

## **IMT-2000 Implementation – Spectrum and other Regulatory Considerations**

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### **Overview**

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  - Regulatory goals in allocation and assignment of spectrum
  - Other considerations
  - Techniques for assigning spectrum
- **IMT-2000 spectrum issues**
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  - Frequency bands identified for IMT-2000
  - ITU spectrum recommendation
  - IMT-2000 technologies and spectrum
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## Spectrum Management Functions and Considerations

Spectrum is a finite resource and regulators should maximize its use to protect the continued viability of current users and to provide opportunities for new services to be deployed. The demands for spectrum greatly affect the major functions of spectrum management. These functions are:

- Allocation
  - For general services, such as mobile and fixed terrestrial, mobile and fixed satellite, amateur radio, etc.
- Development of service rules
  - Sets essential technical criteria
  - Minimal requirements permit operators to be flexible
- Assignment
  - To individual users or licensees
- Compliance and enforcement
  - To prevent harmful interference, unauthorized use

## Regulatory Goals in Allocating and Assigning Spectrum

- Maximizing spectrum efficiency
- Ensuring equity for all citizens
- Providing adequate spectrum for national defense and public safety
- Coordinating international communications

## Other Considerations for Allocating Spectrum

- Technology neutrality
  - Allocating spectrum for generic services rather than specific technologies provides flexibility for rapid changes in the development of new technologies
- Flexible services rules
  - Making service rules as flexible as possible reduces regulatory burdens on service providers and enables them to meet their customers' needs in the immediate and longer term (e.g., permits provision of fixed and mobile services by the same service provider)
- Regional/global coordination
  - Maximizing regional and global allocation commonality assists in the development of larger economies of scale for equipment, and in the provision of "borderless" services

## Techniques for Assigning Spectrum

### First-come, First-served

- Pros:** speed, inexpensive
- Cons:** may not end up in hands of an entity that values it the most; value of license not taken into account; resellers instead of public may profit

### Auctions

- Pros:** speed, less expensive than beauty contest, entity who places highest value on license wins, spectrum is public resource so revenues benefit citizens, provide information about economic value of spectrum
- Cons:** could lead to increased concentration in industry, may ignore non-financial public interest objectives (equity), revenue potential may create incentive for government to restrict output and raise prices

### Beauty Contest

- Pros:** awards license to contender who would best serve public interest, allows for equity considerations, can require licensees to serve isolated areas
- Cons:** time consuming, expensive, no rules for a "tie", less transparent than other techniques, allows government to determine what the market wants

### Lotteries

- Pros:** quick process, provides rule for "tie"
- Cons:** unqualified party can win, resellers instead of public may profit

## IMT-2000 Spectrum Background

- The ITU has taken a lead role in the development and deployment of IMT-2000, and has recently an update to its Recommendation on IMT-2000 (ITU-R M.1036) IMT-2000 spectrum usage
- The ITU's World Radio Conferences in 1992 and 2000 identified several frequency bands for the deployment of IMT-2000 systems and services
- This identification is not an allocation to a particular technology or set of technologies, nor is it an allocation to a new service
- Instead, the identification is a recommendation to administrations to use these frequencies for IMT-2000 technologies in an attempt to harmonize use of the bands internationally

## Terrestrial Frequency Bands Identified for IMT-2000

**806-960 MHz**

**1710-1885 MHz**

**1885-2025 MHz**

**2110-2200 MHz**

**2500-2690 MHz**

**IMT-2000 technologies will be deployed in all frequency bands**

Ref: World Radio Conference – 2000 (WRC-2000) Istanbul, June 5, 2000:  
Footnote S5.388 is associated with Resolutions 212 and 223 (the 1.9 and 2.1 bands)  
Footnote S5.384A is associated with Resolution 223 (the 1.7 and 2.5 bands)  
Footnote S5.317A is associated with Resolution 224 (the 800/900 bands)

## ITU Recommendation on IMT-2000 Spectrum

- ITU-R approved a Recommendation on Frequency Arrangements for IMT-2000 (ITU-R M.1036)
  - Approved at the Radio Assembly in June, 2003
  - The Recommendation proposes seven frequency pairing arrangements for IMT-2000 system deployments, plus three unpaired bands\*
    1. 824-849 paired with 869-894 (cellular)
    2. 880-915 paired with 925-960 (GSM 900)
    3. 1920-1980 paired with 2110-2170 (UMTS)
    4. 1710-1785 paired with 1805-1880 (DCS-1800)
    5. 1850-1910 paired with 1930-1990 (PCS)
    6. 1750-1800 paired with 2110-2160 (new arrangement)
    7. 1710-1770 paired with 2110-2170 (new arrangement)
    8. 1880-1920, 1910-1930, 2010-2025 (unpaired spectrum)

\*ITU WP 8F will develop recommendations on pairing arrangements for the 2500-2690 MHz band at a future date

## ITU Recommendation on IMT-2000 Spectrum cont.

- Administrations are encouraged to allow existing pre-IMT-2000 systems to migrate to IMT-2000
  - The first commercial IMT-2000 systems were implemented by upgrading existing cellular and PCS systems in the 450, 800 and 1800 and 1900 MHz bands
- Administrations may implement IMT-2000 in any band allocated for the Mobile Service (not just the identified bands)
  - Several countries have deployed IMT-2000 systems in the 450 MHz band
  - China is planning to implement IMT-2000 in the 2300-2400 MHz band
  - The United States recently auctioned frequencies in the 700 MHz band that can be used for IMT-2000
- Administrations may implement IMT-2000 in the identified bands using different pairing arrangements from the ones included in the Recommendation
  - Korea's PCS operators have upgraded their systems to IMT-2000 using 1750-1780 paired with 1840-1870 MHz
  - Japan's cellular operators have upgraded their systems to IMT-2000 using 887-924 paired with 832-869 MHz

## IMT-2000 Technology and Spectrum

- The ITU has approved five radio air interface standards (ITU-R M.1457) and has identified multiple frequency bands for IMT-2000
  - The IMT-2000 technologies are frequency agnostic
    - Both of the primary IMT-2000 standards, WCDMA and CDMA2000, will be deployed in multiple frequency bands
  - The CDMA2000 standard is defined for:
    - 400 MHz, 800 MHz, 900 MHz, 1700 MHz, 1800 MHz, 1900MHz, and 2100 MHz
  - The WCDMA standard is defined for:
    - 1800 MHz, 1900 MHz, 2100 MHz
  - The decision in which bands IMT-2000 technologies are first deployed depends on regulatory decisions, the marketplace, and politics

## WRC 2003 Developments

- ITU-R World Radio Conference (WRC-03) approved plans for the future development of IMT-2000, and created a new agenda item on IMT-2000 for WRC-07 (agenda item 1.4):
  - “To consider frequency-related matters for the future development if IMT-2000 and systems beyond IMT-2000 taking due account of the results of ITU-R studies in accordance with Resolution 228. (Rev. WRC-03)”
  - Res. 228 (Rev.WRC-03) invites regarding studies of lower frequency bands for IMT-2000:
    - “To invite ITU-R to conduct regulatory and technical studies on the usage of frequencies below those identified for IMT-2000 in No. 5.317A for the future development if IMT-2000 and systems beyond IMT-2000”
- WRC-03 also identified frequency bands for Public Protection Disaster Relief (PPDR), noting the ability of IMT-2000 technologies and systems to meet PPDR requirements
  - “Administrations are encouraged to consider the future development of commercial technologies and systems, such as IMT-2000, to meet the needs of PPDR organizations”

## Considerations In Choosing Frequencies for IMT-2000

- Priorities must be ranked
  - Cost of equipment (leveraging of economies of scale)
  - Advanced services (high speed Internet access, multimedia, etc.)
  - Capacity to meet projected demand
  - Evolution of existing pre-IMT-2000 systems (leveraging investments)
  - Roaming (national, regional, international)
  - Spectrum utilization and efficiency
  - Competing uses for frequencies and cost of relocation of existing systems
- Multi-band, multi-mode phones will play an important role
  - There is no single frequency band and no single technology that will be used worldwide
  - Multi-band, multi-mode phones will be necessary to provide nationwide coverage for IMT-2000 subscribers as new networks are rolled out
  - International roaming between different IMT-2000 networks will only be possible through multi-band, multi-mode phones

## Considerations In Choosing Frequencies cont.

- Technology and Frequency Selection Make a Difference
  - Economies of scale for wireless equipment already exist for pre-IMT-2000 systems existing frequency bands
    - Permitting existing systems to upgrade to IMT-2000 will maximize existing economies of scale, keep costs low, and enable new services to be delivered quickly
    - Operators deploying IMT-2000 systems in new spectrum must build an entirely new network from the ground up, which will have significant impact on network costs and time to market
  - Spectrum will continue to be a scarce and valuable resource
    - Utilization of spectrally efficient technologies in available spectrum will be critical
  - Early licensing for IMT-2000 does not equate to early deployment

***THANK YOU!***

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