



“Allocation and Assignment of Radio-Spectrum Resources by using Price Mechanism: Proposals for a New System”

WORKSHOP on Advanced Wireless Technologies:
Implications for Spectrum Management
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I. Introduction and Background

A. History of spectrum use: technological progress

B. Administration of spectrum resources

C. Emergence of spectrum shortage



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C. Emergence of spectrum shortage

**1. End of spectrum-frontier expansion
no more spectrum band of “good quality”
upper limit: 3-5 GHz**

**2. Emergence of new technologies
possibility of “spectrum commons”
spread spectrum, underlay, UWB,
software radio**



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II. Present System of Spectrum Utilization

- A. Spectrum as an economic resource
- B. Allocation of spectrum bands (ALLOC)
- C. Assignment of spectrum blocks (ASSGN)
- D. The challenge in the age of spectrum shortage



B. Allocation of spectrum bands (ALLOC)

1. Outline

- a. *zoning* of spectrum
- b. two-level system:
 - country and international
- c. no price mechanism is used
 - command and control
 - direct negotiations



C. Assignment of spectrum blocks (ASSGN)

3. Exclusive use----alternative systems for ASSGN

a. Traditional system

assignment by country government

comparative hearings (beauty contest)

lotteries

zero or nominal rent

automatic (or likely) renewal of

license at expiration



C. Assignment of spectrum blocks (ASSGN)

3. Exclusive use----alternative systems for ASSGN

b. Private-property (or semi-private property)

system

assignment with auction

competitive price paid in one installment

automatic (or likely) renewal



C. Assignment of spectrum blocks (ASSGN)

3. Exclusive use----alternative systems for ASSGN

c. Competitive lease system *(V.)

assignment by country government with
 auction on lease price
 competitive lease price paid
 re-assignment with auction at expiration
 no automatic renewal
 modifications in favor of incumbents



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C. Assignment of spectrum blocks (ASSGN)

4. Club use

a. Traditional system

licensing by country government
 unlimited entry
 zero or nominal rent
 automatic renewal
 examples: amateur wireless, navigation, aviation

b. *privatized* club use *(III.)



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C. Assignment of spectrum blocks (ASSGN)

5. Commons-----open use

a. traditional system

no licensing

power limit

b. commons as a public good *(III.)



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D. The challenge in the age of spectrum shortage

1. Present state

incumbent users with vested interests

free and continuing use

2. Need for re-allocation

emergence of new objectives for spectrum use



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D. The challenge in the age of spectrum shortage

- 3. Need for re-assignment**
new users, new business
- 4. Need for accommodating new technologies**
for spectrum sharing
- 5. *The challenge***
gradual but steady improvement



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III. Provision for Spectrum Commons as a Public Good (A Proposal)

A. Outline

- 1. spectrum sharing under direct governmental control (Mode-G)**
commons: ISM
clubs: navigation and aviation,
outdoor wireless-LAN



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A. Outline

2. Spectrum sharing under private licensee's control (Mode-L)

a. commons:

broadcast (free commercial)

b. clubs: mobile telephony, pay-per-view broadcast



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B. Proposals*

1. Preference of Mode-L to Mode-G for spectrum sharing

a. strong incentives for efficient use

b. convenience for re-allocation and re-assignment



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B. Proposals*

2. Mode-G spectrum sharing (spectrum as a *public good*)

- a. establish a *public agent* to administer Mode-G spectrum clubs or commons
to avoid formation of unlimited rights of using spectrum



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IV. Re-allocation of Spectrum Bands with Compensation -----An Insurance-Compensation System with Proper Incentives

- A. Outline
- B. Insurance-compensation system for re-allocation within a country* (a proposal)
- C. International insurance-compensation system for spectrum re-allocation* (a proposal)



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A. Outline

1. **Re-allocation of spectrum bands**
 - a. **need arises from technological progress and changes in demand**
 - b. **shortage of spectrum bands to meet new demand**
 - c. **shortage is a global (frequency-wise) problem over all spectrum bands**



A. Outline

1. **Re-allocation of spectrum bands**
 - d. **re-allocation is to be made locally with a single band**
 - e. **a band to be re-allocated is a “sacrifice” for the benefit of other users**
 - f. **need for compensation to outgoing users at re-allocation**



B. Insurance-compensation system for re-allocation within a country (a proposal)

1. Acceptable compensation and premium

- a. acceptable compensation to be declared by each spectrum user**



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B. Insurance-compensation system for re-allocation within a country (a proposal)

1. Acceptable compensation and premium

- b. annual compensation premium to be paid by each spectrum user annually to spectrum manager (country government)
= (declared acceptable compensation) times (premium rate)**



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B. Insurance-compensation system for re-allocation within a country (a proposal)

2. Premium rate and government budget

a. premium rate

to be determined by spectrum manager so that the total annual income from the compensation premiums be equal to the total annual compensations paid for the re-allocation in the year.



C. International insurance-compensation system for spectrum re-allocation (a proposal)

1. Group of country governments for international insurance-compensation system (GIIC)

a. to be formed voluntarily by country governments

b. objectives:

to administer international insurance-compensation for re-allocation to reveal information of the supply price of spectrum bands via compensation

