

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

Submission Title: [Introduction of New Frequency Regulation for Smart Utility Network in Japan]

Date Submitted: [July 19th, 2011]

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Re: [In response to TG4g Call for Proposals]

Abstract: [This contribution summarizes new frequency regulation on 920 MHz band for Smart Utility Network in Japan and differences from current frequency regulation on 950 MHz.]

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Introduction of New Frequency Regulation for Smart Utility Network in Japan*

* The view and thought in this contribution are NOT ones of Ministry of Internal Affairs and Communications (MIC) in Japan. The amendment regulation described in this contribution may be changed in the future.

Summary

- The latest status of the reallocation of 950 MHz band in Japan is summarized
- The differences between current 950MHz and new 920 MHz band regulations are summarized
- Prospective addition and revision to current draft document are summarized.

Background

Background on Reallocation of Frequency Band for Smart Utility Network (SUN) in Japan

- Currently 950 MHz band has been assigned for SUN and 802.15.4g draft has been edited on the frequency band.
- 950MHz band will be reallocated to new mobile phone services such as LTE: Long Term Evolution in order to harmonize with other countries / regions.
- Instead, the frequency band for sensor networks including SUN, smart meters, etc will be moved from 950MHz band to 920MHz band (915MHz - 930MHz).

Timeline for the amendment

- First Amendment Draft Completion Apr 2011
- Call for Public Comment May 2011
- Close Public Comments Jun 2011
- Revised Amendment Draft approval (Expected) Jul/Aug 2011
- New ARIB Standard Approval (Expected) Dec 2011
- 920MHz Band Effectuation (Expected) July 2012

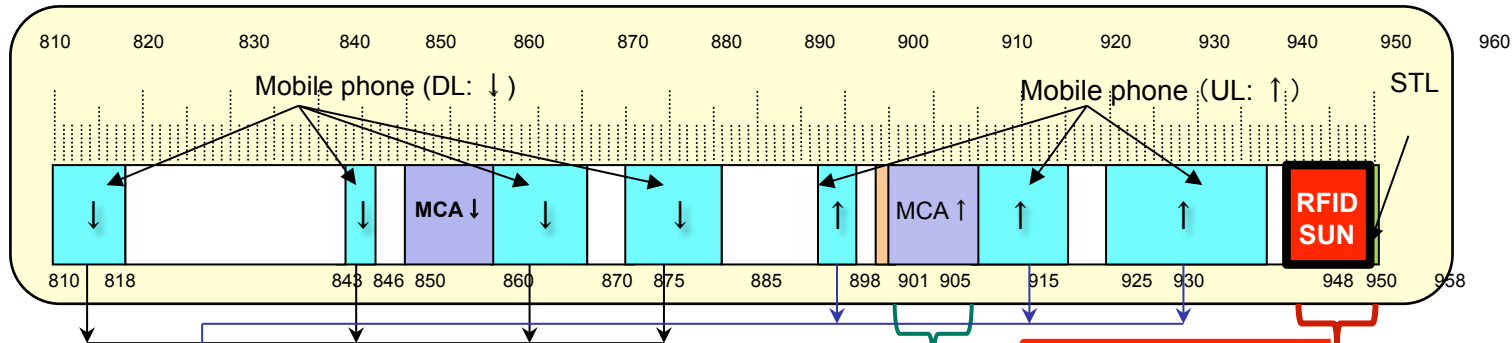
The difference between current 950MHz and new 920 MHz band regulations

Major changes from 950 MHz to 920 MHz

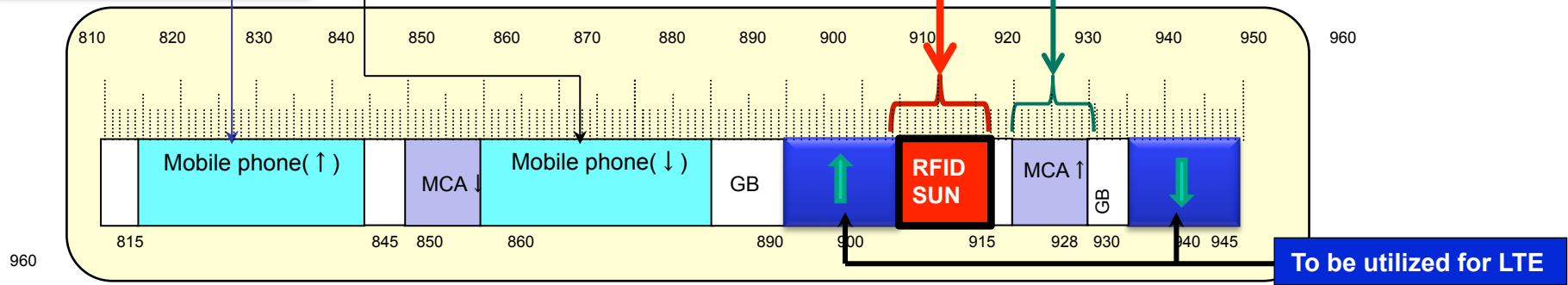
	950 MHz band	920 MHz band
Frequency band	950MHz – 958MHz	915MHz – 930MHz
Output power	10mW / 1mW	250mW / 20mW / 1mW
Spectrum mask	See Slide #15	
Sending control	See Slide #18	

Overview of frequency band reallocation

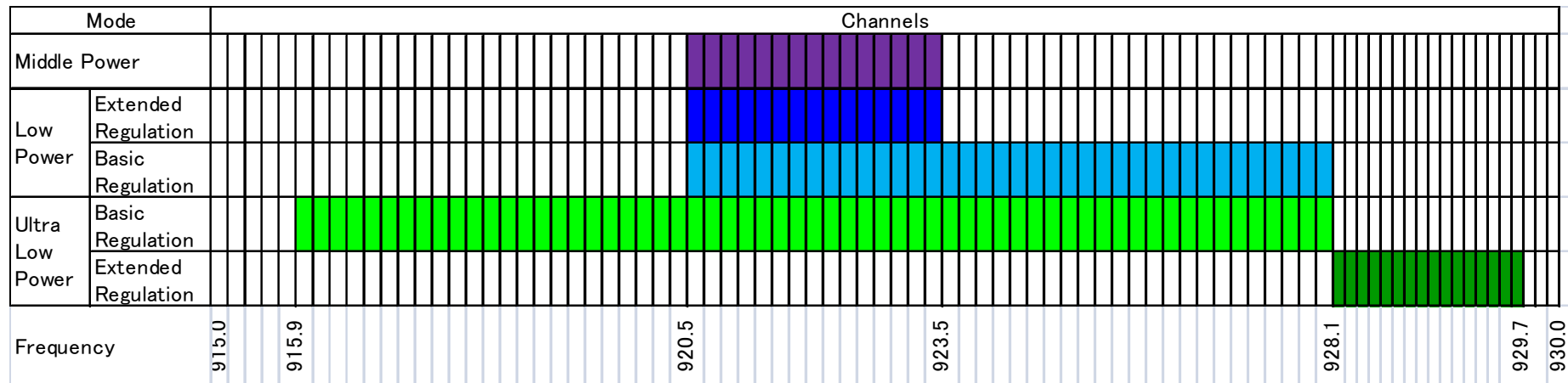
Current band allocation



After reallocation



Channel Plan and output power in 920MHz Band



- 5 Regulatory Mode
 - Middle Power Mode ($\leq 250\text{mW}$)
 - Low Power Mode ($\leq 20\text{mW}$)
 - Basic Regulation
 - Extended Regulation
 - Ultra low Power Mode ($\leq 1\text{mW}$)
 - Basic Regulation
 - Extended Regulation

Middle Power Mode & Low Power Mode (Basic)

- Expected Applications: Sensor Networks, **Smart Meters**
- Frequency: 920.5 - 928.1MHz
- Antenna Power:
 - $\leq 20\text{mW}$ ($920.5\text{MHz} \leq f \leq 928.1\text{MHz}$)
 - $\leq 250\text{mW}$ ($920.5\text{MHz} \leq f \leq 923.5\text{MHz}$)
- Antenna Gain: $\leq 3\text{dBi}$
- Channel Width: 200kHz*n (n=1-5)
- Adjacent Channel Leakage Power:
 - 15dBm (Output Power $\leq 20\text{mW}$)
 - 5dBm (Output Power $> 20\text{mW}$)
- Carrier Sense Level: -80dBm
- Sending Control:

Carrier sense time	Sending duration	Pause duration	The amount of sending time summed for 1 hour
$\geq 128 \mu\text{s}$	$\leq 400\text{ms}$	$\geq 2\text{ms}$ (sending time $\geq 6\text{ms}$) Not needed (sending time $< 6\text{ms}$)	$\leq 360\text{s}$

Low Power Mode (Extended)

- Expected Applications: Tele-metering, Tele-control
- Frequency: 920.5 - 923.5MHz
- Antenna Power: $\leq 20\text{mW}$
- Antenna Gain: $\leq 3\text{dBi}$
- Channel Width: 200kHz*n (n=1-5)
- Adjacent Channel Leakage Power: -18dBm
- Carrier Sense Level: -80dBm
- Sending Control:

Carrier sense time	Sending duration	Pause duration	The amount of sending time summed for 1 hour
$\geq 5\text{s}$	$\leq 4\text{s}^*$	$\geq 50\text{ ms}$	Don't care

* The sender can transmit again during continuous sending time if it does carrier sense longer than $128\mu\text{s}$ at every transmission.

Ultra Low Power Mode (Basic)

- Expected Applications: Active RFID
- Frequency: 915.9 - 928.1MHz
- Antenna Power: $\leq 1\text{mW}$
- Antenna Gain: $\leq 3\text{dBi}$
- Channel Width: 200kHz*n (n=1-5)
- Adjacent Channel Leakage Power:
-26dBm
- Sending Control:

Carrier sense time	Sending duration	Pause duration	The amount of sending time summed for 1 hour
Not needed	$\leq 100\text{ms}$	$\geq 100\text{ms}$	$\leq 3.6\text{s}$

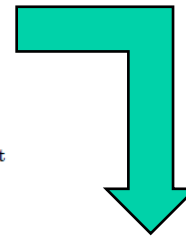
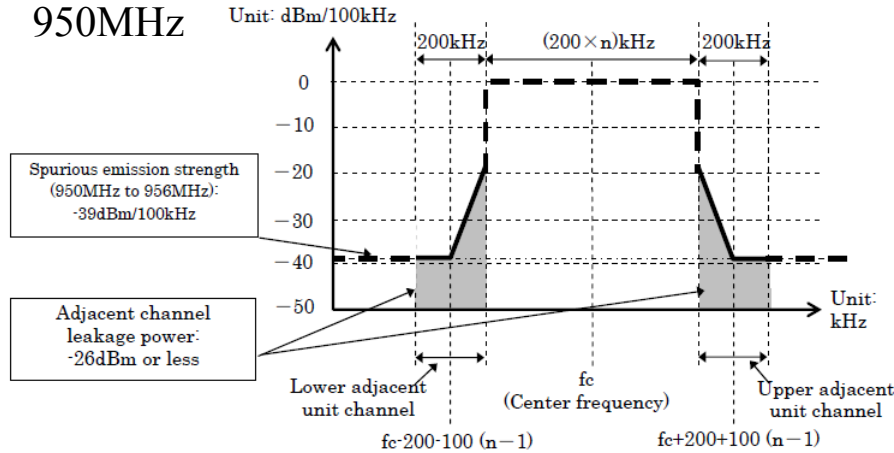
Ultra Low Power Mode (Extended)

- Expected Applications: Remote Control
- Frequency: 928.1 - 929.7MHz
- Antenna Power: $\leq 1\text{mW}$
- Antenna Gain: $\leq 3\text{dBi}$
- Channel Width: 100kHz*n (n=1-5)
- Adjacent Channel Leakage Power:
-26dBm
- Sending Control:

Carrier sense time	Sending duration	Pause duration	The amount of sending time summed for 1 hour
Not needed	$\leq 50\text{ms}$	$\geq 50\text{ms}$	Don't care

Spectrum Mask

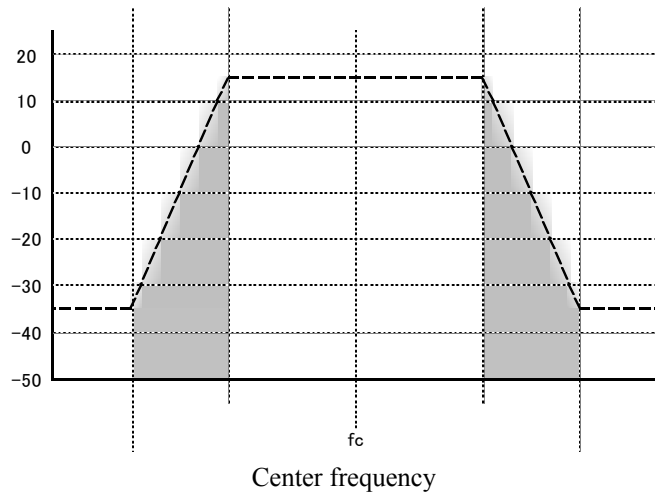
950MHz



Spectrum Mask is relaxed comparing to 950MHz

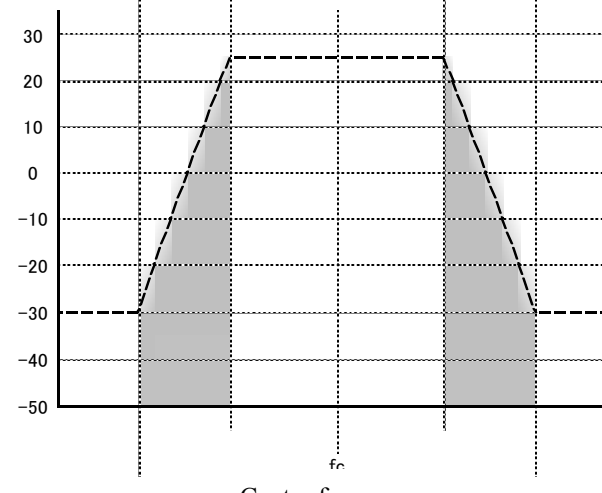
920MHz

1mW < Output Power ≤ 20mW



920MHz

20mW < Output Power ≤ 250mW



Spurious Emission Strength in 950MHz

Frequency band	Spurious Emission Strength	Reference bandwidth
$f \leq 710$ MHz	-36 dBm	100 kHz
710 MHz < $f \leq 945$ MHz	-55 dBm	1 MHz
945 MHz < $f \leq 950$ MHz	-55 dBm	100 kHz
950 MHz < $f \leq 958$ MHz [except for $ f - f_c \leq 200 + 100 \times (n - 1)$ kHz]	-39 dBm	100 kHz
958 MHz < $f \leq 1000$ MHz	-58 dBm	100 kHz
1000 MHz < $f \leq 1215$ MHz	-48 dBm	1 MHz
1215 MHz < $f \leq 1884.5$ MHz	-30 dBm	1 MHz
1884.5 MHz < $f \leq 1919.6$ MHz	-55 dBm	1 MHz
1919.6 MHz < f	-30 dBm	1 MHz

Spurious Emission Strength in 920MHz

Frequency band	Spurious Emission Strength	Reference bandwidth
$f \leq 710$ MHz	-36 dBm	100 kHz
710 MHz < $f \leq 900$ MHz	-55 dBm	1 MHz
900 MHz < $f \leq 915$ MHz	-55 dBm	100 kHz
915 MHz < $f \leq 920.3$ MHz	-36 dBm	100 kHz
920.3 MHz < $f \leq 924.3$ MHz [except for $ f - f_c \leq 200 + 100 \times (n - 1)$ kHz]	-36dBm (Output power ≤ 20 mW) -29dBm (Output power > 20 mW)	100 kHz
924.3 MHz < $f \leq 928.1$ MHz [except for $ f - f_c \leq 200 + 100 \times (n - 1)$ kHz]	-36 dBm	100 kHz
928.1 MHz < $f \leq 930.0$ MHz [except for $ f - f_c \leq 100 + 50 \times (n - 1)$ kHz]	-36 dBm	100 kHz
930 MHz < $f \leq 1000$ MHz	-55 dBm	100 kHz
1000 MHz < $f \leq 1215$ MHz	-48 dBm	1 MHz
1215 MHz < f	-30 dBm	1 MHz

The blue colored items are different from the regulation of 950MHz band.

- Spurious emission strength should be -55dBm/100kHz or less when the frequency is higher than 915MHz and less or equal to 930MHz until July 24th 2012.

Sending Control

Combination of carrier sense time and sending control parameters in 950MHz

Antenna power (P_t)	Carrier sense time	Limit of sending time	Pause time of sending	The amount of sending time summed for 1 hour
$P_t \leq 1 \text{ mW}$	$\geq 10 \text{ ms}$	$\leq 1 \text{ s}$	$\geq 100 \text{ ms}$	Don't care
	$\geq 128 \mu\text{s}$	$\leq 100 \text{ ms}$	$\geq 100 \text{ ms}$	$\geq 360 \text{ s}$
	0	$\leq 100 \text{ ms}$	$\geq 100 \text{ ms}$	$\geq 3.6 \text{ s}$
$1 \text{ mW} < P_t \leq 10 \text{ mW}$	$\geq 10 \text{ ms}$	$\leq 1 \text{ s}$	$\geq 100 \text{ ms}$	Don't care
	$\geq 128 \mu\text{s}$	$\leq 100 \text{ ms}$	$\geq 100 \text{ ms}$	$\geq 360 \text{ s}$

Combination of carrier sense time and sending control parameters in 920MHz

Antenna power (P_t)	Frequency	Carrier sense time	Limit of sending time	Pause time of sending	The amount of sending time summed for 1 hour
$P_t \leq 1 \text{ mW}$	928.1 – 929.7MHz	0	$\leq 50 \text{ ms}$	$\geq 50 \text{ ms}$	Don't care
	915.9 – 928.1MHz	0	$\leq 100 \text{ ms}$	$\geq 100 \text{ ms}$	$\geq 3.6 \text{ s}$
$1 \text{ mW} < P_t \leq 20 \text{ mW}$	920.5 – 928.1MHz	$\geq 128 \mu\text{s}$	$\leq 400 \text{ ms}$	$\geq 0/6 \text{ ms}$	$\geq 360 \text{ s}$
	920.5 – 923.5MHz	$\geq 5 \text{ s}$	$\leq 4 \text{ s}$	$\geq 50 \text{ ms}$	Don't care
$20 \text{ mW} < P_t \leq 250 \text{ mW}$	920.5 – 923.5MHz	$\geq 128 \mu\text{s}$	$\leq 400 \text{ ms}$	$\geq 0/6 \text{ ms}$	$\geq 360 \text{ s}$

It should be confirmed whether the same operating mode as 950MHz can be applied to 920MHz.

Prospective revision and addition to current draft document

- Both 920 MHz and 950 MHz regulation parameters must be included
- The following parts need to be revised in reflect of addition of 920 MHz parameters
 - operating mode, channel page, CCA, and so on
- During sponsor ballot, some comments related to revised parts will be made and the recommended changes to the draft document will be proposed