ITU-R Update:

# IMT-2030 (6G)

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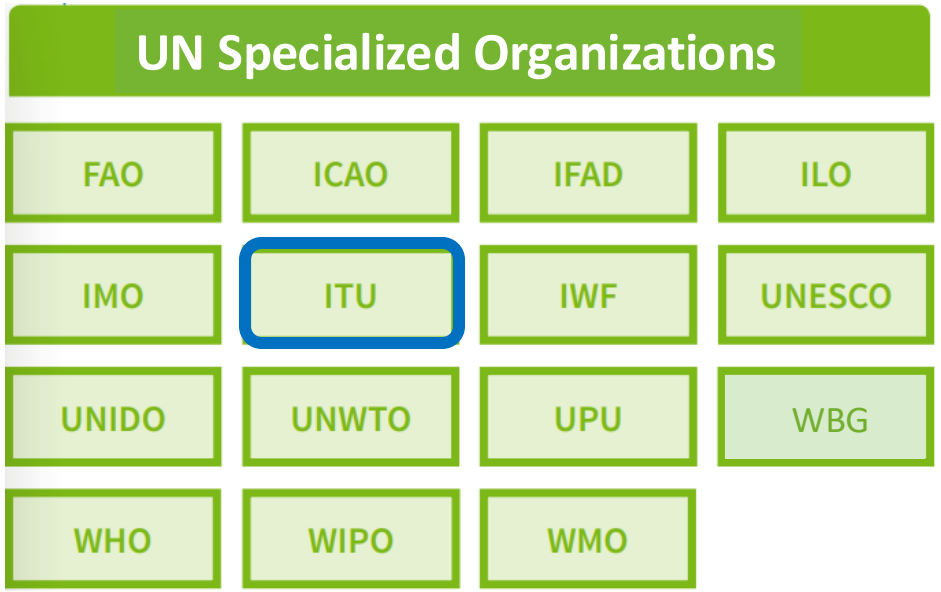
Counsellor, ITU-R SG 5

# Table of Contents

# International Telecommunications Union (ITU)

**The International Telecommunication Union (ITU) is the United Nations specialized agency for information and communication technologies – ICTs.**

- **One of 15** special organizations which are legally and organizationally independent, but part of "UN-family"
- **Founded in 1865** to facilitate international connectivity in communications networks,




**We are responsible to**

- **allocate global radio spectrum** for wireless services (terrestrial, maritime and aeronautical),
- **coordinate the world's satellites** through the management of spectrum and orbits,
- **develop the technical standards** that ensure networks and technologies seamlessly interconnect, and strive to improve access to ICTs to **underserved communities worldwide**,
- helps support communications in the wake of **disasters and emergencies.**

# Overall structure of the ITU

ITU

ITU-R | ITU-T | ITU-D

WRC ⇔ RA

SG13 Future networks

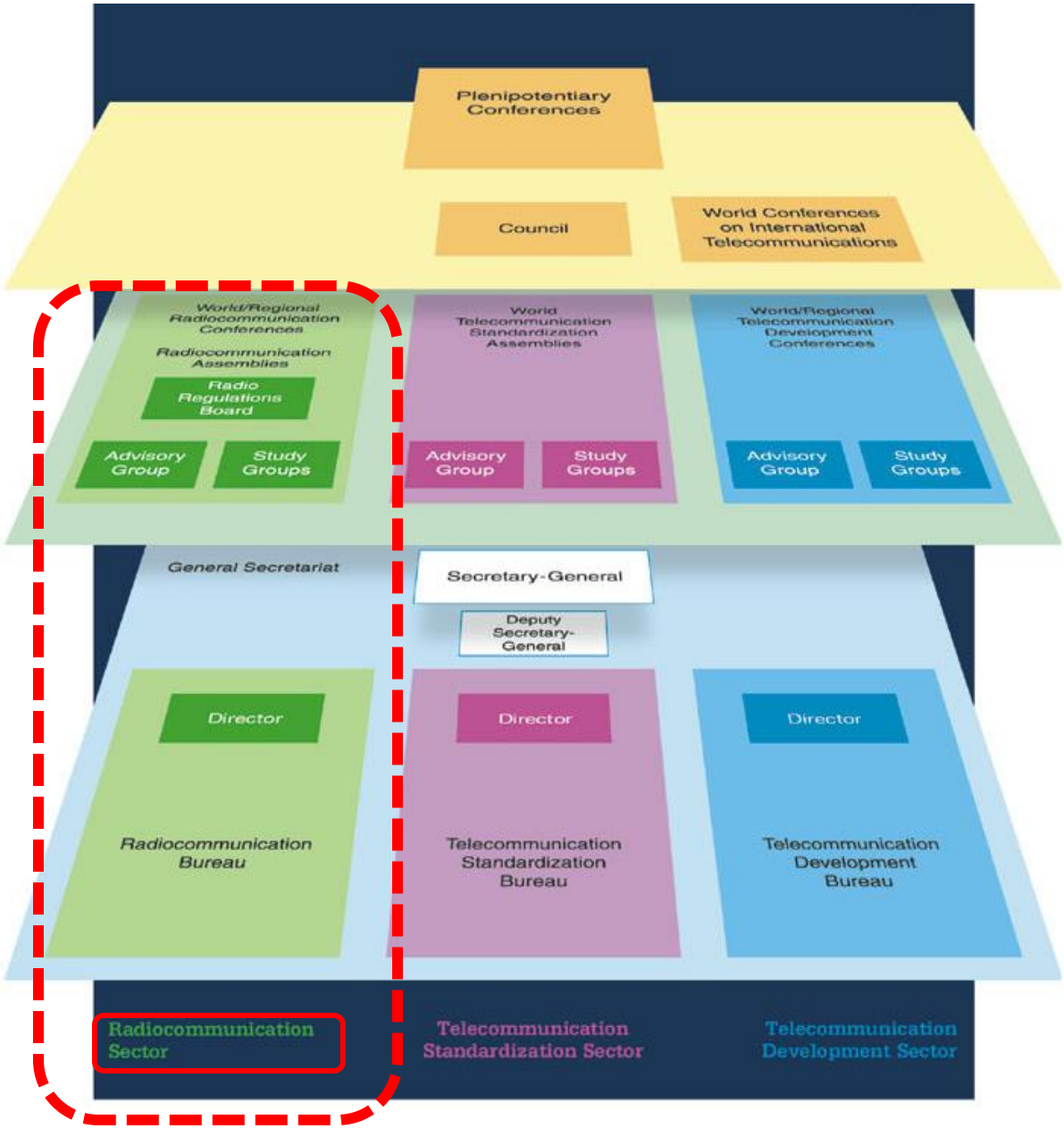
World Radiocommunication Conference

ITUWRC DUBAI2023

Radio Regulations (RR)
(9 kHz – 300 GHz)
www.itu.int/pub/R-REG-RR-2024

Radiocommunication Assembly (*Study Period 2023-2027*)

- SG1
- SG3
- SG4 Satellite Services (Mr. STRELETS, RUS)
  - ...
  - WP4C MSS & RDSS (Mr. KAWAI, JPN)
- SG5 Terrestrial Services (Dr. WEE, KOR)
  - ...
  - WP5D IMT (Dr. ATARASHI, JPN)
- SG 6
- SG 7



# IMT and ITU-R M.2160

# IMT-Family and naming conventions

Resolution ITU-R. 56 "Naming for IMT"

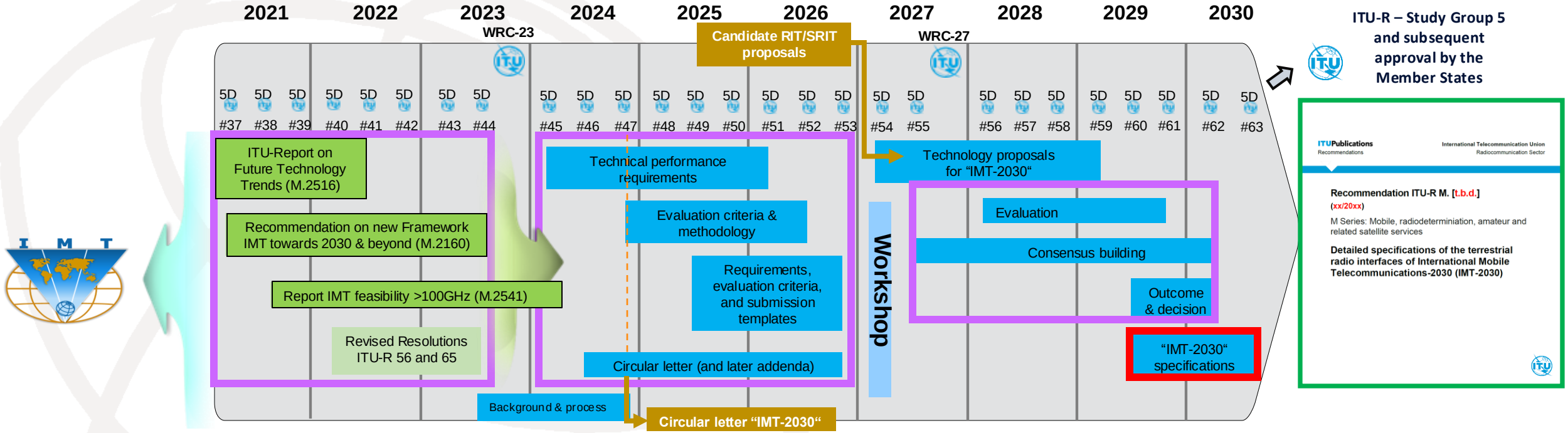
Documents for previous IMT-generations, see "IMT-Family History" (annex)

## International Mobile Telecommunication (IMT)

| | IMT-2000 | IMT-Advanced | IMT-2020 | IMT-2030 |
|---|---|---|---|---|
| **Name** | | | | |
| **Rec.** | ITU-R M.1457-15 | ITU-R M.2012-6 | ITU-R M.2150-2 | Res. ITU-R 56-3 (Rev. WRC-23) |
| **Radio Interface Technology (RIT)** | • IMT-2000 CDMA DS<br>• IMT-2000 CDMA MC<br>• IMT-2000 CDMA TDD<br>• IMT-2000 TDMA SC<br>• IMT-2(RIT)000 FDMA/TDMA<br>• IMT 2000 OFDMA TDD WirelessMAN | • LTE-Advanced<br>• WirelessMAN-Advanced | • 3GPP 5G-SRIT<br>• 3GPP 5G-RIT<br>• 5Gi [3]<br>• DECT 5G-SRIT | • recognising j<br>• resolves 4 … *that the term* ***"IMT-2030"*** *be applied to those systems* |
| **Year** 1st / latest publication *(as of 1. October 2024)* | 05/2000 – 10/2020 | 02/2014 – 12/2023 | 02/2021 – 12/2023 | 2030 ? |
| **Market name** | "3G" | "4G" | "5G" | "6G" |

3 *In Document 5D/926 , TSDSI indicates that the 5Gi technology is merged into the 3GPP 5G specifications from Release 17 forward, and that TSDSI does not intend to submit proposals to WP5D for any further updates of 5Gi*

# ITU-R Timeline and Process




*Note 1: WP 5D #59 will additionally organize a workshop involving the Proponents and registered Independent Evaluation Groups (IEGs) to support the evaluation process*

*Note 2: While not expected to change, details may be adjusted if warranted. Content of deliverables to be defined by responsible WP 5D groups*

**Framework** ⇨ **Requirements and Evaluation criteria** ⇨ **Evaluation and Consensus building** ⇨ **Specification** ⇨ **Approval**

# Overall framework for IMT-2030

## Report ITU-R M.2516 - Future Technology Trends *

- This Report provides a broad view of **future technical aspects** of terrestrial IMT systems considering the timeframe up to 2030 and beyond, characterized with respect to **key emerging services, applications trends and relevant driving factors.**

| Drivers for future technologies | Emerging technology trends, services, applications and enablers | Technologies to enhance the radio interface | Technology enablers to enhance the radio network |
|---|---|---|---|

- The technology trends of terrestrial IMT systems described in Report ITU-R M.2516 **are applicable to radio interfaces, mobile terminals, and radio access networks** by considering the timeframe up to 2030 and beyond

## Report ITU-R M.2541 - Feasibility of IMT above 100 GHz *

- This report investigates the technical feasibility of IMT >92 GHz and indicates that **utilizing the bands above 92 GHz is feasible for studied IMT deployment scenarios** and could be considered for IMT-2030

## Recommendation ITU-R M.2160 – New Framework for IMT-2030

* Note: Detailed inventory, see Annex

# ITU-R M.2160 “Framework for IMT-2030”

## Main body (Preamble)

Scope

Keywords

Abbreviations/Glossary

Related documents

The ITU Radiocommunication Assembly,

*considering*

*considering further*

*recognizing*

*recommends*

that the Annex should be considered as **the framework and the overall objectives to guide the future development of IMT-2030**.

## Annex

**Table of Contents**



Why is IMT-2030 (6G) needed?
IMT-2030 expected benefits

Trend and prospect of 6G features/technology/spectrum in around 2030

Guidance of 6G features

Guidance of 6G capabilities to fulfil usage scenarios

Relationship with existing IMTs and other access systems
Roadmap for technology/standardization/ deployment/spectrum

# ITU-R M.2160 (§2) - Trends

## § 2.1 Motivation and societal considerations

IMT-2030 is expected to be an important enabler for achieving the following characteristics, among others:

- Inclusivity
- Ubiquitous connectivity
- Sustainability
- Innovation
- Enhanced and resilience
- Standardization and interoperability
- Interworking

## § 2.3 Technology trends

§ 2.3 Technology trends

"Summary of Future Technology Trends (FTT)"

- Emerging technology trends and enablers
- Technologies to enhance the radio interface
- Technology enablers to enhance the radio network

## § 2.2 User and application trends

**9 trends**

- Ubiquitous intelligence
- Ubiquitous computing
- Immersive multimedia and multi-sensory interactions
- Digital twin and virtual world
- Smart industrial applications
- Digital health and well-being
- Ubiquitous connectivity
- Integration of sensing and communication
- Sustainability

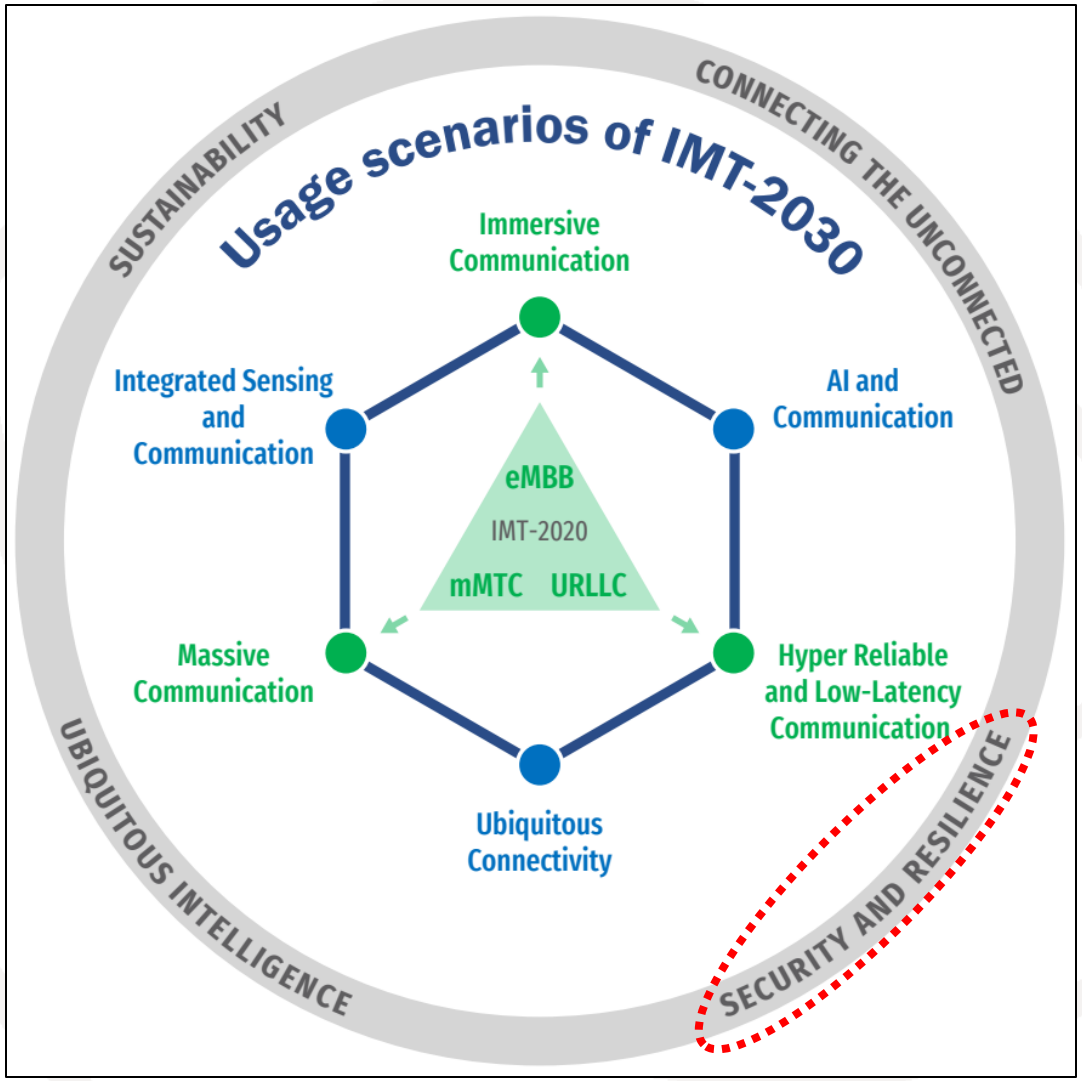
## § 2.4 Envisaged frequency bands and § 2.5 Spectrum harmonization

- § 2.4. Multiple frequency ranges will be needed to meet the capacity and coverage requirements of IMT systems and to serve the emerging services and applications. New generations of IMT may expect new spectrum for increasing data rates, capacity, new applications and to provide for new capabilities. IMT-2030 is envisaged to utilize a wide range of frequency bands ranging from sub-1 GHz up to frequency bands above 100 GHz. Low bands will continue to be crucial to enable nationwide coverage, in particular addressing the digital divide and expanding coverage to unconnected areas.
- § 2.5. The benefits of spectrum harmonization include facilitating economies of scale, enabling global roaming, reducing complexity of equipment design, improving spectrum efficiency including potentially reducing cross border interference. Harmonization of spectrum for IMT would lead to increased commonality of equipment and is desirable for achieving economies of scale and affordability of equipment, thus promoting digital inclusion.

## § 2.6 IMT in bands above 100 GHz

The development of IMT for 2030 and beyond is expected to enable new use cases and applications with high data rate and low latency, which will benefit from large contiguous bandwidths of tens of GHz. This suggests the need to consider spectrum in higher frequency ranges above 92 GHz as a complement to the use of lower frequency bands.

# ITU-R M.2160 (§3) - Usage scenarios for IMT-2030




So called "Wheel diagram", Recommendation ITU-R M.2160

## 6 Usage scenarios

Extension from IMT-2020 (5G)

- eMBB ➡ Immersive Communication
- mMTC ➡ Massive Communication
- URLLC ➡ HRLLC (Hyper Reliable & Low-Latency Communication)

New

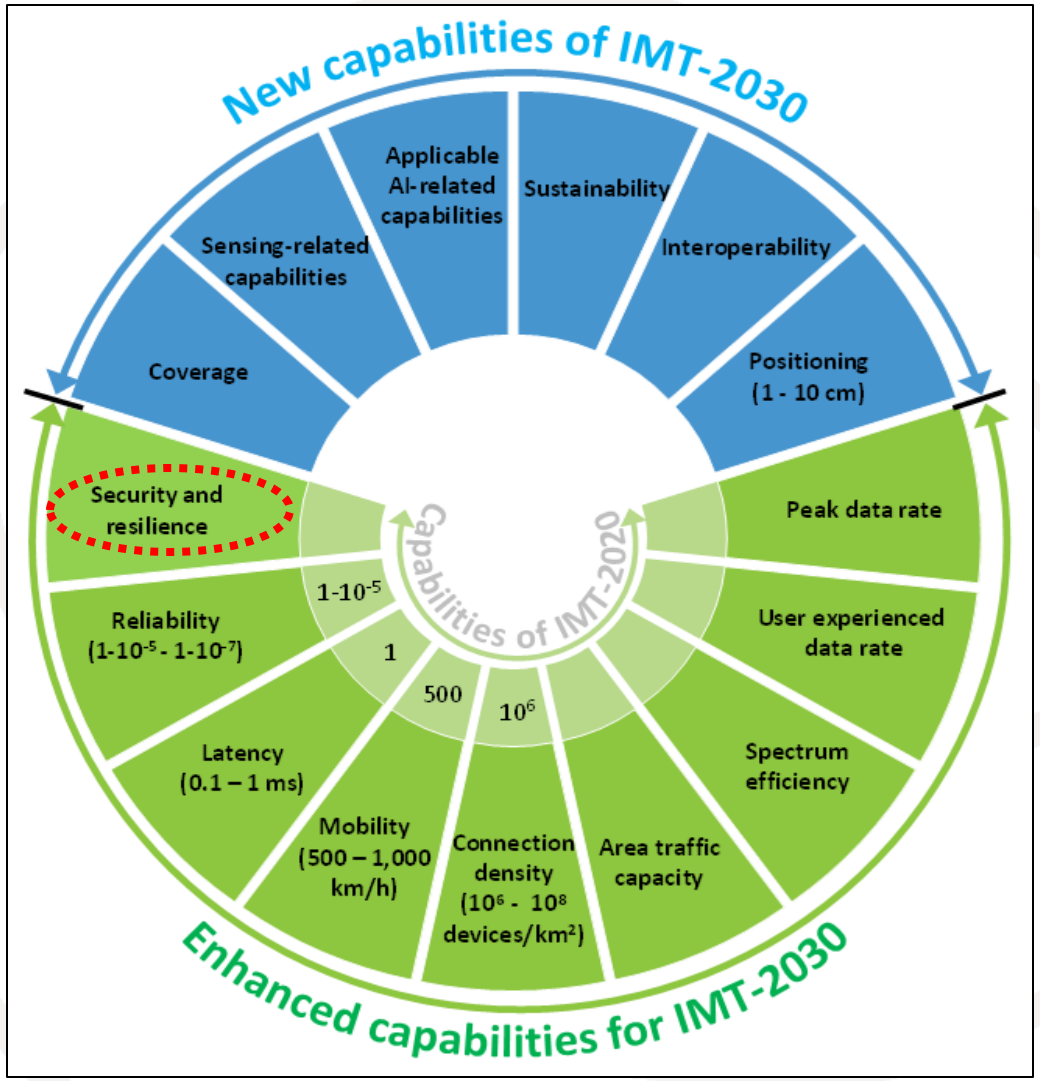
- Ubiquitous Connectivity
- AI and Communication
- Integrated Sensing and Communication

## 4 Overarching aspects

*act as design principles commonly applicable to all usage scenarios*

- Sustainability
- Connecting the unconnected,
- Ubiquitous intelligence,
- Security / resilience

# ITU-R M.2160 (§4) - Capabilities of IMT-2030




So called “Palette diagram”, Recommendation ITU-R M.2160

IMT-2030 Framework Recommendation identifies **15 capabilities** for 6G technology

- Nine of those capabilities are derived from existing 5G systems

**The range of values given for capabilities are estimated targets for research and investigation of IMT-2030**

- All values in the range have equal priority in research and investigation
- For each usage scenario, a single or multiple values within the range would be developed in future in other ITU-R Recommendations/Reports

IMT-2030 is also expected to help **address the need for increased environmental, social and economic sustainability,** and also support the goals of the Paris Agreement of the United Nations Framework Convention on Climate Change

# ITU-R M.2160 (§5) - Relationship and Timelines

## § 5.1 Relationships

- § 5.1.1 Relationship between IMT-2030 and existing IMT

  Enhancements to existing IMT

  Interworking with existing IMT

- § 5.1.2 Relationship between IMT-2030 and other access systems

  Interworking between different access networks

  such as non-terrestrial network of IMT (including satellite, HIBS and UASs)

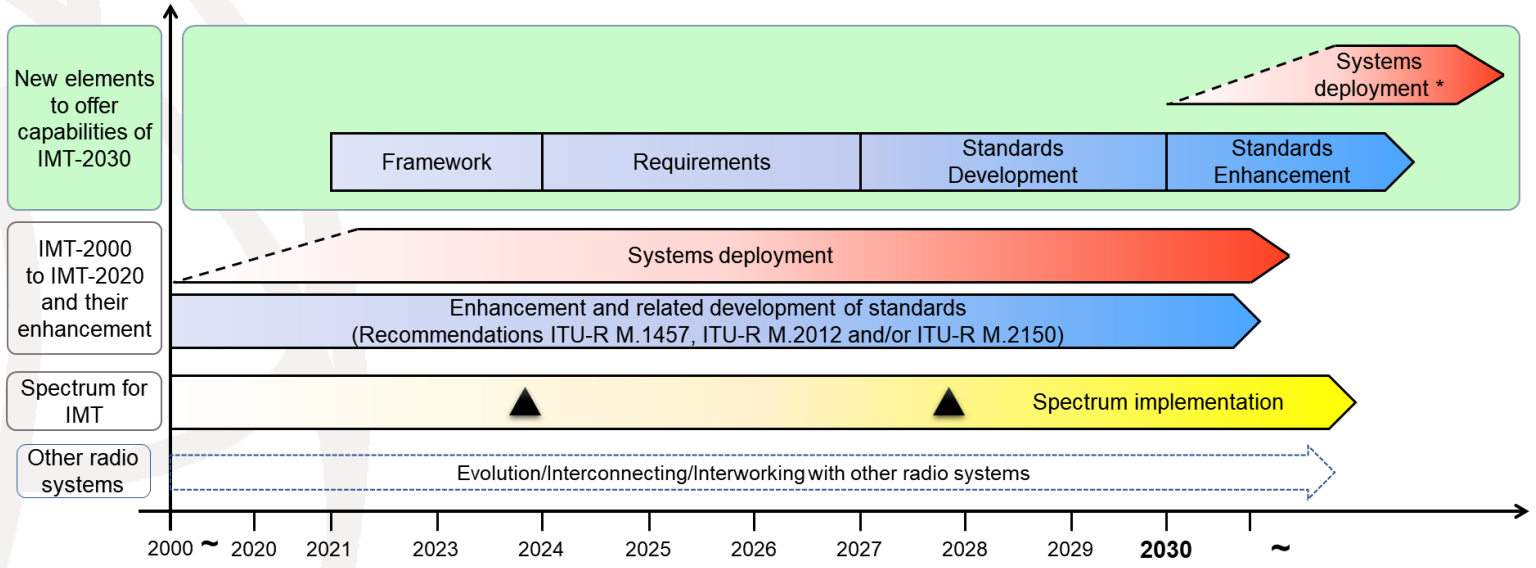
  as well as with other non-IMT terrestrial networks (including RLAN and broadcast)

## § 5.3 Focus areas for further study

- Radio interface(s) standards development
- Access network related issues
- Traffic characteristics
- Spectrum related issues

## § 5.2 Timelines

- Roadmap for technology/standard development, deployment and spectrum
- In addition, enhancement of existing IMTs and relationship with other radio systems




The sloped dotted lines in systems deployment indicate that the exact starting point cannot yet be fixed.

▲ : Possible spectrum identification at WRC-23, WRC-27 and future WRCs

* : Systems to satisfy the technical performance requirements of IMT-2030 could be developed before year 2030 in some countries.
: Possible deployment around the year 2030 in some countries (including trial systems)

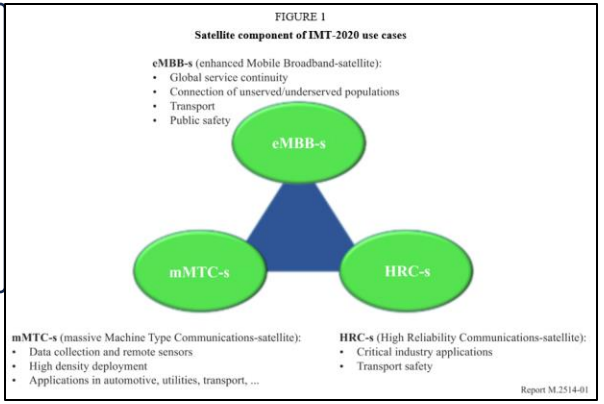
# ITU-R Work on IMT-Satellite/NTN

# NTN in the ITU-R "Framework" for IMT-2030 (Rec. ITU-R M.2160)

*"The Non-Terrestrial Network (NTN) will complement existing terrestrial mobile networks and enhance the next generation of mobile networks and services, striving to improve connectivity for users in unserved and underserved areas, benefiting both consumers and industries."*

From the very beginning of the IMT-development, a satellite component was part of the ITU-R work and a series of ITU-R Recommendations for the satellite component for the according IMT generation has been developed:

| | |
|---|---|
| **IMT-2000** | Recommendations ITU-R M.818-2, M.1167, M.1182-1, M.1850-2 and M.2014-1 |
| **IMT-Advanced** | Recommendation ITU-R M.2047 |
| **IMT-2020** | • Report ITU-R M.2514 – Vision, requirements and evaluation guidelines for the satellite radio interface(s) of IMT-2020<br>• Ongoing work in **ITU-R WP 4B** regarding the according **IMT-process**, incl. the **evaluation of potential RIT-candidates** |
| **IMT-2030** | t.b.d. |

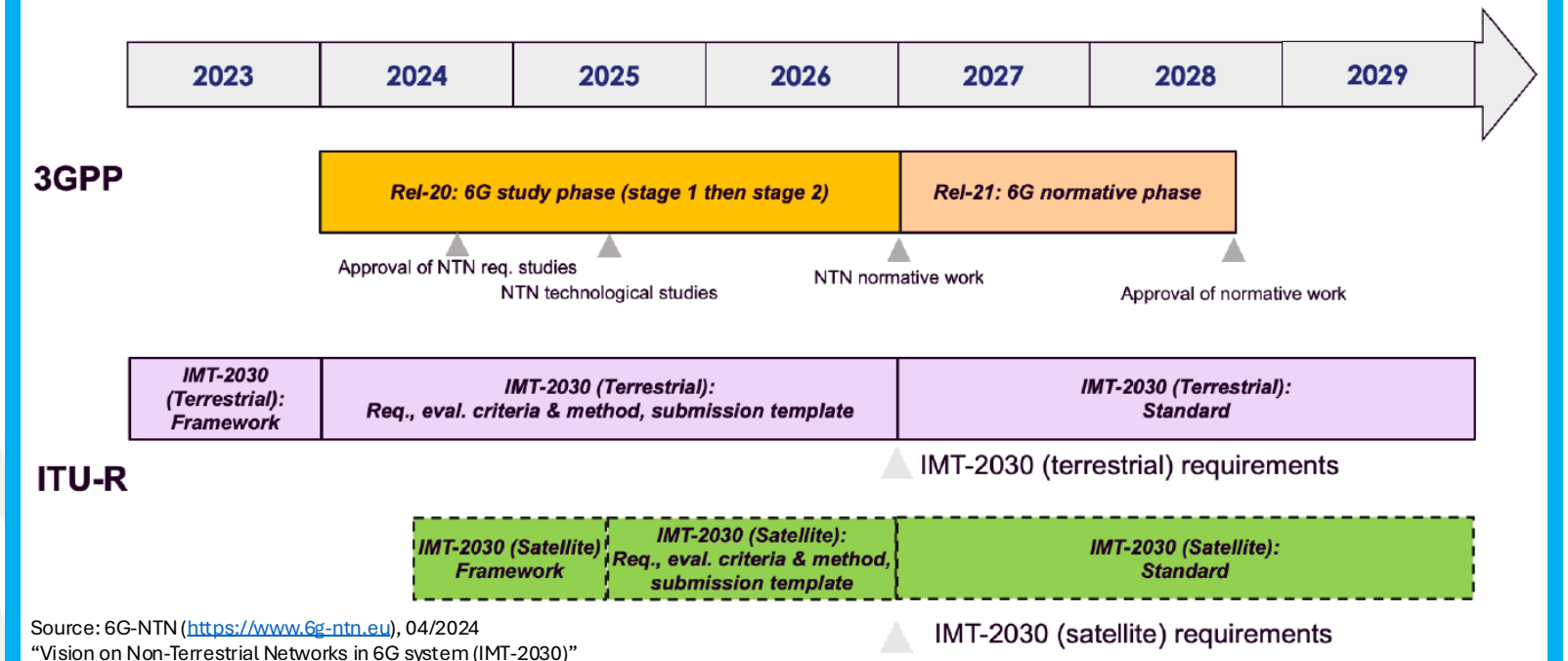


# Timeline and ITU-R Process (satellite component)

ITU-R (WP 4B) maintains several documents addressing the underlying IMT-process for developing the satellite component of IMT-2020. One is the "*Submission and evaluation process and consensus building for satellite radio interface technology proposals of IMT-2020*" (ITU-R IMT-2020.SAT/02).

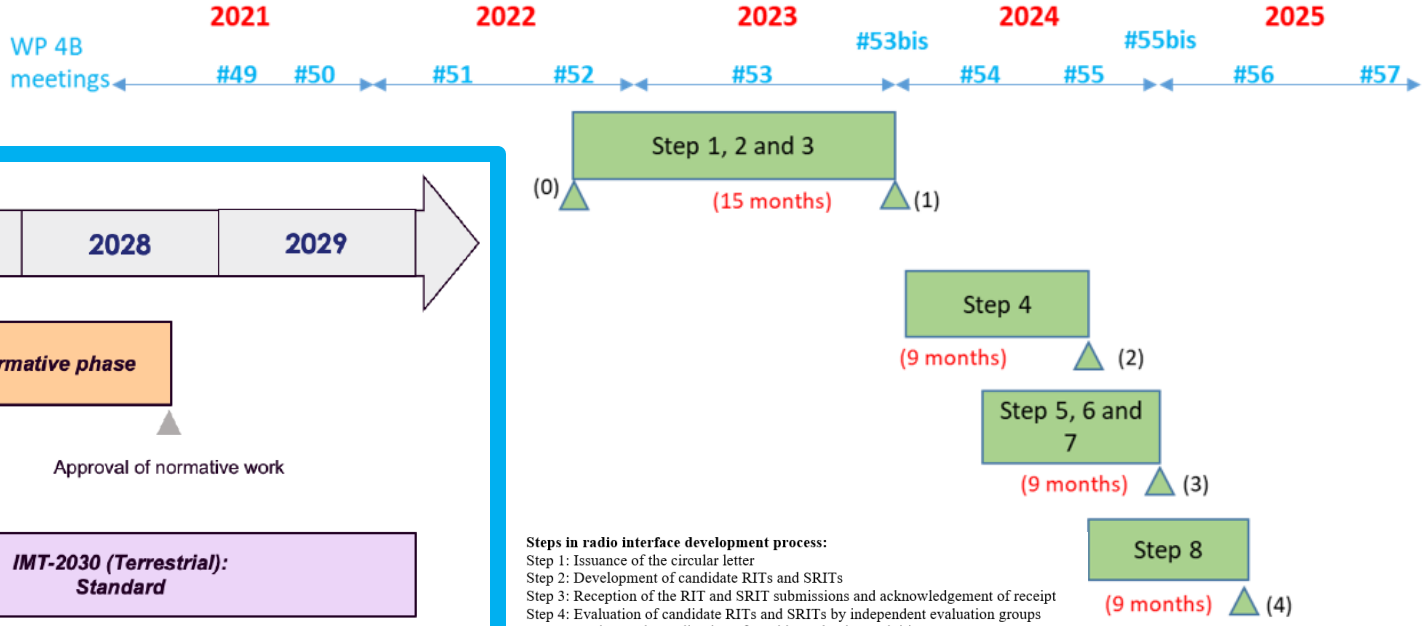
**3GPP standardisation schedule with respect to IMT-2030 definition in ITU-R**

Source: 6G-NTN




Source: 6G-NTN (https://www.6g-ntn.eu), 04/2024
"Vision on Non-Terrestrial Networks in 6G system (IMT-2030)"

**Schedule for the development of IMT-2030 satellite radio interface Recommendations**




**Steps in radio interface development process:**
Step 1: Issuance of the circular letter
Step 2: Development of candidate RITs and SRITs
Step 3: Reception of the RIT and SRIT submissions and acknowledgement of receipt
Step 4: Evaluation of candidate RITs and SRITs by independent evaluation groups
Step 5: Review and coordination of outside evaluation activities
Step 6: Review to access compliance with minimum requirements
Step 7: Consideration of evaluation results, consensus building and decision
Step 8: Development of radio interface Recommendation(s)

**Critical milestones in radio interface development process:**
(0): Issue an invitation to propose RITs
(1): ITU proposed cut off for submission of candidate RIT proposals
(2): Cut off for evaluation report to ITU
(3): WP 4B decides framework and key characteristics of IMT-2020-Sat RITs and SRITs
(4): WP 4B completes development of radio interface specification Recommendation(s)

# Potential considerations for the NTN component

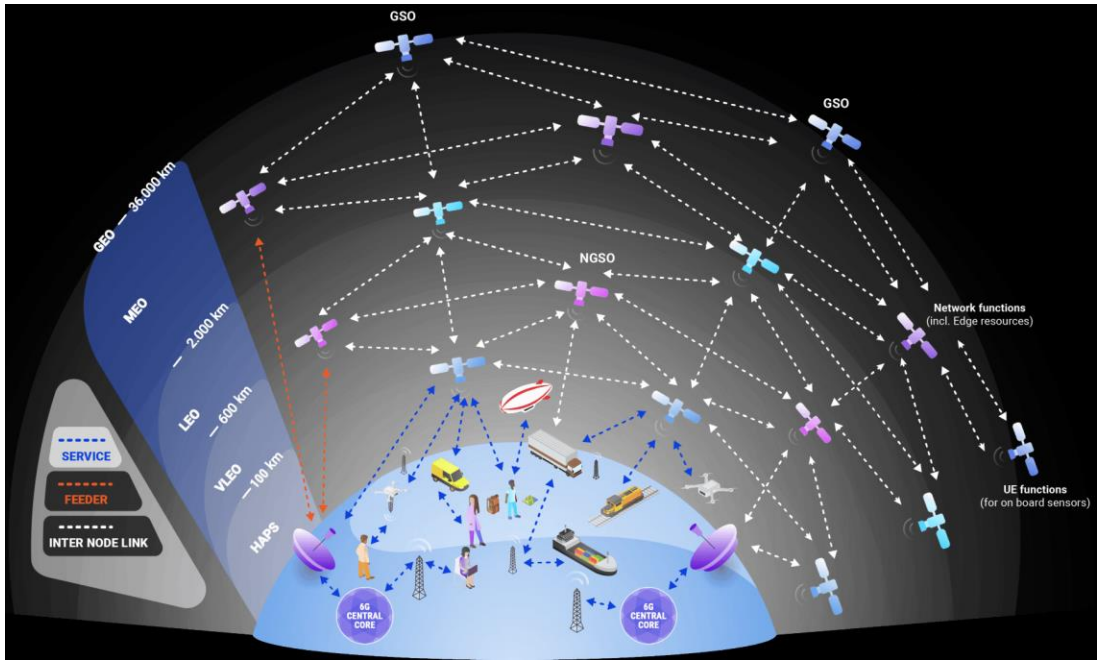
- **3GPP "Phase 3"** (Link)*: **NTN for New Radio (NR) <> NTN for Internet of Things (IoT)**

* https://www.3gpp.org/news-events/3gpp-news/5g-ntn

- **Spectrum:** **MSS spectrum <> IMT-bands**
  - MSS (3GPP bands): n254, n255, n256 and n510, n511, n512
  - IMT: current studies for 694-2700 MHz (WRC-27 AI 1.13)

| Band | UL | DL | 3GPP |
|---|---|---|---|
| n254 | 1,610.0-1,626.5 MHz | 2,483.5-2,500.0 MHz | Rel. 18 |
| n255 | 1,626.5-1,660.5 MHz | 1,525.0-1,559.0 MHz | Rel. 17 |
| n256 | 1,980.0-2,010.0 MHz | 2,170.0-2,200.0 MHz | Rel. 17 |
| n510-n512 | 27.5-30.0 GHz | 17.7-20.2 GHz | Rel. 18 |
| «Ku-Band» | 12.75-14.5 GHz (tbc) | 10.7.12.75 GHz (tbc) | Rel. 19 |

- **Orbit of the satellite service:** **GSO <> non-GSO**
- **Radio technology:** **IMT-Technology [Y/N]**
- **Relevant assumptions**
  - **1 single user-device <> massive user-devices (UE)**
  - **Fixed UE <> Mobile UE (moving speed)**
  - **Enable indoor-coverage**
  - **Many more …**




Source: 6G-NTN (https://www.6g-ntn.eu)

# 3x Vision / Framework in ITU-R

**Satellite** (ITU-R SG 4)

- Report ITU-R M.2514 - "Vision, requirements and evaluation for satellite RIT(s) of IMT-2020"
- PD New Recommendation ITU-R M.[IMT 2020-SAT.SPECS]

**Broadcasting** (ITU-R SG 6)

- Report ITU-R BT.2522 - "A framework for the future of broadcasting"
- Report ITU-R BT.2524 - "A framework for future of broadcast production"

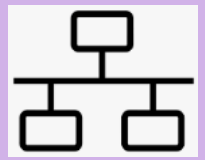
**IMT** (ITU-R SG 5)

- Recommendation ITU-R M.2160 - "Framework and overall objectives of the future development of IMT for 2030 and beyond"

## ITU-T SG 13

Future networks and emerging network technologies

- ITU-T Y.3100 (09/17) - Terms and definitions for IMT-2020 network
- ITU-T Y Suppl. 59: Y.3100-series (11/22) - IMT-2020 standardisation roadmap
- ITU-T X.1814 (09/22) Security guidelines for IMT-2020



**Study Period 2022-2024**

- ITU-T Question 20/13 – "Networks beyond IMT-2020 machine learning: Requirements & architecture"
- New ITU-T Question 23/13 - "IMT-2030 networks: Fixed, mobile and satellite convergence"
- Draft New Recommendation ITU-T Y.3216 (EX Y.FMSC-DCN) "Fixed, Mobile and Satellite convergence – distributed core network for IMT-2020 networks and beyond" (25.07.24)

# Summary

- The new "Framework Recommendation" ITU-R M.2160 for IMT-2030 describes the overall objectives including use cases. This marks the achievement of the initial phase, setting the basis for the development of IMT-2030. The next phase (2024-2027) will be the definition of relevant requirements and evaluation criteria for potential radio interface technologies (RIT) for the terrestrial component of IMT-2030.
- The satellite component of IMT ("NTN") has always been a part of the IMT-development, but now - with the evolution of underlying satellite technologies, the development of the satellite component for IMT-2020 (and IMT-2030) will enable the delivery of IMT-service to those places where it is technically very difficult or cost too much to deliver with terrestrial network.
- Essential part of the IMT-process is liaison with External Organizations to receive contributions covering and elaborating future trends and new services …

  … but also, internal liaison within ITU (other ITU-R Study Groups and ITU-sectors)


ITU – Radiocommunication Bureau

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# Helpful links

**More about ITU** https://www.itu.int/en/about/Pages/default.aspx

**ITU-Journal on Future and Evolving Technologies** https://www.itu.int/en/journal/j-fet/Pages/default.aspx

**More about IMT-2030**
https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/imt-2030/Pages/default.aspx

**Details about IMT-2020 submission & evaluation (ITU-R M.2150 Rev.3)**
https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/imt-2020/Pages/submission-eval-3rd-release.aspx

**Details about Satellite IMT-2020 submission and evaluation process**
https://www.itu.int/en/ITU-R/study-groups/rsg4/Pages/imt-2020-sat-submission-eval.aspx

SG 4 https://www.itu.int/en/ITU-R/study-groups/rsg4/Pages/default.aspx
WP 4B https://www.itu.int/en/ITU-R/study-groups/rsg4/rwp4b/Pages/default.aspx

SG 5 https://www.itu.int/en/ITU-R/study-groups/rsg5/Pages/default.aspx
WP 5D https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/Pages/default.aspx


**Rec. ITU-R M.2150 (IMT-2020)**
https://www.itu.int/rec/R-REC-M.2150/en

**Rec. ITU-R M.2160 (IMT-2030)**
https://www.itu.int/rec/R-REC-M.2160/en

**Rep. ITU-R M.2514 (Vision IMT-2020 SAT)**
https://www.itu.int/pub/R-REP-M.2514

**Rep. ITU-R M.2516 (FTT)**
https://www.itu.int/pub/R-REP-M.2516

# ITU-R M.2516 - "Future Technology Trends" (FTT) *

## Contents "*Future Technology Trends of Terrestrial IMT Systems towards 2030 and beyond*"

§ 4 - Overview of **emerging services and applications**
- § 4.1 - New services and application trends
- § 4.2 - Drivers for future technology trends towards 2030 and beyond

§ 5 - Emerging **technology trends and enablers**
- § 5.1 - Technologies for AI-native communications
- § 5.2 - Technologies for integrated sensing and communication
- § 5.3 - Technologies to support convergence of communication & computing architecture
- § 5.4 - Technologies for device-to-device communications
- § 5.5 - Technologies to efficiently utilize spectrum
- § 5.6 - Technologies to enhance energy efficiency and low power consumption
- § 5.7 - Technologies to natively support real-time services/communications
- § 5.8 - Technologies to enhance trustworthiness

§ 6 - Technologies to **enhance the radio interface**
- § 6.1 - Adv. modulation, coding & multiple access schemes
- § 6.2 - Advanced antenna technologies incl. E-MIMO
- § 6.3 - In-band full duplex communications
- § 6.4 - Multiple physical dimension transmission incl. Reconfigurable Intelligent Surface (RIS)
- § 6.5 - Terahertz (THz) communications
- § 6.6 - Technologies to support ultra-high accuracy positioning

§ 7 - Technology enabler to **enhance radio network**
- § 7.1 - RAN slicing
- § 7.2 - Technologies to support resilient and soft network and guaranteed QoS
- § 7.3 - New RAN interface
- § 7.4 - Technologies to support Digital Twin Networking (DTN)
- § 7.5 - Technologies for interconnection with non-terrestrial networks
- § 7.6 - Support for ultra-dense radio network deployments
- § 7.7 - Technologies to enhance RAN infrastructure sharing

* Report published as **ITU-R M.2516**

# ITU-R M.2541 - "Feasibility of IMT above 100 GHz"

- IMT-2030 is expected to enable new use cases and applications with extremely high data rate and low latency, which will benefit from large contiguous bandwidth spectrum with around tens of GHz, which suggests the need to consider spectrum in higher frequency ranges above 92 GHz.
- This report
  - investigates technical feasibility of IMT >92 GHz
  - provides a series of propagation measurements carried out by academia and industry
  - describes enabling antenna and semiconductor technologies, material technologies including reconfigurable intelligent surfaces and MIMO and beamforming technologies as potential solutions
  - envisages some typical use cases
  - includes summary of measurement activities collected

**The report indicates that utilizing the bands above 92 GHz is feasible for studied IMT deployment scenarios and could be considered for IMT-2030**

**§ 4 - Radio wave propagation in bands above 100 GHz**
- § 4.1 Radio channel characteristics
- § 4.2 Activities on radiocommunication channel characteristics and modelling
- § 4.3 Summary of the results of the studies

**§ 5 - Characteristics of IMT in bands above 100 GHz**
- § 5.1 Outdoor-to-outdoor coverage
- § 5.2 Outdoor-to-indoor coverage
- § 5.3 Indoor-to-indoor coverage
- § 5.4 Mobility
- § 5.5 Impact of bandwidth

**§ 6 - Enabling technologies toward IMT in bands above 100 GHz**
- § 6.1 Antenna technology
- § 6.2 Semiconductor technology
- § 6.3 Material technology
- § 6.4 MIMO and Beamforming
- § 6.5 Radio over Fiber (RoF) technology

**§ 7 - Deployment scenarios and architectures**
- § 7.1 Use cases for IMT in bands above 100 GHz
- § 7.2 Deployment scenarios
- § 7.3 Deployment architecture

**§ 8 - Conclusions**

*plus* **22 Annexes with specific measurements and studies**

# Bands identified for IMT

*Reference Documents: Recommendation ITU-R M.1036 and RR edition 2024*

| Frequency Bands identified for IMT (MHz) | Footnotes identifying the band for IMT in the Radio Regulations | | | Available Bandwidth (MHz) | Timing |
|---|---|---|---|---|---|
| | Region 1 | Region 2 | Region 3 | | |
| **450-470** | 5.286AA | | | 20 | **WRC-07** |
| **470-698** | 5.307A** | 5.295** 5.308A** | 5.296A** | 228 | **WRC-15/23** |
| **694/698-960** | 5.317A | 5.317A | 5.313A** 5.317A | 262 | **WRC-07/2000** |
| **1 427-1 518** | 5.341A, 5.346** | 5.341B | 5.341C, 5.346A | 91 | **WRC-15** |
| **1 710-2 025** | 5.384A, 5.388 | | | 315 | **WARC-92, WRC-2000** |
| **2 110-2 200** | 5.388 | | | 90 | **WARC-92** |
| **2 300-2 400** | 5.384A | | | 100 | **WRC-07** |
| **2 500-2 690** | 5.384A | | | 190 | **WRC-2000** |
| **3 300-3 400** | 5.429B** | 5.429D | 5.429F** | 100 | **WRC-15/23** |
| **3 400-3 600** | 5.430A | 5.431B | 5.432A** 5.432B** 5.433A** | 200 | **WRC-07** |
| **3 600-3 700** | 5.433B, ** 5.434B** | 5.434 | - | 100 | **WRC-15/23** |
| **3 700-3 800 *** | 5.434B** | 5.435B** | - | 100 | **WRC-23** |
| **4 800-4 990** | 5.441B** | 5.441A** 5.441B** | 5.441B** | 190 | **WRC-15** |
| **6 425-7 025 *** | 5.457E | 5.457F** | 5.457D** | 600 | **WRC-23** |
| **7 025-7 125 *** | 5.457E | 5.457F** | 5.457E | 100 | **WRC-23** |
| **10 000-10 500 *** | | 5.480A | | 500 | **WRC-23** |
| **24 250-27 500** | 5.532AB | | | 3250 | **WRC-19** |
| **37 000-43 500** | 5.550B | | | 6500 | **WRC-19** |
| **45 500-47 000** | 5.553A** | | | 1500 | **WRC-19** |
| **47 200-48 200** | 5.553B** | | | 1000 | **WRC-19** |
| **66 000-71 000** | 5.559AA | | | 5000 | **WRC-19** |

* *this band is identified for IMT from 01.01.2025* ** *this band is identified in some countries of the Region*

**List of frequency bands under WRC-27 agenda items**
(considered by ITU-R WP 5D)

| Frequency bands | WRC-27 agenda items |
|---|---|
| **608-614 MHz** | 1.17 |
| **694/698-960 MHz** | 1.13 |
| **1 427-1 518 MHz** | 1.12 (1 427-1 432 MHz), 1.13 |
| **1 710-1 785 MHz** | 1.13 |
| **1 805-2 025 MHz** | 1.12 (1 880-1 920 MHz, 2 010-2 025 MHz), 1.13, 1.14 (2 010-2 025 MHz) |
| **2 110-2 200 MHz** | 1.13, 1.14 (2 120-2 170 MHz) |
| **2 300-2 400 MHz** | 1.13 |
| **2 500-2 690 MHz** | 1.13 1.15 |
| **3 500-3 600 MHz** | 1.15 |
| **3 600-3 800 MHz** | 1.15 |
| **4 400-4 800 MHz** | 1.7 1.19 (4 200-4 400 MHz) |
| **7 125-8 400 MHz** | 1.7 1.15 (7 190-7 235MHz) 1.19 (8 400-8 500 MHz) |
| **14.8 – 15.35 GHz** | 1.7 |
| **25.25-28.35 GHz** | 1.15 |
| **37-43.5 GHz** | 1.6 |
| **47.2-48.2 GHz** | 1.1, 1.6 |

(Table 1 in Annex 4.9 to Document 5D/242)