Samsung Research

UK SPF Plenary: Update on the ITU-R WP 5D (IMT technologies)

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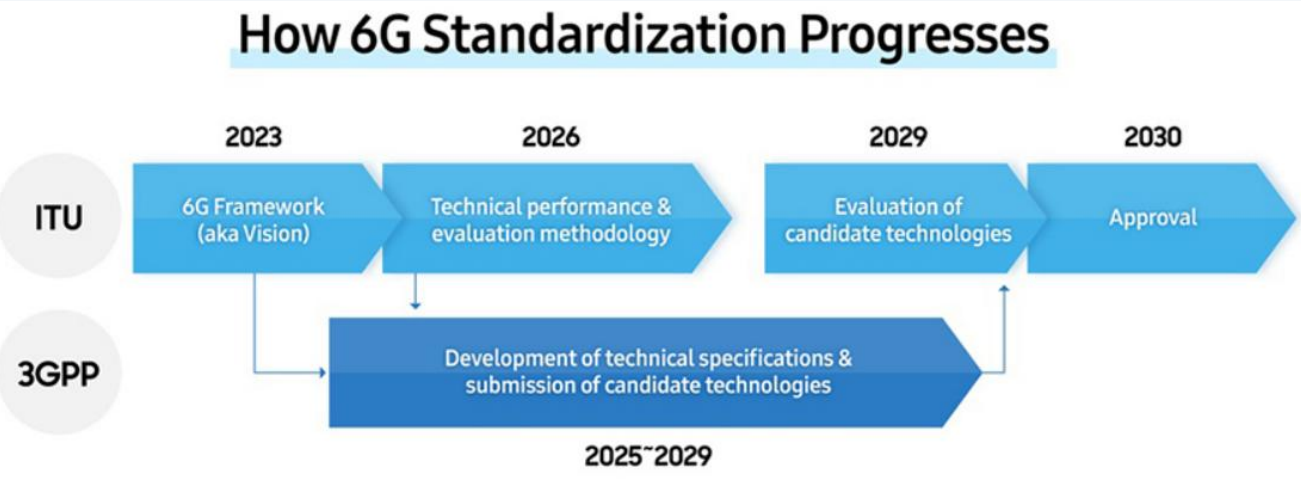
24/07/2025

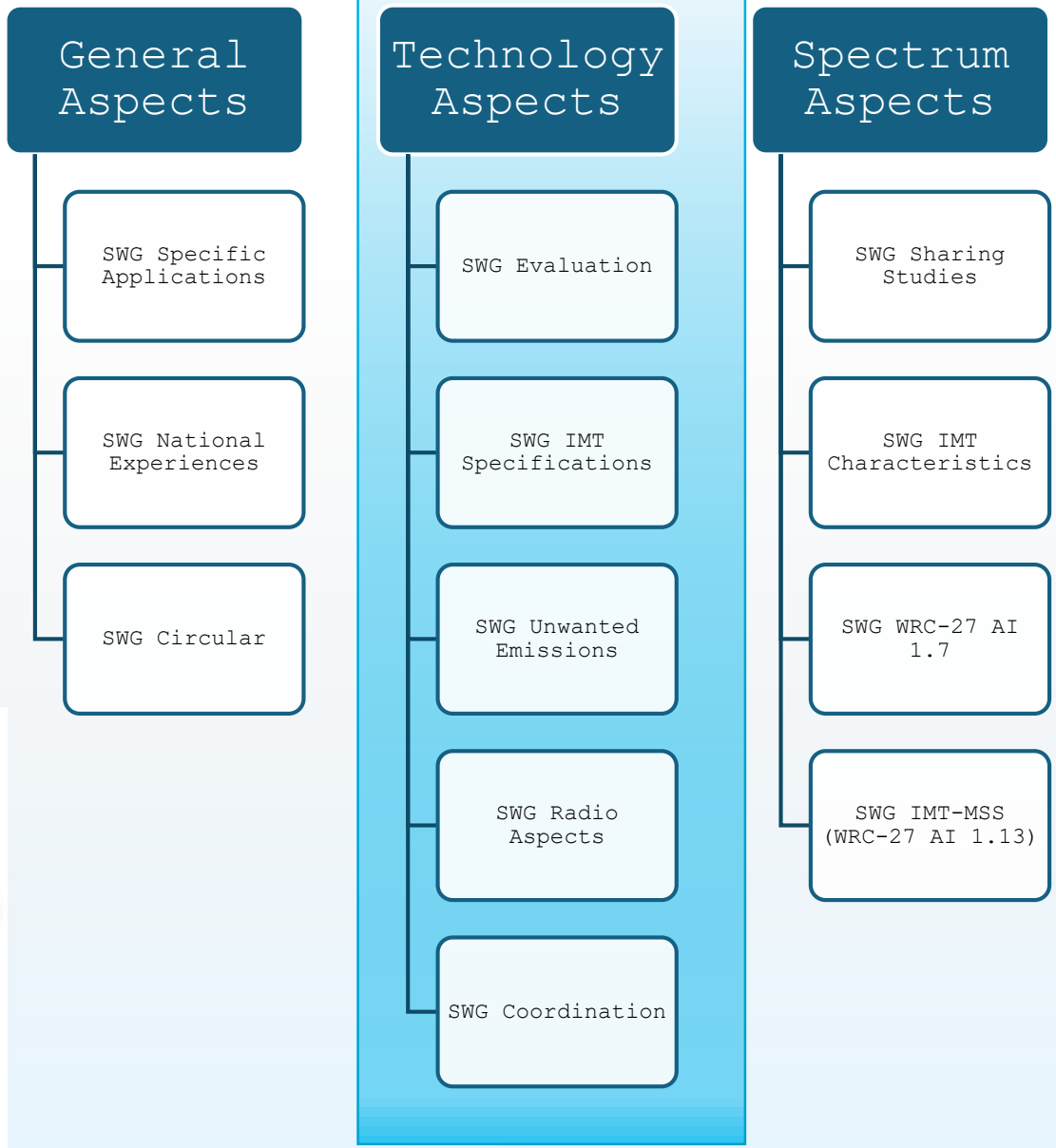
Contents

ITU-R WP 5D structure

The IMT-2030 track

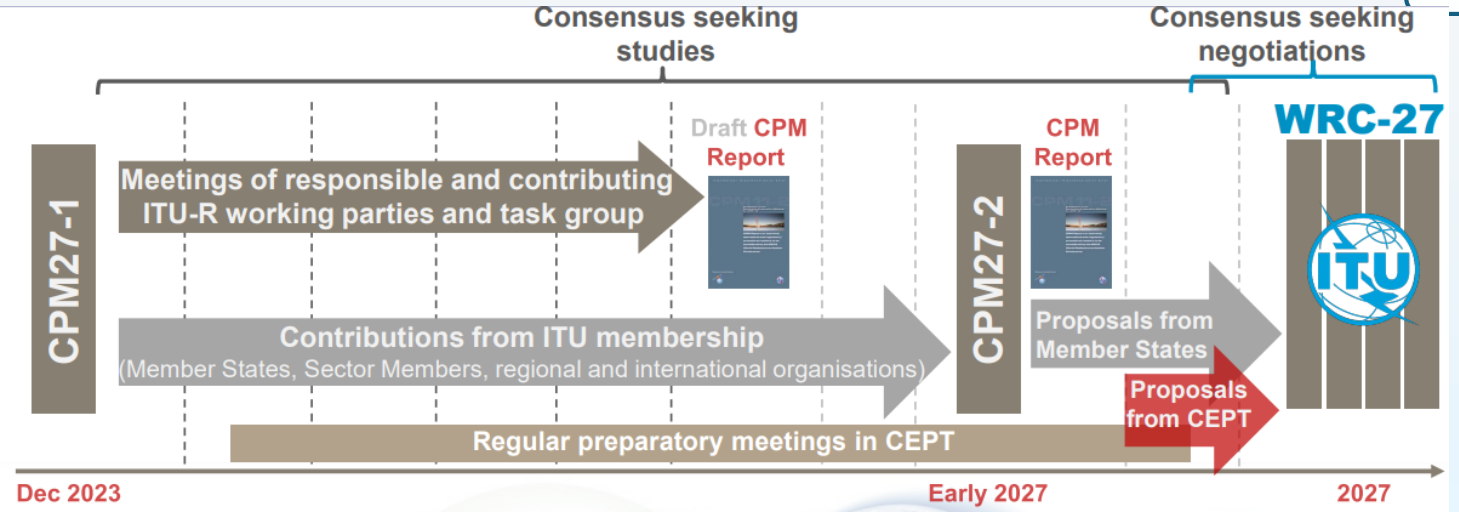
Now the fourth round!
IMT-2000 (WCDMA/HSPA + others)
IMT-Advanced (LTE-A, IEEE 802.16m)
IMT-2020 (NR, DECT-NR+)
IMT-2030 (3GPP Rel-20/21)





ITU-R WP 5D structure

The WRC-27 track



- General Aspects
  - SWG Specific Applications
  - SWG National Experiences
  - SWG Circular
- Technology Aspects
  - SWG Evaluation
  - SWG IMT Specifications
  - SWG Unwanted Emissions
  - SWG Radio Aspects
  - SWG Coordination
- Spectrum Aspects
  - SWG Sharing Studies
  - SWG IMT Characteristics
  - SWG WRC-27 AI 1.7
  - SWG IMT-MSS (WRC-27 AI 1.13)

Technical Performance Requirements

- Current list of minimum technical performance requirements (TPRs) – 18 items
  - Peak data rate, *5th percentile user data rate (User experienced data rate)**, Peak spectral efficiency, Average spectral efficiency, 5th percentile user spectral efficiency, Area traffic capacity, Connection density, User plane latency, Control plane latency, Mobility, Mobility interruption time, Reliability, Bandwidth, Positioning, *Energy efficiency for sustainability**, *Sensing-related requirements**, AI-related capabilities, *Resilience*

  Note) Title of the items have been updated.*

- Outcome of discussions on other candidate TPRs
  - Security: No TPR (To be included in description template)
  - Sustainability: No TPR (Energy efficiency is defined as a representative TPR for sustainability.)
  - [Coverage]: TBD (Concern expressed by *sector members and administrations* on this TPR.)
  - [Composite requirement]: TBD (Concern expressed by *a sector member and administration* on this TPR.)
  - [Interoperability]: TBD (Clarification and discussion on this TPR is needed at the next meeting.)

TPRs	High-level evaluation methodology	Usage scenarios / Test environments
Peak data rate	Analytical	IC
Peak spectral efficiency	Analytical	IC
5th percentile user data rate	DL: Analytical UL: Simulation	Dense Urban – IC [Rural – UC]
5th percentile spectral efficiency / Average spectral efficiency / Mobility	Simulation	Indoor Hotspot – IC Dense Urban – IC Rural – IC [Rural – UC]
Area traffic capacity	Analytical	Indoor Hotspot – IC [Dense Urban – IC]
User plane latency	Analytical	IC & HRLLC
Control plane latency	Analytical	IC & HRLLC
Connection density	Simulation	Urban Macro – MC
Reliability	Simulation	Urban Macro – HRLLC
Mobility interruption time	Analytical	IC & HRLLC
Bandwidth	Inspection	N/A
Energy efficiency for sustainability	Unloaded case: Analytical [Loaded case: Analytical or Simulation]	Unloaded case: IC Loaded case: [Dense Urban – IC], [Rural – IC]
Positioning	Simulation	Indoor Factory – ISAC Urban[Macro] – ISAC
Sensing-related requirements	Simulation [Analytical (only for Resolution)]	Indoor Factory – ISAC Urban[Macro] – ISAC
AI-related capabilities	Inspection	N/A
Resilience	Inspection	N/A
[Composite requirement]	[Simulation]	[Dense Urban – IC] [Indoor Factory – HRLLC]
[Coverage]	[Simulation]	[Rural-UC]
[Interoperability]	[Inspection]	N/A

IC – Immersive Communication, HRLLC –Hyper Reliable and Low Latency Communication,
MC – Massive Communication, UC – Ubiquitous Connectivity
AIC – Artificial Intelligence and Communication, ISAC – Integrated Sensing and Communication

Sharing studies on the IMT candidate bands

DG 4 GHz

- FS, MS, FSS allocated on a primary basis
- AM(R)S, ARNS, FS, MS on adjacent channels on a primary basis
- 13 contributions

DG 7/8 GHz

- FS, MS, SRS, EESS, MetSat, FSS, MMSS, MSS, SOS allocated on a primary basis
- FS, MS, SRS on adjacent channels on a primary basis
- 52 contributions

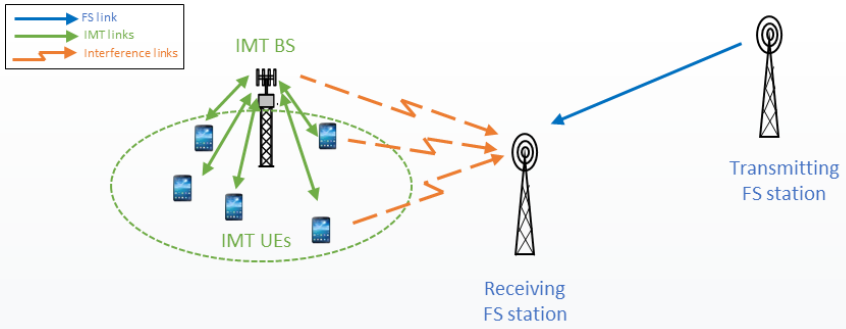
DG 14/15 GHz

- FS, MS, SRS allocated on a primary basis
- FS, MS, FSS, EESS (passive), RAS, SRS (passive) on adjacent bands on a primary basis
- 6 contributions

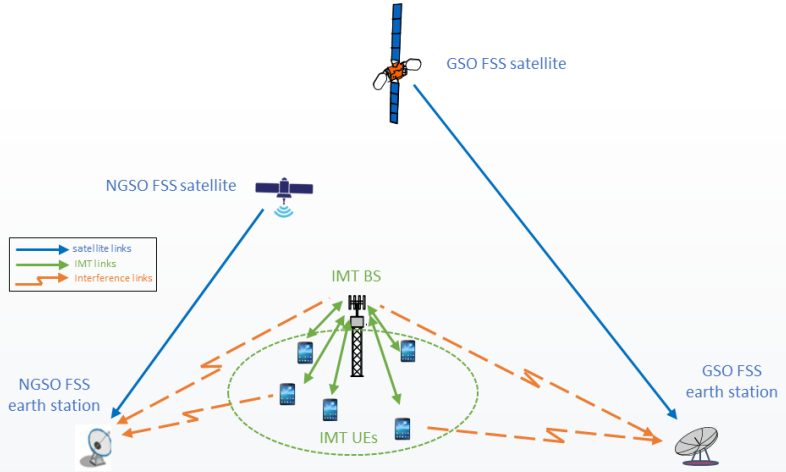
Documents related to studies to assess potential interference from incumbent systems into IMT (“reverse studies”) were also introduced.

Some potential interference scenarios

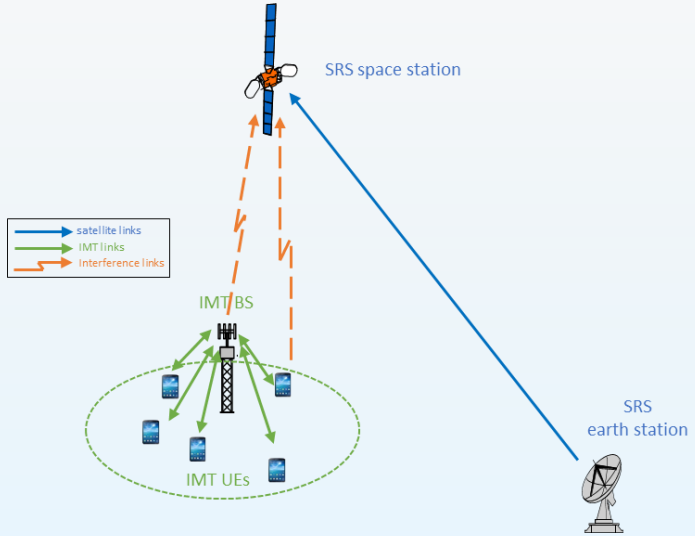
IMT transmitters → FS receivers



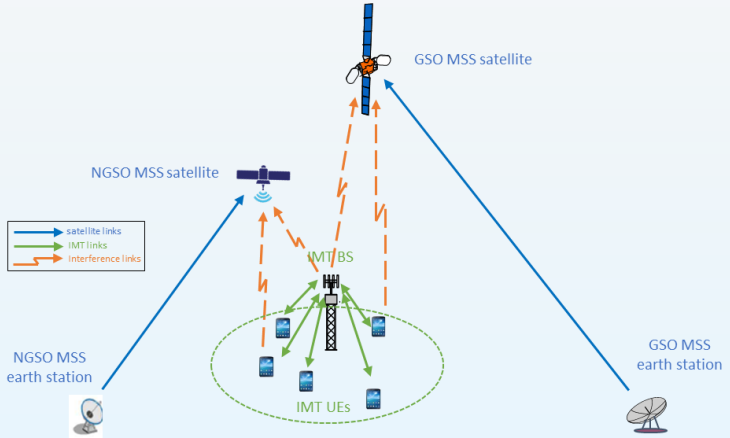
IMT transmitters → FSS earth stations



IMT transmitters → SRS space stations



IMT transmitters → MSS space stations



Other AIs where IMT is the victim: IMT Characteristics, chapter 4

The working document is largely stabilized and the content agreed, except for text intended to address cases beyond the baseline characteristics for parameters such as UE antenna gain and body loss (including protection of wall-mounted CPEs)

One very thorny open item is section 7 on the protection criterion for IMT, which remains unresolved

- IMT protection criteria is has been -6dB during previous study periods
- One approach is to use I/N CDF as measure to evaluate exceedance probability, whilst keeping IMT protection criterion fixed without reference to time percentage
- Another approach is to have non-exceedance probability as a range of values. The non-exceedance probability of X% in the CDF of I/N indicates that X% of the simulation snapshots satisfies this I/N value
- Yet another approach is C/(N+I) and a throughput criterion

[Editor's Note for Section 7:
The whole Section 7 is inside […] and not agreed as a whole yet. However, in SWG, texts highlighted in GREEN were agreed, texts in YELLOW are not agreed and need more consultations and text in CYAN have not been reviewed.]

Table 25 contains the *I/N* value for assessing the protection of IMT (irrespective of the number of interferers) in sharing and compatibility studies [+footnote]

TABLE 25

***I/N* value for protection of IMT**

I/N	−6 dB

For the Monte-Carlo simulation analysis:

Results of Monte-Carlo studies can be assessed by analysing the CDF of I/N, which could vary depending on the scenario being studied.

For the assessment of the protection of IMT, non-exceedance probability values for I/N in Table 25 can be set at 98% for IMT user equipment and 99.5% for IMT base stations. In some particularly specific cases, higher non-exceedance probability values could be used (e.g., up to 99.99 or 100%).

To enable comparison across studies, the non-exceedance probability used in the assessment should be presented alongside the results of studies. [It is to be noted that complementary approach is to examine C/(I+N) statistics and/or throughput loss metrics.]

For the MCL analysis:

The evaluation of the IMT protection can be performed using the value in Table 25.
To enable comparison across studies, the time percentage value set in the propagation model should be presented alongside the results of studies.

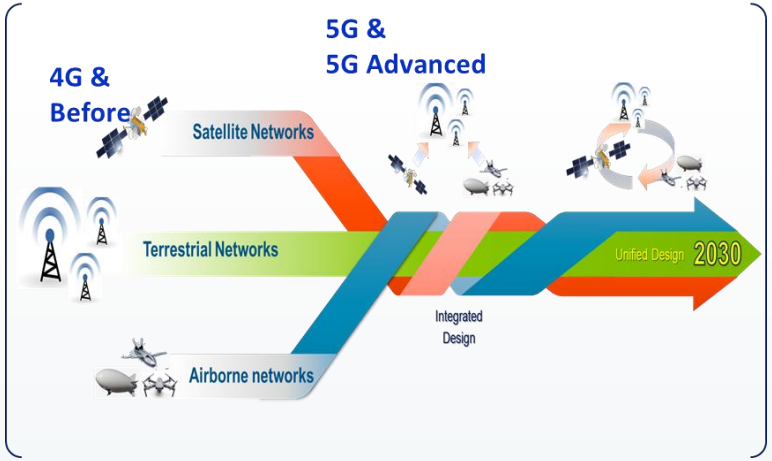
Other AIs where IMT is the victim: IMT Characteristics, chapter 4

Some MNOs and four southern African countries raised the topic of CPEs used in IMT-based Fixed Wireless Access.
Question on whether the same body loss and antenna gains should be considered for CPEs as IMT UEs, since it can be argued that deployment is different for IMT CPE devices.
Typically CPE devices are wall mounted/vehicle mounted and therefore body loss is not applicable

Current un-agreed text in the working document:

[Beyond the baseline characteristics provided in the referenced material, [sensitivity] studies may be performed with clear justification for different values used (e.g. Tx Power, antenna pattern, antenna gain (0 - 5 dBi), body loss (0 dB) and noise figure).]

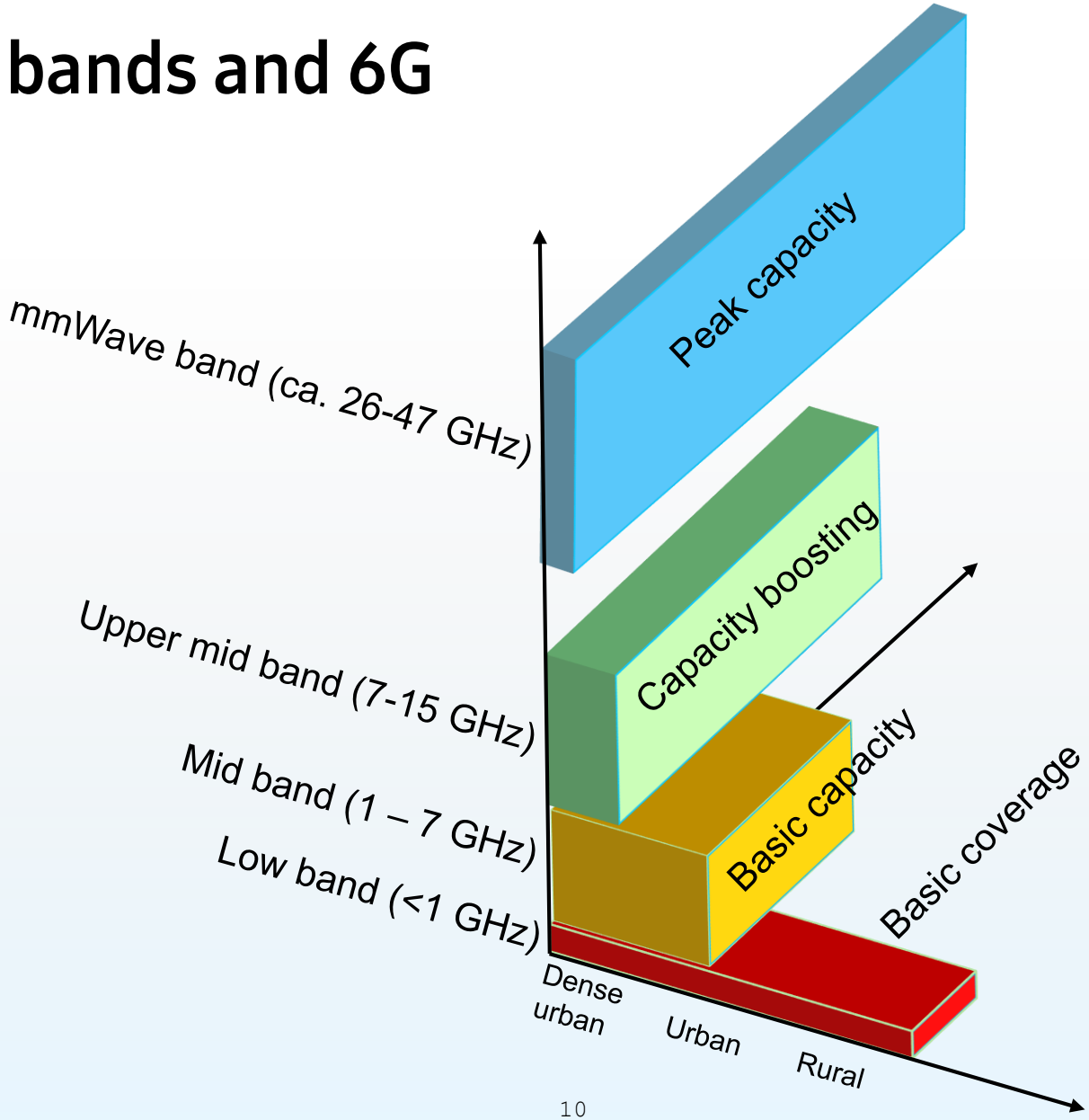
Integration of TN and NTN in 6G?



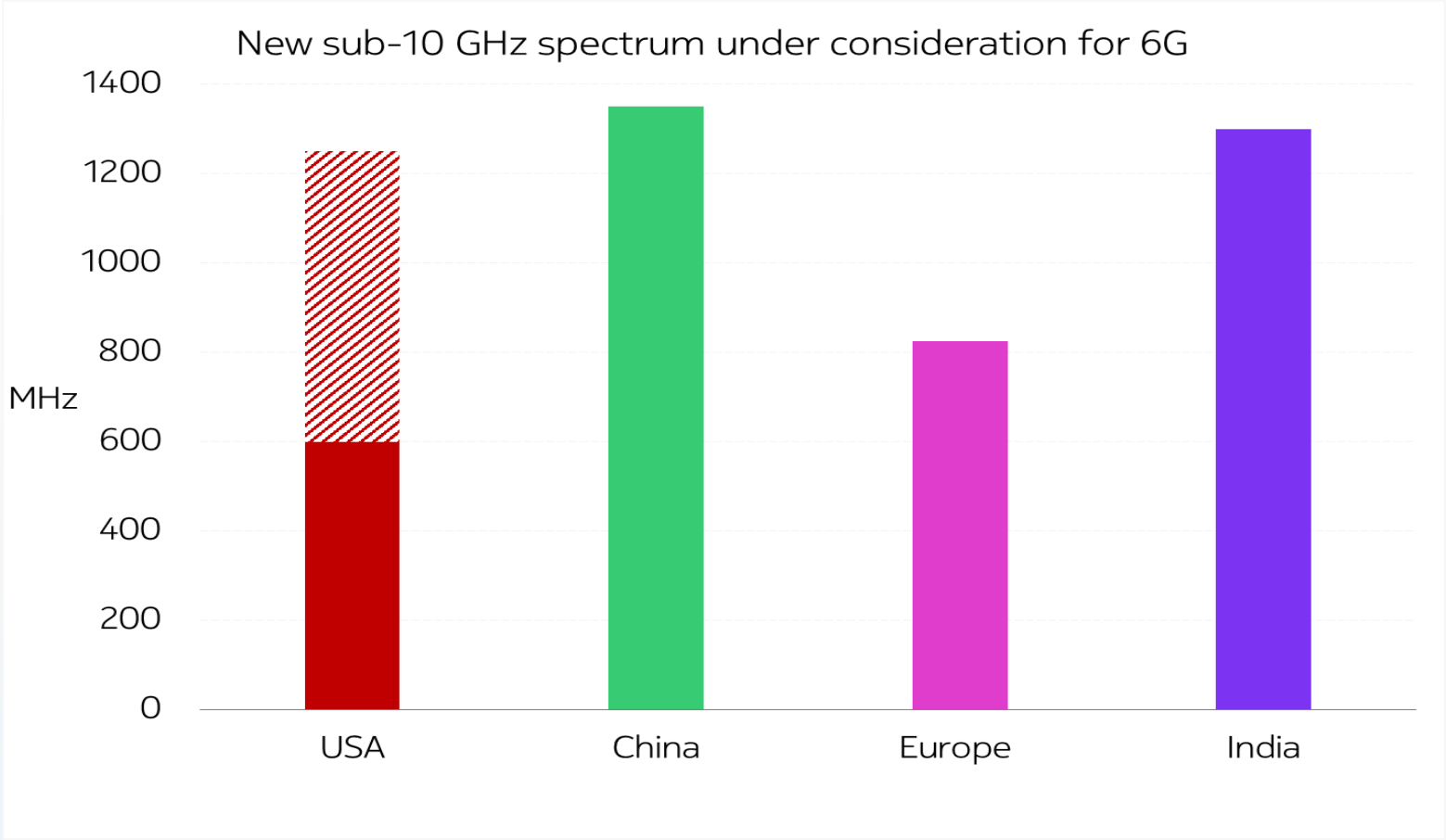
But…
IMT-2030 terrestrial and satellite components are under the purview of totally separate Study Groups. Terrestrial component is addressed by WP 5D whereas non-terrestrial component is addressed by WP 4B.

The TPRs at WP 5D do not address TN-NTN integration. The TPR for interoperability relates to completely different aspects.

IMT Spectrum bands and 6G



Europe is falling behind in 6G assignments?



Source: Global Mobile Suppliers Association

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Thank you