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

**Submission Title:** [Latest Japanese Spectrum Mask for UWB]

**Date Submitted:** [September 21, 2005]

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**Abstract:** [A draft of spectrum mask for UWB in 3-10GHz has been announced in Japanese regulator MIC on August 25, 2005. Although this mask is still a draft and should be revised to be approved in Japanese radio regulation, it is important for IEEE P802.15 standard to be compliant in a world as well as other nations' masks.]

**Purpose:** [To reconsider a band plan and additional requirement for IEEE P802.15 in microwave band]

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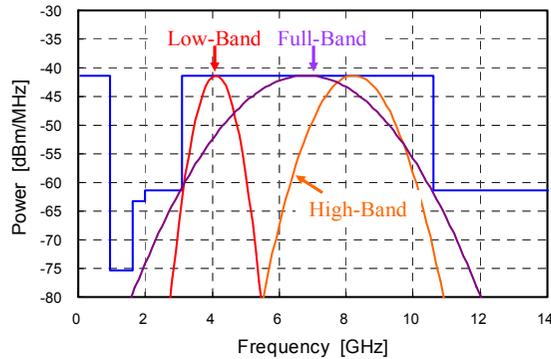
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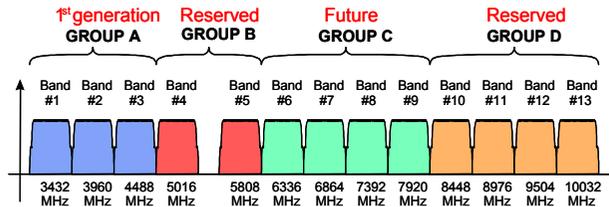
# UWB Models and Spectral Mask in Japan

## Different types of UWB radio systems under consideration

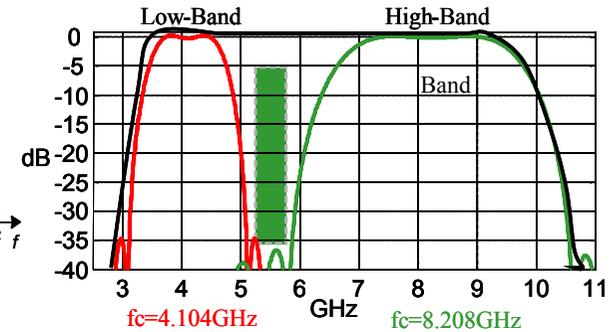
### Impulse Radio type



### MB-OFDM type



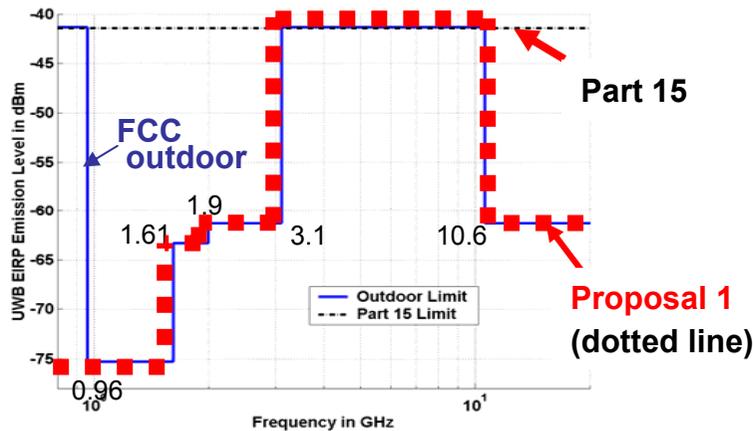
### DS-UWB type



## Draft Proposals for emission power spectral mask (Feb.2, 2004)

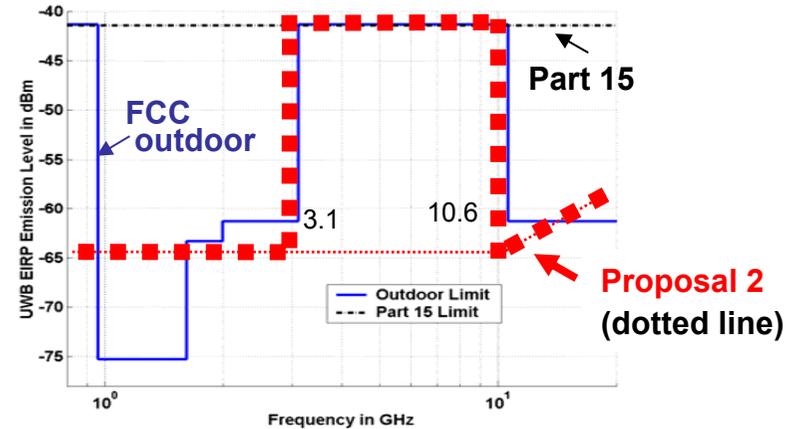
### < Proposal 1 >

Based on FCC Outdoor specifications



### < Proposal 2 >

Standards for Extreme Low Power Stations in Japan applied to portion of spectrum outside the range 3.1 – 10.6 GHz



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# **UWB Interference Measurement Report of MMAC Forum, Japan**

## **UWB Demonstration Experiments Task Force**

**(Over 30 companies joined during March-August 2005)**

**Victim systems are categorized to 5 groups to test**

**Fixed Micro systems**

**Broadcasting (Analog FPU, Digital FPU)**

**Satellite · Base station (GPS, Mobile BC, FSS)**

**Cellular phones (1xEV-DO, PDC, WCDMA)**

**Wireless Access (WLAN IEEE802.11a, 11j)**

**The common UWB interference signal sources are as follows.**

- ① MB-OFDM (made by Wisair , offered by Ti/Intel )**
- ② DS-UWB (made and offered by FSL)**
- ③ IR (PRF =1M& 10MHz) (made and offered by NICT)**
- ④ AWGN**

# UWB Interference Measurement Report of MMAC Forum, Japan

<http://www.arib.or.jp/mmac/e/index.htm>

## UWB Demonstration Experiments Task Force

**Over 30 companies joined**

Intel

Willcom

Space Communication Corporation

NEC TOSHIBA Space Systems, Ltd.

NHK Science & Technical Research Laboratories

NTTDoCoMo

FM Tokyo

KDDI

JSAT

NICT

Advanced Space Business Corporation

SONY

TDK

TV Asahi

TV Tokyo

TOKYO ELECTIRIC POWER,

TBS

Japan TI

NTV

NTT

NAB (The National Association of Broadcasters in Japan)

JRC

Hitachi

Fujitsu

Fuji TV

FSL

Furuno Systems

Nippon Cultural Broadcasting

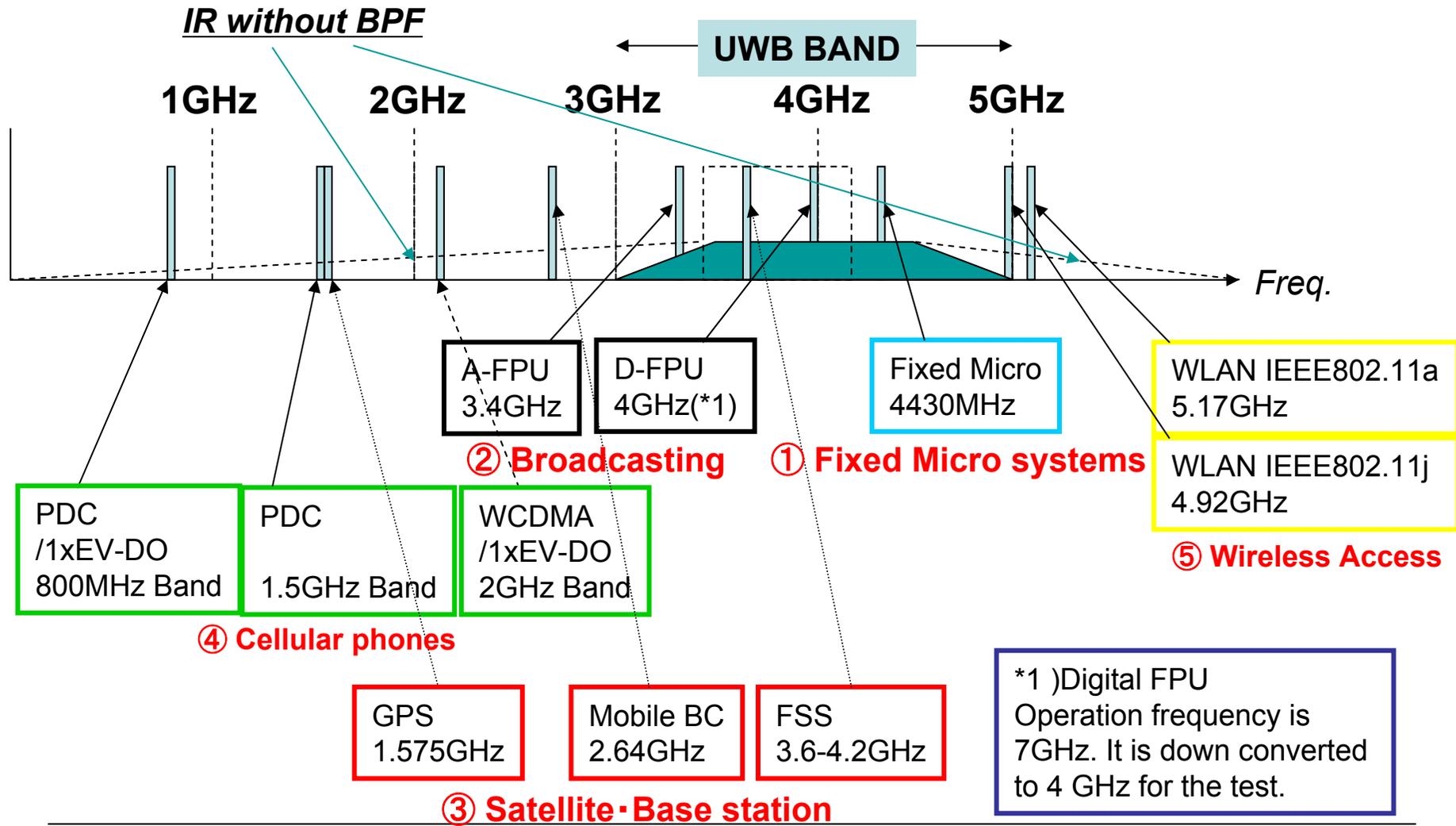
Matsushita

Mitsubishi

Mobile Broadcasting

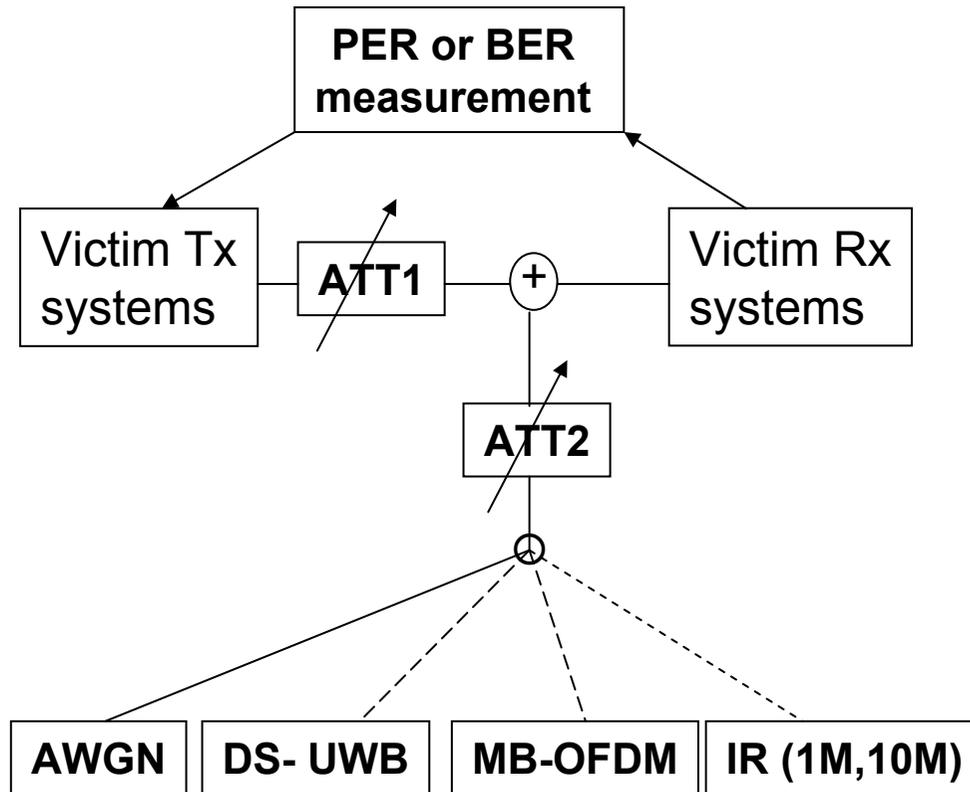
YOKOGAWA Electric

# Spectral Allocation of Tested Victim Systems



# Simplified Common Experiment Scheme

## ~ Always Wired ~

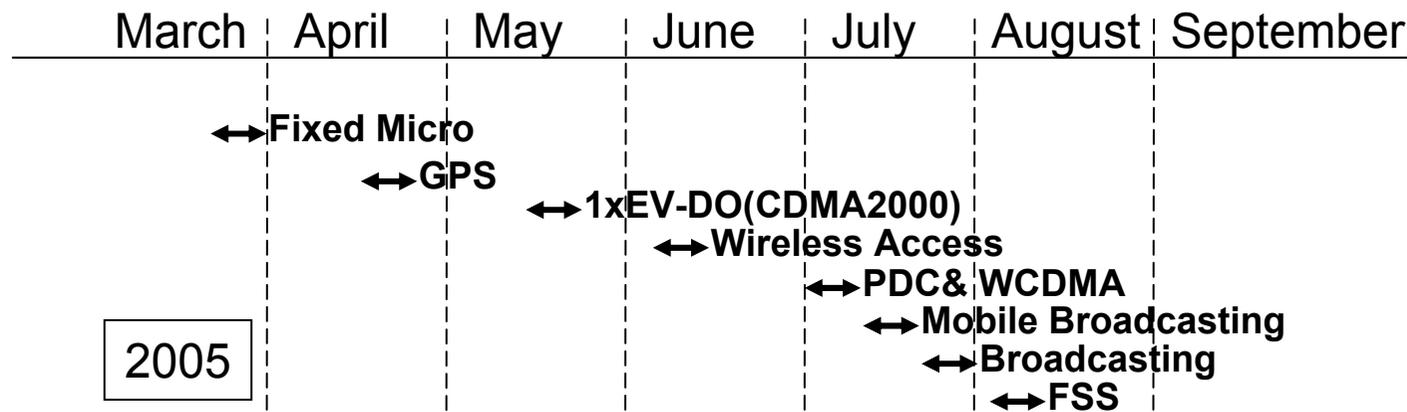


### General test flow

1. 'Minimum sensitivity' is measured by desired signal only
2. Set desired signal to a certain level from 'Minimum sensitivity', and
3. Measure PER/BER by adding various level of interference signals
4. The output is C/N vs. BER (PER)

# TEST TIME TABLE

Group	Tested system	Test Done at	Reported to Telecommunication council
Fixed Micro systems	Fixed Micro	Mar.22-24	Done at August 25 <sup>th</sup> . Therefore, the report is open to the public.
Broadcasting	Digital FPU Analog FPU	July 19-20	
Cellular phones	1xEV-DO	May 23-26	
	PDC&WDCM A	July 4-6	
Satellite Base station  (Common test done April 11 <sup>th</sup> )	GPS	April 19-20	
	Mobile Broadcasting	July 11-12	Not open yet as of Sep. 7th
	FSS	August 2-5	Not open yet as of Sep. 7th
Wireless Access	11a, 11j	June 7-9	Not open yet as of Sep. 7th



# Spectral Mask of CEPT(1/2)

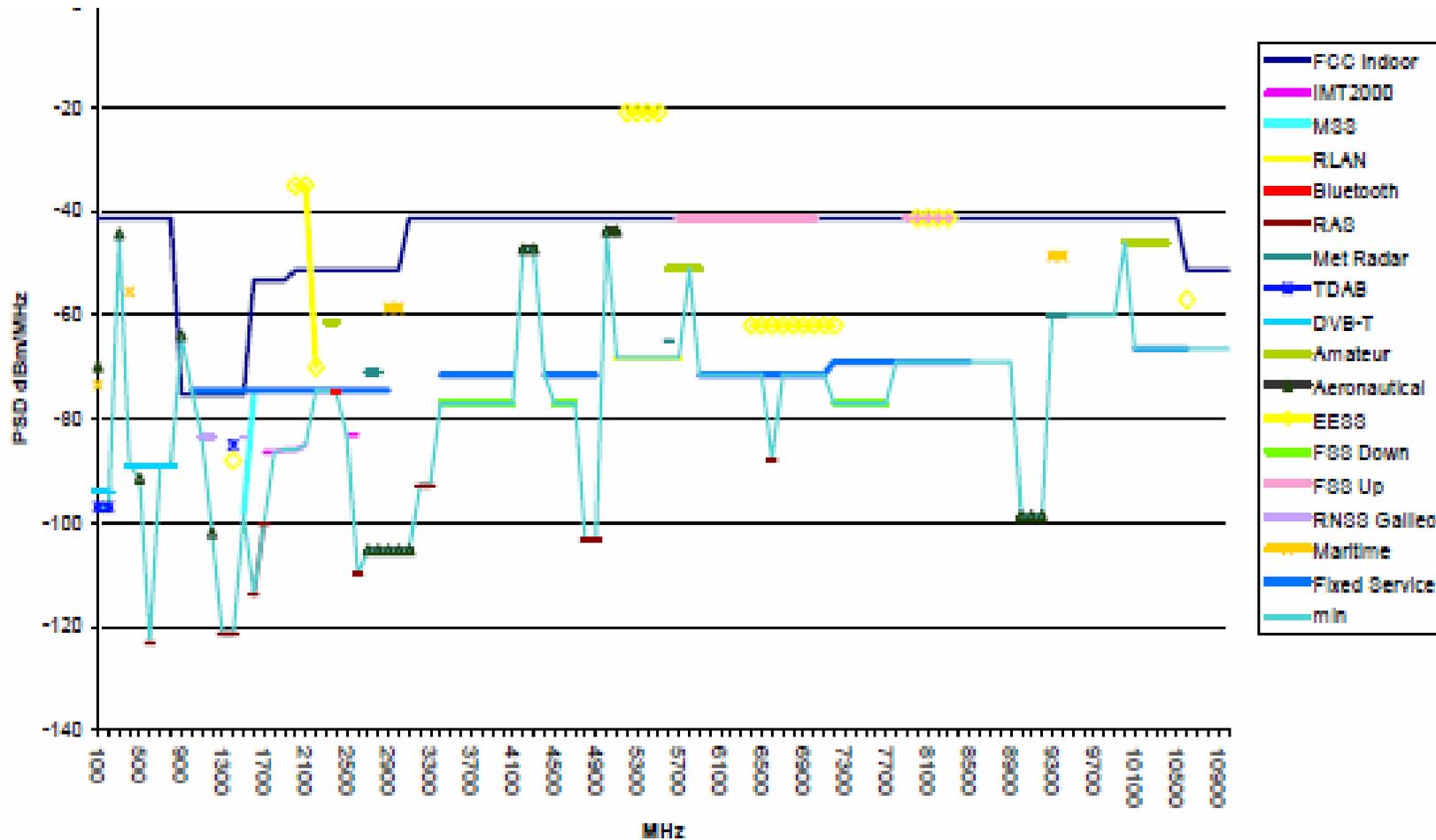


Fig. 1 Comparison between CEPT and FCC Mask

# Spectral Mask of CEPT(2/2)

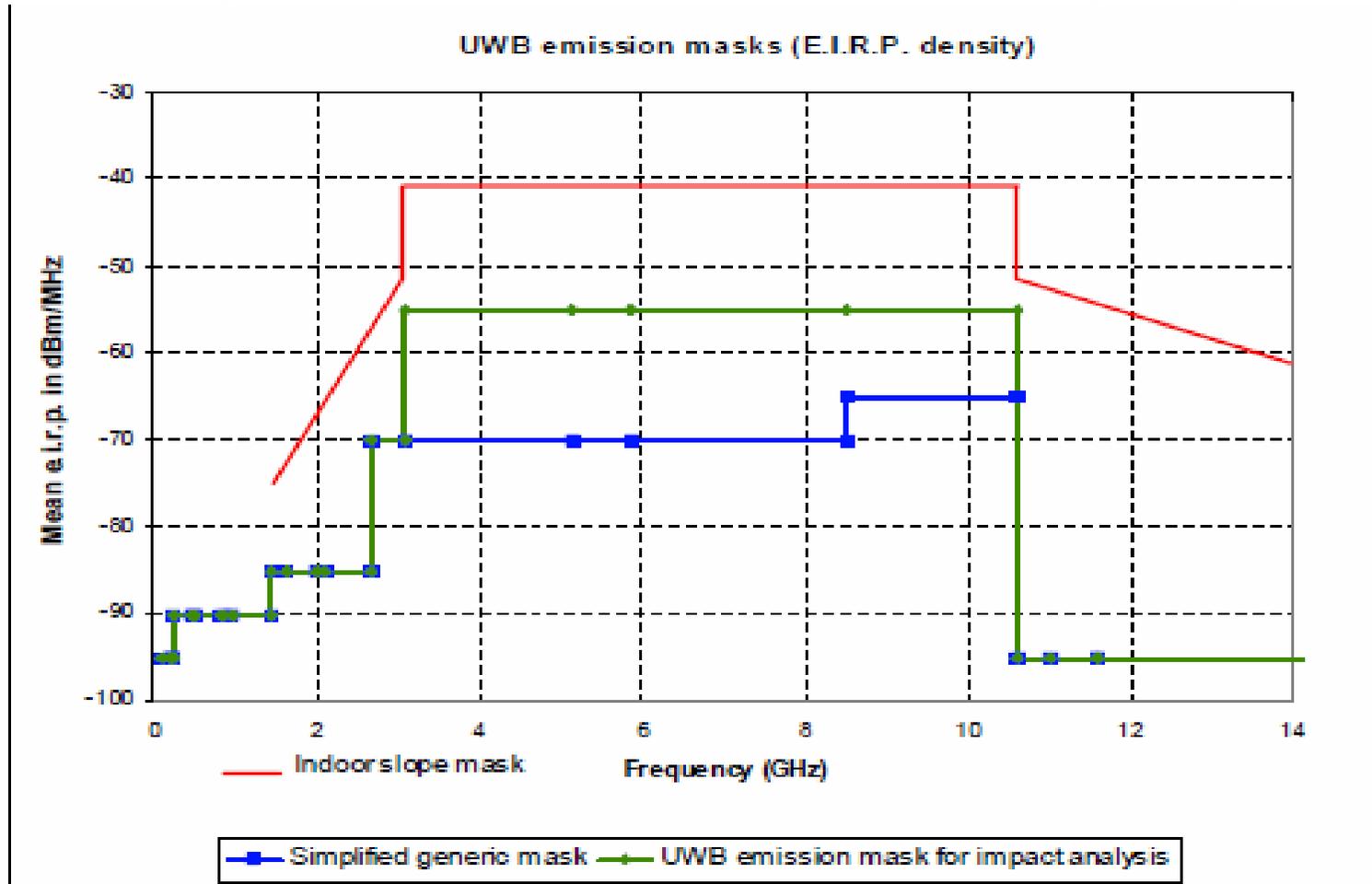


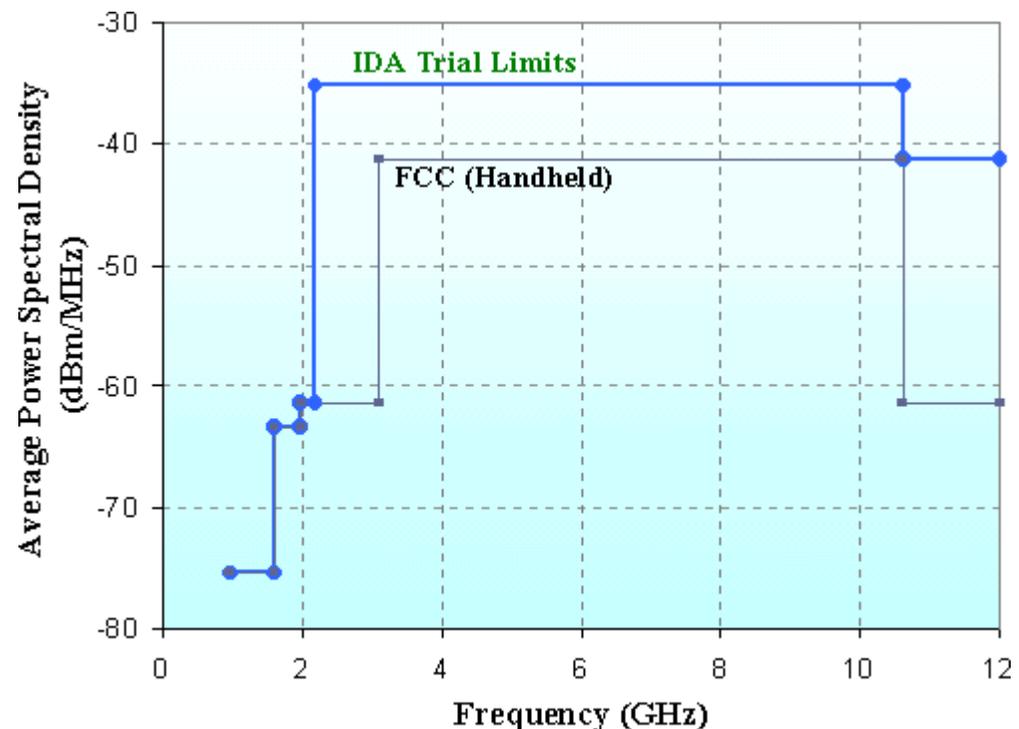
Fig. 2 Switzerland Proposed Mask to ITU-R TG1/8

# Present Regulations for UWB in Singapore

- Impose slightly less stringent emission limits to encourage experimentation and innovation
- UWB operation is permitted for demonstration or trial purpose
  - FCC's Limits applicable to demo use
  - IDA's trial emission mask applicable to trial use

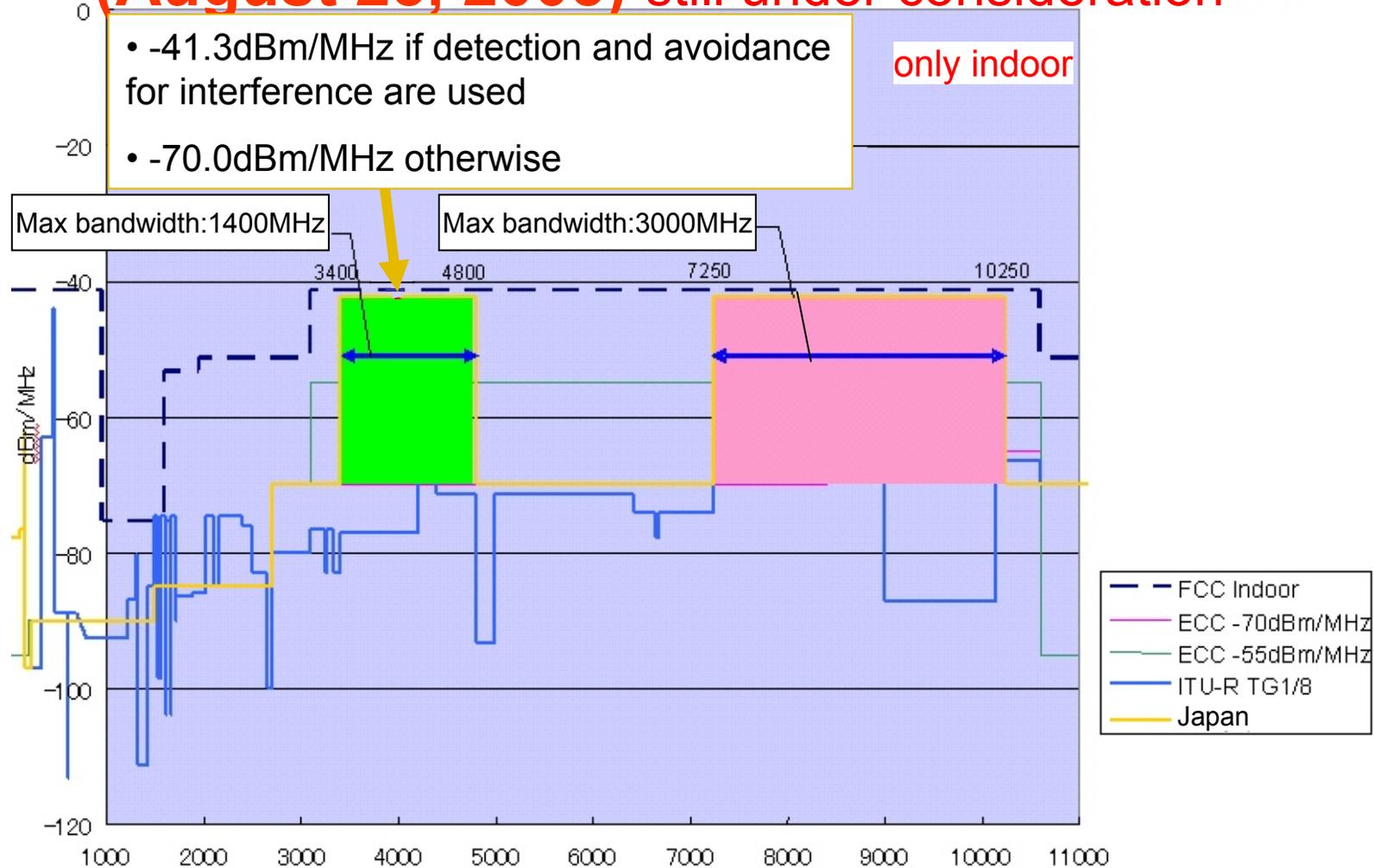
Reference:

<http://www.ida.gov.sg/idaweb/techdev/infopage.jsp?infopagecategory=18:techdev&versionid=4&infopageid=12107>



# Draft Spectrum Mask in Japan (MIC)

**(August 25, 2005) still under consideration**



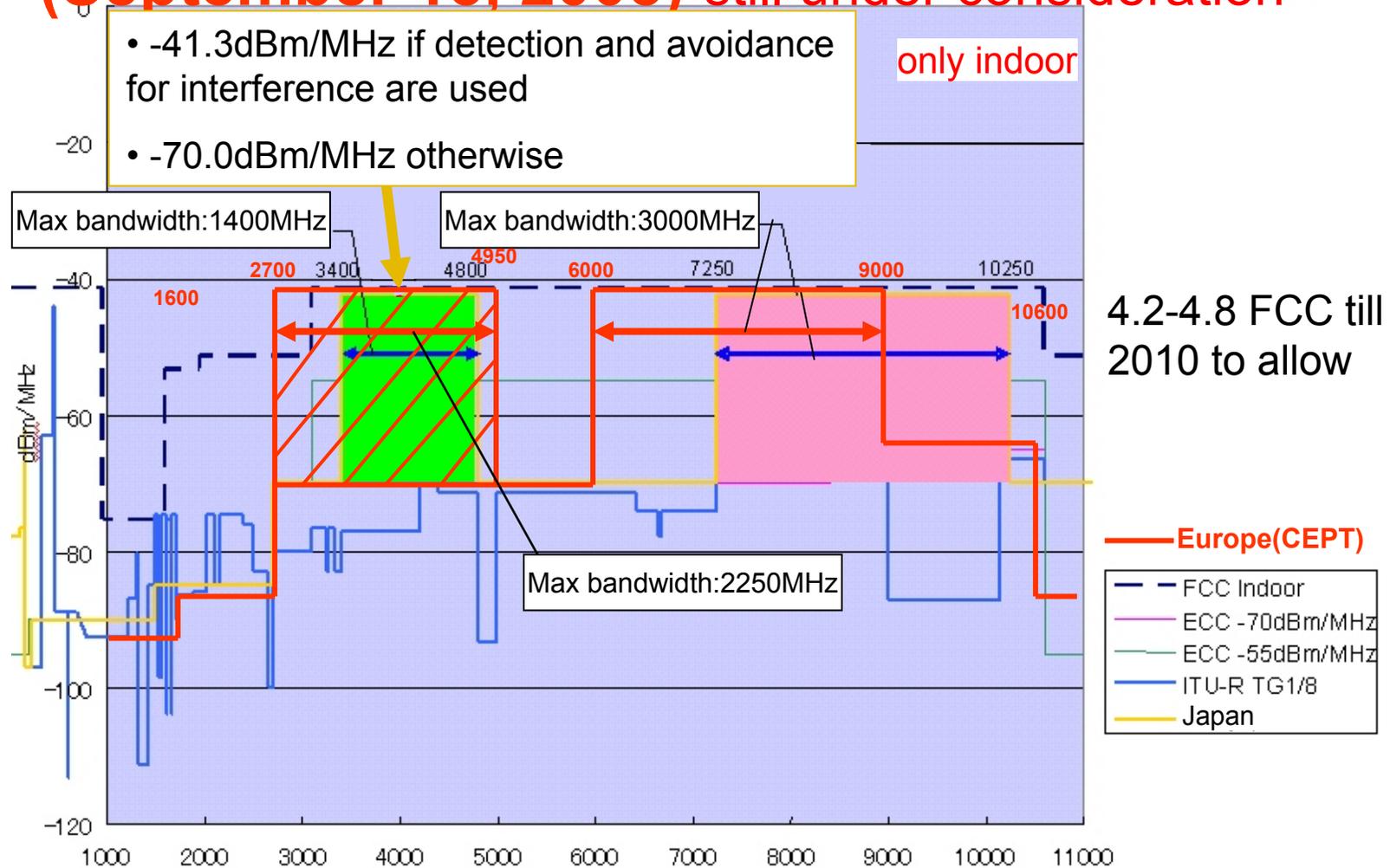
# Last EU Regulatory News (Sept.15, 2005)

		General Devices without Mitigation (Indoor)			Detect and Avoid (DAA)		Low Duty Cycle Devices	
<b>Agreed</b>		No Mitigation			Mitigation+Indoor		5% / Sec AND 0,5% / Hour	
Frequency	GHz	Average	Peak	Average	Peak	Average	Peak	
below	1,6	-90	-50					
	1,6 - 2,7	-85	-45					
	2,7 - 3,1	-70	-30	<b>Agreed</b>		<b>Proposed (To be finalised in Nov. 2005)</b>		
	3,1 - 4,95	-70	-30	<b>-41,3</b>	<b>0</b>	<b>-41,3</b>	<b>0</b>	
	4,95 - 6	-70	-30					
	<b>6 - 9</b>	<b>-41,3</b>	<b>0</b>					
	9 - 10,6	-65	-25					
above	10,6	-85	-45					
		dB/MHz	dB/50MHz	dB/MHz	dB/50MHz	dB/MHz	dB/50MHz	
<b>4,2-4,8 FCC until 2010 to allow USA devices on Europe Market in 2006</b>								

DRAFT for DECISION ,  
Still NOT FINAL

# Draft Spectrum Mask in Europe (CEPT)

(September 15, 2005) still under consideration



# Adaptive interference avoiding techniques by SSA

## Soft-Spectrum Adaptation (SSA)

### Adaptive band eliminating filter

- Analog Implementation
- Digital Implementation or hybrid

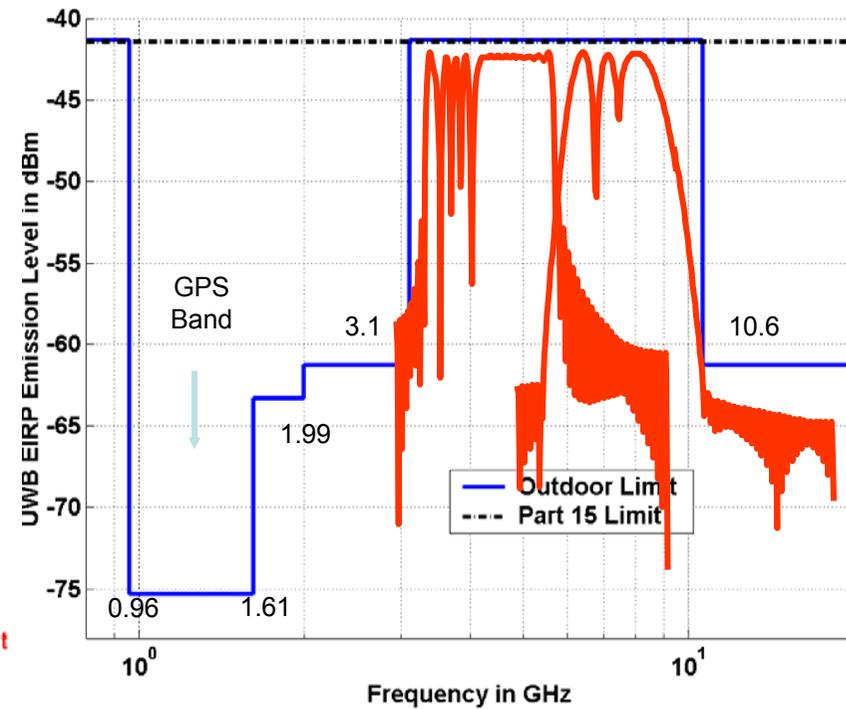
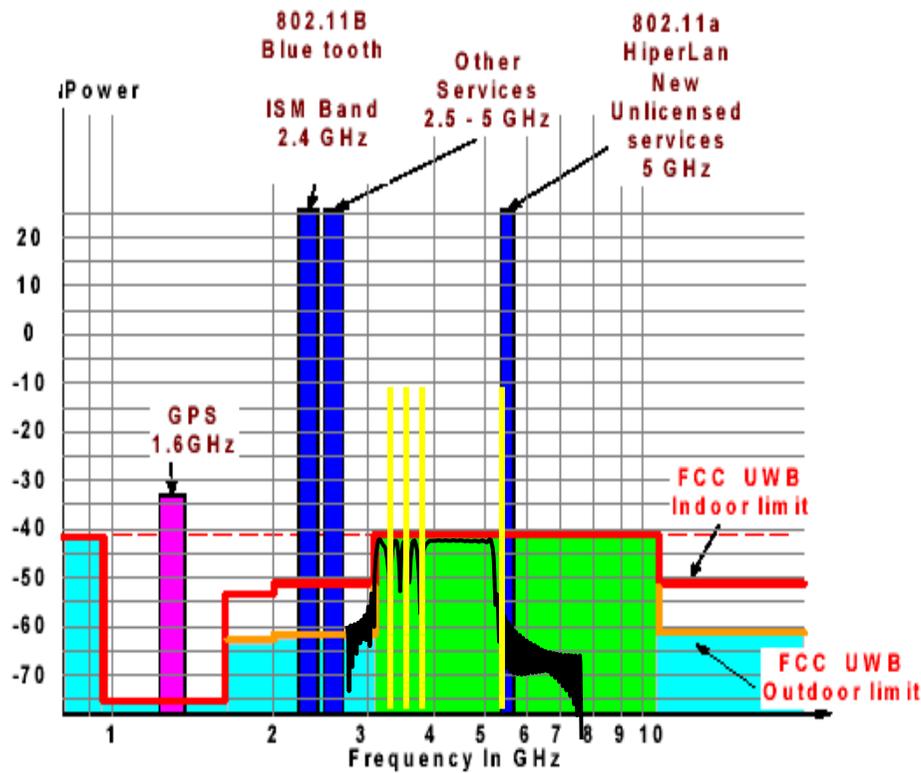
### Adaptive pulse shaping

- Pulse shaping by high-speed DAC
- Pulse shaping by combining an wavelet

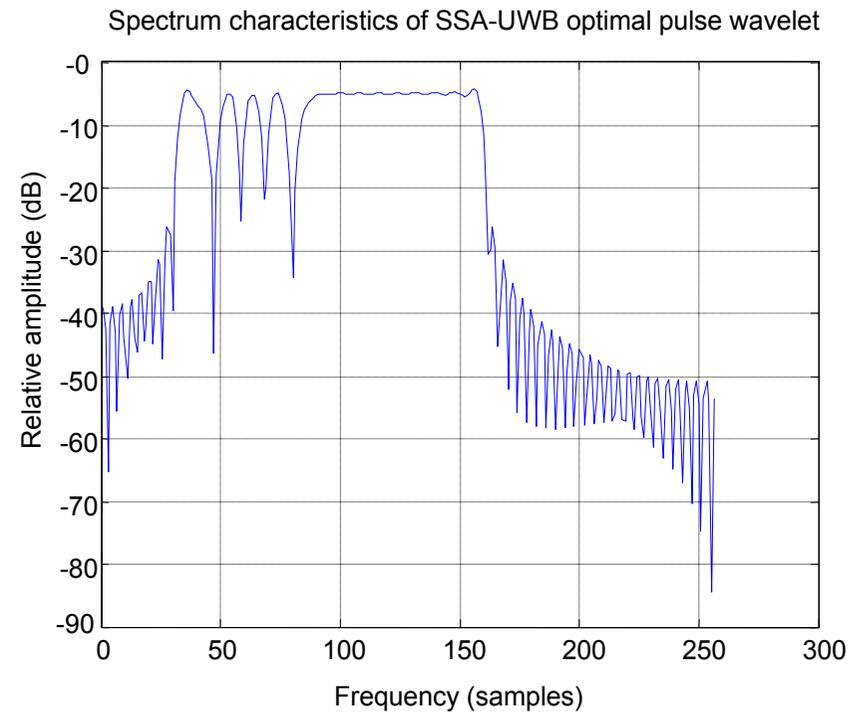
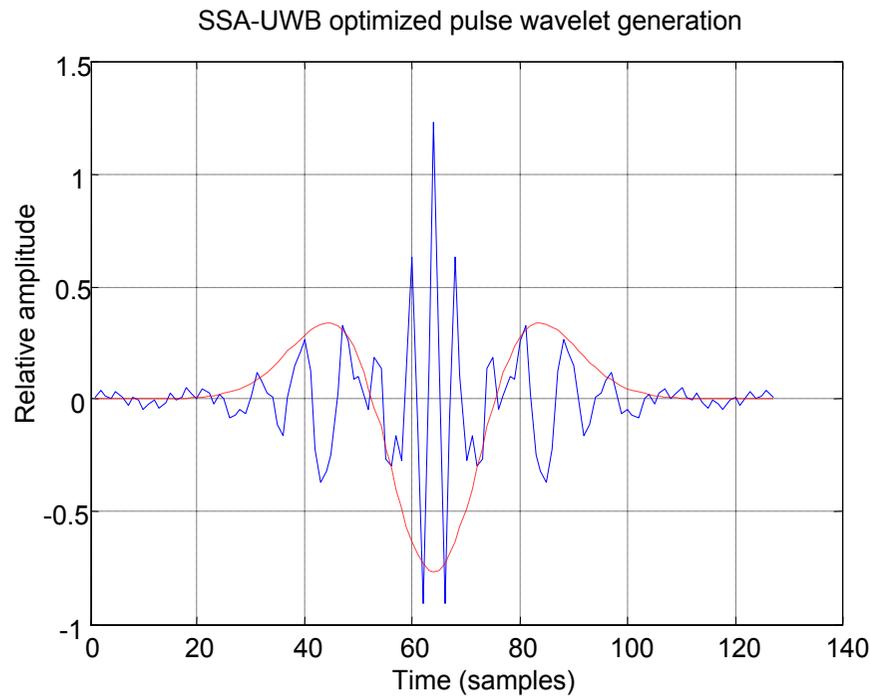
### Adaptive spreading sequence

- Spectrum null coding

# Global harmonization and compliance utilizing optimized SSA-UWB pulse wavelets



# Optimized SSA-UWB pulse wavelet with adaptive spectral notches achieving coexistence, flexibility and efficient power transmission



# Concluding Remark

- Although a global single regulation for UWB may not be agreed soon, UWB business will soon start or has already started if regional regulation is not much different. Regional and international consensus are important for a world trade.
- If dynamic detection and avoidance of interference to coexisting systems is implemented with reasonable cost, then a lower band(3-5GHz) for UWB will be available. Otherwise, a higher band(7-10GHz) will be first applied. However, this is not the best solution but we need effort for a better solution.
- Manufactures developing both 4G and UWB systems should focus on reasonable solution to succeed both businesses while common carrier operators make better business model for integrated services of 4G and UWB.
- IEEE P802.15 can contribute a few spectral masks in a world.