



## Status of Radio Spectrum Managements in Korea

2013. 07. 10.~ 2013. 07. 12

Dr. Yong-Seok Choi\*
Dr. Sang-Tae Kim
Dr. Jae-Ick Choi

Radio Technology Research Department

ETRI(Korea Electronics and Telecommunications Research Institute) located in the middle of S. Korea (distance 120 km from Seoul) about 2,000 peoples work in all IT field(Radio Telecomms, etc) (for more details http://www.etri.re.kr)







## Contents

- I. Brief History of Spectrum Management in Korea
- II. Introduction of Handheld Radio Monitoring System
- III. Introduction of Transportable Radio Monitoring System

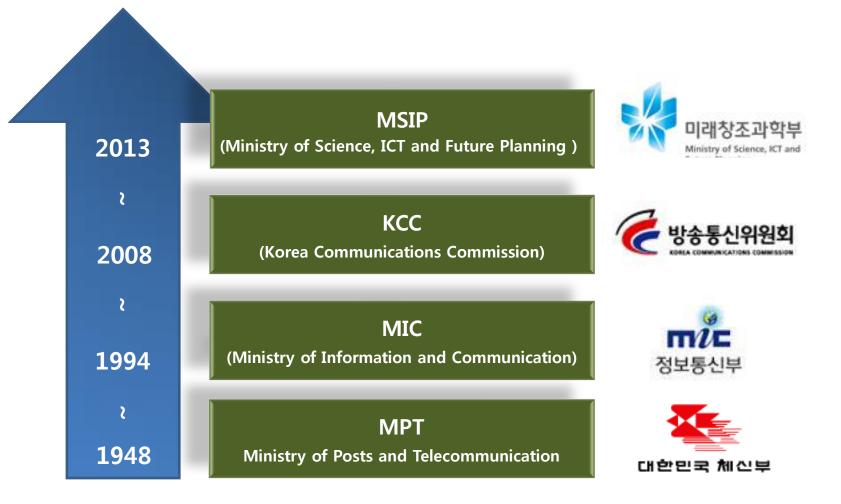
# I. Brief History of Spectrum Management in Korea





## History of Spectrum Management in Korea



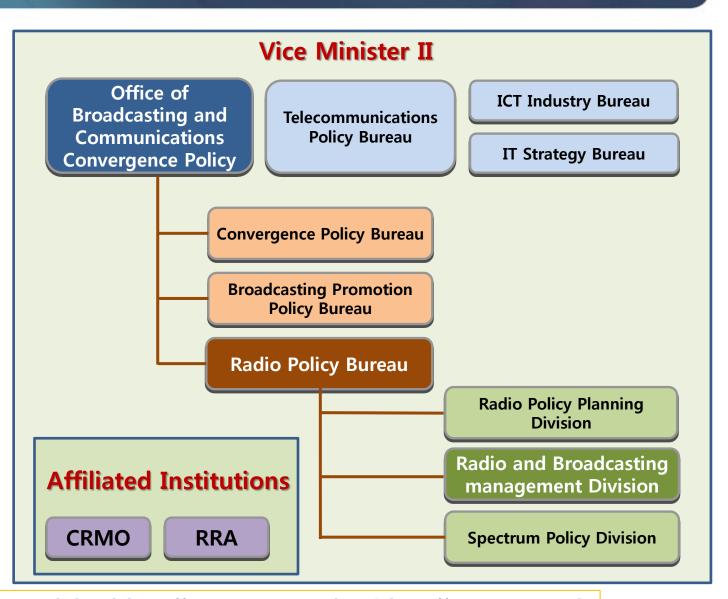




## Organization of MSIP



#### Vice Minister I Office of Planning and Coordination Office of Future Leading R&D Policy **Deputy Minister for** Science & Technology Coordination Science and **Technology Policy** Bureau **R&D Coordination** Bureau **Performance Evaluation Bureau**

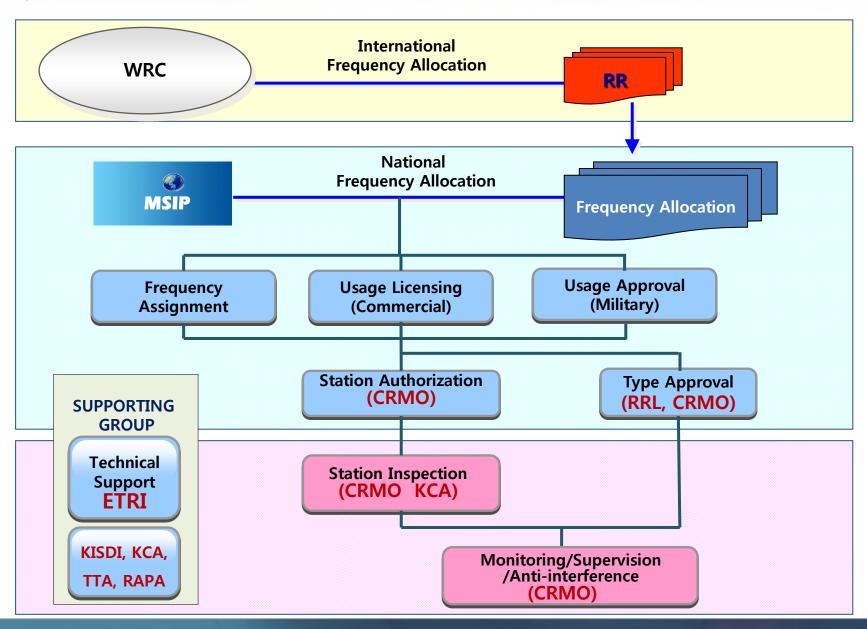


\* MSIP (http://www.msip.go.kr), CRMO (http://www.crmo.go.kr), RRA (http://www.rra.go.kr)



## Spectrum Management Service in Korea

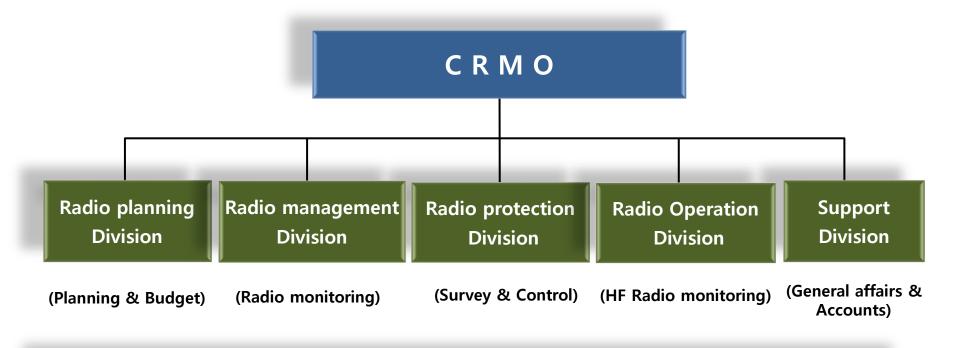






## Spectrum Management Service in Korea





#### **Regional Branches**

Satellite Radio Monitoring Centre Regional Offices (10) : Seoul, Busan, Kwanju,

Kangneung, Daejeon, Jeju, Ulsan,

Daegu, Jeonju, Cheongju



## History of Radio Monitoring in Korea



Phase I User/ # of **Main System Feature Problem** Action station year Vacuum tub HF 1980 receiver(UK·USA·Korea) needed to monitor prepare to introduction of emission parameters of equipment for emission . TR/IC Receiver(foreign) parameters station automatic DF for HF . Frequency distribution band recorder(foreign) . HF fixed/mobile DF system(foreign) governmen 1970 increased importance of expanded structure of radio tal organ . Electric field receiver radio management monitoring , public measurement of . Frequency measuring o needed the position of - personnel, radio act, license institution electric field and tester interference of station . HF radio monitoring frequency 1.067('60) - frequency system(foreign) 2.232('65) assignment-enrollment 26.243('80) - radio monitoring and facility maintenance 1960 MF/HF receiver lack of personnel, equipment freq. measurement . military tension between Korean and listening

> agency and foreign couterpart due to domestic radio wave

1947

equipment(foreign)



## History of Radio Monitoring in Korea



#### Phase II

User/ # of station

**Main System** 

**Feature** 

**Problem** 

plan for establishment of

Action

year 2000

> V/UHF mobile DF system(foreign) . HF/VHF/UHF integrated radio monitoring system(foreign.

'92~'97)

measurement of analog narrow band signal/manual data analysis

 needed satellite radio monitoring to obtain radio sovereignty

o needed radio monitoring of o plan for establishment of digital signal

efficiency of radio resource

Korean advanced radio o needed to improve usage monitoring system with Korean technology

satellite radio monitoring centre

public 27.367.111 (00)

general

 increased violation and illegality of radio use

 compaign for proper use of radio wave

 legal authority for the monitoring staff to crack down efficiently('94)

1990

school. research institute. private business

182,057 ('90)

- . V/UHF receiver (foreign-Korea)
- . Monitoring equipment for maritime station(Korea)
- . HF/VHF/UHF radio monitoring system(foreign)
- supporting international &domestic communication network for Seoul Olympic('88)
- measurement of emission parameters
- allowed civil radio station(≤0.1W) ('82)

 increased repair time and cost after failure for foreign radio monitoring equipment

- limited performance maintenance of equipment
- o needed to enforce order of radio wave with increased station
- interference between commercial freq. and military one

- plan for establishment of integrated radio monitoring system
- launching research for development of radio monitoring system
- focus on identifying illegal signal and eliminating interference

1980



## History of Radio Monitoring in Korea



#### Phase III

User/ # of station

**Main System** 

**Feature** 

**Problem** 

Action

year 2012

> Person, thing

53,810,131 ('11)

HF/VHF/UHF advanced radio monitoring system(Korea, '05~) Satellite radio monitoring system

 measurement of high frequency, wideband, low power, digital signal/automatic wideband, low power, data analysis

odouble shift to work 24/7 only during the day time('04)

 needed to deal with high frequency, digital signals

 needed to improve usage of radio wave

 development of Korean transportable radio monitoring system('11~'12) development of Korean mobile/handheld radio monitoring system('05~'10)

 survey of spectrum utilisation ('06)

2000

















# II. Introduction of Handheld Radio Monitoring System





#### **Background**

- Proximity monitoring of signals with a high freq. and a low power
- Spectrum sharing in ISM band to maximize spectrum usage
- Key role of USN(Ubiquitous Sensor Network) and Digital Home industry

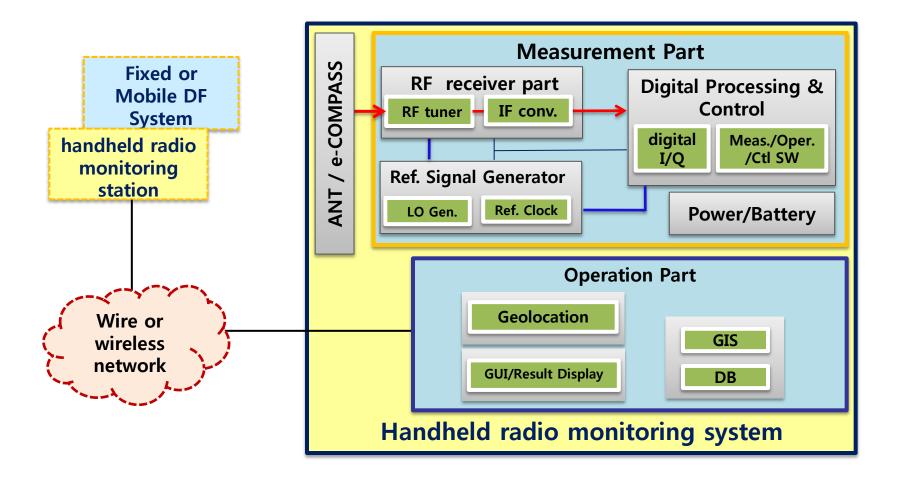




#### Features

- Main Functions: Portable Direction Finding, Emission Parameters Meas. & Demodulation, Wideband Spectrum Measurement
- Connection with Mobile & Fixed Monitoring Systems
- Target Frequency: 20MHz ~ 6GHz with IF BW of 10MHz
- Power Consume: less than 25W which can operate more than 3 hours
  - \* @Sleep Mode : less than 2W



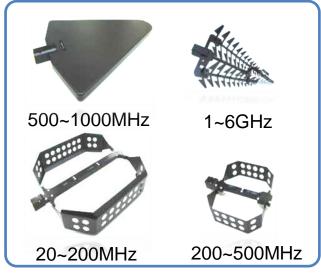




## Configuration



#### Antenna



#### **Antenna Part**





speaker

Power

button

(Flash Memory/WiFi Access/Battery)

antenna



## **Specifications**



○ Frequency range : 20 ~ 6,000 MHz

O IF bandwidth : 10 MHz

Frequency Accuracy : 0.1ppm

Sensitivity(@DANL\*) : <-160dBm/Hz (@3GHz)</p>

Operating time : 3.5 hr\*\*

○ Size : 270(W) x 196(D) x 84.8(H) mm

Weight : 3.7 kg(Li-ion Battery Included)

O Display : 7 " /4.1 " LED touch (16Mega color, 800 × 480)

Built-in Device : GPS, e-compass, Wi-Fi, camera (2Mega)

<sup>\*</sup> DANL: Displayed Average Noise Level

<sup>\*\*</sup> Operating condition





- Emission parameters measurement with wideband scan
- Spurious measurement
  - Spurious emissions & harmonics
- Illegal frequency detection
- DF(Direction Finding) homing and Geolocation
  - 🦴 DF polar, DF azimuth vs. level
  - ♥ DF accumulative azimuth vs. level
  - Seographic map display

#### Operation mode

- Fixed frequency mode
- Wideband detection mode



### Features in detail



#### Multi-Functional Radio Monitoring

- Spurious measurement, Illegal frequency detection
- Direction finding

#### Operation with Editable Data Base

- Stand-alone operation only with auxiliary monitor
- Quick search for authorized frequency with licensing data base

#### Smart Navigator for Emitter

- ➡ Built-in GPS, compass and electric map (option)
- Seolocation via remote control for fixed & mobile station

#### Easy-to-Use GUI and Easy Accessible Wireless Environment

- Built-in WiFi & supporting a variety of wireless modem

#### Others

- ♦ Flexible HW platform via USB 2.0 port
- Supporting power saving mode, swappable battery

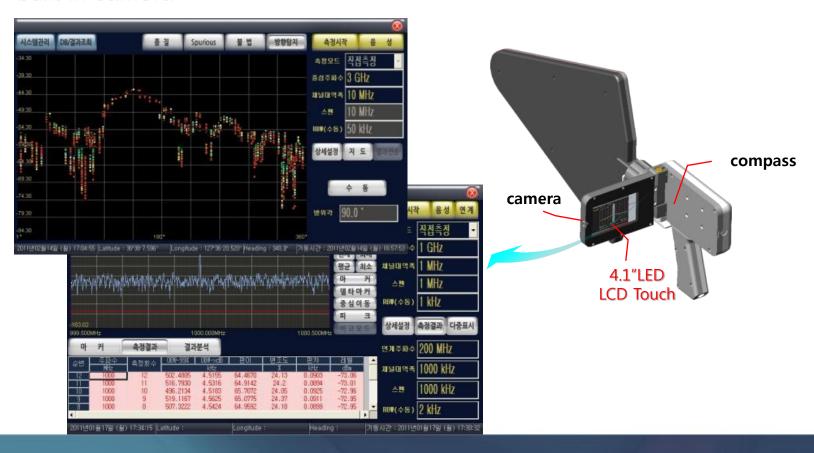


### **Features in detail**

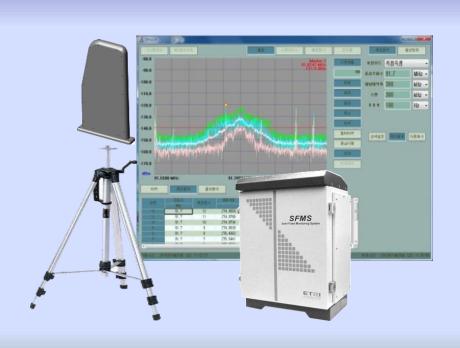


#### User Friendly Operation

- Easy operation with auxiliary monitor(4.1 ") in line with the direction of measurement
- Radio monitoring and DF though auxiliary touch LED LCD monitor
- built-in camera



## III. Introduction of Transportable Radio Monitoring System

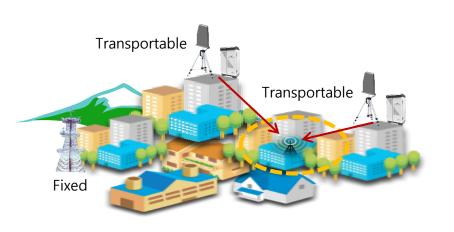






#### **Background**

 Need of proximity monitoring all the time to respond the trends of signals with a high freq. and a low power



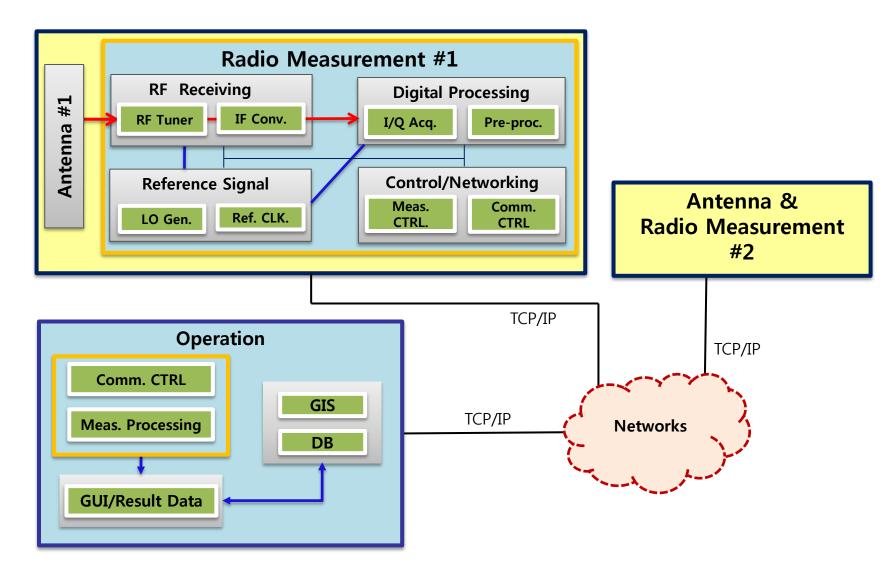


TRANSPORTABLE MONITORING SYSTEM

#### Features

- 24/7 monitoring near the target located at the shadow area and dense area
- Install at the top of a building and tower with a small scale
- Main functions: Emission parameters meas., illegal signal search,
   spectrum occupancy, Environmental Noise Measurement
- Target Frequency: 20MHz ~ 6GHz with max IF BW of 25

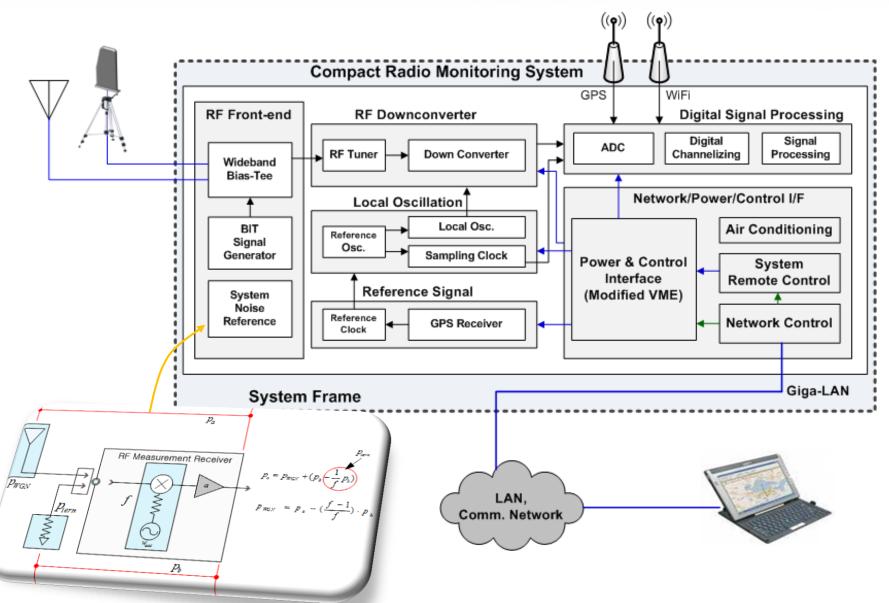






## Configuration











**Front** 







Side





**Bottom** 

Antenna Part Measurement System



## Comparison with Existed System



Items	Existed Fixed Monitoring System ( '05 $\sim$ )	Transportable Monitoring System ( '13~ )
Frequency Range	20 MHz ~ 3 GHz	20 MHz ~ 6 GHz
IF BW	10 MHz	25 MHz
Measure Channel	4 Channels	1 Channel
Specification	<ul> <li>Large, High Power Consume</li> <li>Fixed Setup on a metal Tower</li> <li>In-door Installed Receivers</li> <li>Radio Quality, Illegal Radiation</li> <li>Freq. Occupancy Measure</li> <li>Installed with Direction Finder</li> </ul>	<ul> <li>Small, Light, Low Power Consume</li> <li>Flexible Deploy on the Rooftop etc.</li> <li>Out-door Installed Receiver</li> <li>Increased Receiving sensitivity</li> <li>Radio Noise Analysis</li> <li>GPS Disciplined Frequency Reference</li> </ul>



## **Specifications**



○ Frequency range : 20 ~ 6,000 MHz

• IF bandwidth : 25 MHz

• Frequency Resolution : 1 Hz

Frequency Accuracy : 0.1 ppm (0.03ppm@GPS)

○ 3<sup>rd</sup> IIP3\* : > 12 dBm typ.

O Noise Figure : < 14 dB typ.

O Phase Noise : < 95 dBc/Hz @ 10 kHz

Sensitivity(@DANL\*) : < -160 dBm/Hz typ.</p>

○ Size : < 360(H)x300(W)x200(D) mm

• Weight : < 10 kg

<sup>\*</sup> IIP3: Input 3rd Order Intercept Point

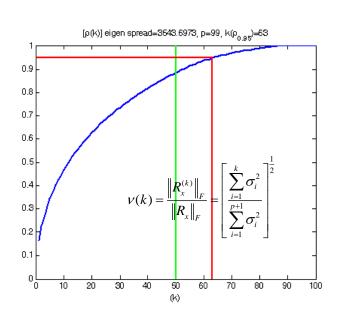


### **Measurement of Radio Noise**



#### Radio Noise Measurements & Analysis

- Reference Values to Spectrum Engineering & Monitoring Activities
- Rec. ITU-R SM.1753 Method for measurements of radio noise
- Measurement Threshold Level



**Eigen Value Analysis** 



**Capture of Measurement Example** 





#### Importance of Spectrum Monitoring

- It is encouraging to use SRD device and develop sharing technology in order to enhance efficiency in the management of radio resources.
- In order to prevent a side effect of deregulation which promotes frequency utilization, it is important to strengthen monitoring after licensing.
- A radio monitoring allows us to promote and spread the industry related to radio wave.







#### Radio Monitoring in Korea

- Korean radio monitoring systems have been deployed successfully with recent IT technology for the last 7 years. Now we have a total solution compliant with international recommendations.
- As a result, the number of violation stations and illegal stations has been decreased since 2005 with a successful operation of Korean monitoring system.





## Дуже дякую

IT R&D Global Leader



yschoi@etri.re.kr stkim@etri.re.kr jichoi@etri.re.kr