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]
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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.]

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

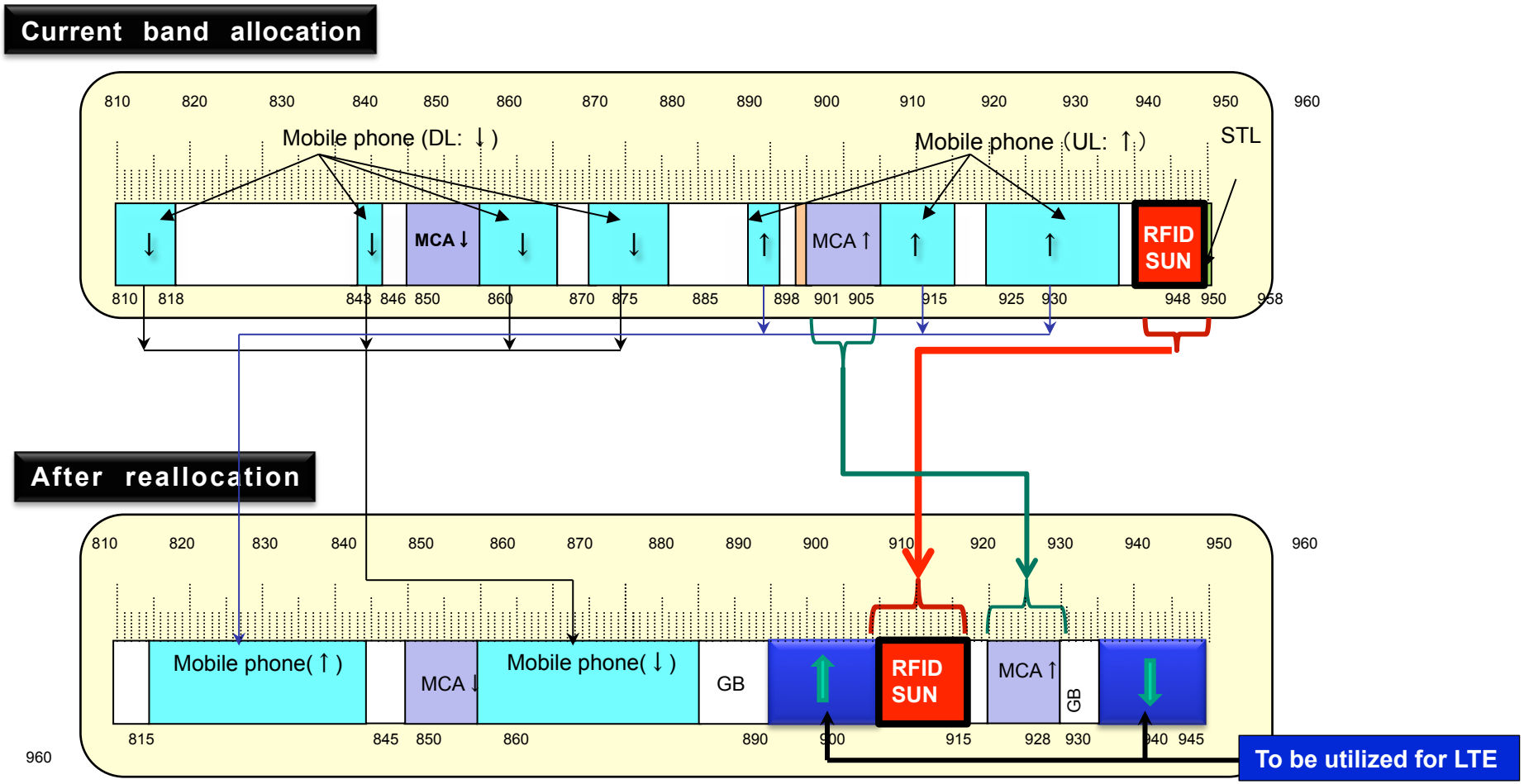
- First Amendment Draft Completion Apr 2011
- Call for Public Comment May 2011
- Close Public Comments Jun 2011
- Revised Amendment Draft approval (Expected) Jul/Aug 2011
- New ARIB Standard Approval (Expected) Dec 2011
- 920MHz Band Effectuation (Expected) July 2012

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

Major changes from 950 MHz to 920 MHz

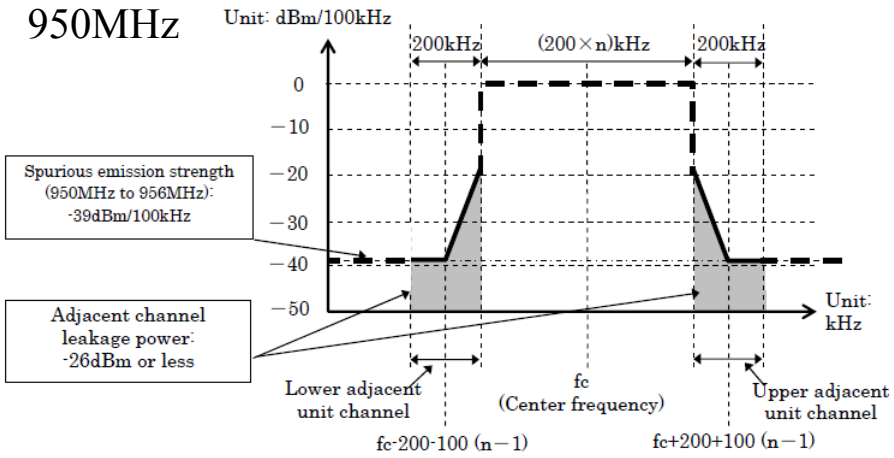
	950 MHz band	920 MHz band
Frequency band	950MHz – 958MHz	915MHz – 930MHz
Output power	10mW / 1mW	250mW / 20mW / 1mW
Spectrum mask	See Slide #10	
Sending control	See Slide #13	

Overview of frequency band reallocation



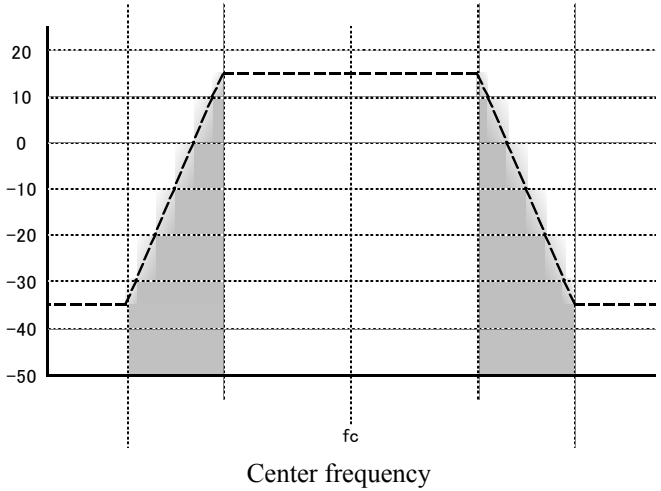
Spectrum Mask

950MHz

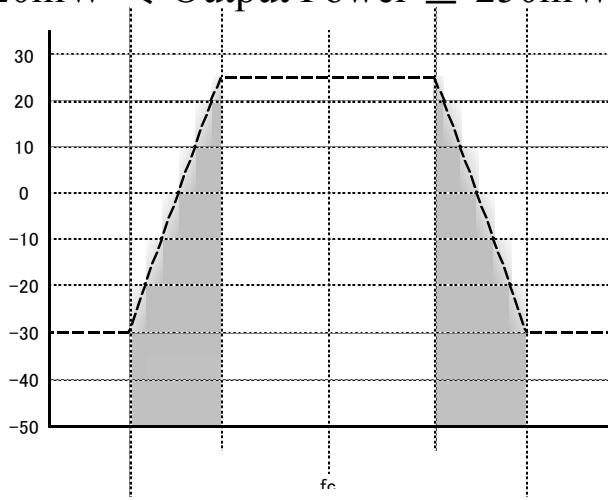


Spectrum Mask is relaxed comparing to 950MHz

920MHz
1mW < Output Power ≦ 20mW



920MHz
20mW < Output Power ≦ 250mW



Spurious Emission Strength in 950MHz

Frequency band	Spurious Emission Strength	Reference bandwidth
f ≤ 710 MHz	–36 dBm	100 kHz
710 MHz < f ≤ 945 MHz	–55 dBm	1 MHz
945 MHz < f ≤ 950 MHz	–55 dBm	100 kHz
950 MHz < f ≤ 958 MHz [except for |f – fc| ≤ 200 + 100 × (*n* – 1) kHz]	–39 dBm	100 kHz
958 MHz < f ≤ 1000 MHz	–58 dBm	100 kHz
1000 MHz < f ≤ 1215 MHz	–48 dBm	1 MHz
1215 MHz < f ≤ 1884.5 MHz	–30 dBm	1 MHz
1884.5 MHz < f ≤ 1919.6 MHz	–55 dBm	1 MHz
1919.6 MHz < f	–30 dBm	1 MHz

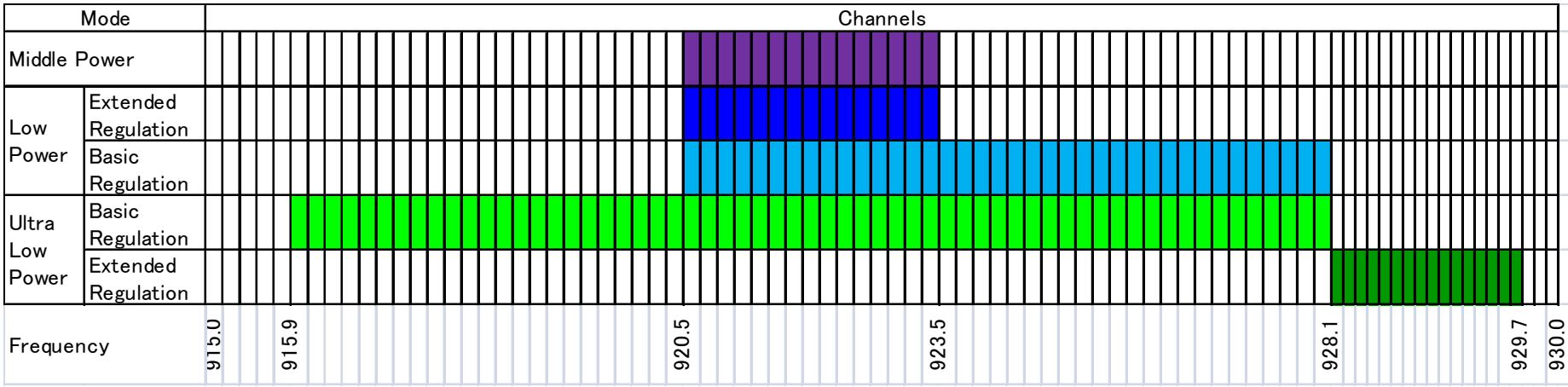
Spurious Emission Strength in 920MHz

Frequency band	Spurious Emission Strength	Reference bandwidth
f ≤ 710 MHz	–36 dBm	100 kHz
710 MHz < f ≤ 900 MHz	–55 dBm	1 MHz
900 MHz < f ≤ 915 MHz	–55 dBm	100 kHz
915 MHz < f ≤ 920.3 MHz	–36 dBm	100 kHz
920.3 MHz < f ≤ 924.3 MHz [except for |f – fc| ≤ 200 + 100 × (n – 1) kHz]	-36dBm (Output power ≦ 20mW) -29dBm (Output power ＞ 20mW)	100 kHz
924.3 MHz < f ≤ 928.1 MHz [except for |f – fc| ≤ 200 + 100 × (n – 1) kHz]	–36 dBm	100 kHz
928.1 MHz < f ≤ 930.0 MHz [except for |f – fc| ≤ 100 + 50 × (n – 1) kHz]	–36 dBm	100 kHz
930 MHz < f ≤ 1000 MHz	–55 dBm	100 kHz
1000 MHz < f ≤ 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.

Channel Plan and output power in 920MHz Band



- 5 Regulatory Mode
  - Middle Power Mode (≦250mW)
  - Low Power Mode (≦ 20mW)
    - Basic Regulation
    - Extended Regulation
  - Ultra low Power Mode (≦ 1mW)
    - Basic Regulation
    - Extended Regulation

Middle Power Mode & Low Power Mode (Basic)

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

Carrier sense time	Sending duration	Pause duration	The amount of sending time summed for 1 hour
≥ 128 μ s	≤ 400ms	≥ 2ms (sending time ≧ 6ms) Not needed (sending time ＜ 6ms)	≤ 360s

Low Power Mode (Extended)

- Expected Applications: Tele-metering, Tele-control
- Frequency: 920.5 - 923.5MHz
- Antenna Power: ≤ 20mW
- Antenna Gain: ≤ 3dBi
- 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
≥ 5s	≤ 4s*	≥ 50 ms	Don't care

* The sender can transmit again during continuous sending time if it does carrier sense longer than 128μs at every transmission.

Ultra Low Power Mode (Basic)

- Expected Applications: Active RFID
- Frequency: 915.9 - 928.1MHz
- Antenna Power: ≤ 1mW
- Antenna Gain: ≤ 3dBi
- 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	≤ 100ms	≥ 100ms	≤ 3.6s

Ultra Low Power Mode (Extended)

- Expected Applications: Remote Control
- Frequency: 928.1 - 929.7MHz
- Antenna Power: ≤ 1mW
- Antenna Gain: ≤ 3dBi
- 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	≤ 50ms	≥ 50ms	Don't care

Sending Control

Conbination 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**
$P_t \leq 1$ mW	$\geq$ 10 ms	$\leq$ 1 s	$\geq$ 100 ms	Don't care
	$\geq$ 128 μs	$\leq$ 100 ms	$\geq$ 100 ms	$\geq$ 360 s
	0	$\leq$ 100 ms	$\geq$ 100 ms	$\geq$ 3.6 s
1 mW < $P_t \leq$ 10 mW	$\geq$ 10 ms	$\leq$ 1 s	$\geq$ 100 ms	Don't care
	$\geq$ 128 μs	$\leq$ 100 ms	$\geq$ 100 ms	$\geq$ 360 s

Conbination 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**
$P_t \leq 1$ mW	928.1 − 929.7MHz	0	$\leq$ 50 ms	$\geq$ 50 ms	Don't care
	915.9 − 928.1MHz	0	$\leq$ 100 ms	$\geq$ 100 ms	$\geq$ 3.6 s
1 mW < $P_t \leq$ 20 mW	920.5 − 928.1MHz	$\geq$ 128 μs	$\leq$ 400 ms	$\geq$ 0/6 ms	$\geq$ 360 s
	920.5 − 923.5MHz	$\geq$ 5 s	$\leq$ 4 s	$\geq$ 50 ms	Don't care
20 mW < $P_t \leq$ 250 mW	920.5 − 923.5MHz	$\geq$ 128 μs	$\leq$ 400 ms	$\geq$ 0/6 ms	$\geq$ 360 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