TV White Space (TVWS) Policy and Services in Korea

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I Background and Progress
(Definition) **Television white spaces (TVWS)**

“A portion of spectrum in a band allocated to the broadcasting service and used for television broadcasting that is identified by an administration as available for wireless communication at a given time in a given geographical area on a non-interfering and non-protected basis with regard to other services with a higher priority on a national basis”

(Source: ITU)

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TVWS Availability on a Given Channel Across a Geography

- Licensed but unutilized television (TV) band spectrum is called as TV white space. Ultra high frequency (UHF) TV band spectrum has very good wireless radio propagation characteristics.

(Source: ‘TV white spaces: A consultation on white Space device requirements’, Ofcom, November 2012)
TVWS Background

- To solve shortage problem of spectrum below 1GHz band, caused by increase in mobile traffic
- To strengthen global competitiveness by discovering new technologies and services
  - In line with R&D of CR/SDR, efforts to discover new wireless service and establish WS database in order to utilize TVWS after Digital TV switchover

<table>
<thead>
<tr>
<th>CH</th>
<th>Freq. (MHz)</th>
<th>DTV Reserved</th>
<th>DTV Reserved</th>
<th>DMB / DTV Reserved</th>
<th>DTV (TVWS band in Korea)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>72</td>
<td></td>
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<tr>
<td>5</td>
<td>76</td>
<td></td>
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<tr>
<td>6</td>
<td>88</td>
<td></td>
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<tr>
<td>7</td>
<td>174</td>
<td></td>
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</tr>
<tr>
<td>13</td>
<td>216</td>
<td></td>
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<tr>
<td>14</td>
<td>470</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>51</td>
<td>698</td>
<td></td>
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</tr>
</tbody>
</table>

※ Primarily considering DTV band(CH. 14~51 : 470~698MHz), Spectrum Policy for VHF band(CH. 2~13 : 54~216MHz) will be determined in future, after finalizing broadcasting radio spectrum plans in South Korea

※ R&D: Research and Development, CR : Cognitive Radio, SDR : Software Defined Radio
TVWS Background

(ITU-D Report) FINAL REPORTS FOR THE 2014-2017 STUDY PERIOD for ITU-D Study Group 1

Questions

“To date, Canada, Singapore, the United Kingdom, Republic of Korea, Colombia, South Africa, and USA have adopted technical and service rules allowing for TVWS access to the VHF and/or UHF-band television broadcast spectrum.”
### TVWS Global Reach

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Countries with TVWS Regulations Now In Place</strong></td>
<td></td>
</tr>
<tr>
<td>United States*</td>
<td>324 Million</td>
</tr>
<tr>
<td>United Kingdom*</td>
<td>65 Million</td>
</tr>
<tr>
<td>Singapore</td>
<td>6 Million</td>
</tr>
<tr>
<td>Canada*</td>
<td>36 Million</td>
</tr>
<tr>
<td>South Korea</td>
<td>50 Million</td>
</tr>
<tr>
<td>Colombia*</td>
<td>49 Million</td>
</tr>
<tr>
<td>South Africa*</td>
<td>55 Million</td>
</tr>
<tr>
<td><strong>Countries with TVWS Regs Likely in Place in the Next 0-12 Months</strong></td>
<td></td>
</tr>
<tr>
<td>Malawi*</td>
<td>18 Million</td>
</tr>
<tr>
<td>Ghana*</td>
<td>28 Million</td>
</tr>
<tr>
<td>The Philippines*</td>
<td>102 Million</td>
</tr>
<tr>
<td><strong>Countries Allowing Use of TVWS Pre-Regulation</strong></td>
<td></td>
</tr>
<tr>
<td>Botswana*</td>
<td>2 Million</td>
</tr>
<tr>
<td>Pakistan*</td>
<td>193 Million</td>
</tr>
<tr>
<td>Tanzania*</td>
<td>55 Million</td>
</tr>
<tr>
<td>New Zealand</td>
<td>5 Million</td>
</tr>
<tr>
<td>Kenya*</td>
<td>47 Million</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,035 Million</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other Countries Hosting Trials and Pilot Projects</strong></td>
<td></td>
</tr>
<tr>
<td>China*</td>
<td>1,383 Million</td>
</tr>
<tr>
<td>India*</td>
<td>1,327 Million</td>
</tr>
<tr>
<td>Indonesia*</td>
<td>261 Million</td>
</tr>
<tr>
<td>Brazil*</td>
<td>206 Million</td>
</tr>
<tr>
<td>Nigeria*</td>
<td>187 Million</td>
</tr>
<tr>
<td>Argentina*</td>
<td>43 Million</td>
</tr>
<tr>
<td>Uganda*</td>
<td>40 Million</td>
</tr>
<tr>
<td>Morocco*</td>
<td>34 Million</td>
</tr>
<tr>
<td>Nepal*</td>
<td>29 Million</td>
</tr>
<tr>
<td>Taiwan*</td>
<td>23 Million</td>
</tr>
<tr>
<td>Cote d’Ivoire*</td>
<td>23 Million</td>
</tr>
<tr>
<td>Zambia*</td>
<td>16 Million</td>
</tr>
<tr>
<td>Rwanda*</td>
<td>12 Million</td>
</tr>
<tr>
<td>Jamaica*</td>
<td>3 Million</td>
</tr>
<tr>
<td>Namibia*</td>
<td>2 Million</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3,589 Million</td>
</tr>
</tbody>
</table>

Additional discussions relating to projects in Mexico*, Ethiopia*, Vietnam*, Congo, Myanmar*, Trinidad & Tobago*, Mauritius*, etc.

* Microsoft project locations/engagements

(Updated Source: ‘Commercial Deployments Leveraging TV White Space Frequencies’, MS, May 2017)
TVWS Progress

- **‘10.Dec.**
  - Report utilization plan to President

- **‘11.Nov.**
  - Conduct Trial Test

- **‘11.Dec.**
  - Release TVWS Roadmap

- **‘12.Sep.**
  - Propose revising law and policy

- **‘13**
  - Start to Set up TVWS DB (May)
  - Select Trial providers (Aug)

- **‘14~’15**
  - TVWS Pilot ~ present

- **‘16.Nov.**
  - Notice of TVWS Rule

- **‘17.April. ~**
  - 1st TVWS Device KC Issue
Trial Test – Wireless Internet in Rural areas

- Develop new WiFi AP for Super WiFi service and explore service feasibility

Disaster Communication (Namyangju City)

- Transmit image of disaster happened underground by using human-searching equipment
WS Database Establishment

- Establish WS database providing available channels, appropriate for Korea’s spectrum environment
  - DB Establishment: Government (RRA*)
  - Management and Operation: Public organization is in consideration

* National Radio Research Agency
## Korea TVWS Pilot Project

- **TVWS Pilot**
  - Select 5 trial service providers to explore service availability and discover various services feasibility
    - Management: RAPA

<table>
<thead>
<tr>
<th>No.</th>
<th>Service Type</th>
<th>Service Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fire Monitoring CCTV at forest area</td>
<td>Gangwon-do</td>
</tr>
<tr>
<td>2</td>
<td>Wireless Internet in remote area</td>
<td>Ganghwa Island, Jeju Island</td>
</tr>
<tr>
<td>3</td>
<td>Telescreen</td>
<td>Seoul, Daejun, Cheongju City</td>
</tr>
<tr>
<td>4</td>
<td>Establishment of AMI for Smart Grid</td>
<td>Jeju Island</td>
</tr>
<tr>
<td>5</td>
<td>Hybrid high-quality mobile Broadcasting</td>
<td>Goyang City</td>
</tr>
</tbody>
</table>
Korea TVWS Pilot Project

Main Goal

- To promote efficient use of frequency resources in the TV broadcast band (470~698 MHz)
  - To discover various new services and support available channel DB interlocking device development
  - To validate DB-based trial service and complement enhancement for service commercialization

Main Content

- (Outline) Select 5 consortium to check service availability and discover various services
- (Select providers) Select the best performing consortium based upon scores by the selection committee’s reviewing document and presentation
- (Management) Mid-term evaluation, result presentation, opening the Ceremony, the TVWS trials in Korea
Korea TVWS Pilot Project (’13~’16)

Implementation Procedures

Planning
- MSIT ↔ RAPA

Selection criteria
- Configuration expert group and selection criteria

Public presentation
- Introduction outline, procedure, plans

Selection
- Configuration selection committee / evaluation, selection

Development
- Support fund by a consortia, development of the system

Establishment
- Announcement of establishing and equipment demonstration

※ MSIT: Ministry of Science and ICT, RAPA: Korea Radio Promotion Association
II TVWS Pilot - Details
TVWS Pilot Site in Korea
<table>
<thead>
<tr>
<th>Host</th>
<th>Participation</th>
<th>Service Type</th>
<th>Service Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munhwa Broadcasting Corporation</td>
<td>Omnitel, Broadwave</td>
<td>Hybrid high-quality mobile broadcasting</td>
<td>Lake Park</td>
</tr>
<tr>
<td>CJ Hellovision</td>
<td>TBroad, C&amp;M, Hyundai HCN, CMB, Klabs</td>
<td>Fire monitoring at forest</td>
<td>Sol-Hyang arboretum, Muuido-Jamjindo, Olympic Park, Nat’l Museum, Art Center</td>
</tr>
<tr>
<td>Jeju Technopark</td>
<td>Jeju Province Do-Dream, KT, Kisan telecom, Spectrum</td>
<td>Wireless Internet in remote place</td>
<td>Jeju – Marado, Songak MT, Ganghwado-Seongmodo</td>
</tr>
<tr>
<td>KOREA Electric Power Corporation</td>
<td>Jeju Province, Innovid</td>
<td>Establishment of AMI for SmartGrid</td>
<td>Jeju Island</td>
</tr>
<tr>
<td>WiWorld</td>
<td>-</td>
<td>Telescreen</td>
<td>Yuseong-gu</td>
</tr>
</tbody>
</table>
Title: Region-based hybrid high-definition DMB broadcasting transmission service

Host / Participation: MBC / Omnitel, Broadwave

Location: Lake Park (Janghang-dong, Ilsandong-gu, Goyang-si, Gyeonggi-do)

Details: To improve the quality of SD (640*480 or higher) than QVGA (320*240) by combining T-DMB and TVWS IP networks.
**Title:** Fire monitoring and Local information service based on WiFi

**Host / Participation:** CJ Hellovision / Tbroad, C&M, Hyundai HCN, CMB, KLabs

**Location and Details**

<table>
<thead>
<tr>
<th>CJ Hellovision</th>
<th>Tbroad</th>
<th>C&amp;M</th>
<th>Hyundai HCN</th>
<th>CMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solhyang arboretum</td>
<td>Muuido-Jamjjindo</td>
<td>Seoul Olympicpark</td>
<td>Nat’l Museum</td>
<td>Art Center</td>
</tr>
<tr>
<td>Fire Monitoring</td>
<td>Wireless Internet</td>
<td>Telescreen</td>
<td>Telescreen</td>
<td>CCTV Monitoring</td>
</tr>
</tbody>
</table>

**Service Framework**

- **Base Station**
- **Super Wi-Fi**
- **Internet**
- **Remote Station**
- **Wi-Fi Users**

**Development Equipment**

- **Server**
- **SMS Tx System**
- **CCTV Camera**
- **Telescreen Display**
- **Data Receiver System**
- **TV White Space Equipment**
Title: Wireless Internet in remote place and Provide public information
Host / Participation: Jeju Technopark / Jeju Province, Do-Dream, KT, Kisan telecom
Location and Details

<table>
<thead>
<tr>
<th>Industry Convergence</th>
<th>Provide Information</th>
<th>Underdeveloped regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeju Island ↔ Mara Island</td>
<td>Bus stop at Songak MT</td>
<td>Ganghwa ↔ Seongmo Island</td>
</tr>
<tr>
<td>Transmit Power usage info.</td>
<td>Bus arrival and departure guidance</td>
<td>Wireless Internet in remote place</td>
</tr>
</tbody>
</table>

Service Framework

Development Equipment

TVWS Pilot– Details (3)
Title: Establishment Smart Grid and elderly safety check service

Host / Participation: KEPCO / Jeju Province, Innovid Co. Ltd.

Location: Gujwa-eup (Jeju-si, Jejudo) – 200 households target

Details: Data collection and utilization in areas through smart meters, 1 person household safety checks over 15min cycle through meter data analysis
WiWorld Company (‘13.~’14.)

Overview

- Title: Smart advertising media content delivery
- Host: Wiworld
- Location: Yuseong-gu(Daejeon city)
- Details: To deliver Advertising data to outdoor fixed and mobile telescreen device
Overview

- **Title**: Town Broadcasting & Wireless Internet Service using TVWS bands
- **Host**: Convergence ICT Square
- **Location**: Yeonpyung-island(Incheon)
- **Details**: Town Broadcasting & Wireless Internet Service at area(island)

Service Framework

- **Small island**
  - WiFi AP
  - TVWS CPE
  - Hub
  - Interface PC
  - Audio In/AC24V

- **Big island**
  - TVWS AP
  - DSL MODEM
  - Router
  - Interface PC
  - Audio In/AC24V

**Backbone**
**Overview**

- **Title**: Wireless Internet & Video Streaming Service in TVWS Backhaul based Using Soral Energy
- **Host**: Jecheon City (Local government)
- **Location**: Jecheon City (Chungcheongbuk-do)
- **Details**: Wireless internet in remote unconnected place at area (e.g., 6.4km distance)

**Service Framework**

The real Maximum throughput of TVWS Devices is 21 Mbps per 6 MHz Bandwidth and 42 Mbps per 12 MHz Bandwidth.
Title: The TVWS System Establishment for Local-based Public Service

Host: Korea Digital Cable Laboratories

Location: Jinju-si (Gyungsangnam-do)

Details: Public Wireless Internet Service & Cultural Heritage monitoring on Jinju Castle
Main Content

- Revised the frequency allocation and Radio technical standard for introducing TVWS services
  - Set up legal criteria; 1) for protection of the existing services, 2) for efficient use and management of radio spectrum between emerging services

Revision of Frequency allocation table

- Adding a new application, for allowing TV Band Device to use DTV spectrum band(470~698MHz) on the basis of unlicensed usage

Revision of Radio Tech. Standard

- Make technical requirements of TVWS wireless equipment through analysis of interference and actual measurement
Title: TVWS Wi-Fi service and IoT sensor application in a local sea farm area

Host: Tongyoung City with Innonet Co. Ltd.

Location: Sea farm areas

Details: Big Data gathering at the sea farm water quality such as the water temperature and Oxygen density of the sea, Public Wi-Fi and CCTV application

The real Maximum throughput of TVWS Devices is 35 Mbps
Title: TVWS system for Port safety and ship traffic monitoring management

Host: Ongjin-Town with Widtechnology Co. Ltd.

Location: West Sea 5 island (Ongjin-gun)

Details: Port surveillance system using wireless CCTV application

The real Maximum throughput of TVWS Devices is 32 Mbps
Recent local government TVWS Service(3)

Jecheon City Consortium

Overview

- Title: The citizen security enhancement and Digital signage in walkway using TVWS system
- Host: Jecheon City with Korea Telecom Co. Ltd.
- Location: Sam–Han walkway in Jecheon city
- Details: Public safety CCTV monitoring system, Digital signage using IoT sensor and Wi-Fi service

Service Framework
Conclusion
The Korean government made the unlicensed based TVWS regulatory requirements to build a TVWS database that protects incumbent services such as terrestrial DTV, licensed wireless microphone, and CATV services in 470-698 MHz band.

The TVWS Services in Korea can be summarized such a service models like Wi-Fi, IoT Sensor and disaster monitoring wireless CCTV applications.
- Korea will develop and provide public services specified for a remote area with local government involvement, such as Internet service and wireless CCTV in nationwide.

TVWS will help to close the digital divide, bridge the Urban-Rural Digital Gap, and make wireless broadband access more affordable for people across the country.
- It also figures that spectrum sharing could address the scarcity of frequency resources, and increase public convenience in the coming hyper-connected society.
TVWS technology may play an important role to achieve some key strategic initiatives regarding to No.3 and No.4 initiative of the Master Plan for the Asia-Pacific Information Superhighway 2019-2022 initiative; (No.3)enhancing information and communications technology infrastructure resilience; and (No.4)providing inclusive access to broadband Internet.

- TVWS could be used to provide underserved communications, such as rural villages and island with low-cost Internet access infrastructure.

Bridging the digital divide(OECD DIGITAL ECONOMY PAPERS, Feb. 2018) : This document examines recent policy and technology approaches to bridging the digital divide in and remote areas in OECD countries.

- Korea ranked the second largest Internet access rate in and remote areas among OECD countries.
- Some countries are interested in using the TVWS technology for broadband program by themselves.
THANK YOU

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