IMT-2020 TSDSI RIT Update

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India Scenario

• 5G, IoT Technology ownership and control is critical to National interest

• Enhancing Current R&D capabilities – domestic manufacturing and export oriented

• Big thrust on IP/IPR creation

• Influence standards – Ensure India’s requirements are met
  • TSDSI/3GPP/ITU
India Rural Scenario
What’s Unique about India’s Mobile Telephony

- Mobile Broadband (MBB) is the prime source of internet access in India
- 80% of internet traffic generated by Mobile phones

<table>
<thead>
<tr>
<th>Wired Internet Subscribers</th>
<th>22.386 Million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless Internet Subscribers</td>
<td>696.36 Million</td>
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</tbody>
</table>

Source: TRAI report

- Voice users: 64 crore Urban Vs 50 crore rural users

<table>
<thead>
<tr>
<th>Wireless Subscribers</th>
<th>1,151.44 Million</th>
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<tbody>
<tr>
<td>% change over the previous quarter</td>
<td>-1.90%</td>
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<tr>
<td>Urban Subscribers</td>
<td>643.97 Million</td>
</tr>
<tr>
<td>Rural Subscribers</td>
<td>507.46 Million</td>
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<tr>
<td>Market share of Private Operators</td>
<td>89.45%</td>
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<tr>
<td>Market share of PSU Operators</td>
<td>10.55%</td>
</tr>
<tr>
<td>Teledensity</td>
<td>86.98</td>
</tr>
<tr>
<td>Urban Teledensity</td>
<td>151.90</td>
</tr>
<tr>
<td>Rural Teledensity</td>
<td>56.39</td>
</tr>
<tr>
<td>Total Wireless Data Usage during the quarter</td>
<td>21,402 million GB</td>
</tr>
</tbody>
</table>

Source: TRAI report
Internet in Indian Rural Scenario

- For the first time, India has more rural net users than urban Indian – ToI
- Rural settings are quite important (especially after COVID-19)
- Significant investments will be made in this space
Bharat Net – A Quick Glance!

- Project cost: 45,000 crore INR
- Fiber to reach all 2.5 Lakh Gram Panchayat’s (GP) in India
- Length of fiber laid till date
  - 4.45 Lakh Km
- Fiber laid and equipment connected till date
  - 1.4 Lakh GPs
- Number of WiFi APs planned to be installed
  - 1Lakh
- WiFi an interim solution –
  - 5G to address last mile connectivity at GP
BS at the GP should serve the nearby villages

**Important configuration parameters**

1. Cell radius
2. UE height
3. Mobility model
4. Target edge/average cell spectral efficiency

Fig. courtesy: Prof. Ganti, IITM
Distribution of the Distance between Villages and their Closest Gram Panchayat

- Radius of 3 Km (ISD = $3\sqrt{3} = 5.19$ Km)
  - Covers only 60% of the villages
- Radius of 3.46 Km, (ISD = $3.46\sqrt{3} = 6$ Km)
  - Covers only 68% of the villages,
- Radius of 6 Km, (ISD = $6\sqrt{3} = 10.3$ Km)
  - Covers 95% of the villages

The GP and village list was obtained from the government website [http://lgdirectory.gov.in/](http://lgdirectory.gov.in/).

ISD: Inter Site Distance, R: Radius

Fig. courtesy: Prof. Ganti, IITM
Till IMT-2020, ITU did not have a rural use case that suited to rural needs of developing countries

Hence, the IMT advanced technology development (such as 4G LTE) did not meet rural requirements in countries like India.
- Recall the GP distribution shown earlier
LMLC and TSDSI RIT

Content courtesy: Prof. Ganti, IITM
ITU Mandatory Requirements for IMT 2020

- A RIT/SRIT should fulfil the TPR of all the test-environments
- The TPR for a test-environment is fulfilled if it is fulfilled for one of the test configurations

8.4 Evaluation configurations

Evaluation configurations are defined for the selected test environments. The configuration parameters shall be applied in analytical and simulation assessments of candidate RITs/SRITs. For the cases when there are multiple evaluation configurations under the selected test environment, one of the evaluation configurations under that test environment can be used to test the candidate RITs/SRITs. The technical performance requirement corresponding to that test environment is fulfilled if this requirement is met for one of the evaluation configurations under that specific test environment.

In addition, for the Rural-eMBB test environment, the average spectral efficiency value should meet the threshold values for the LMLC evaluation configuration with ISD of 6,000 m and either evaluation configuration with ISD of 1,732 m.
TSDSI RIT cleared step-7 of 8 step process at ITU-R

**Radiocommunication Study Groups**

Source: Document 5D/TEMP/159

8 July 2020
English only

**Working Party 5D**

LIAISON STATEMENT TO RIT/SRIT PROONENTS¹ ON THE COMPLETION AND CONCLUSIONS OF STEPS 5 TO 7 OF THE IMT-2020 PROCESS FOR THE FIRST RELEASE OF NEW RECOMMENDATION ITU-R M.[IMT-2020.SPECS]

(Copy to GCS Proponents²)

<table>
<thead>
<tr>
<th>Radio Interface Technologies:</th>
<th>NAME: (TSDSI RIT)</th>
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<tbody>
<tr>
<td>Determination whether the RIT or SRIT meets the requirements of Res. ITU-R 65, resolves 6 c) and d), for the five test environments comprising the three usage scenarios</td>
<td>YES (Requirements met for five test environments)</td>
</tr>
<tr>
<td>Inclusion in the standardization phase described in Step 8</td>
<td>YES</td>
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</tbody>
</table>

¹ Proponents
² GCS Proponents
One of the key elements of TSDSI RIT is “pi/2 BPSK with spectrum shaping” waveform – a central feature in uplink aimed at LMLC coverage expansion.

When UE operates in low duty cycle mode with less than 50% uplink activity (e.g., TDD, VoIP etc), the UE with pi/2 BPSK with spectrum shaping power boosts to 26 dBm during active Tx state. However, UE average power is limited to 23 dBm.

Rural: The technology enables ISD of at least 12 Km in the 3.5GHz band.
Summary

• TSDSI RIT
  • On its way to become a global IMT-2020 5G RIT
  • A central feature in the uplink: Pi/2 BPSK with spectrum shaping.
    Power boosting in low-duty cycle Tx mode
  • Increases the uplink cell radius by 70-80% - supports large cells