>Bandwidth (GHz)</b>	<b>Frequency band (GHz)</b>	<b>Note</b>
<b>7.25</b>	<b>2.5</b>	<b>6.0-8.5</b>	<b>EU</b>
<b>7.5</b>	<b>3</b>	<b>6.0-9.0</b>	<b>China</b>
<b>8.7</b>	<b>3</b>	<b>7.2 – 10.2</b>	<b>Korea</b>
<b>8.75</b>	<b>3</b>	<b>7.25 – 10.25</b>	<b>Japan</b>
<b>8.3</b>	<b>4.6</b>	<b>6 -10.6</b>	<b>USA</b>

# Conclusion Remarks

- Update on UWB regulation status.
- Discussion on UWB bandwidth usage.
- Proposal of UWB channelization in accordance to local regulation.