Received: 12 June 2024

Source: Annex 5.9 Annex 3.5 to Document 5D/77

**Document 5D/XXX-E**
**12 June 2024**
**English only**

**GENERAL ASPECTS**

# IAFI [1]

## FURTHER MODIFICATIONS TO THE WORKING DOCUMENT OF DOCUMENT IMT-2030/1 "IMT-2030 BACKGROUND"

At the 45th meeting of Working Party 5D, to the Working document of document IMT-2030/1 "IMT-2030 Background"was further developed and is expected to be finalized during the 47th Meeting of the WP5D in October 2024

This contribution proposes further changes to the WD with a view to _______ . Additions and changes to the working documents are in track change mode, and highlighted in yellow in the attachment below.

[1] ITU-APT Foundation of India (https://itu-apt.org )

PROPOSED FURTHER MODIFICATIONS TO THE WORKING DOCUMENT OF DOCUMENT IMT-2030/1 "IMT-2030 BACKGROUND" IN ANNEX 5.9 - ANNEX 3.5 TO DOCUMENT 5D/77

# IMT-2030 background

## 1 Evolution of IMT

Following the adoption by International Radio Consultative Committee (CCIR) of the Study Question on the Future Public Land Mobile Telecommunication Systems (FPLMTS) in 1985, it took a total of 15 years for the identification of the radio spectrum in 1992 and development of IMT-2000 specifications (Recommendation ITU-R M.1457) in 2000. After this development, deployment of IMT-2000 systems started.

Thereafter, in 2000 the ITU started developing the Vision Recommendation (Recommendation ITU-R M.1645, June 2003) for IMT-Advanced, and it took a total of nine years for the development of IMT-Advanced specifications (Recommendation ITU-R M.2012, January 2012). After this development, deployment of the IMT-Advanced systems started.

From July 2012, the ITU started developing the Vision Recommendation (Recommendation ITU-R M.2083, September 2015) on Framework and overall objectives of the future development of IMT for 2020 and beyond. Based on this Recommendation, the ITU has released the Recommendation ITU-R M.2150 in the terrestrial radio interface of IMT-2020 in 2021, which took six years after the completion of the Vision Recommendation.

Towards 2030 and beyond, to meet the ever-increasing demand for wireless communication, IMT has been, and continues to be, enhanced.

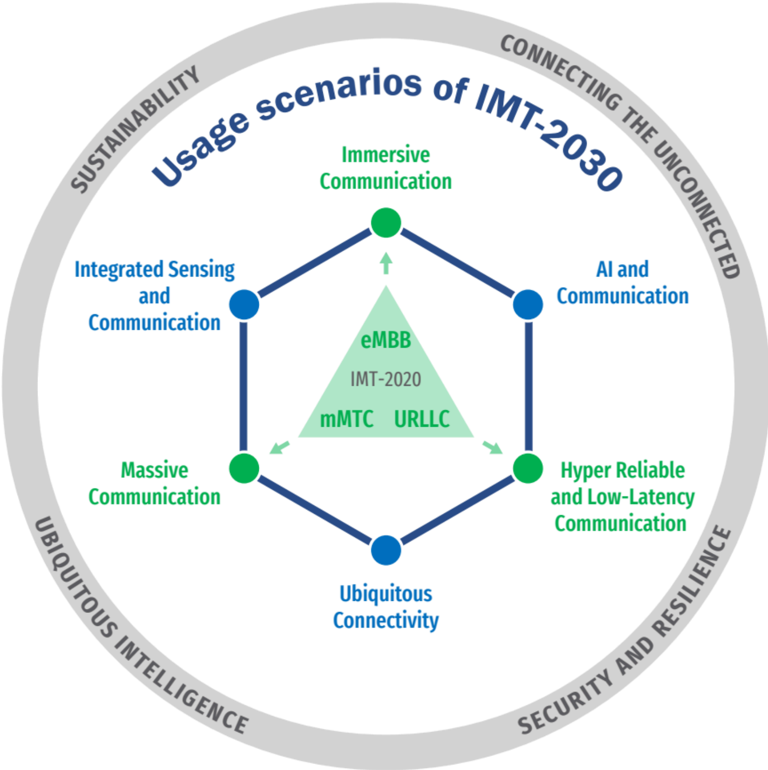
## 2 User demands

The motivation for the development of IMT-2030 is to continue to build an inclusive information society towards contributing to support the UN's sustainable development goals (SDGs). Applications and services enabled by IMT-2030 are expected to connect humans, machines and various other things together. In addition, technological advancement and the corresponding user needs would promote innovation and accelerate the delivery of advanced communication applications to consumers. Recommendation ITU-R M.2160 "Framework and overall objectives of the future development of IMT for 2030 and beyond" describes these motivation and societal considerations, potential user and application trends, technology trends, spectrum harmonisation and envisaged frequency bands. Also Report ITU-R M.2156 "Future technology trends of terrestrial IMT systems towards 2030 and beyond" and Report ITU-R M.xxxx "Technical feasibility of IMT in bands above 100 GHz" details these expected trends and phenomena for IMT-2030.

In order to fulfil these varied demands, Usage scenarios of IMT-2030 are envisaged to expand on those of IMT-2020 (i.e., eMBB, URLLC, and mMTC introduced in Recommendation ITU-R M.2083) into broader use requiring evolved and new capabilities. In addition to expanded IMT-2020 usage scenarios, IMT-2030 is envisaged to enable new usage scenarios arising from capabilities, such as artificial intelligence and sensing, which previous generations of IMT were not designed to support. Figure 1 illustrates the usage scenarios for IMT-2030.

FIGURE 1

**Usage scenarios and overarching aspects of IMT-2030**




## 3 Capabilities of IMT-2030

IMT-2030 is expected to provide enhanced capabilities compared to those described for IMT-2020 in Recommendation ITU-R M.2083, as well as new capabilities to support the expanded usage scenarios of IMT-2030. In addition, each capability could have different relevance and applicability in the different usage scenarios.

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. These values may further depend on certain parameters and assumptions including, but not limited to, frequency range, bandwidth, and deployment scenario. Further these values for the capabilities apply only to some of the usage scenarios and may not be reached simultaneously in a specific usage scenario.

The capabilities of IMT-2030 include:

### 1) Peak data rate

Maximum achievable data rate under ideal conditions per device.

The research target of peak data rate would be greater than that of IMT-2020. Values of 50, 100, 200 Gbit/s are given as possible examples applicable for specific scenarios, while other values may also be considered.

**2) User experienced data rate**

Achievable data rate that is available ubiquitously[2] across the coverage area to a mobile device.

The research target of user experienced data rate would be greater than that of IMT-2020. Values of 300 Mbit/s and 500 Mbit/s are given as possible examples, while other values greater than these examples may also be explored and considered accordingly.

**3) Spectrum efficiency**

Spectrum efficiency refers to average data throughput per unit of spectrum resource and per cell[3].

The research target of spectrum efficiency would be greater than that of IMT-2020. Values of 1.5 and 3 times greater than that of IMT-2020 could be a possible example, while other values greater than these examples may also be explored and considered accordingly.

**4) Area traffic capacity**

Total traffic throughput served per geographic area.

The research target of area traffic capacity would be greater than that of IMT-2020. Values of 30 Mbit/s/$m^2$ and 50 Mbit/s/$m^2$ are given as possible examples, while other values greater than these examples may also be explored and considered accordingly.

**5) Connection Density**

Total number of connected and/or accessible devices per unit area.

The research target of connection density could be $10^6 – 10^8$ devices/$km^2$.

**6) Mobility**

Maximum speed, at which a defined QoS and seamless transfer between radio nodes which may belong to different layers and/or radio access technologies (multi-layer/multi-RAT) can be achieved.

The research target of mobility could be 500 – 1 000 km/h.

**7) Latency**

Latency over the air interface refers to the contribution by the radio network to the time from when the source sends a packet of a certain size to when the destination receives it.

The research target of latency (over the air interface) could be 0.1 – 1 ms.

**8) Reliability**

Reliability over the air interface relates to the capability of transmitting successfully a predefined amount of data within a predetermined time duration with a given probability.

The research target of reliability (over the air interface) could range from $1\text{-}10^{-5}$ to $1\text{-}10^{-7}$.

---

[2] The term “ubiquitous” is related to the considered target coverage area and is not intended to relate to an entire region or country.

[3] The coverage area over which a mobile terminal can maintain a connection with one or more units of radio equipment located within that area. For an individual base station, this is the coverage area of the base station or of a subsystem (e.g., sector antenna).

**9) Coverage**

Coverage refers to the ability to provide access to communication services for users in a desired service area. In the context of this capability, coverage is defined as the cell edge distance of a single cell through link budget analysis.

**10) Positioning**

Positioning is the ability to calculate the approximate position of connected devices. Positioning accuracy is defined as the difference between the calculated horizontal/vertical position and the actual horizontal/vertical position of a device.

The research target of the positioning accuracy could be 1 – 10 cm.

**11) Sensing-related capabilities**

Sensing-related capabilities refer to the ability to provide functionalities in the radio interface including range/velocity/angle estimation, object detection, localization, imaging, mapping, etc. These capabilities could be measured in terms of accuracy, resolution, detection rate, false alarm rate, etc.

**12) Applicable AI-related capabilities**

Applicable AI-related capabilities refer to the ability to provide certain functionalities throughout IMT-2030 to support AI enabled applications. These functionalities include, distributed data processing, distributed learning, AI computing, AI model execution, and AI model inference, etc.

**13) Security and resilience**

In the context of IMT-2030:

– Security refers to preservation of confidentiality, integrity, and availability of information, such as user data and signalling, and protection of networks, devices and systems against cyberattacks such as hacking, distributed denial of service, man in the middle attacks, etc.
– Resilience refers to capabilities of the networks and systems to continue operating correctly during and after a natural or man-made disturbance, such as the loss of primary source of power, etc.

**14) Sustainability**

Sustainability, or more specifically environmental sustainability, refers to the ability of both the network and devices to minimize greenhouse gas emissions and other environmental impacts throughout their life cycle. Important factors include improving energy efficiency, minimizing energy consumption and the use of resources, for example by optimizing for equipment longevity, repair, reuse and recycling.

Energy efficiency is a quantifiable metric of sustainability. It refers to the quantity of information bits transmitted or received, per unit of energy consumption (in bit/Joule). Energy efficiency is expected to be improved appropriately with the capacity increase in order to minimize overall power consumption.

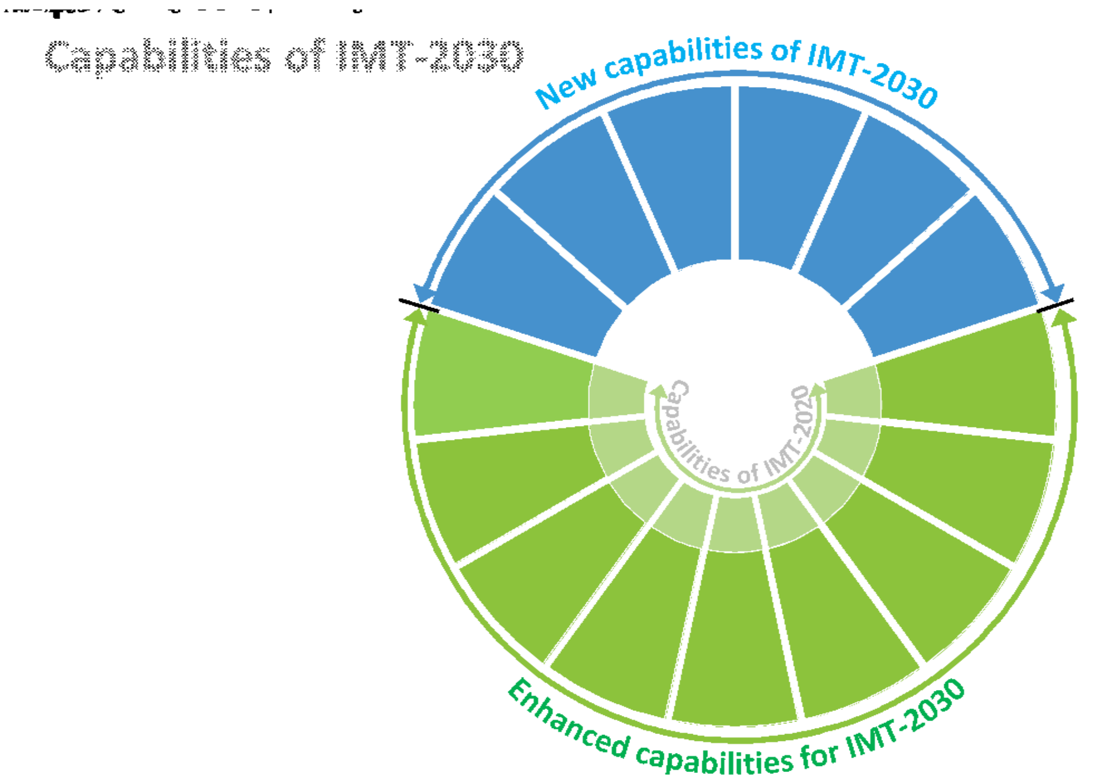
**15) Interoperability**

Interoperability refers to the radio interface being based on member-inclusivity and transparency, so as to enable functionality(ies) between different entities of the system.

The capabilities of IMT-2030 are shown in Figure 2.

FIGURE 2

**Capabilities of IMT-2030**




## 4 Relationship between existing IMT and IMT-2030

In order to support emerging usage scenarios and applications for 2030 and beyond, it is foreseen that development of IMT-2030 would be required to offer enhanced capabilities as described in § 3. The values of these capabilities go beyond those described in Recommendation ITU-R M.2083. The minimum technical requirements (and corresponding evaluation criteria) are to be defined by ITU-R based on these capabilities for IMT-2030. They could potentially be met by adding enhancements to existing IMT, incorporating new technology components and functionalities, and/or the development of new radio interface technologies. Furthermore, IMT-2030 is envisaged to interwork with existing IMT.

## 5 Framework of IMT-2030

The framework and objectives including overall timeframes for the future development of IMT for 2030 and beyond are described in some detail in Recommendation ITU-R M.2160.