

MMAC-2008-0001

MMAC Technical Document

**Regulatory Comparison of Ultra-Wideband (UWB) Radio Systems between Japan and CEPT**

2008/8/\*\*

MMAC Forum UWB Working Group

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## Differences between Japanese and CEPT regulation regarding the use at outdoor and in vehicles

Japan (regulated 1 Aug, 2006.)				CEPT (European Conference of Postal and Telecommunications Administrations amended 6 July, 2007.)			
No.	Reference Regulations & Documents	Article or Chapter	Specific Provisions	No.	Reference Regulations & Documents	Article or Chapter	Specific Provisions
1	Regulations for Enforcement of Radio Law	Item 2 of paragraph 2, Article 4.4	The transmitter of ultra-wideband radio stations stipulated in item 2 of paragraph 2, Article 4.4 of Regulations for Enforcement of Radio Law (This refers to the radio stations that mainly handle data transmissions with the required frequency bandwidth of 450MHz or more and uses 0.001W or less for the antenna input power (hereinafter referred to as "antenna power") with use of frequency from 3.4GHz to 4.8GHz or from 7.25GHz to 10.25GHz <u>for indoor use</u> )			2.Background	ECC Report 64 on the protection requirements of radiocommunication systems below 10.6 GHz from Generic Ultra-wide Band (UWB) applications was adopted February 2005. ECC Report 64 generally assumes <u>an activity factor of 5%</u> and that 80% of the generic UWB devices would be deployed indoor and <u>20% outdoor.</u>
2	Ordinance Regulating Radio Equipment	Item 3 of paragraph 27, Article 49	A mark of the usage restriction that <u>radio waves can be emitted only indoor</u> shall be visibly shown on the cabinet.	1	ECC Decision of 24 March 2006 amended 6 July 2007 at Constanta on the harmonised conditions for devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz  (ECC/DEC/(06)04) (2007/131/EC) amended 6 July 2007	3.Requirement for an ECC Decision	x) that <u>the operation of UWB devices installed in road and rail vehicles can be justified mainly due to the average screening attenuation of vehicles</u> and is subject to the implementation of appropriate mitigation techniques for the protection of outdoor radio stations;
		Item 4 of paragraph 27, Article 49	<u>A radio equipment not connected to the AC mains power supply shall be permitted</u> to emit radio waves only after it receives a signal from another radio equipment connected to the AC mains power supply. (This item 4 of paragraph 27 Article 49 is provided to assure indoor use, and to assure compliance with the previous regulation item 3 of paragraph 27 Article 49.)			3. that this <u>ECC Decision is not applicable to:</u> a) devices and infrastructure used at <u>a fixed outdoor location or connected to a fixed outdoor antenna;</u> b) devices installed in <u>flying models, aircraft and other aviation;</u>	
/						Annex 1, Note 2 (4.2 to 4.8GHz, 6 to 8.5GHz)	In case of devices installed in road and rail vehicles, operation is subject to the implementation of <u>Transmit Power Control (TPC) with a range of 12 dB with respect to the maximum permitted radiated power.</u> <u>If no TPC is implemented, the maximum mean e.i.r.p. spectral density is -53.3 dBm/MHz.</u>

## Differences between TELEC and ETSI regarding the technical requirements specification

Japan (regulated 1 Aug, 2006.)				ETSI EN 302 065 V1.1.1 (2008.2)																																															
TELEC-T406 V2.1 (2007.6)				Electromagnetic compatibility and Radio spectrum Matters (ERM); Ultra WideBand (UWB) technologies for communication purposes; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive																																															
No	Title	Chapter	Specific Provisions	No	Title	Chapter	Specific Provisions																																												
1	Operating bandwidth	2	<p>Occupied frequency bandwidth allowed shall be as follows:</p> <p>For those using radio wave with frequency of 3.4 GHz or more and less than 4.8 GHz      1.4 GHz</p> <p>For those using radio wave with frequency of 7.25GHz or more and less than 10.25GHz      3 GHz</p>	1	Scope	1	<p>These radio equipment types are capable of operating in all or part of the frequency bands given in table 1.</p> <p>Table 1: Radiocommunications frequency bands</p> <table border="1"> <thead> <tr> <th></th> <th>Radiocommunications frequency bands</th> </tr> </thead> <tbody> <tr> <td>Transmit</td> <td>3,4 GHz to 4,8 GHz</td> </tr> <tr> <td>Receive</td> <td>3,4 GHz to 4,8 GHz</td> </tr> <tr> <td>Transmit</td> <td>6,0 GHz to 8,5 GHz</td> </tr> <tr> <td>Receive</td> <td>6,0 GHz to 8,5 GHz</td> </tr> </tbody> </table>		Radiocommunications frequency bands	Transmit	3,4 GHz to 4,8 GHz	Receive	3,4 GHz to 4,8 GHz	Transmit	6,0 GHz to 8,5 GHz	Receive	6,0 GHz to 8,5 GHz																																		
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2	Permissible values for unwanted emission intensity	3	<table border="1"> <thead> <tr> <th rowspan="2">Frequency band</th> <th colspan="2">Permissible values for unwanted emission intensity</th> </tr> <tr> <th>Average power per 1 MHz bandwidth</th> <th>Peak power per 1 MHz bandwidth</th> </tr> </thead> <tbody> <tr> <td>Less than 1.600 MHz</td> <td>-90 dBm or less</td> <td>-84 dBm or less</td> </tr> <tr> <td>From 1.600 MHz to 2.700 MHz</td> <td>-85 dBm or less</td> <td>-79 dBm or less</td> </tr> <tr> <td>From 2.700 MHz to 10.6 GHz</td> <td>-70 dBm or less</td> <td>-64 dBm or less</td> </tr> <tr> <td>From 10.6 GHz to 10.7 GHz</td> <td>-85 dBm or less</td> <td>-79 dBm or less</td> </tr> <tr> <td>From 10.7 GHz to 11.7 GHz</td> <td>-70 dBm or less</td> <td>-64 dBm or less</td> </tr> <tr> <td>From 11.7 GHz to 12.75 GHz</td> <td>-85 dBm or less</td> <td>-79 dBm or less</td> </tr> <tr> <td>More than 12.75 GHz</td> <td>-70 dBm or less</td> <td>-64 dBm or less</td> </tr> </tbody> </table> <p>Note: In the case that the use of the frequency is within a range from 3.4 GHz to 4.8GHz, the antenna power for the frequency band from 3.4 GHz to 4.8 GHz shall comply with the antenna power instead of the permissible values for unwanted emission intensity. Similarly, in the case that the use of the frequency is within a range from 7.25 GHz to 10.25 GHz, the antenna power for the frequency band from 7.25 GHz to 10.25 GHz shall comply with the antenna power instead of the permissible values for unwanted emission intensity.</p>	Frequency band	Permissible values for unwanted emission intensity		Average power per 1 MHz bandwidth	Peak power per 1 MHz bandwidth	Less than 1.600 MHz	-90 dBm or less	-84 dBm or less	From 1.600 MHz to 2.700 MHz	-85 dBm or less	-79 dBm or less	From 2.700 MHz to 10.6 GHz	-70 dBm or less	-64 dBm or less	From 10.6 GHz to 10.7 GHz	-85 dBm or less	-79 dBm or less	From 10.7 GHz to 11.7 GHz	-70 dBm or less	-64 dBm or less	From 11.7 GHz to 12.75 GHz	-85 dBm or less	-79 dBm or less	More than 12.75 GHz	-70 dBm or less	-64 dBm or less	2	Maximum value of mean power spectral density	4.1.2	<p>Table 3: Maximum value of mean power spectral density limit at frequency band edges</p> <table border="1"> <thead> <tr> <th>Frequency (GHz)</th> <th>Maximum value of mean power spectral density (dBm/MHz)</th> </tr> </thead> <tbody> <tr> <td><math>f \leq 1,6</math></td> <td>-90</td> </tr> <tr> <td><math>1,6 &lt; f \leq 2,7</math></td> <td>-85</td> </tr> <tr> <td><math>2,7 &lt; f \leq 3,4</math></td> <td>-70</td> </tr> <tr> <td><math>3,4 &lt; f \leq 3,8</math> (applies for equipment not using LDC)</td> <td>-80</td> </tr> <tr> <td><math>3,8 &lt; f \leq 4,8</math> (applies for equipment not using LDC)</td> <td>-70</td> </tr> <tr> <td><math>4,8 &lt; f \leq 6</math></td> <td>-70</td> </tr> <tr> <td><math>8,5 &lt; f \leq 10,6</math></td> <td>-65</td> </tr> <tr> <td><math>f &gt; 10,6</math></td> <td>-85</td> </tr> </tbody> </table>	Frequency (GHz)	Maximum value of mean power spectral density (dBm/MHz)	$f \leq 1,6$	-90	$1,6 < f \leq 2,7$	-85	$2,7 < f \leq 3,4$	-70	$3,4 < f \leq 3,8$ (applies for equipment not using LDC)	-80	$3,8 < f \leq 4,8$ (applies for equipment not using LDC)	-70	$4,8 < f \leq 6$	-70	$8,5 < f \leq 10,6$	-65	$f > 10,6$	-85
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3	Antenna Power (average power)	4	<p>Average power per 1MHz bandwidth shall be -41.3 dBm or less.</p> <p>*As an interim measure until December 31, 2008, the following condition shall apply: Of radio equipment with use of frequency from 3.4 GHz to 4.8GHz, those without an interference mitigation function stipulated in 3.4 (2) shall have the average power of -70 dBm or less per 1 MHz bandwidth within the frequency band from 3.4 GHz to 4.2 GHz, and the average power of -41.3 dBm or less per 1 MHz bandwidth within the frequency band from 4.2 GHz to 4.8 GHz. (According to ORE, Supplementary provision (MIC Ordinance No. 105 on August 1, 2006).)</p>	3	Maximum value of mean power spectral density	4.1.2	<p><b>Table 2: Maximum value of mean power spectral density limit</b></p> <table border="1" data-bbox="1532 193 2018 288"> <thead> <tr> <th>Frequency (GHz)</th> <th>Maximum value of mean power spectral density (dBm/MHz)</th> </tr> </thead> <tbody> <tr> <td>3,4 &lt; f ≤ 4,8</td> <td>≤ -41,3 (see note 1)</td> </tr> <tr> <td>4,2 &lt; f ≤ 4,8</td> <td>≤ -41,3 (see note 2)</td> </tr> <tr> <td>6 &lt; f ≤ 8,5</td> <td>≤ -41,3 (see note 2)</td> </tr> </tbody> </table> <p>NOTE 1: LDC is required (see clause 4.1.7). If LDC is not implemented then the following applies:  - 3,4 GHz to 3,8 GHz ≤ -80 dBm/MHz;  - 3,8 GHz to 4,2 GHz ≤ -70 dBm/MHz.</p> <p>NOTE 2: In case of devices installed in road and rail vehicles, operation is subject to the implementation of Transmit Power Control (TPC) with a range of 12 dB with respect to the maximum value of mean power spectral density. If TPC is not implemented then the following applies:  - 4,2 GHz to 4,8 GHz ≤ -53,3 dBm/MHz;  - 6 GHz to 8,5 GHz ≤ -53,3 dBm/MHz.</p>	Frequency (GHz)	Maximum value of mean power spectral density (dBm/MHz)	3,4 < f ≤ 4,8	≤ -41,3 (see note 1)	4,2 < f ≤ 4,8	≤ -41,3 (see note 2)	6 < f ≤ 8,5	≤ -41,3 (see note 2)
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6 < f ≤ 8,5	≤ -41,3 (see note 2)														
4	Antenna Power (peak power)	4	<p>Peak power per 50MHz bandwidth shall be 0 dBm or less.</p> <p>*As an interim measure until December 31, 2008, the following condition shall apply: Of radio equipment with use of frequency from 3.4 GHz to 4.8 GHz, those without an interference mitigation function stipulated in 3.4 (2) shall have a peak power of -30 dBm or less per 50 MHz bandwidth within the frequency band from 3.4 GHz to 4.2 GHz, and the peak power of 0 dBm or less per 50 MHz bandwidth within the frequency band from 4.2 GHz to 4.8 GHz. (According to ORE, Supplementary provision (MIC Ordinance No. 105 on August 1, 2006).)</p> <p>Measurement resolution bandwidth is 3MHz, therefore  Peak power at 50MHz bandwidth  = measurement data + 20 log (50/3)</p>	4	Maximum value of peak power	4.1.3	<p><b>Table 4: Maximum peak power limit</b></p> <table border="1" data-bbox="1532 552 2033 647"> <thead> <tr> <th>Frequency (GHz)</th> <th>Maximum peak power (dBm, measured in 50 MHz)</th> </tr> </thead> <tbody> <tr> <td>3,4 &lt; f ≤ 4,8</td> <td>0 (see note 1)</td> </tr> <tr> <td>4,2 &lt; f ≤ 4,8</td> <td>0 (see note 2)</td> </tr> <tr> <td>6 &lt; f ≤ 8,5</td> <td>0 (see note 2)</td> </tr> </tbody> </table> <p>NOTE 1: LDC is required (see 4.1.7). If LDC is not implemented then the following applies:  - 3,4 GHz to 3,8 GHz ≤ -40 dBm, measured in 50 MHz;  - 3,8 GHz to 4,2 GHz ≤ -30 dBm, measured in 50 MHz.</p> <p>NOTE 2: In case of devices installed in road and rail vehicles, operation is subject to the implementation of Transmit Power Control (TPC) with a range of 12 dB with respect to the maximum value of peak power. If TPC is not implemented then the following applies:  - 4,2 GHz to 4,8 GHz ≤ -12 dBm, measured in 50 MHz;  - 6 GHz to 8,5 GHz ≤ -12 dBm, measured in 50 MHz.</p> <p>The power reading on the spectrum analyser can be directly related to the peak power limit when a spectrum analyser resolution bandwidth of 50 MHz is used for the measurements. If a spectrum analyser resolution bandwidth of X MHz is used instead, the maximum peak power limit shall be scaled down by a factor of 20 log (50/X), where X represents the measurement bandwidth used.</p> <p>For rf carrier based modulation using multi-tone carriers and not having gating techniques implemented, the maximum peak power limit shall be scaled down by a different factor of 10 log(50/X), where X represents the measurement bandwidth used.</p>	Frequency (GHz)	Maximum peak power (dBm, measured in 50 MHz)	3,4 < f ≤ 4,8	0 (see note 1)	4,2 < f ≤ 4,8	0 (see note 2)	6 < f ≤ 8,5	0 (see note 2)
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5	Limit on Secondary Radiated Emissions, etc.	5	<table border="1"> <thead> <tr> <th rowspan="2">Frequency band</th> <th colspan="2">Average power at any 1 MHz bandwidth</th> </tr> <tr> <th>When using frequency from 3.4 GHz to 4.8 GHz</th> <th>When using frequency from 7.25 GHz to 10.25 GHz</th> </tr> </thead> <tbody> <tr> <td>Less than 1,600 MHz</td> <td colspan="2">90 dBm or less</td> </tr> <tr> <td>From 1,600 MHz to 2,700 MHz</td> <td colspan="2">85 dBm or less</td> </tr> <tr> <td>From 2,700 MHz to 3.4 GHz</td> <td colspan="2">70 dBm or less</td> </tr> <tr> <td>From 3.4 GHz to 4.8 GHz</td> <td>54 dBm or less</td> <td>70 dBm or less</td> </tr> <tr> <td>From 4.8 GHz to 7.25 GHz</td> <td colspan="2">70 dBm or less</td> </tr> <tr> <td>From 7.25 GHz to 10.25 GHz</td> <td>70 dBm or less</td> <td>54 dBm or less</td> </tr> <tr> <td>From 10.25 GHz to 10.6 GHz</td> <td colspan="2">70 dBm or less</td> </tr> <tr> <td>From 10.6 GHz to 10.7 GHz</td> <td colspan="2">85 dBm or less</td> </tr> <tr> <td>From 10.7 GHz to 11.7 GHz</td> <td colspan="2">70 dBm or less</td> </tr> <tr> <td>From 11.7 GHz to 12.75 GHz</td> <td colspan="2">85 dBm or less</td> </tr> <tr> <td>More than 12.75 GHz</td> <td colspan="2">70 dBm or less</td> </tr> </tbody> </table>	Frequency band	Average power at any 1 MHz bandwidth		When using frequency from 3.4 GHz to 4.8 GHz	When using frequency from 7.25 GHz to 10.25 GHz	Less than 1,600 MHz	90 dBm or less		From 1,600 MHz to 2,700 MHz	85 dBm or less		From 2,700 MHz to 3.4 GHz	70 dBm or less		From 3.4 GHz to 4.8 GHz	54 dBm or less	70 dBm or less	From 4.8 GHz to 7.25 GHz	70 dBm or less		From 7.25 GHz to 10.25 GHz	70 dBm or less	54 dBm or less	From 10.25 GHz to 10.6 GHz	70 dBm or less		From 10.6 GHz to 10.7 GHz	85 dBm or less		From 10.7 GHz to 11.7 GHz	70 dBm or less		From 11.7 GHz to 12.75 GHz	85 dBm or less		More than 12.75 GHz	70 dBm or less		5	Receiver spurious emissions	4.1.5	<p>The narrowband spurious emissions of the receiver shall not exceed the values in tables 6 and 7 in the indicated bands.</p> <p><b>Table 6: Narrowband spurious emission limits for receivers</b></p> <table border="1"> <thead> <tr> <th>Frequency range</th> <th>Limit</th> </tr> </thead> <tbody> <tr> <td>30 MHz to 1 GHz</td> <td>- 57 dBm (e.i.r.p.)</td> </tr> <tr> <td>above 1 GHz to 40 GHz</td> <td>- 47 dBm (e.i.r.p.)</td> </tr> </tbody> </table> <p><b>Table 7: Wideband spurious emission limits for receivers</b></p> <table border="1"> <thead> <tr> <th>Frequency range</th> <th>Limit</th> </tr> </thead> <tbody> <tr> <td>30 MHz to 1 GHz</td> <td>- 47 dBm/MHz (e.i.r.p.)</td> </tr> <tr> <td>above 1 GHz to 40 GHz</td> <td>- 37 dBm/MHz (e.i.r.p.)</td> </tr> </tbody> </table> <p><b>5.8.5 Receiver spurious emissions</b> Where these measurements are made with a spectrum analyser, the following settings shall be used for narrowband emissions:</p> <ul style="list-style-type: none"> <li>• resolution BW: 100 kHz;</li> </ul> <p>For measuring emissions that exceed the level of 6 dB below the applicable limit, the resolution bandwidth shall be switched to 30 kHz and the span shall be adjusted accordingly. If the level does not change by more than 2 dB, it is a narrowband emission; the observed value shall be recorded. If the level changes by more than 2 dB, the emission is a wideband emission and its level shall be measured and recorded.</p>	Frequency range	Limit	30 MHz to 1 GHz	- 57 dBm (e.i.r.p.)	above 1 GHz to 40 GHz	- 47 dBm (e.i.r.p.)	Frequency range	Limit	30 MHz to 1 GHz	- 47 dBm/MHz (e.i.r.p.)	above 1 GHz to 40 GHz	- 37 dBm/MHz (e.i.r.p.)
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6	Gain of the transmitting antenna	6	Absolute gain of the transmitting antenna shall be 0 dBi or less. However, in the case that the e.i.r.p. (Equivalent Isotropic Radiated Power) falls short of the antenna power provided in "4. Antenna power" added with the transmitting antenna gain of 0 dBi absolute gain, the difference may be complemented by adjusting the gain of the transmitting antenna..	6	none																																																				
7	Frequency bandwidth	7	Frequency bandwidth between upper and lower limits of the frequency bandwidth for radiation power which is 10 dB lower than the maximum radiation power shall be 450 MHz or more.	7	Operating bandwidth	4.1.1	The operating bandwidth shall be greater than 50 MHz (at -23 dB relative to the maximum spectral power density).																																																		
8	none			8	Other emissions from device circuitry	5.7	<u>UWB transmitters emit very low power radio signals, comparable with the power of spurious emissions from digital and analogue circuitry. If it can be clearly demonstrated that an emission from the ultra-wideband device is not the ultra-wideband emission identified in clause 4.1.1 (e.g. by disabling the device's UWB transmitter), that emission shall be considered against the receiver spurious emissions limits (see clause 4.1.5.3).</u>																																																		

\* The public comments for extension of the interim measure until December 31, 2010 were collected by MIC in June 2008. Official announcement is due to be made by MIC on the extension of the limit date to the end of 2010.

## Differences between Japanese regulation and European regulation regarding the LDC UWB device

### 1. Differences

Japan (2006.8/1)				Europ (2007.2/21)			
#	Regulation	Article or Chapter	Specific Provisions	#	Regulation	Article or Chapter	Specific Provisions
1	Ordinance Regulating Radio Equipment (ORE)	Article 49.27(9)	Interference mitigation function The radio equipment using radio with frequency <a href="#">from 3.4 GHz to 4.8 GHz</a> shall have the interference mitigation function that meets the technical conditions notified separately by Minister of Internal Affairs and Communications.	1	COMMISSION DECISION of 21 February 2007 on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community  (2007/131/EC)	(18)	The conditions in the <a href="#">4.2 to 4.8 GHz band</a> for equipment using ultra-wideband technology without appropriate mitigation techniques should be time limited and be replaced by more restrictive conditions beyond <a href="#">the date of 31 December 2010</a> , because there is an expectation that equipment of this type should operate exclusively above 6 GHz in the longer term.
2	MIC Ordinance	Supplementary provision (MIC Ordinance No. 105 on August 1, 2006)	*As an interim measure until <a href="#">December 31, 2008</a> , it is not mandatory to install an interference mitigation function.				
3		None		2		annex-2	<a href="#">Appropriate mitigation techniques</a> <a href="#">A maximum mean e.i.r.p. density of – 41,3 dBm/MHz is allowed in the 3,4 to 4,8 GHz bands provided that a low duty cycle restriction is applied in which the sum of all transmitted signals is less than 5 % of the time each second and less than 0,5 % of the time each hour, and provided that each transmitted signal does not exceed 5 milliseconds.</a>

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### 2. Additional requirements in Japan to use LDC UWB devices approved in EC

1	Ordinance Regulating Radio Equipment (ORE)	Article 49.27(1)	<a href="#">Communication methods:</a> <a href="#">Communication methods shall be either simplex operation, full duplex operation or half duplex operation.</a>	1		None	
2	Ordinance Regulating Radio Equipment (ORE)	Article 49.27(4)	<a href="#">Controls of radio emission:</a> <a href="#">A radio equipment not connected 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.</a>	2		none	
3	Ordinance Regulating Radio Equipment (ORE)	Article 49.27(8)	<a href="#">Transmission data rate:</a> <a href="#">Transmission data rate shall be higher than 50 Mbps excepting for such cases as noise or interference from other radio stations need be avoided.</a>	3		none	