Migration to IMT-2000 in Developing countries:
The view of Policy Makers and Regulators and market reaction

Rajendra Singh
Secretary
Telecom Regulatory Authority of India

Why Migration

- Need of High speed data services
- Inadequacy of 2 G spectrum
- Need of additional operators in the market to increase the level of competition
- These additional operators could offer IMT-2000 services

The Key Considerations

- Existing Licensing Regime
  - Is it a hurdle for migration
- Availability of equipment
  - Is it that the equipment for IMT-2000 services is available only in a particular spectrum
- Technological developments
  - SDRs, Multi Tx-Rx in a single chip

Spectrum Policy

- Efficient Utilization of Spectrum
- Spectrum allocation Procedure
- Spectrum Pricing

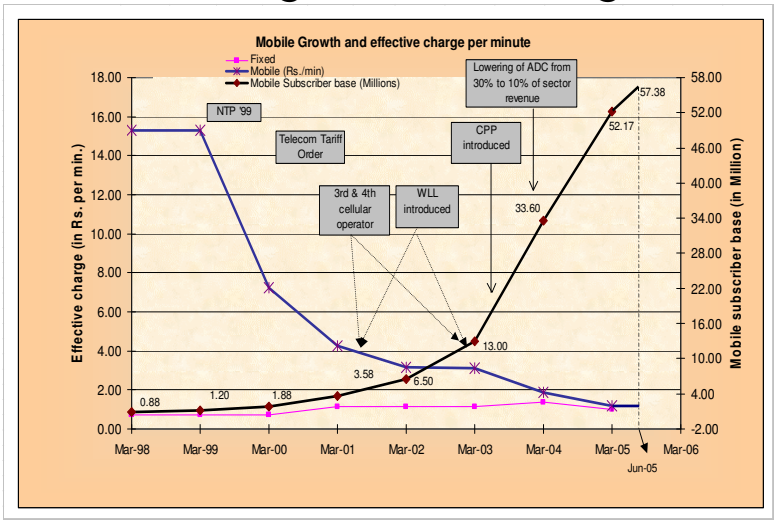
- Other related issues
  - Spectrum Re-farming
  - Spectrum trading
  - Mergers and Acquisitions

Growth of Mobile services

- Targeted Market
- Level of Competition
- Current penetration level
- Tariff
- Affordability
- Population coverage
- Applications

Growth of mobile services

Subscribers growth and falling tariffs



Spectrum allocation for 2/2.5 G mobile services

	International allocations	Indian allocation
450 MHz	Spectrum allocated in some countries: 452.5-457.475 paired with 462.5-467.475 452 – 456.475 paired with 462-466.475 450-454.8 paired with 460-464.8 411.675 – 415.850 paired with 421.675-425.850 415.5-419.975 paired with 425.5-429.975 479-483.48 paired with 498-493.48 455.23-459.99 paired with 465.230-469.99 451.310-455.730 paired with 461.31-465.73	Not allocated
800 MHz	824 – 849 MHz paired with 869 –894 MHz	824 – 844 paired with 869 – 889 MHz *(Used to provide WLL (M) & CDMA based mobile services)*

Spectrum allocation for 2/2.5 G mobile services

	International allocations	Indian allocation
900 MHz	890 – 915 MHz paired with 935 – 960 MHz (880 – 890 MHz paired with 925 – 935 MHz E-GSM band)	890 – 915 paired with 935 –960 MHz *(Used by 1st, 2nd and 3rd Cellular Mobile Service Providers for GSM)*
1800 MHz	1710 – 1785 MHz paired with 1805 – 1880 MHz	1710 – 1785 paired with 1805 – 1880 MHz *(Used by 4th CMSP and for additional allocations to 1st, 2nd and 3rd CMSPs.)*
1900 MHz	1850 – 1910 MHz paired with 1930 – 1990 MHz *(North American PCS band)*	1880–1900 MHz is earmarked for Micro cellular technologies based on TDD

Spectrum for IMT-2000 Services

- ITU-R Recommendations M.1036
- WARC-92 identified bands
  - 1885-2025 MHz
  - 2110- 2200 MHz
- WRC-2000 identified bands
  - 806-960 MHz
  - 1710-1885 MHz
  - 2500-2690 MHz

Frequency Arrangements in the band 1710-2200 MHz band

Frequency arrangements	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	Un-paired spectrum (e.g. for TDD) (MHz)
B1	1920-1980	130	2110-2170	190	1880-1920; 2010-2 025
B2	1710-1785	20	1805-1880	95	None
B3	1850-1910	20	1930-1990	80	1910-1 930
B4 (harmonized with B1 and B2)	1710-1785 1920-1980	20 130	1805-1880 2110-2170	95 190	1900-1920; 2010-2 025

Frequency Arrangements in the band 1710-2200 MHz band

Frequency arrangements	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	Un-paired spectrum (e.g. for TDD) (MHz)
B5* (harmonized with B3 and parts of B1 and B2)	1 850-1 910 1 710-1 755 1 755-1 805	20 50 305	1930-1990 1805-1850 2110-2 160	80 95 355	1910-1930
B6 (harmonized with B3 and parts of B1 and B2)	1 850-1 910 1 710-1 770	20 340	1930-1990 2110-2170	80 400	1910-1930

*It is understood that frequency arrangement B5 has been dropped due to interference problems.

TRAI's recommendations on Spectrum related issues (dated May 13, 2005)

- **Spectrum policy recommendations are based on:**
  - objectives of Government viz. target of 200 million mobile phones by 2007
  - adequate spectrum to operators to permit longer term spectrally efficient planning
  - reduced input costs for telecom services so as to increase coverage in semi- urban and rural areas and ensuring roll out of 3G services.

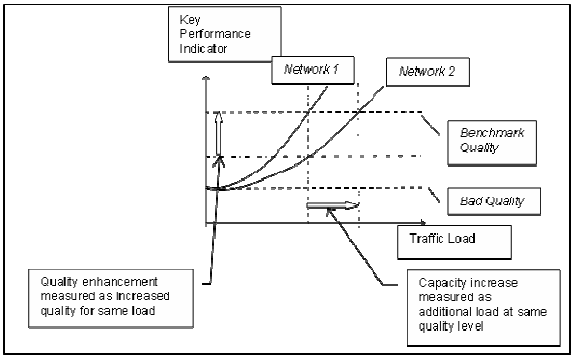
TRAI's recommendations on Spectrum related issues

- **Annual Spectrum charge**
  - Existing ceiling on annual spectrum charges of 6% AGR to be brought down to 4% of AGR.

- **Spectrum allocation Procedure**
  - Present spectrum allocation criterion for both GSM and CDMA operators to be technology neutral within one month of acceptance of these recommendations.

Efficient utilization of Spectrum

Spectral Efficiency concept



For cellular mobile systems, it can be expressed as

$$SUE = \frac{\text{(Traffic in Erlangs)}}{\text{(Amount of Spectrum in MHz) X (Area in Sq. Kms)}} \quad \text{For a specified GoS}$$

SUE = Spectrum Utilization Efficiency

Efficient Utilization of Spectrum

- Is it practically possible to measure efficiency based on this formulae?
- Is it necessary?
- **TRAI's recommendations on Benchmarking criterion**
  - may be practically difficult to implement.
  - Not appropriate at this stage
  - At a later stage, this concept of benchmarking could be reconsidered.

Efficient Utilization of Spectrum

Keeping in mind the current constraint in availability of spectrum and pricing (existing revenue share) as a method of ensuring efficient utilisation of spectrum the existing subscriber base approach for allocation of additional spectrum should continue.

TRAI's recommendations on Spectrum related issues

- **Strategy for availability of additional spectrum**
  - Present level of spectrum allocated to Mobile operators
    - Much below the International averages
    - Need for immediate time bound action for making more spectrum available.
  - Constraint in additional 2G spectrum availability
    - Partial mitigation of spectrum constraints through introduction of services in IMT-2000 spectrum.

.

TRAI's recommendations on Spectrum related issues

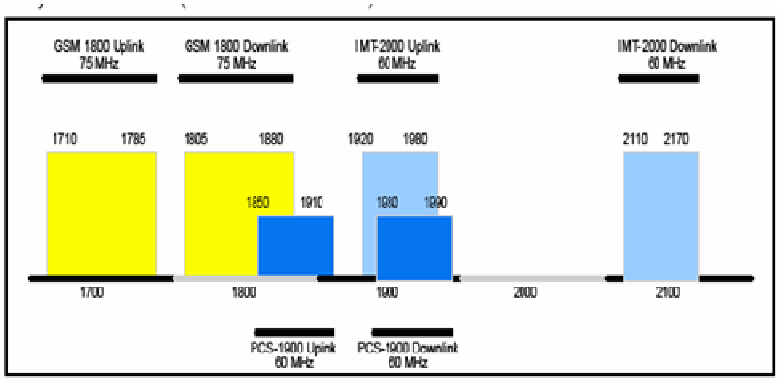
- **Spectrum shortage is not likely to be faced in too many cities and certainly not all over the country.**
  - Area specific (city level or even specific area within a city) co-ordination may be required to ensure availability of adequate spectrum.

TRAI's recommendations on Spectrum related issues

- **IMT-2000 (3G) services in the 2GHz band for both GSM and CDMA**
  - US-PCS 1900 MHz band for CDMA operators cannot be vacated by defence
  - Interference problems in mixed allocation of 1900 MHz US-PCS and IMT-2000 2 GHz spectrum.

Interference Issue

IMT-2000 2 GHz Vs. 1.9 GHz band



Base Station to Base Station Interference:: CDMA2000 TX will cause interference into the WCDMA RX
Mobile Station to Mobile Station Interference: WCDMA TX will cause interference into CDMA 2000 RX

TRAI's recommendations on Spectrum related issues

- **IMT-2000 2GHz spectrum allocation to the existing operators as extension of 2 G spectrum allocation**
  - No one time entry fee
  - Additional annual per MHz charge till service provider rolls out IMT-2000 services.
  - Cancellation of IMT-2000 spectrum if IMT-2000 (3G) services are not rolled out within 2 years from the date of allocation of spectrum

TRAI's recommendations on Spectrum related issues

- **New operators to be allowed in areas where spectrum requirements of existing operators have been met and additional spectrum is available.**
- **CorDECT spectrum delinked from mobile spectrum and distributed rationally.**
- **Spectrum trading may be considered at a later stage through a consultation process.**

TRAI's recommendations on Spectrum related issues

- Spectrum charging for terrestrial wireless links rationalized.
  - This will help in increasing internet and broadband penetrations. For shorter distances and lower spectrum bandwidth discounts from 50% to 98%.

Thank You