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**Re:** [ Contribution to IEEE 802.15.6 Meeting, July 2010 ]

**Abstract:** [ This document presents regulations for 900 MHz frequency band in Korea and suggests a proposal of frequency channel plan for the IEEE 802.15.6 ]

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# 900 MHz Frequency Band Utilization for IEEE 802.15.6 in Korea

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# PHY Regulation for 902-928 MHz Band

- 902-928 MHz bands has different modulation parameters from those of the 863-870 and 950-963 MHz bands.
- The current channel plan for 902-928 MHz band in Korea does not well match with that of the RFID/USN regulatory requirements.
- If we modify the modulation parameters for the 902 MHz to 928 MHz bands into the same parameters of the 863-870 and 950-963 MHz bands, we can adjust the channels to fit the channels of the RFID/USN in Korea.

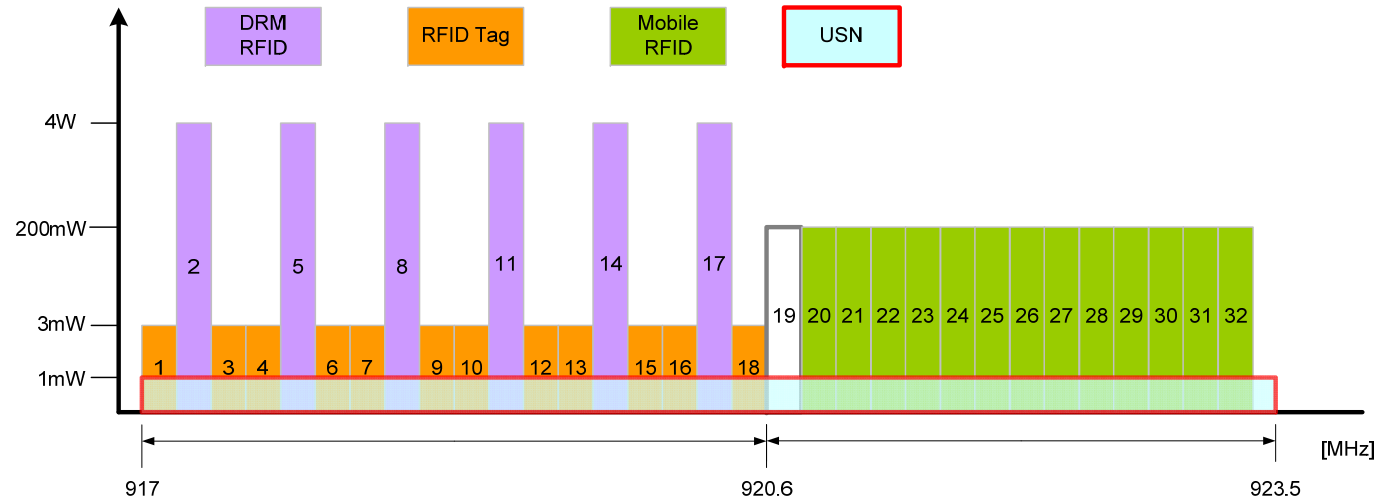
Packet Component	Modulation	Symbol Rate (ksps)	Information Data Rate (kbps)	Support
PLCP Header	$\pi/2$ -DBPSK	300	91.9	Mandatory
PSDU	$\pi/2$ -DBPSK	300	121.4	Mandatory
PSDU	$\pi/2$ -DBPSK	300	242.9	Mandatory
PSDU	$\pi/4$ -DQPSK	300	485.7	Mandatory
PSDU	$\pi/8$ -D8PSK	300	728.6	Optional

[902-928 MHz Bands]

Packet Component	Modulation	Symbol Rate (ksps)	Information Data Rate (kbps)	Support
PLCP Header	$\pi/2$ -DBPSK	250	76.6	Mandatory
PSDU	$\pi/2$ -DBPSK	250	101.2	Mandatory
PSDU	$\pi/2$ -DBPSK	250	202.4	Mandatory
PSDU	$\pi/4$ -DQPSK	250	404.8	Mandatory
PSDU	$\pi/8$ -D8PSK	250	607.1	Optional

[863-870 MHz, 950-956 MHz Bands]

# RFID/USN Frequency Regulation in Korea



- 900MHz New Band RFID/USN Technical Regulation
  - 917~920.6 MHz for the Channelization of the fixed RFID systems
    - DRM(Dense Reader Mode) RFID & Tag Band
    - 18 Channels (CH#1 ~ CH#18)
  - 920.6~923.5 MHz for the Channelization of the mobile RFID systems
    - Low transmission power RFID Channelization
    - 13 Channels (CH#20 ~ CH#32)
  - 917~923.5 MHz USN Channelization
  - Guard Channel : CH#19

\* USN : Ubiquitous Sensor Network  
For example 15.4, 15.4a, 15.4g, and 15.6

# Detailed Technical Descriptions

- 917~920.6 MHz DRM(Dense Reader Mode) RFID Channelization
  - Separates powerful Readers and weak tags spectrally to prevent reader-tag interference
  - RFID Readers use 6 fixed high power channels of 200KHz spacing and each of 600 KHz apart
  - Therefore interrogator transmissions may take place on the same channel and it reduces interference to tag transmissions
  - Fixed type DRM 6 Channels (CH# 2, 5, 8, 11, 14, 17)
  - Transmit level is up to 4 watts EIRP Frequency Hopping
  - Frequency accuracy :  $\pm 10$  ppm
  - In the channels 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18 the transmission power is restricted to 3 mW for the tag's backscatter reply signals
- 920.6~923.5 MHz Mobile RFID & Low Tx power RFID Channelization
  - Max. transmission power : 200 mW EIRP
  - Low transmission power for the hand/mobile RFID Readers
- 917~923.5 MHz USN Channelization
  - Generic USN devices can share the channels with spectrum access methods
  - Max. transmission power : 10mW EIRP
  - Frequency accuracy :  $\pm 40$  ppm

# Sharing Conditions for RFID/USN

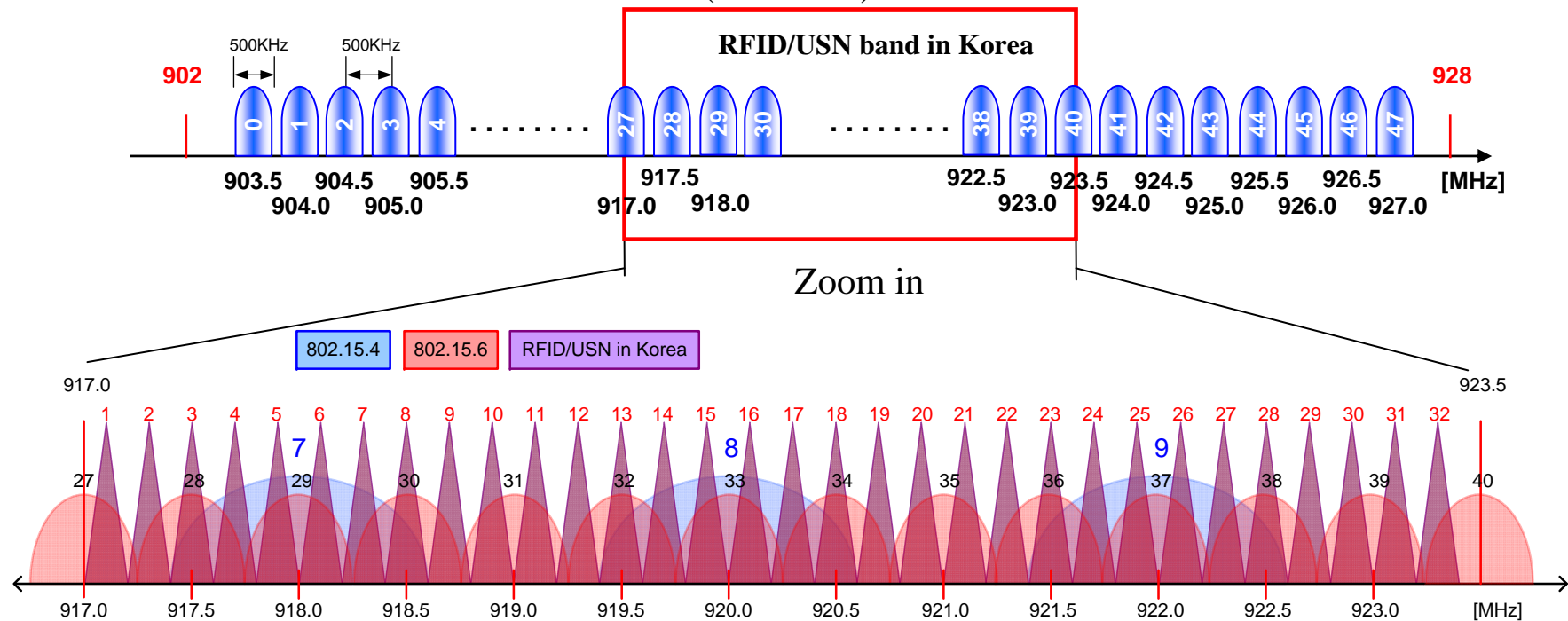
- FHSS (Frequency Hopping Spread Spectrum)
  - No. of hopping channels for RFID should be more than 16.
  - No. of hopping channels for DRM RFID should be more than 6.
  - Max. hopping time should be less than or equal to 0.4 second.
- LBT (Listen Before Transmission)/CSMA-CA
  - Maximum period of continuous transmission should be 4 seconds.
  - Transmission is required to cease for a period of not less than 50 ms.
  - Carrier sensing time should be greater than 5 ms.
  - Only transmit if no signals are detected at levels greater than -65 dBm.
- Other devices without LBT and FH schemes should observe Duty Cycle Criteria.
  - It must be lower than 2% for any 20 sec.

More than 5ms , -65 dBm



# The Problem of Current Channelization

- 12 channels in 900 MHz band are available in Korea
  - Channels # 28th through #39<sup>th</sup> are available
  - The high power RFID channels (200 kHz) are not well aligned with the channels for IEEE 802.15.6 (500 kHz).





## Proposed Channel Plan for 902-928 MHz

- We propose to assign 60 channels at the frequency range from 902 MHz through 928 MHz, whose modulation parameters are the same as those of the 863-870 and 950-963 MHz bands
- The proposed channel plan is as follows

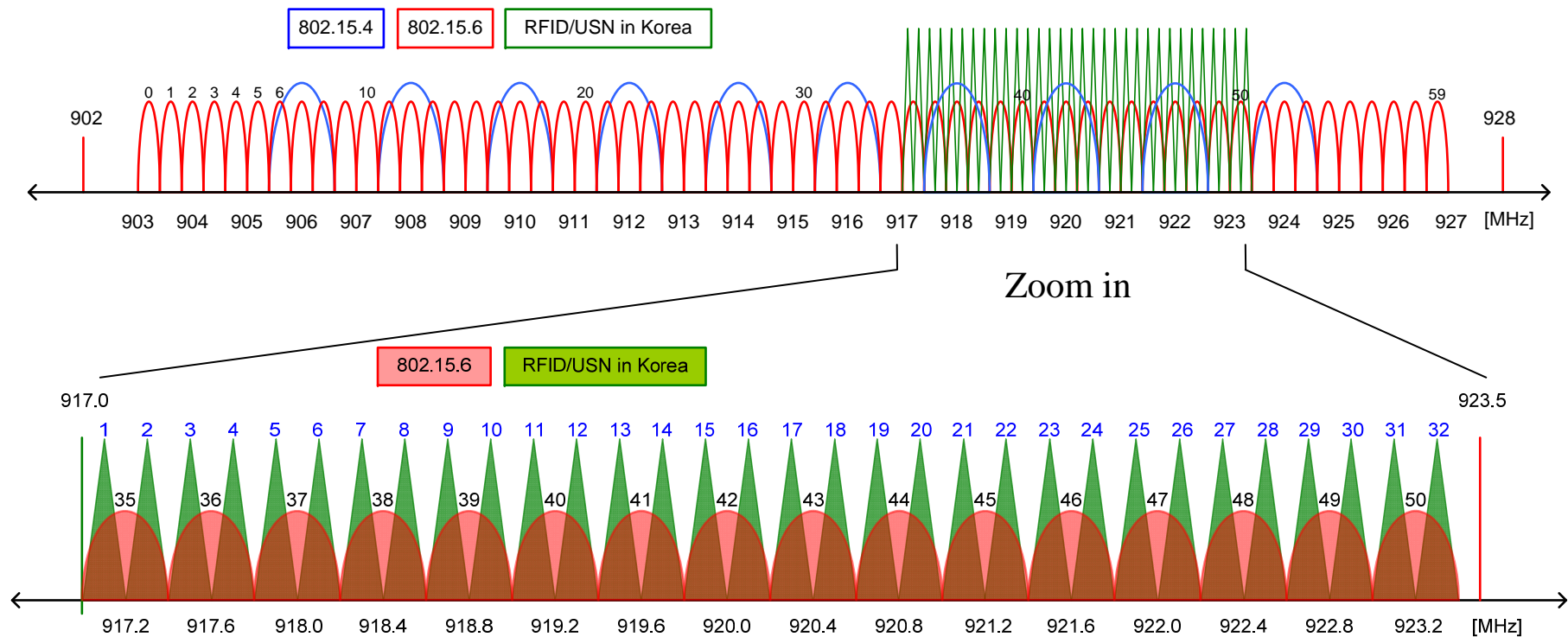
$$f_c = 903.20 + 0.40 \times n_c \text{ (MHz)}, n_c = 0, \dots, 59$$

- 16 channels (6.4 MHz) can be available in RFID/USN bands of Korea with the proposed plan.
  - Channels # 35th through #50th are available

\* USN : Ubiquitous Sensor Network  
For example 15.4, 15.4a, 15.4g, and 15.6

# Proposed WBAN Channel Plan in Korea

- 16 WBAN channels can be available in RFID/USN bands of Korea
  - They are well aligned with the RFID/USN Channels.



# Summary

- The present document gives information on the regulatory issues in the frequency range from 917 MHz to 923.5 MHz of Korea.
- RFID/USN devices can co-exist within the band if using LBT or other spectrum access methods such as duty cycle.
- The channel plan of 902-928 MHz frequency bands of the WBAN narrowband specification is not appropriate for the frequency regulation of Korea.
- It is proposed to alter the current modulation parameters for bands of 902-928 MHz into the same parameters of the 863-870 and 950-963 MHz bands.
- The present document also proposes a new channel plan of 902-928 MHz frequency bands to be adequate for the regulations of RFID/USN band in Korea.
- The proposed plan designates 60 available channels and adopting the same modulation parameters would be more advantageous to implement multiple frequency systems at the multiple bands.