

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

Submission Title: [Progress and Schedule of Japanese Regulation for UWB]

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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. The Japanese draft mask as well as European CEPT draft one were involved in Recommendation of ITU-R TG1/8 in October. 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: [Suggestion to modify specifications such as a band plan, MAC and additional requirement for IEEE P802.15 in microwave band to be world-wide compliant.]

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Progress and Schedule of Japanese Regulation for UWB

(update of Doc.15-05-570-02-004a
and Doc.15-05-677-00-004a)

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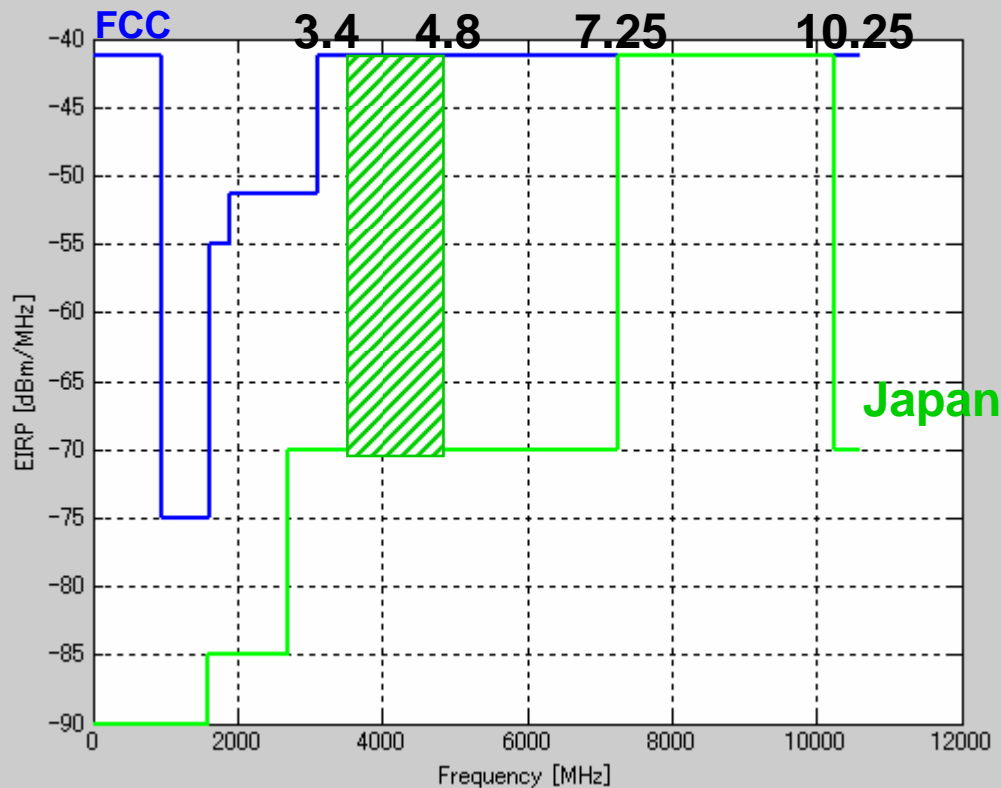
Liaison with Japanese Regulator (MIC)

Schedule of Japanese UWB radio regulation

- **Oct.27, 2005:** Technical Group meeting of UWB Radio Systems Regulatory Committee of Japanese regulator MIC was held to report results of ITU-R TG1/8 and to decide action plan. The Japanese draft spectrum mask was involved in ITU-R recommendation DNR ITU-R SM.
- **Nov. 25, 2005:** TG meeting of UWB Radio Systems Regulatory Committee was held to report evaluation results of the draft spectrum mask for coexistence and to discuss on remained problems etc.
- **Dec. 22, 2005:** TG meeting of UWB Radio Systems Regulatory Committee was held to summarize evaluation results and solution for the remained problems.
- **Jan. 24, 2006:** TG meeting of UWB Radio Systems Regulatory Committee will be held to make the final draft of regulation with spectrum mask for indoor.
- **Jan. 31, 2006:** UWB Radio Systems Regulatory Committee will be held to approve the final draft of regulation with spectrum mask for indoor.
- **During Feb., 2006:** MIC will request public comments for the final draft from any sector in Japan.
- **March 20, 2006:** UWB Radio Systems Regulatory Committee will be held to modify the final draft considering the public comments.
- **March 27, 2006:** MIC will authorize it as the official regulation for indoor.

Draft Spectrum Mask in Japan

still under consideration



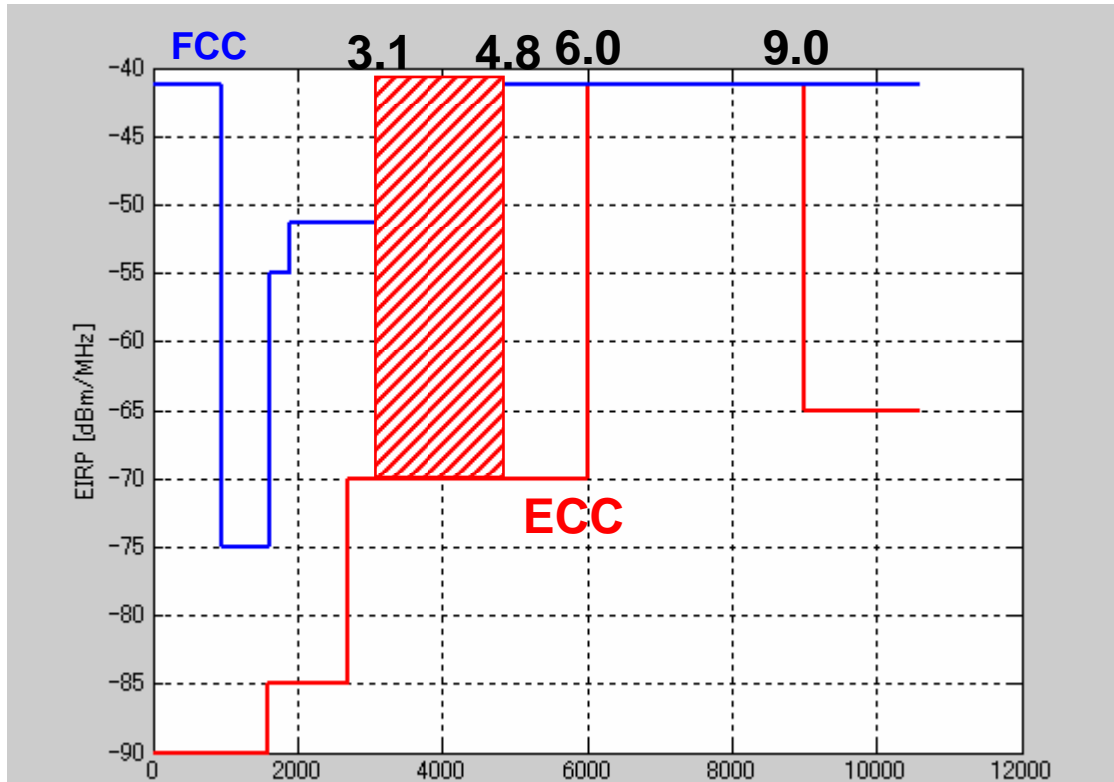
- In the frequency band 3.4-4.8GHz, efficient mitigation techniques are required.
- This mask is only for indoor communications.
- Chirp or CS waveform is applicable.

Channel Number	Center frequency (MHz)	Applicable (A) or Not A (NA)
1	3458	NA
2	3952	A*
3	4446	A*
4	3952	A*
5	6337.5	NA
6	7098	NA
7	7605	A
8	8112	A
9	8619	A
10	9126	A
11	9633	A
12	10140	NA
13	6591	NA
14	8112	A
15	8961.75	A

*: DAA technique is required.

Draft Spectrum Mask in Europe (ECC)

still under consideration



- In the frequency band 3.1-4.8GHz, ECC has decided to use efficient mitigation techniques, such as LDC.
- In the frequency band 4.2-4.8GHz, UWB devices are permitted until 30 June 2010 with -41.3dBm/MHz.

Channel Number	Center frequency (MHz)	Applicable (A) or Not A (NA)
1	3458	A
2	3952	A*
3	4446	A*
4	3952	A*
5	6337.5	NA
6	7098	NA
7	7605	A
8	8112	A
9	8619	NA
10	9126	A
11	9633	A
12	10140	A
13	6591	NA
14	8112	A
15	8961.75	NA

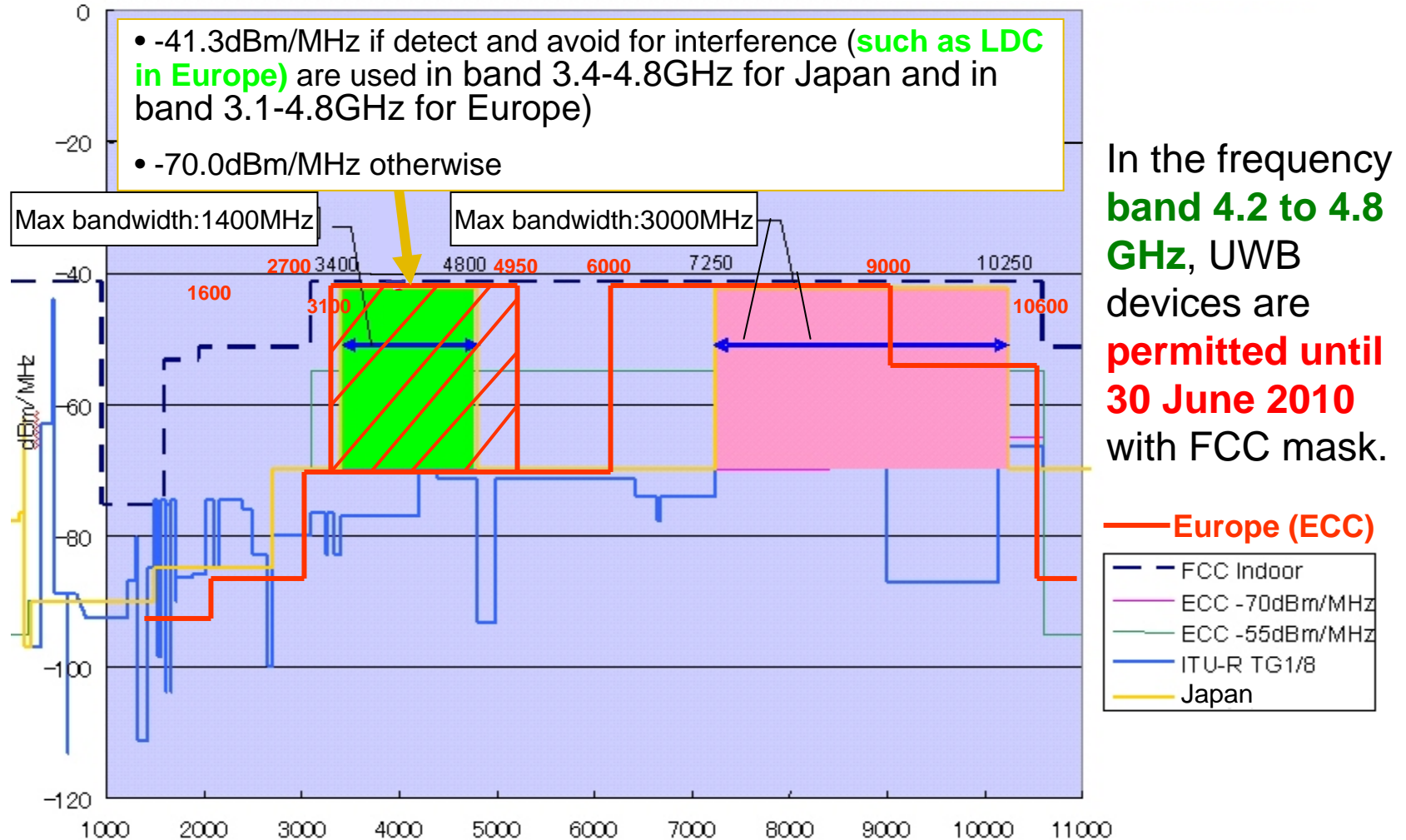
Draft Spectrum Mask in Europe (ECC)

still under consideration

- Peak e.i.r.p density
 - Below 1.6GHz: -50dBm/50MHz
 - 1.6 to 2.7GHz: -45dBm/50MHz
 - 2.7 to 3.1 GHz: -30dBm/50MHz
 - 3.1 to 4.8 GHz: -30dBm/50MHz
 - with efficient DAA techniques, peak e.i.r.p is 0dBm/50MHz
 - 4.8 to 6 GHz: -30dBm/50MHz
 - 6GHz to 9GHz: 0dBm/50MHz
 - 9GHz to 10.6GHz: -25dBm/50MHz
- PRF is not less than 1MHz.

Draft Spectrum Masks in Japan and Europe

still under consideration



In the frequency band 4.2 to 4.8 GHz, UWB devices are permitted until 30 June 2010 with FCC mask.

Key Issues to finalize Japanese Regulation for UWB in MIC, Japan (1/2)

1. Requirement for UWB

Describe required conditions for UWB systems for expected applications

Investigate feasibility of the required conditions

2. Expectation of UWB Market

Review expected market in other countries

Expectation of Japanese market

3. Technical Specification

Draft Spectrum Mask:

- Analysis and testing interference for the draft spectrum mask
- Transparency with regulation in other countries, e.g. Time-limited permission for 4.2-4.8GHz, DAA or LDC for 3.1- 4.8GHz

Dependency on Modulation Scheme:

- Keep fairness to support possible schemes or determine only a specific scheme.

Restriction of UWB Signal Transmission:

- Permissible average and peak levels of emission in band and spurious emission as well as spectrum mask
- Secondary emission of receivers

Key Issues to finalize Japanese Regulation for UWB in MIC, Japan (2/2)

4. Restriction of Indoor Application for UWB

Reconsider outdoor applications as well as indoor
How to guarantee indoor applications only?
Attenuation of walls

5. Feasibility of Interference Reduction to Existing Systems

Review feasible methods of reducing interference, e.g. DAA and LDC
Required conditions for such methods of interference reduction

6. Measurement Method

Method of measuring UWB signals
Method of Type-approval for compliant UWB system

7. Regulatory Restriction

Restricted zoon
Restriction of total number of products
Time Restriction, e.g. **Time-limited constraint during 4.2-4.8GHz**

UWB Demonstration Experiments and Updated Results of on-going Discussion

According to the instruction of MIC, a task force carried out UWB demonstration experiments to examine the effects of UWB to the following radio systems.

- (1) Fixed Microwave radio systems**
- (2) Terrestrial Electronic News Gathering (ENG)**
- (3) Maritime Radar**
- (4) Satellite Systems**
- (5) Cellular phones**
- (6) Wireless Access**
- (7) Amateur Communication Systems**
- (8) Aeronautical and meteorological Radar**

MIC issued the Japanese draft mask based on both of experimental results and discussions with the above system representatives. Hereafter, main results and conclusions are briefed.

(1) Microwave Fixed Radio Systems

- *UWB signal can be regarded as AWGN like.*
- *The effect of UWB depends on the use case such as the related locations, antenna height, wall attenuation for indoor use.*
- *The effect will also be related to activity factor (5%) and device density (1000/km²).*
- *The final report for coexistence with -70dBm/MHz mask and -41.3 dBm/MHz (until 201?) will be ready soon.*

(2) Terrestrial Electronic News Gathering (ENG)

- *Indoor UWB may have no problem for coexistence when the FPU devices only be operated outdoor.*
- *For indoor operated FPU or BS receiver, UWB should be subjected to some conditions because there is no wall attenuation.*
- *For large-scale indoor event with FPU, the use of UWB should be restricted. However, coexistence may be possible after setting some restriction on UWB.*

Examples of Required Distance of UWB Devices By Terrestrial ENG

	Aggregate interference			Single-entry interference
Density (devices/km ²)	1000	500	100	
Activity factor	5%			
Wall attenuation	0 dB			
Power mask	-70 dBm/MHz			
Frequencies of existed systems	5850MHz ~ 7125MHz			
Allowed interference level	-129.8 dBm/MHz			
Required distance (m)	43.2	33.1	22.9	21.6

(3) Maritime Radar

Examples of required distance of UWB devices by harbor radar

	Aggregate interference			Single-entry interference
Density (devices/km ²)	1000	500	100	53.0
Required distance (m) (Summation within 0.4 degree width of horizontal beam *)	53.1	53.1	53.0	
Required distance (m) (Summation over 360 degrees *)	808	281	64.4	
Required distance (m) (All UWB devices at a same location)	375.3 (50 devices)	265.7 (25 devices)	118.6 (5 devices)	

* Single UWB devices at the start point of summation on distance.

(4) Satellite systems

- All fixed satellite services including C, Ku and Ka bands have acceptability for emission limit of -70dBm/MHz
- Almost all mobile broadcasting services have acceptability for emission limit of -70dBm/MHz, but **acceptability for a downlink service (2630-2655MHz) is still being examined**
- Almost all Japan's N-STAR, quasi-ZENITH, mobile satellite and GPS services have acceptability for emission limit of -70 to -90dBm/MHz, but **acceptability for EES services is still being examined for emission limit of -70dBm/MHz**
- acceptability for X band services is still being examined for emission limit of -41.3dBm/MHz**

(5) Cellular Phones

System	Frequency band [MHz]	UWB signal level [dBm/MHz]	Permissible UWB level [dBm/MHz]	Required separation [m]
PDC	800	-90	-125.2 (BS) -115.2 (MS)	12.5 (BS) 0.5 (MS)
PDC	1500	-90	-125.2 -115.2	7.3 0.3
cdma2000	800	-90	-128.0 -114.0	9.9 0.4
cdma2000	2000	-85	-128.9 -114.9	13.0 0.4
PHS	1900	-85	-130.8 -120.8	15.5 0.8
WCDMA	2000	-85	-128.8 -114.8	13.0 0.4
4G	3600-4200	-70 (DAA)	-114.8 (MS)	~1 (DAA)
	4400-4900	-70 (DAA) -41.3	-114.8 (MS)	~1 (DAA) 25.7

- Single-entry interference
- Free-space propagation
- Wall-attenuation: 12dB
- Average power evaluation

UWB signals would not cause large interferences to the all of the in-service systems.

UWB devices with time-limited constraint will probably cause interferences to 4G system.

DAA technique is required to compromise with 4G system.

(6) Wireless Access

System	Frequency band [MHz]	UWB signal level [dBm/MHz]	Permissible UWB level [dBm/MHz]	Required separation [m]
Outdoor	5000	-70	-114.0	1.2
Indoor	5000	-70	-114.0 (STA) -114.0 (AP)	<1 <1

- Single-entry interference
- Free-space propagation
- Wall-attenuation: 12dB
- Average power evaluation

} UWB signals would not cause large interferences to these systems.

System Parameters

Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Symbol rate	250kHz
Bandwidth	20MHz
FEC	Convolutional coding
Antenna	Outdoor: 16dBi (Directional) Indoor: 10dBi (Non-directional)

(7) Amateur Radio Communication Systems

- Single-entry interference
- Free-space propagation
- Wall-attenuation: 12dB
- Average power evaluation

System	Frequency band [MHz]	UWB signal level [dBm/MHz]	Permissible UWB level [dBm/MHz]	Required separation [m]
5.6G A1A	5600	-70	-102.0	3.4
5.6G F8W	5600	-70	-94.0	1.3
10G A1A	10100	-41.3	-102.0	72.2
10G F8W	10100	-41.3	-94.0	28.8

UWB signals would not cause large interferences to these systems.

Additional evaluation is required.

System Parameters

	5.6G A1A	5.6G F8W	10G A1A	10G F8W
Modulation		FM		FM
Symbol rate				
Bandwidth	less than 125Hz		less than 125Hz	
FEC	Non	Non	Non	Non
Antenna Gain	30 dBi	30	30 dBi	30

(8) Aeronautical and Meteorological Radar

A. Aeronautical Radar systems

System	Frequency band [MHz]	UWB signal level [dBm/MHz]	Permissible UWB level [dBm/MHz]	Required separation [m]
VHF	118	-90	-68.5	21.3
DME	1150	-90	-77.0	0.7
TCAS	1030	-90	-90.5	0.2
ATC	1090	-90	-93.5	0.1
R/A	4238	-41.3	-149.0	699.1

- Single-entry interference
- Free-space propagation
- Wall-attenuation: 12dB
- Average power evaluation

UWB signals would not cause large interferences to these systems.

Additional evaluation is required.

System Parameters

	Aeronautical Radar				
System	VHF	DME	TCAS	ATC	R/A
Frequency [MHz]	118 - 137	1025 - 1150	1030	1090	4238 - 4362
Modulation	MSK, D8PSK	PM	PM	PM	FM
Bandwidth	2.8kHz	670kHz	9MHz	25Hz	5kHz

(8) Aeronautical and Meteorological Radar

B. Meteorological (Weather) Radar systems

- Single-entry interference
- Free-space propagation
- Wall-attenuation: 12dB
- Average power evaluation

System	Frequency band [MHz]	UWB signal level [dBm/MHz]	Permissible UWB level [dBm/MHz]	Required separation [m]
General	5260	-70	-114.0	250.5
Airport	5260	-70	-112.0	265.3
Thunder	5260/5695	-70	-118.0	18.9/17.7
WX RDR	9300	-41.3	-121.4	334.6

UWB signals would not cause large interferences to these systems.

Additional evaluation is required.

System Parameters

	Meteorological Radar			
System	General	Airport	Thunder	WX RDR
Frequency [MHz]	5260 - 5340	5260 - 5290	5260/5695	9345
Modulation			PM	PM
Bandwidth	1.6MHz	4MHz	3.2MHz	467kHz

Summary in Impacts of Draft Spectral Mask on Existing Radio Services (till Dec. 22) (1/2)

- **Fixed Microwave Radio Systems**
 - Under consideration
- **Terrestrial Electronic News Gathering (ENG): Broadcasting**
 - Broadcast auxiliary service: Acceptable other than indoor FPU (6.85-7.125 GHz)
 - BS/CS and terrestrial digital (ISDBT): Under consideration
- **Maritime radar**
 - Acceptable other than port and harbor radar and fishing ground radar (9.740 GHz)
- **Aeronautical and meteorological radar**
 - Acceptable other than meteorological radar (5.26-5.34 GHz)

Summary in Impacts of Draft Spectral Mask on Existing Radio Services (till Dec. 22) (2/2)

- **Mobile satellite / fixed satellite / earth exploration satellite / radio navigation satellite**
 - Under consideration
- **Radio astronomy**
 - Under consideration
- **Amateur radio**
 - Acceptable other than using wall-bouncing path (10.1 GHz)
- **Cellular phone**
 - Acceptable except for next generation systems (4.4-4.9 GHz)
- **Wireless access and WLAN**
 - Acceptable
- **ITS-DSRC**
 - Acceptable