



Experimental Grid Radio Monitoring Network for Low- power Interference Monitoring

Beijing Satellite Navigation Center

LIU Zhijian

(liuzhijian@bsnc.com.cn)

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Part One

Relevant Laws and Regulations



Our Government has paid close attentions to the spectrum protection issue:

- Promulgated series laws and regulations to prevent the harmful interference to legal services.



Relevant Laws and Regulations

1. State Administrative Regulation : 《中华人民共和国无线电管理条例(Radio Regulations of the People's Republic of China)》

- 第25条 对依法设置的无线电台（站），无线电管理机构应当保护其使用的频率免受有害干扰。

Article 25 The radio regulatory organs shall protect the radio stations established in compliance with law from harmful interference in the use of their frequencies.



Relevant Laws and Regulations

1. State Administrative Regulation : 《中华人民共和国无线电管理条例(Radio Regulations of the People's Republic of China)》

➤ 第43条 对有下列行为之一的...给予...处罚.....:

(1)擅自设置、使用无线电台（站）；

(2)违反本《条例》规定研制、生产、进口无线电发射设备； ...

Article 43 In the circumstances where any institution or individual

a) establishes and operates a radio station without approval;

b) develops, manufactures or imports radio transmission equipment in violation of these Regulations; ...

the state radio regulatory organ ... may impose on it or him (her) any of such penalties as warning, seizure and confiscation of the equipment in question and the illegal revenue obtained,



Relevant Laws and Regulations

1. 2014年《中华人民共和国无线电管理条例(修订草案)》 (Radio Regulations of the People's Republic of China (Draft Amendment))》

- 进一步从无线电发射设备的研制、生产、进口等环节规定了无线电发射设备管理制度，并明确将对未经批准、擅自设置和操作无线电台（站）造成严重后果的行为进行严厉惩罚。
- Further specifying the administration regulations on the develop, manufacture and import...of radio transmission equipment, and clarifying the serious cases of establishes and operates a radio station without approval should be severely punished.



Relevant Laws and Regulations

2. MIIT: Prevention of interference to BSS, RNSS, MSS by Micro-Power (Short-Range) Radio Equipment :

✓ 《微功率（短距离）无线电设备管理暂行规定》

Interim Measures on Micro-Power (Short-Range) Radio
Equipment (1998)

✓ 《微功率（短距离）无线电设备的技术要求》

Technical Specifications of Micro-Power (Short-Range) Radio
Equipment (2005)



Relevant Laws and Regulations

3. 中华人民共和国刑法 (Criminal Law of the People's Republic of China)

第二百八十八条 违反国家规定，擅自设置、使用无线电台（站），或者擅自占用频率，经责令停止使用后拒不停止使用，干扰无线电通讯正常进行，造成严重后果的，处三年以下有期徒刑、拘役或者管制，并处或者单处罚金。

Article 288 Whoever, in violation of state's stipulations, without authorization establishes or uses a wireless radio station, or without authorization occupies frequency and refuses to stop his act after being ordered to stop and disturbs the normal operation of wireless communication shall, if serious consequences are caused, be sentenced to fixed-term imprisonment of not more than three years, criminal detention or public surveillance, and concurrently or independently be sentenced to a fine.



Relevant Laws and Regulations

4. 中华人民共和国治安管理处罚法 (Law of the PRC on Penalties for Administration of Public Security)

第28条 违反国家规定，故意干扰无线电业务正常进行的，或者对正常运行的无线电台（站）产生有害干扰，经有关主管部门指出后，拒不采取有效措施消除的，处五日以上十日以下拘留；情节严重的，处十日以上十五日以下拘留。

Article 28 A person who, in violation of state regulations, intentionally interferes with ,or causes harmful interference to the normal operation of radio stations and refuses to take effective measures to eliminate such interference after the relevant competent department points out the fact, shall be detained for not less than 5 days but not more than 10 days; if the circumstances are serious, he shall be detained for not less than 10 days but not more than 15 days.



Part Two

Experimental Grid Radio Monitoring Network and Test Results



Grid Radio Monitoring Network

- The state radio regulation organ has enhanced the construction of radio monitoring technical infrastructures.
- Facing more complicated spectrum circumstance.



Grid Radio Monitoring Network

Challenges

- Quickly spread wireless applications makes the spectrum space crowded,
 1. difficult for the availability of the appropriate channel for new application,
 2. interferences between different wireless communication systems emerged frequently.
- To deal with them effectively, comprehensive spectrum data is required.
- The present monitoring system cannot meet these requirements ideally.



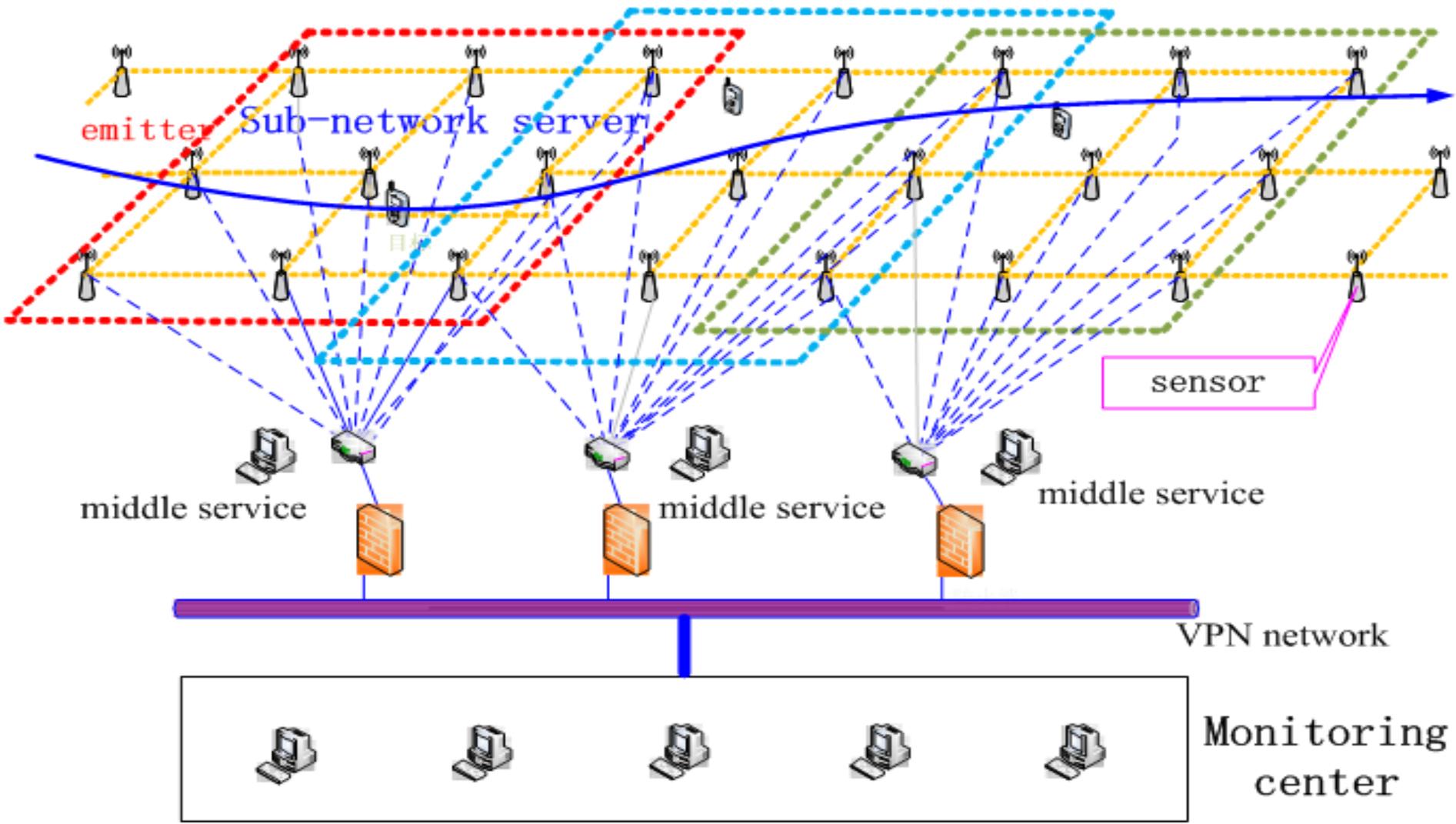
Grid Radio Monitoring Network

Preliminary Solution

- A new monitoring mechanism is required;
- The new system should be able to make the spectrum regulating more active and effective, and it should cooperate with the existing system smoothly.
- One choice is the **grid radio monitoring network**.



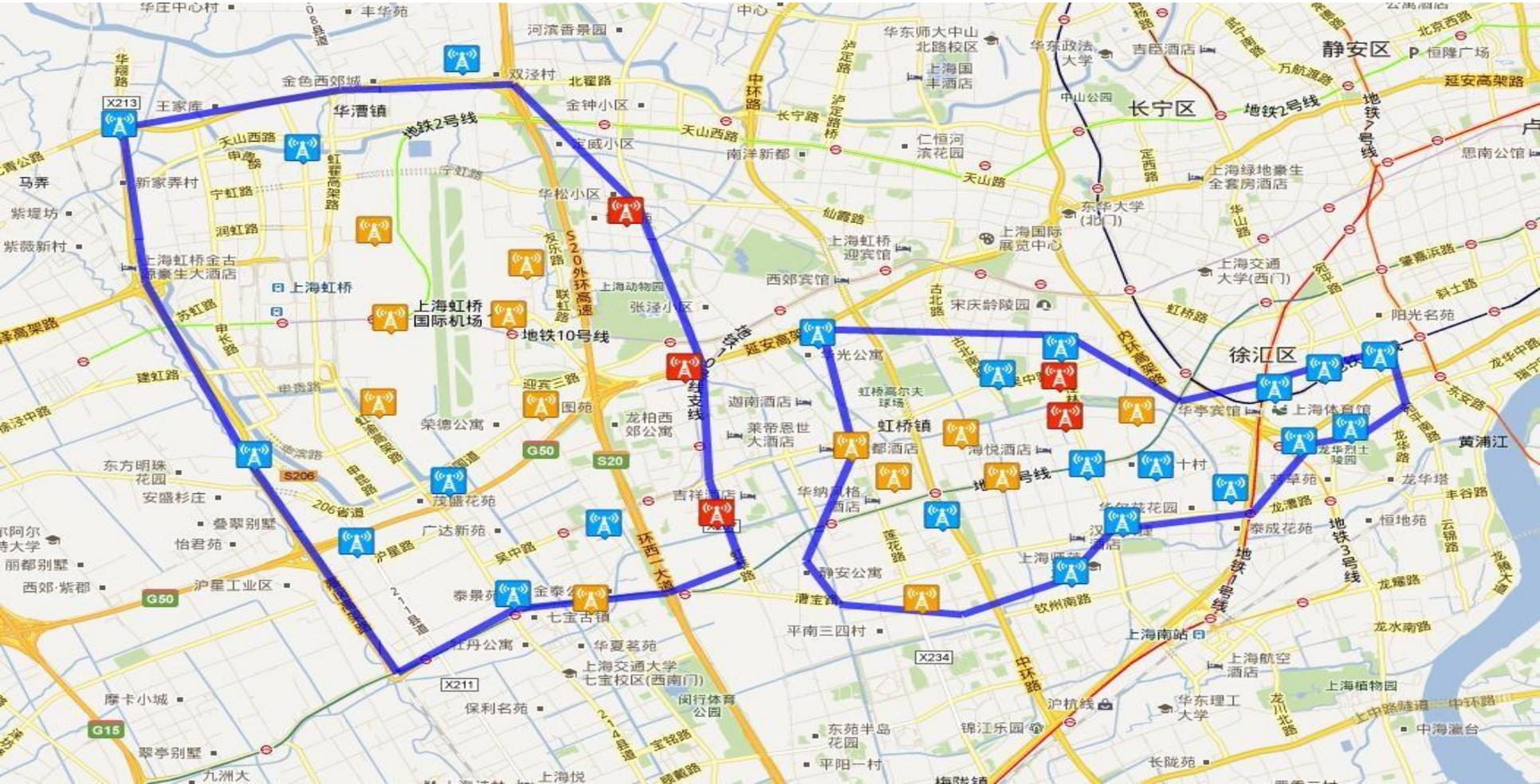
Grid Radio Monitoring Network in Shanghai





Grid Radio Monitoring Network in Shanghai

◆ Network deployment—sensors





Grid Radio Monitoring Network in Shanghai

◆ Network deployment—experimental areas

Block	A	B
Characteristic	CBD	Airport area
Area(km ²)	18	40
Average Building Height	high	low
Building Denisty	high	low
the number of sensors	20	15



Grid Radio Monitoring Network in Shanghai

- **Monitoring low- power emitter**
- **Combined grid localization**



Grid Radio Monitoring Network in Shanghai

◆ Monitoring low- power emitter

- Cover frequency is from 30MHz to 3000MHz
- Monitoring frequency in this testing:

✓ 140.5MHz

✓ 194.5MHz

✓ 400.5MHz

✓ 811MHz

Bandwidth: 100kHz



◆ Monitoring low- power emitter





◆ Monitoring low- power emitter

Frequency Parameter		Minimum power (detective emitter) (W)
Test point 1	140.5MHz	0.1
	194.5MHz	0.1
	400.5MHz	0.1
	811MHz	0.1
Test point 2	140.5MHz	0.1
	194.5MHz	0.1
	400.5MHz	0.2
	811MHz	1.0
Test point 3	140.5MHz	0.1
	194.5MHz	0.1
	400.5MHz	0.3
	811MHz	0.3



◆ Combined grid localization

➤ Parameters of the testing transmitter

Parameter	Value
Frequency(MHz)	140.5, 194.5, 400.5, 811, 1600, 2999
Bandwidth(kHz)	6.25, 12.5, 25.00, 200,1250
Power(w)	0.5, 1.0

➤ Test result shows the proportion to the typical value of the grid locating deviation less than 300 meters is about 79%.



◆ Combined grid localization





Grid Radio Monitoring Network

Result and Further Work

- ◆ According to the testing result, the idea of grid monitoring network is feasible and effective for low-power interference detection and location.
- ◆ Further monitoring performance testing of GNSS jammer need be conducted.



Summary

- ◆ Government has paid close attentions to the GNSS interference issues.
- ◆ The experimental network in Shanghai shows the idea of grid monitoring network is feasible and has distinctive features for low-power spectrum monitoring.
- ◆ Further experiments need to be done for the GNSS jammer in different scenarios.



Thanks & Question!