Spectrum for 5G

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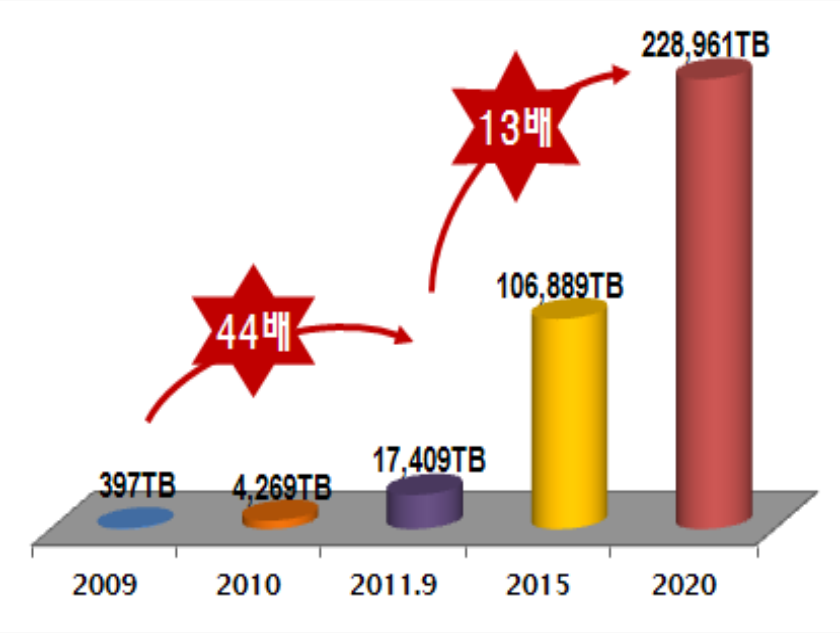
Ministry of Science, ICT and Future Planning

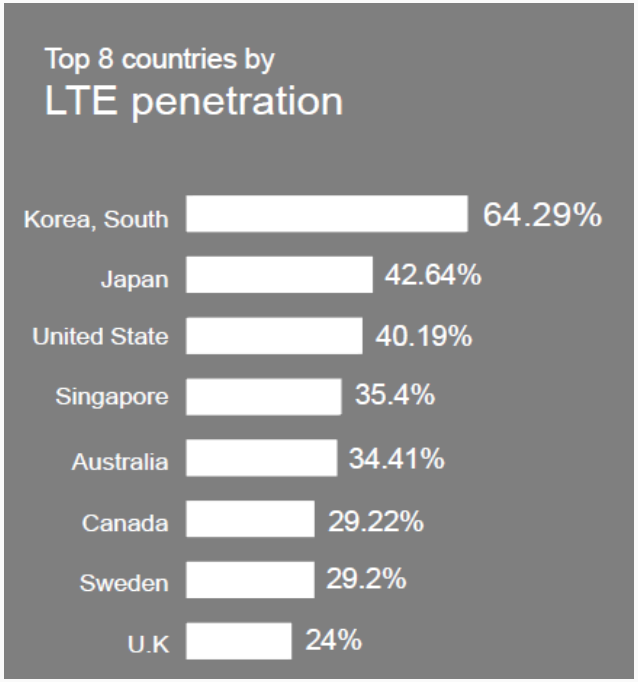
Contents

1. Demands for Mobile Broadband

Mobile Traffic Increase

- ITU-R M.2290 is future spectrum requirements estimate for IMT
- Data traffic increased rapidly from 2009 to 2011 in Korea
- Expect 13-fold increase in 2020 compared with in 2011
- LTE penetration rate





< Traffic increase in Korea >

Spectrum requirements

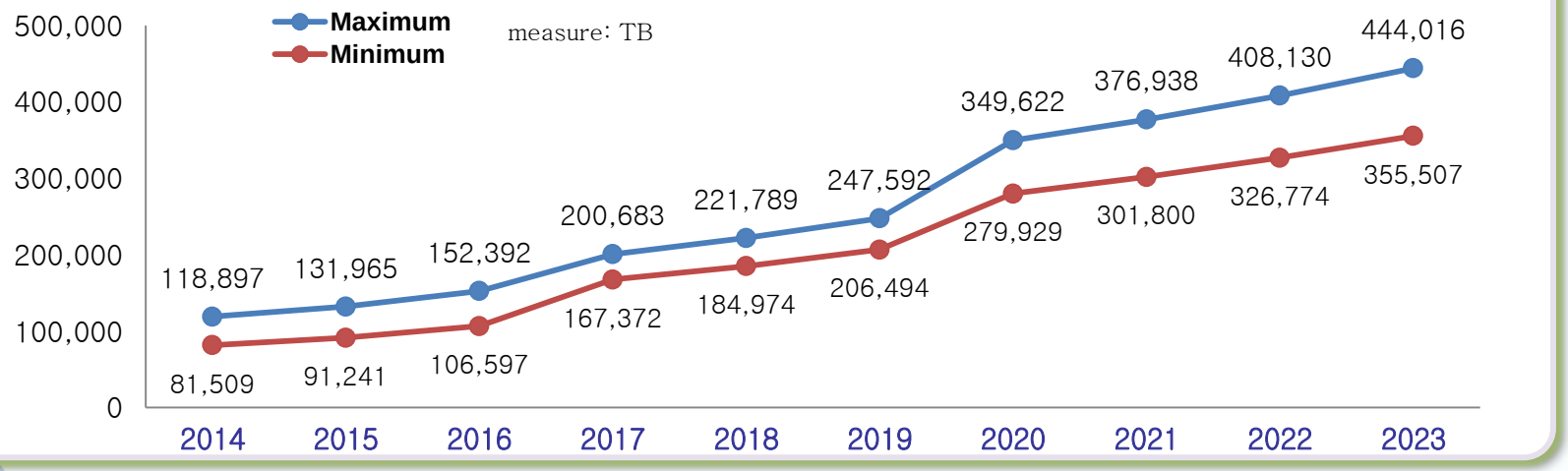
Prediction of Traffic

- **Mobile traffic is rapidly increasing due to deployment of smart devices and development of communications technology.**

※ In the short run, traffic occurred by increase of smartphone users. In the mid and long term, the increase traffic is predicted by the introduction of new services such as M2M, sending HD video, mobile cloud service.

- **Prediction of mobile traffic in Korea: maximum 349,622 TB in 2020, 444,016 TB in 2023**

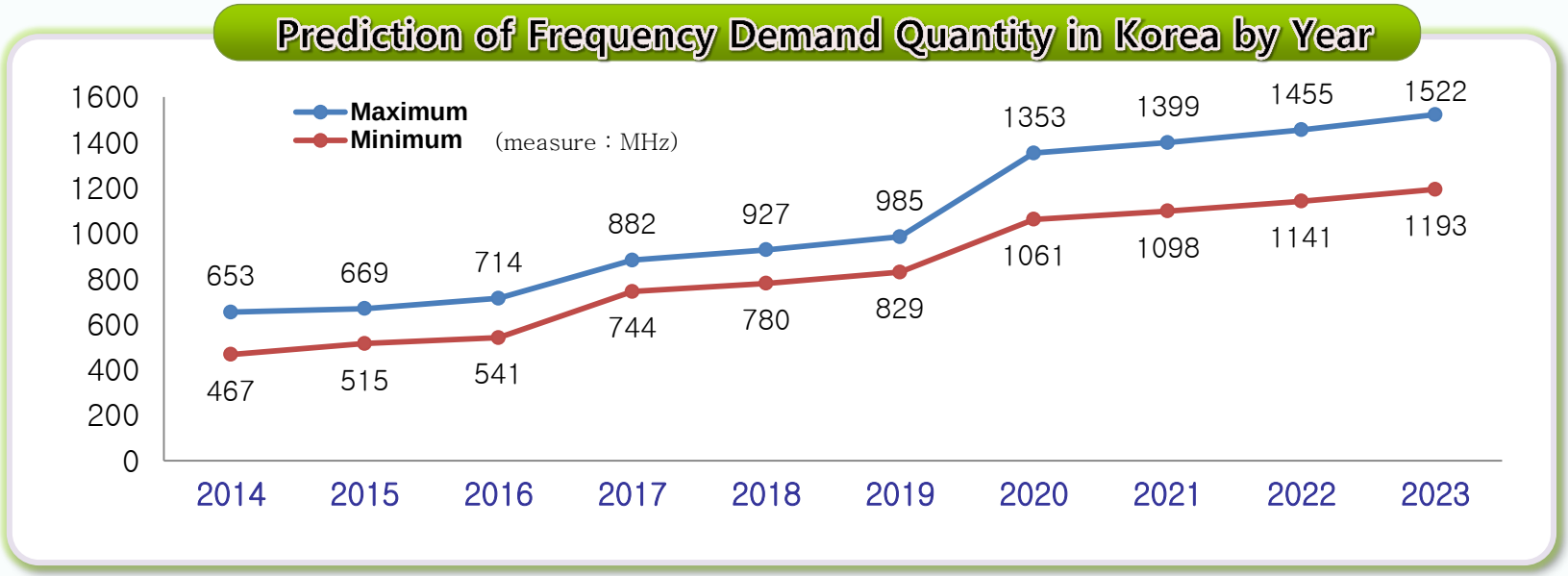
Prediction of Mobile Traffic in Korea (a monthly average)



Spectrum requirements

Demand for Quality of Service

- **Additional bandwidths of 803-1132 MHz will be needed around by 2023.**



Mobile Gwanggaeto Plan 2.0

Step-by-Step Action Plan

Phase 1 — 2015
Secure 170 MHz Bandwidth at least
(700 MHz / 1.8 GHz / 2.5-2.6 GHz)

Phase 2 — 2018
Secure 290 MHz Bandwidth at least
(2.1 GHz / 2.3 GHz / 3.5 GHz)

Phase 3 — 2020
Secure 220 MHz Bandwidth at least
(1.8 GHz / above 6 GHz)

Phase 4 — 2023
Secure 510 MHz Bandwidth at least
(2.6 GHz / above 6 GHz)

Korea Mobile Broadband Plan

- Corresponding to rapid increase of mobile data traffic
- Additional bands of 1 GHz bandwidth by 2023
- Securing 1190 MHz band-width including bands already allocated (390 MHz)

2. Candidate bands for 5G

IMT bands below 6 GHz

- Additional IMT bands
  - below 6 GHz -> WRC-15 AI 1.1
  - above 6 GHz -> WRC-19 AI
- Discussion on IMT band below 5 GHz (WRC-15 AI 1.1)
  - Sharing studies and evaluation of availability
    - Sufficient bandwidths: wider than 10 MHz bandwidth
    - Service coverage: national or local
    - Global harmonization: channeling arrangements
    - Coordination with neighboring countries: harmonized use to reduce mutual interferences
    - Easy relocation/re-farming: available bands for relocation, clearing schedule and expenses
  - Support 3600-3800 MHz and 1452-1492 MHz

IMT bands above 6 GHz

- Future Works for IMT to solve:
  - Congested use of incumbent services below 6GHz
  - Heavy traffic in dense urban area (e.g., 'hot-spot')
  - Demands on maximized efficiency of data delivery
- IMT in the bands above 6 GHz with advantages:
  - Wide contagious bandwidth
  - Development of semiconductor technology
  - Facilitation of multi-beamforming in higher frequency
  - Tolerable path loss within small cells

5G Vision

Key Capabilities	Values
User experienced data rate	100 Mbps – 1 Gbps
Peak data rate	10-20 Gbps
Mobility	500km/h
Latency	1ms
Connection density	10^6 /km^2
Network Energy efficiency	100 times IMT-Advanced
Spectrum efficiency	3-5 times IMT-Advanced
Area traffic capacity	10Mbps/m^2

Criteria for candidate band above 6GHz

- Mobile Bands in the RR on a primary basis in 6-100 GHz
  - Stage 1: Mobile bands in all Regions on a primary basis
  - Stage 2: by additional allocation or upgrade to primary service

✓ Exclude bands for passive services (Earth Exploration Satellite service or Radio astronomy)

✓ Exclude Planned bands for satellite service

✓ Preferably, bands with less operating stations

✓ Wide contiguous bandwidths (at least 500㎒ bandwidth)

- Korea supports:

✓ 27-29.5 GHz, 31.8 - 33.4 GHz, 37 - 42.5 GHz, 45.5 - 52.6 GHz (Exclusion of 50.2 – 50.4 GHz), 66 - 74 GHz

3. Preparation towards WRC-19

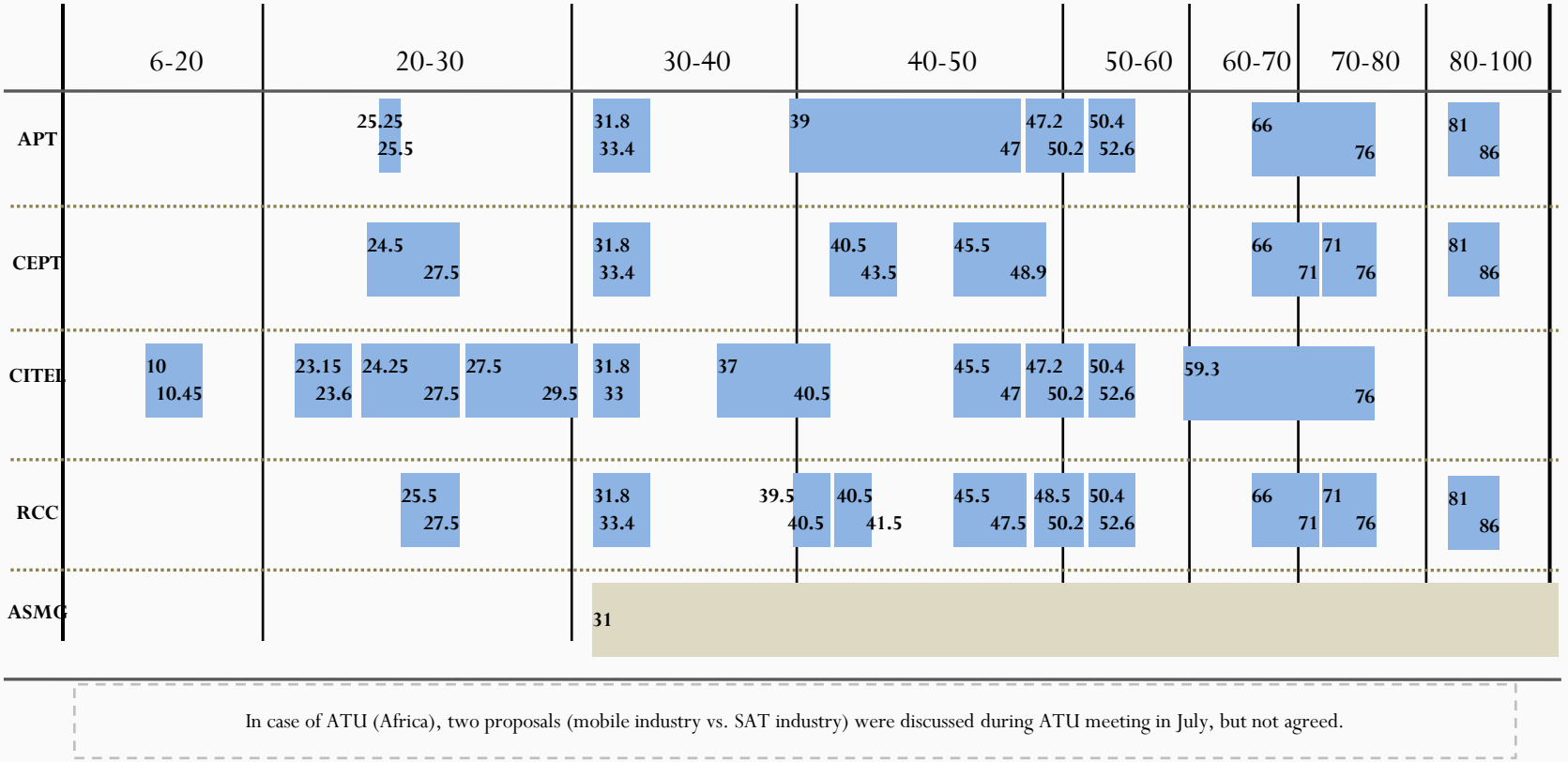
Proposal for WRC-19

- Korea proposed WRC-19 AI to APG15-5
  - *" To consider identification to IMT in the frequency range between 27 GHz and 74 GHz including possible additional allocations to mobile service on a primary service in accordance with Resolution YYY (WRC-15)"*

- APT common Proposal
  - "to consider identification of frequency bands for IMT including possible additional allocations to the mobile service on a primary basis in accordance with Resolution [ASP-B10- IMT_ABOVE_6GHz] (WRC-15)"
  - Resolution [ASP-B10- IMT_ABOVE_6GHz] (WRC-15) "Studies on frequency-related matters for IMT identification including possible additional allocations to the mobile services on a primary basis in portion(s) of the frequency range between 25.25 and 86 GHz for the future development of IMT for 2020 and beyond"
    - Consensus bands: 25.25-25.5GHz, 31.8-33.4GHz, 39-47GHz, 47.2-50.2GHz, 50.4-52.6GHz, 66-76GHz

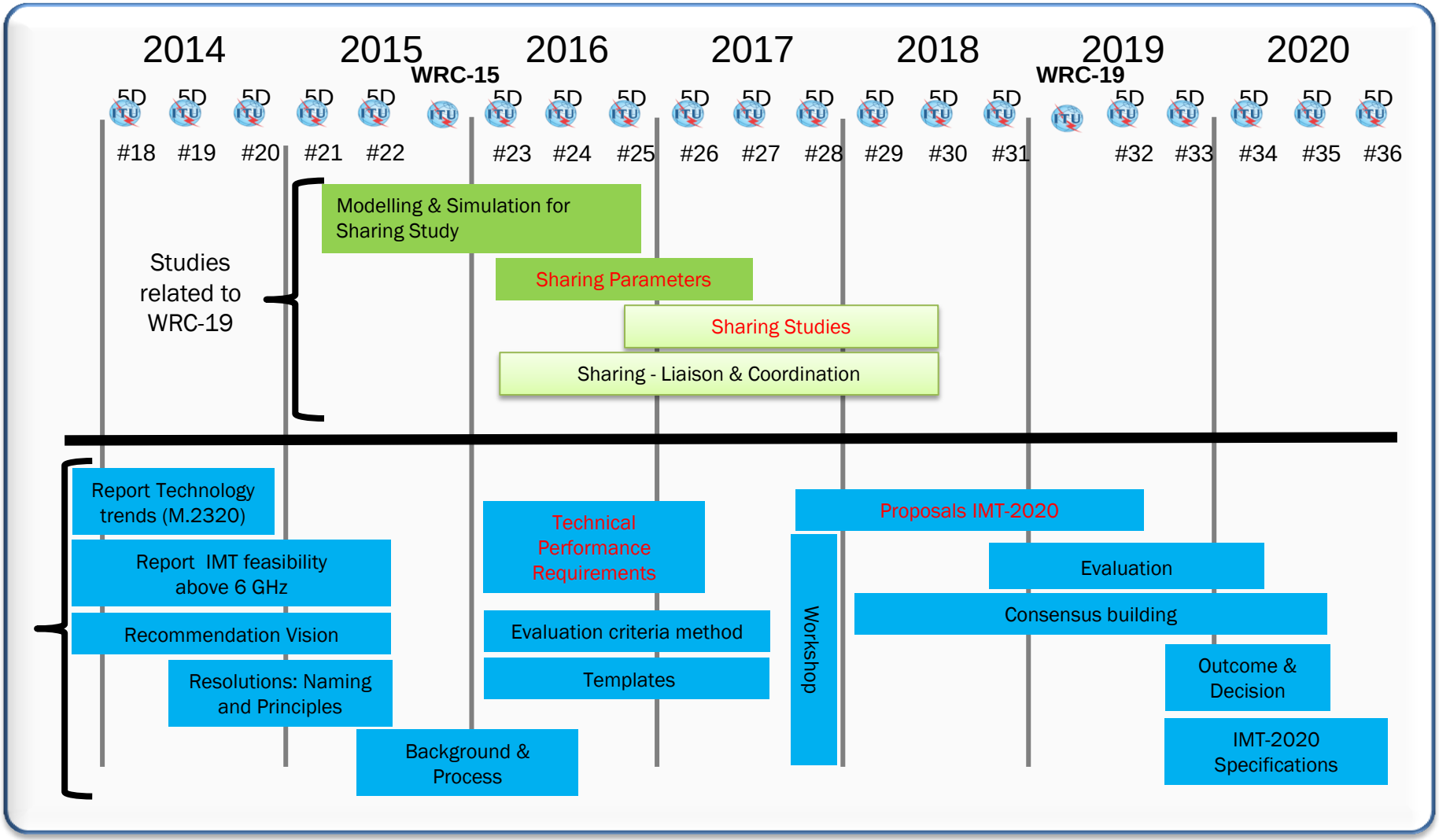
    * non-consensus bands: 6-8.5 GHz, 10-10.5 GHz, 14.4-15.35 GHz, 25.5-29.5 GHz

Frequency ranges for WRC-19



In case of ATU (Africa), two proposals (mobile industry vs. SAT industry) were discussed during ATU meeting in July, but not agreed.

ITU Time schedule for 5G



Thank You