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

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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

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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
### Spectrum allocation for 2/2.5 G mobile services

<table>
<thead>
<tr>
<th>International allocations</th>
<th>Indian allocation</th>
</tr>
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<tbody>
<tr>
<td><strong>450 MHz</strong> Spectrum allocated in some countries:</td>
<td>Not allocated</td>
</tr>
<tr>
<td>452.5 - 457.475 MHz paired with 462.5 - 467.475</td>
<td></td>
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<td>452 - 456.475 MHz paired with 462 - 466.475</td>
<td></td>
</tr>
<tr>
<td>450 - 454.8 MHz paired with 460 - 464.8</td>
<td></td>
</tr>
<tr>
<td>411.675 - 415.850 MHz paired with 421.675 - 425.850</td>
<td></td>
</tr>
<tr>
<td>415.5 - 419.975 MHz paired with 425.5 - 429.975</td>
<td></td>
</tr>
<tr>
<td>479.483.48 MHz paired with 498 - 493.48</td>
<td></td>
</tr>
<tr>
<td>455.23 - 459.99 MHz paired with 465.230 - 469.99</td>
<td></td>
</tr>
<tr>
<td>451.310 - 455.730 MHz paired with 461.31 - 465.73</td>
<td></td>
</tr>
<tr>
<td><strong>800 MHz</strong></td>
<td>824 - 844 MHz paired with 869 - 889 MHz (Used to provide WLL (M) &amp; CDMA based mobile services)</td>
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<td>824 - 849 MHz paired with 869 - 894 MHz</td>
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<td><strong>900 MHz</strong> 890 - 915 MHz paired with 935 - 960 MHz (880 - 890 MHz paired with 925 - 935 MHz E-GSM band)</td>
<td>890 - 915 MHz paired with 935 - 960 MHz (Used by 1st, 2nd and 3rd Cellular Mobile Service Providers for GSM)</td>
</tr>
<tr>
<td><strong>1800 MHz</strong> 1710 - 1785 MHz paired with 1805 - 1880 MHz</td>
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<tr>
<td><strong>1900 MHz</strong> 1850 - 1910 MHz paired with 1930 - 1990 MHz (North American PCS band)</td>
<td>1880 - 1900 MHz is earmarked for Micro cellular technologies based on TDD</td>
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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

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<th>Centre gap (MHz)</th>
<th>Base station transmitter (MHz)</th>
<th>Duplex separation (MHz)</th>
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<td>B1</td>
<td>1920-1980</td>
<td>130</td>
<td>2110-2170</td>
<td>190</td>
<td>1880-1920; 2010-2025</td>
</tr>
<tr>
<td>B2</td>
<td>1710-1785</td>
<td>20</td>
<td>1805-1880</td>
<td>95</td>
<td>None</td>
</tr>
<tr>
<td>B3</td>
<td>1850-1910</td>
<td>20</td>
<td>1930-1990</td>
<td>80</td>
<td>1910-1930</td>
</tr>
<tr>
<td>B4 (harmonized with B1 and B2)</td>
<td>1710-1785, 1920-1980</td>
<td>20, 130</td>
<td>1805-1880, 2110-2170</td>
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<td>B5* (harmonized with B3 and parts of B1 and B2)</td>
<td>1 850-1 910 1 710-1 755 1 755-1 805</td>
<td>20 50 305</td>
<td>1930-1990 1805-1850 2110-2160</td>
<td>80 95 355</td>
<td>1910-1930</td>
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<tr>
<td>B6 (harmonized with B3 and parts of B1 and B2)</td>
<td>1 850-1 910 1 710-1 770</td>
<td>20 340</td>
<td>1930-1990 2110-2170</td>
<td>80 400</td>
<td>1910-1930</td>
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*It is understood that frequency arrangement B5 has been dropped due to interference problems.*

TRAIs 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

\[
\text{SUE} = \frac{\text{(Traffic in Erlangs)}}{\text{(Amount of Spectrum in MHz)} \times \text{(Area in Sq. Kms)}}
\]

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) coordination 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 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 2G 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

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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