US National Spectrum Strategy: Reflections on Possible Impacts

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Need for a common understanding of purpose

"The United States needs a comprehensive strategy to modernize spectrum policy and make the most efficient use possible of this vital national resource."

How do we define "efficient" use of spectrum?

- Different users contending for the spectrum range (federal, commercial,…)
- Different uses (terrestrial and satellite communications, radiolocation, radio navigation, earth and environmental sciences,….
- Different geographies (fixed services, earth stations,..)
- Different time dimensions (intermittent, always-on,..)
- Different importance (national security, critical communications, entertainment,..)
- Different economic impact (digital equity and inclusion, scientific exploration,…)

A common framework will go a long way towards resolving contentions among different services

Intersection of WRC-23 and US NSS

Harmonized spectrum range needed to leverage global economy of scale

WRC-23 resolutions impacting 5G-Adv/6G

- Agenda Items resolved from **WRC-19**
  - Identification of **3.3-3.4** GHz for IMT
  - Identification of **6.425-7.125** GHz for IMT, not only in **EMEA** but also some other countries in Asia and the Americas
- **New** Agenda Item for **WRC-27**
  - **4400-4800 MHz** (in EMEA and Asia)
  - **7125-8400 MHz** (excluding 7250-7750 MHz in Europe)
  - **14.8-15.35 GHz** (global

US position at WRC-23 and NSS

- Following new bands were proposed by the US delegation at WRC-23 as study item towards WRC-27 for wireless broadband use:
  - **3.1-3.3 GHz**:
  - **12.7-13.25 GHz**
- The NSS proposed these additional bands for further investigation by the US government:
  - **7.125 – 8.4 GHz**
  - **37 – 37.6 GHz**

7.125-8.4 GHz is the only common range between WRC-27 Agenda Items and National Spectrum Strategy

Relative importance of 3.1 GHz and 7-8 GHz bands

3.1-3.45 GHz

- Relatively smaller amount of spectrum, considered 5G-Adv extension band
- Enables reuse of C-band deployment grid, minimizing cost and contributing to sustainability
- Important for cellular in the next 2-3 years
- Challenging due to national security purpose served by incumbents

7.125-8.4 GHz

- Potential for significantly large amount of spectrum, critical for 6G
- Larger channel bandwidths needed for target user experience and cell edge performance to reuse C-band grid
- Important for cellular in 4-5 years
- Many incumbents posing a wide array of challenges

While both spectrum ranges are important, they serve different purposes in different time horizons

Comparing PATHSS conclusions and NSS content

Delivering divergent messages

PATHSS conclusions

- DoD concluded that without a reliable mechanism for reducing or eliminating 5G emissions, USG systems will experience interference. Commercial systems should be allowed to operate **only** when USG systems are **not active**
- Pursuing a dynamic spectrum management system (DSMS) **operated by and within the DoD**, presents a feasible spectrum sharing framework.
- **Time domain** based spectrum sharing in the 3100-3450 MHz band is possible for shipborne and ground-based systems. USG airborne systems are highly challenging for spectrum and thus commercial availability of the spectrum will continue to be **limited**.

NSS statements

- DoD determined that sharing **is feasible** if certain advanced interference mitigation features and a coordination framework to facilitate spectrum sharing are put in place.
- The Departments of Commerce and Defense will **co-lead** any follow-on studies to the Emerging Mid-band Radar Spectrum Study (EMBRSS) that focus on future use of the 3.1-3.45 GHz band.
- Additional studies will explore **dynamic spectrum sharing** and other opportunities for private-sector access in the band, while ensuring DoD and other Federal mission capabilities are preserved, with any necessary changes.

Better collaboration framework needed not only between commercial and federal but also among federal entities

Technology innovation

Demand for spectrum is likely increasing for both commercial and federal usage

Efficient use of spectrum is the responsibility of both incumbents and potential new players

Different technology development cycles for federal and commercial systems make spectrum use more challenging

Spectrum sharing technologies likely to be service-specific, rather than band-specific

A diverse set of technological evolutions will be needed to support the nation's evolving spectrum needs


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Example IMT-2030 Use Cases and their KPIs

Immersive experiences

- **Description**: Dynamic interaction among people, things, and environments through lifelike 3D rendering
- **Example applications**:
  - Personalized education, training
  - Specific seats in concerts, sports venues
- **KPIs**:
  - Throughput per stream: multi-Gbps (uncompressed)
  - Number of streams: many
  - Latency and jitter: <20 ms

Multi-sensory communications

- **Description**: Experiencing touch (including the feelings of temperature, pressure, texture)
- **Example applications**:
  - Remote work, Virtual meetings
  - Travel and tourism
- **KPIs**:
  - Throughput per stream: multi-Gbps
  - Number of streams: many
  - Latency and jitter: <20 ms
  - Synchronization across streams: <10ms

Mapping & Twinning

- **Description**: Sense, detect, locate, identify, and image targets during remote operation, thus improving situational awareness, and enabling better allocation of for physical resources including preventive maintenance
- **Example applications**:
  - Manufacturing
  - Smart cities
- **KPIs**:
  - Throughput per stream (Bidirectional): Multi-Gbps
  - Number of streams: several
  - Latency and jitter: < 10 ms

Robots and Cobots

- **Description**: Humans working collaboratively with robots to achieve outcomes that are challenging to be done by robots alone
- **Example applications**:
  - Bespoke manufacturing
  - Industry 5.0 applications
- **KPIs**:
  - Throughput: Multi-Gbps
  - Latency: <10 ms
  - Number of streams: many
  - Reliability: 7 9’s
  - Positioning accuracy: < 1 cm
  - Sensing accuracy: >99%