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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

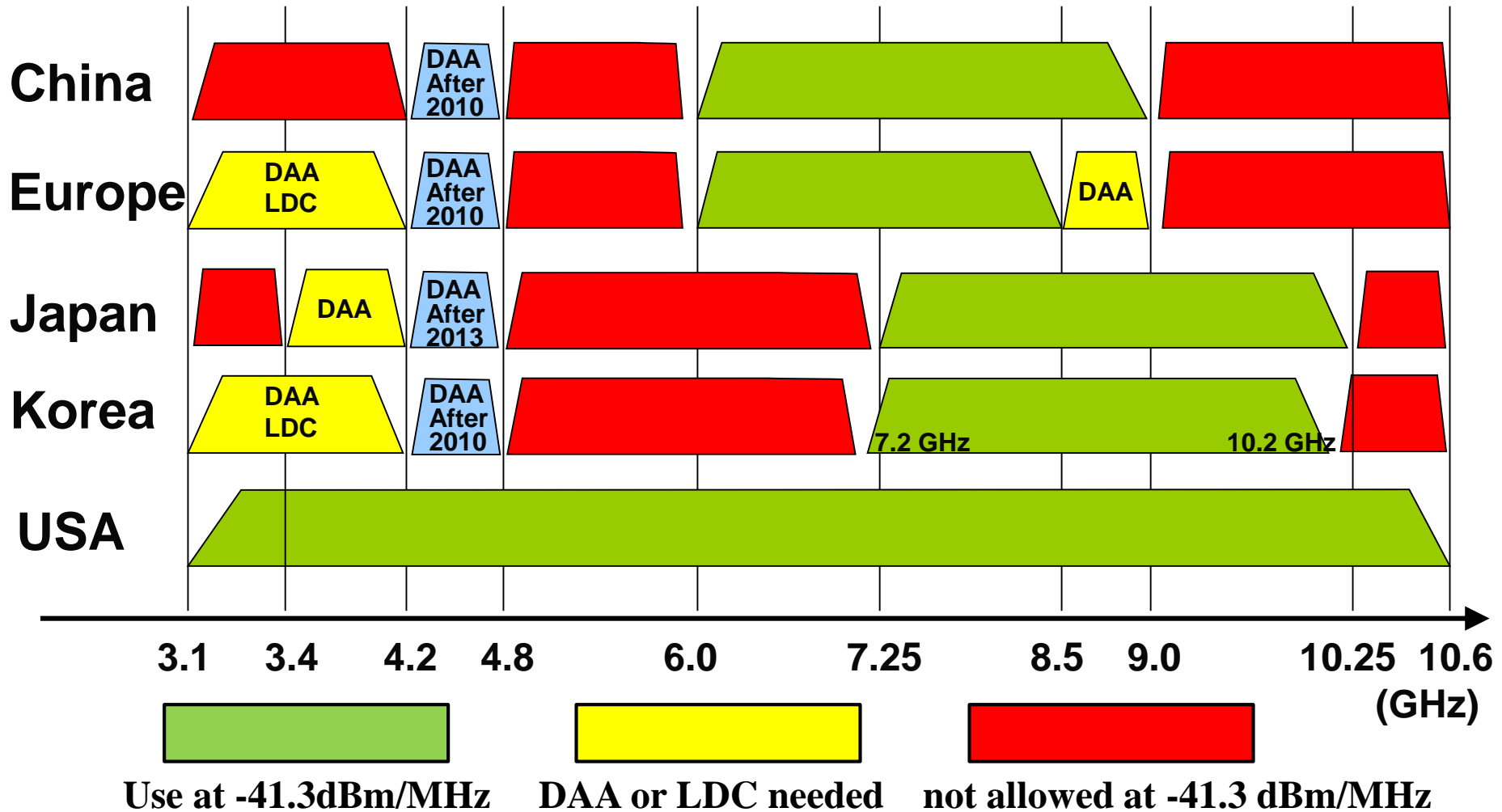
- Available UWB frequency band worldwide
- UWB regulation activities in Japan
- Effect of UWB bandwidth
- Consideration on UWB channelization

- 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 PSD 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
Indoor vs. outdoor	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.
Low band High band	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
Date rate	Must be larger than 50Mbps	Not required	Not required
DAA and LDC	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 – 8.5 GHz).

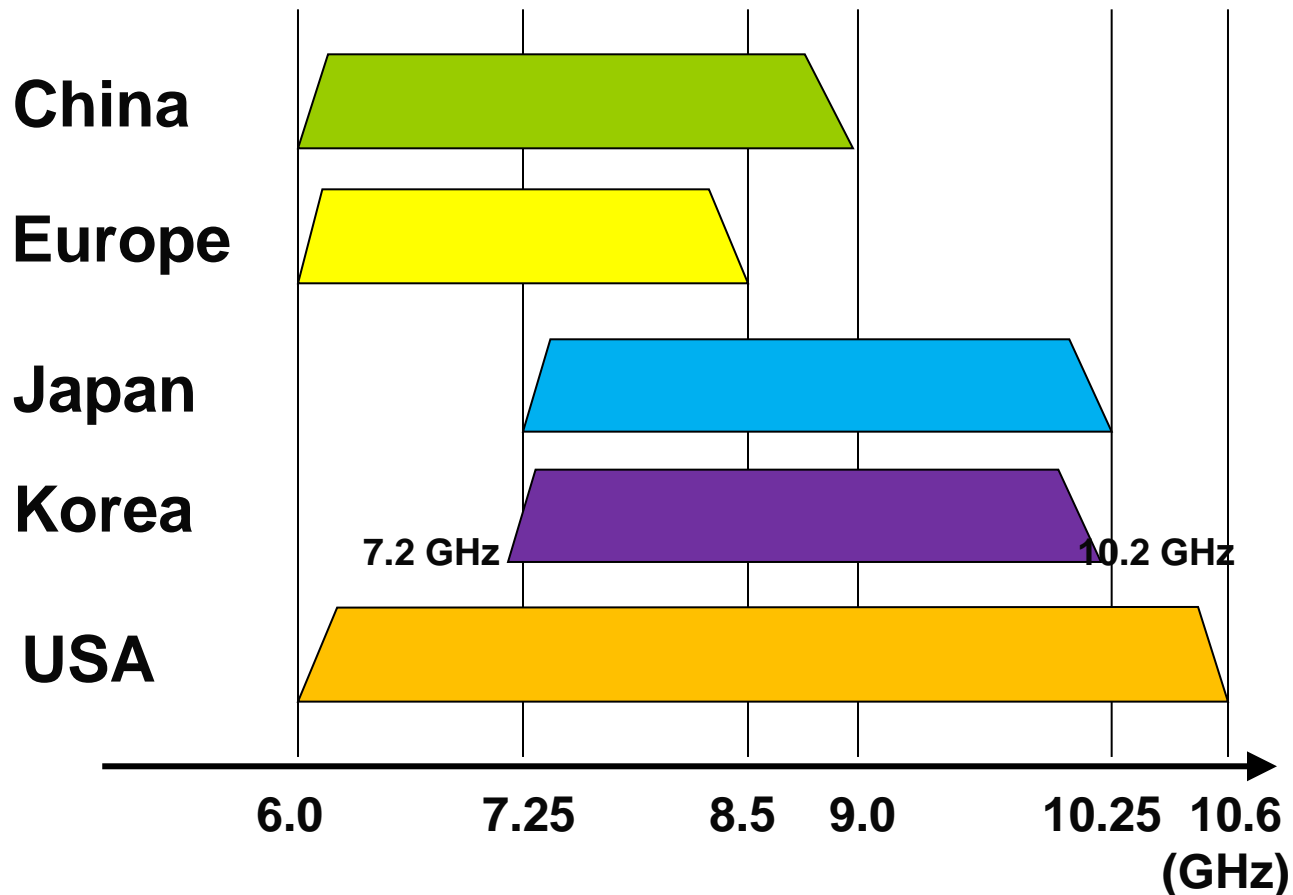
Effect of UWB Bandwidth

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

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

Conclusion Remarks

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